Final Report

Dam Safety Assessment of CCW Impoundments

Reid/Green/HMP&L Station II Report

Lockheed Martin
Contractor for the USEPA

December 2009

O'BRIEN & GERE

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1. Introduction

1.1. General

In response to the coal combustion waste (CCW) impoundment failure at the TVA/Kingston coal-fired electric generating station in December of 2008, the U. S. Environmental Protection Agency has initiated a nationwide program of structural integrity and safety assessments of coal combustion waste impoundments or "management units". A CCW management unit is defined as a surface impoundment or similar diked or bermed management unit or management units designated as landfills that receive liquid-borne material and are used for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. Management units also include inactive impoundments that have not been formally closed in compliance with applicable federal or state closure/reclamation regulations. The administration of this program is being supported by Lockheed Martin, who has authorized O'Brien & Gere to provide actual site specific impoundment assessments at selected facilities. This project is being conducted in accordance with the terms of our Purchase Order No. 7100051854, dated May 29, 2009, as amended on September 23, 2009.

1.2. Project Purpose and Scope

The purpose of this work is to provide Dam Safety Assessment of CCW management units, including the following:

- Identify conditions that may adversely affect the structural stability and functionality of a management unit and its appurtenant structures
- Note the extent of deterioration, status of maintenance, and/or need for immediate repair
- Evaluate conformity with current design and construction practices
- Determine the hazard potential classification for units not currently classified by the management unit owner or by state or federal agencies

O'Brien & Gere's scope of services for this project includes performing a site specific dam safety assessment of all CCW management units at the subject facility. Specifically, the scope includes the following tasks:

- Perform a review of pertinent records (prior inspections, engineering reports, drawings, etc.) made available at the time of the site visit to review previously documented conditions and safety issues and gain an understanding of the original design and modifications of the facility.
- Perform a site visit and visual inspection of each CCW management unit and complete the visual inspection checklist to document conditions observed.
- Perform an evaluation of the adequacy of the outlet works, structural stability, quality and adequacy of the management unit's inspection, maintenance, and operations procedures.
- Identify critical infrastructure within 5 miles down gradient of management units.
- Evaluate the risks and effects of potential overtopping and evaluate effects of flood loading on the management units.
- Immediate notification of conditions requiring emergency or urgent corrective action.

- Identify all environmental permits issued for the management units
- Identify all leaks, spills, or releases of any kind from the management units within the last 5 years.
- Prepare a report summarizing the findings of the assessment, conclusions regarding the safety and structural integrity, recommendations for maintenance and corrective action, and other action items as appropriate.

This report addresses the above issues for the Reid/HMPL Station Ash Pond and the Green Station Ash Pond at the Reid/Green/HMPL Station II in Robards, Kentucky. The above impoundments are owned and operated by Big Rivers Electric Corporation. In the course of this assessment, we obtained information from representatives of Big Rivers Electric Corporation, Kentucky Department for Environmental Protection (KDEP), and Associated Engineers, Inc.

2. Project/Facility Description

The Reid/Green/HMPL Station II is located at 9000 Highway 2096 in Robards, Kentucky. A Site Location Map is included as Figure 1. The coal-fired power station includes the Reid Station generating unit (72 MW, commercial operation 1966), the HMPL Station II with 2 units (Unit H1, 165 MW, commercial operation 1973 and Unit H2, 172 MW, commercial operation 1974), and the Green Station with 2 units Unit G1, 250 MW, commercial operation 1979 and Unit G2, 242 MW, commercial operation1981). Coal combustion waste that is produced during power generation is managed on-site with two CCW impoundments and a "dry" landfill. All of the units are equipped with flue-gas desulphurization (FGD) scrubbers, which help to remove emissions such as sulphur dioxide and nitrous oxide. A byproduct of the emission scrubbing process is synthetic gypsum, which is primarily disposed of in the on-site landfill.

The facility utilizes two impoundments known as the Reid/HMPL Ash Pond and the Green Ash Pond for CCW management. This safety assessment report summarizes the September 2009 inspection of these management units at the Reid/Green/HMPL Station II facility.

2.1. Management Unit Identification

The locations of the two CCW impoundments inspected during this safety assessment are identified on Figure 2 – Facility Layout Plan.

2.1.1. Reid/HMPL Ash Pond

The Reid/HMPL Ash Pond is located on the north side of the power plant. The Reid/HMPL Ash Pond carries the following identification numbers:

- Kentucky Department of Environmental Protection (KDEP) state dam identification number #0855
- National Inventory of Dams identification number #KY0855.

The Reid/HMPL Ash Pond was built in 1968, with a vertical expansion in 1971. Coal combustion waste stored in the pond consists of fly ash and bottom ash. Fly ash is no longer sluiced to the Reid/HMPL Ash Pond, as it is currently collected using electrostatic precipitators and placed in the on-site landfill. Bottom ash is sluiced to the pond using water from the Green River. Water that is routed through the pond is discharged into an outlet structure and ultimately back to the Green River.

2.1.2. Green Ash Pond

The Green Ash Pond carries the following identification numbers:

- Kentucky Department of Environmental Protection (KDEP) state dam identification number #0980
- National Inventory of Dams identification number #KY0980.

Bottom ash is sluiced to the Green Ash Pond. The water in the pond is cycled back to the plant via pumps located on the north end of the pond.

2.2. Hazard Potential Classification

The Commonwealth of Kentucky classifies dams or embankments in accordance with the Kentucky Revised Statutes (KRS) and Kentucky Administrative Regulations (KAR). The regulations are administrated by the Kentucky Department for Environmental Protection (KDEP), Division of Water, Dam Safety and Floodplain Compliance Section of the Water Infrastructure Branch. The KRS defines a dam as any structure that is 25 feet in height, measured from the outboard toe to the crest of the dam, or has a minimum impounding capacity of 50 acre-feet or more at the top of the structure (KRS Chapter 151.100).

Dam and embankment hazard classifications are established by the 401 KAR 4:030 and provide standards regarding impoundment facility structure classification from the Division of Water Engineering Memorandum No. 5 (incorporated by reference in 401 KAR 4:030).

> *"In determining structure classification, a number of factors must be considered. Consideration must be given to the damage that might occur to existing and future developments outboard resulting from a sudden breach of the earth embankment and the structures themselves. The effect of failure on public confidence is an important factor. State and local regulations and the responsibility of the involved public agencies must be recognized. The stability of the spillway materials, the physical characteristics of the site and valley outboard, and the relationship of the site to industrial and residential areas all have a bearing on the amount of potential damage in the event of a failure."*

2.2.1. Reid/HMPL Ash Pond

The KDEP has assigned the Reid/HMPL Ash Pond a *moderate* hazard classification, reportedly due to the importance of the structure to the operation of this facility in which a failure of the structure could render the power plant inoperable. A *moderate* hazard classification may be applied for structures located such that failure may cause significant damage to property and project operation, but loss of human life is not envisioned. Such structures will generally be located in predominantly rural agricultural areas where failures may damage isolated homes, main highways or major railroads, or cause interruption of use or service of relatively important public utilities.

The definitions for the four hazard potentials (Less than Low, Low, Significant and High) to be used in this assessment are included in the EPA CCW checklist found in Appendix A. Based on the checklist definitions and as a result of this assessment, the hazard potential rating recommended for the Reid/HMPL Ash Pond is **SIGNIFICANT.** This rating is generally synonymous with the State of Kentucky definition of *moderate* hazard discussed above**.** A failure of embankments impounding the Reid/HMPL Ash Pond could cause significant environmental damage if the CCW was released into the Green River thereby damaging the surrounding area, wildlife and habitat, and threatening the drinking water supplies of the downstream communities. The power station is located in a rural area;

therefore, damage to critical infrastructure or lifeline facilities in the event of a dam failure would likely be limited to the power plant facilities.

2.2.2. Green Ash Pond

The State of Kentucky has classified the Green Ash Pond as a *low* hazard structure. Low hazard dams are structures located such that failure would cause loss of the structure itself but little or no additional damage to other property.

Based on the checklist definitions and as a result of this assessment, the hazard potential rating recommended for the Green Ash Pond is **LOW.** This rating is generally synonymous with the State of Kentucky definition of *low* hazard discussed above**.** A failure of the Green Ash Pond embankments is not likely to cause significant environmental damage to off-site properties or significant economic losses.

2.3. Impounding Structure Details

The following sections summarize the structural components and basic operations of the Reid/HMPL Ash Pond and the Green Ash Pond. The location of these impoundments on the plant grounds is shown on Figure 2. A site plan of the Reid/HMPL Ash Pond and the Green Ash Pond and their relevant features are provided as Figure 3 and Figure 4, respectively. It should be noted that the site plans shown in Figures 3 and 4 are adapted from the original design drawings and may not depict all current features. Additionally, photos taken during the visual inspection are incorporated in a Photographic Log provided as Appendices B and C for Reid/HMPL Ash Pond and Green Ash Pond, respectively.

2.3.1. Embankment Configuration

<u>Reid/HMPL Ash Pond</u>

The Reid/HMPL Ash Pond is a combined incised/diked earthen embankment structure that impounds an area of approximately 20 acres. The Reid/HMPL Ash Pond is diked on the majority of its perimeter except on the north side of the pond where the east and west dikes tie into surrounding grades. The crest is at approximately elevation (EL) 430 feet above mean sea level. The southwest dike is the highest at approximately 39 feet above the outboard toe of slope. The pond bottom (as designed) ranges from EL 403 to EL 388 with a 1 percent sloping grade toward the southwest. The outboard dike slopes were designed at an inclination of 3H:1V with an inboard slope of 2.5H:1V.

<u>Green Ash Pond</u>

The Green Ash Pond is also a combined incised/diked earthen embankment structure. The Green Ash Pond impounds an area of approximately 32 acres. Green Ash Pond is diked on its west, south, and east sides, while the north side is incised below surrounding grades. The crest of the Green Ash Pond dike is at EL 397, and the original pond bottom was at EL 360, which resulted an estimated 15 feet of excavation below original grades. The southern dike is the highest at approximately 21 feet above the outboard toe of slope. The western dike is estimated to be less than 5 feet in height and serves to prevent storm water runoff from entering the pond on the west side. The eastern dike is of variable height with a maximum of about 8 feet. The eastern ash pond dike is buttressed with a secondary

parallel embankment that serves as a 40-foot wide roadway between the power plant and the solid waste landfill. It should also be noted that bottom ash has been allowed to accumulate above the normal pool along the inboard side of the east dike. As such, the southeastern portion of the pond is now essentially reclaimed land. This area is used for stockpiling and loading of excavated bottom ash (See Appendix C – Photo 7). The northern end of the Green Ash Pond is incised below grade. The inboard slopes of the Green Ash Pond were designed at 5H:1V. The outboard slopes were designed at 3H:1V.

As shown in Figure 4, a small impoundment known as the Industrial Waste (IW) Pond is located adjacent to the northeastern corner of the Green Ash Pond. The two impoundments are separated by a divider dike. The IW Pond functions to collect boiler cleaning and precipitator wash down. The IW Pond discharges into the Green Ash Pond through a 10 to 12-inch conduit between the divider dike. The Emergency Slurry Pond is located northeast of the IW pond, is not currently used, and is nearly full of silt from storm water runoff. Both the IW Pond and the Emergency Slurry Pond are incised below surrounding grades, except on portions of their east sides, where a low dike generally less than 8 feet high is present. This dike is buttressed by a parallel 40-foot wide roadway embankment, as described above. It should be noted that the water level in these non-CCW ponds is normally below the downstream toe elevation.

In addition to the impoundments described above, there are three storm water runoff ponds located to the south and east of the Green Ash Pond. These ponds function as storm water runoff sedimentation basins. These ponds were not assessed as part of this CCW impoundment assessment since their purpose is not to store CCW, although some ash fines may be transported by storm water flow into the runoff ponds.

2.3.2. Type of Materials Impounded

Reid/HMPL Ash Pond

Currently, influent into the Reid/HMPL Ash Pond includes water with solids consisting of primarily bottom ash and lesser quantities of miscellaneous fines composed of coal fines, fly ash, and surface runoff silt.

Green Ash Pond

Influent into the Green Ash Pond includes water with solids consisting of primarily bottom ash and lesser quantities of miscellaneous fines composed of coal fines, fly ash, and surface runoff silt. In addition, solid waste processing facility sump discharge is routed to the pond which contains solids in the form of calcium sulfite and calcium sulfate.

2.3.3. Outlet Works

Reid/HMPL Ash Pond

The Reid Ash Pond is an incised/diked impoundment that has been designed to receive sluice flows, plant runoff from specific areas, and direct precipitation. The ash pond outlet structure, located within the southeastern corner of the impoundment, consists of a three-sided concrete weir equipped

with stop logs to govern the water level in the pond (See Appendix B - Photo 1). An aluminum baffle serves to exclude floating debris and cenospheres from the discharge. The effluent discharges into a 24-inch pipe (type unknown, dwgs. indicate "AHBI") that extends below grade toward the east to outfall some distance away into the Green River. The pond discharge to the Green River is permitted under KPDES permit # KY0001929.

Green Ash Pond

The Green Ash Pond operates on a closed-loop system where water in the pond is cycled back to the plant via a pump station located on the north end of the pond. An emergency overflow outlet consisting of dual 30-inch diameter corrugated metal pipes is located at the southwestern corner of the pond (See Appendix C – Photo 3, 4, and 5). The invert elevation of the emergency overflow pipes is about 3 feet below the crest elevation. The pipes extend below grade, across the crest, then emerge above grade and extend down the outboard slope. The pipes discharge onto a riprap apron. Discharge from the emergency outlet pipes flows into a swale that extends parallel to the outboard toe of dike and is ultimately discharged into the Green River.

3. Records Review

A review of the available records related to design, construction, operation and inspection of the Ash Pond was performed as part of this assessment. The documents provided by Big Rivers Electric Corp. are listed below:

Table 3.1 *Summary of Reid/HMPL Ash Pond Documents Reviewed*

Document	Dates	By	Description
Ash Pond Design Drawings	1971	Burns & McDonnell Engineering Co.	Site plan, grading plan, sections and details of Reid/HMPL Ash Pond
Ash Pond Discharge Modification Drawings	1981	Burns & McDonnell	Engineering drawings of outlet structure modifications/improvements
Certificate of Inspection	2004, 2009	Kentucky DEP	State inspection reports
Impoundment Inspection Report	2009	Associated Engineers, Inc.	Visual inspection report by private consultant
Water Flow Diagram	2009	Big Rivers Electric Corp.	Flow chart of plant process and waste water
Response to EPA RFI	2009	Western Kentucky Energy	Utility's response to EPA questionnaire regarding CCW impoundments

Table 3.2 *Summary of Green Ash Pond Documents Reviewed*

Document	Dates	By	Description
Ash Pond Design Drawings	1976-1978	Burns & Roe, Inc.	Site plan, grading plan, sections and details of Green Ash Pond
Impoundment Inspection Report	2009	Associated Engineers, Inc.	Visual inspection report by private consultant
Response to EPA RFI	2009	Western Kentucky Energy	Utility's response to EPA questionnaire regarding CCW impoundments
Water Flow Diagram	2009	Big Rivers Electric Corp.	Flow chart of plant process and waste water

3.1. Engineering Documents

Review of the design drawings revealed information on the design details, construction chronology, and modifications of the Reid/HPML Ash Pond and the Green Ash Pond, which are summarized below.

<u>Reid/HMPL Ash Pond</u>

- The ash pond was originally constructed during the early 1970's at the time of the HMP&L Station II.
- Originally, the ash pond received fly ash and bottom ash. Fly ash was redirected to the on-site landfill in 1980.
- The ash pond dike was originally constructed to a crest elevation of 428 feet above mean sea level (msl). During the 1970's, the dike crest was raised to its current elevation of 430 feet above msl.
- In 1980, a slide on the outboard dike slope occurred; however, no water or CCW was released. The slide occurred along the northwest portion of the dike and resulted in a shallow displacement of the slope that measured approximately 150 feet along the crest. The slide was believed to have

occurred along the interface between the original dike and the additional material that was added to raise the dike in the 1970's. The slide area was repaired and no other slope failures have occurred.

- In the early 1980's, the original outlet structure was abandoned by filling with concrete and the current outlet structure was built as a replacement.
- No information on an engineered pond liner system was noted in the records reviewed; however, we understand from our interviews with plant personnel and their engineering consultant that the soils in the area are primarily clayey soils that have a naturally low permeability.
- The dike section details indicate that clayey soils were to be placed within the inboard slope and core zones with an outboard zone to consist of sandy soils. A sand blanket drain is shown in the outboard third of the base of the dike for the majority of the length of dike (See Figure 5-Typical Cross Sections-Reid/HMPL Ash Pond).
- According to the Ash Pond Dike cross section for Sta. 20+00 to 25+00 on Sheet Y-12-2 of the design drawings (Burns & McDonnell, 1974), a 500 ft. section of dike located within the southwest corner, at the original outlet structure location, is designed with a crushed stone layer topped with a sand layer that extends across the entire width of the dike cross section. We do not understand the function of this layer, as we would expect it to perform as a low-level drain that would cause the pond to seep excessively. The intent of this gravel and sand layer may have been to alleviate uplift water pressures on the base of the clay embankment; however, this highly permeable layer would be expected to carry significant seepage flows under the dike, because it daylights on the upstream face of the dike and extends to the downstream toe, as illustrated.
- No design or as-built geotechnical information was provided in the records reviewed.
- No slope stability analyses, hydrologic, or hydraulic analyses were provided in the records reviewed.
- A water flow diagram for the power plant was provided, which indicates normal and maximum design flows for the various water management systems in use at the facility.
- The design drawings indicate that the existing embankments were founded on native soils.
- No indication or mention of ash, coal slimes, or other CCW by-products within the dikes or dike foundations was noted in our review of the engineering records listed above.
- No indication of former spills or releases of impounded materials from the Ash Pond was noted in the records reviewed.

Green Ash Pond

- The Green Ash Pond was constructed during construction of the Green generating unit in 1979.
- The ash pond was designed by Burns & Roe.
- The pond has always been utilized to store bottom ash.
- No information on an engineered pond liner system was noted in the records reviewed; however, we understand from our interviews with plant personnel and their engineering consultant that the soils in the area are primarily clayey soils that have a naturally low permeability.
- The ash pond has not undergone any significant modifications since original construction.
- No design or as-built geotechnical information was provided in the records reviewed.
- No slope stability analyses, hydrologic, or hydraulic analyses were provided in the records reviewed.
- A water flow diagram for the power plant was provided, which indicates normal and maximum design flows for the various water management systems in use at the facility.
- The design drawings indicate that the existing embankments were founded on native soils.

- No indication or mention of ash, coal slimes, or other CCW by-products within the dikes or dike foundations was noted in our review of the engineering records listed above.
- No indication of former spills or releases of impounded materials from the Ash Pond was noted in the records reviewed.

3.1.1. Stormwater Inflows

Stormwater inflows to both the Reid/HMPL and the Green Ash Ponds are minimal. The impounding structures are comprised of diked embankments on three sides which direct storm water away from the impoundment and limit runoff to that which falls directly on the water surface and crest of the dikes. The land area to the north of both ponds is separated from the pond by a ditch or swale that directs runoff away from the north end of the ponds.

3.1.2. Stability Analyses

As mentioned above, no geotechnical reports or records of design or as-built slope stability analyses were provided in the records made available by Big Rivers Electric Corporation. Based on our discussion with plant personnel, geotechnical/slope stability records are either non-existent or could not be located in preparation for our visit. We did not observe any indications of slope distress during our visual inspection of both ponds.

3.1.3. Modifications from Original Construction

Reid/HMP&L Ash Pond

As noted above, the Reid/HMPL Ash Pond has undergone some modification since original construction. In the 1970's, the crest of the ash pond was raised approximately 2 feet from EL 428 feet msl to 430 feet msl. In addition, the original outlet structure was abandoned in place in the early 1980's and replaced with the current outlet structure.

Green Ash Pond

Based on the records review and discussions with plant personnel, the Green Ash Pond has not undergone any significant modifications since its original construction. We do note that the freeboard portion of the south dike was armored with riprap several years after original construction to protect the exposed inboard slope from wave action.

3.1.4. Instrumentation

No instrumentation is present at either of the two ponds.

3.2. Previous Inspections

Reid/HMPL Ash Pond

KDEP Dam Safety personnel have been performing regular dam safety inspections of the Reid/HMPL Ash Pond since 1984. State inspections were subsequently completed in 1988, 1989, 1992, 1994, 1996, 1998, 2000, 2002, 2004, and 2006. The most recent state inspection was performed on May 7, 2009. A copy of the 2009 and 2004 inspections were provided with the other documentation. A summary of deficiencies cited in the previous state inspection reports is provided below:

Date of State Inspection	Findings (deficiencies)
May 2009	Mow slopes, monitor seepage with v-notch weir
October 2004	A small rut or an old slide on the right side of the downstream slope needs to be monitored

In June of 2009, Western Kentucky Energy retained Associated Engineers, Inc. to perform an independent impoundment inspection of the Reid/HMPL Ash Pond. This inspection report cited the following observations and recommendations:

- Seepage from the sand fill underdrain at the outboard toe was observed to be clear. Rate noted as "trickle".
- Erosion problems noted on downstream slope near cooling tower (east side)
- Three feet of freeboard was provided above the normal pond water level
- Area of ponded water created by ash berm near NE corner should be investigated to ensure water level is not above existing ground level/crest elevation.
- Plans for repairs to deficient conditions cited in the report are underway.

Based on our conversations with Mr. David Lamb, PE of Associated Engineers, Inc., plans are underway to repair the erosion problems on the east outboard slope.

Green Ash Pond

KDEP Dam Safety personnel have been performing regular dam safety inspections of the Green Ash Pond since 1983. State inspections were subsequently completed in 1989, 1993, 1998, 2003, and 2008. Based on conversations with a Kentucky Dam Safety engineer, no serious deficiencies have been identified for the Green Ash Pond. We understand that previous corrective action recommendations included repairs of wave action erosion on portions of the northern inboard slope. Based on our observations at the site, the portions of the inboard slope subject to wave action have been armored with riprap.

In June of 2009, Western Kentucky Energy retained Associated Engineers, Inc. to perform an independent impoundment inspection of the Green Ash Pond. This inspection report cited the following observations and recommendations:

- Erosion occurring on the western inboard slope, where no riprap armoring is present

- Standing water impounded at the toe of the western and southern outboard slopes (due to poor drainage, not seepage)
- Emergency overflow corrugated metal pipes are deteriorated and partially obstructed at the discharge end.
- Plans for repairs of deficient conditions noted in the report are underway.

Based on our conversations with Mr. David Lamb, PE of Associated Engineers, Inc., plans are underway to repair the erosion problems on the western inboard slope and to repair the emergency overflow pipes.

3.3. Operator Interviews

Numerous plant and corporate personnel took part in the inspection proceedings. The following is a list of participants for the inspection of the Reid/HMPL Ash Pond and the Green Ash Pond:

Table 4 *List of Participants*

Name	Affiliation	Title
Thomas L. Shaw	Big Rivers Electric Corp.	Manager-Environmental Services
Edwin N. Chisholm	Big Rivers Electric Corp.	Senior Engineer
Keith Ballard	Big Rivers Electric Corp.	Performance/Environmental Specialist
Ken Brooks	Henderson Municipal Power & Light	Power Plant Coordinator
David A. Lamb, PE	Associated Engineers, Inc.	President
Scott Phelps, PE	Kentucky DEP	Supervisor
Javier Garcia	EPA	Environmental Engineer
Dreher Whetstone, PE	O'Brien & Gere	Technical Associate
Timothy W. Kraus, PE	O'Brien & Gere	Vice President

Facility personnel provided a good working knowledge of both the Reid/HMPL Ash Pond and the Green Ash Pond, provided general plant operation background and provided requested historical documentation. In addition to the facility personnel, the plant's engineering consultant and the Kentucky DEP representative was present to provide additional information from previous impoundment inspections. These personnel also accompanied O'Brien & Gere and EPA staff throughout the visual inspections to answer questions and to provide additional information as needed in the field.

4. Visual Inspection

The following sections summarize the inspection of the Reid/HMPL Ash Pond and the Green Ash Pond, which occurred on September 17, 2009. At the time of the inspection, O'Brien & Gere completed an EPA inspection checklist for each ash pond, which was submitted electronically to EPA on September 28, 2009. A copy of the completed inspection checklist is included as Appendix A.

4.1. General

The weather on the dates of the inspection was clear and approximately 80 degrees. The visual inspection consisted of a thorough site walk along the perimeter of both ash ponds. O'Brien & Gere team members made observations along the toe, outboard slope, and crest of the embankments, and along exposed portions of the inboard slopes. We also observed the inlet/outlet structures and current operation.

Photos of relevant features and conditions observed during the inspection were taken by O'Brien & Gere and are provided in Appendix B and C for the Reid/HMPL Ash Pond and the Green Ash Pond, respectively. Site Plans of the Reid/HMPL Ash Pond and the Green Ash Pond are presented as Figure 3 and 4, respectively, which provide photograph locations and directions.

4.2. Summary of Findings

<u>Reid/HMPL Ash Pond</u>

The following observations were made during the inspection:

- Sluiced CCW by-product discharge enters the pond near the northeast corner and is routed to the south end of the pond through a shallow ditch that has been excavated into the accumulated bottom ash deposits (Appendix B –Photo 5).
- The CCW has accumulated above the normal pool level over an estimated 40 percent of the pond area. Water in the pond is isolated to primarily the southern half of the pond.
- The outboard slope and crest were covered with well maintained grass. The crest has been rutted by the mowing tractor in a few isolated locations.
- Minor seepage was evident along the toe of the outboard southern and western slopes. The seepage rate was very low with no discernible flow. Seepage was observed to accumulate in rutted areas at the toe of slope created by the mowing tractor. The seepage is believed to be controlled discharge from the sand toe drain.
- A combination of seepage and poor drainage has resulted in areas of soft, wet soils along the toe of the outboard slope. The mowing tractor has created ruts due to the weak soils.
- A few small animal burrows were noted on the outboard slopes of the southern and western embankments.
- Several short, wooden poles similar to power line poles were observed to be embedded vertically into the outboard slope.

- Vegetative cover on the eastern outboard slope is poor, and is experiencing erosion problems, as a result. We also understand that portions of the eastern outboard slope along the cooling towers were excavated to a relatively steep grade to provide crane access between the cooling tower and the toe of slope (Appendix B – Photo 7).
- A mature willow tree is growing on the eastern crest and/or inboard slope.
- The outlet structure appeared to be in good condition and functioning normally (Appendix B – Photo 1).

Although the northwestern outboard slope of the ash pond has experienced a shallow slope slide in the past, the triggering mechanism that appears to have caused this slide was an isolated case, which has been corrected, based on a nearly 30-year history of incident-free performance. Based on our conversations with plant personnel, no releases have occurred from the Reid/HMPL Ash Pond impoundment. Aside from the slope slide repairs cited above, no other patchwork on the embankments appears to have been performed.

Green Ash Pond

The following observations were made during the visual inspection:

- The inboard slopes along portions of the pond were overgrown with reedy grasses such as fragmites (Appendix C – Photo 2).
- Some erosion of the exposed inboard slopes was observed along the west side of the pond.
- The inboard slopes along the south end of the pond are armored with riprap to protect against wave action (Appendix C – Photo 3).
- Standing water (less than 6-inches deep) was observed within poorly drained swales along the western and southern embankment toe. The source of this water appears to be storm water and not seepage from the impoundment.
- The dual 30-inch emergency overflow pipes (CMP) located at the southwestern corner of the ash pond were observed to be deteriorated and damaged. These pipes were partially obstructed with silt at the discharge end. Our observations of the pipes indicated that they are rarely used (Appendix C – Photos 4 and 5).
- The crest and outboard slopes appeared to be covered with well-maintained grass and in good condition (Appendix C – Photo 6).
- Bottom ash has accumulated above the normal pool elevation in much of the eastern portion of the pond. This area is used to stockpile excavated bottom ash which is allowed to drain, then loaded on trucks and hauled to the landfill located south of the ash pond. (Appendix C – Photo 7).
- The sluice pipes discharge flow into the pond near the northeastern corner (Appendix C – Photo 8).
- A pump station is located at the north end of the ash pond, which recycles water from the pond back to the plant ash sluicing system (Appendix C – Photo 9).

Based on our conversations with plant personnel, no releases have occurred from the Green Ash Pond impoundment. No patchwork on the embankments appears to have been performed.

5. Conclusions

Reid/HMPL Ash Pond

Based on the ratings defined in the RFP (Satisfactory, Fair, Poor and Unsatisfactory), the information reviewed and the visual inspection, the overall condition of the Reid/HMPL Ash Pond is considered to be **FAIR**. Acceptable performance is expected under all loading conditions; however, some minor deficiencies exist that require repair and/or additional studies or investigations. The deficiencies include the following:

- The eastern outboard slope has been impacted by excavation which has resulted in a steep slope with poor vegetative cover that has experienced significant erosion.
- Minor seepage is discharging from toe drains. The toe area is poorly drained which has resulted in soft, wet soils and ponding water along portions of the toe.
- Significant rutting is occurring along the toe of the south and west outboard slopes due to mower traffic over soft, wet areas described above.
- A mature tree is growing on the crest of the east embankment.

Other than the conditions cited above, the owner has implemented regular inspections and maintenance which enable the impoundment to be kept in good working order. We understand through our on-site conversations with the utility representatives and their engineering consultant that plans are in development to address the deficiencies cited above. In addition to the physical deficiencies, we also noted that no geotechnical data or associated slope stability analyses are on record for the earth dike. Completion of these additional studies for critical slopes (highest and steepest) should be considered, to formally document the stability of the earth structure in accordance with applicable safety criteria for earth dams.

Our interviews with plant engineering personnel responsible for the operation of the impoundment indicate that a regular operations plan is in use at the Reid/HMPL facility. The regular operating procedures of the facility do not appear to be impacting the structural integrity of the impounding embankments. The isolated case of excavation of the outboard slope of the east embankment to provide for crane access was a risky action. Modification of the dike of any kind should be supported with engineering analyses to ensure that such modifications will not impact the stability of the embankment.

The plant engineering staff maintains all design documents and inspection reports in a well organized manner. The plant participates in and cooperates with regular state inspections. The plant operations personnel have received training in dam safety inspections and will implement monthly internal inspections, supported by periodic inspections by a private consultant. Based on these findings, we are of the opinion that the operations and maintenance procedures being practiced at the Reid/HMPL Ash Pond are adequate, although we recommend additional maintenance/improvement actions be implemented to correct some of the conditions observed.

Green Ash Pond

Based on the ratings defined in the RFP (Satisfactory, Fair, Poor and Unsatisfactory), the information reviewed and the visual inspection, the overall condition of the Green Ash Pond is considered to be **FAIR**. Acceptable performance is expected under all loading conditions; however, some minor deficiencies exist that require repair and/or additional studies or investigations. The deficiencies include the following:

- The west inboard slope is experiencing erosion due to wave action.
- The emergency outlet pipes are deteriorated and obstructed at the downstream end.

Other than the conditions cited above, the owner has implemented regular inspections and maintenance which enable the impoundment to be kept in good working order. We understand through our on-site conversations with the utility representatives and their engineering consultant that plans are in development to address the deficiencies cited above. In addition to the physical deficiencies, we also point out that no geotechnical data or associated slope stability analyses are on record for the earth dike. Completion of these additional studies for critical slopes (highest and steepest) should be considered, to formally document the stability of the earth structure in accordance with applicable safety criteria for earth dams.

Our interviews with plant engineering personnel responsible for the operation of the impoundment indicate that a regular operations plan is in use at the Green Ash Pond facility. The regular operating procedures of the facility do not appear to be impacting the structural integrity of the impounding embankments.

The plant engineering staff maintains all design documents and inspection reports in a well organized manner. The plant participates in and cooperates with regular state inspections. The plant operations personnel have received training in dam safety inspections and will implement monthly internal inspections, supported by periodic inspections by a private consultant. Based on these findings, we are of the opinion that the operations and maintenance procedures being practiced at the Green Ash Pond are adequate, although we recommend additional maintenance/improvement actions be implemented to correct some of the conditions observed.

6. Recommendations

Based on the findings of our visual inspection and review of the available records for the Reid/HMPL Ash Pond and the Green Ash Pond, O'Brien & Gere recommends that additional maintenance of the embankments be performed to correct the erosion, drainage, and other miscellaneous deficiencies cited above.

6.1. Urgent Action Items

None of the recommendations are considered to be urgent, since the issues noted above do not appear to threaten the structural integrity of the dam in the near term.

6.2. Long Term Improvement

The deficient conditions observed during the inspection do not require immediate attention, but should be implemented in the near future as part of a regular maintenance plan. The recommended maintenance/improvement actions are provided below, along with Big Rivers Electric's plans to address these recommendations:

Reid/HMPL Ash Pond

- Crest – fill ruts on crest and re-establish vegetative cover. We understand from the utility representative that the ruts have been filled with crushed stone to provide support for vehicles.
- Inboard slopes – repair eroded inboard slopes. Repairs should be completed in accordance with an engineered design. Inspect and maintain erosion that may develop on freeboard section of all inboard slopes on a regular basis. Keep vegetation under control to allow for visual inspection of the exposed portion of the slope above the waterline. We understand that these issues are currently being evaluated by the utility's engineering consultant.
- Outboard slopes – restore the eastern slope to its design inclination and re-vegetate. The slope restoration should be performed in accordance with an engineered design with reference to the original design. Remove wooden poles embedded in slope and backfill with compacted fill consistent with the original design. We understand that an engineering specification for the slope repairs has been prepared and a solicitation for bids has been issued. The poles will be removed and the holes backfilled.
- Outboard toe – re-grade the swale along the toe to improve drainage. The swale may need to be lined with alternate materials, such as crushed stone or concrete to alleviate the soft soil condition. Consider installing a V-notch weir to monitor seepage flow rate. Remove wooden poles and fill with compacted material consistent with the dike design. We understand that the utility is planning to re-grade the swale to improve drainage, and will consider installing a weir.
- Additional studies – perform geotechnical investigation, cross-sectional topographic survey, and slope stability analyses of critical slopes. Install piezometers to check phreatic levels within the embankment. Analyze for normal pool with steady state seepage, maximum surcharge pool, and seismic loading conditions. The utility has requested a proposal to complete these recommended action items and will establish an implementation schedule upon review of the proposal.

Green Ash Pond

Inboard slopes – repair eroded inboard slopes. Repairs should be completed in accordance with an engineered design. Inspect and maintain erosion that may develop on freeboard section of all inboard slopes on a regular basis. Keep vegetation under control to allow for visual inspection of the exposed portion of the slope above the waterline**.** We understand that these issues are currently being evaluated by the utility's engineering consultant.

- Emergency outlet – replace emergency overflow outlet pipes. Repairs should be completed in accordance with an engineered design. We understand that a repair design has been completed and bids are being solicited to complete the repairs, which is expected to be complete by the end of 2010.
- Outboard toe – re-grade poorly drained swale along west and south toe to reduce ponding stormwater. We understand that the utility plans to complete the re-grading by the end of 2010.
- Additional studies – perform geotechnical investigation, cross-sectional topographic survey, and slope stability analyses of critical slopes. Install piezometers to check phreatic levels within the embankment. Analyze for normal pool with steady state seepage, maximum surcharge pool, and seismic loading conditions. The utility has requested a proposal to complete these recommended action items and will establish an implementation schedule upon review of the proposal.

6.3. Monitoring and Future Inspection

O'Brien & Gere recommends continued participation in state biennial inspections. Consideration should also be given to independent inspections, such as the one conducted by Associated Engineers, Inc., by licensed dam safety engineers on at least a biennial basis. Consideration should be given to development of an O&M Plan that would establish a firm schedule for operations, maintenance, and inspection activities.

6.4. Time Frame for Completion of Repairs/Improvements

The majority of the identified deficiencies for both ponds were noted in the previous impoundment inspections by Associated Engineers, Inc. Based on our conversations with representatives of Big Rivers Electric and Associated Engineers, Inc. engineering designs for items such as erosion repairs, Reid/HMPL Pond east slope repair, and emergency overflow outlet pipe restoration are currently underway and are expected to be implemented upon completion of the design. We recommend that the owner continue toward this schedule as planned. We recommend that the other improvements and stability analyses recommended above be completed prior to the next scheduled inspection by KDEP, or by the end of 2010. The results of the stability analyses should be provided to KDEP for review and formal filing.

6.5. Certification Statement

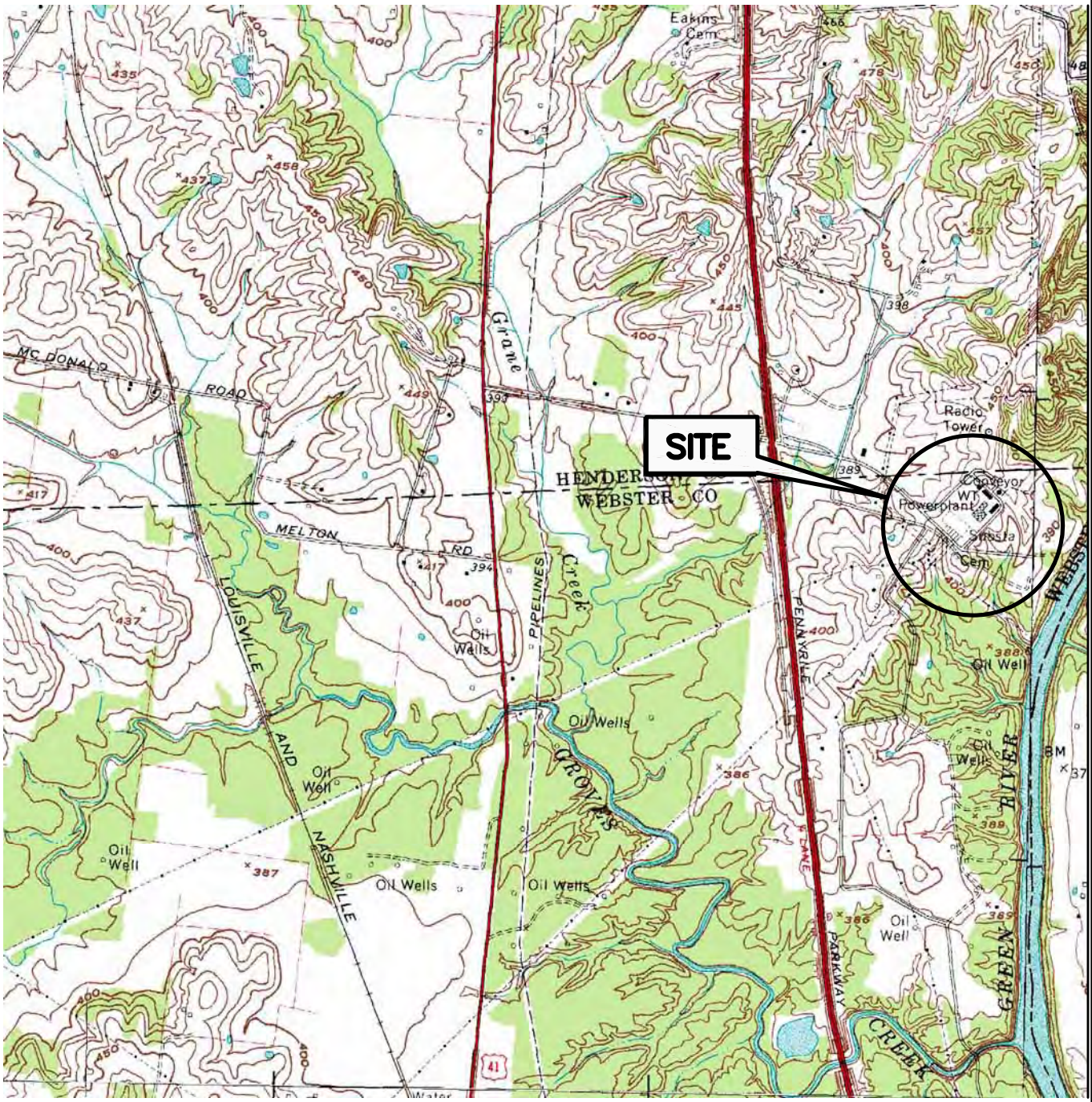
I acknowledge that the Reid/HMPL Ash Pond and the Green Ash Pond CCW management units referenced herein were personally inspected by me on September 17, 2009 and were found to be in the following condition:

~~SATISFACTORY~~
FAIR
~~POOR~~
~~UNSATISFACTORY~~

Signature: Date: December 9, 2009

Timothy W. Kraus, PE
KY PE # 16209

FIGURE 1



ADAPTED FROM: ROBARDS QUADRANGLE, KENTUCKY U.S.G.S. 7.5 MIN. QUAD

REID/GREEN/HMPL STATION II
ROBARDS, KENTUCKY

QUADRANGLE LOCATION

SITE LOCATION MAP

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

FILE NO. 5851.44642-REID-001 SCALE: 1:24000

OCTOBER 2009

O'BRIEN & GERE

2009 © O'Brien & Gere Engineers, Inc.

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FIGURE 2

PLANT NORTH

TRUE NORTH

US EPA &
LOCKHEED MARTIN

COAL COMBUSTION WASTE
IMPOUNDMENT INSPECTIONS
REID/GREEN/HMPL STATION II
ROBARDS, KENTUCKY

FACILITY
LAYOUT MAP

1"=800' 800 0 800

FILE NO. 5851/44642-REID-002
OCTOBER 2009

O'BRIEN & GERE

2009 © O'Brien & Gere Engineers, Inc.

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6/30/09

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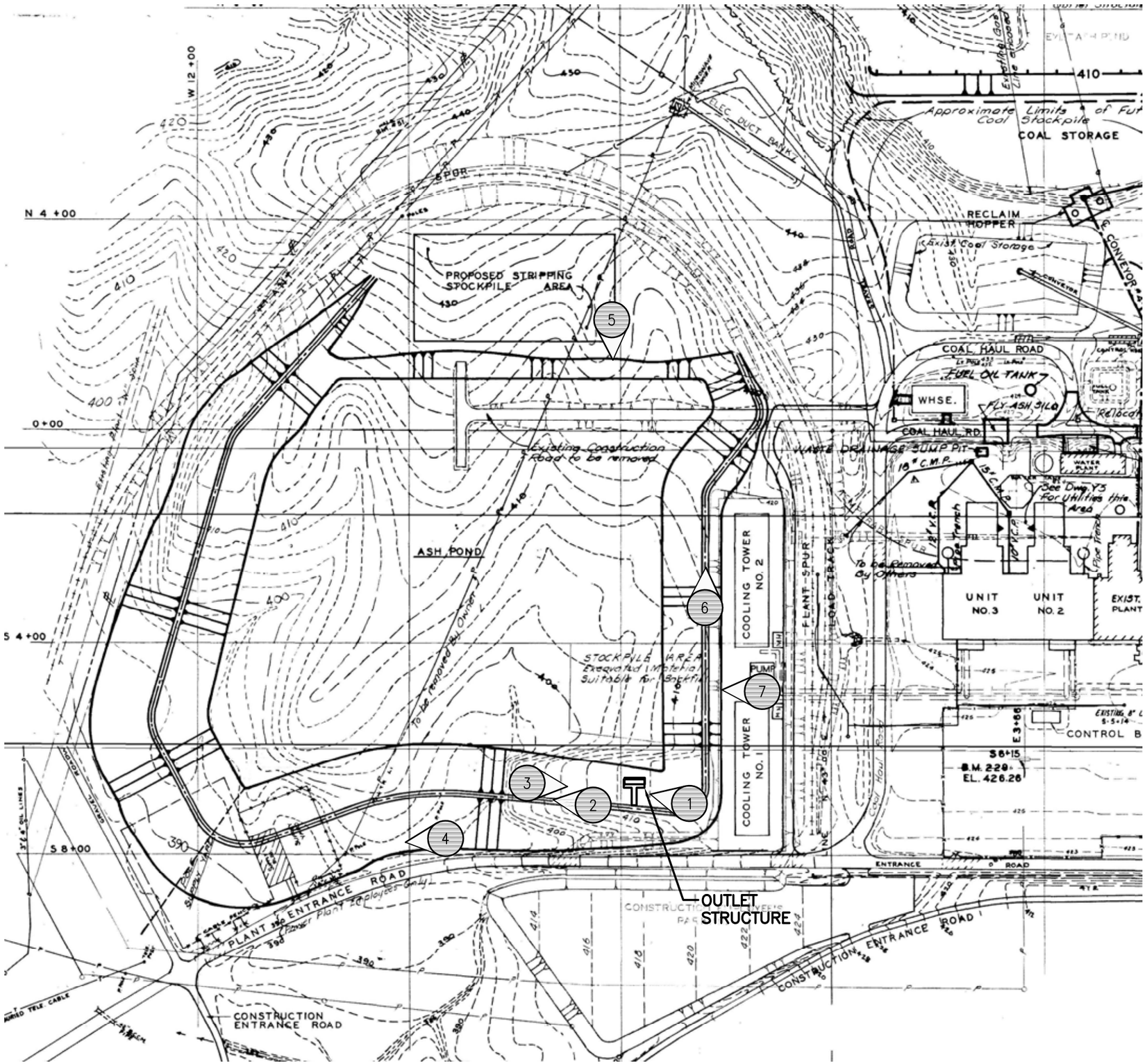
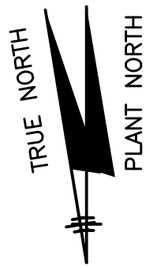


FIGURE 3



LEGEND:

1 PHOTOGRAPH LOCATION/DIRECTION

REFERENCE:
BASE MAP TAKEN FROM DRAWING TITLED "SITE PLAN" BY BURNS & McDONNELL ENGINEERING CO., KANSAS CITY, MISSOURI, DRAWING NO. YI-3, SHEET 1 OF 30, REVISION 3, DATE UNKNOWN.

US EPA &
LOCKHEED MARTIN

COAL COMBUSTION WASTE IMPOUNDMENT INSPECTIONS
REID/GREEN/HMPL STATION II
ROBARDS, KENTUCKY

REID/HMPL ASH POND SITE PLAN

1"=200' 200 0 200

FILE NO. 5851/44642-006
OCTOBER 2009

O'BRIEN & GERE

2009 © O'Brien & Gere Engineers, Inc.

07/09/09

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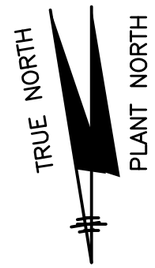
FIGURE 4



LEGEND:

1 PHOTOGRAPH LOCATION/DIRECTION

REFERENCE:
BASE MAP TAKEN FROM DRAWINGS TITLED "PLAN SITE GRADING" BY BURNS & ROE, INC., ENGINEERS & CONSTRUCTORS, ORADELL, NEW JERSEY; DRAWINGS C013, REV. 9, DATED 3/22/96 AND C014, REV. 6, DATED 7/20/93.

US EPA &
LOCKHEED MARTIN

COAL COMBUSTION WASTE IMPOUNDMENT INSPECTIONS
REID/GREEN/HMPL STATION II
ROBARDS, KENTUCKY

GREEN ASH POND SITE PLAN

1"=200' 200 0 200

FILE NO. 5851/44642-005
OCTOBER 2009

O'BRIEN & GERE

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10/20/09

APPENDIX A

Visual Inspection Checklist

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: Reid/Green/HMPL STA. II

Date: 09-17-09

Unit Name: Reid/HMPL STA. II Ash Pond

Operator's Name: Big Rivers Electric Co.

Unit I.D.: KY Dam No. 0855

Hazard Potential Classification: High Significant Low

Inspector's Name: D. Whetstone, PE / Tim Kraus, PE

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?	Monthly		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	427+/-		19. Major erosion or slope deterioration?	X	
3. Decant inlet elevation (operator records)?	N/A		20. Decant Pipes: N/A		
4. Open channel spillway elevation (operator records)?	427+/-		Is water entering inlet, but not exiting outlet?		
5. Lowest dam crest elevation (operator records)?	430		Is water exiting outlet, but not entering inlet?		
6. If instrumentation is present, are readings recorded (operator records)?	N/A		Is water exiting outlet flowing clear?		
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)?	X		From underdrain? Trickle, Clear	X	
9. Trees growing on embankment? (If so, indicate largest diameter below)	X		At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?	N/A		From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?		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?	X	
17. Cracks or scarps on slopes?		X	24. Were Photos taken during the dam inspection?	X	

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

Inspection Issue #	Comments
1)	Prior TVA Kingston failure, internal inspections were periodic and informal/ undocumented.
9)	10-in diameter Willow tree.
19)	Portions of upstream slope are eroded by wave action along freeboard. Plans are in development for repair/armoring.
21)	Source of seepage is likely discharge from toe drain.
23)	Some minor ponding of water at isolated locations along toe of dam. Water is likely a combination of toe drain discharge and ponded stormwater due to poor drainage conditions.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # KY0001929-004

INSPECTOR D. Whetstone, PE/ T. Kraus, PE

Date 09-17-09

Impoundment Name Reid/HMPL STA. II Ash Pond

Impoundment Company Big Rivers Electric Corp.

EPA Region 4

State Agency (Field Office) Addresss Kentucky Dept. of Environmental Protection (Div of Water)
200 Fair Oaks Ln., Frankfort, KY 40601

Name of Impoundment _____

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

New _____ Update _____

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

IMPOUNDMENT FUNCTION: Bottom Ash Storage

Nearest Downstream Town : Name Curdsville, KY

Distance from the impoundment 12.5 miles

Impoundment Location:

Longitude 37 Degrees 44 Minutes 15 Seconds

Latitude 87 Degrees 19 Minutes 52 Seconds

State KY County Daviess

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

If So Which State Agency? KYDEP - Dam Safety And Flood Compliance Section

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.

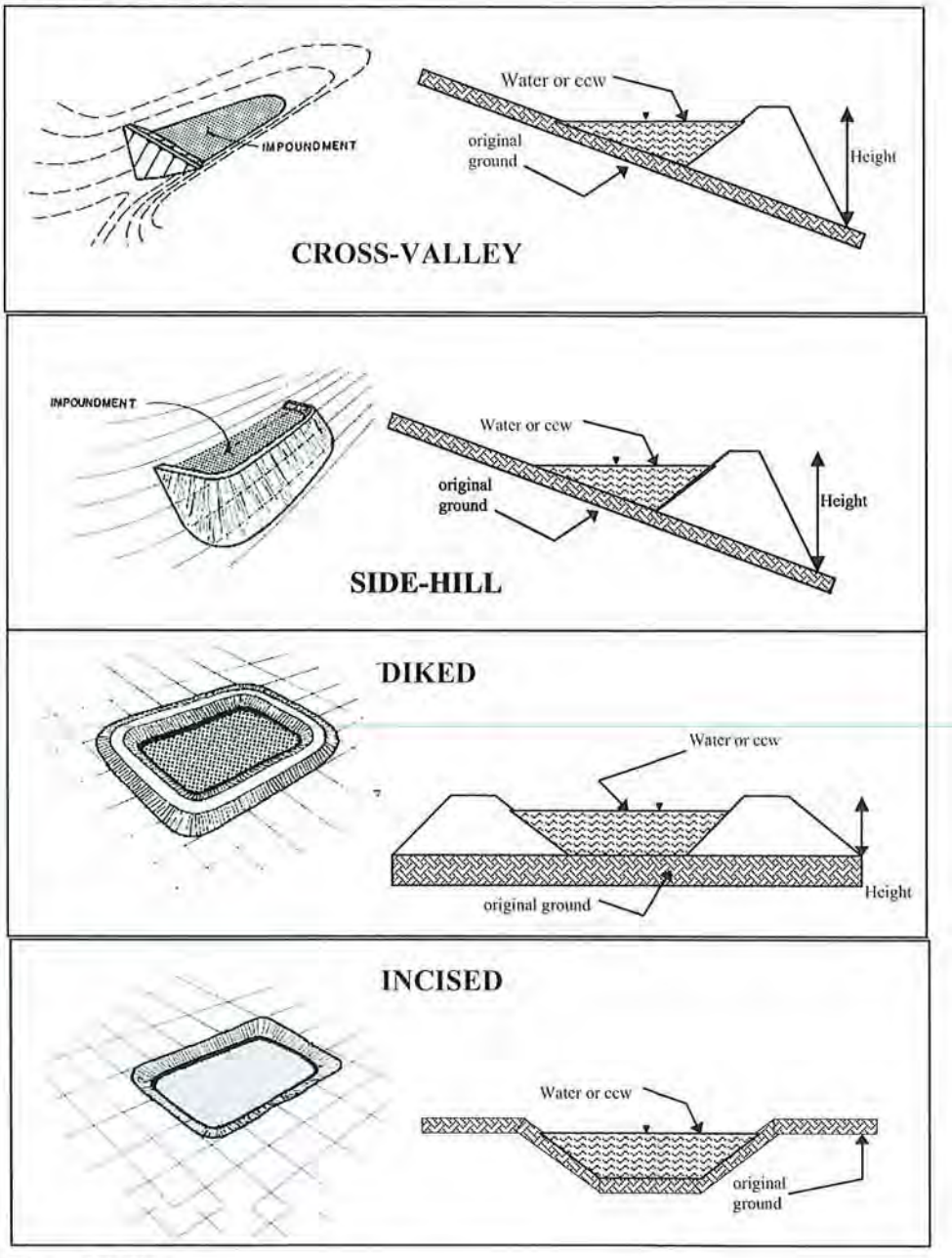
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

Synonymous with State Rating of "Moderate" Hazard Definition.

Potential for Environmental Impact to Downstream Woodlands and Waterways.

Potential for plant shutdown if failure occurs.

CONFIGURATION:



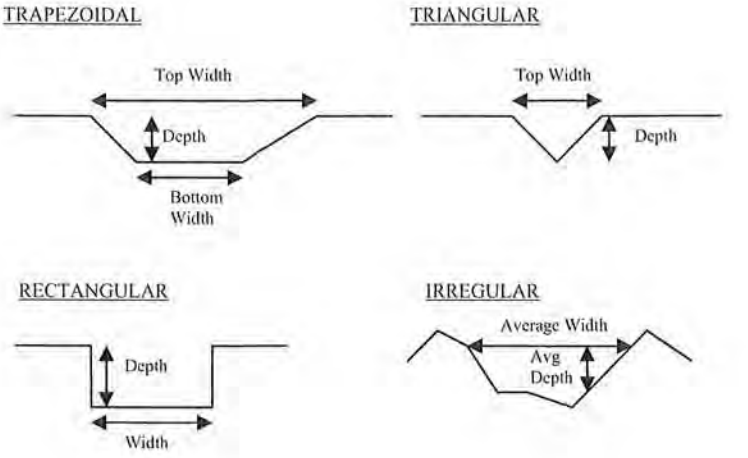
_____ Cross-Valley
__X__ Side-Hill with incised pond bottom
_____ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height 40 feet Embankment Material Clayey Soil
Pool Area 12.4 acres Liner None other than natural clay
Current Freeboard 3 feet Liner Permeability N/A

TYPE OF OUTLET (Mark all that apply)

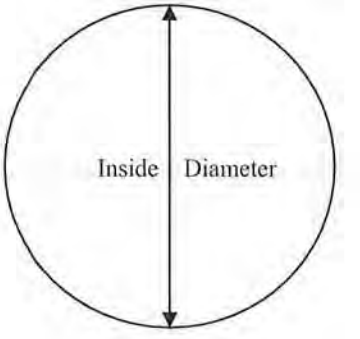
_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

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



X **Outlet**

24" inside diameter



Material
_____ corrugated metal
_____ welded steel
_____ concrete
_____ plastic (hdpe, pvc, etc.)
X other (specify) "AHBI" shown on plan

Is water flowing through the outlet? YES X NO _____

_____ **No Outlet**

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

The Impoundment was Designed By Burns & McDonnell Engineering Co., Mr. H. J. Hanna, P.E. # 5980

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

If So When? 1981

If So Please Describe :

Downstream slope slide on NE side of Pond; 150 ft long along crest; crest dropped about 2 ft where slide occurred. No release of impounded material occurred.

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: Reid/Green/HMPL STA. II

Date: 09-17-09

Unit Name: Green STA. Ash Pond

Operator's Name: Big Rivers Electric Corp.

Unit I.D.: KY Dam No. 0980

Hazard Potential Classification: High Significant Low

Inspector's Name: D. Whetstone, P.E./ Tim Kraus, P.E.

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?	Monthly		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	392		19. Major erosion or slope deterioration?	X	
3. Decant inlet elevation (operator records)?	394.5		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	397		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	N/A		Is water exiting outlet flowing clear?	N/A	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	X		From underdrain?		X
9. Trees growing on embankment? (If so, indicate largest diameter below)		X	At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?		X	From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?	X		Around the outside of the decant pipe?		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?	X	
17. Cracks or scarps on slopes?		X	24. Were Photos taken during the dam inspection?	X	

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

Inspection Issue # Comments

1) Company performed informal/undocumented inspections prior to 2009. Currently, performs monthly formal internal inspections with quarterly inspections by third party engineer.

3) The Green Pond is a closed-loop system where pumps recirculate water back to plant processes. Emergency dual 30-inch CMP decanting pipes are present at SW corner of Pond.

12) No trashracks present, although these are rarely-used emergency overflow pipes.

14) CMP overflow pipes are partially collapsed and obstructed.

15) CMP overflow pipes are deteriorated on bottom and damaged by mowing equipment on top.

~~16) CMP overflow pipes are partially obstructed at discharge point by siltation, an~~ indication of infrequent flow.

19) Upstream freeboard area eroded on west side.

20) No flow through emergency overflow pipes.

23) Some shallow ponding of water due to poor drainage along west and south toe.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # KY 0001929

INSPECTOR D. Whetstone, PE/ T. Kraus, P.E.

Date 09-17-09

Impoundment Name Green Station Ash Pond

Impoundment Company Big Rivers Electric Corp.

EPA Region 4

State Agency (Field Office) Addresss KYDEP - Div of Water
200 Fair Oaks Lane, Frankfort, KY 40601

Name of Impoundment _____

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

New _____ Update _____

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

IMPOUNDMENT FUNCTION: Storage of Bottom Ash

Nearest Downstream Town : Name Curdsville, KY

Distance from the impoundment 12.5 miles

Impoundment Location:

Longitude 37 Degrees 44 Minutes 15 Seconds

Latitude 87 Degrees 19 Minutes 52 Seconds

State KY County Daviess

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

If So Which State Agency? KYDEP - Dam Safety & Flood Compliance Section

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.

_____X_____ **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.

_____ **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.

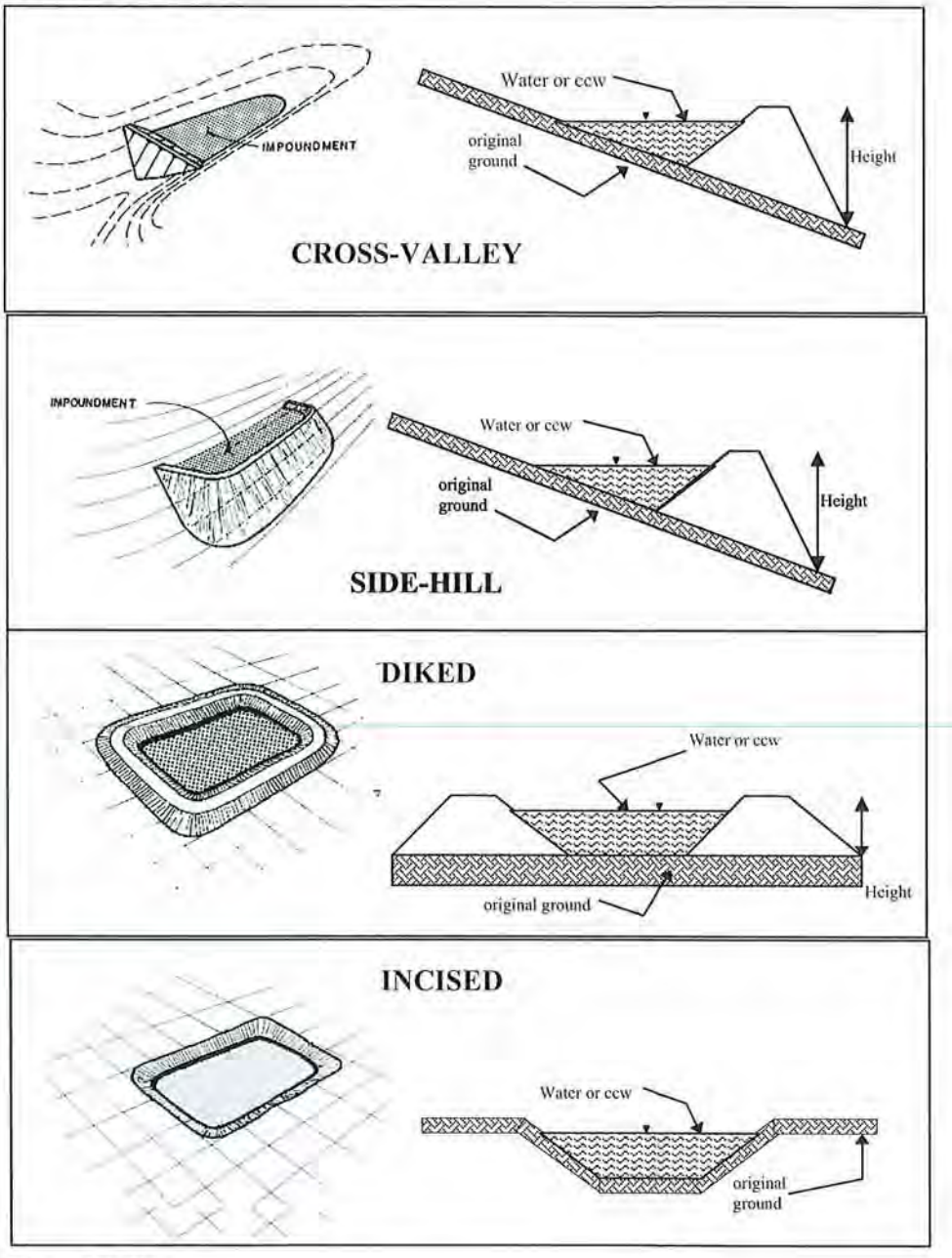
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

Consistent with KY State Rating of Low Hazard.

Releases may be partially contained by downstream stormwater ponds.

Downstream innundation will probably be contained to plant property and not expected to disrupt plant operations, or other critical facilities.

CONFIGURATION:



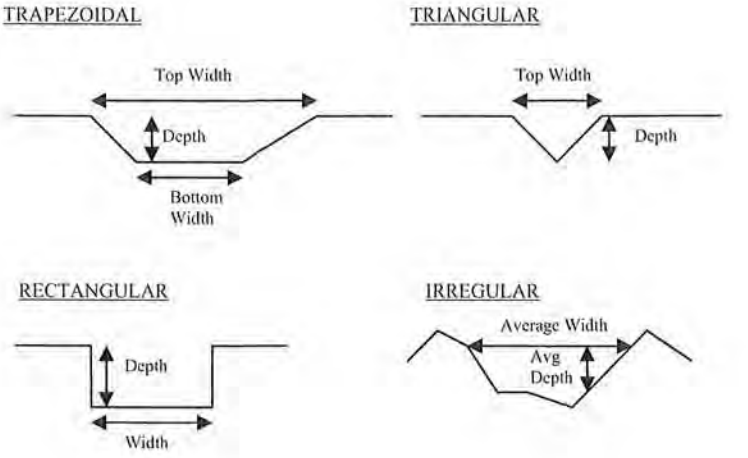
_____ Cross-Valley
__X__ Side-Hill
_____ Diked
__X__ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height 21 feet
Embankment Material Compacted Clay
Pool Area 21.3 acres
Liner Natural Clay
Current Freeboard 4 - 5 feet
Liner Permeability N/A

TYPE OF OUTLET (Mark all that apply)

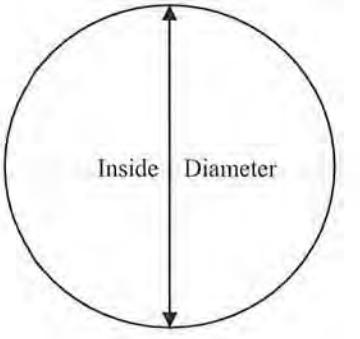
_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

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



X **Outlet**

30" inside diameter (Double)



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

Is water flowing through the outlet? YES _____ NO X

_____ **No Outlet**

X **Other Type of Outlet** (specify) Recirculation Pumps

The Impoundment was Designed By Burns & Roe, Inc. (1978)

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 : _____

APPENDIX B

Photographs-Reid/HMPL Ash Pond

Photo 1 – View of pond outlet structure

Photo 2 – View of south dike crest looking west.

Photo 3 – View along inboard slope of south dike looking east. Note riprap armoring.

Photo 4 – Seepage and rutting along south outboard toe.

Photo 5 – Influent pipe discharging into northern ditch that parallels a portion of the northern inboard slope.

Photo 6 – East dike crest with willow tree.

Photo 7 – East dike outboard slope impacted by excavation and erosion.

APPENDIX C

Photographs-Green Ash Pond

Photo 1 – Typical erosion of inboard slope on west side of pond.

Photo 2 – Crest of low west dike looking south. Note heavy vegetation on inboard slope.

Photo 3 – Riprap-armored inboard slope of south dike. Note emergency overflow pipes in background.

Photo 4 – View of deteriorated 30-inch CMP emergency overflow pipe at upstream end.

Photo 5 – Downstream end of emergency overflow pipes. Note siltation of outlet.

Photo 6 – View along outboard toe of south dike looking east. Note high vegetation in drainage swale beyond the toe.

Photo 7 – View across the pond toward the west from the east side. Land in the foreground is former pond area that has been reclaimed with bottom ash.

Photo 8 – Influent pipes discharging sluiced bottom ash into pond.

Photo 9 – View of pump station on incised inboard slope at the north end of the pond.