OCTOBER 2016

CLECO POWER LLC
BRAME ENERGY CENTER

STRUCTURAL STABILITY ASSESSMENT:

BOTTOM ASH POND

Prepared By:

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Project Number 002-186

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1.0 INTRODUCTION

Providence was contracted by Cleco Power LLC (Cleco) to conduct a structural stability assessment of the Bottom Ash Pond at Cleco's Brame Energy Center. Recent Coal Combustion Residual (CCR) regulations at 40 CFR 257.73(d)(1) established requirements for owners and operators to conduct a structural stability assessment by a qualified professional engineer to document whether the design, construction, operation and maintenance is consistent with recognized and generally accepted good engineering practices. This assessment must, at a minimum, document whether the CCR unit has been designed, constructed, operated, and maintained with:

- Stable foundations and abutments.
- Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown.
- Dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit.
- A single spillway or a combination of spillways designed, operated, and maintained to adequately manage flow during a 1,000-year flood for a significant hazard potential CCR surface impoundment.
- Hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure.
- For CCR units with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body.

The Cleco Brame Energy Center is located near Lena in Rapides Parish, Louisiana. A site location map showing the Brame Energy Center is included as **Figure 1**. This structural stability assessment pertains to the Bottom Ash surface impoundment (Pond) utilized for the Unit 2 coal-fired generation unit. A site map for the Bottom Ash Pond is included as **Figure 2**. Providence reviewed the construction drawings and operational plan, and reviewed the inspection and maintenance procedures for the Bottom Ash Pond.

2.0 STRUCTURAL STABILITY

Stable Foundations and Abutments

Providence modeled a short-term slope stability analysis for the pond using a scenario where the facility allows the pond to fill to the freeboard level for the Bottom Ash surface impoundment. This scenario represents the flood/heavy

rainfall conditions. The new elevation was determined using 2.5 feet of freeboard from the lowest levee crown elevation for this pond.

Based on the results of the short-term slope stability analysis, the following minimum factors of safety were obtained:

Table 1 Short-Term Factors of Safety

Surface Impoundment	Section Number	Soil Boring No.	Maximum Water Elevation (feet NAVD 88)	Analysis	Factor of Safety
Bottom Ash	Section 1	B-13	103.5	Spencer Method Deep Failure	1.52
Bottom Ash	Section 2	B-12	103.5	Spencer Method Deep Failure	1.52
Bottom Ash	Section 3	B-3	103.5	Spencer Method Deep Failure	1.54

The calculated short-term static factor of safety under maximum surcharge pool loading conditions is greater than 1.40, therefore these safety factors are adequate.

It must be noted that Cleco keeps the operating water levels in the Bottom Ash Pond at low levels with a pumping system. The low operating levels for this pond do not adversely affect the structural stability of the perimeter levees around the Bottom Ash Pond. The normal operating water level in the Bottom Ash Pond ranges from 90 to 96 feet NAVD 88. These levels are significantly lower than the modeled flooded/heavy rainfall conditions.

The interior and exterior slopes of the perimeter levees are on a three horizontal to one vertical and were compacted during the construction of the levees.

Adequate Slope Protection to Protect Against Surface Erosion, Wave Action, and Adverse Effects of Sudden Drawdown

The levees have adequate slope protection against surface erosion, wave action, and adverse effects of a sudden drawdown. The levees have a minimum three-foot thick layer of clay on the interior, exterior, and crest of the levee. Vegetation is adequate on the top of the levee where it may be exposed to the elements. As part of Cleco's operational plan, they inspect the levees weekly for any erosion due to weather, animals, or other elements and promptly correct any deficiencies.

Dikes Mechanically Compacted to a Density Sufficient to Withstand the Range of Loading Conditions in the CCR Unit

The dikes were mechanically compacted to a density sufficient to withstand the range of loading conditions for the daily operation of the unit.

A Single Spillway or a Combination of Spillways Designed, Operated, and Maintained to Adequately Manage Flow During a 1,000-Year Flood for a Significant Hazard Potential CCR Surface Impoundment

Water discharges from the Bottom Ash Pond by means of a series of pumps on the northern end of the pond. An overflow control structure also exists near the pumps should the need arise. This water discharges into Lake Rodemacher, thence to Bayou Jean de Jean, thence to the Red River. This impoundment does not have an emergency spillway, but the water elevation is controlled through three floating pumps that are designed to pump approximately 5,000 gallons per minute (gpm). For normal operation, these pumps keep the water elevation below the existing control structure.

The Soil Conservation Service (SCS) Type III rain distribution for a 1,000-year, 24-hour rain event would cause a precipitation depth of 22.6 inches. Based on the operating water levels and the pumping system in the pond, the facility would adequately manage the rainfall for a 1,000-year flood event.

Hydraulic Structures Underlying the Base of the CCR Unit or Passing Through the Dike of the CCR Unit that Maintain Structural Integrity and are Free of Significant Deterioration, Deformation, Distortion, Bedding Deficiencies, Sedimentation, and Debris Which May Negatively Affect the Operation of the Hydraulic Structure

As part of the structural evaluation, Providence reviewed the presence of any culverts or pipes buried in the levees of the Bottom Ash Pond. Based on the survey of the pond levees, several site inspections, review of solid waste permit files, and discussions with Cleco personnel, Providence determined that the following culverts/pipes exist within the levees surrounding the Bottom Ash Pond:

- 24” Corrugated Metal Pipe near the southwest corner of the Bottom Ash Pond. This pipe is connected to a surface storm water ditch along the northwest perimeter of the Bottom Ash Pond.
- 24” Corrugated Metal Pipe on the west side of the Bottom Ash Pond. This pipe is the gravity overflow pipe for the Bottom Ash Pond.
- 6” HDPE pipe in the levee between the Bottom Ash Pond and Fly Ash Pond. This pipe is connected to a pump on the Fly Ash Pond side of the levee. Water is pumped from the Fly Ash Pond to the Bottom Ash Pond through this Pipe.

These drain pipes are in satisfactory condition and do not pose a threat to the levee system. These pipes have maintained their structural integrity and are free from significant deterioration, deformation, distortion, bedding deficiencies,

sedimentation, and debris. None of the known pipes lead to offsite locations on the surface or to public drainage systems or waterways or pose any significant risks to Cleco as a result of their operation.

For CCR Units with Downstream Slopes Which Can Be Inundated By The Pool of an Adjacent Water Body, Such as a River, Stream or Lake, Downstream Slopes Must Maintain Structural Stability During Low Pool of the Adjacent Water Body or Sudden Drawdown of the Adjacent Water Body

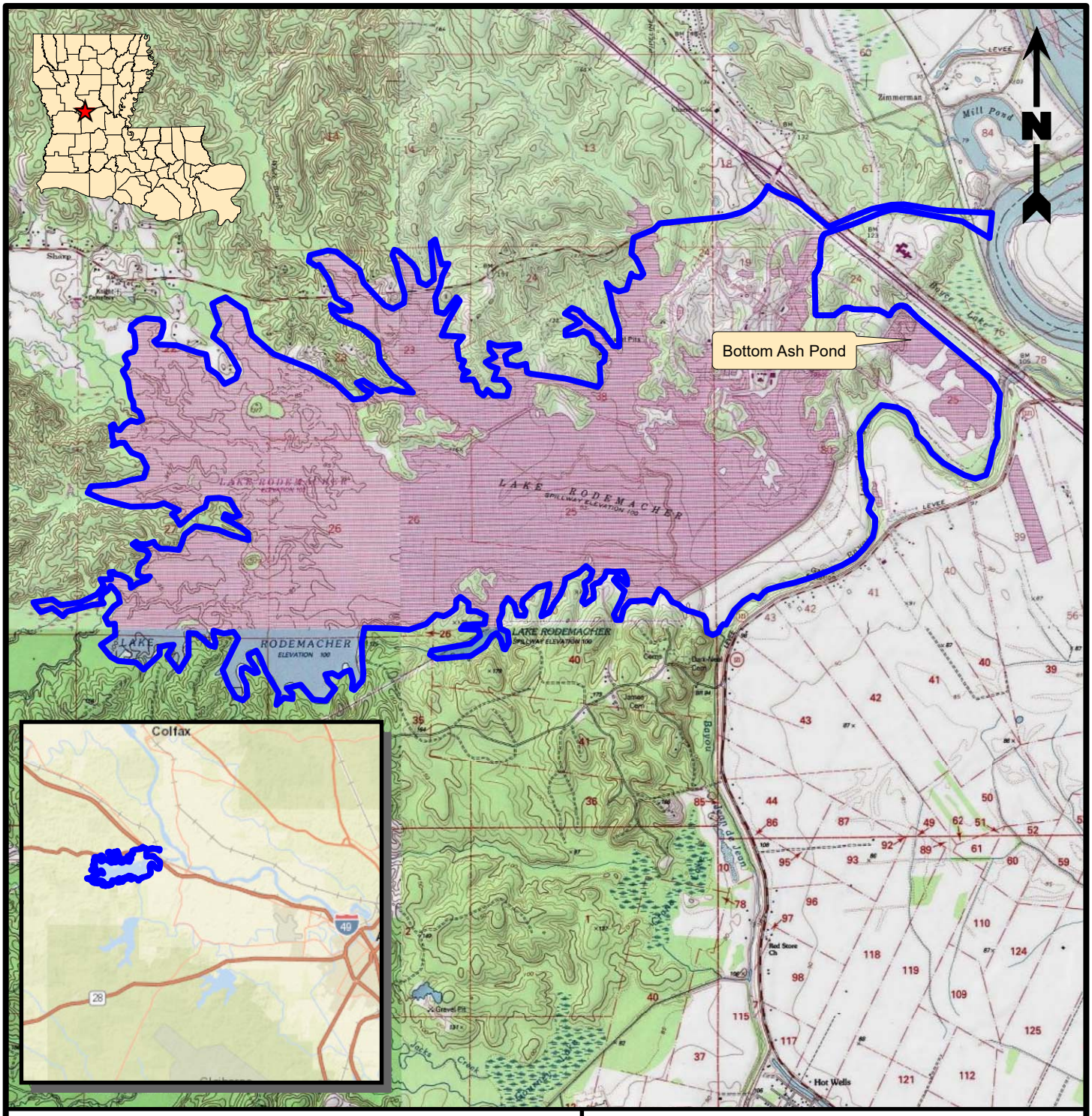
During normal operation of the Bottom Ash Pond, the levees are not inundated by surface waters from adjacent features. Occasionally, Bayou Jean de Jean will cause water to backup along the northernmost levee during high water events. However, when it does happen, the backwater levels occur as a gradual rise and/or a gradual drawdown, therefore, the levees are not negatively impacted.

3.0 CONCLUSION

Based on the results from the structural stability assessment, the Bottom Ash Pond's design, construction, operation and maintenance is consistent with recognized and generally accepted good engineering practices. The Bottom Ash Pond meets the requirements at 257.73(d)(1) of the CCR regulations. **Appendix A** contains a P.E. Certification that attests to this assessment.

FIGURE 1

SITE LOCATION MAP



Legend

Property Boundary

Reference

Base map comprised of U.S.G.S. 7.5 minute topographic maps, "Lena, LA", "Boyce, LA", "Jericho, LA", and "Gardner, LA".

Site Location Map

Structural Stability Assessment - Bottom Ash Pond
Boyce, Rapides Parish, Louisiana

Cleco Power LLC
Brame Energy Center

PROVIDENCE

Drawn By	LMM	10/04/16
Checked By	LMH	10/04/16
Approved By	CVH	10/04/16

Project Number	002-186
Drawing Number	002-186-A017
1 Figure	

Providence Engineering and Environmental Group LLC

FIGURE 2

SITE MAP

N

Legend

Property Boundary

Reference

Base map comprised of Google Earth aerial imagery from 10/03/14.

1,000 500 0 1,000
Feet

Site Map

Structural Stability Assessment - Bottom Ash Pond
Boyce, Rapides Parish, Louisiana

Cleco Power LLC
Brame Energy Center

PROVIDENCE

Drawn By	LMM	10/04/16
Checked By	LMH	10/04/16
Approved By	CVH	10/04/16

Project Number 002-186

Drawing Number 002-186-B018

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Figure

APPENDIX A

P.E. CERTIFICATION

CLECO BRAME ENERGY CENTER
BOTTOM ASH POND
CCR STRUCTURAL STABILITY ASSESSMENT

PROFESSIONAL ENGINEER CERTIFICATION

I hereby certify that I have performed a structural stability assessment for Cleco's Brame Energy Center Bottom Ash Pond in accordance with the 40 CFR 257.73(d)(1) CCR requirements. This structural stability assessment has determined that the Bottom Ash Pond's design, construction, operation and maintenance is consistent with recognized and generally accepted good engineering practices. It has been designed, constructed, operated, and maintained with:

- Stable foundations and abutments.
- Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown.
- Dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit.
- The discharge structures are designed, operated, and maintained to adequately manage rainfall during a 1,000-year flood for a significant hazard potential CCR surface impoundment.
- Hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure.
- For CCR units with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes must maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body.

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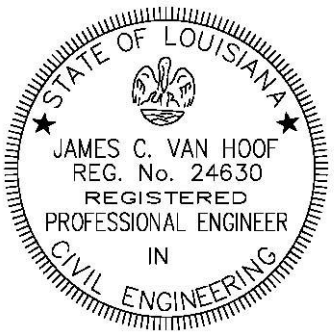
Signature

10/16/2016
Date



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