

**HAZARD POTENTIAL CLASSIFICATION ASSESSMENT
MARTIN LAKE STEAM ELECTRIC STATION
ASH POND AREA AND PERMANENT DISPOSAL POND NO. 5
RUSK COUNTY, TEXAS**

October 2016

Prepared for:

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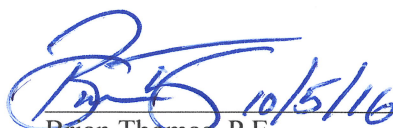
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PBW Project No. 5196B

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.





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

LUMINANT

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1.0 INTRODUCTION

Luminant Generation Company, LLC (Luminant) owns and operates the Martin Lake Steam Electric Station (MLSES) located approximately five miles southwest of Tatum in Rusk County, Texas. The power plant and related support areas occupy approximately 700 acres on a peninsula on the southwest side of Martin Lake (Figure 1). The MLSES consists of three coal/lignite-fired units with a combined operating capacity of approximately 2,250 megawatts. Coal Combustion Residuals (CCR) including fly ash, bottom ash, and gypsum are generated as part of MLSES unit operation. The CCRs are transported off-site for beneficial use by third-parties, are managed by Luminant on-site at Permanent Disposal Pond No. 5 (PDP-5) or are disposed at Luminant's A-1 Area Landfill.

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 MLSES. 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 MLSES Impoundments Subject to Hazard Potential Classification Assessments

The CCR Rule defines CCR's 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 MLSES have been identified as CCR Units subject to the hazard potential classification assessment requirements (Figure 2):

- West Ash Pond (WAP),
- East Ash Pond (EAP),
- New Scrubber Pond (SP), and
- PDP-5.

A simplified flow diagram for the MLSES impoundments is shown on Figure 3.

1.3 Description of Bottom Ash Ponds

The WAP and EAP (collectively "Bottom Ash Ponds" or "BAPs") are located approximately 2,000 feet east of the MLSES power plant (Figure 4). The WAP and EAP receive recovered sluice water from bottom ash dewatering bins and other MLSES process wastewater sources that typically include bottom ash fines. The ponds also act as surge basins for various water streams in the ash-water system. Process wastewater can be transferred from the MLSES impoundments to the SP and PDP-5 or used as makeup water to the bottom ash system. When sufficient ash has accumulated in either the WAP or EAP, the recovered sluice water is diverted to the other pond. Ash in the inactive pond is then removed and transported via rail car to the A1 Area Landfill. The BAPs were originally constructed in the 1977 and upgraded in 1988 (WAP) and 2010 (EAP).

The WAP and EAP are constructed partially above and partially below grade and are surrounded by

engineered earthen embankments that extend above grade. The WAP and EAP share an interior embankment and cover areas of approximately 14.6 acres and 9.6 acres, respectively. The crest elevation of the BAP embankments is 330 feet above mean sea level (MSL) and the EAP borders Martin Lake (normal pool elevation 306 feet MSL).

The BAPs impoundments were originally constructed in the 1977 with an in-situ compacted clay liner. The WAP was removed from service in March 1988 and re-lined with a double 60-mil high density polyethylene (HDPE) liner system overlain with a concrete revetment mat. The EAP was dredged and removed from service in 1989, and a new south embankment was constructed to allow for an increase in the size of the SP. The EAP remained inactive until the installation of a new double 60-mil HDPE liner system with concrete revetment mat was completed in February 2010.

1.4 Description of New Scrubber Pond

The New Scrubber Pond (SP) is located immediately south of the EAP and east of the WAP (Figure 4). The SP is an approximately 12.5 acre surface impoundment that is used to manage FGD wastes as well as discharge from the sludge thickener sumps, the plant yard sumps, and storm water management areas. Solids present in the FGD wastewater settle within the pond and are periodically removed and managed similar to the ash solids from the WAP and EAP. Process wastewater can be transferred from the SP to the BAPs and PDP-5, or used as makeup water to the scrubber systems. The SP was originally constructed in the 1977 and was expanded to its current size in 1989.

The SP is constructed partially above and partially below grade and is surrounded by engineered earthen embankments that extend above grade. The west embankment of the SP is an internal/shared embankment with the WAP and a portion of the northern embankment is an internal/shared embankment with the EAP. The crest elevation of the SP embankments is 330 feet MSL. Martin Lake (normal pool elevation 306 feet MSL) adjoins portions of the north and south embankments of the SP.

The SP was originally constructed in 1977 with an in-situ compacted clay liner and was expanded to its current size in 1989. The SP was relined in 1989 with a double 60-mil HDPE liner system, overlain with a concrete revetment mat.

1.5 Description of PDP-5

Permanent Disposal Pond No. 5 (PDP-5) is located approximately 3,000 feet west-northwest of the MLSES power plant (Figure 2). PDP-5 is an approximately 40-acre surface impoundment that was constructed in 2010 over three closed PDPs (PDPs 1-3; Figure 5). PDP-5 is primarily used to manage excess liquids, including storm water from large precipitation events and excess process wastewater from both the FGD and bottom ash loops. Recovered CCR wastewaters are received in PDP-5 during cleaning cycles for the BAPs and SP. Process wastewater can be transferred between the BAPs, SP, or used as makeup water for specific CCR related systems. Process wastewater can be transferred from PDP-5 to the BAPs and the SP.

PDP-5 is constructed above grade and is surrounded by engineered earthen embankments. The crest elevation of the PDP-5 embankments is 405.5 feet MSL, and the embankments are approximately 10 to 15 feet above surrounding grade. The liner system for the PDP-5 consists of the following:

- a six-inch thick soil layer over the closed PDPs (in-place permeability of 1×10^{-5} cm/sec);
- two-foot thick compacted clay liner (in-place permeability of 1×10^{-7} cm/sec); and
- three-foot thick compacted clay interior/exterior embankment liner (minimum in-place permeability of 1×10^{-7} cm/sec).

Based on available construction data the BAPs, SP and PDP-5 were constructed to provide the following estimated storage capacities:

- WAP: 232.6 acre-feet;
- EAP: 125.8 acre-feet;
- SP: 198.9 acre-feet; and
- PDP-5: 190.3 acre-feet.

Total design capacity of the CCR impoundments located within the ash pond area (WAP, EAP and SP) is 557.2 acre-feet or approximately 181,564,000 gallons.

1.6 USACE Size Classification for BAPs, SP and PDP5

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 heights and operating capacities of the BAPs, SP and PDP-5 impoundments, these impoundments would be categorized as small impoundments based on 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

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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, SP and PDP-5 impoundments 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, SP and PDP-5 was assessed by identifying the development, occupancy and land use characteristics of potentially affected areas downstream of the impoundments. The assessment included a review of available aerial photographs, USGS topographic maps, interviews with Luminant personnel familiar with the area, and similar resources. Classification of the BAPs, SP and PDP-5 in accordance with the FEMA hazard potential criteria is based on the assessment of 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, SP and PDP-5.

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3.0 PREVIOUS BAP, SP & PDP-5 HAZARD POTENTIAL CLASSIFICATION ASSESSMENT

In 2012, the USEPA contracted with Dewberry Consultants LLC (Dewberry) of Fairfax, Virginia to assess the stability and functionality of the CCR impoundments at the MLSES. The purpose of the assessment was to evaluate the condition and potential for residue release from the BAPs, SP and PDP-5 impoundments based on a review of available documentation and a site assessment conducted by Dewberry personnel on September 25, 2012. The assessment included a determination of the hazard potential classification of the impoundments.

The results of the MLSES impoundment assessments were presented to EPA in a March 2014 report (Dewberry, 2014). Key findings related to the hazard potential classification for the BAPs, SP and PDP-5 can be summarized as follows:

- Based on the size of the BAPs, SP and PDP-5 impoundment embankment heights and impoundment storage capacities, the impoundments would be classified as Small by USACE criteria.
- With exception of Martin Lake State Park, which is located along the northern portion of the lake, Luminant owns most of the property in the vicinity of the plant, including the lake and dam (Figure1).
- Failure or misoperation of the impoundments was not expected to result in a probable loss of human life; however, the Dewberry report concluded that a release into the reservoir (Martin Lake) is expected to have some economic and environmental impact since Martin Lake State Park provides public access for recreational purposes. Therefore, a Federal Hazard Classification of Significant was identified for the BAPs, SP and PDP-5.

The hazard potential classification checklist developed by Dewberry for the BAP, SP and PDP-5 impoundments as part of the assessment is reproduced in Appendix A.

4.0 BAP, SP & PDP-5 HAZARD POTENTIAL CLASSIFICATION ASSESSMENT

The hazard potential classification of the impoundments 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 impoundments, and using the results of the assessment to classify the impoundments based on the FEMA hazard potential criteria described in Section 2.0 of this report.

4.1 Areas Downstream BAPs, SP and PDP-5

The MLSES is located approximately five miles southwest of Tatum, Texas. Martin Creek Reservoir (Martin Lake) borders the plant on the north, east and south sides. The BAPs, and SP impoundments are located on the northeast side of the plant and border Martin Lake. The PDP-5 impoundment is located approximately 3,000 feet west-northwest of the plant. The impoundments are located in the drainage areas of Martin Lake and a failure of the embankments surrounding the impoundments would release CCR solids/fluids that would flow into Martin Lake. Figure 2 shows the locations of the impoundments relative to Martin Lake and adjacent areas.

Martin Lake is a man-made reservoir located on Martin Creek and was constructed in 1974 to provide cooling water for MLSES. Luminant owns the water rights to the lake and operates and maintains Martin Lake Dam. The crest of the dam is approximately 321 ft. above mean sea level (MSL) with a normal lake (conservation pool) elevation of 306 ft. MSL. At the conservation pool elevation, the lake covers an area of approximately 4,954 acres, and contains a total volume of approximately 75,726 acre-ft of water (TWDB, 2015). The emergency spillway elevation is 312 ft. MSL.

The shoreline of Martin Lake is mostly undeveloped and there are no permanent residences along the lake shoreline. Luminant owns all property immediately adjacent to the lake, except for Martin Lake State Park, which is located on the north side of Martin Lake (Figure 1). The park covers an area of approximately 290 acres. Activities available at the park include camping, backpacking, hiking, bird watching, boating, fishing and related water sports on the lake. Lake access is also provided by one boat ramp.

Several gas gathering lines and petroleum pipelines traverse Martin Lake at various locations (RRC, 2016). In addition, three Farm Market Roads (FM 2145, FM 2658, FM 3231), and the Luminant railroad cross Martin Lake.

4.2 Hazard Potential Classification Assessment

A failure of the embankments surrounding the impoundments would release CCR solids/fluids that would flow north, east and south toward Martin Lake. As described in Sections 1.3, 1.4 and 1.5 of this report, the total combined operating volume of the MLSES impoundments is approximately 747.6 acre-ft. In the unlikely event that the entire volume of all impoundments is released through catastrophic failure of the embankments, the total volume of fluids that could enter the lake from the impoundments (747.6 acre-ft) represents less than one percent of the conservation pool volume of Martin Lake (75,726 acre-ft).

Assuming a lake surface area of 4,954 acres at the conservation pool elevation of 306 feet, the total volume of the impoundments would raise the lake level by approximately 0.15 feet or slightly less than two inches. The resulting water surface elevation (306.15 feet) is well below the emergency spillway elevation at Martin Lake Dam (312 feet), indicating that the total volume of the impoundments would be retained and equalized within Martin Lake.

Using the FEMA hazard potential criteria described in Section 2.0 of this report, the projected effects of catastrophic failure or misoperation of the impoundments results in a hazard potential classification of **Low** for the BAP, SP and PDP-5 impoundments. 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 Martin Lake is mostly undeveloped and there are no permanent residences along the lake shoreline. In addition, the total volume of the impoundments would be retained and equalized in Martin Lake in the event of a catastrophic failure of the impoundment embankments, since the lake level would be raised by approximately 0.15 feet, which is well below the emergency spillway elevation of Martin Lake Dam. As a result, a release from the impoundments 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 Martin Lake and the land surrounding the lake (with exception of 290 acres owned by TPWD), any losses would primarily be limited to the Luminant property.

As described above, catastrophic failure of the impoundments into Martin Lake would result in only a nominal increase in lake water levels. As a result, land-based activities in Martin Lake State Park would not be adversely affected by impoundment failure. Impoundment failure could

adversely affect access from Martin Lake State Park to the lake for swimming, fishing and related water sports due to potential changes in lake water quality; however, the economic and environmental losses associated with these activities are low.

- No Significant Disruption of Lifelines. There are several gas gathering lines, petroleum pipelines, highways and railroad bridge that traverse Martin Lake. A release from the surface impoundments would only result in a small rise in the elevation of Martin Lake, therefore these lifelines would be unaffected by a release from the impoundments.

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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, SP and PDP-5 surface impoundments at the MLSES in accordance with the requirements of Section 257.73(a)(2) of the CCR Rule. The hazard classification assessment for the impoundments 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 impoundments are classified as LOW hazard potential CCR surface impoundments, since a failure or misoperation of the impoundments 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 MLSES 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

Dewberry Consultants, LLC (Dewberry), 2014. *Coal Combustion Residue Impoundment Round 12 - Dam Assessment Report, Martin Lake Steam Electric Plant Coal Combustion Residuals Impoundments, Tatum, Texas*, EP-09W001727, March.

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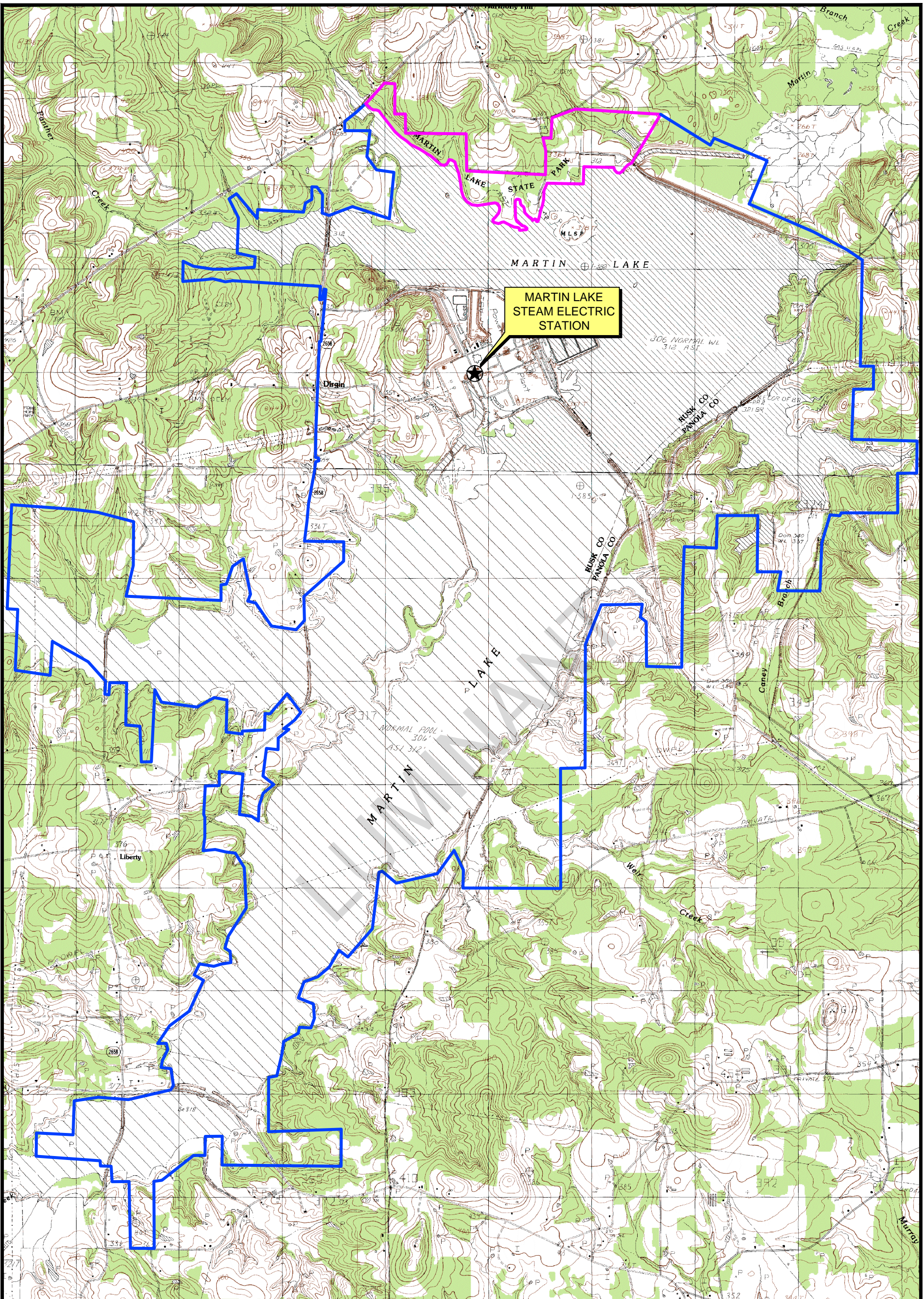
Texas Water Development Board (TWDB), 2015, *Volumetric Survey of Martin Lake, Prepared for Luminant Generation Company, LLC*, April.

United States Army Corps of Engineers (USACE), 1979. *Recommended Guidelines for Safety Inspections of Dams*, ER 1110-2-106, September 26.

Pastor, Behling & Wheeler, LLC, 2011. *Revised Affected Property Assessment Report, Martin Lake Steam Electric Station – Ash Pond Area, 8850 FM 2658 North, Tatum, Texas*, May 3.

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Figures



Contour Interval = 10 Feet

EXPLANATION

- Approximate Luminant Property Boundary
- Approximate Limits of Martin Lake State Park

NOTES:

- 1.) Luminant On-Site boundaries do not represent divestiture of Martin Lake State Park Area.

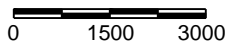
SOURCE:

Base map from <http://www.tnris.state.tx.us> Tatum and Fair Play, Texas 7.5 min. U.S.G.S. quadrangles, 1983, as adapted by TXU Power with On-Site Property Boundaries.



QUADRANGLE LOCATIONS

Scale in Feet



LUMINANT GENERATION COMPANY, LLC
MARTIN LAKE STEAM ELECTRIC STATION

Figure 1

ON-SITE PROPERTY MAP

PROJECT: 5196B

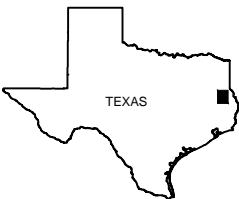
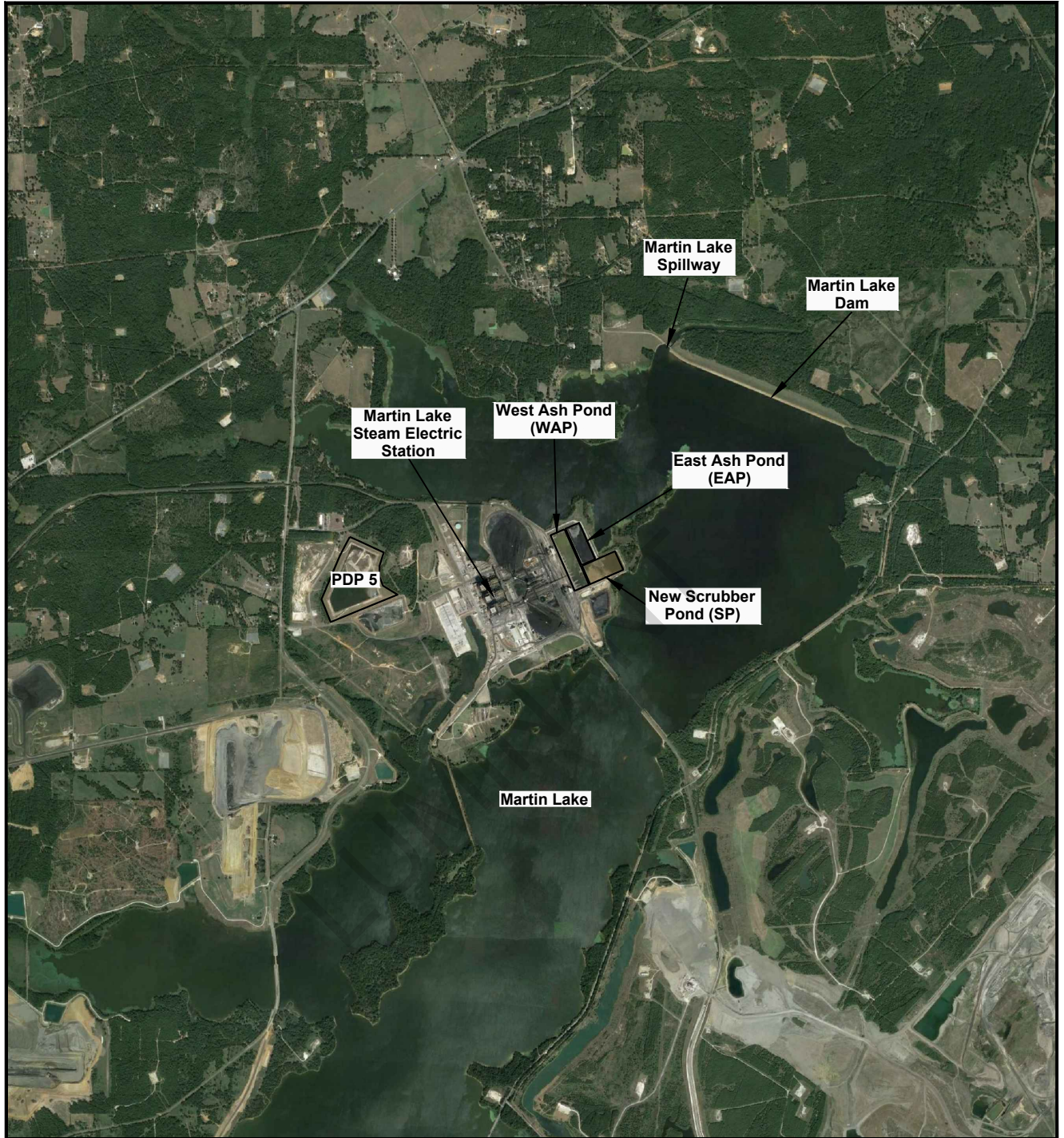
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DATE: SEPT., 2016

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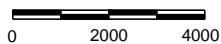
PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS



PHOTOGRAPH LOCATION



Scale in Feet



LUMINANT GENERATION COMPANY, LLC
MARTIN LAKE STEAM ELECTRIC STATION

Figure 2

SITE VICINITY MAP

PROJECT: 5196B

BY: AJD

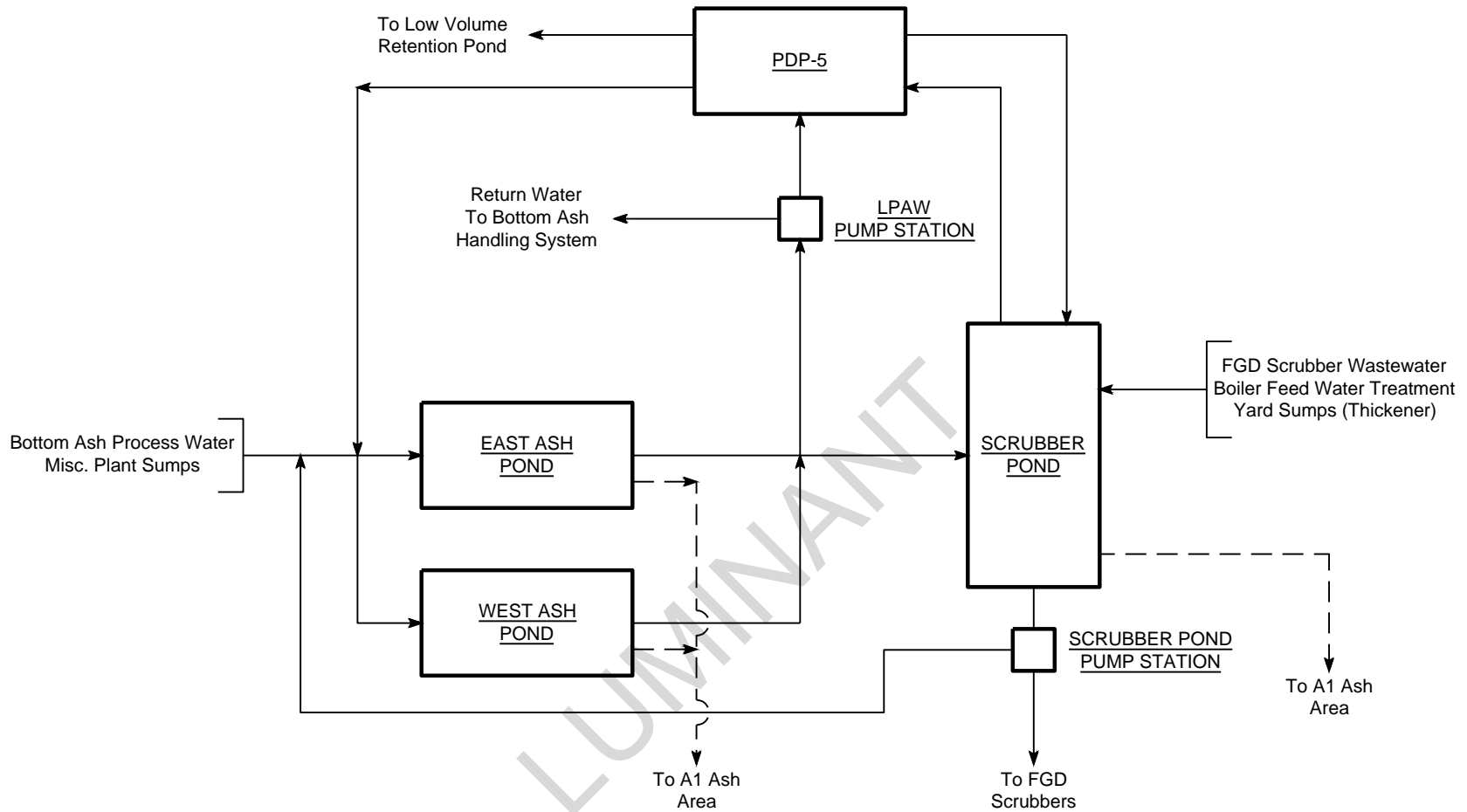
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 CONSULTING ENGINEERS AND SCIENTISTS

SOURCE:
 Imagery from Google Earth, photography dated October 1, 2015.



EXPLANATION

- > Water
- -> Solids

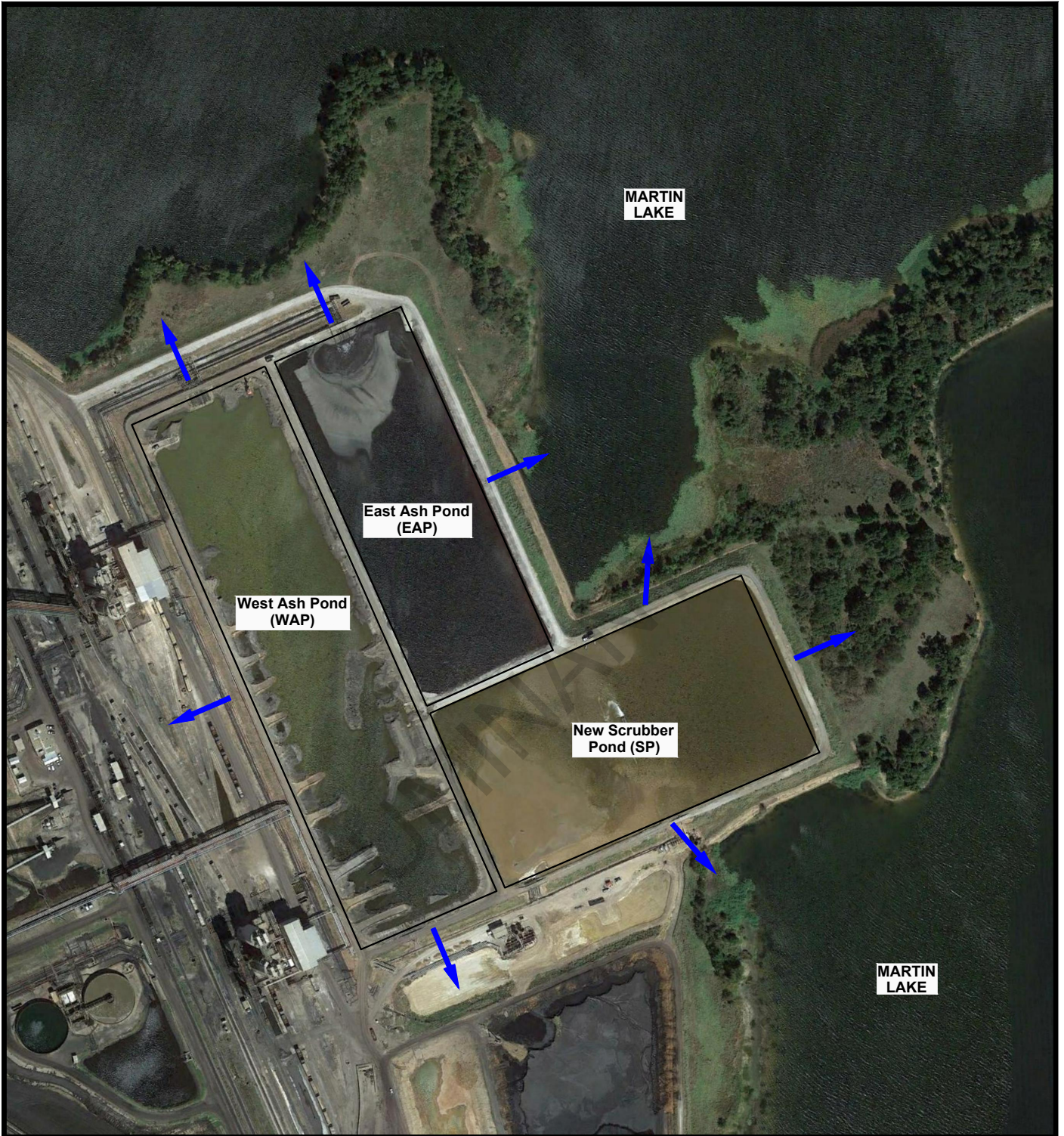
LUMINANT GENERATION COMPANY, LLC
 MARTIN LAKE STEAM ELECTRIC STATION

Figure 3

**SIMPLIFIED CCR SURFACE
 IMPOUNDMENT FLOW DIAGRAM**

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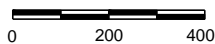


EXPLANATION

→ Surface Flow Direction



Scale in Feet



SOURCE:
Imagery from Google Earth, photography dated October 1, 2015.

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MARTIN LAKE STEAM ELECTRIC STATION

Figure 4

ASH POND AREA MAP

PROJECT: 5196B

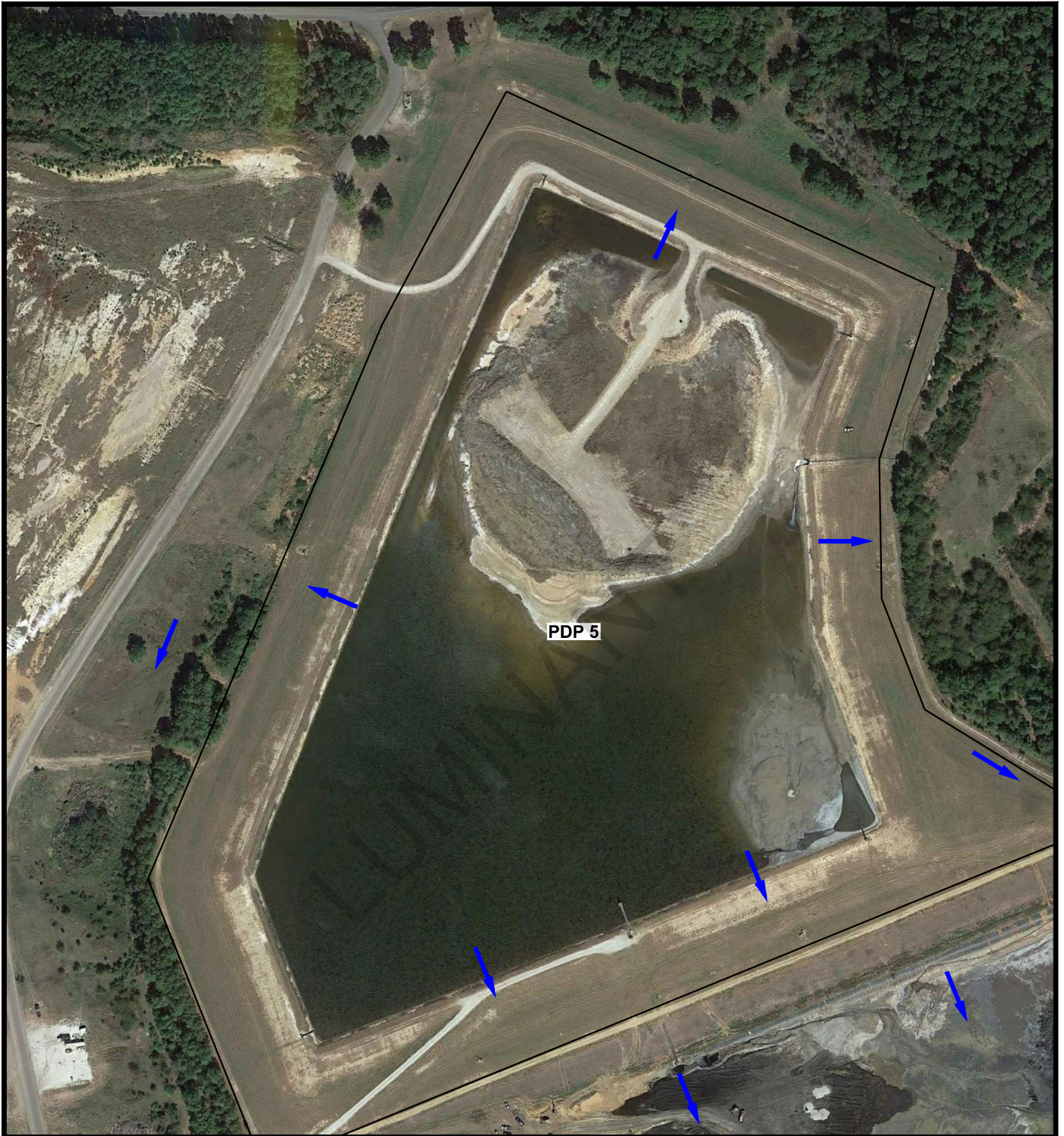
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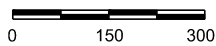


EXPLANATION

→ Surface Flow Direction



Scale in Feet



SOURCE:
Imagery from Google Earth, photography dated October 1, 2015.

LUMINANT GENERATION COMPANY, LLC
MARTIN LAKE STEAM ELECTRIC STATION

Figure 5

PDP 5 AREA MAP

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BY: AJD

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DATE: SEPT., 2016

CHECKED: BDT

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CONSULTING ENGINEERS AND SCIENTISTS

Appendix A
2012 Dewberry Hazard Potential Classification

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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.
- 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:

Based on the size and location of the Martin Lake Steam Electric Station PDP 5, there is no probable loss of life in the event of failure or misoperation. Economic and environmental losses are expected to be low and limited to the owner's property. The plant owner owns Martin Lake and much of the surrounding property. Martin Lake State Park located on across an arm of the lake north and down gradient from the plant. However, the park property is owned by Luminant and leased to the State for a nominal annual amount to provide public recreational access to the lake.