

TVA Allen Fossil Plant Groundwater Flow & Solute Transport Modeling Report

Allen Fossil Plant

Memphis, Tennessee

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Prepared for:

Tennessee Valley Authority Chattanooga, Tennessee

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ABBREVIATIONS

ACC	Allen Combined Cycle Plant
ALF	Allen Fossil Plant
amsl	above mean sea level
ASTM	American Society for Testing and Materials
CAESER	Center for Applied Earth Science and Engineering Research
CCR	coal combustion residuals
CSM	conceptual site model
COCs	constituents of concern
CPT	Cone Penetrometer Test
DEM	Digital Elevation Model
EVS	Earth Volumetric Studio
EW	extraction well
ft	feet
ft bgs	feet below ground surface
ft/ft	feet per foot
ft/day	feet per day
ft²/day	square feet per day
gpm	gallons per minute
IRA	Interim Response Action
Kh	horizontal hydraulic conductivity
Kv	vertical hydraulic conductivity
MCLs	maximum contaminant levels
MERAS	Mississippi River Valley Alluvial Aquifer System
µg/L	micrograms per Liter
MLGW	Memphis Light, Gas and Water Division
NOAA	National Oceanic and Atmospheric Administration
NGVD29	National Geodetic Vertical Datum of 1929
PMW	performance monitoring well
RIR	Remedial Investigation Report
RSS	Residual Sum of Squares
RSTD	Residual Standard Deviation
TVA	Tennessee Valley Authority
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey



1.0 INTRODUCTION

The Tennessee Valley Authority (TVA) developed a groundwater flow and transport model (the Model) for the Allen Fossil Plant (ALF) in Memphis, Tennessee. The location of ALF and its surroundings is presented in **Figure 1-1**. The Model was developed to support specific proposed remedial actions focused on the East Ash Disposal Area, which was used to manage coal combustion residuals (CCR) while ALF was operational, and to be used to support a comprehensive regional groundwater flow framework for future projects that require modeling support.

This report presents the findings and results of groundwater modeling activities performed to meet the objectives described above based on available data at the time of construction of the Model. Future updates to the Model are anticipated as additional data are obtained.

1.1 SITE HISTORY

The Site is defined as the area within the property boundary, including the Allen Combined Cycle Plant (the ACC), the East and West Ash Disposal Areas, and the subsurface investigation and monitoring well locations. ALF was constructed in 1959 by Memphis Light, Gas and Water Division (MLGW) and consisted of three coal-fired electric generating units. TVA began operating ALF in 1965, and the East and West Ash Disposal Areas were used to manage CCR. By 1993, the West Ash Disposal Area no longer received sluiced ash, and by 2015, the area was retrofitted to no longer receive flows or impound water. The East Ash Disposal Area ceased receiving CCR in 2018 and ceased receiving all types of flows in 2019. A facility location map and detailed site map have been included as **Figures 1-1** and **1-2**.

1.2 GROUNDWATER FLOW MODEL OBJECTIVES AND USAGE

The overall objective of the modeling activities is to create a quantitative tool capable of predicting groundwater flow and transport of potential CCR constituents of concern (COC) under varying conditions to evaluate groundwater management scenarios and remedial strategies. The specific objectives of the modeling activities are summarized below:

- Develop and calibrate a numerical groundwater flow model of ALF using site-specific and regional hydrogeologic and hydrologic properties. The Model was constructed to:
 - Incorporate the approximately 500-acre ALF property including the East and West Ash Disposal Areas;
 - Include the subsurface heterogeneity noted in the Alluvial aquifer during previous investigation activities;
 - Capture observed patterns of groundwater flow direction and velocity in the Alluvial aquifer; and



- Include simulation of relevant hydrological features, such as the interaction between Lake McKellar and the Alluvial aquifer.
- Link the groundwater flow model with a contaminant transport model to evaluate the fate and transport of COCs.
- Provide a framework for predictive modeling including:
 - Performance of interim hydraulic capture systems; and
 - Influence of ash disposal area closure activities (i.e., dewatering) on the hydraulic system and fate and transport of COCs.

1.3 REPORT ORGANIZATION

This report is organized into twelve sections, including this introductory chapter. Section 2 presents the model development approach, Section 3 summarizes the data compiled for the development of the model, and Section 4 presents the conceptual site model (CSM) for ALF. The numerical code selected to prepare the groundwater model is described in Section 5, with the model construction, calibration, and sensitivity analysis presented in Sections 6, 7, and 8, respectively. Predictive simulations conducted with the model are summarized in Section 9, conclusions and recommendations are presented in Section 10, and limitations of the modelling are presented in Section 11. Cited references are presented in Section 12.

2.0 MODEL DEVELOPMENT APPROACH

The Model has been developed in general accordance with American Society for Testing and Materials (ASTM) Standard D5547 - Guide for Application of a Numerical Groundwater Flow Model to a Site-Specific Problem (ASTM, 2017) and was designed to be consistent with the objectives outlined above.

The modeling approach was to develop a sub-watershed scale transient groundwater flow model of the Alluvial aquifer and couple the flow model with transport models to evaluate potential migration of constituents of concern (COCs) in groundwater. Although available hydrogeologic data is primarily available within the limits of ALF property, the sub-watershed scale was selected to accommodate naturally occurring boundary conditions located, where possible, distal to the primary areas of concern (i.e., the East Ash Disposal Area and the West Ash Disposal Area). A transient model was selected to evaluate the objective of simulating time-varying groundwater and surface water stresses and responses resulting from seasonal and precipitation-related groundwater-surface water interactions.

The objectives are focused on understanding the hydrogeologic system and potential fate and transport of COCs associated with the storage of CCR. Because CCR material is present in disposal areas near the ground surface, the model was more finely discretized in the upper portion of the Alluvial aquifer. However, the full thickness of the Alluvial aquifer was included to allow for simulation of the integrated groundwater-surface water flow system. Other numerical models completed in the area have included portions of the aquifers underlying the Alluvial aquifer (**Section 2.1**); however, these models were completed for different objectives and were not suitable to evaluate the site at the scale necessary for this study. The vertical extent of the Model was limited to the Alluvial aquifer to concentrate on the area of concern. Finally, the flow model was used to evaluate groundwater flow paths and velocity and was coupled with a contaminant transport model to evaluate COC distribution as a result of advection, dispersion, and partitioning in the subsurface.

To accomplish the approach outlined above, the Model was constructed using the three-dimensional finite-difference MODFLOW2005 computer code developed by the United States Geological Survey (USGS) (Harbaugh, 2005; Harbaugh et al., 2017) coupled with a modular 3-D multi-species transport model (MT3DMS) for simulation of advection, dispersion, and chemical reactions of constituents in the groundwater system (Zheng and Wang, 1999). These programs were selected because they are thoroughly documented; widely used by consultants, government agencies, and researchers (including several projects that include or are adjacent to the study area); and are consistently accepted by regulatory agencies.

2.1 HISTORICAL MODEL STUDIES

The following modeling studies have been completed in or proximal to the study area:

• Hydrogeology and Ground-Water Flow in the Memphis and Fort Pillow Aquifers in the Memphis Area, Tennessee: U.S. Geological Survey Water-Resources Investigations Report 89-4131. A groundwater flow model built to simulate groundwater flow within the Memphis aquifer in the Memphis area to



evaluate the potential for leakage between the principal aquifers and assist in managing groundwater resources (Brahana and Broshears, 2001).

- Recalibration of a Ground-Water Flow Model of the Mississippi River Valley Alluvial Aquifer of Northeastern Arkansas, 1918-1998, with Simulations of Water Levels Caused by Projected Ground-Water Withdrawals through 2049: U.S. Geological Survey Water-Resources Investigations Report 03-4109 prepared in cooperation with the Arkansas Soil and Water Conservation Commission and the United States Army Corps of Engineers (USACE), Memphis District. A groundwater flow model of the Mississippi River Valley Alluvial Aquifer of Northeastern Arkansas (bordering the study area) used to evaluate the impact of increasing pumping from the Alluvial aquifer (Reed, 2003).
- The Mississippi Embayment Regional Aquifer Study (MERAS): Documentation of a Groundwater-Flow Model Constructed to Assess Water Availability in the Mississippi Embayment: U.S. Geological Survey Scientific Investigations Report 2009-5172. The USGS Mississippi Embayment Regional Aquifer System (MERAS) groundwater-flow model was developed as a tool to estimate available groundwater within the Mississippi embayment aquifer system (Clark and Hart, 2009).
- Preliminary Evaluation of the Hydrogeology and Groundwater Quality of the Mississippi River Valley Alluvial Aquifer and Memphis Aquifer at the Tennessee Valley Authority Allen Power Plants, Memphis, Shelby County, Tennessee: U.S. Geological Survey Open-File Report 2018-1097 prepared for the Tennessee Valley Authority in cooperation with the University of Memphis, Center for Applied Earth Science and Engineering Research [CAESER]. The MERAS groundwater-flow model was used to evaluate the potential influence of operation of Allen Combined Cycle (ACC) plant extraction wells on the Memphis aquifer over a 30-year simulation period (Carmichael, et al., 2018).
- Application of Numerical Tools to Investigate a Leaky Aquitard Beneath Urban Well Fields. A groundwater flow model built to evaluate potential leakage through the aquitard overlying the Memphis aquifer that incorporates nine active MLGW well fields within the Memphis area (Jazaei, et al. 2018).

These models were reviewed during the development of the hydrogeologic CSM and planning for the Model construction phase. The Model was developed based in part on the parameters and model design used within these models for the areas outside of ALF. **Figure 2-1** presents the ALF model domain within the above historical model domains.

3.0 DATA COMPILATION

Development of the Model required the collection and analysis of hydrogeologic and hydrologic data pertinent to the characterization of the model study area. The study area includes ALF and the surrounding areas that are relevant to simulate groundwater flow within the model domain. The model study area is expanded to include the alluvial floodplain where ALF is located, and a portion of the loess covered uplands east of the alluvial flood plain.

The data compilation task was necessary to provide the basis for constructing model input files. Available data pertinent to the development of the hydrogeologic CSM, construction of the groundwater flow model and definition of the predictive simulations was assembled, compiled, reviewed, evaluated, and reduced into a usable format.

As discussed in **Section 2.1**, the study area has been the subject of several previous modeling studies. In addition to these studies, a review of data was completed to develop the hydrogeologic conceptual model and assist in the construction and simulation of the groundwater flow model. Data compiled for incorporation into the groundwater flow model included:

- Stratigraphic data from 113 soil borings, 32 cone penetrometer test (CPT) locations, 68 monitoring well and extraction well lithologic logs and associated well construction details.
- Geologic and topographic maps including:
 - Surficial Geologic Map of the Southwest Memphis Quadrangle, Shelby County, Tennessee, and Crittenden County, Arkansas (Moore and Diehl, 2004);
 - Fletcher Lake Quadrangle Arkansas-Tennessee (2014), USGS 7.5-Minute Series; and
 - Tennessee Geologic Map (USGS, 2005).
- Publications pertaining to hydrogeologic features and boundaries, including faults, geology, and streams.
- Historical groundwater level data for piezometers and monitoring wells.
- Aquifer testing results.
- Groundwater quality sampling results for two pilot extraction wells (EW-series), performance monitoring wells (PMW-series) and monitoring wells (ALF-series).
- Precipitation data from the National Oceanic & Atmospheric Administration's (NOAA) Memphis International Airport, TN US USQ00013893 Station.
- Stream flow data from USGS stream gauge number 07032000 Mississippi River at Memphis, Tennessee and on-site river gauge operated by TVA.

The data reviewed and compiled is explained in more detail in subsequent sections of this report.



4.0 Hydrogeologic Conceptual Site Model

4.1 STUDY AREA DESCRIPTION

ALF is a retired coal-fired power plant located in Shelby County in the southwest corner of the City of Memphis, Tennessee (**Figure 1-1**). ALF is located on the southern shore of Lake McKellar, on the eastern bank of the Mississippi River and adjacent to a USACE flood-control levee. The local topography is relatively level except for the USACE levee and the CCR disposal area dikes, which rise approximately 20 to 25 feet (ft) above the surrounding land surface. ALF contains two ash disposal areas, the East Ash Disposal Area and West Ash Disposal Area (**Figure 1-2**). The surface area of the East Ash Disposal Area is approximately 80 acres and is located east of the former coal yard and inactive powerhouse. The surface area of the West Ash Disposal Area is approximately 18 acres and is located west of the powerhouse. The study area is defined by the Model domain and pertinent regions extending beyond the Model domain. The study area includes the Horn Lake Cutoff water diversion channel, uplands to the east, and the Mississippi River valley to the west and south.

4.2 REGIONAL STRATIGRAPHY AND GEOLOGY

ALF lies within the Mississippi Alluvial Plain, which is adjacent to the western boundary of the Gulf Coastal Plain of the Coastal Plain physiographic province (**Figure 4-1**). The Mississippi Alluvial Plain is relatively flat with alluvial deposition features, and the East Gulf Coastal Plain is characterized by loess covered hills and bluffs (Parks, 1990).

ALF is in the north-central part of the Mississippi Embayment geological depositional environment. The Mississippi Embayment is a geologic basin filled with 3,000 ft or more of Cretaceous to Recent age sediments deposited primarily in an ancestral Coastal Plain setting. The sedimentary sequence is dominated by unconsolidated sand, silt, and clay with minor lignite (Hosman and Weiss, 1991).

Regional fault zones have been identified to have northeast-southwest and northwest-southeast trends (Kingsbury and Parks, 1993). Vertical displacement ranging from 50 to 150 ft has been identified in the Memphis aquifer and its underlying Fort Pillow aquifer (Kingsbury and Parks, 1993).

The terrace deposits (also referred to as fluvial-terrace deposits in some literature references) are fluvial deposits which overlie the upper Claiborne confining unit in the uplands east of the Mississippi Alluvial Plain and were deposited during the Pleistocene. Loess overlies the terrace deposits and primarily consist of wind-blown silt, silty clay, and some sand derived from alluvium deposited within the valley (Waldron, et al., 2011; Leighton & Willman, 1950).

The alluvium of the Mississippi River Valley Alluvial Aquifer (Alluvial aquifer) was deposited during the Quaternary within the Mississippi Alluvial Plain. The alluvium can be separated into two general units, the upper alluvium and the lower alluvium, both primarily derived from reworked older Pleistocene deposits (Boswell, et al., 1968). The upper alluvium deposits generally consist of silty sand with intervals of silts



and clays that reflect the meandering river depositional environment. The lower alluvium consists of sand and gravel deposited by the higher energy glacial meltwater river system.

TVA's groundwater modeling efforts have focused on the near surface hydrogeologic units most likely to be influenced by operations at ALF. These units include the Alluvial aquifer, which is divided into the upper alluvium and the lower alluvium, in addition to loess deposits, terrace deposits, and the upper Claiborne confining unit. **Table 4-1** summarizes the Model's stratigraphic divisions compared to unit divisions in the *Preliminary Evaluation of the Hydrogeology and Groundwater Quality of the Mississippi River Valley Alluvial Aquifer and Memphis Aquifer at the Tennessee Valley Authority Allen Power Plants, Memphis, Shelby County, Tennessee (Carmichael, et al., 2018). A generalized geologic map and regional cross-section adapted from the USGS Professional Paper 448-E (Boswell, et al., 1968) are included as Figures 4-2 and 4-3, respectively, to provide a regional perspective of the stratigraphy and depositional environment. A conceptual cross-section and stratigraphic column illustrating the stratigraphy distribution within the model layers and a conceptual block model diagram are presented as Figures 4-4 and 4-5.*

4.3 SURFACE WATER

The hydrogeological system within the study area is dominated by the Mississippi River, but is also influenced by anthropogenic features. The Mississippi River at the mouth of Lake McKellar drains 932,700 square miles at an average flow rate of 360,000 cubic ft per second (DOE, 1981). The bathymetry mapped by the USACE of the Mississippi River west of the Site displays the deepest part of the river (approximately 40 to 60 ft below Low Water River Plane) at the eastern boundary of the study area, south of where Lake McKellar intersects the Mississippi River (USACE, 2016). **Figure 4-6** presents the USACE's bathymetry maps of the Mississippi River adjacent to the study area (from approximately river mile marker 724 to 726) from 1964 through 2004.

Lake McKellar is located along the northern boundary of ALF. Lake McKellar is an artificial cut-off meander of the Mississippi River and was formerly known as the Tennessee Chute. The lake was created as a deep-water harbor for the City of Memphis in 1948. The southern and eastern shores of President's Island have been developed as an industrial area. The mouth of Lake McKellar meets the Mississippi River at approximately mile marker 725.5. The lake is approximately seven miles long and receives drainage from Nonconnah Creek, Cypress Creek, and miscellaneous unnamed small streams and runoff. Lake McKellar has an average yearly discharge of approximately 302 ft per second into the Mississippi River (DOE, 1981).

The Mississippi River's elevations fluctuated up to approximately 46 ft at the West Memphis USGS gaging station between October 2014 and December 2018 (USGS stream gauge number 07032000 Mississippi River at Memphis, Tennessee). Water levels in Lake McKellar displayed up to 43 ft of elevation fluctuation between September 2017 and December 2018, with elevations ranging from 175 to 219 ft. A hydrograph of Lake McKellar stage data collected at ALF is included in **Appendix A**.

As the water level in the Mississippi River or Lake McKellar rises as a result of precipitation, rapid snow melt, or release of water from reservoirs upstream, it becomes higher than the surrounding groundwater. The hydraulic pressure gradient causes water to move from the surface water into the banks where it is

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temporarily stored. This process is termed bank storage. During high water events, surface water is pushed into the bank and becomes groundwater. When the river level subsides, the water that flowed into the bank reverses flow back into the river. The interaction between surface water and groundwater can influence groundwater quantity, flow direction, and chemistry.

The upland loess hills are characterized by a network of small streams that are tributaries of the Mississippi River, Lake McKellar, and the Horn Lake Cutoff (Moore and Diehl, 2004). The Horn Lake Cutoff is a water control feature that lies north and west of the uplands, discharging into Horn Lake located south of the Site.

4.4 STUDY AREA HYDROGEOLOGY

Various subsurface investigations have been conducted at ALF to characterize the geology, evaluate slope stability of dikes, monitor groundwater elevations and quality, evaluate potential water supplies, and develop remedial alternatives for groundwater impacts. **Figure 4-7** displays monitoring well, extraction well, soil boring, and CPT locations at ALF. **Tables 4-2** and **4-3** provide a summary of monitoring well and subsurface boring construction details. The stratigraphy at the Site (**Figure 4-3**) consists of the following units listed generally in order of increasing depth and corresponding age of deposition from Recent to Eocene:

- Fill
- Ash disposal areas
- Alluvial aquifer
 - upper alluvium
 - lower alluvium
- Loess
- Terrace deposits
- Upper Claiborne confining unit

These stratigraphic units define the vertical extent of the model and are discussed in greater detail in the following sections.

4.4.1 Fill

Fill, excluding CCR, is locally present beneath areas of Site, specifically in areas that have been developed. The fill generally consists of alluvium dredged from Lake McKellar and materials from cut and fill excavations from the surrounding floodplain. The fill can range in thickness from a few feet to tens of feet beneath industrial areas in the river floodplain (Stantec, 2019b). The fill material is generally above the water table and is not considered to be significant to the development groundwater flow model.

4.4.2 Ash Disposal Areas

The following sections will briefly describe the ash disposed at the Site.



4.4.2.1 Composition

The ash disposal areas have been used for storage of fly ash, bottom ash and boiler slag from coal burning at the ALF (Stantec, 2016). Ash samples were collected from five locations within the East Ash Disposal Area. Nineteen ash samples were collected from various depths (generally less than 20 feet below ground surface (ft bgs)). Moisture contents ranged from 12% to 80% with a median of approximately 35% (Stantec, 2019b).

4.4.2.2 Extent and Structure

Two ash disposal areas are located at the Site, the West Ash Disposal Area and East Ash Disposal Area. The surface area of the East Ash Disposal Area is approximately 80 acres and is located east of the former coal yard and non-operational power plant. The surface area of the West Ash Disposal Area is approximately 18 acres and is located west of the powerhouse. The bottom of both ash areas is approximately 210 ft in the National Geodetic Vertical Datum of 1929 (ft NGVD29) and generally flat (TriAD, 2017). Both areas are shown in **Figure 1-2**.

4.4.2.3 Hydraulic Properties

Laboratory permeameter tests of soil samples collected at ALF indicated a vertical hydraulic conductivity of hydraulically emplaced ash of 0.085 feet per day (ft/day) (Stantec, 2011). Heyman et al. (2017) estimate that the Kv of CCR can range from 2.83×10^{-2} ft/day (fly ash with or without bottom ash) to 2.83 ft/day (bottom ash). Heyman et al. (2017) estimated the horizontal hydraulic conductivity (Kh) of CCR can range from 2.83×10^{-2} ft/day (fly ash without bottom ash layers) up to 28.3 ft/day (bottom ash).

Heyman et al. (2017) suggest that the specific yield of CCR is typically in the range of 5-15% for fly ash and 20-30% for bottom ash. Total porosity typically ranges from 40-50%.

4.4.2.4 Water Quality

Ash pore water is trapped between submerged ash particles and is not considered to be groundwater nor ponded surface water. As part of the remedial investigation, ash pore water samples were collected from 20 locations within the East Ash Disposal Area. At each location, filtered and unfiltered samples were collected from various depths between the top of the saturated interval to approximately 27.5 ft bgs.

Arsenic was detected in filtered ash pore water at concentrations ranging from 2.5-13,800 micrograms per liter (μ g/L), with an average of 1,624 μ g/L (which was estimated using detectable concentrations). A similar arsenic concentration range was observed in unfiltered samples (1.4-13,700 μ g/L). Fluoride was detected in filtered ash pore water at concentrations ranging from 0.14-8.6 mg/L, with an average of 3.68 mg/L. A similar fluoride concentration range was observed in unfiltered samples (1.4-15 mg/L). Lead was detected in filtered ash pore water at concentrations ranging from 0.027-66.3 μ g/L, with an average of 4 μ g/L. A wider lead concentration range was observed in unfiltered samples (0.029-1,300 μ g/L). Filtered and unfiltered pH ranged from 7.20 to 12.00 standard pH units (SU), with an average of 10.17 SU. Complete analytical results for the filtered and unfiltered samples are reported in Remedial Investigation Report (RIR) **Tables 6-17a** and **6-17b** (Stantec, 2019b).



Pore water samples from the East Ash Disposal Area exhibited concentrations of most parameters below the maximum concentrations reported for pore water at other coal combustion facilities (Roy, et al., 1981; DaSilva, et al., 2018) except for arsenic.

4.4.2.5 Sluiced Water

The sluiced water in the East Ash Disposal Area was maintained at a surface elevation between 225 and 226 ft NGVD29 when the actively receiving CCR.

4.4.3 Alluvial Aquifer

4.4.3.1 Composition

Regionally, the Alluvial aquifer is composed of sand, gravel, silt, and clay. The deposits consist of fine sand, silt, and clay in the upper portion of the unit and sand and gravel in the lower portion of the unit (Parks, 1990).

The upper portion of the Alluvial aquifer consists predominantly of overbank deposits on the flood plain of the Mississippi River. The fine-grained deposits are not uniformly distributed through the upper Alluvial aquifer and likely act as a heterogenous leaky confining unit (Carmichael, et al., 2018). A clay interval described as silty clay with interbedded very fine-grained sand underlies the overbank deposits and has been identified by Carmichael, et al. (2018) as the blue clay interval. The term "blue clay interval" was introduced in *Preliminary Evaluation of the Hydrogeology and Groundwater Quality of the Mississippi River Valley Alluvial Aquifer and Memphis Aquifer at the Tennessee Valley Authority Allen Power Plants, Memphis, Shelby County, Tennessee* (Carmichael et al, 2018) and is described as follows:

"The blue clay interval is composed of blue-gray silty clay and interbedded very fine-grained sand. The thickness of this interval ranges from less than 1 ft in the boring for monitoring well MW 3A and in stratigraphic test hole P-4c to 27 ft in test hole 212c. The designation of the blue clay interval is based on the presence of laminated to massive blue-gray silty clay that contains calcium carbonate and, in most cases, weathered millimeter-sized calcium carbonate gastropod shells. Fining-upward beds that are 1 to 4 ft thick and composed of very fine-grained sand to silt are interbedded with the clay."

As cited above, the blue clay interval ranges from 1 to 27 feet in thickness and is composed of very finegrained sand to silt interbedded with clay. The blue clay interval was likely deposited in a shallow lake environment resulting from an oxbow lake during the Pleistocene epoch (Carmichael, et al., 2018). The blue clay interval generally represents the lower limit of the fine-grained sediment zone in the alluvium. While the presence, depth and thickness of blue clay is variable across the investigated area, the presence of interbedded fine-grained sediments in the upper portion of the alluvium is pervasive.

The lower portion of the Alluvial aquifer consists of fine to coarse-grained sand and gravel deposits with minor lenses of silt and lignite interspersed throughout the sediment column. In general, the sediments fine upward from gravel to sand to silty sand and minor interbedded silt intervals. As described in **Section 4.2**, these deposits are believed to have originated as glacial valley-train transported to and deposited within the Mississippi River Valley (Carmichael, et al., 2018). Site-specific data collected through boring

advancement and monitoring well installation indicate Alluvial aquifer deposits consisting of fine- to medium-grained silty sand with intervals of clayey silty sand, clayey sand, sandy silt, clayey silt, and silty clay in the alluvium underlain by fine- to coarse-grained sand with trace to common fine- to coarse-grained gravel in the lower alluvium. The lithology observed during subsurface investigations at ALF are displayed on cross-sections included as **Figures 4-8** through **4-13**. Boring logs recording subsurface observations are included as **Appendix B**.

4.4.3.2 Extent and Structure

The Alluvial aquifer is consistently present beneath the Site and overlies the upper Claiborne confining unit within the Mississippi Alluvial Plain. In the area of the PMW-11 series wells where the upper Claiborne confining unit is not present, the Alluvial aquifer overlies the Memphis aquifer. The Alluvial aquifer does not extend past the boundary between the Mississippi Alluvial Plain and the Coastal Plain that is roughly defined by the uplands south and east of the Site (Parks, et al., 1995).

The average regional thickness of the Alluvial aquifer is approximately 100 ft with maximum thicknesses up to 250 ft (Boswell, et al., 1968). Site-specific data collected at the Site indicate that the thickness of this unit ranges from 111 to 225 ft, with the thickest part of the unit observed in borings PMW-11C and ALF-212C along the southeastern margin of the East Ash Disposal Area. Observed thicknesses of the upper alluvium and lower alluvium have been presented in **Figure 4-14** and tabulated in **Table 4-4**.

Stantec reviewed 223 historical and recent subsurface logs for borings, CPT, and wells completed at the Site and identified 56 unique locations that reached the bottom of the upper alluvium and 26 borings that reached the bottom of the lower alluvium. The bottom of the upper and lower alluvium is presented in **Figures 4-15a and 4-15b**, respectively. Boring Logs are included in **Appendix B**.

The blue clay interval (generally representative of the lower limit of the upper alluvium) may extend beyond the mapped area; however, the lithologic descriptions in other borings logs are not specific enough to definitively define the upper and lower elevations of the fine-grained clay, silty clay, clayey silt, silt, and clayey sand that defines this interval. Detailed lithologic observation and natural gamma ray logs were used to establish the presence of the blue clay in the two most important areas of interest where the groundwater remedy will be implemented (the north and south areas).

4.4.3.3 Hydraulic Properties

Groundwater in the Alluvial aquifer is present under unconfined to leaky confined conditions with variable saturated thickness. The saturated thickness is dependent on the water table elevation, which fluctuates along with the Mississippi River and Lake McKellar stage and with recharge from precipitation.

Regionally, the Alluvial aquifer has a Kh ranging between 90 and 992 ft/day (see **Table 4-5)**. No published sources of Kv were available in the literature reviewed in this investigation. The Alluvial aquifer portion of the MERAS model proximal to the Site (MERAS Layer 1) was assigned a hydraulic conductivity of 166.7 ft/day and a specific storage of 4.03×10^{-3} ft⁻¹ (Clark and Hart, 2009). Estimates of transmissivity within the Alluvial aquifer range from 8,500 to 50,000 ft/day and estimates of storage coefficients in deeper portions of the Alluvial aquifer range from 1.0×10^{-4} to 4.0×10^{-2} (Brahana and Broshears, 2001).



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Single well rising head aquifer testing (slug testing) was completed at 32 monitoring wells to estimate hydraulic conductivity of the Alluvial aquifer (Stantec, 2019b). A summary of the slug test analyses results by well is in **Table 4-6**.

In December 2018, pumping tests were conducted at extraction wells EW-N02 (north area) and EW-S03 (south area), both screened within the upper alluvium. These tests were used to estimate transmissivity and hydraulic conductivity values representative of the upper alluvium north and south of the East Ash Disposal Area. The estimated hydraulic parameters calculated using results from the aquifer analysis are summarized in **Tables 4-7** and **4-8** (Stantec, 2019a).

A summary of samples collected from the Alluvial aquifer and analyzed using ASTM D 5084 Method C to estimate vertical hydraulic conductivity is provided in **Table 4-9**.

A figure summarizing the average horizontal and vertical hydraulic conductivity values available for the Alluvial aquifer at locations across the Site is presented in **Figure 4-16**.

4.4.3.4 Estimated Yields

Cushing et al. (1964) noted that the alluvial deposits were capable of yielding large amounts of groundwater. Well yields up to 4,000 gallons per minute (gpm) were observed by Stephenson and others (1928).

At ALF, two extraction wells (the Harsco wells) were installed in September 1971 and August 1979 by Harsco Corporation (Harsco), formerly known as Reed Minerals. The driller's logs indicate the Harsco wells could yield up to 500 gpm. Both were completed in the lower alluvium. The active Harsco well was operated at 300 gpm for eight to nine hours per day approximately five days per week (averaging of approximately 80 gpm) until December 2018 when the Harsco wells were taken out of service. The Harsco wells have not been permanently closed; however, there are no known plans to restart extraction from the Harsco wells.

In December 2018, the constant rate drawdown tests completed in upper alluvium extraction wells EW-N02 and EW-S03 indicated sustainable yields of 10.8 gpm and 30.1 gpm, respectively. Results from the 24-hour constant rate pumping test are summarized in **Table 4-8**.

4.4.3.5 Water Quality

In 2017, USGS CAESER collected groundwater samples at the ACC Plant from wells completed in the Alluvial aquifer and Memphis aquifer to compare water quality of the two aquifers. The Alluvial aquifer was observed to have higher specific conductance, total dissolved solids, and arsenic levels in groundwater compared to the Memphis aquifer. Groundwater chemistry displayed similar characterization of major ions across both aquifers; however, the ions' relative concentrations were between two and five times higher in the Alluvial aquifer when compared to the concentrations in the Memphis aquifer (Carmichael, et al., 2018).

Alluvial aquifer groundwater quality samples have been collected at ALF since November 2016. The results have been used to identify COCs at the Site that exceed maximum contaminant levels (MCLs),



which are standards that are set by the United States Environmental Protection Agency (USEPA) for drinking water quality. Analytical results from groundwater sampling indicate that arsenic, fluoride and lead exceed their respective MCLs in localized areas (Stantec, 2019b).

4.4.3.6 Groundwater Flow

The Alluvial aquifer groundwater elevation surface defines the water table within the Mississippi Alluvial Plain and at the Site. The Mississippi Alluvial Plain is dominated by a network of rivers and streams at the surface that are connected to the Alluvial aquifer and act as a drainage system of the aquifer for much of the year (Brahana and Broshears, 2001).

Regional groundwater flow is generally to the north and west towards Lake McKellar and the Mississippi River, respectively. A regional groundwater contour map within the Alluvial aquifer was created by Brahana and Broshears (2001) and is presented as **Figure 4-17.** Lake McKellar is connected to and is hydraulically influenced by the Mississippi River, and the stage of Lake McKellar has been observed to influence water table elevations and direction of groundwater flow at the Site. Groundwater flow at the Site is further complicated because discontinuous, interbedded clay, silt, and sand deposits in the upper alluvium result in localized groundwater mounding. The heterogeneity observed in the upper alluvium adds complexity to the groundwater flow system by reducing connectivity/increasing anisotropy between deposits with higher hydraulic conductivity (sand and gravel) and impeding flow between deposits of contrasting hydraulic properties (i.e., sand and clay).

Site-specific transducer data recorded between September 2017 and December 2018 indicates groundwater elevation fluctuations at individual wells range from approximately 5 to 40 ft with an average of approximately 25 ft variation over time across the Site. Hydrographs displaying transducer data and the Mississippi River and Lake McKellar stage levels are included in **Appendix A**. Lake McKellar and the Mississippi River stage elevation fluctuated over a 43-foot range between September 2017 and December 2018. As a result, the groundwater elevation data at the Site indicates highly variable flow directions that display temporary localized reversals of groundwater gradients away from Lake McKellar. These Site (localized) groundwater gradient reversals observed between 2017 and 2018 are presented in **Figures 4-18** through **4-31**.

Several lines of evidence differentiate groundwater within the shallow wells screened above and within fine-grained, less permeable sediments (termed the "blue clay zone" of the shallow Alluvial aquifer in the Updated RIR) and those wells screened within the more permeable zones within and below the upper alluvium (including the sandy zone of the shallow Alluvial aquifer, and the underlying intermediate and deep intervals of the Alluvial aquifer). The following table presents the distribution of wells throughout the Alluvial Aquifer:



	Alluvial Aquif	er	General		
Remedial I	nvestigation	Model	Ranges of Bottom Screen Elevation (ft msl)	ALF and ACC-Series Monitoring Well IDs (RI)	PMW and EW-Series Well IDs (IRA)
	Blue Clay Zone	Upper Alluvium	168-190	ALF-202; ALF-203; ALF-212; ALF-215; ALF-217	EW-N02; EW-S03; PMW- 02A; PMW-04A; PMW- 07A; PMW-10A; PMW- 11A; PMW-14A
Shallow			171-173	ALF-207; ALF-209	-
	Sandy Zone		158-175	ACC-5B; ALF-201; ALF-204; ALF-205; ALF-206; ALF-208; ALF-210; ALF-213; ALF-214; ALF-216; ALF-P-4S	-
Intern	nediate	Lower Alluvium	110-162	ALF-210B; ALF-202B; ALF- 203B; ALF-204B; ALF-205B; ALF-213B; ALF-214B; ALF- 217B; ALF-P-4	PMW-02B; PMW-04B; PMW-07B; PMW-10B; PMW-11B; PMW-14B
D	еер		45-110	ACC-1A; ACC-3A; ACC-5A; ALF-201A; ALF-202A; ALF- 203A; ALF-204A; ALF-205A; ALF-207A; ALF-208A; ALF- 209A; ALF-210A; ALF-212A; ALF-213A; ALF-214A; ALF-217A	PMW-02C; PMW-04C; PMW-07C; PMW-10C; PMW-11C; PMW-14C
	Numb	er of Wells	-	43	20

Wells ALF-202, ALF-203, ALF-212, ALF-215 and ALF-217 are screened across the water table above and within an area of the upper alluvium with fine-grained sediments, and static water levels appear mounded (i.e., elevated by several feet relative to the underlying, more permeable sandy intervals of the Alluvial aquifer). The shallow upper alluvium PMW- and EW-series wells installed in 2018 were also screened above or within the fine-grained zones within the upper alluvium, and they exhibit similar mounded groundwater elevations. Groundwater elevations and groundwater elevation trends in other alluvium wells (completed in the coarser grained, more permeable zones) are distinct from the wells within the mounded groundwater; as such, groundwater flow patterns in wells screened within the mounded zones are evaluated separately from those that are not screened within the mounded zones. Deep wells located in the northern area proximal to the East Ash Disposal Area monitor the base of the regional "deep" zone of the alluvial aquifer within the lower alluvium directly above the upper Claiborne confining unit while wells located in the southern area proximal to the East Ash Disposal Area monitor the regional "intermediate" and "shallow" zones of the alluvial aquifer in the lower alluvium at depths 50-60 feet above the upper Claiborne confining unit. The classification of wells within the Alluvial aquifer for this report as compared to the aquifer designation in the Updated RIR (Stantec, 2019b) have been summarized in Table 4-10.



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Average horizontal gradients calculated using manual gauging data resulted in values of 0.0163 feet per foot (ft/ft) and 0.0018 ft/ft within the upper alluvium and lower alluvium, respectively. **Table 4-11** summarizes horizontal gradient at the Site.

Vertical gradients between the upper alluvium and the lower alluvium ranged from -0.015 and -0.34 ft/ft (the negative sign indicating a downward gradient). Vertical gradients within the lower alluvium ranged between -0.023 and 0.020 ft/ft. **Tables 4-12a** and **4-12b** summarize vertical gradients at the Site.

4.4.4 Terrace and Loess Deposits

4.4.4.1 Composition

Terrace deposits are a saturated unit primarily consisting of sand and gravel with minor clay. The loess deposits primarily consist of silt, silty clay, and minor sand (Carmichael, et al., 2018).

4.4.4.2 Extent and Structure

The terrace deposits, which are overlain by the loess deposits, are present in the uplands, southeast of the Site. Neither of these deposits are present directly beneath the Site.

Thicknesses of the terrace and loess deposits range from 0-65 ft and 0-100 ft, respectively (Carmichael, et al., 2018).

Stantec does not have site-specific boring data within the uplands where the loess and terrace deposits are present; however, seven historical borings located south and east within the uplands within the Davis Well Field were reviewed to provide a general idea of where the loess and terrace deposit contacts would be expected to be closer to the Site, north of the Davis Well Field (Parks, et al., 1995).

4.4.4.3 Hydraulic Properties

Terrace deposit transmissivity has been estimated to be between 5,000 and 10,000 square feet per day (ft²/day) (Brahana and Broshears, 2001). The USGS MERAS calibrated groundwater flow model has assigned a Kh of 27.9 and 200 ft/day and a Kv of 1.27 and 2.00 ft/day for the loess and terrace deposits, respectively (Clark and Hart, 2009).

4.4.4.4 Estimated Yields

The terrace deposits have the potential to yield up to 50 gpm (Criner, et al., 1964). The loess deposits are unlikely to yield a significant amount of water (Brahana and Broshears, 2001).

4.4.4.5 Groundwater Flow

Regionally, groundwater flow within the uplands where the terrace and loess deposits are is generally west towards the Mississippi River and north towards Lake McKellar (Brahana and Broshears, 2001).



4.4.5 Upper Claiborne Confining Unit

4.4.5.1 Composition

Regionally, the upper Claiborne confining unit is composed of the Cook Mountain Formation and the Cockfield Formation and consists of clay, silt, sand and lignite (Carmichael, et al., 2018). The Cook Mountain Formation, as defined by Parks and Carmichael (1990), was identified as the primary and most clay-rich component of the upper Claiborne confining unit in the Memphis area (Parks, 1990).

Site-specific data collected through boring advancement and monitoring well installation indicate that the upper Claiborne confining unit at ALF is composed of the Cook Mountain Formation and is predominantly fat clay, lean clay, and silty clay.

4.4.5.2 Extent and Structure

The upper Claiborne confining unit underlies the Alluvial aquifer and overlies the Memphis aquifer. The top and the bottom of the upper Claiborne confining unit was observed in 27 and 14 subsurface data logs, respectively.

Regional thicknesses of the upper Claiborne confining unit are cited to range from 0 to 360 ft (Carmichael, et al., 2018). The four deep stratigraphic borings advanced at the Site indicated that when present, the upper Claiborne confining unit near the East Ash Disposal Area ranges in thickness from approximately 27 to 69 ft. Interpretation of borehole geophysical logs for the five ACC production wells indicated that the upper Claiborne confining unit, when present, ranges in thickness from approximately 48 to 100 ft. The upper Claiborne confining unit has also been demonstrated to be absent at the PMW-11C location, just south of the East Ash Disposal Area, and the Alluvial aquifer directly overlies the Memphis aquifer.

As indicated on the cross-section location map (**Figure 4-8**) and the structural stratigraphic cross-sections (**Figures 4-9** through **4-13**), in addition to the cross-sections developed by the USGS-CAESER (Carmichael, et al., 2018), a fault is inferred to be present beneath the southeastern corner of the East Ash Disposal Area. The inferred fault underlying the East Ash Disposal Area has offset (i.e., lowered) the sedimentary sequence of the Alluvial aquifer, the upper Claiborne confining unit, and upper part of the Memphis aquifer to the southeast by varying amounts. The offset is most evident between well locations ALF-212 and ALF-213 (**Figure 4-9**) and between well locations ALF-214 and ALF-212 (**Figure 4-11a**). In addition, deep exploratory drilling at the Pre-design PMW-11C well location near ALF-202 indicates the upper Claiborne confining unit is absent and the Alluvial aquifer directly overlies the Memphis aquifer (**Figure 4-11a**).

4.4.5.3 Hydraulic Properties

When present, the upper Claiborne confining unit inhibits vertical groundwater flow between the Alluvial and Memphis aquifers.



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ASTM D 5084 Method C analyses were conducted on samples from 13 borings to obtain measured vertical hydraulic conductivity values for the upper Claiborne confining unit. The testing results yielded a range of Kv values between 1.72×10^{-3} ft/day to 1.17×10^{-6} ft/day. The Kv geometric mean was 9.5×10^{-6} ft/day. These values show that the upper Claiborne confining unit is considerably less permeable than the overlying Alluvial aquifer. **Table 4-13** summarizes Kv results of the upper Claiborne confining unit beneath the Site. A figure summarizing the average Kv values available for the upper Claiborne confining unit at locations across the Site is presented in **Figure 4-32**.

Transmissivity values were not available for the upper Claiborne confining unit underlying the Site; however, low transmissivity of the upper Claiborne confining unit is inferred from its low vertical hydraulic conductivity and thickness.

4.4.5.4 Estimated Yields

The upper Claiborne confining unit is a confining unit that impedes groundwater flow because of the material's low hydraulic conductivity; therefore, it is not a unit that would be anticipated to yield a significant amount of water.

4.4.5.5 Groundwater Flow

The upper Claiborne confining unit hydraulic properties impede groundwater flow and therefore very little groundwater flow would be expected within the unit.

4.5 THREE-DIMENSIONAL LITHOLOGIC MODEL

The lithologic model represents a statistical interpretation of lithology based upon the data from available boring logs. Lithology data from historical borings, geophysics and CPT data were evaluated with the aid of Earth Volumetric Studio (EVS) software. EVS facilitates the geostatistical interpretation and visualization of the subsurface.

Figure 4-33 presents the locations used in the geostatistical evaluation the Site lithologic model. Subsurface logs are included in **Appendix B**. Cross sections from EVS are presented in **Figures 4-34** through **4-36**.

The interpreted lithology defined within EVS served as a basis for the Model layers. The EVS geostatistical model was used to calculate the dominant lithology (largest percentage) in each grid cell within the Model (limited to the Site). When an equal amount of lithologies occurred in a cell, the finer-grained material hydraulic properties were applied to the grid cell. Lithology texture type was used to assign hydraulic properties as zones of hydraulic conductivity and porosity, specific yield or specific storage. In areas that were not covered by the geostatistical model (e.g., below the upper alluvium and outside of ALF), a general lithology was applied based upon the CSM.



5.0 COMPUTER CODE

5.1 MODFLOW

The selected groundwater flow model utilized for this modeling study was MODFLOW-2005 (Harbaugh, 2005; Harbaugh et al., 2017). MODFLOW-2005 is a publicly available groundwater flow simulation program developed by the USGS and is designed to simulate three-dimensional groundwater flow using the finite-difference method (Harbaugh, 2005). The first version of MODFLOW (McDonald and Harbaugh, 1988) was developed by the USGS in the 1980s. By the early 1990s, MODFLOW had become the most widely used groundwater flow model both within and outside the USGS (Harbaugh, 2005). The program was selected for this study, in part, because it is thoroughly documented; widely used by consultants, government agencies, and researchers; and is consistently accepted by regulators.

In addition to its attributes of widespread use and acceptance, MODFLOW-2005 was also selected because of its versatile simulation features. MODFLOW-2005 can simulate transient or steady-state saturated groundwater flow in one, two, or three dimensions and offers a variety of boundary conditions, including specified head, areal recharge, hydraulic barriers, injection or extraction wells, evapotranspiration, drains, and rivers or streams. Aquifers simulated by MODFLOW can be confined or unconfined, or convertible between confined and unconfined conditions. MODFLOW's three-dimensional capability and boundary condition versatility are essential for the simulation of groundwater flow conditions given the complex hydrostratigraphy of the Site, which consists of a multi-layered geologic system with variable unit thicknesses and the hydrogeologic framework necessitates the inclusion of a variety of boundary conditions.

5.2 MT3DMS

The groundwater flow Model was used in conjunction with MT3DMS, a modular 3-D multi-species transport model for simulation of advection, dispersion, and chemical reactions of constituents in groundwater systems. MT3DMS calculates dissolved solute distribution as a function of time. MT3DMS is based on the original MT3D code with the main difference of the ability to simulate fate and transport without utilizing computer memory space with unused options. MT3DMS allows contaminant transport simulation without having to modify the existing groundwater flow model to fit the transport model (Zheng and Wang, 1999).

6.0 MODEL CONSTRUCTION

This section describes how the hydrogeologic framework of the groundwater system, as described in **Section 4.5**, was translated into a numerical model. The numerical translation includes the definition of the model aquifer geometry, the assignment of the initial and boundary conditions, discretization in space, and the selection of hydraulic parameter zonation and heterogeneity. The Model construction was accomplished using a host of software packages. The primary software packages used include:

- Groundwater Vistas[®] version 7.0, developed by Environmental Simulations, Inc. Used as a pre/postprocess to prepare MODFLOW-2005 input files and process and visualize model output;
- Microsoft Excel and Access to manage most of the data used to prepare model input files and evaluate calibration results;
- ArcGIS[®] version 10.4, developed by ESRI, to create shapefiles that can be imported into Groundwater Vistas[®] input files;
- Surfer[®] version 16.1, developed by Golden Software, LLC., to assist in creating and working with grid and surfaces that can be imported into Groundwater Vistas[®] and ArcGIS[®]; and
- EVS software, developed by C Tech, used for three-dimensional visualization and lithology exports that can be imported into ArcGIS[®].

6.1 MODEL DISCRETIZATION

The extent of the model domain was selected based on surrounding hydrologic features that were utilized as boundary conditions (summarized in **Section 6.4**). Additionally, the extent of the model was chosen to facilitate potential future use of the model at a larger scale that would allow groundwater to be evaluated beyond the immediate extent of ALF. The entire model domain is approximately 14.5 square miles with the active portion of the model domain consisting of approximately 9.8 square miles. **Section 6.4.1** provides a discussion of boundary conditions. **Figure 6-1** shows the areal extent of the model and the model grid within the domain.

6.1.1 Horizontal Discretization

The model grid consists of 550 rows and 816 columns and is defined by a constant areal grid spacing of 30 by 30 ft. The horizontal discretization of the model was selected based on the necessity to have a fine enough grid to simulate localized patterns of groundwater flow and solute transport. **Figure 6-2** presents the model grid.

6.1.2 Vertical Discretization

The selection of model layers is based on the lithology and stratigraphy described in **Section 4.4** and conceptually summarized in **Figure 4-3**.

The focus on evaluation flow directly below the Site and complexity of the upper Alluvial aquifer guided the decision to refine Model into the upper alluvium (five layers) and lower alluvium (two layers). The Model layers are as follows:



- Layers 1 through 4 represent upper alluvium in the alluvial plain and loess, stream deposits, and terrace deposits in the uplands;
- Layer 5 represents the base of the upper alluvium and terrace deposits in the uplands;
- Layer 6 represents the top portion of the lower alluvium;
- Layer 7 represents sand with coarser material within the bottom portion of the lower alluvium;
- Layers 6, 7, and 8 represent the upper Claiborne confining unit in the uplands; and
- Layer 8 represents the upper Claiborne confining unit.

Layer elevations are presented in **Figures 6-3a** through **6-3c**. **Figure 6-4** presents a comparison of a cross-section of the model layers and the conceptual regional cross section (layer configuration and generalized lithology).

6.2 TIME DISCRETIZATION

The temporal discretization in MODFLOW-2005 includes division of the transient model into bi-weekly stress periods defined by the average hydraulic conditions observed at the Site during the respective two-week periods. Lake McKellar transducer daily, weekly, and bi-weekly averages are included in **Figure 6-5**. Bi-weekly stress periods allow for sufficient detailed simulation of the short-term fluctuations caused by flood events and allow reasonable simulation times. The calibrated Model was simulated over two years with 52 stress periods. The transient model begins on January 1, 2017 and ends December 31, 2019, to use available high-resolution groundwater elevation transducer data from the Site monitoring network.

6.3 PARAMETER DISTRIBUTION

6.3.1 Hydraulic Conductivity

The hydraulic conductivity in the Model has been used to simulate the heterogeneity observed in the upper alluvium based on the lithologic model and Site conceptual model. A total of ten zones of hydraulic conductivity have been applied in varying distributions across the model vertically and horizontally.

Zones 1-7 represent the generalized lithology types described in **Section 4.4.5.2**, silt, sand, clay, sand with fines, gravel, CCR Unit material, and sand with coarse material, respectively. Zones 8-10 represent the upper Claiborne confining unit, loess deposits, and terrace deposits, respectively. A range of hydraulic conductivities for zones 1-7 was defined using Site-specific slug testing results, aquifer testing results, and laboratory permeability results presented in **Tables 4-6 through 4-9**, respectively. Zones 8-10 were applied hydraulic conductivity values based on cited values from literature resources included in **Table 4-5**. The hydraulic conductivity values assigned to each zone are uniform across model layers. Hydraulic conductivity zone distribution varies spatially from layer to layer.

The hydraulic conductivity ranges and the distribution of each zone have been included as **Table 6-1**. **Figures 6-6a** and **6-6b** present the hydraulic conductivity zone distribution across Layers 1-8.



6.3.2 Storage

The two main types of aquifer storativity are confined storage (specific storage) and unconfined storage (specific yield). Unconfined storage is related to the release of water as the water table lowers (dewatering of the aquifer material); thus, it occurs only along the top boundary of the saturated flow system. Confined storage is related to the release of water as the head drops because of expansion of the water itself as the pressure changes and changes in the solid framework of the aquifer (no dewatering occurs). Specific yield and specific storage were applied generally based on literature values for associated subsurface materials (Morris and Johnson, 1967; Heath, 1983; Jazaei, et al., 2018). Ten zones of specific yield and storage were applied across the Model. Zone distribution mirrors the hydraulic conductivity zones discussed in **Section 6.3.1**. **Table 6-2** summarizes the specific yield and storage zones across Layers 1 through 8.

6.3.3 Recharge

Applied groundwater recharge is derived from infiltrating precipitation. Precipitation data was obtained from daily precipitation totals recorded at the NOAA Memphis International Airport station (USW00013893) in Memphis, Tennessee. Daily totals were averaged over the associated 52 bi-weekly stress periods which are included in **Table 6-3**. Three zones of recharge were utilized across the model domain and are presented in **Figure 6-7**. The Model was calibrated using recharge rates of 15%, 8%, and 0% of the average bi-weekly precipitation for zones 1, 2 and 3, respectively. Each zone's recharge rate is included in **Table 6-3**.

Recharge zones were established during the calibration process. Because direct measurements of recharge were unavailable, model calibration was used to predict recharge rates from information on hydraulic heads directly measured at the Site and associated aquifer properties (hydraulic conductivity and storage). Because recharge and hydraulic conductivity are often highly correlated, Model inversion using hydraulic-head data only is limited to estimating the ratio of recharge to hydraulic conductivity and the reliability of these recharge estimates is thereby dependent on the accuracy of the hydraulic conductivity data. An inverse modeling approach was used in which hydraulic properties and subsurface variability was assigned based upon the available investigation data and recharge was varied to match observation (groundwater elevation measurements, gradient, and flow direction).

To simplify and simulate the system's key behaviors, a single recharge zone was initially assigned (Zone 2). However, this proved to be unsatisfactory in two key areas: (1) the East and West Ash Disposal areas and (2) the areas north and south of the East Ash Disposal Area that exhibit mounded groundwater conditions. A new Zone 0 was applied to the East and West Ash Disposal Ponds. The recharge at the East Ash Disposal Area is controlled by constant head boundary conditions (see **Section 6.4.2**) and negligible recharge is assumed at the West Ash Disposal Area based upon the presence of clay beneath the West Ash Disposal Area and a recharge of 15% of annual precipitation was applied to simulate the mounded groundwater observed in the upper alluvium. It is recognized that the additional zonation in this area is not linked to the conceptual understanding of the physical system. However, the recharge was



necessarily derived from the calibration process and is representative of the groundwater flow system in this area This is an area of ongoing investigation and it is anticipated that the recharge zonation will be revisited in future model updates.

6.4 BOUNDARY CONDITIONS

The boundary conditions in the Model consist of two types: (1) no flow boundaries and (2) constant head boundaries. Each is described below, with location of application in the Model shown in **Figure 6-8**.

6.4.1 No Flow

No flow boundaries represent model cells across which groundwater flow cannot occur. No flow boundary conditions encompass the outer edge of the model domain and are applied in all layers of the Model. A no flow boundary is also implicitly included at the bottom of the model domain. In the conceptual model for the Site, regional groundwater flow is generally flowing west towards the Mississippi River and north towards Lake McKellar based on the regional groundwater water table surface (Brahana & Broshears, 2001); therefore, the southern no flow boundary was drawn along an equipotential line of the regional water table. The western and northern no flow boundaries were based on transecting the deepest part of the Mississippi River (**Figure 4-6**; USACE, 2016) and the northern bank of Lake McKellar, respectively. The eastern boundary was applied based on the watershed boundary shown in **Figure 6-1** that was identified using USGS's StreamStats tool.

6.4.2 Constant Head

Constant head boundaries represent model cells of equal and constant total (hydraulic and pressure) head in the Model. A transient constant head boundary representing the average biweekly stage elevation of the Mississippi River and Lake McKellar was applied to Layers 4 through 6. The bottoms of model Layers 1 through 3 are above the constant head elevation during some stress periods and therefore do not contain transient constant head boundaries. Layers 7 through 8 are below the bottom of the surface water body and also do not include transient constant heads. The average biweekly transient constant head data is included in **Table 6-4**. A steady-state constant head boundary of 226 ft was applied within the East Ash Disposal Area in Layer 1 to represent the East Ash Disposal Area standing water that is maintained between 225 and 226 ft. A steady-state constant head boundary of 198 ft was applied to the Horn Lake Cutoff in Layers 2 through 4 based on the general elevation observed in the digital elevation model (DEM) along the Horn Lake Cutoff.



7.0 CALIBRATION

Calibration is the process of adjusting the model parameters to produce the best match between simulated and observed groundwater system responses. The Model calibration was performed by developing calibration targets, identifying calibration criteria, and finally conducting model calibration. The calibration criteria represent acceptable model performance with respect to predicted versus observed target values. In the process of calibration, model parameters are adjusted (subject to reasonable bounds) to match observed water levels at wells.

Calibration is critical in evaluating the model performance. However, this does not imply that a real groundwater system is properly represented by a model. If a conceptual model fails to reproduce the salient features of a system, the given calibrated model may not be able to match observed data as expected. Residual analysis can reveal potential trends in residuals, indicating a systematic error in a model or the data, and can point out aspects in a model that need to be modified.

This section describes the procedure for calibrating the model and discusses the selection of calibration data and residual analysis.

7.1 MODEL CALIBRATION APPROACH

Calibration data points are a key element to the success or failure of model development. Information about the model parameters is drawn from measurements of the groundwater system. Model output and measured data are compared at discrete points in space and time. The differences between the measured and the computed system responses at the calibration points are termed residuals. Calibration is the process of minimizing the residuals by updating the model parameters. Numerous simulations of MODFLOW-2005 were performed with varying parameter values to obtain the simulated water levels that correspond to measured water levels. Adjustments of parameters were held within reasonable ranges to obtain a match between the observed and simulated head calibration targets. The range over which the parameters were varied was derived from the conceptual site model. In addition, the principle of parameter parsimony was applied, where appropriate, to achieve an adequate calibration of the Model through adjustment of the fewest number of model parameters. It should be noted that the use of greater numbers of model parameter values produce similar calibration results. In this case, the Model calibration parameters are considered non-unique. Following the principal of parameter parsimony reduces the degree of non-uniqueness and results in more reliable calibrated parameter values.

During the calibration process each model simulation was compared to site-specific measured head values (water levels). The degree of agreement between the model simulation and the physical hydrogeological system data can then be compared to that for previous simulations to ascertain the success of alterations made in response to previous calibration efforts, and to identify potentially beneficial directions for further calibration. Qualitative and quantitative comparisons are both essential in the calibration process (ASTM, 2017). Both were used to evaluate the degree of agreement between the groundwater flow model simulation and site-specific information.



7.2 SELECTION OF CALIBRATION DATA

The calibration targets consist of observed groundwater head values (water levels). The transient Model was calibrated using the average groundwater elevation observed biweekly between September 2017 and December 2018. Wells within the Model domain with data available during the calibration period were used for calibration. A total of 1,044 average biweekly groundwater elevations at 65 unique locations were used to calibrate the Model.

Figure 7-1 shows the location of the selected calibration wells in the Model. **Appendix C** presents observed versus simulated hydrographs of the data used in the model calibration. **Figures 7-2** and **7-3**, present a summary of selected hydrographs.

7.3 CALIBRATION CRITERIA

The primary criterion for evaluating the quantitative calibration was the head residual. A residual or model error, e_i , is defined as the difference between an observed and simulated variable measured at a target location:

$$e_i = h_i - h'_i$$

where h_i is the measured value and h'_i is the simulated value at a specific target location. Spatial or temporal correlation among residuals can indicate systematic trends or bias in the model. Correlations among the residuals may be evaluated through temporal and spatial plots.

Residuals are further evaluated through several summary statistics including: the residual sum of squares (RSS). The calibration procedure seeks to minimize a RSS function:

$$RSS = \sum_{i=l}^{n} (h_i - h'_i)^2$$

where n is the total number of calibration targets. The RSS is the primary measure of model agreement. Second order statistics can be used to quantify the amount of spread (range of variability) of the residuals about the residual mean. One example is the residual standard deviation (RSTD), which normalizes the RSS by the number of calibration targets and number of estimated parameters (P), is defined as follows:

$$RSTD = \sqrt{\frac{\sum (x - x')^2}{n - 1}}$$

The RSTD is useful for comparing model calibrations with different numbers of calibration targets. Smaller values of standard deviation indicate better correlation between model simulations and observed field data. A large variance or standard deviation either indicates that the data were noisier than expected or that there is a trend in the residuals.



Another calibration measure is the mean of all residuals (e):

$$e = \frac{1}{n} \sum_{i=l}^{n} e_i$$

A mean residual significantly different from zero indicates model bias. A large positive or negative mean indicates that data are systematically under-predicted or over-predicted by a model. The mean of the residuals is expected to be close to zero. Calibration may be viewed as a regression analysis designed to bring the mean of the residual close to zero and to minimize the standard deviation of the residuals. Statistics on hydraulic head residuals aid in the evaluation of model calibration. The standard error in a regression is the square root of the calculated error variance.

7.4 CALIBRATION RESULTS

Residual analysis was used to reveal potential trends in residuals, indicating a systematic error in a model or the data, and can point out aspects in a model that need to be modified. The calibration of the Model sought to minimize the residual and the relative error computed for the 1,012 groundwater elevation data points in the calibration data set. Using the model residuals, a quantitative comparison of the model's fit to observed data may be made.

Figure 7-4 graphically presents a summary of the observed versus simulated residuals and includes a table of summary statistics for the calibrated model. **Figure 7-4** also shows a graphical representation of the fit of simulated to observed data. In a perfectly calibrated model, the points would fall directly on the 1:1 match line. A poorly calibrated model would show most points falling very far from the match line. Hence, **Figure 7-4** shows that the fit is good, with most points falling very close to the match line. There is a minor bias indicating that the simulated data is slightly higher than the observed data with more points falling above the line. In general, the disagreement between observed and simulated groundwater levels is likely the result of assumptions contained in the Model, such as time averaging of boundary conditions, usage of calibration wells spanning multiple lithology types, inferred subsurface geology based on limited data points, and potential unidentified or unincorporated influences on local water levels.

The calibration statistics indicate that the model accurately represents the measured potentiometric surface. The residual mean of -1.38 ft is close to zero and the scaled residual mean is -3.8%. Residual standard deviation is 2.75 and the range of observed heads is 35.99 ft, resulting in a scaled relative error of 7.6%. Residual mean standard error is 3.08 resulting in a scaled residual mean standard error of 8.5%.

Based upon review of residuals as shown in **Figure 7-4** and **Appendix C**, the majority of the data reflect the ability of the model to capture the important groundwater conditions. Given the absolute size of the model and range in heads across it, these values are considered to indicate a satisfactory calibration and the model is suitable to use for the identified objectives .

A qualitative evaluation of the calibration was made by comparing the observed water levels for the Site with the simulated water levels. It is apparent from a comparison of the observed potentiometric surface maps and the Model simulated potentiometric surface maps that the calibrated Model is capturing the

major features of the groundwater flow system. The elevation, shape, magnitude, gradient, and position of the observed water table are reasonably simulated by the calibrated model.

An evaluation of simulated and observed vertical gradients indicates that the model results accurately reflect the observed gradients at the Site. Plots of simulated versus observed vertical hydraulic gradients are included in **Appendix C**. Based upon review of observed versus simulated hydraulic gradients, the data do not indicate the presence of important but unrepresented groundwater conditions. The largest vertical gradients are between wells completed in the mounded groundwater zone and underlying sandy zones of the alluvium (e.g., paired wells at ALF-202, ALF-212, and ALF-217). Between the mounded water bearing zone and underlying sandy zone vertical gradients in the observed and simulated water levels are strongly downward. However, the vertical gradients within coarse grained portions of the upper alluvium and the lower alluvium are predominantly small and upward in both the observed and simulated data sets. The minor difference between observed and simulated groundwater levels are likely the result of assumptions contained in the model.

7.5 CONVERGENCE CRITERIA

The quality of an iterative solution is measured by a number of convergence statistics. These parameters include the maximum head change for model cells (residual change) and the percentage discrepancy between the total flow into and out of the model (volumetric flow budget discrepancy). Generally, the head change should be small, and the volumetric flow budget discrepancy should be less than 0.1% (Konikow, 1996).

The convergence statistics for the final calibrated model are as follows: 0.1 ft head change and 0.015 percent volumetric flow budget discrepancy. The convergence criteria are small indicating a good approximation of the solution.

8.0 SENSITIVITY ANALYSIS

This section presents the parameter sensitivity analysis. Parameter sensitivity measures the impact of a parameter change on the calculated system response. For example, if a small hydraulic parameter change results in a large change in the simulated water levels, then the model is regarded as sensitive to that parameter. Because certain parameter values, such as hydraulic conductivity, differ by orders of magnitude, sensitivities are best discussed within the context of the anticipated reasonable range of values. This allows for assessing the relative sensitivity of a model calibration and for evaluating the importance of the parameters.

The purpose of a sensitivity analysis is to assess the uncertainty in the calibrated model caused by the uncertainty in the estimates of aquifer parameters and boundary conditions. Assessment of sensitivity can provide a framework of how the model outputs respond to changes in the inputs, and thus increase the confidence in the model and its predictive abilities.

8.1 SENSITIVITY APPROACH

Sensitivity analysis of the model was performed to evaluate which parameters would be part of the calibration process.

During the sensitivity analysis/calibration process the following parameters and boundary conditions were considered for systematic and logical variation:

- Vertical and horizontal hydraulic conductivity
- Recharge
- Storativity

8.2 DISCUSSION OF SENSITIVITY

8.2.1 Hydraulic Conductivity

Hydraulic conductivity in the environment can vary several orders of magnitude. During calibration, it was observed that relatively small changes of hydraulic conductivity (in the range of 0.5 to 2 times the initial value) resulted in relatively large changes in simulated head values, particularly in the upper portion of the Alluvial aquifer, which is highly interbedded with low and high permeability materials, and there is some resistance to flow in the vertical direction.

As discussed in **Section 6.3.1**, the Model domain was subdivided into hydraulic conductivity zones primarily based on geological and hydrogeologic conditions. Each of the zones was iteratively adjusted by varying the lithologically-derived hydraulic conductivity by a multiplier. The hydraulic conductivity values were iteratively adjusted by a range of 0.1 to 10 times the initial estimation and the residual errors were observed.



Observations made during the sensitivity analysis indicated that the Model was sensitive to horizontal and vertical hydraulic conductivity and, as such, these were considered primary calibration parameters.

8.2.2 Storativity

Specific storage in the environment can vary based upon the aquifer compressibility and effective porosity. During calibration, it was observed that variations in specific storage resulted in changes in head, particularly with distance from the surface water bodies.

As discussed in **Section 6.3.2**, the Model domain was subdivided into hydraulic conductivity zones primarily based on geological and hydrogeologic conditions. Each of the zones was iteratively adjusted by varying the specific storage by a multiplier. The specific storage values were iteratively adjusted by a range of 0.01 to 100 times the initial estimation and the residual errors were observed.

Observations made during the sensitivity analysis indicated that the Model was moderately sensitive to storage.

8.2.3 Recharge

Initial recharge in the study area is approximately 0.0 to 0.026 inches per day. During sensitivity analysis, recharge was varied between 0.5 to 2 times initial estimates. Based upon the sensitivity analyses, recharge is deemed to be a sensitive parameter and was most sensitive in areas of low hydraulic conductivity assigned in the upper Model layers.


9.0 SIMULATIONS

9.1 CALIBRATED MODEL SIMULATION

The following is a summary of the Model output and interpretations related to the simulated groundwater system.

Figures 9-1a through **9-1d** depict the simulated groundwater elevation for the Model domain and the area of the East Ash Disposal Area for the upper (water table) and lower portions of the Alluvial aquifer. The calibrated model simulates the Alluvial aquifer flow system in the study area from January 2017 through December 2018. The flow analysis represents the results of 52 bi-monthly stress periods; however, to provide a range of results, three selected times are presented: low water (September 2017), high water (March 2018), and a transitional between high water and low water (June 2018).

The water-bearing units underlying the loess hills have simulated groundwater elevations that are greater than the groundwater elevations in the Alluvial aquifer, resulting in water moving from these units into the Alluvial aquifer. The higher groundwater elevations in these units are the result of the relatively high altitude of their recharge areas as compared to the elevation of the alluvial plain. The Mississippi River on the western boundary and Lake McKellar on the northern boundary are lateral recharge/discharge areas for the Alluvial aquifer. The depth of the river channel allows the area bordering the surface water to be in almost complete hydraulic connection with the aquifer. Depending upon the surface water stage, the aquifer is either recharged by surface water or the aquifer is discharging to surface water.

Model simulated and measured groundwater elevations indicate that in most areas within Site groundwater levels in the Alluvial aquifer are influenced by stages in the river (**Appendix C**). The exception is areas which either contain or are underlain by low permeability sediments (silts, clays; or highly interbedded sands, silts, and clays). These areas are partially isolated from the underlying hydraulically forced groundwater zones. Examples include areas of mounded groundwater located north, south, and southeast of the East Ash Disposal Area (e.g. monitoring well locations: ALF-202, ALF-203, ALF-212, ALF-21,5 and ALF-217).

Groundwater flow patterns within the deeper portion of the Alluvial aquifer is a more muted form of that displayed in the upper portion of the aquifer due to the more uniform and transmissive aquifer properties of the coarser materials present in the lower aquifer. The lower aquifer exhibits the similar pattern of recharge from the uplands and discharge to the surface water features with temporary reversals due to fluctuations in surface water stage during high water events.

The simulated direction of groundwater flow is depicted using model flow vectors on **Figures 9-2a** through **9-2d** for the Model domain and the area of the East Ash Disposal Area for the upper and lower portions of the Alluvial aquifer. Cross sections displayed on the figures depict vertical flow direction. Within the areas of mounded water, groundwater moves downward and then flows laterally towards surface water.



Simulated groundwater velocity is variable throughout the Model. As shown on **Figures 9-3a** and **9-3b**, the bulk of groundwater flow occurs in the coarser alluvium.

9.2 SIMULATED SCENARIOS

The Model was used to simulate a series of hypothetical scenarios to demonstrate the applicability of the Model for evaluating the potential impact of various actions.

The simulations include:

- Scenario 1. Simulation that includes operation of the Harsco water supply well at historical operation rates to evaluate the potential radius of influence caused by groundwater extraction.
- Scenario 2. Baseline simulation of solute transport of arsenic from the North area
- Scenario 3. Simulation of solute transport under proposed interim groundwater extraction in the North
- Scenario 4. Area Baseline simulation of solute transport from the South area
- Scenario 5. Simulation of solute transport under proposed interim groundwater extraction in the South Area.

The predictive scenarios were performed using a steady-state simulation based upon the calibrated transient model to allow for evaluation of longer time frames than available in the two-year transient simulation. Stress Period 1 was selected for the steady state run because it is not biased by the influence of previous changes and it is near long term average conditions for the dominant boundary conditions: Lake McKellar (elevation 194.34 in Stress Period 1 versus average elevation of 194.56 feet) and precipitation (0.178 feet/day in Stress Period 1 versus long term average of 0.174 feet/day).

9.2.1 Simulation 1 Impact of Historical Operation of Harsco Well

For this scenario, a Harsco water supply well was simulated to be operated at historical groundwater extraction rates to evaluate the potential effect of the water withdrawal on the hydrologic system.

At the Site, two extraction wells (the Harsco wells) were installed in September 1971 and August 1979 by Harsco Corporation (Harsco), formerly known as Reed Minerals. The driller's logs indicate the Harsco wells could yield up to 500 gpm. Both were completed in the lower alluvium, although only one had been active in the recent history of operation. The active Harsco well is reported to have been operated at 300 gpm for eight to nine hours per day approximately five days per week (averaging approximately 80 gpm) until December 2018 when the Harsco wells were taken out of service.

For the simulation, the most recently active Harsco well was simulated to be completed into Layers 6 and 7 and operated at the time averaged flow rate of 80 gpm. To evaluate the long-term impact of pumping from the well, the heads produced during the simulation were compared to the heads from a baseline simulation in which the well was not operating. **Figure 9-4** depicts the simulated drawdown results for

Simulation 1. As depicted in **Figure 9-4**, drawdown greater than 0.1 ft is simulated to extend approximately 75 to 125 ft from the Harsco well. The hydraulic influence is simulated to be asymmetrical, with less influence to the north, as a result of the hydraulic boundary influence of Lake McKellar.

9.2.2 Solute Transport Scenarios

In May 2017, TVA identified two areas of groundwater north and south of the East Ash Disposal Area that contained arsenic, and to a lesser degree, lead, and fluoride, at concentrations above USEPA MCLs. Subsequently, TVA performed remedial investigation activities and prepared an Interim Remedial Design for an Interim Response Action (IRA) to control and begin treating groundwater in these two areas. Scenarios 2 through 5, presented below, are intended to inform and refine the understanding of transport in the two identified areas,

Scenarios 2 through 5 couple the Model with the three-dimensional transport model, MT3DMS (Zheng and Wang, 1999), to evaluate the potential migration of arsenic in groundwater at the Site. The Model provides the steady-state flow field in which the constituents move and allows for performing simulations under conditions that may have existed in the past or could be reasonably expected to occur in the future. On the scale of contaminant transport (decades), the flow processes at the Site are anticipated to tend towards the average with time. To facilitate the transport modeling, a simplification that steady-state flow approximates the long-term flow was incorporated into the flow Model. Two boundary conditions change over time: Mississippi River/Lake McKellar time variant specified head and recharge. The steady-state flow model substituted conditions from Stress Period 1 for these Model inputs (river elevation of 194.34 ft above mean sea level (amsl) and recharge scaled to precipitation of 2.12 inches per year). The major difference between the steady-state assumption and the transient assumption is that temporary reversals in groundwater flow are not simulated. On the time-scale of groundwater transport, the reversals in groundwater flow are not anticipated to be a significant process in advective flow. However, the temporary reversals may influence dispersive and reactive transport. These processes may be evaluated in future model updates.

Dissolved arsenic was selected for evaluation based upon the relatively larger identified distribution in comparison to the other COCs (lead and fluoride). The concentrations of fluoride and lead are substantially lower (relative to their respective MCLs) and the distributions of fluoride and lead in groundwater are within the areas impacted by arsenic. Initial arsenic concentrations were defined based on the current observed concentration (Stantec, 2019b). Limited site-specific information is available to support a history matching simulation; therefore, the Model was run as a forward prediction to provide insight, assist in the design of the IRA, and inform the conceptual understanding of solute flow. The point concentrations of arsenic were interpolated to develop initial conditions and then imported into the Model for Layers 1 through 4 based upon the inferred vertical distribution of arsenic at the Site. Arsenic partitioning coefficients were calculated based on batch adsorption analysis of subsurface sediment samples collected at the Site. A discussion of the methods and results of the batch test used to determine partitioning coefficients for the transport model are included as **Appendix D**. Values of dispersivity were based upon established relationships to the size of the area where arsenic was detected above the MCL (Gelhar, et al., 1992). In this method, dispersivities are estimated as a function of contaminant transport distance. The apparent longitudinal dispersivity is estimated to be one-tenth the plume length. The



arsenic plume dimensions are estimated to be approximately 500 feet by 1,500 feet. For the purposes of the dispersivity estimate, the plume length is estimated to be 1,000 feet and the longitudinal dispersivity to be 100 feet. Transverse and vertical dispersivities are estimated to be one tenth and one hundredth the longitudinal dispersivity, respectively. Transport parameters used in the solute transport simulation are summarized in **Table 9-1**.

9.2.2.1 Scenario 2 Baseline Simulation of Solute Transport East Ash Disposal Area – North Area

As a baseline case, a solute transport simulation was performed to evaluate the potential migration of arsenic in groundwater from the area of elevated concentration observed north of the East Ash Disposal Area to illustrate solute transport mechanisms, in particular, solute transport direction and velocity. In this simulation, the IRA is not simulated to be operating and the Model is simulated forward in time for 20 years using the steady-state groundwater flow model to provide the groundwater flow field. Arsenic distribution is input as an initial concentration based upon 2018 dissolved arsenic concentrations in groundwater. No continuing source was simulated. This does not imply that the source has been eliminated, rather that source properties are equivocal. In general, over the simulated time period, dissolved arsenic is simulated to generally decrease in concentration as it moves in the direction of groundwater to the north toward Lake McKellar. Simulated transport of the current distribution of arsenic shows differential migration of arsenic primarily controlled by sediment type. Migration within low permeability sediments is retarded both by lower groundwater velocities and increased sorption properties. **Figures 9-5a** and **9-5b** present the simulated distribution of arsenic in the upper Alluvial aquifer for 20 years at five-year increments.

9.2.2.2 Scenario 3 Groundwater Extraction Simulation of Solute Transport East Ash Disposal Area – North Area

A second predictive solute transport simulation was performed to evaluate a conceptual design of the IRA hydraulic control scenario to mitigate the presence of dissolved arsenic in the area north of the East Ash Disposal Area (Stantec, 2019b). The conceptual design of the IRA is focused on groundwater in the area north of the East Ash Disposal Area where the arsenic concentrations are greater than 1,000 micrograms per liter (μ g/L). As in Scenario 2, the Model is simulated forward in time for 20 years using the steady-state groundwater flow model to provide the groundwater flow field.

The Model was used to simulate the proposed IRA with pumping from four extraction wells completed in the upper Alluvial aquifer. The groundwater flow model was used in conjunction with the particle-tracking program MODPATH (Pollock, 2012) to evaluate groundwater capture. MODPATH is a particle-tracking post-processing package that was developed to compute three-dimensional flow paths using output from steady-state or transient groundwater flow simulations by MODFLOW. MODPATH was used to calculate the flow paths of simulated particles moving through the modeled flow system and to assess the hydraulic capture of a hypothetical advective particle released from each of the wells in the capture monitoring network.

Each groundwater extraction well was simulated to pump groundwater from the upper Alluvial aquifer (Model Layers 1 through 4). Extraction well locations and simulated extraction rates for each well are



displayed in **Figure 9-6**. The extraction wells were simulated to be operating at rates between 10 and 30 gpm for a combined simulated extraction rate of 81 gpm. **Figure 9-6** presents the extent of hydraulic containment as defined by simulated groundwater flow paths (particle tracking). Particle tracking provides a depiction of capture corresponding to the simulated groundwater levels and pumping rates.

Simulated arsenic transport indicates a reduction of arsenic, both areal extent and concentration, within the inferred area of groundwater where arsenic is initially above approximately 1,000 μ g/L. **Figures 9-7a** and **9-7b** present the simulated distribution of arsenic in the upper Alluvial aquifer (model Layers 3 and 4) for 20 years at five-year increments. The upper alluvium is displayed because this is the zone that includes the greatest observed arsenic distribution. The simulation indicates that the simulated groundwater extraction provides hydraulic containment and arsenic mass removal in the area of highest dissolved arsenic.

9.2.2.3 Scenario 4 Baseline Simulation of Solute Transport East Ash Disposal Area – South Area

Similar to the north area, a baseline solute transport simulation was performed to evaluate the potential migration of arsenic in groundwater from the area of elevated concentration observed south of the East Ash Disposal Area for a comparison to simulation of an IRA. In this simulation, the IRA is not simulated to be operating and the Model is simulated forward in time for 20 years using the steady-state groundwater flow model to provide the groundwater flow field. In general, over the simulated time period, dissolved arsenic is simulated to generally decrease in concentration as it moves in the direction of groundwater to the north towards Lake McKellar. Simulated transport of the current distribution of arsenic shows differential migration of arsenic primarily controlled by sediment type. Migration within low permeability sediments is retarded both by lower groundwater velocities and increased sorption properties. Note that in Model Layer 4, there are predominantly low permeability sediments within the footprint of the arsenic distribution which leads to lower groundwater flow velocities. As a result of the low flow velocities, there is little change in the simulated arsenic distribution in this layer. **Figures 9-8a** and **9-8b** present the simulated distribution of arsenic in the upper Alluvial aquifer for 20 years at five-year increments.

9.2.2.4 Scenario 5 Groundwater Extraction Simulation of Solute Transport East Ash Disposal Area – South Area

A second predictive solute transport simulation was performed to evaluate a conceptual design of an IRA hydraulic control scenario to mitigate the presence of dissolved arsenic in an area south of the East Ash Disposal Area (Stantec, 2019b). The conceptual design of the IRA is focused on groundwater in the area south of the East Ash Disposal Area where the arsenic concentrations are greater than 100 μ g/L. As in Scenario 4, the Model is simulated forward in time for 20 years using the steady-state groundwater flow model to provide the groundwater flow field.

The Model was used to simulate pumping from five extraction wells completed in the upper Alluvial aquifer. Each groundwater extraction well was simulated to pump groundwater from the upper Alluvial aquifer (Model Layers 1 through 4). Each well was operating at a rate between approximately 20 and 30 gpm for a combined simulated extraction rate of 124 gpm. Extraction well locations and simulated extraction rates for each well are displayed in **Figure 9-9**. **Figure 9-9** presents the extent of hydraulic



containment as defined by simulated groundwater flow paths (particle tracking). Particle tracking provides a depiction of capture corresponding to the simulated groundwater levels and pumping rates.

Simulated arsenic transport indicates a reduction of the migration of arsenic, both areal extent and concentration, within the inferred area of groundwater where arsenic is initially above approximately 100 μ g/L. **Figures 9-10a** and **9-10b** presents the simulated distribution of arsenic in the upper Alluvial aquifer for 20 years at five-year increments. The simulation indicates that the simulated groundwater extraction provides hydraulic containment and arsenic mass removal in the area of highest dissolved arsenic.



10.0 SUMMARY AND CONCLUSIONS

A numerical groundwater flow model of the study area was constructed as a tool to assess groundwater flow conditions at the Site. The Model reasonably matches observed water levels, and based on simulated groundwater level, the Model reasonably reproduces the flow paths as expected based on the CSM. The calibrated aquifer properties values for the identified sediments are within the expected ranges of values of the individual geologic units. While the Model reasonably reproduces the hydrogeologic flow system underlying the Site, it should be noted that the Model, by necessity, is a simplified representation of the actual hydrogeologic system. The Model is a suitable quantitative tool capable of predicting groundwater flow and transport under varying conditions. However, the scale of the Model discretization, simplifying assumptions, and the Model limitations should be considered when making management decisions based upon simulated results.

Based on construction, calibration, and simulation of the Model the following observations are provided.

- The flow of groundwater in and around the study area generally follows the regional topography with final discharge into the nearby river system. The study area can be divided into two separate groundwater systems divided at the break in topography in the eastern portion of the model domain. At a regional scale, groundwater beneath the higher elevation areas (in the eastern portion of the study area) moves from these units into the Alluvial aquifer along the Mississippi River floodplain. The higher groundwater elevations in these units are the result of the relatively high altitude of their recharge areas as compared to the elevation of the alluvial plain.
- The Mississippi River on the western boundary and Lake McKellar on the northern boundary are lateral recharge/discharge areas for the Alluvial aquifer. Model simulations, as well as observed data, indicate that in the area bordering the surface water bodies, surface water is in hydraulic connection with the Alluvial aquifer. Model simulations indicate that during high surface water events, surface water flows from the surface water bodies to groundwater. When the river level subsides, the water that flowed into the groundwater reverses flow back into the surface water bodies.
- At the Site scale, there is greater observed variability in the groundwater elevations table. At the Site, the first encountered groundwater is in the upper portion of the Alluvial aquifer. Local heterogeneities in sediment type results in localized groundwater mounding.
- Model simulated and measured groundwater elevations indicate that groundwater elevation in the Alluvial aquifer are strongly influenced by surface water stage except in areas which either contain or are underlain by low permeability sediments that act as a confining unit. These areas are partially isolated from the underlying lower alluvium. Most notably, groundwater mounding is observed in the areas with elevated concentrations of COCs, north and south of the East Ash Disposal Area.



- A model simulated operation of the Harsco water supply well at historical groundwater extraction rates indicated drawdown greater than 0.1 ft is simulated to extend approximately 75 to 125 ft from the Harsco well.
- The Model was linked to a fate and transport model and predictive simulations were performed to evaluate performance of interim response action hydraulic containment system. Based upon the predictive simulations, the conceptual interim response system would be anticipated to operate as intended to hydraulically contain and reduce mass of dissolved COCs at the Site.



11.0 MODEL LIMITATIONS

A calibrated groundwater model is not an absolute representation of the complex heterogeneous flow and transport system of the aquifer. There is always uncertainty associated with the numerical simulation of groundwater. The simulated system represents a simplified version of the current conceptual model of a complex hydrogeologic system. For example, the Model assumes no-flow boundary condition at the bottom of the Model domain. This assumption is deemed reasonable based upon the focus of the model on the upper portion of the Alluvial aquifer, the relatively small observed vertical gradients in the deeper portion of the Alluvial aquifer, and the location of the upper Claiborne confining unit encountered in borings at ALF. However, investigations have indicated that locally the upper Claiborne confining unit may be absent, and the lower boundary may not be a true no flow boundary for the actual groundwater system. Therefore, even though the groundwater model is considered reliable to meet the objectives of the study, prudence should be used in its application as a planning tool.

Some of the additional key limitations/assumptions and data gaps of the Model are presented below:

- Because the Model has a grid size of 30 ft × 30 ft, it is not capable of reproducing groundwater levels or concentrations at a resolution less than this due to limitations imposed by the spatial resolution of the Model.
- Because there are few calibration targets in the Model outside of the Site, the uncertainty in these areas is greater than that of the investigated areas.

It is expected that the Model will be utilized on an on-going basis to simulate the groundwater flow system and evaluate fate and transport of COCs. Additional hydraulic data, such as aquifer testing, production data, water level measurements, and time series groundwater quality data, may be beneficial in further verifying the Model and may be incorporated into the Model, as appropriate.

12.0 REFERENCES

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FIGURES





















Legend

Gulf Coastal Plain

Mississippi Alluvial Plain

Notes 1. Physiographic province map is from: Parks, W.S., 1990. Hydrogeology and Preliminary Assessment of the Potential for Contamination of the Memphis Aquifer in the Memphis Area, Tennessee: U.S. Geological Survey Water-Resources Investigations Report 90-4092.

Project Location

Memphis, Tennessee

175578046 Prepared by AH on 2019-06-05 Technical Review by JT on 2019-10-21 Independent Review by JG on 2019-11-15

Client/Project

Tennessee Valley Authority Allen Fossil Plant

Figure No. 4-1

> **Regional Physiographic Province** Distribution









Star	ntec	TVA
Project Location		17557
Memphis, Tennessee	Prep Technical R	ared by AH on 2019 eview by JT on 2019
Client/Project Tennessee Valley A Allen Fossil Plant	uthority	view by JG ON 2019
Figure No. 4-4		
	Spacific	















Geologic Cross-Section Location Map -East Ash and West Ash Disposal Area

Client/Project

Tennessee Valley Authority Allen Fossil Plant

Project Location				175578	046
Memphis, Tennessee			Prepared by MB on 2019-11 Technical Review by JJ on 2019-11		1-07 1-07
0	350	700	1,050	1,400	
				гееі	

1:4,200 (At original document size of 22x34)

Legend

- Extraction Well (EW) or Performance Monitoring Well (PMW)
- Deep Stratigraphic Boring
- $oldsymbol{eta}$ Production Well (Memphis Sand)
- C1-C1' D1-D1' Cross-Section Focused
- A-A' B-B' E-E' Cross-Section North-South
- C-C' D-D' Cross-Section East-West
 - Shallow Well
 - Intermediate Well (B-Series)
 - Deep Well (A-Series)
 - Sewer Manhole Location of Force Main Transition to Gravity

Notes

- 2019 monitoring wells (ALF-207B, ALF-208B, ALF-210B, ALF-218/A/B, & ALF-219/A/B) were included in this figure in response to TDEC comments 33 and 34 on Draft GW Model Report (letter dated September 16, 2019). These wells were not available at the time of Model development and were not incorporated into the Model. They will be incorporated in future model updates.
- 2. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet 3. Imagery Provided by TerraServer (2016) & TVA (2015)









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	Stantec
<u>orth</u> A' 240 220	Asphalt Fill Clay (CL) Clay with Sand (CL) Clayey Silt (MH) Clayey Silt with Sand (ML) Sandy Silt (ML)/Silty Sand (SM) Clayey Sand (SC) Clay (CH) Sand with Silt (SP-SM)
200 180	Image: Sand SP (SP) Image: Sand With Clay (SP-SC) Image: Sand With Clay (SP-SC) Image: No Recovery
160 140	Gamma Log Approximate Approximate Stratigraphic Contact
120	single column, but are actually closely spaced and separate well installations) Stratigraphic contact elevation is indefinite (no data available) Stratigraphic contact elevation is approximate based on limited data points Stratigraphic contact correlated between definitive data points
80 NIT 60	
40 20	
0 20	Notes
-40	1. The upper Claiborne confining unit at TVA Allen is composed of the Cook Mountain Formation. Project Location 175578046 Memphis, Tennessee Prepared by MB on 2019-06-05 Technical Review by JJ on 2019-10-21 Independent Review by JG on 2019-11-15
	Client/Project Tennessee Valley Authority Allen Fossil Plant Figure No. 4-9
	Geologic Cross-Section A-A'



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	Stantec	IVA
 ²⁰ B' North ²⁴⁰ ²²⁰ ²⁰⁰ ¹⁸⁰ ¹⁶⁰ 	Asphalt Fill Clay (CL) Clay with Sand Clayey Silt (MH) Clayey Silt with Sandy Silt (ML)/Silty Sand (SM) Clayey Silt with Clay (CH) Clayey Sand with Silt (S Silty Clay (CL) Sand with Silt (S Silt (ML) Sand with Clay (SP-SC) No Recovery Silt with Sand (N	I (CL) Sand (ML) SC) P-SM) Iel (SP or SW) VL)
140	Approximate	
120	Elevation of well screened intervals (screens of well sets are single column, but are actually closely spaced and separa installations) Stratigraphic contact elevation is indefinite (no data ava	depicted in a te well ilable)
80 20 20 -20	Stratigraphic contact elevation is approximate based on Stratigraphic contact correlated between definitive data	i points
-40	Notes 1. The upper Claiborne confining unit at TVA Allen is composed of th Mountain Formation.	e Cook
00	Project Location Prepared by Memphis, Tennessee Prepared by Technical Review b Independent Review b Client/Project Tennessee Valley Authority Allen Fossil Plant Figure No. 4-10 Title Geologic Cross-Section B-B'	175578046 MB on 2019-06-05 у JJ on 2019-10-21 у JJ on 2019-11-15



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DISTANCE, feet (Distance Scale 1 in. = 250.0 ft)

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Tennessee Valley Authority Allen Fossil Plant

Figure No. 4-16

> Alluvial Aquifer Average Site-Specific Horizontal and Vertical Hydraulic **Conductivity Summary Map**








The McKellar Lake elevation listed corresponds to the value measured during the median time between the first and last well gauged on the date listed. The
estimated shoreline indicated is based on interpretation of the United States Geological Survey (USGS) National Elevation Dataset (NED).
 Water table surface contours were inferred based on pressure transducer data at the locations indicated and estimated surface water elevation of McKellar
Lake as indicated at 00:00 on December 26, 2018.

5. Groundwater elevations from the wells shown on this figure were interpolated separately from the shallow Alluvial aquifer wells. Review of hydrographs and lithology indicate that the water levels in these wells may be mounded above a semi-confining layer, and thus, are not well correlated with the water levels in the other unconfined shallow wells.



Client/Project Tennessee Valley Authority Allen Fossil Plant Memphis, Tennessee

Figure No. **4-18**

Groundwater Elevation Map in the Upper Alluvium -December 2018 November 2019





The McKellar Lake elevation listed corresponds to the value measured during the median time between the first and last well gauged on the date listed. The
estimated shoreline indicated is based on interpretation of the United States Geological Survey (USGS) National Elevation Dataset (NED).
 Water table surface contours were inferred based on gauging results at the locations indicated and estimated surface water elevation of McKellar Lake as
indicated.







The McKellar Lake elevation listed corresponds to the value measured during the median time between the first and last well gauged on the date listed. The
estimated shoreline indicated is based on interpretation of the United States Geological Survey (USGS) National Elevation Dataset (NED).
 Water table surface contours were inferred based on gauging results at the locations indicated and estimated surface water elevation of McKellar Lake as
indicated.







The McKellar Lake elevation listed corresponds to the value measured during the median time between the first and last well gauged on the date listed. The
estimated shoreline indicated is based on interpretation of the United States Geological Survey (USGS) National Elevation Dataset (NED).
 Water table surface contours were inferred based on gauging results at the locations indicated and estimated surface water elevation of McKellar Lake as
indicated.







The McKellar Lake elevation listed corresponds to the value measured during the median time between the first and last well gauged on the date listed. The
estimated shoreline indicated is based on interpretation of the United States Geological Survey (USGS) National Elevation Dataset (NED).
 Water table surface contours were inferred based on gauging results at the locations indicated and estimated surface water elevation of McKellar Lake as
indicated.







The McKellar Lake elevation listed corresponds to the value measured during the median time between the first and last well gauged on the date listed. The
estimated shoreline indicated is based on interpretation of the United States Geological Survey (USGS) National Elevation Dataset (NED).
 Water table surface contours were inferred based on gauging results at the locations indicated and estimated surface water elevation of McKellar Lake as
indicated.

5. Groundwater elevations from ALF-202, ALF-203, and ALF-212, and the EW-series and PMW-series wells were excluded from interpolation of the shallow Alluvial aquifer water table surface. Review of hydrographs and lithology indicate that the water levels in these wells may be mounded above a semi-confining layer, and thus, are not well correlated with the water levels in the other unconfined shallow wells. December 2018 groundwater elevations from these wells are included in Figure 6-6.







 Imagery provided by client (dated 2015)
 The McKellar Lake elevation listed corresponds to the value measured during the median time between the first and last well gauged on the date listed. The estimated shoreline indicated is based on interpretation of the United States Geological Survey (USGS) National Elevation Dataset (NED).







 Imagery provided by client (dated 2015)
 The McKellar Lake elevation listed corresponds to the value measured during the median time between the first and last well gauged on the date listed. The estimated shoreline indicated is based on interpretation of the United States Geological Survey (USGS) National Elevation Dataset (NED).







 Imagery provided by client (dated 2015)
 The McKellar Lake elevation listed corresponds to the value measured during the median time between the first and last well gauged on the date listed. The estimated shoreline indicated is based on interpretation of the United States Geological Survey (USGS) National Elevation Dataset (NED).







The McKellar Lake elevation listed corresponds to the value measured during the median time between the first and last well gauged on the date listed. The
estimated shoreline indicated is based on interpretation of the United States Geological Survey (USGS) National Elevation Dataset (NED).
 Water table surface contours were inferred based on gauging results at the locations indicated and estimated surface water elevation of McKellar Lake as
indicated.







 Imagery provided by client (dated 2015)
 The McKellar Lake elevation listed corresponds to the value measured during the median time between the first and last well gauged on the date listed. The estimated shoreline indicated is based on interpretation of the United States Geological Survey (USGS) National Elevation Dataset (NED).







 Imagery provided by client (dated 2015)
 The McKellar Lake elevation listed corresponds to the value measured during the median time between the first and last well gauged on the date listed. The estimated shoreline indicated is based on interpretation of the United States Geological Survey (USGS) National Elevation Dataset (NED).







 Imagery provided by client (dated 2015)
 The McKellar Lake elevation listed corresponds to the value measured during the median time between the first and last well gauged on the date listed. The estimated shoreline indicated is based on interpretation of the United States Geological Survey (USGS) National Elevation Dataset (NED).







The McKellar Lake elevation listed corresponds to the value measured during the median time between the first and last well gauged on the date listed. The
estimated shoreline indicated is based on interpretation of the United States Geological Survey (USGS) National Elevation Dataset (NED).
 Water table surface contours were inferred based on gauging results at the locations indicated and estimated surface water elevation of McKellar Lake as
indicated.











Legend

Site-Specific Hydraulic Conductivity Locations (ft/day)



Laboratory Testing (Vertical Hydraulic Conductivity)



Property Boundary

Coal Combustion Residual Unit

River or Stream Flow Line (USGS National Hydrography Dataset [NHD])

Road



Notes

Notes 1. Coordinate System: NAD 1927 StatePlane Tennessee FIPS 4100 2. Basemap Data Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, MEII, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community 3. Average hydraulic conductivity values for each location are displayed. 4. Hydraulic conductivity values are in feet per day (ft/day).



Prepared by AH on 2019-06-05 Technical Review by JT on 2019-10-21 Independent Review by JG on 2019-11-15

Client/Project Tennessee Valley Authority Allen Fossil Plant

Figure No. 4-32

> Upper Claiborne Confining Unit Average Site-Specific Vertical Hydraulic **Conductivity Summary Map**











Distance (Feet)





D1' EAST







Legend Surface Top	ography	
Elevation (F	T NGVD29) High : 320	
-	-	
	Low : 190	
	line every 5th line (150 fe	et by 150 feet)
	Inset at the East Ash Disp displaying all grid lines (3 Road	oosal Area Grid 30 feet by 30 feet)
	Coal Combustion Residu	al Unit
	Property Boundary	
	Water Body or River Arec	a (NHD)
Active Are	ea (Square Miles)	9.8
Active Are Rows	ea (Square Miles)	9.8 550
Active Are Rows Columns	ea (Square Miles)	9.8 550 816
Active Are Rows Columns Active Ce	ea (Square Miles)	9.8 550 816 2,432,270 3 590 400
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Active Are Rows Columns Active Ce Total Cells Cell Size	ea (Square Miles) ells s	9.8 550 816 2,432,270 3,590,400 30 feet x 30 fe
Active Are Rows Columns Active Ce Total Cells Cell Size	ea (Square Miles) HIS 5 1,750 26,000 (At original document	9.8 550 816 2,432,270 3,590,400 30 feet x 30 fe 3,500 Feet size of 11x17)
Active Are Rows Columns Active Ce Total Cells Cell Size	ea (Square Miles) ells 5 1,750 26,000 (At original document e East Ash Disposal Area and the gri	9.8 550 816 2,432,270 3,590,400 30 feet x 30 fe 3,500 Feet size of 11x17) d dt a 30 foot x 30 foot cell si
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Active Are Rows Columns Active Ce Total Cells Cell Size 0 1: Notes 1. Inset displays the within the Model. Project Location Memphis, Tenne Client/Project Tennessee Allen Fossi Figure No.	ea (Square Miles) ells 3 1,750 26,000 (At original document East Ash Disposal Area and the gr ssee Tec Indeper	9.8 550 816 2,432,270 3,590,400 30 feet x 30 fe 3,500 Feet size of 11x17) id at a 30 foot x 30 foot cell size Prepared by AH on 2019- Infical Review by JI on 2019- Indent Review by JG on 2019-







Tennessee Valley Authority Allen Fossil Plant

Figure No. **6-3a**

Elevation of the Top of the Model (Ground Surface)







Model Cross Section's Legend

	-	
Hydraulic Zone	Soil Type	
	Silt	
	Poorly Graded Sand	
	Clay	
	Sand with Clay/Silt	
	Gravel	
	Ash	
	Sand with Coarse Grains	
	Upper Claiborne Confining Unit	
	Loess	
	Terrace Deposits	





Section Comparison



Stantec	TVA
-	
Project Location Memphis, Tennessee Technica	175578 epared by AH on 2019-0 I Review by JT on 2019-1 Review by JC on 2019-1
Client/Project Tennessee Valley Authority Allen Fossil Plant	NO VIEW DY JO ON 2019-
Figure No. 6-5	



Prepared by AH on 2019-06-05

















Legend

- Property Boundary
- Road
- Coal Combustion Residual Unit

Calibration Target Location

- Layer 2 (Transducer)
- Layer 3 (Transducer)
- Layer 4 (Transducer) \bigcirc
- Layer 4 (Manual Measurements) \land
- Layer 6 (Transducer)
- Layer 6 (Manual Measurements)
- Layer 7 (Transducer)
- Layer 7 (Manual Measurements)



Notes

Notes 1. Coordinate System: NAD 1927 StatePlane Tennessee FIPS 4100 2. Basemap Data Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community Sources: Esri, HERE, Garmin, Intermap, Increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community



Tennessee Valley Authority Allen Fossil Plant

Figure No. 7-1

Calibration Target Location Map











	Stantec	N A
Legend	b	
	1:1 Ratio	
•	Layer 2	
	lavor 3	
•	Luyer 3	
•	Layer 4	
•	Layer 6	
•	Layer 7	
Residual Me	ean widual Moan	-1.38
Residual Sta	andard Deviation	2.75
Sum of Squa		9883.80
RMS Error		7000.00
KING EITOI		3.08
Minimum Re	əsidual	3.08
Minimum Re Maximum R	esidual esidual	3.08 -10.99 15.76
Minimum Re Maximum R Number of (esidual esidual Observations	3.08 -10.99 15.76 1044
Minimum Re Maximum R Number of (Range in Ol Scaled Resi	esidual esidual Observations oservations dual Standard Deviation (%)	3.08 -10.99 15.76 1044 35.99 7.65
Minimum Re Maximum R Number of (Range in Ol Scaled Resi Scaled Abs	esidual esidual Observations oservations dual Standard Deviation (%) olute Residual Mean (%)	3.08 -10.99 15.76 1044 35.99 7.65 6.63
Minimum Re Maximum R Number of (Range in Ol Scaled Resi Scaled Abso Scaled RMS	esidual esidual Observations oservations dual Standard Deviation (%) olute Residual Mean (%) Error (%)	3.08 -10.99 15.76 1044 35.99 7.65 6.63 8.55
Minimum Re Maximum R Number of C Range in Ol Scaled Resi Scaled RMS Scaled RMS	esidual esidual Observations oservations dual Standard Deviation (%) olute Residual Mean (%) Error (%) dual Mean (%)	3.08 3.08 -10.99 15.76 1044 35.99 7.65 6.63 8.55 -3.82
Minimum Re Maximum R Number of C Range in Ol Scaled Resi Scaled Abso Scaled RMS Scaled RMS Scaled Resi	esidual esidual Observations bservations dual Standard Deviation (%) olute Residual Mean (%) Error (%) dual Mean (%)	3.08 3.08 -10.99 15.76 1044 35.99 7.65 6.63 8.55 -3.82
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Minimum Re Maximum R Number of C Range in Ol Scaled Resi Scaled Abso Scaled RMS Scaled RMS Discontinues Notes 1. RMS = Root-Mec 2. % = Precent	esidual esidual Observations bservations dual Standard Deviation (%) olute Residual Mean (%) Error (%) dual Mean (%) an-Square Prepared by Technical Review by	175578044 175578044 175578044 175578044 175578044
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Minimum Re Maximum R Maximum R Number of C Range in Ol Scaled Resi Scaled Abs Scaled RMS Scaled Resi Notes 1. RMS = Root-Mec 2. % = Precent Project Location Memphis, Tenne Client/Project Tennessee Allen Fossil Figure No. 7-4	esidual esidual Observations bservations dual Standard Deviation (%) olute Residual Mean (%) Error (%) dual Mean (%) m-Square Prepared by Technical Review by Nalley Authority Plant	175578046 AH on 2019-01-02 y JT on 2019-11-15





Figure No. **9-1a**

Simulated Potentiometric Surfaces - Upper Alluvium
September 2017 Simulation





March 2018 Simulation



June 2018 Simulation





175578046 Prepared by AH on 2019-06-05 Technical Review by JT on 2019-10-21 Independent Review by JG on 2019-11-15

Client/Project Tennessee Valley Authority Allen Fossil Plant

Figure No.

Titlo

9-1b

Project Location

Memphis, Tennessee

Simulated Potentiometric Surfaces at the East Ash Disposal Area - Upper Alluvium





Figure No. **9-1c**

Simulated Potentiometric Surfaces - Lower Alluvium

















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egend	



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Simulated Extraction Well



Coal Combustion Residual Unit

Lake McKellar

Simulated Arsenic Isocontour (ug/L)



100 - 1,000

10 - 100

> 1,000

Location	Layers Extaction is	Pumping Rate
LOCATION	Applied	(Gallons per Minute)
EW-N01	3 - 4	30.0
EW-N02	1 - 4	11.0
EW-N03	2 - 4	10.0
EW-N04	3 - 4	30.0



0		50	00	1,00	0
	1:5,40	0 (At original c	document size of 11x17)		Feet

Coordinate System: NAD 1927 StatePlane Tennessee FIPS 4100
Basemap Data Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
ug/L - micrograms per liter



Project Location Memphis, Tennessee

175578046 Prepared by AH on 2019-06-05 Technical Review by JT on 2019-10-21 Independent Review by JG on 2019-11-15

Client/Project Tennessee Valley Authority Allen Fossil Plant

Figure No. 9-7a

Scenario 3 Arsenic Distribution - Layer 3







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egend	1	



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Simulated Extraction Well



Coal Combustion Residual Unit

Lake McKellar

Simulated Arsenic Isocontour (ug/L)



100 - 1,000

10 - 100

> 1,000

Location	Layers Extaction is	Pumping Rate
LOCATION	Applied	(Gallons per Minute)
EW-N01	3 - 4	30.0
EW-N02	1 - 4	11.0
EW-N03	2 - 4	10.0
EW-N04	3 - 4	30.0



0		500	1,000
	1:5,400 (At original	document size of 11x17)	Feet

 Coordinate System: NAD 1927 StatePlane Tennessee FIPS 4100
Basemap Data Source: Source: Esri, DigitalGlabe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USCS, AeroGRID, IGN, and the GIS User Community
ug/L - micrograms per liter



Project Location Memphis, Tennessee 175578046 Prepared by AH on 2019-06-05 Technical Review by JT on 2019-10-21 Independent Review by JG on 2019-11-15

Client/Project Tennessee Valley Authority Allen Fossil Plant

Figure No. **9-7b**

Scenario 3 Arsenic Distribution - Layer 4













Figure No. **9-9**

Simulated Capture Zones - South Area







Legend

Simulated Extraction Well



Coal Combustion Residual Unit

Simulated Arsenic Isocontour (ug/L)



10 - 100 100 - 1,000

> 1,000

Location	Layers Extaction is	Pumping Rate
LOCATION	Applied	(Gallons per Minute)
EW-S01	2 - 4	19.5
EW-S02	2 - 4	19.5
EW-S03	3 - 4	25.0
EW-S04	2 - 4	30.0
EW-S05	2 - 4	30.0





1. Coordinate System: NAD 1927 StatePlane Tennessee FIPS 4100 2. Basemap Data Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community 3. ug/L - micrograms per liter



Project Location Memphis, Tennessee

175578046 Prepared by AH on 2019-06-05 Technical Review by JT on 2019-10-21 Independent Review by JG on 2019-11-15

Client/Project Tennessee Valley Authority Allen Fossil Plant

Figure No. 9-10a

Scenario 5 Arsenic Distribution - Layer 3







Legend

Simulated Extraction Well



Coal Combustion Residual Unit

Simulated Arsenic Isocontour (ug/L)



10 - 100 100 - 1,000

> 1,000

Location	Layers Extaction is	Pumping Rate
Location	Applied	(Gallons per Minute)
EW-S01	2 - 4	19.5
EW-S02	2 - 4	19.5
EW-S03	3 - 4	25.0
EW-S04	2 - 4	30.0
EW-S05	2 - 4	30.0





Coordinate System: NAD 1927 StatePlane Tennessee FIPS 4100
Basemap Data Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
ug/L - micrograms per liter



Project Location Memphis, Tennessee

175578046 Prepared by AH on 2019-06-05 Technical Review by JT on 2019-10-21 Independent Review by JG on 2019-11-15

Client/Project Tennessee Valley Authority Allen Fossil Plant

Figure No. 9-10b

Scenario 5 Arsenic Distribution - Layer 4

TABLES



TABLES



Table 4-1 Groundwater Flow Model Stratigraphic Division Comparison TVA Allen Fossil Plant Memphis, Tennessee

Groundwater Flow Model	Preliminary Evaluatior the Mississippi River V Tennessee Valley Auth	n Fossil Plant - East Ash Disposal Area - Remedial Investigation Report ⁽²⁾						
Upper Alluvium		Upper Alluvium		Upper Portion of Alluvium				
		Blue Clay Interval		Blue Clay Interval				
	Mississippi River Valley Alluvium	Channel Unit III	Alluvium (Alluvial Aquifer)	Lower Portion of Alluvium (Sandy Zone ⁽⁴⁾)				
Lower Alluvium		Channel Unit II						
		Channel Unit I						
Upper Claiborne Confining Unit (Cook Mountain Formation ⁽³⁾)		Cook Mountain Formation	Upper Claiborne Confining Unit					

Note

(1) Charmichael, et al., 2018

(2) Stantec, 2019b

(3) The Cook Mountain Formation is the primary and most clay-rich component of the upper Claiborne confining unit for the Memphis aquifer in the Memphis area (Parks, 1990).

(4) This section of fine- to coarse-grained sand with trace to common fine- to coarse-grained gravel compose the sandy zone of the shallow Alluvial aquifer (which underlies the blue clay interval) and underlying intermediate and deep intervals of the Alluvial aquifer. Charmicheal et al, (2018) identified three distinct channel deposits in this interval; however, those channel subdivisions were interpreted from the thicker alluvium sequence in the southern portion of ALF and at the ACC Plant and, thus, are not directly correlative to hydrogeological shallow, intermediate, and deep interval designations of the Alluvial aquifer near the East Ash Disposal Area (RIR, Stantec 2019b).



Page 1 of 1

Table 4-2 Monitoring Well Summary TVA Allen Fossil Plant Memphis, Tennessee

Plant	Well ID	Facility / Location	Screened Interval in Alluvial Aquifer	Well Installation Date	Transducer Depth (ft btoc)	Screened Interval (ft bgs)	Top of Screen (ft btoc)	Bottom of Screen (ft btoc)	Screen Length (ft)	Well Inside Diameter (in)	Surveyed Date	Latitude NAD83 (D M S)	Longitude NAD83 (D M S)	Top of Well Casing Elevation (ft NGVD 29)	Top of Concrete Pad Elevation (ft NGVD 29)	Ground Surface Elevation (ft NGVD 29)	Top of Screen (ft NGVD 29)	Bottom of Screen (ft NGVD 29)	Well Depth (ft btoc)	Bottom of Well Elevation (ft NGVD 29)	Existing Stickup Height (ft ags)	Pump Intake Set Depth (ft btoc)	Pump Intake Set Depth (ft NGVD 29)	Pump Intake Set Depth (ft bgs)
ALF	ALF-P-4S	Northwest of East Ash Disposal Area	Shallow	8/29/2017	49	30.7-50.7	29.7	49.7	20.0	4.0	9/22/2017	N35°04'29.25"	W90°08'31.94''	215.89	216.81	216.89	186.2	166.2	50.1	165.8	-1.0	41.0	174.9	42.0
ALF	ALF-P-4	Northwest of East Ash Disposal Area	Intermediate	2/12/1988	64	69.7-79.8	71.7	81.8	10.1	2.0	11/18/2016	N35°04'28.86"	W90°08'32.04"	221.20	219.79	217.40	149.5	139.4	83.0	138.2	3.8	77.0	144.2	73.2
ALF	ALF-201	South of East Ash Disposal Area	Shallow	9/14/2016	49	19.6-46.2	23.3	49.9	26.6	4.0	11/18/2016	N35°04'10.01"	W90°08'22.98"	222.21	219.18	218.50	198.9	172.3	50.7	171.5	3.7	49.0	173.2	45.3
ALF	ALF-201B	South of East Ash Disposal Area	Intermediate	8/24/2017	64	79.6-89.6	83.9	93.9	10.0	4.0	9/22/2017	N35°04'09.95"	W90°08'22.66"	222.65	219.37	218.43	138.8	128.8	94.3	128.4	4.2	89.0	133.7	84.8
ALF	ALF-201A	South of East Ash Disposal Area	Deep	8/4/2017	64	116.4-126.4	120.3	130.3	10.0	4.0	9/22/2017	N35°04'09.98"	W90°08'22.84''	222.47	219.13	218.63	102.2	92.2	130.7	91.8	3.8	126.0	96.5	122.2
ALF	ALF-202	South of East Ash Disposal Area	Mounded	9/15/2016	43	19.5-40.7	23.4	44.6	21.2	4.0	11/18/2016	N35°04'09.07''	W90°08'11.67''	220.18	216.88	216.30	196.8	175.6	44.8	175.4	3.9	43.0	177.2	39.1
ALF	ALF-202B	South of East Ash Disposal Area	Intermediate	8/23/2017	64	80.8-90.8	84.1	94.1	10.0	4.0	9/22/2017	N35°04'09.09''	W90°08'11.98"	220.75	217.45	217.50	136.7	126.7	94.5	126.3	3.2	89.5	131.3	86.3
ALF	ALF-202A	South of East Ash Disposal Area	Deep	7/31/2017	64	137.4-147.4	140.1	150.1	10.0	4.0	9/22/2017	N35°04'09.08''	W90°08'11.83"	220.25	217.09	217.50	80.1	70.1	150.5	69.7	2.7	145.5	74.8	142.8
ALF	ALF-203	North of East Ash Disposal Area	Mounded	9/15/2016	53	29.3-50.3	33.1	54.1	21.0	4.0	11/18/2016	N35°04'27.68"	W90°08'23.98"	222.39	219.43	218.60	189.3	168.3	54.1	168.3	3.8	52.0	170.4	48.2
ALF	ALF-203B	North of East Ash Disposal Area	Intermediate	8/16/2017	64	80.4-90.4	83.9	93.9	10.0	4.0	9/22/2017	N35°04'27.69"	W90°08'24.25"	222.30	219.07	218.75	138.5	128.5	94.3	128.1	3.6	89.0	133.3	85.4
ALF	ALF-203A	North of East Ash Disposal Area	Deep	8/2/2017	64	108.3-118.3	112.3	122.3	10.0	4.0	9/22/2017	N35°04'27.69"	W90°08'24.12"	222.34	219.07	218.33	110.0	100.0	122.7	99.6	4.0	118.0	104.3	114.0
ALF	ALF-204	North of East Ash Disposal Area	Shallow	9/14/2016	58	45.2-55.4	49.0	59.2	10.2	4.0	11/18/2016	N35°04'28.14"	W90°08'14.94"	218.58	215.60	214.70	169.6	159.4	59.2	159.4	3.9	49.0	169.6	45.1
ALF	ALF-204B	North of East Ash Disposal Area	Intermediate	8/17/2017	64	79.5-89.5	83.7	93.7	10.0	4.0	9/22/2017	N35°04'28.14"	W90°08'15.35"	218.70	215.45	214.50	135.0	125.0	94.1	124.6	4.2	89.0	129.7	84.8
ALF	ALF-204A	North of East Ash Disposal Area	Deep	8/4/2017	64	106.1-116.1	110.3	120.3	10.0	4.0	9/22/2017	N35°04'28.13"	W90°08'15.16"	218.76	215.41	214.60	108.5	98.5	120.7	98.1	4.2	116.0	102.8	111.8
ALF	ALF-205	North of East Ash Disposal Area	Shallow	9/16/2016	55	30.7-51.7	34.5	55.5	21.0	4.0	11/18/2016	N35°04'26.62"	W90°08'05.93"	221.62	219.38	217.90	187.1	166.1	56.4	165.2	3.7	54.0	167.6	50.3
ALF	ALF-205B	North of East Ash Disposal Area	Intermediate	8/18/2017	64	71.3-81.3	76.1	86.1	10.0	4.0	9/22/2017	N35°04'26.65"	W90°08'05.67"	221.31	218.06	216.51	145.2	135.2	86.5	134.8	4.8	81.5	139.8	76.7
ALF	ALF-205A	North of East Ash Disposal Area	Deep	8/11/2017	64	97-107	102.0	112.0	10.0	4.0	9/22/2017	N35°04'26.73"	W90°08'06.25"	221.14	217.87	216.15	119.2	109.2	112.4	108.8	5.0	107.0	114.1	102.0
ALF	ALF-206	Northeast of East Ash Disposal Area	Shallow	9/16/2016	50	50.2-60.4	54.0	64.2	10.2	4.0	11/18/2016	N35°04'25.57"	W90°07'58.80''	226.02	223.18	222.30	172.0	161.8	64.4	161.6	3.7	54.0	172.0	50.3
ALF	ALF-207	North of West Ash Disposal Area	Shallow	9/17/2016	NA	24.9-56.3	28.7	60.1	31.4	4.0	11/18/2016	N35°04'31.09"	W90°09'13.07"	231.61	228.69	228.2	202.9	171.5	60.7	170.9	3.4	59.0	172.6	55.6
ALF	ALF-207A	North of West Ash Disposal Area	Deep	8/12/2017	NA	117-127	121.0	131.0	10.0	4.0	9/22/2017	N35°04'31.08"	W90°09'12.78"	232.04	228.77	228.00	111.0	101.0	131.4	100.6	4.0	126.0	106.0	122.0
ALF	ALF-208	North of West Ash Disposal Area	Shallow	9/16/2016	NA	25-51.9	28.8	55.7	26.9	4.0	11/18/2016	N35°04'31.21"	W90°09'18.74"	230.97	228.18	227.4	202.2	175.3	55.9	175.1	3.6	54.0	177.0	50.4
ALF	ALF-208A	North of West Ash Disposal Area	Deep	8/15/2017	NA	130.8-140.8	134.5	144.5	10.0	4.0	9/22/2017	N35°04'31.21"	W90°09'18.43"	231.27	228.05	227.60	96.8	86.8	144.9	86.4	3.7	140.2	91.1	136.5
ALF	ALF-209	North of West Ash Disposal Area	Shallow	9/16/2016	NA	10.9-32	14.6	35.7	21.1	4.0	11/18/2016	N35°04'32.29"	W90°09'25.37"	208.52	228.18	204.7	193.9	172.8	35.7	172.8	3.8	34.0	174.5	30.2
ALF	ALF-209A	North of West Ash Disposal Area	Deep	8/13/2017	NA	114-124	118.3	128.3	10.0	4.0	9/22/2017	N35°04'32.16"	W90°09'25.24"	210.58	207.35	206.30	92.3	82.3	128.7	81.9	4.3	123.7	86.9	119.4
ALF	ALF-210	South of Coal Power Plant	Shallow	9/17/2016	47	23.4-44.3	27.2	48.1	20.9	4.0	11/18/2016	N35°04'14.46"	W90°08'59.09"	219.78	216.74	216.20	192.6	171.7	48.8	171.0	3.6	47.0	172.8	43.4
ALF	ALF-210A	South of Coal Power Plant	Deep	8/2/2017	64	115.7-125.7	120.0	130.0	10.0	4.0	9/22/2017	N35°04'14.38"	W90°08'58.94"	220.46	217.19	216.18	100.5	90.5	130.4	90.1	4.3	125.0	95.5	120.7
ALF	ALF-212	Southeast of East Ash Disposal Area	Mounded	9/16/2016	64	48-64	51.8	67.8	16.0	4.0	11/18/2016	N35°04'17.01"	W90°07'57.45"	239.70	237.31	236.60	187.9	171.9	69.0	170.7	3.1	67.0	172.7	63.9
ALF	ALF-212A	Southeast of East Ash Disposal Area	Deep	8/10/2017	64	155.5-165.5	159.4	169.4	10.0	4.0	9/22/2017	N35°04'09.22''	W90°08'00.21"	239.65	236.41	235.84	80.3	70.3	169.8	69.9	3.8	165.0	74.7	161.2
ALF	ALF-213	East of East Ash Disposal Area	Shallow	9/14/2016	64	67.3-77.5	71.0	81.2	10.2	4.0	11/18/2016	N35°04'17.00"	W90°07'57.44"	240.54	237.39	237.3	169.5	159.3	81.3	159.2	3.2	71	169.5	67.8
ALF	ALF-213B	East of East Ash Disposal Area	Intermediate	11/14/2018	72	108-118	111.4	121.4	10.0	4.0	12/5/2018	N35°04'17.35"	W90°07'57.43"	241.18	237.97	237.7	129.8	119.8	121.8	119.4	3.5	116.75	124.4	113.3



Table 4-2 Monitoring Well Summary TVA Allen Fossil Plant Memphis, Tennessee

Plant	Well ID	Facility / Location	Screened Interval in Alluvial Aquifer	Well Installation Date	Transducer Depth (ft btoc)	Screened Interval (ft bgs)	Top of Screen (ft btoc)	Bottom of Screen (ft btoc)	Screen Length (ft)	Well Inside Diameter (in)	Surveyed Date	Latitude NAD83 (D M S)	Longitude NAD83 (D M S)	Top of Well Casing Elevation (ft NGVD 29)	Top of Concrete Pad Elevation (ft NGVD 29)	Ground Surface Elevation (ft NGVD 29)	Top of Screen (ft NGVD 29)	Bottom of Screen (ft NGVD 29)	Well Depth (ft btoc)	Bottom of Well Elevation (ft NGVD 29)	Existing Stickup Height (ft ags)	Pump Intake Set Depth (ft btoc)	Pump Intake Set Depth (ft NGVD 29)	Pump Intake Set Depth (ft bgs)
ALF	ALF-213A	East of East Ash Disposal Area	Deep	11/8/2018	72	149-159	152.4	162.4	10.0	4.0	12/5/2018	N35°04'17.44''	W90°07'57.41"	241.16	237.90	237.7	88.8	78.8	162.8	78.4	3.5	157.75	83.4	154.3
ALF	ALF-214	Southwest of East Ash Disposal Area	Shallow	8/23/2017	50	30.7-50.7	34.5	54.5	20.0	4.0	9/22/2017	N35°04'10.75"	W90°08'33.59"	221.29	218.02	217.51	186.8	166.8	54.9	166.4	3.8	45.0	176.3	41.2
ALF	ALF-214B	Southwest of East Ash Disposal Area	Intermediate	8/22/2017	64	79.2-89.2	82.9	92.9	10.0	4.0	9/22/2017	N35°04'10.76"	W90°08'33.76"	221.17	217.75	217.52	138.3	128.3	93.3	127.9	3.7	88.0	133.2	84.3
ALF	ALF-214A	Southwest of East Ash Disposal Area	Deep	8/17/2017	64	118.9-128.9	122.6	132.6	10.0	4.0	9/22/2017	N35°04'10.79"	W90°08'33.90"	221.28	217.98	217.56	98.7	88.7	133.0	88.3	3.7	130.0	91.3	126.3
ALF	ALF-215	South of East Ash Disposal Area	Mounded	9/6/2017	29	15.9-25.9	20.0	30.0	10.0	4.0	9/22/2017	N35°04'04.93"	W90°08'11.95"	216.36	213.10	212.27	196.4	186.4	30.4	186.0	4.1	25.0	191.4	20.9
ACC	ALF-216	ACC Plant (Alternate ALF-215 location)	Shallow	8/29/2017	54	35.3-55.3	39.6	59.6	20.0	4.0	9/22/2017	N35°04'01.20''	W90°08'18.44"	217.16	213.91	212.9	177.6	157.6	60.0	157.2	4.2	50	167.2	45.8
ALF	ALF-217	East of East Ash Disposal Area	Mounded	11/21/2018	67	46-68	49.4	71.4	22.0	4.0	12/5/2018	N35°04'12.87''	W90°07'57.90"	240.97	237.64	237.4	191.6	169.6	71.8	169.2	3.6	60.75	180.2	57.2
ALF	ALF-217B	East of East Ash Disposal Area	Intermediate	11/20/2018	72	118-128	121.4	131.4	10.0	4.0	12/5/2018	N35°04'12.94"	W90°07'57.89"	240.82	237.50	237.3	119.5	109.5	131.8	109.1	3.5	126.75	114.1	123.2
ALF	ALF-217A	East of East Ash Disposal Area	Deep	11/19/2018	72	179-189	182.4	192.4	10.0	4.0	12/5/2018	N35°04'13.01"	W90°07'57.89"	240.90	237.60	237.4	58.6	48.6	192.8	48.2	3.5	187.75	53.2	184.2
ACC	ACC-1A	Adjacent to Production Well 1	Deep	8/27/2017	64	156.2-166.2	160.1	170.1	10.0	4.0	9/22/2017	N35°03'55.15"	W90°08'21.01"	214.82	211.55	210.89	54.7	44.7	170.5	44.3	3.9	165.5	49.3	161.6
ACC	ACC-3A	Adjacent to Production Well 3	Deep	8/25/2017	64	117-127	120.4	130.4	10.0	4.0	9/22/2017	N35°03'59.31"	W90°08'53.34"	219.10	215.78	215.65	98.7	88.7	130.8	88.3	3.4	126.0	93.1	122.6
ACC	ACC-5A	Adjacent to Production Well 5	Deep	8/27/2017	55	129.8-139.8	133.6	143.6	10.0	4.0	9/22/2017	N35°04'03.70"	W90°08'32.94"	220.33	217.08	216.6	86.8	76.8	144.0	76.4	3.8	139	81.3	135.2
ACC	ACC-5B	Adjacent to Production Well 5	Shallow	8/27/2017	60	45.9-55.9	50.2	60.2	10.0	4.0	9/22/2017	N35°04'03.38"	W90°08'32.61"	220.33	217.08	216.0	170.1	160.1	60.6	159.7	4.3	55.5	164.8	51.2
ALF	EW-N02	North of West Ash Disposal Area	Mounded	10/31/2018	35	16-36	19.9	39.9	20.0	6.1	12/5/2018	N35°04'27.98"	W90°08'21.73"	220.28	217.45	217.3	200.4	180.4	40.4	179.9	3.0	30	190.3	27.0
ALF	PMW-02A	North of West Ash Disposal Area	Mounded	10/17/2018	35	15-36	19.0	40.0	21.0	4.0	12/5/2018	N35°04'28.77"	W90°08'22.51"	220.12	216.81	216.6	201.1	180.1	40.4	179.7	3.5	29	191.1	25.5
ALF	PMW-02B	North of West Ash Disposal Area	Intermediate	10/17/2018	50	45-55	48.4	58.4	10.0	4.0	12/5/2018	N35°04'28.79"	W90°08'22.41"	219.90	216.60	216.5	171.5	161.5	58.8	161.1	3.4	54	165.9	50.6
ALF	PMW-02C	North of West Ash Disposal Area	Deep	10/10/2018	50	115-125	119.3	129.3	10.0	4.0	12/5/2018	N35°04'28.80"	W90°08'22.30"	219.98	216.77	216.5	100.7	90.7	129.7	90.3	3.5	124	96.0	120.5
ALF	PMW-04A	North of West Ash Disposal Area	Mounded	10/9/2018	35	15-36	19.3	40.3	21.0	4.0	12/5/2018	N35°04'27.98''	W90°08'22.21"	220.87	217.68	217.4	201.5	180.5	40.7	180.1	3.5	29	191.9	25.5
ALF	PMW-04B	North of West Ash Disposal Area	Intermediate	10/5/2018	52	48-58	52.0	62.0	10.0	4.0	12/5/2018	N35°04'27.97"	W90°08'22.09"	220.99	217.84	217.6	169.0	159.0	62.4	158.6	3.4	57	164.0	53.6
ALF	PMW-04C	North of West Ash Disposal Area	Deep	10/4/2018	52	115-125	119.3	129.3	10.0	4.0	12/5/2018	N35°04'27.98"	W90°08'21.97"	220.90	217.61	217.5	101.6	91.6	129.7	91.2	3.4	124	96.9	120.6
ALF	PMW-07A	North of West Ash Disposal Area	Mounded	10/24/2018	24	15-25	18.9	28.9	10.0	4.0	12/5/2018	N35°04'28.59''	W90°08'19.91"	219.02	215.70	215.5	200.1	190.1	29.3	189.7	3.5	24	195.0	20.5
ALF	PMW-07B	North of West Ash Disposal Area	Intermediate	10/23/2018	50	46-56	49.5	59.5	10.0	4.0	12/5/2018	N35°04'28.59"	W90°08'19.82"	219.03	215.71	215.6	169.6	159.6	59.9	159.2	3.4	55	164.0	51.6
ALF	PMW-07C	North of West Ash Disposal Area	Deep	10/19/2018	50	108-118	112.5	122.5	10.0	4.0	12/5/2018	N35°04'28.59"	W90°08'19.74"	219.07	215.78	215.6	106.6	96.6	122.8	96.3	3.5	117	102.1	113.5
ALF	EW-S03	South of East Ash Disposal Area	Mounded	10/30/2018	39	20-40	25.9	45.9	20.0	6.1	12/5/2018	N35°04'09.34''	W90°08'12.22"	220.76	218.57	218.3	194.9	174.9	46.4	174.4	2.5	30	190.8	27.5
ALF	PMW-10A	South of East Ash Disposal Area	Mounded	10/24/2018	38	18-39	22.6	43.6	21.0	4.0	12/5/2018	N35°04'09.28"	W90°08'13.68"	222.26	219.01	218.9	199.7	178.7	44.0	178.3	3.4	32	190.3	28.6
ALF	PMW-10B	South of East Ash Disposal Area	Intermediate	10/24/2018	54	59-69	62.9	72.9	10.0	4.0	12/5/2018	N35°04'09.27"	W90°08'13.60"	222.34	219.08	218.9	159.5	149.5	73.3	149.1	3.4	68	154.3	64.6
ALF	PMW-10C	South of East Ash Disposal Area	Deep	10/23/2018	54	139-149	142.0	152.0	10.0	4.0	12/5/2018	N35°04'09.27''	W90°08'13.51"	222.31	219.02	218.8	80.3	70.3	152.4	69.9	3.5	148	74.3	144.5
ALF	PMW-11A	South of East Ash Disposal Area	Mounded	10/17/2018	33	13-34	16.6	37.6	21.0	4.0	12/5/2018	N35°04'08.05"	W90°08'13.56"	218.11	214.80	214.5	201.5	180.5	38.0	180.1	3.6	27	191.1	23.4
ALF	PMW-11B	South of East Ash Disposal Area	Intermediate	10/17/2018	50	54-64	57.3	67.3	10.0	4.0	12/5/2018	N35°04'08.05"	W90°08'13.49"	217.97	214.71	214.4	160.6	150.6	67.7	150.2	3.6	63	155.0	59.4
ALF	PMW-11C	South of East Ash Disposal Area	Deep	10/16/2018	50	135-145	139.0	149.0	10.0	4.0	12/5/2018	N35°04'08.04"	W90°08'13.43"	218.00	214.68	214.4	79.0	69.0	149.4	68.6	3.6	144	74.0	140.4



Plant	Well ID	Facility / Location	Screened Interval in Alluvial Aquifer	Well Installation Date	Transducer Depth (ft btoc)	Screened Interval (ft bgs)	Top of Screen (ft btoc)	Bottom of Screen (ft btoc)	Screen Length (ft)	Well Inside Diameter (in)	Surveyed Date	Latitude NAD83 (D M S)	Longitude NAD83 (D M S)	Top of Well Casing Elevation (ft NGVD 29)	Top of Concrete Pad Elevation (ft NGVD 29)	Ground Surface Elevation (ft NGVD 29)	Top of Screen (ff NGVD 29)	Bottom of Screen (ft NGVD 29)	Well Depth (ft btoc)	Bottom of Well Elevation (ft NGVD 29)	Existing Stickup Height (ft ags)	Pump Intake Set Depth (ft btoc)	Pump Intake Set Depth (ft NGVD 29)	Pump Intake Set Depth (ft bgs)
ALF	PMW-14A	South of East Ash Disposal Area	Mounded	10/31/2018	55	35-56	38.5	59.5	21.0	4.0	12/5/2018	N35°04'10.03"	W90°08'09.92"	240.34	237.10	237.0	201.8	180.8	59.9	180.4	3.3	49	191.3	45.7
ALF	PMW-14B	South of East Ash Disposal Area	Intermediate	10/30/2018	71	76-86	79.5	89.5	10.0	4.0	12/5/2018	N35°04'10.02"	W90°08'09.81"	240.47	237.23	237.1	161.0	151.0	89.9	150.6	3.4	85	155.5	81.6
ALF	PMW-14C	South of East Ash Disposal Area	Deep	10/29/2018	71	147-157	151.9	161.9	10.0	4.0	12/5/2018	N35°04'10.01"	W90°08'09.71"	240.45	237.21	237.1	88.6	78.6	162.3	78.2	3.3	156	84.4	152.7

Notes:

Well information based on data provided by TVA and Stantec (e.g., well logs, well inspection report).

Wells ALF-202A, ALF-203A, and ALF-214 were installed the day after their respective boring completion date.

Ground surface elevations are based on survey datum and/or well completion data.

EADA: East Ash Disposal Area

A&H, Inc.: Allen&Hoshall, Inc. [Surveyors]



Table 4-3 Soil Boring And Cone Penetration Testing Summary TVA Allen Fossil Plant Memphis, Tennessee

Well ID	Easting (ft TN NAD 27)	Northing (ft TN NAD 27)	Ground Surface Elevation (ft NGVD 29)	Year Boring was Advanced	Туре	TVA Report Reference	
CPT-1	757312.781	275092.9785	228.1	2004	Cone Penetration Test		
CPT-2	757198.4794	274921.1556	228.2	2004	Cone Penetration Test		
CPT-3	761427.5984	274310.6945	238.6	2004	Cone Penetration Test		
CPT-4	763325.5609	273394.0483	236.4	2004	Cone Penetration Test		
CPT-5	761176.2058	273269.0562	236.6	2004	Cone Penetration Test		
EAD-1	761427.5984	274310.6945	238.6	2004	Cone Penetration Test	_	
EAD-1B	761427.5984	274310.6945	238.6	2004	Soil Boring	MACTEC, 2004. Report of Geotechnical Exploration,	
EAD-2	763379.7279	273782.2322	236.6	2004	Soil Boring	East and West Ash Disposal Areas, Allen Fossil Plant,	
EAD-3	763325.5609	273394.0483	236.4	2004	Soil Boring	Memphis, Tennessee, August 18, 2004.	
EAD-4	761176.2058	273269.0562	236.6	2004	Soil Boring	-	
EAD-5	761238.0121	273671.1287	230.5	2004	Soil Boring	-	
WAD-1	756559.9766	275143.3159	227.9	2004	Soil Boring	4	
WAD-2	/5/2//.9606	2/5113./942	228.1	2004	Soil Boring	4	
WAD-20d	/5/2//.9606	2/5113./942	228.1	2004	Soil Boring	4	
WAD-3	757190.531	2/492/.9681	228.2	2004	Soil Boring		
HA-10	/63/48.55	2/4010.5898	237.2	2009	Hand Auger	4	
HA-9	763612.3701	2/3021.6/	237.0	2009	Hand Auger		
SIN-10	763731.886	2/4052.9119	236.9	2009	Soll Boring	Stantec, 2010a. Report of Geotechnical Exploration	
SIN-11	763661.6743	2/355/.9/33	237.8	2009	Soil Boring	and Evaluation of Slope Stability, Eastern Perimeter	
SIN-12	763650.3434	2/3053.524/	216./	2009	Soll Boring	County Tennessee February 4 2010	
SIN-13	763591.5623	2/3054.9054	236.9	2009	Soll Boring		
SIN-14	/63321.41/1	2/2/96.0443	236.5	2009	Soll Boring	4	
511N-9	763793.9874	274043.8314	221.2	2009			
HA-I	763235.8119	2/4226.3401	235./	2009		-	
HA-2	763227.9742	2/4168.304/	230.5	2009	Hand Auger	-	
HA-3	763025.6678	2/4231.2335	234.2	2009	Hand Auger	4	
HA-4	762696.2343	2/4299.2509	233.6	2009	Hand Auger	4	
HA-5	762227.9531	2/43/5.0565	233./	2009	Hand Auger	4	
HA-6	762217.5535	2/4360.9863	232.5	2009		-	
HA-7	762227.8032	2/4363.8965	232.4	2009	Hand Auger	4	
HA-8	762277.6823	2/4358.0168	232.1	2009	Hand Auger	Stantec, 2010b. Report of Geotechnical Exploration	
SIN-I	762170.4565	2/4635.4089	215.3	2009	Soll Boring	and Evaluation of Slope Stability, Northern Perimeter	
SIN-2	762169.2163	2/44//.9824	238.8	2009	Soll Boring	County Tennessee March 25, 2010	
STN-ZA	762169.2163	2/44/7.9824	238.8	2009	Soli Boring		
STN-3	762169.0261	2/444/.9931	234.3	2009	Soil Boring	4	
STN-4	762661.3738	2/4401.64/6	237.3	2009	Soli Boring	4	
	763174.1058	274401.0113	217.5	2009	Soil Boring	4	
511N-6	763150.6551	2/4298./036	238.3	2009	Soil Boring	-	
	763144.3631	274207.3744	233.0	2007	Soil Boring	4	
	763620.464	2/4199.0290	237.5	2009	Soil Boring	4	
	763620.464	2/4199.0290	237.5	2009	Soil Boring		
	763640.7139	273535.0137	230.0	2010	Soil Boring	4	
STN-113	763661.0043	2730227054	237.3	2010	Soil Boring	-	
STN-12K	763631.0236	273022.7034	216.0	2010	Soil Boring		
	763720.2030	273330.0027	210.0	2010	Soil Boring	Stantec, 2011. Geotechnical Report for the	
STN-7K	763777.0471	274060.4300	223.0	2010	Soil Boring	the Eastern Perimeter Dike East Stilling Pond Allen	
STIN-10 STNI 12 A	763407 5007	274103.0033	200.7	2011	Soil Boring	Fossil Plant, Memphis, Tennessee, May 11, 2011.	
STIN-TOA STNI 17	763360 2001	213000.0274	230.U 032.0	2011	Soil Boring		
STIN-17 STIN-18	763081 0121	273023.7030	230.2	2011	Soil Boring	1	
	763302 1.2404	273205 3252	200.7	2011	Soil Boring	1	
STN-TOA STNL19	758763 5000	27 0200.0200	233.3	2011	Soil Boring		
STIN-17 STNL-19A	758723 5000	274700.0102	230.3	2012	Soil Boring	1	
	758269 5709	275061 6086	200.0	2012	Soil Boring	1	
STIN-20 STIN-21	757001 2551	275022002	211.0	2012	Soil Boring	1	
STIN-21 STIN-21	757761 8710	275072 2010	220.7	2012	Soil Boring	Stanton 2012 Controbuind Fundamities Date of	
STN-22	757761.8710	275072.0047	227.1	2012	Soil Boring	Northern Perimeter Dike Stability Chemical	
STN-22/1 STNL-23	757772 2115	2751/20120	227.1	2012	Soil Boring	Treatment Pond Closure, Allen Fossil Plant, Shelby	
STIN-23	757652 7280	27/1951 200	204.0	2012	Soil Boring	County, Tennessee, August 17, 2012.	
STN-24 STN-25	757740 0000	274777 2012	220.7	2012	Soil Boring	1 <i>,</i>	
STN-23	757060.0707	214112.2710	220.3	2012	Soil Boring	1	
STN-20 STN1 07	750107 7101	214140.0072	201.1	2012	Soil Boring	1	
STN-2/	759357 0005	2/4/37.2003	201.0 027.0	2012	Soil Boring	4	
SIIN-20 ALE D 1 A	742000 0520	2/400/.7/14	201.7	2012	Conc Ponatration Test		
	763100 3445	214020.0/07	230.3	2012	Cone Penetration Tost	Geocomp Consulting, Inc., 2016. IVA EPA Seismic	
	742097 2020	214402.0407	217.J	2012		Ash Disposal Area Final Report Volume 2 of 4	
ALC-D-ZA	7621007.2237	274320.3038	200.0 017 F	2012	Soil Boring	October 2016.	
ALL-D-7D	100100./343	2/4400.1013	Z17.3	2012	SOUDOUND		



Table 4-3 Soil Boring And Cone Penetration Testing Summary **TVA Allen Fossil Plant** Memphis, Tennessee

Well ID	Easting (ft TN NAD 27)	Northing (ft TN NAD 27)	Ground Surface Elevation (ft NGVD 29)	Year Boring was Advanced	Туре	TVA Report Reference
STN-70	760924.762	274288.8021	238.2	2015	Soil Boring	
STN-71	761353.1704	274430.5937	239.2	2015	Soil Boring	
STN-74	762248.6874	274044.3907	236.8	2015	Soil Boring	
STN-76	761686.6763	273710.5053	235.0	2015	Soil Boring	-
STN-78	760718.4577	273735.8169	238.3	2015	Soil Boring	-
STN-79	761340.8696	273496.2143	238.6	2015	Soil Boring	
SIN-80	/61//1.8///	2/3201./153	235.1	2015	Soil Boring	Stantec, 2015. Geotechnical Exploration Data
STN-84	761829.6793	2/4154.893/	237.6	2015	Cone Penetration Test	Shelby County Tennessee, December 11, 2015
STN-84	762007.0040	274367.4637	236.1	2015	Cone Penetration Test	
STN-90	763430 4103	274031.4712	236.8	2015	Cone Penetration Test	-
STN-93	761681,7763	273711.6053	235.2	2015	Cone Penetration Test	1
STN-94	762024.2828	273543.6045	235.0	2015	Cone Penetration Test	
STN-99	761764.0773	273198.8155	235.1	2015	Cone Penetration Test	
STN-99A	761764.0773	273198.8155	235.1	2015	Cone Penetration Test	1
STN-29	756228.8914	275210.1309	209.8	2015	Soil Boring	
STN-30	756290.8525	275146.3617	228.2	2015	Soil Boring	
STN-31	756628.4091	275319.9537	197.3	2015	Soil Boring	
STN-32	756635.5194	275205.2861	215.3	2015	Soil Boring	-
STN-33	756634.8394	275154.2672	228.2	2015	Soil Boring	-
STN-33A	756643.4895	275154.9269	227.9	2015	Soil Boring	-
SIN-34	/5/545./1/	2/5254.3336	197.3	2015	Soil Boring	4
SIN-35	757533.7168	275202.9847	201.9	2015	Soil Boring	4
STN-36	7570591774	2/5104./569	227.8	2015	Soll Boring	-
STN-37	756627 4792	275046 939	227.7	2015	Soil Boring	
STN-38A	756636 3593	275067 189	212.7	2015	Soil Boring	1
STN-39	757042.217	275035.4446	227.7	2015	Soil Boring	
STN-40	757508.8063	274994.7896	227.7	2015	Soil Boring	
STN-41	756374.5942	274920.2358	214.9	2015	Soil Boring	Stantec, 2016a. Geotechnical Exploration Report,
STN-42	756204.8609	274809.4303	228.2	2015	Soil Boring	Northern Perimeter Dike Stability, West Ash Pond
STN-43	756498.9164	274616.3008	218.5	2015	Soil Boring	Tennessee, February 22, 2016.
STN-44	756906.1245	274727.4932	216.9	2015	Soil Boring	
STN-45	757446.1149	274605.779	222.1	2015	Soil Boring	
STN-46	756633.3393	275318.4836	197.5	2015	Cone Penetration Test	-
STN-47	757524.6264	275212.2446	200.7	2015	Cone Penetration Test	-
STN-49	756618.9088	275056.9794	213.5	2015	Cone Penetration Test	4
SIN-52	756363.924	274923.1357	215.1	2015	Cone Penetration Test	4
311N-33 STNI 54	754404.0802	274815.7542	228.1	2015	Cone Penetration Test	-
STN-58	756917 6547	274010.3321	213.0	2015	Cone Penetration Test	
STN-59	756323 3333	275064 5031	213.1	2015	Soil Boring	4
STN-60	756779.8121	275079.207	216.6	2015	Soil Boring	
STN-63	756575.3781	274872.304	215.2	2015	Soil Boring	1
STN-64	756893.4641	274894.2998	215.7	2015	Soil Boring	
STN-67	756713.0008	274702.2863	216.8	2015	Soil Boring	
ALF-A-1A	762108.9952	274666.1788	215.1	2015	Cone Penetration Test	
ALF-A-1B	762097.4749	274535.5219	239.0	2015	Cone Penetration Test	
ALF-A-1BC	762097.4749	274535.5219	239.0	2015	Cone Penetration Test	
ALF-A-1BD	762097.4749	274535.5219	239.0	2015	Cone Penetration Test	
ALF-B-3A	763101.4844	274450.7912	217.5	2015	Soil Boring	-
ALF-B-3A-2	763095.5542	274452.1412	217.4	2015	Soil Boring	-
ALF-C-1A	763711.2857	274095.6913	237.3	2015	Cone Penetration Test	4
ALF-C-1AB	763711.2857	274095.6913	237.3	2015	Cone Penetration Test	Geocomp Consulting, Inc., 2016. TVA EPA Seismic
ALF-C-IB	763///.2169	2/4076.5402	221.8	2015		Assessment Supplemental Site Exploration ALF East
	100000.000/ 763600 0050	213003.372/	200.U 017 5	2015		Ash Disposal Area Final Report, Volume 2 of 4,
ΑLI -D-2Α ΑL F-F-1Δ	763560 9619	273090 0048	217.3	2013	Cone Penetration Test	October 2016.
AIF-F-1R	763633 3033	273101 3439	213.1	2015	Cone Penetration Test	1
ALF-E-2A	763564.912	273105.5047	237.4	2015	Soil Borina	1
ALF-E-2B	763560.822	273115.1543	237.3	2015	Soil Boring	1
ALF-E-2B-2	763552.9817	273099.8149	237.3	2015	Soil Boring	1
ALF-E-2C	763553.5519	273113.2745	237.3	2015	Soil Boring]
ALF-E-2D	763638.4235	273094.3838	213.6	2015	Soil Boring]
ALF-E-2E	763565.4321	273103.6645	0.0	2015	Soil Boring	



Table 4-3 Soil Boring And Cone Penetration Testing Summary **TVA Allen Fossil Plant** Memphis, Tennessee

Well ID	Easting (ft TN NAD 27)	Northing (ft TN NAD 27)	Ground Surface Elevation (ft NGVD 29)	Year Boring was Advanced	Туре	TVA Report Reference
ALF-200	757235.86	274307.9	231.8	2016	Soil Boring	Stantec, 2017. Geotechnical Field Services for Well Installation and Closures: Well Installations and
ALF-211	756704.88	274346.39	233.9	2016	Soil Boring	Phase 3, Allen Fossil Plant, Memphis, Shelby County, Tennessee, February 2, 2017.
ALF-205C	763029.6706	274393.4234	216.0	2017	Soil Boring	-
ALF-212C	763409.0861	272613.9399	235.8	2017	Soil Boring	-
ALF-214C	760629.4993	272887.4807	217.5	2017	Soil Boring	-
ALF-P-4C	760848.97	274709.73	216.9	2017	Soil Boring	-

Notes:

Soil Boring and Cone Penetration Testing location information based on data provided by TVA and Stantec (e.g., well logs, well inspection report).

Ground surface elevations are based on survey datum and/or well completion data.

ft TN NAD 27 - Feet Tennessee North American Datum of 1927 ft NGVD 29 - Feet Nation Geodetic Vertical Datum of 1929



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Table 4-4 Upper and Lower Alluvium Distribution Summary TVA Allen Fossil Plant Memphis, Tennessee

Well ID	Easting (ft TN NAD 27)	Northing (ft TN NAD 27)	Ground Surface Elevation (ft NGVD 29)	Inferred Elevation of the Base of Upper Alluvium (ft NGVD 29)	Thickness of the Upper Alluvium	Inferred Elevation of the Base of Lower Alluvium (ft NGVD 29)	Thickness of the Lower Alluvium
ALF-212C	763409.0861	272613.9399	235.8	163.8	72.0	8.8	155.0
ALF-A-1BC	762097.4749	274535.5219	239.0	167	72.0	-	-
STN-47	757524.6264	275212.2446	200.7	167.95	32.8	-	-
STN-46	756633.3393	275318.4836	197.5	168.5	29.0	-	-
ALF-B-1B	763109.3445	274452.6409	217.5	170.5	47.0	-	-
ALF-D-1A	763636.5637	273603.3927	238.0	172	66.0	-	-
STN-1	762170.4565	274635.4089	215.3	173.3	42.0	-	-
STN-18	763281.2464	273051.6394	235.7	173.7	62.0	-	-
STN-5	763174.1058	274401.0113	217.5	175	42.5	-	-
STN-36	757526.9265	275104.7569	227.8	175.8	52.0	-	-
ALF-211	756704.88	274346.39	233.9	175.9	58.0	-	-
STN-6	763150.6551	274298.7036	238.3	176.3	62.0	-	-
ALF-C-1B	763777.2169	274096.5402	221.8	176.8	45.0	-	-
ALF-B-1A	763080.0538	274326.3739	238.3	177.3	61.0	-	-
ALF-A-1A	762108.9952	274666.1788	215.1	179.1	36.0	-	-
STN-2	762169.2163	274477.9824	238.8	179.3	59.5	-	-
STN-21	757991.2554	275023.983	228.9	179.9	49.0	-	-
CPT-1	757312.781	275092.9785	228.1	180.1	48.0	-	-
STN-38	756627.4792	275066.939	212.7	180.2	32.5	-	-
STN-4	762661.3758	274401.6476	237.5	181	56.5	-	-
EAD-3	763325.5609	273394.0483	236.4	182.9	53.5	-	-
EAD-2	763379.7279	273782.2322	236.6	183.1	53.5	-	-
STN-57	756917.6547	274723.5832	213.1	184.1	29.0	-	-
STN-27	758187.7191	274759.2665	231.5	184.2	47.3	-	-
CPT-4	763325.5609	273394.0483	236.4	184.4	52.0	-	-
STN-30	756290.8525	275146.3617	228.2	184.7	43.5	-	-
STN-23	757772.2115	275143.2129	204.3	184.8	19.5	-	-
ALF-P-4C	760848.97	274709.73	216.9	185.9	31.0	88.9	97.0
STN-56	756494.9875	274616.5321	218.0	187.01	31.0	-	-
STN-28	758357.9225	274887.9714	237.9	187.4	50.5	-	-
STN-99A	761764.0773	273198.8155	235.1	187.6	47.5	-	-
ALF-205C	763029.6706	274393.4234	216.0	188	28.0	105	83.0
ALF-214C	760629.4993	272887.4807	217.5	188	29.5	89.5	98.5
CPT-2	757198.4794	274921.1556	228.2	189.2	39.0	-	-
STN-14	763321.4171	272796.0443	236.5	189.7	46.8	-	-
STN-55	757459.0852	274815.7542	228.1	190.1	38.0	-	-
STN-17	763360.6084	273625.7656	236.2	190.2	46.0	-	-
STN-33	756634.8394	275154.2672	228.2	190.2	38.0	-	-
STN-37	757058.1774	275140.122	227.9	190.4	37.5	-	-
STN-24	757652.7389	274951.309	228.7	190.7	38.0	-	-
STN-94	762024.2828	273543.6045	235.0	191	44.0	-	-
WAD-1	756559.9766	275143.3159	227.9	191.4	36.5	-	-
STN-22	757761.8712	275072.8049	229.1	192.1	37.0	-	-
STN-19	758263.5909	274986.8102	230.5	193.5	37.0	-	-
STN-86	762238.5872	274031.4912	236.3	194.3	42.0	-	-
STN-25	757760.0909	274772.2916	228.3	194.5	33.8	-	-
STN-40	757508.8063	274994.7896	227.7	195.7	32.0	-	-
STN-93	761681.7763	273711.6053	235.2	197.2	38.0	-	-
CPT-3	761427.5984	274310.6945	238.6	197.6	41.0	-	-
STN-26	757962.7947	274748.5592	231.1	198.1	33.0	-	-
CPT-5	761176.2058	273269.0562	236.6	198.6	38.0	-	-
EAD-5	761238.0121	273671.1287	230.5	200.5	30.0	-	-
ACC-1A	761621.217	271265.47	210.9	175.4	35.5	42.9	132.5
ACC-3A	758953.5762	271799.9713	215.7	185.7	30.0	88.7	97.0
ACC-5A	760667.1997	272171.4742	216.6	186.1	30.5	75.6	110.5



Table 4-4 Upper and Lower Alluvium Distribution Summary TVA Allen Fossil Plant Memphis, Tennessee

Well ID	Easting (ft TN NAD 27)	Northing (ft TN NAD 27)	Ground Surface Elevation (ft NGVD 29)	Inferred Elevation of the Base of Upper Alluvium (ft NGVD 29)	Thickness of the Upper Alluvium	Inferred Elevation of the Base of Lower Alluvium (ft NGVD 29)	Thickness of the Lower Alluvium
ALF-203A	761491.0393	274563.6202	218.3	170.8	47.5	98.3	72.5
ALF-204A	762248.0808	274576.9138	214.6	179.6	35.0	92.1	87.5
ALF-206	763595.3863	274260.6192	222.3	175.3	47.0	-	-
ALF-207A	757475.7365	275077.378	228.0	167	61.0	100	67.0
ALF-208A	757007.111	275110.7311	227.6	-	-	86.6	-
ALF-209A	756445.2373	275230.6067	206.3	174.6	31.7	82.3	92.3
ALF-210A	758553.2768	273341.9165	216.2	180.2	36.0	72.2	108.0
ALF-213A	763675.472	273432.551	237.7	175.7	62.0	77.2	98.5
ALF-215	762415.5545	272221.4121	212.3	168.8	43.5	-	-
ALF-216	761860.3116	271867.3427	212.9	183.4	29.5	-	-
ALF-217A	763616.395	272986.837	237.4	166.4	71.0	47.4	119.0
ALF-EW-S03	762410.679	272667.175	218.3	173.3	45.0	-	-
PMW-02C	761656.243	274668.268	216.5	174.5	42.0	89.5	85.0
PMW-04C	761680.825	274584.239	217.5	174.5	43.0	91.5	83.0
PMW-07C	761868.578	274637.275	215.6	175.6	40.0	96.6	79.0
PMW-10C	762303.086	272664.531	218.8	167.8	51.0	90.8	77.0
PMW-11C	762304.874	272540.013	214.4	167.4	47.0	73.9	93.5
PMW-14C	762622.102	272725.878	237.1	166.1	71.0	99.1	67.0
B-14A	755911.3102	276246.6579	-	-	-	70	-
B-9A	757714.9437	277622.5523	-	-	-	57	-
PW-2	759979.3939	271483.66	-	-	-	65.02	-
PW-4	759472.0562	272274.2655	-	-	-	74.51	-
ALF-201A	761532.8108	272769.8226	218.6	-	-	89.6	-
ALF-202A	762443.3323	272640.54	217.5	-	-	70.5	-

Notes:

Soil Boring and Cone Penetration Testing location information based on data provided by TVA and Stantec (e.g., well logs, well inspection report).

Ground surface elevations are based on survey datum and/or well completion data.

ft TN NAD 27 - Feet Tennessee North American Datum of 1927

ft NGVD 29 - Feet Nation Geodetic Vertical Datum of 1929



Table 4-5 Summary of Literature Referenced Hydraulic Properties TVA Allen Fossil Plant Memphis, Tennessee

Lithology		Loess	Terrace Deposits	Alluvium	Upper Claiborne Confining Unit
Clark & Hart (2000)	Кху	27.9	200		1
Clark & Hart (2009)	Kz	1.27	1		6.78E-04
127201 at al (2018)	Кху		3.28 - 150.92	118.11 - 390.42	2.0E-05 - 3.0
Jazael, et al. (2010)	Kz		8.5E-05 - 2.29		4.9E-06 - 2.0E-02
Charmichael et al. (2018)	Кху			90 - 390	2.0E-05 - 5.0E-05
Chamichael, et al. (2016)	Kz				5.0E-06 - 2.5E-03
Reed (2003)	Кху			120 - 390	
U.S. Dept. of Energy (1981)	Kxy			283.5 - 992	
Arthur & Taylor (1988)	Kz				1.00E-05

Notes:

Kxy - Horizontal Hydraulic Conductivity in feet per day

Kz - Vertical Hydraulic Conductivity in feet per day



Well ID	Test	Test Date	Horizontal Hydraulic Conductivity (ft/day)	Average Horizontal Hydraulic Conductivity (ft/day)	Horizontal Hydraulic Conductivity (cm/sec)	Average Horizontal Hydraulic Conductivity (cm/sec)	Solution Method (AQTESOLV)
	Slug In (1)	12/5/18	2.80		9.86E-04		
	Slug In (2)	12/5/18	2.62		9.26E-04		
	Slug In (3)	12/6/18	2.64	0.73	9.32E-04		Deuwer Dies
ALF-217	Slug Out (1)	12/5/18	2.03	2.63	7.16E-04	9.26E-04	BOUMEL-RICE
	Slug Out (2)	12/5/18	2.72		9.60E-04		
	Slug Out (3)	12/6/18	2.94		1.04E-03		
	Slug-In (1)	12/19/18	8.97		3.16E-03		
	Slug-In (2)	12/19/18	8.81		3.11E-03		
	Slug-In (3)	12/19/18	8.92	0.07	3.15E-03	2 125 02	Deuwer Dies
P/MVV-04A	Slug-Out (1)	12/19/18	9.01	8.86	3.18E-03	3.13E-03	BOUWEI-RICE
	Slug-Out (2)	12/19/18	8.83		3.12E-03		
	Slug-Out (3)	12/19/18	8.62		3.04E-03		
	Slug In (1)	8/20/17	38.96		1.37E-02		
	Slug In (2)	8/20/17	40.15		1.42E-02		
415 000	Slug In (3)	8/20/17	38.32	41.70	1.35E-02	1 475 00	Deuwer Dies
ALF-209	Slug Out (1)	8/20/17	42.77	41.68	1.51E-02	1.4/E-02	Bouwer-Rice
	Slug Out (2)	8/20/17	45.13		1.59E-02		
	Slug Out (3)	8/20/17	44.76		1.58E-02		
	Slug In (1)	8/30/17	25.46		8.98E-03		
	Slug In (2)	8/30/17	24.80		8.75E-03		
	Slug In (3)	8/30/17	25.31	0/ 27	8.93E-03		Derman Die e
ALF-214	Slug Out (1)	8/30/17	29.37	26.37	1.04E-02	9.30E-03	BOUMEL-RICE
	Slug Out (2)	8/30/17	25.93		9.15E-03		
	Slug Out (3)	8/30/17	27.33		9.64E-03		
	Slug In (1)	8/30/17	15.47		5.46E-03		
	Slug In (2)	8/30/17	16.09		5.68E-03	5.80E-03	
ALF-216	Slug Out (1)	8/30/17	15.90	16.43	5.61E-03		Bouwer-Rice
	Slug Out (2)	8/30/17	17.29		6.10E-03		
	Slug Out (3)	8/30/17	17.41		6.14E-03		
	Slug In (1)	8/30/17	135.90		4.79E-02		
	Slug In (2)	8/30/17	72.70		2.56E-02		
ALF-P-4S	Slug In (3)	8/30/17	64.36	84.15	2.27E-02	2.97E-02	Bouwer-Rice
	Slug Out (1)	8/30/17	75.08		2.65E-02		
	Slug Out (2)	8/30/17	72.69		2.56E-02		
	Slug In (1)	8/30/17	164.7		5.81E-02		
	Slug In (2)	8/30/17	120.5		4.25E-02		
	Slug In (3)	8/30/17	157.6	150 7	5.56E-02		Rouwer Pico
ACC-JB	Slug Out (1)	8/30/17	170.3	130.7	6.01E-02	J.00E-02	DOUWEI-RICE
	Slug Out (2)	8/30/17	166.5		5.87E-02		
	Slug Out (3)	8/30/17	172.5		6.09E-02		
	Slug In (1)	8/28/17	126.9		4.48E-02		
	Slug In (1)-2	8/28/17	119.3		4.21E-02		
	Slug In (1)-3	8/28/17	114.2		4.03E-02		
	Slug In (2)	8/28/17	115.5	130 1	4.07E-02		BOUWER BIOD
ALF-ZUID	Slug In (3)	8/28/17	132.6	130.4	4.68E-02	4.0UE-UZ	DOUWEI-RICE
	Slug Out (1)	8/28/17	135.8		4.79E-02		
	Slug Out (2)	8/28/17	159.6		5.63E-02		
	Slug Out (3)	8/28/17	139.3		4.91E-02		



Well ID	Test	Test Date	Horizontal Hydraulic Conductivity (ft/day)	Average Horizontal Hydraulic Conductivity (ft/day)	Horizontal Hydraulic Conductivity (cm/sec)	Average Horizontal Hydraulic Conductivity (cm/sec)	Solution Method (AQTESOLV)
	Slug In (1)	8/29/17	137.8		4.86E-02		
	Slug In (2)	8/29/17	149.1		5.26E-02		
	Slug In (3)	8/29/17	158.7	160 7	5.60E-02		Rouwer Dioo
ALF-202B	Slug Out (1)	8/29/17	172.9	158./	6.10E-02	5.60E-02	BOUWEI-RICE
	Slug Out (2)	8/29/17	161.3		5.69E-02		
	Slug Out (3)	8/29/17	172.3		6.08E-02		
	Slug In (1)	8/29/17	421.1		1.49E-01		
	Slug In (2)	8/29/17	406.5		1.43E-01		
	Slug In (3)	8/29/17	399.0	114 7	1.41E-01	1 A7E O1	Bouwor Pico
ALF-203D	Slug Out (1)	8/29/17	428.0	410./	1.51E-01	1.47 E-01	DOUWEI-RICE
	Slug Out (2)	8/29/17	442.2		1.56E-01		
	Slug Out (3)	8/29/17	403.3		1.42E-01		
	Slug In (1)	8/29/17	110.4		3.89E-02		
	Slug In (2)	8/29/17	110.5		3.90E-02		
	Slug In (3)	8/29/17	119.6	115 1	4.22E-02		Rouwer Pico
ALF-204D	Slug Out (1)	8/29/17	115.9	113.1	4.09E-02	4.000-02	DOUWEI-RICE
	Slug Out (2)	8/29/17	115.2		4.06E-02		
	Slug Out (3)	8/29/17	118.7		4.19E-02		
	Slug In (1)	8/29/17	191.60		6.76E-02		
	Slug In (2)	8/29/17	183.70		6.48E-02		
	Slug In (3)	8/29/17	182.80	104.2	6.45E-02	4 005 00	Rouwer Pico
ALF-203D	Slug Out (1)	8/29/17	205.30	170.3	7.24E-02	0.72E-02	DOUWEI-RICE
	Slug Out (2)	8/29/17	207.90		7.33E-02		
	Slug Out (3)	8/29/17	206.20		7.27E-02		
	Slug In (1)	12/12/18	16.16		5.70E-03		
	Slug In (2)	12/12/18	16.28		5.74E-03		
ALE-213B	Slug In (3)	12/12/18	16.26	17.08	5.74E-03	6 02E-03	Bouwer-Rice
ALI-2100	Slug Out (1)	12/12/18	18.39	17.00	6.49E-03	0.022-00	DOOWCI-RICC
	Slug Out (2)	12/12/18	17.91		6.32E-03		
	Slug Out (3)	12/12/18	17.47		6.16E-03		
	Slug In (1)	8/30/17	217.20		7.66E-02		
	Slug In (2)	8/30/17	237.90		8.39E-02		
ALE-214B	Slug In (3)	8/30/17	204.40	259.2	7.21E-02	9 14F-02	Bouwer-Rice
	Slug Out (1)	8/30/17	304.70	207.2	1.07E-01		
	Slug Out (2)	8/30/17	298.80		1.05E-01		
	Slug Out (3)	8/30/17	292.20		1.03E-01		
	Slug In (1)	12/6/18	423.90		1.50E-01		
	Slug In (2)	12/6/18	584.80		2.06E-01		
	Slug In (3)	12/6/18	495.50		1.75E-01		
	Slug In (4)	12/12/18	549.20		1.94E-01		
	Slug In (5)	12/12/18	561.20		1.98E-01		
ALF-217B	Slug In (6)	12/12/18	493.30	482.34	1.74E-01	1.70E-01	Bouwer-Rice
	Slug Out (1)	12/6/18	476.80		1.68E-01		
	Slug Out (2)	12/6/18	414.00		1.46E-01		
	Slug Out (3)	12/6/18	423.40		1.49E-01		
	Slug Out (4)	12/12/18	451.30		1.59E-01		
	Slug Out (5)	12/12/18	471.50		1.66E-01		
	Slug Out (6)	12/12/18	443.20		1.56E-01		



Well ID	Test	Test Date	Horizontal Hydraulic Conductivity (ft/day)	Average Horizontal Hydraulic Conductivity (ft/day)	Horizontal Hydraulic Conductivity (cm/sec)	Average Horizontal Hydraulic Conductivity (cm/sec)	Solution Method (AQTESOLV)
	Slug-In (1)	12/19/18	23.21		8.19E-03		
	Slug-In (2)	12/19/18	22.56		7.96E-03	0.015.00	
	Slug-In (3)	12/19/18	23.08	02.2	8.14E-03		Decision Diese
P/VIVV-04B	Slug-Out (1)	12/19/18	23.43	23.3	8.27E-03	8.21E-03	BOUWEI-RICE
	Slug-Out (2)	12/19/18	23.34		8.23E-03		
	Slug-Out (3)	12/19/18	23.99		8.46E-03		
	Slug In (1)	8/16/17	137.2		4.84E-02		
	Slug In (2)	8/16/17	96.75		3.41E-02		
	Slug In (3)	8/16/17	113.7	100 5	4.01E-02	1 57E 00	Bouwor Pico
ALI-201A	Slug Out (1)	8/16/17	146.7	127.5	5.18E-02	4.J/L-02	DODMEI-KICE
	Slug Out (2)	8/16/17	141.7		5.00E-02		
	Slug Out (3)	8/16/17	141.0		4.97E-02		
	Slug In (1)	8/16/17	36.80		1.30E-02		
	Slug In (2)	8/16/17	36.40		1.28E-02		
ALE-202A	Slug In (3)	8/16/17	36.35	36 57	1.28E-02	1.295-02	Bouwer Pice
ALI-202A	Slug Out (1)	8/16/17	37.87	50.57	1.34E-02	1.272-02	bouwel-kice
	Slug Out (2)	8/16/17	35.13		1.24E-02		
	Slug Out (3)	8/16/17	36.87		1.30E-02		
	Slug In (1)	8/17/17	79.16		2.79E-02		
	Slug In (2)	8/17/17	84.58		2.98E-02		
ALE-203A	Slug In (3)	8/17/17	90.84	89.87	3.20E-02	3 17E-02	Bouwer-Rice
7121 20071	Slug Out (1)	8/17/17	98.96	07.07	3.49E-02	0.17 2 02	
	Slug Out (2)	8/17/17	87.96		3.10E-02		
	Slug Out (3)	8/17/17	97.70		3.45E-02		
	Slug In (1)	8/17/17	53.27		1.88E-02		
	Slug In (2)	8/17/17	51.31		1.81E-02		Bouwer-Rice
ALF-204A	Slug In (3)	8/17/17	51.72	52.55	1.82E-02	1.85E-02	
	Slug Out (1)	8/17/17	53.62		1.89E-02		
	Slug Out (2)	8/17/17	52.15		1.84E-02		
	Slug Out (3)	8/17/17	53.23		1.88E-02		
	Slug In (1)	8/18/17	170.3		6.01E-02		
	Slug In (2)	8/18/17	194.0		6.84E-02		
ALF-205A	Slug In (3)	8/18/17	213.2	201.3	7.52E-02	7.10E-02	Bouwer-Rice
	Slug Out (1)	8/18/17	206.9		7.30E-02		
	Slug Out (2)	8/18/17	216.8		7.65E-02		
	Siug Out (3)	8/18/17	206.7		7.29E-02		
	Siug In (1)	8/18/17	156.10		5.5TE-02		
	Siug in (2)	8/18/17	143.10		5.05E-02		
ALF-207A	Sing in (3)	8/20/17	166.30	165.5	5.87E-02	5.84E-02	Bouwer-Rice
	Slug Out (1)	8/18/17	180.20		6.36E-U2		
	Slug Out (2)	0/10/17	174.50		6.16E-02		
		0/20/17	1/2.00		0.1UE-UZ		
	Sind in (1)	0/27/1/ 0/27/17	44.47 17 00		1.J/E-UZ		
	Sind in (2)	0/27/1/ 8/00/17	47.UZ 12 09		1.00E-UZ		
ALF-209A	sive Out (3)	0/27/1/ 8/00/17	40.UO 51 15	50.15	1.0JE-UZ	1.77E-02	Bouwer-Rice
		0/27/1/ 8/00/17	54.40		1.72E-UZ		
		0/27/1/ 8/00/17	J4.24 51 20		1.7 I E-UZ		
	310g OUI (3)	0/27/1/	J4.6Z		1.73E-UZ		



Well ID	Test	Test Date	Horizontal Hydraulic Conductivity (ft/day)	Average Horizontal Hydraulic Conductivity (ft/day)	Horizontal Hydraulic Conductivity (cm/sec)	Average Horizontal Hydraulic Conductivity (cm/sec)	Solution Method (AQTESOLV)
	Slug In (1)	8/16/17	14.05		4.96E-03		
	Slug In (2)	8/16/17	13.01		4.59E-03		
ALE 010A	Slug In (3)	8/16/17	14.14	14.20	4.99E-03		Rouwer Dioo
ALF-210A	Slug Out (1)	8/16/17	14.60	14.39	5.15E-03	5.08E-03	BOUWEI-RICE
	Slug Out (2)	8/16/17	15.21		5.37E-03		
	Slug Out (3)	8/16/17	15.32		5.40E-03		
	Slug Out (1)	8/15/17	232.70		8.21E-02		
ALF-212A	Slug Out (2)	8/15/17	226.50	227.0	7.99E-02	8.01E-02	Bouwer-Rice
	Slug Out (3)	8/15/17	221.80		7.82E-02		
	Slug In (1)	12/12/18	512.10		1.81E-01		
	Slug In (2)	12/12/18	507.40		1.79E-01		
	Slug In (3)	12/12/18	511.30	500 70	1.80E-01		D
ALF-213A	Slug Out (1)	12/12/18	514.30	508.78	1.81E-01	1./9E-01	BOUMEL-KICE
	Slug Out (2)	12/12/18	491.00		1.73E-01		
	Slug Out (3)	12/12/18	516.60		1.82E-01		
	Slug In (2)	8/30/17	7.07		2.50E-03		
	Slug In (3)	8/30/17	7.05		2.49E-03		
	Slug In (4)	8/30/17	7.11		2.51E-03		Bouwer-Rice
ALF-214A	Slug Out (1)	8/30/17	7.14	7.21	2.52E-03	2.54E-03	
	Slug Out (2)	8/30/17	7.21		2.54E-03		
	Slug Out (3)	8/30/17	7.66		2.70E-03		
	Slug In (1)	12/12/18	6.81		2.40E-03		
	Slua In (2)	12/12/18	7.17		2.53E-03		
	Slug In (3)	12/12/18	7.08		2.50E-03		
ALF-217A	Slug Out (1)	12/12/18	9.03	7.80	3.19E-03	2.75E-03	Bouwer-Rice
	Slug Out (2)	12/12/18	8.45		2.98E-03		
	Slug Out (3)	12/12/18	8.27		2.92E-03		
	Slug In (1)	8/30/17	110.2		3.89E-02		
	Slug In (2)	8/30/17	100.5		3.55E-02		
	Slug In (3)	8/30/17	96.93		3.42E-02	3.75E-02	
ACC-1A	Slug Out (1)	8/30/17	110.0	106.4	3.88E-02		Bouwer-Rice
	Slug Out (2)	8/30/17	108.3		3.82E-02		
	Slug Out (3)	8/30/17	112.6		3.97E-02		
	Slug In (1)	8/30/17	75.00		2.65E-02		
	Slug In (2)	8/30/17	85.73		3.02E-02		
	Slug In (3)	8/30/17	96.25		3.40E-02		
ACC-3A	Slug Out (1)	8/30/17	88.57	88.11	3.12E-02	3.11E-02	Bouwer-Rice
	Slug Out (2)	8/30/17	90.42		3.19E-02		
	Slug Out (3)	8/30/17	92.68		3.27E-02		
	Slug In (1)	8/30/17	42.46		1.50E-02		
	Slug In (2)	8/30/17	43.07		1.52E-02		
	Slug In (3)	8/30/17	41.51	10.00	1.46E-02	1 (05 00	
ACC-5A	Slug Out (1)	8/30/17	36.22	40.30	1.28E-02	1.42E-02	Bouwer-Rice
	Slug Out (2)	8/30/17	38.08		1.34E-02		
	Slug Out (3)	8/30/17	40.47		1.43E-02		
	Slug-In (1)	12/19/18	90.03		3.18E-02		
	Slug-In (2)	12/19/18	82.52		2.91E-02		
	Slug-In (3)	12/19/18	79.41		2.80E-02	a a a a a	_
PMW-04C	Slua-Out (1)	12/19/18	75.49	80.66	2.66E-02	2.85E-02	Bouwer-Rice
	Slug-Out (2)	12/19/18	77.96		2.75E-02		
	Slug-Out (3)	12/19/18	78.53		2.77E-02		

Notes:

ft/day - feet per day

cm/sec - centimeters per second

Aqtesolv - Aquifer Test Solver

Bouwer-Rice - a solution for slug testing results


Well ID	Flowrate (Q) (gpm)	Drawdown (s) (ft)	s/Q (ft/gpm)	Specific Capacity (gpm/ft)	Transmissivity (gpd/ft)	Transmissivity (ft²/day)	Geometric Mean of Transmissivity (ft²/day)	Horizontal Hydraulic Conductivity (ft/day)*
	5.2	3.33	0.64	1.56	2,345.9	314.9		
EW-N02	8.9	5.70	0.64	1.56	2,343.3	314.5	310.7	11.1
	14.6	9.71	0.66	1.50	2,256.1	302.8	issivity lay)Geometric Mean of Transmissivity (ft²/day)Hydrau Conduct (ft/day)4.9310.711.12.8310.711.12.8591.619.18.2591.619.1	
	5.27	1.888	0.36	2.79	4,187.0	562.0		
	11.15	3.794	0.34	2.94	4,408.3	591.7	591 6	10 1
L # - 303	17.1	5.696	0.33	3.00	4,503.2	604.4	571.0	17.1
	24.53	8.12	0.33 3.02		4,531.4	608.2		

<u>Notes</u>

gpm - gallons per minute

ft - feet

ft² - square feet

* Calculated based on the geometric mean of transmissivity and saturated thickness of 28 and 31 ft at EW-N02 and EW-S03, respectively (Stantec, 2019).



Table 4-8 Summary of Constant Rate Test Aquifer Analysis TVA-ALF Memphis, Tennessee

Extraction Well	Monitoring Well	Transmissivity (ff²/day)	Horizontal Hydraulic Conductivity (ft/day)*
	PMW-2A	4,230	
EW-N02	PMW-4A	5,700	166
	PMW-7A	4,186	
	PMW-10A	17,320	
	ALF-202	21,490	207
EVV-303	PMW-11A	7,876	577
	PMW-14A	7,799	

Extraction Well	Statistic	Transmissivity (ft²/day)
	Minimum	4,186
	Maximum	5,700
EW-N02	Standard Deviation	862
	Mean	4,705
	Geometric Mean	4,656
	Minimum	7,799
	Maximum	21,490
EW-S03	Standard Deviation	6,892
	Mean	13,621
	Geometric Mean	12,297

<u>Notes</u>

* - Calculated based on the calculated geometric mean and a saturated thickness of 28 and 31 ft at EW-N02 and EW-S03, respectively (Stantec, 2019).



Table 4-9 Alluvial Aquifer Vertical Hydraulic Conductivity Laboratory Test Results TVA Allen Fossil Plant Memphis, Tennessee

Sample Location	Permeability Test Date	Average Vertical Hydraulic Conductivity (ft/day)	Average Vertical Hydraulic Conductivity (cm/s)	Estimated Sample Elevation (ft NGVD 29)
HA-1	10/23/2009	1.11E-01	3.90E-05	232.50
HA-4	10/23/2009	1.21E-01	4.26E-05	229.00
HA-5	10/23/2009	2.36E-01	8.34E-05	231.50
HA-9	10/23/2009	1.53E-01	5.38E-05	232.00
STN-1	9/17/2009	2.00E-04	7.04E-08	180.25
STN-1	11/17/2009	3.97E-01	1.40E-04	183.03
STN-2	9/17/2009	1.47E-04	5.17E-08	201.75
STN-2	11/17/2009	3.17E-03	1.12E-06	221.54
STN-2A	1/8/2010	3.83E-04	1.35E-07	228.25
STN-3	11/17/2009	1.15E-01	4.05E-05	219.87
STN-4	11/17/2009	9.35E-01	3.30E-04	220.62
STN-5	11/17/2009	1.03E+00	3.62E-04	185.01
STN-6	10/23/2009	1.04E-01	3.66E-05	226.00
STN-6	11/17/2009	1.50E+01	5.30E-03	222.97
STN-7	9/16/2009	2.58E-02	9.11E-06	205.25
STN-7	11/17/2009	1.53E+02	5.38E-02	222.38
STN-8	11/17/2009	7.17E-01	2.53E-04	221.12
STN-8A	1/8/2010	4.17E-04	1.47E-07	232.25
STN-9	11/17/2009	1.03E-02	3.63E-06	185.69
STN-9		5.67E-05	2.00E-08	192.25
STN-10	11/17/2009	3.06E-03	1.08E-06	226.55
STN-11	11/17/2009	8.73E-01	3.08E-04	225.96
STN -11R		8.50E-03	3.00E-06	225.75
STN -11R		1.50E-05	5.30E-09	199.75
STN -11R		1.13E-01	4.00E-05	215.75
STN -11R		1.96E-01	6.90E-05	209.75
STN-12	11/17/2009	1.41E-01	4.97E-05	179.48
STN-13	11/17/2009	1.05E-02	3.72E-06	221.78
STN-14	11/17/2009	3.91E-01	1.38E-04	219.44
STN-17		1.73E+03	6.10E-01	231.00
STN-17		5.95E+02	2.10E-01	231.00
STN-19	4/13/2012	4.54E-02	1.60E-05	230.50
STN-19	4/18/2012	2.21E-02	7.80E-06	230.50
STN-19A	4/18/2012	3.40E-02	1.20E-05	230.50
STN-22A	4/18/2012	9.64E-02	3.40E-05	229.10
STN-22A	4/18/2012	2.21E-02	7.80E-06	229.10
STN-22A	4/19/2012	3.69E-02	1.30E-05	229.10
STN-30	11/3/2015	3.69E-02	1.30E-05	228.20
STN-32	11/3/2015	7.09E-03	2.50E-06	215.30
STN-33A	11/3/2015	7.09E-02	2.50E-05	227.90



Table 4-9 Alluvial Aquifer Vertical Hydraulic Conductivity Laboratory Test Results TVA Allen Fossil Plant Memphis, Tennessee

Sample Location	Permeability Test Date	Average Vertical Hydraulic Conductivity (ft/day)	Average Vertical Hydraulic Conductivity (cm/s)	Estimated Sample Elevation (ft NGVD 29)
STN-35	11/11/2015	8.22E-02	2.90E-05	201.90
STN-37	11/3/2015	1.50E-02	5.30E-06	27.25
STN-74	11/3/2015	7.09E-05	2.50E-08	236.80
STN-78	11/3/2015	1.53E-05	5.40E-09	238.30
STN-80	11/11/2015	2.49E-04	8.80E-08	235.10

Notes:

ft/day - feet per day

cm/s - centimeters per second

ft NGVD 29 - Feet Nation Geodetic Vertical Datum of 1929



Table 4-10 Alluvial Aquifer Monitoring Well Distribution Summary TVA Allen Fossil Plant Memphis, Tennessee

Well ID	Facility / Location	Groundwater Model Hydrogeologic Zone within Alluvial Aquifer	2019 RIR Hydrogeologic Zone within Alluvial Aquifer	Transducer Depth (ft btoc)	Screened Interval (ft bgs)	Top of Screen (ft btoc)	Top of Screen (ft NGVD 29)	Bottom of Screen (ft btoc)	Bottom of Screen (ft NGVD 29)	Screen Length (ft)	Bottom of Well Elevation (ft NGVD 29)
ALF-P-4S	Northwest of East Ash Disposal Area	Lower Alluvium	Shallow	49	30.7-50.7	29.7	186.2	49.7	166.2	20.0	165.8
ALF-P-4	Northwest of East Ash Disposal Area	Lower Alluvium	Intermediate	64	69.7-79.8	71.7	149.5	81.8	139.4	10.1	138.2
ALF-201	South of East Ash Disposal Area	Lower Alluvium	Shallow	49	19.6-46.2	23.3	198.9	49.9	172.3	26.6	171.5
ALF-201B	South of East Ash Disposal Area	Lower Alluvium	Intermediate	64	79.6-89.6	83.9	138.8	93.9	128.8	10.0	128.4
ALF-201A	South of East Ash Disposal Area	Lower Alluvium	Deep	64	116.4-126.4	120.3	102.2	130.3	92.2	10.0	91.8
ALF-202	South of East Ash Disposal Area	Upper Alluvium	Mounded	43	19.5-40.7	23.4	196.8	44.6	175.6	21.2	175.4
ALF-202B	South of East Ash Disposal Area	Lower Alluvium	Intermediate	64	80.8-90.8	84.1	136.7	94.1	126.7	10.0	126.3
ALF-202A	South of East Ash Disposal Area	Lower Alluvium	Deep	64	137.4-147.4	140.1	80.1	150.1	70.1	10.0	69.7
ALF-203	North of East Ash Disposal Area	Upper Alluvium	Mounded	53	29.3-50.3	33.1	189.3	54.1	168.3	21.0	168.3
ALF-203B	North of East Ash Disposal Area	Lower Alluvium	Intermediate	64	80.4-90.4	83.9	138.5	93.9	128.5	10.0	128.1
ALF-203A	North of East Ash Disposal Area	Lower Alluvium	Deep	64	108.3-118.3	112.3	110.0	122.3	100.0	10.0	99.6
ALF-204	North of East Ash Disposal Area	Lower Alluvium	Shallow	58	45.2-55.4	49.0	169.6	59.2	159.4	10.2	159.4
ALF-204B	North of East Ash Disposal Area	Lower Alluvium	Intermediate	64	79.5-89.5	83.7	135.0	93.7	125.0	10.0	124.6
ALF-204A	North of East Ash Disposal Area	Lower Alluvium	Deep	64	106.1-116.1	110.3	108.5	120.3	98.5	10.0	98.1
ALF-205	North of East Ash Disposal Area	Lower Alluvium	Shallow	55	30.7-51.7	34.5	187.1	55.5	166.1	21.0	165.2
ALF-205B	North of East Ash Disposal Area	Lower Alluvium	Intermediate	64	71.3-81.3	76.1	145.2	86.1	135.2	10.0	134.8
ALF-205A	North of East Ash Disposal Area	Lower Alluvium	Deep	64	97-107	102.0	119.2 112.0		109.2	10.0	108.8
ALF-206	Northeast of East Ash Disposal Area	Lower Alluvium	Shallow	50	50.2-60.4	54.0	172.0	64.2	161.8	10.2	161.6
ALF-207	North of West Ash Disposal Area	Upper Alluvium	Shallow	NA	24.9-56.3	28.7	202.9	60.1	171.5	31.4	170.9
ALF-207A	North of West Ash Disposal Area	Lower Alluvium	Deep	NA	117-127	121.0	111.0	131.0	101.0	10.0	100.6
ALF-208	North of West Ash Disposal Area	Lower Alluvium	Shallow	NA	25-51.9	28.8	202.2	55.7	175.3	26.9	175.1
ALF-208A	North of West Ash Disposal Area	Lower Alluvium	Deep	NA	130.8-140.8	134.5	96.8	144.5	86.8	10.0	86.4
ALF-209	North of West Ash Disposal Area	Upper Alluvium	Shallow	NA	10.9-32	14.6	193.9	35.7	172.8	21.1	172.8
ALF-209A	North of West Ash Disposal Area	Lower Alluvium	Deep	NA	114-124	118.3	92.3	128.3	82.3	10.0	81.9
ALF-210	South of Coal Power Plant	Lower Alluvium	Shallow	47	23.4-44.3	27.2	192.6	48.1	171.7	20.9	171.0
ALF-210A	South of Coal Power Plant	Lower Alluvium	Deep	64	115.7-125.7	120.0	100.5	130.0	90.5	10.0	90.1
ALF-212	Southeast of East Ash Disposal Area	Upper Alluvium	Mounded	64	48-64	51.8	187.9	67.8	171.9	16.0	170.7
ALF-212A	Southeast of East Ash Disposal Area	Lower Alluvium	Deep	64	155.5-165.5	159.4	80.3	169.4	70.3	10.0	69.9
ALF-213	East of East Ash Disposal Area	Lower Alluvium	Shallow	64	67.3-77.5	71.0	169.5	81.2	159.3	10.2	159.2
ALF-213B	East of East Ash Disposal Area	Lower Alluvium	Intermediate	72	108-118	111.4	129.8	121.4	119.8	10.0	119.4
ALF-213A	East of East Ash Disposal Area	Lower Alluvium	Deep	72	149-159	152.4	88.8	162.4	78.8	10.0	78.4
ALF-214	Southwest of East Ash Disposal Area	Lower Alluvium	Shallow	50	30.7-50.7	34.5	186.8	54.5	166.8	20.0	166.4
ALF-214B	Southwest of East Ash Disposal Area	Lower Alluvium	Intermediate	64	79.2-89.2	82.9	138.3	92.9	128.3	10.0	127.9
ALF-214A	Southwest of East Ash Disposal Area	Lower Alluvium	Deep	64	118.9-128.9	122.6	98.7	132.6	88.7	10.0	88.3
ALF-215	South of East Ash Disposal Area	Upper Alluvium	Mounded	29	15.9-25.9	20.0	196.4	30.0	186.4	10.0	186.0
ALF-216	ACC Plant (Alternate ALF-215 location)	Lower Alluvium	Shallow	54	35.3-55.3	39.6	177.6	59.6	157.6	20.0	157.2
ALF-217	East of East Ash Disposal Area	Upper Alluvium	Mounded	67	46-68	49.4	191.6	71.4	169.6	22.0	169.2
ALF-217B	East of East Ash Disposal Area	Lower Alluvium	Intermediate	72	118-128	121.4	119.5	131.4	109.5	10.0	109.1
ALF-217A	East of East Ash Disposal Area	Lower Alluvium	Deep	72	179-189	182.4	58.6	192.4	48.6	10.0	48.2
ACC-1A	Adjacent to Production Well 1	Lower Alluvium	Deep	64	156.2-166.2	160.1	54.7	170.1	44.7	10.0	44.3
ACC-3A	Adjacent to Production Well 3	Adjacent to Production Well 3 Lower Alluvium Deep		64	117-127	120.4	98.7	130.4	88.7	10.0	88.3
ACC-5A	Adjacent to Production Well 5	Adjacent to Production Well 5 Lower Alluvium		55	129.8-139.8	133.6	86.8	143.6	76.8	10.0	76.4



Table 4-10 Alluvial Aquifer Monitoring Well Distribution Summary TVA Allen Fossil Plant Memphis, Tennessee

Well ID	Facility / Location	Groundwater Model Hydrogeologic Zone within Alluvial Aquifer	2019 RIR Hydrogeologic Zone within Alluvial Aquifer	Transducer Depth (ft btoc)	Screened Interval (ft bgs)	Top of Screen (ft btoc)	Top of Screen (ft NGVD 29)	Bottom of Screen (ft btoc)	Bottom of Screen (ft NGVD 29)	Screen Length (ft)	Bottom of Well Elevation (ft NGVD 29)
ACC-5B	Adjacent to Production Well 5	Lower Alluvium	Shallow	60	45.9-55.9	50.2	170.1	60.2	160.1	10.0	159.7
EW-N02	North of West Ash Disposal Area	Upper Alluvium	Mounded	35	16-36	19.9	200.4	39.9	180.4	20.0	179.9
PMW-02A	North of West Ash Disposal Area	Upper Alluvium	Mounded	35	15-36	19.0	201.1	40.0	180.1	21.0	179.7
PMW-02B	North of West Ash Disposal Area	Lower Alluvium	Intermediate	50	45-55	48.4	171.5	58.4	161.5	10.0	161.1
PMW-02C	North of West Ash Disposal Area	Lower Alluvium	Deep	50	115-125	119.3	100.7	129.3	90.7	10.0	90.3
PMW-04A	North of West Ash Disposal Area	Upper Alluvium	Mounded	35	15-36	19.3	201.5	40.3	180.5	21.0	180.1
PMW-04B	North of West Ash Disposal Area	Lower Alluvium	Intermediate	52	48-58	52.0	169.0	62.0	159.0	10.0	158.6
PMW-04C	North of West Ash Disposal Area	Lower Alluvium	Deep	52	115-125	119.3	101.6	129.3	91.6	10.0	91.2
PMW-07A	North of West Ash Disposal Area	Upper Alluvium	Mounded	24	15-25	18.9	200.1	28.9	190.1	10.0	189.7
PMW-07B	North of West Ash Disposal Area	Lower Alluvium	Intermediate	50	46-56	49.5	169.6	59.5	159.6	10.0	159.2
PMW-07C	North of West Ash Disposal Area	Lower Alluvium	Deep	50	108-118	112.5	106.6	122.5	96.6	10.0	96.3
EW-S03	South of East Ash Disposal Area	Upper Alluvium	Mounded	39	20-40	25.9	194.9	45.9	174.9	20.0	174.4
PMW-10A	South of East Ash Disposal Area	Upper Alluvium	Mounded	38	18-39	22.6	199.7	43.6	178.7	21.0	178.3
PMW-10B	South of East Ash Disposal Area	Lower Alluvium	Intermediate	54	59-69	62.9	159.5	72.9	149.5	10.0	149.1
PMW-10C	South of East Ash Disposal Area	Lower Alluvium	Deep	54	139-149	142.0	80.3	152.0	70.3	10.0	69.9
PMW-11A	South of East Ash Disposal Area	Upper Alluvium	Mounded	33	13-34	16.6	201.5	37.6	180.5	21.0	180.1
PMW-11B	South of East Ash Disposal Area	Lower Alluvium	Intermediate	50	54-64	57.3	160.6	67.3	150.6	10.0	150.2
PMW-11C	South of East Ash Disposal Area	Lower Alluvium	Deep	50	135-145	139.0	79.0	149.0	69.0	10.0	68.6
PMW-14A	South of East Ash Disposal Area	Upper Alluvium	Mounded	55	35-56	38.5	201.8	59.5	180.8	21.0	180.4
PMW-14B	South of East Ash Disposal Area	Lower Alluvium	Intermediate	71	76-86	79.5	161.0	89.5	151.0	10.0	150.6
PMW-14C	South of East Ash Disposal Area	Lower Alluvium	Deep	71	147-157	151.9	88.6	161.9	78.6	10.0	78.2

Notes:

ft btoc = feet below top of casing

ft NGVD 29 = feet National Geodetic Vertical Datum of 1929

ft = feet

RIR = Remedial Investigation Report (Stantec, 2019b)



Table 4-11 Alluvial Aquifer Horizontal Hydraulic Gradients TVA Allen Fossil Plant Memphis, Tennessee

	Upper Alluvial Aquifer													
	Groundwa	ter Elevation (ft NAVD29)	Calcu	lated Vector Compon	ents								
Gauging Date	ALF-202	ALF-212	ALF-215	Direction (degrees azimuth)	Direction (16-wind)	Magnitude (ft/ft)								
9/20/2017	204.62	204.20	202.79	175.5	South	0.0044								
10/16/2017	203.83	203.76	202.09	180.4	South	0.0042								
11/13/2017	204.58	204.56	202.41	181.2	South	0.0052								
12/26/2018*	207.82	206.66	205.66	168.0	South-Southeast	0.0054								
Gauging Date	PMW-02A	PMW-04A	ALF-EW-N02	Direction (degrees azimuth)	Direction (16-wind)	Magnitude (ft/ft)								
12/26/2018*	206.38	205.95	208.21	250.7	West-Southwest	0.0599								
Gauging Date	ALF-EW-N02	PMW-02A	PMW-07A	Direction (degrees azimuth)	Direction (16-wind)	Magnitude (ft/ft)								
12/26/2018*	208.21	206.38	208.15	341.3	North-Northwest	0.0187								
	-				Average	0.0163								

			Lower Alluvi	al Aquifer							
	Groundwo	ater Elevation (f	ft NAVD29)	Calcu	lated Vector Compon	nents 🛛					
Gauging Date	ALF-201	ALF-204	ALF-213	Direction (degrees azimuth)	Direction (16-wind)	Magnitude (ft/ft)					
5/30/2017	201.15	202.96	202.04	188.6	South	0.0010					
9/20/2017	187.56	180.64	183.29	16.3	North-Northeast	0.0036					
10/16/2017	185.49	184.99	184.86	53.8	Northeast	0.0003					
11/13/2017	188.88	192.87	190.70	186.5	South	0.0021					
12/26/2018*	198.80	201.78	199.09	168.0	South-Southeast	0.0019					
Gauging Date	ALF-202B	ALF-204B	ALF-205B	Direction (degrees azimuth)	Direction (16-wind)	Magnitude (ft/ft)					
9/20/2017	185.96	180.67	180.51	16.9	North-Northeast	0.0029					
10/16/2017	185.10	185.14	185.04	93.7	East	0.0001					
11/13/2017	188.74	192.91	192.72	187.0	South	0.0022					
12/26/2018*	197.41	201.85	201.50	182.4	South	0.0023					
Gauging Date	ALF-202A	ALF-204A	ALF-205A	Direction (degrees azimuth)	Direction (16-wind)	Magnitude (ft/ft)					
9/20/2017	186.08	180.81	180.70	16.1	North-Northeast	0.0029					
10/16/2017	185.20	185.14	185.15	347.9	North-Northwest	0.0000					
11/13/2017	188.87	193.02	192.89	188.8	South	0.0022					
12/26/2018*	12/26/2018* 197.56		201.68	186.2	South	0.0023					
	-				Average	0.0018					

Notes

NAVD29 degrees azimuth -16-wind ft/ft -* National Geodetic Vertical Datum of 1929

Direction measured in degrees from north (positive values indicate direction measured clockwise from north) Direction specified using the eight principal directions and the eight half directions with 22.5 degrees separating each Feet per foot

December groundwater elevations shown were based on automated pressure transducer values at 00:00 on December 26, 2018



Table 4-12a Alluvial Aquifer Vertical Hydraulic Gradients in Co-Located Monitoring Wells: Upper and Lower Alluvium TVA Allen Fossil Plant Memphis, Tennessee

		Upper Alluvium Well Details			Lower Allu	vium Intermedi	iate Well Details	Lower All	uvium Deep W	/ell Details	Delto	H (ff)	Si	Jbmerge	ed	Calcul	ation Point (ft N	NAVD29)	Vertical Gr	adient (ft/ft)	Average Vertical Gradient (ft/ft)			
Co-Located Well Group	Gauging Date	TOS (ft NAVD29)	BOS (ft NAVD29)	GWE (ft NAVD29)	TOS (ft NAVD29)	BOS (ft NAVD29)	GWE (ft NAVD29)	TOS (ft NAVD29)	BOS (ft NAVD29)	GWE (ft NAVD29)	UA-I	UA-D	UA	I	D	UA	I	D	UA-I	UA-D	UA-I	UA-D		
	9/20/2017			204.62			185.96			186.08	-18.66	-18.54	TRUE	TRUE	TRUE	186.18	131.30	74.70	-0.340	-0.166				
ALE 202	10/16/2017	104 79	175 59	203.83	134 30	124.30	185.10	70 70	49.70	185.20	-18.73	-18.63	TRUE	TRUE	TRUE	186.18	131.30	74.70	-0.341	-0.167	0.290	0.142		
ALI -202	11/13/2017	170.70	175.50	204.58	130.30	120.00	188.74	77.70	07.70	188.87	-15.84	-15.71	TRUE	TRUE	TRUE	186.18	131.30	74.70	-0.289	-0.141	-0.270	-0.142		
	12/26/2018			207.82			197.41			197.56	-10.41	-10.26	TRUE	TRUE	TRUE	186.18	131.30	74.70	-0.190	-0.092				
	9/20/2017			189.69			181.76			181.75	-7.93	-7.94	TRUE	TRUE	TRUE	178.79	133.40	110.10	-0.175	-0.116				
AL E-203	10/16/2017	189.29	168.29	189.23	138.40	128.40	184.46	110.10	110.10	184.46	-4.77	-4.77	FALSE	TRUE	TRUE	178.76	133.40	110.10	-0.105	-0.069	-0.090	-0.056		
7 (EI -200	11/13/2017	107.27	100.27	193.14	100.40	120.40	191.07	110.10	110.10	192.09	-2.07	-1.05	TRUE	TRUE	TRUE	178.79	133.40	110.10	-0.046	-0.015	-0.070	-0.036		
	12/26/2018			203.20			201.60					201.66	-1.60	-1.54	TRUE	TRUE	TRUE	178.79	133.40	110.10	-0.035	-0.022		
	9/20/2017			204.20			-			185.23	-	-18.97	TRUE	-	TRUE	179.90	-	75.30	-	-0.181				
AL E-212	10/16/2017	187.90	171.90	203.76			-	80.30	70.30	185.02	-	-18.74	TRUE	-	TRUE	179.90	-	75.30	-	-0.179		-0.148		
/ \LI - Z Z	11/13/2017	107.70	171.70	204.56	_	_	-	00.00	70.30	189.18	-	-15.38	TRUE	-	TRUE	179.90	-	75.30	-	-0.147		-0.140		
	12/26/2018			206.66			-			197.84	-	-8.82	TRUE	-	TRUE	179.90	-	75.30	-	-0.084				
ALF-217	12/26/2018	191.62	169.62	213.66	119.47	109.47	197.98	58.55	48.55	198.63	-15.68	-15.03	TRUE	TRUE	TRUE	180.62	114.47	53.55	-0.237	-0.118	-0.237	-0.118		
PMW-02	12/26/2018	201.09	180.09	206.38	171.50	161.50	201.94	100.71	90.71	202.04	-4.44	-4.34	TRUE	TRUE	TRUE	190.59	166.50	95.71	-0.184	-0.046	-0.184	-0.046		
PMW-04	12/26/2018	201.53	180.53	205.95	168.99	158.99	202.01	101.57	91.57	202.00	-3.94	-3.95	TRUE	TRUE	TRUE	191.03	163.99	96.57	-0.146	-0.042	-0.146	-0.042		
PMW-07	12/26/2018	200.10	190.10	208.14	169.55	159.55	201.97	106.59	96.59	202.18	-6.17	-5.96	TRUE	TRUE	TRUE	195.10	164.55	101.59	-0.202	-0.064	-0.202	-0.064		
PMW-10	12/26/2018	199.71	178.71	208.56	159.46	149.46	197.85	80.29	70.29	197.85	-10.71	-10.71	TRUE	TRUE	TRUE	189.21	154.46	75.29	-0.308	-0.094	-0.308	-0.094		
PMW-11	12/26/2018	201.47	180.47	206.73	160.63	150.63	197.86	78.99	68.99	197.68	-8.87	-9.05	TRUE	TRUE	TRUE	190.97	155.63	73.99	-0.251	-0.077	-0.251	-0.077		
PMW-14	12/26/2018	201.80	180.80	209.26	161.00	151.00	197.87	88.58	78.58	197.92	-11.39	-11.34	TRUE	TRUE	TRUE	191.30	156.00	83.58	-0.323	-0.105	-0.323	-0.105		

Notes:

Co-Located Well Group	Generalized name of wells completed in close proximity with different screened intervals.
TOS	Elevation of Top of Screen
BOS	Elevation of Bottom of Screen
GWE	Groundwater Elevation
ft	feet
NAVD29	North American Vertical Datum of 1929
UA	Upper Alluvium
S	Shallow Well
D	Deep Well
UA-I	Comparison between Upper Alluvium and the Lower Alluvium Intermediate Well
UA-D	Comparison between Upper Alluvium and Lower Alluvium Deep Well
Delta H	Difference in groundwater elevation between wells
Calculation Point	For submerged screens the calculation point is equal to the mid point elevation of the screen. For partially submerged wells the calculation point is mid point of the wetted screen interval.
Vertical Gradient	Calculated as Delta H / (Calculation Point for Shallower Well - Calculation Point for Deeper well)
ft/ft	Feet per foot



Table 4-12b

Alluvial Aquifer Vertical Hydraulic Gradients in Co-Located Monitoring Wells: Shallow, Intermediate and Deep Zones of the Lower Alluvium TVA Allen Fossil Plant Memphis, Tennessee

		Shallow Well Details			Intermediate Well Details			D	eep Well Detai	ils	D	elta H (f	t)	Su	bmerge	ed	Calcula	tion Point (ft N	AVD29)	AVD29) Vertical Gradient (ft/ft)			Average Vertical Gradient (ft/ft)					
Co-Located Well	Gauging	TOS	BOS	GWE	TOS	BOS	GWE	TOS	BOS	GWE																		
Group	Date	(ft NAVD29)	(ff NAVD29)	(ft NAVD29)	(ft NAVD29)	(ft NAVD29)	(ft NAVD29)	(ft NAVD29)	(ft NAVD29)	(ft NAVD29)	S-I	S-D	I-D	S	1	D	S	I	D	S-I	S-D	I-D	S-1	S-D	I-D			
	9/20/2017			187.56			186.66			186.74	-0.90	-0.82	0.08	FALSE	TRUE	TRUE	179.94	133.80	97.20	-0.020	-0.010	0.002						
	10/16/2017	109 01	170.21	185.49	120.00	100 00	184.96	102.20	02.20	185.04	-0.53	-0.45	0.08	FALSE	TRUE	TRUE	178.90	133.80	97.20	-0.012	-0.006	0.002	0.012	0.004	0.003			
ALF-201	11/13/2017	170.71	172.31	188.88	130.00	120.00	188.59	102.20	72.20	188.71	-0.29	-0.17	0.12	FALSE	TRUE	TRUE	180.60	133.80	97.20	-0.006	-0.002	0.003	-0.013	-0.008	0.003			
	12/26/2018			198.80			198.07			198.30	-0.73	-0.50	0.23	FALSE	TRUE	TRUE	185.56	133.80	97.20	-0.014	-0.006	0.006						
	9/20/2017			180.64			180.67			180.81	0.03	0.17	0.14	TRUE	TRUE	TRUE	164.48	130.40	103.40	0.001	0.003	0.005						
ALE 204	10/16/2017	140 59	150 39	184.99	135.40	125 40	185.14	108.40	08.40	185.14	0.15	0.15	0.00	TRUE	TRUE	TRUE	164.48	130.40	103.40	0.004	0.002	0.000	0.002	0.002	0.003			
ALI -204	11/13/2017	107.50	137.30	192.84	155.40	123.40	192.91	100.40	70.40	193.02	0.07	0.18	0.11	TRUE	TRUE	TRUE	164.48	130.40	103.40	0.002	0.003	0.004	0.002	0.002	0.005			
	12/26/2018			201.78			201.85			201.89	0.07	0.11	0.04	TRUE	TRUE	TRUE	164.48	130.40	103.40	0.002	0.002	0.001						
	9/20/2017			181.16			180.51			180.70	-0.65	-0.46	0.19	FALSE	TRUE	TRUE	173.64	140.20	114.10	-0.019	-0.008	0.007						
ALE 205	10/16/2017	197 10	144.10	183.73	145.20	135.20	185.04	110 10	109.10	185.15	1.31	1.42	0.11	FALSE	TRUE	TRUE	174.93	140.20	114.10	0.038	0.023	0.004	0.020	0.014	0.004			
ALI -200	11/13/2017	107.12	100.12	191.43	145.20	155.20	192.72	117.10	107.10	192.89	1.29	1.46	0.17	TRUE	TRUE	TRUE	176.62	140.20	114.10	0.035	0.023	0.007	0.020	0.014	0.000			
	12/26/2018			200.60			201.50			201.68	0.90	1.08	0.18	TRUE	TRUE	TRUE	176.62	140.20	114.10	0.025	0.017	0.007						
	9/20/2017			184.01			-			182.90	-	-1.11	-	FALSE	-	TRUE	177.76	-	106.00	-	-0.015	-						
ALF-207	10/16/2017	202.91	171.51	182.11	-	-	-	111.00	101.00	182.77	-	0.66	-	FALSE	-	TRUE	176.81	-	106.00	-	0.009	-	-	0.001	-			
	11/13/2017			190.63			-			191.42	-	0.79	-	FALSE	-	TRUE	181.07	-	106.00	-	0.011	-						
	9/20/2017			182.58			-			182.73	-	0.15	-	FALSE	-	TRUE	178.92	-	91.80	-	0.002	-						
ALF-208	10/16/2017	202.17	175.27	182.24	-	-	-	- 96.80 -	86.80	182.60	-	0.36	-	FALSE	-	TRUE	178.75	-	91.80	-	0.004	-	-	-0.002	-			
	11/13/2017			192.56			-			191.36	-	-1.20	-	FALSE	-	TRUE	183.91	-	91.80	-	-0.013	-						
	9/20/2017			182.59			-			182.36	-	-0.23	-	FALSE	-	TRUE	177.70	-	87.30	-	-0.003	-						
ALF-209	10/16/2017	193.92	172.82	182.37	-	-	-	92.30	82.30	182.25	-	-0.12	-	FALSE	-	TRUE	177.59	-	87.30	-	-0.001	-	-	-0.003	-			
	11/13/2017			191.77			-			191.31	-	-0.46	-	FALSE	-	TRUE	182.29	-	87.30	-	-0.005	-						
	9/20/2017			186.66			-			186.84	-	0.18	-	FALSE	-	TRUE	179.17	-	95.50	-	0.002	-						
ALE-210	10/16/2017	192 58	171.68	184.30			-	100 50	90.50	184.55	-	0.25	-	FALSE	-	TRUE	177.99	-	95.50	-	0.003	-	_	0.005				
ALI-210	11/13/2017	172.50	171.00	188.95	_	-	-	100.50	70.50	189.58	-	0.63	-	FALSE	-	TRUE	180.32	-	95.50	-	0.007	-	-	0.000	-			
	12/26/2018			200.14			-			200.72	-	0.58	-	TRUE	-	TRUE	182.13	-	95.50	-	0.007	-						
ALF-213	12/26/2018	169.40	159.20	199.08	129.83	119.83	199.49	88.81	78.81	199.92	0.41	0.84	0.43	TRUE	TRUE	TRUE	164.30	124.83	83.81	0.010	0.010	0.010	0.010	0.010	0.010			
	9/20/2017			187.53			187.28			187.22	-0.25	-0.31	-0.06	FALSE	TRUE	TRUE	177.12	93.70	133.30	-0.003	-0.007	0.0015						
ALE-214	10/16/2017	187 70	166 70	185.16	98.70	88 70	185.02	138.30	128.30	184.94	-0.14	-0.22	-0.08	FALSE	TRUE	TRUE	175.93	93.70	133.30	-0.002	-0.005	0.0020	-0.003	-0.005	-0.0002			
ALI-214	11/13/2017	107.70	100.70	188.99	70.70	00.70	188.77	130.30	120.00	188.93	-0.22	-0.06	0.16	TRUE	TRUE	TRUE	177.20	93.70	133.30	-0.003	-0.001	-0.0040	-0.003	-0.005	-0.0002			
	12/26/2018			199.51			199.11			0.00	-0.40	-	-	TRUE	TRUE	-	177.20	93.70	-	-0.005	-	-						
	9/20/2017			181.49			180.70			-	-0.79	-	-	FALSE	TRUE	-	174.00	144.45	-	-0.027	-	-						
Δ1 F-P-1	10/16/2017	187 50	166 50	183.06	149.50	139 /0	182.26	_		-	-0.80	-	-	FALSE	TRUE	-	174.78	144.45	-	-0.026	-	-	0 023					
	11/13/2017	107.50	100.00	191.08	147.50	137.40	190.78	_		-	-0.30	-	-	TRUE	TRUE	-	177.00	144.45	-	-0.009	-	-	-0.025	-	-			
	12/26/2018			201.30			200.31			-	-0.99	-	-	TRUE	TRUE	-	177.00	144.45	-	-0.030	-	-						
	9/20/2017			187.71			-			187.91	-	0.20	-	TRUE	-	TRUE	164.39	-	77.05	-	0.0023	-						
	10/16/2017	169 39	159.39	185.55		_	-	82.05	72.05	72.05	72.05	72.05	185.55	-	0.00	-	TRUE	-	TRUE	164.39	-	77.05	-	0.0000	-		0.0002	
ACC-0	11/13/2017	107.07	107.07	188.21	_	-	-	82.05					72.05	72.05	72.05	72.05	188.30	-	0.09	-	TRUE	-	TRUE	164.39	-	77.05	-	0.0010
	12/26/2018			198.29			-			198.07	-	-0.22	-	TRUE	-	TRUE	164.39	-	77.05	-	-0.0025	-						

Notes:

Co-Located Well Group Generalized name of wells completed in close proximity with different screened intervals.

TOS	Elevation of Top of Screen
BOS	Elevation of Bottom of Screen
GWE	Groundwater Elevation
ft	feet
NAVD29	North American Vertical Datum of 1929
S	Shallow Well
T	Intermediate Well
D	Deep Well
S-I	Comparison between Shallow and Intermediate Well
S-D	Comparison between Shallow and Deep Well
I-D	Comparison between Intermediate and Deep Well
Delta H	Difference in groundwater elevation between wells
Calculation Point	For submerged screens the calculation point is equal to the mid point elevation of the screen. For partially submerged wells the calculation point is mid point of the wetted screen interval.
Vertical Gradient	Calculated as Delta H / (Calculation Point for Shallower Well - Calculation Point for Deeper well)
ft/ft	Feet per foot
-	Not applicable or not available



Table 4-13 Upper Claiborne Confining Unit Vertical Hydraulic Conductivity Test Results TVA Allen Fossil Plant Memphis, Tennessee

Sample Location	Permeability Test Date	Average Vertical Hydraulic Conductivity (ft/day)	Average Vertical Hydraulic Conductivity (cm/s)	Sample Interval Elevation (ft NGVD 29)
ALF-203A	9/5/2017	4.22E-06	1.49E-09	128.3-128.7
ALF-204A	9/5/2017	1.78E-06	6.27E-10	128.6-129.0
ALF-205A	9/5/2017	1.15E-05	4.05E-09	118.4-118.8
ALF-207A	9/5/2017	6.94E-05	2.45E-08	137.6-138.0
ALF-208A	9/5/2017	3.03E-05	1.07E-08	147.3-147.7
ALF-209A	9/5/2017	8.96E-05	3.16E-08	133.4'-133.8
ALF-210A	9/5/2017	1.72E-03	6.06E-07	147.6-148.0
ACC-3A	9/5/2017	1.17E-06	4.11E-10	137.6-138.0
ACC-5A	9/5/2017	2.60E-06	9.16E-10	148.6-149.0
ALF-205C	9/5/2017	2.20E-06	7.76E-10	117.1-117.4
ALF-212C	9/5/2017	3.94E-06	1.39E-09	247.4-247.7
ALF-214C	9/5/2017	2.30E-06	8.13E-10	138.7-139.0
ALF-P-4C	9/5/2017	3.06E-06	1.08E-09	138.0-138.3

Notes:

ft/day - feet per day

cm/s - centimeters per second

ft NGVD 29 - Feet Nation Geodetic Vertical Datum of 1929



Table 6-1 Summary Hydraulic Conductivity Applied to the Model TVA Allen Fossil Plant Memphis, Tennessee

Model		Hydraulic Conductivity (Feet Per Day)							
Zone	Soil Type	Hydraulic Conductivity Applied to the Model		Site-Specific Kxy Ranges			Site-Specific Kz Ranges		
Number		Кху	Kz	Minimum	Maximum	Average	Minimum	Maximum	Average
1	Silt	4.74E-02	4.70E-03	*	*	*	8.50E-03	2.34E-01	7.20E-02
2	Poorly Graded Sand	300	30	1.55E+01	1.73E+02	6.65E+01	*	*	*
3	Clay	2.37E-03	2.37E-03	*	*	*	1.50E-05	2.62E+00	2.39E-01
4	Sand with Clay/Silt	10	0.001	3.10E-03	1.59E+02	2.72E+01	3.83E-04	9.35E-01	1.58E-01
5	Gravel	500	50	*	*	*	*	*	*
6	Ash	8.50E-02	8.50E-02	*	*	*	8.50E-02**	8.50E-02**	8.50E-02**
7	Coarse-Grained Sand	375	3.75	6.81E+00	5.85E+02	1.56E+02	*	*	*
8	Upper Claiborne Confining Unit	3.50E-05	3.50E-06	*	*	*	1.17E-06	1.72E-03	1.49E-04
9	Loess	27.9	12.7	*	*	*	*	*	*
10	Terrace Deposits	200	20	*	*	*	*	*	*

Notes:

Kxy - Horizontal Hydraulic Conductivity in the x-direction and y-direction

Kz - Vertical Hydraulic Conductivity in the z-direction

* - No Site Specific Data available

** - Only one sample was available



Table 6-2 Summary of Specific Storage and Specific Yield Values Applied to the Model TVA Allen Fossil Plant Memphis, Tennessee

Zone	Soil Type	Specific Storage	Specific Yield
1	Silt	0.0001	0.20
2	Poorly Graded Sand	0.0011	0.37
3	Clay	0.0001	0.05
4	Sand with Clay/Silt	0.0001	0.20
5	Gravel	0.0001	0.42
6	Ash	0.0001	0.20
7	Sand with Coarse Grains	0.0011	0.35
8	Upper Claiborne Confining Unit	0.0001	0.05
9	Loess	0.0001	0.20
10	Terrace Deposits	0.00001	0.37

Notes

Values were assigned based on literature values cited in Jazaei, et al. (2018), Heath (1983),

Morris & Johnson (1967), and the 2004 API Interactive LNAPL Guide



Table 6-3 Average Biweekly Precipitation and the Model Applied Recharge Summary TVA Allen Fossil Plant Memphis, Tennessee

Stress Period	Total Biweekly Precipitation (inches)	Precipitation (in/day)	Recharge Zone 1 - 8% (in/day)	Recharge Zone 2 - 15% (in/day)	Recharge Zone 3 - 0% (in/day)
1	2.43	1.74E-01	1.39E-02	2.60E-02	0.00E+00
2	1.83	1.31E-01	1.05E-02	1.96E-02	0.00E+00
3	0.39	2.79E-02	2.23E-03	4.18E-03	0.00E+00
4	0.75	5.36E-02	4.29E-03	8.04E-03	0.00E+00
5	2.70	1.93E-01	1.54E-02	2.89E-02	0.00E+00
6	1.10	7.86E-02	6.29E-03	1.18E-02	0.00E+00
/	0.8/	0.21E-02	4.9/E-03	9.32E-03	0.00E+00
8	2.09	1.47E-01	1.19E-02	2.24E-02	0.00E+00
9	3.02	2.16E-01	1.73E-02	3.24E-02	0.00E+00
10	1.60	1.14E-01	9.14E-03	1.71E-02	0.00E+00
11	2.08	1.49E-01	1.19E-02	2.23E-02	0.00E+00
12	2.37	1.69E-01	1.35E-02	2.54E-02	0.00E+00
13	2.23	1.59E-01	1.27E-02	2.39E-02	0.00E+00
14	1.38	9.86E-02	7.89E-03	1.48E-02	0.00E+00
15	2.53	1.81E-01	1.45E-02	2.71E-02	0.00E+00
16	2.64	1.89E-01	1.51E-02	2.83E-02	0.00E+00
17	2.21	1.58E-01	1.26E-02	2.37E-02	0.00E+00
18	4.56	3.26E-01	2.61E-02	4.89E-02	0.00E+00
19	1.48	1.06E-01	8.46E-03	1.59E-02	0.00E+00
20	0.01	/.14E-04	5.71E-05	1.07E-04	0.00E+00
21	2.55	1.82E-01	1.46E-02	2.73E-02	0.00E+00
22	1.81	1.29E-01	1.03E-02	1.94E-02	0.00E+00
23	1.47	1.05E-01	8.40E-03	1.58E-02	0.00E+00
24	0.02	1.43E-03	1.14E-04	2.14E-04	0.00E+00
25	1.11	7.93E-02	6.34E-03	1.19E-02	0.00E+00
26	6.15	4.39E-01	3.51E-02	6.59E-02	0.00E+00
27	2.47	1.76E-01	1.41E-02	2.65E-02	0.00E+00
28	1.55	1.11E-01	8.86E-03	1.66E-02	0.00E+00
29	4.06	2.90E-01	2.32E-02	4.35E-02	0.00E+00
30	5.65	4.04E-01	3.23E-02	6.05E-02	0.00E+00
31	5.13	3.66E-01	2.93E-02	5.50E-02	0.00E+00
32	0.76	5.43E-02	4.34E-03	8.14E-03	0.00E+00
33	3.02	2.16E-01	1.73E-02	3.24E-02	0.00E+00
34	3.03	2.16E-01	1.73E-02	3.25E-02	0.00E+00
35	4.47	3.19E-01	2.55E-02	4.79E-02	0.00E+00
36	1.16	8.29E-02	6.63E-03	1.24E-02	0.00E+00
37	1.79	1.28E-01	1.02E-02	1.92E-02	0.00E+00
38	0.18	1.29E-02	1.03E-03	1.93E-03	0.00E+00
39	1.86	1.33E-01	1.06E-02	1.99E-02	0.00E+00
40	0.59	4.21E-02	3.37E-03	6.32E-03	0.00E+00
41	3.69	2.64E-01	2.11E-02	3.95E-02	0.00E+00
42	0.95	6.79E-02	5.43E-03	1.02E-02	0.00E+00
43	1.15	8.21E-02	6.57E-03	1.23E-02	0.00E+00



Table 6-3 Average Biweekly Precipitation and the Model Applied Recharge Summary TVA Allen Fossil Plant Memphis, Tennessee

Stress Period	Total Biweekly Precipitation (inches)	Precipitation (in/day)	Recharge Zone 1 - 8% (in/day)	Recharge Zone 2 - 15% (in/day)	Recharge Zone 3 - 0% (in/day)
44	2.66	1.90E-01	1.52E-02	2.85E-02	0.00E+00
45	1.19	8.50E-02	6.80E-03	1.28E-02	0.00E+00
46	2.11	1.51E-01	1.21E-02	2.26E-02	0.00E+00
47	2.12	1.51E-01	1.21E-02	2.27E-02	0.00E+00
48	2.53	1.81E-01	1.45E-02	2.71E-02	0.00E+00
49	2.46	1.76E-01	1.41E-02	2.64E-02	0.00E+00
50	1.39	9.93E-02	7.94E-03	1.49E-02	0.00E+00
51	3.18	2.27E-01	1.82E-02	3.41E-02	0.00E+00
52	1.73	1.24E-01	9.89E-03	1.85E-02	0.00E+00

Notes

in/day - inches per day



Table 6-4 Transient Constant Heads Applied to the Mississippi River and Lake McKellar TVA Allen Fossil Plant Memphis, Tennessee

			Transient
Stress Period	Start Date	End Date	Constant Head
			Elevation (feet)
1	1/1/2017	1/14/2017	194.34
2	1/15/2017	1/28/2017	197.75
3	1/29/2017	2/11/2017	198.88
4	2/12/2017	2/25/2017	191./5
5	2/26/2017	3/11/2017	192.88
0 7	3/12/2017	3/23/2017	196.00
/	3/20/2017	4/0/2017	202.15
0	4/7/2017	5/4/2017	202.13
7	4/23/2017	5/20/2017	204.02
10	5/21/2017	5/20/2017	214.31
11	5/21/2017	6/3/2017	208.93
12	6/4/2017	7/1/2017	200.70
13	0/10/2017	7/1/2017	173.43
14	7/2/2017	7/15/2017	196.11
15	7/16/2017	7/29/2017	190.96
16	//30/2017	8/12/2017	190.55
17	8/13/2017	8/26/2017	183.73
18	8/2//201/	9/9/2017	187.44
19	9/10/2017	9/23/2017	181.97
20	9/24/2017	10/7/2017	176.80
21	10/8/2017	10/21/2017	182.35
22	10/22/2017	11/4/2017	187.40
23	11/5/2017	11/18/2017	192.19
24	11/19/2017	12/2/2017	188.49
25	12/3/2017	12/16/2017	182.62
26	12/17/2017	12/30/2017	186.45
27	12/31/2017	1/13/2018	187.16
28	1/14/2018	1/27/2018	188.85
29	1/28/2018	2/10/2018	191.00
30	2/11/2018	2/24/2018	201.30
31	2/25/2018	3/10/2018	215.33
32	3/11/2018	3/24/2018	212.39
33	3/25/2018	4/7/2018	202.72
34	4/8/2018	4/21/2018	208.31
35	4/22/2018	5/5/2018	206.83
36	5/6/2018	5/19/2018	197.58
37	5/20/2018	6/2/2018	198.82
38	6/3/2018	6/16/2018	194.88
39	6/17/2018	6/30/2018	194.56
40	7/1/2018	7/14/2018	198.59
41	7/15/2018	7/28/2018	190.63
42	7/29/2018	8/11/2018	187.56



Table 6-4 Transient Constant Heads Applied to the Mississippi River and Lake McKellar TVA Allen Fossil Plant Memphis, Tennessee

Stress Period	Start Date	End Date	Transient Constant Head Elevation (feet)
43	8/12/2018	8/25/2018	185.93
44	8/26/2018	9/8/2018	185.68
45	9/9/2018	9/22/2018	199.11
46	9/23/2018	10/6/2018	201.04
47	10/7/2018	10/20/2018	200.43
48	10/21/2018	11/3/2018	199.24
49	11/4/2018	11/17/2018	203.17
50	11/18/2018	12/1/2018	202.68
51	12/2/2018	12/15/2018	203.43
52	12/16/2018	12/31/2018	203.01



Table 9-1 Summary of Groundwater Transport Parameters TVA Allen Fossil Plant Memphis, Tennessee

	Coarse Sediments (Sand and Gravel)	Fine Sediments (Silt and Clay)	Reference
Effective Porosity	0.35-0.42	0.05-0.20	Jazaei, et al. (2018), Heath (1938), and Morris & Johnson (1967)
Longitudinal Dispersivity (ft)	100	100	Gelhar et al (1992)
Transverse Dispersivity (ft)	10	10	Gelhar et al (1992)
Vertical Dispersivity (ft)	1	1	Gelhar et al (1992)
Arsenic Distribution Coefficient (cm ³ /g)	4.7	18.7	Site-specific Data
Bulk Density (g/cm ³)	1.62	1.28	Jury (1986)
Zone 7 - Sand with Coarse Grains	0.0011	0.35	-
Zone 8 - upper Claiborne confining Unit	0.0001	0.05	-
Zone 9 - Loess	0.0001	0.2	-
Zone 10 - Terrace Deposits	0.00001	0.366	-

Notes:

ft - feet

cm³/g - cubic centimeter per gram

g/cm³ - grams per cubic centimeter



APPENDIX A TRANSDUCER DATA HYDROGRAPHS





Figure/Well No.







Stantec

Figure/Well No.

2 ACC-1A





Figure/Well No.

3 ACC-3A



Figure/Well No.

4

Title



(ACC-5A, ACC-5B) Groundwater Elevation Hydrograph With Surface Water and Rainfall



Client/Project

Tennessee Valley Authority Allen Fossil Plant (ALF)

Alien Fossil Piani



Figure/Well No.

ALF-201, ALF-201A, ALF-201B



Figure/Well No.

6

ALF-202, ALF-202A, ALF-202B





Stantec

Figure/Well No.

7

(ALF-203, ALF-203A, ALF-203B)



Stantec

Figure/Well No.

8

(ALF-204, ALF-204A, ALF-204B)



Figure/Well No.

9

(ALF-205, ALF-205A, ALF-205B)





Tennessee Valley Authority

Allen Fossil Plant (ALF)



Figure/Well No.

ALF-206 10





Figure/Well No.

11

(ALF-210, ALF-210A) Groundwater Elevation Hydrograph Title With Surface Water and Rainfall





Figure/Well No.

12

(ALF-212, ALF-212A) Groundwater Elevation Hydrograph Title With Surface Water and Rainfall





Figure/Well No.

(ALF-213, ALF-213A, ALF-213B) Groundwater Elevation Hydrograph 13

Title With Surface Water and Rainfall





Figure/Well No.

(ALF-214, ALF-214A, ALF-214B) Groundwater Elevation Hydrograph 14

Title With Surface Water and Rainfall



Tennessee Valley Authority

Allen Fossil Plant (ALF)



Figure/Well No.

15 ALF-215





Figure/Well No.

16 ALF-216





Figure/Well No.

(ALF-217, ALF-217A, ALF-217B) Groundwater Elevation Hydrograph





Figure/Well No.

18 (ALF-P-4, ALF-P-4S)




Figure/Well No.

19 EW-NO2





Figure/Well No.

20 EW-SO3





Figure/Well No.

21 (PMW-02A, PMW-02B, PMW-02C)



Figure/Well No.

- 22 (PMW-04A, PMW-04B, PMW-04C)
- TitleGroundwater Elevation HydrographWith Surface Water and Rainfall





tantec

Figure/Well No.

23 (PMW-07A, PMW-07B, PMW-07C)





Figure/Well No.

- 24 (PMW-10A, PMW-10B, PMW-10C)
- TitleGroundwater Elevation HydrographWith Surface Water and Rainfall





Figure/Well No.

25 (PMW-11A, PMW-11B, PMW-11C)





Figure/Well No.

26 (PMW-11A, PMW-11B, PMW-11C)



Client/Project

Tennessee Valley Authority Allen Fossil Plant (ALF)

tantec

Figure/Well No.

27 (PMW-14A, PMW-14B, PMW-14C)

APPENDIX B BORING LOGS





Page: 1 of 2

Project	Number	175565292			Location	N	l 35°04'10	.01", W 90°	08'22.98" (NAD83)
Project	Name	TVA - ALF Well Ins	stallations		Boring No.	ALF	F-201	Total Depth 48.0 ft	
County		Shelby Co., TN			Surface Ele	vation	218	8.5 ft (NGVI	D29)
Project	Туре	Well Installations			Date Started	d 9.	/13/16	Completed	y/13/16
Supervi	sor	B. Bryant Dr	iller D. Coo	per	Depth to Wa	ater 2	9.4 ft	Date/Time	9/13/16
Logged	By	J. Andrew		<u> </u>	Depth to Wa	ater N	I/A	Date/Time	N/A
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
218.5	0.0	Top of Hole							
218.1 -	0.4			-					4" Monitoring -
-		brown, moist, med	own to dium stiff		00 50	2.5	70%		Well Installed
-					0.0 - 5.0	3.5	1070		_
-									-
 -									_
_									-
-					5.0 - 10.0	5.0	100%		-
_							10070		-
_									-
-									_
-									-
_					40.0 40.0	10			-
-					10.0 - 16.0	4.3	72%		_
_									
201.9	16.6	Sand brown to gr	av moist	-					_
_		to wet medium de	ay, moist ense		16.0 - 19.0	4.0	44%		_
_		- Becomes gray b	elow						-
		20.6'							_
-									-
-									_
_									_
-					19.0 - 29.0	3.5	35%		-
–									Analytical –
_									sample from
-									
-									-
-									-



SUBSURFACE LOG

Project I	Number	175565292			Location	Ν	35°04'10	0.01", W 90°	08'22.98" (NAD83)
Project I	Name	TVA - ALF Well Ins	stallations		Boring No.	ALF	-201	Total Dept	h48.0 ft
Litholo	ogy Depth	Description	Overburden Rock Core	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
		Sand, brown to gr to wet, medium de (Continued)	ay, moist ense		29.0 - 39.0	9.0	90%		Analytical – sample from 30.0' - 40.0'
- - - - - - -	40.0	Silty Sand, dark gr medium dense, wi organics	ray, wet, ith trace		39.0 - 46.0	7.0	100%		- - - - - - -
	48.0	Bottom of Hole							



_										
ſ	Stantec	Borehol	e Identification ALI	F-201B				Tota	I Boring De	pth 90.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'09.	95", W90°0	8'22.66" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	18.4 ft	Elevation	Datum NGVD29
	Project I	Name	TVA-ALF Remedia	I Investigati	on	Date Started	d8/	/22/17	Completed	8/24/17
	Project	Locatior	Memphis, Tenn	essee		Depth to Wa	ater 2	7.1 ft	Date/Time	9/6/17
	Supervis	sor	Briggs Evans			Depth to Wa	ater N	/A	Date/Time	N/A
	Logged	by	Mike Pilot			Driller	La	arry Yanc	еу	
	Drilling (Contract	or Cascade Drilling	9		Drill Rig Typ	be and ID	D_Terras	onic 150C /	#10-00100
	Overbur	den Dril	ling and Sampling To	ools (Type a	and Size) Sonic Tooli	ing - 9" Bit	t, 9" Casing	, 6" Barrel, 3.	5" Rods
	Sampler	Hamme	er Type N/A	Weight	t NA	Drop	NA	Ef	ficiency _	NA
	Borehole	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
ſ	Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
┢	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
ł	218.4' 217.9'	0.0' \.\.0.5' \			-					
t			Silty Sand (SM), li							4" Monitoring - Well Installed.
	-		brown, moist	9		0.0' - 6.0'	6.0'	100		See Well
ł	-									Log for details.
ł	- 212.4'	6.0'							6.0'	-
	_		Poorly Graded Sa	nd (SP)						-
╞	210.4'	8.0'	with clay, light bro ∖ moist	wn, ⁄~						-
┢	-		Lean Clay (CL), da	ark						-
ľ	_		brown, firm, moist			6.0' - 16.0'	10.0'	100		_
	-									-
ł	-									-
ŀ	-									-
Ŀ	202.4'	16.0'							16.0'	-
DT 11/27/	200 41	10 01	Clayey Sand (SC)	, light d. moist						-
IC LOG.GI	200.4	10.0	Poorly Graded Sa	nd (SP).	-					-
M-GRAPH	_		brown, fine graine	d, moist						_
SPJ FMS	-		lo wei			16.0' - 26.0'	9.0'	90		-
3 - REV.0						20.0				-
1755770	-									-
K ALLEN	_									_
- NO ROC									26.0'	-
SING LOG	-									-
DNIC BOR	_									-
TVA SC										



Stantec Borehole Identification <u>ALF-201B</u>						Total Boring Depth 90.0 ft				
	Client		Tennessee Valley		Boring Location <u>N35°04'09.95", W90°08'22.66" (NAD83</u>					
	Project I	Number	175577013			Surface Ele	vation 2	18.4 ft	Elevation I	Datum NGVD29
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Elevation Depth Description Sonic Core			Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
-	-		Poorly Graded Sa brown, fine graine to wet <i>(Continue</i>	nd (SP), d, moist <i>d)</i>		26.0' - 36.0'	10.0'	100		
	- 182.4'	36.0'			_				36.0'	-
	-		Poorly Graded Sa gray, fine grained, trace gravel	nd (SP), wet,		00.01	40.01	400		
-						36.0' - 46.0'	10.0	100		
	-								46.0'	
	170.9'	47.5'								_
	-	54.01	Sand with SIIt (SP gray, fine grained, wet,	P-SM), wet to	-	46.0' - 56.0'	10.0'	100		- - - - -
┢	164.4	54.0 [°]	Poorly Graded Sa	nd (SP)						-
ľ	-		gray, fine grained,	wet,					56.0'	
FMSM-GRAPHIC LOG.GDT 11/27/17	- 157.4'	61.0'	some silt			56.0' -	10.0'	100		
CK ALLEN_175577013 - REV.GPJ F	-		Poorly Graded Sa (SP),brown, fine g wet, trace gravel	nd rained,		66.0'			66.0'	
G - NO R(-									
TVA SONIC BORING LO	_									-



Stantec	Borehole	e Identification ALI	F-201B				Tota	I Boring De	pth 90.0 ft
Client		Tennessee Valley		Boring Location <u>N35°04'09.95", W90°08'22.66" (NAD83</u>					
Project I	Number	175577013			Surface Ele	vation 21	8.4 ft	Elevation I	Datum NGVD29
Litholo	ogy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-		Poorly Graded Sa (SP),brown, fine g wet, trace gravel (Continued)	nd rained,		66.0' - 76.0'	3.0'	30		
 142.4'	76.0'							76.0'	
-		No recovery			76.0' - 86.0'	0.0'	0		from 76' to 96'
-								86.0'	-
-					86.0' - 90.0'	0.0'	0		-
_ 128.4'	90.0'							90.0'	
		No Refusal / Bottom of Hole							



	Stantec	Borehol	e Identification AL	-201A				Tota	I Boring De	pth 181.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion N	35°04'09	98", W90°0	08'22.84" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	18.6 ft	Elevation	Datum NGVD29
	Project I	Name	TVA-ALF Remedia	I Investigati	ion	Date Starte	d8	/2/17	Complete	d 8/4/17
	Project	Location	n Memphis, Tenno	essee		Depth to Wa	ater 2	9.7 ft	Date/Time	9/6/17
	Supervis	sor	Briggs Evans			Depth to Wa	ater N	/A	Date/Time	e N/A
	Logged	by	Walker Padgett			Driller	L	arry Yanc	еу	
	Drilling (Contract	or Cascade Drilling	9		Drill Rig Typ	be and I	D_Terras	onic 150C /	#10-00100
	Overbur	den Dril	ling and Sampling To	ools (Type a	and Size) Sonic Tool	ing - 9" Bi	t, 9" Casing	, 6" Barrel, 3.	5" Rods
	Sampler	r Hamme	er Type _N/A	Weight	t NA	Drop	NA	Ef	ficiency	NA
	Borehol	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
ľ	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
┟	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
┟	218.6'	0.0'	Top of Hole							-
ŀ			Topsoil		1					4" Monitoring
ł	216.6	2.0	Silty Gravel (GM)	with	-	0.0' - 6.0'	5.0'	83		Well Installed.
ł	-		grained, dry			0.0 - 0.0	5.0	00		Construction
ł	_		Poorly Graded Sa	nd with						Log for details.
	_		Silt, (SP-SM), brov	vn, very					6.0'	
	_		moist	, diy to						
+	- 200 Cl	0.01								
ŀ	209.0	9.0	Lean Clay (CL) br	own	-					
t	_		firm, moist	own,		6.0' - 16.0'	•			-
	_									
╞	-									
┢	203.6'	15 0'								
ŀ	_ 200.0	10.0	Clayey Sand (SC)	, brown,	-				16.0'	
11/27/17	201.6'	17.0'	fine grained, medi	um moist	_					
OG.GDT	-		Poorly Graded Sal	nd with						
RAPHICL	-		grained, moist							
FMSM-GF	-					16 0' -				-
EV.GPJ F	_					26.0'				
77013 - RI	_									
EN_1755	_									
OCK ALL	-								26.01	-
G - NO R	-								20.0	-
RING LO	_									
SONIC BC	-									
TVA S										



Γ	Stantec Borehole Identification ALF-201A Client Tennessee Valley Authority							Tota	I Boring De	oth 181.0 ft
	Client		Tennessee Valley	Authority		Boring Location <u>N35°04'09.98", W90°08'22.84" (NAE</u>				<u>8'22.84" (NAD83</u>)
	Project I	Number	175577013			Surface Ele	vation 2	18.6 ft	Elevation [Datum NGVD29
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
╞	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	-		Poorly Graded Sa SIIt (SP-SM), brov grained, moist (Continued)	nd with vn, fine		26.0' - 36.0'	•			
┢	- 182.6'	36 0'							36.0'	_
	-	00.0	Poorly Graded Sa gray, fine grained,	nd (SP). wet	-	36.0' -			00.0	
						46.0'				-
╞	175.6'	43.0'			-					-
	-		Silty Sand (SM), g grained, medium v laminated with org matter	iray, fine wet, janic					46.0'	-
	- 164.6'	54.0'	Poorly Graded Sa	nd with	-	46.0' - 56.0'				- - - - -
21/2			medium grained, v	, wet					56.0'	-
NO ROCK ALLEN_175577013 - REV.GPJ FMSM-GRAPHIC LOG.GDT 11/27/	-					56.0' - 66.0'			 66.0'	- - - - - - - - - -
g LOG - NC										-
IVA SONIC BORIN	_									-



ſ	Stantec	Borehol	e Identification AL				Tota	I Boring De	oth 181.0 ft	
	Client		Tennessee Valley	Authority		Boring Location <u>N35°04'09.98", W90°08'22.84" (NAD</u>				
	Project I	Number	175577013			Surface Ele	vation 2	18.6 ft	Elevation I	Datum NGVD29
	Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
╞	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_			Poorly Graded Sa SIIt (SP-SM), gray medium grained, v <i>(Continued)</i>	nd with , wet		66.0' - 76.0'	6.0'	60		-
┟	-								76.0'	_
-	140.6'	78.0'	Well Graded Sand	I (SW),						-
	-		grained, wet, trace	e gravel		76.0' - 86.0'	7.5'	75		-
	133.6'	85.0'	Poorly Graded Sa	nd (SP).	-				86.0'	-
-			gray, medium grai very wet	ned,						-
-						86.0' - 96.0'	•			- - -
┢	-								96.0'	-
REV.GPJ FMSM-GRAPHIC LOG.GDT 11/27/17	-					96.0' - 106.0'	10.0'	100		- - - - -
OCK ALLEN_175577013 -	_								106.0'	-
TVA SONIC BORING LOG - NO RO	_									-



Γ	Stantec	Borehol	e Identification AL	F-201A				Tota	I Boring De	oth 181.0 ft
	Client Tennessee Valley Authority					Boring Loca	ition <u>N</u>	35°04'09.	98", W90°0	8'22.84" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	18.6 ft	Elevation I	Datum NGVD29
	Litholo	gy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
┝	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
			Poorly Graded Sa gray, medium grai very wet <i>(Contine</i>	nd (SP), ined, ued)		106.0' - 116.0'	4.0'	40		-
ŀ	-								116.0'	_
-	99.6'	119.0'	Poorly Graded Sa	nd with	-	440.01	0.01	00		-
	_		medium grained s to coarse grained	and, fine gravel		116.0' - 126.0'	9.0	90		-
									126.0'	-
-	89.6'	129.0'			-					Trace gravel at - depth of 128'
-	-		Fat Clay (CH), gra moist	ıy, firm,		126.0' - 136.0'	10.0'	100		-
E	85.1'	133.5'	Woll Graded Sand	h with Silt						-
┢	-		and Gravel (SW-S	SM), gray,					400.01	_
HICLOG.GDT 11/27/17			medium to coarse sand, fine to medi grained gravel, we	grained um et,					136.0'	
175577013 - REV.GPJ FMSM-GRAP	-					136.0' - 146.0'	5.0'	50		-
K ALLEN	-								146.0'	
- NO ROC	71.6'	147.0'			-					-
TVA SONIC BORING LOG	-		Poorly Graded Sa (SP),gray, mediun grained, very wet, gravel (<5%)	nd n trace						



Stantec Borehole Identification ALF-201A								Tota	I Boring De	oth 181.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u>	35°04'09.	.98", W90°0	8'22.84" (NAD83)
	Project I	Number	175577013			Surface Ele	evation 21	8.6 ft	Elevation I	Datum NGVD29
ľ	Litholc	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_			Poorly Graded Sa (SP),gray, mediun grained, very wet, gravel (<5%) (Co	nd n trace ontinued)		146.0' - 156.0'	10.0'	100		-
ľ	-								156.0'	_
						156.0' - 176.0'	20.0'	100		
	42.6'	176.0'			-				176.0'	center barrel
APHIC LOG.GDT 11/27/17	-		No Recovery							sank to a deptn of 181' in very – loose sand. No – samples were – recovered from 176' to 181'.
MSM-GRJ	37.6'	181.0'	No Refueal /							
VA SONIC BORING LOG - NO ROCK ALLEN 175577013 - REV.GPJ F	- - - -		Bottom of Hole							- - - - - - - - -



Page: 1 of 2

Project	Number	175565292			Location N 35°C			35°04'09.07", W 90°08'11.67" (NAD83)		
Project	Name	TVA - ALF Well Ins	stallations		Boring No.	ALI	F-202	Total Dept	h 42.0 ft	
County		Shelby Co., TN			Surface Ele	vation		6.3 ft (NGVI	D29)	
Project	Туре	Well Installations			Date Started	d 9	/14/16	Completed	9/14/16	
Supervi	sor	B. Bryant Dr	iller Coope	r	Depth to Wa	ater 1	3.5 ft	Date/Time	9/14/16	
Logaed	Bv	J. Andrew	<u> </u>		Depth to Wa	ater 1	1.9 ft	Date/Time	9/15/16	
Litholo			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
216.3	0.0	Top of Hole								
215.3	1.0	Topsoil							4" Monitoring -	
		Lean Clay, dark b	rown,						Well Installed	
		moist to wet, med	ium stiff		0.0 - 5.0	4.6	92%		_	
									_	
L										
									_	
									_	
					5.0 - 10.0	5.0	100%		_	
Γ										
									_	
					10.0 - 15.0	4.1	82%		_	
									_	
201.3	15.0								-	
		Sand, brown to da	ark gray						Sample from	
-		and gray, wet, me	dium						19.0' - 29.0'	
-		dense			15.0 - 20.0	4.5	90%		-	
-		- Becomes silty be	elow 17.5'						-	
F									=	
F									_	
5									=	
193.3	23.0								-	
		Silty Sand, gray, v	vet,	1					-	
5		medium dense			20.0 - 29.0	9.0	100%		-	
									-	
									-	
<u> </u>									-	
									-	
-									-	



Project Number 175565292			Location	N	35°04'09	9.07", W 90°	08'11.67" (NAD83)		
Project	Name	TVA - ALF Well Ins	stallations		Boring No.	ALF	-202	Total Dept	h42.0 ft
Lithol	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Silty Sand, gray, w medium dense (Continued)	vet,		29.0 - 42.0	5.5	42%		
- 174.3	42.0								-
		Bottom of Hole				II			
_									-
F									_
_									-
-									-
-									-
-									-
\vdash									-
-									-
_									-
									-
2/16									_
3.GDT 10%									-
									-
									-
ECT.6P1									-
									_
LEGACY /									-
									-
STANT									
			Stanteo	: Consul	ting Services	Inc.			10,0/10



	Stantec	Borehol	e Identification ALI				Tota	I Boring De	pth 90.0 ft	
	Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'09.	.09", W90°0	8'11.98" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	17.5 ft	Elevation	Datum NGVD29
	Project I	Name	TVA-ALF Remedia	I Investigati	on	Date Starte	d 8/	/22/17	Completed	8/23/17
	Project	Locatior	n Memphis, Tenn	essee		Depth to Wa	Depth to Water28.2 ft Date/Time			9/6/17
	Supervis	sor	Briggs Evans			Depth to Wa	Depth to Water N/A Date/Tim			N/A
	Logged by Mike Pilot					Driller	La	arry Yanc	еу	
	Drilling (Contract	or Cascade Drilling]		Drill Rig Typ	be and ID	D Terras	onic 150C /	#10-00100
	Overbur	den Dril	ling and Sampling To	ools (Type a	and Size) Sonic Tool	ing - 9" Bit	, 9" Casing	, 6" Barrel, 3.	5" Rods
	Sampler Hammer Type N/A Weight				t NA	Drop	NA			
	Borehole Azimuth N/A (Vertical)					Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	_ 217.5'	0.0'	Top of Hole							
	217.0'	~_ <u>0.5'</u> _⁄	Topsoil		-					4" Monitoring
	215.5'	2.0'	Fat Clay (CH), gra	y, firm, 🛛 _/ _	-					Well Installed.
	-					0.0' - 8.0'	8.0'	100		Construction
	-		light brown, mediu	in to		0.0 - 0.0	0.0	100		Log for details.
	_		coarse grained, dr	y to						-
	_		moist							
	209.5'	8.0'							8.0'	
	-		Poorly Graded Sa	nd (SP), d. drv to						-
	-		moist	a, ary to						-
	-									-
	_					8.0' - 18.0'	7.0'	70		
	203.0'	14.5'								-
	_	11.0	Well Graded Sand	I (SW),						-
27/17	-		brown, dry to mois	st, fine to						-
GDT 11/2	199.5'	18.0'	recovery 15' to 18')					18.0'	-
HIC LOG.	_		Clayey Sand (SC)	, light						
M-GRAPH	_		brown, medium to	coarse						_
PJ FMSI	- 196.0'	21.5'	grained, moist to v	vel						
- REV.G	-	196.0' 21.5' Poorly Graded Sand (SP).				40.01	7.01	70		-
75577013	-		gray, fine grained,	wet		18.0 [°] - 28.0'	7.0	70		-
ALLEN_1	-									
ROCK .	_									-
LOG - NC	-									
BORING	-								28.0'	
A SONIC	_									
Ξ					1	1	1		1	1



Γ	Stantec	Borehol	e Identification AL				Tota	I Boring De	pth 90.0 ft	
	Client		Tennessee Valley	Authority		Boring Location <u>N35°04'09.09", W90°08'11.98" (NAD8</u>				
	Project I	Number	175577013			Surface Ele	vation 2	17.5 ft	Elevation [Datum NGVD29
	Litholo	gy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
			Poorly Graded Sa gray, fine grained, (Continued)	nd (SP), wet		28.0' - 38.0'	10.0'	100		
	179.5'	38.0'			_				38.0'	_
	176.5'	41.0'	Clayey Sand (SC) to gray, fine graine Poorly Graded Sa gray, fine grained,	, brown ed, dense nd (SP), wet	_	38.0' - 48.0'	7.0'	70		
╞										-
	169.5'	48.0'							48.0'	-
			Poorly Graded Sa Silt (SP-SM), brow gray, fine grained,	nd with /n to wet		48.0' - 58.0'	8.0'	80		- - - - - - - - - - - -
DG.GDT									58.0'	_
BORING LOG - NO ROCK ALLEN_175577013 - REV.GPJ FMSM-GRAPHIC LO	156.5'	61.0'	Poorly Graded Sa gray, fine grained wet	nd (SP), sand,	_	58.0' - 68.0'	6.0'	60	 68.0'	- - - - - - - - - - -
TVA SONICE										-



Stantec	Borehol	e Identification ALI	-202B				Tota	I Boring Dep	oth 90.0 ft
Client		Tennessee Valley	Authority		Boring Location N35°04'09.09", W90°08'11.98" (NAD83				
Project I	Number	175577013			Surface Ele	vation 21	7.5 ft	Elevation [Datum NGVD29
Litholo	ogy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	Poorly Graded Sand (SP), gray, fine grained sand, wet <i>(Continued)</i>				68.0' - 78.0'	9.0'	90		-
- 120 5'	139.5' 78.0'							79.01	-
139.5	139.5 78.0 No Recovery							78.0	-
_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	90.0'	No Recovery							-
		No Refusal / Bottom of Hole							



_											
	Stantec	Borehol	e Identification AL	F-202A				Tota	I Boring De	pth 167.0 ft	
	Client		Tennessee Valley	Authority		Boring Loca	ation N	35°04'09.	.08", W90°0	8'11.83" (NAD83)	
	Project I	Number	175577013			Surface Ele	vation 2	17.5 ft	Elevation	Datum NGVD29	
	Project I	Name	TVA-ALF Remedia	I Investigati	on	Date Starte	d 7	/28/17	Complete	d 7/30/17	
	Project	Locatior	n Memphis, Tenn	essee		Depth to Wa	ater 2	7.9 ft	Date/Time	9/6/17	
	Supervis	sor	Briggs Evans			Depth to Water N/A			Date/Time	N/A	
	Logged by Lee Eaves					Driller	Driller Matt Pope				
	Drilling Contractor Cascade Drilling					Drill Rig Typ	be and II	D Prosor	nic LS600 /	#10-00273	
	Overburden Drilling and Sampling Tools (Type a) Sonic Tool	ing - 8" Bi	t, 8" Casing	, 7" Barrel, 3.	5" Rods	
	Sampler Hammer Type N/A Weigh				t NA	Drop	NA	Ef	ficiency	NA	
	Borehole	e Azimu	thN/A (Vertica	al)		Borehole Ir	nclinatior	ר (from Ve	ertical)	0 deg.	
	Litholo	ogy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
E	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
	217.5'	0.0'	Top of Hole								
F	217.0	~_0.5'_~	Topsoil		-					4" Monitoring	
┢			Silty Clay (CL), da	rk						Well Installed.	
┢			brown, moist			0.0' - 7.0'	7.0'	100		Construction	
F										Log for details.	
F										-	
F									7.0'		
F										-	
										_	
╞						7.0' - 17.0'	10.0'	100			
┢											
╞	202 5'	15.0'									
	202.5	15.0	Silty Sand (SM) d	ark	-					-	
127/17			brown, fine graine	d, wet					17.0'	-	
.GDT 11	199.5'	18.0'									
HIC LOG			Sandy Silt (ML), b	rown to							
M-GRAP			gray, moist to wet,	, fine						-	
PJ FMS			graineu sanu								
- REV.G	195.5' 22.0'				_	17.0' -	8.0'	80			
1	Poorly Graded Sand (SP), gray, fine grained, wet			nd (SP), wet		27.0					
	gray, fine grained, wet										
ROCK										-	
00 - NO									27.0'		
ORINGL											
SONICB											
A											



ſ	Stantec Borehole Identification ALF-202A					Total Boring Depth 167.0 ft				
	Client Tennessee Valley Authority					Boring Location <u>N35°04'09.08", W90°08'11.83" (NAE</u>				
	Project I	Number	175577013			Surface Elev	vation 2	17.5 ft	Elevation [Datum NGVD29
	Litholo	ogy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	-		Poorly Graded Sa gray, fine grained, <i>(Continued)</i>	nd (SP), wet		27.0' - 37.0'	9.5'	95		
-	-								37 0'	-
ŀ	-								57.0	-
-	- - - -					37.0' - 47.0'	3.5'	35		- - - - -
ŀ	-								47 0'	-
-	· - - - - -					47.0' - 57.0'	9.5'	95		- - - - - - - - - - - - -
1/27/17	-								57.0'	_
VGLOG - NO ROCK ALLEN_175577013 - REV.GPJ FMSM-GRAPHIC LOG.GDT 1:	- - - - -					57.0' - 67.0'	5.0'	50	 67.0'	- - - - - - - - - - - - - -
ONIC BORI.	-									-
TVA S(_									_



ſ	Stantec Borehole Identification ALF-202A					Total Boring Depth 167.0 ft				
	Client Tennessee Valley Authority					Boring Location <u>N35°04'09.08", W90°08'11.83" (NAD83</u>)				
	Project I	Project Number 175577013				Surface Elevation 217.5 ft			Elevation [Datum NGVD29
	Litholc	ogy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	-		Poorly Graded Sa gray, fine grained, <i>(Continued)</i>	nd (SP), wet		67.0' - 77.0'	5.0'	50		-
	-								77.01	-
ł	-								77.0	_
-	- - - - -					77.0' - 87.0'	0.0'	0		- - - - - - - - - -
ł	-								07.0	_
-	- - - - -					87.0' - 97.0'	9.5'	95		- - - - - - - - -
F 11/27/17	-								97.0	-
0G - NO ROCK ALLEN_175577013 - REV.GPJ FMSM-GRAPHIC LOG.GDT	- - - - -					97.0' - 107.0'	4.5'	45	 107.0'	-
RING LOC									-	
IVA SONIC BC	-									-



ſ	Stantec Borehole Identification ALF-202A					Total Boring Depth 167.0 ft					
	Client	Client Tennessee Valley Authority				Boring Location N35°04'09.08", W90°08'11.83" (NAD83					
	Project N	Number	175577013			Surface Ele	vation 2	17.5 ft	Elevation [Datum NGVD29	
	Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
			Poorly Graded Sa gray, fine grained, <i>(Continued)</i>	nd (SP), wet		107.0' - 117.0'	7.0'	70		- - -	
	-								117.0'	-	
	· · · · · · · · · · · · · · · · · · ·					117.0' - 127.0'	9.5'	95	 127.0'	- - - - - - - - - - -	
17	· · · · · · · · · · · · · · · · · · ·					127.0' - 137.0'	0.0'	0	 137.0'		
JO ROCK ALLEN_175577013 - REV.GPJ FMSM-GRAPHIC LOG.GDT 11/27/1	- - - - - 70.5'	147.0'				137.0' - 147.0'	10.0'	100	 147.0'	- - - - - - - - - - - -	
TVA SONIC BORING LOG - NC			Fat Clay (CH), gra very stiff, wet	y, stiff to						-	



Stantec	Borehol	e Identification AL	F-202A				Tota	I Boring De	oth 167.0 ft
Client		Tennessee Valley		Boring Location N35°04'09.08", W90°08'11.83" (NAD83)					
Project I	Number	175577013			Surface Ele	evation 21	17.5 ft	Elevation [Datum NGVD29
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
- - 64.5'	64.5' 153.0' Fat Clay (CH), gray, stiff to very stiff, wet <i>(Continued)</i> Well Graded Sand (SW).				147.0' - 157.0'	10.0'	100		-
-	gray to brown, fine to coarse grained, wet, trace gravel							157.0'	-
-					157.0' - 159.0'	0.0'	0	159.0'	-
-					159.0' - 167.0'	6.5'	81		
-					167.0				-
50.5'	167.0'							167.0'	-
		Bottom of Hole							
									-



Page: 1 of 2

Project I	Number	175565292			Location	N	35°04'27	.68", W 90°	08'23.98" (NAD83)
Project	Name	TVA - ALF Well Installations			Boring No.	ALI	F-203	Total Depth 51.6 ft	
County		Shelby Co., TN			Surface Ele	vation	21	8.6 ft (NGVD29)	
Project ⁻	Гуре	Well Installations			Date Started	d 9,	/14/16	Completed 9/14/16	
Supervis	sor	B. Bryant Dr	iller Young		Depth to Wa	ater 2	6.0 ft	Date/Time	9/14/16
Logged	Ву	Thaxton		Depth to Wa	ater N	/A	Date/Time	N/A	
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
218.6	0.0	Top of Hole							
-		Silty Sand with Gr brown, slightly mo medium dense	avel, ist,			6.0	100%		4" Monitoring Well Installed _
-					0.0 - 6.0	6.0	100 %		-
212.6	6.0			_					_
_		Fat Clay, gray-bro moist, stiff to very	wn, stiff						-
-									-
L									_
_					6.0 - 16.0	10.0	100%		-
205.6	13.0								-
	13.0	Silty Sand, light br slightly moist to m medium dense, zo clayey	rown, oist, ones	-					-
-		- Clayey Sand from to 16.5'	m 15.0'						_
-									-
107.6	21 0								-
	21.0	Fat Clay, gray-bro	wn,	-	16.0 - 26.0	10.0	100%		-
-		moist, stiff							-
									-
									_
192.6	26.0								_
									_
									_
									_



Project Number 175565292		Location	N 35°04'27.68", W 90°08'23.98" (08'23.98" (NAD83)				
Project I	Name	TVA - ALF Well Ins	stallations		Boring No.	ALF	-203	Total Deptl	n 51.6 ft
Lithold) QV		Overburden	Sample #	Depth	Rec Et	Blows	Mois Cont %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-		Sand, gray-brown brown-gray, wet, of fine grained <i>(Cont</i>	and dense, <i>inued)</i>		26.0 - 36.0	10.0	100%		
-		- Organics noted f - 41.0'	rom 38.0'						-
-		- Clayey zone fron 40.0'	n 39.0' to						-
-									-
-					36.0 - 46.0	10.0	100%		-
-									-
-									-
-									-
-					46.0 - 51.6	5.6	100%		-
167.0	51.6								-
-	01.0	Bottom of Hole		1		<u> </u>			_
-									_
66 —									_
- 10/5 									_
									_
FMSM-GR									_
DECTORU									_
									_
ECFMSM_LEGAC									-
STANTE									



Stantec	Borehol	e Identification AL	F-203B				Tota	I Boring De	pth 92.0 ft	
Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'27.	69", W90°0	08'24.25" (NAD83)	
Project I	Number	175577013			Surface Ele	vation 2	18.8 ft	Elevation	Datum NGVD29	
Project I	Name	TVA-ALF Remedia	l Investigati	ion	Date Starte	d8/	/15/17	Completed	d <u>8/16/17</u>	
Project	Locatio	n Memphis, Tenn	essee		Depth to Wa	ater 2	9.1 ft	Date/Time	9/6/17	
Supervis	sor	Briggs Evans			Depth to Wa	Depth to Water N/A Date/Tim				
Logged	by	Walker Padgett		Driller	La	arry Yanc	еу			
Drilling (Drilling Contractor Cascade Drilling					be and ID	D_Terras	onic 150C /	/ #10-00100	
Overbur	rden Dril	ling and Sampling To	ools (Type a	and Size) Sonic Tool	ing - 9" Bit	, 9" Casing	, 6" Barrel, 3.	5" Rods	
Sampler	r Hamm	er Type N/A	Weight	t NA	Drop	NA	Ef	ficiency _	NA	
Borehol	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.	
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	-	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
218.8'	0.0'		~	-						
			/							
215.8'	3.0'			_	0.0' - 6.0'	6.0'	100			
-		Silty Sand (SM), b	orown, dry to							
-		moist, organic ma	aterial					6.0'	-	
211.8'	7.0'	throughout							1	
-		Clayey Sand (SC)), gray to							
208 8'	10.0'		su, moist							
200.0	10.0	Fat Clay (CH), ora	ay to	-	6.0' - 16.0'	9.0'	90		-	
		brown, high plasti	city, firm,							
-										
-										
								16.0'	-	
					16.0' -	9.0'	90		-	
196.8'	22.0'			_	26.0'					
195.8 '	23.0'	Clayey Sand (SC)), brown, t	_						
		Sand with Clay (S								
2020A		gray to brown, me	dium					26.0'	-	
		granica, molot								
189.8'	29.0'	0.5' Fat Clay Lens	(CH)							
		gray-orange mottl moist @ 27.5'	ed, soft	-						



	Stantec Borehole Identification ALF-203B Client Tennessee Valley Authority					Total Boring Depth 92.0 ft					
	Client Tennessee Valley Authority					Boring Location <u>N35°04'27.69", W90°08'24.25" (NAD</u>					
	Project Number 175577013					Surface Ele	vation 2	18.8 ft	Elevation I	Datum NGVD29	
	Litholo	рду	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
┝	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
-	- Poorly Graded Sand (SP), brown, medium grained, moist <i>(Continued)</i>			26.0' - 36.0'	9.0'	90					
	184.8	34.0	Clavey Sand (SC)	aray to	-					_	
-	181.8'	37.0'	brown, fine graine 0.5' Fat Clay Lens ~ 35'	, gidy to d, moist, (CH) @	-				36.0'	-	
-	179.8'	39.0'	Poorly Graded Sa brown, medium gr moist to wet	nd (SP), ained,	-					-	
-	moist to wetClayey Sand (SC), gray to brown, fine grained, wet, stratified organic material (6-10mm).173.8'45.0'45.0'43'Fat Clay with Sand (CH), gray, high plasticity, very soft, moist, fine grained			36.0' - 46.0'	10.0'	100		-			
_			d (CH), y, very ained	-				46.0'			
-	405.01	50.01	Sand with Clay (S gray, fine grained,	P-SC), wet		46.0' - 56.0'	10.0'	100		- -	
-	165.8'	55.0'	Clayey Sand (SC) wet, fine grained s	, gray, and	-					-	
			Poorly Graded Sa	nd (SP)	1				56.0'	-	
T 11/27/17	160.8'	58 0'	grained, wet	e						-	
ROCK ALLEN_175577013 - REV.GPJ FMSM-GRAPHIC LOG.GD1	100.8	30.0	Poorly Graded Sa gray, fine to mediu grained, wet	nd (SP), ım		56.0' - 66.0'	10.0'	100	 66.0'	- - - - - - - -	
DG - NO R								-			
TVA SONIC BORING LC									-		



Stantec Borehole Identification ALF-203B Total Boring Depth 92.0 ft								
Client Tennessee Valley Authority				Boring Location N35°04'27.69", W90°08'24.25" (NAD				
Project Numbe	Project Number 175577013			Surface Elevation 218.8 ft			Elevation Datum NGVD29	
Lithology		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	Poorly Graded Sa gray, fine to medi grained, wet (Co	ind (SP), um <i>ntinued)</i>		66.0' - 76.0'	0.0'	0		- - -
F							76.0'	_
-							70.0	-
-								- - -
				76.0' - 86.0'	0.0'	0		-
-								_
							86.0'	
<u>131.8'</u> 87.0 - - -	Well Graded San with gravel, gray, coarse grained sa gravel, very wet	d (SW) fine to ind and	-	86.0' - 92.0'	6.0'	100		- - -
126.8' 92.0							92.0'	_
	No Refusal / Bottom of Hole							- - - - - - - - - - - - - - - - - - -



Stantec	Borehol	e Identification AL	F-203A				Tota	I Boring De	pth 129.0 ft
Client Tennessee Valley Authority				Boring Location N35°04'27			.69", W90°08'24.12" (NAD83)		
Project I	Project Number 175577013				Surface Elevation 218.3 ft		18.3 ft	Elevation Datum_NGVD29	
Project I	Project Name TVA-ALF Remedial Investigation				Date Started 7/31/17		Completed 8/1/17		
Project	Project Location Memphis, Tennessee				Depth to Water 29.2 ft		Date/Time	9/6/17	
Supervis	Supervisor Briggs Evans				Depth to Water N/A		Date/Time	e <u>N/A</u>	
Logged by Lee Eaves				Driller Matt Pope					
Drilling Contractor Cascade Drilling					Drill Rig Type and ID Prosonic LS600 / #10-00273				
Overburden Drilling and Sampling Tools (Type and Size) Sonic Tooling - 8" Bit, 8" Casing, 7" Barrel, 3.5" Rods									5" Rods
Sampler	r Hamme	er Type N/A	Weight	t NA	Drop	NA	Ef	ficiency _	NA
Borehole	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
218.3'	0.0'	Top of Hole							
		CI OPSOII							4" Monitoring
-		(SM), fine to coars	avei Se			7.01	400		See Well
_		grained, moist			0.0' - 7.0'	7.0	100		Construction
212.3'	0.0' 7 0'	Silty Fat Clay (CH) with	-				7 0'	
211.5	7.0	$\sqrt{\text{sand}, \text{light brown},}$	nigh /	-				1.0	-
_		plasticity, stiff, moist							
_ 208.3'	10.0'	\neg brown, moist, fine	gnt to ┌	-					-
-		medium grained	/		7 0' - 17 0'	10.0'	100		
-		Sandy Lean Clay	(CL), Im		7.0 - 17.0	10.0	100		
_		plasticity, moist	2						
_ 203.3'	15.0'		· · · ·	-					-
_		Silty Fat Clay (CH), mottled						17 0'	
		firm, high plasticity	/, moist					17.0	1
									-
197.3'	21.0'		arouto	-	17.0'	10.0'	100		
- YEA		Clayey Sand (SC), gray to brown, fine grained, stiff,			27.0'	10.0	100		
		low plasticity, mois	st						
									-
192.3'	26.0'			-				27.01	
		gray to light brown	na (SP), 1, fine					27.0	-
		grained, wet							


Stantec Borehole Identification ALF-203A Client Tennessee Valley Authority								Tota	I Boring De	oth 129.0 ft
	Client	_	Tennessee Valley	Authority		Boring Loca	ition N	35°04'27.	.69", W90°0	8'24.12" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 22	18.3 ft	Elevation I	Datum NGVD29
	Litholo	ogy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	-		Poorly Graded Sa gray to light brown grained, wet (Co	nd (SP), ı, fine ntinued)		27.0' - 37.0'	9.5'	95		
┢									37 0'	_
_	- 176.3'	42.0'				37.0' -	10.0'	100	01.0	- - - -
	-		Poorly Graded Sa Silt (SP-SM), gray wet, fine grained 6" lens of Fat Clay gray green, stiff, w plasticity	nd with green, ⁄ (CH), ⁄et, high	-	47.0'			47.0'	- - - - -
27/17	-		1' layer of Silty Fat (CH), gray green, high plasticity	t Clay stiff, wet,		47.0' - 57.0'	8.5'	85	 57.0'	- - - - - - - - - - - - - -
3DT 11/27									57.0	-
3 LOG - NO ROCK ALLEN_175577013 - REV.GPJ FMSM-GRAPHIC LOG.G	-					57.0' - 67.0'	8.0'	80	67.0'	-
TVA SONIC BORING	148.3'	70.0'								-



TVA

ſ	Stantec	Borehol	e Identification AL	F-203A				Tota	I Boring De	pth 129.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'27.	.69", W90°0	8'24.12" (NAD83)
	Project N	Number	175577013			Surface Ele	vation 2	18.3 ft	Elevation I	Datum NGVD29
	Litholc	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
			Well Graded Sand gray, fine to medit grained, wet, trace gravel <i>(Continue</i>	d (SW), um e round d)		67.0' - 77.0'	10.0'	100		
╞									77.0'	=
	· · · · · · · · · · · · · · · · · · ·					77.0' - 87.0'	8.0'	80		- -
	- 127.3' 	91.0'	Poorly Graded Sa gray, fine grained, trace round grave	nd (SP), wet, I	-	87.0' - 97.0'	7.5'	75		
ROCK ALLEN_175577013 - REV.GPJ FMSM-GRAPHIC LOG.GDT 11/27/17	· · · · · · · · · · · · · · · · · · ·					97.0' - 107.0'	5.5'	55		- - - - - - - - - -
LOG - NO									107.0'	-
VA SONIC BORING	_									-



Γ	Stantec	Borehole	e Identification ALI	-203A				Tota	I Boring Dep	oth 129.0 ft
	Client Tennessee Valley Authority					Boring Loca	ation <u>N</u>	35°04'27.	69", W90°0	8'24.12" (NAD83)
	Project I	Number	175577013			Surface Ele	evation 21	8.3 ft	Elevation [Datum NGVD29
	Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
┝	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	100.01	Poorly Graded Sand (SP), gray, fine grained, wet, trace round gravel (Continued)103.3'115.0'		nd (SP), wet,		107.0' - 117.0'	10.0'	100		-
-	103.3	Well Graded Sand (SW), brownish gray, fine to coarse grained, wet, trace round gravel		I (SW), e to et, trace	-				117.0'	-
-	98.3' 120.0' Sandy Lean Clay (CL)			-					-	
-	Sandy Lean Clay (CL), gray, firm, low plasticity, wet		(CL), sticity,		117.0' - 127.0'	10.0'	100		-	
	94.3' 124.0' Lean Clay (CL), gray, medium plasticity, very stiff, wet, some fine sand (classification based on		-					-		
_							127.0'	_ - -		
F	89.3'	129.0'	Particle Size and A Limits analysis, sa ∕interval 127.8' to 1	Atterberg mple 28.3') /	ST-1	127.0' - 129.0'	2.0'			-
77013 - REV.GPJ FMSM-GRAPHIC LOG.GDT 1127/17		89.3' 129.0' Limits analysis, sample interval 127.8' to 128.3') No Refusal / Bottom of Hole								- - - - - - - - - - - - - - - - - - -
VA SONIC BORING LOG - NO ROCK ALLEN_17557.										- - - - -



Γ	Project I	Number 175565292 Name TVA - ALF Well Installations				Location	N	35°04'28	3.14", W 90°	08'14.94" (NAD83)
	Project I	Name	TVA - ALF Well Ins	stallations		Boring No.	ALF	-204	Total Dept	h 56.0 ft
	County		Shelby Co., TN			Surface Elev	vation	21	4.8 ft (NGVI	029)
	Project 7	Гуре	Well Installations			Date Started	d 9/	/13/16	Completed	9/14/16
	Supervis	sor	B. Bryant Dr	iller Young		Depth to Wa	ater 24	4.5 ft	Date/Time	9/13/16
	Logged	Ву	Thaxton			Depth to Wa	ater N	/A	Date/Time	N/A
f	Litholo	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	214.8	0.0	Top of Hole							
F	_214.3	0.5	Topsoil		_					4" Monitoring - Well Installed
F			brown, moist, med	lium stiff				000/		
F					BAG-1	0.0 - 6.0	5.0	83%		-
l	209.8	5.0								_
			Lean to Fat Clay, moist, medium sti	brown, ff						-
			Becomes dark gra below 15.0'	ау						-
										-
	-									_
					BAG-2	6.0 - 16.0	8.0	80%		-
										-
╞										-
╞										-
┢	-									_
┟										-
╞										-
┟										-
╞										-
	-				PAC 3	160 260	10.0	100%		-
DT 10/5/16					DAG-3	10.0 - 20.0	10.0	100%		-
IC LOG.GE										-
M-GRAPH										-
GPJ FMS	-									-
PROJECT										-
ACY ALF										-
ASM_LEG/										-
STANTEC/FI										-



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Project Number 175565292				Location	Ν	35°04'28	8.14", W 90°	08'14.94" (NAD83)	
Project N	Project Name TVA - ALF Well Installations				Boring No.	ALF	-204	Total Dept	h56.0 ft
Litholo	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-		Lean to Fat Clay, moist, medium stit <i>(Continued)</i>	brown, ff		26.0 - 36.0	10.0	100%		-
-					36.0 - 46.0	7.0	70%		Analytical – Sample from 34.5 to 35.0' – –
171.8	43.0	Sand, dark gray, v	vet,	_			10,0		-
-		uense							
					46.0 - 56.0	4.0	40%		
158.8 158.8	56.0	Bottom of Hole							
PROJECT SPJ FMSN-GRAI									-
ITANTECFMSM_LEGARY_ALF									-



71/22/11

TVA V

Stantec	Boreho	le Identification AL	.F-204B				Tota	I Boring De	pth 91.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u>	35°04'28	.14", W90°0	8'15.35" (NAD83)
Project	Number	175577013			Surface Ele	vation 2	14.5 ft	Elevation	Datum NGVD29
Project	Name	TVA-ALF Remedia	al Investigat	ion	Date Starte	d 8	/16/17	Completed	8/17/17
Project	Locatio	n Memphis, Tenr	nessee		Depth to Wa	Depth to Water 25.1 ft D			9/6/17
Supervi	sor	Briggs Evans			Depth to Water N/A Date/Tir				N/A
Logged	by	Walker Padget		Driller	L	arry Yanc	еу		
Drilling	Contract	tor Cascade Drillin		Drill Rig Typ	be and I	D_Terras	onic 150C /	#10-00100	
Overbur	rden Dril	ling and Sampling T	and Size) Sonic Tool	ing - 9" Bi	t, 9" Casing	, 6" Barrel, 3.	5" Rods	
Sample	r Hamm	er Type N/A	t NA	Drop	NA	Ef	ficiency	NA	
Borehol	e Azimu	th N/A (Vertic	al)		Borehole Ir	nclination	n (from Ve	ertical)	0 deg.
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_ 214.5'	0.0'	Top of Hole							
214.0'	0.5'	Topsoil		-					4" Monitoring
212.5'	2.0'	Silty Sand (SM), t	prown,	_					Well Installed.
211.5'	3.0'	tine grained, mois	st, FILL	-	0.0' - 6.0'	5.0'	83		Construction
-		Very Stated Sa with Silt brown fi	nd (SP)						Log for details.
208 5'	6.0'	grained, dry to mo	pist					6 0'	-
207.5'	7.0'	$\sqrt{\text{Silty Sand (SM), t}}$	prown,	_				0.0	
_		fine grained, mois	st/						
_		verv fine to fine o), brown, rained.						
_		moist	,						-
-		Fat Clay (CH), bro	own with		6.0' - 16.0'	9.0'	90		
-		gray mottling, hig	h Nist						
-			150						
_									
-								16.0'	-
197.5'	17.0'			_					
-		Fat Clay (CH), gra	ay, high						
-		brown and white	nottling						
-					16.0' -	10.0'	100		-
192.5'	22.0'				26.0'				
_		Clayey Sand (SC							
190.5'	24.0'	fine grained, wet							
┝	Fat Clay (CH), gray, high plasticity, soft, moist							26.0'	-
-		· · · ·							
_									



ſ	Stantec Borehole Identification ALF-204B Client Tennessee Valley Authority							Tota	I Boring De	oth 91.0 ft
	Client Tennessee Valley Authority				Boring Loca	tion <u>N</u>	35°04'28.	.14", W90°0	<u>8'15.35" (NAD83</u>)	
	Project N	Number	175577013			Surface Ele	vation 2	14.5 ft	Elevation [Datum NGVD29
	Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	- - - 180.5'	Fat Clay (CH), gray, high plasticity, soft, moist <i>(Continued)</i> 180.5' 34.0'			26.0' - 36.0'	10.0'	100			
ļ	_		Clayey Sand (SC) fine grained, wet,	, gray, brown	-				36.0'	_
-	- - - - - - - - - - - -	fine grained, wet, brown mottling 171.5' 43.0' Poorly Graded Sand (SP), gray, fine grained, wet			36.0' - 46.0'	5.0'	50		- - - - - - - - - - - - - - - - 	
-	-								46.0'	
-	- - - - - - - 158.5'	56.0'				46.0' - 56.0'	10.0'	100	 56.0'	- - - - - - - - -
OCK ALLEN_175577013 - REV.GPJ FMSM-GRAPHIC LOG.GDT 11/27/17	- - - - - - - -	63.0'	Well Graded Sand Gravel (SW), brow coarse grained, ve Well Graded Sand with gravel, brown coarse grained, w	I with vn, fine to ery wet I (SW) , fine to et		56.0' - 66.0'	7.0'	70	 66.0'	
TVA SONIC BORING LOG - NO RC	-								00.0	-



Γ	Stantec	Borehole	e Identification ALI				Tota	I Boring Dep	oth 91.0 ft	
	Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u>	35°04'28	.14", W90°0	8'15.35" (NAD83)
	Project N	Number	175577013			Surface Ele	evation 21	4.5 ft	Elevation [Datum NGVD29
	Litholo	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-			Well Graded Sanc with gravel, brown coarse grained, we (Continued)	l (SW) , fine to et		66.0' - 76.0'	10.0'	100		-
-									76.0'	_ - - - -
						76.0' - 91.0'	14.0'	93		- - - - -
_	123.5'	91.0'	No Defued /						91.0'	- -
-			Bottom of Hole							-
APHIC LOG.GDT 11/27/17										-
175577013 - REV.GPJ FMSM-GF										-
A SONIC BORING LOG - NO ROCK ALLEN										



Stanton	Borehal	e Identification	E-204A				Toto	l Boring Do	nth 129 0 ft
Client	DOIGHO				Poring Loop	tion N	10ta		
Drainat			Autionity				<u>35°04'28.</u>	<u>13°, W90°C</u>	<u>18°15.16° (NAD83)</u>
Project	Number	1/55//013				vation $\frac{2}{2}$	14.6 π	Elevation	
Project	Name		il Investigati	on	Date Started	a <u>8</u>	(3/17	Complete	d <u>8/4/17</u>
Project	Location	n Memphis, Tenn	essee		Depth to Wa	ater 2	5.0 ft	Date/Time	9/6/17
Supervis	sor	Briggs Evans			Depth to Wa	ater N	/A	Date/Time	e <u>N/A</u>
Logged	by	Lee Eaves			Driller	N	latt Pope		
Drilling (Contract	or Cascade Drilling		Drill Rig Typ	be and II	Prosor	nic LS600 /	#10-00273	
Overbur	den Dril	ling and Sampling To	ools (Type a	and Size) Sonic Tooli	ing - 8" Bi	t, 8" Casing	, 7" Barrel, 3.	5" Rods
Sampler	r Hamm	er Type N/A	Weight	t NA	Drop	NA	Ef	ficiency _	NA
Borehol	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	_
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_ 214.6'	0.0'	Top of Hole							-
									4" Monitoring
-		brown, fine graine	gnt d, moist						See Well
211.1'	3.5'		, 1	-	0.0' - 7.0'	7.0'	100		Construction
		brown, low to mec	L), lium						
-		plasticity, soft to fi	rm, moist					- 01	
206 6'	9 N '							7.0'	-
200.0	0.0	Silty Lean Clay (C	L), grav.	-					
_		low to medium pla	isticity,						_
-		firm, moist							
-					7.0' - 17.0'	10.0'	100		
-									
-									
 198.6'	16.0'								-
11/27/17		Silty Lean Clay (C	L), gray,					17.0'	-
06.601		low to medium pla	isticity,						
MSM-GF									-
- CGPJ F					17.0' -	10.0'	100		
7013 - RE					27.0'				
									-
- NO RO								27 0'	
L LOC								21.0	-
TVASC									



ſ	Stantec Borehole Identification ALF-204A Client Tennessee Valley Authority							Tota	I Boring De	oth 129.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'28.	13", W90°0	<u>8'15.16" (NAD83</u>)
	Project I	Number	175577013			Surface Elev	vation 21	14.6 ft	Elevation I	Datum NGVD29
Ī	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
┟	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	Silty Lean Clay (CL), gray, low to medium plasticity, firm, moist to wet <i>(Continued)</i>			27.0' - 37.0'	10.0'	100				
	179.6' 35.0'		-					_		
	176.6'	Clayey Sand (SC), gray, fine grained, low plasticity, wet176.6'38.0'		_				37.0'	-	
	- 		Poorly Graded Sa gray, fine grained,	nd (SP), wet						-
						37.0' - 47.0'	10.0'	100		-
									47.0'	-
	_									-
						47.0' - 57.0'	2.0'	20		-
1/27/17	- 157.6'	57.0'			-				57.0'	-
M-GRAPHIC LOG.GDT 1	_		Well Graded Sand brownish gray, find medium grained, v gravel	d (SW), e to wet, trace						-
175577013 - REV.GPJ FMS						57.0' - 67.0'	5.5'	55		-
- NO ROCK ALLEN	-								67.0'	-
TVA SONIC BORING LOG	_									-



ſ	Stantec Borehole Identification ALF-204A Client Tennessee Valley Authority			F-204A				Tota	I Boring Dep	oth 129.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'28.	13", W90°0	8'15.16" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 21	4.6 ft	Elevation [Datum NGVD29
Ī	Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	-		Well Graded Sand brownish gray, find medium grained, v gravel <i>(Continue</i>)	l (SW), e to wet, trace d)		67.0' - 77.0'	4.0'	40		
╞	-								77 0'	_
ł	-								77.0	-
-	- - - - - - - - - - - - - - - - - - -	83.0'	Wall Creded Same		_	77.0' - 87.0'	9.0'	90		-
ł	130.0	04.0	$\sqrt{\frac{1}{2}}$ dark gray, fine to a	(SVV), coarse \int	-					-
	_		grained, wet, with	gravel						-
╞	-		brownish gray, find	e to					87.0'	-
7/17	- - - - -		medium grained, v gravel	wet, trace		87.0' - 97.0'	5.0'	50	 97.0'	- - - - - - - -
DT 11/27	_									_
NO ROCK ALLEN_175577013 - REV.GPJ FMSM-GRAPHIC LOG.GI	- - - - - - - - - - - - - - - - - - -	107.0'				97.0' - 107.0'	1.0'	10		
G LOG - N	107.0	107.0	Poorly Graded Sa	nd (SP),	-				107.0	-
IVA SONIC BORIN	- - -		gray, fine grained, trace gravel	wet,						-



Stantec	Borehole	e Identification ALI	-204A				Tota	I Boring Dep	oth 129.0 ft
Client	Client Tennessee Valley Authority				Boring Loca	tion N	 35°04'28	.13", W90°08	8'15.16" (NAD83)
Project I	Number	175577013			Surface Ele	vation 2	14.6 ft	Elevation D	Datum NGVD29
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
- - -		Poorly Graded Sa gray, fine grained, trace gravel (Cor	nd (SP), wet, <i>ttinued)</i>		107.0' - 117.0'	8.5'	85		- - -
-								117.0'	-
96.6'	118.0'							117.0	-
- - -		Clayey Sand (SC) fine grained, wet, plasticity	, gray, ow		117 0' -	10.0'	100		- - -
92.1'	122.5'				127.0'	10.0	100		-
-		Fat Clay (CH), gra stiff, high plasticity (classification bas Particle Size and A Limits analysis, sa interval 128 1' - 12	y, very , wet ed on Atterberg mple 8 6')					127.0'	
- 85.6'	129.0'		.0.0)	ST-1	127.0' - 129.0'	2.0'			-
		No Refusal / Bottom of Hole							



Project	Number	175565292			Location N 3			N 35°04'26.62", W 90°08'05.93" (NAD83		
Project	Name	TVA - ALF Well Ins	stallations		Boring No.	ALI	F-205	Total Dept	h 53.0 ft	
County		Shelby Co., TN			Surface Ele	vation	21	7.8 ft (NGVD29)		
Project	Туре	Well Installations			Date Started	d 9.	/16/16	Completed	9/16/16	
Supervi	sor	B. Bryant Dr	iller W. Ca	steel	Depth to Wa	ater 2	7.5 ft	Date/Time	9/16/16	
Logged	Ву	B. Evans			Depth to Water N/A		Date/Time	N/A		
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
217.8	0.0	Top of Hole								
-		Sandy Silt, brown damp to moist, so medium stiff	, soft, ft to						-	
-		- Less Sand belov	v 8.0'						-	
_					0.0 - 10.0	10.0	100%		-	
-									-	
_									_	
F									_	
-									-	
-									-	
204.3	13.5								-	
-		Lean Clay, brow	n-gray						-	
-		stiff to stiff	ealam		10.0 - 20.0	10.0	100%		-	
-									-	
-									-	
-									-	
_									-	
196.8	21.0								_	
	21.0	Fat Clay, gray, me stiff, moist to wet	edium	-					-	
		- Silt layer from 25 26.0'	5.0' to						-	
					20.0 - 30.0	10.0	100%		Analytical –	
191.8 -	26.0	Sand, light brown, medium dense, fir	, wet, ne	-					25.0' - 25.5'	
		grameu							-	



SUBSURFACE LOG

Project I	Number	175565292		Location N 35°04'2		35°04'26	04'26.62", W 90°08'05.93" (NAD		
Project I	Name	TVA - ALF Well Ins	stallations		Boring No.	ALF	-205	Total Depth	n 53.0 ft
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-		Sand, light brown medium dense, fir grained <i>(Continu</i>	, wet, ne <i>ied)</i>						
 177.8	40.0				30.0 - 40.0	10.0	100%		- - - -
		Sand, gray, wet, r dense, with some	nedium organics		40.0 - 50.0	10.0	100%		
- - 164 8	53.0				50.0 - 53.0	3.0	100%		-
	00.0	Bottom of Hole		1		1			
		DOLLOTH OF HOLE							- - - - - - - - - - -



71/22/11

TVA V

Stantec	Borehol	e Identification AL	F-205B				Tota	I Boring De	pth 82.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ition N	35°04'26	.65", W90°0)8'05.67" (NAD83)
Project I	Number	175577013			Surface Ele	vation 2	16.5 ft	Elevation	Datum NGVD29
Project I	Name	TVA-ALF Remedia	I Investigati	ion	Date Started	d 8	/17/17	Complete	d <u>8/18/17</u>
Project	Locatio	nMemphis, Tenn	essee		Depth to Wa	ater 2	7.7 ft	Date/Time	9/6/17
Supervis	sor	Briggs Evans			Depth to Water N/A Date/Time			e N/A	
Logged	by	Walker Padgett			Driller Larry Yancey				
Drilling	Contract	or Cascade Drilling	g		Drill Rig Typ	be and II	D Prosor	nic LS600 /	#10-00273
Overbur	den Dril	ling and Sampling To	ools (Type a	and Size) Sonic Tooli	ing - 9" Bi	t, 9" Casing	, 6" Barrel, 3.	5" Rods
Sample	r Hamm	er Type_N/A	Weight	t NA	Drop	NA	Ef	ficiency	NA
Borehol	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatio	n (from Ve	ertical)	0 deg.
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %)
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
216.5'	0.0'	Top of Hole							-
		Topsoil		_					4" Monitoring
214.5	2.0	Clayey Sand (SC)	, brown, ∫ moist	-					Well Installed.
-		organic material							Construction
-		Silty Sand (SM), fi	ne						Log for details.
		grained, dry to mo	ist						-
					0.0' 15.0'	9 O '	53		
_					0.0 - 15.0	0.0	55		
-									
-									-
-									
203.5'	13.0'								
_		Fat Clay (CH), gra	iy to						
_		brown mottled, firr	n, high					15.0'	
_		plactory, molet,							
-									
_									
-					15.0' -	10.0'	100		
_					25.0'				
_									
102 5'	24.01								
192.5	24.U	Fat Clay (CH) with	sand	-				25.0'	
190.5'	26.0'	gray, soft, high pla	isticity,					20.0	-
_	moist, mottled, very fine to								
-		Poorly Graded Sa	nd (SP)						
-		brown, fine graine	d, wet		25 01	10.01	100		
	1			1	2011-	1 10 0	1 1111	1	1

Stantec Consulting Services Inc.



Stantec Borehole Identification ALF-205B					Total Boring Depth 82.0 ft				
Client		Tennessee Valley	Authority		Boring Location <u>N35°04'26.65", W90°08'05.67" (NAD</u>				
Project	Number	175577013			Surface Ele	vation 2	16.5 ft	Elevation [Datum NGVD29
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
 	- Poorly Graded Sand (SP), brown, fine grained, wet (Continued) 182.5' 34.0' 180.5' 36.0' Poorly Graded Sand (SP), brown, fine grained, wet (Continued) - - <tr< td=""><td></td><td>35.0'</td><td></td><td></td><td></td><td>-</td></tr<>			35.0'				-	
			_					-	
_ 180.5'			_				35.0'	_	
 	39.0'	Poorly Graded Sa Clay (SP-SC), gra	nd with y, wet	-	05.01	7.01	70		-
- -		Poorly Graded Sa gray, fine grained,	nd (SP), wet		35.0' - 45.0'	7.0'	70		-
173.5'	<u>173.5'</u> 43.0'			-					-
172.5	44.0 45.0'	high plasticity, mo	ist /	-				45.0'	-
- - - - - - - - - - - - - - - - - - -	54.0'	Clayey Sand (SC) grained, wet Poorly Graded Sa Silt (SP-SM), gray grained, wet, orga material from 54' t	nd with r, fine nic to 55'	-	45.0' - 55.0'	9.0'	90		- - - - - - - - -
		Well Graded Sand	d (SW),					55.0'	-
172211 102 001 112211 11211 11211 11211 11211 11211 112111 112111 112111 112111111	Well Graded Sand (SW), gray, fine to coarse grained, wet 155.5' 61.0' Well Graded Sand (SW) with gravel, gray, fine to coarse grained sand and gravel, wet		e		55.0' - 65.0'	10.0'	100		
C ALLEN 17557703 - REVORT 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1							65.0'	- - -	
		3" lens of Sandy S non-plastic, soft, r 69'	Silt (ML), noist @		65.0' -	10.0'	100		- - -



Stantec Borehole Identification ALF-205B							Tota	I Boring Dep	oth 82.0 ft
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'26	.65", W90°0	8'05.67" (NAD83)
Project N	lumber_	175577013			Surface Ele	vation 21	16.5 ft	Elevation [Datum NGVD29
Litholog	JY	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	Well Graded Sand (SW) with gravel, gray, fine to coarse grained sand and gravel, wet <i>(Continued)</i>			75.0'				-	
_								75.0'	_
								_	
				75.0' - 82.0'	4.0'	57		- - -	
134.5' 82.0'							82.0'	-	
		Bottom of Hole							- - - - - - - - - - - - - - - - - - -



71/22/11

	Stantec	Stantec Borehole Identification ALF-205A						Tota	I Boring De	pth 119.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'26.	73", W90°0	8'06.25" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	16.2 ft	Elevation	Datum NGVD29
	Project I	Name	TVA-ALF Remedia	l Investigati	on	Date Starte	d8/	/10/17	Completee	d <u>8/11/17</u>
	Project	Locatior	nMemphis, Tenn	essee		Depth to Wa	ater 2	7.5 ft	Date/Time	9/6/17
	Supervis	sor	Briggs Evans			Depth to Wa	ater N	/A	Date/Time	eN/A
	Logged	by	M. McDonald			Driller	La	arry Yanc	еу	
	Drilling Contractor Cascade Drilling					Drill Rig Typ	be and ID	D Terras	onic 150C /	#10-00100
	Overburden Drilling and Sampling Tools (Type and) Sonic Tool	ing - 9" Bit	, 9" Casing	, 6" Barrel, 3.	5" Rods
	Sampler	Hamm	er Type N/A	Weight	t NA	Drop	NA	Ef	ficiency	NA
	Borehole Azimuth N/A (Vertical)					Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
	Litholo	ogy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	216.2'	0.0'	Top of Hole							-
	- 215.4	0.8	Top Soil		-					4" Monitoring
	-		(CL), light brown to	th Sand						See Well
	-		moist, fine grained	l sand		0.0' - 7.0'	7.0'	100		Construction
	211.2'	5.0'								Log for details.
	_		Lean Clay (CL) br	own,						
	-		moist, with silt and sand	I fine					7.0'	-
	_									
	206 2'	10 0'								
		10.0	Fat Clay (CH), bro	wn to						-
			gray, very stiff, ver	ry moist,		7.0' - 17.0'	10.0'	100		
	_		trace red to brown	asticity, siltv						
	-		sand lens and gra	vel						
	_									-
27/17	-								17.0'	
GDT 11/2	-								17.0	
HIC LOG.	_									
M-GRAPI	_									_
PJ FMSI	_									
REV.G	- 400 01	00.01				17.0' - 27.0'	10.0'	100		
75577013	193.2	23.0	Eat Clay (CH) are		-	27.0				
ALLEN_1	-		stiff, very moist, hi	gh						
D ROCK	190.2' 26.0' plasticity, trace silty sand								moisture at	
LOG - NC	189.2' 27.0' lenses							27.0'	depth of 25'	
BORING	187.7'	28.5'	with Silt, brown to	gray,						
A SONIC	-		tine grained, mois	t/]					
>1			1 1		1	1	1		1	1



ſ	Stantec	Borehol	e Identification _AL				Tota	I Boring De	pth 119.0 ft	
	Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'26.	.73", W90°0	8'06.25" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	16.2 ft	Elevation I	Datum NGVD29
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	-		Fat Clay (CH), bro gray, very stiff, ve Poorly Graded Sa Silt (SP), light bro gray, very moist to fine grained <i>(Col</i>	own to ry moist ind with wn to o wet, ntinued)		27.0' - 37.0'	10.0'	100		
	179.2' 176.7'	37.0' 39.5'	Fat Clay (CH) with sand, gray, very s moist,	n fine tiff, very					37.0'	
			Poorly Graded Sa SIIt (SP-SM), fine gray, wet	nd with grained,		37.0' - 47.0'	10.0'	100		
	-								47.0'	
127/17		51.0' 52.5'	Poorly Graded Cla Sand (SP-SC), gra trace clay, trace r Poorly Graded Sa gray, medium to c grained, wet, trace sub-rounded fine	ayey ay, wet, nica ond (SP), coarse e of to	-	47.0' - 57.0'	10.0'	100	 57.0'	
OG - NO ROCK ALLEN_175577013 - REV.GPJ FMSM-GRAPHIC LOG.GDT 11:	-		medium gravel			57.0' - 67.0'	7.0'	70	 67.0'	- - - - - - - - - - - - -
TVA SONIC BORING LL	_									-



Stantec Borehole Identification ALF-205A						Total Boring Depth 119.0 ft					
	Client		Tennessee Valley	Authority		Boring Location N35°04'26.73", W90°08'06.25" (NAE					
	Project I	Number	175577013			Surface Ele	vation 2	16.2 ft	Elevation Datum NGVD29		
	Litholo	ygy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
-	Poorly Graded Sand (SP), gray, medium to coarse grained, wet, trace of sub-rounded fine to medium gravel (<i>Continued</i>)		_	67.0' - 77.0'							
ŀ			Poorly Graded Silf	y Sand					77 0'	Lens of CH from	
	138.2'	38.2' 78.0' (SP-SM), gray to tan, medium to coarse grained, wet, little rounded medium gravel		-				11.0	depth 76.5' to 77' -		
	-		Well Graded Sand gray to light browr coarse grained, w rounded fine to me gravel	I (SW), i, fine to et, little edium		77.0' - 87.0'	9.0'	90			
	131.2'	85.0'			-					_	
			Poorly Graded Sa gray to light brown medium to coarse	nd (SP), l, grained					87.0'	-	
	126.7'	89.5'	wet, little fine to m rounded gravel, tra organics	edium ace	-					-	
	-		Poorly Graded Sa gray to brown, fine medium grained, v some fine to medi rounded to sub-an gravel	nd (SP), e to vet, um gular		87.0' - 97.0'	8.0'	80		- - - -	
117									97.0'	-	
77013 - REV.GPJ FMSM-GRAPHIC LOG.GDT 11/27/	-	104 0'				97.0' - 107.0'	9.0'	90			
EN_1755	112.2	104.0	Poorly Graded Silf	v Sand	-					-	
NG LOG - NO ROCK ALL	(SP-SM), gray to brown, medium to coarse grained, wet, some fine to medium gravel, trace silt						107.0'				
⁸ ⁸ ⁸ ⁸ ⁸ ⁸ ⁸ ⁸		-					_ Very moist soft ─				



Stantec	Borehol	e Identification AL	F-205A				Tota	I Boring De	oth 119.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u>	35°04'26.	.73", W90°0	8'06.25" (NAD83)
Project	Number	175577013			Surface Ele	evation 21	6.2 ft	Elevation I	Datum NGVD29
Lithold	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Lean Clay with Sand (CL), gray, very stiff to hard, moist, fine grained poorly graded sand (classification based on Particle Size and Atterberg Limits analysis, sample interval 117.8' - 118.4')			107.0' - 117.0'	10.0'	100		soil from depth _ 110' to 115' _ - - -
-		(Continued)					117.0	-	
97.2'	119.0'			ST-1	117.0' - <u>119</u> .0'	'			
		Bottom of Hole							



SUBSURFACE LOG

_										
ſ	Project I	Number	175565292			Location N 35°04'25.57", W 90°07'58.80				07'58.80" (NAD83)
	Project I	Name	TVA - ALF Well Ins	stallations		Boring No.	ALF	-206	Total Dept	h 62.0 ft
	County		Shelby Co., TN			Surface Elev	vation	22	2.2 ft (NGVI	029)
	Project ⁻	Туре	Well Installations			Date Started	d 9/	/15/16	Completed	9/16/16
	Supervis	sor	B. Bryant Dr	iller W. Cas	steel	Depth to Wa	ater 3	7.0 ft	Date/Time	9/15/16
	Logged	Ву	Briggs Evans			Depth to Wa	ater N	/A	Date/Time	N/A
t	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
┟	222.2	0.0	Top of Hole							
ł	221.7	0.5	Topsoil		-					4" Monitoring -
	-		Sandy Silt, brown moist, medium sti very fine grained s	, damp to ff, with sand						Well Installed
ľ	-		, ,							_
	-					0.0 40.0				_
ſ	-					0.0 - 10.0	9.0	90%		_
	-									_
	_									_
	_									_
	_									
	_									_
	_									_
	_									_
	_					10.0 - 20.0	10.0	100%		-
	206.2	16.0				10.0 20.0	10.0	10070		_
	-		Fat Clay, gray to brown-gray, mottle medium stiff to sti	ed, ff, moist						-
	_		- Silty Zones from	18.0' to						-
	_		20.0'							_
r 10/5/16	-		- Becomes dark g trace organics fro	ray with m 30.0' to						-
LOG.GDT	_		57.0							_
GRAPHIC	_									_
J FMSM-0	_					20.0 - 30.0	10.0	1000/		
NECT.GP.	_					20.0 - 50.0	10.0	100%		-
ALF_PRO	_									-
LEGACY .	_									_
C/FMSM_I	_									-
STANTE										



Page: 2 of 2

Project Number 175565292		Location	N 35°04'25.57", W 90°07'58.80" (N		7'58.80" (NAD83)				
Project I	Name	TVA - ALF Well In:	stallations		Boring No.	ALF	-206	Total Dept	h 62.0 ft
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
- - -		Fat Clay, gray to brown-gray, mottle medium stiff to sti <i>(Continued)</i>	ed, ff, moist		20.0 40.0	10.0	4000/		-
					30.0 - 40.0	10.0	100%		
	37.0	Lean Clay, gray, v to medium, zones and very silty and - Sand, gray, wet,	wet, soft sandy clayey , loose,	_					-
- - - - - 175.2	47.0	from 43.0' to 43.5' 45.0' to 45.5' Sand, light gray to wet medium den	o gray,	_	40.0 - 50.0	10.0	100%		- - - - - -
		wet, medium dens dense	se to		50.0 - 60.0	10.0	100%		- - - - - - - - - - -
160.2	62.0	Bottom of Hole			60.0 - 62.0	2.0	100%		
-		201101101010							_



	Project I	Number	175565292			Location N 35°04'			31.09", W 90°09'13.07" (NAD83)		
	Project I	Name	TVA - ALF Well Ins	stallations		Boring No.	ALF	-207	Total Depth 58.0 ft		
	County	·	Shelby Co., TN			Surface Ele	vation	22	7.8 ft (NGVD29)		
	Project ⁻	Гуре	Well Installations			Date Started	d 9/	/16/16	Completed	9/16/16	
	Supervis	sor	B. Bryant Dr	iller D. Coo	per	Depth to Wa	ater 30	6.3 ft	Date/Time	9/16/16	
	Logged	Ву	J. Andrew			Depth to Water N/A		Date/Time	N/A		
	Litholo	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
	Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
	_ 227.8	0.0	Top of Hole								
	226.8	1.0	Topsoil with fly as	h, moist	_					4" Monitorina -	
	_		Sandy Silt, dark gray,							Well Installed	
			clayey	n, zones		0.0 - 5.0	4.4	88%		_	
	_									_	
	_										
	_									-	
	-					5.0 - 10.0	3.2	64%		-	
	-									-	
	-									-	
	—									_	
	-									-	
	-					10.0 15.0	11	88%		-	
	-					10.0 - 15.0	4.4	0070		-	
	213.8	14.0	Dottom Ach		-					-	
	_		Bollom ASh							-	
	_									-	
	-					15.0 - 19.0	3.3	83%		-	
	_									-	
	-									-	
	_ 207.8	20.0			-					_	
	_		Silt, dark gray, mo	ist,						_	
										_	
-CO.001											
	<u>2</u> 03.8	<u>2</u> 4.0				10.0 00.0	70	70%		_	
			Silty Sand, dark g	ray,		19.0 - 29.0	7.9	1970		_	
20.0			moist, medium de	nse						_	
10021-1-	-									-	
	-									-	
	198.8	29.0								-	
	100.0	20.0			-					-	
ň.	•	1			1	1	1	1	1		



Project I	Project Number 175565292			Location N 35°04'31		31.09", W 90°09'13.07" (NAE			
Project I	Name	TVA - ALF Well Ins	stallations		Boring No.	ALF	-207	Total Depth	58.0 ft
Litholo	bgy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
197.2	30.6	Sandy Silt, dark gr moist, medium stif (<i>Continued</i>) Sand, dark gray to moist to wet, medi dense	ray, f		29.0 - 39.0	9.2	92%		
-					39.0 - 55.0	7.0	44%		-
- <u>179.3</u> - - - - -	48.5	Sandy Silt, gray, w medium stiff	vet,						- - - - -
169.8	58.0				55.0 - 58.0	3.0	100%		-
		Bottom of Hole							-
STATECFMS_LEGACY A									-



Stantec	Borehol	e Identification AL	F-207A				Tota	I Boring De	pth 138.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'31.	.08", W90°0	9'12.78" (NAD83)
Project N	Number	175577013			Surface Ele	vation 2	28.0 ft	Elevation	Datum NGVD29
Project N	Name	TVA-ALF Remedia	I Investigati	ion	Date Starte	d8/	/11/17	Completed	8/12/17
Project	Locatior	Memphis, Tenn	essee		Depth to Wa	ater 3	9.4 ft	Date/Time	9/6/17
Supervis	sor	Briggs Evans			Depth to Wa	ater N	/A	Date/Time	e <u>N/A</u>
Logged	by	Walker Padgett	:		Driller	La	arry Yanc	еу	
Drilling (Contract	or Cascade Drilling	g		Drill Rig Typ	be and ID	D_Terras	onic 150C /	#10-00100
Overbur	Overburden Drilling and Sampling Tools (Type and S) Sonic Tool	ing - 9" Bit	t, 9" Casing	, 6" Barrel, 3.	5" Rods
Sampler	r Hamme	er Type N/A	Weight	t NA	Drop	NA	Ef	ficiency _	NA
Borehole	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	-
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
228.0'	0.0'	Top of Hole	ing to						
-		Silty Sand (SM), fi medium grained, ([FILL]	ine tp dry,		0.0' - 6.0'	6.0'	100		4" Monitoring Well Installed. See Well Construction Log for details.
222.0'	6.0'			_				6.0'	
- 220.0' 219.0' - -	8.0' 9.0'	Well Graded Sand and Gravel (SW-S to coarse grained, [FILL] Poorly Graded Sili with Gravel (SM), medium grained, f gravel, dry [FILL]	d with Silt SM), fine moist, ty Sand fine to fine	-	6.0' - 16.0'	10.0'	100		
-		Silty Sand (SM), v to fine grained, mo [FILL]	ery fine oist,					16.0'	-
210.0' - - - 207.5'	18.0' 20.5'	Poorly Graded Sa black, coarse grai to moist, Bottom A	nd (SP), ned, dry Ash	-	16 0' -	10.0'	100		- -
		Sandy Silt (ML), lo plasticity, soft, mo organics	ow ist, trace		26.0'	10.0	100	 26 0'	-
201.0'	27.0'								
		Silty Sand (SM), g grained, moist	ıray, fine						



Stantec	Borehol	e Identification AL	F-207A				Tota	I Boring De	oth 138.0 ft
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'31	.08", W90°0	9'12.78" (NAD83)
Project	Number	175577013			Surface Ele	vation 22	28.0 ft	Elevation I	Datum NGVD29
Lithol	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
 - - - 194.0'	34.0'	Silty Sand (SM), g grained, moist <i>(Continued)</i>	gray, fine		26.0' - 36.0'	10.0'	100		-
-		Silty Sand (SM), brown, medium grained, wet						36.0'	-
- - - 188.0' - 187.0'	40.0' 41.0'	Clayey Sand (SC) soft, medium plas wet, fine grained s	-	36.0' - 46.0'				-	
185.0'	43.0	∇ Fat Clav (CH). high		_					-
104.0	44.0	_∖plasticity,`verý sof	t, wet $/$	-					-
182.0'	46.0'	Poorly Graded Sa medium grained,	ind (SP), wet	-				46.0'	-
-		Sandy Lean Clay gray, very soft, mo grained sand	(CL), pist, fine						-
_ _ _ 176.0'	52.0'	Clayey Sand (SC) medium grained, wet), brown, moist to		46.0' - 56.0'	10.0'	100		-
- 174.5'	53.5'	Sandy Fat Clay (C _ high plasticity, sof	CH), gray, ˈt, moist	-					-
173.0'	55.0'	Poorly Graded Sa	ind (SP),	-					
172.0'	56.0'	∖gray, medium gra	$\frac{1}{1}$	-				56.0'	-
171.0'	57.0'	∣ ∖Sandy ⊢at Clay (C ∏∖high plasticitv. sof	5н), gray, / t, moist /┌	_					-
169.5'	58.5'	Poorly Graded Sa	ind (SP),	-					-
168.0' 167.0'	60.0' 61.0'	Fat Clay (CH), gra	Gray, medium grained, wet		56.0' -	10.0'	100		
577013 - REV.GP		Clayey Sand (SC), gray, fine grained, moist to wet			00.0				-
CK ALLEN_175		Fat Clay (CH), gray, high plasticity, soft, moist						66 0'	-
01-00-00-00-00-00-00-00-00-00-00-00-00-0	Poorly Graded Sand with Silt (SP-SM), gray, medium grained, wet						00.0	-	
158.0'	70.0'	70.0'Clayey Sand (SC), gray, wet, medium grained							-



ſ	Stantec Borehole Identification ALF-207A					Total Boring Depth 138.0 ft					
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'31.	31.08", W90°09'12.78" (NAD83)		
	Project N	Number	175577013			Surface Ele	vation 22	28.0 ft	Elevation [Datum NGVD29	
Ī	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
	156.0'	72.0'	Poorly Graded Sa Silt (SP-SM), gray grained, wet (Co	nd with , medium 		66.0' - 76.0'	5.0'	50		-	
	-		Poorly Graded Sa gray, medium grai sand, wet	nd (SP), ned					70.01	-	
╞	-		,						76.0'	-	
	-									-	
	-					76.0' - 86.0'	10.0'	100		-	
	-								86.0'		
	- - -					86 0'	5 5'	55			
	-					96.0'	0.0	55		- - - -	
╞	-								96.0'	-	
7013 - REV.GPJ FMSM-GRAPHIC LOG.GDT 11/27/17	- - - -	101 2				96.0' - 106.0'	7.5'	75		- - - - -	
EN_17557.	124.0	104.0	Poorly Graded Sa	nd (SP)						-	
ROCK ALLE	- -		with gravel, gray, i	medium					106.0'		
IVA SONIC BORING LOG - NO F	-		grained gravel, we	et et							



Stantec	Borehol	e Identification AL				Tota	I Boring Dep	oth 138.0 ft	
Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'31.	08", W90°0	9'12.78" (NAD83)
Project I	Number	175577013			Surface Ele	vation 22	28.0 ft	Elevation [Datum NGVD29
Litholo	рду	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
<u>117.0'</u> - - -	-111.0'-	Well Graded Sand with gravel, fine to grained sand and wet	l (SW) coarse gravel,		106.0' - 116.0'	4.5'	45		- - -
-								116.0'	_
- - - - - -					116.0' - 126.0'	10.0'	100		- - - - - - - - -
-								120.0	-
- <u>100.0'</u> - - - - -	128.0'	Fat Clay (CH), gra brown, high plastic moist (classification bas Particle Size and a Limits analysis, sa interval 137.0' - 13	y and city, hard, ed on Atterberg imple 37.6')		126.0' - 136.0'	10.0'	100		- - - - - - -
-								136.0'	_
- - - 90.0'	138.0'			ST-1	136.0' - 138.0'	2.0'			-
VA SONIC BORING LOG - ND ROCK ALLEN _ 175577013 - REV.GPJ FMSM-GRAPHICLOG GD		No Refusal / Bottom of Hole							- - - - - - - - - - - -



Project I	Number	175565292			Location	N	35°04'31	.21", W 90°	09'18.74" (NAD83)
Project I	Name	TVA - ALF Well Ins	stallations		Boring No.	ALI	F-208	Total Depth 53.0 ft	
County		Shelby Co., TN			Surface Ele	vation	22	7.2 ft (NGVI	029)
Project ⁻	Туре	Well Installations			Date Started	d 9.	/16/16	Completed	9/16/16
Supervis	sor	B. Bryant Dr	iller D. Coc	per	Depth to Wa	ater 3	5.5 ft	Date/Time	9/16/16
Logged	By	J. Andrew			Depth to Wa	ater 3	8.0 ft	Date/Time	9/16/16
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_ 227.2	0.0	Top of Hole							
_		Lean Clay, brown	, moist,						4" Monitorina -
_									Well Installed
					0.0 - 5.0	4.6	92%		_
_									_
221.2	6.0								
		Sandy Silt, dark g	ray,						-
-		moist, medium sti	ff		5.0 - 10.0	5.0	100%		-
-									-
-									-
F									
-									-
-					10.0 15.0	10	900/		-
-					10.0 - 15.0	4.0	00%		-
-									-
F									-
-									-
- 000 7	175				150-190	4.0	100%		_
	17.5	Bottom Ash		_	10.0 10.0	1.0	10070		_
		Bollom Ash							_
206.2	21.0								_
5		Sandy Silt, dark g	ray,						_
-		moist, medium sti	ff						-
_									-
_					19.0 - 29.0	9.8	98%		-
-									-
—									-
-									-
—									-
—									-



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Project I	Project Number 175565292				Location	Ν	35°04'31	.21", W 90°0	09'18.74" (NAD83)
Project I	Name	TVA - ALF Well Ins	stallations		Boring No.	ALF	-208	Total Depth	n <u>53.0 ft</u>
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	31.6	Sandy Silt, dark g moist, medium stit (<i>Continued</i>) Sand, dark gray, r wet, medium dens	ray, ff 		29.0 - 39.0	8.8	88%		- - - - -
- 100 7	20 5								-
- - - - - - - - - - - - - - - - - - -	53.0	Sand with Gravel, wet, medium dens dense	brown, se to		39.0 - 49.0 49.0 - 53.0	9.4	94%		- - - - - - - - - - - - - - - - - - -
	55.0	Bottom of Hole							
									- - - - - - - - - - -



Stantec	Stantec Borehole Identification ALF-208A						Tota	I Boring De	pth 148.0 ft
Client		Tennessee Valley	Authority		Boring Loca	tion N	35°04'31	21", W90°0	9'18.43" (NAD83)
Project	Number	175577013			Surface Ele	vation 2	27.6 ft	Elevation	Datum NGVD29
Project	Name	TVA-ALF Remedia	al Investigati	ion	Date Starte	d _8	/13/17	Completee	d <u>8/14/17</u>
Project	Locatio	nMemphis, Tenn	essee		Depth to Wa	ater 3	8.9 ft	Date/Time	9/6/17
Supervi	sor	Briggs Evans			Depth to Wa	ater N	I/A	Date/Time	N/A
Logged	by	Walker Padgett	t		Driller	L	arry Yanc	еу	
Drilling	Contract	or Cascade Drillin		Drill Rig Typ	be and II	D_Terras	onic 150C /	#10-00100	
Overbui	rden Dril	ling and Sampling T	ools (Type a	and Size) Sonic Tool	ing - 9" Bi	t, 9" Casing	, 6" Barrel, 3.	5" Rods
Sample	r Hamm	er Type _N/A	Weight	t NA	Drop	NA	Ef	ficiency	NA
Borehol	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatio	n (from Ve	ertical)	0 deg.
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_ 227.6'	0.0'	Top of Hole							
_ _ 	3.0'	Silty Sand (SM) w gravel, brown, fine medium grained, non-plastic, very s to moist, FILL Silty Sand (SM) o	rith e to soft, dry	-	0.0' - 6.0'	6.0'	100		4" Monitoring Well Installed. See Well Construction Log for details.
_		grained, moist, Fl	LL					6.0'	-
					6.0' - 16.0'	10.0'	100		-
 208.1'	19.5'	Dearly Creded Se		-					_
204.6'	23.0'	black, coarse grai to moist, BOTTON	ned, dry M ASH		16.0' - 26.0'	10.0'	100		
203.1'	24.5'	Silty Sand (SM), g black, fine grained	gray to d, moist	_					
- 199.6'	28.0'	Fat Clay (CH) with gray, high plasticit moist	n sand, ty, soft,					26.0'	-
198.6'	29.0'	Clayey Sand (SC)), gray, _						
197 6'	30.01	\fine grained, mois	st /						



Stantec Borehole Identification ALF-208A							Tota	I Boring De	oth 148.0 ft	
	Client Tennessee Valley Authority					Boring Loca	ition <u>N</u>	35°04'31.	21", W90°0	9'18.43" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 22	27.6 ft	Elevation I	Datum NGVD29
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	-		Fat Clay (CH) with gray, high plasticit moist Silty Sand (SM), g grained, wet	ray, fine		26.0' - 36.0'	9.0'	90		
									36.0'	-
	- 186.6'	41.0'	Clayey Sand (SC)	, gray-	_	36.0' - 46.0'	10.0'	100		- - - -
	183.6' 182.6' 181.1'	44.0' 45.0' 46.5'	Poorly Graded Sa coarse grained, w	nd (SP), et	-				46.0'	- - -
	-		Poorly Graded Sa Clay (SP-SC), gra medium grained, v Fat Clay (CH) lens moist from 48' to 4	d, wet nd with y, fine to wet s, soft, i8.5'		46.0' - 56.0'	8.0'	80	 56.0'	- - - - - - - - - -
127/17										-
SM-GRAPHIC LOG.GDT 11/2	167.6'	60.0'	Clayey Sand (SC)	aray to	-	56 0'	Q ()'	90		
113 - REV.GPJ FN.	164.6'	63.0'	black, fine grained	, wet		66.0'	0.0	50		-
D ROCK ALLEN_1755770	-		Poorly Graded Sa gray, fine to mediu grained, wet	nd (SP), um					66.0'	-
TVA SONIC BORING LOG - NC	_									-



Stantec Borehole Identification ALF-208A								Tota	l Boring De	pth 148.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'31.	.21", W90°0	9'18.43" (NAD83)
	Project I	Number	175577013			Surface Elev	vation 22	27.6 ft	Elevation	Datum NGVD29
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
┝	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_	153.6'	74.0'	Poorly Graded Sa gray, fine to medit grained, wet <i>(Co</i>	nd (SP), um <i>ntinued)</i>		66.0' - 76.0'	5.0'	50		-
			Clayey Sand (SC)	, gray,						_
-			fine grained, wet						76.0'	
_										-
	146.6' 81.0'		-	76.0' -	9.0'	90		-		
_	1 40 01	05.01	Poorly Graded Sa Clay (SP-SC), gra medium grained, v	nd with y, wet		86.0				-
┢	142.6 [°] 141.6'	85.0 [°] 86.0'	Fat Clay (CH) ver	v soft					86 0'	_
	141.0	00.0	moist	y 301t,	-				00.0	-
_			Poorly Graded Sa gray, medium grai	nd (SP), ned, wet						-
						86.0' - 96.0'	8.0'	80		-
-	134.6'	93.0'			-					-
F			Well Graded Sand brown, fine to med	l (SW), lium						-
F			grained, wet, trace	e lignite,					96.0'	
/27/17 			graver and organic							-
G.GDT 1										-
APHICLO										-
FMSM-GR						96.0' -	10.0'	100		-
REV.GPJ						106.0				-
5577013 - I										-
ALLEN_17										_
0 ROCK /									106.0'	_
l l										-
IC BORIN								-		
TVA SON										



ſ	Stantec Borehole Identification ALF-208A					Total Boring Depth 148.0 ft				
	Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u>	35°04'31.	.21", W90°0	9'18.43" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 22	27.6 ft	Elevation [Datum NGVD29
Ī	Litholo	ogy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
			Well Graded Sand brown, fine to med grained, wet, trace gravel and organic <i>(Continued)</i>	I (SW), lium e lignite, cs		106.0' - 116.0'	0.0'	0		-
┟	111.6'	116.0'			-				116.0'	-
			Well Graded Sanc with gravel, brown medium grained, v	I (SW) , fine to vet						-
	- 105.6'	122.0'	Well Graded Sanc with gravel, brown	I (SW) , fine to	-	116.0' - 126.0'	9.0'	90		-
ľ	_		coarse grained sa	nd and						_
╞	-		graver, wet						126.0'	
	_					126.0' - 136.0'	6.0'	60		- - - -
	- - -								136.0'	-
SAPHIC LOG.GDT 11/27/17										- - -
FMSM-G	86.6'	141.0'	Sandy Eat Clay (C		-	136.0' - 146.0'	10.0'	100		-
REV.GPJ	00.0	142.0	high plasticity, firm	n, moist /	-					-
ALLEN_175577013 - F	_		Fat Clay (CH), gra brown, high plastic to very firm, moist	y to dark city, firm , organic					146 0'	-
NO ROCK			(classification base	ed on	ст 1	146.0'	2 0'			-
SONIC BORING LOG - 1	79.6'	148.0'	Particle Size and A Limits analysis, sa interval 146.8' - 14 4" lens of Sandy F	Atterberg mple 7.3') at Clay	51-1	148.0'	2.0			-
ΥA 5			(CH) @ 145'	, ,						_



Γ	Stantec	Borehol	e Identification AL	F-208A				Tota	I Boring Dep	oth 148.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ation N	35°04'31	.21", W90°0	9'18.43" (NAD83)
	Project	Number	175577013			Surface Ele	evation 22	27.6 ft	Elevation E	Datum NGVD29
t	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
E	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
Γ										
	-		No Refusal /							-
	-		Bottom of Hole							-
┢	-									-
ŀ	_									-
ł	-									-
E	-									_
	-									-
┢	-									_
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ŀ	-									_
11/27/17	-									_
0G.GDT	-									-
APHIC LO	_									-
MSM-GR.	-									-
V.GPJ F	-									-
013 - RE	-									-
N_175577	_									_
X ALLEI	-									-
- NO ROC										-
NG LOG	-									_
UIC BORII	-									-
TVA SOF	_									


Project	Number	175565292		Location	N	35°04'32	29", W 90°	09'25.37" (NAD83)	
Project	Name	TVA - ALF Well Ins	stallations		Boring No.	ALI	F-209	Total Dept	h 33.0 ft
County		Shelby Co., TN			Surface Ele	vation	204	4.8 ft (NGVI	029)
Project ⁻	Туре	Well Installations			Date Started	d 9,	/15/16	Completed	9/15/16
Supervi	sor	B. Bryant Dr	iller Coope	r	Depth to Wa	ater 1	6.0 ft	Date/Time	9/15/16
Logged	Ву	J. Andrew			Depth to Wa	ater N	I/A	Date/Time	N/A
Lithold	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
204.8	0.0	Top of Hole							
204.3	0.5	Crushed Aggrega	te	-					4" Monitoring -
		Lean Clay, dark b	rown, ff						Well Installed
		moist, medium sti				3.7	74%		
_									_
F									_
-									-
197.3	7.5					47	04%		-
-		Sand, brown, moi	Sand, brown, moist to wet,				3470		-
-		grained	ie						-
–		C							-
_									-
_									-
_					10.0 - 15.0	4.4	88%		-
_									_
									_
									_
187.8	17.0								
		Sand with gravels	, dark	_	15.0 - 20.0	4.9	98%		_
-		brown, wet, dense	9						-
-									-
F									_
-									-
-									-
-									-
_							40004		-
_					20.0 - 29.0	9.0	100%		_
-									-
_									-
_									-
									_
175.3	29.5			-					



Project I	Project Number 175565292				Location	Ν	35°04'32	2.29", W 90°0	9'25.37" (NAD83)
Project I	Name	TVA - ALF Well Ins	stallations		Boring No.	ALF	-209	Total Depth	33.0 ft
Litholo	bgy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
174.3	_ 30.5_	Silt, dark gray, we medium stiff <i>(Col</i> Sand, dark gray, v	t, n <i>tinued)</i> vet,		29.0 - 33.0	3.4	85%		
171.8	33.0	medium dense	,						
-		Bottom of Hole							
-									-
-									-
									-
-									-
-									-
91/ 									-
HICLOS.GDT 10/									-
ALF_PROJECT OF1_FINSN									- - -
STANTECFINSM_LEGACY									
			Stanteo	Consul	ting Services	Inc.			10/3/10



Stantec	Boreho	le Identification AL	F-209A				Tota	I Boring De	pth 134.0 ft	
Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'32.	.16", W90°0	9'25.24" (NAD83)	
Project I	Number	175577013			Surface Ele	vation 2	06.3 ft	Elevation	Datum NGVD29	
Project I	Name	TVA-ALF Remedia	al Investigati	ion	Date Starte	d8/	/11/17	Completee	d 8/13/17	
Project	Locatio	n Memphis, Tenn	essee		Depth to Water 17.5 ft Da			Date/Time	9/6/17	
Supervis	sor	Briggs Evans			Depth to Wa	ater N	/A	Date/Time	e N/A	
Logged	by	M. McDonald			Driller	Driller Matt Pope				
Drilling (Contract	tor Cascade Drilling	g		Drill Rig Typ	be and ID	Prosor	nic LS600 /	#10-00273	
Overburden Drilling and Sampling Tools (Type and Siz) Sonic Tool	ing - 8" Bit	t, 8" Casing	, 7" Barrel, 3.	5" Rods	
Sampler	r Hamm	er Type N/A	Weight	t NA	Drop	NA	Ef	ficiency _	NA	
Borehole	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.	
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
_ 206.3'	0.0'	Top of Hole								
205.3	1.0' 2.0'	No. 57 Stone FILL		_					4" Monitoring	
204.3	2.0	brown. medium st	;L), ;iff. Iow	-					See Well	
202.3'	4.0'	plasticity, moist, s	ome fine		0.0' - 7.0'	7.0'	100		Construction	
		Sanu	ith Clay							
200.3'	6.0'	light brown to tan,	moist,	_				7.01		
-		trace mica						7.0	-	
-		Silty Lean Clay (C	L), asticity							
- 105 8'	10 5'	very moist to wet,	trace						_	
195.0	11.5	Tine sand		_						
-	11.7	light brown to brow	with Sill, /	_	7.0' - 17.0'	10.0'	100			
-		grained, very mois	st to wet							
		Silty Lean Clay wi	th Sand low							
<u>-</u>		plasticity, very mo	ist, fine							
T 11/27/		sand lens, trace q	ravel					17.0'	-	
<u>-</u> 187.8'	18.5'	Poorly Graded Sa	nd (SP)							
186.6'	19.7'	with Silt, light brow	vn to tan,							
L FMSM		gravel							-	
- REV.GP		Poorly Graded Cla	ayey		17.0' -	10.0'	100			
		Gravel (GP-GC), g medium size, wet	gray, . some		27.0					
181.3'	25.0'	fine sand	,							
X0020		Poorly Graded Sa	nd (SP),	_					-	
2 - 9 -	tan to orange brown, medium to coarse grained,							27.0'		
	wet, trace gravel									
176.6'	29.7'	Sand (SP), tan to brown, wet, fine to	orange coarse _						· · ·	



Stante	c Borehol	e Identification _AL				Tota	I Boring De	oth 134.0 ft	
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'32	.16", W90°0	9'25.24" (NAD83)
Projec	t Number	175577013			Surface Ele	vation 20	06.3 ft	Elevation I	Datum NGVD29
Litho	ology		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
 	31.7'	grained sand, trac subrounded grave medium Lean Clay (CL), g wet to saturated, t sand <i>(Continued</i>	ray, soft, race fine	-	27.0' - 37.0'	8.0'	80		
- - -		Poorly Graded Sand (SP), gray, medium grained, wet, trace subrounded gravel, trace lignite						37.0'	-
- - - <u>162.8'</u>	43.5'				37.0' - 47.0'	7.0'	70		-
-		Poorly Graded Sa gray to tan, fine gr wet, trace gravel	nd (SP), rained,					47.0'	- - -
- - - - - - - - - - - - -	55.0'				47.0' - 57.0'	10.0'	100		
150.3	56.0	│ Lean Clay (CL), g	ray, soπ, e fine	-				57 0'	-
		Poorly Graded Sand (SP), gray to tan, fine grained, wet, trace gravel			57.0' -	10.0'	100		- - - -
143.3'	63.0'			_	67.0'				-
140.8'	65.5'	Sand (SP) gray ta medium grained, some chert gravel	n, wet,	-					-
VA SONIC BORING LOG - NO F	Poorly Graded Sand (SP), gray to tan, fine grained, wet, trace gravel						67.0'		



Stantec E	Borehol	e Identification _AL	F-209A				Tota	I Boring De	oth 134.0 ft
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'32.	.16", W90°0	9'25.24" (NAD83)
Project N	lumber	175577013			Surface Ele	vation 20	06.3 ft	Elevation I	Datum NGVD29
Litholog	ду		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-		Poorly Graded Sa gray to tan, fine gr wet, trace gravel (Continued)	Poorly Graded Sand (SP), gray to tan, fine grained, wet, trace gravel (Continued)		67.0' - 77.0'	10.0'	100		
129.8'	76.5'		Nell Creded Cand (C)N()					77 0'	-
 126.3' 	80.0'	Well Graded Sand gray, fine to coars grained, wet, trace gravel Poorly Graded Sa gray to tan, fine gr wet, trace gravel	Well Graded Sand (SW), gray, fine to coarse grained, wet, trace chert gravel Poorly Graded Sand (SP), gray to tan, fine grained, wet, trace gravel		77.0' - 87.0'	8.0'	80		
119 3'	87 0'		Well Graded Sand (SW), gray, fine to coarse grained, wet, some chert gravel Poorly Graded Sand (SP), gray to tan, fine grained,					87 0'	-
- 116.8' 	89.5' 92.0'	Well Graded Sand gray, fine to coars grained, wet, som gravel Poorly Graded Sa gray to tan, fine gr wet, trace gravel			87.0' - 97.0'	8.0'	80		- - - - -
<u> </u>	94.0'	Well Graded Sand gray, fine to coars grained, wet, trace gravel	d (SW), e e chert	-				97 0'	-
	103.0'	Poorly Graded Silty Sand (SP-SM), gray, fine grained, wet, trace gravel Poorly Graded Sand (SP), gray to tan, fine grained, wet, trace gravel Well Graded Sand (SW), gray to tan, fine to coarse grained, wet, trace chert gravel, intervals of lignite		-	97.0' - 107.0'	8.0'	80		- - - - - - - - - - - - - -
								-	



	Stantec	Borehole	e Identification _AL				Tota	I Boring Dep	oth 134.0 ft	
	Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u>	35°04'32.	.16", W90°0	9'25.24" (NAD83)
	Project N	Number	175577013			Surface Ele	evation 20)6.3 ft	Elevation [Datum NGVD29
	Litholo	gy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	Well Graded Sand (SW), gray to tan, fine to coarse grained, wet, trace chert gravel, intervals of lignite <i>(Continued)</i>		l (SW), coarse chert lignite		107.0' - 117.0'	10.0'	100			
┢									117 0'	-
				117.0' - 127.0'	10.0'	100		- - - - - -		
_	79.3'	127.0'	Fat Clay (CH), bro stiff, moist, some I trace to some fine sand	wn, very ignite, grained	-				127.0'	- -
	74.01		Sandy Fat Clay (C to gray, very stiff, i trace lignite, trace sand	H), blue noist, fine		127.0' - 132.0'	6.0'	120		-
-	74.8	131.5	Sandy Silty Clay (CL-ML)	_				132.0'	_
E	72.3'	134.0'	gray, stiff, moist, fi grained sand, poo	ne rly	ST-1	132.0' - 134.0'	2.0'			-
SONIC BORING LOG - NO ROCK ALLEN_175577013 - REV.GPJ F MSM-GRAPHIC LOG.GDT 1/127/17	graded (classification based on Particle Size and Atterberg Limits analysis, sample interval 132.9' - 133.4') No Refusal / Bottom of Hole									



Project I	Number	175565292			Location	N	35°04'14	.46", W 90°	08'59.09" (NAD83)
Project I	Name	TVA - ALF Well Ins	stallations		Boring No.	ALF	-210	Total Dept	h 50.0 ft
County		Shelby Co., TN			Surface Elev	vation	21	6.0 ft (NGVI	029)
Project ⁻	Туре	Well Installations			Date Started	d 9,	/17/16	Completed	9/17/16
Supervis	sor	B. Bryant Dri	iller W. Cas	steel	Depth to Wa	ater 1	6.3 ft	Date/Time	9/17/16
Logged	Ву	B. Evans			Depth to Wa	ater N	/A	Date/Time	N/A
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
216.0	0.0	Top of Hole	Top of Hole						
-		Sandy Silt, brown, moist to saturated medium stiff	Sandy Silt, brown, soft, moist to saturated, medium stiff						4" Monitoring
-					0.0 - 10.0	10.0	100%		-
-	0.5								-
- 207.5	8.5	Lean Clay to F	at Clay,	_					-
-		mottled, moist, me to stiff	edium stiff						
- <u>203.5</u> - -	12.5	Silt, brown, moist soft to medium sti	to wet, ff	-					-
-		- Lean Clay, brown from 16.0' - 17.0'	n-gray,		10.0 - 20.0	10.0	100%		-
-	40.5								-
- 196.5	19.5	Sand brown to an	av and	-					_
DT 10/5/16		gray-brown, wet, r dense to dense, fi grained, with silty	nedium ne zones						-
ISM-GRAPHIC LOG.G		- Clayey Zone fror 23.8'	- Clayey Zone from 23.3' to 23.8'						Analytical - Sample from 23.3' to 23.8'
ALF_PROJECT.GPJ_FN					20.0 - 30.0	10.0	100%		
startecFMSM_Legacy									-



Project	Number	175565292		Location N 35°04'14.46", W 90°08'59.09" (NA			08'59.09" (NAD83)		
Project	Name	TVA - ALF Well Ins	stallations		Boring No.	ALF	-210	Total Dept	h50.0 ft
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-		Sand, brown to gra gray brown, wet, r dense to dense, fi grained, with silty <i>(Continued)</i>	ay and nedium ne zones						Analytical – Sample from – 24.0' to 34.0' –
-		- Organics noted f to 39.1'	rom 39.0'		30.0 - 40.0	10.0	100%		-
-									Analytical – Sample from 34.0' to 44.0' –
-					40.0 - 50.0	10.0	100%		- - - -
-	50.0								-
166.0	50.0	Pottom of Holo							
		Bottom of Hole							- - - - - - - - - - - - - - - - - - -



Stantec	Borehol	e Identification AL	F-210A				Tota	I Boring De	pth 148.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ition N	 35°04'14.	38", W90°0	8'58.94" (NAD83)
Project I	Number	175577013			Surface Ele	vation 2	16.2 ft	Elevation	Datum NGVD29
Project I	Name	TVA-ALF Remedia	I Investigati	on	Date Started	d 7.	/31/17	Completed	d 8/2/17
Project	Location	n Memphis, Tenn	essee		Depth to Wa	ater 2	7.4 ft	Date/Time	9/6/17
Supervis	sor	Briggs Evans			Depth to Water N/A Date/Tim				N/A
Logged	by	Walker Padgett			Driller Larry Yancey				
Drilling (Drilling Contractor Cascade Drilling					e and I	D Terras	onic 150C /	#10-00100
Overbur	Overburden Drilling and Sampling Tools (Type and Size					ing - 9" Bi	t, 9" Casing	, 6" Barrel, 3.	5" Rods
Sampler	Sampler Hammer Type N/A Weight N					NA	Ef	ficiency	NA
Borehole	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_ 216.2'	0.0'	Top of Hole							-
-		Poorly Graded Sil (SP-SM), brown, v to fine grained, mo	ty Sand very fine bist		0.0' - 6.0'	6.0'	100		4" Monitoring Well Installed. See Well Construction Log for details.
-								6.0'	
206.2'	10.0'	Fat Clay (CH), bro moist	own, stiff,	-	6.0' - 16.0'	10.0'	100		-
 	13.0	Poorly Graded Sil (SP-SM), gray, ve fine grained, mois	ty Sand ry fine to t	-				16.0'	-
	20.0'								
ALEN, 1767703 - REV.GPJ FMSM	20.0' Poorly Graded Sand (SP), gray, medium grained, moist				16.0' - 26.0'	10.0'	100		
0 ROCK								26.0'	-
TVA SONIC BORING LOG - P									



S	Stantec Borehole Identification _ALF-210A				Total Boring Depth 148.0 ft					
С	lient		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'14	.38", W90°0	8'58.94" (NAD83)
P	roject I	Number	175577013			Surface Ele	vation 2	16.2 ft	Elevation [Datum NGVD29
	Litholo	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elev	vation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_ 	85.2'	31.0'				26.0' -	10.0'	100		
18	84.2'	32.0'	Clayey Sand (SC)	, gray, t	-	36.0				-
- - _ 18 _ 18	3 <u>1.2'</u> 30.2'	Poorly Graded Silty Sand 35.0' Grained, wet 36.0' Fat Clay (CH) gray stiff		-				36.0'	-	
_			Fat Clay (CH), gray, stiff, moist Poorly Graded Sand (SP),							-
			gray, medium grai trace silt	ned, wet,		36.0' - 46.0'	10.0'	100		
-									46.0'	
- - - - - - -						46.0' - 56.0'	10.0'	100	 56.0'	- - - - - - - -
коок ацем, 1755/7013 - RNSN-GRAPHICLOS GDT 1127/17 2014 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	50.2'	66.0'				56.0' - 66.0'	10.0'	100	 66.0'	- - - - - - - -
14	8.2'	68.0'	Well Graded Sand (SW-SM), gray, fir medium grained, y	d with Silt ne to wet						-



Stantec Borehole Identification ALF-210A								Tota	I Boring De	oth 148.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'14.	.38", W90°0	8'58.94" (NAD83)
	Project N	Number	175577013			Surface Ele	vation 2	16.2 ft	Elevation I	Datum NGVD29
	Litholo	рду	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
┟	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Well Graded Sand (SW), gray, medium to coarse grained, wet, some gravel <i>(Continued)</i>			66.0' - 76.0'	10.0'	100		-	
Į	_								76.0'	
	136.2'	80.0'	Wall Craded Sand	d verities	-	76.0'	10.0'	100		-
	131.2'	85.0'	Gravel (SW), gray coarse grained, w	, fine to et		78.0 - 86.0'	10.0	100		-
ľ	130.2'	86.0'	_ Poorly Graded Sa	nd (SP), _					86.0'	– No recovery –
	- - - - -		gray, medium grai Well Graded Sand Gravel (SW), gray coarse grained, w	ned, wet d with r, fine to et		86.0' - 96.0'	0.0'	0		from sample 10 _ due to flapper bit malfunction _
	-								96.0'	-
CK ALLEN_175577013 - REV.GPJ FMSM-GRAPHIC LOG.GDT 11/27/1	- - - - - - - - - - - - - - - - - - -	106.0'				96.0' - 106.0'	3.0'	30		-
TVA SONIC BORING LOG - NO ROI			Well Graded Sand Gravel (SW), gray coarse grained, w	d with , fine to et						



Γ	Stantec	Borehole	e Identification _AL	F-210A				Tota	I Boring De	oth 148.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u>	35°04'14	.38", W90°0	8'58.94" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 21	16.2 ft	Elevation I	Datum NGVD29
	Litholo	рду		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-			Well Graded Sand Gravel (SW), gray coarse grained, w (Continued)	d with ⁄, fine to et		106.0' - 116.0'	10.0'	100		-
	100.2'	116.0'							116.0'	- Limited recovery
-			Well Graded Sand Gravel (SW), gray coarse grained, w thin beds of organ material / lignite	ell Graded Sand with ravel (SW), gray, fine to arse grained, wet, some n beds of organic aterial / lignite			6.0'	60		due to sand compression in _ recovery bags
-	89.2'	127.0'							126.0'	
-	87.2'	129.0'	Lean Clay (CL) wi tan, stiff, wet	th sand,	-					-
	85.2'	131.0'	Organic Clay (OH gray, very stiff, we), dark t, lignite		126.0' -	10.0'	100		_
_	81.2'	135.0'	Poorly Graded Sa gray, fine grained, lignite laminations silt	nd (SP), wet, , trace		136.0'				-
			Poorly Graded Sa	nd with					136.0'	
3 - REV.GPJ FMSM-GRAPHICLOG.GDT 11/27/17	70.01		Clay (SP-SC), gra dense	y, wet,		136.0' - 146.0'	10.0'	100		
1755770	72.2'	144.0'			-					-
X ALLEN			stiff, moist	ay, very					146.0'	
ING LOG - NO ROC	68.2'	148.0'	(classification bas Particle Size and A Limits analysis, sa	ed on Atterberg ample	ST-16	146.0' - 148.0'	2.0'			-
IVA SONIC BOR	No Refusal / Bottom of Hole									-



Project Number 175565292							N	25004100	122" \\/ 000	
	Project I	Number	175565292			Location	N		.23, 10 90	0800.51 (NAD83)
	Project I	Name	TVA - ALF Well Ins	stallations		Boring No.	ALI	212	Total Dept	n 66.0 ft
	County		Shelby Co., TN			Surface Ele	vation	23	5.9 ft (NGVL	J29)
	Project 7	Гуре	Well Installations			Date Started	d	/15/16	Completed	9/16/16
	Supervis	sor	B. Bryant Dr	iller I. Youn	g	Depth to Wa	ater 5	9.0 ft	Date/Time	9/16/16
	Logged	Ву	F. Thaxton			Depth to Wa	ater N	/A	Date/Time	N/A
	Litholo	рду		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
E	levation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-2	235.9	0.0	Top of Hole							
	234.9	1.0	Gravelly Sand, red → moist to wet, dens	d-brown, e /	-					4" Monitoring -
-			Silty Clay with Sar	nd, dark						Well Installed
_			gray to gray-brow	n, moist,		0.0 - 6.0	6.0	100%		-
-			medium dense							-
F										_
_										-
										-
										-
										_
L										_
						60 160	10.0	100%		_
	223.9	12.0				0.0 - 10.0	10.0	100 %		
	221.9	14 0	Silty Sand, dark g moist, medium de	ray, nse						_
	21.0	11.0	Fat Clay, dark gra to moist, medium	y, damp stiff	-					-
_			- Silty Sand layer 1 15.0' - 17.0'	from						-
-										-
╞										-
	215.9	20.0			-					_
п 10/5/16 			Lean Clay, dark g moist, medium stit silty and sandy	ray, ff, zones		16.0 - 26.0	10.0	100%		-
1			- Organics noted f	rom 20.0'						_
GRAPHIC			to 26.0'	2010						-
J FMSM-										_
UECT.GP.										_
ALF_PRC										
EGACY										
VFMSM_L										_
STANTEC										



Project Number		175565292			Location	on N 35°04'09.23", W 90°08'00.51" (N		08'00.51" (NAD83)	
Project N	Name	TVA - ALF Well Installations		Boring No.	ALF	- 212	Total Dept	h 66.0 ft	
								1	
Litholo	gy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
L									
204.9	31.0				26.0 36.0	10.0	1000/		_
		Fat Clay, dark gra	y to		20.0 - 30.0	10.0	100%		
-		green-brown, mois	st,						_
-		medium stiff							-
-									-
-									_
-									-
-									-
_									-
									_
-					36.0 - 46.0	10.0	100%		_
-									-
192.9	43.0			-					-
_		Lean Clay, dark gi	ray, ium ctiff						_
		moist to wet, mea	um sun						
189.9	46.0								
100.0		Well Graded Sand	dark	-					-
-		gray, moist, mediu	um dense						-
-			fram						-
_		- Lean Clay layer 1 49.0' to 50.0'	IOM						_
_					46.0 - 56.0	10.0	100%		-
-									-
_									-
181.9	54.0								_
		Fat Clay, dark gra	y to						
		green-gray, moist,	medium						
-		Still							-
-									Analytical -
-									Sample from
176.9	59.0								54.0 10 64.0
		Silt, dark gray, we	t,						_
		medium stiff							
					56.0 - 66.0	10.0	100%		-
									_
; ;									_
1									1



Page: 3 of 3

Project Numbe		175565292			Location	N	35°04'09	9.23", W 90°08'	00.51" (NAD83)
Project I	Name	TVA - ALF Well Ins	stallations		Boring No.	ALF	-212	Total Depth	66.0 ft
Litholo	Nu		Overburden	Sample #	Depth	Rec. Ft	Blows	Mois Cont %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
- - 169 9	66.0	Silt, dark gray, we medium stiff <i>(Co</i>	t, ntinued)						-
	00.0	Bottom of Hole							
-									-
_									-
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Stantec	Borehol	e Identification AL	F-212A				Tota	I Boring De	pth 182.0 ft	
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'09.	22", W90°0	8'00.21" (NAD83)	
Project I	Number	175577013			Surface Ele	vation 2	35.8 ft	Elevation	Datum NGVD29	
Project I	Name	TVA-ALF Remedia	al Investigati	on	Date Started	d <u>8</u>	/9/17	Completed	d <u>8/10/17</u>	
Project	Location	n Memphis, Tenn	essee		Depth to Wa	ater 4	7.1 ft	Date/Time	9/6/17	
Supervis	sor	Briggs Evans			Depth to Wa	ater N	/A	Date/Time	e <u>N/A</u>	
Logged	by	Walker Padgett	t		Driller					
Drilling (Drilling Contractor Cascade Drilling					e and I	D Terras	onic 150C /	#10-00100	
Overbur	Overburden Drilling and Sampling Tools (Type and					e) Sonic Tooling - 9" Bit, 9" Casing, 6" Barrel, 3.5" Rods				
Sampler	r Hamm	er Type N/A	t NA	Drop NA Efficiency NA						
Borehol	Borehole Azimuth N/A (Vertical)					nclinatior	n (from Ve	ertical)	0 deg.	
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
235.8'	0.0'	Top of Hole							-	
235.3	~ <u>0.5'</u> ~	Asphalt Fill		-	0.0' - 6.0'	6.0'	100		4" Monitoring Well Installed. See Well	
-									Construction Log for details.	
	7.01							6.0'	-	
 _ _ _ _ _ _ _ _ _ _ _ _ _ _ 223.8'	12.0'	Lean Clay (CL), b stiff, medium plas moist, interbedded graded fine sand	rown, ticity, d poorly		6.0' - 16.0'	10.0'	100		- - -	
- - - 219.8'	16.0'	Sandy Lean Clay gray, medium to s medium plasticity, interbedded poorl fine sand	(CL), stiff, , moist, y graded					16.0'	-	
218.8'	17.0'	Poorly Graded Sa	nd with	_						
217.8'	18.0'	Silt (SP-SM), fine gray, moist	grained,	_						
215.8'	215.8' 20.0' Lean Clay (CL), gray, medium plasticity, firm, moist				16.0' - 26.0'	10.0'	100		-	
213.0	213.8' 22.0' Poorly Graded Silty Sand (SM), gray, fine grained, moist									
	Lean Clay (CL) with Sand, gray, medium plasticity, firm, moist							26.0'	-	
	firm, moist Sandy Silt (ML), gray, low plasticity, firm, moist, very fine to fine sand, trace									

Stantec Consulting Services Inc.



Stantec	Borehol	e Identification ALI	F-212A		Total Boring Depth 182.0 ft				
Client		Tennessee Valley	Authority		Boring Location <u>N35°04'09.22", W90°08'00.21" (NAD83</u>				
Project I	Number	175577013			Surface Eler	vation 23	85.8 ft	Elevation [Datum NGVD29
Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
 205.3'_/ 	~30.5'~	organics Lean Clay (CL), bi gray mottled, med plasticity, firm, mo	rown ium ist to wet	-	26.0' - 36.0'				
-								36.0'	_
- - - - - - -	43.5'				36.0' - 46.0'	10.0'	100		- - - - - -
_		Sandy Silt (ML), g	ray, non						-
 189.8'	46.0'	plastic, soft, wet, v sand	very fine					46.0'	-
-		No Recovery			46.0' - 56.0'	0.0'	0	 56.0'	- - - - - - - -
ок итег/1281/013-кклова кимение пое сод издил. 172.83' 172.83' 172.83' 169.8'	<u>63.0'</u>	Poorly Graded Silf (SM), gray, mediu grained, wet,	y Sand		56.0' - 66.0'	3.0'	30		- - - - - - - - - - -
	00.0	No Recovery						00.0	



ſ	Stantec	Borehol	e Identification _AL	F-212A		Total Boring Depth 182.0 ft				
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'09.	.22", W90°0	8'00.21" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	35.8 ft	Elevation I	Datum NGVD29
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	163.8'	72.0'	No Recovery (Co	ontinued)		66.0' - 76.0'	4.0'	40		-
	- 159.8'	76.0'	Sandy Silt (ML), g plastic, soft, moist very fine grained s with 1"-2" intervals Sandy Clay (CL)	ray, non to wet, sand, s of	_				76.0'	-
-	_		No Recovery	No Recovery		70.01		45		
	- 154.3' 81.5' Poorly Graded Sand (SP), gray, very wet, trace silt		-	76.0' - 86.0'	4.5	45				
ľ	- 149.8'	19.8' 86.0'						86.0'	_	
	- 143.8'	92.0'	No Recovery			86.0' - 96.0'	4.0'	40		-
	- 139.8'	96.0'	Well Graded Sand with gravel, gray, coarse grained, ve	t (SW) fine to ery wet					96.0'	-
GRAPHIC LOG.GDT 11/27/17	- 135.3'	100.5'	No Recovery							
CK ALLEN_175577013 - REV.GPJ FMSM-		Well Graded Sand with Gravel (SW), gray, fine to coarse grained sand, fine gravel, wet, intermittent 1-2" lenses of Sandy Clay (CL)			96.0' - 106.0'	5.5'	55	 106.0'		
TVA SONIC BORING LOG - NO RC	_								-	



ſ	Stantec	Borehol	e Identification AL	F-212A				Tota	I Boring De	pth 182.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'09.	22", W90°0	8'00.21" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	35.8 ft	Elevation I	Datum NGVD29
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
╞	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	- - - - - 119 8'	116 0'	Well Graded Sand Gravel (SW), gray coarse grained sa gravel, wet, interm 1-2" lenses of Sar (CL) <i>(Continued)</i>	d with r, fine to nd, fine hittent ndy Clay		106.0' - 116.0'	8.0'	80		
		110.0	Well Graded Sand Gravel (SW), gray coarse grained sa gravel, wet 3" lens Fat Clay (0 123.5'	CL) (Continued) Well Graded Sand with Gravel (SW), gray, fine to coarse grained sand, fine gravel, wet B" lens Fat Clay (CH) @ 123.5'			7.0'	70		
-	- - - - - - 99.8'	136.0'				126.0' - 136.0'	8.0'	80	 136.0'	- - - - - - - - - - - -
NG LOG - NO ROCK ALLEN_175577013 - REV.GPJ FMSM-GRAPHIC LOG.GDT 11/27/17	No Recovery			136.0' - 146.0'	0.0'	0	 146.0'	- - - - - - - - - - - - - - - - - - -		
'VA SONIC BOF	85.8' 150.0'			-					-	



Stantec	Borehole	e Identification ALI	-212A		Total Boring Depth 182.0 ft					
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'09.	22", W90°0	8'00.21" (NAD83)	
Project N	Number	175577013			Surface Eler	vation 23	85.8 ft	Elevation [Datum NGVD29	
Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
Poorly Graded Sand with Gravel (SP), brown, medium grained sand, fine gravel, wet <i>(Continued)</i>			146.0' - 156.0'	6.0'	60					
							156.0'	_		
- - 73.8'	162.0'				156.0' - 166.0'	10.0'	100		- - - -	
Poorly Graded Sand (SP), brown, medium grained, wet, <5% gravel sized lignite						166.0'	- - -			
- - - -	170.01				166.0' - 176.0'	10.0'	100		- - - - - - -	
59.8'	176.0'	Care Damal again		_				176.0'	-	
- - -	182.01	Core Barrel sank o casing advanceme Recovery.	auring ent, No						- - - -	
00.0	102.0	No Refusal /								
-		Bottom of Hole							- - - - - - -	
	Stantec Client Project I Litholo Elevation 73.8' 59.8'	Stantec Borehole Client Project Number Lithology Elevation Depth A A A A A A A A A A A A A A A A A A A	Stantec Borehole IdentificationALI Client Tennessee Valley / Project Number 175577013 Lithology Description Elevation Depth Description Elevation Depth Description Gravel (SP), brown medium grained s. gravel, wet (Content of the second seco	Stantec Borehole Identification ALF-212A Client Tennessee Valley Authority Project Number 175577013 Lithology Overburden Elevation Depth Description Sonic Core Poorly Graded Sand with Gravel (SP), brown, medium grained sand, fine gravel, wet (Continued) medium grained sand, fine gravel, wet (Continued) 73.8' 162.0' Poorly Graded Sand (SP), brown, medium grained, wet, <5% gravel sized lignite	Stantec Borehole Identification ALF-212A Client Tennessee Valley Authority Project Number 175577013 Lithology Overburden Sample # Elevation Depth Description Sonic Core Elevation Depth Description Sonic Core Image: Core Core Elevation Depth Poorly Graded Sand with Gravel (SP), brown, medium grained sand, fine gravel, wet (Continued) Image: Core Core Core Core Core Core Image: Core Core Core Core 73.8' 162.0' Poorly Graded Sand (SP), brown, medium grained, wet, <5% gravel sized lignite Image: Core Core Core Core Core Core Image: Core Core Core Core 59.8' 176.0' Core Barrel sank during casing advancement, No Recovery. Image: Core Core Core 53.8' 182.0' No Refusal / Bottom of Hole Image: Core	Stantec Borehole Identification ALF-212A Boring Local Client Tennessee Valley Authority Boring Local Surface Ele Project Number 175577013 Sonic Core Run Elevation Depth Description Sonic Core Run Sinde Core Poorly Graded Sand with Gravel (SP), brown, medium grained sand, fine gravel, wet (Continued) 146.0' - 156.0' 146.0' 73.8' 162.0' Poorly Graded Sand (SP), brown, medium grained, wet, <5% gravel sized lignite 156.0' 59.8' 176.0' Poorly Graded Sand during casing advancement, No Recovery. 166.0' 53.8' 182.0' No Refusal / Bottom of Hole Image: Superstructure Superstructur	Stantec Borehole Identification ALF-212A Client Tennessee Valley Authority Boring Location NI Project Number 175577013 Surface Elevation 22 Lithology Description Sonic Core Run Rec. Ft. Elevation Depth Description Sonic Core Run Rec. Ft. Elevation Depth Description Sonic Core Run Rec. Ft. Elevation Depth Description Sonic Core Run Rec. Ft. Elevation Poorly Graded Sand with Gravel (SP), brown, medium grained, gravel, wet (Continued) 146.0' - 6.0' 73.8' 162.0' Poorly Graded Sand (SP), brown, medium grained, wet, <5% gravel sized lignite 156.0' 10.0' 59.8' 176.0' Core Barrel sank during casing advancement, No Recovery. Ife6.0' - 10.0' 53.8' 182.0' No Refusal / Bottom of Hole No Refusal / Ife6.0'	Stantec Borehole Identification ALF-212A Total Client Tennessee Valley Authority Boring Location N35"04'09. Project Number 175577013 Surface Elevation 235.8 ft Lithology Description Sonic Core Run Rec. Ft Blows Elevation Depth Description Sonic Core Run Rec. Ft Blows Strates Poorly Graded Sand with Gravel (SP), brown, medium grained sand, fine gravel, wet (Continued) 146.0'- 6.0' 60 73.8' 162.0' Poorly Graded Sand (SP), brown, medium grained, wet, <5% gravel sized lignite	Total Boring Deg Total Boring Deg Client Total Boring Deg Discription N35"04'09.22", W90"0 Surface Elevation 235.8 ft Elevation 1 Lithology Description Sorie Core Boring Location N35"04'09.22", W90"0 Lithology Description Sorie Core N0 Boring Core Boring Core Boring Core Ithe Core Boring Core Distor Fore	



Project Number 175565292				Location	N	35°04'17	01" W 90°	07'57 45" (NAD83)	
Project	Vame		stallations		Boring No		=_213	Total Depth 80.0 ft	
County	Varne	Shelby Co. TN	Stallations		Surface Elev	vation	23	6 7 ft (NGVI)29)
Project	Type	Well Installations			Date Starter	4 Q	/13/16		9/14/16
Supervie	sor	B Bryant Dr	iller W/ Ca		Depth to W	a <u>- 3</u>	10ft	Date/Time	9/13/16
Supervis		B. Bryant Di			Depth to Wa	ater U		Date/Time	9/13/10
Logged	БУ	D. EVAIIS	0.1.1						N/A
Elevation	Denth	Description	Overburden Rock Core	Sample #	Depth	Rec. Ft.	Blows	Run Denth	Remarks
236.7		Top of Hole	TOCK COLE	RQD	Tturi	Rec. r t.	1.00.70		Remarks
-	0.0	Lean Clay, brown moist, medium sti	Lean Clay, brown, damp to moist, medium stiff						4" Monitoring Well Installed
232.2	4.5								-
- - -		Sandy Silt, gray, o moist, medium sti	damp to ff		0.0 - 10.0	10.0	100%		-
226 7	10.0								-
	10.0	Silty Sand, gray, o moist, dense	lamp to		10.0 - 20.0	10.0	100%		
- <u>213.2</u> -	23.5	Sand, gray, wet, l	oose	-					-
	27.5				20.0 - 30.0	10.0	100%		-
		Silt, gray to gray-t moist to wet, med trace organics	prown, ium stiff,						-



Project Number		175565292			Location N 35°04'17.01", W 90°07'57.45" (07'57.45" (NAD83)	
Project I	Name	TVA - ALF Well Installations		Boring No.	ALF	-213	Total Dept	h80.0 ft	
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
- -		Silt, gray to gray-t moist to wet, med trace organics (Continued)	orown, ium stiff,						-
202.2	34.5								-
- - -		Fat Clay, brown-gray to gray, moist, medium stiff - Wood Fragment at 43.5' - Soft, saturated, from 46.0' to 48.0'		-	30.0 - 40.0	10.0	100%		
- - - -					40.0 - 50.0	10.0	100%		- - - - - - - -
 <u>181.7</u> 	55.0	Silt, gray, wet, sof medium stiff, zone Sand, gray to brov gray, wet, mediun fine grained	ft to es clayey wn- n dense,	-	50.0 - 60.0	10.0	100%		
-									-



Project I	Number	175565292			Location	Ν	35°04'17	′.01", W 90°0)7'57.45" (NAD83)
Project I	Name	TVA - ALF Well Ins	stallations		Boring No.	ALF	-213	Total Depth	80.0 ft
Litholo	bav		Overburden	Sample #	Depth	Rec Ft	Blows	Mois Cont %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-		Sand, gray to brow gray, wet, medium fine grained (Continued)	vn- 1 dense,		60.0 - 70.0	8.0	80%		-
-									- - - -
-					70.0 - 80.0	7.0	70%		-
156.7	80.0								-
L		Bottom of Hole							-
-									-
-									-
-									-
5DT 10/5/16									-
									-
OLECT.GPJ FMS1									-
									-
STANTECFMSM									-



71/2011

Stantec	Borehol	e Identification _ALF				Tota	I Boring De	pth 57.0 ft	
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'10.	75", W90°0)8'33.59" (NAD83)
Project I	Number	175577013			Surface Ele	vation 2	17.5 ft	Elevation	Datum NGVD29
Project I	Name	TVA-ALF Remedia	l Investigati	on	Date Starte	d 8	/22/17	Completee	d 8/22/17
Project	Locatior	n Memphis, Tenne	essee		Depth to Wa	ater 2	8.0 ft	Date/Time	9/6/17
Supervis	sor	Briggs Evans			Depth to Wa	Depth to Water N/A Date/Time			e N/A
Logged	by	Lee Eaves			Driller				
Drilling Contractor Cascade Drilling					Drill Rig Typ	be and II	D Prosor	nic LS600 /	#10-00273
Overburden Drilling and Sampling Tools (Type and) Sonic Tool	ing - 8" Bi	t, 8" Casing	, 7" Barrel, 3.	5" Rods
Sampler Hammer Type <u>N/A</u> Weight					Drop	NA	Ef	ficiency	NA
Borehole Azimuth N/A (Vertical)					Borehole Ir	nclination	n (from Ve	ertical)	0 deg.
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
217.5'	0.0'	Top of Hole							
217.0'~	0.5'_~	Top Soil		-					4" Monitoring
-		Silty Sand (SM), b	rown,						Well Installed.
-		organics	, liace		0.0' - 7.0'	7.0'	100		Construction
-		Ū							Log for details.
211.5'	6.0'								-
-		Silty Lean Clay (Cl	L), gray					7.0'	
-		brown, soft to firm,	moist						-
-									-
-									-
-					7.0' - 17.0'	9.5'	95		-
-									-
_									-
-									-
-								17.0'	
198 5'	19.0'								-
100.0	10.0	Silty Sand (SM), b	rown.	-					-
		fine grained, moist	to wet						-
_					17.0' -	6.0'	60		
-					27.0'				-
-									
-									-
190.5'	190 5' 27 0'							27.0'	-
		Poorly Graded Sa	nd (SP)	1					
-		with Silt, brown, fir	ne						
187.5'	30.0'	granieu, wei							



Stantec	Borehol	e Identification AL	F-214				Tota	I Boring De	oth 57.0 ft
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'10	.75", W90°0	8'33.59" (NAD83)
Project	Number	175577013			Surface Ele	vation 2	17.5 ft	Elevation [Datum NGVD29
Lithold	ogy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
- - - - - -	~30.5'~	Lean Clay (CL), gi plasticity, soft, well Poorly Graded Sa with Silt, brown, fir grained, wet	ray, low t nd (SP) ne		27.0' - 37.0'	9.0'	90		
-								37.0'	-
 	<u>39.0'</u> 41.0'	Sandy Lean Clay gray, low plasticity	(CL), v, soft,	-					-
173.5'	44.0'	∖wet Poorly Graded Sa brown, fine graine	nd (SP), d, wet		37.0' - 47.0'	10.0'	100		-
173.0' _	- 44.5'	Lean Clay (CL), gr plasticity, firm, we Poorly Graded Sa brown to gray fine	ray, low t					47.0'	-
- - - - -		medium grained, v	vet		47.0' - 57.0'	9.5'	95		
ן 160.5'	57.0'							57.0'	-
	01.0	No Refusal / Bottom of Hole		1	1	1		1 07.0	-



Sta	ntec	Borehol	e Identification _AL	-214B				Tota	I Boring De	pth 97.0 ft
Clie	ent		Tennessee Valley	Authority		Boring Loca	ition N	35°04'10.	.76", W90°0)8'33.76" (NAD83)
Pro	ject I	Number	175577013			Surface Ele	vation 2	17.5 ft	Elevation	Datum NGVD29
Pro	ject I	Name	TVA-ALF Remedia	l Investigati	on	Date Starte	d8/	21/17	Completee	d <u>8/22/17</u>
Pro	ject	Locatior	n Memphis, Tenne	essee		Depth to Wa	ater 28	3.2 ft	Date/Time	9/6/17
Sup	pervis	sor	Briggs Evans			Depth to Wa	ater N	/A	Date/Time	e N/A
Log	ged	by	Lee Eaves			Driller	Μ	att Pope		
Drill	ling (Contract	or Cascade Drilling	9		Drill Rig Typ	be and ID	Prosor	nic LS600 /	#10-00273
Ove	erbur	den Dril	ling and Sampling To	ools (Type a	and Size) Sonic Tool	ing - 8" Bit	, 8" Casing	, 7" Barrel, 3.	5" Rods
San	npler	Hamme	er Type _N/A	Weight	t NA	Drop	NA	Ef	ficiency	NA
Bor	ehole	e Azimu	th N/A (Vertica	l)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
L	Litholo	gy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	•
Elevat	tion	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
217.	.5'	0.0'	Top of Hole							
$\begin{bmatrix} 211. \\ \end{bmatrix}$.0	<u> </u>								4" Monitoring
-			Clayey Sand (SC) grav. moist	, tan to						See Well
						0.0' - 7.0'	5.0'	71		Construction
211.	.5'	6.0'							7.01	
-			to gray, high plasti), brown city, stiff,					7.0'	-
-			moist							-
L										_
-							10.01	400		-
-						7.0' - 17.0'	10.0'	100		-
-										-
Ĺ										_
-										-
100	5'	18 0'							17.0'	-
0 1 33.	.5	10.0	Clayey Sand (SC)	brown	-					-
I I			to gray, moist to w	et						
FMS										-
3 - REV.G						17.0' - 27.0'	7.0'	70		
17557701										-
NO ROCK										
- DOG -									27.0'	-
TVA SOF										



Stantec	Borehol	e Identification AL	F-214B				Tota	I Boring De	pth 97.0 ft
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'10.	.76", W90°0	<u>8'33.76" (NAD83</u>)
Project I	Number	175577013			Surface Elev	vation 2	17.5 ft	Elevation I	Datum NGVD29
Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	21 01								_
-	51.0	Clayey Sand (SC) wet	, gray,		27.0' - 37.0'	5.0'	50		
-								37.0'	
- - -					37.0' - 47.0'	7.0'	70		
- - - - 170.5'	47.0'			_				47.0'	- - - -
-		Poorly graded Sar brownish gray, find medium grained, v rounded gravel	nd (SP), e to wet, trace						- - -
-					47.0' - 57.0'	8.0'	80		
- 21/								57 0'	-
								01.0	
EL_17877013- REV EPJ FMS					57.0' - 67.0'	10.0'	100		
								67.0'	-



Stantec	Borehol	e Identification AL	F-214B				Tota	I Boring Dep	oth 97.0 ft
Client		Tennessee Valley	Authority		Boring Loca	tion N	35°04'10.	.76", W90°0	8'33.76" (NAD83)
Project I	Number	175577013			Surface Ele	vation 21	7.5 ft	Elevation [Datum NGVD29
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-		Poorly graded Sar brownish gray, fin medium grained, rounded gravel (Continued)	nd (SP), e to wet, trace		67.0' - 77.0'	8.0'	80		- - -
-								77 0'	=
_								11.0	-
- - - -					77.0' - 87.0'	1.5'	15		- - - - - -
-								07.01	-
_								87.0	_
- - - -					87.0' - 97.0'	8.0'	80		- - - - - -
120.5'	97.0'							97.0'	
- - - - - - - - - -		No Refusal / Bottom of Hole							- - - - - - - - - - - - - - - - - - -



Stantec	Borehol	e Identification AL				Tota	I Boring De	pth 135.0 ft	
Client		Tennessee Valley	Authority		Boring Loca	ition N	 35°04'10.	79", W90°0	8'33.90" (NAD83)
Project I	Number	175577013			Surface Ele	vation 2	17.6 ft	Elevation	Datum NGVD29
Project I	Name	TVA-ALF Remedia	I Investigati	on	Date Starte	d	/15/17	Completed	d 8/17/17
Project	Location	Memphis, Tenn	essee		Depth to Wa	ater 2	9.3 ft	Date/Time	9/6/17
Supervis	sor	Briggs Evans			Depth to Wa	ater N	/A	Date/Time	N/A
Logged	by	Lee Eaves			Driller	N	latt Pope		
Drilling (Contract	or Cascade Drilling	g		Drill Rig Typ	be and ID	D Prosor	nic LS600 /	#10-00273
Overbur	den Dril	ling and Sampling To	ools (Type a	and Size) Sonic Tool	ing - 8" Bit	t, 8" Casing	, 7" Barrel, 3.	5" Rods
Sampler	r Hamme	er Type N/A	Weight	t NA	Drop	NA	Ef	ficiency	NA
Borehol	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
217.6'	0.0'	Top of Hole							
									4" Monitoring
-		fine grained, mois	t			. =			See Well
_					0.0' - 7.0'	4.5'	64		Construction
211.6	6.0	Sandy Lean Clay		-				7 0'	
-		dark brown, low to	medium					7.0	
_		plasticity, soft to fi	rm, moist						
–									-
-					7.0' 17.0'	10.0'	100		
-					7.0 - 17.0	10.0	100		
F									-
	47.01							47.01	
200.0	17.0	Clavey Sand (SC)	dark	-				17.0	-
		brown, fine graine	d, moist						
M-GRAPH		to wet							-
END FMS					47.01	40.01	400		
13 - REV.(17.0' - 27.0'	10.0	100		
1755770									· · · · ·
192.6'	25.0'			_					_
2 191.6'	26.0'	Lean Clay (CL), g	ray, firm wet ∕	-				07.01	
- DOL DOL DOL		Poorly Graded Sa	nd (SP)					27.0'	
		brown, fine graine	d, wet						



Γ	Stantec Borehole Identification ALF-214A							Tota	I Boring De	oth 135.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'10.	79", W90°0	8'33.90" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 21	7.6 ft	Elevation I	Datum NGVD29
	Litholo	рду		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	<u>182.6'</u> 181.6'	35.0' 36.0'	Poorly Graded Sa brown, fine graine <i>(Continued)</i>	Poorly Graded Sand (SP), brown, fine grained, wet <i>(Continued)</i> Lean Clay (CL), gray, medium plasticity, soft, wet Poorly Graded Sand (SP).		27.0' - 37.0'	8.0'	80		
			medium plasticity, soft, wet Poorly Graded Sand (SP), brownish gray, fine grained, wet, trace rounded gravel			37.0' - 47.0'	6.0'	60		- - - - - - - - - - - - - - -
						47.0' - 57.0'	8.0'	80	 57.0'	- - - - - - - - - - - - - -
NO ROCK ALLEN_175577013-REV.GPJ FMSM-GRAPHICLOG.GDT 11	152.6'	65.0'	Well Graded Sand	I (SW),		57.0' - 67.0'	6.5'	65		- - - - - - - -
TVA SONIC BORING LOG - N			brownish gray, fine to medium grained, wet, trace rounded gravel						67.0'	



ſ	Stantec Borehole Identification ALF-214A					Total Boring Depth 135.0 ft				
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'10.	.79", W90°0	8'33.90" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 21	17.6 ft	Elevation [Datum NGVD29
Ī	Litholo	ogy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
ŀ	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Well Graded Sand (SW), brownish gray, fine to medium grained, wet, trace rounded gravel <i>(Continued)</i>			67.0' - 77.0'	5.5'	55			
ŀ									77.0'	-
	· · · · · · · · · · · · · · · · · · ·					77.0' - 87.0'	7.0'	70		- - - - - - - - - - - - - - -
21/12	· • • • •					87.0' - 97.0'	8.5'	85	 97.0'	- - - - - - - - - - -
06 - NO ROCK ALLEN_175577013 - REV.GPJ FMSM-GRAPHIC LOG.GDT 11/2	- 	<u>105.0'</u> 107.0'	Well Graded Sand Gravel (SW), gray ∖ coarse grained sa	d with r, fine to nd. wet _ ┌		97.0' - 107.0'	10.0'	100	 107.0'	
TVA SONIC BORING LO	- —		rounded to subrou gravel	inded						-



Stantec	Stantec Borehole Identification ALF-214A Total Boring Depth 135.0 ft									
Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u>	35°04'10	.79", W90°0	8'33.90" (NAD83)	
Project I	Number	175577013			Surface Ele	vation 21	7.6 ft	Elevation [Datum NGVD29	
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
-	Well Graded Gravelly Sand (SW), brownish gray, fine to coarse grained, wet, some rounded to subrounded gravel, trace gray fat clay <i>(Continued)</i>		elly nish gray, ned, wet, I, trace ntinued)		107.0' - 117.0'	9.0'	90		- - -	
_								117.0'	-	
					117.0' - 127.0'	6.0'	60		- - - - - - -	
-								127.0'	_	
89.6'	128.0'								_	
-		Fat Clay (CH), gra plasticity, hard to v hard, wet, trace ro gravel	y, high /ery unded		127.0' - 133.0'	6.0'	100		-	
_								133.0'	Shelby tube	
82.6'	135.0'			ST-1	133.0' - 135.0'	0.0'			crushed due to _ gravel	
		No Refusal / Bottom of Hole							- - - - - - - - - - - - - - - - - - -	



Stantec	Borehol	e Identification AL				Tota	I Boring De	pth 47.0 ft	
Client		Tennessee Valley	Authority		Boring Loca	ition N	35°04'04.	.93", W90°0)8'11.95" (NAD83)
Project I	Number	175577013			Surface Ele	vation 2	12.3 ft	Elevation	Datum NGVD29
Project I	Name	TVA-ALF Remedia	I Investigati	on	Date Started	d	/5/17	Completee	d <u>9/6/17</u>
Project	Locatior	Memphis, Tenn	essee		Depth to Wa	ater 1	0.2 ft	Date/Time	9/6/17
Supervis	sor	Briggs Evans			Depth to Wa	ater N	/A	Date/Time	e N/A
Logged	by	Briggs Evans			Driller Larry Yancey				
Drilling (Contract	or Cascade Drilling	g		Drill Rig Typ	e and I	D Terras	onic 150C /	/ #10-00100
Overbur	den Dril	ling and Sampling To	ools (Type a	and Size	Sonic Tooling - 9" Bit, 9" Casing, 6" Barrel, 3.5" Rods				
Sampler	r Hamme	er Type <u>N/A</u>	Weight	t NA	Drop	NA	Ef	ficiency _	NA
Borehol	Borehole Azimuth N/A (Vertical)				Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	-
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
212.3'	0.0'	Top of Hole							-
_		Silty Lean Clay (C	/						4" Monitoring Well Installed
- 208 8'	3.5'	brown, stiff, mediu	im Im		0 0' - 7 0'	7 0'	100		See Well
-	0.0	sand			0.0 1.0	1.0	100		Log for details.
-		Lean Clay (CL), b	rown,						-
_		stiff, medium plast moist to wet, trace	ticity, e fine					7.0'	
-		sand	-						
202.6'	9.7'								
_		Poorly Graded Sa	nd (SP),						-
		brown, fine graine	d, wet		7.0' - 17.0'	10.0'	100		
-									
-									
F									-
11/22/11								17.0'	_
100:00									
APHIC L									
FMSM-GF									-
					17.0' -	10.0'	100		
					27.0'				
.LEN_1776									
[∡] 2 186.3'	26.0'								-
		Poorly Graded Silf	ty Sand	1				27.0'	
		(SP-SM), gray, we	et						
182.8'	29.5'			-					· ·



Stantec	Stantec Borehole Identification ALF-215						Tota	I Boring De	oth 47.0 ft
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'04.	93", W90°0	8'11.95" (NAD83)
Project I	Number	175577013			Surface Ele	vation 21	12.3 ft	Elevation [Datum NGVD29
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
182.3'/ 181.3' 180.8' 179.8' 179.3'	\30.0'/ \31.0'/ \31.5'/ \32.5'/ \33.0'/	Lean Clay (CL), g medium plasticity, moist Sandy Silt (ML), g wet, fine grained s	ray, soft, very ray, soft, sand	-	27.0' - 37.0'	10.0'	100		
_ - _ 174.5'	37.8'	Lean Clay (CL), g medium plasticity, moist	ray, soft, very					37.0'	-
172.3' 	40.0'	Lean Clay (CL), g medium plasticity,	ray, soft, very	-	07 0l				-
- - 168.8' -	43.5'	Sandy Silt (ML), g wet, fine grained s	ray, soft, and	-	37.0' - 47.0'	9.0'	90		-
_ _ 	47.0'	Lean Clay (CL), g to medium stiff, m wet	ray, soft oist to					47.0'	-
_		Sandy Silt (ML), g wet, fine grained s	ray, soft, and						
-		Poorly Graded Sa (SP-ML), gray, find grained, wet	ndy Silt e						-
-		No Refusal / Bottom of Hole							-
-									-
									-
									-
597/013- KEV.GP									-
									-
									-



TVA V

Stantec Borehole Identification ALF-216							Tota	I Boring De	pth 57.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ition N	35°04'01	.20", W90°0	8'18.44" (NAD83)
Project	Number	175577013			Surface Ele	vation 2	12.9 ft	Elevation	Datum NGVD29
Project	Name	TVA-ALF Remedia	al Investigat	ion	Date Starte	d 8	/29/17	Completed	d <u>8/29/17</u>
Project	Locatio	n _ Memphis, Tenn	essee		Depth to Wa	ater 2	4.3 ft	Date/Time	9/6/17
Supervi	sor	Briggs Evans			Depth to Wa	Depth to Water N/A Date/Time			
Logged	by	Lee Eaves			Driller	Ν	latt Pope		
Drilling	Contract	or Cascade Drilling	g		Drill Rig Typ	be and II	D Prosor	nic LS600 /	#10-00273
Overbui	rden Dril	ling and Sampling To	ools (Type a	and Size) Sonic Tool	ing - 8" Bi	t, 8" Casing	, 7" Barrel, 3.	5" Rods
Sampler Hammer Type <u>N/A</u> Weigl				t NA	Drop	NA	Ef	ficiency	NA
Borehole Azimuth N/A (Vertical)					Borehole Ir	nclinatio	n (from Ve	ertical)	0 deg.
Lithold	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
212.9'	0.0'	Top of Hole							
211.9	1.0	ABC Storie		-					4" Monitoring
		low plasticity, firm	to hard,						See Well
-		moist			0.0' - 8.0'	8.0'	100		Construction
_									
-									
204.9'	8.0'							8.0'	
-		Silty Lean Clay (C	;L),						
_ 202.9'	10.0'	\neg medium plasticity,	vio firm,	_					-
-		\moist	/						
_		Clayey Silty Sand	(SM), e		8.0' - 17.0'	7.0'	78		
-		grained, moist	-						
-									-
-								17.0'	
194.9'	18.0'			_					
-		Silty Sand (SM), g	rayish						
-			u, wei						-
-					17.0' -	7.5'	75		
_					27.0'				
-									
–									-
185.9'	27.0'							27.0'	
184 4'	28.5' Silty Sand (SM), gray, fine								
183.4'	29.5'	grained, wet							



Stantec	Borehol	e Identification _ALI				Tota	I Boring De	oth 57.0 ft	
Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'01	.20", W90°0	8'18.44" (NAD83)
Project	Number	175577013			Surface Ele	vation 21	2.9 ft	Elevation [Datum NGVD29
Lithold	ogy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	plasticity, soft, wet Poorly Graded Sand (SP), brownish gray, fine to medium grained, wet <i>(Continued)</i>		nd (SP), e to vet		27.0' - 37.0'	7.0'	70		
-								37.0'	_
- - - -	42.0'				37.0'	7.5'	75	01.0	- - - -
	Poorly Graded Sand (SP) with Silt, gray, fine grained, wet		-	47.0'	7.5	75		- - - -	
-								47.0'	-
-					47.0' - 57.0'	8.5'	85		- - - - - - - -
155.9'	57.0'							57.0'	
		No Refusal / Bottom of Hole							- - - - - - - - - - - - - - - -


Stantec	Borehol	e Identification _ALI	F-P-4-S				Tota	I Boring De	pth 52.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'29.	25", W90°0	8'31.94" (NAD83)
Project I	Number	175577013			Surface Ele	vation 2	16.9 ft	Elevation	Datum NGVD29
Project I	Name	TVA-ALF Remedia	I Investigati	on	Date Started	d _ 8,	/28/17	Completed	8/29/17
Project	Locatior	Memphis, Tenn	essee		Depth to Wa	ater 2	9.6 ft	Date/Time	9/6/17
Supervis	sor	C. Sutherland			Depth to Wa	ater N	/A	Date/Time	N/A
Logged	by	Jeff Bechtel			Driller Larry Yancey				
Drilling (Contract	or Cascade Drilling	g		Drill Rig Typ	be and ID	D Terras	onic 150C /	#10-00100
Overbur	Overburden Drilling and Sampling Tools (Type and) Sonic Tooli	ing - 9" Bit	t, 9" Casing	, 6" Barrel, 3.	5" Rods
Sampler	r Hamme	er Type N/A	Weight	t NA	Drop	NA	Ef	ficiency	NA
Borehole	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
216.9'	0.0'	Top of Hole							
- 216.4	~ 0.5' /-	─ Gravel Fill Poorly Graded Sa Silt (SP-SM), dark	nd with brown.	-					4" Monitoring Well Installed.
212.9'	4.0'	fine grained, loose	e, moist, ied sand, ed sand	_	0.0' - 6.0'	5.0'			Construction Log for details.
209.9'	7.0'	little fine to coarse gravel	grained						
-		Poorly Graded Sa Silt (SP-SM), light fine grained, loose trace coarse grain trace fine grained	nd with brown, e, moist, ed sand, gravel						-
204.9' 	12.0'	Silty Lean Clay (C grayish brown, low medium plasticity, wet, trace fine san	L), dark v to soft, id	-					
	18 0'	Clayey Silt (ML), d soft, wet, trace fine	lark gray, e sand		6.0' - 26.0'	19.0'			-
	18.0	Silty Lean Clay (C gray, low to mediu plasticity, soft to m stiff, wet, trace fine	L), dark im nedium e sand	-					
191.9' 	25.0' 29.0'	Well Graded Sand brown, medium to grained, loose, we fine to coarse grav	t (SW), coarse et, little /el						-
XA &									



Stantec Bor	rehole	e Identification _ALF					Tota	I Boring De	oth 52.0 ft
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u> 3	35°04'29	.25", W90°0	8'31.94" (NAD83)
Project Nun	nber	175577013			Surface Elev	vation 21	6.9 ft	Elevation I	Datum NGVD29
Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation De	epth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
 <u></u>	182.9'34.0'Poorly Graded Sand (SP), light grayish brown, fine grained, loose, wet (Continued)182.9'34.0'Well Graded Sand (SW), light brown, medium to coarse grained, loose, wet, little fine subrounded 			26.0' 46.0'	16.01			- - 2 inch clay layer at 34'	
179.9' 37 178.9' 38 - - - - - - - - - - -				26.0' - 46.0' 46.0' - 52.0'	3.0'				
-					40.0 - 52.0	5.0			-
164.9' 52	2.0'								-
164.9' 52.0' No Refusal / Bottom of Hole									- - - - - - - - - - - - - - - - - - -



Stantec	Borehol	e Identification _AC	C-1A				Tota	I Boring De	pth 176.0 ft
Client		Tennessee Valley		Boring Loca	tion <u>N</u>	35°03'55.	.15", W90°0	<u>8'21.01" (NAD83</u>)	
Project	Number	175577013			Surface Ele	vation 2	10.9 ft	Elevation	Datum NGVD29
Project	Name	TVA-ALF Remedia	I Investigati	ion	Date Starte	d <u>8</u> /	26/17	Completed	8/27/17
Project	Location	n Memphis, Tenn	essee		Depth to Wa	ater 2	2.7 ft	Date/Time	9/11/17
Supervi	sor	C. Sutherland			Depth to Wa	ater N	/A	Date/Time	N/A
Logged	by	Jeff Bechtel			Driller Larry Yancey				
Drilling	Drilling Contractor Cascade Drilling				Drill Rig Typ	e and ID	Terras	onic 150C /	#10-00100
Overbu	Overburden Drilling and Sampling Tools (Type and S) Sonic Tool	ing - 9" Bit	, 9" Casing	, 6" Barrel, 3.	5" Rods
Sample	Sampler Hammer Type N/A Weight				Drop	NA	Ef	ficiency _	NA
Boreho	Borehole AzimuthN/A (Vertical)				Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
Lithol	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
210.9'	0.0'	Top of Hole							
209.9	1.0	Silt (ML) Dark gra	wish	-					4" Monitoring
-		brown, low plastic	ity,		0.0' - 6.0'	4.5'	75		See Well
_		fine to coarse and	st, trace ular						Log for details.
- 204 0'	fine to coarse angular gravel							6.0'	-
	0.0	Well Graded Sand	d (SW)	-				0.0	
- 203.4'	7.5'	with Silt, brown, fi	nè to ́	-					
-		Eat Clay (CH) da	rk aravish						
-		brown, medium to	high		6.0' - 16.0'	10.0'	100		-
-		plasticity, medium moist	stiff,		0.0 - 10.0	10.0	100		
_									
196.9'	14.0'			-					
-		Poorly Graded Sa brown, fine graine	nd (SP), d, moist,					16.0'	-
1/27/17		trace silt	, ,					10.0	
G.GDT 1									
WSM-GRV					16.0'	0 0'	<u>00</u>		-
					26.0'	0.0	80		
7013 - RE									
186.9'	24.0'			_					
								26.01	-
20 NOR	-							20.0	
183.4' 182.9' -	- 183.4' 27.5' - 182.9' - 28.0' Eat Clay (CH) dark gray								
		medium to high pl	asticity,						
TVA .		medium stiff, mois	st to wet						



	Stantec Borehole Identification ACC-1A Client Tennessee Valley Authority							Tota	I Boring De	oth 176.0 ft
	Client Tennessee Valley Authority					Boring Loca	ition <u>N</u>	35°03'55.	.15", W90°0	8'21.01" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	10.9 ft	Elevation [Datum NGVD29
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	Poorly Graded Sand (SP), brown, fine grained, moist to wet, trace to little medium grained sand (Continued)176.4'34.5'175.4'35.5'			26.0' - 36.0'	10.0'	100				
F	175.4' 35.5' Fat Clay (CH), dark gray,						00.01	_		
-		medium to high plasticity, soft, moist to wet		-				36.0'	-	
-	Poorly Graded Sand (SP), gray, fine grained, wet, trace medium sand 169.9' 41.0'							-		
_	169.9'41.0'Poorly Graded Silty Sand (SP-SM), dark gray, fine grained, soft, wet, trace lignite and clay			36.0' - 46.0'	10.0'	100		-		
F	166.4'44.5'lignite and clay164.9'46.0'Poorly Graded Sand (SP), brown modium grained		_				46.0'	_		
-	162.4'	64.9'46.0'Poorly Graded Sand (SP), brown, medium grained, wet, trace fine grained gravel and coarse sand62.4'48.5'		-				46.0	-	
	159.9'	51.0'	Poorly Graded Sa gray, fine grained, trace silt Poorly Graded Sa grayish brown, fine medium grained, v gravel and coarse Poorly Graded Sa gray, fine grained,	nd (SP), wet, nd (SP), e to wet, trace sand nd (SP), wet,	-	46.0' - 56.0'	10.0'	100	 56.0'	
ROCK ALLEN_175577013 - REV.GPJ FMSM-GRAPHICLOG.GDT 11/27/17	<u>148.9'</u> 147.9'	62.0' 63.0'	Poorly Graded Sa grayish brown, fin- medium grained, y Poorly Graded Sa gray, fine grained	nd (SP), e to wet nd (SP), wet	-	56.0' - 66.0'	9.0'	90	 66.0'	
TVA SONIC BORING LOG - NO	gray, fine grained, wet, trace gravel and lignite							-		



ſ	Stantec Borehole Identification ACC-1A Client Tennessee Valley Authority							Tota	I Boring De	oth 176.0 ft
	Client	Client Tennessee Valley Authority					tion <u>N</u>	35°03'55.	15", W90°0	<u>8'21.01" (NAD83</u>)
	Project N	Number	175577013			Surface Ele	vation 2	10.9 ft	Elevation I	Datum NGVD29
	Litholo	ogy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	139.9' - -	139.9' 71.0' Well Graded Sand (SW), gray, fine to coarse grained, wet, trace fine to coarse gravel and lignite		-	66.0' - 76.0'	10.0'	100			
┢	_		<u> </u>	5					70.01	_
╞	-								76.0'	-
	- - 					76.0' - 86 0'	6.0'	60		- - - -
	- - - 124 9'	86.0'				80.0			86.0'	- - -
ł	124.5	00.0	No Recoverv		-				00.0	-
	- - - - - -	00.01	Nonecovery			86.0' - 96.0'	10.0'	100		
ŀ	114.9'	96.0'	Wall Craded Sana		-				96.0'	-
OCK ALLEN_175577013 - REV.GPJ FMSM-GRAPHIC LOG.GDT 11/27/17	- - - - -		grayish brown, find coarse grained, we to some fine to coa gravel	a (Svv), e to et, trace arse		96.0' - 106.0'	0.0'	0		- - - - - - - -
- NO RO(-		
TVA SONIC BORING LOG	-									-



ſ	Stantec Borehole Identification ACC-1A Client Tennessee Valley Authority							Tota	I Boring De	oth 176.0 ft
	Client Tennessee Valley Authority					Boring Location <u>N35°03'55.15", W90°08'21.01" (NAD</u>				8'21.01" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	10.9 ft	Elevation I	Datum NGVD29
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_	99.9'	-111.0'	Well Graded Sand dark gray, mediun coarse grained, w fine to coarse grav	d (SW), n to et, some vel, trace	_	106.0' - 116.0'	9.0'	90		-
F	- 94.9'	94.9' 116.0'						116.0'	-	
	-	100.01	No Recovery			116.0' - 126.0'	0.0'	0		- - - - - - - - - - -
┢	84.9'	126.0'			-				126.0'	-
	81.9' -	129.0'	Well Graded Sand light gray, fine to r grained, wet, trace coarse sand and f coarse gravel, trace Poorly Graded Sa gray, fine grained, little medium grain trace fine gravel	d (SW), nedium e to little ine to ce lignite nd (SP), wet, ned sand,		126.0' - 136.0'	9.0'	90		- - - - - - - -
	- 74.9'	136.0'							136.0'	_
ALLEN_175577013 - REV.GPJ FMSM-GRAPHIC LOG.GDT 11/27/17	-		Poorly Graded Sa gray, fine grained, little medium grair trace fine to coars trace lignite	nd (SP), wet, ned sand, e gravel,		136.0' - 146.0'	9.0'	90		- - - - - - - -
ROCK AL							146.0'	-		
TVA SONIC BORING LOG - NO F	-									



Stantec	Stantec Borehole Identification ACC-1A Client Tennessee Valley Authority						Tota	I Boring Dep	oth 176.0 ft
Client		Tennessee Valley		Boring Loca	tion <u>N</u>	35°03'55.	15", W90°0	8'21.01" (NAD83)	
Project	Number	175577013			Surface Ele	vation 21	10.9 ft	Elevation [Datum NGVD29
Litholo	ogy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	Poorly Graded Sand (SP) gray, fine grained, wet, little medium grained sand trace fine to coarse grave trace lignite <i>(Continued)</i> 54.9' 156.0'		nd (SP), wet, ned sand, e gravel, ntinued)		146.0' - 156.0'	7.0'	70		- - -
54.9'	54.9' 156.0'			-				156.0'	-
-		Poorly Graded Sa gray, fine grained, trace fine subroun gravel	nd (SP), wet, ded		156.0' -	10.0'	100		- - -
-		Some Lignite @ 1	65'		166.0'				-
44.9'	166.0'			-				166.0'	-
- <u>42.9'</u> - <u>-</u> - <u>-</u> 	168.0'	Poorly Graded Sa gray, fine grained, little medium grain trace coarse sand fine to coarse sub gravel, trace lignit Fat Clay (CH), gra gray, high plasticit stiff, moist, trace fi grained sand	nd (SP), wet, led sand, , trace rounded e y to olive y, very ne	_	166.0' - 176.0'	10.0'	100		- - - - - -
34 9'	176 0'	olive gray with little	more e fine					176 0'	_
	110.0	∖grained sand @ 1 No Refusal / Bottom of Hole	73'	1	L	1 1		1 110.0	- - - - - - - - - - - - - - - - - - -



71/22/11

											_
	Stantec	Borehol	e Identification AC	C-3A				Tota	I Boring De	pth 138.0 ft	
	Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u>	35°03'59.	.31", W90°0)8'53.34" (NAD83)	1
	Project I	Number	175577013			Surface Ele	vation 2	15.7 ft	Elevation	Datum NGVD29	
	Project I	Name	TVA-ALF Remedia	I Investigati	on	Date Starte	d 8	/24/17	Completee	d 8/25/17	
	Project	Locatior	Memphis, Tenno	essee		Depth to Wa	ater 2	6.0 ft	Date/Time	9/11/17	
	Supervis	sor	Briggs Evans			Depth to Wa	ater N	/A	Date/Time	e N/A	
	Logged	by	Mike Pilot			Driller Larry Yancey					
	Drilling Contractor Cascade Drilling					Drill Rig Typ	be and I) Terras	onic 150C /	/ #10-00100	
	Overbur	den Drill	ling and Sampling To	and Size) Sonic Tool	ing - 9" Bi	t, 9" Casing	, 6" Barrel, 3.	5" Rods		
	Sampler	Hamme	er Type N/A	Weight	NA	Drop	NA	Ef	ficiency	NA	
	Borehole	e Azimut	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.	
	Litholo	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		-
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
	_ 215.7'	0.0'	Top of Hole								_
	-		Silty Sand (SM), b fine grained, poorl graded, moist	rown, y		0.0' - 6.0'	6.0'	100		4" Monitoring Well Installed. See Well Construction Log for details.	
	209.7'	6.0'			_				6.0'	_	
			Fat Clay (CH), gra medium plasticity,	y, firm, moist		6.0' - 16.0'	8.0'	80			-
	201.7'	14.0'			_						
	 199.7'	16.0'	Clayey Sand (SC) fine grained, moist	, brown, t					16.0'		_
APHIC LOG.GDT 11/27/17	-		Poorly Graded Sai brown, very fine gi moist	nd (SP), rained,							-
MSM-GR	- 195.2'	20.5'			-	16.0' -	9 0'	90			-
NLLEN_175577013 - REV.GPJ F	- - - 190 7'	25.0'	Lean Clay with Sill Sand (CL), gray, lo plasticity, very soft saturated	t and ow ;,		26.0'					
ROCK F	189.7'	26.0'	No Recovery		-				26.0'	No Recovery from 25' to 26'	-
VA SONIC BORING LOG - NC		30.0'	Lean Clay with Sill Sand (CL), gray, lo plasticity, very soft saturated	t and ow ;,							-



Stantec	Borehol	e Identification _AC	;C-3A				Tota	I Boring Dep	oth 138.0 ft
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°03'59.	.31", W90°0	8'53.34" (NAD83)
Project	Number	175577013			Surface Ele	vation 22	15.7 ft	Elevation I	Datum NGVD29
Lithol	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
- - -		Poorly Graded Sand (SP), brown, very fine grained, moist			26.0' - 36.0'	10.0'	100		-
_								36.0'	
- - - -					36.0' - 46.0'	10.0'	100		- - - - - - - -
F								46.0'	-
- - - - - - - 159.7'	56.0'				46.0' - 56.0'	10.0'	100	 56.0'	
- - - - - - - - - - - - - - - - - - -	66.0'	No Recovery			56.0' - 66.0'	0.0'	0		from 56' to 66'
<u>173.1</u>	00.0	Well Graded Sand light gray, fine to o grained, saturated	l (SW), xoarse I					00.0	-



ſ	Stantec Borehole IdentificationACC-3AClientTennessee Valley Authority							Tota	I Boring De	oth 138.0 ft
	Client Tennessee Valley Authority					Boring Loca	tion <u>N</u>	35°03'59.	31", W90°0	<u>8'53.34" (NAD83</u>)
	Project I	Number	175577013			Surface Eler	vation 2	15.7 ft	Elevation I	Datum NGVD29
ſ	Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
┢	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
			Well Graded Sand	I (SW),		66.0' -	10.0'	100		_
$\left \right $	light gray, fine to coarse grained, saturated (Continued)			76.0'				-		
$\left \right $	(Continued)							-		
							76.0'	-		
	137.7' 78.0'									
$\left \right $	No Recovery							from 78' to 86'		
	-			76.0' - 86.0'	2.0'	20		-		
										-
ł	- 							-		
	129.7'	86.0'			-				86.0'	-
			Well Graded Sand light gray, fine to c grained, saturated	I (SW), œarse						-
	-					86.0' - 96.0'	10.0'	100		-
										-
ŀ	_								96.0'	-
GDT 11/27/17										-
RAPHIC LOG.	_									-
SPJ FMSM-GF						96.0' - 106.0'	10.0'	100		-
577013 - REV.G										_
X ALLEN_175	-							106 0'	_	
- NO ROC										
RING LOG									-	
SONIC BOI									-	
ž										



Γ	Stantec	Stantec Borehole Identification ACC-3A Client Tennessee Valley Authorit						Tota	I Boring De	pth 138.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u> 3	35°03'59.	.31", W90°0	8'53.34" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 21	5.7 ft	Elevation I	Datum NGVD29
	Litholo	рду		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	Well Graded Sand (SW), light gray, fine to coarse grained, saturated <i>(Continued)</i>		l (SW), coarse		106.0' - 116.0'	9.0'	90		-	
┝	<u>100.7' 115.0'</u> 00.7' 116.0' No Recovery				-					No Recovery –
-	99.7' 116.0' No Recovery		-				116.0'	from 115' to 116'_		
	98.7' 117.0' Well Graded Sand (SW), 97.7' 118.0' gray, medium to coarse grained, saturated, trace gravel		-					-		
-	Poorly Graded Sand (SP), gray, fine grained, wet Well Graded Sand (SW),			116.0' - 126.0'	10.0'	100		-		
-	light gray, fine to coarse grained, saturated							-		
									126.0'	
╞	88.7'	127.0'	Fat Clay (CH), gra	v, verv	-					-
_			stiff, moist							_
F						126.0' - 136.0'	10.0'	100		-
-										-
-									136.0'	
DT 11/27/17	77.7'	138.0'			ST-1	136.0' - 138.0'	0.0'			
APHIC LOG.G			No Refusal / Bottom of Hole							-
PJ FMSM-GR	-									-
77013 - REV.GI										-
ALLEN_1755	_									_
I I I	-								-	
NIC BORING LC	-								-	
TVA SC										_



71/22/11

	Stantec	Borehol	e Identification AC	C-5A				Tota	I Boring De	pth 149.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'03.	70", W90°0	8'32.94" (NAD83)
	Project N	Number	175577013			Surface Ele	vation 2	16.6 ft	Elevation	Datum NGVD29
	Project N	Name	TVA-ALF Remedia	I Investigati	on	Date Starte	d _ 8/	/24/17	Completee	d <u>8/27/17</u>
	Project	Location	n Memphis, Tenno	essee		Depth to Wa	ater 2	7.6 ft	Date/Time	9/11/17
	Supervis	sor	Briggs Evans			Depth to Wa	ater N	/A	Date/Time	e N/A
	Logged	by	Lee Eaves			Driller				
	Drilling Contractor Cascade Drilling					Drill Rig Typ	be and ID) Prosor	nic LS600 /	#10-00273
	Overburden Drilling and Sampling Tools (Type and) Sonic Tool	ing - 8" Bit	, 8" Casing	, 7" Barrel, 3.	5" Rods
	Sampler Hammer Type <u>N/A</u> Weight _					Drop	NA	Ef	ficiency	NA
	Borehole Azimuth N/A (Vertical)					Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
	Litholo	уgy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	_ 216.6'	0.0'	Top of Hole							
	216.1'	~ 0.5'_/	ABC Stone		-					4" Monitoring
			Silty Sand (SM), b	rown to						Well Installed.
	213.6'	3.0'	gray, fine grained,	moist	-	0.0' - 7.0'	7.0'	100		Construction
	-		Silty Sand (SM), ta grained, moist	an, fine						Log for details.
	-		g							-
									7.0'	
	208.6'	8.0'			_					
	-		Silty Lean Clay (C	L), gray						-
	-		soft to firm, noist	ticity,						-
	-					7 01 47 01	40.01	100		
	_					7.0 - 17.0	10.0	100		-
	-									-
										-
										-
11/27/17									17.0'	
G.GDT	-									-
PHIC LC	-									-
ISM-GRA	-									-
V.GPJ FN	194 6'	22 0'				17 0' -	10.0'	100		-
013 - REY	194.6 [°] 22.0 [°] Silty Sand (SM), tan, fine				-	27.0'	10.0	100		
N_175577	grained, moist									
CK ALLE										-
- NO RO	190.6' 26.0' 189.6' 27.0' Silty Sand (SM) gravish				-				27 0'	
ING LOG	<u>189.6'</u> <u>27.0'</u> Silty Sand (SM), grayish <u>188.6'</u> <u>28.0'</u> brown, fine grained, wet				-				21.0	-
SONIC BOR.	188.6' 28.0' brown, fine grained, wet Sandy Lean Clay (CL), brown, act low to modium									
Ř	186 6'	30.0'	DIOWII, SOIT, IOW TO	meaium			1			1



Stantec	Borehol	e Identification _AC	C-5A				Tota	I Boring De	oth 149.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'03.	70", W90°0	8'32.94" (NAD83)
Project I	Number	175577013			Surface Ele	vation 2	16.6 ft	Elevation I	Datum NGVD29
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
 	~30.5'~	plasticity, wet Silty Sand (SM), g brown, fine graine Sandy Lean Clay gray, soft, low plas wet Silty Sand (SM), g		27.0' - 37.0'	6.5'	65	 37.0'		
		brown, fine to med grained, wet	dium		37.0' - 47.0'	6.5'	65		- - - - - -
_ 171.6'	45.0'			-					_
169.6'	47.0'	Poorly Graded Sa gray, fine to mediu ⊂∖grained, wet	nd (SP), um /	-				47.0'	-
		Poorly Graded Sa grayish brown, fin medium grained, v	nd (SP), e to wet		47.0' - 57.0'	7.5'	75	 57.0'	
- по нокох итем 1/182/143 низичение гоз ово 1 1/12 - по	67.0'				57.0' - 67.0'	5.0'	50	67.0'	-
									-



Stantec	Borehol	e Identification _AC	C-5A				Tota	al Boring De	pth 149.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u>	35°04'03	.70", W90°0	8'32.94" (NAD83)
Project	Number	175577013			Surface Ele	vation 2	16.6 ft	Elevation I	Datum NGVD29
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
- - -		Well Graded Grav Sand (SW), gray, coarse grained, w rounded fine to co gravel <i>(Continue</i>)	/elly fine to /et, parse ed)		67.0' - 77.0'	6.0'	60		
139.6'	77.0'							77.0'	-
		Poorly Graded Sa gray, fine to media grained, wet, trace rounded gravel	und (SP), um e	-	77.0' - 87.0'	7.5'	75		- - - - - - - - -
F								87.0'	_
- - - - -					87.0' - 97.0'	6.5'	65		
119.6'	97.0'	Mall Creded Con		-		+		97.0'	-
- - - - - - - - - - -	103.0'	Well Graded Sand gray, fine to coars grained, wet, trace rounded gravel Well Graded Grav Sand (SW), gray, coarse grained, w rounded fine to co	d (SW), e e velly fine to vet, trace parse	-	97.0' - 107.0'	7.5'	75		
-		gravel						107.0	Depth 107 to
-									trace lean clay



TVA

Stantec	Borehol	e Identification AC	C-5A		Total Boring Depth 149.0 ft					
Client		Tennessee Valley	Authority		Boring Loca	ation N	35°04'03.	.7 <u>0", W90°0</u>	8'32.94" (NAD83)	
Project	Number	175577013			Surface Ele	vation 21	16.6 ft	Elevation [Datum NGVD29	
Litho	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
-	116.01	Well Graded Grav Sand (SW), gray, coarse grained, w rounded fine to cc gravel <i>(Continue</i>)	velly fine to vet, trace barse ed)		107.0' - 117.0'	7.0'	70			
100.0	Poorly Graded Sand (SP),		-				117 0'	-		
		Poorly Graded Sa gray, fine grained, trace rounded gra	ınd (SP), , wet, vel		117.0' - 127.0' 127.0' - 137.0'	9.5'	95			
\vdash									-	
<u></u> ₹ 79.6'	137.0'							137.0'	-	
75.6'	141.0'	Well Graded Grav Sand (SW), grayis fine to coarse grai fine to coarse rour gravel	/elly sh brown, ined, wet, nded						-	
LEN_17557013- REV.GPJ FM		Lean Clay (CL), g medium plasticity, very hard, wet	ray, , hard to		137.0' - 147.0'	10.0'	100			
300K AL								147.01	-	
- 90 - 90								147.0	-	
67.6'	- 57.6' 149.0' ST				147.0' - 149.0'	2.0'			-	
		No Refusal / Bottom of Hole						-		



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Stantec	Borehol	e Identification AC	C-5B				Tota	I Boring De	pth 57.0 ft
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'03.	38", W90°0)8'32.61" (NAD83)
Project	Number	175577013			Surface Ele	vation 2	16.0 ft	Elevation	Datum NGVD29
Project	Name	TVA-ALF Remedia	al Investigati	ion	Date Started	d _8	/27/17	Complete	d 8/27/17
Project	Location	n Memphis, Tenn	essee		Depth to Wa	ater 2	7.7 ft	Date/Time	9/11/17
Supervi	sor	Briggs Evans			Depth to Wa	ater N	/A	Date/Time	e N/A
Logged	by	Lee Eaves			Driller	Ν	latt Pope		
Drilling	Contract	or Cascade Drillin	g		Drill Rig Typ	e and II	D Prosor	nic LS600 /	#10-00273
Overbur	rden Dril	ling and Sampling Te	ools (Type a	and Size) Sonic Tooli	ing - 8" Bi	t, 8" Casing	, 7" Barrel, 3.	5" Rods
Sample	r Hamm	er Type _N/A	Weight	t NA	Drop	NA	Ef	ficiency	NA
Borehol	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclination	n (from Ve	ertical)	0 deg.
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
216.0'	0.0'	Top of Hole							-
215.5	0.5	ABC Stone							4" Monitoring
-		Silty Sand (SM), to brown, fine graine	an to d. moist						See Well
-			-,		0.0' - 7.0'	7.0'	100		Construction
_									Log for details.
_									
-	0.01							7.0'	
200.0	0.0	Silty Lean Clay (C	(L) grav	-					-
-		to brown, low to m	nedium						-
		plasticity, soft to fi	rm, moist						
-					7.0' - 17.0'	10.0'	100		-
-									
-									-
F									-
-								17.0'	-
_									-
_									-
-									-
194.0'	22.0'				17.0' -	10.0'	100		-
- 102 5'	23 5'	Silty Sand (SM), b	prown,		27.0'				-
192.0	23.5	fine grained, mois	t r	-					-
191.5'	<u>24.5'</u> ∕ 25.5'∕	brown, fine graine	ed, moist $\prod_{r=1}^{\infty}$						
		Silty Sand (SM), b	prown,					27.0'	
-		tine grained, mois							-
186.0'	30.0'	brown, fine graine	d, moist						-



Stantec Boreh	ole Identification AC	C-5B		Total Boring Depth 57.0 ft				
Client	Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'03.	.38", W90°0	8'32.61" (NAD83)
Project Numbe	er 175577013			Surface Eler	vation 21	6.0 ft	Elevation [Datum NGVD29
Lithology		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	Silty Sand (SM), g brown, fine grained Poorly Graded San brown, fine grained trace medium sand	rayish d, wet nd (SP), d, wet, d		27.0' - 37.0'	7.5'	75		
							37.0'	_
- - - - -				37.0' - 47.0'	6.5'	65		
171.0' 45.0'		rovioh						_
169.0' 47.0'	brown, fine graine	d, wet					47.0'	-
- - - - - -	Poorly Graded Sau brown, fine to med grained, wet	nd (SP), lium		47.0' - 57.0'	4.0'	40		- - - - - - - - - - - - -
⊾ 159.0' 57.0'	,						57.0'	-
	No Refusal / Bottom of Hole				· · · · · ·			- - - - - - - - - - - - - - - -



-									
Stantec	Borehol	e Identification AL	F-205C				Tota	I Boring De	pth 187.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	ot Yet Su	rveyed,	
Project	Number	175577013			Surface Ele	vation 2	16.0 ft	Elevation	Datum NGVD29
Project	Name	TVA-ALF Remedia	al Investigati	on	Date Started	d	/26/17	Complete	d 9/27/17
Project	Locatio	nMemphis, Tenn	essee		Depth to Water N/A Date/Time			9/27/17	
Supervi	sor	C. Sutherland			Depth to Water N/A Date/Time				e N/A
Logged	by	Lee Eaves			Driller	Ja	ames Sm	ith	
Drilling	Contract	or Cascade Drilling	g		Drill Rig Typ	be and ID	D Prosoi	nic LS600 /	#10-00273
Overbur	den Dril	ling and Sampling To	ools (Type a	and Size) Sonic Tooli	ing - 8" Bit	t, 8" Casing	, 7" Barrel, 3.	5" Rods
Sample	r Hamm	er Type N/A	Weight	: NA	Drop	NA	Ef	ficiency	NA
Borehol	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
216.0'	0.0'	Top of Hole							-
215.5' _ _ _ _ _ _ _ _ _	~ 0.5' ~	─ Topsoil (6") Silty Sand (SM), b (7.5YR 4/4), fine g moist	prown grained,		0.0' - 7.0'	7.0'	100	7.0'	Boring abandoned upon completion by tremie grouting to surface with 30% solids bentonite grout.
 	12.0' 14.0'	Clayey Silty Sand brown (7.5YR 4/4) grained, moist Silty Clay (CL), bro (7.5YR 4/2), medi low plasticity, mois	(SM),), fine own um stiff, st	-	7.0' - 17.0'	6.0'	60		P.P. = Pocket Penetrometer Result P.P. = 1.75 tsf P.P. = 1.5 tsf
_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	28.0'				17.0' - 27.0'	9.5'	95	 27.0'	P.P. = 1.5 tsf -
186.0'	30.0'	Poorly Graded Sa brown (7.5YR 4/1)	nd (SP),), fine						



Stantec B	Borehol	e Identification ALI	F-205C				Tota	I Boring De	pth 187.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ation N	ot Yet Su	rveyed,	
Project N	umber	175577013			Surface Ele	vation 2	16.0 ft	Elevation I	Datum NGVD29
Lithology	IY		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
Elevation	ation Depth Description Sonic Core grained, moist				Run 27.0' - 37.0' 37.0' - 47.0' 47.0' - 57.0'	Rec. Ft. 10.0' 8.0' 8.5'	80 85	Run Depth 37.0' 47.0'	Remarks
-		Well Graded Sanc grayish brown (10 fine to medium gra	I (SW), YR 5/2), ained,					57 0'	_
SONIC BORING LOG- NO ROCK ALLEN_175577103 GPJ F NSM-CRAPHIC LOG GDT 126/17		wet, contains few	gravel		57.0' - 67.0'	8.5'	85	67.0'	- - - - - - - - - - - - - - - - - - -



Stantec Bo	orehole	e Identification ALI	-205C		Total Boring Depth 187.0 ft					
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	ot Yet Su	rveyed,		
Project Nu	umber	175577013			Surface Ele	vation 21	6.0 ft	Elevation [Datum NGVD29	
Lithology	′	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation E	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
- - - 141.0' 7	75.0'	Well Graded Sand grayish brown (10 fine to medium gra wet, contains few (Continued)	l (SW), YR 5/2), ained, gravel		67.0' - 77.0'	8.0'	80			
139.0' 7	77.0'	Silty Sand (SM), b (7.5YR 4/4), fine g	rown rained,					77.0'	-	
		wet Well Graded Sand grayish brown (10 fine to coarse grai contains some gra	Well Graded Sand (SW), grayish brown (10YR 5/2), fine to coarse grained, wet, contains some gravel		77.0' - 87.0'	5.0'	50	 87.0'		
-					87.0' - 97.0'	7.0'	70	97.0'	- 	
USCC ATER 1182:001 1287 	99.0' 06.0'	Poorly Graded Sa grayish brown (10 fine grained, wet, o trace gravel	nd (SP), YR 5/2), contains		97.0' - 107.0'	8.0'	80		- 	
		Well Graded Sand grayish brown (10 fine to coarse grai contains some gra	I (SW), YR 5/2), ned, wet, ivel					107.0'	-	



Stantec	Borehol	e Identification AL	F-205C		Total Boring Depth 187.0 ft				
Client		Tennessee Valley	Authority		Boring Loca	ition No	ot Yet Su	rveyed,	
Project	Number	175577013			Surface Ele	vation 21	16.0 ft	Elevation	Datum NGVD29
Lithold	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
<u>105.0'</u> - -	-111.0'-	Silty Lean Clay (C gray (7.5YR 4/1), plasticity, moist to	L), dark hard, low wet		107.0' - 117.0'	10.0'	100		P.P. = 4.5 tsf
_									P.P. > 4.5 tsf -
99.0'	117.0'							117.0'	-
-		Fat Clay (CH), dar stiff, medium plast to wet	rk gray, tic, moist	ST-1	117.0' - 119.0'	0.6'			-
- - 94.0'	122.0'	(classification bas Particle Size and A Limits analysis, sa	Atterberg						P.P. = 4.25 tsf -
-		Sandy Lean Clay dark gray (7.5YR	(CL), 4/1),		119.0' - 127.0'	8.0'	100		P.P. > 4.5 tsf -
-		plasticity, wet (classification bas Particle Size and)	n, IOW ed on Atterbera					127.0'	-
- - - -		Limits analysis, sa intervals 130.5' - 1 and 148.0' - 149.0	ample 31.0' ')		127.0' - 137.0'	10.0'	100		P.P. > 4.5 tsf - - - P.P. = 1.0 tsf - P.P. = 1.25 tsf -
								137.0'	-
					137.0' - 147.0'	10.0'	100	 147.0'	P.P. = 1.5 tsf - P.P. = 2.5 tsf - P.P. = 1.0 tsf -
									P.P. = 1.0 tsf



Stantec	tantec Borehole Identification _ALF-205C Total Boring Depth _187.0 ft									
Client		Tennessee Valley	Authority		Boring Loca	ition N	ot Yet Su	rveyed,		
Project I	Number	175577013			Surface Ele	vation 2	16.0 ft	Elevation I	Datum NGVD29	
Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
-					147.0' - 157.0'	10.0'	100		P.P. = 1.25 tsf -	
	156.0'	Clayey Silty Sand	(SM),	_				157.0'	-	
- - - -		dark gray (7.5YR 4 grained, wet	4/1), fine		457.01	0.51	05		- - -	
-					157.0' - 167.0'	8.5	85		- - -	
49.0'	167.0'			_				167.0'	_	
-		Poorly Graded Sa dark gray (7.5YR 4 grained, wet	nd (SP), 4/1), fine		167.0' - 177.0'	6.0'	60		-	
41.0'	175.0'			-					_	
- 39.0'	177.0'	Clayey Sandy Silt dark gray (7.5YR	(ML), 4/1),					177.0'	-	
ALLEN,175577013.634 FMSM-GRAPHIC LOG. GDT 125677		medium stiff to stif plasticity, wet Poorly Graded Sa dark gray (7.5YR 4 grained, wet	f, low nd (SP), 4/1), fine		177.0' - 187.0'	9.0'	90		- - - - - - - -	
29.0'	187.0'							187.0'	-	
		No Refusal / Bottom of Hole							-	



Stantac	Borehol	e Identification AI	F-212C				Toto	l Boring Do	nth 267 0 ft	
Client	00121101				Boring Loop	tion N			pur 201.0 IL	
Dreiget			Authonity			wation \underline{N}		rveyed,		
Project	Number	T/55/7013				vation $\frac{2}{2}$	35.8 π	Elevation		
Project	Name		il Investigat	on	Date Starte	a <u>9</u> /	(21/17	Completed	9/22/17	
Project	Location	n Memphis, Tenn	essee		Depth to Water N/A Date/Time			9/22/17		
Supervis	sor	C. Sutherland			Depth to Wa	Depth to Water N/A Date/Time N/A				
Logged	by	Lee Eaves			Driller	Ja	ames Sm	ith		
Drilling (Contract	or Cascade Drillin	g		Drill Rig Typ	be and ID	Prosor	nic LS600 /	#10-00273	
Overbur	den Dril	ling and Sampling To	and Size) Sonic Tool	ing - 8" Bit	t, 8" Casing	l, 7" Barrel, 3.	5" Rods		
Sampler	r Hamm	er Type <u>N/A</u>	Weight	t NA	Drop <u>NA</u> Efficiency <u>NA</u>					
Borehol	Borehole Azimuth N/A (Vertical)					nclinatior	n (from Ve	ertical)	0 deg.	
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
235.8'	0.0'	Top of Hole		-						
235.5	1.6	Asphalt (4")	/						Boring	
-		(2.5YR 5/8), fine to	ed o						upon completion	
		medium grained,	dry,		0.0' - 7.0'	7.0'	100		by tremie	
		gravel	ded						surface with _	
229.3'	6.5'	Clayey Silty Sand	(SM),						30% solids	
-		brown (7.5YR 4/4)), fine					7.0'		
226.8'	9.0'	Silty Sand (SM) li								
	0.0	brown (7.5YR $6/4$)), fine						D D - Dookot -	
_		\grained, moist							Penetrometer	
-		(SC) (7.5YR 4/4), fine c	, brown Irained.		7.0' - 17.0'	8.0'	80		Result	
-	14.0'	moist	,,						-	
221.0	14.0	Silty Clay (CL) or	av	-						
219.8'	16.0'	(7.5YR 5/1), stiff, l	ow						P.P. = 2.0 tsf -	
218.8'	17.0'	plasticity, moist						17.0'		
1		(7.5YR 5/1), g	ray rained.						P.P. = 3.0 tsf	
		wet	· · ·						-	
GRAPHI		Clayey Silt (ML), g	gray						P.P. = 1.0 tsf -	
L FMSM-		low plasticity, mois	stin,		17.0' -	10.0'	100		-	
7013.GP					27.0'				-	
EN_1755										
									P.P. = 1.5 tsf -	
- NOR								27 0'		
								21.0	- - -	
206.8'	29.0'									
LVA SI										



Γ	Stantec	Borehol	e Identification ALI		Total Boring Depth 267.0 ft					
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	ot Yet Su	rveyed,	
	Project N	Number	175577013			Surface Ele	vation 23	35.8 ft	Elevation I	Datum NGVD29
	Litholo	gy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-			Silty Lean Clay (C brown (7.5YR 4/2) medium stiff, low p moist <i>(Continued</i>	L), , blasticity, /)		27.0' - 37.0'	10.0'	100		P.P. = 1.25 tsf
F										P.P. = 1.0 tsf -
									37.0'	-
-									P.P. = 1.0 tsf -	
-						37.0' -	10.0'	100		P.P. = 1.0 tsf -
						47.0'				P.P. = 1.5 tsf -
L	190.8'	45.0'			_					-
-			Silty Sand (SM), g (7.5YR 5/1), fine g wet	ray rained,					47.0'	-
-			Wet							
_			51': 6" seam gray (CL)	Clay		47.0' - 57.0'	10.0'	100		-
F	179.8'	56.0'	Silty Lean Clay (C) grav	-				57 0'	P.P. = 1.0 tsf -
-06.GDT 12/7/17			(7.5YR 5/1), mediu medium plasticity,	um stiff, wet						- P.P. = 1.0 tsf - -
	173.8'	62.0'				57.0' -	9.5'	95		– – P.P. = 0.75 tsf –
LLEN_175577013.G	Sandy Silt (ML), gray (7.5YR 5/1), low plasticity, soft, wet			07.0						
DG - NO ROCK A	-						67.0'			
TVA SONIC BORING LC										-



Stantec	Borehol	e Identification _AL	F-212C				Tota	I Boring De	oth 267.0 ft
Client		Tennessee Valley	Authority		Boring Loca	tion No	ot Yet Su	rveyed,	
Project	Number	175577013			Surface Ele	vation 23	35.8 ft	Elevation I	Datum NGVD29
Lithol	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
163.8'	72.0'				67.0' -	5.0'	50		_
-		Poorly Graded Sa gray (7.5YR 5/1), grained, wet	nd (SP), fine		77.0'				-
_ 158.8'	77.0'							77.0'	-
- - -		Well Graded Sand grayish brown (10 fine to medium gra wet, contains trace	Well Graded Sand (SW), grayish brown (10YR 5/2), fine to medium grained, wet, contains trace gravel						-
-					77.0' - 87.0'	6.0'	60		- - -
-								87.0'	-
- - -					87.0' -	6.0'	60		
- - -					97.0'			97.0'	- - -
									-
K ALEN 17577013.0PJ FMSM					97.0' - 107.0'	7.0'	70		- - -
- NO ROC							107.0'	-	
									-



Stantec	Borehol	e Identification AL	F-212C		Total Boring Depth 267.0 ft				
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	ot Yet Su	rveyed,	
Project	Number	175577013			Surface Ele	vation 23	35.8 ft	Elevation I	Datum NGVD29
Lithol	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
- - - 120.8'	115.0'	Well Graded Sand grayish brown (10 fine to medium gra wet, contains trace (Continued)	d (SW), YR 5/2), ained, e gravel	_	107.0' - 117.0'	7.0'	70		
_ 118.8'	117.0'	Black Decompose No trace of soils	ed Log,					117.0'	-
- - - - - -		Well Graded Sand with gravel (SW), grayish brown (10YR 5/2), fine to coarse grained, wet, fine to coarse grained gravel		_	117.0' - 127.0'	0.0'	0		- - - - - - - - - - - - -
107.8'	128.0'							121.0	
- - - - -		Poorly Graded Sa grayish brown (10 fine grained, wet, trace gravel	Poorly Graded Sand (SP), grayish brown (10YR 5/2), fine grained, wet, contains trace gravel		127.0' - 137.0'	10.0'	100		-
- -									-
1.00 - ND ROOK ALLEN, 77677013 GPJ FMSM-GRAPHIC LOG. 6DT 127/					137.0' - 147.0'	8.0'	80		
									-



						5 -1	
l'ennessee \	alley Authority		Boring Loca	tion <u>N</u>	ot Yet Su	rveyed,	
nber 175577013			Surface Elev	vation 23	85.8 ft	Elevation [Datum NGVD29
	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
epth Description	n Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
Poorly Grac grayish brow fine grained trace grave	led Sand (SP), wn (10YR 5/2), l, wet, contains l <i>(Continued)</i>		147.0' - 157.0'	8.0'	80		- - -
						157 0'	-
			157.0' - 167.0'	9.0'	90		- - - - - - - - - - - - - - - -
			167.0' - 177.0'	6.5'	65		
			177.0' - 187.0'	7.0'	70	 187.0'	-
	hber <u>175577013</u> pth Description Poorly Grac grayish brow fine grained trace grave	uber 175577013 pth Description Sonic Core Poorly Graded Sand (SP), grayish brown (10YR 5/2), fine grained, wet, contains trace gravel (Continued)	hber 175577013 Overburden Sample # pth Description Sonic Core Poorly Graded Sand (SP), grayish brown (10YR 5/2), fine grained, wet, contains trace gravel (Continued)	Ibber 175577013 Surface Ele Overburden Sample # Depth pth Description Sonic Core Run Poorly Graded Sand (SP), grayish brown (10YR 5/2), fine grained, wet, contains trace gravel (Continued) 147.0' - 157.0' 147.0' Image: Second	ber 175577013 Surface Elevation 22 Ph Description Sonic Core Run Rec. Ft. Poorly Graded Sand (SP), grayish brown (10YR 5/2), fine grained, wet, contains trace gravel (Continued) 157.0'- 8.0' 157.0'- 9.0' 167.0' 9.0' 167.0' 6.5' 177.0' 6.5' 177.0' 7.0'	bber 175577013 Surface Elevation 235.8 ft pth Description Sonic Core Run Rec. Ft. Blows Poorly Graded Sand (SP), grayish brown (10YR 5/2), fine grained, wet, contains trace gravel (Continued) 147.0'- 157.0' 8.0' 80 157.0'- 167.0' 9.0' 90 157.0'- 167.0' 9.0' 90 157.0'- 167.0' 157.0'- 167.0'- 167.0' 157.0'- 167.0'- 167.0'- 157.0'- 167.0'- 167.0'- 167.0'- 157.0'- 167.0'- 167.0'- 167.0'- 167.0'- 167.0'- 157.0'- 167.0'-	ber 175577013 Surface Elevation 235.8 ft Elevation 1 Description Overburden Sample # Depth Rec. Ft. Blows Mois.Cont. % pth Description Sonic Core Run Rec. Ft. Blows Mois.Cont. % pth Description Sonic Core Run Rec. Ft. Rec. % Run Depth grayish brown (10YR 5/2), fine grained, wet, contains trace gravel (Continued) 147.0° - 157.0° 8.0° 80 157.0° 157.0° 8.0° 80 157.0° 157.0° 9.0° 90 167.0° 167.0° 167.0° 9.0° 90 167.0° 167.0° 167.0° 167.0° 167.0° 6.5° 65 177.0° 177.0° 187.0° 7.0° 7.0° 7.0° 187.0°



TV/A

ſ	Stantec	Borehol	e Identification AL	F-212C				Tota	I Boring De	pth 267.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ition No	ot Yet Su	rveyed,	
	Project I	Number	175577013			Surface Ele	vation 23	35.8 ft	Elevation [Datum NGVD29
t	Litholc	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	-		Poorly Graded Sa grayish brown (10 fine grained, wet, trace gravel <i>(Cor</i>	nd (SP), YR 5/2), contains ntinued)		187.0' - 197.0'	9.0'	90		
┟	-								197.0'	-
	· · · · · · · · · · · · · · · · · · ·					197.0' - 207.0'	3.0'	30		- - - - - -
	- - -								207.0'	
-	- - - -		6" Lens of Well Gr Sand with Gravel Brown (10YR 5/2) coarse grained sa gravel	raded (SW) , fine to nd and		207.0' - 217.0'	5.0'	50	 217.0'	
ROCK ALLEN_175577013.GPJ FMSM-GRAPHIC LOG.GDT 127/17	16.8' - 13.8' - - - 8.8'	219.0' 222.0' 227.0'	Well Graded Sand Gravel (SW), gray brown (10YR 5/2), coarse grained, we coarse grained gra Poorly Graded Sa grayish brown (10 fine grained, wet, trace gravel	J with rish , fine to et, fine to avel nd (SP), YR 5/2), contains		217.0' - 227.0'	10.0'	100	 227.0'	
OG - NO	-									_
VA SONIC BORING L	_									P.P. = 4.25 tsf -



TVA

Stantec	Stantec Borehole Identification _ALF-212C Total Boring Depth _267.0 ft									
Client		Tennessee Valley	Authority		Boring Loca	ation <u>No</u>	ot Yet Su	rveyed,		
Project I	Number	175577013			Surface Ele	vation 23	5.8 ft	Elevation I	Datum NGVD29	
Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
- - 1.8'	234.0'	Sandy Lean Clay dark gray (7.5YR hard, low to mediu plasticity, wet (classification bas	(CL), 4/1), ım ed on	-	227.0' - 237.0'	10.0'	100		P.P. = 4.0 tsf	
-		Particle Size and A Limits analysis, sa interval 230 0' - 23	Atterberg Imple					237.0'	P.P. > 4.5 tsf -	
-		<i>(Continued)</i> Lean Clay with Sa dark gray (7.5YR 4 hard, low to mediu	ind (CL), 4/1),	ST-1	237.0' - 239.0'	0.0'			- P.P. > 4.5 tsf —	
- - -8.2'	244.0'	plasticity, wet (classification bas Particle Size and / Limits analysis, sa intervals 240.01	ed on Atterberg Imple	-	239.0' - 247.0'	10.0'	125		-	
-		Fat Clay (CH), dar hard, medium plas	k gray, stic,					247.0'	P.P. > 4.5 tsf -	
-		moist (classification bas Particle Size and / Limits analysis, sa interval 247.3' - 24	ed on Atterberg Imple I7.4')	ST-2	247.0' - 249.0'	0.8'			- - P.P. >4.5 tsf —	
- - 18.2'	254.0'	Boorly Craded So	nd (SD)	-	249.0' - 257.0'	10.0'	125		-	
-		light gray (7.5YR 7 grained, wet	7/1), fine					257.0'	-	
		265'-265.5': 6" Ler	ns Gray		257.0' - 267.0'	10.0'	100		- 	
	007.01	Sandy Clayey Silt	(ML)					207.01	-	
5 -31.2'	267.0'	No Refusal / Bottom of Hole		<u> </u>				267.0'	 - - -	



Stantec	Borehol	e Identification AL	F-214C				Tota	l Boring De	pth 207.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	ot Yet Su	rveyed,	
Project	Number	175577013			Surface Ele	vation 2	17.5 ft	Elevation	Datum NGVD29
Project	Name	TVA-ALF Remedia	I Investigati	ion	Date Starte	d9/	/23/17	Completee	d 9/25/17
Project	Locatior	n Memphis, Tenn	essee		Depth to Wa	ater N	/A	Date/Time	9/25/17
Supervi	sor	C. Sutherland			Depth to Wa	ater N	/A	Date/Time	e N/A
Logged	by	Lee Eaves			Driller	Ja	ames Sm	ith	
Drilling	Contract	or Cascade Drilling	g		Drill Rig Typ	be and ID	Prosor	nic LS600 /	#10-00273
Overbur	den Dril	ling and Sampling To	ools (Type a	and Size) Sonic Tool	ing - 8" Bit	, 8" Casing	, 7" Barrel, 3.	5" Rods
Sample	r Hamme	er Type N/A	Weigh	t NA	Drop	NA	Ef	ficiency	NA
Borehol	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_ 217.5'	0.0'	Top of Hole							_
217.0'	0.5'_/	_∖Topsoil (6")		_					Boring
-		Silty Sand (SM), b	orown						abandoned
214.5'	3.0'	(7.5YR 4/4), fine g	rained,	_	0.0' - 7.0'	5.5'	79		upon completion
_			w graver		0.0 7.0	0.0			arouting to
F		Silty Sand (SM), b (7 5YR 4/4) fine c	orown Irained						surface with _
-		moist	jraincu,						30% solids
-								7.0'	
-	0.0'								P.P. = Pocket
208.5	9.0	Silty Loop Clay (C	1.1	-					Penetrometer
┝		brown (7.5YR 4/4)	·∟ <i>)</i> ,).						P.P. = 1.25 tsf
-		medium stiff, low	plasticity,		7 0' - 17 0'	8.0'	80		-
-		moist			1.0 - 11.0	0.0	00		
-									P.P. = 1.5 tsf
-									-
Γ									-
_								17.0'	
199.5'	18.0'			_					
_		Silty Sand (SM), b	orown						
197.5'	20.0'	(7.51R 4/4), fine g ∖wet	jrained, /	_					
196.5'	21.0'	∫ Silty Lean Clay (C	/	-	47.01				-
_		brown (7.5YR 4/4)),		17.0 [°] - 27.0'	5.5	55		-
_		medium stiff, low	plasticity,		21.0				-
I		moist							
- 101 5'	26.0'	Silty Sand (SM), b (7 5YR 4/4) fine c	orown Irained						
190.5'	27.0'	$\sqrt{\text{wet}}$	/ /	-				27 0'	
		Silty Lean Clay (C	L),	1					
189.0'	28.5'	brown (7.5YR 4/4)),	-					
<u> </u>	29.5'	meaium stiff, low	plasticity,	-					P.P. = 0.5 ISI



Stantec	Borehol	e Identification _AL	F-214C				Tota	I Boring De	oth 207.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	ot Yet Su	rveyed,	
Project I	Number	175577013			Surface Ele	vation 2	17.5 ft	Elevation I	Datum NGVD29
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
- - - -		moist Silty Sand (SM), b (7.5YR 4/4), fine g wet Sandy Lean Clay dark gray (7.5YR low plasticity, wet	orown grained, (CL), 4/1), soft,		27.0' - 37.0'	8.0'	80		
<u>180.5'</u> - - - - - -	37.0'	Silty Sand (SM), b (7.5YR 4/4), fine g wet (Continued) Well Graded Sand dark gray (7.5YR to medium grained contains trace gra	d (SW), 4/1), fine d, wet, vel		37.0' - 47.0'	6.0'	60		
170.5'	47.0'							47.0'	_
- - - - -		Well Graded Sand grayish brown (10 fine to medium gra wet, contains trace	d (SW), YR 5/2), ained, e gravel		47.0' - 57.0'	4.5'	45	 57.0'	-
					57.0' - 67.0'	6.0'	60		- - - - - - - - - - -
								07.0	



ſ	Stantec	Borehol	e Identification _AL				Tota	I Boring De	oth 207.0 ft	
	Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	ot Yet Su	rveyed,	
	Project I	Number	175577013			Surface Ele	vation 2	17.5 ft	Elevation I	Datum NGVD29
	Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
┢	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
			Well Graded Sand grayish brown (10 fine to medium gra wet, contains trace <i>(Continued)</i>	l (SW), YR 5/2), ained, e gravel		67.0' - 77.0'	3.0'	30		
ŀ									77.0'	-
						77.0' - 87.0'	9.0'	90		- - - - - - - - -
									87.0'	-
	-					87.0' - 97.0'	6.5'	65		
			96': trace sand an	d					97.0'	_
3 - NO ROCK ALLEN_175577013.GPJ FMSM-GRAPHIC LOG.GDT 125/17	-		decomposed woo	a		97.0' - 107.0'	6.5'	65	 107.0'	
RING LOG	109.5'	108.0'			-					-
TVA SONIC BOI	_									



Stantec	Borehol	e Identification AL	.F-214C		Total Boring Depth 207.0 ft				
Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u> e	ot Yet Su	rveyed,	
Project	Number	175577013			Surface Ele	vation 21	17.5 ft	Elevation [Datum NGVD29
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
- - 	115.0'	Well Graded Sand Gravel (SW), gray brown (10YR 5/2) coarse grained, w coarse grained gr contains trace wo fragments (Cont	Well Graded Sand with Gravel (SW), grayish brown (10YR 5/2), fine to coarse grained, wet, fine to coarse grained gravel, contains trace wood fragments (Continued) Well Graded Sand (SW), grayish brown (10YR 5/2), fine to medium grained,		107.0' - 117.0'	4.0'	40		- - - - -
-		Well Graded Sand (SW), grayish brown (10YR 5/2), fine to medium grained, wet, contains trace gravel							- - -
-					117.0' - 127.0'	3.5'	35		-
-								107.01	-
- 89.5'	128.0'							127.0	-
-		Lean Clay (CL), d (7.5YR 4/1), hard, medium plasticity (classification bas Particle Size and Limits analysis, sa interval 130.0' - 1	ark gray low to wet ed on Atterberg ample 30.5')	-	127.0' - 137.0'	10.0'	100	-	
80.5'	137.0'							137.0'	-
-		Fat Clay (CH) dar (7.5YR 4/1), hard plastic, moist	k gray medium	ST-1	137.0' - 139.0'	2.0'			
- - -		Particle Size and Limits analysis, sa interval 138.3' - 1	ea on Atterberg ample 38.7')		139.0' - 147.0'	8.0'	100		P.P. = 4.25 tst - - P.P. > 4.5 tsf - -
-								147 0'	-
-								147.0	-
67.5'	150.0'			_					- P.P. = 4.25 tsf -



Star	Stantec Borehole Identification ALF-214C				Total Boring Depth 207.0 ft				
Clie	nt	Tennessee Valley	Authority		Boring Loca	ation No	ot Yet Su	rveyed,	
Proj	ect Numbe	r 175577013			Surface Ele	vation 21	17.5 ft	Elevation	Datum NGVD29
L	ithology		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevati	on Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-		Lean Clay (CL), d (7.5YR 4/1), hard, medium plasticity (classification bas Particle Size and	ark gray low to wet ed on		147.0' - 157.0'	10.0'	100		
-		Limits analysis, sa interval 152.0' - 1 (Continued)	ample 52.5')					157.0'	P.P. > 4.5 tsf -
-									P.P. > 4.5 tsf -
_									P.P. = 4.25 tsf -
-					157.0' - 167.0'	10.0'	100		-
53.5	<u>' 164.0</u>	Lean Clay with Sa	and (CL),						P.P. = 1.5 tsf -
-		dark gray (7.5YR medium stiff, low wet	4/1), plasticity,					167.0'	P.P. = 1.75 tsf -
-		(classification bas Particle Size and	ed on Atterberg						P.P. = 1.75 tsf -
		interval 170.0' - 1	70.5')		407.01	40.01	400		P.P. = 1.75 tsf -
45.5	<u> </u>	Lean Clay (CL), d	ark gray		167.0' - 177.0'	10.0'	100		-
-		medium plasticity	wet						- P.P. = 1.75 tsf -
_								177.0'	-
39.5	5 178.0			-					-
13.6PJ FMSM-GRAPHICLOG GDT 125		Clayey Sand (SC) gray (7.5YR 4/1), grained, wet (classification bas Particle Size and Limits analysis, sa interval 183.0' - 18), dark fine ed on Atterberg ample 33.5')		177.0' - 187.0'	10.0'	100		- - P.P. = 4.25 tsf -
EN_175577									– P.P. > 4.5 tsf –
₹ <u>31.5</u>	3' 186.0 3' 187.0	' Clavey Silt (ML)	hark grav	-				187 0'	P.P. > 4.5 tsf -
00.00 - 00.00 - 00.00 - 00.00	, 107.0	(7.5YR 4/1), hard, medium plasticity	low to	-				107.0	-
26.5	; 191.0	(7.5YR 7/1), fine g	grained,						



Stantec	Stantec Borehole Identification ALF-214C Total Boring Depth 207.0 ft								
Client	Client Tennessee Valley Authority Boring Location Not Yet Surveyed,								
Project	Number	175577013			Surface Ele	vation 21	7.5 ft	Elevation [Datum NGVD29
Lithol	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-		wet Poorly Graded Sa light gray (7.5YR 7 grained, wet (Co	nd (SP), 7/1), fine ntinued)		187.0' - 197.0'	10.0'	100		- - -
								197.0'	-
-									-
-					197.0' - 207.0'	9.5'	95		-
F									-
10.5'	207.0'							207.0'	-
-		No Refusal / Bottom of Hole							- - -
- - -									- - -
									- - -
									-
MSM-GRAPI									-
7013.GPJ F									-
-TEN_17557								-	
								-	
46 L06 - N								-	
									-
M									-



Stantec	Borehol	e Identification AL	F-P-4C				Tota	I Boring De	pth 227.0 ft	
Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u>	ot Yet Su	rveyed,		
Project	Number	175577013			Surface Ele	vation 2	16.9 ft	Elevation	Datum NGVD29	
Project	Name	TVA-ALF Remedia	al Investigati	ion	Date Starte	d 9/	/28/17	Complete	d 9/30/17	
Project	Location	n Memphis, Tenn	essee		Depth to Wa	ater N	/A	Date/Time	9/30/17	
Supervi	sor	C. Sutherland			Depth to Wa	ater N	/A	Date/Time	e N/A	
Logged	by	Lee Eaves			Driller					
Drilling	Contract	or Cascade Drilling	g		Drill Rig Type and ID Prosonic LS600 / #10-0027					
Overbui	rden Dril	ling and Sampling To	ools (Type a	and Size	e) Sonic Tooling - 8" Bit, 8" Casing, 7" Barrel, 3.5" Rods					
Sample	r Hamme	er Type N/A	Weigh	t NA	Drop	NA	Et	ficiency	NA	
Borehol	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.	
Lithold	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
_ 216.9'	0.0'	Top of Hole								
216.4'	0.5'	Asphalt/ABC Ston	ie (6")	-					Boring	
-		Silty Sand (SM), b	orown						abandoned	
-		(7.5YR 4/4), fine to medium grained	0 moist		0.0' - 7.0'	7.0'	100		by tremie	
	5.01	contains trace gra	vel						grouting to	
_ 211.9	5.0			_					surface with _	
200.01	7.0'	grav (7.5 YR 3/1)	ery dark					7.0'	bentonite arout	
209.9	7.0	\neg grained, moist		_				7.0		
-		Silty Sand (SM), b	orown							
		(7.5YR 4/4), fine to medium grained	0 moist							
Γ		contains trace gra	vel						Penetrometer	
		-			7.0' - 17.0'	7.0'	70		Result	
202.9'	14.0'			_						
F		Sandy Silt (ML), v	ery dark						P.P. = 0.5 tsf -	
-		gray (7.5 YR 3/1), medium firm low	soft to plasticity						P.P. = 0.75 tsf	
E		wet	plastionty,					17.0'		
125									P.P. = 1.25 tsf	
									-	
									P.P. = 1.5 tsf -	
					17 0' -	6 5'	65		-	
13.GPJ					27.0'	0.5	00		-	
1755770									-	
									-	
190.9'	26.0'								-	
- 90 - 90		Well Graded Sand	d (SW),					27.0'		
		strong brown (7.5)	YR 5/6),							
ONCR		contains trace grai	neu, wet, vel							
186.9'	30.0'		-							


Stantec	Borehol	e Identification AL	F-P-4C				Tota	I Boring De	oth 227.0 ft
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	ot Yet Su	rveyed,	
Project	Number	175577013			Surface Ele	vation 21	16.9 ft	Elevation I	Datum NGVD29
Lithol	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
 _ <u>185.9'</u> _ _ _ _	31.0'	Sandy Fat Clay (C dark brown (7.5YF stiff, high plasticity Well Graded Sand strong brown (7.5 fine to coarse grai contains trace gra	CH), very R 2.5/2), /, wet d (SW), YR 5/6), ned, wet, vel		27.0' - 37.0'	5.0'	50		P.P. = 2.5 tsf _ _ _ _ _ _ _ _
					37.0' - 47.0'	4.5'	45		- - - - - - - - - - - - - - - -
166.9' 	50.0'	Well Graded Sand grayish brown (10 fine to coarse grai contains trace gra	d (SW), YR 5/2), ned, wet, vel		47.0' - 57.0'	8.0'	80		
VA SONIC BORING LOG- ND ROCK ALLEN 175577013 GPJ FMSM-SRAPHICLOG GDT 126/17		62'-67': contains tr gray silty fat clay (medium to high pl stiff, wet	race dark CH), asticity,		57.0' - 67.0'	6.0'	60	67.0'	



Stantec Borehole Identification ALF-P-4C Client Tennessee Valley Authority							Tota	I Boring De	oth 227.0 ft	
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	ot Yet Su	rveyed,	
	Project N	Number	175577013			Surface Eler	vation 21	6.9 ft	Elevation I	Datum NGVD29
	Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
╞	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
			Well Graded Sanc grayish brown (10 fine to coarse grai contains trace gra <i>(Continued)</i>	l (SW), YR 5/2), ned, wet, vel		67.0' - 77.0'	4.0'	40		-
ŀ									77.0'	_
	· · · · ·					77.0' - 87.0'	4.5'	45		- - - - - - - - - - - - - - - - -
	-					87.0' - 97.0'	2.0'	20	 97.0'	- - - - - - - -
2/5/17	-									
- NO ROCK ALLEN_175577013.GPJ FMSM-GRAPHIC LOG.GDT 12	- -		103': 4" seam of fi coarse gravel	ne to		97.0' - 107.0'	4.5'	45	 107.0'	
NG LOG	-									-
TVA SONIC BORI										-



Stantec Borehole Identification ALF-P-4C Client Tennessee Valley Authority							Tota	I Boring De	oth 227.0 ft
Client	Client Tennessee Valley Authority Project Number 175577013				Boring Loca	ation N	ot Yet Su	rveyed,	
Project	Number	175577013			Surface Ele	vation 2	16.9 ft	Elevation I	Datum NGVD29
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
- - -	Well Graded Sand grayish brown (10 fine to coarse grai contains trace gra <i>(Continued)</i>		d (SW), IYR 5/2), ined, wet, avel		107.0' - 117.0'	5.0'	50		
-								117.0'	-
					117.0' - 127.0'	1.5'	15		- - - - - - - -
- .								127.0'	-
88.9'	128.0'								-
-		Silty Fat Clay (CH gray (7.5YR 4/1), high plasticity, we	I), dark hard, t		127.0' - 137.0'	10.0'	100		
79.9'	137.0'							137.0'	-
		Lean Clay (CL), g (7.5YR 4/1), hard, plasticity, wet (classification bas Particle Size and Limits analysis, sa interval 137.6' - 1 152.0' - 152.5')	ray , medium ed on Atterberg ample 38' and	ST-1	137.0' - 139.0' 139.0' - 147.0'	1.3' 10.0'	125		P.P. = 4.0 tsf - P.P. > 4.5 tsf - P P = 3.75 tsf -
-								147.0'	
-									P.P. > 4.5 tsf



Stantec	itantec Borehole Identification <u>ALF-P-4C</u> lient <u>Tennessee Valley Authority</u>						Tota	I Boring De	oth 227.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u> e	ot Yet Su	rveyed,	
Project I	Number	175577013			Surface Ele	vation 21	16.9 ft	Elevation I	Datum NGVD29
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
- - - 62.9'	154.0'			-	147.0' - 157.0'	10.0'	100		- P.P. > 4.5 tsf -
-	150.01	Lean Clay (CL), gray (5Y 4/1), hard, moist, contains fine sand and silt Lean Clay with Sand (CL),						157.0'	– P.P. > 4.5 tsf - -
58.9' 55.9' 53.9' 51.9' 	158.0' 160.0' 161.0' 163.0' 165.0'	Lean Clay with Sa gray (5Y 4/1), very moist, fine grained Clayey Sand (SC) (5Y 4/1), wet, cont trace silt Lean Clay with Sa gray (5Y 4/1), very moist, fine grained Clayey Sand (SC) (5Y 4/1), wet, cont some silt Sandy Lean Clay gray (5Y 4/1), very moist, fine grained (classification bas Particle Size and / Limits analysis, sa interval 169.0' - 16	Lean Clay with Sand (CL), gray (5Y 4/1), very stiff, moist, fine grained sand Clayey Sand (SC), gray (5Y 4/1), wet, contains trace silt Lean Clay with Sand (CL), gray (5Y 4/1), very stiff, moist, fine grained sand Clayey Sand (SC), gray (5Y 4/1), wet, contains some silt Sandy Lean Clay (CL), gray (5Y 4/1), very stiff, moist, fine grained sand (classification based on Particle Size and Atterberg Limits analysis, sample		157.0' - 167.0' 167.0' - 177.0'	10.0'	100	 167.0'	P.P. = 4.0 tsf
-								177 0'	P.P. > 4.5 tsf -
- 	181 0'								- P.P. > 4.5 tsf - -
31.9'	185.0'	Clayey Sand (SC) to Sandy Silt (ML), gray (5Y 4/1), fine grained sand, wet			177.0' - 187.0'	10.0'	100		P.P. = 3.25 tsf -
		Lean Clay with Sand (CL) to Clayey Sand (SC), gray (5Y 4/2), stiff to very stiff,						187.0'	– P.P. > 4.5 tsf –
		(5Y 4/2), stiff to very stiff, moist to wet							- P.P. > 4.5 tsf - -



Stantec	Borehol	e Identification _AL	F-P-4C				Tota	I Boring De	oth 227.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u> e	ot Yet Su	rveyed,	
Project	Number	175577013			Surface Ele	vation 21	16.9 ft	Elevation I	Datum NGVD29
Lithold	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
- -	Lean Clay with Sand (CL) to Clayey Sand (SC), gray (5Y 4/2), stiff to very stiff, moist to wet <i>(Continued)</i>		nd (CL) C), gray ery stiff, ntinued)		187.0' - 197.0'	10.0'	100		- P.P. > 4.5 tsf -
20.4'	196.5'								P.P. = 2.5 tsf
19.9'	197.0	☐ Silty Sand (SM), g	ıray (5Y ┌	-				197.0'	-
 	202.0' 205.0' 208.0'	Slity Sand (SM), g 6/1), fine grained s moist to wet Clayey Sand (SC) (5Y 4/1), hard, we contains trace org material (classification bas Particle Size and A Limits analysis, sa interval 200.0' - 20 Clayey Silty Sand gray (5Y 6/1), fine sand, medium de Lean Clay (CL), g 4/1), hard, damp, fine grained sand Silty Sand (SM), g 6/1), fine grained, contains trace clay	ray (5Y sand, , gray t, anic ed on Atterberg ample 00.5') (SM), grained nse, wet ray (5Y contains lenses rray (5Y wet, y lenses		197.0' - 207.0' 207.0' - 217.0'	10.0'	100	 207.0'	
_								217.0'	-
-1.1' -1.1' -4.1' -4.1' -4.1'	218.0' 221.0' 227.0'	Clayey Sand (SC) (5Y 4/1), fine grain moist, lenses of fin grained silty sand (classification bas Particle Size and Limits analysis, sa interval 219.5' - 22 Silty Sand (SM), g 6/1), fine grained, contains trace classification	ed on Atterberg ample 20.0') rray (5Y wet, y lenses	-	217.0' - 227.0'	10.0'	100	 227.0'	-
SORING LOG - NOF	No Refusal / Bottom of Hole								
									-



ſ	Stantec	Borehol	e Identification ALI	F-213A				Tota	I Boring De	pth 167.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ation N	<u>35°04'17.</u>	.44", W90°0	7'57.41" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	37.7 ft	Elevation	Datum NGVD29
	Project I	Name	TVA-ALF RIWP W	ells		Date Starte	d _1	1/1/18	Completed	11/8/18
	Project	Locatior	Memphis, Tenn	essee		Depth to Wa	ater 4	0.00 ft	Date/Time	12/4/18
	Supervis	sor	Lee Eaves			Depth to Wa	ater N	/A	Date/Time	N/A
	Logged by Michael McDonald/ Lee Eaves					Driller Matt Pope				
	Drilling Contractor Cascade Drilling					Drill Rig Typ	be and I	D Prosor	nic LS600 /	#10-00273
	Overburden Drilling and Sampling Tools (Type and S) Sonic Tool	ing - 8" Bi	t, 8" Casing	, 6" Barrel, 3.	5" Rods
	Sampler Hammer Type <u>N/A</u> Weight					Drop	N/A	Ef	ficiency _	N/A
	Borehol	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclination	n (from Ve	ertical)	0 deg.
ľ	Lithology Overburden S					Depth	Rec. Ft.	Blows	Mois.Cont. %	-
┟	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
┟	_ 237.7'	0.0'	Top of Hole							
			l opsoil and grave	I						
	236.7'	1.0'			-					4" Monitoring
			Silty clay (CL), bro	wn, sand.						Well Installed,
			stiff, moist	,						Construction
	-									Log For Details
	234.7'	3.0'			-					-
	234.3'	3.4'	Clay (CH), gray, s	tiff, moist	_	0.0' - 7.0'	7.0'	100		
			Silty sand (SM) gra	ay,						
	-		sub-rounded fine-	grained						-
2/4/19			gravel, trace clay, damp, lenses of g	dense, rav clav.						
G.GDT			trace lignite	,,,						
MPHIC LC	_									_
-MSM-GR										
ST.GPJ										
013NEWE	-									-
N_175577										
CK ALLE										
3 - NO RO	-								7.0'	-
RING LOC										
SONIC BC										
TVA S										



ſ	Stantec Borehole Identification ALF-213A							Tota	I Boring De	oth 167.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'17.	.44", W90°0	7'57.41" (NAD83)
	Project I	Number	175577013			Surface Eler	vation 23	37.7 ft	Elevation I	Datum NGVD29
Ī	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
╞	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
			Silty sand (SM) gr fine-grained, trace sub-rounded fine- gravel, trace clay, damp, lenses of g trace lignite (Cor		7.0' - 17.0'	10.0'	100			
	224.2'	13.5'								-
	223.7'	14.0'	Clayey sand (SC) fine-grained, mois	, gray, t						_
ST.GPJ FMSM-GRAPHIC LOG.GDT 2/4/19	-		Silty sand (SM) gr fine-grained, trace sub-rounded fine- gravel, trace clay, damp, with lenses clay	ay, grained dense, s of silty						
5577013NEWE	220.7'	17.0'							17.0'	
VA SONIC BORING LOG - NO ROCK ALLEN_175	-		Silty sand (SM) gr fine-grained, trace sub-rounded fine- gravel, trace clay, organics, dense, o with lenses of clay trace lignite and o	ay, grained and Jamp, /ey sand, rganics						-



ſ	Stantec Borehole Identification ALF-213A							Tota	I Boring De	oth 167.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'17.	44", W90°0	7'57.41" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	37.7 ft	Elevation I	Datum NGVD29
Ī	Litholo	gy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	- -		Silty sand (SM) gr fine-grained, trace sub-rounded fine- gravel, trace clay, organics, dense, c with lenses of clay trace lignite and o <i>(Continued)</i>	ay, grained and lamp, /ey sand, rganics		17.0' - 27.0'	10.0'	100		
	214.7'	23.0'								_
	213.7'	24.0'	Sand (SW), slightl gray, fine- to medium-grained, _l sorted, moist	ly silty, poorly						
	-		Silty sand (SM) gr fine-grained, trace sub-rounded fine- gravel, trace clay, organics, dense, c with lenses of clay trace lignite and o	ay, grained and Jamp, vey sand, rganics	_					_
5PJ FMSM-GRAPHIC LOG.GDT 2/4/19									27.0'	-
LLLEN_175577013NEWEST.G	209.7'	28.0'								_
TVA SONIC BORING LOG - NO ROCK AI			Silty clay (CL), gra (2.5Y/4/1) medium trace of very fine-g sand and organics moist	ay n-stiff, grained s, very						_



ſ	Stantec Borehole Identification ALF-213A						Tota	I Boring De	pth 167.0 ft	
	Client	_	Tennessee Valley	Authority		Boring Loca	tion N	35°04'17.	44", W90°0	7'57.41" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	37.7 ft	Elevation I	Datum NGVD29
Ī	Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	_	Silty clay (CL), gray (2.5Y/4/1) medium-stiff, trace of very fine-grained sand and organics, very							_	
	moist (Continued)									
	206.7'	206.7' 31.0'								
	-	206.7' 31.0' Clay (CL to CH), bluish-gray (gley 4/N) with brownish-tan mottling, very stiff, moist			27.0' - 37.0'	10.0'	100		-	
ľ	-								-	
╞	204.2'	33.5'								
	-		orange-brown and (2.5Y 4/2) with rec staining (10YR 4/2 stiff, moist	gray I-brown I), very						-
ł	-									_
ł	-									-
4/19										
G.GDT 2/									37.0'	
APHIC LO	-									-
FMSM-GF										
EST.GPJ	_								_	
7013NEW										
LEN_1755;										
ROCK AL								-		
LOG - NO I										
BORING										
IVA SONIC										



ſ	Stantec Borehole Identification ALF-213A					Total Boring Depth 167.0 ft				
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'17.	.44", W90°0	7'57.41" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	37.7 ft	Elevation I	Datum NGVD29
	Litholc	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Clay (CL to CH), orange-brown and gray (2.5Y 4/2) with red-brown staining (10YR 4/4), very stiff, moist <i>(Continued)</i>							-	
		stiff, moist <i>(Continued)</i>								
╞	195.7'	195.7' 42.0'		-	37.0' -	10.0'	100		-	
		Clay (CL to CH), bluish-gray (gley 4/10Y), trace silt, very stiff, moist to very moist			47.0				-	
	192.7'	45.0'								_
			Clay (CL). slightly bluish-gray (2.5Y medium stiff to stif tan angular fine gr very moist	silty, 4/1), ff, trace ravel,						-
	101 2'	16 5'	5							
PHIC LOG.GDT 2/4/19	189.7'	191.2' 46.5' Clayey silt (ML), gray to bluish-gray, with some fine-grained sand, soft to medium stiff, wet						47.0'	-	
CCK ALLEN_175577013NEWEST.GPJ FMSM-GRAF	189.7' 48.0' Clay (CH), bluish-gray (2.5Y 4/1) and tan mottling, trace lignite fragments, very stiff, moist							-		
00 - NO	-									
TVA SONIC BORING L										



ſ	Stantec Borehole Identification <u>ALF-213A</u>							Tota	I Boring De	pth 167.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ition N	35°04'17.	.44", W90°0	7'57.41" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	37.7 ft	Elevation I	Datum NGVD29
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Clay (CH), bluish-gray (2.5Y 4/1) and tan mottling, trace lignite fragments, very stiff, moist <i>(Continued)</i>			47.0' -	10.0'	100		_	
					57.0					
┟	183.7'	54.0'			_					-
		Clayey silt (ML), gray, trace very fine-grained sand, medium stiff, moist								
┟	182.7'	55.0'			-					-
			Silty clay (CL), gra 4/1), with some ve fine-grained sand, very moist	ery stiff,						
╞	-								57.0'	
	470 -	50.01								
T 2/4/19	1/9.7'	58.0'	Clay (CL to CH)	lightly	-					-
C LOG.GD	179.2'	58.5'	silty, gray (gley 1 3	3/5GY),	-					
FMSM-GRAPHIC	178.7'	59.0'	sand, with parting	s of silty	-					-
EST.GPJ		Clayey Silt, loose								
75577013NEW	177.7'	<u>177.7'</u> 60.0' Clay (CL to CH), slightly silty, gray (gley 1 3/5GY), trace very fipe-grained								
O ROCK ALLEN 1			sand, stiff	s of silty						
C BORING LOG - N	176.7' 61.0' Sand (SW) slightly silty, gray with traces of black grains, fine to							-		
TVA SONK	medium-grained, dense, saturated									



ſ	Stantec Borehole Identification ALF-213A Client Tennessee Valley Authority						Tota	I Boring De	oth 167.0 ft	
	Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'17.	44", W90°0	7'57.41" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	37.7 ft	Elevation I	Datum NGVD29
	Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
╞	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	175.7'	62.0'	Clay (CL to CH), s ∃ silty, gray (gley 1 1	slightly 1/5GY), ┌	-	57.0' - 67.0'	10.0'	100		-
	174.7'	.7' 63.0'			07.0				_	
			Sand (SW) slightly silty, grayish-tan, fine to medium-grained, loose, wet Silty Sand (SM), gray							
	_		Silty Sand (SM), g fine-grained, with laminations and p clayey sand, loose medium-dense, w	ray, thin artings of e to et						_
		66.0	Sand (SW) slightly grayish-tan, fine to medium-grained, l medium dense, w lignite	y silty, o loose to et, trace	-				67.0'	-
	_		.g							-
.GDT 2/4/19	-									-
GPJ FMSM-GRAPHIC LOG	_									_
ALLEN_175577013NEWEST.	166.7'	71.0'								_
TVA SONIC BORING LOG - NO ROCK ,	-		Silty sand (SM), g fine-grained, trace sand partings, loo medium-dense, ve to wet	ray, e clayey se to ery moist		67.0' - 77.0'	8.0'	80		-



ſ	Stantec Borehole Identification ALF-213A				Total Boring Depth 167.0 ft					
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'17.	44", W90°0	7'57.41" (NAD83)
	Project N	Number	175577013			Surface Elev	vation 23	37.7 ft	Elevation I	Datum NGVD29
	Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	-		Silty sand (SM), g fine-grained, trace sand partings, loo medium-dense, ve to wet <i>(Continue</i>)	ray, e clayey se to ery moist d)						-
	_									_
	161 7'	76 0'								
		10.0	Well Graded Sand grayish-tan with multi-colored grain coarse-grained, sa trace sub-rounded	d (SW), ns, fine to aturated, I fine	-				77.0'	-
	-		gravel, trace lignit	e, wet						-
	-									-
HIC LOG.GDT 2/4/19	_									_
WEST.GPJ FMSM-GRAP	_									
JCK ALLEN_175577013NE						77.0' -	10.0'	100		
0G - NO R(-				87.0'				-	
TVA SONIC BORING LC	-		(82.5' - 83') Blacki organics with sand	sh-gray d						



TV/A

ſ	Stantec Borehole Identification ALF-213A Client Tennessee Valley Authority							Tota	I Boring De	oth 167.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'17.	44", W90°0	7'57.41" (NAD83)
	Project N	Number	175577013			Surface Elev	vation 23	37.7 ft	Elevation [Datum NGVD29
Ī	Litholo	ogy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	-		Well Graded Sand grayish-tan with multi-colored grair coarse-grained, sa trace sub-rounded gravel, trace lignite	d (SW), ns, fine to aturated, I fine e, wet						_
			(Continued)							
	-									_
	_									_
	150.7'	87.0'			_				87.0'	_
	-		Well Graded Sand grayish-tan with multi-colored grain medium-grained, the sub-angular to sub-rounded fine to	t (SW), ns, fine to trace						-
	_		medium gravel, tra lignite, saturated	ace						-
PHIC LOG.GDT 2/4/19	_									_
MSM-GRA	-									-
ST.GPJ F										
7013NEWE						87.0' -	5.0'	50		
EN_175577	-					97.0'				
- NO ROCK ALLE										
SONIC BORING LOG	-									-



Stantec Bore	Stantec Borehole Identification ALF-213A Client Tennessee Valley Authority					Tota	I Boring De	oth 167.0 ft
Client	Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'17.	44", W90°0	7'57.41" (NAD83)
Project Num	ber 175577013			Surface Elev	vation 23	37.7 ft	Elevation [Datum NGVD29
Lithology		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation Dep	oth Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
Lithologu Elevation Dep 	Stantec Borehole Identification <u>ALF-213A</u> Client <u>Tennessee Valley Authorit</u> Project Number <u>175577013</u> <u>Lithology Overbu</u> Elevation Depth Description Sonic O Well Graded Sand (SW), grayish-tan with multi-colored grains, fine medium-grained, trace sub-angular to sub-rounded fine to medium gravel, trace lignite, saturated (<i>Continued</i>)		Sample #	Depth Run 97.0' - 107.0'	Rec. Ft. Rec. Ft.	Blows Rec. %	Mois.Cont. % Run Depth 97.0'	Remarks
VA SONIC BORING LOG - NO ROCK ALLEN_175577013NEWEST.GP								_



ſ	Stantec Borehole Identification ALF-213A Client Tennessee Valley Authority						Tota	I Boring Dep	oth 167.0 ft	
	Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'17.	44", W90°0	7'57.41" (NAD83)
	Project N	Number	175577013			Surface Ele	vation 23	37.7 ft	Elevation [Datum NGVD29
Ī	Litholc	рду		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_	-		Well Graded Sand grayish-tan with multi-colored grain medium-grained, f sub-angular to sub-rounded fine t medium gravel, tra lignite, saturated (Continued)	d (SW), ns, fine to trace to ace					107.01	_
ł	-							107.0	-	
										_
										_
	_									_
/4/19										-
G.GDT 2	-					107.0' - 117.0'	7.0'	70		-
T.GPJ FMSM-GRAPHIC LO	-					117.0				_
ALLEN_175577013NEWES										
C BORING LOG - NO ROCK										_
TVA SON										_



Stantec Borehole Identification <u>ALF-213A</u>								Tota	I Boring De	oth 167.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'17.	44", W90°0	7'57.41" (NAD83)
	Project N	Number	175577013			Surface Elev	vation 23	37.7 ft	Elevation I	Datum NGVD29
ſ	Litholo	рду	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
╞	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	_ 122.2'	-115.5'-	Sand (SW), grayis with multi-colored fine to medium-gra with some coarse- sand, trace fine to sub-rounded grave orgaincs/wood, sa	h-tan grains, ained grained medium el and turated					117.0'	-
	- - 117 7'	120 0'								_
	116.7'	120.0	Clay (CL), slightly dark gray, with inte medium-grained s wet	silty, erbedded and, stiff,						_
1/4/19	115.2'	122.5'	Sand (SW), grayis with multi-colored fine to medium-gra trace of coarse-gra sand and thin clay partings, saturated	h-tan grains, ained, ained (CL)	-	117.0' - 127.0'	10.0'	100		_
FMSM-GRAPHIC LOG.GDT 2	-		Clay (CL to CH), g wet	ıray, stiff,						_
EST.GPJ	113.9' 123.8'		-							
ROCK ALLEN_175577013NEWE	113.2'	124.5'	Sand (SW), grayis with multi-colored fine to medium-gra trace of coarse-gra sand and thin clay	sh-tan grains, ained, ained (CL)	-					-
TVA SONIC BORING LOG - NO	-		partings, saturated							



ſ	Stantec Borehole Identification ALF-213A Client Tennessee Valley Authority							Tota	I Boring De	pth 167.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'17.	44", W90°0	7'57.41" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	37.7 ft	Elevation I	Datum NGVD29
ſ	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	110.7'	Clay (CL to CH), slightly silty, gray, with silty laminations and traces of 110.7' 127.0' thin sandy (SW) interbeds,						127.0'		
			(Continued)	/						
			Sand (SW), gravis with muli-colored	sh-tan grains,						
	-		trace coarse sand clay (CL to CH), tr to medium grained subrounded grave	, trace ace fine d						
	-		saturated, clay inte from 130.8'-134.0'	erbeds						
	_									_
	-					127 0' -	10.0'	100		-
	-					137.0'	10.0	100		-
PHIC LOG.GDT 2/4/19	-								-	
ISM-GRA	-									-
7013NEWEST.GPJ FN										
O ROCK ALLEN_17557	_									_
G LOG - N	-									-
IVA SONIC BORIN										



Stantec Borehole Identification ALF-213A						Tota	I Boring De	pth 167.0 ft	
Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'17.	.44", W90°0	7'57.41" (NAD83)
Project I	Number	175577013			Surface Ele	vation 23	37.7 ft	Elevation I	Datum NGVD29
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
Project I	ntcc Borehole Identification ALF-213A int Tennessee Valley Authority ject Number 175577013 ithology Overburden is ion Depth Description Sand (SW), grayish-tan with muli-colored grains, fine to medium grained, trace coarse sand, trace clay (CL to CH), trace fine to medium grained subrounded gravel, saturated, clay interbeds from 130.8'-134.0' nt nt 139.0' (Continued) Sand (SW), grayish-tan with muli-colored grains, medium grained, trace fine to coarse rounded gravel (up to 2.5" diameter), Clay (CH) gray interbeds 139.0'-139.4' and 140.0'-140.5' 2' 144.5' Silty sand (SM), grayish-brown, fine-grained, trace clay and some organics		Sample #	Surface Ele Depth Run 137.0' - 147.0'	vation 2 Rec. Ft. Rec. Ft. 10.0'	37.7 ft Blows Rec. %	Elevation I Mois.Cont. % Run Depth 137.0'	Datum_NGVD29	
93.2	144.5	Silty sand (SM),		-					
-	90 7' 147 0'								
90.7' 147.0'		_				147.0'	_		



Stantec Borehole Identification ALF-213A								Tota	I Boring De	oth 167.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'17.	44", W90°0	7'57.41" (NAD83)
	Project I	Number	175577013			Surface Elev	vation 23	37.7 ft	Elevation I	Datum NGVD29
	Litholc	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	-		Poorly Graded Sa with silt, gray, fine saturated <i>(Contir</i>	nd (SP) -grained, nued)						_
	-									_
	_									_
	-					147 0' -	10.0'	100		-
	-					157.0'	10.0	100		-
	-									_
3.GDT 2/4/19	_									_
ST.GPJ FMSM-GRAPHIC LOC	_									_
CK ALLEN_175577013NEWE.	_								157.0'	
A SONIC BORING LOG - NO ROU	_									-



Stantec	Borehol	e Identification ALI	-213A				Tota	I Boring De	oth 167.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ition N3		.44", W90°0	7'57.41" (NAD83)
Project I	Number	175577013			Surface Ele	vation 23	37.7 ft	Elevation [Datum NGVD29
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-		Poorly Graded Sa with silt, gray, fine- saturated (Contir	nd (SP) grained, <i>ued)</i>						-
_									_
77.2'	160.5'								
_		Silty Fat Clay (CH) greenish-gray (Gle 4/5GY), very stiff to wet, high plasticity), dark ey 1 o hard,						-
-					157.0' - 167.0'	8.0'	80		-
_									-
_									-
C LOG.GDT 24/19									_
	167.0'							167.0'	-
D ROCK ALLEN_175577013	No Refusal / Bottom of Hole								
TA SONIC BORING LOG - M	-								_



TVA SONIC BORING LOG - NO ROCK ALLEN_175577013NEWEST.GPJ FMSM-GRAPHIC LOG.GDT 2/4/19

SUBSURFACE LOG

Stantec	Borehol	e Identification AL	F-213B				Tota	I Boring De	pth 119.0 ft
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'17.	.35", W90°0	07'57.43" (NAD83)
Project I	Number	175577013			Surface Ele	vation 2	37.7 ft	Elevation	Datum NGVD29
Project I	Name	TVA-ALF RIWP W	ells		Date Started	d <u>1</u>	1/9/18	Completed	d <u>11/14/18</u>
Project	Locatior	Memphis, Tenn	essee		Depth to Wa	ater 3	9.86 ft	Date/Time	12/4/18
Supervis	sor	Stephen Karpe	nko		Depth to Wa	ater N	/A	Date/Time	e <u>N/A</u>
Logged	Logged by Stephen Karpenko					Μ	latt Pope		
Drilling (Drilling Contractor Cascade Drilling					e and ID	Prosor	nic LS600 / :	#10-00273
Overbur	den Dril	ling and Sampling T	ools (Type a	and Size) Sonic Tooli	ing - 8" Bit	, 8" Casing	, 6" Barrel, 3.	5" Rods
Sampler	Hamm	er Type N/A	Weight	N/A	Drop	N/A	Ef	ficiency _	N/A
Borehole	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	-
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_ 237.7'	0.0'	Top of Hole							
		Topsoll and grave							
236.7'	1.0'			-					4" Monitorina -
		Silty clay (CL), bro	own,						Well Installed,
		stiff, moist	Sanu,						Construction
_									Log For Details
234.7'	3.0'			_					-
234.3'	3.4'	Clay (CH), gray, s	tiff, moist			7.0'	100		
		Silty sand (SM) gr	ay,		0.0 - 7.0	7.0	100		
_		fine-grained, trace	e arained						_
		gravel, trace clay,	dense,						
		damp, lenses of g	ray clay,						
		u dee nginte							
									_
_									-
								7.0'	
									-



Stantec Borehole Identification ALF-213B							Tota	I Boring De	oth 119.0 ft	
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'17.	35", W90°0	7'57.43" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	37.7 ft	Elevation I	Datum NGVD29
ſ	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
┟	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
			Silty sand (SM) gr fine-grained, trace sub-rounded fine- gravel, trace clay, damp, lenses of g trace lignite <i>(Cor</i>	ay, grained dense, ray clay, <i>tinued)</i>						-
	-									_
						7.0' - 17.0'	10.0'	100		
	-									_
ŀ	-									-
╞	224.2'	13.5'	Clavay aand (SC)	arov	-					
	223.7'	14.0'	fine-grained, mois	, gray, t	-					_
19	_		Silty sand (SM) gr fine-grained, trace sub-rounded fine- gravel, trace clay, damp, with lenses	ay, grained dense, of silty						_
5577013NEWEST.GPJ FMSM-GRAPHIC LOG.GDT 2/4	220.7'	17.0'	clay						17.0'	-
X ALLEN_17			Silty sand (SM) gr fine-grained, trace	ay,						_
BORING LOG - NO ROC	-		sub-rounded fine- gravel, trace clay, organics, dense, o with lenses of clay	grained and lamp, /ey sand,						-
TVA SONICE			trace lignite and o	rganics						



ſ	Stantec Borehole Identification ALF-213B				Total Boring Depth 119.0 ft					
	Client Tennessee Valley Authority				Boring Location <u>N35°04'17.35", W90°07'57.43" (NAD8</u>					
	Project I	Number	175577013			Surface Ele	vation 23	37.7 ft	Elevation I	Datum NGVD29
	Litholo	gy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
╞	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_	Silty sand (SM) gray, fine-grained, trace sub-rounded fine-grained gravel, trace clay, and organics, dense, damp, with lenses of clayey sand, trace lignite and organics <i>(Continued)</i>									
	214.7'	23.0'				17.0' - 27.0'	10.0'	100		-
	213.7'	24.0'	Sand (SW), slightl gray, fine- to medium-grained, j sorted, moist	ly silty, poorly	-					-
2/4/19	_		Silty sand (SM) gr fine-grained, trace sub-rounded fine- gravel, trace clay, organics, dense, c with lenses of clay trace lignite and o	ay, grained and damp, /ey sand, rganics	-					
77013NEWEST.GPJ FMSM-GRAPHIC LOG.GDT									27.0'	-
LEN_1756	209.7' 28.0'									
TVA SONIC BORING LOG - NO ROCK ALI	-		Silty clay (CL), gra (2.5Y/4/1) medium trace of very fine-g sand and organics moist	ay n-stiff, grained s, very						



ſ	Stantec Borehole Identification ALF-213B Client Tennessee Valley Authority			-213B				Tota	I Boring De	oth 119.0 ft
	Client	_	Tennessee Valley	Authority		Boring Loca	tion N	35°04'17.	35", W90°0	7'57.43" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	37.7 ft	Elevation I	Datum NGVD29
Ī	Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
ļ	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	Silty clay (CL), gray (2.5Y/4/1) medium-stiff, trace of very fine-grained sand and organics, very							_		
	moist (Continued)									
	206.7' 31.0'									
	-		Clay (CL to CH), bluish-gray (gley 4 brownish-tan mott stiff, moist	/N) with ling, very	_	27.0' - 37.0'	10.0'	100		-
ľ	-									_
╞	204.2'	33.5'			-					
	-		orange-brown and (2.5Y 4/2) with rec	gray -brown						-
			staining (10YR 4/4 stiff, moist), very						
ľ	-									_
	-									-
T 2/4/19										
C LOG.GD	-								37.0'	_
ASM-GRAPHI										
EST.GPJ FA										
77013NEWE	-								-	
ALLEN_1755										
VO ROCK								-		
NG LOG - 1										
ONIC BOR										
TVA S.	_									



ſ	Stantec	Borehol	e Identification AL				Tota	I Boring De	oth 119.0 ft	
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'17.	.35", W90°0	7'57.43" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	37.7 ft	Elevation I	Datum NGVD29
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
╞	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Clay (CL to CH), orange-brown and gray (2.5Y 4/2) with red-brown staining (10YR 4/4), very stiff moist (Continued)							_	
		195 7' 42 0'			27.01	10.01	100			
	195.7' 42.0' Clay (CL to CH), bluish-gray (gley 4/10Y), trace silt, very stiff, moist to very moist		-	37.0' - 47.0'	10.0	100		-		
	very moist							-		
	192.7'	45.0'								
			Clay (CL). slightly bluish-gray (2.5Y medium stiff to sti tan angular fine gr very moist	silty, 4/1), ff, trace ravel,						-
	191.2'	46.5'								
SDT 2/4/19		Clayey silt (ML), gray to bluish-gray, with some fine-grained sand, soft to medium stiff, wet						47.0'	-	
HIC LOG.	189 7'	48 0'								
- NO ROCK ALLEN_175577013NEWEST.GPJ FMSM-GRAPH		Clay (CH), bluish-gray (2.5Y 4/1) and tan mottling, trace lignite fragments, very stiff, moist							_	
TVA SONIC BORING LOG	-									



ſ	Stantec Borehole Identification ALF-213B Client Tennessee Valley Authority Design 175577012							Tota	I Boring De	pth 119.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ition N	35°04'17.	.35", W90°0	7'57.43" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	37.7 ft	Elevation I	Datum NGVD29
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Clay (CH), bluish-gray (2.5Y 4/1) and tan mottling, trace lignite fragments, very stiff, moist <i>(Continued)</i>			47.0' -	10.0'	100		_	
	-					57.0				
╞	183.7'	54.0'		rou tropp	-					-
			very fine-grained s medium stiff, mois	sand, st						
╞	182.7'	55.0'		(=) (-					_
			Silty clay (CL), gra 4/1), with some ve fine-grained sand, very moist	ay (5Y ery stiff,						
ł	-								57.0'	-
<u>_</u>	179.7'	58.0'								
.GDT 2/4/1	470.0		Clay (CL to CH), s	lightly	1					-
VPHIC LOG	179.2	58.5	trace very fine-gra	ined [-					
-MSM-GRA	178.7'	59.0'	sand, with parting \neg sand, stiff	s of silty	-					-
EST.GPJ F		Clayey Silt, loose								
77013NEW.	477 71	Clay (CL to CH), slightly silty, gray (gley 1 3/5GY),								
ROCK ALLEN_1755	_ 1/7.7	trace very fine-grained sand, with partings of silty sand, stiff							_	
ORING LOG - NO	176.7' 61.0' Sand (SW) slightly silty, gray with traces of black		-					-		
IVA SONIC BC			medium-grained, saturated	dense,						



TVA

ſ	Stantec Borehole Identification ALF-213B Client Tennessee Valley Authority Design to the set three targets AZEE77042							Tota	I Boring De	oth 119.0 ft
	Client Tennessee Valley Authority Project Number 175577013					Boring Loca	tion <u>N</u>	35°04'17.	35", W90°0	7'57.43" (NAD83)
	Project N	Number	175577013			Surface Ele	vation 23	37.7 ft	Elevation I	Datum NGVD29
Ī	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	175.7'	62.0'	Clay (CL to CH), s ⊃ silty_gray (gley 1	slightly 1/5GY)	-	57.0' -	10.0'	100		-
	174.7'	63.0'	sand, with parting sand, stiff, moist to moist (Continued	ined s of silty o very		67.0				_
			Sand (SW) slightly grayish-tan, fine to medium-grained, wet	y silty, o loose,						
	_		Silty Sand (SM), g fine-grained, with laminations and p clayey sand, loose medium-dense, w	ray, thin artings of e to ret						_
-	171.7'	66.0'	Sand (SW) slightly grayish-tan, fine to medium-grained, medium dense, w lignite	y silty, o loose to et, trace	_				67.0'	-
	_		Ĵ							
DT 2/4/19										
PJ FMSM-GRAPHIC LOG.G	-									
ALLEN_175577013NEWEST.C	166.7'	71.0'								
VA SONIC BORING LOG - NO ROCK /	-		Silty sand (SM), g fine-grained, trace sand partings, loo medium-dense, ve to wet	ray, e clayey se to ery moist		67.0' - 77.0'	8.0'	80		_



TV/A

Stantec Borehole Identification ALF-213B Client Tennessee Valley Authority								Tota	I Boring De	oth 119.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'17.	35", W90°0	7'57.43" (NAD83)
	Project I	Number	175577013			Surface Elev	vation 23	37.7 ft	Elevation I	Datum NGVD29
	Litholc	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	-		Silty sand (SM), g fine-grained, trace sand partings, loo medium-dense, ve	ray, e clayey se to erv moist						-
	to wet <i>(Continued)</i>		d)						-	
ŀ	-									_
	161.7'	76.0'								
			Well Graded Sand grayish-tan with multi-colored grair	t (SW), ns, fine to						
	-		coarse-grained, sa trace sub-rounded gravel, trace lignit	aturated, I fine e. wet					77.0'	_
	_		9.2.2,	,						_
.GDT 2/4/19	-									-
SM-GRAPHIC LOG	-									_
VEWEST.GPJ FM	-									-
X ALLEN_1755770131						77 0'	10.0	100		
ING LOG - NO ROC	-					87.0'	10.0	100		-
/A SONIC BORI	_									_



TVA

ſ	Stantec	Borehol	e Identification _AL	F-213B				Tota	I Boring Dep	oth 119.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'17.	35", W90°0	7'57.43" (NAD83)
	Project I	Number	175577013			Surface Elev	vation 23	37.7 ft	Elevation [Datum NGVD29
Ī	Litholc	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
			Well Graded Sand grayish-tan with multi-colored grain coarse-grained, sa trace sub-rounded	d (SW), ns, fine to aturated,						-
			gravel, trace lignit (Continued)	e, wet						
	_									_
	_									_
	150.7'	87.0'			-				87.0'	-
	_		Poorly Graded Sa grey, fine grained, saturated, trace gr trace medium to c sand, trace organi	nd (SP), loose, ravel, oarse cs						-
										_
APHIC LOG.GDT 2/4/19										
3NEWEST.GPJ FMSM-GF						87 0'	3 0'	30		
NO ROCK ALLEN_17557701	-					97.0'	5.0	50		-
VA SONIC BORING LOG - N	-									_



ſ	Stantec Borehole Identification ALF-213B Client Tennessee Valley Authority Desired Numbers 175577040							Tota	I Boring Dep	oth 119.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'17.	35", W90°0	7'57.43" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	37.7 ft	Elevation [Datum NGVD29
ľ	Litholc	рду		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	_		Poorly Graded Sa grey, fine grained, saturated, trace gr trace medium to c sand, trace organi (Continued)	nd (SP), loose, ravel, oarse cs						_
	-								97.0'	-
	_									_
	-									_
	_									_
2/4/19	-									_
MSM-GRAPHIC LOG.GDT	_					97.0' -	8.0'	80		_
175577013NE WEST.GPJ F	_					107.0'				
ING LOG - NO ROCK ALLEN	_									
IVA SONIC BOR										



ſ	Stantec Borehole Identification ALF-213B Client Tennessee Valley Authority							Tota	I Boring Dep	oth 119.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'17.	35", W90°0	7'57.43" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	37.7 ft	Elevation I	Datum NGVD29
ľ	Litholo	рду		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	_		Poorly Graded Sa grey, fine grained, saturated, trace gr trace medium to c sand, trace organi (Continued)	nd (SP), loose, avel, oarse cs						_
	_								107.0'	_
	-									-
	_									_
	_									-
SDT 2/4/19	-					107.0' -	7.0'	70		-
ST.GPJ FMSM-GRAPHIC LOG.(_					117.0'				-
ALLEN_175577013NEWE										
SONIC BORING LOG - NO ROCK	_									_
ΓA.										



S	tantec	Borehol	e Identification ALI	-213B				Tota	I Boring Dep	oth 119.0 ft
c	lient		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'17.	.35", W90°0	7'57.43" (NAD83)
P	roject I	Number	175577013			Surface Ele	vation 23	87.7 ft	Elevation I	Datum NGVD29
	Litholo	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Ele	vation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_ 12	Poorly Graded Sand (SP), grey, fine grained, loose, saturated, trace gravel, trace medium to coarse sand, trace organics <i>(Continued)</i> (116' to 117') Organics and gravel No Recovery								117.0'	-
_						117.0' - 119.0'	0.0'	0		_
11	8.7'	119.0'							119.0'	
-00N0 ROCK ALLEN_TT#277013KE/WEST.GPJ FM8KI-GRAMERIC LOG.GDT 2/4/19			No Refusal / Bottom of Hole							-
TVA SONIC BORING LC									_	



SUBSURFACE LOG

Stantec	Borehol	e Identification _AL	-217				Tota	I Boring De	pth 69.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'12.	87", W90°0	7'57.90" (NAD83)
Project I	Number	175577013			Surface Ele	vation 2	37.4 ft	Elevation	Datum NGVD29
Project I	Name	TVA-ALF RIWP W	ells		Date Started	d 1	1/20/18	Completed	d 11/21/18
Project	Locatior	Memphis, Tenno	essee		Depth to Wa	ater 2	4.26 ft	Date/Time	12/4/18
Supervis	sor	Stephen Karper	ıko		Depth to Wa	ater N	/A	Date/Time	N/A
Logged	by	Stephen Karper	ıko		Driller	N	latt Pope		
Drilling (Contract	or Cascade Drilling]		Drill Rig Typ	e and I	Prosor	nic LS600 /	#10-00273
Overbur	den Dril	ling and Sampling To	ools (Type a	and Size) Sonic Tooli	ing - 8" Bi	t, 8" Casing	, 6" Barrel, 3.	5" Rods
Sampler	r Hamme	er Type N/A	Weight	tN/A	Drop	N/A	Ef	ficiency _	N/A
Borehol	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
Litholo	ogy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_ 237.4'	0.0'	Top of Hole							
236.4'	1 0'	I opsoil and grave							
200.4	1.0	Silty clay (CL), bro	wn,						4" Monitoring Well Installed.
_		trace fine-grained	sand,						See Well
224 4'	3 0'								Log For Details
234.4	3.4'	_ Clav (CH). grav. st	tiff. moist _		0.0' - 7.0'	7.0'	100		
_		Silty sand (SM) gra	ay,						
		fine-grained, trace	arained						
F		gravel, trace clay,	dense,						-
_		trace lignite	ay clay,						
-								7.0'	
0T 2/4/19									
- C F00.0E									-
1-GRAPHI									
PJ FWSN									-
E WEST.G									
5577013N					7 01 47 01	40.01	100		
121 12					7.0 - 17.0	10.0	100		-
0 ROCK									
223.9'	13.5'			-					
223.4'	14.0'	Clayey sand (SC),	gray, t ∕⁻	-					-
VA SONIC			/						



Stantec Borehole Identification ALF-217 Client Tennessee Valley Authority Project Number 175577013								Tota	I Boring De	oth 69.0 ft
Client Tennessee Valley Authority Project Number 175577013						Boring Loca	ition <u>N</u>	35°04'12	.87", W90°0	7'57.90" (NAD83)
	Project N	Number	175577013			Surface Ele	vation 23	37.4 ft	Elevation I	Datum NGVD29
	Litholo	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_	- Silty sand (SM) gray, fine-grained, trace sub-rounded fine-grained gravel, trace clay, dense, damp, with lenses of silty						17.0'			
-	-		Silty sand (SM) gr fine-grained, trace sub-rounded fine- gravel, trace clay, organics, dense, c with lenses of clay trace lignite and o	ay, grained and damp, /ey sand, rganics						-
-						17.0' - 27.0'	10.0'	100		_
╞	214.4'	23.0'	Cand (CM/) alight							_
-	213.4'	24.0'	sand (SW), slight gray, fine- to ∖ medium-grained, \sorted, moist	poorly						_
_	-	Silty sand (SM) gray, fine-grained, trace sub-rounded fine-grain- gravel, trace clay, and organics, dense, damp with lenses of clayey sa		ay, grained and Jamp, yey sand, rganics					27.0'	-
	209.4'	28.0'		gamoo						_
I FMSM-GRAPHIC LOG.GDT 2/4/19	-		Silty clay (CL), gra (2.5Y/4/1) medium trace of very fine-of sand and organics moist	ay 1-stiff, grained s, very						-
VEST.GP.	206.4'	206.4' 31.0' Clay (CL to CH), bluish-gray (gley 4/N) with brownish-tan mottling, very stiff, moist 203.9' 33.5'								_
- NO ROCK ALLEN_175577013NEV	203 9'				27.0' - 37.0'	10.0'	100		-	
TVA SONIC BORING LOG		00.0								-



Stantec Borehole Identification ALF-217 Client Tennessee Valley Authority Project Number 175577013								Tota	I Boring De	pth 69.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'12.	.87", W90°0	7'57.90" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	37.4 ft	Elevation I	Datum NGVD29
	Litholo	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
╞	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
			Clay (CL to CH), orange-brown and (2.5Y 4/2) with rec staining (10YR 4/4 stiff, moist <i>(Conti</i>	l gray I-brown I), very <i>nued)</i>					37.0'	-
	-									-
ľ	195.4' 42.0'									-
╞			-	37.0' - 47.0'	10.0'	100		-		
		Clay (CL to CH), bluish-gray (gley 4/10Y), trace silt, very stiff, moist to very moist		/10Y), , moist to		47.0				-
ľ	-									-
╞	192.4'	45.0'			-					_
	190.9'	46.5'	Clay (CL). slightly bluish-gray (2.5Y medium stiff to stil	silty, 4/1), ff, trace						-
	190.4'	47.0'	very moist		-				47.0'	
T 2/4/19	-		Clayey silt (ML), g bluish-gray, with s fine-grained sand, medium stiff, wet	ray to ome soft to						-
MSM-GRAPHIC LOG.GD	-	Fat Clay, (CH), gray, high plasticity, medium stiff, saturated, trace silt and very fine-grained sand		ay, high stiff, lt and sand						-
ST.GPJ F.		very fine-grained sand							_	
7013NEWE	105 4			47.01	40.01	400				
EN_17557.	185.4	52.U [°]	Sandv Silt with Cla	av (ML).	-	47.0' - 57.0'	10.0	100		-
3 - NO ROCK ALL	-		gray, soft to mediu saturated, with ve fine-grained sand	um stiff, ry						-
ORING LOI	-		_							-
TVA SONIC BI	-									


Stantec	Borehol	e Identification _AL	F-217				Tota	I Boring Dep	oth 69.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u>	35°04'12	.87", W90°0	7'57.90" (NAD83)
Project I	Number	175577013			Surface Ele	vation 23	37.4 ft	Elevation [Datum NGVD29
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	Sandy Silt with Clay (ML), gray, soft to medium stiff, saturated, with very fine-grained sand (Continued)						57.0'	-	
	178 // 59 0/								
<u> 178.4'</u> _ _ _ _	'8.4' 59.0' Silty Sand with Clay (SM), gray, very fine- to fine-grained, loose to medium dense, saturated, with lenses of clay (CH) from 60.5-62.0 and 63.5-65.5			57.0' - 67.0'	10.0'	100			
-								67.0'	-
-					67.0' - 69.0'	2.0'	100		-
168.4'	69.0'							69.0'	
A SONIC BORING LOG - NO ROCK ALLEN, 175577013NEWESTGPJ FMSM-GRAPHIC LOG.	Bottom of Hole								-



-										
	Stantec	Borehol	e Identification AL	F-217B				Tota	I Boring De	pth 128.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'12.	94", W90°0	07'57.84" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	37.3 ft	Elevation	Datum NGVD29
	Project I	Name	TVA-ALF RIWP W	'ells		Date Started	d _1	1/19/18	Completed	d <u>11/20/18</u>
	Project	Locatior	Memphis, Tenn	iessee		Depth to Wa	ater 4	0.22 ft	Date/Time	12/4/18
	Supervis	sor	Lee Eaves			Depth to Wa	ater N	/A	Date/Time	e <u>N/A</u>
	Logged	by	Lee Eaves			Driller	Ν	latt Pope		
	Drilling (Contract	or Cascade Drillin	g		Drill Rig Typ	e and II	D Prosor	nic LS600 /	#10-00273
	Overbur	den Dril	ling and Sampling T	ools (Type a	and Size) Sonic Tooli	ing - 8" Bi	t, 8" Casing	, 6" Barrel, 3.	5" Rods
	Sampler	Hamme	er Type <u>N/A</u>	Weight	t N/A	Drop	N/A	Ef	ficiency _	N/A
	Borehole	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclination	n (from Ve	ertical)	0 deg.
	Litholo	уgy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	-
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	237.3	0.0'	Topsoil							
	230.7	0.0	Clay with Silt (Cl -	-ML)	-					4" Monitoring
			sandy, brown, me	dium						Well Installed,
	_		sun, moist							See Well Construction
	234.3'	3.0'								Log For Details
			Clayey Silt (ML), t	orown						
	-		and gray, medium moist	n stiff,						
	232.3'	5.0'								
			Clayey Silt (ML), g	gray,						-
	_		medium stiff, som fine-grained sand	e . trace						
	230 3'	7 O'	dark gray clay len	ses,						
ł	200.0	7.0	Sandy Silt (ML to	SM)	-					
19	229.3'	8.0'	gray, fine-grained	, trace	-					
6.GDT 2/4			Ciay, moist	/						
PHIC LOG	-		loose, fine-graine	d, with						
VISM-GRA	_		laminated dark-gr clay, moist	ay silty						_
ST.GPJ FI										
113NE WE	_									
1755770	_									
CK ALLEN										
3 - NO RO	224.3'	13.0'	Sandy Silt (ML) o	irav to	-					
RING LOC			dark gray, trace c	lay and						
SONIC BO			organics, moist							
\$	222.3'	15.0'								1



	Stantec	Borehol	e Identification AL	F-217B				Tota	I Boring De	oth 128.0 ft
	Client Tennessee Valley Authority Project Number 175577013					Boring Loca	ation <u>N</u>	35°04'12.	.94", W90°0	7'57.84" (NAD83)
	Project I	Number	175577013			Surface Ele	evation 23	37.3 ft	Elevation I	Datum NGVD29
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_	220.3' 17.0' Interbedded Sandy Silt (ML) and Silty Sand (SC), dark gray, loose, fine-grained, trace organics, moist			-					-	
-	Sandy Silt (ML), tanish-gray to dark gray, very fine-grained, trace clay, organics and wood fragments, with lenses of fine-grained sand, moist, (18.0'-18.5') Sand (SP), silty, gray, loose, fine-grained, moist, (19.7'-20.0') Clayey-silt									
-	211.3'	26.0'			-					-
_			Clayey Silt (ML), g dark gray, soft to r stiff, trace very find sand, moist	gray to medium e-grained						-
MSM-GRAPHIC LOG.GDT 2/4/1:	208.8' 28.5' Clay (CH), dark brownish-gray, very stiff, trace organics, very moist		-					-		
A SONIC BORING LOG - NO ROCK ALLEN_175577013NEWEST.GPJ FI	Clay (CH), gray and brown with orange-brown to reddish-brown staining, hard, moist							-		



ſ	Stantec	Borehol	e Identification AL				Tota	I Boring De	oth 128.0 ft	
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'12.	94", W90°0	7'57.84" (NAD83)
	Project N	Number	175577013			Surface Elev	vation 2	37.3 ft	Elevation I	Datum NGVD29
	Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	-		Clay (CH), gray ar with orange-browr reddish-brown sta hard, moist <i>(Con</i>	nd brown n to ining, <i>tinued)</i>						_
ľ								_		
	_									_
	-									_
$\left \right $	195.8' 41.5'		-							
ŀ	<u>195.3'</u> <u>42.0'</u> Clay (CH), dark gray, very stiff, very moist							-		
	-	Sandy Clay with Silt (CL), dark gray, soft to medium stiff, wet, fine-grained sand							-	
	192.3'	45.0'								_
	191.3'	46.0'	Clayey Sand with dark gray, loose, v ⊃ to fine-grained we	Silt (SC), very fine	-					-
	189.8'	47.5'	Silty to Clayey San SC), dark gray, tra	nd (SM to ace						-
DT 2/4/19	189.3'	48.0'	Silty Sandy Clay (gray, soft, wet, fine	CL), dark						_
M-GRAPHIC LOG.GE	-		Clay (CH), dark gr some tan mottling	ay with , stiff to						_
VEST.GPJ FMSN	wet							_		
175577013NEV								-		
O ROCK ALLEN								-		
NG LOG - N	183.3' 54.0'		_					-		
IVA SONIC BORI									_	



ſ	Stantec	Borehol	e Identification AL				Tota	I Boring De	oth 128.0 ft	
	Client		Tennessee Valley		Boring Loca	ition <u>N</u>	35°04'12.	.94", W90°0	7'57.84" (NAD83)	
	Project I	Number	175577013			Surface Elev	vation 23	37.3 ft	Elevation I	Datum NGVD29
ſ	Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
┟	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	Clay some fine s stiff, t (Cont 178.8' 58.5'		Clay (CH), dark gr some tan mottling fine sand, soft to r stiff, trace organic <i>(Continued)</i>	ay with , some nedium s, wet						-
	178.8'	58.5'			_					
ŀ	178.3'	59.0'	Clayey Sand (SC) dark gray, loose, fine-grained, wet	gray to	-					_
	-		Silty Sand (SM), d loose, wet to satur with some partings (CH)	ark gray, rated, s of clay						-
	174.8'	174.8' 62.5'							=	
	-	65.0'	Sandy Clay (CL), gray, stiff, moist, s sand fine-grained	dark some silt,						_
	170.3'	67.0'	Sandy Clay (CL), gray, interbedded sand (SM), sand fine-grained, wet	dark silty						-
ŀ	170.5	07.0	Sand with silt (SW	() dark	-					_
-	169.3'	68.0'	gray, loose, fine to medium-grained, s	saturated /	-					-
RAPHIC LOG.GDT 2/4/1	167.8'	<u>167.8'</u> <u>69.5'</u> <u>Silty Clay with Sand (CL), dark gray, soft to medium stiff, with lenses of silty sand (SM) wet</u>		nd (CL), medium f silty	-					_
WEST.GPJ FMSM-G	166.3' 71.0' grayish-brown, very stiff,		-					-		
ROCK ALLEN_175577013NE	Sand (SW), tan to gray, fine-grained with some medium-grained, wet,trace silt, trace organics and thin lenses of clay (CL)							-		
SLOG - NO	lenses of clay (CL)							_		
TVA SONIC BORING	-							_		



ſ	Stantec	Borehol	e Identification AL				Tota	I Boring De	oth 128.0 ft	
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'12.	94", W90°0	7'57.84" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	37.3 ft	Elevation I	Datum NGVD29
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
╞	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
ł	-									-
	160.3'	77.0'								
			Well Graded Sand	d (SW),						
┢	-		medium-grained,	wet,						-
			trace of organics a	and el trace						
	-		lignite							_
┢	_									-
ľ	-									-
╞	-									-
ľ	-									-
	-									-
ľ	-									
╞	-									-
	-									_
+	-									-
2/4/19										
LOG.GDT	-									_
GRAPHIC	-									-
PJ FMSM										
EWEST.GI	-									-
75577013N								-		
ALLEN_17										
VO ROCK								_		
1 - 90 T 91	-									-
VIC BORIN										
TVA SON	-							_		



ſ	Stantec	Borehol	e Identification AL	F-217B				Tota	I Boring De	oth 128.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ation N	35°04'12	.94", W90°0	7'57.84" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	37.3 ft	Elevation I	Datum NGVD29
Ī	Litholo	рду		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	-		Well Graded Sand tan to gray, fine to medium-grained, trace of organics a rounded fine grave	l (SW), wet, and el, trace						-
	-								-	
	-									-
	-									-
	-									-
	132.3'	105.0'			_					_
-	-		Well Graded Sand tan to gray, fine- to medium-grained, sub-rounded fine and lenses of sub- coarse-grained sa	l (SW), o wet, with gravel -rounded nd						-
$\left \right $	129.3'	108.0'	Well Graded Sand	I (SW),	-					-
HIC LOG.GDT 2/4/19	-	tan to gray, fine to medium-grained, loose, saturated, trace							_	
J FMSM-GRAPH	_		trace silt	<u>.</u> ,						_
113NEWEST.GP.	_									
ALLEN_1755770	_									
LOG - NO ROCK /	-									-
ONIC BORING	_ 122.3'	115.0'			-					_
TVAS										



Stantec	Borehol	e Identification Al I	F-217B				Tota	l Boring Der	oth 128.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ation N'	 35°04'12	94" W90°0	7'57 84" (NAD83)
Project	Number	175577013	lationty		Surface Fle	vation 23	37 3 ft	Elevation [Datum NGVD29
Lithol			Overburden	Sample #		Rec. Ft	Blows	Mois Cont %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		ii							
- - - - -	Well Graded Sand (SW), tan to gray, with some silty sand partings, sub-rounded, some coarse sand, fine- to medium-grained, saturated, trace sub-rounded fine gravel, trace sub-round cobbles (Continued) Well Graded Sand (SW), grayish-brown, fine-grained, wet, trace								-
-	grayish-brown, fine-grained, wet, trace 1/4" to 1/2" gravel				118.0' - 128.0'	6.0'	60		-
-	128 0'							128.0'	-
	120.0	No Refusal /			L			120.0	l
.06.6DT 2/4/19 		Bottom of Hole							-
ISM-GRAPHIC									-
MEST.GPJ FN									-
175577013NEV									-
ROCK ALLEN								-	
NG LOG - NO									-
VA SONIC BORI									_



	Stantec Borehole Identification ALF-217A									
S	Stantec Borehole Identification ALF-217A Client Tennessee Valley Authority							Tota	I Boring De	pth 207.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'13.	.01", W90°C	07'57.84" (NAD83)
F	Project N	Number	175577013			Surface Ele	vation 2	37.4 ft	Elevation	Datum NGVD29
F	Project N	Name	TVA-ALF RIWP W	/ells		Date Starte	d _1	1/15/18	Completee	d <u>11/19/18</u>
F	Project	Locatior	Memphis, Tenr	iessee		Depth to Wa	ater 4	0.23 ft	Date/Time	12/4/18
s	Supervis	sor	Michael McDor	nald		Depth to Wa	ater N	/A	Date/Time	e <u>N/A</u>
L	ogged	by	Michael McDor	nald		Driller	Ν	latt Pope		
	Drilling Contractor Cascade Drilling					Drill Rig Typ	be and II	D Prosor	nic LS600 /	#10-00273
	Overburden Drilling and Sampling Tools (Type and				and Size) Sonic Tool	ing - 8" Bi	t, 8" Casing	, 6" Barrel, 3.	5" Rods
s	Sampler Hammer Type N/A Weight				tN/A	Drop	N/A	Ef	ficiency _	N/A
B	Borehole	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclination	n (from Ve	ertical)	0 deg.
	Litholo	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	,
Ele	evation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
23	37.4'	0.0'	Top of Hole							
23	36.8'	0.6'	Iopsoil							
-			Clay with Silt (CL- sandy, brown, me	-ML), dium						4" Monitoring
			stiff, moist							See Well
-										Construction
23	34.4'	3.0'	Clavey Silt (ML)		-		7.01	400		-
			and gray, medium	n stiff,		0.0' - 7.0'	7.0'	100		
-			moist							
_{2'}	22 11	5 O'								
	52.4	5.0	Clavev Silt (ML).	orav.	-					-
			medium stiff, som	le tracc						
-			dark gray clay len	, trace ses,						
T 2/4/19	20 41	7.0'	moist						7.0'	
	50.4	7.0	Sandy Silt (ML to	SM).					7.0	-
-GRAPHI	20 /1	8 O'	gray, fine-grained	, trace						
PJ EMSN	2J.7	0.0	Silty Sand (SM)		-					
EWEST.G			loose, fine-graine	d, with						
5577013N	laminated dark-gray silty clay, moist									
rtren_17	clay, moist									
										-
LOG - NC										
BORING										
VA SONIC						7.0' - 17.0'	10.0'	100		



Γ	Stantec	Borehol	e Identification AL				Tota	I Boring De	pth 207.0 ft	
	Client Tennessee Valley Authority Project Number 175577013					Boring Loca	ition <u>N</u>	35°04'13.	01", W90°0	7'57.84" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	37.4 ft	Elevation I	Datum NGVD29
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
┢										_
ŀ	224.4'	13.0'	Sandy Silt (ML) a	ray to	-					-
		Sandy Silt (ML), gray to dark gray, trace clay and								
ŀ		organics, moist							_	
	000 (1	45 01	.0'							
F	222.4	15.0	Interbedded Sand	Interbedded Sandy Silt						
		Interbedded Sandy Silt (ML) and Silty Sand (SC),								
F			fine-grained, trace	•						-
	220 41	a' 17.0'						17.0'		
	220.4	17.0	Sandy Silt (ML),		-				17.0	
			tanish-gray to darl	k gray, trace						
F			clay, organics and	wood						-
			fragments, with le fine-grained sand.	nses of moist,						
			(18.0 ^{-18.5}) Sand	(SP), [′]						-
			fine-grained, mois	t,						
	-		(19.7'-20.0') Claye	ey-silt						_
										_
						17.0' -	10.0'	100		
						27.0'				_
DT 2/4/19										_
IC LOG.G										
M-GRAPH										_
GPJ FMS										
NEWEST	-								_	
755770131										
ALLEN_1	211.4'	211.4' 26.0'		-					-	
NO ROCK			Clayey Silt (ML), g	ray to medium						
1-901.01			stiff, trace very find	e-grained					27.0'	-
JIC BORIN			sana, moist							
TVA SON										_



Stantec	Borehol	e Identification _AL				Tota	I Boring De	oth 207.0 ft	
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'13.	.01", W90°0	7'57.84" (NAD83)
Project I	Number	175577013			Surface Ele	vation 23	37.4 ft	Elevation I	Datum NGVD29
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
208.9'	28.5'								
-		Clay (CH), dark brownish-gray, ve	ry stiff,						-
		trace organics, ve	ry moist						29.7-30.3 very
206.7'	30.7'								son, wei –
-		Clay (CH), gray an with orange-brown	nd brown n to						-
-		reddish-brown staining, hard, moist			27.0' -	10.0'	100		-
					37.0				
-									-
-									-
									_
_									
-									-
-								37.0'	-
									_
-									-
-									-
195.9'	41.5'			_					-
195.4'	42.0'	Clay (CH), dark gi stiff, very moist	ray, very	-	37.0' - 47.0'	10.0'	100		-
		Sandy Clay with S dark gray, soft to	Silt (CL), medium						
		stiff, wet, fine-grai	Sandy Clay with Silt (CL), dark gray, soft to medium stiff, wet, fine-grained sand						



Γ	Stantec	Borehol	e Identification AL	F-217A				Tota	I Boring De	pth 207.0 ft
	Client Tennessee Valley Authority					Boring Loca	tion <u>N</u>	35°04'13.	01", W90°0	7'57.84" (NAD83)
	Project I	Number	175577013			Surface Eler	vation 23	37.4 ft	Elevation I	Datum NGVD29
	Litholo	рду	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	-
┢	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	192.4'	45.0'								
			Clayey Sand with Silt (SC),							
	191.4'	46.0'	dark gray, loose, v to fine-grained, we	very fine et						
			Silty to Clayey Sa	nd (SM to						
			SC), dark gray, tra	ace					47.0'	
Γ	189.9'	89.9' 47.5' organics, wet.								
	189.4'	89.4' 48.0' Silty Sandy Clay (CL), dark								
			∖ gray, soft, wet, fine ∖sand	e grained						
			Clay (CH), dark gr	ay with						_
			some tan mottling verv stiff. trace or	, stiff to panics.						
			wet	, ,						_
										_
						47.0' -	10.0'	100		_
						57.0				
										-
	183.4'	54.0'			_					-
			Clay (CH), dark gr	ay with						
T 2/4/19			fine sand, soft to r	nedium						
C LOG.GD			stiff, trace organic	s, wet						
-GRAPHIC										-
J FMSM										
EWEST.G									57.0'	-
5577013N										
I I										-
D ROCK /	178.9'	58.5'		arouto						
PLOG - N	178.4'	59.0'	\neg dark gray, loose,	gray to						-
C BORING			\fine-grained, wet	/						
IVA SON										



Γ	Stantec	Borehol	e Identification AL	Total Boring Depth 207.0 ft					oth 207.0 ft	
	Client Tennessee Valley Authority					Boring Loca	tion <u>N</u>	35°04'13.	01", W90°0	7'57.84" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	37.4 ft	Elevation I	Datum NGVD29
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	Silty Sand (SM), dark gray, loose, wet to saturated, with some partings of clay (CH) <i>(Continued)</i>			57.0' - 67.0'	10.0'	100		-		
	174.9' 62.5'			-						
	Sandy Clay (CL), dark gray, stiff, moist, some silt, sand fine-grained							-		
	172.4'	65.0'			_					_
		Sandy Clay (CL), dark gray, interbedded silty sand (SM), sand fine-grained, wet							-	
	170.4'	67.0'			_				67.0'	_
	169.4'	68.0'	Sand with silt (SW gray, loose, fine to medium-grained, s	/), dark o saturated	_					_
-	167.9'	69.5'	Silty Clay with Sar dark gray, soft to r stiff, with lenses o sand (SM), wet	nd (CL), medium f silty						-
			Clay (CH), dark							
			grayish-brown, ve verv moist	ry stiff,						_
V19	166.4'	71.0'	,							
I FMSM-GRAPHIC LOG.GDT 2/4		166.4' 71.0' Sand (SW), tan to gray, fine-grained with some medium-grained, wet,trace silt, trace organics and thin lenses of clay (CL)			67.0' - 77.0'	10.0'	100		-	
VEST.GPJ										-
175577013NEW										
ROCK ALLEN								-		
00 - DO	_									
VIC BORING L										
TVA SON										-



TVA

_	_					_			
Stantec	Borehol	e Identification AL	F-217A				Tota	I Boring De	oth 207.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'13.	01", W90°0	7'57.84" (NAD83)
Project	Number	175577013			Surface Ele	vation 23	37.4 ft	Elevation I	Datum NGVD29
Lithol	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
160.4'	77.0'							77.0'	_
	Well Graded Sand (SW), tan to gray, fine to								
-	medium-grained, wet, trace of organics and							-	
-	lignite							-	
F								-	
-								-	
_					77.0' -	3.5'	35		_
					87.0'				
-									-
_									-
									-
-									-
0 –								87.0'	Drill fluid and
C LOG.GDT 2/									catcher bit added
ISM-GRAPHIC									-
/EST.GPJ FA	-							-	
75577013NE V									
OK ALLEN 1								-	
- NO ROI								-	
RING LOG									
VA SONIC BO					87.0' - 97.0'	8.0'	80		-



ſ	Stantec Borehole Identification ALF-217A							Tota	I Boring De	oth 207.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u>	35°04'13.	01", W90°0	7'57.84" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	37.4 ft	Elevation I	Datum NGVD29
Ī	Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	Well Graded Sand (SW), tan to gray, fine to medium-grained, wet, trace of organics and rounded fine gravel, trace lignite <i>(Continued)</i>							-		
ł	-									_
	-									-
	-								97.0'	_
	-									_
	-									_
ľ	_									_
	-					97.0' -	10.0'	100		_
						107.0'				
: LOG.GDT 2/4/19	-									
J FMSM-GRAPHIC	132.4'	105.0'								
X ALLEN_175577013NEWEST.GP.	-	100.0	Well Graded Sand tan to gray, fine- to medium-grained, w sub-rounded fine of and lenses of sub-	l (SW), o wet, with gravel -rounded						-
G - NO ROC	-		coarse-grained sa	na					107.0'	-
NIC BORING LO	129.4'	108.0'								-
TVA SON										



ſ	Stantec Borehole Identification <u>ALF-217A</u>							Tota	I Boring De	oth 207.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'13.	01", W90°0	7'57.84" (NAD83)
	Project I	Number	175577013			Surface Elev	vation 23	37.4 ft	Elevation I	Datum NGVD29
Ī	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	- - - - - - - - - - - - - - - - - - -		Well Graded Sand (SW), tan to gray, fine to medium-grained, loose, saturated, trace sub-rounded fine gravel, trace silt <i>(Continued)</i> Well Graded Sand (SW), tan to gray, with some silty sand partings, sub-rounded, some coarse			107.0' - 117.0'	10.0'	100		
TVA SONIC BORING LOG - NO ROCK ALLEN_175577013NEWEST.GPJ FMSM-GRAPHIC LOG.GDT 2/4/19	-	tan to gray, with some silty sand partings, sub-rounded, some coarse sand, fine- to medium-grained, saturated, trace sub-rounded fine gravel, trace sub-round cobbles			117.0' - 127.0'	10.0'	100			



ſ	Stantec	Borehol	e Identification ALI	F-217A				Tota	I Boring De	oth 207.0 ft
	Client Tennessee Valley Authority					Boring Loca	tion <u>N</u>	35°04'13.	01", W90°0	7'57.84" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	37.4 ft	Elevation I	Datum NGVD29
	Litholo	gy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
╞	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
ſ	-									_
										-
	110.4'	127.0'							127.0'	
			Well Graded Sand tan, medium to coarse-grained, sa	I (SW), aturated,	-					-
			trace sub-rounded coarse gravel and	cobbles						-
	-									_
ŀ										_
	105.4'	132.0'			_	127.0' -	10.0'	100		-
			Well Graded Sand tan, fine- to	I (SW),		137.0'				
	103.9'	133.5'	sub-rounded, satu	rated, ∣fine	-					-
ŀ			Silty Sand (SM),	/						_
	102.4'	135.0'	grayish-brown, sat trace clay partings		-					_
G.GDT 2/4/19			Well Graded Sand tan, fine to	l (SW),						
-GRAPHIC LC			saturated, trace	pravel						_
PJ FMSM-				5					137.0'	-
7013NEWEST.C										_
ALLEN_17557.										
DG - NO ROCK										-
BORING LC	-									-
TVA SONIC										



TV/A

Stantec	Borehol	e Identification ALI	F-217A				Tota	I Boring De	oth 207.0 ft
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'13.	01", W90°0	7'57.84" (NAD83)
Project	Number	175577013			Surface Ele	vation 23	37.4 ft	Elevation I	Datum NGVD29
Lithold	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-		Well Graded Sand tan, fine to medium-grained, saturated, trace sub-rounded fine (<i>(Continued)</i>	l (SW), gravel		137.0' - 147.0'	10.0'	100		-
-								147.0'	_
106 - ND ROCK ALLEN_17557703NEWEST GAD FNSM-DEMPHIC LOG GOT 24/19	151.0'	Well Graded Sand tan, fine to medium-grained, sub-rounded, satu with sub-angular fi coarse gravel	ł (SW), irated, ine to		147.0' - 157.0'	10.0'	100		-
A SONIC BORING									-



ſ	Stantec	Borehol	e Identification ALI		Total Boring Depth 207.0 ft					
	Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'13.	01", W90°0	7'57.84" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	37.4 ft	Elevation I	Datum NGVD29
Ī	Litholc	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	-		Well Graded Sand tan, fine to medium-grained, sub-rounded, satu with sub-angular fi coarse gravel (Co	I (SW), rated, ine to ontinued)						-
	_									-
	75 4'	162 0'				157 0' -	10 0'	100		
6	-	102.0	Well Graded Sand tan, fine to medium-grained, sub-rounded, satu trace sub-rounded gravel	I (SW), rated, fine		167.0'		100		-
GDT 2/4/1	69.4'	168.0'			_					_
K ALLEN_175577013NEWEST.GPJ FMSM-GRAPHIC LOG	_		Well Graded Sand tan, fine- to coarse-grained, sa trace sub-angular medium gravel	I (SW), aturated, fine to						
TVA SONIC BORING LOG - NO ROCI	-					167.0' - 177.0'	10.0'	100		-



ſ	Stantec	Borehol	e Identification AL				Tota	I Boring De	oth 207.0 ft	
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'13.	01", W90°0	7'57.84" (NAD83)
	Project N	Number	175577013			Surface Elev	vation 23	37.4 ft	Elevation I	Datum NGVD29
ſ	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
┟	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	63.4' 174.0'									
	63.4' 174.0' Clay (CL), very silty, dark gray, medium stiff to stiff, wet, trace of very			_					-	
	61.4' 176.0' 61.4' 176.0' Well Graded Sand (SW), tanish-gray, fine to medium-grained, saturated, trace rounded fine to medium gravel, trace silty clay lenses									
			-				177.0'	-		
								-		
	-								_	
	_									_
	-									-
	-					177.0' -	6.0'	60		-
	-					187.0				-
GDT 2/4/19	53.4'	184.0'			-					_
SM-GRAPHIC LOG	_		Well Graded Sand tan, multi-colored medium to coarse	d (SW), grains, -grained,						_
INEWEST.GPJ FM	-		some fine grained saturated, trace sub-rounded fine f	to coarse						-
ALLEN_175577010	-		cobbles, trace silty lenses	y clay					187.0'	-
IG LOG - NO ROCK	_							-		
IVA SONIC BORIN	-									



ſ	Stantec	Borehol	e Identification AL				Tota	I Boring De	oth 207.0 ft	
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'13.	01", W90°0	7'57.84" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	37.4 ft	Elevation I	Datum NGVD29
ſ	Litholo	рду		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	47.4'	190.0'								_
-	-		Silty Clay (CH), lig to grayish-tan, har trace lignite	iht gray d, moist,						-
-	-					187.0' - 197.0'	10.0'	100		-
-	-									-
	-									-
	-									-
	-								197.0'	-
	-									-
-	-									-
IC LOG.GDT 2/4/19	37.4'	200.0'	Interbedded Clay Silty Sand (SM) Ii	(CH) and	-					-
T.GPJ FMSM-GRAPH	-		dense, fine-graine graded, moist to w lignite fragments	ed, poorly vet, trace			0.01	00		-
EN_175577013NEWES	-					207.0'	ð.U ⁻	δU		-
LOG - NO ROCK ALL	_									-
'VA SONIC BORING L	_									_



Γ	Stantec	Borehol	e Identification AL	F-217A				Tota	al Boring Dep	oth 207.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u> a	35°04'13	.01", W90°0	7'57.84" (NAD83)
	Project	Number	175577013			Surface Ele	evation 23	7.4 ft	Elevation [Datum NGVD29
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_	Interbedded Clay (CH) and Silty Sand (SM), light gray, dense, fine-grained, poorly graded, moist to wet, trace		(CH) and ght gray, ed, poorly vet_trace						-	
	30.4'	207.0'	lignite fragments						207.0'	
	No Refusal /									
╞	Bottom of Hole								-	
										_
										_
-										-
_										_
										_
-										-
╞										_
2/4/19 										_
PHIC LOG.GDT										
SPJ FMSM-GRA										-
013NEWEST.G										-
LEN_1755770										_
NO ROCK AL										
DRING LOG -										
A SONIC BC										
ŕ										



Stantec	Borehol	e Identification _EV				Tota	I Boring De	pth 45.0 ft		
Client	Client Tennessee Valley Authority Proiect Number 175577013					ation <u>N</u>	35°04'27.	98", W90°0	8'21.73" (NAD83)	
Project I	Number	175577013			Surface Ele	vation 2	17.3 ft	Elevation	Datum NGVD29	
Project I	Name	TVA-ALF RIWP W	ells		Date Starte	d _1	0/31/18	Completed	10/31/18	
Project	Locatior	n Memphis, Tenn	essee		Depth to Wa	ater 9	.69 ft	Date/Time	11/27/18	
Supervis	sor	Michael McDon	ald		Depth to Wa	ater 1	0.65 ft	Date/Time	12/3/18	
Logged	Logged by Michael McDonald					Driller Thesius Taylor				
Drilling (Drilling Contractor Cascade Drilling					Drill Rig Type and ID Terrasonic TSi 150T/ #11-38212				
Overbur	Overburden Drilling and Sampling Tools (Type and Size					ing - 8" Bit	, 8" Casing	, 6" Barrel, 3.	5" Rods	
Sampler	Sampler Hammer Type <u>N/A</u> Weight				Drop	N/A	Ef	ficiency _	N/A	
Borehole	Borehole AzimuthN/A (Vertical)				Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.	
Litholo	Lithology Overburden S				Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
_ 217.3'	0.0'	Top of Hole								
216.9'	0.4'	l'opsoli		-						
		Silty Sand (SM), b	orown ses							
_	with dark gray lenses, fine-grained, wet, trace								6" Extraction	
	fine-grained, wet, trace clay and sub-rounded gravel								Well Installed,	
		0							Construction	
-									Log For Details	
					0.0' - 5.0'	5.0'	100			
-									-	
213.8'	3.5'									
		Clayey Sand (SC)	, dark							
213.3'	4.0'	gray with some br	own ned verv /	_						
212.8'	4.5'	moist								
06.601		Wood Fragments		-						
<u>212.3'</u>	5.0'	Clayey Silt (ML), t	an and	_				5.0'		
211.8'	5.5'	sand, very moist	ameu							
EST.GPJ		Well Graded Sand	d (SW),	-						
013NE W		medium-grained,	o trace						-	
210.8'	6.5'	sub-angular fine g	ravel,							
		Clavey Silt (ML) t	race silt	1						
- NORG		brown with gray m	nottling,							
RINGLO		nodules, stiff, very	vn v moist							
SONIC BO										
2 AVT										



ſ	Stantec Borehole Identification EW-N02 Client Tennessee Valley Authority							Tota	I Boring De	oth 45.0 ft
	Client Tennessee Valley Authority					Boring Loca	tion <u>N</u>	35°04'27.	.98", W90°0	8'21.73" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 21	7.3 ft	Elevation I	Datum NGVD29
İ	Litholc	уgy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	-		Clay (CL), trace si with gray streaks, orange-brown nod stiff, very moist <i>(Continued)</i>	lt, brown some ules,						_
	-					5.0' - 15.0'	10.0'	100		_
-	-									-
	204.3'	13.0'	Clayey and Silty S to SC), brown, ver fine-grained, dens saturated	and (SM y e,						_
-	202.3'	14.0	Silty Sand (SM), b fine-grained, medi dense, wet	rown, um					15.0'	-
A-GRAPHIC LOG.GDT 2/4/19			Well Graded Sand slightly silty, browr fine to medium-gra wet, clay lense 18	l (SW), n to tan, ained, .0'-18.5'						_
5577013NEWEST.GPJ FMSN	-									
G LOG - NO ROCK ALLEN 17	-									(18.0'-18.5') -
TVA SONIC BORIN										Clayey Sand Lense (18.5'-20.0)



	Stantec Borehole IdentificationEW-N02ClientTennessee Valley Authority							Tota	I Boring De	oth 45.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'27.	98", W90°0	8'21.73" (NAD83)
	Project N	Number	175577013			Surface Ele	vation 2	17.3 ft	Elevation I	Datum NGVD29
Ī	Litholo	gy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
			Wall Craded Sana							Sample
	-	slightly silty, brown to tan, fine to medium-grained, wet, clay lense 18.0'-18.5' (Continued)							Saturated -	
┢	197.3'	20.0'			1	15.0' - 25 0'	10.0'	100		-
	Well Graded Sand (SW), slightly silty, brown to orange-brown, some red-brown interbeds, fine to medium-grained, wet			20.0				_		
	195.3'	195.3' 22.0' Silty Sand (SM), dark gray, fine-grained, wet to saturated, trace clay								
	-			-					-	
	-									-
	192.3'	25.0'							25.0'	
T 2/4/19	_		Clayey Sand (SC) gray, fine-grained, wet, trace clay len	, silty, , dense, ses						_
C LOG.GD	100.91	26 E'								
PJ FMSM-GRAPHI	190.8	190.8' 26.5' Well Graded Sand (SW), silty, tan to brown, fine to		-					_	
LLEN_175577013NEWEST.G	_	medium-grained, wet							_	
O ROCK A	188.8'	188.8' 28.5'								
VA SONIC BORING LOG - N	Silty Sand (SM), dark gray, fine-grained, wet.							-		



	Stantec Borehole Identification EW-N02 Client Tennessee Valley Authority			/-N02				Tota	I Boring De	oth 45.0 ft
	Client	Client Tennessee Valley Authority Project Number 175577013		Authority		Boring Loca	tion <u>N</u>	35°04'27.	.98", W90°0	8'21.73" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	17.3 ft	Elevation I	Datum NGVD29
I	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	_	Silty Sand (SM), dark gray, fine-grained, wet. <i>(Continued)</i>			25.0' - 35.0'	10.0'	100		(29.5'-30.5') Perched Groundwater _	
	186.8'	186.8' 30.5'								
	_	Silty to Clayey Sand (SM to SC), gray, fine-grained, medium dense, wet							-	
	185.3'	185.3' 32.0'		-					-	
		Silty Sand (SM), gray, fine-grained, wet								
	184.3'	33.0'			-					-
	_		Clayey Sand (SC) fine-grained, soft t medium stiff, wet saturated, with so lenses of silty san	, gray, to to me d						_
				G						
	182.3'	35.0'			-				35.0'	_
			No recovery in Ru Unable to observe from 35.0' to 45.0'	n No. 5. sample BGS.						
	-									-
GDT 2/4/19										
PHIC LOG	-									-
T.GPJ FMSM-GRA										
13NEWES	-								-	
1755770										
CK ALLEN										
3 - NO RO	-								_	
RINGLOC										
IVA SONIC BC	-			35.0' - 45.0'	0.0'	0				



ſ	Stantec	Borehol	e Identification EW				Tota	I Boring Dep	oth 45.0 ft	
	Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u>	35°04'27.	.98", W90°0	8'21.73" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 21	7.3 ft	Elevation [Datum NGVD29
ſ	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	-		No recovery in Ru Unable to observe from 35.0' to 45.0' <i>(Continued)</i>	n No. 5. sample BGS.						-
	-									-
	-									-
	-									-
┢	172.3'	45.0'							45.0'	
			Bottom of Hole							
-	-									-
PHIC LOG.GDT 2/4/19	-									-
I3NEWEST.GPJ FMSM-GRA	-									
NO ROCK ALLEN_1755770:	-									-
TVA SONIC BORING LOG	_									_



s	Stantec Borehole Identification EW-S03 Client Tennessee Valley Authority							Tota	I Boring De	pth 45.0 ft
C	Client		Tennessee Valley	Authority		Boring Loca	ation N	35°04'09.	34", W90°0	8'12.22" (NAD83)
P	Project I	Number	175577013			Surface Ele	vation 2	18.3 ft	Elevation	Datum NGVD29
P	Project I	Name	TVA-ALF RIWP W	ells		Date Starte	d _1	0/30/18	Completed	10/30/18
P	Project	Locatior	Memphis, Tenn	essee		Depth to Wa	ater 1	1.10 ft	Date/Time	11/27/18
s	Supervis	sor	Michael McDon	ald		Depth to Wa	ater 1	1.02 ft	Date/Time	12/3/18
L L	Logged by Michael McDonald					Driller Thesius Taylor				
	Drilling Contractor Cascade Drilling					Drill Rig Typ	be and I	D Terras	onic TSi 15	0T/ #11-38212
C	Overbur	den Dril	ling and Sampling To	ools (Type a	and Size) Sonic Tool	ing - 8" Bi	t, 8" Casing	, 6" Barrel, 3.	5" Rods
s	Samplei	Hamme	er Type N/A	Weight	t N/A	Drop	N/A	Ef	ficiency _	N/A
В	Borehol	e Azimu	thN/A (Vertica	al)		Borehole Ir	nclination	n (from Ve	ertical)	0 deg.
	Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Ele	evation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
$+\frac{2}{}$	18.3	0.0'								
2	17 7'	0.6'	100001							
_		0.0	Well Graded Silty	Sand						
F			(SM), brown, very fine-grained, mois	fine to t. trace						6" Extraction
			clay and clay lense	es						See Well
										Log For Details
F										-
						0.0' - 5.0'	5.0'	100		
6										
GDT 2/4/										
HIC LOG.									5.0'	
ISM-GRAF										
I.GPJ FM										
2	12.3'	6.0'								
1755770			Clay (CL), silty + s	andy,						
X ALLEN			red-brown to oran	ge-brown						
- NO RO			slightly silty and ve	ecomes ery stiff at						
2	10.8'	7 5'	7.5'	-						
ONIC BOL					1					
TVA S										



Stantec Borehole Identification <u>EW-S03</u> Client <u>Tennessee Valley Authority</u> Project Number 175577013							Tota	I Boring De	oth 45.0 ft
Client	Client Tennessee Valley Authority Project Number 175577013 Lithology Overburde				Boring Loca	ition <u>N</u>	35°04'09.	.34", W90°0	8'12.22" (NAD83)
Project I	Project Number 175577013 Lithology Overburd Elevation Depth Description				Surface Ele	vation 2	18.3 ft	Elevation I	Datum NGVD29
Litholo	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_	Clay (CL), slightly silty, grayish-brown with red-brown mottling, very stiff, damp <i>(Continued)</i>							_	
-					5.0' - 15.0'	10.0'	100		_
207.3'	11.0'			_					-
_		trace red-brown n very stiff, moist	oray, nottling,						_
-									_
_								15.0'	_
202.8'	15.5'	Well Graded Sand	d (SW),	_					
-		prownish-gray, fin medium-grained,	e to wet						-
200.3'	18.0'								_



TV/A

ſ	Stantec Borehole IdentificationEW-S03ClientTennessee Valley Authority			V-S03				Tota	I Boring De	oth 45.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'09.	34", W90°0	8'12.22" (NAD83)
	Project N	Number	175577013			Surface Elev	vation 21	18.3 ft	Elevation [Datum NGVD29
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
┢	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	199.3'	19.0'	_ Clayey to Silty Sa	nd (SM to _						_
	SC), brownish-gray with some red-brown mottling, fine-grained, wet (<i>Continued</i>) Well Graded Sand (SW).			15.0' -	10.0'	100		_		
	-		brownish-gray, fin medium-grained, trace gray sand le	e to wet, nses		25.0				-
	196.3'	22.0'			-					-
	_		Well Graded Sand gray, fine to medium-grained, ' trace silt	d (SW), wet,						_
	-								25.0'	_
ŀ	-								20.0	_
- 2/4/19										
FMSM-GRAPHIC LOG.GD1	-									
LEN_175577013NEWEST.GPJ										
BORING LOG - NO ROCK AL	-									_
A SONIC										



ſ	Stantec Borehole Identification EW-S03 Client Tennessee Valley Authority						Tota	I Boring De	pth 45.0 ft	
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'09.	.34", W90°0	8'12.22" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 21	8.3 ft	Elevation I	Datum NGVD29
Ī	Litholo	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	188.3'	30.0'				25.0' -				_
			Well Graded Silty (SM), gray, fine to medium-grained, trace fine grained	Sand wet,		35.0'				
	-		sub-rounded + sul gravel, trace clay	b-angular						-
-	-									_
	-									_
	_									
	183.8'	34.5'			_					
$\left \right $	_		stiff, very moist	jray, very					35.0'	Perched GW – from 35.5' to
ł	182.8'	35.5'	Woll Graded Silty	to	_					37.0'
19	-		Clayey Sand (SM gray, very fine-gra to saturated	to SC), iined, wet						-
3.GDT 2/4/	181 3'	37 0'								
ST.GPJ FMSM-GRAPHIC LOC	101.0	07.0	Clay (CH), gray, w silt and very fine-g sand, very stiff	vet, trace grained	-					-
ALLEN_175577013NEWE	-									-
O ROCK /	179.3'	39.0'	Clavov Sond (SC)	with cilt	-					(39.0'-40.0') -
DRING LOG - N			gray, saturated	i wili'i Siil,						Groundwater
TVA SONIC BC	178.3'	40.0'				35.0' - 45.0'	•			



ſ	Stantec Borehole Identification EW-S03 Client Tennessee Valley Authority							Tota	I Boring Dep	oth 45.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ation N	35°04'09.	.34", W90°0	8'12.22" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 21	8.3 ft	Elevation [Datum NGVD29
Ī	Litholo	уgy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	177.8'	40.5'	Clay (CH), gray, w $\overline{\ }$ fine grained sand	vet, trace <i>┌</i>	_					
	177.3'	41.0'	(Continued)							-
		Silty Sand (SM), gray, fine to medium grained, wet								
			organics, very stiff	et, trace						-
	175.3'	43.0'			_					-
			Sandy Clay (CL), stiff, wet, with lens	gray, ses of						
			clayey to silty sand SM)	d (SC to						_
	173.3'	45.0'							45.0'	
			No Refusal /							
			Bottom of Hole							
+										-
										-
IT 2/4/19										
PHIC LOG.GD										
I FMSM-GRA										-
INE WEST.GP.										
N_175577013										-
O ROCK ALLE										
RING LOG - N	-							-		
VA SONIC BOF										



Stantec	Borehol	e Identification _PM	1W-02A				Tota	I Boring De	pth 37.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'28.	.77", W90°C	08'22.51" (NAD83)
Project I	Number	175577013			Surface Ele	vation 2	16.6 ft	Elevation	Datum NGVD29
Project I	Name	TVA-ALF RIWP W	ells		Date Starte	d _1	0/17/18	Completee	d <u>10/17/18</u>
Project	Locatior	nMemphis, Tenn	essee		Depth to Wa	ater 1	0.52 ft	Date/Time	11/27/18
Supervis	sor	Lee Eaves			Depth to Wa	ater 1	1.81 ft	Date/Time	12/3/18
Logged	by	Lee Eaves			Driller	N	latt Pope		
Drilling	Drilling Contractor Cascade Drilling				Drill Rig Typ	be and I	D Prosor	nic LS600 /	#10-00273
Overburden Drilling and Sampling Tools (Type ar				and Size) Sonic Tool	ing - 9" Bi	t, 9" Casing	, 6" Barrel, 3.	5" Rods
Sampler Hammer Type <u>N/A</u> Weight				t N/A	Drop	N/A	Ef	ficiency	N/A
Borehole Azimuth N/A (Vertical)				Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.	
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_ 216.6'	0.0'	Top of Hole							
215.6'	1.0'	Topsoil		-					4" Monitoring
-		Silty sand (SM), b	rown, t						Well Installed,
-				0.0' - 7.0'	6.0'	86		Construction	
Ľ								Log For Details	
_									
-								7.0'	
-									
-									
									-
204.6'	12.0'				7.0' - 17.0'	10.0'	100		
_		Sandy Lean Clay	(CL),						
-		with fine-grained s	sand, soft						
201.1'	15.5'	to medium-stiff, w	et	_					-
-		Poorly Graded Sa	nd (SP),					17.0'	
_			a, wei						
-									
–									-
-					17.0'	10.0'	100		
193 6'	23 0'				27.0'	10.0	100		
	Poorly Graded Sand (SP),			_					
L	grayish-brown,								-
						07.01			
189.6	189.6' 27.0' Poorly Graded Sand (SP)		-				27.0'		
-		dark gray, fine-gra	ained,						



Stantec	Borehol	e Identification PM				Tota	I Boring Dep	oth 37.0 ft	
Client		Tennessee Valley	Authority		Boring Loca	ation N3	35°04'28	.77", W90°0	8'22.51" (NAD83)
Project N	Number	175577013			Surface Ele	evation 21	6.6 ft	Elevation [Datum NGVD29
Litholo	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
- - -		Poorly Graded Sa dark gray, fine-gra wet <i>(Continued)</i>	nd (SP), iined,		27.0' - 37.0'	5.0'	50		- - -
180.6'	36.0'			_					
179.6'	37.0'	Silty sand (SM), da	ark gray, 🖯					37.0'	
		No Refusal / Bottom of Hole							
	<u></u>								



ſ	Stantec	Borehol	e Identification PM	W-02B				Tota	I Boring De	pth 57.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'28.	.79", W90°0	8'22.41" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	16.5 ft	Elevation	Datum NGVD29
	Project I	Name	TVA-ALF RIWP W	ells		Date Starte	d _1	0/16/18	Completed	10/17/18
	Project	Locatior	n Memphis, Tenn	essee		Depth to Wa	ater 1	5.20 ft	Date/Time	11/27/18
	Supervis	sor	Lee Eaves			Depth to Wa	ater 1	7.03 ft	Date/Time	12/3/18
	Logged	by	Lee Eaves			Driller				
	Drilling Contractor Cascade Drilling					Drill Rig Typ	be and ID	Prosor	nic LS600 /	#10-00273
	Overburden Drilling and Sampling Tools (Type and) Sonic Tool	ing - 9" Bit	, 9" Casing	, 6" Barrel, 3.	5" Rods
	Sampler Hammer Type N/A Weight					Drop	N/A	Ef	ficiency _	N/A
	Borehole	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
ŀ	Lithology Overburden					Depth	Rec. Ft.	Blows	Mois.Cont. %	
\mathbf{F}	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
ŀ	210.0	0.0	Topsoil							
	215 5'	1 0'								
ŀ	210.0	1.0	Silty sand (SM), bi	rown,	-					4" Monitoring Well Installed,
			fine-grained, mois fragments at 7'	t, wood						See Well Construction
										Log For Details
	_									-
							6.01	06		
						0.0 - 7.0	0.0	00		
	-									-
/4/19										
G.GDT 2.										
MPHIC LC	_									-
FMSM-GF										
EST.GPJ										
7013NEW	-									-
EN_17557										
OCK ALL										
NON - DC	-								7.0'	-
30RING LC										
A SONICE										
È										



Stantec Borehole Identification PMW-02B Client Tennessee Valley Authority								Tota	I Boring De	oth 57.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'28.	79", W90°0	<u>8'22.41" (NAD83</u>)
	Project N	Number	175577013			Surface Ele	vation 2	16.5 ft	Elevation I	Datum NGVD29
	Litholc	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	-		Silty sand (SM), b fine-grained, mois fragments at 7' <i>(Continued)</i>	rown, t, wood						-
	206.5'	10.0'								
			Sandy Lean Clay sandy, dark browr 3/4), low plasticity medium stiff, mois	(CL), n (7.5YR , soft to st to wet	-					_
	_					7.0' - 17.0'	10.0'	100		_
-	_									_
	-									-
	201 5'	15.0'								
SM-GRAPHIC LOG.GDT 2/4/19	_ 201.3	13.0	Poorly Graded Sa brown, fine-graine with lenses of clay (SC), grayish-brow fine-grained	nd (SP), d, wet, vey sand vn,						
75577013NEWEST.GPJ FMS	199.5'	17.0'							17.0'	_
NO ROCK ALLEN_17	199.0'	17.5'	Clayey Sand (SC) grayish-brown, we fine-grained	, et,	-					
TVA SONIC BORING LOG - 1	-		Poorly Graded Sa brown, fine-graine with lenses of clay (SC), grayish-brow	nd (SP), d, wet, vey sand vn,						_


ſ	Stantec	Borehol	e Identification PM		Total Boring Depth 57.0 ft					
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'28.	.79", W90°0	<u>8'22.41" (NAD83</u>)
	Project I	Number	175577013			Surface Ele	vation 2	16.5 ft	Elevation I	Datum NGVD29
	Litholo	рду	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
╞	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	196.5'20.0'fine-grained Poorly Graded Sand (SP), brown, fine-grained, wet, with lenses of clayey sand (SC), grayish-brown, fine-grained (Continued)Clayey Sand (SC), gravish-brown, wet							-		
		Clayey Sand (SC), grayish-brown, wet, fine-grained 195.5' 21.0'								
ŀ	195.5'	21.0'	De erik : Ore de d. Ce		-					-
	195.0' 21.5' Poorly Graded Sand (SP), brown, fine-grained, wet, \vee with lenses of clayey sand \vee									
	195.0'21.5'brown, fine-grained, wet, with lenses of clayey sand (SC), grayish-brown, fine-grained		-	17.0' -	10.0'	100		-		
	400 51	00.01	Clayey Sand (SC) grayish-brown, we fine-grained	, et,		27.0				
	193.5	23.0	Poorly Graded Sa brown, fine-graine with lenses of clay (SC), grayish-brow fine-grained	nd (SP), d, wet, /ey sand vn,						-
			Poorly Graded Sa grayish-brown, fine-grained, wet	nd (SP),						
2/4/19										
FMSM-GRAPHIC LOG.GDT									27.0'	_
EN_175577013NEWEST.GPJ										-
VA SONIC BORING LOG - NO ROCK ALLE										-



Stantec	Borehol	e Identification PM	1W-02B		Total Boring Depth 57.0 ft				
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'28.	.79", W90°0	8'22.41" (NAD83)
Project	Number	175577013			Surface Ele	vation 2	16.5 ft	Elevation I	Datum NGVD29
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Poorly Graded Sa grayish-brown,	nd (SP),						_
		(Continued)							
_									-
_					27.0' - 37.0'	5.0'	50		-
					37.0				
183.5'	33.0'			_					-
		Silty sand (SM), d fine-grained, wet	Silty sand (SM), dark gray, fine-grained, wet						
_									-
-									_
_									-
179.5'	37.0'			_				37.0'	-
		Sandy Clay (CL), (7.5YR 4/1) fine-g low plasticity, soft medium stiff, wet,	dark gray rained, to sand						
-		lens 40.0'-40.5'							-
_									-
L									_



ſ	Stantec Borehole Identification PMW-02B					Total Boring Depth 57.0 ft				
	Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'28.	79", W90°0	8'22.41" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	16.5 ft	Elevation [Datum NGVD29
	Litholo	рду		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
┢	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
			Sandy Clay (CL), (7.5YR 4/1) fine-g low plasticity, soft medium stiff, wet, lens 40.0'-40.5'	dark gray rained, to sand						_
			(Continued)							
	174.5'	42.0'				37.0' -	9.0'	90		_
	Silty Sand (SM), dark gray, fine-grained, wet			47.0'						
										_
										-
	-									_
╞	170.5'	46.0'			-					-
			Poorly Graded Sa dark gray, fine-gra	nd (SP), ained,						
			wet							
┢									47.0'	-
IC LOG.GDT 2/4/19										
SM-GRAPH										-
.GPJ FMS										
3NE WEST										
17557701										-
ROCK ALLEN										
LOG - NO F	-									_
ONIC BORING										
TVA S(



Stantec	Stantec Borehole Identification PMW-02B Total Boring Depth 57.0 ft									
Client		Tennessee Valley	Authority		Boring Loca	ation N	35°04'28	.79", W90°0	8'22.41" (NAD83)	
Project I	Number	175577013			Surface Ele	vation 21	6.5 ft	Elevation [Datum_NGVD29	
Litholo	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
_		Poorly Graded Sa dark gray, fine-gra wet <i>(Continued)</i>	nd (SP), ained,		47.0' -	7.0'	70		_	
_					57.0'				-	
-									-	
_									_	
-									-	
159.5'	57.0'							57.0'		
		No Refusal / Bottom of Hole								
_									_	
									_	
									-	



Stantec	Borehol	e Identification PM				Tota	I Boring De	pth 137.0 ft	
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'28.	80", W90°0	8'22.30" (NAD83)
Project I	Number	175577013			Surface Ele	vation 2	16.5 ft	Elevation	Datum NGVD29
Project I	Name	TVA-ALF RIWP W	ells		Date Started	d _1	0/9/18	Completed	d 10/10/18
Project	Location	nMemphis, Tenn	essee		Depth to Wa	ater 1	5.18 ft	Date/Time	11/27/18
Supervis	sor	Lee Eaves			Depth to Wa	ater 1	7.00 ft	Date/Time	12/3/18
Logged	by	Lee Eaves			Driller	Ν	latt Pope		
Drilling	Contract	or Cascade Drilling	g		Drill Rig Typ	e and I	Prosor	nic LS600 /	#10-00273
Overbur	den Dril	ling and Sampling To	ools (Type a	and Size) Sonic Tooli	ing - 9" Bi	t, 9" Casing	, 6" Barrel, 3.	5" Rods
Sample	r Hamm	er Type N/A	Weight	t N/A	Drop	N/A	Ef	ficiency	N/A
Borehol	Borehole Azimuth N/A (Vertical)				Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_ 216.5'	0.0'	Top of Hole							
215.5'	1.0'	Topsoil		_					4" Monitoring
-		Silty sand (SM), b	rown,						Well Installed,
-		fine-grained, mois	it i		0.0' - 7.0'	6.5'	93		Construction
-									Log For Details
F									-
-								7 0'	
								1.0	-
206.5'	10.0'			_					-
		Sandy Lean Clay	(CL),						
-		low plasticity soft	₹ 3/4), to		7.0' - 17.0'	9.0'	90		
203.5'	13.0'	medium stiff, mois	st to wet	_					
-		Poorly Graded Sa	nd (SP),						
F		brown, fine-graine	ed, wet						-
214/19								17.0'	
06.601									-
196.5'	20.0'			_					-
195.5'	21.0'	Clayey Sand (SC)	lens,	_					
					17.0' - 27 0'	10.0'	100		
102 5'	24 0'	brown, fine-graine	nd (SP), ed, wet		21.0				
192.5	25.0'	Poorly Graded Sa	nd (SP)	-					
		lens, dark gray,		1					-
DN - 50	fine-grained, wet							27.0'	
	Poorly Graded Sand (SP), brown_fine-grained_wet								
187.5'	29.0'		···, ••···	-					
\$				1		1		1	



Stantec Borehole Identification PMW-02C								Tota	I Boring De	oth 137.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'28.	.80", W90°0	8'22.30" (NAD83)
F	Project I	Number	175577013			Surface Ele	vation 2	16.5 ft	Elevation [Datum NGVD29
	Litholo	gy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Ele	evation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_ _ _ _ 1	82.5'	34.0'	Silty Sand (SM), d fine-grained, wet <i>(Continued)</i>	ark gray,		27.0' - 37.0'	10.0'	100		
- 1	80.5'	36.0'	Clayey sand (SC), gray, fine-grained,	dark wet	_					-
- - 1	77.5'	39.0'	Clayey silt (ML), d (7.5YR 4/1), low p soft to medium stil	rey silt (ML), dark gray YR 4/1), low plasticity, to medium stiff, wet d (SP), dark gray,					37.0'	-
_ 1	76.5'	40.0'	Sand (SP), dark g	ray, sorted √	-					
1	74.5'	42.0'	wet		-	37.0' -	10.0'	100		-
- - 1	71.5'	45.0'	(7.5YR 4/1), low p soft to medium stil	Age Silt (ML), dark gray 7.5YR 4/1), low plasticity, oft to medium stiff, wet wilty Sand (SM), dark gray,		47.0				_
-			fine-grained, wet	Silty Sand (SM), dark gray, fine-grained, wet Poorly Graded Sand (SP), dark gray, fine-grained, wet					47 0'	-
			Poorly Graded Sa dark gray, fine-gra wet			47.0' - 57.0'	9.0'	90		- - - - - - - - - - - - - - -
5DT 2/4/1									57.0'	_
K ALLEN_175577013NEWEST.GPJ FMSM-GRAPHIC LOG G	52.5'	64.0'	Sand (SP-SW),	and (SP-SW), ravish-brown,		57.0' - 67.0'	8.0'	80		- - - - - -
30RING LOG - NO ROC			fine-grained, mode graded, with grave to 3.0" in diameter	erately el 0.25" , wet					67.0'	-
TVA SONIC B								-		



Stante	c Borehol	e Identification _PM				Tota	I Boring De	oth 137.0 ft	
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'28.	.80", W90°0	8'22.30" (NAD83)
Projec	t Number	175577013			Surface Ele	vation 2	16.5 ft	Elevation I	Datum NGVD29
Lith	ology		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	Sand (SP-SW), grayish-brown, fine-grained, moderately graded, with gravel 0.25" to 3.0" in diameter, wet (Continued)139.5'77.0'		erately el 0.25" ⁻ , wet		67.0' - 77.0'	7.0'	70		
139.5'	77.0'			-				77.0'	-
		Well Graded Sand grayish-brown, fine-grained, trace 0.25" to 1.0" in dia wet	d (SW), e gravel imeter,		77.0' - 87.0'	10.0'	100	 87.0'	-
- - - -					87.0' - 97.0'	8.0'	80		
3DT 2/4/					<u> </u>			31.0	-
					97.0' - 107.0'	6.0'	60		-
									-



Stantec	Borehol	e Identification PM	W-02C				Tota	I Boring Dep	oth 137.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u>	35°04'28.	.80", W90°0	8'22.30" (NAD83)
Project	Number	175577013			Surface Ele	evation 21	16.5 ft	Elevation [Datum NGVD29
Lithol	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
- - -		Well Graded Sand grayish-brown, fine-grained, trace 0.25" to 1.0" in dia wet <i>(Continued)</i>	l (SW), gravel meter,		107.0' - 117.0'	6.5'	65		- - -
-								117.0'	_
- - - -					117.0' - 127.0'	8.5'	85		- - - - -
92.5'	124.0'								_
_ 90.5'	126.0'	Silty Sand (SM), g fine-grained, wet	ray,						_
89.5'	127.0'	Clayey Sand (SC)	, gray,	-				127.0'	_
- - - - -		fine-grained, wet Silty Fat Clay (CH greenish-gray (Gle 5GY), highly plasti stiff, wet), dark ey / city, very		127.0' - 137.0'	10.0'	100		- - - - - -
<u>_</u> 79.5'	137.0'							137.0'	_
		No Refusal / Bottom of Hole							- - - - - - - - - - - - - - - - - - -



Stantec	Borehol	e Identification PM	W-04A				Tota	I Boring De	pth 37.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ition N	35°04'27.	.98", W90°0)8'22.21" (NAD83)
Project I	Number	175577013			Surface Ele	vation 2	17.4 ft	Elevation	Datum NGVD29
Project I	Name	TVA-ALF RIWP W	ells		Date Starte	d _1	0/5/18	Complete	d 10/5/18
Project	Location	Memphis, Tenn	essee		Depth to Wa	ater 1	1.89 ft	Date/Time	e 11/27/18
Supervis	sor	Lee Eaves			Depth to Wa	ater 1	3.45 ft	Date/Time	e 12/3/18
Logged	by	Lee Eaves			Driller	N	latt Pope		
Drilling (Contract	or Cascade Drilling]		Drill Rig Typ	be and ID	D Prosor	nic LS600 /	#10-00273
Overbur	den Dril	ling and Sampling To	ools (Type a	and Size) Sonic Tool	ing - 9" Bit	t, 9" Casing	, 6" Barrel, 3.	5" Rods
Sampler	r Hamm	er Type N/A	Weight	N/A	Drop	N/A	Ef	ficiency	N/A
Borehol	Borehole Azimuth N/A (Vertical)				Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
217.4'	0.0'	Top of Hole							-
210.9	<u> </u>			-					4" Monitoring
-		Silty Sand (SM), b (7.5YR 4/4), fine-a	rown rained.						Well Installed,
-		moist			0.0' - 7.0'	7 0'	100		Construction
_					0.0 - 7.0	7.0	100		Log For Details
F									-
211.4'	6.0'			_					
-		Silty Lean Clay (C	L), Low					7.0'	
-		plasticity, soft to m	iedium						
_		stiff, moist							
_									-
-									
-					7.0' - 17.0'	10.0'	100		
_									
T 2/4/19									
LDG.GDJ									_
-									
200.4'	17.0'			-				17.0'	-
VEST.GPJ		Silty sand (SM), bi	rown						
7013NE V		moist to wet	iancu,						
17557									-
L ICK AFTE									
- NO RO					17.0' -	7.0'	70		
					27.0'				
- NIC BOR									
TVA SO									



Stantec	Borehol	e Identification PM	IW-04A				Tota	I Boring Dep	oth 37.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'27	.98", W90°0	8'22.21" (NAD83)
Project I	Number	175577013			Surface Ele	vation 21	7.4 ft	Elevation [Datum NGVD29
Litholo	ogy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-		Silty sand (SM), bi (7.5YR 4/4), fine-g moist to wet <i>(Cor</i>	rown jrained, <i>ntinued)</i>					27.0'	
- - _ 187.4'	30.0'			-					-
-		Poorly Graded Sa dark gray (7.5YR 4 fine-grained, wet	nd (SP), 4/1),		27.0' - 37.0'	8.0'	80		-
-									-
180.4'	37.0'	No Dofucol /						37.0'	-
- - - -		Bottom of Hole							- - - - -
1 2.4.19									-
									-
EWEST.G									_
CK ALLEN_175577013N									-
TVA SON									-



Stantec	Borehol	e Identification PM	1W-04B				Tota	I Boring De	pth 62.0 ft
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'27.	.97", W90°0	8'22.09" (NAD83)
Project	Number	175577013			Surface Ele	vation 2	17.6 ft	Elevation	Datum NGVD29
Project	Name	TVA-ALF RIWP W	ells		Date Starte	d1	0/4/18	Completee	10/4/18
Project	Location	n Memphis, Tenn	essee		Depth to Wa	ater 1	6.50 ft	Date/Time	11/27/18
Supervi	sor	Lee Eaves			Depth to Wa	ater 1	8.25 ft	Date/Time	12/3/18
Logged	by	Lee Eaves			Driller	Ν	latt Pope		
Drilling	Contract	or Cascade Drilling	g		Drill Rig Typ	be and ID	Prosor	nic LS600 /	#10-00273
Overbur	rden Dril	ling and Sampling To	ools (Type a	and Size) Sonic Tool	ing - 9" Bit	t, 9" Casing	, 6" Barrel, 3.	5" Rods
Sample	r Hamm	er Type <u>N/A</u>	Weight	t N/A	Drop	N/A	Ef	ficiency _	N/A
Borehol	Borehole Azimuth N/A (Vertical)				Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	_
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
217.6'	0.0'	Top of Hole							
210.0	1.0	I Opsoll		-					4" Monitoring
-		(7.5YR 4/4), fine-g	grained,			7.01	100		See Well
_		moist			0.0" - 7.0"	7.0	100		Construction
-									
-								7.0'	-
209.6'	8.0'							1.0	-
_		Silty Lean Clay (C	EL),						-
-		firm, low plasticity	, son to , moist						-
-					7 0' - 17 0'	10.0'	100		-
_						10.0	100		-
-									
	16.01								-
201.0	16.0	Silty Sand (SM) h	nown	-				17.0'	-
06.601		(7.5YR 4/4), fine-g	grained,						
		moist to wet							
EMSM-G									-
EST.GPJ					17 0' -	7 0'	70		-
7013NE W					27.0'				-
17557									
									-
- NO RI								27.0'	
SONIC BI									
TVA									



Stantec	Borehol	e Identification _PN	IW-04B				Tota	al Boring Dep	oth 62.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u> 3	35°04'27	.97", W90°08	3'22.09" (NAD83)
Project I	Number	175577013			Surface Ele	evation 21	7.6 ft	Elevation E	Datum NGVD29
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_ 	31.0'			-					-
	33.0'	Clayey Sand (SC) grey (7.5YR 4/1), \[fine-grained, wet]	, dark	-	27.0' - 37.0'	10.0'	100		-
182.6'	35.0'	Poorly Graded Sa dark grey (7.5YR	nd (SP), 4/1),	-					-
-	Clayey Sand (SC), dark grey (7.5YR 4/1), fine-grained, wet							37.0'	-
-					37.0' - 47.0'	6.5'	65		-
172.6'	45.0' Silty Sand (SM), dark grey		-					-	
		(7.5YR 4/1), fine-g	grained,					47.0'	-
		wet			47.0' - 57.0'	7.0'	70		-
2/4/19								57.0'	-
				57.0' - 62.0'	3.0'	60		- - -	
	155.6' 62.0' No Pofusol /							02.0	
BORING LOG - NO ROCK ALLEN 17837013	Bottom of Hole								-
								_	



Stantec	Borehol	e Identification PN	1W-04C				Tota	I Boring De	pth 137.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'27.	.98", W90°0	8'21.97" (NAD83)
Project I	Number	175577013			Surface Ele	vation 2	17.5 ft	Elevation	Datum NGVD29
Project I	Name	TVA-ALF RIWP W	ells		Date Started	d _1(0/2/18	Completed	10/3/18
Project	Locatior	nMemphis, Tenn	essee		Depth to Wa	ater 10	6.36 ft	Date/Time	11/27/18
Supervis	sor	Lee Eaves			Depth to Wa	ater 18	8.11 ft	Date/Time	12/3/18
Logged	by	Lee Eaves			Driller	Μ	latt Pope		
Drilling (Contract	or Cascade Drilling	g		Drill Rig Typ	e and ID	Prosor	nic LS600 /	#10-00273
Overbur	den Dril	ling and Sampling To	ools (Type a	and Size) Sonic Tooli	ing - 9" Bit	, 9" Casing	, 6" Barrel, 3.	5" Rods
Sampler	r Hamme	er Type _N/A	Weight	t N/A	Drop	N/A	Ef	ficiency	N/A
Borehole	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
217.5'	0.0'	Top of Hole							
- 2 17.0'~-	~_0.5'_~	Topsoil Silty Sand (SM), b	prown						4" Monitoring Well Installed,
-		(7.5YR 4/4), fine-g moist	grained,		0.0' - 7.0'	7.0'	100		See Well Construction Log For Details
_									
-								7.0'	_
209.5'	8.0'		<u>, , , , , , , , , , , , , , , , , , , </u>	_					
-		brown (7.5YR 4/4)), soft to						_
-		firm, low plasticity							
_					7.0' - 17.0'	8.5'	85		
-									
-									_
201.5'	16.0'			_					
-		Silty Sand (SM), b (7.5YR 4/4), fine-c	prown grained.					17.0'	
-		moist to wet	j c,						
_									
_									
- 104 5'	23 0'				17.0' - 27.0'	9.0'	90		
194.0	23.0	Sandy Lean Clay	(CL). Г	-					
_		gray (7.5YR 4/1), plasticity, wet	soft, low						-
_		Poorly graded Sar	nd					27.0'	
_		(7.5YR 4/4), fine-g	grained,						
187.5'	30 0'	moist to wet							



Stantec Borehole IdentificationPMW-04CClientTennessee Valley Authority							Tota	I Boring De	oth 137.0 ft
Client		Tennessee Valley	Authority		Boring Location <u>N35°04'27.98", W90°08'21.97" (</u>			<u>8'21.97" (NAD83</u>)	
Project	Number	175577013			Surface Ele	vation 2	17.5 ft	Elevation I	Datum NGVD29
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_ _ 	32.0'	Clay with Sand (C (7.5YR 4/1), fine-c ∖wet	E), gray grained,	-	27.0' - 37.0'	8.0'	80		-
183.5'	34.0'	Poorly Graded Sa	nd (SP), 4/1), /	-					-
	36.0'	fine-grained, wet Clay with Sand (C	/ E), gray	-				27.0'	
-		wet						57.0	-
- - - -	42.0'	gray (7.5YR 4/1), s firm, low to mediu plasticity, wet	(CL), soft to m		37.0' - 47.0'	8.5'	85		- -
	43.0	Silty Sand (SM), g (7.5YR 4/1), fine-g	jray, grained,	-					
-		wet						47.0'	-
 	48.0'	Poorly Graded Sa gray, (7.5YR 4/1), fine-grained, wet	nd (SP),	_					-
-					47.0' - 57.0'	9.0'	90		-
1								57.0'	-
									-
6577013NE WEST GPJ F					57.0' - 67.0'	9.0'	90		-
11- 	66.0'								-
		Poorly Graded to Graded Sand (SP grayish brown (10 fine to medium gra wet, trace 1/4' to 3	Well -SW), YR 5/2), ained, 3" gravel					67.0'	-



Stantec Borehole Identification PMW-04C								Tota	I Boring De	pth 137.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'27.	.98", W90°0	8'21.97" (NAD83)
	Project N	Number	175577013			Surface Ele	vation 2	17.5 ft	Elevation I	Datum NGVD29
Ī	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
ŀ	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	- - -		Poorly Graded to ' Graded Sand (SP grayish brown (10 fine to medium gra wet, trace 1/4' to 3 (Continued)	Well -SW), YR 5/2), ained, 8" gravel		67.0' - 77.0'	5.5'	55		
	-								77.0'	-
	· 					77.0' - 87.0'	4.0'	40		- - - - - - - - - - - -
ł	-								87.0	
	128.5' 	89.0'	Well Graded Sand grayish brown (10 fine to coarse grai trace 1/4' to 1" gra	d (SW), YR 5/2), ned, wet, avel		87.0' - 97.0'	7.0'	70		-
2/4/19	120.5'	97.0'			-				97.0'	
75577013NEWEST.GPJ FMSM-GRAPHIC LOG.GDT	- - - 113.5'	104.0'	Poorly Graded Sa gray, (7.5YR 4/1), fine-grained, wet, fragments from 97	nd (SP), wood 7'-98'		97.0' - 107.0'	4.0'	40		- - - - -
G - NO ROCK ALLEN_17	- 110.5'	107.0'	Well Graded Sand grayish brown (10 fine to coarse grai _ trace 1/4' to 1" gra	d (SW), YR 5/2), ned, wet, avel ~					107.0'	
IVA SONIC BORING LO	- _		Poorly Graded Sa gray, (7.5YR 4/1), fine-grained, wet	nd (SP),						



	Stantec	Borehole	e Identification PM	W-04C				Tota	I Boring Dep	oth 137.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ation N	35°04'27.	.98", W90°0	8'21.97" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 21	7.5 ft	Elevation [Datum NGVD29
	Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	105.5'	112.0'	Well Graded Sand	I (SW),		107.0' - 117.0'	9.0'	90		-
	grayish brown (10YR 5/2), fine to coarse grained, wet, trace 1/4' to 1" gravel							-		
┢									117.0'	-
										- - -
	95.5' 122.0'		-	117.0' - 127.0'	9.5'	95		-		
			Clayey Sand (SC) gray (7.5YR 3/1), fine-grained, wet	, dark		127.0				-
┢	91.5'	126.0'			-				(07.0)	-
-			Fat Clay (CH), dar (7.5YR 3/1), very s plasticity, wet	k gray stiff, high					127.0'	-
-	-					127.0' - 137.0'	9.0'	90		-
┢										-
4/19	80.5'	137.0'							137.0'	-
APHIC LOG.GDT 2/			No Refusal / Bottom of Hole							-
FMSM-GR	-									-
EST.GPJ	-									-
7013NEW										-
LEN_17557										_
ROCK ALI										-
L L	-								-	
A SONIC BORING	-									-



Stantec Borehole Identification PMW-07A									
Stantec	Borehol	e Identification PM	/W-07A				Tota	I Boring De	pth 27.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'28.	.59", W90°C	08'19.91" (NAD83)
Project I	Number	175577013			Surface Ele	vation 2	15.5 ft	Elevation	Datum NGVD29
Project I	Name	TVA-ALF RIWP W	ells		Date Started	d _ 1	0/23/18	Complete	d 10/23/18
Project	Location	n Memphis, Tenn	lessee		Depth to Wa	ater 7	.69 ft	Date/Time	e <u>11/27/18</u>
Supervis	sor	Lee Eaves			Depth to Wa	ater 8	.67 ft	Date/Time	e <u>12/3/18</u>
Logged	by	Lee Eaves			Driller	N	latt Pope		
Drilling (Drilling Contractor Cascade Drilling				Drill Rig Typ	be and I	D Prosor	nic LS600 /	#10-00273
Overburden Drilling and Sampling Tools (Type an				and Size) Sonic Tooli	ing - 9" Bi	t, 9" Casing	, 6" Barrel, 3.	5" Rods
Sampler Hammer Type N/A Weight				t N/A	Drop	N/A	Ef	ficiency _	N/A
Borehole Azimuth N/A (Vertical)				Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.	
Lithology Overburden				Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_ 215.5'	0.0'	Top of Hole							-
214.5'	1.0'			-					4" Monitoring
_		Silty Sand (SM), b fine-grained, mois	prown, st						Well Installed, See Well
212.5'	3.0'	,							Construction
		Sandy Silt (ML), b	prown,		0.0' - 7.0'	7.0'	100		Log For Details
-		fine-grained sand	St,						
F		-							-
209.5'	6.0'	Loop Clay with Si	Ity Sand	_					
-		(CL), dark brown	(7.5YR					7.0'	-
_		3/4), firm, low plas moist	sticity,						
									-
1 2/4/15									
IIC F00.0					7.0' - 17.0'	10.0'	100		
M-GRAPH									
^{ଞ୍} 201.5'	14.0'			_					
200.5'	15.0'	Clayey Sand (SC)), brown,						
75577013		Poorly Graded Sa	nd (SP)						-
ALLEN	Poorly Graded Sand (SP), brown, fine-grained, wet							47.01	
N0 R0CK 								17.0	-
- 907 9A									
TVA SO									



Stantec	Borehol	e Identification _PM				Tota	I Boring Dep	oth 27.0 ft	
Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u>	35°04'28.	.59", W90°0	8'19.91" (NAD83)
Project N	Number	175577013			Surface Ele	vation 21	15.5 ft	Elevation [Datum NGVD29
Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_									-
194.5'	21.0'			-					_
		Silty Sand (SM),			17.0' -	9.0'	90		
192 5'	23 0'	fine-grained, wet			27.0'				_
	20.0	Silty Sand (SM), d	ark gray.	-					-
_		fine-grained, wet	0 7						-
_ 190.5'	25.0'		(01)	-					_
_		Sandy Lean Clay	(CL), v. (GLEY						_
188.5'	27.0'	1 4/5GY), soft to fi	rm, low					27.0'	
		No Refusal /	ity, wei						
-		Bottom of Hole							-
-									_
-									_
									_
									_
-									-
-									-
F									_
									_
<u>6</u>									-
.GDT 2/4									-
									-
ISM-GRAI									_
T.GPJ FN									
3NEWES									
17557701									-
									-
N 0400									-
- 90 T 00									_
									_
TVA SOI									



ΓV

SUBSURFACE LOG

-										
ſ	Stantec	Borehol	e Identification _PM	W-07B				Tota	I Boring De	pth 57.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'28.	59", W90°0)8'19.82" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	15.6 ft	Elevation	Datum NGVD29
	Project I	Name	TVA-ALF RIWP W	ells		Date Starte	d _1	0/22/18	Completee	d <u>10/22/18</u>
	Project	Locatior	Memphis, Tenno	essee		Depth to Wa	ater 1	4.30 ft	Date/Time	. 11/27/18
	Supervis	sor	Lee Eaves			Depth to Wa	ater 1	6.18 ft	Date/Time	. 12/3/18
	Logged	by	Lee Eaves			Driller	Ν	latt Pope		
	Drilling (Contract	or Cascade Drilling	9		Drill Rig Typ	be and ID	Prosor	nic LS600 /	#10-00273
	Overburden Drilling and Sampling Tools (Type and				and Size) Sonic Tool	ing - 9" Bit	, 9" Casing	, 6" Barrel, 3.	5" Rods
	Sampler	r Hamme	er Type N/A	Weight	tN/A	Drop	N/A	Ef	ficiency _	N/A
	Borehole	e Azimut	h N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
Ī	Litholo	ogy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
ļ	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
┟	215.6'	0.0'	Top of Hole							
ł	214.6	1.0								4" Monitoring
ł	-		fine-grained, moist	rown, t						See Well
ľ	_		0			0.0' - 7.0'	7.0'	100		Construction
	_									
╞	209.6'	6.0'							7.01	-
ł	-		(CL). dark brown (ty Sand 7.5YR					7.0'	-
	-		3/4), firm, low plas	ticity,						-
	_		moist							_
	-									-
ł	202 6'	13 0'				7.0' - 17.0'	9.5	95		-
ł	202.0	10.0	Silty Sand (SM), b	rown,	-					-
	200.6'	15.0'	fine-grained, wet							_
4/19	-		Poorly Graded Sal	nd (SP), d. wot					47.01	-
6DT 2/	-		brown, nne-granie	u, wei					17.0'	
PHIC LOG	-									-
SM-GRA	_									_
LGPJ FN	194.6'	21.0'			-					-
3NE WEST	-		Silty Sand (SM), gravish-brown			17.0' - 27.0'	4.0'	40		-
17557701	-		fine-grained, wet							-
ALLEN	_									-
NO ROCK	-									-
- 901 9I	188.6'	27.0'		dort	-				27.0'	
IIC BORIN	-		gray, fine-grained,	wet						-
VA SON	185 6'	30.0'								-



Stantec	Borehol	e Identification _PM				Tota	I Boring Dep	oth 57.0 ft		
Client	Client Tennessee Valley Authority					Boring Location <u>N35°04'28.59", W90°08'19.82" (NAD</u>				
Project	Number	175577013			Surface Ele	vation 21	5.6 ft	Elevation [Datum NGVD29	
Lithol	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
-		Sandy Lean Clay dark greenish gray 1 4/5GY), soft to fi to medium plastici	(CL), y, (GLEY rm, low ty, wet		27.0' - 37.0'	7.0'	70		-	
- 178.6'	37.0'							37.0'	-	
- - - -		Sandy Clayey Silt dark greenish-gra (GLEY1 4/5GY), s plasticity, fine grai	(ML), y, oft, low ned, wet		37.0' -	7.0'	70		- - - -	
172.6'	43.0'	Silty Sand (SM) d	ark grav	-	47.0'				-	
170.6'	45.0'	fine-grained, wet	an gray,	_					-	
-		Poorly Graded Sa dark gray, fine-gra wet	nd (SP), iined,					47.0'	-	
- - - -					47.0' - 57.0'	6.0'	60		- - - -	
_ 158.6'	57.0'							57.0'	-	
	57.0	No Refusal / Bottom of Hole		<u> </u>				57.0	- - - - - - - - - - - - - - - - - -	



TVA V

	Stantec	Borehol	e Identification PM	1W-07C				Tota	I Boring De	pth 124.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'28.	59", W90°0	8'19.74" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	15.6 ft	Elevation	Datum NGVD29
	Project I	Name	TVA-ALF RIWP W	ells		Date Started	d1	0/18/18	Completed	10/19/18
	Project	Locatior	n Memphis, Tenn	essee		Depth to Water 14.26 ft Date/Time				11/27/18
	Supervis	sor	Lee Eaves			Depth to Wa	Depth to Water 16.12 ft Date/Time			
	Logged by Lee Eaves					Driller	Ν	latt Pope		
	Drilling Contractor Cascade Drilling					Drill Rig Typ	be and ID	Prosor	nic LS600 /	#10-00273
	Overbur	den Dril	ling and Sampling Te	ools (Type a	and Size) Sonic Tooli	ing - 8" Bit	, 8" Casing	, 6" Barrel, 3.	5" Rods
	Sampler	Hamm	er Type N/A	Weight	t N/A	Drop	N/A	Ef	ficiency	N/A
	Borehol	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	_ 215.6'	0.0'	Top of Hole							
	214.6'	1.0'	Topsoil							4" Monitoring
			Silty Sand (SM), b	prown,						Well Installed,
			fine-grained, mois	it						See Well
	212.6'	3.0'	Clayay Sand (SC)	brown	-	0.0' - 7.0'	7.0'	100		Log For Details
	_		fine-grained, mois	st						-
	210.6'	5.0'	-							
			Lean Clay with Sil	ty Sand						_
	_		(CL), dark brown (3/4), firm, low plas	(7.5YR sticity.						-
	_		moist	,					7.0'	
	_									
	_									-
T 2/4/19	_									
CLOG.GD	203.6'	12.0'			-	7.0' - 17.0'	10.0'	100		-
GRAPHIC	_		Silty Sand (SM), b	prown,						
J FMSM-			into granioa, wor							
VEST.GP	_									-
7013NEV	_									-
EN_1755:	199.6'	16.0'			-					-
OCK ALL	_		Poorly Graded Sa brown, fine-graine	nd (SP), ed. wet					17.0'	
G - NO R				,						
RING LO	_									-
SONIC BC	_									-
A 5										



Stantec Borehole Identification PMW-07C					Total Boring Depth 124.0 ft					
	Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'28.	.59", W90°0	8'19.74" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	15.6 ft	Elevation I	Datum NGVD29
	Litholo	рду		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
╞	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
┢										
	194.6'	21.0'			-					_
			Silty Sand (SM), g	rayish		17.0' -	10.0'	100		_
			brown, nine-graine	.u, wet		27.0'				
F	101 0	24.01								-
┢	191.0	24.0	Clavey Sand (SC)	dark	-					-
┢	190.6'	190.6' 25.0' Grayey Sand (SC), dark gray, fine-grained, wet		-						
╞			Sandy Lean Clay	(CL),						_
	dark greenish-gray, (GLEY 1 4/5GY), soft to firm, low						27.0'	_		
			to medium plastic	ity, wet						
F										-
F										-
┢										
╞										_
						27.0' -	6.0'	60		_
						37.0'				
F										_
F										-
┢										
╞	179.6'	36.0'			-					-
	178.6'	37.0'	Silty Sand (SM) da → fine grained, wet	ark gray,					37.0'	_
14/19			Sandy Lean Clay	(CL),						
DG.GDT			dark greenish-gra	y, (GLEY						_
MPHIC LC	175 01		to medium plastic	ity, wet						_
FMSM-GF	175.6'	40.0'	Silty Sand (SM)	lark grav	-					
I			fine-grained, wet	iaik glay,						-
013NEW						37.0' -	9.0'	90		_
N_175571						47.0'				
DCK ALLE										_
G - NO RC										-
DRING LO										
SONIC BC										-
YA §										



Stantec Borehole Identification PMW-07C				Total Boring Depth 124.0 ft					
Clien	t	Tennessee Valley	Authority		Boring Location N35°04'28.59", W90°08'19.74" (Na				
Proje	ct Number	175577013			Surface Ele	vation 21	15.6 ft	Elevation Datum NGVD29	
Lit	nology		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevatio	n Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-									-
167.6	48.0'							47.0_/	
		Poorly Graded Sa	nd (SP),						
-		dark gray, fine-gra	ained,						-
\vdash									_
-									-
_					47.0' -	8.0'	80		-
					57.0				
-									-
\vdash									-
-									-
_								57.0'	-
_									_
-									_
F									
-									-
-					57.0' - 67.0'	7.0'	70		-
_					07.0				-
2/4/19									_
06.6DT									_
									-
148.6	67.0'		A / - 11	-				67.0'	-
L L		Graded Sand (SP	vvell -SW),						-
7013NEW		grayish-brown, fin	e to						
EN_175573		contains 1/4" to 2'	' gravel						_
									-
- 90 - NO KI									-
					67.0' - 77.0'	1.5'	15		-
SONICBC									-
TVA									



Stantec Borehole Identification PMW-07C						Tota	I Boring De	pth 124.0 ft		
	Client		Tennessee Valley	Authority		Boring Loca	tion N	35°04'28.	.59", W90°0	8'19.74" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	15.6 ft	Elevation I	Datum NGVD29
Ī	Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	-		Poorly Graded to Graded Sand (SP	Well -SW),						-
	-		grayisn-brown, fin medium grained, v contains 1/4" to 2" (Continued)	e to wet, gravel					77.0'	-
	-		. ,							
ł	-									-
ł	-									-
┢	_									_
	-									-
	133.6'	82.0'			_	77.0' - 87.0'	6.5'	65		-
	_		grayish-brown, fin	l (SW), e to		07.0				-
	_		coarse grained, w	et, ' gravel						_
				graver						
	_									_
	-								87.0'	-
ł	-								07.0	
	-									-
	-									-
┟	_									_
19	-									-
3.GDT 2/4/	-					87.0' - 07.0'	10.0'	100		-
PHIC LOG	-					97.0				-
MSM-GR4	_									_
EST.GPJ 1										_
77013NEW	119.6'	96.0'								
LEN_17553			Well Graded Sand	ly Gravel					97 0'	_
ROCK AL	-		(Gvv), grayish-bro to coarse grained	wn, fine sand,					01.0	-
LOG - NO	-		wet, contains 1/4" gravel	to 3"						-
C BORING	-		5							-
LVA SONE	_ 115.6'	100.0'			-					



ſ	Stantec	Borehole	e Identification _PM				Tota	I Boring Dep	oth 124.0 ft	
	Client		Tennessee Valley	Authority		Boring Location <u>N35°04'28.59", W90°08'19.74" (NAD</u>				
	Project N	Number	175577013			Surface Ele	vation 21	5.6 ft	Elevation [Datum NGVD29
	Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
┟	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	-		Poorly Graded to Graded Sand (SP- grayish-brown, fin- medium-grained, v contains 1/4" to 2" (Continued)	Well -SW), e to wet, ' gravel		97.0' - 107.0'	6.5'	65		-
	108.6'	107.0'			-				107.0'	-
	- Well Graded Gravelly Sand (SW), grayish-brown, fine to coarse grained sand, wet, contains 1/4" to 3" gravel							-		
-	-		Well Graded Sand grayish-brown, fin- coarse grained, w contains 1/4" to 3"	d (SW), e to et, ' gravel	-	107.0' - 117.0'	6.0'	60		- - - -
	_								117.0'	_
.0G.GDT 2/4/19	96.6'	119.0'		deale	-					-
75577013NEWEST.GPJ FMSM-GRAPHIC L	-		Silty Fat Clay(CH) greenish-gray (GL 4/5GY), very stiff, plasticity, wet	, оагк EY 1 high		117.0' - 124.0'	7.0'	100		-
ALLEN 1	91.6' 124.0'							124.0'		
O ROCK	No Refusal /			I		ı				
VA SONIC BORING LOG - N	- Bottom of Hole									-



-										
ſ	Stantec Borehole Identification PMW-10A							Tota	I Boring De	pth 45.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'09.	.28", W90°0	08'13.68" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	18.9 ft	Elevation	Datum NGVD29
	Project I	Name	TVA-ALF RIWP W	ells		Date Starte	d _1	0/24/18	Completed	10/24/18
	Project	Locatio	n Memphis, Tenn	essee		Depth to Wa	ater 12	2.44 ft	Date/Time	11/27/18
	Supervis	sor	Stephen Karper	nko		Depth to Wa	12/3/18			
	Logged by Stephen Karpenko					Driller Thesius Taylor				
	Drilling Contractor Cascade Drilling					Drill Rig Typ	be and ID	D Terras	onic TSi 15	0T/ #11-38212
	Overbur	den Dril	ling and Sampling To	ools (Type a	and Size) Sonic Tool	ing - 8" Bit	, 8" Casing	, 6" Barrel, 3.	5" Rods
	Sampler	r Hamm	er Type <u>N/A</u>	Weight	t N/A	Drop	N/A	Ef	ficiency _	N/A
	Borehole	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
ſ	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	-
╞	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
F	218.9' 218.4'./	0.0' 0.5' /								
ľ			Silty Lean Clay wi	th Sand				100		4" Monitoring Well Installed.
			(CL), grayish-brow	vn (10YR		0.01 - 5.01	5.0	100		See Well
┢			low plasticity, mois	st,					5.0'	Log For Details
ŀ	-		contains fine grain with intermittent cl	ied sand, avev					5.0	-
			sand lens, poorly	graded						
╞			Sanu II 0111 4.0 10 4	+.5						
┢						5 0' - 15 0'	6.0'	60		
E	- 208.4'	10.5')	_		0.0	00		-
┟			gray (2.5Y 4/1), m	edium						
┟	204 0'	14 0'	stiff, medium plast	ticity,						
ł	204.9	14.0	Poorly Graded Sa	nd with	_				15.0'	
6	_		Clay and Silt (SP)	, light d. loose						
GDT 2/4/			moist to saturated	u, 1003e,						
HIC LOG.										
SM-GRAP	_					15.0' -	7.0'	70		_
.GPJ FM						25.0'				
3NE WEST										
17557701	195.4' 23.5'				_					
ALLEN	- Silty Sand (SM), gray, very								25.0'	
- NO ROCI	- fine to fine grained, loose, saturated									
NG LOG -										
NIC BORI										
TVA SO						25.0' -	9.0'	90		



Stantec Borehole Identification PMW-10A Client Tennessee Valley Authority							Tota	I Boring Dep	oth 45.0 ft
Client	Client Tennessee Valley Authority				Boring Loca	ition <u>N</u>	35°04'09.	.28", W90°0	8'13.68" (NAD83)
Project I	Number	175577013			Surface Ele	vation 21	18.9 ft	Elevation [Datum NGVD29
Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_ _ _	32.0'	Sandy Silt (ML), g to medium stiff, sa	ray, soft turated,		35.0'				 - -
-		trace mica, trace of trace lignite, trace grained sand	lay, very fine					35.0'	-
- - - 178.9'	40.0'				35.0' -	8.0'	80		-
- 177.4'	178.9' 40.0' 177.4' 41.5' Fat Clay (CH), gray, medium stiff, high plasticity, saturated			45.0'				-	
173.9'	Sandy Silt (ML), gray, soft to medium stiff, saturated, trace mica, trace clay,						45.0'		
		grained sand No Refusal / Bottom of Hole							- - - - - - - - - - - - - - - - - - -



_										
	Stantec Borehole Identification PMW-10B							Tota	I Boring De	pth 75.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'09.	.27", W90°0	08'13.60" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	18.9 ft	Elevation	Datum NGVD29
	Project I	Name	TVA-ALF RIWP W	ells		Date Starte	d _1(0/23/18	Completed	10/23/18
	Project	Locatio	n Memphis, Tenn	essee		Depth to Water 22.18 ft Date/Time				11/27/18
	Supervis	sor	Stephen Karper	nko		Depth to Water 22.98 ft Date/Time				12/3/18
	Logged by Stephen Karpenko					Driller	Т	hesius Ta	ylor	
	Drilling (Contract	or Cascade Drillin	g		Drill Rig Typ	e and ID	D Terras	onic TSi 15	0T/ #11-38212
	Overbur	den Dril	ling and Sampling To	ools (Type a	and Size) Sonic Tool	ing - 8" Bit	, 8" Casing	, 6" Barrel, 3.	5" Rods
	Sampler	Hamm	er Type <u>N/A</u>	Weight	t N/A	Drop	N/A	Ef	ficiency _	N/A
	Borehole	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	-
F	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	218.9' 218 4' ~	0.0' ⊃_0.5' ∠								
			Silty Lean Clay wi	th Sand			5.01	100		4" Monitoring Well Installed.
-			(CL), grayish-brov	vn (10YR		0.0" - 5.0"	5.0	100		See Well
-			low plasticity, moi	st,					5.0'	Log For Details
		I	contains fine grain with intermittent c	ned sand lavev					5.0	-
F	212.4'	6.5'	sand lens, poorly	graded	-					
+			Silty Fat Clay (CH) dark						
-			gray (2.5Y 4/1), m	edium		5 0' - 15 0'	9.0'	90		
F			moist	licity,						-
-										
+	204 0'	14 0'								
-	204.3	14.0	Poorly Graded Sa	nd with	-				15.0'	
- 10 -			Clay and Silt (SP)	, light						
GDT 2/4/			moist to saturated	u, 1003e,						
HIC LOG.										
SM-GRAP						15.0' -	10.0'	100		_
I.GPJ FM						25.0'				
3NE WEST										
17557701	<u>195.4'</u> 23.5'				-					
	- Silty Sand (SM), gray, fine grained, loose, moist to								25.0'	-
- NO ROC	- grained, loose, moist to saturated									
NG LOG										
NIC BOR										
TVA SC						25.0' -	10.0'	100		



Stantec	Borehol	e Identification _PM				Tota	I Boring De	oth 75.0 ft	
Client	Client Tennessee Valley Authority				Boring Location N35°04'09.27", W90°08'13.60" (NAD83				
Project	Number	175577013			Surface Ele	vation 21	18.9 ft	Elevation I	Datum NGVD29
Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	31 0'				35.0'				_
107.9	51.0	Sandy Silt (ML), g	rav. soft	-	00.0				-
_		to medium stiff, sa	iturated,						-
-		trace lignite	Jay,					05.01	-
-								35.0	
-									-
_									-
-	40.0'				25.01	5 5'	EE		-
_ 170.9	40.0	Fat Clay (CH), gra	V.	-	45.0'	5.5	55		-
- 177.4'	41.5'	medium stiff, high	д /	-					-
_		Sandy Silt (ML) a	u /						-
-		to medium stiff, sa	iturated,					45 0'	-
-		trace mica, trace o trace o	slay,					+0.0	_
_		Ū							-
_									-
-					45 0' -	8.0'	80		-
 	51.0'				55.0'	0.0			
_		Silty Sand (SM), g	ray, fine						-
-		trace lignite and cl	ay						-
-								55.0'	-
_									-
DT 2/4/19									-
									-
					55.0' -	4.0'	40		-
BPJ FMSI					65.0'				-
156.4'	62.5'								Grading coarser
75577013		Poorly Graded Sa	nd (SP),						with depth
		fine-grained, loose	2,					65.0'	_
0 R 0 C C C C C C C C C C C C C C C C C		saturated, trace si and lignite	lt, clay,						-
10 10 10		U •••							-
									-
§148.9'	70.0'				65.0' -	9.0'	90		



ſ	Stantec	Borehol	e Identification PN				Tota	I Boring De	oth 75.0 ft	
	Client Tennessee Valley Authority					Boring Loca	ation <u>N</u> :	35°04'09	.27", W90°0	8'13.60" (NAD83)
	Project I	Number	175577013			Surface Ele	evation 21	8.9 ft	Elevation [Datum NGVD29
Ī	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_			Poorly Graded Sa gray, fine-grained, saturated, trace: s lignite, and gravel (Continued)	nd (SP), , loose, ilt, clay,		75.0'				- - -
╞	143.9'	75.0'							75.0'	
ł	No Refusal / Bottom of Hole									-
╞										-
										-
										-
┟										-
										_
┟	-									_
										-
┢										-
	_									-
┢										-
t										-
╞										-
ŀ	_									_
2/4/19										-
LOG.GDT										-
A-GRAPHIC	_									-
GPJ FMSN										-
3NEWEST.										-
17557701:										-
CK ALLEN	_									_
G - NO RO										-
ORING LOI										-
A SONIC B(_									-
₹ L	-									



_										
	Stantec Borehole Identification PMW-10C							Tota	I Boring De	pth 175.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'09	.27", W90°0	08'13.51" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	18.8 ft	Elevation	Datum NGVD29
	Project I	Name	TVA-ALF RIWP W	ells		Date Starte	d _1	0/18/18	Complete	d <u>10/18/18</u>
	Project	Locatio	n Memphis, Tenn	essee		Depth to Wa	ater 2	2.11 ft	Date/Time	e <u>11/27/18</u>
	Supervis	sor	Stephen Karper	nko		Depth to Water 22.90 ft Date/Time 12/3				
	Logged by Stephen Karpenko					Driller	Т	hesius Ta	aylor	
	Drilling Contractor Cascade Drilling					Drill Rig Typ	be and ID	D Terras	onic TSi 15	0T/ #11-38212
	Overbur	den Dril	ling and Sampling To	ools (Type a	and Size) Sonic Tool	ing - 8" Bit	t, 8" Casing	, 6" Barrel, 3.	5" Rods
	Sampler	r Hamm	er Type N/A	Weight	t N/A	Drop	N/A	Ef	ficiency _	N/A
	Borehole	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
	Lithology Overburden Sar					Depth	Rec. Ft.	Blows	Mois.Cont. %	
┢	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
┢	218.8'	0.0'	Top of Hole							
ŀ	217.8	1.0		th Cand	_					4" Monitoring
Ē			(CL), grayish-brow	vn (10YR		0.0' - 5.0'	5.0'	100		See Well
			4/2), soft to mediu low plasticity, mois	ım stiff, st.						Construction
┢	-		contains fine grain	ned sand					5.0'	-
F	212.3'	6.5'		ауеу	_					
			Silty Fat Clay (CH), dark						
╞			gray (2.5Y 4/1), m stiff, medium plast	edium ticity,			40.01	400		
┢	-		moist	-		5.0' - 15.0'	10.0	100		-
F	207.3'	11.5'			_					· · ·
			light brown, fine g	nd (SP), rained,						
┝	204.8'	14.0'	loose, moist, trace	e clay and $_{/}$	_				45.01	
ŀ	203.8	15.0	Clavey Poorly Gra	ded /	_				15.0	-
T 2/4/19			Sand (SC), light b	rown,						
: LOG.GD			trace silt	e, moist,						
GRAPHIC			Poorly Graded Sa	nd (SP),		15.0'	7.0'	70		
J FMSM	-		light brown, fine g loose, moist, trace	rained, e clav and		25.0'	7.0	70		-
WEST.GF			silt	, ,						
577013NE										
LLEN_178	194.8' 24.0'								25.0'	
D ROCK A	-		grained, loose, mo	pist to					20.0	-
LOG - NC			very moist, trace r	nica						
BORING										
VA SONIC						25.0'-	9 0'	90		



Stantec Borehole Identification PMW-10C								Tota	I Boring De	oth 175.0 ft
	Client		Tennessee Valley	Authority		Boring Location <u>N35°04'09.27", W90°08'13.51" (NA</u>				
	Project I	Number	175577013			Surface Ele	vation 2	18.8 ft	Elevation [Datum NGVD29
	Litholo	рду	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
╞	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	- 185.8'	33.0'	Silty Sand (SM), g grained, loose, mo very moist, trace r (<i>Continued</i>)	ray, fine bist to nica	-	35.0'				
E			Sandy Silt (ML), g	ray, soft erv moist					35.0'	_
		40.01	to saturated, trace trace clay, trace ve grained sand	e mica, ery fine			40.01	400		-
┢	178.8	40.0	Eat Clay (CH) are	N/	-	35.0 [°] - 45.0'	10.0	100		-
F	176.8'	42.0'	medium stiff, high	plasticity	-					-
			to medium stiff, sa trace mica, trace of	ray, soft iturated, clav						-
┢	-		,						45.0'	_
	- 167.8'	51.0'				45.0' - 55.0'	9.0'	90		- - -
	_		Silty Poorly Grade (SM), gray, very fi grained, loose, sa trace lignite, trace trace medium to	d Sand ne to fine turated, clay,					55.0'	- -
CGPJ FMSM-GRAPHIC LOG.GDT 2/4/19	-		coarse-grained sa	na		55.0' - 65.0'	10.0'	100		- - - -
3NE WEST	156.3' 62.5'		-					_		
112557701	Poorly Graded Sand (SP), gray, very fine to 153.8' 65.0' fine-grained, loose,						65.0'	-		
3- NO ROCK A	saturated, trace: clay, silt, and lignite							-		
RING LOG	No Recovery							-		
TVA SONIC BC						65.0' -	0.0'	0		



Stantec Borehole Identification PMW-10C							Tota	I Boring De	oth 175.0 ft	
	Client Tennessee Valley Authority				Boring Location <u>N35°04'09.27", W90°08'13.51" (N</u>			8'13.51" (NAD83)		
	Project I	Number	175577013			Surface Ele	vation 21	18.8 ft	Elevation [Datum NGVD29
Ī	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
┟	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	-	No Recovery (Continued)			75.0'				-	
ł	143.8' 75.0' 143.8' 75.0' Poorly Graded Sand (SP), gray, very fine to fine grained, loose, saturated, trace silt, trace lignite, trace clay, trace medium to coarse-grained sand Silty Sand (SM) with lignite from 83.0' to 84.0'							-		
								-		
┟			-				75.0'	-		
				75.0' - 85.0'	10.0'	100		- - - - -		
							85.0'	-		
t	-								00.0	
						85.0' - 95.0'	7.0'	70		- - - - - -
ł	-								95.0	-
7013NEWEST.GPJ FMSM-GRAPHIC LOG.GDT 2/4/19						95.0' - 105.0'	7.0'	70		- - - - - -
EN_17557							105.0'	-		
ROCK ALL	-							-		
RING LOG - NO R								-		
TVA SONIC BO.	- - -			105.0' -	10.0'	100		-		



Stantec Borehole Identification PMW-10C					Total Boring Depth 175.0 ft				
Clien	Client Tennessee Valley Authority				Boring Location <u>N35°04'09.27", W90°08'13.51</u>			8'13.51" (NAD83)	
Proje	ct Number	175577013			Surface Ele	vation 2	18.8 ft	Elevation I	Datum NGVD29
Lit	hology	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevatio	n Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_				115 0'				_	
-					110.0				-
105.8	' 113.0'	Poorly Graded Sa	nd (SP)	-					-
_ 103.8	' 115.0'	gray, very fine to f	ine (SF),					115.0'	-
		grained, loose, sa intermittent clav. t	turated, race silt.						_
-		trace lignite, trace	clay,					-	
-		coarse-grained sa	ind						-
		Poorly Graded Sa	nd (SP),		115.0' -	10.0'	100		-
		gray, very fine to f grained, loose, sa	turated,		125.0'				_
-		trace silt, trace cla	iy, trace						-
-		iigritte							-
								125.0'	-
-									-
90.8'	128 0'								-
00.0	120.0	Fat Clay (CH)							-
- 69.3	129.5			-	125.0' -	10.0'	100		_
-		Poorly Graded Sa grav, very fine to f	nd (SP), îne		135.0				-
-		grained, loose, sa	turated,						-
		lignite, trace grave	el						-
\vdash		Intermittent Silt ar	nd lignite					135.0'	_
-		1011 134.0 10 130							_
	138.0'								-
<mark>8 79.8'</mark>	139.0'	Fat Clay (CH)		-					-
SM-GRAP		Poorly Graded Sa	nd (SP), ine		135.0' - 145.0'	10.0'	100		
M 76.8'	142.0'	grained, loose, sa	turated,						-
75.8'	75.8' 143.0' trace silt, trace clay, trace Fat Clay (CH) Fat Clay (CH)							-	
75577013							4.45.01	-	
ALLEN_1	Well Graded Sand (SW), grav, fine to coarse						145.0		
40 R0 CK	gray, fine to coarse grained, loose, saturated,							-	
1- 100	trace fine to coarse							-	
AIC BORIN					145 0'	3 0'	30		-
					<u>145.0 -</u> <u>155.0'</u>	3.0	30		_



Stante	Stantec Borehole Identification PMW-10C						Tota	I Boring Dep	oth 175.0 ft
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'09	.27", W90°0	8'13.51" (NAD83)
Project	Number	175577013			Surface Ele	vation 2	18.8 ft	Elevation [Datum NGVD29
Litho	logy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-		Well Graded Sand gray, fine to coars grained, loose, sa trace fine to coars grained gravel	l (SW), e turated, e					155.0'	- - -
- - - - - 56.8'	162.0'	(Continued)			155.0' - 165.0'	3.0'	30		- - - - -
54.8'	54.8' 164.0' Well Graded Gravel with Sand (GW) Well Graded Sand (SW)			-				105.01	-
		gray, fine to coars grained, loose, sa trace fine to coars	e turated, e gravel		165.0' - 175.0'	5.0'	50		
43.8'	175.0'							175.0'	
	Bottom of Hole								- - - - - - - - - - - - - - - - - - -



Stante	ec Boreho	le Identification PN	/W-11A				Tota	I Boring De	pth 35.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'08	.05", W90°0)8'13.56" (NAD83)
Projec	t Number	175577013			Surface Ele	vation 2	14.5 ft	Elevation	Datum NGVD29
Projec	t Name	TVA-ALF RIWP W	/ells		Date Starte	d _1	0/17/18	Completee	d <u>10/17/18</u>
Projec	t Locatio	n Memphis, Tenr	nessee		Depth to Water 9.14 ft Date/Time			e <u>11/27/18</u>	
Super	visor	Stephen Karpe	nko		Depth to Wa	ater 8	73 ft	Date/Time	e 12/3/18
Logge	d by	Stephen Karpe	nko		Driller Thesius Taylor				
Drilling	Drilling Contractor Cascade Drilling				Drill Rig Typ	be and ID	D Terras	onic TSi 15	0T/ #11-38212
Overb	Overburden Drilling and Sampling Tools (Type and) Sonic Tool	ing - 8" Bit	, 8" Casing	, 6" Barrel, 3.	5" Rods
Samp	Sampler Hammer Type N/A Weight				Drop	N/A	Ef	ficiency	N/A
Boreh	Borehole Azimuth N/A (Vertical)				Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
Lith	Lithology Overburden				Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
214.5	0.0'	Top of Hole							-
212.5'	2 0'								4" Monitoring
	2.0	$\langle \text{light brown, fine-g} \rangle$	jrained,	_	0.0' - 5.0'	5.0'	100		See Well
[210 0'	4 5'	loose, moist]						Construction
-		Silty Clay (CL), br	rown to	_				5.0'	-
-		banding, moist, tra	ace sand,						
-		to stiff	aium stiπ						
		Poorly Graded Sa	and (SP),						
-		light brown, fine-g	rained, e clav and		5.0' - 15.0'	6.0'	60		-
-		silt	,						
201.5'	13.0'								
_		Clayey Sand (SC)), light						
_ 199.5'	15.0'	brown, fine-graine	ed, moist, /	_				15.0'	
2/4/19		Sand (SP), light b	prown,						
06.6DT		fine-grained, well	et trace						
	19 5'	clay and silt	51, 11200						
LOOID	10.0	Silty Sand (SM), o	gray,	_	15.0' - 25.0'	5.5'	55		-
EST.GPJ		fine-grained, loos	e to		20.0				
013NEWE	medium dense, moist, intermittent silt and clay								
N_175577									
	-							25.0'	-
- NO RO	-								
186.5'	186.5' 28.0'								
ZVA S					25.0' -	10.0'	100		


Stantec Borehole	Identification PM	W-11A				Tota	I Boring Dep	oth 35.0 ft
Client	Client Tennessee Valley Authority					35°04'08.	.05", W90°0	8'13.56" (NAD83)
Project Number	175577013			Surface Ele	vation 21	4.5 ft	Elevation [Datum NGVD29
Lithology	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	Silty Sand (SM), g fine-grained, mois interbedded silt ar intermittent silt + c 28' to 34' <i>(Contin</i>	ray, t, with nd clay, lay from <i>ued)</i>		35.0'				
_ 179.5' 35.0'							35.0'	
 - -<								- - - - - - - - - - - - - - - - - - -
GDT 2/4/19								-
								-
-wsw-csa								_
								- - -
HE BORING LOG - ND ROCK -								-



SUBSURFACE LOG

_													
Γ	Stantec	Borehol	e Identification PM	W-11B				Tota	I Boring De	pth 65.0 ft			
	Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'08.	.05", W90°0	8'13.49" (NAD83)			
	Project I	Number	175577013			Surface Ele	vation 2	14.4 ft	Elevation	Datum NGVD29			
	Project I	Name	TVA-ALF RIWP W	ells		Date Starte	d _1	0/16/18	Completed	10/16/18			
	Project	Location	n Memphis, Tenn	essee		Depth to Wa	ater 1	7.80 ft	Date/Time	11/27/18			
	Supervis	sor	Stephen Karper	ıko		Depth to Wa	ater 18	8.58 ft	Date/Time	12/3/18			
	Logged	by	Stephen Karper	ıko		Driller Thesius Taylor							
	Drilling (Drilling Contractor Cascade Drilling					be and ID	Terras	onic TSi 15	0T/ #11-38212			
	Overburden Drilling and Sampling Tools (Type and) Sonic Tool	ing - 8" Bit	, 8" Casing	, 6" Barrel, 3.	5" Rods			
	Sampler Hammer Type N/A Weight					Drop	N/A	Ef	ficiency _	N/A			
	Borehole Azimuth N/A (Vertical)					Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.			
	Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %				
┢	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks			
F	214.4	0.0' ~ 0.5' ⁄~			-								
			Clavev Sand (SC)	. brown.			5.01	100		4" Monitoring Well Installed.			
	211.4'	3.0'	fine-grained, loose	-	0.0 - 5.0	5.0	100		See Well				
┢			Silty Clay (CL) bro					5.0'	Log For Details				
F	-		(7.5YR 4/2) with so	Silty Clay (CL), brown (7.5YR 4/2) with some			some					5.0	-
			with some fine-gra	ained									
╞	005 41	0.01	sand	and									
┢	205.4	9.0	Poorly Graded Sa	nd (SP)	-	5.0' - 15.0'	6.0'	60					
	-		with silt, light brow	in to						-			
╞			clay	liace									
┢			Clay lens 13 0' to	13 5'									
				10.0					15.0'				
- 19										_			
GDT 2/4/													
HIC LOG.													
SM-GRAP	_					15.0' -	4.0'	40		_			
F.GPJ FM	193.4'	21.0'			-	25.0'							
3NE WEST			Silty Sand (SM), g	ray, very									
17557701		fine to fine-grained, loose to medium dense, moist to											
ALLEN	-	saturated, trace mica							25.0'				
NO ROCI													
- DOL DO													
NIC BORI													
TVA SOI						25.0' -	5.0'	50					



Γ	Stantec Borehole Identification PMW-11B Client Tennessee Valley Authority							Tota	I Boring Dep	oth 65.0 ft
	Client Tennessee Valley Authority					Boring Loca	ation <u>N</u>	35°04'08.	.05", W90°0	8'13.49" (NAD83)
	Project I	Number	175577013			Surface Ele	evation 21	14.4 ft	Elevation [Datum NGVD29
	Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
╞	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-						35.0'				-
╞	181.4'	33.0'			-					-
-	179.4'	35.0'	Silty Sand with Cla very fine to fine-gr sand, loose to me dense moist to sa	ay (ML), ained dium	-				35.0'	-
-	- - <td></td> <td></td> <td></td> <td></td> <td></td> <td>-</td>									-
_	to medium dense, moist to saturated, trace mica					35.0' - 45.0'	6.0'	60		-
-	(5Y4/1), soft to medium stiff, saturated, trace very fine-grained sand									-
╞	Silt (ML), gray, soft to							45.0'	-	
-	163.9'	50.5'	medium stiπ, satu with very fine-grain	rated, ned sand		45.0' - 55 0'	5.0'	50		- - -
-			Silty Sand (SM), g medium dense, fine-grained, satur	ray, rated		33.0			55 0'	-
DT 2/4/19									33.0	-
77013NEWEST.GPJ FMSM-GRAPHIC LOG.GE	155.9'	58.5'	Poorly GradedSar gray, fine-grained, saturated, trace m coarse-grained sa fine gravel	nd (SP), loose, edium to nd and		55.0' - 65.0'	7.0'	70		- - - -
LLEN_175	149.4'	65.0'							65.0'	-
SONIC BORING LOG - NO ROCK AL			No Refusal / Bottom of Hole		1					



Stantec	Borehol	e Identification PM	W-11C				Tota	I Boring De	pth 256.0 ft
Client		Tennessee Valley	Authority		Boring Loca	tion N	 35°04'08.	.04". W90°0	
Project	Number	175577013			Surface Ele	vation 2	14.4 ft	Elevation	Datum NGVD29
Project	Name	TVA-ALF RIWP W	ells		Date Started	d 10	0/8/18	Completed	10/11/18
Project	Location	n Memphis, Tenn	essee		Depth to Water 17.76 ft Date/Time			11/27/18	
Supervi	sor	Stephen Karper	nko		Depth to Water 18.55 ft Date/Time			12/3/18	
Logged by Stephen Karpenko					Driller Thesius Taylor				
Drilling	Drilling Contractor Cascade Drilling					e and ID) Terras	onic TSi 15	0T/ #11-38212
Overburden Drilling and Sampling Tools (Type and) Sonic Tooli	ina - 8" Bit	. 8" Casino	. 6" Barrel. 3.	5" Rods
Sampler Hammer Type N/A Weight					Dron	N/A	Ff	ficiency	N/A
Borehol	e Azimu	th N/A (Vertica	+ • • • 9 · • al)		Borehole Ir	clination	 1 (from Ve	ertical)	0 dea.
Litholo			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	<u> </u>
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
214.4'	0.0'	Top of Hole							
213.9'	0.5'	Topsoil		_					4" Monitoring
- 212.9	1.5	Sand (SP), tan,		_					Well Installed,
211.4'	3.0'	∏\graded, loose	e, poorly	-	0.0' - 6.0'	6.0'	100		Construction
_		Silty Sand (SM), ta	an to						Log For Details
_		gray, fine-grained,	medium					6.0'	-
-		Silty Clay (CL), bro	own						
205 4'	0.0'	(7.5YR 4/2), mediu	um stiff,						
203.4	9.0	banding, moist	wn	_					
_		Poorly Graded Sa	nd		6.0' - 16.0'	10.0'	100		-
-		(SP-SM) with silt, l brown to gray, loo	light se. moist						
-			,						
_									
								16.0'	-
197.4'	17.0'			_					
_		Poorly Graded Sa	nd (SP), loose						
-		moist to very mois	t, trace						
_		mica, trace silt			16.0' -	10.0'	100		-
_					26.0'				
_									
_									
–								26.0'	-
_									
185.4'	29.0'			-					



Stantec Borehole Identification PMW-11C						Tota	I Boring De	pth 256.0 ft		
	Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'08.	.04", W90°0	8'13.43" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	14.4 ft	Elevation I	Datum NGVD29
	Litholo	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
╞	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	-		Sandy Silt (ML), g fine-grained, mois moist, trace mica interbedded silty c (Continued)	ray, t to very and lay		26.0' - 36.0'	10.0'	100		
	178.4'	36.0'			-				36.0'	
_	176.4'	38.0'	Silty Clay (CH), gr 4/1), soft to mediu moist to very mois very fine-grained s Silt (ML) with very	ay (5Y m stiff, t, with sand	-	26.01	0.01	80		
_			fine-grained sand, medium dense, m trace mica	gray, oist,		36.0' - 46.0'	8.0	80		
	-								46.0'	
	<u>167.4'</u>	47.0'	Poorly Graded Sa little silt, gray, fine loose, moist, trace trace medium to coarse-grained sa	nd (SP) -grained, mica, nd		46.0' - 56.0'	10.0'	100	 56.0'	- - - - - - - - - - -
COCK ALLEN_175577013NEWEST.GPJ FMSM-GRAPHIC LOG.GDT 2/4/	149.4'	65.0'			_	56.0' - 66.0'	7.0'	70	 66.0'	
TVA SONIC BORING LOG - NO RI	_									- - - -



Stantec Borehole Identification PMW-11C						Tota	I Boring De	pth 256.0 ft	
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'08.	.04", W90°0	8'13.43" (NAD83)
Projec	t Number	175577013			Surface Ele	vation 2	14.4 ft	Elevation I	Datum NGVD29
Lith	ology		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-		Poorly Graded Sa little silt, gray, fine loose, moist, trace trace medium to coarse-grained sa	nd (SP) -grained, e mica, ind, trace		66.0' - 76.0'	8.0'	80		(66.0'-76.0') No Recovery, Unable to Log Sample
- 138 //	76.0'	fine to coarse sub	-round d)					76.0'	-
-	10.0	No Recovery	-,	-				10.0	
-					76.0' - 86.0'	0.0'	0		-
128.4	86.0'							86.0'	-
- - - - - -		Poorly Graded Sa little silt, gray, fine coarse-grained, lo moist, trace mica, medium to coarse sand	nd (SP) to ose, trace -grained		86.0' - 96.0'	8.0'	80		- - - - - - - - - - - - - -
1/4/19 									-
ID COCK ALLEN_17877013NEWEST GPJ FINSMGRAPHIC LOG.GDT 2					96.0' - 106.0'	10.0'	100	 106.0'	-
L L L L L L L L L L L L L L L L L L L								-	
									-
LIVA SO									



ſ	Stantec	Borehol	e Identification _PM				Tota	I Boring De	oth 256.0 ft	
	Client		Tennessee Valley		Boring Loca	tion <u>N</u>	35°04'08.	04", W90°0	8'13.43" (NAD83)	
	Project N	Number	175577013			Surface Ele	vation 2	14.4 ft	Elevation I	Datum NGVD29
Ī	Litholo	рду	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
┟	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
			Poorly Graded Sa little silt, gray, fine coarse-grained, lo moist, trace mica, medium to coarse sand (Continued	nd (SP) to ose, trace -grained		106.0' - 116.0'	10.0'	100		
╞			(,	, ,					116.0'	-
	- - - -					116.0' - 126.0'	10.0'	100		- - - - - - - - - - - -
ľ	- 88.4'	126.0'							126.0'	(126.0) 126.0)
	- 83.4'	131.0'	No Recovery		-	126.0' -	5.0'	50		No Recovery, _ Unable to Log _ Sample _ _
	- - -		Poorly Graded Sa little silt, gray, fine loose, moist, trace trace medium to coarse-grained sa	nd (SP) -grained, mica, nd		136.0'				
₀									100.0	-
MSM-GRAPHIC LOG.GDT 2/4/1	- 73.9' - 73.4'	<u>140.5'</u> _141.0'-		· · · · ·		136.0' -	10.0'	100		- - -
ALLEN_175577013NEWEST.GPJ Fi	- 68 4'	146 0'	Silty Fat Clay (CH Poorly Graded Sa little silt, gray, fine loose, moist, trace trace medium to coarse-grained sa)		146.0'			146.0'	-
TVA SONIC BORING LOG - NO ROCK ,	00.4	140.0	No Recovery						140.0	(146.0'-156.0') - No Recovery, _ Unable to Log _ Sample _



Γ	Stantec	Borehol	e Identification _PM	1W-11C				Tota	I Boring De	pth 256.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u>	35°04'08.	.04", W90°0	<u>8'13.43" (NAD83</u>)
	Project I	Number	175577013			Surface Ele	vation 2	14.4 ft	Elevation	Datum NGVD29
	Litholo	рду		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
E	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-			No Pocovory (C	ontinued)		146 0' -	0.0'	0		-
F			No Recovery (Co	Sillinded)		156.0'	0.0	Ū		-
										-
F										_
	58.4'	156.0'	Mall Craded San		-				156.0'	_
-			with gravel, gray,	fine to						-
			coarse-grained, lo saturated, gravel	oose, fine to						-
\vdash			coarse			450.01	0.01	00		-
-						156.0' - 8	8.0	80		-
										-
	50.4'	164.0'			-					-
	49.4'	165.0'	Well Graded Sand (GW), light brown	dy Gravel ,	_				166 0'	-
Ľ			sub-rounded, fine	to					100.0	-
-			gravel, loose, satu	urated						-
-			Well Graded Sand	d (SW) fino to						-
F			coarse-grained, s	aturated,		166.0' -	4.0'	40		-
			with fine to coarse	e gravel		176.0'				(172.0') Added
-	40 4'	174 0'								Drill Fluid to
	т 0.т	174.0	Poorly Graded Sa	ind (SP),	_					
Γ			gray, fine-grained	, loose,					176.0'	-
4/19			coarse-grained sa	and, trace						-
06.GDT 2			gravel							-
										-
FMSM-GR						176.0' - 186.0'	6.0'	60		-
EST.GPJ						100.0				-
7013NE WI										-
EN_17557.			Well Graded San	dv Gravel						-
OCK ALL			(GW) from 184.5'	to 185.0'					186.0'	-
DG - NO R								-		
I I										-
A SONICE						106 0	10.01	100		
2						- U.OOI	10.0	100		

Stantec Consulting Services Inc.



Stantec Borehole Identification PMW-11C						Tota	I Boring Dep	oth 256.0 ft		
	Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u>	35°04'08.	04", W90°0	8'13.43" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 21	4.4 ft	Elevation [Datum NGVD29
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	-		Poorly Graded Sa gray, fine-grained, saturated, trace m coarse-grained sa gravel. (Continue	nd (SP), loose, edium to nd, trace		196.0'				-
ł	-		glavel (Continue	u)					196.0'	-
•	- - - - -					196.0' - 206.0'	10.0'	100		- - - - - - - - - -
ł	-		Traca lignita from	2051 to					206.01	_
	-		206'	205 to					206.0	-
•	- - - - -					206.0' - 216.0'	10.0'	100		- - - - - - -
ł	-		from 215.0' to 215	rel (GW) 5.5'					216.0'	-
175577013NEWEST.GPJ FMSM-GRAPHIC LOG.GDT 2/4/19	- - - - -					216.0' - 226.0'	10.0'	100		- - - - - -
ALLEN	-11.6'	226.0'			_				226.0'	-
TVA SONIC BORING LOG - NO ROCK	- - -		Well Graded Sand with gravel, light b gray, fine to coarse-grained, lo saturated, trace lig	d (SW) rown to ose, gnite		226.0' -	7.0'	70		- - - -

Stantec Consulting Services Inc.



Stantec	Borehol	e Identification PM	W-11C				Tota	I Boring Dep	oth 256.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u>	35°04'08.	.04", W90°08	3'13.43" (NAD83)
Project	Number	175577013			Surface Ele	vation 21	4.4 ft	Elevation D	Datum NGVD29
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	Well Graded Sand (SW) with gravel, light brown to gray, fine to coarse-grained, loose, saturated, trace lignite (Continued)			236.0'			236.0'	- - -	
- - - 25.6' -	240.0'	Poorly Graded Sa brown, fine-graine	nd (SP), d.		236.0' - 246.0'	7.0'	70		- - - -
- - 30.6'	245.0'	saturated, trace of medium- to coarse sand, trace gravel Poorly Graded Sa	clay, e-grained nd (SP),					246.0'	- - -
-		gray, very fine to fine-grained, loose saturated	3,		246.0' - 256.0'	8.0'	80		- - - - - - - -
	256 0'							256 0'	_
	250.0	No Refusal / Bottom of Hole						250.0	



ſ	Stantec	Borehol	e Identification PM				Tota	I Boring De	pth 57.0 ft	
	Client		Tennessee Valley	Authority		Boring Loca	ition N	35°04'10.	03", W90°0	08'09.92" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	37.0 ft	Elevation	Datum NGVD29
	Project I	Name	TVA-ALF RIWP W	ells		Date Started	d _1	0/31/18	Completed	d 10/31/18
	Project	Locatior	n Memphis, Tenn	essee		Depth to Wa	Depth to Water 28.81 ft Date/Time			
	Supervis	sor	Stephen Karper	nko		Depth to Wa	ater N	/A	Date/Time	e N/A
	Logged by Stephen Karpenko					Driller Matt Pope				
	Drilling (Contract	or Cascade Drilling	g		Drill Rig Typ	be and ID	Prosor	nic LS600 /	#10-00273
	Overbur	den Dril	ling and Sampling To	ools (Type a	and Size) Sonic Tooli	ing - 8" Bit	, 8" Casing	, 6" Barrel, 3.	5" Rods
	Sampler	r Hamme	er Type _N/A	Weight	N/A	Drop	N/A	Ef	ficiency _	N/A
	Borehole	e Azimu	th N/A (Vertica	al)		Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
Ī	Litholo	ogy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
╞	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
┢	237.0'	0.0'	Top of Hole							
ŀ	230.5	0.5	I OPSOII	th Cond	_					
ŀ	-		(CL), light brown (2	2.5Y						4" Monitoring Well Installed.
	-		4/2), medium stiff,	low to iron rich						See Well
			moist	li oli iloli,						Log For Details
ł	-					0.0' - 7.0'	7.0'	100		-
	_							100		
┢	_									-
	231.0'	6.0'								
ľ			Silty Sand (SM), g	ray, very	-					-
	-		fine grained, loose	e to oist					7.0'	
			intermittent clay le	ns						
2/4/19	-									-
OG.GDT	_									
RAPHIC L										
FMSM-G	-									-
EST.GPJ										
7013NEW	-									-
EN_17557	-					7.0' - 17.0'	10.0'	100		
OCK ALLE										
G - NO R(-									
DRING LO	_									
SONIC BC										
AVT.										



Stantec Borehole Identification PMW-14A								Tota	I Boring De	oth 57.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'10.	03", W90°0	8'09.92" (NAD83)
	Project I	Number	175577013			Surface Elev	vation 23	37.0 ft	Elevation [Datum NGVD29
Ī	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
╞	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	-		Silty Sand (SM), g fine grained, loose medium dense, m intermittent clay le <i>(Continued)</i>	ray, very e to oist, ens					17.0'	-
╞	219.5'	219.5' 17.5'		_						
	218.0'	218.0' 19.0' Silty Sand (SM), gray, very fine grained, loose to medium dense, moist, intermittent clay lens, trace organic matter		_					-	
┟	217.0' 20.0' Fat Clay (CH)		-					_		
			Silty Sand (SM), g fine grained, loose medium dense, m intermittent clay le organic matter	iray, very e to oist, ens, trace		17.0' - 27.0'	10.0'	100		-
╞	214.0'	23.0'			-					_
	_		Silty Sand (SM), g fine grained, loose medium dense, m intermittent clay le	iray, very e to oist, ens						_
										_
									27 0'	
ł	-								27.0	_
	209.0'	28.0'			_					_
M-GRAPHIC LOG.GDT 2/4/19			Silty Fat Clay (CH (2.5Y 4/1), mediur stiff, medium to hi plasticity, moist, tr fine grained sand), gray n stiff to gh ace very						-
GPJ FMSI			U							
SNEWEST.	-								-	
175577013	_					27.0' -	10.0'	100		_
CK ALLEN					37.0'					
3 - NO ROC								-		
JRING LOC								-		
VA SONIC BC	_									_



Stantec	Borehol	e Identification PM	W-14A				Tota	I Boring De	oth 57.0 ft
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'10.	03", W90°0	8'09.92" (NAD83)
Project	Number	175577013			Surface Ele	vation 23	37.0 ft	Elevation I	Datum NGVD29
Litholo	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
201.5'	35.5'	Poorly Graded Sa	nd (SP).	_					
		light brown to gray fine to fine grained moist to saturated	, very I, loose, trace					37.0'	-
_		clay and silt	and silt						-
-									-
-									-
_									-
-					37.0' - 47.0'	10.0'	100		-
									-
193.0	44.0	Silty Sand (SM), li	ght	-					-
-		brown to gray, ver fine grained, loose to saturated, trace	y fine to , moist, clay						_
-									-
190.0'	47.0'			_				47.0'	-
2/4/19		Poorly Graded Sa light brown to gray fine to fine grained moist to saturated	nd (SP), v, very I, loose, , trace						-
APHIC LOG.GDT		clay and silt							-
.GPJ FMSM-GR2									_
013NEWEST					47.0	40.01	466		-
X ALLEN_175571					47.0' - 57.0'	10.0'	100		-
									-
182.5'	54.5'								-
		Silty Fat Clay (CH)						_



Stanted	Stantec Borehole Identification PMW-14A Total Boring Depth 57.0 ft									
Client		Tennessee Valley	Authority		Boring Loc	ation <u>N</u>	35°04'10	.03", W90°08	8'09.92" (NAD83)	
Project	Number	175577013			Surface Ele	evation 23	87.0 ft	Elevation E	Datum NGVD29	
Lithol	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
		Silty Fat Clay (CH (Continued))						-	
180.5'	56.5'			-						
180.0' 57.0' 		Poorly Graded Sa light brown to gray fine to fine grained moist to saturated clay and silt	nd (SP), y, very d, loose, l, trace					57.0'	_	
_		No Refusal / Bottom of Hole							-	
\vdash									-	
-									-	
-									-	
_									-	
_									-	
\vdash									_	
_									-	
-									-	
-									-	
G.GDT 2/4/19									-	
									_	
T.GPJ FMSM									-	
577013NE WES									_	
< ALLEN_175										
06 - NO ROC									-	
NIC BORING L									-	



SUBSURFACE LOG

Γ	Stantec	Borehol	e Identification PM	W-14B				Tota	I Boring De	pth 87.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'10.	02", W90°0	08'09.81" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 2	37.1 ft	Elevation	Datum NGVD29
	Project I	Name	TVA-ALF RIWP W	ells		Date Started	d _1	0/30/18	Completed	d 10/30/18
	Project	Locatior	n Memphis, Tenn	essee		Depth to Wa	ater 4	1.10 ft	Date/Time	12/3/18
	Supervis	sor	Stephen Karper	nko		Depth to Wa	Depth to Water N/A Date/Time			N/A
	Logged	by	Stephen Karper	nko		Driller	N	latt Pope		
	Drilling (Contract	or Cascade Drilling	9		Drill Rig Typ	e and ID	Prosor	nic LS600 /	#10-00273
	Overburden Drilling and Sampling Tools (Type and Sized Size				and Size) Sonic Tooli	ng - 8" Bit	t, 8" Casing	, 6" Barrel, 3.	5" Rods
	Sampler Hammer Type <u>N/A</u> Weight <u>N</u>				N/A	Drop	N/A	Ef	ficiency _	N/A
	Borehole Azimuth N/A (Vertical)					Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.
	Lithology Overburden Sampl				Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	-
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
F	237.1	0.0' 0.5' /			-					
F			Silty Lean Clay wit	th Sand						4" Monitoring
F			(CL), light brown ((CL), light brown (2.5Y			7.0'	100		See Well
╞			medium plasticity,	iron rich,		0.0 7.0	1.0	100		Log For Details
┢	231 1'	6 0'	moist							-
	20111	0.0	Silty Sand (SM), g	ray, very	-				7.0'	
╞			fine grained, loose	e to oist						
┢			trace clay	0131,						
┢	-									-
E						7.0' - 17.0'	10.0'	100		
╞										
┢	-									-
T 2/4/19									17.0'	
LOG.GD										
GRAPHIC										
J FMSM-0	-									-
VEST.GP.						17.0' -	10.0'	100		
77013NE/						27.0'				
LEN_1755										
ROCK AL			24.2'-24.5'	m						-
- 00 - NO	210.1'	27.0'							27.0'	
BORINGL										
VA SONIC										



Γ	Stantec	Borehol	e Identification PM	IW-14B		Total Boring Depth 87.0 ft				
	Client	_	Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'10.	.02", W90°0	8'09.81" (NAD83)
	Project I	Number	175577013			Surface Ele	vation 23	37.1 ft	Elevation I	Datum NGVD29
	Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
	Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	201.1'	36.0'	Silty Fat Clay (CH (2.5Y 4/1), mediur stiff, medium to his plasticity, moist, tr fine grained sand (Continued)	Silty Fat Clay (CH), gray (2.5Y 4/1), medium stiff to stiff, medium to high plasticity, moist, trace very fine grained sand (<i>Continued</i>)		27.0' - 37.0'	10.0'	100		
L			Poorly Graded Sa	ly Graded Sand (SP),					37.0'	_
	- 193.6'	43.5'	light brown to gray fine to fine grained moist to saturated clay and silt	/, very d, loose, , trace		37.0' - 47.0'	10.0'	100		- - - -
F			Poorly Graded Silf	ty Sand	-					-
-	- 190.1'	47.0'	(SM), light brown to gray, very fine to fine-grained, loose, moist to saturated, trace clay	-				47.0'	-	
	-		Poorly Graded Sa light brown to gray fine to fine grained moist to saturated clay and silt	nd (SP), , very d, loose, , trace		47.0' - 57.0'	10.0'	100		- - - -
┢	182.1'	55.0'			_					_
4/19	181.1'	56.0'	Fat Clay (CH), gra						57 0'	-
0G - NO ROCK ALLEN_175577013NEWEST.GPJ FMSM-GRAPHIC LOG.GDT 2/4	-		Silty Fat Clay (CH (2.5Y 4/1), very so medium stiff, med high plasticity, sat intermittent silt and lens), gray ift to ium to urated, d clay		57.0' - 67.0'	10.0'	100	67.0'	- - - - - - - - - - - -
ORING L										-
IVA SONIC B	-									_



Star	ntec E	Borehole	e Identification PM	W-14B				Tota	I Boring Dep	oth 87.0 ft
Clie	nt	_	Tennessee Valley	Authority		Boring Loca	ation <u>N</u> 3	35°04'10	.02", W90°0	8'09.81" (NAD83)
Proj	ect N	umber	175577013			Surface Ele	evation 23	87.1 ft	Elevation [Datum NGVD29
L	itholog	IУ	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevati	on	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
- <u>166.</u> (- - -	5.6' 70.5' Poorly Graded Sand with Silt (SP), gray, very fine to fine grained, loose, saturated, trace organics, grading coarser Silty from 73.0'-74.0'			67.0' - 77.0'	10.0'	100		- - - -		
									77.0'	-
-						77.0' - 87.0'	7.0'	70		- - - - - - - -
150		07.01							97.01	-
150.1	1.	87.0	No Refusal /						87.0	
_			Bottom of Hole							-
-										-
-										_
F										-
-										-
3DT 2/4/19										-
										-
FMSM-GRA										_
VEST.GPJ										_
5577013NEV										-
										_
- NO ROCK										-
RING LOG										-
										-



SUBSURFACE LOG

Stantec	Borehol	e Identification PM	1W-14C				Tota	I Boring De	pth 167.0 ft	
Client		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'10.	.01", W90°C	08'09.71" (NAD83)	
Project I	Number	175577013			Surface Ele	vation 2	37.1 ft	Elevation	Datum NGVD29	
Project I	Name	TVA-ALF RIWP W	ells		Date Starte	d _1	0/25/18	Complete	d 10/26/18	
Project	Locatior	n Memphis, Tenn	essee		Depth to Wa	ater 4	1.08 ft	Date/Time	e <u>12/3/18</u>	
Supervis	sor	Lee Eaves			Depth to Wa	Depth to Water N/A Date/Time			e <u>N/A</u>	
Logged	by	Lee Eaves			Driller	Driller Matt Pope				
Drilling (Contract	or Cascade Drillin	g		Drill Rig Typ	e and ID	Prosor	nic LS600 /	#10-00273	
Overbur	den Dril	ling and Sampling T	ools (Type a	and Size) Sonic Tool	ing - 8" Bit	t, 8" Casing	, 6" Barrel, 3.	5" Rods	
Sampler	r Hamme	er Type <u>N/A</u>	Weight	t N/A	Drop	N/A	Ef	ficiency _	N/A	
Borehol	Borehole Azimuth N/A (Vertical)				Borehole Ir	nclinatior	n (from Ve	ertical)	0 deg.	
Lithology Overburden Samp				Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
237.1'	0.0'	Top of Hole								
	1.0	Sandy Silt (ML), b	orown,	-					4" Monitoring Well Installed,	
-		soft to firm, low pl	asticity,		0.0' - 7.0'	7.0'	100		See Well Construction	
232 1'	5.0'		, moior						Log For Details	
	0.0	Sandy Clayey Silt	(ML),	-					-	
230.1'	7.0'	soft, low plasticity	, fine ist ∕⁻	-				7.0'	-	
- 228 1'	0.0'	Silty Sand (SM), c	ravish							
	9.0	∖brown, fine`graine ∖moist	d sand,	-					_	
_		Sandy Clayey Silt	(ML),							
-		gray, soft, low plat	sticity,		7.0' - 17.0'	10.0'	100			
-			, 110131							
419 -								47.01		
6.GDT 2/								17.0	-	
MSM-GR									-	
					17.0'	10.0'	100			
					27.0'	10.0	100			
1756770										
									-	
210 1'	27 0'							27 0'		
	21.0	Silty Fat Clay (CH), dark	-				21.0	-	
		gray (7.5YR 4/1), high plasticity, we	very stiff, t							



5	Stantec	Borehol	e Identification _PM	IW-14C				Tota	I Boring De	pth 167.0 ft
	Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'10.	01", W90°0	<u>8'09.71" (NAD83</u>)
F	Project I	Number	175577013			Surface Ele	vation 23	37.1 ft	Elevation I	Datum NGVD29
	Litholo	рду	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Ele	evation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
- - -			Silty Fat Clay (CH gray (7.5YR 4/1), high plasticity, wet (Continued)	Silty Fat Clay (CH), dark gray (7.5YR 4/1), very stiff, nigh plasticity, wet <i>'Continued)</i>		27.0' - 37.0'	9.0'	90		
2	00.1'	37.0'			_				37.0'	-
-			Poorly Graded Sa brown, fine graine	nd (SP), d, wet						
- - -	95.1'	42.0'	Silty Sand (SM), g grained, wet	ray, fine	-	37.0' - 47.0'	9.0'	90		-
-	00.41	49.01							47.0'	
- - - - - -	81.1'	56.0'	Poorly Graded Sa brownish gray, find grained, wet	nd (SP), e	_	47.0' - 57.0'	10.0'	100		
2/4/19	-		Clayey Silt (ML), d	lark gray,					57.0'	-
G- ND ROCK ALLER_175577013NEWESTGPJ FMSNLGRAPHIC LOG GDT			soft to stiff, low to plasticity, wet	medium		57.0' - 67.0'	10.0'	100	67.0'	-
										-



Stantec	Borehol	e Identification PM	W-14C				Tota	I Boring De	oth 167.0 ft
Client		Tennessee Valley	Authority		Boring Loca	ition <u>N</u>	35°04'10.	01", W90°0	8'09.71" (NAD83)
Project	Number	175577013			Surface Ele	vation 23	37.1 ft	Elevation I	Datum NGVD29
Lithol	ogy	-	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
166 1	71.0'								
- - -	71.0	Poorly Graded Sa Silt (SM), dark gra grained, wet	nd with y, fine		67.0' - 77.0'	10.0'	100		-
-									-
_								77.0'	-
	78.0'	Poorly Graded Sa gray, fine grained, trace 1/4" to 2" gra	nd (SP), wet, avel	_					-
-		Ū			77.0' - 87.0'	6.5'	65		-
									_
-								87.0'	-
-									-
-					87.0' - 97.0'	4.0'	40		-
								97.0'	-
									-
17557013NEWEST.GPJ FMSMC					97.0' - 107.0'	2.0'	20		-
								107.0'	-
									-



St	antec	Borehol	e Identification _PM	IW-14C				Tota	I Boring De	oth 167.0 ft
C	lient		Tennessee Valley	Authority		Boring Loca	tion <u>N</u>	35°04'10.	01", W90°0	8'09.71" (NAD83)
Pr	roject l	Number	175577013			Surface Elev	vation 23	37.1 ft	Elevation I	Datum NGVD29
	Litholo	gy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elev	ation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-	Poorly Graded Sand (SP), gray, fine grained, wet, trace 1/4" to 2" gravel <i>(Continued)</i>		nd (SP), wet, avel		107.0' - 117.0'	9.0'	90			
-									117.0	-
						117.0' - 127.0' 127.0' - 137.0'	7.0'	70	<u> 117.0'</u> 127.0'	- - - - - - - - - - - - - - - - - - -
-										-
2/4/19	11	120 01							137.0'	-
	<u>ə.1'</u>	138.0'	Sandy Silt (ML), d firm to stiff, low to plasticity, wet, fine sand	ark gray, medium e grained		137.0' - 147.0'	10.0'	100		
NO ROC			Poorly Graded Sa	nd (SP),	1				147.0'	-
TVA SONIC BORING LOG -			grayish brown, fino grained, wet, trace 3" gravel	e e 1/4" to						-



Stantec	Stantec Borehole Identification _PMW-14C Total Boring Depth _167.0 ft								
Client		Tennessee Valley	Authority		Boring Loca	ation <u>N</u>	35°04'10.	.01", W90°0	8'09.71" (NAD83)
Project I	Number	175577013			Surface Ele	vation 23	37.1 ft	Elevation [Datum NGVD29
Litholo	ogy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Sonic Core		Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-		Poorly Graded Sa grayish brown, fine grained, wet, trace 3" gravel <i>(Contin</i>	nd (SP), e e 1/4" to <i>ued)</i>		147.0' - 157.0'	10.0'	100		- - -
-								157 0'	-
								107.0	_
78.1' 	159.0'	Clayey Sand (SC) brown, fine graine intermittent clay	, grayish d, wet,		157.0' - 167.0'	10.0'	100		-
70.1'	167.0'							167.0'	-
		No Refusal / Bottom of Hole							

APPENDIX C CALIBRATION HYDROGRAPHS













Stantec







Title





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Title











Groundwater Model Calibration Hydrograph



Title













Title





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Title

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Title





Stantec



Title











	Tennessee Valley Authority	
	Allen Fossil Plant (ALF)	
Well No.	ALF-201/B/A	
Model Laye	No. K / 7 / 7	







Client/Project
Tennessee Valley Authority
Allen Fossil Plant (ALF)
Well No. ALF-202/B/A
Model Layer No. 2 / 6 / 7
THe





Client/Project	
Te	ennessee Valley Authority
Ą	Allen Fossil Plant (ALF)
Well No.	ALF-203/B/A
Model Layer No.	4 / 7 / 7
Title	







Client/Project	
Tennessee Valley Authority	
Allen Fossil Plant (ALF)	
Well No. ALF-204/B/A	
Model Layer No. 6 / 7 / 7	
Title	







Client/Proje	ct	
	Tennessee Valley Authority	
	Allen Fossil Plant (ALF)	
Well No.	ALF-205/B/A	
Model Laye	or No. 6 / 7 / 7	







Client/Project
Tennessee Valley Authority
Allen Fossil Plant (ALF)
Well No. ALF-210/A
Model Layer No. 6 / 7
Title





Client/Project
Tennessee Valley Authority
Allen Fossil Plant (ALF)
Well No. ALF-212/A
Model Layer No. 3 / 7
Title





Date

Client/Project	
Tennessee Valley Authority	
Allen Fossil Plant (ALF)	
Well No. ALF-214/B/A	
Model Layer No. 6 / 7 / 7	
Title	



APPENDIX D MEASUREMENT OF ARSENIC ADSORPTION COEFFICIENTS (Kd)





Stantec Consulting Services Inc. 1340 Treat Boulevard Suite 300, Walnut Creek CA 94597-7966

May 15, 2020 File: Allen Fossil Plant Remedial Investigation

Attention: Tennessee Valley Authority

Reference: Measurement of Arsenic Adsorption Coefficients (Kd) – Tennessee Valley Authority, Allen Fossil Plant, East Ash Pond, Memphis, Tennessee

This technical memorandum was prepared by Stantec Consulting Inc. (Stantec) on behalf of Tennessee Valley Authority (TVA) for the Allen Fossil Plant (ALF) in Memphis, Tennessee, in support of groundwater modeling being conducted for the East Ash Disposal Area (EADA; see **Figure 1**). Groundwater and solute transport modeling require input parameters that estimate the potential for the adsorption and resulting impact on mobility or retardation of dissolved constituents (such as arsenic) moving through saturated soil. The groundwater model uses a partitioning coefficient, or Kd to estimate the effects of soil-arsenic interactions to assess mobility relative to groundwater flow and predict contaminant transport.

Given the right chemical conditions in the subsurface, arsenic in coal combustion residuals (CCR) may dissolve into porewater. Arsenic is mobilized by high pH and reducing conditions present in the EADA and locally present in groundwater near the EADA. For example, elevated pH and reducing conditions were observed at monitoring well ALF-203. High pH and reducing conditions lower arsenic adsorption because iron oxide minerals present in the fine fraction of the soil develop a negative charge that reduces the tendency of the oxides to adsorb the negatively charged arsenic ions. Coarse materials, because they have different mineralogy, lower surface area and lower mass of adsorbent minerals, will tend to have different a lower Kd, resulting in less adsorption in coarser grained areas Furthermore, under reducing conditions, iron oxides, which are formed with ferric iron, are dissolved as the iron is reduced to ferrous iron, thus decreasing the amount of adsorbent mineral present in the soils. Reducing conditions also cause arsenic to change from the more adsorbent arsenate form to the less adsorbent arsenite form further reducing the tendency for arsenic to adsorb. As dissolved arsenic migrates away from the source area or once the CCR is removed, the source of arsenic, high pH and reducing potential diminishes or is removed. As a result, the pH in groundwater is anticipated to be neutralized by the native soils. Oxygenated water migrating into the area oxidizes the ferrous iron back to ferric iron (reforming iron oxides) and arsenite to arsenate, increasing the amount of adsorbent mineral and the concentration of the more adsorbent form of arsenic. These processes are anticipated to return groundwater conditions back to native, optimal conditions for arsenic adsorption (neutral pH), as estimated by the Kd value derived from measurements conducted on site soils. As a result, the site specific Kd value measured by Stantec provides a reasonable estimate for groundwater modeling to predict the potential for arsenic attenuation in site soils following CCR removal.

The following technical memorandum describes how arsenic adsorption was measured for the soil samples and Kd values for arsenic were derived from groundwater and soil data at the ALF site. Soil samples were collected from borings north, south, and east of the EADA in support of this effort (**Figure 2**). Groundwater chemistry from grab samples and monitoring wells in each area were used to provide representative groundwater composition for the calculation of the Kd.

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Stantec characterized the partitioning of cations and anions bound to soil samples from the Alluvial aquifer using a selective extraction procedure developed by Tessier et al. (1979).

SITE DESCRIPTION

A detailed discussion of the lithology of the Alluvial aguifer at the site can be found in the Updated TVA Allen Fossil Plant – East Ash Disposal Area – Remedial Investigation Report (RIR), dated May 31, 2019. In general, site-specific observations of the Mississippi River Valley alluvium deposits composing the Alluvial aquifer indicate that this unit is a silty sand with intervals of silts and clay in the upper portion of the unit and sand and gravel in the lower portion. The upper portion of the Alluvial aquifer consists of interbedded silts, clays and sands, including a naturally occurring "blue clay" layer with a base elevation of approximately 165-175 ft elevation. The blue clay layer marks a transition from shallow fine-grained and interbedded sediments to coarser-grained sands and gravels at depth. The lower sand and gravel interval has two distinctive lithologic facies. The lowermost lithology observed in PMW-02C and ALF-213A, located on the high side of an inferred fault underlying the East Ash Disposal Area, is composed of poorly sorted fine- to coarse grained sands and gravels directly overlying the upper Claiborne confining unit at depth (89.5 ft elevation in PMW-02A and 77.2 ft elevation in ALF-213A) and transitions upward into well sorted, generally fine-grained sands at roughly the same elevation (152.5 ft elevation in PMW-02A and 161.7 ft elevation in ALF-213A). Because PMW-11C is located on the downside side of the inferred fault where the sediment package of the Alluvial aguifer is much thicker, the elevation of the poorly sorted to well sorted sand lithology transition is notably lower (58.5 ft elevation).

SAMPLE COLLECTION

Soil samples were collected in late 2018 during the advancement of boreholes PMW-02C, PMW-11C, and ALF-213A, located along the north, south, and east perimeters respectively of the EADA (**Figure 2**). Samples were collected from boreholes PMW-02C and ALF-213A based primarily on lithology while samples from PMW-11C were collected from each 10-foot interval of the borehole. Each sample consisted of multiple smaller samples with similar composition within a given interval that were stored together in one-gallon heavy-duty Zip-Lock bags. Following collection, samples were double bagged, labeled, sealed with packing tape and stored in chilled coolers for shipment to the Stantec treatability laboratory located in Sylvania, OH.

Boreholes PMW-02C and ALF-213A were both terminated at the upper Claiborne confining unit (a clay layer at the base of the Alluvial aquifer) at 137 and 167 ft bgs, respectively. A total of 17 samples were collected from borehole PMW-02C, and 20 samples were collected from ALF-213A. The upper Claiborne confining unit was not encountered in borehole PMW-011C and the boring was terminated in the Memphis Sand at 256 ft bgs. A total of 31 samples were collected from this location. Soil paste pH was measured at Stantec's treatability lab following standard methods to chemically screen for potential lithologic variation that may not have been visually detected. **Tables 1a, 1b** and **1c** summarize the sample identification, lithology, and paste pH for each sample interval for boreholes PMW-02C, PMW-11C and ALF-213A, respectively.

It should be noted that while the intent of this technical memorandum was to present the methods followed to calculate site-specific Kd values for the upper 100 feet of the Alluvial aquifer, soil samples were collected from the entire vertical extent of the boreholes and archived at the Stantec treatability lab for potential future

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evaluation. **Tables 1a, 1b and 1c** indicate which samples were analyzed using the sequential extractions and which were archived for potential future use.

Samples were selected based on particle size and where encountered, differences in pH within each identified lithologic unit.

SAMPLE ANALYSIS

Stantec's treatability lab performed a sequential, selective extraction procedure on the identified samples using a method developed by Tessier et al. (1979) to evaluate the portion of arsenic and select anions and cations that were associated with the following fractions in soils:

- Extraction 1 exchangeable arsenic (sodium acetate extraction);
- Extraction 2 carbonate associated arsenic (sodium acetate adjusted to pH 5 with acetic acid);
- Extraction 3 iron and manganese oxide associated arsenic (sodium dithionite, and a mixture of citrate sodium citrate); and
- Extraction 4 organic matter associated arsenic (nitric acid and hydrogen peroxide, ammonium acetate rinse).

Extractions 1 through 3 were performed on all samples and extraction 4 was performed on one clay interval at each boring location to evaluate the potential role of organic matter.

The resulting leachate from each of the extractions was analyzed by Pace Analytical for arsenic and select anions and cations. Sodium was excluded as a cation for analysis because it was used in the extraction solutions.

Table 2 summarizes the results of the sequential extractions and the cation exchange capacity for each sample analyzed.

Groundwater concentrations for each specified soil interval were necessary for the calculation of Kd values. Groundwater data used for the Kd calculations was from the 2019 Updated RIR permanent groundwater monitoring wells (**Table 3** and **Figure 2**) and temporary Direct Push Technology (DPT) groundwater wells (**Table 4** and **Figure 3**) located near each borehole sample location.

DISTRIBUTION COEFFICIENTS

Site-specific distribution coefficients (K_d , **Table 5**) were calculated using the sequential extraction data (**Table 2**) and groundwater quality data (**Table 3** and **Table 4**) for the Alluvial aquifer. Calculations were performed using the following formula:

$$m_{i(ads)} = K_d m_{i(soln)}$$

where $m_{i(ads)}$ is the concentration of a species of interest adsorbed on the solid phase and $m_{i(soln)}$ is the concentration of the species in solution in milligrams per liter (mg/L).

The concentration of arsenic adsorbed $(m_{i(ads)})$ for a given sample was calculated by summing the concentrations reported in each of the sequential extraction solutions. The corresponding concentrations in solution $(m_{i(soln)})$ were obtained from groundwater analytical results reported in the 2019 Updated RIR for

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permanent groundwater monitoring wells and temporary DPT groundwater wells located near each borehole sample location. **Table 6** provides the minimum, maximum, average, median, and standard deviation of the calculated Kd for fine, medium and coarse (insufficient detectable concentrations in coarse samples to calculate statistics) particle size samples in the full data set.

The dataset was tested for normality with the Shapiro-Wilks test and results are summarized in Table 7.

SUMMARY

Stantec collected representative soil samples for the purpose of measuring the distribution coefficient or Kd in soil for arsenic. A Kd is a measure of the ratio of solid concentration to dissolved concentration of an element or compound where the solutes in the groundwater are in equilibrium with the soil. In order to assess the solid concentration of arsenic on the soil, sequential extractions were performed using a method developed by Tessier et al. (1989). Representative groundwater concentrations from nearby wells screened in the same zone the soil sample was collected were used to provide a dissolved concentration to calculate the Kd. The following formula was used to calculate the Kd:

$$m_{i(ads)} = K_d m_{i(soln)}$$

where $m_{i(ads)}$ is the concentration of a species of interest adsorbed on the solid phase and $m_{i(soln)}$ is the concentration of the species in solution in mg/L. The method evaluated arsenic associated with exchangeable, carbonate, iron and manganese oxide fractions in all samples extracted, and organic matter associated arsenic in four representative samples with a higher concentration of finer particles. Organic matter associated arsenic did not represent a significant fraction of the overall arsenic in the four samples analyzed. The arsenic Kd values calculated in this study are site-specific constants that provide the best estimate of arsenic adsorption in situ at the site and can be used to model arsenic transport at the ALF site.

Regards,

Stantec Consulting Services Inc.

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Attachment: Table 1 Borehole Sample Collection - ALF-PMW-02C-SB; ALF-PMW-11C; ALF-213A Table 2 Sequential Extraction and Ion Exchange Capacity Data Table 3 Groundwater Sample Results - Monitoring Wells (November-December 2018) Table 4 Alluvial Aquifer Groundwater Sample Results (DPT Boring) - Filtered Table 5 Calculated Distribution Coefficients for Alluvial Aquifer Table 6 Distribution Coefficient Summary Statistics Table 7 Distribution Coefficient Shapiro Wilk Normality Test Figure 1 Allen Fossil Plant Site Plan May 15, 2020 Tennessee Valley Authority Page 5 of 5

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Figure 2 East Ash Disposal Area Geochemical Evaluation Soil/Aquifer Sampling Locations Figure 3 Direct Push Technology (DPT) Locations - Groundwater, Pore Water and Ash Sampling

TABLES

Sample Identification	Depth (ft bgs)	Geologic Unit	рН	Sequential Extractions
ALF-PMW-02C	0-7	Light brown fine-grained sand and silt	7.82	Yes
ALF-PMW-02C	11-17	Brown sand, silt and clay with red	7.65	Yes
ALF-PMW-02C	17-27	Brown sand and silt	8.31	Yes
ALF-PMW-02C	29-33	Dark brown and gray sand and silt; trace Organics	7.95	Yes
ALF-PMW-02C	36-42	Gray clay with some sand and organics	7.16	Yes
ALF-PMW-02C	42-47	Gray sand and silt	7.2	Yes
ALF-PMW-02C	47-48	Gray and red fine- to medium-grained sand	7.78	Yes
ALF-PMW-02C	48-57	Gray fine-grained sand and silt; some red sand grains	8.04	Yes - Composite 1
ALF-PMW-02C	5767	Gray, fine-grained sand and silt	7.98	Yes - Composite 1
ALF-PMW-02C	67-80	Brown medium to coarse sand	8.17	Yes
ALF-PMW-02C	80-97	Brown coarse sand with trace gravel; lignite	7.65	Yes - Composite 2
ALF-PMW-02C	97-107	Brown coarse sand with little gravel; lignite/wood	7.35	Yes - Composite 2
ALF-PMW-02C	107-117	Coarse sand - red lithics and lignite	7.92	No - Archive
ALF-PMW-02C	117-120	Brown, coarse sand, gravel with some cobbles; red lithics and coarse to cobble sized lignite	7.69	No - Archive
ALF-PMW-02C	120-127	Brown coarse sand with some red grains and lignite; mixed with gray tight medium to coarse sand with trace silt and clay	8.05	No - Archive
ALF-PMW-02C	125-127	Gray tight medium to coarse sand with trace silt and clay		Yes
ALF-PMW-02C	127-137	Gray clay with some lignite (Claiborne)	7.54	Yes

Note:

ft bgs - feet below ground surface



Table 1b Borehole Sample Collection - ALF-PMW-11C TVA Allen Fossil Plant Memphis, Tennessee

Sample Identification	Depth (ft bgs)	Geologic Unit	pН	Sequential Extractions
ALF-PMW-11C	0-6	Tan, fine-grained sand; tan-gray fine-grained silty sand	7.65	Yes
ALF-PMW-11C	6-16	Brown and red silty clay (6-9ft bgs); brown and red clay with brown poorly-graded sand and silt (9-16)	7.66	Yes
ALF-PMW-11C	16-26	Light brown to gray sand and silt (16-17); gray, fine- grained silty sand (17-29)	7.84	Yes
ALF-PMW-11C	26-36	Gray fine-grained silty sand (26-36); intermixed gray silty clay from 29-34; lignite and organics	7.59	Yes
ALF-PMW-11C	36-46	Gray silty clay with little fine-grained sand (36-38); gray silt with very fine sand, trace mica (38-46); clayey silt at 43'	7.5	Yes
ALF-PMW-11C	46-56	Gray fine-grained sand and silt, trace medium to coarse sand, trace mica (46-56)	7.77	Yes - Composite 1
ALF-PMW-11C	56-66	Gray fine-grained sand and silt, trace medium to coarse sand, trace mica (56-65); fine to coarse sub-rounded gravel starts at 65 ft	7.72	Yes - Composite 1
ALF-PMW-11C	66-76	Brown coarse sand and silt with fine to coarse gravel	7.87	Yes - Composite 2
ALF-PMW-11C	86-96	Brown coarse sand and silt with fine to coarse gravel	6.49	Yes - Composite 2
ALF-PMW-11C	96-106	Brown coarse sand and silt with fine to coarse gravel	6.95	No - Archive
ALF-PMW-11C	106-116	Brown coarse sand and silt with fine to coarse gravel	7.62	No - Archive
ALF-PMW-11C	116-126	Brown coarse sand and silt with fine to coarse gravel	7.94	No - Archive
ALF-PMW-11C	126-136	Brown coarse sand and silt with fine to coarse gravel	7.46	No - Archive
ALF-PMW-11C	136-146	Brown coarse sand and silt with fine to coarse gravel	6.66	No - Archive
ALF-PMW-11C	146-150	Brown coarse sand and silt with fine to coarse gravel	6.67	No - Archive
ALF-PMW-11C	156-166	Gray fine to coarse well-graded sand and gravel (156- 164); light brown fine to coarse well-graded sandy gravel; saturated (164-165)	7.13	No - Archive
ALF-PMW-11C	166-176	Gray well-graded fine to coarse grained sand and gravel; saturated (165-174) – mud for drilling	7.95	No - Archive
ALF-PMW-11C	176-186	Gray, fine-grained poorly-graded sand - trace medium to coarse sand, trace gravel, saturated (174-186)	8.2	No - Archive
ALF-PMW-11C	186-196	Gray, fine-grained poorly-graded sand - trace medium to coarse sand, trace gravel, saturated (186-196)	7.88	No - Archive
ALF-PMW-11C	196-206	Gray, fine-grained poorly-graded sand - trace medium to coarse sand, trace gravel, lignite, saturated (196-206)	7.89	No - Archive
ALF-PMW-11C	206-216	Gray, fine-grained poorly-graded sand - trace medium to coarse sand, trace gravel, lignite, saturated (206-216) - Zone of well-graded sand at 215-215.5	8.01	No - Archive



Table 1b Borehole Sample Collection - ALF-PMW-11C TVA Allen Fossil Plant Memphis, Tennessee

Sample Identification	Depth (ft bgs)	Geologic Unit	рН	Sequential Extractions
ALF-PMW-11C	216-226	Gray, fine-rained poorly-graded sand - trace medium to coarse sand, trace gravel, saturated (216-226)	8.04	No - Archive
ALF-PMW-11C	226-236	Well-graded light brown to gray coarse- to fine-grained sand with gravel; saturated; trace lignite	6.79	No - Archive
ALF-PMW-11C	236-246	Poorly-graded brown fine-grained sand, trace medium to coarse grained sand, trace gravel; trace clay; saturated	7.43	No - Archive
ALF-PMW-11C	246-256	Gray very fine to fine-grained poorly-graded sand; saturated	7.31	Yes

Note:

ft bgs - feet below ground surface



Table 1c Borehole Sample Collection - ALF-213A TVA Allen Fossil Plant Memphis, Tennessee

Sample Identification	Depth (ft bgs)	Geologic Unit	pН	Sequential Extractions
ALF-213A	0-3.5	Brown silty and fine sand with trace lean clay	6.95	Yes
ALF-213A	3.5-4.0	Light gray clayey sand and silt with some lignite and intermixed red clay	7.33	Yes
ALF-213A	4.0-14.5	Light brown fine-grained sand and silt with trace organics and med. brown clayey lenses	7.24	Yes
ALF-213A	14.5-28	Light grayish brown medium-grained sand and silt with some clayey lenses and lignite	7.13	Yes
ALF-213A	28-34	Intermixed grayish-brown clay with some fine-grained sand and silt, some cobbles-sized lignite and woody organics	6.93	Yes
ALF-213A	34-40	Brown fat clay with patches of reddish-brown iron staining. Trace gravel/cobble-sized organic material	7.43	Yes
ALF-213A	40-46	Bluish-gray fat clay with little organic material	7.14	Yes
ALF-213A	46-48	Gray sandy clay	6.96	Yes
ALF-213A	48-62	Gray clay with some woody material or lignite. Sandier interval at 54 ft bgs.	6.97	Yes
ALF-213A	62-67	Gray medium-grained sand with thin lean intervals (~0.25 - 0.5') of gray lean clay	7.02	Yes
ALF-213A	67-77	Brown medium- to coarse-grained sand with lithics and translucent pink/red grains, trace lignite	6.98	Yes - Composite 1
ALF-213A	77-87	Brown medium- to coarse-grained sand with lithics and translucent pink/red grains, trace lignite	7.06	Yes - Composite 1
ALF-213A	87-97	Brown medium- to coarse-grained sand with lithics and translucent pink/red grains, trace lignite	7.15	No - Archive
ALF-213A	97-107	Brown medium- to coarse-grained sand with lithics and translucent pink/red grains, trace lignite	7.11	No - Archive
ALF-213A	107-117	Brown medium- to coarse-grained sand with lithics and translucent pink/red grains, trace lignite	7.6	No - Archive
ALF-213A	117-127	Brown medium- to coarse-grained sand with lithics and translucent pink/red grains, trace lignite	8.14	No - Archive
ALF-213A	127-137	Brown coarse sand and gravel with trace cobbles and lignite	7.45	No - Archive
ALF-213A	137-144.5	Brown coarse sand and gravel with trace cobbles and lignite	7.35	No - Archive
ALF-213A	147-160.5	Brown coarse sand and gravel with trace cobbles and lignite	7.77	No - Archive
ALF-213A	160.5-167	Bluish-gray clay (Claiborne)	7.55	No - Archive

Note:

ft bgs - feet below ground surface



Table 2 Sequential Extraction and Ion Exchange Capacity Data TVA Allen Fossil Plant Memphis, Tennessee

Sample Identification	Depth (ft bgs)	Geologic Unit	CEC (meq/100 grams soil)	AEC (meq/100 grams soil)	Extract Number	Extract Concentration (mg/L)
						Arsenic
Alf-PMW-02C-SB-1	0-7	Tan silty sand	50.7	5.43	1	< 0.0100
					2	< 0.0100
					3	0.0156
ALF-PMW-02C-SB-2	11-17	Red clay zone	37	4.8	1	0.0141
					2	< 0.0100
					3	0.0755
Alf-PMW-02C-SB-3	17-27	Brown sand/silt - high pH	31.4	3.14	1	0.16
					2	0.254
					3	0.515
ALF-PMW-02C-SB-4	29-33	Dark brown sand/silt	26.9	2.17	1	0.0136
					2	< 0.0100
					3	0.0535
Alf-PMW-02C-SB-5	36-42	Gray clay zone	41.9	3.14	1	< 0.0100
					2	< 0.0100
					3	0.0761
					4	0.0236
Alf-PMW-02C-SB-6	42-47	Gray sand/silt	21.9	1.77	1	< 0.0100
					2	< 0.0100
					3	0.0787
Alf-PMW-02C-SB-7	47-48	Gray and red zone	23.7	2.51	1	< 0.0100
					2	< 0.0100
					3	0.0392
ALF-PMW-02C-SB-8	48-67	Gray sand/silt	24.7	2.17	1	< 0.0100
					2	< 0.0100
					3	< 0.0100
ALF-PMW-02C-SB-9	67-80	Brown coarse sand	22.2	4.23	1	< 0.0100
					2	< 0.0100
					3	< 0.0100
Alf-PMW-02C-SB-10	80-107	Brown sand/gravel/cobbles	18.9	3.66	1	< 0.0100
					2	< 0.0100
					3	0.0136


Table 2 Sequential Extraction and Ion Exchange Capacity Data TVA Allen Fossil Plant Memphis, Tennessee

Sample Identification	Depth	Coologic Unit	CEC	AEC	Extract	Extract Concentration (mg/L)
sample identification	(ft bgs)		grams soil)	grams soil)	Number	Arsenic
					1	< 0.0100
ALF-PMW-02C-SB-11	125-127	Tight gray sand/silt	22.1	3.14	2	< 0.0100
					3	< 0.0100
					1	< 0.0100
ALF-PMW-02C-SB-12	127-137	Clay (Claiborne)	28	3.66	2	< 0.0100
					3	0.0174
					1	< 0.0100
ALF-PMW-11C-SB-1	0-6	Tan silty sand	29.7	4.8	2	< 0.0100
					3	0.0178
					1	< 0.0100
	. 1.			2.1.4	2	< 0.0100
ALF-PMW-TTC-3B-2	0-10	Brown and rea clay zone	27.7	3.14	3	< 0.0100
					4	0.0115
					1	< 0.0100
ALF-PMW-11C-SB-3	16-26	Brown and gray sand/silt	20.9	2.63	2	< 0.0100
					3	0.0168
					1	< 0.0100
ALF-PMW-11C-SB-4	26-36	Gray silty sand	11.7	1.77	2	< 0.0100
					3	0.0361
					1	< 0.0100
ALF-PMW-11C-SB-5	36-46	Gray clay zone	27.9	3.14	2	< 0.0100
					3	0.0825
					1	< 0.0100
ALF-PMW-11C-SB-6	46-66	Gray fine sand/silt	23.4	2.63	2	< 0.0100
					3	< 0.0100
					1	< 0.0100
alf-pmw-11C-SB-7	66-96	Brown coarse sand/gravel	20.9	2.17	2	< 0.0100
					3	< 0.0100
					1	< 0.0100
ALF-PMW-11C-SB-8	246-256	Memphis sand	26.9	4.23	2	0.0104
					3	< 0.0100



Table 2 Sequential Extraction and Ion Exchange Capacity Data TVA Allen Fossil Plant Memphis, Tennessee

Sample Identification	Depth		CEC	AEC	Extract	Extract Concentration (mg/L)
sample identification	(ft bgs)		grams soil)	grams soil)	Number	Arsenic
		Brown silty and fine sand with trace			1	< 0.0100
ALF-PMW-213AA-SB-1	0-3.5	lean clay	57.6	6.74	2	< 0.100
					3	< 0.100
		Light grow aloway and and silt with			1	< 0.0100
ALF-PMW-213AA-SB-2	3.5-4.0	some lighter and intermixed red clay	43.5	5.49	2	< 0.100
					3	< 0.100
		Light brown fine-grained sand and silt			1	< 0.0100
ALF-PMW-213AA-SB-3	4.0-14.5	with trace organics and med. brown	37.9	3.14	2	< 0.100
		clayey lenses			3	< 0.100
		Light gravish brown medium-grained			1	< 0.0100
ALF-PMW-213AA-SB-4	14.5-28	sand and silt with some clayey lenses	36.4	3.66	2	< 0.100
		and lignite			3	< 0.100
		Intermixed aravish-brown clay with			1	< 0.0100
	00.04	some fine-grained sand and silt, some	17.0	5.40	2	< 0.100
ALF-PMW-ZIJAA-SB-S	28-34	cobbles-sized lignite and woody	47.8	5.43	3	0.159
		organics			4	0.185
		Brown fat clay with patches of reddish-			1	< 0.0100
ALF-PMW-213AA-SB-6	34-40	brown iron staining. Trace	45.7	4.23	2	< 0.100
		gravel/cobble-sized organic material			3	< 0.100
					1	< 0.0100
ALF-PMW-213AA-SB-7	40-46	Biulsh-gray fat clay with little organic	47.3	5.43	2	< 0.100
					3	0.142
					1	< 0.0100
ALF-PMW-213AA-SB-8	46-48	Gray sandy clay	38.2	3.14	2	< 0.100
					3	0.120
		Gray clay with some woody material			1	< 0.0100
ALF-PMW-213AA-SB-9	48-62	or lignite. Sandier interval at 54'	55.1	6.06	2	< 0.100
					3	0.154



Table 2 Sequential Extraction and Ion Exchange Capacity Data TVA Allen Fossil Plant Memphis, Tennessee

Sample Identification	Depth	Goologic Unit	CEC	AEC	Extract	Extract Concentration (mg/L)
Sample Idennication	(ft bgs)		grams soil)	grams soil)	Number	Arsenic
		Gray medium-grained sand with thin			1	0.0105
ALF-PMW-213AA-SB-10	62-67	lean intervals (~0.25 - 0.5') of gray lean	40.9	4.23	2	< 0.100
		clay			3	0.0834
		Brown medium- to coarse-grained			1	< 0.100
ALF-PMW-213AA-SB-11	67-87	sand with lithics and translucent	26.1	2.63	2	< 0.100
		pink/red grains, trace lignite			3	0.0288

Notes:

CEC - cation exchange capacity

AEC - anion exchange capacity

ft bgs - feet below ground surface

meq - milliequivalents

mg/L - milligrams per liter

mg/kg - milligrams per kilogram

J6 - The sample matrix interfered with the ability to make accurate determination; spike value is low

O1 - The analyte failed the method required serial dilution test and/or subsequent post-spike criteria. These failures indicate matrix interference.

V - The sample concentration is too high to evaluate accurate spike recoveries.



Table 3 Groundwater Sample Results - Monitoring Wells November - December 2018 TVA Allen Fossil Plant Memhis, Tennessee

	Location	ALF-202	ALF-202-B	ALF-203	ALF-203-B	ALF-213	EWN02	PMW02A	PMW02B	PMW04A	PMW04B	PMW07A	PMW07B	PMW10A	PMW10B	PMW11A	PMW11B
	Sampling Date	29-Nov-18	29-Nov-18	28-Nov-18	28-Nov-18	04-Dec-18	29-Nov-18	29-Nov-18	29-Nov-18	29-Nov-18	29-Nov-18	03-Dec-18	03-Dec-18	04-Dec-18	03-Dec-18	29-Nov-18	04-Dec-18
	Depth (ft toc)	43	90	52	89	71	30	29	54	29	57	24	55	32	68	27	63
General Chemistry (mg/L)	MCL																
Alkalinity, Bicarbonate (as CaCO3)	-	90.4	267	5.0 U	225	151	26.7	5.0 U	370	186	260	104	279	102	378	136	130
Alkalinity, Carbonate (as CaCO3)	-	5.0 U	5.0 U	194	5.0 U	5.0 U	217	237	5.0 U	5.0 U	5.0 U	137	5.0 U				
Alkalinity, Total (as CaCO3)	-	90.4	267	246	225	151	244	248	370	186	260	241	279	102	378	136	130
Chloride	-	15.4	18.2	18.1	16.6	16.6	13.4	15.2	23.3	15.6	17.2	17	19.7	14.9	22.8	15.6	17.5
Fluoride	4	3.3	0.2	4.3	0.94	0.4	3.1	2.9	0.13	4.4	0.2	3.5	0.24	2.9	0.34	3.4	2.3
Sulfate	-	147	60.1	212	64.3 J	24.6	210	210	372	184	37.9	178	52.1	129	14.1	118	122
Total Dissolved Solids	-	391	400	756	346	230	646	674	1010	561	372	696	395	374	448	406	404
рН	-	7.6 J	7.0 J	10 J	7.7 J	7.1 J	10 J	10.0 J	7.4 J	7.6 J	7.1 J	9.4 J	7.1 J	7.6 J	7.7 J	7.2 J	7.4 J
Metals (ug/L)	1		1														
Antimony	6	0.50 U	0.50 U	1.8	0.50 U	0.50 U	0.99	1.5	0.50 U	0.47 J	0.50 U	0.98	0.50 U	0.50 U	0.38 J	0.50 U	0.50 U
Arsenic	10	336	2.8	2120	44.7	7.8	2400	3450	71	3050	45.1	1480	67.9	234	43	111	12.1
Barium	2000	68.6	422	20.4	168	286	27.1	28.2	236	55.8	256	49.7	316 J	70.9	89.5 J	87.3	189
Beryllium	4	0.10 U	0.10 U	0.1	0.10 U	0.10 U	0.12	0.095 J	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Boron	-	5580	2330	6950	2320	180	6090	6430	1700	7380	2870	8250	3380	4640	1560	4530	6490
Cadmium	5	0.13	0.080 U	1.4	0.080 U	0.080 U	1.2	2.2	0.080 U	0.15	0.080 U	0.72	0.080 U	0.091	0.080 U	0.080 U	0.1
Calcium	-	23400	75400	6320	62200	38300	4020	4270	83300	39300	75300	17700	69200	26300	58500	37900	39700
Chromium	100	0.52	0.50 U	1.6	0.50 U	0.50 U	1.2	1.4	0.50 U	0.50 U	0.50 U	0.68	0.50 U				
Cobalt	6 (a)	0.16	0.050 J	0.49	0.1	0.10 U	1.1	1.9	0.76	1.3	0.14	1.8	0.72	0.8	0.42	0.87	0.15
Copper	1300	1.9	0.50 U	39.2	0.34 J	0.50 U	23.3	34.4	0.50 U	7.5	0.50 U	24.9	0.36 U*	0.30 U*	0.50 U	0.31 J	0.50 U
Lead	15	0.74	0.10 U	41.7	0.16 U*	0.10 U	11.7	23.4	0.075 J	0.19	0.10 U	8.4	0.059 J	0.073 J	0.086 J	0.10 U	0.10 U
Lithium	40 (a)	5.8	4.6	2.5 U	10.7	6.8	6.2	0.58 J	19	6.8	10.7	2.1 J	9.4	6.9	21.7	5.6	11.6
Magnesium	-	5440	20800	674	14500	11900	221	96.7	19100	6880	18900	1490	20200	5810	10400	7810	11100
Mercury	2	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Molybdenum	100 (a)	389	152	409	225	3.9	327	339	81	679	245	1000	368	414	45	259	490
Nickel	100	1.6	0.21 J	7.1	0.61 U*	0.20 J	7.2	13.3	0.83	12.2	0.27 J	7.3	0.41 J	2.7	1	1.8	0.40 J
Potassium	-	1950	3230	1190	2040	2970	1350	1410	4220	3770	2250	1960	4420 J	3550	4560 J	1920	2460
Selenium	50	0.26 J	0.50 U	4.9	0.50 U	0.50 U	1.3	3.2	0.14 J	0.78	0.50 U	0.93	0.50 U	0.26 J	0.24 J	0.24 J	0.16 J
Silver	-	0.40 U	0.40 U	0.090 J	0.40 U	0.40 U	0.050 J	0.079 J	0.40 U	0.40 U	0.40 U	0.057 J	0.40 U				
Sodium	-	121000	17900	210000	30700	16800	202000	200000	276000	166000	12800	170000	23600	108000	69100	87700	63400
Thallium	2	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Vanadium	-	1.6	0.30 U	20.5	0.26 U*	0.30 U	21.6	38.4	0.68	6.8	0.24 J	19.1	0.30 U	0.92	1.3	1.2	2.8
Zinc	-	2.2 J	5.0 U	4.7 U*	3.3 U*	1.8 U*	4.0 J	8.8	5.0 U	2.6 J	5.0 U	9.6	2.3 U*	1.9 U*	1.9 U*	5.0 U	4.3 U*
Arsenic Speciation (ug/L)	1		1	1	1	1	1	1	1	1	1		1	1	1	1	
Arsenic III	10	344	2.65	1140	28.8	6.27	976	212	58.2	115	44	142	58.8	216	33.5	101	10.2
Arsenic V	10	13.8	0.783 J	177	3.63	1.50 J	1680	4100	8.46	3470	7.36	1260	9.93	6.54	2.84	5.86	1.40 J
Dimethylarsinic	-	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2,10 U	21.0 U	2.10 U	21.0 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U	2.10 U
Monomethylarsonic	-	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	23.0 U	2.30 U	23.0 U	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U
Radium (pCi/L)		2.000	2.00 0	2.50 0	2.50 0	2.50 0	2.000	20.0 0	2.50 0	20.00	2.000	2.00 0	2.50 0	2.30 0	2.50 0	2.50 0	2.000
Radium-226	-	0.289+-0.34911	0.677+-0.473	0 155+-0 353 11	0 198+-0 302 11		0 268+-0 323 11	0.622+-0.58211	0.482+-0.629.11	0 344+-0 358 11	0.254+-0.35411						
Radium-226+228	5	0.778+.0.53011	1 38+ 0 6/6	0.327±0.524	0.973. 0.470		0.6224 0.565 1	0.622+0.602 U	1 02+0 771 1		0.254+-0.676 U						
Radium 220	-	0.490, 0.200 !!	0.704 0.440 //	0.172. 0.401.1	0.775 0.272		0.254 0.442 1	0.155, 0.274	0.624.0444.1	0.452.0.402.1	0.202.0574.1						
Kaulum-228		0.489+-0.399 0	0.704+-0.440 U	0.172+-0.401 U	0.775+-0.372		0.354+-0.463 U	-0.155+-0.374 0	0.534+-0.446 U	0.053+-0.482 U	-0.203+-0.576 U						

Notes:

Depths reported in feet below ground surface (ft bgs).

mg/L - milligrams per liter

ug/L - micrograms per liter

pCi/L - picocuries per liter

U - The analyte was not detected above the indicated reporting limit.

J - The result is estimated.

U* - The analyte was detected in an associated blank.

UJ - The analyte was not detected above the estimated reporting limit.

Results above the MCL (maximum contaminant level) are shaded.

(a) Groundwater protection standard per EPA CCR rule amendment.



Table 4 Alluvial Aquifer Groundwater Sample Results (DPT Boring) - Filtered TVA Allen Fossil Plant Memphis, Tennessee

		Northern Are	ea										Southern A	rea				
	Location	GP-04	GP-07	GP-07	GP-07	GP-11	GP-11	GP-13	GP-13	GP-13	GP-21	GP-21	GP-51	GP-51	GP-51	GP-51	GP-51	GP-54
	Sampling Date	20-Jul-17	21-Jul-17	21-Jul-17	21-Jul-17	13-Jul-17	12-Jul-17	12-Jul-17	12-Jul-17	12-Jul-17	11-Jul-17	11-Jul-17	24-Aug-17	24-Aug-17	23-Aug-17	23-Aug-17	23-Aug-17	08-Aug-17
	Depth (ft bgs)	42.5	17.5	22.5	47.5	27.5	37.5	17.5	22.5	32.5	22.5	37.5	32.5	37.5	47.5	57.5	67.5	32.5
General Chemistry (mg/L)	MCL																	
Alkalinity, Bicarbonate (as CaCO3)	-	354	5.0 U	107	249	5.0 U	141	65.4	141	116	5.0 UJ	207 J	413	43.9	123	88.0	488	842
Alkalinity, Carbonate (as CaCO3)	-	5.0 U	151	5.0 U	5.0 U	271	5.0 U	74.6	15.4	5.0 U	214 J	5.0 UJ	5.0 U	89.9	5.0 U	5.0 U	5.0 U	5.0 U
Alkalinity, Total (as CaCO3)	-	354	179	107	249	285	141	140	157	116	247 J	207 J	413	134	123	88.0	488	842
Chloride	-	20.9	13.9 J	14.6 J	17.5 J	14.8	17.7	17.8	15.1	14.8	14.0 J	22.8 J	13.1	17.0	17.2	17.0	6.8	8.4
Fluoride	4	0.16	3.1 J	6.4 J	0.20 J	4.8	4.8	5.0	5.2	4.3	3.8 J	0.16 J	0.74	2.4	3.4	2.8	0.14	0.54
Sulfate	-	115	208 J	207 J	55.1	134	143	182	140	108	200 J	132 J	74.9	105	125	141	1.0 U	8.1
Total Dissolved Solids	-	579	542	532	326	684	400	628	486	371	682 J	499 J	559	377	394	379	495	836
pH (standard units)	-	7.0	10.6 J	7.6 J	6.9 J	10.4 J	7.9 J	9.2 J	8.6 J	7.7 J	10.3 J	7.3 J	7.3 J	9.5 J	7.9 J	7.1 J	7.3 J	7.4 J
Metals (ug/L)																		
Antimony	6	2.5 U	1.2 J	2.5 U	2.5 U	1.7	0.50 U	1.1	1.5 J	0.50 U	1.3	0.13 J	2.5 U	2.0 J	2.5 U	2.5 U	2.5 U	2.5 UJ
Arsenic	10	50.5 J	558	1100	72.8	5690	4.1	4080	3910	2550 J	2450	27.7	154	873	226	114	86.2	29.5 J
Barium	2000	387	5.0 U	82.2	300	8.2	123	16.7	36.7	97.9	4.0 J	271	108	7.7	97.1	142	267	374
Beryllium	4	0.50 U	0.50 U	0.50 U	0.50 U	0.055 J	0.10 U	0.047 U*	0.42 J	0.10 U	0.045 J	0.025 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Boron	-	3740	10300	9910	3500	6210	7440 J	12300 J	7720 J	5460 J	8020	10200	3600	5730	5870	6460	341	869
Cadmium	5	0.40 U	0.40 U	0.40 U	0.40 U	0.84	0.080 U	0.86	4.3	0.080 U	0.071 J	0.080 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U
Calcium	-	97400	2220	35700	65200	4430	49500	8410	17200	31700	6530	89400	107000	3210	33800	37800	108000	194000
Chromium	100	2.5 U	2.5 U	2.5 U	2.5 U	1.8	0.24 J	0.85	4.0	0.23 J	1.5	0.28 J	2.5 U	1.0 J	2.5 U	2.5 U	2.5 U	2.5 U
Cobalt	-	0.51 J	0.24 U*	0.080 U*	0.24 U*	2.2	0.11	1.9	3.4	0.062 J	0.45	0.53	0.75	0.20 J	0.095 J	0.15 J	0.37 U	5.9
Copper	1300	2.5 U	3.6	2.5 U	2.5 U	18.3	0.22 J	18.5	117	0.50 U	2.0	0.48 J	0.68 J	2.6	2.5 U	2.5 U	2.5 U	2.5 U
Lead	15	0.50 U	2.4	0.50 U	0.50 U	17.6	0.10 U	3.7	51.3	0.10 U	1.5	0.10 U	0.50 U	2.1	0.50 U	0.50 U	0.50 U	0.50 U
Lithium	-	11.9 J	0.96 U*	9.3 J	9.1 J	0.52 J	12.4	2.1 J	3.3 J	11.8	1.1 J	10.4	8.2 J	1.6 J	9.7 J	8.8 J	7.5 J	15.8
Magnesium	-	34200	100 U	5590	20800	83.8 J	7670	1670	2260	6480	365	26100	27000	335	7820	9240	34800	52700
Mercury	2	0.20 U	0.20 U	0.20 U	0.20 U	0.11 J	0.20 U	0.20 U	0.15 J	0.20 U	0.20 UJ	0.20 UJ	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Nickel	100	3.8 J	3.6	2.5 U	2.5 U	21.5	1.3	15.7	30.6	0.50	5.5	3.0	15.1	4.0	2.5 U	2.5 U	2.5 U	7.9
Potassium	-	6760	5000 U	4920 J	5720	5000 U	6260	5000 U	4860 J	3760 J	5000 U	6080 J	5000 U	5000 U	3820 J	3050 J	7020	50000 U
Selenium	50	2.5 U	2.5 U	2.5 U	2.5 U	10.0 U	0.50 UJ	2.3	13.1	0.50 U	10.0 U	10.0 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Silver	-	2.5 U	2.5 U	2.5 U	2.5 U	0.50 U	0.50 U	0.50 U	2.5 U	0.50 U	0.50 U	0.087 J	2.5 U	2.5 U	2.5 U	2.5 U	0.40 U*	2.5 U
Sodium	-	18200	188000	118000	27300	191000	75200	166000 J	125000 J	71200	186000 J	20500 J	27400	122000	74400	60600	17000	24500 J
Thallium	5	0.50 U	0.50 U	0.50 U	0.50 U	0.020 J	0.10 U	0.020 U*	0.50 U	0.10 U	0.10 UJ	0.10 UJ	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Vanadium	-	0.51 J	28.4 J	1.3 J	0.41 J	45.1	0.51	28.2	60.4	0.80	26.2	1.9 J	0.63 J	12.6	0.52 J	0.98 J	2.5 U	0.64 J
Zinc	-	25.0 U	25.0 U	25.0 U	16.5 J	6.3	6.7	4.0 J	25.0 U	5.0 U	2.6 J	8.8	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U

Notes:

Depths reported in feet below ground surface (ft bgs).

mg/L - milligrams per liter

ug/L - micrograms per liter

U - The analyte was not detected above the indicated reporting limit.

J - The result is estimated.

 U^{\star} - The analyte was detected in an associated blank.

 $\ensuremath{\mathsf{UJ}}\xspace$ - The analyte was not detected above the estimated reporting limit.

Results above the MCL (maximum contaminant level) are shaded.



Table 4 Alluvial Aquifer Groundwater Sample Results (DPT Boring) - Filtered TVA Allen Fossil Plant Memphis, Tennessee

		Southern Ar	ea															
	Location	GP-54	GP-54	GP-56	GP-56	GP-56	GP-56	GP-56	GP-58	GP-58	GP-63	GP-65						
	Sampling Date	08-Aug-17	08-Aug-17	06-Aug-17	06-Aug-17	06-Aug-17	19-Aug-17	18-Aug-17	07-Aug-17	07-Aug-17	05-Aug-17	05-Aug-17	05-Aug-17	05-Aug-17	04-Aug-17	20-Aug-17	20-Aug-17	27-Jun-17
	Depth (ft bgs)	42.5	47.5	37.5	42.5	47.5	70	87.5	42.5	47.5	22.5	27.5	32.5	37.5	47.5	62.5	77	40.5
General Chemistry (mg/L)	MCL																	
Alkalinity, Bicarbonate (as CaCO3)	-	95.6	73.9	293	32.5	119	396	217	302	140	111	93.7 J	76.4	87.9	93.2	275	145	115 J
Alkalinity, Carbonate (as CaCO3)	-	5.0 U	5.0 U	5.0 U	65.5	5.0 U												
Alkalinity, Total (as CaCO3)	-	95.6	73.9	293	98.0	119	396	217	302	140	111	93.7 J	76.4	87.9	93.2	275	145	115 J
Chloride	-	18.7	15.0	14.0	17.2	17.1	10.6	16.6	21.6	18.7	19.0	17.3	17.2	16.2	13.9	20.3	20.0	17.5
Fluoride	4	4.3	3.8	1.8	2.7	3.0	0.15	0.17	0.85	2.1	4.3	4.7	4.7	4.6	4.3	0.44	2.8	3.8
Sulfate	-	94.7	120	57.3 J	120 J	137 J	16.8	54.3	115 J	122 J	77.6 J	94.4	95.5	111	102 J	26.6	64.2	144
Total Dissolved Solids	-	359	315	422	378	384	422 J	339	556	379	365	314	346	336	338 J	373	335	389
pH (standard units)	-	7.8 J	7.9 J	7.4 J	9.7 J	8.4 J	7.5 J	7.3 J	8.0 J	7.5 J	7.7 J	7.7 J	7.5 J	7.6 J	7.4 J	7.6 J	7.8 J	7.8 J
Metals (ug/L)			-	-	-		-	-	-				-	-	-	-	-	-
Antimony	6	2.5 UJ	2.5 UJ	2.5 U	1.1 J	2.5 U	2.5 UJ	2.5 UJ	2.5 U	2.5 UJ	2.5 UJ	0.11 J						
Arsenic	10	63.9 J	287 J	244	861	443	28.9	2.7	4.7	9.5	42.3	578	209	500	213	5.3	62.6	143
Barium	2000	53.0	56.0	104	16.3	49.4	388	475	90.8	94.8	89.3	75.6	109	74.0	98.5	295	163	76.8
Beryllium	4	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.10 U
Boron	-	4740	3370	4510	4890	5810	529	1180	9840	4840	7560	4020	4960	4340	5340	3120	7650 J	6050
Cadmium	5	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.080 U
Calcium	-	18600	16700	67300	2780	28200	85400	62400	48200	38100	30400	18500	24700	18500	23100	67600	31100	28700 J
Chromium	100	0.54 J	0.65 J	0.52 J	0.92 J	2.5 U	0.70 J	2.5 U	0.35 J									
Cobalt	-	0.36 J	0.27 J	0.60	0.32 J	0.085 J	0.68	0.52	0.84	0.68	0.74	0.090 J	0.50 U	0.10 J	0.085 U*	0.34 J	0.21 J	0.18
Copper	1300	1.6 J	2.5 U	1.9 J	0.94 J	2.5 U	0.60 J	2.5 U	1.6 J	0.20 J								
Lead	15	0.50 U	0.50 U	0.50 U	0.95	0.50 U	0.090 J											
Lithium	-	8.2 J	6.3 J	5.7 J	1.6 U*	7.3 J	9.7 J	5.8 J	9.8 J	10.6 J	10.3 J	7.6 J	10.2 J	7.5 J	8.7 J	10.8 J	8.0 J	8.5
Magnesium	-	3640	3820	17000	263	6230	24800	17500	10500	12400	7100	3720	5410	3850	4650	18100	7800	6410
Mercury	2	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.14 J	0.20 U					
Nickel	100	4.3	2.5 U	3.5	5.3	2.5 U	5.7	3.5	7.4	2.7	8.0	2.5 U	1.5					
Potassium	-	3350 J	2700 J	5000 U	5000 U	3010 J	6810	3860 J	5320	3980 J	3820 J	3140 J	2780 J	3140 J	4510 J	7320	4780 J	3030 J
Selenium	50	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 UJ	2.5 UJ	2.5 U	2.5 UJ	2.5 UJ	2.5 UJ	2.4 J					
Silver	-	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	0.50 UR
Sodium	-	77400	65400	51200	107000	87200	17600	13700	121000	67400	78900	65400	65400	72300	81000	25200	55200	92900
Thallium	5	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.10 U
Vanadium	-	2.2 J	3.5	2.1 J	15.8	2.0 J	2.5 U	2.5 U	0.38 J	0.76 J	0.64 J	1.3 J	0.82 J	3.6	5.3	2.5 U	3.8 J	1.4
Zinc	-	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	5.0 U

Notes:

Depths reported in feet below ground surface (ft bgs).

mg/L - milligrams per liter

ug/L - micrograms per liter

U - The analyte was not detected above the indicated reporting limit.

J - The result is estimated.

 U^{\star} - The analyte was detected in an associated blank.

UJ - The analyte was not detected above the estimated reporting limit.

Results above the MCL (maximum contaminant level) are shaded.



Table 4 Alluvial Aquifer Groundwater Sample Results (DPT Boring) - Filtered TVA Allen Fossil Plant Memphis, Tennessee

		Southern Ar	ea				
	Location	GP-66	GP-67	GP-67	GP-71	GP-71	GP-71
	Sampling Date	26-Jun-17	27-Jul-17	27-Jul-17	04-Aug-17	04-Aug-17	03-Aug-17
	Depth (ft bgs)	17.5	42.5	47.5	27.5	37.5	47.5
General Chemistry (mg/L)	MCL						
Alkalinity, Bicarbonate (as CaCO3)	-	187	237	387	131	272 J	221
Alkalinity, Carbonate (as CaCO3)	-	9.4	5.0 U				
Alkalinity, Total (as CaCO3)	-	196	237	387	131	272 J	221
Chloride	-	16.2	19.3	13.8	17.5	22.1	24.0
Fluoride	4	2.4	0.49	0.10 J	2.3	0.36	0.38
Sulfate	-	106	76.8	1.0 U	138	67.1	92.0
Total Dissolved Solids	-	418	447	412	436	440	443
pH (standard units)	-	8.5 J	7.1 J	6.9 J	7.2 J	7.0 J	7.0 J
Metals (ug/L)							
Antimony	6	0.83	2.5 U				
Arsenic	10	737	30.6	85.3	33.0	46.5	27.4
Barium	2000	44.9	284	413	117	283	247
Beryllium	4	0.12	0.50 U				
Boron	-	4320	5030 J	775	6540	7140	8500
Cadmium	5	1.0	0.40 U				
Calcium	-	7360 J	71300	91200	40500	70000	62000
Chromium	100	3.7	2.6	0.90 J	0.52 J	2.5 U	2.5 U
Cobalt	-	1.9	0.30 J	0.41 J	0.12 U*	0.14 U*	0.34 J
Copper	1300	10.7	2.5 U				
Lead	15	6.9	0.50 U				
Lithium	-	2.0 J	11.9 J	7.9 J	9.3 J	7.9 J	7.4 J
Magnesium	-	1620	21100	26900	9690	21400	19800
Mercury	2	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Nickel	100	8.8	3.0	2.5 U	2.5 U	2.5 U	2.5 U
Potassium	-	5000 U	5480	7250	3790 J	5110	5440
Selenium	50	3.6 J	2.5 U	2.5 U	2.5 UJ	2.5 UJ	2.5 U
Silver	-	0.50 UR	2.5 U				
Sodium	-	126000	41600	16900	82000	38200	47500
Thallium	5	0.026 J	0.50 UJ	0.50 U	0.50 U	0.50 U	0.50 U
Vanadium	-	10.3	0.53 J	0.45 J	2.5 U	2.5 U	0.54 J
Zinc	-	8.4	25.0 U				

Notes:

Depths reported in feet below ground surface (ft bgs).

mg/L - milligrams per liter

ug/L - micrograms per liter

U - The analyte was not detected above the indicated reporting limit.

J - The result is estimated.

 U^{\star} - The analyte was detected in an associated blank.

UJ - The analyte was not detected above the estimated reporting limit.

Results above the MCL (maximum contaminant level) are shaded.



Table 5 Calculated Distribution Coefficients for Alluvial Aquifer TVA Allen Fossil Plant Memphis, Tennessee

	Sequential									Sum of Sequential	
Sequential	Extraction			Groundwater		Groundwater			Groundwater	Extraction	Calculated
Extraction	Depth			Sample		Sample Depth	MW Screen		Concentration	Concentrations	Distribution
Location	(ff bgs)	Geologic Unit	Grain Size	Borehole	MW/ DPT	(ff bgs)	(ff bgs)	Constituent	(mg/L)	(mg/kg)	Coefficient
PMW-11C	36-46	Gray Clay zone	Fine	ALF-202	MW	43	19.5-40.7	Arsenic	0.336	1.65	4.9
PMW-11C	66-96	Brown Coarse Sand/Gravel	Coarse	ALF-202-B	MW	90	80.9-90.9	Arsenic	0.0028		NC
PMW-11C	26-36	Gray Silty Sand	Medium	EWS03	EW	30	20-40	Arsenic	0.557	0.722	1.3
PMW-11C	26-36	Gray Silty Sand	Medium	PMW10A	MW	32	18-39	Arsenic	0.234	0.722	3.1
PMW-11C	66-96	Brown Coarse Sand/Gravel	Coarse	PMW10B	MW	68	59.5-69.5	Arsenic	0.043		NC
PMW-11C	26-36	Gray Silty Sand	Medium	PMW11A	MW	27	13-34	Arsenic	0.111	0.722	6.5
PMW-11C	46-66	Gray fine Sand/Silt	Medium	PMW11B	MW	63	54-64	Arsenic	0.0121		NC
PMW-11C	26-36	Gray Silty Sand	Medium	GP-51	DPT	32.5	NA	Arsenic	0.154	0.722	4.7
PMW-11C	36-46	Gray Clay zone	Fine	GP-51	DPT	37.5	NA	Arsenic	0.873	1.65	1.9
PMW-11C	46-66	Gray fine Sand/Silt	Medium	GP-51	DPT	47.5	NA	Arsenic	0.226		NC
PMW-11C	46-66	Gray fine Sand/Silt	Medium	GP-51	DPT	57.5	NA	Arsenic	0.114		NC
PMW-11C	66-96	Brown Coarse Sand/Gravel	Coarse	GP-51	DPT	67.5	NA	Arsenic	0.0862		NC
PMW-11C	26-36	Gray Silty Sand	Medium	GP-54	DPT	32.5	NA	Arsenic	0.0295	0.722	24.5
PMW-11C	36-46	Gray Clay zone	Fine	GP-54	DPT	42.5	NA	Arsenic	0.0639	1.65	25.8
PMW-11C	46-66	Gray fine Sand/Silt	Medium	GP-54	DPT	47.5	NA	Arsenic	0.287		NC
PMW-11C	36-46	Gray Clay zone	Fine	GP-56	DPT	37.5	NA	Arsenic	0.244	1.65	6.8
PMW-11C	36-46	Gray Clay zone	Fine	GP-56	DPT	42.5	NA	Arsenic	0.861	1.65	1.9
PMW-11C	46-66	Gray fine Sand/Silt	Medium	GP-56	DPT	47.5	NA	Arsenic	0.443		NC
PMW-11C	66-96	Brown Coarse Sand/Gravel	Coarse	GP-56	DPT	70	NA	Arsenic	0.0289		NC
PMW-11C	66-96	Brown Coarse Sand/Gravel	Coarse	GP-56	DPT	87.5	NA	Arsenic	0.0027		NC
PMW-11C	36-46	Gray Clay zone	Fine	GP-58	DPT	42.5	NA	Arsenic	0.0047	1.65	351.1
PMW-11C	46-66	Gray fine Sand/Silt	Medium	GP-58	DPT	47.5	NA	Arsenic	0.0095		NC
PMW-11C	16-26	Brown and Gray Sand/Silt	Medium	GP-63	DPT	22.5	NA	Arsenic	0.0423	0.336	7.9
PMW-11C	26-36	Gray Silty Sand	Medium	GP-63	DPT	27.5	NA	Arsenic	0.578	0.722	1.2
PMW-11C	26-36	Gray Silty Sand	Medium	GP-63	DPT	32.5	NA	Arsenic	0.209	0.722	3.5
PMW-11C	36-46	Gray Clay zone	Fine	GP-63	DPT	37.5	NA	Arsenic	0.5	1.65	3.3
PMW-11C	46-66	Gray fine Sand/Silt	Medium	GP-63	DPT	47.5	NA	Arsenic	0.213		NC
PMW-11C	46-66	Gray fine Sand/Silt	Medium	GP-63	DPT	62.5	NA	Arsenic	0.0053		NC
PMW-11C	66-96	Brown Coarse Sand/Gravel	Coarse	GP-63	DPT	77	NA	Arsenic	0.0626		NC
PMW-11C	36-46	Gray Clay zone	Fine	GP-65	DPT	40.5	NA	Arsenic	0.143	1.65	11.5
PMW-11C	16-26	Brown and Gray Sand/Silt	Medium	GP-66	DPT	17.5	NA	Arsenic	0.737	0.336	0.5
PMW-11C	36-46	Gray Clay zone	Fine	GP-67	DPT	42.5	NA	Arsenic	0.0306	1.65	53.9
PMW-11C	46-66	Gray fine Sand/Silt	Medium	GP-67	DPT	47.5	NA	Arsenic	0.0853		NC
PMW-11C	26-36	Gray Silty Sand	Medium	GP-71	DPT	27.5	NA	Arsenic	0.033	0.722	21.9
PMW-11C	36-46	Gray Clay zone	Fine	GP-71	DPT	37.5	NA	Arsenic	0.0465	1.65	35.5
PMW-11C	46-66	Gray fine Sand/Silt	Medium	GP-71	DPT	47.5	NA	Arsenic	0.0274		NC
PMW-02C	48-67	Gray Sand/Silt	Medium	ALF-203	MW	52	29.3-50.3	Arsenic	2.12		NC
PMW-02C	80-107	Brown Sand/Gravel/Cobbles	Coarse	ALF-203-B	MW	89	80.4-90.4	Arsenic	0.0447	0.272	6.1
PMW-02C	29-33	Dark Brown Sand/Silt	Medium	GP-11	DPT	27.5	NA	Arsenic	5.69	1.1788	0.2



Table 5 Calculated Distribution Coefficients for Alluvial Aquifer TVA Allen Fossil Plant Memphis, Tennessee

Sequential Extraction	Sequential Extraction Depth			Groundwater Sample		Groundwater Sample Depth	MW Screen		Groundwater Concentration	Sum of Sequential Extraction Concentrations	Calculated Distribution
Location	(ft bgs)	Geologic Unit	Grain Size	Borehole	MW/ DPT	(ft bgs)	(ft bgs)	Constituent	(mg/L)	(mg/kg)	Coefficient
PMW-02C	36-42	Gray Clay zone	Fine	GP-11	DPT	37.5	NA	Arsenic	0.0041	1.994	486.3
PMW-02C	17-27	Brown Sand/Silt - High pH	Medium	GP-13	DPT	22.5	NA	Arsenic	3.91	13.612	3.5
PMW-02C	17-27	Brown Sand/Silt - High pH	Medium	GP-13	DPT	17.5	NA	Arsenic	4.08	13.612	3.3
PMW-02C	29-33	Dark Brown Sand/Silt	Medium	GP-13	DPT	32.5	NA	Arsenic	2.55	1.1788	0.5
PMW-02C	17-27	Brown Sand/Silt - High pH	Medium	GP-21	DPT	22.5	NA	Arsenic	2.45	13.612	5.6
PMW-02C	36-42	Gray Clay zone	Fine	GP-21	DPT	37.5	NA	Arsenic	0.0277	1.994	72.0
PMW-02C	42-47	Gray Sand/Silt	Medium	GP-4	DPT	42.5	NA	Arsenic	0.0505	1.574	31.2
PMW-02C	17-27	Brown Sand/Silt - High pH	Medium	GP-7	DPT	22.5	NA	Arsenic	1.1	13.612	12.4
PMW-02C	17-27	Brown Sand/Silt - High pH	Medium	GP-7	DPT	17.5	NA	Arsenic	0.558	13.612	24.4
PMW-02C	47-48	Gray and Red Sand/Silt	Medium	GP-7	DPT	47.5	NA	Arsenic	0.0728	0.784	10.8
PMW-02C	29-33	Dark Brown Sand/Silt	Medium	PMW02A	MW	29	15.5-36.5	Arsenic	3.45	1.1788	0.3
PMW-02C	48-67	Gray Sand/Silt	Medium	PMW02B	MW	54	45-55	Arsenic	0.071		NC
PMW-02C	29-33	Dark Brown Sand/Silt	Medium	PMW04A	MW	29	15.8-36.8	Arsenic	3.05	1.1788	0.4
PMW-02C	48-67	Gray Sand/Silt	Medium	PMW04B	MW	57	48.6-58.6	Arsenic	0.0451		NC
PMW-02C	17-27	Brown Sand/Silt - High pH	Medium	PMW07A	MW	24	15.4-25.4	Arsenic	1.48	13.612	9.2
PMW-02C	48-67	Gray Sand/Silt	Medium	PMW07B	MW	55	46-56	Arsenic	0.0679		NC
ALF-2132A	67-87	Brown Sand	Medium	ALF-213	MW	71	67.3-77.5	Arsenic	0.0078	0.576	73.8

Notes:

-- result less than detection limit

ft bgs - feet below ground surface

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

DPT - direct push technology borehole

MW - monitoring well

NA - not applicable

NC - not calcul

Table 6 Distribution Coefficient Summary Statistics TVA Allen Fossil Plant Memphis, Tennessee

Constituent	Grain Size	Number of Observations	Percent Non- Detect	Minimum	Maximum	Average*	Median*	Standard Deviation*
Arsenic	Fine	12	0	1.9	486.3	87.9	18.7	158.8
Arsenic	Medium	37	38	ND	73.8	10.9	4.7	16.4
Arsenic	Coarse	7	86		6.1			

Notes:

* - calculation for values above the detection limit

--- not enough values to calculate

ND - non-detect



Table 7 Distribution Coefficient Shapiro Wilk Normality Test TVA Allen Fossil Plant Memphis, Tennessee

Constituent	Grain Size	P.Value	Distribution
Arsenic	Fine	0.00011	Not Normal
Arsenic	Medium	0.000003	Not Normal
Arsenic	Coarse		

Note:

-- - not enough values to calculate



FIGURES



Client/Project	llev Aut	hority		
Allen Fossil Pla	int	lienty		
Project Location Memphis, Tennessee			Pre Technical R	17557701 pared by LT on 2019-02-0 eview by JJ on 2019-02-0
0	400	800	1,200	1,600
1:4,	800 (At oriç	ginal docum	nent size of 22	2x34)
Legend				
Levee				
Current In	nnoundme	ant (Annrovi	mate)	
Cunent in	ipoundine	επ (Αρριολί	mate)	
Former Di	sposal Area	a (Approxim	nate)	
lotes				
lotes 1. Coordinate Syste	∙m: NAD 1	1983 StateP	lane Tennes	see FIPS 4100 Feet
Notes 1. Coordinate Syste 2. Imagery Provideo 3. The West Ash Disj	em: NAD 1 d by Terras	1983 StateP server (2016 a does not i	lane Tennes 5) & TVA (201 impound wa	see FIPS 4100 Feet 5) ater; therefore, a wa
Notes 1. Coordinate Syste 2. Imagery Provided 3. The West Ash Disponent surface elevatio	em: NAD 1 d by Terras posal Area n is not ap	1983 StateP server (2016 a does not i oplicable to	lane Tennes 5) & TVA (201 impound wa 5) the West As	see FIPS 4100 Feet 5) ater; therefore, a wa h Disposal Area.
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otes Coordinate Syste Imagery Provided The West Ash Disj surface elevatio The water surface to the National G TVA property bou Allen Fossil Plant I	em: NAD 1 d by Terras posal Area n is not ap e elevatio Geodetic N undary is ra Reservatio	1983 StateP server (2016 a does not i oplicable to n for the Ea /ertical Dat eferenced in.	lane Tennes b) & TVA (201 impound wa b) the West As ast Ash Dispo tum of 1929. from TVA Dra	see FIPS 4100 Feet 5) ater; therefore, a wa h Disposal Area. sal Area is reference awing 421 P 504









East Ash Disposal Area Geochemical Evaluation Soil/Aquifer Sampling

Locations Client/Project

Tennessee Valley Authority Allen Fossil Plant

Project Location	175577012
Memphis, Tennessee	Prepared by LT on 2019-02-14
	Technical Review by JJ on 2019-02-14

0	250	500	750	1,000		
1	Feet					
1:3,000 (At original document size of 22x34)						

Legend

Geochemical Modeling Alluvial Soll/Aquiter Sample Location		Geochemical Modeling Alluvial Soil/Aquifer Sample Location
--	--	--

- Abandoned Harsco Production Wells (PW)
- McKellar Lake Gauging Station
- Performance Monitoring Well (PMW) (Shallow)
- Performance Monitoring Well (PMW) (Intermediate)
- Performance Monitoring Well (PMW) (Deep)
- IRA Extraction Well (EW)
- Monitoring Well (Shallow)
- Monitoring Well (Intermediate)
- Monitoring Well (Deep)
- Production Well (Memphis Sand) \bullet
- Sewer Manhole Location of Force Main Transition to Gravity
- Sanitary Sewer Pipes
- East Ash Pond Perimeter

Notes Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
 Imagery Provided by TVA (2018)

Figure No.

Direct Push Technology (DPT) Locations -Groundwater, Pore Water and Ash Sampling

Client/Project

Tennessee Valley Authority Allen Fossil Plant

Project Location 175577013								
Memph	is, Tennesse	e		Prepared by LT on 2018-02-16 Technical Review by JJ on 2018-02-16				
	0	150	300	450	600 Feet	_		
1:1,800 (At original document size of 22x34)								
Leg	end							
•	Monitoring Well; ALF-P-4							
	DPT Pore Water Sample Location							
	DPT Pore Water and Ash Sample Location							
	DPT Groundwater Sample Location							
	· Sanitary Sewer Pipes							
	Sewer Manhole Location of Force Main Transition to Gravity							

Notes

Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
 Imagery Provided by TerraServer (2016)

