Geotechnical Engineering Report

AEP Rockport Bottom Ash Complex
Professional Engineering Certification
Rockport, Indiana
January 11, 2016
Terracon Project No. N4155126

Prepared for:
American Electric Power
Columbus, Ohio

Prepared by:
Terracon Consultants, Inc.
Columbus, Ohio
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1.0 INTRODUCTION

This report provides the results of our field and laboratory testing programs, and presents our conclusions and slope stability analysis results to satisfy the criteria set forth by the most recently mandated USEPA rule 40 CFR Part 257, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities (CCR rules) for the AEP Rockport Bottom Ash Complex in Rockport, Indiana. The subsurface conditions were explored by two (2) borings sampled to depths of about 30 to 44 feet below the existing ground surface. Additionally, a groundwater observation well was installed within the embankment to a depth of about 15 feet, located approximately 10 feet south of Boring B-2.

2.0 PROJECT INFORMATION

In AEP’s Stability Assessment of Bottom Ash Pond, West Dike report dated June 21, 2010, AEP conducted geotechnical engineering analyses of the Rockport impoundment and determined the minimum upstream and downstream dike factors of safety against slope failure considering both existing and earthquake loading conditions. As part of the current project, Terracon was requested to perform the following tasks in order to certify that the existing impoundment meets the minimum requirement of the recently mandated USEPA CCR rules:

- Perform Site Visit
- Review Previous Slope Stability Analysis
- Perform Hydrologic and Hydraulic Analysis
- Establish Piezometer Action Values

The results of these tasks are summarized in the following sections. Please note that the results of the hydrologic and hydraulic analysis are being submitted in a separate report.
3.0 SITE VISIT

On July 14, 2015 the undersigned representatives of Terracon met with AEP personnel and performed a site reconnaissance of the Rockport Plant Bottom Ash Pond Complex. The only above-grade embankment is along the west side of the West Bottom Ash Pond and West Wastewater Pond. The remaining ponds were constructed by excavating below original grade. Based on conversations with AEP, we understand that no significant modifications have been made to the geometry of the existing impoundment perimeter embankment slopes since the time of AEP’s 2010 slope stability analyses. However, based on site observations and information in provided topographic information, the exterior slopes appeared to be flatter than the 2.5H:1V presented in the original design drawings and used in the 2010 analyses. The embankment also appeared to be lower in height than the 13 feet used in the 2010 analyses. Previous modifications to the perimeter embankment of the existing complex are understood to have occurred in 1984. These previous modifications included regrading and redressing of the slopes. Pertinent photographs from the July 14, 2015 site reconnaissance have been included in the Appendix of this report in Appendix E.

4.0 REVIEW OF PREVIOUS SLOPE STABILITY ANALYSES

Terracon has completed a review of the slope stability analyses performed by AEP in 2010. During the previous analyses, an idealized cross-section consisting of a 13-foot high embankment with 2.5H:1V exterior and 2H:1V interior slopes based on the original construction drawings. The profile was determined based on borings performed in 1977 as part of the original investigation for the Rockport Power Plant. As no strength testing was performed during this investigation, the parameters used in the model were assumed typical values for the material encountered.

Considering the AEP 2010 analyses and the limited subsurface exploration, Terracon performed two additional borings at the site (one along the crest and one at the toe of the embankment) to verify the soil conditions and conduct strength testing on the embankment and foundation soils. Additionally, a groundwater monitoring well was installed within the embankment to evaluate the presence of groundwater within the embankment, and updated topographic information provided by AEP was used to develop a cross-section for analysis.
5.0 SUBSURFACE CONDITIONS

5.1 Site Geology

The site of Rockport Bottom Ash Complex is within the flood plain of the Ohio River and the Boonville Hills physiographic province of the Southern Hills and Lowlands physiographic region.

According to the USDA Soil Survey of Spencer County, Indiana (September 2015), the predominant soil in the vicinity of the site is the Ginat silt loam (Gn). The Weinbach silt loam (WcA), Sciotoville silt loam (ScA and ScB2), and Wheeling loam (WhB2) are also present near the facility, but to a lesser extent. A majority of the soils in the vicinity of the site have been altered or removed during site development and are classified as Udorthents (Uaa) or Mine Dumps (Du).

The Ginat consists of poorly-drained silt loam and silty clay loam. The Weinbach consists of somewhat poorly drained silt loam and silty clay loam. The Sciotoville and Wheeling consist of moderately well-drained to well-drained silt loam, clay loam, and loam.

The Bottom Ash Complex is located on the western bank of the Ohio River and is underlain by Quaternary age alluvium consisting of Wisconsinan age undifferentiated outwash. Geotechnical borings performed at the site during the original subsurface investigation indicate clay generally ranging from less than 5 to about 15 feet in thickness, but may extend up to about 30 feet and contain layers or lenses of fine sand. The clay layer was underlain by fine to coarse sand deposits. Historical boring information is presented in Appendix A.

Bedrock consists of the Raccoon Creek Group Formation of Pennsylvanian age and is comprised of predominantly shale and sandstone with thin beds of limestone, clay, and coal. The Raccoon Creek Group is underlain by rocks ranging in age from Middle Devonian to Late Mississippian and is located at about elevation 280 to 300 feet.

Structurally, the area is located within the Illinois Basin, near the eastern border of the Wabash Valley Seismic Zone, which generally consists of vertically-oriented faults buried under layers of sediment.

5.2 Site Characterization

Subsurface conditions were explored by two (2) borings. The approximate locations of the borings are presented on Exhibit A-3 in Appendix A. Logs of the borings are also included in Appendix A. Note that stratification boundaries on the boring logs represent the approximate locations of changes in soil types; in situ, the transition between materials may be gradual. In
addition to the borings, one groundwater observation well was installed within the embankment in an offset hole. Well completion details are also presented in Appendix A.

Borings 361, 364, and 367 provided by AEP for the initial design of the power plant were included in this study. The locations and logs of these previous borings are presented in Appendix A.

Laboratory tests were conducted for soil classification and strength measurements. The laboratory testing methods are described in Appendix B. The laboratory test results are presented on the boring logs in Appendix A and laboratory data sheets in Appendix B.

5.3 Typical Profile

Two borings were drilled at the location of the selected critical cross-section, which represented the tallest embankment section. Boring B-1 was performed at the outboard toe of the embankment. Boring B-2 was performed at the crest of the embankment section. At the time the soil borings were performed, the East Bottom Ash Pond was receiving an inflow of Bottom Ash from the plant. The West Bottom Ash Pond did not contain standing water.

Boring B-2 encountered approximately 12 feet of embankment fill consisting of lean clay with varying amounts of sand, and sandy silt, to about elevation 389.5. Beneath the embankment fill, and within Boring B-1, a layer of stiff fat and lean clay was encountered to elevations of approximately 372 to 376 feet. Below the clay, the soils contained a 1 to 2 foot thick transitional layer of loose clayey sand and sandy silt deposits, grading to deposits of loose to medium dense poorly graded sand and silty sand containing varying amounts of gravel to the termination depths of the borings.

5.4 Water Level Observations

The borings were observed while drilling for the presence and level of groundwater. Groundwater was encountered within the sand deposits at depths of approximately 17.5 feet in Boring B-1, and at 25.1 feet in Boring B-2, which correspond to elevations of about 372.2 and 372.3 feet, respectively. At the time the borings were performed, the West Bottom Ash Pond was not in service, and was not filled with standing water.

A groundwater monitoring well was installed in an offset hole within the embankment approximately 10 feet south of Boring B-2 to a depth of about 15 feet below the ground surface. At the time of installation, no water was encountered within the well. The West Bottom Ash Pond was returned to service the week of September 6, 2015. A water reading within the well, obtained on October 13, 2015, indicated water at a depth of 3.36 feet below the top of the well cover, corresponding to a water elevation of about 394.2 feet. This elevation approximately matches the
minimum normal operating elevation of the West Bottom Ash Pond. The West Bottom Ash Pond contained standing water at the time of this water reading.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff, ash pond levels, river levels, and other factors not evident at the time the borings were performed. In addition, perched or trapped water can develop over low permeability soils. Therefore, groundwater levels at other times in the life of the ponds may be higher or lower than the levels indicated on the boring logs.

5.5 Laboratory Testing Summary

A summary of the laboratory tests results are included in the following tables. The testing program and test results are presented in Appendix B. Abbreviations used in the tables are as follows:

- USCS = United Soil Classification System
- LL = Liquid Limit
- PI = Plasticity Index
- UU = Unconsolidated Undrained Triaxial Test
- CU = Consolidated Undrained Triaxial Test
- $\phi$ = Soil Internal Angle of Friction
- C = Soil Cohesion
- Effective = Effective Stress Parameters
- Total = Total Stress Parameters

The test results are presented for embankment fill and native soils samples collected during the field exploration.

**Embankment Fill**

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<th>PI (%)</th>
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<th>CU Effective</th>
<th>CU Total</th>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>$\phi$ (deg)</td>
<td>C (tsf)</td>
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<th>PI (%)</th>
<th>UU C (tsf)</th>
<th>CU Effective</th>
<th>CU Total</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>φ (deg)</td>
<td>C (tsf)</td>
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6.0 GEOTECHNICAL ANALYSES

6.1 Slope Stability

To evaluate the stability existing embankment slope, slope stability analyses were performed on the selected “critical” cross-section of the western dike. The critical section was selected based on the tallest embankment height. During the planning of the geotechnical exploration, the critical section was considered to be about 2/3 of the way south along the West Bottom Ash Pond embankment, where the borings were drilled; however, considering the provided topographic mapping, the final cross-section used in analyses is about 3/4 of the way south along the embankment to represent the tallest dike section. The location of this cross-section is shown on Exhibit A-3.

Previous documents for the Rockport Bottom Ash Complex indicate approximately 2H:1V inboard and 2.5H:1V outboard slopes. However, based on our site visits and provided topographic information, the outboard slopes generally range from about 5H:1V to 6H:1V. The existing ground surface was developed from topographic survey mapping provided by AEP, which was performed by Henderson Aerial Surveys, Inc. dated November 10, 2007. The geometry of the inboard slopes and bottoms of the pond were estimated using the 1977 design drawings.

Strength parameters were developed based on the results of the field and laboratory testing. Soil profiles were developed based on subsurface conditions interpreted from the borings. The soil parameters used for the slope stability analyses are summarized in the following table and included on their respective slope stability summary exhibits in Appendix D.
The following general cases were analyzed:

- **Long Term, Steady-State at Maximum Storage Pool Elevation 396 feet** – This case represents the expected maximum normal operating elevation.

- **Long Term, Steady-State at Maximum Surcharge Pool Elevation 398 feet** – This case represents a long-term condition when the pond is completely filled to top of dike and represents an extreme case.

- **Seismic** – For this case, seismic loading was applied to the “Long Term, Steady-State at Maximum Storage Pool Elevation 396 feet” case and performed using a horizontal seismic coefficient of 0.145. The seismic coefficient considers ½ of the 2008 Peak Ground Acceleration with 2% Probability of Exceedance in 50 Years for firm rock (0.22), with an amplification factor of 1.32.

The stability analyses were performed using the computer program Slope/W 2012 (Version 8.12.3) developed by Geo-Slope International, Ltd. Spencer’s Method was used in the program to perform 2-Dimensional limit equilibrium slope stability analyses with a deterministic approach. Water levels within the embankment were estimated based on piezometric information from the borings during drilling, and from well readings after the borings were performed.

The analyzed factors of safety (FoS) for each case, as well as the minimum FoS values as outlined in the mostly recently mandated USEPA CCR rules, are presented in the following table. Detailed graphical summaries showing the cross-section and critical trial failure surfaces are presented in Appendix D. It should be noted that a minimum failure depth of 5.0 feet was specified to eliminate reporting of local, surficial failure surfaces.
Summary of Stability Analysis Results – Section A-A’

<table>
<thead>
<tr>
<th>Slope Stability Case</th>
<th>Minimum Factor of Safety from Slope Stability Analysis</th>
<th>Required Minimum Factor of Safety</th>
<th>Exhibits</th>
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<td>Exterior</td>
<td>Interior</td>
<td></td>
</tr>
<tr>
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<td>Long-Term, Maximum Storage Pool Loading</td>
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<td>1.5</td>
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<tr>
<td>Long-Term with Seismic Loading</td>
<td>2.14</td>
<td>1.21</td>
<td>1.0</td>
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</table>

1. Refers to exhibit designation of slope stability output included in Appendix D of this submittal.

In addition, the CCR rules require that for dikes constructed of soils with a susceptibility to liquefaction, the calculated factor of safety against liquefaction must equal or exceed a value of 1.20. The west dike is constructed predominantly of lean clay containing varying amounts of sand and is not considered to be susceptible to liquefaction.

Based on the analyses performed to date, it is the conclusion of Terracon that the subject impoundment satisfies all of the minimum slope stability factor of safety values required by the CCR rules.

7.0 HYDROLOGIC AND HYDRAULIC ANALYSIS

As stated previously, the required hydrologic and hydraulic analysis for the Rockport Plant Bottom Ash Pond Complex is being submitted in a separate report.

8.0 GENERAL COMMENTS

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or
prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.
9.0 P.E. CERTIFICATION

Based on the site reconnaissance visit, review of previous analyses, field and laboratory testing, and the slope stability analysis performed by Terracon personnel, I hereby certify that the factors of safety for slope stability for the Rockport Plant Bottom Ash Pond Complex meet or exceed the minimum required factors of safety, in accordance with requirements of Section 257.73 of the USEPA CCR Rules.

Baba Yahaya, P.E.
Certifying Engineer
PE11500100
APPENDIX A
FIELD EXPLORATION
Field Exploration Description
The subsurface exploration consisted of drilling and sampling two (2) borings at the site to depths of about 35 to 44 feet below existing grades. The boring locations were staked in the field by Terracon personnel using existing site features as references. Elevations of the ground surface at each boring location were provided by Chamness Land Surveying. Ground surface elevations indicated on the logs are rounded to the nearest 0.1 foot. Latitude and longitude information was determined from Google Earth based on location information provided by Chamness Land Surveying. The locations and elevations of the borings and test pits should be considered accurate only to the degree implied by the means and methods used to define them. The approximate boring locations are indicated on the attached Boring Location Plan.

The borings were drilled with a track-mounted rotary drill rig using continuous flight hollow-stem augers to advance the boreholes. Samples of the soil encountered in the borings were obtained using the split barrel sampling procedures or Shelby tube (push-tube) samplers.

An observation well was installed in an offset hole within the embankment. The screened interval for the well was determined in the field based on the subsurface conditions encountered in Boring B-2. A well completion record for this well has been included in this appendix.

In the split-barrel sampling procedure, the number of blows required to advance a standard 2-inch O.D. split-barrel sampler the last 12 inches of the typical total 18-inch penetration by means of a 140-pound auto-hammer with a free fall of 30 inches, is the standard penetration resistance value (SPT-N). This value is used to estimate the in-situ relative density of cohesionless soils and consistency of cohesive soils.

An automatic SPT hammer was used to advance the split-barrel sampler in the borings performed on this site. A significantly greater efficiency is achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. This higher efficiency has an appreciable effect on the SPT-N value. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

In the push-tube sampling procedure, a thin-walled tube is hydraulically pushed into the soil.

The samples were tagged for identification, sealed to reduce moisture loss, and taken to our laboratory for further examination, testing, and classification. Information provided on the boring logs attached to this report includes soil descriptions, consistency evaluations, boring depths, sampling intervals, and any groundwater conditions. The borings were backfilled with cement/bentonite grout prior to the drill crew leaving the site.

A field log of each boring/test pit was prepared by a Terracon engineer. These logs included visual classifications of the materials encountered during drilling, as well as the engineer’s interpretation of the subsurface conditions between samples. Final boring logs included with this report.
represent the engineer’s interpretation of the field logs and include modifications based on laboratory observation and tests of the samples.
NOTE
### WATER LEVEL OBSERVATIONS

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- Water encountered at 17.5 feet while sampling

### Laboratory Observations

#### Atterberg Limits

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### Advancement Method

- 3.25" Hollow Stem Auger

### Abandonment Method

- Boring backfilled with cement/bentonite grout upon completion.

### Notes

- See Exhibit A-1 for description of field procedures
- See Appendix B for description of laboratory procedures and additional data (if any)
- See Appendix C for explanation of symbols and abbreviations

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**Project:** Rockport Plant Impoundment Certification  
**Client:** American Electric Power  
**Site:** Rockport, Indiana  
**Client:** Columbus, Ohio  
**Location:** See Exhibit A-3  
**Latitude:** 37.918487°  
**Longitude:** -87.039045°  
**Driller:** Davis  
**Boring Started:** 9/3/2015  
**Boring Completed:** 9/4/2015  
**Project No.:** N4155126  
**Exhibit:** A-4

---

**Stratification lines are approximate. In-situ, the transition may be gradual.**
**POORLY GRADED SAND (SP)**, trace gravel, brown, medium dense

(continued)

<table>
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<th>DEPTH (Ft.)</th>
<th>WATER LEVEL OBSERVATIONS</th>
<th>RECOVERY (In.)</th>
<th>FIELD TEST RESULTS</th>
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**Boring Terminated at 35 Feet**

Stratification lines are approximate. In-situ, the transition may be gradual. Hammer Type: Automatic

**Notes:**

Advancement Method: 3.25" Hollow Stem Auger

Abandonment Method: Boring backfilled with cement/bentonite grout upon completion.

See Exhibit A-1 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

- Water encountered at 17.5 feet while sampling

**GRAPHIC LOG**

This boring log is not valid if separated from original report.

**PROJECT:** Rockport Plant Impoundment Certification  
**SITE:** Rockport, Indiana  
**CLIENT:** American Electric Power  
Columbus, Ohio

**LOCATION** See Exhibit A-3

Latitude: 37.918487° Longitude: -87.039045°

Surface Elev.: 389.7 (Ft.)

**DEPTHPLOT**

800 Morrison Road  
Columbus, Ohio

**Exhibit:** A-4

**Driller:** Davis

**Boring Started:** 9/3/2015  
**Boring Completed:** 9/4/2015

**Notes:**

**PROJECT NO.:** N4155126

**Drill Rig:** Track  
**Driller:** Davis

**Exhibit:** A-4
**BORING LOG NO. B-2**

**PROJECT:** Rockport Plant Impoundment Certification  
**CLIENT:** American Electric Power  
Columbus, Ohio

**SITE:**  
Rockport, Indiana

<table>
<thead>
<tr>
<th>Depth (Ft.)</th>
<th>Surface Elev. (Ft.)</th>
<th>Sample Type</th>
<th>Field Test Results</th>
<th>Laboratory Test Results</th>
<th>Atterberg Limits</th>
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<tbody>
<tr>
<td>397.4</td>
<td></td>
<td></td>
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<td></td>
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</tbody>
</table>

**GRAPHIC LOG**

**LOCATIONS**

- See Exhibit A-3
- Latitude: 37.918457°  Longitude: -87.038804°

**DEPTH**

- **TOPSOIL (1")**
  - FILL - LEAN CLAY (CL), trace sand, brown
  - Depth: 1.0
  - Elevation: 397.4

- **FILL - SANDY SILT (ML)**, brown
  - Depth: 4.0
  - Elevation: 393.5

- **FILL - SANDY LEAN CLAY (CL)**, trace gravel, gray and brown
  - Depth: 8.0
  - Elevation: 391.5
  - 3" poorly graded sand seam from 6-6.4"

- **LEAN CLAY (CL)**, trace sand, gray, very stiff
  - Depth: 12.0
  - Elevation: 385.5

- **LEAN CLAY (CL)**, brown, stiff
  - Depth: 14.0
  - Elevation: 383.5

- **SANDY LEAN CLAY (CL)**, trace gravel, gray and orange, stiff
  - Depth: 14.0
  - Elevation: 383.5

- **CLAYEY SAND (SC)**, brown, loose
  - Depth: 20.8
  - Elevation: 376.5

- **POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, brown, loose
  - Depth: 22.7
  - Elevation: 374.5

**Stratification lines are approximate. In-situ, the transition may be gradual.**

**Advancement Method:** 3.25" Hollow Stem Auger  
**Abandonment Method:** Boring backfilled with cement/bentonite grout upon completion.

**WATER LEVEL OBSERVATIONS**

- Water encountered at 25.1 feet while sampling

**Notes:**  
A monitoring well was installed in an offset hole approximately 10 feet south of the boring.

**Hammer Type:** Automatic

**Exhibit:** A-5
### BORING LOG NO. B-2

**PROJECT:** Rockport Plant Impoundment Certification  
**SITE:** Rockport, Indiana  
**CLIENT:** American Electric Power  

#### GRAPHIC LOG

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<thead>
<tr>
<th>LOCATION</th>
<th>See Exhibit A-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latitude: 37.918457°</td>
<td>Longitude: -87.038804°</td>
</tr>
</tbody>
</table>

#### DEPTH (Ft.)  
<table>
<thead>
<tr>
<th>ELEVATION (Fl.)</th>
</tr>
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<tbody>
<tr>
<td>Surface Elev.: 397.4 (Ft.)</td>
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#### WATER LEVEL OBSERVATIONS  

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<th>Sample Type</th>
<th>Water Level Observations</th>
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<td>21</td>
<td>N=11</td>
</tr>
<tr>
<td>24</td>
<td>6-6-5-4 N=11</td>
</tr>
<tr>
<td>18</td>
<td>2-2-5-3 N=7</td>
</tr>
<tr>
<td>24</td>
<td>2-3-4-4 N=7</td>
</tr>
<tr>
<td>19</td>
<td>1-2-2-2 N=4</td>
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<td>8</td>
<td>2-3-3-4 N=6</td>
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<td>17</td>
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<td>9</td>
<td>3-5-6-5 N=11</td>
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<td>6</td>
<td>4-6-9-12 N=15</td>
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</table>

#### Atterberg Limits  

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**Notes:**  

- Advancement Method: 3.25" Hollow Stem Auger  
- Abandonment Method: Boring backfilled with cement/bentonite grout upon completion.

Water encountered at 25.1 feet while sampling

**Stratification lines are approximate. In-situ, the transition may be gradual.**

**Hammer Type:** Automatic

---

**Exhibit:** A-5  
**Driller:** Davis  
**Boring Started:** 9/4/2015  
**Boring Completed:** 9/4/2015  
**Drill Rig:** Track  
**Project No.:** N4155126  
**Surface Elev.:** 397.4 (Ft.)  
**Location:** 37.918457° Lat., -87.038804° Long.
MONITORING WELL INSTALLATION RECORD

Job Name: ROCKPORT BOTTOM ASH PE CERTIFICATION
Well Number: B-2A

Job Number: N4155126
Installation Date: 9-4-15
Location: 37.918422°N, 87.038781°W

Datum Elevation: 397.56
Surface Elevation: 397.56

Datum for Water Level Measurement: TOP OF METAL WELL COVER

Screen Diameter & Material: 1" PVC SCHEDULE 40
Riser Diameter & Material: 1" PVC SCHEDULE 40
Granular Backfill Material: GLOBAL #5 SAND

Drilling Method: 3 1/4" HSA
Drilling Contractor: TERRACON

Terracon Representative: ALMA BARATTA

Flushing Joint
Length of Solid riser: 4.0'

Depth to Top of Primary Filter Pack: 4.0'

Depth to Top of Bentonite Seal: 0.5'

Total Depth Drilled: 15.3' fbg's

NOTE: LOCATION/ELEVATION DATA FROM CHAMNESS LAND SURVEYING ON 9/29/2015
NOTE: This figure is from historical planning documents, and the points shown do not necessarily represent current conditions.
Exhibit A-7
<table>
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<tr>
<th>DEPTH</th>
<th>SOIL STRATA</th>
<th>SOIL DESCRIPTION AND REMARKS</th>
<th>TIME</th>
<th>TYPE</th>
<th>NO</th>
<th>DEPTH FROM</th>
<th>TO</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>1.0</td>
<td>Very loose brown silty fine sand</td>
<td></td>
<td>SS</td>
<td>1</td>
<td>5</td>
<td>5.0</td>
<td>6.5</td>
</tr>
<tr>
<td>1.0</td>
<td>Very stiff brown and gray silty clay</td>
<td></td>
<td>SS</td>
<td>2</td>
<td>10.0</td>
<td>11.5</td>
<td>8</td>
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<tr>
<td>13.0</td>
<td>Firm brown silty fine sand</td>
<td></td>
<td>SS</td>
<td>3</td>
<td>15.0</td>
<td>16.5</td>
<td>5</td>
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<tr>
<td>19.0</td>
<td>Very loose brown silty fine sand</td>
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<td>SS</td>
<td>4</td>
<td>20.0</td>
<td>21.5</td>
<td>1</td>
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<tr>
<td>30.0</td>
<td>Very loose brown silty fine sand</td>
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<td>SS</td>
<td>5</td>
<td>25.0</td>
<td>26.5</td>
<td>1</td>
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<tr>
<td>30.0</td>
<td>Very dense dark brown silty fine sand</td>
<td></td>
<td>SS</td>
<td>6</td>
<td>30.0</td>
<td>31.5</td>
<td>66</td>
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<tr>
<td>34.0</td>
<td>Firm brown medium to coarse silty sand</td>
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<td>40.0</td>
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<td>9</td>
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<tr>
<td>44.0</td>
<td>Firm brown medium and coarse sand</td>
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<td>SS</td>
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<td>45.0</td>
<td>46.5</td>
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<tr>
<td>48.0</td>
<td>Dense grayish brown silty fine to medium sand</td>
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<td>21</td>
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</table>

Boring Terminated @ 51.5
3/17/77

METHOD OF DRILLING (Check One)

- **A** Jabber
- **B** Wash
- **C** Power

WEATHER: Overcast 45 degrees

NON-DRILLING TIME (Hrs)

BORING LAYOUT

MOVING

HAULING WATER

STANDBY

WATER LEVEL: |

@ | DATE | TIME

| @ | DATE | TIME

CAVE-IN DEPTH: @

DATE | TIME

REMARKS: (All remarks should be explained on the back of this form. This is a Drillers Log and Exhibit A-7. The classifications have not been reviewed by an Engineer.)

Exhibit A-7
<table>
<thead>
<tr>
<th>DEPTH</th>
<th>SOIL STRATA</th>
<th>SOIL DESCRIPTION AND REMARKS</th>
<th>TIME</th>
<th>TYPE</th>
<th>NO.</th>
<th>DEPTH</th>
<th>FROM</th>
<th>TO</th>
<th>FIRST 6&quot;</th>
<th>2ND 6&quot;</th>
<th>3RD 6&quot;</th>
<th>REC.</th>
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<tbody>
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<td>6</td>
<td>7</td>
<td>16</td>
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<td></td>
</tr>
<tr>
<td>13.0</td>
<td>Stiff brown and gray silty clay traces fine sand</td>
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<td>3</td>
<td>4</td>
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</tr>
<tr>
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<td>8</td>
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</tr>
<tr>
<td>34.5</td>
<td>Firm brown fine to medium sand</td>
<td>SS 6</td>
<td>30.0</td>
<td>31.5</td>
<td>6</td>
<td>8</td>
<td>9</td>
<td>8</td>
<td></td>
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<tr>
<td>34.5</td>
<td>Firm brown medium to coarse sand</td>
<td>SS 7</td>
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<td>36.5</td>
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<td>8</td>
<td>10</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43.0</td>
<td>Firm brown medium to coarse sand</td>
<td>SS 8</td>
<td>40.0</td>
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<td>5</td>
<td>6</td>
<td>8</td>
<td>7</td>
<td></td>
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<tr>
<td>43.0</td>
<td>Loose brown medium to coarse sand &amp; gravel</td>
<td>SS 9</td>
<td>45.0</td>
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<td>4</td>
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<td>8</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>47.0</td>
<td>Firm brown medium to coarse sand traces gravel</td>
<td>SS 10</td>
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<td>13</td>
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</tbody>
</table>

Boring Terminated @ 51.5 3/15/77

METHOD OF DRILLING (Check One)
- a. AUGER Rod SIZE A
- b. WASH  XX WATER MUD  XX
- 2. NG SIZE BIT USED 2-7/8" Side Discharge Hauling Water
- CASING: SIZE NW LENGTH 5' UNDISTURBED SAMPLES: NO SIZE
- BAG SAMPLES: NO WATER LOSSES: DEPTH SPECIAL TESTS: (Explain)

WEATHER 70 degrees clear

NON-DRILLING TIME (Hrs) MOVING

BORING LAYOUT STANDBY

WATER LEVEL: © DATE TIME

© DATE TIME

CAVE IN DEPTH: © DATE TIME

REMARKS: (All marks should be explained on the Exhibit/Ex Copy) THIS IS A DRILLER'S LOG THE CLASSIFIED PAGE
<table>
<thead>
<tr>
<th>DEPTH FROM</th>
<th>DEPTH TO</th>
<th>SOIL STRATA</th>
<th>TIME</th>
<th>TYPE</th>
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<th>DEPTH FROM</th>
<th>DEPTH TO</th>
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<th>SECON 6&quot;</th>
<th>THIRD 6&quot;</th>
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<td>3</td>
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<td>5</td>
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<td>Firm brown silty fine to medium sand</td>
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<tr>
<td>44.0</td>
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<td>Firm brown silty medium to coarse sand</td>
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<tr>
<td>51.5</td>
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<td>Firm brown silty medium to coarse sand</td>
<td>SS 10</td>
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<td>51.5</td>
<td>7</td>
<td>12</td>
<td>11</td>
<td>10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Boring Terminated @ 51.5

METHOD OF DRILLING (Check One)
- XXXX Rod Size A
- XXXX Water MUD

WEATHER Clear 60 degrees

NON-DRILLING TIME (Hrs.)

BORING LAYOUT MOVING

HAULING WATER STANDBY

WATER LEVEL: @ DATE TIME @ DATE TIME

CAVE-IN DEPTH: @ DATE TIME

REMARKS: (All remarks should be explained on the back of white copy. THIS IS A DRILLER'S LOG AND EXHIBIT A-7. THE CLASSIFICATIONS HAVE NOT BEEN REVIEWED BY AN ENGINEER.)
APPENDIX B
LABORATORY TESTING
Laboratory Testing
As a part of the laboratory testing program, the soil samples were classified in the field based on visual observation, and texture. The soil descriptions presented on the boring logs for native soils are in accordance with our enclosed General Notes and Unified Soil Classification System (USCS). A brief description of the Unified System is included in this report. Classification was predominantly by visual manual procedures. Moisture content, Atterberg Limits, grain size distribution, unconsolidated undrained triaxial, and consolidated undrained triaxial with pore-water pressure measurements, were performed on selected samples. Testing followed ASTM procedures. The results of this laboratory testing are presented on the boring logs and laboratory data sheets are included in Appendix B.
### Soil Description
Brown SANDY FAT CLAY, trace gravel

### Atterberg Limits
- PL = 26
- LL = 69
- PI = 43

### Coefficients
- $D_{90} = 3.9559$
- $D_{10} = 0.0066$
- $D_{50} = 0.0406$
- $D_{15} = 0.0035$
- $C_{u} = 2.0$
- $C_{c} = 0.0$

### Classification
- USCS = CH
- AASHTO = A-7-6(25)

### Remarks
F.M. = 1.79

### Particle Size Distribution Report

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<th>Percent Finer</th>
<th>Coarse</th>
<th>Fine</th>
<th>Coarse</th>
<th>Medium</th>
<th>Fine</th>
<th>Silt</th>
<th>Clay</th>
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<td>SIEVE SIZE</td>
<td>PERCENT</td>
<td>SPEC.*</td>
<td>PASS?</td>
<td>SIZE</td>
<td>FINER</td>
<td>PERCENT</td>
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<td>63.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>#200</td>
<td>62.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0240 mm.</td>
<td>57.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0155 mm.</td>
<td>56.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0092 mm.</td>
<td>53.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0067 mm.</td>
<td>50.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0049 mm.</td>
<td>47.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0029 mm.</td>
<td>43.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* (no specification provided)

Source of Sample: B-1
Sample Number: S-2
Depth: 2.0'-4.0'
Date: 9-21-15

Client: American Electric Power
Project: Rockport Plant Impoundment Certification
Project No: N4155126
Exhibit: B-2
LIQUID AND PLASTIC LIMITS TEST REPORT

Dashed line indicates the approximate upper limit boundary for natural soils.

**MATERIAL DESCRIPTION**

<table>
<thead>
<tr>
<th>LL</th>
<th>PL</th>
<th>PI</th>
<th>%&lt;#40</th>
<th>%&lt;#200</th>
<th>USCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>69</td>
<td>26</td>
<td>43</td>
<td>64.1</td>
<td>62.4</td>
<td>CH</td>
</tr>
</tbody>
</table>

**Project No.**  N4155126  **Client:** American Electric Power  
**Project:** Rockport Plant Impoundment Certification  
**Source of Sample:** B-1  
**Depth:** 2.0'-4.0'  
**Sample Number:** S-2  
**Date:** 9-21-15  
**Remarks:**

Brown SANDY FAT CLAY, trace gravel

TERRACON CONSULTANTS, INC.

Columbus, Ohio

Tested By: DS  
Checked By: AM
**Particle Size Distribution Report**

<table>
<thead>
<tr>
<th>SIEVE SIZE</th>
<th>PERCENT FINER</th>
<th>SPEC.* PERCENT</th>
<th>PASS? (X=NO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#4</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#10</td>
<td>99.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#20</td>
<td>98.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#40</td>
<td>87.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#100</td>
<td>7.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#200</td>
<td>4.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0357 mm.</td>
<td>4.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0227 mm.</td>
<td>3.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0131 mm.</td>
<td>3.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0093 mm.</td>
<td>3.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0066 mm.</td>
<td>3.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0038 mm.</td>
<td>2.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* (no specification provided)

**Soil Description**

Brown poorly graded SAND

**Atterberg Limits**

\[ \text{PL} = \text{NP} \]
\[ \text{LL} = \text{NP} \]
\[ \text{PI} = \text{NP} \]

**Coefficients**

\[ D_{10} = 0.4785 \]
\[ D_{50} = 0.4068 \]
\[ D_{60} = 0.2938 \]
\[ D_{5} = 0.2631 \]
\[ D_{15} = 0.1721 \]
\[ D_{10} = 0.1577 \]
\[ C_{u} = 1.86 \]
\[ C_{c} = 0.95 \]

**Classification**

USCS = SP

AASHTO = A-3

**Remarks**

F.M.=1.37

---

Source of Sample: B-1

Sample Number: S-7

Depth: 18.0'-20.0'

Date: 9-21-15

---

**TERRACON CONSULTANTS, INC.**

Columbus, Ohio

Client: American Electric Power

Project: Rockport Plant Impoundment Certification

Project No: N4155126

Exhibit B-4

Tested By: DS

Checked By: AM
**Soil Description**
Brown poorly graded SAND, trace gravel

**Atterberg Limits**
- PL = NP
- LL = NP
- PI = NP

**Coefficients**
- \( D_{90} = 0.8432 \)
- \( D_{50} = 0.7776 \)
- \( D_{90} = 0.5735 \)
- \( D_{30} = 0.5129 \)
- \( D_{10} = 0.3986 \)
- \( D_{15} = 0.2992 \)
- \( C_{u} = 2.23 \)
- \( C_{c} = 1.08 \)

**Classification**
USCS = SP
AASHTO = A-1-b

**Remarks**
F.M.=2.26

**Source of Sample:** B-1
**Depth:** 28.0'-30.0'
**Sample Number:** S-9
**Date:** 9-21-15
**Soil Description**

Brown poorly graded SAND, trace gravel

**Atterberg Limits**

\[ \text{PL} = \text{NP} \quad \text{LL} = \text{NP} \quad \text{PI} = \text{NP} \]

**Coefficients**

\[ \begin{align*}
D_{90} &= 3.0772 \\
D_{50} &= 1.1849 \\
D_{10} &= 0.2999 \\
C_{U} &= 4.79 \\
C_{C} &= 1.34
\end{align*} \]

**Classification**

USCS = SP \quad AASHTO = A-1-b

**Remarks**

F.M. = 3.34

---

**Source of Sample:** B-1  \quad **Date:** 9-21-15

**Sample Number:** S-10  \quad **Depth:** 33.0'-35.0'

---

**TERRACON CONSULTANTS, INC.**

Columbus, Ohio

---

**Client:** American Electric Power

**Project:** Rockport Plant Impoundment Certification

**Project No:** N4155126  \quad **Exhibit:** B-6
**Soil Description**

FILL: Brown sandy lean clay, trace gravel

**Atterberg Limits**

<table>
<thead>
<tr>
<th>PL</th>
<th>LL</th>
<th>PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>28</td>
<td>13</td>
</tr>
</tbody>
</table>

**Coefficients**

<table>
<thead>
<tr>
<th>D90</th>
<th>D85</th>
<th>D60</th>
<th>D50</th>
<th>D15</th>
<th>Cc</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.7745</td>
<td>2.0607</td>
<td>0.0375</td>
<td>0.0054</td>
<td>0.0036</td>
<td></td>
</tr>
<tr>
<td>Cu</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Classification**

USCS = CL  AASHTO = A-6(6)

**Remarks**

F.M. = 0.86

---

**Particle Size Distribution Report**

<table>
<thead>
<tr>
<th>GRAIN SIZE - mm.</th>
<th>PERCENT FINER</th>
<th>SPEC.* PERCENT</th>
<th>PASS?</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 in.</td>
<td>100.0</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>3 in.</td>
<td>99.6</td>
<td>14.9</td>
<td></td>
</tr>
<tr>
<td>2 in.</td>
<td>84.7</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>1½ in.</td>
<td>84.5</td>
<td>14.9</td>
<td></td>
</tr>
<tr>
<td>1 in.</td>
<td>84.0</td>
<td>39.8</td>
<td></td>
</tr>
<tr>
<td>¾ in.</td>
<td>76.6</td>
<td>29.3</td>
<td></td>
</tr>
<tr>
<td>½ in.</td>
<td>69.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/4 in.</td>
<td>55.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0185 mm.</td>
<td>47.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0111 mm.</td>
<td>40.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0081 mm.</td>
<td>35.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0058 mm.</td>
<td>30.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0034 mm.</td>
<td>26.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* (no specification provided)

---

**Source of Sample:** B-2  **Depth:** 0.0'-2.0'  **Sample Number:** S-1  **Date:** 9-21-15

---

**TERRACON CONSULTANTS, INC.**

Columbus, Ohio

**Client:** American Electric Power  **Project:** Rockport Plant Impoundment Certification  **Project No:** N4155126  **Exhibit:** B-7

**Tested By:** DS  **Checked By:** AM
LIQUID AND PLASTIC LIMITS TEST REPORT

Dashed line indicates the approximate upper limit boundary for natural soils

WATER CONTENT

NUMBER OF BLOWS

MATERIAL DESCRIPTION

LL  PL  PI  %<#40  %<#200  USCS

FILL: Brown sandy lean clay, trace gravel 28  15  13  84.0  69.1  CL

Project No.  Project:  Source of Sample:  Depth:  Sample Number:  Remarks:
N4155126  Rockport Plant Impoundment Certification  B-2  0.0'-2.0'  S-1  Date: 9-21-15

TERRACON CONSULTANTS, INC.

Columbus, Ohio  Exhibit B-8

Tested By:  DS  Checked By:  AM
### Particle Size Distribution Report

#### Soil Description
Gray and orange SANDY LEAN CLAY, trace gravel

#### Atterberg Limits
- **PL** = 15
- **LL** = 35
- **Pl** = 20

#### Coefficients
- **D_{90}** = 30.0206
- **D_{50}** = 4.4748
- **D_{10}** = 0.0049
- **D_{5}** = 0.0049
- **Cu**
- **C_{c}**

#### Classification
- **USCS** = CL
- **AASHTO** = A-6(10)

#### Remarks
F.M. = 1.61

#### Source of Sample:
- **B-2**
- **Depth**: 16.0'-18.0'
- **Sample Number**: S-7

#### Date:
- **9-21-15**

---

<table>
<thead>
<tr>
<th>SIEVE SIZE</th>
<th>PERCENT FINER</th>
<th>SPEC.* PERCENT</th>
<th>PASS? (X=NO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>85.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/4</td>
<td>85.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/2</td>
<td>85.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/8</td>
<td>85.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#4</td>
<td>85.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#10</td>
<td>79.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#20</td>
<td>78.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#40</td>
<td>77.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#100</td>
<td>69.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#200</td>
<td>63.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0275 mm.</td>
<td>52.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0181 mm.</td>
<td>47.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0109 mm.</td>
<td>40.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0079 mm.</td>
<td>36.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0057 mm.</td>
<td>31.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0034 mm.</td>
<td>26.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*(no specification provided)*

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<table>
<thead>
<tr>
<th>% +3&quot;</th>
<th>% Gravel</th>
<th>% Sand</th>
<th>% Fines</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coarse</td>
<td>Fine</td>
<td>Coarse</td>
<td>Medium</td>
</tr>
<tr>
<td>14.2</td>
<td>0.5</td>
<td>6.1</td>
<td>2.0</td>
</tr>
</tbody>
</table>
LIQUID AND PLASTIC LIMITS TEST REPORT

Dashed line indicates the approximate upper limit boundary for natural soils.

---

**MATERIAL DESCRIPTION**

- **Gray and orange SANDY LEAN CLAY, trace gravel**

<table>
<thead>
<tr>
<th>LL</th>
<th>PL</th>
<th>PI</th>
<th>%&lt;#40</th>
<th>%&lt;#200</th>
<th>USCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>15</td>
<td>20</td>
<td>77.2</td>
<td>63.5</td>
<td>CL</td>
</tr>
</tbody>
</table>

**Project No.**  N4155126  **Client:**  American Electric Power

**Project:**  Rockport Plant Impoundment Certification

**Source of Sample:**  B-2  **Depth:**  16.0’-18.0’

**Sample Number:**  S-7

---

**TERRACON CONSULTANTS, INC.**

**Columbus, Ohio**

---

**Tested By:**  DS  **Checked By:**  AM

---

**Remarks:**  

- Date: 9-21-15
Soil Description
Brown poorly graded SAND with silt, trace gravel

Atterberg Limits

PL = NP
LL = NP
Pl = NP

Coefficients

D<sub>60</sub> = 0.4948
D<sub>50</sub> = 0.4338
D<sub>30</sub> = 0.3031
D<sub>10</sub> = 0.2128
D<sub>15</sub> = 0.1722

USCS = SP-SM

Classification
AASHTO = A-3

Remarks
F.M. = 1.42

Source of Sample: B-2
Sample Number: S-9
Depth: 22.0'-24.0'
Date: 9-21-15

TERRACON
CONSULTANTS, INC.
Columbus, Ohio

Client: American Electric Power
Project: Rockport Plant Impoundment Certification
Project No: N4155126
Exhibit: B-11

Tested By: DS
Checked By: AM
**Soil Description**

Brown poorly graded SAND with silt, trace gravel

**Atterberg Limits**

\[ \text{PL} = \text{NP} \quad \text{LL} = \text{NP} \quad \text{PI} = \text{NP} \]

**Coefficients**

- \( D_{90} = 2.1334 \)
- \( D_{85} = 1.3167 \)
- \( D_{50} = 0.6037 \)
- \( D_{30} = 0.4980 \)
- \( D_{10} = 0.2100 \)
- \( D_{10} = 0.1667 \)
- \( C_u = 3.62 \)
- \( C_c = 1.06 \)

**Classification**

USCS = SP-SM  
AASHTO = A-1-b

**Remarks**

F.M. = 2.32

**Source of Sample:** B-2  
**Sample Number:** S-12  
**Depth:** 28.0'-30.0'

**Date:** 9-21-15
Particle Size Distribution Report

Soil Description
Brown SILTY SAND

Atterberg Limits
- PL = NP
- LL = NP
- PI = NP

Coefficients
- D90 = 0.1621
- D50 = 0.1384
- D10 = 0.0815
- Cc = 56.2
- Cd = 43.6

Classification
- USCS = SM
- AASHTO = A-4(0)

Remarks
F.M. = 0.14

Source of Sample: B-2
Sample Number: S-14A
Depth: 32.0'-33.7'
Date: 9-21-15

TERRACON
CONSULTANTS, INC.
Columbus, Ohio

Client: American Electric Power
Project: Rockport Plant Impoundment Certification
Project No: N4155126
Exhibit: B-13

Tested By: DS
Checked By: AM
**Soil Description**

Brown SILTY SAND, trace gravel

**Atterberg Limits**

<table>
<thead>
<tr>
<th>( \text{PL}=\text{NP} )</th>
<th>( \text{LL}=\text{NP} )</th>
<th>( \text{PI}=\text{NP} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( D_{90}=0.8715 )</td>
<td>( D_{85}=0.6088 )</td>
<td>( D_{50}=0.2033 )</td>
</tr>
<tr>
<td>( D_{50}=0.1468 )</td>
<td>( D_{30}=0.0537 )</td>
<td>( D_{15}=0.0137 )</td>
</tr>
<tr>
<td>( D_{10}=0.002 )</td>
<td>( C_{u}=1.0 )</td>
<td>( C_{c}=0.2 )</td>
</tr>
</tbody>
</table>

**Coeficients**

**Classification**

USCS = SM

AASHTO = A-2-4(0)

**Remarks**

F.M. = 1.06

---

**Source of Sample:** B-2  
**Depth:** 34.0'-36.0'

**Sample Number:** S-15  
**Date:** 9-21-15

---

**Particle Size Distribution Report**

---

**TERRACON CONSULTANTS, INC.**

---

**American Electric Power**

**Rockport Plant Impoundment Certification**

---

**Project No:** N4155126  
**Exhibit:** B-14

---

**Tested By:** DS  
**Checked By:** AM
### Soil Description

Brown poorly graded SAND, trace gravel

### Atterberg Limits

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PL</td>
<td>NP</td>
</tr>
<tr>
<td>LL</td>
<td>NP</td>
</tr>
<tr>
<td>PLC</td>
<td>NP</td>
</tr>
</tbody>
</table>

### Coefficients

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>D90</td>
<td>5.0861</td>
</tr>
<tr>
<td>D50</td>
<td>3.7126</td>
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<tr>
<td>D30</td>
<td>0.6494</td>
</tr>
<tr>
<td>D10</td>
<td>0.2206</td>
</tr>
</tbody>
</table>

### Classification

USCS: SP  
AASHTO: A-1-b

### Remarks

F.M.=2.98

---

**Source of Sample:** B-2  
**Sample Number:** S-19  
**Date:** 9-21-15

---

**TERRACON CONSULTANTS, INC.**  
Columbus, Ohio

---

**Client:** American Electric Power  
**Project:** Rockport Plant Impoundment Certification  
**Project No:** N4155126  
**Exhibit:** B-15

---

**Tested By:** DS  
**Checked By:** AM
Particle Size Distribution Report

<table>
<thead>
<tr>
<th>SIEVE SIZE</th>
<th>PERCENT FINER</th>
<th>SPEC.* PERCENT</th>
<th>PASS? (X=NO)</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>.375</td>
<td>100.0</td>
<td></td>
<td></td>
<td>BROWN GRAY LEAN CLAY</td>
</tr>
<tr>
<td>#4</td>
<td>99.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#10</td>
<td>99.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#20</td>
<td>99.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#40</td>
<td>98.2</td>
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<td></td>
</tr>
<tr>
<td>#60</td>
<td>96.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#140</td>
<td>92.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#200</td>
<td>91.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(no specification provided)

Source of Sample: B-1
Sample Number: ST-2
Depth: 8-10'
Date: 9-28-15

Terracon, Inc.
Cincinnati, Ohio

Client: AEP
Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION
Project No: N4155126
Exhibit 7353

Tested By: DR
Checked By: GS

Exhibit B-16
# LIQUID AND PLASTIC LIMITS TEST REPORT

Dashed line indicates the approximate upper limit boundary for natural soils.

<table>
<thead>
<tr>
<th>MATERIAL DESCRIPTION</th>
<th>LL</th>
<th>PL</th>
<th>PI</th>
<th>%&lt;#40</th>
<th>%&lt;#200</th>
<th>USCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BROWN GRAY LEAN CLAY</td>
<td>42</td>
<td>22</td>
<td>20</td>
<td>98.2</td>
<td>91.0</td>
<td>CL</td>
</tr>
</tbody>
</table>

Project No. N4155126  Client: AEP
Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION

- Source of Sample: B-1  Depth: 8-10'  Sample Number: ST-2

Terracon, Inc.
Cincinnati, Ohio

Tested By: MD  Checked By: GS

Exhibit B-17
**Type of Test:**
CU with Pore Pressures

**Sample Type:** ST

**Description:** BROWN GRAY LEAN CLAY

**LL =** 42  
**PL =** 22  
**PI =** 20

**Assumed Specific Gravity =** 2.70

**Remarks:**

---

**Sample No.**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Content, %</td>
<td>25.2</td>
<td>28.6</td>
<td>27.0</td>
</tr>
<tr>
<td>Dry Density,pcf</td>
<td>99.0</td>
<td>94.6</td>
<td>97.1</td>
</tr>
<tr>
<td>Saturation, %</td>
<td>96.6</td>
<td>98.7</td>
<td>98.9</td>
</tr>
<tr>
<td>Void Ratio</td>
<td>0.7033</td>
<td>0.7825</td>
<td>0.7364</td>
</tr>
<tr>
<td>Diameter, in.</td>
<td>2.867</td>
<td>2.885</td>
<td>2.862</td>
</tr>
<tr>
<td>Height, in.</td>
<td>5.748</td>
<td>5.717</td>
<td>5.757</td>
</tr>
</tbody>
</table>

**At Test**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Content, %</td>
<td>25.2</td>
<td>27.8</td>
<td>24.9</td>
</tr>
<tr>
<td>Dry Density,pcf</td>
<td>100.4</td>
<td>96.3</td>
<td>100.7</td>
</tr>
<tr>
<td>Saturation, %</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Void Ratio</td>
<td>0.6794</td>
<td>0.7499</td>
<td>0.6736</td>
</tr>
<tr>
<td>Diameter, in.</td>
<td>2.854</td>
<td>2.867</td>
<td>2.827</td>
</tr>
<tr>
<td>Height, in.</td>
<td>5.721</td>
<td>5.682</td>
<td>5.687</td>
</tr>
</tbody>
</table>

**Strain rate, in./min.**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

**Back Pressure, tsf**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.600</td>
<td>3.600</td>
<td>3.600</td>
<td></td>
</tr>
</tbody>
</table>

**Cell Pressure, tsf**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.852</td>
<td>4.097</td>
<td>5.602</td>
<td></td>
</tr>
</tbody>
</table>

**Fail. Stress, tsf**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.388</td>
<td>1.252</td>
<td>2.652</td>
<td></td>
</tr>
</tbody>
</table>

**Total Pore Pr., tsf**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.686</td>
<td>3.802</td>
<td>4.615</td>
<td></td>
</tr>
</tbody>
</table>

**Ult. Stress, tsf**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.554</td>
<td>1.547</td>
<td>3.638</td>
<td></td>
</tr>
</tbody>
</table>

**σ₃ Failure, tsf**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.166</td>
<td>0.295</td>
<td>0.986</td>
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</tr>
</tbody>
</table>

**Client:** AEP

**Project:** ROCKPORT PLANT IMPROVEMENT CERTIFICATION

**Source of Sample:** B-1  
**Depth:** 8-10'

**Sample Number:** ST-2

**Proj. No.:** N4155126  
**Date Sampled:** 9-28-15

---

**TRIAXIAL SHEAR TEST REPORT**

_Terracon, Inc._

_Cincinnati, Ohio_

---

**Tested By:** FCE  
**Checked By:** GS
Particle Size Distribution Report

GRAIN SIZE - mm

<table>
<thead>
<tr>
<th>% +3&quot;</th>
<th>% Gravel</th>
<th>% Sand</th>
<th>% Silt</th>
<th>% Clay</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>0.0</td>
<td>9.7</td>
<td>58.1</td>
<td>32.2</td>
</tr>
</tbody>
</table>

**Material Description**

BROWN GRAY LEAN CLAY

**Atterberg Limits**

<table>
<thead>
<tr>
<th>PL</th>
<th>LL</th>
<th>PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>28</td>
<td>10</td>
</tr>
</tbody>
</table>

**Coefficients**

<table>
<thead>
<tr>
<th>D90</th>
<th>D85</th>
<th>D60</th>
<th>D30</th>
<th>D15</th>
<th>Cu</th>
<th>Cc</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0742</td>
<td>0.0645</td>
<td>0.0227</td>
<td>0.0038</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

**Classification**

USCS = CL  AASHTO = A-4(8)

**Remarks**

(no specification provided)

Source of Sample: B-1  Depth: 14-16'  Date: 10-05-15

Sample Number: ST-3

**Terracon, Inc.**

Cincinnati, Ohio

Client: AEP  Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION

Project No: N4155126  Exhibit

Tested By: JB  Checked By: GS  Exhibit B-20
LIQUID AND PLASTIC LIMITS TEST REPORT

Dashed line indicates the approximate upper limit boundary for natural soils.

<table>
<thead>
<tr>
<th>MATERIAL DESCRIPTION</th>
<th>LL</th>
<th>PL</th>
<th>PI</th>
<th>%&lt;#40</th>
<th>%&lt;#200</th>
<th>USCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BROWN GRAY LEAN CLAY</td>
<td>28</td>
<td>18</td>
<td>10</td>
<td>98.9</td>
<td>90.3</td>
<td>CL</td>
</tr>
</tbody>
</table>

Project No. N4155126  Client: AEP
Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION

- Source of Sample: B-1  Depth: 14-16'  Sample Number: ST-3

Remarks:
- MC - 22.5%

Terracon, Inc.
Cincinnati, Ohio
Type of Test: Unconsolidated Undrained
Sample Type: ST
Description: BROWN GRAY LEAN CLAY

LL = 28  PL = 18  PI = 10
Assumed Specific Gravity = 2.70
Remarks:

Sample No. 1
Initial
- Water Content, % 22.5
- Dry Density,pcf 104.7
- Saturation, % 99.5
- Void Ratio 0.6095
- Diameter, in. 2.860
- Height, in. 5.734

At Test
- Water Content, % 22.9
- Dry Density,pcf 104.7
- Saturation, % 101.4
- Void Ratio 0.6095
- Diameter, in. 2.860
- Height, in. 5.734

Strain rate, in./min. 0.057
Back Pressure, tsf 0.000
Cell Pressure, tsf 0.144
Fail. Stress, tsf 2.528
Ult. Stress, tsf

Client: AEP
Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION
Source of Sample: B-1  Depth: 14-16'
Sample Number: ST-3
Proj. No.: N4155126  Date Sampled: 10-05-15

TRIAXIAL SHEAR TEST REPORT
Terracon, Inc.
Cincinnati, Ohio

Tested By: FCE  Checked By: GS
Exhibit B-22
Client: AEP
Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION
Source of Sample: B-1    Depth: 14-16'    Sample Number: ST-3
Project No.: N4155126    Exhibit B-23

Tested By: FCE    Checked By: GS

Terracon, Inc.
**Particle Size Distribution Report**

**Material Description**
BROWN SANDY SILT

**Atterberg Limits**
- PL = 16
- LL = 19
- PI = 3

**Coefficients**
- D₉₀ = 0.2316
- D₅₀ = 0.0538
- D₁₀ = 0.0094
- Cᵤ = 0.0905
- Cₜ = 0.0905

**Classification**
- USCS = ML
- AASHTO = A-4(0)

**Remarks**

**Source of Sample:** B-2  
**Depth:** 4-6'  
**Sample Number:** ST-1  
**Date:** 10-5-15

**Terracon, Inc.**
Cincinnati, Ohio

**Client:** AEP  
**Project:** ROCKPORT PLANT IMPROVEMENT CERTIFICATION  
**Project No:** N4155126  
**Exhibit**

**Tested By:** JB  
**Checked By:** GS

Exhibit B-24
LIQUID AND PLASTIC LIMITS TEST REPORT

Dashed line indicates the approximate upper limit boundary for natural soils.

<table>
<thead>
<tr>
<th>MATERIAL DESCRIPTION</th>
<th>LL</th>
<th>PL</th>
<th>PI</th>
<th>%&lt;#40</th>
<th>%&lt;#200</th>
<th>USCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BROWN SANDY SILT</td>
<td>19</td>
<td>16</td>
<td>3</td>
<td>97.8</td>
<td>57.3</td>
<td>ML</td>
</tr>
</tbody>
</table>

Project No.  N4155126  Client:  AEP
Project:  ROCKPORT PLANT IMPROVEMENT CERTIFICATION

• Source of Sample:  B-2  Depth:  4.6'  Sample Number:  ST-1

Terracon, Inc.
Cincinnati, Ohio

Exhibit B-25

Tested By:  VD  Checked By:  GS
Type of Test: CU with Pore Pressures
Sample Type: ST
Description: BROWN SANDY SILT

LL= 19  PL= 16  PI= 3  Assumed Specific Gravity= 2.70
Remarks:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Content, %</td>
<td>15.6</td>
<td>17.3</td>
</tr>
<tr>
<td>Dry Density, pcf</td>
<td>110.4</td>
<td>114.3</td>
</tr>
<tr>
<td>Saturation, %</td>
<td>80.0</td>
<td>98.5</td>
</tr>
<tr>
<td>Void Ratio</td>
<td>0.5262</td>
<td>0.4741</td>
</tr>
<tr>
<td>Diameter, in.</td>
<td>2.853</td>
<td>2.844</td>
</tr>
<tr>
<td>Height, in.</td>
<td>5.704</td>
<td>5.702</td>
</tr>
<tr>
<td>Water Content, %</td>
<td>18.1</td>
<td>15.8</td>
</tr>
<tr>
<td>Dry Density, pcf</td>
<td>113.2</td>
<td>118.0</td>
</tr>
<tr>
<td>Saturation, %</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Void Ratio</td>
<td>0.4887</td>
<td>0.4279</td>
</tr>
<tr>
<td>Diameter, in.</td>
<td>2.829</td>
<td>2.814</td>
</tr>
<tr>
<td>Height, in.</td>
<td>5.657</td>
<td>5.642</td>
</tr>
<tr>
<td>Strain rate, in./min.</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td>Back Pressure, tsf</td>
<td>3.600</td>
<td>3.600</td>
</tr>
<tr>
<td>Cell Pressure, tsf</td>
<td>3.852</td>
<td>7.596</td>
</tr>
<tr>
<td>Fall. Stress, tsf</td>
<td>0.883</td>
<td>4.618</td>
</tr>
<tr>
<td>Total Pore Pr., tsf</td>
<td>3.607</td>
<td>5.378</td>
</tr>
<tr>
<td>Ult. Stress, tsf</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Pore Pr., tsf</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\sigma_1$ Failure, tsf</td>
<td>1.127</td>
<td>6.836</td>
</tr>
<tr>
<td>$\sigma_2$ Failure, tsf</td>
<td>0.245</td>
<td>2.218</td>
</tr>
</tbody>
</table>

Client: AEP
Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION
Source of Sample: B-2  Depth: 4-6'
Sample Number: ST-1
Proj. No.: N4155126  Date Sampled: 10-5-15

TRIAXIAL SHEAR TEST REPORT
Terracon, Inc.
Cincinnati, Ohio

Tested By: FCE  Checked By: GS

Exhibit B-26
Client: AEP
Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION
Source of Sample: B-2 Depth: 4-6' Sample Number: ST-1
Project No.: N4155126 Exhibit _______ Terracon, Inc.

Tested By: FCE Checked By: GS

Exhibit B-27
## Particle Size Distribution Report

![Graph showing particle size distribution](image)

### Material Description

**GRAY LEAN CLAY**

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Atterberg Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PL = 21</td>
<td>LL = 30</td>
</tr>
<tr>
<td></td>
<td>PI = 9</td>
</tr>
</tbody>
</table>

| D_50 = 0.0662 | \(D_{85}\) = 0.0568 | \(D_{60}\) = 0.0159 |
| D_50 = 0.0078 | D_30 =            | D_15 =             |
| D_10 =        | C_u =             | C_c =             |

**Classification**

AASHTO = A-4(8)

**Remarks**


### Source of Sample

- **Sample Number:** ST-2
- **Depth:** 10-12'

### Test Results

<table>
<thead>
<tr>
<th>SIEVE SIZE</th>
<th>PERCENT FINER</th>
<th>SPEC.* PERCENT</th>
<th>PASS?</th>
</tr>
</thead>
<tbody>
<tr>
<td>#4</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#10</td>
<td>99.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#20</td>
<td>99.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#40</td>
<td>98.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#60</td>
<td>97.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#140</td>
<td>94.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#200</td>
<td>93.0</td>
<td></td>
<td></td>
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</tbody>
</table>

*(no specification provided)*

### Additional Information

- **Client:** AEP
- **Project:** ROCKPORT PLANT IMPROVEMENT CERTIFICATION
- **Project No:** N4155126
- **Date:** 10-13-15

**Terracon, Inc.**

- **Cincinnati, Ohio**

**Checked By:** GS

**Tested By:** DR

**Exhibit:** Exhibit B-28
LIQUID AND PLASTIC LIMITS TEST REPORT

Dashed line indicates the approximate upper limit boundary for natural soils

<table>
<thead>
<tr>
<th>MATERIAL DESCRIPTION</th>
<th>LL</th>
<th>PL</th>
<th>PI</th>
<th>%&lt;#40</th>
<th>%&lt;#200</th>
<th>USCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gray Lean Clay</td>
<td>30</td>
<td>21</td>
<td>9</td>
<td>98.1</td>
<td>93.0</td>
<td>CL</td>
</tr>
</tbody>
</table>

Project No. N4155126  Client: AEP
Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION

• Source of Sample: B-2  Depth: 10-12'  Sample Number: ST-2

Remarks:
• Initial MC - 27.2%

Terracon, Inc.
Cincinnati, Ohio
Type of Test: Unconsolidated Undrained
Sample Type: ST
Description: GRAY LEAN CLAY

LL = 30 PL = 21 PI = 9
Assumed Specific Gravity = 2.70
Remarks:

Sample No. 1

| Water Content, % | 27.2 |
| Dry Density, pcf | 94.9 |
| Saturation, % | 94.7 |
| Void Ratio | 0.7768 |
| Diameter, in. | 2.860 |
| Height, in. | 6.020 |

At Test

| Water Content, % | 27.2 |
| Dry Density, pcf | 94.9 |
| Saturation, % | 94.7 |
| Void Ratio | 0.7768 |
| Diameter, in. | 2.860 |
| Height, in. | 6.020 |

Strain rate, in./min. 0.060
Back Pressure, psi 0.000
Cell Pressure, psi 0.750
Fail. Stress, psi 7.691
Ult. Stress, psi

σ₁ Failure, psi 8.441
σ₃ Failure, psi 0.750

Client: AEP
Project: ROCKPORT PLANT IMPROVEMENT CERTIFICATION
Source of Sample: B-2 Depth: 10-12'
Sample Number: ST-2
Proj. No.: N4155126 Date Sampled: 10-13-15

TRIAXIAL SHEAR TEST REPORT
Terracon, Inc.
Cincinnati, Ohio

Tested By: FCE Checked By: GS
Exhibit B-30
**Exhibit B-31**

**Client:** AEP  
**Project:** ROCKPORT PLANT IMPROVEMENT CERTIFICATION  
**Source of Sample:** B-2  
**Depth:** 10-12’  
**Sample Number:** ST-2  
**Project No.:** N4155126

---

**Graphs and Diagrams:**

- **Graph 1:** Deviator Stress (psi) vs. 0% to 16%.
- **Graph 2:** Deviator Stress (psi) vs. 0% to 16%.
- **Graph 3:** Deviator Stress (psi) vs. 0% to 16%.
- **Graph 4:** Deviator Stress (psi) vs. 0% to 16%.
- **Graph 5:** Peak Strength, q (psi) vs. p (psi).

Stress Paths: o indicates peak  + indicates end

**Text:**

- Peak Strength: Total
- $a = 3.845$ psi
- $\alpha = 0.00$ deg
- $\tan \alpha = 0.00$

---

**Signatures:**

**Tested By:** FCE  
**Checked By:** GS

---

**Exhibit B-31**
APPENDIX C
SUPPORTING DOCUMENTS
### GENERAL NOTES

#### DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

<table>
<thead>
<tr>
<th>Sampling</th>
<th>Water Level</th>
<th>Field Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auger</td>
<td>Water Initially Encountered</td>
<td>(HP) Hand Penetrometer</td>
</tr>
<tr>
<td>Split Spoon</td>
<td>Water Level After a Specified Period of Time</td>
<td>(T) Torvane</td>
</tr>
<tr>
<td>Shelby Tube</td>
<td>Water Level After a Specified Period of Time</td>
<td>(b/f) Standard Penetration Test (blows per foot)</td>
</tr>
<tr>
<td>Macro Core</td>
<td></td>
<td>(PID) Photo-Ionization Detector</td>
</tr>
<tr>
<td>Ring Sampler</td>
<td></td>
<td>(OVA) Organic Vapor Analyzer</td>
</tr>
<tr>
<td>Rock Core</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grab Sample</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Recovery</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### WATER LEVEL

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

#### LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

### DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

### LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

### CONSISTENCY OF FINE-GRAINED SOILS

(50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance

<table>
<thead>
<tr>
<th>Strength Terms (Density)</th>
<th>Standard Penetration or N-Value Blows/Ft.</th>
<th>Unconfined Compressive Strength, Qu, tsf</th>
<th>Standard Penetration or N-Value Blows/Ft.</th>
<th>Ring Sampler Blows/Ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Loose</td>
<td>0 - 3</td>
<td>Very Soft</td>
<td>less than 0.25</td>
<td>0 - 1</td>
</tr>
<tr>
<td>Loose</td>
<td>4 - 9</td>
<td>Soft</td>
<td>0.25 to 0.50</td>
<td>2 - 4</td>
</tr>
<tr>
<td>Medium Dense</td>
<td>10 - 29</td>
<td>Medium-Stiff</td>
<td>0.50 to 1.00</td>
<td>4 - 8</td>
</tr>
<tr>
<td>Dense</td>
<td>30 - 50</td>
<td>Stiff</td>
<td>1.00 to 2.00</td>
<td>8 - 15</td>
</tr>
<tr>
<td>Very Dense</td>
<td>&gt; 50</td>
<td>Very Stiff</td>
<td>2.00 to 4.00</td>
<td>15 - 30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hard</td>
<td>&gt; 4.00</td>
<td>&gt; 30</td>
</tr>
</tbody>
</table>

### GRAIN SIZE TERMINOLOGY

<table>
<thead>
<tr>
<th>Particle Size</th>
<th>Boulders</th>
<th>Over 12 in. (300 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 in. to 3 in. (300mm to 75mm)</td>
<td>Cobbles</td>
<td>12 in. to 3 in. (300mm to 75mm)</td>
</tr>
<tr>
<td>3 in. to #4 sieve (75mm to 4.75 mm)</td>
<td>Gravel</td>
<td>3 in. to #4 sieve (75mm to 4.75 mm)</td>
</tr>
<tr>
<td>#4 to #200 sieve (4.75mm to 0.075mm)</td>
<td>Sand</td>
<td>#4 to #200 sieve (4.75mm to 0.075mm)</td>
</tr>
<tr>
<td>Passing #200 sieve (0.075mm)</td>
<td>Silt or Clay</td>
<td>Passing #200 sieve (0.075mm)</td>
</tr>
</tbody>
</table>

### RELATIVE PROPORTIONS OF SAND AND GRAVEL

<table>
<thead>
<tr>
<th>Descriptive Term(s) of other constituents</th>
<th>Percent of Dry Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trace</td>
<td>&lt; 15</td>
</tr>
<tr>
<td>With</td>
<td>15 - 29</td>
</tr>
<tr>
<td>Modifier</td>
<td>&gt; 30</td>
</tr>
</tbody>
</table>

### RELATIVE PROPORTIONS OF FINE

<table>
<thead>
<tr>
<th>Descriptive Term(s) of other constituents</th>
<th>Percent of Dry Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trace</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>With</td>
<td>5 - 12</td>
</tr>
<tr>
<td>Modifier</td>
<td>&gt; 12</td>
</tr>
</tbody>
</table>

### PLASTICITY DESCRIPTION

<table>
<thead>
<tr>
<th>Term</th>
<th>Plasticity Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-plastic</td>
<td>0</td>
</tr>
<tr>
<td>Low</td>
<td>1 - 10</td>
</tr>
<tr>
<td>Medium</td>
<td>11 - 30</td>
</tr>
<tr>
<td>High</td>
<td>&gt; 30</td>
</tr>
</tbody>
</table>

Exhibit C-1
### UNIFIED SOIL CLASSIFICATION SYSTEM

#### Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests

<table>
<thead>
<tr>
<th>Gravels:</th>
<th>Clean Gravels: Less than 5% fines&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Cu ≥ 4 and 1 ≤ Cc ≤ 3&lt;sup&gt;ε&lt;/sup&gt;</th>
<th>GW Well-graded gravel&lt;sup&gt;f&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than 50% of coarse fraction retained on No. 4 sieve</td>
<td>Cu &lt; 4 and/or 1 &gt; Cc &gt; 3&lt;sup&gt;ε&lt;/sup&gt;</td>
<td>GM Silty gravel&lt;sup&gt;T&lt;/sup&gt;,&lt;sup&gt;R&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Gravels with Fines:</td>
<td>Fines classify as ML or MH</td>
<td>Fines classify as CL or CH</td>
<td>GC Clayey gravel&lt;sup&gt;T&lt;/sup&gt;,&lt;sup&gt;R&lt;/sup&gt;</td>
</tr>
<tr>
<td>More than 12% fines&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Cu ≥ 6 and 1 ≤ Cc ≤ 3&lt;sup&gt;ε&lt;/sup&gt;</td>
<td>SW Well-graded sand&lt;sup&gt;1&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Sands:</td>
<td>Cu &lt; 6 and/or 1 &gt; Cc &gt; 3&lt;sup&gt;ε&lt;/sup&gt;</td>
<td>SP Poorly graded sand&lt;sup&gt;1&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>50% or more of coarse fraction passes No. 4 sieve</td>
<td>Sands with Fines: More than 12% fines&lt;sup&gt;d&lt;/sup&gt;</td>
<td>Fines classify as ML or MH</td>
<td>GM Silty gravel&lt;sup&gt;T&lt;/sup&gt;,&lt;sup&gt;R&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Fines classify as CL or CH</td>
<td>Fines classify as CL or CH</td>
<td>GM Silty gravel&lt;sup&gt;T&lt;/sup&gt;,&lt;sup&gt;R&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

#### Coarse Grained Soils:
- More than 50% retained on No. 200 sieve

#### Sands:
- 50% or more of coarse fraction passes the No. 200 sieve

#### Fine-Grained Soils:
- 50% or more passes the No. 200 sieve

#### Silts and Clays:
- Liquid limit less than 50

#### Inorganic:
- PI > 7 and plots on or above “A” line: CL Lean clay<sup>K</sup>,<sup>L</sup>,<sup>M</sup>
- PI < 4 or plots below “A” line: ML Silt<sup>K</sup>,<sup>L</sup>,<sup>M</sup>

#### Organic:
- Liquid limit - oven dried < 0.75: OL Organic clay<sup>K</sup>,<sup>L</sup>,<sup>M</sup>,<sup>N</sup>
- Liquid limit - not dried: CH Fat clay<sup>K</sup>,<sup>L</sup>,<sup>M</sup>

#### Highly organic soils:
- Primarily organic matter, dark in color, and organic odor

#### Fine-grained soils and fine-grained fraction of coarse-grained soils

#### For classification of fine-grained soils and fine-grained fraction of coarse-grained soils

- Equation of “A” - line
  - Horizontal at PI=4 to LL=25.5, then PI=0.73 (LL-20)
- Equation of “U” - line
  - Vertical at LL=16 to PI=7, then PI=0.9 (LL-8)

#### Plots:
- CH or OH
- CL or OL
- MH or OH
- CL - ML
- ML or OL

---

<sup>A</sup> Based on the material passing the 3-inch (75-mm) sieve

<sup>B</sup> If field sample contained cobbles or boulders, or both, add “with cobbles or boulders, or both” to group name.

<sup>C</sup> Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

<sup>D</sup> Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

<sup>E</sup> Cu = D<sub>60</sub>/D<sub>10</sub>  Cc = \((D_{60})^2 / D_{10} \times D_{60}\)

<sup>F</sup> If fines are organic, add “with organic fines” to group name.

<sup>G</sup> If soil contains ≥ 15% gravel, add “with gravel” to group name.

<sup>H</sup> If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

<sup>I</sup> If soil contains ≥ 15% gravel, add “with gravel” to group name.

<sup>J</sup> If soil contains ≥ 30% plus No. 200 predominantly sand, add “sandy” to group name.

<sup>K</sup> If soil contains ≥ 30% plus No. 200 predominantly gravel, add “gravelly” to group name.

<sup>L</sup> PI plots on or above “A” line.

<sup>M</sup> PI plots below “A” line.

---

Exhibit C-2
APPENDIX D
SLOPE STABILITY ANALYSES
Method: Spencer

- **Name:** Embankment Fill
  - Unit Weight: 130 pcf
  - Cohesion: 50 psf
  - Phi: 29°
  - Piezometric Line: 1

- **Name:** Stiff Clay
  - Unit Weight: 123 pcf
  - Cohesion: 50 psf
  - Phi: 34°
  - Piezometric Line: 1

- **Name:** Loose Sand
  - Unit Weight: 115 pcf
  - Cohesion: 0 psf
  - Phi: 30°
  - Piezometric Line: 1

- **Name:** Medium Dense Sand
  - Unit Weight: 123 pcf
  - Cohesion: 0 psf
  - Phi: 33°
  - Piezometric Line: 1

---

MAXIMUM SURCHARGE POOL WATER LEVEL: EXTERIOR
MAXIMUM SURCHARGE POOL WATER LEVEL: INTERIOR

Method: Spencer

Name: Embankment Fill      Unit Weight: 130pcf     Cohesion': 50 psf     Phi': 29 °     Piezometric Line: 1
Name: Stiff Clay      Unit Weight: 123pcf     Cohesion': 50 psf     Phi': 34 °     Piezometric Line: 1
Name: Loose Sand      Unit Weight: 115pcf     Cohesion': 0 psf     Phi': 30 °     Piezometric Line: 1
Name: Medium Dense Sand      Unit Weight: 123pcf     Cohesion': 0 psf     Phi': 33 °     Piezometric Line: 1
MAXIMUM STORAGE POOL WATER LEVEL: EXTERIOR

- **Name:** Embankment Fill  **Unit Weight:** 130 pcf  **Cohesion:** 50 psf  **Phi:** 29°  **Piezometric Line:** 1
- **Name:** Stiff Clay  **Unit Weight:** 123 pcf  **Cohesion:** 50 psf  **Phi:** 34°  **Piezometric Line:** 1
- **Name:** Loose Sand  **Unit Weight:** 115 pcf  **Cohesion:** 0 psf  **Phi:** 30°  **Piezometric Line:** 1
- **Name:** Medium Dense Sand  **Unit Weight:** 123 pcf  **Cohesion:** 0 psf  **Phi:** 33°  **Piezometric Line:** 1

**Method:** Spencer
### MATERIAL PROPERTIES

<table>
<thead>
<tr>
<th>Material</th>
<th>Unit Weight</th>
<th>Cohesion</th>
<th>Phi</th>
<th>Piezometric Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embankment Fill</td>
<td>130 pcf</td>
<td>50 psf</td>
<td>29°</td>
<td>1</td>
</tr>
<tr>
<td>Stiff Clay</td>
<td>123 pcf</td>
<td>50 psf</td>
<td>34°</td>
<td>1</td>
</tr>
<tr>
<td>Loose Sand</td>
<td>115 pcf</td>
<td>0 psf</td>
<td>30°</td>
<td>1</td>
</tr>
<tr>
<td>Medium Dense Sand</td>
<td>123 pcf</td>
<td>0 psf</td>
<td>33°</td>
<td>1</td>
</tr>
</tbody>
</table>

### GRAPHIC LAYOUT

- **Method:** Spencer
- **File Name:** N4155126SS
- **Drawn by:** N.T.S.
- **Checked by:** KME
- **Approved by:** KME
- **Date:** Jan 2016

---

MAXIMUM STORAGE POOL WATER LEVEL: INTERIOR

**SLOPE/W MODEL SECTION A-A’**

**American Electric Power**

**AEP Rockport Bottom Ash Complex PE Certification**

**Rockport, Indiana**

**Method:** Spencer

<table>
<thead>
<tr>
<th>Distance (ft)</th>
<th>Elevation (ft)</th>
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<tbody>
<tr>
<td>-60</td>
<td>300</td>
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<tr>
<td>-40</td>
<td>305</td>
</tr>
<tr>
<td>-20</td>
<td>310</td>
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<tr>
<td>0</td>
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<tr>
<td>20</td>
<td>320</td>
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<tr>
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<td>325</td>
</tr>
<tr>
<td>60</td>
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<tr>
<td>80</td>
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<td>100</td>
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<td>120</td>
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<td>140</td>
<td>350</td>
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<td>160</td>
<td>355</td>
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</tbody>
</table>

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**AMERICAN ELECTRIC POWER**

**AEP ROCKPORT BOTTOM ASH COMPLEX PE CERTIFICATION**

**ROCKPORT, INDIANA**

**Method:** Spencer

- **File Name:** N4155126SS
- **Drawn by:** N.T.S.
- **Checked by:** KME
- **Approved by:** KME
- **Date:** Jan 2016
MAXIMUM STORAGE POOL WATER LEVEL (SEISMIC): EXTERIOR

Name: Embankment Fill      Unit Weight: 130 pcf     Cohesion': 50 psf     Phi': 29 °     Piezometric Line: 1
Name: Stiff Clay      Unit Weight: 123 pcf     Cohesion': 50 psf     Phi': 34 °     Piezometric Line: 1
Name: Loose Sand      Unit Weight: 115 pcf     Cohesion': 0 psf     Phi': 30 °     Piezometric Line: 1
Name: Medium Dense Sand      Unit Weight: 123 pcf     Cohesion': 0 psf     Phi': 33 °     Piezometric Line: 1

Method: Spencer
MAXIMUM STORAGE POOL WATER LEVEL (SEISMIC):
INTERIOR

Name: Embankment Fill      Unit Weight: 130 pcf     Cohesion': 50 psf     Phi': 29 °     Piezometric Line: 1
Name: Stiff Clay      Unit Weight: 123 pcf     Cohesion': 50 psf     Phi': 34 °     Piezometric Line: 1
Name: Loose Sand      Unit Weight: 115 pcf     Cohesion': 0 psf     Phi': 30 °     Piezometric Line: 1
Name: Medium Dense Sand      Unit Weight: 123 pcf     Cohesion': 0 psf     Phi': 33 °     Piezometric Line: 1

Method: Spencer

AMERICAN ELECTRIC POWER
AEP ROCKPORT BOTTOM ASH COMPLEX PE CERTIFICATION
ROCKPORT, INDIANA

KME

N4155126

Jan 2016

N4155126SS

D-6
APPENDIX E
PHOTO LOG
Photo 1: West Bottom Ash Pond, west dike: exterior slope (facing north).

Photo 2: West Bottom Ash Pond, west dike: exterior slope (facing south).

Date Photos Taken: July 14, 2015
Photo 3: West Bottom Ash Pond, west dike: ponded water at exterior toe.

Photo 4: West Bottom Ash Pond, west dike: crest and interior slope (facing south).
Photo 5: West Bottom Ash Pond, west dike: crest and interior slope (facing north).

Photo 6: West Bottom Ash Pond, west dike: bottom ash pond interior.
Photo 7: West Bottom Ash Pond, west dike: bottom ash pond interior.