HISTORY OF CONSTRUCTION

CFR 257.73(c)(1)

Landfill Runoff Collection Pond

Clifty Creek Plant
Madison, Indiana

October, 2016

Prepared for: Indiana-Kentucky Electric Corporation

Prepared by: American Electric Power Service Corporation

1 Riverside Plaza

Columbus, OH 43215

GERS-16-141

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Attachments

Attachment A – Location Map
Attachment B – Design Drawings
Attachment C – Instrumentation Location Map
Attachment D – Construction Specifications

1.0 OBJECTIVE

This report was prepared by AEP- Geotechnical Engineering Services (GES) section to fulfill requirements of CCR 257.73(c)(1) with an evaluation of the facility.

2.0 DESCRIPTION OF CCR THE IMPOUNDMENT

The Clifty Creek Power Plant is located near the City of Madison, Jefferson County, Indiana.
It is owned and operated by Indiana-Kentucky Electric Corporation (IKEC). The facility has one inactive surface impoundment called the Landfill Runoff Collection Pond (LRCP).

The LRCP dam is a cross valley dam located on a no-name tributary to the Ohio River. The dam is approximately 1,025 feet long and has a maximum height of 75 feet. Currently, the facility functions as the stormwater and leachate collection pond for the CCR landfill, and discharges to the Ohio River through a NPDES-permitted outfall.

The LRCP was constructed between 1956 and 1957 at the time when the plant was constructed. The crest elevation of the dam is 26 feet wide and at elevation 505 feet. The upstream slopes are 2.5H:1V. A stabilizing berm was constructed along the toe of the upstream slope, having a height of 10 feet and width of 100 feet due to movement of the dam in the upstream direction.

The downstream slopes are 2.5H:1V above elevation 478 feet and 3H:1V below this elevation. The crest has asphalt pavement to serve as an access road to the principal spillway, located along the right abutment hillslope.

A small saddle dike was also constructed adjacent to the LRCP dam. This dike has a crest length of 225 feet, and is approximately 17 feet high. The design slopes are 2.5H:1V. The crest elevation is also at elevation 505 feet.

3.0 SUMMARY OF OWNERSHIP 257.73(c)(1)(i)

[The name and address of the person(s) owning or operating the CCR unit: the name associated with the CCR unit: and the identification number of the CCR unit if one has been assigned by the state.]

The LRCP at the Clifty Creek Plant is located at State Route 56, Madison, Jefferson County, Indiana. It is owned and operated by the Indiana-Kentucky Electric Corporation.

4.0 LOCATION OF THE CCR UNIT 257.73 (c)(1)(ii)

[The location of the CCR unit identified on the most recent U.S. Geological Survey (USGS) 7 ½ minute or 15 minute topographic quadrangle map, or a topographic map of equivalent scale if a USGS map is not available.]

A location map is included in Attachment A.

5.0 STATEMENT OF PURPOSE 257.73 (c)(1)(iii)

[A statement of the purpose for which the CCR unit is being used.]

The LRCP was initially constructed for settling and storage of fly ash. The wet disposal operations ceased around 1986 and the reservoir was converted into a dry landfill. Since then, the pond has functioned as a stormwater and leachate pond.

6.0 NAME AND SIZE OF WATERSHED THE CCR UNIT IS LOCATED 257.73 (c)(1)(iv)

[The name and size in acres of the watershed within which the CCR unit is located.]

The LRCP is located in the Silver-Little Kentucky Watershed (HUC 05140101), which is 811,706 acres (1,268.29 square miles). The watershed to the LRCP is approximately 510 acres, consisting of primarily wooded hillsides, portions of the CCR landfill and some off site drainage.

7.0 DESCRIPTION OF THE FOUNDATION AND ABUTMENT MATERIALS 257.73(c)(1)(v)

[A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is located.]

The LRCP dam was constructed on the natural soils, and the abutment consists of the hillslope of the Devils Backbone Ridge at the left abutment and natural ground on the right abutment. A subsurface investigation was conducted in 2009, and the strength parameters of the foundation, as well as the embankment were defined based on laboratory tests or correlations to known strengths based on blow counts. The foundation materials are described as lean clay with sand and a relative density of very soft to medium stiff. The bedrock beneath the foundation soils is described as weathered gray shale. Results of laboratory testing of the foundation soils yield strength parameters of 27 degrees and 160 psf cohesion.

The geotechnical reports related to the safety factor assessment provide more specific properties of the foundation and embankment materials. Based on these reports, the foundation materials are adequate to support this facility.

8.0 DESCRIPTION OF EACH CONSTRUCTED ZONE OR STAGE OF THE CCR UNIT 257.73 (c)(1)(vi)

[A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit; and the approximate dates of construction of each successive stage of construction of the CCR unit.]

The LRCP dam was constructed as a homogenous dam. The materials of construction consisted of native sandy, lean clay soils. There is no formal design report for this facility. However, the overall design parameters were defined by Casagrande Consultants.

Construction was completed in 1957. The compacted embankment material was tested and has strength values of 33 degrees and 165 psf cohesion.

Based on these reports, the site investigation and test results, the embankment materials are adequate to support this facility.

9.0 ENGINEERING STRUCTURES AND APPURTENANCES, 257.73 (c)(1)(vii)

[At a scale that details engineering structures and appurtenances relevant to the design, construction, operation, and maintenance of the CCR unit, detailed dimensional drawings of the CCR unit, including a plan view and cross sections of the length and width of the CCR unit, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection…]

The primary spillway is a sloping concrete shaft connected to a 72-inch diameter, reinforced concrete pipe, which regulates normal flow conditions. There is no emergency spillway.
The engineering drawings of the engineering structures and appurtenances are included in Attachment B.

As described previously, the LRCP dam is a cross valley dam, so there are no diversion ditches.

Slope protection along the inboard slope consists primarily of riprap over the compacted embankment. The outboard slope has grass vegetation for the entire slope.

10.0 SUMMARY OF POOL SURFACE ELEVATIONS, AND MAXIMUM DEPTH OF CCR, 257.73 (c)(1)(vii)

[…in addition to the normal operating pool surface elevation and the maximum pool elevation following peak discharge from the inflow design flood, the expected maximum depth of CCR within the CCR surface impoundment.]

The table below describes the normal pool elevations and maximum pool elevations, as well as maximum depth of CCR within the impoundment. The facility is considered a significant hazard potential classification. The corresponding design flood is the 1,000-year event. The flood routing evaluation is based on the PMF, which has a rainfall value (27.6 inches in 6 hours) greater than the 1,000-year rainfall value (7.19 inches in 6 hours). Additional information is contained in the Inflow Design Flood Control Plan for this CCR unit.

	South fly ash pond
Dam Crest Elevation (ft)	505
Normal Pool Elevation/max. operating(ft)	486
Maximum Pool Elevation (ft) following peak discharge from inflow design flood (full PMF)	501.4
Expected Maximum depth of CCR within impoundment	60

11.0 FEATURES THAT COULD ADVERSELY AFFECT OPERATION DUE TO MALFUNCTION OR MIS-OPERATION (257.73 (c)(1)(vii))

[…and any identifiable natural or manmade features that could adversely affect operations of the CCR unit due to malfunction or mis-operation]

During an extreme flood event, natural debris may tend to collect in front of the concrete tower and block flow from being discharge. There is a floating skimmer structure in front to minimize any potential blockage.

12.0 DESCRIPTION OF THE TYPE, PURPOSE AND LOCATION OF EXISTING INSTRUMENTATION 257.73 (c)(1)(viii)

[A description of the type, purpose, and location of existing instrumentation.]

The LRCP dam has 7 piezometers located within the structure of the dam. These piezometers are read on a minimum of every 30 days for the purpose of determining the phreatic water level within the dike. An instrumentation location map is provided in Attachment C.

13.0 AREA – CAPACITY CURVES FOR THE CCR UNIT 257.73 (c)(1)(ix)

[Area-capacity curves for the CCR unit.]

The area capacity table is shown below.

Table 2. LRCP Stage-Storage – Existing Conditions

Elevation (feet)	LRCP Storage (acre-feet)
440	0.0
445	14.7
450	62.7
455	170.5
460	353.0
465	590.2
470	871.9
475	1,198.0
480	1,491.9
485	1,549.2
490	1,737.5
495	1,965.0
500	2,248.9
504	2,560.8

14.0 257.73 (c)(1)(x) DESCRIPTION OF EACH SPILLWAY AND DIVERSION

[A description of each spillway and diversion design features and capacities and calculations used in their determination.]

The primary spillway is a sloping concrete tower shaft connected to a 72-inch diameter reinforced concrete pipe which regulates normal flow conditions.

Complete details of each spillway structure are included with the design drawings in Attachment B. Hydrology and Hydraulic Analysis which include calculations for each spillway structure are included in Inflow Design Flood Control Plan (separate from this report).

15.0 SUMMARY CONSTRUCTION SPECIFICATIONS AND PROVISIONS FOR SURVEILLANCE, MAINTENANCE AND REPAIR 257.73 (c)(1)(xi)

[The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.]

There are no construction specifications in the historic files for this facility. As noted, Casagrande Consultants provided recommendations for design parameters.

As required by the CCR rule, the LRCP dam is inspected at least every 7 days by a qualified person. Instrumentation data is collected at least every 30 days and reviewed by AEP Engineering Services. Also as a requirement of the CCR rule, the impoundment is also inspected annually by a professional engineer.

If repairs are found to be necessary during any inspection they will be completed as needed.

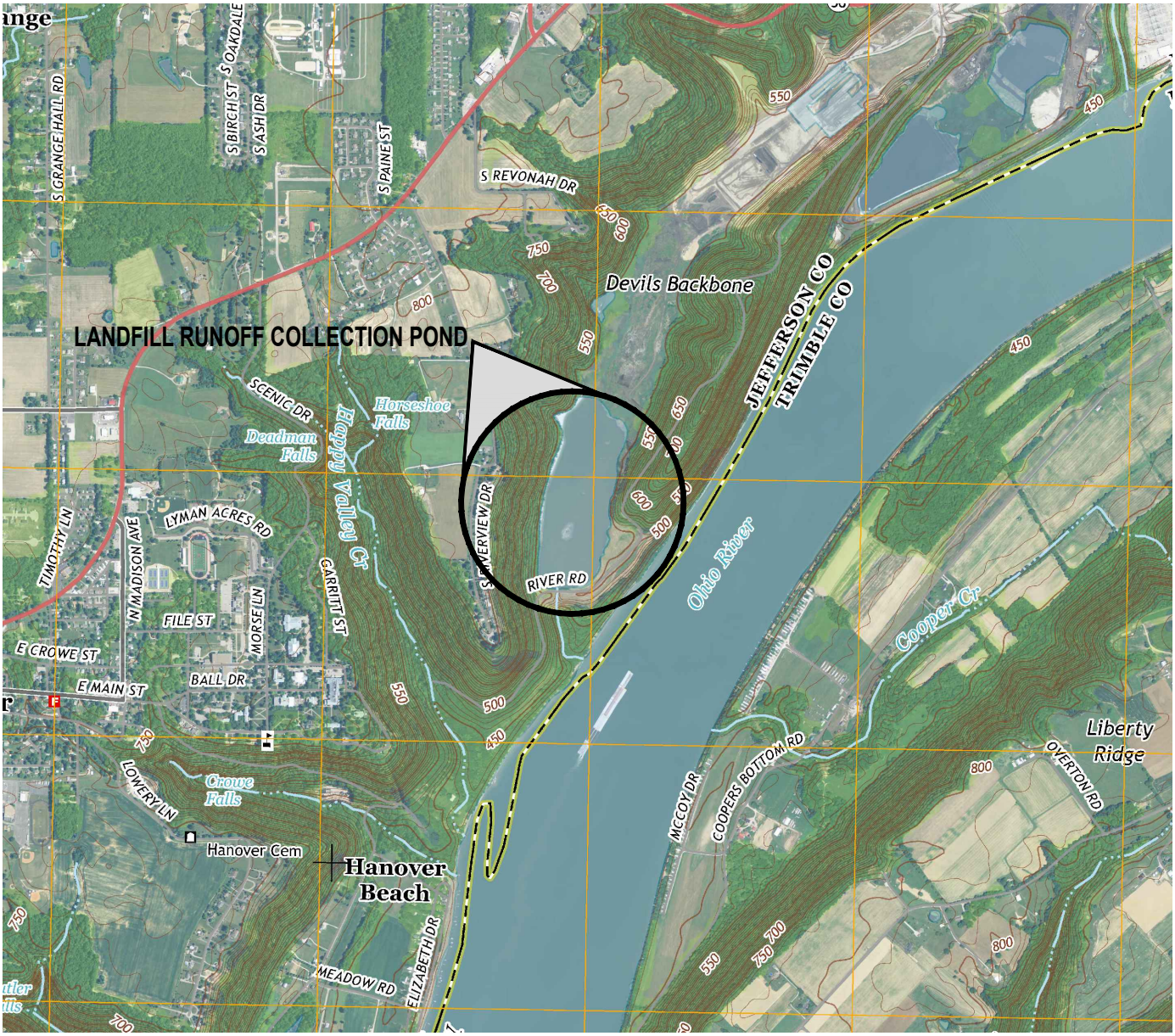
16.0 RECORD OR KNOWLEDGE OF STRUCTURAL INSTABILITY 257.73 (c)(1)(xii)

[Any record or knowledge of the structural instability of the CCR unit.]

To date there has been no record of knowledge of the structural instability of the CCR unit since the facility started operations.

ATTACHMENT A

LOCATION MAP



1 0.5 0 KILOMETERS 1 2

1000 500 0 METERS 1000 2000

1 0.5 0 1

MILES

1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

FEET

N

W E

THIS DRAWING IS CLASSIFIED AS:

AEP PUBLIC

REFERENCE AEP's CORPORATE INFORMATION SECURITY POLICY

INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK PLANT

MADISON INDIANA

LANDFILL RUNOFF COLLECTION POND

USGS TOPO MAP

7.5-MINUTE SERIES

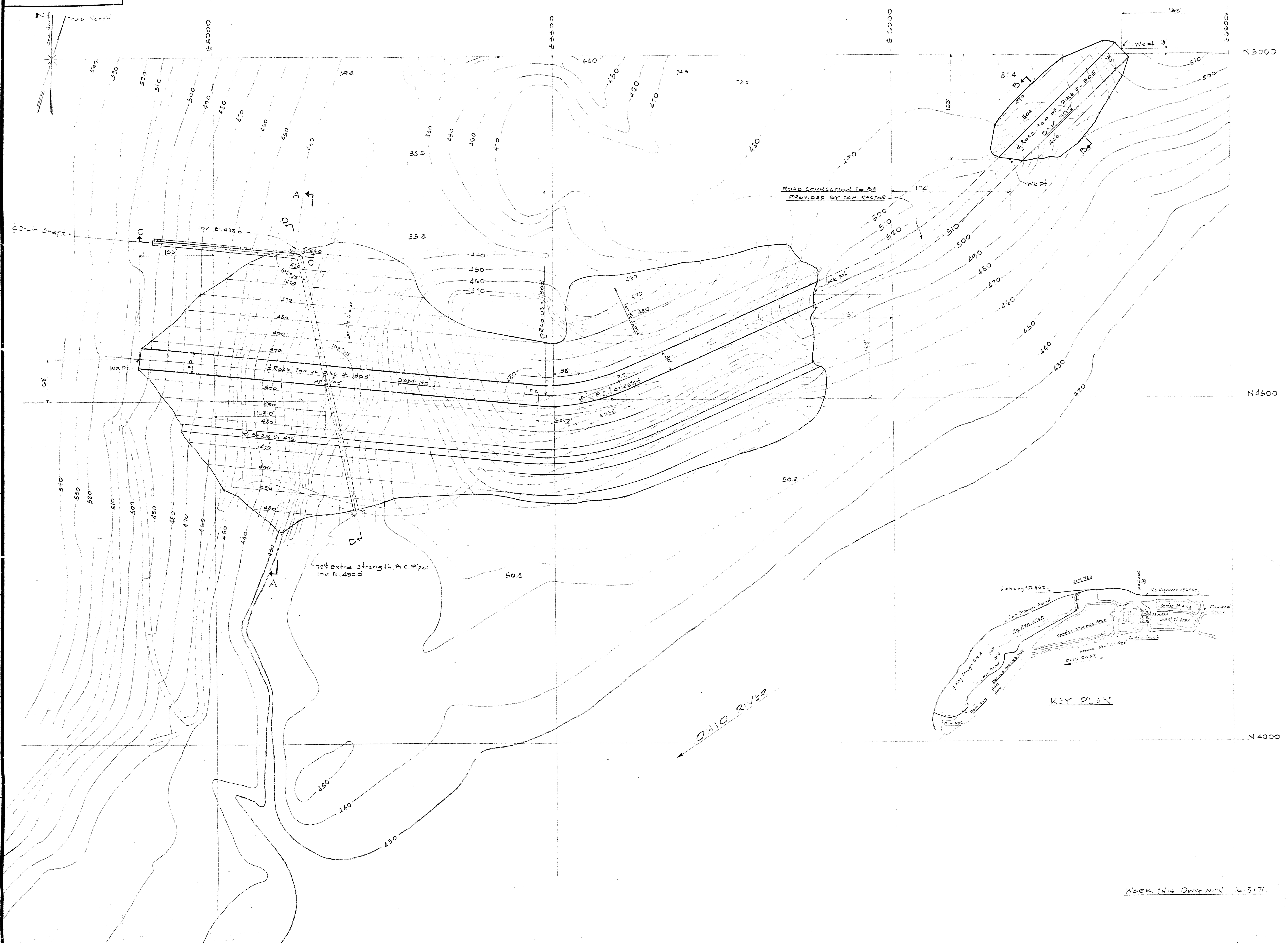
UNIT:	DRAWING NUMBER:	REV:
16	LOCATION MAP	1
SCALE: 1"=2000'	CIVIL ENGINEERING	
DR:		
CH:		
SUP:		
ENG:		
DATE: 10/10/16		

AEP AMERICAN ELECTRIC POWER

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

ATTACHMENT B

DESIGN DRAWINGS



GENERAL NOTES

For Notes see Dwg. 3171

MATERIAL

Earth Fill	Big Dam	246000
	Small Dam	4000
		250000 CY
72"ϕ Conc Pipe		400 lf

REFERENCE

16-3171 — Earth Dam Sections

Map of Survey by Gordon R. Neal & Asso.

DATE	No.	DESCRIPTION	APPD.
4-24-56	1	Relocated Drain shaft & 72"ϕ Pipe	S.S.

REVISIONS

FLY ASH AREA

LOWER EARTH DAMS No. 1 & 2 PLAN

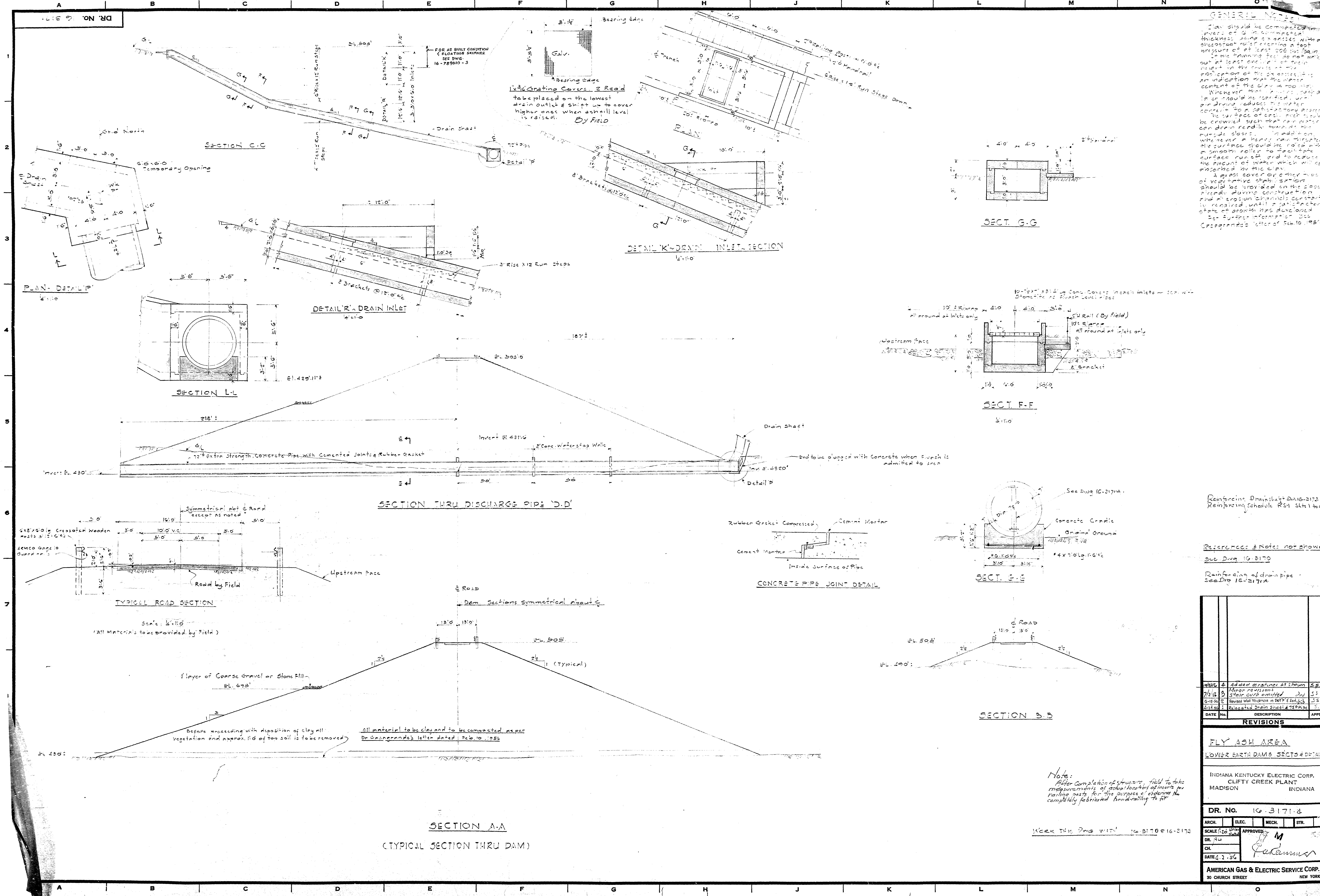
INDIANA KENTUCKY ELECTRIC CORP.
CLIFTY CREEK PLANT
MADISON INDIANA

DR. No. 16-3170-1

ARCH. | ELEC. | MECH. | STR.

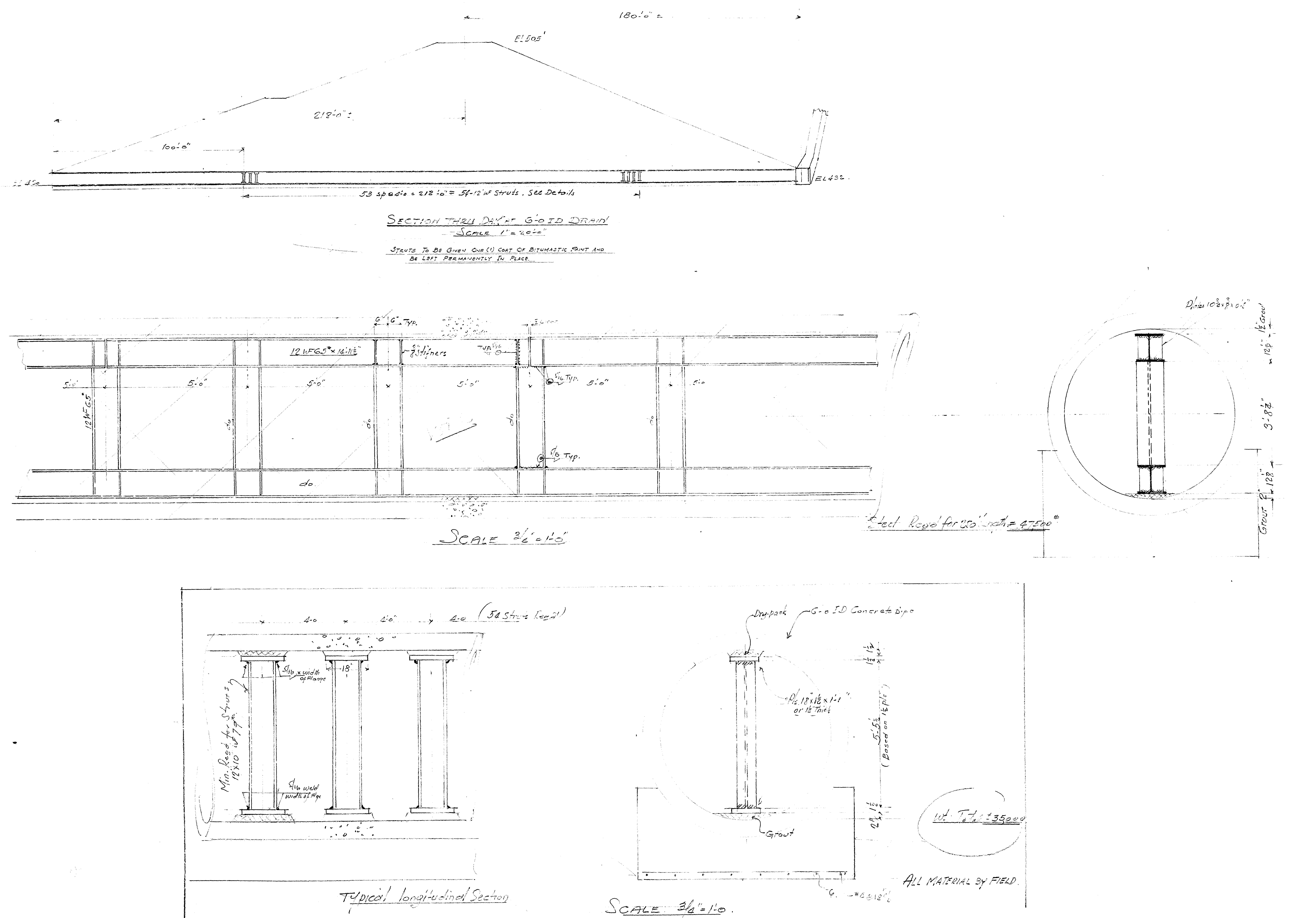
SCALE 1" = 50'
DR. Ho
CH.
DATE 4-2-56
APPROVED S.S.

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



DR. NO. 16-3171-4
GENERAL NOTES
SECTION C-C
PLAN - DETAIL 'P'
DETAIL 'R' - DRAIN INLET
DETAIL 'K' - DENT INLET SECTION
PLAN
SECTION L-L
SECT. G-G
SECT. F-F
SECT. E-E
SECTION THRU DISCHARGE PIPE 'D-D'
72" ϕ Extra Strength Concrete Pipe with Cemented Joints & Rubber Gasket
Drain Shaft
End to be plugged with Concrete when Flyash is admitted to area
CONCRETE PIPE JOINT DETAIL
Rubber Gasket Compressed
Cement Mortar
Inside Surface of Pipe
TYPICAL ROAD SECTION
(All Materials to be provided by Field)
Road by Field
Upstream Face
Dam Sections symmetrical about ℄
SECTION A-A
(TYPICAL SECTION THRU DAM)
SECTION B-B
All material to be clay and to be compacted as per Dr Casagrande's letter dated Feb.10, 1956
Before proceeding with deposition of clay all vegetation and approx. 1'-6" of top soil is to be removed
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
REVISIONS
FLY ASH AREA
LOWER EARTH DAMS SECTS & DETAIL
INDIANA KENTUCKY ELECTRIC CORP.
CLIFTY CREEK PLANT
MADISON INDIANA
DR. No. 16-3171-4
AMERICAN GAS & ELECTRIC SERVICE CORP.
30 CHURCH STREET NEW YORK

DR. No. 16-3171A



DATE	No.	DESCRIPTION	APPD.
7/2/56	1	Added Note & Revised Weight on	S.S

REVISIONS

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

INDIANA KENTUCKY ELECTRIC CORP.
CLIFTY CREEK PLANT
MADISON INDIANA

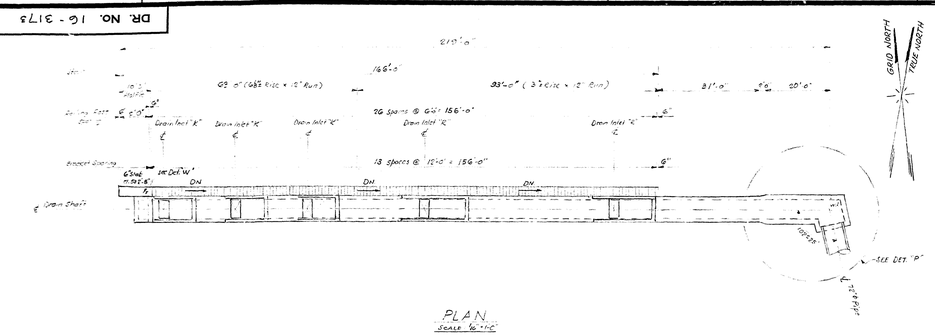
DR. No. 16-3171A-1

ARCH.		ELEC.		MECH.		STR.	

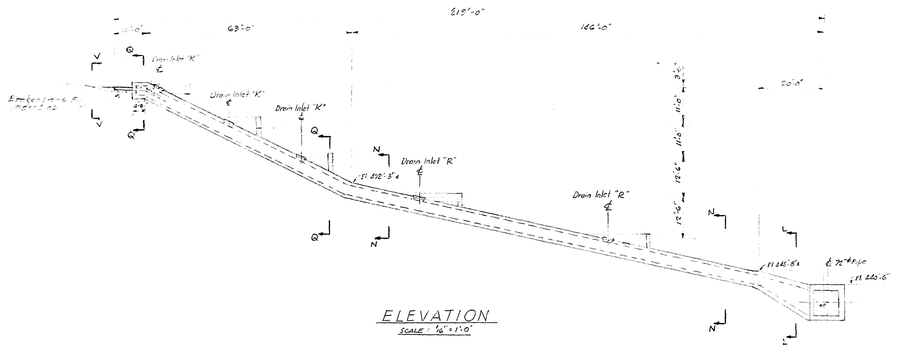
SCALE As Noted
DR. JH
CH.
DATE 6/28/56
APPROVED

AMERICAN GAS & ELECTRIC SERVICE COR[P]
30 CHURCH STREET NEW Y[ORK]

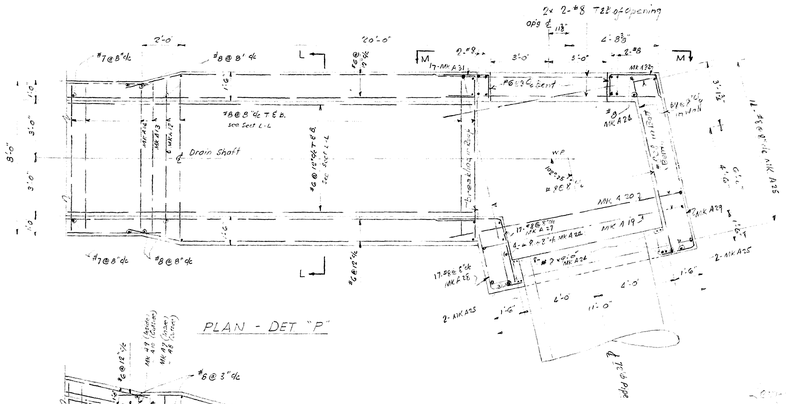
DR. NO. 16 - 3173



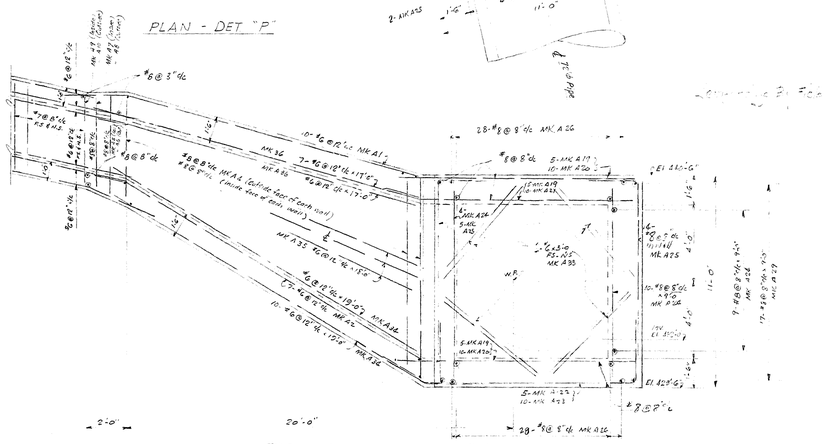
PLAN
SCALE 1/16" = 1'-0"



ELEVATION
SCALE 1/16" = 1'-0"



PLAN - DET "P"



FRONT ELEVATION - DET. "P"
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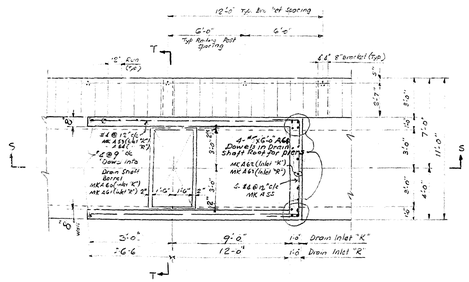
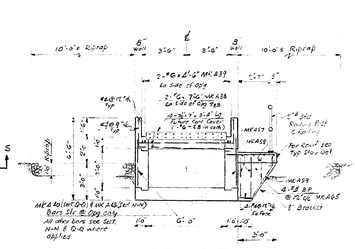
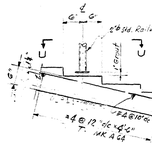


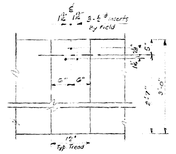
SECTION S-S
SCALE 1/8" = 1'-0"



SECTION T-T
SCALE 1/8" = 1'-0"



TYP STAIR & RAILING POST DETAIL
SCALE : 3/4" = 1'-0"



SECTION U-U
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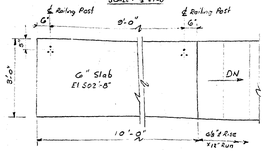
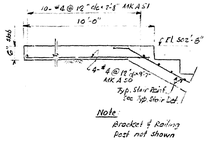


PLAN



SECTION

DETAIL "W"
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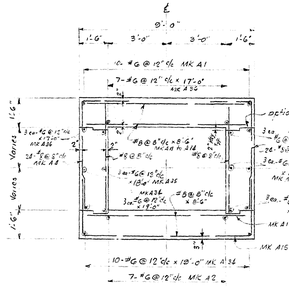

SECTION L-L
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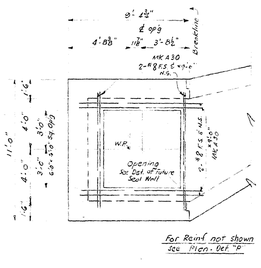
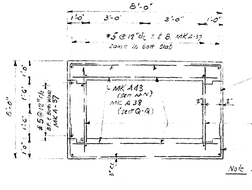
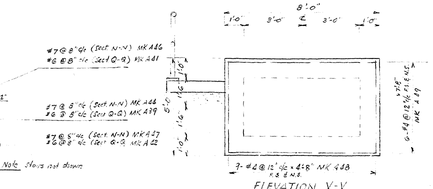


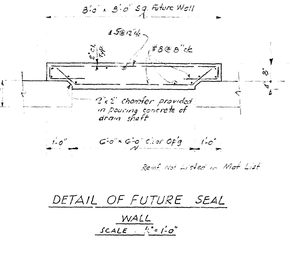
ELEVATION M-M
SCALE : 2" = 1'-0"



SECTION N-N & Q-Q
SCALE 3/8" = 1'-0"



ELEVATION V-V
SCALE : 3/8" = 1'-0"



DETAIL OF FUTURE SEAL WALL
SCALE 1" = 1'-0"

Dwg No. 3171 - Masonry Details
RSH Sht 132 Reinf. Schedule

DATE	No.	DESCRIPTION	APPD.
REVISIONS			

FLY ASH AREA
LOWER EARTH DAM - DRAIN SHAFT
REINFORCING DETAILS

INDIANA KENTUCKY ELECTRIC CORP.
CLIFTY CREEK PLANT
MADISON INDIANA

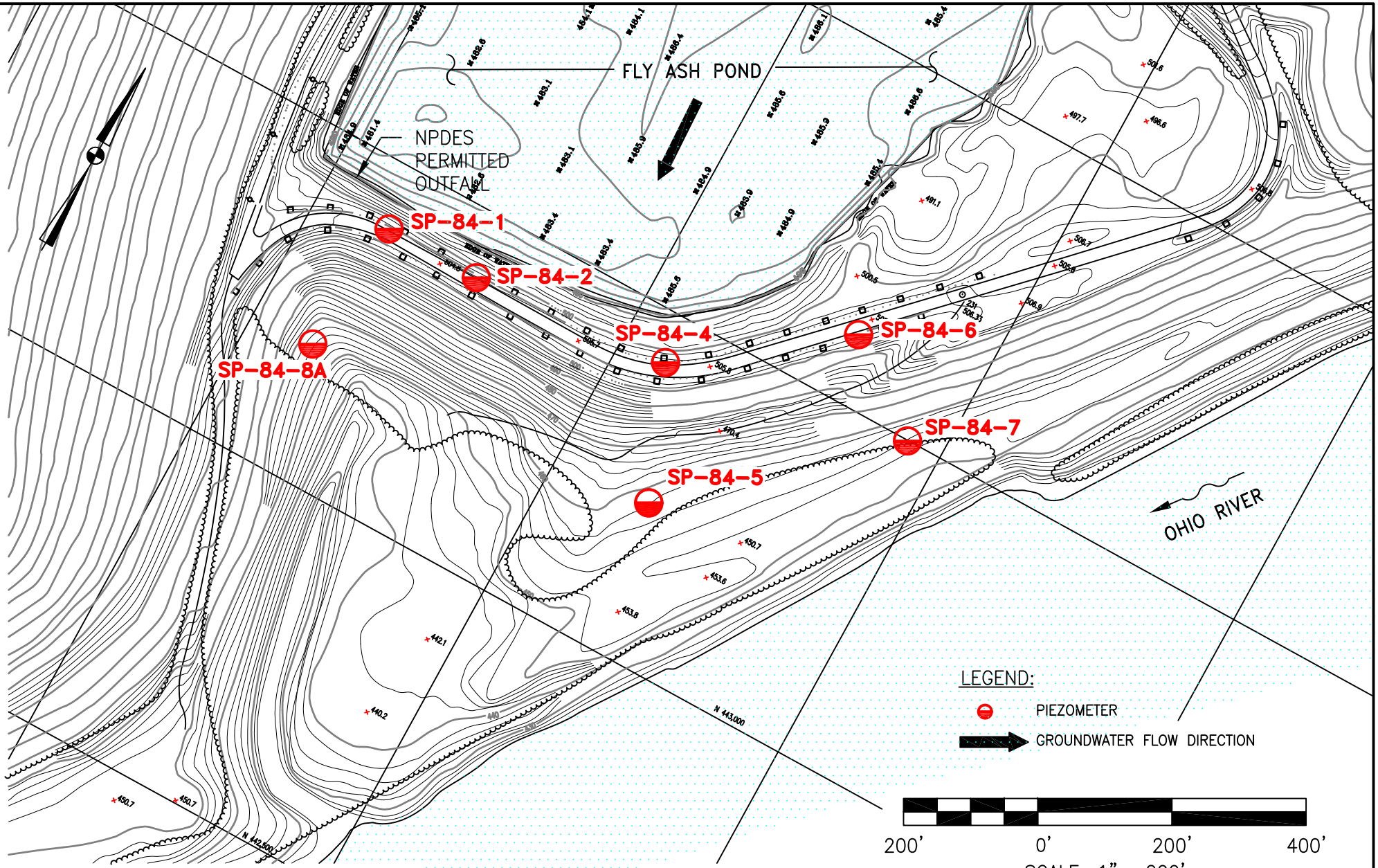
DR. No. 16 - 3173

ARCH.	ELEC.	MECH.	STR.
SCALE AS NOTED	APPROVED		
DR. J.S.			
CH. WH			
DATE 9/16/66			

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

ATTACHMENT C

INSTRUMENTATION LOCATION MAP



DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	P200852-03-IKEC
DWG FILE	CLIFTY CRK PZ Locations a04.dwg
DRAWING SCALE	AS SHOWN

Applied Geology and Environmental Science, Inc.
2402 Hookstown Grade Road
Suite 200
Clinton, PA 15026
(412) 264-6453

INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK PLANT
MADISION, INDIANA
PIEZOMETER LOCATION MAP

DRAWING NAME: FIGURE 1

REV.: 0

Plot: 10/11/2016 10:26 \PROJECTS_PROGRAMS-IKEC\IKEC-IDEM\CAD\CLIFTY CRK PZ Locations a04.dwg

ATTACHMENT D

CONSTRUCTION SPECIFICATIONS

ARTHUR CASAGRANDE
LEO CASAGRANDE

Pierce Hall
Cambridge 38, Massachusetts

February 10, 1956

Mr. E. A. Kammer, Chief
Design Division
American Gas and Electric Service Corporation
30 Church Street
New York 8, New York

Subject: Earth Dam for Fly Ash Storage
for Clifty Creek Plant

Dear Mr, Kammer:

Complying with your request, I visited Clifty Creek on February 8, and I inspected the dam site and proposed borrow areas in the company of Messrs. Brown and Dean, and in addition we reviewed the new design drawings which they had just received from your office. Upon my return, I discussed the pertinent details with my brother and we wish to summarize our impressions and recommendations below.

In view of your decision not to store water to any appreciable height directly against the dam, we have agreed that the original design of a homogeneous clay dam, as outlined in our report to you of September 16, 1955, will be satisfactory.

Preparation of the foundation should consist in removal of all vegetation and of a thin layer of top soil, probably averaging six inches in thickness. It will not be necessary to remove all soil containing some organic material.

Based on our examination and tests of the samples of clay from the proposed borrow areas which we have received during recent weeks, and on my field inspections on August 16, 1955 and February 8, 1956, we conclude that there is an ample volume of suitable clay soils available for the construction of the dam and the dike.

Although we will submit a report on our tests on the samples, we wish to emphasize that the selection of the clay should be based entirely on examination of the consistency by kneading the material by hand. Any clay which is somewhat crumbly, and which cannot be molded like putty, has the right moisture content for placement and compaction. When the clay can be readily molded like putty, it is definitely too wet for compaction. The only practicable method of assuring proper control is to have reliable inspectors on the job while placement and compaction are in progress.

Individual loads of clay which are somewhat too wet, may be placed within the limits of the core as indicated on your drawings by the 45 degree lines. However, one should not make it a practice to place deliberately soft clay into the core because such material cannot be properly compacted.

If it should be found desirable, or necessary, to utilize also the fine, silty sand which is located close to the dam, it should be placed downstream from the 45 degree core limit-line as shown on your drawing. However, this sandy soil cannot be properly compacted by means of a sheepsfoot roller. Therefore, if the contractor elects to compact the clay by means of a sheepsfoot roller, the sandy soil would have to be compacted either by means of a crawler-type tractor or a rubber-tired roller (four wheels abreast) loaded to at least 35 tons.

I was asked whether extra-heavy corrugated Armco-pipe would be suitable for the culvert. We consider such a pipe to have the great advantage as compared to concrete pipe, of being able to stretch longitudinally without causing joints to open up. Therefore, we would prefer such a pipe. However, you should check with the manufacturer whether the proposed pipe will withstand the height of fill.

Mr. Brown inquired whether I would have any objections against moving the trough onto the natural slope of one of the abutments. We can see no objection to locating the trough onto the natural slope. In fact, it may be advantageous to do so, first because the natural slope is steeper and, therefore, the length of the trough would be reduced; and second, because the natural slope is not subject to settlement, in contrast to the dam, and therefore, the danger of development of cracks in the trough would be substantially reduced.

Very truly yours,

Leo Casagrande

LC/eck
cc: E. T. Snodgrass
J. F. Brown ✓