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## ABSTRACT OF THESIS

# LITHOLOGIC AND STRATIGRAPHIC COMPILATION OF NEAR-SURFACE SEDIMENTS FOR THE PADUCAH GASEOUS DIFFUSION PLANT, MCCRACKEN COUNTY, KY

The Jackson Purchase region of western Kentucky consists of Coastal Plain sediments near the northern margin of the Mississippi Embayment. Within this region is the Paducah Gaseous Diffusion Plant (PGDP), a uranium enrichment facility operated by the US Department of Energy. At PGDP, a Superfund site, soil and groundwater studies have provided subsurface lithologic data from hundreds of monitoring wells and borings. Despite preliminary efforts by various contractors, these data have not been utilized to develop detailed stratigraphic correlations of sedimentary units across the study area. In addition, sedimentary exposures along streams in the vicinity of PGDP have not been systematically described beyond the relatively simple geologic quadrangle maps published by the US Geological Survey in 1966-67. This study integrates lithologic logs, other previous site-investigation data, and outcrop mapping to provide a compilation of near-surface lithologic and stratigraphic data for the PGDP area. A database of borehole data compiled during this study has been provided to PGDP for future research and archival. Developments in understanding near-surface geology include the adoption of nomenclature used by the Illinois State Geological Survey (ISGS), which separates the "Continental Deposits" into two distinct units, the Mounds Gravel and Metropolis Formation, based on their unique depositional histories. Additionally, faulting presented on the preliminary Joppa (IL) 7.5-minute quadrangle map, but not mapped on the Joppa (KY) 7.5-minute quadrangle map, appears to have impacted deposition of post-Eocene sediments at the site. These faults are co-linear to zones of irregularity noted in the Cretaceous McNairy Formation structure elevation map created during this study, thick zones of the Mounds Gravel noted in an isopach map from this study, and contaminant plume maps created previously by contractors.

Key Words:

Geologic Mapping, Jackson Purchase, Mounds Gravel, Metropolis Formation, Paducah Gaseous Diffusion Plant

Joshua L. Sexton

7/25/2006

### LITHOLOGIC AND STRATIGRAPHIC COMPILATION OF NEAR-SURFACE SEDIMENTS FOR THE PADUCAH GASEOUS DIFFUSION PLANT, MCCRACKEN COUNTY, KY

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THESIS

Joshua Lane Sexton

The Graduate School

University of Kentucky

# LITHOLOGIC AND STRATIGRAPHIC COMPILATION OF NEAR-SURFACE SEDIMENTS FOR THE PADUCAH GASEOUS DIFFUSION PLANT, MCCRACKEN COUNTY, KY

THESIS

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in the College of Arts and Sciences at the University of Kentucky

By

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Lexington, Kentucky

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#### Chapter 1. Introduction

#### Location and History

The Jackson Purchase region of western Kentucky consists of Coastal Plain sediments outlined by the northern extent of the Mississippi Embayment (Figure 1.0). The Paducah Gaseous Diffusion Plant (PGDP), a uranium enrichment facility operated by the United States Department of Energy (USDOE) (CH2M Hill, 1992; Clausen et al., 1992), resides in this region, in McCracken County, Kentucky (Jacobs, 1997) (Figure 1.1).

PGDP began operation in 1952 and enriches uranium fuel for use in nuclear reactors. Fuel is formed from  $UF_6$  gas, a mixture of uranium 235 (<sup>235</sup>U) and fluorine (F) that passes through cascade diffusion process to achieve enrichment. Unfortunately, because of this processing there is now a groundwater contamination problem on and around the PGDP facility.

On May 31, 1994, PGDP was designated a Superfund site, making it a priority for cleanup among contaminated sites in the United States (Jacobs, 1997). The primary contaminants of concern at the site are trichloroethene (TCE) and technetium-99 (<sup>99</sup>Tc). TCE was used as a degreasing agent and <sup>99</sup>Tc was formed at the site as a byproduct of processing nuclear fuel rods (Sweat, 2000). Neither contaminant is being used or generated at the site now due to changes in practice, but previous releases have resulted in dissolved-phase transport of both contaminants into plumes stretching beyond the borders of the facility (Sweat, 2000). This off-site contaminant migration has impacted groundwater and surface water quality. Previous monitoring has determined that plumes propagated north from the facility toward the Ohio River (Clausen et al., 1992; Jacobs, 1997).

Groundwater contamination by TCE and <sup>99</sup>Tc has resulted in monitoring and remediation by PGDP contractors under the oversight of the United States Environmental Protection Agency (USEPA). Through the 1990's, site investigations and groundwater studies have sought answers to site-specific problems in and around the facility ranging from contaminant plume projection to waste cell siting (EDGe, 1989; CH2M Hill, 1992; Clausen et al., 1992; Jacobs, 1997). These studies contain shallow lithologic data from hundreds of monitoring wells and borings. Because the data were collected for different purposes, the data do not have a consistent style or use the same nomenclature. Detailed stratigraphic correlations of sedimentary units have not previously been developed from data gathered at the site.







Figure 1.1: Map of study area indicating property boundaries and local roads (CDM and JEG, 1995).

Additionally, sedimentary exposures along streams in the vicinity of PGDP have not been systematically described beyond the broad, formation-scale mapping of 7.5-minute quadrangles published by the United States Geological Survey (USGS) in 1966–67.

#### Purpose

This project was funded under a USDOE grant through the Kentucky Research Consortium for Energy and Environment (KRCEE) with a goal of locating and compiling available data into a common database from which those data could be accessible to future researchers. The second goal of this project was to create a site-wide stratigraphic framework for the Late Tertiary through Quaternary sediments within which the Regional Gravel Aquifer (RGA) is located. The RGA is the primary pathway of lateral contaminant transport within the study area (Clausen et al., 1992; Jacobs, 1997). By understanding the extent, potential interconnection of stratigraphic units, and sedimentology of the RGA and confining units at the site, more realistic projections of groundwater flow may be possible in future research. To achieve these goals I utilized the newly created geologic database, reviewed previous studies, and conducted additional field investigations across the region.

#### General Geology

The geologic units in the shallow subsurface in the study area are Tertiary to Quaternary fluvial, lacustrine, and eolian sediments (Olive, 1966; Finch, 1967; Clausen et al., 1992). These sediments are associated with deposition/erosion of the Illinois Basin, Mississippi Embayment, glacial slack-water lakes, and the ancestral Tennessee River (Olive, 1966; Finch, 1967).

#### Stratigraphy

Mississippian limestone bedrock is unconformably overlain by Upper Cretaceous sediments in the study area (Figure 1.2) (Olive, 1980; Clausen et al., 1992; Langston and Street, 1998). The Tuscaloosa Formation is the first stratigraphic unit overlying this regional unconformity. The Tuscaloosa consists of well-graded chert gravel (rubble zone) with a sandy to clayey matrix (Jacobs, 1997). Tuscaloosa sediments, where present, are overlain by micaceous clays and interlensing fine to medium-grained sands and silts of the Upper Cretaceous McNairy Formation (Olive, 1980; Clausen et al., 1992).

South	-			North
Age Pliocene?	Description Clayey Chert Gravel	PGDP	Description	Age
	Orand with Oilth & Olay	Loess // Loess //	Loess Deposits	Peoria Wisconsinan
Eocene	Sand with Silt & Clay	F0.00-0-0	Metropolis Formation	Loveland Illinoian
Paleocene	Micaceous Clay and Fine Sand, Glauconitic	Porters Creek Clay	Predominantly Silt with Sand and Gravel Horizons Lower Continetal Deposits or Mounds Gravel Gravel and Coarse Sand	Pleistocene
Cretaceous	Upper Member Micaceous Clay and Fine Sand, Carbonaceous Levings Member	Clayton Formation	Upper Member Micaceous Clay and Fine Sand, Carbonaceous Levings Member	Cretaceous
	Fine Sand Lower Member		Fine Sand Member	
	Ohard Oraual	Rubble Zone	Tuscaloosa Fm	?
? Mississippian	Limestone and Chert with some Shale	Mississippian Carbonates	Limestone and Chert with some Shale	Mississippian

**Figure 1.2:** Stratigraphic column of geologic units above the Mississippian bedrock unconformity (modified from Jacobs, 1997).

The Paleocene Clayton Formation is only distinguished from the McNairy Formation in the study area by palynological evidence (Davis et al., 1973). Palynological investigations were not part of this study; therefore, I follow methods of Olive (1966) in combining the Clayton Formation into the McNairy Formation. The undifferentiated McNairy Formation unconformably overlies the Tuscaloosa Formation where present and directly overlies limestone bedrock where the Tuscaloosa Formation is absent. Subsurface investigations at the plant indicate that the McNairy Formation consists of 40 to 50 percent sand with an average thickness of 225 feet (ERCE, 1990). Davis (1996) indicates the McNairy consists of three members in the study area: an upper silt and sand member, a middle silt and clay member referred to as the Levings Member, and a lower sand member.

The McNairy contains more clay near Paducah than in the southeastern portion of the Jackson Purchase (Davis et al., 1973). Because of its clay content the unit forms a semi-confining surface underlying the RGA (Clausen et al., 1992). These Cretaceous deposits have been interpreted as deltaic in origin and center near the northeast edge of the embayment, grading to marine sands and clays to the southwest (Pryor, 1960). Reconstructions of the paleo-geography during the Cretaceous support this interpretation (Figure 1.3). The Cretaceous-Tertiary extinction event (KT boundary) occurred at the end of the Cretaceous (~65.5 Ma). This event was not described in literature reviewed during the study and no distinct indicators were noted during the study.

The Paleocene Porters Creek Clay unconformably overlays the McNairy Formation and is present to the southeast of PGDP. The Porters Creek Clay is characterized as a dark gray, slightly to very micaceous, glauconitic clay containing variable amounts of fine-grained sand with a substantial silt component (Lambert, 1966; Olive, 1966; Finch, 1967). The Porters Creek Clay (Jacobs, 1997) was interpreted by Olive (1980) to have formed during marine to fresh-water sedimentation from a sea that covered much of the embayment during this time.

Eocene sands of the Wilcox, Claiborne and Jackson Formations unconformably overlay the Porters Creek Clay and are undifferentiated in the study area. Eocene sands are generally very thin north of US Highway 60 (CH2M Hill, 1992). These sediments are actually comprised of interlensing sand- to clay-size grains and are only found in the southernmost portion of the study area (Clausen et al., 1992).



Figure 1.3: Paleogeography of North America during the Cretaceous (Levin, 2003).

As the ancestral Tennessee River became incised in the region, the Porters Creek Clay and Eocene sands were removed from a large portion of the study area, leaving a terrace to the south of Grahamville where the northernmost exposures of these units occur (Figure 1.2, 1.4). Olive (1966, 1980) labeled the sediments overlying the Cretaceous to Eocene sediments the Continental Deposits, which were further subdivided into upper and lower members by later investigators (EDGe, 1989; CH2M Hill, 1992). The Lower Continental Deposits are stratigraphically equivalent to the Mounds Gravel as designated by the Illinois State Geological Survey (ISGS) or the Lafayette Formation (Lafayette gravel) in other parts of the region (Langston and Street, 1998). For the purposes of this study the Mounds Gravel designation will be used for nomenclature, as this unit has been extensively mapped in southern Illinois. Mounds Gravel deposits unconformably overlie Paleocene and Eocene units in the southern portion of the site and the McNairy Formation north of the truncation of the Porters Creek Clay (Figure 1.4). Mounds Gravel deposits consist of reddish-orange to brown chert clasts with a glossy patina. Clasts occur within a matrix of poorly sorted sands containing lenses of clay and silt (Potter, 1955a; Potter, 1955b; Clausen et al., 1992, Nelson, 2005). The unit has been interpreted as a deposit of high-energy braided rivers (Potter, 1955a), which occupied a broad steep-sided valley formed by the ancestral Tennessee River (Nelson et al., 1999). Olive (1980) recognized four erosional surfaces, three of which have been identified as terraces at the site within the RGA (Clausen et al., 1992). Nelson et al. (2002) indicates that the lower terraces formed under the incised flat and broad deep-valley conditions proximal to the current course of the Ohio River. These lower terraces occur at a base elevation of 245 to 310 feet above mean sea level (msl) (Clausen et al., 1992).

Capping the Mounds Gravel in the study area is the Metropolis Formation (Nelson et al., 1999), also commonly referred to as the Upper Continental Deposits by PGDP contractors (Clausen et al., 1992; Jacobs, 1997) and mapped as Quaternary sands and silts by Finch (1967). The Metropolis Formation is primarily silt and sand with lesser components of clay and gravel (Nelson et al., 1999) in a massive to finely laminated matrix (Clausen et al., 1992). The average thickness of the Metropolis Formation is 15 to 55 feet at the site.



Figure 1.4: Structural elevation map of the Porters Creek Clay illustrating relief and truncation of the unit (Jacobs, 1997).

The unit is generally light gray to yellowish-brown and commonly shows evidence of cylindrical vertical burrows (Nelson et al., 1999; Nelson, 2006). Gravels in the Metropolis Formation most likely were derived from the underlying Mounds Gravel, but can be differentiated by rounding, pitting, and a complete or substantial loss of the glossy patina indicative of Mounds Gravel (Nelson et al., 1999; Nelson, 2005). The contact between Mounds Gravel and Metropolis Formation is often gradational across an interval of 3 to 15 feet (Nelson, 2005). Clausen et al. (1992) note that the Metropolis Formation may locally be laterally traceable along erosional contacts, as indicated by WLA (2005). However, Nelson (2005) states that lateral traceability cannot be expected regionally because of the small scale of bed forms (5 to 15 feet). Deposition of the Metropolis Formation is thought to have occurred early in the Pleistocene as the ancestral Tennessee River became diverted, leaving slow-moving, underfit meandering streams to flow down the ancestral Tennessee River valley (Nelson et al., 2003). These rivers were much narrower than the preceding braided streams leading to laterally heterogeneous deposits. Slow sediment aggradation in this environment led to the extensive weathering, bioturbation and soil formation seen (Nelson et al., 1999, 2002).

A series of loess deposits, averaging 5 to 25 feet in thickness, blankets the majority of the site (Finch, 1967; Clausen et al., 1992; US DOE, 1997). These deposits are fine-grained and interpreted as glacial eolian sediments, similar to the underlying Metropolis Formation (Upper Continental Deposits) (Finch, 1967). Loess deposits are separated by buried soils that indicate unconformities (Olive, 1980). Loveland, Roxana and Peoria are the principal loess units at the site (Follmer, 2005). The Loveland formed during Illinoisan glaciation and is the oldest loess unit at the site (Follmer, 2005). The Sangamon geosol caps this unit and is a useful marker bed between the Illinoisan and Wisconsin-stage loess deposits. Wisconsin-age Roxana loess lies above the Sangamon geosol and is darker brown to reddish silt that is coarser than the Loveland loess. The Peoria is very similar to the older Loveland unit. This uppermost loess has been carbon-14 (<sup>14</sup>C) dated throughout the Midwest with an age of 13 to 24 thousand years before the present (ka) (Follmer, 2005). The Peoria loess is a massive yellowish silt (Follmer, 2005). The Roxana and Peoria loesses are commonly combined into an informal unit known as the Wisconsin loess where intervals are thin and stratigraphic leakage has occurred (Follmer, 2005). Reworking of deposits in the active Ohio River floodplain has left Holocene alluvium deposits in lowland areas throughout the northern sections of the study area (Finch, 1967).

#### Structure

The Jackson Purchase region consists of a thick package of flat-lying unlitihified sediments underlain by Mississippian bedrock, regionally dipping toward the center of the Illinois Basin (Clausen et al., 1992). Olive (1980) states that sediments overlying bedrock form an unconformity parallel to the outline of the Mississippi Embayment and dip towards the axis of the embayment. It is estimated that the McNairy and Porters Creek Clay dip 30 to 35 feet per mile towards the axis of the embayment while the younger Eocene sediments dip 25 feet per mile in the same direction (Olive, 1980).

Seismicity in the area is a function of the New Madrid Seismic Zone (NMSZ) lying to the southwest and the Fluorspar Area Fault Complex (FAFC) to the northeast (Figure 1.0). Nelson et al. (1999) postulate that these complexes formed during failed Cambrian rifting of the Reelfoot Rift, an arm of the currently active NMSZ. The Pascola Arch also developed during the Cretaceous due to activation of faults along the Reelfoot Rift. The arch formed a highland in the Jackson Purchase region (Langston and Street, 1998). Mapping in Southern Illinois has indicated displacement of Pleistocene strata along FAFC faults. Several of these faults are projected into western Kentucky (Langston and Street, 1998; Nelson et al., 1999; Woolery and Street, 2002). Faults of the FAFC in southern Illinois are dominantly high-angle normal faults striking to the northeast with fewer high-angle reverse and oblique-slip faults (Nelson et al., 1999). These faults bound narrow pull-apart grabens following the same strike (Nelson et al., 1999).

Olive (1966) mapped soft-sediment deformation in the study area within the Porters Creek Clay and other researchers have noted soft-sediment deformation in both the Porters Creek Clay (Davis, 2005; Amick, 2005) and the clay facies of Quaternary deposits (Clausen et al., 1992; WLA, 2006). Langston and Street (1998) suggest that faulting appears to have propagated from bedrock into the Mounds Gravel in the northern portion of the study area. Woolery and Street (2002) imaged near-vertical northeast-trending faults displacing Quaternary sediments within 25 feet of the ground surface using shear-wave seismic reflection methods at the site. These features support an interpretation of faulting from the FAFC of southern Illinois into western Kentucky presented by Nelson et al. (1999) and are consistent with major fault displacement of the Quaternary strata.

#### Chapter 2. Methods

#### Field Investigation

Examination of surficial geology within the study area concentrated on creeks and excavations because they provided extended sections where near-surface features could be viewed and sampled. Little Bayou Creek and Bayou Creek had the most exposures (Figure 1.1). These generally north-south oriented creeks cross the West Kentucky Wildlife Management Area (WKWMA), the PGDP site, and private properties. Descriptions of exposures in the Tennessee Valley Authority's (TVA) Shawnee Fossil Plant borrow pits and drainage ditches also provided useful information. Investigations of Newton Creek, Nasty Creek, and Metropolis Lake provided geologic information. Gravel pits shown on the Joppa and Heath 7.5-minute geologic quadrangle maps proved inaccessible during site investigations because they had been flooded or revegetated. Locations strategic to plant security or with institutional controls in place for possible health hazards remained un-surveyed.

For all exposures, strata descriptions were taken using standard methods. Clast orientations were measured where a gravel or cobble fabric was observable in outcrop. Photographs were taken for database archival and to aid in comparison of exposures. Sediments were sampled for dating at selected locations where the stratigraphic units were thought to be undisturbed and well represented. A hand-held Global Positioning System (GPS), with approximately ± 15 feet horizontal resolution, was utilized with 1:24,000-scale topographic maps to reference all locations spatially. Elevations were measured for selected bedding contacts using a Total Station electronic distance measuring device and a stadia rod equipped with a prism. Elevations of exposures used known top-of-casing elevations from the closest monitoring wells as a reference for all elevation calculations. A magnetic compass and inclinometer set at a declination of 3.5° to the northwest were used to determine the strike of gravel and cobble clasts in outcrop. Soil sample collection utilized a sliding hammer adapted to a double-wall sample barrel. Samples collected with this system fed through the steel outer barrel into inner aluminum sleeves 2 inches in diameter and 6 inches in length. All aluminum sleeves were cut to length, ground, decontaminated, and stored in sealable plastic bags prior to use.

#### Age Dating

Because of the lateral heterogeneity of stratigraphic units and the possibility of multiple unconformities in these units, it was determined that absolute age dating should be attempted. The aim of this task was to assist in the interpretation of surficial geology by using age, along with depositional context, for comparison with mapped exposures in the area. Radiometric dating using <sup>14</sup>C is a common method for dating Quaternary deposits; however, the units of interest preserved very little organic material. Sampling was considered along Little Bayou Creek and Bayou Creek, but during the WLA (2005) site investigation, 87 (30-foot) soil cores were found to be too deficient in organic material to facilitate <sup>14</sup>C sampling. Additionally, vegetation proximal to all exposures made contamination from modern rooting likely. Another complication was that manganese (Mn) concretions in the Mounds Gravel and Metropolis Formation appeared indistinguishable from charcoal under field conditions.

Optically Stimulated Luminescence (OSL) was chosen as an alternative method for dating the carbon-deficient sediment (Foreman, 2005; Owen, 2005). The OSL technique measures the energy of photons released from sediment, in this case, quartz grains, to calculate a burial age (Aitken, 1998; Foreman, 2005). This is accomplished by stimulating the release of absorbed ionized elements like uranium (U) and thorium (Th) using light energy (Aitken, 1998). As the samples absorb light energy, ionized radiation is released as a luminescence emission (Aitken, 1998). This occurs naturally when sediments are exposed to sunlight. When these sediments are buried, they begin to retain ionized radiation from cosmic rays and other sources because there is no longer an energy source (sun or heat) to promote ionization (Aitken, 1998).

Using OSL for geochronology is accomplished by measuring the intensity of the luminescence emission and calibrating this to a dosage rate needed to release all ionized elements (Aitken, 1998). This dose rate is then divided by the estimated radioactivity that the sample received after burial to yield a luminescence age (Aitken, 1998). The following equation by Aitken (1998) illustrate these relationships:

#### Age = Paleodose / Dose-rate

Sample preparation occurred at the University of Cincinnati (UC) under the guidance of Dr. Lewis Owen. Samples were processed in a light-controlled laboratory using sodium-vapor lamps equipped with filters to create a yellow-orange light that would not liberate ionized radiation. Approximately 1 inch of sediment along each end of each sample tube was extruded to lower the possible light contamination incurred during

sample collection. These ends were set aside to be processed for later neutron activation analysis, which is not a light-sensitive process. Samples were then extruded into glass beakers and weighed. Next, samples were placed in a drying oven set at 50°C and allowed to dry slowly for several days. Once samples were dry, they were reweighed to calculate in-situ moisture content (Table 2.0).

Samples were sieved using a magnetic shaker and clean brass sieves with mesh sizes of 1000  $\mu$ m, 500  $\mu$ m, 250  $\mu$ m, 180  $\mu$ m, 125  $\mu$ m, and 90  $\mu$ m, plus the pan to isolate grain-size fractions for analysis. Sieving took approximately 1 hour for each sample. Sieves were cleaned after each run using a fine needle and soft bristle brush to remove grains lodged in the brass mesh. This process was done at a light table outside of the lab to insure all lodged grains were removed, and every attempt was made not to damage the mesh of the sieves during cleaning. Sieves were then rinsed to remove all dust particles, flushed with compressed air and placed in an oven to dry for reuse. One sample required wet-sieving because of its high fines content. This was accomplished, after the initial dry sieving attempt, using tap water and a 20-gallon container. The sieve stack was placed over the container (minus the pan) and each sieve was flushed with water and gently rubbed by hand to break up clods. Once the size fraction of interest remained, particles on that sieve were flushed with water into a glass beaker and the process was repeated for the next sieve. All materials less than 90 µm were allowed to flow into the 20-gallon container and discarded. Grain size analysis from samples can be viewed in Table 2.1.

Container ID		LM01 L	LM01 U	LM02	LM03 L	LM03 U	LM04	LM06	LM07	LM08
Weight of beaker	( G )	165.45	163.08	163.86	164.46	163.75	164.57	203.74	164.31	165.72
Weight of moist soil + beaker	( G )	388.63	354.69	384.14	387.37	314.35	389.71	370.78	291.96	336.08
Weight of dry soil + beaker	( G )	372.06	339.8	364.38	363.71	308.2	364.04	337.41	288.69	325.86
Weight of moisture	( 6 )	16.57	14.89	19.76	23.66	6.15	25.67	33.37	3.27	10.22
Weight of dry soil	( G )	206.61	176.72	200.52	199.25	144.45	199.47	133.67	124.38	160.14
Water content	(%)	8.02	8.43	9.85	11.87	4.26	12.87	24.96	2.63	6.38

Table 2.0: Moisture content of OSL samples collected.

	S								. 0	
	% Los	0.68%	6.27%	%66.0	3.89%	0.82%	1.85%	2.58%	3.99%	NA
Mass post	sieving (g)	205.2	165.64	198.53	191.5	143.27	195.78	130.22	119.42	NA
Mass pre	sieving (g)	206.61	176.72	200.52	199.25	144.45	199.47	133.67	124.38	160.14
	<90	0.84	64.28	8.76	71.28	8.89	86.77	73.43	0.94	
(mµ n	06	0.89	23.62	2.31	10.94	2.67	14.19	11.54	0.25	-
ve (mesh i	125	4.54	38.92	5.86	19.32	6.35	23.07	11.61	0.87	t sieved
d above sie	180	12.54	31.31	17.67	21.01	11.05	18.42	13.89	2.18	d to be we
g) obtainec	250	54.9	7.34	51.76	39.61	38.45	26.48	12.03	12.43	Sample ha
Weight (	500	15.48	0.17	14.55	13.99	18.71	14.13	1.08	14.79	
	1000	116.01	0	97.62	15.35	57.15	12.72	6.64	87.96	
	D	LM01 L	LM01 U	LM02	LM03 L	LM03 U	LM04	LM06	LM07	LM08

Table 2.1: Grain size distribution from sieve analysis of OSL samples collected.

Post-sieving removal of organic and carbonate material was accomplished by a series of acid treatments. The samples were first soaked in 30% hydrogen peroxide  $(H_2O_2)$  for approximately 96 hours to dissolve any organic material. Samples were then rinsed with de-ionized water and placed in a 10% hydrochloric acid (HCI) solution for 24 hours to remove carbonate material. Samples were rinsed again and given a 10% hydrofluoric acid (HF) treatment for 1 hour to remove feldspars and other minerals not removed during the previous treatments. After the HF treatment, samples were rinsed and allowed to sit in a 10% HCI solution for 1 hour to remove any fluorite (CaF<sub>2</sub>) that may have precipitated during the HF treatment. Chemical treatments were finished with a triple rinse of all samples with deionized water followed by a triple rinse with acetone to accelerate sample drying. Samples were then placed in a 50°C oven and allowed to dry.

Isolation of minerals was accomplished by density separation using lithium heteropolytungstate (trade name LST), a heavy liquid with a specific gravity of 2.85 g/cm<sup>3</sup>. Four solutions of LST were prepared by dilution with deionized water to densities of 2.75, 2.62, 2.58, and 2.53 g/cm<sup>3</sup>. These density ranges allow for the separation of heavy minerals, quartz, feldspars and clays, respectively, for each sample (Figure 2.0). Mineral separation for samples began by immersing the sample in a 2.53 g/cm<sup>3</sup> solution, spinning the sample in a centrifuge for 2 minutes and then decanting the liquid containing suspended grains into an appropriately labeled container. This process was repeated until separation of all four density ranges was accomplished. Density ranges of greater than 2.75 g/cm<sup>3</sup> and less than 2.53 g/cm<sup>3</sup> were discarded as heavy minerals and clays, and were not used for analysis. The 2.53 g/cm<sup>3</sup> - 2.58 g/cm<sup>3</sup> and 2.58 - 2.62 g/cm<sup>3</sup> density ranges corresponded to potassium feldspar and sodium feldspar, respectively, and were triple rinsed with deionized water to remove all traces of the LST solution, then triple rinsed with acetone and allowed to dry prior to storage.



Figure 2.0: Densities of heavy liquids used for mineral separation of OSL samples (Aitken, 1998).

The quartz fraction in the density solution of 2.62 - 2.75 g/cm<sup>3</sup> was triple rinsed with deionized water and subjected to a series of acid treatments to remove any plagioclase minerals in the sample as well as any alpha contamination along the skin of the quartz grains (Aitken, 1998). A treatment of 49% HF was performed for one hour, followed by a 2-hour 10% HCl treatment to remove any CaF<sub>2</sub> precipitation from the previous action. After acid treatment, each isolated quartz sample was triple rinsed with deionized water followed by a triple rinse with acetone and allowed to dry prior to storage.

Sub-samples removed for neutron activation were placed in a 100°C oven and allowed to dry. These samples were then divided and 25% (~25 grams) of each sample was ground to a powder using a mortar and pestle. Approximately 5 grams of this powder were placed in a resealable plastic bag and set aside to be sent to the USGS luminescence lab for neutron activation analysis. The remaining ground sample was placed in a resealable plastic bag as a backup. Leftover, un-ground samples were also placed in resealable plastic bags for archival. After each sample was ground, the mortar and pestle were washed with a mild detergent, rinsed with tap water, and wiped dry with a paper towel. To ensure drying, a small amount of acetone was wiped onto the mortar and pestle and was allowed to dry before preparation of the next sample began.

Analysis of the prepared samples was performed by Dr. Lewis Owen at UC using a Risø OSL-TL system. The single aliquot regenerative method was used to analyze all samples. Twenty (or greater) aliquots from each sample were analyzed by this method. Neutron activation analysis results are pending from the USGS luminescence lab in Denver, CO. Calculations will be made once neutron activation data are obtained.

#### Acquisition and Application of Published Data

Boring records for the PGDP were cited from published documents and logs provided by the Kentucky Division of Waste Management in hard-copy format. TVA borehole data were provided in digital and hardcopy formats. USGS borehole data for the Joppa geologic quadrangle (GQ) map were acquired from the Kentucky Geological Survey in archived microfiche format. This data were scanned into a digital image format for preservation prior to manual entry into the digital database. USGS boring data for the Heath GQ were provided by Science Applications International Corporation (SAIC) in hard-copy format.

#### Spatial Reference

All borehole data that were input into the database were spatially referenced in two coordinate systems: the PGDP's plant coordinate system and Universal Transverse Mercador (UTM), a projected coordinate system. A dual-coordinate system was selected to simplify future data use. For the PGDP borings, surveyed plant coordinates were referenced from the original borehole log or extracted from the report in which they were presented. Non-PGDP borings were generally presented in a projected coordinate system and were transferred into UTM coordinates. Transformation of all borehole data into a dual coordinate system was accomplished by use of the Transform Oak Ridge Coordinates (TORC) program version 2.0 provided by KRCEE.

#### Lithologic Data

All lithologic data entered into the database originated from published borehole logs. When possible, the original driller's/geologist's log was used for lithologic description; if unavailable, the next-published log for the boring was selected. The RockWorks<sup>2004</sup> program was used to store and manage all borehole data. All pertinent information was copied directly from the boring log to create a digital copy. For consistency and simplification, the grain size of a unit is located at the front of the description column in uppercase letters, followed by a colon and the rest of the formal description (color, sorting, grain size percentages, etc.), which is presented in lower case format. Where non-continuous sampling was noted in logs, the description for the last lithology described was carried through until a change in lithology was noted usually because of sampling or a change in drilling conditions. This was easily resolved in many instances where a graphical log was presented with written descriptions. When only written descriptions were present, contacts were determined using lithologic descriptions for proximal borings. Depths for all lithologies were entered in feet and converted between metric and English units as needed.

A modified Unified Soil Classification System (USCS) was implemented to create an identifier for individual lithologic units. This identifier is a summation of formal lithologic descriptions found at set sample depths from borehole logs. Identifiers may be used in later modeling tasks for geologic interpretation or the log can be reviewed in its entirety for detailed geologic characterization. The USCS was chosen because of the geotechnical nature of most boreholes and because it was already adopted as the primary classification system on many geologic logs. This system also addressed the

non-lithified lithologies of the site as well as or better than other systems considered. Table 2.2 depicts the USCS classification system. Additional labels for classification were created for site-specific geologic characteristics. USCS and site-specific identifiers utilized are presented in Table 2.3. USCS lithologic identification is based primarily on grain size. Beyond grain size analysis, USCS classification uses the following descriptors: "well-graded", "poorly-graded", "low plasticity", and "high plasticity". Wellgraded is equivalent to the geologic term poorly-sorted and poorly-graded is equivalent to well-sorted. This graded descriptor refers to the amount of variation seen on a grain size distribution plot for coarse-grained soils. Plasticity is related to the behavior of finegrained soil at different moisture contents and is identified by conducting a liquid-limit test on the soil, commonly determined by an ASTM D-4318 test. However, for most of the geotechnical borings used in this study, the liquid limit was estimated in the field. A liquid limit exceeding 50 indicates a high plasticity soil. High plasticity soils are generally clays and are often referred to as fat or swelling clays. Low plasticity soils, those with a liquid limit below 50, include both silts and clays. These soils are often described as lean.

In instances of incomplete or inconsistent lithologic description, the following assumptions were made. If clay plasticity was not designated as "fat" or "lean", lean was assumed due to fewer fat clays noted in the boring database. Where lithologic description for a silt lithology was not designated "fat" or "lean", lean was assumed as silt rarely exhibits plastic properties. If sand or gravels were identified with no sorting indicated, well-graded (poorly-sorted) was assumed because of the heterogeneous nature of sediments previously noted at the site. All assumptions were also evaluated with respect to the lithology described in adjacent borings.

A sample population of 58 borings was selected from the 400 entered for sitewide cross-sections. The original logs of the 58 selected borings can be viewed in Appendix A. A sample population was created to simplify geologic cross-sections because of massive data overlap. The boreholes chosen were based on spatial distribution, detail of lithologic log, and total well depth. To verify that the selected sample population was in agreement with the total dataset, a block model of each dataset was created using RockWorks<sup>2004</sup> software. The model was generated using an inverse distance algorithm with random blending and interpretation of outliers to smooth data. Slices were made through both models every 10 feet at equal elevation ranges to calculate lithologic percentages.

Coarse-G	rained Soils					a	
% -#200?	% of C.F#4	% -#200?			USCS Symbol	USCS Name	
		0-5%	e >6 and 1 <e <3?<="" td=""><td>yes</td><td>SW</td><td>Well-graded sand</td></e>	yes	SW	Well-graded sand	
		0-570	$c_n = 0$ and $1 = c_c = 0$ .	no	SP	Poorly-graded sand	
					SP-SM	Poorly-graded sand with silt	
	<50%	5 1294	Dual classificati	0.7	SP-SC	USCS Name   Well-graded sand   Poorly-graded sand   Poorly-graded sand   with silt   Poorly-graded sand   with silt   Poorly-graded sand   with clay   Well-graded sand with   silt   Well-graded sand with   clay   Clayey sand   Silty sand   Well-graded gravel   Poorly-graded gravel   Poorly-graded gravel   with silt   Poorly-graded gravel   with clay   Well-graded gravel with silt   Poorly-graded gravel with clay   Well-graded gravel with   silt   Well-graded gravel with   silt	
<50%	~50%	5-1270	Duar classificati	on	SW-SM		
					SW-SC	Well-graded sand with clay	
		12-50%	PI>0 73(1 L_20)%2	yes	SC	Clayey sand	
		12-5070	11-0.75(LL-20)70.	no	SM	Silty sand	
	2	0-5%	a >4 and 1 <a 39<="" <="" td=""><td>yes</td><td>GW</td><td>Well-graded gravel</td></a>	yes	GW	Well-graded gravel	
		0-570	$c_{\mu}$ = 4 and 1 = $c_c$ = 5.	no	GP	Poorly-graded gravel	
			GP-GM Poorly-grade GP-GM Poorly-grade with s				
	> 500/		Dalalaciónd	2277	GP-GC	Poorly-graded gravel with clay	
	>30%	5-12%	Duai classifican	on	GW-GM	Well-graded gravel with silt	
					GW-GC	Well-graded gravel with clay	
		12-50%	PI>0 73(1 L-20)%?	yes	GC	Clayey gravel	
		12-5070	11-0.75(LL-20)/0.	no	GM	Silty gravel	

#### **Fine-Grained Soils**

% -#200?	LL > 50%?	PI > 0.73(LL-20)%?	USGS Symbol	USCS Name
	100	yes	CH	Fat clay
~500/	yes	no	MH	Elastic silt
25076		yes	CL	Lean clay
	по	no	ML	Lean silt

Notes:

% - #200? = The precent of material passing the # 200 sieve

% - C.F. - #4 = The precent of material passing the # 4 sieve

 $c_u = D_{60} / D_{10}$   $c_c = D_{30} / (D_{60} * D_{10})$ ; where  $D_{10}$ ,  $D_{30}$ , and  $D_{60}$  correspond to 10%, 30% and 60% passing, respectively

LL= Liquid Limit: ASTM D-4318

PL= Plastic Limit: ASTM D-4318

PI = Plasticity Index = LL - PL



	CL	Lean clay		SM-SP	Silty sand
	СН	Fat clay	: I.:  : :  :	SP-SM	Poorly graded silty sand
	СМ	Silty clay		SW-SM	Well-graded sand with silt
	CL-ML	Lean clay with silt	::::  : :	SW-SC	Well graded sand with gravel
	CH-MH	Fat clay with elastic silt	::::  : :	SP-SC	Poorly graded sand with clay
· · ·	CL-SM	Lean clay with silty sand		SP-GM	Poorly graded sand with silty gravel
	CS	Sandy clay	::::  : :	SP-ML	Poorly graded sand with silty clay
	CG	Gravelly clay	::::::::::::::::::::::::::::::::::::::	SW-CL	Poorly graded sand with clay
	ML	Silt	20.0 20.0	SP-SG	Poorly graded sand with gravel
	MC	Clayey silt	۲Ŋ	GW	Well-graded gravel
	MS	Sandy silt	$[\underline{\mathbb{N}}]$	GP	Poorly graded gravel
	MH	Elastic silt	Δj	GS	Sandy gravel
	SW	Well-graded sand		GC	Clayey gravel
·····	SP	Poorly graded sand		GM	Silty gravel
	SC	Clayey sand	Δ	RZ	Rubble zone
	SM	Silty sand		LS	Limestone
<b>S</b>	SG	Gravelly sand		FILL	Secondary fill
	SP-CM	Poorly graded sand with silty clay	$\boxtimes$	DG	Data gaps (no data)

Table 2.3: Lith	ologic identifiers u	sed.
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A Mann-Whitney rank sum test was performed using SigmaStat software to test for statistical differences between the models based on lithologic percentages. Comparison of six lithology types for comparable elevation ranges did not illustrate a statistical difference between the two populations. Raw data and analysis are presented in Appendix B.

#### Stratigraphic Data

Stratigraphic units were chosen based on borehole lithology and followed the PGDP hydro-stratigraphic unit (HU) nomenclature (Clausen et al., 1992; Jacobs, 1997). A columnar section of this nomenclature can be viewed in Figure 2.1, including the equivalent chrono-stratigraphic units described in the introduction. HU nomenclature for database archival should prove more useful to future researchers than chronostratigraphic nomenclature because HU nomenclature traces similar lithologic units according to physical properties. Surficial loess comprises HU-1, which was described as undifferentiated because of a lack of detail in lithologic logs. HU-2 is characterized by discontinuous sandy to pebbly lenses in a silty matrix. HU-2 was divided into HU-2A and HU-2B, where possible, as individual upward-fining intervals with a pebbly base (Davis, 2005). HU-3 is a confining layer of clay and silt with variable amounts of sand. Units HU-2 and HU-3, however, do not always appear in the sequence illustrated in Figure 2.1. In some logs the entire HU-2 or HU-3 unit is missing. In other logs these units alternate multiple times before they contact the underlying HU. HU-4 is a discontinuous, wellsorted sand directly overlying the Mounds Gravel, where the sand is present. HU-2 through HU-4 are equivalent to the Metropolis Formation. HU-5 defines the Mounds Gravel/RGA and is identified by coarse chert gravels in a silty sand matrix of similar color. HU-6 is a semi-confining surface below the RGA, generally sandy clay to fine sand, and is equivalent to the upper member of the McNairy Formation. Reworked deposits pose a unique problem to the hydro-stratigraphic nomenclature because these units can be found at the same elevation with similar lithology as in-place deposits; however, they are obviously not age-equivalent.



Figure 2.1: Hydrostratigraphic units used for input into the geologic database presented with the chrono-stratigraphic equivalent units (modified from Jacobs, 1997).
Reworking is most likely proximal to drainage features and in the northernmost portion of the study area within the active Ohio River floodplain, and therefore should not affect a site-wide stratigraphic model. Chrono-stratigraphic units (geologic units mapped on GQ maps) are used on all lines of cross-section, thickness and elevation maps. These units are used for all visualizations, as they are the common names referenced to the unit, which fit best into a local stratigraphic framework.

# Geologic Interpretations

All interpreted stratigraphic contacts presented in cross-sections were picked by hand from strip-log profiles created using RockWorks<sup>2004</sup>. Stratigraphic boundaries were drawn manually on all cross-sections using Canvas 8, a 2-D vector drafting program, and scale was preserved on all lines of section. Grid models for isopach maps and structural elevation maps were created from the total available well population using a kriging point algorithm in Surfer 7 software. Color-fills, contour maps and base maps were all created using Surfer 7, and background images were added later to aid in spatial reference.

### Chapter 3. Data

Original data and data from previous studies are referenced in the following section. Locations of surficial investigations are shown in Figure 3.0, a map of the site illustrating points where data were collected, including notes, measurements, photos, orientations, and sampling locations. Clast orientation data may be viewed in Figure 3.1 and raw data are presented in Table 3.0. OSL sample locations may be viewed in Figure 3.2 and field logs from sample collection are presented in Appendix C.

# Surficial Information

Exposures along Bayou Creek and Little Bayou Creek offer the best insight into the near-surface geology of the study area. Previous studies indicate that near-surface sediments are dominantly Pleistocene in age (Table 3.1) (WLA, 2006). Exposures along creeks are complicated by modern fluvial processes. Erosion and deposition by modern processes include fine sediment veneers from back-flooding of the Ohio River, stream cut-and-fill structures from seasonally variable flow, and disturbances from rooting. All surface inspection points from the study area are referenced in Appendix D.

#### Bayou Creek

Bayou Creek flows parallel to Little Bayou Creek in the western portion of the study area until the streams converge approximately 1,100 feet from the Ohio River. Gravel deposits appear in a substantial portion of the creek exposures. Data for Bayou Creek are arranged along geologically similar stream reaches, starting at the southern (upstream) end of the stream and proceeding downstream to the Ohio River.

### First Reach

Surveyed deposits along the southernmost reach, Woodville Road to Acid Road, contain upward-fining, reddish-yellow, medium to fine chert gravels in a sandy matrix atop a massive light-gray clay, with a sharp contact between the two units at ID 130 (Figure 3.3). These sediments appear to be reworked materials from the Mounds Gravel upper terrace and Metropolis Formation (Nelson, 2006). Gravel lenses average approximately 2 feet in thickness and appear throughout this reach.







ID	Northing (UTM)	Easting (UTM)	Strike (degrees)	ID	Northing (UTM)	Easting (UTM)	Strike (degrees)
ID 113	4108987	338002	294	ID 99	4108970	338005	45
ID 113	4108987	338002	320	ID 99	4108970	338005	48
ID 113	4108987	338002	265	ID 106	4110058	337930	86
ID 113	4108987	338002	286	ID 106	4110058	337930	94
ID 113	4108987	338002	20	ID 106	4110058	337930	337
ID 114	4108995	338002	311	ID 106	4110058	337930	75
ID 114	4108995	338002	327	ID 87	4114874	340224	90
ID 114	4108995	338002	291	ID 87	4114874	340224	130
ID 92	4107985	338074	99	ID 72	4114768	340278	70
ID 92	4107985	338074	128	ID 72	4114768	340278	115
ID 92	4107985	338074	161	ID 73	4114645	340323	90
ID 92	4107985	338074	166	ID 73	4114645	340323	100
ID 92	4107985	338074	208	ID 73	4114645	340323	30
ID 92	4107985	338074	98	ID 73	4114645	340323	50
ID 92	4107985	338074	9	ID 73	4114645	340323	45
ID 92	4107985	338074	97	ID 73	4114645	340323	10
ID 99	4108970	338005	328	ID 73	4114645	340323	52
ID 99	4108970	338005	295	ID 73	4114645	340323	310
ID 99	4108970	338005	312	ID 74	4115047	339825	310
ID 99	4108970	338005	42	ID 74	4115047	339825	40
ID 99	4108970	338005	328	ID 74	4115047	339825	85
ID 99	4108970	338005	296	ID 76	4115275	339619	90

 Table 3.0:
 Raw clast orientation data collected along stream exposures.

tion	Section Line	(Feet)	Lab Number	Sampie Material	OSL Age (ka) <sup>4</sup>	Unit
	UKK-1A-1A'	5.8 - 6.0	UIC 1693IR <sup>1</sup>	Silt/Loess	$16.6 \pm 1.2$	Upper Peoria Loess (unit 1)
	UKK-1B-1B'	5.6 - 5.9	UIC 1698IR	Silt/Loess	$19.3 \pm 1.4$	Upper Peoria Loess (unit 1)
	UKK-2A-2A'	4.5 - 4.7	UIC 1695IR	Silt/Loess	$23.5 \pm 1.7$	Upper Peoria Loess (unit 1)
	UKK-2A-2A'	4.5-4.7	UIC 1695IRr <sup>2</sup> (Duplicate)	Silt/Loess	22.3 ± 1.6	Upper Peoria Loess (unit 1)
	UKK-2A-2A'	4.5 - 4.7	UIC 1695IG <sup>3</sup> (Duplicate)	Silt/Loess	$20.6 \pm 1.5$	Upper Peoria Loess (unit 1)
	UKK-1A-1A'	8.4 - 8.7	UIC 1694IR	Silt/Loess	$27.3 \pm 1.9$	Lower Peoria Loess (unit 2)
	UKK-1B-1B'	8.1 - 8.4	UIC 1699IR	Silt/Loess	$23.5 \pm 1.7$	Lower Peoria Loess (unit 2)
	UKK-2A-2A°	7.2 - 7.4	UIC 1696IR	Silt/Loess	$27.3 \pm 1.9$	Lower Peoria Loess (unit 2)
	UKK-2B-2B'	7.5 - 7.7	<b>UIC 1702IR</b>	Silt/Loess	$28.8 \pm 2.1$	Lower Peoria Loess (unit 2)
	UKK-1A-1A'	10.3 - 10.5	UIC 1701IR	Silt/Loess	$34.6 \pm 2.5$	Roxana Silt (unit 3)
	UKK-1A-1A'	9.4 - 9.6	<b>UIC 1700IR</b>	Silt/Loess	$47.2 \pm 3.5$	Roxana Silt (unit 3)
	UKK-2A-2A?	10.8 - 11.0	UIC 1697IR	Silt/Loess	$39.6 \pm 2.8$	Roxana Silt (unit 3)
	UKK-2A-2A'	10.8 - 11.0	UIC 1697IRr (Duplicate)	Silt/Loess	41.1±2.9	Roxana Silt (unit 3)
	UK-2B-2B'	13.1 - 13.4	(awaiting confirmation)	Silt/Loess	50 to 80 (awaiting refinement)	unnamed intermediate loess (unit 4)

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3.1: Ages calculated using Optical
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Table 3.1: Ages calculated using Optical

Hard, light-gray clay is present below the gravels and forms a firm bottom in the creek bed (in locations not covered by eroded gravel deposits). This clay is continuously present along the stream banks and is likely derived from the Metropolis Formation. Loess and modern soil cap the gravel deposits in this area. One OSL sample was collected from a gravel lens at ID 183 and a grain-size distribution curve for this sample is presented in Appendix E. Iron oxide precipitation appears along several sections of the creek, firmly cementing gravels in some locations and occurring as amorphous iron (III) hydroxide ( $Fe(OH)_3$ ) in others (Figure 3.4).

## Second Reach

North of Acid Road until approximately 0.9 miles downstream of Rice Spring Road gravel is continuously exposed with mean clast size increasing up to 2.5 inches along the long axis. Gravels within bank exposures south of Rice Spring Road appear to be modern reworking of the Metropolis Formation while deposits to the north are in place (Nelson, 2006). Gravel deposits along this portion of creek are as much as 300 feet in length and average approximately 3 feet in thickness. Gravels appear transitional with sandy silts in some locations upstream of Rice Spring Road. Light-gray clay crops-out below the gravel deposits in creek banks (Figure 3.5) and is also continuous along this reach with a sharp, undulating contact separating the two units. Clay deposits at various locations along this reach have been mapped as the Porters Creek Clay by Olive (1966).

One soft-sediment deformation feature was noted in a gravel deposit between Acid Road and Rice Spring Road (Figure 3.6). This feature is a thinly laminated silt that penetrates into the gravel sequence bounded above and below by silt. Silts above and below the structure exhibit horizontal lamination. The gravels penetrated show little imbrication and are dark bronze chert clasts with occasional weathered chert and quartz pebbles. The boundary separating the upper and lower gravel zones is similar to other transitional zones along this stretch. A clastic dike mapped in the lower clay deposit by Olive (1966) (near ID 112) was not found, but it was confirmed to exist by Davis (2005). Collection of 2 OSL samples was attempted at locations ID 181 and ID 184; however, cementation of the gravel deposits allowed for the recovery of the ID 184 sample only. A grain-size distribution curve generated during OSL sample preparation is presented in Appendix E. Amorphous Fe(OH)<sub>3</sub> was noted at ID 98 and intense Fe and Mn staining was noted at ID 103. Gravels exhibit a preferred median clast strike of 284° across five locations of this reach (Figure 3.1).

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**Figure 3.3:** Outcrop at ID 130 illustrating the sharp contact between pebble-gravel deposits and underlying clay.



Figure 3.4: Amorphous Fe(OH)<sub>3</sub> precipitating out into Bayou Creek at ID 138.



Figure 3.5: Sharp contact between clay and gravel deposits at ID 152.



Figure 3.6: Soft-sediment deformation feature noted downstream of Acid Road.

## Third Reach

Downstream of ID 159, bank exposures are overgrown and occasionally muddraped north of ID 174 due to agricultural land-use practices. Gravels appear in the bed of the creek along with sand bars, as opposed to the gravel-dominated bed upstream. Additionally, only fine gravels sparsely crop out along banks. Exposures along reach three are covered by modern fluvial deposits and represent reworked loess and finegrained material from the Metropolis Formation. These materials form a surficial veneer along the creek banks. Increasing sand was noted in exposures along with active stream features. Excavation into the banks revealed a buff to tan silty sand overlying dark bluish-gray clay (Figure 3.7). These sediments are likely part of the Metropolis Formation. One OSL sample was collected from the underlying clay unit at ID 182 and sieve analysis is presented in Appendix E. Downstream of ID 175 the stream became nearly impassable because of beaver dams and deadfall. Exposures along this section of stream during the study period were overgrown, flooded and/or inaccessible until the low-water bridge just downstream of ID 63.

# Fourth Reach

Downstream from the low-water bridge to ID 6, the creek takes an easterly course. Stream morphology also begins to change as the stream widens, and gravels once again are present in the stream bed. Diffuse seeps along banks emanate from gravels appearing low in the banks and often precipitate amorphous Fe(OH)<sub>3</sub>. Banks are composed of an upward-fining sequence of gravel to sand to mud (ID 5). Bank sediments are poorly graded and friable with a bleached buff outer surface that is dark brown upon excavation (ID 6). The Metropolis Formation is the source of material in the creek bed and bank exposures, but most exposures appear reworked by modern processes.

#### Fifth Reach

ID 17 (Figure 3.8) marks the location where gravel to cobble sequences appear in outcrop. These continue, where not eroded, downstream to ID 74. These exposures exhibit a sharp, inclined upper contact that undulates on the order of 1 to 2 feet. Gravels show faint imbrication and signs of internal scour. Gravels in bank exposures are derived from the Mounds Gravel and may be in-place deposits or have undergone slight reworking by the current fluvial system.

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Figure 3.7: Outcrop at ID 168 illustrating facies change to silty sand overlying gray clay.



Figure 3.8: Return to well cemented coarse gravel-cobble sequences at ID 17.

These gravels are sharply overlain by a light-tan loess and modern soil cap until the gravels are completely draped downstream of ID 74 by fine sediment deposited by the backflooding of the Ohio River. Elevation of the gravel deposit at ID 17 was measured at 303 to 306 feet above mean sea level (amsl) (Figure 3.0). One OSL sample was collected at ID 178 and grain size distribution from sieve analysis is presented in Appendix #. Clast measurements collected at ID 74 and ID 76 (Figure 3.1, Table 3.1) yield a median long-axis clast strike of 86°.

#### Little Bayou Creek

Little Bayou Creek flows along the eastern portion of the WKWMA and has undergone channelization along its northern reaches, resulting in good geologic exposures. Institutional controls for health hazards are in place along the southernmost portion of the creek, so it was not surveyed. However, a previous study by SAIC (2004) was referenced for descriptive purposes along this section of the creek. Surficial data are presented along geologically similar segments of the creek.

#### Sixth Reach

SAIC (2004) indicates no exposures south of the lowest portion of the terrace slope defined by Jacobs (1997) along Little Bayou Creek. Upstream of McCaw Road, clay crops out in the bank as much as 2 feet above stream level. The stream dissects into this unit (SAIC, 2004). A layer of thin massive silt (1 foot thick, immediately upstream of McCaw Road) and modern soil cap the clay (SAIC, 2004). The exposure height increases between McCaw Road and Ogden Landing Road. Massive silt (6 feet thick) appears in a 9-foot-high exposure, over the clay, with vertical to sub-vertical fractures along a 30-foot-long exposure midway along this reach. Immediately downstream a 50-foot-long exposure contains a 6.5-foot-thick layer of medium-grained, silty sand grading to massive silt, which is separated from the underlying weathered clay by a gravel-rich contact (SAIC, 2004). This sequence continues with a total height of 6 to 8 feet for approximately 200 feet along the stream (SAIC, 2004). The silt along this reach represents undifferentiated loess.

# Seventh Reach

North of Ogden Landing Road to ID 34, pebble and sand lenses appear frequently in the massive silt that caps the clay unit subcropping below the stream (Figure 3.9). These lenses appear partially iron cemented and are as much as 19 feet in length with an average thickness of 1 foot. At ID 34 and progressing downstream, clasts within lens-shaped deposits increase to gravel and cobble size and appear in banks until ID 36. Sediments along reach seven are reworked material from the Metropolis Formation and loess deposits. Exposure was limited from this point downstream to Anderson Road, but cross-bedded coarse gravel bars (modern) were noted in the stream.

#### Eighth Reach

The largest natural outcrop of the study area is located approximately 0.3 mile downstream of Anderson Road at ID 43 (Figure 3.10). This large exposure is a model for all exposures starting at ID 42, where fine-grained silty sand is noted in the banks and continues until channelization has occurred 0.7 mile downstream. This exposure represents the upper portion of the Metropolis Formation capped by undifferentiated loess. Outcrops along this reach consist of 5- to 15-foot vertical banks of tan to white silty sand with stringers of iron cement over a creek bed of hard, mottled, light gray clay, which is covered occasionally with an eroded sandy veneer. Weakly cemented sand layers eroded from exposures occur occasionally along this reach as "flagstone" along the creek banks. One OSL sample was collected at ID 43 and a grain-size distribution curve from sieve analysis is provided in Appendix E.

Where channelization begins, the creek bed takes a new form. Increased sand in the bed is noted along this reach with seeps and boils forming along the banks and in the bed. Water temperatures from seeps and boils differ significantly from stream temperatures in summer and winter, which indicates these features to be areas of groundwater discharge (LaSage, 2004). Bank lithology, however, remains a massive silt to silty sand until ID 83.



Figure 3.9: Pebble lens downstream of Ogden Landing Road.



Figure 3.10: Large outcrop at ID 43.

## Ninth Reach

Interbedded dark gray clay, orange sand and tan silt are present upon excavation of the surface veneer at ID 83 (Figure 3.11). The dark gray clay, however, only appears locally on the northeast bank, and dark gray to black clay is seen washing down the same bank in other locations. This is a modern feature, influenced by sediment delivered from the nearby TVA ashponds.

Gravel deposits crop out along both creek banks approximately 90 feet downstream of ID 84 until ID 72. Exposures along this portion of the ninth reach illustrate the Metropolis Formation / Mounds Gravel contact. This contact was confirmed by Nelson (2006) and consist of an estimated 2-foot gradational interval where preserved. The Metropolis Formation and/or Sangamon Geosol (Loveland loess unit) cap the Mounds Gravel along this reach. The Mounds Gravel deposits are iron stained, weakly to well cemented, and reddish-brown in color. Clasts have a bronze patina and are gravel- to cobble-sized. The sandy matrix of the unit retains the reddish-brown color. Elevation of the gravels at the start of the exposure is 318 feet amsl and undulates +/- 1 foot along the exposure at measured locations. In high banks (where preserved) the Metropolis Formation consists of orange and gray silty sand and weathered-brown chert gravel, with a gradational contact between the two units. In other locations, silty sand or silt loess beneath modern soil overlies the gravels, and a gradational contact separates the upper sediments from the gravel deposits. At the start of the gravel exposure a medium gray clayey silt is present below the gravels, but the clay is not visible further downstream as the gravels sub-crop below stream level (Figure 3.12). Two OSL samples were collected at ID 179; one in the gravel deposit and one in the underlying clayey silt. Sieve analyses of these samples can be viewed in Appendix E.



Figure 3.11: Interbedded silts and clays at ID 83.



Figure 3.12: Start of gravel deposit overlying gray clay.

Gravel deposits continue to be exposed from ID 72 until slightly beyond ID 77, where they become masked by silt drapes and bank erosion. The extent of exposures depends greatly upon the season and recent stage of the Ohio River. Deposits along this reach differ slightly from those downstream as cementation is mostly or completely absent and the sandy matrix of the unit is a yellowish-tan instead of the reddish-brown color of the clast. Sediments from ID 72 to ID 77 retain the bronze patina indicating Mounds Gravel, but have been reworked by modern fluvial processes. Massive silt overlies the gravel deposits and good exposures are available because of the channelization/rerouting of the creek. The overlying silt, while not indicating bedforms, does contain various leach zones and a sandy contact where it merges with the underlying gravels (Figure 3.13). This silt represents in-place undifferentiated loess. Elevation of the gravel deposits ranges from 310 to 313 feet along this reach and modern sediment drapes had to be excavated prior to measurement in some areas. Two OSL samples were collected at ID 177, one in the upper silt unit and one in the gravel unit. Sieve analyses of the samples is presented in Appendix E. A preferred fabric in clast orientation for the gravel deposits was also noted at ID 69, ID 72, and ID 73, and orientation measurements from these locations indicate a mean clast strike of 76° (Figure 3.1, Table 3.0). Downstream of ID 77 to the Ohio River exposures are heavily masked by modern deposition.

### OSL Data

OSL results are still pending. Neutron activation data are required for age calculations and these data have not been received from the USGS luminescence laboratory. Using a range of dose rate values recommended by Owen (2006), OSL data appear to be erroneous. Data at ID 177 do not follow the law of superposition. All aliquots sampled at ID 177 appear much younger in the lower gravel unit than in the upper silt unit. Other samples from the Metropolis Formation exhibit ages much younger than the loess ages presented in Table 3.1. These results are inconsistent with the known stratigraphy of the site.



Figure 3.13: Outcrop at ID 69.

### Subsurface Data

Borings conducted from previous site investigations were the primary source of subsurface data on underlying geology. Spatial distribution of selected borings (Figure 3.14) resulted in adequate resolution for site-wide geologic assessment. Surface elevation of selected borings ranged from 415 feet to 322.5 feet amsl and the deepest borings penetrated into limestone bedrock 350 feet below the surface. Boring logs from continuous sediment cores yielded the most useful information, while discrete interval sampling generally provided information on lithologic boundaries. Data quality ranged from excellent to poor and every attempt was made to confirm the accuracy of data before they were used for interpretation. In most wells deeper than 80 feet, three to four distinctive boundaries were discernable by changes in color, grain size and mineralogy.

Stratigraphic interpretations of data have been assembled from surficial and subsurface data. Subsurface data are presented in isopach maps, structural elevation maps, and cross-section profiles. Surficial data were used to aid in identification of stratigraphic units, understand the spatial distribution of lithologies, and interpret depositional environments.

#### Structural Elevation and Thickness

Limestone bedrock dips to the south (Figure 3.15). Six additional boreholes from outside the study area were added to increase the resolution of Figure 3.15 (Figure 3.16). A bedrock low underlying the study forms a lobe striking to the north. This low drops 63 feet across the five borings that penetrate bedrock directly underlying the site. A small structural high appears immediately south of the terrace slope and bedrock elevation varies 28 feet on opposite sides of the terrace slope. The median elevation of bedrock in Figure 3.15 is 42 feet amsl. The overlying Tuscaloosa Formation had insufficient data points to create a structural elevation map.



Figure 3.14: Spatial distribution across the study area.





Figure 3.16: Map indicating boreholes used outside of the study area (modified from Davis, 1996).

The McNairy Formation overlies bedrock through most of the study area and exhibits a 122-foot elevation change across Figure 3.17. Most of the elevation change is in the southern portion of the study area where elevation changes abruptly from 180 to 270 feet amsl. The elevation change for the McNairy Formation appears less prominent in the southwestern portion of the study area, but this may be related to reduced well control in that region. North of the terrace slope an additional zone of irregularity is noted. This zone strikes northeast, perpendicular to the Ohio River. The Porters Creek Clay (Figure 3.18) is preserved south of the terrace slope (Jacobs, 1997) and dips to the east. The Eocene sands sparsely occur in the study area and insufficient data were present to create a structural elevation map of the unit.





The Mounds Gravel shows a similar pattern to the McNairy Formation (Figure 3.19), with rapid elevation change in the southern portion of the study area, southward to the terrace slope (Jacobs, 1997). The highest elevation of the Mounds Gravel appears in the southwest of the study area at 412 feet amsl, and elevation decreases 147 feet to 265 feet amsl in the northern portion of the study area. The Mounds Gravel trend also is similar to the McNairy Formation trend: elevations are higher along the western border of the study area, and a similar zone of irregularity is displaced in the northeastern quadrant.

The Mounds Gravel was the deepest unit with sufficient data points to create an isopach map (Figure 3.20). Thickening of the unit occurs in two distinct locations, along a northwest trend, parallel to the terrace slope (Jacobs, 1997) and along the same anomalous northeast strike noted from the Mounds Gravel and McNairy Formation structure contour maps. The thickness of the Mounds Gravel varies from 80 to 2 feet with a mean thickness of 29 feet.

The Metropolis Formation blankets the Mounds Gravel with a gentle dip toward the Ohio River (Figure 3.21). The average elevation for the Metropolis Formation is 353 feet amsl in the study area. The elevation drops 168 feet from the terrace slope to the Ohio River floodplain. Figure 3.22, an isopach map of the Metropolis Formation, displays a median thickness of 27 feet, with thinning occurring along dip, nearing the Ohio River.

Undifferentiated surficial loess caps all formations. The loess has a median thickness of 15.5 feet (Figure 3.23), which increases in structural lows of the Metropolis Formation structure-contour map (Figure 3.21).

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## **Geologic Sections**

The location of geologic cross-sections is presented in Figure 3.24 along with the borings used in each section. All cross-sections are presented at 50 times vertical exaggeration. Lithologic and stratigraphic identifications for all cross-sections are presented on section A-A' and are consistent through all lines of section.

## South - North Sections

The westernmost profile, A-A', is presented in Figure 3.25, and clearly illustrates the truncation of Porters Creek Clay by the Mounds Gravel. The Mounds Gravel directly overlies the McNairy Formation north of the terrace face between boreholes 20 and 13 on A-A'. Profile A-A' additionally illustrates thickening of the Metropolis Formation and Mounds Gravel to the north of the terrace face.

Crossing the center of the site, profile B-B' (Figure 3.26) illustrates the same truncation of the Porters Creek Clay, but an elevated and irregular McNairy Formation appears north of the terrace face between S-18 and MW-158. This juxtaposition indicates that the Mounds Gravel has dissected into the McNairy Formation in the northern portion of the study area. The Metropolis Formation caps the Mounds Gravel and has a relatively uniform thickness compared to the Mounds Gravel.

Across the eastern portion of the study area, profile C-C' (Figure 3.27) illustrates the full stratigraphic record of the area. Eocene sands are present at the southern flank of the section between AH-203 and MW-346, and the Porters Creek Clay extends north until it is truncated at boring MW-122. Between boreholes MW-122 and MW-345 there is a significant elevation change in the top of the McNairy Formation. The formation continues at this new elevation through the rest of the section. The Mounds Gravel thickens between borings MW-346 and MW-345, filling in the terrace slope. However, the unit appears to vary in thickness as the Metropolis Formation dissects into the unit at borings MW-122 and S-15.










### West - East Sections

Sub-parallel to the Ohio River, profile D-D' (Figure 3.28) exhibits a subtle change in the McNairy Formation elevation at the western most extent of the sections; however, the elevation is consistent through the rest of the section east of boring 14. The Mounds Gravel thickness undulates throughout the section, thinning at the eastern most limit. A thick Metropolis Formation is preserved east of boring 13.

Profile E-E' (Figure 3.29) cuts across the southern portion of the study area. The Porters Creek Clay is preserved through the length of this section. The terrace face occurs east of boring AH-210, where a deep sequence of Mounds Gravel deeply incises into the Porters Creek Clay. The Mounds Gravel and Metropolis Formation thicken to the east of the section.





Unknown

50

#### Chapter 4. Discussion

#### Deposition and Geologic Units

Data and results of this investigation support previous interpretations of the general depositional environments discussed in the introduction. There is, however, significant influence of paleotopography and possibly tectonic structures on these environments. In the study area, the structural elevation of the McNairy Formation exhibits areas of disruption striking to the northeast, in the center of Figure 3.17. These disruptions are along the trend of faulting across the Ohio River in the Joppa (IL) and Metropolis (IL) GQ maps. Further evidence of disruption is present along profile B-B' (Figure 3.26), where the upper surface of the McNairy varies substantially in elevation between boreholes S-18 and 005-013. A similar phenomenon is present to the east along profile C-C' (Figure 3.27) between MW-346 and MW-122. This elevation change may have led to increased erosion of the Porters Creek Clay in the southeastern portion of the study area.

Scour by the ancestral Tennessee River has been interpreted as having formed the terrace slope (Jacobs, 1997). This is well represented by the steep slope of the Porters Creek Clay in Figure 1.2. The paleocurrent direction of the ancestral Tennessee River was probably similar to the orientation of the modern Ohio River. Assuming the long axis of gravel is oriented perpendicular to flow, to roll along in bedload, clast orientations can be used as crude paleocurrent indicators. Orientations of long-axis clast strikes measured from exposures along Little Bayou and Bayou Creek averaged 284° in the south and 76° in the north (Figure 3.1), indicating an east – west component to flow.

The ancestral Tennessee River occupied a much broader valley than the current Ohio River floodplain. The southern extent of the incised river during the Pleistocene stretched from the terrace slope (Figure 1.2) in Kentucky to the High Mounds contour on the Joppa (IL) geologic map (Nelson and Masters, 2006). These two features form a steepsided valley created by down-cutting of the ancestral Tennessee River.

The Porters Creek Clay and Eocene sands are terminated by the terrace slope in the southern region of the study area. Truncation of the Porters Creek Clay is best illustrated on profile A-A' (Figure 3.25), but also appears on profile B-B' (Figure 3.26) where it is slightly complicated by the elevated McNairy Formation. The use of the term "Terrace Slope" may be misleading when referring to this truncated surface. While the Mounds Gravel has been deposited by the ancestral Tennessee River in terraces across the site, the feature causing truncation of the Paleocene and Eocene units is better described as an erosional scarp. This

scarp is identified from the steep surface left on the structural elevation map of the Mounds Gravel base (Figure 4.2) and along profile A-A' (Figure 3.25).

Comparison of structural elevation maps and isopach maps (Figures 3.19 to 3.23) indicates that deposition of post-Eocene units mantled the pre-Eocene topography. Structural lows in the underlying McNairy Formation (Figure 3.17) tend to be overlain by increased thicknesses in the Mounds Gravel (Figure 3.20). In some cases, increased thicknesses may be due to infilling of paleotopographic lows, while in others increased thickness may have resulted from scouring into underlying units. Scouring of the Mounds Gravel into the Porters Creek Clay is evident on profile E-E' (Figure 3.29) at borehole AH-210. Scouring of the Metropolis Formation is present along profile C-C' (Figure 3.27) at boreholes MW-122 and S-15. Evidence of such cut and fill is also present in Metropolis Formation exposures along Bayou Creek (Figure 3.5).

Diversion of the ancestral Tennessee River into Smith Gap, IL, during the mid-Pleistocene (Nelson et al., 1999) led to a significant change in regional drainage. As sluggish, underfit streams (with deposits preserved in the Metropolis Formation) overtook the previous, broad braided-stream valley filled by the Mounds Gravel, upward-fining, gravel to silt sequences developed along meandering tracks within the paleovalley (Nelson et al, 1999). Slow aggradation of sediments in this environment resulted in weak soils development locally during inter-fluvial periods of Metropolis Formation deposition.

In the study area, numerous upward-fining sequences are noted in the Metropolis Formation with great spatial variability across the site. On profiles C-C' and E-E' (Figures 3.27 and 3.29), areas of thick, upward-fining, sharp-based Metropolis Formation lie above the thin Mounds Gravel. These likely represent scours into the Mounds Gravel due to changes in the fluvial system and deposition of small channel fills.

Evidence of cut and fill is presented in Figure 3.5 and weak soil development is noted in Figure 3.7, both from Metropolis Formation exposures along Bayou Creek. No large paleochannels were noted in outcrop exposures in creeks. Lateral traceability of internal units in the Metropolis Formation (HU-2 – HU-4) is also difficult on a site-wide scale due to the nature of deposition.

#### Geologic Age Dating

Preliminary results of OSL analyses appear inconsistent with the stratigraphy of the site. Data do not follow the law of superposition, nor fit into the stratigraphic context of the study area presented in Figure 1.2. Recrystallization and the depletion of radionuclide concentrations can both cause a reduction in the luminescence signal. Failure of the OSL method is likely due to bioturbation and illuviation of grains, resulting in the stratigraphic "leakage" of younger grains into the horizon sampled. As infiltrating water and roots disrupted sediments, the radionuclide concentrations were likely reduced by the introduction of younger particles, resulting in age calculation errors. Zones of cementation (iron oxide) and mineralization (manganese) noted in outcrops also likely affected the luminescence signal, causing recrystallization that resulted in younger age calculations. Based on these preliminary results, it does not appear that the OSL method is effective for dating sediments in an environment that includes pronounced infiltration and bioturbation.

#### Site Implications

The RGA is the primary aquifer at the site, and is of concern because of contamination. Consisting of the Mounds Gravel, the RGA is a semi-confined aquifer. The Metropolis Formation contacts the upper surface of the RGA while the McNairy Formation forms the underlying confining unit in the study area. Several depositional relationships have influenced the RGA. In coarser sequences of the Metropolis Formation (HU-2A – HU-2B), higher hydraulic conductivity is likely, which would allow groundwater and possibly pollutants to preferentially flow into the RGA. Incision of the Metropolis Formation into the Mounds Gravel, resulting in thinning of the RGA, also probably altered aquifer properties. In these areas, hydraulic conductivity values of the RGA could be lower.

Understanding the distribution of the Mounds Gravel will aid in understanding contaminant transport through the RGA. As such, it is useful to view the current contaminant plumes in relation to site geology and discern possible controls that might affect pollutant migration. The units confining the Mounds Gravel consist of clay and silt, which have a drastic contrast in hydraulic conductivity compared to the Mounds Gravel (Domenico and Schwartz, 1998). This contrast limits vertical groundwater and contaminant propagation (Clausen et al., 1992; Jacobs, 1997).

Groundwater flow in the study area is to the northeast (Figure 4.0). The year 2000 TCE plume boundary map indicates two distinct lobes of contamination, both traveling to the northeast, away from the terrace slope (Figure 4.1).



**Figure 4.0:** Hydraulic heads in the RGA from 1997 data, contour interval 3 feet (modified from Fryar et al., 2000).



Figure 4.1: TCE plume boundary from year 2000 data.

The limit of vertical contaminant migration is the base of the Mounds Gravel (Figure 4.2). When the year 2000 TCE plume boundary map is superimposed on a structural elevation map of the base of the Mounds Gravel, a structural high corresponds to plume bifurcation (Figure 4.3). Also, when an isopach map of the Mounds Gravel (Figure 4.3) is overlain with the year 2000 TCE plume boundary map, there is a correlation between contaminant migration and Mounds Gravel thickness. As the plume crosses Little Bayou Creek in the northeast quadrant of the study area, the Metropolis Formation is thin (Figure 3.22) and the upper surface of the Mounds Gravel is mapped in outcrop downstream at ID 84 (Figure 3.0) at 318 feet amsl. Spring-water samples from this area indicate TCE concentrations greater than the maximum contaminant level set by the USEPA (Fryar et al., 2000). These contaminated discharge points indicate the connection between the RGA and surface water (Fryar et al., 2000). The interconnection of the Mounds Gravel with surface exposures was not obvious from the Joppa (KY) GQ (Finch, 1967).





Faults mapped by the ISGS in the Joppa (IL) and Metropolis (IL) GQ maps also postdate geologic maps of the study area in Kentucky. These faults are co-linear to the northeast – southwest oriented zones of irregularity noted on the McNairy Formation and Mounds Gravel structural elevation maps in this study (Figures 3.17 and 3.19). The timing of such faulting is hard to pinpoint. Nelson et al. (1999) indicate faulting in southern Illinois has been noted to displace the Metropolis Formation. However, the structural elevation map (Figure 3.21) and all geologic profiles (Figures 3.25 – 3.29) do not illustrate displacement of the Metropolis Formation across the river in Kentucky.

The soft-sediment deformation feature noted along Bayou Creek (Figure 3.6) is not interpreted to be a seismite. This is because the widespread occurrence of similar features has not been noted in the same unit, one of the conditions that identifies seismites (Greb and Dever, 2002). This deformation feature most likely formed during deposition as pore pressure in the fine sediment exceeded the confining pressure of the overlying gravels (Figure 3.6). Overpressurization in fluvial sediments caused by hydraulic-head differences (artesian-pressure differences), usually following flooding, can trigger fluidization and form sand dikes (Kolb, 1976; Li et al., 1996). Liquefaction of the soil probably occurred at this point, allowing the underlying fine soil to became suspended in pore fluid and injected into the unconsolidated gravels above.

Deformation features are also noted in the Porters Creek Clay. Olive (1966) mapped one clastic dike in the Heath GQ map. Amick (2005) indicated these features were commonly evident in borrow pits that had once operated in the area. Similar clastic dikes form throughout the Jackson Purchase region in the Porters Creek Clay and have been interpreted to be seismically related (Hendricks, 2000).

Faults propagating from the FAFC likely influence the erosional scarp left by the ancestral Tennessee River and Mounds Gravel deposition. This is due to the local dip to the south of the erosional scarp (Figure 1.2), correlating with both the zone of irregularity previously noted on structural elevation maps and with northeast – southwest thickening of the Mounds Gravel (Figure 3.20), all along the same strike.

Supporting this hypothesis is the undulating upper surface of the McNairy Formation noted on geologic profiles (Figures 3.26 - 3.27). In the northeastern portion of the study area, faulting mapped on the Joppa (IL) geologic map (Nelson and Masters, 2006) also correlates with contours of an erosional surface of late Cretaceous and Paleocene units mapped on the Joppa (KY) geologic map by Finch (1967) (Figure 4.4).



Figure 4.4: Joppa (IL) (Nelson and Masters, 2006) and Joppa (KY) (Finch, 1967) GQ maps.

Langston and Street (1998) have proposed a structural control on contaminant transport at the site. Based on a comparison of plume position, structure contour maps, and isopach maps in this study, it is likely that a combination of factors controls the RGA flow system. These factors include thickness and channel trends within the Mounds Gravel, which sometimes correspond with structural lows of the McNairy Formation paleotopography. Along with faulting and possibly fracturing, zones of thick gravels may offer preferential pathways for groundwater / contaminant transport.

#### Conclusions

Near-surface sediments underlying the Paducah Gaseous Diffusion Plant and surrounding area are highly varied because of the fluvial depositional environment in which they formed. This variability manifests itself mostly in the Metropolis Formation, where underfit streams filled the broader braided-stream valley in which the Mounds Gravel was deposited. Separating the Mounds Gravel and Metropolis Formation from the previously defined Continental Deposits aids in making the distinction between the two different depositional environments and resulting deposits.

Zones of irregularity in the McNairy Formation and Mounds Gravel also complicate the near-surface geology. These zones appear to be caused by faulting from the FAFC. This faulting has affected the Mounds Gravel by limiting the deposition of the gravel from structural highs created in the McNairy Formation, by creating zones of preferential erosion in post-Miocene units, by direct uplift of stratigraphic units including the Mounds Gravel, or by a combination of all these factors.

Faulting at the site is not well understood and will require future study. At this time, spatial resolution of data in the study area is not adequate to extend faults presented on adjacent geologic maps of southern Illinois. High resolution seismic profiles along areas of irregularity noted in the structural elevation maps and geologic profiles may assist in defining faults and illustrating potential pathways for contaminant transport.

Understanding the geology of the units impacted by contamination is the key first step in predicting future contaminant transport. The lithologic and stratigraphic database provided to the PGDP for inclusion in a new data warehouse program should enable future researchers to better understand and model the hydraulic properties of the RGA.

## APPENDIX A

Lithologic logs of boreholes used in geologic profiles. All boreholes appear as they did in their respective references

Borehole Identification	Page Number	<b>Borehole Identification</b>	Page Number
AH-114	77	MW-197	155
AH-203	78	MW-215	159
AH-208	79	MW-217	161
AH-210	80	MW-219	163
AH-211	81	MW-239	165
AH-212	83	MW-346	174
AH-328	84	S-14	180
DB01	85	S-15	184
MW-120	97	S-18	187
MW-121	104	S-19	192
MW-122	111	3	195
MW-140	118	11	196
MW-144	124	13	197
MW-158	129	14	198
MW-161	133	15	199
MW-163	136	18	200
MW-183	140	19	201
MW-185	144	20	202
MW-188	148	27	203
MW-193	151	29	204
MW-196	155	31	205

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Slev. Tyre	of surf. 385" Elev. of Fm. Tops of well B-40 Monthle Drill Auger Driller F. Wron Material	Tu-325" ik Thickness Deg :: (ft.)
Slev. Type unit	of surf. 385* Elev. of Fm. Tops of well B-40 Mobile Drill Auger Driller F. Wron Material	Tu-325* ik Thickness Dep :: (ft.) (ju.)
Slev. Type Unit	of surf. 385" Elev. of Fm. Tops bf well B-40 Mobile Drill Auger Driller F. Wron Material Silt, yellowish-brown slightly early in part, pobly returns from 20"	Tu-325* ik Thiokness Der : 1 (ft.) (1) 30
Slov. Type	of surf. 385* Elev. of Fm. Tops of well B-10 Mobile Drill Auger Driller F. Wroo Haterial Silt, yellowish-bfown slightly early in part, pobly returns from 20*	Tu-325* ik Thickness Dep :: (ft.) (j) 30 30 60
Slov. Tyre : Unit	of surf. 385" St well B-40 Material Bilt, yellowish-brown slightly early in part, pebbly returns from 20" Onevel Bund, yellowish-gauy, fine-modium, contains lungs on thin lawar of light gaux elay	Tu-325* ik Thilekness Der : 1 (rt.) (1) 30 30 30 60 20 80
Slov. Tyre Unit	of surf. 385* Elev. of Fm. Tops Driller F. Wron Natorial Silt, yellowish-brown slightly early in part, pobly returns from 20* Gravel Sand, yellowish-gray, fine-molium, contains lungs on thin layers of light gray diag	Tu-325* ik Thiokness Der : 1 (ft.) (1) 30 30 30 80 20 80
Slev. Tyre	of surf. 365" Elev. of Fm. Tops of well B-10 Mobile Drill Auger Driller F. Wron Haterial Silt; yellowish-brown slightly early in part, pobly returns from 20" Oraval Sund, yellowish-gray, fine-modium, contains lungs on thin layers of light gray clay TD-80"	TW-325* ik Thickness Det :: (ft.) (1) 30 30 30 60 20 80

# AH-208

## W 4675- 57650

.

Qued. Heath County Kantucky Coord Discriptive location McCracken ource of Data 0.85 mi. II. Spring Deyou Creedato Elev. of surf. 362 (very little valerilev. of Fm. Tops Thre of wall 395"	208 1 Ly H. H. D d. S1,104,5 293,4	5) 7 1
B-40 Hobile Drill Augor	Thickness	Dopth
Silt, sendy and pebbly in part Gravel in clay matrix Clay, dark gray and yellowish brown in upper 13' dark gray to lower 2' - upper part is deeply weathered	17 6 15+	23 38
		1
		]

Tp c J Quad. Discr burc	Bosth Bosth iptive location of vatertable	RGA TOP ? EOT - 316 TPL TOP - 216 M. 1 1.2 ml. County 1.2 ml. County 1.2 ml. County	.ti McCrachon	AH-21 E 238-545 Read the D Longert by Kontucky Co Date	0 38 505 0.6-1.9 7.730/64	2/0
Elev. Type Unit	of well B-NO He	Matorial	Elev. of Drill	Pn. Topa lor 7. Pr	31.6°	Der
)	Stitt, yellowist lestimated yellowish lestimated Oravelly, fine Sund, fine gray light gray Onavel, coarse Clay, dark gray	ai h brown greding ist andy light gray ai brown sendy silt, w in part. ined, yellowish brow clay streaks - land	about 12° int Ny for 2 or 3° Ith southered p m, silty-argil ime?	o finaly and back to obblas	23 5 7 28	2 2 3 6 6
1					t.	



AH-211		
W 3350 - N2 400	• .6	211) 2
bole to	1. 1. 611	20
Quals Heath Grants MoGracken Served; G	1110 302	,950 ,200
	Los) 287	
Silt, (easier drilling at 45") grading downward (at 45"?)	55	55
Into sendy silt, non-calculatedas.	26	83
Sand, and light grayish brown olay with blabs of fine grained soul, soft.	22	105
Clay, light grayish brown with blobs fine grained sand, compact, zicaccous.	2	107
······································		71

inad. Discr ( ure Elev. Elev.	Heath Gounty McCracken iptive location 1.15 mi. W. Harmony Cem Wes of Data Bayou Crock of watertable of surf. 363' = 6L Elev.	2. 325 Kentucky Coord.31,103, t Bank of Date 0/11/64 of Fm. Tops 273 (TKcm)	212 1
Туре	of well B-40 Mobile Drill Anger Dr	iller F. Wreck	Der tit
Unit	Matorial -	(ft.)	(15.)
	Road fill and silt	8	8
	Gravel in sand matrix, reddish-brown Silt, yellowish-brown, slightly sandy to very	sandy 19	15 34
	Sand, fine-medium, clayey, reddich-brown. Pu hit at 37	liked and sampled 15	49
1	Gravel	. 41	
	Sand and clay interlain, mottled orange and 1 grading downward into dark gray	1cht gray 10	100

AH-328		
E4094 - N3556		
-	C	
Hole No	0903	8.75-0.3
Qual, County Hocrachan Entraly C Disuria thethonstice 0.65 at. K. Carneal Chapel on E. alde Ey. 30	000-1,115,7 300,3	50-
GL= 374' GL= 374' GL= 267'	(Then) NOT	z
in the second seco	"ne.	Le stil
Stilt, yellow-brown, thin layer gravel @ 28'	43	43
Pebbly silty yellow-brown send with stringers of gravel	30 34	107
Sand, dark gray very fine grained, argillaceous, and alayey, dark gray, sandy - no glamoonite	±.	107
· · · · · · · · · · · · · · · · · · ·		i
NOTE 1-29-65 Toc at 267'		

LITHOLOG	GIC LO	OG			BC	RING/WELL NO: DB01	PAGE 1 of 12	
Facility: Padu	icah Ga	aseous Di	ffusion P	lant	, Pa	Paducah, KY Site: Site 3A		
Project No: D	O 110				Clie	ant/Project: USDOE/PGDP Site 3A Se	smic Assessment	
Contractor: S	AIC				Dril	Contractor: Miller Govt Services	Driller: Robert Stiles	
Drill Start (tim	ne/date)	: 13:30 o	n 02-18-	02	Dril	End (time/date): 15:12 on 02-21-02	Borehole Dia: 6 inch with 4-inch core	
Drill Method/9	Rig Typ	e: Versa-	Sonic				Total Depth: 359 ft	
Logged By: K	enneth	Davis (S	AIC)		Co	ordinates: E -3062.74 N -7132.19	Protective Level: D	
	SAMPLE		RESULT	HEA SAF	ETY	1	004/94	
00 INTERNAL	NUMBER	HELCOVERY	- 21	yoo	840	LITHOLOGIC DESCRIPTION	LOG COMMENTS	
	١	37	NA	-	-	Gravely, Sit (ML), boxen (10Y/M/3), frm, etginty most Set (ML), median plasticity, light brownish yellow (10Y/RGH) motiled with light gray (10Y/RTH), frm, moist	Residuant, MPK 501, MPK Daniel (1 2 inch diamated)	
	2	a	NA	-	-	Sill (ML) as above, but light brownish pray (107/96/3) Sill (ML) as above, but pain brown (107/96/3) motified with spin pray (107/92/1)		
1000						City (CL) modum plantarly, pair brown (10976/2) models with bits may (16972/1), fam. model	20-35% all	
	3	6.5	NA.	-	-	Clay (CL) as above, but yellowish brown (1071644), moderately soft grading downward to brownish yellow (10716/6) motiod with yellow (1071676) and light gray (1071674), soft		
		63	NA.	-	-	Clay (Cl.) as above, but yallow (10YR/N) method with light gamy (16YR/Y1), firm		
2 2 	5	11.0	NA	_	_	Clay (CL) as above, but browsish yokee (101716/1) motiod with light gay (10711071) Clay (CL) as above	Trace medium to coame Gravel (up to 1.5-trah diameter) from 21-04 ti bgs, rounded to extraordied, chert	
25						Citey (CL), machum piastichy, light gray (1911771) motified with boownish yellow (1911978), grading downward from firm to soli, motif	30-35% e#	
						Cley (CL), medium planktly, light gray (1699824), fam, molet	80-85% ell Trace medium gravel (up to 0.4-inch diameter), eutrounded	
20 ///								

L	LITHOLOGIC LOG BORING/WELL NO: DB01							PA	GE 2 of 12
Fa	cility: Pac	ducah (	Gaseous	Diffusion	Plar	nt, P	aducah, KY	Site	Site 34
Pro	oject No:	DO 110	0			CI	ent/Project USDOE/PGDP Site 3A 5	Seismie	Assessment
Co	ntractor:	SAIC				Dri	Il Contractor: Miller Govt Services	Гра	fer: Bohort Stilee
Dri	il Start (ti	me/dat	o): 13:30	) on 02-18	3-02	De	End (time/date): 15:12 on 02:21.02	Bos	abole Dia: 6 loch with 4 loch core
Dri	II Method	Pig Ty	pe: Vers	a-Sonic			- Cho (unievolate). 15:12 01 02-21-02	Tet	andre biel o inch with 4-inch core
Log	gged By:	Kennet	th Davis	(SAIC)		ICo	ordinator: E 2022 74 N 7122 42	Deel	in Depth: 359 it
	1	SAMPLE		8PT	HE	ALTH	Ordinates. E -3062.74 N -7132.19	1910	iecove Level: D
00.01	INTERNAL	NUMBER	RECOVER	1 6444	1.00	law		GRAP	ne l
	111		1 -	- 20	1	-	CINOLOGIC DESCRIPTION	1.00	COMMENTS
	<i>\///</i>		1				1		3
Ι.			1	1			Cher Million alterna bus lists and the second second		3
			1				antimeter year water (1017R/str)		Trace coarse gravel (up to 1-exch diamater), substrunded to rounded
1 -	<i>\///</i>						1		3
1 -			1						3
I	////						City (CL) as above		
35	1///	6	8.0	NA	-	-		200	ST.
-			1			E			3
							Sill (ML), medium pleaticity, brownish yallow (107/Feys)	100	8
-	2///			1			motified with light gray (109/10/1), moderately-fem-to-fem, most	1000	25-00% skey
-									a
	mmr			1	-	-			8
40_	111111							222	8
							Silt (ML) as above, but light gray (10//R211)	<b>688</b>	
-							Sill (ML) as shown		Trace medium to come gravel (up to 1.5-inch
		1					Sandy Sill (ML), medium plasticity, motified light gray	222	d Section, named to veri rounded
		- 1		1 1			(10YH2V1) and yellow (10YP2V1), firm, molet	1222	40% the set (subargular, quarts) 10% Cay
		7	11.5	NA	-	-	Sit (ML), medium planticity, years (10/14108), and, recent		married, quert and race opaque invente
45_		- 1		1 1		H	with light gray (107/R011), fars, most	<u>  </u>	damaint, party grated, marcled
		- 1				ł	with light group (10//RD11) moderately from moint to well		mended to subsequity) 30% are 15% paired
		- 1							1
-		- 1					Clay (CL), medium to high planticity, gray (7 Sythern).		
						1	Seri, svojat		20% Sit, masks
-	<b>/////</b>	+			$\rightarrow$	+			
"J						1	Sit (ML), medium plasticity, light gray (10/47071) motion		25% day, contains black of the same (10%).
						Ľ	way pase brown (10YEDN), Sine, most	1.2.2	subsingular and all (KO%) with some marganese
-						Ň	sally cleaned with Saind (Seld), norginatic, wary pain brown 10/767/4), isose, wel		Well graded: 50% gravel (up to 1 ench diameter, automatical): 30% machine to course sand; 20% Siz /
1					1	L			
Ľ		- 1				- 13	notel		30% SR; 10% and (fine)
-1								_	
-4		.	10.0			b	well Graded Gravel with Clay and Sand (SW-SC).	000	50% fire to methan gravel (up to 0.75-exh diatestar).
1		°		~	-	- N		- 66	autocanted to rounded, chart 20% free to medium
-									
								00	
						ž	All Graded Crovel with Sit and Send (OW-OM), orginatic, both reductab boxes (Stricted)	88	subrounded to medium provel (up to 0.75-inch diameter), subrounded to munded, chart; 30% medium to coarse
7						ľ	and have been and the second factories of the second	80	send, subangular to rounded, quartz and histoper; 10% all
-1						V	Well Graded Gravel with Giry and Sand (Oliv GG)	68	NN medum to coarse gravel (up to 1.25 each
						H	week	H2	sand, subscrated to rounded, chert, 20% ocered, sand, subscrates, chert, 20% day
	m				+	13	h gray (10VRev1), fem, motel		ION, day
50 1						8	(ML) an above	222	

LITHOLOG	IC LOG			BC	RING/WELL NO: DB01	PAG	iE 3 of 12
Facility: Padu	cah Gaseous	Site: 3	Site 3A				
Project No: D	O 110	ismic /	Assessment				
Contractor: SA	AIC	Driller	r: Robert Stiles				
Drill Start (time	e/date): 13:30	on 02-18	-02	Dril	End (time/date): 15:12 on 02-21-02	Boreh	nole Dia: 6 inch with 4-inch core
Drill Method/R	lig Type: Vers	a-Sonic				Total	Depth: 359 ft
Logged By: K	enneth Davis	(SAIC)		Cod	ordinates: E -3062.74 N -7132.19	Prote	ctive Level: D
06874	SAMPLE	RESULT	84	ALTHY FETY		-	
PO INTERVAL P	NUMBER (N	00	VOC	RAD	LITHOLOGIC DESCRIPTION	100	COMMENTS
					Clay (CL), low pleasely, gray (10779811), hard, alightly moved		
	9 10.0	NA	-	-	Gay (GL), madum plasticity, vary dark grayish brown (107953/5), firm, moail		
7-		-			Ciay (CL) as above but hard, dry		
	10 9.5	NA	-	-	Clay (CL), medium planticity, vory dark graylah boxen (1977R3/2), firm, melet		
	11 8.5	×	-	-	Ciny (CL), madium, plasticity, vary dark gray (19741871), frm to hard, slightly molet		Frinkin
» ////				_ 1	cult for the grave		

LITHOLOGIC LOG BORING/WELL NO: DB01							PAG	E 4 of 12	
Facility: Paducah Gaseous Dilfusion Plant, Paducah, KY								Site: \$	Site 3A
Project No: DO 110 Client/Project: USDOE/PGDP Site 3A Sets								ismic /	Assessment
Contractor: SAIC Drill Contractor: Miller Govt Services								Driller	r: Robert Stiles
D	ili Start (tir	ne/date	): 13:30 o	n 02-18-	-02	Drill	End (time/date): 15:12 on 02-21-02	Boreh	hole Dia: 6 inch with 4-inch core
D	ill Method	Rig Typ	e: Versa-	Sonic				Total	Depth: 359 ft
Lo	gged By: I	Kennett	h Davis (S	AIC)		Cox	ordinates: E -3062.74 N -7132.19	Prote	ctive Level: D
		SAMPLE		8PT REBULT	HEA SAZ	LTV ETY			
1	NTERVAL	NUMBER	AECOVERY (b)	10	voc	RAD	LITHOLOGIC DESCRIPTION	LOG	COMMENTS
95		12	10.2	NA	-	-	Clay (CL), medium plasticity, vary dark gray (16v7Rin), Sen to hard, algeby mole		Breaks along horizontal lamanatore
100		13	11.0	NA	_	-	Citry (CL.) an adove		Trace (2-5%) mice (muscowies)
110.		м	9.6	NA	-	-	Ciny (CL) as above		
120							Clay (CL) as above		

LITHOLOGIC	LOG			BO	RING/WELL NO: DB01	PAGE 5 of 12		
Facility: Paducah	Gaseous D	iffusion F	Plant	, Pa	ducah, KY	Site: Site 3A		
Project No: DO 11	0			Clie	nt/Project: USDOE/PGDP Site 3A Se	ismic Assessment		
Contractor: SAIC			_	Dril	Contractor: Miller Govt Services	Driller: Robert Stiles		
Drill Start (time/da	le): 13:30 d	n 02-18-	02	Dril	End (time/date): 15:12 on 02-21-02	Borehole Dia: 6 inch with 4-inch core		
Drill Method/Rig T	ype: Versa	-Sonic		-		Total Depth: 359 ft		
Logged By: Kenne	th Davis (a	SAIC)	T HEA	Coc	rdinates: E -3062.74 N -7132.19	Protective Level: D		
DEPTH	RECOVERY	RESULT	SAP	ety.		CIWH		
(t) INTERVAL NUMBE	<u>m</u>	M	VOC	AND .	LITHOLOGIC DESCRIPTION	LOS COMMENTS		
		1						
	1							
		1						
15	9.8	NA	-	-	Citey (CL), medium plasticity, very dark gray (10VPG/1), firm to hard, slightly motel	Trace (2-5%) mice (muscovite), triable		
<sup>10</sup> -11111								
	1							
	<u> </u>		-	-				
130_								
		1						
		[						
	1							
	1							
<i>-///</i> / "	10.5	NA	-	-	Clay (Cl.) as above			
135		ł						
		1						
	1							
-///								
					City (CL) as above			
140-11111								
165								
	20.8	NA	-	-	Clay (CL) as above but moderately firm to exit, motel			
150 110100								

LITHOLOGIC LOG	BO	RING/WELL NO: DB01	PAG	E 6 of 12		
Facility: Paducah Gaseous Diffusion Plan	vt, Pa	ducah, KY	Site:	Site: Site 3A		
Project No: DO 110	Clie	nt/Project: USDOE/PGDP Site 3A Se	ismic /	Assessment		
Contractor: SAIC	Dril	Contractor: Miller Govt Services	Driller: Robert Stiles			
Drill Start (timo/date): 13:30 on 02-18-02	Drill	End (time/date): 15:12 on 02-21-02	Boreh	hole Dia: 6 inch with 4-inch core		
Drill Method/Rig Type: Versa-Sonic			Total	Depth: 359 ft		
Logged By: Kenneth Davis (SAIC)	Coc	ordinates: E -3062.74 N -7132.19	Prote	ctive Level: D		
SAMPLE RESULT SA	SALTH/					
IN INTERVAL NUMBER (N M) VOC	C RAD	LITHOLOGIC DESCRIPTION	GRAPH LOG	COMMENTS		
		City (CL), medium plasticity, very dark gray (10YR2/1), moderatily from in will, model		Trace (2-5%) mice (mancovite), triable		
		Clay (CL) as above but with luminations of glauconite aund (SP-SC)				
		grading downward to	888			
165_		Glauconte Sill (M.), medium plasticity, black (1897631), firm to hard, mole:		375 day		
		Bery Santi (SH), finel, subargular, glauconfe, medum pleation, deck grayiet-brown (1977H42), finn, molet		47% eff		
	$\left  \cdot \right $		5555 	We have been at the second at the first (Fig. 1) and a		
100_		Clay (CL), plants, blank (1011921), first, molai		gridet, schanguler		
		Poorly Chested Sand (SP), vey Ime, schenguler, light greenen grey (SLEY2 171), ent, mole				
	-	Poorly Graded Sand (SP), fine is very line, autorarched is rounded, receptantic, light grantals gray (BLEY2 7/1), lifer, motell				
		greanish gray (CLEY2 51), hand, moint AND Poorly Graded Sand (SP), fine to very line, subrounded to rounded, light greanish gray (CLEY2 171), moint				
		Poorly Gradiel Sand (SP), live to very line, extensionaled to nouncled, light generality gray (NLEY2 TH), live, moint		Sand appears to be predominately quark but contains abundant gissconfis. Appearint organic-rich hotizons at 174.9 ft bgs and 178.4 to 179.0 ft bgs		
		quarts, light gray (30/RTVI), Cay (CL), dark grayers				
		(ISHNO)	~~~~			

ĺ	LIT	HOLO	GIC L	OG			BC	RING/WELL NO: DB01	PAG	E 7 of 12	
	Faci	lity: Pad	lucah G	aseous D	flusion	Plan	t, Pa	ducah, KY	Site: Site 3A		
	Proje	ect No:	DO 110				Clie	nt/Project: USDOE/PGDP Site 3A Se	ismic Assessment		
Contractor: SAIC								Contractor: Miller Govt Services	Driller: Robert Stiles		
L	Drill	Start (ti	me/date	): 13:30 c	n 02-18	-02	Dri	End (time/date): 15:12 on 02-21-02	Boret	hole Dia: 6 inch with 4-inch core	
L	Drill	Method	/Rig Typ	pe: Versa-	Sonic				Total	Depth: 359 ft	
	Logg	ood By:	Kennet	h Davis (S	AIC)		Co	ordinates: E -3062.74 N -7132.19	Prote	ctive Level: D	
	SAMPLE SPT HEA								-		
F	10	INTERVAL	N.MBER	00	00	voc	PAC .	LITHOLOGIC DESCRIPTION	103	COMMENTS	
1								istarlaminated Clay (CL), dark grayish incom (101/14/2) AND Poorly Cashed Sand (SP), way inco quarts byta gray (1011071), nodisen plasticity, ten, moret		80%-clay; 40% aand	
1			19	23.8	NA	-	-	Intertaminated Clay (CL) AND Poorty Graded Sand (SP), as above		60% clay; 20% aand	
	-							Interlemented Clay (CL) AND Poorly Graded Sand (SP), as above			
1:	- - *-							Clayey Sand (SC), very fine to fine, poorly graded, medium plasticity, graytah brown (16/1932), fine, moist		20% olay	
L	-							Cley (CL), plastic, black (10YR2/1), hard, motel			
	-							Interfaministed Cary (CL), dark greytek boxer (10704/2) AND Pooly Greded Sand (SP), vary fine, quartz, light gray (19757/1), modum plasticity, firm, molai		50%. clay; 50% sand	
20	. 1	//						mentance real frei wan peud iou) en stoke			
20			20	20.5	25	-	-	Chey (CL), plantit, black (10798211), tern, monet		20% very fine aans, quarty	
21							_	and and field	-	or a cary: or a very one save, querz	

LI	HOLO	GIC L	OG			BC	RING/WELL NO: DB01	PAG	GE 8 of 12		
Fac	ility: Pad	ucah G	aseous D	iffusion I	Plan	t, P	aducah, KY	Site:	Site: Site 3A		
Pro	ject No:	DO 110	1			Cli	en/Project: USDOE/PGDP Site 3A S	eismic /	Assessment		
Cor	ntractor:	SAIC				Dri	Contractor: Miller Govt Services	Drille	r: Robert Stiles		
Dril	I Start (tir	me/date	): 13:30 c	n 02-18	-02	Dri	End (time/date): 15:12 on 02-21-02	Borel	nole Dia: 6 inch with 4-inch core		
Dril	Method	/Rig Typ	pe: Versa	-Sonic				Total	Depth: 359 ft		
Log	ged By:	Kennet	h Davis (S	SAIC)		Co	ordinates: E -3062.74 N -7132.19	Prote	ctive Level: D		
		SAMPLE		SPT PESULT	HE SA	ALTH					
m	INTERWAL	NUMBER	RECOVERY (7)	8885 M	voc	244	UTHOLOGIC DESCRIPTION	LOS	COMMENTS		
-							Sendy Lean City (CL), medium plasticity, wary dark gray (107/HD11) moderately firm, molai		50% oldy; 45% very line sand, quartz; trace ((/5) gravel		
-	<i>\///</i>						City (CL). medium plasticity, black (10//R21) firm, maint		Pire and leminations make up 10%		
215_							City (C.) as above but send invitations increasing		First and invitations increases to 1000, of here		
[···-							koweds base		The local and and a second a second a second		
-							stantin, grav (10/10/10 firm, molat	888			
-							58 (HL) with some sand (vary fire) laminations, low plantety, gray (10/1951) and vary dark gasy (10/7Rb/), firm, most				
225_		21					88 (ML), low planticity, gray (10171011), fam, molet		17% mice (numcovite); abundant carbonized plant fuestio		
239			£1.9	~	-		Sill (ML), medium plasificity, gmy (101171511), frm, moiat Sill (ML), low to medium plasificity, laminated gmy (10171511) and light gmy (10171011), frm, excisi		18-18%, mica (muncovite), carborizad plant louals rat activit.		
240							Silt (ML), medium plasticity, very dark gray (1017824), fere, model				

Facility: Paducah Caseous Diffusion Plant, Paducah, KY         Site: Site 3A           Project No: DO 110         Clenn/Project: USDCD/PGDP Site 3A. Seame: Assessment           Contractor: SAC         Drill Contractor: Miller Gord Services         Drill Contractor: Miller Gord Services           Drill Statut (timediale): 133: 30 on 02-18-02         Drill End (timediale): 151: 20 on 02-11.02         Berthole Dit: 6 inch with 4-inch core           Drill Mohoding Type: Veras-Sonic         Coordinates: E -3062.74         N -7132.19         Protective Level: D           Iogged By: Kenneth Davis (SMC)         Coordinates: E -3062.74         N -7132.19         Protective Level: D           Iogged By: Kenneth Davis (SMC)         Coordinates: E -3062.74         N -7132.19         Protective Level: D           Iogged By: Kenneth Davis (SMC)         Coordinates: E -3062.74         N -7132.19         Protective Level: D           Iogged By: Kenneth Davis (SMC)         Coordinates: E -3062.74         N -7132.19         Protective Level: D           Iogged By: Kenneth Davis (SMC)         Coordinates: E -3062.74         N -7132.19         Protective Level: D           Iogged By: Kenneth Davis (SMC)         Iogged By: Kenneth Davis (SMC)         Iongen: Size (SMC)         Coordinates: E -3062.74           Iogged By: Kenneth Davis (SMC)         Iongen: Size (SMC)         Iongen: Size (SMC)         Iongen: Size (SMC)           Iogged B	LIT	HOLO	GIC L	OG			BC	RING/WELL NO: DB01	PAG	E 9 of 12		
Project No: DO 110 Cillent/Project: USDOE/PGDP Sile 3A Selarmic Assessment Contractor: SAAC Diff Contractor: SAACC Diff Contracto	Fac	ility: Pad	ucah G	aseous D	iffusion F	lan	t, Pa	ducah, KY	Site: 1	Site: Site 3A		
Contractor: SAC DPIE Contractor: Miler Gox Services Driffer: Robert Siles Driff Start (fremeldale): 13.30 on 02-16-02 Driff End (fremeldale): 15.12 on 02-17-02 Borehol Drive: Vera-Sonic Coordinates: E-3062.74 N-7132.19 Protective Level: D  Coordinates: E-3062.74 N-7149.74 N-7149 Protective Level: D  Coordinates: E-30	Pro	ect No: (	DO 110				Clie	ent/Project: USDOE/PGDP Site 3A Se	ismic /	Assessment		
Drift Statut (timediate): 13:0 on 02-16-02         Drift Statut (timediate): 13:0 on 02-16-02         Total Depth: 350 ft           Drift Method/Fight Type: Verse-Socie         Total Depth: 350 ft         Coordinates: E - 3062 74         N -7132 19           Drift Method/Fight Type: Verse-Socie         Coordinates: E - 3062 74         N -7132 19         Protective Level: D           Drift Verse-Socie         Coordinates: E - 3062 74         N -7132 19         Protective Level: D           Drift Verse-Socie         Coordinates: E - 3062 74         N -7132 19         Protective Level: D           Drift Verse-Socie         Coordinates: E - 3062 74         N -7132 19         Protective Level: D           Drift Verse-Socie         Coordinates: E - 3062 74         N -7132 19         Protective Level: D           Drift Verse-Socie         Coordinates: E - 3062 74         N -7152 19         Protective Level: D           Drift Verse-Socie         Coordinates: E - 3062 74         N -7152 19         Protective Level: D           Drift Verse-Socie         Socie         Coordinates: E - 3062 74         N -7150 75         Protective Level: D           Drift Verse-Socie         Socie         Socie         Socie         Protective Level: D         Protective Level: D           Drift Verse-Socie         Socie         Socie         Socie         Socie         Protective Le	Con	stractor: \$	SAIC				Drill Contractor: Miller Govt Services Driller: Robert Stiles			r: Robert Stiles		
Diff Method Fig Type: Versa-Socie         Total Depth: 359 ff           Logged By: Konnelb Davis (SAIC)         Coordinates: E -3082.74 N -7132.19         Profective Lowel: D           method Fig Type: Versa-Socie         method Fig Type: Versa-Socie         000V           method Fig Type: Versa-Socie         method Fig Type: Versa-Socie         000V           method Fig Type: Versa-Socie         method Fig Type: Versa-Socie         000V           method Fig Type: Versa-Socie         method Fig Type: Versa-Socie         000V           method Fig Type: Versa-Socie         method Fig Type: Versa-Socie         000V           method Fig Type: Versa-Socie         method Fig Type: Versa-Socie         000V           method Fig Type: Versa-Socie         method Fig Type: Versa-Socie         000V           method Fig Type: Versa-Socie         method Fig Type: Versa-Socie         000V           method Fig Type: Versa-Socie         method Fig Type: Versa-Socie         000V           method Fig Type: Versa-Socie         method Fig Type: Versa-Socie         000V           method Fig Type: Versa-Socie         Fig Type: Versa-Socie         000V           method Fig Type: Versa-Socie         Fig Type: Versa-Socie         000V           method Fig Type: Versa-Socie         Fig Type: Versa-Socie         000V           Fig Type: Versa-Socie         Fig Type: Ve	Dril	Start (tir	ne/date	): 13:30 o	n 02-18-	02	Dril	End (time/date): 15:12 on 02-21-02	Boreh	nole Dia: 6 inch with 4-inch core		
Loggerd by: Kennell Dava (SAC) Coordinates: E - 3062.74 N -7132.19 Protective Level: D Coordinates: E - 3062.74 N - 7132.19 Protective Level: D Coordinates: E - 3062.74 N - 7132.19 Protective Level: D Coordinates: E - 3062.74 N - 7132.19 Protective Level: D Coordinates: E - 3062.74 N - 7132.19 Protective Level: D Coordinates: E - 3062.74 N - 7132.19 Protective Level: D Coordinates: E - 3062.74 N - 7132.19 Protective Level: D Coordinates: E - 3062.74 N - 7132.19 Protective Level: D Coordinates: E - 3062.74 N - 7132.19 Protective Level: D Coordinates: E - 3062.74 N - 7132.19 Protective Level: D Coordinates: E - 3062.74 N - 7132.19 Protective Level: D P	Drill Method/Rig Type: Versa-Sonic T									Depth: 359 ft		
Comment         Comment <t< td=""><td colspan="9">Logged By: Kenneth Davis (SAIC) Coordinates: E -3062.74 N -7132.19 Pr</td><td>ctive Level: D</td></t<>	Logged By: Kenneth Davis (SAIC) Coordinates: E -3062.74 N -7132.19 Pr									ctive Level: D		
INTERVA         MARCEN         ID         ID         VICE PAGE         LOD         LOD         LOD         COMMENTS	DEPTH	ļ	84WPLE	BECOMERY	RESULT	84	FETY	4	GRAPH			
20       22       11.8       NA       =       =       Stat (A1, makes) (MASS), say (A4, ppp (10/1001), frame, and p	10	INTERNAL	NUMBER	. 00	- 29	VOC	RAD	LITHOLOGIC DESCRIPTION	1.00	COMMENTS		
24       22       11.8       NA       -       -       Bit MQ1 resting during for the set of	-							Silt (M.), medium pisaticity, vary dark gray (10YR8/1), finn, molai		Maastro		
200         201         Sile (AL) as above         These manual graved (p-to 1.15-ixch diamater), model           200         1         Sile (AL) as above but moderately tim         Sile (AL) as above but moderately tim           200         1         Sile (AL) as above but moderately tim         Sile (AL) as above but moderately tim           200         1         Sile (AL) as above but moderately tim         Sile (AL) as above but moderately tim           200         1         Sile (AL) as above but moderately tim         Sile (Sile) time, sourced, party, moderately graded, quark, grad (Sile)           201         1         NA         -         -         Sile (Sile) time, sourced, party, moderately (Sile)         Sile (Sile) Sile (Sile)         Sile (Sile) Sile (Sile)         Sile (Sile) <t< td=""><td>245</td><td></td><td>22</td><td>11.8</td><td>NA</td><td>-</td><td>-</td><td>Sill (AQ.), medium plasticity, lemmated gray (10YHS/1) and light gray (10YHW1), lims, most</td><td></td><td></td></t<>	245		22	11.8	NA	-	-	Sill (AQ.), medium plasticity, lemmated gray (10YHS/1) and light gray (10YHW1), lims, most				
255     23     18.1     NA     -     -     S8 (60) as above but moderately tem     30% add       266     23     18.1     NA     -     -     -     S8 (60) as above for moderately tem     30% add       266     23     18.1     NA     -     -     -     -     -     -       267     23     18.1     NA     -     -     -     -     -     -     -       268     269 (2017071), sol, sec     .     .     .     .     .     .     .       269     23     18.1     NA     -     -     -     -     -     .     .     .     .     .     .       269     23     18.1     NA     -     -     -     -     .	250							Sill (UR.) an albany		Trace coarse gravel (up is 1.25-inch diameter), rounded		
23 18.1 NA	255_							Sill (ML) as above but moderately live				
23     18.1     NA     -     -     Site Sand (Site) as above       23     18.1     NA     -     -     -     -       1     -     -     -     -     -     -       1     -     -     -     -     -     -       1     -     -     -     -     -     -       1     -     -     -     -     -     -       1     -     -     -     -     -     -       1     -     -     -     -     -     -       1     -     -     -     -     -     -       1     -     -     -     -     -     -       1     -     -     -     -     -     -       205     -     -     -     -     -     -       205     -     -     -     -     -     -       205     -     -     -     -     -     -       205     -     -     -     -     -     -       205     -     -     -     -     -     -       205     -     -     -     -     - </td <td>-</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Shity Sand (SML free, muncied, powrły grecied, quantz, gray (7.379691), auto, wet</td> <td></td> <td>30% aft</td>	-							Shity Sand (SML free, muncied, powrły grecied, quantz, gray (7.379691), auto, wet		30% aft		
23 18.1 NA 23 18.1 NA								Silly Sand (Sill) as above				
Prody Graded Savi (59), subargaine to advanceded,     Sec. corplands, byte pay (1075071), and, set			23	19.1	NA	-	-	Leminated City (CL) AHD Pooly Graded Sand (SP), fine, rounded, quartz, medium plasticity, gray (15/RS/1) and light gray (10/RS/1), fare, acute		70% day; 30% sand. Hole: some glautoritie present		
Unmeased Sitt (vic) APD Pooly Graded Sand (SP), very tree, and any date, guarty, for plasticity, gray (10/15/1) 200								Poorly Cirschel Sand (SP), subergater to advounded, quarte, norphasic, light gray (HOTROVI), and, wat		·		
CIU CALANDA AND AND AND AND AND AND AND AND AND	270							Lemmand Sill (ML) AND Poolly Graded Sand (SP), very fire, extengular, quarts, low plasticity, gray (101765/1) and light gray (10176711), fire, model	200	70% efft 30% sand. Some glauconike present		

Į	LIT	HOLO	GIC L	.OG			BC	RING/WELL NO: DB01	PAG	GE 10 of 12			
l	Fac	cility: Paducah Gaseous Diffusion Plant, Paducah, KY								Site: Site 3A			
ļ	Proj	ect No: I	DO 110	)		_	Clie	ent/Project: USDOE/PGDP Site 3A Se	elsmic /	Assessment			
L	Con	tractor: 5	SAIC				Dri	Contractor: Miller Govt Services	Drille	Driller: Robert Stiles			
ļ	Drift	Start (tir	ne/date	e): 13:30 d	on 02-18	3-02	Dri	End (time/date): 15:12 on 02-21-02	Boref	hole Dia: 6 inch with 4-inch core			
L	Drill	Method	Rig Typ	pe: Versa	-Sonic				Total	Depth: 359 ft			
ŀ	Log	ged By: I	Kennet	h Davis (S	SAIC)		Co	ordinates: E -3062.74 N -7132.19	Prote	ctive Level: D			
			SAMPLE	large re-	PESULT	8	ALTHY FETY						
F	(9)	INTERVAL	NUMBER	m.	N	VD	RAD	UTHOLOGIC DESCRIPTION	LOB	COMMENTS			
	-							Laminated SH (ML) AND Poorly Gradied Sand (SP), very films. subergater, querts, itsy plasticity, gray (10//R(s1)) and light gray (10//RD1), item, model		70% all; 20% and. Some planomic present			
2	5 1 1 1 1 1							Poorly Gradial Sand (SP), very live, subangular, quartz, with some day landsakers, kyle gery (15191711) with some gazy (15195511), live, wel		15-20% day lammatona			
2			24	19.8	NA	-		Laminated Sift (ML) AND Poorly (Inseled Band (SP), vary first, low planticity, black (16/YEP) and light gray (10/YEP), fers, recist WFH impared Clay (CL) Michaels (2 to 6 inches fulch), plantic, black (10/YEP1), fers, recist					
25								Historianistical Clary (CL), pisatic, dark gray (1017641), Arn, maist AND Pooley Graded Sand (SP), vary fina, exbangutar to subnounded, quarte, norginalic, light gray (1017624), locas/soft, valid		85%, clay; 26%, sand			
25			25	19.8	ş	-	-	Provity Graded Sand (SP), vary line to fine, autoergouier in advanced.c. gast2, receptantic. Spit gray (10/19371), WTH inferences Interbacks of Clay (CL), 2 to 4 inches Next, planets, dark gray (10/19471); acit, wel Provity Graded Sand (SP), WTH interbacks of Clay (CL) as above		60% sand; 15% day 80% sand; 40% day			

LITHOLOGIC LOG	B	DRING/WELL NO: DB01	PAGE 11 of 12		
Facility: Paducah Gaseous Diffusion	Plant, P	aducah, KY	Site: Site 3A		
Project No: DO 110	Cli	ent/Project: USDOE/PGDP Site 3A Se	ismic Assessment		
Contractor: SAIC	Dr	Il Contractor: Miller Govt Services	Driller: Robert Stiles		
Drill Start (time/date): 13:30 on 02-18	-02 Dr	II End (time/date): 15:12 on 02-21-02	Borehole Dia: 6 inch with 4-inch core		
Drill Method/Rig Type: Versa-Sonic			Total Depth: 359 ft		
Logged By: Kenneth Davis (SAIC)	Co	ordinates: E -3062.74 N -7132.19	Protective Level: D		
SAMPLE SPT RESULT	HEALTH		0000		
OT INTERNAL NUMBER RECOVERY 0-0-4-4-4	VOC RM	D UTHOLOGIC DESCRIPTION	LOG COMMENTS		
		Poorty Oraded Serd (SP), very fire to fine, subangular to subrounded, querg, rengilastic, light gray (00/90/1), WITH introquent interfects of Clay (CL) 2 to 4 inches mick, plastic, dam gray (10/764*1), solt, vet	075 sand; 475 day		
305		Interbackled Gay (CL) (97%), in 2-10 8-inch beds, plastic, dark gay (10/1947), very firm, maie AND Poorly Graded Sand (37) (47%), in 2-10 1-inch beds, very film to fine, subangular to subnomiael, conglesio, light gray (90/17/7/1), locasted, well	City contains 10% fine said, day breaks with fine isometics. Some said lawnations present in day.		
		Clay (CL), plastic, dark gray (1017R471), vary liss, moist	10% fire and		
310		Poorly Graded Sard (SP), fire, rounded to extremeted, quarts, nonplastic, light gray (1097071), not, well	Trace (F-5%) opeque minerale. Spane day interbade (up to 2 inches thick)		
		Clay (CL), plastic, 6a/s, brown (151/R3C), Ses, molei	20% fire Sand. Contains few sand lawinations		
		Poorty Graded Sand (SP), fire, rounded to advounded, ouests, remplassic, light gray (16717771), soft, wet	Trace (2-5%) opeque minerals		
20		Intertructional Pourly Gradied Sand (SP), Inte, rounded to autorounded, quarta, norplastic, light gray (1977071), ant, we Add Carey (CL), plantic, dark brown (1677070), Inter, realist	Sand contains trace (2-5%) opeque minerais. Cley contains 20% fina sand. Bedding is approximately 5 inches flick		
		SB (M.), medum is investigation, dark innen (1977B20), finn, molei	At 323.2 ft bys: gravel layer, schengeler, up to 1.75- inch diamater, fine-grained lanastone		
		Sill (ML), low planikity, dark graphet brown (10794612), anti-ko-firm, molei	Trace Bas and		
330		Poorty Graded Sand (SP), very line to line, schenguler to subrounded, quests			

Facility: Project M Contract Drill Star Drill Met Logged I COMPTINE PO ENTRY Star PO ENTRY ENTRY Star PO ENTRY	Paducah G No: DO 110 ctor: SAIC art (time/dat) thod/Rig Ty I By: Kennet swirt	aseous D ) e): 13:30 c pe: Versa	iffusion	Plan	t, Pa Clie Dri	iducah, KY int/Project: USDOE/PGDP Site 3A Se	Site:	Site 3A Assessment	
Project N Contract Drill Star Drill Met Logged I Po entry Po entry	No: DO 110 ctor: SAIC art (time/date thod/Rig Ty I By: Kennel save.r	e): 13:30 c	on 02-18	_	Clie	int/Project: USDOE/PGDP Site 3A Se	ismic /	Assessment	
Contract Drill Star Drill Met Logged I	ctor: SAIC art (time/datu thod/Rig Ty I By: Kennet sawp.r	e): 13:30 c	m 02-18		Drit	Cashardan Miller Cash Cashard			
Drill Star Drill Met Logged I 	art (time/dat ithod/Rig Ty I By: Kennel swins	e): 13:30 c pe: Versa	n 02-18		1	Contractor: Miller Govt Services	Driller: Robert Stiles		
Drill Met Logged I P0 PTH P0 PTH P1 P	thod/Rig Ty By: Kennel SAMPLE	pe: Versa		-02	Drii	End (time/date): 15:12 on 02-21-02	Boreh	ole Dia: 6 inch with 4-inch core	
Logged I	By: Kennel		Sonic				Total	Depth: 359 ft	
000/11H	SAMPLE	h Davis (S	SAIC)		Coo	ordinates: E -3062.74 N -7132.19	Protec	ctive Level: D	
			RESULT	HE/ SA	ALTIV				
	ERVAL MUMBER	RECOVERY	66.66	voc	RAD	LITHOLOGIC DESCRIPTION	LOS	COMMENTS	
	27	19.7	NA			Poorly Orneled Sand (SP), vary line to fine, subengular to subtrardied, guartz, norpiastic, light gray (19711011) and gray (19711971), advitose, well		5-10 % mos (muscovite) and 1-0% opeque minerale. Some mise etch horizone. Rure all lanvinatione. Some gyr#e-comercial operations	
		15.3	NA	-	-	Pooly Graded Sand (SP), very line, subergate to Abroarded, gaarti: vith approximately 5% exc., Kepiaski, byle gey (107/5211), adhtoose, we		Some néce-kéh horizone, otherwise maastra	


					000 1005 1001000			
					SED20170 E	BORI	NG NUMBER	
					3CD28176.PI	W	BIT 20 SHEET 1 OF 6	
					SOIL	BORI	NG LOG	
PRO	DJECT_	PGDP	Phase	I Site Invest	igation LOCATION	Well	Cluster WC1, Southeast Corner of PI	ant
ELE	VATION			0	DRILLING CONTRACTOR_GO	otek E	ngineering	
DRIL	LLING M	ETHOO	AND D	Static-26 F	53 Mobile Drill, 6-inch ID Hollow Ste	m	1/20/0	
mA1	TENCEN	EL AND	UNIE_	STANDARD	START TUTOROS	INISH	U23/90 LOGGER M. Henry	
36	₌⊢	SAMPL	E	PENETRATION	SOIL DESCRIPTION		COMMENTS	
128	휘 코	2	R.	RESULTS	SOIL NAME, COLOR, MOISTURE CONTEN RELATIVE DENSITY OR CONSISTENCY, S	T, Off.	DEPTH OF CASING,	
E	E S	A BB	Š.	6"-6"-6"	STRUCTURE, MINERALOGY, USCS GROU	P	ORIULING FLUID LOSS.	
68	동 보	ES	EE	(N)		SYMBOL		
0		1-			CLAVEN OF T LICUT RECEIPT OF AN IS	(D. et a)		
1	- 0-2		1.6'	3-5-9-10	DAMP, STIFF, WITH ROOT TRACES THR	(H 6/4), OUGH	USING 140 LB. HAMMER WITH HOIST	
				(14)	OUT SAMPLE			_
1 *					SILTY CLAY, GRAY (N7), WITH RUST AN	D	HEADSBACE MAIN AND ADDING	_
	- 24	4010	1.8'	10-20-20-25	BLACK MOTTLING, DAMP, HARD, WITH	900T -	BACKGROUND	_
4	+	1					-	_
	4-6		1.8'	15-15-15-20	SAME AS ABOVE, ALSO PLASTIC	_		
	1			(30)			TIME 15:30	
l °								-
	7 8-8		5.0	(25)	SAME AS ABOVE, VEHY STIFF	E AS ABOVE, VERY STIFF		-
8		(00)			-	-		
	8-10	4011	2.0'	15-15-18-19 (33)	SAME, VERY FINE SAND 0-5% VISIBLE IN SUNLIGHT	_	HEADSPACE M011-NOT ABOVE BACKGROUND	-
10-	- 10-12		2.0'	7-9-8-13	SILTY CLAY, GREENISH GRAY, (5 YR 6/4 MOIST, VERY STIFF, PLASTIC, WITH RUS	). ST _	COLLECTED RAD SCREEN OVER FIRST FIRST 12 FT.	
12				(17)	MOTTLING AND BLACK-ORGANIC NODU	LES	16.00	
1.					SILTY CLAY, GRAY, (N7), DAMP, HARD,		11/19/89 09:35	-
	12.14		1.5	(37)	LAYER OF ORGANIC MATERIAL IN SAMP	INCH LE	1.0.000 09.35	-
14 -		1					HEADSPACE #4012-NOT ABOVE	-
·	14-16	4012	2.0"	16-13-16-19	SAME AS ABOVE, VERY STIFF	_	BACKGROUND	
16		4		(29)				
1					SILTY SAND, GRAY, MEDIUM DEINSE, WI	тн	INTO UPPER CONTINENTAL DEPOSITE	1
1	10.19		2.0	(28)	VERY FINE WITH = \$% PEA-SIZED GRAVI	0 EL	and other opening the derivation	-
18	+				SAND CRAY (NT HOIST VERY DENSE		10:20	-
· ·	18-20		2.0'	12-22-30-33	SLIGHTLY SILTY, WELL SORTED 60% VE	RY _		_
20-	_			(52)	FINE-10% MEDIUM SANDS - 5% GRAVE	a.	HEADSPACE #4013-NOT ABOVE	- 1
	-				SAND, GRAY, (N7), MEDIUM DEN SE WITH	1	BACKGROUND	-
	20-22	4013	2.0	5-10-15-22 (25)	SAND IS FINE, 5% PEA-SIZED GRAVEL	r. –	1	-
22	22-23	1 1	10	16-50-5	SAND AND SHT CRAY (NT) DAME VCD	~	RIG CHATTERING BETWEEN 22 AND 24 F	$\tau$
	+	3 1.0 16-50'S SAND AND SILT GRAY, (N7), DAMP, VERY DENSE, FINE SAND WITH BLUE AND PINK		÷ _		4		
24 -					INCLUSIONS OF SILF		11:10	
_	24.26	EINE SAND, GRAY, (N7), MOIST, VERY DENSE,		INSE.				
	24.60			(90)	GRAINED, PINK SILTY INCLUSIONS		WET SPOON AT +26 FT.	
26		1		-	FINE SAND, BROWN, IS YR 4441, MOUST		HEADSPACE #4014-NOT ABOVE	-
· ·	26-28	4014	2.0'	11-13-13-16	MEDIUM DENSE, SLIGHTLY SILTY WITH		BACKGROUND WATER LEVEL AT 22 ET AFTER	4
28 -	_		(26) STRE	TREAKS OF REDDISH, PLASTIC SANDY SILTS		SAMPLING TO 30 FT.		
	- 28-30 1.7 9-17-28-29 WITH STREAKS OF RED AND GRAY SANDY - (44) SILTS GRADING INTO SILTY SAND			ense, Dy -	ISOLATED GRAVEL-VERY DRY AND CHALKY, VERY HARD			

						000 IF 07 III III						
						PHOJECT NUMBER	BORIN	NG NUMBER				
ĩ						SE028178.FI	We	11120 SHEET 2 OF 6				
J						SOIL	BORI	NG LOG				
	PROJ	ECT I	PGDP	Phase	Site Investi	gation LOCATION	Well C	Cluster WC1, Southeast Corner of Pla	nt			
	ELEV	ATION_				DRILLING CONTRACTOR Ge	otek Er	ngineering	. 11			
	DRILL	ING ME	THOD	AND EX	DUIPMENT_B	53 Mobile Drill, 6-inch ID Hollow St	em					
	WATE	H LEVE	EL AND	DATE_	Statio-16 Ft., af	W https://www.start_11/18/89_F	INISH_1	/23/90 LOGGER M. Henry				
	30	L	SAMPL	E .	PENETRATION	SOIL DESCRIPTION		COMMENTS				
	CE FI	W	AND	VERY	RESULTS	SOIL NAME, COLOR, MOISTURE CONTEN RELATIVE DENSITY OR CONSISTENCY, \$	T. OIL	DEPTH OF CASING, DRILLING RATE,				
	SURFA	INTER	TYPE	RECO	666- (N)	SYMBOL *	۲	DRILLING FLUID LOSS. TESTS AND INSTRUMENTATION				
	-	30-32 1.5 13-17-17-21 SANDY SILT, LIGHT GRAY, MOIST, HARD, (34) SAND IS FINE TO MEDIUM GRAINED (<5%)				D	HEADSPACE #4015-NOT ABOVE	-				
	32 -	32-34 4015 2.0 17-15-21-24 0			17-15-21-24	SAME AS ABOVE, WITH RED STREAKS; 0.4 FT. SAND, WET, DENSE, FINE TO VE FINE	OVER	BACKGROUND 16:10 11/19/89				
-	34	34-34		0.5	50.5	SAND, BROWN, (5 VR. SIRL WET, VEDV		DBILLED EFIT WE WAS DANISHED ON A				
			14.5 0.4 SOS SAND, BROWN, (5 YH, 5/6), WET, VEHY DENSE, FINE					ORICCEN FELT HE WAS BANGING ON A RO	CK			
	36 -	-						LOWER CONTINENTAL DEPOSITS				
	-	36-38		1.97	21-27-20-50 (47)	SAND AND GRAVEL, BROWN, (5 YR, 56 DENSE, WELL SORTED SAND, MEDIUM- COARSE GRAINED WITH 20% GRAVEL 1 344-INCH	), WET, TO		-			
)	38 - 38-		4017	1.6'	42-50-5-6 (55)	GRAVELAND SAND, BROWN, (10R 4/0), DENSE, COARSE SAND WITH GRAVEL ( 1-INCH; OVER 0.5 FT. CLAYEY SAND	VERY UP TO	COBBLE 3V, INCH IN DIAMETER AND V <sub>2</sub> -INCH THICK BROUGHT TO SURFAC	Ē			
	40	40-42 2.0		21-33-38-50/5	AND GRAVEL, REDDISH, MEDIUM DENS CLAYEY SAND AND GRAVEL (NN), AS AN OVER 1.2 FT, SAND WHITE, VERY DENS DOORLY SOPRED MEDIUM OR ANALYSIS	BOVE; BOVE; BE,	HEADSPACE #4017—NOT ABOVE BACKGROUND	-				
	42 -				(71)	5% GRAVEL TO 1/2-INCH	NITH	09:50 11/20/89				
	-							CHATTERING AT 42 TO 44 FT.				
	44							PROBABLY IN SANDS				
								TRYING TO GET THROUGH BOA TODAY				
								STORE STORE STORE STORE				
	46 -				10.00	GRAVEL AND SAND, BROWN, (5 YR. 4/4)			-			
	-	40-65	4018	2.0	(91)	MEDIUM TO COARSE GRAINED SANDS	-	HEADSPACE #4018NOT ABOVE BACKGROUND	-			
	48 -							10:40	+			
	-						-	ROUGH DRILLING! CENTER PLUG IS STUCK IN AUGERS AS	-			
	50					GRAVEL AND SAND, DENSE, WELL SOR	TED	SANDS ARE HEAVING				
	-	50-52	NONE	0.4	25-21-19-17	70% GRAVEL AND 30% MEDIUM TO COM GRAINED SAND, 1% INCH GRAVEL STUR	ASE _	USING ROTARY WASH DRILLING	-			
	52 -				(40)	IN SAMPLER-FASY DRILLING	_	AT SALATE PROBABLY OUT OF GRAVEL	-			
	-						_		4			
	54 -	54-56 2.0' 6-8-27-50 HARD, WITH ORANGE MOTTL										
				6-8-27-50	CLAYEY SILT, GRAY, (N6), DAMP, STIFF HARD, WITH ORANGE MOTTLING.	то		1				
					(35)	FRACTURES EASILY		EADERACE AND LOST COME				
	56							BACKGROUND	-			
	-		4021				-		-			
	58 -		+			CLAVEY SILT CRAVICU DLACK (112) UK	80		_			
	-	- 58-59.5		1.41	24-42-50/5	MICACEOUS, FRACTURES IN CONCHOR	DAL	10:00 12/6/89				

					PROJECT NUMBER	BORIN	G NUMBER				
					SED28178.FI	SED28178.FI Well 120 SHEET 3 OF 6					
					SOIL	BORIN	GLOG				
	IF OF	PGDP	Phase	I Site Invecti	nation contract	Well C	luctor WC1 Southwart Compared Plant				
ELE/	ATION	GDI	110.00	CALC INVOID	DRILLING CONTRACTOR Get	otek En	gineering				
DRIL	LING M	ETHOD	AND EC	OUIPMENT_LO	ngyear 44, Rotary Drilling With 8-inc	aar 44, Rotary Drilling With 8-inch Paddle Bit					
WAT	ER LEV	EL AND	DATE_	STANDARD	START_11/18/89 FI	INISH_1/	23/90 LOGGER M. Henry				
ا≥د	-	SAMPL	E	PENETRATION	SOIL DESCRIPTION		COMMENTS				
125	1 3	2 %	ERV	RESULTS	SOIL NAME, COLOR, MOISTURE-CONTENT RELATIVE DENSITY OR CONSISTENCY, SC	n.	DEPTH OF CASING,				
DEPTH	INTERV	TYPEA	RECOV	6"-6"-6" (N)	STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	P	DRILLING FLUID LOSS. TESTS AND INSTRUMENTATION				
60	-										
	-					-	MOVE LONGYEAR 44 RIG ONTO SITE, SET SURFACE CASING TO 61 FT.				
63	63-65		1.5		CLAY, DARK GRAY, (N3) TO BLUISH, (5 F DRY, MICACEOUS, VERY STICKY	РЬ 3/2).	DROVE SHELBY TUBE				
65-	1						-				
	1	· ·				-					
	- 1					-	-				
68	+						· _				
· ·	68-70	4022	2.0	3-2-1-5	SAME AS ABOVE, SOFT	. –	USING 300 LIB, HAMMER ON A SAND LINE				
70-	-			(0)			15:15 1/16/90				
	-					-	_				
						_	_				
73	-										
ľ.,	73-75	4023	1.9	7-10-12-14	SAME AS ABOVE, VERY STIFF, WITH 2-II	NCH	08:15 017/90				
-				(22)	DRY	AS .					
75-	-			-		_	SLOW ORILLING, DRILLING MUD, THICKENS EASILY AND MUST BE DILUTED ABOUT EVERY 10 FT.				
	-	1				-					
78		+				-	_				
	78-80	4025 4026	1.97	1-5-10-16 (15)	CLAY, DARK GRAY, (N3), DRY, STIFF, SLIGHTLY SILTY STICKY, MICACEOUS		10:00				
80											
	- I.					-	. 1				
· ·						-					
83	+						· · · -				
	83-85	4027	1.6*	8-10-12	SAME AS ABOVE, VERY STIFF	-	NO HEADSPACE ANALYSIS DONE				
85				feet			11.90				
	-					_	_				
	_					_					
88	-										
	88-90	4028	2.0	2-8-12-14	SAME AS ABOVE, WITH SEVERAL VERY (V,-INCH) INTERVALS OF GRAY VERY FIL	THIN NE	14:00 1/17/90				

							_							
						PROJECT NUMBER	BORI	NGNUMBER						
ċ						SED28178.FI	We	ALL 120 SHEET 4 OF 6						
)						SOIL	SOIL BORING LOG							
	PRO	JECT 1	PGDP	Phase	I Site Invest	igation LOCATION	Well (	ell Cluster WC1, Southeast Corner of Plant						
	ELEV	ATION_	_			DRILLING CONTRACTOR GE	otek E	ngineering	SIL					
	ORIL	LING ME	THOD	AND E	QUIPMENT_L	ongyear 44, Rotary Drilling With 8-in	ch Pad	dle Bit						
	WAI	EN LEVI	L AND	DATE_	STAND400	START_11/18/89F	INISH	1/23/90 LOGGER M. Henry						
	3 ⊂		SAMPL	E	PENETRATION	SOIL DESCRIPTION		COMMENTS						
	35		9~	2 de	RESULTS	SOIL NAME, COLOR, MOISTURE CONTEN	Τ.	DEPTH OF CASING,						
1	H H H	R I	BER	18	5° 6° 8°	STRUCTURE, MINERALOGY, USCS GROU	P	DRILLING RATE, DRILLING FLUID LOSS						
		E S	121	RE	(N)7	SYMBOL .		TESTS AND						
	-90	·						INSTRUMENTATION						
		_												
							-	1	-					
					· · ·		-	1	-					
	93 ·					PRETVOIAN CONVICT OFFICE		· · · · · · · · · · · · · · · · · ·	_					
		93-95	4024	1.3	1-2-6-8	TO ABOVE CLAY, SLIGHTLY MICACEOU	MILAR S	08:10 1/18/90						
	95				(6)	-		1						
	**							1 .	-					
		1	i i					1	-					
		-							_					
1	98 -								_					
1	_	98-100	4031	1.9'	6-9-9	SAME AS ABOVE, VERY STIFF, WITH		VEIGHT OF BODS ALLOWING SPOON						
					(18)	GREATER S OF MICA	-	TO ONLY BE DRIVEN 18 FT.	-					
ł	100								-					
ł		-							- 4					
	-	4					-							
1	103 -													
1		103-	4032	0.97	3.4.12.14	1		14:15						
1	-	105		9.9	(16)	SAME AS ABOVE, WITH VARYING AMOU OF MICA	NTS -	VERY FAST, EVERY 5-10 FT.	-					
ľ	105								_					
1	-	-					_							
ł		<u> </u>												
							-		-					
1	- 80	108-							-					
ł	-	110	4033	2.07	2-2-4-7	SAME AS ABOVE, FIRM	-	15:45	_					
1	10					-								
1	_	- 1												
			1											
							-		-					
1	13 -	113-							-					
	-	1,10	4034	1.8"	4-11-16	SAME AS ABOVE, VERY STIFF	_	10:45 1/19/90						
1	15	113			(27)									
ľ									-					
L		1					-		-					
L	-				_									
1	18 -	110												
	_		4035	2.0'	8-16-18	SAME AS ABOUE HARD		14:40	7					
1.		1 120 1			17.43	SHARE NO NOUVE, IMPO	_		_					

					PROJECT NUMBER	POP	NO NUMBER			
					SED28178-FI	We	all 120 evert 5 or 6			
							ALL S OF 5			
					SOIL	SOIL BORING LOG				
PROJE	CT_	PGDP	Phase	I Site Investi	gation LOCATION	Well (	Cluster WC1, Southeast Corner of Pt	lant		
ELEVA	TION_	7000		Number 1	DRILLING CONTRACTOR_G	totek E	ngineering	1		
WATER	ng mi A levi	ETHOD	DATE	JUPMENT_LO	erapy 11/18/89	ch Pad	die Bit			
	1 62.11	CAMBI	e e	STANDARD		10150	DOGGER M. Henry			
₹E		SAMPL		PENETRATION	SOIL DESCRIPTION		COMMENTS	_		
100	Z	2	ES -	RESULTS	SOIL NAME, COLOR, MOISTURE CONTEN RELATIVE DENSITY OR CONSISTENCY, S	IT, KOIL	DEPTH OF CASING,			
ES	副	N BR	Š.	6"-6"-6"	STRUCTURE, MINERALOGY, USCS GROU	P	ORILLING FLUID LOSS.			
98	- Z	ΕĒ	26	(N)	under .		INSTRUMENTATION			
120		-								
- 1						-				
						-	1 .	-		
123 -	129.				SILTY CLAY, GRAY, (N7), DRY, HARD,			-		
	14.3-	4036	2.0'	4-11-12	MICACEOUS	-	16:00 1/19/90	_		
125	125			(33)						
1 7						_	1 .	-		
- 1							ł	-		
128 -	-	-						_		
	128-	4038		67.14	CASIONAL LENSES OF VERY FINE GRA	ITH OC-				
	130	1030	1.0	(21)	SAND, ~1/8-INCH THICK		0:900 1/20/90	1		
130	-						· ·	-		
-						-	-	-		
133										
~	133-				PILTY CLAY COLV AND DRY UPOL		1	-		
-	135	4039	1.9'	2-3-22	MICACEOUS	are,	10:15	-		
135				1441				_		
-						_				
								7		
						-		-		
138 -	120	4040						-		
-		4040	2.0"	4-9-17	SAME AS ABOVE	-	13:45	1		
140	140	4041		(26)						
							1	-		
						-		-		
-						-		-		
143 -								-		
	143-	4042	18	5.7.13	STIFF.OVER 0.5 FT. SANDY CLAY WITH	Y 1 15	15:15			
145	145			(21)	25% VERY FINE SAND IN THE SAME SIL	TY	DRILLER NOTES CHANGE IN DRILLING BEHAVIOR			
140					LIGE TROLING			$\neg$		
-						-		-		
-						_	BAD SCOCCHING			
148							PND OVREENING			
	148-				SILTY CLAY, GRAY, (N7), VERY STIFF, W	ATH T	16:00	H		
.en -	100	4043	1.9"	6-9-11	WHITE FILLINGS, MICAGEOUS		30 PPM ABOVE BACKGBOUND	-		

					PROJECT NUMBER	BORI	NG NUMBER
					SED28178.FI	We	HI 120 SHEET 6 OF 6
					SOIL	BORI	NG LOG
PROJE	стР	GDP	Phase	I Site Investi	gation LOCATION	Well C	Cluster WC1, Southeast Corner of Plant
ELEVA	TION_	THOD			DRILLING CONTRACTOR Ge	eotek Er	ngineering
WATER	ILEVE	L AND	DATE	JUPMENT_CO	START 11/18/89 F	inish 1	1/23/90 LOGGER M Henry
-	. 1	SAMPL	E	STANDARD PENETRATION	SOIL DESCRIPTION		COMMENTS
PTH BELOW RFACE (FT)	TERVAL	PE AND MBER	COVERY )	TEST RESULTS 6" -6" -6"	SOIL NAME, COLOR, MOISTURE CONTEN RELATIVE DENSITY OR CONSISTENCY, 5 STRUCTURE, MINERALOGY, USICS GROU SYMBOL	П, ЮЦ, IP	DEPTH OF CASING, DRILLING FATE, DRILLING FLUID LOSS, TFETS AND
Supp.	Z.	도로	분도	(N)	1		INSTRUMENTATION
~ _						-	
_		1				_	
53 -							
-	153- 155	4045	2.0	1-2-6-8 (8)	SAME AS ABOVE, SLIGHTLY MOIST, FIR LESS MICA THAN ABOVE	ам,	11:20 1/21/90
30							
-						_	DRILLER NOTES CHANGE IN RIG'S BEHAVIOR
58 -	158- 160	4045	1.8"	6-9-9 (18)	SILTY CLAY, DARK GRAY, (N3), VERY S' (NO MICA), WITH LENSES OF LIGHT GR, WHITE, VERY FINE, POORLY SORTED S SANDS ARE MOIST	TIFF, AY- AND;	08:15 1/22/90
~							
						-	1 . –
. 7							1 . 7
63 - 64 -	163- 164		0.6'	50-50/2	SAND, SALT AND PEPPER COLORED, M TO WET, VERY DENSE, FINE, POORLY SORTED, WITH -5-10% GLAUCONITE	OIST -	10:15
-							· ·
-		4047				-	-
-						-	_
68 -	168-		0.6'	45-50/3	SAME AS ABOVE		-
69 -	169						13:30
-							TO OF BORING
72					FOUR WELLS SET AT THIS SITE SCREENED INTERVALS		
-					160-170 44V,-49V, 34V,-39V,		
					20-30	-	_

	24	1	-17	1	PROJECT NUMBER	BORBA	GNUMBER		
	14	$\omega$	-14	£	SE028178.FI	Well	121 SHEET 1 OF 7		
					SOIL	BORIN	G LOG		
· · · ·			75	L Clie Januard	· · · · · · · · · · · · · · · · · · ·		terment of the second second		
FRO. B	ST	<u>apr-</u>	1111158	TERE Investo	IDEATION Well Cluster WC2, Nothwest of Plant				
DEUX	NC ME	1470		USAENT HO	liow Stem Auger 18-inch Ó D \ 8-57		ameenna		
Wa (26	s feve	ANC A	0477		97407 11/14/89 C	Janess 1	/6/90 Jossen J. Mitcholl		
				STANCARD		11131			
1≥			-	PENETRATION			CONMENTS		
(음종)	=	5!	Δ	REFUCTS	SOL NAME, COLOR, MOISTURE CONTENT	<u>.</u>	DEPTS OF CASING,		
192		28	NO	6.2.5	STRUCTURE, WRETALOGY, USCS (CACU)	Pr	1746_LING RATE. DRILLING RUXILOSS.		
「島園	Ę.	훈클.	'≧E'	ĨŇ1 (	SYMICE.		TESIS AND		
5 2 3	<u> </u>		<i>a</i> =				19STRUMEY ATION		
[ _	C-2		U.F	1-3-4-5 (7)	<u>SAN DY CLAY,</u> PINK YELLOWISH BROWN (16 YR, 6/2), DAMP, RAM, MEDIUM FO C SAND SIZE, DCOTS AT TOP	N, KDARSEL	853IN CRUEING 11/1465 AT 10:22		
2	Z-4	4050	1.5'	4.E-7-7	SAME AS ABOVE, STIFF, INCREASED & VERSUS CLAY, (40% SAND)		1990 <b>= 0.0</b> 22M		
1			<u>.</u>	(12)		!			
4 -	1				FAT CLAY WITH SAND, MODERATE	•			
	46		12	6-S-10-10	YELLOWISH BROWN TO DARK YELLOWI RECYMM MINNE SMI VERY STORE (CH)	лзн <u> </u>	MINDE IAON STAINING OF CLAY - ESILLING EXTERNING OF CLAY		
6 -			h-r • .	. <u>. (</u> .a)					
L _	ea.		· 97	2.7.0.11	SAND AS MOVE				
	1			(15)		_			
je –		1	$\vdash$	· · · · · · · ·	STATE OF AN DADK YELLOWISS COMMAN	e ·			
	3-:0	4651	17	. <del>8.0.</del> 0-11 (-9)	(IO YR. S6), MCCBT, VEW STIFF, TRACE (10%), PLASTIC, (CH)	Ë SAND	IINU = C.C PFW.		
- 10	10 °2		1.7	2-5-6-8 (11)	CLAYEY SANO, DAVK YELLOWISH BROY (10YR, 4/2), MOIST, MEDIUM DENSE, (50 1975), CROANIC STANING, DOODS, TAN	WN, 2807			
12					(22)		MINOR CHGANID MATERIAL		
-	12-14		i'a.	8-10-10-:1 (20)	ECWISH BROWN, (SYR, SKI), VERY STR TRACE SILT, (CL)	760- j			
100-	1	i			STATY CLAY, LIGHT BROWN TO PALE		-		
}	- 16-16 -	2052	<u>1.</u> Z	11-13-12-12 (25)	YELLOWISH BROWN, IS YR. 56) TO (10) 6/2], YERY STIFF, TRACE SAND, (CL)	YR. —	Ī		
1.6		]			8.6		Ī		
-	- 16-18	ļ	1.9	4-7-:0-11	SAME AS ADOVE	_	EVERD COLUMN STUG 40		
13 -		•					Consection Candidan Inclu		
	10.20			4 5 10 19	SAME AS ABOUT INCREASING SANO				
	10.55		1	(10)	CONTENT		RESUMED DRIFTLING 1015/05 AT 08:19		
20-		1	<u> </u>	· · ·			4		
ς -	-zc-zz	1000	1.2	2.3.7.9	SILTY DIAY, PAUG YELLOWSSII DROWN	۰. –	]		
-	<u> </u>			, (12)	(10 YE 62) STIFF, TABE MECON SAV	ND	THON BRAINIAG A CANDS		
	- 22 24		2.3'	10-11-12-15	SAME AS ABOVE, VOIST, VERY STIFF, I PLIABLE	MORE -	-		
24 T	<u>-</u>						-		
24-26 1 2 15-12-16-17 SAME AS ABOVE, VERY STIFF, NOT FND URILLIN 129 PLIABLE					FND DRILLING AT 10.55				
26 SILTY CLAY, GRAYISH CRANGO 20 - 20-29 4054 207 8-7 3-7 1YELLOW GRAY (5 YR. 201 MO				2-7-0-17	SILTY CLAY, GRAMSH CRANGS FINK T [YELLOW:EN GRAY, (S YR. 7/2), MOST T	01 00	RESUMPTION DRUGARIES INTO CELTA		
		1		(19)	WET, VERY SIGN		ENCILM FEREN WATCH TABLE AT 20 52 (MILT)		
(°), -	-18.30	i	م	i Bursinstre	SAND AS ABOVE, WET HADD, TRACE S	SAND -			

					PROJECT NUMBER	BORTON	NUMBER		
					SEC/28178.FI	Well	121 SHEET	2 .CF	7
					SOIL	BORIN	g log		
		GDP	Phase	l Site (nyesti)	COATCH	Well Ci	uster WC2. Nor	trwest of	Plant
ELEVA	TCN				DRILLING CONTRACTOR Q	eolek Ent	ineening.		
עהאס	ING ME	DICC /	4NR 50	TUIPMENT_HO	llow Stem Auger (8-inch C.C.) B-	STATV			Uiloned
WATE	R LEVE	LANG	DAI'E	OTSHDEED	START 11/14/89	FEASH 1	velań	GEA	. waiça es
≈	8	AMPLS	= '	PRATEATON	SOIL DESCRIPTION		C	OMMENT	<u>s</u>
CIVENTIA BELIOV SURFIXOE (FT	INTERVAL	TYPE AND NUMBER	REDOVEHY IFTI	TEST REQUICTS 8' -5" -6" (N)	\$02, NAME, COLOR, MOISTURE CONTE RELATIVE CENSICY OR CONSISTENCY, STRUCTURE, MONERALOOV, 2505 GRO SYMBOL	nt, 504. X/P	DEPTH OF ( OPILLING R DRILLING F TEATS AND INSTRUME?	CASING. AFE. LLVD COSS. AFA DON	
32 -	33-22	4054	2.0	3 <del>47</del> 8 (11)	SAME AS ABOVE, WET, STEFF, TOP 02 BLACK OF GANIC STASSING	3FT	HNU - OO PPM		CSUTS
-	32-34		18	12-14-17-17 (31)	<u>SILTY CLAY.</u> MODERATE REDDISH BR (10 R 34), HARD, TRACE SMO	NIVICH	GFFER CONTRE		
34 ·	- 24-36	4055 	1.0°	14-35-38-38 (31)	SAME AS ABOVE, LAYERED COLOR O BETWEEN FALS YELLOWISH REOWN REODISH DROWN	ANC	ISCLATED BLACK	CHGANG	emaco (
	 		1,9'	4-8-16 22 (24)	SAME AS ABOVE, PALE YELLOWISH F ABOVE REDDISH BROWN, VERY SUF	rijaciwin	<u> </u> 		
	38-40		1.4	10-25-23-27 (49)	SAME AS ABOVE, HARD, ISOLATED (	COOBLE -			
-0-	- 410-4.2	605E	20	8-7 5-10 (15)	SAME AS ABOVE, VERY STIFF, BOLA	- CET	HNU - 0.0 PPM		
12	- 42.44	4097	1.5	:2.14-19 Ia  32;	SAME AS ASCIVE, HAND, NO COSSU	e –	<u>]</u>		
4	· +++45		1.5	11-15-14-54 (29)	SAME AS ABOVE, VERY STIFF, FOC LIGHT GRAY CLAY, WITH TRACE OF SAND	Xets of Vedium	איזיז איזיז אען באאר איזיז איזיז		
16	-46 48		  e	5-8-(2-)4 (2E)	SAVE AS ABOVE	•	i l		
48	48-53	1	L7	10-12-15-17 (27)	SAME AS ABOVE, THUN ORGANIC SE	AM -		•	
50-	- 30-52	z	20	€ & 5+16 (17)	<u>(LAYEV 5) TIVITH SAND</u> REDOKA (198 4/2), VERY STIFF, MCACEOUS (SEAMS, (CC)	BIROWIN, OTICANIC	-		
		507 <sup>ل</sup> ه ا	a∣ i,a	(11-) 4-15-1) (29)	SANG WITH SILT, REDCISH BROWN. MEDIUM ODNSE, WEI,L GRADEC, FI COARSE, WOACEDUS, (RO-20%) (SM	. (10H 445). NE TO 4)	HNG = 0.0 PFM		
=4	52 S	E	1.5	7 : 15-22-34-3 (55)	SAME AS AGOVE, VERY SENSE, FIL MEDIUM SAND SIZE	NE TG	ENDED DHILLIN	IG AT 10.2	9
55		9	1.2	8 4 8 13-8 (18)	SANDY CLAM, REDCISP BROWN, (1) WO'ST, STIFF, PLIABLE: OVER 10 P VEDIOM DENSE, MEDIUM COARSE	371 6/4), T. <u>SANC:</u>	_RESUMED CR .	цика нич Г	/ <i>a</i> /s AT 08:14
1		- 000 - 000	a — 	: 12.60.71	SAND, REDICISH BECWN, MORE, VI DENSE, MIGACEDUS: UNDER 10 FF.	ERY GEAVEL	LOWER CONTO	n Milan Ci	2005179

						_					
					PROJECT NUMBER	BORIN	G NUMBER				
					SE028173.FI	Wei	1121 SHEET 0 OF 7				
					SOIL	SOIL BORING LOG					
_	_										
PACUE	ст <u>Р</u>	GDP	<u>Phase</u>	Sita Investi	gation LOCATION	Well C	luster WC2, Northwest of Pla.				
BLEVA	7.ON_				DRILLING CONTRACTOR	actes En	<u>oneenro</u>				
200 LLC	NE ME	CHOD 4	AND RO	NUSWENT HO	How Stem Augor (8-Inch O.D.) B-	STATV					
WATER	LEVEL	ANC	CATE_	and the former of	stAat11/14/89	FINISH	UNVAU LOGGER J, MAQDEIL				
	2	AMPLE	E	FENETRATION	SOIL DESCRIPTION		CONVENTS				
3ê			٢	TEST	SCIL, NAME, COLOR, MOISTUFFE CONTE	ST.	DEPTH OF CASTNS				
88	물는	ういい	Ξ.	PEQUEIT	RELATIVE DENSITY OR CONSISTENCY.	534	DRULING ANIC				
문감	5.	눈물'	8_	6-6-6	SYNEOL		TES12 AND				
55	i ≊	≿≓j	문론	ן ייי ן			INSTRUMENTATION				
80	. 1		-		SANO, REDDISH RINOWN, VERY DENS	F,					
l –	50.62	4050	1.8	7-32-53/5*	MEXUM COARSE; OVER 0.4 FT. GRAV	( <u>FT</u> ) 3 /353/					
	1				BAND/25% GET	-9 (n a - 10					
62 —			i –			5.01 	1				
- 1	52-64		1.7	5-4-16-18	MEDIUM DENSE, MICACEOUS; OVER (	oral CRAVELLT					
د -				(25)	MODERATE DROWN, (5 YR. 4/4), SUZE	ROUNDED	-				
l⊶ -	i l		!		SAME AS AROVE DENSE, GRAVE, CO	ONTENT	ĺ				
-	64-66	4061	1.3	4-12-28-535	INCREASED VERSUS SAND, (60% GRA	AVEL-	1				
66 -	<u> </u>		L	140,	40% SAND)		-				
					1						
i -	- 66-33		1.6	(47)	SAME AS ABOVE		ENDED DRULLING AT 15:34				
63 -	+		<u></u>		·		1				
- 1	50-70	i	1 13	11:6-23-24	SAND DARK YELLOWISH CRANGE, (I	CYR. GG.	THESE INCLUSION AND A STREAM THE A				
	1			[45)	WET, DENSE, MELICAR, COMPAR, WET	L GRADEL	A COMPERCIAL AND A CONTRACT OF A CONTRACT.				
70-	; <del></del>	1									
1 -	70.72	4062	1.4	3-19-34-36	CVEN & SECVE, VENY WES, VENY L CVEN & SET, CDAVEL 185% SAND/24	JENSE; Sé	HP210 - 39 CFM				
29 -		1	1	(53)	GRAVEL						
1°*		·			SANDY GRAVEL DARK YELLOW SHO		DROUND ENDED AT 11:53				
1	72,74		1.1	8-17-27-26	(10 YFL GET, DENSE (1/8-1/2-WCH DIA	метел) т	1				
74 -	:	<u> </u>	- · -	(444)	(SOR GRAVEL/20% SAND)		-				
Į.		· ·			SAME AS ABOVE, WET, VERY DENSE	, SAND					
) —	1		1.2	20-19-003 1	CONTENT INCREASING (SD%, GRAVE)	1/50%	UPILLING BEGINNING 11/27/59 AT 3T:				
78	+	÷	-	<u> </u>			4				
	76-78	4064	l ur	9-38-505	SAME AS ABOVE, WET, (30% GRAVE)	L22%					
					i cownae ann by		à la companya de la c				
78 -	<u> </u>				DAME AS ADDUS OTHER MOTH & 25	ET 1/15	7				
	- 78-80		2.01	12-14-25-505	YELLOWSH BROWN, 110 YR. 621 CU	AVEY	10NU = 0.5 PPM				
ĺ so .		ς	j	(30)	SAND LEWS AT CENTER						
~	_	1		1	SAME AS ADOVE, VERY DENSE, NO	CLAYEY	7				
1	-j90.82		1.3	4-25-03-31	SAXD, VERY LAPGE ( IN-IN, TO 1-IN, I	CIAMETER	n -				
22	-		-	644	TORDELES, GRAVEL	awarse vič	5				
	63.84			1.0.02.02.02.00	YR. 66), MOIST TO WET, VERY DEVE	S. FNET	S. RED STAINING IN SANCE				
1	100.04	-030	*  <sup>1.2</sup>	(501	MERICA; OVER GRAVEL OHERT		- '				
94		1					-				
	94-66		1.4	r   8-13 27 38	BANDY GRAVEL MODERATE YELLO	WISH MEDIUM	DED IDON STAINING				
1				(45)	TO COARSE, (SON GRIDDY, SAND)		s to ministry				
. 36	1		1								
1	38-33	4	2.0	2-12-43-30/4	SAME AS ABOVE, VEHY DONSE		1N.0 - 0.0 PPM				
69			1	:20]			HP210 = 05 02 M				
1		:	1	1	SELA SAVE TEN CHANGE FOR (31)		r				
	1.5	1	- 13	5-2-57-52	T USYS, SET TO VEHY PALL OHANGE?	10461-520	TE EQCENT RAND AND GLAY 1.				

					BRO ISCT NUMBER	107Dist	CHUNRER
					5EC28178 EL	i Wel	1121 SHEET 4 OF 7
					SOIL	BORIN	IG LOG
		202	Thorn	Cite (mutart)	action i contrare	Moll C	here WCA Northwart of Black
PRCJI ELEW	EGT P	GUP	Phase	i zne sivies.	DAILLING CONTRACTOR G	actek En	kastat mozz, morthmest or main
DHILL	ING ME	THOO A	AND EC	uirvenr <u>"H</u> o	llow Stem Auger (B-inch O.D.) B-5	7 ATV	
WATE	F.LEVE	L AND	DATE_		START 11/14/89 5		//6/90 LOGGER J. Minemell
-	8	AMPLE	± :	BEAGAANDARD PEAGTRATION	SOL DESCRIPTION		COMMENTS
일트	- <u>-</u>	4	ĤΥ	TEBT. HESULTO	SOL NAME, COLOR, MORFULE CONTRA	ат, 2011	CEPTH OF GASNIG.
E S	2		18	8"-8"-5"	STRUCTURE, MANERALOGY, COLA GHILL	UP .	ORILLING STUD LCSS.
별물	1 <u>8</u> 1		ŵĘ,	(Ň)	SYNEKI.		TESTS AND INSTRUMENTATION
30	90 6Z	4066	1.5	4-1-5-0 1	NTEGOLIYYSO, CLAM, PALE BROWN, (SYR. 5 CRAYUS, CHARLIS PINK, (SYR. 72), FIDLS AT UCH I CROWN, (SYR. 55), TO VERY PALE (J	12; TO 55 54M1 20565;	GEST SANDYDLAY SELOW SOX GRAVEL
93 -				fat	NCYR 10,1005- WCWERTE BELOW DR	аурц — —	AUGE/IED \$2-45 FT. CHILLER DESCRIBES 3 FT. 20NE AS CLAY UNIT
97 -			5'0.	2-4-7-10 (11)	SILTY C. AY, YELLOWISH BROWN (10Y) TO CLIVE FLACK MOIST, STIFF, MICAG WITH INTERRECOED CLAY AND SAND OLS FT	F 22) _ 2009, IN 70P _	FORTERS URBEK CLAY
100-	-	4067	 	 	<u>אין די כ' אין ס</u> נגאי <u>אַבויסיאיט פּ</u> רס	· -	-
102	1 :02	-	2,3	2 6-13-19 (18)	'(10 YŘ. 22), VERY STIFF, MCACEOUS <u> </u> 	-	ENCED ORIULING AT 15 25
102	1	4038				-	
·	1			i		-	12/1//99
105	106-		2.9	$\mathbb{X}$	SHELEY TUSE WAS COLLAPSED ON SOTTOM, COULD NOT GET TO SOL 9	THE .	<ul> <li>RESUMED OHILLING AF 16:10</li> <li>TOOK SHELBY TUBE SAMPLE AT 16:55</li> <li>ON 12/11/64: SHELBY WAS PUBLICD</li> <li>FT VERYLARD TO 2016-0</li> </ul>
107	) 107	4077		20 27 47 02	LI CLASSIFICATION LEAN CLAY WITH SAND, DUSKY YEL.	-CWISH	QUIT FOR THE DAY AT 17.99
		-		(74)	BROWN, (197F, 321, MOIST, HARD, M CAUSOUS, 15-20% SAND (OL)		BECIN CRIELING AT 11 CO ON 12/15/89
:09	(05	-i 1.9°				· -	T. OUIT FOR THE GAY AT 15 29 co : 2/13/2
110							ASSUMED DRIVING COURSE AT 1240
1	1 106	·	i aa	30 67 55-33	. CLAYEY SAND, DUSKY YOUCWISH (	BCWN.	
	112	2	0.9	25 51 203	UDYR, 32), MOLST, VERV DENSE, SI PLASTICITY, 20-438, P200, SIDNE SM	ាលី) សារ	7
102	T				BLACK WOODCHAS, (SC)		7
5.52		4075	ļ				-
		1		1		-	-
្រាទ	1. 116	<u>.</u>	1	1 .	POORLY SEADED SAND WITH SILT.	DUSKY	i
	1	7	c.2	270/31	YELLOWISH OPOWN, (10 YFI 22), W VERY DENSE, 5-12% 2200, THE VERY SPOCH MAD LEAN CLAY, STRATIGE	CIST Y TIR OR AFHY	
115					<ul> <li>SEEMS TO BE ALTERNATING GANO.</li> <li>CLAY _SE-SWI</li> </ul>	A\0	1
110	-	1 40.0		1			-

					PROJECT NUMBER	3 ORI	NG XUM	BER			
					SE02\$178.71	We	alt (21	анаат -	δ, ς	хř	7
					SOIL	SOIL BORING LOG					
an ar	P	GE 2	Thase	I Sile Investi		Wall	Cluster !	NC2 Nerr	hwes	l of l	Flaza
ELEVA1	ICN				DRILLING CONTRACTOR	ORILLING CONTRACTOR _ GROLEK Engineering					
DRILLUS	IG ME	THEO /	AND EQ	UPMENT MU	d Sotary (79, Frich O.D.) Lothervear	44					
WATER	1SVE	G/A 1	CATE_			пиан_	1/6/90		леч_	_N\$	<u>elsen</u>
¥⊊			E	STANDARD PEHETRATION	SOIL DESCRIPTION	·		Ct	омма	нтэ	_
훈문.	코	[쿺도]	È i	RESULTS	PELATIVE DENSITY OF CONSISTENCY. 3	87. 9771		CEVERCER C	ASING	•	
EE	E al	집::	8-1	6, 4, 6,	9771UCTUFE, MINEFALOOY, USCS CROU SYMBLA	91		CHULLING PL	0010	155.	
변화	Ę.	ĕ₹	문도	(N)				NSTRUMPA	сатно		
122 -	123- 122		1.07	30-100/16*	POOPLY CRACED SAND WITH SILE CO BUCSH CRAY, (55 7/1), MORT, VERY DENSE, OUARTZ SAND, VERY FINE TO 5-128, P200, (SP-SM)	ISHT DRINE.	RE5(J) AT (9) AT (2)	MED DEALLIN AS SWITCHE LET.	4/3 12 30 TO	1996) 300 (	а СБ. НАМ
		4179					-				
_			i				-				
125							WHOLE	DRICENS	rc 12:	FT.	DARLE
_	125-						- LCSS	VTED HELO WAS VERY I	OT EC MINCI	рыв ( П	n: 75CL
I	127		a,ar	54 66/61	SAME AS ABOVE, (SP-SM)						
127 -							-				
-		4591	i				4				
_							-				2
150			h .				L GUITT	TOR DAY AT	1251	· .	
	135-				INTERREDCED POCKLY GRADED SAM	ND	AT 16.	65 GN 12/19	8.9		
	132		· 3.3	35-46-24 (72)	, <u>AND SAND<sup>O</sup> SLAY,</u> POORLY GRADED LIIDISSA, LICHT GRAV, INZI, MOIST, VER	ISAND - IY	HESU	иео сялы	NG AT	1:23	a
132 -	-			1	RENSE, CLARTZ SAND, FINE, G-55, PS	200. (SF)	CN 12	13-93			
-		4082			SROWN (10YA 4/2) SLIGHT PLAST/CIT	Ď,	_				
_					20-40% SAND (CL)						
				1							
<u> </u>	125-			3			QUIT	FOH CAY AT	1357	· · ·	
1 7	. 497		2.0'	3-6-8-10	ELASTIC SILT CUSKY YELLOWISH BY	ROWR	- AT 15	45 OM 1210	720		
137 :-		<u>!</u>		(14)	VERY VERY THIN LENSES OF GUART THEOUGYOUT SAMPLE, (ML)	ZSAND	RESU CN 12	MED CHALLI V2004a	NG A1	T 11:2	:0
-	1	acoa			1		1 6017	FOR DAY AL	F 127 (	ET)	
! -			1				- AT 12	20 CN 12(2)	1834		
142											
_	40	!	212	10-21-26-50/1	: ELASTIC S'LL CLIVE BLACK, (SY S/1)	i. The	SWCT AT 16	아파의 10-14 이번지	619.	HAM	MER
	148		1	(≦9)	VESY TWO LENSES OF QUARTZ SAN	IC .	· 7651	MED DRILL	AG AI	F ce g	20
142 -	i				THROUGHOUT SAMPLE, (ML)			2.00			
	-į	İ.					-				
1 -	-	-113:5	· ·	;							
1.4-1		!	3	1							
	155				1		CWIT	CHEC BACK	170.0	51 00	Sec. 14
	] . • 47		30.	23 42 50/41	<u>SLASTIC SILT_CLIVE REACK, (SY SM</u> MONT_VERM STILT_MCGERATELY C	). Di asciñan	AT 14 W(TH	136 .LAF	AIM CO	FINI	SHED
147		1.			VERMITHIN LENSES OF QUARIZISA	ïC	. CEIV	NO SAMPLE	WITH	1 3 20	LE. ·
i .		1024	,		MICAGE(213) (ML)						
1											

	PROJECT NUMBER	BORING NUMBER
	SED28178.FF	Well 121 SIEET 6 CF 7
	SOIL	BORING LOG
incurse ECOP Fluxiel Site Invest	tioning	Molt Change 1922 March 1942
ELEVATION	OFFILING CONTRACTOR GE	weit Gaster WO2, Norshwest of Plant
SPILLING METHOD AND EQUIPMENT_M	ud Retary (797,-Inch O.D.) Longyear	44
WATEH LEVEL AND DATE		INISH 1/8/90 LOAGER Bringerd
BANPLE STANDARD	SCRL DESCRIPTION	COLUMENTS
D → J = F Passucts	SGIL NAME, COLCA, MOISTCHE CONTRA	T. SEPTH OF GASNE
800 S 20 U 6 6 6 6	STRUCTURE, MINERALOGY, USCS GROU	ERICING RATE. P CRUDING FUNC (CS4.
동풍 토 <u>방</u> 울 원도) (M	SP900	PEETS AND INSCRIMENTATION
1.50	FLASTIC SILT OUVE DLACK OV SOL	
- 2.3 5-3-12-40	WOIST, VERY STIFF, SUGHTLY PLASTIC	, STIFF
152 152 (20)	THAN ASOVE, MICACCOUS, (ML)	
		Li doine 300 E. SAMMerk
4037		
		_
158 - 155-	ELASTIC SILT. OUVE DEACK, (SY 211, M	D:37.
2.0' 5-:1-20-50	HARD, SLIGHTLY PLASTIC, HIGHER	
157	0 6 SATUHATED, DOES NOT HAVE BAN	D Terod relea
	LAMINATIONS, MICAGEOUS, (ML)	RESUVE ORILLING GELD
1 JCISH		- CN 04492
		-
163 - 180	LELASSIC SELF. CLIVE BLACK, JEV 2013, V	KOIST.
	ST.FF, SLIGHTLY PLASTIC, HIGH PERCENTAGE OF THIN SAND SEAMS	-
162 182	VICACZOUS, (ML)	_
	s	7
	INTERREDUCT ELASTICISTEL OUVER	ACK, THE TOP OF RAMPLE WAS WET, PROPABLY OUT TO DEPUTY OF MULT
	MICACECUS, (ML), AND POORLY CRAO	
157 1671	SAND WHATE, FINE LAMINATIONS, 30-	40% - CRULISH NEIDATED A CHANGE
		IN DRILLING AT 167 FT
177		
20 2-7-5-7	O MEN SILT OTHER AND REVIEW	
(6)	MOST, FIRM, MODERATELY PLASTIN,	(014)
172	_	-
4001	i	4
		_
	<u> </u>	
2.1 2.17 G-12.17 VE	SLASTIC SILT, GLIVE BLACK 15Y 220	-
(28)	MOIST, VERY STIFF, MODERATELY PL	ASTIC, FRO DRILLING FOR THE DAY ASTIC, I 15:10 CM (4400
	FINE SAND, (ML)	
4792		-

					12-04					
					PROJECT NUMBER	BORIN		ER		
					SED28178.Ft	We:	i 121	SHEET	ΤCF	7
					SOIL	BORIN	IG LO	G		
PHOUGHT	r_ 9(	BDP I	Phase	Site Investic	12tion LOCATION	Woll C	luster V	NC2. Nor	thwest of	hale
ELEVATIO	ON				DRILLING CONTRACTOR G	exex En	gineeri	ng		
WATER L	S MET EVEN	AND A	NNO EQ DATÉ	UPMENT MUK	<u>1 Solary (7%,- nch O.D.) Longeyezr</u> Stapt 11/14/95	124 Civiso 1	/8/90	.02	052 B	ciprami
i	3	AMPLE		STANDARD	SOIL DESCRIPTION				XIMMENTS	3
3£	. i	-	≥ ;		901 NAME, COLOR, MOSTURE CONTEN	л.		76275-061		
. 23 <b>2</b>	Ē	粪티	B I	RESULTA	RELATIVE DEVISITY OR CONSISTENCY, 5 97/JUCTUTE, MANURACOST, CSDS CARS	SOL		SALLINGA	ATE,	
E E	NE		₿€	(N)	SYMPOL			TESISAND		
- 69	-  - - 80-							Mathioxe-	1141121	
_			z.σ	WOR-5-8-7	FLASTIC SILT, OLIVE BLACK (5Y 2'D),	-	USING	200 LB. ; V	WMER	
102	192		!	(14)	MOIST, STIFF, MODERATELY PLASTIC THIN SEAMS OF WHITE FIRE SAND, IN	41 –	į.			
		4055		i i		_				
						_				
1.25										
100	185-1		2.01	WD8-5-7-11	CLAYEY SILT, OLIVE BLACK (SY 57).		1			
Ì	(87)			(12)	THIN SEAMS OF WHITE FINE SAND AT	÷ –	1			
102 +					BUT OW OF SAMPLE, (MR)	_	-			
1	!	4094				-				· · .
-!	i			i		-	1			لي ا
190	196-		·		ELASTIC STIT AND BAND CLIVE PLAC	СК	{			
-	. 1		2.J	WOA5-7-17 (12)	(5Y 5/1), MOISE, STIFF, WOUSPATELY 21 ASTICLIARGIA NUMBER OF TUNING	-	{			
182 +	192		<u> </u>		FINE BAND SEAKS, (W-SP)	-	-			
-		4095								
						-	4			
195	1951						1			
- 1	122-		2.0	W0R-5-7-15	ELASTIC SULT, OLIVE BLACK, WET, ST MODERATELY PLASTIC, FEW SEAVE	TPF. OF .				
197	197			(12)	SATURATED FINE SAND, MICACEDUS	2, (ML)				
i										
	i	4096	1			-	]	ANDI 6 26	aw.200152	202 57
				. 1			29 APP	AFESTLY	FROM 199	TC 230 FT.
	220-		217	1/ 3.4	ELASTIC SILT CLIVE ELACK, ISY 2/1					
	300			( <sup>1</sup> 0)	WE1, SCH1, MCCERATELY FORSTIC.	190		NG AT AB	DOL 500'P	icua÷ ⊡.
237				<u> </u>			, 650 A	PILLING T VG EASIER	EPORTEDU I WITH DEF	.Y TH
1 1		4097					i .			
i H						-				
200-	205-	· · · -	· · · · · · · · · · · · · · · · · · ·	ţ	PROPER GEA (101 ST TV SAME LICH	TSEAN	-			
1 4	90 <u>6 (*</u>	{	_1 Z	Z3 75 50/Z"	(KA), WET, MERY DENSE, VEHY PINE	(3P GM)	-			
227		i							-	



					PROJECT NUMBER	BORIN	GNUMBER	_	
					SED28178.FI	Wel	122 SHEET 1 OF 6		
					SOIL B	SOIL BORING LOG			
ROJE	ct_P	GDP	Phase	I Site Invest	igation LOCATION	Well C	luster WC3, East of Plant		
LEVA	TION_	THOD		OURMENT	DRILLING CONTRACTOR_ GEO	tek En	gineering		
VATER	R LEVE	L AND	DATE_		START_11/18/89 FIN	IISH 1/	/5/90 LOGGER MK Dwyer		
		SAMPL	E	STANDARD	SOIL DESCRIPTION		COMMENTS		
	, M	26	ERY	TEST	SOIL NAME, COLOR, MOISTURIE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL	L 3	DEPTH OF CASING, DBALING BATE		
SURFAC	INTERN	TYPE A NUMBE	Necov E	6"-6"-6" (N)	STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	a,	DRILLING FLUID LOSS. TESTS AND INSTRUMENTATION		
-	0-2		1.0"	2-2-3-4 (5)	BLTY CLAY, GARK YELLOWSH BROWN, (19 YE 40), MORT, FIRM, HOMOGENEOUR, BLEMTLY PLASTIC, (CJ)		HNU = 0 PPM HP 260 = BACKGBOUND	-	
-	2-4	4100	1.3	10-12-14-16 (26)	SETT CLAY, MODERATELY TELLOWISH BROWN, (10 YR 54, MORET STAT, SOME MOTTLING, MEDIUM RUSTROTY, (KL)	IT, VIERY	SAME READINGS	_	
-	4-6		2.0	7-7-10-13 (17)	BUTT CLAY, PALE YELLOWSH BROWN, (10YH MG), MONT, VERY ST HON NCH LINEAND, MICH GNEARCE, LOW PLASTICITY, (5)	stre#		_	
-	6-8		1.7	8-8-10-8 (18)	BUTT CLAY, MODERNIE VELOREN BROWN, LI ORI SHI, AND UGH (MO, MODET (74), TO WET (9-2, VERN STOPP, INCH ROLL AVERAGE SHATTOTY, 603)	NT GAWY.		_	
_	8-10	4101	1.Z	7-7-10-10 (17)	SETT CLAY, SAME AS ABOVE, HOMOGOROUS, (F-9, PON RICH WOTTLING, (F-10), (CL)	-	HNU = 0 PPM HP 260 = BACKISROUND (30 CPM)		
-	10-12		1.5	12-14-14-15 (28)	SETT CLAY, SAME KE KBOVE, MOTTUNG THEOREFUT, CO.J	_		-	
-	12-14		1.9	4-7-7-9 (14)	SETTIONE MODERATE FELOWER RECHT, 15 YR MI, AND GA (13.5 Y 6071, DAM, 2707, ISON RCH LAYERS, 20 % FRE 5440 12 13.5 YT. (51)	AIY 013	HNU = 0 PPM HP 260 = 30 CPM (BACKGROUND)	_	
_	14-16	4102	2.0'	5-9-13-13	SETY CLAR, MODERATE VELOWER BROWN, (19 YE SH, MORT, V STRF, HOMOSEHEOVE, (CL, OVER SAED, YELLOWER GWY, (IV SH), GRY, MONIH DENSITY, FINE SK	NDRY		_	
6 -				(.ee)	SETY CLAY, SHIEL AS (1415 FT) FROM 1616 SPT: OVER			-	
-	16-18		2.0°	8-9-9-12 (18)	SANDY CLAY, MELICIWICH GRAY, SY MYO, MORET, HERV STAP, SON SAND, HOM RICH HOTTLING THROUGHOUT, (CL.)	~ -	SAME READINGS	-	
s —	18-20		1.6	8-11-11-12 (22)	BLITY CLAY AND EARDY CLAY, MODERNIE VELLOWER BROWN, ON DAL BLATERY, AND YELLOWER GRAY, (STAT) 18-40 FC, MODE TYPE, BONE BOOM ROLLOWER, LOW PLACEDITY, JONE FRE SAME	1018 97, v692 10, (CL)	HNU = 0 PPM HP 260 = 30 CPM	-	
-	20-22	4103	1.9	9-10-12-12 (22)	SASSE CLAY, USHT GAMP, (HT), DAMP TO HONST, WOY STWF, HAS STANED LANDRAG AND INCLUSIONS, LOW PLASTICITY, (HT), SAND WITH 24F, FINE SAND LANDRS, (CL)	04 -	(BACKGROUND)	-	
-	22-24		0.4	6-6-11-13 (17)	SETY CLAY, VELLOWISH GRAY, 19Y MIL WORF, WERY STUP, HOMOGENEOUS, LOW HEDRIG PLATFOTY, (CLa	-	16:15 END SAMPLING	-	
_	24-26		2.0	6-6-8-9 (14)	SET (CAT, UGHT SHOWN AND GRAY, IS IN SEE, INT), 1996, WORLSTREE, HOW STARSHO AND MOTTLING THROUGHOUT, PLATECTY, SOME FIRE SARD, (CL)	c yaw	SAMPLE #4104 IS EQUIPMENT BLANK TAKEN ON 11/18/89		
	26-28	4105	2.0'	7-10-10-13 (20)	<u>In 17 cili (</u> ucht Bronn and Bruy, (3 yr Bru, (4), Dinaity, Yeny Styf, from Standys and Motti,Ma, 10W Plasticity, with Laters of Well Bortisp free (440) (2 ft. (6)	000 -	HNU = 0 PPM HP 260 = 32 CPM (BACKGROUND)	_	
	28-30		1.6	8-8-9-11	SAMPLOLY UCHT MOWN AND CRAY, SYR SHENRY, MOST, YEN NON STANDING AND NOTTING, TAKER SAMPLINGED FEBLUS, WI SET AND PART SAMPLOYD, WELL CRAUDER (CL	RT BT WY		_	

					PROJECT NUMBER	BORI	NG NUMBER	_
					SED28178.FI	We	II 122 SHEET 2 OF 6	
					SOIL	BORI	NG LOG	
000		COR	Dhares	I Site Inves	tigation	141-11-1		
FLEVA	TION	GUP	rijase	i one inves	DRILLING CONTRACTOR G	well (	Juster WC3, East of Plant	
DRILLI	NG ME	THOO	AND E	OUIPMENT_B	-61 Hollow Stem Auger, 7-inch ID, 1	13/4-in	ch OD	
WATER	R LEVE	EL AND	DATE_		START 11/18/89 F	INISH_1	/5/90 LOGGER MK Dwyer	
-		SAMPL	E	STANDARD	SOIL DESCRIPTION		COMMENTS	
SE.	-		à	TEST RESULTS	SOIL NAME, COLOR, MOISTURE CONTEN	т,	DEPTH OF CASING	
H H H H	PACE FACE		Ne la	6" 6" 6"	STRUCTURE, MINERALOGY, USCS GROU	P	DRILLING RATE,	
불불	EM	183	₩E	(N)	SYMBOL		TESTS AND	
30							INSTRUMENTATION	
	10.12		2.00	0770	SLTY CLAY, PALE YELLOWISH SHOWS, (1978 425, STPP, IDON LATERING AND NOTTLING, TAKES SUBPONDED PERSONAL STAT	NG8		
	30-95		20	(14)	LOW PLASTICITY, TRACE FINE 3ARD (19%), (CL)		HNU = 0 PPM HP 260 = 32 CPM	-
32 -		1			BUTY CLAY, LIGHT BROWN (BYB 545, 410 PALE		(BACKGROUND)	-
-	32-34	4106	1.6'	6-6-8-12	YELLOWIEN SNOWN, ITS YELD, MORT, STIFF, INCH ROM, MOR PERSUE LAYERS AT 24 FT, LOW PLASTICITY, SOME FIRE SAVE.	TLED, THIN		_
34				(14)				
					SECTI CLAY, SAME AS 35-34 FT, RAAD, TRACE SUBPOLINDED (1) PEDRUCS			. 7
	34-30		1.9	(31)		_	1. ·	
36 -								-
-	36-38		2.0'	10-7-7-9	SHI, MORET, STUP, MOTTLED, LOW PLASTICITY, PINE GRAINED I (WTH SUE, ICL)	5440 (10%)	HNU = 0 PPM HP 250 = 32 CPM	_
38 -				(14)			(BACKGROUND)	1
					SANDY TLAY, UGHT BROWN, GYR 545 AND UGHT GRWY (NO. 14	KORT, VERT		
	39-40	4107	1.8	12-12-14-16 (26)	(39-34.5 PT.) (CL)			-
40-								
-	40-42		1.9	13-14-14-16	BUTY CLAY, LIGHT BROWN, (SYR 56), AND LIGHT GRAF, (N7), IN STRY, MOTILES, LINK PLASTICITY, SCHE FREE BAND, DONL (CL	COUT, VERY		_
42 -				(28)				- 1
					CAVES SHE USED BROWN STOP OF ADDRESS INTERIOR		HNU = 0 PPM	7
	42-46		1.8	8-6-6-9 (12)	SELT CLAY, (43-44 PT.), LIGHT DRAY, (MI), (CL)	12, 0161	HP 260 + BACKGROUND	-1
44 -								-
-	44-46	4108	1.0'	7-5-9-11	SETTI CLAY, SAME AS ABOVE, INS. THE SAME, INC.			_
45 -				(14)				
					CLARK SHOLLOW REPORT OF THE STATE			1
-	45-48		1.7	5-7-7-12 (14)	STATE AND STATED AND STORE STATES AND	rates		-
48 -				1.4			SAMPLE #4109 EQUIPMENT BLANK	-
	48-50		1.8*	6-8-9-14	SETY CLAY, LIGHT BROWN (SYR 54), MORT, MERY STUT, HOMO MULLIOUS, 10 % FIRE SAME (27)	GENEOUS	ON BOWL USED TO COMPOSITE #4110	_
50				(17)	and the second second fight			
1					-			$\neg$
	50-52	4110	1.0'	7-10-13-15 (23)	THE FUEL AND AN ADDAR	-		-
52 -				1=01				-
-	52-54		1.8"	3-5-5-8	MARTY CLAY, (1994, SAUT), USAIT SHOWIN, (2019, Seb, INDIST' TO WE HOMODERFELLS, (1997, New York, Sauth John)	T, 81147.		-
54 -	_			(10)	Second Second Second Second Second			
~					STYRING INTERNET			
	54-56		1.7	8-11-14-16 (25)	HOMOGENEOUS, (14-30% STATE), (342 CHERT TO WERT, MEDIUM ; HOMOGENEOUS, (14-30% STATE), (342 CHERT) FOR THE STATE (34)	CENSITY	SAMPLE 56-58 FT:	-
56 -				(2.0)	1044	-	1-INCH ANGULAR, MODERATE	-
	56-58	4111	1.8	16-21-24-26	SITT GRAVEL HO STAL GRAVEL LEVET BROWN, MERE DR. MOR	T TO WET	RED, (SR 4/6), 1/4-INCH SUB- ANGULAR MODERATE RED ROOMN	
58				(45)	(104 44); [16-20% SAT, (Dag		(10R 4/6)	
								-
en +	58-60		1.7	13-16-21-25	BUTT DEWYEL, SAME AS ABOVE, 1046			-

					PROJECT NUMBER	BORI	NG NUMBER	
					SED28178.FI	We	II 122 SHEET 3 OF	6
					SOIL	BORI	NG LOG	
PRO	JECT_	PGDP	Phase	I Site Invest	ligation LOCATION	Well 0	Cluster WC3, East of Plant	
ELE\	ATION_	THOO		OLIPMENT B	-61 Hollow Stem Auger, 7-inch ID, 1	eotek Er 13/4-in	ngineering ch OD	
WAT	ER LEV	EL AND	DATE_		START_11/18/89 F	INISH 1	1/5/90 LOGGER D	wyer/Lahoud
_		SAMPL	E	STANDARD	SOIL DESCRIPTION		COMMENTS	Pathone
BELOW	IVAL .	N S	WERY	TEST RESULTS	SOIL NAME, COLOR, MOISTURE CONTEN RELATIVE DENSITY OR CONSISTENCY, S	T, OL	DEPTH OF CASING, DRILLING PATE,	
DEPTH	INTER	TYPE	₩E	6"-6"-6" (N)	SYMBOL		TESTS AND INSTRUMENTATION	
80	- 60-62		0.8'	8-10-19-6 (29)	SETY GRAVEL, SAME AS ABOVE, MEDIUM DENSE, O TO WELL ROUNDED, (GM)	GRADING -		-
62	62-64	4112	1.1*	11-16-18-18 (34)	SETY GRAVEL SAME AS ABOVE, DENSE, 1041	_		-
	64-56		0.7	9-13-16-21 (29)	SELTY GRAVEL, SAME AS ABOVE, MEDIUM DENSE, (	GM)		· _
66	-					_		
68	1					-		-
70-						_		
	- 70-72	4113	1.2	13-16-18-23 (34)	SETY DRAVEL SAWE AS ABOVE CENSE, (CM)	-		-
	- 72-74		1.1"	8-11-13-13 (24)	SETY GRAVEL, SAME AS ADOVE, WEDLIN DENSE, (	GMI —		
-	74-76	4114	1.0"	7-13-19-30 (32)	GRAVEL WITH SAND, PALE YELLOW ORANGE (10YR MI), TO DARK YELLOW ORANGE (10YR MI), WELL SORTED, SO-60% COARSE SAND, (SYM)	ENSE		
/6	76-78		1.9'	9-12-21-26 (33)	GRAVEL WITH SAND, (\$0-60%), LOGSE, MCDERATE' BROWN, (10YI SHI, TO DARK YELLOW ORANGE, (10YI SH), O UP TO INFCH, POORLY SORTED, SO-60%, SAND, R	YELLOW		-
78 -	78-80	4115	1.2	11-14-19-21 (33)	SAND WITH GRAVEL SAME AS ABOVE. 70% SAND, ( OVER I-IN, SAND, WEDLIN GRAY, (NSL DEASE, COAN SP)	SW1: USE_(SW-		
eo	-					_		
82					*	-	ORILLER NOTES GRAVEL WIT LARGE COBBLES	гн _
84 -						_		-
85	85-87		0.7	15-15-24-22 (39)	SAND WITH GRAVEL AS ABOVE, 40% GRAVEL, 50-59 DOAASE, POORLY SORTED SAND, 5 10%, FINE SAND (SM)	5		
88 -	87-89	4117	0.8	12-12-25-19 (37)	SAND WITH DRAVEL AS ABOVE, WITH 30% GRAVEL, SAND, AND 10% FINE SAND, (SW)	674 _		-
	80.01	1	0.00	0.0.20.12	SAND WITH GRAVEL, AS ABOVE, (SW)			-

					PROJECT NUMBER	BORIN	GNUMBER
					SED28178 El	We	
					GLOEBTIGHT		The Sheet 4 OF 0
					SOIL	BORIN	IG LOG
PROJE	OT P	GDP	Phase	I Site Invest	igation LOCATION	Well C	luster WC3, East of Plant
ELEVA	TION_		1.1		DRILLING CONTRACTOR GE	otek En	gineering
DRILLI	NG ME	THOD	AND EC	UIPMENT B-	61 Hollow Stem Auger, 7-inch ID, 1	13/4-inc	h 00
WATER	R LEVE	L AND	DATE_		START 11/18/89	INISH_1	5/90 LOGGER Lahoud
_	1	SAMPL	E	STANDARD	SOIL DESCRIPTION		COMMENTS
9E		~	≿	TEST DCOLUTE	SOIL NAME, COLOR, MOISTURE CONTEN	π.	DEPTH OF CASING.
표망	NN I	¥6	VEP	NEOVEIO	RELATIVE DENSITY OR CONSISTENCY, S STRUCTURE, MINERALOGY, USCS GROU	JP	DRILLING RATE,
틒쯡	E	23	SE	6"-6"-6" (N)	SYMBOL		TESTS AND
83	2	ρz	껲빈				INSTRUMENTATION
- 90					CAND WITH COAVEL CAME AS ABOVE	1000	
91	89-91	4117	0.3	(48)	SALE HITT SPATEL, SAME AS PROVE,	(311)	
02 -						·	
96							DRILLER REPORTS LITH, CHANGE
-	1					_	NO CHATTER AND MORE PRESSURE
94 -							HEQUINED-CLAY
							_
					LEAN CLAY, DARK GRAY, (N3), DRY, HA	RD,	
96 -	96-97	4118	1,8"	20-20-28-31	LOW PLASTIC, HOMOGENEOUS, FINE L	AM	
-				(40)	The armoutane (ag)		
98 -						. –	
· · ·	<u> </u>						SAMPLE TAKEN USING KELLY, NOT
- 1	98.5-	4410	10	out Hammond	LEAN CLAY, AS ABOVE JCL)		HAMMER
100	100.5	4119	1.0	not manmaned	LEAT SEAL AS ABOVE ; (oc)		· · · · -
- 1						-	
1.00 -						-	
108	1						
- 1	1						1
104 -						-	
106 -	105.5-	4120	2.00	12.14.12.16	LEAN CLAY, AS ABOVE, SUGHTLY MOD	ST, -	
-	107.5	4120	20	(26)	SLIGHTLY PLASTIC, (CL)	-	· · · ·
108 -		_					
	108-						
-		4121	2.0'	12-18-16-14	LEAN CLAY, AS ABOVE, HARD, (CL)	_	
110	110			[34]			
-						-	
110 -						-	
112							WATER IN DRILL STRING SAMPLE MOIST
-					SANDY CLAY, OLIVE BLACK, (5Y 2/1), 10	0-15%	
114-	113-	4122	2.07	10-14-11-12	STIFF, MEDIUM PLASTIC, MICACEOUS,	10-15%	
	110			(25)	FINE SAND, (CL)		_
	115						
116 -						-	
-	-				1	-	
118 -	ļ				CANTER AV AS ABOUT WITH PUTCOD	EDDER	
	118-			1	SAND, MEDIUM GRAY, (N5), DRY TO M	NST,	
1.00		4123	2.0"	9-11-12-16	FINE TO WELL SORTED, (1/16-1/2-IN. LE	INSES).	

					and least hillings	D.O.F.		
					CEDART 20 ET	BOHI	IL LOO	
					SEU281/8.PI	We	TITZZ SHEET 5 OF 6	
					SOIL	BORI	NG LOG	
PROJE	ст Р	GDP	Phase	I Site Invest	igation LOCATION	Well (	Cluster WC3, East of Plant	
ELEVA	TION				DRILLING CONTRACTOR GO	otek Er	ngineering	
ORILLI	NG ME	THOD	AND EX	UIPMENT B-	61 Hollow Stern Auger, 7-inch ID, 1	13/4-in	ch OD	
WATER	R LEVE	el and	DATE_		START_11/18/89F	INISH_1	/5/90 LOGGER Lahoud	
		SAMPL	E	STANDARD	SOIL DESCRIPTION		COMMENTS	
SE			7	TEST	SOIL NAME, COLOR, MOISTURE, CONTEN	r.		
평균 전 전 년 년			ι Έ	RESULTS	RELATIVE DENSITY OR CONSISTENCY, S	ÓIL.	DRILLING PATI,	
돈준	臣	光월	8_	6 6 6	STHOOTOHE, MINERALOGY, USICS GHOD SYMBOL	ih.	DRILLING FLUID LOSS.	
83	ĭ Z	È₹	높匠	(14)			INSTRUMENTATION	
120	120-							
		4123	2.0"	8-10-10-13	SANDY CLAY, AS ABOVE, WITH MOIST	TO WET_	-	_
	122			(20)	40-50% SAND, LENSES OF TO THINCH, (	GC)		.
122							1 .	1
	123-						1	-
124-		4124	1.9'	9-12-16-20	CANON OF ANY AG ADONES AN ADAY CANOD	-	4	_
	125			(20)	SANDT CLAT, AS ABOVE, 30-40% SAND	, (CL)		
_							1 .	-
126 -								-
						_		
128	128-	41.95	2.00					-
		4125	2.0	(26)	SANDY CLAY, AS ABOVE, WITH LAYERS 1-INCH. (CL)	S UP TO_	1	-
130	130	<u> </u>						
		-				-	1	-
132						-		-
· _	133.							
	133-	4126	1.7	7-11-14-17	SANDY CLAY, AS ABOVE, (CL)		-	
134	176			(25)				
	130					_		
136 -						_		_
	1			-				
-						-	1	-
138 -	138-							-
_		4127	1.9"	8-12-18-23	SANDY CLAY, AS ABOVE, MOIST, WITH	4-INCH		
	140			(30)	SAND LAYER NEAR 139 FT., (CL)			
140								-
~~						-		-
142						_		_
							· · · · · · · · · · · · · · · · · · ·	
	143-				SAND MEDIUM GRAY, (N2-N3), WET TO	MOIST,		-1
144-		4128	1.Z	23-32 Refusal	VERY DENSE, MEDIUM GRAINEID, WELL SORTED, CLEAN, (SP)		REFUSAL AT 144 FT.	-
	145				and and and the h		AUGERED THERE WITH NO PROBLEM	
. 1								
146 -						-		-
-						-		_
148							1	
	148-	4129	1.3'	9-14-21-33	SANDY CLAY, AS ABOVE, 138-140 FT., (C OVER	SL)		
I - I				(35)	SAND AS ABOVE 141-145 ET AMEDIUM	newse <sup>-1</sup>		-

					PROJECT NUMBER	BORING N	UMBER	
					SED28178.FI	Well 1	22 SHEET 6 OF 6	
					SOIL	BORING	LOG	
	OT P	GDP	Phase	I Site Invest	igation LOCATION	Well Chrs	ter WC3, East of Plant	
ELEVA	TION_	301	. 11336	. one medal	DRILLING CONTRACTOR GE	eotek Engin	eering	
ORILLI	NG ME	THOD	AND EC	UIPMENT_B-	61 Hollow Stern Auger, 7-Inch ID, 1	13/4-inch (	DD	
WATER	R LEVE	L AND	DATE_		START_11/18/89F	INISH 1/5/5	0 LOGGER Lahoud	
30	1	SAMPL	E	PENETRATION	SOIL DESCRIPTION		COMMENTS	
CE (FT	WAL	CH RH	VERY	RESULTS	SOIL NAME, COLOR, MOISTURE CONTEN RELATIVE DENSITY OR CONSISTENCY, S STRUCTURE, MINERAL OCY, USCS (BOU	ICIL.	DEPTH OF CASING, DRILLING RATE,	
DEPTH	INTEF	TYPE	E B	6"-6"-6" (N)	SYMBOL		TESTS AND INSTRUMENTATION	
150	150-	4129	0.1°	5-5-15-15	SAND, AS ABOVE, (SP)			
152-	152			(40)				
1.52							14 A.	_
	153-		2.0"	9-11-18-25				. –
154-	155	4130		(29)	MOIST, VERY STIFF, (CL)	-		-
	155-	41.00			SAND, AS ABOVE, (143-145), (SP): OVER	R		
156 -			1.2	7-9-12-15 (21)	SANDY CLAY AS ABOVE (138-140) (CL			-
-	157				20112121212 X3 X407E. (130-140); (00			
158-							TD OF BORING 158 FT.	_
_					and the second second	_		_
100								
100								
						-		-
					and the second			-
						-		-
						-		-
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-						-		-
						_		-



						PROJECT NUMBER	BOR	NGNIMBER				
						SED28178.FS	W	NI 140 SHEET 1 OF 5				
	1-					SOIL B	SOIL BORING LOG					
	280. ELEV	JECT_	PG	DP Pha	ase I Site Inv	vestigation LOCATION	WC-4;	NW of Plant, Big Bayou Cr. at Opden Landi	ing Ref			
	DRIL	LING I	NETHO	AND	EQUIPMENT	follow Stem Augers/Split Spoon Samo	Geote	# Engineering				
	WAT	ER LE	VEL AN	D DATE	1.0000000	START 3/20/90 FIN	ISH_	1/6/90 LOGGER B. Cocke				
	180	<u> </u>	SAMP	LE	PENETRATIO	N SOIL DESCRIPTION		COMMENTS				
	35	1	2.	. È	RESULTS	SOIL NAME, COLOR, MOISTURE CONTENT, BILATIVE DENSITY OF CONSISTENCY, ACC		DEPTH OF CASING				
	E S	1	L H H	18_	6 6 6.	STRUCTURE, MINERALOGY, USCS GROUP		DRILLING RATE, DRILLING FLUD LOSS				
	83	Z	≿ 2	[ 문토	(N)			TESTS AND INSTRUMENTATION				
	Ľ.				-	SLT YELLOWSH GRAY (10 YR 42), BROWN, D FRM, MOTTLED BLACK OPGANC SPOTS LOW	OIST,	BACKGROUND-				
		1 ~	1	2.0	3-3-4-5	PLASTICITY, (ML)	- "	RAD-52 CPM	_			
	2 -	1				SELL SAME AS ABOVE, DAMP, (ML)	-	FAD-44 CPM	_			
	-	2-4	4157	2.0'	3-3-3-3		-	START DRILLING 1100	_			
1	4 -		1		(0)	SLL SAME AS ABOVE, ML), CHANGING TO SL	n -	RAD-34 CPM				
1	_	4-6		1.75	2-2-2-2	LOOSE, FINE-MEDIUM, WELL GRADED, (SM)	VERY	HNL-O PPM RAD-us CPM				
	6 -	<u> </u>	-	+		POOPLY CRIPCO SILC HERE OF A DOMESTIC	-					
	-	6.8		1.75	2-2-2-2	LOWISH BROWN (10 YR 42), MOIST, VIRY LOOS	6E,	HNU-0 PPM RAD-36 CPM	1			
1	8 -		+		(4)	(SP-SM)	412		-			
I	-	8-10	4158	e.		NO SAMPLE, EXTREMELY LOOSE		INU-0 PPM	-			
	7		-					RAD-38 CPM	-			
ï	í	10.13	1			WELL GRADED GRAVEL WITH SLT AND SAND MODERATE REDOCH BROWN (10 B. 48) MATT	-	HNULS PPM	-			
1	12 -	10-12			3-10-20-18 (30)	MEDIUM DENSE, SUBANGULAR GRAINS, (GW-GA	w T	RAD-IO CPM	-			
1	_	12-14		200	13.14.19.13	WELL GRADED GRAVEL WITH SAND, MODERATE REDDISH BROWN (10 F 44), STREAKS OF GRAY		LATER DOL	-			
L	14 -				(34)	GRAINS, (GW)	H	PAD-38 CPM	-			
L		14-16	4150	18	2-3-4-9	WELL GRADED GRAVEL WITH SAND AS ABOVE,	H	HNU-0 PPM	-			
1.					(7)	MOST, STFF, PLASTIC, (CH)	Y <u>Bra</u>	RAD-60 CPM				
Ľ	° 7		1			EAT CLAY, GREENISH GRAY IS GY 611, WITH	-		_			
L		16-18		1.8	7-10-14-22 (24)	STIFF, CHANGING TO GRAVEL, (CH)	VERY	HAU-O PPM RAD-42 CPM				
Ľ	8 -		1.1			EAT CLAY, GREENESH GRAY IS GY AND CHARGEN						
	-	18-20		2.07	6-12-15-14	SALTY CLAY (DARK YELLOWISH BROWN (10 YR 4/ DAMP, VERY STIFF, (CL-ML)	a	RAD-44 CPM				
12	×+				(27)	SLTY CLAY WITH SAND, MODERATE REDOVER	_					
	-	20-22	4160	1.8	5-7-10-12	BROWN (10 YR 46) WITH GRAY (NT) STREAKS, DU VERY STIFF, GRAINS OF DARK MINERALS, DUART	AMP.	HALLO PPM BADLED CPM				
2	2 +				119	SOME PEBBLIS, (CL-ML)	_					
	-	22-24		2.0	5-12-13-17	HOST, VIRY STIFF, PLASTIC WITH STREAKS OF	۰	HALLO PPM RAD-42 CPM				
2	• +					SETT CLAY WITH SAND, LIGHT GRAY (NE), ICH			1			
	-	24-25		1.75	9-10-25-29	STEFF, (CL-ML); CHANGING TO SLTY SAND , LIGHT GRAY INDI MOTTLED CORGANIC STATISTICS	ят, Т	HNULO PPM	-			
2	6 +				(25)	DAMP, DENSE, IRON DIZOE, FINE, POORLY GRAD (SW-SM)	έο,	RAD-62 CPM	-			
	1-	8.24	410-			SLTY SAND , SAME AS ABOVE, (SWISH, CHANGE TO SANDY SLTY CLAY, MOTTLED AS ABOVE ON	NG	HNULO PPM				
a	í-1		- 101	1.75	(23)	VERY STIFF, (CL-ML)	-	INDER CPM	-			
	1	26-30			0.20.30.96	SILTY SAND WITH CLAY, MODERATE REDORSH BROWN (10 YR 44) MOTTLED, MORST, DENSIL FIN	е <sup>–</sup>	HNULO PPM BAD-12 CPM	-			
-3	,				(44)	MEDIUM, (SPISM, CHANGING TO <u>SAND</u> , UGHT GR (MB) MOTTLED, MOIST, INON OXIDE, ORGANIC, GW	WY-	STOP DRILLING 1620	-			

					PROJECT NUMBER	BORI	NG NUMBER	
					SED28178.FS	We	1 140 SHEET 2 OF 5	
$\sim$					SOIL	BORIN	IG LOG	
PROJ	ECT	PGD	P Phas	e I Site Inv	estigation LOCATION	WC-4U	W of Blant Bin Baunu Cr. at Carton	
ELEV/	ATION				DRILLING CONTRACTOR	Geote	k Engineering	Landing Rd
DRILL		ETHOO	AND EC	DUIPMENT_H	ollow Stem Augers/Split Spoon Sam	pler		
	1	SAUP	E	STANDARD	STAHT_3/20/90 F	NISH_4	/6/90 LOGGER B. Co	cke
≷∈	<u> </u>	1 Contraction		PENETRATION TEST	SOIL DESCRIPTION		COMMENTS	
EEC BEEC	₹	38	臣	RESULTS	RELATIVE DENSITY OR CONSISTENCY, SC	34,	DEPTH OF CASING, ORILLING BATE	
E	TER	E B	SE	6"-6"-6" (N)	STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	р	DRILLING FLUID LOSS. TESTS AND	
33	-	FZ	28		-		INSTRUMENTATION	
- 1	30-32	· ·	1.07	15-16-12-17	WELL GRADED GRAVEL WITH SAND LIGHT GI AND MODERATE RED BROWN (10 YR 46) MOD	RAY (N7). ST.	RESUME DRILLING 3/21/90, G800 HNU-0 PPM	
32 -		4		(28)	LIGHT GRAY, DAMP, VERY STIFF, (ML)	SLT.	RAD-28 CPM	1
-	32-34	4164	2.07	25-72-107-180 (179)	WELL GRACED GRAVEL WITH SAND. LIGHT GO MODERATE RED BROWN, MOIST, VERY DENS COARSE, (GW)	E, -	HNULO PPM RAD-34 CPM	-
34 -		1			SAME AS ABOVE, (GW)	-	HNU-0 PPM	-
	34-36		1.87	22-18-63-80 (61)			RAD-22 CPM	
36 -					BOORLY GRADED SAND WITH CLAY, DARK YE	uow -		-
	36-36		1.2	38-61-51-52 (112)	VERY COARSE; TOP 4: WITH VERY FINE COM	RSE -	PAD-32 CPM	_
30 -		+ · .			SAVE AS ABOVE LESS (2 AV SUBDOLADED )	. –		-
'	38-40	4165	1.87	12-15-38-39	SUBANGULAR, QUARTZ, TRACE MICA AND FEI MAGNESILM MINERALS, (SP-SC)	RAO _	0905 HMULAO PPM BAD, SP, CTM	-
. –				(34)			MURED CPM	
-	40-42		1.8	15-16-26-29	SAME AS ABOVE, SOME CLAYEY SAND IN LOW (SP-SC)	(ER 4°,	0912 HWILD 00H	
42 -		-		[44]			RAD-40 CPM	1
	42-44		1.8	12-34-40-50	SAME AS ABOVE, BOTTOM 6*. FINE-COARSE ( (SP-SC)	GRAVEL.	0922 HNULIS PPM	
44 -				(74)			RAD-40 CPM	
	44-45	4166	1.7	19-24-32-38	GRADED GRAVE, WITH SAMD, DARK YELLOW		1018	-
46				(56)	CHANGE (10 TH 60), WET, VERY DENSE, VERY COARSE SAND, MOSTLY FINE MEDIUM GRAVE	L, —	RADiazo CPM	-
1°° 1				-	WELL GRADED SAND, DARK YELLOWISH ORAN	IGE (10	1028	
	46-48		2.0	12-27-27-29 (54)	SUBANGULAR-SUBROUNDED, (SW)		HNULO PPM RAD-20 CPM	-
48 -					SAME AS ABOVE: BOTTOM 4' GRADED TO VER	Y FINE		· -
	48-50		2.0	23-29-31-41 (60)	owner faul	-	1040 HEALLO PPM	-
50		-			SAME AS ADVINE	_	RAD-36 CPM	_
-	50-52	4167	2.0'	15-27-20-33		-	HNLLO PPM	
52 -		-		(55)	SAME AS ABOVE, TOP 12: WITH VERY FINE GE	WEL-	HADAZE CPM	_
-	52-54		2.0"	33-65-55-50	(5W)		HNU-0 PPM	
54 -				(120)		_	MORE CPM	
	54.56		3.00	-	SAME AS ABOVE. (SW)		HRU-O PPM BAD-DE COM	
'., ⊥			~	(75)		_	THE STREET	
	56-54	4164	15	24.40.12.11	TOP 6" SAME AS ABOVE; BOTTOM 12"; BOOPLY GRADED GRAVEL AND SAND, SAME COLDR, W	ы. –1	1405 HELLO POM	-
E. 7				(52)	MEDIUM-VERY COARSE SAND, SUBANGULAR- SUBPOUNDED, SOME SILT, (GP)	-	RAD-32 CPM	-
58		7			NO RECOVERY	-		-
	58-60	/		13-16-10-11		-		_
- <del>00</del>		<u></u>						

					PROJECT NUMBER	BOR	NG NIMOSO	
					SED28178.FS	W	ell 140 SHEET 3 OF 5	
					SOIL	BORI	NG LOG	
AOJ	ECT_	PG	DP Pha	ise I Site Inv	restigation	1410 4		
ELEV	ATION				DRILLING CONTRACTOR	Geote	NW of Plant, Big Bayou Cr. at Ogden Landin K. Engineering	g Rd
DRILL	JNG M	AETHOO	AND E	QUIPMENT_	follow Stem Augers/Split Spoon Sam	pler		
	T	SAMP	IF	STANDARD	START_3/20/90 P	NISH	4/6/90 LOGGER B. Cocke	
18€	$\vdash$	T	T	PENETRATIO	N SOIL DESCRIPTION		COMMENTS	
BBE	×.	28	1 E	RESULTS	RELATIVE DENSITY OF CONSISTENCY, SC	r. 54L	DEPTH OF CASING, DBILLING BATE	
E	Ë	CNPC I	86	6"-6"-6" (N)	STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	P	DRILING FLUD LOSS.	
83	-	F 2	0.6				INSTRUMENTATION	
_	60-63	2 /	1 .	13-25-65-60	NO RECOVERY		NEW LOGGER & COCKE	
0		$\vee$		[91]		-		-
02 -					POORLY GRADED SAND WITH GRAVEL DARK	<u>к</u>	HNU-0 PPM	-
	62-64	4109	1.8	330.6.	MOIST, VERY DENSE, SUBANGUAR SUBROX	AY (NB), JNDED,-	NOTE: CHANGE TO 1004 HALANCO	_
64 -		1			SAME AS ABOVE DENSE AND	-	STATE OF THE TO STORE FOR WERE	
-	64-66	1	2.0'	20-14-15-30	Shine ha hadre, bende, (SP)	-	HNULO PPM BAD-22 CPM	
66 -					WELL CRUTCH CALLS COMMENT STATUST	-	STOP DAILUNG 1600	
-	66-68		20	20-13-15-52	WET, MEDIUM DENSE, FINE-MEDIUM, SUBAN	YR 740, GULAR,	0822 MALLO PRM	1
68 -				(85)	(34)	_	PAD-28 CPM BESIME DEILING School	-
	68-70	4171	20	48-41-10-36		-	0646	-
·				(60)	SAME AS ADOVE, BOTTOM 6" FINER SAND, (S	5W)	HNLLO PPM BADLOD CRM	-
. –		1						-
1 1	70-72			20-13-18-33	SAME AS ABOVE, (SW)	-	HNLED PPM	
72 -				(21)		_	OGTAN SAMPLE	
	72-74	1	2.0	37-47-60-50	SAME AS ABOVE, (SW)		HNLLO PPM	7
74 -		1		(107)			DRULER CONDITION THE BOREHOLE BY RU	NNINC
· · ·	74.75	4172			SAME AS ABOVE, (SW)		1035	-
76		41/2	20	(35)		-	RAD-32 CPM	
1° T	26.74	1				-	1410	-
	14-24			4-6-7-7	SAME AS ABOVE, MEDIUM DENSE, (SW)	-	RAD-36 CPM	_
78 +						_	OBTAIN SAMPLE 4172 & DUPLICATE 4173	_
	78-80			2-3-5-7	ELASTIC SLT, UGHT GRAY (NT), MOIST, FIRM, PLASTIC, STREAKS OF MODERATE REDOCH F	BOWE	HAUS PPM	
80				(8)	(10 R 46), IRON CODES, (MH)		HAD-46 CPM	
	80-82	4174	-	3-5-7-7	SAME AS ABOVE, STIFF, SMALL INTERBEDOED		1530	-
82 -				(12)	LAYERS OF GRAVEL, WELL-GRADED, DARK RU BROWN, (MH)	DOKSH	RAD-50 CPM	-
					SAME AS ADOVE (MA-0	-	1558	-
	82:84			4-3-3-5 (5)		-	HMULO PPM RAD	-
-					SAME AS ABOVE, (MP)	-	0834	
	34.66		1.8	3-4-5-5			RAD-44 CPM	_
86		ł			ELASTIC SLT, SAME AS ABOVE, WITH THIN	-	PESUME DRILLING/SAMPLING 3/2590, 0600	
1-1	86-88	4176	2.0	4435	INTERBEDDED SAVO WITH SLT, GRAYSH ORA (10 YR 74), MEDUM, POORLY GRADED WET	NGE	DESC HNULLO PIPM	
1 B8 -	_	- F		(7)	SUBANGULAR ANGULAR GRAINS, 410% DARK, MINERALS, MOSTLY OLARTZ		RAD-58 CPM	1
	66-90		2.07	3323	ELASTIC SAT, LIGHT GRAY (N7) STREAKED WIT MEDUM GRAY (N5), NOIST, FIRM, PLASTIC	пн 🗍	OSIZ HNULO PPM	-
<b></b>				(5)	WITH INTERBEDOED SAND, GRAYISH ORANGE THE AS ABOVE, MAN	(10 YR	SAMPLE COMPOSITED 0918	-

					PROJECT NUMBER	BOF	RING NUMBER	_
					SED28178.FS	w	el 140 SHEFT 4 os s	
					SOIL	BOR	NG LOG	_
PRO	NECT	PG	DP Pha	se i Site in	undankan.	_		
ELE	VATION	4	1112	be i one in	DBULING CONTRACTOR	WC-4	NW of Plant, Big Bayou Cr. at Ogden Landing P	Ы
DRIL	LING #	METHO	D AND E	OUIPMENT_	follow Stem Augers/Solit Social Sam	Geot	ek Engineering	
WAT	ER LE	VEL AN	D DATE		START_3/20/90 F	INISH .	4/6/90 LOGOER R Costs	_
-		SAME	PLE	STANDARD PENETRATIO	SOIL DESCRIPTION		COMUNITY B. COCKE	-
156			2	TEST	SOIL NAME, COLOR, MOISTURE CONTENT		COMMENTS	_
뿔岩		No.	티튠	HEAULIS	RELATIVE DENSITY OR CONSISTENCY, SC	л.	DEPTH OF CASING, DBLLING BATE	
E a		1 yr	1 XF	666- (N)	SYMBOL	2	ORILING FLUID LOSS	
-90	90						INSTRUMENTATION	
	90.92 20 448.10				SAME AS ABOVE, CHANGING TO FAT CLAY W	ITH .	1020	_
	20 448-10 SLT (12) DED			(12)	DED COARSE SAND AND GRAVEL GRAVISH	RBED-	HNU-0 PPM RAD-36 CPM	
85	-	1			ORANGE, (CHAM-I) EAT CLAY WITH SET, SAME AS ABOVE, CHAM		-	
1 .	\$2-94	417	19	4454	CHANGING TO EAT CLAY, BROWNISH BLACK (	5 YR 2	1035	1
94 -		-		(9)	1. 10001, 2111, (21)		RAD-34 CPM	-
_	94-96				SAME AS ABOVE, (CH)	-	1103	_
	1			(9)		_	RAD-	
96 -	100.000				-	-	STOP DRILLING 1145, SAMPLE COMPOSITED 1110	Л
-		1/	1 1				CASING SET @ 97	1
98 -	_	1			WELL CRUDER FUEL		HNLED SAMPLING 4550, 1010	-
_	97.6-	4178	20	N/A	(SW)	RTY, -	SAMPLE 4178-SHELEY TUBE SAMPLE	4
1	99.5		1 - 1	NA .		-	Contract Contract	
P	99.6					_		
1 -	1 100	Ķ						1
102 ~	101-103	4179	1 1	\$7.10.11	Durite dur Linden	-	1050	+
			[	(17)	MCACEOUS, VERY STIFF, (MH)	° -	PAD-40 CPM	4
		1				-	300# HAMMER	1
104	107-100	17				-		
	1001100	1/	1 1			_	-	
106 -		K			WELL CONDED SAND LIGHT CONV. AND LIGHT			1
	106-108	4180		A-20-17-28	DENSE, FINE-MEDIUM, SUBANGULAR, 45% DAR	ĸ T	1405 -	Ł
				(37)	EAT CLAY, BROWNISH BLACK IS YR 211, DAMP.	머니	HAULO PPM RAOL32 CPM _	
108 -		1			HAND, (CH)			
-	108-111						-	1
110							-	1
-		4				-	· · · · · · · · · · · · · · · · · · ·	1
112 -	111-113	4141	1.75	6 18 12 20	WELL GRADED SAND, UGHT GRAY (ND) TO MED	NM I	450	L
· · ·				(30)	MEDILM, 45%, MOIST, MEDILM DENSE, VERY FINE- MEDILM, 45%, DARK RED, 5-10% MICA, SUBANG		ND-48 CPM	
1					LAR, (SW)	~ ·		
114 -		- /1					-	
	13-116	/ 1				_		
116 -						-		
						-		
1-1	15-118	4162	2.07	3-7-8-16	SELTY SAND, LIGHT TO MEDIUM GRAY (N7-N4), M TO DAMP, MEDIUM DENSE, FINE TO MEDIUM AN	OIST H	530 NULLO PPM	
~ b~		1		(15)	THIN LAYERS, 15-40% SILT, 5-10% MICA, (SM	R	AD-28 CPM	
_						-	-	
20-1		/				-	-	
2.V								

					PROJECT NUMBER	808	ING NUMBER	_
					SED28178.FS	We	all 140 SHEET 5 OF 5	
					SOIL	BORI	NG LOG	-
PROJ ELEV DRILL WATE	ATION_	PGC ETHOD	AND E	OUIPMENT_	estigation LOCATION DRILLING CONTRACTOR blow Stem Augers/Spit Spoon San	WC-4; Geote	NW of Plant, Big Bayou Cr. at Ogden Landing R ek. Engineering	d
		SAMP	E	STANDARD	SOIL DESCRIPTION	INISH_4	LOGGER B. Cocke	_
3 DEPTH BELOW SURFACE (FT)	NTERVAL	TYPE AND NUMBER	RECOVERY	TEST RESULTS 6"-6"-6" (N)	SOIL NAME, COLOR, MOISTURE CONTENT RELATIVE DENSITY OR CONSISTENCY, SI STRUCTURE, MINERALOGY, USCS GROUT SYMBOL	T, OIL P	DEPTH OF CASING, ORILING RATE, ORILING FUND LOSS, TESTS AND INSTRUMENTATION	
-		$\leq$						-
122 -	121-123	4183	2.0'	17-8-10-17 (18)	SLTY SAND, SAME AS AROVE, 10-35N, SUT (5) CHANGING TO WELL GRADPD SAND WITH ST UGHT GRAY (NT), MOST, MEDUAI DENSE, VE FINE TO MEDUAI, MICAGEOUS, SN, SLT, (SW	ым,: — L. RY — SM0	HNILLO PPM HADLAD CPM STOPPED DRILLING 1620	-
124 -						-		-
128	126-128	4105	15	6-21-18-20 (39)	POOPLY GRADED SAND, MEDIUM UCHT GRAY MOIST-WET, DENSE, FINE, 2% DARK MINERALS MICA, (SP)	(148). 5, 3%	RESUMED SAMPLING 4/690, 0030, 300% HAMMER HALLO PPM RADJO CPM 9000	-
)o						_	-	
132 -	131-133	4186	1.75	8-17-35-96 (52)	SAME AS ABOVE, FINE-MEDUAA (SP); CHANGIN <u>EAL CLAY,</u> VERY HARD, MICACEOUS, BROWNE BLACK @ 133,5, (CH)	45 TO -	1020 ANU-0 PPM RADe	ł
134	-			-		-		
138	136-134	4187	2.0	10-3-15-16 (24)	POOPLY GRADED SAND, SAME AS ABOVE, MED DENSE, CONTAINS TWO 4" SEAMS OF FAT GLAY ABOVE, (SP)		100 NLL© РРМ АД-ко СРМ	
140		$\wedge$						
142	41-143	4188		4-10-21-23 (31)	AT CLAY, BROWNISH BLACK (S YR 21), MOIST, FRY STEF, MCACEOUS, (CH, CHANGING TO COOLY GRADED SAND, SAME AS ABOVE, (SP)	- A - S	ML-0 PPM	
								4



					PROJECT NUMBER	BOG						
					SED28178.Fi Weil 144 SHEET 1 or 4							
					SOIL BORING LOG							
1	OUTET PODP Phase I Sto Investigation											
ELE	VATIO	PGUP	Phase	T Site Inve	stigation LOCATION	WC-9	; Dyke Rd, NE of Plant					
DRI	LUNG	METHOD	AND E	QUIPMENT	Mobile B-57 ATV; using 4" ID HSA	B-57 ATV: using 4" ID HSA						
WAT	TER LE	VEL AN	D DATE	~72', 3/23	90START_3/23/90	INISH	3/25/90 LOGGER A Bryda	-				
1 -		SAMP	LE	PENETRATIC	SOIL DESCRIPTION		COMMENTS					
25	Ē "	9	.≧	RESULTS	SOIL NAME, COLOR, MOISTURE CONTEN	π,	DEPTH OF CLEAR	_				
o DEPTH B	NTERV	TYPEAN	RECOME	6°-6°-6° (N)	STRUCTURE, MINERALOGY, USCS GROU SYMBOL	ρ P	DRILING RATE, DRILING RUID LOSS. TESTS AND INSTRUMENTATION					
	-					_	AR MONITORING : HNU, EXPLOS. & RAD GM TU DETECTOR: AN ANNU, EXP. RAD NOTE: USING A 1400 HAMMER, FALL MATERIAL FOR DRALING RAD IS -25 THICK, ALL DEPTHS FROM THIS GROUND SURFACE	GE				
	-					-		-				
s						_		-				
	- 54	51	1.5	3-3-6-6 (9)	SILT, ISOME CLAY), PALE YELLOWISH ORANG PALE YELLOW BROWN (10 YR &G TO 10 YR & FIRM TO STIFF, SOME ROOTLETS, (ML)	E TO Q. DRY.	AM (0.0.31) RAD COUNTSMIN TME 0740					
						-		-				
						· _		_				
						-		4				
	10-12	52	1.5	3-4-5-6 (9)	SAME AS ABOVE, MOIST, (ML)		AM(0.0.36)	-				
						-		]				
-	1					_						
_	1					_						
15	15-17	53	2.0'	3-4-5-6	SAME AS ABOVE, SOME BLACK ORGANIC ROC (ML)	ILETS,	DRUER CONDITING THE BOREHOLE BY RUNNIN	G				
-				(5)			TIME 0815	1				
-								1				
-		·						1				
xo								1				
-	20-22	54	2.0'	4-5-8-10 (13)	SAME AS ADOVE, DAMP, STIFF, (ML)	7	M/0.0.42) IME 0035	1				
-						-	-					
. ]						_	-					
1	25-27	85	1.5	\$-8-14-11 (22)	MELL GRADED SAMD WITH SAT, LIGHT OLIVE G Y 5YD, MORT, MEDRIM DENSE, FINE TO MEDRIM RUBPOUNDED TO SUBANGULAR, SUGHTLY COM N BOTTOM & OF SPOON, GW-SM	RAY (S	Alico Joh ME peso					
-						-						
-						-	-	1				
						1	-					

						PROJECT NUMBER	808						
						SED28178.FI	W	eli 144 SHEET 2 OF 4					
2.5	,					SOIL	SOIL BORING LOG						
i, jaj	RO.	ECT_	PGDP	Phas	e I Site Inve	stigation (OCATION	WC.0	Date Dd NE of Direct					
· 8		ATION	ETHO		For up the	DRILLING CONTRACTOR G	DRILLING CONTRACTOR Geotek Engineering						
w	ATE	ER LEV	EL AN	D DATI	EQUIPMENT_ E ~72', 3/23	MODIE B-57 ATV; using 4" ID HSA 90 81481 3/23/00		0.05.00					
	SAMPLE STANDARD				STANDAR	8/01 DESCRIPTION	HINISH_	3/25/90 LOGGER A. Bryda					
18	ξĒ	·	1	15	TEST	SOIL NAME OF OF LOWING CONTRA	SOL DESCRIPTION						
DEPTH REL	NTERVAL NTERVAL NTERVAL NTERVAL NTERVAL		6"-6"-6" (N)	RELATIVE DENSITY OR CONSISTENCY, SOL STRUCTURE, MINERALOGY, USOS GROUP SYMBOL		DEPTH OF CASING, DRILING RATE, DRILING FLUD LOSS. TESTS AND							
30	-	30-32	56	20		TOP 18": SEE (SOME CLAY), PALE YELLOW, TO PALE YELLOW BROWN (10 YR &S TO 10 Y	COARSE R 62).	INSTRUMENTATION DRULER SLOWING DOWN TO PREVENT RUNNING					
	-		-		(14)	LEAN CLAY, SAME COLOR AS TOP, DAMP, FR	RM. (CL)	TAN(0,0,35) TANE 0007					
	-	1					_						
	-			1			_	1 7					
35	174.00	<u> </u>	-	_			-	1					
	-	15-37	87	2.0'	4-5-7-9 (12)	LEAN CLAY, DARK YELLOW ORANGE (10 994 6 STEFF, (CL)	NG), DRY,	AM(0.0.34) TMAE 1015					
						1 .	-	· _					
				[			-	_					
1							-	_					
1	-	40-42	58	2.0	11-12-13-13	SAME AS ABOVE, WITH 4" SAND SEAM FROM	18-22",	AM(0.0,41) TME 1990					
	+					-	-						
	-						-						
1	1			1	ĺ .		_						
45 -						SANDY LEAN CLAY, DARK YELLOW ORANGE (1) 61. MOIST, STIFF, (CL)	0 YR 6/	AA4(0,0,36)					
1		40-47	24	2.0'	5-5-9-13 (14)		-	TME 1115 -					
							-	· · · · -					
							-	-					
							-	· _					
50 _	-	50-52	\$10	2.0'	12-15-12-13	CLAYEY SAND WITH GRAVEL, DARK YELLOW C TO PAUL YELLOW ORANGE (10 YR 66 TO 10 YR NOIST, MUDRAM DENSE, FINE TO MEDIUM, SUB	NUNGE	AM(0,0,48) TME 1345					
	T		_		(47)	THROUGHOUT, (\$0)	AMS						
	-							-					
55 -			_				-	-					
	-	55-67	811	2.0"	5-6-8-12 (14)	SAME AS ABOVE WITH SLICHTLY HIGHER CLAY CONTENT, (SC)		AA4(0,0,45)					
1	Ť	-	-				-						
	1						-						
60-	_	-						7					

					PROJECT NUMBER	808	ING NUMBER				
					SED28178.FI	W	ell 144 SHEET 3 OF 4				
\			_		SOIL	SOIL BORING LOG					
. ÁQJE	ECT_	PGDP	Phase	1 Site Inves	tigation LOCATION	WC-9	; Dyke Rd, NE of Plant				
DRILLI	NG ME	THOD	AND E	OURMENT N	DRILLING CONTRACTOR G	eotek E	ngineering				
NATE	R LEVE	EL AND	DATE	-72, 3/23/9	0 START 3/23/90	FINISH 3	3/25/90 LOGGER & Boda				
		SAMPL	.E	STANDARO	SOIL DESCRIPTION	1000	CONVENTO				
δĒ			2	TEST	SOL NAME, COLOR, MOISTURE CONTEN	мт.	COMMENTS				
SURFACE	NTERVA TYPE ANE NUMBER RECOVER		6"-6"-6" (N)	RELATIVE DENSITY OF CONSISTENCY, S STRUCTURE, MINURALOGY, USCS GROU SYMBOL	RELATIVE DENSITY OR CONSISTENCY, SOL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL						
-	70-72	S14	1.7	3-4-6-7 (10)	CLAYEY SAND, UGHT GRAY (ND, MORT, LC MEDIUM, DENSE, FINE-MEDIUM, SUBANGUL SUBROUNDED, (SC)	XOSE TO AR TO	AM(0.0,25) TIME 1600				
						_	-				
_						-	1				
_						-	1 -				
-	75-77	815	2.0	11-13-20-35 (33)	CLAYEY SAND, UGHT GRAY (N7), WET, DEN COARSE, ROUNDED TO SUBANGULAR, BLAC SPECS, POSSIBLE FERROMAGNESIUM MINE (SC)	SE FINE CK RALS,	AM(0.0.50) TIME 1625 RAN OUT OF AUGERS				
						-	WET ROOS -72				
1						_	-				
1	1						_				
-	40-42	S16	1.0'	39-45-81-110 (126)	PODRLY GRADED SAND WITH GRAVEL LUGA AND GRANISH BLACK (NT AND NA) TO DARK YELLOWSH ORANGE (10 YR 640, WET, VER) TOP 41, INT TO NS; BOTTOM 81 (10 YR 640, C	(T GRAY	BEGIN DRILLING 3/2590 1100 -7 RUNUP IN AUGERS, USED ROOS TO CLEAN CUT AUGERS				
1					WENT COARSE, SOME GRAVEL, (SP)	_	AM(0.0.30)				
-							-				
-+											
1	85-67				NO SAMPLE TAKEN	-	TIME 1150 TIME 1405 AM0.01, NO RAD NO GUTTING COMING OUT OF THE ROSTING F				
_						-					
_						_					
						-					
_						-	-				
_						~	-				
_						-					
_						-	-				
						-	·				
-	15-47	517	0.5	22-39-50 (89)	BOORLY GRADED GRAVEL WITH SAMD, GRAV DRANGE (10 YR 7x), WET, VERY DENSE, MED VERY COARSE SAND, GRAVEL UP TO 3X" DA ANGULAR-SUBROUNDED, GP GRA	ISH N.M. METER:	TME 1445 AM(0.20,36) MT SPUT SPOON ORTAINED -				
1						1	· · -				
-							1				
							_				

					PROJECT NUMBER	BCG	IN HINDER		
					SED28178.FI	W	Vell 144 SHEET 4 crs 4		
					SOIL F	BOR	NG LOG		
handling	T 0	GDD	Dises	1.0%					
ELEVATI	ON T	300	Filase	a Site Inve	DBULING CONTRACTOR	WC-S	: Dyke Rd, NE of Plant		
DRILLIN	3 ME	THOO	AND E	QUIPMENT_	Mobile B-57 ATV; using 4* ID HSA	DOEK E	ngineering		
WATER	LEVE	L AND	DATE	-72, 3/23/	90 START 3/23/90 FI	NISH_	3/25/90 LOGGER A. Bryda		
>		SAMPL	E	PENETRATIO	N SOIL DESCRIPTION		COMMENTS		
<u>S</u> E	2	8~	2E	TEST RESULTS	SOIL NAME, COLOR, MOISTURE CONTENT,		DEPTH OF CARING		
8 DEPTH B SURFACI	NTERV	TYPEAN	RECOVE	6*-6*-6* (N)	STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	HL .	DRILING RATE, DRILING RUND LOSS, TESTS AND INSTRUMENTATION		
_						-	AMIS (I		
							THE ISIS HNU HT AT DOFENDE MANY THE THE		
						-			
	- 1					-	4		
-						-	-		
5						_	1		
-						_	AM(0.0)		
-									
						-			
_		- 1				-	1		
		- 1				_	1		
_ 510	-112	S18-	0.8'	42-30-30-64 (50)	BOOFLY GRADED GRAVEL WITH SAND AND CLU GRAVISH YELLOW DRANGE (10 Y R 744, WET, V DRIVEL SAMLAR TO ADOVE GRAVEL IS MORE	AY.	AM(5.20,30) TMI 1610		
+-	-				HIGGON AND BLOCKY, (GHGM)	~			
-		- 1				_			
-									
i	_								
1						_	440.0		
						-	TME 1650 BIG CHATTER HARDER STOLEN		
						-			
٦.						-			
7					1. A	-			
	+					_	W 00		
-						-	THE 1700 AT 121': 7 DRULING ACTION, POSSBLY IN THE CLAY		
-						_			
					OF SETY CLAY MEDIAL DUCK COUR AND LODGE				
-125-1	27 :	518	2.0	15-34-72-104 (106)	HARD, LENTICULAR WITH SEVERAL, VERY FRE S SEAMS, ICL-MC: 624", POOLY GRADED SAND Y STY, CL-MC: 624", POOLY GRADED SAND Y MOST, VERY DENSE, FRE TO MEDIAN, SEVERAL THEN CT AY SEARCE SEVERAL	SAND MITH MO.	am (0.0) prior to putting rads down have Time 1710		
	+				THIN CLAT SEAMS, (SP-SC)		TD OF BORING 127		
-									
-									
						7			

					PROJECT NUMBER	BORING	NUMBER		
					0R0 30888.FI	MW-15	8	SHEET, I OF 4	
						SOIL BOR	RING L	OG	
PROJ	ECT _PI	SOP Pha	ise 11 S	ite Investigation			4U-91, C	vinder Drop Test Area	
ELEV	ATION	<u>2" TO</u>	C N/A		DRILLINS CONTRACTOR	Brotcke Enginee	ring		
RIL	LINS M	THOD	AND ED	UTPMENT CHE 58	, 12" CFA, 7 3/4" 00 auger, 5'x 3"3	D sampler			
ATE	RLEVE	15			START90	FINISH _12/02	7/90	LOGGER G. Schaefer	
ЪÊ		SAMP	<u>.e</u>	PENETRATION	SOIL DESCRIPTIO	N		COMMENTS	
ž8	1	1 2.	EN 1	RESULTS	SOIL NAME, USCS GROUP SYMBO	L. COLOR,	2	DEPTH OF CASING DRIVE INC. ANT	
	INTER	TYPE	RECOV	6* -6* -6* DN)	OR CONSISTENCY, SOIL STRUCT MINERALOGY	UENSITY TURE,	2VMB0L	DRILLING FLUID LOSS TESTS AND INSTRUMENTATION	
	11				From O ft. to 20 ft., see bioring HM-159	g log for		Background: HNu = 0 Red Background is high due to proximity of U-cylinders	
-	1								
								-	
,									
	0.20.0	0huou:				-			
	0.0 10	5.Con			-	-		Did not sample from 0' to 20', som descriptions shown are taken from a similar boring at MH-158	
_						-		1	
1						-			
1						-			
-	ł	1	1	-	Sand with Gravel (SM); light brok course grained sand, subangular (15-25%) chert pebbles are pres	n, moist, gravel sent		HNu = 0 Sampled from 20' to 25'	
-	20.0 to 25	5" Continuo	2.3		inroughout the interval.			due to low recovery in similar boring at NH-159.	
_	Ļ	4			Free AF 44 at 25 at				
					From 25 ft. to 35 ft. see boring MN-159	log for		1	
						-			
1									

)

T PGC	P Phase			0R0 30888.F1	MW-158	3	SHEET 2 OF 4		
T _PGC	P Phase								
T <u>PGC</u>	P Phase	-		so	SOIL BORING LOG				
T10N		e 11 Site	Investigation	100	ATION MY	U-91, Cy	linder Drop Test Area		
	* TOC	N/A		DRILLING CONTRACTOR Brotck	e Engineer	ing			
NG MET	HOD AN	ed Egnî	PHENT CHE 55.	12" CFA, 7 3/4" 0D auger, 5'x -3"3D same	vier .				
LEVELS				START 11/30/90 FINISH 12/07/90			LOBSER 6. Schaefer		
	SAMPLI	<u> </u>	PENETRATION	SOIL DESCRIPTION		1	COMMENTS		
TERVAL	YPE AND UNBER	ECOVERY	RESULTS 6* -6* -6*	SOIL NAME, USCS GROUP SYMBOL, COL MOISTURE CONTENT, RELATIVE DENS OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	.OR. ITY	NBOLIC 6	DEPTH OF CASING, DRILLING RATE DRILLING FLUID LOSS TESTS AND INSTRUMENTATION		
A	<u>FZ</u>	<u>x</u>				53	Production of the second secon		
					-		soil descriptions shown are taken, from a similar boring at MM-159.		
					-				
							1		
1 0.0	1 sno			Lean Clay with Sand (CL); nounded cl gravel @ 37.5, sight grey to moderate hoist, stiff, some gravel in top 2.5.	red,		-		
5.0 to 4	Cantinu	5.0			-		HNu = 0 Red = background		
Ĩ	is 	_		Candu Lana Cinu 1011 and and a solar	_				
\$50	5400			orange, moist, firm, sand is fine graine	10 10		HNu = 0 Red = background		
40.0 to	5' Contin	5.0			-	•	1		
+	-			Poorly Sorted Sand with Clay SPI:	-		1		
- 50.0 -	inuous -			noderate red to orange, moist, very k sand is fine grained.	2058, -		Htta = 0		
45.0 1	- 5' Cont	2.2			-				
	+			Mell Sorted Stort (SH) endersite	_				
0 55.0	tinuous			reddshbrown, wet, very loose, sand is grained.	fine		HNs = 0 Sampler wet out of hole.		
- 50.D t	- 5' Con	2.0			-				
t	1			Mell Sorted Sand (SW); reddish brown grey, wet, very loose, fine grained san			L.		
55.0 to 60.0	Continuou:	5.0			-		Sampler wet out of hole.		
	- 55.0 to 90.0	- 55.0 to 50.0 5 Continuous	Statute         Statute <t< td=""><td>EVELS         STANDURD PENETRATION RESULTS           Sample         STANDURD PENETRATION RESULTS           010 0000         010 000           010 0000         010 000           010 0000         010 000           010 0000         010 000           010 0000         010 000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         00000           010 0000         00000           010 0000         00000           010 0000         00000           010 00000         00000           010 00000         000000           010 00000<td>EVELS     STANDLE       SAMPLE     STANDLEO       SAMPLE     STANDLEO       SAMPLE     STANDLEO       RESULTS     SOIL DESCRIPTION       Main     Soil Press       Main     Soil Pres</td><td>EVELS     START     If/30/90     FINER     [2/07]       SAMPLE     STARD AND PERFECT     STARD AND PERFECT     SOIL DESCRIPTION     FINER     [2/07]       Y     Q     Arrow     PERFECT     SOIL DESCRIPTION     SOIL DESCRIPTION       Y     Q     Arrow     PERFECT     SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OF error     OF error     MOISTURE CONTENT, RELATIVE DENSITY OF error       I     PERFECT     Branch     Consistent Cr, Soil STRUCTURE, MINERALOGY     Soil NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OF CONSISTENCY, Soil STRUCTURE, MINERALOGY       I     Provide 337.5, Spril grey to moderoife red, Branch, soil, staft, pore granelin top 2.5.     Soil Name, Rost, ten, sand is fine graned.       I     I     Sandy Lean Clay (CL), noderate red to orange, Rost, ten, sand is fine graned.     Soil Soil Soil Soil Soil Soil Soil Soil</td><td>EVELS     START     II/30/30     FMISH       SAMPLE     PSTART II/30/30     FMISH     12/07/90       SAMPLE     PSTART II/30/30     SOIL DESCRIPTION       V     Gr     Association     SOIL DESCRIPTION       V     Gr     Association     Gr     SOIL DESCRIPTION       V     Gr     Association     Gr     SOIL DESCRIPTION       V     Gr     Association     Gr     Gr       V     Gr     Gr     Gr     SOIL NAME, USCS GROUP SYMBOL, COUGR, MOISTURE, CONTENT, RELATIVE DENSITY OF CONSISTENCY, SOIL STRUCTURE, MOISTURE, CONTENT, RELATIVE, SOIL STRUCTURE, MOISTURE, CONTENT, RELATIVE, SOIL STRUCTURE, MOISTURE, SOIL, STRUCTURE, SOIL STRUCTURE, MOISTURE, SOIL STRUCTURE, SOIL STRUCT</td></td></t<>	EVELS         STANDURD PENETRATION RESULTS           Sample         STANDURD PENETRATION RESULTS           010 0000         010 000           010 0000         010 000           010 0000         010 000           010 0000         010 000           010 0000         010 000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         0000           010 0000         00000           010 0000         00000           010 0000         00000           010 0000         00000           010 00000         00000           010 00000         000000           010 00000 <td>EVELS     STANDLE       SAMPLE     STANDLEO       SAMPLE     STANDLEO       SAMPLE     STANDLEO       RESULTS     SOIL DESCRIPTION       Main     Soil Press       Main     Soil Pres</td> <td>EVELS     START     If/30/90     FINER     [2/07]       SAMPLE     STARD AND PERFECT     STARD AND PERFECT     SOIL DESCRIPTION     FINER     [2/07]       Y     Q     Arrow     PERFECT     SOIL DESCRIPTION     SOIL DESCRIPTION       Y     Q     Arrow     PERFECT     SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OF error     OF error     MOISTURE CONTENT, RELATIVE DENSITY OF error       I     PERFECT     Branch     Consistent Cr, Soil STRUCTURE, MINERALOGY     Soil NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OF CONSISTENCY, Soil STRUCTURE, MINERALOGY       I     Provide 337.5, Spril grey to moderoife red, Branch, soil, staft, pore granelin top 2.5.     Soil Name, Rost, ten, sand is fine graned.       I     I     Sandy Lean Clay (CL), noderate red to orange, Rost, ten, sand is fine graned.     Soil Soil Soil Soil Soil Soil Soil Soil</td> <td>EVELS     START     II/30/30     FMISH       SAMPLE     PSTART II/30/30     FMISH     12/07/90       SAMPLE     PSTART II/30/30     SOIL DESCRIPTION       V     Gr     Association     SOIL DESCRIPTION       V     Gr     Association     Gr     SOIL DESCRIPTION       V     Gr     Association     Gr     SOIL DESCRIPTION       V     Gr     Association     Gr     Gr       V     Gr     Gr     Gr     SOIL NAME, USCS GROUP SYMBOL, COUGR, MOISTURE, CONTENT, RELATIVE DENSITY OF CONSISTENCY, SOIL STRUCTURE, MOISTURE, CONTENT, RELATIVE, SOIL STRUCTURE, MOISTURE, CONTENT, RELATIVE, SOIL STRUCTURE, MOISTURE, SOIL, STRUCTURE, SOIL STRUCTURE, MOISTURE, SOIL STRUCTURE, SOIL STRUCT</td>	EVELS     STANDLE       SAMPLE     STANDLEO       SAMPLE     STANDLEO       SAMPLE     STANDLEO       RESULTS     SOIL DESCRIPTION       Main     Soil Press       Main     Soil Pres	EVELS     START     If/30/90     FINER     [2/07]       SAMPLE     STARD AND PERFECT     STARD AND PERFECT     SOIL DESCRIPTION     FINER     [2/07]       Y     Q     Arrow     PERFECT     SOIL DESCRIPTION     SOIL DESCRIPTION       Y     Q     Arrow     PERFECT     SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OF error     OF error     MOISTURE CONTENT, RELATIVE DENSITY OF error       I     PERFECT     Branch     Consistent Cr, Soil STRUCTURE, MINERALOGY     Soil NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OF CONSISTENCY, Soil STRUCTURE, MINERALOGY       I     Provide 337.5, Spril grey to moderoife red, Branch, soil, staft, pore granelin top 2.5.     Soil Name, Rost, ten, sand is fine graned.       I     I     Sandy Lean Clay (CL), noderate red to orange, Rost, ten, sand is fine graned.     Soil Soil Soil Soil Soil Soil Soil Soil	EVELS     START     II/30/30     FMISH       SAMPLE     PSTART II/30/30     FMISH     12/07/90       SAMPLE     PSTART II/30/30     SOIL DESCRIPTION       V     Gr     Association     SOIL DESCRIPTION       V     Gr     Association     Gr     SOIL DESCRIPTION       V     Gr     Association     Gr     SOIL DESCRIPTION       V     Gr     Association     Gr     Gr       V     Gr     Gr     Gr     SOIL NAME, USCS GROUP SYMBOL, COUGR, MOISTURE, CONTENT, RELATIVE DENSITY OF CONSISTENCY, SOIL STRUCTURE, MOISTURE, CONTENT, RELATIVE, SOIL STRUCTURE, MOISTURE, CONTENT, RELATIVE, SOIL STRUCTURE, MOISTURE, SOIL, STRUCTURE, SOIL STRUCTURE, MOISTURE, SOIL STRUCTURE, SOIL STRUCT		

					PROJECT NUMBER	BORING N	UNBER	
					OR0 30888.F1	MW-15	8	SHEET 3 OF 4
					s	OIL BOR	ING L	.0G
PRO.	JECT PI	GOP Pha	ne II S	ite Investigation		CATION NH	U-96, C	vinder Drop Test Area
ELE	VATION	2' 10	C N/A		DRULLING CONTRACTOR Broto	ke Engineer	ing	
DRIL	LING M	ETHOD	AND EQ	UPPENT CHE S	5, 12" CFA, 7 3/4" 0D auger, 5'x 3"10 sar	npier		
MATE	WATER LEVELS				START _1//30/90FT	NISH 12/07	/90	LOSOFE G. Schaefer
æĒ	-	SAMP	LE	STANDARD	SOIL DESCRIPTION	SOIL DESCRIPTION		
18			Σ	TEST	SOF MANE USES SPOND SHURLES		1	COMPENIS
1 23	1 2	₹¢		11230213	MOISTURE CONTENT, RELATIVE DEN	SITY	1 ä	DEPTH OF CASING, DRILLING RATE
6		123	[ ] <u>[</u>	0° -0° -0° (N)	MINERALOSY		₩.	TESTS AND INSTRUMENTATION
	17	17			TOP I' Same at above		65	
	0 to 65.0 -	- sontinuous	3.0		Well Graded Gravel with Sand (GM): brown to crange, wel, very loose, si are fine, gravel is rounded.	light - ands -		HNu = 0 Sampler wet out of hole.
85	18	1				-		
100	11	Î			TOP f: Sand Mell Graded (SW); mode red to orange, wet.	rate -		
	65.0 to 70.	5' Continuou	1.5		0.5': Well Graded Gravel (GM); chert, rounded, moderate red to light brow loose.	wel n, very		HNu = 0 Sample wet out of hole; augers were temporarily locked during = drilling.
70 -	15.0	storu			Well Sorted Sand with Gravel. (Swi); g approx. 35%, chert, rounded, coarse grained to fine sands, light brown to orange, wet very loose.	ight -		HNz = 0 - Sempter wet out of hole.
75 -	70.0 to	- 5' Conti	3.9			-		-
	75.0 10 80.0	5' Continuous	0.6		Mell Soffed Gravel with Sand (BM); is chert pieces, well rounded, light brow orange, well loose, coarse grained si	in to and		HNu = 0 3 in, die, chert cobble stuck in bottom of sampler.
80 -						1	- 1	1
-	- 80.0 to 85.0	- 5' Continuous	1.5		Well Sorted Sand with Gravel (SW); lig brown to orange, well, loose, well roun gravel, sand was coarse to time grain	ht ed.		HNu = 0 Sampler wet out of hole.
85	- 85.0 to 90.0	- 5' Continuous	1,4		Moli Sorted Sand with Gravel (SW); sa as above; bottom 7 in. is a well grade gravel with sand (GW).	ne -		HNu = 0 . Sampler wet out of hole.

					PROJECT NUMBER ORO 30888.F1	BORUNG MW-15	NUNBER 8	SHEET 4 OF 4	
						SOIL BO	RING L	06	
PROJE ELEV	ECT PGI	P Phase 2° TOC	<u>r 11 Siti</u> N/A	e Investigation			MU-9L Cy	Inder Drop Test Area	
DRILL	ING NET	THOD AN	B EDU	PHENT CHE 55.	12" CFA, 7 3/4" OD auger, 5'x 3"10 s	ampier	ang.		
MATE	RLEVEL	s			START 1/30/90	DUISH 12/0	7/90	LOGGER G. Schaeler	
zÊ		SAMPLI	1	STANDARD	SOIL DESCRIPTION			COMMENTS	
DEPTH BELO	DITERVAL	TYPE AND NUMBER	RECOVERY	TEST RESULTS 0*-0*-0* (N)	SOIL NAME, USCS GROUP SYMBOL, I MOISTURE CONTENT, RELATIVE DE OR CONSISTENCY, SOIL STRUCTUR MINERALOGY	COLOR, NSITY E,	SYMBOLIC	DEPTH OF CASING, DRILLING RATE DRILLING FLUID LOSS TESTS AND INSTRUMENTATION	
	- 90.0 to 95.0	- 5' Continuous	1.4		Well Sorted Sand with Gravet (SH) as above, botton 0.5' is a well gra- gravel with sand (SH); gravets are rounded, sand is coarse to fine, al amount of clay present.	same ded well ight	-	HNu = 0 Sampler wet out of hole.	
95 -	85.0 to 100.0	5' Continuous	1.1		Well Graded Sand with Gravel (SW) 3 in, is Well Graded Gravel with Sa light brown to light orange, wet, wi rounded gravel, fine to coarse gra sand, very loose.	t bottom nd (GW): si ined	-	HNs = 0 Sampler wel out of hole. Size of chert increasing towards - bottom end of sampler.	
-00	- 100.0 to 105.0 -	- 5' Continuous	17		Well Graded Sand with Gravet (SW) 10 in. is a Poorly Graded Gravet () brown to light grange, wel, well rou gravet, smaller diameter than above coarse grained sand.	Dotton PE Sght nded		HNu = 0 Sampler wet out of hole. Chert gravel up to 2.5 in. found - in end of sampler.	
05-	- 105.0 to 110.0	- 5' Continuous	5.0		TOP 3.9': Well Graded Sand with Gr. [SML same as above except sands fine grained. Bottom LI: Well Sorte (SML highly stratified, color varies layers - white, light brown, to oran loose, very fine grained.	avel are d Sand with ge, wet,		HNu= 0 Sampler wet out of holo.	
10 -	+	+	-		Total Depth = 110.0 feet			1	
					PROJECT NUMBER	BORING	NUMBER		
-------	----------	---------	-----------	-------------------	--	--	-----------	--	------
					OR0 30888,F1	MW-16	1	SHEET 1 OF 3	
_					s	OIL BOR	ING L	OG	
PRO	ест 🖻	SOP Pha	se 11 Sit	e Investigation		CATION M	IU-I, Nor	th of Oil Landfarm	
ELE	VATION	2º TO	: N/A		DRELLING CONTRACTOR Broto	ke Engineer	ring		
DRI	LING M	STHOD /	ANB EQU	IPNENT CHE 55	12" CFA, 7 3/4" OD auger, 5's 3"10 set	npler			
HAT	ER LEVE	15			START 10/20/90 FT	NUSH 11/30	/90	LOGGER 0. Gestwender	
ΞĒ		SAMP	LE	STANDARD	SOIL DESCRIPTION		T	COMMENTS	-
Ĩ	-   =	9	≿	RESULTS	SOIL NAME, USCS GROUP SYMBOL, CO	0.08	].		-
DEPTH	ANTERV	TYPE A	RECOVE	0* -8* -6* (N)	MOISTURE CONTENT, RELATIVE DEN OR CONSISTENCY, SOIL STRUCTURE MINERALOGY	MOISTURE CONTINUT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING DRILLING FLUID LOSS TESTS AND INSTRUMENTATIO	RATE
	1 T	N.			Top I': LEAN CLAY WITH SAND (CL)			Reckningent Litter O. Darts 201	
		ig.			gravel. Bottom 1.4: Lean Clay (CL)			Deckground: Hete-0, Hade 350	°" -
	1 2	- in	2.4		scan w/ gravel.	nu -			- 4
	18	Cor			-	-	-	HNu = 0, Rad = background	- 1
	- 1	10			-	-			_]
5		++			E E AN CLAY JELL AND A CLASS				-1
1	11	Î			plasticity, some motting.	-		HNU = 0, Rad = background	1
1	8	sto		1 1		-			1
E.	1 2	dine.	4.4			-			-
	1 3	ő		1 1		-			-
1	11	6		1 1		_			
10	++	++-			LEAN PLAN AND A				-1
1	11	1 î		1	for black notting that appears to b	ept -		HNu = 0, Rad = background	-
1	0.9	0.015			organic. End 0.6': Sand (SP); reddit brown, wet.	h -			-
	5	din	5.0			- 1			
	0.0	ů				-			-
	1 ī	10				-			1
15	-1-1-	++			Top 0.3' LEAN CLAY MITH CLASS (C				
	1	T			reddish brown, wet. Middle 18': Lean	Clay		HNU = 0, Rad = background	٦
	0.0	snor			(CL): gray, wet, with gravel grading t	o			1
	n n	-th	3.85		sand.	1			+
	20	ő				-			-
	tī.	10				-			
20 -	++		-						
· .	1 T	T			See borehole log for HM-182			Cobble in tip of sampler.	1
	22	Sho				1			1
	ę	ntin.	0			1			1
	0.0	õ				-			
-	ĩ	in I				-			1
25 -							-		
-	I T I	1.			FAT CLAY ICHO: few to little gravel, moderately reddish brown, moist.	-		HNs = 0, Rad = background	1
	0.0	500				1			1
	10.3	tin	3.1			-			+
	20	ĉ				-			+
-	20	io I				-			1
		1.1	- 1	1			1		

					PROJECT NUMBER DRO 30888.FT	BORING N MW-161	NINBER	SHEET 2 OF 3	
					so	DIL BOR	ING L	.06	-
PROJ	ECT PG	DP Pha	ve 11 Sri	e Investigation	100	NH MOLTAN	U-1. Nor	rth of Oil Landfarm	_
ELEV	ATION	2° TOC	N/A		DRILLING CONTRACTOR Brotck	e Engineer	ing		
DROL	ling me	THOD A	ND EGU	IPHENT CHE 55	12" CFA, 7 3/4" OD auger, 5'x 3"10 same	oler			
MATE	RLEVE	15			START _1/29/90 FIN	OSH _1/30/	/90	LOGGER D. Geshwender	_
ΖĒ	-	SAMPL	.E	STANDARD PENETRATION	SOIL DESCRIPTION			COMMENTS	٦
	<b>WAL</b>	N <sup>A</sup> E	rERV	RESULTS	SOIL NAME, USCS GROUP SYMBOL, COL MOISTURE CONTENT, RELATIVE DENS	LOR,	8	DEPTH OF CASING, DRILLING RA	TE
E.S.	INTER	BUN	RECOV	6* -6* -6* 040	OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		SYMBO 00	DRILLING FLUID LOSS TESTS AND INSTRUMENTATION	
	11	T †			LEAN CLAY ICL); moderate reddish b	NOWN.		HNu = 10 ppm, Rad = backgroun	
	3	50			and groy working most.	. 1			H
	- B	- in the	5.0			-	·		+
	8	32				-			1
	17	i.o	1			_			1
35 -	11	1	-		Top 0 6's i Cabi di any Im L				1
	Ĩ	I T		1	noderately reddish brown, moist. Bot	1010		HNu = 1.0 ppm, Rad = backgroun	σ
	8	10			<ol> <li>LEAN CLAY (CL); yellowish brown, moist.</li> </ol>	- 1			1
	1 2	i i	3.7	1 1		-			+
	3	S							4
	17	10	1	· ·					
40 -	<u> </u>	1	L						
-10	, ĉ	i i			gray, noist. Bottom 2.4': CLAYEY SAN	in 7		HNu = 0, Rad = background	1
	4	i i i			USC); noderately reddish brown with g clay notifing, moist.	arah -			1
	18	guo:	3.8			-	.		ł
	- 9	ŝ							ł
	<u> </u>				CLAYEY SAND, ISC: moderately reddi	ch -		Like = 0. Rod - background	1
45 -	-		_		brown with slight mottling.			Hive - 0, Had - background	
	IT.	T			CLAYEY SAND (SC); same as above				1
	0.0	0002			continuous vertical member 0.5 in. x1	in, T			1
	10.0	100			in cross section, wel.	-		HNu = 5 ppn, Rad = background	1
-	2:0	3º				-		-	-
-	4	â				-			1
50 -					Too 0.6' CLAVEY CAND LITEL COLUMN	_			
	Ĩ	T			(SC): moderately reddsh brown wet.	1		HNU = 10 ppm, Rad = background	1
	5.0	500			reddish brown, moist.	1			1
1	20 20	phinu 008				-	- 1	· · ·	ł
-	8	20				-			Ł
-	25 1	io				- 1			1
55 -	+	+			The DAL SLAVEY FILM INC.				
	T	Ť			reddish brown with gray nottling, wel.	ery _		HNu = 5 ppm, Rad = background Cobble in the auger	1
1	8	SD			Bottom 0.47: Sand with Gravel (SM): reddish brown, wet.	1		- i,	)
-	0.0	the				+			1
-	20	S C				-			Ł
-	66	in			4	1			
	1	11	- 1				1		1

					PROJECT NUMBER ORD 30888.F1	BORING M MW-161	NWBER	SHEET 3 OF 3
					so	DIL BOR	ING L	06
PRO.	ECT PGC	P Phase	: 11 Site N/A	Investigation	LO	CATION MM	U-l Nor	th of Oil Landfarm
DRIL	LING MET		O EQU	PHENT CHE 55.	12" CFA, 7 3/4" 00 auger, 5's 3"ID sam	pler	ang .	
MATE	ER LEVEL	s	_		START _!!/29/90 FD	<b>CISH</b> 11/30	/90	LOGGER D. Geshwender
δĒ	3	SAMPLE		STANDARD PENETRATION	SOIL DESCRIPTION			COMMENTS
DEPTH BEL	DITERVAL	TYPE AND NUNBER	RECOVERY	RESULTS 6" - 6" - 6" (N)	SOIL NAME, USCS GROUP SYMBOL, CO MOISTURE CONTENT, RELATIVE DENS OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	LOR. SITY	SYMBOLIC	DEPTH OF CASING, DRILLING RATE DRILLING FLUID LOSS TESTS AND INSTRUMENTATION
er	60.0 to 65.0	5' Continuous —	0.8		SAND (SP): medium grained, moderat reddish brown, wet. Bottom 0.3': Gra with Sand (SW); sand is coarse grain moderately reddish brown, wet.	ety wel ed.		HNu = 0, Rad = background
65 70		5' Continuots	0		No recovery. No recovery. Tpiece of chert Japan VG dia.) in the end of the sampler. Total Depth = 70.0 feet	- - 		HNu = 0, Rad = background Onlier notes that poor recovery is due to gravel falling out of the auger.

						PROJECT NUMBER	BORING	NUMBER		_			
¥.						0R0 30888.F1	MW-16	3	SHEET I OF A				
ĺ							SOIL BOR	ING L	.0G	_			
	PROJ	ECT PS	OP Pha	se 11 Sit	e Investigation		6						
	ELEV	ATION	2º TO	C 386.14	ft. MSI,	DDI I ING CONTRUCTOR B	LOCATION Last Plant Area, near Blog. C-746-G						
	DROL	LING ME	THOD /	AND EQU	IPMENT CHE 7	5. 12" CFA, 7 3/4" OD auger, 5's 3"10	DRULLING CONTRACTOR Brotoke Engineering     CFA 7 3/4" OD avons 5's 3"ID sampler						
	WATE	RLEVE	LS			START 12/11/90	START 12/11/90 Ebuteu 12/14/00 0 Centre 0						
	жÊ	-	SAMP	L.E.	STANDARD	SOIL DESCRIPTION	SOIL DESCRIPTION			-			
	135	-	1.	≿	TEST DECLEY	CON NUME USED COM & FURTHER		1	COMMENTS				
	DEPTH B SURFACE	INTERVA	TYPE AN	RECOVER	6" -6" -6" (N)	MOISTURE CONTENT, RELATIVE OR CONSISTENCY, SOIL STRUCT MINERALOGY	SOIL NAME, USES GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY			RATE N			
			- snor			Top f: Clayey Gravel (GC); gray Bottom 0.5': Sit (ML); gray, som and some large gravel, nois1.	e organics		Background: HNu=0 ppm RAD=33 cpm	-			
		0.0 10 5	- 5' Centin	1.5					HNu=0 RAD=background				
	5 -	to 10.0	antinuous 3009	5.0		Top 2.2: Siti (ML); gray, moist. 2.8: Lean Clay (CL): moderate y brown with gray mottling, some o moist.	Bottom		HNu=0 RAD=background	-			
1	10 -	20	10				-			-			
	<u>ا</u> ٣	1 î	1			Lean Clay (CL); Same as above.	-			-			
		3	5				1		HNu=0 RAD=background	-			
		10.0 to 15	Continu	5.0						1			
	·	11	Ĩ				-			1			
	15 -	++-	++			No Recovery.	_			_			
		1.					_		Parala anticipation in a				
	-	50.0	100L						Somple catcher in backwards.	1			
		2	offic la	0				1		1			
		20	10				1			1			
		11	1							-			
	20 -		1			Lean Clay (CL); yellowish brown w	ith gray 🚽			-			
	-	to 25.0 -	ntineous -	5.0		eording, noist.	-		HNu=0 RAD=background				
	-	- 20.0	ب د ده				-						
	25 -	100	- 510			Top 0.5'; Lean Clay (CL); Same a: Next 0.6': Poorly Graded Sand (S reddish brown, moist, medium grain Bottom 3.9'; Lean Clay (CL); oray	above. – P): ed. – moist.						
		- 25.0 to 31	- 5' Continu	5.0			-			-			
- 1		+	4		1		1	- 1		1			

					PROJECT NUMBER ORO 30888.F1	BORINS N MW-163	umber 3	SHEET 2 OF 4
					s	DIL BOR	ING L	DG
PROJEC	CT PGD	P Phase	11 Site	Investigation	10	CATTON Ea	st Plant	Area.near Bidg. C=748-G
ELEVA		* TOC	386.14 1	1. MSL	DRILLING CONTRACTOR Brotes	e Engineer	ing	
DR3LL1	NG MET	HOD AN	D EONÌ	PMENT CHE 75,	12" CFA, 7 3/4" 0D auger, 5's 3"1D san	pier		
WATER	LEVEL	5			START 12/11/90 FD	NISH <u>12/14</u>	/90	LOBBER D. Geshwender
a£		SAMPLE		STANDARD PENETRATION	SOIL DESCRIPTION			COMMENTS
DEPTH BEL SURFACE	INTERVAL	TYPE AND NUMBER	RECOVERY	RESULTS 6"-6"-8" [N]	SOIL NAME, USCS GROUP SYMBOL, CO MOISTURE CONTENT, RELATIVE DENS OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	LOR. SITY	SYMBOLIC LOG	DEPTH OF CASING, DRILLING RATE ORILLING FLUID LOSS TESTS AND INSTRUMENTATION
-	- 30.0 to 35.0 -	- 5' Cantinuous	3.9		Lean Clay ICL): with trace gravel, re brown, moist, gravel is rounded, gray motting. Bottom 16: Lean Clay (CL gravel, moderately reddsh brown, m gray motting.	eddish λ. with oist,		HNu=0 RAD=background
35 -	4				Mell Graded Gravel with Specif (SM) -	-		
-	16.0 to 40.0	Continuous	3.8		brown, moist, Next USP, Poorly Grad Sand (SP): reddish brown, moist, fin grained. Bottom 2.5': Lean Clay ICL yelowish brown with reddish brown mottling, moist.	edish i: i:		HNu=0 RAD=background
	ĩ	ŝ				-		
40 -	40 to 45	5' Continuous	4.3		Poorly Graded Sand (SP); gray, nois grained with trace coarse grains; 14 top of sample there is a 0.3" seam of coarse grains.	t, fine from f	,	HNu=0 RAD=background
		1						-
45 -	- 45 to 50	5' Continuaut	2.4		Top 2': Poorly Graded Sand (SP); wit trace gravel, gray, moist, fine graine Bottom 0.4': Lean Clay (CL); with so: sand, moderate reddish brown, gray mottling, moist.	lh d, se -		
		Ĩ				-		-
50	50 to 55	5 Centinuous	5.0		Top 1.2': Lean Clay (CL); with frace s reddish brown, gray motting, noist. Bottom 3.8': Lean Clay (CL); reddish brown, gray molting, moist, very stiff	land,		HNu=0 RAD=background
55	to 60	intinuous	2.5		Lean Clay (CL); gray with reddish bro mottling, very stiff, moist.	own -		HNs=0 RAD=background
	1	5 Co				. 1		2.5' Slough.

						PROJECT NUMBER		BORING N	UMBER		-
<ul> <li>I</li> </ul>						OR0 30888.F1		MW-163	3	SHEET 3 OF 4	
							so	IL BOR	ING L	06	
1	PROJE	CT P6	OP Phas	e II Site	c Investigation		100	ATION Eas	d Plant	Area new Rido C-240-0	_
	ELEV	ATION .	2º TOC	386.14	H. HSL		LOC Mcke	Engineeri	ing	Area near brog. c=748-b	-
1	DRILL	ING ME	THOD A	ND EQUI	PHENT CHE 75,	12" CFA, 7 3/4" 00 auger, 5'x 3"10 :	samp	ier			-
2	NATE	R LEVE	.s			START 12/11/90	FIN	ISH 12/14/	90	LOSGER D. Geshwender	
- [	зÊ		SAMPL	E	STANDARD RENE TRATION	SOIL DESCRIPT ION				COMMENTS	٦
	E.	4	ę	1 2	TEST RESULTS	SOIL NAME, USCS GROUP SYMBOL	ca	OB.			-
	SURFAC	INTERV	TYPE AN NUMBER	RECOVE	6* -6* -6* (N)	MOISTURE CONTENT, RELATIVE O OR CONSISTENCY, SOIL STRUCTUR HINERALOGY	ENSI RE.	ĬŤΫ	SYNEOLD LOG	DEPTH OF CASING, DRILLING RA DRILLING FLUID LOSS TESTS AND INSTRUMENTATION	TE
		- 60 to 65	5' Continuous -	3.5		Top 0.2": Poorly Graded Sand (Si moist, medum grein size. Middle I Poorly Graded Sand (SP): redds fine grained, noist. Bottom 1.55": Graded Sand (SP); gray with red brown mottling, noist, coarse grai	P): g .75': h bro Poor dish ined.	ray, jun, - iy -		HNu=0 RAD-background	-
1.	85 -	L ŧ						1			1
-1'	00 -	TT	TT			Poorly Graded Sand (SP); modera vellowish brown, well, coarse, grade	atety	-			┥
		to 70	ntinuous	13		,	iicu.	-		HNu=0 RAD=background	1
		18	ů					-			+
-	-	11.	1		1 1			-			1
7	70 -	70 10 75	Cantinuous	3.25		Top 2.25': Clayey Sand (SC): gra- nedium grained. Bottom 10': Poor Graded Sand (SP): gray, wet, coa grained.	y, no ly irse	int		HNu=0 RAD-background	
	-	1	in						- 1		1
7	5-	+	+			Poorly Graded Sand (SP); same as except mediun grained.	ab:	>ve _			
		to 80	mtim uo u:	3.2						HNu=0 RAD=background	
Ľ	1	- 75	° 2					1		1	1
	. 1		1			,		-			
8	0-	1	snor			Poorty Graded Sand (SP); same as except coarse grained.	abo	we -		HNu=0 RAD=background	
		80 to 8	Continu	3.5				1			
			Ĩ					-			Ł
8	5+	+				Poorly Graded Sand (SP); same as	abo	ve -		-	Ł
	1		s			except with some gravels.		· -		HNu=0 RAD=background	
	-	8	Unu I	-				-			
	-	82 F	Cont	3.0				1			
	-	ī	ĩn								
			+					1			1

-					PROJECT NUMBER ORD 30888.FJ	SOIL BOR	NUMBER 3	SHEET 4 OF 4
PROJEC	ст <u>Р60</u>	IP Phase	11 Site	Investigation		LOCATION	st Plant	Area, near Bidg, C-746-G
ELEVA	TION _2	* TOC :	386.14 1	L MSL	DRILLING CONTRACTOR	Brotcke Engineer	ring	
WATER	NO MET	HOU AN	D EOUI	PMENT	12" CFA, 7 374" 00 auger, 5's 3'	ID sampler		
MATER	LEVEL	CANDIC		CT HID HOLD	START 471/90	FINISH 2714	790	LOGGER D. Geshwender
35		SAMPLE		PENETRATION	SOIL DESCRIPTI	ON	1	COMMENTS
DEPTH BEI SURFACE	INTERVAL	TYPE AND NUMBER	RECOVERY	RESULTS 6"-6"-6" (N)	SOIL NAME, USCS GROUP SYME MOISTURE CONTENT, RELATIV OR CONSISTENCY, SOIL STRUM MINERALOGY	OL, COLOR, E DENSITY TURE,	SYMBOLIC 500	DEPTH OF CASING, DRILLING RAT DRILLING FLUID LOSS TESTS AND INSTRUMENTATION
-	10 85	tinuous —	5.0		Poorly Graded Sand (SP); san except no gravel.	ne as above		HNu=0 RAD=background
A.F.	-	+ 5' Cor						Driller Indicates hitting gravel.
95	- 95 to 100	5' Continuous	2.0		Top L4': Poorly Braded Sand as above: Bottom 0.6': Hell 5 10H); with sand, yellowish bro sand is coarse grained.	(SP): some		- - 
<sub>00</sub> ]		Ļ			Total Depth = 100.0 feet	-		



					PROJECT NUMBER	BORD	NO NUMBER	
					unu 30000.F1	MW-	10.3	SHEET 1 OF 3
						SOIL B	ORING L	06
PROJ	ю <b>ст</b> <u>Р</u> б	DP Phas	ie 11 Site	t Investigation		LOCATION	MMU-8, Sa	nitary Landfill
ELEV	ATION .				DRILLING CONTRACTOR	otcke Enge	teering	
DRILL	ING NE	THOD A	ND EQUI	PHENT ONE 55.	12" CFA, 7 3/4" OD auger, 5'x 3"ID	sampler		
MATE	T	CAMP:	F	OTHIOLOG	START _1/24/90	FINISH	1/29/91	LOGGER G. Schaeferer
횴		J	<u> </u>	PENETRATION	SOIL DESCRIPTION		_	COMMENTS
DEPTH BE SURFACE	DITERVAL	TYPE AND NUMBER	RECOVERY	RESULTS 8*-8*-6* 0N)	SOIL NAME, USCS GROUP SYMBOL MOISTURE CONTENT, RELATIVE ( OR CONSISTENCY, SOIL STRUCTU MINERALOSY	. COLOR, XENSITY JRE,	SYMBOLIC SYMBOLIC	DEPTH OF CASING, DRILLING DRILLING FLUID LOSS TESTS AND INSTRUMENTATIO
	11	Î			0.4': Fill Material			Backgroundt
	9	\$101			10': Lean Clay (CL); dark brown, very stiff, some plant roots and	noist,	1	PP = pocket penetroseter
	102	- Up	1.4		contraction and their roots did	Stater.	1	
	18	ů					-	pp=3.25Kg/cm2 for CL.
		1 I					-	
5 -	++	++		I	Fill Naterial: pieces of wood, blav	ck, moist.	-	
		1					-	HNIED Bade Street protide
	l ĝ	1072						recovery due to wood chips
۰.	2	at a	0.4					attick in end.
	10	.6						
10		1					1	
10 -		t-			Top 0.5": Mell Graded Gravel with (6W); light brown, wet, loose, coa	Sand the send	-	
	9	50			some wood chips. Bottom 2.4': Lean Clay (CL): dwil	k brown	-	HNu=0, Rad=3lcpm,
-	10 15	dinu 061	2.9		noist, stiff.		1.1	Bottom of sampler wet out of hole
. 1	10.0	00	- 10					10/121
-	Ī	<u>ن</u>					-	
15 -	+	1			Lean Clay (CL): same as above.		-	
-							1 1	When Date 24
_	20.0	5000						pp=2.0Kg/cm2 for CL.
_	5	ontin 1308	5.0				1	Took two samples:
	15.0	is C					1	13062 and 13063
_ 1	1	1					1	
20-					Lean Clay (CL); same as above.		- 1	
1	\$	5						HNu=0, Rad=29cpm,
-	0 25	ineo					+	pp=2.0Kg/cm2.
-	0.0 t	ß	5.0				- 1	
-	8	in.					1 1	· .
5	-				Land Class (Cl.)			
۳.	11	1			dark yellowish orange striations, v	cept for ery	1	
1	8	500			8011.		1	HNu=0. Rad=27cpm, pp=3.5Kg/cm2.
1	10	atic	3.5				1	Sampler wet out of hole.
1	220	ů,		1				
	1	10					-	•

					PROJECT NUMBER	BORING M MW-18	AUMBER 3					
					s	DIL BOR	ING LO	SHEET 2 DF 3				
PROJE	CT <u>PGD</u>	P Phase	11 Site	Investigation	LO	LOCATION MPU-8, Sanitary Landhill						
DBILLI	NO NET	HOD AN	D EQUI	WENT CHE 55.	12" CFA, 7 3/4" OD auger, 5'x 3"10 sat	pler						
WATER	LEVEL	s			START 11/24/90 FI	START 1//24/90 FINISH 01/29/91 LOSSER G. Schaeferer						
-6		SAMPLE		STANDARD	SOIL DESCRIPTION			COMMENTS				
DEPTH BELO	DITERVAL	TYPE AND NUMBER	RECOVERY	RESULTS 8* -8* -8* (N)	SOIL NAME, USCS GROUP SYMBOL, CO MOISTURE CONTENT, RELATIVE DEN OR CONSISTENCY, SOIL STRUCTURE MINERALOGY	OLOR. SITY	L06	DEPTH OF CASING, DRILLING RATE DRILLING FLUID LOSS TESTS AND INSTRUMENTATION				
	- 30.0 to 35.0	- 5 Continuous	5.0		Lean Clay (CL): light gray with light orange layering, moist, brittle, very faitly blocky.	stift,	-	HNu=0, Red=32cpe, pp=3.75Kg/cm2. Sampler wet out of hole.				
35 -	ł	1			Lean Clay (CL); same as above.	-		Hitsen Rade Marca				
	- 35.0 to 40.0	- 5' Cantinuous	4.2					pp-3.75Kg/cm2. Sampler wet out of hole.				
40 -	40.0 to 45.0	5' Continuous	5.0		Lean Clay (CL): grayish black, noisi fissered.	, hard,	-	HNu=0, Rad=38cpm, pp=4.5kg/cm2. Sampler wet out of hole.				
45 -	50 to 50.0	Continu ous	5.0		Lean Clay ICL); same as above exc highly fissured and brittle, micaceou	ept -		HNu=Q, Rad=38cpm, pp=4.5Kg/cm2. Sampler wet out of hole.				
50 -	0	2 2.			Lean Clay (CL); same as above eso dry.	ept –		HNs=0, Rad= 45cp#,				
-	50.0 to 55/	- 5' Continuo	5.0					pp=4.5Kg/0#2.				
	- 55.0 to 80.0	- 5' Continuous -	5.0		Lean Clay ICLI: same as above			HNu=0, Rad=4lcpn, pp=4.5Kg/c#2.				

					PROJECT NUMBER ORO 30688.F1	BORING N MW-183	UMBER 3	SHEET 3 OF 3			
					SOIL BORING LOG						
PROJE	CT _PGD	P Phase	11 Site	Investigation	L0	LOCATION WHU-B, Sanitary Landfill					
ELEVA	T10N	-			DRILLING CONTRACTOR Brotch	DRILLING CONTRACTOR Brotoke Engineering					
DRILLI	ING MET	HOD AN	D EQUI	PMENT CHE 55,	12" CFA, 7 3/4" OD augev, 5'x 3"1D sam	pler					
WATER	LEVEL	5		-	STARTFD	USH 01/28	/81	LOGGER G. Schaeferer			
зÊ		SAMPLE		PENETRATION	SOIL DESCRIPTION			COMMENTS			
DEPTH DEL	DITERVAL	TYPE AND NUMBER	RECOVERY	1EST RESULTS 6* - 6* - 6* (N)	SOIL NAME, USCS GROUP SYMBOL, CO MOISTURE CONTENT, RELATIVE DENS OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	LOR, SITY	LOG SYMBOLIC	DEPTH OF CASING, DRULING RAT DRULING FLUID LOSS TESTS AND INSTRUMENTATION			
		- 5" Continuous	5.0		Lean Clay (CL); grayish block, dry; i higNy fissured, micaceous.	hard, - - -		HNe=0, Rad=32cpm, pp=4.0Kg/cm2. Sampler wet out of hole.			
70 -	🗝 65.0 to 70.0 —	- 5' Continuous	5.0		Lean Clay (CL): some as above. Total Depth = 70.0 feet	-		HNu=0, Rad=35cpm, pp=4.25Kg/cm2.			



					PROJECT NUMBER	BORING N	UNBER		
					0R0 30888.F1	MW-185	5	SHEET I OF 3	
					so	IL BOR	ING L	OG	
PROJ	ECT PB	DP Phas	e 11 Siti	e Investigation	100	ATTON MM	U-7 Buri	al Ground	
ELEV	ATION .	2º TOC	373.64	IL MSL	DRILLING CONTRACTOR Brotck	e Engineer	ing		
DROLL	ling me	THOS A	ND EQU	PHENT CHE 55.	12" CFA, 7 3/4" 0D auger, 5'x 3"ID same	pler			
MATE	RLEVE	LS		-	START _01/17/01FD	O1/23	/91	LOSSER G. Schaefer	
зĒ	:—	SAMPL	E	STANDARD PENETRATION	SOIL DESCRIPTION			COMMENTS	
DEPTH BEL	INTERVAL	TYPE AND NUMBER	RECOVERY	RESULTS 6* -6* -6* (N)	SOIL NAME, USCS GROUP SYMBOL, CO MOISTURE CONTENT, RELAT IVE DENS OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	LOR, ITY	SYMBOLIC	DEPTH OF CASING, DRILLING DRILLING FLUID LOSS TESTS AND INSTRUMENTATIO	RATE
	105	ontinuous	u		Top 0.4': Gravel fill material SBLT DMLX light gray, moist, firm	-		Background: HNu=0 Rad=29 cpm PP = pocket penetrometer	
5.	Ĩ	20			Tan 21' CB T (Hill Page of shore	-		HNv= 0 ppm Red= 38 cpm PP = 1.75 kg/sq. cm. Rod chatter	
	5 to 10	- 5' Continuous	4.3		Botton 2.2: LEAN CLAY (CL, light by Botton 2.2: LEAN CLAY (CL, light by with gray streaking, moist, very stiff	σwn -		HNu≕ 0 ppn Rad+ 30 cpm PP = 2.25 kg/sq. cm.	
10 -	- 10 to 15	Continuous	4.7		LEAN CLAY (CL), Same as above	-		HNu= 0 ppm Rad= 40 cpm PP = 2.25 kg/sq. cm.	
15 -		1 1			Top 4.2': LEAN CLAY (CL), Same as a Boltom 0.5': WELL GRADED SAND (SW	bove -		HNu= 0 ppm Rad= 30 cpm PP = 2.25 kg/sq. cm. for CL	-
	- 15 to 20 -	5' Continuous 13041	4.7		nedum grained sand				
20 -	- 20 to 25	5' Continuous	4.8		Top 2.8': WELL GRADED SAND (SW), S as above Bottom 2': LEAN CLAY WITH GRAVEL moderate red to gray, moist, very stift rounded gravel	ame – (CL). – I. –		HNu= O ppm Rad= 33 cpm PP = 3.1 kg/sq. cm.	
25 -	- 25 to 30	5 Continuous	5.0		Top LO': MELL SORTED GRAWEL WITH CLAY (GN), moderate red, moist, stiff, rounded gravel Bettom 40': LEAN CLAY WITH SAND ( moderate red to gray, moist, hard	481 - CLL -		HNu= O ppm Rad= 43 cpm PP = 4.50 kg/sq. cm.	1

					PROJECT NUMBER	BORING N	UNBER	
					0R0 30888.F1	MM-185	5	SHEET 2 OF 3
					50	DIL BOR	ING L	06
890.0	ест Рб	DP Phas	e 11 Sit	e Investigation		DATION MN	u⇒7 Bur	al Ground
ELEV	ATION .	2º TOC	373.64	ft. MSL	DBILLING CONTRACTOR Brotck	e Engineer	ing	
DRILL	LING HE	THOD A	ND EQU	PMENT CHE 55,	12" CFA, 7 3/4" 00 auger, 5's 3"1D sam	pler		
NATE	R LEVEL	.s			START 01/17/91 FD	05H 01/23	/91	LOBGER G. Schaefer
<b>PE</b>		SAMPL	ε	STANDARD	SOIL DESCRIPTION			COMMENTS
TH BELO	ERVAL	E AND BER	OVERY	RESULTS	SOIL NAME, USCS GROUP SYMBOL, CO MOISTURE CONTENT, RELATIVE DENS OR CONSISTENCY, SOIL STRUCTURE,	LOR. SITY	BOLIC	DEPTH OF CASING, DRILLING RATE DRILLING FLUID LOSS
85	X	22	Ĕ	(N)	MINERALOGY		103	TESTS AND INSTRUMENTATION
	- 30 to 35	5' Continuous	4.9		LEAN CLAY WITH SAND ICL), modera red to grey, moist, hard, me-dium to fo grained sand	ine -		HNs= 0 ppm Rad= 30 cpm PP = 4.5 kg/sq. cm.
35 -	10 40	Minuous	4.8		LEAN CLAY WITH SAND, (CL) Same a above			HNu= 0 ppm Rad= 29 cpm PP = 4.25 kg/sq. cm.
40 -	3	2 Co			Top 19": LEAN CLAY WITH SLAND (CL Same as above, except very stiff			HNa= 0 ppm Rad= 41 cpm — PP = 3.0 kg/sq. cm.
	40 to 45	- 5' Continuos	3.0		Bottom LI': WELL GRADED SAND (SW) brown, moist, loose, fine to medium gr sand	light T ained		-
45 -	45 to 50	- 5' Centinuous	5.0		Top 3.5': LEAN CLAY ICL), dark brow moist, very still Bottom 1.5': MELL SORTED S.AND WITH CLAY (SN-SC), light gray with black streaking, moist, soft	n, —		HNy= 0 ppm Rad= 38 cpm PP = 3.5 kg/sq. cm. for OL PP = 0.5 kg/sq. cm. for SH-SC =
50 -	50 to 55	- 5' Continuous	4.8		Top 17': WELL SORTED SAND MITH CI ISM-SCI, Same as above Midde 0.4': WELL GRADED SAND (SM) black to dark gray, moist, loose Bottom 2.7': LEAN CLAY MITH SAND dark brown with gray streaks, moist, v stiff, fine grained sands	LAY -		HNu= 0 ppm Rad= 37 cpm PP = 2.5 kg/sq. cm. for CL
55 -	- 55 to 60	- 5' Continuous	3.8	-	Top 1.9': LEAN CLAY WITH SAND (CL) Same as above, except firm Bottom 1.9': WELL SORTED SAND (SW) light brown to moderate red, wet, very loose			HNu= O ppm Rad= 34 cpm PP = 0.75 kg/sq. cm. for CL

					PROJECT NUMBER ORO 30886.FI	BORING N MW-185	UNBER	SHEET 3 OF 3
					s	OIL BOR	ING L	DG
PROJE	CT _PGD	P Phase	II Site	Investigation	L	OCATION MM	U-7 Buri	al Ground
ELÉVA	TION _2	" TOC	373.64	fi. MSL	DRILLING CONTRACTOR Brote	ke Engineer	ing	
DRILLI	NG MET	HOD AN	D EQUI	PHENT	12" CFA, 7 3/4" OD auger, 5's 3"1D sa	npler 01/22	100	C. Cabadar
RATER	LEVEL	SAMPLE	1	STANDARD	SOU DESCRIPTION	INDSH	781	LOSGER D. Schaller
콜토		JANFLE	<u> </u>	PENETRATION	SOIL DESCRIPTION			COMMENTS
DEPTH BE Surface	INTERVAL	TYPE AND NUMBER	RECOVERY	RESULTS 0*-0*-0* 0N)	SOIL NAME, USCS GROUP SYMBOL, C MOISTURE CONTENT, RELATIVE DEI OR CONSISTENCY, SOIL STRUCTURE MINERALOGY	OLOR. ISITY	SYMBOLIC LOG	DEPTH OF CASING, DRILLING RAT DRILLING FLUID LOSS TESTS AND INSTRUMENTATION
-	60 to 65	- 5' Continuous	5.0		Top 4.0": NELL GRADED SAND ISM brown, wet, very loase Botton 10": MELL GRADED SAND W GRAVEL (GN), light brown to moder red, wet, loase, well rounded grave medium grained sands	), light ITH ale I		HNu= 0 ppm Rad= 38 cpm PP = N/A Sampler wet out of hole
65		- 5' Continuous	1,4		WELL GRADED GRAVEL WITH SAND Same as above, except larger cher pieces lapprox. 2 in. d'ameter ma			HNu= 0 ppm Rad+ 36 cpm P.P.= N/A Sampler wet out of hole
70 -	70 to 75	e- 5' Continuous	2.0		WELL GRADED GRAVEL WITH SAND Same as above	(GH) -		HNU= 0 ppn Rad= 38 cpn PP = N/A Sampler wet out of hole
75 -		- T -			Total Depth = 75.0 (est			-

					PROJECT NUMBER	BORING N	LINRER	
					0R0 30888.F1	MW-188	8	SHEET & OF A
					s	DIL BOR	ING L	06
PRO	COT PE	OP Pha	se II Si	e Investigation				-1 1711
PHUS ELEX		2* TOC	374.24	ft. HSL	LOC	CATION WHI	U-L SM	of Di Landform
DRI		THOD 4		TRAFAT CHE 75	12" CEA 7 3/4" OD away 5'x 1"ID sage	ne chuneer.	ng	
MATE	IR LEVE	15			CTARY 01/22/94	nou 01/23	/01	
	1	SAMPL	E	STANDARD	SOU DESCRIPTION	CISH	1	LOSSER D. SOLTA
鮃			1.	PENETRATION	our peschi ryon		ł	COMMENTS
l <u><u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u></u></u>	N N	NA C	l Ř	RESULTS	SOIL NAME, USCS GROUP SYMBOL, CO MOISTURE CONTENT, RELATIVE DENS	LOR	3	DEPTH OF CASING, DRILLING RATE
1 55	Ē	방풍	8	6" -6" -6"	OR CONSISTENCY, SOIL STRUCTURE. MINERALOGY		8	TESTS AND INSTRUMENTATION
80	17	<u> </u>	- E		HELL GRADED SPAVEL IED ()		53	
	- 1		1		HELE GHIDED BRAVEL (FILL)			PP = pocket penetroneter
	1	non			LEAN CLAY (CL), dark yellowish oran	ge		PP ≥ 2.0 to 2.5 kg/sq. cm.
	2	n tin	1.5		IUTR 6/6, moist			
	1 °	10				-		
	1	1				-		
5	++	+ *		<u> </u>		4		
								HNu= 0.ppm Rad= 65 cpm
	1.	20072			moist CLAY (CL), light onlye gray 5Y (	6/1. T		PP = 0 to 2 kg/sq. cm. Took two samples:
1.	1 🚊	문교	4.7	1 1		-		13047 and 13048
	- vî	6C0	· ·			-		
	-	1 in m		1 1		_		]
10 -	<u>+ t</u>	++			SANDY I SAN CLAY (CL)			
· ·	11	I T	· ·	1 1	yelowish brown IOYR 5/4, fine sand			1
		sno				1		HNU= 0 pps Rad= 80 cpm
	2	- inite	3.9			- 1	- 1	to a the star light tax.
1	2	8						
l -		in I				-		
15 -	++	4			Paulos I state of the sector of the			1
Ĩ.	1 T	T I			SANDT LEAN CLAY (CL), same as abo	we ]	- 1	HNu= 0 pp# Rad= 45 cpm
		Si				1		PP = 1 to 1.9 kg/sq. cm.
	0.20	19 City	35			-		
	12	100	~~			-		
		in						
20 -		4				1		1
20	1	1				- 1		HNur 0 ppp Bad- 50 con
	1	5			SANDY LEAN CLAY (CL), light brown 5	YR -		PP = 1.7 to 3.0 kg/sq. cn.
-	0 21	tine	40		to at most, the oast, neuron gravel	-		
-	20 1	Con	4.0			-		
· .		în				1		· · · · · · · · · · · · · · · · · · ·
25 -		+				1		1
20	1	1			SANDY LEAN CLAY (CL), same as abo	ve -		Hite Coop Date to an
-		-				-		PP = 2.0 to 2.5 kg/sq. cm.
-	8	inuo	I			-		
-	5 11	Lon Con	4.5					
_	ï	ŝ						- 1
						-		

					PROJECT NUMBER ORD 30888.F1	BOF MV	<b>11 18</b> 8	INBER	SHEET 2 OF 3
					s	DIL	BORI	NG L	OG
PROJE	CT PG	DP Phas	e 11 Situ	e Investigation		ATD	ON MAL	-1, SW	of Oil Landform
ELEV	ATION .	2° TOC	374.24	ft. MSL	DRILLING CONTRACTOR Brotck	e En	gineerik	ng .	
DRILL	ING ME	THOD AN	io Egui	IPHENT CHE 75,	12" CFA, 7 3/4" OD auger, 5'x 3"ID sam	pler			
MATE	RLEVEL	.s		-	START 01/22/91 FD	(ISH	01/23/	91	LOGGER B. Souza
l sE		SAMPLI	L	STANDARD PENETRATION	SOIL DESCRIPTION				COMMENTS
DEPTH BELL	INTERVAL	TYPE AND NUMBER	RECOVERY	TEST RESULTS 6* -0* -0* (N)	SOIL NAME, USCS GROUP SYMBOL, CO NOISTURE CONTENT, RELATIVE DENS OR CONSISTENCY, SOIL STRUCTURE, NINERALOGY	LOR		SYMBOLIC LOG	DEPTH OF CASING, DRILLING RATE DRILLING FLUID LOSS TESTS AND INSTRUMENTATION
	30 to 35	5" Continuous 🛶	4.5		LEAN CLAY (CL), light brown SYR 5/i moist, fine sand	в,	-		HNu= O ppn Rad= 65 cpm PP = 1 to 2.5 kg/sq. cm. -
35 -					SANDY LEAN CLAY (CL), dark yellow orange 10 YR 6/6	ish	-		
	35 10 40	- 5 Continuous -	5.0		LEAN CLAY (CL), dark yellowish braw YR 6/8 nottling with blash grey 58 7	n 10 /1			HNs≕ 0 ppm Rad= 50 cpm PP = 1 to 2,5 kg/sq. cm.
40 -	40 to 45	- 5' Continuous	1.5		LEAN CLAY NITH SAND LENSE (CL), brown 5 YR 5/6 mottling	lighd	-		HNu= 0.5 ppm Rad= 60 cpm
40 -	45 to 50	- 5' Continuous	5.0		SANDY CLAY (SC), moderately reddis brown 10YR 4/6 mottling with light gra sand 5N 6	h IY			HNu= 10 ppm Rad= 65 cpm PP = 2.0 kg/sq. cm.
50 -	50 to 55	- 5 Continuous	4.5		SANDY CLAY ISCI, light brown 5 YR 5 slightly moist, moltling from 50 to 53 f	/6, eet.			HNs= 0 ppm Rad= 60 cpm PP = 10 kg/sq. cm.
	- 55 to 80	- 5" Continuous	5.0		SANDY CLAY (CL), with numerous same lenses and tractures, light grey N7	1			HNu= 0 ppm Rad= 70 cpm PP = 2.75 kg/sq. cm.

P80.F	CT PS	OP Phan	e II Sit	e Investigation	S	OIL BOR	ING L	.0G		
ELEV	TION -	2" TOÇ	374.24	ft. MSI,	DBILLING CONTRACTOR Broto	CATION HH	10-1, SM 100	of Oil Landform		
DRILL	ING HET	THOD A	ND EGU	IPHENT CHE 75	12" CFA, 7 3/4" OD auger, 5'x 3"1D san	npier	·			
WATER	LEVEL	S			START _01/22/01FI	NISH _01/23	191	LOBGER B. Souza		
鹫		SAMPL	-	PENETRATION	SOIL DESCRIPTION			COMMENTS		
304 PHI BO	DITERVAL	TYPE AND NUMBER	RECOVERY	RESULTS 8*-8*-8* (N)	SOIL NAME, USCS GROUP SYMBOL, CO MOISTURE CONTENT, RELATIVE DEN OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	LOR. SITY	21 NBOLIC	DEPTH OF CASING, DRILLI DRILLING FLUID LOSS TESTS AND INSTRUMENTA		
-	60 to 65	Continuous	3.0		SANDY CLAY (SC), light gray, N7 mo very noist	ottling		HNv= 0 open Rad= 70 open PP = 0.75 kg/sq. cm,		
65 -	85 to 70	5' Continuous	2.5		SILTY GRAVEL (GM), subangular and subrounded, several 2 in, subangular stores, poorly sorted, saturated deri yellowish orange ID YR 8/6	-		HNu≕ Dippn Rad≈ 55 cpm PP = N/£		
70	- 70 to 75	5" Continuous	2.0		SELTY GRAVEL (GHO Dark ye/lowish or 10 YR/6/6. Poorly sorted, saturated	range -		HNu= 0 ppn Rad= 45 cpn PP = N/A		
75 -	+	+			Total Depth = 75.0 feet					
-										
90 -						-				
85 -						-				



0					PROJECT NUMBER	DODA/O A	IIIIII IIII			
CH/	MINIT I				OR030888.B1	MW	193	A	arr 1	. 3
Can	ana						100		SHEET	¥ 3
					SOIL	BORI	NGI	LOG		1
PROJ	ECT	PGD	P Pha	se II Site In	vestigation Loca	ATION Ogo	len Ln	dg. Roa	d at Power Lines	_
ELEW	TION_3	66.24 N	IGVD		DRILLING CONTRACTOR Brotcke	Enginee	ring C	o., inc.		
DRILL	ING METH	HOD AND	EQUIP	MENT CME	75 Rig; 7-3/4" OD CME Augers; 3"x!	5' CME St	ainles	s Steel S	Sampler	
WATE	R LEVEL	AND DAT	ε	N/A	START 4/26/91 09:03 FIN	ISH _4/26/	91_12	:23 LO	GGER_C. Webb	
l§₽		SAMPLE		STANDARD	SOIL DESCRIPTION				COMMENTS	
100	1 3	2.	È	RESULTS	SOL NAME, COLOR, MOISTURE CONT	ENT	0		DEPTH OF CASING	
DEPTH SURFA	INTERN	TYPE A NUMBER	PICON	6"-6"-6" (N)	RELATIVE DENSITY OR CONSISTENCY, STRUCTURE, MINERALOGY, USCS GRO SYMBOL	SOIL	2VMBOL		DRILLING RATE, DRILLING FLUID LOS TESTS AND INSTRUMENTATION	is,
	0-5	5' Con	4.5	N/A	OHGANIC SOIL (OL/OH), dark yellowish 5 (10 YR 4/2), moist firm, crumbles, fine grait	rown	555	Bkgd: F	HNu =0 ppm; Rad -	-21 cpm
		tinuou	5		LEAN CLAY (CL), motiled moderate yellow (10 YR 5/4) and light gray (N7), moist, hard	ish brown -		HNu = Rad = Pocke	0 ppm 52 cpm t Pen (P.P.) = 1.0	-74.5
					LEAN CLAY (CL), mottled moderate yellow	ish brown	///	kg/cm	2	-
_	1				stiff to very still, moist, slightly plastic, exide		1		-	
5	5-10	5' Con	5.0	N/A	moisture in with depth			LINIU	0.000	
	1	tinuous	0.0	110	-	-		Rad =	44 com	-
1.	-	1				_		P.P. =	1.0-3.25+ kg/cm	2
						1		1		
	1	[`								-
10-						7		1		) ji
10	10-15	5" Con-	5.0	N/A	LEAN CLAY (CL), same as above.	-		HNu =	0 pom	- 1
	1	tinuous			except with heavy oxidation 2'-2.5'		Rad = (	65 cpm	-	
· ·	1									
· ·	-					1				-
Ľ.	-					t t				
15-	-					7				1
15	15-20	5' Con-	5.0	N/A	LEAN CLAY (CL), same as above,			Libba	0.000	
		tinuous			except with trace ferrous nodules	- t		Rad = 2	28 com	-
· ·	1					ť		P.P. = 3	2.5-3.75 kg/cm <sup>2</sup>	-
· ·				1	LEAN CLAY W/SAND (CL), 3.5-4.5', trace gr	ravel and	m		-	_
-					ferrous nodules, same color, very stift, moist	E E				
20-					LEAN CLAY (CL), motiled light brown (5 YR brown (5 YR 4/4) and light brown grav (5 YR	5/6).mod				1
	20-25	5' Coo.	5.0	NIA	moist, still to very still, crumbles	~~ <i>X</i>	$//\lambda$		-	
	-0 -0	tinuous	5.0		WELL GRADED SAND W/CLAY (SW-SC), II	ght brown		HNU = (	0 ppm	
-				1	(5 TH SO), moist, sace chert graver, 4 below	<u>~</u> {E		P.P. = 2	2 opm 2.0-3.0 ko/cm2	-
			- 1		SANDY LEAN CLAY (CL), mottled	lioht -	$//\lambda$		in oto ngraniz	
-					brown (5 YR 5/6), moderate yellowis	sh	$//\lambda$			1
25-					brown (10 YR 5/4) and light brown g	aray T	$\langle \rangle \rangle$			1
	25-30	5' Con-	5.0	N/A	(5 TH 6/1), moist, stiff, crumbles, tra chert gravel, some ovidation staining	ice T	1/2	HNu = 0	) ppm	
1		unuous			and grand, come existence statistic	3 cpm				
-						E		P.P. = 1	25-1.75 kg/cm2	1
-						-E	$\langle \rangle$			
-		ł				E	$\langle \rangle$			
- 30						E C	1A			1

8					PROJECT NUMBER BORING NUMBER						
					OR030888.B1	MANO	MBE				
CA	annut					MAAN	53	SHEET 2 OF 3			
					SOIL	BORIN	GL	.OG			
PRO.	ECT	PGD	P Pha	se II Site In	vestigation	Ogde	n Lne	dg. Road at Power Lines			
ELEV	ATION 3	66.24 N	GVD		DRILLING CONTRACTOR Brotcke	Engineerir	na Ce	o, Inc.			
DRILL	LING MET	HOD AND	EQUIP	MENT CME	75 Rig; 7-3/4* OD CME Augers; 3*x5	CME Stair	niess	Steel Sampler			
WATE	R LEVEL	AND DAT	E	N/A	START 4/26/91 09:03 EM	4/26/91	1 12	23 Losora C Webb			
3		SAMPLE		STANDARD				COGGEN_CO. HOUD			
1 36			1.	TEST	SOAL DESCRIPTION			COMMENTS			
DEPTH B	INTERVAL	TYPE AND NUMBER	RECOVER	6"-6"-5" (N)	SOL NAME, COLOR, MOISTURE CONTI RELATIVE DENSITY OR CONSISTENCY, STRUCTURE, MINERALOGY, USCS GRO SYMBOL	ent, Soil: UP	SYMBOLIC LOG	DEPTH OF CASING, DRILING PATE, DRILING FLUID LOSS, TESTS AND INSTRUMENTATION			
35	- 30-35	5' Con tinuous	5.0	N/A	SANDY LEAN CLAY (CL), motified pale yoil brown (10 YR 6/2) and light brown (5 YR 6/ light brown gray (5 YR 6/1), moi st, stiff to vo crumbles CLAYEY SAND (SC), motified pale yellowist ight brown, and medium gray, moist, trace oxidized streaking	INDY LEAN CLAY (CL), motfled pale yellowish wm (10 YR 6/2) and light brown (5 YR 5/6) and ht brown gray (5 YR 6/1), moist, stiff to vary stiff, moles AYEY SAND (SC), motfled pale yellowish brown, ht brown, and medium gray, moist, trace gravel and dized streaking dec					
40	35-40	5' Con- tinuous	5.0	N/A	SANDY LEAN CLAY (CL), motiled pale yolk brown (10 YR 6/2) and light brown (5 YR 5/1 light brownish gray (5 YR 6/1), wet from D.N very stiff to hard LEAN CLAY W/SAND (CL), moderate brown (5 YR 4/4), moist, very stiff, trace subrounds chert gravel	SANDY LEAN CLAY (CL), motiled pale yollowish rown (10 YR 6/2) and light brown (5 YR 5/6) and ght brownish gray (5 YR 6/1), wet from D.N. H <sub>2</sub> O, ory stiff to hard <u>EAN CLAY W/SAND (CL)</u> , moderate brown 5 YR 4/4), moist, very stiff, trace subrounded hert gravel					
45-	40-45	5' Con- tinuous	4.5	N/A	LEAN CLAY W/ SAND (CL), same a above, except mottled with light bro oxidation streaking and trace nodul	EAN CLAY W/ SAND (CL), same as bove, except mottled with light brown kidation streaking and trace nodules					
	45-50	5' Con- tinuous	5.0	N/A	LEAN CLAY W/ SAND (CL), same a above, darker oxidation	EAN CLAY W/ SAND (CL), same as bove, darker oxidation					
50			-+		most, only set to hard		1				
55_	50-55	5' Con- tinuous	5.0	N/A	POORLY GRADED SAND W/ CLAY (SP-SC), mottled moderate brown (5 YR 4/4), and light gray (N7), gray plastic, top 2' wet, rest is moist, very micaceous fine sand.	is -		HNu = 0 ppm Rad = 50 cpm P.P. = 2.0-2.5 kg/cm2 Driller reports water in hole			
-	55-60	5' Con- inuous	3.0	N/A	POORLY GRADED SAND W/ CLAY (SP-SC), same as above, no gray P.P. = 1.0-1.75			HNu = 0 ppm Rad = 42 cpm - P.P. = 1.0-1.75 kg/cm2 -			
-				1	POORLY GRADED SAND W/CLAY SP-SC), micaceous, light gray (N7).	wet.		]			

8					PROJECT NUMBER	BORING NUM	RED				
CHA	HILL				ORO30688.B1	MW193	3	SHEET	3	0E	3
					SOIL	BORING	LOG				÷.,
PROJE	ст	PGDF	Pha	use II Site Im	restigation Loca	Dgden	Lndg. Roa	d at Powe	r Line	es	
ELEWA	NON_38	56.24 N	GVD		DRILLING CONTRACTOR Brotcke	Engineering	Co., Inc.				
DRILLIN	IG METH	OD AND	EQUIP	MENT CME 7	5 Rig: 7-3/4" OD CME Augers: 3"x5	CME Stain	ess Steel S	Sampler			
WATER	LEVEL /	AND DATE	i	N/A	START_4/26/91 09:03 FIN	SH 4/26/91	12:23 LO	GGER C.	Web	b	
§€.		SAMPLE		STANDARD PENETRATION TEST	SOIL DESCRIPTION			COM	AENTS		
DEPTH BI SURFACE	INTERVAL	TYPE AND NUMBER	RECOVERY	6*-6*-6* (N)	SOL NAME, COLOR, MOISTURE CONTE RELATIVE DENSITY OR CONSISTENCY, STRUCTURE, MINERALOGY, USCS GROU SYMBOL	NT, OTOGINAS	8	DEPTH OF C DRILLING R DRILLING FI TESTS AND INSTRUMENT	ASING ATE, LUD L	i, OSS,	
65-	60-65	5' Con- tinuous	2.5	N/A	WELL GRADED SAND WGRAVEL (SW), r sand, subrounded chert gravel, moderate y brown (10 YR 5/4), wel, gravel contant in cr WELL GRADED GRAVEL (GW), wet, subro	nicaceous ellowish widepth unded to	HNu - Rad - P.P	0 ppm 47 cpm N/A			-
70-	65-70	5' Con- tinuous	2.5	N/A	subanguar chert WELL GRADED GRAVEL (GW), sa above		HNu = Rad = P.P. = Sand h recover	0 ppm 35 cpm N/A reave on to red sample	ip 1'	of	
-					End of Boring		Stoppe	d drilling 1	1:45		1





	0					PROJECT NUMBER					
	CHA					ORO30888.B1	BORING N	IUMBE	ER		
	Canto	214111					MIVV	197	SHEET 1	OF	3
						SOIL	L BORI	NG	LOG		
	PROJE	CT	PGD	P Pha	ise II Site In	vestigation Loc/	M6 I	Road	North of Plant		_
	ELEWO	TION	366.54	NGVE	)	DRILLING CONTRACTOR_BROTCK	Engineer	ring C	Co., Inc.		
	DRILLP	NG MET	HOD AND	EQUIP	MENT CME	55 Rig: 7-3/4" OD CME Augers: 3"x5	5" CME Sta	ainles	s Steel Sampler		
1	WATER	LEVEL	AND DAT	TE	N/A		ISH 3/21/5	91	LOGGER D. Ges	hwend	ler
l	Š€.	<u> </u>	SAMPLE	E	PENETRATIO	SOIL DESCRIPTION			COMMENTS		
l	=	5	36	Ē	RESULTS	SOIL NAME, COLOR, MOISTURE CONTI	ENT.	2	DEPTH OF CASING	1	
ł	55	1	22	80	6-6-6	STRUCTURE, MINERALOGY, USCS GRO	SOL UP	B.	DRILLING RATE, DRILLING FLUID L	OSS,	
ŀ	09	Z Z	i ≓z	20	114	STRUCK		53	INSTRUMENTATION		
		0.5	5' Con	3.1	N/A	LEAN CLAY (CL), medium gray (N	5), moist,		Bkgd: HNu=0 ppm; Rad-	-30 cpr	m
ĺ			tinuou	s		very stiff	1		HNu = 0 ppm		
		1 .					+		Had = 30 cpm		
		1							kg/cm <sup>2</sup>		۰.
	-	ł i					1				
	5-						1		1		
	-	5-10	5' Con tinuous	5.0	N/A	LEAN CLAY (CL), medium dark gra	ay (N4)		HNu = 0 ppm		
			· · ·			war notwing, moist, very stiff	1		Rad = 30 cpm	÷.	
ŀ							÷		P.P. = 3.0 kg/cm <sup>2</sup>		-
	· 1	1		-			Ł		1		-
	-						-l		}		
	10-			-			E				
	_	10-15	5' Con- tinuous	5.0	N/A	LEAN CLAY (CL), same as above e	except		HNu = 0 ppm		
						(10 VB 4/6) (N5) to pale yellowish	brown -	$\langle \rangle$	Rad = 30 cpm		1
	1					(10 11 400)	Ð		P.P. = 2.5 kg/cm2		-
	- 1						£	$//\lambda$			4
	- 1						Ł	$//\lambda$			
	15+			_			E	$//\lambda$			
	-	15-20	5' Con-	3.5	N/A	Top 2.5' : SANDY LEAN CLAY (CL),	. 7		HNu = 0 ppm		
			anuous			fine grained fine grained	sand -		Rad = 30 cpm		-1
	1					Bot 10' CLAVEY SAND (SC)	to and the	M	P.P. = 3.5 kg/cm <sup>2</sup> (lop)	)	-+
						reddish orange (10 R 6/6), moist fin	m. 1	1/2	P.P. = 1.0 kg/cm <sup>2</sup> (botte	om)	1
	-					sand - medium grained	~~ ¥				
	20+						23				1
	-12	20-25	5" Con-	5.0	N/A	Top 1.0' : CLAYEY SAND (SC), san	ne as				-
		1	linuous			above	ť	77	HNU = 0 ppm Bad = 30 cpm		1
	1							11	P.P. = .25 kg/cm <sup>2</sup> (top)		-
	-					brown (10 YB 4/6) moist ware stiff	lowish		P.P. = 4.0 kg/cm <sup>2</sup> (botto	m)	
	-				l'	to the wey, moist, wery stiff		$\square$		,	1
	25						P	1			1
	2	5-30 5	Con-	5.0	N/A	EAN CLAY (CL), same as above	ť	1	HNu = 0 ppm		-
	1	t i	inuous				-12	1	Rad = 30 cpm		-
	1						-12	1	P.P. = 4.0 kg/cm2		1
	-							1			
	-							1			1
	20						1/	11			-

0					PRO IECT MUMPER	DODING N		0	
CH4					ORO30888.B1	MW1	197	n	area 2 or 3
Cin	анш					POP		00	SHEET & OF 5
					301	- BOAI		.00	)
PROJE	CT	PGDF	Pha	se II Site Inv	vestigation Loc/	M6	Road	North of P	lant
ELEWA	TION	566.54	NGVL	ONE	DRILLING CONTRACTOR Brotoks	Enginee	ring C	o., Inc.	
DRILLI	NG METH	KOD AND	EQUIP	N/A	55 Hig; 7-3/4" OD CME Augers; 3"x!	5' CME St	ainles	s Steel Sa	mpler
TALE	LEVEL /	AND DAI		STANDARD		ISH _ 3/21/;	91. 	L066	ERD. Gesnwender
≦€		SAMPLE	1.	PENETRATION	SOIL DESCRIPTION				COMMENTS
88	M	1 <b>N</b>	E	RESULTS	SOIL NAME, COLOR, MOISTURE CONTI RELATIVE DENSITY OR CONSISTENCY.	ENT, SOIL	3	B	EPTH OF CASING, BILLING BATE
SURF 1	NTER	1 22	BE	6-6-6-	STRUCTURE, MINERALOGY, USCS GRO SYMBOL	NUP -	₩8	8	ALLING FLUID LOSS, ISTS AND
					LEAN CLAY (CLAUSE IN THE STORE		1777	1	STRUMENTATION
· ·	-30-35	5' Con tinuous	5.0	N/A	gray (N5) with mottling, moist, very	medium ∕stiff, ⊺		Rad = 30	ppm .
	-				sand is fine grained			P.P. = 4	.0 kg/cm <sup>2</sup>
	-					-			
	-					_			
35-									
· · ·	35-40	5' Con-	5.0	N/A	Top 2.0' : LEAN CLAY (CL), same as above			HNu = 0	ppm
					Bot. 3.0' : LEAN CLAY (CL), yellowish			Rad = 30	cpm ·
		1			brown with mottling, moist, hard, w	ith large		P.P. = >4	.5 kg/cm <sup>2</sup> (bottom)
· · ·	1				(.15') gravel	1			
	1	1				1			5
40-	40-45	5' Con-	3.5	N/A	LEAN CLAY (CL), moderate reddish brown			HNu = 0	0000
1	1	tinuous			(10 R 4/6), with mottling, moist, hard			Rad = 30	cpm -
· ·	1		•			-		P.P. = >4	1.5 kg/cm2
						4			-
.						Į	$//\lambda$		
45-						_{	$//\lambda$		
	45-50	5" Con-	5.0	N/A	LEAN CLAY (CL), moderate reddisi	h j	$//\lambda$	HNu = 0	ppm
		unuous			stiff, with fine sand and mica flakes	st, very	$//\lambda$	Rad = 30	cpm
						t	$\langle \rangle \rangle$	P.P. = 2.9	skg/cm= -
						t	$\langle \rangle \rangle$		-
50			- 1			t	$\langle \rangle \rangle$		-
50_					The LOCAL EARLOY MUCH A SHORE	-4	$//\lambda$		
-	50-55	5' Con-	2.8	N/A	above	s f	$//\lambda$	HNu = 0 p	opm _
			- (			Ł	IA	Had = 30 P.P. = N/	cpm
-					Bol. 1.5' : POORLY GRADED SAN	D (SP),	$\langle \rangle \rangle$		
-		·	- 1		sand is medium to coarse orained	wet,	44		
55_			$ \rightarrow $		granted	8			1
	55-60	5° Con-	1.4	N/A	WELL GRADED SAND W/GRAVEL	(SW)		HNu = 0 p	pm
]					wet, sand is fine to coarse grained, gravel -			Had = 30	cpm
1					and the second sec	122			· ·
1									-
<u> </u>						-12			·· -
00	1					18	32025		

	СНМ	нш				PROJECT NUMBER ORO30688.B1	BORING	NUMBER	SHEET 3 OF 3	
ł						sc	IL BORI	NG L	OG	
	PROJE	ст	PGDP	Pha	se II Site Inv	estigation LC	CATION M6	Road N	North of Plant	
	DRILLIN	KG METH	00.34 N	EQUIP	MENT CME 5	DRILLING CONTRACTOR Broto 5 Rig; 7-3/4* OD CME Augers: 3*	ke Enginee x5' CMF St	ring Co ainless	Steel Sampler	
	WATER	LEVEL A	ND DATE		N/A	START_3/19/91	INISH 3/21/	91	LOGGER D. Geshwender	
	≸E		SAMPLE		STANDARD PENETRATION TEST	SOIL DESCRIPTION		COMMENTS		
	DEPTH BE	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	RESULTS 6"-6"-6" (N)	SOL NAME, COLOR, MORSTURE CON RELATIVE DENSITY OR CONSISTENC STRUCTURE, MINERALOGY, LISCS G SYMDOL	rtent Y, Sor Roup	SWIBOLIC	DEPTH OF CASING, DIRLING RATE, DRUING FLUID LOSS, TESTS AND INSTRUMENTATION	
	-	60-65	5' Con- tinuous	0.0	N/A	No Recovery	-			
	65-						-			
	35				N/A	End of Boring				

6000			_						
Sugar.							BORING NUMBER MW-215	SHEET 1	OF 2
CDM	EEDER						PROJECT Paducah UST Inves	stigation	
(Coline	TLUER	AL PHL	RIKAMS	S CORP	ORATI	ON	LOCATION PGDP Paducah, K	entucky	
BRASS	DINATES S MARKER	S 2,30	380 70	3,905.	.7		GENERAL ORDER NO. 18B-9905	2 C	
			000.73	DAT	OM MS	»L	LOGGED BY D. Swanson	-	
	SAN	IPLE IN	FORMA	TION		_₹		WELL	z
DEPTH	LAB	SAMPL	Effectivery	Beta/ Gemma	OVA/ HNu	IRA.	DESCRIPTION	CONSTRUCTION	1 Ĕ
(40	SAMPLE	TYPE	%	(cpm)	(ppm)	50		DETAIL	E E
		M SPT	25	Bkgd	Bkpd	1888	FILL consisting of Gravel and Sand		- u
		N			1	88	and Clay.		-380
		SPT	76	Bkgd	Bkgd	IIII	Very stiff pinkish gray (7.6YR 7/2)	Commentantenite	ŀ
	1	N^					clayey SILT (ML) with trace sand and gravel.	grout mixture	ł
	1	SPT	85	Bkgd	Bkgd	1111	SILT as above but stiff and no around		ŀ
5-	f · I	∦ ³				ШИ	and the graves.		-
	1 6	SPT	85	Bkgd	Bkod	HH	Sill T at about Mains		-375
1	1 1	∛ 4					one a above, indiet,		1
1		SPT	85	Bkod	Bind	НШ	OILT as about	88	Ĺ
		6					OILT BE BOOVE.		L
10-	l f	SPT	100	Bired	Blood	2111	011 5		
	. )	6		Diego	окра	IIIII	SILT as above.	88	
·	L L	SPT	100			ШШ			[ <sup>370</sup>
-	. b	7.	100	Bkgd	Bkgd		SILT as above.		ľ.
-	Ľ Ľ	i orre						Soh. 40 flush	t i
15-	. N	8	100	Bkgd	Bkgd	11111	SILT as above.	pipe	t i
-	μ								t i
-	N	9 9	100	Bkgd	Bkgd	MIII	SILT as above with little send.		-365
	Δ								-
-	M	5PT 10	76	Bkgd	Bkgd		Vary stiff light brownish gray to		-
20	N			- 1		HHH.	6/8) clayey SILT (ML) with some send.		-
~	M	SPT 11	100	Bkgd	Bkgd	##	Same as abovo.		-
1	W						Strong brown (7.5YR 5/8) fine to madium SAND (SMI) middle to		-360
1	М	SPT	100	Bkgd .	Bkgd	22 N	and some clay. Molet.		
1	M	12		- (		1	Angular to sub-angular GRAVEL and SAND and CLAY (GC), Moist.		
	. H	SPT	76	8kgd	Bkgd	场	Same as above with more clay in		
25-	W	13				3A)	16". Pebbles angular to rounded. Dry.		
1	H	SPT	76	Bkgd	Bked	14	Same as above.		-355
-	X	14				A	Very dense red dish yellow (7.5YR 6/8)		
	H	SPT	100	Bkod	Shad N	4	line to medium SAND (SC) with trace slit and cley. Occasional pebblas inco		
1	X	16			Child B	24	steining. Moist.		
	11					10	above; GRAVEL and SAND and CLAY;	22	
DRILLING	CONTRAC	TOR	Mideas	tern Ge	otech	76	MARKS Single-cased monitoring	woll Litherate	-
RILLING	METHOD		Hollow	Stem #	luger	9	description obtained from offset bo	ring located within 1	o İ
RULLING	EQUIPME	NT	CME-5	5			eet of monitoring well boring. OV/	A/HNu and Beta/Game	ma
RILUNG	STARTED	12/	19/91 Er	NDED	12/19/	<u>91</u> /1	han 1cpm.	ona readings are less	
				and the second second			and the second second second second second second second second second second second second second second second		

CDM	FEDER	AL PRO	GRAMS	CORP	ORATI	ON	BORING NUMBER MW-215 PROJECT Paducah UST Inve LOCATION PGDP Paducah, K	SHEET 2 of stigation entucky	DF 2
BRASS	DINATES MARKER	S 2,30	1.2 W 380.79	3,905. DATU	7 JM MS	L	GENERAL ORDER NO. 18B-9905 2 LOGGED BY D. Swanson	2 C	
	SAM	IPLE IN	FORMA	TION					
DEPTH (ft)	LAB SAMPLE	SAMPLE TYPE	Recovery %	Beta/ Gamma (cpm)	OVA/ HNu (ppm)	STRATA	DESCRIPTION	WELL CONSTRUCTION DETAIL	ELEVATION (H)
		16	10	Bkgd	Bkgd	10	eandy CLAY. Moist. No obvious	Top of benton ite	
		М . SPT 17	100	Bkgd	Bkgd	Ø	Very stiff vellowish red (5YR 5/8) clayey fine to coarse SAND (SC) with (crace sit, Moist, Medium dense light grey to brownish	Soal	-360
35-		SPT 18	100	Bkgd	Bkgd		vellow (10YR 7/1 to 10YR 6/8) clayey very fine to medium SAND (SC). Moist, Gredes to a SAND and CLAY.	Top of screen	
-		SPT 19	100	Bkød	Bkgd	Ø	As above with trace gravel to 3/4". Moint to wet, Variable composition, Varies from GRAVEL and SAND and CLAY to well		-346
. 1	ţ	8PT 20	86	Bkgd	Bkgd	Ø	sorted SAND to sandy CLAY. Principal material is SAND, Wet. No obvious sediment structures.	Continuous	
40-	5	<b>SPT</b> 21	100	Bkpd	Bkgd		Very dense fine to medium SAND (SC) with trace clay and trace eilt. Occasional pobles. Saturated.	elotted screen	
-	ľ.	SPT 22	100	Bkgd	Bkgd		Very stilf light gray to yellowish brown (10 VR 7/2 to 10 VR 6/8) CLAY (CH) with trace to 50 % vary fine to fine send. Irom steining.		~340
							CLAY as above with trace of eand.		

)	CDM COORD BRASS	FEDERA DINATES MARKER	AL PRO	0GRAM1 9.3 W 375.46	5,079.	ORATIC 6 M MSI	)N	BORING NUMBER MW-217 PROJECT Paducah UST Invest LOCATION PGDP Paducah, Ko GENERAL ORDER NO. 188-9905 2 LOSSED BY D. Summer	atiga Intu 2 C	SHEET 1 tion cky	OF 2
		SAN	IPLE IN	FORMA	TION			D. Swanson			
	DEPTH (ft)	LAB SAMPLE	SAMPL	Recover %	Bete/ Gamma (opm)	OVA/ HNu (ppm)	STRATA	DESCRIPTION	с	WELL ONSTRUCTION DETAIL	LEVATION
			SPT 1	64	Bkgd	Bkgd	1	Brown FILL material. Stiff pinkish grav (SVB 8/2) CLAY (CL			-375
			В 5РТ 2	79	Bkgd	Bkgd		with little silt. Moist. CLAY (CL) as above but mottled with light gray to reddish yellow (5YR 7/1 to 5YR 8/6).		Cement/bentonite grout mixture	-
	6-		SPT 3	100	Bkgd	Bkgd		CLAY (CL) as above.			ŀ
			SPT 4	58	Bkgd	Bkgd		CLAY (CL) as above. Slightly more plastic,			-370
			SPT 6	100	Bkgd	Bkgd		CLAY (CL) as above.			F
	10-	ĺ	SPT 6	4	Bkgd	Bkgd		CLAY (CL) as above.			-365
)		ĺ	SPT 7	100	Bkgd	Bkgd		Very stiff CLAY (CL) as above with little very fine send and little sit.			-
		ĥ	SPT	100	Bkgd	Bkgd		CLAY (CL) as above.	88		ł
	10-	Š	SPT 9	100	Bkgd	Bkgd	N. N.	Dense red (2.5YR 5/8) sendy eubengular CLAY and GRAVEL (GC), Plastic, tough. GRAVEL (GC) as above.		Sch. 40 flush threaded 2" PVC	-360
		5	<b>БРТ</b> 10	92	Bkgd	Bkgd		Very stiff light red (2.5YR 6/6) pravely and eandy CLAY (CL) with pebbles to 1/2".		pipe	
	20-	X	SPT 11	100	Bkod	Bkgd		CLAY (CL) as above with some medium to coarse subrounded gravel. Mottled, gray to yellowish brown (10 VR 6/1 to 10 VR 5/8).			- 365
	-	Ŕ	SPT 12	100	Bkgd	Bkgd		Ind (2.5YR 4/8) GRAVEL and SAND and CLAY (GC ). GRAVEL and SAND and CLAY (GC) as			-
	25-	Ŕ	SPT 13	100	Bkgd	Bkgd		above. GRAVEL and SAND and CLAY (GC) as above but reddish yellow (7,5YR 7/8).			
	-	M	SPT 14	100	Bkgd	Bkgd		Moist. Interlayered thin (11) streaks of medium to coarse send with trace	J		-360
	-	Ŵ	SPT 16	42	Bkgd	Bkod		CLAY (CL) as above. GRAVEL and SAND and CLAY (GC). Well graded with occasional layers of			
)[	DRILLING	CONTRA	CTOR	Mideas	item Ge	otech	5	PEMARY? Cingle			_
	DRILLING	METHOD		Hollow	Stem A	luger		description obtained from offset bo	wei	I. Lithologic located within 1	
	DRILLING	EQUIPME	INT	CME-5	5			teet of monitoring well boring. OV/	V/HN	u and Beta/Gam	ma
Ľ	DRILLING	STARTED	12/	17/91 E	NDED	12/18/9	nli	than 1cpm.	ana i	readings are less	J

1440	AIII						BORING NUM	BER	MW	-217			SHEET	2 0	
8-4	WITH.						PROJECT	Pad	ucah i	UST Im	/estig:	tion	SHEET	2 0	- 2
CDM	FEDER	AL PRO	GRAM	S COR	PORAT	ION	LOCATION	PGD	P Pa	ducah,	Kentu	icky			
COOR	DINATES	S 2,75	9.3 W	5,079	9.6		GENERAL ORD	ER NO.	18	B-990	5 2 C				
DIMOS	MARKER	ELEV. 2	375.46	DA	TUM MS	SL	LOGGED BY	D. S	wans	on					
	SAN	IPLE IN	FORMA	TION		1									-
DEPTH	LAB	SAMPLE	Recover	Beta	OVA	7 2	DES	SCRIP	TION			W NONCT	ELL	.	10 L
(14)	SAMPLE	TYPE	%	(opm	(ppm)	18					1	DEI	NUCTION	¥	AN IN
		SPT	79	Bikgd	Bkgd	172	better sorted m	Interial	Suban	malar	West 1	224			-
	1	W ''				14	GRAVEL and S	AND an	d CLAY	(GC) as	40	8		. 1	346
	1	SPT	100	Bkgd	Bkgd	-	GRAVEL and SA	AND an	d CLAY	(GC) as	1	8		ŀ	
1		Ň ''				12	above.		1 1 1 1 1	10.0	14B	8		ł	
1		SPT	100	Bkpd	Bkod	4	above.	and and	d CLAY	(GC) as	/*	Тор о	f bentonit	. ł	
-35-		18				124	With little clay a	n (10YR Ind trace	1 8/3) S. # fine to	AND	1 1	608		-	
1	1	SPT	100	Bkod	Bhad	1	medium gravel.	Moist.	Pebble	e to 1*.	0			F	340
1	6	19			- Charles	<u> </u>	26' to 28'.	and and	O CLAY	(GC) as	1			ŀ	
1	E	SPT	100	Birad	Bhad		(CL-SW), Sand	I CLAY	and SA fine to f	ND	П	Top of	f sand pao	ĸ  .	
I	0	20			- Child		grained.	1010-01	00/00 01		11	ŝ		ł	
40-	- F	SPT	100	Direct			sandy CLAY (CL	). Sand	is very	e) fine to		Topol		ŀ	
- 1	0	21	100	orĝa	BKgd		(7.5YR 6/B) SAM	o reddia VD en d (	eh yello CLAY,	w	作目		screen	L	335
	- F	807	100		1.		Reddish yellow ( CLAY (CL-SW)	7.5YR (	6/8) S.A	ND and	目目			1	
-	E D	22	100	Bkgd	Bkgd		Stilf pinkish gray	to rede	dish y <del>e</del> l	low	自己				
-	Ľ Ľ						with little very fa	5YR 7/8 98 send	8) CLA'i I.	(CL)	昌	1			
46-	- N	23	100	Bkgd	Bkgd		CLAY (CL) as abo	dve.	0.001.00		「目	Contin	JOUR	L	
· -	0						(CL) with some v	ary fine	to fine	send.	目	PVC 0	rapped 010"	L.	
	N	24	100 .	Bkgd	Bkgd		CLAY (CL) as abo	es. Mo	list. Inss car	ud. /	目	elotted	screen		
	Δ		· . ]				CLAY (CL) as abo 7/81	ve but	yellow	10YR	目	:		[	
	M	25	100	Bkgd	Bkgd		CLAY (CL) as abo	we but	yellowia	u h	目			ſ	
50-	· 10						brewn (10YR 6/6	Q			18	Monitor boring (	ing well trilled to	1	
	M	28	100	Bkpd	Bkgd		CLAY (CL) as abo	we.				50 feet	10	İ.	
	M													-3	25
1	M	SPT	100	Bkgd	Bkgd	//// d	CLAY (CL) as abo	ve but n	mottled	with				t	
1	W		1	- 1		7	ight grey to beew 7/1 to 10YB 6mb	nish yei Moist	flow (10	YR				ŀ	1
]	M	SPT .	100	Bkgd	Bkgd	/// - c	CLAY (CL) as about	ve.						ŀ	
· ·	W	20	- I.											Ł	
1	M	SPT	100	Bkgd	Bkgd	/// o	LAY (CL) as about	a Son						-32	20
1	Ŵ	28		- 1		•	andy.		the cond					ł	
1	· H	SPT	100 1	Bkgd	Bkod	MA c	AV ICLL as all							ŀ	
1	X	30					Contract as sidoy	·e.						F	
60-	H	SPT	100 8	Bkpd	Bkgd	MA -	AV ICIL es et							Ł	
	X	32				<i>"</i>		•.						-31	6
1	Н				P									ŀ	
						_									

CDM COORI BRASS	FEDER/ DINATES MARKER	AL PRO S 1,91 ELEV. 3	GRAM: 16.0 W 377.79	5 CORP 4,480. DAT	ORATI	ON il	PROJECT Paducah UST Invest LOCATION PGDP Paducah, Ke GENERAL ORDER NO. 188-9905 2 LOGGED BY D. Swanson	SHEET 1 stigation antucky 2 C	OF 2
	SAN	PLE IN	FORMA	TION		₹		14.051	Z
DEPTH (ft)	LAB SAMPLE	SAMPLI TYPE	Recover %	Beta/ Gamma (cpm)	OVA/ HNu (ppm)	STRAT	DESCRIPTION	CONSTRUCTION	LEVATIO
		SPT	10	Bkgd	Bkgd		Sendy clay with trace gravel. FILL.		-
	RW-14	2	50	Bikgd	Bkgd		Stiff grey to reddish yollow (7.5YR 6/0 to 7.5YR 6/6) SILT and CLAY (ML) with several large pobbles to 1-1/4".	Cement/bentonite grout mixture	-375
6-	01	3	60	Bkgd	3		Stiff pinkish gray (7.5YR 6/2) SILT and CLAY or eity CLAY (CL). Sightly plantic.		F
		4	100	Bkgd	Bkgd		Sity CLAY (CL) as above.		-
10-		5 5	100	Bkgd	Bkgd		CLAY (CL) as above. Wet,		-370
		6 6	100	Bkgd	Bkgd		CLAY (CL) as above. Prominent manganees stains.		
	X	SPT 7	100	Økgd	Bkgd		CLAY (CL) an above.	Sch. 40 flush threaded 2" PVC pipe	-365
16-	X	8PT 8	100	Bkgd	Bkød		CLAY (CL) as above with trace very fine to fine send.	-	-
	1	SPT 9	100	Bkgd	1		Very stiff gray to reddish yellow 7.5YR 6/0 to 7.5YR 6/8) clayey SILT MLI with trace sand and occasional obbies. Name		
-	M	SPT 10	100	Bkgd	Bkgd	1 1	BLT (ML) as above. Ight brown (7.5YR 6/4) clayey SILT ML) with little and and accessed	-	-360
207	Ň	SPT 11	75	Bkgd	Bkgd		rebbles. Fary stiff graw to reddish yellow 7.5YR 6/0 to 7.5YR 6/8) clayey, ravely vary fine to fine SAND (SP)		
	X	SPT 12	100	Bkgd	1.2		Noiet. Naryey SILT (ML) with trace send. (ary stiff light gray to strong brown , 6118 7/0 to 7.519 K30) site CLAY		365
1	X	SPT 13	100	Bkgd	6		CLI with trace send and occessional obbies. Moiet. LAY (CL) as above grading to CLAY	-	
RILLING	CONTRAC	TOR	Mideas	tern Ge	otech	R	EMARKS Single-cased flushmount	ed monitoring well	
RILLING /	METHOD	-	Hollow	Stem A	luger	A	VA/HNu and Beta/Gamma reading	s are above backgrou	Ind.
acone (	CONPMER	11	CME-5	5			the ress than 1cpm.		

CDM COORD BRASS	FEDER/ DINATES MARKER	AL PRO S 1,91 ELEV. 3	GRAMS 6.0 W 177.79	CORPO 4,480.1 DATU	DRATIC 1 JM MSI	DN L	BORING NUMBER MW-219 PROJECT Paducah UST Inve LOCATION PGDP Paducah, K GENERAL ORDER NO. 188-9905 LOGGED BY D. Swanson	stig onti 2 C	SHEET 2 a ation ucky	OF 2
DEPTH (ft)	LAB SAMPLE	SAMPLE TYPE	FORMA Recovery %	TION Beta/ Gamma (cpm)	OVA/ HNu (ppm)	STRATA	DESCRIPTION		WELL CONSTRUCTION DETAIL	ELEVATION
		SPT	75	Bkgd	2	Ĵ,	and SAND. Strong brown (7.5YR 5/8) clayey SAND and GRAVEL (GC) with subrounded pebbles to 1/2".			-
		8PT 16	90	Bkgd	7		6/0 to 7.5YR 5/8) GRAVEL and SAND and CLAY (GC). Moist. Strong brown (7.5YR 5/8) fine to medium SAND (SP) with trace clay.		Top of bentonite seal	-360
30-		SPT 16	50	Bkgd	4		Molet Dense gray to strong brown (7,5YR 6/0 to 7,5YR 5/8) SAND and CLAY (SC) with occasional pebbles. Molet. Herd light gray to strong brown	3	Top of send peck	
		SPT 17	100	Bkgd	Bkgd		(7.5YR 7/0 to 7.5YR 6/8) very fine to fine SAND (SP) with trace eley. Moist. SAND (SC) as above but clayey to			-345
35-	02	SPT 18	75	Bkgd	Bkod		Hard strong brown (7.5YR 5/8) GRAVEL and SAND and CLAY (GC) with pables to 1/2*. Gravel is subrounded,		Top of screen	ľ
	Į.	19 697	100	Bkgd	10		GRAVEL and SAND and CLAY (GC) but with pebbles to 3/4". Gravel is subrounded.			240
40-	NV.14	20	100	Bkgd	Bkgd		Stiff gray to strong brown (7,5YR 6/0 to 7.5YR 5/6) sandy CLAY (CL). Very molet.		Continuous wire-wrapped PVC 0.010* slotted screen	- 340
	03	21 8PT	100	Binga	Bkgd		Firm strong brown to gravish brown 7.5YR 4/6 to 10YR 5/21 sandy CLAY (CL). Sand is subangular, fine to medium grained. Very wet.			
1	04	22		okgd	osgd		CLAY (CL) as above with occasional pobbles. Mottled.			-335

D	0 0	DITTT		TONE			
) R	čкR	INTER	NAT	IONA	AL MONITORING	WELL L	OG
					Page	1 of	9
Monitoring Well N	0.:	239			Date Started: Sept. 16, 1994	Logged By:	GLB, LJS, BLY
R&P Deniest No.		MK-Ferguson	of Oak B	tidge Con	npany	Drilling Co.:	Pennsylvania Drilling
MK-F Project No.:		302122			Date Completed: Sept. 29, 1994	Driller:	D. Newman
Drilling Method:		6 25" ID and 1	0.255 m		Location/Coordinates:		
Final Elevation:		0.23 10 800 1	10.25 10	HSA/W	L-SC Semaling Months for		
Riser: Type -	Stair	uless Steel	Diamet	er -	2.0"	split-spoon/Shelby	ube
Screen: Type -	PP S	tainless Steel	Diamen	er -	2.0*	ength -	146.88"
Total Depth:	157.	00" (161.00")	Top Sa	nd Pack:	132.00'	Sengen -	10.00
Water Level at Con	npletios	a:	45.21		104100	lop or sear:	129.00
State of Kentucky P	ermit l	Number:	8000-45	37	8.00" Carbon Steel Isolation Casi	ng -	110.00
Depth	в	Sample No.	PID/	Rec	Lithology	Grain Size	Granhie
(in feet)	C	Interval	RAD	(In feet)	Description	GSStC	Boring
		N /	1				
1		\ /			Drilled blind to 70.0"		
. 2		1 - 1					
-		1 //			See Soil Borings 28 and 31 for		
3		1 / /			continue comparative intratogy		
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4 4		1 []					
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R&	R	INTERN	VAT	ION	MONITORING	7.1	VET	T T		
				10112	Page	J ۷ 2	vei	L L، of	4	9 9
Monitoring Well No.:		239			Date Started: Sept. 16, 1994		Logg	ed By:		GLB. LIS RIV
D.D. Duplicate Man		MK-Ferguson (	of Oak R	idge Con	opany		Drilli	ng Co.	.:	Pennylyania Drilling
MK F Project No.:		302122			Date Completed: Sept. 29, 1994		Drille	<b>r</b> :		D. Newman
MIR-L LLOIGET 100"		5014/2005			Location/Coordinates:					
Depth	в	Sample No.	PID/	Rec	Lithology		Grain	Size	-	Granhie
(in feet)	С	Interval	RAD	(In feet)	Description		GS	St	c	Boring
16				· ·						
		\ Л			Drilled blind to '70,0'			-		
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RAR	INTERNATIONAL	MONITODING	WET I	TOO
	THE TERMINE	MONTORING	WELL	LOG

Monitoring Well No.: Client: R&R Project No.:

R&R Project No.: MK-F Project No.:

MK-Ferguson of Oak Ridge Company

Page Date Started: Sept. 16, 1994 of 9 Logged By: GLB, LJS, BLY Drilling Co.

3

302122 5014/2005

239

Date Completed: Sept. 29, 1994 Location/Coordinates: Drilling Co.: Pennytranis Drilling Driller: D. Newman

	Depth	I B I	Sample No.	PID/	Dec			
	(in free)		Sample (40.	PID/	Rec -	Litbology	Grain Size	Graphic
	(mileet)	10	interval	RAD	(In feet)	Description	GSStC	Boring
	34		\ A			Drilled blind to 70.0*	-	
	35		1. //					
	36		\ //					
	37	F	\ /					
	38							
1	39		11					
1	40							
	41		-V-I					
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2	51	1						1

## R&R INTERNATIONAL MONITORING WELL LOG

Monitoring Well No.: Client: R&R Project No.: MK-F Project No.:

Il No.: 239 Date MK-Ferguson of Oak Ridge Company a.: 302122 Date fo.: 5014/2005 Loca

Page Date Started: Sept. 16, 1994

Date Completed: Sept. 29, 1994

Location/Coordinates:

4 of 9

Logged By: GLB, LJS, BLY Drilling Co.: Pennyivania Deilling Driller: D. Newman

Depth	B	Sample No.	PID/	Rec	Lithology	Grain Size	Granbie						
(in feet)	C	Interval	RAD	(In feer)	Description	GSStC	Boring						
52					Dvilled blind so 70.0'		Dot mg						
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55		1:11											
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	R&R INTERNATIONAL MONITOPRICE												
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		, IC	INTER	NAL	ION.	AL MONITORING	W	ΕI	L	L	DG 👘		
	Monitoring Well No -		220			Page	5		of		9		
	Client:		MV-Eeroneen			Date Started: Sept. 16, 1994	L	.0gg	ed By	y:	GLB, LJS, BLY		
	R&R Project No.		302122	OF Calk B	adge Co	mpany	D	)rilli	ng C	0.:	Penasylvaria Drilling		
	MK-F Project No.		5014/2005			Date Completed: Sept. 29, 1994	$\mathbf{D}$	rille	r:		D. Newman		
			3014/2003			Location/Coordinates:							
	Depth	в	Sample No.	PID/	Rec	Titheless	1.0						
	(in feet)	С	Interval	RAD	(In feet	Description	G	rain	Size		Graphic		
			$\sim$	1	1	1. Sescription	G	s	St	С	Boring		
	70		$\sim$										
					1	GRAVEL (95%) subscentise with more and			*				
	71		I	0	1.6	(5%); medium to poarts evaluated, automatical	1						
			(70 - 72)	100	1	medium oranaish hrown (10 YR 5(8)							
	72	_											
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## R&R INTERNATIONAL MONITORING WELL LOG

Monitoria	g Well No.:
Client:	
R&R Proj	ect No.:
MK-F Pro	ject No.:

239 MK-Ferguson of Oak Ridge Company 302122 5014/2005

Page Date Started: Sept. 16, 1994

Date Completed: Sept. 29, 1994

Location/Coordinates:

7 of 9 Drilling Co.:

Logged By: GLB, LJS, BLY Pennsylvania Doilling Driller: D. Newman

1	Depth	B	Sample No.	PID/	Rec	Lithology	0 1 0	_	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1
-1	(in feet)	c	lotervai	RAD	(In feet)	Description	Grain Size		Graphič
		12	(105 - 107)	120	Con more	C S YR SCH LOS C S YR	GSSt	C	Boring
- 1	107	15	,,			(r.2 TK 3/2) and medium orangish brown			
1		-				(10 YR 6/8); damp; stiff	-		
- 1	108	<u> </u>	1						
- 1	100		1 //						
	100	$\vdash$	1 //						
- 1	109		1 //	1				- 1	
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Monitoring Well No.: Client: R&R Project No.: MK-F Project No.:	239 MK-Ferguson 302122 5014/2005	of Oak F	tidge Con	Page Date Started: Sept. 16, 1994 apany Date Completed: Sept. 29, 1994 Location/Coordinates:	ų	Logge Drillin Drille	of d By: ng Co.:	9 GLB, LJS, BLY Pennsylvania Deillie D. Newman
(in feet)	B Sample No.	PID/ RAD	Rec (In feet)	Lithology		Grain	Size	Graphic
126	(124 - 126)		Tube	Description		GS	St C	Boring
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129	=\: /							
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Pro	ject No.:	1999	jai	· 1	TN & A WAGS LITH	SSOCIATES, INC. 3/8/28/DG RI HOLOGIC LOG		1
Tas	ik No.			ì			1	PAGE L or C
LIT	HOLOGI	C LOG		Boring/We	ell No.:	Dag Min		
Fact	ility: Pad	ucah Gas	390	-				
Clie	nt: Secht	el Jacobs	Compar	ny LLC			Jice. ()	ATA 6 APS
Con	tractor: T	N & Asso	ciates	Drill Contrac	ctor: Mill	ler Drilling	Driller:	(
Star	t Time/I	)ate: 10	54 6	Bully End	Time/De	te: 1320/ 7/15/04	Borchole	(P. MALKGAAE
Drill	Methad,	Rig Type	= BA	AKBER	RIL		Total De	oth: 316
Logg	ed By:	SCHL	wan	Coordinates:			Protectio	a Level:
Dept	th	SAMPLE	Recover	Field Measu	drement		CRAPH	
<u></u>	) Interva	Number	( <i>t</i> t)	(com)	(pom	HUTHOLOGIC DESCRIPTIO	LOG	COMMENTS
-	A		F	44		SILTY CLAY MIN		
5	14		5	OCL	D	101x 1/3, MORAD		2=2204
10-	12	}	5	BKL	0	SUTY CLAY, CLAYUH BROWN (2073 5/2) Now PLASTIC SUM	1.1	t= 1107
5-	3		. 5	BRL	0	SILT. CLAY LT YALDWASH- DROW-		t = 1114
20	Ô		5	OKC	0	CLAYOYSILT, LT Yourness and Core	100	6= 1120
5	Ð		5	BCK	0	SILTY CLAY, SLOWARD. YOLOW (JUYL 1/L), RALG FINGS AND LUNA		1= 1456
0	Ø		5	BGK	0	A/A		E= 2502
5	Ø		5	BGIC	0	A/A WITHATT SAND		6= 2524
0	8		5	BGK	0	A/A		t=1525
	0		5	66 C	0	4/4		c = 1.729
	20		5	CG K	0	SILTY SAVE, LT. YOUN STOWNE 30 YELLY) Ent. 61.940 SUBAL		t= 1727
	11		5	66 IC	0 4	54~0+ 614-02 3072 5/3) - 503A-6 2 102 2000000	:00	t = 1729
.	12		5	36.C	0	A/A WITH GRAWL	0.0	5= 1732

TN & ASSOCIATES, INC. WAGs 3/8/28/DG RI Project No .: 1999ac LITHOLOGIC LOG PAGE 2 or 6 Task No. 7. ì LITHOLOGIC LOG Boring/Well No .: 23 -MW 346 Facility: Paducah Gaseous Diffusion Plant Sile: NATA GAPS Client: Sechtel Jacobs Company LLC Contractor: TN & Associates Drill Contractor: Miller Drilling Driller: Start Time/Date: 10 54 MALKER . 1/30/45 End Time/Date: 1320 Borehole Dia(s): 7/25/49 Drill Method/Rig Type: BARBER Total Depth: 310 FT Logged By: /) Scrnosar Coordinates: Protection Level: Depth SAMPLE Field Measurements (R) Interval Number Recovery Beta/Gamma VOC's (R) (com) (com) Depth LITHOLOGIC DESCRIPTION CRAPH COMMENTS LOG 10 61 AVE, YELW-SO 000 13 5 BEL (10 YA F/4) TO YSCM 0 1 = 12y= 0 15 0 SUBANG TO SUGAR 60 SILTY SAD-GLAM 5 ۍ: 14 Yaun Stor Start St. 17 ) O SKL υ t= 1257 7U ς A/A 15 0 0 0 BKL O 75 モニタマシス 5 A/A 50 BEL 0 80 0=1257 00 SILTY SAND, YOLLO ALLOW (307/ St.) BAT TU MUSIUM, JULANT P IVAL 27 F 3KL 0 81 t = 09W SILTY SAND + GAAMA SILTY SAND + GAAMA YATING AND A SUD ANNO DAALE TO SUD ANNO DAALE TO SUD ANNO DAALE TO SUD ANNO GAAM / YACAN - 3 AN AND TO AND / SUS AND N END ANNO - SUS AND N END ANNO - SUS AND N END ANNO - SUS AND N SULT SAND - SULLAY 5 0.0 BKL 0 t=0905 .0 90 0 29 à 5 IKL D 9i 2=0120 a . SILTY SAL MCLAY Ô 5 0 NC MOD TO COASS GIM t - 0920  $\omega$ TALCO PRO CLAUR ÷. SILTY SA-3, YOUW 22 5 BK1. 2=1143 105 0 FINT LAMMA A/A BUT BROWN 22 5 BK. U 0 1= 1246 (10 yr 5/3) 110 . A/A 23 5 BRL 0 111 t = 1149 3 ICL ALA 5 υ t = 1153 5 1 1.1.5 - 7

TN & ASSOCIATES, INC. WAGs 3/8/28/DG RI LITHOLOGIC LOG Project No .: 1999ac PAGE 3 or 6 Task No. ì LITHOLOGIC LOG Boring/Well No .: D 23 -MW 346 Facility: Paducah Gaseous Diffusion Plant Site: NATA GARS Client: Sechtel Jacobs Company LLC Contractor: TN & Associates Drill Contractor: Miller Orilling Driller: MATTERAR Start Time/Date: 10 54 1/30/44 End Time/Date: 1320 7/15/44 Borchole Dis(s): Drill Method/Rig Type: BARBER Total Depth; 316 FT Logged By: D. SCHLOG an Coordinates: Protection Lavel: 
 SAMPLE
 Field Measurements

 (ft)
 Interval Number
 Recovery Bets/Gamma
 VOC's

 (ft)
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 (com)
 Depth GRAPH LITHOLOGIC DESCRIPTION COMMENTS LOG 120 · ``. ġ. 25 5 GKG Ala υ t= 100 125  $\mathbf{b}$ CLAYOY SA-3, OALE-GWY (2.57 1/1) FIND SAAN SA-3 1 26 5 BKG υ t = 1705 120 SILTY CLAY - VUNY 27 T BKL Ö ~ . \_ t= 1725 135 -NO ROTUR~ 0 140 CLAY , DARE GWY 28 5 BKG (10YR 3/1), TRACO PINO 5 A-2 0 t= OYFY 145 24 5 BKC A/A 0 t =0857 450 1 -4/A 30 OKL 5 Q t = 01W 258 \_ -ALA 31 5 OKG Ũ t = 100L ž 120 4 /A 5 3ź sri 0 ---6= 1001 115 #/A 33 5 BKI 0 t= 1013 1D . -AlA 5 SKL 34 0 t= 1015 175 (10 YR 3/1) ANY-35 5 0 BICL ;t = 1137 260 GRAINSO, MILA

TN & ASSOCIATES, INC. WAGs 3/8/28/DG RI Project No .: 2999al LITHOLOGIC LOG PAGE 4 of 6 Task No. LITHOLOGIC LOG Boring/Well No .: 23 -MW ت 46 Facility: Paducah Gaseous Diffusion Plant Site: NATA GARS Client: Bechtel Jacobs Company LLC Contractor: TN & Associates Drill Contractor: Miller Drilling Driller: MALKERA Start Time/Date: 10 54 (130/45) End Time/Date: 1320 Borchole Dia(s): 7/15/44 Drill Method/Rig Type: BAKBER ρ, Total Depth: 318 FT Logged By: A SCHLOS ar Coordinates: Protection Level: Depth SAMPLE Field Measurements (ft) Interval Number (ft) (com) (pem) Depth GRAPH LITHOLOGIC DESCRIPTION COMMENTS LOG 110-NO ROLOWRY Œ Õ 10NO REDOWNY 37 D 140 CLAYEY SA-ODALE, CALOW HOULS OUSLY PING GRAMA 32 5 BICC 0 9 195 £ = 1141 - e GRAM SILTY SA-0 GLOY ( 20 TA 35) FITA ALS MUL 5 (39 BKG 0 t= 1324 200 ALA WITH 40) 5 BKG 0 1=1325 CARSOMICONS NONS 205 5 4/A . 41 3K6 0 t= 1326 220 4Ź 0 NO RECOVERY 215 SILTY SAND, OANK 43 5 SKL (~ 54(10YA 3/2) t - 1507 0 220 A/A W/ TAACS 44 5 GKL 0 t= 1509 221 PYRI & Mary ġ, ō. 45 A/A 5 BKG 0 t = 1510 ł 230 ζ, · A/A 5 Hc. BK L 0 t= 1511 235 5 A/A V/NO PYRITS 7 BRL υ t = 1632

TN & ASSOCIATES, INC. WAGs 3/8/28/DG RI LITHOLOGIC LOG Project No .: 2999ac PAGE 5 of 6 ) Task No. LITHOLOGIC LOG Boring/Well No .: 23 -MW 346 Facility: Paducah Gaseous Diffusion Plant Site: NATA GARS Client: Bechtel Jacobs Company LLC Contractor: TN & Associates Drill Contractor: Miller Drilling Driller: Start Time/Date: 10 54 MALES 6. /30/45 End Time/Date: 1320 Borchole Dia(s): 7/15/49 Drill Method/Rig Type: BAKBER P, Total Depth: 315 FT Logged By: Λ Scrinosan Coordinates: Protection Level: Depth SAMPLE Field Measurements (ft) Interval Number (ft) (com) (gom) GRAPH LITHOLOGIC DESCRIPTION COMMENTS LOG 2407 4/A 48 · · .. 5 BEL 0 £= 1633 245  $r = \sqrt{2}$ \*/A 49, T BICC 0 t= 1135 2.50 с. ÷., A/A 50 5 BKL Ø t= 2636 ł 255 - ; 51 5 A/4BKL 2 b t=1732 260 . 52 5 BKL 4/4 ÷ 0 £= 1733 265-÷ • ". 5 £., 53 BEL A/A Ó t=1734 270 -5Ξ. 5 5 BK6 AIA t= 1735 O . . 271 5 2 0 10 Rozoway 210 56 Ο NO RECOVERY 291 CLAY, DANK CALY, (1041 3h), MOD 37 5 BKG 2= 0952 D 290 MA 5 58 BKL 0 6 = 0955 295 5 A/p 54 BKL HIGH 0 t = 1057 3,00 PLASTILITY

				100	201	Th T	AGS TAGS LITE	SSOCIA1 3/8/28 OLOGIC	DG RI				
	Pro	oject	No.:	197	ac				104			1 1	
Ł	Tai	t <u>k</u> Na				4		.i			E	AGE (and C	
	LITHOLOGIC LOG Boring/Well No.: Dag Much												
	Fac	Facility: Paducah Gaseous Diffusion Plant											
	Client: Bechtel Jacobs Company LLC Site: ATA 6 APS												
	Contractor: TN & Associates Drill Contractor: Willer Drilling Desilier												
	Star	rt Tin	le/D	ale: 10	54 ()	30/44 End Ti	me/Dai	a: 132	0/7/15/	an B	grebole	P. MALKGAAF.	
	Dril	l Meti	hod/	Rig Type	: BA	KOON I	211		1 1 201	17 - T	otal Dee	12: 246	_
	Logg	red Bj	r: D	SCHM	wan !	cordinates:				Pr	rotection	Level: 0	+
	Dep	Lh		SAMPLE	Recovery	Field Measur	ementa	UTSIOLO			GRAPH	per p	-
	300		1149	INumber	((t)	(com)	(20m)	GIROLD	GIC DESCRI	PTION	LOG	COMMENTS	
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	100	T.	2					MUN	GRAY		4	0	
	320	<u>l</u> e	2		5	3K6	0	Π/A			Ļ	t= 1112	
ì	315	161	È		5	BKL	0	4/A			4	t = 1245	
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BORING	NO. :,	S-14	

PAGE 1 0F 4

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5000 . 1 0611 / 11	HEN: <u>3</u> Ne metanti	67 Ann Einim	P: 0	F-55 KSA to	Trinotinali	nations to %11	Sell HIGH UP HILLING	
DATE S	INRIED:	0/2//91		)	ITE FINOSIED:	10/25/91	LOGGER: 0.E.	Phillips
DEPTH (FT)	SAMPLE INTERVAL	BAMPLE NO.	RECOVERY (FT)	SPT Blows (N)	GPAIN SIZE PLOT	PROFILE	LITHOLOGIC DESCRIPTI	on / coments
	M	5-14-1	5.0	H.			SDLT: tr reate, tr cl. jet br (7 rdah-yel (7.511) 7/61, dry	5/R 6/31 to 
-5.0=		5-1 <del>4</del> -2	5.0	in.			CLANET SILT for ong morti, pole be gr (1019 6/11' and be	-11017 6/36 wort stryel (1017 6/8), woist -
-15.0-		5-14-3	5.0	10				-
	X	8-3 <del>1 1</del>	5.0	۳			DANTI SILL of ode (5-2011 af -f	- rodd pole br (1008 7/3)
-21.0-		8-34-5	5.0	H.			w' yel <del>si t</del> r (1019 S	Gistric, el los
-31.0-		8-14-6	5.0	W			CLATEY SD.1- soly (408) vF-a, subs srtd, yeish-br (100	vndel to model, priy to ead 3 5/61 wett gr (110111 6/11)

		BORING NO. : S-14		PMGE_2	0F_4_
	l		SUBSURFACE	BORING LOG	
PROJECT: A2-054 Gil Monito	ring Phase 3	LD.	CATION: EAST:3301	. 2. NORT	H: <u>7399.5</u>
ORILLING HETHOD AND EQUIP.	DE-55, HEA 1	to 70° and aud notary to 9	pbell well Uniting 0'		
DATE STARTED: 10/24/91		DATE FIDUISHED 10/25/91		.066ER: B.E. Phillips	
C DEPTH CFTJ SAMPLE SAMPLE NO. RECOVERY	E BLOUS E IND	GRAIN SIZE PLOT J F CO S B B C L CO C C C C C C C C C C C C C C C C C C	LITHO	.OGOC DESCRIPTION / CON	EMIS
5-10-0	о на		de SWAD: (530-6020 v/) (1078 7/40,	f, sity, yel 1307R 2/61 lawer contact is sharp	to pole br,
-35.0 - 25.0	0 14		QLAVET SILT: yeld poss QLAVET SILT: edy si to	v=rd 15178 5/61 and gr 151 las 121-3021 vf-f, subcong no 121-3021 vf-f, subcong no 121-3021 vf-f, subcong no 121-3021 vf-f, subcong no	R 5/1), d ortd, tr org moti, (7.5m 7/01
8-14-9 5.0			3440: 140-7011 v <sup>2</sup> rddh-yel 17,	f accivell srtd, sity, S18 6/6iw/or f1, 518 1/	tr org motil. 11 striks, mic
-5 0 - 5 0 -	) HA		9400: (8000) yf -n br 17, 578 50 511,11: ody 140-500 br wf gr, ac 9400: (50-600) yf - acti, air, s jaa7	subong privertid sity, bi, traic, moist wi-f, subong mic, org nist n, privertid subong tr ity, moist, br w/gretri	tr org motil, motil, org ks,
-55 0 55 0	3 <b>N</b> A	-	SWU⊡ (800–9020) f trong set),	submudt, well smtd, v nai noist tov wet, br 17.5	c slaity, loa, RESGI
-60 0 50 0.0	1 WA		50.11: sdy 030-4000 50401: 160-4000 (Fre pole br 0.00 6944401: 160-7051 e (Fre, silty,	vf, lgt gr (30178 7/1) , submodd, acol well an ti k 7/40, wet ang to subang, priyan ti trang acol, br to dk b	, trait, traic, sisdy 100-2001 r, wet

RORING NO.	: S	-14
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PAGE\_3\_0F\_4\_

PROJECT:	AZ-05	<u>4 64 No</u> 57	nitoring	Phose 3	INC OLEVENIEW	100 Co	DCATION: EAST:3301.2	NORTH: 7399.5
ORTLL ING	METHOD	NHD EQUI	P.: _(	NE-55, HSA to	70' and aud	rotory to	90'	
DATE STA	ATED: _1	0/24/91		0	WIE FINISHED	10/25/91	L066ER: 8.E.	Phillips
CETH CETH	SAMPLE INTERVAL	BAHPLE NO.	RECOVERY (FT)	spt Bloks Ini	GRAIN SIZE PLOT > 0 0 0 1 1 0 0 Σ L 00	SECTION	LITHOLOGIC DESCRIPTIO	dn / contents
-60.0						=° •	SMOI: 190-9021 arvs, submit, and tr sit, di velab-br (1978 4	srtd, sigviy (1013), V11 wet
-65.0-	.65.0_			17-37-60-92		00000000	or sin, as yendror table t	-1, 187
		5-14-13	1.9	ധ്ര		• • •	GFWED.: (40-502) and to submodel subong, and antid, all ality, wet SWO: (802) c-vs, one to submodel	and SWO 140001 c-vc, , dk yelshitar 10017R 4040, , acciencil articl, tricel to
	.m.e.	-14-14	0.9	21-51- <b>K</b> D			si gviy (5-1027, tr sit, tr to br 17.5119/61, wet, sho GRWEL: (40-5021, ong to subong, pr	nic, yelsi-br (1017 5/6) rp bedding contact at 70.5'
-75.0	.75.0 .77.0	≻14-15	1.3	24-37-37-41. (74)			ervc, suborig to submidd ' br 17.57R 5761 w∕se rdsh	uciarta, trait ta sisity, sta, wet - -
-80.0+ -	. 80. 0 . 82. 0 . 82. 0	-34-16	13	21-33-34-41 1671		00000	SWD: 1900 e-vt, subarg to submit (30-250), si sity, yeish-br	81, priv to anod srtd gviv LLDRR 5/61 -
-85.0	85 Q 81.03	-14-17	1.0	44-57-15-15 (112)			SWO: 1903) F-a, submott and well brah-yel LIDTR 6/81, lower o SWO: 1803) F-a, submot and well yelsh-br 1307R 5/81, alty of Q.MEY SOLT: loa, tr org acti, sti LIDTR 6/21 w/ sa yel	srtd, si sity, contact is sharp srtd, si sity, tr gvi, in end of sampler of 86' ff. let brak-or (LOTR 7/80 stn
-90.0	20.0-1-					and the new second		

	BORING NO. : S-14	1	PAGE 4 OF 4
		SUBSURFACE I	BORING LOG
ROLECT: AZ-054, GN Monitoring Phase 3	ц	CATION: EAST:3301	.2 NDRTH: 7399.5
SURF. ELEV.: <u>367</u> DRUL Drulling Hethod and Edudp.: <u>Che-55</u> , Kga (	LING SUBCOMINACION: <u>Car</u> to 70° and aud natary to 9	gbell Hell Drilling 90'	
DATE STARTED: 10/24/91	ONTE FINISHED: 10/25/91	l	DEEER: B.E. Phillips
SPTH BLORS SAMPLE SAMPLE SAMPLE RECOVERY RECOVERY SCOVER SCOVERY SCOVER SCOVERY SCOVER SCOVE	GRAIN SIZE PLOT	LITHOL	OGIC DESCRIPTION / COMENTS
S-1+18 2.0 (12)	8088	â	-
1 × 0	■ 53333	10 - 92"	-
-50-			-
			-
-100.0-			-
			-
			-
			-
-105.0-			-
			-
			-
-110.8-			-
			-
			1
			-
-115.0-			-
I_120 P			

BORING NO. : S-15

PHGE 1 OF 3

PROJECT	<u>AZ-05</u>	<u>4. Gii No</u>	ni tor ing	Phose 3		LD	CATION: EAST: 1842.9 NORTH: 66835.7
DRELLIN	ie hethod	NIC EDUT	P.: _0	16-55 164 to	65"	un <u>co</u>	100070- 11 Charter
DATE ST	WILE:	1/14/91		¥	NE FINISHED: _	II/PV91	LUCOCA LIGUSON
0EPTH (FT)	SAMPLE INTERVAL	SAMPLE NO.	RECOVERY (FT)	spt Blous (Ni)	GRAIN SIZE PLOT > 0 0 0 J 0 0 2 L 00	PROFILE	LITHOLOGIC DESCRIPTION / CONTENTS
	M	S-15-1	5.0	m		•	SILI: trinesta, accipat, triang edit, gras rook at pr (1977: 5/3) to whitshiftin (1977: 7/1), Firm
-5.0-	(sa)	S-15-2	5.0	M			yelai-br LIDR 6/61, stiff
-10.0-		8-15-3	5.0				CLATEI SILT: tr ad, vf, submodd, velsh-br (UDTR 6/6), eare gr ol ice froe 13.8° to 18.4° w'yeish-br (UDTR 5/6) strka, si ice
-	X	s-15-4	5.0	NPA			STUTT CLAY: to ad vf. submodel to any motil, or (UDTR 7/1)
-20.0-		\$-15-5	5.0	m			w'yel lon, v stiff
-30 0-		8-15-6	3.1	M			SMED: (60-8000) off-c, submodd to redd, occ pbi, si sity, whteotryel, sequence fines upword, lower port is privertid, upper is well artid

	BORING NO.:_S-15	PAGE 2 0F 3
	SUBSURF	ACE BORING LOG
RELECT: A2-054 GM Nonitoring Phose 3	LOCATION: EAST:	1942 9 NORTH: 6026.7
DRILLING METHOD AND EDUIP .: CHE-55, HSA	to 65'	11 ing
DATE STARTED _11/14/91	DATE FINISHED: 11/14/91	LD66ER: J.L. Clausen
SAMPLE BTH BTHE BTHE BTHE BTHE BTHE BTHE BTHE		LITHOLOGIC DESCRIPTION / CONTENTS
-30.0 -35.0 -35.0		vc, ang, priyarte, si gviy 130001, trol, r 130176 17/13 to yei 130176 17/61, v stiff cret, subang to ang, well arte, trol, i fram 31, 4° to 36, 1°, yei 130176 17/63 to yei 130178 6/93, base is sharp
5-15-8 2.5 M		01) vç, subrnakî, ciy (20-402), acc pbi, yel (517, 7/7)
5-5 0 50 M	Constant Con	v (1000),vf,rndd, well srtd, ty, occipbl, lotigr (10011877/1) w/ velstn 117/511816/51, staff
-50.0 50.0 8-15-10 4.7 HA	Contraction Contra	r (1-1581), vf. subradd, acc pbl, lan, Hatribr (101116/41 w/gr lan -
5-15-11 5.0 M		
50 0 50 0 M	C.AT al ady proba	to sdy (10-3011), vf-f, well srtd, occ pbl, br (7.508 5/8) w/wht (7.508 8/0), fire f, tr mico, cly, mossive, gr (51 7/2)

	BORING NO. : S	-15 PMGE <u>3</u> OF <u>3</u>
		SUBSURFACE BORING LOG
PROJECT: AZ-054 GN Monitoring Phase 3		LOCHTION: EAST: 1942.9 NORTH: 6826.7
SURF. ELEV.: <u>366.4</u> DRULL Drulling method and edutp.: (76-55, KSA t	ling subcontractor: _ » 65"	Compbell Hell Drilling
DATE STARTED: 11/14/90 1	wie finisłed: 11/14	/31 L066ER: L Clousen
INDERVAL SMPLE SAMPL	GRAIN SIZE PLOT J - OD > 0 0 0 J - OD 0 0 0 L 00	LITHOLOGIC DESCRIPTION / CONTENTS
8-15-13 3.5 W		de SWAD: 19020 c, mold, well antd, tripbl, trinic, tricle/cllyrs in lower part, pole br ULOTR 7/40, Fine SWAD: 16520 f. trinica cly accessive, or 151 7/21
-65.0		GRAVEL: USSEL, si sely USEL a, priy arte, org. tr cl, soft Decoving)
		10 • 65' 
		FOR HELL INSTALLATION: NO SAMPLES TAKEN
-70.0-		-
		-
-75.0-		-
-60.0-		-
	,	
-80.0-		
L		

Т

BORING ND. : S-18	
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PAGE 1 OF 5

PROLECT:	AZ-054 G	floni tor in	Phose 3	THE OLEVANIES	<u></u>	XITON: EAST: <u>-6</u>	258	NORTH:	-3469.)
DRILLING (	iethod and i	CUTP. :	DE-55, HOA, D	Continuous seep	ling to 85	ond 3" 55 15' c	enteri to l	C	
date star	FED: _10/16	/91	0	WTE FINISHED:	10/18/91		LOGGER	B.E. Phillips	
DEPTH (FT)	SAMPLE INTERVAL SAMPLE	ND. RECOVERY (FT)	spt Bloks Ini	GRAIN SIZE PLOT > 0 0 1 J 0 0 1 L 10	PROFILE	LTT	HOLOGOC DES	SCRIPTION / CONNENIS	
	8-10	1 2.7	an		0	SILJ- occ pbl,	tr cl, yeln	n-67 (1009) 5741 (Fill)	) - -
-5.0	5-10-	2 5.0	HA.			- SILT: cly to tr to gr III	rel trees MR 5/11 €Fi	dy eaterial, lgt gr l 11)	- 
	5.0	3 1.6	un.						-
	\$-10-	3.7	84			SILT: tr cl, mo	vist-vet, br	110MR 5/31 (F-1199)	
-20.0	5-18-1	3.9	w.			SILT di br (10 lover con	rfit 3/31 w/ r rtect is she	abund bik (poes corb) rp (fii1??) 9 (fi) een eti	ecterial,
	5.0)	4.5	m			SMD 18520, F- (STR 3/80 GRWEL: (SDB) # GRWEL: (SDB) # tr cl,	n, mod artid and gr 151 eil modd, c poorly artid yelatend 15	, radd, sity, yelshirn R 7/11, si gvly of bo ly, rabi-br (STR 4/41 , well radd, sdy (2011 TR 5/8)	d item I, f, sity,

BORING NO. : S-18	
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PAGE 2 OF 5

PROJECT: AZ-	<u>054 GU Ne</u> 300 J	eni tan ing	Phase 3	INC. CHECONTON	100 C	OCATION: EAST: -6258	NORTH:	-3489.1
ORILLING NETH	TO AND EQU	P. C	TE-55, HOA, I	lantinuous sas	pling to 8	S' and 3" SS (5' center) to 142'		
DATE STARTED	10/16/91			ATE FOUSHO	10/18/91	LOGGER: B.E. P	hillips	
GEPTH (FT) g SAMPLE D THTEDVAL	SAMPLE	RECOVERY (FT)	spt Blows Ini	GRAIN SIZE PLOT	SECTION PROFILE	LITHOLOGIC DESCRIPTIO	( / Content	S
	8-18-7	3.6	<b>18</b> 4		°   ° ° ° ° ° ° ° ° ° °	SMAD: 18530, end, well made w trisit, yelstvird (STR 5/8) SMAD: 16030, and, mode well a and pass wongarese could sta (2, STR 4/4)	ciisrta, s rta, gviy i , tr sit, r	l gviy 13061, 2561, henotite dah-br
	5-18-0	5.0	M			SULT: soly (405), f, trict, br (7.5	ni 5/6) c. poerly s	rtd, sity, ciy,
	5-10-5	1.0	m	٦		SWED: 16521, and, and well antig rd (2,513,476), shorp lower of SWED: 18021, F, well antig, sity, cl QLATEY SD,T: si ady (1521, vf, bri- ligt gr (7,513,771) SWED: 1502, vf-f, etc. and well at	viy (251), contect ly, acist, r (7.518 5/6)	tr sit, moist, - nd (2.5 TR 4/6) w/strks of
	S-18-10	5.0	NA			ecist to vert, se blik carb sel predos brsh-yel (1017 6/6) w	terisl fræn / se lgt gr	45 -10 (1011 1/2)
-50.0 - 50.0	S-18-11	5.0	×			CLANET SILT: sdy (20-405), vf-f, or bran-yel (100R 5/8) w (100R 7/11, tr ang ad	ocipòl, moin Vistrika d' ternial	strwet, predae gi gr
	8-1 <b>9</b> -12	5.0	м					

BORING ND. : S-18

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PROLET	T <u>AZ-00</u>	94 GN No	nitering	Phose 3		L0	CATION: EAS	1: <u>-6258</u>		NORTH:	3489.1
	illey. Ing hethod	and educ	P.: 0	TE-55, HSA	Dentinuous ser	sius: <u>caa</u> plina to 85	poor i ven S'ond 3'SS	15' centeri to	12		
DATE S	TIMITED:	10/16/91			WTE FINDSHED:	10/18/91		LOGGER	B.E. Phi	Hips	
DEPTH (FT)	SAMPLE INTERVAL	SAMPLE NO.	RECOVERY (FT)	SPT BLOWS ON)	GRAIN SIZE PLOT	BECTION PROFILE		LITHOLOGIC I	ESCRIPTION /	COMENTS	
-60.0	$\mathbb{X}$	S-18-13	5.0	M			a) SNID [5	105), w <sup>r</sup> m, poort	y artd, w civ	gity tr	gel,
-65.0		5-18-34	5.0	m	E		SAND IN SOLTT O	SD) ar-c, woll o syl2020 fra, yele Al sdy 13020, v w'sa yelsh	rte obly in rte slovy in h-br 1001R S/ f-a, pearly s br, tr bik co	iterbedded 81 w/ se g rtd, predd rtb eater i a	w'ailt, cly, r a gr (1017R 6/1)
-70.0		8-18-15	5.0	m			SMID IS GLWIEY S	SDLI of -f. well e algr (LDNR 771) SDLT - tried (SDL) (LDNR 771)	rtd, sity, cl f, yelehitr stiff	y, yelsh-b 1101R 5/61	ectt gr
-0.0	X	5-18-16	4.6	NA.		1 - 1000 (000 000 (000 (000 (000 (000 (000	SNID IS DUNEY S SNID ID DOWDL	DDR 1/, well arts DDR 1/11 SUT: al ady (DD SUT: al ady (DD SUT: al ady (DD SUT: al ady (DD SUT: ady (DDS (SUD), ady (DDS)	(, sity, yeish (), vf-f, lgt utd, si sity, 1)UfR 7/1) (, f-c, paoriy	enter (11011) ger (11011): 7 tr gvl, y sertd, si	5/60 and gr - /11, occ pbl - elsh-br - sity, gr
-80.0-		\$-1 <b>8-</b> 17	1.2	m			GRANICL	19000 poorly srt froos, sdy 1354 srtd, tr sit, br wet	td, sub-modd, , antilyc, sw 17.5118 5/40,	abund chit in-wit, sub sin nd lite	and sitst . mdd, ead eatiteîistr, .
-85.0-	8.0	9-18-18	1.4	33 <b>-15-36-25</b> (81)		9000 000 000 000 000 000	SWD 15	SEI mostly c, an SEI, poorly arts a ndshista, tribi	i erve, eub an 1. tr ait, yet 1. (poss ang)	g to sub r shrtr (10) moterial,	ndd gyly - R S/SI, wet -
-90.0-	90.0_							ω/brshryel v stiff	(1018 6/8) el	t olong fr	ver, dry, .

	BORING NO. :	-18 PMGE_*	<u>1</u> DF <u>5</u>			
		SUBSURFACE BORING LOG				
PROJECT: AZ-054, GJ Monistering Phone	۰ <u>ــــــــــــــــــــــــــــــــــــ</u>	LOCATION: EAST: -6258 N	NTH: - 2489. 1			
SUFF. ELEY.: 382.7 Okilling Method and Equip.: Che-55	OFILLING SUBCONTRACTOR: EX. Continuous accoling	Comptell Well Drilling to 85' and 3" 95 (5' center) to 142'				
DATE STARTED: 10/16/91	DATE FINISHED _ 10/1	V91 LUGGER: B.E. Philli	PA			
RECOVERY RECOVERY ISTHPLE RECOVERY IFT)	T GRAIN SIZE HS PLOT 6 > 0 0 0 J 6 0 0 0 0 J 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	LITHOLOGIC DESCRIPTION / CI	menis			
-90.0 90.0 5-19-19 2.0 5-19-1 -95.0	-26	de CLAT: si alty, exc, bik (2.57.270), atri CLAT: si alty, si exc, dry to exist, bik glocc, v stiff	T to v stiff			

				[	BORING N	0. : <u> </u>	8	PAGE_	<u>5</u> OF <u>5</u>
				l			SUBSURFACE	BORING LOG	
PROJECT SIDE D	i: <u></u>	54, 64 No	ni toning	Phase 3	nic subcavitavi		OCATION: EAST: <u>-62</u>	<u>98                                    </u>	DRTH:3489_1
DRILLID DRILLID	ig hethod	MO EOU	P.: _C	XE-35, HEA, D	antinuous son	pling to 8	5' and 3' 55 15' cer	nterito 142" Integra de C. Deutro	
Drift of	(INTED: _	10/10/11			CONTRACTO	10/16/1		Licoch <u>G.C. Philip</u>	pa
DEPTH (FT)	BAMPLE INTERVAL	SAMPLE NO.	RECOVERY (FT)	BLONS (N)	PLOT PLOT + L 0 0 0 1 2 00 0 0 2 1 0 0	SECTION PROFILE	LITH	DLOGOC DESCRIPTON / CI	ITENIS
-120.6-	122,	S-10-22	2.0	12-24-25-30 (46)			do		
-130.0		5-18-23	2.0	15-21-27-43 (48)			SULTY CLAY: wic, port tr g	gleu, belk 15172,5711, ∘ ingsofsd, vf-f, veilt s leuc, sic, en pyrcent, r	rstiff, w∕thin srtit, subirnöd, al is ligt gr 157 17/10 - - - - -
-135.0							SNHD (50-958) (2:57 5/0)	f, sub-mabi ⊌ell srtd, toda gr 12.51 4/00, wa	trali, traic, gr zes, predos qtz, wet . -
-140.0-	19.0	5-18-24	2.0	8-13-36-ACF 6450		-	TD = 142'		
-115.0-									-

BORING NO. : S-19

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PROJECT	NZ-05	4 Gi the	vitoring	Phose 3		U THE C	OCATION: EAST: -6596.0	NORTH3698.5
DRILLIN	E NETHOU	AND EQUI	P.: 0	NE-95, HSA, C	Das soeconiano Sentinuous som	nue <u>co</u> pling to 6	5'	
date st	inite	0/22/91		D	ATE FIXISHED:	10/22/90	LUGGER: <u>B.E.</u>	Phillips
DEPTH (FT)	SAMPLE INTERVAL	SAMPLE NO.	RECOVERY (FT)	SPT Bloks (N)	GRAIN SIZE PLOT > 0 0 LL 0 0 LL CO	SECTION PROFILE	LITHOLOGOC DESCRIPT.	ion / cottents
-5.0-	5.0	9-19-1	13	Hen.			SDLT: acc pbl, tr cl, tr vf-f sd pole br (1,01% 6/3) ts lgt	1581, razta, ar 1,007R 7/30 - -
-10.0-		s-19-2	3.5	W.			SWO 18000 erc, redd ta subredd si gely (1500, fine ion, b BWWL: 16001 suborg, sdy 13001 al alty, rdahrâr 12 517	nod well artd, al alty, r (7.509 544) arc, aubrack, and artd, 494)
-	Х	s-19-0	3.5	MA			SMAD: 160-7020 F-a, submidd, acc acc pbl, pole br (1076 7/ SMAD: 18020, a-c, submidd, acd + midd, tr sit, wet, br (2.MF: si sity, igt gr (7.578 7/) (2000): (50-502), poerio article	well antd, alty, al cl, 40 cliantd, al gvly (1520), ) dv (30)–9160, c. avelantet
-15.0-		9-19-4	3.5	*			CLANEY SILT: tr ad to soly lup to yeish-br and gr	intΩti, f−a, modi, si ioa, .
-20.0-		s-19-5	5.0	M			9000 (50-600) e subradd well fer weistuise (1000 L/4) -	sr1ć, sity, occ pbl,
-30.0-		8-19-6	4.7	M			SWD: (70-600) F-n, and well srt br (7.518 5/16, base is cl SOLITY OLAT: sdy (25-308) vf-f, y br (7.518 5/4)	ut, tr gvl, sity, y and Canitaina 1025 gvl yr (7.5118 17/1) and

DODTNO	ND .	C-10	
SUKLIND -	BU. F	3713	

PAGE <u>2</u> OF <u>3</u>

PROJECT SURF. 8	1: <u>A2-05</u> 11:V	74 <u>644 No</u> 371.4	si tar ing	Phose 3 DRBLL	ING SLECONTING	TDR: Comp	ATION: EAST: <u>-6596.8</u> MORTH: <u>-3698.5</u> defl Hell Drilling
DRULLDA DATE ST	6 NETHOD	MO E010	P0	1E-55, KSA,	Continuous som	pling to 65"	INCOTO O C Duilling
Direct of		10/22/31			NIC FUCIDIUS	10/22/31	Cutoch B.C. Phillips
CEPTH (FT)	SAMPLE INTERVAL	BAHPLE NO.	RECOVERY (FT)	spt Blows (N)	GRAIN SIZE PLOT	PROFILE	LITHOLOGIC DESCRIPTION / COMENTS
- 0, 02- - -	X	s-19-7	5.0	Nef.			CLANTEY SIL1: tr f ed. gr (7.519 7/1) and rdsh-br 1579 4/41 SWMD: (60-302) f-m, subrodd, mod woll artid, sity, gr (579 7/1) and rdsh-br (579 4/4), moist
-35.0-	(*)					202 	CLAYET SILT: adv (40-402) a, rndd, well artd, gr (519 7/1), wet SWAD: (50-603) fra, alty, gr to yeishrbr, wet
-	X	S-15-8	3.7	**		• • _• • _•	- SWAD: 18051 f-c, al gviy 11051, tr ait, br, moistreet -
-10.0- - - 15.0-		5-19-9	2.2	*			SWWD: 1906) erc, subradd, prly to eod artd, al alty, rdshryel (7.51R 6/6), wot
	X	\$-19-10	5.0	w		0 - 2 - 2 - - -	SMMD: 160-7051 erc, submakt and entid, tr gvi 15-1000), sity, bretryel (110118 6/81, ligt br and gr, wet -
-90.0	X	S-19-11	5.0	w			CLAFET SILT: stiff, tr f-a set, tr gvi, mole brsh-yel and gr 
-55.0		8-19-12	1.0	M			GREWEL: USERI clay clast, priy antid, all alty, trici, br 17.578 5/31, wet SILTY QLAY: los, Frect, tr mic, br w/indokryal, stilly, dry

PAGE <u>3</u> OF <u>3</u>

PROJECT: AZ-C	54, 64 Ma	ni toning	Phose 3	NE SIGMATIN	1	dontion: east: The ball and the second	-6596.8	NORTH:3658.5
DROLLING KETHŪ	D NHO EDU	P	TE-55, KSA, D	ontinuous set	eling to 6	3		
DATE STARTED	10/22/91		¥	TE FINISIED:	10/22/9		LOGER: BE	Phillips
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	Joppa	and a second second	9118	Silt, gray	spars Silt, yell and g	ne Silty and o	. Gravel, her	Sand, redd sand, Sand, Sannyl, o

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alt		Material			(e)	E
Sil	t, pale gra	rish-brown, clayey, d	lamp, abundant b	lack, opaques	10	ġ
34B11	t, yellowis sparse cher	a-brown, sandy. Fine	e to granules of	quartz and	32	EL I
He Cra	vel				3	16
E E	y, light-gran	W, bright red wuggy sampled. <u>Dry</u> Fulle is, few white chert 1	blebs of altere d at 22'. Spars /4" pebbles=con	df e coarse taminants?	9	8
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Q1       Bilt, yellowish-brown, clayey, dry. no gand. very sparse       20       20         359       sand at 20'       sand at 20'       10       30         359       Bandy, red very silty, very fine to fine quartz and chert, 10       10       30         99-349       very sparse medium-grained mice flakes       10       30         976       Cravel, red, brown, coarse, up to 2 1/2" across. Water at 40'.       13       43         379       Thy dark-gray Sampled.       1       4       4	Unit	inter angered test lot	Tichness (r.)	Ct.)
9-349 Bandy, red very silty, very fine to fine quartz and chert, 10 30 very sparse medium-grained mice flakes Growel, red, brown, coarse, up to 2 1/2" across. Mater at 40". 13 43 The Clav, dark-gray Sampled. 1 / 1 / 1 / 1 / 1	ел 260	Bilt, yellowish-brown, clayey, dry. <u>no sand</u> . very sper sand at 20'	e 20	ଷ
QTc     Gravel, red, brown, coarse, up to 2 1/2" across. Mater at 40'.     13     43 $\tilde{T}_{20}^{10}$ Clav, dark-gray Sampled.     h     h	616-6	Bandy, red very silty, very fine to fine quartz and che very sparse medium-grained mica flakes	t, 10	R
<sup>3</sup> 76 Ulevy, dark-grey Bempled. 1 나	ŝ	Gravel, red, brown, coarse, up to 2 1/2" across. Water (	t 40'. 13	F
	24	Clay, dark-gray Sampled.	4	4

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	HOLO IE BELL JAN	Jogna Jogna Josefe Later Core. 1/20/65		Clayey silt, Grey	Clayey silt, orange to dark brown	. Clayey silt, trace medium sand, orange Gravel	Clayer silt, micaceous, white, yellow and red #1 at 96-98 Loess - QTq (fine) 327' QTq(fin )-WTg 299' QTg- Kn 263'

PC	ູ s11.08.5-308.6	22-65	and the second second second second second second second second second second second second second second second	Thickness / Depth		h3 h3 20 63	43 43 43 20 63 69 69	43 43 6 69 13 62	43 43 6 69 13 82 13	h3 h3 20 65 69 69 13 88	h3 20 6 69 13 32 32 32 32	h3 h3 20 69 6 69 13 882	h3 h3 20 69 13 82 13
ASSIST LARGE.	Jopra Gounty Runtucky Gou	te Anteritade Late 13D 3631 artentation 13D 3631	surf. Depth 32' Aleve of Fm. Tope			ty clay, yellow-brown	ty clay, yellow-brown yey very fine sand orange well 2" cemented gravel at 59'	ty clay, yellow-brown yey very fine sand orange ivel 2" cemented gravel at 69' ty fine sand, light gray, some clay <sup>4</sup> 1 at 75'	ty clay, yellow-brown yey very fine sand orange vel 2" cemented gravel at 69' ty fine sand, light gray, some clay #1 at 75' to fine sand, light gray, some clay #1 at 75' for fine - 24g (fine) 320' eTg (fine) - 24g 29' eTg - Km	ty clay, yellow-trown wey very fine sand orange vel 2" cemented gravel at 69' ty fine sand, light gray, some clay #1 at 75' ty fine sand, light gray, some clay #1 at 75' cone fine) = 04g (fine) 320' cone fine) = 04g 29' cone fine) = 04g 29'	ty clay, yellow-brown wey very fine sand orange well 2" comented gravel at 69' ty fine sand, light gray, some clay <sup>4</sup> 1 at 75' ty fine sand, light gray, some clay <sup>4</sup> 1 at 75' ty fine sand, light gray, some clay <sup>4</sup> 1 at 75' or or of the sand orange state sand of the sand of the sand or state sand of the sand of the sand of the sand of the sand sand sand sand sand sand sand sand	ty clay, yellow-brown yey very fine sand orange vel 2" cemented gravel at 69' ty fine sand, light gray, some clay #1 at 75' ty fine sand, light gray, some clay #1 at 75' ty fine sand, light gray, some clay 20' off (fine) - 2tg 20' off (fine) - 2tg 20' off (fine) - 2tg 20'	ty clay, yellow-trown yey very fine sand orange well 2" cemented gravel at 69' ty fine sand, light gray, some clay #1 at 75' toess - 9FG (fine) 320' GTE (fine) - 0ft 330' GTE (fine) - 0ft 29'
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# **APPENDIX B**

Test for significant statistical difference between the selected borehole population used in geologic profiles and the total borehole dataset compiled for this study.

Midpoint							
Depth	CLAY -x	CM to MC -x	Silt -x	MS to SM -x	Sand -x	Sand to Gravel -x	Gravel-x
405.00	0.00	0.00	0.23	0.23	0.00	0.23	0.32
395.00	0.04	0.02	0.22	0.22	0.02	0.20	0.24
385.00	0.04	0.07	0.21	0.21	0.04	0.17	0.17
375.00	0.08	0.12	0.17	0.24	0.03	0.14	0.14
365.00	0.14	0.19	0.09	0.27	0.01	0.08	0.08
355.00	0.08	0.25	0.04	0.32	0.01	0.07	0.03
345.00	0.04	0.22	0.05	0.38	0.01	0.12	0.05
335.00	0.06	0.16	0.06	0.36	0.01	0.13	0.06
325.00	0.08	0.19	0.05	0.38	0.01	0.12	0.05
315.00	0.06	0.20	0.07	0.29	0.03	0.09	0.09
305.00	0.04	0.08	0.05	0.45	0.02	0.19	0.08
295.00	0.04	0.06	0.06	0.43	0.03	0.19	0.09
285.00	0.06	0.09	0.09	0.31	0.03	0.14	0.15
275.00	0.10	0.14	0.10	0.25	0.09	0.09	0.11
265.00	0.12	0.19	0.14	0.11	0.17	0.01	0.02
255.00	0.04	0.28	0.16	0.10	0.16	0.00	0.00
245.00	0.04	0.29	0.14	0.12	0.16	0.00	0.00
235.00	0.20	0.22	0.07	0.20	0.10	0.00	0.00
225.00	0.22	0.12	0.08	0.27	0.02	0.08	0.08
215.00	0.08	0.12	0.11	0.23	0.15	0.11	0.11
205.00	0.14	0.15	0.00	0.17	0.38	0.00	0.00
Midpoint	CLAY -	CM to MC -	Silt -	MS to SM -	Sand -	Sand to Gravel -	Gravel -
Depth	all	all	all	all	all	all	all
405.00	0.00	0.00	0.08	0.44	0.00	0.24	0.10

l muchouur	L OF ULL		Jone -	1413 (0 3141 -	Jana -	Sana to Oraver-	Uldver -
Depth	all	all	all	all	all	all	all
405.00	0.00	0.00	0.08	0.44	0.00	0.24	0.10
395.00	0.00	0.00	0.08	0.44	0.00	0.24	0.10
385.00	0.06	0.16	0.16	0.19	0.04	0.12	0.13
375.00	0.06	0.16	0.16	0.19	0.04	0.12	0.13
365.00	0.06	0.21	0.15	0.13	0.09	0.06	0.06
355.00	0.06	0.21	0.15	0.13	0.09	0.06	0.06
345.00	0.14	0.17	0.08	0.14	0.06	0.03	0.07
335.00	0.14	0.17	0.08	0.14	0.06	0.03	0.07
325.00	0.10	0.19	0.04	0.32	0.02	0.11	0.07
315.00	0.10	0.19	0.04	0.32	0.02	0.11	0.07
305.00	0.02	0.17	0.04	0.35	0.03	0.14	0.04
295.00	0.02	0.17	0.04	0.35	0.03	0.14	0.04
285.00	0.04	0.32	0.04	0.23	0.03	0.06	0.05
275.00	0.04	0.32	0.04	0.23	0.03	0.06	0.05
265.00	0.28	0.10	0.05	0.26	0.04	0.05	0.02
255.00	0.28	0.10	0.05	0.26	0.04	0.05	0.02
245.00	0.10	0.22	0.02	0.13	0.25	0.01	0.01
235.00	0.10	0.22	0.02	0.13	0.25	0.01	0.01
225.00	0.02	0.18	0.13	0.20	0.00	0.13	0.13
215.00	0.02	0.18	0.13	0.20	0.00	0.13	0.13
205.00	0.10	0.03	0.00	0.42	0.09	0.16	0.00

Notes: x = boreholes selected for use in geologic profiles all = total borehole dataset compiled for this study

Tables above were used for statistical comparison of grain-size percentage along 10-foot intervals. Gaps in data, unknown data, and grain sizes not listed above were left out of analysis, therefore percentages may not equal 100%.

## Mann-Whitney Rank Sum Test

Tuesday, June 13, 2006, 4:38:57 PM

**Data source:** Data 1 in Notebook 1

Normality Test:		Failed (F	<b>P</b> = 0.002)		
Group	Ν	Missing	Median	25%	75%
CLAY -x-section	21	0	0.0600	0.0400	0.105
CLAY - all	21	0	0.0600	0.0200	0.1000

T = 464.500 n(small) = 21 n(big) = 21 (P = 0.753)

The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.753)

Data source: Data 1 in Notebook 1

Mann-Whitney Rank Sum Test

Normality Test: Passed (P > 0.050)

Equal Variance Test: Passed (P = 0.587)

Group	Ν	Missing	Median	25%	75%
CM to MC -x-section	21	0	0.150	0.0875	0.205
CM to MC - all	21	0	0.170	0.145	0.210

T = 427.000 n(small) = 21 n(big) = 21 (P = 0.546)

The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.546)

### **Mann-Whitney Rank Sum Test**

Tuesday, June 13, 2006, 4:40:00 PM

Data source: Data 1 in Notebook 1

Normality Test:		Failed (F	Failed $(P = 0.007)$						
Group	Ν	Missing	Median	25%	75%				
Silt -x-section	21	0	0.0900	0.0575	0.145				
Silt - all	21	0	0.0500	0.0400	0.130				

T = 522.500 n(small) = 21 n(big) = 21 (P = 0.076)

The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.076)

## **Mann-Whitney Rank Sum Test**

Tuesday, June 13, 2006, 4:40:49 PM

**Data source:** Data 1 in Notebook 1

Normality Test: Passed (P > 0.050)

**Equal Variance Test:** Passed (P = 0.653)

Group	Ν	Missing	Median	25%	75%
MS to SM -x-section	21	0	0.250	0.207	0.330
MS to SM - all	21	0	0.230	0.140	0.328

T = 477.000 n(small) = 21 n(big) = 21 (P = 0.529)

The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.529)

### Mann-Whitney Rank Sum Test

Data source: Data 1 in Notebook 1

Normality Test:		Failed (F	<b>P</b> = <0.001)		
Group	Ν	Missing	Median	25%	75%
Sand -x-section	21	0	0.0300	0.01000	0.113
Sand - all	21	0	0.0400	0.0200	0.0675

T = 445.500 n(small) = 21 n(big) = 21 (P = 0.890)

The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.890)

### **Mann-Whitney Rank Sum Test**

Tuesday, June 13, 2006, 4:41:41 PM

Tuesday, June 13, 2006, 4:41:12 PM

**Data source:** Data 1 in Notebook 1

Normality Test: Passed (P > 0.050)

**Equal Variance Test:** Passed (P = 0.703)

Group	Ν	Missing	Median	25%	75%
Sand to Gravel -x-section	21	0	0.110	0.0550	0.148
Sand to Gravel - all	21	0	0.110	0.0500	0.133

T = 463.000 n(small) = 21 n(big) = 21 (P = 0.782)

The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.782)

## Mann-Whitney Rank Sum Test

**Data source:** Data 1 in Notebook 1

Normality Test:	]	Failed (P =	0.010)		
Group	Ν	Missing	Median	25%	75%
Gravel -x-section	21	0	0.0800	0.0275	0.118
Gravel - all	21	0	0.0600	0.0350	0.1000

T = 482.000 n(small) = 21 n(big) = 21 (P = 0.450)

The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.450)

# **APPENDIX C**

Map ID	Date of Collection	Log Label	UTM Northing	UTM Easting	Notes
177	12/18/2005	LM01	4114910	340229	Upper and Lower Samples
178	12/18/2005	LM02	4115264	339629	Single Sample
179	12/18/2005	LM03	4113292	340966	Upper and Lower Samples
180	12/18/2005	LM04	4112286	341006	Single Sample
181	12/18/2005	LM05	4110438	337965	Failed Sampling Attempt
182	12/18/2005	LM06	4112632	337847	Single Sample
183	12/19/2005	LM07	4106678	337515	Single Sample
184	12/19/2005	LM08	4110296	337968	Single Sample

Optically Stimulated Luminescence sampling logs.

Luminescence Sampling Log	
Josh Sexton University of Kentucky Phone: 540-818-27 101 Slone Bld. Fax: 859-323-19 Lexington, KY 40506-0053 Email: <u>ilsexton@uk</u>	89 38 <del>.y.edu</del>
Location: LM Ø1 (Lower) 4/149	10, 340229
Sample #: Date & Date & Time: 12/19/05 10:00 cm	
Moisture Content: Maist	
From Surface D	epth Sampled Into Outcrop
Burial Depth (ft): 17' 60"	+ 6" pilot hale photo / sketch of sampling location
Notes:	OLMOIL (UPPED)
Estimated Age Range: Pleistocene	2'
Stratigraphic Formation:	Sand Stringer
Anticipated Age (range):	Soil Darbas pour Frasipan
Additional Notes: Gravelly Sand Maderately graded to a Zin. Ing axis	V. ft. ton wichert growl " V. ft. ton wicher growl"

212

Josh Sexton University of Kentucky 101 Slone Bld. Lexington, KY 40506-0053	Phone: 5 Fax: 8 Email: j	540-818-27 859-323-19 jlsexton@uk	789 938 ky.edu
Location: LMOI (UPPE	R)	41140	910, 340229
Sample #:			
Date & Time: 12/19/05- 9	:45		
Moisture Content: Dry			
From Surface		D	epth Sampled into Outcrop
Burial Depth (ft): ~ 고식 '		20''	oc/6" Pilot hole
Notoci		· [	photo / sketch of sampling location
Notes.		×	
Formation: Loess			
Estimated Age Range:			15" 14 ten Silt
Stratigraphic Formation:			14" man she leach zane
Anticipated Age (range):			· Change and Canada
Additional Notes:	~ / ` C		are sand stears
Some the with	Sond in S,	(5)	ore SD Stringers
Massive			

Luminescence Sampling Log	
Josh Sexton University of Kentucky Phone: 54 101 Slone Bld: Fax: 88 Lexington, KY 40506-0053 Email: jls	40-818-2789 59-323-1938 sexton@uky.edu
Location: LMD2	4115264, 339629
Sample #: //	
Date & 12/19/05 11:15	am
Moisture Content: Saturated	
From Surface	Depth Sampled into Outcrop
Burial Depth (ft): /////	13" + 10" Pilot hole
Notes:	photo raketor or sempling location
Formation: Mðunds	
Estimated Age Range: Pleistocene	- Massive sill
Stratigraphic Formation:	
Anticipated Age (range):	22" "
Additional Notes: 3 adjacent samples tried, failed	o y Bolling
due to cobble size too large.	Creek stage
long axis, grand, concor material than LM. Lost. Mate	Ø2 Mal

Luminescence Sampling Log				
Josh Sexton University of Kentucky 101 Slone Bld. Lexington, KY 40506-0053	Phone: 540-818- Fax: 859-323- Email: <u>ilsexton@</u>	2789 1938 Juky.edu		
Location: LMB3 (Lover)	<u>) ५॥</u>	3292, 340	71ele	
Sample #:				
Date & Time: 12/19/05	1300		· · · · ·	
Moisture Content: Slightly maist				
From Surface	1	Depth Sampled in	to Outcrop	
Burial Depth (ft): /00 <sup>#</sup>		22 "		
3.7		photo / ske	etch of sampling location	
Notes:		- Sie Preu	rio ·s photo.	
?		1		
Estimated Age Range:		30'	GS	
Stratigraphic Formation:		- k		
Anticipated Age (range):			7"	
Additional Notes: · 2 other samples offumples Samples Not-retrievable	l with pilot-boring.	(	5 xo cn	
· sample taken from ch shoe light contamin	ean face, therefore, which			

Luminescence Sampling Log	
Josh Sexton University of Kentucky Phone: 540 101 Slone Bld. Fax: 859 Lexington, KY 40506-0053 Email: <u>jise</u>	0-818-2789 0-323-1938 xton@uky.edu
Location: LM.Ø3 (49per)	4113292, 340966
Sample #: // // Date & Time: 12/19/05 Moisture	
Content: V'/	
From Surface	Depth Sampled into Outcrop
(ft): 00	photo / sketch of sampling location
Notes:	
Estimated Age Range:	20" ("M
Stratigraphic Formation:	Boh Mad DK Gry ? bands
Anticipated Age (range):	. 0 14.5" 0 0
Additional Notes: Lots & FE in Sample, Coorse grained gravel	30' 00 0 0 0 0 Rust to ton 65 CL
	Blue gray clay

Luminescence	Samplin	g Log
--------------	---------	-------

Joch Covton	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	1499 ··· ··· ··· ···
University of Kentucky	Phone:	540-818-278
101 Slone Bld.	Fax:	859-323-193
Lexington, KY 40506-0053	Email:	<u>jlsexton@uky</u>

540-818-2789	
859-323-1938	
<u>jlsexton@uky.edu</u>	

Location: LMØ4 411-	2286, 341000e
Sample #: // //	
Date & Time: 12/19/05	
Content: Slightly moist to mois	+
From Surface	Depth Sampled into Outcrop
Burial Depth 3'	16"
	photo / sketch of sampling location
Notes:	
Formation: ML	
Estimated Age Range:	13' multitive reach - wat-
Stratigraphic Formation:	Time orange
Anticipated Age (range):	
	1 + an il within the
Additional Notes: 10" pilot hole, unable to retvieve samp	k Red gray

Luminescence Sampling Log	9	
Josh Sexton University of Kentucky 101 Slone Bld. Lexington, KY 40506-0053	Phone: Fax: Email:	540-818-2789 859-323-1938 jlsexton@uky.edu
Location: LMØ5		4110438,337965
Sample #: // //		
Date & Time:		
Moisture Content: Dry		
From Surface		Depth Sampled into Outcrop
Burial Depth (ft): 9		10'"
		photo / sketch of sampling location
Notes:		Surface
Formation:		light ton massive silt
Stratigraphic Formation:		0 410 0 0
Anticipated Age (range):		12' Blue-gray clar, provige mottles
Additional Notes:		

Luminescence Sampling Log	)	
Josh Sexton University of Kentucky 101 Slone Bld: Lexington, KY 40506-0053	Phone: Fax: Email:	540-818-2789 859-323-1938 jlsexton@uky.edu
Location: LM Ø6		4112632, 337847
Sample #: " "		
Date & Time: 12/19/05		
Moisture Content: Saturated		
From Surface		Depth Sampled into Outcrop
Burial Depth (ft):		12"
Notes:		photo / sketch of sampling location
Formation:		7' Moolevn soil
Stratigraphic Formation:		2' silty sand to
Anticipated Age (range):		+ ragpari
Additional Notes: hole flooded as sample sample saturated	was netw	Viewed, 10" interworked brange Silt/Blue gray clay

Luminescence Sampling Log		
Josh Sexton University of Kentucky P 101 Slone Bld: F Lexington, KY 40506-0053 E	hone: ax: mail:	540-818-27-89 859-323-19-38 jlsexton@uky.edu
Location: LMØ7		4106678, 337515
Sample #: "		
Date & Time: 12/20/05		
Moisture Content: Dry		·
From Surface		Depth Sampled into Outcrop
Burial Depth (ft):		20 "
		photo / sketch of sampling location
Notes:		Sul for
Formation: Upper Terrace		masive silt
Estimated Age Range: Pleistoc	ene	
Stratigraphic Formation:		
Anticipated Age (range):		
Additional Notes:	face	it ton sand with brown chert gravel
and duy out.	The	Staye

Luminescence Sampling Log	)			
Josh Sexton University of Kentucky 101 Slone Bld: Lexington, KY 40506-0053	Phone: Fax: Email:	540-818-2789 859-323-1938 jlsexton@uky.edu		
Location: LMD8		4110296,3	337968	
Sample #: '' ''			-	
Date & Time: 12/20/05				
Moisture Content: Dry				
From Surface		Depth San	npled into Outcr	op
Burial Depth (ft):		18"		_
		pt	hoto / sketch of sar	npling location
Notes: Formation: H U - 3		Surface	80" VNC	ive soil and ssive sit
Estimated Age Range:			Å.	-> coarse 45
Stratigraphic Formation:			a ler trans	ation to flue sand
Anticipated Age (range):		L	A A	in suc
Additional Notes: Sample is a very firm I sample driven pavailed and dry out, to drive in sample	ight gray to face very dil le	filt ficult	9 9 7 5 tuge	group ivon staining

# APPENDIX D

Notes on the surficial geology of Bayou Creek and Little Bayou Creek.

		Bay	you Creek F	ield Notes	used in Site Maps
	Data	1 - 1 - 1	Waypoin	t (UTM)	
טו	Date	Labei	Northing	Easting	Notes concerning waypoint
1	7/12/04	LM03	4115682	338544	Bend w/ coarse gravel (Lower Cont.?) no evidence in cut bank
2	7/12/04	LM04	4115613	338727	Gravel lining creek bed ~3' below surface
3	7/12/04	LM05	4115605	338799	Riffle, gravel bed in bank (Lower Cont.?) (pic 30yds below waypoint)
4	7/12/04	LM06	4115603	338859	Gravel lag deposit at stream level
5	7/12/04	LM07	4115596	338928	Exposed upper fining sequence gravel - sand - mud
6	7/12/04	LM08	4115645	339128	Muddy sand in bank outcrop / friable / poorly graded / buff color on outer surface / dk brown on inside
7	7/12/04	LM09	4115587	339152	Stiff gray clay / oxidized on surface / inside beds ???? sand bar
8	7/12/04	LM10	4115625	339220	Sandy riffles in stream bed
9	7/12/04	LM11	4115552	339380	Sand bar
10	7/12/04	LM12	4115519	339437	Sandy beneath oxidized layer of very dark gray clay, sand on bar with high enough mud contact to exhibit polygonal desiccation (mud) cracks
11	7/12/04	LM13	4115452	339406	Gravel stream bed
12	7/12/04	LM14	4115478	339489	Dissemination of gravel sequence
13	7/12/04	LM15	4115375	339584	Gravel stream bed / rather deep channelized section
14	7/12/04	LM16	4115305	339465	Diffused seeps on south bank (16.7 C / 121.7 us)
15	7/12/04	LM17	4115291	339448	Gravel seep on south bank, ~1' above water level / (16.4 C / 171.4 us)
16	7/12/04	LM18	4115245	339522	Gravel bar / pic
17	7/12/04	LM19	4115262	339608	Gravel to cobble sequence w/ fine grained matrix / long axis < 10cm / weakly cemented with iron oxide
18	7/12/04	LM20	4115252	339619	Sandy bars with mud cracks

		Ba	you Creek F	ield Notes	used in Site Maps
	Data	Labal	Waypoin	t (UTM)	
טו	Date	Labei	Northing	Easting	Notes concerning waypoint
20	7/12/04	LM22	4115139	339729	3 pictures
21	7/12/04	LM23	4115085	339764	Gravel in lower sequence probably covered with mud / 1 picture
22	7/12/04	LM24	4115041	339807	Tributary on south bank, origin from a diffuse set of seeps (333 us/20.5C @ road) (322 us/ 19.4C @ stream)
23	7/12/04	LM25	4115130	339886	Boil (325us / 16.2C)
24	7/12/04	LM26	4115125	340015	Lots of fines covering in place stratigraphy
25	7/12/04	LM27	4115057	340102	Uniform U-shaped channel / lots of Ohio River mud
63	7/14/04	LM65	4115338	338299	Shallow, irregular, firm clay btm. sculpted by current
64	7/14/04	LM66	4115145	338117	Gravel base and bars
65	7/14/04	LM67	4115067	338130	Picture
66	7/14/04	LM68	4114950	338101	Gravel base and bars to this point
67	7/14/04	LM69	4114878	338153	Intermittent gravel and pools
74	8/17/04	LM80	4115047	339825	Gravel deposit w/ clast orientation strike: 310, 40-80, indicates some bedding
75	8/17/04	LM81	4115252	339670	Gravel deposit, ~1-1.5' above stream stage, exposed 50-60' along bank, overlain by 6-8' of sandy silt overgrown by modern vegetation
76	8/17/04	LM82	4115275	339619	Gravel deposit, (LM19) inclined sharp upper contact undulating w/ 1-2' of relief, (bar w/ internal scours), faintly imbricated, dominant strike 90, dip 125, 10-100, stream strike 40
88	6/10/05	LM06	4107617	337866	Gravel in outcrop, ~ 16" to contact above stream, upward fining chert cobbles

		Bayo	ou Creek Fie	Id Notes u	ised in Site Maps
	Dete	Lahal	Waypoin	t (UTM)	
U	Date	Laber	Northing	Easting	Notes concerning waypoint
89	6/10/05	LM07	4107687	337963	Pic of gravel lag, stringer, above contact, silty clay w/ interbedded sand below lag, massive silt off-white to tan above lag, contact grades coarser; contact about 32" above stage
90	6/10/05	LM08	4107789	338011	Cross channel?
91	6/10/05	LM09	4107798	337996	Lag w/ interbedding
92	6/10/05	LM10	4107985	338074	Contact about 4' above stage; clast orientation taken
93	6/10/05	LM11	4108268	338156	Good cutbank for sampling, fining upward, finer gravel, worked w/ silt, overlaid by massive silt
94	6/10/05	LM12	4108324	338149	Inter-worked sediments, 4 pics
95	6/10/05	LM13	4108631	338116	Gravel appears in lags (thick) or undulating, confluence of major tributary before wooden bridge
96	6/10/05	LM14	4108673	338068	Wooden RR bridge
97	6/10/05	LM15	4108721	338031	Pipe leaking water
98	6/10/05	LM16	4108844	337968	Ferric plume, some hard mottled clay in stream base, MW-344 at edge of stream, need to find well log (well elev. 366.14' mls)
99	6/10/05	LM17	4108970	338005	Gravel lag above firm silty clay, coarse gravel, clast orientation taken
100	6/10/05	LM18	4109133	338038	Gravel just after bridge still appearing in lag along bank, much lower however, still w/ a gravel stream base
101	6/10/05	LM19	4109345	338025	Gravel outcrop, black oxide stringer along the bank, undulating, but mostly continuous elevation
102	6/10/05	LM20	4109593	337957	Bank w/ black oxide stringer
103	6/10/05	LM21	4109618	337953	Start of lots of black oxide staining in bank w/ red staining further below
104	6/10/05	LM22	4109764	337933	Lag contact

		Bayo	ou Creek Fie	eld Notes ι	used in Site Maps
	Data	Labal	Waypoin	t (UTM)	Notoo concerning weyneint
	Dale	Laber	Northing	Easting	Notes concerning waypoint
105	6/10/05	LM23	4109962	337929	Gravel contact w/ silt above, worked grey clay between contact below, lt. grey clay below 2nd lag to stream bed, stream bed hard clay
106	6/10/05	LM24	4110058	337930	Contact, 2 photos, clast orientation taken
107	7/4/05	LM01	4207702	675603	Start of mottled clay in creek bed and bank under gravels (east bank)
108	7/4/05	LM02	4108977	337983	End of mottled clay, banks eroding
109	7/4/05	LM03	4108840	337965	Start of hard clay in creek bed again
110	7/4/05	LM04	4108779	337995	End of mottled clay in creek bed, covered bed by flat gravel scour, concurrent w/ linear feature causing an elevation change/ripple
111	7/4/05	LM05	4108707	338022	Mottled clay in deep hole in stream
112	7/4/05	LM06	4108701	338027	Could not find clastic dike in creek
113	7/4/05	LM07	4108987	338002	Gravels in outcrop subrounded, stream bearing 27°, Clast strike 294, 320, 265, 286, 20
114	7/4/05	LM08	4108995	338002	Clast strike 311, 327, 291
115	7/4/05	LM09	4112156	337169	Brushy creek stream is dry, bed load of fine subangular gravel, banks appear to be loess and modern soil.
116	7/4/05	LM10	4106380	337243	Start near SR 725 Bridge, Loess banks, well graded gravel bed load
117	7/4/05	LM11	4106383	337319	Gravels in bank, light hard mottled clay below, sharp gravel contact w/ loess, light gray clay interlensing w/ gravels
118	7/4/05	LM12	4106401	337353	More chert gravels in bank, inter- lensed w/ It gray clay, just before old bridge

		Ba	you Creek F	ield Notes	used in Site Maps
	Dete	Labal	Waypoin	t (UTM)	Notoo concerning weyneint
	Dale	Laber	Northing	Easting	Notes concerning waypoint
119	7/4/05	LM13	4106432	337361	Large gravel bar after bridge, fine gravel appears in bank above It gray clay
120	7/4/05	LM14	4106480	337416	Lt clay, hard in creek bed, gravels in bank appear to fine upward, top of gravel bed undulates, largest clast ~ 2", mean clast size 1.25"
121	7/4/05	LM15	4106493	337417	Gravel continues in banks, no longer clay base, now fine sand and gravel scour
123	7/4/05	LM17	4106519	337445	Picture w/ pen for scale showing upward fining w/ clay inter-layered
124	7/4/05	LM18	4106533	337468	Sandy to hard clay transition in creek bed
125	7/4/05	LM19	4106570	337482	Fine gravel cropping out in bank, less clay in stream bed
126	7/4/05	LM20	4106606	337499	Gravel still cropping out in bank, soft gravel stream bed
127	7/4/05	LM21	4106612	337492	Transition to hard clay stream bed
128	7/4/05	LM22	4106652	337503	Clay appears to be cementing gravel slightly above creek stage, buff-tan to off-white in color
129	7/4/05	LM23	4106650	337499	Massive silt over generally upward fining medium to fine gravel, over lt gray clay (pic)
130	7/4/05	LM24	4106674	337524	Measured Section; massive silt over ~ 25" upward fining sandy gravel bed; transitions to It gray clay.
131	7/4/05	LM25	4106706	337534	Continued gravel bed exposure
132	7/4/05	LM26	4106715	337549	Outcrop exposure w/ shovel for scale, large gravel bar opposite bank
133	7/4/05	LM27	4106801	337606	Fewer fine gravels in bank and bed, hard clay below thin gravel lenses, lots of gravel deposits in stream beds

		Bayo	ou Creek Fie	eld Notes ι	used in Site Maps
	Dete	Label	Waypoin	t (UTM)	
טו	Date	Laber	Northing	Easting	Notes concerning waypoint
135	7/4/05	LM29	4106850	337605	Pic of gravel bed w/ shovel for scale above mottled hard clay steam bed
136	7/4/05	LM30	4106870	337618	Pic of thin gravel bed w/ clay below, clay now appears higher in bank (section)
137	7/4/05	LM31	4106922	337647	Fine gravel now lower in section (creek level)
138	7/4/05	LM32	4106958	337662	Iron oxide discharge into stream (pic)
140	7/4/05	LM34	4107035	337708	Stream banks have flattened out, crossed over WKWMA horse trail, lots of gravel bars, don't appear in banks
141	7/4/05	LM35	4107083	337714	Fine gravels appear again in banks, coarse in bed load
142	7/4/05	LM36	4107102	337714	Hard cemented black gravel chunk (paver), continued gravel in banks, small area of orange (iron oxide) in stream bed
144	7/4/05	LM38	4107255	337805	Stream was straight and overgrown since last point, but now gravel appears in the banks and bars appear opposite cut banks
145	7/4/05	LM39	4107290	337812	More iron oxides in creek
146	7/4/05	LM40	4106712	337535	Gravels cropping out in bank
147	7/4/05	LM41	4106669	337496	Cemented gravel lenses "pavers"
148	10/21/05	LM01	4110266	338002	Gravel in bank, ~2' thick, large gravel bar upstream of bridge
149	10/21/05	LM02	4110252	337979	Gravel in bank continuous from LM01, some mang. staining @ creek level, Buff to orange-brown, 2.5" to pebble size clast
150	10/21/05	LM03	4110231	337959	Possible channel deposit, mixed gravel/sand at base, migrating to sand, migrating to 17" of upward fining gravel max clast size 1.5", covered by soil.

		Bayo	ou Creek Fie	eld Notes u	used in Site Maps
	Dete	Label	Waypoin	t (UTM)	
טו	Date	Label	Northing	Easting	Notes concerning waypoint
151	10/21/05	LM04	4110281	337946	Measured Section 42", see photo
152	10/21/05	LM05	4110365	337966	Med. to fine gravel over lt. gray clay, mang. staining at bed contact, clay pinches out
153	10/21/05	LM06	4110430	337966	M-C 3.5' thick gravel over It gray clay
154	10/21/05	LM07	4110584	337850	Same gravel over clay, clay is hard and extends to stream bed
155	10/21/05	LM08	4110668	337826	Fine sand deposit in stream bed
156	10/21/05	LM09	4110828	337781	Gravel outcrop above clay, no re good outcrop from LM05 to BoBo Rd. to LM09
157	10/21/05	LM10	4110994	337774	~10' cutbank, lt. tan loess over M-C gravel over gray silt in stream bed
158	10/21/05	LM11	4111179	337802	Thick clay below gravel in stream bed, clay > 4' thick
159	10/21/05	LM12	4111251	337813	Cemented gravel in place in stream above clay? pic start of increased vegetation, hard to see geology
160	10/21/05	LM13	4111536	33790	F gravel cropping out in bank, covered by overlying soil eroding off bank, steep to vertical banks ~8' high, Loess
161	10/21/05	LM14	4112189	337811	Large gravel bar, cutbank of modern soil over hard clay in creek, not much to see, spare gravel in bank, good in bed load, next to farm fields causing mud/silt drapes over outcrop
162	10/21/05	LM15	4112209	337786	Gravels in bank covered by mud drape, more sand appearing in bars/bed load, gradual decrease in gravel since entering private property, fairly continuous gravel bars or possible beds in creek?
163	10/21/05	LM16	4112242	337734	Gravel bar or bed?

		Bayo	u Creek Fie	ld Notes u	ised in Site Maps
	Data	Labal	Waypoin	t (UTM)	
טו	Date	Label	Northing	Easting	Notes concerning waypoint
164	10/21/05	LM17	4112262	337664	Large gravel bar, small tributary nearby, mud banks
165	10/21/05	LM18	4112439	337699	Pebbles to fine gravels ~ 4' above stream, ~1' thick, looks different than upstream outcrops, but could be due to mud drape, just upstream of Ogden Landing Rd. bridge
166	10/21/05	LM19	4112539	337753	Large sand bar after bridge, some gravel in opposite bank, a lot less gravel in bed load.
167	10/21/05	LM20	4112640	337826	Small gravel bar
168	10/21/05	LM21	4112662	337820	Measured section including blue- gray clay, see pic / section
169	10/21/05	LM22	4112800	337881	Gravel bars before and between riprap flood control structures
170	10/21/05	LM23	4113088	338021	Blue-gray mud in creek, standing on sand next to field drainage ditch
171	10/21/05	LM24	4113123	337997	Small gravel / sand bar
172	10/21/05	LM25	4113157	337974	Small gravel / sand bar / Fe oxide deposits, several deep pools in this stretch of creek
174	10/21/05	LM27	4113546	337996	Blue-gray clay in bank, see pic / section
175	10/21/05	LM28	4113803	338183	Very little gravel after deep pools, now mostly sand bars and sand in bed load
176	10/21/05	LM29	4108148	336758	Creek very deep, and snaggy due to beaver dams and downed trees from LM28 to low water bridge

		Little E	Bayou Creek	<b>Field Not</b>	es used in Site Maps
	Data	Labol	Waypoin	t (UTM)	Notos concorning waynaint
	Dale	Laber	Northing	Easting	notes concerning waypoint
27	7/13/04	LM29	4109477	341383	Sandy stream bed, shoaling behind dead fall / banks clay
28	7/13/04	LM30	4109516	341428	Small gravel bar, cemented grains with Fe-Manganese? / clay banks
29	7/13/04	LM31	4109589	341441	Pebble lens (picture)
30	7/13/04	LM32	4109810	341421	3 pebble banding pictures of upper continental
31	7/13/04	LM33	4109868	341429	Pebble lens (picture)
32	7/13/04	LM34	4109969	341438	Pebble lense(17'L, 1'Max H)
33	7/13/04	LM35	4110092	341459	Pebble lens (19'L, ?H)
34	7/13/04	LM36	4110342	341413	Gravel lags exposed on both sides of the creek, <1' thick
35	7/13/04	LM37	4110982	341293	Gravel appears to have coarsened to cobble size, lags are frequent but appear discontinuous
36	7/13/04	LM38	4111018	341303	Coarse sand bars and gravel lags in stream bed
37	7/13/04	LM39	4111254	341038	Coarse gravel bar
38	7/13/04	LM40	4111291	340995	NS diversion ditch???
41	7/13/04	LM43	4111885	340966	Lots of debris in water causing pooling >4'
42	7/13/04	LM44	4112139	340997	Fine grained sand
43	7/13/04	LM45	4112287	341022	Large cut bank w/ white silty sand, Cut bank mostly composed of clay, weakly Fe cemented sand "flag stones" in creek bed
44	7/13/04	LM46	4113251	340959	WB 1.5
45	7/13/04	LM47	4113295	340911	Lower Cont. Deposit
46	7/13/04	LM48	4113482	340857	Lower Cont. Deposit thickened to ~3' above stream level
47	7/13/04	LM49	4113581	340828	Seep (317us / 15.7 C)
48	7/13/04	LM50	4113677	340825	Fe cemented material no longer present in stream bed
49	7/13/04	LM51	4113832	340801	Visual contact of LC/UC ~1' above stream level
50	7/13/04	LM52	4114034	340637	(131us / 16.6C)

		Little	Bayou Cree	k Field Not	es used in Site Maps
л	Data	Labol	Waypoin	t (UTM)	Notos concerning waynoint
	Dale	Laber	Northing	Easting	Notes concerning waypoint
51	7/13/04	LM53	4114126	340597	(149us / 15.8C)
53	7/13/04	LM55	4114218	340549	Last visual west bank seep
54	7/13/04	LM56	4114261	340528	Ash pond seep, east bank (1110us / 16.2 C)
55	7/13/04	LM57	4114279	340519	Ash pond seep, east bank (1314us / 16.4 C) / west bank seep (250us / 18C)
56	7/13/04	LM58	4114565	340376	LC reappears on east bank, east bank boil (325us / 16.2C)
57	7/13/04	LM59	4114564	340362	East bank seep (328us / 16.4C)
58	7/13/04	LM60	4114567	340354	East bank seep (327us / 16.3C)
59	7/13/04	LM61	4114580	340347	West bank seep (186us / 16.6C)
60	7/13/04	LM62	4114774	340237	LC crops out on both banks
61	7/13/04	LM63	4115076	340204	Confluence of Bayou / Little Bayou
69	8/17/04	LM71	4114874	340224	Gravel deposit in cut bank, showing some preferred clast orientation (strike long axis 90-130; dip 350-40), Gross upward fining sequence evident in "cycles", clast up to 4.5" long axis, chert gravel
70	8/17/04	LM76	4114821	340225	(near LM62) thinner gray soil layer than LM71, similar leach horizon, can't see contact w/ gravel due to erosion
71	8/17/04	LM77	4114771	340243	Gravel deposit @~ the same height as LM71, covered by soil and silt, ~ 8' above stream level

		Little	Bayou Cree	k Field Not	es used in Site Maps
	Dato	Labol	Waypoin	t (UTM)	Notes concerning waynoint
	Date	Laber	Northing	Easting	Notes concerning waypoint
72	8/17/04	LM78	4114768	340278	Chert gravel deposit, similar size range to other deposits, ~ 5-6' above stream stage, Long axis orientation, Strike 90, 30-50, 45, 10, 52, 310; Dip 29, Upward fining sequence w/ irregular but sharp contact w/ overlying silts
73	8/17/04	LM79	4114645	340323	Gravel layer, scoured upper contact ~5' above stream stage, upward fining sequence, w/ sharp irregular upper contact w/ overlying silts, clast orientation strike: 90,100,30- 50,45,10,52,310; dip: 29 (modern stream strike 329), this gravel layer seems to be supporting the modern stream terrace, defining a fairly consistent break in slope
82	8/18/04	LM88	4113262	340948	Gray clay above gravel?
83	6/8/05	LM01	4113241	340964	Dark gray clay washing into creek (from ash pond?)
84	6/8/05	LM02	4113262	340963	Areas appear to contain organic material, but appears modern
85	6/8/05	LM03	4113381	340879	Sampled
86	6/8/05	LM04	4113391	340879	Sampled / hand augered / photo
87	6/8/05	LM05	4114870	340231	Attempted sampling location on LBC near confluence. (Pit 3X5X4'), 2 hand auger samples taken. 1 at contact ~ 15" into back of pit and 1 ~5" deep in contact 20" below contact

# APPENDIX E

Grain-size distribution curves from

Optically Stimulated Luminescence sample preparation.

Map	Graph		Weight (	g) obtaine	d above s	ieve (mes	h in μm)		Mass pre	Mass post	
ē	Label	1000	500	250	180	125	90	<90	sieving (g)	sieving (g)	% Loss
177	LM01 L	116.01	15.48	54.9	12.54	4.54	0.89	0.84	206.61	205.2	0.68%
177	LM01U	0	0.17	7.34	31.31	38.92	23.62	64.28	176.72	165.64	6.27%
178	LM02	97.62	14.55	51.76	17.67	5.86	2.31	8.76	200.52	198.53	0.99%
179	LM03 L	15.35	13.99	39.61	21.01	19.32	10.94	71.28	199.25	191.5	3.89%
179	LM03 U	57.15	18.71	38.45	11.05	6.35	2.67	8.89	144.45	143.27	0.82%
180	LM04	12.72	14.13	26.48	18.42	23.07	14.19	86.77	199.47	195.78	1.85%
182	LM06	6.64	1.08	12.03	13.89	11.61	11.54	73.43	133.67	130.22	2.58%
183	LM07	87.96	14.79	12.43	2.18	0.87	0.25	0.94	124.38	119.42	3.99%
184	LM08			sample ha	ad to be w	et sieved			160.14	NA	NA

# Grain-size distribution data from OSL sample preparation.



# **Grain Size Distribution Curve**



# **Grain Size Distribution Curve**



**Grain Size Distribution Curve** 



**Grain Size Distribution Curve** 






## **Grain Size Distribution Curve**



# **Grain Size Distribution Curve**



### **Grain Size Distribution Curve**

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