ENGINEERS & CONSULTANTS

FINAL REPORT

CCW IMPOUNDMENTS INSPECTION REPORT

BRUCE MANSFIELD POWER PLANT
BEAVER COUNTY, PENNSYLVANIA

PREPARED FOR:

U.S. ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC

UNDER SUBCONTRACT TO:

LOCKHEED MARTIN
EDISON, NJ

Engineering & Construction Management
Hydro-Nuclear-Fossil
Geotechnical Engineering
Seismic and Structural Engineering
Hydrological & Hydraulic Engineering
Tunnel Engineering

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PROJECT NO. 09-4157
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CCW IMPOUNDMENT ASSESSMENT REPORT
BRUCE MANSFIELD POWER PLANT
BEAVER COUNTY, PENNSYLVANIA

1.0 EXECUTIVE SUMMARY

1.1 GENERAL

This Section is a summary of the Independent Engineer's Review of Management Units for the Bruce Mansfield Power Plant. The Report was prepared by Paul C. Rizzo Associates, Inc. (RIZZO) for the United States Environmental Protection Agency (USEPA) under subcontract to Lockheed Martin. This Section summarizes the finding, assessments, conclusions, and recommendations of the Independent Engineer.

The Bruce Mansfield plant is a coal-fired power plant located on the south bank of the Ohio River in Shippingport, Beaver County, Pennsylvania-owned and operated by First Energy Generation Corporation (First Energy). A Site Vicinity map is shown on ***Figure 1-1***, and an aerial photograph of the plant is shown on ***Figure 1-2***. Under normal operating conditions, byproducts of coal combustion, including fly ash, bottom ash, boiler slag, flue gas emission control residuals, and other general wastewater products, are sluiced or trucked into several storage basins east of the plant. The impoundments include a North Low Dissolved Solids Pond (North LDS), a South Low Dissolved Solids Pond (South LDS), and a West High Dissolved Solids Pond (West HDS). An East High Dissolved Solids pond exists at the Site as well, but it was decommissioned in 2003. These ponds are shown on the aerial photograph provided on ***Figure 1-3***. A plan view and typical sections for these impoundments are included on ***Figures 1-4 and 1-5***, respectively. In addition, fly ash and other generation byproducts are pumped seven miles away to the Little Blue Run Dam and Reservoir for permanent disposal. The Little Blue Run impoundment is not addressed in this report.

The impoundments are of a side-hill configuration with the embankments constructed of soil with an asphalt liner. An additional asphalt layer covers the entire crest and downstream slope of the embankments, reducing the potential for vegetation overgrowth, erosion, and provides protection if the impoundment is overtopped. The West HDS pond has a vertical, reinforced concrete wall for the south end of the impoundment. The Ponds have been classified as significant hazard potential structures by the USEPA. Significant hazard potential structures are

classified as structures where failure is not likely to result in loss of life, but may cause significant economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. The predominant risk of failure for the three impoundments is environmental damage.

1.2 SUMMARY OF FIELD INSPECTION FINDINGS

The Site inspection was conducted on September 1, 2009. The inspection team consisted of representatives from First Energy, GAI Consultants, Inc. (GAI), the Pennsylvania Department of Environmental Protection (PADEP), the USEPA, and RIZZO. The team stopped at each of the Project features to inspect the structures and the surrounding area. Particular attention was paid to Site features that may contribute to typical failure modes of embankment structures, such as settlement, seepage, and slope stability. A copy of the USEPA inspection checklists for each impoundment are included in ***Appendix A***.

The North and South LDS Ponds were found to be well-maintained and in good condition at the time of inspection. The embankments were clear of vegetation, and no seepage was observed. The only inflows to the impoundments include the slurry which is pumped in, storm runoff, and a storm sewer discharge from the Coal Handling Area. The decant pipes and intake structures for the two ponds have been deactivated. Minor surface cracks were observed along the top asphalt layer of the crest and downstream slope. This asphalt paving is not of structural importance to the embankment and does not pose a serious concern. In addition, the Owner seals these cracks on a regular basis as part of their maintenance activities. The small concrete spillway between the North and South Ponds showed no deficiency at time of inspection.

The West HDS Ponds was found to be well-maintained and in good condition. No seepage was observed. The only inflow to the impoundment includes the slurry, which is trucked in at the southwest corner and storm runoff. Minor surface cracks were observed along the top asphalt layer of the crest and downstream slope. At the time of inspection, maintenance crews were clearing the downstream slope of some minor vegetation and sealing the surface cracks in the top asphalt layer. This asphalt paving is not of structural importance to the embankment and does not pose a serious concern. The adjacent East HDS Pond was decommissioned in 2003 and is currently used for ammonia tank storage. The small concrete spillway between it and the West HDS Pond has been sealed up and decommissioned. The South concrete wall of the impoundment showed no deficiency at time of inspection.

1.3 SUMMARY OF O&M STATUS

The Project is attended full-time by plant operators and dedicated safety personnel. The current inspection schedule for the structures consists of quarterly inspections by GAI, a third party consultant, and the PADEP performs an inspection every two years. RIZZO and USEPA were provided with a copy of the last five inspections of each of these dams. The facility has storm water drains throughout, but no monitoring wells, piezometers, or other instrumentation has been provided at or around the Ponds.

At the time of inspection, the structures and the Plant appeared to be well maintained and in good working order.

1.4 CONCLUSIONS

1.4.1 Project Description

The Bruce Mansfield Power Plant is a coal-fired power plant constructed in 1974. Coal combustion waste (CCW) byproducts are sluiced to onsite storage ponds, which appear to be well-maintained and operated. The CCW impoundments were constructed at the same time as the plant.

The last major revisions to the CCW storage structures occurred shortly after initial construction, in 1975, with the additional layers of asphalt placed along the crest and slopes. The structures are regulated by the PADEP, the Department of Dam Safety, and the USEPA. Quarterly inspections are performed by an independent consultant, while the state conducts inspections every two years. The impoundments are also subject to a walk through visual inspection by First Energy Site personnel at the beginning of every shift (three 8-hour shifts per day).

1.4.2 Field Inspection

The field inspection was performed in accordance with USEPA guidelines considering typical embankment failure modes. The embankments are in good condition. The asphalt liner along the upstream embankment slope is in good condition and is free of major cracks. No seepage was noted at the time of inspection, and the downstream slopes appear to be well maintained.

Recommendations were developed based on our field observations and our technical review of the Project documentation provided by First Energy and GAI.

1.5 SUMMARY OF RECOMMENDATIONS

The following recommendations result from the document review and field inspection. The Recommendations are summarized below in ***Table 1-1*** and discussed in detail in ***Section 5.0.***

TABLE 1-1
SUMMARY OF RECOMMENDATIONS

NO.	RECOMMENDATION	TIMEFRAME
1	Seal and maintain all asphalt surfaces.	According to First Energy's current Maintenance Plan.

1.6 CERTIFICATION

1.6.1 List of All Field Inspection Participants

The field inspection was conducted on September 1, 2009. The individuals participating in the inspection were:

Robert W. Kish, P.E.	First Energy
Mike Horvath, P.E.	First Energy
Rick Sprecker	First Energy
Stanley P. Michalski	GAI
Phil Glogowski	GAI
Dennis Dickey, P.E.	PADEP – Dam Safety
Roger Adams, P.E.	PADEP – Dam Safety
Paul Minor	PADEP – Waste Management
Diana McDaniel	PADEP – Waste Management
Jesse Miller	USEPA
John P. Osterle, P.E.	RIZZO – Independent Engineer
Kevin R. Cass, P.E.	RIZZO

1.6.2 Signature of Independent Engineer

I acknowledge that the management units referenced herein were personally inspected by me on September 1, 2009 and were found to be in the following condition:

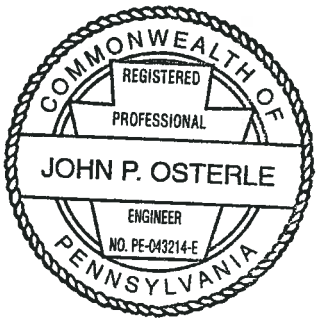
SATISFACTORY

No existing or potential management unit safety deficiencies are recognized. Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable criteria. Minor maintenance items may be required.

Signature

John P. Osterle, P.E.
PA Registration No. PE043214E
Independent Engineer
Paul C. Rizzo Associates, Inc.

1.6.3 PE Stamp



2.0 PROJECT DESCRIPTION

2.1 EXISTING PROJECT FEATURES AND HAZARD POTENTIAL CLASSIFICATION

2.1.1 North and South Low Dissolved Solids Ponds

The North and South LDS Ponds are identified as a Significant Hazard Potential structures, according to USEPA guidelines (PADEP ID Nos: D04-059 and D04-060, respectively). The PADEP designated the hazard as C-2, non-high hazard structures, which is consistent with the USEPA designation. They are presented together herein since they were constructed together and share a berm, which separates the two impoundments.

The North and South LDS Ponds were originally constructed in 1974 as an earthen berm overlain with a 7-inch thick asphalt liner. Therefore, the ponds were constructed prior to the operation of the plant and subsequent production of coal waste products such as fly ash and bottom ash. The liner included 4 inches of porous asphalt, overlain with 3 inches of impermeable asphalt. Due to higher seepage rates than anticipated, an additional 3-inches of porous hydraulic asphalt cement and 3 inches of impermeable hydraulic asphalt cement were placed in 1975. At that time, asphalt was also placed along the crest and downstream slope of the impoundment. This additional asphalt was intended to minimize maintenance and the potential for vegetative growth. A self-healing tar emulsion sealer was placed as a top coat on the impoundment. According to First Energy, the Ponds are founded on rock. The two impoundments are hydraulically connected by a 5-foot-wide concrete-lined rectangular spillway. The spillway crest is approximately 2.5 feet below the crest of the impoundments.

The North LDS Pond has a crest elevation of 762 feet. According to information provided by First Energy, the North LDS Pond has an approximate area of 3.2 acres and storage capacity of 38.5 acre-ft with 2 feet of freeboard. The impoundments upstream and downstream slopes are 2H:1V with a crest width of 15 feet. Only the northern, southern, and western embankments of the impoundment have an exposed downstream (outside) slope. The eastern slope of the impoundments is cut into the existing ground surface. The Coal Handling Area is located above the eastern embankment on top of a 48-foot high vegetated slope. The impoundment has a maximum height of 32 feet at the northern embankment. The upper half of the northern downstream slope is asphalt-lined, while the bottom half is vegetated. The two halves are separated by a paved bench, approximately 25-foot-wide at minimum, which wraps around to the

western side of the impoundment as it travels towards the crest. The western downstream slope is vegetated. The southern downstream slope of the North LDS Pond is also the northern upstream slope of the South LDS, and vice-versa.

The South LDS Pond has a crest elevation of 762 feet. According to information provided by First Energy, the South LDS Pond has an approximate area of 3.1 acres and storage capacity of 35.3 acre-ft with 2 feet of freeboard. The impoundments upstream and downstream slopes are 2H:1V with a crest width of 15 feet. Only the northern and western embankments of the impoundment have an exposed downstream slope. The impoundment has a maximum height of 17 feet at the western embankment, and the western downstream slope is vegetated. The northern downstream slope of the South LDS Pond is also the southern upstream slope of the South LDS, and vice-versa. The eastern and southern slopes of the impoundment are cut into the side of the existing ground surface. The Coal Handling Area is located above the eastern embankment on top of a 48-foot-high vegetated slope. A 27-inch storm drainage pipe flows into the South LDS from the Coal Handling Area, and the South LDS Pond was receiving stormwater runoff at the time of inspection.

Both the North and South LDS Ponds have decant pipes and intake structures which have been decommissioned. Waste water enters and leaves the ponds and is transferred between, via a system of pumps. The LDS Ponds serve three purposes. Currently, CCW byproducts are sluiced from the Bruce Mansfield combustion units to the LDS ponds. The primary purpose is as an ash storage pond. The secondary and tertiary purposes are for sedimentation and waste water storage, respectively. The ponds are operated so that only one pond is storing waste at any given time. Therefore, the other pond is essentially empty so storm water that fills one pond up to the spillway elevation will flow into the other pond. The storm sewer outlet for the Coal Handling Area is equipped with a Y-section, which allows the storm sewer to outlet into either the North or South LDS Ponds. Currently, a removable steel plate was blocking the flow to the North LDS Pond.

Based on the field reconnaissance, a review of U.S. Geological Survey maps and aerial photographs, and the PADEP hazard classification, the North and South LDS Ponds have been classified by the Independent Engineer as significant hazard potential structures, due to the environmental damage that would be caused by misoperation or failure of the structure. The location information for the impoundments is summarized in ***Tables 2-1 and 2-2***. Coordinates are located at the center of the impoundments.

TABLE 2-1
NORTH LDS POND LOCATION DATA

	DEGREES	MINUTES	SECONDS
LONGITUDE	40	38	11.16
LATITUDE	80	24	47.92
STATE	Pennsylvania	COUNTY	Beaver

TABLE 2-2
SOUTH LDS POND LOCATION DATA

	DEGREES	MINUTES	SECONDS
LONGITUDE	40	38	9.73
LATITUDE	80	24	45.24
STATE	Pennsylvania	COUNTY	Beaver

2.1.2 West High Dissolved Solids Pond

The West HDS Pond is identified as a Significant Hazard Potential structures, according to USEPA guidelines (PADEP ID No. D04-062). The PADEP designated the hazard as C-2, high hazard structures, which is consistent with the USEPA designation.

The West and East HDS Ponds were originally constructed in 1974 as an earthen berm overlain with a 7-inch thick asphalt liner. The liner included 4 inches of porous asphalt overlain with 3 inches of impermeable asphalt. Due to higher seepage rates than anticipated, an additional 3 inches of porous hydraulic asphalt cement and 3 inches of impermeable hydraulic asphalt cement were placed in 1975. At the time of placement of the additional layer, asphalt was also placed along the crest and downstream slope of the impoundment. This additional asphalt minimizes maintenance and the potential for vegetative growth. According to First Energy, rock excavation at the southern limits of the impoundments was required. A cut slope of 1H:2V was made, and a reinforced concrete wall was constructed with a granular backfill and foundation drain. The concrete wall makes up the inside wall of the southern end of the impoundments. The two impoundments are hydraulically connected by a 5-foot-wide concrete-lined rectangular spillway, with an elevation approximately 2.5 feet below the crest of the impoundments. The East HDS Pond was formally decommissioned May 12, 2003, with the issuance of the PADEP Dam Breach

Completion Certification. Presently, the East HDS pond is used as an ammonia tank storage facility. The spillway connecting the two impoundments has been decommissioned and sealed off with two plywood bulkheads.

The West HDS Pond has a crest elevation of 787 feet. According to information provided by First Energy, the West HDS Pond has an approximate area of 2.9 acres and storage capacity of 39.5 acre-feet with 2 feet of freeboard. The impoundments upstream and downstream slopes are 2H:1V with a crest width of 15 feet. The southern embankment is the only one excavated with a vertical concrete wall. The northern, western, and eastern embankments of the impoundment all have an exposed downstream (outside) slope. The impoundment has a maximum height of 27 feet at the north embankment. The northern and western downstream slopes are asphalt-lined. The eastern downstream slope of the West HDS Pond is also the western upstream slope of the now decommissioned East HDS Pond, and vice-versa.

For the West HDS Pond, all decant pipes and intake structures have been decommissioned. Currently, CCW byproducts are trucked in at the southwest corner for temporary storage.

Based on the field reconnaissance, a review of USGS maps and aerial photographs, and the PADEP hazard classification, the West HDS Pond has been classified by the Independent Engineer as a significant hazard potential structure, due to the environmental damage that would be caused by misoperation or failure of the structure. The location information for the impoundment is summarized in ***Table 2-3***. Coordinates are located at the center of the impoundment.

TABLE 2-3
WEST HDS POND LOCATION DATA

	DEGREES	MINUTES	SECONDS
LONGITUDE	40	38	4.54
LATITUDE	80	24	40.62
STATE	Pennsylvania	COUNTY	Beaver

2.2 SUMMARY OF STANDARD OPERATING PROCEDURES

2.2.1 Purpose of the Project

The Bruce Mansfield Plant is a coal-fired power plant. The North and South LDS Ponds were constructed to provide temporary storage for waste coal combustion products and to provide necessary decantation capacity. Since none of the impoundments discharge from the plant to waters of the Commonwealth, no National Pollutant Discharge Elimination System permit requirements. The West HDS Pond was constructed to provide solely for the purpose of waste decant.

To date, there have been no failures, overtopping events, or uncontrolled releases into the Ohio River from the North and South LDS Ponds or the West HDS Pond.

2.2.2 Current Inspection Schedule

The current inspection schedule for the structures at the Bruce Mansfield Plant are as follows:

- **Visual Inspection by Site Staff**: Performed at the beginning of each shift (three 8-hour shifts per day).
- **Engineering Inspection by Independent Consultant**: A more in-depth inspection by independent consultant firm with expertise in dam safety, performed quarterly, with fourth quarter being an annual inspection, including a summation of the previous 3 quarterly inspections.
- **State DEP inspection**: A more in-depth inspection by the Pennsylvania DEP Department of Dam Safety, performed every two years.

2.3 MODIFICATIONS CONDUCTED FOR PROJECT SAFETY

In 1975, an additional asphalt layer was placed on the impoundment slopes and crest. No safety improvements have been conducted since 1975.

2.4 ENGINEERING INFORMATION

The following documents provided by First Energy and GAI were reviewed in the preparation of this Report:

1. North LDS Dam Permit, May 1995
2. South LDS Dam Permit, May 1995
3. West HDS Dam Permit, May 1995
4. Bruce Mansfield Plant 2008 Annual Inspections, December 5, 2008 – Inspections for all 3 impoundments, performed by GAI Consultants
5. Construction Drawings for LDS and HDS Storage Ponds

Documentation reviewed as a part of the inspection included design stability calculations for normal, seismic, and flood loading conditions, the construction drawings for the Ponds, and the Hydrologic Study. The review of these documents did not include a detailed check of calculations, however, assumptions made in the analysis, such as loading conditions and material properties were well-documented, and the assumptions and results of the analyses appeared reasonable to the reviewers.

The PADEP permitted these structures in 1996 and the analyses presented herewith were reviewed and approved at that time.

2.4.1 Geologic Conditions

A review of geologic maps of the project area compiled by the Pennsylvania Department of Environmental Resources in 1975 entitled "Greater Pittsburgh Region Geologic Map" indicates that the site is underlain by alluvial soils, consisting of unconsolidated deposits of sand and gravel with varying amounts of silt and clay. Pebbles and gravel are generally rounded to well rounded, and sand grains are typically angular. These unconsolidated deposits generally provide poor foundation support but are easily excavated. The thickness of these deposits can vary from 1 to more than 150 feet. Bedrock underlying the alluvial deposits belong to the Allegheny Group. The rock in the Allegheny Group is about 300 feet thick and consists of cyclic sequences shale, sandstone, limestone, and coal.

There is no subsurface information for the site (i.e., borings and/or test pits) in the engineering reports and documents provided by First Energy. However, based on our general understanding of the soil conditions at the Site based on published information, we expect that granular soils consisting primarily of sand and gravels were used to construct the earthen berms. According to First Energy, the embankments are founded on rock.

2.4.2 Slope Stability Analyses

A series of slope stability analyses for the existing ponds was completed as part of the 1995 PADEP permitting process. A copy of the stability analyses failure surfaces and results are included in ***Appendix C***. The recommended minimum factors of safety for dams contained in the "Recommended Guidelines for Safety Inspections of Dams" (US Army Corps of Engineers ER-1110-2-106) are:

- Steady State Seepage Condition: 1.5
- Sudden Drawdown Condition: 1.2
- Steady State Seepage with Seismic: 1.0

For the Impoundments, stability analyses were performed for both saturated and dry cases. For these two cases, various sections were analyzed for stability under steady state seepage and seismic loading conditions. The Sudden Drawdown Condition is normally computed from the embankment crest to the pool level. No analysis which meets these criteria was performed for the impoundments at the Bruce Mansfield Plant. In the case of these impoundments, the impermeable asphalt liner is intended to keep pore water out of the embankment and would not be expected to be a critical loading condition. Soil parameters used for the stability analyses are presented in ***Table 2-4***.

TABLE 2-4
STABILITY ANALYSES SOIL PARAMETER

PARAMETER	UNITS
Unit Weight (pcf)	120
Cohesion (psf)	500
Friction Angle (degrees)	30

For the North LDS Pond - Dry Case, stability analyses were performed for the southern upstream slope and for the northern downstream slope. The northern downstream slope was analyzed both

for failure of the full height of the embankment, through the crest, and for failure at the lower bench. For the Saturated Case, stability analysis was performed for entirety of the impoundment, with the failure plane starting at the bench along the northern downstream slope and passing under the impoundment through the southern upstream slope's crest. A stability analysis was also performed for the entirety of the northern downstream embankment. Stability analyses resulted in the following factors of safety presented in ***Table 2-5***.

TABLE 2-5
NORTH LDS STABILITY ANALYSES RESULTS

EMBANKMENT SECTION	DRY CASE		SATURATED CASE	
	STEADY STATE	SEISMIC	STEADY STATE	SEISMIC
South Upstream	4.4	3.8	NA	NA
North Downstream (Full)	5.5	4.3	3.8	2.9
North Downstream (Lower Bench)	4.8	4.0	NA	NA
Full Impoundment Slide at North Toe	NA	NA	4.4	3.8

For the South LDS Pond - Dry Case, no stability analyses was performed; however, the northern downstream slope is identical to the southern upstream slope of the North LDS Pond presented in ***Table 2-5*** above. For the Saturated Case, stability analyses were performed for both the northern upstream and southern upstream slopes. Stability analyses resulted in the following factors of safety presented in ***Table 2-6***.

TABLE 2-6
SOUTH LDS STABILITY ANALYSES RESULTS

EMBANKMENT SECTION	DRY CASE		SATURATED CASE	
	STEADY STATE	SEISMIC	STEADY STATE	SEISMIC
NORTH UPSTREAM	NA	NA	1.7	1.5
SOUTH UPSTREAM	NA	NA	2.2	1.9

For the West HDS Pond, no stability analysis was performed; however, the East HDS Pond was analyzed at the southern upstream slope and the northern downstream slope. Through review of the site drawings, photographs, and the dam permits, the construction of the East and West HDS Ponds is near identical. They share a similar southern embankment concrete wall, and the northern downstream slopes are identical in height and construction.

For the East HDS Pond, both the Dry Case and Saturated Case had a single stability analysis performed along the southern upstream slope and two stability analyses performed along the northern downstream slope (full slope and upper bench). Stability analyses resulted in the following factors of safety presented in ***Table 2-7***.

TABLE 2-7
EAST HDS STABILITY ANALYSES RESULTS

EMBANKMENT SECTION	DRY CASE		SATURATED CASE	
	STEADY STATE	SEISMIC	STEADY STATE	SEISMIC
South Upstream	1.7	1.6	1.7	1.6
North Downstream (Full)	4.6	3.9	3.6	2.9
North Downstream (Upper Bench)	3.6	3.2	3.4	2.9

The required factors of safety are exceeded for all load cases and all structures. A review of the analysis showed that for the Saturated Case a phreatic line exists within the embankments and can be considered conservative assuming the impermeable liner fails to functions as designed.

2.4.3 Hydrologic Analyses

A Hydrologic Study for the existing ponds was completed by Civil & Environmental Consultants, Inc. (CEC) to determine inflow and outflow hydrographs, drainage areas, and other physical constraints. The study, which was part of the 1995 PADEP permitting process, included the analysis of three major drainage areas: the LDS Ponds, the HDS Ponds, and the Coal Handling Area. The standard Design Flood (SDF) was the 1/2 Probable Maximum Precipitation (PMP) rainfall event. The study was performed assuming 2 feet of freeboard in the ponds at the start of the 1/2 PMP rainfall event.

For the study, both HDS Ponds were treated as one reservoir, and both LDS Ponds were treated as one reservoir. The study looked at the contribution to the watershed areas by the Coal Handling Area, the Coal Handling Area Diversion Ditch, and the surrounding area watershed. The HDS and LDS Ponds both overtop by approximately 0.3 foot during the SDF. The overtopping will not result in a failure of the embankment since the downstream slope of the dam is covered with asphalt. The results of thy hydrologic study are shown in ***Table 2.8*** below. The depth of overtopping flow and the velocity for both sets of ponds were relatively low and were

determined to not negatively impact the integrity or stability of the embankments due to the asphalt on the downstream slope.

TABLE 2-8
HYDROLOGIC STUDY RESULTS

EMBANKMENT SECTION	NORMAL POOL (FT)	MAX POOL STAGE (FT)	CREST OF IMPOUNDMENT (FT)	WEIR FLOW DEPTH (FT)	WEIR FLOW VELOCITY (FT/S)
HDS Ponds	785.0	787.266	787.0	3.2	1.75
LDS Ponds	760.0	762.283	762.0	3.4	1.9

Since no well-defined downstream channel exists, and the site is wide and flat, the downstream inundation area was not determined using traditional methods. An approximation of the inundation area was assumed to be primarily the areas below the ponds and the Ohio River.

The hydrologic study assumes that both the North and South LDS Ponds have 2 feet of freeboard at the start of the PMP event. Since the ponds are operated so that only one pond is storing waste at any given time, this hydrologic study is conservative. As storm water fills one pond up to the spillway elevation, it will flow into the other pond before overtopping the crest.

3.0 FIELD INSPECTION

3.1 FIELD INSPECTION OBSERVATIONS

The Site inspection was conducted on September 1, 2009. The inspection team consisted of representatives from First Energy, GAI, the PADEP, the USEPA, and RIZZO. The team stopped at each of the Project features to inspect the structures and the surrounding area. Particular attention was paid to Site features that may contribute to typical failure modes of embankment structures, such as settlement, seepage, and slope stability. Photographs taken during the site inspection are provided in ***Appendix B***, and their locations are shown on ***Figure 3-1***.

The individuals participating in the inspection were:

Robert W. Kish, P.E.	First Energy
Mike Horvath, P.E.	First Energy
Rick Sprecker	First Energy
Stanley P. Michalski	GAI
Phil Glogowski	GAI
Dennis Dickey, P.E.	PADEP – Dam Safety
Roger Adams, P.E.	PADEP – Dam Safety
Paul Minor	PADEP – Waste Management
Diana McDaniel	PADEP – Waste Management
Jesse Miller	USEPA
John P. Osterle, P.E.	RIZZO – Independent Engineer
Kevin R. Cass, P.E.	RIZZO

3.1.1 North LDS Pond

At the time of inspection, the North LDS Pond appeared to be well-maintained and in good condition. The crest of the structure appeared well-maintained and showed no signs of settlement or rutting. The upstream slope did not show signs of major cracking. The downstream slope was clear of vegetation where asphalt-lined, and was without signs of sloughing or sliding. The abutment contacts appeared to be in good condition downstream but were not visible upstream.

The upstream slope was mostly clear; at the time of inspection, the pond had been nearly drained for cleaning purposes. When the inside of the impoundment is finished being cleaned, site personnel will inspect for and seal any cracks, if found. No major cracks (cracks that extend

through to the embankment material or underlying layers) were observed in the upstream liner, which is constructed of the more impervious asphalt material. The crest of embankment and downstream slope, showed minor cracks and spalling throughout the top layer (about 3 inches) asphalt due to sun exposure and weathering (***Photographs 1 and 2***). Some minor damage appears to be done along the northern downstream slope, most likely due to trucks scrapping the side of the slope (***Photograph 2***). These cracks and scars are cosmetic, do not extend to the underlying soil, and do not pose any risk to the stability and integrity of the embankments, but should be sealed periodically to reduce vegetation growth. The vegetated portions of the downstream northern and western slopes were well-maintained and trimmed. No seepage was observed anywhere along the downstream toe of the North LDS Pond.

The rebuild and revegetation of the earthen embankment at the northeast corner of the impoundment due to a prior manhole overflow appeared to be in good condition. The rebuild was well-graded, and the vegetation was taking hold nicely (***Photograph 4***).

Along the eastern embankment, the vegetation is well-maintained and trimmed back approximately 10 feet from the edge of the asphalt liner. Some minor vegetation creep was observed along the end of the asphalt line along the slope of the eastern embankment (***Photograph 5***).

The small spillway between the North and South LDS Ponds was in good condition at the time of inspection (***Photograph 10***). The concrete was in good condition, while the weir and trashrack were observed to be free of obstructions or debris.

3.1.2 South LDS Pond

At the time of inspection, the South LDS Pond appeared to be well-maintained and in good condition. The crest of the structure appeared well-maintained and showed no signs of settlement or rutting. The upstream slope did not show signs of major cracking. The downstream slope was clear of vegetation and was without signs of sloughing or sliding. The abutment contacts appeared to be in good condition downstream but were not visible upstream.

There was about 2 feet of freeboard along the upstream slope of the South LDS Pond at the time of inspection. No major cracks were observed in the visible portion of the upstream liner, which is constructed of the more impervious asphalt material. Some minor damage and vegetation was observed at the northwest corner of the upstream slope, near the fire hose system and bubbler

(***Photograph 9***). The crest of embankment and downstream slope showed cracks and spalling throughout the top layer (about 3 inches) asphalt, due to sun exposure and weathering (***Photograph 11***). These cracks are cosmetic, do not extend to the underlying soil, and do not pose any risk to the stability and integrity of the embankments. Nonetheless, they should be sealed periodically to reduce vegetation growth. Along the eastern embankment, the vegetation is well-maintained and trimmed back approximately 10 feet from the edge of the asphalt liner. The western downstream slope is vegetated and was well maintained and trimmed at the time of inspection. No seepage was observed by RIZZO along the downstream toe of the South LDS Pond. Several minor wet spots were observed at the toe of the western downstream embankment by the PADEP and RIZZO at the time of the inspection. According to the owner, this area is subject to rain, periodic dust control watering, and is periodically hosed down for general cleaning.

The small spillway between the North and South LDS Ponds was in good condition at the time of inspection (***Photograph 10***). The concrete was in good condition, while the weir and trashrack were observed to be free of obstructions or debris.

3.1.3 West HDS Pond

At the time of inspection, the West HDS Pond appeared to be well-maintained and in good condition. The crest of the structure appeared well-maintained and showed no signs of settlement or rutting. The upstream slope did not show signs of major cracking. The downstream slope was clear of vegetation and was without signs of sloughing or sliding. The abutment contacts appeared to be in good condition downstream but were not visible upstream.

There was about 4 feet of freeboard along the upstream slope of the West HDS Pond at the time of inspection. The water was clear, and no major cracks were observed in the visible portion of the upstream liner, which is constructed of the more impervious asphalt material. The crest of embankment and downstream slope showed minor cracks and spalling throughout the top layer (about 3 inches) asphalt due to sun exposure and weathering (***Photographs 14 and 17***). These cracks are cosmetic, do not extend to the underlying soil, and do not pose any risk to the stability and integrity of the embankments. Nonetheless, they should be sealed periodically to reduce vegetation growth. At the time of inspection, maintenance crews were clearing away vegetation along the northern downstream slope and sealing the cracks with tar (***Photograph 13***). The southern reinforced concrete wall was in good condition (***Photograph 16***). No seepage was observed along the downstream toe of the West HDS Pond.

The small spillway between the East and West HDS Ponds has been decommissioned, but the concrete still appeared in good condition at the time of inspection (***Photograph 21***).

4.0 ANALYSIS

4.1 SAFETY, OPERATIONS, AND MAINTENANCE

The stability of the embankments for each management unit was analyzed as described in ***Section 2.4.2*** of this report. The resulting factors of safety exceed the requirements for all load cases. However, it is not clear how the soil parameters were selected since there is no subsurface information and/or laboratory testing data for the soils at the location of the management units. We expect that the engineering documentation for the power plant includes geotechnical information for the entire Site, and that this information was likely used to select the soil strength parameters. Our review of available published geologic information for the Site suggests that the site soils likely consisted of sands and gravels. This is consistent with the use of an asphalt liner placed on the upstream slope to control seepage. On the other hand, the use of a friction angle of 30° and a cohesion value of 500 pounds per square foot for the soil shear strength suggests that a cohesive soil consisting of low plasticity clay may have been used to construct the embankments. The shear strength of a soil consisting of sand and gravel soil would be characterized by a friction angles varying from 30 to 38° and no cohesion. Considering the adequate structural performance of the embankments over the last 34 years, we conclude that the embankments have an adequate factor of safety against slope stability. This is consistent with the evaluation performed by PADEP. However, given the uncertainty with the subsurface conditions and associated shear strength parameters, the factors of safety reported in ***Section 2.4.2*** may be overestimated.

The hydrologic analyses reported in ***Section 2.4.3*** are conservative since First Energy generally operates the management units with one pond essentially empty. Waste material is currently pumped into and out of the ponds. Additional inflow into the pond is from the runoff from the coal pile located to the east of the ponds. The reported analyses assume that both the north and south ponds have two feet of freeboard under the SDF. The SDF is assumed to be the ½ Probable Maximum Precipitation. We generally concur with the hydrologic analyses and their results. The asphalt-lined crest and downstream slopes of the embankment will prevent failure due to overtopping under the SDF. Therefore, we conclude that the management units have adequate protection against a failure due to overtopping.

The management units are well-maintained. The minor cracks in the asphalt are sealed on a periodic basis as observed during our Site inspection. Due to the presence of the asphalt along the crest and downstream slopes, the removal of vegetative and filling of animal borrows are not

required. This is a significant Maintenance benefit from the asphalt liner along the downstream slopes. In addition, the asphalt liner provides overtopping protection for the embankment, which is another significant benefit for the management units.

4.2 DESIGN AND OPERATION CHANGES

The discharge structure located in the North LDS pond and the West HDS ponds has been decommissioned. Therefore, water can only be discharged from the pond by pumping or overtopping in the event of an extreme rainfall event. In addition, the East HDS pond and associated spillway from West to East HDS have been decommissioned. The East HDS pond is now used as an ammonia storage facility.

4.3 INSPECTION AND MONITORING

As described in ***Section 1.3***, the management units are inspected on a regular basis by plant personnel, an independent consultant (GAI), and the PADEP. There are currently no instruments to monitor. We conclude that current inspection program is adequate.

5.0 RECOMMENDATIONS/ CONCLUSIONS

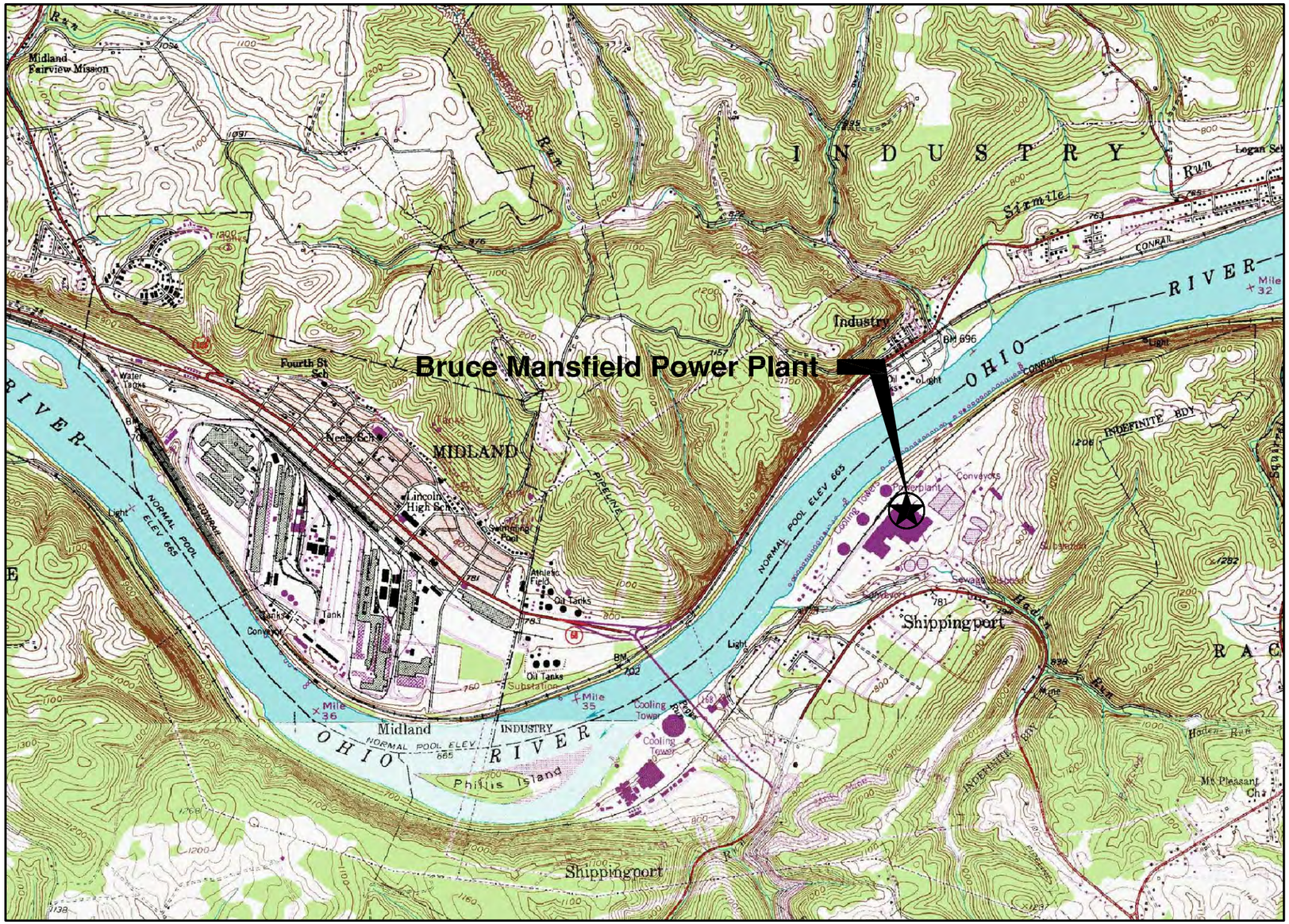
Based on our review of the engineering documentation, inspection reports, and the results of our field inspection, we conclude that the North LDS, South LDS, and West HDS management units are structurally sound and all are in Satisfactory condition as defined by the USEPA (i.e., no existing or potential management unit safety deficiencies are recognized. Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with applicable criteria. Minor maintenance items may be required).

The following recommendation was generated during the preparation of this Inspection Report. All of the Recommendations are considered dam safety items. Each recommendation is presented below, along with a proposed schedule to address the Recommendation.

We recommend that the surface asphalt along the crest and downstream slopes of all embankments continue to be maintained as part of the plant facility's regular maintenance activities. Clearing of vegetation, sealing of cracks, and repair of larger defects should be performed on a regular basis. The hydrologic study for the site states that SDF will overtop the impoundments by approximately 0.3 foot. Passage of the SDF without erosion of the embankments is dependent on the asphalt layer, and it should not be allowed to degrade to a point where an overtopping could cause a failure.

Schedule: According to First Energy's current Maintenance Program.

FIGURES



REFERENCE:

U.S.G.S. 7.5 MIN. TOPOGRAPHIC MAP,
MIDLAND, PENNSYLVANIA AND HOOKSTOWN, PENNSYLVANIA QUADRANGLES

FIGURE 1–1

SITE VICINITY MAP

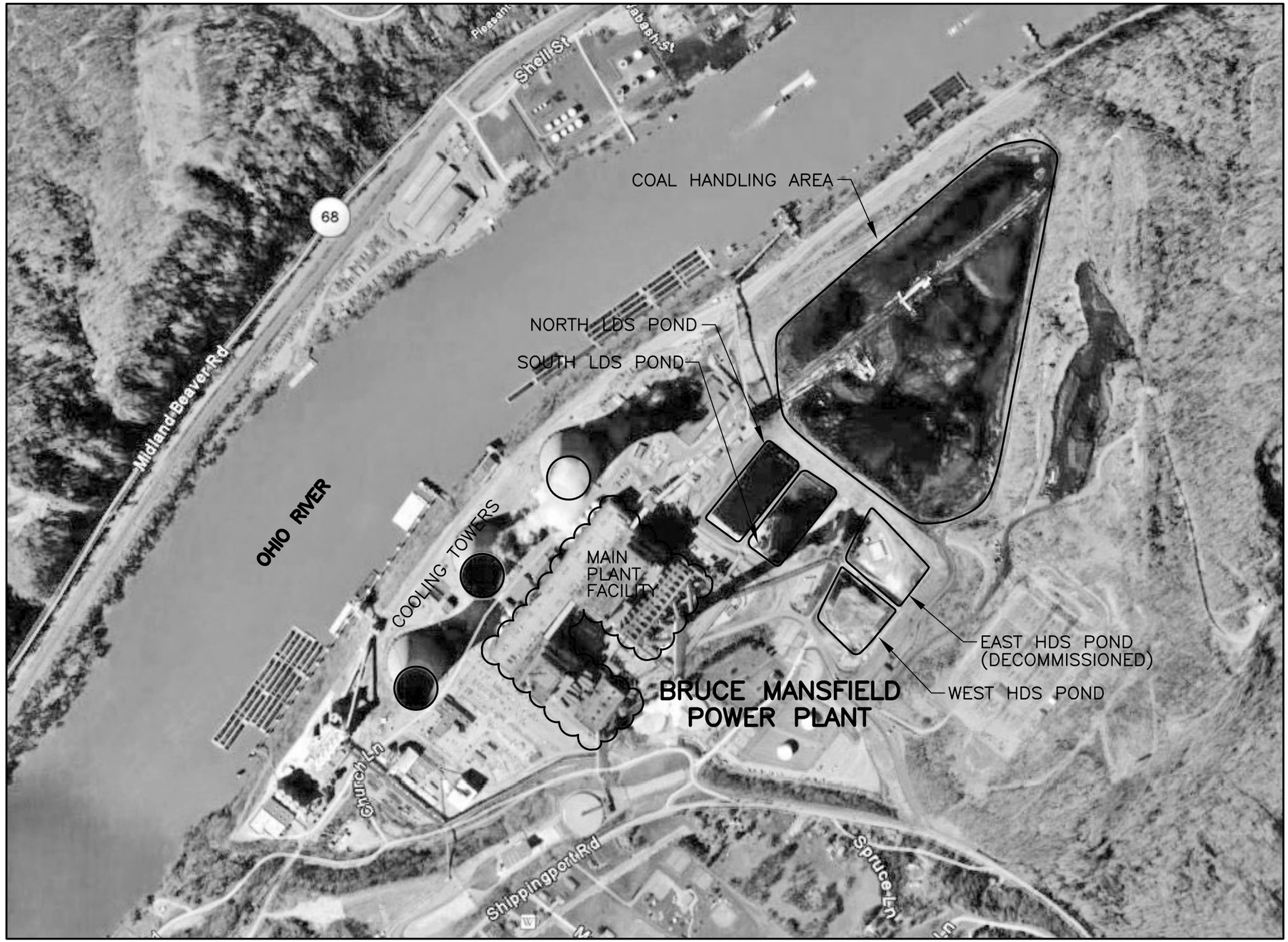
BRUCE MANSFIELD POWER PLANT
CCW IMPOUNDMENT ASSESSMENT

PREPARED FOR

USEPA
WASHINGTON, D.C.

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

PLOT	DRAWN BY	CHECKED BY	CAD FILE NUMBER
1=1	KRC 9/26/09	APPROVED BY	09–4157–B3(M)



REFERENCE:
GOOGLE EARTH, 2009, NTS

FIGURE 1–2

SITE FEATURES
BRUCE MANSFIELD POWER PLANT
CCW IMPOUNDMENT ASSESSMENT
PREPARED FOR

USEPA
WASHINGTON, D.C.

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

PLOT 1=1	DRAWN BY	KRC 9/26/09	CHECKED BY / APPROVED BY		CAD FILE NUMBER	09-4157-B3(M)

REFERENCE:
GOOGLE EARTH, 2009, NTS

FIGURE 1–3
LDS & HDS PONDS
AND FEATURES
BRUCE MANSFIELD POWER PLANT
CCW IMPOUNDMENT ASSESSMENT
PREPARED FOR

USEPA
WASHINGTON, D.C.

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

PLOT	DRAWN BY	CHECKED BY		CAD FILE NUMBER
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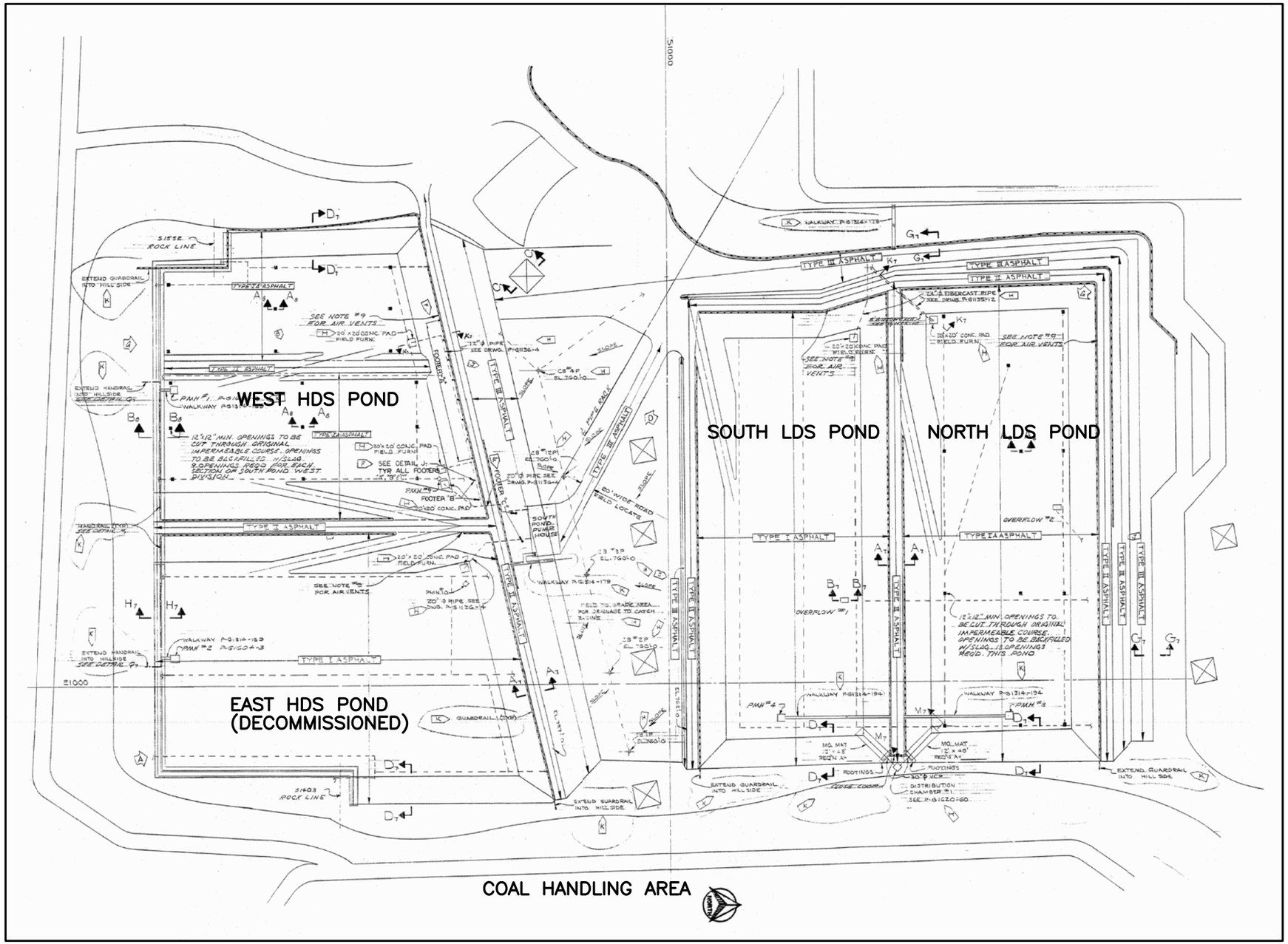


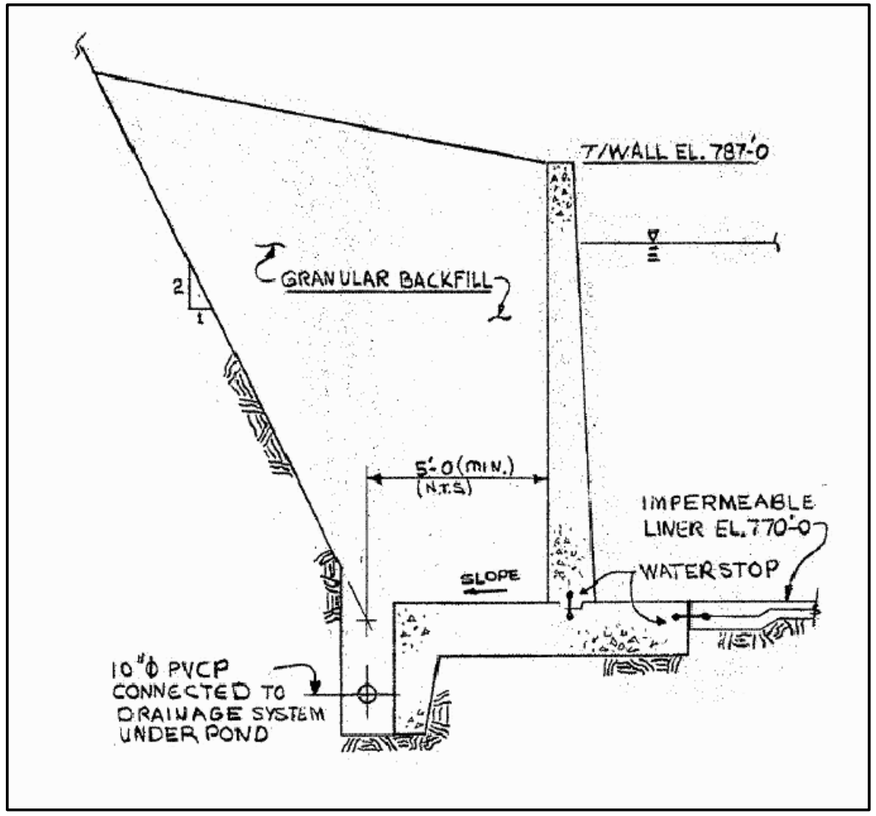
FIGURE 1–4

SITE PLAN VIEW
BRUCE MANSFIELD POWER PLANT
CCW IMPOUNDMENT ASSESSMENT
PREPARED FOR

USEPA
WASHINGTON, D.C.

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

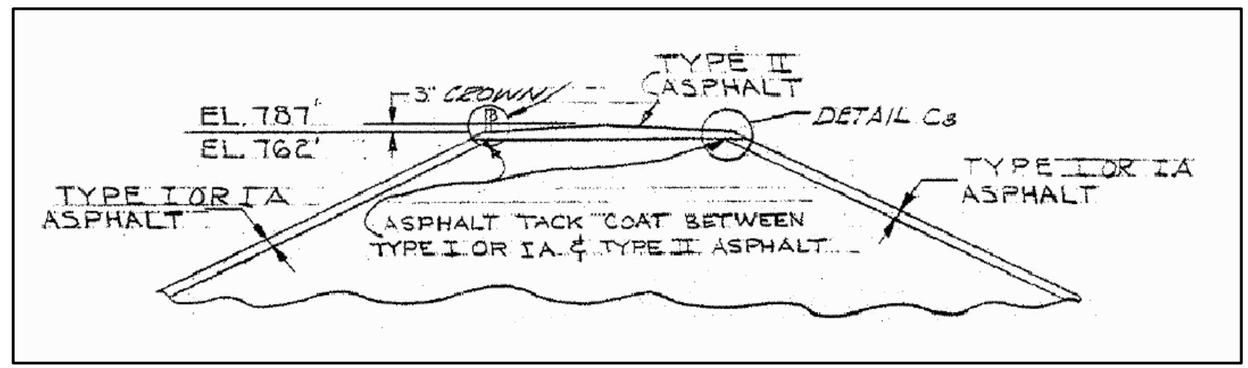
CAD FILE NUMBER	CHECKED BY	APPROVED BY	DRAWN BY	KRC	9/26/09	PLOT	1=1
09-4157-B3(M)							



TYPICAL SECTION

WEST HDS POND SOUTH WALL

(N.T.S.)



TYPICAL SECTION

TYP. ALL DIKES

(N.T.S.)

FIGURE 1–5

TYPICAL SECTIONS
BRUCE MANSFIELD POWER PLANT
CCW IMPOUNDMENT ASSESSMENT
PREPARED FOR

USEPA
WASHINGTON, D.C.

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

CAD FILE NUMBER	CHECKED BY	APPROVED BY	DRAWN BY	KRC	9/26/09	PLOT	1=1
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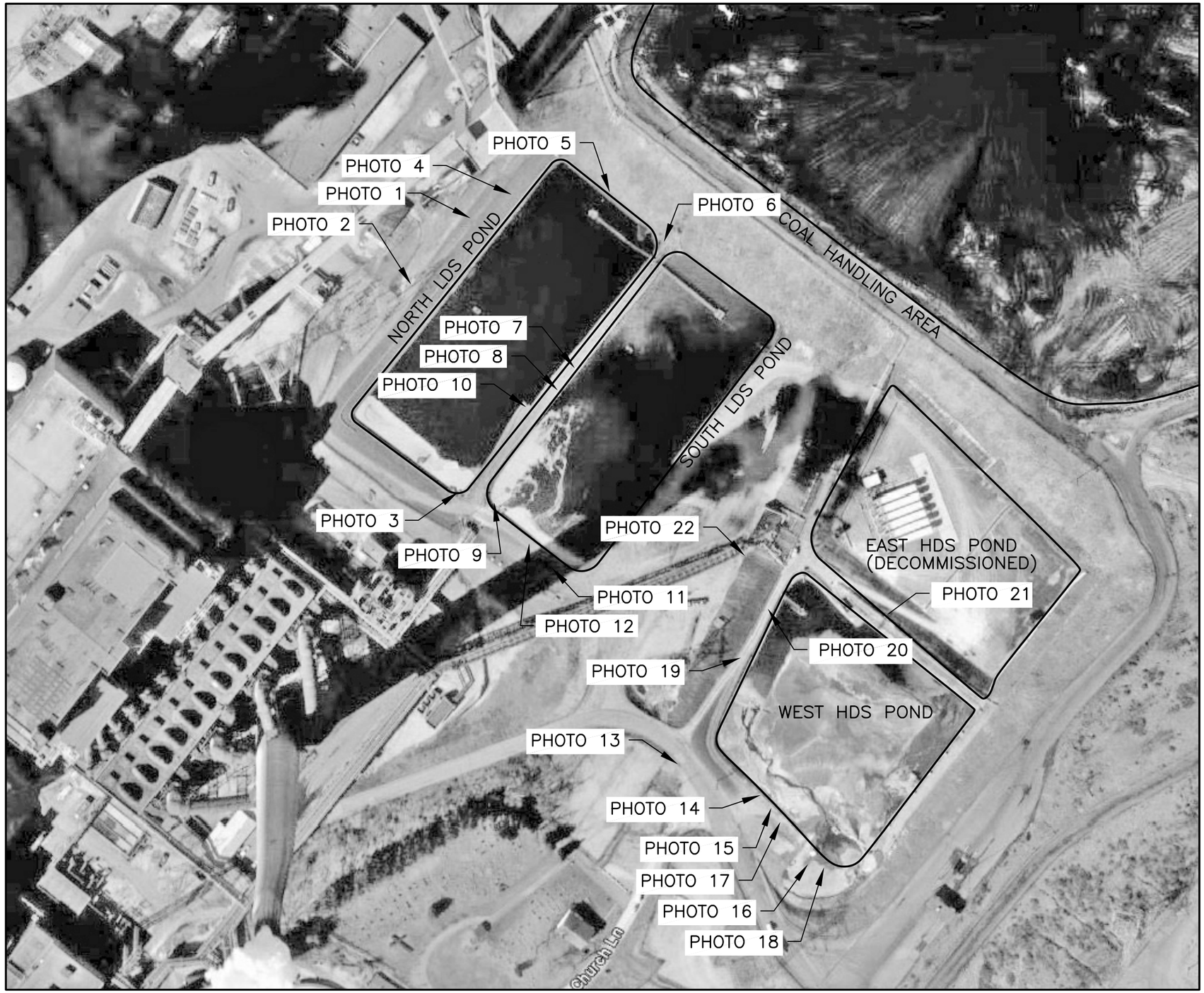


REFERENCE:
GOOGLE EARTH, 2009, NTS

FIGURE 3–1

PHOTOGRAPH LOCATION MAP
BRUCE MANSFIELD POWER PLANT
CCW IMPOUNDMENT ASSESSMENT
PREPARED FOR

USEPA
WASHINGTON, D.C.

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

PLOT 1=1	DRAWN BY	CHECKED BY	CAD FILE NUMBER
	KRC 9/26/09	APPROVED BY	09-4157-B3(M)

APPENDIX A

FIELD INSPECTION CHECKLISTS

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	Bruce Mansfield Power Station	Date:	09-01-2009
Unit Name:	North Low Dissolved Solids (LDS) Pond	Operator's Name:	First Energy
Unit I.D.:	NA	Hazard Potential Classification:	High☐ Significant☒ Low☐
Inspector's Name:	John Osterle / Kevin Cass		

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)?	746 ft		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	NA		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	759.5± ft		Is water entering inlet, but not exiting outlet?		NA
5. Lowest dam crest elevation (operator records)?	762 ft		Is water exiting outlet, but not entering inlet?		NA
6. If instrumentation is present, are readings recorded (operator records)?		NA	Is water exiting outlet flowing clear?		NA
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?		NA
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. Quarterly inspection is performed by GAI Consultants, Inc. Fourth quarter inspection includes summary for entire year. PADEP performs an inspection every 2 years.

#2. Daily water level readings are recorded by operations department for LDS ponds only. Pond was drained at time of inspection, with 1 to 7 feet of slurry.

#3. The decant pipe and intake structure has been deactivated (18" dia. vitrified clay pipe).

#4. Spillway consists of a weir which flows between the North LDS Pond and the South LDS Pond. One pond is always drained so that it can store discharge from the other pond. Water is discharged from the pond via pumping.

#6. No instrumentation.

#8. According to First Energy, the foundations were excavated to rock. Ponds were constructed prior to the operation of the plant. Therefore, there was no fly ash available during construction.

#10 & #17. Minor cracks were observed in the top asphalt layer. These cracks do not extend into the bottom asphalt layer or the embankment.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NA INSPECTOR John Osterle / Kevin Cass

Date 09-01-2009

Impoundment Name North Low Dissolved Solids (LDS) Pond

Impoundment Company First Energy

EPA Region III

State Agency (Field Office) Addresss Pennsylvania Department of Environmental Protection
909 Elmerton Avenue, Harrisburg, PA 17110

Name of Impoundment _____

(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: Primary: Ash Storage, Secondary: Sedimentation, Tertiary: Waste

Nearest Downstream Town : Name Midland, PA

Distance from the impoundment about 2 miles downstream

Impoundment Location:

Longitude 40 Degrees 38 Minutes 11.16 Seconds

Latitude 80 Degrees 24 Minutes 47.92 Seconds

State PA County Beaver

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

If So Which State Agency? Pennsylvania Department of Environmental Protection, Bureau of Waterways Engineering, Division of Dam Safety

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.

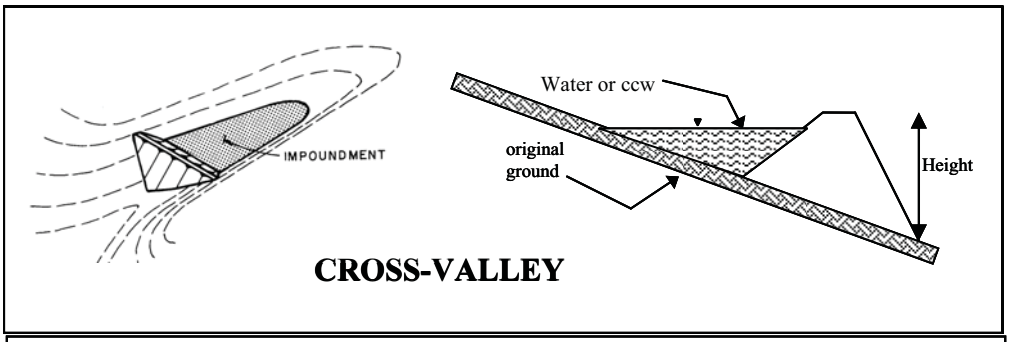
__X__ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.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

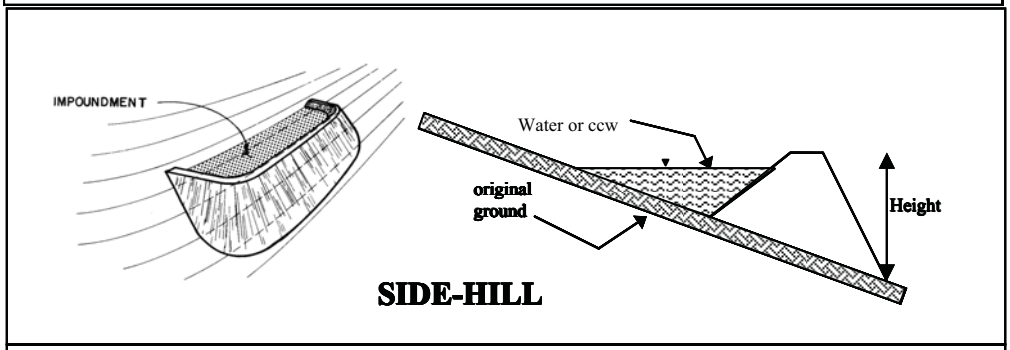
_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

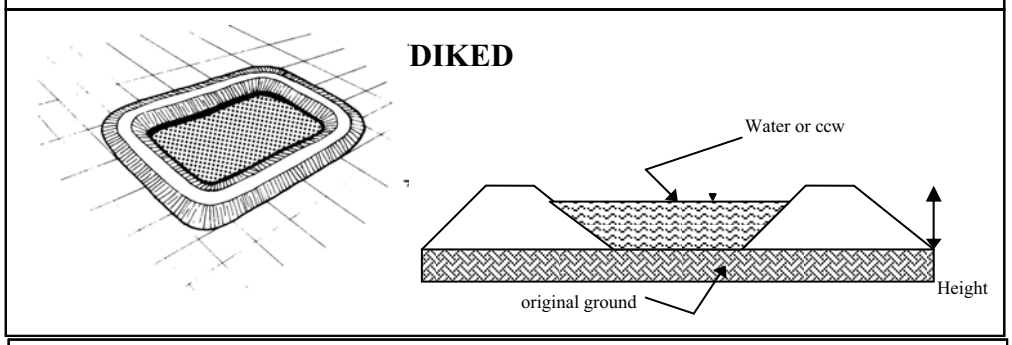
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

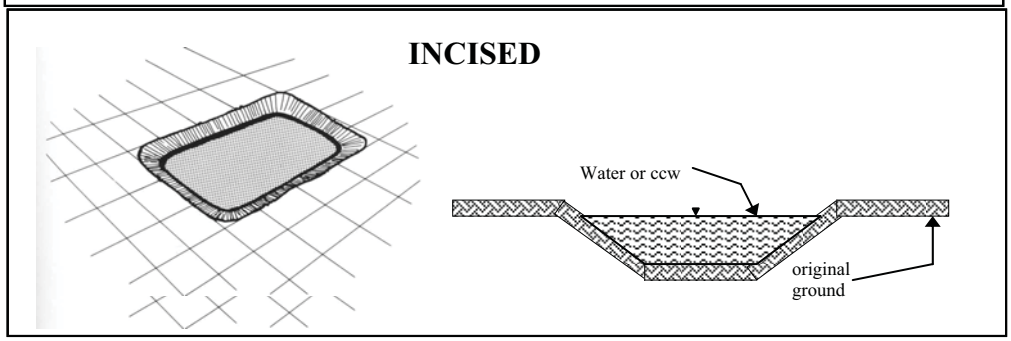
Refer to State classification of C-2, High hazard Structure per PA-DEP letter (August 18, 1994) and 25PaCode105.91 Classification of Dams and Reservoirs. State's classification is equivalent to the Environmental Protection Agency's (EPA) Significant Hazard rating.

CONFIGURATION:









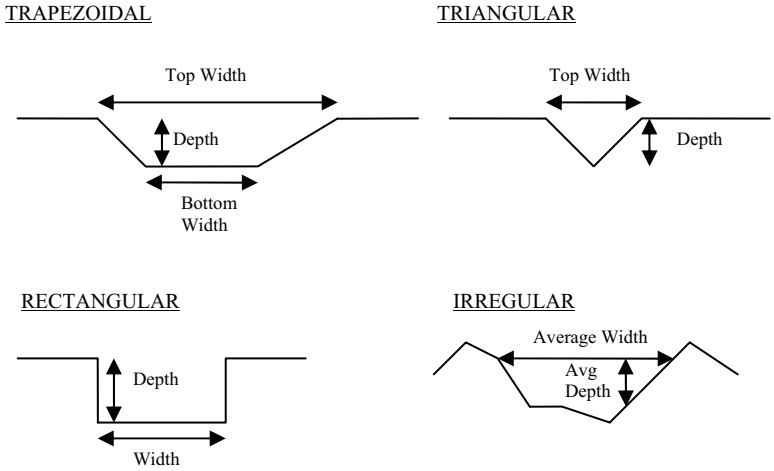
_____ Cross-Valley
__X__ Side-Hill
_____ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height 32 (max) feet Embankment Material Soil with asphalt on crest and downstream slope
Pool Area 3.2 acres Liner Asphlat
Current Freeboard 16 feet Liner Permeability 10^-7 cm/s (estimated)

TYPE OF OUTLET (Mark all that apply)

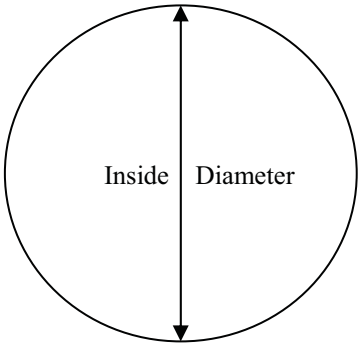
X **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
X Rectangular
_____ Irregular

2.5 ft depth
5 ft bottom (or average) width
5 ft top width



_____ **Outlet**

_____ inside diameter



Material
_____ 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 Commonwealth Associates, Jackson, Michigan

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 : _____

BRUCE MANSFIELD POWER STATION – SHIPPINGPORT, PA
NORTH LOW DISSOLVED SOLIDS POND

Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that.

No.

Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation?

No.

From the site visit or from photographic documentation, was there evidence of prior releases, failures, or patchwork on the dikes?

No.

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	Bruce Mansfield Power Station	Date:	09-01-2009
Unit Name:	South Low Dissolved Solids (LDS) Pond	Operator's Name:	First Energy
Unit I.D.:	NA	Hazard Potential Classification:	High☐ Significant☒ Low☐
Inspector's Name:	John Osterle / Kevin Cass		

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)?	760 ft		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	NA		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	759.5± ft		Is water entering inlet, but not exiting outlet?		NA
5. Lowest dam crest elevation (operator records)?	762 ft		Is water exiting outlet, but not entering inlet?		NA
6. If instrumentation is present, are readings recorded (operator records)?		NA	Is water exiting outlet flowing clear?		NA
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?		NA
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. Quarterly inspection is performed by GAI Consultants, Inc. Fourth quarter inspection includes summary for entire year. PADEP performs an inspection every 2 years.

#2. Daily water level readings are recorded by operations department for LDS ponds only.

#3. The decant pipe and intake structure has been deactivated (18" dia. vitrified clay pipe).

#4. Spillway consists of a weir which flows between the North LDS Pond and the South LDS Pond. One pond is always drained so that it can store discharge from the other pond. Water is discharged from the pond via pumping.

#6. No instrumentation.

#8. According to First Energy, the foundations were excavated to rock. Ponds were constructed prior to the operation of the plant. Therefore, there was no fly ash available during construction.

#10 & #17. Minor cracks were observed in the top asphalt layer. These cracks do not extend into the bottom asphalt layer or the embankment.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NA INSPECTOR John Osterle / Kevin Cass

Date 09-01-2009

Impoundment Name South Low Dissolved Solids (LDS) Pond

Impoundment Company First Energy

EPA Region III

State Agency (Field Office) Addresss Pennsylvania Department of Environmental Protection
909 Elmerton Avenue, Harrisburg, PA 17110

Name of Impoundment _____

(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: Primary: Ash Storage, Secondary: Sedimentation, Tertiary: Waste

Nearest Downstream Town : Name Midland, PA

Distance from the impoundment about 2 miles downstream

Impoundment Location:

Longitude 40 Degrees 38 Minutes 9.73 Seconds

Latitude 80 Degrees 24 Minutes 45.24 Seconds

State PA County Beaver

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

If So Which State Agency? Pennsylvania Department of Environmental Protection, Bureau of Waterways Engineering, Division of Dam Safety.

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.

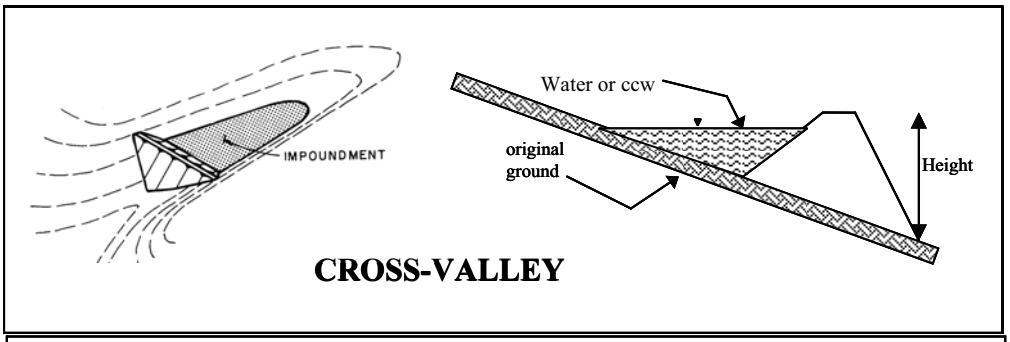
__X__ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.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

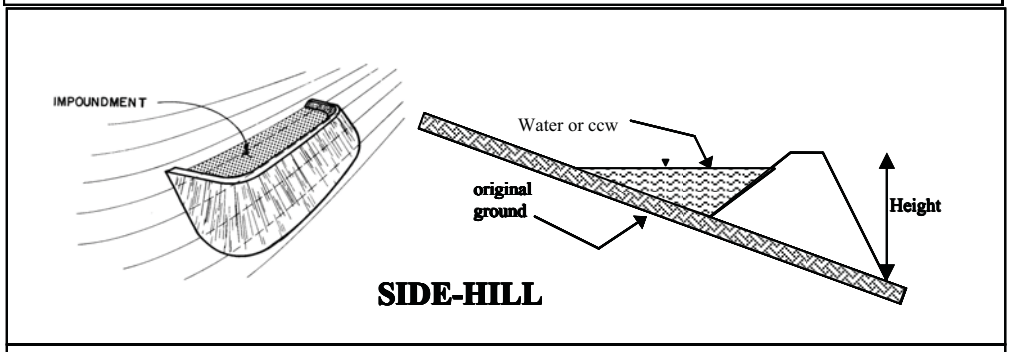
_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

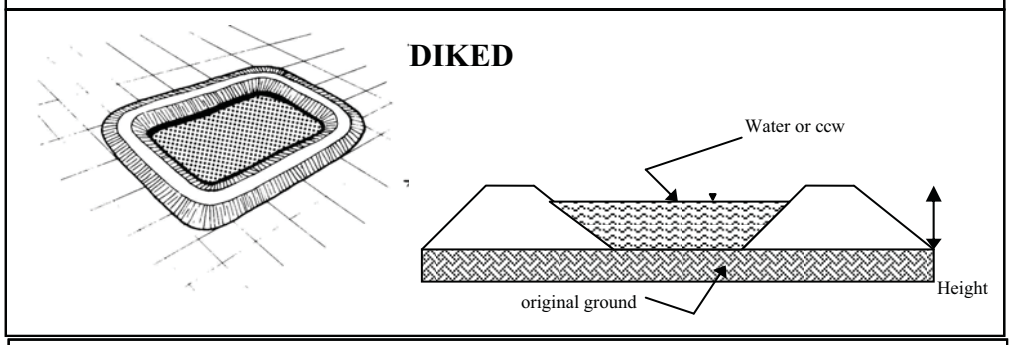
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

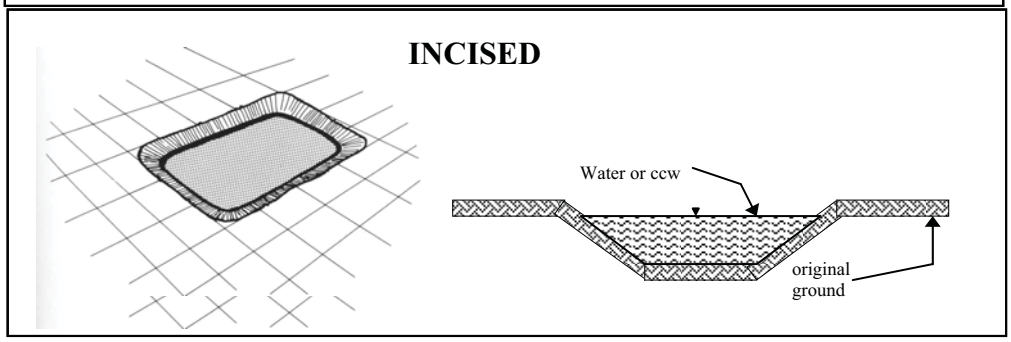
Refer to State classification of C-2, High hazard Structure per PA-DEP letter (August 18, 1994) and 25PaCode105.91 Classification of Dams and Reservoirs. State's classification is equivalent to the Environmental Protection Agency's (EPA) Significant Hazard rating.

CONFIGURATION:









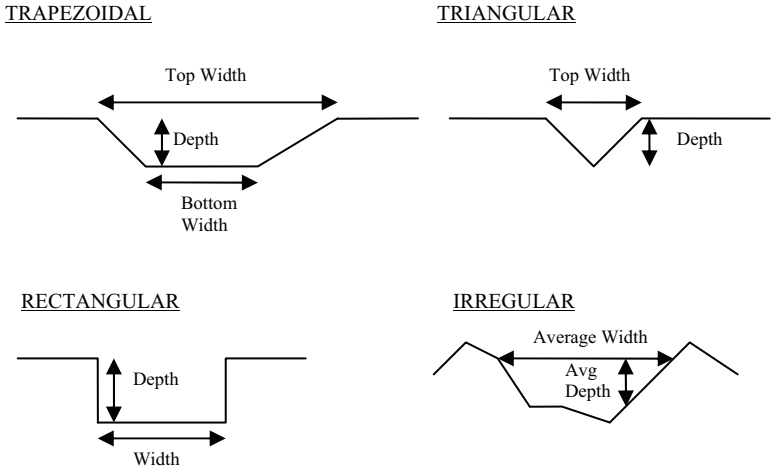
_____ Cross-Valley
__X__ Side-Hill
_____ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height 17 feet Embankment Material Soil with asphalt on crest and downstream slope
Pool Area 3.1 acres Liner Asphlat
Current Freeboard 2 feet Liner Permeability 10^-7 cm/s (estimated)

TYPE OF OUTLET (Mark all that apply)

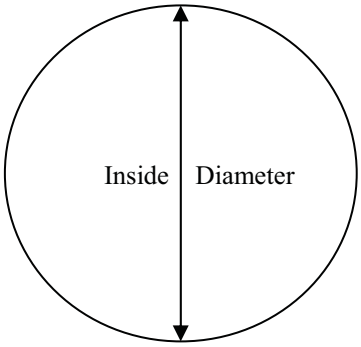
X **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
X Rectangular
_____ Irregular

2.5 ft depth
5 ft bottom (or average) width
5 ft top width



_____ **Outlet**

_____ inside diameter



Material
_____ 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 Commonwealth Associates, Jackson, Michigan

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 : _____

BRUCE MANSFIELD POWER STATION – SHIPPINGPORT, PA
SOUTH LOW DISSOLVED SOLIDS POND

Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that.

No.

Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation?

No.

From the site visit or from photographic documentation, was there evidence of prior releases, failures, or patchwork on the dikes?

No.

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	Bruce Mansfield Power Station	Date:	09-01-2009
Unit Name:	West High Dissolved Solids (HDS) Pond	Operator's Name:	First Energy
Unit I.D.:	NA	Hazard Potential Classification:	High☐ Significant☒ Low☐
Inspector's Name:	John Osterle / Kevin Cass		

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)?	783± ft		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	NA		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	NA		Is water entering inlet, but not exiting outlet?		NA
5. Lowest dam crest elevation (operator records)?	787 ft		Is water exiting outlet, but not entering inlet?		NA
6. If instrumentation is present, are readings recorded (operator records)?		NA	Is water exiting outlet flowing clear?		NA
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?		NA
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. Quarterly inspection is performed by GAI Consultants, Inc. Fourth quarter inspection includes summary for entire year. PADEP performs an inspection every 2 years.

#2. Daily water level are not recorded for the HDS pond. Only the LDS ponds.

#3. The decant pipe and intake structure has been deactivated (18" dia. vitrified clay pipe).

#4. Spillway consists of a weir which flows between the North LDS Pond and the South LDS Pond. One pond is always drained so that it can store discharge from the other pond. Water is discharged from the pond via pumping.

#6. No instrumentation.

#8. According to First Energy, the foundations were excavated to rock. Ponds were constructed prior to the operation of the plant. Therefore, there was no fly ash available during construction.

#10 & #17. Minor cracks were observed in the top asphalt layer. These cracks do not extend into the bottom asphalt layer or the embankment.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NA INSPECTOR John Osterle / Kevin Cass

Date 09-01-2009

Impoundment Name West High Dissolved Solids (HDS) Pond

Impoundment Company First Energy

EPA Region III

State Agency (Field Office) Addresss Pennsylvania Department of Environmental Protection
909 Elmerton Avenue, Harrisburg, PA 17110

Name of Impoundment _____

(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	** Slurry is trucked in and dumped into HDS pond.*

IMPOUNDMENT FUNCTION: Primary: Ash Storage, Secondary: Sedimentation

Nearest Downstream Town : Name Midland, PA

Distance from the impoundment about 2 miles downstream

Impoundment Location:

Longitude 40 Degrees 38 Minutes 4.54 Seconds

Latitude 80 Degrees 24 Minutes 40.62 Seconds

State PA County Beaver

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

If So Which State Agency? Pennsylvania Department of Environmental Protection, Bureau of Waterways Engineering, Division of Dam Safety

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.

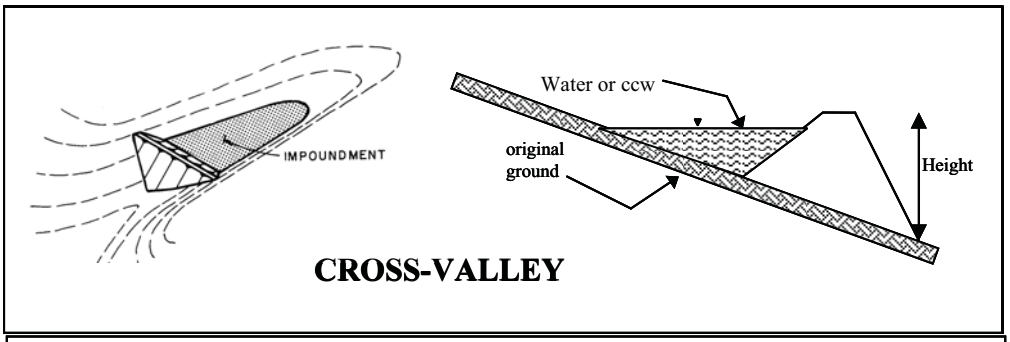
__X__ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.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

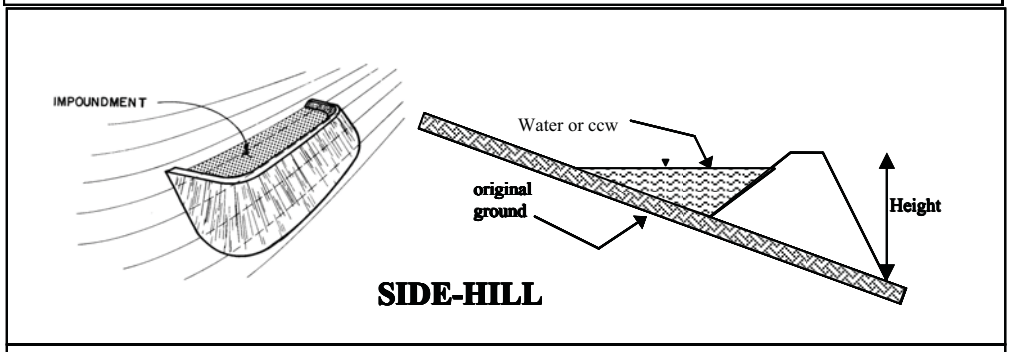
_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

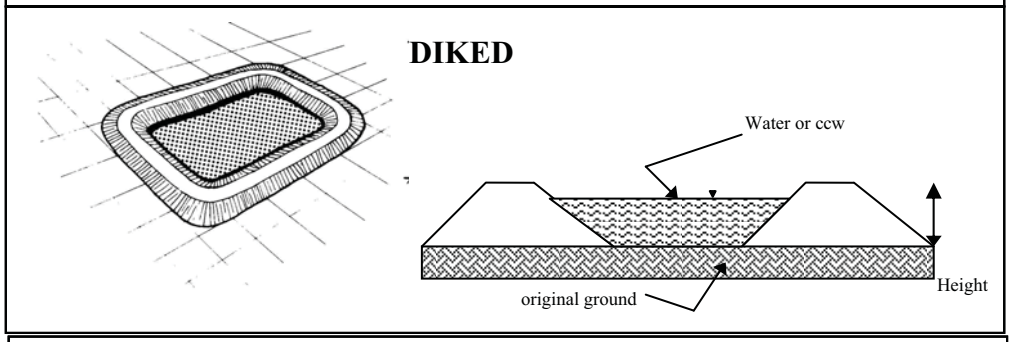
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

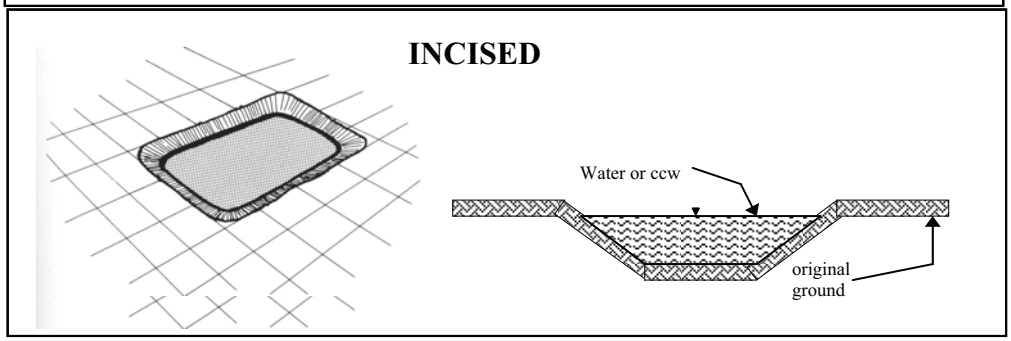
Refer to State classification of C-2, High hazard Structure per PA-DEP letter (August 18, 1994) and 25PaCode105.91 Classification of Dams and Reservoirs. State's classification is equivalent to the Environmental Protection Agency's (EPA) Significant Hazard rating.

CONFIGURATION:









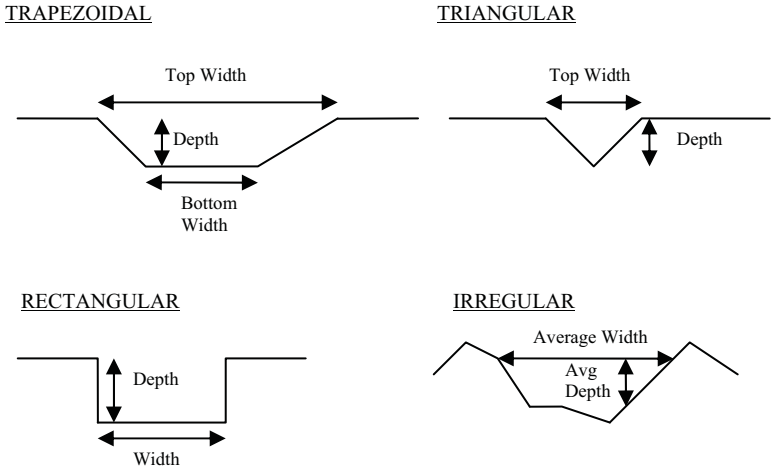
_____ Cross-Valley
__X__ Side-Hill **The South end of the impoundment is a concrete wall.*
_____ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height 27 (max) feet Embankment Material Soil with asphalt on crest and downstream slope
Pool Area 2.9 acres Liner Asphlat
Current Freeboard 4± feet Liner Permeability 10^-7 cm/s (estimated)

TYPE OF OUTLET (Mark all that apply)

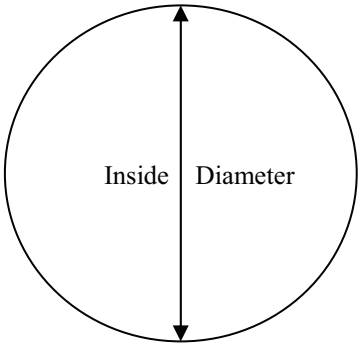
_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

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



_____ **Outlet**

_____ inside diameter



Material
_____ 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 Commonwealth Associates, Jackson, Michigan
_____

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 : _____

BRUCE MANSFIELD POWER STATION – SHIPPINGPORT, PA
WEST HIGH DISSOLVED SOLIDS POND

Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that.

No.

Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation?

No.

From the site visit or from photographic documentation, was there evidence of prior releases, failures, or patchwork on the dikes?

No.

APPENDIX B

BRUCE MANSFIELD POWER PLANT
PHOTO LOG

PHOTO 1: DOWNSTREAM NORTH SLOPE OF NORTH LDS POND

PHOTO 2: CUTS IN NORTH SLOPE OF NORTH LDS POND

PHOTO 3: NORTH LDS POND DRAINED AND CLEANING

PHOTO 4: CREST ALONG NORTH LDS POND W/ REVEG IN B.G.

PHOTO 5: VEGETATION AT N.E. CORNER OF NORTH LDS POND

PHOTO 6: COAL AREA STORM DISCHARGE INTO SOUTH LDS POND

PHOTO 7: BERM BETWEEN NORTH AND SOUTH LDS PONDS

PHOTO 8: SOUTH LDS POND W/ COAL HANDLING AREA IN B.G.

PHOTO 9: VEGITATION AT N.W. CORNER OF SOUTH LDS POND

PHOTO 10: SPILLWAY BETWEEN NORTH AND SOUTH LDS PONDS

PHOTO 11: WEST EMBANKMENT CREST FOR SOUTH LDS POND

PHOTO 12: SOUTH LDS POND LOOKING EAST

PHOTO 13: REPAIR OF ASPHALT ON WEST HDS POND NORTH SLOPE

PHOTO 14: WEST HDS POND LOOKING NORTH

PHOTO 15: WASTE BUILDUP IN WEST HDS POND

PHOTO 16: CLOSEUP OF SOUTH WALL OF WEST HDS POND

PHOTO 17: TRUCK DUMP AREA OF WEST HDS POND

PHOTO 18: WEST HDS POND LOOKING EAST

PHOTO 19: ALONG NORTH CREST OF WEST HDS POND

PHOTO 20: DECOMMISIONED STRUCTURE IN WEST HDS POND

PHOTO 21: SPILLWAY BETWEEN WEST AND EAST HDS POND

PHOTO 22: NORTH DOWNSTREAM SLOPE OF WEST HDS POND

APPENDIX C

STABILITY ANALYSIS RESULTS

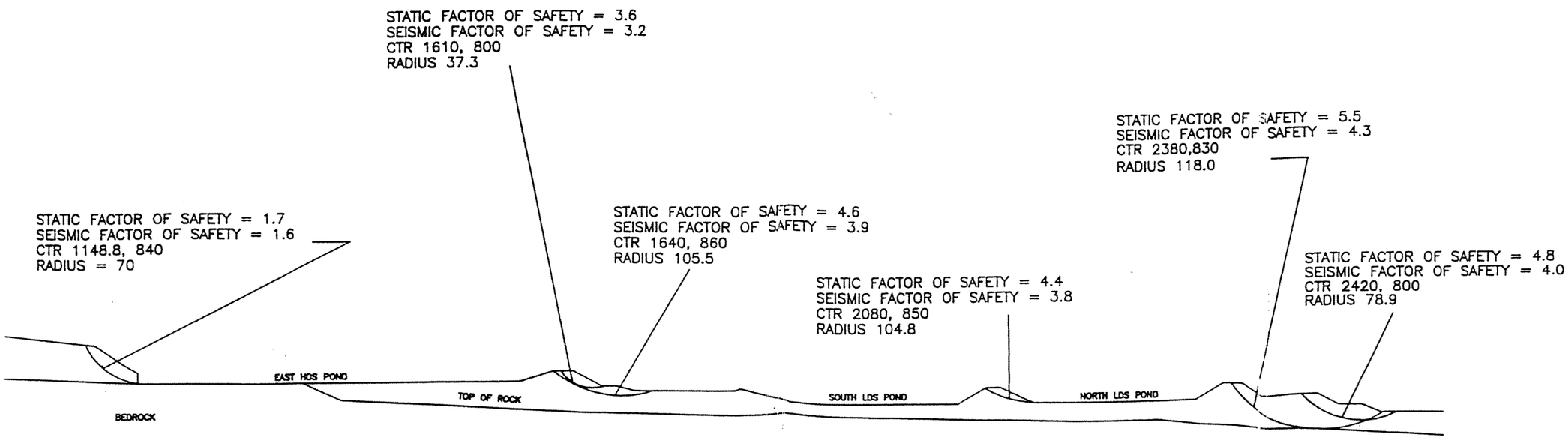
PENNSYLVANIA POWER COMPANY

BRUCE MANSFIELD PLANT HDS and LDS PONDS

DIKE STABILITY – DRY CASE

JOB NO. 92122

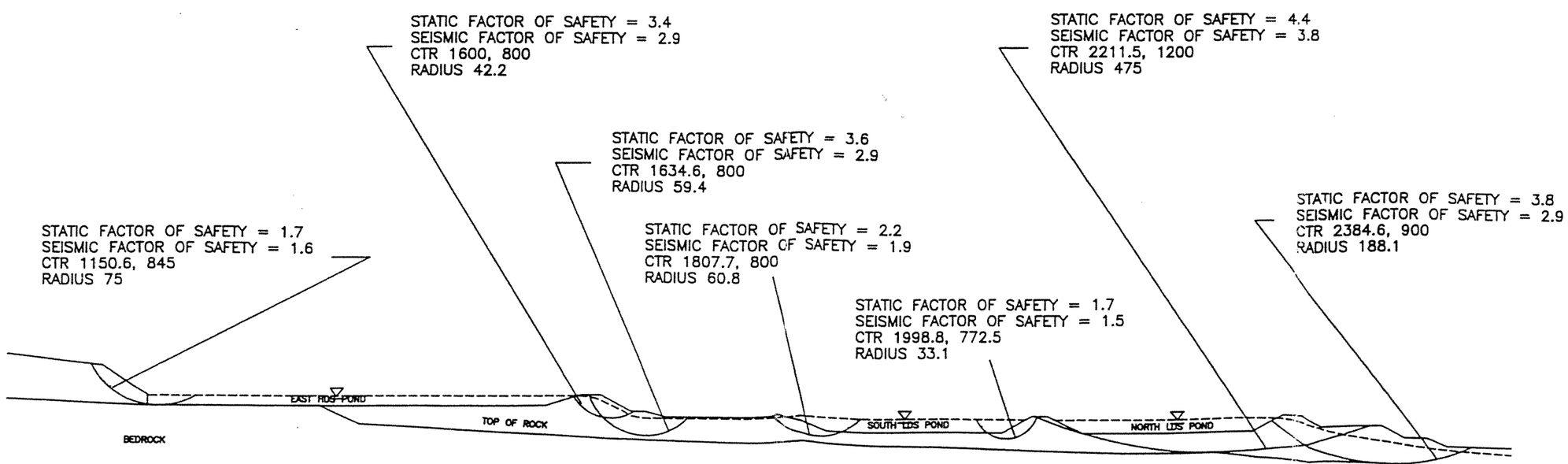
SOIL PARAMETERS:	MINIMUM FACTOR OF SAFETY:
UNIT WEIGHT = 120 pcf	STATIC = 1.7
COHESION = 500 psf	SEISMIC = 1.6
FRICTION ANGLE = 30 degrees	⊕CTR 1148.75, 840
	RADIUS = 70



PENNSYLVANIA POWER COMPANY

BRUCE MANSFIELD PLANT HDS and LDS PONDS

DIKE STABILITY – SATURATED CASE

JOB NO. 92122

SOIL PARAMETERS:	MINIMUM FACTOR OF SAFETY:
UNIT WEIGHT = 120 pcf	STATIC = 1.7
COHESION = 500 psf	SEISMIC = 1.5
FRICTION ANGLE = 30 degrees	@ CTR 1998.7, 772.5
	RADIUS = 33.1