OVEC IKEC

OHIO VALLEY ELECTRIC CORPORATION
3932 U. S. Route 23
P. O. Box 468
Piketon, Ohio 45661
740-289-7200

WRITER'S DIRECT DIAL NO:
740-289-7259

June 29, 2023

Delivered Electronically

Mr. Brian Rockensuess
Commissioner
Indiana Department of Environmental Management
100 N. Senate Avenue
Mail Code 50-01
Indianapolis, IN 46204-2251

Re: Indiana-Kentucky Electric Corporation- Clifty Creek Station
Revision to the Landfill Runoff Collection Pond Closure Plan

Dear Mr. Rockensuess:

As required by 40 CFR 257.106(i)(4), Indiana-Kentucky Electric Corporation is providing notification to the Commissioner of the Indiana Department of Environmental Management (IDEM) that the Closure Plan for Clifty Creek Station's Landfill Runoff Collection Pond has been revised. The newly revised plan will be placed in the facility's operation record as well as the publicly accessible internet site, which can be viewed at http://www.ovec.com/CCRCompliance.php

If you have any questions, or require any additional information, please call me at (740) 289-7259, or you can contact Tim Fulk at (740) 897-7768.

Sincerely,

Jeremy Galloway

Jeremy Galloway
Environmental Specialist

JDG: tlf

Stantec Consulting Services Inc.
9200 Shelbyville Road, Suite 800, Louisville KY 40222-5136

June 27, 2023

Project/File: 175531036

Mr. Gabriel Coriell
Indiana-Kentucky Electric Corporation
3932 U.S. Route 23
P.O. Box 468
Piketon, Ohio 45661

Reference: Closure Plan
Clifty Creek Station
Landfill Runoff Collection Pond
Madison, Jefferson County, Indiana

Dear Mr. Coriell,

The attached closure plan for Clifty Creek Station's Landfill Runoff Collection Pond (LRCP) was prepared by Stantec Consulting Services Inc. (Stantec) for the Indiana-Kentucky Electric Corporation (IKEC).

The initial closure and post-closure plans for the LRCP were posted on October 11, 2016 as part of the U.S. Environmental Protection Agency (EPA) final coal combustion residuals (CCR) rule demonstrations. The plans were conceptual and subject to the completion of all necessary environmental reviews. Though conceptual, they demonstrated compliance with the requirements set forth in 40 CFR 257.102(b) and 257.104(d).

IKEC, Stantec, and the Indiana Department of Environmental Management (IDEM) met in Indianapolis on December 9, 2019 to discuss the requirements for Indiana CCR surface impoundment closures. IKEC submitted the closure plan for the LRCP to IDEM on June 17, 2021. No comment has been received from IDEM on this proposed closure plan to date.

The plan was prepared in accordance with the accepted practice of engineering and accurate information at the date of its submittal to meet the requirements described in 40 CFR 257.102(b). Changes to the closure plan may be required. Revised plans will be posted at that time.

Regards,

STANTEC CONSULTING SERVICES INC.

Matt Vaughan
Principal
*Licensed in KY, IN
Phone: (502) 212-5088
matt.vaughan@stantec.com

stantec.com

Attachment: Stantec Consulting Services Inc. (2021). Closure Plan. Clifty Creek Station. Landfill Runoff Collection Pond. Madison, Jefferson County, Indiana. Prepared for Indiana-Kentucky Electric Corporation. June 16.

ATTACHMENT

Closure Plan. Clifty Creek Station. Landfill Runoff Collection Pond.

Stantec Consulting Services Inc. (2021)

OVEC IKEC

OHIO VALLEY ELECTRIC CORPORATION
INDIANA- KENTUCKY ELECTRIC CORPORATION
3932 U. S. Route 23
P.O. Box 468
Piketon, Ohio 45661
740-289-7200

WRITER'S DIRECT DIAL NO:
(740) 897-7768

June 17, 2021

Ms. Kate Garvey
Office of Land Quality
Indiana Department of Environmental Management
Solid Waste Permits Section
100 N. Senate Avenue
MC 65-45 IGCN 1101
Indianapolis, IN 46204-2205

Dear Ms. Garvey:

Re: Indiana-Kentucky Electric Corporation
Clifty Creek Station Landfill Runoff Collection Pond Closure Plan

In accordance with 329 IAC 10-3-1(9), the Indiana-Kentucky Electric Corporation (IKEC) is submitting for agency review the accompanying Closure Plan for Clifty Creek Station's Landfill Runoff Collection Pond (LRCP). IKEC is committed to being a good steward of the environment and to satisfying our environmental compliance obligations. We recognize the importance of maintaining a close partnership with IDEM in this endeavor, and appreciate the opportunity to submit this plan for agency review. Note that while IKEC desires to work closely with IDEM, IKEC is not waiving any of the positions it identified in its May 28, 2021 letter to Steven Thill or those identified in its June 1, 2021 Petition for Review of the Approval of the Partial Closure Plan for IKEC's WBSP.

If you have any questions or comments please contact me at (740) 897-7768.

Sincerely,

Tim Fulk

Tim Fulk
Engineer II

TLF:gsc

Attachments

Stantec

OVEC IKEC
Ohio Valley Electric Corporation Indiana-Kentucky Electric Corporation

Closure Plan

Clifty Creek Station
Landfill Runoff Collection Pond
Madison, Jefferson County, Indiana

Prepared for:
Indiana-Kentucky Electric Corporation
3932 U.S. Route 23
Piketon, Ohio 45661

June 16, 2021

Design with community in mind

Closure Plan
Landfill Runoff Collection Pond

Clifty Creek Station
Madison, Jefferson County, Indiana

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Clifty Creek Station
Madison, Jefferson County, Indiana

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1. Objective

Indiana-Kentucky Electric Corporation (IKEC) is submitting this Closure Plan for the Clifty Creek Station's Landfill Runoff Collection Pond (LRCP) to the Indiana Department of Environmental Management (IDEM) Office of Water Quality (OWQ) with copies to the Office of Land Quality (OLQ), Waste Section. IKEC requests OWQ coordinate its review and comments with OLQ in a timely manner that facilitates adherence to the proposed schedule to close the LRCP at the Clifty Creek Station.

The LRCP is an inactive coal combustion residuals (CCR)surface impoundment. It currently receives stormwater runoff from more than 500 acres. Contact water from the adjacent landfill and stormwater run-on from the adjacent hillsides flow into the LRCP. Discharge from the LRCP is managed under the site's National Pollution Discharge Elimination System (NPDES) permit at the southwest corner of the LRCP. The applicable NPDES Permit No. is IN0001759. IKEC is preparing to cap and close the LRCP following the requirements in 329 Indiana Administrative Code (IAC) 10-9-1(9)(b) and (c) which incorporates portions of the United States Environmental Protection Agency (EPA) Final CCR Rule by reference.

The closure design includes two distinct phases of construction. Phase 1 involves the operational drawdown of the existing water surface elevation within the LRCP to a reduced footprint using the existing discharge structure and construction of a stormwater run-on diversion ditch around the perimeter of the LRCP to divert run-on from the surrounding hillsides directly to a new outfall to the Ohio River. These two steps in Phase 1 will remove water from the LRCP and promote drying of the CCR material in preparation for closure.

Phase 2 involves dewatering the CCR, grading the CCR to subgrade elevations, the installation of the final cover system, and modifications to the existing outfall structure.

In association with the closure of the LRCP, minor modifications will be necessary at the landfill to manage stormwater runoff and leachate flows. This will require the construction of two interim sediment basins and two leachate collection ponds, and appurtenances. Proposed modifications to the existing IDEM landfill permit will be submitted under a separate permit application. For the purposes of this Closure Plan, it is assumed these landfill improvements will be completed prior to commencing LRCP closure construction.

Appendix A is a list of acronyms and abbreviations.

2. Description of the CCR Unit

The Clifty Creek Station is located on the north bank of the Ohio River west of Madison, Indiana. It consists of six coal-fired electric generating units, each nominally rated at 217megawatts. The station began producing electricity in 1955 to support the Department of Energy's (DOE's) Portsmouth Gaseous Diffusion Plant located near Piketon, Ohio. The LRCP is located southwest of the station, adjacent to the CCR landfill. Figure 1shows the location of the LRCP and other key facilities at the site.

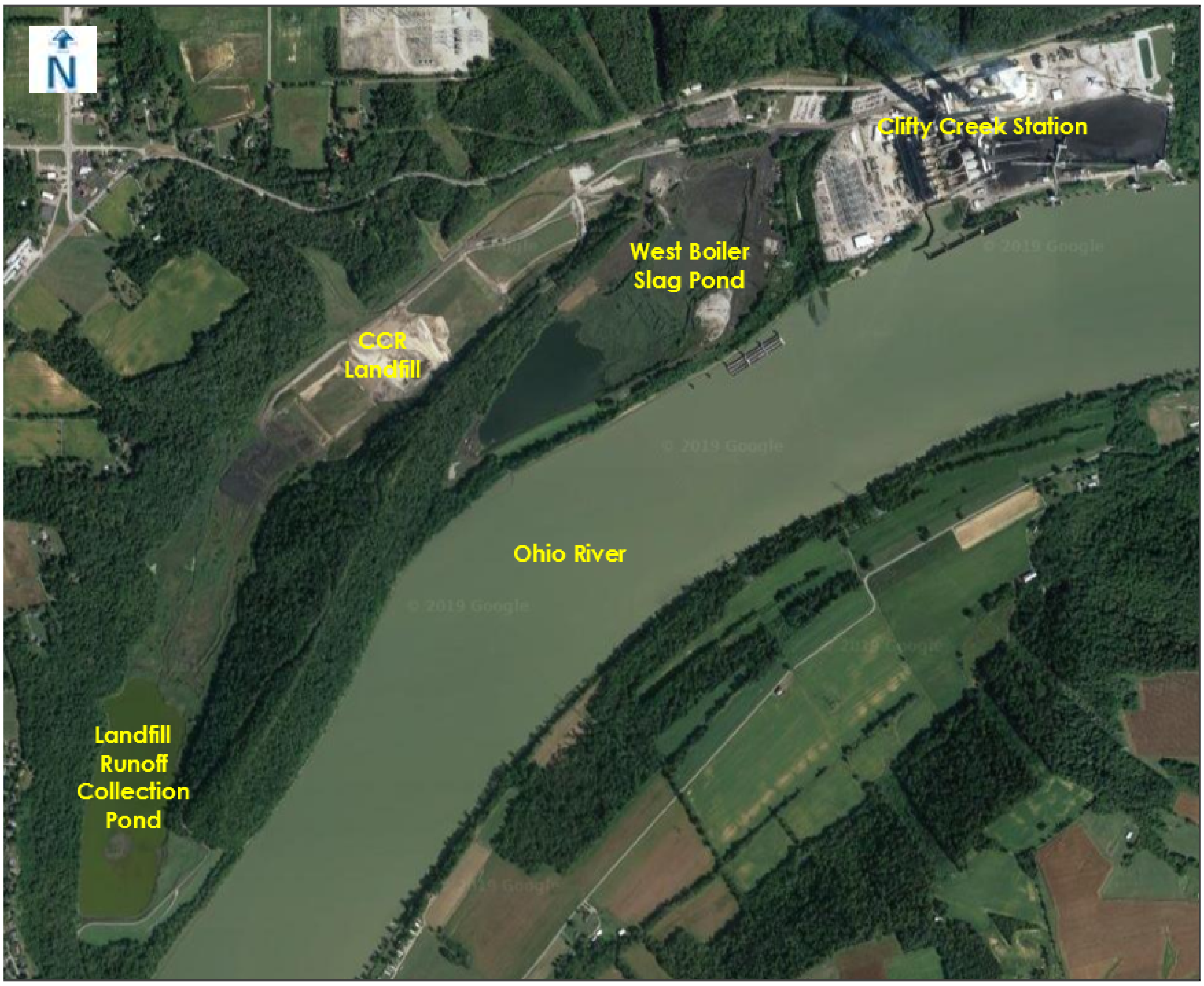

Figure 1- Aerial View of Clifty Creek Station

2.1. Impoundment Structure

The LRCP is surrounded by steep hillsides to the east and west, the CCR landfill to the north, and a constructed embankment to the south. The total closure area is approximately 57 acres, 38 of which is currently surface water. The current water surface elevation is approximately 486 feet. The crest of the south embankment is at approximate elevation 505 feet. FEMA (2015) Flood Insurance Study No. 18077CV000A shows that the flood stages of the Ohio River at the LRCP are 463 feet and 468 feet for the 1 percent and 0.2 percent annual chance of flooding.

According to As-built drawings 16-3170-1, 16-3171-4, and 16-3171A-4, the crest of the dam is 26 feet wide. The upstream slopes are 2.5H:1V (horizontal slope : vertical slope). The downstream slopes are 2.5H:1V above elevation 478 feet and 3H:1V below this elevation. The exterior LRCP slopes are grass covered. As-built drawings are included in Appendix B.

2.2. Primary Spillway

Flows from the LRCP are currently permitted to be discharged through Outfall 001 to the Ohio River under NPDES Permit No. IN0001759 effective May 1, 2018, which is administered by IDEM. The LRCP's primary spillway consists of an intake structure in the pond connected by riser structures to a concrete pipe which runs under the LRCP dam and eventually to the Ohio River. The CCR pond intake structure consists of an inclined 6-feet x 3-feet reinforced concrete box culvert with intermittent riser box structures containing grated inlets located at every 11 feet in elevation. Currently, the two uppermost riser box structures are above the pond level and the lower riser structure is the active outlet for the pond. The inclined box is connected to a 400-feet long, 72-inch diameter concrete pipe that is located under the dam where outflow discharges into the Ohio River.

2.3. LRCP Location

The Clifty Creek Station is in Jefferson County, Madison Township, Indiana in Township 3N, Range 10E, Section 5. A legal description of the facility boundary is included in Appendix C. Located south of Indiana State Route 56 and northwest of a bedrock geologic feature called the Devil's Backbone, the CCR Landfill is being constructed in two phases from northeast to southwest, down the valley. Water from the landfill and stormwater run-on from the adjacent hillsides flows southwest to the LRCP. Discharge from the LRCP is managed under the site's NPDES permit at the southwest corner of the site.

In Appendix D, Figures 2 and 3 reflect a half-mile offset from the LRCP's waste boundary with regional water wells identified in the Indiana Department of Natural Resources (IDNR), Division of Water Well Record Database (IDNR, 2019). Figure 2 shows a plan view of the LRCP overlain on a November 2017 ESRI aerial. Figure 3 reflects the same data shown on a portion of the 7½-minute USGS topographic quadrangle map for Madison West (2019).

Four wells are shown within the half-mile offset. Available IDNR well information is provided in Appendix D. All four wells are owned by nearby Hanover College. Table 1 details the four wells within the half-mile offset from the LRCP.

Table 1 - Water Wells Within a Half-Mile Offset

Well Record Reference No.	Type	Depth (feet)	Completion Date	Location	Status
219384	Unconsolidated	68	06/30/1967	Madison–West, Jefferson County, IN	Inactive
219399	Unconsolidated	69	10/11/1948	Madison–West, Jefferson County, IN	Inactive
312919	Unknown	--	--	Madison–West, Jefferson County, IN	Inactive
312920	Unconsolidated	80	01/01/1940	Madison–West, Jefferson County, IN	Inactive

2.4. Available Geotechnical Data

Geotechnical data is available from six field explorations at the LRCP. A plan view of the borings and logs are provided in Appendix E. Appendix F contains a slope stability analysis for the LRCP closure.

American Gas & Electric Service Corp. (1953)
The 1956 as-built design drawings include geotechnical profiles within the LRCP dam. The drawings show the embankment dimensions and generalized original ground topography.

American Gas & Electric Service Corp. (1985)
An exploration program was carried out in 1984 to obtain geotechnical properties of the LRCP dam to evaluate the feasibility of raising it by 30 feet to elevation 535 feet. Thirty-seven borings and nine CPT soundings were advanced along the dam crest, downstream toe and pond of the LRCP facility. Results from the exploration indicate that the dam was constructed in compacted layers of silty and sandy clays. A 30 to 40-ft thick seam of gray clay was encountered underlying the main dam and the bedrock underlying foundation soils was described as Indiana Limestone with layers of calcareous shale.

Stantec (2016)
Stantec performed two geotechnical field explorations to support the safety factor demonstration under the CCR Rule. Four borings were advanced along the crest and the downstream toe of the LRCP Dam in 2009/2010 and one borehole was advanced in 2015 to confirm field conditions. Laboratory testing was performed to confirm field classifications (natural moisture content, hydrometer analyses, Atterberg limits), estimate shear strength (consolidated-undrained triaxial compression testing), and permeability. Results from the explorations indicate that the dam was constructed of lean and silty clay with sand. Silt with sand and silty sand soils were encountered in the foundation.

AGES (2016)

Applied Geology and Environmental Science (AGES), Inc. was contracted by IKEC to identify upgrades in the groundwater monitoring program of the LRCP necessary for compliance with the CCR Rule. In 2015, three monitoring wells were installed using a sonic drill rig. Excerpts from AGES (2018) are included in Appendix E. This includes a well summary table, a generalized geologic cross section, groundwater flow maps for four sampling periods, and sample/well construction logs.

Stantec (2021)

Stantec conducted a field exploration in 2021 to support design and construction of the LRCP closure. Six geotechnical borings were advanced to a depth ranging from 15 to 40 feet below existing grade. The logs described the material as boiler slag (coarse sand); lean and silty clay, silty sand, gravel with sand, or shale bedrock. Laboratory testing of samples collected during this exploration was ongoing at the time of this report. A plan view and boring logs for this exploration are included in Appendix E.

3. Regulatory Overview

3.1. Regulatory Framework for Design

The United States EPA Final CCR Rule defines the criteria for conducting the closure of CCR units under 40 CFR 257.102.

Per the IDEM CCR Fact Sheet, Indiana coal ash surface impoundments that are subject to an NPDES permit are not regulated under IDEM's solid waste program (IDEM 2021). Once the NPDES permit is terminated, the final disposal of solid waste in the surface impoundment is subject to the closure requirements under 329 Indiana Administrative Code (IAC) 10-9-1(9)(b) and (c), which incorporates portions of the CCR Rule by reference.

This submittal is an amendment to a written closure plan (40 CFR 257.102(b)(3)) describing closure in place (40 CFR 257.102(d)) for the LRCP.

Below is a general summary of how the LRCP will be closed. The permit-level drawings are included in Appendix G. Ditch sizing calculations associated with the permit-level design are included in Appendix H.

3.2. Description of Closure Plan - 257.102(b)(1)(i)

[A narrative description of how the CCR unit will be closed in accordance with this section.]

The intent is to consolidate within the LRCP where possible, grade stored CCR, and close the facility in place. The closure will consist of dewatering the unit through an NPDES-permitted outfall, grading, and construction of an engineered cap.

IDEM's OLQ has requested that the LRCP be closed in accordance with Type I restricted waste site (RWS) standards. Under 329 IAC 10-30-2, final cover must have:

- A maximum projected erosion rate of five tons per acre per year
- A final compacted cover of six inches of topsoil plus a minimum depth of compacted clay of 30 inches:
- Slopes not less than two percent nor greater than 33 percent.

Appendix I includes the final cover soil loss calculations. The final cover consists of a 30-inch cover material layer and six inches of earthen material capable of growing and sustaining native vegetative growth. A geosynthetic membrane liner and geocomposite drainage layer is included below the cover material. The capped surface will be graded to promote surface water runoff, and then seeded and mulched to promote growth of the vegetative cover.

3.3. Closure in Place - 257.102(b)(1)(iii)

[If closure of the CCR unit will be accomplished by leaving the CCR in place, a description of the final cover system, designed in accordance with paragraph (d) of this section, and the methods and procedures to be used to install the final cover.]

Prior to installing the final cover system, the CCR unit will be drained of free water and the material within the unit will be stabilized and graded to provide a stable and suitable subgrade upon which to construct the cap. All water will be managed in the remaining open portion of the pond and discharged through the existing NPDES outfall. The final closure system will consist of a flexible geomembrane liner (FML), that will have a permeability that is less than or equal to the permeability of the natural subsoils, and is no greater than $1x10^{-5}$ cm/sec. FML will be installed directly over the graded CCR material followed by a layer of geocomposite drainage media, 2.5-foot thick cover soil, and 6-inches of earthen material capable of growing and sustaining native vegetative growth. The capped surface will be graded to promote surface water runoff, and then seeded and mulched to promote growth of the vegetative cover.

Piezometers will be installed to monitor water levels within the closed footprint. Wellpoints and sump pumps may be added as needed to drawdown the near surface water to support construction of the proposed final cover system. All pumped water will be returned to the remaining open portion of the pond to be discharged through the existing NPDES outfall.

Stormwater drainage improvements will be implemented during the final closure activities with minor grading of existing channels and construction of new channels to improve drainage of the closed pond. The final cover slope will be a minimum of two percent (2%) and will convey surface water to an NPDES-permitted outfall. Permanent stormwater ditch slopes may vary and will be sized to adequately convey anticipated design storm events.

3.4. Closure Performance Standards - 257.102(d)(1)

3.4.1. Section 257.102(d)(1)(i),(ii),(iii)

[(i)Control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere; (ii) Preclude the probability of future impoundment of water, sediment, or slurry; (iii) Include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period]

Post-closure infiltration of liquids into the waste will be controlled through the design of the site grading plan, construction of an engineered cap system, and establishment of a stormwater management system in accordance with engineering practices. The intent of such a plan is to limit the infiltration of precipitation, cover, control, and prevent the releases of CCRs, and promote positive drainage. CCR materials will be placed and compacted in a manner to minimize settling and subsidence that could affect the integrity of the final cover system prior to cap placement.

Installation and quality control testing of the geosynthetics will be performed as specified by the manufacturer.

Stability analyses were performed as part of the EPA Final CCR Rule's design criteria demonstrations (Stantec, 2016). Stability analyses can be found in Appendix F. Additional analyses have been performed to support the proposed closure configuration and improvements to the LRCP dam.

3.4.2. Section 257.102(d)(1)(iv)

[Minimize the need for further maintenance of the CCR unit.]

The impoundment will be vegetated to prevent erosion. Maintenance of the final cover system will include regularly scheduled inspections to monitor post-closure conditions and preventative maintenance.

3.4.3. Section 257.102(d)(1)(v)

[Be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices.]

The impoundment will be closed in a time frame consistent with recognized and generally accepted good engineering practices. Refer to the schedule below for key milestone dates.

3.5. Draining and Stabilizing the Surface Impoundment

[The owner or operator of a CCR surface impoundment or any lateral expansion of a CCR surface impoundment must meet the requirements of paragraph (d)(2)(i) and (ii) of this section prior to installing the final cover system required under paragraph (d)(3) of this section.]

3.5.1. Section 257.102(d)(2)(i)

[Free liquids must be eliminated by removing liquid wastes or solidifying the remaining wastes and waste residue.]

Free liquid will be removed as part of the final closure of the CCR unit and discharged in a manner consistent with the facility's NPDES permit.

3.5.2. Section 257.102(d)(2)(ii)

[Remaining waste must be stabilized sufficient to support the final cover system.]

The remaining wastes that constitute the subgrade of the final cover system will be stabilized by removal of free liquids and providing bridging material as necessary.

3.6. Final Cover System - 257.102(d)(3)

[If a CCR unit is closed by leaving the CCR in place, the owner or operator must install a final cover system that is designed to minimize infiltration and erosion, and at a minimum, meets the requirements of paragraph (d)(3)(i) of this section, or the requirements of the alternative final cover system specified in paragraph (d)(3)(ii) of this section.

The final cover system must be designed and constructed to meet the criteria in paragraphs (d)(3)(i)(A) through (D) of this section. The design of the final cover system must be included in the written closure plan.]

The final closure system details are included above in Sections 3.2 and 3.3

3.7. Estimate of Maximum CCR Volume - 257.102(b)(1)(iv)

[An estimate of the maximum inventory of CCR ever on-site over the active life of the CCR unit.]

The LRCP is an inactive facility that no longer receives CCR material. The estimated maximum amount of CCR to ever be on-site for the LRCP is approximately 1,900 acre-feet.

3.8. Estimate of Largest Area of CCR Requiring Cover - 257.102(b)(1)(v)

[An estimate of the largest area of CCR unit ever requiring a final cover.]

The area of the proposed final cover system is approximately 57 acres.

3.9. Closure Schedule - 257.102(b)(1)(vi)

[A schedule for collecting all activities necessary to satisfy the closure criteria in the section, including an estimate of the year in which all closure activities for the CCR unit will be completed. The schedule should provide sufficient information to describe the steps that will be taken to close the CCR unit, including identification of major milestones such as coordinating with and obtaining necessary approvals and permits from other agencies, the dewatering and stabilization of the CCR surface impoundment closure, or installation of the final cover system, and the estimated timeframes to complete each step or phase of the CCR unit closure.]

LRCP closure activities will begin upon approval of this permit application. The intent is to complete construction of the cap .

USEPA (2020) has defined a closure schedule process for existing CCR surface impoundments that are considered "unlined" under the CCR Rule. Table 2 provides an approximate closure schedule to meet the required regulation.

Table 2 - Proposed Closure Schedule

Task	Completion Date
Phase 1 construction	End of 2023
Phase 2 construction	Within 5 years of cessation of flows or when technically feasible

4. General Considerations

General considerations for the LRCP closure are presented in the following sections. Subsequent to final closure, IKEC will address environmental concerns and permit obligations that are regulated by other IDEM divisions during the closure process. All demonstrations reflecting the LRCP's compliance with the EPA Final CCR Rule in terms of location restrictions, design criteria, operating criteria, and groundwater monitoring are available on IKEC's public website, www.ovec.com/CCRClifty.php.

The closure design includes two distinct phases of construction. Phase 1 involves the operational drawdown of the existing water surface elevation within the LRCP to a reduced footprint using the existing discharge structure, and construction of a stormwater run-on diversion ditch around the perimeter of the LRCP to divert run-on from the surrounding hillsides directly to a new outfall to the Ohio River. These two steps in Phase 1 will remove water from the LRCP and promote drying of the CCR material in preparation for closure.

Phase 2 involves dewatering the CCR, grading the CCR to subgrade elevations, the installation of the final cover system, and modifications to the existing outfall structure.

In association with the closure of the LRCP, minor modifications will be necessary at the landfill to manage stormwater runoff and leachate flows. This will require the construction of two sediment basins and two leachate collection ponds, and appurtenances. Proposed minor modifications to the existing IDEM landfill permit will be submitted under a separate permit application. For the purposes of this Closure Plan, it is assumed these landfill improvements will be completed prior to commencing LRCP closure construction.

5. Closure Plan Scope of Work

The closure design includes two distinct phases of construction. The following general tasks are anticipated as part of the closure process.

5.1. Phase 1 – Drawdown and Ditch Diversion

Specific activities associated with Phase 1 of the LRCP closure plan include:

- Operational drawdown of the existing water surface elevation within the LRCP to a reduced footprint using the existing discharge structure.
- Construction of a stormwater run-on diversion ditch around the perimeter of the LRCP to divert landfill runoff and run-on from the surrounding hillsides directly to a new outfall to the Ohio River.
- Notification of completion of Phase 1 closure to the IDEM OWQ and OLQ.
- Once Phase 1 construction is complete, the only inflows to the LRCP will be direct precipitation and stormwater run-on. All CCR waste streams will cease no later than 2023.

5.2. Phase 2 – Dewatering and Cover System

Specific activities associated with Phase 2 of the LRCP closure plan include:

- Continued dewatering of the CCR in the LRCP's reduced footprint.
- Re-grading the CCR to design subgrade elevations.
- Construct piezometers to monitor water levels.
- Construct the engineered cap system.
- Establish the access road and vegetation on the site.
- Notification of completion of Phase 2 final closure to the IDEM OWQ and OLQ.

5.3. Cap System

An engineered cap system will be constructed over the LRCP closure area. Appendix G provides the proposed permit drawings, including the cap area and details.

The engineered cap will consist of the following materials, listed in order of construction (from bottom to top):

- 40-mil geomembrane
- Geocomposite drainage layer
- 36 inches of cover soil, of which the top 6 inches are capable of supporting vegetation

The final cap system design will accommodate settling and subsidence so to preserve the cap system's integrity.

5.4. Stormwater Construction Permit

Since more than one acre will be disturbed during the pond closure activities, a Stormwater Notice of Intent (NOI) to discharge stormwater associated with construction activities will be submitted to IDEM OWQ. A Stormwater Pollution Prevention Plan (SWPPP) will be prepared and submitted as required by the NOI along with applicable permit fees. A Notice of Termination (NOT) to terminate the stormwater construction permit will be submitted upon completion of the pond closure.

5.5. Construction Quality Assurance

Construction quality assurance (CQA) plan activities will be finalized as part of the detailed design and prior to construction of each phase of the LRCP closure. Construction observations will be conducted and recorded to document the closure and CQA testing. CQA activities are included in the project Quality Management Plan (QMP). Sections of the QMP will include:

A. Purpose and Scope

B. Responsibility and Authority

C. Quality Control Activities

D. Quality Assurance Activities

E. Material Testing

F. Project Documentation

Appendix J includes a draft QMP. This is proposed as the basis for the final plan to maintain consistency on the site.

5.6. Closure Documentation

Upon completion of approved closure construction activities, a closure report will be prepared by an independent professional engineer registered in the State of Indiana to document the completed construction activities. The closure report will be submitted to IDEM OLQ and OWQ. The letter report will document the source of fill material, amount of fill material used, details regarding cap construction, and final cap elevations.

6. Post-Closure Plan

Post-closure care will be performed in accordance with the Post-closure Plan included as Appendix K.

Estimated Closure and Post-Closure costs are provided in Appendix L.

7. References

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APPENDIX A

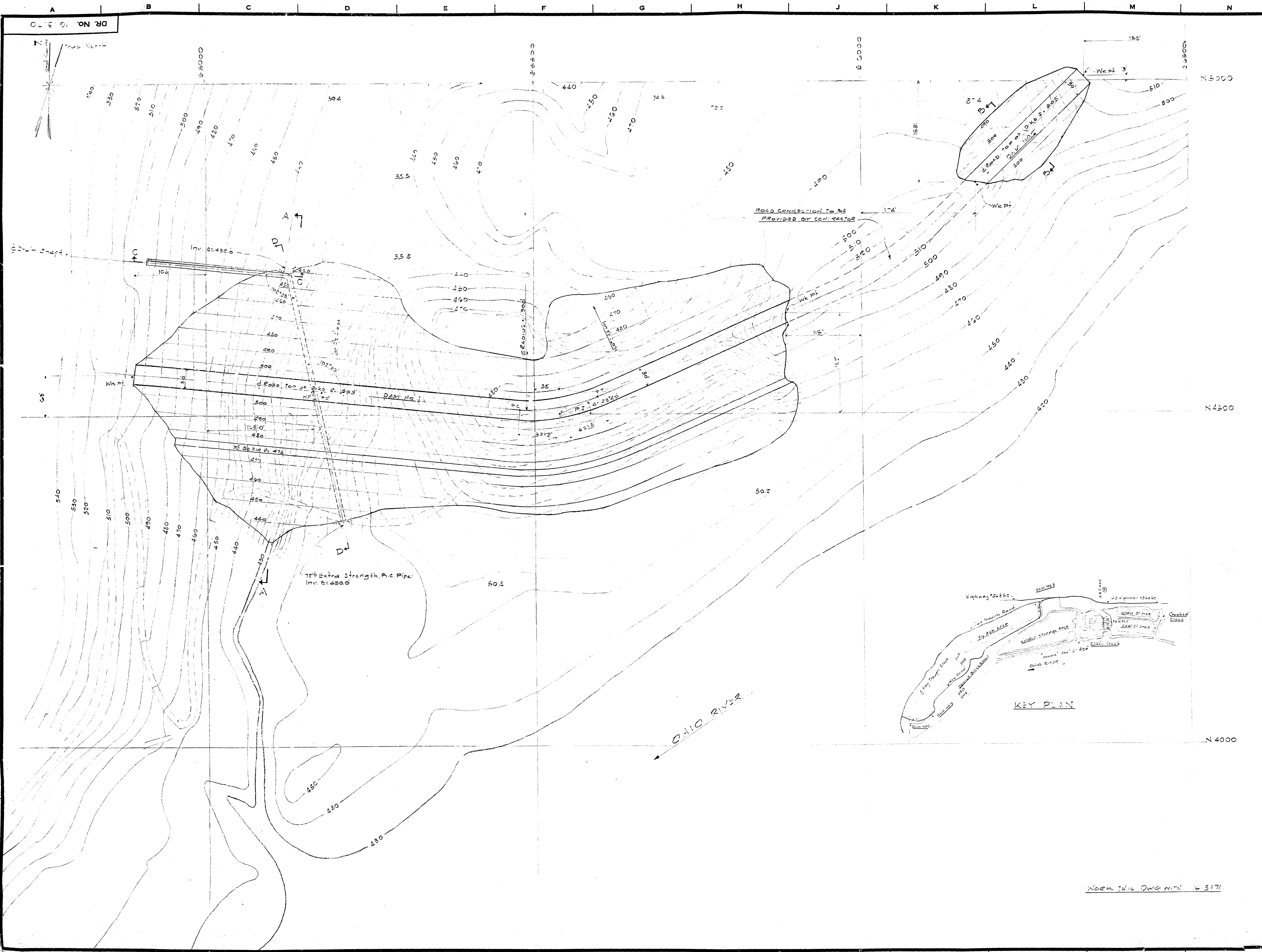
Acronyms and Abbreviations

Acronyms and Abbreviations

AEPSC	American Electric Power Service Corporation
AGES	Applied Geology and Environmental Science, Inc.
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
cm/sec	centimeters per second
CQA	Construction Quality Assurance
DOE	Department of Energy
ELG	Effluent Limitations, Guidelines
FML	flexible membrane liner
H:V	horizontal slope : vertical slope
IAC	Indiana Administrative Code
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
IKEC	Indiana-Kentucky Electric Corporation
LRCP	Landfill Runoff Collection Pond
mW	megawatts
No.	number
NOI	Notice of Intent
NOT	Notice of Termination
NPDES	National Pollutant Discharge Elimination System
OLQ	Office of Land Quality
OWQ	Office of Water Quality
QMP	Quality Management Plan
SWPPP	Stormwater Pollution Prevention Plan
UMA	uppermost aquifer
USEPA	United States Environmental Protection Agency
WBSP	West Boiler Slag Pond

APPENDIX B

As-Built Design Drawings



WORK THIS DWG WITH 16.3171

GENERAL NOTES

For Notes see Dwg. 3171

MATERIAL

Earth Fill { Big Dam 246000
Small Dam 4000
250000 CY

72" ø Conc Pipe .... 400 l.f.

REFERENCE

16.3171 ... Earth Dam Sections

Map of Survey by Gordon R. Neri & Asso.

DATE	No.	DESCRIPTION	APPD.
4.24.56	1	Relocated Drain Shaft & 72" ø Pipe	S.S.

REVISIONS

FLY ASH AREA

LOWER EARTH DAMS No. 1 & 2 PLAN

INDIANA KENTUCKY ELECTRIC CORP.
CLIFTY CREEK PLANT
MADISON INDIANA

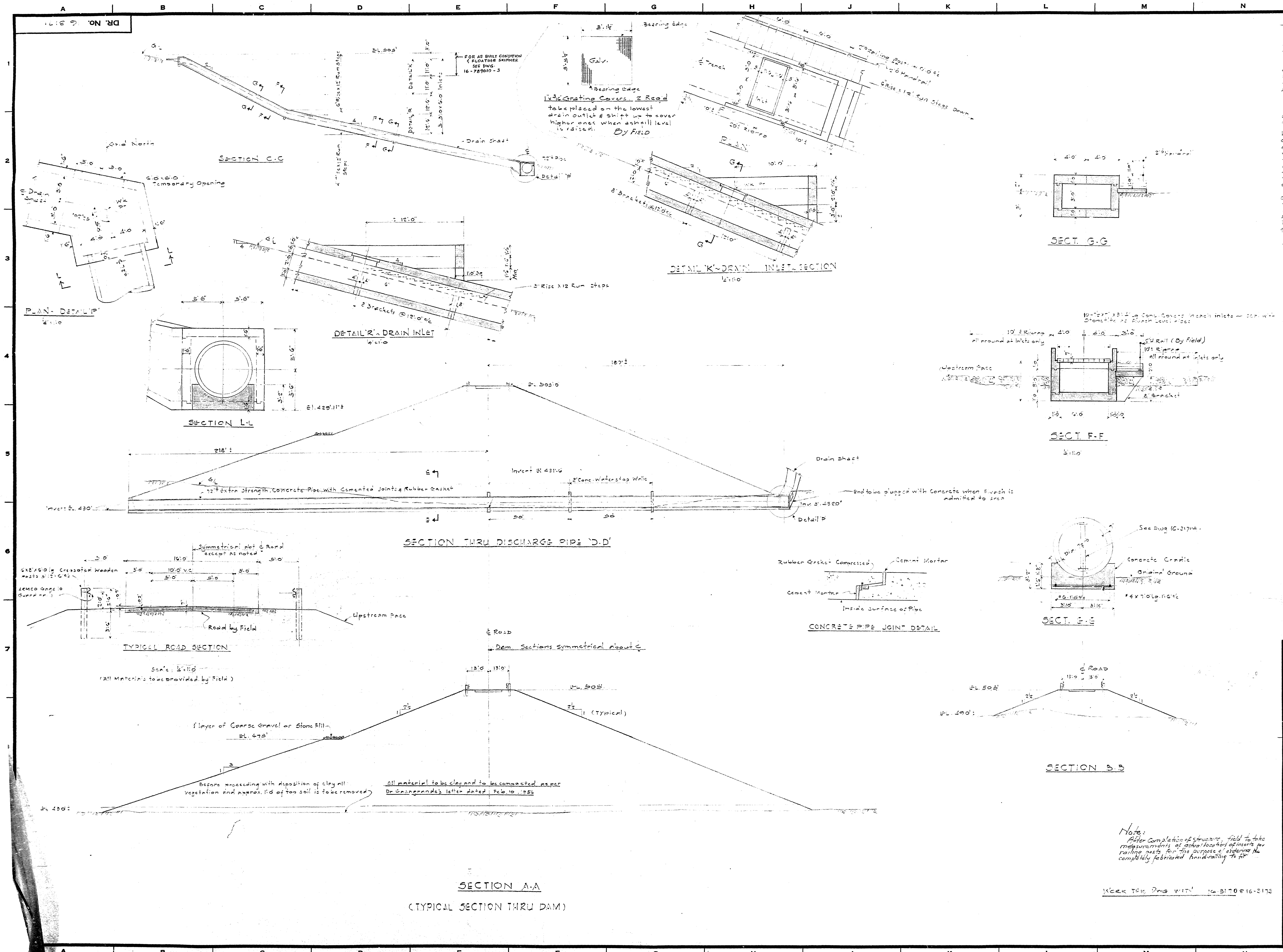
DR. No. 16.3170.1

ARCH. ELEC. MECH. STR.

SCALE 1" = 50'
DR. Ho
CH.
DATE 4.2.56

APPROVED S.S.

AMERICAN GAS & ELECTRIC SERVICE CORP.
30 CHURCH STREET NEW YORK



Note:
After Completion of structure, field to take measurements of actual location of inserts for railing posts for the purpose of ordering the completely fabricated hand-railing to fit

WORK THIS DWG WITH 16-3170 & 16-3173

GENERAL NOTES

Clay should be compacted in layers of 6 in. compacted thickness using six passes with a sheepsfoot roller exerting a foot pressure of at least 300 lbs/sq. in.

If the tamping feet do not walk out at least one half of their height in the course of the application of the six passes, it is an indication that the water content of the clay is too high.

Whenever that happens, such a layer should be scarified, until air drying reduces the water content to a satisfactory degree.

The surface of each layer should be crowned such that rain water can drain readily towards the outside slopes. In addition, whenever a heavy rain threatens the surface should be rolled with a smooth roller to facilitate surface run-off and to reduce the amount of water which will be absorbed by the clay.

A grass cover or other type of vegetative stabilization should be provided on the slopes already during construction and all erosion channels constantly repaired, until a satisfactory state of growth has developed.

For further information see Casagrande's letter of Feb. 10, 1956

Reinforcing Drainshaft Dw. 16-3173
Reinforcing Schedule RS-1 Sht. 1 to 4

References & Notes not shown
See Drg. 16-3170

Reinforcing of drain pipe
See Drg 16-3171-A

DATE	No.	DESCRIPTION	APPD.
10/2/56	4	Added gratings as shown	S.S.
7/2/56	3	Minor revisions stair curb omitted DW	SS
6-15-56	2	Revised Wall Thickness in Det "P" & Sect. L-L	SS
4-24-56	1	Relocated Drain Shaft & 72" Pipe	S.S.

REVISIONS

FLY ASH AREA
LOWER EARTH DAMS SECTS & DETAIL

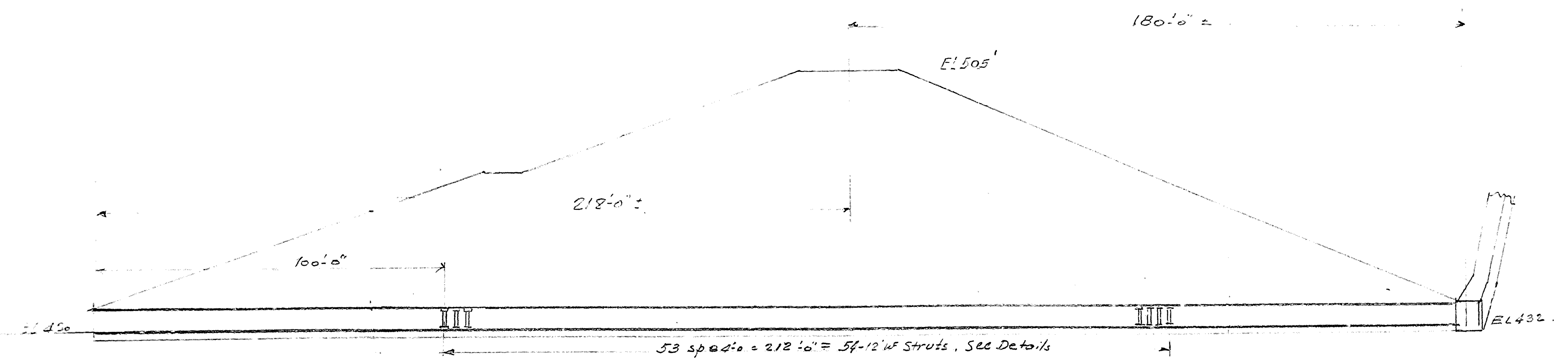
INDIANA KENTUCKY ELECTRIC CORP.
CLIFTY CREEK PLANT
MADISON INDIANA

DR. No. 16-3171-4

ARCH. ELEC. MECH. STR.
SCALE 1"=20' Unless Noted
DR. Hu
CH.
DATE 4.2.56
APPROVED M
Casagrande

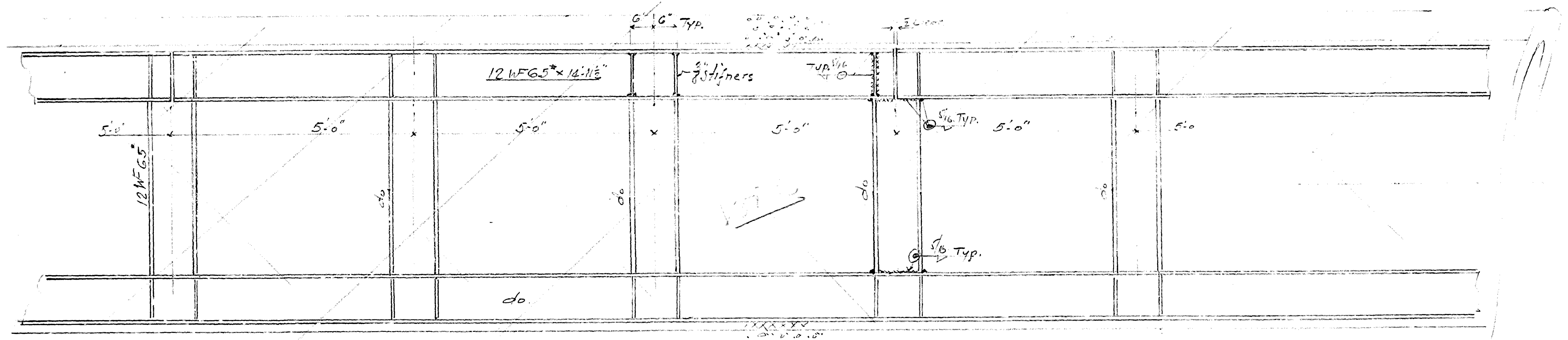
AMERICAN GAS & ELECTRIC SERVICE CORP.
30 CHURCH STREET NEW YORK

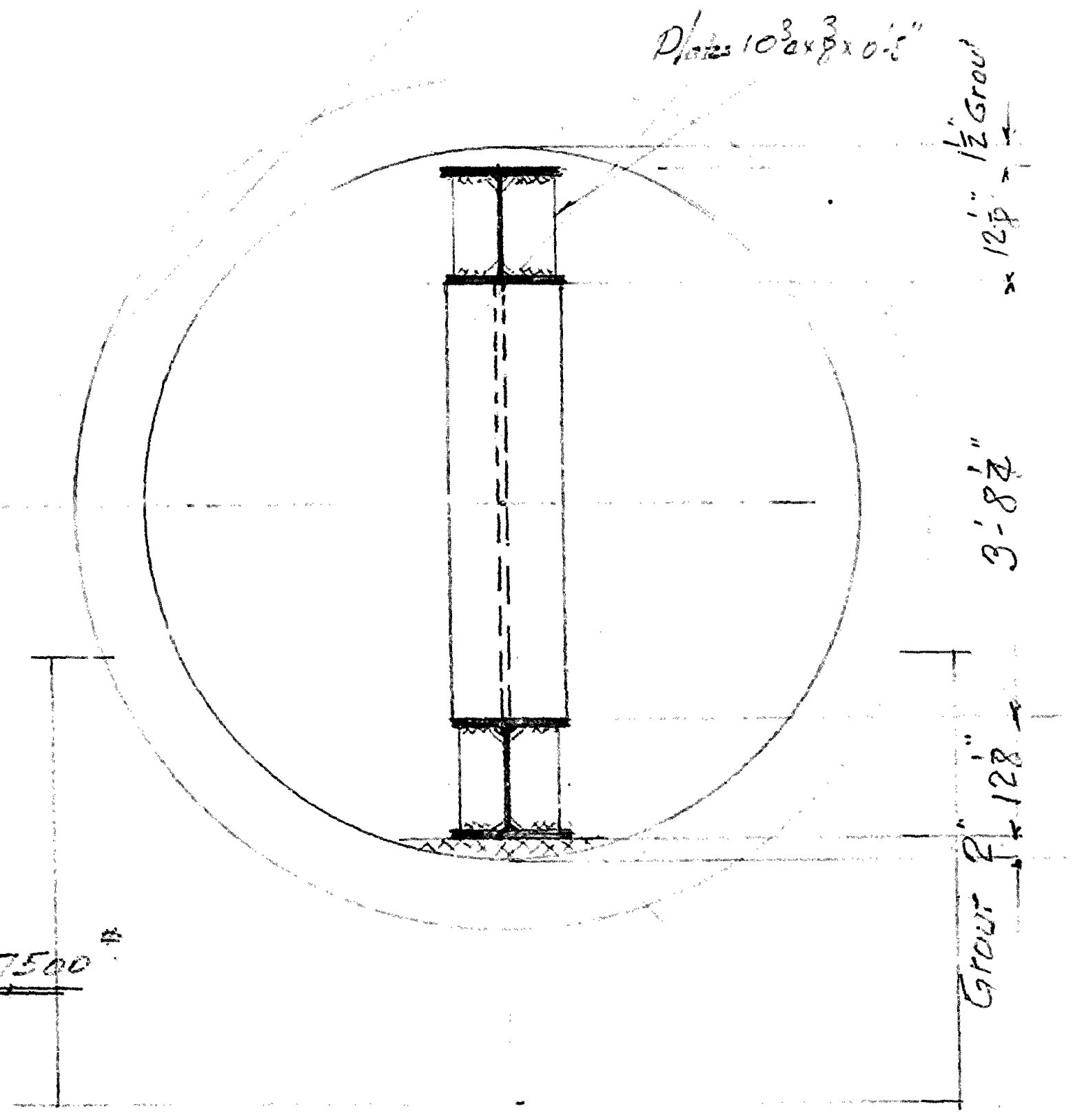
DR. NO. 16-3171A



SECTION THRU DAM AT 6'-0 I.D. DRAIN
SCALE 1" = 20'-0"

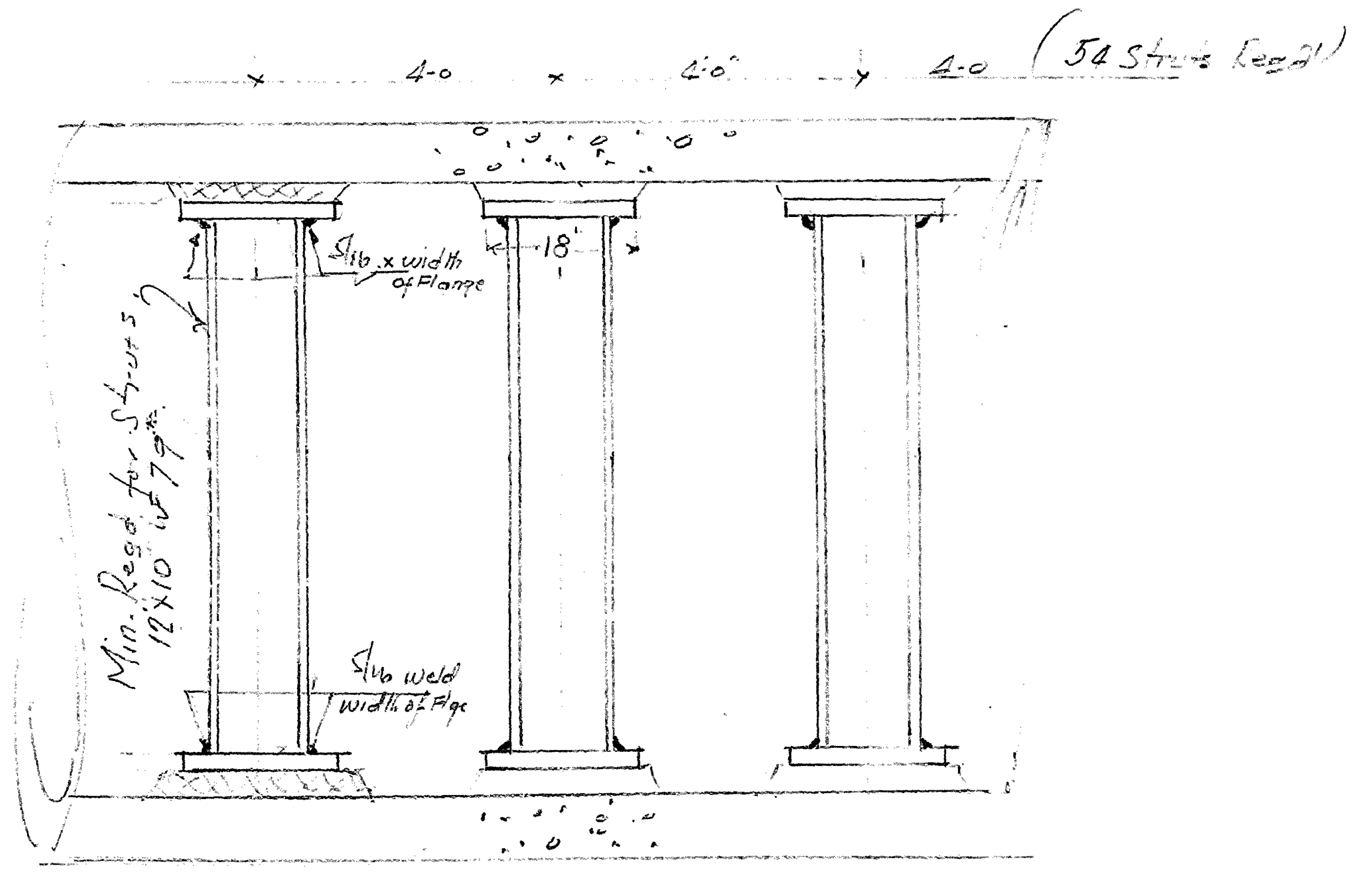
STRUTS TO BE GIVEN ONE (1) COAT OF BITUMASTIC PAINT AND BE LEFT PERMANENTLY IN PLACE.



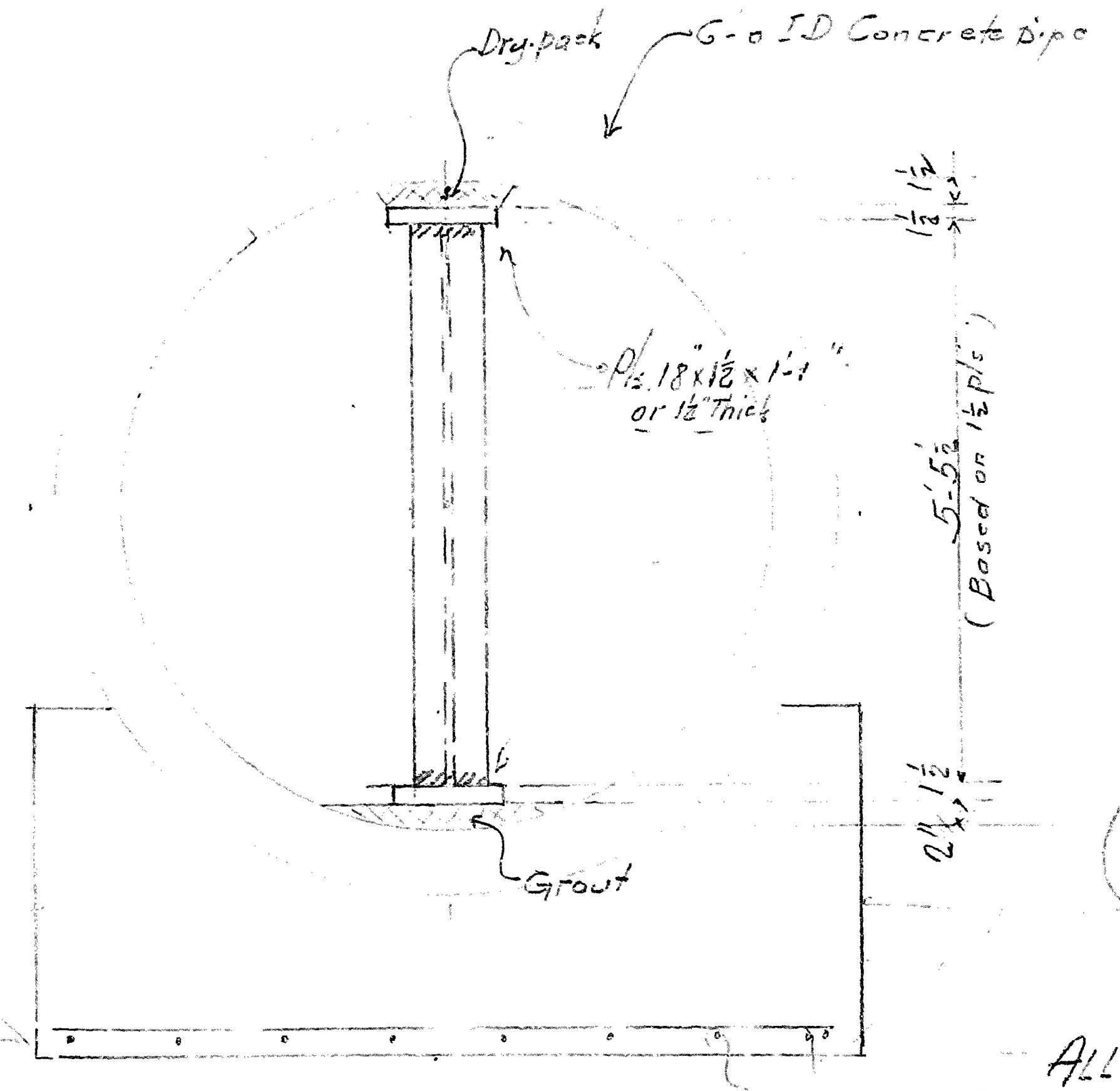


Steel Reqd for 250' Length = 47500#

SCALE 3/4" = 1'-0"



Typical longitudinal Section



SCALE 3/4" = 1'-0.

Wt. Total ± 35000

ALL MATERIAL BY FIELD.

Sect. & detail: of Drainshaft and and 6'-0" I.D. Drain See Drg 16-3171

7/2/56	∴	Added Note & Revised Weight on	S.S
DATE	No.	DESCRIPTION	APPD.

REVISIONS

FLY ASH AREA.
LOWER EARTH DAM
6'-0" DRAIN REINFORCING

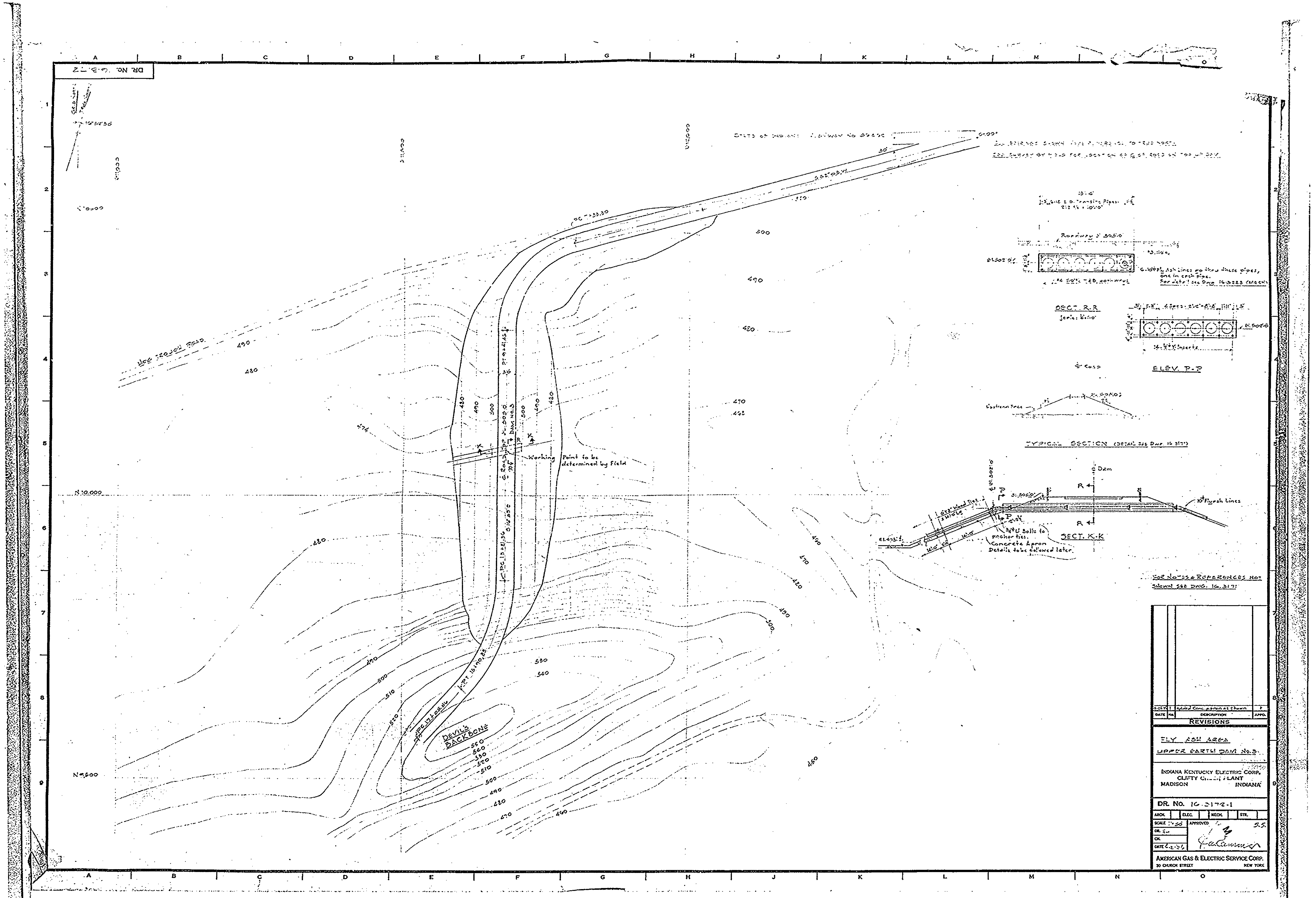
INDIANA KENTUCKY ELECTRIC CORP.
CLIFTY CREEK PLANT
MADISON INDIANA

DR. No. 16-3171A-1

ARCH. ELEC. MECH. STR.

SCALE as Noted
DR. JW
CH.
DATE 6/28/56
APPROVED

AMERICAN GAS & ELECTRIC SERVICE COR
30 CHURCH STREET NEW Y



Added Conc. apron as shown

DATE	NO.	DESCRIPTION	APPD.

REVISIONS

FLY ASH AREA

UPPER EARTH DAM No. 3

INDIANA KENTUCKY ELECTRIC CORP.
CLIFTY CREEK PLANT
MADISON INDIANA

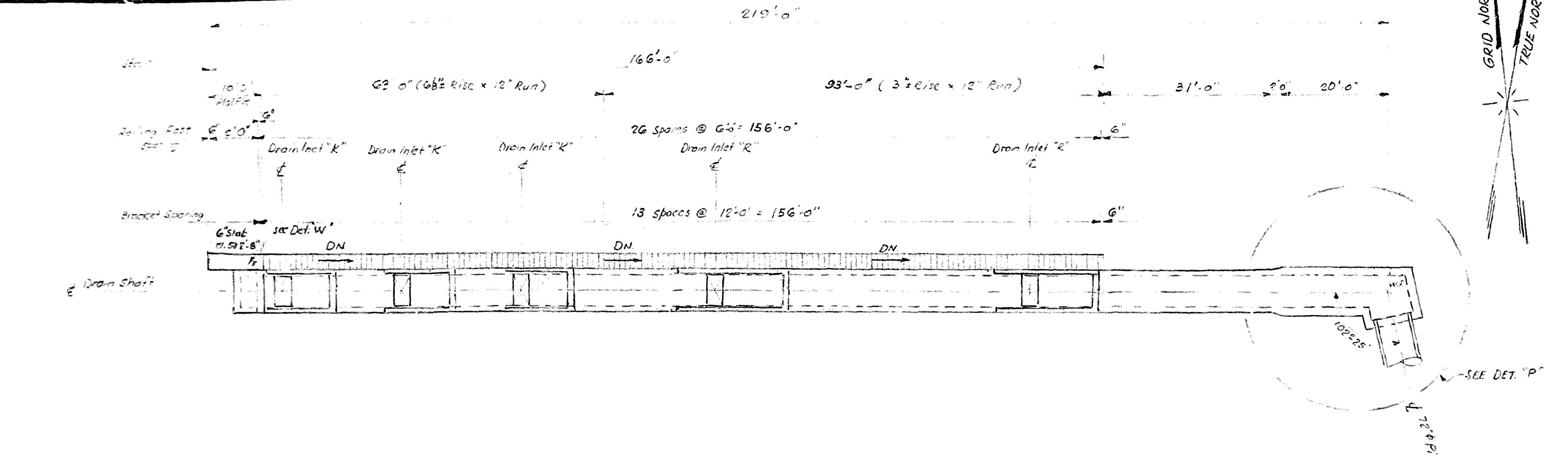
DR. NO. 16-3172-1

ARCH. ELEC. MECH. STR.

SCALE 1"=50'
DR.
CK.
DATE
APPROVED S.S.

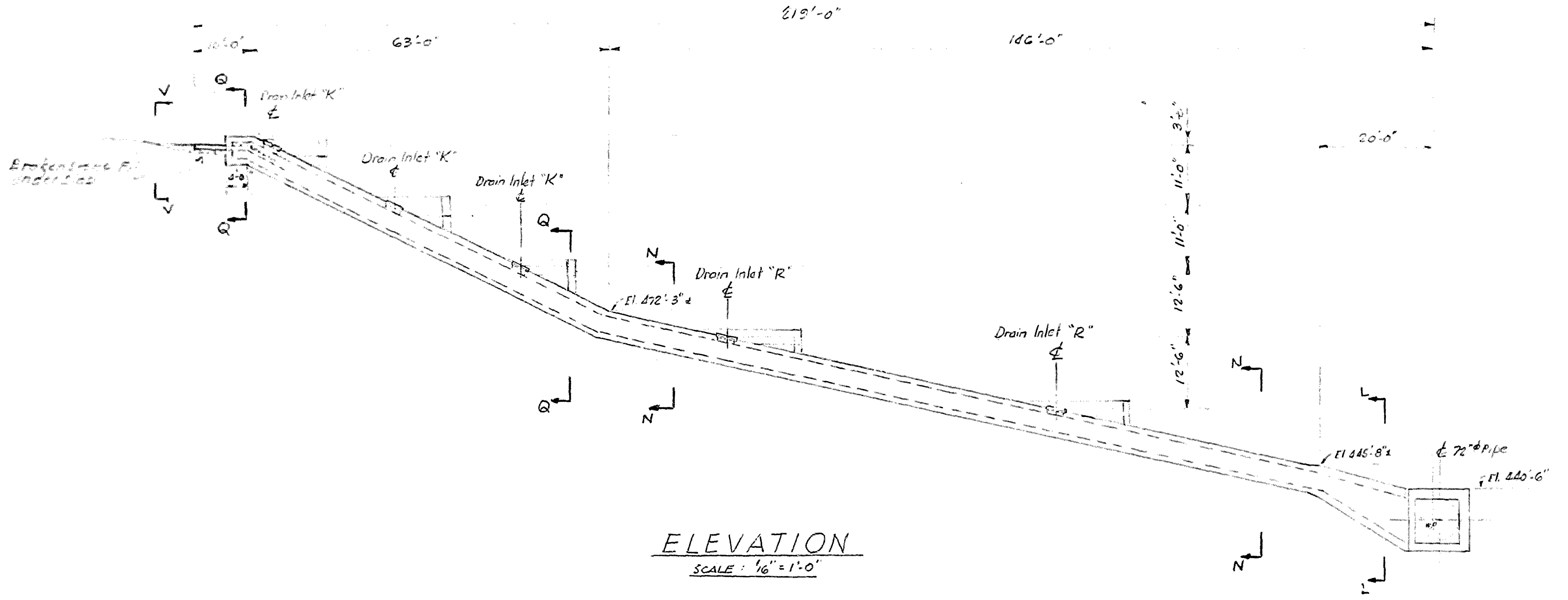
AMERICAN GAS & ELECTRIC SERVICE CORP.
30 CHURCH STREET NEW YORK

DR. No. 16-3173



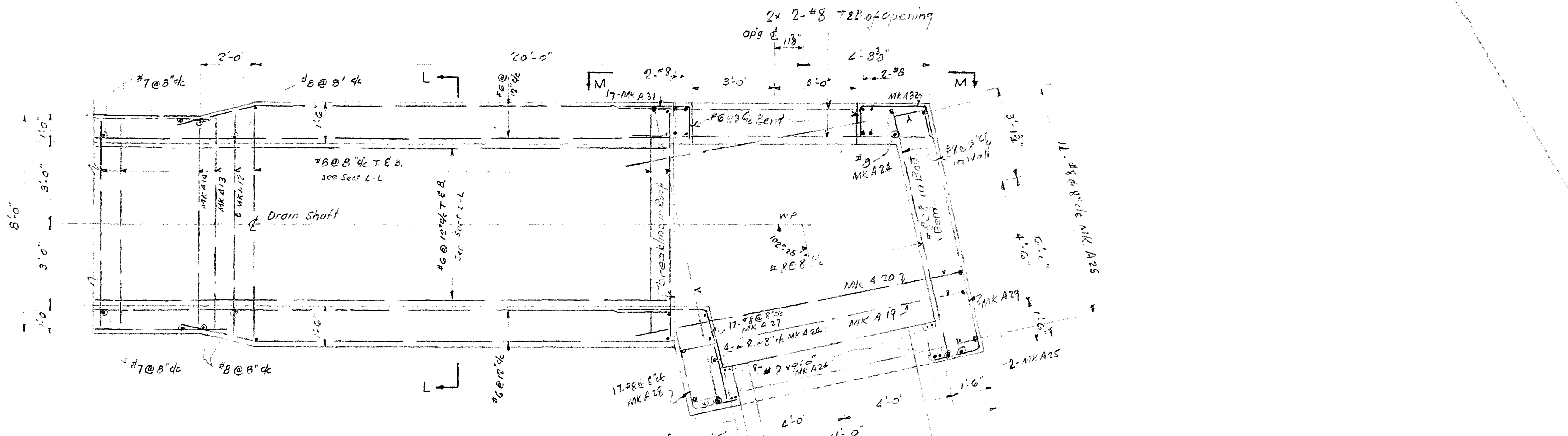
PLAN

SCALE 1/16" = 1'-0"

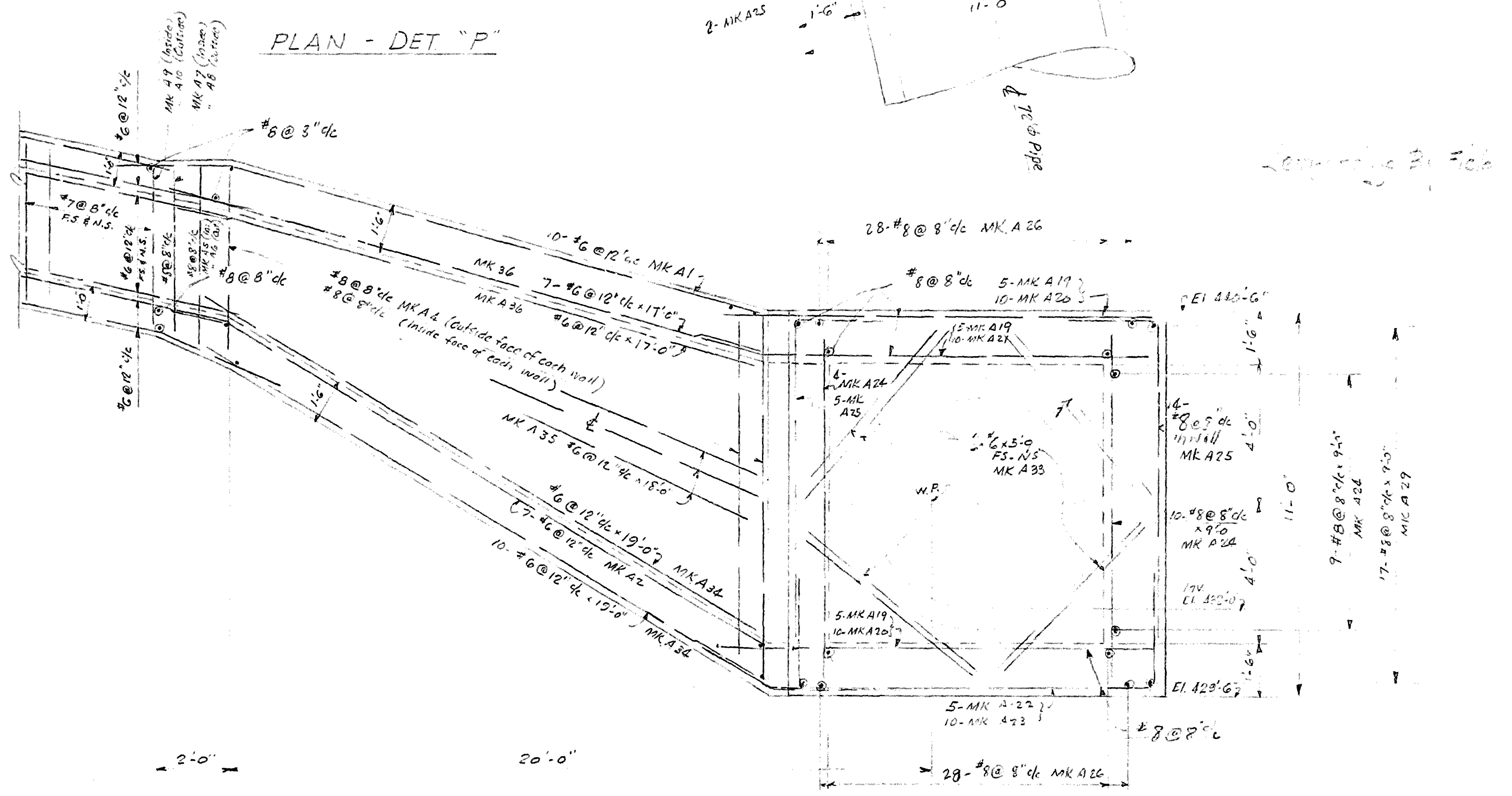


ELEVATION

SCALE 1/16" = 1'-0"

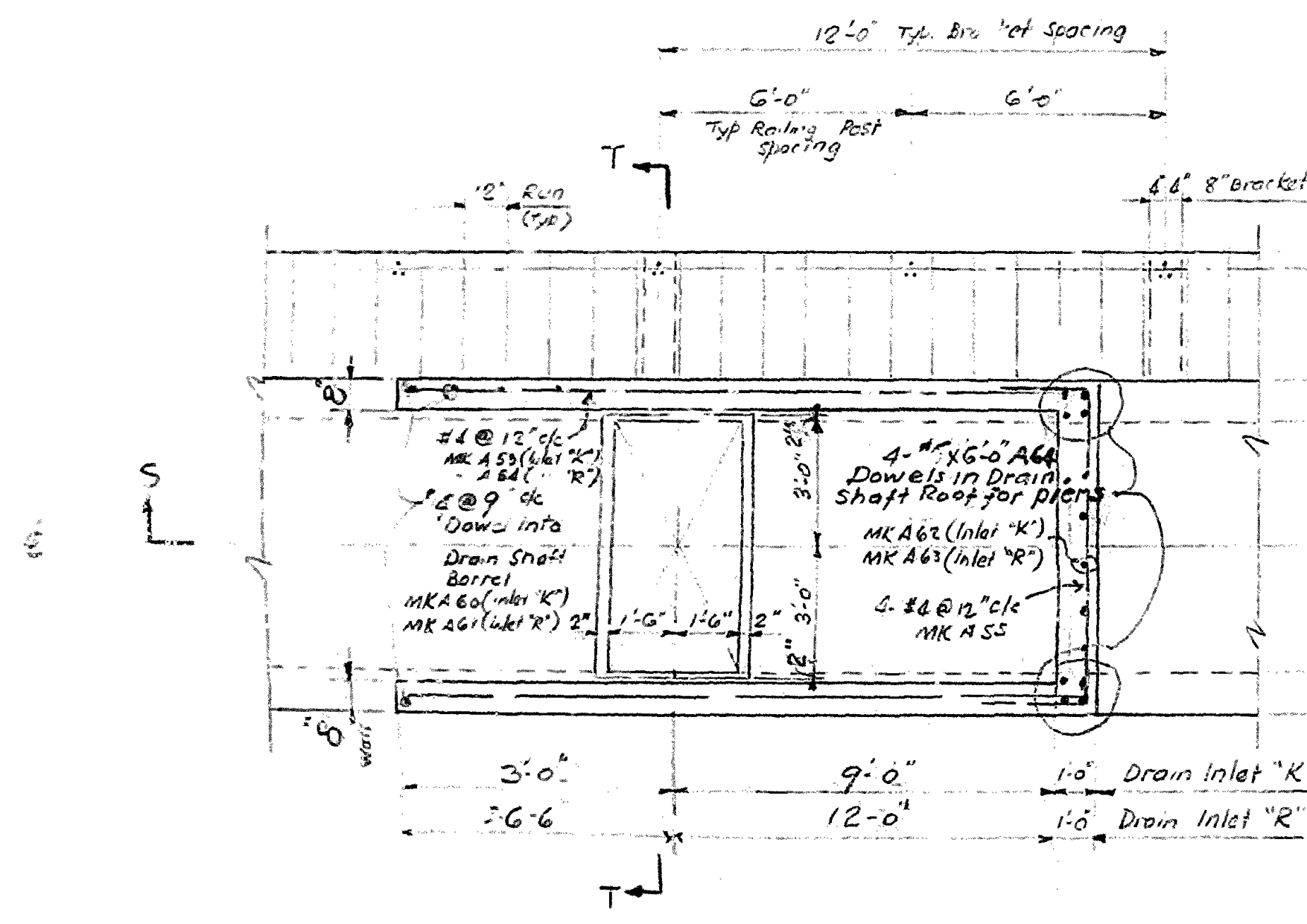


PLAN - DET "P"



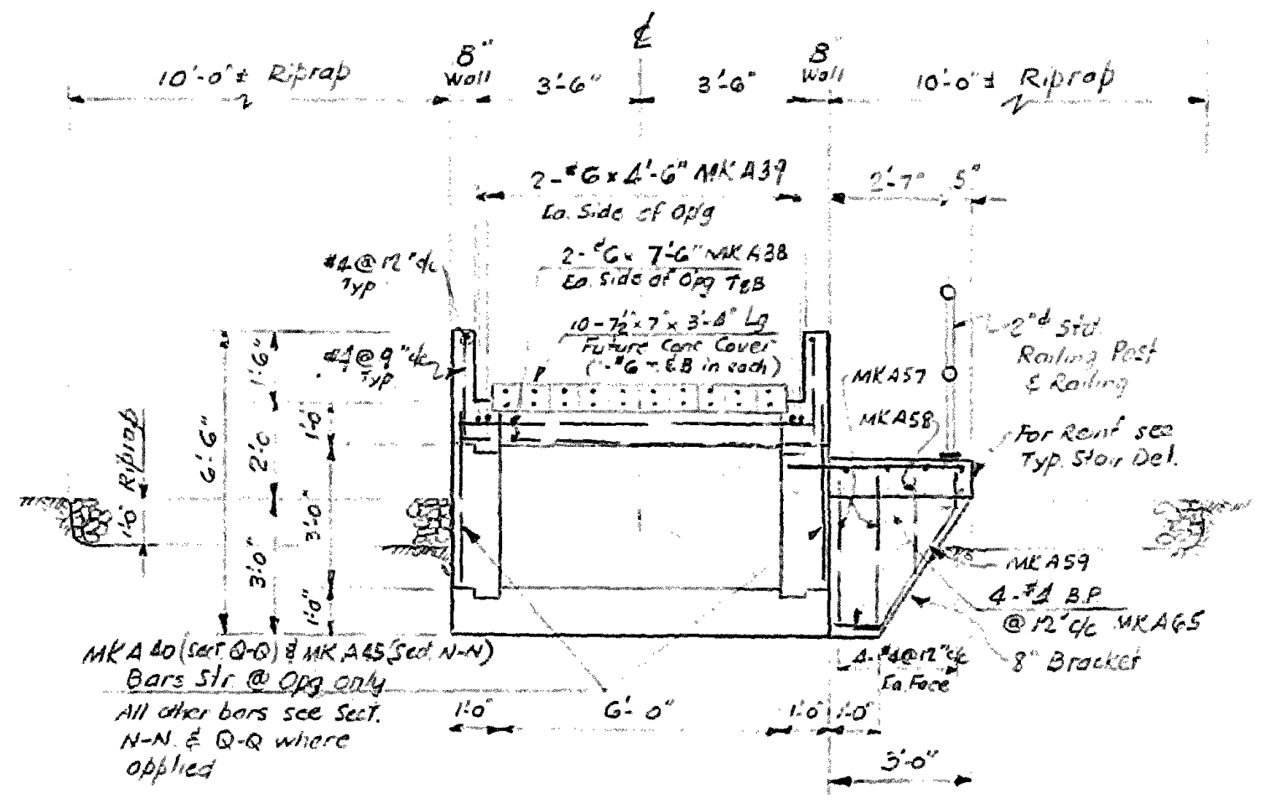
FRONT ELEVATION - DET "P"

SCALE 3/8" = 1'-0"



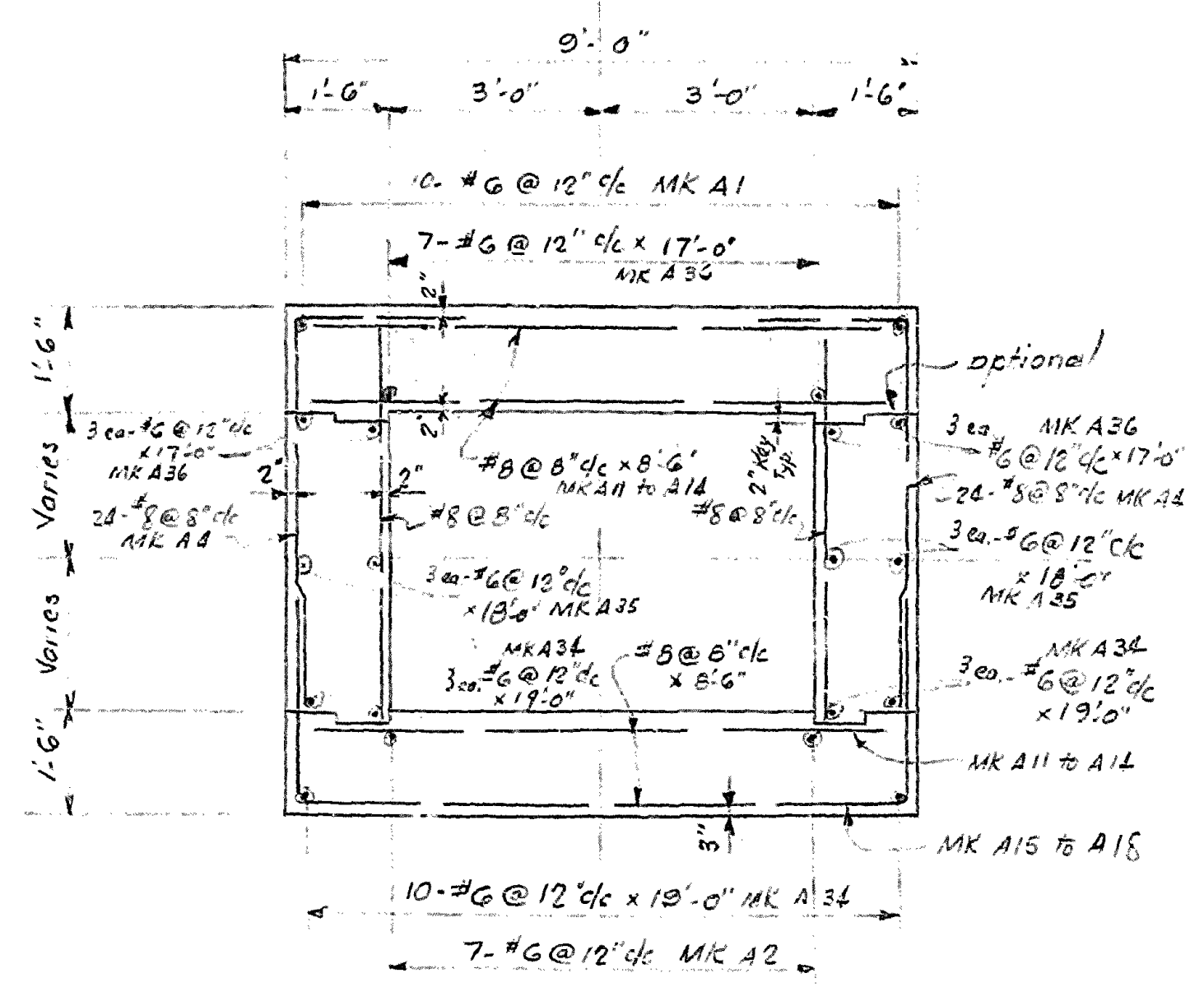
DRAIN INLET "K" & "R"

SCALE 1/4" = 1'-0"



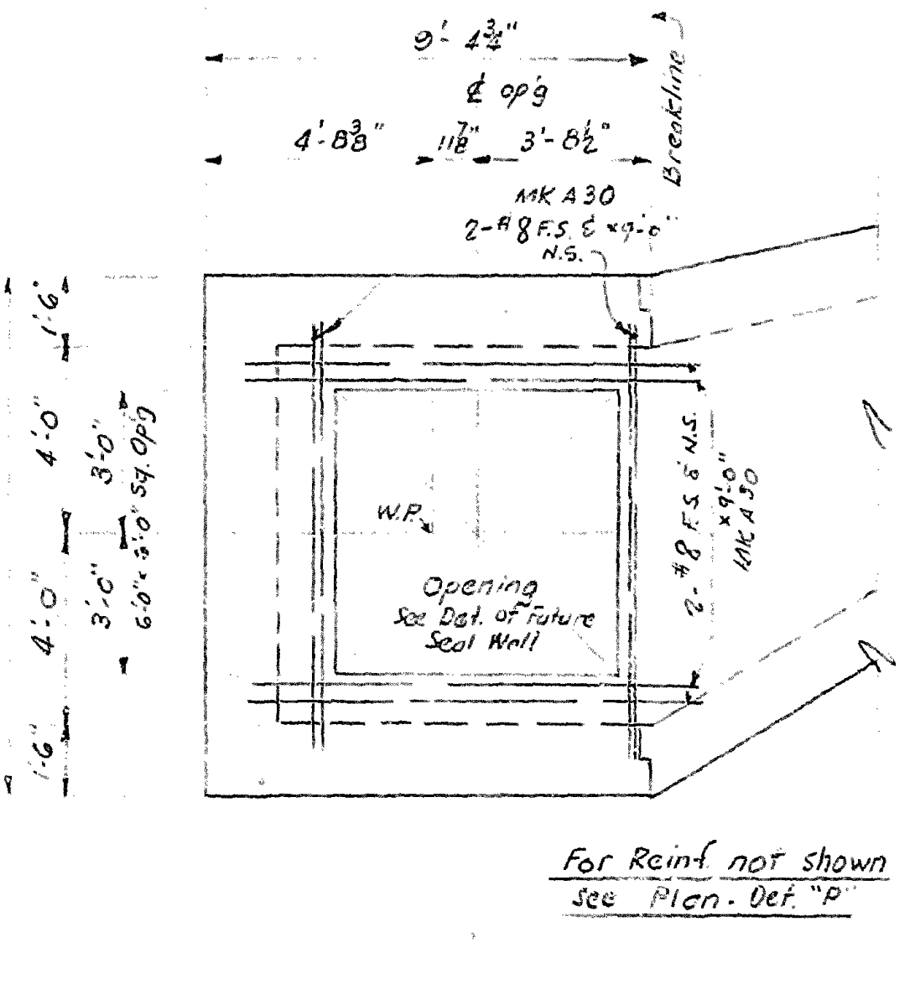
SECTION T-T

SCALE 1/4" = 1'-0"



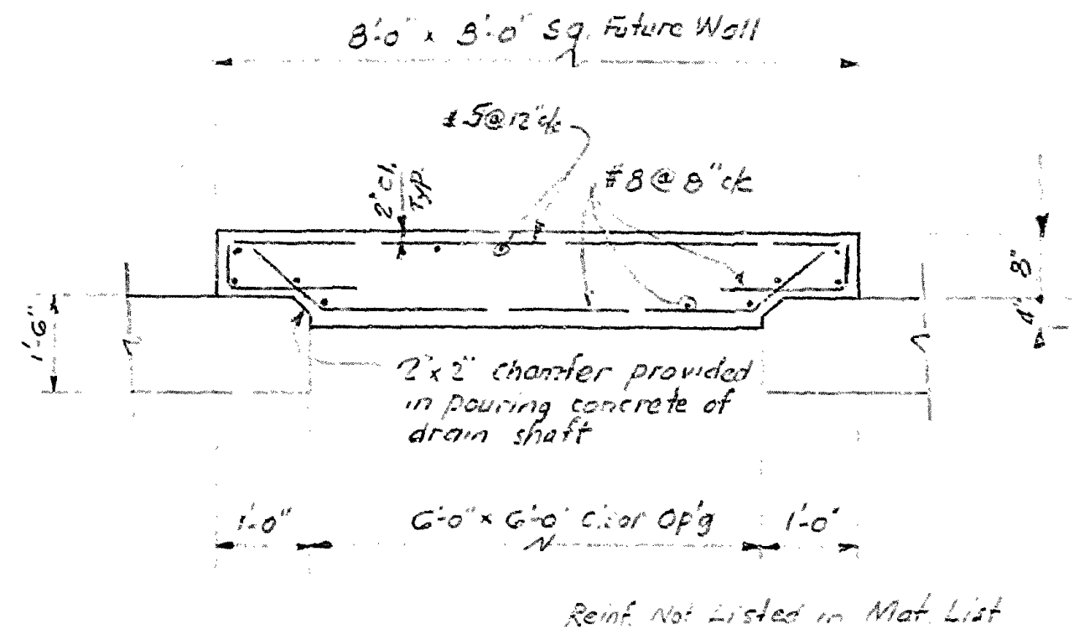
SECTION L-L

SCALE 3/8" = 1'-0"



ELEVATION M-M

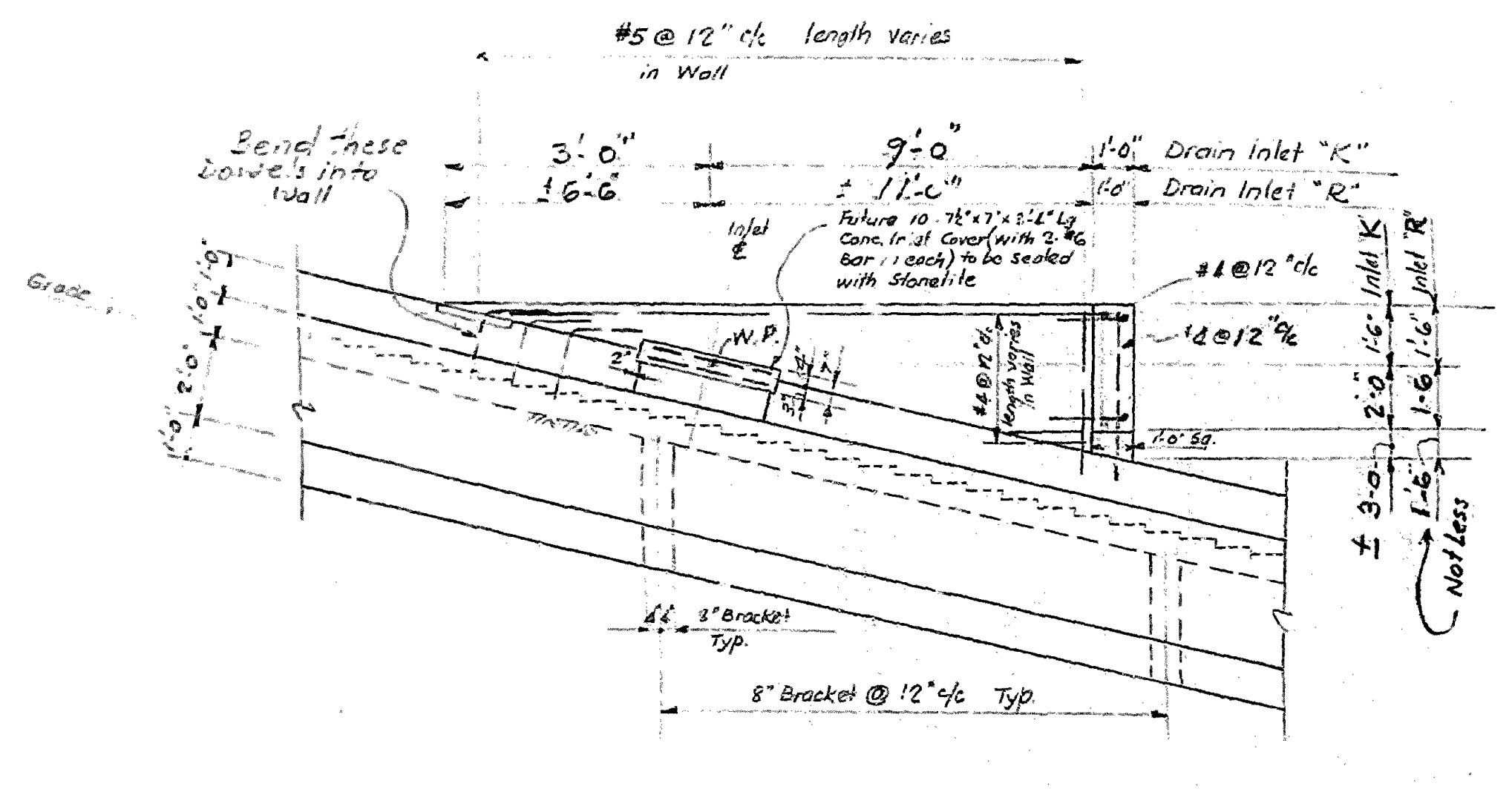
SCALE 1/4" = 1'-0"



DETAIL OF FUTURE SEAL WALL

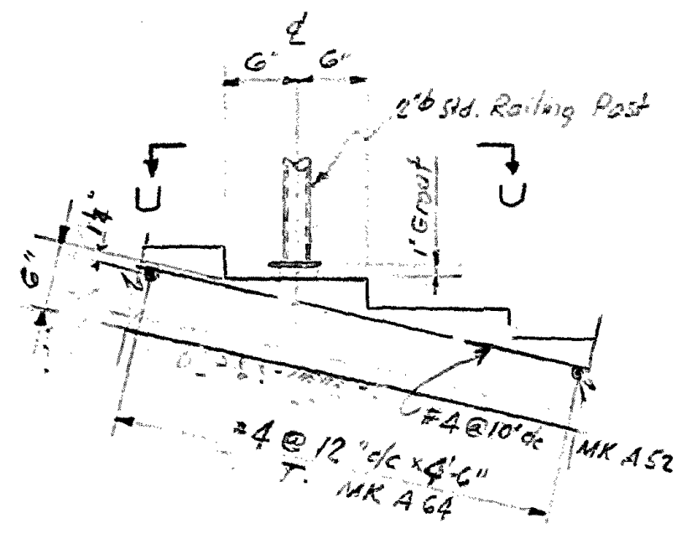
SCALE 1/4" = 1'-0"

DWG 16-3171 - Masonry Details
RS-1 Sht 1 & 2 Reinf. Schedule



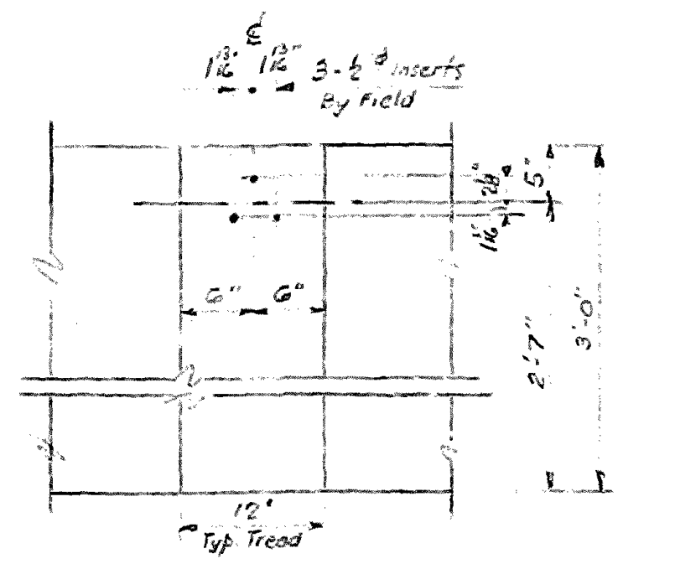
SECTION S-S

SCALE 1/4" = 1'-0"



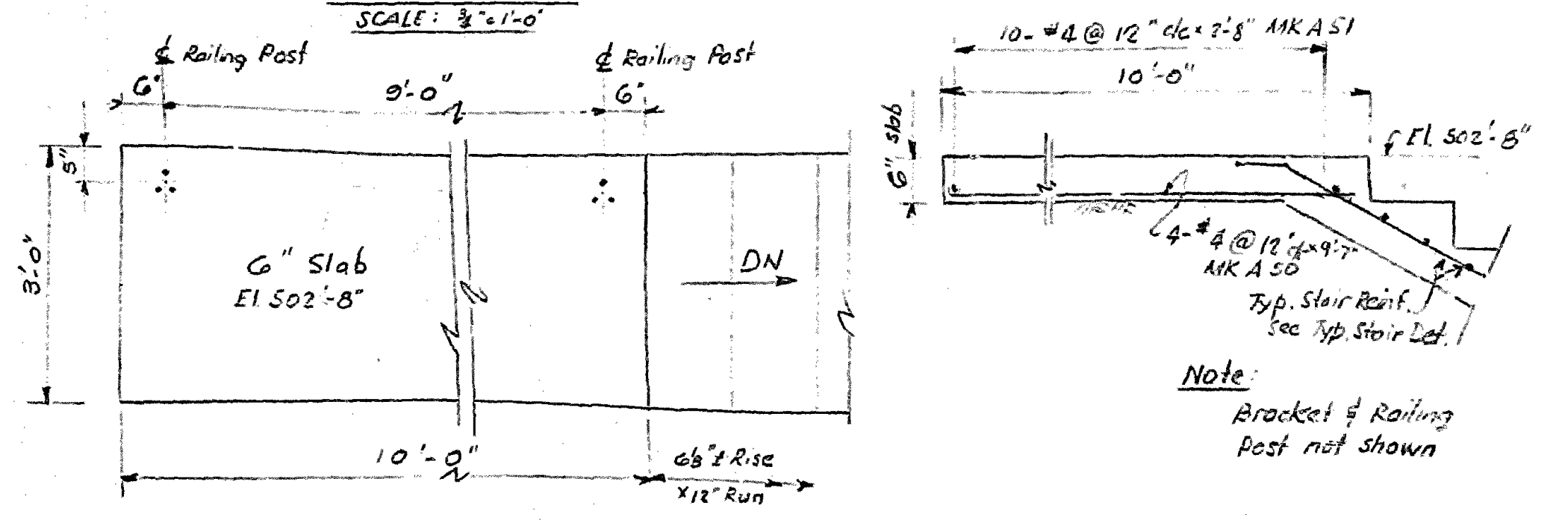
TYP STAIR & RAILING POST DETAIL

SCALE 3/4" = 1'-0"



SECTION U-U

SCALE 3/4" = 1'-0"



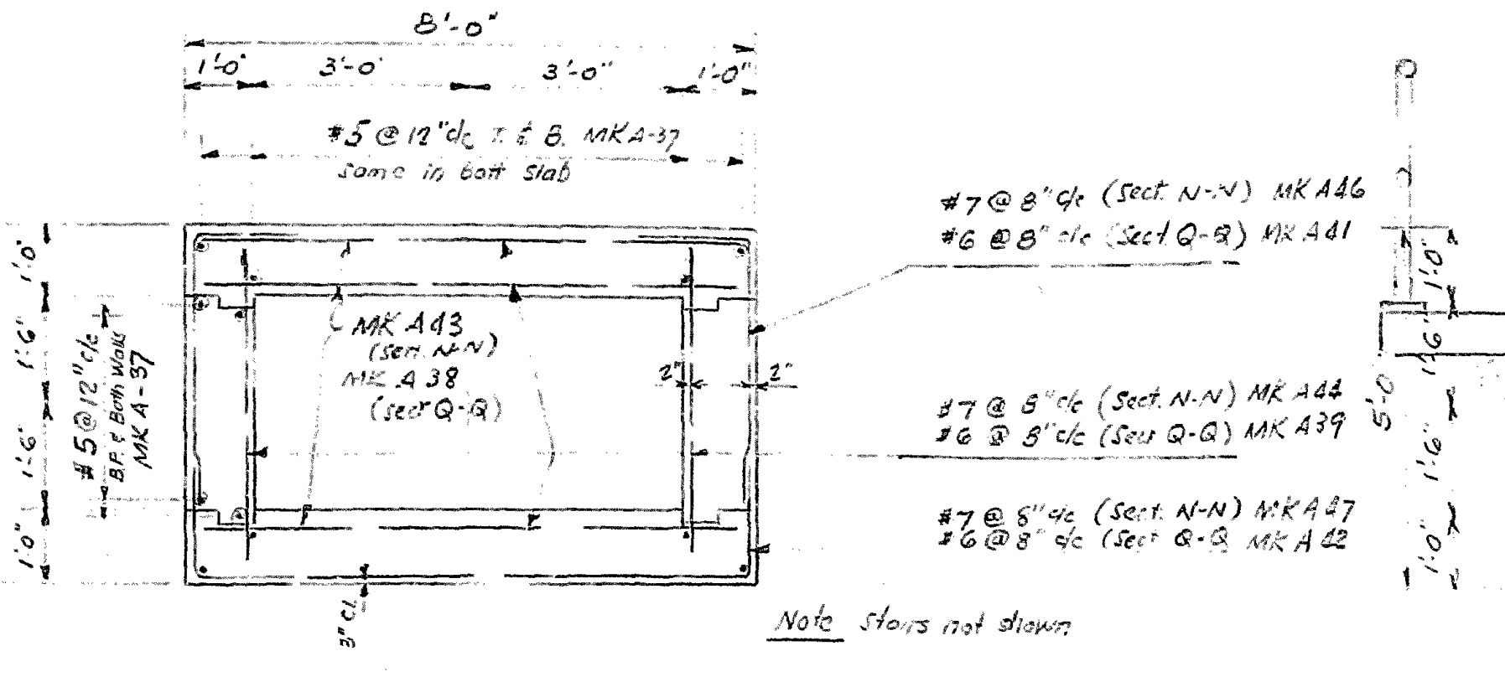
PLAN

SECTION

Note
Bracket & Railing Post not shown

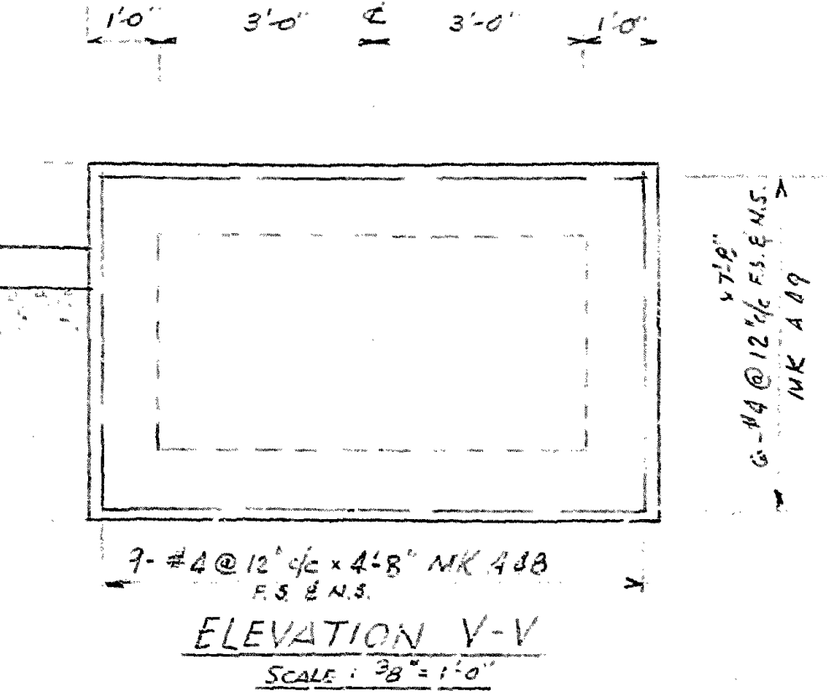
DETAIL "W"

SCALE 1/2" = 1'-0"



SECTION N-N & Q-Q

SCALE 3/8" = 1'-0"



ELEVATION V-V

SCALE 3/8" = 1'-0"

DATE	No.	DESCRIPTION	APPD.

REVISIONS

FLY ASH AREA
LOWER EARTH DAM. - DRAIN SHAFT
REINFORCING DETAILS

INDIANA KENTUCKY ELECTRIC CORP.
CLIFTY CREEK PLANT
MADISON INDIANA

DR. No. 16-3173

ARCH. | ELEC. | MECH. | STR.

SCALE AS NOTED
DR. J.S.
CH. JW
DATE 7/2/56

APPROVED E M Fakanmer

AMERICAN GAS & ELECTRIC SERVICE CORP.
30 CHURCH STREET NEW YORK

APPENDIX C

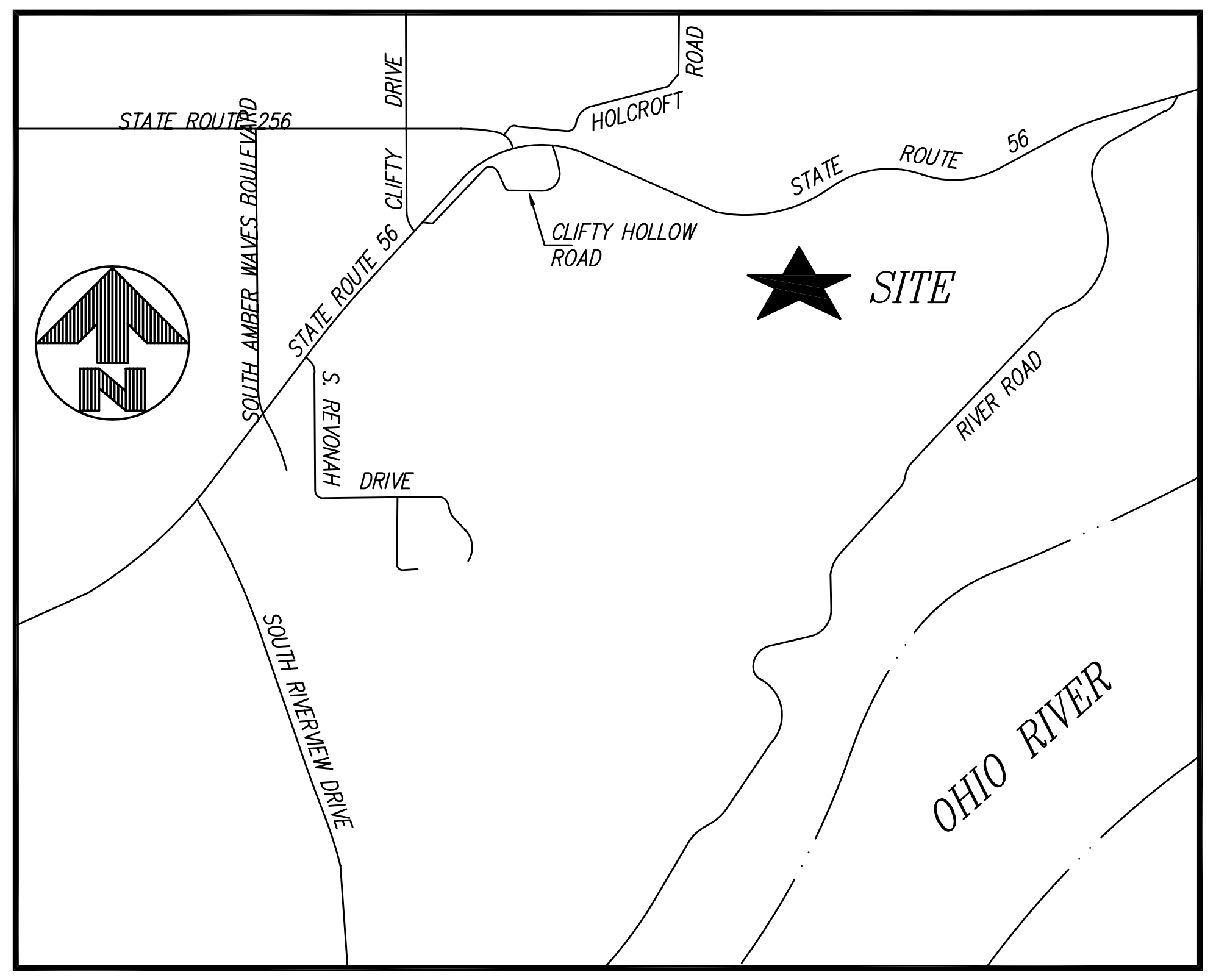
Boundary Survey

LEGEND

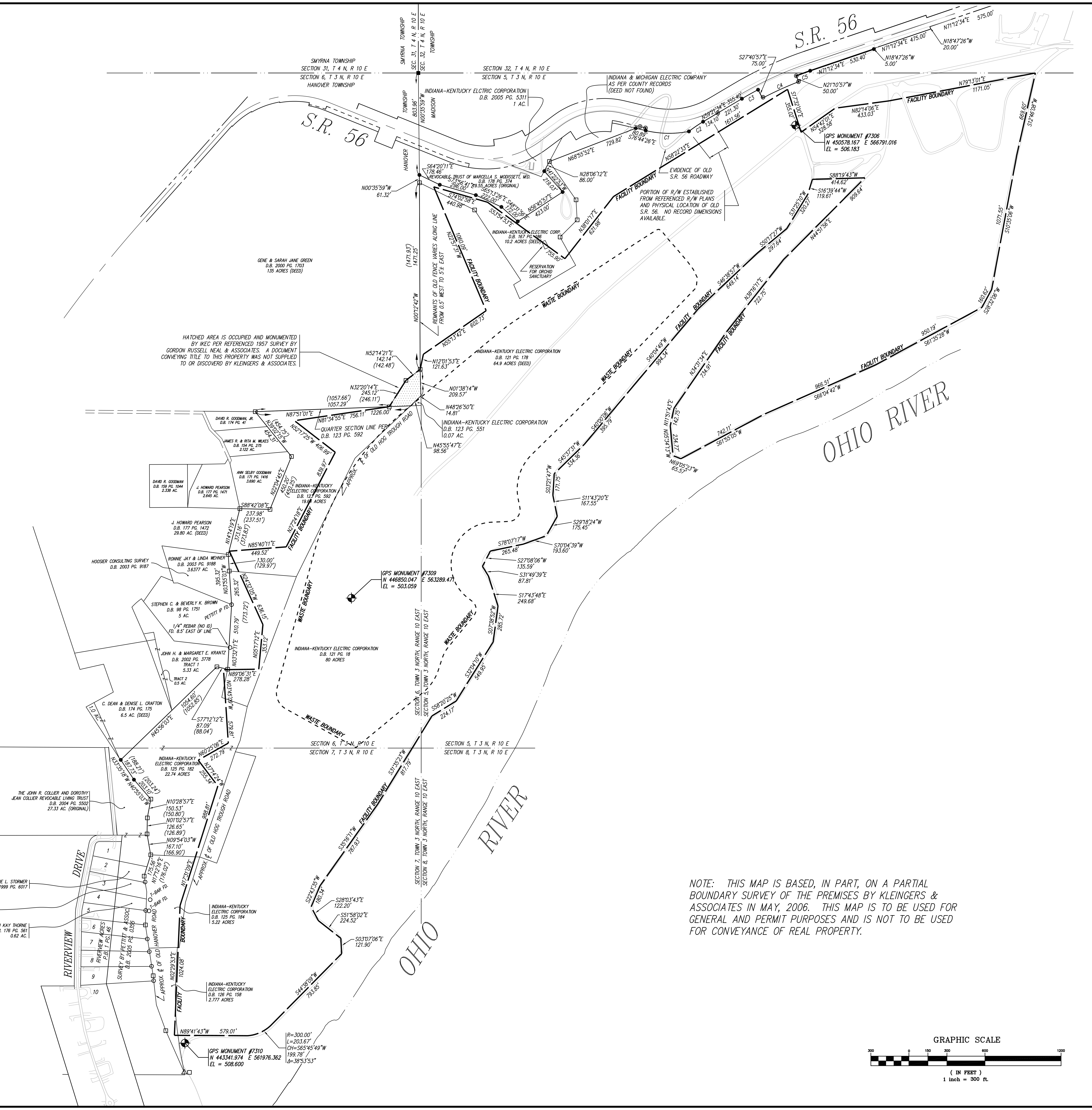
- ● 5/8" REBAR SET
- ○ 5/8" REBAR FOUND UNLESS NOTED OTHERWISE
- ◎ CONCRETE R/W MARKER FOUND
- △ RAILROAD SPIKE FOUND
- ▲ RAILROAD SPIKE SET
- ☐ CONCRETE MONUMENT WITH BRASS PLUG FOUND (SET PER 1957 NEAL SURVEY)
- ■ STONE FOUND

NORTH

CURVE	LENGTH	RADIUS	DELTA	CHORD	
C1	343.16'	806.20'	24°23'16"	S88°56'04"E	340.57'
C2	135.55'	1054.46'	7°21'55"	N55°40'37"E	135.46'
C3	146.10'	2829.79'	2°57'29"	N60°50'19"E	146.08'
C4	312.52'	2754.79'	6°30'00"	N65°34'03"E	312.35'
C5	117.09'	2804.79'	2°23'31"	N70°00'49"E	117.09'



VICINITY MAP
N.T.S.



NOTE: THIS MAP IS BASED, IN PART, ON A PARTIAL BOUNDARY SURVEY OF THE PREMISES BY KLEINGERS & ASSOCIATES IN MAY, 2006. THIS MAP IS TO BE USED FOR GENERAL AND PERMIT PURPOSES AND IS NOT TO BE USED FOR CONVEYANCE OF REAL PROPERTY.

GENERAL NOTES:

1.) PHYSICAL FEATURES, DRIVES, BUILDINGS, WATER COURSES, ETC. ARE BASED ON A COMBINATION OF FIELD LOCATIONS AND AERIAL PHOTOGRAPHIC MAPPING SUPPLIED BY THE CLIENT.
2.) SECTION LINES ARE SHOWN FOR REFERENCE ONLY. SECTION LINES AND CORNERS WERE NOT RETRACED PER THIS SURVEY.
3.) BEARINGS ARE BASED ON THE INDIANA STATE PLANE COORDINATE SYSTEM, NAD '27, AS PER COORDINATES OF THE PLANT MONUMENTS SHOWN HEREON.
4.) INTERIOR PLANT PARCEL LINES NOT SHOWN IN FULL.
5.) REFERENCES USED INCLUDE INDIANA STATE HIGHWAY COMMISSION, F.A. PROJECT NO. 212 SEC. C PAVING PLANS FOR S.R. 56, DATED AUGUST, 1930 AND ADDITIONAL IMPROVEMENT PLANS DATED 1957.
6.) ADDITIONAL REFERENCE DATA INCLUDES A "REVISED BOUNDARY SURVEY – CLIFTY CREEK POWER PLANT SITE" AS PERFORMED BY GORDON RUSSELL NEAL & ASSOCIATES, DATED JULY, 1957.
7.) EASEMENTS OF RECORD NOT SHOWN.

FACILITY BOUNDARY / WASTE BOUNDARY MAP
INDICATING A PORTION OF THE LANDS OF
INDIANA – KENTUCKY ELECTRIC CORPORATION
SECTIONS 5, 6 & 7, TOWN 3 NORTH, RANGE 10 EAST
SECTION 32, TOWN 4 NORTH, RANGE 10 EAST
MADISON & HANOVER TOWNSHIPS JEFFERSON COUNTY, INDIANA

REVISIONS

KLEINGERS
& ASSOCIATES
ENGINEERS AND SURVEYORS
6305 Centre Park Drive, West Chester, OH 45069
(513) 779-7851 Fax: (513) 779-7852

DAVID L. COX
No. 890008

SCALE: 1"=300'
DATE: 11/22/06
DRAWN: DLC
DESIGNED: .
CHECKED: DLC
XREF:
JOB NO.: 060192VB
IN-KY ELECTRIC CORP
Page 1 Of 1

KLEINGERS
& ASSOCIATES
ENGINEERS AND SURVEYORS

November 22, 2006

LEGAL DESCRIPTION
INDIANA – KENTUCKY ELECTRIC CORPORATION
FACILITY BOUNARY
357.74 ACRES

Situated in Section 5, Town 3 North, Range 10 East, Madison Township and in Sections 6 and 7, Town 3 North, Range 10 East, Hanover Township, Jefferson County, Indiana and being part of the lands conveyed to Indiana-Kentucky Electric Corporation and being more particularly described as follows:

Commencing at a stone found at the northwest corner of said Section 5 and the northeast corner of said Section 6;

Thence along the westerly line of Section 5 and the easterly line of Section 6, also being the line between Madison and Hanover Townships, S00°35’59”E a distance of 803.96 feet;

Thence continuing along said section line, S00°12’42”E a distance of 1471.25 feet to a concrete monument found at the true Point of Beginning;

Thence along the lines or through the lands of the Indiana-Kentucky Electric Corporation the following sixty five (65) courses:

1) N12°01'53"E a distance of 121.63 feet;
2) N55°13'42"E a distance of 602.73 feet;
3) N22°57'31"W a distance of 1060.09 feet;
4) S74°02'58"E a distance of 440.98 feet;
5) S53°54'53"E a distance of 755.90 feet;
6) N38°01'17"E a distance of 621.98 feet;
7) N58°22'33"E a distance of 1611.56 feet;
8) S17°32'00"E a distance of 355.02 feet;
9) N54°42'01"E a distance of 328.58 feet;
10) N82°14'06"E a distance of 433.03 feet;
11) N79°13'01"E a distance of 1171.05 feet;
12) S12°46'08"W a distance of 669.60 feet;
13) S10°35'06"W a distance of 1071.55 feet;
14) S28°32'06"W a distance of 160.62 feet;
15) S61°35'28"W a distance of 950.19 feet;
16) S66°04'42"W a distance of 966.51 feet;
17) S61°55'05"W a distance of 742.11 feet;
18) N69°05'23"W a distance of 65.57 feet;
19) N05°34'13"W a distance of 234.77 feet;

20) N11°51'43"E a distance of 142.75 feet;
21) N34°31'34"E a distance of 734.91 feet;
22) N38°16'11"E a distance of 722.75 feet;
23) N44°51'56"E a distance of 909.64 feet;
24) S88°19'43"W a distance of 414.62 feet;
25) S16°39'44"W a distance of 119.61 feet;
26) S31°25'10"W a distance of 320.27 feet;
27) S50°17'27"W a distance of 297.64 feet;
28) S46°38'57"W a distance of 649.14 feet;
29) S40°04'49"W a distance of 994.34 feet;
30) S40°00'06"W a distance of 395.79 feet;
31) S45°37'31"W a distance of 334.36 feet;
32) S03°21'47"W a distance of 171.75 feet;
33) S11°43'20"E a distance of 167.55 feet;
34) S29°18'24"W a distance of 175.45 feet;
35) S70°04'39"W a distance of 193.60 feet;
36) S78°07'17"W a distance of 265.48 feet;
37) S27°08'06"W a distance of 135.59 feet;
38) S31°49'39"E a distance of 87.81 feet;
39) S17°43'48"E a distance of 249.68 feet;
40) S07°38'52"W a distance of 285.72 feet;
41) S32°04'10"W a distance of 549.95 feet;
42) S58°20'25"W a distance of 224.17 feet;
43) S31°35'23"W a distance of 817.79 feet;
44) S35°16'11"W a distance of 787.93 feet;
45) S22°43'35"W a distance of 180.34 feet;
46) S28°03'43"E a distance of 122.20 feet;
47) S51°58'02"E a distance of 224.52 feet;
48) S03°07'06"E a distance of 121.90 feet;
49) S44°38'09"W a distance of 793.85 feet;
50) Along a curve to the right, an arc distance of 203.67 feet, said curve having a central angle of 38°53'53", a radius of 300.00 feet, and a chord bearing S65°45'49"W for 199.78 feet;
51) N89°41'43"W a distance of 579.01 feet;
52) N02°29'53"E a distance of 1024.08 feet;
53) N17°31'09"E a distance of 988.81 feet;
54) N37°14'24"W a distance of 255.34 feet;
55) N60°25'06"E a distance of 272.79 feet;
56) N03°45'09"W a distance of 579.81 feet;
57) N89°06'31"E a distance of 278.28 feet;
58) N05°17'12"E a distance of 353.12 feet;
59) N24°32'05"W a distance of 636.15 feet;
60) N85°40'11"E a distance of 449.52 feet;
61) N27°24'18"E a distance of 839.97 feet;
62) N52°17'25"W a distance of 406.99 feet;
63) N81°34'55"E a distance of 756.11 feet;
64) N32°20'14"E a distance of 245.12 feet;

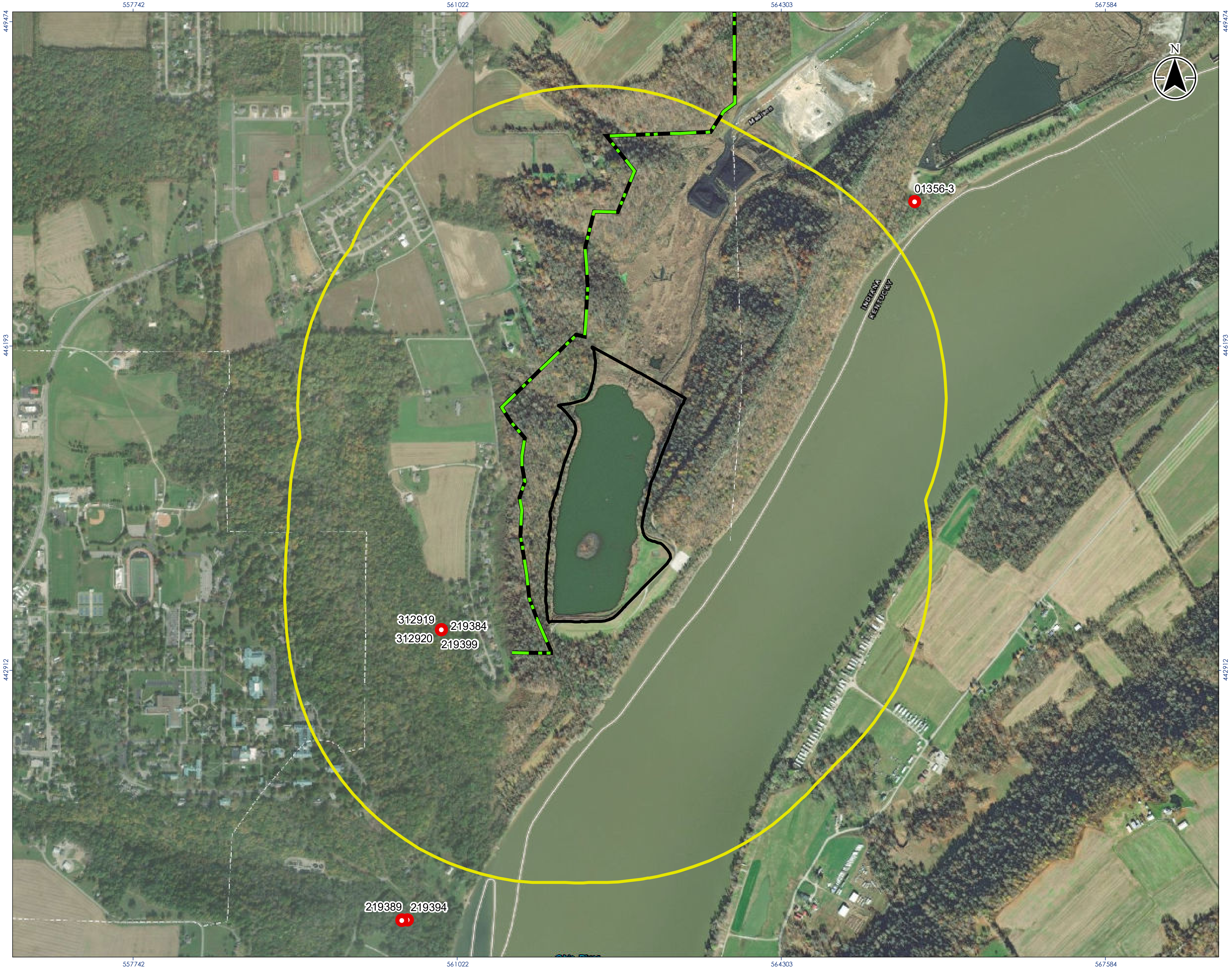
65) N52°14'21"E a distance of 142.14 feet to the Point of Beginning, containing 357.74 acres, more or less.

Bearings are based on the Indiana State Plane Coordinate System, NAD ’27 as per the coordinates of the plant monuments provided by others.

This description was prepared by Kleingers & Associates, Inc., under the direction of David L. Cox, Indiana Licensed Surveyor No. 890008 and is based on a partial survey of the subject property performed in April and May, 2006. This description is to be used for permit purposes only and is not for the conveyance of real property.

APPENDIX D

Location Figures



OVEC IKEC
Ohio Valley Electric Corporation
Indiana-Kentucky Electric Corporation

Stantec

Legend

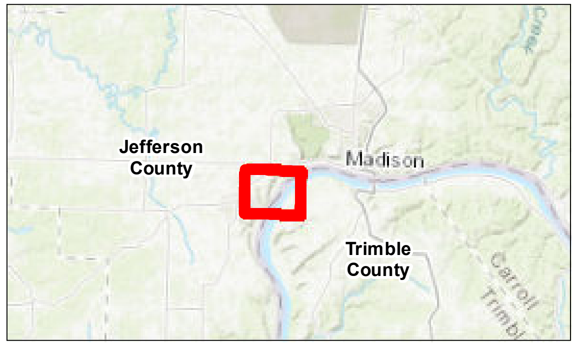
- ● Private Wells
- ▬ Property Line
- ☐ LRCP Closure Boundary
- ☐ Half-Mile Offset

0 1,000 2,000 Feet

1:12,000 (At original document size of 11x17)

Notes

1. Coordinate System: Indiana State Plane East NAD83
2. Base features - ESRI
3. IDNR Water Wells June 2019
4. Kentucky Water Wells - 2015
5. USGS Quadrangle - Madison West
6. IDNR estimated location by township, range, section, quarter section, and county



Project Location
Clifty Creek Station
Jefferson County, IN

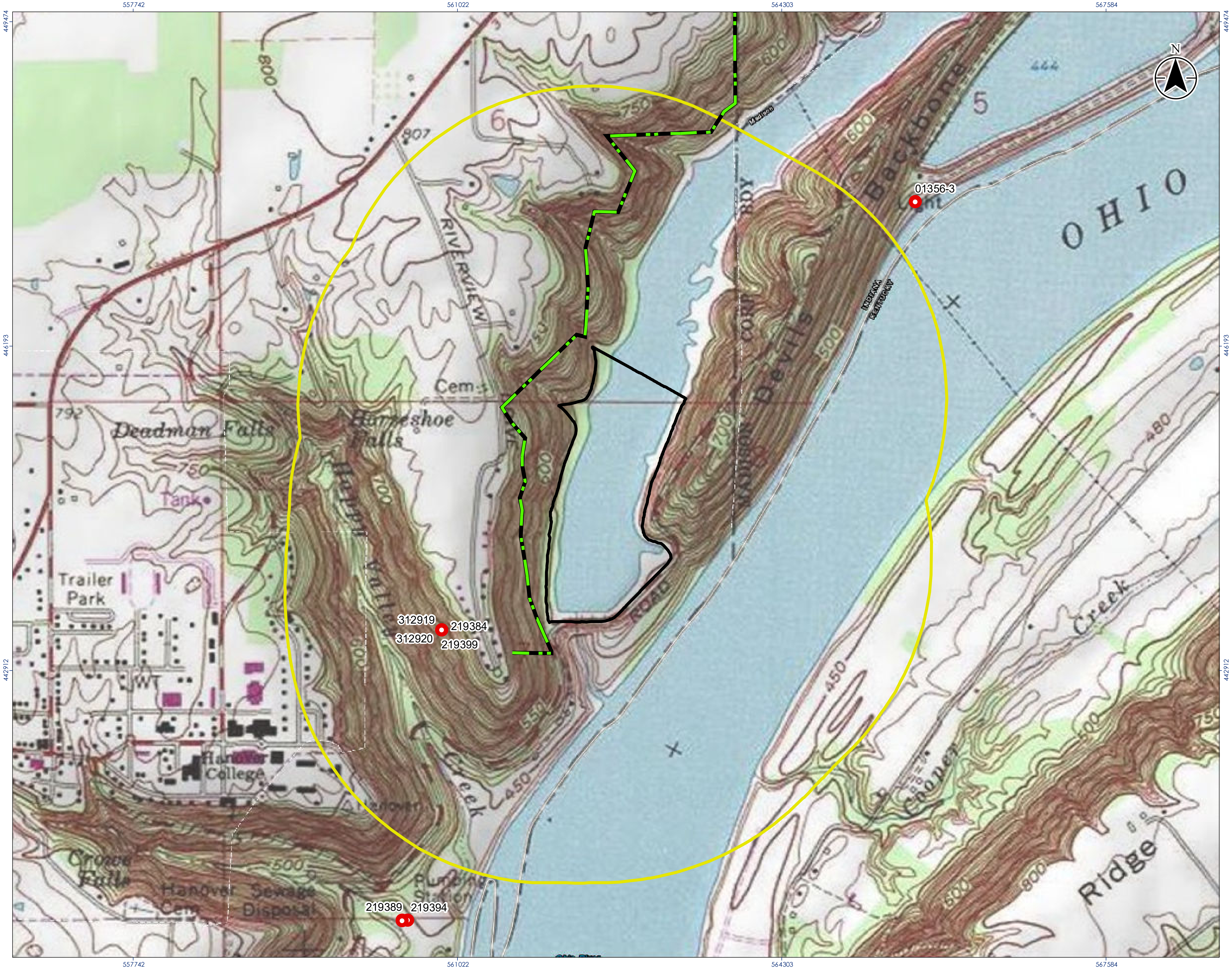
175539026
Prepared by AP on 04/14/2021
Technical Review by EC on 04/14/2021
Independent Review by PS on 04/14/2021

Client/Project
Indiana - Kentucky Electric Corporation
Clifty Creek Station

Figure No.
2

Title
Water Well Half-Mile Offset
Landfill Runoff Collection Pond Closure

U:\1755\175539026\gis\mxds\WaterWells\LRCP WaterWells Clifty Half-Mile radius.mxd Revised: 2021-05-21 By: apooler



Ohio Valley Electric Corporation / Indiana-Kentucky Electric Corporation

Stantec

Legend

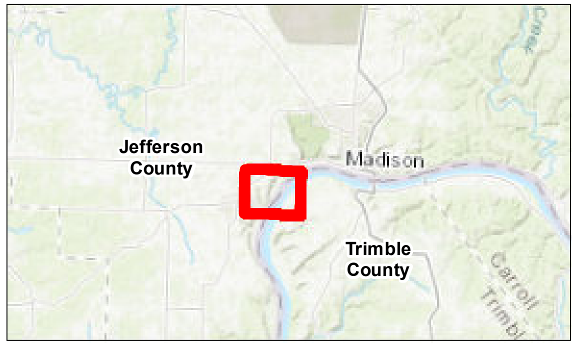
- ● Private Wells
- 🟩 Property Line
- ☐ LRCP Closure Boundary
- ☐ Half-Mile Offset

0 1,000 2,000 Feet

1:12,000 (At original document size of 11x17)

Notes

1. Coordinate System: Indiana State Plane East NAD83
2. Base features - ESRI
3. IDNR Water Wells June 2019
4. Kentucky Water Wells - 2015
5. USGS Quadrangle - Madison West
6. IDNR estimated location by township, range, section, quarter section, and county



Project Location

Clifty Creek Station
Jefferson County, IN

175539026
Prepared by AP on 04/14/2021
Technical Review by EC on 04/14/2021
Independent Review by PS on 04/14/2021

Client/Project

Indiana - Kentucky Electric Corporation
Clifty Creek Station

Figure No.

3

Title

Water Well Half-Mile Offset
Landfill Runoff Collection Pond Closure

U:\1755\175539026\gis\mxds\WaterWells\LRCP_WaterWells_Clifty_Half-Mile_radius.mxd Revised: 2021-05-21 By: apooler

Record of Water Well
Indiana Department of Natural Resources

Reference Number	Driving Direction to Well	Date Completed
219384	2100W, 300N OF SE CORNER	6/30/1967

Owner-Contractor	Name	Address	Telephone
Owner	HANOVER COLLEGE	Not available	Not available
Driller	LAYNE NORTHERN	INDIANAPOLIS	Not available
Operator	LESTER HOYT	License Not available	

Construction Details

Well	**Use:** Not available	**Drilling Method:** Not available	**Pump Type:** Not available
	Depth: 68.0	**Pump Setting Depth:** Not available	**Water Quality:** Not available
Casing	**Length:** Not available	**Material:** Not available	**Diameter:** 12.0
Screen	**Length:** 15.0 **Slot Size:** 50	**Material:** Not available	**Diameter:** 12.0

Well Capacity Test	**Type of Test:** Not available	**Test Rate:** 720.0 gpm	**Bail Test Rate:** Not available
	Drawdown: 13.0 ft.	**Static Water Level:** 30.0 ft.	**Bailer Drawdown:** Not available

Grouting Information	**Material:** Not available	**Depth:** From (not available) To (not available)
	Installation Method: Not available	**Number of Bags Used:** Not available

Well Abandonment	**Sealing Material:** Not available	**Depth:** From (not available) To (not available)
	Installation Method: Not available	**Number of Bags Used:** Not available

Administrative

County: JEFFERSON
Township: 3N
Range: 10E
Section: SE of the SE of the SW of Section 7
Topo Map: MADISON WEST, IN-KY
Grant: Not available
Field Located By: Not available
Field Located On: Not available
Courthouse Location By: Not available
Courthouse Location On: Not available
Location Accepted w/o Verification By: Not available
Location Accepted w/o Verification On: Not available
Subdivision Name: Not available
Lot Number: Not available
Ft W of EL: Not available
Ft N of SL: Not available
Ft E of WL: Not available
Ft S of NL: Not available
Ground Elevation: Not available
Depth of Bedrock: Not available
Bedrock Elevation: Not available
Aquifer Elevation: Not available
UTM Easting: Not available
UTM Northing: Not available

Well Log

Top	Bottom	Formation
0.0	30.0	TOPSOIL & SOFT RED CLAY
30.0	33.0	GRITTY YEL CLAY
33.0	55.0	C. SAND AND GRAVEL W/ BOULDERS
55.0	60.0	M TO F SAND W/ BOULDERS
60.0	68.0	BLUE GREEN SHALE

Comments
CHEMICAL
ANALYSIS

Record of Water Well
Indiana Department of Natural Resources

Reference Number	**Driving Direction to Well**	**Date Completed**
219399	SW 1/4 OF SE 1/4	10/11/1948

Owner-Contractor	**Name**	**Address**	**Telephone**
Owner	HANOVER COLLEGE	HANOVER	Not available
Driller	A D COOK	Not available	Not available
Operator	Not available	License Not available	

Construction Details

Well	**Use:** Not available	**Drilling Method:** Not available	**Pump Type:** Not available
	Depth: 69.0	**Pump Setting Depth:** Not available	**Water Quality:** Not available
Casing	**Length:** Not available	**Material:** Not available	**Diameter:** Not available
Screen	**Length:** 16.0 **Slot Size:** Not available	**Material:** Not available	**Diameter:** Not available

Well Capacity Test	**Type of Test:** Not available	**Test Rate:** 250.0 gpm	**Bail Test Rate:** Not available
	Drawdown: Not available	**Static Water Level:** Not available	**Bailer Drawdown:** Not available

Grouting Information	**Material:** Not available	**Depth:** From (not available) To (not available)
	Installation Method: Not available	**Number of Bags Used:** Not available

Well Abandonment	**Sealing Material:** Not available	**Depth:** From (not available) To (not available)
	Installation Method: Not available	**Number of Bags Used:** Not available

Administrative

County: JEFFERSON
Township: 3N
Range: 10E
Section: SW of the SE of Section 7
Topo Map: MADISON WEST, IN-KY
Grant: Not available
Field Located By: Not available
Field Located On: Not available
Courthouse Location By: Not available
Courthouse Location On: Not available
Location Accepted w/o Verification By: Not available
Location Accepted w/o Verification On: Not available
Subdivision Name: Not available
Lot Number: Not available
Ft W of EL: Not available
Ft N of SL: Not available
Ft E of WL: Not available
Ft S of NL: Not available
Ground Elevation: Not available
Depth of Bedrock: Not available
Bedrock Elevation: Not available
Aquifer Elevation: Not available
UTM Easting: Not available
UTM Northing: Not available

Well Log

Top	Bottom	Formation
0.0	11.0	CLAY
11.0	33.0	LIME
33.0	57.0	S&G
57.0	60.5	FINE SAND
60.5	64.0	CLAY
64.0	69.0	CRS GRAV

Comments
None

Record of Water Well
Indiana Department of Natural Resources

Reference Number	**Driving Direction to Well**	**Date Completed**
312919	Not available	Not available

Owner-Contractor	**Name**	**Address**	**Telephone**
Owner	HANOVER COLLEGE	HANOVER	Not available
Driller	A.D. COOK	Not available	Not available
Operator	Not available	License Not available	

Construction Details

Well	**Use:** Not available	**Drilling Method:** Not available	**Pump Type:** Not available
	Depth: Not available	**Pump Setting Depth:** Not available	**Water Quality:** Not available
Casing	**Length:** Not available	**Material:** Not available	**Diameter:** Not available
Screen	**Length:** Not available **Slot Size:** Not available	**Material:** Not available	**Diameter:** Not available

Well Capacity Test	**Type of Test:** Not available	**Test Rate:** Not available	**Bail Test Rate:** Not available
	Drawdown: Not available	**Static Water Level:** Not available	**Bailer Drawdown:** Not available

Grouting Information	**Material:** Not available	**Depth:** From (not available) To (not available)
	Installation Method: Not available	**Number of Bags Used:** Not available

Well Abandonment	**Sealing Material:** Not available	**Depth:** From (not available) To (not available)
	Installation Method: Not available	**Number of Bags Used:** Not available

Administrative

County: JEFFERSON
Township: 3N
Range: 10E
Section: SW of the SE of Section 7
Topo Map: MADISON WEST, IN-KY
Grant: Not available
Field Located By: Not available
Field Located On: Not available
Courthouse Location By: Not available
Courthouse Location On: Not available
Location Accepted w/o Verification By: VCH
Location Accepted w/o Verification On: 6/1/1966
Subdivision Name: Not available
Lot Number: Not available
Ft W of EL: Not available
Ft N of SL: Not available
Ft E of WL: Not available
Ft S of NL: Not available
Ground Elevation: Not available
Depth of Bedrock: Not available
Bedrock Elevation: Not available
Aquifer Elevation: Not available
UTM Easting: Not available
UTM Northing: Not available

Well Log Comments

ABANDONED

Record of Water Well
Indiana Department of Natural Resources

Reference Number	**Driving Direction to Well**	**Date Completed**
312920	Not available	1/1/1940

Owner-Contractor	**Name**	**Address**	**Telephone**
Owner	HANOVER COLLEGE	HANOVER	Not available
Driller	A.D. COOK	Not available	Not available
Operator	Not available	License Not available	

Construction Details

Well	**Use:** Not available	**Drilling Method:** Not available	**Pump Type:** Not available
	Depth: 80.0	**Pump Setting Depth:** Not available	**Water Quality:** Not available
Casing	**Length:** Not available	**Material:** Not available	**Diameter:** Not available
Screen	**Length:** 20.0 **Slot Size:** Not available	**Material:** Not available	**Diameter:** Not available

Well Capacity Test	**Type of Test:** Not available	**Test Rate:** Not available	**Bail Test Rate:** Not available
	Drawdown: Not available	**Static Water Level:** Not available	**Bailer Drawdown:** Not available

Grouting Information	**Material:** Not available	**Depth:** From (not available) To (not available)
	Installation Method: Not available	**Number of Bags Used:** Not available

Well Abandonment	**Sealing Material:** Not available	**Depth:** From (not available) To (not available)
	Installation Method: Not available	**Number of Bags Used:** Not available

Administrative

County: JEFFERSON	**Township:** 3N
Range: 10E	**Section:** SW of the SE of Section 7
Topo Map: MADISON WEST, IN-KY	**Grant:** Not available
Field Located By: Not available	**Field Located On:** Not available
Courthouse Location By: Not available	**Courthouse Location On:** Not available
Location Accepted w/o Verification By: Not available	**Location Accepted w/o Verification On:** Not available
Subdivision Name: Not available	**Lot Number:** Not available
Ft W of EL: Not available	**Ft N of SL:** Not available
Ft E of WL: Not available	**Ft S of NL:** Not available
Ground Elevation: Not available	**Depth of Bedrock:** Not available
Bedrock Elevation: Not available	**Aquifer Elevation:** Not available
UTM Easting: Not available	**UTM Northing:** Not available

Well Log Comments

SAND AND GRAVEL; S.WL. 9/49-35' AND PUMPING LEVEL OF 44'; S.W.L. 1950-48' PUMPING LEVEL-40'; S.W.L. 8/50-24' PUMPING LEVEL 16'

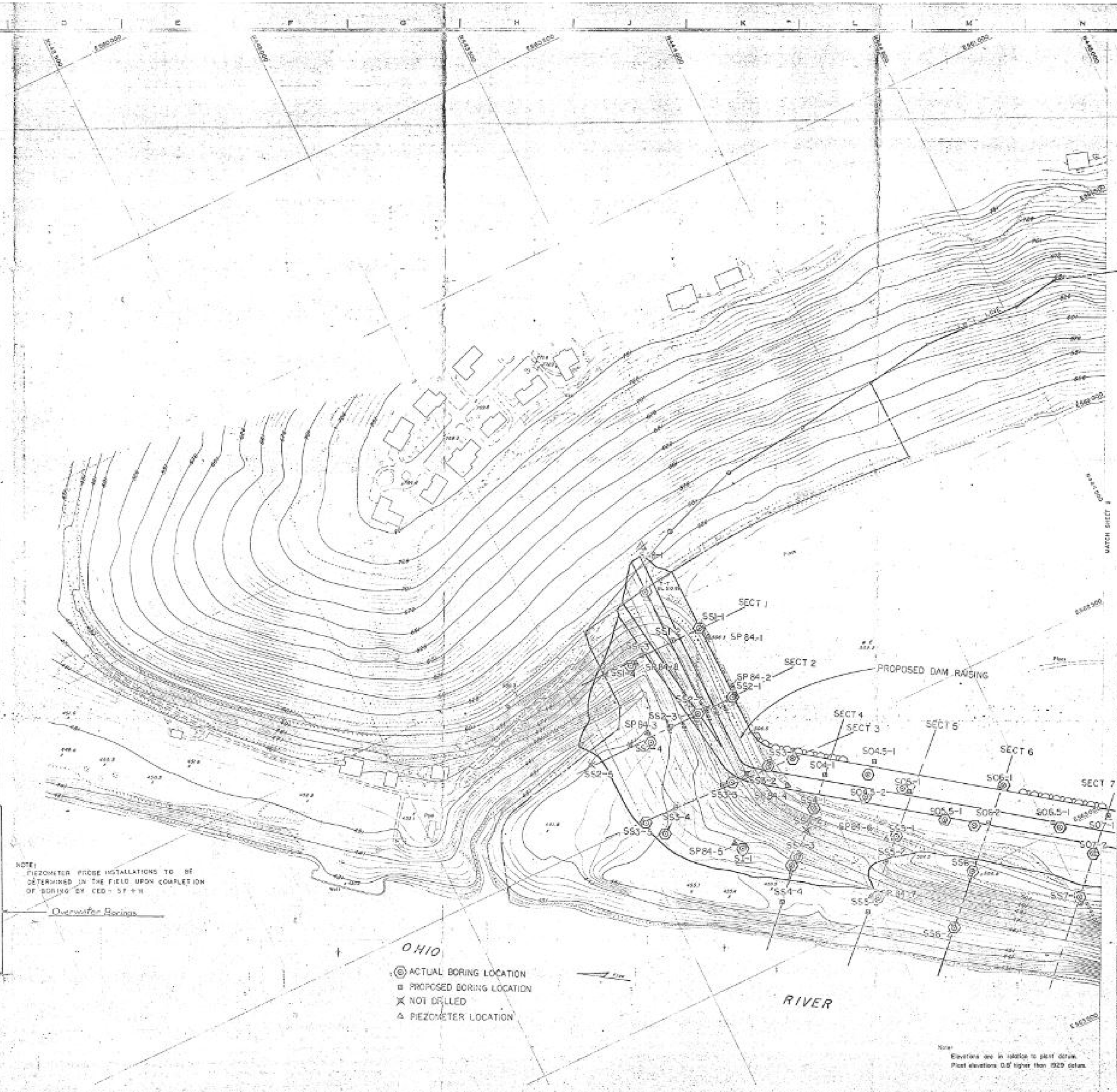
APPENDIX E

Geotechnical Data

AGESC (1956)

PRI-OR-ITY	BORING NUMBER	COORDINATES		BORING TYPE	REMARKS
2	SI-1	N 443246 E 562675	EL [illegible]	SPT	20' ROCK CORE
1	SAB-1	N 443350 E 561830	EL [illegible]	SPT	ROCK CORE TO ELEV. 430± PRESSURE TESTS
1	SS1-1	N 443396 E 562095	EL [illegible]	SPT	20' ROCK CORE
✕	~~SS1-2~~	N 443315 E 562092	EL [illegible]	CPT	NO ROCK CORE MAYBE AUGER BORING
2	SS1-3	N 443185 E 562105	EL [illegible]	CPT	NO ROCK CORE MAYBE AUGER BORING
4	SS1-4	N 443112 E 562096	EL [illegible]	SPT	20' ROCK CORE
1	SS2-1	N 443396 E 562208	EL [illegible]	SPT	20' ROCK CORE 1" PIEZOMETER
✕	~~SS2-2~~	N 443318 E 562256	EL [illegible]	CPT	NO ROCK CORE MAYBE AUGER BORING
2	SS2-3	N 443291 E 562239	EL [illegible]	CPT	20' ROCK CORE 2" PIEZOMETER
3	SS2-4	N 443146 E 562315	EL [illegible]	SPT	NO ROCK CORE
4	SS2-5	N 442974 E 562200	EL [illegible]	CPT	20' ROCK CORE
1	SS3-1	N 443490 E 562507	EL [illegible]	SPT	ROCK CORE TO 420 ±
✕	~~SS3-2~~	N 443338 E 562500	EL [illegible]	CPT	NO ROCK CORE MAYBE AUGER BORING
2	SS3-3	N 443292 E 562502	EL [illegible]	CPT	NO ROCK CORE
3	SS3-4	N 443072 E 562552	EL [illegible]	SPT	20' ROCK CORE
4	SS3-5	N 443040 E 562501	EL [illegible]	CPT	NO ROCK CORE
1	SS4-1	N 443462 E 562663	EL [illegible]	SPT	ROCK CORE TO ELEV. 420± 1" PIEZOMETER
✕	~~SS4-2~~	N 443419 E 562710	EL [illegible]	CPT	NO ROCK CORE MAYBE AUGER BORING
2	SS4-3	N 443370 E 562760	EL [illegible]	CPT	NO ROCK CORE 2" PIEZOMETER
3	SS4-4	N 443144 E 562773	EL [illegible]	SPT	20' ROCK CORE
1	SS5-1	N 443629 E 562826	EL [illegible]	SPT	ROCK CORE TO ELEV. 430±
✕	~~SS5-2~~	N 443570 E 562828	EL [illegible]	CPT	NO ROCK CORE
3	SS5-3	N 443468 E 562976	EL [illegible]	CPT	20' ROCK CORE
1	SS6-1	N 443763 E 562997	EL [illegible]	SPT	ROCK CORE TO ELEV. 430± PRESS' TEST: 1" PIEZOMETER
2	SS6-2	N 443657 E 563115	EL [illegible]	SPT	20' ROCK CORE 2" PIEZOMETER
1	SS7-1	N 443998 E 563186	EL [illegible]	SPT	ROCK CORE TO ELEV. 430±
1	SO4-1	N 443473 E 562515	EL [illegible]	CPT	ROCK CORE ELEV. 430±
1	SO4.5-1	N 443633 E 562641	EL [illegible]	SPT	10' ROCK CORE
1	SO4.5-2	N 443602 E 562692	EL [illegible]	SPT	10' ROCKCORE
1	SO5-1	N 443100 E 562717	EL [illegible]	CPT	ROCK CORE ELEV. 430
1	SO5.5-1	N 443765 E 562842	EL [illegible]	SPT	10' ROCK CORE
1	SO6-1	N 443647 E 562827	EL [illegible]	SPT	10' ROCK CORE
1	SO6-2	N 443829 E 562890	EL [illegible]	CPT	ROCK CORE ELEV. 430
1	SO6.5-1	N 444031 E 562993	EL [illegible]	SPT	10' ROCK CORE
1	SO7-1	N 444160 E 563020	EL [illegible]	CPT	10' ROCK CORE
1	SO7-2	N 444080 E 563034	EL [illegible]	SPT	ROCKCORE ELEV. 430
		WATER	EL [illegible]		
1	SAB-2	N 444374 E 563200	EL [illegible]	SPT	ROCK CORE TO ELEV. 430 PRESSURE TESTS
2	SAB-3	N 444219 E 563174	EL [illegible]	SPT	20' ROCK CORE

Overwater Borings



NOTE:
PIEZOMETER PROBE INSTALLATIONS TO BE DETERMINED IN THE FIELD UPON COMPLETION OF BORING BY CED - 57 + 11

- ◎ ACTUAL BORING LOCATION
- ▫ PROPOSED BORING LOCATION
- ✕ NOT DRILLED
- △ PIEZOMETER LOCATION

Note:
Elevations are in relation to plant datum.
Plant elevations 0.5' higher than 1929 datum.

DATE	NO.	DESCRIPTION	APP'D.
		1st Issue	

REVISIONS

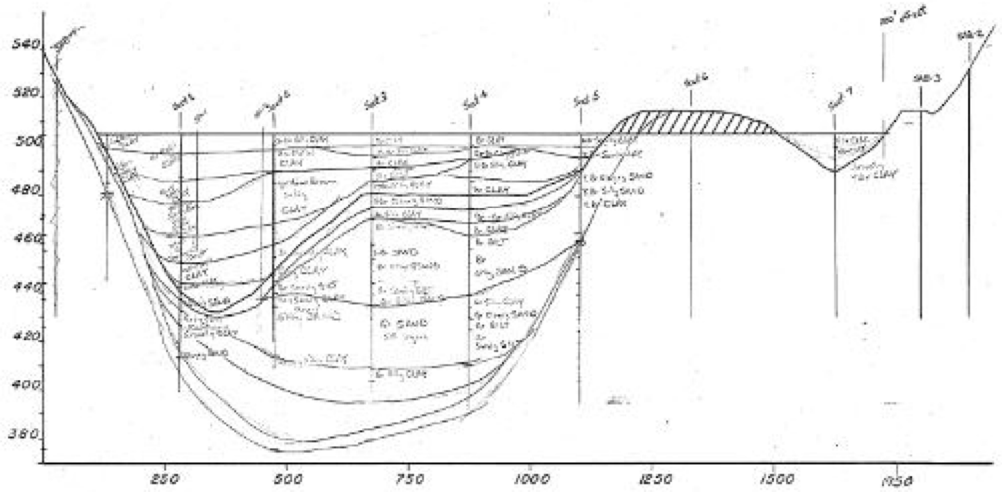
CLIFTY CREEK

FLY ASH STORAGE AREA
BORING PLAN

DR. No. CE-CCBP-1-84

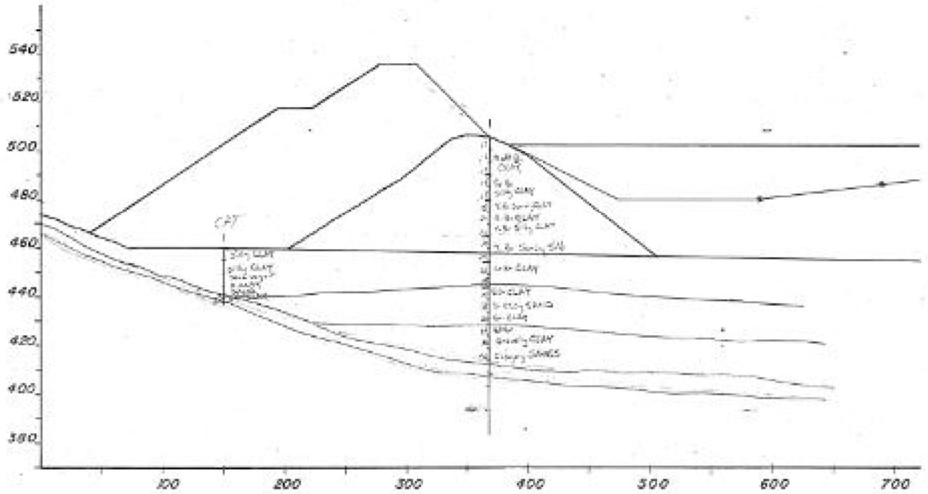
ARCH. | ELEC. | MECH. | CIVIL

SCALE: 1" = 100'
DR.
CK.
GR. LDR.
DATE: JULY, 1984
APPROVED BY
ENGINEERING DIV.
DESIGN DIV.



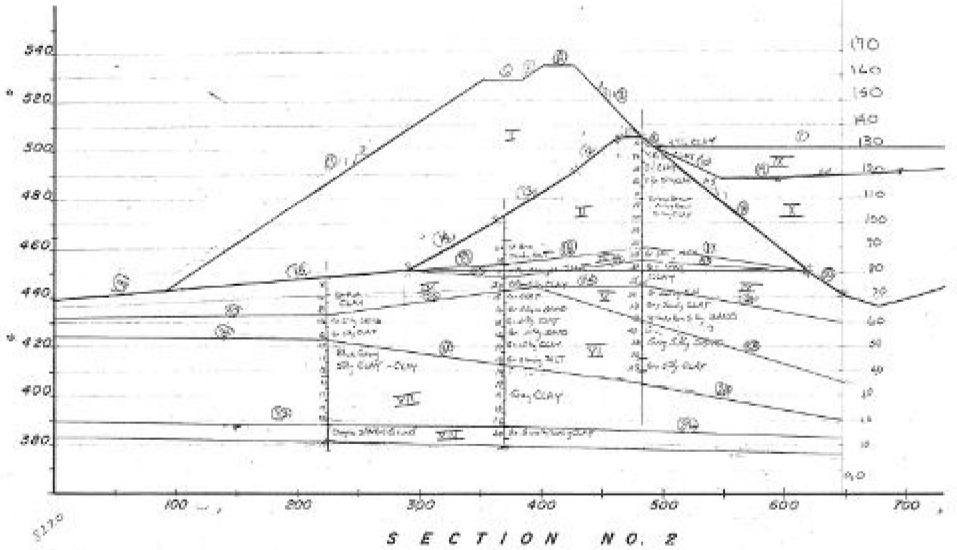
SOUTH DAM PROFILE

SCALE:
Horiz. 1" = 125
Vert. 1" = 25

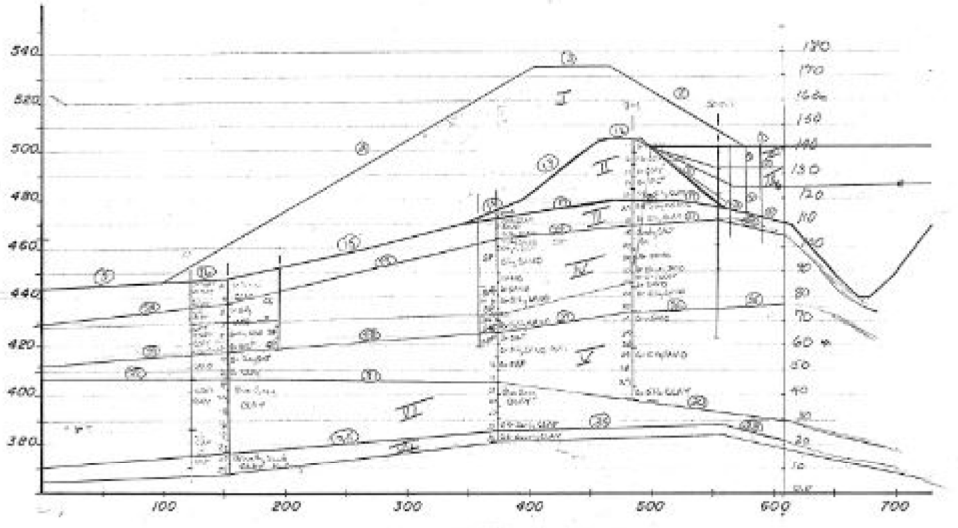


SECTION NO. 1

Ordinary High Water
431.2



SECTION NO. 2



SECTION NO. 3

SCALE:
ACCEPT AS NOTED

Horiz. 1" = 50'
Vert. 1" = 25'

DATE	NO.	DESCRIPTION	APPD.

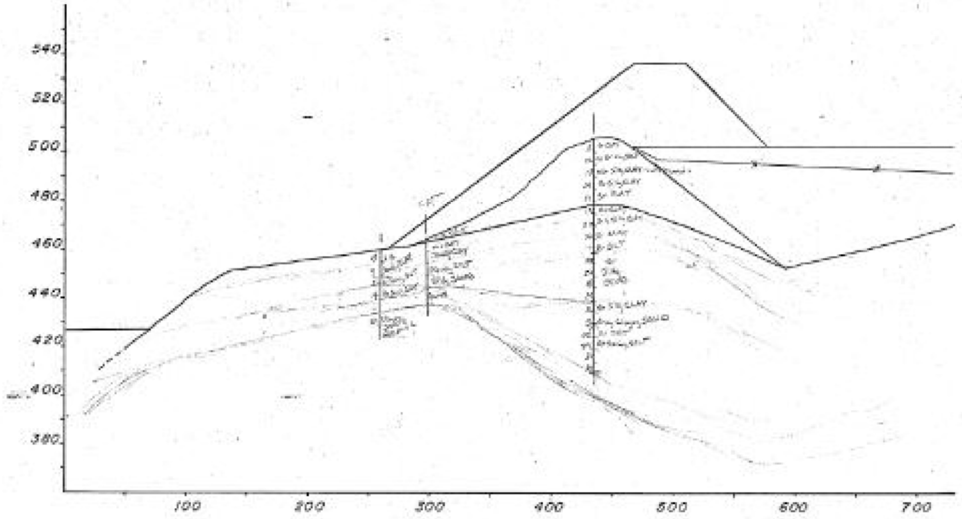
REVISIONS

CLIFTY CREEK

FLYASH STORAGE
SOUTH DAM
SECTIONS + PROFILE

DR. NO. CE-CCBP-4-84

AMERICAN ELECTRIC POWER SERVICE CORP.



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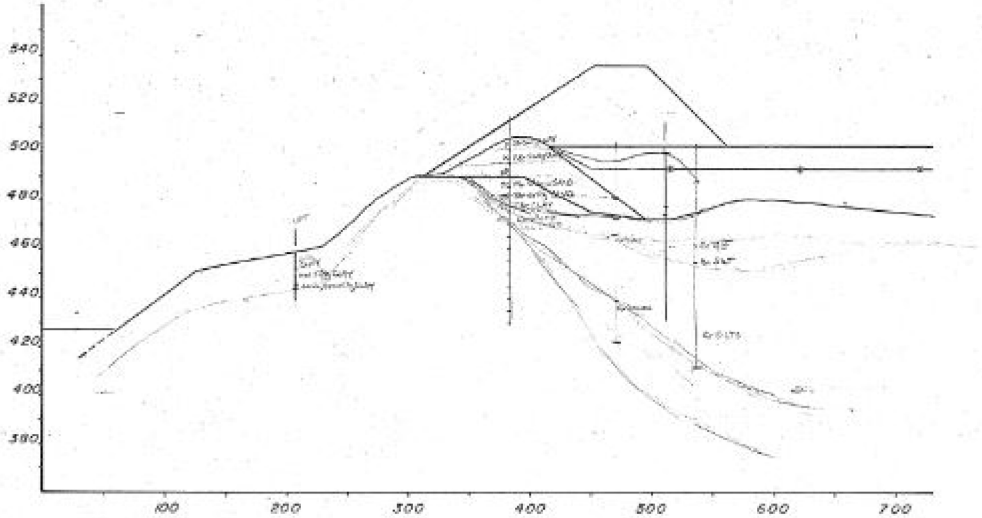

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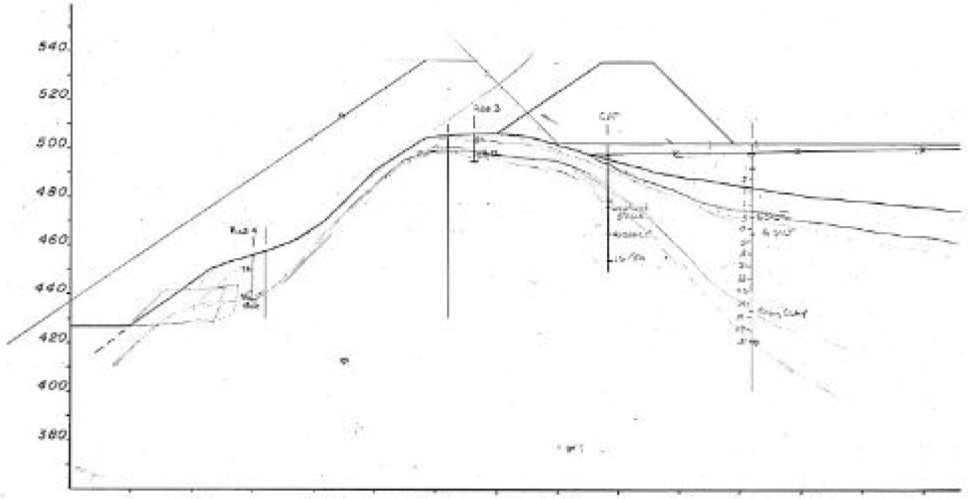
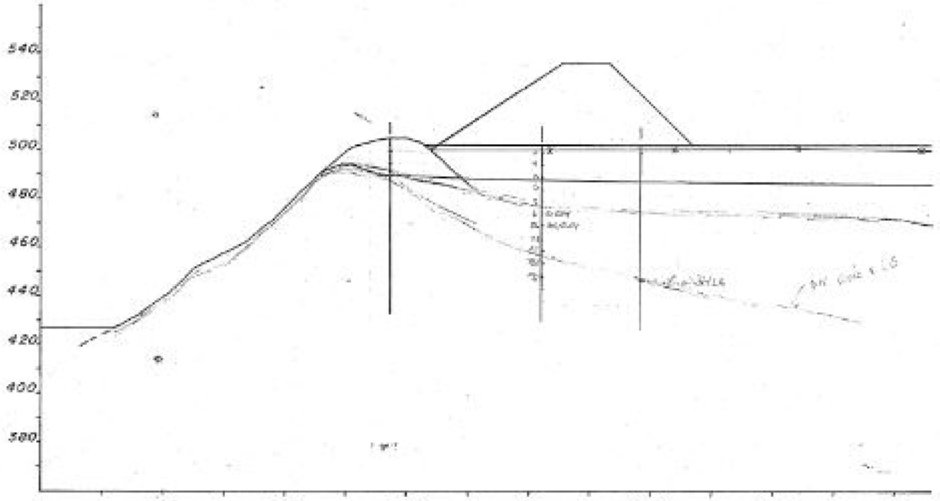


SECTION NO. 6



SECTION NO. 7

SCALE:
HORIZ. 1" = 50'
VERT. 1" = 25'

DATE	NO.	DESCRIPTION	APPD.

REVISIONS

CLIFTY CREEK

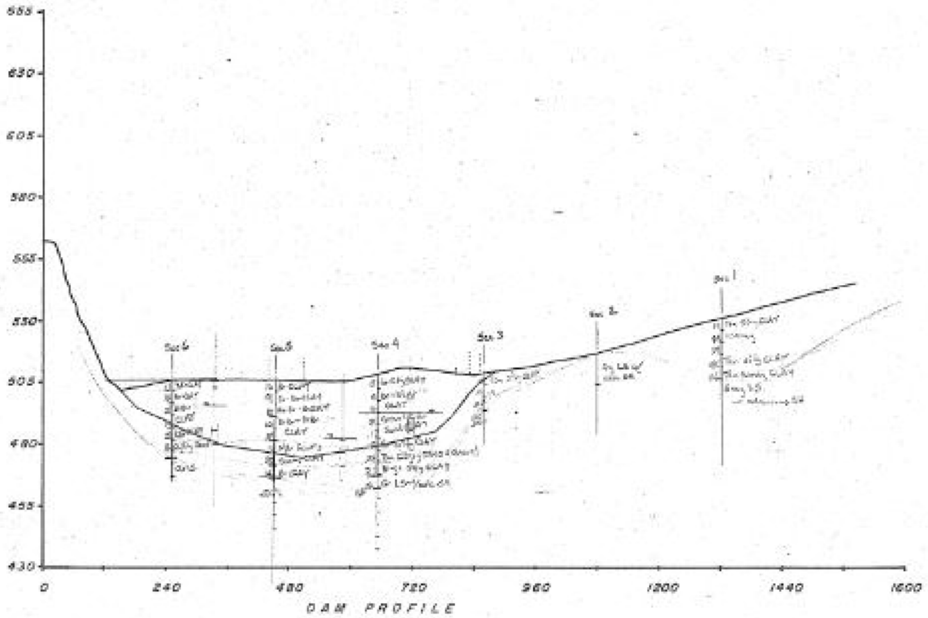
FLYASH STORAGE
SOUTH DAM
SECTIONS

DR. NO. CE-CCBP-5-848

ARCH. | ELEC. | MECH. | STR.

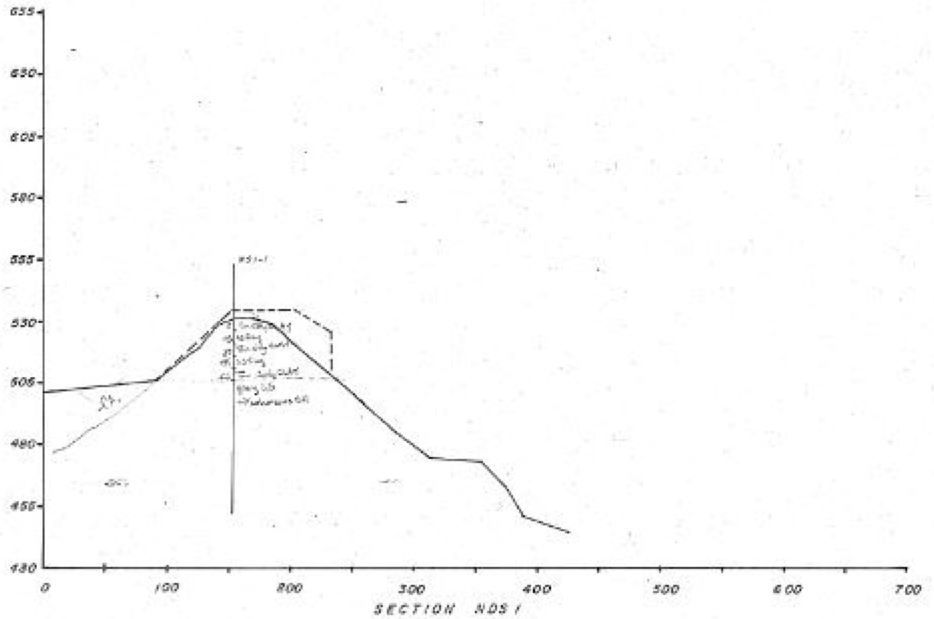
SCALE:
DR. JMD
CH.
SA. LIST
DATE: 6/15/84

AMERICAN ELECTRIC POWER SERVICE CORP.

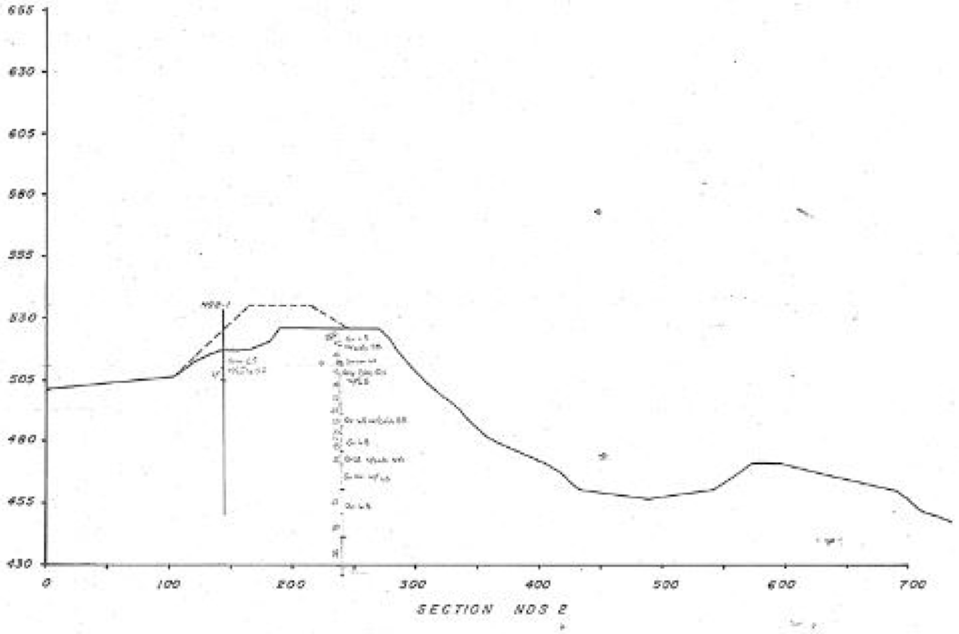


DAM PROFILE

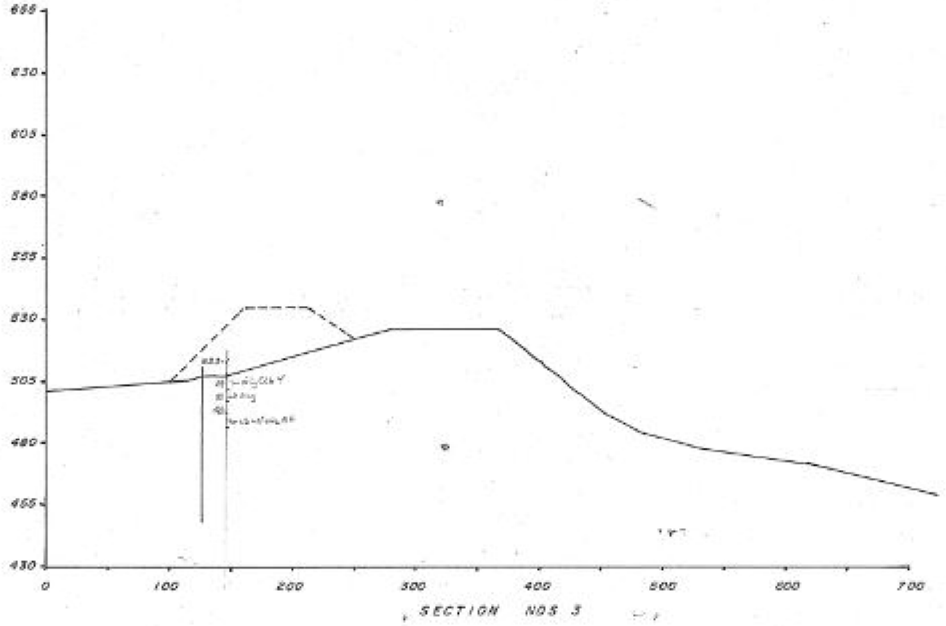
SCALE:
Horiz. 1" = 120
Vert. 1" = 25



SECTION NDS 1



SECTION NDS 2



SECTION NDS 3

SCALE:
ACCEPT AS NOTED

HORIZ. 1" = 50'
VERT. 1" = 25'

DATE	NO.	DESCRIPTION	APPD

REVISIONS

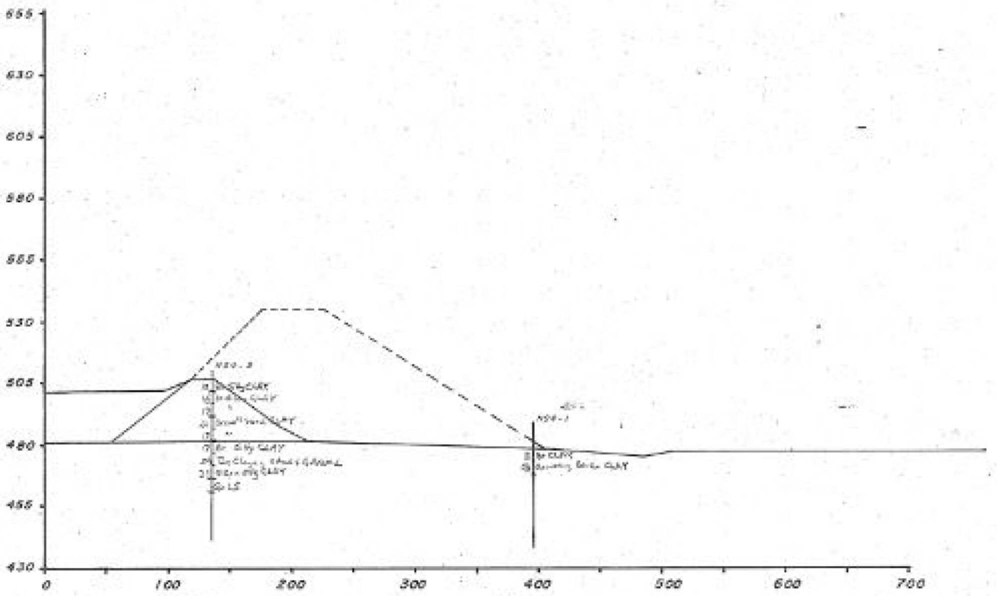
CLIFTY CREEK

FLYASH STORAGE
NORTH DAM
SECTIONS + PROFILE

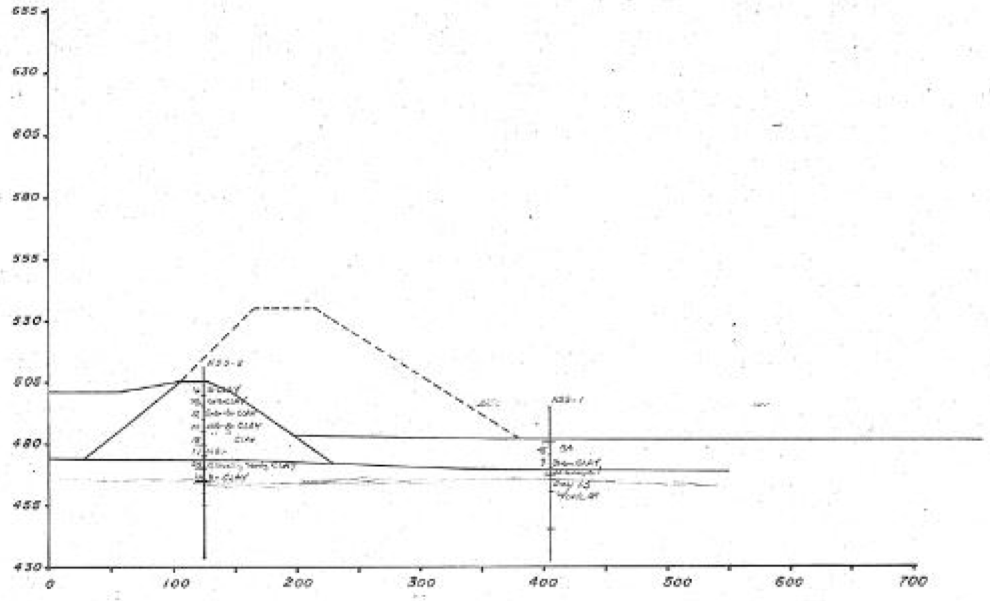
DR. NO. CE-CCBP-6-84

DR. JBD

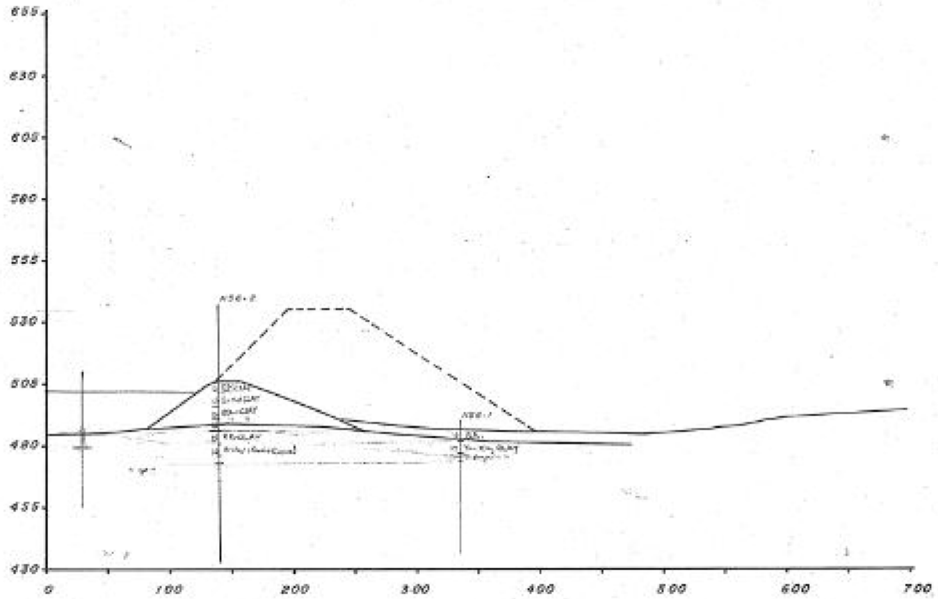
AMERICAN ELECTRIC POWER SERVICE CORP.



SECTION NDS 4



SECTION NDS 5



SECTION NDS 6

SCALE:
HORIZ. 1" = 50'
VERT. 1" = 25'

DATE	NO.	DESCRIPTION	APPD.

REVISIONS

CLIFTY CREEK

FLYASH STORAGE
NORTH DAM
SECTIONS

DR. NO. CE-CCBP-7-84

ARCH. | ELEC. | MECH. | STR.

SCALE:
DR. JMD
CH.
SQ. LDR.
DATE 6-13-84
APPROVED BY
ENGINEERING DIV.
DESIGN DIV.

AMERICAN ELECTRIC POWER SERVICE CORP.

AGESC (1984)

Indiana - Kentucky Electric Corporation

Clifty Creek Plant

Madison, Indiana

Flyash Dam Raising Feasibility Report

APPENDIX G
Boring Logs

January 31, 1985

Prepared by

Soils, Foundation and Hydro Section
Civil Engineering Division
American Electric Power Service Corporation

AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. ____________

ompany ____________

ject ____________

ation of Boring:	
ater Level	
Time	
Date	

Boring No. NS4-1 Date ________ Sheet 3 of 4

Type of Boring ________ Rig ________

Casing used ______ Size ______ Drilling mud used ______

Boring begun ________ Boring completed ________

Ground Elevation ________ referred to ________

________ Datu

Field Party: ________

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
							Gray Calcareous Shale
					18		Gray Calcareous Shale
					19		
					20		
		20.0 30.0	31%	9.8			Gray Calcareous Shale
					21		Gray Calcareous Shale
					22		Gray Calcareous Shale
					23		
					24		

REV. 3/74

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____

Company ____

ect ____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. NSB Date ____ Sheet 4 of 4

Type of Boring ____ Rig ____

Casing used ____ Size ____ Drilling mud used ____

Boring begun ____ Boring completed ____

Ground Elevation ____ referred to ____ Datum

Field Party: ____

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depth water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					25		Calcareous Shale Gray
					26		
							Gray Calcareous Shale
					27		
					28		
					29		
					30		
							Stopped boring 30.0

FORM CE-5
REV. 5/61

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO.

MPANY TIKEC

PROJECT Clifty Creek North FAD

LOCATION OF BORING:	
WATER LEVEL	27.5
TIME	
DATE	

BORING NO. N54-2 DATE 8-22-84 SHEET 1 OF 3

TYPE OF BORING SPT- core RIG B-61

CASING USED SIZE DRILLING MUD USED

BORING BEGUN 8-22-84 BORING COMPLETED 8-22-84

GROUND ELEVATION 504.79 REFERRED TO DATUM

FIELD PARTY: Roush - Lambert

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	Boring moved 5.' west of stake
								1	
								2	Silty clay - Br. moist - Low to med.
1	2.5	4.0	4	7	6	4"		3	plasticity - Strong Reaction To HCL
								4	CL
								5	
								6	
								7	clay - Br. Blue Green mottled - moist
2	7.5	9.0	4	9	6	3"		8	Low to med. plasticity - Trace of Sand
								9	CL
								10	
								1	
								2	Same as Sample No. 2
3	12.5	14.0	4	8	9	3"		3	
								4	
								5	
								6	
								7	Gravelly sand clay - moist - 1" max size Gray - limestone frag
4	17.5	19.0	9	12	12	3"		8	GC
								9	
								20	

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ______

MPANY ______

PROJECT ______

BORING NO. N34-2 DATE ______ SHEET 2 OF 3

TYPE OF BORING ______ RIG ______

CASING USED ______ SIZE ______ DRILLING MUD USED ______

BORING BEGUN ______ BORING COMPLETED ______

GROUND ELEVATION ______ REFERRED TO ______

______ DATU

FIELD PARTY: ______

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								20	
								1	
								2	Gravelly Sand-Clay- Br-moist
5	22.5	24.0	10	7	10	3"		3	1" max size- Limestone Frag. GC
								4	
								5	
								6	
								7	Silty Clay- Br-moist- Low To med
6	27.5	29.0	5	9	8	9"		8	plasticity- Slight Reaction To HCL
								9	CL
								30	
								1	
								2	Clayey Sand + Gravel - Tan - Saturated
7	32.5	34.0	7	9	15	7"		3	3/4" max size - Limestone Frag.
								4	GC
								5	
								6	
								7	Silty Clay - Blue Green - moist- Low
8	37.5	39.0	6	11	10	3"		8	To med. plasticity - Slight Reaction To HCL
								9	CL
								40	

ENGINEER ______

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ________

ompany ________

ject ________

ation of Boring:

ater Level	
Time	
ate	

Boring No. NS4-2 Date ______ Sheet 3 of 3

Type of Boring ______ Rig ______

Casing used ____ Size ____ Drilling mud used ____

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______

______ Datum

Field Party: ______

ELEVATION FEET	SAMPLE No.	Sample Depth (from-to) (In feet)	RQD	Recovery (In feet)	Depth In feet	Graph Log	DESCRIPTION Rock Type. Color. Quality. Drilling observations. Depths water lost. Observed fluctuations in water level. notes on drilling ease, etc.
		40.0 44.8	22%	4.8			
	=						40.0 - 44.8 Gray Hard Limestone w/ Calcareous Shale
					41		Gray Calcareous Shale
					42		
							Gray calcareous shale
					43		
					44		Gray Calcareous Shale
					45		
							Stopped boring 44.8

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB No. ____________

COMPANY IKEC

PROJECT CLIFTY CREEK NORTH FAD

BORING No. NSS-1 DATE 8-20-84 SHEET 1 OF 5

TYPE OF BORING SPT core RIG B-61

CASING USED ______ SIZE ______ DRILLING MUD USED ______

BORING BEGUN 8-20-84 BORING COMPLETED 8-21-84

GROUND ELEVATION 479.40 REFERRED TO ______ DATUM

FIELD PARTY: Roush - Lambert

LOCATION OF BORING:	
WATER LEVEL	7.5
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	
								1	
								2	
1	.0	4.5	17	20	25	5"		3	Bottom ash saturated
								4	
								5	
								6	
								7	
	8.0	9.5	5	5	4	6"		8	Clay - Blue Green + Br mottled - med to low plasticity - Moist
								9	
								10	
								1	
								2	
3	13.0	13.1				1"		3	Limestone Gravel
								4	
								5	
								6	
								7	
								8	
								9	
								20	

ENGINEER ____________

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No.

Company

Project

tion of Boring:

ter Level	
ime	
Date	

Boring No. NSS-1 Date Sheet 2 of 5

Type of Boring Rig

Casing used Size Drilling mud used

Boring begun Boring completed

Ground Elevation referred to Datum

Field Party:

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
		13.1 14.8	67%	1.7			Limestone
							Lt. Br. clay
							Gray calcareous shale
					14		Limestone
							Gray calcareous shale
		14.8 18.7	32%	3.9			
							Limestone
					15		Gray calcareous shale
							13.1-24.8 Gray Hard limestone w/ Gray calcareous shale layers
					16		
					17		Gray calcareous shale
							Gray calcareous shale
					18		
							Gray calcareous shale
		18.7 24.8	25%	5.9	19		
							Gray hard limestone w/ calcareous layers ~~20%~~
					20		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ______

Company ______

Project ______

Location of Boring:

Water Level	
Time	
Date	

Boring No. N55-1 Date ______ Sheet 3 of __

Type of Boring ______ Rig ______

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______ Datum

Field Party: ______

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depth of water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					21		
					22		
					23		
					24		
		24.8 34.8	22%	10.0	25		Gray calcareous shale
					26		
							Gray calcareous Shale
					27		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ______

ompany ______

roject ______

cation of Boring:

Nater Level	
Time	
Date	

Boring No. VSS-1 Date ______ Sheet 4 of 5

Type of Boring ______ Rig ______

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______

______ Datu

Field Party: ______

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depth water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					28		
					29		
					30		
					31		
					32		
					33		
					34		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No.

Company

Project

Location of Boring:

Water Level	
Time	
Date	

Boring No. NSS-1 Date Sheet 5 of

Type of Boring Rig

Casing used Size Drilling mud used

Boring begun Boring completed

Ground Elevation referred to

Datu

Field Party:

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Dep s water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					35		
							Stopped boring 34.8

FORM CE-5
REV. 5/61

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB No. ____________

COMPANY IKEC

PROJECT CLIFTY CREEK FAD

LOCATION OF BORING:	
WATER LEVEL	25.5
TIME	
DATE	

BORING NO. N55-2 DATE 8-17-84 SHEET 1 OF 2

TYPE OF BORING SPT RIG B-61

CASING USED ________ SIZE ____ DRILLING MUD USED ________

BORING BEGUN 8-17-84 BORING COMPLETED 8-17-84

GROUND ELEVATION 504.59 REFERRED TO ____________ DATUM

FIELD PARTY: Roush - Lambert

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	Moved boring 4' west of stake
								1	
								2	Clay - Br. moist, Low to med.
1	2.5	4.0	6	7	9	4"		3	plasticity - moderate reaction to HCL
								4	CL
								5	
								6	
								7	Clay - Gray Br. moist, Low to med.
2	7.5	9.0	4	10	50/2	7"		8	plasticity, moderate reaction to HCL
								9	CL
								10	
								1	
								2	Clay - Gray Br. + Br. Low to med.
3	12.5	14.0	6	6	6	5"		3	plasticity, moist, moderate reaction to HCL.
								4	CL
								5	
								6	
								7	Clay - LT Br. Dr. Br. Low to med.
4	17.5	19.0	3	8	14	2"		8	plasticity, strong reaction to HCL moist to wet
								9	CL
								20	

ENGINEER

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ______

…PANY ______

PROJECT ______

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING NO. NSS-2 DATE ______ SHEET 2 OF 2

TYPE OF BORING ______ RIG ______

CASING USED ______ SIZE ______ DRILLING MUD USED ______

BORING BEGUN ______ BORING COMPLETED ______

GROUND ELEVATION ______ REFERRED TO ______

______ DATU

FIELD PARTY: ______

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								20	
								1	
								2	Clay- LT. BR. DR. BR. Low TO med. plasticity, STRONG REACTION TO HCL, moist TO wet.
5	22.5	24.0	4	6	12	2"		3	
								4	CL
								5	
								6	
								7	Gravelly Sandy Clay- LT. BR. Saturated, STRONG REACTION TO HCL
6	27.5	29.0	5	6	5	3"		8	
								9	Limestone Sand+ Gravel GC
								30	
								1	
								2	Same as Sample No. 6
7	32.5	34.0	6	9	11	5"		3	
								4	
								5	
								6	
								7	
8	37.5	39.0	4	7	7	1"		8	BR. Clay
								9	
								40	Auger Refusal 39.5 Stopped boring 39.5

ENGINEER

ORM CE-5
EV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

OB No.
PANT JKEC
ROJECT CLIFTY CREEK NORTH FAD

LOCATION OF BORING:
WATER LEVEL 11.0
TIME
DATE

BORING NO. NS5.51 DATE 8-21-84 SHEET 1 OF 2
TYPE OF BORING Spt-core RIG B-61
CASING USED SIZE DRILLING MUD USED
BORING BEGUN 8-21-84 BORING COMPLETED 8-21-84
GROUND ELEVATION REFERRED TO
DATUM
FIELD PARTY: Roush + Lambert

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	boring moved 40' EAST of STAKE
								1	
								2	MiSTure - Gray SiLTy Clay - Bottom Ash - Limestone Frag - Moist - Trace of org. mat.
1	2.5	4.0	7	8	5	3"		3	
								4	
								5	
								6	
								7	Clay - Reddish Br. - med. To Low plasticity - Moist. CL
2	7.5	9.0	2	3	6	12"		8	
								9	
								0	
								1	
								2	SiLTy ClAy - Tan - Moist To weT - Low To med. PlasTiciTy - Moderate Reaction To HCL CL
3	12.5	13.2	4	50/2		6"		3	
								4	
								5	
								6	
								7	
								8	
								9	
								0	

ENGINEER

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

ob No. ____________

ompany ____________

roject ____________

ation of Boring:

Water Level	
Time	
Date	

Boring No. NSS.S-1 Date ________ Sheet 2 of 2

Type of Boring ________ Rig ________

Casing used ________ Size ________ Drilling mud used ________

Boring begun ________ Boring completed ________

Ground Elevation ________ referred to ________ Datum

Field Party: ________

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depth water lost, Observed fluctuations in water level, notes on drilling ease, etc.
		14.9 19.5	35%	4.1	15		Gray Hard Lime Stone w/ Calcareous Shale Layers
					16		Calcareous Shale Core Lost ?
					17		
					18		Gray Hard Limestone w/ calcareous shale layers
					19		
							Stopped boring 19.5
					20		
					21		

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB No. ____________

COMPANY IKEC

PROJECT CLIFTY CREEK NORTH F.A.D.

BORING No. NS6-1 DATE 8-21-84 SHEET 1 OF 5

TYPE OF BORING SPT - CORE RIG B-61

CASING USED ________ SIZE ____ DRILLING MUD USED ________

BORING BEGUN 8-21-84 BORING COMPLETED 8-21-84

GROUND ELEVATION 482.88 REFERRED TO ____________ DATUM

FIELD PARTY: Roush- Lambert

LOCATION OF BORING:	
WATER LEVEL	11.0
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	WATER ELEV. GROUND LEVEL 8-22-84 Moved boring 7' WEST OF STAKE
								1	
								2	
1	3.0	4.5	7	7	6	4"		3	Bottom ash moist
								4	
								5	
								6	
								7	
2	8.0	9.5	2	9	8	6"		8	Clay SilT - TAN. moist to weT - Limestone Frag. TRACE OF ORG. MAT.
								9	
								10	ML
								1	
								2	
3	13.0	13.5	15	50/0		2"		3	GRAY shale + Limestone FRAG.
								4	
								5	
								6	
								7	
								8	
								9	
								0	

ENGINEER ____________

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ________

Company ________

Project ________

Location of Boring:

Water Level	
Time	
Date	

Boring No. NSL-1 Date ________ Sheet 2 of __

Type of Boring ________ Rig ________

Casing used ____ Size ____ Drilling mud used ____

Boring begun ________ Boring completed ________

Ground Elevation ________ referred to ________

________ Datum

Field Party: ________

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
		13.5 15.2	20%	1.1			13.5- 35.2
							Gray Hard limestone w/ calcareous shale layers
					14		Core lost ?
							Gray shale calcareous
					15		
		15.2 25.2	25%	9.8			Gray shale calcareous
					16		
							Gray shale calcareous
					17		
					18		Gray Shale Calcareous
					19		
					20		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ______

Company ______

Project ______

Location of Boring:

Water Level	
Time	
Date	

Boring No. NS6-1 Date ______ Sheet 3 of 5

Type of Boring ______ Rig ______

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______

______ Datum

Field Party: ______

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type. Color. Quality. Drilling observations. Depths water lost. Observed fluctuations in water level. notes on drilling ease. etc.
					21		
							> Shale Gray calcareous
					22		> Shale Gray calcareous
					23		Shale Gray calcareous
							> Shale " "
					24		
		25.2 35.2	58%	10.0	25		
					26		
					27		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____________

Company ____________

Project ____________

Location of Boring:

Water Level	
Time	
Date	

Boring No. NS6-1 Date ____________ Sheet 4 of 5

Type of Boring ____________ Rig ____________

Casing used ______ Size ______ Drilling mud used ______

Boring begun ____________ Boring completed ____________

Ground Elevation ____________ referred to ____________ Datum

Field Party: ____________

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					28		
							Shale Gray Calcareous
							Shale " "
							Shale " "
					29		
					30		
							Shale " "
					31		
					32		
					33		
					34		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____________

Company ____________

roject ____________

cation of Boring:

Vater Level	
Time	
Date	

Boring No. NS6-1 Date ________ Sheet 5 of 5

Type of Boring ________ Rig ________

Casing used ________ Size ________ Drilling mud used ________

Boring begun ________ Boring completed ________

Ground Elevation ________ referred to ________

________ Datu

Field Party: ________

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					35		
							Stopped boring 35.2

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ________

MPANY IKEC

PROJECT Clifty Creek FAD

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING NO. NSG-2 DATE 8-16-84 SHEET 1 OF 3

TYPE OF BORING SPT - core RIG B-61

CASING USED ______ SIZE ____ DRILLING MUD USED ______

BORING BEGUN 8-16-84 BORING COMPLETED 8-16-84

GROUND ELEVATION 505.39 REFERRED TO ______

______ DATU

FIELD PARTY: Roush- Lambert

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	
								1	
								2	
1	2.5	4.0	3	6	7	8"		3	Clay- yellowish Br. Blue Gray + Blue Green mottled, moist strong reaction to HCL med to low plasticity
								4	CL
								5	
								6	
								7	
2	7.5	9.0	4	7	9	2"		8	Clay- multi-colored Br. moist- med. to low plasticity, strong reaction to HCL
								9	
								10	CL
								1	
								2	
3	12.5	14.0	5	15	8	3"		3	Clay- Blue Green, moist, strong reaction to HCL one 1¾ size limestone gravel
								4	
								5	
								6	
								7	Same as Sample No. 3
4	17.5	19.0	4	3	7	2"		8	
								9	
								20	

ENGINEER ________

ORM CE-5
EV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB No. ______

PANY ______

PROJECT ______

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING No. NSC-2 DATE ______ SHEET 2 OF 3

TYPE OF BORING ______ RIG ______

CASING USED ______ SIZE ______ DRILLING MUD USED ______

BORING BEGUN ______ BORING COMPLETED ______

GROUND ELEVATION ______ REFERRED TO ______ DATUM

FIELD PARTY: ______

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								20	
								1	
								2	Clay- Reddish Br. moist, Low to med, plasticity w/ Limestone Frag.
5	22.5	24.0	6	10	13	4"		3	
								4	
								5	
								6	
								7	
6	27.5	29.0	14	8	8	12"		8	Clayey Sandy + Gravel - Br. Saturated 3/4" max size, strong Reaction to HCL (Limestone Gravels)
								9	
								30	
								1	
								2	Limestone Gravel
7	32.5	32.8	50/.3			1"		3	
								4	
								5	
								6	
								7	
								8	
								9	
								0	

ENGINEER ______

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No.:

Company

Project

Location of Boring:

Water Level	
Time	
Date	

Boring No. NS6-2 Date Sheet 3 of

Type of Boring Rig

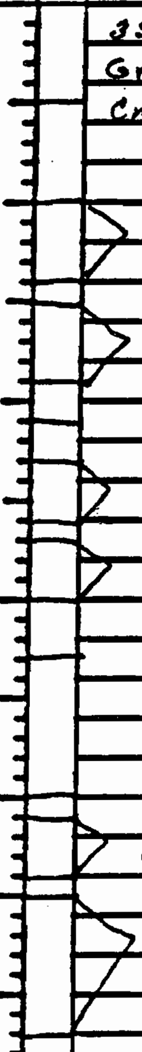
Casing used Size Drilling mud used

Boring begun Boring completed

Ground Elevation referred to

Datu

Field Party:



ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Dep water lost, Observed fluctuations in water level, not on drilling ease, etc.
		35.5 40.2	68%	4.6		35.5 - 40.2 Gray Hard Limestone w/ Gray Calcareous Shale Layers
					36	Gray calcareous shale
						" " "
					37	
						" " "
					38	" " "
					39	" " "
						" " "
					40	
						Stopped boring 40.2
					41	

ORM CE-5
EV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

OB No.

PANY IKEC

PROJECT Clifty Creek FAD

LOCATION OF BORING:

WATER LEVEL	
TIME	
DATE	

BORING No. NAB-5 DATE 8-27-84 SHEET 1 OF 5
TYPE OF BORING Core NQ RIG B-61
CASING USED SIZE DRILLING MUD USED
BORING BEGUN 8-27-84 BORING COMPLETED 8-30-84
GROUND ELEVATION 529.62 REFERRED TO
DATUM
FIELD PARTY: Roush-Lambert

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	Water Elev- 9-5-84 15.0 FT
								1	
								2	
								3	
								4	Gray Lime stone
	4.5	5.8				.3	RQD 0	5	
								6	Gray Hard Limestone w/ Calcareous shale layers
								7	
								8	
	5.8	12.8				6.1	RQD 46%	9	
								0	
								1	
								2	
	12.8	14.4				.9	RQD 0	3	Broken Limestone + Calcareous shale
								4	
	14.4	18.7				3.4	RQD 18%	5	Gray Calcareous shale w/ Limestone layers
								6	
								7	
								8	Gray Calcareous Shale w/ limestone layers
	18.7	25.5				5.7	RQD 23%	9	
								0	

ENGINEER

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB No. ____

COMPANY ____

PROJECT ____

LOCATION OF BORING:

WATER LEVEL	
TIME	
DATE	

BORING No. NAB-5 DATE ____ SHEET 2 OF 5

TYPE OF BORING ____ RIG ____

CASING USED ____ SIZE ____ DRILLING MUD USED ____

BORING BEGUN ____ BORING COMPLETED ____

GROUND ELEVATION ____ REFERRED TO ____

____ DATUM

FIELD PARTY: ____

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								20	
								1	
								2	
								3	
								4	
								5	
	25.5	31.0				5.0	RQD 32%	6	Gray Calcareous Shale w/ Lime stone Layers
								7	
								8	
								9	
								30	
								1	Gray Calcareous Shale w/ Lime. stone Layers
	31.0	35.0				4.0	RQD 55%	2	
								3	
								4	
								5	Gray Limestone w/ Calcareous Shale Layers
	35.0	40.4				4.7	RQD 20%	6	
								7	
								8	
								9	
								40	

ENGINEER ____

RM CE-5
V. 5/61

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

B No. ____________

ANY ____________

ROJECT ____________

LOCATION OF BORING:

WATER LEVEL	
TIME	
DATE	

BORING NO. NAB-5 DATE ____________ SHEET 3 OF 5

TYPE OF BORING ____________ RIG ____________

CASING USED ____________ SIZE ______ DRILLING MUD USED ____________

BORING BEGUN ____________ BORING COMPLETED ____________

GROUND ELEVATION ____________ REFERRED TO ____________

____________ DATUM

FIELD PARTY: ____________

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								40	Gray Lime stone
	40.4	42.9				2.4	RQD 30%	1	
								2	
	42.9	45.8				2.8	RQD 26%	3	Gray Lime stone
								4	
								5	
	45.8	50.8				4.7	43%	6	Gray Lime stone
								7	
								8	
								9	
								50	
	50.8	55.8				4.9	25%	1	Gray Lime stone w/ calcareous shale layers
								2	
								3	
								4	
								5	
	55.8	65.8				9.6		6	Gray Calcareous shale w/ Limestone layers
								7	
								8	
								9	
								60	

ENGINEER ____________

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB No. ____________

PANY ____________

PROJECT ____________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING No. NAB-5 DATE ____________ SHEET 4 OF 5

TYPE OF BORING ____________ RIG ____________

CASING USED ____________ SIZE ______ DRILLING MUD USED ______

BORING BEGUN ____________ BORING COMPLETED ____________

GROUND ELEVATION ____________ REFERRED TO ____________

____________ DATUM

FIELD PARTY: ____________

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								60	
								1	
								2	
								3	
								4	
	65.8	75.8				9.8	RQD 62%	5	Gray Lime stone
								6	
								7	
								8	
								9	
								70	
								1	
								2	
								3	
								4	
	75.8	85.8				10.0	39%	5	Gray Lime stone
								6	
								7	
								8	
								9	
								80	

ENGINEER ____________

ORM CE-5
EV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB No. ______

PANY ______

ROJECT ______

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING No. ______ DATE ______ SHEET 5 OF 5

TYPE OF BORING ______ RIG ______

CASING USED ______ SIZE ______ DRILLING MUD USED ______

BORING BEGUN ______ BORING COMPLETED ______

GROUND ELEVATION ______ REFERRED TO ______

______ DATUM

FIELD PARTY: ______

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
								80	
								1	
								2	
								3	
								4	
								5	Gray Hard Limestone
	85.8	95.8				10.0	RQD 84%		
								6	
								7	
								8	
								9	
								90	
								1	
								2	
								3	
								4	
								5	Gray Hard Limestone
	95.8	100.5				5.0	RQD 83%		
								6	
								7	
								8	
								9	
								100	

ENGINEER ______

BOWSER-MORNER, INC.

420 DAVIS AVENUE, P.O. BOX 51, DAYTON, OHIO 45401

ENGINEERING REPORT

REPORT TO: American Electric Power Service Corp.
1 Riverside Plaza
P.O. Box 16631
Columbus, Ohio 43216

REPORT DATE: October 2, 1984

REPORT NO.: 28089-1084-425

Attention: Mr. Kevin C. Miller
Civil Engineering Division

REPORT ON: Submitted of Field Boring Logs, Indiana-Kentucky Electric Corporation, Clifty Creek Power Station Flyash Inpoundment, Madison, Indaina

Bowser-Morner, Inc. was authorized to provide drilling services at the subject site by contract number 1134 dated August 24, 1984.

All soil samples, rock cores, and field boring logs were given to A.E.P. drill crews working at site. Results of the cone penetration tests performed by Woodward Clyde Consultants have not been received by Bowser-Morner, Inc. as of this date. This information is expected to be received by October 5, 1984, and will be forwarded immediately upon receipt.

All field boring logs have been rewritten to help clarify the hand written submitted field logs. All soil strata were visually classified by the driller and no attempt was made to change his logs, but only to make them more legible.

Please contact the writer if ther are any questions.

Respectfully submitted,

Bowser-Morner, Inc.

Robert L. Disney

Robert L. Disney, Manager
Soils Exploration Department

RLD/lag(#7)
2-Client
2-File

Coordinates, Elevations - Clifty Creek Ash Pond
Borings and Piezometers

Boring No.	North	East	Grd. Elev.
SS1-1	443,396.608	562,095.889	506.4'
SS1-2	443,309.415	561,945.600	511.2
SS1-3	443,185.435	562,105.878	457.5
SS2-1	443,396.944	562,298.268	505.2
SS2-3	443,291.332	562,299.155	473.5
SS2-4	443,146.177	562,315.152	444.0
SS3-1	443,400.792	562,507.540	505.7
SS3-3	443,292.943	562,502.207	475.0
SS3-4	443,072.526	562,552.619	453.1
SS3-5	443,040.442	562,501.381	450.3
SS4-1	443,462.922	562,663.196	504.4
SS4-4	443,344.316	562,773.019	456.5
SS5-1	443,629.159	562,826.808	504.0
SS6-1	443,769.260	562,997.733	506.0
SS6-2	443,657.692	563,115.269	452.4
SS7-1	443,998.052	563,186.481	506.0
SAB-1	443,311.870	561,942.766	511.2
SAB-3	444,219.168	563,174.539	510.3
SI-1	443,246.916	562,675.227	456.9
NS1-1	449,764.876	566,714.021	530.6
NS2-1	449,972.633	566,848.095	517.2
NS5-1	450,696.599	567,097.703	481.8
NS5-2	450,593.658	566,839.317	505.4
NS5.5-1	450,706.318	566,947.011	483.5
NS6-1	450,808.096	566,964.043	484.4
NS6-2	450,742.242	566,781.840	506.2
NS4-1	450,415.751	567,159.228	477.2
NS4-2	450,380.723	566,901.629	505.7
NAB-5	450,031.446	566,992.941	528.8
NS3-1	450,153.057	566,937.097	507.7

SS4-3

N	E	El
443365.4	562761.5	458.0

SS5-3

443510.0	562,954.6	453.5

Piezometer	North	East	Elevations		
			Ground	Casing	Top Pipe
SP84-1	443,404.716	562,121.849	505.30'	507.79'	507.70'
SP84-2	443,404.130	562,270.565	504.66	508.48	508.38
SP84-3	443,149.098	562,289.250	440.65	444.07	444.02
SP84-4	443,429.340	562,578.553	504.18	507.52	507.45
SP84-5	443,231.782	562,657.726	457.60	460.52	460.46
SP84-6	443,603.765	562,810.631	505.04	507.77	507.68
SP84-7	443,497.555	562,943.715	454.42	457.37	457.29
SP84-8	443,200.487	562,104.880	456.69	459.59	459.52
NP84-1	450,320.291	566,927.815	505.59	508.27	508.19
NP84-2	450,441.324	566,890.223	505.48	509.03	508.98
NP84-3	450,660.383	566,703.275	502.62	505.79	505.69
NP84-4	450,413.695	567,161.991	477.32	480.02	479.80
NP84-5	450,692.879	567,088.078	481.80	484.92	484.92

Coordinates - Clifty Creek Ash Pond
Borings - Underwater

Boring No.	North	East
S04-1	443,473.371	562,515.058
S04.5-1	443,633.008	562,641.125
S04.5-2	443,602.971	562,692.785
S05-1	443,700.203	562,717.288
S05.5-1	443,765.818	562,842.851
S06-1	443,947.949	562,827.761
S06.5-1	444,031.583	562,993.305
S06-2	443,829.158	562,890.528
S07-2	444,080.933	563,094.392

Water Elevation 10/2/84 500.16'

S07-1 Not found in pond

OCT 29 1984

AMERICAN ELECTRIC POWER SERVICE CORPORATION

TE: Oct. 26, 1984

SUBJECT: Boring Locations and 765KV Tower Elevations
Clifty Creek Plant fly ash dam area.

OM: K. L. Hern

TO: Kevin Miller - Columbus

As per our phone conversation of Oct. 23, 1984 please find listed below the coordinates and ground elevations of borings SS-4-3 and SS-5-3 in the south end of the fly ash dam area.

Boring No.	North	East	Elev.
SS4-3	443,365.4	562,761.5	458.0' (Grd.)
SS5-3	443,510.0	562,954.6	453.5' "

Boring S07-1 was not located due to the float being missing.

We also ran elevations on the 765KV tower legs that you requested, please find elevations listed below. Direction is noted as facing the Jefferson sub-station.

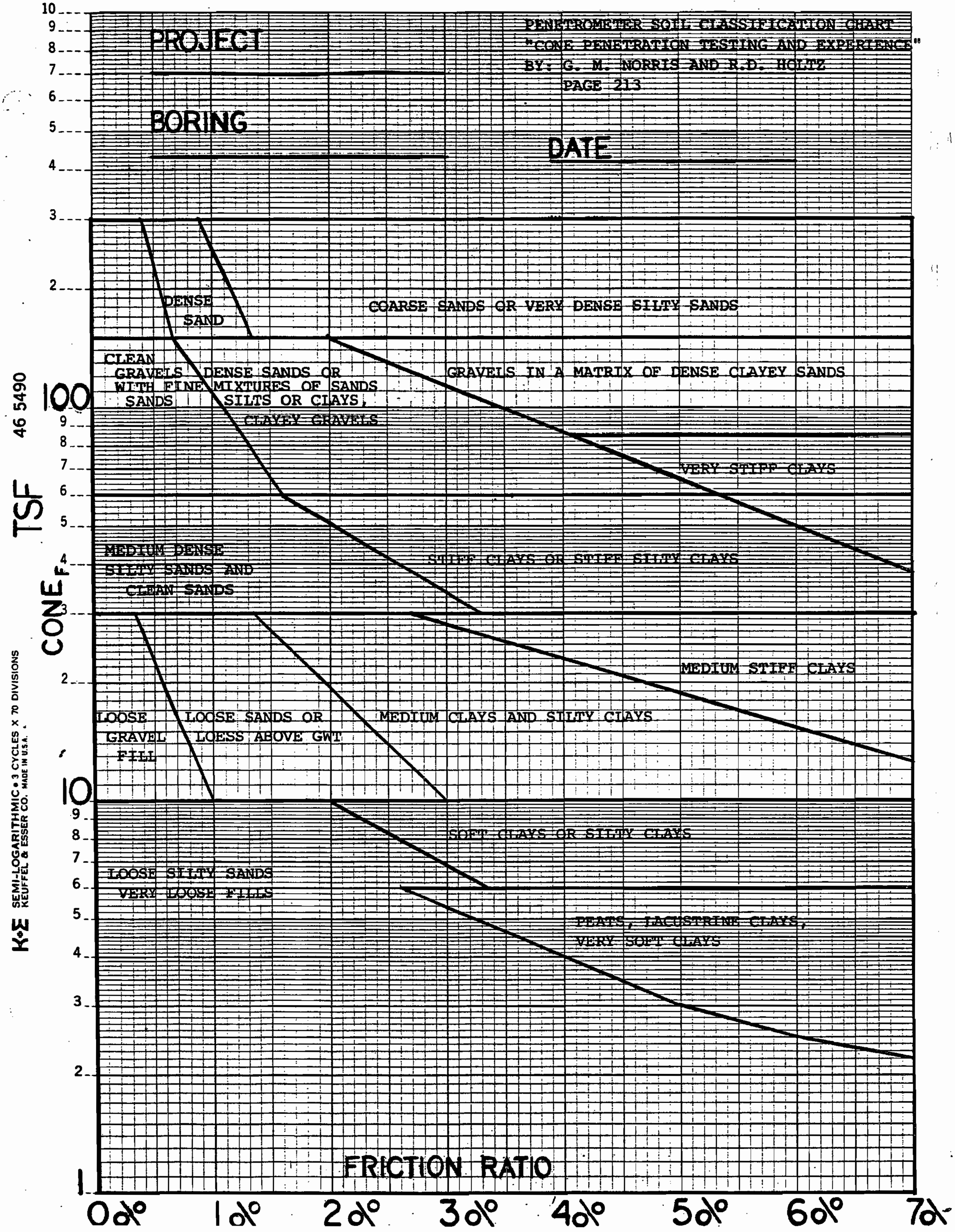
Leg	Ground Elev.
L/Rear	535.06
R/Rear	534.86
L/Front	511.25
R/Front	511.61

K. L. Hern, jp

K. L. Hern

/jp
xc: 001.011.000.003:984.300
068.447.290.001:984.300

INTRA-SYSTEM



PENETROMETER SOIL CLASSIFICATION CHART
"CONE PENETRATION TESTING AND EXPERIENCE"
BY: G. M. NORRIS AND R.D. HOLTZ
PAGE 213

PROJECT

BORING

DATE

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB No. ______

COMPANY IKEC

PROJECT CLiFTY CREEK Fly Ash Dam

LOCATION OF BORING:

WATER LEVEL	62.5
TIME	
DATE	

BORING No. SSI-1 DATE 6-27-84 SHEET 1 OF 9

TYPE OF BORING SPT-Core RIG B-61

CASING USED ______ SIZE ______ DRILLING MUD USED ______

BORING BEGUN 6-27-84 BORING COMPLETED 6-27-84

GROUND ELEVATION 505.52 REFERRED TO ______ DATUM

FIELD PARTY: ______

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	moved boring 4.0 FT South of STAKE
								1	
								2	Clay - multi-colored Brs-, Low to med. plasticity, moist
1	2.5	4.0	7	7	10	6"		3	CL
								4	
								5	
								6	
								7	Same as Sample No. 1
2	7.5	9.0	3	5	7	7"		8	
								9	
								10	
								1	
								2	Same as Sample No. 1
3	12.5	14.0	3	7	10	8"		3	
								4	
								5	
								6	
								7	Silty Clay - Gray + Br. mottled, Low
4	17.5	19.0	7	7	8	9"		8	To med plasticity, Strong Reaction To HCL, moist
								9	
								20	

ENGINEER ______

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ____

COMPANY ____

PROJECT ____

BORING NO. SS1-1 DATE ____ SHEET 2 OF 9

TYPE OF BORING ____ RIG ____

CASING USED ____ SIZE ____ DRILLING MUD USED ____

BORING BEGUN ____ BORING COMPLETED ____

GROUND ELEVATION ____ REFERRED TO ____

____ DATU

FIELD PARTY: ____

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								20	
								1	
								2	
5	22.5	24.0	6	8	9	11"		3	Silty Clay - Gray + Br. mottled, Low plasticity, strong Reaction To HCL, moist
								4	CL-ML
								5	
								6	
								7	
6	27.5	29.0	5	6	9	9"		8	Sandy clay - yellowish Br. Low plasticity, moist, slight Reaction To HCL
								9	CL
								30	
								1	
								2	
7	32.5	34.0	5	9	12	9"		3	Clay - Reddish Br. Low To med. plasticity, moist
								4	
								5	
								6	
								7	
8	37.5	39.0	8	12	11	16"		8	Silty clay - yellowish Br. Low plasticity, moist, moderate Reaction To HCL
								9	
								40	

ENGINEER ____

ORM CE-5
EV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ____________

PANY ____________

ROJECT ____________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING NO. SSI-1 DATE ____________ SHEET 3 OF 9
TYPE OF BORING ____________ RIG ____________
CASING USED ____________ SIZE ______ DRILLING MUD USED ____________
BORING BEGUN ____________ BORING COMPLETED ____________
GROUND ELEVATION ____________ REFERRED TO ____________
____________ DATUM
FIELD PARTY: ____________

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
									Piezometer
								40	
								1	
								2	Sandy SILT - yellowish Br. slight plasticity, moist
9	42.5	44.0	5	12	18	14"		3	ML
								4	
								5	40.0 To 50.0 Reddish Br. SATURATED ~~wet~~ SILT(AUGER RETURN)
								6	
								7	Same AS Sample NO. 9
0	47.5	49.0	11	13	11	15"		8	
								9	
								50	
								1	
								2	clAy - GRAY + BR. moTTled, Low TO med. plASTiciTY, moisT
11	52.5	54.0	7	10	13	15"		3	CL
								4	
								5	
								6	
								7	Same AS Sample NO. 11
2	57.5	59.0	13	16	19	16"		8	
								9	
								60	

ENGINEER ____________

FORM CE-5
REV. 5/61

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ____

ANY ____

PROJECT ____

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING NO. SS1-1 DATE ____ SHEET 4 OF 9

TYPE OF BORING ____ RIG ____

CASING USED ____ SIZE ____ DRILLING MUD USED ____

BORING BEGUN ____ BORING COMPLETED ____

GROUND ELEVATION ____ REFERRED TO ____

____ DATUM

FIELD PARTY: ____

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								60	
								1	
								2	Clay- Reddish Br. med plasticity,
13	62.5	64.0	9	11	16	16"		3	moist CL
								4	
								5	65.2 water
								6	
								7	Clayey Sand- Br. Saturated,
14	67.5	69.5	2	4	4	7"		8	Poorly Graded, 100% Fine grain
								9	SC
								70	
								1	
								2	Clay- Gray- moist- med plasticity
15	72.5	74.0	4	8	12	16"		3	CL
								4	
								5	
								6	
								7	Gravelly Clay- Blue, moist, med
16	77.5	79.0	9	10	14	16"		8	To Hi plasticity, Gravel poorly Graded Limestone Frag.
								9	CL
								80	

ENGINEER ____

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ____________

MPANY ____________

PROJECT ____________

BORING NO. SSI-1 DATE ____________ SHEET 5 OF 9

TYPE OF BORING ____________ RIG ____________

CASING USED ____________ SIZE ______ DRILLING MUD USED ____________

BORING BEGUN ____________ BORING COMPLETED ____________

GROUND ELEVATION ____________ REFERRED TO ____________ DATUM

FIELD PARTY: ____________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								8 0	
								1	
								2	gravelly clay - olive Green, moist
17	82.5	84.0	10	13	17	14"		3	med To Hi plasticity, Gravel poorly Graded Lime-stone Frag
								4	CL-GC
								5	
								6	
								7	Clayey Sands - yellowish Br.
18	87.5	89.0	21	26	20	15"		8	poorly Grade, moist SC
								9	
								9 0	90.5 Augering Hard
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								0	

ENGINEER ____________

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____

Company ____

Project ____

Location of Boring:

Water Level	
Time	
Date	

Boring No. SSI-1 Date ____ Sheet 6 of ____

Type of Boring ____ Rig ____

Casing used ____ Size ____ Drilling mud used ____

Boring begun ____ Boring completed ____

Ground Elevation ____ referred to ____ Datum

Field Party: ____

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depth water lost, Observed fluctuations in water level, notes on drilling ease, etc.
							93.0 - 94.0
	=	93.0-95.0	0	2.0			Weathered limestone w/ calcareous
							Br shale on joints
					94		
					95		
		95.0-105.0	34%	9.3			
							Gray Hard limestone
					96		
					97		
					98		
							98.2 Lost water
					99		
					100		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____

Company ____

Project ____

Location of Boring:

Water Level	
Time	
Date	

Boring No. SSI-1 Date ____ Sheet 7 of 9

Type of Boring ____ Rig ____

Casing used ____ Size ____ Drilling mud used ____

Boring begun ____ Boring completed ____

Ground Elevation ____ referred to ____

____ Datum

Field Party: ____

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					101		
					102		
					103		
					broken		
					104		
							Core loss ?
					105		
		105-115	51%	10.0			Gray Hard Limestone w/ laminate layers of calcareous shale
					106		
					107		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____

Company ____

Project ____

Location of Boring:

Water Level	
Time	
Date	

Boring No. *SS1-1* Date ____ Sheet *8* of

Type of Boring ____ Rig ____

Casing used ____ Size ____ Drilling mud used ____

Boring begun ____ Boring completed ____

Ground Elevation ____ referred to ____ Datum

Field Party: ____

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					108		
					109		
					110		
					111		
					112		
					113		
							Shale x
					114		*Shale x*

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____________

Company ____________

ject ____________

cation of Boring:

Water Level	
Time	
Date	

Boring No. SSI-1 Date ____________ Sheet 9 of 9

Type of Boring ____________ Rig ____________

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______

____________ Datu

Field Party: ____________

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					115		
							Stopped boring 115.0
							32 Bags of cement + Drilling mud
							Grouting Hole

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ____________

IPANY IKEC

PROJECT Clifty Creek Fly Ash Dam

LOCATION OF BORING:

WATER LEVEL	Dry
TIME	
DATE	

BORING NO. SS1-2 DATE 7-10-84 SHEET 1 OF 2

TYPE OF BORING SPT RIG B-61

CASING USED ______ SIZE ______ DRILLING MUD USED ______

BORING BEGUN 7-10-84 BORING COMPLETED 7-10-84

GROUND ELEVATION ______ REFERRED TO ______

______ DATUM

FIELD PARTY: Roush - Lambert

SAMPLE NO.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	
								1	
								2	
1	3.0	4.5	7	10	13	5"		3	Clay. Reddish Br. moist, Low to med. plasticity.
								4	
								5	CL
								6	
								7	
2	8.0	8.8	7	50/.3		5"		8	Same as Sample No. 1
								9	
								10	
								1	
								2	
3	13.0	13.6	17	50/.1		4"		3	Gravelly Clay - Reddish Br. Yellowish Br moist. Gravel consist of Limestone Frag. ½" max size
								4	
								5	
								6	
								7	
	18.0	19.5	8	12	15	4"		8	Same as Sample No. 3
								9	
								20	

ENGINEER ____________

FORM CE-5
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AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ____________

MPANY ____________

PROJECT ____________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING NO. SS1-2 DATE ____________ SHEET 2 OF 2

TYPE OF BORING ____________ RIG ____________

CASING USED ____________ SIZE ______ DRILLING MUD USED ____________

BORING BEGUN ____________ BORING COMPLETED ____________

GROUND ELEVATION ____________ REFERRED TO ____________

____________ DATUM

FIELD PARTY: ____________

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
								0	boring moved To New Location
								1	
								2	
								3	Gray calcareous shale
5	23.0	23.1	50/.1					4	
								5	
								6	Stopped boring 23.1
								7	
								8	
								9	
								0	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								0	

ENGINEER ____________

FORM-CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ______

COMPANY I K E C

PROJECT CliFTy CReeK F.A.D.

BORING NO. SAB-1 DATE 9-12-84 SHEET 1 OF ____

TYPE OF BORING SPT RIG B-61

CASING USED ______ SIZE ______ DRILLING MUD USED ______

BORING BEGUN 9-12-84 BORING COMPLETED ______

GROUND ELEVATION ______ REFERRED TO ______ DATUM

FIELD PARTY: ______

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	
								1	
								2	
								3	Gravelly Sandy clay - Br. moisT 1" max size Gravel. Consist of Lime stone Frag.
1	3.0	4.5	4	5	12	3"		4	
								5	
								6	
								7	
								8	SilTy clay - Reddish Br. moisT - Low To med. plasticiTy CL
2	8.0	9.5	4	9	11	8"		9	
								10	
								1	
								2	
								3	clay - yellowish Br - moisT - med. To Low plasTicity CL
3	13.0	14.5	4	7	15	11"		4	
								5	
								6	
								7	
								8	Gravelly Sand clay - yellowish Br. moisT - Gravel. Consist of Lime sTone Frag
[illegible]	18.0	19.5	14	20	26	10"		9	
								20	

ENGINEER ______

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EV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB No. ________

PANY ________

ROJECT ________

LOCATION OF BORING:

WATER LEVEL	
TIME	
DATE	

BORING No. SAB-1 DATE ________ SHEET 2 OF ____

TYPE OF BORING ________ RIG ________

CASING USED ________ SIZE ____ DRILLING MUD USED ________

BORING BEGUN ________ BORING COMPLETED ________

GROUND ELEVATION ________ REFERRED TO ________

________ DATUM

FIELD PARTY: ________

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								2 0	
								1	
								2	
5	23.0	23.0	50/0			0		3	
								4	
								5	
								6	
								7	
								8	
								9	
								0	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								0	

ENGINEER ________

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

ob No. ______

ompany ______

roject ______

ation of Boring:

Water Level	
Time	
Date	

Boring No. SAB-1 Date ______ Sheet 3 of ______

Type of Boring ______ Rig ______

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______ Datum

Field Party: ______

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Dept water lost. Observed fluctuations in water level, notes on drilling ease, etc.
		23.0 24.9	0	1.7			Core Lost ? 23.0 - 24.9 Gray Hard Limestone w/ Calcareous Shale Layers .15 max length of core
					24		
		24.9 32.7	10%	6.8	25		24.9 - 32.7 Core Lost ? Gray Calcareous Shale w/ Lime stone Layers
					26		
					27		
					28		
					29		
					30		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____________

ompany ____________

ject ____________

cation of Boring:

ater Level	
Time	
Date	

Boring No. SAB-1 Date ________ Sheet 4 of ___

Type of Boring ________ Rig ________

Casing used ____ Size ____ Drilling mud used ____

Boring begun ________ Boring completed ________

Ground Elevation ________ referred to ________

________ Dat

Field Party: ________

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type. Color. Quality. Drilling observations. Depth water lost. Observed fluctuations in water level. notes on drilling ease. etc.
					31		
					32		
		32.7 34.9	58%	2.0	33		limestone Gray Hard Gray calcareous shale
					34		Gray calcareous shale
		34.9 44.9	39%	9.8	35		34.9-44.9 Gray Hard limestone w/ calcareous Shale Layers
							Gray calcareous shale
					36		
					37		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ______

Company ______

Project ______

Boring No. SAB-1 Date ______ Sheet 5 of

Type of Boring ______ Rig ______

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______ Datu

Field Party: ______

cation of Boring:	
Water Level	
Time	
Date	

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Dec is water lost, Observed fluctuations in water level, not s on drilling ease, etc.
							Gray calcareous Shale
					38		
					39		
					40		
					41		
					42		
					43		
					44		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. __________

Company __________

ect __________

cation of Boring:

ater Level	
Time	
Date	

Boring No. SAB-1 Date ______ Sheet 6 of ____

Type of Boring ______ Rig ______

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______

______ Datur

Field Party: ______

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					45		
							Stopped boring 44.9

Dutch Cone Test

Company IKEC

Job CLIFTY CREEK FAD

Recorder Lambert

Probe No. SSI-3

Date 8-15-84

Drillers

Page 1 of 2

Elevation

ELEV.	DEPTH (Ft.)	DEPTH (m)	C or C + S	GAGE READINGS HIGH	LOW	CONE RESIST. (1000N)	SLEEVE RESIST. (1000N)	FRICTI N RATIO (%)
GAGE ZERO READINGS								
		.2	C		—		25' SOUTH OF STAK	
			C+S		—			
		.4	C		1.6	19	0.56	0.029
			C+S		2.4			
		.6	C		5.0	54	0.42	0.008
			C+S		5.6			
		.8	C		1.2	15	1.25	0.083
			C+S		3.0			
		1.0	C		1.2	15	0.84	0.056
			C+S		2.4			
		.2	C		1.8	21	0.28	0.013
			C+S		2.2			
		.4	C		1.2	15	0.42	0.028
			C+S		1.8			
		.6	C		2.2	25	0.70	0.028
			C+S		3.2			
		.8	C		.2	4	1.39	0.347
			C+S		2.2			
		2.0	C		.4	6	0.56	0.093
			C+S		1.2			
		.2	C		.4	6	0.70	0.117
			C+S		1.4			
		.4	C		2.0	23	0.70	0.030
			C+S		3.0			
		.6	C		1.4	17	0.97	0.057
			C+S		2.8			
		.8	C		1.6	19	0.70	0.037
			C+S		2.6			
		3.0	C		1.6	19	0.70	0.037
			C+S		2.6			
		.2	C		1.8	21	1.39	0.066
			C+S		3.8			
		.4	C		2.2	25	2.78	0.111
			C+S		6.2			
		.6	C		3.0	33	1.39	0.042
			C+S		5.0			
		.8	C	10.0		106	2.09	0.020
			C+S	13.0				
		4.0	C		2.4	27	6.68	0.247
			C+S	12.0				
		.2	C		2.6	29	2.23	0.077
			C+S		5.8			
		.4	C		2.6	29	1.25	0.043
			C+S		4.4			
		.6	C	16.0		169	334	0.020
			C+S	11.0				
		.8	C		6.2	67	1.25	0.019
			C+S		8.0			
		5	C	25.0		263	3.48	0.013
			C+S					

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ____________

COMPANY ____________

PROJECT ____________

BORING NO. SS1-3 DATE ____________ SHEET 2 OF 2

TYPE OF BORING ____________ RIG ____________

CASING USED ____________ SIZE ______ DRILLING MUD USED ____________

BORING BEGUN ____________ BORING COMPLETED ____________

GROUND ELEVATION ____________ REFERRED TO ____________

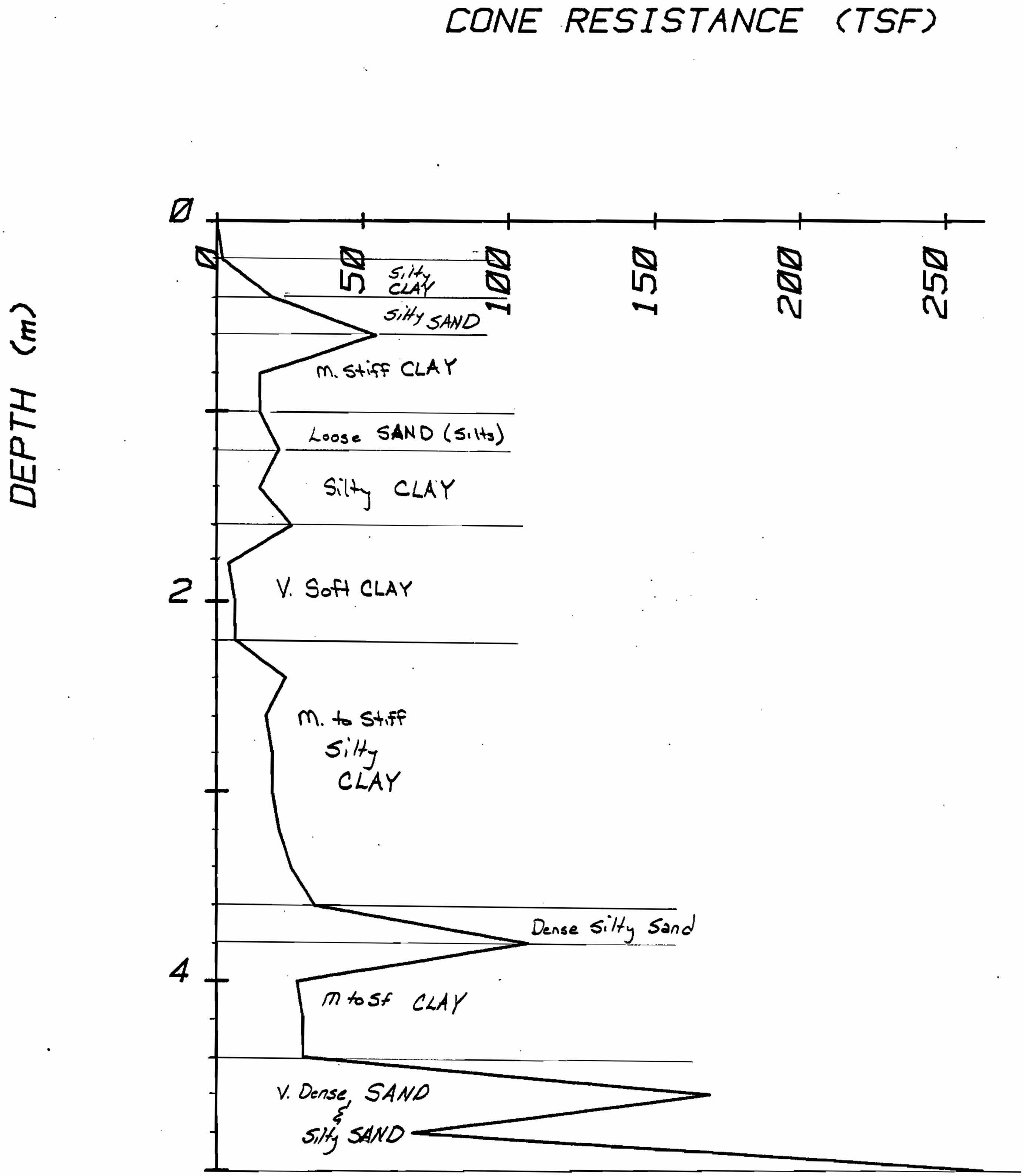
____________ DATUM

FIELD PARTY: ____________

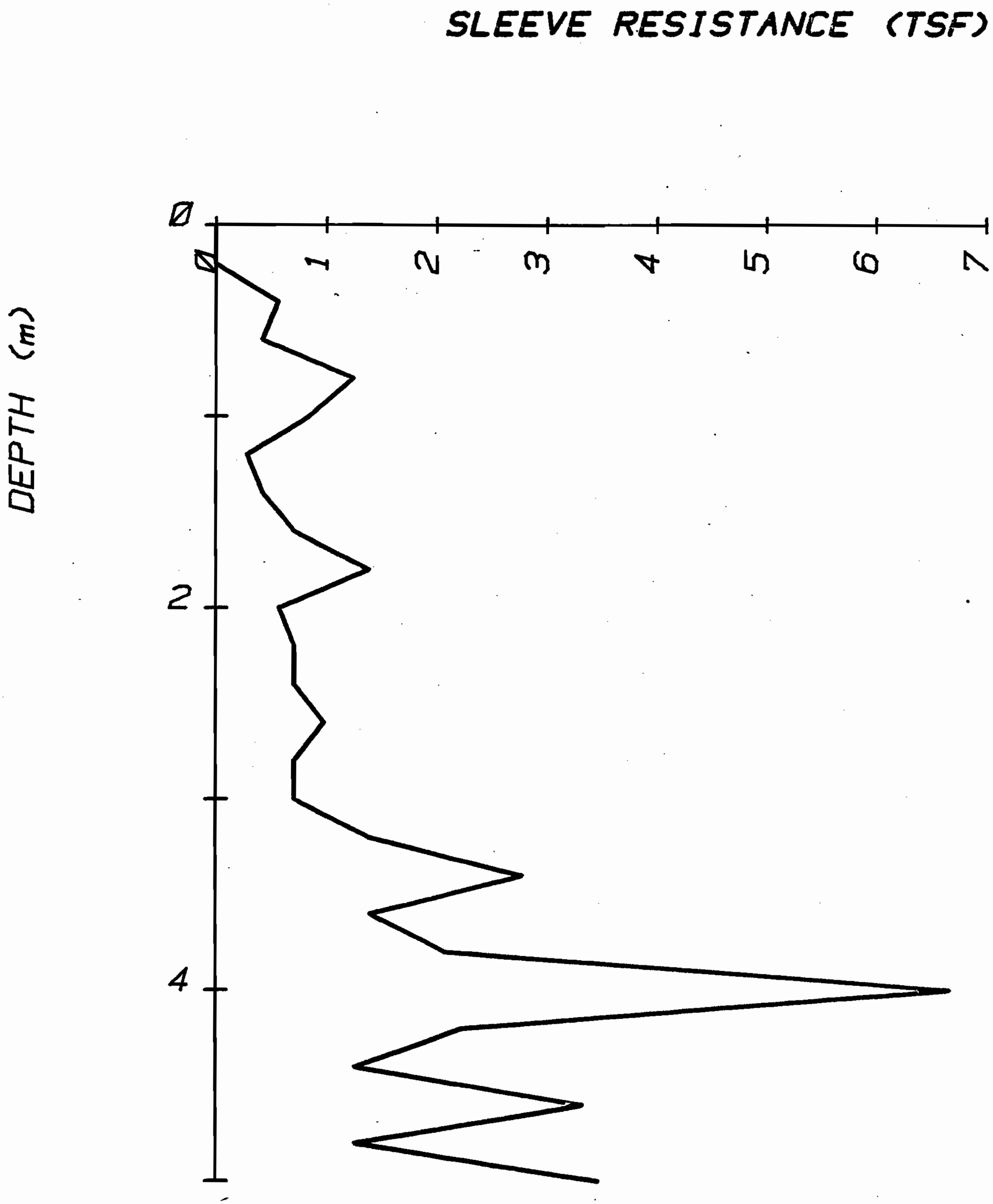
LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	
								1	
								2	
								3	
								4	
								5	Dutch cone To 5m SpT 17.0 -
								6	
1	17.0	18.5	9	19	17	2"		7	Clay - Dr. Br. moist, Low To med Plasticity, Slight Reaction To HCl, Trace of Rock Frag.
								8	
								9	CL
								0	
								1	
								2	Auger Refusal Stopped boring 21.0
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								0	

ENGINEER ____________

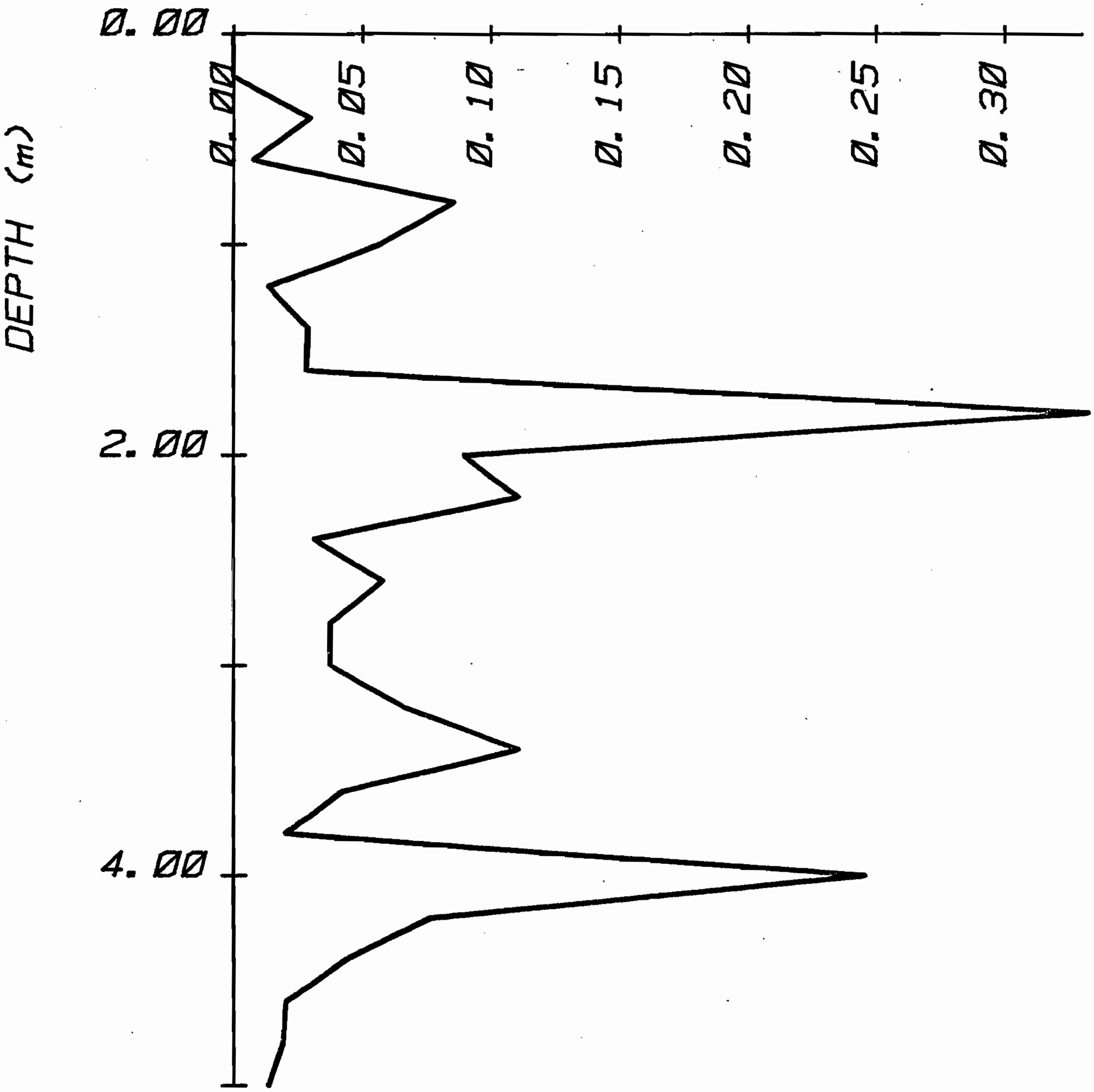


Clifty Creek Flyash Dam
Dam Raising Study
PROBE SS1-3



Clifty Creek Flyash Dam
Dam Raising Study
PROBE SS1-3

FRICTION RATIO



Clifty Creek Flyash Dam
Dam Raising Study
PROBE SS1-3

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ______

COMPANY IKEC

PROJECT Clifty Creek Fly Ash Dam

LOCATION OF BORING:	
WATER LEVEL	28.5
TIME	
DATE	7-10-84

BORING NO. SS2-1 DATE 6-28-84 SHEET 1 OF 5

TYPE OF BORING SPT - Core RIG B-61

CASING USED ______ SIZE ______ DRILLING MUD USED ______

BORING BEGUN 6-28-84 BORING COMPLETED ______

GROUND ELEVATION 504.45 REFERRED TO ______ DATUM

FIELD PARTY: Roush - Bumgarner

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	Moved boring 5 FT South
								1	
								2	
1	3.0	4.5	3	5	5	8"		3	Silty Clay - Gray Br. Low to med. plasticity, moist
								4	
								5	CL
								6	
								7	
2	8.0	9.5	3	5	7	6"		8	Clay - Yellowish Br. + Gray Br. Low to med. plasticity, moist, slight reaction to HCL CL
								9	
								10	
								1	
								2	
3	13.0	14.5	4	5	8	8		3	Clay - Gray Low to med. plasticity, moist, slight reaction to HCL
								4	CL
								5	
								6	
								7	
4	18.0	19.5	6	13	13	12"		8	Silty Clay - Yellowish Br. Low plasticity, moist
								9	
								20	CL-ML

ENGINEER ______

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ____________

COMPANY ____________

PROJECT ____________

BORING NO. SS2-1 DATE ____________ SHEET 2 OF 5

TYPE OF BORING ____________ RIG ____________

CASING USED ____________ SIZE ______ DRILLING MUD USED ______

BORING BEGUN ____________ BORING COMPLETED ____________

GROUND ELEVATION ____________ REFERRED TO ____________

____________ DATUM

FIELD PARTY: ____________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								20	
								1	
								2	
5	23.0	24.5	5	7	7	13"		3	SiTY clay- yellowish Br.-Gray Br. Low, To med plasticity, moist CL
								4	
								5	
								6	
								7	
6	28.0	29.5	5	8	9	12"		8	Same as Sample No 5
								9	
								30	
								1	
								2	
7	33.0	34.5	11	12	12	14"		3	Same as Sample No. 5
								4	
								5	
								6	
								7	
	38.0	39.5	9	12	13	13"		8	SiTY clay - yellowish Br. Low To med. plasticity, moist, w/ slight Reaction To HCL CL
								9	
								40	

ENGINEER ____________

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO.

COMPANY

PROJECT

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING NO. SS2-1 DATE SHEET 3 OF 5

TYPE OF BORING RIG

CASING USED SIZE DRILLING MUD USED

BORING BEGUN BORING COMPLETED

GROUND ELEVATION REFERRED TO

 DATUM

FIELD PARTY:

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								40	
								1	
								2	
								3	SilTy clAy - yellowish Br. Low To med. plAsTiciTy, slighT ReAcTion To HCL, moisT
9	43.0	44.5	7	6	14	12"		4	
								5	CL
								6	
								7	
								8	SAndy ClAy - BR. moisT, Low plAsTiciTy, slighT ReAcTion TO HCL
10	48.0	49.5	6	8	21	16"		9	
								50	CL
								1	
								2	
								3	ClAy - BR + GRAy - Low To med plAsTiciTy, moisT
11	53.0	54.5	10	14	19	15"		4	
								5	CL
								6	
								7	
								8	ClAy. GRAy. med To Low plAsTiciTy moisT
2	58.0	59.5	10	16	19	16"		9	
								60	

ENGINEER

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ____________

COMPANY ____________

PROJECT ____________

BORING NO. SS2-1 DATE ____________ SHEET 4 OF 5

TYPE OF BORING ____________ RIG ____________

CASING USED ____________ SIZE ______ DRILLING MUD USED ____________

BORING BEGUN ____________ BORING COMPLETED ____________

GROUND ELEVATION ____________ REFERRED TO ____________

____________ DATU

FIELD PARTY: ____________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								60	
								1	
								2	
								3	
13	63.0	64.5	8	12	14	15"		4	Sandy SilT - Br. slight plasticity moist ML
								5	
								6	
								7	
								8	
14	68	69.5	4	6	7	14"		9	Sandy clay. Gray, Low plasticity moist, Trace of organic CL
								70	
								1	
								2	
								3	
15	73.0	74.5	4	5	7	14"		4	Silty Sand - yellowish Br. 100% Fine Grain, Saturated SM
								5	
								6	
								7	
								8	
[illegible]	78.0	79.5	15	23	20	16"		9	SiTy Sand - Gray, Saturated, 100% Fine Grain, Strong Reaction To HCL SM
								80	

ENGINEER ____________

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO.

COMPANY

PROJECT

BORING NO. SS2-1 DATE SHEET 5 OF 5

TYPE OF BORING RIG

CASING USED SIZE DRILLING MUD USED

BORING BEGUN BORING COMPLETED

GROUND ELEVATION REFERRED TO DATUM

FIELD PARTY:

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								80	
								1	
								2	
								3	SILTY SAND- GRAY, 100% FINE GRAIN,
17	83.0	84.5	10	13	15	16"		4	SATURATED, STRONG REACTION TO HCL
								5	SM
								6	
								7	
								8	Same as Sample No 17
18	88.0	89.5	7	10	12	16"		9	
								90	
								1	
								2	
								3	Cla
19	93.0	94.5	10	14	15	16"		4	SILTY CLAY- GRAY LOW TO MED. PLASTICITY, MOIST TO WET, STRONG
								5	REACTION TO HCL CL
								6	
								7	Stopped boring 94.5
								8	
								9	
								0	

ENGINEER

[illegible]

Dutch Cone Test

Company IKEC

Job Clifty Creek FAD

corder Lambert

Probe No. SS2-3 Date 8-15-84

Drillers Roush + Lambert

Page 1 of 6 Elevation

ELEV.	DEPTH (Ft.)	DEPTH (m)	C or C + S	GAGE READINGS HIGH	GAGE READINGS LOW	CONE RESIST.	SLEEVE RESIST.	FRICTION RATIO
GAGE ZERO READINGS				0.0	-0.2	(1000N)	(1000N)	(%)
		.2	C				20' South of SS2-2	
			C+S					
		.4	C					
			C+S					
		.6	C		7.4	79	1.11	0.014
			C+S		9.0			
		.8	C		5.4	58	2:37	.0.041
			C+S		8.8			
		.0	C		4.8	52	2.78	0.054
			C+S		8.8			
		1.2	C		6.8	73	1.67	0.023
			C+S		9.2			
		.4	C		4.4	48	2.09	0.044
			C+S		7.4			
		.6	C		4.4	48	1.95	0.041
			C+S		7.2			
		.8	C		3.6	40	1.39	0.035
			C+S		5.6			
		2.0	C		3.2	35	1.81	0.052
			C+S		5.8			
		.2	C		2.0	23	2.09	0.091
			C+S		5.0			
		.4	C		5.0	54	0.84	0.016
			C+S		6.2			
		.6	C		4.2	46	2.37	0.052
			C+S		7.6			
		.8	C		4.8	52	2.51	0.048
			C+S		8.4			
		3.0	C		4.0	44	2.09	0.048
			C+S		7.0			
		.2	C		5.2	56	2.09	0.037
			C+S		8.2			
		.4	C		6.4	69	1.81	0.026
			C+S		9.0			
		.6	C		6.4	69	2.09	0.030
			C+S		9.4			
		.8	C		3.4	38	2.51	0.066
			C+S		7.0			
		4.0	C		4.2	46	2.37	0.052
			C+S		7.6			
		.2	C					
			C+S					
		.4	C					
			C+S					
		.6	C					
			C+S					
		.8	C					
			C+S					
		5	C					

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ____

COMPANY ____

PROJECT ____

BORING NO. SS2-3 DATE ____ SHEET 2 OF 6

TYPE OF BORING ____ RIG ____

CASING USED ____ SIZE ____ DRILLING MUD USED ____

BORING BEGUN ____ BORING COMPLETED ____

GROUND ELEVATION ____ REFERRED TO ____ DATUM

FIELD PARTY: ____

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								10	
								1	
								2	
1	12.5	14.0	5	11	9	8"		3	Sandy SilT - LT. Br. moisT, 100% V-Fine Grain ML
								4	
								5	
								6	
								7	
2	17.5	19.0	4	8	7	8"		8	Same as Sample No 1
								9	
								20	
								1	
								2	
3	22.5	24.0	3	6	10	7"		3	Clayey SilT - LT. Br. moisT, Low plasticity Trace of V-Fine Sand ML
								4	
								5	
								6	
								7	
4	27.5	29.0	8	14	13	14"		8	SilTy Clay - Gray Br. moisT, Low To med. plasticity CL
								9	
								30	

ENGINEER ____

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ______

MPANY ______

PROJECT ______

BORING NO. SS2-3 DATE ______ SHEET 3 OF 6

TYPE OF BORING ______ RIG ______

CASING USED ______ SIZE ______ DRILLING MUD USED ______

BORING BEGUN ______ BORING COMPLETED ______

GROUND ELEVATION ______ REFERRED TO ______

______ DATUM

FIELD PARTY: ______

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								30	
								1	
5	32.5	34.0	7	9	9	13"		2	Clay - Gray, moist - Low To med. plasticity
								3	
								4	CL
								5	
								6	
6	37.5	39.0	7	7	9	16"		7	Clayey Sand - Gray - moist - poorly Graded. 100% Fine Grain
								8	
								9	SC
								40	
								1	
7	42.5	44.0	5	7	8	16"		2	Silty Clay - Gray - Low plasticity - moist
								3	
								4	CL
								5	
								6	
8	47.5	49.0	4	6	6	16"		7	Silty Sand - Gray - moist to wet - 100% Fine Grain - Fine Grain Lens w/ org. MAT.
								8	
								9	SM
								50	

ENGINEER ______

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB No. ________

PANY ________

ROJECT ________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING No. SS2-3 DATE ________ SHEET 4 OF 6

TYPE OF BORING ________ RIG ________

CASING USED ________ SIZE ________ DRILLING MUD USED ________

BORING BEGUN ________ BORING COMPLETED ________

GROUND ELEVATION ________ REFERRED TO ________ DATUM

FIELD PARTY: ________

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								50	
								1	
								2	
9	52.0	54.0	6	9	8	16"		3	SiITy Clay - moisT-GRAy- Low plasTiciTy - w/ oRg. mAT. (Lignite ?)
								4	
								5	
								6	
								7	
10	57.5	59.0	3	6	7	15"		8	Sandy SiIT - GRAy - MoisT To weT - 100% V-Fine GRAin
								9	ML
								60	
								1	
								2	
11	62.5	64.0	5	6	8	15"		3	clAy - GRAy - moisT - Low To med. plasTiciTy
								4	CL
								5	
								6	
								7	
12	67.5	69.0	5	9	10	16"		8	Same As Sample No 11
								9	
								70	

ENGINEER

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ________

COMPANY ________

PROJECT ________

LOCATION OF BORING:

WATER LEVEL	
TIME	
DATE	

BORING NO. SS2-3 DATE ________ SHEET 5 OF 6

TYPE OF BORING ________ RIG ________

CASING USED ________ SIZE ________ DRILLING MUD USED ________

BORING BEGUN ________ BORING COMPLETED ________

GROUND ELEVATION ________ REFERRED TO ________

________ DATUM

FIELD PARTY: ________

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								70	
								1	
								2	Clay- Gray- moist- Low to med. plasticity
13	72.5	74.0	5	8	9	16"		3	
								4	CL
								5	
								6	
								7	
14	77.5	79.0	4	7	8	16"		8	Same as Sample No. 13
								9	
								80	
								1	
								2	
15	82.5	84.0	6	8	8	16"		3	Same as Sample No 13
								4	
								5	
								6	
								7	Gravelly Sandy Clay - Gray Saturated (Gravelly Sand Lime stone) 1" max size
16	87.5	89.0	8	12	8	8"		8	
								9	
								90	

ENGINEER ________

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ________

MPANY ________

PROJECT ________

BORING NO. SS2-3 DATE ________ SHEET 6 OF 6

TYPE OF BORING ________ RIG ________

CASING USED ________ SIZE ________ DRILLING MUD USED ________

BORING BEGUN ________ BORING COMPLETED ________

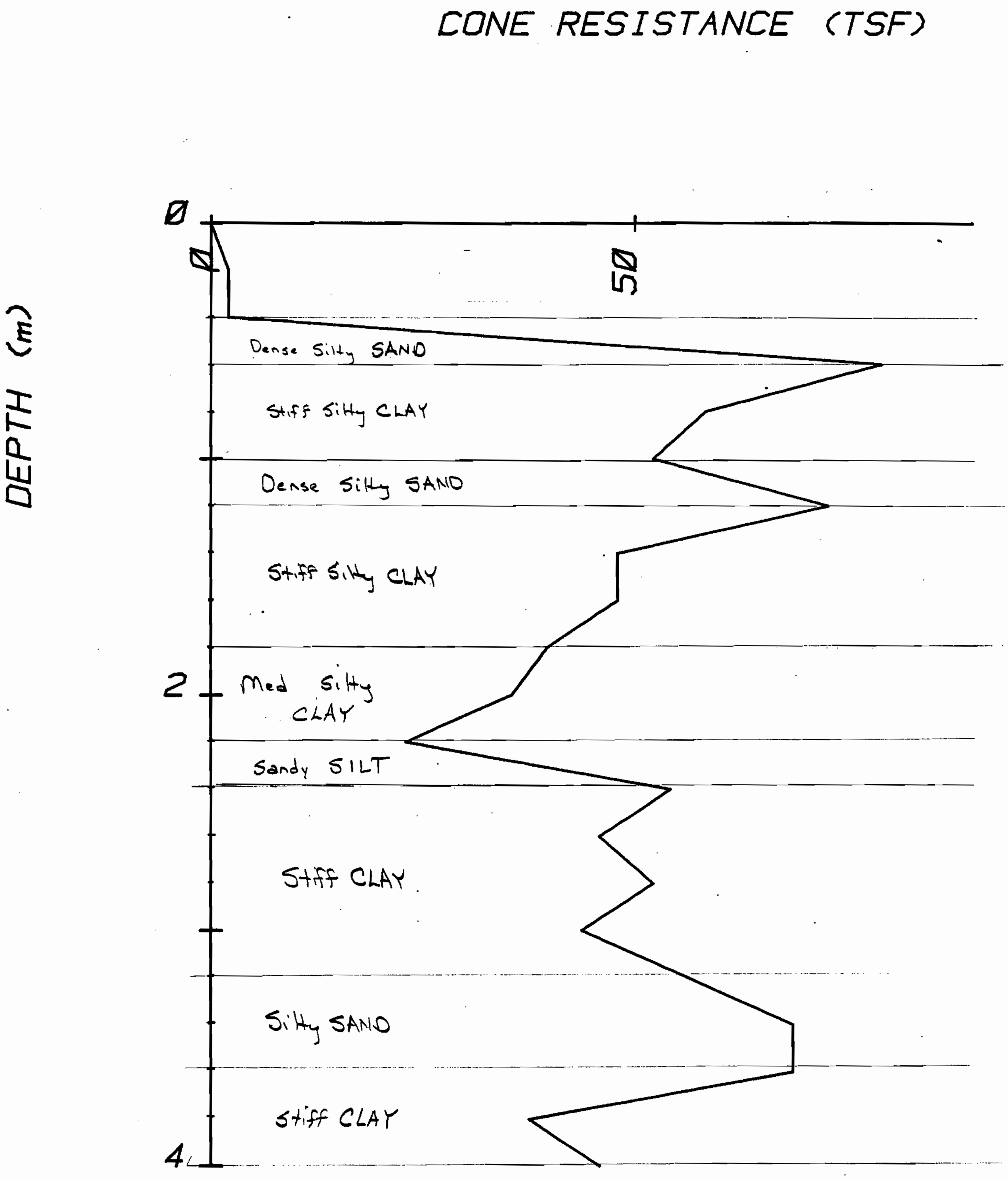
GROUND ELEVATION ________ REFERRED TO ________ DATUM

FIELD PARTY: ________

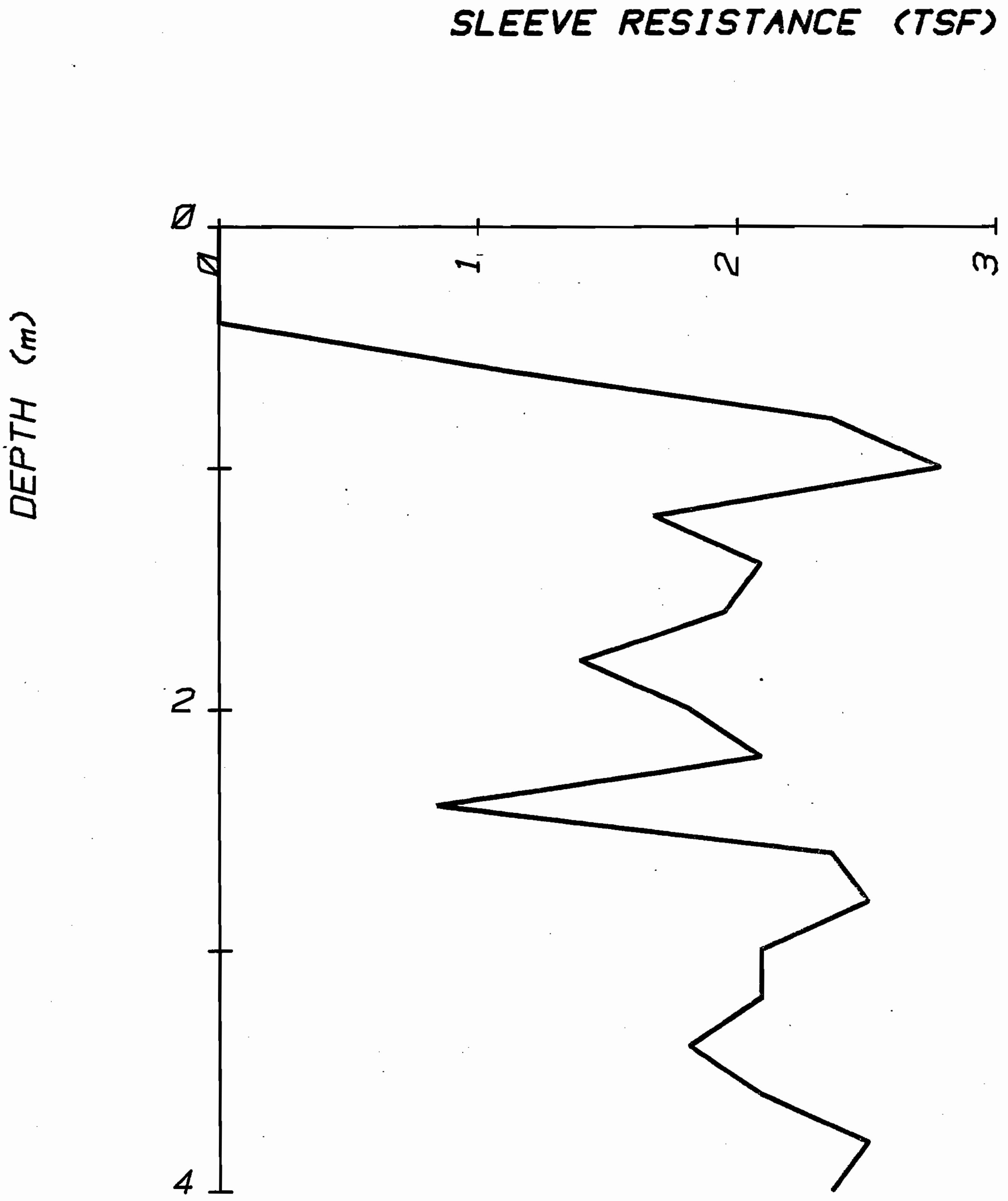
LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								90	
								1	
17	92.5	93.6	9	19	50/1	6'		2	Gravelly Sandy Clay- Gray Saturated. 1" max size
								3	
								4	(Grave + Sand - Lime stone)
								5	
								6	
								7	Stopped boring 94.9
								8	
								9	
								0	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								0	

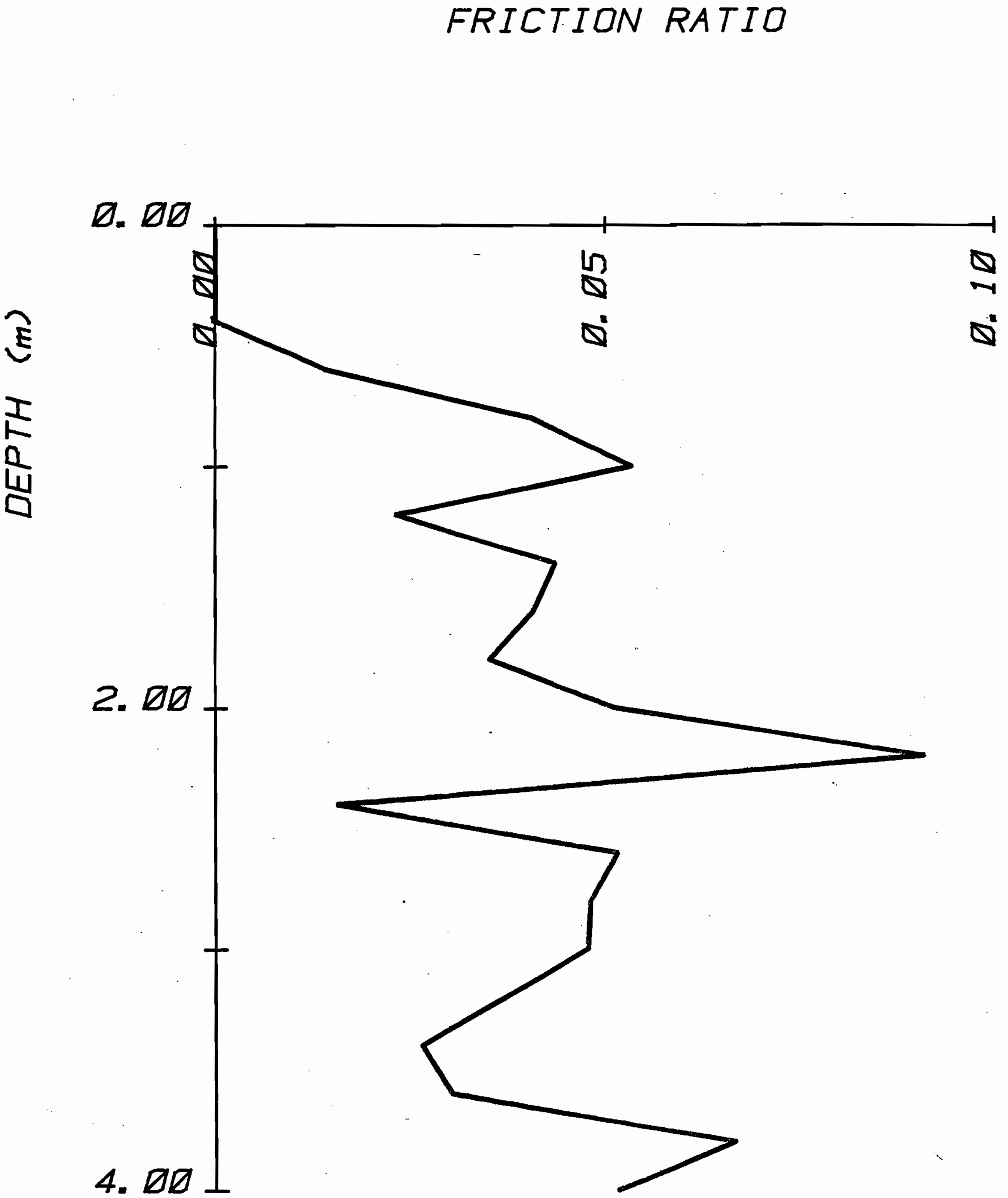
ENGINEER



Clifty Creek Flyash Dam
Dam Raising Study
PROBE SS2-3



Clifty Creek Flyash Dam
Dam Raising Study
PROBE SS2-3



Clifty Creek Flyash Dam
Dam Raising Study
PROBE SS2-3

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ______

MPANY IKEC

PROJECT Clifty Creek FAD

BORING NO. SS2-4 DATE 8-1-84 SHEET 1 OF 4

TYPE OF BORING SPT RIG B-61

CASING USED ______ SIZE ______ DRILLING MUD USED ______

BORING BEGUN 8-1-84 BORING COMPLETED 8-1-84

GROUND ELEVATION 439.80 REFERRED TO ______

______ DATUM

FIELD PARTY: Roush + Lambert

LOCATION OF BORING:	
WATER LEVEL	54'
TIME	
DATE	8-1-84

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	7.4 water Elev - 8-2-84
								1	
								2	
1	2.5	4.0	3	6	9	4"		3	Clay - Multi-colored Br. moist Low to med. Plasticity
								4	CL
								5	
								6	
								7	
2	7.5	9.0	5	7	5	2"		8	Same as Sample No 1
								9	
								10	
								1	
								2	Same as Sample No. 1
3	12.5	14.0	2	3	5	14"		3	
								4	
								5	
								6	
								7	Silty Sand - Gray saturated, Poorly
4	17.5	19.0	3	6	6	10"		8	Graded, 100% V-Fine grain, strong Reaction to HCL
								9	SM ML
								20	

ENGINEER ______

FORM CE-5
REV. 5/61

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ____________

COMPANY ____________

PROJECT ____________

BORING NO. SS2-4 DATE ____________ SHEET 2 OF 4

TYPE OF BORING ____________ RIG ____________

CASING USED ____________ SIZE ______ DRILLING MUD USED ____________

BORING BEGUN ____________ BORING COMPLETED ____________

GROUND ELEVATION ____________ REFERRED TO ____________ DATUM

FIELD PARTY: ____________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								20	
								1	
								2	Silt & Clay - Gray, wet, Low to med. plasticity, w/ Black (Lignite?)
5	22.5	24.0	2	3	3	16"		3	
								4	CL
								5	
								6	
								7	Clay. Blue Green, moist, Med to Low plasticity
6	27.5	29.0	4	8	9	16"		8	
								9	CL
								30	
								1	
								2	Same as Sample No 6 Trace of V-Fine sand
7	32.5	39.0	4	8	9	16"		3	
								4	
								5	
								6	
								7	
8	37.5	39.0	4	7	8	16"		8	Same as Sample No. 6
								9	
								40	

ENGINEER ____________

FORM CE-5
REV. 5/61

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB No. ____________

COMPANY ____________

PROJECT ____________

BORING No. SS2-4 DATE ____________ SHEET 3 OF 4

TYPE OF BORING ____________ RIG ____________

CASING USED ____________ SIZE ______ DRILLING MUD USED ____________

BORING BEGUN ____________ BORING COMPLETED ____________

GROUND ELEVATION ____________ REFERRED TO ____________ DATUM

FIELD PARTY: ____________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								40	
								1	
								2	
9	42.5	44.0	3	4	7	16"		3	Clay- Blue-Gray- Low to med plasticity moist to wet- Trace of V-Fine Sand CL
								4	
								5	
								6	
								7	
10	47.5	49.0	5	7	10	16"		8	Same As Sample No. 9
								9	
								50	
								1	
								2	
11	52.5	54.0	5	8	11	16"		3	Same As Sample No. 9
								4	
								5	Water 54'
								6	
								7	
12	57.5	59.0	8	11	11	12"		8	Silty Clay. Blue Gray Saturated Low to med plasticity. Trace of Limestone Frag End of Spoon CL
								9	
								60	

ENGINEER ____________

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ____________

MPANY ____________

PROJECT ____________

BORING NO. 552-4 DATE ____________ SHEET 4 OF 4

TYPE OF BORING ____________ RIG ____________

CASING USED ____________ SIZE ______ DRILLING MUD USED ______

BORING BEGUN ____________ BORING COMPLETED ____________

GROUND ELEVATION ____________ REFERRED TO ____________

____________ DATU

FIELD PARTY: ____________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
								40	
								1	
								2	Clayey Sand+ Gravel- Poorly Graded, Blue-Gray, Saturated, Limestone Frag.
13	62.5	64.0	8	10	11	10"		3	
								4	GC
								5	
								6	
								7	Auger Refusal 67.0
								8	
								9	
								0	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								0	

ENGINEER ____________

ORM CE-5
EV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

OB NO. ____________

ANY IKEC

ROJECT Clifty Creek Fly Ash Dam

LOCATION OF BORING:

WATER LEVEL	58.1
TIME	
DATE	

BORING NO. SS3-1 DATE 6-26-84 SHEET 1 OF 5

TYPE OF BORING SpT RIG B-61

CASING USED ______ SIZE ______ DRILLING MUD USED ______

BORING BEGUN 6-26-84 BORING COMPLETED 6-26-84

GROUND ELEVATION 459.16 REFERRED TO ______

______ DATUM

FIELD PARTY: Roush - Lambert

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	Moved boring 5' SE OF STAKE
								1	
								2	Clay - Br, moist, Low to med. plasticity
1	2.5	4.0	3	4	7	10"		3	CL
								4	
								5	
								6	
								7	Silty Clay - yellowish Br. Low plasticity, moist, slight Reaction to HCl
2	7.5	9.0	5	6	7	10"		8	
								9	CL-ML similar to SS1-1 #6
								10	
								1	
								2	Clay - Br. moist, Low to med. plasticity
3	12.5	14.0	4	10	12	8"		3	CL
								4	
								5	
								6	
								7	Silt - Br. slight plasticity, moist
1	17.5	19.0	3	7	10	12"		8	ML
								9	
								20	

ENGINEER ______

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB No. ____________

COMPANY ____________

PROJECT ____________

BORING No. SS3-1 DATE ____________ SHEET 2 OF ____

TYPE OF BORING ____________ RIG ____________

CASING USED ____________ SIZE ______ DRILLING MUD USED ____________

BORING BEGUN ____________ BORING COMPLETED ____________

GROUND ELEVATION ____________ REFERRED TO ____________ DATUM

FIELD PARTY: ____________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET		STANDARD PENETRATION RESISTANCE			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
	FROM	TO	BLOWS / 6"						
								20	
								1	
								2	SiLTY ClAY- GRAY + BR. mottled.
5	22.5	24.0	7	9	13	14"		3	Low To med. plasticity, moisT, STRONG REACTION TO HCL
								4	CL
								5	Original ground
								6	
								7	ClAyey SAnd - Reddish BR. pooRly
6	27.5	29.0	15	13	14	12"		8	GRAded, 100% Fine GRAin, moisT
								9	SC
								30	
								1	
								2	SilTy ClAy- BR. moisT, Low To med.
7	32.5	34.0	3	4	6	8"		3	plASTicity
								4	CL
								5	
								6	
								7	Sandy silT - BR. slighT plasTicity
8	37.5	39.0	5	7	8	12"		8	moisT ML
								9	
								40	

ENGINEER ____________

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB No. ____________

COMPANY ____________

PROJECT ____________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING No. SS3-1 DATE ________ SHEET 3 OF ____

TYPE OF BORING ________ RIG ________

CASING USED ________ SIZE ____ DRILLING MUD USED ________

BORING BEGUN ________ BORING COMPLETED ________

GROUND ELEVATION ________ REFERRED TO ________ DATUM

FIELD PARTY: ________

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								40	
								1	
								2	Sandy silt - Br. moist, slight
9	42.5	44.0	7	9	13	15"		3	plasticity, strong reaction to HCL
								4	ML
								5	
								6	⊛ Not found in 4-1
								7	Sand - Lt Br. moist, poorly graded,
10	47.5	49.0	11	12	12	13"		8	100 % fine grain, strong reaction to HCL
								9	SP
								50	
								1	
								2	Clayey sand - Br. moist, strong
11	52.5	54.0	11	13	20	15"		3	reaction to HCL 100% fine grain SC
								4	
								5	
								6	Top - silty clay - Br. moist, low
								7	plasticity, slight reaction to HCL CL
12	57.5	59.0	5	15	2	16"		8	58.1 water
								9	Bottom - sand - Br. poorly graded,
								60	strong reaction to HCL SP

ENGINEER ____________

FORM CE-5
REV. 5/61

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB No. ____________
COMPANY ____________
PROJECT ____________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING No. SS3-1 DATE ____________ SHEET 4 OF 5
TYPE OF BORING ____________ RIG ____________
CASING USED ____________ SIZE ______ DRILLING MUD USED ____________
BORING BEGUN ____________ BORING COMPLETED ____________
GROUND ELEVATION ____________ REFERRED TO ____________
____________ DATUM
FIELD PARTY: ____________

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	SAMPLE DEPTH IN FEET TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								60	
								1	
								2	TOP
13	62.5	64.0	6	8	12	16"			Sandy SilT - Br. weT, slight plasTiciTy - STRONG ReacTion To HCL.
								3	Bottom ML
								4	Sand. Br. poorly Graded 100% Fine Grain, STRong ReacTion To HCL SP
								5	
								6	
								7	
14	67.5	69.0	6	12	13	16"			SilTy Sand - Br moderate ReacTion To HCL, weT, poorly Graded
								8	
								9	SM
								70	
								1	
								2	
15	72.5	74.0	6	7	7	16"			Sand - Gray - SaTuraTed, poorly Graded, 100% Fine Grain, STRONG ReacTion To HCL
								3	
								4	SP
								5	
								6	
								7	
16	77.5	79.0	13	20	17	16"			Same as Sample No. 15
								8	
								9	
								80	

ENGINEER ____________

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ____

MPANY ____

PROJECT ____

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING NO. SS3-1 DATE ____ SHEET 5 OF 5

TYPE OF BORING ____ RIG ____

CASING USED ____ SIZE ____ DRILLING MUD USED ____

BORING BEGUN ____ BORING COMPLETED ____

GROUND ELEVATION ____ REFERRED TO ____ DATUM

FIELD PARTY: ____

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								80	
								1	
								2	Sand - Gray. poorly Graded,
17	82.5	84.0	10	14	14	4"		3	100% Fine Grain, Strong Reaction To HcL. Saturated
								4	SP
								5	
								6	
								7	Silty Sand - Gray. poorly Graded
18	87.5	89.0	11	14	15	7"		8	moist, Strong Reaction To HCL SM
								9	
								90	
								1	
								2	Same As Sample No. 18
19	92.5	94.0	11	12	16	5"		3	
								4	
								5	
								6	
								7	Silty Clay - Gray, moist, slight Reaction
20	97.5	99.0	13	13	16	8"		8	To HcL, Slight Reaction To HCL, w/ Fine Grain Sand Lens
								9	CL
								100	Stopped boring 99.0 WATER 59.6

ENGINEER

Dutch Cone Test

Company IKEC

Job CLIFTY CREEK FAD

Order LAMBERT

Probe No. 553-3

Date 8-7-84

Drillers MACKnight · Lambert

Page 1 of 6

Elevation ELEV. 6 TO 8' Higher - 468.09

ELEV.	DEPTH (Ft.)	DEPTH (m)	C or C + S	GAGE READINGS		CONE RESIST.	SLEEVE RESIST.	FRICTION RATIO
				HIGH	LOW			
GAGE ZERO READINGS				0.0	- 0.2	(1000N)	(1000N)	(%)
			C		—			
		.2	C+S		—			
			C		7.8	84	0	0
		.4	C+S		—			
			C	14.0		148	0	0
		.6	C+S		—			
			C		9.4	100	5:29	0.053
		.8	C+S	17.0				
			C		7.0	75	6.96	0.093
		1.0	C+S	17.0				
			C		4.2	46	3.20	0.070
		.2	C+S		8.8			
			C		2.8	31	3.20	0.103
		.4	C+S		7.4			
			C		3.4	38	1.39	0.037
		.6	C+S		5.4			
			C		3.2	35	1.81	0.052
		.8	C+S		5.8			
			C		3.6	40	1.53	0.038
		2.0	C+S		5.8			
			C		4.0	44	0.84	0.019
		.2	C+S		5.2			
			C		2.2	25	1.11	0.044
		.4	C+S		3.8			
			C		2.6	29	0.56	0.019
		.6	C+S		3.4			
			C		2.2	25	0.70	0.028
		.8	C+S		3.2			
			C		1.8	21	0.70	0.033
		3.0	C+S		2.8			
			C		2.0	23	0.70	0.030
		.2	C+S		3.0			
			C		2.4	27	0.84	0.030
		.4	C+S		3.6			
			C		3.0	33	0.42	0.013
		.6	C+S		3.6			
			C		1.6	19	0.56	0.031
		.8	C+S		2.4			
			C		3.0	33	0.28	0.008
		4.0	C+S		3.4			
			C		2.8	31	0.84	0.027
		.2	C+S		4.0			
			C		2.6	29	0.70	0.024
		.4	C+S		3.6			
			C		3.2	40	0.28	0.007
		.6	C+S		4.0			
			C		2.0	23	0.56	0.024
		.8	C+S		2.8			
			C		2.0	23	0.42	0.018
		5						

Dutch Cone Test

Company__________ Probe No. 553-3 Date__________

Job__________ Drillers__________

Recorder__________ Page 2 of 6 Elevation__________

ELEV.	DEPTH (Ft.)	DEPTH (m)	C or C + S	GAGE READINGS HIGH	LOW	CONE RESIST. (1000N)	SLEEVE RESIST. (1000N)	FRICTION RATIO (%)
GAGE ZERO READINGS				0.0	-0.2			
			C		1.6	19	0.28	0.015
		.2	C+S		2.0			
			C		3.2	35	1.95	0.056
		.4	C+S		6.0			
			C		7.6	81	0.42	0.005
		.6	C+S		8.2			
			C	20.0		211	0	0
		.8	C+S	20.0				
			C	12.0		127	4.18	0.033
		6.0	C+S	18.0				
			C		9.2	98	4.73	0.048
		.2	C+S	16.0				
			C		8.0	86	1.11	0.013
		.4	C+S		9.6			
			C		9.0	96	0.56	0.008
		.6	C+S		9.8			
			C		9.2	98 ~~106~~	2.64	0.027
		.8	C+S	13.0				
			C	10.0		106 ~~96~~	2.78	0.026
		7.0	C+S	14.0				
			C		9.0	96 ~~88~~	2.09	0.022
		.2	C+S	12.0				
			C		8.2	88 ~~92~~	1.95	0.022
		.4	C+S	11.0				
			C		8.6	92 ~~159~~	3.06	0.033
		.6	C+S	13.0				
			C	15.0		159 ~~200~~	4.18	0.026
		.8	C+S	21.0				
			C	19.0		200 ~~106~~	2.09	0.010
		.0	C+S	22.0				
			C	10.0		106 ~~88~~	4.18	0.039
		.2	C+S	16.0				
			C		8.2	88 ~~106~~	2.64	0.030
		.4	C+S	12.0				
			C	10.0		106	3.48	0.033
		.6	C+S	15.0				
			C	12.0		127	3.48	0.027
		.8	C+S	17.0				
			C	11.0		118	2.78	0.024
		.0	C+S	15.0				
			C		9.2	98	4.04	0.041
		.2	C+S	15.0				
			C					
		.4	C+S					
			C					
		.6	C+S					
			C					
		.8	C+S					
			C					

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB No. ____________

COMPANY ____________

PROJECT ____________

LOCATION OF BORING:	
WATER LEVEL	36.0
TIME	
DATE	

BORING No. 553-3 DATE ____________ SHEET 3 OF 6

TYPE OF BORING ____________ RIG ____________

CASING USED ____________ SIZE ______ DRILLING MUD USED ______

BORING BEGUN ____________ BORING COMPLETED ____________

GROUND ELEVATION ____________ REFERRED TO ____________

____________ DATUM

FIELD PARTY: ____________

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								30	
								1	
								2	Ditch come to 31.) Auger Return V-Fine Grain Sand.
								3	Sand- Br. Poorly Graded, Saturated, Strong Reaction to HCl
1	32.5	34.0	15	16	16	6"		4	SP
								5	
								6	
								7	Silty Sand- Br. Saturated, Slight Reaction to HCL
2	37.5	39.0	6	11	12	13"		8	SM
								9	
								40	
								1	
								2	Same as Sample No 2
3	42.5	44.0	11	20	17	16"		3	
								4	
								5	
								6	
4	47.5	49.0	15	27	28	12		7	
								8	Silty Sand- Rust Br. Poorly Graded, Wet to Saturated, Strong Reaction to HCL
								9	
								50	SP-SM

ENGINEER ____________

AMERICAN ELECTRIC POWER CIVIL ENGINEERING LABORATORY

Dutch Cone Test

Company

Job

Recorder

Probe No. 553-3 Date

Drillers

Page 4A of 6 Elevation

ELEV.	DEPTH (Ft.)	DEPTH (m)	C or C + S	GAGE READINGS HIGH	GAGE READINGS LOW	CONE RESIST. (1000N)	SLEEVE RESIST. (1000N)	FRICTION RATIO (%)
GAGE ZERO READINGS								
			C					
		.2	C+S					
			C					
		.4	C+S					
			C					
		.6	C+S					
			C					
		.8	C+S					
			C					
		16.0	C+S					
			C					
		.2	C+S					
			C		7.8	84	2.92	0.035
		.4	C+S	12.0				
			C		6.8	73	2.92	0.040
		.6	C+S	11.0				
			C		4.2	46	2.37	0.052
		.8	C+S		7.6			
			C		7.0	75	1.39	0.018
		.0	C+S		9.0			
			C		8.4	90	2.51	0.028
		.2	C+S	12.0				
			C		6.6	71	3.06	0.043
		.4	C+S	11.0				
			C		2.2	25	3.34	0.134
		.6	C+S		7.0			
			C		7.2	77	0.70	0.009
		.8	C+S		8.2			
			C		4.4	48	2.51	0.052
		.0	C+S		8.0			
			C		4.6	50	2.64	0.053
		.2	C+S		8.4			
			C					
		.4	C+S					
			C					
		.6	C+S					
			C					
		.8	C+S					
			C					
		.0	C+S					
			C					
		.2	C+S					
			C					
		.4	C+S					
			C					
		.6	C+S					
			C					
		.8	C+S					
			C					

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ____________

MPANY ____________

PROJECT ____________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING NO. SS3-3 DATE ____________ SHEET 4 OF 6

TYPE OF BORING ____________ RIG ____________

CASING USED ____________ SIZE ______ DRILLING MUD USED ______

BORING BEGUN ____________ BORING COMPLETED ____________

GROUND ELEVATION ____________ REFERRED TO ____________

____________ DATUM

FIELD PARTY: ____________

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								50	
								1	
								2	
5	52.5	54.0	7	12	11	14"		3	SILT- GRAY. SATURATED, STRONG REACTION TO HCL ML
								4	
								5	DC.
								6	
								7	Dutch cone
								8	
								9	
								60	
								1	
								2	
7	62.5	64.0	4	5	7	10"		3	Same AS Sample NO 5
								4	
								5	
								6	
								7	Same AS Sample NO 5
8	67.5	69.0	5	8	9	16		8	
								9	
								70	

ENGINEER ____________

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ____________

COMPANY ____________

PROJECT ____________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING NO. SS3-3 DATE ____________ SHEET 5 OF 6

TYPE OF BORING ____________ RIG ____________

CASING USED ____________ SIZE ______ DRILLING MUD USED ____________

BORING BEGUN ____________ BORING COMPLETED ____________

GROUND ELEVATION ____________ REFERRED TO ____________ DATUM

FIELD PARTY: ____________

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
								70	
								1	
								2	Clay- Blue-Gray- Low plasticity,
9	72.5	74.0	8	13	15	12"		3	moist To weT
									CL
								4	
								5	
								6	
								7	Same As Sample No. 9
10	77.5	79.0	7	10	13	16"		8	
								9	
								80	
								1	
								2	Same As Sample No. 9
11	82.5	84.0	6	10	13	16"		3	
								4	
								5	
								6	
								7	Sandy clay - Gray BR. Low To med
12	87.5	89.0	6	9	13	16"		8	plasticity, weT
								9	CL
								90	

ENGINEER ____________

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. __________

COMPANY __________

PROJECT __________

LOCATION OF BORING:

WATER LEVEL	
TIME	
DATE	

BORING NO. SS 3-3 DATE __________ SHEET 6 OF 6

TYPE OF BORING __________ RIG __________

CASING USED __________ SIZE ______ DRILLING MUD USED __________

BORING BEGUN __________ BORING COMPLETED __________

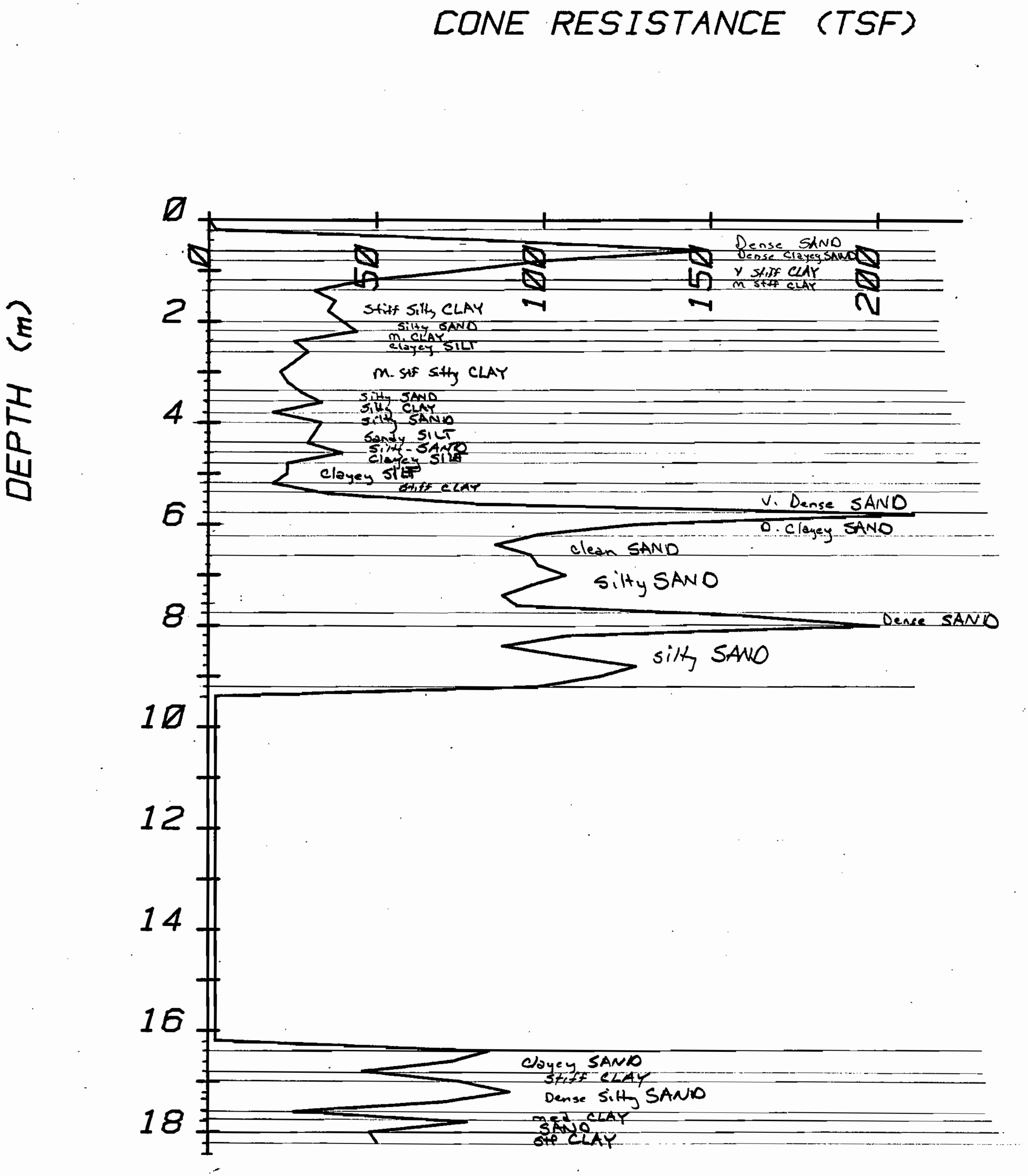
GROUND ELEVATION __________ REFERRED TO __________

__________ DATU

FIELD PARTY: __________

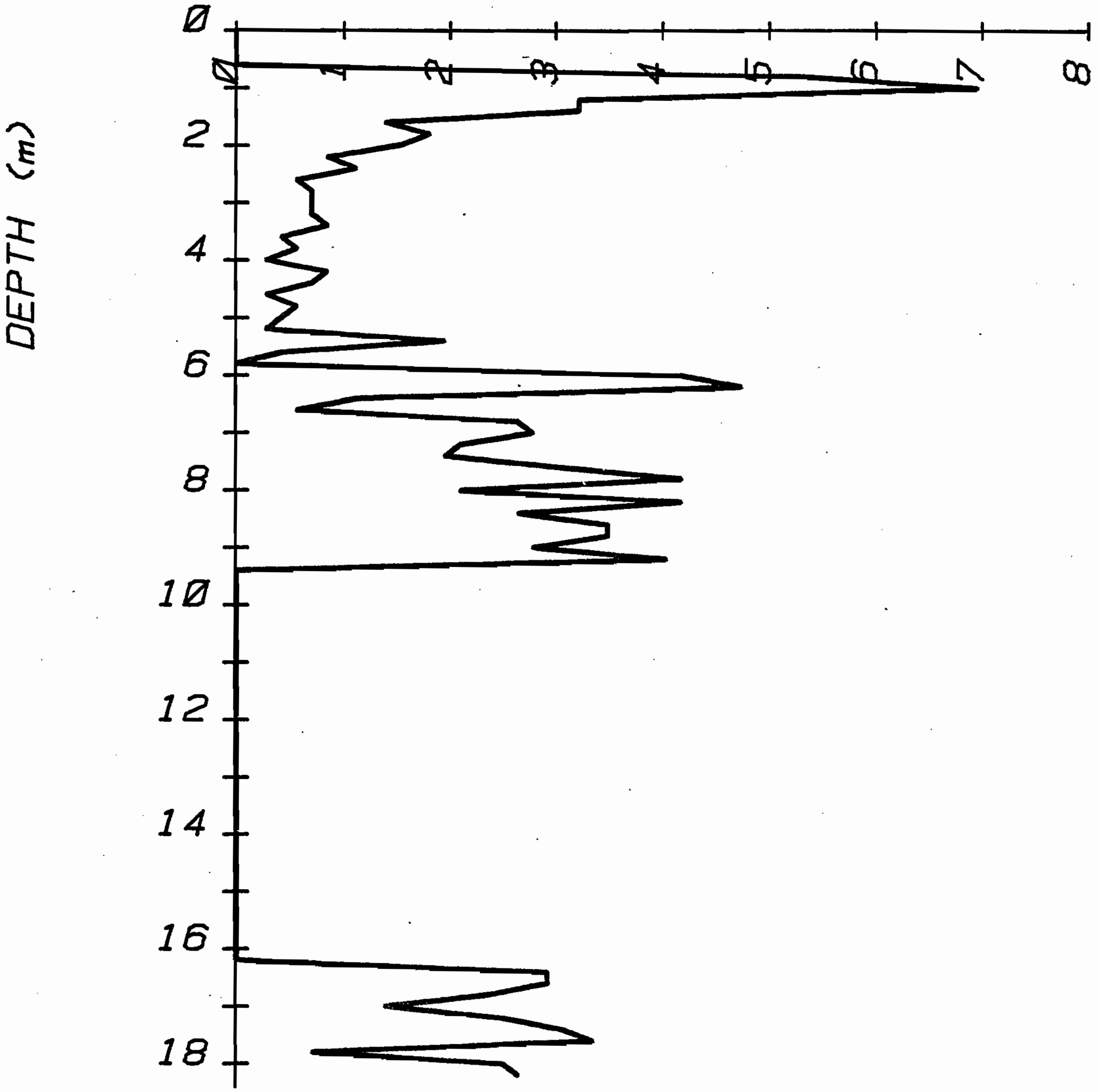
SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								90	
								1	
								2	Gravelly clay - poorly graded
13	92.5	94.0	10	11	5	6"		3	Gray Br. wet, Broken limestone Frag
								4	GC
								5	
								6	over Drove Sample Spoon - Spoon Refusal 95.0
								7	
								8	Stopped boring 95.0
								9	
								0	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								0	

ENGINEER __________

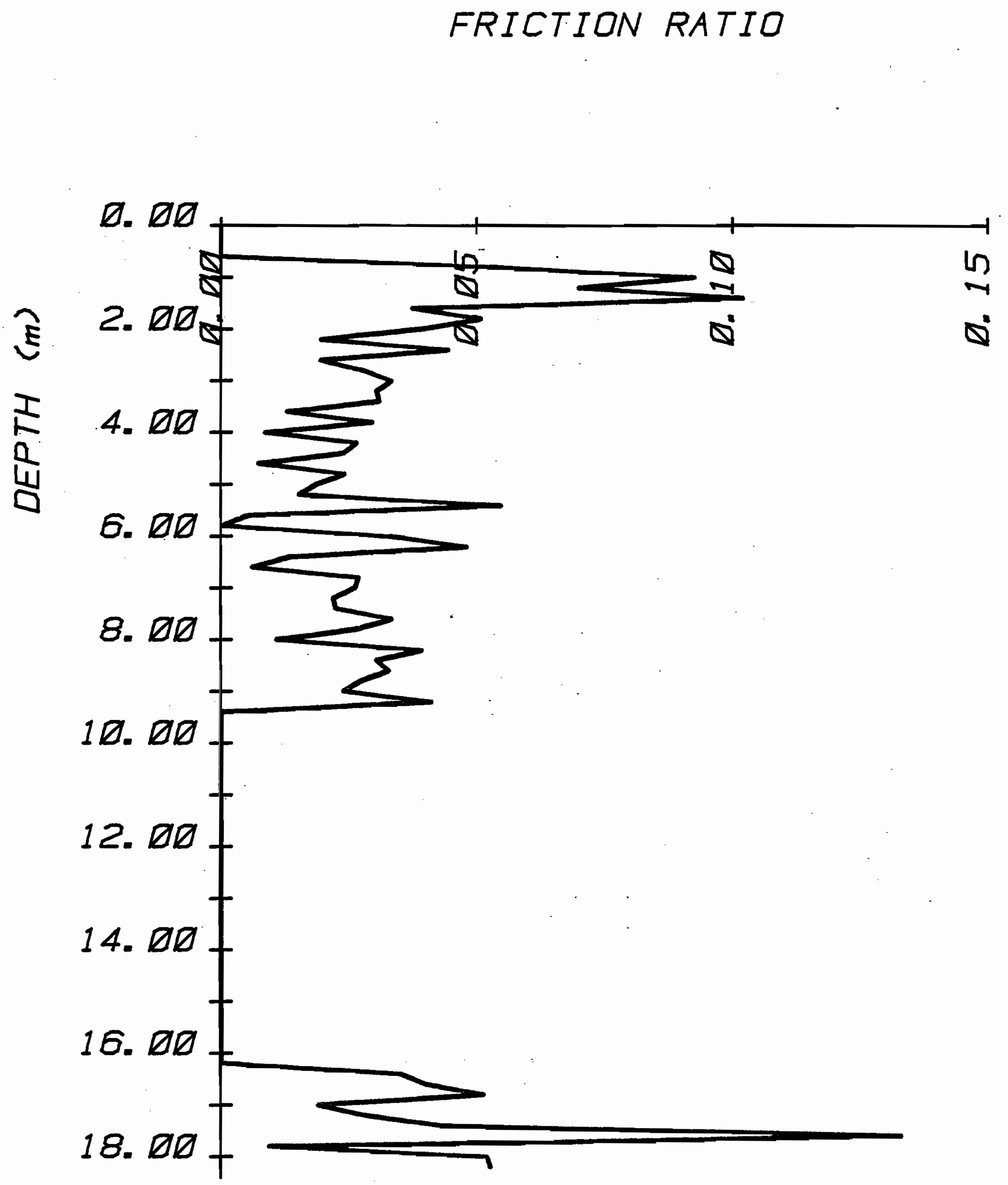


Clifty Creek Flyash Dam
Dam Raising Study
PROBE SS3-3

SLEEVE RESISTANCE (TSF)



Clifty Creek Flyash Dam
Dam Raising Study
PROBE SS3-3



Clifty Creek Flyash Dam
Dam Raising Study
PROBE SS3-3

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB No.

PANY IKEC

PROJECT Clifty Creek FAD

LOCATION OF BORING:	
WATER LEVEL	30.0
TIME	8-1-84
DATE	

BORING No. SS3-4 DATE 8-1-84 SHEET 1 OF 7

TYPE OF BORING SPT-Core RIG B-61

CASING USED SIZE DRILLING MUD USED

BORING BEGUN 8-1-84 BORING COMPLETED

GROUND ELEVATION 451.82 REFERRED TO

DATUM

FIELD PARTY: Roush-Lambert

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	Boring moved 30' South out of woods
								1	
								2	
								3	Sandy Clay - Br. moist Low to med. plasticity.
1	3.0	4.5	3	4	6	5"		4	CL
								5	
								6	
								7	
								8	Same as Sample No 1
2	8.0	9.5	2	4	5	16"		9	
								10	
								1	
								2	
								3	Silty Sand - Br. wet to saturated, 100% Fine Grain
3	13.0	14.5	2	2	3	15"		4	
								5	SM
								6	
								7	
								8	
	18.0	19.5	2	4	3	13"		9	Same as Sample No 3
								20	

ENGINEER

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ____________

MPANY ____________

PROJECT ____________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING NO. SS3-4 DATE ____________ SHEET 2 OF 7

TYPE OF BORING ____________ RIG ____________

CASING USED ____________ SIZE ______ DRILLING MUD USED ______

BORING BEGUN ____________ BORING COMPLETED ____________

GROUND ELEVATION ____________ REFERRED TO ____________

____________ DATUM

FIELD PARTY: ____________

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								20	
								1	
								2	
								3	Clayey Sand - Br. wet to Saturated
5	23.0	24.5	2	1	1	7"		4	100% Fine Grain
									SC
								5	
								6	
								7	
								8	Silt - Br. wet to Saturated, w/
6	28.0	29.5	4	5	6	16"		9	Fine Grain Sand Layers
									ML
								30	
								1	
								2	
								3	Clayey Silt - Gray moist Low
7	33.0	34.5	6	4	5	16"		4	plasticity w/ Trace of organic
									material
								5	ML
								6	
								7	
								8	Clay - Gray - moist Low to med
	38.0	39.5	1	1	1	16"		9	plasticity, w/ Lignite
									CL
								40	

ENGINEER

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB No. ____

PANY ____

PROJECT ____

LOCATION OF BORING:

WATER LEVEL	
TIME	
DATE	

BORING No. SS3-4 DATE ____ SHEET 3 OF 7

TYPE OF BORING ____ RIG ____

CASING USED ____ SIZE ____ DRILLING MUD USED ____

BORING BEGUN ____ BORING COMPLETED ____

GROUND ELEVATION ____ REFERRED TO ____

____ DATUM

FIELD PARTY: ____

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								40	
								1	
								2	
9	43.0	44.5	4	8	11	16"		3	clay - Blue Gray - moist, Low to med. Plasticity
								4	
								5	CL
								6	
								7	
10	48.0	49.5	8	11	11	16"		8	Same as Sample No. 9
								9	
								50	
								1	
								2	
11	53.0	54.5	4	7	8	16"		3	Same as Sample No. 9
								4	
								5	
								6	
								7	
[illegible]	58.0	59.5	4	7	9	16"		8	Same as Sample No. 9
								9	
								60	

ENGINEER ____

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ______
COMPANY ______
PROJECT ______

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING NO. SS3-4 DATE ______ SHEET 4 OF 7
TYPE OF BORING ______ RIG ______
CASING USED ______ SIZE ______ DRILLING MUD USED ______
BORING BEGUN ______ BORING COMPLETED ______
GROUND ELEVATION ______ REFERRED TO ______
______ DATUM
FIELD PARTY: ______

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								60	
								1	
								2	
13	63.0	64.5	6	9	10	16"		3	Clay- Blue Gray - moist, Low to med. plasticity
								4	
								5	CL
								6	
								7	
14	68.0	69.5	7	9	12	16"		8	Same as Sample No. 13
								9	
								70	
								1	
								2	
15	73.0	74.5	15	9	11	12"		3	Gravelly Sand Clay- Blue Gray Saturated - Limestone Frag.
								4	
								5	CL
								6	
								7	
16	78.0	79.5	8	16	18	13"		8	Same as Sample No. 15 (Yellowish Br)
								9	
								80	

ENGINEER ______

AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. ______

Company IKEC

Project Clifty Creek FAD

Location of Boring:

Water Level	
Time	
Date	

Boring No. SS3-4 Date ______ Sheet 5 of

Type of Boring Core Rig B-61

Casing used ______ Size ______ Drilling mud used ______

Boring begun 8-14-84 Boring completed 8-14-8

Ground Elevation ______ referred to ______ Datu

Field Party: Roush-Lambert

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Dep is water lost, Observed fluctuations in water level, notes on drilling ease, etc.
		80.9 85.3	45%	3.9	81		80.9- 85.3 Gray Hard Limestone w/ Gray calcare Shale Layers
					82		
					83		
					84		
					85		
		85.3 87.5	19%	2.2			
					86		Gray calcareous shale
							Gray calcareous Shale
					87		

AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No.

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ject

cation of Boring:

ater Level	
Time	
ate	

Boring No. 553-4 Date Sheet 6 of 7

Type of Boring Rig

Casing used Size Drilling mud used

Boring begun Boring completed

Ground Elevation referred to Datu

Field Party:

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
		87.5 95.3	64%	7.8			
					88		Gray calcareous shale
							" " "
					89		" " "
					90		" " "
					91		
					92		Gray calcareous shale
					93		
					94		

AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No:

Company

Project

Location of Boring:

Water Level	
Time	
Date	

Boring No. SS3-4 Date Sheet 7 of 7

Type of Boring Rig

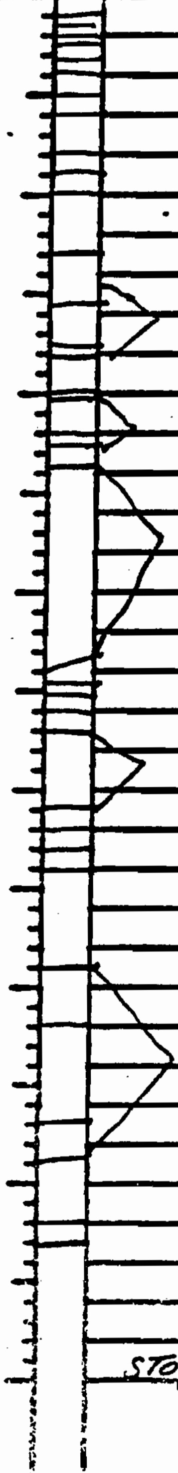
Casing used Size Drilling mud used

Boring begun Boring completed

Ground Elevation referred to

Dat

Field Party:

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, De th water lost, Observed fluctuations in water level, note on drilling ease, etc.
					95		
		95.3 100.3	49%	5.0			
							Gray Calcareous Shale
					96		
							" " "
							" " "
					97		
							" " "
					98		
					99		
					100		
							Stopped boring 100.3

AMERICAN ELECTRIC POWER CIVIL ENGINEERING LABORATORY

Dutch Cone Test

Company TKEC

Job Clifty Creek FAD

Recorder Lambert

Probe No. SS3-S Date 8-6-84

Drillers MacKnight · Lambert

Page 1 of 5 Elevation 449.34

ELEV.	DEPTH (Ft.)	DEPTH (m)	C or C + S	GAGE READINGS HIGH	LOW	CONE RESIST. (1000N)	SLEEVE RESIST. (1000N)	FRICTION RATIO (%)
GAGE ZERO READINGS				0.0	-0.2			
			C		1	Boring 8' NORTH OF STAKE		
		.2	C+S		2			
			C		2.2			
		.4	C+S		3			
			C		2.2			
		.6	C+S		3.2			
			C		1.8			
		.8	C+S		2.2			
			C		1.0			
		1.0	C+S		2.8			
			C		.6			
		.2	C+S		1.8			
			C		.6			
		.4	C+S		1.6			
			C		.6			
		.6	C+S		1.6			
			C		1.8			
		.8	C+S		2.4			
			C		1.0			
		2.0	C+S		1.8			
			C		1.6			
		.2	C+S		2.4			
			C		1.4			
		.4	C+S		2.8			
			C		1.4			
		.6	C+S		2.6			
			C		1.0			
		.8	C+S		2.0			
			C		1.2			
		3.0	C+S		1.8			
			C		1.6			
		.2	C+S		2.0			
			C		1.2			
		.4	C+S		2.0			
			C		1.2			
		.6	C+S		2.0			
			C		1.0			
		.8	C+S		1.8			
			C		1.2			
		4.0	C+S		2.0			
			C		1.4			
		.2	C+S		2.2			
			C		1.4			
		.4	C+S		2.2			
			C		1.2			
		.6	C+S		2.0			
			C		1.2			
		.8	C+S		2.0			
			C		1.2			

AMERICAN ELECTRIC POWER CIVIL ENGINEERING LABORATORY

Dutch Cone Test

ompany______________________ Probe No. SS3-5 Date______________

ob__________________________ Drillers______________

der_________________________ Page 2 of 5 Elevation______________

ELEV.	DEPTH (Ft.)	DEPTH (m)	C or C + S	GAGE READINGS HIGH	GAGE READINGS LOW	CONE RESIST.	SLEEVE RESIST.	FRICTION RATIO
GAGE ZERO READINGS				0.0	- 0.2	(1000N)	(1000N)	(%)
			C		1.2			
		.2	C+S		2.0			
			C		1.2			
		.4	C+S		2.0			
			C		1.0			
		.6	C+S		1.8			
			C		1.2			
		.8	C+S		1.8			
			C		.8			
		6.0	C+S		1.8			
			C		0.8			
		.2	C+S		1.4			
			C		.2			
		.4	C+S		1.6			
			C		.2			
		.6	C+S		1.4			
			C		0.2			
		.8	C+S		2.0			
			C		0.2			
		7.0	C+S		1.0			
			C		0.6			
		.2	C+S		1.8			
			C		0.2			
		.4	C+S		0.6			
			C		0.2			
		.6	C+S		1.6			
			C		Void	Gravel Layer ?		
		.8	C+S		Void			
			C		2.2			
		8.0	C+S		3.6			
			C		Void			
		.2	C+S		3.8			
			C		4.4			
		.4	C+S	15.0				
			C		2.8			
		.6	C+S		5.6			
			C		5.6			
		.8	C+S		7.0			
			C		5.6			
		9.0	C+S		7.2			
			C		5.4			
		.2	C+S		8.0			
			C		6.0			
		.4	C+S		7.4			
			C		5.2			
		.6	C+S		6.6			
			C		3.6			
		.8	C+S		4.2			
			C		4.0			
		10.0	C+S		4.4			

AMERICAN ELECTRIC POWER CIVIL ENGINEERING LABORATORY

Dutch Cone Test

Company

Probe No. SS3- 5 Date

Job

Drillers

Order

Page 3 of 5 Elevation

ELEV.	DEPTH (Ft.)	DEPTH (m)	C or C + S	GAGE READINGS HIGH	GAGE READINGS LOW	CONE RESIST. (1000N)	SLEEVE RESIST. (1000N)	FRICTION RATIO (%)
GAGE ZERO READINGS				0.0	-0.2			
			C		4.4			
		.2	C+S		7.4			
			C		8.0			
		.4	C+S		8.4			
			C		7.6			
		.6	C+S		8.4			
			C		8.0			
		.8	C+S		8.6			
			C		8.2			
		11.0	C+S		9.0			
			C		8.4			
		.2	C+S		5.4			
			C		1.8			
		.4	C+S		3.6			
			C		5.4			
		.6	C+S		6.4			
			C		2.4			
		.8	C+S		3.8			
			C		0.8			
		12.0	C+S		3.2			
			C		0.2			
		.2	C+S		2.2			
			C		1.0			
		.4	C+S		1.6			
			C		0.2			
		.6	C+S		1.6			
			C		0.2			
		.8	C+S		2.0			
			C		1.0			
		13.0	C+S		1.8			
			C		0.2			
		.2	C+S		2.0			
			C		0.2			
		.4	C+S		2.0			
			C		0.2			
		.6	C+S		2.0			
			C		0.2			
		.8	C+S		1.8			
			C		0.2			
		14.0	C+S		2.0			
			C		1.0			
		.2	C+S		2.2			
			C		0.2			
		.4	C+S		2.2			
			C		0.2			
		.6	C+S		2.2			
			C		0.2			
		.8	C+S		2.0			
			C		0.2			
		15.0	C+S					

AMERICAN ELECTRIC POWER CIVIL ENGINEERING LABORATORY

Dutch Cone Test

Company________________ Probe No. 553-5 Date__________

Job________________ Drillers________________

Recorder________________ Page 4 of 5 Elevation__________

ELEV.	DEPTH (Ft.)	DEPTH (m)	C or C + S	GAGE READINGS HIGH	LOW	CONE RESIST.	SLEEVE RESIST.	FRICTION RATIO
GAGE ZERO READINGS				0.0	−0.2	(1000N)	(1000N)	(%)
			C		0.2			
		.2	C+S		2.0			
			C		0.2			
		.4	C+S		1.8			
			C		0.2			
		.6	C+S		2.2			
			C		0.2			
		.8	C+S		2.4			
			C		0.2			
		16.0	C+S		2.0			
			C		0.2			
		.2	C+S		2.4			
			C		1.2			
		.4	C+S		2.2			
			C		1.2			
		.6	C+S		2.4			
			C		0.2			
		.8	C+S		2.2			
			C		0.2			
		17.0	C+S		2.0			
			C		1.2			
		.2	C+S		2.2			
			C		0.2			
		.4	C+S		2.0			
			C		0.2			
		.6	C+S		2.4			
			C		0.2			
		.8	C+S		2.6			
			C		1.6			
		18.0	C+S		2.6			
			C		2.0			
		.2	C+S		3.6			
			C		3.6			
		.4	C+S		5.2			
			C		3.6			
		.6	C+S		6.2			
			C		2.4			
		.8	C+S		5.4			
			C		0.2			
		19.0	C+S		4.2			
			C		2.4			
		.2	C+S		4.4			
			C		3.0			
		.4	C+S		4.4			
			C		2.6			
		.6	C+S		5.2			
			C		2.6			
		.8	C+S		5.0			
			C		2.2			

AMERICAN ELECTRIC POWER CIVIL ENGINEERING LABORATORY

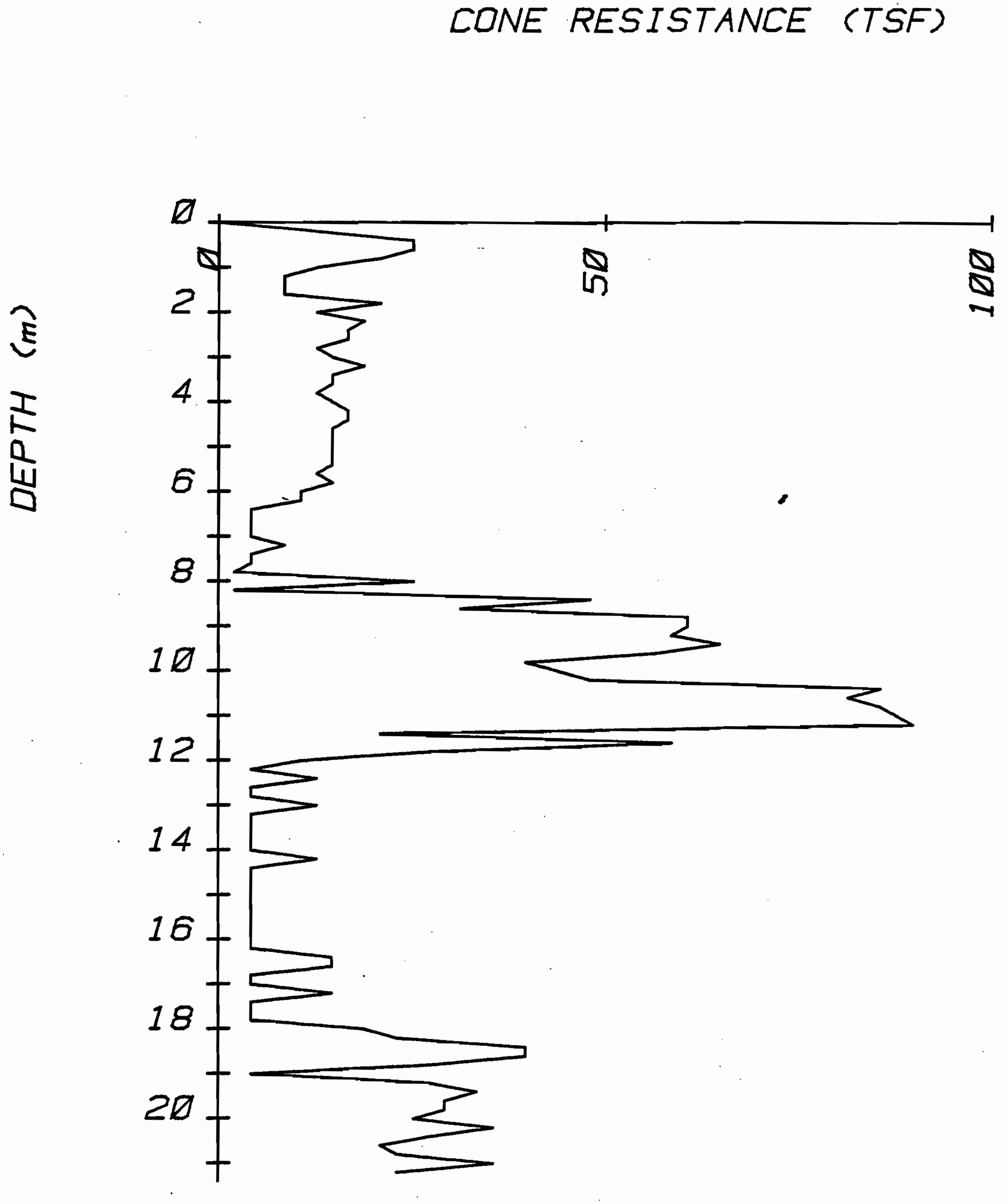
Dutch Cone Test

Company ______________________ Probe No. 553-5 Date ______________________

b ______________________ Drillers ______________________

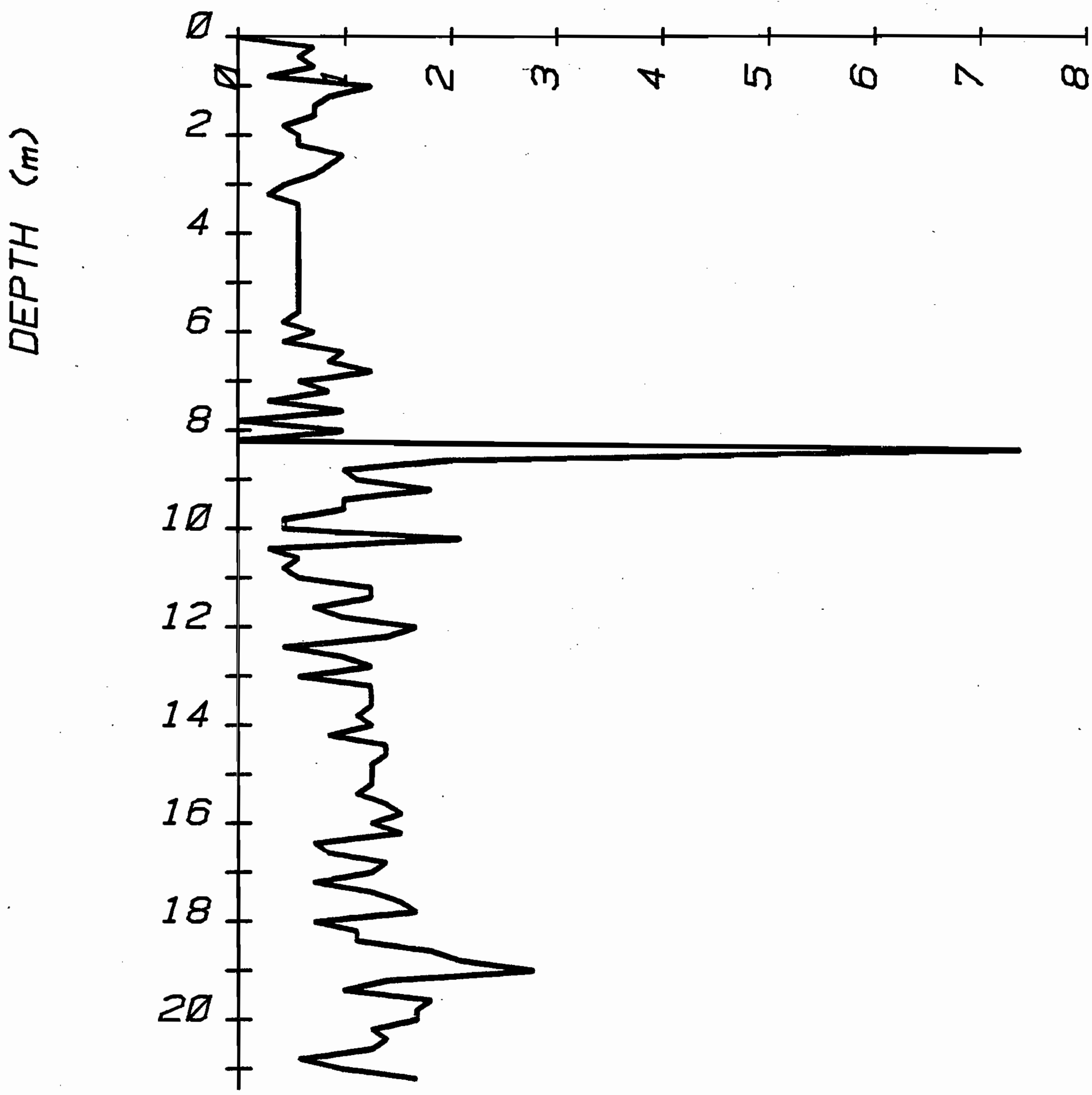
R rder ______________________ Page 5 of 5 Elevation ______________________

ELEV.	DEPTH (Ft.)	DEPTH (m)	C or C + S	GAGE READINGS HIGH	GAGE READINGS LOW	CONE RESIST. (1000N)	SLEEVE RESIST. (1000N)	FRICTION RATIO (%)
GAGE ZERO READINGS				0.0	- 0.2			
			C		3.2			
		.2	C+S		5.0			
			C		2.4			
		.4	C+S		4.4			
			C		1.8			
		.6	C+S		3.6			
			C		2.0			
		.8	C+S		2.8			
			C		3.2			
		21.0	C+S		4.6			
			C		2.0			
		.2	C+S		4.4			
			C					
		.4	C+S					
			C					
		.6	C+S			Stopped boring 21.2 M		
			C					
		.8	C+S					
			C					
		.0	C+S					
			C					
		.2	C+S					
			C					
		.4	C+S					
			C					
		.6	C+S					
			C					
		.8	C+S					
			C					
		.0	C+S					
			C					
		.2	C+S					
			C					
		.4	C+S					
			C					
		.6	C+S					
			C					
		.8	C+S					
			C					
		.0	C+S					
			C					
		.2	C+S					
			C					
		.4	C+S					
			C					
		.6	C+S					
			C					
		.8	C+S					
			C					



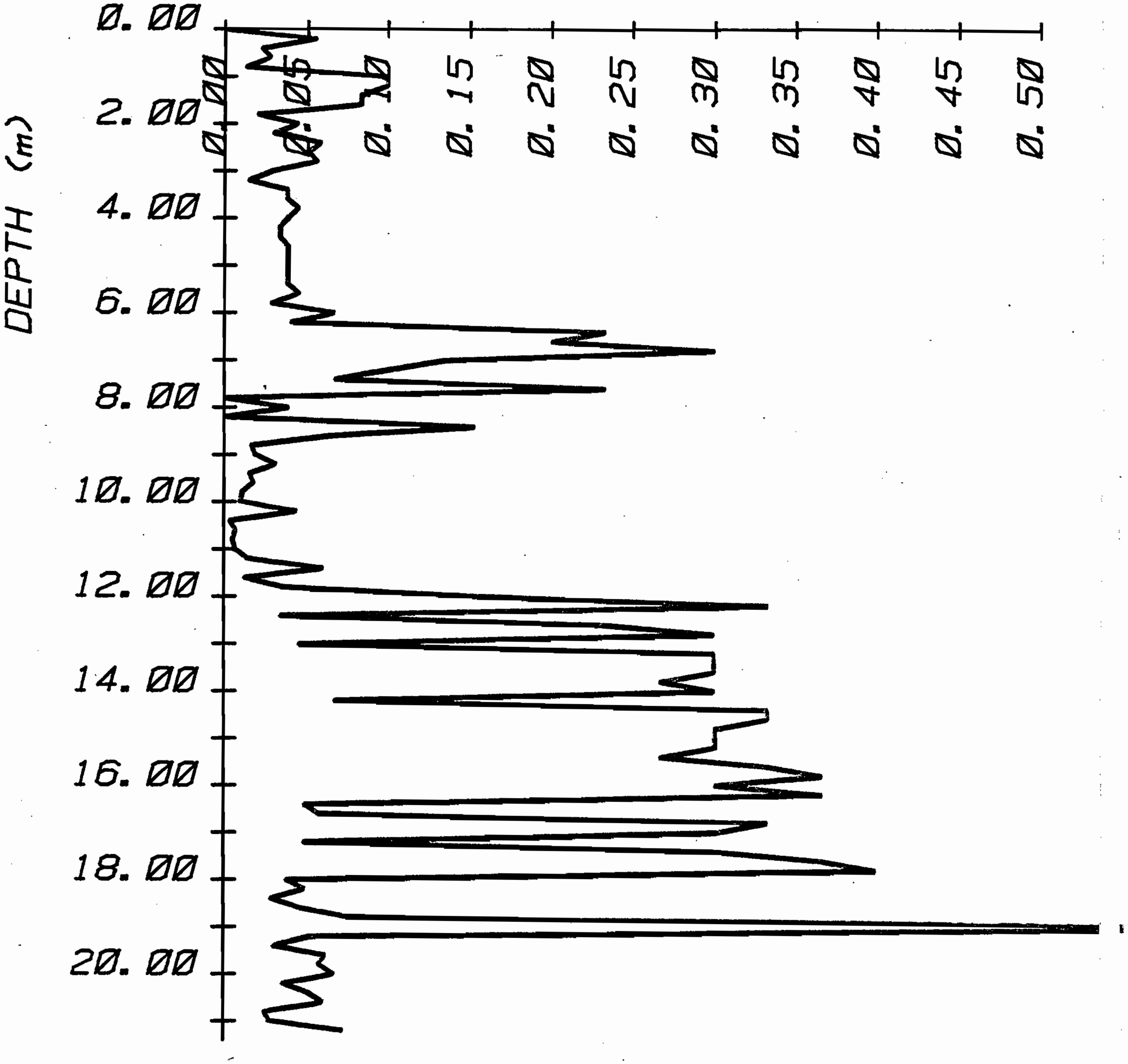
Clifty Creek Flyash Dam
Dam Raising Study
PROBE SS3-5

SLEEVE RESISTANCE (TSF)



Clifty Creek Flyash Dam
Dam Raising Study
PROBE SS3-5

FRICTION RATIO



Clifty Creek Flyash Dam
Dam Raising Study
PROBE SS3-5

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO.

MPANY IKEC

PROJECT Clifty Creek Fly Ash Dam

LOCATION OF BORING:

WATER LEVEL	29.4
TIME	
DATE	

BORING NO. SI-1 DATE 7-25-84 SHEET 1 OF 8

TYPE OF BORING SPT Core RIG B-61

CASING USED ___ SIZE ___ DRILLING MUD USED ___

BORING BEGUN 7-25-84 BORING COMPLETED ___

GROUND ELEVATION 456.57 REFERRED TO ___ DATUM

FIELD PARTY: Roush + Lambert

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	SAMPLE DEPTH IN FEET TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	
								1	Moved boring 5' NW of STAKE
								2	
								3	Clayey Sand- Reddish Br. moist
1	3.0	4.5	4	7	9	16"		4	100% Fine Grain
									SC
								5	
								6	
								7	
								8	Same as Sample No. 1 (More Sand)
2	8.0	9.5	4	6	7	16"		9	
								10	
								1	
								2	
								3	SilT - Br. SATURATed, slight
3	13.0	14.5	3	5	2	3"		4	plasticity
									ML
								5	
								6	
								7	
								8	Same as Sample No 3
	18.0	19.5	2	3	2	14"		9	
								20	

ENGINEER ___

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ______
MPANY ______
PROJECT ______

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING NO. SZ-1 DATE ______ SHEET 2 OF 8
TYPE OF BORING ______ RIG ______
CASING USED ______ SIZE ______ DRILLING MUD USED ______
BORING BEGUN ______ BORING COMPLETED ______
GROUND ELEVATION ______ REFERRED TO ______
______ DATUM
FIELD PARTY: ______

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								20	
								1	
								2	
								3	Clayey SilT - BR. moisT To weT w/
5	23.0	24.5	5	6	3	16"		4	Fine Grain Sand Lens
								5	ML
								6	
								7	
								8	Clayey Sand - BR. moisT To weT
6	28.0	29.5	10	12	11	16"		9	poorly Graded, moderATE ReacTion To HCL
								30	SC WATER 29.4 River Elev.
								1	
								2	
								3	Same AS Sample NO 6
7	33.0	34.5	10	11	13	16"		4	
								5	
								6	
								7	
								8	SilTy Sand - GRAY SATURATEd, poorly
	38.0	39.5	8	11	11	16"		9	Graded, STRONG ReacTion To HCL
								40	SM

ENGINEER ______

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ______

COMPANY ______

PROJECT ______

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING NO. BI-1 DATE ______ SHEET 3 OF 8

TYPE OF BORING ______ RIG ______

CASING USED ______ SIZE ______ DRILLING MUD USED ______

BORING BEGUN ______ BORING COMPLETED ______

GROUND ELEVATION ______ REFERRED TO ______

______ DATUM

FIELD PARTY: ______

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								40	
								1	
								2	
								3	
9	43.0	44.5	6	8	10	15"		4	Sandy SilT - GRAY. SATURATEd, Slight Reaction To HCL
								5	ML.
								6	
								7	
								8	SilT. GRAY. SATURATEd, SlighT ReacTion To HCL
10	48.0	49.5	8	10	18	14"		9	ML
								50	
								1	
								2	
								3	Same as Sample No 9
11	53.0	54.5	10	11	11	16"		4	
								5	
								6	
								7	
								8	Same as Sample No. 9
2	580	59.5	7	7	5	13"		9	
								60	

ENGINEER ______

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ____________

MPANY ____________

PROJECT ____________

LOCATION OF BORING:

WATER LEVEL	
TIME	
DATE	

BORING NO. SI-1 DATE ____________ SHEET 4 OF 8

TYPE OF BORING ____________ RIG ____________

CASING USED ____________ SIZE ______ DRILLING MUD USED ____________

BORING BEGUN ____________ BORING COMPLETED ____________

GROUND ELEVATION ____________ REFERRED TO ____________ DATUM

FIELD PARTY: ____________

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								60	
								1	
								2	
								3	SilT- GRay. SaTuraTed, slighT
13	63.0	64.5	3	4	5	5"		4	ReacTion To HcL ML
								5	
								6	
								7	
								8	
14	68.0	69.5	5	7	7	16"		9	clayey silT - GRay SaTuraTed, slighT plasticiTy, slighT ReacTion To HcL
								70	ML
								1	
								2	
								3	Same As Sample No 14
15	73.0	74.5	8	13	15	16"		4	
								5	
								6	
								7	
								8	
	78.0	78.0	50/2			0		9	
								80	

ENGINEER

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____

ompany ____

Project ____

cation of Boring:

Vater Level	
Time	
Date	

Boring No. SI-1 Date 8-9-84 Sheet 5 of 8

Type of Boring ____ Rig ____

Casing used ____ Size ____ Drilling mud used ____

Boring begun ____ Boring completed ____

Ground Elevation ____ referred to ____

____ Datu

Field Party: ____

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
		78.0 83.5	64%	4.8	Core Lost ?		WATER ELEV- 8-9-84 16.0
							78.0 - 99.9 - Gray Hard Limestone w/ Layers of Calcareous Clay Shale
					79		
							Shale Gray
							Shale Gray
					80		
							Shale Gray
					81		
							Shale Gray
					82		
					83		
		83.5 84.9	47%	1.4			Shale Gray
							Shale Gray
					84		
							Shale Gray
		84.9 94.9	56%	10.0	85		Shale Gray

AEP CIVIL ENGINEERING LABORATCRY

LOG OF BORING

Job No. ______

Company ______

Project ______

ation of Boring:

Water Level	
Time	
Date	

Boring No. B5I-1 Date ______ Sheet 6 of 9

Type of Boring ______ Rig ______

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______

______ Datum

Field Party: ______

ELEVATION FEET	SAMPLE No.	Sample Depth (from-to) (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Dept. water lost, Observed fluctuations in water level, notes on drilling ease, etc.
							Shale Gray
					86		Shale Gray
							Shale Gray
					87		
							Shale Gray Lews
					88		
							Shale Gray Lews
					89		
							Shale Gray
					90		
							Shale Gray
							Shale Gray
					91		
							Shale Gray
					92		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____

C mpany ____

P ect ____

cation of Boring:

ater Level	
Time	
ite	

Boring No. SI-1 Date ____ Sheet 7 of 8

Type of Boring ____ Rig ____

Casing used ____ Size ____ Drilling mud used ____

Boring begun ____ Boring completed ____

Ground Elevation ____ referred to ____ Datum

Field Party: ____

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					93		
							Shale Gray
					94		Shale Gray
		94.9 99.9	36%	5.0			
							Shale Clay
					95		Shale Gray
							Shale Gray
					96		Shale Gray
							Shale Gray
					97		Shale Gray
					98		Shale Gray
					99		Shale Gray

AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. ______

Company ______

Project ______

cation of Boring:

Water Level	
Time	
Date	

Boring No. SI-1 Date ______ Sheet 8 of ______

Type of Boring ______ Rig ______

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______

______ Datu

Field Party: ______

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Dec is water lost, Observed fluctuations in water level, notes on drilling ease, etc.
							Shale Grey
							shale Grey
							shale Grey
					100		
							Stopped boring 99.9

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB No.

COMPANY IKEC

PROJECT Clifty Creek Fly Ashdam

LOCATION OF BORING:	
WATER LEVEL	57.8
TIME	7-11-84
DATE	

BORING No. SS4-1 DATE 7-11-84 SHEET 1 OF 5

TYPE OF BORING SPT RIG B-61

CASING USED SIZE DRILLING MUD USED

BORING BEGUN 7-11-84 BORING COMPLETED 7-11-84

GROUND ELEVATION 506.0 REFERRED TO

DATUM

FIELD PARTY: Roush-Lambert

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	
								1	
								2	Clay- Br., moist, Low To med. plasticity w/ Trace of Gravel
1	2.5	4.0	2	2	3	5"		3	CL
								4	
								5	
								6	
								7	Clayey Silt- Gray Br. moist, Low plasticity
2	7.5	9.0	5	8	15	8"		8	ML
								9	
								10	
								1	Original Ground?
								2	
3	12.5	14.0	5	6	7	6"		3	Silty Clay- Dr. Br. Low To med. plasticity moist, moderate Reaction To HCL Roots Organics
								4	CL
								5	
								6	
								7	Silty Clay- Br. Low plasticity moist, strong Reaction To HCL
4	17.5	19.0	8	12	12	12"		8	
								9	CL
								20	

ENGINEER

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB No. ____________

COMPANY ____________

PROJECT ____________

BORING No. SS4-1 DATE ____________ SHEET 2 OF 5

TYPE OF BORING ____________ RIG ____________

CASING USED ____________ SIZE ______ DRILLING MUD USED ______

BORING BEGUN ____________ BORING COMPLETED ____________

GROUND ELEVATION ____________ REFERRED TO ____________ DATUM

FIELD PARTY: ____________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								20	
								1	
								2	Clay- Br. moist, Low to med plasticity,
5	22.5	24.0	7	7	10	13"			
								3	CL
								4	
								5	
								6	
								7	Same as Sample No. 5
6	27.5	29.0	6	7	12	15"			
								8	
								9	
								30	
								1	
								2	Silty Clay- Br + Gray mottled, Low
7	32.5	34.0	5	8	12	16"			plasticity, moist
								3	CL
								4	
								5	
								6	
								7	Clay- Br. Low to med plasticity,
8	37.5	39.0	6	8	8	15"			moist
								8	
								9	
								40	

ENGINEER

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. __________

COMPANY __________

PROJECT __________

LOCATION OF BORING:

WATER LEVEL	
TIME	
DATE	

BORING NO. SS4-1 DATE __________ SHEET 3 OF 5

TYPE OF BORING __________ RIG __________

CASING USED __________ SIZE _____ DRILLING MUD USED __________

BORING BEGUN __________ BORING COMPLETED __________

GROUND ELEVATION __________ REFERRED TO __________ DATUM

FIELD PARTY: __________

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								40	
								1	
								2	SilT · BR. slighT plasTiciTy moisT
9	42.5	44.0	6	8	9	12"		3	ML
								4	
								5	
								6	
								7	SilTy SAnd. BR. poorly Graded, 100%
10	47.5	49.0	7	10	11	15"		8	Fine Grain, Slight ReacTion To HCL.
								9	SM
								50	Piezometer
								1	
								2	
11	52.5	54.0	8	12	11	16"		3	Same AS Sample No. 10 (weT)
								4	
								5	
								6	
								7	Same AS Sample No 10
12	57.5	59.0	7	9	9	16"		8	
								9	
								60	

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ____

MPANY ____

PROJECT ____

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING NO. 554-1 DATE ____ SHEET 4 OF 5

TYPE OF BORING ____ RIG ____

CASING USED ____ SIZE ____ DRILLING MUD USED ____

BORING BEGUN ____ BORING COMPLETED ____

GROUND ELEVATION ____ REFERRED TO ____ DATUM

FIELD PARTY: ____

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								60	
								1	
								2	SiTy SAnd- multi-colored BR. wet
13	62.5	64.0	8	10	14	16"		3	100% Fine Grain, moderate Reaction To HcL
								4	SM
								5	
								6	
								7	SiTy clay- Gray- low To med.
14	67.5	69.0	8	12	14	16"		8	plasticity- slight Reaction To HcL moist
								9	CL
								70	
								1	
								2	Clayey Sand- Gray- Saturated, Poorly
15	72.5	74.0	2	2	3	15"		3	Graded, 100% Fine Grain, Slight Reaction To HCL
								4	SC
								5	
								6	
								7	SiLT - Gray Saturaded, Slight
16	77.5	79.0	8	9	13	16"		8	Reaction To HCL
								9	ML
								80	

ENGINEER ____

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ______
COMPANY ______
PROJECT ______

BORING NO. SS4-1 DATE ______ SHEET 5 OF 5
TYPE OF BORING ______ RIG ______
CASING USED ______ SIZE ______ DRILLING MUD USED ______
BORING BEGUN ______ BORING COMPLETED ______
GROUND ELEVATION ______ REFERRED TO ______
______ DATUM
FIELD PARTY: ______

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								8 0	
								1	
								2	Sandy Silt - Gray, wet slight
17	82.5	84.0	10	14	15	13"		3	Reaction to HCL, 100% Fine Grain Trace of org. mat.
								4	ML
								5	
								6	
								7	Same as Sample No 17 w/ A
18	87.5	88.0	9	10	20	14"		8	Fine Grain Sand Layer.
								9	
								9 0	
								1	
								2	Same as Sample No. 17 w/ A
19	92.5	94.0	11	15	15	12"		3	Fire Grain Sand Layer
								4	
								5	
								6	Stopped boring 94.0
								7	
								8	
								9	
								0	

ENGINE

AMERICAN ELECTRIC POWER CIVIL ENGINEERING LABORATORY

Dutch Cone Test

Company IKEC

Job CLIFTY CREEK FAD

Recorder LAMBERT

Probe No. SS4-3 Date 8-7-84

Drillers MAC KNIGHT - LAMBERT

Page 1 of 2 Elevation 459.84

ELEV.	DEPTH (Ft.)	DEPTH (m)	C or C + S	GAGE READINGS HIGH	GAGE READINGS LOW	CONE RESIST. (1000N)	SLEEVE RESIST. (1000N)	FRICTIO RATIO (%)
GAGE ZERO READINGS				0.0	-0.2			
		.2	C		—			
			C+S		—			
		.4	C		7.0			
			C+S		—			
		.6	C		7.8			
			C+S		9.2			
		.8	C		6.8			
			C+S		9.4			
		1.0	C		5.8			
			C+S		9.0			
		.2	C		4.2			
			C+S		8.2			
		.4	C		3.2			
			C+S		6.0			
		.6	C		5.0			
			C+S		6.2			
		.8	C		3.2			
			C+S		5.2			
		2.0	C		3.6			
			C+S		4.8			
		.2	C		3.2			
			C+S		5.0			
		.4	C		2.8			
			C+S		4.4			
		.6	C		1.8			
			C+S		3.4			
		.8	C		1.6			
			C+S		2.6			
		3.0	C		1.6			
			C+S		2.4			
		.2	C		1.4			
			C+S		1.8			
		.4	C		1.2			
			C+S		1.6			
		.6	C		1.4			
			C+S		2.2			
		.8	C		2.4			
			C+S		3.2			
		4.0	C		3.2			
			C+S		4.4			
		.2	C		3.8			
			C+S		5.0			
		.4	C		4.4			
			C+S		6.6			
		.6	C		6.0			
			C+S		7.4			
		.8	C		7.4			
			C+S		7.6			
			C		9.4			
					9.8			

AMERICAN ELECTRIC POWER CIVIL ENGINEERING LABORATORY

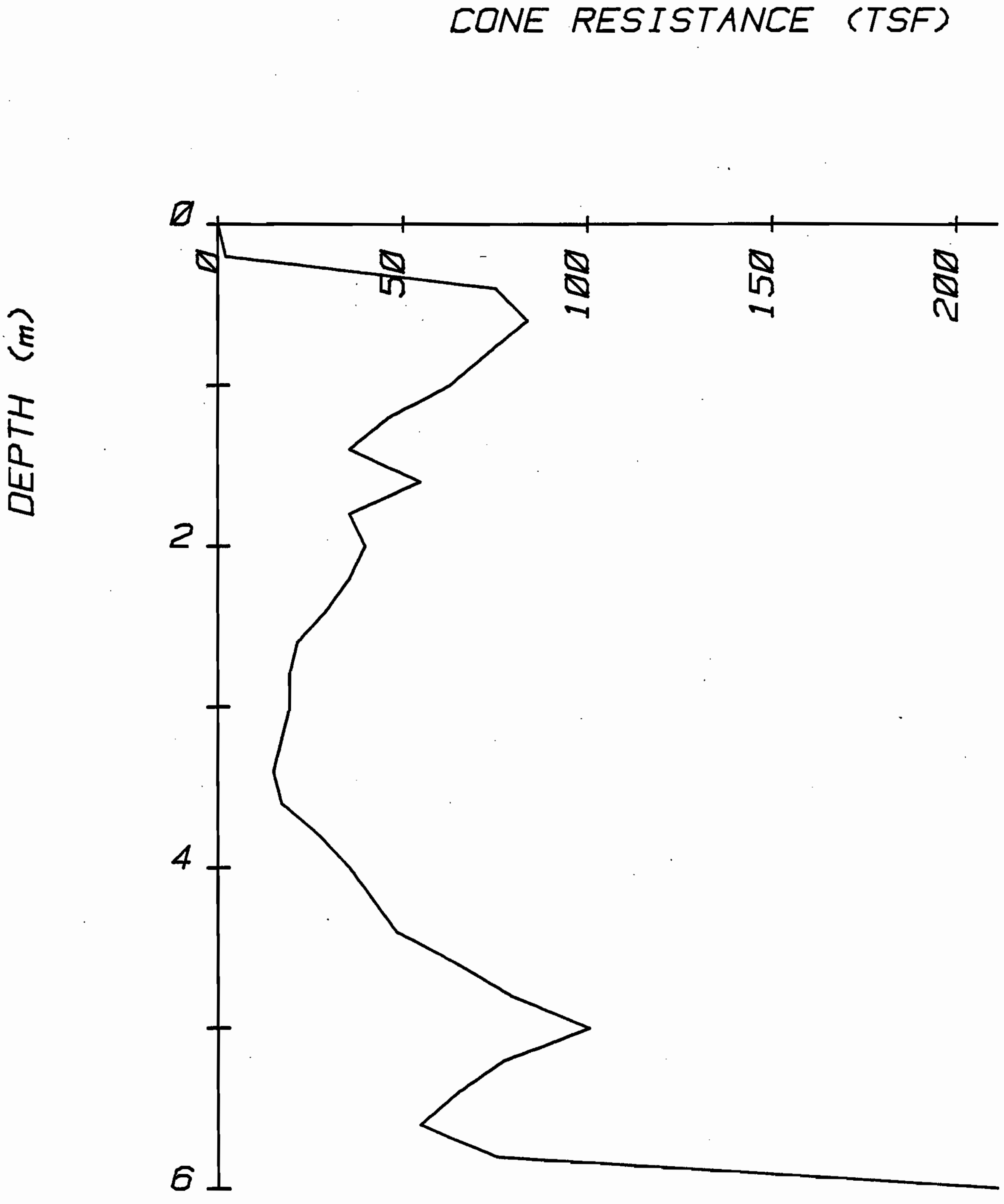
Dutch Cone Test

Company__________ Probe No. SS4-3 Date__________

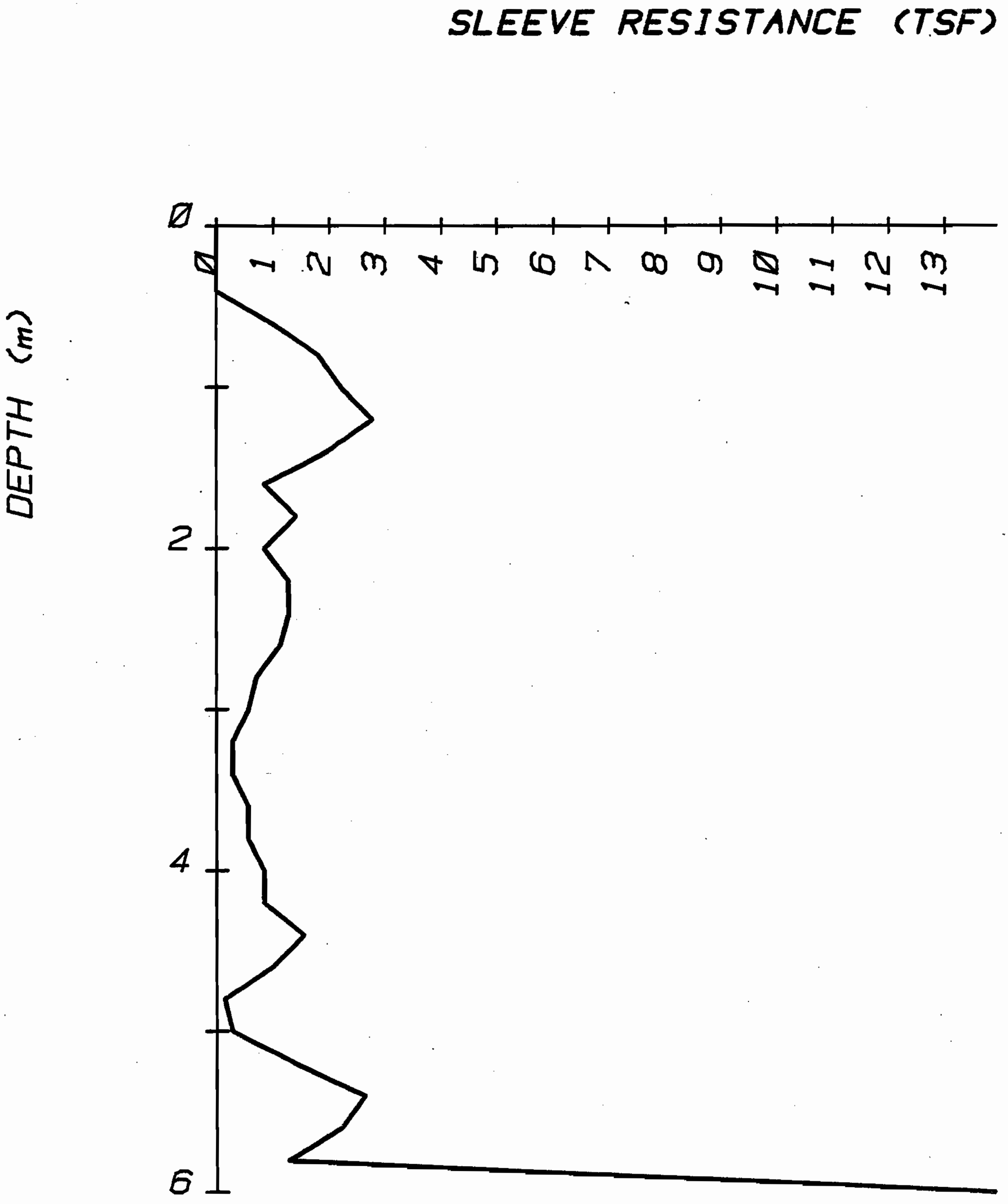
Job__________ Drillers__________

Recorder__________ Page 2 of 2 Elevation__________

ELEV.	DEPTH (Ft.)	DEPTH (m)	C or C + S	GAGE READINGS HIGH	GAGE READINGS LOW	CONE RESIST.	SLEEVE RESIST.	FRICTION RATIO
GAGE ZERO READINGS				0.0	-0.2	(1000N)	(1000N)	(%)
			C		7.2			
		.2	C+S		9.2			
			C		6.0			
		.4	C+S		9.8			
			C		5.0			
		.6	C+S		8.2			
			C		7.0			
		.8	C+S		8.8			
			C	20.0				
		6.0	C+S	40.0				
			C					
		.2	C+S			Augered From 19.68 To 23.5		
			C					
		.4	C+S			Cobbles - Auger Refusal 23.5		
			C					
		.6	C+S					
			C					
		.8	C+S					
			C					
		.0	C+S					
			C					
		.2	C+S					
			C					
		.4	C+S					
			C					
		.6	C+S					
			C					
		.8	C+S					
			C					
		.0	C+S					
			C					
		.2	C+S					
			C					
		.4	C+S					
			C					
		.6	C+S					
			C					
		.8	C+S					
			C					
		.0	C+S					
			C					
		.2	C+S					
			C					
		.4	C+S					
			C					
		.6	C+S					
			C					
		.8	C+S					
			C					

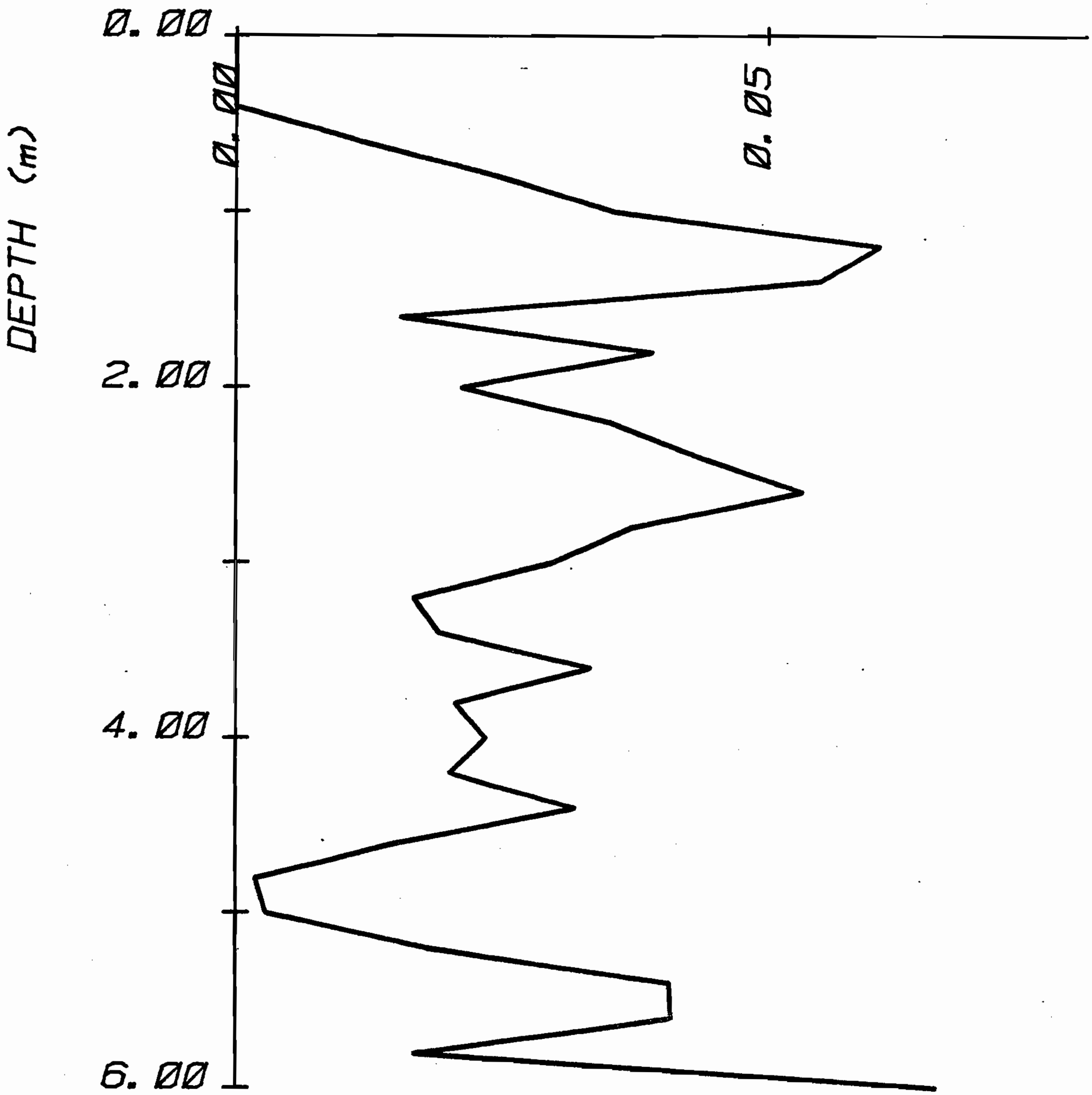


Clifty Creek Flyash Dam
Dam Raising Study
PROBE SS4-3



Clifty Creek Flyash Dam
Dam Raising Study
PROBE SS4-3

FRICTION RATIO



Clifty Creek Flyash Dam
Dam Raising Study
PROBESS4-3

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ____________

MPANY IKEC

PROJECT CliFTy CREEK Fly Ash DAm

BORING NO. SS4-4 DATE 7-26-84 SHEET 1 OF 6

TYPE OF BORING SPT - corE RIG B-61

CASING USED ______ SIZE ______ DRILLING MUD USED ______

BORING BEGUN 7-26-84 BORING COMPLETED ______

GROUND ELEVATION 450.70 ± REFERRED TO ______ DATUM

FIELD PARTY: Roush + Lambert

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	boring moved To Edge of woods
								1	water- 7-31-84 12.0'
								2	
								3	Sandy clay- Reddish Br. moist, Low To
1	3.0	4.5	4	6	7	16"		4	med, plasticity
								5	Cl
								6	
								7	
								8	Same As sample NO 1
2	8.0	9.5	3	4	3	14"		9	
								10	
								1	
								2	
								3	Sandy silT - Br. SaTuraTed
3	13.0	14.5	1	1	1	14"		4	ML-SM
								5	
								6	
								7	
								8	Sandy clay- Br. SaTuraTed, SlighT
	18.0	19.5	1	2	2	16"		9	ReacTion To HCL w/ Trace of Gravel 1/2" max size
								20	
									CL

ENGINEER ____________

FORM CE-5
REV: 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ____________

MPANY ____________

PROJECT ____________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING NO. SS4-4 DATE ________ SHEET 2 OF 6

TYPE OF BORING ________ RIG ________

CASING USED ________ SIZE ________ DRILLING MUD USED ________

BORING BEGUN ________ BORING COMPLETED ________

GROUND ELEVATION ________ REFERRED TO ________

________ DATU

FIELD PARTY: ________

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								20	
								1	
								2	
								3	Lime stone Frag.
5	23.0	23.2	50/.2			2"		4	
								5	
								6	
								7	
								8	Clayey Sand + Gravel - Gray Br.
6	28.0	29.5	9	12	17	7"		9	Saturated, Strong reaction to HcL poorly Graded, 1" max size. Gravel
								30	consist of Lime stone Frag.
								1	GC
								2	
								3	Gray calcareous shale + 1 3/4" piece of
7	33.0	33.1	50/.1			1"		4	Lime stone.
								5	
								6	
								7	
								8	
								9	
								0	

ENGINEER ____________

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____________

Company ____________

Project ____________

Boring No. 5544 Date 7-31-84 Sheet 3 of 6

Type of Boring ____________ Rig ____________

Casing used ______ Size ______ Drilling mud used ______

Boring begun ____________ Boring completed ____________

Ground Elevation ____________ referred to ____________

____________ Datu

Field Party: ____________

Location of Boring:	
Water Level	
Time	
Date	

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
		33.3 34.8	28%	1.4			33.3 - 54.8 - Gray Limestone w/ Calcareous Shale
							Badly Broken
					34		
		34.8 39.8	51%	4.8	35		Core Lost ?
							Badly Broken
					36		
					37		
					38		
					39		
					40		Badly Broken

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ________

Company ________

Project ________

Location of Boring:

Water Level	
Time	
Date	

Boring No. SS4-4 Date ________ Sheet 4 of

Type of Boring ________ Rig ________

Casing used ____ Size ____ Drilling mud used ____

Boring begun ________ Boring completed ________

Ground Elevation ________ referred to ________

________ Dat

Field Party: ________

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
		39.8 44.8	60%	5.0			
					41		
					42		
					43		
					44		
		44.8 54.8	59%	10.0	45		
							Shale Grey
							Shale Grey
					46		
					47		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____________

Company ____________

Project ____________

Location of Boring:

Water Level	
Time	
Date	

Boring No. 559-4 Date ____________ Sheet 5 of

Type of Boring ____________ Rig ____________

Casing used ______ Size ______ Drilling mud used ______

Boring begun ____________ Boring completed ____________

Ground Elevation ____________ referred to ____________

____________ Da

Field Party: ____________

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Dept water lost, Observed fluctuations in water level, note on drilling ease, etc.
	+						
					48		
					49		
					50		
							Shale Grey
					51		
					52		Shale Grey
					53		
					54		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____

Company ____

Project ____

Boring No. 5544 Date ____ Sheet 6 of

Type of Boring ____ Rig ____

Casing used ____ Size ____ Drilling mud used ____

Boring begun ____ Boring completed ____

Ground Elevation ____ referred to ____

Dat

Field Party: ____

Location of Boring:

Water Level	
Time	
Date	

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, D t water lost, Observed fluctuations in water level, note on drilling ease, etc.
					55		
							Stopped boring 54.8

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ____________

MPANY IKEC

PROJECT CLifty CK Flyash Storage Area

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING NO. 5544 DATE 7/26/84 SHEET 1 OF ____

TYPE OF BORING Split spoon RIG B-61

CASING USED ____________ SIZE ______ DRILLING MUD USED ____________

BORING BEGUN 7/26/84 BORING COMPLETED ____________

GROUND ELEVATION 450.70 REFERRED TO ____________

____________ DATUM

FIELD PARTY: Connie & Mike

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
								0	
								1	Moved Boring to edge of woods
								2	
								3	
1	3.0	4.5	4	6	7	16		4	reddish brown clayey silt
								5	
								6	
								7	
								8	Moist
2	8.0	9.5	3	4	3	14		9	reddish brown clayey silt
								0	
								1	
								2	
								3	wet
3	13.0	14.5	1	1	1	14		4	reddish brown clayey silt
								5	
								6	
								7	
								8	wet
	18.0	19.5	1	2	2	16		9	reddish brown clayey silt with rock Frag.
								0	

ENGINEER ____________

FORM CE-5
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AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB No. ______

COMPANY IKEC

PROJECT Clifty CK

BORING No. SS4-4 DATE 7/26/84 SHEET 2 OF ______

TYPE OF BORING Splitspoon RIG B61

CASING USED ______ SIZE ______ DRILLING MUD USED ______

BORING BEGUN 7/26/84 BORING COMPLETED ______

GROUND ELEVATION 450.70 REFERRED TO ______ DATUM

FIELD PARTY: Connie + Mike

LOCATION OF BORING:

WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	
								1	
								2	
								3	wet
5	23.0	24.5	50/2			2		4	Limestone
								5	
								6	
								7	
								8	wet
6	28.0	29.5	9	12	17	7		9	brownish gray clay with rock Frag
								0	
								1	
								2	
								3	
7	33.0	34.5	50/1			1		4	gray clay shale + Limestone
								5	Seated Augers At 33.3'
								6	
								7	
								8	
	38.0	39.5						9	
								0	

ENGINEER ______

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ____________

COMPANY IKec

PROJECT Clifty Creek Fly Ash Storage Area

BORING NO. SSS-1 DATE 6-20-84 SHEET 1 OF 7

TYPE OF BORING SPT - Core RIG B-61

CASING USED ______ SIZE ______ DRILLING MUD USED ______

BORING BEGUN 6-20-84 BORING COMPLETED 6-21-84

GROUND ELEVATION 504.18 REFERRED TO ____________ DATUM

FIELD PARTY: Roush + Lambert

LOCATION OF BORING:	
WATER LEVEL	Dry to Top of Rock
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	
								1	
								2	
1	2.5	4.0	3	3	5	7"		3	Sandy Clay - Dk. Br., moist, low to med plasticity Organics CL
								4	
								5	
								6	
								7	
2	7.5	9.0	5	8	12	12"		8	Sandy Clay - yellowish Br., moist, low to med. plasticity CL
								9	
								10	
								1	
								2	
3	12.5	14.0	5	8	12	13"		3	Same as Sample No. 2
								4	
								5	
								6	
								7	
4	17.5	19.0	6	10	12	13"		8	Clayey Sand - yellowish Br. moist, 100% Fine Grain, Poorly Graded SC
								9	
								20	

ENGINEER ____________

FORM CE-5
REV. 5/61

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ____________

MPANY ____________

PROJECT ____________

BORING NO. SSS-1 DATE ____________ SHEET 2 OF 7

TYPE OF BORING ____________ RIG ____________

CASING USED ____________ SIZE ______ DRILLING MUD USED ____________

BORING BEGUN ____________ BORING COMPLETED ____________

GROUND ELEVATION ____________ REFERRED TO ____________ DATUM

FIELD PARTY: ____________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								20	
								1	
5	22.5	24.0	8	15	10	12"		2	SiTy Sand - yellowish BR., Poorly Graded, 100% Fine Grain, moist
								3	SM
								4	
								5	
								6	
6	17.5	28.3	10	50/.3		6"		7	Clay - yellowish BR. moist, Low to med. plasticity, STRONG REACTION TO HCL
								8	
								9	
								30	
								1	
7	32.5	33.2	10	50/.2		1"		2	Same As Sample No 6
								3	
								4	
								5	
								6	
8	37.5	38.0	50			5"		7	Same As Sample No. 6 w/ Small amount of weathered/Soft Lime Stone Frag.
								8	
								9	
								40	

ENGINEER ____________

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____

ompany ____

ect ____

Location of Boring:

Water Level	
Time	
Date	

Boring No. SSS-1 Date ____ Sheet 3 of 7

Type of Boring ____ Rig ____

Casing used ____ Size ____ Drilling mud used ____

Boring begun ____ Boring completed ____

Ground Elevation ____ referred to ____ Datum

Field Party: ____

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
		43.4-452		1.4			
							43.4 - 43.6 Br. Silty clay w/ Limestone
							Frag
					44		43.6 - 44.4 Gray Hard Limestone
							Core Lost This Area ?
					45		Br. Silty clay + Broken Limestone Frag.
		45.2-55.2	7%	4.3			
							45.5 Lost water
							Core Lost. ?
					46		.3 Limestone
							1.5 Br Silty clay w/ Limestone frag.
							2.2 Gray Hard Limestone
					47		
					48		
					49		
					50		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No.

Company

Project

Location of Boring:

Water Level	
Time	
Date	

Boring No. 555-1 Date Sheet 4 of

Type of Boring Rig

Casing used Size Drilling mud used

Boring begun Boring completed

Ground Elevation referred to Datum

Field Party:

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					51		
					52		
					53		
					54		
					55		
		55.2-60.8	21%	4.2			Core Lost ?
							.4 Gray Hard Limestone
							.9 Soft Gray Calcareous Shale
					56		.9 Gray Hard Limestone
							.6 Soft Gray Calcareous Shale
							.8 Gray Hard Limestone
							.6 Soft Calcareous Shale
					57		

AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. ____________

Company ____________

ject ____________

cation of Boring:

Water Level	
Time	
Date	

Boring No. SSS-1 Date ________ Sheet 5 of 7

Type of Boring ________ Rig ________

Casing used ______ Size ______ Drilling mud used ______

Boring begun ________ Boring completed ________

Ground Elevation ________ referred to ________

________ Datu

Field Party: ________

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					58		
					59		
					60		
		60.8-65.2	62%	4.3			
					61		60.8 - 65.2 Gray Hard Limestone w/ Laminated Layers of CAlcAReous Shale
					62		62.1 ½" Seam of Gray CAlcAReous Shale
					Broken		62.7 - 62.9 Seam of Gray CAlcAReous Shale
					63		
					64		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ______

Company ______

Project ______

Location of Boring:

Water Level	
Time	
Date	

Boring No. 555-1 Date ______ Sheet 6 of 7

Type of Boring ______ Rig ______

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______

______ Datum

Field Party: ______

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depth water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					65		
		65.2-75.2	43%	9.9			65.2- 75.2 Gray Hard limestone w/ Laminated Layers of Calcareou Shale
					66		
					67		
					68		
							68.6-68.8 Gray Calcareous Shale
					69		
							69.4-69.9 Gray Calcareous Shale
					70		
							70.2-70.5 Gray Calcareous Shale
					71		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

ob No. ______

pany ______

ect ______

tion of Boring: ______

ter Level	
Time	
te	

Boring No. SSS-1 Date ______ Sheet 7 of 7

Type of Boring ______ Rig ______

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______ Datum

Field Party: ______

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					72		72.3 - 72.7 Gray calcareous Shale
					73		
					74		
					75		75.2 - 77.2
		75.2-77.2	83%	2.1			Gray Limestone w/ laminated layer of calcareous shale
					76		
					77		
							Stopped boring 77.2
					78		

AMERICAN ELECTRIC POWER CIVIL ENGINEERING LABORATORY

Dutch Cone Test

Company TK EC

Job CLIFTY CREEK EAD

Recorder LAMBERT

Probe No. SSS-3

Date 8-7-84

Drillers MAC Knight - LAMBERT

Page 1 of 4

Elevation 451.00 +- 3To7'

ELEV.	DEPTH (Ft.)	DEPTH (m)	C or C + S	GAGE READINGS HIGH	GAGE READINGS LOW	CONE RESIST.	SLEEVE RESIST.	FRICTION RATIO
GAGE ZERO READINGS				0.0	-0.2	(1000N)	(1000N)	(%)
			C					
		.2	C+S	Road Bed				
			C					
		.4	C+S					
			C		2.8			
		.6	C+S		5.6			
			C		2.4			
		.8	C+S		4.2			
			C		2.4			
		1.0	C+S		4.4			
			C		2.4			
		.2	C+S		4.4			
			C		2.6			
		.4	C+S		4.8			
			C		2.6			
		.6	C+S		4.8			
			C		2.6			
		.8	C+S		5.0			
			C		2.4			
		2.0	C+S		4.8			
			C		2.2			
		.2	C+S		4.6			
			C		2.0			
		.4	C+S		4.0			
			C		1.8			
		.6	C+S		3.2			
			C		1.6			
		.8	C+S		3.0			
			C		1.6			
		3.0	C+S		3.0			
			C		1.2			
		.2	C+S		2.0			
			C		1.2			
		.4	C+S		2.0			
			C		1.2			
		.6	C+S		1.8			
			C		0.4			
		.8	C+S		1.2			
			C		0.8			
		4.0	C+S		2.2			
			C		6.2			
		.2	C+S		8.2			
			C					
		.4	C+S			Augered to 15.0 started		
			C					
		.6	C+S			Rock core		
			C					
		.8	C+S					
			C					
			C+S					

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ______

ompany ______

iect ______

ation of Boring:

ater Level	
Time	
ate	

Boring No. SSS-3 Date 8-8-84 Sheet 2 of 4

Type of Boring ______ Rig ______

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______

______ Datum

Field Party: ______

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
		15.0 20.4	6%	2.2			Gray Limestone w/ calcareous Shale 15.0 - 35.0
					16		
							Core Lost ?
					17		
					18		
					19		
					20		
		20.4 25.0	8%	3.4			
							Core Lost ?
					21		
					22		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____________

Company ____________

Project ____________

Location of Boring:

Water Level	
Time	
Date	

Boring No. SSS-3 Date ____________ Sheet 3 of

Type of Boring ____________ Rig ____________

Casing used ______ Size ______ Drilling mud used ______

Boring begun ____________ Boring completed ____________

Ground Elevation ____________ referred to ____________

____________ Datur

Field Party: ____________

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Dep s water lost, Observed fluctuations in water level, not on drilling ease, etc.
					23		
					24		
		25.0 35.0	53%	10.0	25		
					26		
					27		
					28		
					29		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____________

Company ____________

Project ____________

Location of Boring:

Water Level	
Time	
Date	

Boring No. SSS-3 Date ________ Sheet 4 of 4

Type of Boring ________ Rig ________

Casing used ______ Size ______ Drilling mud used ______

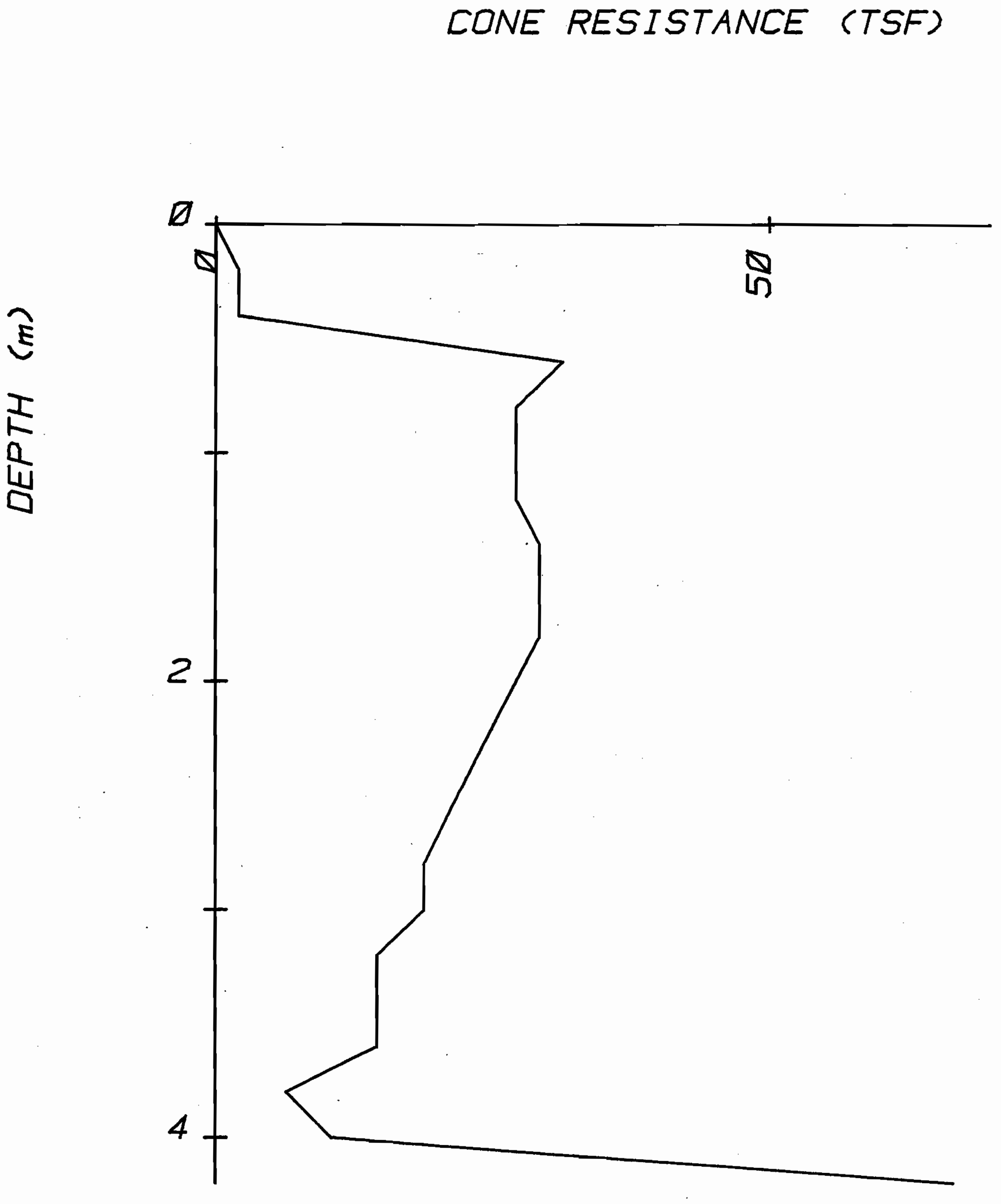
Boring begun ________ Boring completed ________

Ground Elevation ________ referred to ________

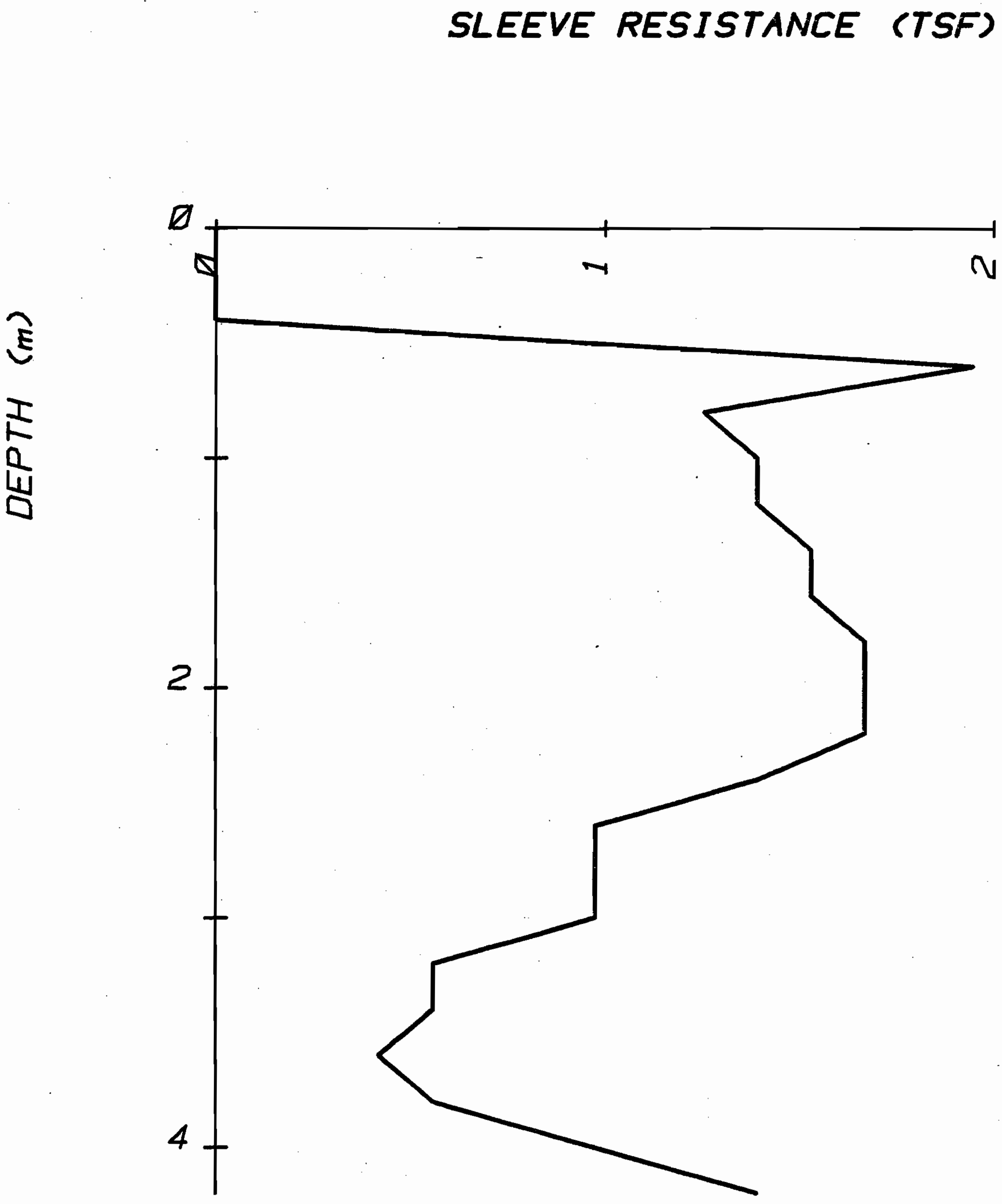
________ Datum

Field Party: ________

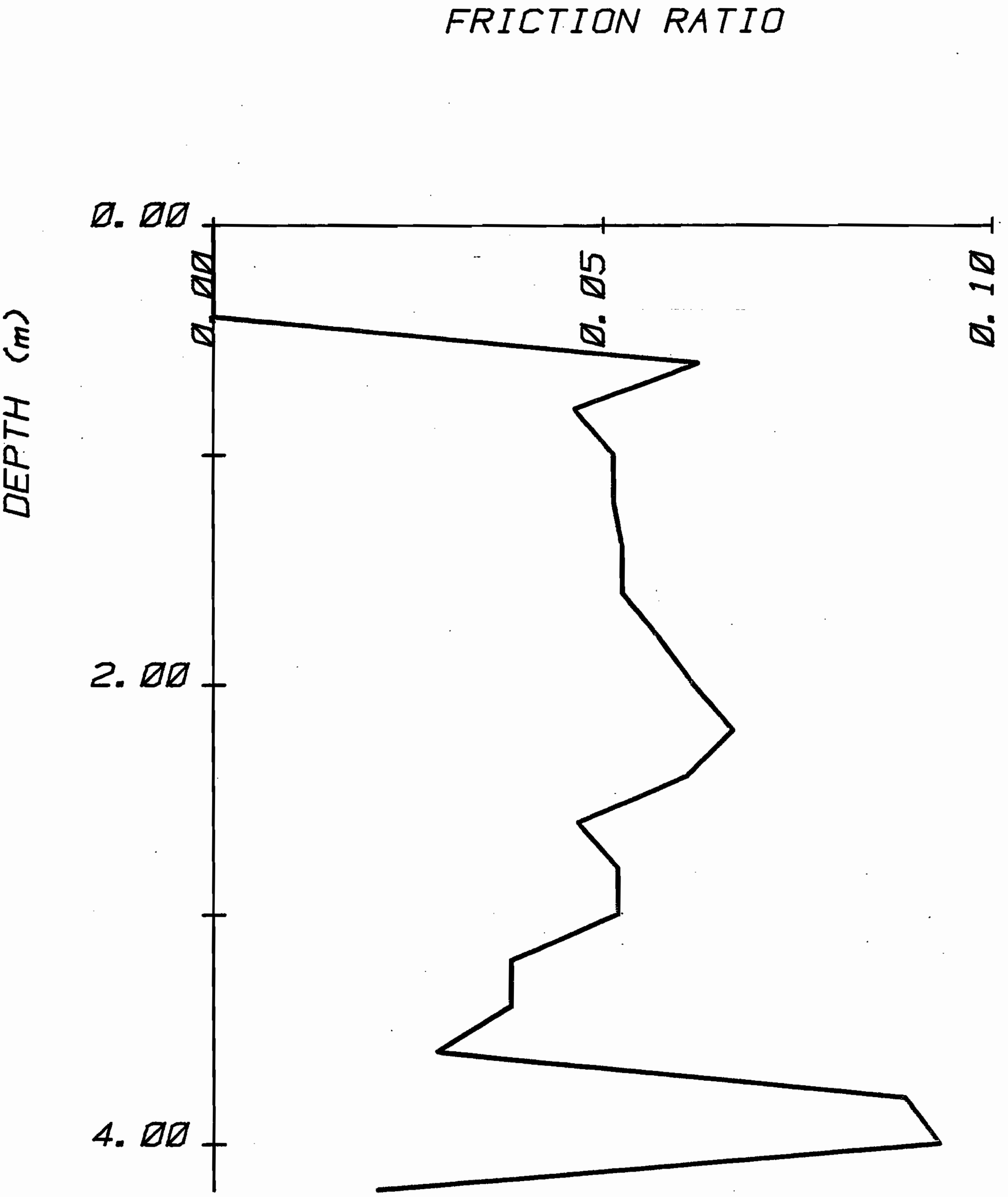
ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					30		
					31		
					32		
					33		
					34		
					35		
							Stopped boring 35.0



Clifty Creek Flyash Dam
Dam Raising Study
PROBE SS5-3



Clifty Creek Flyash Dam
Dam Raising Study
PROBE SS5-3



Clifty Creek Flyash Dam
Dam Raising Study
PROBE SS5-3

ORM CE-5
EV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

OB NO.
PANY IKEC
ROJECT Clifty creek Fly Ash Dam

LOCATION OF BORING:	
WATER LEVEL	Dry To Top of Rock
TIME	
DATE	

BORING NO. SS6-1 DATE 7-11-84 SHEET 1 OF 10
TYPE OF BORING SPT- core RIG B-61
CASING USED - SIZE - DRILLING MUD USED -
BORING BEGUN 7-11-84 BORING COMPLETED 7-19-84
GROUND ELEVATION 506.0 REFERRED TO
DATUM
FIELD PARTY: Roush · Lambert

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	
								1	Moved boring 5' South West
								2	
								3	
1	3.0	3.7	13	50/.2		3"		4	
								5	
								6	
								7	
								8	
2	8.0	8.0	50/0			0		9	
								0	
								1	
								2	
								3	
3	13.0	13.0	50/.0			0		4	Started coring at 13.5
								5	
								6	
								7	
								8	
								9	
								0	

ENGINEER

AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

b No. ______

mpany ______

Location of Boring:

Vater Level	
Time	
Date	

Boring No. SS6-1 Date ______ Sheet 2 of 10
Type of Boring ______ Rig ______
Casing used ______ Size ______ Drilling mud used ______
Boring begun ______ Boring completed ______
Ground Elevation ______ referred to ______
______ Datum
Field Party: ______

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
		13.5-15.3		1.6			Core Lost ?
					14		Gray Hard Lime stone
							Calcareous Shale Gray
					15		
		15.3-25.3	20%	6.7			Gray Hard Lime stone
							Core Lost ?
					16		Gray Calcarcous Shale w/ Four Layers of Gray Hard Lime stone
					17		
					18		
					19		
					20		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

ob No. ____________

pany ____________

t ____________

Location of Boring:

Water Level

Time

Date

Boring No. SS6-1 Date ____________ Sheet 3 of 10

Type of Boring ____________ Rig ____________

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______ Datum

Field Party: ____________

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					21		
					22		
					23		
					24		
					25		
		25.3-35.3	17%	6.3			Gray Hard Limestone w/ Laminated layers of Calcareous Shale
					26		
					27		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____________

Company ____________

Project ____________

Location of Boring:

Water Level	
Time	
Date	

Boring No. 556-1 Date ____________ Sheet 4 of 1

Type of Boring ____________ Rig ____________

Casing used ______ Size ______ Drilling mud used ______

Boring begun ____________ Boring completed ____________

Ground Elevation ____________ referred to ____________ Datum

Field Party: ____________

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depth water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					28		
					29		
					30		
					31		
					32		
					33		
					34		

AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

ob No. ______

Company ______

Project ______

Location of Boring:

Water Level	
Time	
Date	

Boring No. SS6-1 Date ______ Sheet 5 of 10

Type of Boring ______ Rig ______

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______

______ Datum

Field Party: ______

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					35		
		35.3 43.8	52%	7.7 6.9			
							LOST WATER 38.7
					36		
					37		
							RUST BR STAIN ON JOINT
					38		
					39		
					40		
							WATER Level 40.0 7-16-84
					41		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____________

Company ____________

Project ____________

Location of Boring:

Water Level	
Time	
Date	

Boring No. SS6-1 Date ____________ Sheet 6 of ____

Type of Boring ____________ Rig ____________

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______

____________ Datum

Field Party: ____________

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depth water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					42		
					43		
		43.8 48.2	9%	2.9			Gray Calcareous Shale
					44		
					45		
					46		
					47		
					48		

AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. ______

npany ______

t ______

ation of Boring:

ter Level

Time

te

Boring No. SS6-1 Date ______ Sheet 7 of 10

Type of Boring ______ Rig ______

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______

______ Datum

Field Party: ______

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
		48.2 51.8	35%	2.2			
	-						GRAY HARD LIME STONE w/ CALCAREOU SHALE LAYERS
					49		
					50		
					51		
		51.8 -55.6	8%				
					52		
							WATER ELEV- 52.7 7-17-84 AFTER PACKER TEST
							WATER ELEV. 52.5 7/19/84
							GRAY HARD LIME STONE w/ CALCAREOUS SHALE LAYERS
					53		
					54		
							54.5 BR RUST STAIN
					55		

AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. ______________

Company ______________

Project ______________

Location of Boring:	
Water Level	
Time	
Date	

Boring No. SS6-1 Date ______________ Sheet 8 of 1

Type of Boring ______________ Rig ______________

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______________ Boring completed ______________

Ground Elevation ______________ referred to ______________ Datum

Field Party: ______________

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Dept water lost, Observed fluctuations in water level, note on drilling ease, etc.
		55.6 60.6					Gray Calcareous Shale w/ Limestone Layers
					56		
					57		
					58		
					59		
					60		
		60.6 65.6	39%	5.0			Gray Hard Limestone w/ Calcareous Shale Layers
					61		
					62		

AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No.

Company

Project

Location of Boring:

Water Level	
Time	
Date	

Boring No. SS6-1 Date ______ Sheet 9 of 10

Type of Boring ______ Rig ______

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______

______ Datum

Field Party: ______

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					63		
					64		
					65		
		65.6 75.6	61%	9.9			GRAY HARD LIME STONE w/ CALCAREOUS SHALE LAYERS
					66		
					67		
					68		
					69		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____________

Company ____________

Project ____________

Location of Boring:

Water Level	
Time	
Date	

Boring No. SS6-1 Date ____________ Sheet 10 of 1

Type of Boring ____________ Rig ____________

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______

____________ Datum

Field Party: ____________

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Dept water lost, Observed fluctuations in water level, note on drilling ease, etc.
					70		
					71		
					72		
					73		
					74		
					75		
							stopped boring 75.6 FT

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO.

PANY IKEC

PROJECT Clifty Creek Fly Ash Dam

LOCATION OF BORING:	
WATER LEVEL	13.4
TIME	
DATE	

BORING NO. SSL-2 DATE 7-24-84 SHEET 1 OF 4
TYPE OF BORING SPT-Core RIG B-61
CASING USED ______ SIZE ______ DRILLING MUD USED ______
BORING BEGUN 7-24-84 BORING COMPLETED 7-25-84
GROUND ELEVATION 452.99 REFERRED TO ______ DATUM
FIELD PARTY: Roush - Lambert

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	
								1	
								2	
								3	Silty Clay. DR. BR. moist, Low To med
1	3.0	4.5	6	8	12	5"		4	plasticity, Slight Reaction TO HCL
									CL
								5	
								6	
								7	
								8	Clayey Sand - BR Poorly Graded
2	8.0	9.5	3	3	6	13"		9	100% Fine Grain, moist
									SC
								10	
								1	
								2	
								3	Sandy Clay BR. wet To Saturated
3	13.0	14.5	2	2	3	15"		4	100% Fine Grain
								5	CL-SC
								6	
								7	
								8	Clayey Sand. BR. wet To Saturated
	18.0	19.5	1	2	2	15"		9	100% Fine Grain
								20	SC

ENGINEER ______

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ______

Company ______

Project ______

Location of Boring:

Water Level	
Time	
Date	

Boring No. SSL-2 Date ______ Sheet 2 of ______

Type of Boring ______ Rig ______

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______ Datum

Field Party: ______

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depth of water lost, Observed fluctuations in water level, note on drilling ease, etc.
		20.0 24.5	12%	3.2			20.0 - 24.5 Gray Hard Limestone w/ laminated layers of calcareous shale - Core lost ?
					21		
					22		
					23		
					24		
		24.5 29.5	0	3.0			24.5 - 29.5 Gray Hard Limestone w/ laminated layers calcareous shale - Core lost ?
					25		
					26		
					27		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____________________

Company ____________________

bject ____________________

ation of Boring:

ater Level	
Time	
Date	

Boring No. SS6-2 Date ____________ Sheet 3 of 4

Type of Boring ____________ Rig ____________

Casing used ______ Size ______ Drilling mud used ______

Boring begun ____________ Boring completed ____________

Ground Elevation ____________ referred to ____________

____________________ Datu

Field Party: ____________________

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					28		
					29		
		29.5 35.2		5.6			29.5 - 35.2 Gray Hard Lime stone w/ Laminated Layers of Calcareous Shale
					30		
					31		
					32		
					33		
					34		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ______

Company ______

Project ______

Location of Boring:

Water Level	
Time	
Date	

Boring No. 556-2 Date ______ Sheet 4 of ___

Type of Boring ______ Rig ______

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______ Datum

Field Party: ______

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depth water lost, Observed fluctuations in water level, notes on drilling ease, etc.
	〃						
					35		
		35.2 39.5	0	4.1			
							Gray Hard Limestone w/ Laminated
							Layers of Calcareous Shale
					37		
					38		
					39		
					40		
							Stopped boring 39.5

FORM CE-5
REV. 5/61

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ____________

IPANY IKEC

PROJECT Clifty Creek Fly Ash Dam

LOCATION OF BORING:	
WATER LEVEL	Dry To Top of Rock
TIME	
DATE	

BORING NO. 557-1 DATE 6-19-84 SHEET 1 OF 10
TYPE OF BORING SPT- Core RIG B-61
CASING USED ________ SIZE ______ DRILLING MUD USED ________
BORING BEGUN 6-19-84 BORING COMPLETED 6-19-84
GROUND ELEVATION 504.17 REFERRED TO ________
________ DATUM
FIELD PARTY: Roush + Lambert

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	Boring moved 15.0 FT S.E. of STAKe
								1	
								2	Clay- Reddish BR., moist, med.
1	2.5	4.0	4	8	12	10"		3	plasticity CL
								4	
								5	
								6	
								7	
2	7.5	9.0	7	10	14	8"		8	Clay- yellowish Br. moist, med. plasticity. strong Reaction To HCL
								9	CL
								1 0	
								1	
								2	gravelly clay. yellowish BR. med.
3	12.5	13.7	9	20	50/2	7"		3	plasticity, strong Reaction To HCL, gravel consist of Angular Limestone Frag., 3/4" max Size
								4	Auger Refusal 14.4
								5	CL
								6	
								7	
								8	
								9	
								0	

ENGINEER ____________

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ______

Company ______

Project ______

Location of Boring: ______

Water Level	
Time	
Date	

Boring No. 537-1 Date ______ Sheet 2 of 4

Type of Boring ______ Rig ______

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______ Datum

Field Party: ______

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
		14.4-15.5	0	1.1			14.4- 14.5 GRAY Hard Lime STONE
					15		
		15.5-25.5	0	9.2			15.5- 15.6 GRAY HARd LimE STONE 15.6-16.2 SoFT GRAY + GRAY BR. ShAley LimE STONE
					16		16.2 -16.4 GRAY HARd LimE STONE 16.4- 17.0 GRAY BR. SOFT ShAley LimESTONE
					17		
					18		BROKEN CORE LOSS THIS AREA ? 21.2 18.4- 25.5 GRAY HARd LimeSTOME ~~w/~~ LAMINATED LAYERS OF CALCAREOUS ShALE
					19		
					20		
					21		BROKEN

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ______

ompany ______

ject ______

cation of Boring:

Water Level	
Time	
Date	

Boring No. 557-1 Date ______ Sheet 3 of 10

Type of Boring ______ Rig ______

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______

______ Datu

Field Party: ______

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type. Color. Quality. Drilling observations. Depths water lost. Observed fluctuations in water level. notes on drilling ease, etc.
							21.2-25.5 - Gray Shaley Limestone
					X		Soft - Nod
							Broken
					22		
					23		
					24		
							Broken
					25		
		25.5-30.5	0	.1			Piece of core jammed in end of core barrel
							Limestone
					26		
					27		
					28		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____

Company ____

Project ____

Location of Boring:

Water Level	
Time	
Date	

Boring No. 557-1 Date ____ Sheet 4 of ____

Type of Boring ____ Rig ____

Casing used ____ Size ____ Drilling mud used ____

Boring begun ____ Boring completed ____

Ground Elevation ____ referred to ____

____ Datur

Field Party: ____

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Dep s water lost, Observed fluctuations in water level, not on drilling ease, etc.
					28		
					29		
					30		
		30.5-35.5	6%	4.4			30.5-35.5 Gray Hard Limestone w/ Laminated Layers of Calcareous
					31		
							Sandy 31.5-32.0
					32		
					33		
					34		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ________

ompany ________

ject ________

cation of Boring:

Vater Level	
Time	
ate	

Boring No. SST-1 Date ____ Sheet 5 of 10

Type of Boring ____ Rig ____

Casing used ____ Size ____ Drilling mud used ____

Boring begun ____ Boring completed ____

Ground Elevation ____ referred to ____ Datu

Field Party: ____

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					35		
		35.5-45.5	64%	10.0			GRAY HARd LimE STONE - SILTY IN AREA
					36		
					37		
					38		
					39		
					40		
					41		

AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. ____

Company ____

Project ____

Location of Boring:

Water Level	
Time	
Date	

Boring No. SS7-1 Date ____ Sheet 6 of 1

Type of Boring ____ Rig ____

Casing used ____ Size ____ Drilling mud used ____

Boring begun ____ Boring completed ____

Ground Elevation ____ referred to ____ Datum

Field Party: ____

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depth water lost, Observed fluctuations in water level, notes on drilling ease, etc.
							41.6 - 42.3 VERTICAL CRACK. CORE NOT BROKEN
					42		
					43		
					44		
					45		
		45.5-55.5	19%	9.9	Broken		45.5 - 55.5
							GRAY HARD LIME STONE w/ LAMINATED LAYER OF CALCAREOO SHALE HARD
					46		
					47		
					48		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____________

ompany ____________

ject ____________

cation of Boring:

Vater Level	
Time	
Date	

Boring No. SS7-1 Date ________ Sheet 7 of 10

Type of Boring ________ Rig ________

Casing used ____ Size ____ Drilling mud used ____

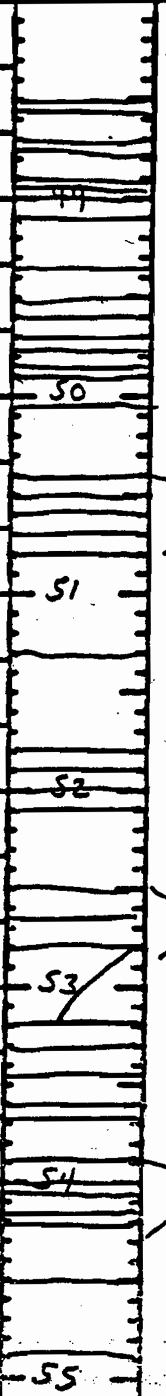
Boring begun ________ Boring completed ________

Ground Elevation ________ referred to ________

________ Datu

Field Party: ________

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.



Calcareous Shale

Calcareous shale

calcareous Shale

AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. ____________

Company ____________

Project ____________

Location of Boring:

Water Level	
Time	
Date	

Boring No. SS7-1 Date ____________ Sheet 8 of 1

Type of Boring ____________ Rig ____________

Casing used ______ Size ______ Drilling mud used ______

Boring begun ____________ Boring completed ____________

Ground Elevation ____________ referred to ____________ Datum

Field Party: ____________

ELEVATION FEET	SAMPLE No.	Sample Depth (from-to) (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Dept water lost, Observed fluctuations in water level, notes on drilling ease, etc.
	F	55.5-65.5	16%	9.9			GRAY LimeSTONE w/ LAMINATEd LAYERS OF CALCAREOUS SHALE HARd
					56		
							CALCAREOUS SHALE
					57		CALCAREOUS SHALE
					58		
					59		CALCAREOUS SHALE
					60		
					61		
					62		

AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. ____________

Company ____________

Project ____________

Boring No. SS7-1 Date ________ Sheet 9 of 10

Type of Boring ________ Rig ________

Casing used ____ Size ____ Drilling mud used ____

Boring begun ________ Boring completed ________

Ground Elevation ________ referred to ________ Datu

Field Party: ____________

Location of Boring:	
Water Level	
Time	
Date	

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					63		
					64		
					65		
		655-75.5	48%	9.8			GRAY LIMESTONE w/ LAMINATED LAYERS OF CALCAREOUS SHALE
					66		
					67		
					68		
					69		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____________

Company ____________

P ject ____________

cation of Boring:

Water Level	
Time	
Date	

Boring No. 557-1 Date ____________ Sheet 10 of 1

Type of Boring ____________ Rig ____________

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______

______ Datum

Field Party: ____________

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Dept water lost, Observed fluctuations in water level, not on drilling ease, etc.
	"						
					70		
					71		
					72		
					73		
					74		
					75		
							Stopped boring 75.5
							80 gAl 564 LBs Cement 25 LBs Quick jell Grouted Hole 75.5 To Surface

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO.

COMPANY IKEC

PROJECT Clifty Creek North F.A.D.

BORING NO. NS1-1 DATE 8-22-84 SHEET 1 OF 5

TYPE OF BORING SPT RIG B-61

CASING USED SIZE DRILLING MUD USED

BORING BEGUN 8-22-84 BORING COMPLETED 8-23-84

GROUND ELEVATION 529.42 REFERRED TO DATUM

FIELD PARTY: Roush + Lambert

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	
								1	
								2	
								3	Silty clay - Tan - moist - Low to med. plasticity - Strong Reaction to HCL
1	3.0	4.5	8	7	10	2"		4	CL
								5	
								6	
								7	
								8	Lime stone Frag.
2	8.0	9.5	18	20	25	1"		9	
								10	
								1	
								2	
								3	Silty clay - Tan - moist - Low to med plasticity - Strong Reaction to HCL Trace of Lime stone Frag.
3	13.0	14.5	25	22	17	6"		4	
								5	CL
								6	
								7	
								8	Lime stone Frag
4	18.0	19.1	17	18	54/.1			9	
								20	

ENGINEER

FORM CE-5
REV 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB No. ____________

ANY ____________________________

PROJECT ____________________________

BORING No. NS1-1 DATE ____________ SHEET 2 OF 5

TYPE OF BORING ____________ RIG ____________

CASING USED ____________ SIZE ______ DRILLING MUD USED ____________

BORING BEGUN ____________ BORING COMPLETED ____________

GROUND ELEVATION ____________ REFERRED TO ____________

____________________________ DATUM

FIELD PARTY: ____________________________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								20	
								1	
								2	
5	23.0	24.5	16	30	36	6"		3	Sandy clay - TAN - moist - Low
								4	plasticity - w/ Br. Sandy Limestone in End of Spoon
								5	CL
								6	
								7	
								8	
								9	
								0	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								0	

ENGINEER ____________________________

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____________

Company ____________

Project ____________

Location of Boring:

Water Level	
Time	
Date	

Boring No. NSI-1 Date ______ Sheet 3 of 5

Type of Boring ______ Rig ______

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______ Datum

Field Party: ______

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					32		
		32.7 35.3	34%	2.4	33		Core lost ? 32.7- 45.3 Gray Hard limestone w/ calcareous shale layers Br stain on joint
					34		Shale calcareous Gray
		35.3 39.0	22%	3.7	35		Gray calcareous shale
					36		Gray calcareous shale
					37		
					38		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ______

Company ______

Project ______

Location of Boring:

Water Level	
Time	
Date	

Boring No. NSH Date ______ Sheet 4 of ___

Type of Boring ______ Rig ______

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______ Datu

Field Party: ______

ELEVATION FEET	SAMPLE No.	Sample Depth (from-to) (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type. Color. Quality. Drilling observations. Dep s water lost. Observed fluctuations in water level. notes on drilling ease. etc.
							Gray Limestone w/ .2 Layer of Lt. Br. Clay - Hard
		24.5 25.3	0	.6	25		
		25.3 27.9	0	1.1			
							Gray Limestone w/ Calcareous Shale Layers - Hard - Core Lost?
					26		
		27.9 32.7	9%	4.3	27		
					28		27.9 - 32.7 Gray Limestone Hard - w/ Calcareous Shale Layers Core Lost?
					29		
					30		
					31		

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____________

Company ____________

oject ____________

cation of Boring:

ater Level	
Time	
Date	

Boring No. N51-1 Date ________ Sheet 5 of 5

Type of Boring ________ Rig ________

Casing used ____ Size ____ Drilling mud used ____

Boring begun ________ Boring completed ________

Ground Elevation ________ referred to ________

________ Datu

Field Party: ________

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
		39.0 45.3	53%	6.3	39		Br STAIN oN joinT
					40		Grey Calcareous Shale
					41		
					42		
					43		
					44		
					45		
							Stopped boring 45.3

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ____________

PANY I K E C

PROJECT Clifty Creek North FAD

LOCATION OF BORING:	
WATER LEVEL	Dry
TIME	
DATE	

BORING NO. NS2-1 DATE 8-23-84 SHEET 1 OF 2

TYPE OF BORING SPT-Core RIG B-61

CASING USED ________ SIZE ____ DRILLING MUD USED ________

BORING BEGUN 8-23-84 BORING COMPLETED 8-23-83

GROUND ELEVATION 517.34 REFERRED TO ________

________ DATUM

FIELD PARTY: Roush - Lambert

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	
								1	
								2	
1	3.0	3.0	50/0					3	Auger cutting Gray Clay Shale
								4	
								5	
								6	
								7	
								8	
								9	
								0	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								0	

ENGINEER ____________

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ______

ompany ______

roject ______

cation of Boring:

ater Level	
Time	
Date	

Boring No. NS2-1 Date ______ Sheet 2 of 2

Type of Boring ______ Rig ______

Casing used ______ Size ______ Drilling mud used ______

Boring begun ______ Boring completed ______

Ground Elevation ______ referred to ______

______ Datu

Field Party: ______

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depths water lost, Observed fluctuations in water level, notes on drilling ease, etc.
		7.2 12.6	27%	3.0			Gray Limestone Hard w/ Gray Calcareous Shale Core Lost?
					8		
					9		
					10		
					11		
					12		
					13		

FORM CE-5
REV. 5/61

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ____________

COMPANY IKEC

PROJECT Clifty Creek North FSD

BORING NO. NS3-1 DATE 8-23-84 SHEET 1 OF ____

TYPE OF BORING SpT - core RIG B-61

CASING USED ____ SIZE ____ DRILLING MUD USED ____

BORING BEGUN 8-23-84 BORING COMPLETED 8-23-84

GROUND ELEVATION 513.18 REFERRED TO ____ DAT

FIELD PARTY: Roush + Lambert

LOCATION OF BORING:	
WATER LEVEL	DRY
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	Moved boring 25' W. of STAKE
								1	WATER ElEV. 12.0 8-24-84
								2	
								3	
1	3.0	4.5	6	11	13	4"		4	SilTY ClAY - TAN - moist - Low to med plasticity - TRACE OF Limestone FRAG.
								5	CL
								6	
								7	
								8	
2	8.0	9.5	11	13	21	2"		9	Limestone FRAG
								10	
								1	
								2	
								3	
3	13.0	14.3	11	20	50/.3	0		4	STARded CORE - 14.9
								5	
								6	
								7	
								8	
								9	
								0	

ENGINEER

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____________

Company ____________

Project ____________

ocation of Boring:

Water Level	
Time	
Date	

Boring No. NS3-1 Date ____________ Sheet 2 of 2

Type of Boring ____________ Rig ____________

Casing used ______ Size ______ Drilling mud used ______

Boring begun ____________ Boring completed ____________

Ground Elevation ____________ referred to ____________

____________ Dat

Field Party: ____________

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depth water lost, Observed fluctuations in water level, notes on drilling ease, etc.
					15		14.9 - 20.6
		14.9 20.6	39%	5.6			Gray Hard Limestone w/ calcareous Shale Layers
					16		
					17		Gray calcareous Shale
					18		
					19		
					20		Stopped boring 20.6
					21		

FORM CE-3
REV. 5/61

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO.

PANY IKEC

PROJECT Clifty Creek F.A.D.

BORING NO. NS4-1 DATE 9-11-84 SHEET 1 OF 4

TYPE OF BORING SPT RIG 13-61

CASING USED SIZE DRILLING MUD USED

BORING BEGUN 9-11-84 BORING COMPLETED 9-11-84

GROUND ELEVATION REFERRED TO

DATUM

FIELD PARTY: Roush- Lambert

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	
								1	
								2	
								3	Clay- Be moist- Low to med.
1	3.0	4.5	2	1	1	2"		4	plasticity CL
								5	
								6	
								7	
								8	Gravelly Clay- Blue Gray- moist-
2	8.0	8.9	6	50/.4		5"		9	Poorly Graded- Gravel Consist of Limestone Frags
								0	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								0	

ENGINEER

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

Job No. ____________

Company ____________

Project ____________

Location of Boring:

Water Level	
Time	
Date	

Boring No. NS4-1 Date ________ Sheet 2 of

Type of Boring ________ Rig ________

Casing used ________ Size ________ Drilling mud used ________

Boring begun ________ Boring completed ________

Ground Elevation ________ referred to ________

________ Dat

Field Party: ________

ELEVATION FEET	SAMPLE No.	Sample Depth from-to (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type. Color. Quality. Drilling observations. Depth water lost. Observed fluctuations in water level. notes on drilling ease. etc.
							10.9-30.0 Gray Hard Limestone w/ Calcareous Shale Layers
		10.9 20.0	44%	8.9	11		
					12		
							Shale Calcareous Gray
							" "
							" "
					13		
					14		Shale Calcareous Gray
					15		Gray Calcareous Shale
							Gray Calcareous Shale
					16		Gray Calcareous Shale
					17		Gray Caloareous Shale

AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. ____________

Company ____________

Project ____________

Location of Boring:	
Water Level	
Time	
Date	

Boring No. NS4-1 Date ________ Sheet 2 of 4

Type of Boring ________ Rig ________

Casing used ______ Size ______ Drilling mud used ______

Boring begun ________ Boring completed ________

Ground Elevation ________ referred to ________

________ Dat

Field Party: ________

ELEVATION FEET	SAMPLE No.	Sample Depth (from-to) (in feet)	RQD	Recovery (in feet)	Depth in feet	Graph Log	DESCRIPTION Rock Type, Color, Quality, Drilling observations, Depth water lost, Observed fluctuations in water level, notes on drilling ease, etc.
							10.9-30.0 GRAy HARd Lime stone w/ CAlcAReous Shale LAyers
		10.9 20.0	44%	8.9	11		
					12		
							Shale CAlcAReous GRAy
							" "
							" "
					13		
							ShAle CAlcAReous GRAy
					14		
					15		GRAy CAlcAReous ShAle
							GRAy CAlcAReous ShAlE
					16		
							GRAy CAlCAReous shAle
					17		GRAy CAloAReous ShAle

Indiana - Kentucky Electric Corporation

Clifty Creek Plant

Madison, Indiana

Flyash Dam Raising Feasibility Report

APPENDIX H
Boring Location Plan and Profile
Drawings CE-CCBP - 1 to 7 - 84

January 31, 1985

Prepared by

Soils, Foundation and Hydro Section
Civil Engineering Division
American Electric Power Service Corporation

BORING LOG TERMINOLOGY

Stratum Depth:

Distance in feet and/or inches below ground surface.

Stratum Elevation:

Elevation in feet below ground surface elevation.

Description of Materials:

Major types of soil material existing at boring location. Soil classification based on one of the following systems: Unified Soil Classification System, Ohio State Highway Classification System, Highway Research Board Classification System, Federal Aviation Authority Classification System, Visual Classification.

Sample No.:

Sample numbers are designated consecutively, increasing with depth for each boring.

Sample Type:

"A"	Split spoon, 2" O.D., 1-3/8" I.D., 18" in length.
"B"	One of the following: Power Auger Sample Piston Sample Diamond Bit NX: BX: AX: Housel Sample Wash Sample Denison Sample
"C"	Shelby Tube 3" O.D. except where noted.

Sample Depth:

Depth below top of ground at which appropriate sample was taken.

Blows per 6" on Sampler:

The number of blows required to drive a 2" O.D., 1-3/8" I.D., split spoon sampler, using a 140 pound hammer with a 30 inch free fall, is recorded for 6" drive increments. (Example: 3/8/9)

"N" Blows/Ft.:

Standard penetration resistance. This value is based on the total number of blows required for the last 12" of penetration. (Example: 3/8/9 ∴ N = 8 + 9 = 17)

Water Observations:

Depth of water recorded in test boring is measured from top of ground to top of water level. Initial depth indicates water level during boring, completion depth indicates water level immediately after boring, and depth after "X" number hours indicates water level after letting water rise or fall over a time period. Water observations in pervious soil are considered reliable ground water levels for that date. Water observations in impervious soils can not be considered accurate ground water measurements for that date unless records are made over several days' time. Factors such as weather, soil porosity, etc., will cause the ground water level to fluctuate for both pervious and impervious soils.

SOIL DESCRIPTION

Color:

When the color of the soil is uniform throughout, the color recorded will be such as brown, grey, black and may be modified by adjectives such as light and dark. If the soil's predominant color is shaded by a secondary color, the secondary color precedes the primary color, such as: grey-brown, yellow-brown. If two major and distinct colors are swirled throughout the soil, the colors will be modified by the term mottled, such as: mottled brown and grey.

Particle Size		Visual
Boulders		Larger than 8"
Cobbles		8" to 3"
Gravel	—Coarse	3" to 3/4"
	Fine	2 mm. to 3/4"
Sand	—Coarse	2 mm.-0.6 mm. (Pencil lead size)
	—Medium	0.6 mm.-0.2 mm. (Table sugar and salt size)
	—Fine	0.2 mm.-0.06 mm. (Powdered sugar and human hair size)
Silt		0.06 mm.-0.002 mm.
Clay		0.002 and smaller (Particle size of both Silt and Clay not visible to naked eye)

Soil Components

Major Component:	Minor Component Term
Gravel	Trace 1-10%
Sand	Some 11-35%
Silt	And 36-50%
Clay	

Moisture Content

Term	Relative Moisture
Dry	Powdery
Damp	Moisture content below plastic limit
Moist	Moisture content above plastic limit but below liquid limit
Wet	Moisture content above liquid limit

Condition of Soil Relative to Compactness
Granular Material

Very Loose	5 blows/ft. or less
Loose	6 to 10 blows/ft.
Medium Dense	11 to 30 blows/ft.
Dense	30 to 50 blows/ft.
Very Dense	51 blows/ft. or more

Condition of Soil Relative to Consistency
Cohesive Material

Very Soft	3 blows/ft. or less
Soft	4 to 5 blows/ft.
Medium Stiff	6 to 10 blows/ft.
Stiff	11 to 15 blows/ft.
Very Stiff	16 to 30 blows/ft.
Hard	31 blows/ft. or more

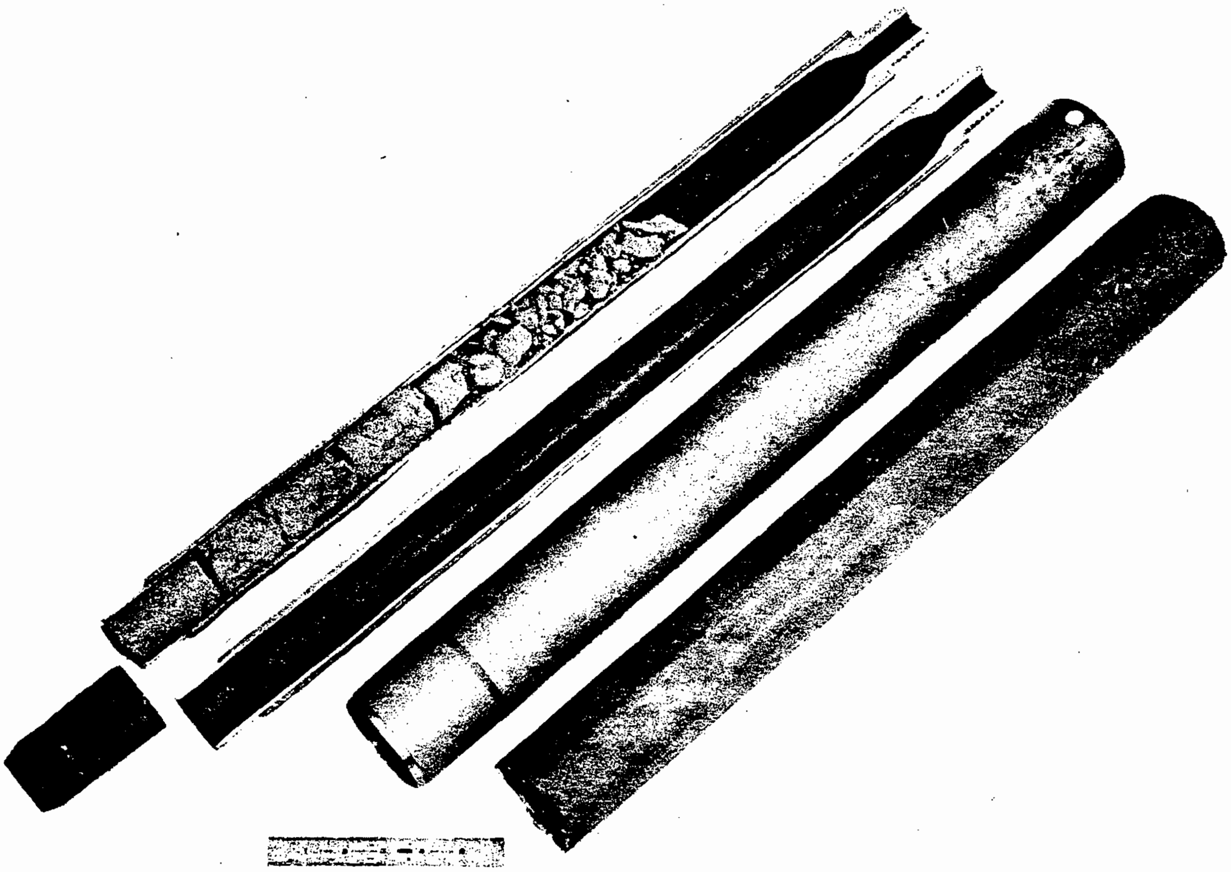
STANDARD PENETRATION RESISTANCE (ASTM D1586)

The purpose of this test is to determine the relative consistency of the soils in a boring, or from boring to boring over the site. This method consists of making a hole in the ground and driving a 2 inch O.D. split spoon sampler into the soil with a 140 pound hammer dropped from a height of 30 inches. The sampler is driven 18 inches and the number of blows recorded for each 6 inches of penetration. Values of standard penetration (N) are determined in blows per foot, summarizing the blows required for the last two 6 inch increments of penetration.

Example: 2–6–8; N = 14

THIN-WALLED SAMPLER (ASTM D1587)

The purpose of the thin-walled sampler is to recover a relatively undisturbed soil sample for laboratory tests. The sampler is a thin-walled seamless tube with a 3 inch outside diameter, which is hydraulically pressed into the ground, at a constant rate. The ends are then sealed to prevent soil moisture loss, and the tube is returned to the laboratory for tests.



BOWSER-MORNER, INC.
420 DAVIS AVENUE, P.O. BOX 51, DAYTON, OHIO 45401

ENGINEERING REPORT

REPORT TO: American Electric Power Service Corp.
1 Riverside Plaza
P.O. Box 16631
Columbus, Ohio 43216

REPORT DATE: October 8, 1984

REPORT NO.: 28089-1084-436

Attention: Mr. Kevin C. Miller,
Civil Engineering Division

REPORT ON: Cone Penetration Test Results, Indiana-Kentucky Electric Corporation, Clifty Creek Power Station Flyash Impoundment, Madison, Indiana

Bowser-Morner, Inc., submitted copies of field boring logs in Bowser-Morner Report No. 28089-1084-425, dated October 2, 1984. Results of the cone penetration tests performed by Woodward-Clyde Consultants were not available at that time.

The results of the cone penetration tests are included with this report. If there are any questions regarding the test results, please contact the writer, or if you prefer, contact Mr. Frederick W. Johnson, Senior Project Engineer, Woodward-Clyde Consultants.

Respectfully submitted,

Bowser-Morner, Inc.

Robert L. Disney

Robert L. Disney, Manager
Soils Exploration Department

RLD/mjj(#95)
2-Client
2-File

11 East Adams Street
Suite 1500
Chicago, Illinois 60603
312-939-1000
Telex 253875 (WOODWARD CGO)

Woodward-Clyde Consultants

October 3, 1984
84C3092

Bowser-Morner
420 Davis Avenue
P.O. Box 51
Dayton, Ohio 45401

Attention: Mr. Robert Disney

Re: Cone Penetration Test Results
AEP Indiana-Kentucky Electric Corporation
Clifty Creek Plant Flyash Impoundment
Near Madison, Indiana

Gentlemen:

This letter transmits the results of four cone penetration test (CPT) borings made at the referenced project on September 19, 20, 21 and 22, 1984. These CPT borings were made in accordance to our August 31, 1984 proposal. The CPT data are summarized in Tables 1 thru 4 and are shown in Figures 3 thru 6. These figures show the cone resistance in lb/in^2 vs depth for each of the CPT borings. A brief discussion of the WCC cone penetrometer system has also been included at the request of Mr. Kevin Miller of AEP.

It was a pleasure to do business with you. If additional information is required please contact us.

Very truly yours,

Frederick W Johnson

Frederick W. Johnson
Senior Project Engineer

Consulting Engineers, Geologists
and Environmental Scientists

Offices in Other Principal Cities

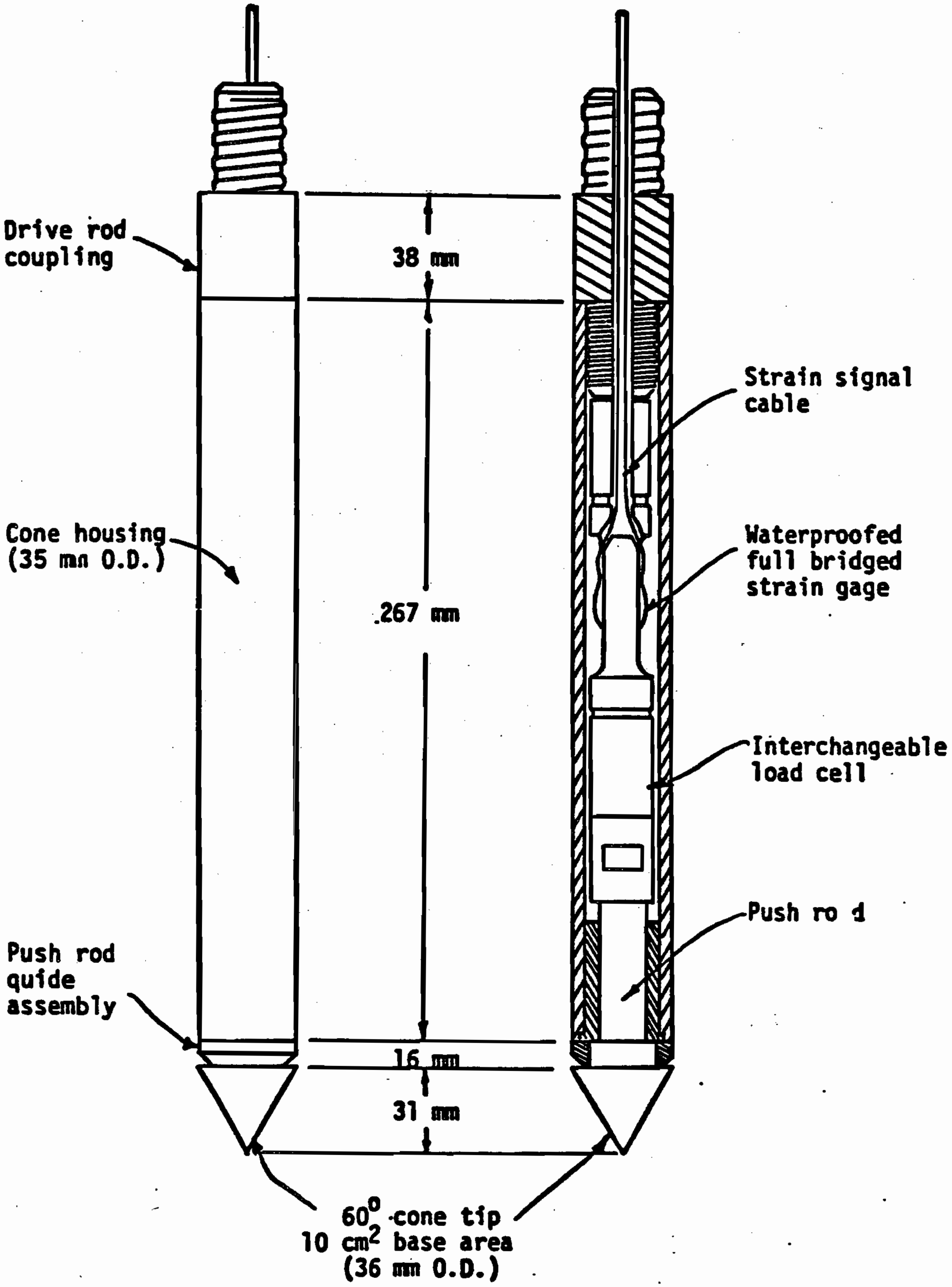
THE WOODWARD-CLYDE CONSULTANTS CONE-PENETROMETER SYSTEM

The Woodward-Clyde Consultants (WCC) cone penetrometer system is patterned after the 60 degree, 10 cm^2 electronic Dutch cone employed in continuous (static) penetration testing and is shown in Figure 1. During cone-penetration resistance testing (CPT), the drill-rig advances the cone at a rate of about 5±1 ft/minute and continuous cone penetration is usually obtained at intervals of at least 5 feet, Figure 2.

The point resistance (q_c) is sensed by the load-cell just above the cone and depth events are sensed by a 360° potentiometer attached to the drive system. The analog (voltage) signals from the load-cell are sent via a signal cable to a strip chart recorder. There the signals are conditioned and displayed in real time. Three signal amplification ranges are available to provide an appropriate scale for the q_c reaction range anticipated.

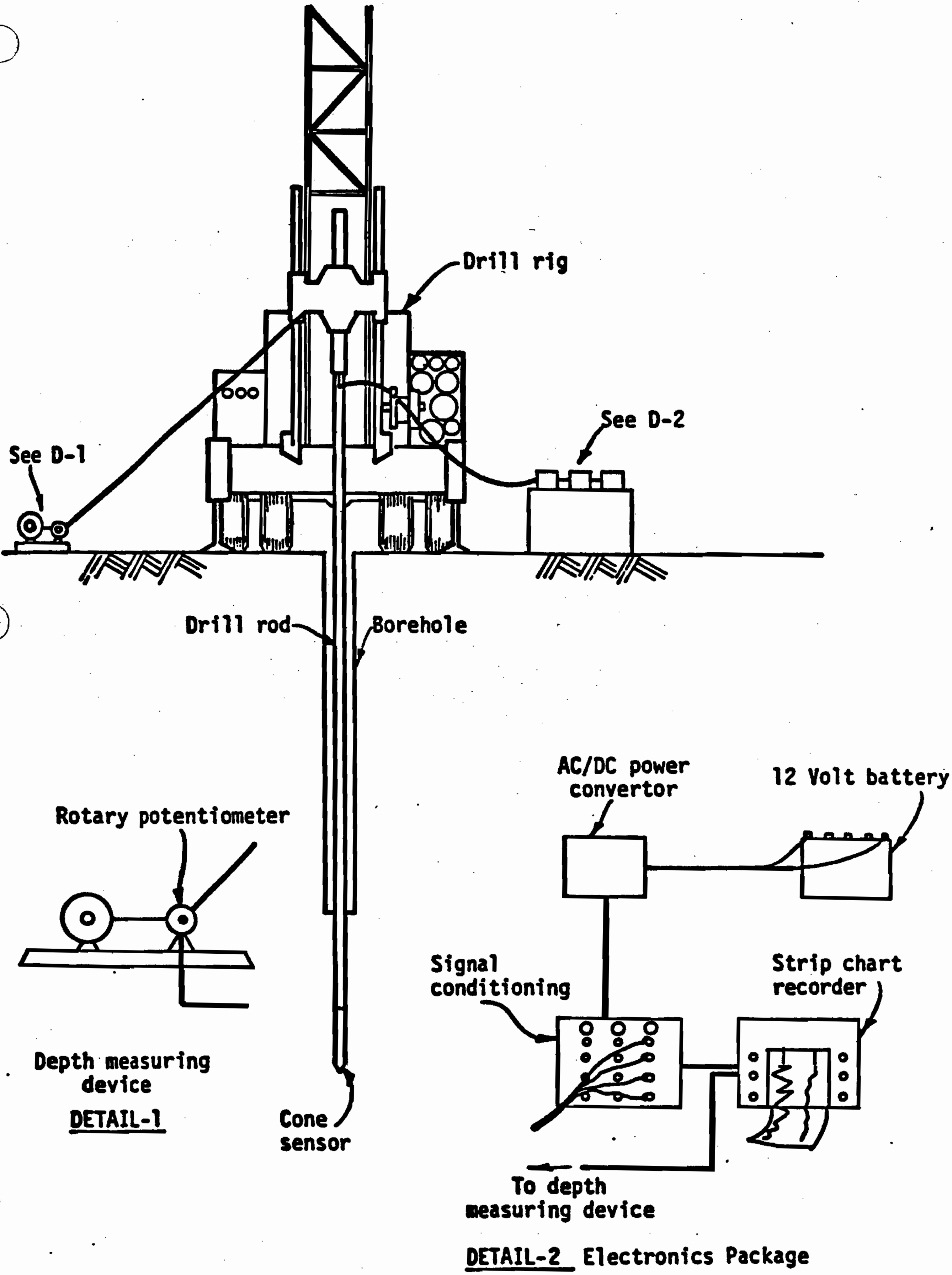
As the strip chart record represents a voltage analog of q_c, the record must be converted to load. A conversion factor is given for each of three signal amplification ranges and a load factor, given for the load-cell, is applied to convert the analog record of each CPT run.

CPT data can be simply reduced by scaling the field record with a proportional divider, by conversion with a hand-held calculator, or alternatively, with a small computer program using either a commercial time-share facility or an in-house microcomputer. The program input for each continuous advance is the analog q_c, the test depth, the signal amplification range selected and the corresponding load factor.



WCC ELECTRICAL CONE PENETROMETER

Fig. 1



CONE PENETRATION TEST - APPARATUS SCHEMATIC

Fig. 2

LOG OF BORING No. SO 4-1

CLIFTY CREEK FLYASH IMPOUNDMENT

BORING LOCATION: AS DIRECTED

DATE STARTED: 9/22/84

SURFACE ELEVATION: 502.2' (WATER)

DATE COMPLETED: 9/22/84

STRATUM	DESCRIPTION OF MATERIAL SOIL CLASSIFICATION SYSTEM:	SAMPLE NO. & TYPE	SAMPLE DEPTH	BLOWS PER 6" ON SAMPLER	"N" BLOWS/ FT.	SAMPLE RECOVERY IN.
0'	BARGE					
2.0'	TOP OF WATER					
9.5'	FLYASH					
80.0'	BOTTOM OF BORING					
	NOTE: CONE PENETRATION TEST BORING					

DRILLING METHOD: HOLLOW STEM AUGER

DRILLER: B. C.-K. G.

JOB NO.: 28089

WATER OBSERVATIONS

INITIAL DEPTH: 2.0'

COMPLETION DEPTH: 2.0'

DEPTH AFTER .... HRS. ....

TYPE SAMPLER:

☐ A. SPLIT SPOON

☐ B.

☐ C. SHELBY TUBE

2B12

BOWSER-MORNER
TESTING LABORATORIES, INC.

Woodward-Clyde Consultants
CHICAGO

SUBJECT Table 1 Cone Resistance vs Depth
COMPUTED JVH CHECKED FWJ
PROJECT Bouser-Morner
FILE NO. 84C3092
DATE 9-30-84 PAGE 1 OF 2 PAGES

Boring SO-4-1

depth, ft	Resistance lb/ft^2	depth, ft	Resistance lb, ft^2
12.7	2788	38.3	18588
13.7	3717	39.1	50187
14.8	9294	39.6	213762
15.8	0	40.1	250933
16.8	0	40.5	250938
17.8	2322	40.75	315996
18.8	3717	41.0	246291
19.8	14870	42.0	246291
20.3	23235	43.0	250938
20.6	57622	43.4	358748
20.8	48328	44.0	330866
21.0	87363	45.0	277703
22.3	18588	46.0	204468
23.3	37176	47.0	232350
24.3	21376	47.8	315996
24.8	69705	49.4	288114
25.5	176586	49.6	130116
25.8	106831	49.9	171939
26.8	18588	51.0	111528
27.8	65411	52.0	94798
28.8	30205	53.0	223056
29.8	84575	54.0	297408
31.1	264879	55.0	269526
31.4	195174	55.5	130116
32.3	51117	56.0	83646
33.3	74352	56.9	223056
34.1	55764	57.3	148704
34.6	63199	58.2	358748
35.0	66916	58.8	97587
35.3	55764	59.6	386630
36.2	78069	60.0	456335
36.9	44611	60.3	428453
37.6	65058		

Table 1

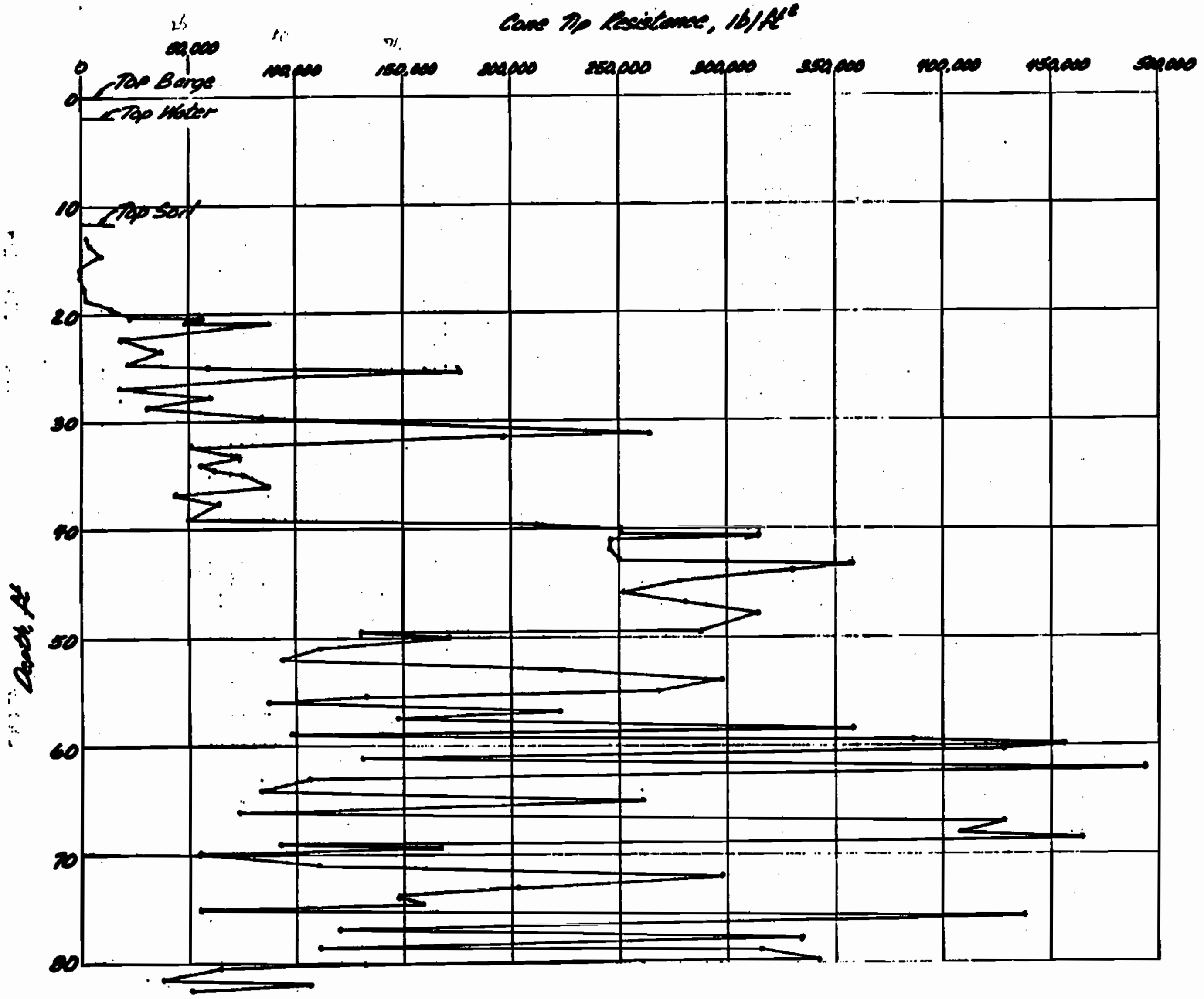
Woodward-Clyde Consultants
CHICAGO

SUBJECT Table 1 cont. Cone Resistance vs Depth
COMPUTED JVH CHECKED FWJ
PROJECT Rowser-Morner
FILE NO. 84C3092
DATE 9-20-84 PAGE 2 OF 2 PAGES

Boring
50-41

depth, ft	Resistance lb/ft^2
61.0	130116
62.2	493511
63.0	111528
64.0	83646
65.0	260232
66.0	74352
67.0	428453
68.0	409865
68.5	465529
69.0	92940
69.3	167292
70.0	55764
71.0	111528
72.0	297408
73.0	204468
74.0	148704
74.5	157998
75.0	55764
75.9	437747
77.0	120822
77.8	335513
78.5	111528
78.8	316925
79.7	391277
80.2	130116
80.5	65058
81.4	37176
81.9	116175
82.3	51117

Table 1



BORING SO-4-1
DRILLED 9-28-1984

CONE PENETRATION TEST
CLIFTY CREEK POWER PLANT
BOWSER-MORNER

Fig. 3

WCC 84C3092

1 Oct. 1984

(PAGE 1 OF 2)

LOG OF BORING No. SO 4.5-1

CLIFTY CREEK FLYASH IMPOUNDMENT

BORING LOCATION: AS DIRECTED

DATE STARTED: 9/6/84

SURFACE ELEVATION: 502.2' (WATER)

DATE COMPLETED: 9/6/84

STRATUM	DESCRIPTION OF MATERIAL SOIL CLASSIFICATION SYSTEM:	SAMPLE NO. & TYPE	SAMPLE DEPTH	BLOWS PER 6" ON SAMPLER	"N" BLOWS/FT.	SAMPLE RECOVERY IN.
0'	BARGE					
2.0'	WATER					
16.0'	FLYASH	1A	18.5-20.0	0-0-0	0	0"
		2A	23.5-25.0	0-0-0	0	0"
		3A	28.5-30.0	1-1-0	1	14"
		1C	33.5-35.5	—	—	0"
		4A	38.5-40.0	1-2-3	5	18"
42.0'	HARD GRAY SILT, TRACE OF SAND - MOIST	5A	43.5-45.0	15-26-31	57	16"
48.5	VERY STIFF BROWN SILT, SOME SAND - WET	6A	48.5-50.0	3-6-12	18	16"
		7A	53.5-55.0	4-8-11	19	16"

DRILLING METHOD: HOLLOW STEM AUGER

DRILLER: B.C.-B.C.M.-K.G.

JOB NO.: 28089

WATER OBSERVATIONS

INITIAL DEPTH: 2.0'

COMPLETION DEPTH: 2.0'

DEPTH AFTER .... HRS. ....

TYPE SAMPLER:

☒ A. SPLIT SPOON

☐ B.

☒ C. SHELBY TUBE

BOWSER-MORNER

2B12

(PAGE 2 OF 2)

LOG OF BORING No. SO 4.5-1

CLIFTY CREEK FLYASH IMPOUNDMENT

BORING LOCATION: AS DIRECTED

DATE STARTED: 9/6/84

SURFACE ELEVATION: 502.2' (WATER)

DATE COMPLETED: 9/6/84

STRATUM	DESCRIPTION OF MATERIAL SOIL CLASSIFICATION SYSTEM:	SAMPLE NO. & TYPE	SAMPLE DEPTH	BLOWS PER 6" ON SAMPLER	"N" BLOWS/FT.	SAMPLE RECOVERY IN.
59.0'	MEDIUM STIFF GRAY SILT, TRACE OF SAND - MOIST	8A	58.5-60.0	4-4-5	9	16"
	(BECOMES HARD AT 63.5')	9A	63.5-65.0	14-19-24	43	16"
68.5'	HARD GRAY SILT, SOME SAND - WET	10A	68.5-70.0	12-20-29	49	17"
		11A	73.5-75.0	11-22-30	52	18"
79.0'	HARD GRAY SILT, SOME CLAY, TRACE OF SAND - MOIST	12A	78.5-80.0	13-21-32	53	16"
		13A	83.5-85.0	11-20-29	49	18"
		14A	88.5-90.0	14-21-30	51	16"
		15A	90.5-92.0	13-19-26	45	16"
92.0'	BOTTOM OF BORING					

DRILLING METHOD: HOLLOW STEM AUGER

DRILLER: B.C. - B.C.M. - K.G.

JOB NO.: 28089

WATER OBSERVATIONS

INITIAL DEPTH: 2.0'

COMPLETION DEPTH: 2.0'

DEPTH AFTER .... HRS. ....

TYPE SAMPLER:

☒ A. SPLIT SPOON

☐ B.

☒ C. SHELBY TUBE

BOWSER-MORNER

2B12

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ____________

PANY *IKEC*

PROJECT *Clifty Creek F.A.D.*

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING NO. *5045-1* DATE ____________ SHEET *1* OF *5*

TYPE OF BORING ____________ RIG ____________

CASING USED ____________ SIZE ______ DRILLING MUD USED ____________

BORING BEGUN ____________ BORING COMPLETED ____________

GROUND ELEVATION ____________ REFERRED TO ____________ DATUM

FIELD PARTY: ____________

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	*boring Taken by Bowser-Morner*
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
1	*18.5*	*20.0*	*0*	*0*	*0*	*0*		9	
								*2*0	
								1	
								2	
								3	
2	*23.5*	*25.0*	*0*	*0*	*0*	*0*		4	
								5	
								6	
								7	
								8	*Fly Ash*
[illegible]	*28.5*	*30.0*	*1*	*1*	*0*	*14"*		9	
								*3*0	

ENGINEER ____________

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ____________

COMPANY ____________

PROJECT ____________

LOCATION OF BORING:

WATER LEVEL	
TIME	
DATE	

BORING NO. SD 4.5-1 DATE ____________ SHEET 2 OF 5

TYPE OF BORING ____________ RIG ____________

CASING USED ____________ SIZE ______ DRILLING MUD USED ____________

BORING BEGUN ____________ BORING COMPLETED ____________

GROUND ELEVATION ____________ REFERRED TO ____________

____________ DATUM

FIELD PARTY: ____________

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								20	
								1	
								2	
	33.5	35.5						3	Shelby Tube
								4	
								5	
								6	
								7	
4	38.5	40.0	1	2	3	18"		8	Fly Ash
								9	
								30	
								1	
								2	
5	43.5	45.0	15	26	31	16"		3	SilT- GRAY BR. - MoisT To weT-TRACE of 1. Fine Sand ML
								4	
								5	
								6	
								7	
6	48.5	50.0	3	6	12	16"		8	Clayey Sand. BR.- SATURATEd. Poorly Graded- 100% Fine Grain SC
								9	
								0	

ENGINEER ____________

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO.

MPANY

PROJECT

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING NO. 504.5-1 DATE SHEET 3 OF 5

TYPE OF BORING RIG

CASING USED SIZE DRILLING MUD USED

BORING BEGUN BORING COMPLETED

GROUND ELEVATION REFERRED TO

DATU

FIELD PARTY:

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								50	
								1	
								2	
								3	clayey SilT - yellowish BR- moist
7	53.5	55.0	4	8	11	16"		4	To weT- Slight PlasTicity
								5	ML
								6	
								7	
								8	clayey silT - Gray Br. - weT To SaTuraTed
8	58.5	60.0	4	9	5	16"		9	slight plasTicity- Trace of Sand
								60	CL-ML
								1	
								2	
								3	Sand-SilT- Gray Br.- moisT- w/
9	63.5	65.0	14	19	24	16"		4	Fine Grain Sand Lens- slight Reaction To HcL
								5	ML
								6	
								7	
								8	Same As Sample No. 9
	68.5	70.0	12	20	29	17		9	
								70	

ENGINEER

FORM CS-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ____________

MPANY ____________

PROJECT ____________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING NO. 504.5-1 DATE ________ SHEET 4 OF 5

TYPE OF BORING ________ RIG ________

CASING USED ________ SIZE ________ DRILLING MUD USED ________

BORING BEGUN ________ BORING COMPLETED ________

GROUND ELEVATION ________ REFERRED TO ________ DATUM

FIELD PARTY: ________

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								70	
								1	
								2	
								3	Clayey Silt - Gray Br. Low plasticity
11	73.5	75.0	11	22	30	18"		4	Slight Reaction To HCL - moist
								5	ML-CL
								6	
								7	
								8	
12	78.5	80.0	13	21	32	16"		9	Same As Sample NO. 11
								80	
								1	
								2	
								3	Same As Sample No. 11
13	83.5	85.0	11	20	29	18"		4	
								5	
								6	
								7	
								8	Same AS Sample NO. 11
1	88.5	89.0	14	21	30	16"		9	
								90	

ENGINEER ____________

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB No. ________

COMPANY ________

PROJECT ________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING NO. S04.5-1 DATE ________ SHEET 5 OF 5

TYPE OF BORING ________ RIG ________

CASING USED ________ SIZE ________ DRILLING MUD USED ________

BORING BEGUN ________ BORING COMPLETED ________

GROUND ELEVATION ________ REFERRED TO ________ DATUM

FIELD PARTY: ________

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								90	
								1	
								2	
								3	Clayey Silt - Gray Br. - moist -
15	90.5	92.0	13	19	26	16"		4	slight Reaction to HCl - Low Plasticity
								5	CL-ML
								6	
								7	
								8	Stopped boring 92.0
								9	
								0	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								0	

ENGINEER ________

(PAGE 1 OF 6)

LOG OF BORING No. SO 4.5-2

CLIFTY CREEK FLYASH IMPOUNDMENT

BORING LOCATION: AS DIRECTED

DATE STARTED: 9/5/84

SURFACE ELEVATION: 502.2' (WATER)

DATE COMPLETED: 9/5/84

STRATUM	DESCRIPTION OF MATERIAL SOIL CLASSIFICATION SYSTEM:	SAMPLE NO. & TYPE	SAMPLE DEPTH	BLOWS PER 6" ON SAMPLER	"N" BLOWS/ FT.	SAMPLE RECOVERY IN.
0'	BARGE					
2.0'	WATER					
7.5'	FLYASH	1A	7.5-9.0	1-1-0	1	12"
		2A	9.0-10.5	0-0-0	0	0"
		3A	10.5-12.0	0-0-0	0	10"
		4A	12.0-13.5	2-1-2	3	10"
		5A	13.5-15.0	0-0-2	2	10"
		6A	15.0-16.5	0-0-0	0	12"
		7A	16.5-18.0	2-0-1	1	10"
		8A	18.0-19.5	0-2-1	3	8"

DRILLING METHOD: HOLLOW STEM AUGER

DRILLER: B.C.-B.C.M.-K.G.

JOB NO.: 28089

WATER OBSERVATIONS

INITIAL DEPTH: 2.0'

COMPLETION DEPTH: 2.0'

DEPTH AFTER .... HRS. ....

TYPE SAMPLER:

☒ A. SPLIT SPOON

☐ B.

☒ C. SHELBY TUBE

BOWSER-MORNER
TESTING LABORATORIES, INC.

2B12

(PAGE 2 OF 6)

LOG OF BORING No. SO 4.5-2

CLIFTY CREEK FLYASH IMPOUNDMENT

BORING LOCATION: AS DIRECTED
DATE STARTED: 9/5/84

SURFACE ELEVATION: 502.2' (WATER)
DATE COMPLETED: 9/5/84

STRATUM	DESCRIPTION OF MATERIAL SOIL CLASSIFICATION SYSTEM:	SAMPLE NO. & TYPE	SAMPLE DEPTH	BLOWS PER 6" ON SAMPLER	"N" BLOWS/FT.	SAMPLE RECOVERY IN.
		9A	19.5-21.0	1-1-1	2	11"
		10A	21.0-22.5	3-2-1	3	13"
23.0'	LOOSE BROWN SAND, SOME SILT, TRACE OF CLAY-MOIST	11A	22.5-24.0	1-2-7	9	9"
		1C	24.0-26.0	— -	-	20"
26.0'	VERY STIFF BROWN SILT, SOME CLAY, TRACE OF SAND-MOIST	12A	26.0-27.5	5-7-13	20	14"
27.5'	VERY STIFF BROWN & GRAY SILT SOME CLAY, TRACE OF SAND-MOIST	13A	27.5-29.0	9-10-17	27	16"
		14A	29.0-30.5	6-11-15	26	12"
31.0'	VERY STIFF BROWN SILT, SOME SAND, TRACE OF CLAY-MOIST	15A	30.5-32.0	9-14-16	30	14"
		16A	32.0-33.5	8-13-15	28	14"
33.5'	MEDIUM DENSE BROWN SAND, SOME SILT, TRACE OF CLAY-MOIST	17A	33.5-35.0	7-12-16	28	17"

DRILLING METHOD: HOLLOW STEM AUGER

DRILLER: B.C.-B.C.M.-K.G.

JOB NO.: 28089

WATER OBSERVATIONS

INITIAL DEPTH: 2.0'

COMPLETION DEPTH: 2.0'

DEPTH AFTER .... HRS. ....

TYPE SAMPLER:

☒ A. SPLIT SPOON

☐ B.

☒ C. SHELBY TUBE

BOWSER-MORNER
TESTING LABORATORIES, INC.

2B12

(PAGE 3 OF 6)

LOG OF BORING No. SO 4.5-2

CLIFTY CREEK FLYASH IMPOUNDMENT

BORING LOCATION: AS DIRECTED

DATE STARTED: 9/5/84

SURFACE ELEVATION: 502.2' (WATER)

DATE COMPLETED: 9/5/84

STRATUM	DESCRIPTION OF MATERIAL SOIL CLASSIFICATION SYSTEM:	SAMPLE NO. & TYPE	SAMPLE DEPTH	BLOWS PER 6" ON SAMPLER	"N" BLOWS/ FT.	SAMPLE RECOVERY IN.
35.0'	MEDIUM DENSE BROWN & GRAY SAND, TRACE SILT, TRACE OF CLAY-MOIST	18A	35.0-36.5	8-11-13	24	16"
36.5'	VERY STIFF BROWN SILT, SOME SAND, TRACE OF CLAY-MOIST	19A	36.5-38.0	9-13-14	27	18"
38.0'	VERY STIFF GRAY SILT, SOME SAND, TRACE OF CLAY-MOIST	20A	38.0-39.5	10-11-17	28	16"
39.5'	STIFF GRAY SILT, SOME CLAY, SOME ORGANIC, TRACE OF SAND-MOIST	21A	39.5-41.0	4-6-7	13	18"
41.0'	VERY STIFF BROWN & GRAY CLAY, SOME SILT, TRACE OF SAND-DAMP	22A	41.0-42.5	5-10-13	23	18"
	(BECOME STIFF AT 42.5')	23A	42.5-44.0	4-6-8	14	18"
		24A	44.0-45.5	4-7-8	15	16"
	(BECOMES VERY STIFF AT 45.5')	25A	45.5-47.0	5-8-10	18	17"
47.0'	STIFF BROWN & GRAY SILT, SOME SAND, TRACE OF CLAY-WET	26A	47.0-48.5	3-4-8	12	16"

DRILLING METHOD: HOLLOW STEM AUGER

DRILLER: B.C.-B.C.M.-K.G.

JOB NO.: 28089

WATER OBSERVATIONS

INITIAL DEPTH: 2.0'

COMPLETION DEPTH: 2.0'

DEPTH AFTER .... HRS. ....

TYPE SAMPLER:

☒ A. SPLIT SPOON

☐ B.

☒ C. SHELBY TUBE

BOWSER-MORNER
TESTING LABORATORIES, INC.

2B12

(PAGE 4 OF 6)

LOG OF BORING No. SO 4.5-2

CLIFTY CREEK FLYASH IMPOUNDMENT

BORING LOCATION: AS DIRECTED

DATE STARTED: 9/5/84

SURFACE ELEVATION: 502.2' (WATER)

DATE COMPLETED: 9/5/84

STRATUM	DESCRIPTION OF MATERIAL SOIL CLASSIFICATION SYSTEM:	SAMPLE NO. & TYPE	SAMPLE DEPTH	BLOWS PER 6" ON SAMPLER	"N" BLOWS/ FT.	SAMPLE RECOVERY IN.
	(BECOMES VERY STIFF AT 48.5')	27A	48.5-50.0	12-13-17	30	15"
	(BECOMES HARD AT 50.0')	28A	50.0-51.5	15-16-16	32	18"
	(BECOMES STIFF AT 51.5')	29A	51.5-53.0	3-5-8	13	16"
	(BECOMES VERY STIFF AT 53.0')	30A	53.0-54.5	8-9-12	21	16"
	(BECOMES HARD AT 54.5')	31A	54.5-56.0	19-19-35	54	18"
56.0'	VERY STIFF GRAY SILT, TRACE OF CLAY- DAMP	32A	56.0-57.5	9-10-19	29	18"
	(BECOMES HARD AT 57.5')	33A	57.5-59.0	19-27-29	56	18"
		34A	59.0-60.5	27-21-20	41	12"
		35A	60.5-62.0	11-13-19	32	16"

DRILLING METHOD: HOLLOW STEM AUGER

DRILLER: B.C.-B.C.M.-K.G.

JOB NO.: 28089

WATER OBSERVATIONS

INITIAL DEPTH: 2.0'

COMPLETION DEPTH: 2.0'

DEPTH AFTER .... HRS. ....

TYPE SAMPLER:

☒ A. SPLIT SPOON

☐ B.

☒ C. SHELBY TUBE

BOWSER-MORNER

2B12

(PAGE 5 OF 6)

LOG OF BORING No. SO 4.5-2

CLIFTY CREEK FLYASH IMPOUNDMENT

BORING LOCATION: AS DIRECTED
DATE STARTED: 9/5/84
SURFACE ELEVATION: 502.2' (WATER)
DATE COMPLETED: 9/5/84

STRATUM	DESCRIPTION OF MATERIAL SOIL CLASSIFICATION SYSTEM:	SAMPLE NO. & TYPE	SAMPLE DEPTH	BLOWS PER 6" ON SAMPLER	"N" BLOWS/ FT.	SAMPLE RECOVERY IN.
		36A	62.0-63.5	11-19-40	59	16"
		37A	63.5-65.0	17-21-40	61	12"
65.0'	VERY DENSE GRAY SAND AND SILT, TRACE OF CLAY-MOIST	38A	65.0-66.5	16-23-30	53	16"
		39A	66.5-68.0	22-25-27	52	16"
		40A	68.0-69.5	19-21-23	44	14"
		41A	69.5-71.0	17-19-22	41	16"
		42A	71.5-73.0	15-20-19	39	14"
		43A	73.0-74.5	19-24-26	50	15"
		44A	74.5-76.0	18-23-24	47	16"

DRILLING METHOD: HOLLOW STEM AUGER
DRILLER: B.C. - B.C.M. - K.G.
JOB NO.: 28089

WATER OBSERVATIONS
INITIAL DEPTH: 2.0'
COMPLETION DEPTH: 2.0'
DEPTH AFTER .... HRS. ....

TYPE SAMPLER:
☒ A. SPLIT SPOON
☐ B.
☒ C. SHELBY TUBE

BOWSER-MORNER

2B12

(PAGE 6 OF 6)

LOG OF BORING No. SO 4.5-2

CLIFTY CREEK FLYASH IMPOUNDMENT

BORING LOCATION: AS DIRECTED

DATE STARTED: 9/5/84

SURFACE ELEVATION: 502.2' (WATER)

DATE COMPLETED: 9/5/84

STRATUM	DESCRIPTION OF MATERIAL SOIL CLASSIFICATION SYSTEM:	SAMPLE NO. & TYPE	SAMPLE DEPTH	BLOWS PER 6" ON SAMPLER	"N" BLOWS/FT.	SAMPLE RECOVERY IN.
	(BECOMES MEDIUM DENSE AT 76.0')	45A	76.0-77.5	8-12-14	26	18"
	(BECOMES DENSE AT 77.5')	46A	77.5-79.0	12-16-19	35	18"
	(BECOMES MEDIUM DENSE AT 79.0')	47A	79.0-80.5	10-15-11	26	16"
	(BECOMES DENSE AT 80.5')	48A	80.5-82.0	9-13-17	30	17"
82.0'	BOTTOM OF BORING					

DRILLING METHOD: HOLLOW STEM AUGER

DRILLER: B.C.-B.C.M.-K.G.

JOB NO.: 28089

WATER OBSERVATIONS

INITIAL DEPTH: 2.0'

COMPLETION DEPTH: 2.0'

DEPTH AFTER .... HRS. ....

TYPE SAMPLER:

☒ A. SPLIT SPOON

☐ B.

☒ C. SHELBY TUBE

BOWSER-MORNER

2B12

ORM CE-5
EV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

OB No.
IPANY IKEC
ROJECT Clifty Creek FAD

LOCATION OF BORING:

WATER LEVEL	
TIME	
DATE	

BORING NO. 504.5-2 DATE SHEET 1 OF 5
TYPE OF BORING RIG
CASING USED SIZE DRILLING MUD USED
BORING BEGUN BORING COMPLETED
GROUND ELEVATION REFERRED TO DATUM
FIELD PARTY:

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	Boring Taken by Bowser-Morner
								1	7.5 FT of Water
								2	
								3	
								4	
								5	
								6	
								7	
1	7.5	9.0	1	1	0	12"		8	7.5- 21.0 Fly Ash
								9	
2	9.0	10.5	0	0	0	0		0	
3	10.5	12.0	0	0	0	10"		1	
								2	
4	12.0	13.5	2	1	2	10"		3	
5	13.5	15.0	0	0	2	10"		4	
								5	
6	15.0	16.5	0	0	0	12"		6	
7	16.5	18.00	2	0	1	10"		7	
								8	
	18.0	19.5	0	2	1	8"		9	
	19.5	21.0	1	1	1	11"		0	

ENGINEER

FORM CE-5
REV. 5/81.

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ____________

COMPANY ____________

PROJECT ____________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING NO. 504.5-2 DATE ______ SHEET 2 OF 5

TYPE OF BORING ______ RIG ______

CASING USED ______ SIZE ______ DRILLING MUD USED ______

BORING BEGUN ______ BORING COMPLETED ______

GROUND ELEVATION ______ REFERRED TO ______ DATUM

FIELD PARTY: ______

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								20	
10	21.0	22.5	3	2	1	13"		1	Fly Ash Top of Sample Clayey SilT - Gray Green - WeT - Trace of Sand ML
11	22.5	24.0	1	2	7	9"		2	Clayey Sand - Br. WeT - 100% Fine Grain Quartz SC
								3	
	24.0	26.0				20"		4	3" Shelby Tube
								5	
	26.0	27.5	5	7	13	14"		6	Sandy SilT - Br. - moisT To WeT - SlighT PlasTicity - Trace of org. maT. ML
								7	
13	27.5	29.0	9	10	17	16"		8	Sandy SilT - Gray + Br. moisT To WeT org. maT. ML
14	29.0	30.5	6	11	15	12"		9	Sandy SilT - Br. - moisT - SlighT PlasTicity ML
								30	Same as Sample No. 14
15	30.5	32.0	9	14	16	14"		1	
16	32.0	33.5	8	13	15	14"		2	Same as Sample No. 14
								3	Sand - Br. moisT 100% Fine Grain QuarTz - Trace of SilT SC-SP
17	33.5	35.0	7	12	16	17"		4	
18	35.0	36.5	8	11	13	16"		5	Clayey SilT - Gray Br. moisT - Trace of Sand ML
								6	
19	36.5	38.0	9	13	14	18"		7	Clay SilT - Br. - moisT - Trace of Sand ML
20	38.0	39.5	10	11	17	16"		8	Clayey SilT - Gray Br. moisT - Trace of org maT. - Trace of Sand ML
								9	
								40	

ENGINEER ______

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ____________
COMPANY ____________
PROJECT ____________

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

BORING NO. 504.5-2 DATE ____________ SHEET 3 OF 5
TYPE OF BORING ____________ RIG ____________
CASING USED ____________ SIZE ______ DRILLING MUD USED ______
BORING BEGUN ____________ BORING COMPLETED ____________
GROUND ELEVATION ____________ REFERRED TO ____________ DATUM
FIELD PARTY: ____________

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
21	39.5	41.0	4	6	7	18"		40	clayey SilT - GRAY BR: moisT - TRACE ORG. MAT. TRACE OF SAND ML
22	41.0	42.5	5	10	13	18"		1 2	SilTY ClAY - BR. - moist - Low TO med plasticity - CL
23	42.5	44.0	4	6	8	18"		3	clayey silT - BR. - weT TO SATURATED. TRACE OF SAND. ML
24	44.0	45.5	4	7	8	16"		4 5	Same AS Sample NO. 23
5	45.5	47.0	5	8	10	17"		6	Same AS Sample NO. 23
26	47.0	48.5	3	4	8	16"		7 8	Same AS Sample NO. 23
27	48.5	50.0	12	13	17	15"		9 50	Sandy SilT - BR. weT TO SATURATED 100% Fine Grain ML
28	50.0	51.5	15	16	16	18"		1	Same AS Sample NO. 27
29	51.5	53.0	3	5	8	16"		2	Same AS Sample NO. 27 (SATURATED)
30	53.0	54.5	8	9	12	16"		3 4	Same AS Sample NO. 27
31	54.5	56.0	19	19	35	18"		5	Same AS Sample NO. 27 (GRAY BR)
32	56.0	57.5	9	10	19	18"		6 7	SilTY ClAY - GRAY BR - moisT - Low To med. plasticity - STRONG REACTION TO HCL - CL
33	57.5	59.0	19	27	29	18"		8	SilT - GRAY BR - moist TO weT - TRACE OF Sand - moderATE REACTION TO HCL - ML
34	59.0	60.5	27	21	20	12"		9 0	SAME AS Sample NO. 33

ENGINEER ____________

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AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ______

COMPANY ______

PROJECT ______

BORING NO. 504S-2 DATE ______ SHEET 4 OF 5

TYPE OF BORING ______ RIG ______

CASING USED ______ SIZE ______ DRILLING MUD USED ______

BORING BEGUN ______ BORING COMPLETED ______

GROUND ELEVATION ______ REFERRED TO ______

______ DAT

FIELD PARTY: ______

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES, BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
35	60.5	62.0	11	13	19	16"		60	SILT - GRAY Br moisT - TRACE OF SAND MODERATE REACTION TO HCL ML
								1	
36	62.0	63.5	11	19	40	16"		2	CLAYEY SILT - GRAY Br moisT - LOW PLASTICITY - MODERATE REACTION TO HCL ML
37	63.5	65.0	17	21	40	12"		3	SILT - GRAY Br moisT - STRONG REACTION TO HCL - TRACE OF SAND. ML
								4	
38	65.0	66.5	16	23	30	16"		5	SILT - GRAY Br moisT - SLIGHT PLASTICITY - STRONG REACTION TO HCL - W/ FINE GRAIN SAND LENS QUARTZ ML
39	66.5	68.0	22	25	27	16"		6	SAME AS AS SAMPLE NO. 38
								7	
40	68.0	69.5	19	21	23	14"		8	SAME AS SAMPLE NO 38
41	69.5	71.0	17	19	22	16"		9	SAME AS SAMPLE NO 38
								70	
42	71.5	73.0	15	20	19	14"		1	SILT - GRAY Br moisT TO WET - SLIGHT PLASTICITY - SLIGHT REACTION TO HCL ML
43	73.0	74.5	14	24	26	15"		2	SAME AS SAMPLE NO 42
								3	
44	74.5	76.0	18	23	24	16"		4	SAME AS SAMPLE NO. 42 (MOIST)
45	76.0	77.5	8	12	14	18"		5	CLAYEY SILT - GRAY Br moisT - SLIGHT PLASTICITY - SLIGHT REACTION TO HCL ML
								6	
46	77.5	79.0	12	16	19	18"		7	SAME AS SAMPLE NO. 45
47	79.0	80.5	10	15	11	16"		8	SILT - GRAY Br moisT - SLIGHT PLASTICITY SLIGHT REACTION TO HCL ML
								9	
								0	

ENGINEER ______

ORM CE-5
EV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB NO. ______

MPANY ______

ROJECT ______

BORING NO. 504.5-3 DATE ______ SHEET 5 OF 5

TYPE OF BORING ______ RIG ______

CASING USED ______ SIZE ______ DRILLING MUD USED ______

BORING BEGUN ______ BORING COMPLETED ______

GROUND ELEVATION ______ REFERRED TO ______ DATUM

FIELD PARTY: ______

LOCATION OF BORING:

WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								80	SILT - GRAY - moist To weT - SlighT
48	80.5	82.0	9	13	17	17"		1	ReacTion To HcL - Trace of org. MAT. ML
								2	
								3	
								4	
								5	
								6	
								7	stopped boring 82.0
								8	
								9	
								0	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								0	

ENGINEER ______

LOG OF BORING No. 505-1

CLIFTY CREEK FLYASH IMPOUNDMENT

BORING LOCATION: AS DIRECTED

DATE STARTED: 9/21/84

SURFACE ELEVATION: 502.2' (WATER)

DATE COMPLETED: 9/21/84

STRATUM	DESCRIPTION OF MATERIAL SOIL CLASSIFICATION SYSTEM:	SAMPLE NO. & TYPE	SAMPLE DEPTH	BLOWS PER 6" ON SAMPLER	"N" BLOWS/FT.	SAMPLE RECOVERY IN.
0'	BARGE					
2.0'	WATER					
4.5'	FLYASH					
80.0'	BOTTOM OF BORING					
	NOTE: CONE PENETRATION TEST BORING					

DRILLING METHOD: HOLLOW STEM AUGER

DRILLER: B.C.-K.G.

JOB NO.: 28089

WATER OBSERVATIONS

INITIAL DEPTH: 2.0'

COMPLETION DEPTH: 2.0'

DEPTH AFTER .... HRS. ....

TYPE SAMPLER:

☐ A. SPLIT SPOON

☐ B.

☐ C. SHELBY TUBE

BOWSER-MORNER
TESTING LABORATORIES, INC.

2B12

Woodward-Clyde Consultants CHICAGO	SUBJECT Table 2 Cone Resistance vs Depth	PROJECT Bowser-Morner
	COMPUTED	CHECKED FWJ	FILE NO. 84C3092
		DATE 9-30-84 PAGE 1 OF 2 PAGES

Boring 50-5-1

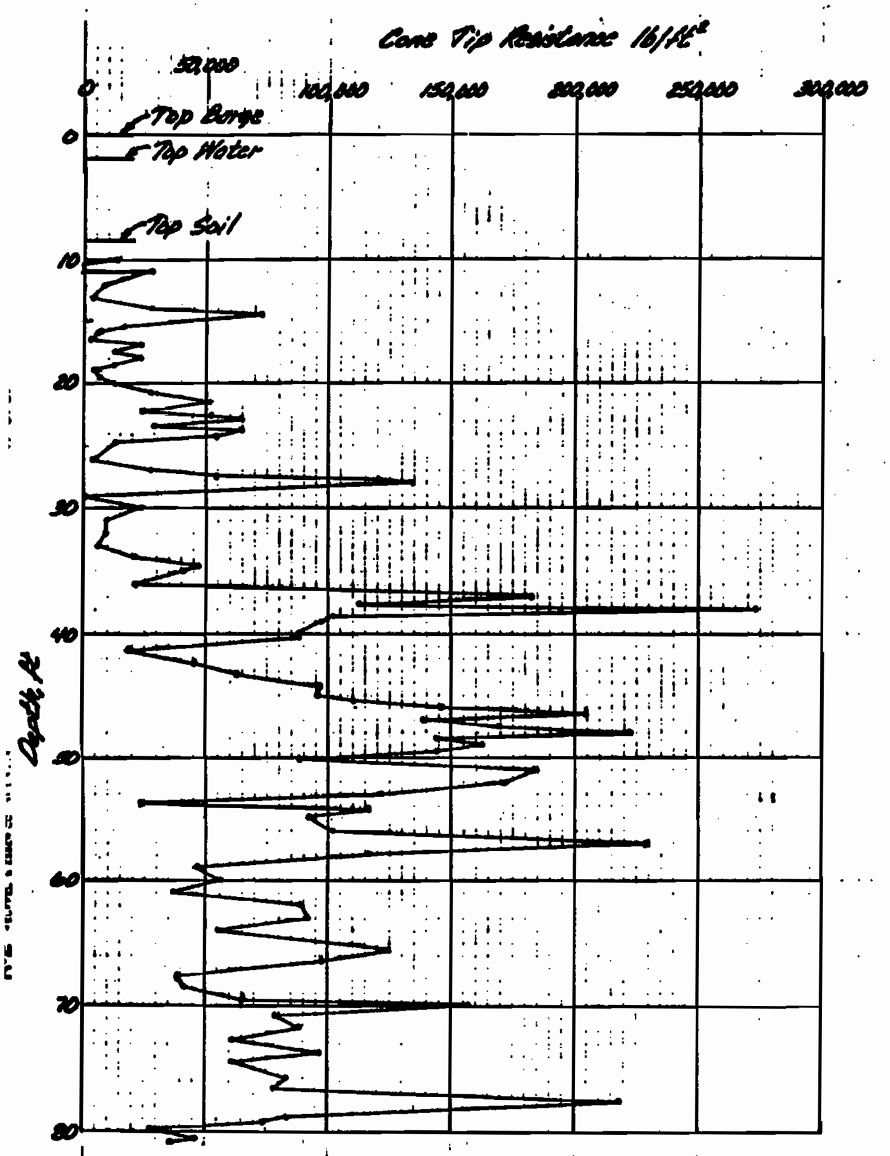
Depth, ft	Resistance lb/ft²	Depth, ft	Resistance lb/ft²	
10.0	16729	27.8	120822	
10.3	0	28.0	134763	
10.8	0	29.0	0	0
11.0	26023	30.0	23235	1309psf
12.0	9294	31.0	9294	
13.0	3717	32.0	9294	367psf
14.0	27417	33.0	5576	107psf
14.5	72493	34.0	20446	
15.3	17658	34.4	48328	
16.0	5576	34.8	21376	
16.5	3717	35.0	37964	
17.0	23235	34.0	20446	
17.5	10223	37.0	185330	
18.0	23235	37.3	111528	
18.5	14870	38.0	278820	
19.0	4647	38.5	102234	
19.5	5576	39.0	97587	
20.0	13941	40.0	88293	
20.2	13941	40.25	88293	
20.8	288114	41.25	18588	
21.4	52046	42.25	46470	
22.1	24164	43.25	65058	
22.2	53905	44.25	97587	
22.4	44611	45.0	46470	
22.8	64128	45.5	60411	
23.2	28814	46.0	144057	
23.8	64128	46.5	204468	
24.2	55764	47.0	139410	
24.8	13011	47.5	167292	
26.0 organic	3717	48.0	223056	
27.0	20446	48.5	144057	
27.5	53905	49.0	162645	

Table 2

Woodward-Clyde Consultants CHICAGO	SUBJECT Table 2 cont. Cone Resistance vs Depth	PROJECT Bowser-Morner
	COMPUTED JHH CHECKED FWJ	FILE NO. 8463092
		DATE 9-30-84 PAGE 2 OF 2 PAGES

depth, ft	Resistance lb/ft²	depth, ft	Resistance lb/ft²
49.5	144057	76.75	78999
50.0	88293	77.75	218409
51.2	185880	78.75	83646
52.2	171939	79.3	74352
53.2	120822	79.6	27882
53.7	23235	80.6	46470
54.2	116175	80.9	35529
55.0	92940		
56.0	102234		
57.0	227703		
58.0	116175		
59.0	46470		
60.0	55764		
60.25	37176		
01.25	37176		
62.25	88293		
63.25	92940		
64.25	55764		
65.5	125469		
66.5	97587		
67.5	37176		
68.5	41823		
69.5	65058		
69.9	157998		
70.9	78999		
71.9	88293		
72.9	60411		
73.9	97587		
74.3	60411		
74.75	23235		
75.75	83646		

Table 2



BORING SO-5-1
DRILLED 9-21-1984

CONE PENETRATION TEST
CLIFTY CREEK POWER PLANT
BOWSER-MORNER

Fig. 4

WCC 84C3092
1 Oct 1984

(PAGE 1 OF 2)

LOG OF BORING No. SO 5.5-1

CLIFTY CREEK FLYASH IMPOUNDMENT

BORING LOCATION: AS DIRECTED
DATE STARTED: 9/7/84
SURFACE ELEVATION: 502.2 (WATER)
DATE COMPLETED: 9/7/84

STRATUM	DESCRIPTION OF MATERIAL SOIL CLASSIFICATION SYSTEM:	SAMPLE NO. & TYPE	SAMPLE DEPTH	BLOWS PER 6" ON SAMPLER	"N" BLOWS/ FT.	SAMPLE RECOVERY IN.
0'	BARGE					
2.0'	WATER					
8.0'	FLYASH	1A	8.5-10.0	1-1-1	2	18"
		2A	13.5-15.0	0-0-0	0	18"
16.5'	HARD BROWN SILT, TRACE SAND, TRACE OF CLAY - DAMP	3A	18.5-20.0	14-23-31	54	18"
22.0'	VERY STIFF BROWN SILT, SOME SAND, TRACE OF CLAY - MOIST (1" TO 6" CLAY LAYERS)	4A	23.5-25.0	7-14-16	30	14"
	(BECOMES HARD AT 28.5')	5A	28.5-30.0	19-28-36	64	18"
32.0'	HARD BROWN SILT, SOME SAND, TRACE CLAY, TRACE OF ROCK FRAGMENTS - DAMP	6A	33.5-34.0	50/3"	50/3"	0"
		7A	38.5-39.0	100/4"	100/4"	4"

DRILLING METHOD: HOLLOW STEM AUGER
DRILLER: B.C.- B.C.M.- R.G.
JOB NO.: 28089

WATER OBSERVATIONS
INITIAL DEPTH: 2.0'
COMPLETION DEPTH: 2.0'
DEPTH AFTER .... HRS. ....

TYPE SAMPLER:
☒ A. SPLIT SPOON
☒ B. NXWL ROCK CORE
☐ C. SHELBY TUBE

BOWSER-MORNER
TESTING LABORATORIES, INC.

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(PAGE 2 OF 2)

LOG OF BORING No. SO 5.5-1

CLIFTY CREEK FLYASH IMPOUNDMENT

BORING LOCATION: AS DIRECTED

DATE STARTED: 9/7/84

SURFACE ELEVATION: 502.2' (WATER)

DATE COMPLETED: 9/7/84

STRATUM	DESCRIPTION OF MATERIAL SOIL CLASSIFICATION SYSTEM:	SAMPLE NO. & TYPE	SAMPLE DEPTH	BLOWS PER 6" ON SAMPLER	"N" BLOWS/ FT.	SAMPLE RECOVERY IN.
41.0'	WEATHERED LIMESTONE/SHALE	8A	43.5-44.5	47-53/4"	100/10"	8"
55.5'	(LOST WATER RETURN AT 50.5') BOTTOM OF BORING	1B	45.5-55.5	—	—	119"

DRILLING METHOD: HOLLOW STEM AUGER

DRILLER: B.C.-B.C.M.-R.G.

JOB NO.: 28089

WATER OBSERVATIONS

INITIAL DEPTH: 2.0'

COMPLETION DEPTH: 2.0'

DEPTH AFTER .... HRS. ....

TYPE SAMPLER:

☒ A. SPLIT SPOON

☒ B. NXWL ROCK CORE

☐ C. SHELBY TUBE

2B12

BOWSER-MORNER
TESTING LABORATORIES, INC.

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

JOB No. ______

COMPANY IKEC

PROJECT CLIFTY CREEK FAD

LOCATION OF BORING:

WATER LEVEL	
TIME	
DATE	

BORING No. 5055-1 DATE ______ SHEET 1 OF 3

TYPE OF BORING ______ RIG ______

CASING USED ______ SIZE ______ DRILLING MUD USED ______

BORING BEGUN ______ BORING COMPLETED ______

GROUND ELEVATION ______ REFERRED TO ______ DATUM

FIELD PARTY: ______

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								0	boring TAken by Bowser-morner
								1	8.0 water DepTH
								2	
								3	
								4	
								5	
								6	
								7	
								8	Fly ash
1	8.5	10.0	1	1	1	18"		9	
								10	
								1	
								2	
								3	Fly ash
2	13.5	15.0	0	0	0	18"		4	
								5	
								6	
								7	
								8	Sandy SilT - yellowish BR. - moist
3	18.5	20.0	14	23	31	18"		9	100% V-Fine GRAin ML
								20	

ENGINEER ______

F M CE-5
R 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF BORING

J No. ______

C NY ______

PROJECT ______

CATION OF BORING:

WATER LEVEL	
ME	
TE	

BORING NO. 505.5-1 DATE ______ SHEET 2 OF 3

TYPE OF BORING ______ RIG ______

CASING USED ______ SIZE ______ DRILLING MUD USED ______

BORING BEGUN ______ BORING COMPLETED ______

GROUND ELEVATION ______ REFERRED TO ______ DATUM

FIELD PARTY: ______

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								20	
								1	
								2	ClAyey SilT - yellowish BR. - moist - Slight PlasTicity.
	23.5	25.0	7	14	16	14"		3	CL
								4	
								5	
								6	
								7	
								8	SilTy ClAy - LT. BR. - moisT. STRong ReacTion To HCL - TRace of Lime STone FRAg.
5	28.5	30.0	19	28	36	18"		9	CL
								30	
								1	
								2	
								3	
6	33.5	33.8	50/.3			0		4	
								5	
								6	
								7	
								8	ClAyey Sand + GRAvel - Yellowish BR. moisT - PooRly GRAded - 1" max Size (Sand + GRAvel Limestone)
	38.5	38.9	100/.4			4"		9	GC
								40	

ENGINEER ______

FORM CE-5
REV. 5/81

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

JOB NO. ______

OMPANY ______

PROJECT ______

BORING NO. 505.5-1 DATE ______ SHEET 3 OF 3

TYPE OF BORING ______ RIG ______

CASING USED ______ SIZE ______ DRILLING MUD USED ______

BORING BEGUN ______ BORING COMPLETED ______

GROUND ELEVATION ______ REFERRED TO ______ DATU

FIELD PARTY: ______

LOCATION OF BORING:	
WATER LEVEL	
TIME	
DATE	

SAMPLE No.	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOWS / 6"			TOTAL LENGTH RECOVERY	ELEVATION	DEPTH IN FEET	DESCRIPTION SOIL TYPE, COLOR, TEXTURE, CONSISTENCY, SAMPLER DRIVING NOTES BLOWS PER FOOT ON CASING, DEPTHS WASH WATER LOST, OBSERVED FLUCTUATIONS IN WATER LEVEL, NOTES ON DRILLING EASE, ETC.
								40	
								1	
								2	
								3	
8	43.5	43.9	47	53/.4		8"		4	Gray calcareous Shale + lime stone Frag.
								5	
								6	Stopped boring 43.9
								7	
								8	
								9	
								0	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								0	

ENGINEER ______

(PAGE 1 OF 2)

LOG OF BORING No. SO 6-1

CLIFTY CREEK FLYASH IMPOUNDMENT

BORING LOCATION: AS DIRECTED
DATE STARTED: 9/8/84
SURFACE ELEVATION: 502.2' (WATER)
DATE COMPLETED: 9/8/84

STRATUM	DESCRIPTION OF MATERIAL SOIL CLASSIFICATION SYSTEM:	SAMPLE NO. & TYPE	SAMPLE DEPTH	BLOWS PER 6" ON SAMPLER	"N" BLOWS/ FT.	SAMPLE RECOVERY IN.
0'	BARGE					
2.0'	WATER					
6.0'	FLYASH	1A	8.5-10.0	0-1-0	1	14"
		2A	13.5-15.0	0-1-1	2	16"
		3A	18.5-20.0	0-1-0	1	16"
		4A	23.5-25.0	0-0-1	1	15"
		5A	28.5-30.0	2-3-2	5	18"
32.0'	STIFF BROWN SILT, SOME SAND TRACE OF CLAY - MOIST	6A	33.5-35.0	3-4-9	13	16"
39.0'	STIFF GRAY SILT, TRACE SAND TRACE OF CLAY - MOIST	7A	38.5-40.0	4-5-8	13	12"
		8A	43.5-45.0	5-7-11	18	18"

DRILLING METHOD: HOLLOW STEM AUGER
DRILLER: B.C.-K.G.-B.C.M.
JOB NO.: 28089

WATER OBSERVATIONS
INITIAL DEPTH: 2.0'
COMPLETION DEPTH: 2.0'
DEPTH AFTER .... HRS. ....

TYPE SAMPLER:
☒ A. SPLIT SPOON
☐ B.
☐ C. SHELBY TUBE

BOWSER-MORNER
TESTING LABORATORIES, INC.

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(PAGE 2 OF 2)

LOG OF BORING No. SO 6-1

CLIFTY CREEK FLYASH IMPOUNDMENT

BORING LOCATION: AS DIRECTED

DATE STARTED: 9/8/84

SURFACE ELEVATION: 502.2' (WATER)

DATE COMPLETED: 9/8/84

STRATUM	DESCRIPTION OF MATERIAL SOIL CLASSIFICATION SYSTEM:	SAMPLE NO. & TYPE	SAMPLE DEPTH	BLOWS PER 6" ON SAMPLER	"N" BLOWS/ FT.	SAMPLE RECOVERY IN.
	(BECOMES HARD AT 48.5')	9A	48.5-50.0	9-13-18	31	16"
		10A	53.5-55.0	8-14-19	33	18"
	(BECOMES VERY STIFF AT 58.5')	11A	58.5-60.0	6-9-13	22	18"
63.5'	VERY STIFF GRAY SILT, TRACE SAND, TRACE CLAY, TRACE ORGANICS - MOIST	12A	63.5-65.0	7-8-12	20	18"
69.5'	VERY STIFF GRAY CLAY WITH LIMESTONE LAYERS - DAMP	13A	68.5-70.0	19-11-8	19	18"
		14A	73.5-75.0	17-13-16	29	4" *
		15A	78.5-80.0	11-14-17	31	8"
81.5'	AUGER REFUSAL (APPARENT ROCK) BOTTOM OF BORING					

DRILLING METHOD: HOLLOW STEM AUGER

DRILLER: B.C.-K.G.-B.C.M.

JOB NO.: 28089

WATER OBSERVATIONS

INITIAL DEPTH: 2.0'

COMPLETION DEPTH: 2.0'

DEPTH AFTER .... HRS. ....

TYPE SAMPLER:

☒ A. SPLIT SPOON

☐ B.

☐ C. SHELBY TUBE

* ROCK IN DRIVE SHOE

2B12

BOWSER-MORNER
TESTING LABORATORIES, INC.

LOG OF BORING No. S06-2

CLIFTY CREEK FLYASH IMPOUNDMENT

BORING LOCATION: AS DIRECTED

DATE STARTED: 9/20/84

SURFACE ELEVATION: 502.2' (WATER)

DATE COMPLETED: 9/22/84

STRATUM	DESCRIPTION OF MATERIAL SOIL CLASSIFICATION SYSTEM:	SAMPLE NO. & TYPE	SAMPLE DEPTH	BLOWS PER 6" ON SAMPLER	"N" BLOWS/FT.	SAMPLE RECOVERY IN.
0'	BARGE		NOTE: CONE PENETRATION TEST BORING TO 28'			
2.0'	WATER					
7.0'	FLYASH					
28.0'	WEATHERED SHALE/LIMESTONE FRAGMENTS	1A	28-28.5	100/1"	100/1"	1"
		2A	34-34.5	100/3"	100/3"	3"
39.0'	GRAY SHALE	3A	39-39.5	100/4"	100/4"	4"
		4A	44-44.5	100/3"	100/3"	3"
50.0'	LIMESTONE/SHALE	5A	49-49.5	100/1"	100/1"	0"
60.0'	BOTTOM OF BORING	1B	50-60	—	—	110"

DRILLING METHOD: HOLLOW STEM AUGER

DRILLER: B.C.-K.G.

JOB NO.: 28089

WATER OBSERVATIONS

INITIAL DEPTH: 2.0'

COMPLETION DEPTH: 2.0'

DEPTH AFTER .... HRS. ....

TYPE SAMPLER:

☒ A. SPLIT SPOON

☒ B. NXW ROCK CORE

☐ C. SHELBY TUBE

2B12

BOWSER-MORNER
TESTING LABORATORIES, INC.

Woodward-Clyde Consultants
CHICAGO

SUBJECT Table 3 Cone Resistance vs Depth
COMPUTED JWH CHECKED FWJ

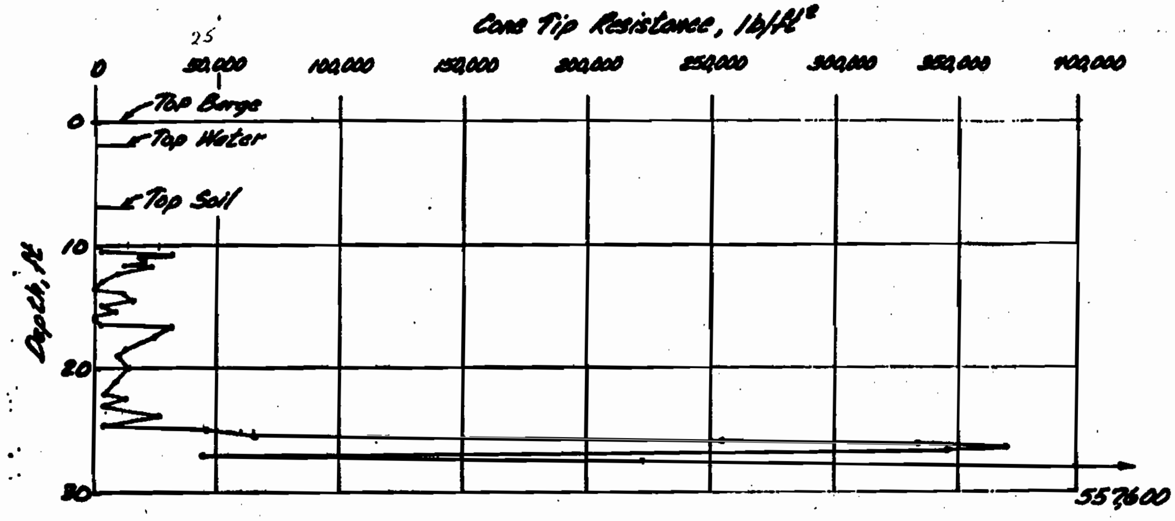
PROJECT Bowser-Morner
FILE No. 84C3092
DATE 9-30-84 PAGE 1 OF 1 PAGES

depth, ft	Resistance lb/ft²
10.5	3345
10.75	32343
11.0	17286
11.25	20075
11.5	13383
11.8	23420
12.3	9479
13.0	2230
13.5	557
13.8	557
14.0	11152
14.5	16729
15.0	3345
15.5	7806
15.75	0
16.0	0
16.5	2230
16.8	31600
17.5	24165
18.5	13010
19.0	10223
19.5	15800
20.1	14870
21.0	9295
22.0	4460
22.25	13940
23.0	4460
23.75	27325
24.5	4460
25	46840
25.5	66916
25.75	255580

depth, ft	Resistance lb/ft²
26.0	334580
26.25	371760
26.5	345750
27.0	44610
27.5	223050
28.0	557340

Boring 50-6-2

Table 3



BORING SD-6-2
DRILLED 9-20-1984

CONE PENETRATION TEST
CLIFTY CREEK POWER PLANT
BOWSER-MORNER

Fig. 5

WCC 84C3092 1 Oct 1984

(PAGE 1 OF 4)

LOG OF BORING No. SO 6.5-1

CLIFTY CREEK FLYASH IMPOUNDMENT

BORING LOCATION: AS DIRECTED

DATE STARTED: 9/9/84

SURFACE ELEVATION: 502.2' (WATER)

DATE COMPLETED: 9/9/84

STRATUM	DESCRIPTION OF MATERIAL SOIL CLASSIFICATION SYSTEM:	SAMPLE NO. & TYPE	SAMPLE DEPTH	BLOWS PER 6" ON SAMPLER	"N" BLOWS/ FT.	SAMPLE RECOVERY IN.
0'	BARGE					
2.0'	WATER					
4.5'	FLYASH	1A	4.5-6.0	0-0-0	0	18"
		2A	6.0-7.5	0-0-0	0	18"
		1C	7.5-9.5	—	—	0"
		3A	9.5-11.0	0-0-0	0	18"
		4A	11.0-12.5	0-0-0	0	18"
		5A	12.5-14.0	0-0-0	0	18"
		6A	14.0-15.5	0-1-1	2	16"
		7A	15.5-17.0	0-0-1	1	18"

DRILLING METHOD: HOLLOW STEM AUGER

DRILLER: B.C.-B.C.M.-K.G.

JOB NO.: 28089

WATER OBSERVATIONS

INITIAL DEPTH: 2.0'

COMPLETION DEPTH: 2.0'

DEPTH AFTER .... HRS. ....

TYPE SAMPLER:

☒ A. SPLIT SPOON

☒ B. NXWL ROCK CORE

☒ C. SHELBY TUBE

BOWSER-MORNER

2B12

LOG OF BORING No. SO 6.5-1

CLIFTY CREEK FLYASH IMPOUNDMENT

BORING LOCATION: AS DIRECTED
DATE STARTED: 9/9/84
SURFACE ELEVATION: 502.2' (WATER)
DATE COMPLETED: 9/9/84

STRATUM	DESCRIPTION OF MATERIAL SOIL CLASSIFICATION SYSTEM:	SAMPLE NO. & TYPE	SAMPLE DEPTH	BLOWS PER 6" ON SAMPLER	"N" BLOWS/ FT.	SAMPLE RECOVERY IN.
		8A	17.0-18.5	0-1-1	2	18"
		2C	18.5-20.5	—	-	21"
21.0'	HARD BROWN SILT, SOME SAND, TRACE OF CLAY - MOIST	9A	20.5-22.0	15-17-16	33	16"
		3C	22.0-24.0	—	-	13"
24.0'	VERY SOFT BROWN SILT, AND SAND - WET	10A	24.0-25.5	3-1-2	3	16"
	(BECOMES MEDIUM STIFF AT 25.5')	11A	25.5-27.0	3-4-4	8	18"
	(BECOMES SOFT AT 27.0')	12A	27.0-28.5	2-2-3	5	14"
	(BECOMES MEDIUM STIFF AT 28.5')	13A	28.5-30.0	1-2-5	7	18"
30.0'	VERY STIFF BROWN CLAY, SOME SILT, TRACE OF SAND - MOIST	14A	30.0-31.5	6-8-10	18	17"
	(BECOMES HARD AT 31.5')	15A	31.5-33.0	12-14-17	31	16"

DRILLING METHOD: HOLLOW STEM AUGER
DRILLER: B.C. - B.C.M. - K. G.
JOB NO.: 28089

WATER OBSERVATIONS
INITIAL DEPTH: 2.0'
COMPLETION DEPTH: 2.0'
DEPTH AFTER .... HRS. ....

TYPE SAMPLER:
☒ A. SPLIT SPOON
☒ B NXWL ROCK CORE
☒ C. SHELBY TUBE

BOWSER-MORNER

(PAGE 3 OF 4)

LOG OF BORING No. SO 6.5-1

CLIFTY CREEK FLYASH IMPOUNDMENT

BORING LOCATION: AS DIRECTED

DATE STARTED: 9/9/84

SURFACE ELEVATION: 502.2' (WATER)

DATE COMPLETED: 9/9/84

STRATUM	DESCRIPTION OF MATERIAL SOIL CLASSIFICATION SYSTEM:	SAMPLE NO. & TYPE	SAMPLE DEPTH	BLOWS PER 6" ON SAMPLER	"N" BLOWS/ FT.	SAMPLE RECOVERY IN.
34.0	VERY STIFF BROWN SILT, SOME SAND, TRACE OF CLAY - MOIST	16A	33.0-34.5	11-13-16	29	18"
		17A	34.5-36.0	6-12-16	28	14"
	(BECOMES HARD AT 44.0')	18A	36.0-37.5	21-21-23	44	16"
37.0	HARD GRAY CLAY, SOME SILT, TRACE OF SAND - MOIST	19A	37.5-39.0	11-14-18	31	18"
	(BECOMES VERY STIFF AT 39.0')	20A	39.0-40.5	5-8-13	21	18"
		21A	40.5-42.0	11-12-13	25	18"
		22A	42.0-43.5	6-7-13	20	18"
		23A	43.5-45.0	6-9-14	23	18"
		24A	45.0-46.5	6-9-11	20	18"

DRILLING METHOD: HOLLOW STEM AUGER

DRILLER: B.C. B.C.M. K.G.

JOB NO.: 28089

WATER OBSERVATIONS

INITIAL DEPTH: 2.0'

COMPLETION DEPTH: 2.0'

DEPTH AFTER .... HRS. ....

TYPE SAMPLER:

☒ A. SPLIT SPOON

☒ B. NXW ROCK CORE

☒ C. SHELBY TUBE

BOWSER-MORNER

2B12

(PAGE 4 OF 4)

LOG OF BORING No. SO 6.5-1

CLIFTY CREEK FLYASH IMPOUNDMENT

BORING LOCATION: AS DIRECTED

DATE STARTED: 9/9/84

SURFACE ELEVATION: 502.2' (WATER)

DATE COMPLETED: 9/9/84

STRATUM	DESCRIPTION OF MATERIAL SOIL CLASSIFICATION SYSTEM:	SAMPLE NO. & TYPE	SAMPLE DEPTH	BLOWS PER 6" ON SAMPLER	"N" BLOWS/ FT.	SAMPLE RECOVERY IN.
		25A	46.5-48.0	4-10-10	20	18"
48.0'	VERY STIFF GRAY CLAY, SOME SILT, ROCK FRAGMENTS - MOIST	26A	48.0-49.5	9-10-13	23	15"
	(BECOMES HARD AT 49.5')	27A	49.5-51.0	13-16-15	31	17"
		28A	51.0-52.0	14-70/3"	84/9"	9"
		29A	52.5-53.5	40-60/2"	100/8"	4"
55.0'	LIMESTONE/SHALE	1B	55.0-65.0	—	—	110"
65.0'	BOTTOM OF BORING					

DRILLING METHOD: HOLLOW STEM AUGERS

DRILLER: B.C.-B.C.M.-K.G.

JOB NO.: 28089

WATER OBSERVATIONS

INITIAL DEPTH: 2.0'

COMPLETION DEPTH: 2.0'

DEPTH AFTER .... HRS. ....

TYPE SAMPLER:

☒ A. SPLIT SPOON

☒ B. NXWL ROCK CORE

☒ C. SHELBY TUBE

BOWSER-MORNER

2B12

LOG OF BORING No. S07-1

CLIFTY CREEK FLYASH IMPOUNDMENT

BORING LOCATION: AS DIRECTED

DATE STARTED: 9/19/84

SURFACE ELEVATION: 502.2' (WATER)

DATE COMPLETED: 9/19/84

STRATUM	DESCRIPTION OF MATERIAL SOIL CLASSIFICATION SYSTEM:	SAMPLE NO. & TYPE	SAMPLE DEPTH	BLOWS PER 6" ON SAMPLER	"N" BLOWS/ FT.	SAMPLE RECOVERY IN.
0'	BARGE					
2.0'	TOP OF WATER					
5.0'	FLYASH					
56.0'	1" TO 3" LIMESTONE LAYERS 1" TO 1' WEATHERED SHALE					
59.0'	LIMESTONE/SHALE	1B	59'-69'	—	—	120"
69.0'	BOTTOM OF BORING					
	NOTE: CONE PENETRATION TEST BORING					

DRILLING METHOD: HOLLOW STEM AUGER

DRILLER: B.C.-K.G.

JOB NO.: 28089

WATER OBSERVATIONS

INITIAL DEPTH: 2.0'

COMPLETION DEPTH: 2.0'

DEPTH AFTER .... HRS. ....

TYPE SAMPLER:

☐ A. SPLIT SPOON

☒ B. NXWL ROCKCORE

☐ C. SHELBY TUBE

BOWSER-MORNER
TESTING LABORATORIES, INC.

2B12

Woodward-Clyde Consultants
CHICAGO

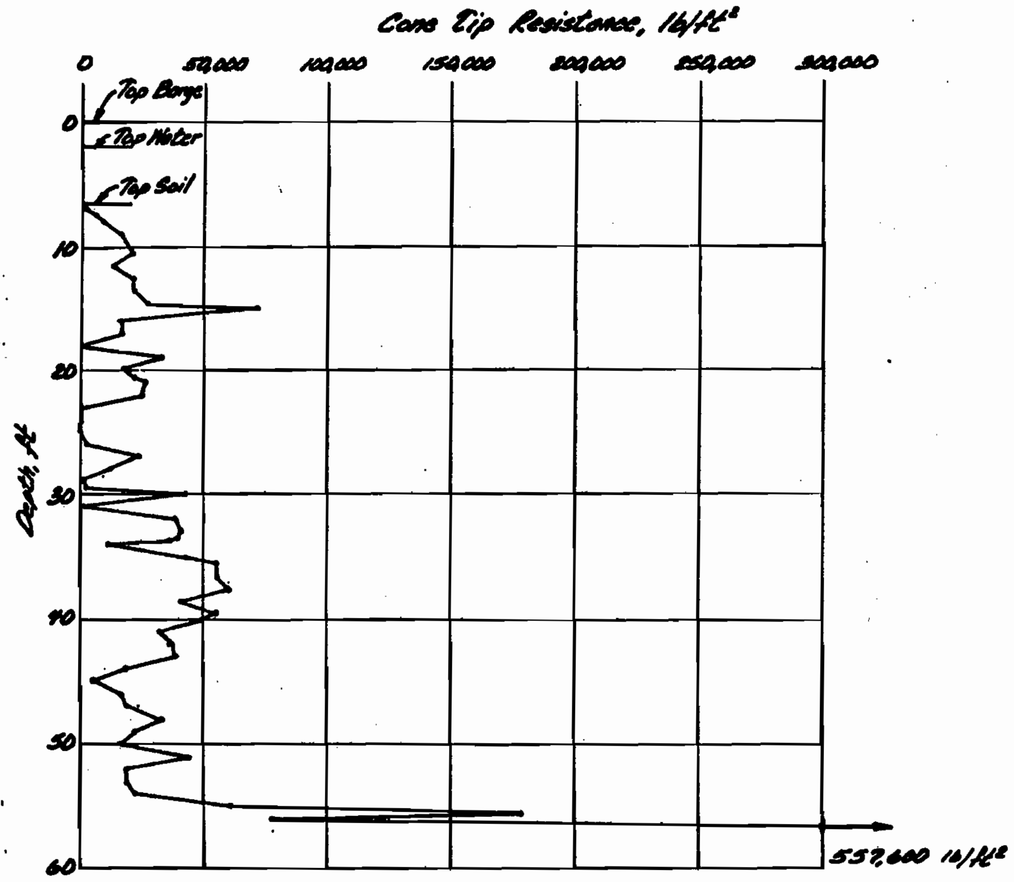
SUBJECT Table 4 Cone Resistance vs Depth
COMPUTED
CHECKED FWJ

PROJECT Bowser-Morner
FILE NO. 84C3092
DATE 9-30-84 PAGE 1 OF 1 PAGES

Boring S07-7

depth, ft	Resistance lb/ft^2	depth, ft	Resistance lb/ft^2
7.0	1115	35.0	43681
7.5	5576	35.5	55764
8.0	8364	36.5	55764
9.0	16729	37.5	61340
10.5	21747	38.5	41823
11.5	13941	39.5	55764
12.5	22305	40.0	50187
13.5	22305	41.0	33458
14.5	27882	42.0	36246
15.0	72493	43.0	39034
16.0	16729	44.0	19517
17.0	16729	45.0	5576
18.0	0	46.0	16724
19.0	3345.8	47.0	19517
20.0	16729	48.0	33458
20.5	21376	49.0	22305
21.0	26023	50.0	16729
22.0	25093	51.0	446111
23.0	557	52.0	19517
24.4	0	53.0	19517
24.9	0	54.0	22305
25.9	3345	55.0	61340
26.9	24164	55.3	66916
27.9	12082	55.5	178444
28.9	1115	56.0	78069
29.4	6691	56.3	557640
30.0	43681		
31.0	2230		
32.0	39034		
33.0	41823		
33.5	39034		
33.8	33458		
34.0	11152		

Table 4



BORING SD-7-1
DRILLED 9-19-1984

CONE PENETRATION TEST
CLIFTY CREEK POWER PLANT
BOWSER-MORNER

Fig. 6

NCC 84C3012 1 Oct. 1984

(PAGE 1 OF 2)

LOG OF BORING No. SO 7-2

CLIFTY CREEK FLYASH IMPOUNDMENT

BORING LOCATION: AS DIRECTED

DATE STARTED: 9/10/84

SURFACE ELEVATION: 502.2' (WATER)

DATE COMPLETED: 9/10/84

STRATUM	DESCRIPTION OF MATERIAL SOIL CLASSIFICATION SYSTEM:	SAMPLE NO. & TYPE	SAMPLE DEPTH	BLOWS PER 6" ON SAMPLER	"N" BLOWS/FT.	SAMPLE RECOVERY IN.
0'	BARGE					
2.0'	WATER					
5.0'	FLYASH	1A	5.0-6.5	0-1-1	2	12"
		2A	8.5-10.0	1-2-2	4	14"
		3A	13.5-15.0	0-0-0	0	10"
		4A	18.5-20.0	0-0-0	0	10"
		5A	23.0-25.0	1-1-2	3	16"
28.0'	MEDIUM STIFF GRAY CLAY, SOME SILT, TRACE OF ORGANICS-DAMP	6A	28.5-30.0	1-2-4	6	10"
34.0'	VERY STIFF BROWN & GRAY CLAY, SOME SILT - DAMP	7A	33.5-35.0	4-9-17	26	14"

DRILLING METHOD: HOLLOW-STEM AUGER

DRILLER: B.C.-B.C.M.-K.G.

JOB NO.: 28089

WATER OBSERVATIONS

INITIAL DEPTH: 2.0'

COMPLETION DEPTH: 2.0'

DEPTH AFTER .... HRS. ....

TYPE SAMPLER:

☒ A. SPLIT SPOON

☒ B. NXW ROCK CORE

☐ C. SHELBY TUBE

BOWSER-MORNER

2B12

(PAGE 2 OF 2)

LOG OF BORING No. S07-2

CLIFTY CREEK FLYASH IMPOUNDMENT

BORING LOCATION: AS DIRECTED

DATE STARTED: 9/10/84

SURFACE ELEVATION: 502.2' (WATER)

DATE COMPLETED: 9/10/84

STRATUM	DESCRIPTION OF MATERIAL SOIL CLASSIFICATION SYSTEM:	SAMPLE NO. & TYPE	SAMPLE DEPTH	BLOWS PER 6" ON SAMPLER	"N" BLOWS/ FT.	SAMPLE RECOVERY IN.
38.0'	VERY STIFF BROWN SILT, TRACE OF CLAY - MOIST	8A	38.5-40.0	5-8-13	21	16"
44.0	HARD BROWN SILT, SOME CLAY, TRACE OF ROCK FRAGMENTS DAMP	9A	43.5-45.0	15-21-30	51	12"
48.5'	HARD GREEN CLAY, SOME LIMESTONE FRAGMENTS - DAMP	10A	48.5-50.0	9-18-60/4"	78/10"	10"
		11A	53.5-54.0	100/5"	100/5"	5"
55.5'	LIMESTONE / SHALE	1B	55.5-65.5	—	-	120"
65.5'	BOTTOM OF BORING					

DRILLING METHOD: HOLLOW STEM AUGER

DRILLER: B.C.-B.C.M.-K.G.

JOB NO.: 28089

WATER OBSERVATIONS

INITIAL DEPTH: 2.0'

COMPLETION DEPTH: 2.0'

DEPTH AFTER .... HRS. ....

TYPE SAMPLER:

☒ A. SPLIT SPOON

☒ B. NXWL ROCK CORE

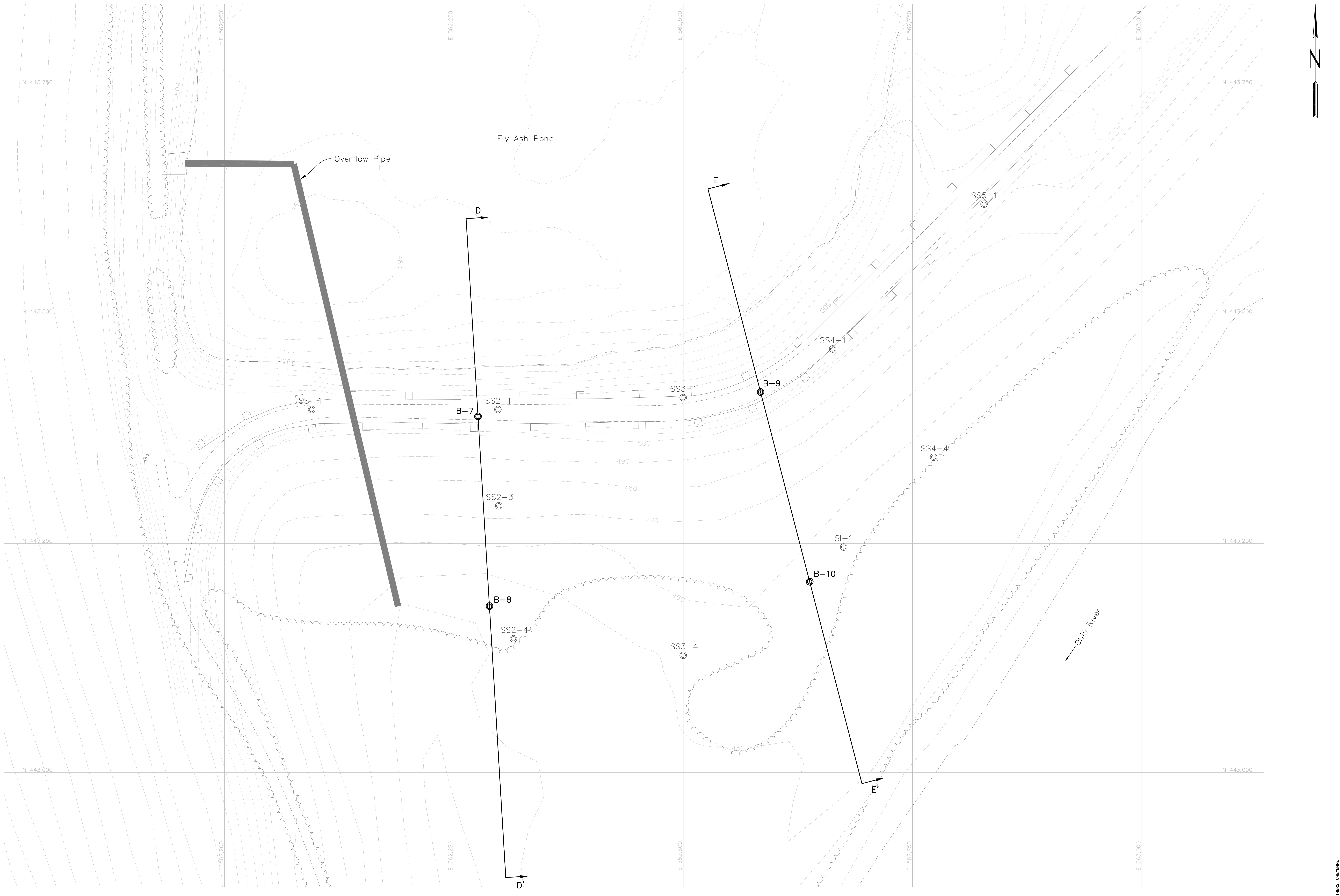
☐ C. SHELBY TUBE

BOWSER-MORNER

2B12

Stantec (2016)

DWG. NO.



BORING LAYOUT
SCALE: 1"=40'

20 0 40 80 FEET
GRAPHIC SCALE

LEGEND

- ◎ Soil Boring with Undisturbed (Shelby) Tube Samples and/or Standard Penetration Tests
- ◎ Historic Boring

NOTES

REFERENCE DRAWINGS

DATE	NO.	DESCRIPTION	APPD.

REVISIONS

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INDIANA – KENTUCKY ELECTRIC CO.
CLIFTY CREEK PLANT
MADISON INDIANA

GEOTECHNICAL EXPLORATION
LANDFILL RUNOFF
COLLECTION POND DAM
BORING LAYOUT

DWG. NO.

SCALE:
CIVIL ENGINEERING DIVISION
DR:
CH:
ARCH:
ENGR:
DATE:
APPROVED BY

AEP AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

PLOT DATE: 05/20/2010 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539022\GEOTECHNICAL\DRAWING\39022B-102-BL2.DWG

SCALE: AS SHOWN
DR: CW
CH: EMK
ENGR: CN
DATE: MAY, 2010

Stantec

Stantec Consulting
Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241
513-842-8200
www.stantec.com

LANDFILL RUNOFF COLLECTION POND:
2009 GEOTECHNICAL EXPLORATION

Stantec

SUBSURFACE LOG

Project Number 175539022
Project Name AEP Clifty Creek / Ash Ponds
County Jefferson, IN
Project Type Geotechnical Exploration
Supervisor C. Nisingizwe Driller M. Wethington
Logged By C. Nisingizwe

Location Crest: LRCP Dam
Boring No. **B-7** Total Depth 29.0 ft
Surface Elevation 503.4 ft
Date Started 11/12/09 Completed 11/12/09
Depth to Water Dry Date/Time 11/12/09
Depth to Water N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
503.4'	0.0'	Top of Hole							
502.9'	0.5'	Asphalt pavement and gravel base							
		Lean Clay, yellow and light gray, moist, stiff							
				ST-1	23.0 - 25.0	2.0		--	
				ST-2	25.0 - 27.0	2.0		20	
				ST-3	27.0 - 29.0	2.0		20	
474.4'	29.0'								
		No Refusal / Bottom of Hole							

SUBSURFACE LOG

Project Number 175539022

Project Name AEP Clifty Creek / Ash Ponds

County Jefferson, IN

Project Type Geotechnical Exploration

Supervisor C. Nisingizwe Driller Danny Jessie

Logged By C. Nisingizwe

Location Toe: LRCP Dam

Boring No. **B-8** Total Depth 31.0 ft

Surface Elevation 441.5 ft

Date Started 11/19/09 Completed 11/19/09

Depth to Water Dry Date/Time 11/19/09

Depth to Water N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
441.5'	0.0'	Top of Hole							
		Silty Clay, yellow and light gray, damp to moist							
425.5'	16.0'								
		Lean Clay, yellowish brown and light gray, moist							
				ST-1	25.0 - 27.0	2.0		25	
				ST-2	27.0 - 29.0	2.0		26	
412.5'	29.0'								
		Lean Clay With Sand, yellowish brown and light gray, moist		ST-3	29.0 - 31.0	2.0		23	
410.5'	31.0'								
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539022 CLIFTY CREEK.GPJ FMSM-GRAPHIC LOG.GDT 4/16/10

Stantec

SUBSURFACE LOG

Page: 1 of 1

Project Number	175539022	Location	Crest: LRCP Dam		
Project Name	AEP Clifty Creek / Ash Ponds	Boring No.	**B-9**	Total Depth	22.0 ft
County	Jefferson, IN	Surface Elevation	504.3 ft		
Project Type	Geotechnical Exploration	Date Started	11/12/09	Completed	11/12/09
Supervisor	C. Nisingizwe Driller M. Wethington	Depth to Water	Dry	Date/Time	11/12/09
Logged By	C. Nisingizwe	Depth to Water	N/A	Date/Time	N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
504.3'	0.0'	Top of Hole							
503.8'	0.5'	Asphalt pavement and gravel base							
		Lean Clay, yellowish brown and light gray, damp to moist							
				ST-1	16.0 - 18.0	2.0		22	
				ST-2	18.0 - 20.0	2.0		19	
482.3'	22.0'			ST-3	20.0 - 22.0	2.0		20	
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539022 CLIFTY CREEK.GPJ FMSM-GRAPHIC LOG.GDT 4/16/10

SUBSURFACE LOG

Project Number 175539022
Project Name AEP Clifty Creek / Ash Ponds
County Jefferson, IN
Project Type Geotechnical Exploration
Supervisor C. Nisingizwe Driller Danny Jessie
Logged By C. Nisingizwe

Location Toe: LRCP Dam
Boring No. **B-10** Total Depth 18.0 ft
Surface Elevation 457.3 ft
Date Started 11/19/09 Completed 11/19/07
Depth to Water Dry Date/Time 11/19/07
Depth to Water N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
457.3'	0.0'	Top of Hole							
		Silty Clay With Sand, yellow and light gray, damp to moist							
444.1'	13.2'			ST-1	12.0 - 14.0	1.5		17	
		Silty Sand, gray to brown, damp to moist		ST-2	14.0 - 16.0	2.0		10	
441.3'	16.0'								
		Silty Clay With Sand, yellow and light gray, damp to moist		ST-3	16.0 - 18.0	2.0		25	
439.3'	18.0'								

No Refusal /
Bottom of Hole

STANTEC/FMSM_LEGACY 175539022 CLIFTY CREEK.GPJ FMSM-GRAPHIC LOG.GDT 4/16/10

LANDFILL RUNOFF COLLECTION POND:
2015 GEOTECHNICAL EXPLORATION

SUBSURFACE LOG

Project Number	175553022	Location	Landfill Runoff Collection Pond Dam		
Project Name	CCR Rule - AEP Clifty Creek	Boring No.	**B-12**	Total Depth	101.5 ft
County	Jefferson, IN	Surface Elevation	503.9 (estimated)		
Project Type	Geotechnical Exploration	Date Started	7/6/15	Completed	7/7/15
Supervisor	C. Nisingizwe Driller E. Caudill	Depth to Water	60.0 ft	Date/Time	7/7/15
Logged By	C. Nisingizwe	Depth to Water	N/A	Date/Time	N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
503.9	0.0	Top of Hole							
(estimated)	0.4	Asphalt and base							
		Lean Clay With Sand, gray, damp, medium stiff to stiff		SPT-1	1.0 - 2.5	1.5	1-2-5	21	Pocket Penetrometer (PP) = 2.50 tsf
				SPT-2	5.0 - 6.5	1.5	3-3-4	20	PP = 2.50 tsf
				SPT-3	10.0 - 11.5	1.2	3-4-5	23	PP = 3.50 tsf
				SPT-4	15.0 - 16.5	1.0	3-3-5	19	PP = 2.50 tsf
				SPT-5	20.0 - 21.5	0.9	4-6-9	18	PP = 2.50 tsf
				SPT-6	25.0 - 26.5	1.1	3-5-7	18	PP = 4.25 tsf
				SPT-7	30.0 - 31.5	1.3	2-5-8	19	PP = 4.50 tsf
				SPT-8	35.0 - 36.5	0.9	WOH-3-4	18	PP = 4.00 tsf

STANTEC/FMSM_LEGACY GINT LOG.GPJ FMSM-GRAPHIC LOG.GDT 8/6/15

Project Number	175553022	Location	Landfill Runoff Collection Pond Dam
Project Name	CCR Rule - AEP Clifty Creek	Boring No.	**B-12**
		Total Depth	101.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	40.0	Lean Clay With Sand, gray, damp, medium stiff to stiff *(Continued)*							
	50.0	Silty Clay With Sand, brown, moist, medium stiff to very stiff		SPT-9	40.0 - 41.5	1.5	6-8-8	16	
				SPT-10	45.0 - 46.5	1.5	1-3-5	19	
	58.0	Silt With Sand, grayish light brown, moist, medium stiff to stiff		SPT-11	50.0 - 51.5	1.5	2-3-3	22	
				SPT-12	55.0 - 56.5	1.0	2-5-8	20	
	63.5	Silty Sand, grayish light brown, damp, very stiff		SPT-13	60.0 - 61.5	1.4	3-11-17	15	
	70.0	Silt With Sand, grayish light brown, wet, stiff		SPT-14	65.0 - 66.5	1.5	2-3-8	28	
	78.0	Sand, mottled gray and brown, moist to wet, medium stiff to stiff		SPT-15	70.0 - 71.5	1.5	3-5-5	22	
				SPT-16	75.0 - 76.5	1.3	2-3-5	28	

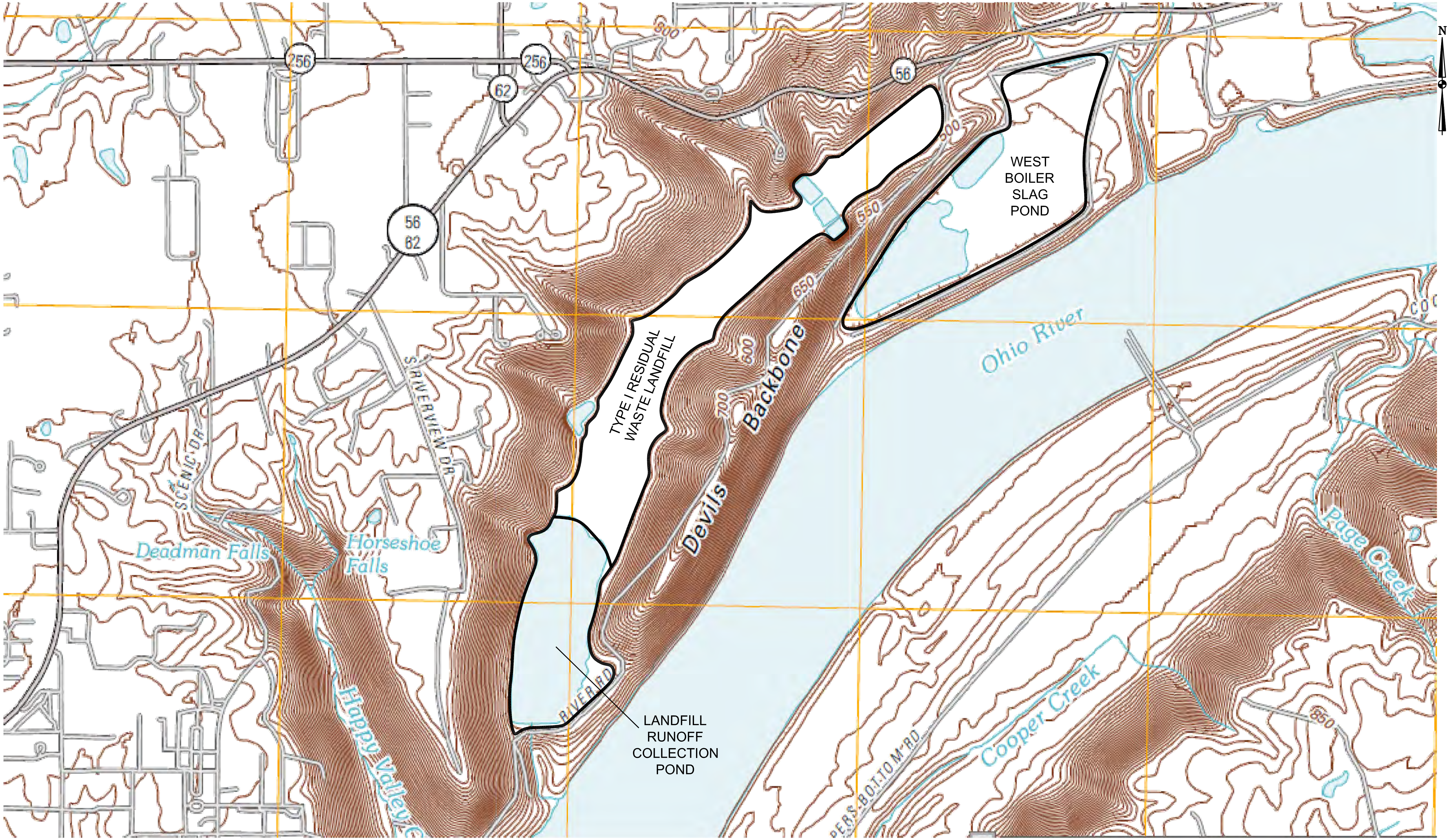
STANTEC/FMSM_LEGACY GINT LOG.GPJ FMSM-GRAPHIC LOG.GDT 8/6/15

Project Number	175553022	Location	Landfill Runoff Collection Pond Dam
Project Name	CCR Rule - AEP Clifty Creek	Boring No.	**B-12** Total Depth 101.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Silt, gray, moist to wet, medium stiff to stiff							
				SPT-17	80.0 - 81.5	1.5	6-9-6	26	
				SPT-18	85.0 - 86.5	1.5	2-3-5	28	
	90.0								PP = 2.25 tsf
		Lean Clay, gray, moist, medium stiff to very stiff		SPT-19	90.0 - 91.5	1.5	2-4-4	25	
									PP = 3.75 tsf
				SPT-20	95.0 - 96.5	1.5	5-8-11	23	
									PP = 3.50 tsf
	101.5			SPT-21	100.0 - 101.5	1.5	4-6-8	27	
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY GINT LOG.GPJ FMSM-GRAPHIC LOG.GDT 8/6/15

AGES (2018)



SOURCE: USGS MADISON WEST 7.5 MINUTE TOPOGRAHIC QUADRANGLE, 2010.

DRAWN BY JM
DATE
CHECKED BY
JOB NO. 2015067–CLIF
DWG FILE IKEC_Clifty MW Install_USGS TOPO b05.dwg
DRAWING SCALE NOT TO SCALE

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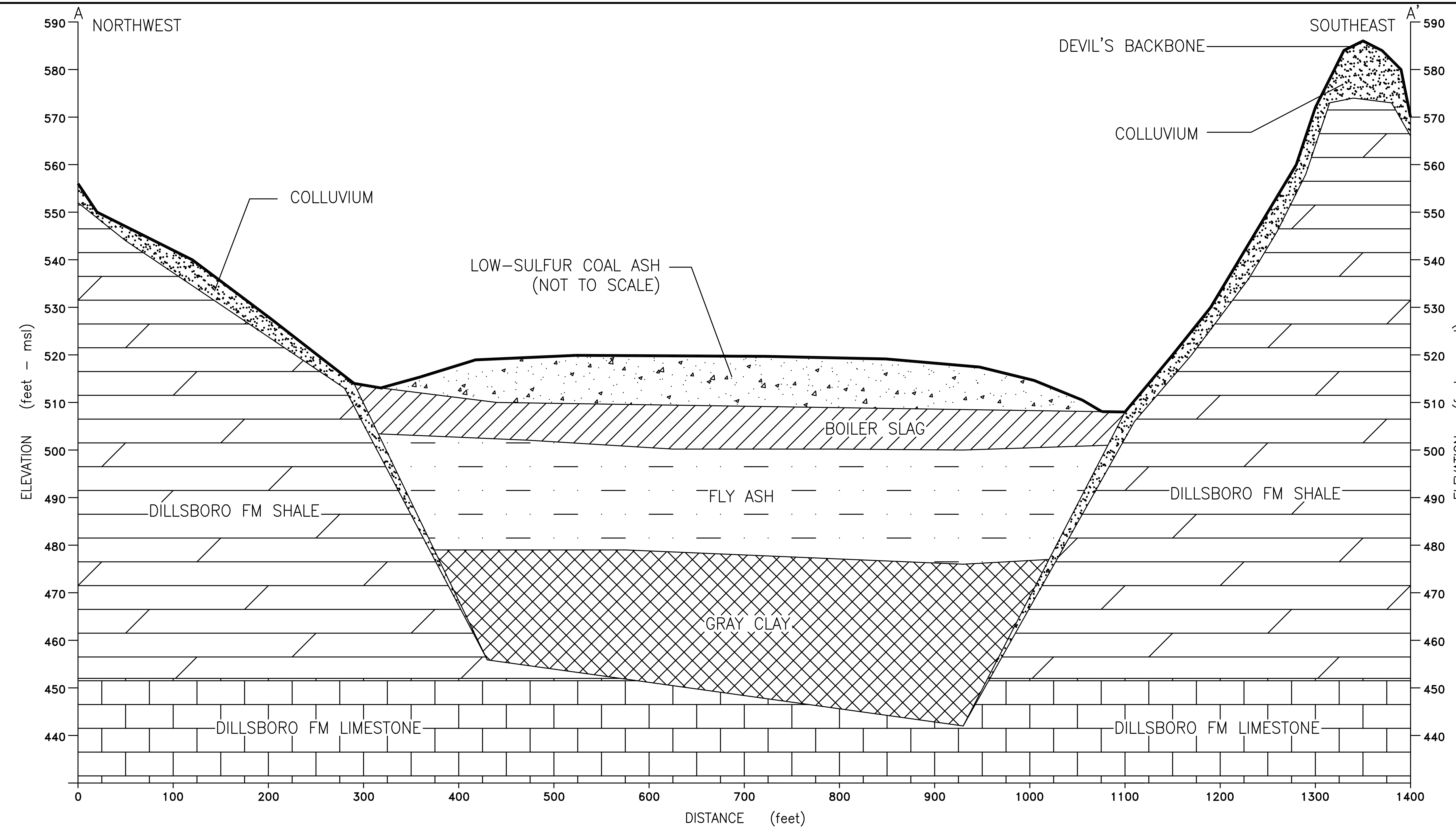
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
TOPOGRAPHIC MAP

DRAWING NAME FIGURE 2
REV. 0

Plot: 10/12/2017 13:10 _PROGRAMS–IKEC\Clifty Creek–CCR Program\CAD\Clifty CCR MW Install\IKEC_Clifty MW Install_USGS TOPO b05.dwg



NOTE:
CROSS–SECTION LOCATION SHOWN ON FIGURE 4.

SOURCE: HYDROGEOLOGIC STUDY REPORT, AGES, APRIL 2007.

100' 0' 100' 200'

HORIZONTAL SCALE: 1"=100'

VERTICAL SCALE 1" = 20'

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DATE	
CHECKED BY	
JOB NO.	2015067–CLIF
DWG FILE	IKEC_Clifty MW Install_Gen XSection b06.dwg
DRAWING SCALE	AS SHOWN

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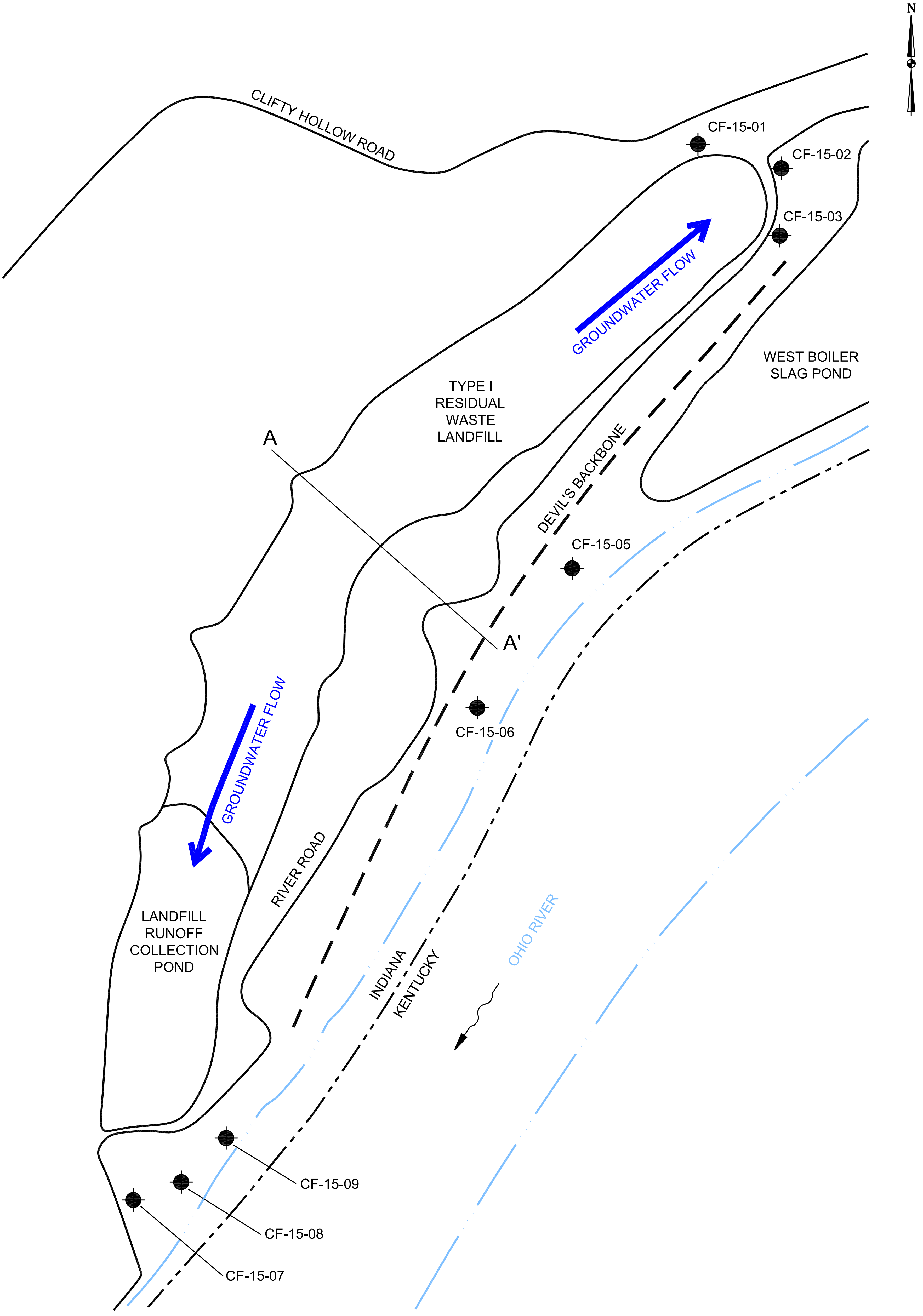
CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION POND
GENERALIZED GEOLOGIC CROSS–SECTION

DRAWING NAME: FIGURE 3

REV.: 0

Plot: 10/12/2017 13:13 _PROGRAMS–IKEC\Clifty Creek–CCR Program\CAD\Clifty CCR MW Install\IKEC_Clifty MW Install_Gen XSection b06.dwg



LEGEND:

● MONITORING WELL LOCATION

NOTE:
SEE FIGURE 4 FOR LOCATION OF BACKGROUND WELL CF–15–04.

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067–CLIF
DWG FILE	IKEC_Clifty MWs_LANDFILL b01.dwg
DRAWING SCALE	NOT TO SCALE

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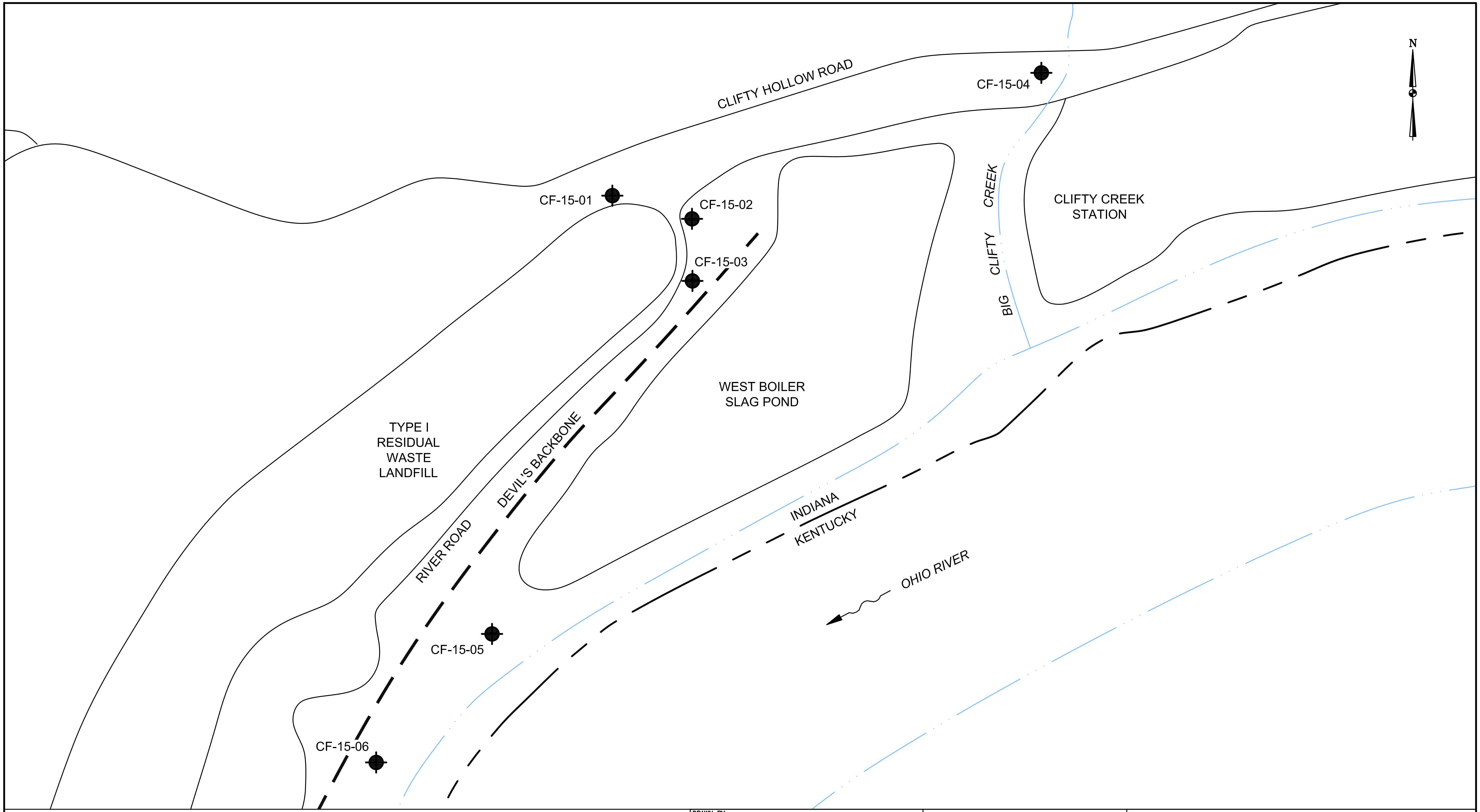
CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION POND
MONITORING WELL LOCATIONS AND
GENERALIZED GROUNDWATER FLOW

DRAWING NAME
FIGURE 4

REV.
0

Plot: 10/12/2017 13:16 _PROGRAMS–IKEC\Clifty Creek–CCR Program\CAD\Clifty CCR MW Install\IKEC_Clifty MWs_LANDFILL b01.dwg



LEGEND:

● MONITORING WELL LOCATION

600' 0' 600' 1200'

SCALE: 1"= 600'

DRAWN BY JM

DATE

CHECKED BY

JOB NO. 2015067–CLI

DWG FILE IKEC_Clifty MW Install_MWs_b02–b03–b04.dwg

DRAWING SCALE AS SHOWN

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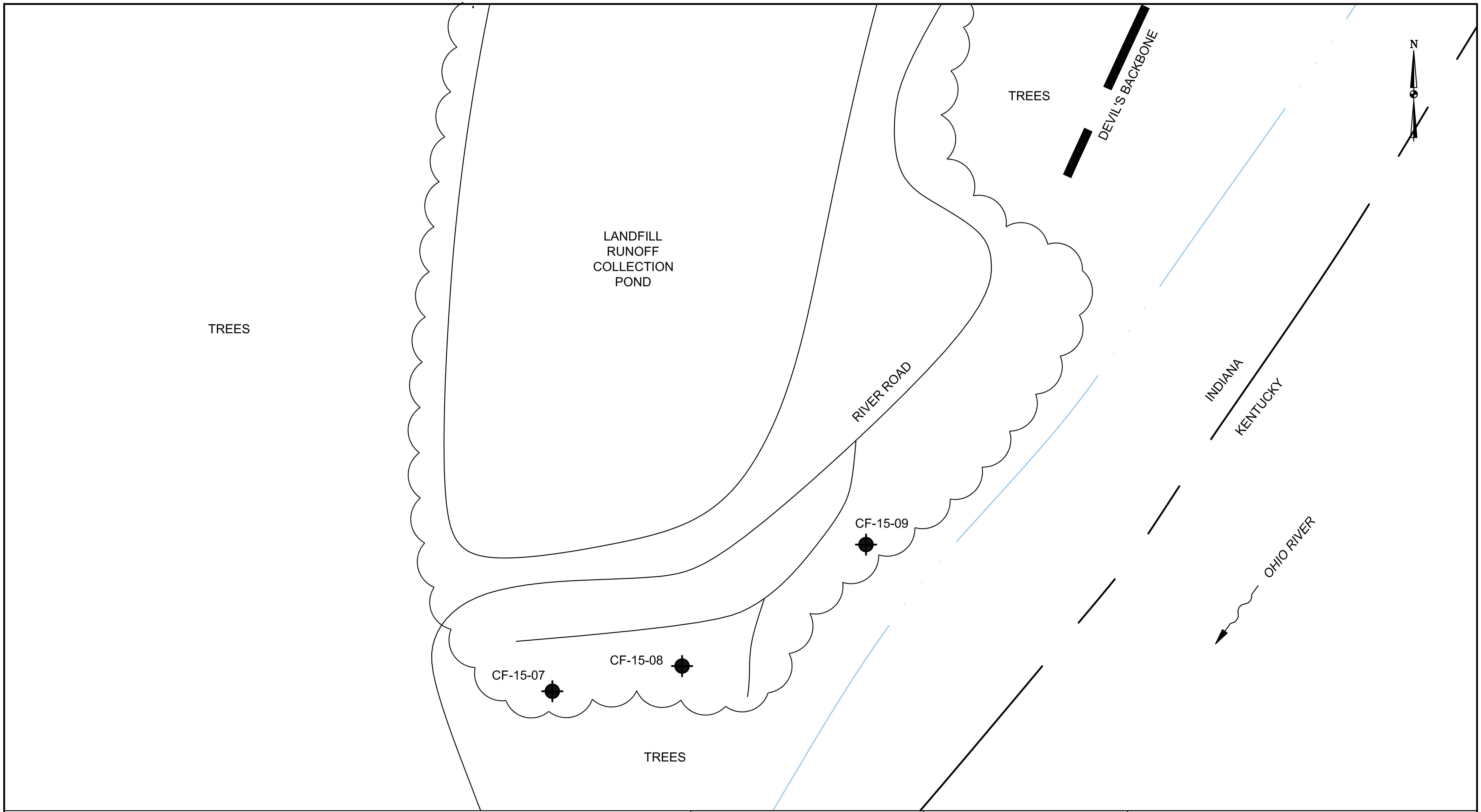
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION POND – NORTHEAST END
MONITORING WELL LOCATIONS
NORTHEAST END & BACKGROUND

DRAWING NAME FIGURE 7

REV. 0

Plot: 10/12/2017 13:22 _PROGRAMS–IKEC\Clifty Creek–CCR Program\CAD\Clifty CCR MW Install\IKEC_Clifty_MWs_b02–b03–b04.dwg\b02



LEGEND:

● MONITORING WELL LOCATION

SCALE: 1"= 200'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067–CLI
DWG FILE	IKEC_Clifty MW Install_MWs_b02-b03-b04.dwg
DRAWING SCALE	AS SHOWN

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INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION POND – SOUTHWEST END
MONITORING WELL LOCATIONS
LANDFILL – SOUTHWEST END

DRAWING NAME FIGURE 8

REV. 0

Plot: 10/12/2017 13:28 _PROGRAMS–IKEC\Clifty Creek–CCR Program\CAD\Clifty CCR MW Install\IKEC_Clifty MW Install_MWs_b02–b03–b04.dwg\b03

APPENDIX B

BORING & WELL LOGS

BORING NO. _____CF-15-01 _
SAMPLE/CORE LOG

Project Number: 2015067
Log Page 1 of 1
Project Location: Clifty Creek Plant Landfill Northeast End
Drilling Contractor: Bowser Morner
Drilling Date(s): 12/1/15
AGES Geologist: Mike Gelles

Drilling Method: Roto-Sonic
Coring Device Size: NA
Hammer Wt. NA and Drop NA
Sampling Method: NA
Borehole Diameter: 6”
Drilling Fluid Used: Water
Sampling Interval: NA
Borehole Depth: 29’
Surface Elevation: 503.51’ MSL

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10	8	NA	Yellow brown silty clay, stiff, plastic, moist	N/A
10-20	8	NA	10’-15’ Gray brown silty clay, stiff, plastic, moist, wet; 15’-20’ light gray limestone, dry	N/A
20-29	6	NA	20’-27’ Orange brown silty clay, limestone fragments, stiff, moist; 27’-29’ light gray limestone, hard, dry	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. CF-15-01

Project Number: 2015067

Project Location: Clifty Creek Plant – Landfill Northeast End

Installation Date(s): 12/1/2015

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/14/15

Development Method: Submersible Pump, Peristaltic Pump, Bailer
Field parameters stabilized.
Turbidity = 3.12 NTUs

Volume Purged: 33

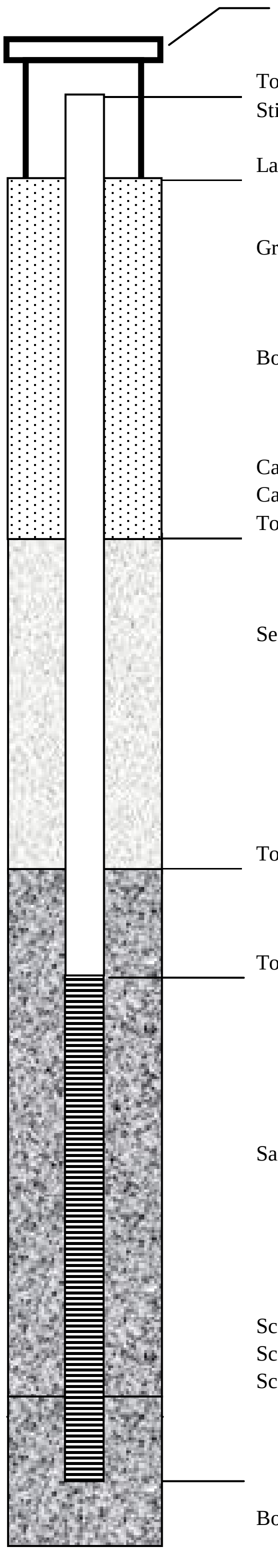
Static Water-Level* 15.35’

Top of Well Casing Elevation: 506.10’

Well Purpose:
Groundwater Monitoring
Northing (Y): 450793.03
Easting (X): 566812.11

Comments/Notes:
2 inch PVC riser and screen
10 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: Michael Gelles



Protective Casing with Locking Cap

Top of Casing Elevation: 506.10 ft.
Stick-up: 2.59 ft.

Land Surface Elevation: 503.51 ft.

Grout; Type: Portland cement/Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 2 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 10 ft*

Top of Well Screen 12 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 22 ft.*

Base of Borehole: 29 ft.*

Total Depth of Well
Below Top of Casing: 24.59 ft.

*Indicates Depth Below Land Surface

CONSTRUCTION MATERIALS USED:

6 Bags of Sand

5 Bags/Buckets Bentonite Pellets

______ Bags Portland for Grout

______ Bags Concrete/Sakrete

BORING NO. _____CF-15-02 _
SAMPLE/CORE LOG

Project Number: 2015067

Log Page 1 of 1

Project Location: Clifty Creek Plant
Landfill Northeast End

Drilling Contractor: Bowser Morner

Drilling Date(s): 12/2/15-12/3/15

AGES Geologist: Mike Gelles

Drilling Method: Roto-Sonic

Coring Device Size: NA

Hammer Wt. NA and Drop NA

Sampling Method: NA

Borehole Diameter: 6”

Drilling Fluid Used: Water

Sampling Interval: NA

Borehole Depth: 39’

Surface Elevation: 503.68’ MSL

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10	4	NA	Brown silty clay, limestone fragments, stiff, plastic, moist	N/A
10-20	6	NA	10’-17’ Brown silty clay, limestone fragments, stiff, plastic, moist; 17’-20’ brown silty clay, limestone fragments, stiff, plastic, wet	N/A
20-30	4	NA	Gray brown silty clay, gravel, stiff, plastic, moist	N/A
30-39	8	NA	30’-38’ Brown sandy clay, silt, wet; 38’-39’ gray limestone	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. CF-15-02

Project Number: 2015067

Project Location: Clifty Creek Plant – Landfill Northeast End

Installation Date(s): 12/1/15

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/7/15

Development Method: Submersible Pump, Peristaltic Pump, Bailer
Field parameters stabilized.
Turbidity = 3.69 NTUs

Volume Purged: 114.5 gallons

Static Water-Level*: 15.89’

Top of Well Casing Elevation: 506.10’

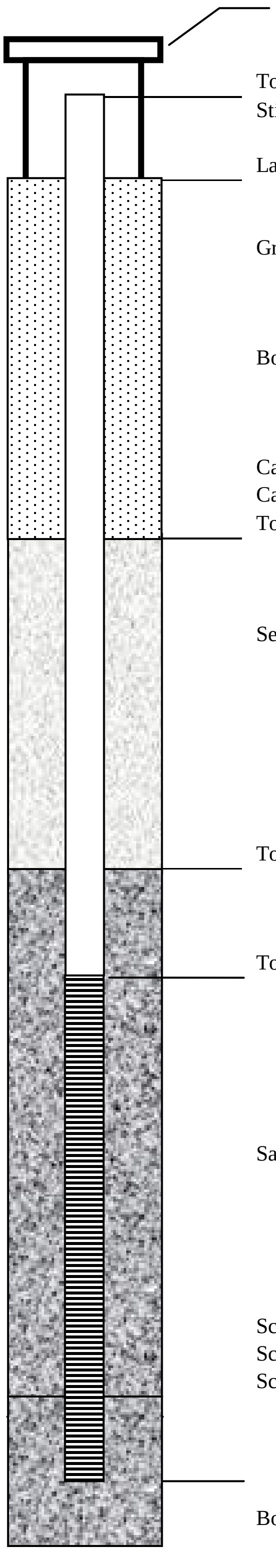
Well Purpose:
Groundawter Monitoring
Northing (Y): 450449.42
Easting (X): 566908.15

Comments/Notes:
2 inch PVC riser and screen
10 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: Michael Gelles

CONSTRUCTION MATERIALS USED:

6 Bags of Sand
2 Bags/Buckets Bentonite Pellets
6 Bags Portland for Grout
______ Bags Concrete/Sakrete



Top of Casing Elevation: 506.10 ft.
Stick-up: 2.42 ft.

Land Surface Elevation: 503.68 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 23 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 27 ft*

Top of Well Screen 29 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 39 ft.*

Base of Borehole: 39 ft.*

Total Depth of Well
Below Top of Casing: 41.42 ft.

*Indicates Depth Below Land Surface

BORING NO. _____CF-15-03 _

SAMPLE/CORE LOG

Project Number: 2015067

Log Page 1 of 1

Project Location: Clifty Creek Plant Landfill Northeast End

Drilling Contractor: Bowser Morner

Drilling Date(s): 12/2/15-12/3/15

AGES Geologist: Mike Gelles

Drilling Method: Roto-Sonic

Coring Device Size: NA

Hammer Wt. NA and Drop NA

Sampling Method: NA

Borehole Diameter: 6”

Drilling Fluid Used: Water

Sampling Interval: NA

Borehole Depth: 40’

Surface Elevation: 506.46’ MSL

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10	5	NA	0’-1.5’ Gravel; 1.5’-5’ boiler slag, fill	N/A
10-20	6	NA	10’-12’ Boiler slag; 12’-16’ yellow brown silty clay, limestone fragments, stiff, plastic, moist	N/A
20-30	6	NA	20’ -27’ yellow brown silty clay, limestone fragments, stiff, plastic, moist; 27’-30’ yellow brown silty clay, limestone fragments, stiff, plastic, wet	N/A
30-40	10	NA	30’-37’ Yellow brown silty clay, limestone fragments, stiff, plastic, wet; 37’-40’ Dark gray silty clay, trace gravel, stiff, plastic, moist, till	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. CF-15-03

Project Number: 2015067

Project Location: Clifty Creek Plant – Landfill Northeast End

Installation Date(s): 12/2/15-12/3/15

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/15/15

Development Method: Submersible Pump
Field parameters stabilized.
Turbidity = 3.99 NTUs

Volume Purged: 32.25 gallons

Static Water-Level* 19.25’

Top of Well Casing Elevation: 508.98’

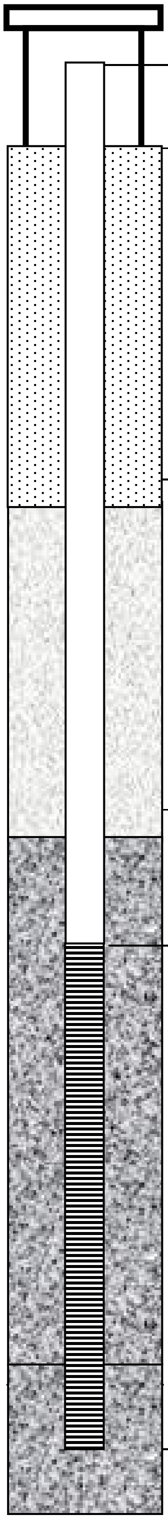
Well Purpose:
Groundwater Monitoring
Northing (Y): 450262.60
Easting (X): 566915.99

Comments/Notes:
2 inch PVC riser and screen
10 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: Michael Gelles

CONSTRUCTION MATERIALS USED:

6.5	Bags of Sand
2	Bags/Buckets Bentonite Pellets
3	Bags Portland for Grout
	Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 508.98 ft.
Stick-up: 2.52 ft.

Land Surface Elevation: 506.46 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 21 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 25 ft*

Top of Well Screen 27 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 37 ft.*

Base of Borehole: 40 ft.*

Total Depth of Well
Below Top of Casing: 39.52 ft.

*Indicates Depth Below Land Surface

BORING NO. _____CF-15-04_

SAMPLE/CORE LOG

Project Number: 2015067

Log Page 1 of 1

Project Location: Clifty Creek Plant Landfill Northeast End

Drilling Contractor: Bowser Morner

Drilling Date(s): 12/3/15

AGES Geologist: Mike Gelles

Drilling Method: Roto-Sonic

Coring Device Size: NA

Hammer Wt. NA and Drop NA

Sampling Method: NA

Borehole Diameter: 6”

Drilling Fluid Used: Water

Sampling Interval: NA

Borehole Depth: 40’

Surface Elevation: 465.55’ MSL

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10	7	NA	0-4’ Boiler slag, clay, fine sand, moist, fill; 4’-7’ gray silty clay, trace gravel, stiff, plastic, moist	N/A
10-20	9	NA	Orange brown silty clay, fine sand, gray mottling, stiff, plastic, moist	N/A
20-30	10	NA	20’-24’ Orange brown silty clay, fine sand, gray mottling, stiff, plastic, moist; 24’-29’ gray brown silty clay, fine sand, stiff, plastic, wet; 29’-30’ gray brown silty clay, fine sand, stiff, plastic, moist	N/A
30-40	10	NA	30’-36’ Orange brown silty clay, fine and medium sand, gravel, stiff, plastic, wet; 36’-40’ brown gray silty clay, trace gravel, stiff, plastic, moist, till	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. CF-15-04

Project Number: 2015067

Project Location: Clifty Creek Plant – Landfill Northeast End

Installation Date(s): 12/3/15

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/9/15

Development Method: Submersible Pump
Field parameters stabilized.
Turbidity = 0.91 NTUs

Volume Purged: 65 gallons

Static Water-Level* 28.53’

Top of Well Casing Elevation: 468.03’

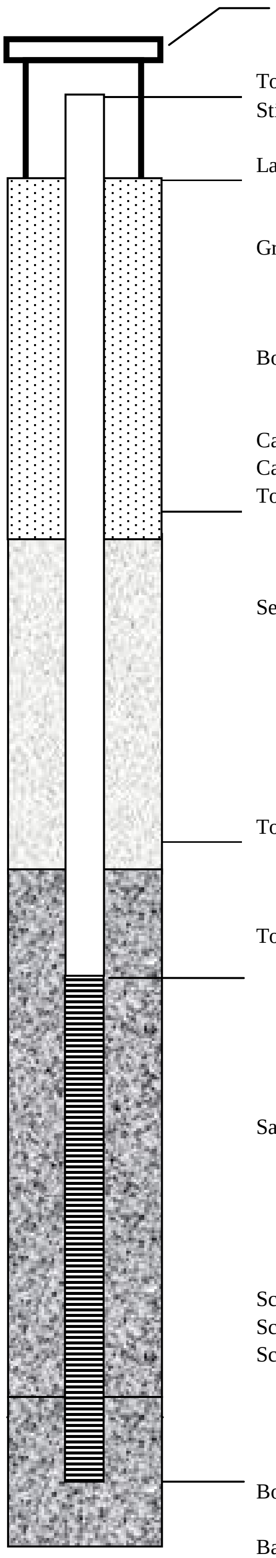
Well Purpose:
Groundawter Monitoring
Northing (Y): 451482.81
Easting (X): 569307.19

Comments/Notes:
2 inch PVC riser and screen
10 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: Michael Gelles

CONSTRUCTION MATERIALS USED:

6 Bags of Sand
2 Bags/Buckets Bentonite Pellets
6 Bags Portland for Grout
______ Bags Concrete/Sakrete



Top of Casing Elevation: 468.03 ft.
Stick-up: 2.48 ft.

Land Surface Elevation: 465.55 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 20 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 24 ft*

Top of Well Screen 26 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 36 ft.*

Base of Borehole: 40 ft.*

Total Depth of Well
Below Top of Casing: 38.48 ft.

*Indicates Depth Below Land Surface

BORING NO. _____CF-15-05 _
SAMPLE/CORE LOG

Project Number: 2015067

Log Page 1 of 1

Project Location: Clifty Creek Plant Landfill South End

Drilling Contractor: Bowser Morner

Drilling Date(s): 11/29/15-11/30/15

AGES Geologist: Joe Webster

Drilling Method: HSA

Coring Device Size: NA

Hammer Wt. 160lb and Drop 2ft

Sampling Method: NA

Borehole Diameter: 4.25”

Drilling Fluid Used: Water

Sampling Interval: NA

Borehole Depth: 27’

Surface Elevation: 439.85’ MSL

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10		NA	Advance augers – no samples	N/A
10-12	2	2-2-2-2	Brown clay, little silt, very moist to wet	N/A
12-14	2	1-2-2-3	Brown clay, little silt, wet.	N/A
14-16	2	2-2-2-2	Brown clay, little silt, very moist to wet	N/A
16-18	2	2-3-2-2	Brown to olive gray clay, little silt, trace sand, very moist to wet	N/A
18-20	1.33	1-1-2-1	Olive gray clay, some silt, wet	N/A
20-22	2	2-2-3-2	Olive gray clay, some silt, wet	N/A
22-24	2	WH-WH-2-2	Gray clay, some silt, trace fine sand, moist to wet	N/A
24-26	2	1-1-2-2	Gray clay, some silt, trace fine sand, moist	N/A
26-27	0.1	10-50/1	Brown to gray weathered shale with limestone	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. CF-15-05

Project Number: 2015067

Project Location: Clifty Creek Plant – Landfill South End

Installation Date(s): 11/29/15-12/1/15

Drilling Method: Hollow Stem Auger
Drilling Contractor: Bowser Morner

Development Date(s): 12/16/15

Development Method: Peristaltic Pump, Bailer
Field parameters stabilized.
Turbidity = 4.28 NTUs

Volume Purged: 46 gallons

Static Water-Level* 11.23’

Top of Well Casing Elevation: 442.58’

Well Purpose:
Groundawter Monitoring
Northing (Y): 447491.91
Easting (X): 565533.64

Comments/Notes:
2 inch PVC riser and screen
10 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: Joe Webster

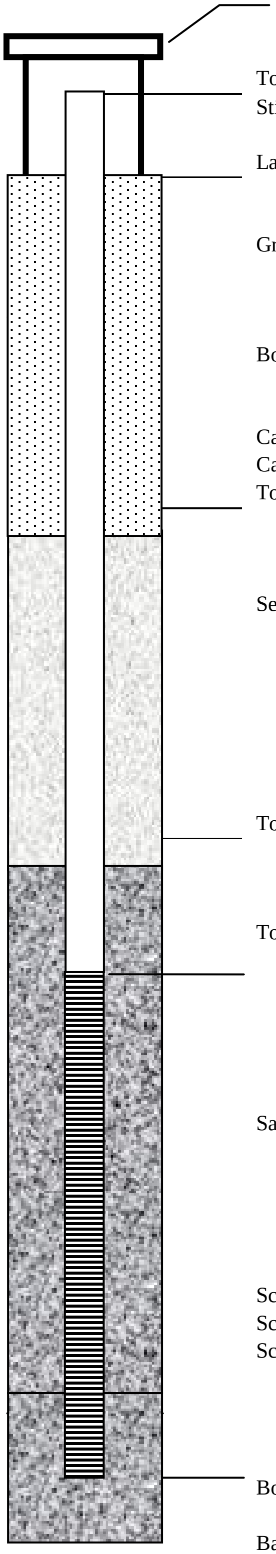
CONSTRUCTION MATERIALS USED:

______ Bags of Sand

______ Bags/Buckets Bentonite Pellets

______ Bags Portland for Grout

______ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 442.58 ft.
Stick-up: 2.73 ft.

Land Surface Elevation: 439.85 ft.

Grout; Type: Portland cement/Grout

Borehole Diameter: 4.25 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 5 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 15 ft*

Top of Well Screen 17 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 27 ft.*

Base of Borehole: 27 ft.*

Total Depth of Well
Below Top of Casing: 29.73 ft.

*Indicates Depth Below Land Surface

BORING NO. _____CF-15-06 _
SAMPLE/CORE LOG

Project Number: 2015067

Log Page 1 of 1

Project Location: Clifty Creek Plant Landfill South End

Drilling Contractor: Bowser Morner

Drilling Date(s): 11/29/15-11/30/15

AGES Geologist: Joe Webster

Drilling Method: HSA

Coring Device Size: NA

Hammer Wt. 160lb and Drop 2ft

Sampling Method: NA

Borehole Diameter: 4.25”

Drilling Fluid Used: Water

Sampling Interval: NA

Borehole Depth: 16’

Surface Elevation: 437.49’ MSL

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10		NA	Advance augers – no samples	N/A
10-12	1.5	3-3-3-5	Brown clay, some silt, soft, moist	N/A
12-14	1.7	3-3-4-3	Brown clay, little silt, soft, moist	N/A
14-16	0.8	4-7-46-50/4	Gray to brown, weathered shale with limestone, hard, dry	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. CF-15-06

Project Number: 2015067

Project Location: Clifty Creek Plant – Landfill South End

Installation Date(s): 11/29/15-11/30/15

Drilling Method: Hollow Stem Auger
Drilling Contractor: Bowser Morner

Development Date(s): 12/16/15

Development Method: Peristaltic Pump, Bailer
Field parameters stabilized.
Turbidity = 5.59 NTUs

Volume Purged: 6.95 gallons

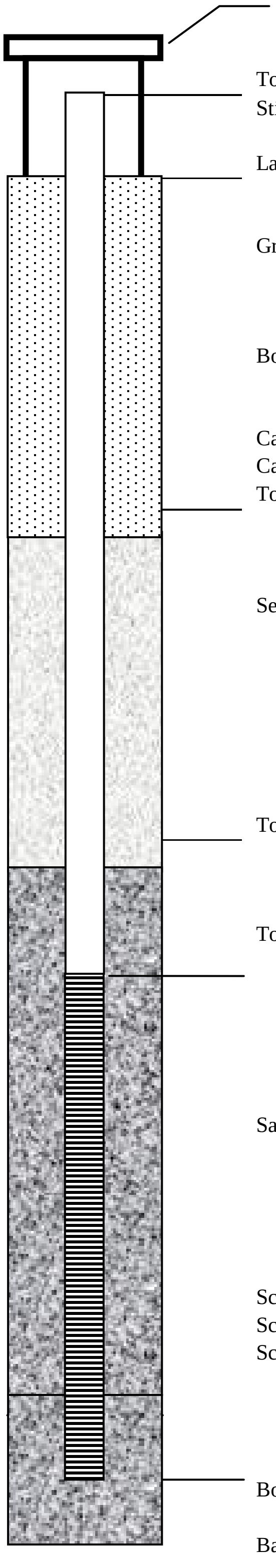
Static Water-Level* 17.65’

Top of Well Casing Elevation: 440.40’

Well Purpose:
Groundwater Monitoring
Northing (Y): 447026.92
Easting (X): 565190.31

Comments/Notes:
2 inch PVC riser and screen
10 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: Joe Webster



Protective Casing with Locking Cap

Top of Casing Elevation: 440.40 ft.
Stick-up: 2.91 ft.

Land Surface Elevation: 437.49 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 4.25 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 2 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 5 ft*

Top of Well Screen 6 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 16 ft.*

Base of Borehole: 16 ft.*

Total Depth of Well
Below Top of Casing: 18.91 ft.

*Indicates Depth Below Land Surface

CONSTRUCTION MATERIALS USED:

______ Bags of Sand

______ Bags/Buckets Bentonite Pellets

______ Bags Portland for Grout

______ Bags Concrete/Sakrete

BORING NO. _____CF-15-07 _

SAMPLE/CORE LOG

Project Number: 2015067

Log Page 1 of 1

Project Location: Clifty Creek Plant Landfill South End

Drilling Contractor: Bowser Morner

Drilling Date(s): 11/19/15-11/23/15

AGES Geologist: Joe Webster

Drilling Method: HSA

Coring Device Size: NA

Hammer Wt. 160lb. and Drop 2ft

Sampling Method: NA

Borehole Diameter: 4.25”

Drilling Fluid Used: Water

Sampling Interval: NA

Borehole Depth: 16’

Surface Elevation: 438.61’ MSL

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10		NA	Advance augers – no samples	N/A
10-12	1	1-1-3-5	Brown silty clay, stiff, plastic, wet	N/A
12-14	0	NA	No recovery	N/A
14-16	1.35	3-2-2-2	Brown gray silty clay with mottling, trace gravel, stiff, moist	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. CF-15-07

Project Number: 2015067

Project Location: Clifty Creek Plant – Landfill South End

Installation Date(s): 11/23/15

Drilling Method: Hollow Stem Auger
Drilling Contractor: Bowser Morner

Development Date(s): 12/15/15

Development Method: Peristaltic Pump, Bailer
Field parameters stabilized.
Turbidity = 4.42 NTUs

Volume Purged: 12.5 gallons

Static Water-Level* 5.92’

Top of Well Casing Elevation: 441.11’

Well Purpose:
Groundwater Monitoring
Northing (Y): 443135.08
Easting (X): 562259.25

Comments/Notes:
2 inch PVC riser and screen
10 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: Joe Webster

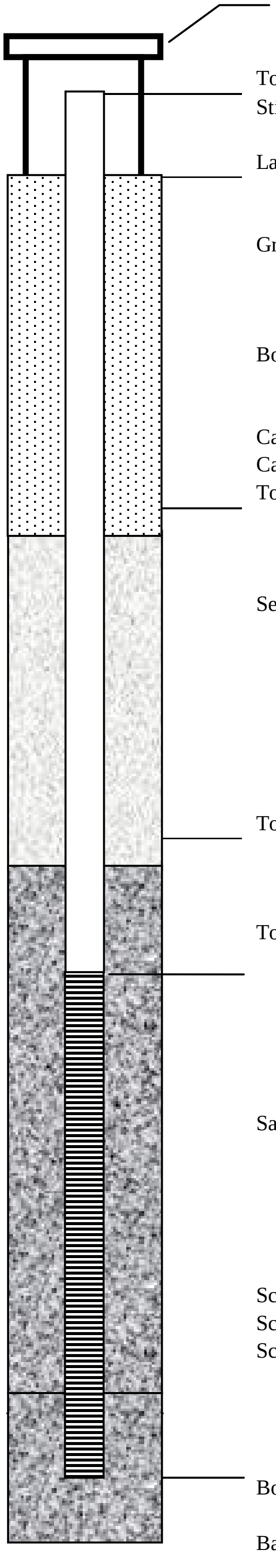
CONSTRUCTION MATERIALS USED:

______ Bags of Sand

______ Bags/Buckets Bentonite Pellets

______ Bags Portland for Grout

______ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 441.11 ft.
Stick-up: 2.50 ft.

Land Surface Elevation: 438.61 ft.

Grout; Type: Portland cement/Grout

Borehole Diameter: 4.25 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 2 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 5 ft*

Top of Well Screen 6 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 16 ft.*

Base of Borehole: 16 ft.*

Total Depth of Well
Below Top of Casing: 18.50 ft.

*Indicates Depth Below Land Surface

BORING NO. CF-15-08
SAMPLE/CORE LOG

Project Number: 2015067
Log Page 1 of 1

Project Location: Clifty Creek Plant Landfill South End
Drilling Contractor: Bowser Morner

Drilling Date(s): 11/17/15-11/19/15
AGES Geologist: Mike Gelles

Drilling Method: HSA
Coring Device Size: NA
Hammer Wt. 160lb and Drop 2ft

Sampling Method: NA
Borehole Diameter: 4.25”
Drilling Fluid Used: Water

Sampling Interval: NA
Borehole Depth: 40’
Surface Elevation: 460.33’ MSL

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10		NA	Advance augers – no samples	N/A
10-12	2	3-6-6-7	Orange brown silty clay, fine sand, slightly plastic, moist	N/A
12-14	1.4	5-7-10-10	Light brown silt, loose, moist	N/A
14-16	1.6	4-8-12-10	Light brown silt, loose, moist	N/A
16-18	1.6	7-6-9-7	Light brown silt, loose, moist	N/A
18-20	1.6	3-6-4-4	18’-19’ Light brown silt, loose, moist; 19’20’ Light brown silt, loose, wet	N/A
20-22	1.2	2-3-6-6	Light brown silt, trace clay, wet	N/A
22-24	0.1	2-3-3-3	Brown silt, clay, wet	N/A
24-26	2	2-4-6-7	Brown silt, clay, wet	N/A
26-28	2	3-5-5-5	Brown fine and medium sand, trace silt, trace clay, wet	N/A
28-30	2	3-5-9-12	Brown fine and medium sand, trace silt, trace clay, wet	N/A
30-32	1.2	1-2-2-2	Brown fine and medium sand, medium gravel, trace silt, trace clay, wet	N/A
32-34	2	4-5-5-9	Brown fine and medium sand, fine and medium gravel, trace silt, trace clay, wet	N/A
34-36	2	WH-3-6-8	Brown fine and medium sand, fine and medium gravel, trace silt, trace clay, wet	N/A
36-38	2	4-5-7-8	Brown fine and medium sand, fine and medium gravel, trace silt, trace clay, wet	N/A
38-40	2	3-5-5-11	38’-39.75’ Brown fine and medium sand, fine and medium gravel, trace silt, trace clay, wet; 39.75’-40’ gray fine and medium sand, silt, trace clay, wet	N/A

WELL CONSTRUCTION LOG
WELL NO. CF-15-08

Project Number: 2015067

Project Location: Clifty Creek Plant – Landfill South End

Installation Date(s): 11/17/15-11/19/15

Drilling Method: Hollow stem Auger
Drilling Contractor: Bowser Morner

Development Date(s): 12/8/15

Development Method: Submersible Pump
Field parameters stabilized.
Turbidity = 2.16 NTUs

Volume Purged: 100 gallons

Static Water-Level* 24.31’

Top of Well Casing Elevation: 462.79’

Well Purpose:
Groundwater Monitoring
Northing (Y): 443219.57
Easting (X): 562537.29

Comments/Notes:
2 inch PVC riser and screen
10 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: Michael Gelles

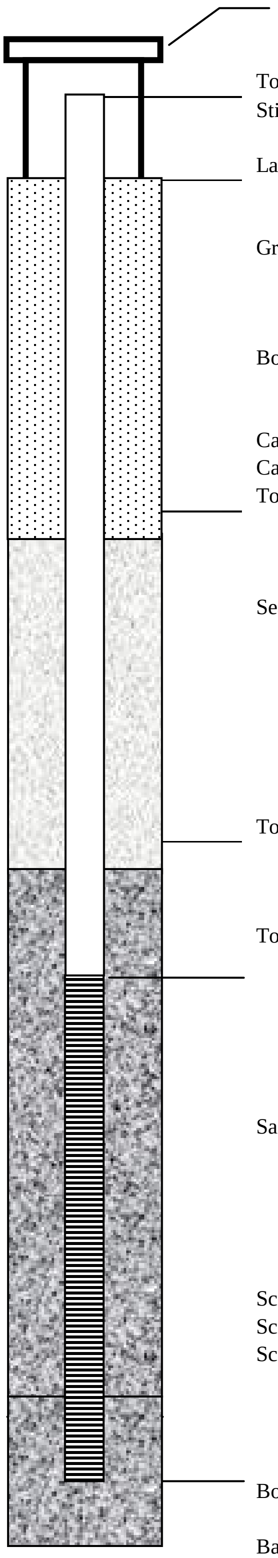
CONSTRUCTION MATERIALS USED:

4.5 Bags of Sand

0.5 Bags/Buckets Bentonite Pellets

3 Bags Portland for Grout

______ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 462.79 ft.
Stick-up: 2.46 ft.

Land Surface Elevation: 460.33 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 4.25 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 24 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 28 ft*

Top of Well Screen 30 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 40 ft.*

Base of Borehole: 40 ft.*

Total Depth of Well
Below Top of Casing: 42.46 ft.

*Indicates Depth Below Land Surface

BORING NO. _____CF-15-09 _

SAMPLE/CORE LOG

Project Number: 2015067

Log Page 1 of 1

Project Location: Clifty Creek Plant Landfill South End

Drilling Contractor: Bowser Morner

Drilling Date(s): 11/24/15-11/25/15

AGES Geologist: Joe Webster

Drilling Method: HSA

Coring Device Size: NA

Hammer Wt. NA and Drop NA

Sampling Method: NA

Borehole Diameter: 4.25”

Drilling Fluid Used: Water

Sampling Interval: NA

Borehole Depth: 14’

Surface Elevation: 456.73’ MSL

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10		NA	Advance augers – no samples	N/A
10-12	1.8	5-9-6-9	Brown weathered shale wilt limestone, hard, dry	N/A
12-14	0.2	50/4	Brown weathered shale wilt limestone, hard, dry	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. CF-15-09

Project Number: 2015067

Project Location: Clifty Creek Plant – Landfill South End

Installation Date(s): 11/24/15-11/25/15

Drilling Method: Hollow Stem Auger
Drilling Contractor: Bowser Morner

Development Date(s): 12/16/15

Development Method: Peristaltic Pump, Bailer
Field parameters stabilized.
Turbidity = 3.21 NTUs

Volume Purged: 6 gallons

Static Water-Level* 12.18’

Top of Well Casing Elevation: 459.45’

Well Purpose:
Groundwater Monitoring
Northing (Y): 443445.96
Easting (X): 562871.69

Comments/Notes:
2 inch PVC riser and screen
5 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.

Inspector: Joe Webster

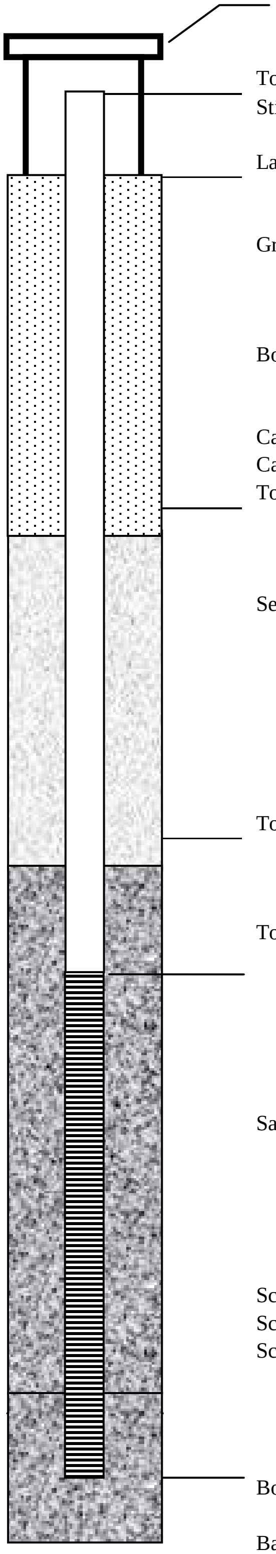
CONSTRUCTION MATERIALS USED:

______ Bags of Sand

______ Bags/Buckets Bentonite Pellets

______ Bags Portland for Grout

______ Bags Concrete/Sakrete



Top of Casing Elevation: 459.45 ft.
Stick-up: 2.72 ft.

Land Surface Elevation: 456.73 ft.

Grout; Type: Portland cement/Grout

Borehole Diameter: 4.25 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 1 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 6 ft*

Top of Well Screen 9 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 14 ft.*

Base of Borehole: 14 ft.*

Total Depth of Well
Below Top of Casing: 16.72 ft.

*Indicates Depth Below Land Surface

APPENDIX C

WELL DEVELOPMENT DATA

TABLE C-1
SUMMARY OF WELL DEVELOPMENT DATA
KYGER CREEK PLANT
GALLIA COUNTY, OHIO

Well/ Piezometer	Dates	Method	Volume (gal)	Final Turbidity (NTU)
Type I Residual Waste Landfill and Landfill Runoff Collection Pond				
CF-15-01	12/08/2015 - 12/14/2015	Pump/Bail	33	3.12
CF-15-02	12/04/2015 - 12/7/2015	Pump/Bail	115	3.69
CF-15-03	12/04/2015 - 12/15/2015	Pump/Bail	32	3.99
CF-15-04	12/9/2015	Pump	65	0.91
CF-15-05	12/09/2015 - 12/16/2015	Pump	46	4.28
CF-15-06	12/09/2015 - 12/18/2016	Pump/Bail	21	9.59
CF-15-07	12/08/2015 - 12/15/2015	Pump/Bail	13	4.42
CF-15-08	12/8/2015	Pump	100	2.16
CF-15-09	12/08/2015 - 12/16/2015	Pump/Bail	6	3.21
West Boiler Slag Pond				
WBSP-15-01	12/03/2015 - 12/17/2015	Pump/Bail	23	70.8
WBSP-15-02	12/03/2015 - 12/15/2015	Pump	31.5	3.48
WBSP-15-03	12/09/2015 - 12/15/2015	Pump/Bail	15	2.42
WBSP-15-04	12/02/2015 - 12/08/2015	Pump	110	1.37
WBSP-15-05	12/02/2015 - 12/03/2015	Pump	130	1.87
WBSP-15-06	12/03/2015 - 12/09/2015	Pump	100	3.44
WBSP-15-07	12/02/2015 -12/16/2015	Pump/Bail	36	2.86
WBSP-15-08	12/02/2015 - 12/16/2015	Pump	90	4.96
WBSP-15-09	1/08/2016 - 1/19/2016	Pump	59	3.57
WBSP-15-10	1/07/2016 - 1/20/2016	Pump	33	3.59

APPENDIX D

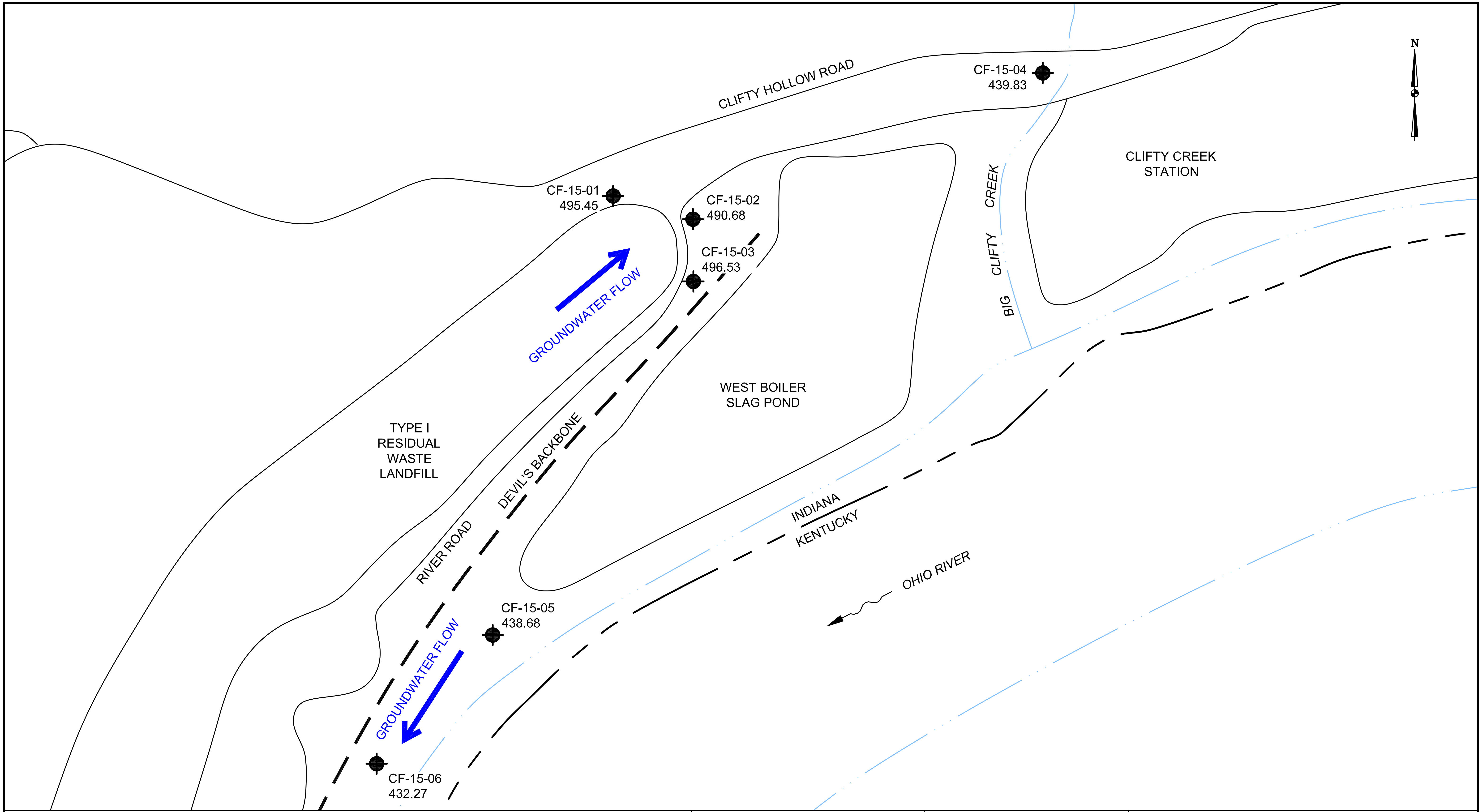
GROUNDWATER LEVELS
January 2016 through May 2016

TABLE D-1
CLIFTY CREEK CREEK PLANT
SUMMARY OF GROUNDWATER ELEVATION DATA
JANUARY 2016 - MAY 2016

Monitoring Well Designation	Jan-16 Groundwater Elevation (ft)	Mar-16 Groundwater Elevation (ft)	May-16 Groundwater Elevation (ft)
LANDFILL AND LANDFILL RUNOFF COLLECTION POND			
CF-15-01	495.45	496.16	496.35
CF-15-02	490.68	490.95	490.97
CF-15-03	496.53	496.64	496.38
CF-15-04	439.83	441.19	441.27
CF-15-05	438.68	439.86	436.25
CF-15-06	432.27	437.12	429.22
CF-15-07	436.61	438.08	437.48
CF-15-08	439.48	440.54	440.88
CF-15-09	450.77	451.58	450.69
WEST BOILER SLAG POND			
WBSP-15-01	451.72	453.01	453.27
WBSP-15-02	468.31	472.52	471.52
WBSP-15-03	477.03	477.11	477.62
WBSP-15-04	429.22	436.25	424.96
WBSP-15-05	428.95	436.12	424.84
WBSP-15-06	428.82	436.06	424.77
WBSP-15-07	429.72	430.41	430.88
WBSP-15-08	434.03	434.62	434.81
WBSP-15-09	432.17	430.39	432.21
WBSP-15-10	431.41	433.28	432.58

APPENDIX E

GROUNDWATER CONTOUR MAPS
January 2016 through May 2016



LEGEND:

● MONITORING WELL LOCATION

← GROUNDWATER FLOW DIRECTION

600' 0' 600' 1200'

SCALE: 1"= 600'

DRAWN BY JM

DATE

CHECKED BY

JOB NO. 2015067–CLI

DWG FILE IKEC_Clifty MW Install_Appx E_Jan16 b08.dwg

DRAWING SCALE AS SHOWN

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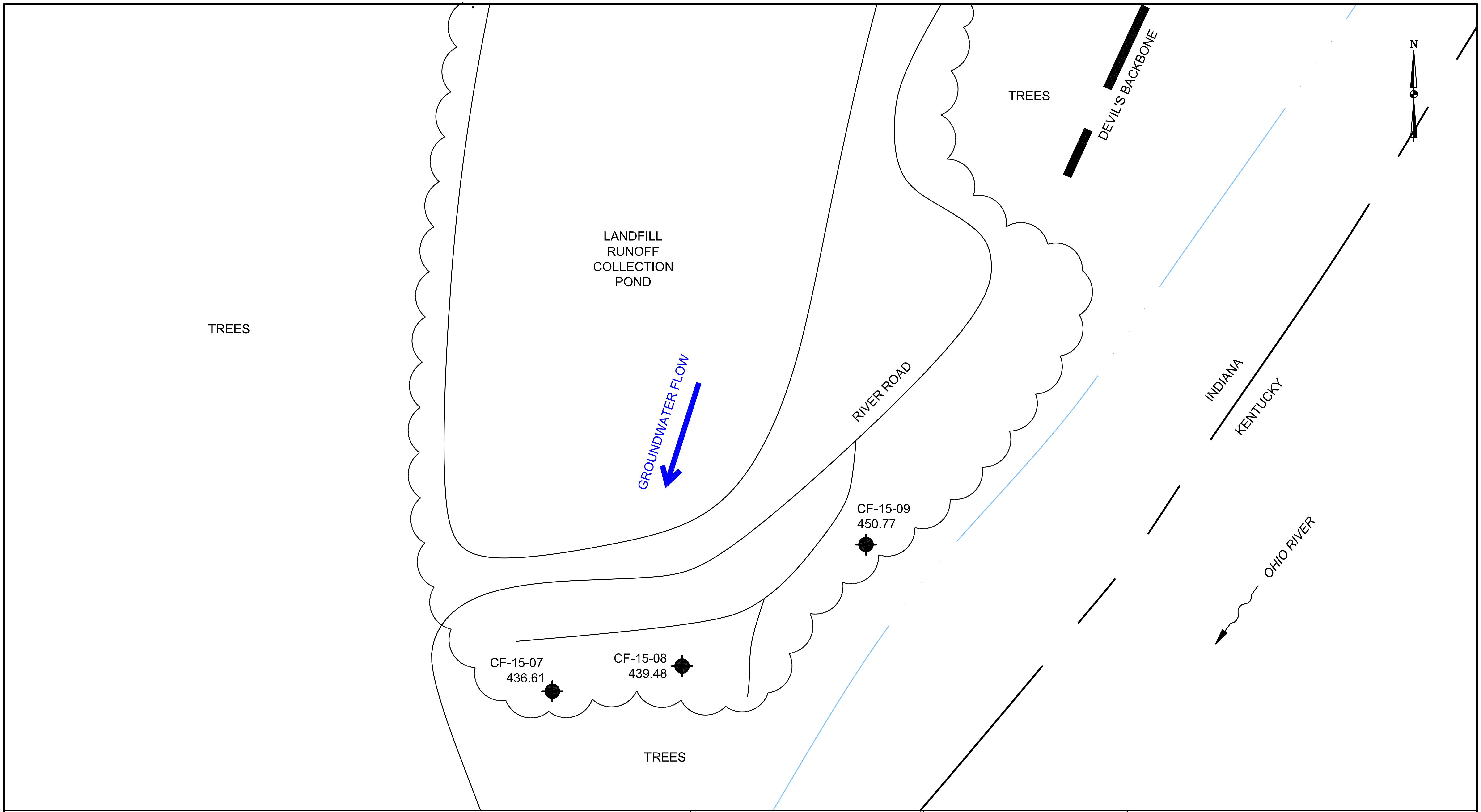
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION POND
NORTHEAST END & BACKGROUND
GROUNDWATER LEVELS & FLOW DIRECTION–JANUARY 2016

DRAWING NAME FIGURE E–1

REV. 0

Plot: 10/12/2017 13:34 _PROGRAMS–IKEC\Clifty Creek–CCR Program\CAD\Clifty CCR MW Install\Appendix E\IKEC_Clifty MW Install_Appx E_Jan16 b08.dwgE–1



LEGEND:

● MONITORING WELL LOCATION

← GROUNDWATER FLOW DIRECTION

200' 0' 200' 400'

SCALE: 1"= 200'

DRAWN BY JM

DATE

CHECKED BY

JOB NO. 2015067–CLI

DWG FILE IKEC_Clifty MW Install_Appx E_Jan16 b08.dwg

DRAWING SCALE AS SHOWN

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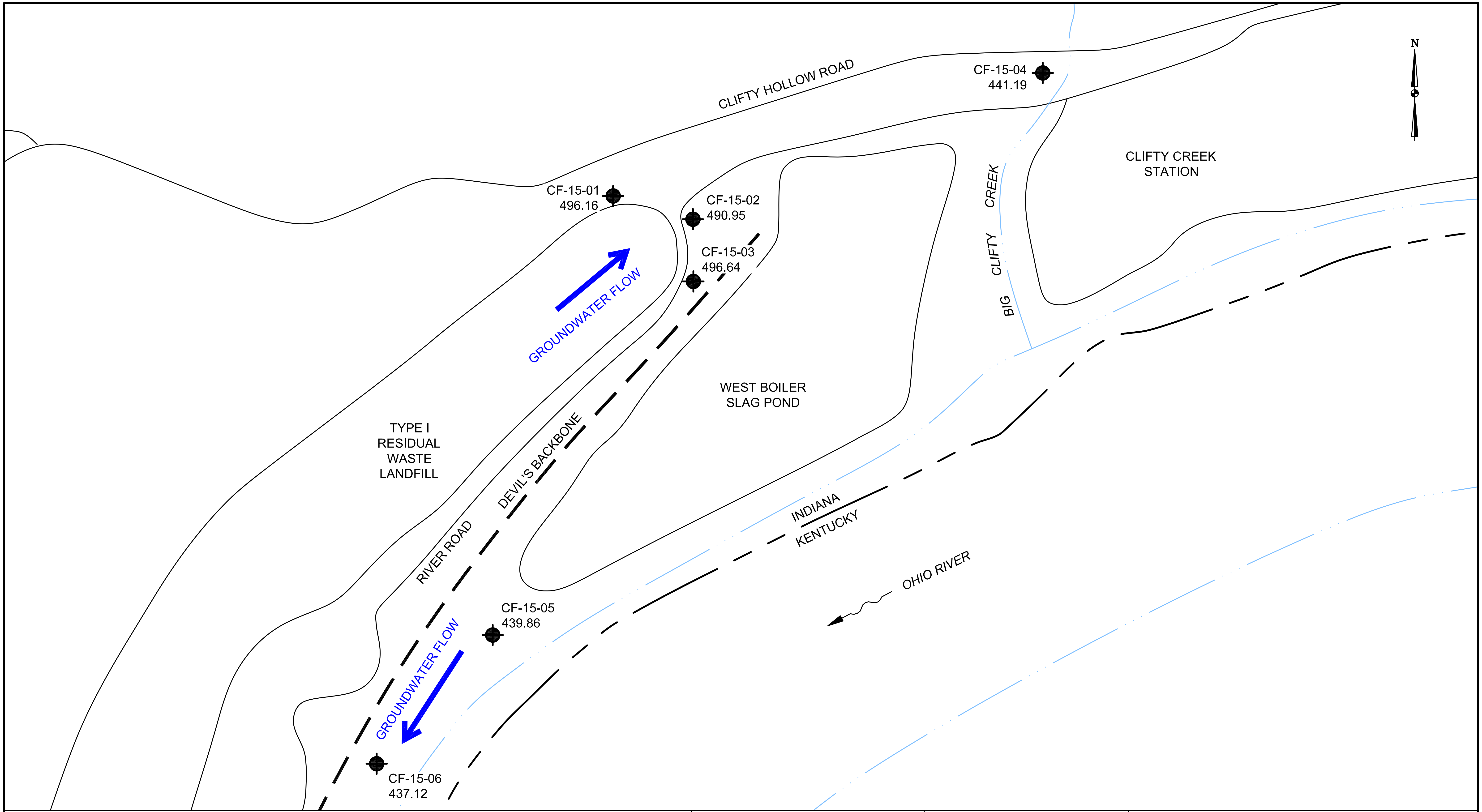
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION POND
SOUTHWEST END
GROUNDWATER LEVELS & FLOW DIRECTION–JANUARY 2016

DRAWING NAME FIGURE E–2

REV. 0

Plot: 10/12/2017 13:37 _PROGRAMS–IKEC\Clifty Creek–CCR Program\CAD\Clifty CCR MW Install\Appendix E\IKEC_Clifty MW Install_Appx E_Jan16 b08.dwg\E–2



LEGEND:

● MONITORING WELL LOCATION

← GROUNDWATER FLOW DIRECTION

600' 0' 600' 1200'

SCALE: 1"= 600'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067–CLI
DWG FILE	IKEC_Clifty MW Install_Appx E_Mar16 b09.dwg
DRAWING SCALE	AS SHOWN

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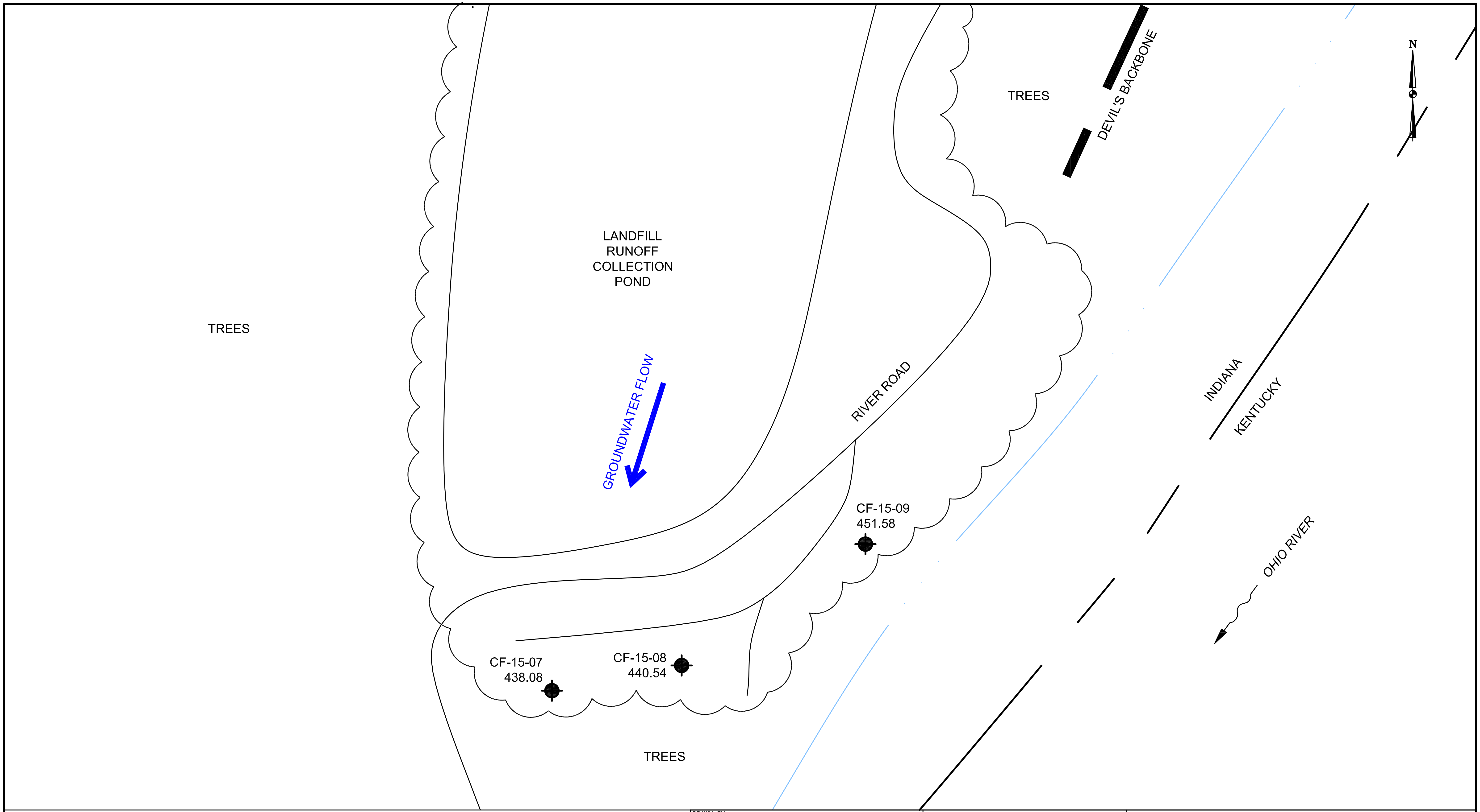
CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION POND
NORTHEAST END & BACKGROUND
GROUNDWATER LEVELS & FLOW DIRECTION–MARCH 2016

DRAWING NAME
FIGURE E–4

REV.
0

Plot: 10/12/2017 13:43 _PROGRAMS–IKEC\Clifty Creek–CCR Program\CAD\Clifty CCR MW Install\Appendix E\IKEC_Clifty MW Install_Appx E_Mar16 b09.dwg\E–4



LEGEND:

● MONITORING WELL LOCATION

← GROUNDWATER FLOW DIRECTION

200' 0' 200' 400'

SCALE: 1"= 200'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067–CLI
DWG FILE	IKEC_Clifty MW Install_Appx E_Mar16 b09.dwg
DRAWING SCALE	AS SHOWN

AGES

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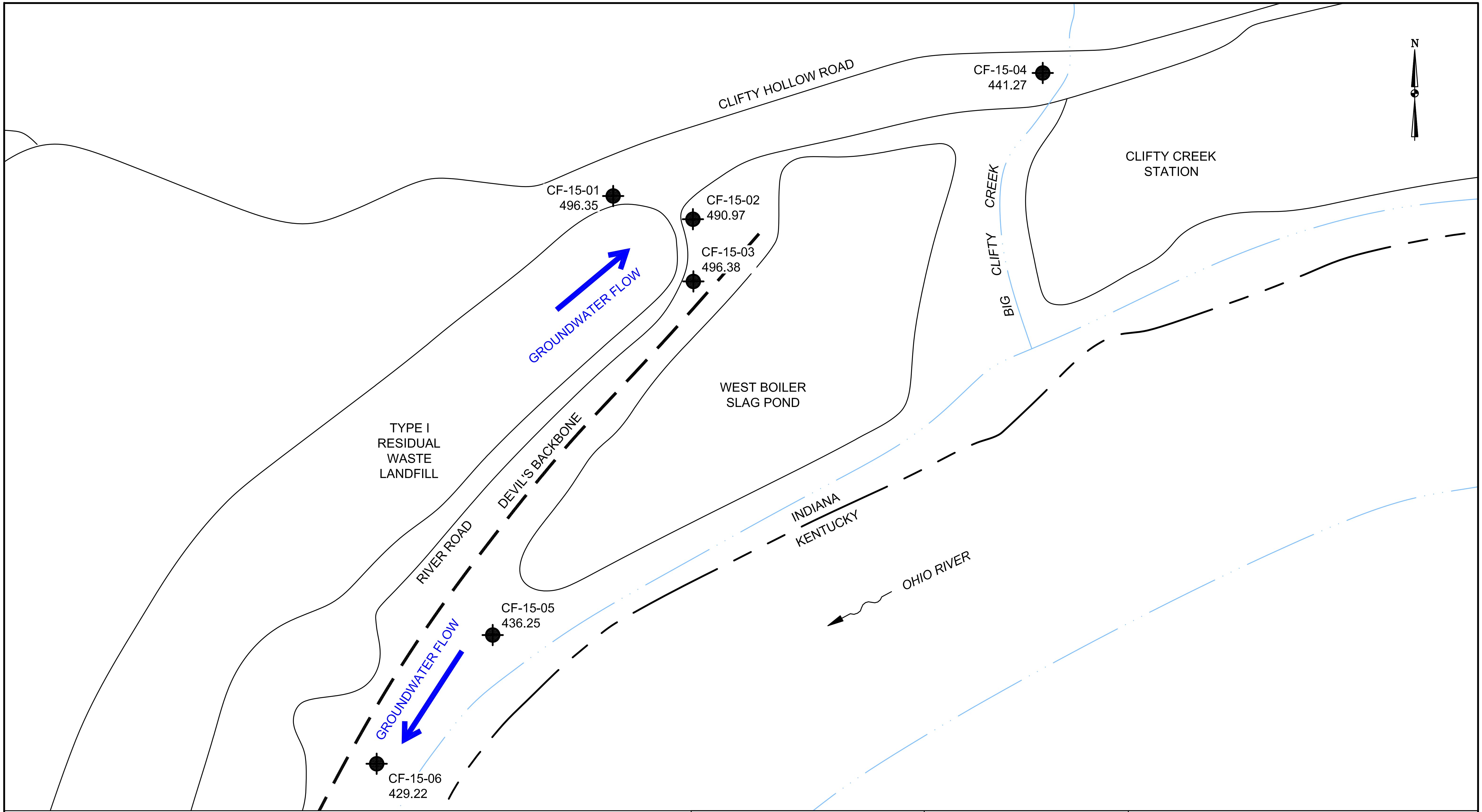
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION POND
SOUTHWEST END
GROUNDWATER LEVELS & FLOW DIRECTION–MARCH 2016

DRAWING NAME: FIGURE E–5

REV.: 0

Plot: 10/12/2017 13:45 _PROGRAMS–IKEC\Clifty Creek–CCR Program\CAD\Clifty CCR MW Install\Appendix E\IKEC_Clifty MW Install_Appx E_Mar16 b09.dwg\E–5



LEGEND:

● MONITORING WELL LOCATION

← GROUNDWATER FLOW DIRECTION

600' 0' 600' 1200'

SCALE: 1"= 600'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067–CLI
DWG FILE	IKEC_Clifty MW Install_Appx E_May16 b10.dwg
DRAWING SCALE	AS SHOWN

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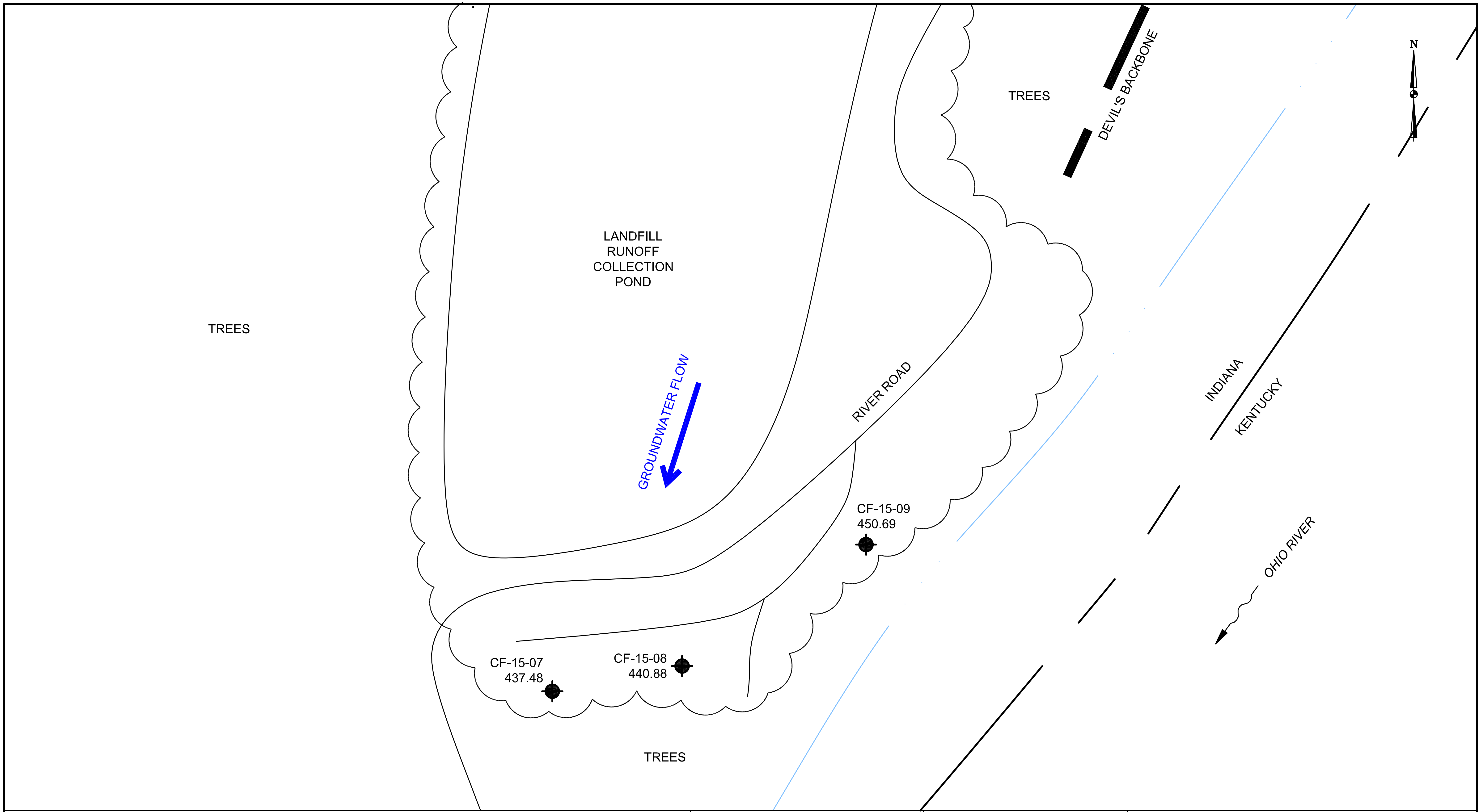
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION POND
NORTHEAST END & BACKGROUND
GROUNDWATER LEVELS & FLOW DIRECTION–MAY 2016

DRAWING NAME: FIGURE E–7

REV. 0

Plot: 10/12/2017 13:48 _PROGRAMS–IKEC\Clifty Creek–CCR Program\CAD\Clifty CCR MW Install\Appendix E\IKEC_Clifty MW Install_Appx E_May16 b10.dwg\E–7



LEGEND:

⊕ MONITORING WELL LOCATION

← GROUNDWATER FLOW DIRECTION

200' 0' 200' 400'

SCALE: 1"= 200'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067–CLI
DWG FILE	IKEC_Clifty MW Install_Appx E_May16 b10.dwg
DRAWING SCALE	AS SHOWN

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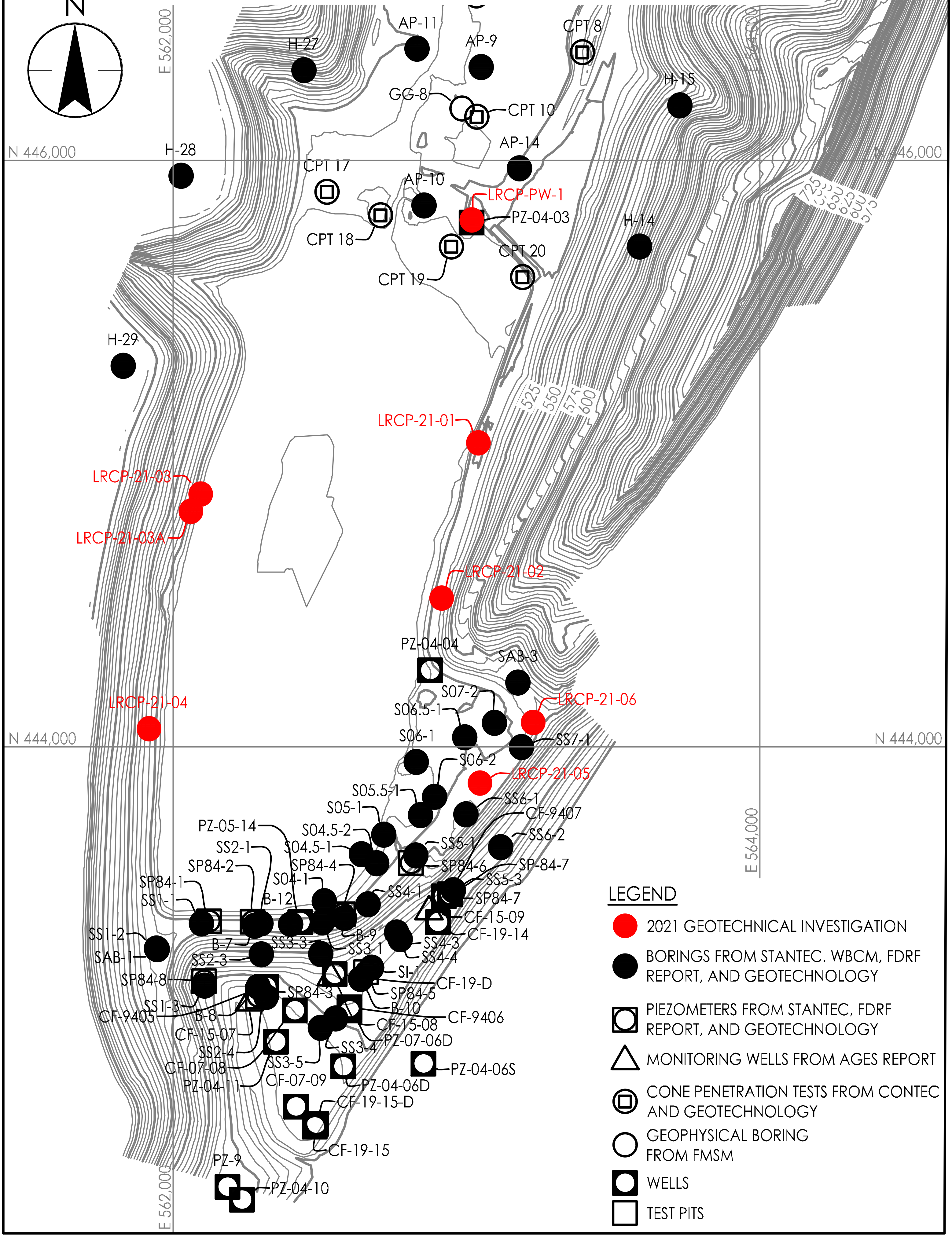
INDIANA–KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION POND
SOUTHWEST END
GROUNDWATER LEVELS & FLOW DIRECTION–MAY 2016

DRAWING NAME	REV.
FIGURE E–8	0

Plot: 10/12/2017 13:51 _PROGRAMS–IKEC\Clifty Creek–CCR Program\CAD\Clifty CCR MW Install\Appendix E\IKEC_Clifty MW Install_Appx E_May16 b10.dwg\E–8

Stantec (2021)

BORINGS AND CPT LOCATED AT THE LANDFILL RUNOFF COLLECTION POND



SUBSURFACE LOG (DRAFT)

Client Borehole Identification LRCP-21-01
Stantec Boring No. **LRCP-21-01**
Client IKEC
Boring Location 445036.29 N; 563040.013 E
Project Number 175539026
Surface Elevation 499.5 ft
Elevation Datum NAVD88
Project Name Clifty Creek WBSP and LRCP Closure
Date Started 3/15/21
Completed 3/15/21
Project Location Clifty Creek Power Plant, Madison, IN
Depth to Water 10.0 ft
Date/Time 3/15/21
Logged by B. Herries
Depth to Water N/A
Date/Time N/A
Drilling Contractor Stantec Consulting Services Inc.
Drill Rig Type and ID CME 55 Track Rig #711
Overburden Drilling and Sampling Tools (Type and Size) 4.25" HSA, 2" Split Spoon w/o liners, 3" Shelby Tubes
Rock Drilling and Sampling Tools (Type and Size) N/A
Sampler Hammer Type Automatic
Weight 140 lb
Drop 30 in
Efficiency 88 % (Avg.)
Borehole Azimuth N/A (Vertical)
Borehole Inclination (from Vertical) Vertical

Lithology		Description	Overburden Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	Remarks
Elevation	Depth		Rock Core RQD	Run	Rec. Ft.	Rec. %	Depth	
499.5	0.0	Top of Hole						
		SAND WITH GRAVEL (SW), CCR, dark brown with black, moist, loose to medium dense, with coal chunks	SPT-1	0.0 - 1.5	1.3	4-8-10	--	
			SPT-2	5.0 - 6.5	1.5	4-3-3	--	
489.5	10.0	SILTY CLAY (CL-ML), dark brownish gray, wet, very soft	SPT-3	10.0 - 11.5	1.5	WH-1-1	--	
484.5	15.0	FAT CLAY (CH), orange brown mottled with tan, moist, medium stiff to very stiff, medium to high plasticity	SPT-4	15.0 - 16.5	1.5	2-2-3	--	

TVA RO BORING LOG CLIFTY_BORINGS_LOGS.GPJ FMSM-GRAPHIC LOG.GDT 4/12/21

SUBSURFACE LOG (DRAFT)

Client Borehole Identification LRCP-21-01
Stantec Boring No. **LRCP-21-01**
Client IKEC
Boring Location 445036.29 N; 563040.013 E
Project Number 175539026
Surface Elevation 499.5 ft
Elevation Datum NAVD88

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	
		FAT CLAY (CH), orange brown mottled with tan, moist, medium stiff to very stiff, medium to high plasticity *(Continued)*		SPT-5	20.0 - 21.5	1.4	6-7-8	--	
473.6	25.9	-at 25.0', wet		SPT-6	25.0 - 26.3	1.2	11-11-50/4"	--	
473.2	26.3	SHALE, gray, moist to wet, friable							
		Auger Refusal / Bottom of Hole							

Borehole was backfilled with a mixture of cement-bentonite grout from the bottom of hole to the ground surface using a tremie pipe.

TVA RO BORING LOG CLIFTY_BORINGS_LOGS.GPJ FMSM-GRAPHIC LOG.GDT 4/12/21

Stantec

SUBSURFACE LOG (DRAFT)

Client Borehole Identification LRCP-21-02
Stantec Boring No. **LRCP-21-02**
Client IKEC
Boring Location 444507.211 N; 562914.551 E
Project Number 175539026
Surface Elevation 501.6 ft
Elevation Datum NAVD88
Project Name Clifty Creek WBSP and LRCP Closure
Date Started 3/14/21
Completed 3/14/21
Project Location Clifty Creek Power Plant, Madison, IN
Depth to Water N/A
Date/Time N/A
Logged by B. Herries
Depth to Water N/A
Date/Time N/A
Drilling Contractor Stantec Consulting Services Inc.
Drill Rig Type and ID CME 55 Track Rig #711
Overburden Drilling and Sampling Tools (Type and Size) 4.25" HSA, 2" Split Spoon w/o liners, 3" Shelby Tubes
Rock Drilling and Sampling Tools (Type and Size) N/A
Sampler Hammer Type Automatic
Weight 140 lb
Drop 30 in
Efficiency 88 % (Avg.)
Borehole Azimuth N/A (Vertical)
Borehole Inclination (from Vertical) Vertical

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	Remarks
501.6	0.0	Top of Hole							
501.3	0.3	TOPSOIL							
		SILTY SAND (SM), dark brown with black, moist, medium dense, with coal pieces of about 3/16" to 3/4", possible CCR -clay from 1.3' to 1.5'		SPT-1	0.0 - 1.5	1.5	2-6-7	--	
497.1	4.5								
		GRAVEL (GP), white to gray, dry, dense, medium coarse to coarse		SPT-2	5.0 - 6.5	1.0	30-12-20	--	
495.1	6.5								
		LEAN CLAY (CL), light brown and tan, moist, very stiff, some gravel -at 8.0', cobbles for 6"		SPT-3	7.5 - 9.0	1.0	8-15-22	--	
				SPT-4	10.0 - 11.5	1.4	5-11-16	--	

TVA RO BORING LOG CLIFTY_BORINGS_LOGS.GPJ FMSM-GRAPHIC LOG.GDT 4/12/21

SUBSURFACE LOG (DRAFT)

Client Borehole Identification LRCP-21-02
Stantec Boring No. **LRCP-21-02**
Client IKEC
Boring Location 444507.211 N; 562914.551 E
Project Number 175539026
Surface Elevation 501.6 ft
Elevation Datum NAVD88

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	Remarks
		LEAN CLAY (CL), light brown and tan, moist, very stiff, some gravel *(Continued)* -at 15.0', medium plasticity		SPT-5	15.0 - 16.5	1.5	7-11-12	--	
481.6	20.0								
		SHALE, light gray to gray, moist, soft rock, horizontal bedding, some fractures		SPT-6	20.0 - 20.3	0.3	50/4"	--	
476.2	25.4			SPT-7	25.0 - 25.4	0.4	50/5"	--	

Auger Refusal /
Bottom of Hole

Borehole was backfilled with a mixture of cement-bentonite grout from the bottom of hole to the ground surface using a tremie pipe.

SUBSURFACE LOG (DRAFT)

Client Borehole Identification LRCP-21-03 Stantec Boring No. **LRCP-21-03**

Client	IKEC	Boring Location	444860.837 N; 562093.44 E
Project Number	175539026	Surface Elevation	490.9 ft
		Elevation Datum	NAVD88
Project Name	Clifty Creek WBSP and LRCP Closure	Date Started	3/9/21
		Completed	3/9/21
Project Location	Clifty Creek Power Plant, Madison, IN	Depth to Water	N/A
		Date/Time	N/A
Logged by	B. Herries	Depth to Water	N/A
		Date/Time	N/A
Drilling Contractor	Stantec Consulting Services Inc.	Drill Rig Type and ID	CME 55 Track Rig #711

Overburden Drilling and Sampling Tools (Type and Size) 4.25" HSA, 2" Split Spoon w/o liners, 3" Shelby Tubes

Rock Drilling and Sampling Tools (Type and Size) N/A

Sampler Hammer Type Automatic Weight 140 lb Drop 30 in Efficiency 88 % (Avg.)

Borehole Azimuth N/A (Vertical) Borehole Inclination (from Vertical) Vertical

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	Remarks
490.9	0.0	Top of Hole							
		FAT CLAY (CH), light brown with brown and little green, moist, very soft to very stiff, trace gravel, roots from 0' to 1.5'		SPT-1	0.0 - 1.5	0.5	WH-WH-1	--	
		-at 5.7', roots and organic matter from 5.7' to 5.8'		SPT-2	5.0 - 6.5	1.2	4-4-6	--	
		-at 10.9', gravel and cobbles from 10.9' to 11.5'		SPT-3	10.0 - 11.5	1.5	7-11-13	--	

TVA RO BORING LOG CLIFTY_BORINGS_LOGS.GPJ FMSM-GRAPHIC LOG.GDT 4/12/21

SUBSURFACE LOG (DRAFT)

Client Borehole Identification LRCP-21-03
Stantec Boring No. **LRCP-21-03**
Client IKEC
Boring Location 444860.837 N; 562093.44 E
Project Number 175539026
Surface Elevation 490.9 ft
Elevation Datum NAVD88

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	
471.7	19.2	FAT CLAY (CH), light brown with brown and little green, moist, very soft to very stiff, trace gravel, roots from 0' to 1.5' *(Continued)* -at 15.6', gray with brown gravelly clay seam from 15.6' to 16.5'		SPT-4 Grab-1	15.0 - 16.5 18.0 - 19.0	1.5	13-22-18 Grab-1-no SPT	-- --	
		Auger Refusal / Bottom of Hole							

Borehole was backfilled with a mixture of cement-bentonite grout from the bottom of hole to the ground surface using a tremie pipe.

Stantec

SUBSURFACE LOG (DRAFT)

Client Borehole Identification LRCP-21-03A
Stantec Boring No. **LRCP-21-03A**
Client IKEC
Boring Location 444802.654 N; 562060.15 E
Project Number 175539026
Surface Elevation 497.1 ft
Elevation Datum NAVD88
Project Name Clifty Creek WBSP and LRCP Closure
Date Started 3/10/21
Completed 3/10/21
Project Location Clifty Creek Power Plant, Madison, IN
Depth to Water N/A
Date/Time N/A
Logged by B. Herries
Depth to Water N/A
Date/Time N/A
Drilling Contractor Stantec Consulting Services Inc.
Drill Rig Type and ID CME 55 Track Rig #711
Overburden Drilling and Sampling Tools (Type and Size) 4.25" HSA, 2" Split Spoon w/o liners, 3" Shelby Tubes
Rock Drilling and Sampling Tools (Type and Size) N/A
Sampler Hammer Type Automatic
Weight 140 lb
Drop 30 in
Efficiency 88 % (Avg.)
Borehole Azimuth N/A (Vertical)
Borehole Inclination (from Vertical) Vertical

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	Remarks
497.1	0.0	Top of Hole							
		FAT CLAY (CH), brown with dark brown, moist, stiff to very stiff, trace to some gravel, some roots from 0' to 1.5'		SPT-1	0.0 - 1.5	1.0	6-7-2	--	
		-at 5.0', light brown and brown		SPT-2	5.0 - 6.5	1.1	2-3-14	--	
				SPT-3	10.0 - 11.5	1.0	8-9-13	--	

SUBSURFACE LOG (DRAFT)

Client Borehole Identification LRCP-21-03A
Stantec Boring No. **LRCP-21-03A**
Client IKEC
Boring Location 444802.654 N; 562060.15 E
Project Number 175539026
Surface Elevation 497.1 ft
Elevation Datum NAVD88

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	
481.8	15.3	SHALE, light gray with white, dry, hightly fractured, horizontal bedding		SPT-4	15.0 - 15.9	0.9	41-50/5"	--	
481.2	15.9	Auger Refusal / Bottom of Hole							

Borehole was backfilled with a mixture of cement-bentonite grout from the bottom of hole to the ground surface using a tremie pipe.

TVA RO BORING LOG CLIFTY_BORINGS_LOGS.GPJ FMSM-GRAPHIC LOG.GDT 4/12/21

SUBSURFACE LOG (DRAFT)

Client Borehole Identification LRCP-21-04
Stantec Boring No. **LRCP-21-04**
Client IKEC
Boring Location 444061.327 N; 561916.533 E
Project Number 175539026
Surface Elevation 509.0 ft
Elevation Datum NAVD88
Project Name Clifty Creek WBSP and LRCP Closure
Date Started 3/10/21
Completed 3/10/21
Project Location Clifty Creek Power Plant, Madison, IN
Depth to Water 15.5 ft
Date/Time 3/10/21
Logged by B. Herries
Depth to Water N/A
Date/Time N/A
Drilling Contractor Stantec Consulting Services Inc.
Drill Rig Type and ID CME 55 Track Rig #711
Overburden Drilling and Sampling Tools (Type and Size) 4.25" HSA, 2" Split Spoon w/o liners, 3" Shelby Tubes
Rock Drilling and Sampling Tools (Type and Size) N/A
Sampler Hammer Type Automatic
Weight 140 lb
Drop 30 in
Efficiency 88 % (Avg.)
Borehole Azimuth N/A (Vertical)
Borehole Inclination (from Vertical) Vertical

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	Remarks
509.0	0.0	Top of Hole							
508.5	0.5	TOPSOIL		SPT-1	0.0 - 1.5	0.5	2-4-6	--	
		FAT CLAY (CH), light brown with tan, moist, stiff to very stiff, trace gravel, angular to subangular							
		-at 5.9', coarse gravel and cobbles for 4"		SPT-2	5.0 - 6.5	1.5	4-4-8	--	
		-at 10.0', roots for 1"							
		-at 11.0', coarse gravel and cobbles for 6"		SPT-3	10.0 - 11.5	1.1	4-8-8	--	
495.0	14.0								
		GRAVEL WITH SAND (GP), gray to dark gray, moist to wet, dense to medium dense, angular, poorly graded		SPT-4	14.0 - 15.5	0.6	25-7-10	--	
489.0	20.0								

SUBSURFACE LOG (DRAFT)

Client Borehole Identification LRCP-21-04

Stantec Boring No. **LRCP-21-04**

Client IKEC

Boring Location 444061.327 N; 561916.533 E

Project Number 175539026

Surface Elevation 509.0 ft

Elevation Datum NAVD88

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	
487.0	22.0	FAT CLAY (CH), gray to olive, moist, very stiff, some gravel, trace sand, subangular to angular. Top of Rock at 22.0'		SPT-5	20.0 - 21.5	1.3	12-7-14	--	
483.7	25.3	SHALE, light gray to gray, dry, highly weathered, fractured, horizontal bedding		SPT-6	25.0 - 25.3	0.3	50/4"	--	

Auger Refusal / Bottom of Hole

Borehole was backfilled with a mixture of cement-bentonite grout from the bottom of hole to the ground surface using a tremie pipe.

TVA RO BORING LOG CLIFTY_BORINGS_LOGS.GPJ FMSM-GRAPHIC LOG.GDT 4/12/21

SUBSURFACE LOG (DRAFT)

Client Borehole Identification LRCP-21-05 Stantec Boring No. **LRCP-21-05**
Client IKEC Boring Location 443875.965 N; 563044.959 E
Project Number 175539026 Surface Elevation 504.8 ft Elevation Datum NAVD88
Project Name Clifty Creek WBSP and LRCP Closure Date Started 3/11/21 Completed 3/13/21
Project Location Clifty Creek Power Plant, Madison, IN Depth to Water 13.2 ft Date/Time 3/11/21
Logged by B. Herries Depth to Water N/A Date/Time N/A
Drilling Contractor Stantec Consulting Services Inc. Drill Rig Type and ID CME 55 Track Rig #711
Overburden Drilling and Sampling Tools (Type and Size) 4.25" HSA, 2" Split Spoon w/o liners, 3" Shelby Tubes
Rock Drilling and Sampling Tools (Type and Size) N/A
Sampler Hammer Type Automatic Weight 140 lb Drop 30 in Efficiency 88 % (Avg.)
Borehole Azimuth N/A (Vertical) Borehole Inclination (from Vertical) Vertical

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	
504.8	0.0	Top of Hole							
504.6	0.2	TOPSOIL		SPT-1	0.0 - 1.5	0.7	2-4-4	--	
504.4	0.4	ASPHALT							
502.3	2.5	GRAVELLY CLAY (CL) with sand, light brown with gray, moist, medium stiff							
		LEAN CLAY (CL), light brown to tan, moist, very stiff to hard, some gravel, subangular		SPT-2	2.5 - 4.0	1.4	6-22-10	--	
		-at 3.6', coarse gravel for 2" -at 5.0', some gravel		SPT-3	5.0 - 6.5	1.5	13-16-26	--	
		-at 8.0', clay is gray for 1.8'		SPT-4	7.5 - 9.0	1.5	13-27-35	--	
				SPT-5	10.0 - 11.5	1.2	7-9-13	--	
		-at 13.2, wet		SPT-6	12.5 - 14.0	1.5	11-14-24	--	
489.8	15.0	SHALE, gray to dark gray, moist, hard, residual soil, weathered		SPT-7	15.0 - 15.6	0.6	43-50/1"	--	

SUBSURFACE LOG (DRAFT)

Client Borehole Identification LRCP-21-05 Stantec Boring No. **LRCP-21-05**

Client IKEC Boring Location 443875.965 N; 563044.959 E

Project Number 175539026 Surface Elevation 504.8 ft Elevation Datum NAVD88

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	
		SHALE, gray to dark gray, moist, hard, residual soil, weathered *(Continued)* -at 20.0', horizontal bedding, less weathered		SPT-8	20.0 - 20.4	0.4	50/5"	--	
				SPT-9	22.5 - 22.9	0.4	50/5"	--	
479.5	25.3			SPT-10	25.0 - 25.3	0.3	50/4"	--	
		Auger Refusal / Bottom of Hole							

Borehole was backfilled with a mixture of cement-bentonite grout from the bottom of hole to the ground surface using a tremie pipe.

SUBSURFACE LOG (DRAFT)

Client Borehole Identification LRCP-21-06
Stantec Boring No. **LRCP-21-06**
Client IKEC
Boring Location 444082.85 N; 563226.249 E
Project Number 175539026
Surface Elevation 506.2 ft
Elevation Datum NAVD88
Project Name Clifty Creek WBSP and LRCP Closure
Date Started 3/14/21
Completed 3/14/21
Project Location Clifty Creek Power Plant, Madison, IN
Depth to Water 22.5 ft
Date/Time 3/14/21
Logged by B. Herries
Depth to Water N/A
Date/Time N/A
Drilling Contractor Stantec Consulting Services Inc.
Drill Rig Type and ID CME 55 Track Rig #711
Overburden Drilling and Sampling Tools (Type and Size) 4.25" HSA, 2" Split Spoon w/o liners, 3" Shelby Tubes
Rock Drilling and Sampling Tools (Type and Size) N/A
Sampler Hammer Type Automatic
Weight 140 lb
Drop 30 in
Efficiency 88 % (Avg.)
Borehole Azimuth N/A (Vertical)
Borehole Inclination (from Vertical) Vertical

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	
506.2	0.0	Top of Hole							
505.6	0.6	CRUSHED STONE AND ASPHALT							
		LEAN CLAY (CL) with gravel, tan with light brown, moist, stiff, angular to subangular							
				SPT-1	2.5 - 4.0	1.3	3-6-6	--	
				SPT-2	5.0 - 6.5	1.2	3-7-5	--	
		-at 5.9', gravel for 2"							
498.7	7.5								
		FAT CLAY (CH), light brown with gray to blueish gray, moist, stiff to hard, with gravel and sand		SPT-3	7.5 - 9.0	1.3	2-7-14	--	
				SPT-4	10.0 - 11.5	1.2	6-5-8	--	
		-at 10.7', olive gray with blue gray							
				SPT-5	12.5 - 14.0	1.5	2-3-4	--	

TVA RO BORING LOG CLIFTY_BORINGS_LOGS.GPJ FMSM-GRAPHIC LOG.GDT 4/12/21

SUBSURFACE LOG (DRAFT)

Client Borehole Identification LRCP-21-06
Stantec Boring No. **LRCP-21-06**
Client IKEC
Boring Location 444082.85 N; 563226.249 E
Project Number 175539026
Surface Elevation 506.2 ft
Elevation Datum NAVD88

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	
		FAT CLAY (CH), light brown with gray to blueish gray, moist, stiff to hard, with gravel and sand *(Continued)*		SPT-6	15.0 - 16.5	0.0	6-7-8	--	
		-at 17.5', olive to olive gray for 1.5'		SPT-7	17.5 - 19.0	0.9	7-9-13	--	
486.2	20.0								
		LEAN CLAY (CL), light brown to brown, some mottling with gray, moist, stiff, low to medium plasticity		SPT-8	20.0 - 21.5	1.5	3-4-8	--	
		-at 22.5', wet, soft		SPT-9	22.5 - 24.0	1.5	3-2-3	--	
481.2	25.0								
		FAT CLAY (CH), brownish orange with with light brown and gray, moist, stiff		SPT-10	25.0 - 26.5	1.5	3-4-12	--	
		-at 30.2', coarse gravel for 1" -at 31.3', coarse gravel for 2"		SPT-11	30.0 - 31.6	1.5	8-9-11	--	

Stantec

SUBSURFACE LOG (DRAFT)

Client Borehole Identification LRCP-21-06
Stantec Boring No. **LRCP-21-06**
Client IKEC
Boring Location 444082.85 N; 563226.249 E
Project Number 175539026
Surface Elevation 506.2 ft
Elevation Datum NAVD88

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	Remarks
		FAT CLAY (CH), brownish orange with with light brown and gray, moist, stiff *(Continued)* -at 36.0', coarse gravel for 6"		SPT-12	35.0 - 36.5	1.0	12-10-15	--	
466.2	40.0								
466.0	40.2	SHALE, gray, dry							
		Auger Refusal / Bottom of Hole							

Borehole was backfilled with a mixture of cement-bentonite grout from the bottom of hole to the ground surface using a tremie pipe.

APPENDIX F

Slope Stability Analysis

Landfill Runoff Collection Pond Dam Stability

Closure Plan
Landfill Runoff Collection Pond
Clifty Creek Station
Madison, Jefferson County, Indiana

April 16, 2021

Prepared for:

Indiana-Kentucky Electric Corporation (IKEC)

Prepared by:

Stantec Consulting Services Inc.

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LIST OF TABLES

LIST OF ATTACHMENTS

1.0 INTRODUCTION

The Clifty Creek Generating Station's Landfill Runoff Collection Pond (LRCP), owned and operated by the Indiana Kentucky Electric Corporation (IKEC), is located in Jefferson County, Indiana. The facility is bordered in the south by the Ohio River, on the east a bedrock outcrop known as the Devil's Backbone and on the west by high ground. The LRCP served as a settling facility for sluiced fly ash produced by the generating plant. The LRCP will no longer receive fly ash and closure documentation is being prepared.

Stantec Consulting Services, Inc. (Stantec) was contracted by the IKEC to prepare construction design documents to support the closure of the LRCP. The purpose of this report is to present the results of slope stability analyses of the LRCP dam with the proposed closure configuration of closure. Closure will be executed by excavating, filling, and grading existing fly ash in the pond to create positive drainage and will include the installation of a cover system. The existing dam will be degraded as stormwater run-on will be captured by a diversion ditch and routed downstream. The cover system, from top to bottom, will consist of 6 inches of topsoil, 2.5 feet of cover soil, a geocomposite drainage layer, and a 40-mil thickness linear low-density polyethylene (LLDPE) flexible membrane liner (FML) overlying the in-place fly ash coal combustion residual (CCR) material.

This report documents the information reviewed from previous field explorations and laboratory testing and geotechnical engineering analyses performed by Stantec to support the closure requirements. The scope of work includes the following:

- Existing documentation review
- Slope stability analyses of the modified LRCP dam under long-term, 1/2 Probable Maximum Flood (PMF), and seismic loading conditions

2.0 GLOBAL SLOPE STABILITY ANALYSES

The global slope stability was evaluated using conventional, limit equilibrium, method of slices analysis as implemented in the SLOPE/W module of GeoStudio 2021. Spencer's method was selected for the analyses as this method includes all interslice forces and satisfies both moment and force equilibrium. A slope stability analysis includes a search for the most critical slip surface, corresponding to the lowest factor of safety. Several options are available in SLOPE/W to facilitate the search for the critical failure surface. In the analyses presented in this report, potential circular failure surfaces were generated using the "entry and exit" method. Considering shallow, surficial failures pose little risk to the overall stability of the slopes, and are usually considered as a potential maintenance issue, a minimum slip surface depth of 3 feet was specified in the analyses to force the evaluation on the deeper potential failure surfaces.

When a soil at the entry of a potential failure surface is assigned with a cohesion value (c>0) in a slope stability analysis, tensile stresses are often computed between the slices in this area. In the field, tensile stresses result in the opening of a tension crack, reducing the lateral stresses to zero. Because tension results in a stabilizing force at the head of the sliding mass, it is unconservative to have tensile stresses between the slices in a slope stability analysis. A tension crack line was used in the analysis to eliminate the tensile inter-slice forces. Multiple iterations were performed to define the appropriate tension crack line.

2.1 LOAD CASES, GROUNDWATER CONDITIONS, AND DESIGN CRITERIA

Global slope stability analyses were performed on the final grading of the LRCP closure. The evaluated load cases, along with the target factors of safety, are summarized in Table 2.1. Target factors of safety were selected per criteria presented in the Indiana Administrative Code (Table 1 of 329 IAC 10-15-8). If the slope were to fail, it would cause major environmental impact due to material being released into the Ohio River. There is small uncertainty of soil strengths with the laboratory testing performed (discussed in Stantec 2016). Therefore, the minimum factors of safety used for these analyses were 1.5 for static conditions and 1.3 for seismic, post-earthquake conditions.

Table 2.1: Evaluated Load Cases

Slope	Load Case	Analysis	Target Factor of Safety
LRCP Dam	Long-term	Drained, effective stress	1.5
	1/2 PMF	Drained, effective stress	1.5
	Seismic (Pseudo-static)	Undrained, total stress	1.0
	Seismic (Post-Earthquake)	Residual strengths for liquefied CCR material Undrained, total stress reduced 20% for non-liquefied soils	1.3

2.1.1 Long-Term

This analysis was performed to evaluate the stability of the final grading under the long-term, drained condition after excess pore pressures have dissipated. Drained, effective stress strength parameters were used in the analysis. A long-term piezometric line was applied to the slope stability models assumed to be five feet below the lowest point of the proposed closure liner.

2.1.2 1/2 Probable Maximum Flood

This analysis was performed to evaluate the stability of the LRCP dam under a design storm event equivalent to 1/2 of the site’s PMF event. Drained, effective strength parameters were used in the analysis. The high water piezometric line was assigned to elevation 487 feet based on an anticipated backwater in the LRCP dam during this flood event.

2.1.3 Seismic (Pseudo-static)

This analysis was performed to evaluate the stability of the embankment dike and final grading under seismic loading from a design earthquake event. Undrained, pseudo-static strength parameters were assigned to low permeability materials in the analysis. Groundwater was assumed to be at the long-term water level.

The US Geological Survey (USGS) Unified Hazard Tool was used to determine the site's peak ground acceleration (PGA) corresponding to a seismic event with a return period of 2,475 years and a peak rock acceleration at the site of 0.0882 g was obtained.

Haynes-Griffin and Franklin (1984) recommended that half of the peak rock acceleration be used as the seismic coefficient in the pseudo-static slope stability analysis. Based on that, a seismic coefficient of 0.0441 (=0.5 x 0.0882) was selected. The selected seismic coefficient was rounded and a horizontal seismic coefficient of 0.045 was used in SLOPE/W. The program calculates seismic force (=column weight x seismic coefficient) and applies to each column in the sliding mass.

Note that the pseudo-static stability analysis should only be considered as an index of the seismic resistance available in a structure not subject to build-up of pore pressure from shaking. A pseudo-static factor of safety greater than 1.0 is very strong evidence that there would be little or no damage to the dam from an earthquake (FEMA 2005).

Groundwater was assumed to be at the long-term water level which was assumed to be 5 feet below the proposed closure liner.

2.1.4 Post-Earthquake

This analysis was performed to evaluate the stability of the LRCP dam assuming liquefaction of the LRCP fly ash to evaluate the potential for a release of CCR offsite. The assumption for performing this analysis is that the saturated fly ash (CCR) deposits will undergo pore pressure build-up and liquefy during the design seismic event. A post-earthquake, residual strength (in the form of Residual Shear Strength ratio as discussed in Section 2.3) was applied to the saturated fly ash (CCR) layers. Undrained, total stress strength parameters were reduced 20% and were applied to non-liquifiable soils to account for potential strength loss due to earthquake shaking.

Groundwater was assumed to be at the long-term water level which was assumed to be 5 feet below the proposed closure liner.

2.2 SECTION GEOMETRY

The section of maximum dam height was selected as the critical section for analyses. Locations of the selected cross sections are shown in the drawings. The subsurface profiles modeled in the analyses for each cross section were selected based on historical data from previous explorations. Soil borings selected for definition of the subsurface lithology for each cross section are shown in Table 2.2 below.

Table 2.2: Soil Borings used for Stratigraphy Definition

Cross Section	Soil Boring
LRCP Dam	Stantec B-7, Stantec B-8, Stantec B-9, and Stantec B-10

2.3 MATERIAL PROPERTIES

Material strength parameters used in the stability analyses of this study are summarized in Table 2.3 below. These parameters are the same parameters that were used and selected in the Stantec 2016 Geotechnical Report, with the exception of the Cover Soil which is based on the field exploration results, reviewed historical geotechnical information, and engineering judgement.

Table 2.3: Material Parameters for Slope Stability Analysis

Material	Unit Weight	Drained Shear Strengths		Undrained Shear Strengths	Residual Strength
		Effective Friction Angle ϕ'	Effective Cohesion c'	S_u	S_r
	(pcf)	(deg.)	(psf)	(psf)	(psf)
Embankment	129	27.5	198	1400[1]	-
Lean Clay with Sand	127	28	206	1200[1]	-
Clayey Gravel with Sand	130	35	0	-	-
Fly Ash (CCR)	115	25	0	-	$S_r / \sigma_{vc}' =$ 0.04 [6]
Sandy Silt	125	30	0	-	-
Silty Sand	94	30	0	-	-
Cover Soil	125	27	300	1000[1]	-

1. For Seismic (Post Earthquake Analyses) use 80% of Undrained Shear Strength.

Soil strength parameters, with the exception of the Cover Soil, were derived in the Stantec February 2016 CCR Rule Stability Analyses report. The 2016 parameters were developed using CU triaxial test data for the Embankment Fill and Lean Clay with Sand soils. Strength parameters for the proposed Cover Soil were taken to be identical to the parameters of the Lean Clay with Sand soil and its unit weight was selected based on preliminary standard Proctor testing data of a potential borrow source soil. Undrained shear strength parameters for coarse-grained (or cohesionless) materials were taken to be identical to the drained shear strength parameters.

The residual strength of liquefied fly ash (CCR) layers for post-earthquake evaluations was estimated by applying a conservative Residual Shear Strength ratio, τ/σ (Shear Strength/Effective Overburden Stress Ratio) of 0.04 using correlations presented by Idriss and Boulanger between corrected SPT blow counts and the Residual Shear Strength Ratio. SPT blowcounts were obtained from existing site data boring logs and a representative SPT N value of 3 was selected to obtain the selected Residual Shear Strength ratio of 0.04 for the fly ash materials.

2.4 ANALYSIS RESULTS

The computed factors of safety of slope stability for the LRCP closure grading under the evaluated loading conditions are summarized in Table 2.4, along with the target factors of safety according to the established design criteria for the project. The computed output plots, depicting the predicted critical failure surfaces, are presented in Attachment A.

Table 2.4: Computed Slope Stability Factors of Safety

Section	Location	Loading Condition	Computed Slope Stability Factor of Safety	Target Factor of Safety
LRCP Dam	Dam – Downstream Slope	Long Term	2.15	1.5
	Dam – Upstream Slope	Long Term	4.12	1.5
	Dam – Downstream Slope	½ PMF Pool	1.93	1.5
	Dam – Upstream Slope	½ PMF Pool	4.49	1.5
	Dam – Downstream Slope	Seismic (Pseudo-Static)	1.50	1.0
	Dam – Upstream Slope	Seismic (Pseudo-Static)	3.05	1.0
	Dam – Downstream Slope	Seismic (Post-earthquake)	1.66	1.3
	Dam – Upstream Slope	Seismic (Post-earthquake)	4.15	1.3

3.0 CONCLUSION

The calculated factors of safety for the analyzed cases meet the minimum factors of safety required by 329 IAC 10-15-8. This analysis is based on the information discussed in this report and the interpretation of the subsurface conditions encountered at the site. No warranties can be made regarding the continuity of conditions. If future design changes are made, Stantec should be notified so that such changes can be reviewed, and the analysis amended as necessary.

4.0 LIMITATIONS

This report was prepared by Stantec Consulting Services, Inc. (Stantec) for IKEC. Stantec's professional services have been performed using a degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. No other warranty, express or implied, is made as to the professional advice included in this report. This geotechnical report has been prepared for IKEC and is to be used solely for the design of the proposed Closure for the Landfill Runoff Collection Pond at the Clifty Creek Station in Jefferson County, Indiana and may not contain sufficient information for use by other parties.

The recommendations provided in this geotechnical report are based upon our understanding of the described project information and our interpretation of available published information and previous field and laboratory investigations. We have made our recommendations based upon experience with similar subsurface conditions. The recommendations apply to the specific project discussed in this report; therefore, any change in the configuration of the proposed design or any change to the site grades should be provided to us so that we can review our conclusions and recommendations and make any necessary modifications.

The recommendations provided in this report are based upon the assumption that the necessary geotechnical observations and testing during construction will be performed by our firm during the entire duration of the construction. The field observation services are considered a continuation of the geotechnical investigation and are essential to verify that the actual soil conditions are as expected. This also provides for the procedure whereby IKEC may be advised of unexpected or changed conditions that would require modifications of our original recommendations.

5.0 REFERENCES

American Electric Power Service Corporation, (1956). Fly Ash Area Lower Earth Dams No. 1 and 2 Drawings. Indiana Kentucky Electric Corporation, Clifty Creek Plan, Madison, Indiana.

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ATTACHMENT A

SLOPE STABILITY ANALYSES OUTPUTS

Indiana Kentucky Electric Corporation (IKEC)
Clifty Creek Generating Station
Landfill Runoff Collection Pond Dam - Station 405+70
Madison, Indiana

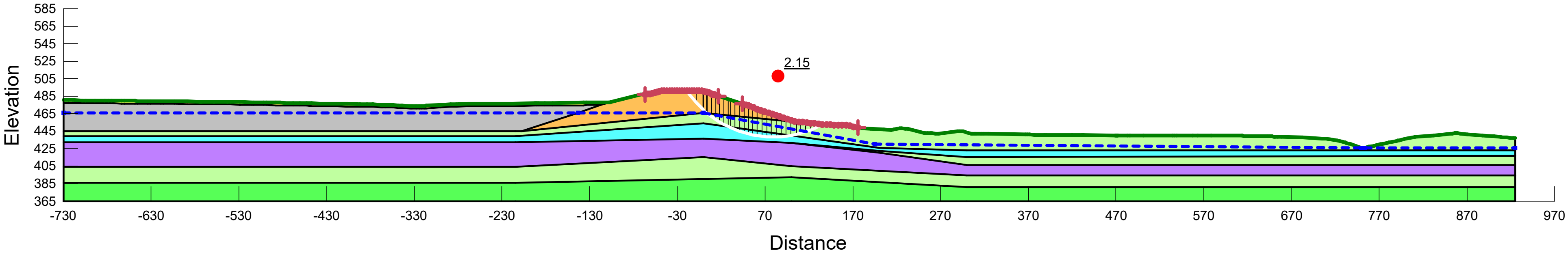
Factor of Safety: 2.15

Long Term, Downstream Slope

Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
🟩	Clayey Gravel with Sand (Drained)	Mohr-Coulomb	130	0	35
🟨	Cover Soil (Drained)	Mohr-Coulomb	125	300	27
🟧	Embankment (Drained)	Mohr-Coulomb	129	198	27.5
⬜	Fly Ash (Drained)	Mohr-Coulomb	115	0	25
🟩	Lean Clay with Sand (Drained)	Mohr-Coulomb	127	206	28
🟦	Sandy Silt (Drained)	Mohr-Coulomb	125	0	30
🟪	Silty Sand (Seismic Undrained)	Mohr-Coulomb	94	0	30

Method: Spencer
Slip Surface: Entry and Exit

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.



Indiana Kentucky Electric Corporation (IKEC)
Clifty Creek Generating Station
Landfill Runoff Collection Pond Dam - Station 405+70
Madison, Indiana

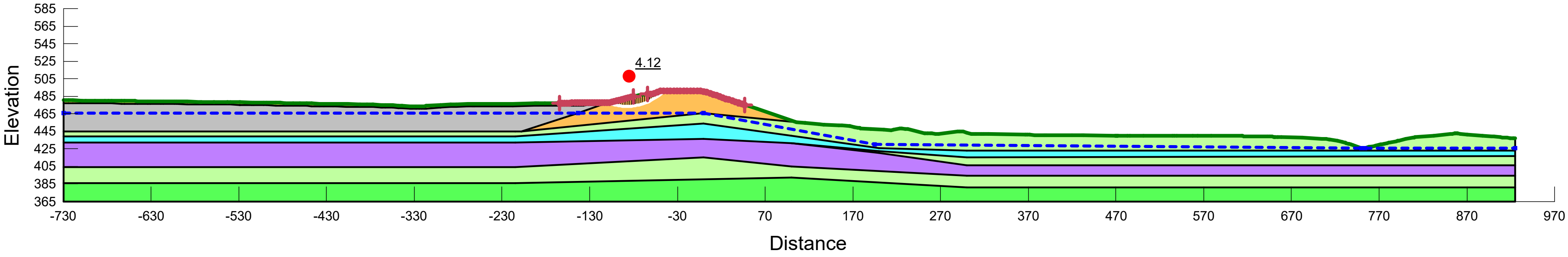
Factor of Safety: 4.12

Long Term, Upstream Slope

Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
🟩	Clayey Gravel with Sand (Drained)	Mohr-Coulomb	130	0	35
🟨	Cover Soil (Drained)	Mohr-Coulomb	125	300	27
🟧	Embankment (Drained)	Mohr-Coulomb	129	198	27.5
⬜	Fly Ash (Drained)	Mohr-Coulomb	115	0	25
🟩	Lean Clay with Sand (Drained)	Mohr-Coulomb	127	206	28
🟦	Sandy Silt (Drained)	Mohr-Coulomb	125	0	30
🟪	Silty Sand (Seismic Undrained)	Mohr-Coulomb	94	0	30

Method: Spencer
Slip Surface: Entry and Exit

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.



Indiana Kentucky Electric Corporation (IKEC)
Clifty Creek Generating Station
Landfill Runoff Collection Pond Dam - Station 405+70
Madison, Indiana

Factor of Safety: 1.93

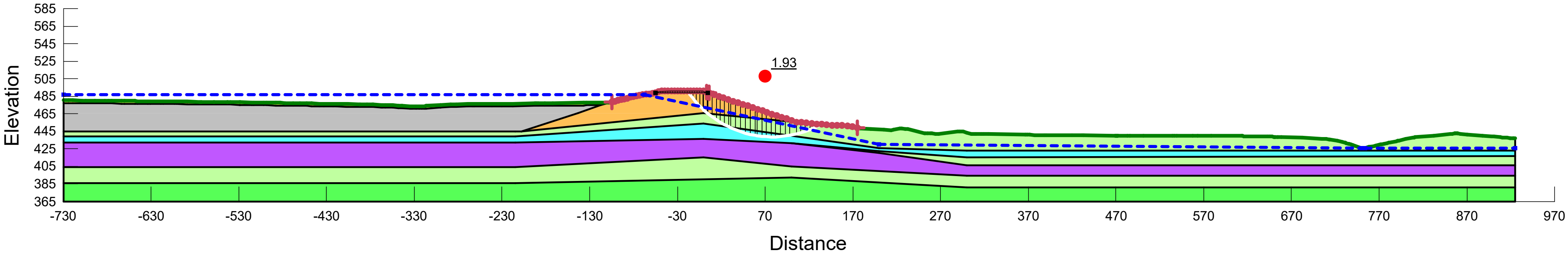
50% PMF Pool, Downstream Slope

50% PMF Pool Elevation: 487 feet

Method: Spencer
Slip Surface: Entry and Exit

Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
🟩	Clayey Gravel with Sand (Drained)	Mohr-Coulomb	130	0	35
🟨	Cover Soil (Drained)	Mohr-Coulomb	125	300	27
🟧	Embankment (Drained)	Mohr-Coulomb	129	198	27.5
⬜	Fly Ash (Drained)	Mohr-Coulomb	115	0	25
🟩	Lean Clay with Sand (Drained)	Mohr-Coulomb	127	206	28
🟦	Sandy Silt (Drained)	Mohr-Coulomb	125	0	30
🟪	Silty Sand (Drained)	Mohr-Coulomb	94	0	30

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.



Indiana Kentucky Electric Corporation (IKEC)
Clifty Creek Generating Station
Landfill Runoff Collection Pond Dam - Station 405+70
Madison, Indiana

Factor of Safety: 4.49

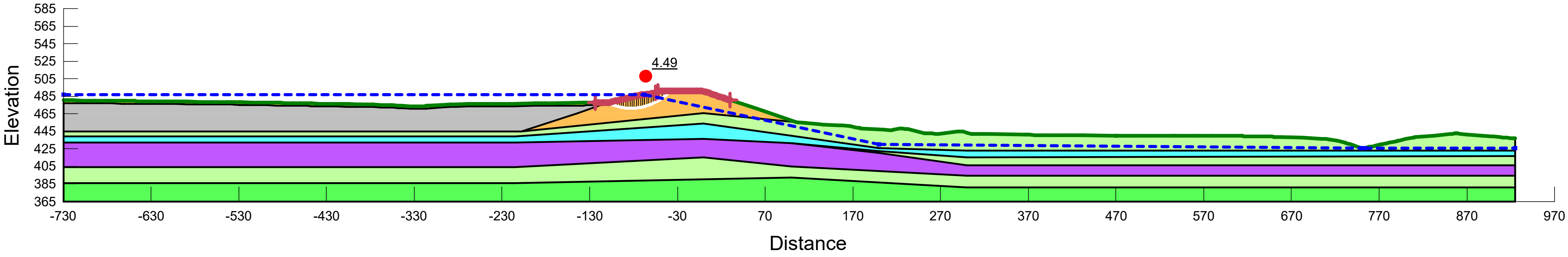
50% PMF Pool, Upstream Slope

50% PMF Pool Elevation: 487 feet

Method: Spencer
Slip Surface: Entry and Exit

Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
🟩	Clayey Gravel with Sand (Drained)	Mohr-Coulomb	130	0	35
🟨	Cover Soil (Drained)	Mohr-Coulomb	125	300	27
🟧	Embankment (Drained)	Mohr-Coulomb	129	198	27.5
⬜	Fly Ash (Drained)	Mohr-Coulomb	115	0	25
🟩	Lean Clay with Sand (Drained)	Mohr-Coulomb	127	206	28
🟦	Sandy Silt (Drained)	Mohr-Coulomb	125	0	30
🟪	Silty Sand (Drained)	Mohr-Coulomb	94	0	30

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.



Indiana Kentucky Electric Corporation (IKEC)
Clifty Creek Generating Station
Landfill Runoff Collection Pond Dam - Station 405+70
Madison, Indiana

Factor of Safety: 1.50

Seismic (Pseudo-static), Downstream Slope

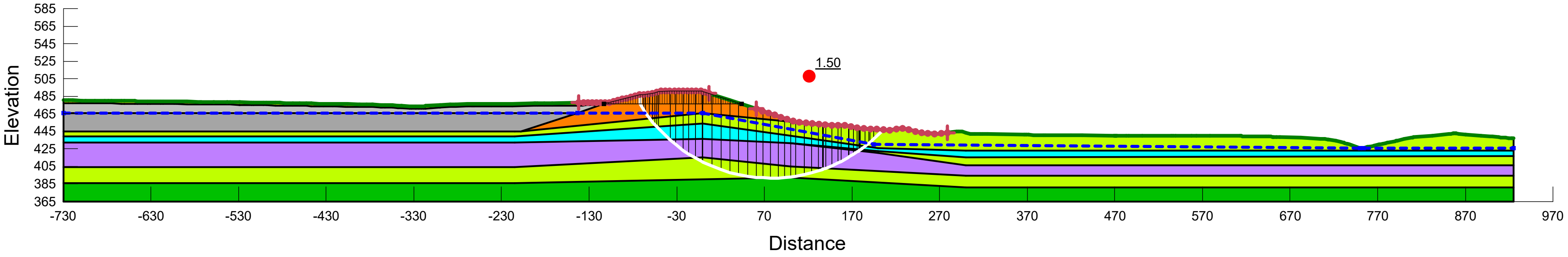
Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Effective Cohesion (psf)	Effective Friction Angle (°)
🟩	Clayey Gravel with Sand (Seismic Undrained)	Mohr-Coulomb	130		0	35
🟨	Cover Soil (Seismic Undrained)	Undrained (Phi=0)	125	1,000		
🟧	Embankment (Seismic Undrained)	Undrained (Phi=0)	129	1,400		
⬜	Fly Ash (Drained)	Mohr-Coulomb	115		0	25
▨	Fly Ash (Seismic Undrained)	Mohr-Coulomb	115		0	25
🟩	Lean Clay with Sand (Seismic Undrained)	Undrained (Phi=0)	127	1,200		
🟦	Sandy Silt (Seismic Undrained)	Mohr-Coulomb	125		0	30
🟪	Silty Sand (Seismic Undrained)	Mohr-Coulomb	94		0	30

Method: Spencer

Slip Surface: Entry and Exit

Horz Seismic Coef.: 0.045

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.



Indiana Kentucky Electric Corporation (IKEC)
Clifty Creek Generating Station
Landfill Runoff Collection Pond Dam - Station 405+70
Madison, Indiana

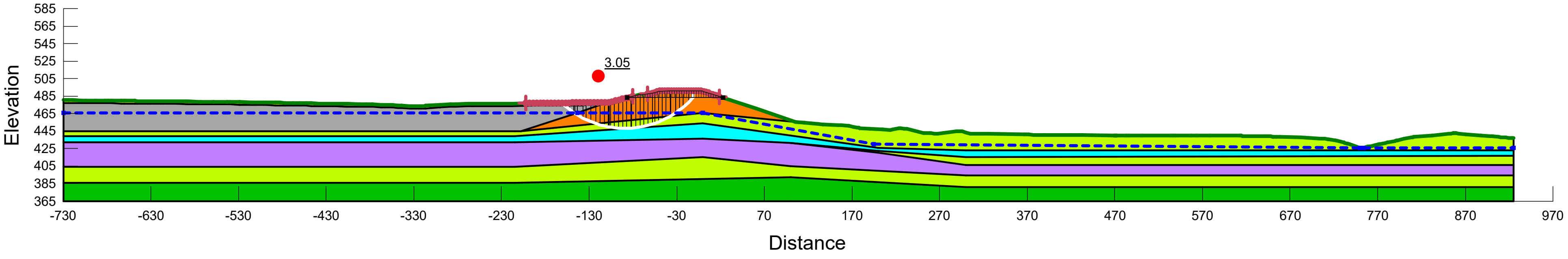
Factor of Safety: 3.05

Seismic (Pseudo-static), Upstream Slope

Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Effective Cohesion (psf)	Effective Friction Angle (°)
🟩	Clayey Gravel with Sand (Seismic Undrained)	Mohr-Coulomb	130		0	35
🟨	Cover Soil (Seismic Undrained)	Undrained (Phi=0)	125	1,000		
🟧	Embankment (Seismic Undrained)	Undrained (Phi=0)	129	1,400		
⬜	Fly Ash (Seismic Undrained)	Mohr-Coulomb	115		0	25
🟩	Lean Clay with Sand (Seismic Undrained)	Undrained (Phi=0)	127	1,200		
🟦	Sandy Silt (Seismic Undrained)	Mohr-Coulomb	125		0	30
🟪	Silty Sand (Seismic Undrained)	Mohr-Coulomb	94		0	30

Method: Spencer
Slip Surface: Entry and Exit
Horz Seismic Coef.: 0.045

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.



Indiana Kentucky Electric Corporation (IKEC)
Clifty Creek Generating Station
Landfill Runoff Collection Pond Dam - Station 405+70
Madison, Indiana

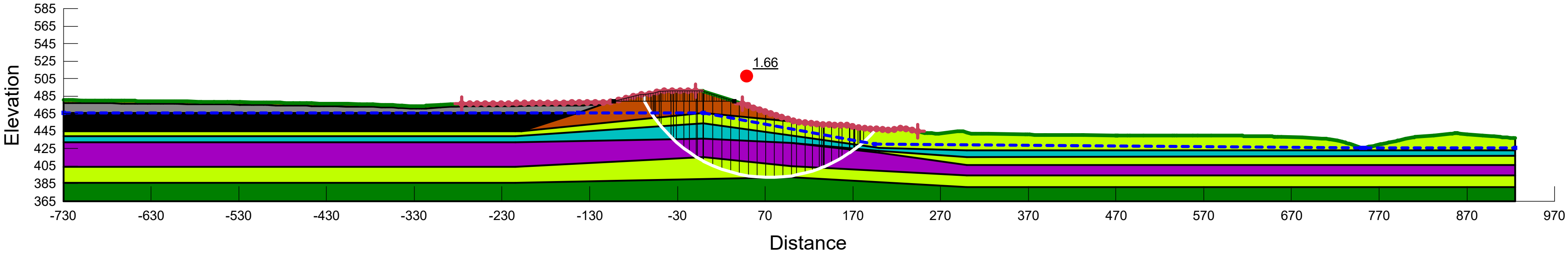
Factor of Safety: 1.66

Seismic (Post Earthquake), Downstream Slope

Color	Name	Model	Unit Weight (pcf)	Tau/Sigma Ratio	Cohesion (psf)	Effective Cohesion (psf)	Effective Friction Angle (°)
🟩	Clayey Gravel with Sand (Post Earthquake)	Mohr-Coulomb	130			0	35
🟨	Cover Soil (Post Earthquake)	Undrained (Phi=0)	125		800		
🟧	Embankment (Post Earthquake)	Mohr-Coulomb	129			1,120	27.5
◼	Fly Ash (Post Earthquake)	Mohr-Coulomb	115			0	25
⬛	Fly Ash (Residual Strength)	SHANSEP	115	0.04			
🟨	Lean Clay with Sand (Post Earthquake)	Undrained (Phi=0)	127		960		
🟦	Sandy Silt (Post Earthquake)	Mohr-Coulomb	125			0	30
🟪	Silty Sand (Post Earthquake)	Mohr-Coulomb	94			0	30

Method: Spencer
Slip Surface: Entry and Exit

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.



Indiana Kentucky Electric Corporation (IKEC)
Clifty Creek Generating Station
Landfill Runoff Collection Pond Dam - Station 405+70
Madison, Indiana

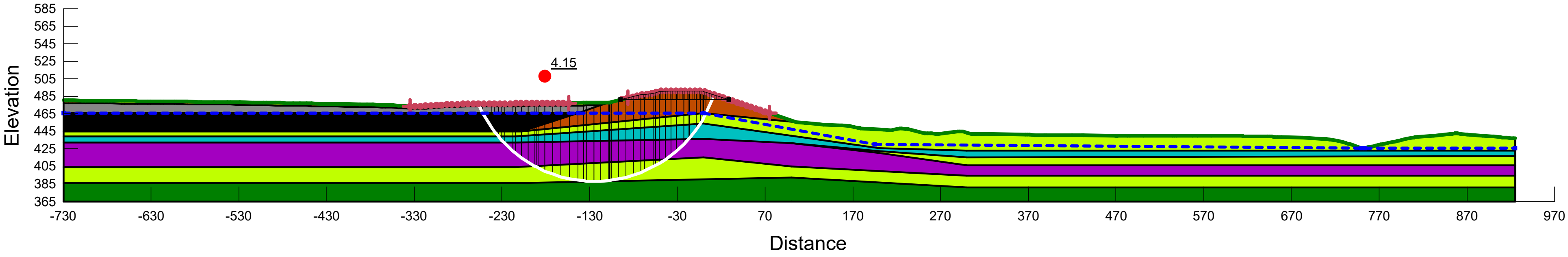
Factor of Safety: 4.15

Seismic (Post Earthquake), Upstream Slope

Color	Name	Model	Unit Weight (pcf)	Tau/Sigma Ratio	Cohesion (psf)	Effective Cohesion (psf)	Effective Friction Angle (°)
🟩	Clayey Gravel with Sand (Post Earthquake)	Mohr-Coulomb	130			0	35
🟨	Cover Soil (Post Earthquake)	Undrained (Phi=0)	125		800		
🟧	Embankment (Post Earthquake)	Mohr-Coulomb	129			1,120	27.5
▨	Fly Ash (Post Earthquake)	Mohr-Coulomb	115			0	25
⬛	Fly Ash (Residual Strength)	SHANSEP	115	0.04			
🟩	Lean Clay with Sand (Post Earthquake)	Undrained (Phi=0)	127		960		
🟦	Sandy Silt (Post Earthquake)	Mohr-Coulomb	125			0	30
🟪	Silty Sand (Post Earthquake)	Mohr-Coulomb	94			0	30

Method: Spencer
Slip Surface: Entry and Exit

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.



APPENDIX G

LRCP Permit Drawings

PERMIT DRAWINGS

POND CLOSURE
LANDFILL RUNOFF COLLECTION POND
CLIFTY CREEK STATION
JEFFERSON COUNTY, MADISON TOWNSHIP, INDIANA

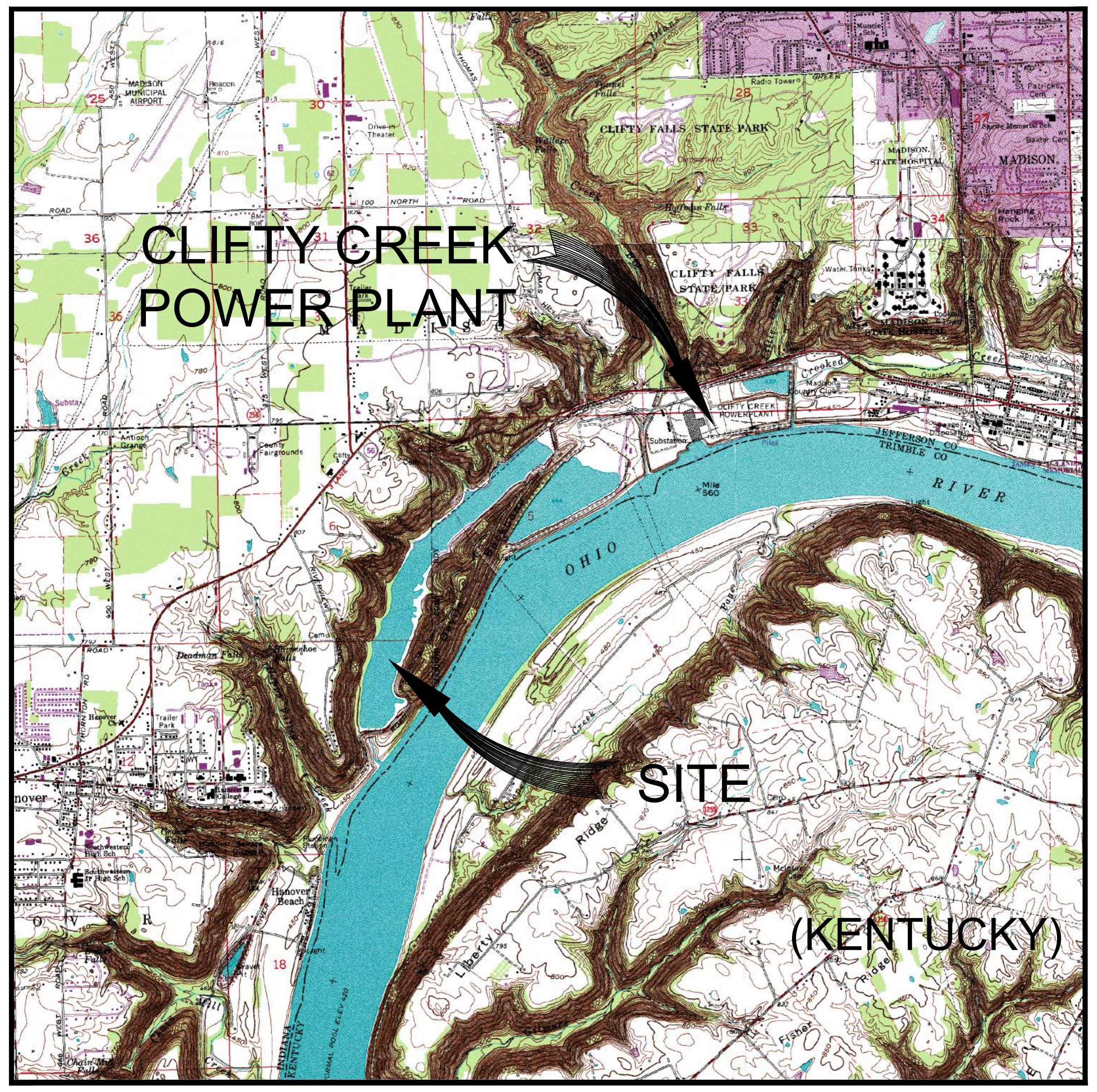
PREPARED FOR

OVEC IKEC
Ohio Valley Electric Corporation / Indiana-Kentucky Electric Corporation

PIKETON, OHIO

INDEX OF SHEETS

SHEET NO.	DRAWING NO.	DESCRIPTION	REVISION
01	P-LRCP-001-CVR	COVER SHEET	A
02	P-LRCP-101-OVR	OVERVIEW / SEQUENCING PLAN	A
03	P-LRCP-102-EC1	EXISTING CONDITIONS	A
04	P-LRCP-104-FG1	FINAL GRADING PLAN - PHASE 1 STORMWATER RUN-ON DIVERSION	A
05	P-LRCP-106-FG3	FINAL GRADING PLAN - PHASE 2 LRCP CAP CLOSURE	A
06	P-LRCP-201-EP	EROSION PREVENTION AND SEDIMENT CONTROL	A
07	P-LRCP-202-SMP	STORMWATER MANAGEMENT PLAN	A
08	P-LRCP-220-PR1	PROFILE - DIVERSION DITCH BASELINE	A
09	P-LRCP-221-PR2	PROFILE - LRCP CLOSURE MAIN CHANNEL BASELINE	A
10	P-LRCP-301-XS	CROSS SECTIONS - MAIN CHANNEL BASELINE	A
11	P-LRCP-501-DTL	CIVIL DETAILS	A
12	P-LRCP-502-DTL	CIVIL DETAILS	A



VICINITY MAP

PREPARED BY

Stantec

Stantec Consulting
Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
Tel. 513.842.8200
www.stantec.com

ISSUED FOR PERMIT

Stantec
Stantec
11687 Lebanon Road
Cincinnati, Ohio 45241-2012
Tel: (513) 842-8200
www.stantec.com

Consultant

Notes

Revision	By	Appd	YYYY.MM.DD

Issued	By	Appd	YYYY.MM.DD
A ISSUED FOR PERMIT	ACS	MCV	2021.04.16

File Name: LRCP_39026C-001-CVR	ACS	ACS	MCV	2021.04.16
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

Permit/Seal

MATTHEW C. VAUGHAN
No. PE11012285
STATE OF INDIANA
Matthew C. Vaughan
6/16/21

Client/Project Logo

OVEC IKEC
Ohio Valley Electric Corporation / Indiana-Kentucky Electric Corporation

Client/Project
OHIO VALLEY ELECTRIC CORPORATION
INDIANA-KENTUCKY ELECTRIC CORPORATION

POND CLOSURE - LANDFILL RUNOFF
COLLECTION POND, CLIFTY CREEK STATION

MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
COVER SHEET

Project No. 175539026
Scale AS SHOWN
Revision A
Sheet 1
Drawing No. P-LRCP-001-CVR

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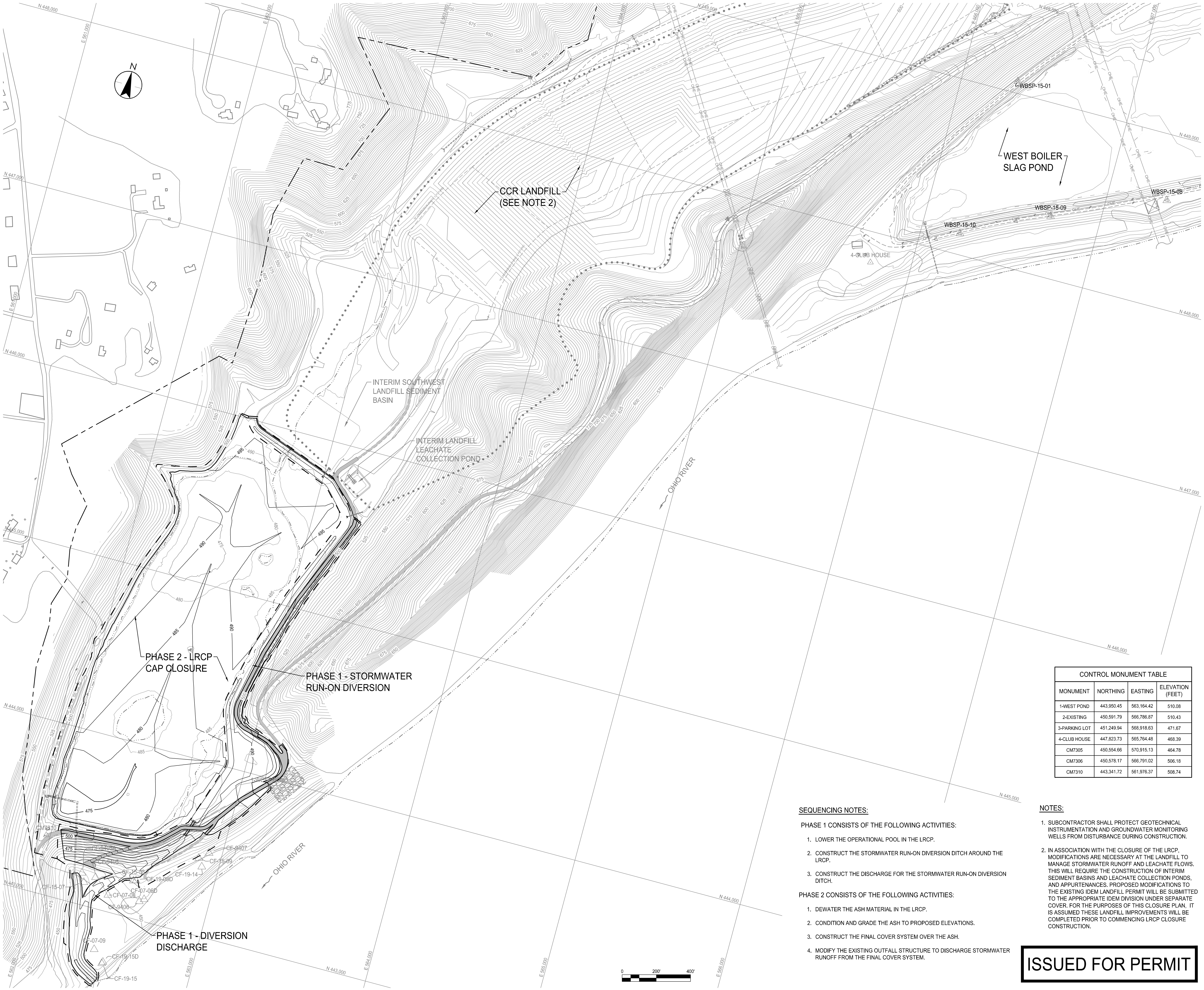

SEQUENCING NOTES:

PHASE 1 CONSISTS OF THE FOLLOWING ACTIVITIES:

1. LOWER THE OPERATIONAL POOL IN THE LRCP.
2. CONSTRUCT THE STORMWATER RUN-ON DIVERSION DITCH AROUND THE LRCP.
3. CONSTRUCT THE DISCHARGE FOR THE STORMWATER RUN-ON DIVERSION DITCH.

PHASE 2 CONSISTS OF THE FOLLOWING ACTIVITIES:

1. DEWATER THE ASH MATERIAL IN THE LRCP.
2. CONDITION AND GRADE THE ASH TO PROPOSED ELEVATIONS.
3. CONSTRUCT THE FINAL COVER SYSTEM OVER THE ASH.
4. MODIFY THE EXISTING OUTFALL STRUCTURE TO DISCHARGE STORMWATER RUNOFF FROM THE FINAL COVER SYSTEM.

CONTROL MONUMENT TABLE

MONUMENT	NORTHING	EASTING	ELEVATION (FEET)
1-WEST POND	443,950.45	563,164.42	510.08
2-EXISTING	450,591.79	566,786.87	510.43
3-PARKING LOT	451,249.94	568,918.63	471.67
4-CLUB HOUSE	447,823.73	565,764.48	468.39
CM7305	450,554.66	570,915.13	464.78
CM7306	450,578.17	566,791.02	506.18
CM7310	443,341.72	561,976.37	508.74

NOTES:

1. SUBCONTRACTOR SHALL PROTECT GEOTECHNICAL INSTRUMENTATION AND GROUNDWATER MONITORING WELLS FROM DISTURBANCE DURING CONSTRUCTION.
2. IN ASSOCIATION WITH THE CLOSURE OF THE LRCP, MODIFICATIONS ARE NECESSARY AT THE LANDFILL TO MANAGE STORMWATER RUNOFF AND LEACHATE FLOWS. THIS WILL REQUIRE THE CONSTRUCTION OF INTERIM SEDIMENT BASINS AND LEACHATE COLLECTION PONDS, AND APPURTENANCES. PROPOSED MODIFICATIONS TO THE EXISTING IDEM LANDFILL PERMIT WILL BE SUBMITTED TO THE APPROPRIATE IDEM DIVISION UNDER SEPARATE COVER. FOR THE PURPOSES OF THIS CLOSURE PLAN, IT IS ASSUMED THESE LANDFILL IMPROVEMENTS WILL BE COMPLETED PRIOR TO COMMENCING LRCP CLOSURE CONSTRUCTION.

ISSUED FOR PERMIT

Stantec
11687 Lebanon Road
Cincinnati, Ohio 45241-2012
Tel: (513) 842-8200
www.stantec.com

Consultant

Notes

MAPPING SOURCE NOTE:

TOPOGRAPHIC, BATHYMETRIC, AND PLANIMETRIC SURVEY INFORMATION FOR THE PLANS WERE OBTAINED FROM MAPPING PROVIDED BY INDIANA-KENTUCKY ELECTRIC CORPORATION (IKEC) AND AMERICAN ELECTRIC POWER (AEP). FIELD SURVEY OF THE WEST BOILER SLAG POND ARE WAS PERFORMED JULY THROUGH OCTOBER 2020 BY HREZO ENGINEERING, INC.. FIELD SURVEY OF THE LANDFILL RUNOFF COLLECTION POND WAS PERFORMED SEPTEMBER THROUGH DECEMBER 2020 BY HREZO ENGINEERING, INC.. ACTIVE WORK AREAS NOT COVERED IN THE 2020 SURVEYS ARE BASED ON AERIAL AND FIELD SURVEYS DATED APRIL 2018, MAY 2018, AND SEPTEMBER 2019. SOME AREAS OUTSIDE OF RECENT WORK ZONES WERE SUPPLEMENTED WITH DATA USED IN THE LANDFILL PERMIT AND CONSTRUCTION DRAWINGS (AERIAL AND FIELD SURVEYS DATED 1992, 2005, 2007, 2008) AND 2011 - 2013 INDIANA STATEWIDE LIDAR (EAST). HORIZONTAL DATUM IS NAD27 AND VERTICAL DATUM IS NAVD88.

LEGEND

⊠	ELECTRIC TOWER
PB ◇	ELECTRIC PULLBOX
	TREE/SHRUB
	ELECTRIC POLE
	POWER POLE
CB ☐	STORM CATCH BASIN
OHE	OVERHEAD ELECTRIC
UGE	UNDERGROUND ELECTRIC
X	FENCE
	PROPERTY LINE
	RAILROAD TRACKS
ST	STORM SEWER
	EDGE OF WATER
	TREELINE
450	EXISTING INDEX CONTOUR
	EXISTING INTERMEDIATE CONTOUR
→→→→	DITCH / FLOW DIRECTION
450	PROPOSED INDEX CONTOUR
	PROPOSED INTERMEDIATE CONTOUR
● ● ● ●	TYPE I LANDFILL WASTE BOUNDARY
△	GROUNDWATER MONITORING WELL
△	CONTROL MONUMENT
	PHASE BOUNDARY

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Revision	By	Appd	YYYY.MM.DD
A ISSUED FOR PERMIT	ACS	MCV	2021.04.16
Issued	By	Appd	YYYY.MM.DD

File Name: 02_LRCP_39026C-101-OVR	ACS	ACS	MCV	2021.04.16
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

Permit/Seal

MATTHEW C. VAUGHAN
No. PE11012285
6/16/21

Client/Project Logo

Client/Project
OHIO VALLEY ELECTRIC CORPORATION
INDIANA-KENTUCKY ELECTRIC CORPORATION

POND CLOSURE - LANDFILL RUNOFF
COLLECTION POND, CLIFTY CREEK STATION

MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
OVERVIEW / SEQUENCING PLAN

Project No.
175539026

Scale
AS SHOWN

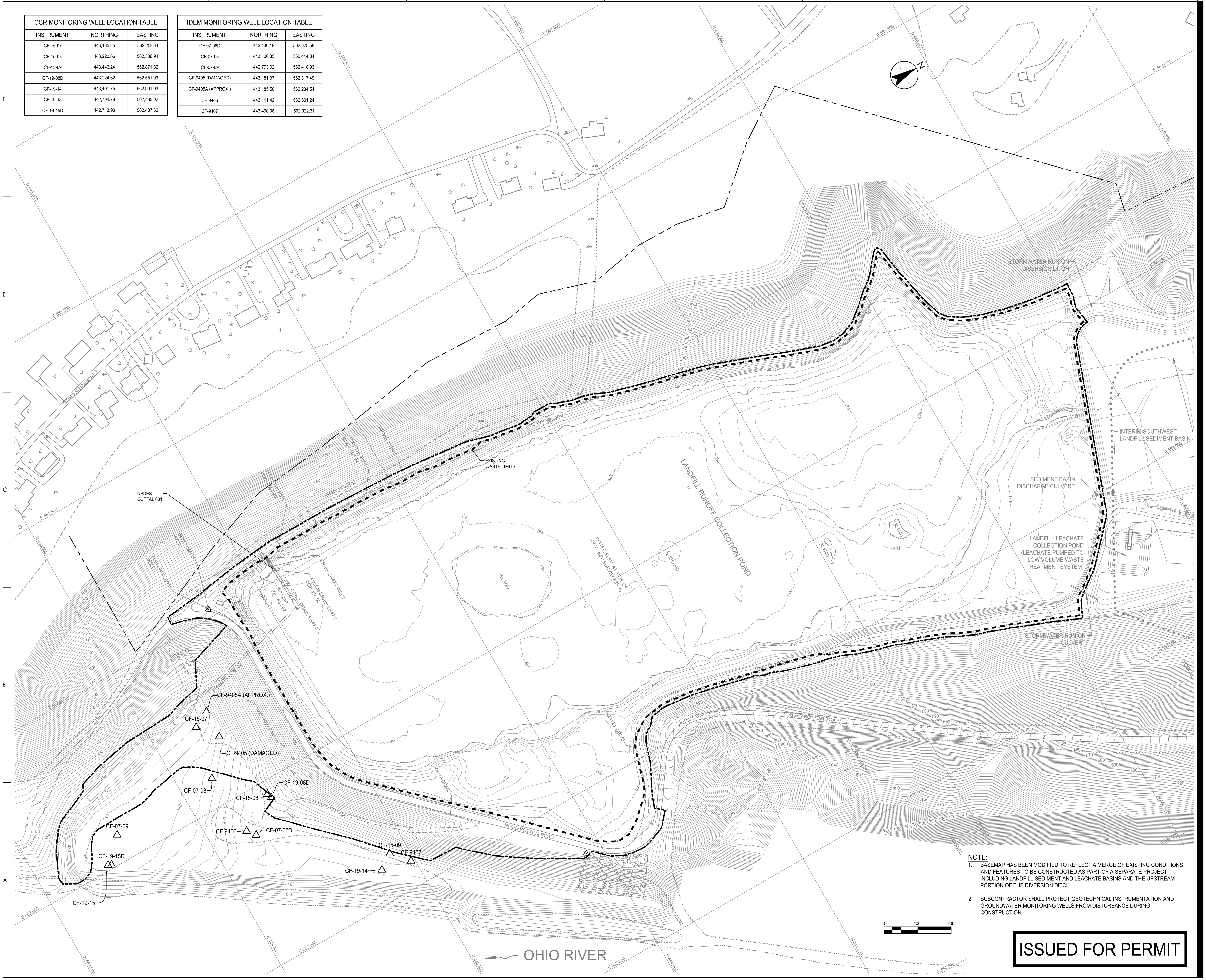
Revision
A

Sheet
2

Drawing No.
P-LRCP-101-OVR

CCR MONITORING WELL LOCATION TABLE		
INSTRUMENT	NORTHING	EASTING
CF-15-07	443,135.65	562,259.41
CF-15-08	443,220.06	562,536.94
CF-15-09	443,446.24	562,871.82
CF-19-08D	443,224.62	562,551.03
CF-19-14	443,401.75	562,901.93
CF-19-15	442,704.78	562,483.02
CF-19-15D	442,713.90	562,487.60

IDEM MONITORING WELL LOCATION TABLE		
INSTRUMENT	NORTHING	EASTING
CF-07-06D	443,130.19	562,625.58
CF-07-08	443,100.35	562,414.34
CF-07-09	442,773.02	562,418.93
CF-9405 (DAMAGED)	443,181.37	562,317.49
CF-9405A (APPROX.)	443,185.50	562,234.54
CF-9406	443,111.42	562,601.24
CF-9407	443,490.08	562,922.31



NOTE:
1. BASEMAP HAS BEEN MODIFIED TO REFLECT A MERGE OF EXISTING CONDITIONS AND FEATURES TO BE CONSTRUCTED AS PART OF A SEPARATE PROJECT INCLUDING LANDFILL SEDIMENT AND LEACHATE BASINS AND THE UPSTREAM PORTION OF THE DIVERSION DITCH.
2. SUBCONTRACTOR SHALL PROTECT GEOTECHNICAL INSTRUMENTATION AND GROUNDWATER MONITORING WELLS FROM DISTURBANCE DURING CONSTRUCTION.

ISSUED FOR PERMIT

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11687 Lebanon Road
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Notes

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NOTES:

WASTE LIMITS SHOWN ON THESE PLANS HAVE BEEN IDENTIFIED USING HISTORICAL OPERATIONAL DOCUMENTS AND CONVERSATIONS WITH IKEC/OVEC PERSONNEL. WASTE BOUNDARY LOCATION WILL BE VERIFIED IN THE FIELD DURING CLOSURE ACTIVITIES AND UPDATED IN THE AS-BUILT DOCUMENTATION.

LEGEND

⊠	ELECTRIC TOWER
PB ◇	ELECTRIC PULLBOX
✿	TREE/SHRUB
-o-	ELECTRIC POLE
∮	POWER POLE
CB ☐	STORM CATCH BASIN
—— OHE ——	OVERHEAD ELECTRIC
—— UGE ——	UNDERGROUND ELECTRIC
—— X ——	FENCE
—— — — ——	PROPERTY LINE
┼┼┼┼┼┼┼┼	RAILROAD TRACKS
—— ST ——	STORM SEWER
— ··· — ··· —	EDGE OF WATER
⌒⌒⌒⌒	TREELINE
—— 450 ——	EXISTING INDEX CONTOUR
————	EXISTING INTERMEDIATE CONTOUR
△	GROUNDWATER MONITORING WELL
⚠	CONTROL MONUMENT
● ● ● ● ● ●	TYPE I LANDFILL WASTE BOUNDARY
▪ ▬ ▪ ▬ ▪	EXISTING WASTE LIMITS
▬ ▬ ▬ ▬	CONSTRUCTION LIMITS

Revision	By	Appd	YYYY.MM.DD
0			

Issued	By	Appd	YYYY.MM.DD
A ISSUED FOR PERMIT	ACS	MCV	2021.04.16

File Name: 03_LRCP_39026C-102-103_EC1-EC2	ACS	ACS	MCV	2021.04.16
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

Permit/Seal

MATTHEW C. VAUGHAN
No. PE11012285
6/16/21

Client/Project Logo

Client/Project
OHIO VALLEY ELECTRIC CORPORATION
INDIANA-KENTUCKY ELECTRIC CORPORATION
POND CLOSURE - LANDFILL RUNOFF COLLECTION POND, CLIFTY CREEK STATION
MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
EXISTING CONDITIONS

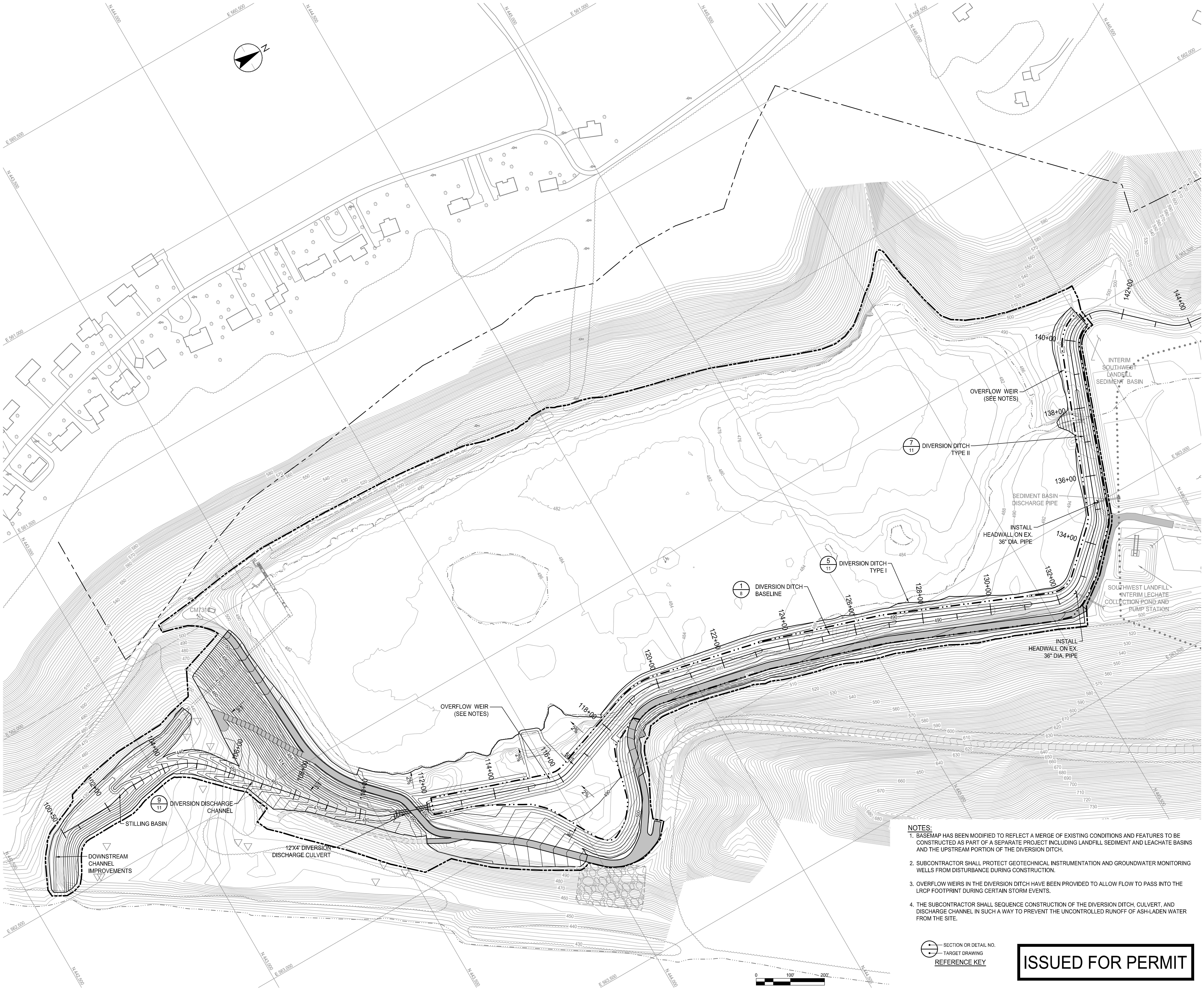
Project No.
175539026

Scale
1"=100'

Revision
A

Sheet
3

Drawing No.
P-LRCP-102-EC1



NOTES:

1. BASEMAP HAS BEEN MODIFIED TO REFLECT A MERGE OF EXISTING CONDITIONS AND FEATURES TO BE CONSTRUCTED AS PART OF A SEPARATE PROJECT INCLUDING LANDFILL SEDIMENT AND LEACHATE BASINS AND THE UPSTREAM PORTION OF THE DIVERSION DITCH.
2. SUBCONTRACTOR SHALL PROTECT GEOTECHNICAL INSTRUMENTATION AND GROUNDWATER MONITORING WELLS FROM DISTURBANCE DURING CONSTRUCTION.
3. OVERFLOW WEIRS IN THE DIVERSION DITCH HAVE BEEN PROVIDED TO ALLOW FLOW TO PASS INTO THE LRCP FOOTPRINT DURING CERTAIN STORM EVENTS.
4. THE SUBCONTRACTOR SHALL SEQUENCE CONSTRUCTION OF THE DIVERSION DITCH, CULVERT, AND DISCHARGE CHANNEL IN SUCH A WAY TO PREVENT THE UNCONTROLLED RUNOFF OF ASH-LADEN WATER FROM THE SITE.

SECTION OR DETAIL NO.
TARGET DRAWING
REFERENCE KEY

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MAPPING SOURCE NOTE:

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LEGEND

ELECTRIC TOWER
PB ELECTRIC PULLBOX
TREE/SHRUB
ELECTRIC POLE
POWER POLE
CB STORM CATCH BASIN
OHE OVERHEAD ELECTRIC
UGE UNDERGROUND ELECTRIC
X FENCE
PROPERTY LINE
RAILROAD TRACKS
ST STORM SEWER
EDGE OF WATER
TREELINE
450 EXISTING INDEX CONTOUR
EXISTING INTERMEDIATE CONTOUR
450 PROPOSED INDEX CONTOUR
PROPOSED INTERMEDIATE CONTOUR
GROUNDWATER MONITORING WELL
CONTROL MONUMENT
GRADING LIMITS
TYPE I LANDFILL WASTE BOUNDARY
CONSTRUCTION LIMITS
COVER SYSTEM LIMITS
PROPOSED PIEZOMETER

Revision	By	Appd	YYYY.MM.DD

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04_LRCP_39026C-104-105-FG01-FG02-PH1	ACS	ACS	MCV	2021.04.16

Permit/Seal

MATTHEW C. VAUGHAN
No. PE11012285
Matthew C. Vaughan
6/16/21

Client/Project Logo

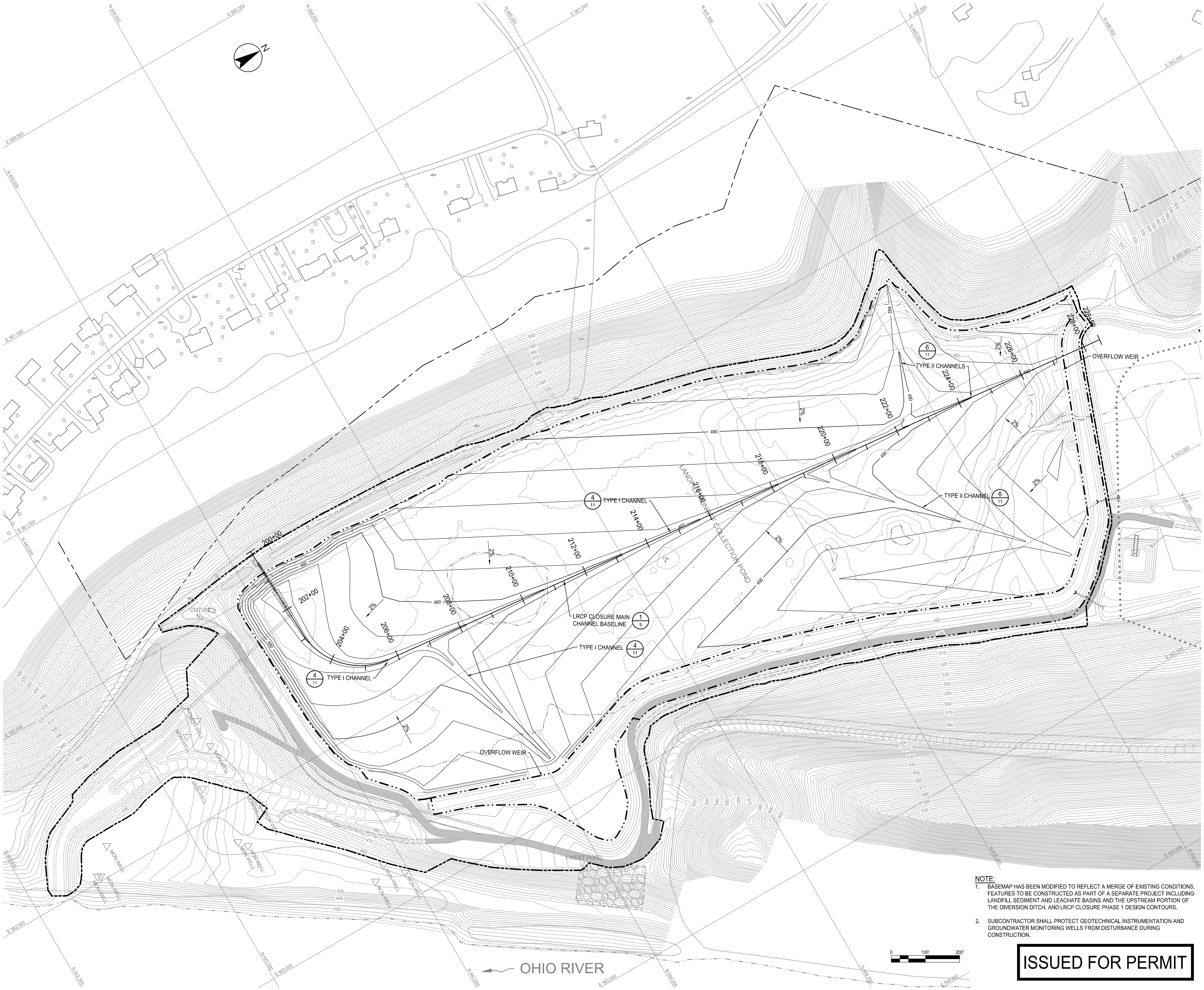
Client/Project
OHIO VALLEY ELECTRIC CORPORATION
INDIANA-KENTUCKY ELECTRIC CORPORATION

POND CLOSURE - LANDFILL RUNOFF
COLLECTION POND, CLIFTY CREEK STATION

MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
FINAL GRADING PLAN - PHASE 1
STORMWATER RUN-ON DIVERSION
AND OUTFALL

Project No. 175539026
Scale 1" = 100'
Revision A
Sheet 4
Drawing No. P-LRCP-104-FG1



NOTE:

1. BASEMAP HAS BEEN MODIFIED TO REFLECT A MERGE OF EXISTING CONDITIONS, FEATURES TO BE CONSTRUCTED AS PART OF A SEPARATE PROJECT INCLUDING LANDFILL SEDIMENT AND LEACHATE BASINS AND THE UPSTREAM PORTION OF THE DIVERSION DITCH, AND LRCP CLOSURE PHASE 1 DESIGN CONTOURS.

2. SUBCONTRACTOR SHALL PROTECT GEOTECHNICAL INSTRUMENTATION AND GROUNDWATER MONITORING WELLS FROM DISTURBANCE DURING CONSTRUCTION.

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LEGEND

☒	ELECTRIC TOWER
PB ◇	ELECTRIC PULLBOX
✿	TREE/SHRUB
-o-	ELECTRIC POLE
ϕ	POWER POLE
CB ☐	STORM CATCH BASIN
—OHE—	OVERHEAD ELECTRIC
—UGE—	UNDERGROUND ELECTRIC
—X—	FENCE
— — —	PROPERTY LINE
┼┼┼┼	RAILROAD TRACKS
—ST—	STORM SEWER
—···—···	EDGE OF WATER
︵︵︵	TREELINE
—450—	EXISTING INDEX CONTOUR
——	EXISTING INTERMEDIATE CONTOUR
—450—	PROPOSED INDEX CONTOUR
——	PROPOSED INTERMEDIATE CONTOUR
△	GROUNDWATER MONITORING WELL
△	CONTROL MONUMENT
——	GRADING LIMITS
● ● ● ●	TYPE I LANDFILL WASTE BOUNDARY
— — —	CONSTRUCTION LIMITS
—··—··	COVER SYSTEM LIMITS
▣	PROPOSED PIEZOMETER

Revision	By	Appd	YYYY.MM.DD

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A ISSUED FOR PERMIT	ACS	MCV	2021.04.16

File Name: 05_LRCP_39026C-106-FG03-PH2	ACS	ACS	MCV	2021.04.16
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

Permit/Seal

MATTHEW C. VAUGHAN
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Matthew C. Vaughan
6/16/21

Client/Project Logo

OVEC IKEC
Ohio Valley Electric Corporation / Indiana-Kentucky Electric Corporation

Client/Project
OHIO VALLEY ELECTRIC CORPORATION
INDIANA-KENTUCKY ELECTRIC CORPORATION

POND CLOSURE - LANDFILL RUNOFF
COLLECTION POND, CLIFTY CREEK STATION

MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title

FINAL GRADING PLAN - PHASE 2
LRCP CAP CLOSURE

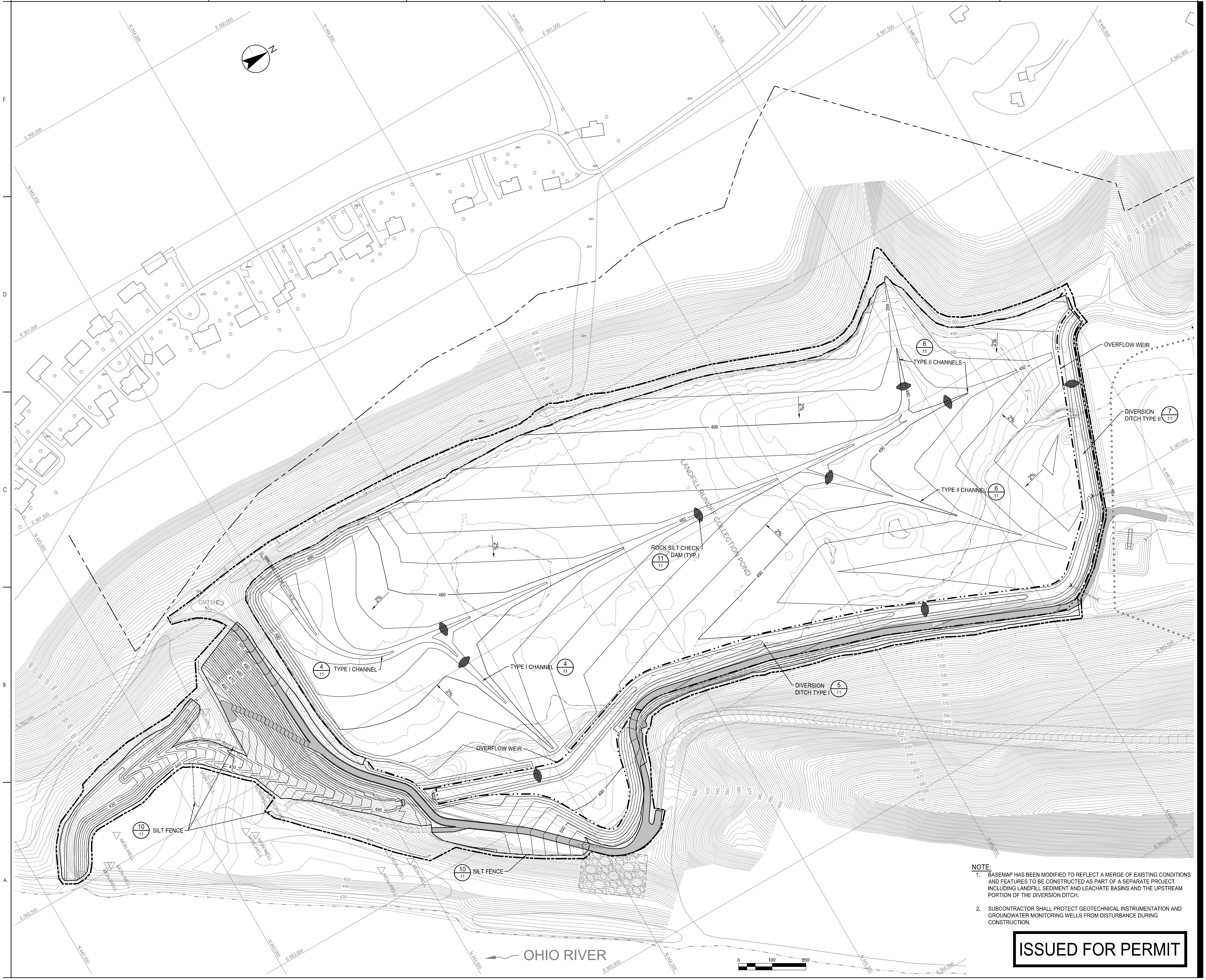
Project No.
175539026

Scale
1" = 100'

Revision
A

Sheet
5

Drawing No.
P-LRCP-106-FG3



NOTE:
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2. SUBCONTRACTOR SHALL PROTECT GEOTECHNICAL INSTRUMENTATION AND GROUNDWATER MONITORING WELLS FROM DISTURBANCE DURING CONSTRUCTION.

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LEGEND

⊠	ELECTRIC TOWER
PB ◇	ELECTRIC PULLBOX
✿	TREE/SHRUB
-o-	ELECTRIC POLE
∅	POWER POLE
CB ☐	STORM CATCH BASIN
—— OHE ——	OVERHEAD ELECTRIC
—— UGE ——	UNDERGROUND ELECTRIC
—— X ——	FENCE
— — — —	PROPERTY LINE
┼┼┼┼┼┼┼	RAILROAD TRACKS
—— ST ——	STORM SEWER
—···—···—	EDGE OF WATER
⌒⌒⌒⌒	TREELINE
—— 450 ——	EXISTING INDEX CONTOUR
————	EXISTING INTERMEDIATE CONTOUR
—— 450 ——	PROPOSED INDEX CONTOUR
————	PROPOSED INTERMEDIATE CONTOUR
△	GROUNDWATER MONITORING WELL
△	CONTROL MONUMENT
————	GRADING LIMITS
• • • • • •	TYPE I LANDFILL WASTE BOUNDARY
— — — —	CONSTRUCTION LIMITS
— · · — · · —	COVER SYSTEM LIMITS
▣	PROPOSED PIEZOMETER
—SF—SF—SF—	SILT FENCE
⬢	ROCK SILT CHECK DAM

Revision	By	Appd	YYYY.MM.DD

Issued	By	Appd	YYYY.MM.DD
A ISSUED FOR PERMIT	ACS	MCV	2021.04.16

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Permit/Seal

MATTHEW C. VAUGHAN
No. PE11012285
Matthew C. Vaughan
6/16/21

Client/Project Logo

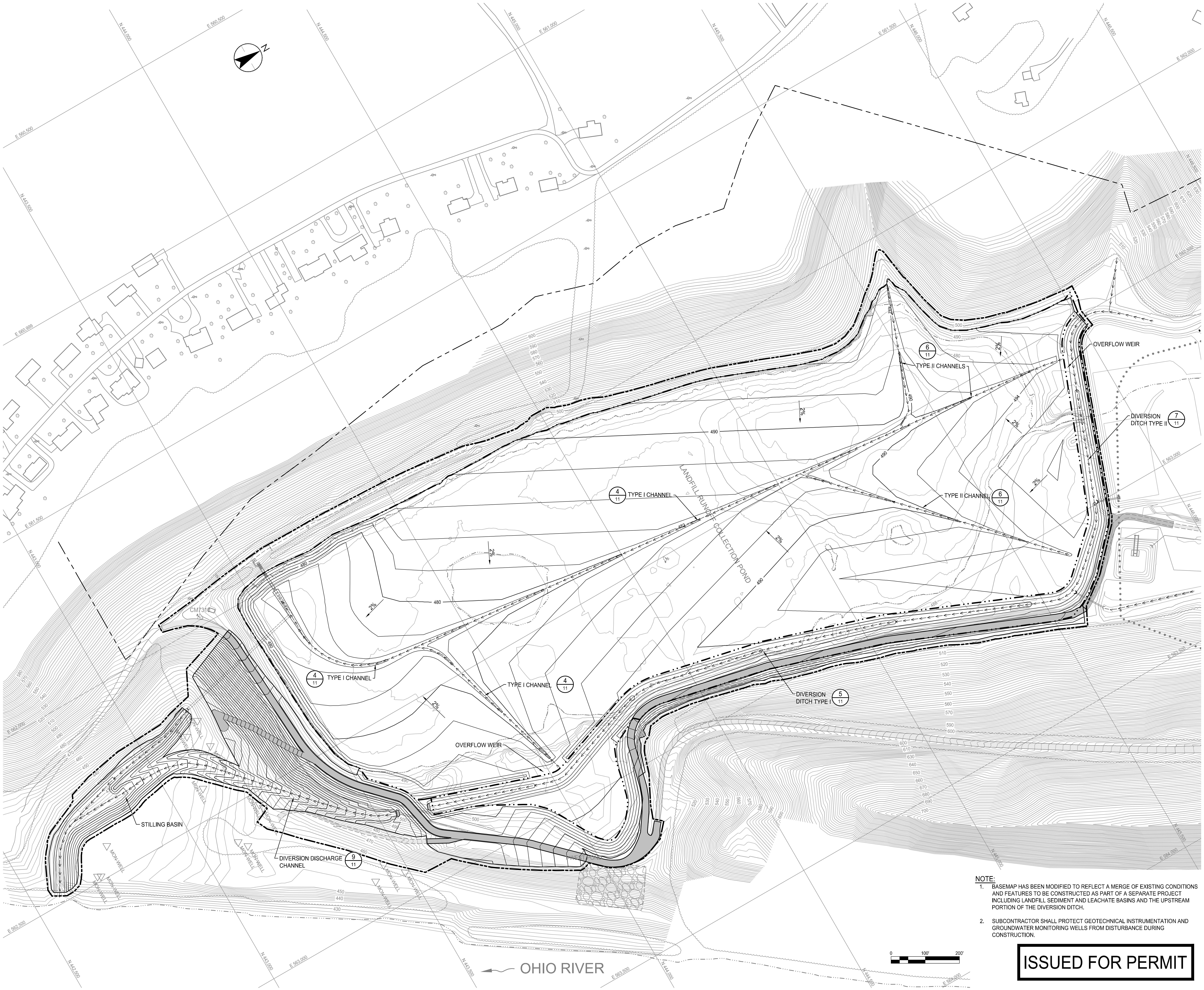
Client/Project
OHIO VALLEY ELECTRIC CORPORATION
INDIANA-KENTUCKY ELECTRIC CORPORATION

POND CLOSURE - LANDFILL RUNOFF
COLLECTION POND, CLIFTY CREEK STATION

MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
LRCP EROSION PREVENTION AND
SEDIMENT CONTROL

Project No. 175539026
Scale 1" = 100'
Revision A
Sheet 6
Drawing No. P-LRCP-201-EP



NOTE:

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Notes

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LEGEND

⊠	ELECTRIC TOWER
PB ◇	ELECTRIC PULLBOX
✿	TREE/SHRUB
-○-	ELECTRIC POLE
⌀	POWER POLE
CB □	STORM CATCH BASIN
—— OHE ——	OVERHEAD ELECTRIC
—— UGE ——	UNDERGROUND ELECTRIC
—— X ——	FENCE
— — — —	PROPERTY LINE
┼┼┼┼┼┼┼	RAILROAD TRACKS
—— ST ——	STORM SEWER
—·· —·· —	EDGE OF WATER
⌒⌒⌒⌒	TREELINE
—— 450 ——	EXISTING INDEX CONTOUR
———	EXISTING INTERMEDIATE CONTOUR
—— 450 ——	PROPOSED INDEX CONTOUR
———	PROPOSED INTERMEDIATE CONTOUR
△	GROUNDWATER MONITORING WELL
△	CONTROL MONUMENT
———	GRADING LIMITS
● ● ● ● ●	TYPE I LANDFILL WASTE BOUNDARY
▬ ▬ ▬ ▬	CONSTRUCTION LIMITS
▬ · · ▬ · · ▬	COVER SYSTEM LIMITS
▣	PROPOSED PIEZOMETER

Revision	By	Appd	YYYY.MM.DD
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Issued	By	Appd	YYYY.MM.DD
A ISSUED FOR PERMIT	ACS	MCV	2021.04.16

File Name: 07_LRCP_39026C-202-STORM	ACS	ACS	MCV	2021.04.16
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Permit/Seal

MATTHEW C. VAUGHAN
No. PE11012285
6/16/21

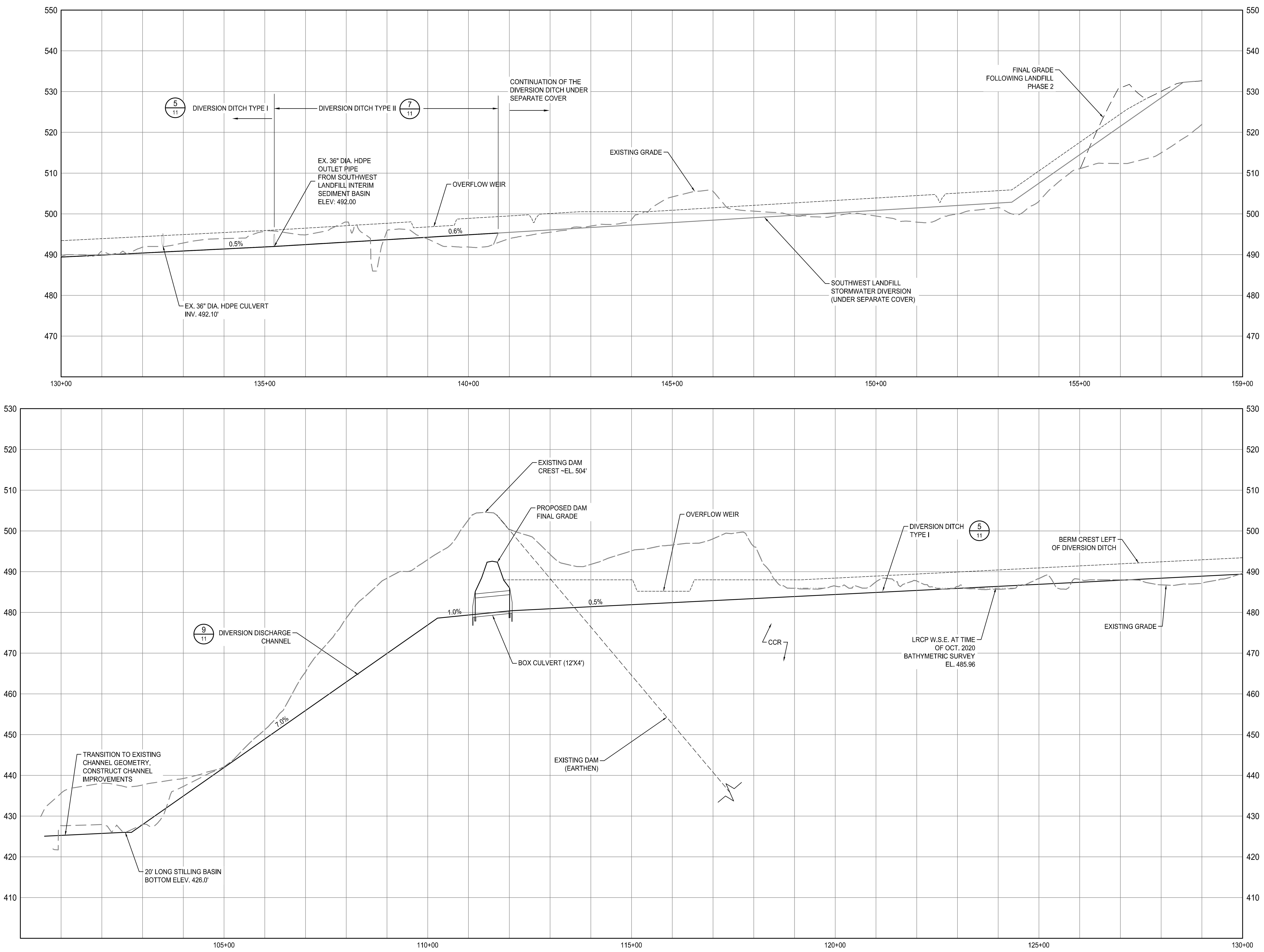
Client/Project Logo

OVEC IKEC
Ohio Valley Electric Corporation Indiana-Kentucky Electric Corporation

Client/Project
OHIO VALLEY ELECTRIC CORPORATION
INDIANA-KENTUCKY ELECTRIC CORPORATION
POND CLOSURE - LANDFILL RUNOFF COLLECTION POND, CLIFTY CREEK STATION
MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
LRCP STORMWATER MANAGEMENT PLAN

Project No. 175539026
Scale 1" = 100'
Revision A
Sheet 7
Drawing No. P-LRCP-202-SMP



1
8
PROFILE - DIVERSION DITCH BASELINE
SCALE: 1"=100' (HORIZONTAL)
1"=10' (VERTICAL)

SECTION OR DETAIL NO.
TARGET DRAWING
REFERENCE KEY

ISSUED FOR PERMIT

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Issued	By	Appd	YYYY.MM.DD

File Name: 08_LRCP_39026C-219-221-PF1-PF2	ACS	ACS	JSH	2021.04.16
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MATTHEW C. VAUGHAN
No. PE11012285
6/16/21

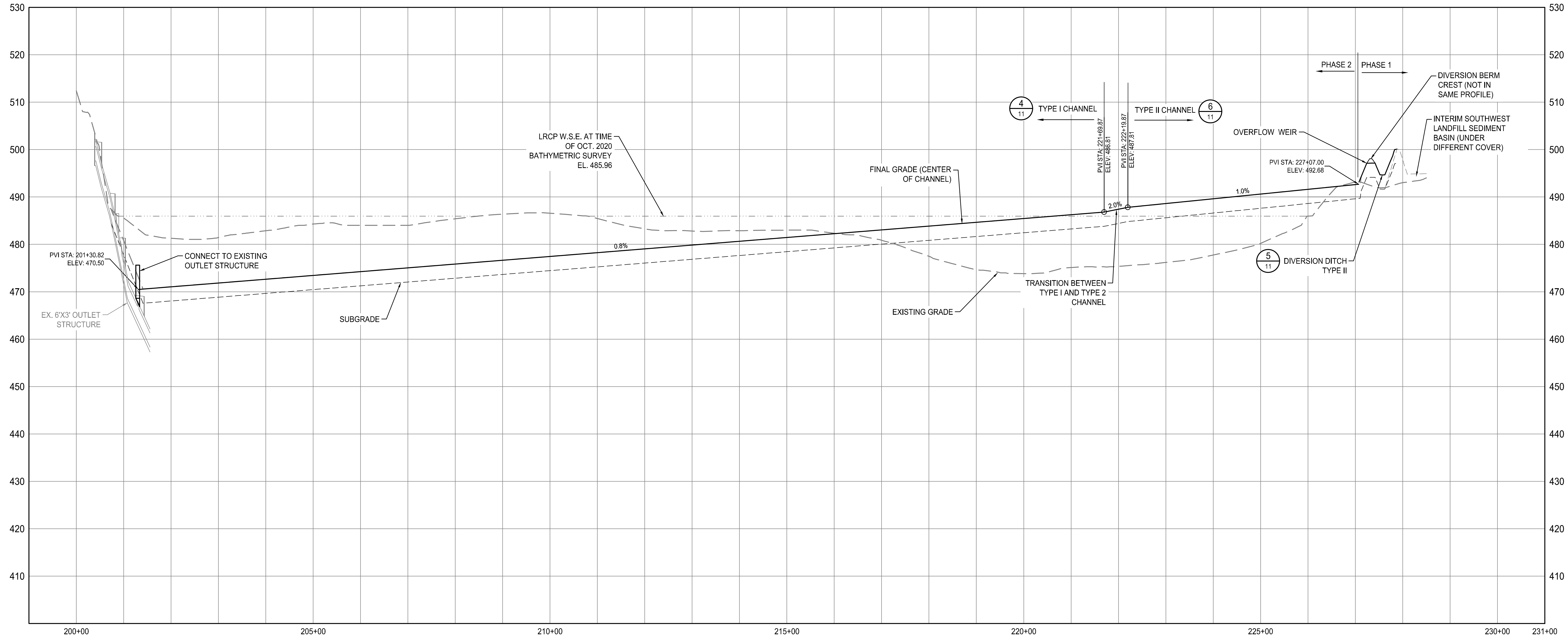
Client/Project Logo

Client/Project
OHIO VALLEY ELECTRIC CORPORATION
INDIANA-KENTUCKY ELECTRIC CORPORATION
POND CLOSURE - LANDFILL RUNOFF
COLLECTION POND, CLIFTY CREEK STATION
MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
PROFILE - DIVERSION DITCH BASELINE

Project No.	Scale
175539026	AS SHOWN

Revision	Sheet	Drawing No.
A	8	P-LRCP-220-PR1



1 / 9 PROFILE - LRCP CLOSURE MAIN CHANNEL BASELINE
SCALE: 1"=100' (HORIZONTAL)
1"=10' (VERTICAL)

SECTION OR DETAIL NO.
TARGET DRAWING
REFERENCE KEY

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A ISSUED FOR PERMIT	ACS	MCV	2021.04.16
Issued	By	Appd	YYYY.MM.DD

File Name: 08_LRCP_39026C-219-221-PF1-PF2	ACS	ACS	MV	2021.04.16
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MATTHEW C. VAUGHAN
No. PE11012285
6/16/21

Client/Project Logo

OVEC IKEC
Ohio Valley Electric Corporation Indiana-Kentucky Electric Corporation

Client/Project
OHIO VALLEY ELECTRIC CORPORATION
INDIANA-KENTUCKY ELECTRIC CORPORATION

POND CLOSURE - LANDFILL RUNOFF COLLECTION POND, CLIFTY CREEK STATION

MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
PROFILES - LRCP CLOSURE MAIN CHANNEL

Project No.	Scale
175539026	AS SHOWN

Revision	Sheet	Drawing No.
A	9	P-LRCP-221-PR2

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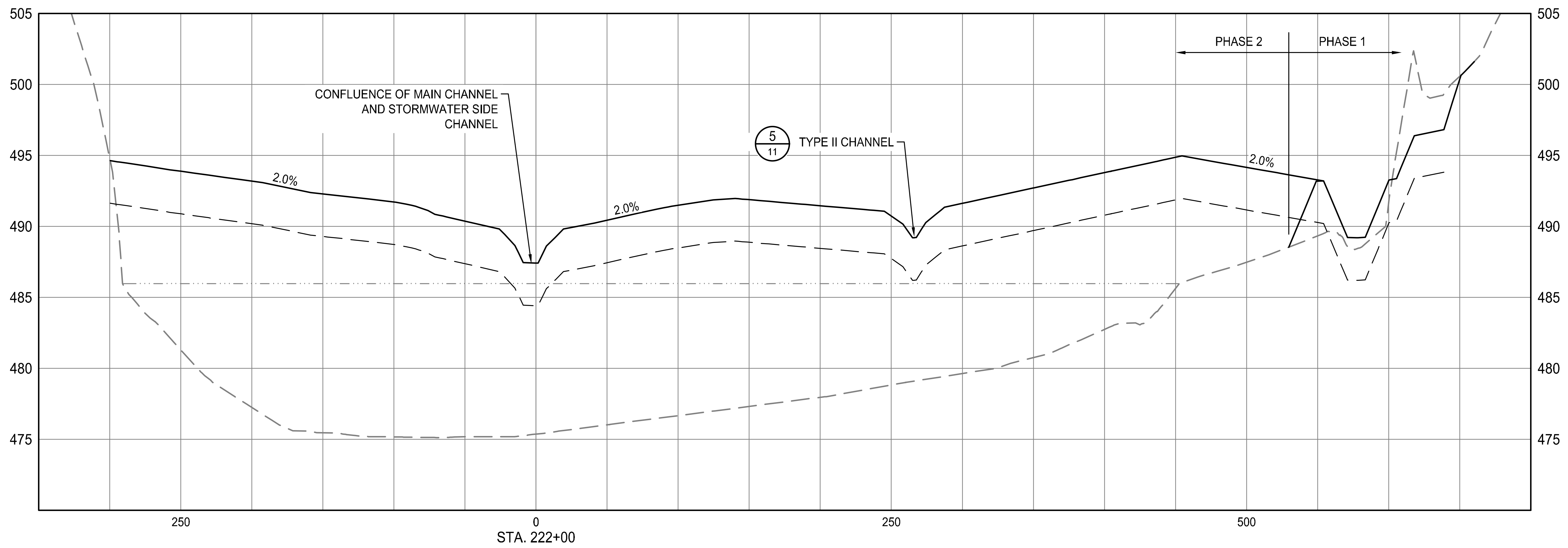

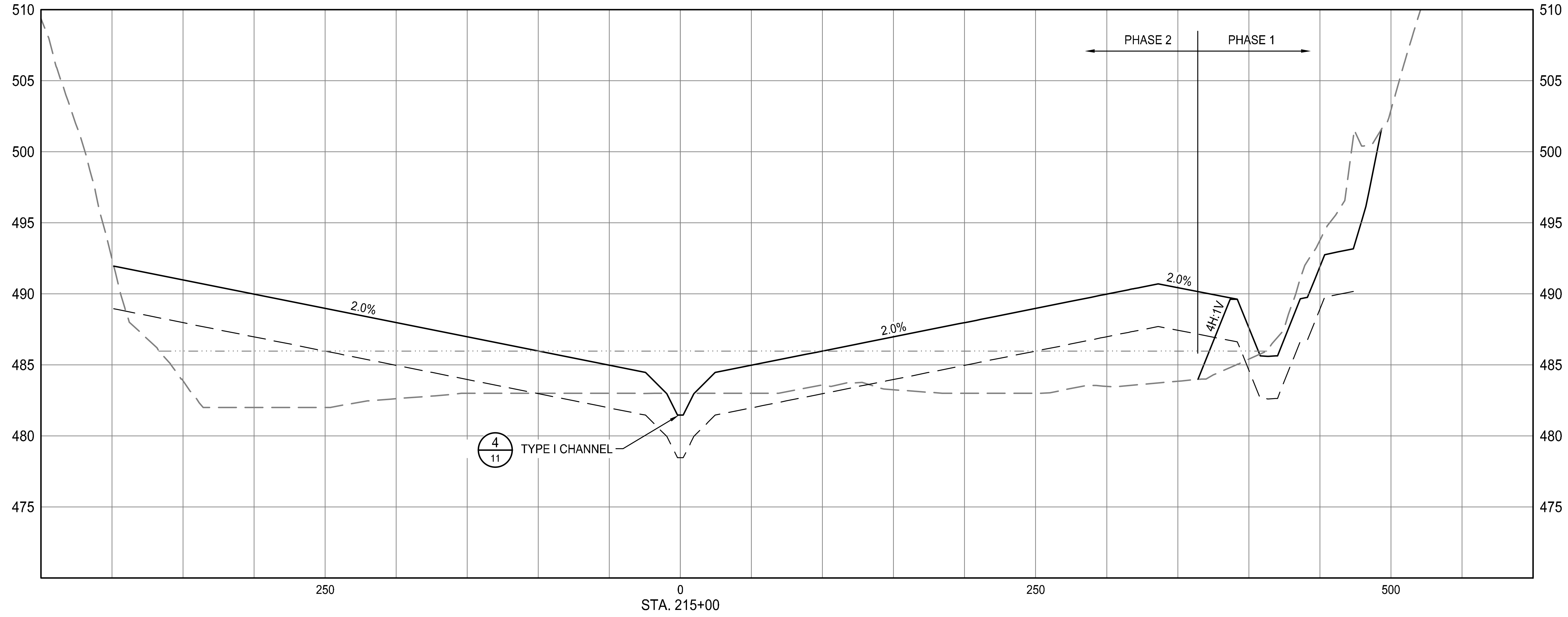

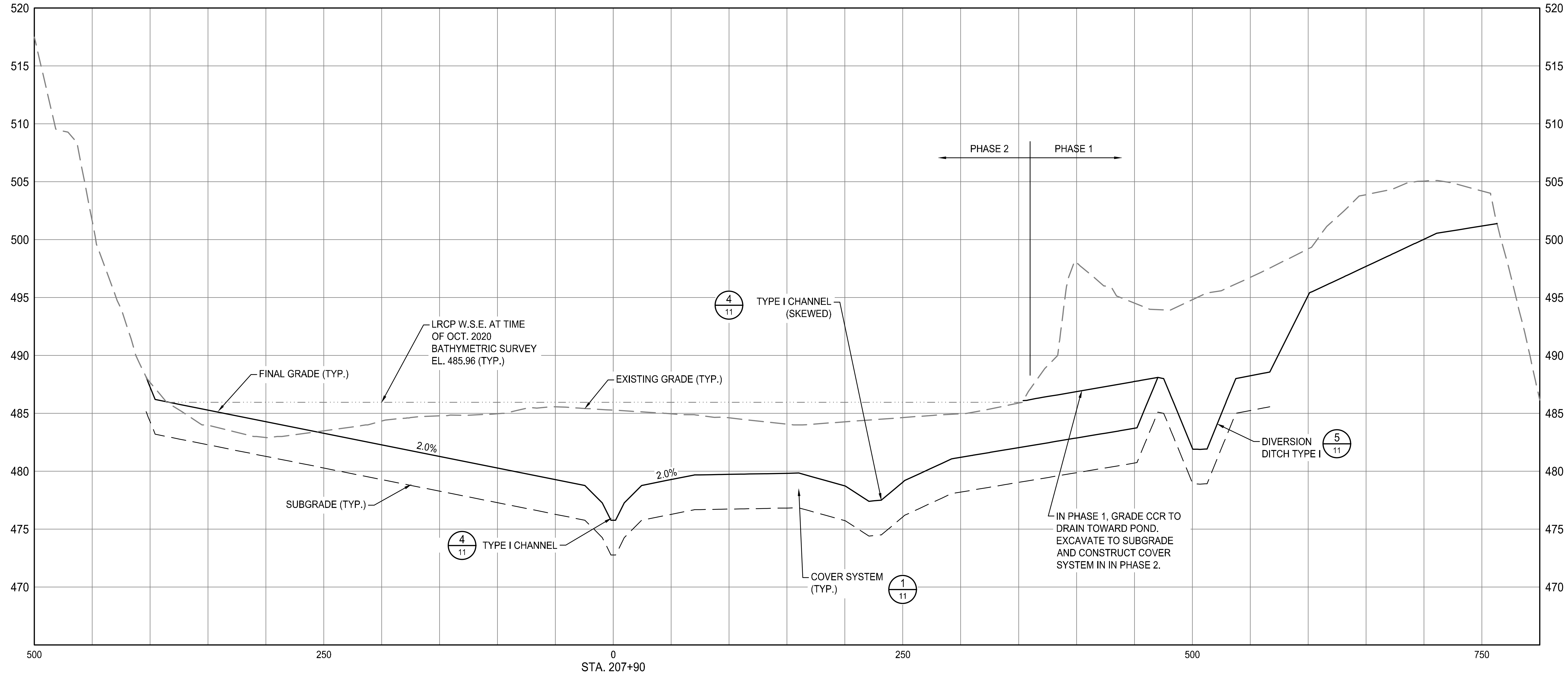

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Notes

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Issued	By	Appd	YYYY.MM.DD

File Name: 10_LRCP_39026C-301-XSEC1	BMS	ACS	MCV	2021.04.16
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

Permit/Seal

MATTHEW C. VAUGHAN
No. PE11012285
STATE OF INDIANA

Matthew C. Vaughan
6/16/21

Client/Project Logo

Client/Project
OHIO VALLEY ELECTRIC CORPORATION
INDIANA-KENTUCKY ELECTRIC CORPORATION

POND CLOSURE - LANDFILL RUNOFF
COLLECTION POND, CLIFTY CREEK STATION

MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
CROSS SECTIONS - MAIN CHANNEL
BASELINE

Project No.	Scale
175539026	AS SHOWN

Revision	Sheet	Drawing No.
A	10	P-LRCP-301-XS

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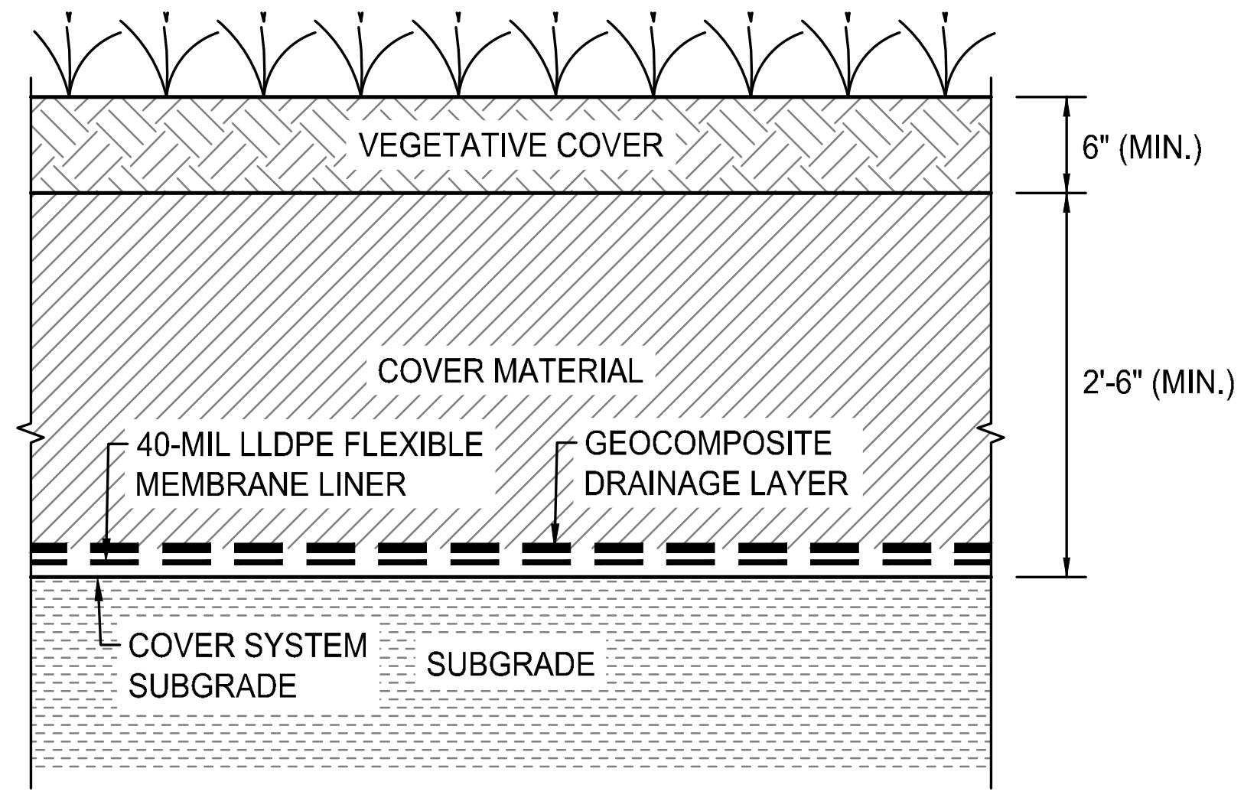
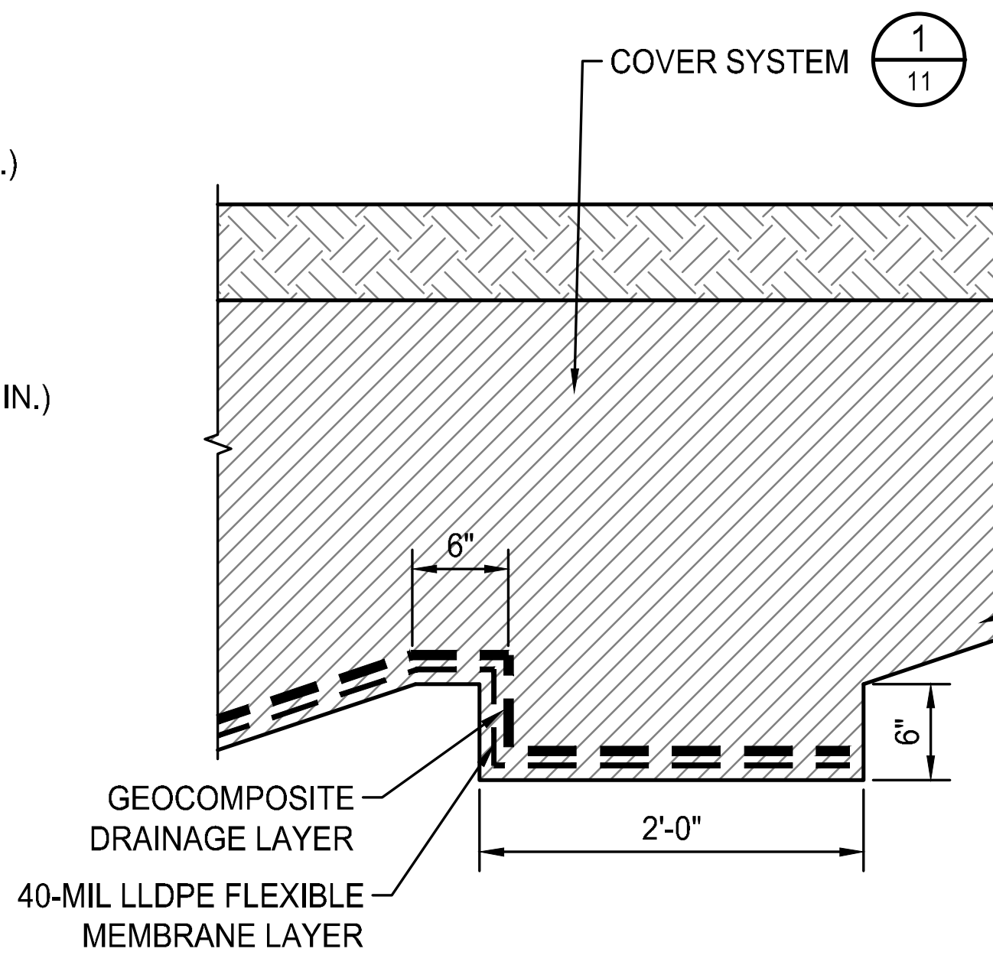


NOTES:
1. MINIMUM CROSS SLOPE = 2%.
2. MAXIMUM SLOPE = 3H:1V.

① 11 DETAIL - COVER SYSTEM
SCALE: 1"=1'-0"



② 11 DETAIL - ANCHOR TRENCH
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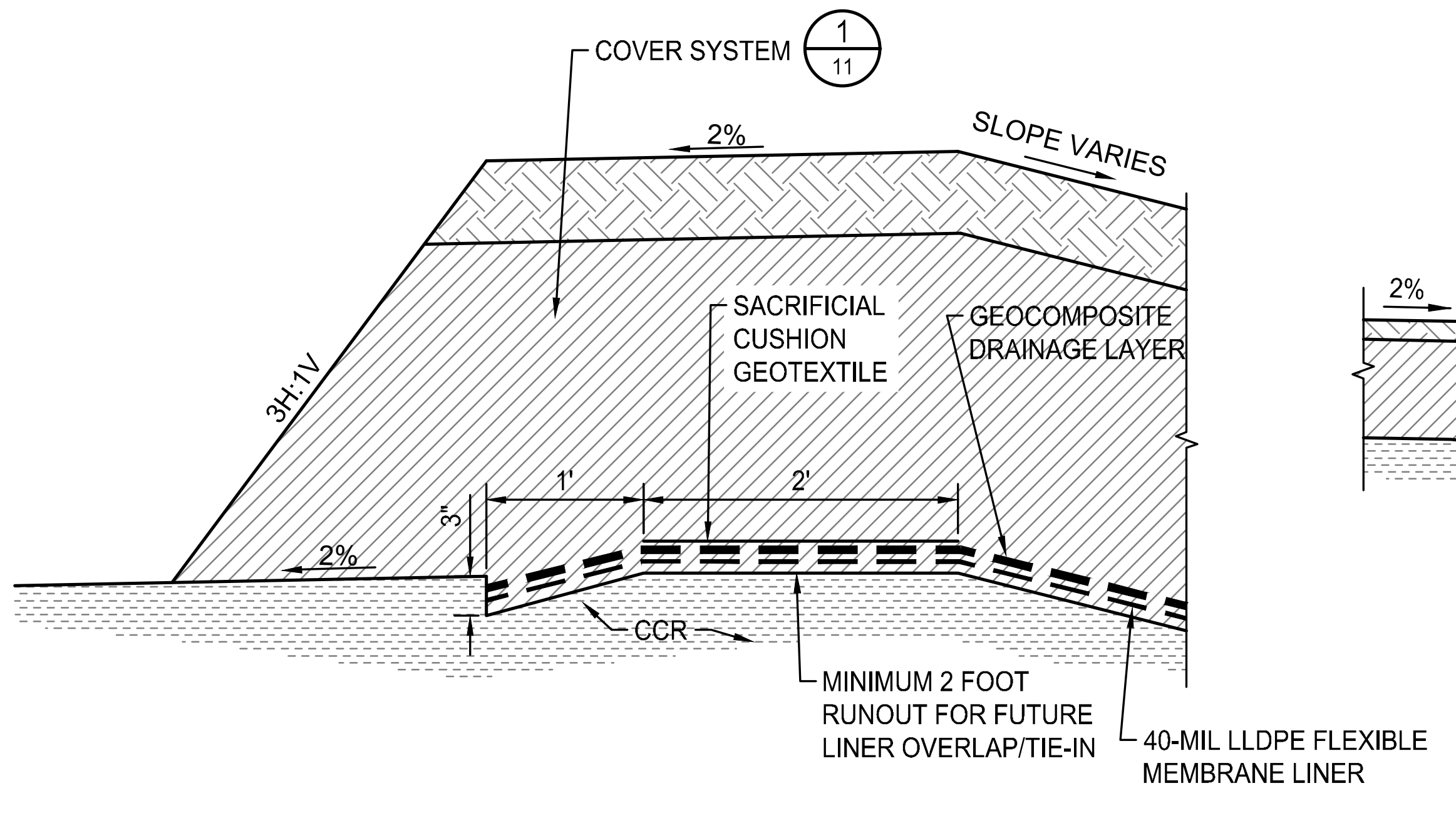

③ 11 DETAIL - TEMPORARY ANCHOR TRENCH
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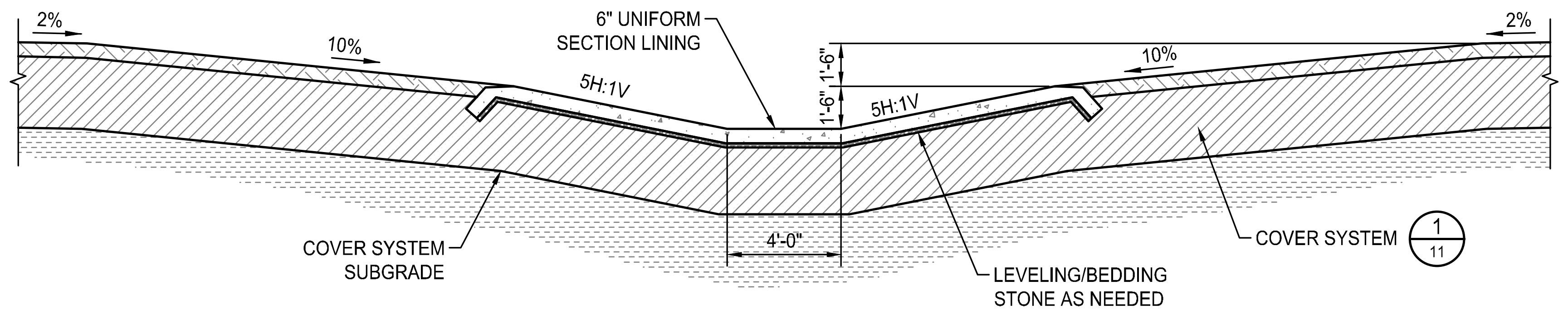

④ 11 DETAIL - TYPE I CHANNEL
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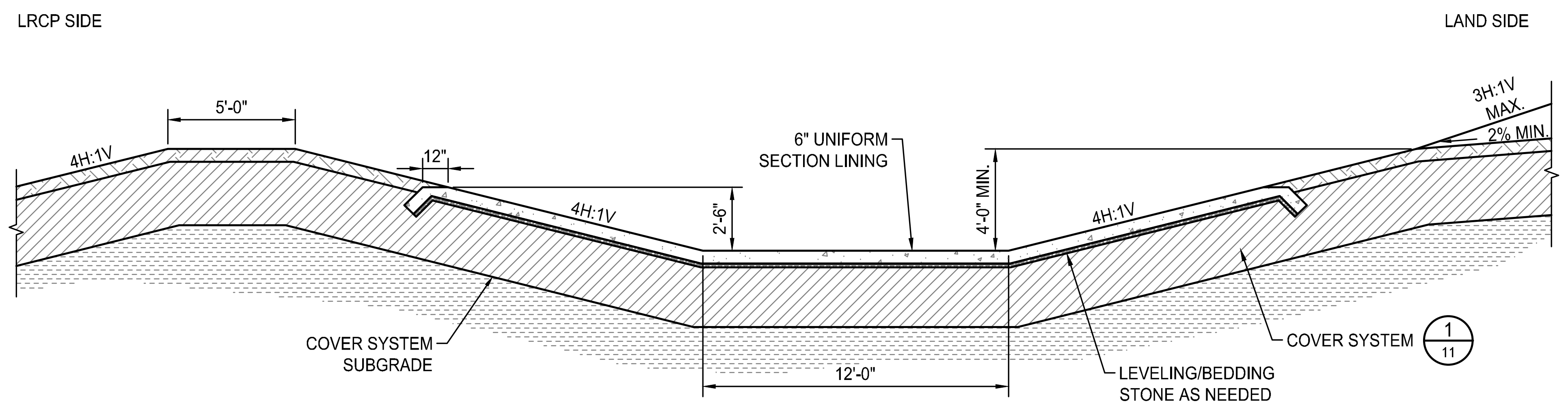

⑤ 11 DETAIL - DIVERSION DITCH TYPE I
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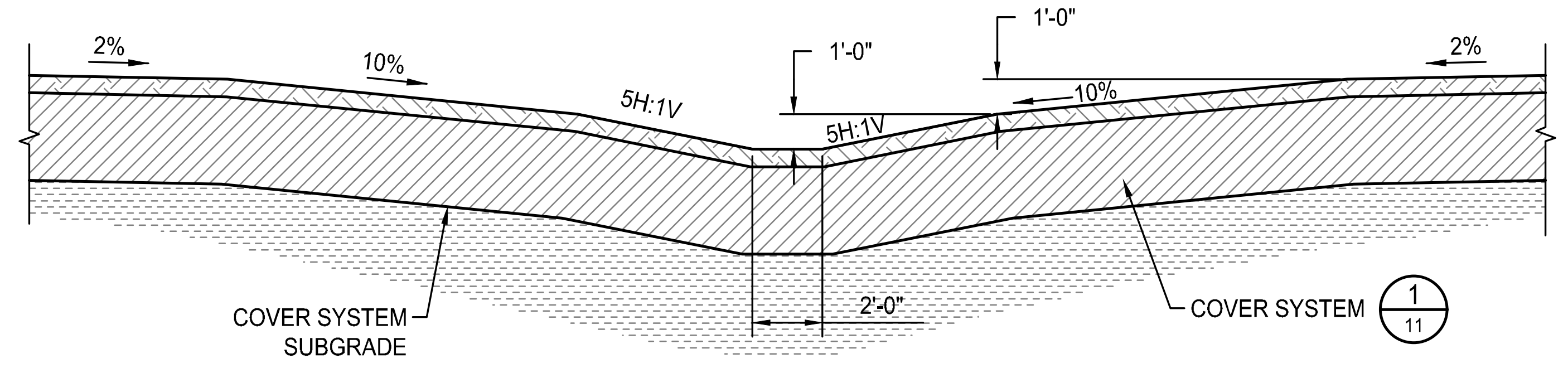

⑥ 11 DETAIL - TYPE II CHANNEL
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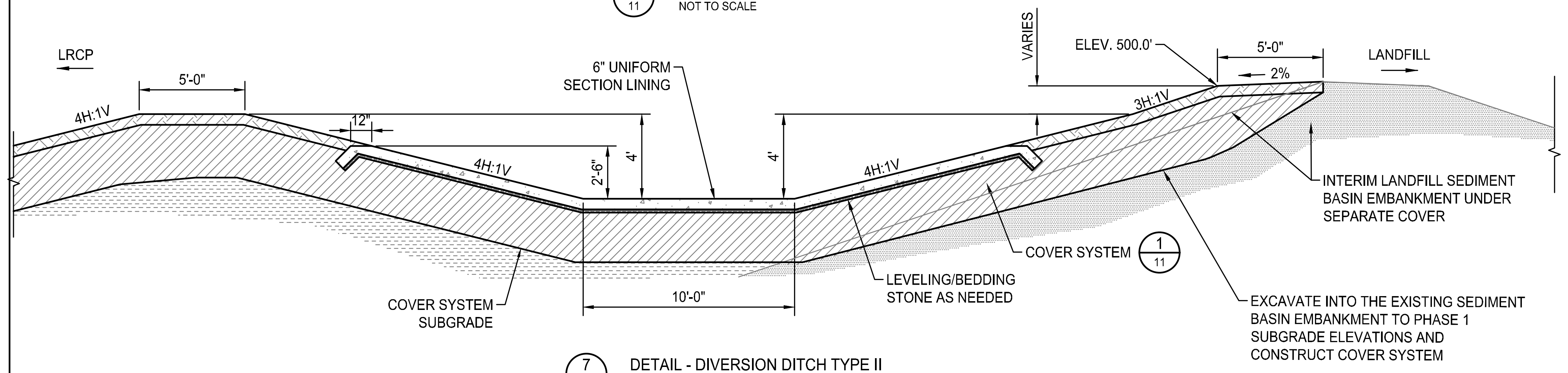
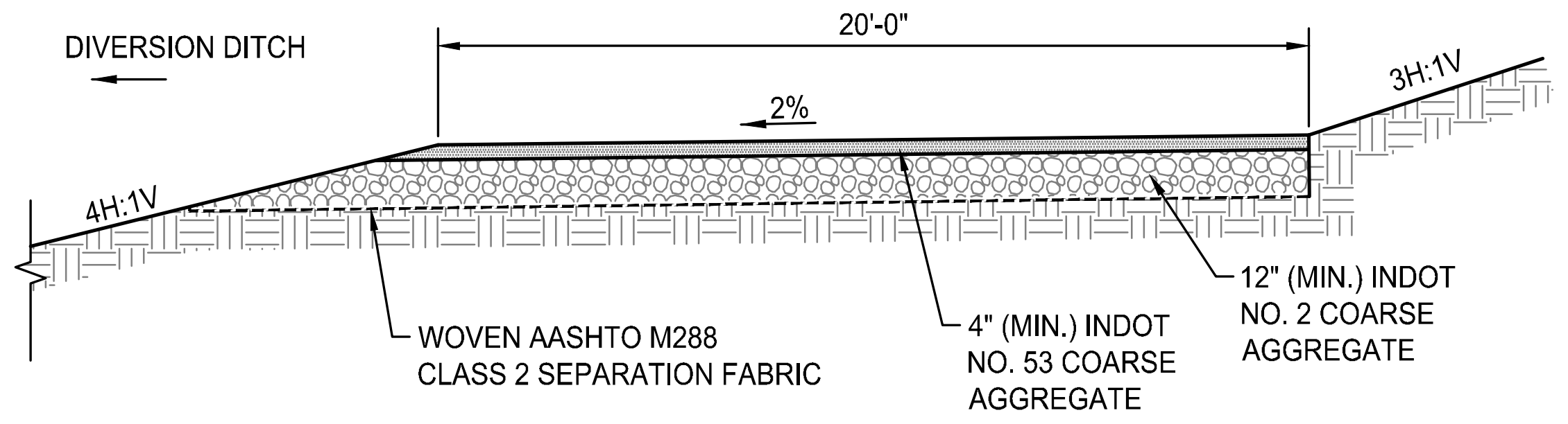


⑦ 11 DETAIL - DIVERSION DITCH TYPE II
NOT TO SCALE



⑧ 11 DETAIL - PERIMETER ROAD
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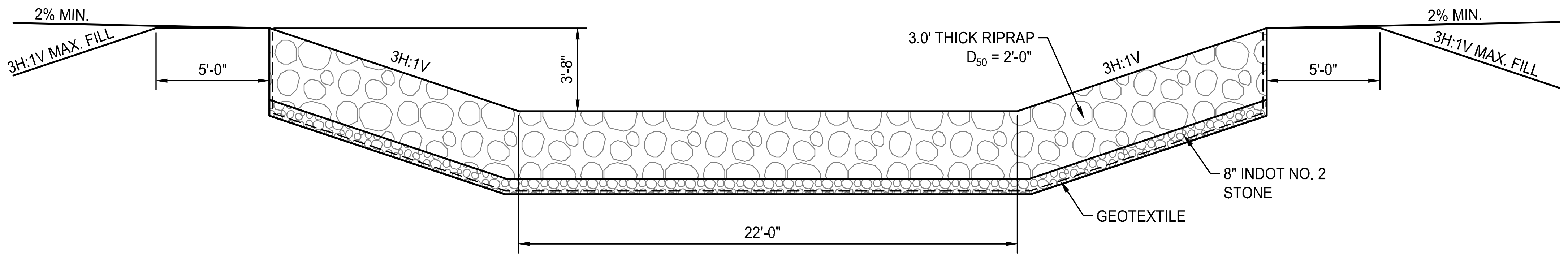
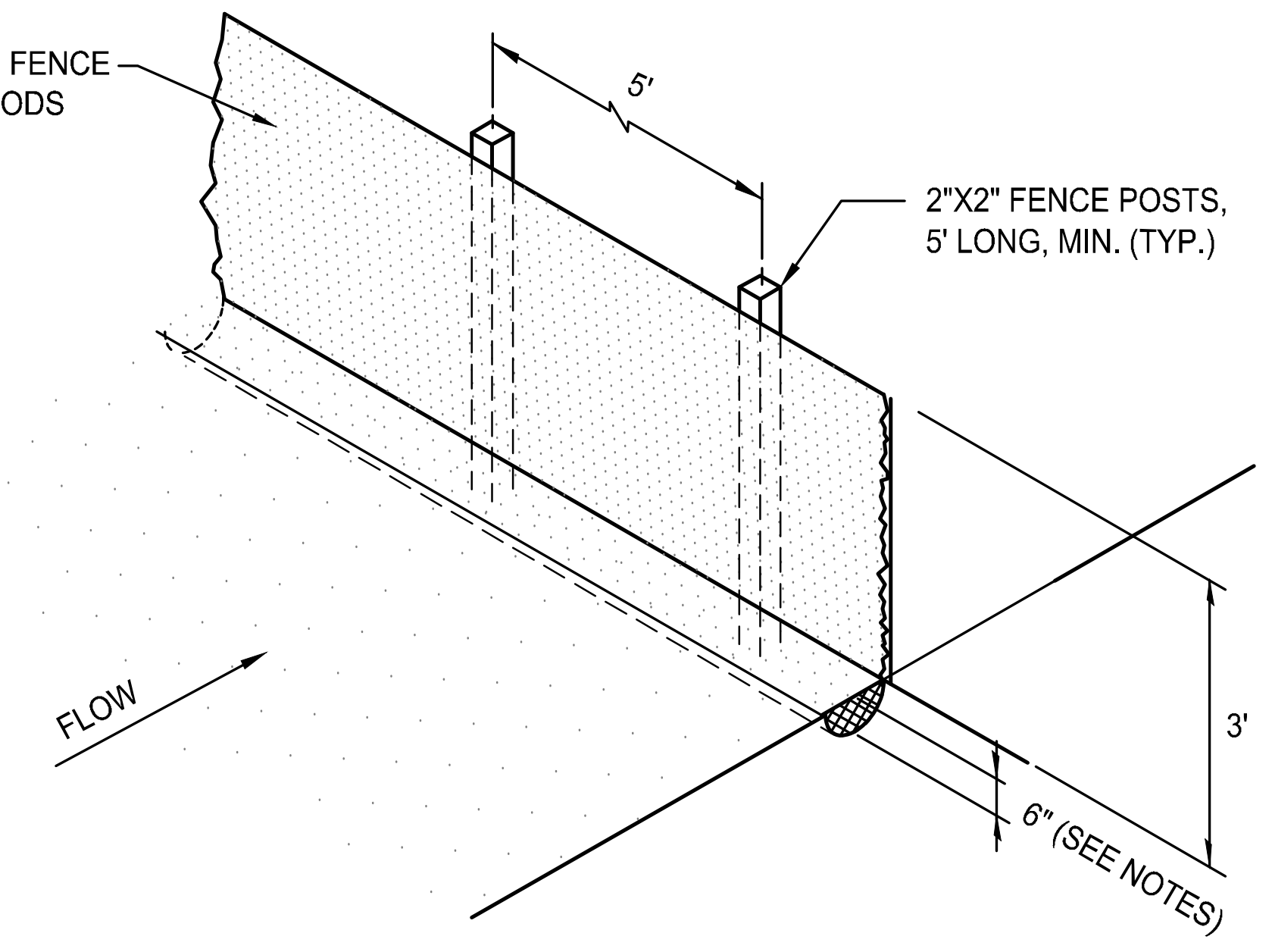
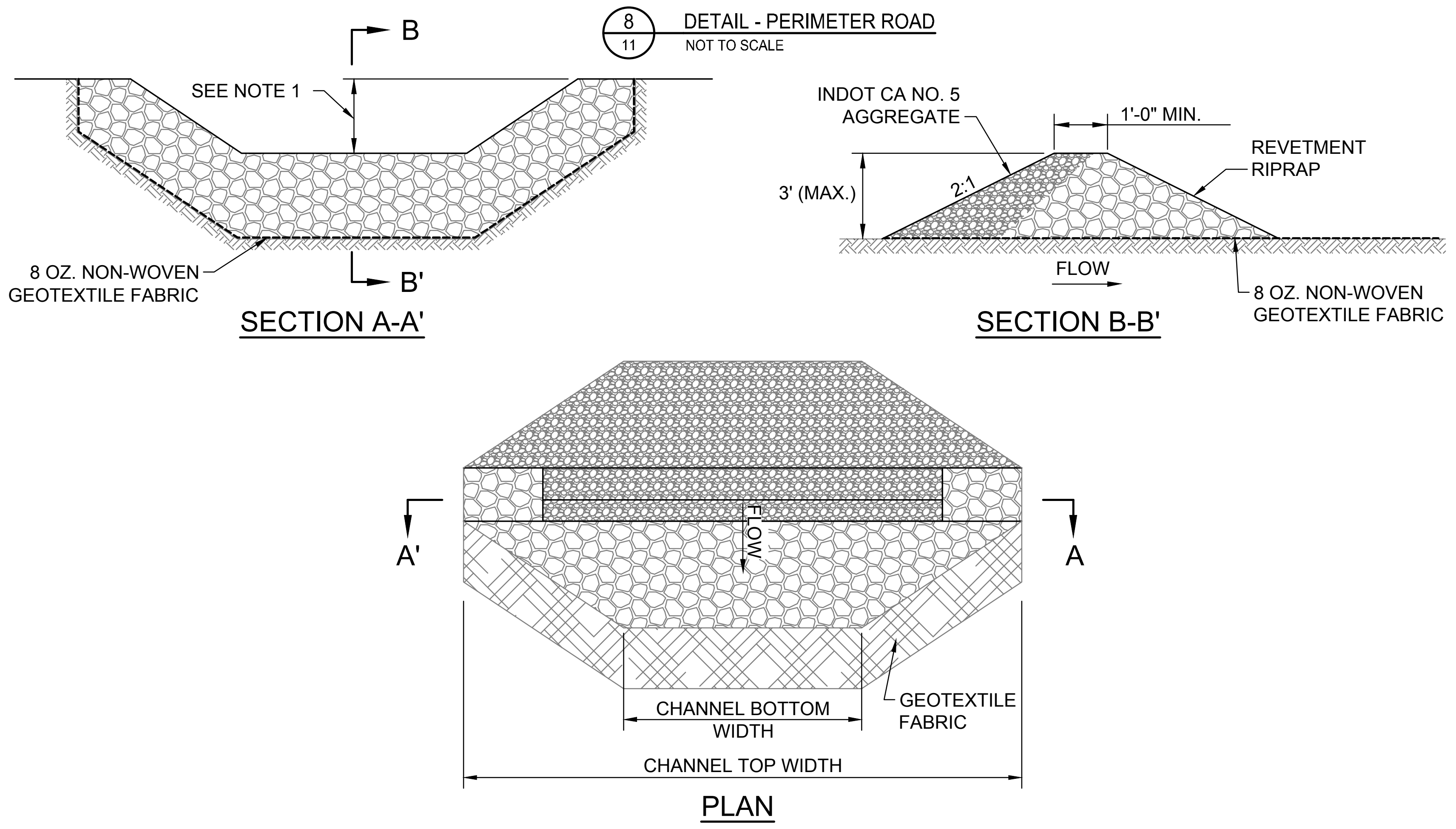


⑨ 11 DETAIL - DIVERSION DISCHARGE CHANNEL
NOT TO SCALE



NOTES:
1. THE BOTTOM 12 INCHES OF THE FABRIC SHALL BE BURIED IN A 6-INCH TRENCH CUT INTO THE GROUND OR COVERED BY 6 INCHES OF FILL MATERIAL TO PREVENT SEDIMENT FROM ESCAPING UNDER THE FENCE. ALL EARTH-WORK SHALL BE ON THE UPSTREAM SIDE OF THE FENCE.
2. GEOTEXTILE FABRIC SHALL MEET THE FOLLOWING SPECIFICATIONS: GRAB STRENGTH (ASTM D 1682) - 100 LBS. MIN., WIDTH - 4' MIN., BURSTING STRENGTH (ASTM D751) - 150 P.S.I. MIN., FLOW RATE (KM64-106) - 0,3 GAL./SQ. FT., RETENTION EFFICIENCY (KM64-106) - 75%

⑩ 11 DETAIL - SILT FENCE
NOT TO SCALE



NOTES:
1. MIDDLE OF ROCK CHECK DAM SHALL BE A MINIMUM OF 9-INCHES LOWER THAN SIDES SO FLOW WILL NOT BYPASS TRAP OR ERODE BANKS.
2. SPACE ROCK CHECK SO THAT THE TOE OF THE UPSTREAM DAM IS AT THE SAME ELEVATION AS THE OVERFLOW WEIR OF THE DOWNSTREAM DAM.
3. EXTEND GEOTEXTILE FABRIC 3'-0" BEYOND DOWNSTREAM TOE OF ROCK CHECK DAM TO PREVENT SCOUR.
4. INSTALL AND MAINTAIN ROCK CHECK DAMS IN ACCORDANCE WITH THE INDIANA STORM WATER QUALITY MANUAL, CURRENT EDITION.
5. REMOVE ROCK CHECK DAMS AFTER CONSTRUCTION IS COMPLETED AND DISTURBED AREAS ARE STABILIZED.

⑪ 11 DETAIL - ROCK CHECK DAM
NOT TO SCALE

SECTION OR DETAIL NO.
TARGET DRAWING
REFERENCE KEY

ISSUED FOR PERMIT

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Tel: (513) 842-8200
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Notes

Revision	By	Appd	YYYY.MM.DD

Issued	By	Appd	YYYY.MM.DD
A ISSUED FOR PERMIT	ACS	MCV	2021.04.16

File Name: 11_LRCP_39026C-501-DT1	ACS	ACS	MCV	2021.04.16
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

Permit/Seal

MATTHEW C. VAUGHAN
No. PE11012285
STATE OF INDIANA
6/16/21

Client/Project Logo

Client/Project
OHIO VALLEY ELECTRIC CORPORATION
INDIANA-KENTUCKY ELECTRIC CORPORATION

POND CLOSURE - LANDFILL RUNOFF COLLECTION POND, CLIFTY CREEK STATION
MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
CIVIL DETAILS

Project No.	Scale
175539026	AS SHOWN

Revision	Sheet	Drawing No.
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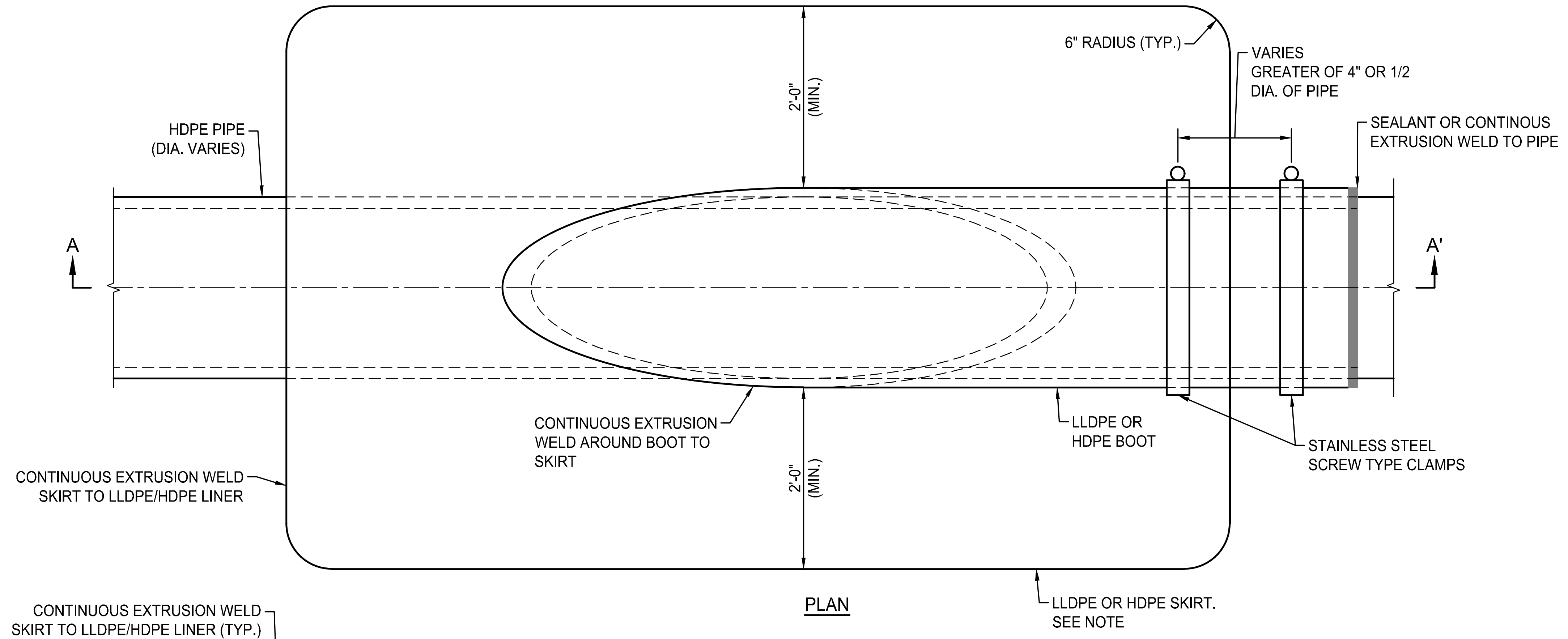
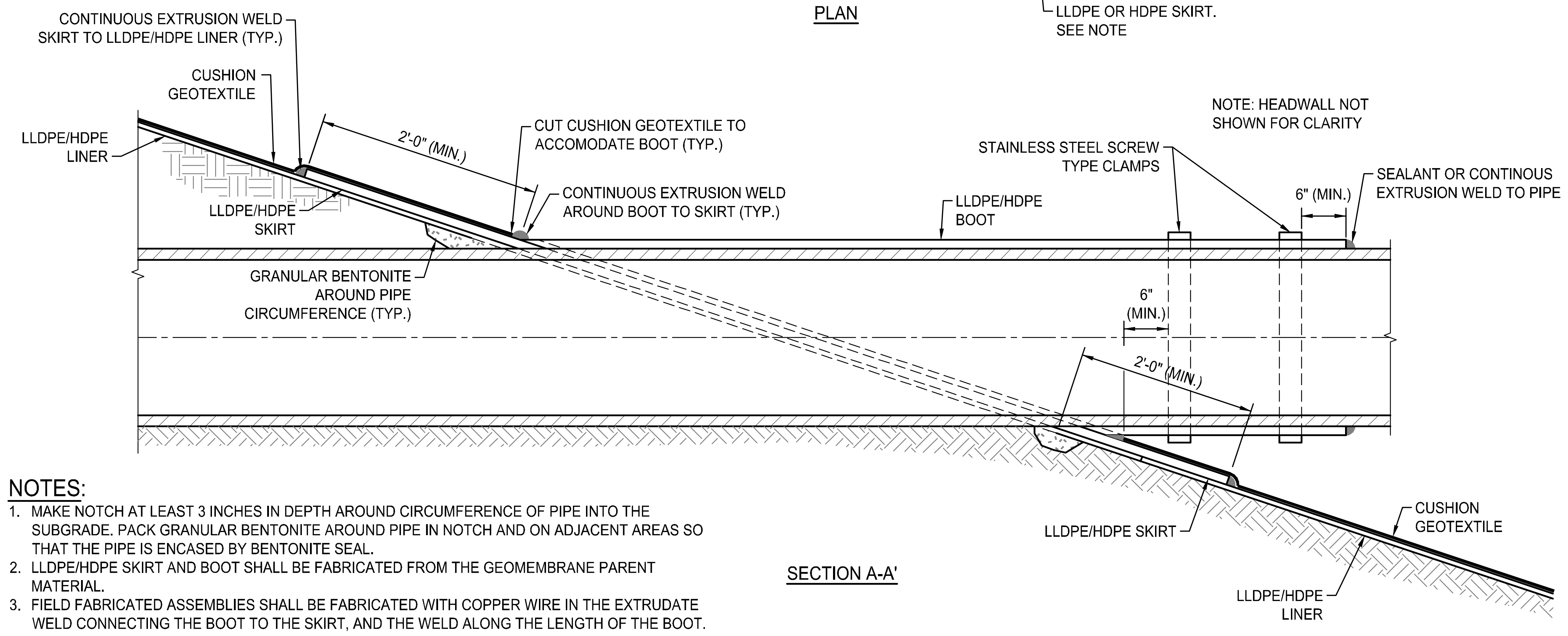


PLAN

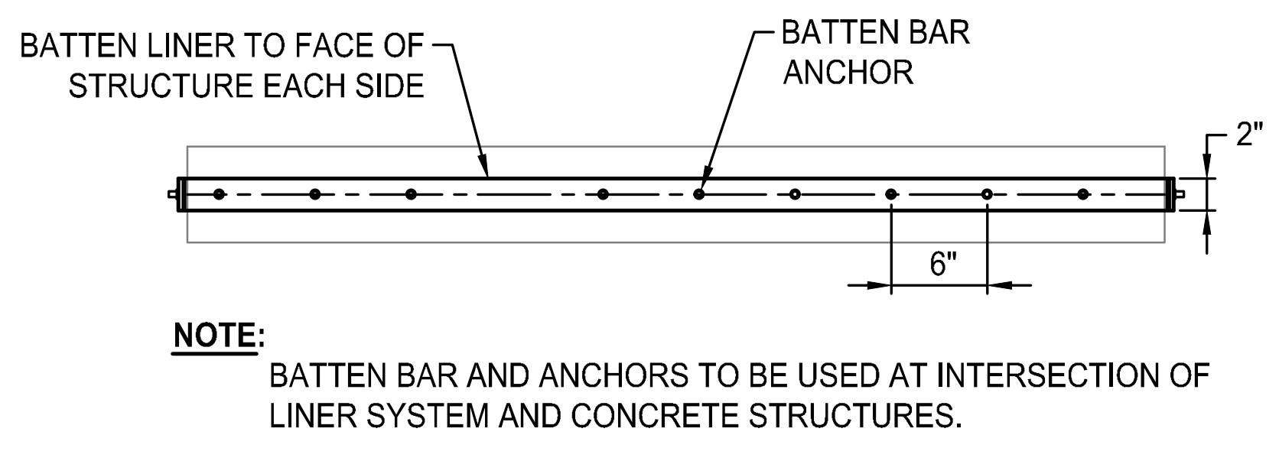


SECTION A-A'

NOTES:

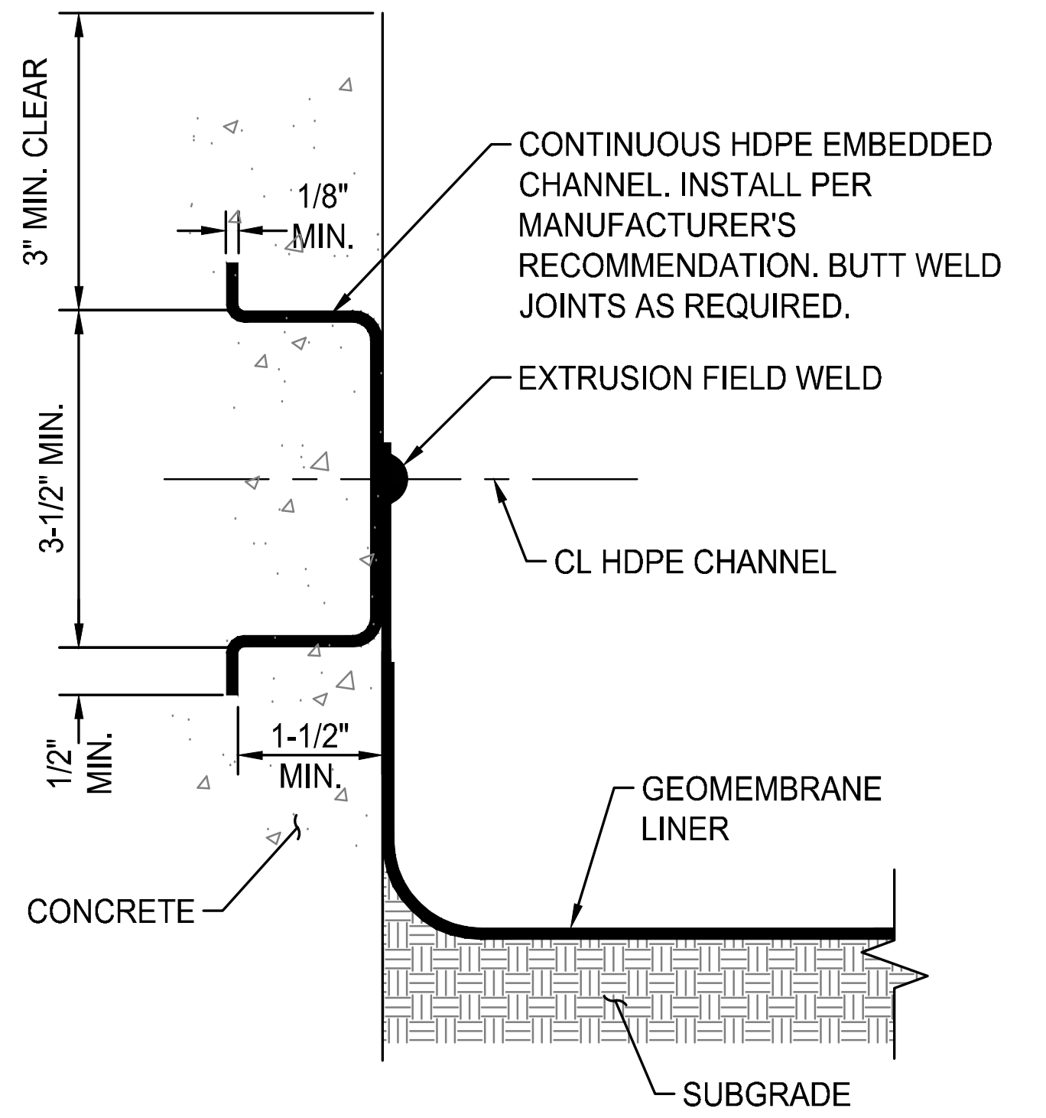
1. MAKE NOTCH AT LEAST 3 INCHES IN DEPTH AROUND CIRCUMFERENCE OF PIPE INTO THE SUBGRADE. PACK GRANULAR BENTONITE AROUND PIPE IN NOTCH AND ON ADJACENT AREAS SO THAT THE PIPE IS ENCASED BY BENTONITE SEAL.
2. LLDPE/HDPE SKIRT AND BOOT SHALL BE FABRICATED FROM THE GEOMEMBRANE PARENT MATERIAL.
3. FIELD FABRICATED ASSEMBLIES SHALL BE FABRICATED WITH COPPER WIRE IN THE EXTRUDATE WELD CONNECTING THE BOOT TO THE SKIRT, AND THE WELD ALONG THE LENGTH OF THE BOOT. SPARK TESTING SHALL BE PERFORMED FOLLOWING INSTALLATION.
4. INSTALL GEOTEXTILE AROUND PENETRATION AS NECESSARY, OR AS DIRECTED BY THE CQA MANAGER, TO PROVIDE PROTECTION FOR THE INSTALLED LINER SYSTEM.

1
12
DETAIL - LINER BOOT/CLAMP ASSEMBLY
NOT TO SCALE



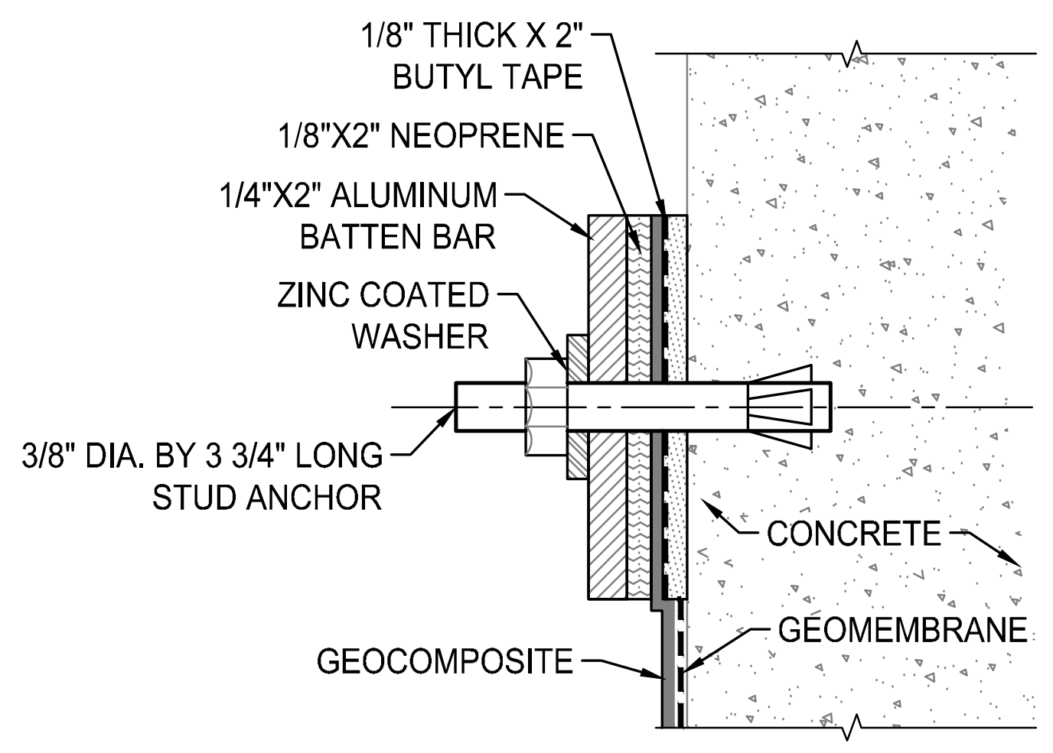
NOTE:
BATTEN BAR AND ANCHORS TO BE USED AT INTERSECTION OF LINER SYSTEM AND CONCRETE STRUCTURES.

2
12
DETAIL - BATTEN BAR ATTACHMENT
NOT TO SCALE



NOTE:
LINER EMBEDMENT STRIP MAY BE USED AS AN ALTERNATIVE TO A BATTEN BAR ANCHOR.

4
12
DETAIL - LINER EMBEDMENT STRIP (OPTIONAL)
NOT TO SCALE



NOTES:
1. ANCHORS SHALL BE INSTALLED ON SIX INCH CENTERS ALONG THE BATTEN BAR.
2. ANCHORS SHALL FEATURE A BOLT BODY AND EXPANDER PLUG.

3
12
DETAIL - BATTEN BAR ANCHOR
NOT TO SCALE

SECTION OR DETAIL NO.
TARGET DRAWING
REFERENCE KEY

ISSUED FOR PERMIT

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Revision	By	Appd	YYYY.MM.DD

Issued	By	Appd	YYYY.MM.DD
A ISSUED FOR PERMIT	ACS	MCV	2021.04.16

File Name: LRCP_39026C-502-DT2	ACS	ACS	MCV	2021.04.16
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

Permit/Seal

MATTHEW C. VAUGHAN
No. PE11012285
6/16/21

Client/Project Logo

Client/Project
OHIO VALLEY ELECTRIC CORPORATION
INDIANA-KENTUCKY ELECTRIC CORPORATION

POND CLOSURE - LANDFILL RUNOFF
COLLECTION POND, CLIFTY CREEK STATION

MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
CIVIL DETAILS

Project No. 175539026
Scale AS SHOWN
Revision A
Sheet 12
Drawing No. P-LRCP-502-DTL

APPENDIX H

Ditch Sizing Calculations

Ohio Valley Electric Corporation /
Indiana-Kentucky Electric Corporation
Madison Township, Indiana

Clifty Creek Station
Landfill Runoff Collection Pond

Stantec

Hydrologic and Hydraulic Analysis Ditch Sizing Calculations

Purpose:

- Calculations to determine sizing of drainage ditches on the final grade closure plan

Methods:

PCSWMM was used to size and model the stormwater ditch network and simulate the peak discharges in the ditches. The model was simulated using the Curve Number Infiltration method and dynamic wave flow routing.

Table 1 - Design Standards and References

Parameter	Design Standard/Method/Source
Design Storm	25-Year, 24-Hour Recurrence Interval
Curve Number	TR-55, SCS CN methodology
Rainfall Temporal Distribution	Soil Conservation Service (SCS) Type II (USDA, 1986)
Rainfall Intensity	NOAA Atlas 14 Precipitation Frequency Data Server
Subbasin Area	Delineation based on Permit Drawings Dated 04.16.2021

Parameters:

Climatological Data:

The 25-year, 24-hour storm was used to determine ditch capacity. Peak rainfall depths for the design storm were taken from NOAA Atlas 14 Precipitation Frequency Data Server specific to the geographic location of the Clifty Creek Plant. The selected Point Precipitation depth is shown in Table 1. An SCS Type II temporal distribution was used to model the rainfall hyetograph over the 24-hour duration.

Table 1 - NOAA Atlas 14 PFDS Rainfall Depths

Storm Return Interval and Duration	Rainfall depth (inches)
25-year, 24-hour	5.30

Watershed Delineation:

Subcatchment delineations were completed in PCSWMM based on the permit design final grade surface. Table 2 provides a breakdown of the subcatchment areas. Subcatchment delineations are shown in Appendix A

Curve Numbers

The NRCS curve number method was used to estimate infiltration during the design storm event. A composite curve number was generated for the watershed using SCS hydrologic soil group data and land use data determined from aerial imagery. Curve number values for each land use and soil type combination were assigned based on the values published in Tables 2-2a through 2-2d in TR-55 (NRCS, 1986). To model the final closed conditions, land uses of "Meadow" (CN = 78) was assumed for the cap liner system and land use of "Open spaces – Fair" (CN = 84) was assumed for regraded areas around the cap. A summary of curve numbers used in this analysis is provided in Table 2.

Table 2 – Subbasin Drainage Areas and Curve Numbers

Subbasin	Area (acres)	Composite Curve Number
Ash_Pond	46.46	98
R1_5	14.29	93
R1_6	22.17	79
R1_7	14.16	78
R5	3.44	92
R6	4.26	80
R7	3.54	94
R8	3.41	77
S2	0.32	94
S3	7.99	78
S4	1.69	83
S5	0.99	67
SB10	37.16	76
SB11	35.73	75
SB16	5.91	94
SB18	6.21	94
SB6	31.55	76
SB7	84.24	80
SB8	71.00	79
SB9	19.75	75
SB-A	20.89	81
SB-F	12.14	77
SB-G_1	9.41	93
SB-G_2	6.37	89
SB-G_3	5.03	94
SB-H_1	6.66	92
SB-H_2	10.66	93

Calculations/Results:

Peak Discharges were calculated in the dynamic PCSWMM model. Peak discharges for each ditch type are shown in the table below

Table 3 – Peak Discharge Calculations

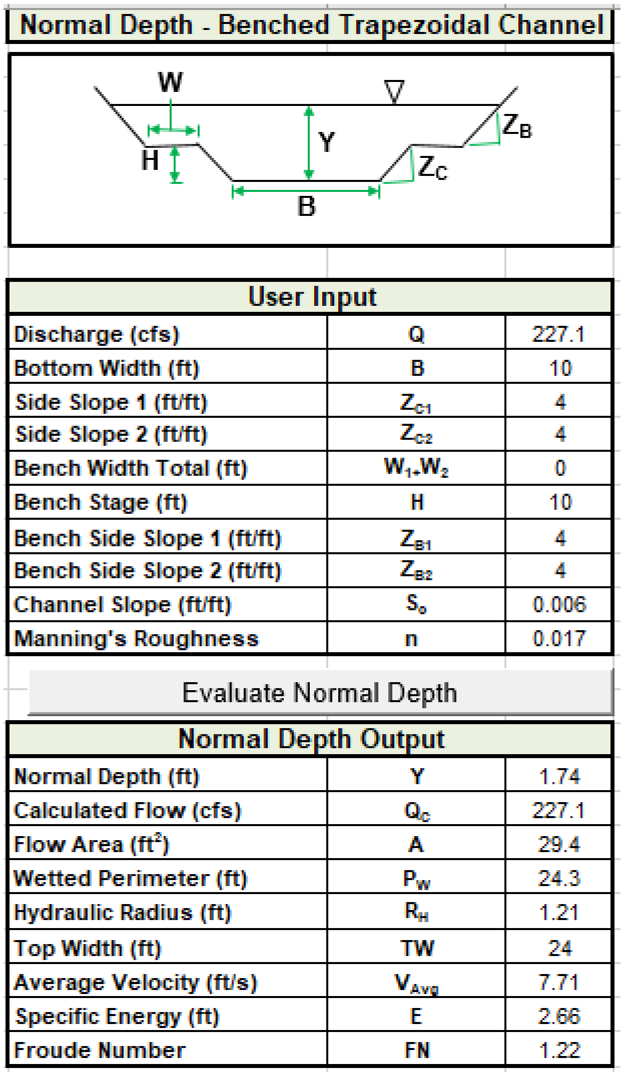
Ditch	Peak 25-year Q (cfs)
Diversion Ditch Upstream	227.1
Diversion Ditch Downstream	380.05

Peak discharges were used to calculate normal depth in the final cover ditches. Ditches were sized to convey the peak discharge accordingly.

Methods:

Hydraulic calculations were performed to determine minimum ditch size required to convey the peak discharges. Manning's equation was used to estimate flow depth in each ditch. The peak flow calculated was used to size all ditches.

Diversion Ditch Upstream Calculations – 25-year, 24-hour storm



Normal Depth - Benched Trapezoidal Channel

User Input

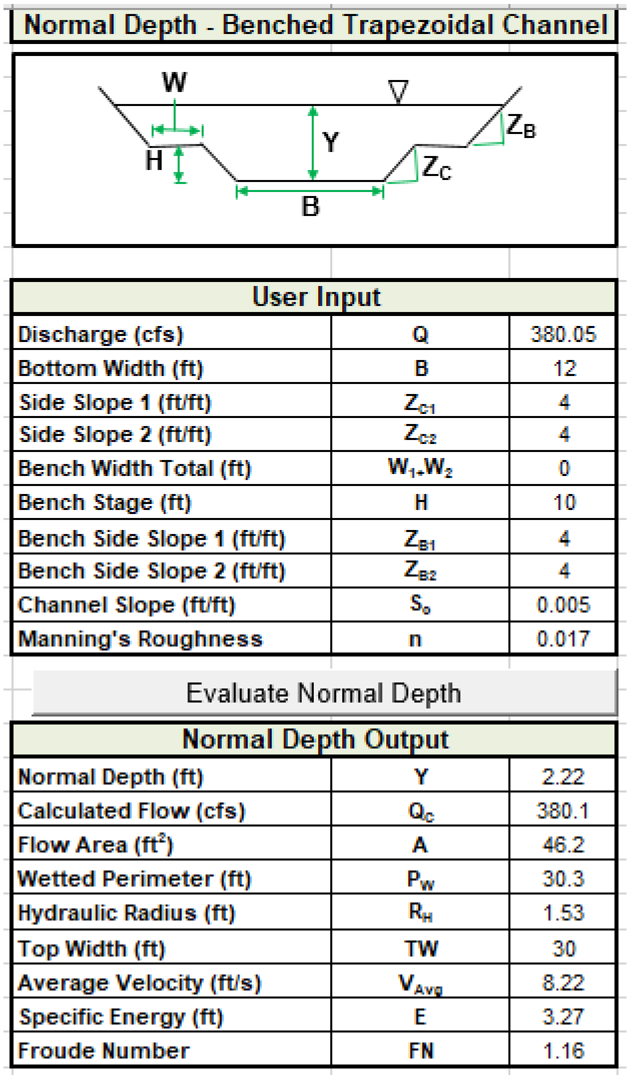
Discharge (cfs)	Q	227.1
Bottom Width (ft)	B	10
Side Slope 1 (ft/ft)	Z_{C1}	4
Side Slope 2 (ft/ft)	Z_{C2}	4
Bench Width Total (ft)	W_1+W_2	0
Bench Stage (ft)	H	10
Bench Side Slope 1 (ft/ft)	Z_{B1}	4
Bench Side Slope 2 (ft/ft)	Z_{B2}	4
Channel Slope (ft/ft)	S_o	0.006
Manning's Roughness	n	0.017

Normal Depth Output

Normal Depth (ft)	Y	1.74
Calculated Flow (cfs)	Q_C	227.1
Flow Area (ft^2)	A	29.4
Wetted Perimeter (ft)	P_W	24.3
Hydraulic Radius (ft)	R_H	1.21
Top Width (ft)	TW	24
Average Velocity (ft/s)	V_{Avg}	7.71
Specific Energy (ft)	E	2.66
Froude Number	FN	1.22

The maximum estimated depth in the channel is 1.74 feet and is less than the design depth of 4 feet.

Diversion Ditch Downstream Calculations – 25-year, 24-hour storm



Normal Depth - Benched Trapezoidal Channel

User Input		
Discharge (cfs)	Q	380.05
Bottom Width (ft)	B	12
Side Slope 1 (ft/ft)	Z_{C1}	4
Side Slope 2 (ft/ft)	Z_{C2}	4
Bench Width Total (ft)	W_1+W_2	0
Bench Stage (ft)	H	10
Bench Side Slope 1 (ft/ft)	Z_{B1}	4
Bench Side Slope 2 (ft/ft)	Z_{B2}	4
Channel Slope (ft/ft)	S_o	0.005
Manning's Roughness	n	0.017

Normal Depth Output		
Normal Depth (ft)	Y	2.22
Calculated Flow (cfs)	Q_C	380.1
Flow Area (ft^2)	A	46.2
Wetted Perimeter (ft)	P_W	30.3
Hydraulic Radius (ft)	R_H	1.53
Top Width (ft)	TW	30
Average Velocity (ft/s)	V_{Avg}	8.22
Specific Energy (ft)	E	3.27
Froude Number	FN	1.16

The maximum estimated depth in the channel is 2.22 feet and is less than the design depth of 4 feet.

References:

NOAA. (2013). *NOAA Atlas 14 Point Precipitation Frequency Estimates*. Retrieved July, 2015, from http://dipper.nws.noaa.gov/hdsc/pfds/

USDA. (1986). Urban Hydrology for Small Watersheds, TR-55. United States Department of Agriculture.

Indiana Department of Transportation – 2013 Design Manual, Chapter 202 Hydrology, Revision Date Feb. 2014

Attachments:

Attachment A: Final Grade Subbasin Boundaries

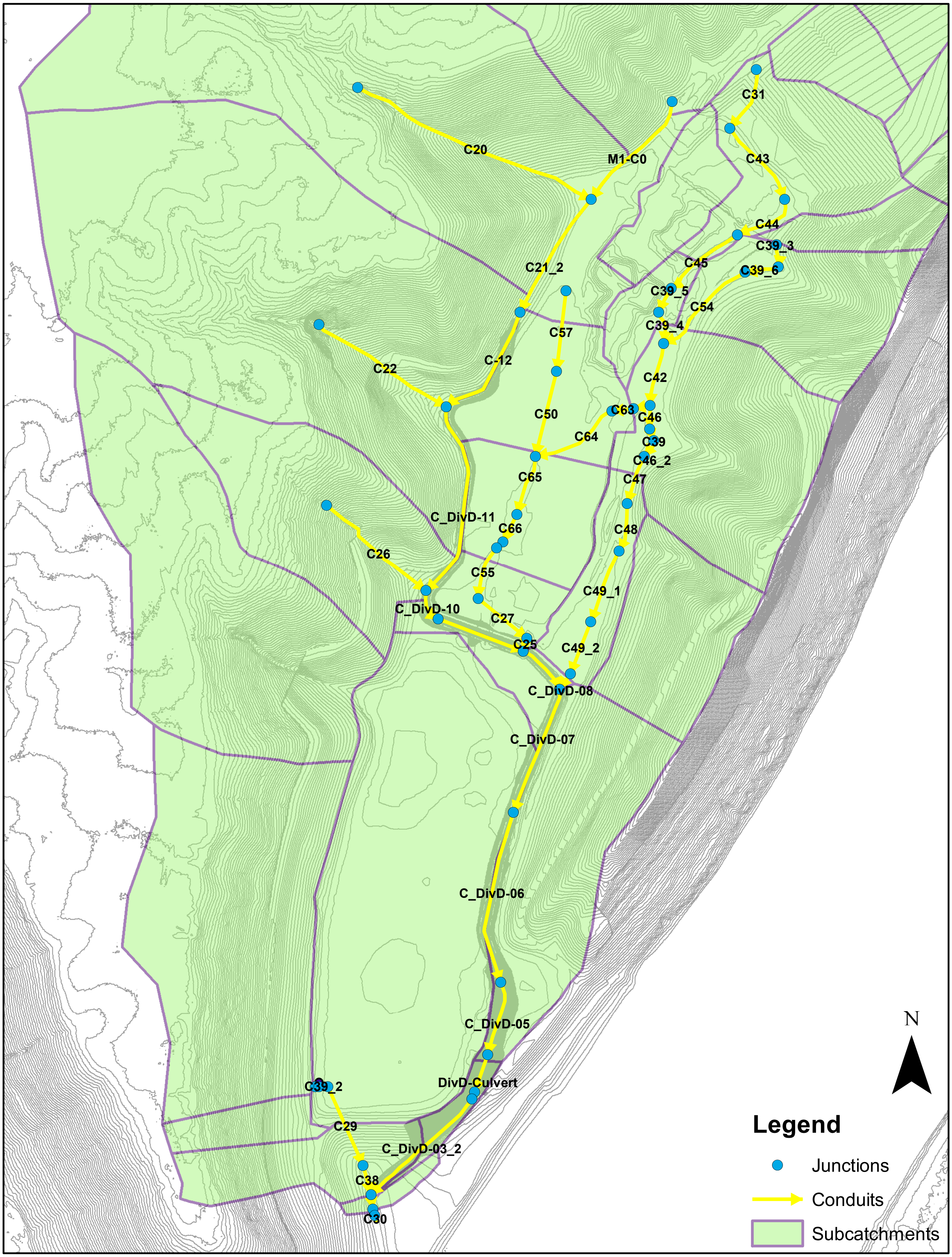
Calculation Performed by: Stantec Consulting Services Inc.

Prepared by: Brenton Newswanger

Reviewed by: Nick Mueller

Revisions:R0

Appendix A - Subbasin Boundaries



APPENDIX I

Final Cover Soil Loss

Stantec

Landfill Runoff Collection Pond
Closure Plan
Final Cover Soil Loss Calculations

175539026
Clifty Creek Station
Madison, Jefferson County, Indiana

The Universal Soil Loss Equation (USLE) is:

A = (R)(LS)(P)(K)(C)

where:
A = soil loss in tons/acre/year,
R = rainfall erosion index,
LS = slope length and steepness factor,
P = erosion control practice factor,
K = soil erodibility factor, and
C = vegetative cover factor.

Under 329 IAC 10-30-2, the final cover must have a maximum erosion rate of five tons per acre per year. Therefore, A ≤ 5.0 tons/acre/year.

R = 180 (southeastern Indiana in Figure 1)

LS = 2.6
for a 1,000-foot distance at 7.0% slope (such as a drainage channel). Assuming bare earth prior to riprap/geotextile placement. (USDA, AH537, 1981 - attached)

P = 1.00
K = 0.43
C = 0.01
(Indiana State Board of Health, 1986 – memorandum attached)

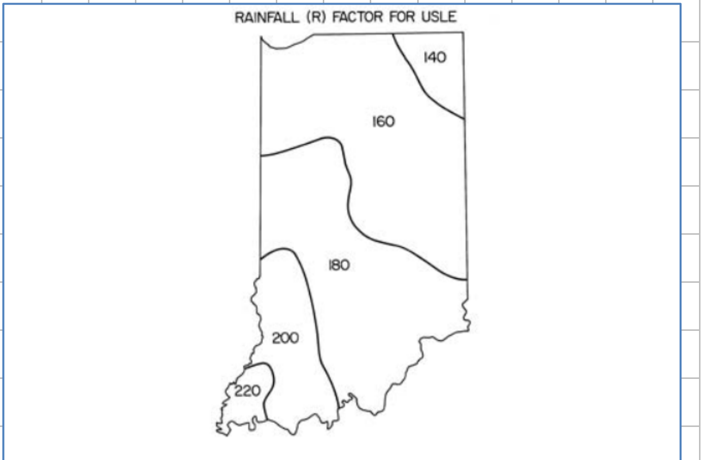


Fig 54. Map of Indiana showing rainfall intensity values (R factor).

1 - https://www.agry.purdue.edu/soils_judging/new_manual/ch6-water.html

A = (180)(2.6)(1.00)(0.43)(0.01) = 2.01 tons/acre/year for a slope length of 1,000 feet at 7.0%.

For LRCP, the steepest slope (excluding ditch sideslopes) is 7.0% with a maximum flow path of approximately 1,000 feet (less than the above calculation). The longest flow path on the surface is roughly 2,500 feet with a slope of 0.5%. However, these flow paths will be covered with 6” Unimat lining upon construction, limiting soil loss potential. The steepest slope (excluding ditch sideslopes) which will be permanently exposed is 2.0% with a maximum flow path of approximately 50 feet (less than the above calculation). The longest flow path on such a surface is roughly 2,000 feet with a slope of 0.8%.

Designed by: E Clare

Checked by: N Mueller

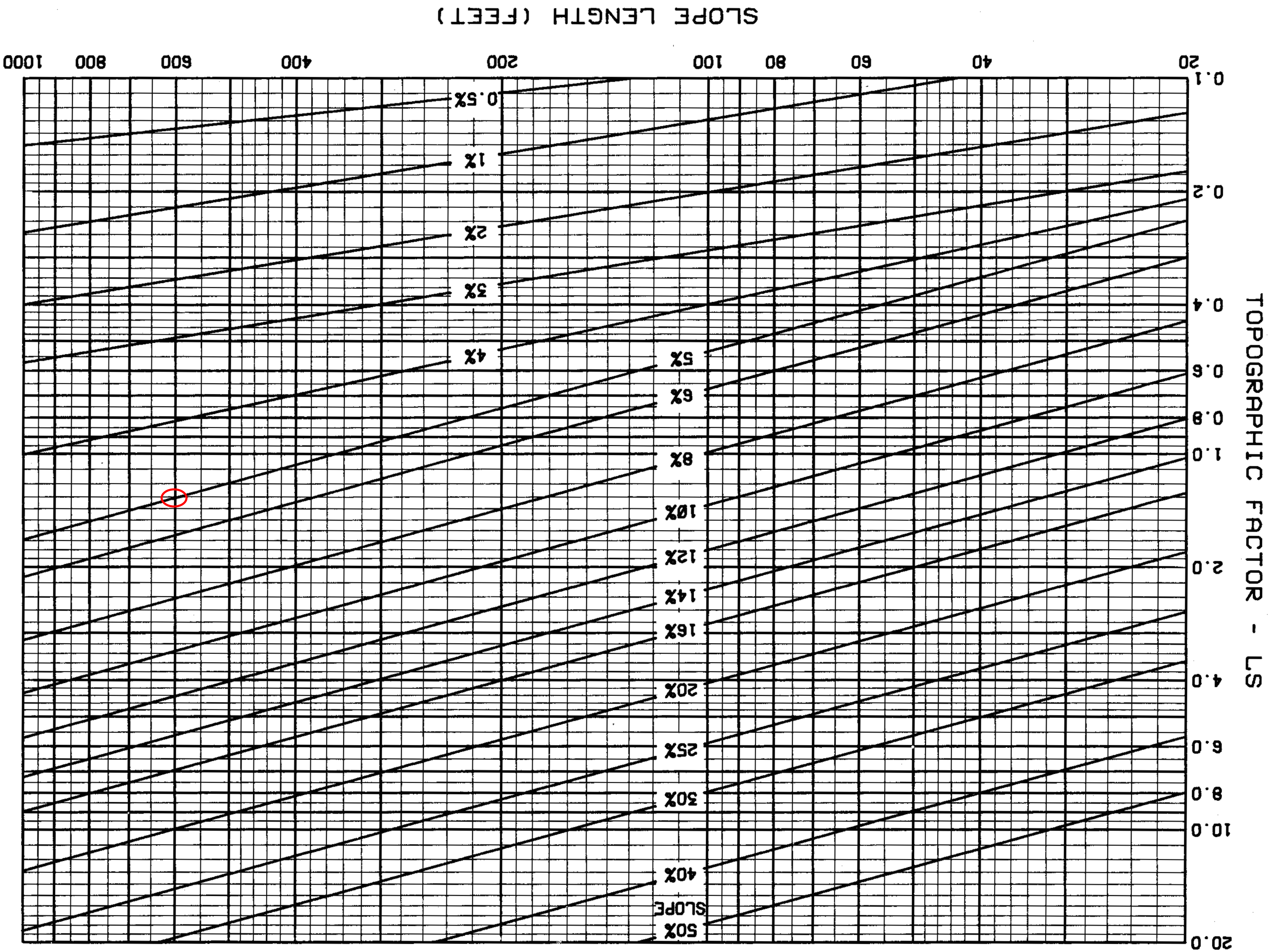


FIGURE 4.—Slope-effect chart (topographic factor, **LS**). **LS** = $(\lambda/72.6)^{m}$ $(65.41 \sin^2\theta + 4.56 \sin \theta + 0.065)$ where λ = slope length in feet; θ = angle of slope; and m = 0.2 for gradients < 1 percent, 0.3 for 1 to 3 percent slopes, 0.4 for 3.5 to 4.5 percent slopes, and 0.5 for slopes of 5 percent or steeper.

State Form 4336

STATE BOARD OF HEALTH

INDIANAPOLIS

OFFICE MEMORANDUM

DATE: January 3, 1986

TO: James E. Traylor
Technical Support Branch

THRU: Bruce Palin

FROM: Duane Leith
Engineering Section

SUBJECT: Guideline for the Evaluation of the Erosion Potential of Landfill Covers

Sanitary landfill covers should be designed for erosion control in order to avoid later exposure of the refuse and infiltration into the refuse. The design standards which are used can be controlling factors for the size and steepness of a landfill and are therefore often the basis for deciding when a landfill will have to close. It is therefore important to have reasonable and defensible standards. The most recent guidance available to staff in this regard is a memo by Mr. Larry Dunbar dated October 17, 1984, entitled "Evaluation of Design of Final Cover for Landfills." Certain publications recently available to staff and conversations with staff of the Soil Conservation Service have led to the conclusion that the guidance contained herein would be more appropriate than the previously-mentioned memo.

The Governor's Soil Resource Study Commission has proposed goals for erosion and sediment reduction as set forth in their report "Indiana's Erosion and Sedimentation Situation." Briefly, these goals are to reduce erosion on all land to an average annual rate denoted as "T" or the tolerable limit, which prevents depletion of the soil resource and to control all off-site sedimentation by application of best available technology. "T" is the rate at which the soil replaces itself. It is based on factors such as soil depth, texture, and permeability; its value is a matter of judgment rather than being quantifiable. The value of "T" is reported to range between two and five plus tons/acre/year. A value of five tons/acre/year is recommended as a standard under this guideline with an exception as noted.

The currently accepted method for determining the erosion potential of landfill covers is found in Agriculture Handbook 537, "Predicting Rainfall Erosion Losses," which is available from SCS offices. Application of the Universal Soil Loss Equation (USLE) from Agriculture Handbook 537 is conducted as follows:

A = RKLSCP, where:

A is the average soil loss in tons per acre calculated on an annual basis for landfill design.

R is the rainfall and runoff factor as obtained from the map Figure 1, inserted between pages 6 and 7 of the handbook, copy is attached to this document. This value ranges from 130 to 225 depending on location.

K is the soil erodibility factor as obtained from Figure 3 on page 11 of the handbook (copy attached), for the composition, structure and permeability of the surface soil as replaced over the landfill. This generally ranges from .30 to .50. If the soil source or characteristics are unknown, it has been recommended that a value of 0.43 be used for landfills.[1]

LS is the combined topographic factor for the length and slope which can be found from Table 3 on page 12, or the chart on page 13 of the handbook, copies of which are attached. Most landfills will have irregular convex slopes. The LS value for irregular slopes is determined by the procedures specified on page 16 of the handbook. The slope is divided into successive equal length segments of uniform slope. The LS factor is obtained for each segment at its respective slope and at a length equal to the total slope length. This LS factor is then adjusted by the "fraction of soil loss" figures shown under the column $M = 0.5$ in Table 4 on page 15 of the handbook, copies attached. Alternatively, this figure can be obtained from the equation

$$\text{Soil loss fraction} = \frac{i^{m+1} - (i-1)^{m+1}}{N^{m+1}}$$

where: i = segment sequence number, m = slope length exponent of 0.5 for slopes greater than or equal to five percent.
N = the number of equal length segments into which the slope was divided. The sum of the adjusted LS values is the LS value to be used for the entire slope.

C is the cover and management factor which can be found from Table 10 on page 32 of the handbook, or the copy attached. For properly prepared and seeded landfill covers which will be maintained in sod, use a value of 0.01. If a different vegetative cover is planned, adjust the value to reflect the anticipated conditions using Tables 5 through 12 of the handbook. A value of C lower than 0.01 should be allowed only with very intensive specifications regarding cover preparation, fertilization, seeding, and management. In order to establish high productivity, staff of the Soil Conservation Service discussed fertilization rates of 1,000 lbs/acre and contractor prices for fertilization, mulching, and seeding of $700 to $1,000 per acre.

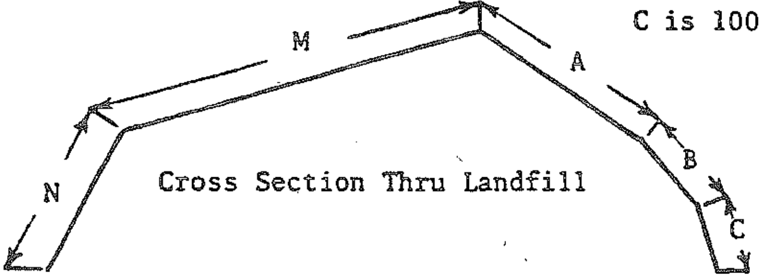
[1] Verbal communication with Mr. Raymond Sinclair of the Soil Conservation Service on October 7, 1985.

P is the supporting practices factor. For landfills, the value of P is 1.00, unless the site is to be used as cropland. Use the figures from Table 13 on page 35 and Table 14 on page 36 of the handbook as required for landfills used for cropland.

Sample calculation:

M is 800 ft. at 6%
N is 200 ft. at 30%

A is 300 ft. at 4%
B is 100 ft. at 10%
C is 100 ft. at 25%



Cross Section Thru Landfill

To determine A values for slopes A, B, C, and M, N:

For slopes A, B, and C

1. R = 175, for Marion County location on the rainfall and runoff map.

2. K = 0.43, assumed typical value since actual soil samples have not been tested.

3. LS determination:

Total Slope Length	Segment	Slope	LS Value from Figure 4	Adjustment Factor from Table 4	Revised LS Value
500 ft	A1	4%	.76	.09	.07
(5	A2	4%	.76	.16	.12
segments	A3	4%	.76	.21	.16
of 100 ft	B4	10%	3.06	.25	.77
each)	C5	25%	13.20	.28	3.70
					Total 4.82

4. C = 0.01, from grass sod, well maintained.

5. P = 1.0, since it is not tilled cropland.

Following the USLE: A = RKLSCP

A = 175 x .43 x 4.82 x .01 x 1.00, for slope A, B, C

A = 3.63 tons per acre

Since A is less than or equal to five tons per acre, this slope is acceptable.

For slopes M and N

1000 ft	M1	6%	2.13	.09	.19
(5	M2	6%	2.13	.16	.34
segments	M3	6%	2.13	.21	.45
of 200 ft	M4	6%	2.13	.25	.53
each)	M5	30%	25.57	.28	7.16
				Total	8.67

A = 175 x .43 x 8.67 x .01 x 1.00, for slope MN

A = 6.52 tons per acre

Since A is greater than five tons per acre, this slope is not acceptable.

It has been suggested that a possible way for a facility to have a cover with an A value higher than five would be to increase the cover depth on the lower slopes. The increased depth can allow for the formation of gullies which can then be stone-lined or similarly stabilized. Whether the increased A value should be allowed and the calculation of the necessary depth increase is not within the scope of this guidance. Erosion control is not the only factor to be considered in cover design. Other factors, such as prevention of ponding, slope stability, drainage, and feasibility of maintenance, will need to be considered.

In conclusion, it is recommended that sanitary landfill covers be designed for an A value not greater than five tons/acre/year, as determined by the Universal Soil Loss Equation from Agriculture Handbook 537. It is further recommended that a K value of 0.43 be used in calculating the A value for typical landfill soils.

References and documents.

1. Predicting Rainfall Erosion Losses, 1978, Agricultural Handbook 537, U.S.D.A.

2. Indiana's Erosion and Sediment Situation, 1984, Governor's Soil Resources Study Commission.

3. Dunbar, Larry, Office Memo to Engineering Staff, October 17, 1984.

4. Design and Construction of Covers for Solid Waste Landfills, 1979, EPA 600/2-79-165, U.S. EPA.

CrF Crosby silt loam

By Eroded silty clay loam

Guideline No. ____________

Co[illegible]ent period ends ______________.

APPENDIX J

LRCP Quality Management Plan (QMP)

Stantec

Construction Quality Management Plan (QMP)

Landfill Runoff Collection Pond Closure

Clifty Creek Plant
Jefferson County, Madison, Indiana

Issued for Bid – 60% Design

Prepared for:

Indiana-Kentucky Electric Corporation

Prepared by:

Stantec Consulting Services Inc.

May 21, 2021

Abbreviations

CCR	Coal Combustion Residuals
CM	Construction Manager
CQA	Construction Quality Assurance
CQC	Construction Quality Control
EDC	Engineering during Construction
EOR	Engineer of Record
EM	Engineering Manager
FR	Field Representative
FTP	File Transfer Protocol
IKEC	Indiana-Kentucky Electric Corporation
LRCP	Landfill Runoff Collection Pond
LVWTS	Low Volume Waste Treatment System
NCR	Nonconformance Reports
OD	Observed Deficiency
POD	Plan of the Day
QMP	Quality Management Plan
RFI	Request for Information
WBSP	West Boiler Slag Pond

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of the Construction Quality Management Plan (QMP) is to promote quality of the constructed work. It consists of three main components, namely, Construction Quality Control (CQC), Construction Quality Assurance (CQA), and Engineering during Construction (EDC). The CQC activities are the Subcontractor's responsibility. The CQA activities are an audit process, performed by the CQA Team, to make sure that the Subcontractor's CQC plan is implemented and on track. EDC activities consist primarily of reviewing and responding to Subcontractor submittals and requests for information (RFIs), and general design support throughout construction.

This Construction QMP provides guidance to the project team and establishes assessment, reporting, and documentation procedures to be implemented throughout the project. Where conflict arises between the requirements of this QMP and the contract documents, the most stringent requirements shall govern.

This QMP describes the CQC and CQA management structure, personnel requirements, and minimum project requirements. This QMP also serves as an outline to develop site-specific protocols based on conditions encountered during the work.

1.2 SCOPE OF WORK

This Construction QMP has been prepared for the Landfill Runoff Collection Pond (LRCP) Pond Closure project.

This project generally consists of the following activities:

- Lowering the pond water surface.
- Constructing a diversion ditch around the perimeter of the pond.
- Grading coal combustion residuals (CCR) to proposed subgrade elevations.
- Installing final cover system over the CCR material.
- Modifying the existing spillway structure.

1.3 CONSTRUCTION QUALITY CONTROL AND QUALITY ASSURANCE

The QMP establishes the requirements for CQC and CQA. It outlines roles, responsibilities, CQC and CQA activities, and establishes project processes and procedures. The CQC/CQA Program structure is shown below as Figure 1-1.

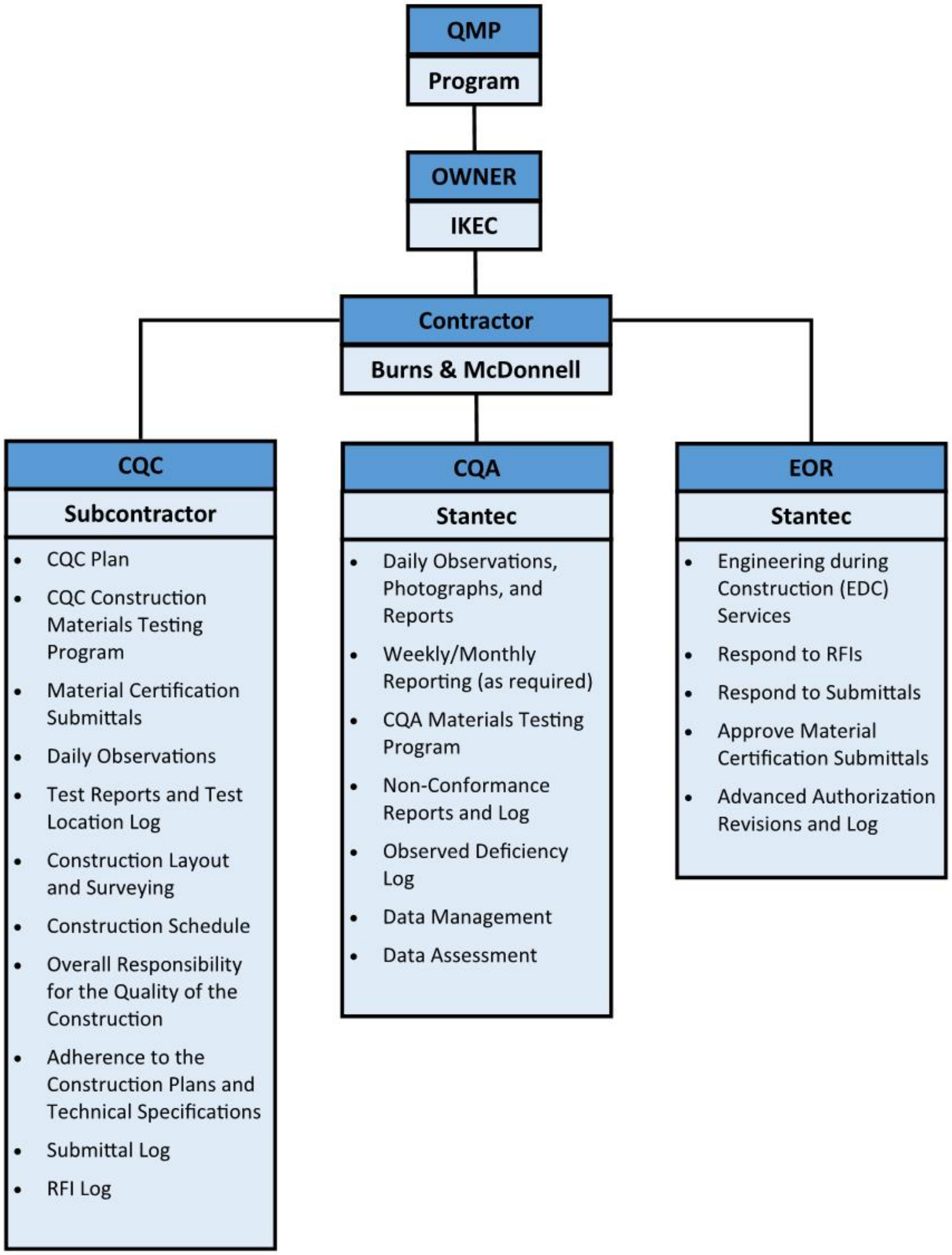

Figure 1-1. General Program Structure for CQC/CQA Program

1.4 SURVEY REQUIREMENTS

The Subcontractor shall provide construction layout services to execute the work according to the contract documents. Final as-built surveys and CQC surveys will be conducted by the Subcontractor and may be supplemented with surveys conducted by the Owner, Contractor, CQA Manager, or identified representative. As-built surveys shall be performed under the supervision of a professional surveyor licensed in the state of Indiana.

1.5 LIMITATIONS

The QMP does not include any facility elements outside the limits of construction designated on the Plans for Construction.

1.6 WORKING ON ASH

The Subcontractor shall be aware that there are inherent risks associated with working on CCR, including but not limited to, soft bearing conditions and unstable slopes. failures and instabilities may occur on apparently firm surfaces when loaded, or during active drawdown and dewatering. It is the Subcontractor's responsibility to actively manage their equipment and personnel to safely execute the work. the Subcontractor shall provide an access and excavation work plan that outlines their means and methods for working on CCR surfaces. The plan shall include sequencing of work and note the equipment and materials used.

Subcontractor is responsible for maintaining the stability of the CCR surfaces and perimeter dikes during construction. Subcontractor shall develop a monitoring plan detailing the type of monitoring to be performed (visual, installation of geotechnical instrumentation, or other methods). The plan shall also include, at a minimum, the potential for sloughing or instability of the perimeter dikes due to groundwater levels, how the risks will be mitigated, and how progressive failures along the perimeter dikes will be reduced and mitigated. the monitoring plan shall be submitted to the owner and their representative for review and approval.

The Subcontractor is responsible for all site safety and near surface ash stability at the site and shall follow all OSHA, Contractor, and owner safety requirements including but not limited to man on the ground exclusion zones. Furthermore, the Subcontractor shall provide to the owner a slope stability analysis prepared by a Registered Engineer in the State of Indiana for all excavations 10-feet or greater located outside of the exclusion zones or as directed by the Contractor. All evaluated excavations will require a minimum factor of safety of 1.3. The Subcontractor shall also prepare and provide to the owner for review a plan outlining all exclusion zones to include, but not limited to, barriers, setbacks, signage, and guidelines for entry.

2.0 ORGANIZATION AND RESPONSIBILITIES

2.1 PROGRAM ROLES AND RESPONSIBILITIES

The major participants in the project are listed below along with a description of their roles. An organizational chart is provided in Figure 1-1.

2.1.1 Owner

The plant and its ancillary functions are owned and operated by the Indiana-Kentucky Electric Corporation (IKEC). The Owner has contracted with the Contractor to serve as the Construction Manager (CM) who shall approve any design and/or QMP revisions. The Owner will administer communication with any regulatory agencies, including any related permit modifications.

2.1.1.1 Construction Manager (CM)

The Construction Manager (CM) is responsible for coordinating with the Subcontractor regarding contractual issues, including scope, budget, and schedule. In addition, the CM will provide daily oversight of the construction activities. The CM has the authority to stop work that is not in conformance with the Plans for Construction and Technical Specifications. The CM is responsible for tracking submittals and RFIs. The CM will then distribute the submittals and RFIs, as needed, to the appropriate party.

In addition, the CM or qualified representative shall perform at least monthly inspections of the LRCP facility. These inspections shall include observations of all outslopes for indications of slope instability including tension cracks, sloughs, and excessive seepage. These inspections shall be documented and retained within the project records. Any suspect site conditions shall be promptly reported to the Owner.

2.1.2 Engineer of Record (EOR)

The Engineer of Record (EOR) is responsible for development of the technical components of the project. During field implementation, the Engineer will provide support to the CQA Team for construction observation and CQA services.

Specific examples of Engineer responsibilities include responding to technical RFIs and submittals, supporting the CQA team, and review of field-testing data.

2.1.3 CQA Manager

The Construction Quality Assurance (CQA) Manager shall be responsible for the execution of the CQA program and related documentation as outlined in the QMP for all work performed. The CQA Manager shall be a Professional Engineer licensed in the state of Indiana.

2.1.4 Contractor

The Prime Contractor (Contractor) holds the Engineering, Procurement, and Construction contract directly with the Owner. The Contractor is responsible for coordinating the design, procurement, and construction work to complete the project. The Subcontractor (CQC Team), CQA Team and Engineer are contracted with the Prime Contractor for execution of the project.

2.1.5 Subcontractor

The Subcontractor is responsible for execution of the work in accordance with the contract documents. The Subcontractor is solely responsible for field implementation activities, including instrumentation and monitoring. The Subcontractor will collaborate with the CM to propose adjustments (if needed) to the scope of work depending on encountered conditions. Review and approval of scope of work adjustments shall be made by the Engineer.

Specific examples of Subcontractor responsibilities include, but are not limited to, data collection and providing that data to the Owner; development and implementation of the CQC Plan, including development of applicable procedures, processes, and work plans; reporting in accordance with the Technical Specifications; CQC materials testing; quantity tracking; conformance to the Technical Specifications; and structure and ground movement monitoring data collection and reporting.

2.1.5.1 Construction Quality Control Manager

The Subcontractor's CQC Manager shall have a minimum of five years of construction experience and be a full-time on-site employee of the Subcontractor. The Subcontractor CQC Manager is responsible for the Subcontractor's tests, inspections, processes, and related actions during and after construction execution to evaluate that both the actual products used, and the completed construction comply with the requirements of the Plans for Construction and Technical Specifications. The CQC Manager shall report to the Subcontractor's principal officers and the CM.

2.2 STOP WORK AUTHORITY

The EOR, CQA Manager, CM, and CQC Manager may exercise stop work authority when concerns related to quality are identified. In situations where personnel safety is concerned, any project personnel may stop work at any time.

3.0 QUALITY ASSURANCE

Construction Quality Assurance (CQA) is the responsibility of the Contractor, Engineer, and CQA Team. CQA includes assessments, observations, and reporting to document that the implementation of the work performed by the Subcontractor meets the requirements of the Plans for Construction and Technical Specifications. The CQA Team functions as the field representative for the Engineer through performance of assessments, verifications, and observations. Specific CQA responsibilities are listed as follows:

- Daily field report of construction activities including photographs.
- Noting observed deficiencies (ODs) during construction that require correction.
- Reviewing applicable Subcontractor submittals and Requests for Information (RFIs) related to quality for adherence to project requirements.
- Reviewing test data for compliance with project requirements and specifications.
- Performing assessments of the Subcontractor CQC Plan to ensure adherence to the QMP.
- Reviewing the Subcontractor documentation deliverables for conformance with project requirements.

- Periodic material testing to audit CQC test results.
- Reporting of test results.
- Special testing requested by the Owner.

3.1 QUALITY ASSURANCE TEAM

3.1.1 Roles and Responsibilities

The CQA Team serves as observers of field implementation of the construction documents and to provide CQA documentation. The CQA Team is responsible for the execution of the CQA Plan and related documentation as outlined herein. Individual roles and responsibilities for the CQA Team members are defined below. Personnel assignments are subject to change, if qualification requirements are met and approved by IKEC.

3.1.1.1 Construction Quality Assurance (CQA) Manager

A professional engineer licensed in the State of Indiana shall be designated as the CQA Manager. The CQA Manager shall be responsible for administering the CQA program and advising the CQA Team.

The CQA Manager will be responsible for the following tasks:

- Observing conformance with the QMP by reviewing and documenting project records and activities;
- Managing overall implementation of the CQA program;
- Evaluating the testing results of the CQC program;
- Evaluating work for conformance with the project plans and specifications and notifying the CM if work is non-compliant with the contract documents;
- Managing the documentation of all CQA activities;
- Reviewing progress of the work and reports prepared by the Subcontractor as part of the CQC Plan;
- Verify the appropriate test standards are used for the methods to conduct assessments and field and laboratory testing for CQA testing;
- Evaluating and auditing the results of CQC and CQA assessments and testing; and
- Review daily field reports prior to submittal to the CM and EOR.

3.1.1.2 Construction Quality Assurance (CQA) Supervisor

The Construction Quality Assurance (CQA) Supervisor provides oversight for the CQA Field Representative(s) on site. The CQA Supervisor is familiar with the materials to be used, the observations and testing to be done, and the functional intent of the QMP. The CQA Supervisor has responsibility for:

- Coordination of the periodic CQA construction testing in the field;
- Coordination of other testing with a commercial laboratory (as needed);
- Provides support to field CQA staff;
- Plans and directs the activities of CQA field representative(s); and
- Reviews Daily Field Reports.

In conjunction with their staff, the CQA Supervisor reviews daily field reports and directives, and reports to the CQA Manager any situation where the Plans for Construction and Technical Specifications do not appear to be appropriate for the conditions encountered.

The CQA Supervisor reviews Nonconformance Reports and has authority to stop work due to adverse quality conditions or potentially unsafe work practices. The CQA Supervisor reports to the CQA Manager. The CQA Supervisor will be on-site an average of one day per month for the duration of construction, or as necessary to observe key construction activities to support the CQA team.

3.1.1.3 Construction Quality Assurance (CQA) Field Representative (FR)

The Construction Quality Assurance Field Representative (CQA FR) staff shall consist of qualified personnel working under the direct supervision of the CQA Manager and CQA Supervisor. The CQA Supervisor will be responsible for the day-to-day coordination and management of the CQA FRs.

The CQA FR is responsible for performing quality assurance in the field, and for performing observations of conformance with the Plans for Construction and Technical Specifications. The CQA FR will document the results of the required CQA observations and testing and inform responsible personnel about unsatisfactory items. The CQA FR is also responsible for documenting that corrective actions are taken to resolve the conditions. For defective work, the site-specific CQA FR will initiate a Nonconformance Report and submit the report to the CQA Supervisor.

The duties of the CQA FR are listed below:

- Daily observations of construction activities to verify conformance with project Plans for Construction and Technical Specifications;
- Observe on-site testing performed by CQC team members;
- Perform periodic on-site CQA testing to verify CQC procedures and test results;
- Coordinate required sampling with commercial laboratory for other quality control testing (as needed);
- Prepare and submit daily field report of observations, testing results, and photographs;
- Conduct periodic inspection of specific construction items;
- Instrumentation monitoring (as needed);
- Verification that testing is performed and that results meet the Technical Specifications;

- Verification of Subcontractor's CQC surveying;
- Reporting of nonconformances; and
- Reporting of observed deficiencies.

3.1.2 Materials Testing

The CQA Team will perform selected CQA sampling and material testing to audit CQC procedures and test results. The material testing schedule is included in Attachment A. The schedule specifies the anticipated types and minimum number of tests for each material subject to testing and required frequency of testing. The CQA Manager or identified representative is responsible for reviewing the material testing and results and manufacturer's supplied information for conformance to the Technical Specifications.

3.2 QUALITY ASSURANCE DAILY FIELD OBSERVATIONS

3.2.1 General

The CQA Team shall review the Plans for Construction and Technical Specifications for each day's construction activities. After observation of the day's activities, they shall document whether the work that was observed has been done in accordance with the Plans for Construction and Technical Specifications. The CQA Team's observation of work serves as an audit function. It is not to be considered a verification that all work performed was in accordance with the Plans for Construction and Technical Specifications. That responsibility remains with the CQC Team.

Daily observations are to be documented in a CQA daily field report.

Any suspect conditions shall be promptly reported to the CM. Each observation shall be documented on the Daily Field Report form for inclusion with the project records.

3.2.2 Conformance Verification

Conformance verification shall consist of observing and documenting testing performed by the Subcontractor to ensure that the required tests and evaluation of materials and construction products are performed. The CQA Team shall confirm that testing is performed at frequencies specified in this QMP. The CQA Team shall perform periodic testing to verify the results of the Subcontractor. Additional or supplementary conformance testing may be added at the discretion of the CQA Manager. Results shall be reviewed by the CQA Manager to assess conformance with project requirements. Copies of all conformance results shall be included on a CQC testing log and with the project records.

The NCR process shall be used, as needed, to immediately report deficiencies, remediation required, and resolution to the Contractor and Engineer. NCRs may be submitted to the CQA Manager by the CQA Team or Subcontractor. The CM will maintain a log as a record of the non-conformances encountered and the final resolution. A detailed description of the NCR process is provided in Subsection 5.2.5.

4.0 QUALITY CONTROL

Construction Quality Control (CQC) and overall construction/material quality is the responsibility of the Subcontractor. CQC includes establishing procedures and work plans, performing observations, documenting construction processes and performance, and performing materials testing to demonstrate the quality of the constructed elements. Specific CQC items are as follows:

- Ensuring that the Subcontractor's work complies in all respects to the Plans for Construction, Technical Specifications, other contract documents, and any approved changes to the contract documents.
- Developing the CQC Plan.
- Developing work plans, procedures, and submittals related to the work.
- Preparing a daily log of observations and activities.
- Providing data collected during this project to the Contractor.
- Demonstrating the means and methods for complying with the Plans for Construction and the Technical Specifications.
- Performing construction staking and layout.
- Performing construction materials quality control testing and reporting.
- Maintaining an updated construction schedule with CQC/CQA hold point milestones represented.
- Maintaining calibrations on measuring and testing equipment.
- Providing final as-built surveys and drawings.
- Testing logs, timely submittal of required deliverables, reporting nonconforming conditions to the Engineer, and data management.

4.1 SURVEY REQUIREMENTS

The Subcontractor shall provide field layout services for the purposes of executing the work according to the contract documents. The work shall be laid out and constructed to the elevations shown in the Plans for Construction and in accordance with the Technical Specifications. Tolerances shall be as defined in the Technical Specifications.

Final as-built surveys and CQC surveys will be conducted by the Subcontractor and may be supplemented with surveys conducted by the Contractor or identified representative.

4.2 CQC EXECUTION AND PLAN PREPARATION

The Subcontractor shall prepare a CQC Plan meeting the requirements of this QMP and the project specifications. The CQC Plan must be approved by the Contractor, CM, and Engineer prior to the start of construction. The Subcontractor shall execute CQC activities in accordance with the approved CQC Plan.

4.3 CQC PLAN REQUIREMENTS

The Subcontractor is responsible for establishing and maintaining a CQC Plan for the project to ensure that the project is executed, and items are installed in accordance with the Plans for Construction and Technical Specifications. The objective of the CQC Plan is to provide a framework where a quality product will be produced. The details of the CQC system will be described in the CQC Plan document, which will establish procedures to ensure uniformity and provide a standard by which comparisons can be made.

The CQC Plan shall include, at a minimum, the following to cover all operations, both on-site and off-site, including work by subcontractors and suppliers:

- Organizational Structure: Chart showing the CQC organizational structure, including line of authority.
- Personnel: Names and qualifications, in resume format, for each person in the QC organization.
- Duties, Responsibilities, and Authorities: Duties, responsibilities, and authorities of each person in the QC organization.
- Outside Organizations: List of outside organizations, such as consulting engineering firms, that will be employed by the Subcontractor and a description of services these firms will provide, including decision-making authority (if any).
- Scope of Work: Scope, including testing laboratory information and accreditations and materials testing schedule.
- Submittals: Procedures for reviewing, approving, and managing submittals. Include the name(s) of the person(s) in the QC organization authorized to prepare required submittals, and the initial submittal of the submittal register as specified in the section entitled “Submittal Procedures.”
- Completing Rework Items: Procedures for addressing nonconformance, deficient, and rework items.
- Measuring and Testing Equipment: Copies of current certifications for monitoring and testing equipment.
- Documentation Procedures: Documentation procedures, including proposed report/forms formats.
- Training Requirements: Documentation of personnel trained in specifics of the CQC Plan.
- Work Plans and Quality Process Documents.

4.4 TESTING SCHEDULE

It is the responsibility of the Subcontractor to perform tests specified in the Technical Specifications and verify that control measures are adequate to provide a product that conforms to the requirements of the project documents. A material testing schedule outlining minimum CQC and CQA testing frequencies is included in Attachment A. The schedule specifies the anticipated types and minimum number of tests for each material subject to testing. The CQC Manager or identified representative is responsible for verifying that material testing and results conform to the Technical Specifications. The Subcontractor shall maintain a log of all CQC material test results.

4.5 SUBMITTALS AND REQUEST FOR INFORMATION

4.5.1 Submittals

Subcontractor submittals shall be provided to the CM, consistent with the requirements of the Technical Specifications. For material submittals, the Subcontractor shall review and certify that the material conforms to the Plans for Construction and Technical Specifications prior to submittal to the CM.

4.5.2 Request for Information

The Subcontractor shall communicate issues such as constructability, discrepancies in the plans, and requests for Engineer support during field implementation, etc., using the RFI form. RFIs shall be submitted by the Subcontractor to the CM. The CM routes the RFI to the Engineer. The Engineer will prepare a response to the RFI and submit it to the CM. The CM then sends the completed RFI response to the Subcontractor.

The CM, or representative, shall document each RFI in an RFI log and in the project records. The RFI log will be maintained by the CM, or representative, and will be reviewed at the weekly project progress meetings. The Subcontractor is encouraged to engage the Engineer and the Engineering Team prior to RFI submittal in efforts to streamline the RFI process. The Engineer has seven calendar days upon receipt of the RFI to provide a response to the CM. If a quicker response is required by the Subcontractor, this should be noted in the RFI and in the correspondence to the CM.

Any changes to the project that result from the RFI process shall be documented and communicated to the CQA Team and the Subcontractor. Communications shall include discussion of the issue that led to the RFI, the intent of the RFI response, and any resulting changes to the project.

It should be noted that, because of the nature of the project, the RFI process may not be suitable for some of the day-to-day adjustments that will be necessary. Instead, daily collaboration between the CM, Engineer, and Subcontractor field staff will be essential to successfully meet the intent of the project. Such daily adjustments shall be documented in both the CQC daily field report and the CQA daily field report.

4.6 MEETINGS

4.6.1 Orientation Meeting

An orientation meeting (i.e., kickoff meeting) shall be held before field implementation of the QMP. At a minimum, those present will include the CM, the Contractor, the Subcontractor's PM, the CQC Manager, the CQA Manager, CQA FR, IDEM, and others as needed. This meeting will include a review of the project document objectives, quality management processes, hold points, and special project requirements. The Subcontractor will prepare meeting minutes and distribute them for review. The Owner shall notify the IDEM permit manager 10 working days prior to the meeting.

Other kickoff meetings may be required before the start of discrete phases of the work.

4.6.2 Daily Meetings

Daily plan-of-the-day (POD) meetings related to safety and construction activities for the day's work shall be conducted by the CM or designated representative. Attendees shall include the CQA FR and the CQC Manager. Other key participants from IKEC, the Engineer, and the Subcontractor will be included in these meetings as appropriate.

4.6.3 Weekly Meetings

The CM will hold weekly on-site meetings with the project team during active construction. Portions of these meeting will be allotted to discuss quality and engineering. Those present shall include the CM; CQA FR; and the CQC Manager and on-site representative. Other key participants from IKEC, the Engineer, Contractor, and the Subcontractor will be included in these meetings as appropriate.

The primary purpose of the weekly meetings shall be to confirm that all parties involved with field activities are familiar with the design, required procedures, and associated quality objectives, along with any issues (e.g., safety, environmental) related to field implementation. Topics to be addressed at this meeting shall include a review of the schedule, any outstanding RFIs, outstanding change orders, status of Subcontractor submittals, and quality issues. The CM, or representative, shall provide minutes of each meeting for inclusion in the project records.

4.6.4 Additional Meetings

Other on-site meetings will be organized to address site-specific issues that need quick resolution but are not conducive to the weekly or other regularly scheduled meetings or that require specific personnel to be present and to work through specific issues as they arise. Such meetings will be documented on the CQC and CQA daily field reports.

5.0 QUALITY MANAGEMENT DOCUMENTATION

5.1 PROJECT DOCUMENTATION

Project CQA documentation shall be obtained and maintained by the CQA Manager and copied to the Engineer during all phases of field implementation. Project CQC documentation shall be obtained and maintained by the CM or identified representative and copied to the Engineer. The Subcontractor is required to submit all data collected, both raw and processed, to the Contractor. Transfer of these data should be through Procore or similar file management platform.

Distribution of the project documentation shall be in accordance with Table 5-1.

Table 5-1. Reporting Responsibility

Item	Originator	Primary Recipients	Secondary Recipients
Daily CQA Report	CQA FR	CQA Supervisor	CM, EOR, CQA Manager, Subcontractor
Daily CQC Report	CQC Team	CM	CQA Manager, EOR
Request for Information (RFI): Submittal	Subcontractor	CM	EOR CQA Manager
Request for Information (RFI): Approval and RFI Log	CM	EOR	CQA Supervisor CQA Manager
Observed Deficiency Log	CQA FR, CQA Supervisor	CM, CQA Manager	Subcontractor
Nonconformance Reports and Log	CQA Supervisor, CQA Manager	CM, EOR	Subcontractor
Subcontractor Submittals	Subcontractor	CM	EOR, CQA Supervisor
Subcontractor Submittal Approval and Log	Subcontractor	CM	EOR, CQA Manager
CQC Testing Results and Log	CQC Team	CM	CQA Manager, EOR
CQC Correspondence and Log	Subcontractor	CM	CQA Manager, EOR
Design Revisions and Log	EOR	CQA Manager	Subcontractor, CM
Subcontractor Daily Production Report	Subcontractor	CM	EOR
Weekly Meeting Minutes	CM	All Present	N/A
Construction Certification Report	CQA Manager	EOR	CM

5.2 CQA DOCUMENTATION

The CQA documentation shall include, but is not limited to, the following:

- Daily field report;
- RFI responses;
- ODs;
- NCRs;
- CQA correspondence (i.e., memos, letters);
- Photographic documentation; and
- Plans for Construction and Technical Specifications revisions and log.

5.2.1 CQA Daily Field Report

The CQA Team shall maintain daily field reports to document daily observations, investigations, and analyses of the construction, as well as to document the progress of the work. These reports shall include photographic documentation, where applicable. The CM will provide daily tracking of quantities, consistent with the Subcontractor pay items (hard quantities, standby hours tracked separately by CM). This daily tracking will allow independent assessment of the Subcontractor quantities in the team's daily field report.

5.2.2 Photographs

The CQA Team shall maintain a photographic record of the field implementation, documenting the progress of project construction. For the purpose of construction, photographs will be taken as needed to document processes, procedures, and any deficiencies or nonconformance, and will provide a photographic record for inclusion in the project record. Each photograph shall have the date recorded, the name of the person taking the photo (if by someone other than the daily field report author), and the location of photographs. This information shall be noted in the daily field report or the photographic log.

5.2.3 Material Testing Reports

CQA material testing reports will be compiled and distributed to the project team. Daily summaries and off-site test CQA results will be included in the CQA Daily Field Report. Reports shall include CQA testing results for both laboratory and field testing.

5.2.4 Observed Deficiencies (ODs)

Observed Deficiencies (ODs) shall identify and document deficiencies in quality, workmanship, materials, equipment, or supplies and unauthorized deviations from Plans for Construction or the Technical Specifications. The OD log is used to track and rectify deficient events that do not need to be escalated to the NCR level. The following procedures shall be used to document ODs:

- When the Subcontractor, Engineer, or CM notices an observed deficiency, the CQA FR records it in the corresponding CQA daily report.

- The CQA Supervisor will enter the OD into the Observations tool in Procore along with the following information: referenced daily report number, observed date, deficiency description, reference to the corresponding requirement (if applicable), hold point (if applicable), and responsible party.

- The CQA Team, CM, and the Subcontractor will work to establish a resolution and corresponding timeframe for the OD.

- Once a corrective action for the OD has been agreed upon by all involved parties, it will be implemented by the responsible party (if necessary).

- After the OD is verified to be resolved, the CQA FR will record it in the corresponding CQA daily report.

- The CQA Supervisor will enter the following information into the Observations tool in Procore: referenced daily report number, the resolved date, and corrective action description.

- The Observations tool in Procore will be maintained by the CQA Supervisor for tracking the status of OD events.

5.2.5 Nonconformance Reports

Nonconformance Reports (NCRs) shall identify, report, and document a nonconforming event in quality, workmanship, materials, equipment, or supplies and unauthorized deviations from Plans for Construction or the Technical Specifications. The following procedures shall be used to report nonconformance:

- When a nonconformance is observed, whether by the Engineer, Subcontractor, or CM, the CQA FR prepares an NCR that describes deficiencies noted (including time, actions, locations, etc.) and references to the corresponding requirements. Additionally, a list of corrective actions is identified for the Subcontractor to complete, or meet, to the satisfaction of the Engineer.

- The NCR form is then routed to the Engineer for assessment, with a disposition on the installed work/materials that need to be replaced, if any. The form is then routed to the CM for finalization.

- The CM then routes the NCR package to the Engineer for final review and signature and returns it to the CM, if acceptable. Once that process is complete, the CM issues the NCR to the Subcontractor.

- The Subcontractor provides a list of proposed corrective actions on the form and returns it to the CM for processing and issuance to the CQA Manager. If the proposed corrective action is acceptable, the CQA Manager signs the NCR and includes a list of required documentation to be provided by the Subcontractor to confirm completion of the corrective action. The NCR is then returned to the CM for processing and issued to the Engineer for final approval and signature. The form is then routed to the CM for issuance to the Subcontractor for implementation. If the proposed corrective action is not deemed acceptable, the CQA Manager returns the form to the CM with additional comments for issuance to the Subcontractor for review and revision.

- The process is repeated until the Subcontractor’s proposed corrective actions are acceptable to the CQA Manager.

- On completion of the rework identified as deficient or nonconforming, the CQA Manager will conduct a reassessment of the items noted in the NCR. If the reworked items are found acceptable, it will be so noted on the NCR. If, however, the items are still not acceptable to the CQA Manager, the items will be rejected and must be reworked before it is resubmitted for further assessment.

- The CM and the CQA Manager will periodically review the status of NCRs and will work with the Subcontractor to establish a timetable for the final resolution of all deficiencies.
- A Nonconformance Log will be maintained by the CM for tracking the status of nonconforming items.

5.3 PLANS AND TECHNICAL SPECIFICATIONS REVISIONS

Periodically during construction, changes to the Plans for Construction and/or Technical Specifications may be required. These changes will be reviewed and drafted by the Engineer and approved by the Engineer prior to field implementation. Any deviations and changes to the Plans for Construction and Specifications require review and concurrence from the Contractor. The revisions will be included on a revision log and in the project records.

5.4 CQC DOCUMENTATION

The CQC documentation shall include, but not be limited to, the following:

- CQC Daily Field Report;
- Field Observation Logs and Test Data Sheets;
- Subcontractor Submittals and Shop Drawings;
- Material Conformance Test Results;
- Construction Problem and Solution Reports;
- Photographic Documentation;
- Design and/or Specification Modifications; and
- Meeting Minutes.

5.4.1 CQC Daily Report

The CQC report shall include a summary of work performed for the day; CQC tests performed; test results; and a “remarks” section that will contain pertinent information, including significant observations, problems encountered during field implementation, and delays encountered. The following CQC data is to be provided in the report:

- Date.
- Weather.
- Quantities of material received on-site with corresponding delivery tickets.

- Quantities of materials used.
- List of CQC tests performed.
- Remarks section outlining any issues, delays, etc., that were encountered during the day.
- Updated drawings, mapping, and graphical representations of field work.
- Quantities of materials and/or debris to be hauled off-site and disposed of at locations not owned, operated, or maintained by the Owner, including proper chain of custody, required haul tickets, and scale tickets.
- Daily hold points.
- Photographs of daily construction activities.

In addition to this reporting, refer to the Technical Specifications for more detailed requirements.

ATTACHMENT A

Material Testing Schedule

LRCP Closure
Quality Management Plan

Materials Testing Schedule

MATERIAL	PROPERTY	TEST	VALUE	QC FREQUENCY	QA FREQUENCY
Concrete					
Cast-in-Place Concrete	Compressive Strength	ASTM C39	4,500 psi	1 / 50 CY placed or 1 / day whichever is more frequent	1 / 200 CY placed. Also review QC laboratory reports
	Entrained Air Content	ASTM C231	2.5 - 6.0 %	1 / delivery	Observe Only
	Slump	ASTM C143	3 ± 1	1 / delivery	Observe Only
CCR Fill					
	Standard Proctor	ASTM D698	laboratory test	1 / change in material	Review laboratory reports
	Field Density and Moisture	ASTM D6938	Min. 85%, within 2% of optimum moisture content	5 / acre per lift	1 / acre per lift
Flexible Membrane Liner (FML)					
40 mil LLDPE Geomembrane	Large scale direct shear testing	ASTM D5321	laboratory test	1 test per material interface	review laboratory reports provided by CQC Manager
	Seam Properties - Shear Strength	ASTM D6392	Fusion - 60 lbs/in , Extrusion - 60 lbs/in	Cut 1 sample / 500 linear feet of weld	1 / destructive test sample provided by CQC Manager
	Seam Properties - Peel Strength	ASTM D6392	Fusion - 50 lbs/in , Extrusion - 44 lbs/in	Cut 1 sample / 500 linear feet of weld	1 / destructive test sample provided by CQC Manager
	Trial Welds	ASTM D6392	Fusion: 50 lbs/in peel; 60 lbs/in shear Extrusion: 44 lbs/in peel; 60 lbs/in shear	2 / operator / machine / day (morning and mid-shift, max 4 hr work intervals)	Observation Only
	Vacuum Testing	ASTM D5641	Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.	1 / extrusion weld and repair location	Observation Only
	Air Pressure Testing	ASTM D5820	Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes	1 / wedge weld and repair location	Observation Only

Materials Testing Schedule

MATERIAL	PROPERTY	TEST	VALUE	QC FREQUENCY	QA FREQUENCY
Soils					
Cover Soil	Soil Classification	ASTM D2487	CL, CH, MH, or ML, CL-ML, SC, or SM-SC according to the Unified Soil Classification System, or a combination of these groups	1 / source / change in material	Review laboratory reports
	Standard Proctor	ASTM D698	laboratory test	1 / source / change in material	Review laboratory reports
	Field Density and Moisture	ASTM D6938	Min. 92%, within 2% of optimum moisture content	5 / acre / lift	1 / acre / lift
Vegetative Cover	Soil Classification	ASTM D5268	Soils used for vegetative cover shall conform to the requirements set forth in ASTM D5268, unless otherwise approved based on the soils ability to sustain vegetation	1 / source / change in material	Review laboratory reports
	Agronomic Testing	-	laboratory test	1 / 10 acres	Review laboratory reports
Clay Berm Soil	Soil Classification	ASTM D2487	CL, CH, MH, or ML, CL-ML, SC, or SM-SC according to the Unified Soil Classification System, or a combination of these groups	1 / source / change in material	Review laboratory reports
	Standard Proctor	ASTM D698	laboratory test	1 / source / change in material	Review laboratory reports
	Field Density and Moisture	ASTM D6938	Min. 95%, within 2% of optimum moisture content	5 / acre / lift	1 / acre / lift
Anchor Trench Backfill	Standard Proctor	ASTM D698	laboratory test	1 / source / change in material	Review laboratory reports
	Field Density and Moisture	ASTM D6938	Compact each layer of material with at least three passes of a vibratory plate compactor with in-place moisture within -2% to +2% of optimum moisture content	1 / 100 linear feet of trench	1 / 500 linear feet of trench

LRCP Closure
Quality Management Plan

Materials Testing Schedule

MATERIAL	PROPERTY	TEST	VALUE	QC FREQUENCY	QA FREQUENCY
Utility/Pipe Trench Backfill					
	Standard Proctor	ASTM D698	laboratory test	1 / source / change in material	Review laboratory reports
	Field Density and Moisture	ASTM D6938	Min. 95%, within 2% of optimum moisture content	1 / 100 linear feet of trench	1 / 500 linear feet of trench
HDPE Pipe					
HDPE Gravity Pipe	Low Pressure Air Test	ASTM F1417	Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air	1 / pipe run	Observation Only
Materials Delivered to Site					
	Defects	Visual Observation	no defects	1 / material delivery	1 / material delivery
	Conformance to Submittals	Visual Observation	conforms to plans	1 / material delivery	1 / material delivery

Notes:

(1) Testing frequency may be adjusted as directed by the CQA Manager

(2) This table does not include all required quality control testing. The Subontractor shall be solely responsible for the proper implementation of its Quality Control Program.

APPENDIX K

Post Closure Plan

Post-closure Plan

CFR 257.104(d)

Landfill Runoff Collection Pond

Clifty Creek Station

Madison, Indiana

April 2021

Prepared by: Indiana-Kentucky Electric Corporation

3932 U.S. Route 23

Piketon, OH 45661

OVEC IKEC

Ohio Valley Electric Corporation Indiana-Kentucky Electric Corporation

Table of Contents

1.0 OBJECTIVE

This report has been prepared to fulfill the requirements of 40 CFR 257.102(b) of the Coal Combustion Residuals (CCR) Rule to develop a Closure Plan for the Clifty Creek Station's Landfill Runoff Collection Pond (LRCP).

2.0 DESCRIPTION OF THE CCR UNIT

The Clifty Creek Station is located on the shore of the Ohio River near Madison, Indiana and consists of six coal-fired electric generating units; each nominally rated at 217 megawatts, that began producing electricity in 1955 to support the Department of Energy's (DOE's) Portsmouth Gaseous Diffusion Plant located near Piketon, Ohio.

The LRCP is an inactive surface impoundment located southwest of the station, adjacent to the CCR landfill. The LRCP is surrounded by steep hillsides to the east and west, the CCR landfill to the north, and a constructed dam to the south. The current water surface elevation is approximately 486 feet. The crest of the dam is at approximate elevation 505 feet. Currently, the facility functions as the stormwater and leachate collection pond for the CCR landfill, and discharges to the Ohio River through an NPDES-permitted outfall.

3.0 DESCRIPTION OF THE POST-CLOSURE PLAN 257.102(b)(1)(i)

[A description of the monitoring and maintenance activities required in paragraph (b) of this section for the CCR unit, and the frequency at which these activities will be performed]

3.1 Section 257.104(b)(1)

[Maintaining the integrity and effectiveness of the final cover system including making repairs to the final cover as necessary to correct the effects of the settlement, subsidence, erosion, or other events and preventing run-on and run-off from eroding or otherwise damaging the final cover.]

Inspections are performed for the items noted below. The inspection frequencies are scheduled to properly detect any issues so that repairs can be performed before significant harm occurs.

- Embankment: The waste embankment will be inspected for slides, settlement, subsidence, displacement, and cover condition (see below).

- Final Cover Surface: The Final Cover surface will be inspected for any ponding of water or flat areas. Due to the design contours required to achieve the final cap grade, special attention will be focused to ensure that no settlement, subsidence, erosion, depressions or flat areas exist and that no water is allowed to pond above the cap system. Condition of the vegetation will be observed for maintenance needs (i.e., gaps in vegetation, presence of undesirable trees or brush).

- Stormwater Management System: The stormwater management system, including channels, culverts, slope drains, etc., will be inspected for erosion, integrity of channel lining, ponding, and accumulated sediment.

Maintenance during the post-closure care period will be performed as discussed below following the facility inspections.

- Embankment: Embankments will be inspected for slides, settlement, subsidence, displacement, and cover condition. Any areas exhibiting any such conditions will be repaired by reworking, replacing and/or compacting the material to design grade/ specifications.

- Erosion Damage Repair: Any areas exhibiting erosion will be repaired by reworking, replacing and/or compacting the material to design grade/specifications, and reseeding the area. Applications of additional fertilizer, selective herbicides, rodent control measures, etc. will be implemented as necessary. The selection of fertilizers and herbicides will strive to minimize their impact on groundwater. Follow-up monitoring of the repaired area will be conducted.

- Settlement, Subsidence, Displacement: Any areas at the closed site exhibiting evidence of settlement, subsidence, or displacement will be examined to determine the cause of the movement. If backfilling or placing additional fill material is needed to maintain the integrity of the closed structure, it will be performed in accordance with the site/closure specifications, including seeding. If the condition reoccurs or persists, or if the severity of the condition initially is judged to warrant it, a detailed investigation of the cause will be performed and remedial action will be performed. Repairs will be made as necessary. Follow-up monitoring of the area will be performed.

- Closure Cap Surface: Any areas that show signs of ponding water or flat contours will be observed and addressed. Due to the design contours required to achieve the final cap grade, special attention will be focused on the cap surface to promote drainage, re-seeded to support vegetative growth, and maintained to minimize the ponding of water.

- Stormwater Drainage System: The channel linings are specified for design velocities. Maintenance of the stormwater management system will consist of removing sediment build up and/or undesirable vegetation from the stormwater management system’s channels, culverts, and sediment basins as required. Eroded areas will be repaired by back-filling and reseeding in accordance with the specifications. Damage to culverts will be repaired; structure replacement will be performed if needed.

3.2 SECTION 257.104(b)(3)

[Maintaining the groundwater monitoring system and monitoring the groundwater in accordance with the requirements of §§257.90 through 257.98.]

The groundwater monitoring system will be observed for the general integrity of the wells, well casings and well protective casings. Any damaged portions of the monitoring wells and/or their protective casings will be replaced in-kind.

Monitoring the groundwater will be in accordance with the groundwater monitoring plan for this facility and in accordance with the requirements of §§257.90 through 257.98.

4.0 POST-CLOSURE CONTACT 257.104 (d)(1)(ii)

[The name, address, telephone number and email address of the person or office to contact about the facility during the post-closure care period.]

The name, address, telephone number, and email address of the person to contact about the facility during thepost-closure period will be provided upon notification of closure.

5.0 POST-CLOSURE PLANNED USE 257.104 (d)(1)(iii)

[A description of the planned uses of the property during the post-closure period. Post-closure use of the property shall not disturb the integrity of the final cover, liner(s), or any other component of the containment system, or the function of the monitoring systems unless necessary to comply with the requirements in this subpart…]

The post-closure use of the property will be undisturbed vacant land space. The only activities occurring on the closed CCR unit will be related to the Post-Closure care activities. All other activities will be prohibited.

Stantec Consulting Services Inc.
11687 Lebanon Road, Cincinnati OH 45241

October 11, 2016
File: 175534018
Revision 0

Indiana-Kentucky Electric Corporation
3932 U.S. Route 23
P.O. Box 468
Piketon, Ohio 45661

RE: Closure and Post-Closure Plans
Landfill Runoff Collection Pond
EPA Final Coal Combustion Residuals (CCR) Rule
Clifty Creek Station
Madison, Jefferson County, Indiana

1.0 PURPOSE

This letter documents Stantec's certification of the EPA Final CCR Rule closure and post-closure plans for the Indiana-Kentucky (IKEC) Clifty Creek Station's Landfill Runoff Collection Pond.

2.0 CLOSURE AND POST-CLOSURE PLAN

The closure plans describe the steps necessary to close the CCR units at any time during the life of the unit and is subject to the requirements described in 40 CFR 257.102(b). The post-closure plans describe the monitoring and maintenance activities to be performed during the post-closure period of the unit and is subject to the requirements of 40 CFR 257.104(d).

3.0 SUMMARY OF FINDINGS

The EPA Final CCR Rule closure and post-closure plans are conceptual and subject to the completion of all necessary environmental reviews. They are therefore subject to change at any time. The attached closure and post-closure plans demonstrate compliance with the requirements set forth in 40 CFR 257.102(b) and 257.104(d).

4.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I, Stan A. Harris, being a Professional Engineer in good standing in the State of Indiana, do hereby certify, to the best of my knowledge, information, and belief:

1. that the information contained in this certification is prepared in accordance with the accepted practice of engineering;
2. that the information contained herein is accurate as of the date of my signature below;

3. that the closure plan for the IKEC Clifty Creek Station's Landfill Runoff Collection Pond meets the requirements described in 40 CFR 257.102(b); and
4. that the post-closure plan for the IKEC Clifty Creek Station's Landfill Runoff Collection Pond meets the requirement of 40 CFR 257.104(d).

SIGNATURE Stan Harris DATE 10/11/16

ADDRESS: Stantec Consulting Services Inc.
11687 Lebanon Road
Cincinnati, OH 45241

TELEPHONE: (513) 842-8200

ATTACHMENT: Clifty Creek Landfill Runoff Collection Pond Closure and Post-Closure Plans

STAN A. HARRIS
No. PE19700150

Stan Harris 10/11/16

APPENDIX L

Closure and Post-Closure Cost Estimate

Opinion of Closure Costs
Landfill Runoff Collection Pond
Clifty Creek Plant
Indiana-Kentucky Electric Corporation
Madison, Jefferson County, Indiana

Facility Name:	**Clifty Creek Landfill Runoff Collection Pond**	
Facility Location:	**Madison, Indiana**	
Facility County:	**Jefferson**	
Total Waste Fill Acreage:	**57.0**	**Acres**
Total Grading Acreage:	**63.0**	**Acres**
Closure Year:	**2020-2025**	
Acreage for Closure	**57.0**	**Acres**

(Based on MSW Landfill Closure Plan State Form 50391, Sections III and VI.)

III. LABOR, MATERIALS, & TESTING (Provide a listing of items necessary to close the facility. For items that will vary depending upon the number of acres to be closed, the quantities should be indicated on a per-acre basis.

A. Item	B. Quantity	C. Units (per acre)
Geosynthetic materials (geomembrane, geotextile, geocomposite drainage layer)	57.0	$ 88,761.60
Uncompacted 30-inch soil layer	57.0	$ 35,717.53
6-inch vegetative soil layer	57.0	$ 12,524.64
Vegetative cover	57.0	$ 3,288.19
Surveying	57.0	$ 850.00
Engineering certification	57.0	$ 3,310.34
Additional items	lump sump	#REF!
Deed notation	lump sump	$ 10,000.00

V. COST PER ACRE FOR FINAL COVER & VEGETATION

A. What Percent of Final Cover and Topsoil is Available from Areas that are Controlled, and will be Controlled through Post-Closure, by the Permittee?

1. % of final cover:	0%
2. Describe location of sources:	Offsite borrow sources are being assessed.
3. % of topsoil:	0%
4. Describe the location of sources:	Offsite borrow sources are being assessed.

B. Cost per Acre for Acquisition and Placement of 30-inch Soil Layer

1. Acquisition			
a. Quantity of soil needed per acre (cubic yard (yd^3)/acre)		4,033	
b. Excavation unit cost ($/$yd^3$) (if obtained onsite)		N/A	
c. Purchase unit cost ($/$yd^3$) (if obtained offsite)	$	0.50	
d. Delivery unit cost ($/$yd^3$) (if obtained offsite)	$	5.50	
e. Acquisition cost ($/acre)	$	24,198.00	[1a * (1c+1d)]
2. Placement and Compaction			
a. Placement/spreading unit cost	$	2.41	
b. Compaction unit cost ($/$yd^3$)	$	-	
c. Placement and compaction cost ($/acre)	$	9,719.53	[1a * (2a+2b)]
3. Testing			
a. Soil classification (if soil source is of variable quality) ($/acre)	$	500.00	
b. Survey control for cover thickness and proper slopes ($/acre)	$	1,300.00	
c. Density testing (if planned) ($/acre)		N/A	
d. Testing cost ($/acre)	$	1,800.00	
4. TOTAL COST, SOIL COVER ($/acre)	**$**	**35,717.53**	[1e + 2c + 3d]

C. Cost per Acre for Acquisition and Placement of Geosynthetic Materials

1. Acquisition			
a. Quantity of material needed per acre (square yards, yd^2)		4,840	
b. Purchase and install geomembrane ($/yd^2)	$	5.67	
c. Purchase and install nonwoven geotextile ($/yd^2)	$	2.19	
d. Purchase and install composite drainage layer ($/yd^2)	$	7.38	
e. Delivery unit cost ($/yd^2) (if applicable)	$	-	
f. Acquisition cost ($/acre)	$	73,761.60	[1a * (1b+1c+1d)]
2. Placement			
Placement cost ($/acre) (if applicable and not included in purchasing unit cost)	$	-	
3. Testing and QA/QC			
a. Fingerprinting, destructive (shear and peel tests) & nondestructive seam test ($/acre)	$	10,000.00	
b. Other testing ($/acre)	$	5,000.00	
c. Testing cost ($/acre) (if applicable)	$	15,000.00	[3a + 3b]
4. TOTAL COST, GEOSYNTHETIC LAYERS ($/acre)	**$**	**88,761.60**	[1f + 2 +3c]

D. Cost per Acre for Acquisition & Placement of Topsoil

1. Acquisition			
a. Quantity of topsoil needed per acre (yd^3/acre)		807	
b. Excavation unit cost ($/yd^3) (if obtained onsite)		N/A	
c. Purchase unit cost ($/yd^3) (if obtained offsite)	$	7.61	
d. Delivery unit cost ($/yd^3) (if obtained offsite)	$	5.50	
e. Acquisition cost ($/yd^3)	$	10,579.77	[1a * (1c+1d)]
2. Placement			
a. Spreading unit cost ($/yd^3)	$	2.41	
b. Placement cost ($/acre)	$	1,944.87	[1a * 2a]
3. Topsoil Cost ($/acre)	$	12,524.64	[1e + 2b]

F. Cost per Acre to Establish Vegetation

1. Vegetation			
a. Seeding unit cost ($/acre)			
b. Fertilization unit cost ($/acre)			
c. Mulching unit cost ($/acre)			
d. Vegetation Establishment Cost ($/acre)	$	3,288.19	[1a + 1b + 1c]

G. Cost per Acre to Certify Closure

1. Registered Professional Engineer			
a. Initial review of closure plan (hours)		80	
b. Total number of inspections		30	
c. Inspection time required (hours/visit)		24	
d. Total inspection time (hours)		720	[1b * 1c]
e. Prepare final documentation (hours)		240	
f. Total engineer time (hours)		1,040	[1a + 1d + 1e]
g. Engineer unit labor cost ($/hour)	$	120.00	
h. Professional engineer cost ($)	$	124,800.00	[1f * 1g]
i. Area of site permitted for filling (acres)		37.7	
j. Closure Certification Cost ($/acre)	$	3,310.34	[1h/1i]

H. Other Costs per Acre for Final Cover and Vegetation			
1. Other Costs ($/acre)		850	soil thickness survey
I. Total of Items B through F (must not be less than $5,000/acre)			
LRCP Closure	$	140,291.96	per acre
VI. OTHER CLOSURE COSTS (total facility basis, not per acre)			
A. Notation of Property Deed	$	10,000.00	
B. Other Costs - such as drainage feature, installation of gas vents, etc.			
Activity		**Cost**	
Ditch Lining (Unimat + Concrete)	$	2,000,000.00	
C. Total	$	2,010,000.00	[A + B]
VII. CLOSURE COST ESTIMATE	**$**	**10,006,641.72**	[(Acreage * VI) + VI.C]
10% Contingency (per IDEM)	**$**	**1,000,664.17**	
Total	**$**	**11,007,305.89**	
VIII. ADDITIONAL INFORMATION REQUIRED FOR FACILITIES PROVIDING FINANCIAL ASSURANCE ON AN INCREMENTAL BASIS			
A. Will Closure Financial Assurance be Provided on an Incremental Basis?		No	

Opinion of Post-Closure Costs
Landfill Runoff Collection Pond
Clifty Creek Plant
Indiana-Kentucky Electric Corporation
Madison, Jefferson County, Indiana

Facility Name:	**Clifty Creek Landfill Runoff Collection Pond**	
Facility Location:	**Madison, Indiana**	
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Total Grading Acreage:	**63.0**	**Acres**
Closure Year:	**2020-2025**	
Acreage for Closure	**57.0**	**Acres**

(Based on MSW Landfill Closure Plan State Form 50391, Section VI.)

A. Cost for Semi-Annual Inspections and Reports

1. Inspection			
a. Number of inspections during post-closure period (semi-annual inspections for 30 years		60	
b. Inspector time required (hours/insp)		30	
c. Inspector time labor cost ($/hour)	$	90.00	
d. Inspection cost ($)	$	162,000.00	[1a * 1b * 1c]
2. Report Preparation			
a. Number of reports during post-closure period		60	
b. Cost per report ($)	$	5,000.00	
c. Report cost	$	300,000.00	[2a * 2b]
3. TOTAL COST, INSPECTIONS AND REPORTS ($)	**$**	**462,000.00**	[1d + 2c]

B. Cost for Maintenance of Final Cover and Vegetation/Vegetation Control

1. Final Cover Maintenance - The cost for cover maintenance and vegetation shall be 10% of the cost per are calculated for final cover and vegetation in the closure plan (329 IAC 10-23-3(c)(5)(A)).

a. 10% of cost for placement of final cover and vegetation (0.10 * cost given in Item VII.I of the closure plan)	$	3,571.75	
b. Total permitted fill acreage		57	
c. Total Cost, Maintenance of Final Cover and Vegetation Cover	$	203,589.92	[1a * 1b]
2. Vegetation Control Costs			
a. Mowing frequency (visits/30 years)		60	
b. Area to be mowed (acres/visit)		63	
c. Mowing unit cost ($/acre)	$	296.63	
d. Total mowing cost ($)	$	1,121,261.40	[2a * 2b * 2c]
e. Other ($) - specify below (weed control for well access, etc.)	$	-	
f. Vegetation Control Costs	$	1,121,261.40	[2d + 2e]
3. TOTAL COST FOR MAINTENANCE OF FINAL COVER AND VEGETATION	**$**	**1,324,851.32**	[1c + 2f]

C. Cost for Leachate Treatment and Disposal	N/A
D. Cost for Leachate Collection System Monitoring and Maintenance	N/A

E. Cost for Groundwater Water Monitoring and Well Maintenance			
1. Monitoring Well Maintenance Labor Cost			
a. Maintenance frequency (visits/30 years)		60	
b. Number of monitoring wells needing maintenance per visit		2	(estimated)
c. Maintenance time required (hours/well)		4	
d. Unit labor cost ($/hour)	$	81.00	
e. Monitoring well maintenance labor cost ($)	$	38,880.00	[1a * 1b * 1c * 1d]
2. Monitoring Well Parts and Sampling Equipment Replacement Cost			
a. Number of wells needing replacement during post-closure period		0	
b. Existing monitoring well abandonment unit cost ($)	$	-	
c. New monitoring well construction unit cost ($)	$	-	(drilling charged by foot)
d. Monitoring well replacement cost ($)	$	-	
e. Number of pumps/bailers needing replacement during post-closure period		5	
f. Pump/bailer unit cost ($/pump)	$	2,000.00	
g. Pump/bailer replacement cost ($)	$	10,000.00	[2e * 2f]
h. Monitoring Maintenance and Pump/bailer Replacement Cost ($)	$	48,880.00	[1e + 2d + 2g]
3. Cost for Groundwater Monitoring			
a. Number of required monitoring wells		10	
b. Monitoring frequency (semi-annual sampling for 30 years)		60	
c. Sampling cost ($/well)	$	1,100.00	
d. Laboratory testing cost ($/well)	$	400.00	
e. Statistical Analyses and Report ($/well)	$	300.00	
d. Groundwater Monitoring Cost ($)	$	1,080,000.00	[3a * 3b * (3c+3d+3e)]
4. TOTAL, GROUNDWATER MONITORING AND WELL MAINTENANCE COST	$	1,128,880.00	[2h + 3d]
F. Cost for Methane Monitoring and Maintenance		N/A	
G. Cost for Drainage and Erosion Control Maintenance			
1. Drainage and erosion control maintenance frequency (visits/30 years)		60	
2. Cost for materials to repair per visit	$	500.00	
3. Total material cost ($)	$	30,000.00	[1 * 2]
4. Maintenance time required per visit (hours)		10	
5. Unit labor cost	$	140.00	
6. Total labor costs ($)	$	84,000.00	[1 * 4 * 5]
7. TOTAL, DRAINAGE AND EROSION CONTROL MAINTENANCE COST	**$**	**114,000.00**	[3 + 6]
H. Cost for Access Control and Benchmark Maintenance			
4. Fencing material cost ($)	$	-	Facility is fenced.
7. Total labor costs ($)	$	-	
8. Benchmark maintenance cost (if applicable ($)	$	5,000.00	
9. Other ($)	$	-	
10. TOTAL, ACCESS CONTROL/BENCHMARK MAINTENANCE COST	**$**	**5,000.00**	[4 + 7 + 8 + 9]
I. Optional - Maintenance of dike(s) required for facilities constructed in floodplain/floodway			
J. Other costs - Costs not included in the above items should be listed here. They may include such items as access road maintenance, lift station power costs, etc. Please enter "N/A" if you do not have additional costs to place here.	N/A		
K. TOTAL POST-CLOSURE COST	**$**	**3,034,731.32**	[A3 + B3 + C4 + D3 + E4 + F3 + G7 + H10 + I7 + J]
10% Contingency (per IDEM)	**$**	**303,473.13**	
Total	**$**	**3,338,204.45**	