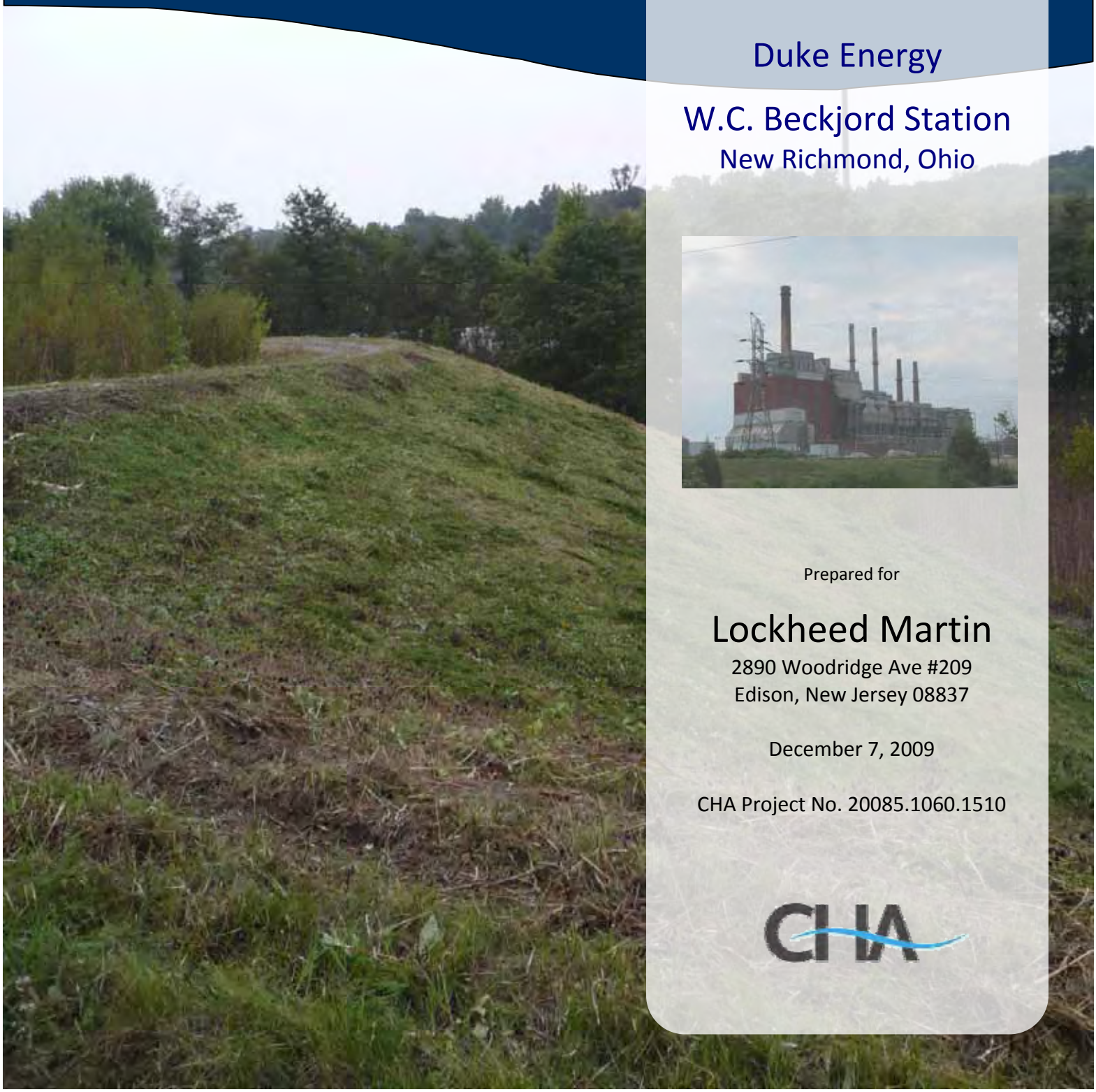
Assessment of Dam Safety
Coal Combustion Surface Impoundments (Task 3)
Draft Report



Duke Energy

W.C. Beckjord Station

New Richmond, Ohio

Prepared for

Lockheed Martin

2890 Woodridge Ave #209
Edison, New Jersey 08837

December 7, 2009

CHA Project No. 20085.1060.1510

CHA

I acknowledge that the management units referenced herein:

- Ash Pond A
- Ash Pond B
- Ash Pond C
- Ash Pond C Extension

Located at the Walter C. Beckjord Generating Station were been assessed on October 8, 2009 and October 9, 2009.

Signature: _____

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

Signature: _____

Rebecca L. Filkins
Geotechnical Engineer

Reviewer: _____

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

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APPENDIX

1.0 INTRODUCTION & PROJECT DESCRIPTION

1.1 Introduction

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 Duke Energy Ohio Inc.'s (DEO) Walter C. Beckjord Generating Station (W.C. Beckjord Station) located in New Richmond, Ohio as shown on Figure 1 – Project Location Map.

DEO reportedly purchased the W.C. Beckjord Station in 2006 and is the legal operator of the station. Ash Pond B is owned by DEO and Ash Pond C and Ash Pond C Extension are owned in combination by DEO, American Electric Power and Dayton Power & Light.

CHA made a site visit on October 8, 2009 and October 9, 2009 to inventory coal combustion surface impoundments at the facility, perform visual observations of the containment dikes, and collect relevant information regarding the Ash Pond A, Ash Pond B, Ash Pond C and Ash Pond C Extension impoundments.

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

Company or Organization	Name
Duke Energy	Jim Cumbow
Duke Energy	Adam Deller
Duke Energy	Jerry Nicholas
Duke Energy	Jim Stieritz
Duke Energy	Ron Ehlers
Duke Energy	Andrew Roebel
Duke Energy	David Holstein
Duke Energy	Tammy Jeff
Ohio DNR Dam Safety	Mia Kannik
Ohio DNR Dam Safety	Jeremy Wenner

1.2 Project Background

Ash Pond A, Ash Pond B, Ash Pond C and Pond C Extension dikes at the W.C. Beckjord Station are regulated by the Ohio Department of Natural Resources, Dam Safety Program. The Ohio Department of Natural Resources (ODNR) file numbers for the dams are as follows:

- Ash Pond A – File No. Unknown;
- Ash Pond B – File No. 9042-017;
- Ash Pond C – File No. 8742-001;
- Ash Pons C Extension – File No. 8742-002.

The Ash Pond B, Ash Pond C and Ash Pond C Extension impoundments are classified by the state as Class II dams. The classification of the Ash Pond A is unknown. Ohio Administrative Code Rule 1501:21-13-01, refers to Class II dams having a total storage volume greater than five hundred (500) acre-feet or a height of greater than forty (40) feet. In addition, a sudden failure of the structure would result in at least one of the following conditions, but loss of human life is not probable.

a. Disruption of a public water supply or wastewater treatment facility, release of health hazardous industrial or commercial waste, or other health hazards.
b. Flooding of residential, commercial, industrial, or publicly owned structures.
c. Flooding of high-value property.
d. Damage or disruption to major roads including but not limited to interstate and state highways, and the only access to residential or other critical areas such as hospitals, nursing homes, or correctional facilities as determined by the chief.
e. Damage or disruption to railroads or public utilities.
f. Damage to downstream class I, II or III dams or levees, or other dams or levees of high value. Damage to dams or levees can include, but is not limited to, overtopping of the structure.

The Ash Pond A, Ash Pond B, Ash Pond C and Ash Pond C Extension impoundments have been given a "significant" hazard rating as defined on the EPA Coal Combustion Dam Inspection Checklists and Coal Combustion Waste (CCW) Impoundment Inspection Forms, included Appendix A, based on the potential for environmental damage in the event of a catastrophic failure of the impoundment dikes.

1.2.1 State Issued Permits

The Ohio Environmental Protection Agency has issued DEO National Pollutant Discharge Elimination System (NPDES) Permit No. 1TB00000 authorizing discharge from the W.C. Beckjord Station to the Ohio River and to Pond Run Creek and Tenmile Creek near their confluence with the Ohio River. The permit became effective on August 1, 2009 and expires July 31, 2013.

1.3 Site Description and Location

The W.C. Beckjord Station is located just north of New Richmond, Ohio in Clermont County off of US Route 52. Figure 2 – Photo Site Plan shows the locations of the Ash Pond A, Ash Pond B, Ash Pond C and Ash Pond C Extension. The Ohio River is located immediately adjacent to the facility and within approximately 200 feet of Ash Pond A, 800 feet of Ash Pond B and 200 feet of Ash Ponds C and C Extension.

An aerial photograph of the region indicating the location of the W.C. Beckjord Station and identifying schools, hospitals, or other critical infrastructure located within approximately five miles down gradient of the ash ponds is provided as Figure 3 – Critical Infrastructure Map.

1.3.1 Ash Pond A

Ash Pond A was designed by D'Appolonia and Sargent Engineers. The pond is approximately 34.4 acres and received bottom ash until the pond became inactive in 1985. The embankment height is approximately 40 feet. CHA was not provided with records on the performance of the dikes at this impoundment. Figure 2 shows the location of Ash Pond A.

1.3.2 Ash Pond B

Ash Pond B was designed by Lundy Engineers and was commissioned in 1963. The pond is approximately 14.6 acres and receives fly ash, bottom ash, boiler slag, and other waste ash (i.e. landfill leachate, water treatment, boiler blow-down, cooling tower blow-down, boiler chemical cleaning waste, coal pile runoff, fire protection, stormwater run-off mill rejects, laboratory drains and drains from equipment cleaning).

The length of the Ash Pond B embankment is approximately 7,200 feet and the height is approximately 45.7 feet. The average width of the dike crests is approximately 20 feet with an elevation of 520 feet MSL. The upstream and downstream embankment slopes are 2H:1V.

The maximum designed operating pool level is 515 feet. The Ash Pond B principal spillway consists of a concrete box inlet with stoplogs and a 28-inch diameter HDPE outlet pipe. Repairs were made to the spillway in 2007. The inlet discharges into a slant pipe with an inlet at 509.5 feet. A skimmer wall and grating prevent obstruction of the inlet. In 2007 a "lake drain" was added which consists of a 12-inch shear gate.

1.3.3 Ash Pond C

Ash Pond C was designed by Cincinnati Gas & Electric and was commissioned in 1966. The pond is approximately 45.9 acres and receives fly ash, bottom ash, boiler slag, and other waste ash (i.e. landfill leachate, water treatment, boiler blow-down, cooling tower blow-down, boiler chemical cleaning waste, coal pile runoff, fire protection, stormwater run-off mill rejects, laboratory drains and drains from equipment cleaning).

The length of the Ash Pond C embankment is approximately 6,800 feet and the height is approximately 50 feet. The width at the crest is approximately 10 feet with an elevation of 515 feet MSL. The upstream embankment slope is 1.5H:1V and downstream embankment slope is 1H:1V. Figures 4A through 4C show typical cross sections for the east, west and south portions of the embankment.

The maximum designed operating pool level is 501 feet. The principal spillway consists of a 24-inch diameter smooth walled HDPE slant pipe. The emergency spillway is a 24-inch diameter smooth walled HDPE pipe which runs through the south embankment adjacent to the principal spillway. The emergency spillway has an inlet at 505 feet. There is a “lake drain” for the reservoir which consists of a 24-inch diameter smooth walled HDPE pipe.

The ODNR reported in their April 23, 2008 dam inspection report the following events that have occurred at the Ash Pond C;

- Slope failures occurred on the south end of the east exterior embankment in 1990.
- In 1991 the south end of the east exterior embankment was repaired by installing a drain buttress.
- In 1992 a slope stability monitoring program was implemented for the north end of the east embankment.
- Slope failures occurred on the west exterior embankment in 1997.

- In 1998 the west exterior embankment was repaired by adding a buttress.
- The old principal spillway riser collapsed in 1999.
- Slope failures occurred on the west exterior embankment in 2000.
- In November 28, 2000 the first ODNR, Division of Water dam safety inspection occurred for the Ash Pond C embankment.
- In 2001 a new principal spillway, lake drain, emergency overflow were installed and the old principal spillway was abandoned. The new spillway was designed by BBC&M Engineering.
- The north end of the west exterior embankment was repaired in 2002 by adding a drain and buttress.
- The north end of the east exterior embankment was repaired in 2003 by adding a drain and buttress. The ditch at the toe of the slope was directed into a culvert.
- On April 23, 2008 ODNR, Division of Water dam safety inspection performed a second inspection of the Ash Pond C embankment. The required remedial measures noted in the ODNR inspection report are discussed further in Section 3.5.1.

1.3.4 Ash Pond C Extension

Ash Pond C Extension was commissioned in 1985. The pond is approximately 53.3 acres and is no longer active. At the time of the site assessment the pond did not have standing liquid. When active the pond received fly ash.

The length of the Ash Pond C Extension embankment is approximately 6,620 feet and the height is approximately 40 feet. The width at the crest is approximately 15 feet with an elevation of 525 feet MSL. The upstream and downstream embankment slopes are 2H:1V. Figures 5A through 5D show typical cross sections for the embankment.

The Ash Pond C Extension spillway is not used and has been plugged. The maximum designed operating pool level is 518 feet. The principal spillway consists of a 30-inch diameter concrete

pipe. The emergency spillway consists of a 24-inch CMP pipe. There is no "lake drain" for the Ash Pond C Extension impoundment.

1.3.5 Other Impoundments

There is a wastewater/acid neutralization basin to the north of Ash Pond C at the W.C. Beckjord Station. The basin is approximately 150 feet long by 150 feet wide.

1.4 Previously Identified Safety Issues

DEO reported to the Ohio EPA on April 26, 1999 a significant drop in pond water elevation in Pond C during a two day period of operation. Underwater divers identified the problem as holes below the control point in the vertical section of the overflow pipe. Some ash escaped into Little Indian Creek exceeding the TSS limits before corrective measures could be completed.

According to DEO letter to the EPA dated March 25, 2009 there were no other spills or unpermitted releases from the three ash ponds within the last ten years.

1.5 Site Geology

Based on a review of available surficial and bedrock geology maps, and reports by others, the site appears to be underlain by glacial till consisting of mixtures of clay, sand, gravel and boulders in various types of deposits of different modes of origin. Bedrock Geology Map of Ohio compiled by the Ohio Division of Geological Survey 2006, indicates that the glacial till is underlain by limestone and shale bedrock.

1.6 Bibliography

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

- *Dam Safety Inspection Report – Beckjord Ash Pond B*, April 23, 2008, ODNR;
- *Dam Safety Inspection Report – Beckjord Ash Pond C*, April 23, 2008, ODNR;
- *Dam Safety Inspection Report – Beckjord Ash Pond C Extension*, April 23, 2008, ODNR;
- *Duke Energy Status of Response to ODNR Dam Safety Inspection Reports*, Duke Energy, September 15, 2009;
- *Geotechnical Engineering Study Ash Impoundment Facility*, January 22, 1982, ATEC Associates, Inc.;
- *Wastewater Permit to Install Application*, April 11, 1991, Duke Energy;
- *Wastewater Permit to Install*, July 9, 1991, Ohio EPA;
- *Summary of In-House Inspection Procedures at the W.C. Beckjord Station*, Duke Energy, September 15, 2009;
- Letter dated March 25, 2009 from Duke Energy to US EPA Responding to Request for Information; and
- Various drawings provided by Duke Energy for Ash Pond B, C and C Extension.

IMAGE DATE: 07/01/1983

N	CHA	**Figure 1** **Project Location Map**
Scale: 1" = 1 mile	**Project No.:** **20085.1060.1510**	**Duke Energy** **W.C. Beckjord Station** **New Richmond, OH**

N

0 5335 10,671
Scale in feet

IMAGE REFERENCE: GOOGLE EARTH, IMAGERY DATED MAY 7, 2007

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PHOTO SITE PLAN

W.C. BECKJORD STATION
NEW RICHMOND, OHIO

PROJECT NO. 20085.1060

DATE: 11/2009

FIGURE 2

IMAGE REFERENCE: GOOGLE EARTH, IMAGERY DATED MAY 7, 2007

LEGEND

SCHOOL

FIRE DEPARTMENT

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CRITICAL INFRASTRUCTURE MAP

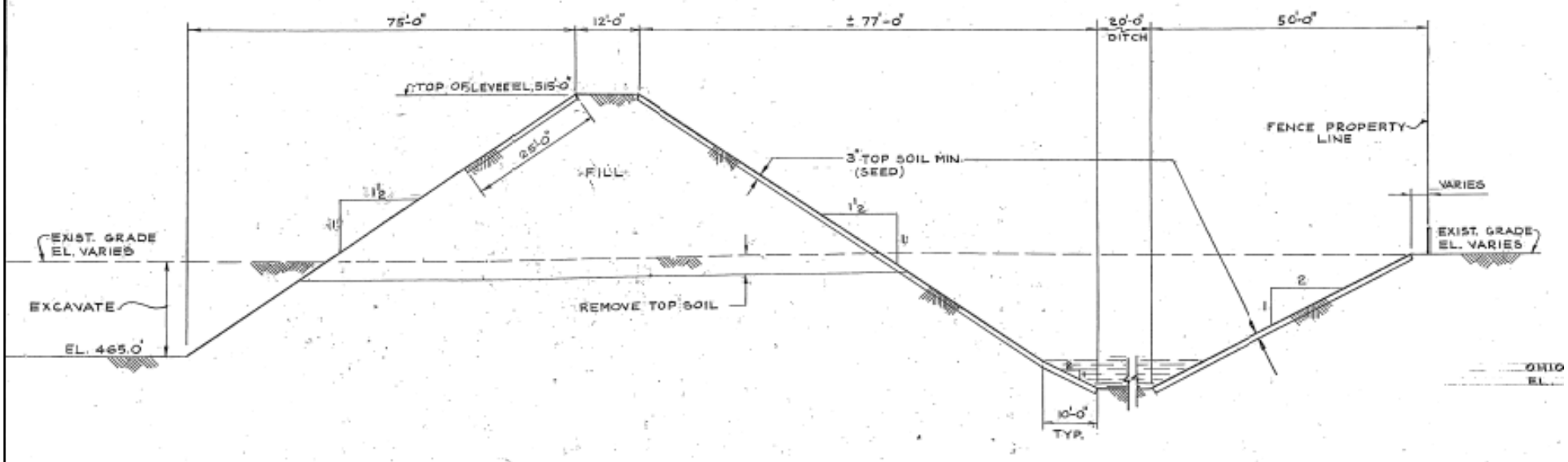
W.C. BECKJORD STATION
NEW RICHMOND, OHIO

PROJECT NO. 20085.1060

DATE: 11/2009

FIGURE 3

File: K:\20085\CADD\ACAD\FIGURES\1060 WC BECKJORD STATION\1060_3_CRITICAL INFRASTRUCTURE MAP.DWG Saved: 12/7/2009 4:37:22 PM PLotted: 12/7/2009 4:38:08 PM User: Gray, Timmolyn



SECTION A-A (B-990)
SCALE: 1/16" = 1'-0"

IMAGE REFERENCE: ASH POND "C" SECTIONS, WALTER C. BECKJORD STATION UNIT NO. 6, THE CINCINNATI GAS & ELECTRIC COMPANY, COLUMBUS & SOUTHERN OHIO ELECTRIC COMPANY, THE DAYTON POWER AND LIGHT COMPANY, DWG. NO. B-991

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ASH POND C TYPICAL CROSS SECTION
SOUTH EMBANKMENT
W.C. BECKJORD STATION
NEW RICHMOND, OHIO

PROJECT NO. 20085.1060

DATE: 11/2009

FIGURE 4A

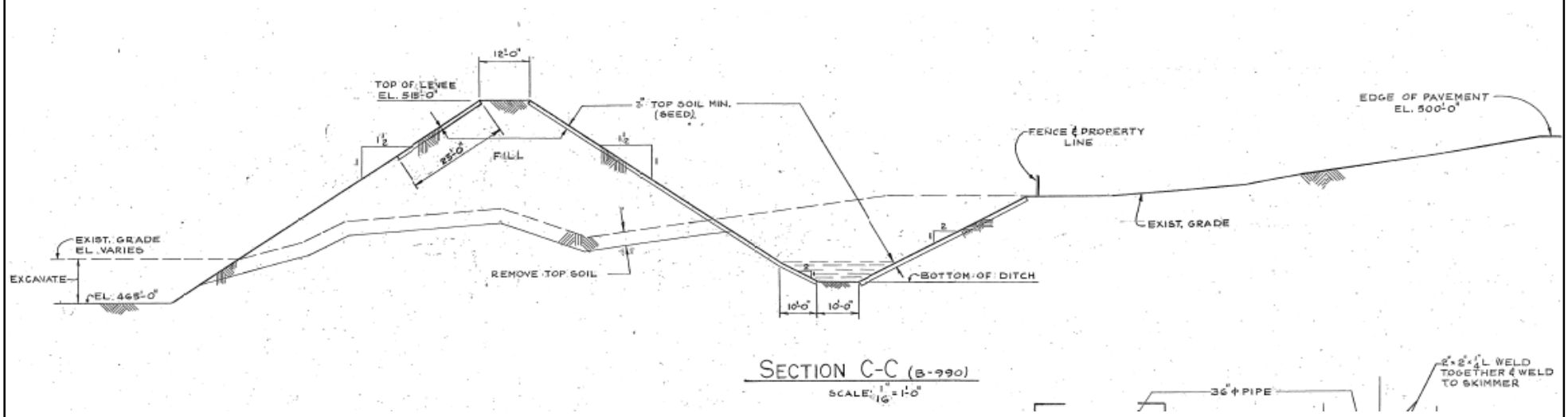

IMAGE REFERENCE: ASH POND "C" SECTIONS, WALTER C. BECKJORD STATION UNIT NO. 6, THE CINCINNATI GAS & ELECTRIC COMPANY, COLUMBUS & SOUTHERN OHIO ELECTRIC COMPANY, THE DAYTON POWER AND LIGHT COMPANY, DWG. NO. B-991

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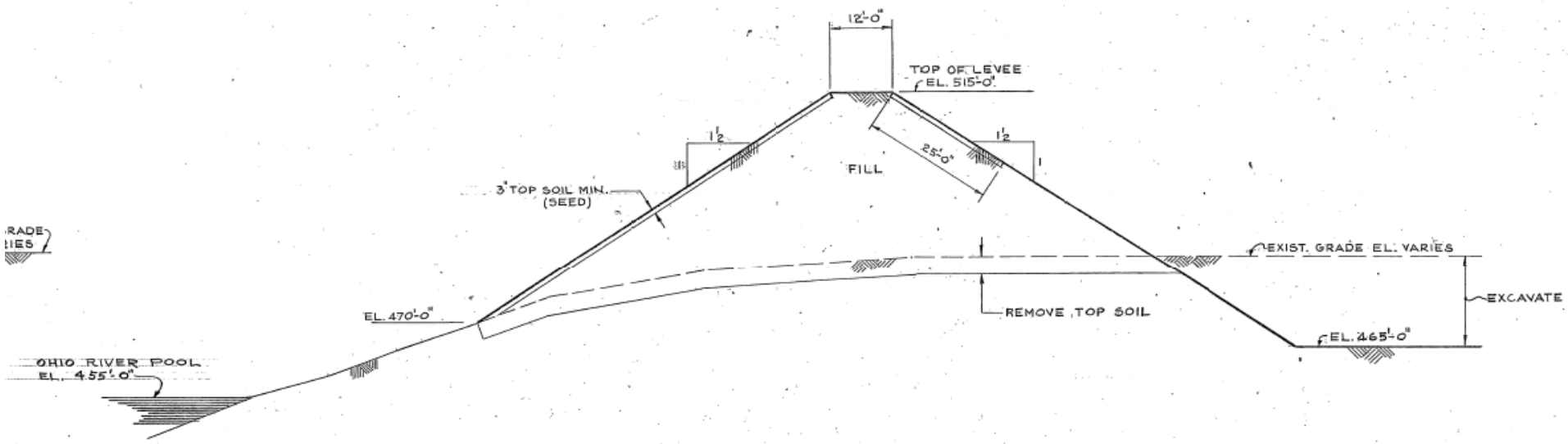
ASH POND C TYPICAL CROSS SECTION
EAST EMBANKMENT
W.C. BECKJORD STATION
NEW RICHMOND, OHIO

PROJECT NO. 20085.1060

DATE: 11/2009

FIGURE 4B



SECTION B-B (B-990)

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

IMAGE REFERENCE: ASH POND "C" SECTIONS, WALTER C. BECKJORD STATION UNIT NO. 6, THE CINCINNATI GAS & ELECTRIC COMPANY, COLUMBUS & SOUTHERN OHIO ELECTRIC COMPANY, THE DAYTON POWER AND LIGHT COMPANY, DWG. NO. B-991

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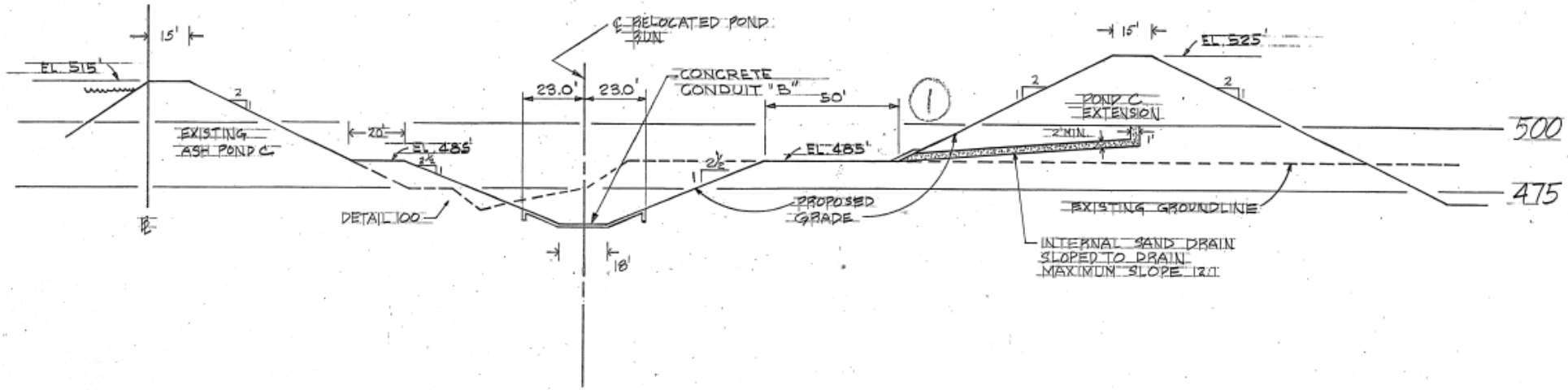
ASH POND C TYPICAL CROSS SECTION
WEST EMBANKMENT

W.C. BECKJORD STATION
NEW RICHMOND, OHIO

PROJECT NO. 20085.1060

DATE: 11/2009

FIGURE 4C



SECTION 8-8
1"=30'

IMAGE REFERENCE: ASH POND "C" EXTENSION SECTIONAL DETAILS SH. 4, WALTER C. BECKJORD STATION, THE CINCINNATI GAS & ELECTRIC COMPANY GENERAL ENGINEERING DEPARTMENT, DWG. NO. 9-20031-S8, DATED 3-26-84

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ASH POND C EXTENSION TYPICAL CROSS SECTION NORTH EMBANKMENT

W.C. BECKJORD STATION
NEW RICHMOND, OHIO

PROJECT NO. 20085.1060

DATE: 11/2009

FIGURE 5A

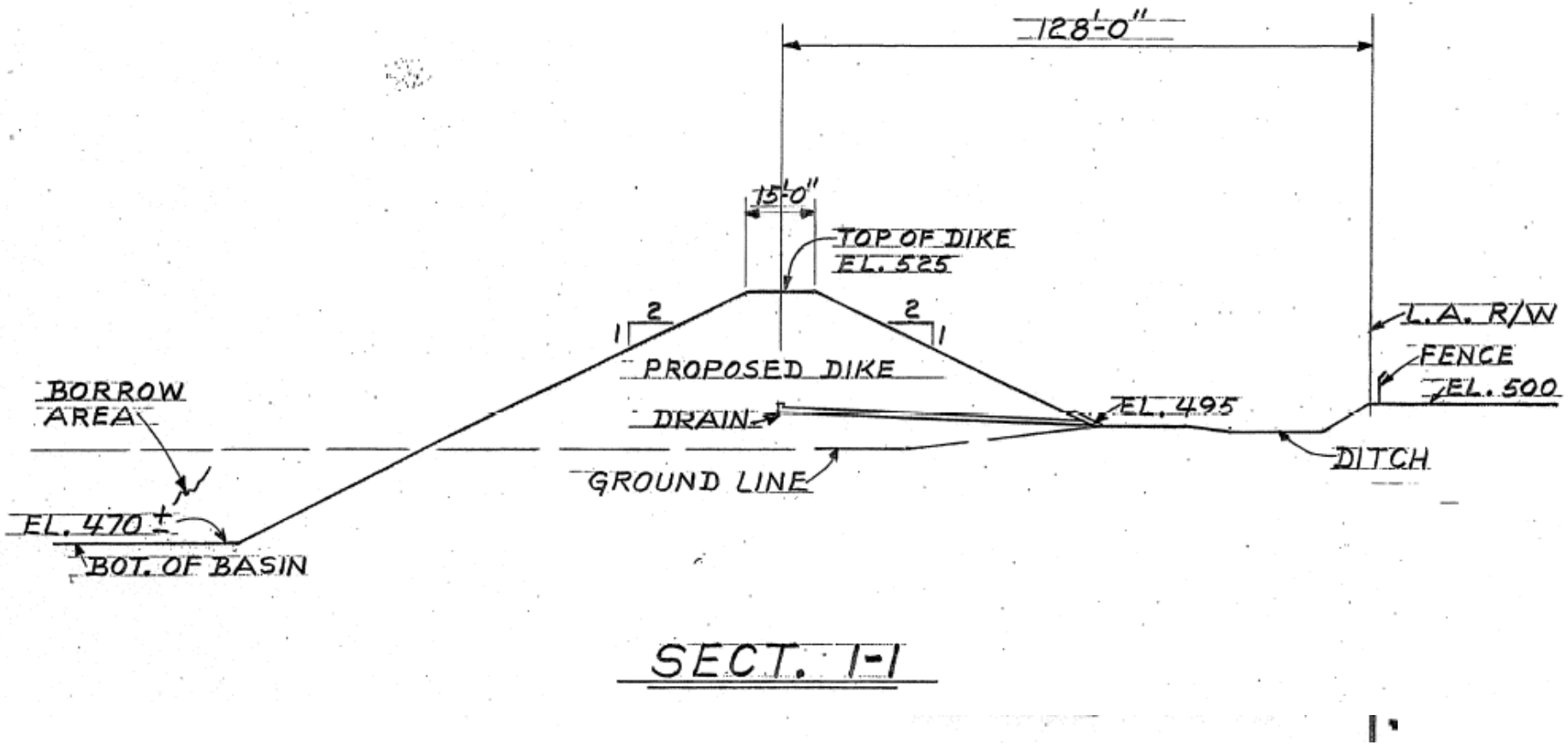

IMAGE REFERENCE: ASH POND "C" EXTENSION SECTIONAL DETAILS SH. 1, WALTER C. BECKJORD STATION, THE CINCINNATI GAS & ELECTRIC COMPANY GENERAL ENGINEERING DEPARTMENT, DWG. NO. 9-20031-S8, DATED 3-26-84

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ASH POND C EXTENSION TYPICAL CROSS SECTION EAST EMBANKMENT

W.C. BECKJORD STATION
NEW RICHMOND, OHIO

PROJECT NO. 20085.1060

DATE: 11/2009

FIGURE 5B

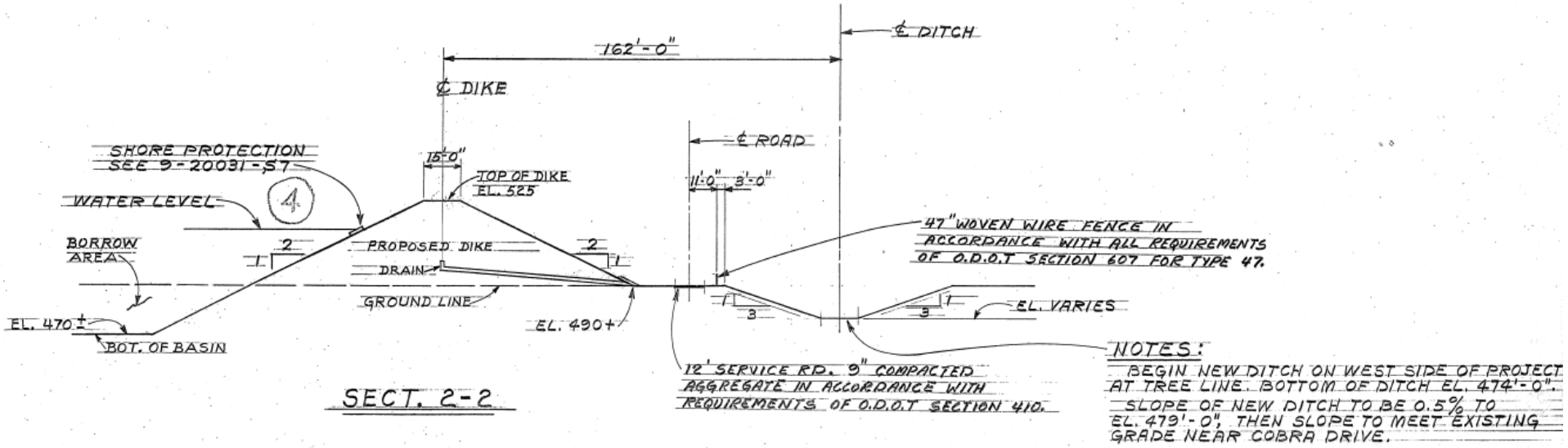

IMAGE REFERENCE: ASH POND "C" EXTENSION SECTIONAL DETAILS SH. 1, WALTER C. BECKJORD STATION, THE CINCINNATI GAS & ELECTRIC COMPANY GENERAL ENGINEERING DEPARTMENT, DWG. NO. 9-20031-S8, DATED 3-26-84

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ASH POND C EXTENSION TYPICAL CROSS SECTION SOUTH EMBANKMENT

W.C. BECKJORD STATION
NEW RICHMOND, OHIO

PROJECT NO. 20085.1060

DATE: 11/2009

FIGURE 5C

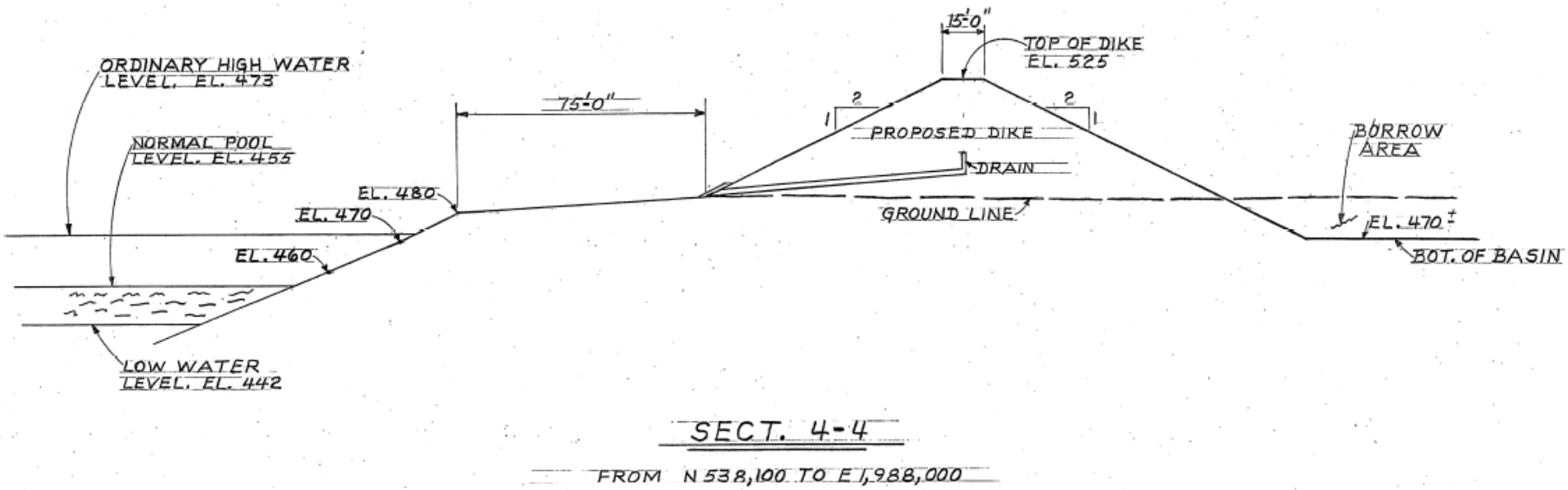

IMAGE REFERENCE: ASH POND "C" EXTENSION SECTIONAL DETAILS SH. 1, WALTER C. BECKJORD STATION, THE CINCINNATI GAS & ELECTRIC COMPANY GENERAL ENGINEERING DEPARTMENT, DWG. NO. 9-20031-S8, DATED 3-26-84

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ASH POND C EXTENSION TYPICAL CROSS SECTION WEST EMBANKMENT

W.C. BECKJORD STATION
NEW RICHMOND, OHIO

PROJECT NO. 20085.1060

DATE: 11/2009

FIGURE 5D

2.0 FIELD ASSESSMENT

2.1 Visual Observations

CHA performed visual observations of the Ash Pond A, Ash Pond B, Ash Pond C and Ash Pond C Extension dikes 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. Copies of the completed forms were submitted via email to a Lockheed Martin representative following the site visit to the W.C. Beckjord Station. Copies of the completed forms are included in Appendix A. A photo log and a Site Photo Location Maps (Figures 6A, 6B, 6C and 6D) are also located at the end of Section 2.6.

CHA's visual observations were made on October 8, 2009 and October 9, 2009. The weather was overcast and rainy with temperatures between 45 and 75 degrees Fahrenheit. Heavy rain fell during the site assessment making it difficult to readily identified seeps in the embankment slopes. Prior to the days we made our visual observations, the following approximate rainfall amounts occurred (as reported by www.weather.com).

Table 1– Approximate Precipitation Prior to Site Visit

Dates of Site Visits – October 8, 2009 & October 9, 2009		
Day	**Date**	**Precipitation (inches)**
Thursday	October 1st	0.18
Friday	October 2nd	0.20
Saturday	October 3rd	0.00
Sunday	October 4th	0.00
Monday	October 5th	0.00
Tuesday	October 6th	0.05
Wednesday	October 7th	0.00
Thursday	October 8th	1.93
Friday	October 9th	0.22
Total	**Week Prior to Site Visit**	**2.58**

2.2 Visual Observations – Ash Pond A

Ash Pond A has been inactive since 1985. The pond was observed to be without standing liquid at the time of the site assessment.

2.2.1 Ash Pond A - Embankments and Crest

There was no visible liquid in the pond at the time of our site visit and the average height observed from the embankment crest to the top of ash in the pond (the freeboard) was approximately 8 to 10 feet. A majority of the ash in the pond is covered with heavy brush and large trees (Photo 2). Ash Pond A reportedly contains an interior dike which could not be located during the site visit. In general, the dikes do not show signs of changes in their horizontal alignments.

The crest width of the north (Photo 10), east (Photo 1), and south (Photo 24) dikes of the Ash Pond A embankment were measured to be approximately 14, 17 and 14 feet, respectively. In general, the east dike (Photo 3), south dike adjacent to Pond B, and the exterior slope of the north dike from the corner at the east end to the cell tower site access ramp appeared to be maintained and mowed.

Vegetation obscured observations of the north (Photo 14) and west dikes. Heavy vegetation was observed on the exterior slopes along north (Photos 11 and 12), west (Photo 17) and part of south dikes, with larger trees (approximately 12 to 16 inches in diameter) at the toe of the north dike next to the creek. Similar vegetation was found on the interior slope of the north (Photos 9 and 10) and south dikes.

Surficial scarps/sloughs were observed on the exterior slope of the east dike. One scarp/slough was measured to be approximately 15 to 20 foot long. The scarps/sloughs appeared to be the

result of an over steepened slope. The areas were generally covered with grass (Photo 5). Water was observed in the US Route 52 drainage swale at the toe of the east dike (Photo 6).
Near the north end of the east dike on the exterior slope there were areas of occasional loss of grass cover observed.

At the east end of the north dike on the exterior slope an erosion rill was noted. The rill was grassed over. Undulations in the slope surface were observed in this location due to grading activity (Photo 7).

On the south dike an animal burrow was observed on the exterior slope (Photo 22).

2.2.2 Ash Pond A Outlet Structures

Near the west end of the north portion of the embankment the inactive outlet pipe and emergency overflow structures were observed (Photo 16).

2.3 Visual Observations– Ash Pond B

CHA performed visual observations of the Ash Pond B embankment and outlet structures.

2.3.1 Ash Pond B - Embankments and Crest

In general, the dikes of Ash Pond B do not show signs of changes in their horizontal alignments.

A bulge approximately 21 inches wide (along width of the dike) was observed at the toe of the exterior slope of the east dike at approximately one-third the length of the embankment from the north end (Photos 36 and 37). Active scarps were observed in the exterior face of the slope at multiple locations (Photos 34, 35 and 38). About mid-way along the dike an active scarp approximately 25 feet wide was observed. Occasional standing water in the heavily vegetated

ditch at slope toe was also observed. Trees up to 2 inches in diameter were noted at the toe of the east dike exterior slope (Photo 39).

The crest of the north dike was measured to be approximately 21 feet wide. Trees, approximately 4 to 8 inches in diameter, and heavy vegetation (brush) was observed on the exterior face of the north dike (Photo 41).

The crest of the west dike was measured to be approximately 35 feet wide (Photo 44). Erosion rills were observed on the exterior slope of the west dike at approximately one-third the length of the embankment from the north end of the dike (Photo 46). Gullies, approximately 3 to 4 feet deep, were noted to the south of the erosion rills (Photo 47). About mid-way along the west dike it was observed that the embankment surface mostly consisted of slag (Photo 48). At the intersection of the west and south dikes large trees (up to 3 feet in diameter) were observed on the exterior slope and crest (Photo 25).

2.3.2 Ash Pond B Outlet Structures

The Ash Pond B outlet structure is located on the south dike. Water was observed flowing from the structure at the time of the site assessment (Photo 27). The outlet consists of a 28-inch diameter HDPE outlet pipe with a 3-foot wide double weir noted at the top of the spillway. The elevation of the intake of the outlet is 517.5 feet.

2.4 Visual Observations – Ash Pond C

CHA performed visual observations of the Ash Pond C embankment and outlet structures.

2.4.1 Ash Pond C - Embankments and Crest

In general, the dikes of Ash Pond C do not show signs of changes in their horizontal alignments.

The east dike crest was measured to be approximately 18 feet wide. At the north end of east dike there is an area of slide repair (2003, Photo 61). The ditch line was enclosed with a culvert pipe to extend the slope toe and flatten the slope. The slide area was reportedly actively seeping before repair work was performed. A rock lined ditch was also placed in this area and was observed during the site visit (Photo 60). To the north of this area there was a previous slide and repair work made in 1991. To the north of these two repaired areas reinforced slope repair work was conducted in 2002.

About mid-way along the east dike a sink hole, approximately 3 feet deep by 5 feet wide by 5 feet long was observed on the exterior slope (Photo 64). In this location, slope repair work was conducted and the toe of the slope was extended approximately 51 feet beyond the original toe (Photo 62). At the toe of the slope the ditch line water flow which includes effluent from Ash Pond B (Photo 65). The ditch line is located approximately 8 to 9 feet from the toe of the slope. On the interior and exterior slopes of the east dike superficial, grassed-over sloughs were observed. At the mid-point of the exterior slope a possible animal burrow was noted and in the same location an old slide area was observed which measured approximately 20 feet wide (Photo 68). Slightly south of the mid-point of the dike an active area of slough was observed and was measured to be approximately 22 to 23 feet wide. An 8-inch wide animal burrow was noted on the exterior slope just south of the active slough area. Another area of active slough was observed to the south of the animal burrow. The area is approximately 22 feet wide. South of this active area of slough an area of old sloughing was noted which is heavily vegetated and approximately 60 to 70 feet long (Photo 71). Erosion rill and/or animal burrow, approximately 4 feet deep and 2 feet wide, was observed behind the headwall in the slope (Photo 74). South of the headwall, slope repair was performed and continuing south. The repair work included adding a bench and rock at the toe. The bottom 20 to 30 feet of the slope and toe are armored with rock

to the creek level. At the south end of the dike there is an older scarp in the original slope above the repair bench. The scarp is approximately 15 to 16 feet wide.

At the toe of the south dike toe/ditch protection was observed to be rip rap ranging from approximately 6 to 10 inches in diameter. The bench area above ditch/protection area is approximately 22 feet wide (Photo 85). At the intersection of the south and west dikes there are grassed-over superficial sloughs/slumps that appear as undulations in the exterior slope surface. On the west exterior slope slightly north of the south end of the dike, repair work was performed with large rip rap (approximately 3 to 4 feet in diameter) being placed (Photo 89). North of this repaired area a vegetated area of slough approximately 42 feet wide was observed. The vegetation on the west dike exterior slope changes from brushy/broad-leaf vegetation to weeds/grass at about the mid-point of the dike. North of the change in vegetation is an area were reinforced slope repair work was performed in 2002. North of the repaired area an area of slope repair/disturbance was observed during the site visit. The erosion control matting was observed to be shredded (Photo 94). At the north end of the west dike the stockpile areas at the toe of the exterior slope have allowed surface water (runoff) to pool (Photo 98).

2.4.2 Ash Pond C Outlet Structures

The Ash Pond C outlet consists of a 24-inch diameter smooth-walled HPDE slant pipe. There is a 12-inch diameter ductile iron siphon. The valve for the siphon is cracked. There is also a 24-inch diameter smooth-walled HDPE pipe. (Photo 82)

2.5 Visual Observations – Ash Pond C Extension

CHA performed visual observations of the Ash Pond C Extension embankment and outlet structures. The pond did not have standing liquid at the time of the site visit and is no longer receiving fly ash. Brush removal operations were occurring on portions of the embankment at the time of our site assessment.

2.5.1 Ash Pond C Extension - Embankments and Crest

In general, the dikes of the Ash Pond C Extension do not show signs of changes in their horizontal alignments. The north crest width was measured to be approximately 13 feet wide (Photo 127).

The east dike crest was measured to be approximately 14 feet wide. At the north end of the east dike 2 to 6-inch diameter rip rap was observed at the toe of the exterior slope. Standing water was noted at the base of the slope beyond the toe drain in the woody and weedy vegetation. The drain was observed to be moderately to heavily vegetated up to where the old road pavement begins (Photo 130). Near the mid-point of the east dike two slightly grassed-over superficial sloughs/slumps were observed on the exterior slope of the dike. At approximately two-thirds the length of the dike from the north end a grassed-over erosion rill was noted. South of the erosion rill an area of slope disturbance and/or grassed-over sloughing was observed. Holes/depressions up to 4 feet wide and 1 to 2 feet deep were noted along approximately 240 feet of the exterior slope of the dike as measured from the south corner (Photos134 and 135).

The south dike was measured to be approximately 13 feet wide at the crest (Photo 141). On the south dike towards the east end an animal burrow was noted in the exterior slope (Photo 143). At approximately the midway point of the south dike material from an old slough has covered the rock toe drain and has grassed over. To the west of the old slough there is a noted change in the vegetation near the top of the slope for a distance of approximately 73 feet. This area also exhibits surficial distress/sloughing. Just to the west of this area standing water was observed in a depression in the slope (Photo 145).

The west dike crest with was measured and found to range from approximately 14 to 20 feet wide (Photo 160). At the south end of the west slope and old animal burrow was observed and there is heavy vegetation at the toe and along the bottom one-third of the slope (Photos 148 and 149). At approximately one-third the length of the dike from the south end a vertical

crack/sinkhole was observed (Photo 150). The crack was holding water and was measured to be approximately 24 inches long and 10 inches wide and a foot deep. At about the mid-point of the west dike a vegetated scarp with the soil somewhat visible was measured to be approximately 30 to 35 feet long and was located along about the bottom one-third the height of the slope.

2.5.2 Ash Pond C Outlet Structures

The Ash Pond C Extension overflow structure could not be inspected as it was covered with vegetations (Photo 166). The 24-inch diameter CMP emergency overflow pipe was visible (Photo 167). Both structures are not in use as the pond is inactive.

2.6 Monitoring Instrumentation

CHA did not receive information indicating that Ash Pond A and Ash Pond B have monitoring instrumentation installed. No instrumentation was observed during our visual observations of the dikes and crests of these impoundments.

Inclinometers and piezometers have been installed at Ash Pond C and are reportedly read quarterly. CHA was not provided with copies of the recorded data for this monitoring instrumentation.

Review of documents for the Ash Pond C Extension indicate that there are groundwater monitoring wells outside of embankment. A monument on the crest of the east dike was noted during the site visit. CHA was not provided with copies of the recorded data for this monitoring instrumentation.

IMAGE REFERENCE: GOOGLE EARTH, IMAGERY DATED MAY 7, 2007

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PHOTO LOCATION MAP ASH POND A

W.C. BECKJORD STATION
NEW RICHMOND, OHIO

PROJECT NO. 20085.1060

DATE: 11/2009

FIGURE 6A

File: K:\20085\CADD\ACAD_SHEET_FILES\1060_6_PHOTO LOCATION MAP.DWG Saved: 11/5/2009 12:54:42 PM Plotted: 11/5/2009 6:22:40 PM User: Everleth, Jennifer

IMAGE REFERENCE: GOOGLE EARTH, IMAGERY DATED MAY 7, 2007

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PHOTO LOCATION MAP ASH POND B

W.C. BECKJORD STATION
NEW RICHMOND, OHIO

PROJECT NO. 20085.1060

DATE: 11/2009

FIGURE 6B

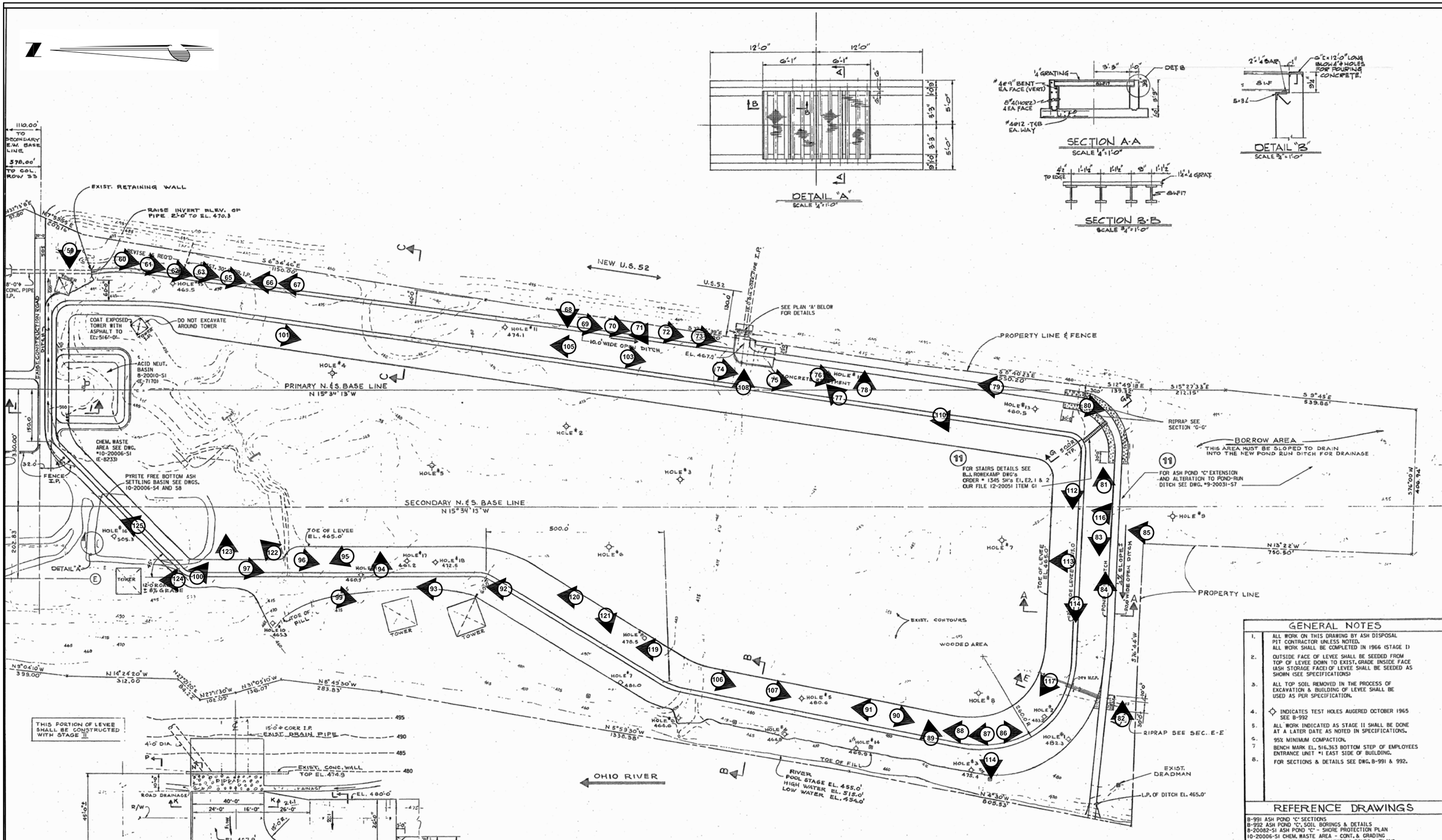

IMAGE REFERENCE: GOOGLE EARTH, IMAGERY DATED MAY 7, 2007

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PHOTO LOCATION MAP ASH POND C

W.C. BECKJORD STATION
NEW RICHMOND, OHIO

PROJECT NO. 20085.1060

DATE: 11/2009

FIGURE 6C

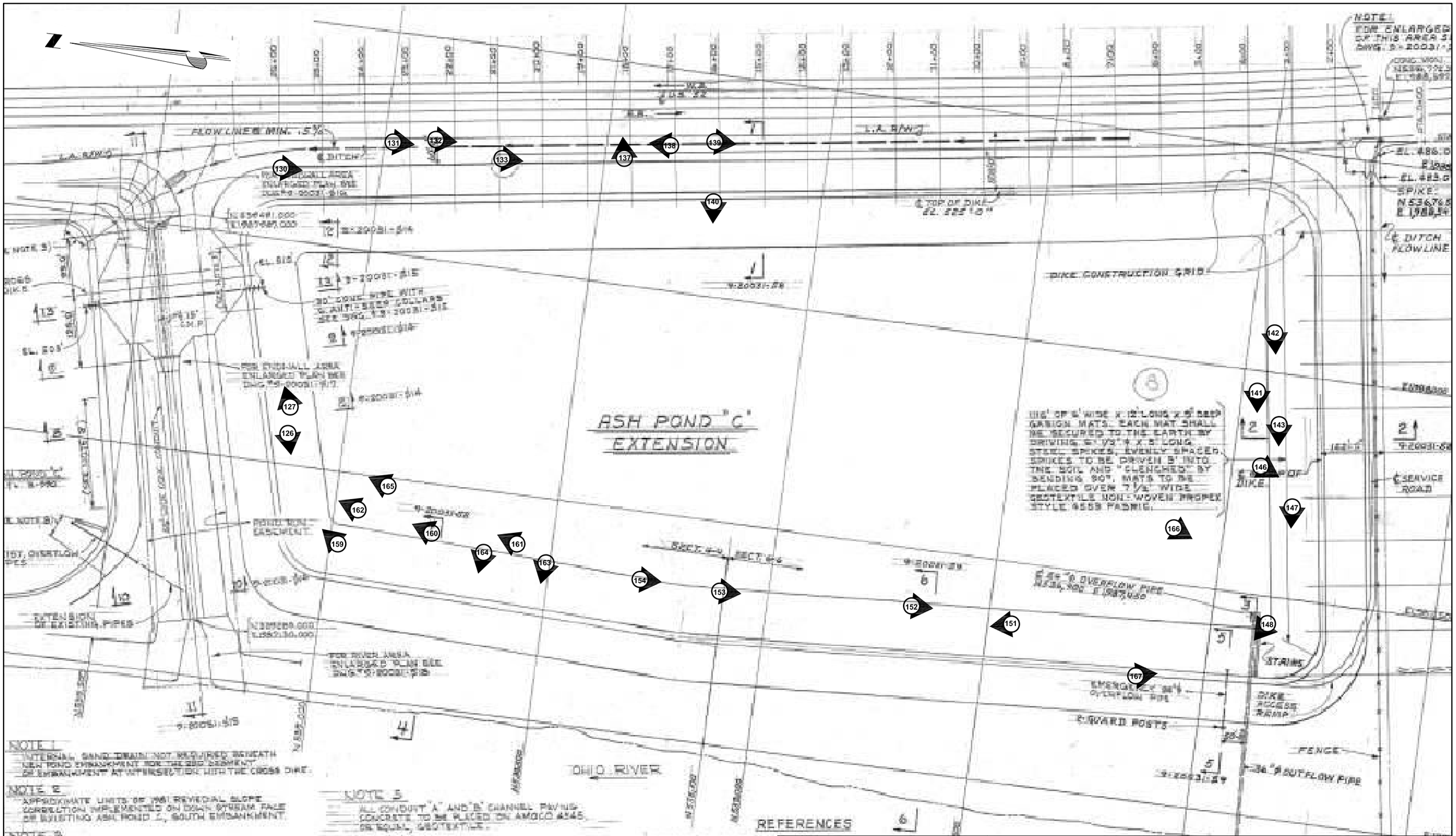

IMAGE REFERENCE: GOOGLE EARTH, IMAGERY DATED MAY 7, 2007

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PHOTO LOCATION MAP ASH POND C EXTENSION

W.C. BECKJORD STATION
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PROJECT NO. 20085.1060

DATE: 11/2009

FIGURE 6D

1

East dike crest and interior slope face, looking north.
Note small isolated “birdbaths” in access drive as a result of recent rainfall.

2

Looking across Ash Pond A from east dike, facing north. Note vegetation and large trees in ash/slag surface.

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3

Exterior slope of east dike, looking north. Note proximity of U.S. Route 52 southbound lanes and ditch at toe.

4

Exterior slope of east dike, looking south.

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5

Faint vegetated creep in east dike exterior slope, looking north.

6

East dike exterior slope, looking south. Runoff is collected in the highway ditch line.

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7

Surface undulations on exterior slope at corner of east and north dikes, looking east.

8

North dike, exterior slope, looking west. Note that slope gets flatter here and vegetation is not maintained where cell tower access road crosses drainage swale/creek at toe of dike.

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9

North dike crest and interior slope, looking east. Note trees and heavy vegetation on slope.

10

North dike crest and interior slope, looking west.

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11

Exterior slope of north dike showing heavy vegetation, looking east.

12

Heavy vegetation on the north dike exterior slope, looking west.

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13

Culvert for creek/drainage swale at toe of north dike carrying flow beneath cell site access drive.

14

Drainage feature at toe of north dike with trees and heavy vegetation obscuring the exterior slope.
Looking east from the northwest corner of pond along north dike.

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15

Heavy vegetation on the exterior slope of the north dike, looking east from the north dike crest.

16

Inactive corrugated metal outlet riser/decanting structure in trees and vegetation.

17

West dike crest, looking south. Note very heavy vegetation overgrowth and trees on interior and exterior slopes.

18

West dike exterior slope along access drive at toe, looking south from northern end.

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19

Very heavy vegetation and brush growth on west dike exterior slope, looking south.

20

West dike exterior slope, looking south. Note heavy, broad, leafy, bush-like vegetation.

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21

Exterior slope of west dike, looking north. Heavy vegetation prevalent with tree growth in basin above slope.

22

Possible rodent burrow at western terminus of south dike.

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23

Exterior slope of south dike, looking west. Note erosion rills in coal material pushed against dike and areas of moderate to heavy vegetation. Dike in this area abuts the coal pile operations.

24

South dike crest near where it abuts the north end of the Ash Pond B west dike, looking west.

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25

Exterior slope of the south dike, looking north. Note large, mature trees at the southwest corner (left) of the dike.

26

Exterior slope of the south dike, looking northeast toward central portion of the dike.
Large trees on dike slope, as well as parking lot embankment, abut the dike.

27

Ash Pond B outlet headwall, rock lined outlet channel and site drainage/seepage pipes.

28

Ash Pond B outlet and vegetation and tress on slope face.

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29

South dike crest and exterior slope, looking west.

30

South dike interior slope and pond elevation, looking west.

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South dike crest area where parking lot embankment abuts the pond, looking east.

32

East dike, crest and interior slope, looking north.

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33

East dike exterior slope, looking north.

34

Active surface scarp on exterior slope of east dike, looking south.

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35

Active surface scarp and slough on east dike (different feature from Photo No. 10).

36

Toe bulge expression from active surface scarp and slough in Photo No. 11, looking south.

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37

Toe bulge expression from active surface scarp and slough in Photo No. 11, looking north.

38

Slough on east dike exterior slope adjacent to mature tree at slope toe.

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38

General view of east dike exterior slope, looking south from northern terminus.
Note vegetation at dike toe. A ditch/drainage swale is located at base of dike toe.

40

Exterior slope of east dike at contact with south dike of Ash Pond A, looking north.

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41

Exterior slope of north dike, looking west. This is also the interior slope of the Ash Pond A south dike. Note heavy vegetation and small tree growth.

42

North dike exterior slope, looking west. Note bottom ash/slag exposed in Ash Pond A surface.

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Erosion rill on exterior slope of north dike.

44

Exterior slope and part of west dike crest, looking south.

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45

Exterior slope of west dike at contact with the Ash Pond A south dike, looking north.
Note exposed bottom ash and slag on slope surface where vegetation is missing.

46

Erosion rills on west dike exterior slope where vegetation is sparse in bottom ash/slag surface material.

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47

Deep erosion gully on west dike, exterior slope.

48

Slag surface prevalent in this portion of the west dike where grass/weed cover is sparse.

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49

Exterior slope of the west dike, looking north. Note vegetation cover and dead/rotten tree trunk.

50

Interior slope of the west dike at the southwest corner of the pond, looking south.
Interior slope of south dike visible in background.

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51

South dike and interior slope, looking south.

52

Crest and interior slope of west dike, looking north from southwest corner of pond.

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53

Exterior slope where the west dike meets the south dike, looking northeast.
Note heavy vegetation and tree growth.

54

South dike, exterior slope looking west, showing trees and vegetation.

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55

Looking northwest at pipe from under ash pile.

56

Looking east at downstream slope, missing ground cover and slough.

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Looking west at settling ditch at north end of pond.

58

Looking south at inflow pipes.

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Grass cover on exterior slope of northeast corner of east dike at driveway embankment contact, facing west.

60

Vegetated rock toe drain/ditch area at northeast corner of east dike, looking south.

61

Vegetated rock toe drain/ditch placed as part of 2003 slide repair.

62

Exterior slope of east dike where the toe was extended out as a part of the 2003 slide repair, looking south.

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63

Slope repair area on east dike showing rock toe drain and location of sinkhole (right).
Southern extent of repair in background where trees are prevalent.

64

Close-up of sinkhole in 2003 slide repair area. Appears to be above pipe for seepage collection system.

65

Looking south beyond 2003 slide repair area. Water in ditch is predominantly effluent from Ash Pond B.

66

East dike, exterior slope, looking north at end of slide repair area. Note steeper slope beyond repair area.

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East dike exterior slope, looking north.

68

Erosion rill or possible animal trail.

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69

Exterior slope at toe of east dike, looking south. Training wall at creek entrance is in background.

70

Toe of east dike, looking south. Slope inclinometer (blue) can be seen in right of photo.

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Vegetated surface scarp/creep on east dike slope.

72

Vegetated toe bulge and surface slough on east dike slope, looking south.
Concrete training wall at creek entrance in background.

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Vegetated undulations on east dike exterior slope above concrete training wall, looking north.

74

Rodent burrow on east dike above concrete training wall.

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75

Rodent burrow (to left) and possible erosion feature (to right) adjacent to and above concrete training wall.

76

East dike exterior slope in area of 1991-1992 slope repair, looking south. Note bench and broad leafy vegetation.

77

Broad leafy vegetation more prevalent in this area of the east dike, looking north.

78

Rock slope protection installed as a part of the 1991-1992 slope repair work. Note saplings and brush.

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79

Exterior slope toe of east dike at the southeast corner, looking north. Note heavy vegetation and young trees.

80

Channelized creek adjacent to east dike toe where the creek starts to turn to the west between Ash Pond C and Ash Pond C Extension.

81

Channelized creek between Pond C and Pond C Extension at the Pond C outlet, looking east. Creek traverses beneath a haul road embankment through large diameter culverts.

82

Ash Pond C outlet (near), siphon pipe (middle, note cracked valve), and high water over flow outlet (far).

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83

Exterior slope of the south dike, looking west. Note slope instrumentation.

84

Exterior slope of the south dike, looking east.

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85

Vegetation adjacent to channelized creek, looking west.
This area is below the bench at the south dike and is believed to be on the creek bank.

86

Exterior slope at the southwest corner of west dike, looking south. Instrumentation visible near slope crest.

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87

West dike exterior slope adjacent to the Ohio River, looking north.

88

West dike exterior slope adjacent to the Ohio River, looking north, showing flood deposited debris on river terrace and beginning of 1998 rip-rap buttress slope repair in background.

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89

Close-up of rip-rap buttress slope repair. Note vegetation in rip-rap.

90

West dike showing the northern extent of rip-rap slope repair, looking south.

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91

West dike slope, looking north. Note groundwater monitoring well at slope toe.

92

West dike slope in area of 2002 slope repair where soil buttress and toe was constructed, looking northeast. Bench can be seen near middle of slope.

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93

West dike exterior slope in area of 2002 slope repair, looking south.

94

Area of exposed and disturbed erosion matting adjacent to 2002 slope repair area.

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95

Rock toe drain of 2002 repair area of west dike. Barely visible due to vegetation in toe drain.

96

Rock toe drain on west dike exterior slope, looking south.

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97

Exterior slope of west dike on bench near northwest corner, looking south from mid slope.

98

Water collecting near toe of west dike from surface runoff. Maintenance spoil placed there has restricted drainage.

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99

West dike outboard slope showing spoil piles that restrict drainage at the slope toe, looking south.

100

Looking south from northwest corner of west dike across pond area. Note there is no open water in this area.

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101

East dike interior slope, looking south.

102

Change in slope, becomes much steeper, end of rock lined ditch, start of creek, looking southeast.

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103

Steeper portion of east exterior slope, looking south.

104

Erosion on upstream slope, looking west.

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105

East dike exterior slope, looking north.

106

Crest and interior slope of west dike, looking south.

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Crest and interior slope at start of rip rap, looking south.

108

Exterior slope at concrete wall where creeks meet, looking east.

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109

Exterior slope and crest after wall, looking south-southwest.

110

Outflow structure, looking south.

CHA	**DUKE ENERGY** **WC BECKJORD POWER PLANT** **NEW RICHMOND, OH** **ASH POND C**
CHA Project No.: 20085.1060.1510	October 8 and 9, 2009

111

Deep rill on interior slope and gap in rip rap, looking west.

112

South dike interior slope and outfall structures, looking west.

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113

Outfall, looking north.

114

Pipe coming in pond next to outfall.

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115

South dike crest and exterior slope, looking west.

116

Exterior slope of south dike, looking southeast.

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117

West dike interior slope corner, looking west-northwest.

118

Exterior slope of west dike, looking north.

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119

West dike interior slope, looking north.

120

West dike exterior slope, note change in slope, looking north.

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121

West dike crest and interior slope, looking south.

122

Culvert pipes under truck entrance, looking north.

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123

Looking east across pond at truck entrance for piling and moving ash.

124

West dike crest and interior, looking north.

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125

Inflow pipes.

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126

Exterior slope of north dike, looking west.

127

Exterior slope of north dike, looking east. Vegetation and rock toe drain is visible at base of slope.

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127

Rock toe drain and vegetation beginning to establish itself.

129

Rock toe drain overgrown with vegetation.

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CHA Project No.: 20085.1060.1510	October 8 and 9, 2009

130

Exterior slope of east dike, looking south. Trees and heavy vegetation established adjacent to and on slope toe.

131

Exterior slope of east dike in area where old access road is located at base of slope.
Note dying vegetation in rock toe drain.

CHA	**DUKE ENERGY** **WC BECKJORD POWER PLANT** **NEW RICHMOND, OH** **ASH POND C EXTENSION**
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132

East dike exterior slope, looking south from old roadway.

133

East dike, exterior slope, looking south form mid-slope in area of vegetation change.

CHA	**DUKE ENERGY** **WC BECKJORD POWER PLANT** **NEW RICHMOND, OH** **ASH POND C EXTENSION**
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134

Grassy surface hole/depression likely the result of shallow creep/sloughing that became prevalent below mid-slope along the southern 240 feet of the east dike. These were typically obscured by vegetation.

135

Example of the holes and depressions noted in this area of the east dike.

CHA	**DUKE ENERGY** **WC BECKJORD POWER PLANT** **NEW RICHMOND, OH** **ASH POND C EXTENSION**
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136

Looking south, monument on crest of east dike to monitor for movement.

137

Looking west at erosion rill at crest on downstream side of east dike.

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138

Looking north along downstream slope of east dike.

139

Looking south along downstream slope of east dike.

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140

Looking west across pond.

141

Looking west along crest of south dike.

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142

Looking west along the exterior slope face of the south dike.

143

Small rodent burrow on south dike.

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144

Small vegetated slough and erosion transporting soil over the rock toe drain on south dike.

145

Depression//hole on south dike exterior slope holding standing water from recent rainfall.

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145

South dike exterior slope, looking south.

147

Exterior slope of south dike, looking west toward western end of dike.

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148

West dike, exterior slope, looking north. Note very heavy vegetation on bottom ⅓ of slope near dike toe.

149

Old rodent burrow obscured in vegetation on west dike.

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CHA Project No.: 20085.1060.1510	October 8 and 9, 2009

150

Vertical crack/sinkhole holding water approximately 24” long,
10” wide, and 12” deep on west dike, exterior slope.

151

Toe of west dike where clearing activities have partially exposed rock toe drain, facing north.

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152

Exterior toe of the west dike, looking south showing effect of recent clearing activities.

153

Grassed pocket/depression on exterior slope of west dike. Likely the result of shallow creep/sloughing.

154

Looking down slope at erosion rill mowing exposed above bottom ¼ to ⅓ of exterior slope of the west dike where the slope steepens in area of heavy vegetation.

155

Another grassed erosion rill mowing has exposed on exterior slope of west dike.

156

Example of an erosion rill on the west dike face normally obscured by vegetation.

157

Exterior slope of the south dike, facing south.
Note heavy brush vegetation at toe of slope where rock toe drain is located.

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CHA Project No.: 20085.1060.1510	October 8 and 9, 2009

158

Looking south along the exterior slope of west dike. Heavy vegetation was recently mowed.

159

Looking east along the exterior slope of the north dike from the north end of the west dike. Access drive embankment from Pond C to Pond C extension can be seen in background.

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160

Crest of west dike, looking north.

161

Interior slope of west dike, looking north.

CHA	**DUKE ENERGY** **WC BECKJORD POWER PLANT** **NEW RICHMOND, OH** **ASH POND C EXTENSION**
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162

Crest of west dike, looking north.

163

Exterior slope of west dike, looking west.

CHA	**DUKE ENERGY** **WC BECKJORD POWER PLANT** **NEW RICHMOND, OH** **ASH POND C EXTENSION**
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164

Erosion rill on exterior slope of west dike, looking west.

165

Interior slope of west dike, looking east.

CHA	**DUKE ENERGY** **WC BECKJORD POWER PLANT** **NEW RICHMOND, OH** **ASH POND C EXTENSION**
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166

Abandoned overflow pipe structure, looking northeast/east.

167

Abandoned 24-inch diameter emergency overflow pipe.

CHA	**DUKE ENERGY** **WC BECKJORD POWER PLANT** **NEW RICHMOND, OH** **ASH POND C EXTENSION**
CHA Project No.: 20085.1060.1510	October 8 and 9, 2009

3.0 DATA EVALUATION

3.1 Design Assumptions

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

3.2 Hydrologic and Hydraulic Design

The impoundments for all Ash Pond A, Ash Pond B, Ash Pond C and Ash Pond C Extension qualify under the Class II Hazard Classification in the State of Ohio. Ohio Administrative Code Rule 1501:21-13-02 states that the minimum design flood for Class II dams is 50% of the probable maximum flood (PMF) or the critical flood. The regulations note that the minimum critical flood shall be 20% of the probable maximum flood for a class II dam.

Ohio Administrative Code Rule 1501:21-13-07 requires that an up-ground reservoir have sufficient freeboard to prevent overtopping of the embankment crest. For Class II dams that are up-ground reservoirs, the minimum elevation of the embankment crest shall be at least five (5) feet higher that the elevation of the designed maximum operating pool level unless otherwise approved. In addition, every up-ground reservoir shall have an overflow or other device to preclude overfilling the reservoir during normal filling operations.

CHA performed an abbreviated H&H Analysis for the Ash Pond A, Ash Pond B, Ash Pond C and Ash Pond C Extension. The analysis was used to evaluate if the basins will adequately store 50% of the volume generated during the PMF event.

Due to the basins being located in different positions on the site the Probable Maximum Precipitation (PMP) was generated for Ash Pond A and Ash Pond B (27.41 inches); and it was also generated for Ash Pond C and Ash Pond C Extension (25.83 inches). Each PMP was

generated using basin characteristics, information gathered from HMR-51 and 52, and the HMR Boss Program. A hydrograph was generated based on the calculated time of concentration and curve numbers, using TR-55 Methodologies. The rainfall amount for the 100-year storm event was referenced from the NRCS Rainfall Distributions Atlas.

Information for each impoundment (with the exception of Ash Pond A) was provided in Dam Inventory Sheets. The following information and assumptions were used to generate hydrographs and determine storage capacity in each impoundment. A Dam Inventory Sheet was not available for Ash Pond A. However, based on the data available in the Dam Inventory Sheet for Pond B it was assumed, for this analysis, that Ash Pond B had been divided into two ponds (Ash Pond A and Ash Pond B). Based on the current sizes and layout of both pond features Pond A consists of a dry pond with approximately 39.9 acres that has been separated from Ash Pond B and is no longer active. Ash Pond B is currently being dredged and filled and therefore was assumed to have a reduced storage capacity due to being partially filled in the current conditions. As no survey or topographic contours were available for either Ash Pond A or Ash Pond B, pond areas were generated from recent aerial photographs. Contours were generated based on embankment data and a recent site visit. Top of pond elevations, and spillway data was used from the W.C. Beckjord Ash Pond B Dam Inventory Sheet.

Table 2 – Summary of Hydrologic and Hydraulic Assessment

Ash Pond	Drainage Area	Peak Flow		Peak WSE	Top of Pond Elev.	Free-board	Bottom of Pond Elev. (ft) (assumed)	Normal Pool Elev.	50% PMF Storage Vol.
	(acres)	Rate In (cfs)	Rate Out (cfs)	(ft)	(ft)	(ft)		(ft)	(ac-ft)
A	39.9	374.7	0.0	513.1	520.0	6.9	512.0	N/A	42.0
B	16.3	154.5	15.4	516.2	520.0	3.8	474.3	515.0	14.9
C	48.0	396.2	3.4	503.9	515.0	11.1	465.0	501.0	234.5
C Ext	54.2	443.8	6.1	519.0	525.0	6.0	485.0	418.0*	630.9

*Assumed although pond is currently dry.

As summarized in the results above it appears Ash Pond A, Ash Pond C, and Ash Pond C Extension at the W.C. Beckjord Generating Station will adequately store 50% of the volume generated during the Probable Maximum Flood (PMF) and allow for a minimum of five feet of freeboard as required by the State of Ohio. Ash Pond B will store 50% of the volume generated during the PMF and it appears to allow for 3.8 feet of freeboard.

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." Minimum required factors of safety outlined by the U.S. Army Corps of Engineers, in EM 1110-2-1902, Table 3-1, are provided in Table 3.

Table 3 - 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 through 3.3.4 we discuss our review of the effects of stability analyses and performance of the Ash Pond A, Ash Pond B, Ash Pond C and Ash Pond C Extension, respectively.

3.3.1 Structural Adequacy & Stability – Ash Pond A

CHA was not provided with information regarding the structural adequacy and stability of Ash Pond A. We were not able to perform stability analyses for the embankment as we were not provided with information on the properties of the foundation and embankment soils.

3.3.2 Structural Adequacy & Stability - Ash Pond B

CHA was not provided with information regarding the structural adequacy and stability of Ash Pond B. We were not able to perform stability analyses for the embankment as we were not provided with information on the properties of the foundation and embankment soils.

3.3.3 Structural Adequacy & Stability - Ash Dam Pond C

The Wastewater Permit to Install Permit Application dated April 11, 1991 noted that during the summer of 1990 Orbital Engineering conducted a study of the East Dike of Ash Pond C. The study included periodic site inspections, subsurface investigations and piezometer installations.

The site inspections reportedly showed several areas along the exterior slope of the embankment were experiencing distress. Seepage was evident in the failure areas, as well as in several areas along the toe of the embankment. Stability analysis of the embankment found calculated factors of safety of 0.9 to 1.1 indicating that the east embankment was marginally stable. Construction was conducted in 1991 to correct the structural deficiencies. Remedial modifications included:

- Constructing a rockfill buttress along the exterior toe of the dike to approximately elevation 485 feet.
- Placing clay backfill on the face of the embankment above the buttress to approximately elevation 500 feet.

- Installing an interceptor drain between the existing embankment face and the proposed earth and rock fill to control seepage.
- Establishing a dense vegetative cover consisting of grasses and legumes on the slope of the embankment above the rockfill buttress.

As-built drawings dated November 2, 1992 indicate that the remediation work was performed. Figure 7 shows a typical section of the repair work that was conducted. CHA was not provided with a copy of stability analyses conducted for the embankment prior to or following the remedial work conducted.

It appears that the analysis performed for the east embankment by Orbital Engineering did not consider loading conditions for maximum surcharge pool (flood), seismic, or rapid drawdown conditions.

CHA was not provided information regarding the structural adequacy and stability of the other portions of the embankment (north, south and west slopes). CHA was not able to perform stability analyses for the embankment for Ash Pond C as we were not provided with information on the properties of the foundation and embankment soils.

3.3.4 Structural Adequacy & Stability - Ash Pond C Extension

The Geotechnical Engineering Study for the Ash Plan C Extension prepared by ATEC Associates, Inc. (ATEC) dated January 22, 1982 provides information for the long-term stability of the embankment. The factor of safety against a long-term slope failure on the exterior slope was calculated to be 1.66. Figure 8 shows the soil properties used and the results of the analysis. The soil properties shown on Figure 8 were based on laboratory testing performed on split-spoon and undisturbed samples obtained from foundation soils and proposed borrow source soils. Laboratory testing included natural moisture content, Atterberg limit, gradation, unconsolidated undrained triaxial, consolidated undrained triaxial, and unconfined compression tests. In the

analysis it was assumed that an internal drainage system would be constructed and drawings (Dwg. Nos. 9-20031-S8 and 9-20031-S9) provided to CHA by DEO indicated that such a system was constructed. The study notes that without this drainage system the long-term factor of safety for the exterior slope would be less than acceptable.

The factor of safety of 1.66 pertained specifically to deep slope failures and the study emphasized that small sloughs may occur on the exterior slopes if localized seeps develop through continuous sand seams which may accidentally be built into the embankment. The vertical portion of the internal drainage system would control this issue for the lower part of the slope. It was recommended in the study that the vertical portion of the drain be extended to elevation 500 feet within the embankment as a cost saving measure and the owner (Cincinnati Gas & Electric) would accept the risk of additional maintenance to the upper level of the slope should small shallow sloughs develop.

The analysis did not consider loading conditions for maximum surcharge pool (flood), seismic, or rapid drawdown conditions.

3.4 Foundation Conditions

CHA was not provided with sufficient information to determine if Ash Pond A, Ash Pond B and Ash Pond C were constructed on wet ash, slag or other unsuitable materials.

Documents reviewed by CHA indicate that portions of the Ash Pond C Extension embankment were constructed above soft clay soils which are underlain by granular soils. The embankment was also constructed above a buried stream system which traversed the site. In the location of the clay soils was noted as being considerably softer than encountered elsewhere (in the upper terrace). Additional borings were advanced in the vicinity of where the stream was located in one of the borings to determine the extent of the stream. It was estimated that the stream was approximately 100 feet wide, however the stream was not delineated due to difficulty in locating

it in the additional borings or by interpreting surface definition or by studying aerial photos of the site.

3.4.1 Documentation of Foundation Conditions

CHA was not provided with documentation of foundation preparation for Ash Pond A, Ash Pond B, Ash Pond C and Ash Pond C Extension.

3.5 Operations & Maintenance

Attachment 5B of the letter DEO prepared to CHA dated September 15, 2009 provides a summary of weekly inspection procedures at the W.C. Beckjord Station. The summary notes that a member of the ash management group performs a weekly inspection of all ash disposal facilities, including the Ash Ponds B, C and C Extension. Observations are described as a "drive-by inspections" to identify any slips, animal activities and/or mechanical failures. These inspections are documented on a weekly basis. A copy of a recent weekly inspection report is included as Figure 9. Additional observations are completed after periods of heavy rain. These additional observations are not documented.

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 B, Ash Pond C and Ash Pond C Extension structures on April 23, 2008. Dam Safety Inspection Reports were provided to DEO 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 2008 inspection reports is provided in Table 4. 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.

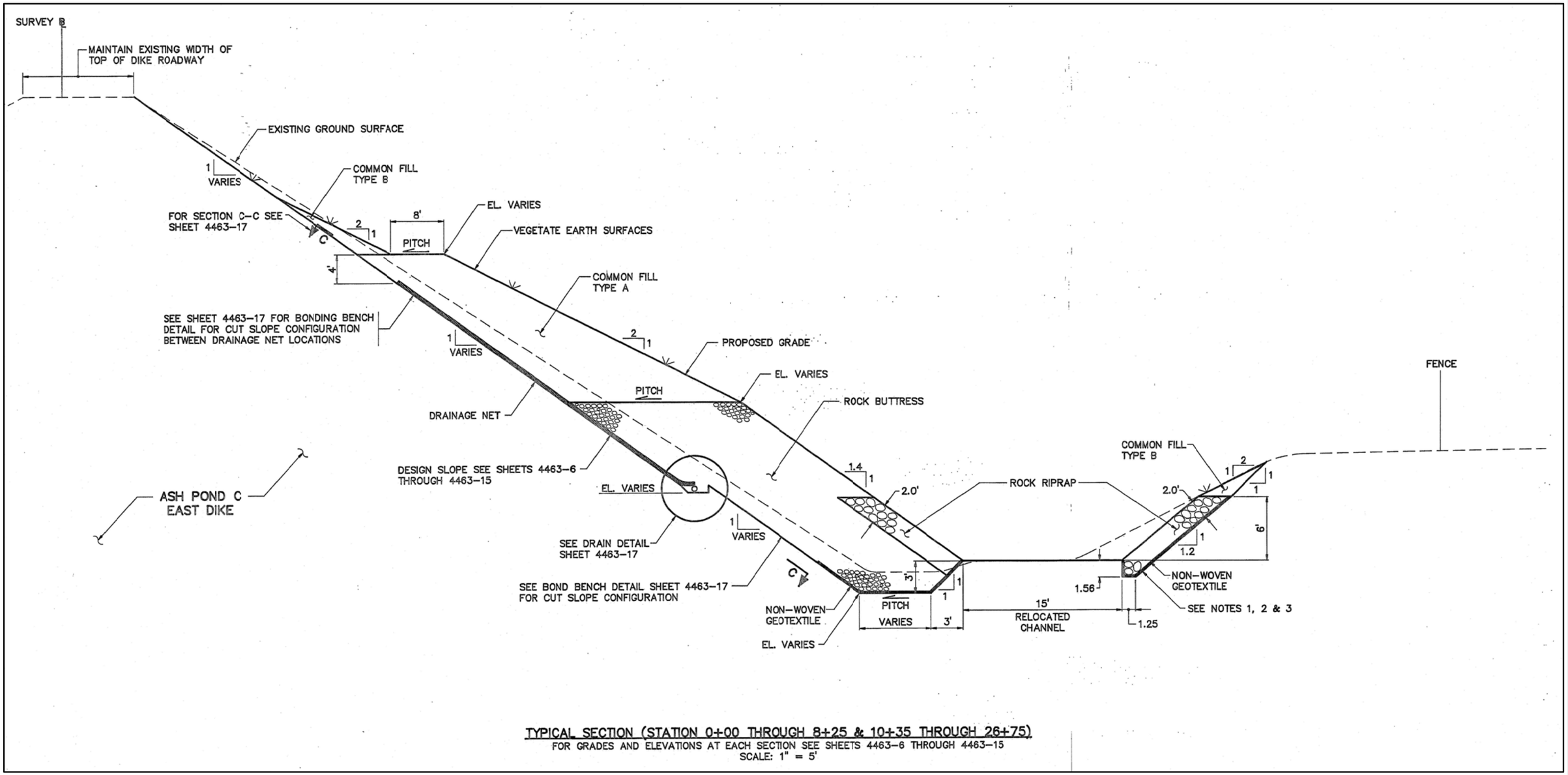
Table 4 – Summary of Required Remedial Measures

Ash Pond B
Engineering Repairs and Investigations
1. The earth slides on the east exterior slope must be repaired. Investigate and prepare plans and specifications for repairing the slides. The slides and overall stability of the embankment must be monitored monthly until repaired.
Owner Repairs
1. Remove trees and brush from the interior and exterior slopes of the embankment.
2. Repair the two large erosion gullies noted on west embankment.
3. Establish healthy grass cover on the eastern interior slope of the embankment.
4. Update the current Emergency Action Plan (EAP) for this structure to match the ICODS guidelines.
5. Monitor for smaller erosion gullies noted during the inspection for any change in condition. Should the condition of these gullies change, repair may be necessary.
6. Monitor for small surficial slide on the south exterior slope near the spillway outlet for any increase in size or new scarping. At the time of the inspection, the slide appeared to be stable and a healthy grass cover was beginning to be established in the area.
7. Monitor the unknown pipe outlet every six months for changes in flow or for cloudy or muddy discharge. This pipe was investigated in the 2007 repair of Ash pond B, but its purpose could not be determined. Any changes in the discharge from this pipe could indicate conditions requiring more frequent monitoring or repair.
Ash Pond C
Engineering Repairs and Investigations
1. The earth slide on the exterior slope of the south and west embankment must be repaired. Investigate and prepare plans and specifications for repairing the slide. The slide and overall stability of the embankment must be monitored monthly until repaired.
2. The earth slides on the exterior slope of the east embankment must be repaired. Plans and specifications for repairing slides have been approved as Phase II of the 2003 repairs. The slide and overall stability of the embankment must be monitored monthly until repaired.
3. The sinkhole on the east exterior embankment must be repaired. Investigate the cause of the sinkhole and prepare plans and specifications for repair. The sinkhole must be monitored monthly until repairs can be made.

Table 5 – Summary of Required Remedial Measures - continued

Owner Repairs
1. Remove trees and brush from the west and east embankments.
2. Repair ruts on the north end of the west embankment crest.
3. Establish a grass cover on the entire exterior slope especially south and west embankments. Remove the woody and vine like vegetation since it makes it difficult to monitor the slope.
4. If the lake drain is inoperable, the cracked valve must be repaired or replaced.
5. Update the current Emergency Action Plan (EAP) for this structure to match the ICODS guidelines.
6. Remove debris from the interior of the emergency spillway pipe. Inspect the outlet for any debris obstruction following high water events on the Ohio River.
7. Monitor the crack on the south embankment for any additional movement.
8. Monitor the old surface slide on the west embankment for any additional movement. At the time of the inspection, the scarp at the top of the slide was grassed over indicating there was no active movement.
9. Monitor the toe drain outlets on the north and south ends of the east embankment.
Ash Pond C Extension
Engineering Repairs and Investigations
None noted.
Owner Repairs
1. Remove trees and brush from the west and east embankments.
2. Fill in rodent burrows on the interior and exterior slopes. This item should be accomplished while addressing the erosion gullies that have formed due to rodent activity.
3. Repair the erosion gullies near the toe of the exterior slope on the west embankment. These erosion gullies appear to have been caused by rodent activity.
4. Tall vegetation and woody growth was noted on the exterior slope. Establish a regular mowing cycle that allows a healthy grass cover to be established on the entire embankment.
5. Currently there is no EAP or OMI (Operations, Maintenance and Inspection Manual) on file at the Division of Water for Ash Pond C Extension.
6. Monitor the toe of the exterior slope on the west embankment during high flow events in the Ohio River for scarping or slides. Following high flow events, the embankment should be thoroughly inspected for any slides or erosion.
7. Monitor the old surface slides near the southeast and southwest corners of the embankment for any recurrence of soil movement. At the time of this inspection, these slides appeared stable; grass had grown into the scarped area.
8. Ash Pond C Extension must have a lake drain or a plan to drain water stored in the reservoir. Currently, no water is stored in the pond. Based upon the current operations of the structure, a plan outlining the use of pumps as a lake drain and identifying pump availability is acceptable.
9. Remove the debris from around the emergency overflow outlet. Inspect the outlet for any debris obstruction following high flow events on the Ohio River.

Attachment 2B of the letter DEO prepared dated September 15, 2009 provided a status response to the ODNR Dam Safety Inspection Reports. The attachment notes that W.C. Beckord Station personnel retained a geotechnical engineering firm to design engineering repairs and conduct engineering investigations to address issues outlined in the ODNR reports. The geotechnical engineering firm has performed investigations, developed drawings and has worked with ODNR towards a resolution of items identified during their inspection. DOE is currently obtaining pricing and negotiating a contract to implement the designs and recommendations of the geotechnical engineering firm. CHA was not provided with a copy of these recommendations.



TYPICAL SECTION (STATION 0+00 THROUGH 8+25 & 10+35 THROUGH 26+75)

FOR GRADES AND ELEVATIONS AT EACH SECTION SEE SHEETS 4463–6 THROUGH 4463–15

SCALE: 1" = 5'

IMAGE REFERENCE: ASH POND C, DIKE REMEDIATION PROJECT, TYPICAL CONSTRUCTION CROSS SECTION, ORBITAL ENGINEERING INC. DWG NO. 12-20057-S16, DATED 11-2-92

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

TYPICAL CROSS SECTION ASH POND C
EAST EMBANKMENT REPAIR
W.C. BECKJORD STATION
NEW RICHMOND, OHIO

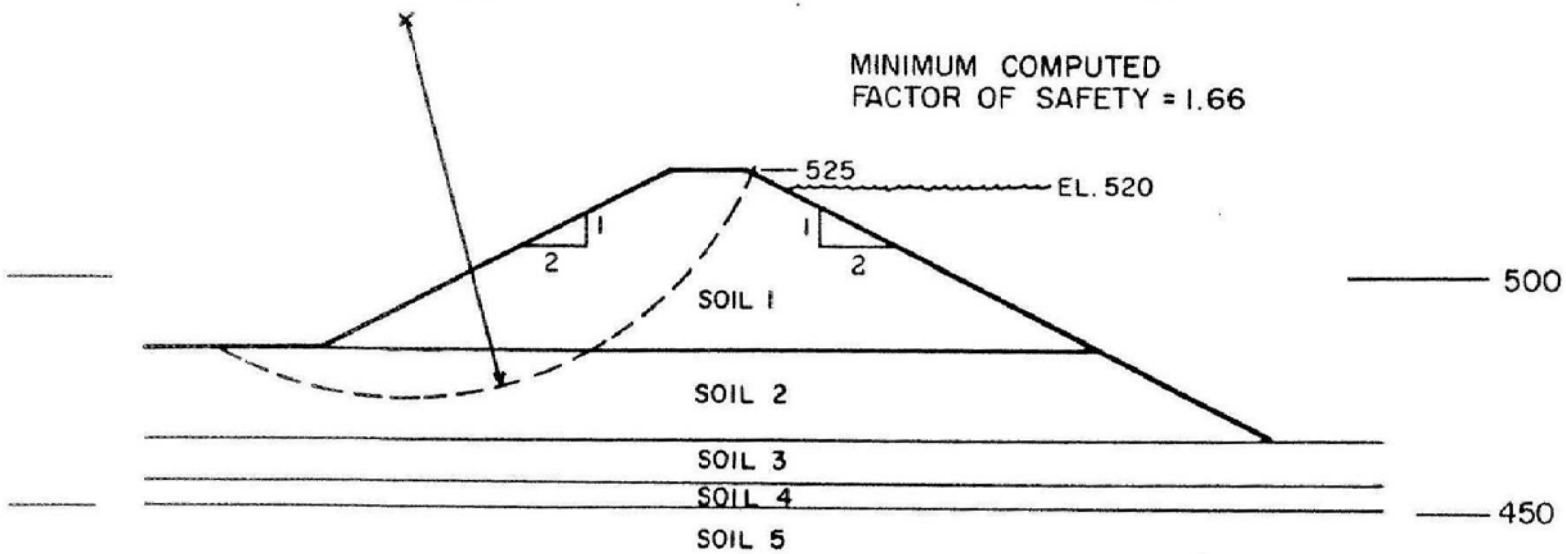
PROJECT NO. 20085.1060

DATE: 11/2009

FIGURE 7

SOIL PARAMETERS

SOIL	DENSITY, γ (pcf)	COHESION, C' (psf)	FRICTION ANGLE, ϕ' (DEGREES)
1	125	300	30
2	120	200	26
3	120	400	26
4	130	0	35
5	130	0	35



TYPICAL SOIL CONDITIONS
LONG TERM STABILITY – OUTSIDE SLOPE

CHA
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SOIL PARAMETERS AND STABILITY ANALYSIS RESULTS ASH POND C
W.C. BECKJORD STATION
NEW RICHMOND, OHIO

PROJECT NO. 20085.1060
DATE: 11/2009
FIGURE 8

W.C. BECKJORD ASH DISPOSAL
WEEKLY INSPECTION

Date: 9-11-09 Reported by: Jerry Nicholas

North Landfill & Lift Station:

Pump 1: OK Pump 2: OK

Creek Condition: OK

Pond Run (South) Landfill & Lift Station:

Pump 1: OK Pump 2: OK

Traffic Lights: — Sed Pond Condition: NORMAL – GREEN
(Color, Level, etc.)

Drainage Areas: OK

Bottom Ash Ponds:

1-4 Basin: OK 5 Basin: OK

6 Basin: OK Pyrite Basin: OK

Silo Operation:

Wet Unloader # 1: OK Wet Unloader # 2: OK

Dry Unloader: OK Scale Condition: OK

Misc.

Yard Scale: OK Entrance Road: OK

Rim Ditch Operation: OK

Other:
(Note erosion, slides, seepage, or other undesirable conditions)

Comments:

Submit Completed Report to Technical Services @ Beckjord Station

Page 127

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

WEEKLY INSPECTION FORM

W.C. BECKJORD STATION
NEW RICHMOND, OHIO

PROJECT NO. 20085.1060

DATE: 11/2009

FIGURE 9

4.0 CONCLUSIONS/RECOMMENDATIONS

4.1 Acknowledgement of Management Unit Condition

I acknowledge that the management units referenced herein were personally inspected by me and were found to be in the following condition: **Poor.**

A management unit found to be in poor condition is defined as one in which a safety deficiency is recognized for any required loading condition (static, hydrologic, seismic) in accordance with the applicable dam safety regulatory criteria. Remedial action is necessary. Poor also applies when further critical studies or investigations are needed to identify any potential dam safety deficiencies.

CHA's assessment of the Ash Pond A, Ash Pond B, Ash Pond C and Ash Pond C Extension embankments indicate that they are in poor condition. As described in the following sections, further studies, maintenance and monitoring will further enhance the condition of these impoundments.

4.2 Maintaining Vegetation Growth

Vegetation obscured visual observations of the north and west dikes of Ash Pond A. Trees and brush should be cleared from all of the interior and exterior slopes of all the ash pond dikes. On impoundments with either standing water, or high water levels within the deposited ash (i.e., not at the surface of the ash, but not as low as the toe of the dike either), tree roots can allow for seepage of the retained water through the dikes, which could lead to internal erosion such as is the concern in an impoundment with free water. Internal erosion would weaken the dike, and could result in a slope failure.

Additionally, the uprooting of trees during storms can create large voids in the embankment that are then susceptible to erosion. Considering the progressive erosion that could occur during a storm which blows the tree over during heavy rains (i.e., hurricane type storm systems) progressive erosion could potentially result in enough loss of soil from the dike to create an unstable situation, which if failure occurs could result in a release of ash.

CHA recommends that vegetation be cut on a regular basis ensure that adequate visual observations are being made by Duke Representatives during routine inspections.

4.3 Erosion Protection and Repair

Erosion rills, sinkholes and subsequent loss of grass cover were observed on multiple embankment slopes of the Ash Pond A, Ash Pond B, Ash Pond C and Ash Pond C Extension as discussed in Sections 2.2.1, 2.3.1, 2.4.1 and 2.5.1, respectively. Thinning and loss of grass cover due to concentrated flow was noted on the embankment slopes. CHA recommends filling all rills and sinkholes and re-seeding these areas.

4.4 Animal Control

Evidence of animal burrows and slides were observed on the south dike of Ash Pond A, east dike of Ash Pond C and on the south and west dikes of Ash Pond C Extension. CHA recommends Duke Energy to make note of areas disturbed by animal activity, trapping of the animals responsible, and repair to the areas to protect the integrity of the dikes. Although not seen on other dikes, vegetation cover hides these features.

4.5 Repair of Surficial Sloughs

Active and/or grassed-over sloughs were observed on the exterior slopes of Ash Pond A (east dike), Ash Pond B (east dike), Ash Pond C (east, south, west dikes), and Ash Pond C Extension

(east, south, west dikes). These areas of slough should be repaired. As outlined in the OH DNR inspection reports the areas of slough should be investigated and plans and specifications be prepared outlining the repair work. It should be noted that plans and specifications for repairing slides on the Ash Pond C east dike have been approved as part of the Phase II of the 2003 repairs. Also as outlined in the OH DNR inspection reports the areas of slough and overall stability of the dikes must be monitored monthly until the repairs are made.

4.6 Monitoring of Unknown Pipe Outlet Ash Pond B

The OH DNR Inspection Report for the Ash Pond B notes that Duke Energy personnel should monitor the unknown pipe outlet every six months for changes in flow or for cloudy or muddy discharge. This pipe was investigated in the 2007 repair of Ash Pond B, but its purpose could not be determined. Any changes in the discharge from this pipe could indicate conditions requiring more frequent monitoring or repair. If changes are observed a qualified engineer should be contacted immediately to investigate the changed condition.

4.7 Hydrologic & Hydraulic Assessment Ash Pond B

Ash Pond B is currently being dredged and filled and therefore was assumed to have a reduced storage capacity due to being partially filled in the current conditions. Our abbreviated H&H Analysis for the pond indicates that Ash Pond B will store 50% of the volume generated during the PMF and appears to allow for 3.8 feet of freeboard. The State of Ohio requires the minimum elevation of the embankment crest shall be at least 5 feet higher than the elevations of the designed maximum operating pool level. CHA recommends that a detailed Hydrologic & Hydraulic Assessment Ash Pond B be performed to evaluate that is freeboard requirement is met.

4.8 Stability Analysis

It is recommended that detailed stability analyses be performed for the Ash Pond A, Ash Pond B, Ash Pond C and Ash Pond C Extension impoundments.

CHA was not provided with information regarding stability analyses performed prior to or following construction of Ash Pond A or Ash Pond B nor information regarding properties of the embankment and foundation soils.

Orbital Engineering performed stability analyses for Ash Pond C which indicated that the embankment was marginal stable and remedial work was required. The stability analyses did not consider loading conditions for maximum surcharge pool (flood), seismic, or rapid drawdown conditions.

ATEC prepared a report for Ash Pond C Extension which included a stability analysis for deep slope failures. The analysis did not consider maximum surcharge pool (flood), seismic, or rapid drawdown conditions.

The stability analyses for each pond should include a subsurface investigation to determine existing soil parameters in the embankments and foundation soils and the installation of piezometers to determine the current pheratic surface.

4.9 Inspection Recommendations

Based on the information reviewed by CHA it does not appear that Duke Energy has an adequate inspection practices. Currently observations by plant personnel consist of "drive-by inspections" to identify any slips, animal activities and/or mechanical failures and the observations are documented on a weekly basis. In recent inspection reports the OH DNR outlined items that should be monitored and the frequency of which these items should be monitored. CHA recommends that plant personnel develop more detailed inspection procedures to ensure they are

performing adequate inspections. Inspection procedures should include the recording of data from existing piezometer and inclinometers in the embankments. In addition, inspections made following heavy rainfall and/or high water events on the Ohio River should be documented. It is recommended that records of inspection be retained at the facility for a minimum of three years.

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 W.C. Beckjord 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: W. C. Beckjord Power Station	Date: October 9, 2009
Unit Name: Ash Pond A	Operator's Name: Duke Energy
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?	not done		18. Sloughing or bulging on slopes?		x
2. Pool elevation (operator records)?	n/a (dry)		19. Major erosion or slope deterioration?	x	
3. Decant inlet elevation (operator records)?	n/a (dry)		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	d/n/a		Is water entering inlet, but not exiting outlet?	see	note
5. Lowest dam crest elevation (operator records)?	520		Is water exiting outlet, but not entering inlet?	see	note
6. If instrumentation is present, are readings recorded (operator records)?	d/n/a		Is water exiting outlet flowing clear?	d/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)?	d/n/a		From underdrain?	d/n/a	
9. Trees growing on embankment? (If so, indicate largest diameter below)	x		At isolated points on embankment slopes?	see	note
10. Cracks or scarps on crest?		x	At natural hillside in the embankment area?	d/n/a	
11. Is there significant settlement along the crest?		x	Over widespread areas?	see	note
12. Are decant trashracks clear and in place?	see	note	From downstream foundation area?	see	note
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?	d/n/a		"Boils" beneath stream or ponded water?		x
14. Clogged spillways, groin or diversion ditches?	see	note	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

"d/n/a" = Does not apply "n/a" = Not available

9 Large brush and small trees up to approximately 12 to 16 inches in diameter were evident along upstream slope of north and west dike. Smaller similar vegetation on upstream slope of south dike. Heavy vegetation observed on downstream slopes along north, west and part of south dikes; larger trees at north dike toe next to creek.

12, 14, 15, 16, 20 Pond is dry, decant spillway/trash rack not used and vegetated; outlet not seen.

17 Isolated, grassed surficial scarps on east dike downstream slope; vegetation obscured north and west dikes.

21 Up to 3 inches of rain fell during assessment period; seeps would not be apparent.

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # OH0009865 INSPECTOR Hargraves/Filkins
Date October 9, 2009

Impoundment Name Ash Pond A
Impoundment Company Duke Energy
EPA Region 5
State Agency (Field Office) Addresss Ohio EPA Southwest District Office
401 East Fifth Street, Dayton, Ohio 45402
Name of Impoundment Ash Pond 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 Ash, Inactive since 1985

Nearest Downstream Town : Name New Palestine
Distance from the impoundment 0.7 miles
Impoundment Location:
Longitude 84 Degrees 17 Minutes 54 Seconds
Latitude 38 Degrees 59 Minutes 57 Seconds
State OH County Clermont

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

If So Which State Agency? ODNR- Division of Water; not inventoried as of site visit

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.

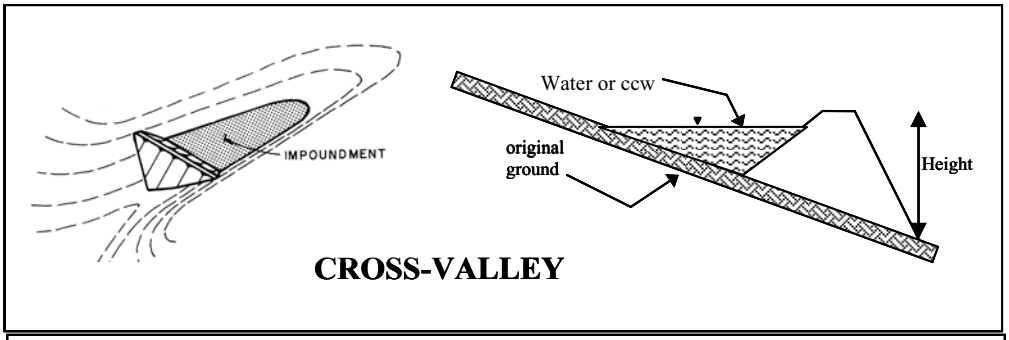
x_____ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. 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.

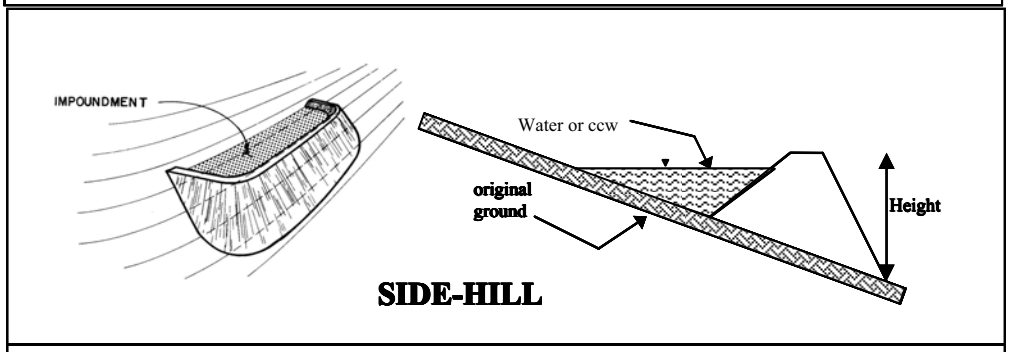
_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

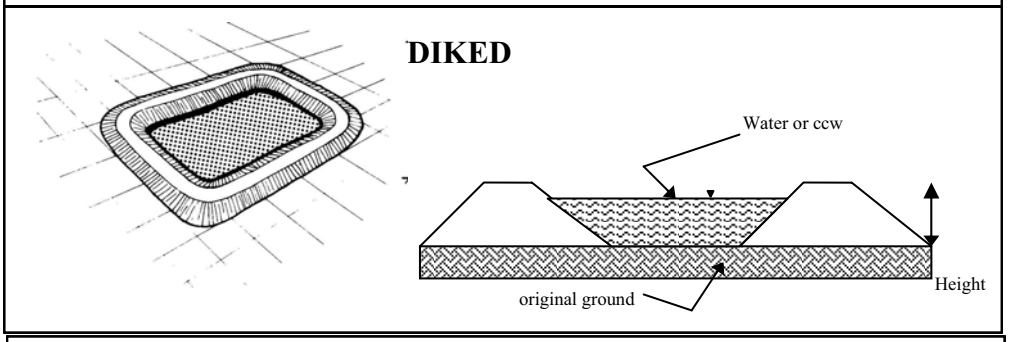
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

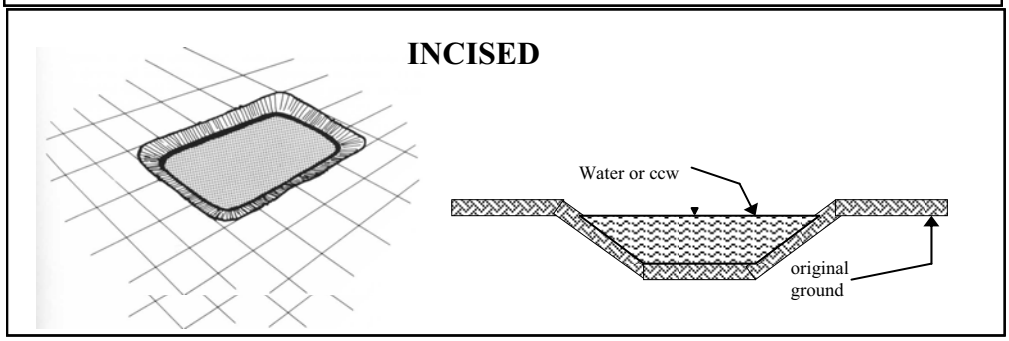
Failure of the west and north dikes and subsequent erosion would impact the Ohio River and creek near dike toe. Failure of the east dike and subsequent erosion would impact U.S. 52 and associated drainage ditches.

CONFIGURATION:









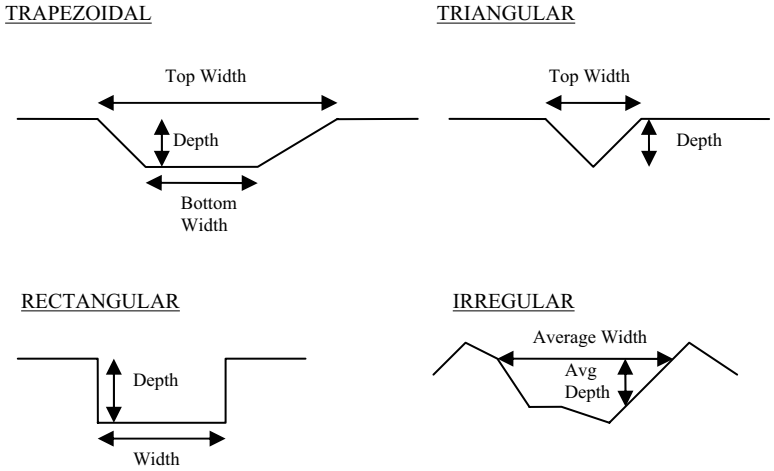
_____ Cross-Valley
_____ Side-Hill
x_____ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height roughly 40 feet Embankment Material Earth
Pool Area 83.2 acres Liner none
Current Freeboard 8 to 10 feet Liner Permeability d/n/a

TYPE OF OUTLET (Mark all that apply)

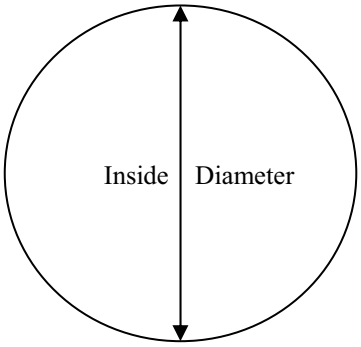
d/n/a **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

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



x **Outlet**

60 inside diameter



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

_____

Is water flowing through the outlet? YES _____ NO x

_____ **No Outlet**

_____

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

The Impoundment was Designed By original designers not known

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

If So When? see note_____

If So Please Describe :

Dike is old and few records are available.

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

If So When? see note

IF So Please Describe:

Dike is old and few records are available.

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,...)? see note _____

If so Please Describe :

Dike is old and few records are available.

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: W. C. Beckjord Power Station	Date: October 9, 2009
Unit Name: Ash Pond B	Operator's Name: Duke Energy
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?	quarterly		18. Sloughing or bulging on slopes?	x	
2. Pool elevation (operator records)?	approx. 514		19. Major erosion or slope deterioration?	x	
3. Decant inlet elevation (operator records)?	approx. 514		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	d/n/a		Is water entering inlet, but not exiting outlet?		x
5. Lowest dam crest elevation (operator records)?	520		Is water exiting outlet, but not entering inlet?		x
6. If instrumentation is present, are readings recorded (operator records)?	d/n/a		Is water exiting outlet flowing clear?	x	
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)?	d/n/a		From underdrain?	d/n/a	
9. Trees growing on embankment? (If so, indicate largest diameter below)	x		At isolated points on embankment slopes?	see	note
10. Cracks or scarps on crest?		x	At natural hillside in the embankment area?	d/n/a	
11. Is there significant settlement along the crest?		x	Over widespread areas?	see	note
12. Are decant trashracks clear and in place?	x		From downstream foundation area?	see	note
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?		x	22. Surface movements in valley bottom or on hillside?		x
16. Are outlets of decant or underdrains blocked?		x	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

"d/n/a" = Does not apply "n/a" = Not available

9 Trees up to approximately 2 to 3 feet in diameter were evident in isolated locations on the south and east embankments. The north embankment had brush and smaller trees on the slope facing Pond A (now dried)

17, 18 Active surface scarps, sloughs, and a toe bulge were observed on the east dike slope.

19 Deep erosion gullies were noted on the west dike in the bottom ash and slag slope surface.

21 Up to 3 inches of rain fell during assessment so seeps would not be apparent; no ash laden seepage was seen.

23 Rainfall collected in ditch along east dike toe intermittently.

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # OH0009865 INSPECTOR Hargraves/Filkins
Date October 9, 2009

Impoundment Name Ash Pond B
Impoundment Company Duke Energy
EPA Region 5
State Agency (Field Office) Addresss Ohio EPA Southwest District Office
401 East Fifth Street, Dayton, Ohio 45402
Name of Impoundment Ash Pond 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: Bottom Ash, Storm Drainage

Nearest Downstream Town : Name New Palestine
Distance from the impoundment 0.8 miles
Impoundment Location:
Longitude 84 Degrees 17 Minutes 43 Seconds
Latitude 38 Degrees 59 Minutes 41 Seconds
State OH County Clermont

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

If So Which State Agency? Ohio Department of Natural Resources - 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.

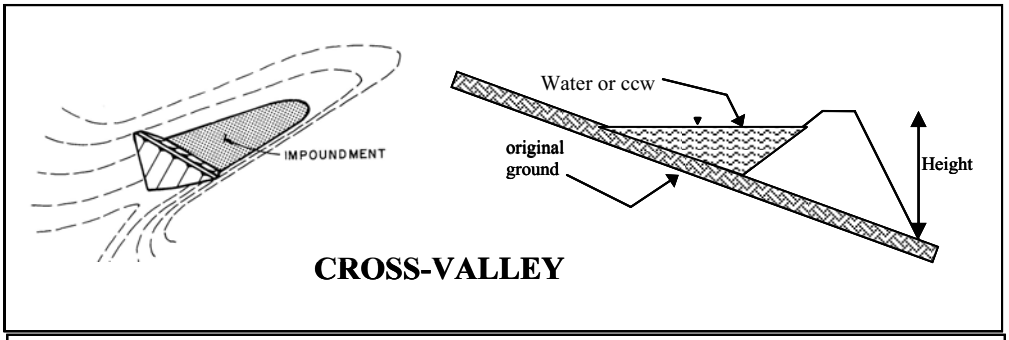
x_____ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. 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.

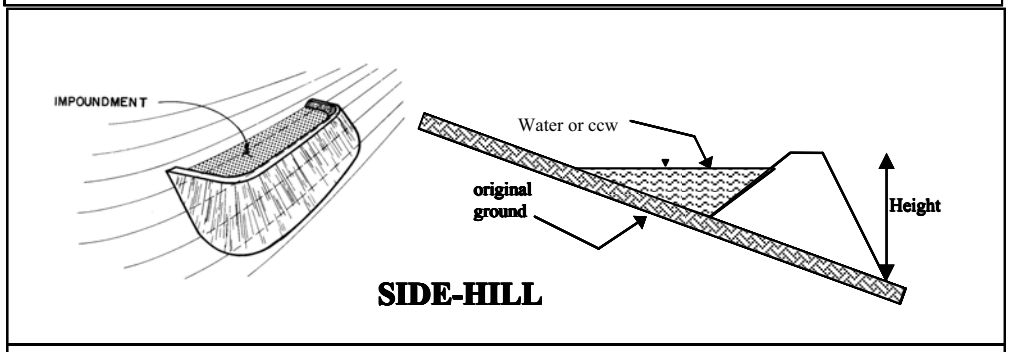
_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

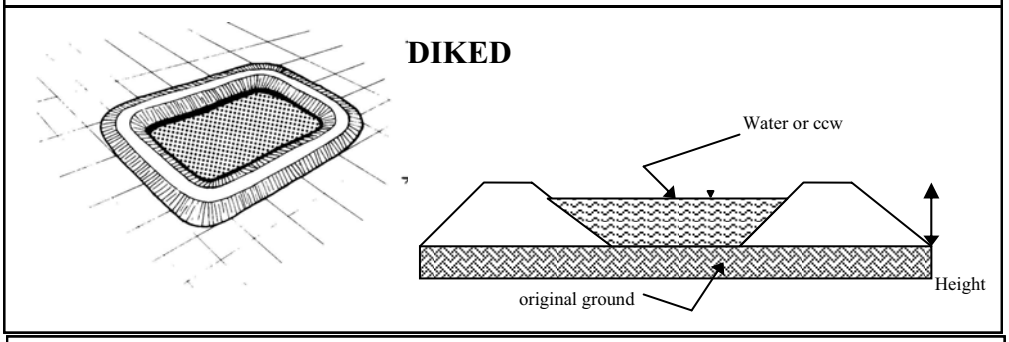
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

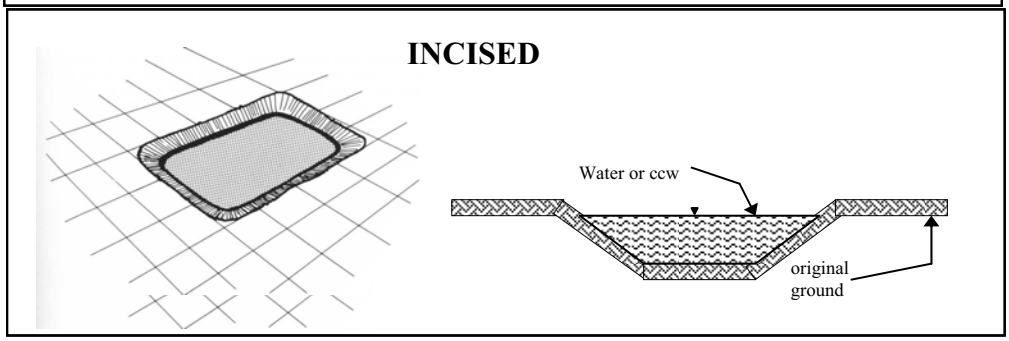
Failure of the west dike would impact the coal pile and possibly push fuel (coal) and ash laden water into the Ohio River. Failure of the east and south dike would impact U.S. 52 or the facility parking areas and convey ash laden water to drainage ditches and a creek at the eastern edge of the facility that eventually feeds the Ohio River.

CONFIGURATION:









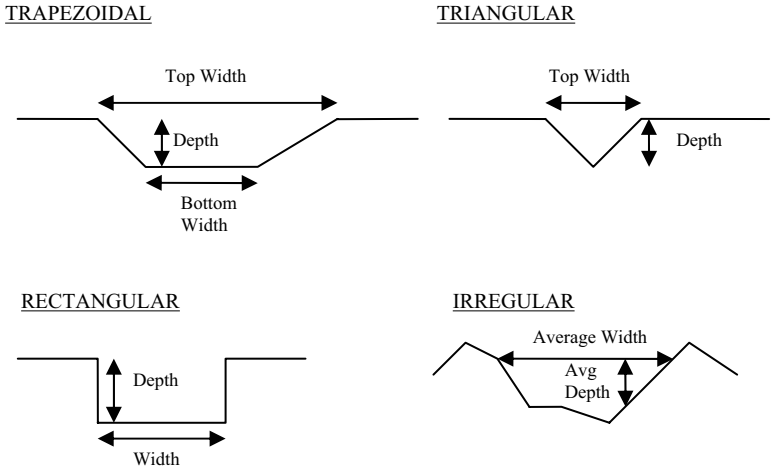
_____ Cross-Valley
_____ Side-Hill
x_____ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height 46 feet Embankment Material Earth
Pool Area 50 acres Liner none
Current Freeboard approx. 5 feet Liner Permeability d/n/a

TYPE OF OUTLET (Mark all that apply)

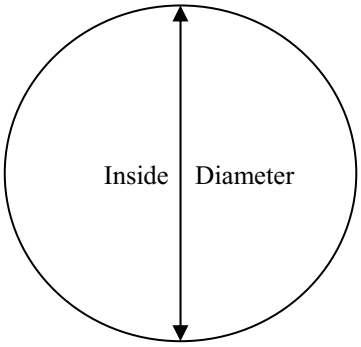
d/n/a **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

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



x **Outlet**

28 inside diameter



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

_____

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

_____ **No Outlet**

_____

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

The Impoundment was Designed By original designers not known; new spillway outlet designed by BBC&M

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

If So When? see note_____

If So Please Describe :

No failures resulting in a breach of the dike have been reported, however there is a history of surface scarping and sloughing failures along the east dike downstream slope. These failures appear to be the result of the fairly steep (2:1 horizontal to vertical) dike slope constructed out of silty clay material that softens over time.

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 :

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	W. C. Beckjord Power Station	Date:	October 8, 2009
Unit Name:	Ash Pond C	Operator's Name:	Duke Energy
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?	weekly		18. Sloughing or bulging on slopes?	x	
2. Pool elevation (operator records)?	approx. 501		19. Major erosion or slope deterioration?		x
3. Decant inlet elevation (operator records)?	approx. 501		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	d/n/a		Is water entering inlet, but not exiting outlet?		x
5. Lowest dam crest elevation (operator records)?	515		Is water exiting outlet, but not entering inlet?		x
6. If instrumentation is present, are readings recorded (operator records)?	x		Is water exiting outlet flowing clear?	x	
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)?	d/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?	d/n/a	
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?	see	note
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?		x
15. Are spillway or ditch linings deteriorated?		x	22. Surface movements in valley bottom or on hillside?		x
16. Are outlets of decant or underdrains blocked?		x	23. Water against downstream toe?	see	note
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

"d/n/a" = Does not apply "n/a" = Not available

6 Inclinometers have been installed on slope and are read quarterly.

17, 18 Isolated grassed over scarps/sloughs and toe bulges noted in steepened (1.8:1 horizontal to vertical) portion of east dike not armored with stone. 5' x 5' Sinkhole about 3' deep also noted on east dike slope.

21, 23 Water and seepage not noted on west and south dikes. Creek and Pond B outfall ditch noted along toe of east dike.

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # OH0009865 INSPECTOR Hargraves/Filkins
Date October 8, 2009

Impoundment Name Ash Pond C
Impoundment Company Duke Energy
EPA Region 5
State Agency (Field Office) Addresss Ohio EPA Southwest District Office
401 East Fifth Street, Dayton, Ohio 45402
Name of Impoundment Ash Pond C
(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: Fly Ash

Nearest Downstream Town : Name New Palestine
Distance from the impoundment 1.7 miles
Impoundment Location:
Longitude 84 Degrees 17 Minutes 39 Seconds
Latitude 38 Degrees 59 Minutes 9 Seconds
State OH County Clermont

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

If So Which State Agency? Ohio Department of Natural Resources - 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.

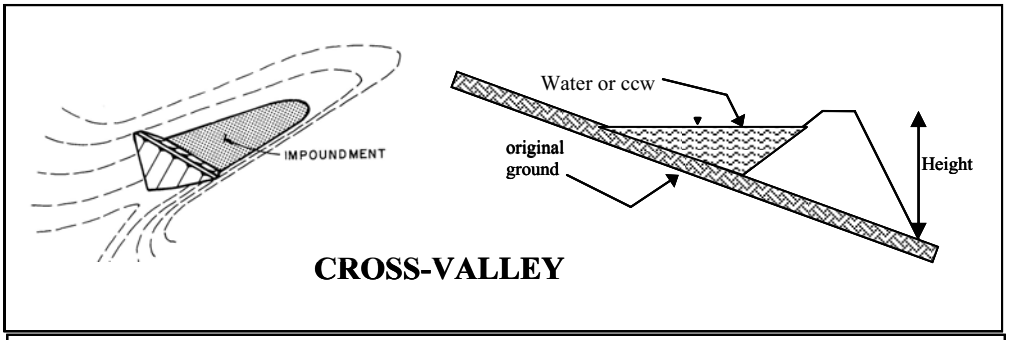
x_____ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. 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.

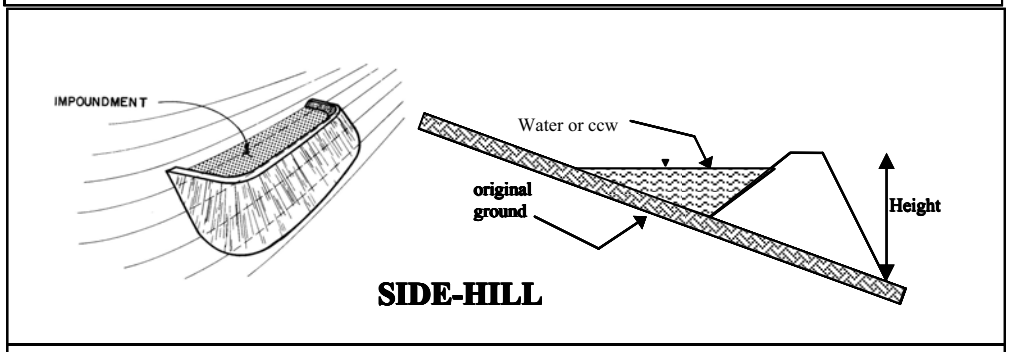
_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

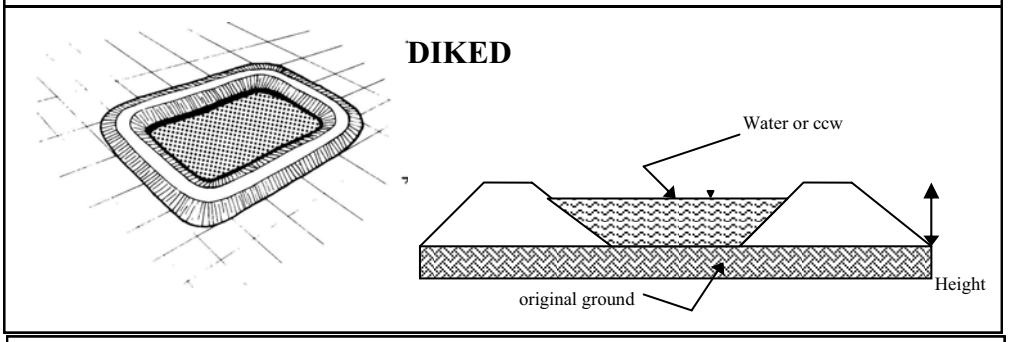
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

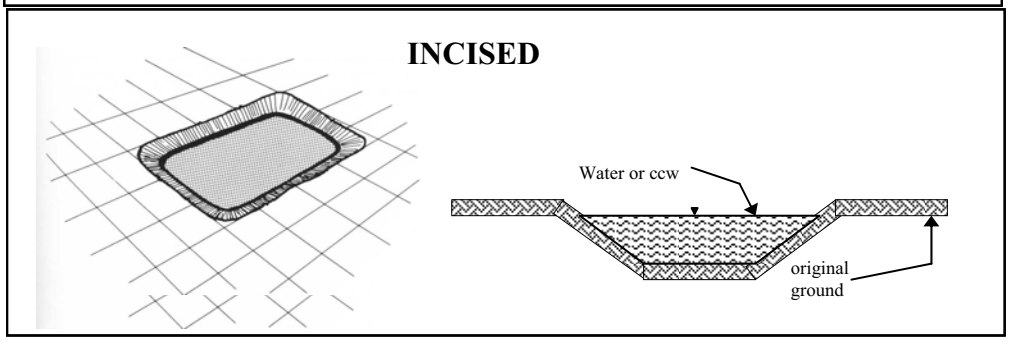
Failure of the west dike would release ash laden water into the Ohio River. Failure of the east and south dike would impact U.S. 52 and convey ash laden water to drainage ditches and a creek at the eastern edge of the facility that eventually feeds the Ohio River.

CONFIGURATION:









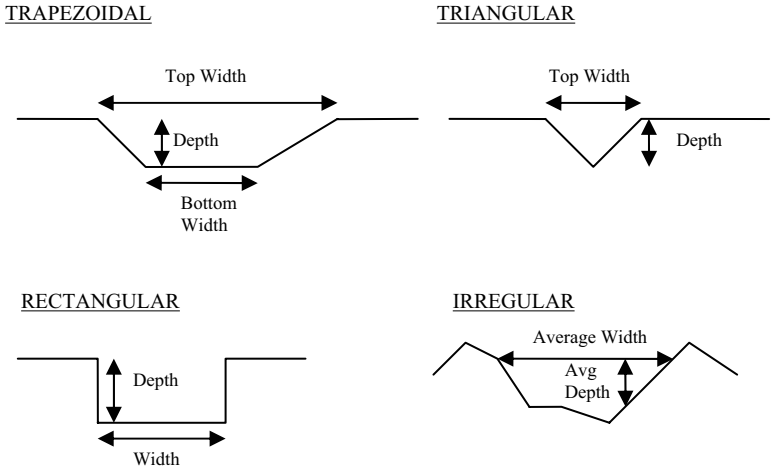
_____ Cross-Valley
_____ Side-Hill
x_____ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height 50 feet Embankment Material Earth
Pool Area 45 acres Liner none
Current Freeboard approx. 14 feet Liner Permeability d/n/a

TYPE OF OUTLET (Mark all that apply)

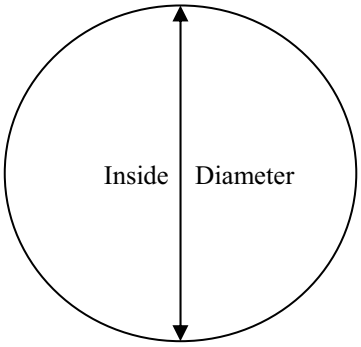
d/n/a **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

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



x **Outlet**

24 inside diameter



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

_____

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

_____ **No Outlet**

_____

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

The Impoundment was Designed By Cincinnati Gas and Electric (CG&E)
_____

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

If So When? see note

If So Please Describe :

No failures resulting in a breach of the dike have been reported, however there is a history of surface scarping and sloughing failures along the east and west dike downstream slopes. Various repairs have been made for these areas dating from 1991. These failures appear to be the result of the steep dike slope constructed out of silty clay material that softens over time. A new riser was also constructed after the original riser collapsed in 1999.

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 :

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: W. C. Beckjord Power Station	Date: October 9, 2009
Unit Name: Ash Pond C ext. (extension)	Operator's Name: Duke Energy
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?	weekly		18. Sloughing or bulging on slopes?	x	
2. Pool elevation (operator records)?	518		19. Major erosion or slope deterioration?		x
3. Decant inlet elevation (operator records)?	518		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	d/n/a		Is water entering inlet, but not exiting outlet?	d/n/a	
5. Lowest dam crest elevation (operator records)?	525		Is water exiting outlet, but not entering inlet?	d/n/a	
6. If instrumentation is present, are readings recorded (operator records)?	x		Is water exiting outlet flowing clear?	d/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)?	d/n/a		From underdrain?	see	note
9. Trees growing on embankment? (If so, indicate largest diameter below)		x	At isolated points on embankment slopes?	see	note
10. Cracks or scarps on crest?		x	At natural hillside in the embankment area?	d/n/a	
11. Is there significant settlement along the crest?		x	Over widespread areas?	see	note
12. Are decant trashracks clear and in place?	see	note	From downstream foundation area?	see	note
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		x	"Boils" beneath stream or ponded water?	d/n/a	
14. Clogged spillways, groin or diversion ditches?	see	note	Around the outside of the decant pipe?	d/n/a	
15. Are spillway or ditch linings deteriorated?		x	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

"d/n/a" = Does not apply "n/a" = Not available

6 Groundwater monitoring well outside of embankment.

12, 14, 16 The pond is dry and no longer active. Decant spillway is not used and has been plugged.

17, 18 Vegetated, intermittent cracks and holes due to progressive sloughing and erosion were visible along the downstream slopes of the east and west dikes; such features more isolated on south dike.

21 Heavy rain (up to 3") fell during assessment period; no seeps could be readily identified. Toe drain vegetated and somewhat silted in on west slope (brush removal in progress); less vegetated on east and south slopes.

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # OH0009865 INSPECTOR Hargraves/Filkins
Date October 9, 2009

Impoundment Name Ash Pond C Ext.
Impoundment Company Duke Energy
EPA Region 5
State Agency (Field Office) Addresss Ohio EPA Southwest District Office
401 East Fifth Street, Dayton, Ohio 45402
Name of Impoundment Ash Pond C Ext.
(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: Fly Ash

Nearest Downstream Town : Name New Palestine
Distance from the impoundment 2.3 miles
Impoundment Location:
Longitude 84 Degrees 17 Minutes 35 Seconds
Latitude 38 Degrees 58 Minutes 40 Seconds
State OH County Clermont

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

If So Which State Agency? Ohio Department of Natural Resources - 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.

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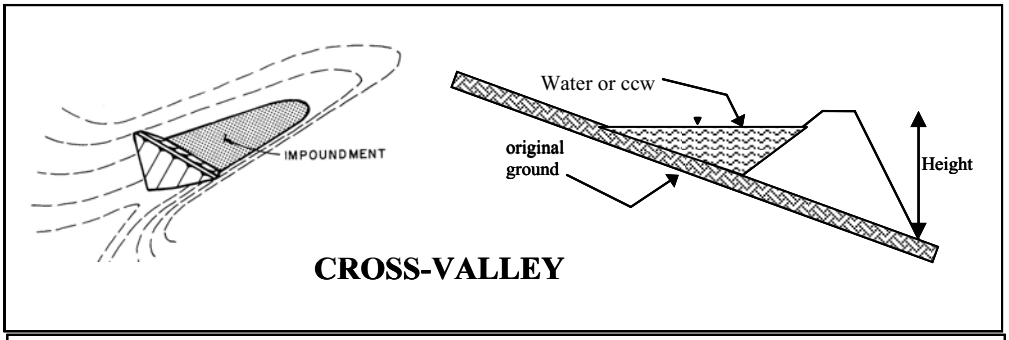
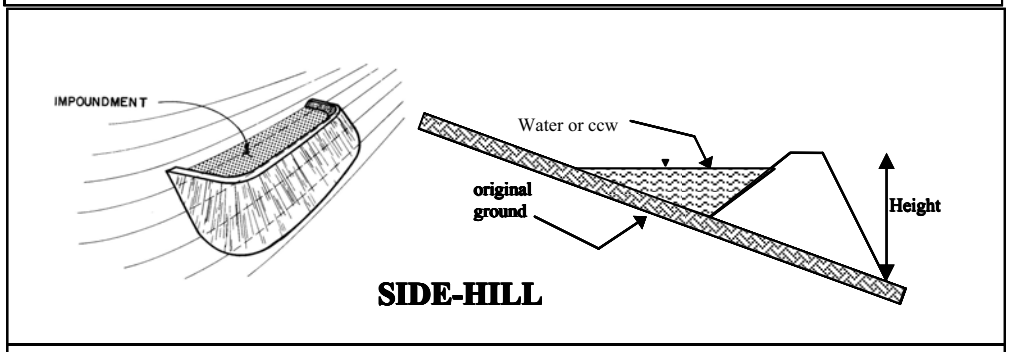
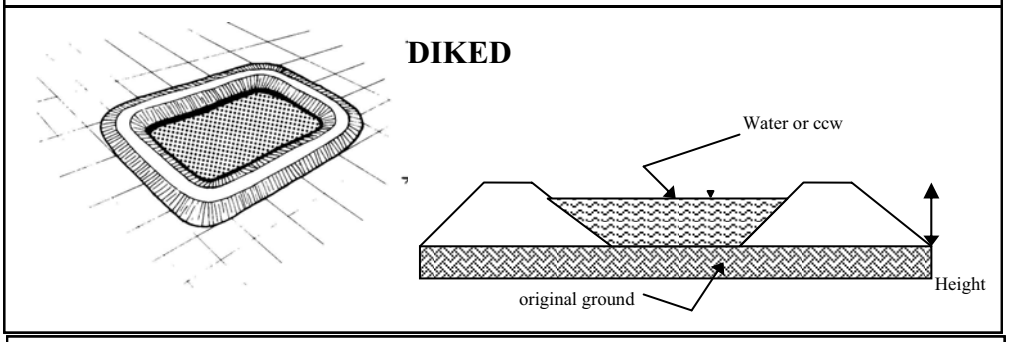
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

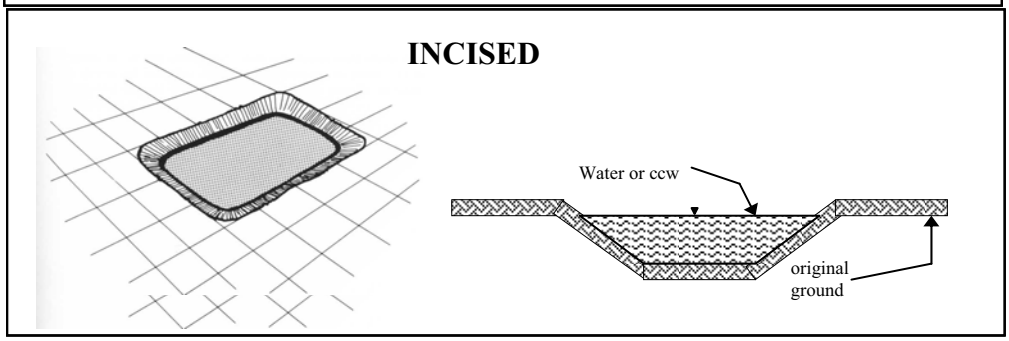
Failure of the west dike and subsequent erosion would release ash sediment into the Ohio River. Failure of the east and north dikes and subsequent erosion would impact drainage ditches and a creek at the northern edge of the facility that eventually feeds the Ohio River.

CONFIGURATION:









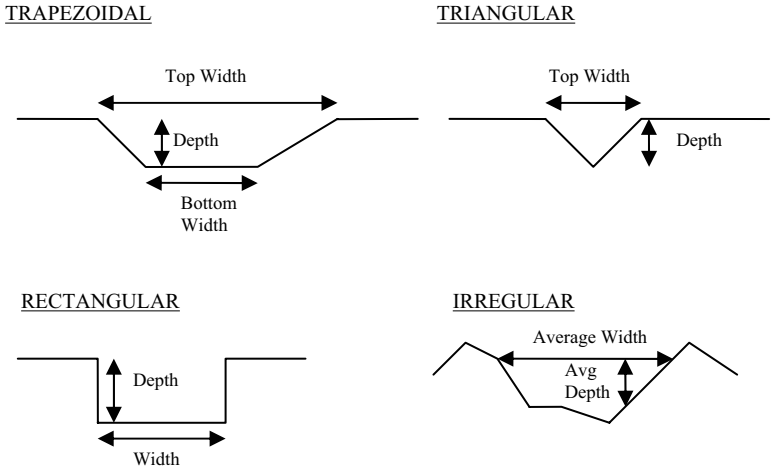
_____ Cross-Valley
_____ Side-Hill
x_____ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height 40 feet Embankment Material Earth
Pool Area 58 acres Liner none
Current Freeboard approx. 7 feet Liner Permeability d/n/a

TYPE OF OUTLET (Mark all that apply)

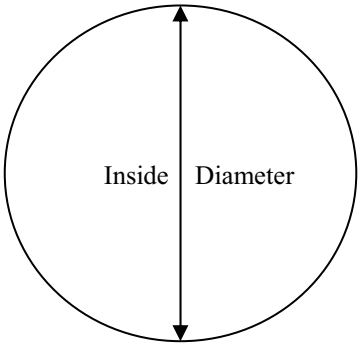
d/n/a **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

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



x **Outlet**

30 inside diameter



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

_____

Is water flowing through the outlet? YES _____ NO x

_____ **No Outlet**

_____

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

The Impoundment was Designed By Cincinnati Gas and Electric (CG&E)

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 :