HAZARD POTENTIAL CLASSIFICATION ASSESSMENT
MONTICELLO STEAM ELECTRIC STATION
BOTTOM ASH PONDS
TITUS COUNTY, TEXAS

OCTOBER 2016

PREPARED FOR:

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PBW Project No. 5196A

PROFESSIONAL CERTIFICATION

This document and all attachments were prepared by Pastor, Behling & Wheeler, LLC under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I hereby certify that the hazard potential classification assessment was conducted in accordance with the requirements of Section 257.73(a)(2) of the CCR Rule.

10/5/16

Brian Thomas, P.E.
Principal Engineer
PASTOR, BEHLING & WHEELER, LLC

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1.0 INTRODUCTION

Luminant Generation Company, LLC (Luminant) owns and operates the Monticello Steam Electric Station (MOSES) located approximately nine miles southwest of Mount Pleasant in Titus County, Texas. The power plant and related support areas occupy approximately 1,000 acres on peninsula located between Lake Monticello and Lake Bob Sandlin (Figure 1). The MOSES consists of three coal/lignite-fired units with a combined operating capacity of approximately 1,880 megawatts. Coal Combustion Residuals (CCR) including fly ash, bottom ash, and gypsum are generated as part of MOSES unit operation. The CCRs are transported off-site for beneficial use by third-parties or are placed in mine pits in the Winfield South Mine/G-Ash Area.

The CCR Rule (40 CFR 257 Subpart D - *Standards for the Receipt of Coal Combustion Residuals in Landfills and Surface Impoundments*) has been promulgated by EPA to regulate the management and disposal of CCRs as solid waste under Resource Conservation and Recovery Act (RCRA) Subtitle D. The final CCR Rule was published in the Federal Register on April 17, 2015. The effective date of the CCR Rule was October 19, 2015.

The CCR Rule establishes national operating criteria for existing CCR surface impoundments and landfills, including periodic hazard potential classification assessment requirements for all CCR impoundments. Pastor, Behling & Wheeler, LLC (PBW) was retained by Luminant to perform the initial hazard potential classification assessment for the CCR impoundments at the MOSES. This report presents the findings of the initial hazard potential classification assessment.

1.1 Hazard Potential Classification Assessment Requirements - CCR Surface Impoundments

Section 257.73(a)(2) of the CCR Rule specifies that periodic hazard potential classification assessments be performed by a qualified professional engineer for each existing CCR surface impoundment. The hazard potential classification assessments must document the hazard potential classification of each CCR impoundment as either:

- A high hazard potential CCR surface impoundment,
- A significant hazard potential CCR surface impoundment, or
- A low hazard potential CCR surface impoundment.

The assessments must document the basis for each hazard potential classification and must be certified by a qualified professional engineer confirming that the hazard potential classifications were conducted in accordance with the requirements of section 257.73(a)(2) of the CCR Rule.

In accordance with 257.73(f) of the CCR Rule, the initial hazard potential classification assessment for an existing CCR surface impoundment must be completed and placed in the facility operating record no later than October 17, 2016. Subsequent periodic hazard potential classification assessments must be completed every five years from the completion date of the initial assessment.

1.2 MOSES Impoundments Subject to Hazard Potential Classification Assessments

The CCR Rule defines coal combustion residuals such as fly ash, bottom ash, boiler slag, flue gas desulfurization (FGD) materials (gypsum), and related solids generated from burning coal for the purpose of generating electricity by electric utilities and independent power producers. The hazard potential classification assessment requirements of the CCR Rule apply to surface impoundments that dispose or otherwise engage in solid waste management of CCRs.

The following surface impoundments at the MOSES have been identified as CCR Units subject to the hazard potential classification assessment requirements:

- Northeast Ash Water Pond (NE Pond),
- West Ash Settling Pond (West Pond), and
- Southwest Ash Settling Pond (SW Pond)

The NE Pond, West Pond and SW Pond (collectively "Bottom Ash Ponds" or "BAPs") are located approximately 800 feet southeast of the MOSES power plant (Figure 2). The BAPs are located approximately 1,100 feet from Lake Monticello (normal pool elevation 340 feet above mean sea level (MSL)). The NE Pond and West Ponds share an interior embankment and are each approximately 500 feet wide, covering an area of approximately 5.5 acres and 6.6 acres, respectively. The crest elevation of the BAP embankments are approximately 386.5 feet MSL. The approximately 8-acre SW Pond shares an embankment with the West Pond (North end of the SW Pond). Due to their proximity to each other, the NE Pond, West Pond and SW Pond will be considered one CCR surface impoundment (identified as the "BAPs") for the purposes of this hazard potential classification assessment.

1.3 Description of Bottom Ash Ponds

A simplified process flow diagram for the BAPs is shown on Figure 3. The BAPs receive recovered overflow from bottom ash dewatering bins and other MOSES process wastewater sources. The ponds also act as a surge basin for various water streams in the ash-water system. Recovered sluice water, process waters and storm water runoff from the MOSES ash-water system are pumped to each pond through a series of above grade pipes. The BAPs are constructed partially above and partially below grade and all material that enters the ponds is pumped into the impoundments – there are no gravity discharges to the BAPs.

The Bottom Ash Ponds serve as settling basins to remove residual bottom ash and fines from a sump that receives the recovered sluice water associated with the dewatering bins, which is the primary bottom ash removal process at MOSES. Water is pumped from the SW Pond, as needed, and returned for reuse in the bottom ash system. When sufficient ash has accumulated in either the NE or West Ponds, the recovered sluice water is diverted to the other pond. Ash is then removed from the first pond. Based on the design of the BAPs, minimal accumulation of solids occurs within the SW Pond.

The BAPs are surrounded by engineered earthen dikes that extend approximately 10 to 20 feet above grade depending on the surrounding topography. The exterior slopes of the embankments are vegetated with grasses and similar vegetation. The south embankment of the Northeast Pond and east embankment of the SW Pond also act as embankments for the MOSES Storm Water Collection Pond, which is not subject to the CCR Rule.

Based on the *CCR Study for Monticello Steam Electric Station* (Burns and McDonnell, 2015), the BAPs were originally constructed in the 1974 as a two-basin system and were subsequently segregated and relined with a 3-foot thick clay liner in 1990. As-built engineering drawings indicate that the existing 3-foot compacted clay liner was constructed to a maximum permeability of 1×10^{-7} cm/sec.

Based on available construction data, each of the BAPs were constructed to provide the following estimated storage capacities:

- NE Pond: 100 acre-feet
- West Pond: 130 acre-feet
- SW Pond: 145 acre-feet

The total design operating capacity of the BAPs is approximately 122,200,000 gallons or approximately

375 acre-ft.

1.4 USACE Size Classification for BAPs

The US Army Corps of Engineers (USACE) classifies the relative size of dams based on the height of the dam and the storage capacity of the impounded area behind the dam (USACE, 1979). As shown in the table below, based on the embankment height (10 to 20 feet above grade) and total operating capacity (375 acre-ft) of the BAPs, the BAPs would be categorized as small impoundments using the USACE dam size classification criteria:

USACE Dam Size Classification		
Size Category	**Impoundment Capacity (acre-ft)**	**Impoundment Height (ft)**
Small	50 and < 1,000	25 and < 40
Intermediate	1,000 and < 50,000	40 and < 100
Large	> 50,000	> 100

2.0 CCR HAZARD CLASSIFICATION ASSESSMENT METHODOLOGY

As defined in Section 257.53 of the CCR Rule, hazard potential classification means the possible adverse incremental consequences that result from the release of water or stored contents due to failure of a diked CCR surface impoundment or misoperation of the diked CCR surface impoundment or its appurtenances. Hazardous potential classifications for CCR surface impoundments include high hazard potential CCR surface impoundment, significant hazard potential CCR surface impoundment, and low hazard potential CCR surface impoundment, which are defined in the CCR Rule as follows:

- High Hazard Potential CCR Surface Impoundment. A diked surface impoundment where failure or misoperation will probably cause loss of human life.

- Significant Hazard Potential CCR Surface Impoundment. A diked surface impoundment where failure or misoperation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns. FEMA considers lifeline facilities to include transportation facilities (highways, airports, ports, trains), electric power, water and sewer, communications (telephone, TV, radio, electronic) and gas and liquid fuel pipelines (FEMA, 1995).

- Low Hazard Potential CCR Surface Impoundment. A diked surface impoundment 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 surface impoundment owner's property.

The hazard classification assessment for the BAPs was performed using the methodology presented in *Federal Guidelines for Dam Safety: Hazard Potential Classification System for Dams* developed by the Federal Emergency Management Agency (FEMA, 2004). The FEMA guidelines classify dams into similar hazard potential categories to those defined in the CCR Rule (low hazard potential, significant hazard potential and high hazard potential) and the FEMA guidelines are listed in the Preamble to the CCR Rule as one of the technical resources considered by EPA during development of the CCR Rule.

The FEMA hazard potential evaluation is based on assessing the probable loss of human life and the potential for economic losses, environmental damage, and/or disruption to lifelines caused by failure or misoperation of a dam or its appurtenances. The location/size of the dam and impoundment area is evaluated against development, occupancy and land use conditions in areas downstream of the dam/impoundment that would be affected by a failure of the dam and release of the impounded water. The FEMA evaluation recognizes that the failure of any dam or water-retaining structure, no matter how small, represents a potential danger to downstream life and property and there is always the possibility of someone being in the path of the resulting discharge. However, the FEMA evaluation recognizes that considering every conceivable circumstance that might remotely place a person in the area potentially inundated as a result of the dam failure should not be the basis for determining the hazard classification

level of the dam/impoundment. The FEMA evaluation considers “probable loss of life” to exist where persons are permanently located in the area potentially inundated as a result of the dam failure.

The hazard classification of the BAPs was assessed by identifying the development, occupancy and land use characteristics of areas downstream of the impoundments. The assessment is based on aerial photographs, USGS topographic maps, interviews with Luminant personnel familiar with the area, and similar resources, evaluating the probable loss of human life and the potential for economic losses, environmental damage, and/or disruption to lifelines caused by failure of the embankments surrounding the BAPs, and classifying the BAPs based on the FEMA hazard potential criteria.

3.0 PREVIOUS BAP HAZARD POTENTIAL CLASSIFICATION ASSESSMENTS

In 2014, the USEPA contracted with O'Brien & Gere (OBG) of Syracuse, New York to assess the stability and functionality of the BAPs at the MOSES. The purpose of the assessment was to evaluate the condition and potential for residue release from the BAPs based on a review of available documentation and a site assessment conducted by OBG personnel on September 18, 2012. The assessment included a determination of the hazard potential classification of the BAPs.

The results of the BAP assessment were presented to EPA in a June 2014 report (OBG, 2014). Key findings related to the hazard potential classification for the BAPs can be summarized as follows:

- Based on the size of the BAP embankment height and impoundment storage capacity, the impoundment would be classified as Small by USACE criteria.
- Luminant owns most of the property in the vicinity of the plant, including the lake and dam. Land near the southwest side of the lake (opposite bank from MOSES) operated as Titus County Park is owned by Luminant and leased to Titus County.
- Although CCR may reach Lake Monticello, failure or misoperation of the BAPs was not expected to result in a probable loss of human life, and the economic and environmental losses are expected to be contained on the owner's property. Therefore, a Federal Hazard Classification of Low was identified for the BAPs.

The hazard potential classification checklist developed by OBG for the BAPs as part of the assessment is reproduced in Appendix A.

4.0 BAP HAZARD POTENTIAL CLASSIFICATION ASSESSMENTS

The hazard potential classification of the BAPs was assessed by identifying the development, occupancy and land use characteristics of areas downstream of the impoundments, assessing the probable loss of human life and/or the potential for economic losses, environmental damage, and/or disruption to lifelines caused by failure of the embankments surrounding the BAPs, and using the results of the assessment to classify the BAPs based on the FEMA hazard potential criteria described in Section 2.0 of this report.

4.1 Areas Downstream of the BAPs

The MOSES is located off FM 127 approximately nine miles southwest of Mount Pleasant, Texas (see Figure 1). The BAPs are located southeast of the MOSES generating units, approximately 1,100 feet from Lake Monticello. The MOSES and the BAPs are located in the drainage area of Lake Monticello and a failure of the embankments surrounding the BAPs would release CCR solids/fluids that would flow westward to Lake Monticello or, in the event of a catastrophic failure of the NE Pond, be intercepted by the Storm Water Collection Pond or within the associated drainage controls. Figure 4 shows the location of the MOSES and BAPs relative to Lake Monticello and adjacent areas.

Lake Monticello is a manmade reservoir located on Blundell Creek and is impounded by Monticello Dam (TWDB, 2003). The lake was constructed in 1972 to provide cooling water for the MOSES. Luminant owns the water rights to the lake and operates and maintains Monticello Dam. Lake Monticello has a drainage area of approximately 36 square miles. At the conservation pool elevation of 340.0 feet, the lake has approximately 23.2 miles of shoreline, covers an area of approximately 2,001 acres, and contains a total volume of approximately 34,740 acre-ft. of water. The emergency spillway for the Monticello Dam is constructed at elevation 343.5 feet. Lake Bob Sandlin is located south of Monticello Dam and the dam controls releases of water from Lake Monticello to Lake Bob Sandlin.

Luminant owns all property immediately adjacent to Lake Monticello (TCAD, 2016). The shoreline of Lake Monticello is mostly undeveloped and there are no permanent residences along the lake shoreline. Titus County Park is located on the southwest side of Lake Monticello. The park covers an area of approximately 57.4 acres and is located on land leased from Luminant by Titus County. Activities available at the park include camping, backpacking, hiking, bird watching, and boating, fishing and related water sports on the lake. Public access to Lake Monticello is provided by a single boat ramp located in Titus County Park.

There are few significant lifeline facilities immediately adjacent to Lake Monticello other than the electric transmission lines that serve the MOSES. The electric transmission lines are overhead lines supported by large towers that run along the east side of the lake and would be unaffected by a release from the BAPs. There are several small county roads outside the perimeter of the lake and one highway that crosses the lake approximately 1.75 miles to the northwest. Due to the relative volume of the BAPs in relation to Lake Monticello, the highway to the north would be unaffected by a release from the impoundments. Underground crude oil and natural gas pipelines run across the northern part of the lake, but the pipelines are installed below ground and would not be affected by a release from the BAPs (RRC, 2016).

4.2 BAP Hazard Potential Classification Assessment

A failure of the embankments surrounding the BAPs would release CCR solids/fluids that ultimately would flow westward to Lake Monticello if not contained by the Storm Water Collection Pond and the associated MOSES storm water management system. As described in Section 1.3 of this report, the total combined operating volume of the NE Pond, West Pond and SW Pond is approximately 375 acre-ft. In the unlikely event that the entire volume of all three impoundments is released through catastrophic failure of the embankments, the total volume of fluids that could enter the lake from the BAPs (375 acre-ft.) represents only 0.01 percent of the conservation pool volume of Lake Monticello (34,740 acre-ft.). Due to surrounding topography, the discharge from a catastrophic failure would not be able to flow in any direction except for towards Lake Monticello.

Assuming a lake surface area of 2,001 acres at the conservation pool elevation of 340.0 feet, the total volume of the BAPs would raise the lake level by approximately 0.1 feet or slightly more than 1 inch. The resulting water surface elevation (340.1 feet) is well below the emergency spillway elevation at Monticello Dam (343.5 feet), indicating that the total volume of the BAPs would be retained and equalized within Lake Monticello. A release from the BAPs would not overtop the dam and enter Lake Bob Sandlin.

Using the FEMA hazard potential criteria described in Section 2.0 of this report, the projected effects of catastrophic failure or misoperation of the BAPs results in a hazard potential classification of Low for the BAPs. This classification is supported by the following:

- No Probable Loss of Human Life - FEMA considers "probable loss of life" to exist where persons are permanently located in the area potentially inundated as a result of dam failure. The shoreline of Lake Monticello is mostly undeveloped and there are no permanent residences along the lake shoreline. In addition, the total volume of the BAPs would be retained and equalized within Lake

Monticello in the event of a catastrophic failure of the BAP embankments, since the lake level would be raised by approximately 0.1 foot, which is well below the emergency spillway elevation of the Lake Monticello dam. As a result, a release from the BAPs would result in no probable loss of human life.

- Low Economic and/or Environmental Losses. FEMA considers low economic and or environmental losses to occur when losses resulting from a dam failure are principally limited to the dam owner's property. Since Luminant owns the water rights to Lake Monticello and the land surrounding the lake, any losses would be limited to the Luminant property.

- No Significant Disruption of Lifelines. There are no significant lifeline facilities immediately adjacent to Lake Monticello other than the electric transmission lines from the MOSES. The electric transmission lines would be unaffected by a release from the BAPs.

5.0 FINDINGS OF HAZARD POTENTIAL CLASSIFICATION ASSESSMENT

Pastor, Behling & Wheeler, LLC was retained by Luminant to perform the initial hazard potential classification assessment for the BAPs at the MOSES in accordance with the requirements of Section 257.73(a)(2) of the CCR Rule. The hazard classification assessment for the BAPs was performed using the methodology presented in *Federal Guidelines for Dam Safety: Hazard Potential Classification System for Dams* developed by the Federal Emergency Management Agency.

Based on the FEMA hazard potential criteria the BAPs are classified as LOW hazard potential CCR surface impoundments, since a failure or misoperation of the BAPs results in no probable loss of human life, low economic and/or environmental losses, and no significant disruption of lifeline systems.

In accordance with 257.73(f) of the CCR Rule, this initial hazard potential classification assessment must be placed in the operating record for the MOSES no later than October 17, 2016. Subsequent periodic hazard potential classification assessments must be completed every five years from the completion date of this initial assessment.

6.0 REFERENCES

Burns & McDonnell, 2015. CCR Study for Monticello Steam Electric Station, July 31.

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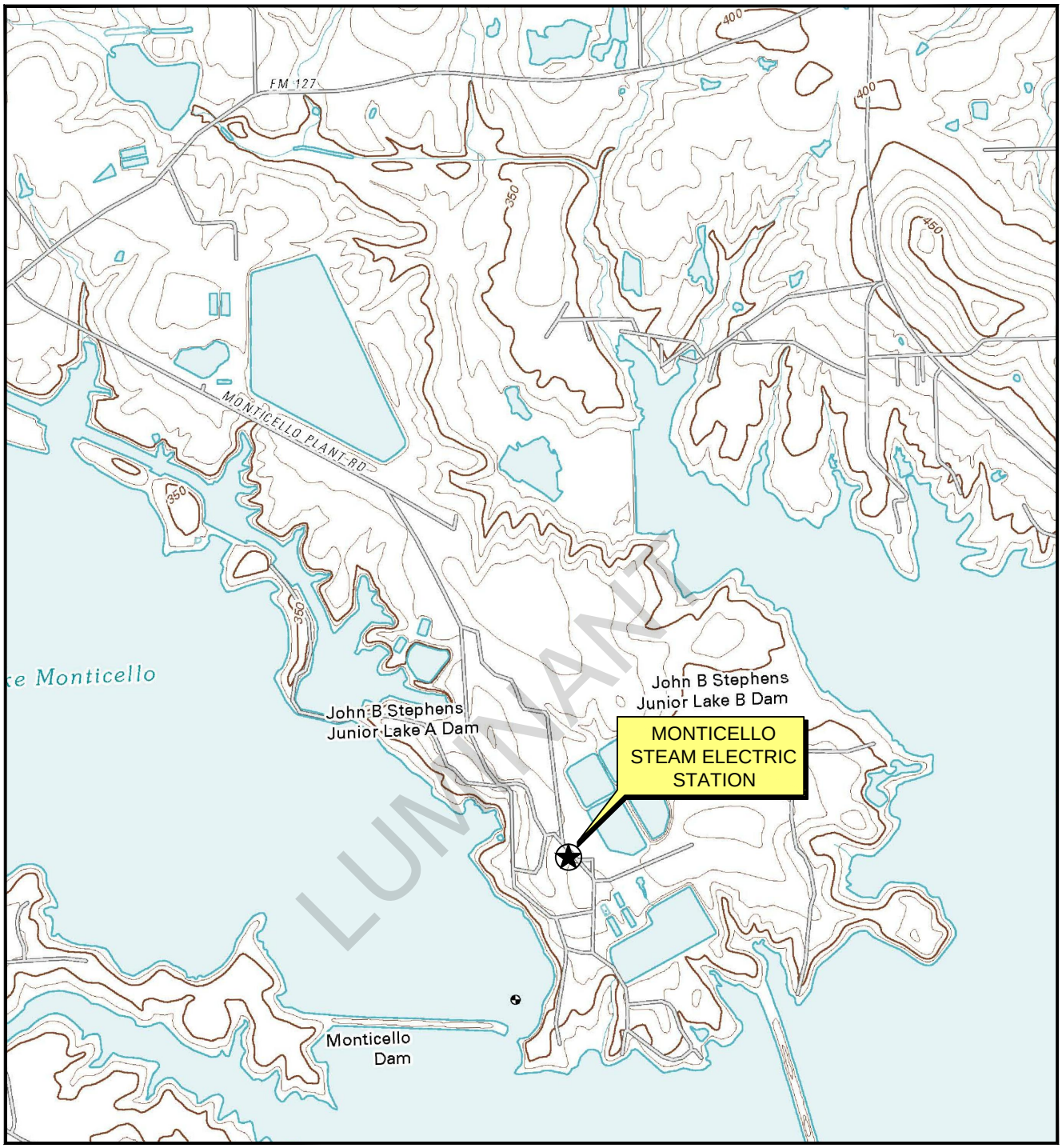
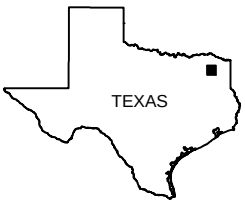
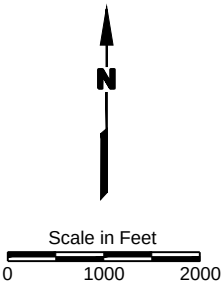
Figures





QUADRANGLE LOCATIONS



SOURCE:
Base map from www.tnris.gov, Monticello, TX 7.5 min. USGS quadrangle dated 2010.

LUMINANT GENERATION COMPANY, LLC
MONTICELLO STEAM ELECTRIC STATION

Figure 1

SITE LOCATION MAP

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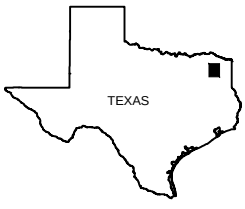

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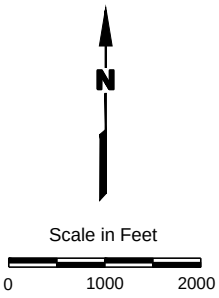

SOURCE:
Imagery from Google Earth, aerial photography dated 12-5-15.

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MONTICELLO STEAM ELECTRIC STATION

Figure 2

SITE VICINITY MAP

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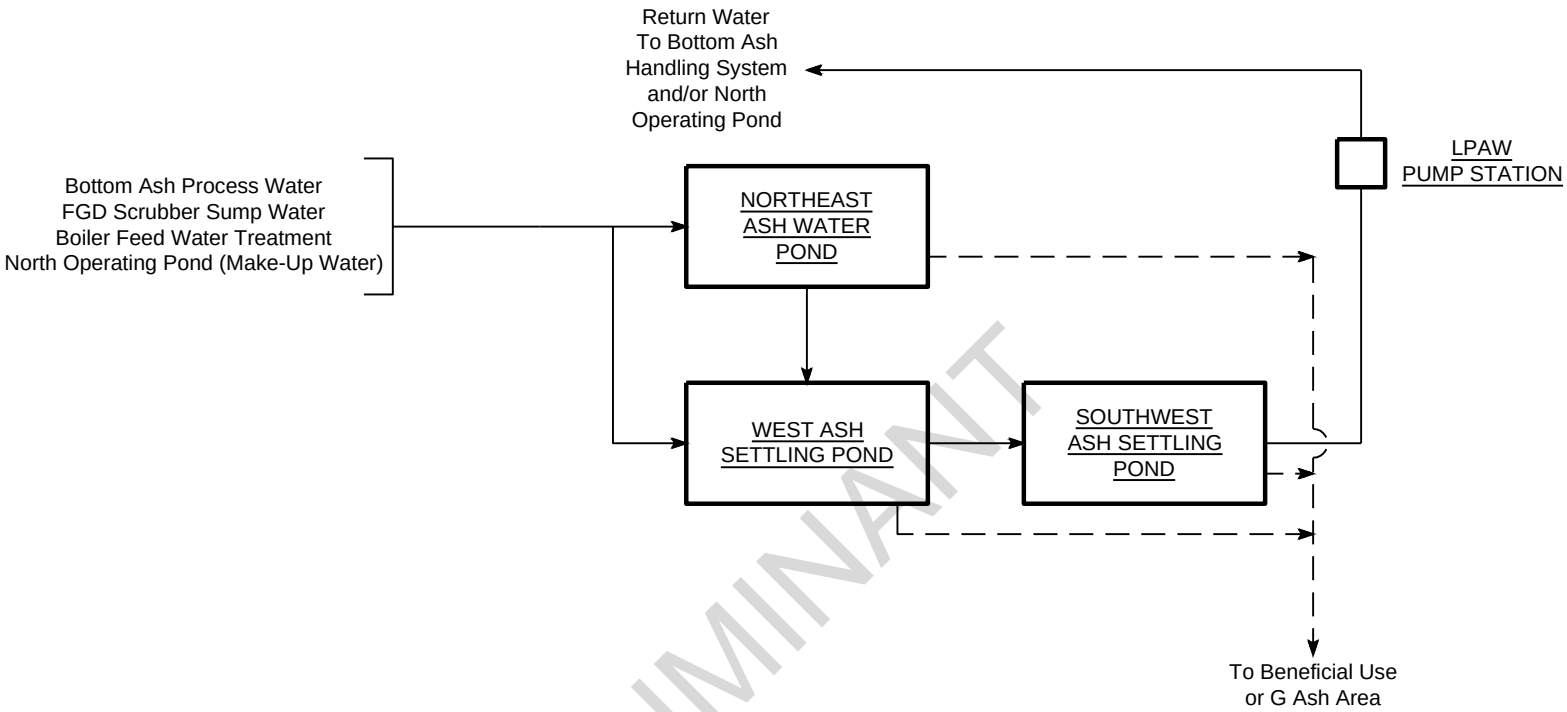

EXPLANATION

Water

Solids

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MONTICELLO STEAM ELECTRIC STATION

Figure 3

SIMPLIFIED CCR SURFACE IMPOUNDMENT FLOW DIAGRAM

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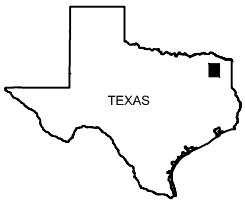

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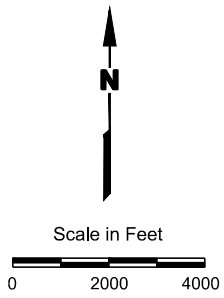

SOURCE:
Imagery from Google Earth, aerial photography dated 12-5-15.

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MONTICELLO STEAM ELECTRIC STATION

Figure 4

LAKE MONTICELLO AND VICINITY MAP

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CONSULTING ENGINEERS AND SCIENTISTS

Appendix A

O’Brien and Gere Hazard Potential Classification

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:

The area potentially inundated by a breach of any embankment of the CCW impoundment is limited to property owned by Luminant Power. The potential exists for some discharge to reach Lake Monticello which is also owned by Luminant Power. Environmental impacts with the waterbody are unknown due to unknown nature of stored materials constituent.