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Assessment of Dam Safety of Coal Combustion Surface Impoundments

Hugo Power Plant

Western Farmers Electric Cooperative
U.S. Highway 70
Fort Towson, Oklahoma

Prepared for:

U.S. Environmental Protection Agency
Washington, D.C.

July 7, 2011

CDM Project No.: 79288.1801.036.SIT.HUGOZ

Final Report

Preface

The assessment of the general condition of the impoundments is based upon available data and visual observations. Detailed investigations and analyses involving topographic mapping, subsurface investigations, testing and detailed computational evaluations are beyond the scope of this report.

In reviewing this report, it should be realized that the reported condition of the impoundments is based on observations of field conditions at the time of assessment, along with data made available to the assessment team. In cases where an impoundment may have been lowered or drained prior to the assessment, such action, while improving the stability and safety of the impoundment, removes the normal load on the structure and may obscure certain conditions, which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is critical to note that the condition of impoundments depends on numerous and constantly changing internal and external conditions and is evolutionary in nature. It would be incorrect to assume that the present condition of the impoundment at the time of the assessment is representative of the condition of the impoundment at some point in the future. Only through continued care and assessment can there be any chance that unsafe conditions will be detected.

Prepared By:

CDM

I certify that the management unit(s) referenced herein have been assessed on October 18 and 19, 2010:

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Section 1
Introduction and Project Description

1.1 Introduction

CDM was contracted by the United States Environmental Protection Agency (USEPA) to perform site assessments of selected coal combustion waste (CCW) surface impoundments. As part of this contract, CDM performed a site assessment of four CCW impoundments at the Hugo Power Plant, owned and operated by Western Farmers Electric Cooperative (WFEC).

The Hugo Power Plant is located 3 miles west of Fort Towson on U.S. Hwy 70, Fort Towson, Choctaw County, 74735, Oklahoma as shown on **Figure 1**. The state boundary with Texas is approximately 7.5 miles south of the site. The Red River is also 7.5 miles downstream of the site.

CDM made a site visit to the Hugo Power Plant on October 18 and 19, 2010 to collect relevant information, inventory the impoundments, and perform visual assessments of the impoundments. CDM representatives Michael L. Schumaker, P.E. and Janet A. Connor were accompanied by the following individuals:

Company	Name and Title
WFEC	Charles Collier, Hugo Plant Manager
WFEC	David Sonntag, Manager, Generation Engineering
WFEC	Kent Fletcher, Environmental Specialist

1.2 State Regulation

The Oklahoma Water Resources Board (OWRB) is responsible for the State's dam safety program. Title 785 Oklahoma Water Resources Board Chapter 25 Dams and Reservoirs outlines requirements relative to reservoir requirements and dam safety. It is our understanding that to date OWRB has not been actively involved in the regulation of CCW impoundments.

1.2.1 Permits

WFEC staff indicated that the Oklahoma Department of Environmental Quality (ODEQ) permits the fly ash ponds as a landfill. The WFEC Hugo Power Plant was issued a permit under the National Pollutant Discharge Elimination System (NPDES). The plant's current permit will expire May 31, 2013. The permit number is OK0035327. The bottom ash ponds are permitted as a flow-through impoundment on the facilities NPDES permit.

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1.3 Datum

Elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Directional coordinates are referenced to magnetic north.

1.4 Site Description and Location

1.4.1 CCW Impoundment Construction and Historical Information

The Hugo Power Plant began operation about April 1982. A 450-net-megawatt coal-fired generating unit is operated at the facility. The plant can burn up to 275 tons of coal per hour.

Four ash ponds were commissioned in 1982 when the plant began commercial operation. Two of the ponds have been utilized for fly ash, and two for bottom ash. Typical cross-sections of the embankments are presented on **Figures 3 and 4**. Pond locations are shown on **Figure 5**.

The bottom ash ponds have surface areas of 34 acres each with embankments up to 11 feet in height. As of March 2009, the bottom ash ponds were estimated to contain 386,015 tons of CCW with additional available volume of 1,213,985 tons. The embankments were constructed with native site soils placed as engineered, compacted fill to a crest elevation of El. 446. A divider berm with a crest at El. 446 separates the North and South Bottom Ash Ponds. The embankments have 10 to 25-foot-wide crests and 2H: 1V interior and exterior side slopes.

The fly ash ponds have surface areas of 17.6 acres each with embankments up to 30 feet in height. As of March 2009, the fly ash ponds were estimated to contain 154,000 tons of CCW with additional available volume of 876,406 tons. The embankments were constructed with native site soils placed as engineered, compacted fill to a crest elevation of El. 515. A divider berm with a crest at El. 515 separates the North and South Fly Ash Ponds. The embankments have 10 to 20-foot-wide crests and 2 horizontal to 1 vertical (2H: 1V) interior and exterior side slopes.

The fly ash and bottom ash ponds were designed by Burns & McDonnell Engineering in 1978. The design and construction of the ponds was under the supervision of R.D. Sands, P.E. Site work specifications for pond construction reviewed by CDM included subgrade preparation, fill material requirements, placement and compaction specifications, and requirements for pond liner systems. Compaction specifications included 8 to 12-inch loose lifts and compaction to 95% of the maximum dry density as determined by American Association of State Highway and Transportation Officials (AASHTO) method T-99 with moisture contents no more than 2% below or 4% above the optimum moisture content. All ponds were specified to be lined with a compacted clay liner with a permeability less than or equal to1 X 10^{-7} centimeters per second (cm/sec).

In addition to the fly and bottom ash ponds, there is a Raw Water Storage Pond at the plant site. This pond is used as a fresh-water holding pond. Water stored in the pond is treated and subsequently used in the boiler and cooling towers. No CCW is stored in this pond. Therefore, it was not addressed as part of our assessment.

1.4.2 Current CCW Impoundment Configuration

The CCW bottom ash and fly ash impoundments at the Hugo Power Plant are used to store CCW and other discharges as follows:

Bottom Ash Ponds:

- Water treatment plant waste discharge
- Plant drain discharge
- Cooling tower blow down
- Coal pile runoff overflow
- Storm drain discharge
- Oil separator pond effluent

Fly Ash Ponds

- Rain water
- Pneumatically placed and truck-dumped fly ash
- Economizer ash

The Process Waste Pond is located downstream and to the east of the Bottom Ash Pond. This pond is primarily incised, and is not used to store CCW.

Three (3) 24-inch-diameter pipes through the divider embankment with an invert at El. 443 control water levels between the North and South Bottom Ash Ponds. Manually controlled influent flows enter either side of the ponds at the Bottom Ash Inlet Structure located at the at the west end of the ponds. In general, bottom ash settles in the west end of the pond, and the majority of the water is stored at the east end. The water from these ponds is generally recycled and reused for plant operations. Clean water discharges from the bottom ash ponds are directed to the Bottom Ash Water Recycle Structure via a riser and pipe outlet. Flows to the Bottom Ash Recycle Structure are directed back to the plant to the Process Waste Pond. Discharges from the Process Waste Pond exit through the Plant Outfall Discharge Pump Structure to the Red River. Water levels are manually controlled and in generally are maintained at or near El. 443.

Pneumatically placed and trucked fly ash is placed in the North and South Fly Ash Ponds. Other than rainfall and the pneumatically placed fly ash, no other liquids are placed into these ponds. One 18-inch-diameter pipe through the divider embankment with an invert at El. 512 controls water levels between the North and South Fly Ash

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Ponds. Water discharge is via a siphon located on the North Fly Ash Pond. Water level is further controlled in the south pond by pumping to the north pond. At the time of the site visit, the North Fly Ash Pond was dry and fly ash was being excavated and sold. Approximately 90% of the fly ash generated at the site is marketed and sold for beneficial reuse.

1.4.3 Other Impoundments

The Process Water Pond is located downstream of the North and South Bottom Ash Ponds. CCW is not placed into the Process Water Pond, and CCW cannot enter this pond from the bottom ash ponds based on the configuration of outlet riser and outlet, and the Bottom Ash Water Recycle Structure. No other impoundments are utilized for CCW storage or disposal at this site.

1.5 Previously Identified Safety Issues

It is our understanding that there have been no pond failures or related spills at the site. Based on our review of the information provided to CDM and as reported by EPA, there have been no identified impoundment-related safety issues at the Hugo Power Plant within the last 10 years.

1.6 Site Geology

The site is located north of the Red River and its tributary, the Kiamichi River. The site and surrounding area is not located in the 100-year floodplain of either river. The ground surface around the impoundments ranges from approximately El. 490 to El. 520 at the fly ash impoundments and El. 430 to El. 460 at the bottom ash impoundments. Natural soils at the site typically consist of Hollywood silty clay and Hollywood-Swink/Swink-Hollywood silty clay complexes based on our review of the Natural Resources Conservation Service, Choctaw County, Oklahoma soil map. These soils are typically fat or lean clays to a depth of about 76 inches where bedrock is encountered. Bedrock in the region typically consists of the Grayson Shale from the Washita Group.

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Section 2
Field Assessment
2.1 Visual Observations

CDM performed a visual assessment of the CCW impoundments at the Hugo Power Plant. The perimeter and divider embankments of all four impoundments total approximately 15,000 feet in length and are up to 30 feet high. The assessments were completed following the general procedures and considerations contained in Federal Emergency Management Agency's (FEMA's) Federal Guidelines for Dam Safety (April 2004) to make observations concerning settlement, movement, erosion, seepage, leakage, cracking, and deterioration. A Coal Combustion Dam Inspection Checklist and CCW Impoundment Inspection Form, developed by USEPA, were completed on site for each impoundment during the site visit. Copies of these forms are included in **Appendix A**. Photograph Location Plans are shown in **Figures 6a through 6c**, and photographs are included in **Appendix B**. Photograph locations were logged using a GPS device. The photograph coordinates are listed in **Appendix C.**

CDM visited the site on October 18, 2010 and October 19, 2010 to make visual assessments of the impoundments. The weather was sunny with daytime high temperatures between 75 and 85 degrees Fahrenheit. The daily total precipitation prior to the site visit is shown in **Table 1**. The data was recorded at Fort Towson which is approximately 3 miles east of the Hugo Power Plant.

Table 1 – Approximate Precipitation Prior to Site Visit

Dates of Site Visits - October 18, 2010 & October 19, 2010		
Day	**Date**	**Precipitation (inches)**
Saturday	October 9	0.00
Sunday	October 10	0.16
Monday	October 11	0.25
Tuesday	October 12	0.00
Wednesday	October 13	0.00
Thursday	October 14	0.00
Friday	October 15	0.00
Saturday	October 16	0.00
Sunday	October 17	0.00
Total	**Week Prior to Site Visit**	**0.25**
Total	**Month Prior to Site Visit**	**1.66**

2.2 North Bottom Ash Pond

An overview of North Bottom Ash Pond photograph locations is shown in Figures 6b and 6c. The North Bottom Ash Pond contained ash and standing water at the time of the assessment. Approximately 3.5 feet of freeboard was observed. The pond's south embankment serves as a divider embankment with the South Bottom Ash Pond.

2.2.1 Exterior Slope

In general, there is only a defined exterior slope on the east end of the pond since the north and west embankments appear to have been constructed primarily by excavating into the existing ground surface. Based on site observations and the existing topography, it does not appear that it is possible for the west or north embankments to breach. The north and west embankments were covered in short grassy vegetation.

The east embankment exterior slope was in good condition and was covered with large riprap, approximate 2 feet in largest dimension. The exterior slope was covered with medium dense vegetation ranging from approximately 3 to 12 inches in height (Photographs 17 and 19). The embankments appeared to be sloped at 2H: 1V. No significant erosion was observed on the slope.

2.2.2 Crest

The crest of the North Bottom Ash Pond appeared to be in good condition (Photographs 13, 14, and 16). A small 3-foot by 3-foot rut was observed on the east embankment crest. The crest width ranged from about 10 feet wide along the west, north, and east embankments, and 25 feet for the south embankment. The entire crest is subjected to vehicle traffic, but most of the traffic occurs along the north and south embankment crests. The crest surface appeared to mainly consist of compacted granular material and grass.

2.2.3 Interior Slope

The interior slopes appeared to be in good condition. Light vegetation covered the embankment interior slopes (Photographs 14, 15 and 16). The interior slopes appeared to be approximately 2H: 1V. No armoring of the interior slope was observed, and no significant erosion or slumping was observed.

2.2.4 Divider Embankment

The south embankment of the North Bottom Ash Pond is the divider between the North and South Bottom Ash Ponds. The embankment was in satisfactory condition and was covered in light vegetation (Photographs 13, 21, and 22). The vegetation was about 6 to 12 inches high. The embankment slopes appeared to be 2H: 1V. Minor sloughing, cracks approximately 15 feet long (Photograph 21), and ruts were observed in some localized areas of the divider embankment. The sloughs observed did not

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impinge on or reduce the crest width. Some large riprap was observed on the south side of the divider.

2.2.5 Outlet

A concrete riser and outlet pipe is located at the eastern end of the pond. The outlet structure discharges to the Bottom Ash Recycle Structure, eventually discharging to the Process Waste Pond. The outlet structure appeared to be in good condition. No unusual movement was observed around the structure.

2.3 South Bottom Ash Pond

An overview of South Bottom Ash Pond photograph locations is shown on Figures 6b and 6c. The pond contained standing water and ash, with approximately 3.5 feet of freeboard at the time of assessment.

2.3.1 Exterior Slope

In general, there is only a defined exterior slope on the east end of the pond since the south and west embankments appear to have been constructed primarily by excavating into the existing ground surface. Based on site observations and the existing topography, it does not appear that it is possible for the south or west embankments to breach. The south and west embankments were covered with about three to six inches of grass. Some 1- to 2-inch-diameter woody growth was observed on the embankment faces.

The exterior slopes of the embankments were inclined at approximately 2H: 1V. . Large riprap, approximately 2 feet in largest dimension, was observed on the face of the east embankment (Photograph 5). The slopes appeared to be in good condition.

2.3.2 Crest

The crest width is about 10 feet on the east, south, and west sides, and 25 feet on the north side. The entire crest is subjected to vehicle traffic, though the majority is restricted to the north and east embankments. The crest surface appeared to mainly consist of compacted granular material and vegetation. The crest appeared to be in satisfactory condition (Photographs 2 and 7).

2.3.3 Interior Slope

The interior slopes were approximately 2H: 1V. Riprap armoring of the interior slope is present on the east embankment (Photographs 4 and 6). Some small desiccation cracks were observed near the southeast corner of the interior slope. There were also some small sloughs observed well above the crest elevation on the excavated portion of the south embankment interior slope. On the south embankment, it appeared that the water level was below the natural ground surface elevation. The interior slopes appeared to be in generally good condition (Photographs 6, 9 and 10).

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2.3.4 Outlet

A concrete riser and outlet pipe is located at the eastern end of the pond. The outlet structure discharges to the Bottom Ash Recycle Structure, eventually discharging to the Process Waste Pond. The outlet structure appeared to be in good condition. No unusual movement was observed around the structure.

2.4 North Fly Ash Pond

An overview of North Fly Ash Pond photograph locations is shown on Figure 6a (Photograph 37). The pond stored a limited amount of water, and ash excavation was in progress at the time of the site visit.

2.4.1 Exterior Slope

The embankment exterior slopes were approximately 2H: 1V. The slopes were covered with light vegetation about 6 to 8 inches high (Photograph 39) with the exception of the east embankment. On the east embankment there were some areas of Johnson grass that was about 3 feet high. An area that was identified by plant personnel as being seasonally wet that was dry at the time of the site visit and some sparse vegetation were observed on the northeast corner of the embankment (Photograph 43). No significant erosion features were observed on the slopes. The exterior slopes appeared to be in good to fair condition.

2.4.2 Crest

The average width of the embankment crest was 10 feet, with the south embankment crest being up to about 25 feet wide. In general, there were no signs of misalignment. The crest is utilized for vehicle access. A portion of the east embankment crest, near the northeast corner, had rutting from vehicle traffic (Photograph 44). The crest appeared to be in fair condition.

2.4.3 Interior Slope

The interior slopes were generally inclined at 2H: 1V. In general the surface of the interior slopes had areas of sparse and light vegetation up to one foot high (Photograph 38). Some small stumps, small-diameter woody growth, and minor surface erosion were observed on the west embankment interior slope. Minor over-steepening of the interior slope was observed in some areas, apparently the result of erosion. Vegetation had been removed from portions of the north and south interior slopes, most likely due to ash excavation (Photographs 42 and 48). Several sloughs (Photographs 40 and 41) were observed along the north embankment. On the north embankment slope, four sloughs were estimated to be 75, 35, 65, and 60 feet long, respectively. In the slough areas, the upper portion of the embankment appeared to be over-steepened to about approximately 1H: 1V. The interior slopes appeared to be in fair condition.

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2.4.4 Divider Embankment

The south embankment serves as the divider embankment between the north and south fly ash ponds. In general, there were no signs of misalignment (Photographs 47 and 48). The divider embankment crest is utilized for vehicle access. An apparent slough approximately 130-foot-long that extended from the crest to the water level was observed on the south side of the divider embankment. The interior slopes appeared to be in fair condition.

2.4.5 Outlet

The outlet of the North Fly Ash pond consists of an approximate 6-inch-diameter siphon. The siphon appeared to be in good operating condition.

2.5 South Fly Ash Pond

An overview of South Fly Ash Pond photograph locations is shown on Figure 6a**.** The pond stored a limited amount of water, and ash excavation was in progress at the time of the site visit.

2.5.1 Exterior Slope

Exterior slopes were inclined at approximately 2H: 1V. Approximately 6 to 8 inches of grass was observed on the slope face. The vegetation appeared to have been recently mowed, and some small-diameter woody brush had been removed. An approximate 8-inch-diameter tree had been recently removed near the southwest corner of the embankment. Approximate 6- to 8-inch-diameter rodent holes were observed near the southwest corner of the embankment.

The west, north, and east exterior slopes appeared to be in good condition. The south exterior slope appeared to be in poor condition. An approximate 15-foot by 90-foot wet area was observed on the south embankment (Photograph 29). Near the south east corner of the embankment, an approximate 24-foot by 60-foot area of cattails was observed (Photograph 30). A 75-foot-long portion of the south embankment slope appeared to be over-steepened and eroded, with some signs of possible slope movement (Photograph 31). Another 75-foot-long slough was observed on the south embankment (Photograph 33).

2.5.2 Crest

The average crest width of the north embankment is approximately 25 feet. The average crest width of the west, south and east embankment was approximately 10 feet. The crest surface consisted of compacted granular fill materials or was vegetated. A minor depression approximately 30 feet long by 12 feet wide was observed on the south embankment crest (Photograph 32). The crest generally appeared to be in good condition (Photograph 28) with the exception of rutting.

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2.5.3 Interior Slope

The slopes were 2H: 1V, except in the areas where sloughing and resulting over-steepening of the interior face occurred. Sloughing was observed on the southern portion of the east embankment (Photograph 26) and at the western end of the south embankment interior slope (Photograph 34). In those areas slopes appear to be approximately 1H: 1V. Vegetation, consisting primarily of grass and brush less than 6 inches tall was observed on the interior slopes of the west, east and north embankments. There were also some small areas where vegetation was observed to be sparse. The interior slopes appeared to be generally in fair condition (Photograph 46).

2.5.4 Outlet

The South Fly Ash Pond is connected to the North Fly Ash Pond via an 18-inch-diameter pipe with an invert at El. 512. Water levels in the South Fly Ash Pond are controlled via the pipe, pumping to the North Fly Ash Pond, and the siphon in the North Fly Ash Pond. The South Fly Ash Pond does not have any other outlet.

2.6 Monitoring Instrumentation

Based on our review of the information provided to CDM, there are a total of 11 monitoring wells at the site. There are two wells identified as up gradient wells and 9 identified as down gradient wells. Five of the down gradient wells are located adjacent to the fly ash ponds and four are adjacent to the bottom ash ponds. Ground water is monitored once per year with results submitted to the Oklahoma Department of Environmental Quality.

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Section 3
Data Evaluation

3.1 Design Assumptions

CDM was not provided with any of the original design assumptions for the CCW impoundments. CDM has reviewed information made available by WFEC related to the construction of the impoundments.

3.2 Hydrologic and Hydraulic Design

CDM was not provided with any hydrologic and hydraulic designs or analyses for the four impoundments.

A preliminary evaluation of the hydraulic capacity of the impoundments was performed to estimate if the ponds are adequately sized to store or pass the design storm event. Based on Title 785 Oklahoma Water Resources Board (OWSD) Chapter 25 Dams and Reservoirs all of the CCW impoundments at this site are classified as small since their storage volume is less than 10,000 acre-feet and the embankments are less than 50 feet in height. Based on the downstream conditions of the subject impoundments, it is anticipated that the OWSB would characterize them as low hazard potential. As such, the design storm for these impoundments is 25% of the Probable Maximum Flood (PMF) with no free board, based on current regulations. The OWSD defines the PMF as the flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region as listed in Hydrometeorological Report (HMR) No. 51 prepared by the National Weather Service.

HMR No. 51 indicates that the Probable Maximum Precipitation (PMP) for a 6-hour storm event over a 10 square-mile area in the vicinity of the site is approximately 29.3 inches. CDM assumed that the PMP is equal to the PMF for the purpose of evaluating impoundment storm capacity. The drainage area contributing to the ponds at this site is limited to the storage area within the impoundments. Preliminary evaluations indicate that at the current operating pools there is enough storage capacity and freeboard in all of the ponds to safely store at least 25% PMP event without the embankments being overtopped.

3.3 Structural Adequacy & Stability

Title 785 Oklahoma Water Resources Board Chapter 25 Dams and Reservoirs requires that the following Factors of Safety (F.S.) be utilized for assessing embankment dam stability:

- Steady Sate Seepage with water level at emergency spillway crest, F.S. = 1.5
- Rapid drawdown with water level at principal spillway, F.S. = 1.2
- Earthquake with reservoir at emergency spillway crest for downstream slope, at principal spillway for upstream slope, F.S. = 1.0.

Procedures established by the United States Army Corps of Engineers (USACE), United States Department of Interior Bureau of Reclamation, Federal Energy Regulatory Commission, and United States Natural Resources Conservation Service, are generally accepted engineering practice. Minimum required factors of safety outlined by the USACE in EM 1110-2-1902, Table 3-1 and seismic factors of safety by FEMA Federal Guidelines for Dam Safety, Earthquake Analyses and Design of Dams (pgs. 31, 32 and 38, May 2005) are provided in **Table 2**.

Table 2 - Minimum Safety Factors Required

Load Case	Minimum Required Factor of Safety
Steady-State Condition at Normal Pool or Maximum Storage Pool Elevation	1.5
Rapid Drawdown Condition from Normal Pool Elevation	1.2
Maximum Surcharge Pool (Flood) Condition	1.4
Seismic Condition at Normal Pool Elevation	1.0
Liquefaction	1.3

CDM was not provided with any information regarding the structural adequacy and stability of any of the ponds. CDM was also not provided with any information relative to the properties of the foundation and embankment soils. As such, evaluation of the stability of the embankments could not be completed.

3.4 Foundation Conditions

CDM was provided with information relative to subsurface conditions at the pond locations. Numerous boring logs were provided, however they were not all identified on boring location plans. Two borings, one each at the Fly Ash and Bottom Ash Ponds, could be positively located relative to the as-built pond locations. Based on our review of the boring data the subsurface conditions at the pond locations generally consisted of a thin layer of topsoil underlain by naturally deposited clay, limestone, and shale. Since all of the ponds were constructed prior to plant operation, it appears that that the embankments were constructed on native clay soil, shale bedrock, or limestone bedrock materials. It also appears that the impoundments were at least partially excavated into shale or limestone bedrock based on the pond bottom elevations depicted on the plans based on our review of the subsurface data. Site work specifications indicated that clearing and grubbing, topsoil stripping, and subgrade preparation were required to be completed during construction.

3.5 Operations & Maintenance

WFEC personnel indicated that there is no written formal operation or maintenance program. They also do not have any emergency action plan. Routine maintenance performed includes

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mowing grass on embankment slopes twice per year, and other activities as needed to address other observed conditions such as erosion and revegetation. WFEC personnel also indicated water levels are tightly controlled in order to meet ODEQ water quality requirements and to be prepared for potential increases in water levels resulting from storm events. Water levels are controlled manually and are monitored at least twice per day, 7 days per week.

WFEC personnel perform visual inspections of the impoundments on a routine basis, with standard operating procedures in place to identify, report, and address observed deficiencies. In addition, ODEQ completes routine dam inspections on an annual basis as part of their Annual Comprehensive Site Compliance Evaluation report for Industrial Facilities.

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Section 4
Conclusions/Recommendations

4.1 Hazard Classification

The Hugo Power Plant impoundments currently do not have an OWSB-developed Hazard Potential Classification. Based on the USEPA classification system as presented on page 2 of the USEPA check list (**Appendix A**) and our review of the site and downstream areas, recommended hazard potential classifications have been assigned to the impoundments as summarized in **Table 3** below:

Table 3 – Recommended Impoundment Hazard Classification Ratings

Impoundment	Recommended Hazard Potential Classification	Basis
North Bottom Ash Pond	Low Hazard Potential	• Surrounding properties and downstream area are gently sloping ranchland. Downstream communities are 25+ miles away. • The impoundment is partially incised, reducing the likelihood of a breach and lessening the volume of a potential release.
South Bottom Ash Pond	Low Hazard Potential	• Surrounding properties and downstream area are gently sloping ranchland. Downstream communities are 25+ miles away. • The impoundment is partially incised, reducing the likelihood of a breach and lessening the volume of a potential release.
North Fly Ash Pond	Low Hazard Potential	• Surrounding properties and downstream area are gently sloping ranchland. Downstream communities are 25+ miles away. • The impoundment is partially incised, reducing the likelihood of a breach and lessening the volume of a potential release. • The impoundment contains mostly dry material that would be highly viscous in the event of a breach, resulting in a limited flood wave.
South Fly Ash Pond	Low Hazard Potential	• Surrounding properties and downstream area are gently sloping ranchland. Downstream communities are 25+ miles away. • The impoundment is partially incised, reducing the likelihood of a breach and lessening the volume of a potential release. • The impoundment contains mostly dry material that would be highly viscous in the event of a breach, resulting in a limited flood wave.

4.2 Acknowledgement of CCW Impoundment Condition

CDM acknowledges that the management units referenced herein were assessed by Michael L. Schumaker and Janet A. Connor, and appear to be in good condition based on site observations. However, there is a lack of documentation relative to the design and construction of these

facilities. It is not known if critical studies or investigations (stability, hydrologic, hydraulic, seismic) have been performed to confirm that potential safety deficiencies do not exist. Therefore, the Bottom and Fly Ash Ponds are judged to be in **POOR** condition based on the lack of design information. Additional documentation and studies performed to confirm the condition and performance of these impoundments may be sufficient to substantiate an improved condition assessment.

As described in the following sections, further studies, maintenance and monitoring will further improve the condition of these impoundments.

4.3 Maintaining and Controlling Vegetation Growth

In general, vegetation on the embankments was well maintained. No large trees were observed on the embankments. Some small brush was observed. Grassy vegetation and small brush was being mowed at the time of our site visit. It is our understanding that vegetation is mowed and baled twice per year.

CDM recommends that vegetation continue to be cut on a regular basis to ensure that adequate visual observations can be made by WFEC's personnel during routine inspections and by the ODEQ during their annual inspection.

4.4 Erosion Protection and Repair

Surface erosion, loss of ground cover, over-steepened slopes, rodent holes, minor sloughing, and vehicle ruts were observed in isolated areas on multiple embankment slopes as discussed in Section 2. In general, the observed conditions do not present an immediate concern provided that they are properly maintained a timely manner. CDM recommends filling over-steepened sloped to the original grades, backfilling rodent holes, repairing sloughs, and filling vehicle ruts with compacted fill. All areas where vegetation is not established and all areas disturbed as part of filling operations should be seeded.

WFEC identified that internal maintenance requests were prepared to address the eroded areas. It is our understanding that the repairs were scheduled to be implemented within three months of April 21, 2011 weather permitting.

4.5 Seepage

Wet areas and seepage were observed at the locations identified in Section 2 of this report. Seepage and wet areas should documented as part of routine inspections, and be observed for changes. Changes in size and coloration of seepage discharge should be documented and reviewed by a qualified professional engineer familiar with earth dam design and construction. WFEC indicated that the seepage area will be marked and monitored, and that maintenance will be performed as necessary.

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4.6 Impoundment Hydraulic and Stability Analysis

WFEC was not able to provide CDM with a hydraulic analysis showing the ability of the ash ponds to safely pass or store the 25% of the PMP event. However, a preliminary evaluation performed by CDM suggests there is enough storage capacity at the current operating pool levels to safely store precipitation from this rainfall event. CDM recommends WFEC perform a complete study to confirm this conclusion and update the study if operating levels of the pond change in the future.

CDM was not provided with information regarding stability analyses performed prior to or following construction of the ponds or information regarding engineering properties of the embankment soils. It is recommended that detailed stability analyses be performed for one cross section through southeast corner of the South Fly Ash Pond embankments. The stability analysis should include an evaluation of subsurface conditions to identify existing soil parameters in the embankments and foundation soils as well as the phreatic surface. Stability analyses should consider all appropriate operating and loading conditions including rapid drawdown if applicable, and seismic events.

4.7 Inspection Recommendations

Based on the information reviewed by CDM, it does not appear that WFEC has adequate inspection practices with respect to documentation. Currently no inspection documentation is prepared. CDM recommends that plant personnel develop detailed inspection documentation procedures, such as a check list, to aid in ensuring that they are performing adequate inspections and adequately documenting observations over time. Documentation should include a sketch of relevant features observed, and the documentation should be periodically reviewed to identify if conditions are worsening and/or if significant changes are occurring which could lead to additional maintenance issues or safety concerns.

Inspection procedures should include the recording of data from the existing piezometers around the ponds. A staff gage should be installed at outlet structures to record water levels in the impoundments, if applicable. In addition, inspections should be made following heavy rainfall, and the occurrence of these events should be documented. It is recommended that inspection records be retained at the facility for a minimum of three years.

WFEC has indicated that their inspection procedures will be updated to ensure better inspection documentation.

Section 5
Closing

The information presented in this report is based on visual field observations and review of reports and data provided to CDM by WFEC for the Hugo Power Plant surface impoundments. The conclusions and recommendations presented are based, in part, on limited information available at the time of this report. This report has been prepared in accordance with generally accepted engineering practices. No warranty, expressed or implied, is made. Should additional information become available or changes in field conditions occur, the conclusions and recommendations provided in this report should be re-evaluated by a qualified professional engineer.

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Section 6
Reports and References

The following is a list of reports and drawings that were provided by Western Farmers Energy Cooperative and were utilized during the preparation of this report and the development of the conclusions and recommendations presented herein.

1. ODEQ Annual Comprehensive Site Compliance Evaluation Report for Industrial Facilities, prepared by WFEC, January 14, 2010

2. WFEC Division 2 – Site Work Specification

3. Water Quality Division – Sanitary Survey, prepared by WFEC, September 1, 2010

4. ODEQ Land Disposal Facility Inspection Report, prepared by WFEC, September 1, 2010

5. ODEQ Surface Impoundments & Septic Tank Systems Form 2SI, prepared by Kent Fletcher of WFEC, April 27, 2007

6. USEPA RFI under Section 104 of the Comprehensive Environmental Response, Compensation, and Liability Act U.S.C. 9604, prepared by WFEC, March 9, 2009.

7. USEPA Request for Property Access, October 6, 2010

8. Drawing Y23-9, "Grading Plan Area 18", prepared by Burns & McDonnell, July 28, 1978

9. Drawing Y24-10, "Grading Plan Area 19", prepared by Burns & McDonnell, July 28, 1978

10. Drawing Y27-6, "Grading Plan Area 22", prepared by Burns & McDonnell, July 28, 1978

11. Drawing Y28-6, "Grading Plan Area 23", prepared by Burns & McDonnell, July 28, 1978

12. Drawing Y71-4, "Grading Details 2", prepared by Burns & McDonnell, June 15, 1979

13. Drawing Y74-4, "Grading Details 5", prepared by Burns & McDonnell, June 15, 1979

14. Subsurface Information for the Coal-Fired Generating Facility for the Western Farmers Electric Cooperative, Volumes I and II, prepared by Burns & McDonnell, undated, Project No. 76-039-1. Boring logs indicate the field work was completed in 1977 and 1978.

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Figures

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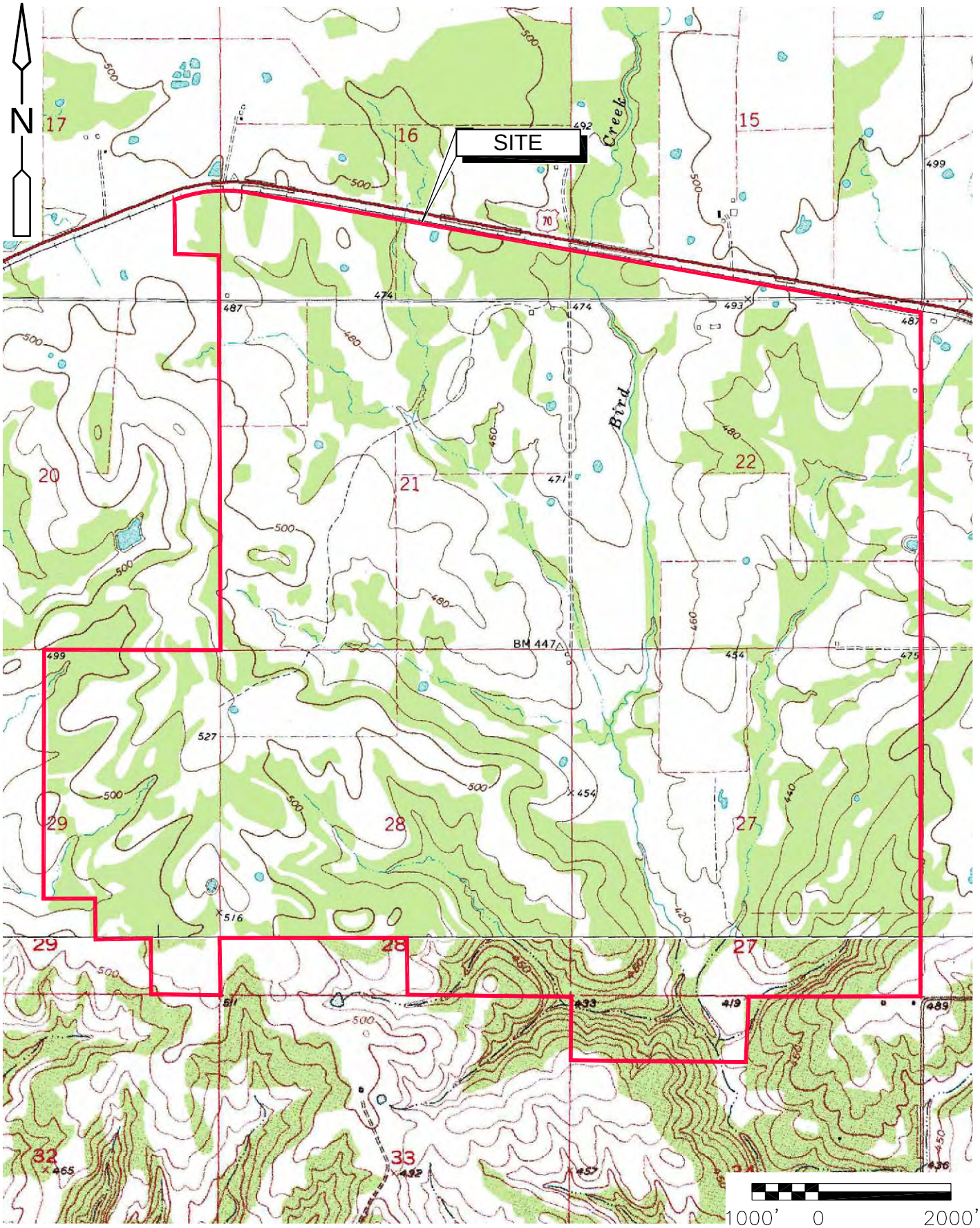

USGS TOPOGRAPHIC MAPS
FORT TOWSON & FROGVILLE QUADRANGLE MAPS
CONTOURS AND ELEVATIONS IN FEET

FORT TOWSON, OKLAHOMA
HUGO POWER PLANT
WESTERN FARMERS ELECTRIC COOPERATIVE

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LOCUS PLAN
OCTOBER 2010

FIGURE 1

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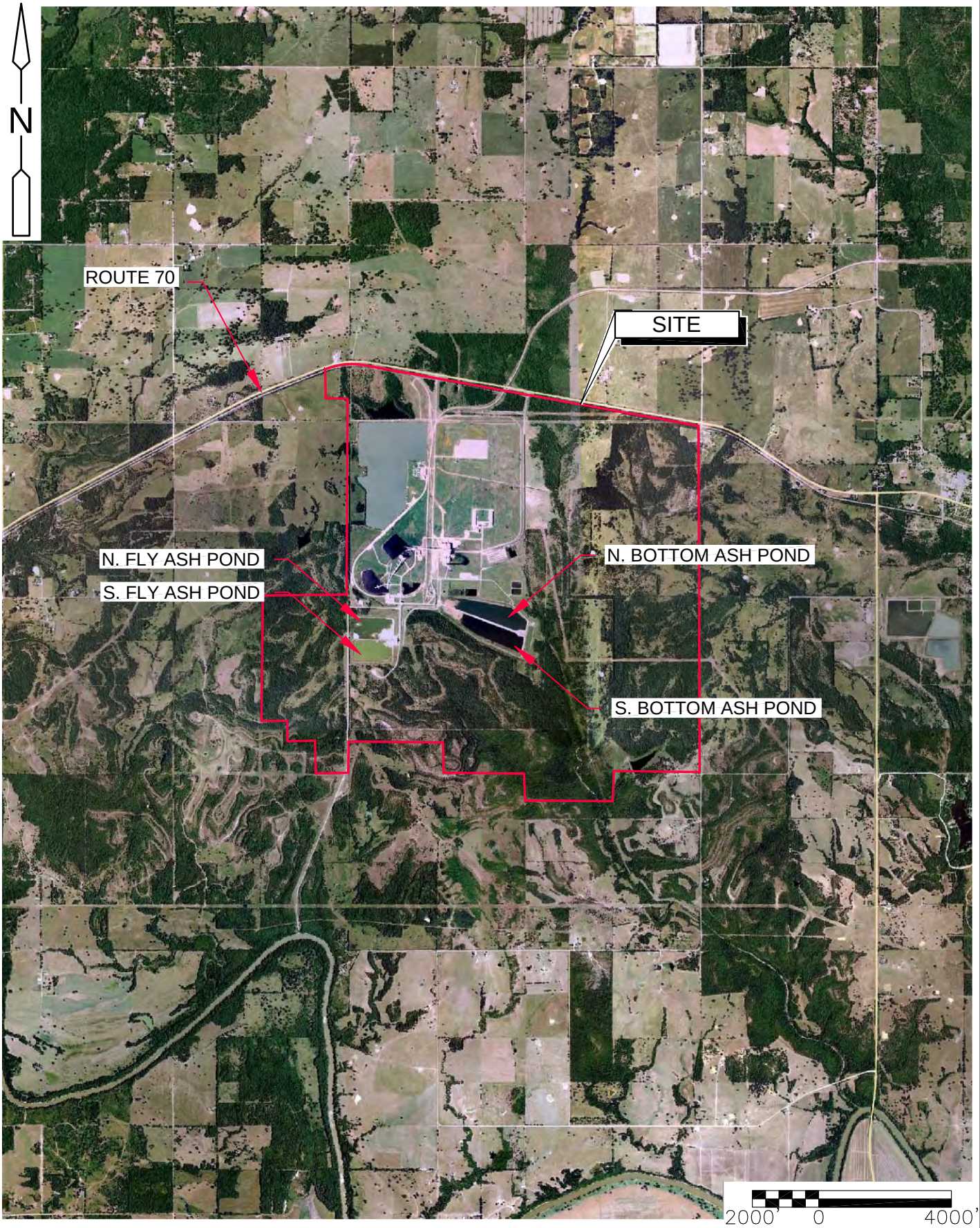

AERIAL PHOTOGRAPH SOURCE:
GOOGLE EARTH PRO.

FORT TOWSON, OKLAHOMA
HUGO POWER PLANT
WESTERN FARMERS ELECTRIC COOPERATIVE

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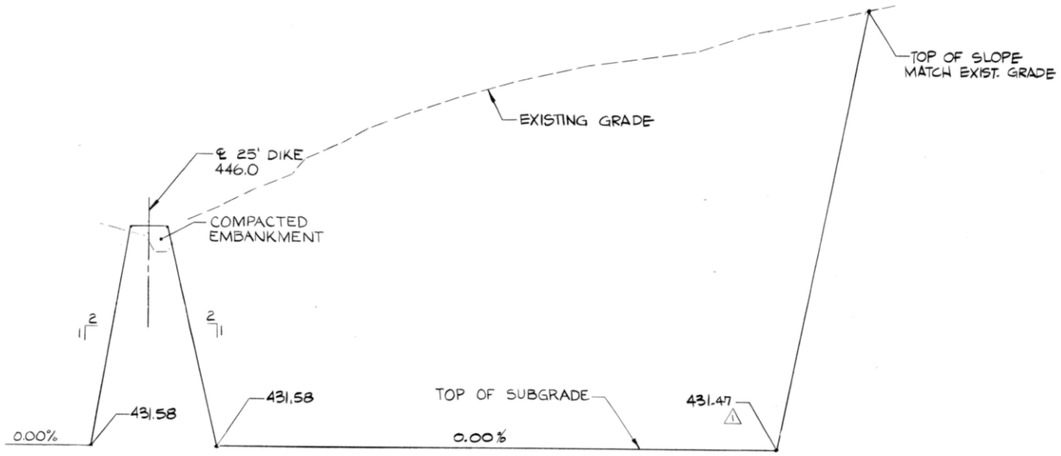
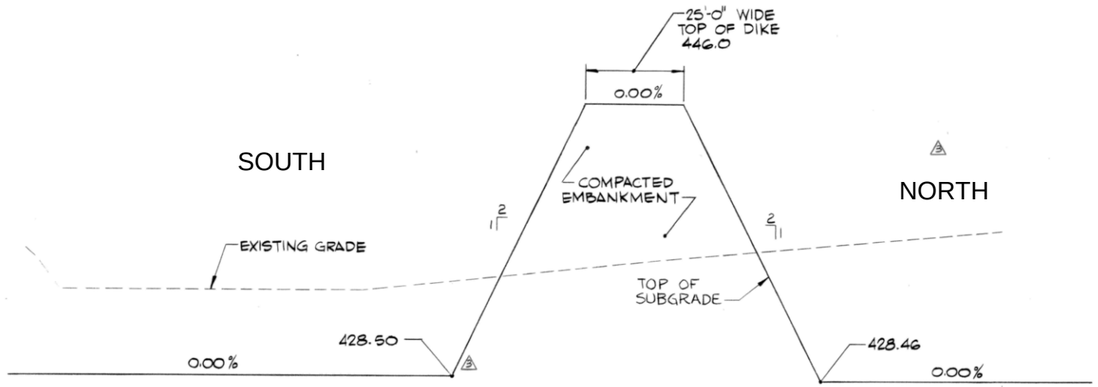
CRITICAL INFRASTRUCTURE MAP
OCTOBER 2010 FIGURE 2

US EPA ARCHIVE DOCUMENT

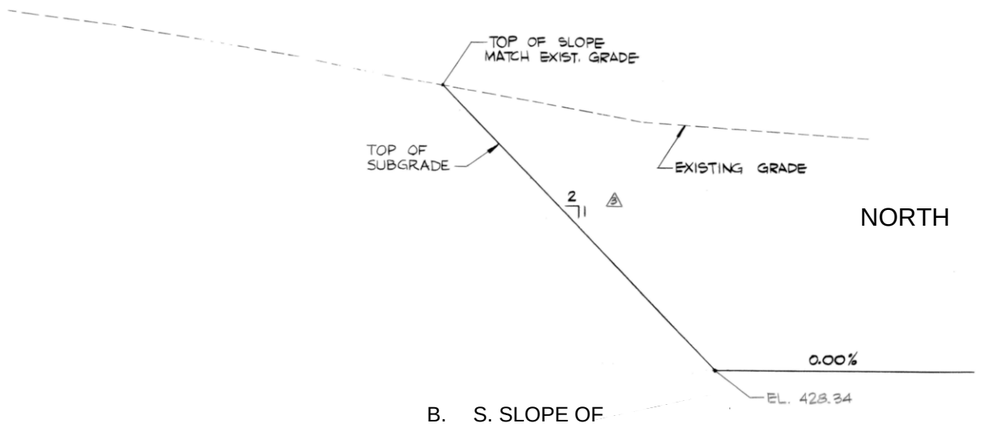
\\Pitsvr01\common\GEOTECHNICAL PROJECTS\Federal\Round 8 - OK Dam Assessments\Drawings\figures\Hugo Figures\Geotech\TCSFG003.DWG



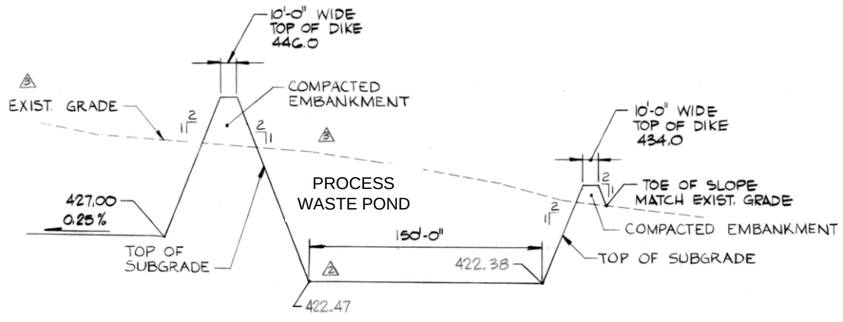
A. LOOKING WEST
CROSS-SECTION OF
N. BOTTOM ASH POND



C. DIKE SEPARATING
N.&S. BOTTOM ASH PONDS



B. S. SLOPE OF
S. BOTTOM ASH POND



D. E. BERM OF
S. BOTTOM ASH POND

NOTES:

1. CROSS-SECTIONS OBTAINED FROM VARIOUS 1978 DRAWINGS PREPARED BY BURNS & McDONNELL

NOTES:
1. ALL SUBGRADE AREAS UNDER ROADWAYS, RAILROADS, PARKING AREAS AND CONCRETE SLABS ON GRADE SHALL BE LIME STABILIZED AS SPECIFIED.

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HUGO POWER PLANT
WESTERN FARMERS ELECTRIC COOPERATIVE

TYPICAL CROSS-SECTIONS
BOTTOM ASH PONDS

FIGURE 3

US EPA ARCHIVE DOCUMENT

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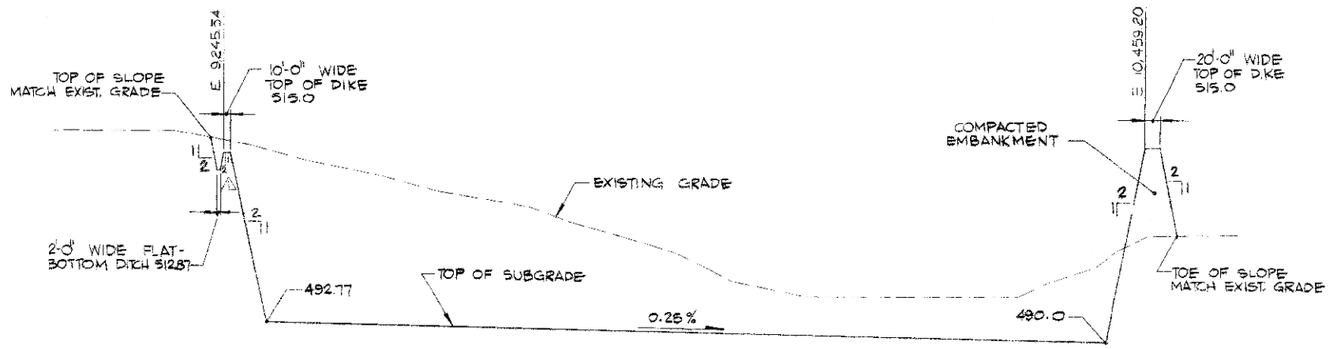
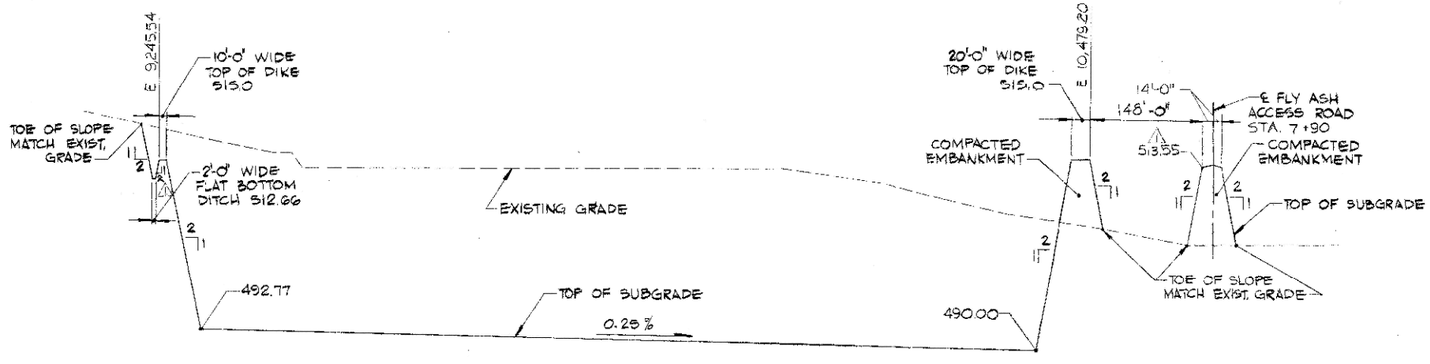
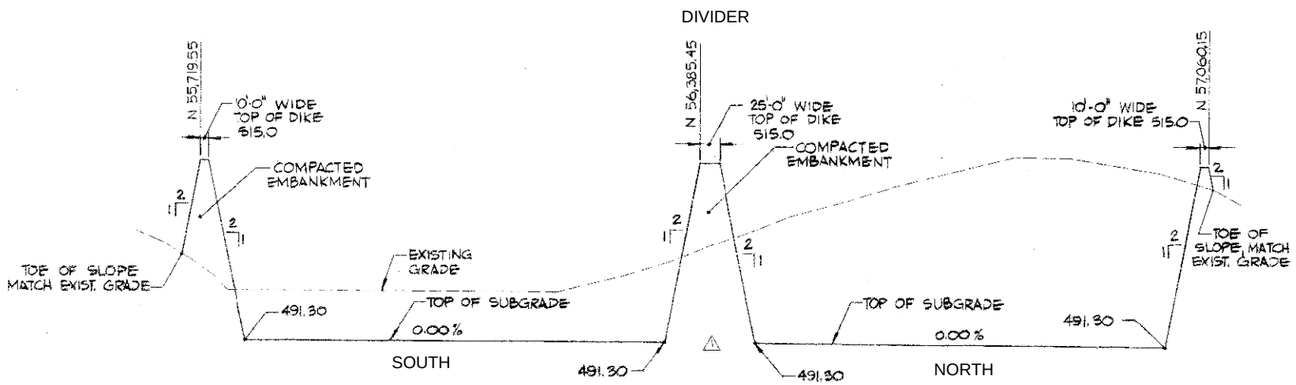


A. FLY ASH CROSS-SECTION
(NORTH)



B. FLY ASH CROSS-SECTION
(SOUTH)



C. FLY ASH CROSS-SECTION
(NORTH & SOUTH)

NOTES:

1. CROSS–SECTIONS OBTAINED FROM VARIOUS 1978 DRAWINGS PREPARED BY BURNS & McDONNELL

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TYPICAL CROSS-SECTIONS FLY ASH PONDS

FIGURE 4

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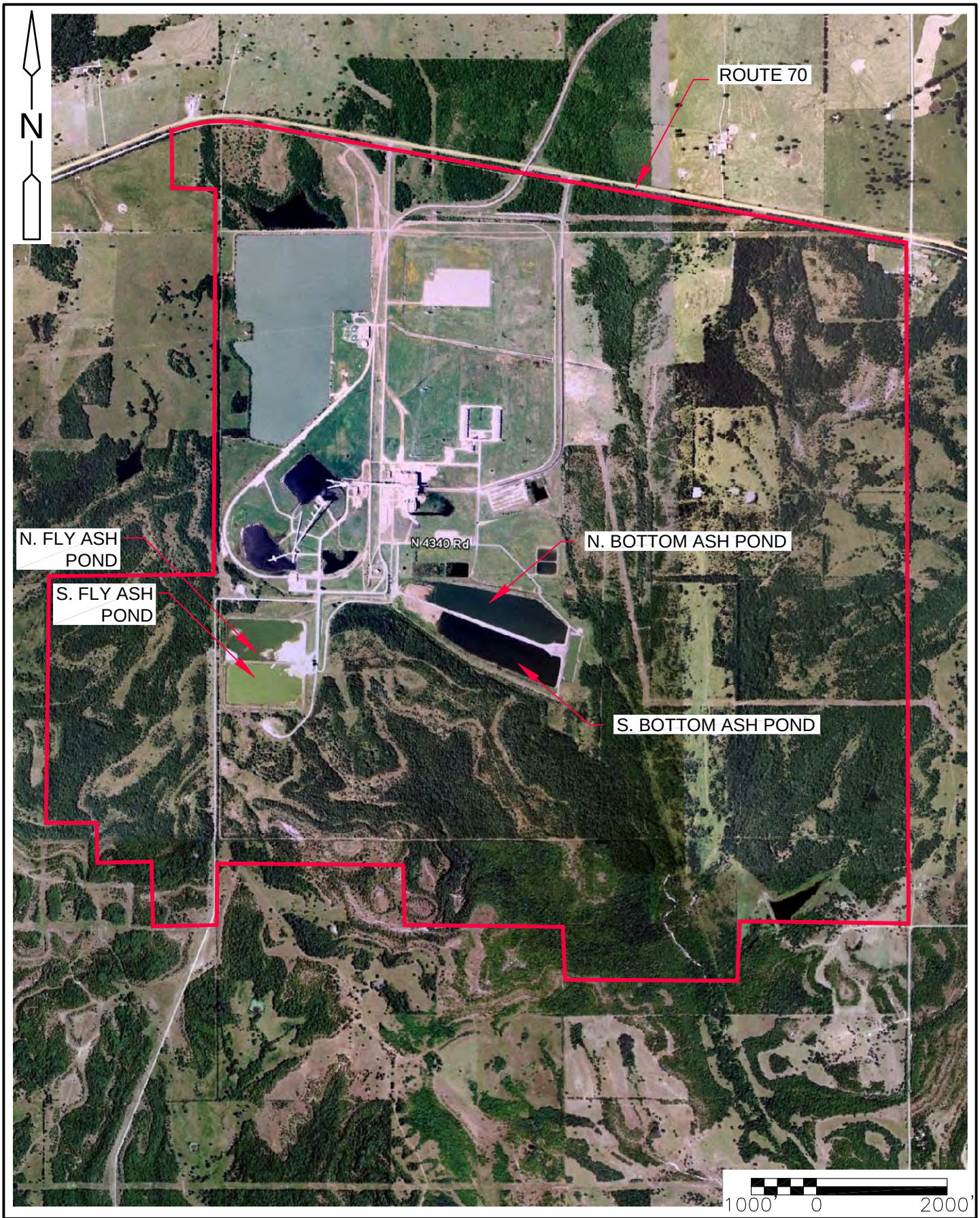

AERIAL PHOTOGRAPH SOURCE:
GOOGLE EARTH PRO.

FORT TOWSON, OKLAHOMA
HUGO POWER PLANT
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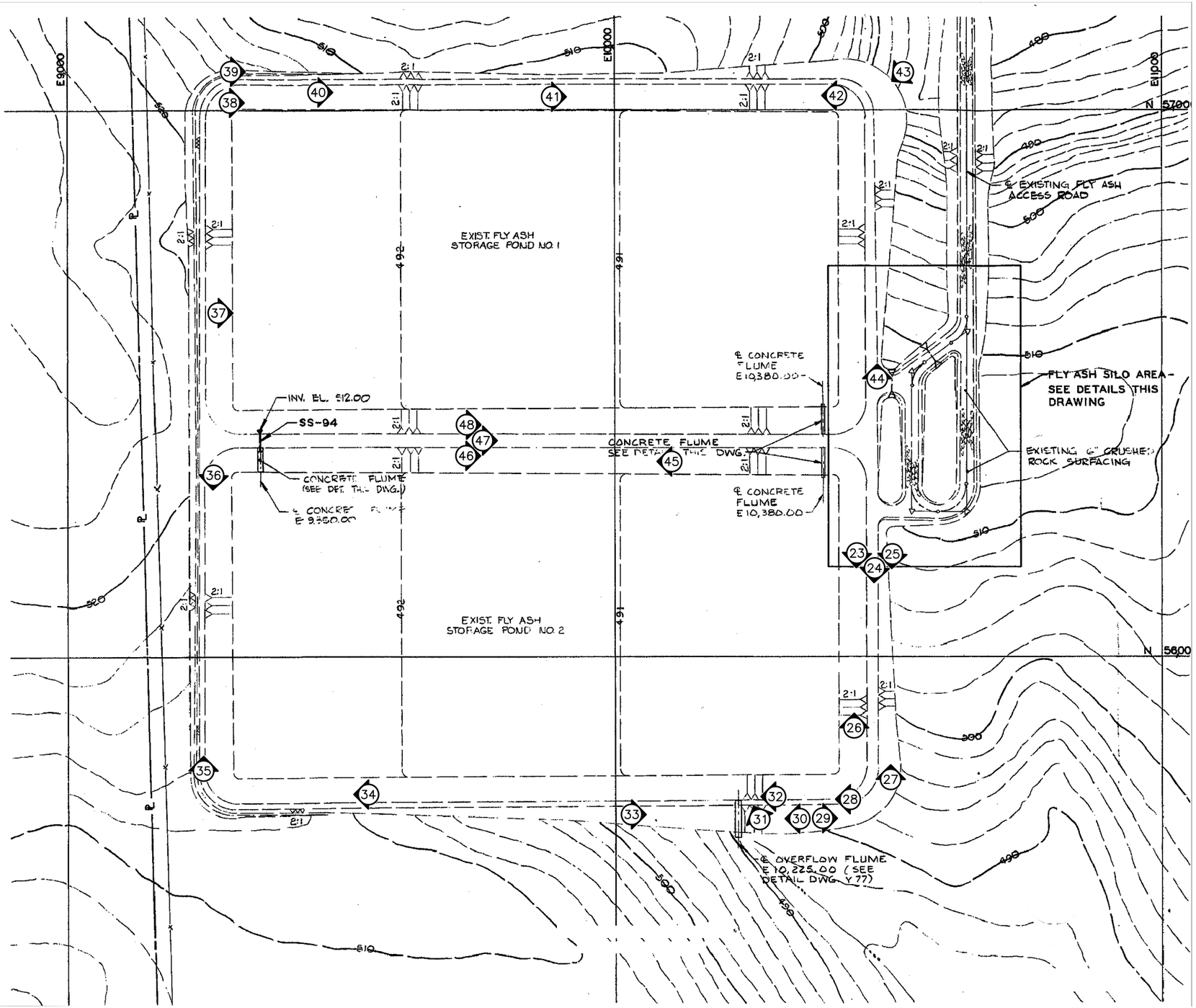
AERIAL MAP
OCTOBER 2010

FIGURE 5

US EPA ARCHIVE DOCUMENT



LEGEND:

(2) PHOTOGRAPH NUMBER AND ORIENTATION

NOTES:

1. BASE PLAN DEVELOPED FROM 1979 DRAWING PREPARED BY BURNS & McDONNELL

FORT TOWSON, OKLAHOMA
HUGO POWER PLANT
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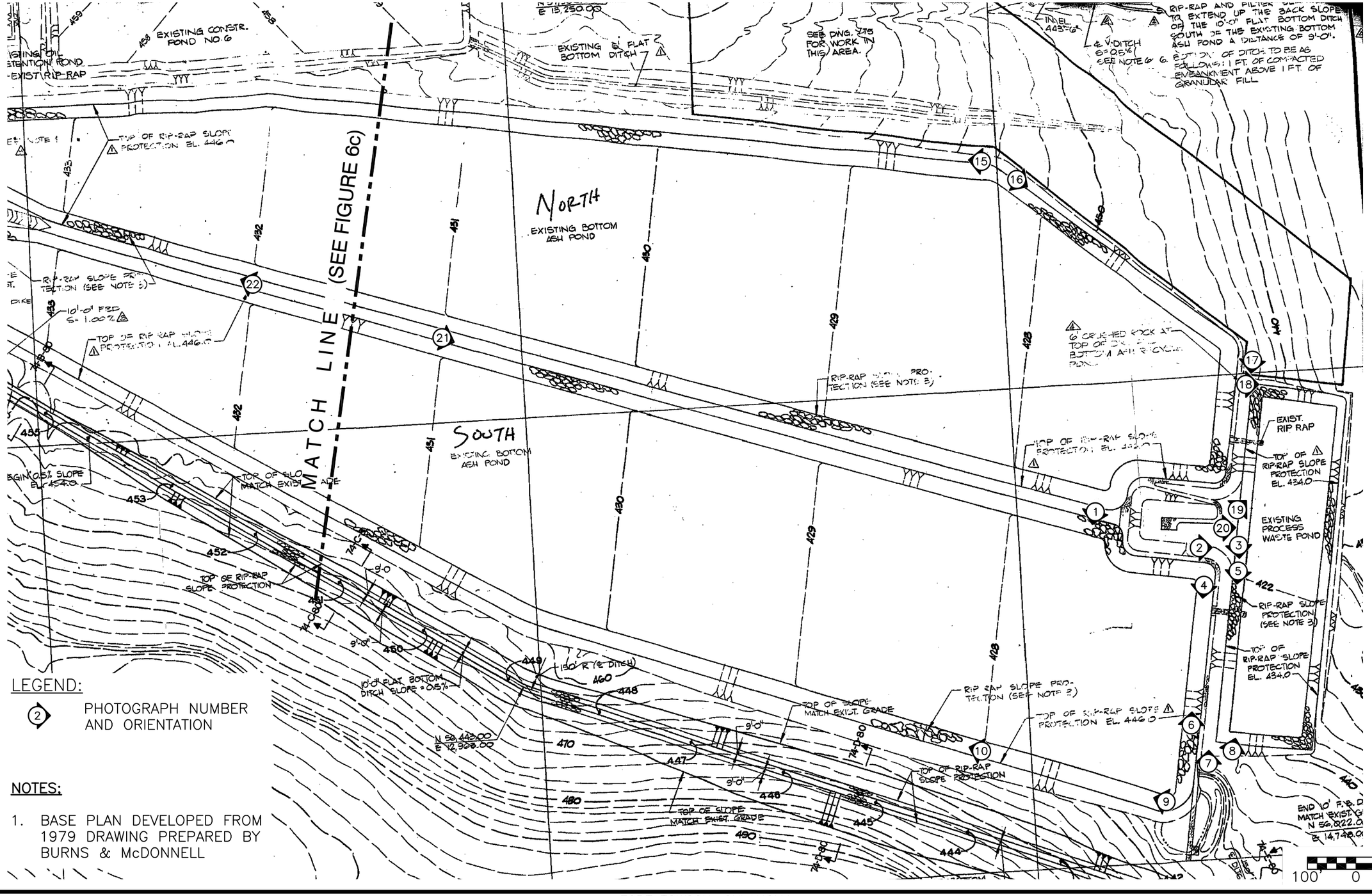
FLY ASH PONDS
PHOTOGRAPH LOCATION PLAN
FIGURE 6a

US EPA ARCHIVE DOCUMENT



LEGEND:

② PHOTOGRAPH NUMBER AND ORIENTATION

NOTES:

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FORT TOWSON, OKLAHOMA
HUGO POWER PLANT
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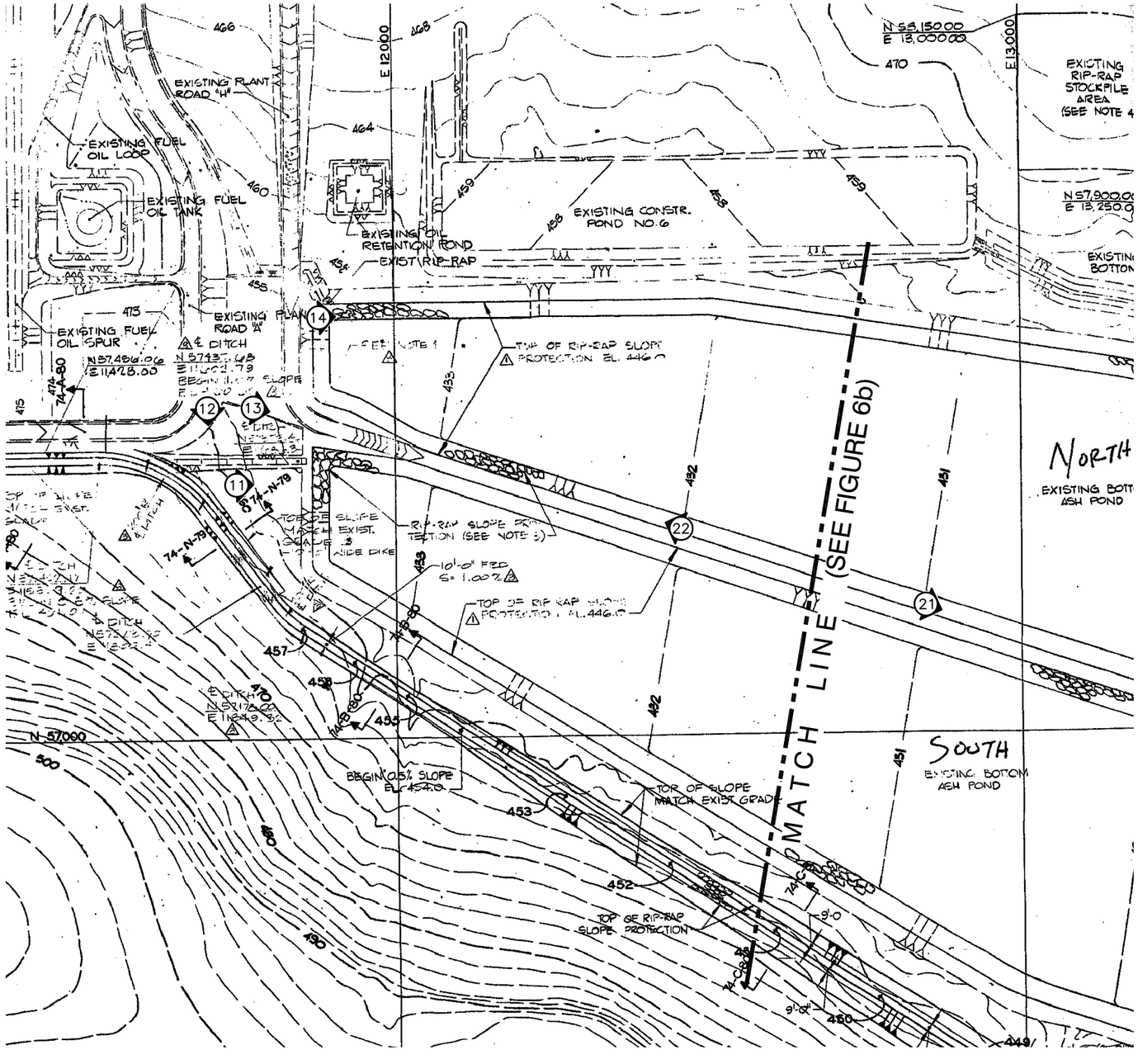
BOTTOM ASH PONDS, EAST
PHOTOGRAPH LOCATION PLAN
FIGURE 6b

US EPA ARCHIVE DOCUMENT



LEGEND:

② PHOTOGRAPH NUMBER AND ORIENTATION

NOTES:

1. BASE PLAN DEVELOPED FROM 1979 DRAWING PREPARED BY BURNS & McDONNELL

100' 0 200'

FORT TOWSON, OKLAHOMA
HUGO POWER PLANT
WESTERN FARMERS ELECTRIC COOPERATIVE

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BOTTOM ASH PONDS, WEST
PHOTOGRAPH LOCATION PLAN
FIGURE 6c

US EPA ARCHIVE DOCUMENT

Appendix A
USEPA Coal Combustion Dam Inspection Checklist Forms

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	Hugo Power Station	Date:	October 18, 2010
Unit Name:	North Bottom Ash Pond	Operator's Name:	Western Farmers Electric Coop
Unit I.D.:	n/a	Hazard Potential Classification:	High Significant (Low)
Inspector's Name:	Michael Schumaker, Janet Connor		

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?	Each Shift		18. Sloughing or bulging on slopes?	x	
2. Pool elevation (operator records)?	442.5		19. Major erosion or slope deterioration?		x
3. Decant inlet elevation (operator records)?	N/A		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?	N/A	
5. Lowest dam crest elevation (operator records)?	446		Is water exiting outlet, but not entering inlet?	N/A	
6. If instrumentation is present, are readings recorded (operator records)?	x		Is water exiting outlet flowing clear?	N/A	
7. Is the embankment currently under construction?		x	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	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?	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?	N/A	
15. Are spillway or ditch linings deteriorated?		x	22. Surface movements in valley bottom or on hillside?		x
16. Are outlets of decant or underdrains blocked?		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

3. Impoundment does not have a decant. Manually-controlled outlet structure invert is at El. 427.
6. Monitoring wells in the vicinity of the impoundment are used for groundwater monitoring on an annual basis.
9. 1"-2" woody growth on east exterior face.
17. Scarps observed on interior slopes on incised portion of embankment, well above the water level.
18. See 17.
23. Water stored in process water pond is right at the toe of the slope.

N/A = Not Applicable

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Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # OK0035327

INSPECTOR Janet Connor
Michael Schumaker

Date October 18, 2010

Impoundment Name North Bottom Ash Pond
Impoundment Company Western Farmers Electric Coop (WFEC)
EPA Region 6
State Agency (Field Office) Addresss 707 N Robinson
Oklahoma City, OK 73102

Name of Impoundment North Bottom Ash Pond
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update _____

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

IMPOUNDMENT FUNCTION: Bottom Ash

Nearest Downstream Town : Name Post Oak, TX
Distance from the impoundment 26 miles south
Impoundment Location:
Longitude -95 Degrees 18 Minutes 57.40 Seconds
Latitude 34 Degrees 0 Minutes 38.33 Seconds
State Oklahoma County Choctaw

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

If So Which State Agency? ODEQ under the OPDES program

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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:

A.) Surrounding property and downstream area is gently sloping ranchland. Downstream communities are 25+ miles away.

B.) The impoundment is partially incised, reducing the likelihood of a breach and lessening the volume of a potential release.

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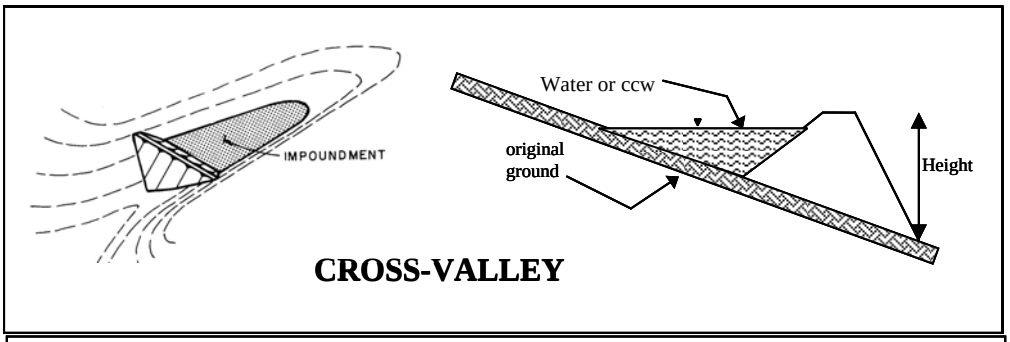
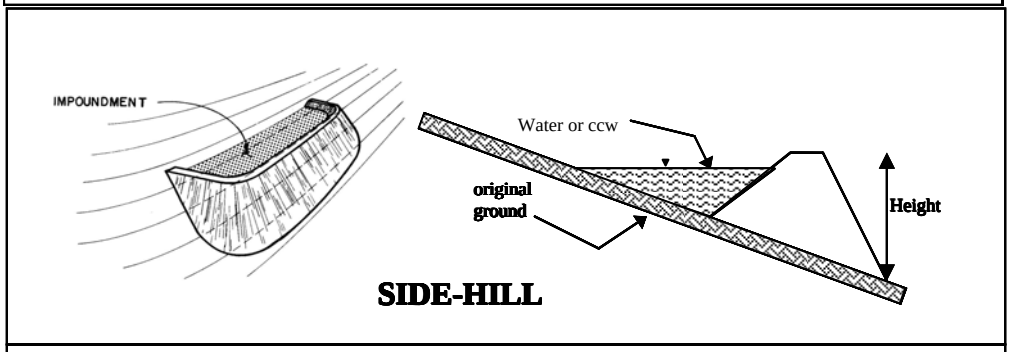
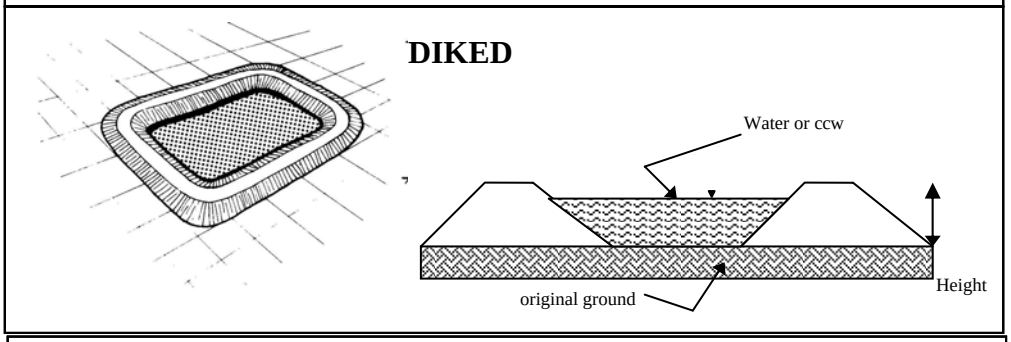
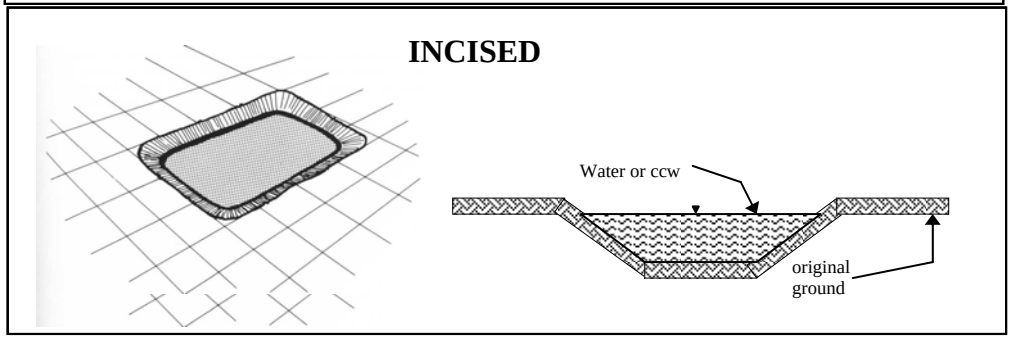
CONFIGURATION:









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

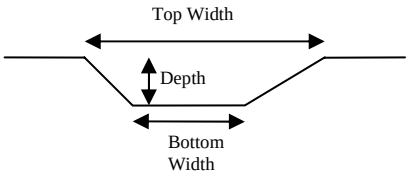
Embankment Height ____11____ feet
Pool Area _____34_____ acres
Current Freeboard ____3.5____ feet

Embankment Material Compacted Earth Fill
Liner Compacted Clay
Liner Permeability 1 X 10^-7 cm/sec

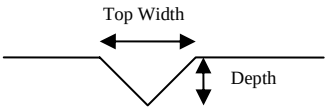
TYPE OF OUTLET (Mark all that apply)

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

TRAPEZOIDAL

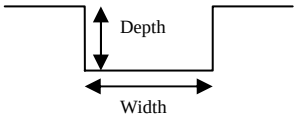


TRIANGULAR

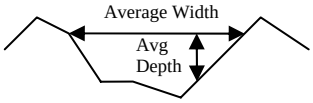


_____ depth
_____ bottom (or average) width
_____ top width
_____

RECTANGULAR

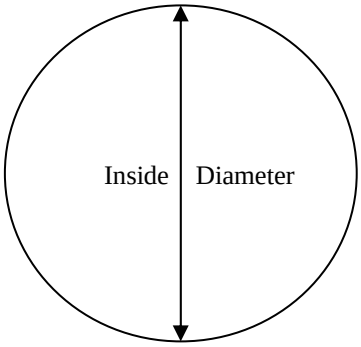


IRREGULAR



_____ **Outlet**

_____ inside diameter



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

_____

Is water flowing through the outlet? YES _____ NO _____

_____ **No Outlet**

_____

X _____ **Other Type of Outlet** (specify) Manually controlled outlet pipe, water discharges into process waste pond

The Impoundment was Designed By Burns & McDonnell

_____

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

If So When? _____

If So Please Describe : _____

US EPA ARCHIVE DOCUMENT

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

If So When? _____

IF So Please Describe: _____

US EPA ARCHIVE DOCUMENT

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 : _____

US EPA ARCHIVE DOCUMENT

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	Hugo Power Station	Date:	October 18, 2010
Unit Name:	South Bottom Ash Pond	Operator's Name:	Western Farmers Electric Coop
Unit I.D.:	n/a	Hazard Potential Classification:	High Significant (Low)
Inspector's Name:	Michael Schumaker, Janet Connor		

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?	Each Shift		18. Sloughing or bulging on slopes?	x	
2. Pool elevation (operator records)?	442.5		19. Major erosion or slope deterioration?		x
3. Decant inlet elevation (operator records)?	N/A		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?	N/A	
5. Lowest dam crest elevation (operator records)?	446		Is water exiting outlet, but not entering inlet?	N/A	
6. If instrumentation is present, are readings recorded (operator records)?	x		Is water exiting outlet flowing clear?	N/A	
7. Is the embankment currently under construction?		x	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	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?	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?	N/A	
15. Are spillway or ditch linings deteriorated?		x	22. Surface movements in valley bottom or on hillside?		x
16. Are outlets of decant or underdrains blocked?		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

3. Impoundment does not have a decant. Manually-controlled outlet structure invert is at El. 427.
6. Monitoring wells in the vicinity of the impoundment are used for groundwater monitoring on an annual basis.
9. 1-2" woody growth on east exterior face.
17. Scarps observed on interior slopes on incised portion of embankment, mainly well above the water level.
18. See 17.
23. Water stored in process water pond is at the toe of the slope.

N/A = Not Applicable

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # OK0035327

INSPECTOR Janet Connor
Michael Schumaker

Date October 18, 2010

Impoundment Name South Bottom Ash Pond

Impoundment Company Western Farmers Electric Coop (WFEC)

EPA Region 6

State Agency (Field Office) Addresss 707 N Robinson
Oklahoma City, OK 73102

Name of Impoundment South Bottom Ash Pond
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update _____

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

IMPOUNDMENT FUNCTION: Bottom Ash

Nearest Downstream Town : Name Post Oak, TX

Distance from the impoundment 26 miles south

Impoundment Location:
Longitude -95 Degrees 19 Minutes 0.03 Seconds
Latitude 34 Degrees 0 Minutes 32.95 Seconds
State Oklahoma County Choctaw

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

If So Which State Agency? ODEQ under the OPDES program

US EPA ARCHIVE DOCUMENT

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.

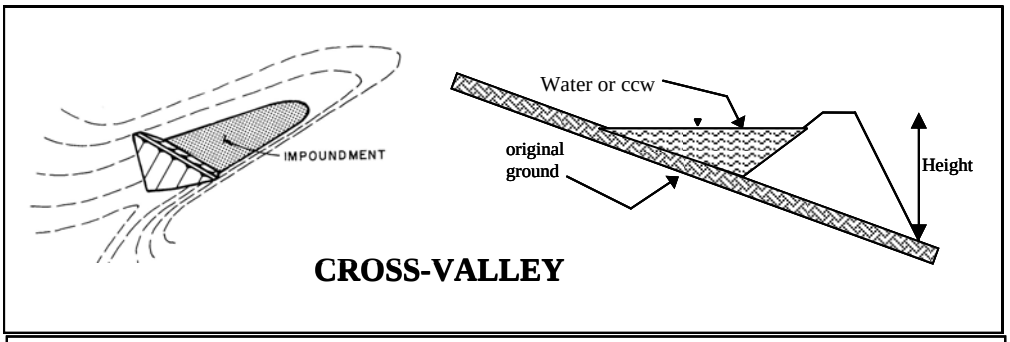
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

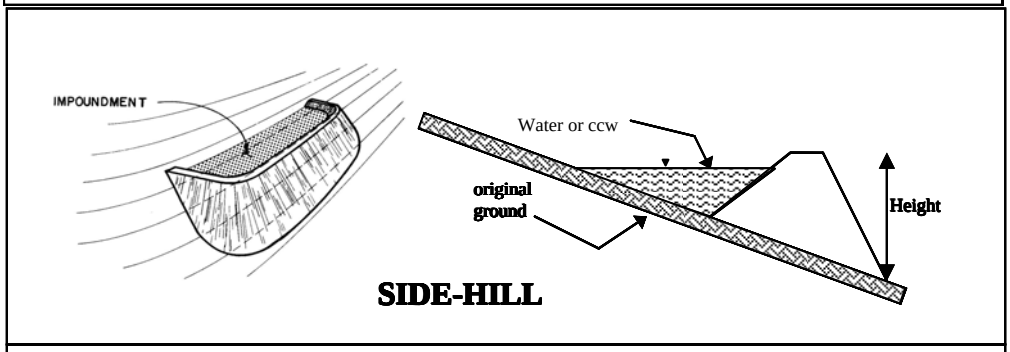
A.) Surrounding property and downstream area is gently sloping ranchland. Downstream communities are 25+ miles away.

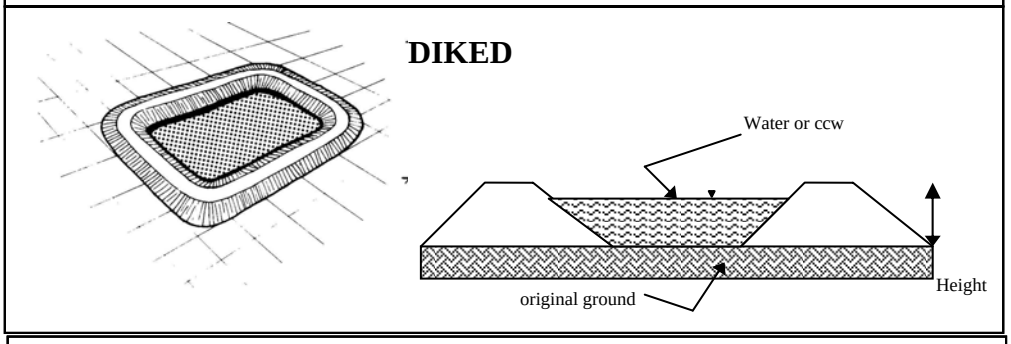
B.) The impoundment is partially incised, reducing the likelihood of a breach and lessening the volume of a potential release.

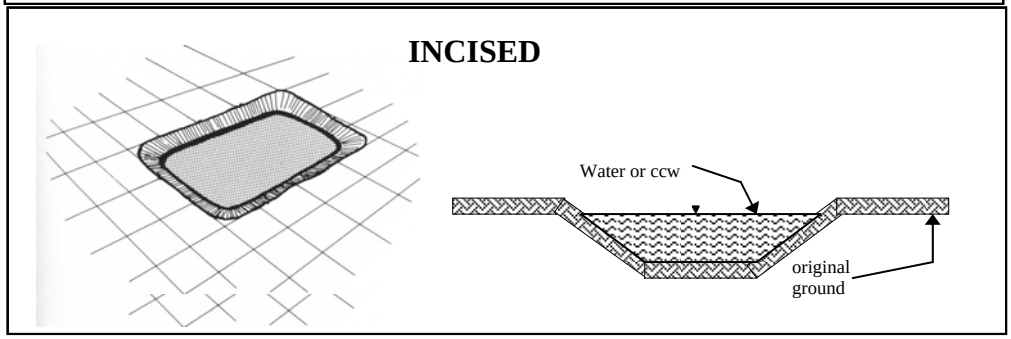
US EPA ARCHIVE DOCUMENT

CONFIGURATION:









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

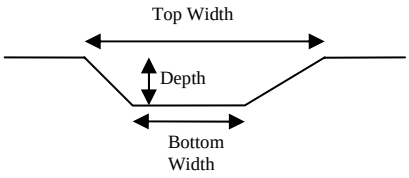
Embankment Height ____11____ feet
Pool Area _____34_____ acres
Current Freeboard ____3.5____ feet

Embankment Material Compacted Earth Fill
Liner Compacted Clay
Liner Permeability 1 X 10^-7 cm/sec

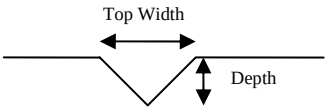
TYPE OF OUTLET (Mark all that apply)

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

TRAPEZOIDAL

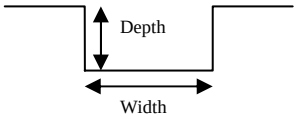


TRIANGULAR

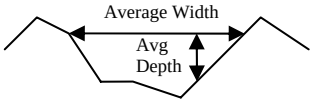


_____ depth
_____ bottom (or average) width
_____ top width
_____

RECTANGULAR

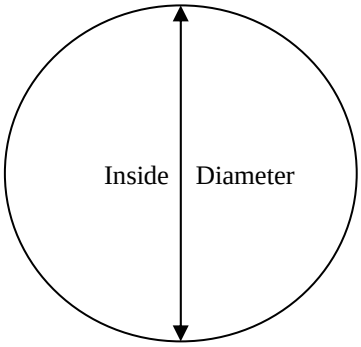


IRREGULAR



_____ **Outlet**

_____ inside diameter



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

_____

Is water flowing through the outlet? YES _____ NO _____

_____ **No Outlet**

_____

X _____ **Other Type of Outlet** (specify) Manually controlled outlet pipe, water discharges into process waste pond

The Impoundment was Designed By Burns & McDonnell

US EPA ARCHIVE DOCUMENT

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

If So When? _____

If So Please Describe : _____

US EPA ARCHIVE DOCUMENT

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

If So When? _____

IF So Please Describe: _____

US EPA ARCHIVE DOCUMENT

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 : _____

US EPA ARCHIVE DOCUMENT

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	Hugo Power Station	Date:	October 18, 2010
Unit Name:	North Fly Ash Pond	Operator's Name:	Western Farmers Electric Coop
Unit I.D.:	n/a	Hazard Potential Classification:	High Significant (Low)
Inspector's Name:	Michael Schumaker, Janet Connor		

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?	Each Shift		18. Sloughing or bulging on slopes?	x	
2. Pool elevation (operator records)?	503		19. Major erosion or slope deterioration?		x
3. Decant inlet elevation (operator records)?	N/A		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?	N/A	
5. Lowest dam crest elevation (operator records)?	515		Is water exiting outlet, but not entering inlet?	N/A	
6. If instrumentation is present, are readings recorded (operator records)?	x		Is water exiting outlet flowing clear?	N/A	
7. Is the embankment currently under construction?		x	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	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?	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?	N/A	
15. Are spillway or ditch linings deteriorated?		x	22. Surface movements in valley bottom or on hillside?		x
16. Are outlets of decant or underdrains blocked?		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

2. Estimated based on field observations.
3. Impoundment has no outlet. Water level controlled manually with a siphon.
17. Scarps observed on interior slopes on incised portion of embankment, above the water level.
18. See 17.
21. Possible seasonal seep observed at northeast corner at toe of north embankment, dry at time of visit.

N/A = Not Applicable

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # OK0035327

INSPECTOR Janet Connor
Michael Schumaker

Date October 18, 2010

Impoundment Name North Fly Ash Pond
Impoundment Company Western Farmers Electric Coop (WFEC)
EPA Region 6
State Agency (Field Office) Addresss 707 N Robinson
Oklahoma City, OK 73102

Name of Impoundment North Fly Ash Pond
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update _____

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

IMPOUNDMENT FUNCTION: Fly Ash

Nearest Downstream Town : Name Post Oak, TX
Distance from the impoundment 26 miles south
Impoundment Location:
Longitude -95 Degrees 0 Minutes 40.81 Seconds W
Latitude 34 Degrees 0 Minutes 33.72 Seconds N
State Oklahoma County Choctaw

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

If So Which State Agency? ODEQ under the OPDES program

US EPA ARCHIVE DOCUMENT

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:

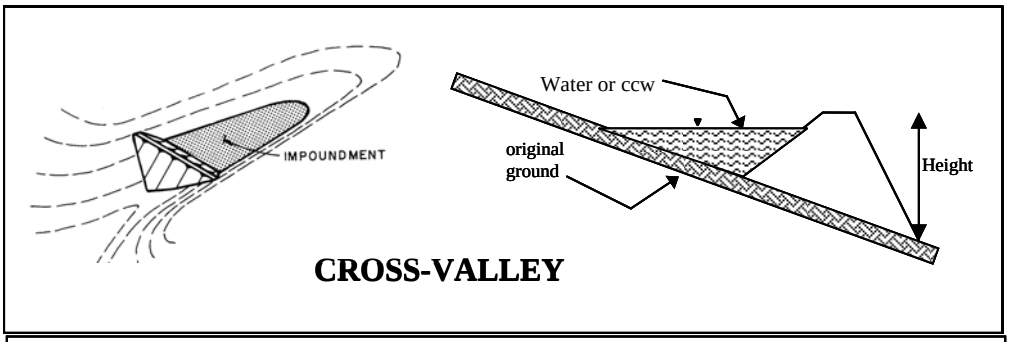
A.) Surrounding property and downstream area is gently sloping ranchland. Downstream communities are 25+ miles away.

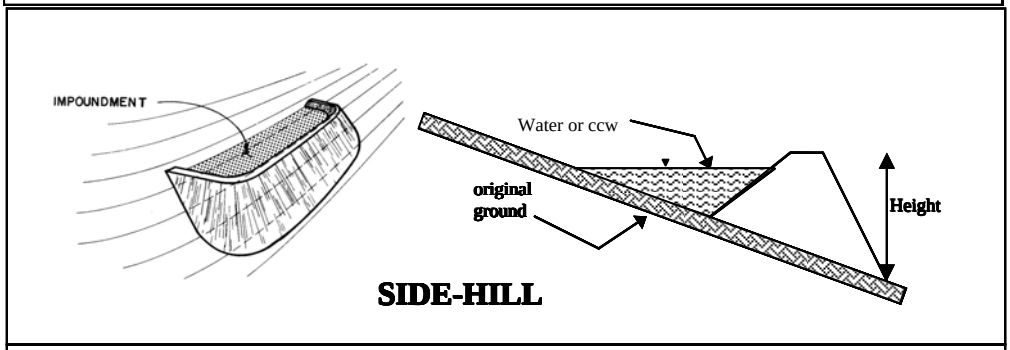
B.) The impoundment contains mostly dry material that would be highly viscous in the event of a breach resulting in a limited flood wave.

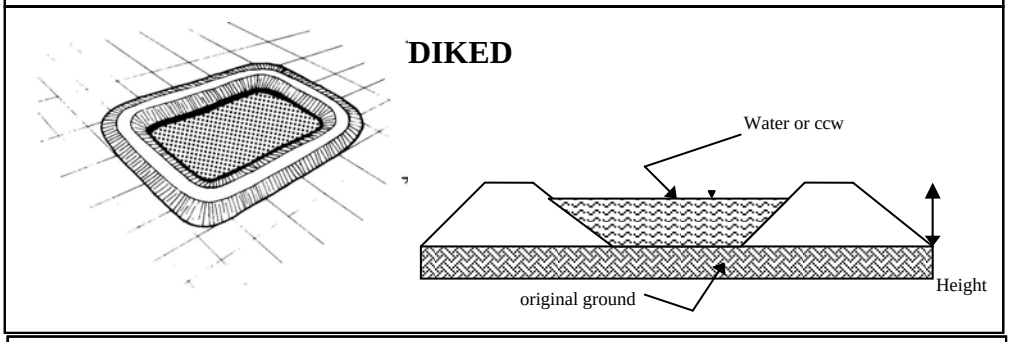
C.) The impoundment is partially incised, reducing the likelihood of a breach and lessening the volume of a potential release.

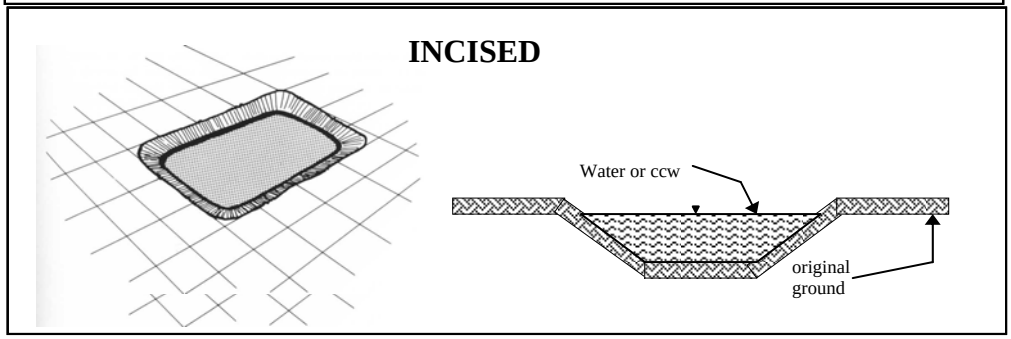
US EPA ARCHIVE DOCUMENT

CONFIGURATION:









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

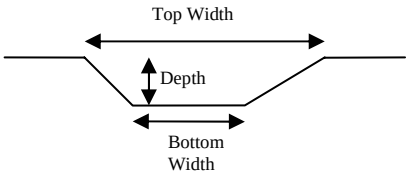
Embankment Height ____30____ feet
Pool Area _____17.6_____ acres
Current Freeboard _____12_____ feet

Embankment Material Compacted Earth Fill
Liner Compacted Clay
Liner Permeability 1X10^-7 cm/sec

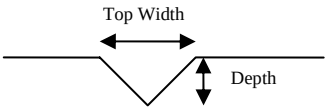
TYPE OF OUTLET (Mark all that apply)

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

TRAPEZOIDAL

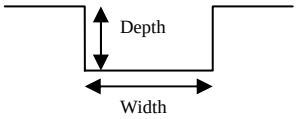


TRIANGULAR

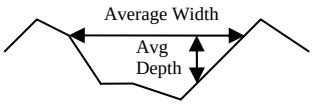


_____ depth
_____ bottom (or average) width
_____ top width
_____

RECTANGULAR

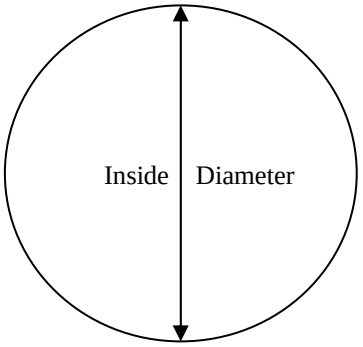


IRREGULAR



_____ **Outlet**

_____ inside diameter



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

_____

Is water flowing through the outlet? YES _____ NO _____

_____ **No Outlet**

_____

X _____ **Other Type of Outlet** (specify) Manual siphon and pump system

The Impoundment was Designed By Burns & McDonnell

US EPA ARCHIVE DOCUMENT

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

If So When? _____

If So Please Describe : _____

US EPA ARCHIVE DOCUMENT

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

If So When? _____

IF So Please Describe: _____

US EPA ARCHIVE DOCUMENT

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 : _____

US EPA ARCHIVE DOCUMENT

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	Hugo Power Station	Date:	October 18, 2010
Unit Name:	South Fly Ash Pond	Operator's Name:	Western Farmers Electric Coop
Unit I.D.:	n/a	Hazard Potential Classification:	High Significant (Low)
Inspector's Name:	Michael Schumaker, Janet Connor		

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?	Each Shift		18. Sloughing or bulging on slopes?	x	
2. Pool elevation (operator records)?	506		19. Major erosion or slope deterioration?		x
3. Decant inlet elevation (operator records)?	N/A		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?	N/A	
5. Lowest dam crest elevation (operator records)?	515		Is water exiting outlet, but not entering inlet?	N/A	
6. If instrumentation is present, are readings recorded (operator records)?	x		Is water exiting outlet flowing clear?	N/A	
7. Is the embankment currently under construction?		x	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	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?	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?	N/A	
15. Are spillway or ditch linings deteriorated?		x	22. Surface movements in valley bottom or on hillside?		x
16. Are outlets of decant or underdrains blocked?		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

2. Estimated based on field observations.
3. Impoundment has no outlet. Water level controlled manually by pumping to the North Fly Ash Pond that discharges manually with a siphon.
11. 30'X12' depression, about 6-inches deep, on south embankment crest
17. Scarps observed on interior and exterior slopes, on both incised and filled portions of embankment, above the water level.
18. See 17.
21. Wet area along toe of south embankment at south east , ~90-foot long and 15-foot wide area.

N/A = Not Applicable

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # OK0035327 INSPECTOR Janet Connor Michael Schumaker

Date October 18, 2010

Impoundment Name South Fly Ash Pond

Impoundment Company Western Farmers Electric Coop (WFEC)

EPA Region 6

State Agency (Field Office) Addresss 707 N Robinson
Oklahoma City, OK 73102

Name of Impoundment South Fly Ash Pond
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update _____

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

IMPOUNDMENT FUNCTION: Fly Ash

Nearest Downstream Town : Name Post Oak, TX

Distance from the impoundment 26 miles south

Impoundment Location:
Longitude -95 Degrees 19 Minutes 41.433 Seconds
Latitude 34 Degrees 0 Minutes 37.32 Seconds
State Oklahoma County Choctaw

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

If So Which State Agency? ODEQ under the OPDES program

US EPA ARCHIVE DOCUMENT

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:

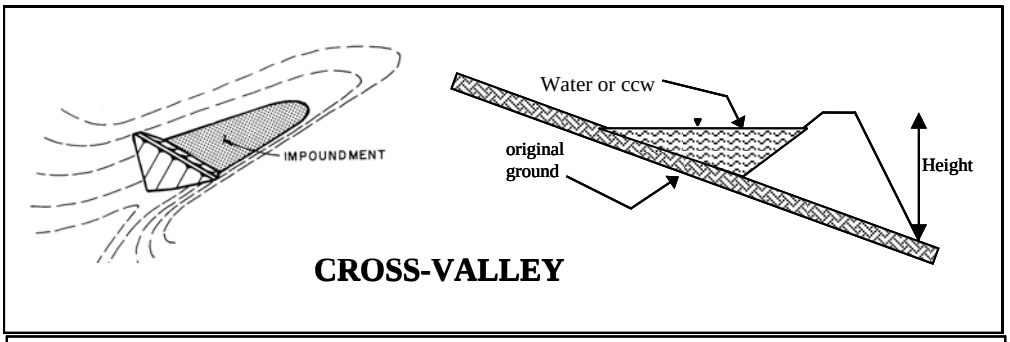
A.) Surrounding property and downstream area is gently sloping ranchland. Downstream communities are 25+ miles away.

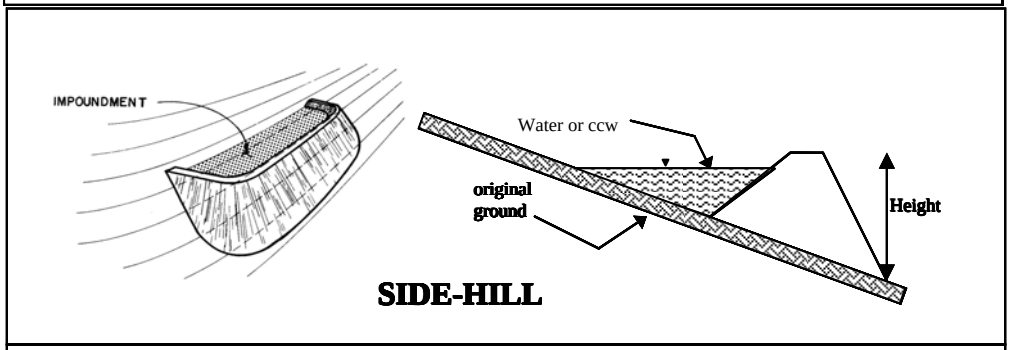
B.) The impoundment contains mostly dry material that would be highly viscous in the event of a breach resulting in a limited flood wave.

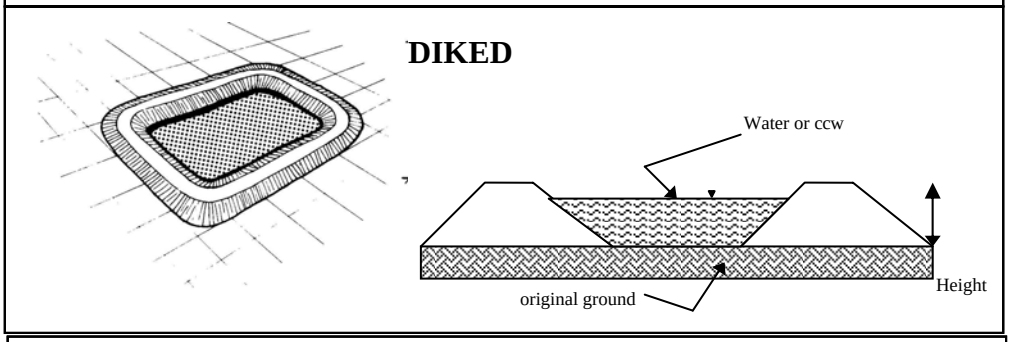
C.) The impoundment is partially incised, reducing the likelihood of a breach and lessening the volume of a potential release.

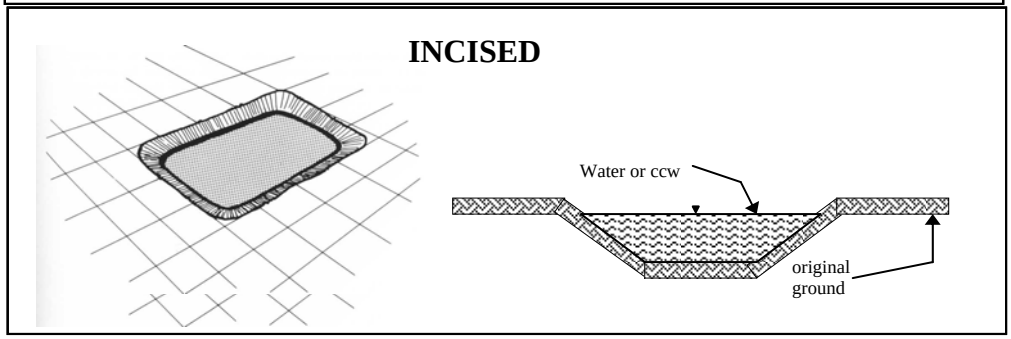
US EPA ARCHIVE DOCUMENT

CONFIGURATION:









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

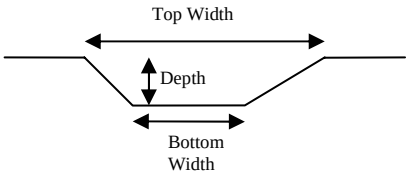
Embankment Height ____27____ feet
Pool Area _____17.6_____ acres
Current Freeboard ____9____ feet

Embankment Material Compacted Earth Fill
Liner Compacted Clay
Liner Permeability 1X10^-7 cm/sec

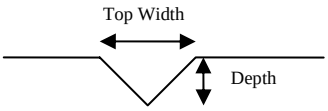
TYPE OF OUTLET (Mark all that apply)

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

TRAPEZOIDAL

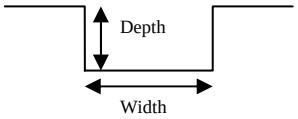


TRIANGULAR

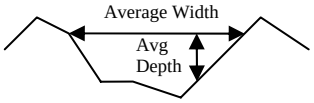


_____ depth
_____ bottom (or average) width
_____ top width
_____

RECTANGULAR

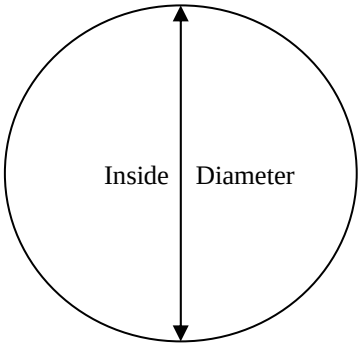


IRREGULAR



_____ **Outlet**

_____ inside diameter



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

_____

Is water flowing through the outlet? YES _____ NO _____

_____ **No Outlet**

_____

X _____ **Other Type of Outlet** (specify) Manually pumped over the embankment to North Fly Ash Pond and siphoned

The Impoundment was Designed By Burns & McDonnell

_____

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

If So When? _____

If So Please Describe : _____

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

If So When? _____

IF So Please Describe: _____

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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 : _____

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Appendix B
Photographs

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1. South Bottom Ash Pond –Outlet Structure, looking south

2. South Bottom Ash Pond – Looking toward east embankment crest embankment?

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3. South Bottom Ash Pond – East embankment exterior slope, looking south

4. South Bottom Ash Pond - East embankment interior slope, looking south

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5. South Bottom Ash Pond – East embankment slope, looking south

6. South Bottom Ash Pond – East embankment interior slope, looking north

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7. South Bottom Ash Pond – East embankment crest, looking north

8. South Bottom Ash Pond – East embankment exterior slope, looking northeast

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9. South Bottom Ash Pond – Southeast embankment interior slope, looking west

10. South Bottom Ash Pond – South embankment crest, looking west

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11. South Bottom Ash Pond – Southwest embankment interior slope, looking east

12. Bottom Ash Intake Structure, looking south

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13. North and South Bottom Ash Pond Divider Embankment– West end of crest, looking east

14. North Bottom Ash Pond – North embankment interior slope, looking east

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15. North Bottom Ash Pond – North embankment interior slope, looking west

16. North Bottom Ash Pond – East embankment crest and interior slope, looking southeast

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17. North Bottom Ash Pond – East embankment exterior slope, looking south

18. Process Waste Pond – Outfall Discharge

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19. North Bottom Ash Pond – Midway point on west exterior slope, looking northeast

20. Bottom Ash Outlet Structure discharge pipe

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21. Bottom Ash Ponds – Longitudinal cracks along divider embankment, looking east

22. Bottom Ash Ponds – Discharge outlets on either side of the divider embankment, looking west

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23. South Fly Ash Pond – East side interior slope, looking south

24. South Fly Ash Pond – East side embankment crest, looking south

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25. South Fly Ash Pond – East side embankment exterior slope, looking south

26. South Fly Ash Pond – Sloughing on east embankment interior slope, looking north

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27. South Fly Ash Pond – Southeast embankment exterior corner, looking north

28. South Fly Ash Pond – South embankment exterior of southeast corner, looking west

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29. South Fly Ash Pond – Wet area on south embankment exterior slope, looking east

30. South Fly Ash Pond – Cattails growing on south embankment exterior face, looking west

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31. South Fly Ash Pond – South embankment exterior face slough, looking northwest

32. South Fly Ash Pond – South embankment crest depression, looking west

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33. South Fly Ash Pond – South embankment exterior slope slough, looking east

34. South Fly Ash Pond – South embankment interior slope slough, looking west

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35. South Fly Ash Pond – West embankment crest, looking north

36. South Fly Ash Pond – Northwest embankment corner interior slope, looking south

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37. North Fly Ash Pond – Overview

38. North Fly Ash Pond – Northwest embankment corner interior slope, looking east

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39. North Fly Ash Pond – Northwest embankment corner exterior slope, looking east

40. North Fly Ash Pond – North embankment interior slope slough, looking east

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41. North Fly Ash Pond – North embankment interior slope slough, looking east

42. North Fly Ash Pond – Northeast embankment corner interior slope, looking west

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43. North Fly Ash Pond – Northeast embankment corner exterior slope seasonal wet area

44. North Fly Ash Pond – West embankment crest vehicle ruts, looking north

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45. Fly Ash Pond Divider Embankment – Central portion of south interior slope, looking west

46. Fly Ash Pond Divider Embankment– Central portion of south interior slope, looking east

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47. Fly Ash Pond Divider Embankment– Central portion of crest and interior slope, looking east

48. Fly Ash Pond Divider Embankment– Central portion of north exterior slope, looking east

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Appendix C
Photo GPS Locations

Appendix C
Photo GPS Locations

Site: WFEC Hugo Power Plant
System: US State Plane 1983
Zone: Oklahoma South 3502
Datum: NAD 1983 (CONUS)
Coordinate Units: Feet

Photo No.	Northing	Easting
1	256688.3	2782533
2	256682.7	2782545
3	256703.8	2782546
4	256605.3	2782696
5	256476.3	2782715
6	256253.8	2782649
7	256255.5	2782660
8	256243.8	2782679
9	256135.5	2782641
10	256244	2782143
11	257335.4	2780118
12	257598.4	3780088
13	257555.5	2780144
14	257762.7	2780258
15	257512.2	2782358
16	257512.2	2782358
17	257024.8	2782814
18	256751.2	2782758
19	256701	2782757
20	257120.5	2781355
21	257366.5	2780706
22	256271.3	2778755
23	256253.8	2778776
24	256217.5	2778788
25	255888.2	2778753
26	255785	2772782
27	255756.6	2778715
28	255687.6	2778577
29	255660.3	2778570
30	255698.7	2778496
31	255766.2	2778520
32	255718	2778335
33	255773.4	2777799
34	255816.9	2777560
35	256366.5	2777577
36	256625.8	2777558
37	257071.6	2777591
38	257098.9	2777587
39	257089.2	2777769
40	257086	2778204
41	257067.9	2778687
42	257109.4	2778842
43	256580.6	2778770
44	256409.5	2778443
45	256425.3	2778069
46	256434.3	2778067
47	256440	2778071
48	256440	2778071

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