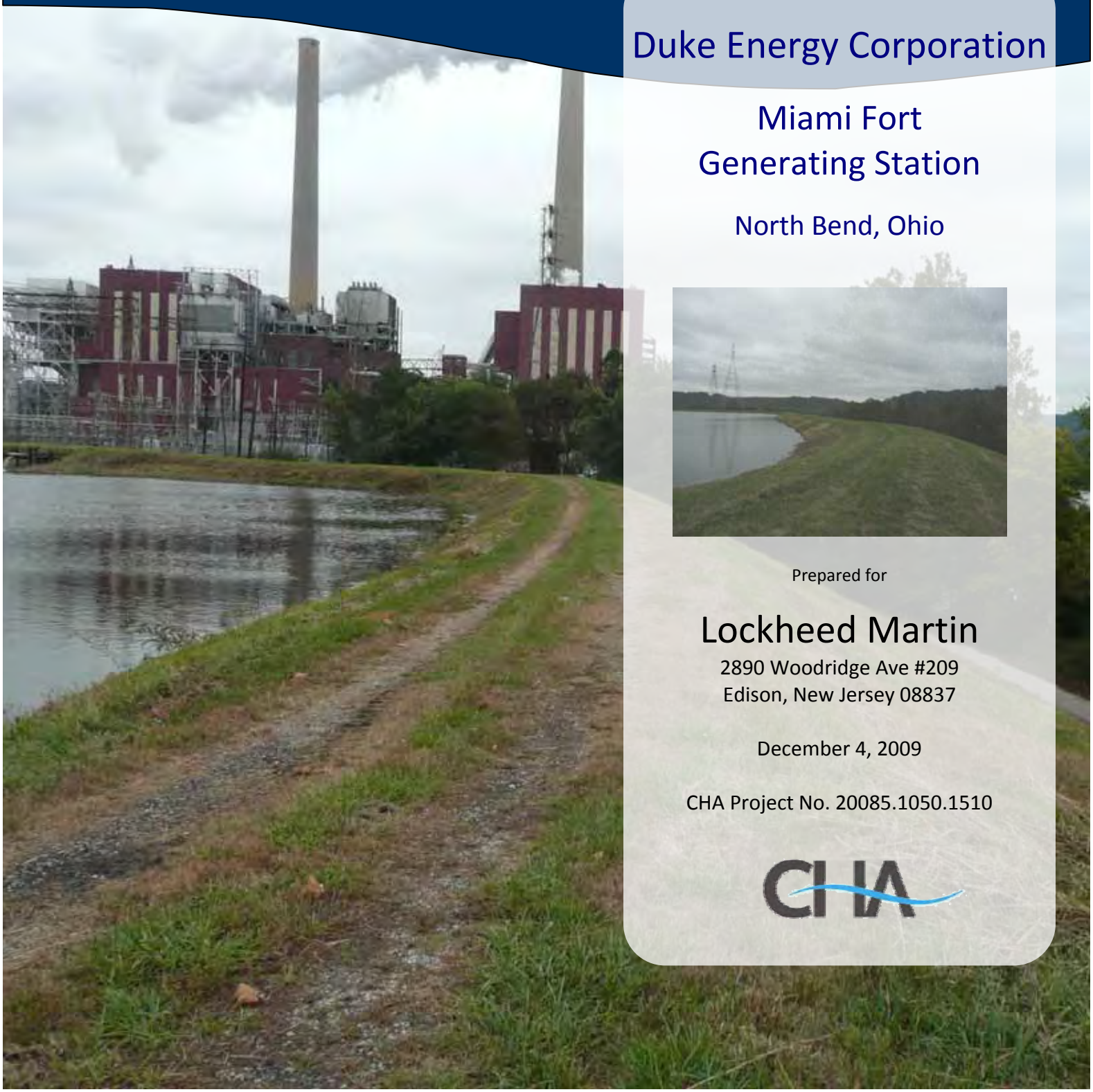
Assessment of Dam Safety
Coal Combustion Surface Impoundments (Task 3)
Draft Report



Duke Energy Corporation

Miami Fort Generating Station

North Bend, Ohio

Prepared for

Lockheed Martin

2890 Woodridge Ave #209
Edison, New Jersey 08837

December 4, 2009

CHA Project No. 20085.1050.1510

CHA

I acknowledge that the management units referenced herein:

- Ash Pond A
- Ash Pond B

Have been assessed on October 6, 2009 and October 7, 2009

Signature: _____

Malcolm D. Hargraves, P.E.
Senior Geotechnical Engineer
Registered in the State of Ohio

Signature: _____

Rebecca Filkins
Geotechnical Engineer

Reviewer: _____

Warren A. Harris, P.E.
Geotechnical Operations Manager

TABLE OF CONTENTS

SECTION **PAGE NUMBER**

1.0 INTRODUCTION & PROJECT DESCRIPTION 1
1.1 Introduction 1
1.2 Project Background 3
1.2.1 State Issued Permits 3
1.2.1.1 NPDES Permits 3
1.3 Site Description 4
1.3.1 Ash Ponds 4
1.3.2 Outlet Structures 7
1.3.3 Haul Roads 7
1.3.4 Transmission Towers 7
1.3.5 Current Operations 8
1.4 Previously Identified Safety Issues 8
1.4.1 Independent Engineers Report 9
1.4.2 ODNR Inspections 9
1.4.2.1 Ash Pond A ODNR Required Remedial Measures 9
1.4.2.2 Ash Pond B ODNR Required Remedial Measures 10
1.5 Site Geology 10
1.6 Bibliography 11

2.0 FIELD ASSESSMENT 23
2.1 Visual Observations 23
2.2 Visual Observation – Ash Pond Dikes 24
2.2.1 Slope and Crest Areas – General 24
2.2.2 Ash Pond A South Dike 25
2.2.3 Ash Pond A East Dike 25
2.2.4 Ash Pond A North Dike 26
2.2.5 Separator Dike Ash Pond A and Ash Pond B 26
2.2.6 Ash Pond B South Dike 27
2.2.7 Ash Pond B West Dike 28
2.2.8 Ash Pond B North Dike 28
2.3 Ash Pond Outlet Control Structures and Discharge 29
2.4 Monitoring Instrumentation 30

3.0 DATA EVALUATION 56
3.1 Design Assumptions 56
3.2 Hydrologic and Hydraulic Design 56
3.3 Structural Adequacy & Stability 58
3.3.1 Ash Pond A 59
3.3.2 Ash Pond B 60
3.3.3 Future Slope Stability Analysis 62
3.4 Foundation Conditions 63
3.4.1 Documentation of Foundation Preparations 64
3.5 Operations & Maintenance 64

TABLE OF CONTENTS - continued

SECTION **PAGE NUMBER**

3.5.1 State of Ohio Inspections 64

4.0 CONCLUSIONS/RECOMMENDATIONS 66
4.1 Acknowledgement of Management Unit Condition 66
4.2 Topographic Survey 66
4.3 Maintaining and Controlling Vegetation Growth 67
4.4 General Crest Areas and Slopes 67
4.5 Ash Pond Spillway 67
4.6 Ash Pond A and Ash Pond B South Dike 68
4.7 Ash Pond Hydraulic Analysis 68
4.8 Additional Stability Analyses 68

5.0 CLOSING 70

TABLES

Table 1 - Ash Pond NPDES Discharge Locations 3
Table 2 - Approximate Precipitation Prior to Site Visit 23
Table 3 - Ash Pond Flood Modeling 57
Table 4 - Soil Strength Parameters as Determined by H. C. Nutting, 1976 59
Table 5 - Soil Strength Parameters as Determined by D'Appalonia, 1979 60
Table 6 - Summary of Safety Factors for Ash Pond B 61
Table 7 - Summary of Required Remedial Measures 65

FIGURES

Figure 1 - Project Location Map 12
Figure 2 - Photo Site Plan 13
Figure 3 - Ash Pond A Typical Sections and Details 14
Figure 4 - Ash Pond B Grading Plan 15
Figure 5A - Ash Pond B Typical Sections 16
Figure 5B - Ash Pond B Typical Sections 17
Figure 5C - Ash Pond B Typical Sections 18
Figure 6 - Ash Pond B General Arrangement 19
Figure 7 - Ash Pond B Instrumentation Location 20
Figure 8 - General Discharge Plan 21
Figure 9 - Critical Infrastructure Map 22
Figure 10 - Photo Location Map 31

APPENDIX

Appendix A - Completed EPA Coal Combustion Dam Inspection Checklist Form &
Completed EPA Coal Combustion Waste (CCW) Impoundment Inspection Form

1.0 INTRODUCTION & PROJECT DESCRIPTION

1.1 Introduction

The Duke Energy Corporation Miami Fort Generating Station is located in the very southwest corner of the State of Ohio on the north shore of the Ohio River at the confluence with the Great Miami River as shown in Figure 1 – Project Location Map. The facility is located within Hamilton County, Miami Township about 5 miles southwest of the village of North Bend, Ohio. The state boundary with Indiana is approximately 1900 feet to the west of the site and the boundary with the State of Kentucky lies just offshore within the Ohio River. The I-275 Bridge over the Ohio River is about one mile southwest of the site and can be seen in Photo No. 48. The City of Lawrenceburg, Indiana is approximately two miles downriver (southwest) of the site.

CHA was contracted by Lockheed Martin (a contractor to the United State Environmental Protection Agency) to perform site assessments of selected coal combustion surface impoundments (Project #0-381 Coal Combustion Surface Impoundments/Dam Safety Inspections). As part of this contract, CHA was assigned to perform a site assessment of Ash Pond A and Ash Pond B at Duke Energy Corporation (Duke) Miami Fort Generation Station. This facility and the ponds were originally constructed by the Cincinnati Gas and Electric Company.

The ash ponds at the steam station are used as settling ponds for coal ash as described in the Operations and Maintenance Manual and Emergency Action Plan. Bottom ash, pyrites (comprised of coal and limestone impurities) and fly ash are sluiced to Ash Pond A and miscellaneous yard drainage is currently discharged directly to Ash Pond B as shown in Photo No. 2. This material is generated by units 1 and 2 (on line since 1926); unit 6 (on line since 1960) and Units 7 and 8 (on line since 1978-79). Units 7 and 8 have limestone based FGD scrubbers which also produce gypsum. This material is sold outside the plant. Fly ash is also exported by rail.

Ash Pond A is about 25 acres in size. It was originally constructed sometime prior to 1959 with a vertical expansion in about 1976. The water surface is typically operated at about Elev. 500 feet. Ash Pond B was constructed between 1979 and 1981 with a basin size of about 20 acres. The impoundment level is typically operated between Elev. 495 and 498 feet. The layout and typical cross sections for each pond and details of the containment structures may be seen in Figure 3 through Figure 7.

Material recovery activities are underway within the northern portions of Basin A as can be seen in Photo No. 1. Water within the basins is generally discharged through the outfall structure in Ash Pond B as shown on Figure 8 and Photos No. 12 and No. 13. Water is allowed to pass between the two basins through a 48-inch diameter HDPE culvert with a CMP extension as seen in Photo No. 7. Ash Pond A has a similar outfall (Photos No. 33, 34 and 35) to Ash Pond B, however it is currently not in use and flow through it is controlled by the gate structure.

Local culverts and ditches also divert storm water from the FGD and coal pile areas to the ash ponds. Inlet pipes may be seen in Photo No. 2 entering Ash Pond B.

CHA made a site visit on October 6, 2009 and October 7, 2009 to inventory coal combustion surface impoundments at the facility, perform visual observations of the containment dikes, and collect relevant information regarding the site assessment.

CHA Engineers Malcolm Hargraves, P.E. and Rebecca Filkins were accompanied by the following individuals:

Company or Organization	**Name**
Duke Energy Corporation	Ron Ehlers
Duke Energy Corporation	Bill Kraemer
Duke Energy Corporation	Wayne Theobold
Duke Energy Corporation	Adam Deller
Duke Energy Corporation	Jim Stierotz
Duke Energy Corporation	J.R. Wood
Ohio Dept. of Natural Resources	Keith Banachowski (October 6th only)
Ohio Dept. of Natural Resources	Matt Hook (October 7th only)

1.2 Project Background

Ash Pond A and Ash Pond B at the Miami fort Generating Station are under the jurisdiction of the Ohio Department of Natural Resources (ODNR) Division of Water – Dam Safety program. The structures creating the impoundments are classified by ODNR as Class II dams based upon each dams height, storage capacity and potential downstream hazard. Potential downstream hazards considered by the ODNR in their February 19, 2009 Dam Safety Inspection Reports included the loss of public water supply (Basin A or B) and the potential damage to public utilities in the case of a breach of Basin A.

1.2.1 State Issued Permits

Duke Energy Corporation has received the following state issued permits for the Ash Pond A and Ash Pond B:

1.2.1.1 NPDES Permits

Permit No. OH0009873 has been issued to Duke Energy of Ohio, Inc. authorizing discharge under the National Pollutant Discharge Elimination System (NPDES) to the Ohio River in accordance with effluent limitations, monitoring requirements and other conditions set forth in the permit. The permit became effective on July 1, 2009 and will expire on July 31, 2013. The permit covers the entire generating facility including 13 discrete sampling locations. Three of the discharge locations and sampling points are specific to the ash ponds as summarized in Table 1.

Table 1 - Ash Pond NPDES Discharge Locations

Outfall No.	Sampling Station	Location Description
002	1IB00001002	Ash Pond Discharge Prior to Ohio River
006	1IB00001608	FGD wastewater treatment system discharge prior to discharge to ash pond
612	1IB00001612	Boiler tube chemical cleaning wastewater prior to discharge to ash pond

1.3 Site Description

Figure 9 depicts the overall view of the Miami Fort Station. The main features identified on the overall site map include the generating station, Ash Pond A and Ash Pond B, the center dike, transmission towers and the two major water bodies, the Ohio and Great Miami Rivers. The following paragraphs summarize the facility as originally designed as well as current operating practices.

1.3.1 Ash Ponds

The Miami Fort Station currently has two primary process and disposal areas for the coal combustion waste products (CCW). These are located as shown on Figures 2, 4, 6 and 9 included in the text of this report. Ash Pond A and Ash Pond B are located adjacent to the main plant facility along the Ohio River. Both ponds are trapezoidal in shape with Ash Pond A having average dimensions of about 1,000 by 1,400 feet. The Ash Pond B dimensions are about 750 by 1,150 feet. No other solid waste disposal facilities or CCW facilities were observed during our inspection. However, CHA was informed that there is another solid waste facility located on another portion of the site that receives CCW in a dry form.

The ash ponds receive bottom ash, pyrite, and yard drainage for disposal. The two ponds were constructed to their present configuration between 1976 and 1981. The original Ash Pond A was constructed prior to 1959 as referenced on Drawing No. 7-3605-S1 and shown on Figure 2 with the top of the dike at Elev. 500 feet. The original embankment forming Ash Pond A was typically about 5 to 30 feet in height with a crest width of 12.5 feet. The 1976 investigation report completed by The H. C. Nutting Company for the dike expansion characterized the soil used to construct the original dike as compacted silty clay. This was considered to have been built some time earlier when the Miami Fort Station plant was initially completed.

Design plans as shown on Figure 3 indicate that Ash Pond A was increased in height by ten feet in 1976 to Elev. 510 feet. Along the east side, the existing dike was only at Elev. 496 feet +/- and a slightly larger increase of up to 14 feet was required. In general the increase in the height of the dikes required the construction to be completed on the downstream side of the current berms. Construction materials to raise the dike to Elev. 510 feet consisted of a combination of compacted bottom and fly ash excavated from within the existing basin and soil borrow as show on Figure 3. The material was placed in discrete zones with the bottom ash used as a drainage media. Along the south side of Ash Pond A only on-site cohesive soils excavated from the future Ash Pond B footprint were used to increase the height of the dike. The 1976 report recommended this material transition due to the proximity to the Ohio River as well as a concern regarding weaker foundation soils as further discussed in Section 3.4.

Toe drains were placed within the drainage layer along the southern berm adjacent to the river as shown in Section B on Figure 3 and in plan view on Figure 2. Side slopes are currently 2 horizontal to 1 vertical on the inside of the basin and typically 2 horizontal to 1 vertical on the outside of the basin, with a steeper section of 1.5 horizontal to 1 vertical at the interior side slope near the discharge structure.

Ash Pond B was designed in 1979 and constructed over three seasons between 1979 and 1982 on the west side of Ash Pond A as a separate impoundment. Construction staging recommendations considered protection of the completed work at the toe of the dike from the flood waters of the Ohio River each succeeding spring as discussed in the July 1979 Site Investigation and Design Report completed by D'Appalonia Consulting Engineers, Inc. The flood stage noted on the drawings is reported to be Elev. 492 feet. The design report recommended the use of a cement stabilized fly ash at the toe of the embankment and also as a shell material to protect the core materials. A specific construction sequence for the raising of the berm was also outlined in the report. The actual construction documents and as-built plans for Ash Pond B indicate that several modifications from the recommendations made in the

design report were made during the implementation phase of the project. Based upon CHA's review of the available documents, these modifications were found to include the following:

- Compacted clay was substituted for cement stabilized fly ash at the toe of the dike;
- A 5-foot clay cover (shell) was substituted for the 4-foot cement stabilized fly ash over the slopes of the dike;
- A 4-foot Clay seal was placed at the toe of the slope;
- Compacted clay was used in the inside base of the embankment; and
- Construction of the dike progressed from the central section of the dike and upward and outward toward the toe rather than constructing the toe area first as a flood mitigation method.

The western dike of Ash Pond A forms a separator dike between the two basins and can be seen in Photos No. 3, 5, 9, and 10. This arrangement is shown on Figure 6. Design plans (Figure 4) indicate that the impoundment is generally constructed as an above grade facility with a 15-foot wide crest at Elev. 510 feet and a typical embankment height of about 40 feet with the toe at Elev. 470 feet. Design drawings indicate a topographic low within the basin footprint at about Elev. 460 feet. Design side slopes are indicated to be 3 horizontal to 1 vertical for the outside face of the berm and 2.5 horizontal to 1 vertical for the interior face as shown on Figure 5A, 5B and 5C. The dikes of Ash Pond B are constructed of compacted ash with sand and gravel chimney drains and a clay shell. This detail is shown on Figure 5C. The chimney drains are extended through the clay shell with an 8-inch diameter schedule 80 perforated PVC pipe as shown in Figure 5C. These pipes were observed in the field and can be seen in Photos No. 46 and 47. A total of 37 toe drains are installed along the toe of the embankment set at a nominal spacing of about 50 feet. A total of 31 drains are along the southwestern portion of the dike parallel to the Great Miami River and the remaining 6 along the northern portion of the dike.

1.3.2 Outlet Structures

The general arrangement for discharge from the two ponds is depicted on Figure 8. This indicates two similar discharge structures located in each pond (southwest corner of Ash Pond A and southeast corner of Ash Pond B) consisting of a 42-inch overflow pipe and skimmer. These discharge points can also be seen on Photos No. 33 and No. 34 for Ash Pond A and Photos No. 12 and No. 13 for Ash Pond B. They each connect to a single 42-inch diameter discharge line at Elev. 463.4 feet located south of Ash Pond A. From that point the pipe discharges to the Ohio River at a submerged outlet. The pond elevation is controlled by a baffle structure at each outlet. The outlet at Ash Pond A is currently inactive as the baffle has been lowered to not allow any flow into the outlet pipe (Photo No. 33).

One single pipe connects the two ponds to allow for the equalization and control of water levels in the impoundments. A 48-inch diameter HDPE pipe with a CMP extension is located midway on the separator dike between the two ponds. It is shown in Photo No. 7.

1.3.3 Haul Roads

A series of perimeter haul roads have been constructed around the site. The roads to the north side of Ash Pond A and Ash Pond B utilized fill materials comprised of both compacted and un-compacted ash materials to reach grades.

1.3.4 Transmission Towers

A key site feature dominating the southern, central and southern dikes of Ash Pond A and Ash Pond B are three electrical transmission towers. These features can be seen in Photos No. 3, 5, 9, 10 and 18. Their foundation elements penetrate the berms and in some case the bottom of Ash Pond B as seen in Photo No. 16.

1.3.5 Current Operations

Ash Pond A receives effluent from the sluice lines (Photo No. 2) which primarily transports bottom ash products as well as FGD effluent and some fly ash. The material is discharged into the northern portion of the pond and through a constructed internal ditch line allowing the solids to settle and the water to decant. Water flows from the open water section of Ash Pond A into Ash Pond B through the 48-inch diameter culvert. Ash Pond B is used as a polishing pond prior to discharge to the Ohio River. The outlet structure for Ash Pond A is currently controlled using a baffle system to prevent operation at this time as shown in Photo No. 33.

Solid materials collected in Ash Pond A are generally reclaimed for sale or use by the County. Stockpiles of material were noted within the basin at the time of our site visit.

Previously both ponds used to operate in parallel. Sluice lines fed CCW to both Ash Pond A and Ash Pond B and solid materials were removed only when a pond became filled. The sluice lines to Ash Pond B have been removed from service. The groin that was previously used for dredging operations still remains in place in this pond (Photo No. 8).

1.4 Previously Identified Safety Issues

Based on our review of the information provided to CHA and as reported by Duke, there have been no significant safety issues at either Ash Pond A or Ash Pond B in the last 10 years. Several inspections of the impoundments have been completed by an independent engineer and the ODNR within the past 12 months. The following sections summarize the results of these inspections.

1.4.1 Independent Engineers Report

Duke Energy 2008 contracted with H. C. Nutting Company to complete a limited inspection of a portion of the ash ponds on November 6, 2008. The report dated November 13, 2008, included the following conclusions and recommendations:

- A zone of seepage was observed between the footings of the transmission tower that straddles the access road. It was recommended that this condition be further investigated and potentially controlled using horizontal drains.
- The 8-inch diameter toe drains were noted to be partially clogged with a bacterial slime and screens were broken. The recommendation was made to clean, inspect and repair the drains.
- Recommendations were made for the removal of woody vegetation along the inboard sides of the embankment, vegetation removal and the flattening of slopes. (Note: This woody vegetation was removed prior to CHA's site inspection).
- Recommendations were made for retaining an arborist to spot treat other woody vegetation each growing season.

1.4.2 ODNR Inspections

The ODNR Division of Water also inspected both Ash Pond A and Ash Pond B on February 19, 2009. The required remedial measures for each impoundment are summarized as follows:

1.4.2.1 Ash Pond A ODNR Required Remedial Measures

- Remove the trees from the rip rap along the south embankment toe;
- Provide a device or plan to permit the draining of the reservoir in a reasonable time;
- Update the operations, maintenance and inspection manual and the emergency action plan;

- Monitor the wet area on the east embankment for any signs of increased flow for sediment transport; and
- Monitor the east embankment erosion area off the exterior toe for any signs of instability.

1.4.2.2 Ash Pond B ODNR Required Remedial Measures

- Provide a device or plan to permit the draining of the reservoir in a reasonable time;
- Provide regular maintenance and monitoring of the embankment drain outlets;
- Update the operations, maintenance and inspection manual and the emergency action plan;
- Monitor the wet area on the east embankment near the transmission towers for any signs of increased flow for sediment transport. A special discussion item was provided indicating that Duke was to actively monitor this condition and was considering the extension of the embankment drain system in this area. The ODNR also recommended the ability to monitor the seepage flow from these drains.
- A visual/video inspection of the submerged outlet into the Ohio River was recommended.

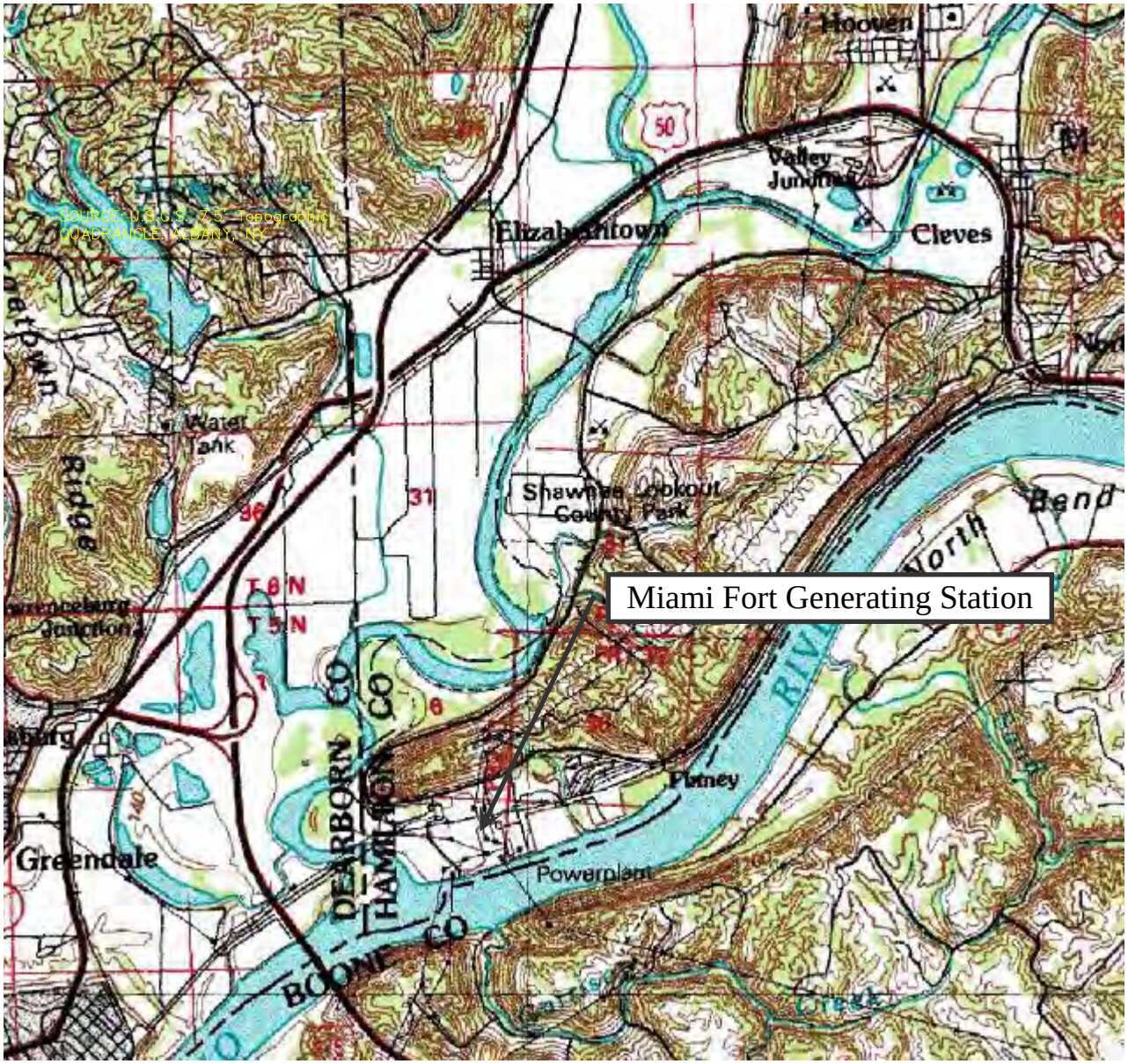
1.5 Site Geology

Based on a review of available surficial and bedrock geology maps, and reports by others, the site lies near the southern border of the Glacial Plains and the northern border of the Interior Low Plateau at the southern edge of the glacial drift deposits. The local geologic conditions within the ash pond area is likely to consist of an alluvial silt, clay and/or sand deposited by the Ohio River floodwaters, and glacial outwash deposits consisting of fine sand silts and clays that were mainly deposited during the Illinoian and Wisconsin stages of the Pleistocene. The thickness of the outwash deposits is estimated to be about 120 feet above bedrock. Bedrock in the area is of Ordovician Age and is comprised of sedimentary rocks which are mostly shales and limestones.

1.6 Bibliography

CHA reviewed the following documents provided by Duke Energy in preparing this report:

- *Miami Fort Station Ash Ponds A and B Operations and Maintenance Manual*, -- Cincinnati Gas and Electric Company, as transmitted by CINERGY Environmental Services, August 31, 1995
- *Ash Pit Dike Modifications (Design Report)* – The H. C. Nutting Company, may 17, 1976
- *Site Investigation and Design Report, Ash Pond B*—D'Appolonia Consulting Engineers, Inc., July, 1979
- *Specifications, Ash Pond Disposal Pond B*- D'Appolonia Consulting Engineers, Inc., July, 1979
- *Letter Report Laboratory Evaluation fly Ash and Bottom Ash Existing Ash Disposal Pond A*-- D'Appolonia Consulting Engineers, Inc., July, 1980
- *Limited Ash Pond Embankment Inspection, Miami Fort Generating Station, North Bend, Ohio.*—H.C. Nutting / a Terracon Company, November 13, 2008
- *Ohio EPA NPDES Permit Application No. OH0009873,* June 12, 2009
- *Dam Safety Inspection Report Basin A, File No. 9046-001*-- Ohio Department of Natural Resources, Division of Water, February 19, 2009
- *Dam Safety Inspection Report Basin A, File No. 9046-002*-- Ohio Department of Natural Resources, Division of Water, February 19, 2009
- *Dam Safety Inspection Report Basin A and B, File No. 9046-001 and 002*-- Ohio Department of Natural Resources, Division of Water, October 7, 1994
- Selected design and as-built drawings For Ash Pond A and Ash Pond B as prepared by Cincinnati Gas and Electric Company
- *Duke Energy Status of Response to ODNR Dam Safety Inspection Reports*—Duke Energy, September, 2009
- *In- House Pond Inspection Procedures*—Duke Energy



SOURCE: U.S.G.S. 7.5' TOPOGRAPHIC
QUADRANGLE: CINCINNATI, OH
MAP DATE: JULY 1, 1984

N	CHA	FIGURE 1 PROJECT LOCATION MAP
Scale: 1" = 1 mile	Project No.: 20085.1050.1510	MIAMI FORT GENERATING STATION DUKE ENERGY CORPORATION NORTH BEND, OHIO

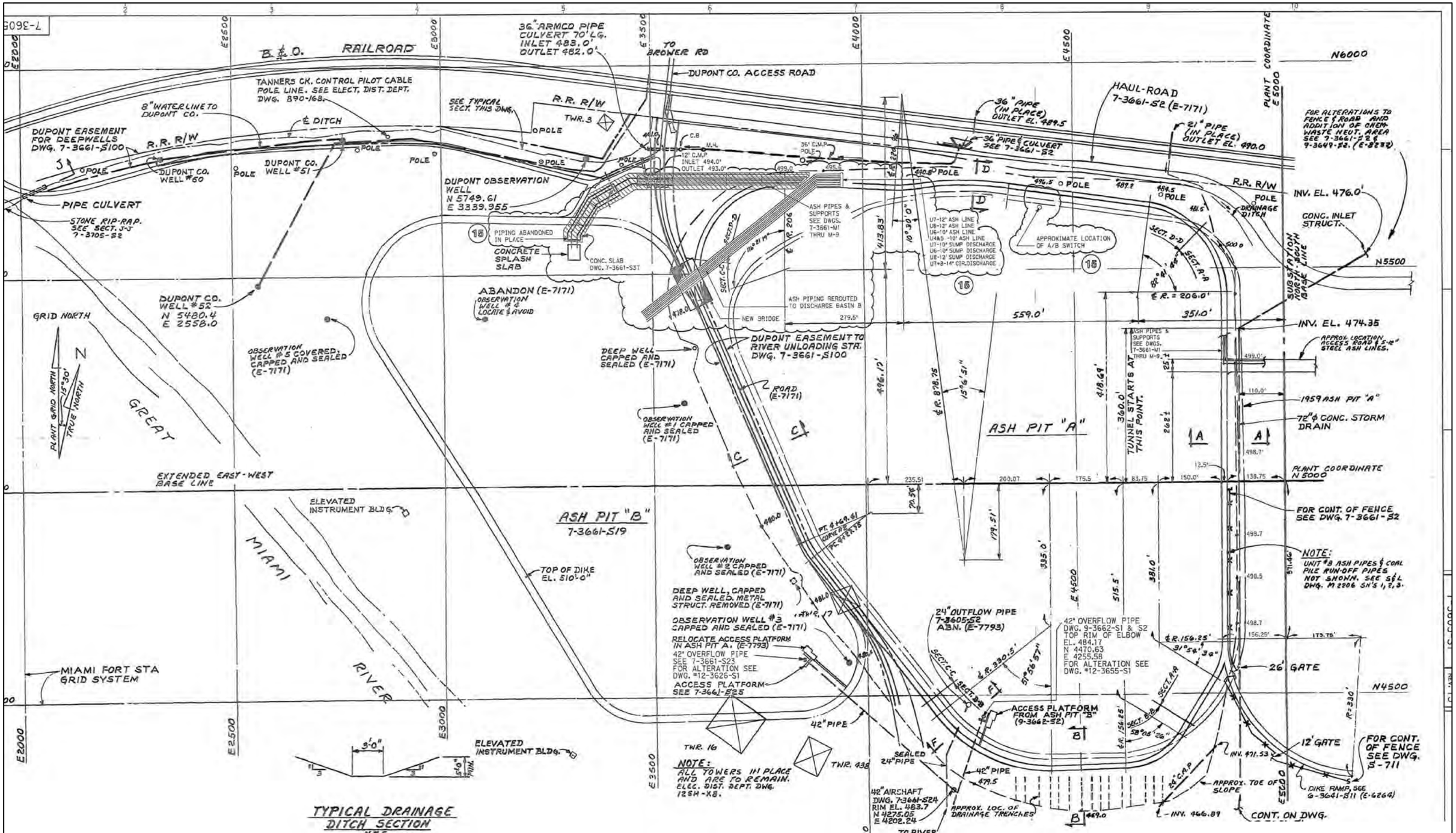


IMAGE REFERENCE: CINERGY, ASH DISPOSAL PIT A, GENERAL ARRANGEMENT, MIAMI FORT STATION, DWG NO. 7-3605-S1, DATED 2-3-05

Drawing Copyright © 2009

CHA
III Winners Circle, PO Box 5269 · Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

SITE PLAN

MIAMI FORT GENERATING STATION
DUKE ENERGY CORPORATION
NORTH BEND, OHIO

PROJECT NO. 20085.1050

DATE: 11/2009

FIGURE 2

File: K:\20085\CADD\ACAD\FIGURES\1050 MIAMI FORT STATION\1050_2_PHOTO SITE PLAN.DWG Saved: 12/2/2009 3:48:34 PM PLotted: 12/2/2009 4:26:57 PM User: Gray, Timmolyn

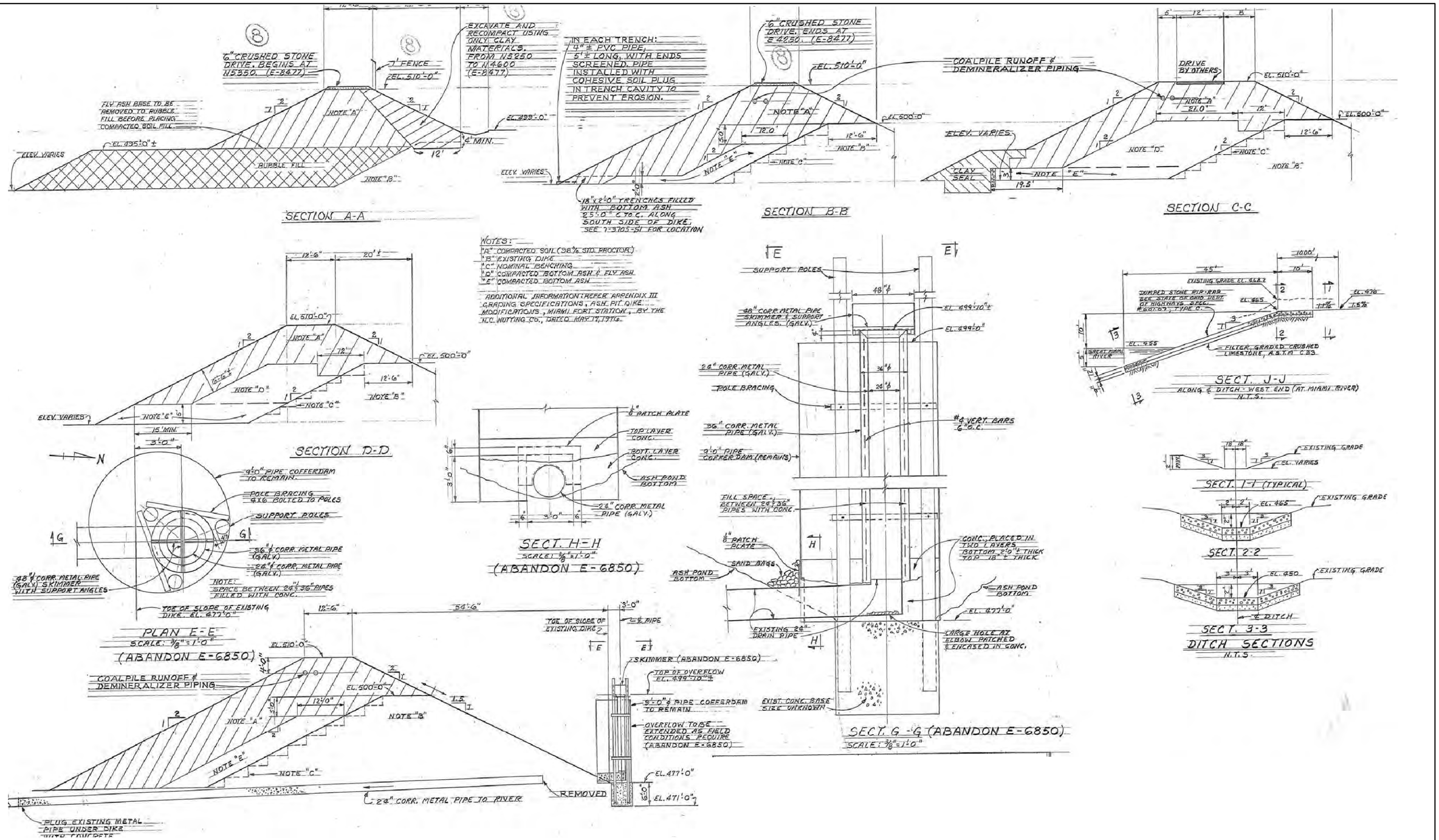


IMAGE REFERENCE: ASH DISPOSAL PIT A, ALTERATIONS SHEET #1, MIAMI FORT STATION, THE CINCINNATI GAS & ELECTRIC COMPANY GENERAL ENGINEERING DEPARTMENT, DWG NO. 7-3605-S2, DATED 6-23-76

Drawing Copyright © 2009

CHA
III Winners Circle, PO Box 5269 · Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

ASH POND A TYPICAL SECTIONS AND DETAILS

MIAMI FORT GENERATING STATION
DUKE ENERGY CORPORATION
NORTH BEND, OHIO

PROJECT NO. 20085.1050

DATE: 11/2009

FIGURE 3

File: K:\20085\CADD\ACAD\FIGURES\1050 MIAMI FORT STATION\1050_3_ASH POND A TYPICAL SECTIONS AND DETAILS.DWG Saved: 12/1/2009 4:04:57 PM Plotted: 12/2/2009 4:25:59 PM User: Gray, Timmolyn

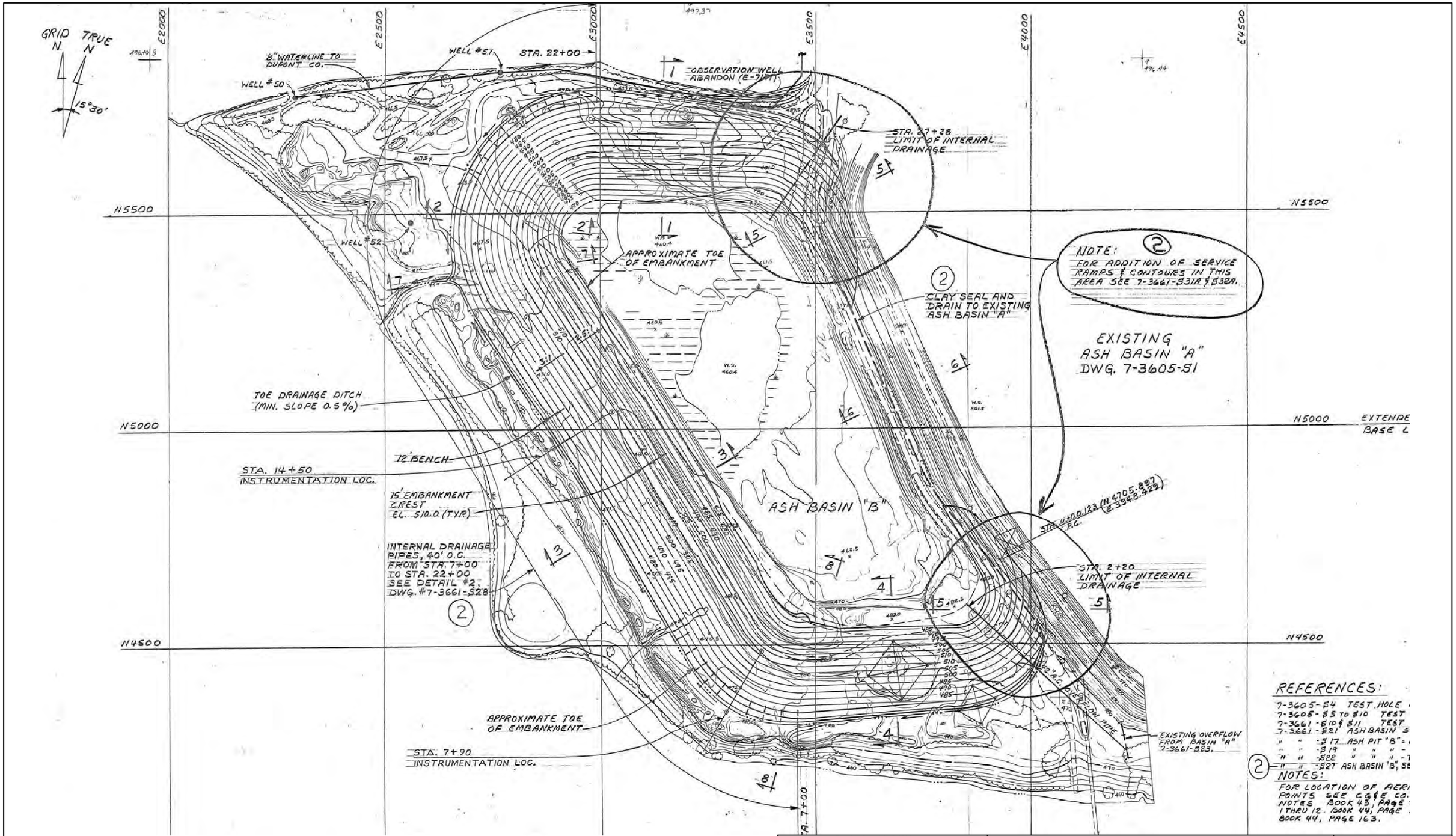


IMAGE REFERENCE: ASH DISPOSAL PIT "B", CONTOURS AND GRADING, MIAMI FORT STATION, THE CINCINNATI GAS & ELECTRIC COMPANY GENERAL ENGINEERING DEPARTMENT, DWG NO. 7–3661–S18, DATED 1–7–80

Drawing Copyright © 2009

CHA
III Winners Circle, PO Box 5269 · Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

ASH POND B GRADING PLAN

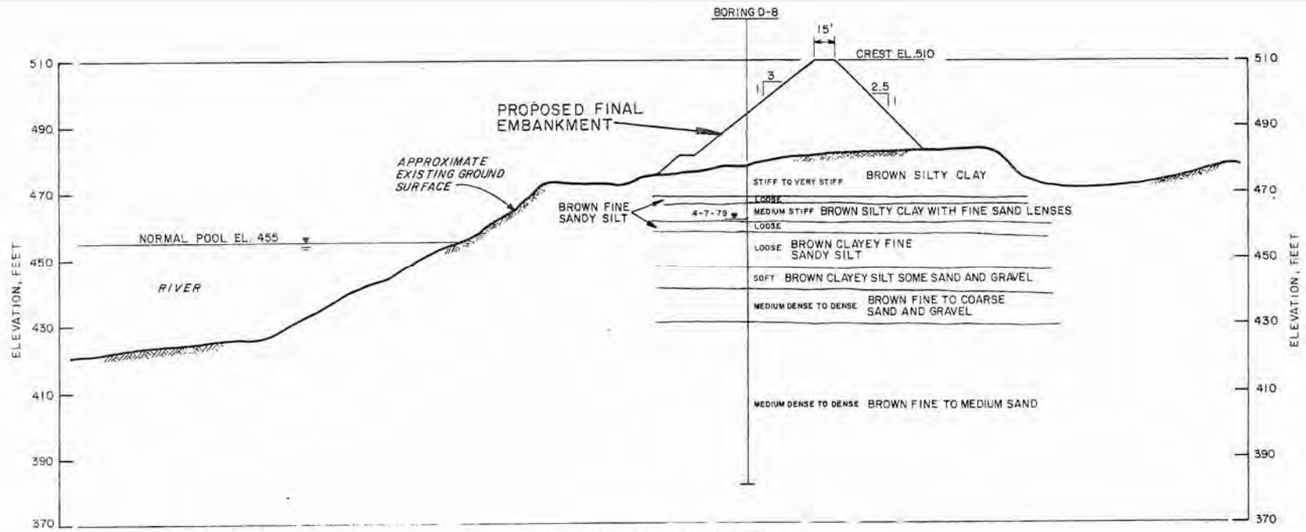
MIAMI FORT GENERATING STATION
DUKE ENERGY CORPORATION
NORTH BEND, OHIO

PROJECT NO. 20085.1050

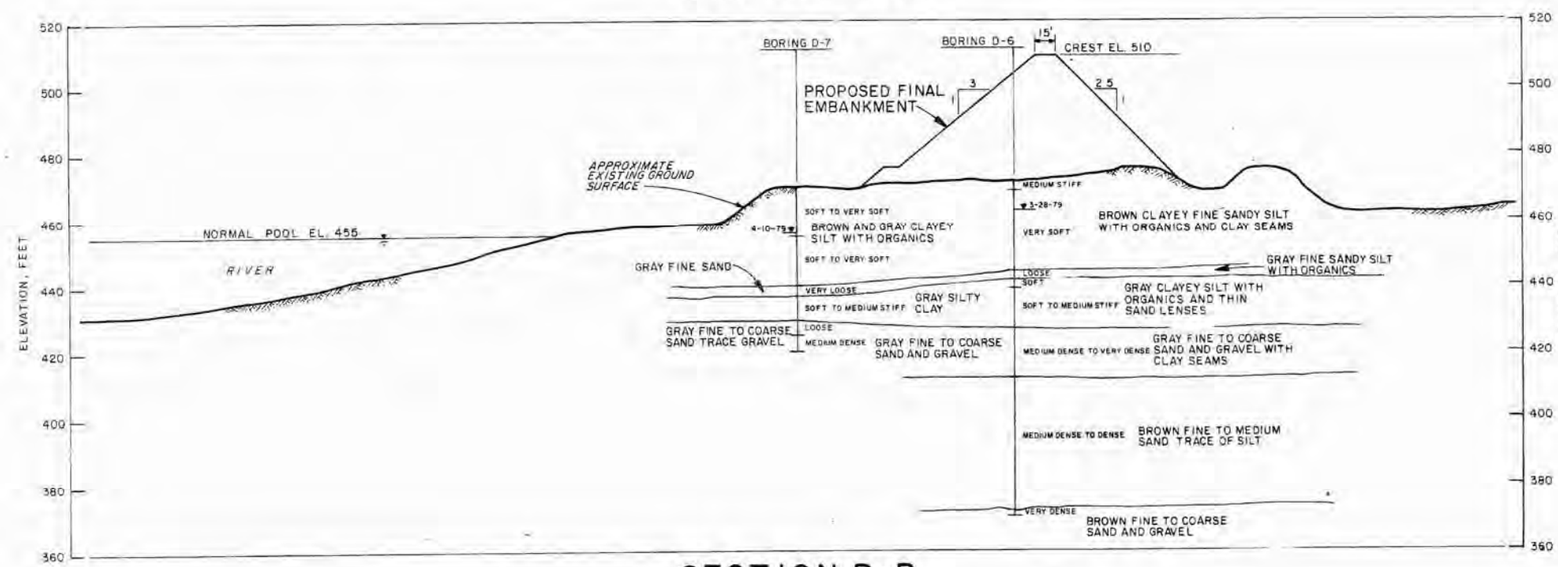
DATE: 11/2009

FIGURE 4

File: K:\20085\CADD\ACAD\FIGURES\1050 MIAMI FORT STATION\1050_4_ASH POND B GRADING PLAN.DWG Saved: 12/1/2009 4:05:20 PM PLotted: 12/2/2009 4:25:07 PM User: Gray, Timmolyn



SECTION A-A



SECTION B-B

THE BORING LOGS AND RELATED INFORMATION DEPICT SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC LOCATIONS AND DATES INDICATED. SOIL CONDITIONS AND WATER LEVELS AT OTHER LOCATIONS MAY DIFFER FROM CONDITIONS OCCURRING AT THESE BORING LOCATIONS. ALSO THE PASSAGE OF TIME MAY RESULT IN A CHANGE IN THE CONDITIONS AT THESE BORING LOCATIONS.

THE DEPTH AND THICKNESS OF THE SUBSURFACE STRATA INDICATED ON THE SECTIONS WERE GENERALIZED FROM AND INTERPOLATED BETWEEN THE TEST BORINGS. INFORMATION ON ACTUAL SUBSURFACE CONDITIONS EXISTS ONLY AT THE LOCATION OF THE TEST BORINGS AND IT IS POSSIBLE THAT SUBSURFACE CONDITIONS BETWEEN THE TEST BORINGS MAY VARY FROM THOSE INDICATED.

VERTICAL SCALE
20 0 20 40 FEET

HORIZONTAL SCALE
50 0 50 100

REFERENCES:
7-3661-S13 HYDROGRAPHIC SURVEY PLAN

REPRODUCED FROM D'APPOLONIA FIG. #10, DATED 2-21-79

SCANNED DWG.
DO NOT REVISE

IMAGE REFERENCE: ASH DISPOSAL PIT "B", SECTIONS A–A & B–B, MIAMI FORT STATION, THE CINCINNATI GAS & ELECTRIC COMPANY GENERAL ENGINEERING DEPARTMENT, DWG NO. 7–3661–S14, DATED 12–5–79

Drawing Copyright © 2009

CHA
III Winners Circle, PO Box 5269 · Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

ASH POND B TYPICAL SECTIONS

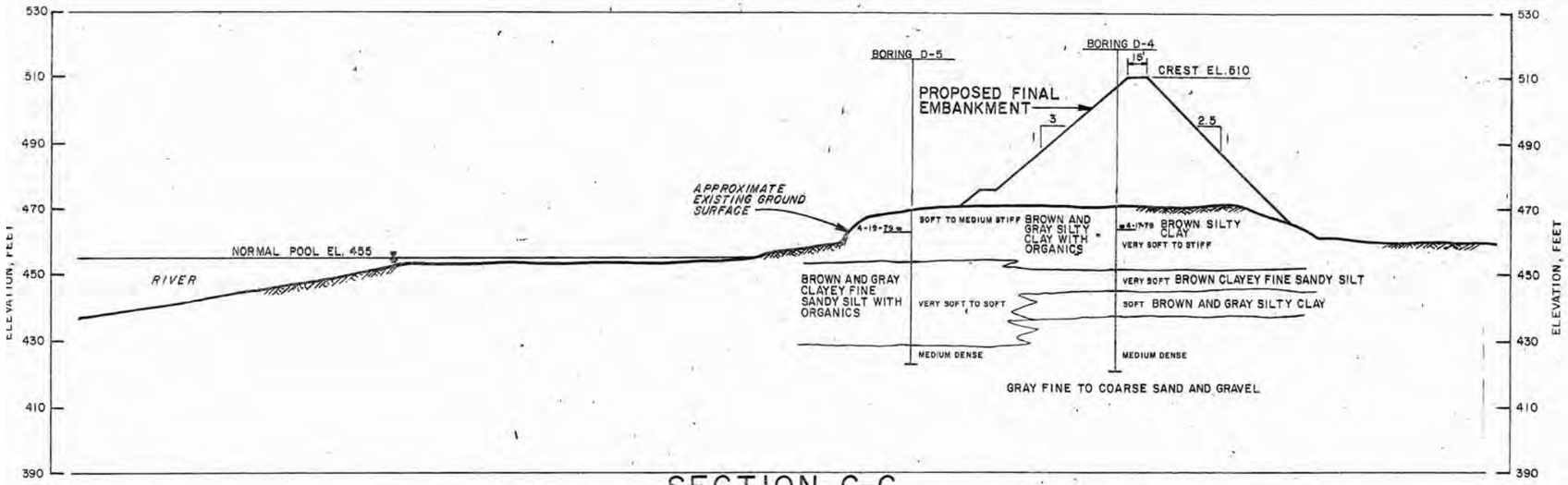
MIAMI FORT GENERATING STATION
DUKE ENERGY CORPORATION
NORTH BEND, OHIO

PROJECT NO. 20085.1050

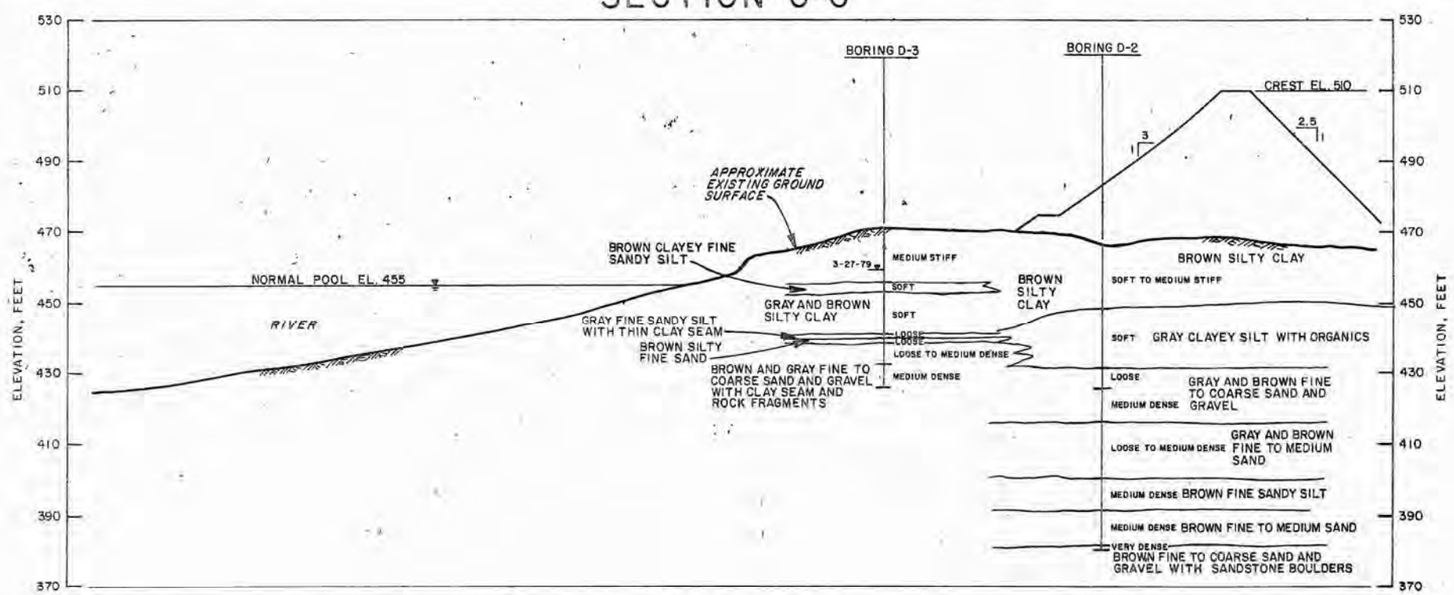
DATE: 11/2009

FIGURE 5A

File: K:\20085\CADD\ACAD\FIGURES\1050 MIAMI FORT STATION\1050_5_ASH POND B TYPICAL SECTIONS.DWG Saved: 12/2/2009 4:11:58 PM PLotted: 12/2/2009 4:24:04 PM User: Gray, Timmolyn



SECTION C-C



SECTION D-D

VERTICAL SCALE
20 0 20 40 FEET

HORIZONTAL SCALE
50 0 50 100

THE BORING LOGS AND RELATED INFORMATION DEPICT SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC LOCATIONS AND DATES INDICATED. SOIL CONDITIONS AND WATER LEVELS AT OTHER LOCATIONS MAY DIFFER FROM CONDITIONS OCCURRING AT THESE BORING LOCATIONS. ALSO THE PASSAGE OF TIME MAY RESULT IN A CHANGE IN THE CONDITIONS AT THESE BORING LOCATIONS.

THE DEPTH AND THICKNESS OF THE SUBSURFACE STRATA INDICATED ON THE SECTIONS WERE GENERALIZED FROM AND INTERPOLATED BETWEEN THE TEST BORINGS. INFORMATION ON ACTUAL SUBSURFACE CONDITIONS EXISTS ONLY AT THE LOCATION OF THE TEST BORINGS AND IT IS POSSIBLE THAT SUBSURFACE CONDITIONS BETWEEN THE TEST BORINGS MAY VARY FROM THOSE INDICATED.

REFERENCES:
7-3661-B13 HYDROGRAPHIC SURVEY PLAN

IMAGE REFERENCE: ASH DISPOSAL PIT "B", SECTIONS C-C & D-D, MIAMI FORT STATION, THE CINCINNATI GAS & ELECTRIC COMPANY GENERAL ENGINEERING DEPARTMENT, DWG NO. 7-3661-S15, DATED 12-5-79

Drawing Copyright © 2009

CHA
III Winners Circle, PO Box 5269 · Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

ASH POND B TYPICAL SECTIONS

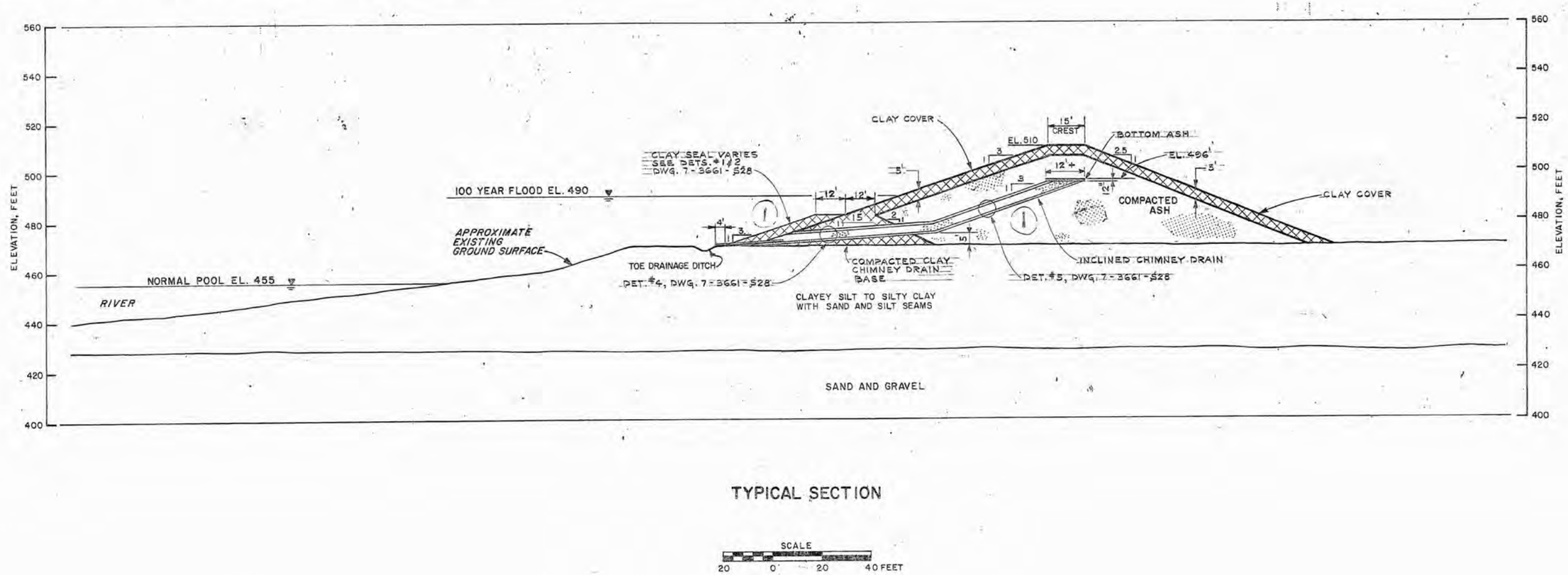
MIAMI FORT GENERATING STATION
DUKE ENERGY CORPORATION
NORTH BEND, OHIO

PROJECT NO. 20085.1050

DATE: 11/2009

FIGURE 5B

File: K:\20085\CADD\ACAD\FIGURES\1050 MIAMI FORT STATION\1050_5_ASH POND B TYPICAL SECTIONS.DWG Saved: 12/2/2009 4:11:58 PM PLotted: 12/2/2009 4:23:08 PM User: Gray, Timmolyn



TYPICAL SECTION

SCALE
20 0 20 40 FEET

REFERENCES:
7-3661-S18 ASH BASIN "B" - CONTOURS & GRADING

SCANNED DI

IMAGE REFERENCE: ASH DISPOSAL PIT "B", TYPICAL SECTION, MIAMI FORT STATION, THE CINCINNATI GAS & ELECTRIC COMPANY GENERAL ENGINEERING DEPARTMENT, DWG NO. 7-3661-S20, DATED 12-5-79

Drawing Copyright © 2009

CHA
III Winners Circle, PO Box 5269 · Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

ASH POND B TYPICAL SECTIONS

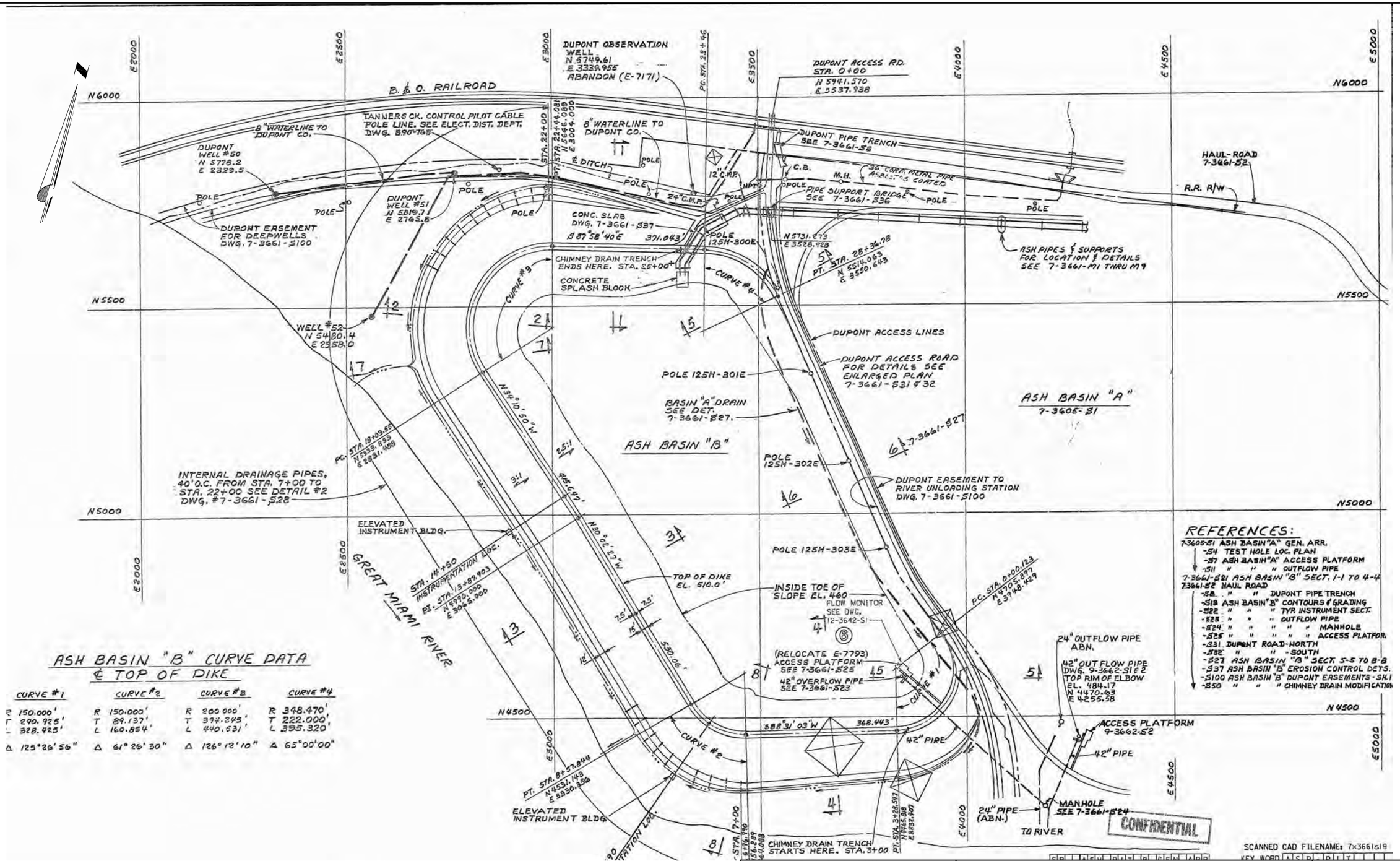
MIAMI FORT GENERATING STATION
DUKE ENERGY CORPORATION
NORTH BEND, OHIO

PROJECT NO. 20085.1050

DATE: 11/2009

FIGURE 5C

File: K:\20085\CADD\ACAD\FIGURES\1050 MIAMI FORT STATION\1050_5_ASH POND B TYPICAL SECTIONS.DWG Saved: 12/2/2009 4:11:58 PM PLotted: 12/2/2009 4:22:11 PM User: Gray, Timmolyn



ASH BASIN "B" CURVE DATA
℄ TOP OF DIKE

CURVE #1	CURVE #2	CURVE #3	CURVE #4
R 150.000'	R 150.000'	R 200.000'	R 348.470'
T 290.925'	T 89.137'	T 397.245'	T 222.000'
L 328.425'	L 160.854'	L 440.531'	L 395.320'
Δ 125°26'56"	Δ 61°26'30"	Δ 126°12'10"	Δ 65°00'00"

IMAGE REFERENCE: ASH DISPOSAL PIT "B", GENERAL ARRANGEMENT, MIAMI FORT STATION, THE CINCINNATI GAS & ELECTRIC COMPANY GENERAL ENGINEERING DEPARTMENT, DWG NO. 7-3661-S19, DATED 2-17-81

Drawing Copyright © 2009

CHA
III Winners Circle, PO Box 5269 · Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

ASH POND B GENERAL ARRANGEMENT

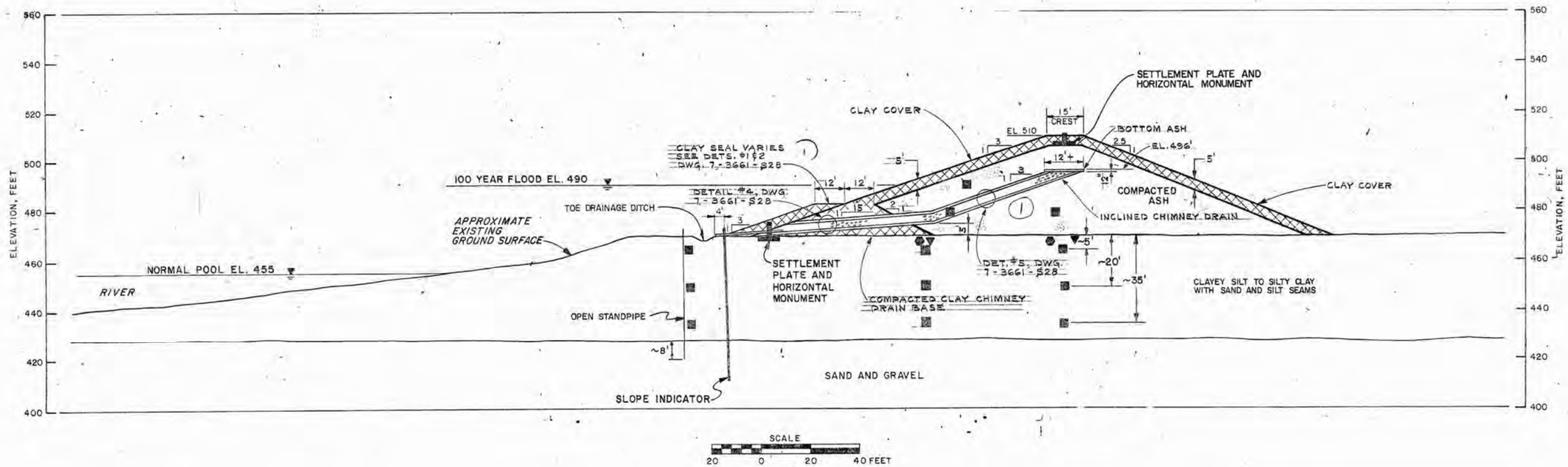
MIAMI FORT GENERATING STATION
DUKE ENERGY CORPORATION
NORTH BEND, OHIO

PROJECT NO. 20085.1050

DATE: 11/2009

FIGURE 6

File: K:\20085\CADD\ACAD\FIGURES\1050 MIAMI FORT STATION\1050_678_ASH POND B GENERAL INSTRUMENT DISCHARGE.DWG Saved: 12/1/2009 4:06:09 PM Plotted: 12/2/2009 4:32:09 PM User: Gray, Timmolyn



TYPICAL INSTRUMENTATION SECTION

NOTE: 2 SECTIONS PROPOSED AT STATIONS 7+90 AND 14+50.

LEGEND

- ■ PNEUMATIC PIEZOMETERS
- ▼ REMOTE SETTLEMENT GAUGE
- ● TOTAL LOAD CELL

IMAGE REFERENCE: ASH DISPOSAL PIT "B", TYPICAL INSTRUMENT SECTION, MIAMI FORT STATION, THE CINCINNATI GAS & ELECTRIC COMPANY GENERAL ENGINEERING DEPARTMENT, DWG NO. 7-3661-S22, DATED 12-5-79

Drawing Copyright © 2009

CHA
III Winners Circle, PO Box 5269 · Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

ASH POND B INSTRUMENTATION LOCATION

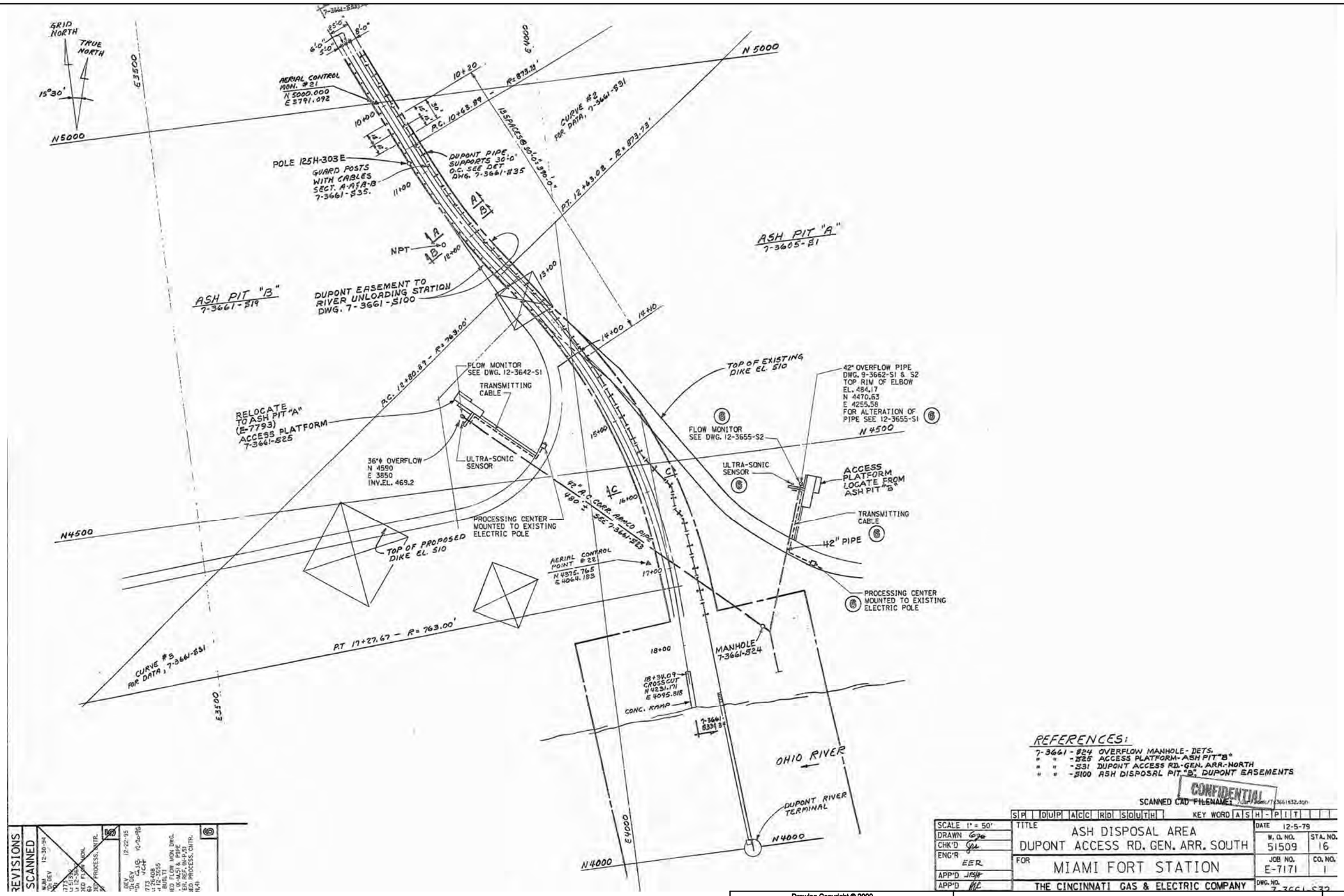
MIAMI FORT GENERATING STATION
DUKE ENERGY CORPORATION
NORTH BEND, OHIO

PROJECT NO. 20085.1050

DATE: 11/2009

FIGURE 7

File: K:\20085\CADD\ACAD\FIGURES\1050 MIAMI FORT STATION\1050_678_ASH POND B GENERAL INSTRUMENT DISCHARGE.DWG Saved: 12/1/2009 4:06:09 PM Plotted: 12/2/2009 4:32:54 PM User: Gray, Timmolyn



REFERENCES:
7-3661-S24 OVERFLOW MANHOLE-DETS.
" " -S25 ACCESS PLATFORM-ASH PIT "B"
" " -S31 DUPONT ACCESS RD.-GEN. ARR.-NORTH
" " -S100 ASH DISPOSAL PIT "B", DUPONT EASEMENTS

CONFIDENTIAL

SCANNED CAD FILENAME: 7-3661-S32.dgn

REVISIONS SCANNED

SCALE 1" = 50'	TITLE ASH DISPOSAL AREA DUPONT ACCESS RD. GEN. ARR. SOUTH	DATE 12-5-79	
DRAWN GJG		W. O. NO. 51509	STA. NO. 16
CHK'D GJG			
ENG'R EER	FOR MIAMI FORT STATION	JOB NO. E-7171	CO. NO. 1
APP'D JSH			
APP'D MC	THE CINCINNATI GAS & ELECTRIC COMPANY	DWG. NO. 7-3661-S32	

KEY WORD: S R | D U P | A C C | R D | S O U T H | ASH-PIT

IMAGE REFERENCE: ASH DISPOSAL AREA, DUPONT ACCESS RD. GEN. ARR. SOUTH, MIAMI FORT STATION, THE CINCINNATI GAS & ELECTRIC COMPANY GENERAL ENGINEERING DEPARTMENT, DWG NO. 7-3661-S32, DATED 12-5-79

Drawing Copyright © 2009

CHA
III Winners Circle, PO Box 5269 · Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

GENERAL DISCHARGE PLAN

MIAMI FORT GENERATING STATION
DUKE ENERGY CORPORATION
NORTH BEND, OHIO

PROJECT NO. 20085.1050

DATE: 11/2009

FIGURE 8

File: K:\20085\CADD\ACAD\FIGURES\1050 MIAMI FORT STATION\1050_678_ASH POND B GENERAL INSTRUMENT DISCHARGE.DWG Saved: 12/1/2009 4:06:09 PM Plotted: 12/2/2009 4:33:41 PM User: Gray, Timmolyn

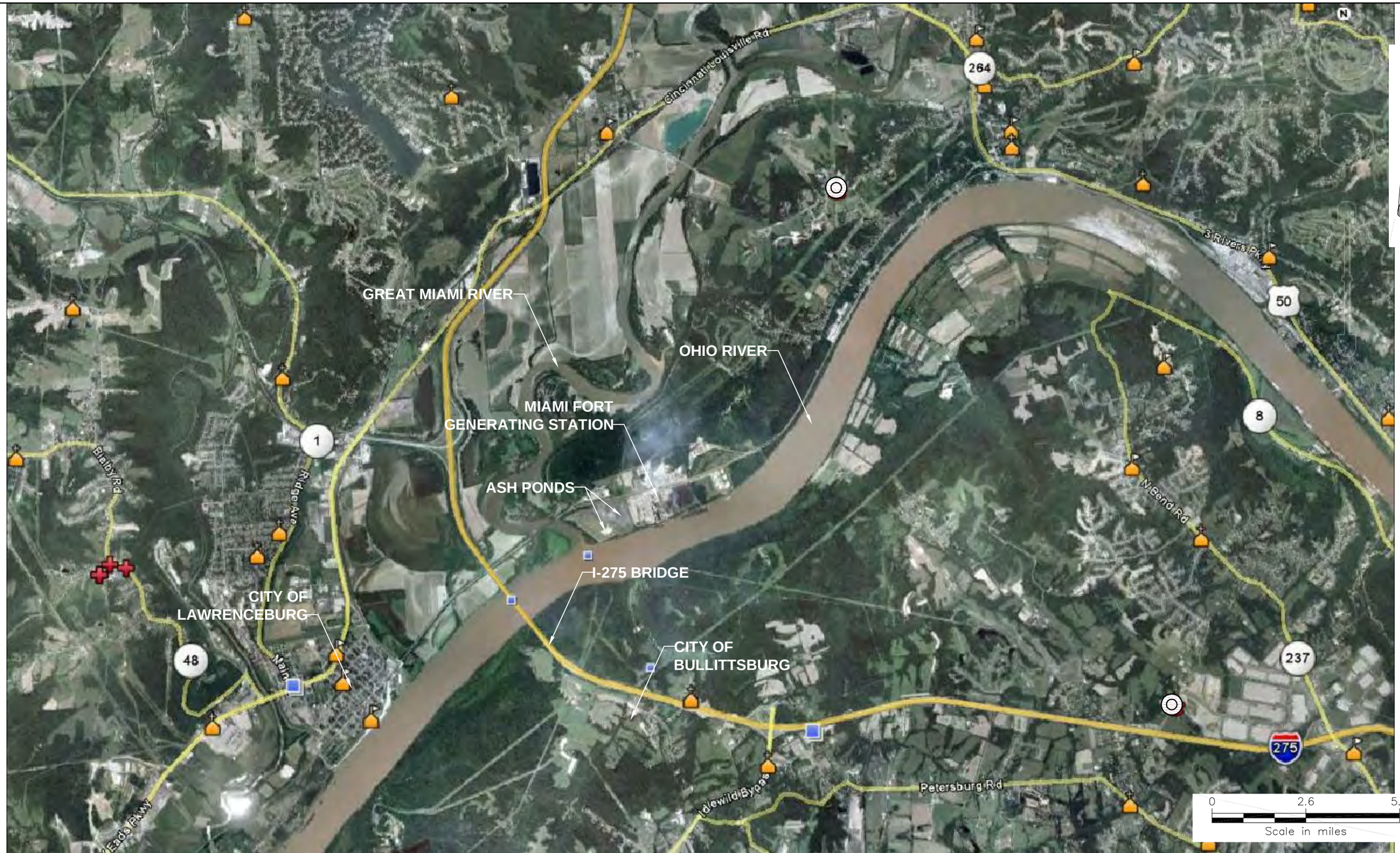


IMAGE REFERENCE: GOOGLE EARTH, IMAGERY DATED AUGUST 24, 2005

LEGEND

48	STREET, HIGHWAY		HOSPITAL
	FIRE DEPARTMENT		SCHOOL
			CHURCH

Drawing Copyright © 2009

CHA
III Winners Circle, PO Box 5269 · Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

CRITICAL INFRASTRUCTURE MAP

MIAMI FORT GENERATING STATION
DUKE ENERGY CORPORATION
NORTH BEND, OHIO

PROJECT NO. 20085.1050

DATE: 11/2009

FIGURE 9

File: K:\20085\CADD\ACAD\FIGURES\1050 MIAMI FORT STATION\1050_9_CRITICAL INFRASTRUCTURE MAP.DWG Saved: 12/2/2009 4:19:34 PM PLotted: 12/2/2009 4:20:31 PM User: Gray, Timmolyn

2.0 FIELD ASSESSMENT

2.1 Visual Observations

CHA performed visual observations of Ash Pond A and Ash Pond B following the general procedures and considerations contained in FEMA's *Federal Guidelines for Dam Safety* (April 2004), and FERC Part 12 Subpart D to make observations concerning settlement, movement, erosion, seepage, leakage, cracking, and deterioration. A Coal Combustion Dam Inspection Checklist Form, prepared by the US Environmental Protection Agency, was completed on-site during the site visit for each impoundment. A copy of the completed form was submitted via email to a Lockheed Martin representative following the site visit to the Miami Fort Station plant. Copies of the completed forms are included in Appendix A. A Photo log and a Site Photo Location Map (Figure 10) for the ash ponds are also located at the end of Section 2.4.

CHA's visual observations were made on October 6, 2009 and October 7, 2009. The weather was generally rainy and overcast to partly cloudy with day time high temperatures of 66 degrees Fahrenheit and low temperatures of 42 and 44 degrees Fahrenheit. Prior to the days we made our visual observations, the following approximate rainfall amounts occurred (as reported by www.weather.com).

Table 2 – Approximate Precipitation Prior to Site Visit

Dates of Site Visits – October 6, 2009 & October 7, 2009		
Day	**Date**	**Precipitation (inches)**
Tuesday	September 29, 2009	0.00
Wednesday	September 30, 2009	0.00
Thursday	October 1, 2009	0.33
Friday	October 2, 2009	0.20
Saturday	October 3, 2009	0.00
Sunday	October 4, 2009	0.00
Monday	October 5, 2009	0.00
Tuesday	October 6, 2009	0.08
Wednesday	October 7, 2009	0.00
Total	**Week Prior to Site Visit**	**0.61**
Total	**Month of September**	**4.69**

2.2 Visual Observation – Ash Pond Dikes

CHA performed visual observations of the Ash Pond A and Ash Pond B dikes. The dikes, including what is now the separation dike between the two ponds, total approximately 7,700 feet in length as measured along the crest, and up to about 40 feet high. Significant vegetation was generally limited to a small southeast corner of the Ash Pond A dike facing the Ohio River and consisted of a mixture of mature trees, weeds, grasses, and small brush. All other areas had been recently mowed although some older erosion features were noted to have vegetation started to re-established over them.

The grading plan for Ash Pond B may be found on Figure 4. The general arrangement plan for Ash Pond B which provides original layout and overview of the typical features of the pond may be found on Figure 6.

2.2.1 Slope and Crest Areas – General

Typical sections depicting the construction of Ash Pond A may be found on Figure 3 and for Ash Pond B on Figures 5A, 5B and 5C. In general, visual observations found that the construction conformed to the general arrangement of these plans. Measurements for each crest are noted in detail below. Deviations for the construction between the design report and the as-built drawings for Ash Pond B were previously noted.

In general, the ash pond dike crests do not show signs of an abrupt change in their horizontal alignment. Since portions of the dike crests also serve as operation access drives, they are routinely graded as required. Refer to the following photos showing the dike crest alignment:

- Photo No. 36 – South Dike Ash Pond A;
- Photo No. 38 – East Dike Ash Pond A;
- Photo No. 41 – North Dike Ash Pond A;

- Photo No. 10 – Interior Separator Dike;
- Photo No. 16 and No. 17 – South Dike Ash Pond B;
- Photo No. 19 and No. 20 – West Dike of Ash Pond B; and
- Photo No. 26 – North Dike Ash Pond B.

2.2.2 Ash Pond A South Dike

The south dike of Ash Pond A faces the Ohio River and can be seen in Photos No. 36 and No. 37. The crest of the dike was observed to have a width of 14 to 17 feet and support occasional vehicle traffic. Design details for this portion of the dike may be seen on Section B-B on Figure 3. Some beaching/wave erosion was noted on the inside face of the dike. Other minor erosion features were noted on the slope as well as construction repairs from recent work on the outfall structure.

2.2.3 Ash Pond A East Dike

The east dike of Ash Pond A borders the generating station and can be seen in Photos No. 38 and No. 39. The dike is generally in the range of 13 to 21 feet in width and has a pipe rack running along the entire length of the crest of the dike. Design drawings as depicted on Figure 2 indicate a 72-inch concrete storm sewer runs parallel to the dike in the proximity of the toe of the embankment. The crown of the pipe near the northeast corner of Ash Pond A is at about Elev. 480.5 feet +/-. This storm sewer line has an outfall in the Ohio River. The condition of the outfall was not observed during the inspection.

The embankment was noted to be in general good condition. Several erosion rills and surface sloughing due to over-steepened slopes were noted along the outside of the berm in particular in the northeast corner (Photo No. 39). Additional erosion was noted on the outside of the fence line.

2.2.4 Ash Pond A North Dike

The north dike is predominantly a grass surfaced structure, with a pipe rack running its entire length towards Ash Pond B. The dike and pipe rack can be seen in Photos No. 40, 41 and 44. Occasional vehicular traffic uses the top of the dike outboard of the pipe rack as evidenced by Photo No. 41. Design drawings (Section D-D on Figure 3 indicates that this portion of the berm was not intended to support an access road as a gravel surface was not incorporated into the design. In general the embankment is in good condition. Several erosion features and surficial sloughing along the outside face of the berm were noted and in particular in the northeast corner of the pond. These features can be seen in Photos No. 42 and No. 43. Several rodent holes were also noted in the northwest corner.

The dike toe area terminates in a perimeter access road that circulates traffic to the southern portion of the property. Design drawings indicate that compacted bottom ash was used construction of the roadway. Drainage swales located northwest of Ash Pond A were noted to have some standing water due to recent rain events. The water in this area is believed to be due to localized grading conditions which prohibit the water from entering a nearby culvert.

2.2.5 Separator Dike Ash Pond A and Ash Pond B

The separator dike between Ash Pond A and Ash Pond B was initially constructed as the western exterior dike of Ash Pond A. The Ash Pond B construction ties into this dike at its northern and southern limits. The dike has a crest width of about 18 to 20 feet with a granular surface comprised of crushed stone and is vegetated on both the side slopes into Ash Pond A and Ash Pond B as shown in Photos No. 3, 5, 10, 11 and 14. A transmission line tower straddles the southern end of the dike and can be seen in Photo No. 10. Erosion features due to over-steepening of the side slopes were noted at several locations, localized surface sloughing (Photo No. 4), beaching erosion due to wave action noted (Photo No. 15) and several rodent holes were

noted along the separator dike. No unusual slumps or bulges were observed in the slopes on either side of the dike.

2.2.6 Ash Pond B South Dike

The south dike of Ash Pond B intersects the southwestern corner of Ash Pond A as shown in Figure 4. The dike along the south side of the Ash Pond B faces along the Ohio River and is about 36 feet in height. Both upstream and downstream slopes and the crest are vegetated. The crest is about 14 feet wide and generally does not appear to have vehicular traffic across it except for maintenance purposes. An electrical transmission tower straddles the crest of the dike with one foundation element in the pond and the other four legs within the embankment. This structure predated the construction of Ash Pond B. A second tower is located on the downstream face of the dike with one leg in the dike and the other three legs straddling the drainage swale at the toe. The transmission towers and their relationship to Ash Pond A and Ash Pond B can be seen in Photos No. 16, 17 and 18.

Seepage that was reported by the ODNR in their site inspection reports on the downstream face of the dike in the vicinity of the tower foundations was not evident during CHA's site inspection. Recent rainfall and overall wet ground conditions could have prevented specific seepage conditions from being evident during the inspection. Standing water was noted in the vegetated swales at the toe of the slope.

No unusual slumps, bulges or erosion features were noted on the south facing slope leading to the Ohio River. The water front area may be seen in Photo No. 48. The dike toes at the high water mark of the River do not have any rip-rip or armor protection against seasonally high water conditions.

2.2.7 Ash Pond B West Dike

CHA performed visual observations of the western dike of Ash Pond B which can be seen in Photos No. 19, 20, 23, 24 and 25. The dike in this location is approximately 1,300 feet in length and up to about 45 feet high and has a typical crest width of 16 to 18 feet. The entire embankment is covered with grass and mowed at the time of the inspection. No erosion features were noted only a few rodent holes as seen in Photos No. 21 and No. 22.

The line of outlet pipes extending from the toe drains extending from the toe drains can be seen in Photo No. 46. In addition the same photo demonstrates an area of standing water that is typical of the drainage swale along the west side of the dike. Most of the water appeared at the time to be related to surface runoff and inadequate grading in the swale from recent rainfall events. Most of the toe drains, though active had little flow activity during the site visit. The seepage the toe drain conveys to the drainage swale was clear. It was reported that Duke is reviewing the potential to improve the drainage in this area as well as connect the toe drains for possible collection and recirculation into the ash pond to address environmental concerns.

2.2.8 Ash Pond B North Dike

The north dike of Ash Pond A is 20 to 35 feet in height and about 700 feet in length with a crest width of about 23 feet. The general condition of the dike can be seen in Photos No. 25 and No. 26. The eastern extent of the north dike of Ash Pond B ties into the northwest corner of Ash Pond A as shown in Figure 4. The dike crests do not show signs of an abrupt change in their horizontal alignment. The dike crests and side slopes are fully vegetated with grass and mowed at the time of the inspection.

A grassy area northwest of Ash Pond B is shown in Photo 27. This area receives drainage from chimney drain outlet pipes. Several of these toe drains were partially submerged due to the recent rain, poor drainage, and nearby construction activity directing water run off towards the

dike area. A series of water wells are located in the grass area and along the roadway to the top of the photo (Dupont wells 50, 51 and 52) as shown on Figure 6.

Photo No. 28 indicates an abandoned structure on the north dike. This structure previously supported ash sluice lines that were used when both Ash Pond A and Ash Pond B were operated in parallel. They have been removed. The only other lines that enter the pond are surface lines for yard drainage as shown in Photo No. 2 which now enter off the central separator dike.

2.3 Ash Pond Outlet Control Structures and Discharge

There are two outlet control structures in the Ash Pond Complex as shown on the General Discharge Plan in Figure 8. Both spillways are drop inlet structures with a sluice gate control to control flow. Ash Pond A has a 42-inch overflow pipe and Ash Pond B a 36-inch overflow pipe each connecting to a 42-inch outlet pipe. The outlet pipes from both control structures merge into a single 42-inch pipe which discharges into the Ohio River. The outlet pipe is normally submerged and was so at the time of the site assessment and could not be observed. The ODNR has requested that this be inspected as part of their dam safety inspection comments.

The sluice gate in Ash Pond A is currently in the down position as shown in Photo No. 33 to prevent flow through the outlet. This is to allow Ash Pond A to function as the initial decanting pond to deliver partially clarified water to the Ash Pond B through a 48-inch culvert through the separator dike as seen in Photo No. 7. Photos No. 33, 34 and 35 show additional views of the outlet control structure for Ash Pond A. As can be seen in the photos, vegetation had started to establish itself in the skimmer, but does not appear to be fouling the spillway function at this time. Photos No. 12 and No. 13 show the Ash Pond B outlet structure. No vegetation was noted in this outlet.

2.4 Monitoring Instrumentation

A monitoring instrumentation network was installed as a part of the construction of Ash Pond B. This network consisted of a series of pneumatic piezometers, settlement monitors, total pressure cells and inclinometers installed at two cross sections through the dike (Station 7+90 and Station 14+50). The typical instrumentation cross section is shown on Figure 7. Instrumentation readings were made from October 1979 through December 1983 both during and after the construction period of the Ash Pond B embankment. Total settlement at the centerline of the dike was measured between 10 and 22 inches at the centerline of the embankment compared to the 5.3 feet estimated in the design report.

No additional data regarding the performance of the embankment is available beyond December 1983. No instrumentation for measurement of seepage flow from the chimney drains or flow monitoring of the outfall is in place.

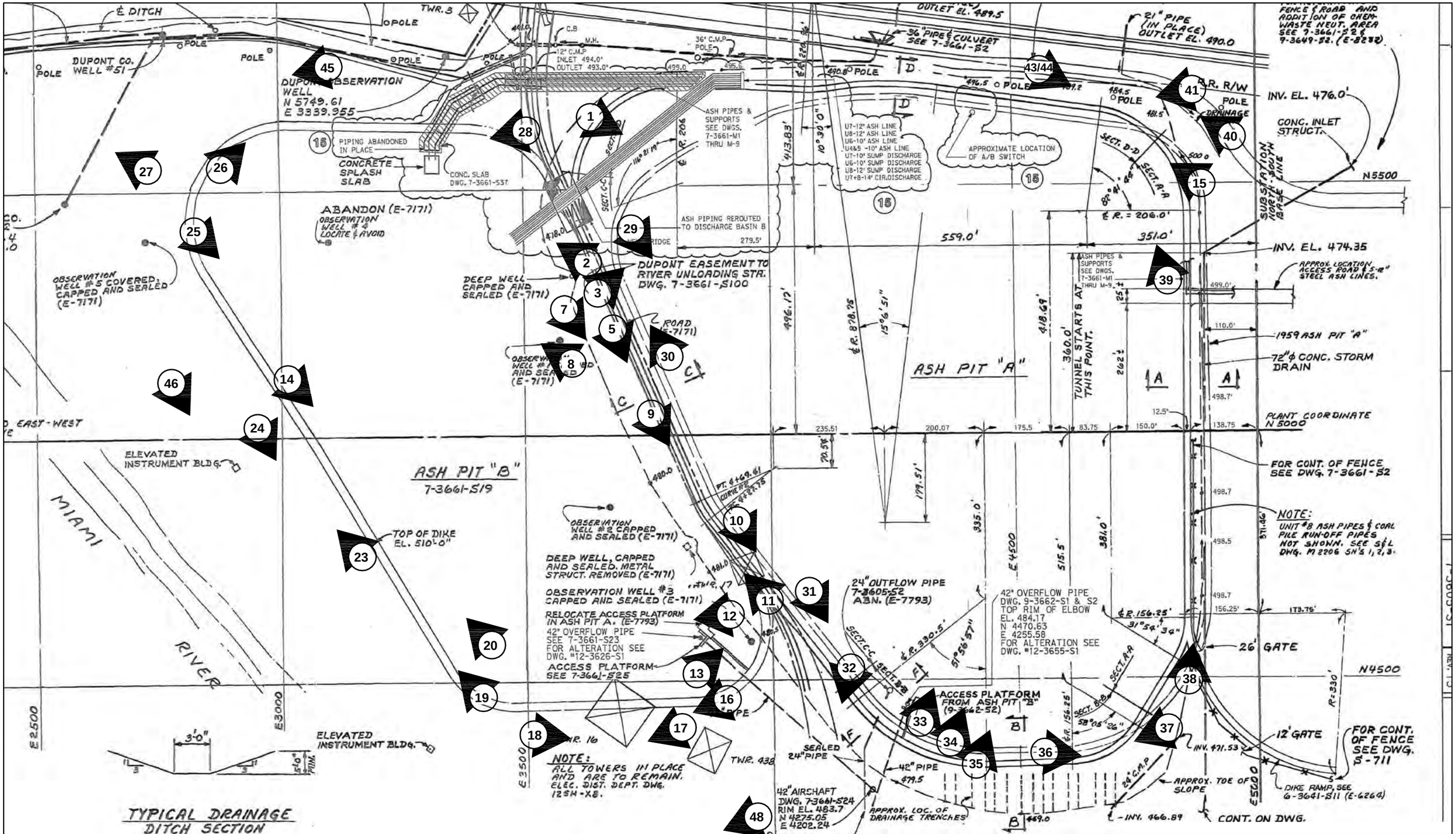


IMAGE REFERENCE: CINERGY, ASH DISPOSAL PIT A, GENERAL ARRANGEMENT, MIAMI FORT STATION, DWG NO. 7-3605-S1, DATED 2-3-05

Drawing Copyright © 2009

CHA
III Winners Circle, PO Box 5269 · Albany, NY 12205-0269
Main: (518) 453-4500 · www.chacompanies.com

PHOTO LOCATON PLAN

MIAMI FORT GENERATING STATION
DUKE ENERGY CORPORATION
NORTH BEND, OHIO

PROJECT NO. 20085.1050

DATE: 11/2009

FIGURE 10

File: K:\20085\CADD\ACAD\FIGURES\1050 MIAMI FORT STATION\1050_10_PHOTO LOCATION PLAN.DWG Saved: 12/1/2009 4:06:50 PM PLotted: 12/2/2009 4:34:22 PM User: Gray, Timmolyn

1

Ash Pond A reclamation area.

2

View of discharge pipes.

CHA	**DUKE ENERGY** **MIAMI FORT STATION** **NORTH BEND, OH** **ASH POND A & ASH POND B**
CHA Project No.: 20085.1050.1510	October 6 and 7, 2009

3

View of Interior Dike looking south.

4

Erosion feature, Interior Dike Ash Pond B.

CHA	**DUKE ENERGY** **MIAMI FORT STATION** **NORTH BEND, OH** **ASH POND A & ASH POND B**
CHA Project No.: 20085.1050.1510	October 6 and 7, 2009

5

Interior Dike western side slope of Ash Pond B.

6

Rodent hole (typical).

CHA	**DUKE ENERGY** **MIAMI FORT STATION** **NORTH BEND, OH** **ASH POND A & ASH POND B**
CHA Project No.: 20085.1050.1510	October 6 and 7, 2009

7

Culvert on northern side of interior groin in Ash Dike B.

8

Interior groin in Ash Dike B. Feature not shown on plans.

9

Loss of vegetation and erosion on Interior Dike.

10

Transmission tower and Dupont unloading line on Interior Dike.

11

Interior Dike side slope of Ash Pond B.

12

Ash Pond B overflow.

13

Ash Pond B overflow.

14

Ash Pond B.

CHA	**DUKE ENERGY** **MIAMI FORT STATION** **NORTH BEND, OH** **ASH POND A & ASH POND B**
CHA Project No.: 20085.1050.1510	October 6 and 7, 2009

15

Culvert through embankment from Ash Pond A.

16

Tower foundation at crest of embankment Ash Pond B.

17

Downstream slope and transmission tower foundation.

18

Tower foundations, looking east, South Dike Ash Pond B.

19

West Dike of Ash Pond B.

20

Interior face of West Dike of Ash Pond B.

CHA	**DUKE ENERGY** **MIAMI FORT STATION** **NORTH BEND, OH** **ASH POND A & ASH POND B**
CHA Project No.: 20085.1050.1510	October 6 and 7, 2009

21

Rodent hole (typical).

22

Rodent hole (typical).

CHA	**DUKE ENERGY** **MIAMI FORT STATION** **NORTH BEND, OH** **ASH POND A & ASH POND B**
CHA Project No.: 20085.1050.1510	October 6 and 7, 2009

23

Downstream face of West Dike of Ash Pond B.

24

Downstream face of West Dike of Ash Pond B, looking south.

25

Ash Pond B, West Dike northwest corner, looking south.

26

Ash Pond B, North Dike, northwest corner, looking east.

27

Area northwest of Ash Pond B.

28

Abandoned ash lines,

29

View of Ash Pond A from Interior Dike.

30

Sloughing along Interior Dike, Ash Pond A.

31

Ash Pond A crest and overflow structure, southwest corner.

32

Ash Pond A, downstream face and Dupont loading rack.

33

Ash Pond A overflow structure.

34

Vegetation build-up at Ash Pond A overflow structure.

35

Vegetation build-up at Ash Pond A overflow structure.

36

Ash Pond A, at crest of Dike looking east.

CHA	**DUKE ENERGY** **MIAMI FORT STATION** **NORTH BEND, OH** **ASH POND A & ASH POND B**
CHA Project No.: 20085.1050.1510	October 6 and 7, 2009

37

Ash Pond A, South Dike.

38

Ash Pond A East side, Ash pipes and coal pile run off pipes.

CHA	**DUKE ENERGY** **MIAMI FORT STATION** **NORTH BEND, OH** **ASH POND A & ASH POND B**
CHA Project No.: 20085.1050.1510	October 6 and 7, 2009

39

Ash Pond A northeast corner.

40

Ash Pond A exterior Dike, northeast corner.

CHA	**DUKE ENERGY** **MIAMI FORT STATION** **NORTH BEND, OH** **ASH POND A & ASH POND B**
CHA Project No.: 20085.1050.1510	October 6 and 7, 2009

41

Ash Pond A North Dike, exterior slope.

42

Ash Pond A erosion feature, northeast corner.

43

Ash Pond A slope slough, north slope.

44

Ash Pond A slope slough, north slope.

45

Ash Pond B northwest corner of exterior berm looking west.

46

Ash Pond B toe drains, West Dike.

47

Ash Pond B typical toe drain outlet.

48

Ohio River waterfront adjacent to Ash Pond B.

CHA	**DUKE ENERGY** **MIAMI FORT STATION** **NORTH BEND, OH** **ASH POND A & ASH POND B**
CHA Project No.: 20085.1050.1510	October 6 and 7, 2009

3.0 DATA EVALUATION

3.1 Design Assumptions

CHA has reviewed the available design assumptions related to the design and analysis of the stability and hydraulic adequacy of Ash Pond A and Ash Pond B available at the time of our site visits and provided to us by Duke Energy. The design assumptions are listed in the following sections.

3.2 Hydrologic and Hydraulic Design

The ash pond dikes are classified as Class II dams based on the Ohio Revised Code Chapter 1521 and Administrative Rules Chapter 1501:21 as indicated in the Division of Water Inspection Reports dated February 19, 2009. This is based on the fact that a sudden breach or failure could release of "health hazardous waste" and impact the Ohio River. As a Class II structure, the dikes are required to safely pass or store the inflow from 50% of the Probable Maximum Precipitation (PMP). This Chapter also requires a minimum freeboard of 5 feet above maximum operating pool unless otherwise approved by the chief (herein assumed to be the chief dam engineer for the State of Ohio).

The present operating pool is about Elev. 500 feet for Ash Pond A and between Elevation 495 to 498 for Ash Pond B. The top of rim of the elbow in the outlet structure in Ash Pond A is reported to be Elev. 484.17 and the invert for the Ash Pond B structure is shown as Elev. 469.2 feet as indicated on Figure 8. The top of rim for the outlet structures was not provided.

A preliminary hydraulics and hydrology analysis was performed for the Ash Pond A and Ash Pond B by CHA at the Miami Fort Station. The analysis was used to confirm that the basins will adequately store 50% of the volume generated during the Probable Maximum Flood (PMF) event. Ash Pond A and Ash Pond B are structures that qualify under the Class II Hazard

Classification in the State of Ohio. Due to these criteria the dams are required to pass 50% of the full PMF without overtopping, based on the Ohio Administrative Code, Design Flood for Dams.

The Probable Maximum Precipitation of 27.42 inches was generated using basin characteristics, information gathered from the HMR-51 and 52, and the HMR Boss Program. The entire watershed contained 51.5± acres which consist of the open pond/basin and impervious/compacted soil areas. A hydrograph was generated based on the calculated time of concentration and curve numbers, using TR-55 Methodologies. Rainfall amounts for the 2-year and 100-year events were referenced from the NRCS Rainfall Distributions Atlas.

Based on the existing site conditions, the outlet of Ash Pond A consists of a 42-inch culvert that connects downstream with the 42-inch culvert outlet from Ash Pond B and ultimately discharges to the Ohio River. However, in the current conditions this culvert from Ash Pond A is not being used as a direct outlet from Ash Pond A. All runoff is routed through a 48-inch culvert from Ash Pond A to Ash Pond B where it ultimately discharges via the 42-inch culvert from Ash Pond B to the Ohio River. For modeling purposes and due to the constant dredging and filling operations of the plant, the overall storage capacity for Ash Pond A was assumed to be 50% filled based on aerial photos and a recent site visit. Ash Pond B was not filled and therefore assumed to have 100% storage capacity of the PMF.

Table 3 - Ash Pond Flood Modeling

Pond	Peak Flow Rate In (cfs)	Peak Flow Rate Out (cfs)	Peak Water Surface Elev. (ft)	Top of Pond Elev. (ft)	Free-board (ft)	Bottom of Pond Elev. (ft) (assumed)	Normal Pool Elev. (ft)	50% PMF Storage Vol. (ac-ft)
Pond A	297	14.9	502.3	510.0	7.7	460.0[1]	500.0[2]	34.9
Pond B	190	16.8	499.3	510.0	10.7	460.0[1]	498.0[2]	22.8

[1]Elevation assumed and subject to change due to dredging and filling operations.
[2]Assumed based on recent site visit.

As summarized in the results above Ash Pond A and Ash Pond B at the Miami Fort Station will adequately store 50% of the volume generated during the Probable Maximum Flood (PMF) and allow for five feet of freeboard as required by the State of Ohio. Duke was not able to provide CHA with a hydraulic analysis showing the ash ponds ability to safely pass the 50 % PMP event. However, preliminary analyses performed by CHA suggest there is enough storage capacity at the current operating pool to safely withstand this rainfall event. We recommend Duke perform a complete study to confirm this, and update the study if operating levels of the pond change in the future or if the dike system is reclassified.

3.3 Structural Adequacy & Stability

The Ohio Department of Natural Resources, Division of Water, Dam Safety Program recognizes "design procedures that have been established by the United States Army Corps of Engineers, the United States Department of Interior, Interior Bureau of Reclamation, the Federal Energy Regulatory Commission, The United States Natural Resources Conservation Service, and others that are generally accepted as sound engineering practice, will be acceptable to the Chief."

In performing a review of the structural adequacy and stability of Ash Pond A and Ash Pond B, CHA has compared the computed factor of safety provided in the original design documents for the ash ponds with minimum required factors of safety as outlined by the U.S. Army Corps of Engineers in EM 1110-2-1902, Table 3-1. The guidance values for minimum factor of safety are provided in Table 3.

Table 4 - Minimum Safety Factors Required

Load Case	Required Minimum Factor of Safety
Steady State Conditions at Present Pool or Maximum Storage Pool Elevation	1.5
Rapid Draw-Down Conditions from Present Pool Elevation	1.3
Maximum Surcharge Pool (Flood) Condition	1.4
Seismic Conditions from Present Pool Elevation	1.0
Liquefaction	1.3

In Sections 3.3.1 and 3.3.2 we discuss our review the available stability analyses for Ash Pond A and Ash Pond B, respectively.

3.3.1 Ash Pond A

The H. C. Nutting Company completed an investigation to establish geotechnical design requirements for the increase in the height of Ash Pond A from Elev. 500 to Elev. 510 feet in 1976. A subsurface investigation was completed along with laboratory testing of natural soils to establish design parameter for the dike expansion. The use of fly ash as structural fill and bottom ash as drainage material was also evaluated. Material testing of ash products also referenced a previous investigation completed in February 1973. Data from this investigation was not available to CHA at the time of this report.

Slope stability analyses were run considering several embankment cross sections with a pond surface at about Elev. 508 feet. The resulting factors of safety were found to range between 1.2 for an embankment expanded using fly ash to 1.64 for one using clay soils. Side slopes for these examples were both 2 horizontal to 1 vertical matching those on the design drawings shown on Figure 3. For the slope construction nearest the river, Nutting recommended monitoring of foundation performance and the rate of filling to prevent potential instability issues. The Table 4 summarizes the data used in the analysis completed for the vertical expansion of Ash Pond A.

Table 4 - Soil Strength Parameters as Determined by H. C. Nutting, 1976

Soil Stratum	Unit Weight (pcf)	Friction Angle (φ)	Cohesion (psf)	Description
Existing Compacted Silty Clay	125	25	300	Consolidated Drained
Compacted Fly Ash	105	29	0	Consolidated Drained
Compacted Silty Clay	125	25	300	Consolidated drained
Existing Silty Clay Base	125	25	300	Consolidated Drained

Only static steady state conditions were considered in the analysis. Normal pool conditions, rapid draw down, liquefaction and seismic slope stability analyses were not performed The factor of safety for the upstream (inboard) embankment slope of the pond was not evaluated as part of the 1976 investigation. Section 4.11 outlines our recommendations for tasks that should be performed to confirm that the embankments are stable under these loading conditions. The location of the groundwater table within the embankment cannot be determined as not monitoring network is in place.

3.3.2 Ash Pond B

D'Appalonia Consulting Engineers, Inc. completed an investigation to establish geotechnical design requirements for the design of Ash Pond B in 1979. A subsurface investigation was completed along with laboratory testing of natural soils and fly ash and bottom ash to establish design parameters for construction of the new impoundment. Over 700,000 tons of fly ash and bottom ash was proposed to be used in the construction of the new embankments. Settlement and stability analysis were completed. A brief discussion regarding settlement may be found under in Section 3.4.

Stability analysis were prepared considering two stage construction and long term performance under steady state seepage conditions. Static and seismic conditions were considered under the long term performance scenario. For the purposes of this report only the long term performance is of concern. The Table 5 summarizes the soil strength properties used by D'Appalonia in their analysis.

Table 5 - Soil Strength Parameters as Determined by D'Appalonia, 1979

Soil Stratum	Unit Weight (pcf)	Friction Angle (φ)	Cohesion (psf)	Description
Cement Stabilized Fly Ash	95	0	5,000	Consolidated Undrained
Compacted Fly Ash	95	35	0	Consolidated Undrained
In Situ Clayey Silt, Silt Clay and Clayey Sandy Silt	113	34	0	Consolidated Undrained
In Situ Sand and Gravel	125	35	0	Consolidated Undrained

Table 6 summarizes the minimum factors of safety computed by D'Appalonia for the construction of the new Ash Pond A. In reviewing this table please note the following:

- The pond surface elevation was not provided within the report;
- The analysis assumed the use of cement stabilized fly ash at the toe of the embankment and as a surface seal. Construction documents as shown on Figure 5C indicate that the toe and shell cover has been replaced with a clay soil material. No additional analysis was completed for this substitution.
- No piezometers are in place to measure the phreatic surface in the embankment; and
- No flow monitoring is conducted of the chimney drain outlet pipes as shown in Figure 5C and Photos No. 46 and No. 47.

Table 6 – Summary of Safety Factors for Ash Pond B

Load Case	Required Minimum Factor of Safety	Calculated Minimum Factor of Safety
Steady State Conditions Downstream Slope	1.5	2.0
Steady State Conditions Upstream Slope	1.5	1.8
Rapid Draw-Down Condition from Present Pool Elevation	1.3	Not Performed
Maximum Surcharge Pool (Flood) Condition	1.4	Not Performed
Seismic Conditions Downstream Slope	1.0	1.4
Seismic Conditions Upstream Slope	1.0	1.0
Liquefaction	1.3	Not Performed

Duke did not provide documentation showing that a stability analysis was performed for all of the typical load cases for Ash Pond B as noted above. In addition the construction materials were modified from the design report and no subsequent review of the stability analysis was completed.

3.3.3 Future Slope Stability Analysis

The existing slope stability analyses are in excess of 40 years old and in some cases do not consider the actual materials used in the construction of the embankment. The facility does not have a monitoring program in place for seepage, settlement or the ability to evaluate changing water levels within the embankment. CHA recommends that additional slope stability analysis be completed at the Miami Fort site which at a minimum should include the following for both Ash Pond A and Ash Pond B:

- Verifying that the present steady state factor of safety for the downstream slope was calculated at the maximum storage pool elevation and determining the factor of safety under of the upstream slope for this load case.
- Determining steady state factors of safety on the upstream and downstream slopes at the maximum flood elevation.
- Determining seismic factors of safety on the upstream and downstream slopes at the maximum storage pool.
- A liquefaction analysis should be performed considering the underlying soil strata.
- Determine the appropriate material properties for use in the analysis and complete an investigation to determine the phreatic surface within the embankment.

In addition to the aforementioned analyses, a rapid draw-down analysis should be considered for the upstream face. CHA understands that rapid drawdown via pumping or other discharge methods may be undesirable for a waste disposal impoundment. We suggest that in the event of an emergency at the facility, rapid drawdown may be more desirable to reduce hydrostatic pressures on the embankments, thereby preventing a more catastrophic collapse. There have been documented case histories where other types of failures (such as a gate failure) have resulted in rapid drawdown conditions developing which have led to a domino effect and made the situation worse.

3.4 Foundation Conditions

No detailed information was available in the Duke files related to the original construction of the Ash Pond A. The geotechnical investigation completed by Nutting in 1976 for the vertical expansion of the pond characterized the underlying foundation soils as weak. The dike expansion was transitioned from an ash fill to a full cohesive soil embankment along the south side of the Ash Pond, facing the Ohio River due to the condition of the underlying weak soils. In addition the future ash pit area adjacent to the Miami River was noted to be founded on weak deposits of low shear strength cohesive soils.

The design reports completed by D'Appalonia in 1979 investigated the weak strata underlying Ash Pond B. Cross sections through the embankments are shown in Figures 5A and 5B. These figures depict the low shear strength alluvial silty clay and clayey silt deposits with sand and silt lenses and clay seams which underlie the Ash Pond B embankment. In general these materials occur from the ground surface to about Elev. 440 feet. Test data from field vane shear tests, laboratory unconsolidated-undrained (UU) tests, triaxial shear tests, pocket penetrometer tests and torvanes are presented in the report. The average unconsolidated-undrained shear strength reported from the triaxial test data was 814 psf.

One dimensional consolidation testing was also performed to assist in a settlement analysis of the Ash Pond B embankment. Total consolidation settlements were estimated to 5.3, 4.5 and 0.8 feet at the center line, quarter point and toe of the embankment respectively as shown in Figure 7. The report also noted that it was anticipated that most settlement should occur during construction. Settlement gauges were established as part of the overall monitoring network. The limited construction monitoring data provided to CHA indicates that settlements at Station 14+50 on the west side of Ash Pond B were recorded at about 22 inches at the centerline and 18 inches at the quarter point.

3.4.1 Documentation of Foundation Preparations

Project specifications for foundation preparation were available for both the Ash Pond A expansion (Nutting, 1976) and the Ash Pond B construction (D'Appalonia, 1979). No specifications were available for the original Ash Pond A construction. No documentation was available regarding actual construction conditions observed during the completion of either to the Ash Pond A or B embankment projects.

3.5 Operations & Maintenance

Duke Energy Miami Fort Station plant staff conducts and document quarterly inspections of the ash pond embankments. Drive-around inspections are completed on a weekly basis. Maintenance items are identified during the weekly inspections and completion of these items is confirmed during subsequent inspections. A standardize reporting form is used for inspections.

Duke Energy has not had routine inspections performed by an engineering consultant for the Ash Pond A and Ash Pond B embankments. H.C. Nutting performed a limited ash pond embankment inspection in November 2008. It is our understanding this is the only inspection report prepared for the facility by a professional engineer.

3.5.1 State of Ohio Inspections

Ohio Revised Code Section 1521.062 states that the owners of dams must monitor, maintain, and operate their dams safely. The owner is to maintain a safe structure and appurtenances through inspection, maintenance, and operation.

Representatives of the ODNR Dam Safety Program inspected Ash Pond A and Ash Pond B structures on February 19, 2009. Dam Safety Inspection Reports were provided to Duke following the department's site visit. The reports included required remedial measures based on

observation made during the inspection, calculations performed and requirements of the Ohio Administrative Code. A summary of the required remedial measures outlined in the 2009 inspection reports is provided in Table 7. For Engineering Repairs and Investigations the dam owner must retain the services of a professional engineer to address the plans, specification, investigative reports, and other supporting documentation. The owner is required to complete the items within five (5) years. Owner repairs may be performed by the dam owner or by a hired contractor.

Table 7 – Summary of Required Remedial Measures

Ash Pond A
Engineering Repairs and Investigations
None noted.
Owner Repairs
1. Remove the trees from the riprap along the south embankment toe.
2. The owner must provide a device or plan to permit draining of the reservoir within a reasonable period of time in accordance with OAC Rule 1501:21-13-06.
3. Update the OMI and EAP.
4. Monitor the wet area on the east embankment toe for signs of increased flow or sediment transport.
5. Monitor the east embankment along the area of erosion that is located off the exterior toe for any signs of instabilities.
Ash Pond B
Engineering Repairs and Investigations
None noted.
Owner Repairs
1. The owner must provide a device or plan to permit draining of the reservoir within a reasonable period of time in accordance with OAC Rule 1501:21-13-06.
2. Continue to provide regular maintenance and monitoring of the embankment drain outlets.
3. Update the OMI and EAP.
4. Monitor the wet area on the south embankment slope and toe for signs of increased flow or sediment transport.

4.0 CONCLUSIONS/RECOMMENDATIONS

4.1 Acknowledgement of Management Unit Condition

I acknowledge that the management units (Ash Pond A and Ash Pond B) referenced herein was personally inspected by me and was found to be in the following condition: **Fair.** This indicates acceptable performance is expected under required loading conditions in accordance with applicable safety regulatory criteria; however some additional analyses should be performed and documented to verify that these criteria are met.

Evidence was observed indicating that Duke Energy attempts and maintains proactive maintenance programs at these facilities. These efforts should be continued. No performance monitoring program is currently in effect.

CHA presents recommendations for maintenance and further studies to bring these facilities into Satisfactory in the following sections. In addition to the items outlined below, CHA recommends that the required remedial measures outlined in the ODNR 2009 Dam Safety Inspection Reports for Ash Pond A and Ash Pond B be implemented.

4.2 Topographic Survey

An updated topographic survey of the Ash Pond A and Ash Pond B area should be completed to serve as the basis for future engineering evaluations and design. It should incorporate all surface features, drainage courses and identified seepage areas to allow for a full evaluation of the facility.

4.3 Maintaining and Controlling Vegetation Growth

The grass cover on Ash Pond A and Ash Pond B appears to be reasonably maintained with only isolated areas of mild cover loss. This practice should continue. Previous recommendations from the ODNR recommended that heavier vegetation be removed and that herbicide treatments be employed to control weeds and woody growth particularly in Ash Pond A rip rap areas CHA recommends that vegetation be cut prior to each quarterly inspection performed by Duke representatives so that adequate visual inspections can be made.

4.4 General Crest Areas and Slopes

These areas typically had intermittent erosion rills, likely exacerbated when grading activities pushed loose material to the crest edge and sheet flow became concentrated during rain events. In addition several erosion features were noted to be covered with grass. These erosion rills should be filled in with compacted material and otherwise stabilized. When grading activities push material to the crest edge, a concerted attempt should be made to compact these areas prior to the next rain event.

Several surface sloughs were noted in over-steepened areas. These areas should be re-graded to a flatter slope where possible and reseeded or armored with a stone material. Monitoring of these areas should be conducted to check for any continued movement.

4.5 Ash Pond Spillway

Vegetation had started to establish itself in the skimmer for Ash Pond A. Although it has not become a problem presently as this outfall is not currently used, removal is recommended to maintain this area before the vegetation fouls the tower outfall or prevents the skimmer from working effectively.

The ODNR has recommended that the outfall be inspected for structural integrity using video cameras. This would be preferable under a low flow or no flow condition.

4.6 Ash Pond A and Ash Pond B South Dike

Normal pool of the Ohio River is at about Elev. 455 feet as shown in the D'Appalonia design Report. These drawings also indicate a design level at about Elev. 460 feet and a staged construction considering a water level at Elev. 492 feet suggesting that routine high water levels are likely to submerge the downstream toe. During the site visit, slope protection such as rip rap was not observed on Ash Pond B and was only partially evident in this area on Ash Pond A. CHA recommends an analysis of the flood level water velocities in the area of the down stream slope to determine if rip rap or some similar slope protection is warranted.

4.7 Ash Pond Hydraulic Analysis

Duke was not able to provide CHA with a hydraulic analysis showing the ash pond's ability to safely pass the 50 % PMP event. However, preliminary analyses performed by CHA suggest there is enough storage capacity at the current operating pool to safely withstand this rainfall event. We recommend Duke perform a complete study to confirm this, and update the study if operating levels of the pond change in the future.

4.8 Additional Stability Analyses

Based on our review of available information for the ash ponds we recommend that the following tasks be performed to confirm that the embankments are indeed stable under the various loading conditions outlined in Section 3.3.

- Verifying that the present steady state factor of safety for the downstream slope was calculated at the maximum storage pool elevation and determining the factor of safety under of the upstream slope for this load case.
- Determining steady state factors of safety on the upstream and downstream slopes at the maximum flood elevation.
- Determining seismic factors of safety on the upstream and downstream slopes at the maximum storage pool.
- A liquefaction analysis should be performed considering the underlying soil strata.
- Determine the appropriate material properties for use in the analysis and complete an investigation to determine the phreatic surface within the embankment.
- CHA recommends a rapid drawdown analysis be performed for the current conditions.

5.0 CLOSING

The information presented in this report is based on visual field observations, review of reports by others and this limited knowledge of the history of the Miami Fort Generating Station surface impoundments. The recommendations presented are based, in part, on project information available at the time of this report. No other warranty, expressed or implied is made. Should additional information or changes in field conditions occur, the conclusions and recommendations provided in this report should be re-evaluated by an experienced engineer.

APPENDIX A

Completed EPA Coal Combustion Dam Inspection Checklist Forms

&

Completed EPA Coal Combustion Waste (CCW) Impoundment Inspection Forms

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: Miami Fort Steam Station	Date: October 6, 2009
Unit Name: Ash Basin A	Operator's Name: Duke Energy Corporation
Unit I.D.:	Hazard Potential Classification: High **Significant** Low
Inspector's Name: Malcolm D. Hargraves P.E./Rebecca Filkins	

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	see note		18. Sloughing or bulging on slopes?	see	note
2. Pool elevation (operator records)?	500		19. Major erosion or slope deterioration?		x
3. Decant inlet elevation (operator records)?	no decant		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	500(culvert)		Is water entering inlet, but not exiting outlet?	n/a	
5. Lowest dam crest elevation (operator records)?	510		Is water exiting outlet, but not entering inlet?	n/a	
6. If instrumentation is present, are readings recorded (operator records)?	x		Is water exiting outlet flowing clear?	n/a	
7. Is the embankment currently under construction?		x	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	n/a		From underdrain?	n/a	
9. Trees growing on embankment? (If so, indicate largest diameter below)		x	At isolated points on embankment slopes?		x
10. Cracks or scarps on crest?		x	At natural hillside in the embankment area?		x
11. Is there significant settlement along the crest?		x	Over widespread areas?		x
12. Are decant trashracks clear and in place?	see	note	From downstream foundation area?		x
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		x	"Boils" beneath stream or ponded water?		x
14. Clogged spillways, groin or diversion ditches?	n/a		Around the outside of the decant pipe?	see	note
15. Are spillway or ditch linings deteriorated?	n/a		22. Surface movements in valley bottom or on hillside?		x
16. Are outlets of decant or underdrains blocked?	see		23. Water against downstream toe?	x	
17. Cracks or scarps on slopes?		x	24. Were Photos taken during the dam inspection?	x	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
1,6	Owner takes water monitoring well readings on 1 to 6 month intervals. Dam inspections not documented.
	Wells installed late 2007.
12,16	Decant rack has skimming unit. Spillway is not active. Water flows through culvert to Ash Basin B.
15, 16, 20, 21	Spillway outlet is buried, inactive, and normally submerged; lining not observed. No underdrains.
18	Superficial grassed over slough/slumps in isolated locations on Basin A dikes where they are steep (2:1 H:V or steeper). A/B separator dike has isolated slumps in ash slope where grading activities have steepend them.
23.	Downstream face of separator dike (old wall of Basin A) is inner wall of Basin B.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # OH0009873 INSPECTOR Hargraves/Filkins
Date October 7, 2009

Impoundment Name Ash Basin A
Impoundment Company Duke Energy Corporation
EPA Region 5
State Agency (Field Office) Addresss Ohio EPA Southwest District Office
401 East Fifth Street, Dayton, Ohio 45402
Name of Impoundment Ash Basin A
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New _____ Update x

	Yes	No
Is impoundment currently under construction?		x
Is water or ccw currently being pumped into the impoundment?	x	

IMPOUNDMENT FUNCTION: Bottom and Fly Ash, Pyrites, FGD waste, waste water, drainage

Nearest Downstream Town : Name Lawerenceburg, Ohio
Distance from the impoundment 2.7 miles
Impoundment
Location: Longitude 39 Degrees 6 Minutes 45 Seconds
Latitude 84 Degrees 48 Minutes 36 Seconds
State Ohio County Hamilton

Does a state agency regulate this impoundment? YES x NO _____

If So Which State Agency? ODNR-Division of Water

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

_____ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

_____ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

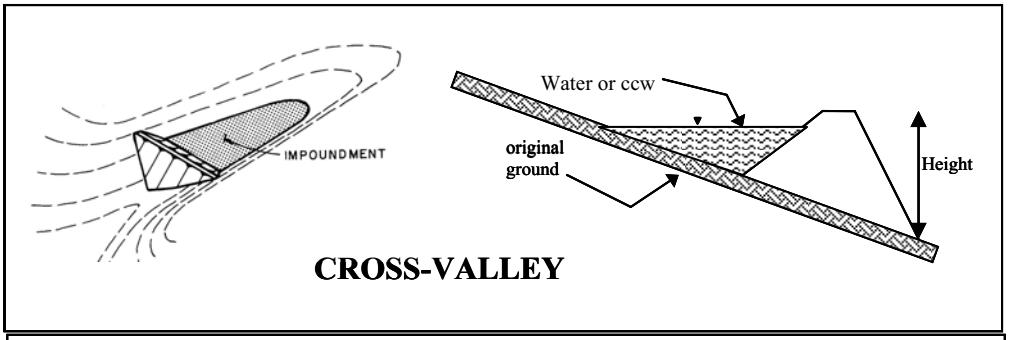
x_____ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

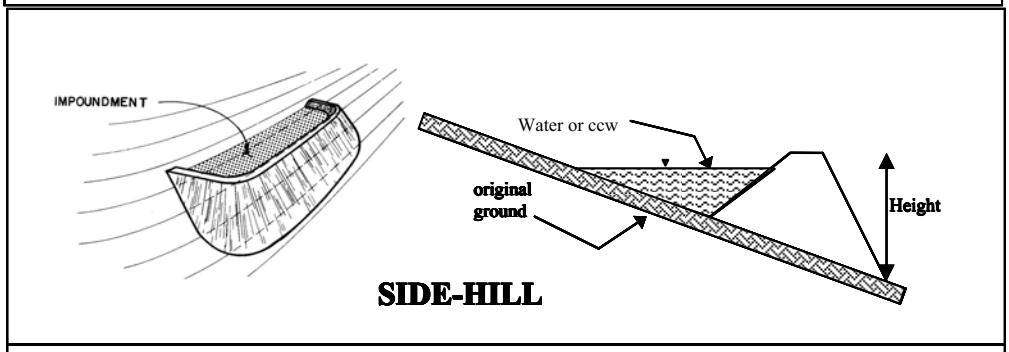
_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

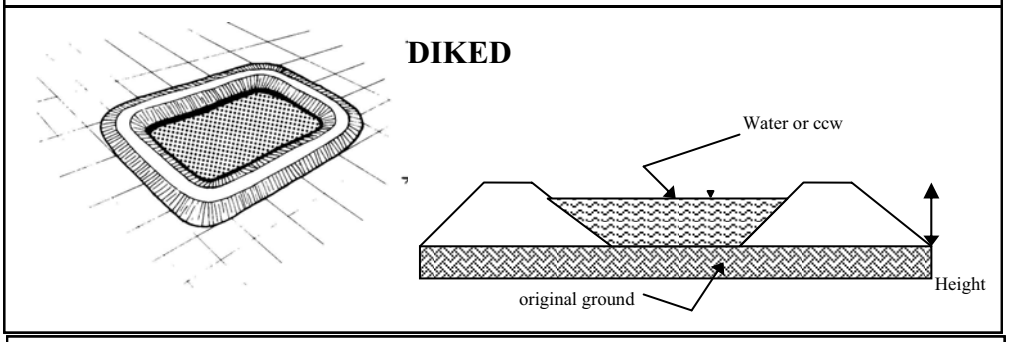
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

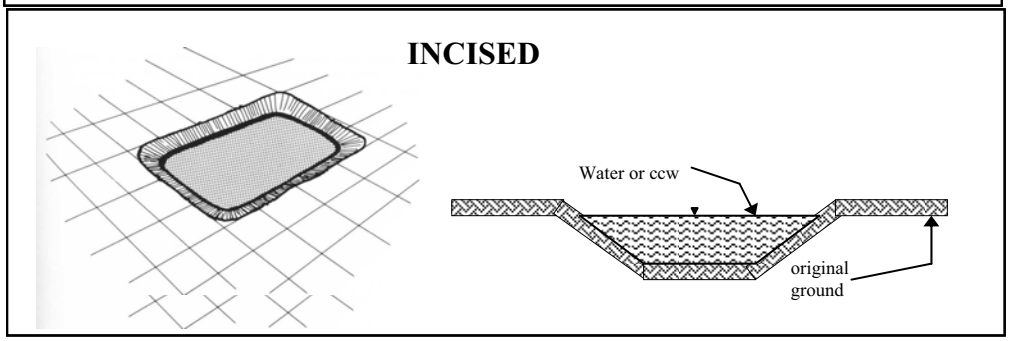
A breach of the dike would adversely impact the Ohio River.

CONFIGURATION:









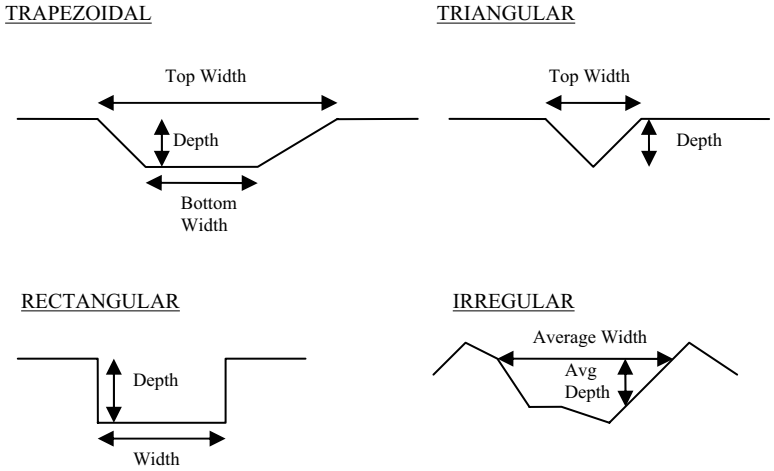
_____ Cross-Valley
_____ Side-Hill
x_____ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height 50 feet Embankment Material Zoned Earth
Pool Area 20 acres Liner none
Current Freeboard 10 feet Liner Permeability n/a

TYPE OF OUTLET (Mark all that apply)

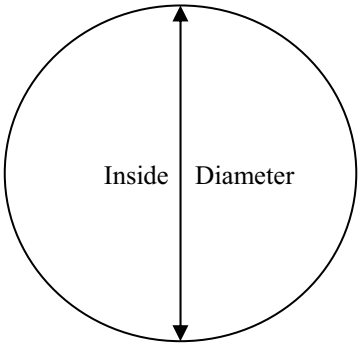
n/a ____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width
_____



yes ____ **Outlet**

48 ____ inside diameter



Material
x _____ corrugated metal
_____ welded steel
_____ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) _____

_____

Is water flowing through the outlet? YES x _____ NO _____

n/a ____ **No Outlet**

_____

_____ **Other Type of Outlet** (specify) _____

The Impoundment was Designed By H. C. Nutting
_____

Has there ever been a failure at this site? YES _____ NO x_____

If So When? _____

If So Please Describe :

Has there ever been significant seepages at this site? YES _____ NO x_____

If So When? _____

IF So Please Describe:

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES _____NO x_____

If so, which method (e.g., piezometers, gw pumping,...)? _____

If so Please Describe :

There have been monitoring wells recently installed (2007) outside of the dike footprint to measure groundwater impact. Water levels and chemical analysis data collection has started on these wells.

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: Miami Fort Steam Station	Date: October 7, 2009
Unit Name: Ash Basin B	Operator's Name: Duke Energy Corporation
Unit I.D.:	Hazard Potential Classification: High **Significant** Low
Inspector's Name: Malcolm D. Hargraves P.E./Rebecca Filkins	

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	see note		18. Sloughing or bulging on slopes?		x
2. Pool elevation (operator records)?	498		19. Major erosion or slope deterioration?		x
3. Decant inlet elevation (operator records)?	498		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	n/a		Is water entering inlet, but not exiting outlet?	n/a	
5. Lowest dam crest elevation (operator records)?	510		Is water exiting outlet, but not entering inlet?	n/a	
6. If instrumentation is present, are readings recorded (operator records)?	x		Is water exiting outlet flowing clear?	n/a	
7. Is the embankment currently under construction?		x	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	n/a		From underdrain?	x	
9. Trees growing on embankment? (If so, indicate largest diameter below)		x	At isolated points on embankment slopes?		x
10. Cracks or scarps on crest?		x	At natural hillside in the embankment area?		x
11. Is there significant settlement along the crest?		x	Over widespread areas?		x
12. Are decant trashracks clear and in place?	x		From downstream foundation area?		x
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		x	"Boils" beneath stream or ponded water?		x
14. Clogged spillways, groin or diversion ditches?		x	Around the outside of the decant pipe?	see	note
15. Are spillway or ditch linings deteriorated?	see	note	22. Surface movements in valley bottom or on hillside?		x
16. Are outlets of decant or underdrains blocked?	see	note	23. Water against downstream toe?		x
17. Cracks or scarps on slopes?		x	24. Were Photos taken during the dam inspection?	x	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
1,6	Owner takes water monitoring well readings on 1 to 6 month intervals. Dam inspections not documented.
	Wells installed late 2007.
12	Decant rack has skimmer configuration unit.
15, 20, 21	Pond spillway outlet is normally submerged; lining not observed. Drainage ditches are grass lined.
16	Underdrains are partially blocked when water backs up into the outlets from the drainage ditches.
18	Interior slopes have isolated irregularities and loose areas where previous grading/construction activities have occurred (cenosphere harvest, dredging, etc.).

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # OH0009873 INSPECTOR Hargraves/Filkins

Date October 7, 2009

Impoundment Name Ash Basin B

Impoundment Company Duke Energy Corporation

EPA Region 5

State Agency (Field Office) Addresss Ohio EPA Southwest District Office
401 East Fifth Street, Dayton, Ohio 45402

Name of Impoundment Ash Basin B

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New _____ Update x

	Yes	No
Is impoundment currently under construction?		x
Is water or ccw currently being pumped into the impoundment?	x	

IMPOUNDMENT FUNCTION: Decanted water from Bottom Ash, Fly Ash, Pyrites, FGD waste

Nearest Downstream Town : Name Lawerenceburg, Ohio

Distance from the impoundment 2.7 miles

Impoundment Location:

Longitude 39 Degrees 6 Minutes 43 Seconds

Latitude 84 Degrees 48 Minutes 46 Seconds

State Ohio County Hamilton

Does a state agency regulate this impoundment? YES x NO _____

If So Which State Agency? ODNR-Division of Water

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

_____ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

_____ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

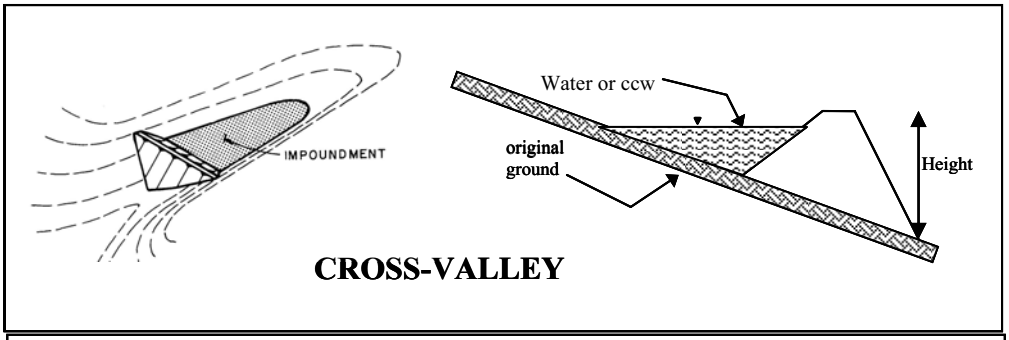
x_____ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

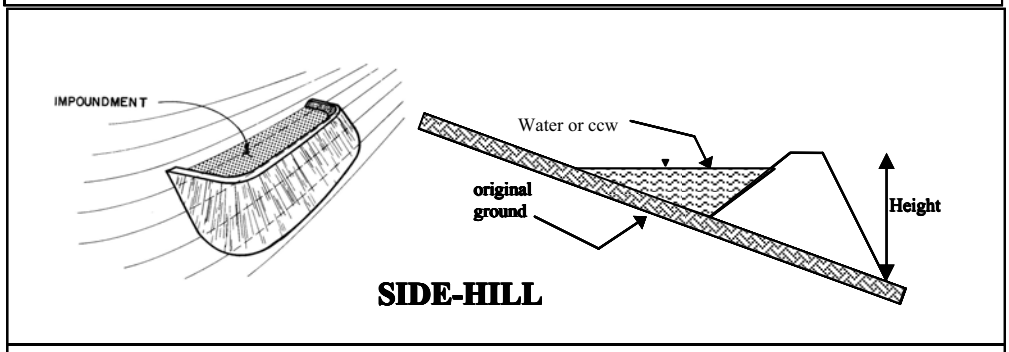
_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

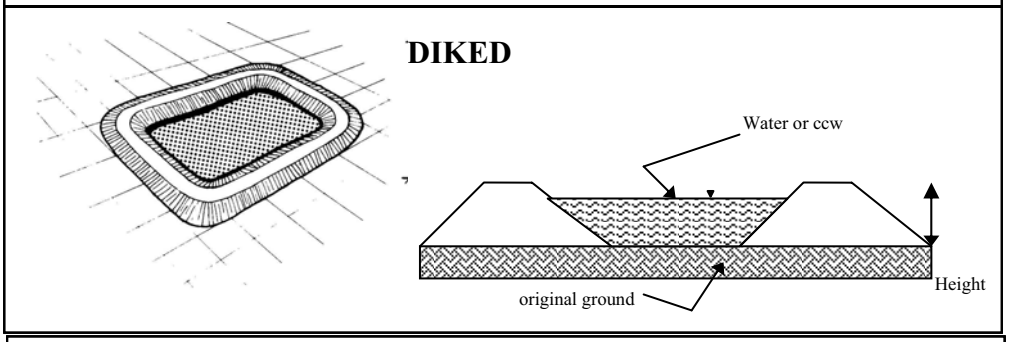
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

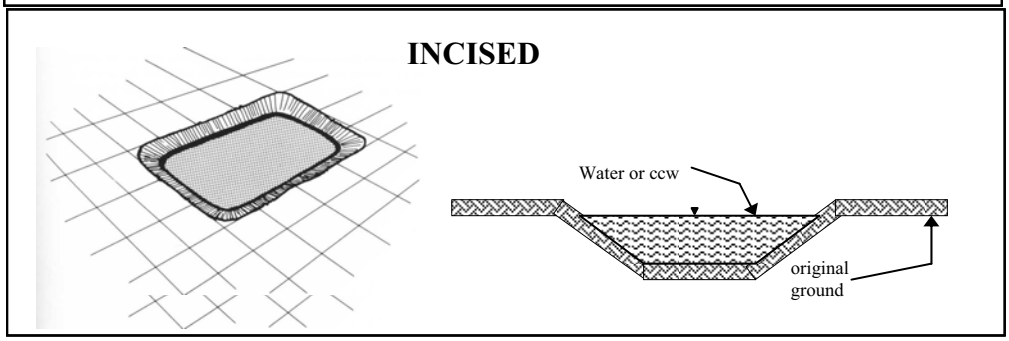
A breach of the dike would adversely impact the Ohio River.

CONFIGURATION:









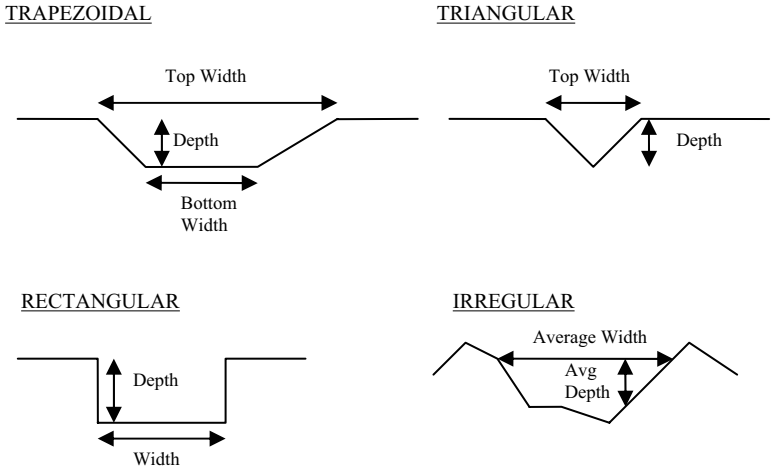
_____ Cross-Valley
_____ Side-Hill
x_____ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height 50 feet Embankment Material Zoned Earth
Pool Area 20 acres Liner none
Current Freeboard 12 feet Liner Permeability n/a

TYPE OF OUTLET (Mark all that apply)

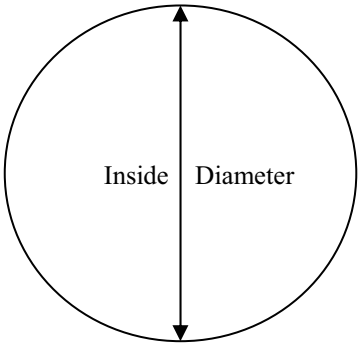
n/a ____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width
_____



yes ____ **Outlet**

42 ____ inside diameter



Material
x _____ corrugated metal
_____ welded steel
_____ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) _____

_____

Is water flowing through the outlet? YES x _____ NO _____

n/a ____ **No Outlet**

_____

_____ **Other Type of Outlet** (specify) _____

The Impoundment was Designed By D'Appolonia
_____

Has there ever been a failure at this site? YES _____ NO x_____

If So When? _____

If So Please Describe :

Has there ever been significant seepages at this site? YES _____ NO x_____

If So When? _____

IF So Please Describe:

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES _____NO x_____

If so, which method (e.g., piezometers, gw pumping,...)? _____

If so Please Describe :

There have been monitoring wells recently installed (2007) outside of the dike footprint to measure groundwater impact. Water levels and chemical analysis data collection has started on these wells.