CLECO POWER LLC
BRAME ENERGY CENTER

BOTTOM ASH POND
LENA, LA

Demonstration for a Site-Specific Alternative to Initiation of Closure Deadline for the Coal Combustion Residuals Rule Pursuant to 40 C.F.R. § 257.103(f)(2)

November 25, 2020

INDEX AND CERTIFICATION

Cleco Power LLC
Brame Energy Center, Boyce, LA
Bottom Ash Pond
Demonstration for a Site-Specific Alternative to Initiation of Closure Deadline
Project No. 01-20-0220

REPORT INDEX

CERTIFICATION

I hereby certify that the information in this document as noted in the above Report Index was assembled under my personal charge. This report is not intended or represented to be suitable for reuse by Cleco Power LLC or others without specific verification or adaptation by the Engineer. I am a duly licensed Professional Engineer under the laws of the State of Louisiana.

BRADLEY E. BATES
LIC. NO. 27124

	27124
Signature	**PE Registration Number**
Bradley E. Bates	*Professional Engineer*
Name	**Title**
Eagle Environmental Services, Inc.	11/11/20
Company	**Date**

CHAPTER 1.0

Executive Summary and Introduction

November 25, 2020

CLECO

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EXECUTIVE SUMMARY

Cleco Power LLC (Cleco) submits this request to the United States Environmental Protection Agency (EPA) for approval of a site-specific alternative deadline to initiate closure pursuant to 40 C.F.R. § 257.103(f)(2)—"Permanent Cessation of a Coal-Fired Boiler(s) by a Date Certain"—for the Bottom Ash Pond located at the Brame Energy Center (BEC) in Lena, Louisiana. The Bottom Ash Pond is 45.8 acres and is currently used to manage CCR and non-CCR wastestreams generated by Rodemacher Unit 2.

As this demonstration describes, the Rodemacher Unit 2 boiler located at BEC will cease generation of coal-fired energy by no later than October 17, 2028. In the meantime, the Bottom Ash Pond must continue to receive CCR wastestreams due to a lack of on-site and off-site alternative disposal capacity.[1] Accordingly, Cleco is requesting approval of an alternative deadline to initiate closure so the Bottom Ash Pond may continue to receive CCR wastestreams after April 11, 2021 and complete closure by no later than October 17, 2028.

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[1] Note that another CCR surface impoundment, the BEC Fly Ash Pond, is also located onsite. Fly ash from this unit is currently being reclaimed and marketed for sale. In 2019, Cleco sold 6,200 tons of fly ash reclaimed from the Fly Ash Pond. So far in 2020, Cleco has sold 1,950 tons of reclaimed fly ash from the Fly Ash Pond. The Fly Ash Pond is not within the scope of this demonstration.

INRODUCTION

BEC is located in Lena, Louisiana. Three units at BEC generate power: Nesbitt Unit 1, Rodemacher Unit 2, and Madison Unit 3. Nesbitt Unit 1 is fueled by natural gas, Rodemacher Unit 2 is fueled by sub-bituminous coal, and Madison Unit 3 is fueled by petroleum coke.

Currently, BEC utilizes the Bottom Ash Pond to manage CCR from Rodemacher Unit 2 and non-CCR wastestreams. The Rodemacher 2 CCR wastestreams consist of bottom ash, economizer ash, and pyrite rejects. These wastestreams are sent to the Bottom Ash Pond via bottom ash sumps and sluice piping. The Bottom Ash Pond also receives water plant resin beads and small amounts of fly ash and related neutralized waste. Because alternative disposal capacity is available off-site for the disposal of these wastestreams, the disposal of these wastestreams will be CCR rule compliant no later than April 11, 2021.They are therefore not considered part of this demonstration.

On August 28, 2020, EPA revised the CCR rule to require all unlined surface impoundments to cease receipt of waste and initiate closure by April 11, 2021.[2] The CCR rule also includes, however, site-specific alternative deadlines for surface impoundments to cease receipt of waste and initiate closure.[3] One of these alternative closure provisions provides a closure extension if a coal-fired boiler(s) at a facility will cease operation by a date certain, but a surface impoundment must continue to be used due the lack of on-site and off-site alternative disposal capacity for CCR and non-CCR wastestreams.[4] Surface impoundments that qualify for this

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[2] 85 Fed. Reg. 53,516 (Sept. 28, 2020); 40 C.F.R. § 257.101(a)(1).

[3] 40 C.F.R. § 257.103(f).

[4] *Id.* § 257.103(f)(2).

extension and are larger than 40 acres must complete closure by October 17, 2028.[5] Qualifying surface impoundments that are 40 acres or smaller must complete closure by October 17, 2023.[6]

BEC Rodemacher Unit 2 will cease generating coal-fired electricity, and Cleco will complete closure of the Bottom Ash Pond, by no later than October 17, 2028. Prior to the cessation of coal-fired generation, the Bottom Ash Pond must continue to receive bottom ash from Rodemacher Unit 2, economizer ash from Rodemacher Unit 2, and pyrite rejects (CCR wastestreams) given the lack of alternative on-site and off-site disposal capacity. Accordingly, Cleco is requesting a site-specific extension for the Bottom Ash Pond to cease receipt and initiate closure after April 11, 2021 and complete closure by no later than October 17, 2028.

In accordance with 40 C.F.R. § 257.103(f)(2)(v), this demonstration includes the following:

1. A narrative explaining the options considered to obtain alternative capacity for CCR and/or non-CCR wastestreams both on- and off-site;[7]
2. A risk management plan describing the measures that will be taken to expedite any required corrective action;[8] and
3. A closure plan required by § 257.102(b) and a narrative that specifies and justifies the date by which Cleco intends to cease receipt of waste into the Bottom Ash Pond to meet the closure deadline.[9]

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[5] *Id.* § 257.103(f)(2)(iv)(B).

[6] *Id.* § 257.103(f)(2)(iv)(A).

[7] Id. § 257.103(f)(2)(v)(A). The purpose of this narrative is to demonstrate the criteria in § 257.103(f)(2)(i) have been met.

[8] *Id.* § 257.103(f)(2)(v)(B).

[9] *Id.* § 257.103(f)(2)(v)(D).

In addition, this demonstration also includes all the information listed in § 257.103(f)(2)(v)(C) to certify and demonstrate that Rodemacher 2 is in compliance with all other requirements of the CCR rule.[10]

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[10] This additional information also addresses the Fly Ash Pond located at BEC, which is also in compliance with the CCR rule.

CHAPTER 2.0

Documentation of No Alternative Disposal Capacity

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DOCUMENTATION OF NO ALTERNATIVE DISPOSAL CAPACITY

1.0 Overview

To qualify for the "Permanent Cessation of a Coal-Fired Boiler(s) by a Date Certain" (Permanent Cessation) alternative closure deadline, owners and operators must demonstrate that they must continue disposing CCR and/or non-CCR wastestreams in a surface impoundment after April 11, 2021 due to the lack of on-site or off-site alternative disposal capacity.[1] The provision is clear that "[i]ncreases in costs or the inconvenience of existing capacity is not sufficient to support qualification under this section."[2] EPA makes it equally clear that owners and operators seeking to qualify for the Permanent Cessation alternative closure deadline are not required to develop alternative disposal capacity given the impending cessation of coal-fired generation.[3] As EPA states, "it would be illogical to require these facilities to construct new capacity to manage CCR and non-CCR wastestreams."[4] This is consistent with EPA's statement in the preamble to the 2015 final CCR rule in which it stated that "the owner or operator does not need to demonstrate any efforts to develop alternative capacity because of the impending closure of the power plant itself."[5]

The following sections (1) describe the CCR wastestreams that are currently disposed in the Brame Energy Center (BEC) Bottom Ash Pond, (2) discuss the options Cleco considered to obtain on-site and off-site alternative disposal capacity for these wastestreams, and (3) explain why these wastestreams must continue to be disposed in the BEC Bottom Ash Pond after April 11, 2021.

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[1] 40 C.F.R. § 257.103(f)(2)(i).

[2] *Id.*

[3] 85 Fed. Reg. 53,516, 53,547 (Aug. 28, 2020).

[4] *Id.*

[5] 80 Fed. Reg. 21,302, 21,424 (Apr. 17, 2015).

2.0 Current Disposal of CCR and non-CCR Wastestreams in the BEC Bottom Ash Pond

The BEC Bottom Ash Pond currently receives the following CCR wastestreams from Rodemacher Unit 2: bottom ash, economizer ash, and pyrite rejects (CCR wastestreams). These wastestreams are sent to the Bottom Ash Pond via bottom ash sumps and sluice piping and are the focus of this demonstration.[6]

The Bottom Ash Pond also receives water plant resin beads and small amounts of fly ash and related neutralized waste. These wastestreams are hauled to the Bottom Ash Pond in dump trucks. Because alternative disposal capacity is available off-site for the disposal of these wastestreams, the disposal of these wastestreams will be CCR rule compliant no later than April 11, 2021. Accordingly, they are not considered part of this demonstration.

3.0 Options Considered for On-Site and/or Off-Site Alternative Disposal Capacity for CCR Wastestreams

The CCR wastestreams are combined in the bottom ash sump under the boiler, pumped through the same sluice piping network, and wet-sluiced in the Bottom Ash Pond. EPA recognized in the preamble to the Part A final rule that “the disposal options for sluiced or wet handled CCR are greatly limited compared to the operations available for dry handled CCR.”[7] Cleco considered several alternative disposal options for these wastestreams. Consistent with EPA’s statement, however, none of these options are viable. Additionally, since Rodemacher Unit 2 will cease coal-fired energy production by a date certain, the CCR rule does not require Cleco to develop alternative disposal capacity for the CCR wastestreams.[8]

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[6] Note that another CCR surface impoundment, the BEC Fly Ash Pond, is also located onsite. Fly ash from this unit is currently being reclaimed and marketed for sale. In 2019, Cleco sold 6,200 tons of fly ash reclaimed from the Fly Ash Pond. So far in 2020, Cleco has sold 1,950 tons of reclaimed fly ash from the Fly Ash Pond. The Fly Ash Pond is not within the scope of this demonstration.

[7] 85 Fed. Reg. at 54,541.

[8] *See id.* at 53,547 (“Since the coal-fired boiler will shortly cease power generation, it would be illogical to require these facilities to construct new capacity to manage CCR and non-CCR wastestreams.”); *see also* 80 Fed. Reg.

Cleco considered disposing the wastestreams in other on-site impoundments or on-site tanks. However, there are no tanks or other impoundments available to receive them. Rodemacher Unit 2's piping network and sluicing infrastructure does not allow for wastestreams to pump anywhere (on-site or off-site) other than the Bottom Ash Pond. Additionally, the other impoundments at BEC are neither (1) permitted by the Louisiana Department of Environmental Quality (LDEQ) to receive bottom ash, nor (2) compliant with the CCR rule's liner requirements. Table 1 below provides specific information for why these other onsite impoundments are not viable options for alternative disposal capacity for the CCR wastestreams.

Table 1

Impoundment	**Why Impoundment Is Not Option For Alternative Disposal Capacity**
Fly Ash Pond[9]	• Does not have liner that meets CCR rule requirements. • Discharges through the existing Bottom Ash Pond. • LPDES permit modifications would be required, which is not feasible by April 11, 2021. • LDEQ solid waste permit modifications would be required, which is not feasible by April 11, 2021.
Leachate Collection Pond	• Not currently a CCR impoundment and was not engineered to receive solids. Contact stormwater and leachate from the non-CCR landfill are the only waste streams that are directed to the pond. • LPDES permit modifications would be required, which is not feasible by April 11, 2021. • LDEQ solid waste permit modifications would be required, which is not feasible by April 11, 2021.
Coal Sedimentation Pond	• Does not have liner that meets CCR rule requirements. • LPDES permit modifications would be required, which is not feasible by April 11, 2021. • LDEQ solid waste permit modifications would be required, which is not feasible by April 11, 2021.

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at 21,424 ("[T]he owner or operator does not need to demonstrate any efforts to develop alternative capacity because of the impending closure of the power plant itself.").

[9] Information regarding the Fly Ash Pond's compliance with the CCR rule is included in Chapter 4.0. Fly ash is currently being reclaimed from the Fly Ash Pond. The Fly Ash Pond is not within the scope of this demonstration.

Petcoke/Limestone Sedimentation Pond	• Does not have liner that meets CCR rule requirements. • Not currently subject to state solid waste regulations because petcoke inside the pond is still considered to be a product and not a waste. Cleco frequently reclaims petcoke from the pond and places the material back on the storage pile for use. Therefore, a LDEQ solid waste permit modification would be required, which is not feasible by April 11, 2021. • LPDES permit modifications would be required, which is not feasible by April 11, 2021.
Unit 1 Metal Cleaning Waste Pond	• Does not have liner that meets CCR rule requirements. • LPDES permit modifications would be required, which is not feasible by April 11, 2021. • LDEQ solid waste permit modifications would be required, which is not feasible by April 11, 2021. • Pond is not designed to be discharged frequently o No discharge structures are present. Portable pumps are used in the event of a discharge.
Unit 2&3 Metal Cleaning Waste Pond	• Does not have liner that meets CCR rule requirements. • LPDES permit modifications would be required, which is not feasible by April 11, 2021. • LDEQ solid waste permit modifications would be required, which is not feasible by April 11, 2021. • Pond is not designed to be discharged frequently o No discharge structures are present. Portable pumps are used in the event of a discharge.
Clarifier Sludge Pond	• Does not have liner that meets CCR rule requirements. • Not currently subject to state solid waste regulations because the clarifier sludge inside the pond is not regulated by the state solid waste regulations. Therefore, a LDEQ solid waste permit modification would be required, which is not feasible by April 11, 2021. • LPDES permit modifications would be required, which is not feasible by April 11, 2021.LDEQ solid waste permit modifications would be required, which is not feasible by April 11, 2021.

Cleco also considered utilizing temporary storage tanks as an option for alternative disposal capacity. However, the volume of water needed to transport the CCR wastestreams to temporary storage tanks—approximately 2.5 million gallons per day (MGD)—is too large for this to be a viable option. In addition, tanks currently located at BEC lack the needed storage capacity and infrastructure for removal of accumulated solids. In light of these factors, disposing the CCR wastestreams from Rodemacher Unit 2 in other impoundments or tanks is not a viable option.

In addition, Cleco considered transporting the CCR wastestreams off-site via trucks and/or pipelines. EPA recognized the infeasibility of these options in the preamble to the final CCR rule, when it stated that "while it is possible to transport dry ash off-site to [an] alternate disposal facility[,] that is simply not feasible for wet-generated CCR."[10] EPA further recognized the compounding issue of facilities not being able to "immediately convert to dry handling systems."[11]

For trucking, the volume of water needed to truck the CCR wastestreams off-site—approximately 2.5 MGD—is too large for this to be a viable option. Additionally, there are no facilities within a reasonable distance from BEC that is able to accept the CCR wastestreams. Further, such a project would require at least 100 trucks per day, which would cause substantial stress to road infrastructure and would also result in increased risk and liability. There is also no existing infrastructure onsite that is needed for loading tankers.

With respect to the piping option, as stated above, Rodemacher Unit 2's piping network and sluicing infrastructure does not allow for bottom ash to be transported off-site. And since Rodemacher Unit 2 will cease coal-fired energy generation in the near future, it would be "illogical" for Cleco to create new capacity to manage these wastestreams.[12] As EPA stated in the final CCR rule, an owner or operator of such units "does not need to demonstrate any efforts to develop alternative capacity because of the impending closure of the power plant itself."[13]

Despite Cleco's efforts to obtain on-site and off-site alternative disposal capacity for the CCR wastestreams that are currently wet-sluiced in the Bottom Ash Pond, no other options are

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[10] 80 Fed. Reg. at 21,423.

[11] *Id.*

[12] 85 Fed. Reg. at 53,547.

[13] 80 Fed. Reg. at 21,424.

currently available. As a result, Cleco must continue to dispose these CCR wastestreams in the Bottom Ash Pond after April 11, 2021.

CHAPTER 3.0

Risk Mitigation Plan

November 25, 2020

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Appendices

1.0 INTRODUCTION

The United States Environmental Protection Agency's (EPA) Coal Combustion Residuals (CCR) Rule includes two site-specific alternative deadlines for owners and operators to initiate closure of their CCR surface impoundments.[1] One of these alternative closure deadlines allows qualifying CCR surface impoundments to continue receiving CCR and/or non-CCR wastestreams if the owner or operator permanently ceases of operation of a coal-fired boiler(s) by a date certain.[2]

To qualify for the "permanent cessation of a coal-fired boiler(s)" alternative closure deadline, the CCR Rule requires owners and operators to develop risk mitigation plans.[3] The purpose of these risk mitigation plans is to demonstrate that "[p]otential risks to human health and the environment from the continued operation of the CCR surface impoundment have been adequately mitigated."[4]

Pursuant to this requirement, Cleco Power LLC (Cleco) has developed this Risk Mitigation Plan (Plan) for the Bottom Ash Pond at the Brame Energy Center (BEC) (**Figure A-1, Appendix A**). In accordance with 40 C.F.R. § 257.103(f)(2)(v)(B)(1)–(3), this Plan describes the measures Cleco will take to expedite any required corrective action and includes the following elements:

- A discussion of any physical or chemical measures a facility can take to limit any future releases to groundwater during operation;
- A discussion of the surface impoundment's groundwater monitoring data and any found exceedances; the delineation of the plume (if necessary based on the groundwater monitoring data); identification of any nearby receptors that might be exposed to current or future groundwater contamination; and how such exposures could be promptly mitigated; and
- A plan to expedite and maintain the containment of any contaminant plume that is either present or identified during continued operation of the unit.

2.0 FACILITY INFORMATION

BEC is a 523 MW facility located at 275 Rodemacher Road, Lena, Louisiana 71447, west of Boyce, Louisiana. The surface impoundments in service at BEC are the Bottom Ash Pond and Fly Ash Pond which are contiguous to each other (**Figure A-2, Appendix A**). The Bottom Ash Pond, which is the subject of this demonstration, operates in accordance with Permit No. P-0005 issued by the Louisiana Department of Environmental Quality (LDEQ) Waste Permits Division. The Bottom Ash Pond is 45.8 acres in size.

The wastestreams disposed in the Bottom Ash Pond consist of non-hazardous, on-site-

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[1] 40 C.F.R. § 257.103(f).

[2] *Id.* § 257.103(f)(2).

[3] *Id.*§ 257.103(f)(2)(v)(B).

[4] *Id.* § 257.103(f)(2)(ii).

generated materials only. These wastestreams include bottom ash, pyrites, sluice and sump water, resin beads, fly ash effluent, and neutralized wastes. The bottom ash handling system provides the piping and transport water to convey the bottom ash and pyrites from tanks and hoppers to the Bottom Ash Pond. Resin beads are transported in drums or other containers and emptied into the pond.

3.0 MEASURES TO LIMIT ANY FUTURE RELEASES TO GROUNDWATER—40 C.F.R § 257.103(f)(2)(v)(B)(1)

The CCR rule requires owners and operators the Plan to include a discussion of "any physical or chemical measures a facility can take to limit any future releases to groundwater during operation."[5] To date, groundwater monitoring conducted at BEC has not indicated the detection of any release to groundwater from the Bottom Ash Pond or Fly Ash Pond. Cleco prioritizes the safety and protection of the community and the environment. Cleco's continued compliance with EPA and LDEQ regulations for the operation of the ash ponds since their construction demonstrates this commitment.

The groundwater monitoring program for the Bottom Ash Pond is a multi-unit groundwater monitoring program as the well network also includes the Fly Ash Pond footprint. Review of the groundwater monitoring program in place for the Bottom Ash Pond and Fly Ash Pond indicates that implementation of assessment monitoring or implementation of corrective action measures to address groundwater quality for the units has never been required. These units comply with the EPA CCR Rule, as well as requirements of their LDEQ-issued solid waste permits.

The LDEQ Waste Permits Division oversees permitting of solid waste facilities and the LDEQ-approved solid waste permit also includes measures to construct and operate the units in a manner which safeguards against adversely impacting groundwater quality. The measures to continue to limit any future releases to groundwater include continuation of the state and federal groundwater detection-monitoring programs in place and continued adherence to the EPA CCR Rule and LDEQ-approved solid waste permit. Additional operational actions that limit future releases beyond continued routine groundwater monitoring include application of non-recirculated, once-through water for sluicing of ash to the impoundment which minimizes concentration of solids in the impoundment water. Also there are the impoundment operational measures integrity inspection of the physical status of the impoundment in regards to its perimeter levees, maintenance of vegetation growth on the perimeter levees, adequate freeboard protection, stormwater controls, routine removal of settled materials, facility security measures, and emergency response plan measures.

The emergency response plan, which is included in the LDEQ-approved solid waste permit, is an organized, planned, coordinated set of procedures that are followed in the event of a fire, explosion, natural disaster, or discharge or release of chemical substances into the environment that could endanger human health or the environment.[6] The emergency response plan is also reviewed and approved by the Louisiana Office of State

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[5] *Id.* § 257.103(f)(2)(v)(B)(1).

[6] Louisiana Administrative Code (LAC) 33:VII. Solid Waste.

Fire Marshal prior to LDEQ issuance of the solid waste permit. A website link for this document is provided here. The emergency response plan includes:

- Fire Response Plan - Includes steps employees are to take after discovery of a fire.
- Fire Response Equipment On-site - Listing of fire response equipment on site Locations of fire extinguishers throughout the plant
- Chemical/Toxic Gas Release Response Plan - Provides the guidelines for responding to an event including items such as assessment of the situation, assignment of personnel for stopping the release, if possible, and initiating action to limit the impact of the release.
- Tornado Response Plan - This includes actions to take during times of inclement weather to mitigate potential damage to the plant.
- Bomb Threat Response Plan - Provides guidelines for assessment of a bomb threat situation and making an immediate action decision.
- First Aid/Medical Emergencies.
- Physical Plant Security - Contains visitor guidelines, use of ID badges, locking and securing of facilities.
- Contact Information for External Emergency, Cleco, and BEC Internal – Includes listing of management staff to be notified of events and to be involved in a response.
- Spill Response contacts - Includes agency contacts.
- Spill Control and Decontamination Equipment On-Site – Includes a listing of spill control and decontamination equipment on site Locations of equipment such as pads, pigs, and shovels.

4.0 GROUNDWATER IMPACTS, RECEPTORS, AND POTENTIAL EXPOSURE MITIGATION—40 C.F.R. § 257.103(f)(2)(v)(B)(2)

The CCR rule requires the Plan to include a "discussion of the surface impoundment's groundwater monitoring data and any found exceedances; the delineation of the plume (if necessary based on the groundwater monitoring data); identification of any nearby receptors that might be exposed to current or future groundwater contamination; and how such exposures could be promptly mitigated."[7] To satisfy this requirement, the following sections discuss (1) the Bottom Ash Pond's groundwater monitoring well network, (2) the most recent groundwater monitoring data, (3) nearby receptors, and (4) how potential groundwater impacts to nearby receptors could be promptly mitigated.

4.1 GROUNDWATER MONITORING WELL NETWORK

Pursuant to 40 C.F.R. § 257.91, BEC has a groundwater monitoring well system to evaluate the groundwater quality conditions near the Bottom Ash Pond. The monitoring system consists of newly installed monitoring wells and monitoring wells installed previously to conduct groundwater monitoring required by BEC's LDEQ solid waste permit. A total of nine monitoring wells have been installed per applicable portions of 40 C.F.R. § 257.91.

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[7] *Id.* § 257.103(f)(2)(v)(B)(2).

BEC straddles two different geomorphologic features: Intermediate Terrace deposits of Pleistocene age to the north and northwest, and alluvium and natural levee deposits of Holocene age to the south and southeast. The northern portion of BEC is located on the Intermediate Terrace deposits and the remainder of BEC is located on the alluvium/natural levee deposits. The northern wall of the Bottom Ash Pond unit abuts the terrace deposits and the remainder of the unit overlying the alluvium deposits. Locations of the monitoring wells can be found on **Figure A-2, Appendix A**. Additional information, including a table of monitoring well construction details (**Table 1, Appendix B**) and well construction diagrams are provided in in the October 17, 2017 Groundwater Certification report, which is included as Appendix B and also available here. Drilling logs for all groundwater monitoring wells for the Bottom Ash Pond are included as Appendix B**,** which is available here.

4.2 GROUNDWATER MONITORING AND EVALUATION—40 C.F.R § 257.103(f)(2)(v)(B)(2)

Groundwater sampling events are conducted by Cleco approved contract personnel in accordance with 40 C.F.R. § 257.93. Semi-annual detection monitoring sampling events are conducted normally in June and October. The most recent annual groundwater report was posted on January 31, 2019 and a copy is included in **Appendix C** and is available here. Additionally, annual reports were prepared for 2017 and 2018.

4.2.1 Field Methods

Field methods for groundwater sampling follow industry protocol and are detailed in the annual report.

4.2.2 Analytical Results

Groundwater samples are collected from the monitoring wells at the Bottom Ash Pond for analysis of the CCR Rule detection monitoring parameters: pH, boron, calcium, chloride, fluoride, sulfate, and TDS. The analyses are performed in accordance with EPA-approved analytical methods. The results are included in the annual report.

4.2.3 Statistical Evaluation

Statistical evaluations of groundwater data are performed in accordance with 40 C.F.R. § 257.93(f). The Certification of Statistical Methodology was posted on October 17, 2017. A copy of this Certification is included as **Appendix D** and is available here. Natural spatial variability is evident in groundwater quality at the BEC facility. Several detection monitoring parameters exhibit sufficient variation over time to warrant performing statistical evaluations using intrawell limit-based tests. Intrawell tests are comparisons of data within the same well comparisons[8] that use intrawell prediction limits. Intrawell limit-based tests are recommended when there

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[8] U.S. EPA, 2009. “Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance, March 2009,” EPA 530/R-09-007, EPA Office of Resource Conservation and Recovery.

is evidence of natural spatial variability in groundwater quality, particularly among unimpacted upgradient wells.

4.2.4 Groundwater Monitoring Conclusions

Cleco has conducted sufficient detection monitoring sampling events in accordance with 40 C.F.R. §§ 257.93 and .94. Potentiometric surface evaluation at the Bottom Ash Pond indicates consistent groundwater flow to the south. Statistical evaluations of data conducted pursuant to 40 C.F.R. § 257.93 indicate that no confirmed statistically significant increases (SSIs) over background levels of appendix III constituents have been generated in downgradient wells.

4.3 RECEPTORS

Water supply in Rapides Parish contains fresh groundwater and surface-water resources. Industrial use is the largest consumer of both water supply sources.

4.3.1 Groundwater Use

The current and potential use of groundwater resources in the vicinity of the facility were evaluated by querying the Louisiana Department of Natural Resources (LDNR) SONRIS registered water well database. All registered water wells identified within a one-mile radius of BEC are included in **Figure E-1, Appendix E.**

BEC obtains water for its operations from power supply wells located on-site. A total of 90 LDNR registered water wells were identified within an approximate one-mile radius of BEC. Of these, 53 wells are registered as active and 37 wells have been registered as plugged and abandoned. Usage descriptions of active water wells identified in the LDNR data base search are as follows:

- 4 Power Supply Wells;
- 12 Domestic Water Wells;
- 0 Public Supply Water Wells;
- 2 Industrial Water Wells;
- 0 Irrigation Water Wells;
- 0 Recovery Water Wells;
- 0 Rig Supply Wells;
- 0 Dewatering Water Wells;
- 33 Monitoring/Observation/Piezometer Wells;
- 0 Test Wells; and
- 2 Other Wells.

The uppermost aquifer monitored at the BEC facility is in the Red River Alluvial aquifer, along with the Mississippi River Valley Alluvial Aquifer, one of the most extensive alluvial aquifers in Louisiana. Review of geological reports indicates that Louisiana alluvial aquifer groundwater quality is reported by the USGS to be primarily limited to use for industrial and agricultural purposes. This is due to excessive concentrations of dissolved solids, hardness, iron, or localized salinity. The natural groundwater quality of these aquifer systems is generally considered not suitable for drinking water supply purposes without first undergoing appropriate water treatment. The LDNR issued an advisory in 2009 addressing the recommended uses of these alluvial aquifers. Furthermore, it is reported that dissolved metals, namely arsenic, have been, and are expected to be, detected in groundwater in localized areas of these aquifers.[9]

The Red River alluvial aquifer yields very hard water (greater than 180 mg/L as calcium carbonate [CaCO3]), and iron and manganese concentrations generally exceed the U.S. Environmental Protection Agency's (EPA) 2006 Secondary Maximum Contaminant Levels (SMCLs) for drinking water. Chloride concentrations generally are less than 180 mg/L; however, local areas contain saltwater (water with a chloride concentration that exceeds 250 mg/L).[10]

4.3.2 Surface Water at BEC

The Bottom Ash Pond lies west of a Red River meander that runs northeast of the site and turns away from the site toward the north and east. The Red River Oxbow lies between BEC and the Red River, greater than 1800 feet northeast of the unit. Bayou Jean de Jean and Lake Rodemacher are the closest surface water bodies to the Bottom Ash Pond. Bayou Jean de Jean is included in Subsegment 101201 of the "*Cotile Reservoir*" and has the following designated uses:

- Primary contact recreation,
- Secondary contact recreation, and
- Fish and wildlife propagation.[11]

Bayou Jean de Jean is positioned hydraulically downgradient of groundwater flow from the Bottom Ash Pond. Lake Rodemacher is primarily up-gradient and partially cross-gradient of the Bottom Ash Pond. The groundwater flow direction in the uppermost aquifer determines the pathway for potential releases from the Bottom Ash Pond to potential receptors. The relative distances of Bayou Jean de Jean and domestic and irrigation wells to the Bottom Ash Pond indicate that Bayou

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[9] Louisiana Department of Natural Resources, Office of Conservation, 2009. "*General Water Quality Summary, Louisiana Groundwater - Alluvial Aquifer Systems,*" *available at* http://www.dnr.louisiana.gov/assets/docs/conservation/documents/Alluvial-Aquifer-Water-Quality-Summary.pdf.

[10] USGS, Water Resources of Rapides Parish, USGS Fact Sheet 2009–3056, Revised September 2011, *available at* https://pubs.usgs.gov/fs/2009/3056/pdf/Rapides_FS.pdf.

[11] LAC 33:IX. Water Quality.

Jean de Jean is the closest potential receptor from the Bottom Ash Pond. Groundwater flow from the Bottom Ash Pond to Bayou Jean de Jean represents the shortest pathway for a potential release from the Bottom Ash Pond. There are no water wells located between the Bottom Ash Pond and Bayou Jean de Jean.

Lake Rodemacher is not part of the *Cotile Reservoir,* which is a separate water body. Stormwater and potential groundwater-to-surface-water seepage downgradient of the Bottom Ash Pond is monitored by Internal Outfall 401 at the point of discharge into Lake Rodemacher. Discharge from Lake Rodemacher is intermittent and is monitored by a final outfall prior to discharge to Bayou Jean de Jean. These discharge points are permitted by LPDES Permit No. LA0008036. Cleco safeguards water quality of Bayou Jean de Jean by maintaining compliance with this permit.

4.4 MITIGATION OF POTENTIAL IMPACT TO NEARBY RECEPTORS

Cleco has strategically positioned the LDEQ-approved monitoring well network to detect potential releases from the Bottom Ash Pond prior to impacting any potential receptors, including Bayou Jean de Jean. Potential future impacts may be addressed by groundwater mitigation measures that include groundwater withdrawal or immobilization technologies such as permeable reactive barriers (PRB) and/or groundwater cutoff walls. These measures are discussed in detail in the following section.

5.0 CONTAINMENT OF CONTAMINANT PLUME—40 C.F.R § 257.103(f)(2)(v)(B)(3)

As part of the Plan, the CCR rule requires the inclusion of a "plan to expedite and maintain the containment of any contaminant plume that is either present or identified during the continued operation of the unit."[12] The "purpose of this plan is to demonstrate that a plume can be fully contained and to define how this could be accomplished in the most accelerated timeframe feasible to prevent further spread and eliminate any potential for exposures."[13] According to EPA, this "plan will be based on relevant site data, which may include groundwater chemistry, the variability of local hydrogeology, groundwater elevation and flow rates, and the presence of any surface water features that would influence rate and direction of contamination movement"[14]

The Bottom Ash Pond is currently subject to the CCR rule's detection monitoring program.[15] As discussed above, groundwater quality data has not identified any SSIs over background levels for any appendix III constituents. Therefore, neither assessment monitoring nor corrective measures are currently warranted for the Bottom Ash Pond.[16]

Although Cleco has not to date identified a contaminant plume associated with the Bottom

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[12] 40 C.F.R. § 257.103(f)(2)(v)(B)(3).

[13] 85 Fed. Reg. 53,516, 53,549 (Sept. 28, 2020).

[14] *Id.*

[15] 40 C.F.R. § 257.94.

[16] *See id.* § 257.94–.98.

Ash Pond, Cleco must have a plan in place to expedite and contain any plume that may be identified during the continued operation of the Bottom Ash Pond. A remedy would ultimately be selected through the assessment of corrective measures process. This selection would be based on a number of factors, including the specific constituents of concern, plume migration characteristics, and plume stability analysis.

Selecting short-term measures to expeditiously contain any future containment plume would also be a fact- and constituent-specific process. There are several options that would likely be considered. These include:

- Groundwater Withdrawal;
- Permeable Reactive Barrier; and
- Groundwater Cutoff Wall.

Additionally, Monitored Natural Attenuation is included in this discussion because it can serve as an important adjunct remedial measure to be applied during or after one of the short-term measures listed above to address any recalcitrant groundwater quality impacts that the primary remedy cannot efficiently mitigate.

The following sections discuss these strategies in further detail.

5.1 Groundwater Withdrawal

Groundwater withdrawal as a potential corrective measure includes the extraction of impacted groundwater by either a series of groundwater pumping wells, horizontal wells, or trenches. These are used to hydraulically control and remove impacted groundwater and thus limit plume expansion and/or off-site migration.

The installation of a groundwater withdrawal system normally includes the following key actions:

- Selection and installation of groundwater withdrawal system consisting of vertical recovery well(s), horizontal well(s), or trench(es);
- Determination of horizontal and vertical plume containment and determination of pumping rates necessary to allow capture of CCR impacted groundwater;
- Treatment system designed to manage extracted groundwater, which may include modification to the existing Louisiana Pollutant Discharge Elimination System (LPDES) permit, including treatment prior to discharge, if necessary; and
- Operation and maintenance (O&M) of the selected withdrawal and treatment system.

The first step in designing a groundwater withdrawal is to refine the hydrogeologic

Conceptual Site Model (CSM) with the necessary hydrogeologic detail to specify well spacing, screen placement, screen length, pumping rates and operational pressures. This may require one or more of the following:

- Pumping tests to determine zone of influence, storativity, and hydraulic conductivity in orthogonal directions, and to calculate horizontal anisotropy;
- Slug tests at distributed locations to establish degree of heterogeneity;
- Vertical pumping tests to measure vertical hydraulic conductivity and calculate vertical anisotropy;
- Laboratory permeability tests of low permeability units to measure vertical anisotropy within aquitards;
- Numerical groundwater flow modeling to facilitate evaluation of pumping tests and optimize placement of groundwater withdrawal wells; and/or
- Numerical groundwater fate and transport modeling to predict effectiveness of plume capture, rates of plume degradation, and changes in concentration of contaminants of concern (COCs) in extracted groundwater over time

The evaluation outlined above will indicate the optimal combination of vertical and/or horizontal wells, their completion specifications, and groundwater treatment system requirements. The evaluation will also provide guidance on the long-term or short-term advantages, disadvantages, costs (including installation and O&M costs), and viability of the groundwater withdrawal system.

5.2 Permeable Reactive Barrier (PRB)

Permeable Reactive Barrier (PRB) is an *in situ* chemical treatment or immobilization technology that includes application of reactive or immobilizing agents, either by emplacement in subsurface trenches or injected through temporary wells. The trench or injected zone creates a barrier designed to intercept the contaminant plume, provide adequate flow paths providing sufficient residence time in contact with reactive media, and immobilize the contaminant(s) or transform them into environmentally acceptable chemical species to attain remediation concentration goals downgradient of the barrier.[17]

To be effective, PRB technology must be specifically designed to address:

- Geochemical properties of groundwater, including oxidation-reduction potential, dissolved oxygen, pH, fraction of organic carbon, and ionic species relevant to the desired transformation or immobilization of contaminants; and

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[17] *Id.*

- Hydrogeologic parameters controlling groundwater flow lines and average linear velocity of groundwater within and around the PRB under the expected range of hydrogeologic conditions, including changes in water table elevation and in both horizontal and vertical hydraulic gradients.

PRB design must be tailored to site conditions, and its effectiveness will vary depending on site hydrogeology and geochemistry. The purpose of a PRB is to prevent downgradient expansion of a groundwater plume. Reactive media are available to address a variety of dissolved metal groundwater plumes. Zero-valent iron has been shown to effectively immobilize CCR constituents, including arsenic, chromium, cobalt, molybdenum, selenium and sulfate, but it has not been proven effective for boron, antimony, or lithium.[18]

Two general configurations of PRBs have been designed and successfully applied in specific hydrogeologic settings:

- Continuous PRBs extend across the entire width of the contaminant plume and are not intended to change the direction of groundwater flow. Some degree of hydraulic mounding upgradient of the PRB is typically expected in response to decreased groundwater flow velocity within the PRB. The width of the PRB remains constant assuming constant groundwater flow velocity across the width of the plume, but the depth (or height) of the PRB can vary if it is designed to key into an aquitard unit underlying the impacted water-bearing unit. The purpose of keying into an aquitard unit is to prevent the plume from vertically evading the PRB.
- Funnel-and-gate PRBs utilize barrier cut-off walls constructed at opposing angles to the groundwater flow direction to funnel the contaminant plume toward a relatively short PRB gate, flanked by the funnel barrier walls. Some funnel-and-gate systems have several PRB gates separated by funnel barrier walls. The funnel-and-gate design increases groundwater flow velocity, and the thickness of the PRB must ensure sufficient residence time. The length of the PRB must prevent horizontal short-circuiting of the groundwater plume. The purpose of the funnel-and-gate design is to minimize opportunities for the groundwater plume to evade the PRB either horizontally or vertically.

Site access, plume dimensions and plume chemistry affect the system configurations for PRBs, and therefore the design of PRB systems requires detailed aquifer and groundwater plume investigations as noted above. In addition, laboratory studies, including batch studies and column studies using samples of site groundwater and matrix soil, are needed to determine the effectiveness of the

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[18] Electric Power Research Institute (EPRI), 2006. Groundwater Remediation of Inorganic Constituents at Coal Combustion Product Management Sites, Overview of Technologies, Focusing on Permeable Reactive Barriers, Electric Power Research Institute, Palo Alto, CA, Final Report 1012584, October 2006.

selected reactive media at the site.[19]

5.3 Groundwater Cutoff Wall

The use of cutoff walls alone, without a PRB component, is another corrective measure that has often been used in attempts to control and/or isolate impacted groundwater. Cutoff walls are trenched and consist of lower permeability materials compared to the water-bearing unit to prevent or limit horizontal and vertical migration of potentially impacted groundwater. The slurry trench method requires excavating a trench and backfilling it with a soil-bentonite mixture. Soils excavated while trenching are often utilized in the mixing process. The trench is temporarily supported with bentonite slurry that is pumped into the trench as it is excavated. Excavation for cutoff walls is conducted with conventional hydraulic excavators, hydraulic excavators equipped with specialized booms to extend their reach (*i.e.*, long-stick excavators), or chisels and clamshells, depending upon the depth of the trench and the material to be excavated.

The technical feasibility of a cutoff wall depends on:

- The presence of an effective aquiclude, or low permeability lower confining unit, to provide a hydraulic seal preventing vertical migration.
- Hydrogeologic characteristics that will prevent the contaminant plume from laterally evading the cutoff wall.

5.4 Monitored Natural Attenuation (MNA)

Monitored Natural Attenuation (MNA) will be evaluated with detailed hydrogeological and geochemical analysis as a potential remedial option. If implemented, it is anticipated that it would include source control measures, through application of the USEPA's tiered approach to MNA[20] (USEPA 1999, 2007 and 2015):

- Demonstrate that the area of groundwater impacts is not expanding;
- Evaluate mechanisms and rates of attenuation;

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[19] *Id.*

[20] USEPA, 1999. Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites. Directive No. 9200.0-17P. Washington, D.C.: EPA, Office of Solid Waste and Emergency Response; USEPA, 2007. Monitored Natural Attenuation of Inorganic Contaminants in Ground Water, Volume 1 —Technical Basis for Assessment. EPA/600/R-07/139. National Risk Management Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio. October 2007; USEPA, 2015. Use of Monitored Natural Attenuation for Inorganic Contaminants in Groundwater at Superfund Sites. Directive No. 9283.1-36. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. August 2015.

- Evaluate aquifer potential to attenuate the mass of constituents in groundwater and that the immobilized constituents are stable and will not desorb and remobilize;
- Implement/augment the current monitoring program based on the mechanisms of attenuation; and
- Establish contingency path forward with corrective measure remedies in the event MNA not perform adequately.

5.5 Expedited Mitigation Path

An estimated timeline for expedited mitigation of potential releases to groundwater from the Bottom Ash Pond has been developed based on current hydrogeologic characterization, review of potential receptors, and mitigation alternatives. Cleco's groundwater monitoring well network is positioned to detect any potential release from the Bottom Ash Pond, and site hydrogeologic characterization indicates that groundwater withdrawal is a leading potential corrective measure that can be implemented expeditiously.

Groundwater withdrawal may be achieved by extraction of impacted groundwater by a series of groundwater pumping wells; either vertical recovery well(s) or horizontal well(s). The depth to groundwater may inhibit the use of excavated trenches at this site and require directionally drilled wells instead. This limitation identifies groundwater withdrawal as the potential mitigation measure for a potential release to groundwater quality in the future. The selected well design will be used to hydraulically control and remove impacted groundwater and thus limit plume expansion and/or off-site migration.

The current Conceptual Site Model (CSM) of the site hydrogeology was developed to establish a groundwater monitoring program for the unit. The CSM will be reviewed and refined to allow for transition from a groundwater quality monitoring phase to a potential corrective action phase. This may include CSM refinement activities such as the need for aquifer testing and fate and transport modeling parameters to safeguard potential receptors identified in this plan.

The estimated timeframes for mitigation activities are presented in the following table.

Mitigation Activity Description	Timeframe (Working Days)	Accumulated Duration (Working Days)
Groundwater Quality Monitoring Prequalification of Consultants/Contractors Conceptual Site Model Refinement	Ongoing/current	0
Release Discovery Requiring Mitigation	0	0
Design of Groundwater Withdrawal System	15-20	20
Drilling Contractor Selection	10	30
Equipment/Materials Procurement/Delivery	20	50
Treatment System Alternatives Design	20	70
Review Potential Need to Modify current LPDES Permit Submit Potential Modification Request Application to LDEQ Monthly Progress Reports Posted to CCR Website until startup		
Drilling Contractor Mobilization to Field	10	80
Groundwater Withdrawal System Installation, Development, Completion	15-20	100
Treatment System Implementation Discharge Piping Installation	20	120
System Operation	10	130
Progress Report Posted to CCR Website Progress Reports Continue (Quarterly First Year) Operation & Maintenance of Mitigation Measures Continues		

Notes:

Please note that the Progress Reports are beyond those reporting requirements listed per 40 C.F.R. § 257.106, .107.

This schedule is an estimate for an expedited implementation of corrective action. Potential delays related to such unforeseen events such as weather, COVID-19, etc. may affect this estimated schedule.

CHAPTER 4.0

Submittal of Additional Information to Demonstrate Compliance with the CCR Rule

November 25, 2020

CLECO

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Appendix

1.0 INTRODUCTION

The United States Environmental Protection Agency's (EPA) Coal Combustion Residuals (CCR) Rule includes two site-specific alternative deadlines for owners and operators to initiate closure of their CCR surface impoundments.[1] One of these alternative closure deadlines allows qualifying CCR surface impoundments to continue receiving CCR and/or non-CCR wastestreams if the owner or operator permanently ceases of operation of a coal-fired boiler(s) by a date certain.[2]

To qualify for the "permanent cessation of a coal-fired boiler(s)" alternative closure deadline, the CCR Rule requires owners and operators to submit additional information regarding the unit.[3] Pursuant to this requirement, Cleco Power LLC (Cleco) has compiled the additional information for the Bottom Ash Pond at the Brame Energy Center (BEC). The information for the other CCR unit, the Fly Ash Pond, is also included.

2.0 ADDITIONAL INFORMATION

To demonstrate that the criteria in 40 C.F.R. § 257.103(f)(2)(iii) has been met, Cleco is submitting the following information as required by 40 C.F.R. § 257.103(f)(2)(v)(C).

2.1 Owners Certification of Compliance – 40 C.F.R. § 257.103(f)(2)(v)(C)(1)

The owner's certification of compliance pursuant to 40 C.F.R. § 257.103(f)(2)(v)(C) (1) is included in **Appendix A.**

2.2 Visual Representation of Hydrogeologic Information – 40 C.F.R. § 257.103(f)(2)(v)(C)(2)

Cleco BEC has attached the following items to this demonstration:

- Maps of groundwater monitoring well locations in relation to the CCR unit (**Appendix B**);
- Well construction diagrams and drilling logs for all groundwater monitoring wells (**Appendix C**);
- Maps that characterize the direction of groundwater flow accounting for seasonal variations (**Appendix D**).

2.3 Groundwater Monitoring Results – 40 C.F.R. § 257.103(f)(2)(v)(C)(3)

The summary tables of groundwater monitoring results at each groundwater monitoring well through 2019 are included in **Appendix E.**

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[1] 40 C.F.R. § 257.103(f).

[2] *Id.* § 257.103(f)(2).

[3] *Id.*§ 257.103(f)(2)(iii).

2.4 Description of Site Hydrogeology including Stratigraphic Cross Sections - § 257.103(f)(2)(v)(C)(4)

A description of the site hydrogeology and stratigraphic cross sections of the site are included as **Appendix F**.

2.5 Corrective Measures Assessment – 40 C.F.R. § 257.103(f)(2)(v)(C)(5)

An assessment of corrective measures is not currently required.

2.6 Remedy Selection Progress Report – 40 C.F.R. § 257.103(f)(2)(v)(C)(6)

An assessment of corrective measures and the resulting remedy selection progress report are not currently required.

2.7 Structural Stability Assessment – 40 C.F.R. § 257.103(f)(2)(v)(C)(7)

Pursuant to 40 C.F.R. § 257.73(d), the structural stability assessment for the Bottom Ash Pond unit was prepared in October 2016 and is included in **Appendix G.** The website link for the Bottom Ash Pond is also provided here. The structural stability assessment for the Fly Ash Pond unit was prepared in October 2016 and is also included in **Appendix G.** The website link for the Fly Ash Pond is also provided here.

2.8 Safety Factor Assessment – 40 C.F.R. § 257.103(f)(2)(v)(C)(8)

Pursuant to 40 C.F.R. § 257.73(e), the safety factor assessment for the Bottom Ash Pond unit was prepared in October 2016 and is included in **Appendix H.** The website link for the Bottom Ash Pond is also provided here. The safety factor assessment for the Fly Ash Pond unit was prepared in October 2016 and is included in **Appendix H.** The website link for the Fly Ash Pond is also provided here.

CHAPTER 5.0

Documentation of Closure Plan Timeframe

November 25, 2020

CLECO

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Appendices

1.0 Overview

To qualify for the alternative closure requirements delineated at 40 C.F.R. § 257.103(f)(2)—"Permanent Cessation of a Coal-Fired Boiler(s) by a Date Certain"—an owner or operator must submit a closure plan required by 40 C.F.R. § 257.102(b), along with a narrative specifying and justifying the date by which they intend to cease receipt of waste into a CCR surface impoundment to meet the alternative closure deadlines.[1] The purpose of submitting the closure plan and narrative is to "demonstrate that the owner or operator can meet the closure timeframes listed in 40 C.F.R. § 257.103(f)(2)(iv)."[2]

The Brame Energy Center (BEC) Bottom Ash Pond is approximately 45.8 acres. Because it is larger than 40 acres, Cleco must cease operation of the Rodemacher Unit 2 boiler and complete closure of the Bottom Ash Pond by no later than October 17, 2028.[3] To meet the October 17, 2028 closure deadline, Rodemacher Unit 2 will cease generation of coal-fired energy and the Bottom Ash Pond will cease receipt of wastestreams by no later than August/September 2027. The closure plan for the Bottom Ash Pond is included as **Appendix A** and is also available here (Closure Plan).[4]

2.0 Closure-In-Place Process

Pursuant to the Closure Plan, Cleco will close the BEC Bottom Ash Pond by leaving CCR material in place (closure-in-place). The closure-in-place process requires the installation of a final cover system that meets the criteria delineated at 40 C.F.R. § 257.102(d). Prior to installing the final cover system, Cleco will (1) eliminate free liquids from the Bottom Ash Pond by

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[1] 40 C.F.R. § 257.103(f)(2)(v)(D).

[2] *Id.*

[3] *Id.* § 257.103(f)(2)(iv)(B).

[4] Upon approval of this demonstration, Cleco will amend the Closure Plan in accordance with 40 C.F.R. § 257.102(b)(2)(3)(ii)(A).

removing liquid wastes or solidifying remaining wastes and waste residues, and (2) stabilize remaining wastes sufficiently to support the final cover system.[5] These activities will take approximately three months and will be completed in approximately December 2027/January 2028.

Once stabilized, Cleco will backfill, compact, and grade the Bottom Ash Pond so it will drain to an existing ditch outside the unit's northwest embankment. The purpose of these activities is to accomplish the following:

1. Control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere;
2. Prevent future impoundment of water; and
3. Provide for slope stability to protect against sloughing or movement of the final cover system.[6]

These activities will take approximately two months and will be completed in approximately February/March 2028.

Once the Bottom Ash Pond is backfilled and graded, Cleco will place the final cover system over the maximum extents of the Bottom Ash Pond to minimize infiltration and cap erosion.[7] This will involve installing an infiltration layer, an erosion layer, drainage features, and erosion control measures.[8] Following the installation of these features, the Bottom Ash Pond will be seeded.[9]

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[5] Closure Plan at 4-1; 40 C.F.R § 257.102(d)(2)(i)–(ii).
[6] Closure Plan at 4-2; 40 C.F.R. § 257.102(d)(1)(i)–(iii).
[7] Closure Plan at 4-2; 40 C.F.R. § 257.102(d)(3).
[8] Closure Plan at 5-1, Table 5-1.
[9] *Id.*

These activities will take approximately six months and will be completed in approximately August/September 2028.

Once the final cover is installed, it will be inspected by the Louisiana Department of Environmental Quality (LDEQ) and certified by a professional engineer.[10] These activities will be completed in September/October 2028.

Table 1 below summarizes the closure tasks, the approximate time each task will likely require, and the approximate completion date for each task. These approximate timeframes include time for unexpected delays resulting from unforeseen circumstances, such as weather events. Cleco has included as **Appendix B** an Addendum that will incorporate this approximate project timeline into the Closure Plan currently located on Cleco's CCR website upon EPA's approval of this demonstration.

Table 1. BEC Bottom Ash Pond Closure Plan Schedule

Closure Activity	Working Days Needed	Approx. Completion Date
Preparation for Closure		
Permitting/Design	120	April/May 2027
Send Notice of Intent to Close to LDEQ	20	May/June 2027
Bid Process/Contract Award	45	July/August 2027
Final Placement of Wastestreams/Cessation of Coal-Fired Generation	-	August/September 2027
Closure Construction		
Commence Construction/Mobilization	30	September/October 2027
Dewatering/Stabilization	90	December 2027/January 2028
Grading/Backfill of Bottom Ash Pond	60	February/March 2028
Final Cover Installation and LDEQ Inspections	180	August/September 2028
Certifying Inspection by a P.E.	20	September/October 2028
Site Clean-Up/Demobilization	10	October 2028
Closure Completion		**October 17, 2028**
Submit Notification of Completion of Closure	20	October 17, 2028

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[10] *Id.*

CHAPTER 3.0

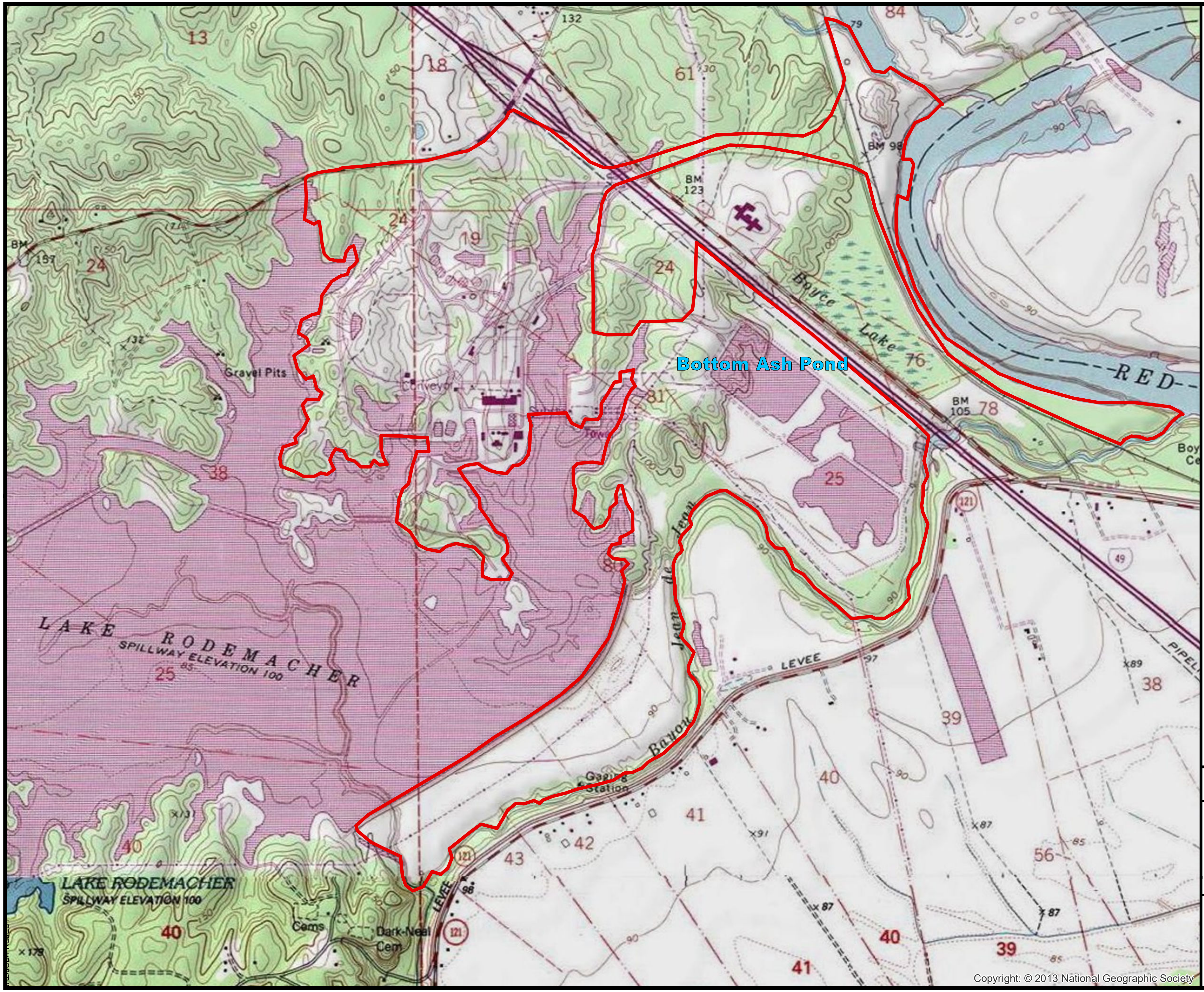
Appendices

A Figures
B Monitoring Well Network Certification
C 2019 Annual Groundwater Report
D Certification of Statistical Methodology
E Water Use Survey

November 25, 2020

APPENDIX A

FIGURES



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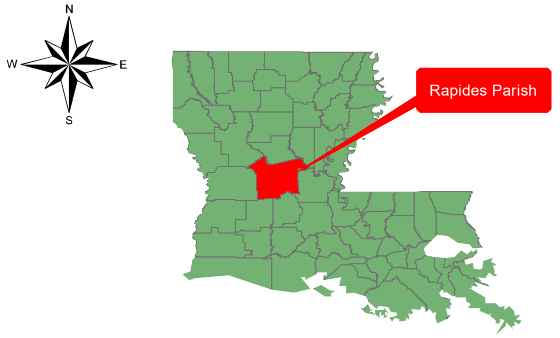


Legend

🟥 Property Boundary Line

Feet

0 750 1,500 3,000 4,500

Reference

U.S.G.S. TOPOGRAPHIC MAPS "LENA, LOUISIANA", "BOYCE, LOUISIANA", "JERICHO, LOUISIANA", AND "GARDNER, LOUISIANA."

CLECO Power LLC

Brame Energy Center

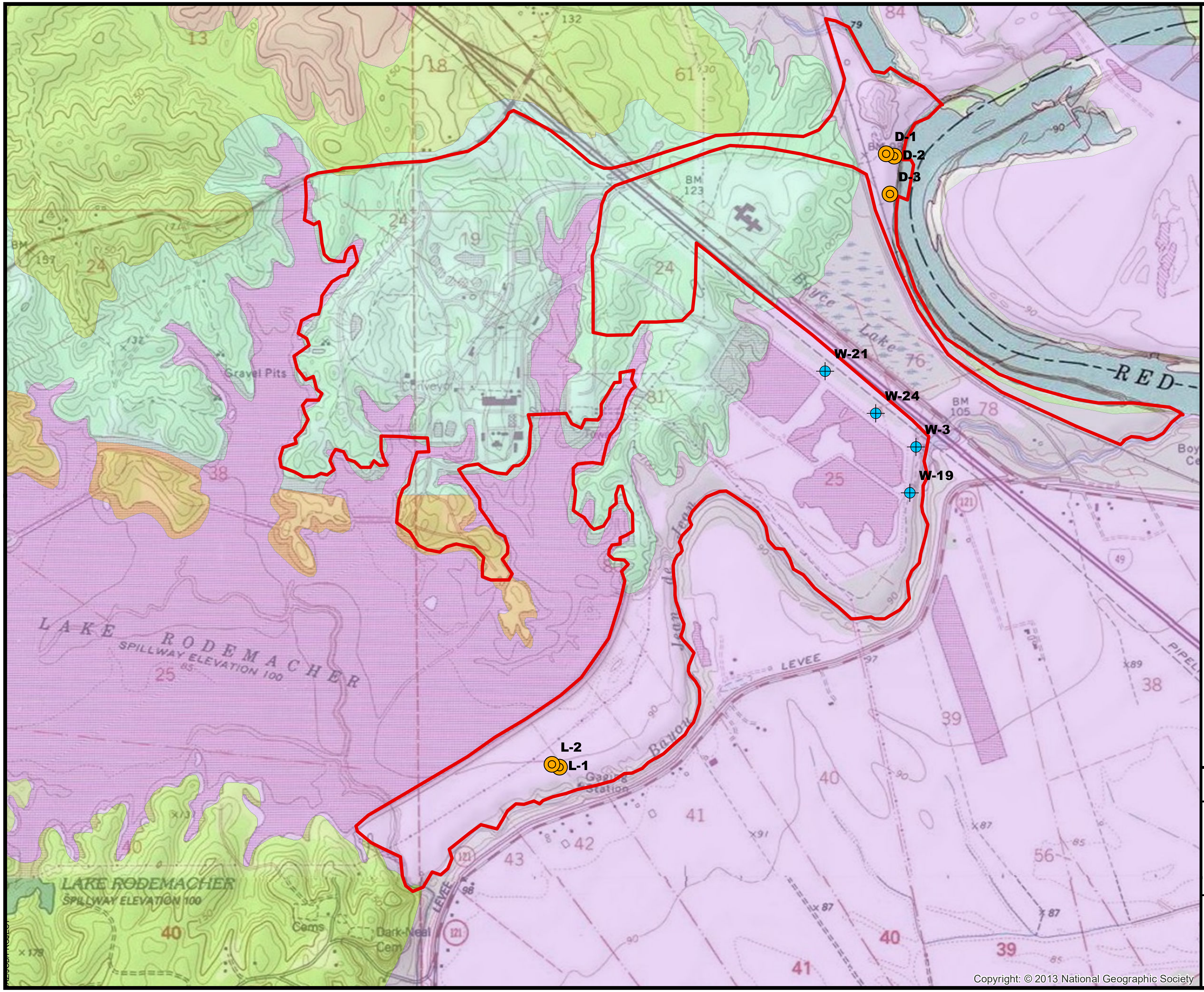
Site Location Map

Rapides Parish, Louisiana

E·A·G·L·E
ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	JM
Approved:	RS
Date:	10/30/20
Dwg. No.:	01-20-0220-APP-A-1

Figure A-1



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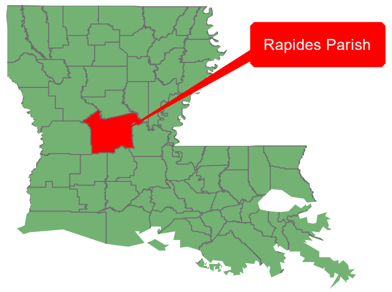


Terraces

- 🟧 Qtp - Prairie Terrace
- 🟥 Mfcb - Carnahan Bayou Member
- 🟩 Qth - High Terrace
- 🟦 Qti - Intermediate Terrace

Alluvial

- 🟪 Qal - Alluvium; Qnl - Natural Levees

Wells

- ⌖ CCR Rule Compliance Wells
- ◎ CCR Rule Background Wells

Feet
0 750 1,500 3,000 4,500

Reference

U.S.G.S. TOPOGRAPHIC MAPS "LENA, LOUISIANA", "BOYCE, LOUISIANA", "JERICHO, LOUISIANA", AND "GARDNER, LOUISIANA."

CLECO Power LLC
Brame Energy Center

Geomorphology Features with CCR Groundwater Monitoring Network

Rapides Parish, Louisiana

Drawn:	JP
Checked:	JM
Approved:	RS
Date:	11/21/17
Dwg. No.:	01-20-0220-APP-A-2

EAGLE ENVIRONMENTAL SERVICES, INC.

Figure A-2

APPENDIX B

MONITORING WELL NETWORK CERTIFICATION

BRAME ENERGY CENTER
LENA, LOUISIANA

MONITORING WELL

NETWORK CERTIFICATION

MONITORING WELL NETWORK

1.0 Introduction

The U.S. Environmental Protection Agency (EPA) published a final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA). The rule applies to the Cleco Power LLC Brame Energy Center (BEC). A site location map is provided in Figure 1. BEC has two permitted facilities that accept CCR: the Bottom Ash and Fly Ash Ponds, as shown in Figure 2.

The CCR Rule, 40 CFR Subpart D-Standards for the Disposal of CCRs, Section §257.91 requires a groundwater monitoring system that consists of sufficient number of wells at appropriate locations and depths based on site-specific technical information, to yield groundwater samples from the uppermost aquifer that:

- Accurately represent the quality of both background groundwater, and groundwater passing the boundary of the CCR unit; and
- Monitor potential contaminant pathways.

The groundwater monitoring system at BEC meets those requirements, as described below.

2.0 Site Hydrogeology Summary

The Bottom Ash and Fly Ash Ponds are situated on the aquifer recharge area for the Red River natural levee and/or Alluvial Aquifer, as well as Lake Rodemacher. Since the Bottom Ash and Fly Ash Ponds are located in the Red River Alluvium, all upgradient and downgradient monitoring wells for these CCR facilities have been installed in these deposits.

Review of geological reports indicates that Louisiana Alluvial Aquifer groundwater quality is reported by the USGS to be primarily limited to use for industrial and agricultural purposes. This is due to excessive concentrations of dissolved solids, hardness, iron, or localized salinity. The natural groundwater quality of these aquifer systems is generally considered not suitable for drinking water supply purposes without first undergoing appropriate water treatment. The Louisiana Department of Natural Resources (LDNR) issued an advisory in 2009 addressing the recommended uses of these alluvial aquifers. Furthermore, it is reported that dissolved metals, namely arsenic, have been, and are expected to be, detected in groundwater in localized areas of these aquifers (LDNR, 2009).

Louisiana Department of Natural Resources, Office of Conservation, 2009. “General Water Quality Summary, Louisiana Groundwater - Alluvial Aquifer Systems”, Louisiana Department of Natural Resources, Baton Rouge, LA, 1 sheet.

3.0 Groundwater Monitoring System

Groundwater monitoring wells have been installed in the uppermost, laterally continuous water bearing zone present beneath the CCR facilities at BEC. Since the areas immediately upgradient of the Bottom Ash and Fly Ash Ponds are situated on Terrace deposits, the background monitoring wells have been installed in alternative locations, per §257.91.1. Thus, all background and compliance monitoring wells are screened in the Red River Alluvial deposits. Monitoring well information is included in Table 1, and the monitoring well locations are provided in Figure 2.

CERTIFICATION

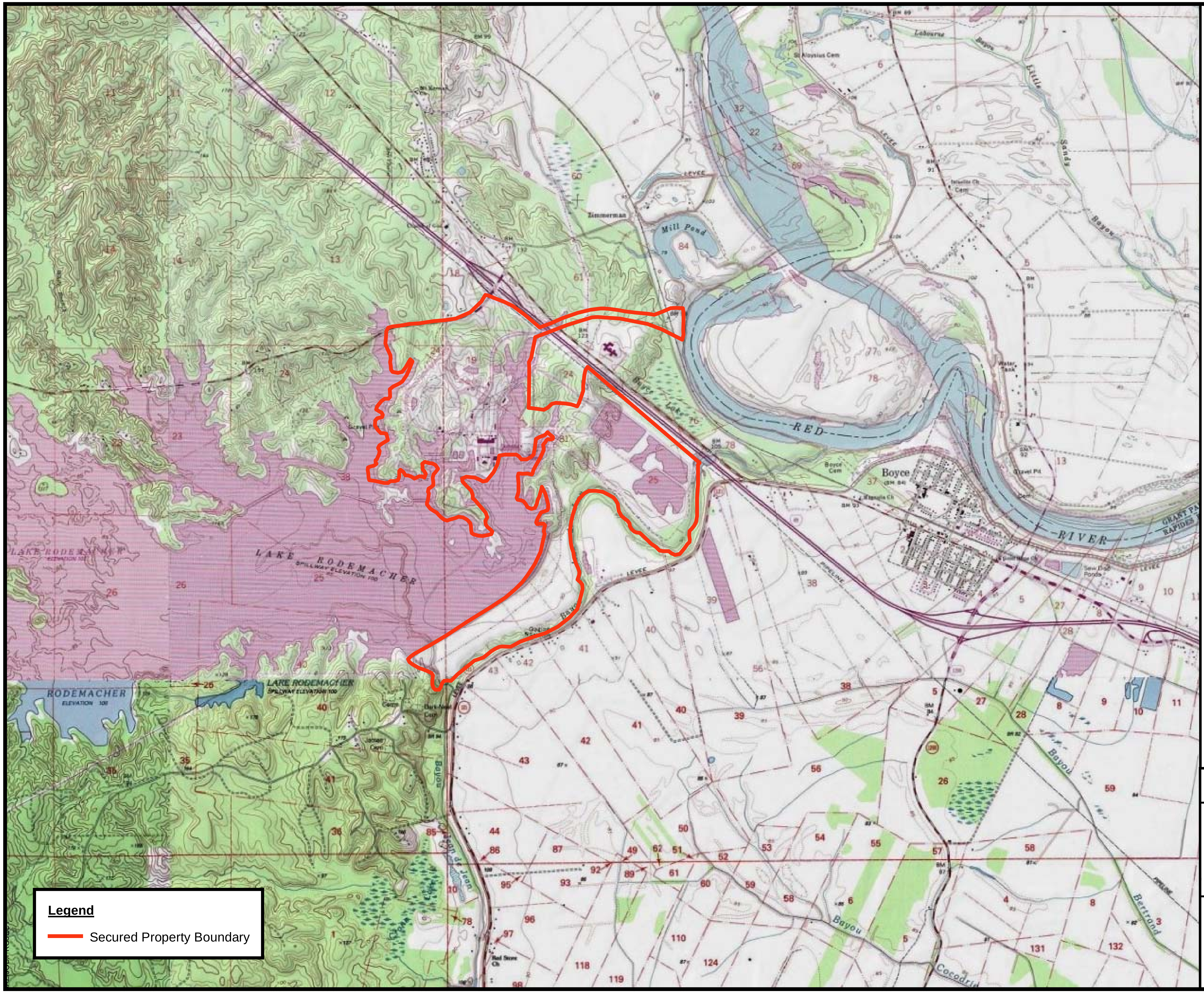
I hereby certify that the groundwater monitoring system described in this report for the Brame Energy Center, owned and operated by Cleco Power, LLC, has been designed and constructed to meet the requirements of the Coal Combustion Residual Rule 40 CFR §257.91. I am a duly licensed Professional Engineer under the laws of the State of Louisiana.

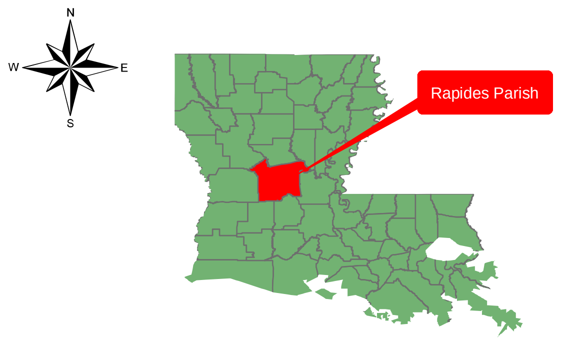
BRADLEY E. BATES
LIC. NO. 27124

________________________________, P.E.

Date: 3/7/17

Louisiana Registration No.: 27124





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3,000	
6,000	
9,000	

Reference

U.S.G.S. TOPOGRAPHIC MAPS "LENA, LOUISIANA", "BOYCE, LOUISIANA", "JERICHO, LOUISIANA", AND "GARDNER, LOUISIANA."

CLECO Power LLC

Brame Energy Center

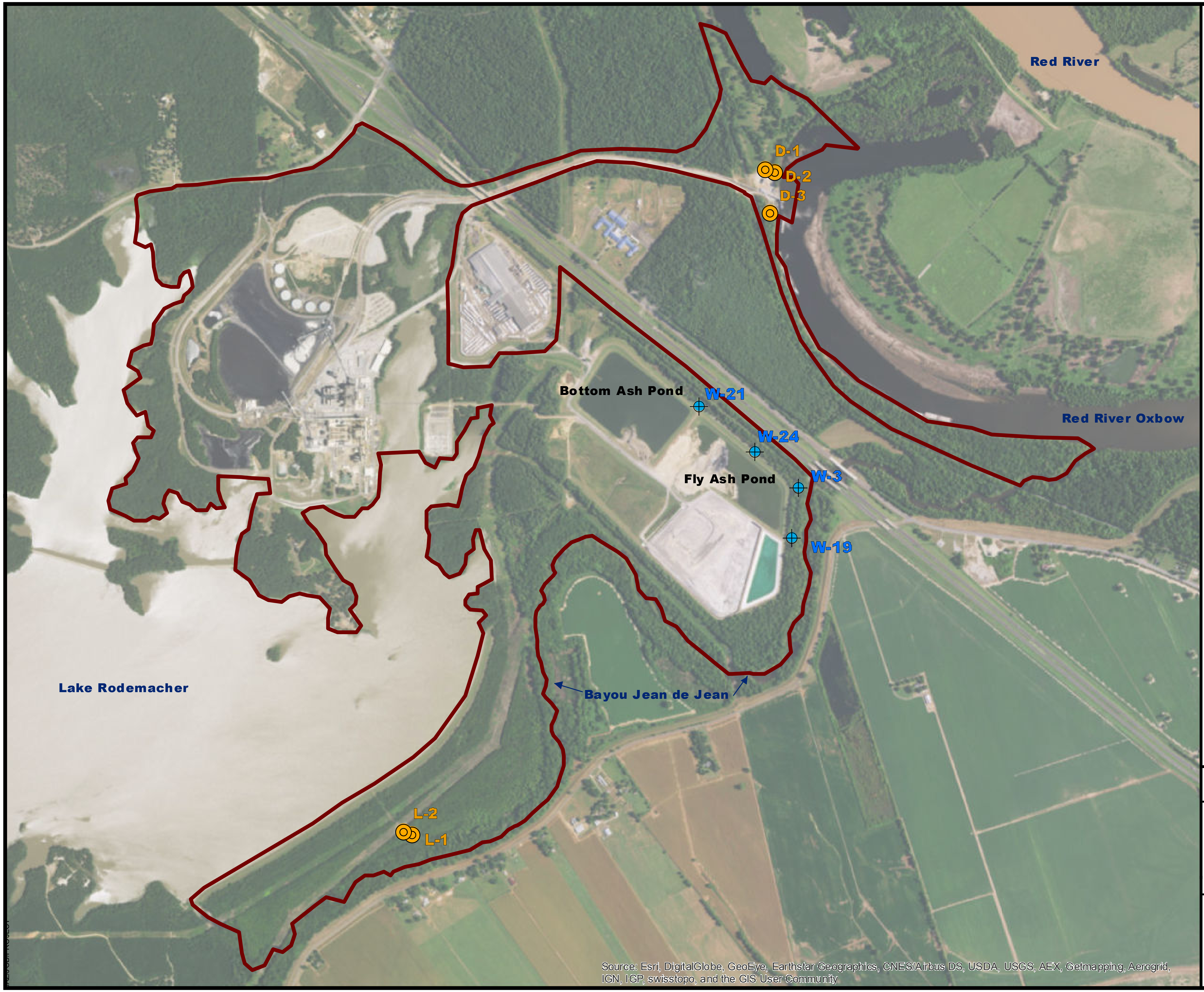
Site Location Map

Rapides Parish, Louisiana

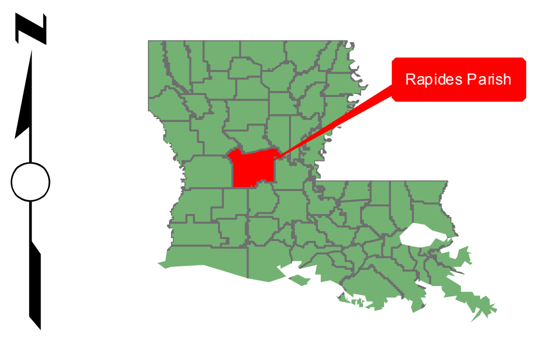
E·A·G·L·E
ENVIRONMENTAL SERVICES

Drawn:	jbh
Checked:	JM
Approved:	RS
Date:	11/08/10
Dwg. No.:	01-10-0071-A003

Figure 1



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Legend

- CCR Rule Compliance Wells
- CCR Rule Background Wells
- Secured Property Boundary

Feet
0 500 1,000 2,000 3,000

CLECO Power LLC

Brame Energy Center

CCR Rule
Monitoring Well Location Map

Rapides Parish, Louisiana

E·A·G·L·E
ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RS
Approved:	JM
Date:	10/4/16
Dwg. No.:	01-16-0160-A003

Figure 2

Table 1
Monitoring Well Construction Data

Well Number	D-1	D-2	D-3	L-1	L-2
Background (B) or Compliance (C)	B	B	B	B	B
Latitude (dd°mm'ss")	31°24'23.84"	31°24'23.41"	31°24'17.52"	31°22'47.68"	31°22'48.17"
Longitude (dd°mm'ss")	92°41' 53.62"	92°41'52.12"	92°41'52.95"	92°42'53.61"	92°42'55.01"
Casing Elevation (ft NGVD)	99.38	99.36	97.37	86.15	86.68
Concrete Pad Elevation (ft NGVD)	96.59	97.10	94.50	83.05	83.73
Well Depth (ft bgs)	40	46	35.5	36	40
Screen Length (ft)	10	10	10	10	10
Top of Screen (ft NGVD)	67.2	61.7	69.3	58.8	54.6
Bottom of Screen (ft NGVD)	57.2	51.7	59.3	48.8	44.6
Screen Slot Size (inches)	0.010	0.010	0.010	0.010	0.010
Casing Diameter (inches) & Material	2" PVC	2" PVC	2" PVC	2" PVC	2" PVC

Well Number	W-3	W-19	W-21	W-24
Background (B) or Compliance (C)	C	C	C	C
Latitude (dd°mm'ss")	31°23'37.79"	31°23'30.48"	31°23'49.57"	31°23'43.05"
Longitude (dd°mm'ss")	92°41'48.33"	92°41'50.26"	92°42'05.00"	92°41'55.61"
Casing Elevation (ft NGVD)	92.07	94.99	87.86	83.71
Concrete Pad Elevation (ft NGVD)	88.87	92.47	85.23	81.03
Well Depth (ft bgs)	77	55	54.5	55
Screen Length (ft)	10	10	10	10
Top of Screen (ft NGVD)	25.7	48.0	41.2	38.4
Bottom of Screen (ft NGVD)	15.7	38.0	31.2	28.4
Screen Slot Size (inches)	0.010	0.010	0.010	0.010
Casing Diameter (inches) & Material	2" PVC	2" PVC	2" PVC	2" PVC

Notes:

bgs = below ground surface

PVC = polyvinyl chloride

APPENDIX C

2019 ANNUAL GROUNDWATER MONITORING REPORT

CLECO POWER LLC
BRAME ENERGY CENTER

BOTTOM ASH POND AND
FLY ASH POND
LENA, LA

2019 Annual Groundwater Monitoring Report for the Coal Combustion Residuals Rule

January 2020

TABLE OF CONTENTS

Figures

Tables

1.0 INTRODUCTION

Cleco Power LLC (Cleco) hereby presents the 2019 Annual Groundwater Monitoring report for the Bottom Ash and Fly Ash Ponds at the Brame Energy Center (BEC) located in Lena, Louisiana (Figure 1). This report summarizes groundwater sampling and analysis activities completed in accordance with applicable portions of the U.S. Environmental Protection Agency (EPA) Coal Combustion Residuals (CCR) Rule.

2.0 FACILITY INFORMATION

Cleco owns and operates the BEC located at 275 Rodemacher Road, Lena, Louisiana 71447. The Bottom Ash and Fly Ash Ponds in service at the plant have been permitted to operate by the Louisiana Department of Environmental Quality (LDEQ) Waste Permits Division. The materials handled by these facilities are non-hazardous, on-site-generated materials only.

As required by the CCR Rule part §257.90, BEC has a groundwater monitoring well system to evaluate the groundwater quality conditions near the Bottom Ash and Fly Ash Ponds. The monitoring system consists of recently installed monitoring wells, in addition to monitoring wells installed previously to conduct groundwater monitoring required by BEC's LDEQ approved solid waste permits. A total of nine monitoring wells have been installed per applicable portions of §257.91. Locations of the monitoring wells can be found on Figure 2, and a table of monitoring well construction details can be found in Table 1.

3.0 FIELD ACTIVITIES

Groundwater sampling events were conducted by Cleco approved contract personnel in accordance with applicable portions of §257.93. Semi-annual detection monitoring sampling events were conducted in April and October 2019, while additional voluntary baseline sampling events were conducted in January and July 2019. It is noted that due to flooding of the Red River during the spring of 2019, flood waters saturated the ground to the east of the Bottom Ash and Fly Ash Ponds. Risers were installed to prevent inundation of flood waters into the monitoring wells.

The depth-to-water below the top of each well casing was measured and recorded prior to purging each well during each sampling event. Water levels were measured to the nearest 0.01 foot from the top of casing using an electronic water level indicator. Total depth of each well was also measured to confirm that the screened interval was open to groundwater flow. Water level measurements were recorded in groundwater sampling forms. The water level measurements were subtracted from the top of casing elevations to obtain the groundwater elevations.

Groundwater purging and sampling activities were conducted using electric submersible pumps. These activities were conducted in accordance with applicable portions of Sections 6.1, 6.2, 6.3 and 8.1.4 of the *Standard Guide for Sampling Groundwater Monitoring Wells* (ASTM International, Publication D4448). Non-dedicated sampling equipment which came into contact with groundwater samples was decontaminated prior to sampling each well to reduce the potential for cross-contamination. Groundwater samples were collected by filling the sample containers directly from the disposable tubing connected to the pump or from a disposable bailer. Care was taken to minimize agitation of the samples. Samples were placed in laboratory-provided plastic containers with appropriate preservatives, per Section 9 of ASTM D4448. Samples were properly preserved on ice in the field and shipped to Pace Analytical Services, LLC of St. Rose, Louisiana, for analysis of the CCR groundwater detection monitoring parameters by the following methods: chloride, fluoride and sulfate by 300.0; total dissolved solids by 2540C; and metals by 6020. Full chain-of-custody protocols were observed during sample collection, transportation, and analysis. Sample shipment/transport procedures were conducted per Sections 9.9 through 9.11 of ASTM D4448.

4.0 GROUNDWATER FLOW EVALUATION

Horizontal groundwater flow was evaluated in the uppermost aquifer by construction of potentiometric surface maps (Figures 3 through 6) from data measured in monitoring wells at BEC. An evaluation of groundwater flow indicates that horizontal groundwater flow at BEC is consistently towards local surface water bodies with flow towards Lake Rodemacher in the power station portion of the property and towards Bayou Jean de Jean in the area of the Bottom Ash Pond, Fly Ash Pond, and Ash Management Area. Based on USGS topographic quadrangles of the Lake Rodemacher area, the spillway elevation of Lake Rodemacher is 100 feet NGVD. Groundwater elevations determined in monitoring wells near the lake are generally higher than this maximum lake elevation, supporting groundwater flow towards the lake.

Groundwater flow rate was evaluated using the groundwater flow equation, $v = [k\ (dh/dl)] / n_e$. For this equation, v is groundwater flow velocity in ft/day, k is hydraulic conductivity in ft/day, dh/dl is hydraulic gradient in ft/ft, and n_e is effective porosity (unitless).

Hydraulic conductivity (k) value ranging from 10 to 100 ft/day was assumed (Heath, 1989) based on the silty sand and fine- to coarse-grained sand observed in soil cuttings from soil borings completed at the site. Hydraulic gradient (dh/dl) value estimates from potentiometric surface maps representing each sampling event for the Ash Ponds areas are summarized below. An effective porosity (n_e) of 0.2 was assumed based on the soil types of the uppermost water bearing zone (Fetter, 2001). Using these values, the groundwater flow rates (v) are listed below.

Date	Hydraulic Gradient (feet/feet)	Estimated Groundwater Flow Velocity (feet/day)
January 2019	0.002	0.01 to 1.0
April 2019	0.00004 to 0.0002	0.0002 to 0.1
July 2019	0.0009 to 0.002	0.045 to 1.0
October 2019	0.0007 to 0.001	0.0035 to 0.5

It is important to note that this is an advective rate and does not take into account potential hydrogeological heterogeneities such as adsorption, biodegradation, dispersion, or other retarding factors in the groundwater flow in this zone. Additionally, variations in the advective flow may occur due to potential lateral geological heterogeneities.

5.0 ANALYTICAL RESULTS

Groundwater samples collected at BEC were analyzed for the CCR Rule detection monitoring parameters pH, boron, calcium, chloride, fluoride, sulfate, and total dissolved solids (TDS) using appropriate EPA approved analytical methods. Results show frequent detections of all parameters in both up- and downgradient monitoring wells at BEC. Analytical results are presented in Table 2.

6.0 STATISTICAL EVALUATION

Statistical evaluations of groundwater data have been performed per applicable portions of §257.93.f. The goal of the statistical evaluation is to determine if there is statistically significant evidence to show that facility operations may have adversely affected groundwater quality. Statistical evaluations are conducted to determine if there are any statistically significant increases (SSIs) between groundwater quality upgradient and groundwater quality downgradient of the Bottom Ash and Fly Ash Ponds.

Due to statistically significant variation found in upgradient monitoring well data, all detection monitoring parameters were statistically evaluated using intrawell prediction limits. Intrawell tests are within well comparisons. In the case of limit-based tests, historical data from within a given monitoring well for a given parameter are used to construct a limit. Compliance points are compared to the limit to determine whether a change is occurring on a per-well/per-parameter basis. Normal distributions of data values use parametric methods. Non-normal distributions use non-parametric methods, in which case, the prediction limit is based on the highest value in the background data set.

Intrawell limit-based tests are recommended when there is evidence of spatial variation in groundwater quality, particularly among upgradient monitoring wells, as it is inappropriate to pool those data across monitoring wells for the purpose of creating interwell limits for comparison with compliance monitoring well data. Intrawell tests may be used at both new and existing facilities. Data used in the intrawell limit-based tests were screened for outliers, which, if found, were removed from the background data set prior to constructing limits for each well/parameter pair. Both upper and lower prediction limits were calculated for pH.

Verification resampling for SSIs is only conducted for SSIs generated in downgradient wells via intrawell methodology. Intrawell statistics have been performed on all wells; however, since the goal of the statistical evaluation is to determine if there is statistically significant evidence to show that facility operations may have adversely affected groundwater quality downgradient of the facilities, only downgradient wells are subject to verification resampling.

Intrawell statistical analysis of the 2019 detection monitoring groundwater data showed that SSIs were generated for chloride in downgradient/compliance wells W-19 and W-21. A verification resampling event was conducted for these well/parameter pairs in December 2019. The resampling results indicate that the referenced SSIs were not confirmed.

7.0 CONCLUSIONS AND RECOMMENDATIONS

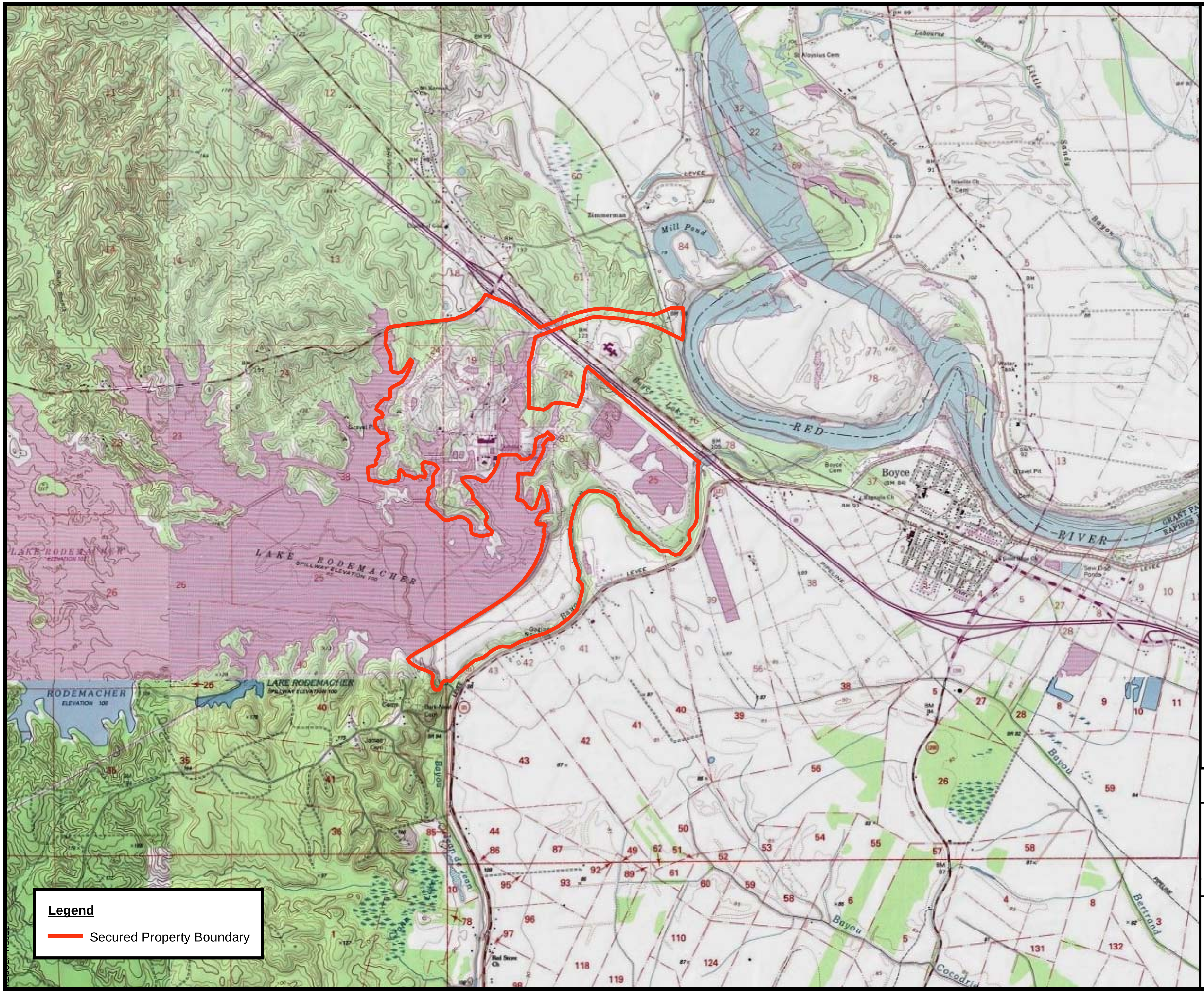
- Cleco BEC has a monitoring well system to monitor groundwater quality at the Bottom Ash and Fly Ash Ponds per applicable portions of §257.91. The network consists of five upgradient and four downgradient monitoring wells.
- Cleco conducted sufficient detection monitoring sampling events, per applicable portions of §257.93 and §257.94.
- Potentiometric surface evaluation at BEC indicates consistent groundwater flow towards local surface water bodies.
- Statistical evaluations of data conducted per applicable portions of §257.93 indicate that no confirmed SSIs were observed in downgradient/compliance wells at BEC.
- Semi-annual detection monitoring sampling events are tentatively scheduled for March and September 2020. Data generated during these sampling events will be included in the next annual report.

8.0 CERTIFICATION

I hereby certify this annual groundwater monitoring report for Cleco Power LLC. I am a duly licensed Professional Engineer under the laws of the State of Louisiana.

BRADLEY E. BATES
LIC. NO. 27124

	27124
Signature	**PE Registration Number**
Bradley E. Bates	*Professional Engineer*
Name	**Title**
Eagle Environmental Services, Inc.	*1/9/2020*
Company	**Date**



Reference

U.S.G.S. TOPOGRAPHIC MAPS "LENA, LOUISIANA", "BOYCE, LOUISIANA", "JERICHO, LOUISIANA", AND "GARDNER, LOUISIANA."

CLECO Power LLC

Brame Energy Center

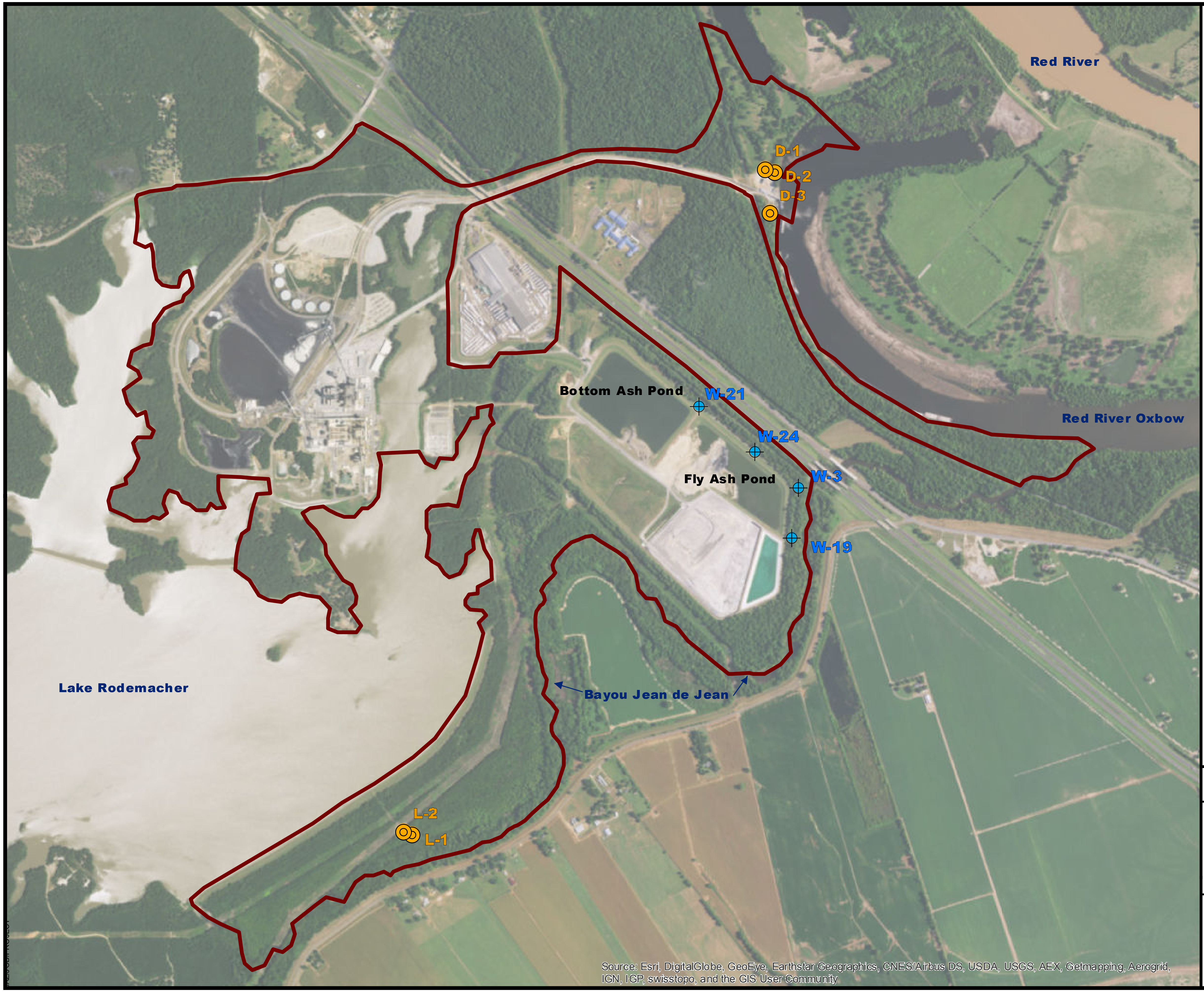
Site Location Map

Rapides Parish, Louisiana

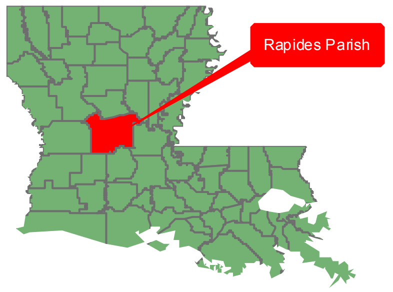
E·A·G·L·E
ENVIRONMENTAL SERVICES

Drawn:	jbh
Checked:	JM
Approved:	RS
Date:	11/08/10
Dwg. No.:	01-10-0071-A003

Figure 1



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Legend

- CCR Rule Compliance Wells
- CCR Rule Background Wells
- Secured Property Boundary

CLECO Power LLC

Brame Energy Center

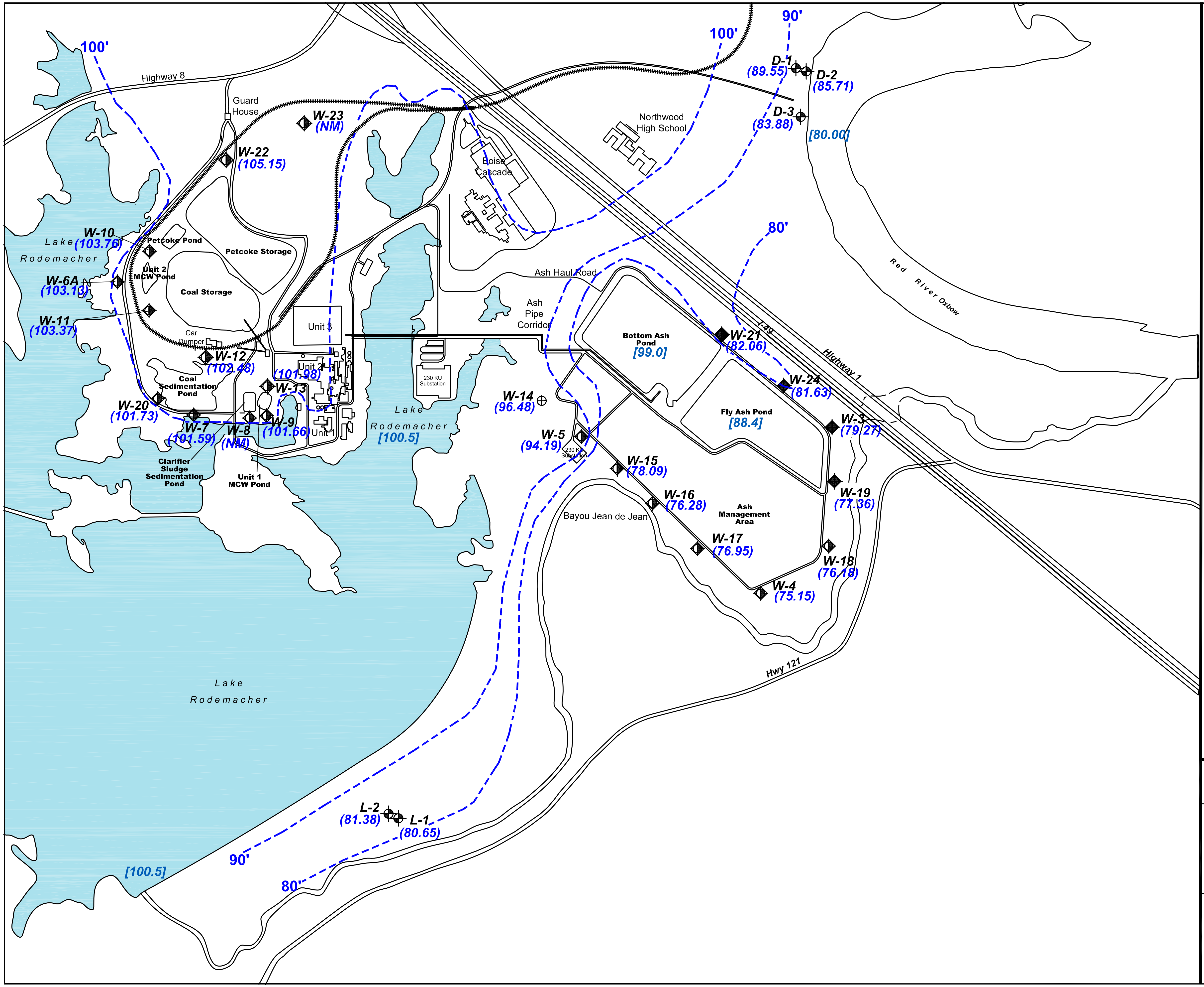
CCR Rule
Monitoring Well Location Map

Rapides Parish, Louisiana

E·A·G·L·E
ENVIRONMENTAL SERVICES, INC.

Drawn: JP
Checked: RS
Approved: JM
Date: 10/4/16
Dwg. No.: 01-16-0160-A003

Figure 2



N

Legend

++++++++	Railroad Tracks
⊕	CCR Background Well Location
◆	CCR Compliance Well Location
◆	Non-CCR Piezometer Location
(80.65)	Potentiometric Surface Elevation, Ft. NGVD
80'—	Potentiometric Surface Elevation Contour, Ft. NGVD
- - -	Inferred Potentiometric Surface Contour, Ft. NGVD
[80.00]	Surface Water Elevation ft. NGVD
NM	Not Measured

Note: Red River elevation reflects difference of Red River at Lock & Dam No. 3 Lower and Red River at Alexandria, LA.

1,200 0 1,200

Scale: 1" = 1,200'

CLECO Corporation

Brame Energy Center

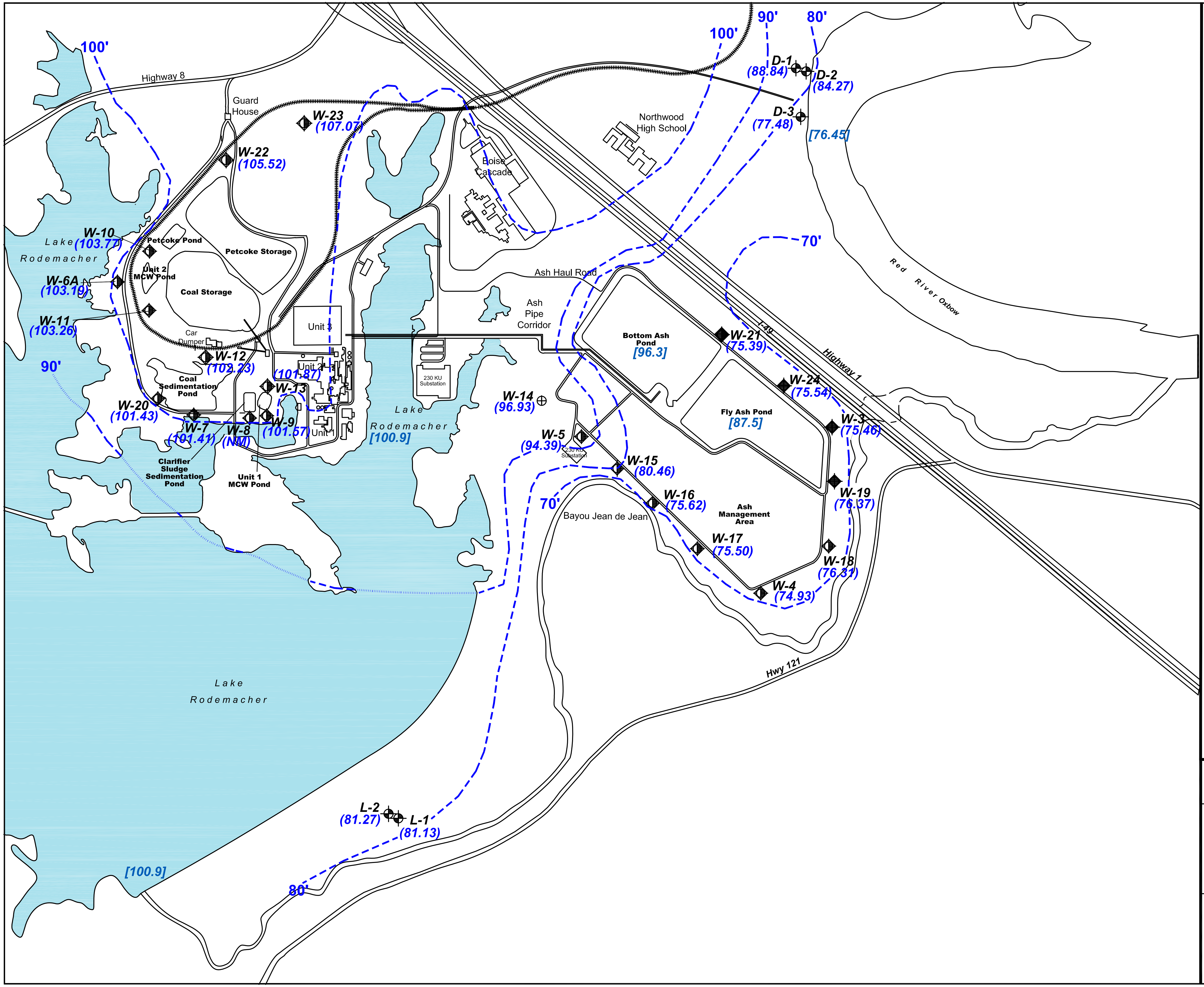
Cleco Brame
Potentiometric Surface Contour Map
January 2019

Rapides Parish, Louisiana

E·A·G·L·E
ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RB
Approved:	JM
Date:	5/9/19
Dwg. No.:	01-19-0169-A001

Figure 3



Legend

Railroad Tracks
CCR Background Well Location
CCR Compliance Well Location
Non-CCR Piezometer Location
(75.46) Potentiometric Surface Elevation, Ft. NGVD
70' Potentiometric Surface Elevation Contour, Ft. NGVD
Inferred Potentiometric Surface Contour, Ft. NGVD
[76.45] Surface Water Elevation ft. NGVD
NM Not Measured

Note: Red River elevation reflects difference of Red River at Lock & Dam No. 3 Lower and Red River at Alexandria, LA.

1,200 0 1,200
Scale: 1" = 1,200'

CLECO Corporation
Brame Energy Center

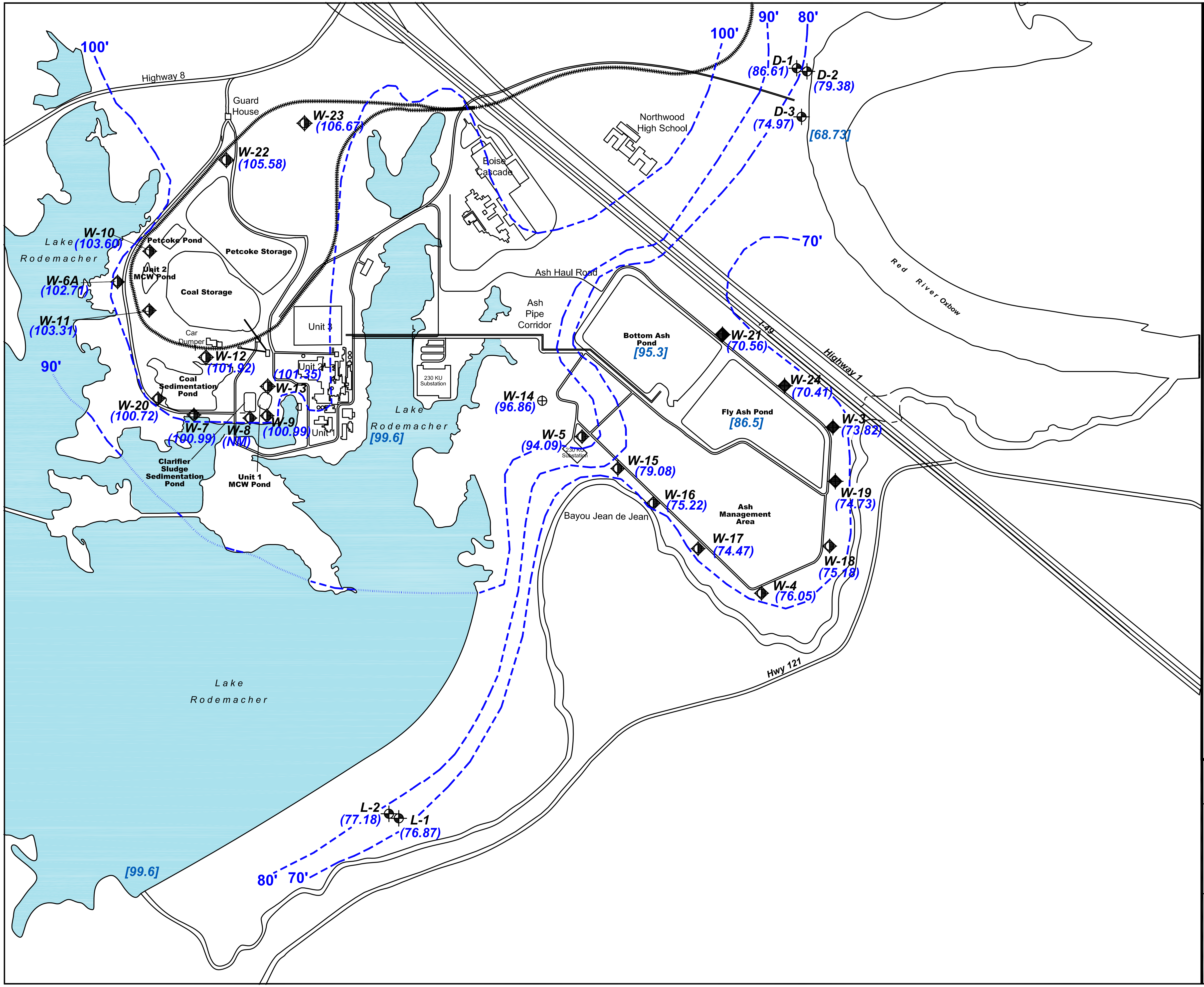
Cleco Brame
Potentiometric Surface Contour Map
April 2019

Rapides Parish, Louisiana

E·A·G·L·E
ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RS
Approved:	JM
Date:	5/9/19
Dwg. No.:	01-19-0169-A002

Figure 4



N

Legend

┼┼┼┼┼	Railroad Tracks
⊕	CCR Background Well Location
◆	CCR Compliance Well Location
◈	Non-CCR Piezometer Location
(75.18)	Potentiometric Surface Elevation, Ft. NGVD
70'—	Potentiometric Surface Elevation Contour, Ft. NGVD
- - -	Inferred Potentiometric Surface Contour, Ft. NGVD
[68.73]	Surface Water Elevation ft. NGVD
NM	Not Measured

Note: Red River elevation reflects difference of Red River at Lock & Dam No. 3 Lower and Red River at Alexandria, LA.

1,200 0 1,200

Scale: 1" = 1,200'

CLECO Corporation

Brame Energy Center

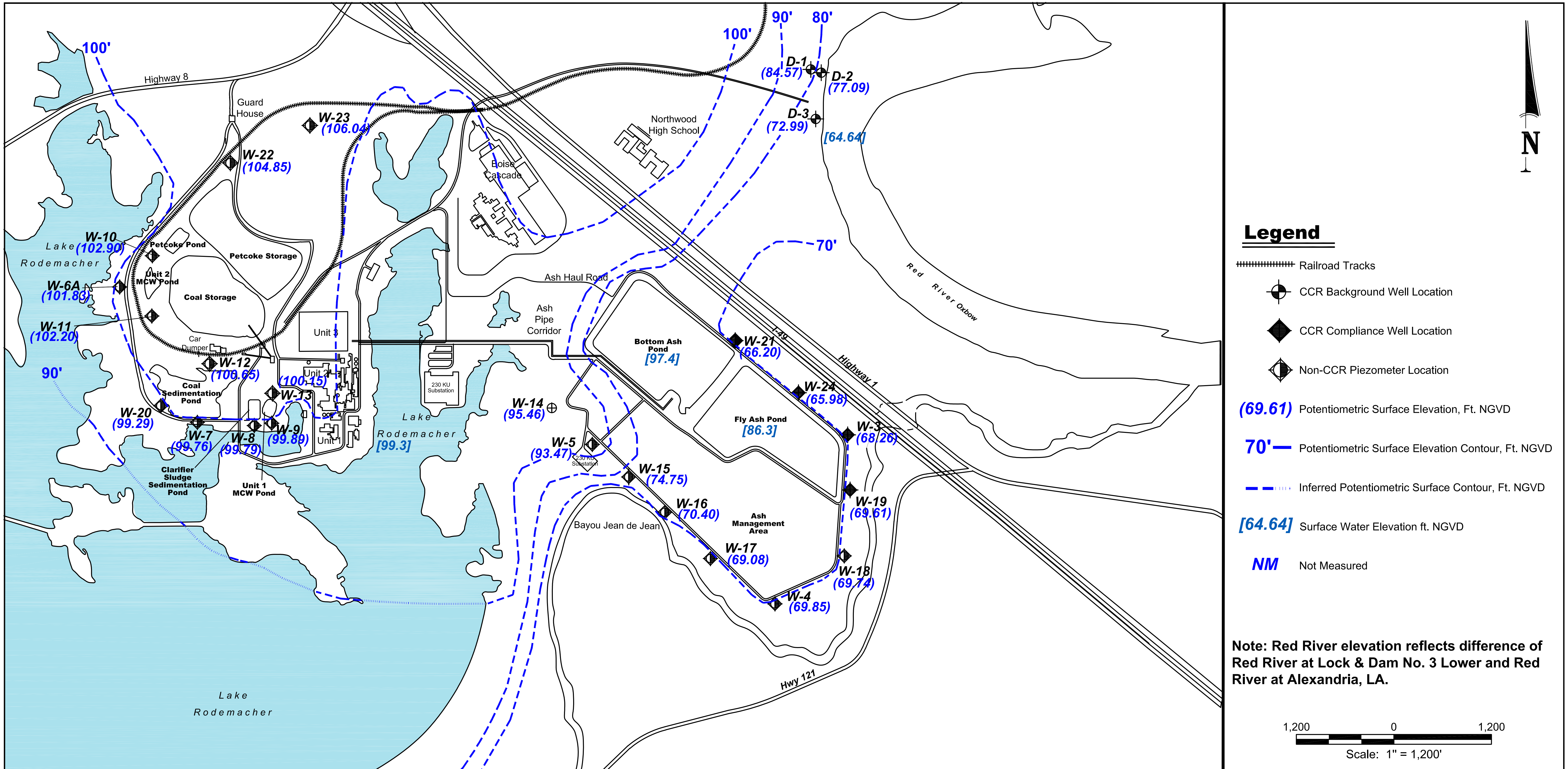
Cleco Brame
Potentiometric Surface Contour Map
July 2019

Rapides Parish, Louisiana

E·A·G·L·E ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RS
Approved:	JM
Date:	7/25/19
Dwg. No.:	01-19-0202-A001

Figure 5



Note: Red River elevation reflects difference of Red River at Lock & Dam No. 3 Lower and Red River at Alexandria, LA.

CLECO Corporation

Brame Energy Center

Cleco Brame
Potentiometric Surface Contour Map
October 2019

Rapides Parish, Louisiana

E·A·G·L·E
ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RS
Approved:	JM
Date:	12/12/19
Dwg. No.:	01-19-0202-A002

Figure 6

Table 1
Monitoring Well Information

Well Number	D-1	D-2	D-3	L-1	L-2
Background (B) or Compliance (C)	B	B	B	B	B
Latitude (dd°mm'ss")	31°24'23.84"	31°24'23.41"	31°24'17.52"	31°22'47.68"	31°22'48.17"
Longitude (dd°mm'ss")	92°41' 53.62"	92°41'52.12"	92°41'52.95"	92°42'53.61"	92°42'55.01"
Casing Elevation (ft NGVD)	99.38	99.36	97.37	86.15	86.68
Concrete Pad Elevation (ft NGVD)	96.59	97.10	94.50	83.05	83.73
Well Depth (ft bgs)	40	46	35.5	36	40
Screen Length (ft)	10	10	10	10	10
Top of Screen (ft NGVD)	67.2	61.7	69.3	58.8	54.6
Bottom of Screen (ft NGVD)	57.2	51.7	59.3	48.8	44.6
Screen Slot Size (inches)	0.010	0.010	0.010	0.010	0.010
Casing Diameter (inches) & Material	2" PVC	2" PVC	2" PVC	2" PVC	2" PVC

Well Number	W-3	W-19	W-21	W-24
Background (B) or Compliance (C)	C	C	C	C
Latitude (dd°mm'ss")	31°23'37.79"	31°23'30.48"	31°23'49.57"	31°23'43.05"
Longitude (dd°mm'ss")	92°41'48.33"	92°41'50.26"	92°42'05.00"	92°41'55.61"
Casing Elevation (ft NGVD)	92.07	94.99	87.86	83.71
Concrete Pad Elevation (ft NGVD)	88.87	92.47	85.23	81.03
Well Depth (ft bgs)	77	55	54.5	55
Screen Length (ft)	10	10	10	10
Top of Screen (ft NGVD)	25.7	48.0	41.2	38.4
Bottom of Screen (ft NGVD)	15.7	38.0	31.2	28.4
Screen Slot Size (inches)	0.010	0.010	0.010	0.010
Casing Diameter (inches) & Material	2" PVC	2" PVC	2" PVC	2" PVC

Notes:

bgs = below ground surface

PVC = polyvinyl chloride

Table 2
2019 Analytical Data Summary

Parameter/Well/Date		Boron (mg/l)	Calcium (mg/l)	Chloride (mg/l)	Fluoride (mg/l)	pH (S.U.)	Sulfate (mg/l)	TDS (mg/l)
D-1 (BG)	1/16/19	0.042	5.7	13.5	<0.1	6.29	10.1	60
	4/17/19	0.045	12.6	11.9	0.48	6.32	5.9	105
	7/19/19	0.045	8.2	11.9	0.23	6.28	9.3	145
	10/30/19	0.036	5	12.7	<0.1	5.92	10.4	175
D-2 (BG)	1/16/19	0.11	82.2	13.2	0.61	6.87	39.4	420
	4/17/19	0.25	88.3	11.4	0.91	6.68	53.2	630
	7/19/19	0.11	94.4	6.9	0.48	6.9	78.2	530
	10/30/19	0.092	93.4	9.6	0.54	6.87	69.6	405
D-3 (BG)	1/16/19	0.35	90.9	13.6	1.1	7.16	58.6	700
	4/17/19	0.11	105	7.3	0.45	7.06	96.9	465
	7/19/19	0.27	79.7	10.9	0.98	7.13	48.7	710
	10/30/19	0.24	85.2	11.8	0.51	6.92	48.6	625
L-1 (BG)	1/15/19	0.088	66.9	3.7	0.2	6.89	23	600
	4/17/19	0.1	104	5.2	0.29	6.74	13.9	370
	7/19/19	0.099	84.4	4.8	0.27	7.19	10.2	445
	10/29/19	0.1	109	5.8	0.21	7.06	4.5	460
L-2 (BG)	1/15/19	0.084	125	7.8	0.59	6.97	68	940
	4/17/19	0.086	150	10	0.43	6.83	98.2	565
	7/19/19	0.082	80.9	5.1	0.41	7.15	33.9	400
	10/29/19	0.082	79.4	2.4	0.52	7.06	15.9	435
W-3	1/15/19	0.18	58.1	144	0.28	6.67	3	900
	4/17/19	0.17	67.5	189	0.32	6.45	3.7	660
	7/19/19	0.18	59.8	154	0.31	6.57	4	640
	10/29/19	0.13	65.6	206	0.2	6.65	1.2	660
W-19	1/15/19	0.21	95.9	66.7	0.59	6.91	<1	400
	4/17/19	0.19	113	58.7	0.31	6.65	<1	640
	7/19/19	0.2	101	52.1	0.33	6.87	<1	725
	10/29/19	0.16	96.9	74.7 / 52.8*	0.38	6.83	<1	605
W-21	1/15/19	0.38	114	54.2	0.75	7.06	166	1,120
	4/17/19	0.3	109	54.2	0.8	6.77	158	1,020
	7/19/19	0.36	108	37.3	0.62	6.93	113	940
	10/29/19	0.32	118	67.4 / 40.5*	0.48	6.92	173	1,080
W-24	1/15/19	0.086	62.6	27.2	0.15	7.43	11.2	540
	4/17/19	0.19	110	85.6	0.89	6.99	6.7	950
	7/19/19	0.23	95.2	89.2	0.58	7.14	3	910
	10/29/19	0.17	120	143	0.3	6.76	4.5	1,030

* 12/17/19 Resampling event.

Notes:

mg/l = milligrams per liter
S.U. = standard units

APPENDIX D

CERTIFICATION OF STATISTICAL METHODOLOGY

CLECO

BRAME ENERGY CENTER
LENA, LOUISIANA

CERTIFICATION OF
STATISTICAL METHODOLOGY

STATISTICAL ANALYSIS

Statistical evaluations of groundwater monitoring data for the permitted Coal Combustion Residuals (CCR) facilities will be performed using prediction limits per §257.93.F. These statistical evaluations will be conducted per performance criteria outlined in applicable portions of §275.93.G and the *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance* (U.S. Environmental Protection Agency, March, 2009). The number of samples collected, the frequency of collection, and the management of non-detect data will be consistent with the statistical method selected. The data set to be considered in the statistical analysis will include data generated from the implementation of the CCR groundwater monitoring program.

The goal of the statistical evaluation is to determine if there is statistically significant evidence to show that facility operations may have adversely affected groundwater quality downgradient of the CCR facility. As shown in the decision logic flowchart for detection monitoring (Figure 1), an evaluation of upgradient well data will be performed first before determining which statistical evaluation approach will be selected. If the background wells are not impacted by a release from any CCR facility and have groundwater quality statistically similar to downgradient wells (assuming no impacts from the CCR facility in the downgradient wells), then interwell statistical evaluation will be performed. If the initial sampling results indicate that background groundwater is statistically dissimilar to downgradient groundwater, then intrawell statistical evaluation will be performed. These techniques are discussed below.

- Interwell statistical evaluations involve an upgradient/downgradient comparison to determine if there are any statistically significant increases (SSIs) between groundwater quality upgradient and groundwater quality downgradient of the CCR facility. Interwell prediction limits will be constructed from the upgradient well data and based on the distribution of that data for each parameter. If the assumption of normality is not rejected for the upgradient data set, then a parametric prediction limit will be calculated. If the assumption of normality is rejected for the upgradient data set, then a non-parametric prediction limit will be calculated, in which case, the prediction limit will be based on the highest value in the upgradient data set. The most recent result for each downgradient well for each parameter will be compared to the applicable prediction limit.

- Intrawell statistical evaluations are within well comparisons. In the case of intrawell prediction limits, historical data from within a given well for a given parameter will be used to construct a limit. Compliance points will be compared to the limit to determine whether a change is occurring on a per-well/per-parameter basis. If the assumption of normality is not rejected for the background data set, then a parametric prediction limit will be calculated. If the assumption of normality is rejected for the background data set, then a non-parametric prediction limit will be calculated, in which case, the prediction limit will be based on the highest value in the background data set. (Note that both upper and lower prediction limits will be used for intrawell evaluations of pH.)

  Intrawell limit-based tests are recommended when there is evidence of natural spatial variability in groundwater quality, particularly among unimpacted upgradient wells, as it is inappropriate to pool those data across wells for the purpose of creating interwell limits for comparison with downgradient well data. Intrawell tests may be used at both new and existing facilities. Data used in intrawell limit-based tests will be screened for outliers, which, if found, will be removed from the background data set prior to constructing limits for each well/parameter pair.

An integral part of using prediction limits for statistical evaluation of groundwater data is the selection of a verification resampling strategy. For the Cleco Power, LLC sites, a 1/2 verification resampling strategy will be used to lower the site-wide false positive rate (SWFPR). Verification resampling is mathematically incorporated into the prediction limit calculations, which improves statistical power while maintaining the SWFPR. Note that in the event intrawell statistical evaluations are performed that verification resampling for SSIs will only be conducted for SSIs generated in downgradient wells. Intrawell statistics will be performed on all wells; however, since the goal of the statistical evaluation is to determine if there is statistically significant evidence to show that facility operations may have adversely affected groundwater quality downgradient of the CCR facility, only downgradient wells will be subject to verification resampling.

In the event that SSIs are reported, verification resampling will be conducted for the appropriate well/parameter pairs. If SSIs are confirmed through verification resampling, the timelines listed in either §257.94.E.1 or §257.94.E.2 will be followed.

CERTIFICATION

I hereby certify that the selected statistical methodology as described above is appropriate for evaluating the groundwater monitoring data for the CCR management areas at the Cleco Power, LLC Brame Energy Center. I am a duly licensed Professional Engineer under the laws of the State of Louisiana.

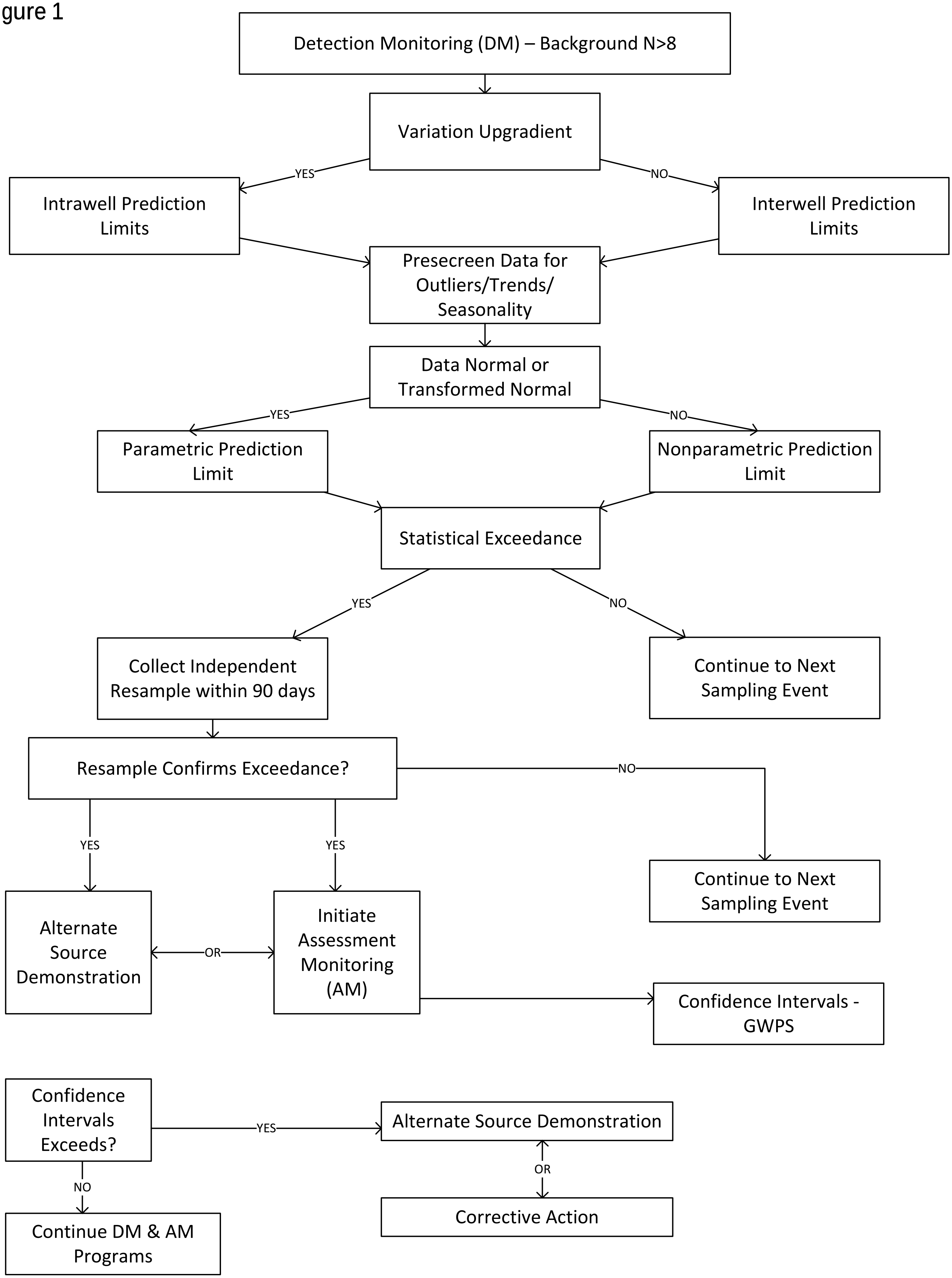
BRADLEY E. BATES
LIC. NO. 27124

_________________________________, P.E.

Date: 10/12/17

Louisiana Registration No.: 27124

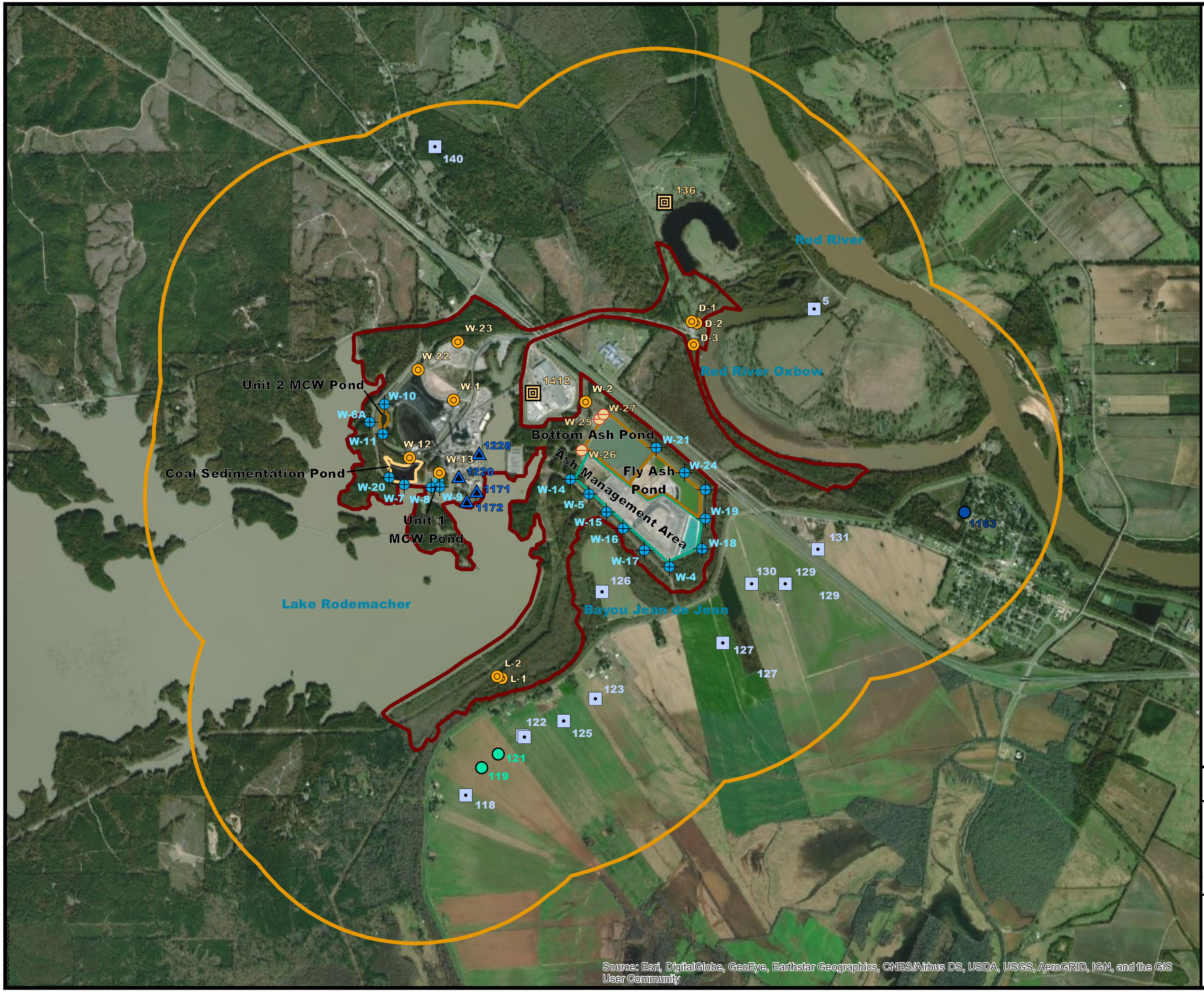
Figure 1



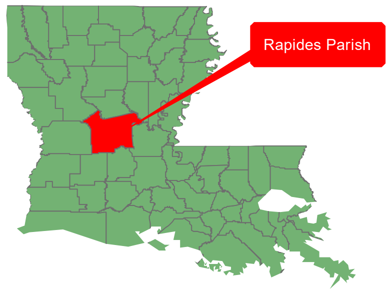
Detection Monitoring (DM) – Background N>8
Variation Upgradient
YES
NO
Intrawell Prediction Limits
Interwell Prediction Limits
Presecreen Data for Outliers/Trends/ Seasonality
Data Normal or Transformed Normal
YES
NO
Parametric Prediction Limit
Nonparametric Prediction Limit
Statistical Exceedance
YES
NO
Collect Independent Resample within 90 days
Continue to Next Sampling Event
Resample Confirms Exceedance?
NO
YES
YES
Continue to Next Sampling Event
Alternate Source Demonstration
OR
Initiate Assessment Monitoring (AM)
Confidence Intervals - GWPS
Confidence Intervals Exceeds?
YES
Alternate Source Demonstration
OR
Corrective Action
NO
Continue DM & AM Programs

APPENDIX E

WATER USE SURVEY



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Legend

- ⊕ Piezometer
- ● Water Level Observation
- ▣ Domestic Well
- ▲ Power Generation
- ▣ Industrial Well
- ● Other; Unknown
- ◎ Background Wells
- ⊕ Compliance Wells
- ☐ P-0027R1
- ☐ P-0062R1
- ☐ P-0005R1
- ☐ Ash Management Area (P-0379)
- — Secured Property Boundary
- — One Mile Radius

Reference

Registered water well data from Louisiana SONRIS data source in 2020.

CLECO Power LLC

Brame Energy Center

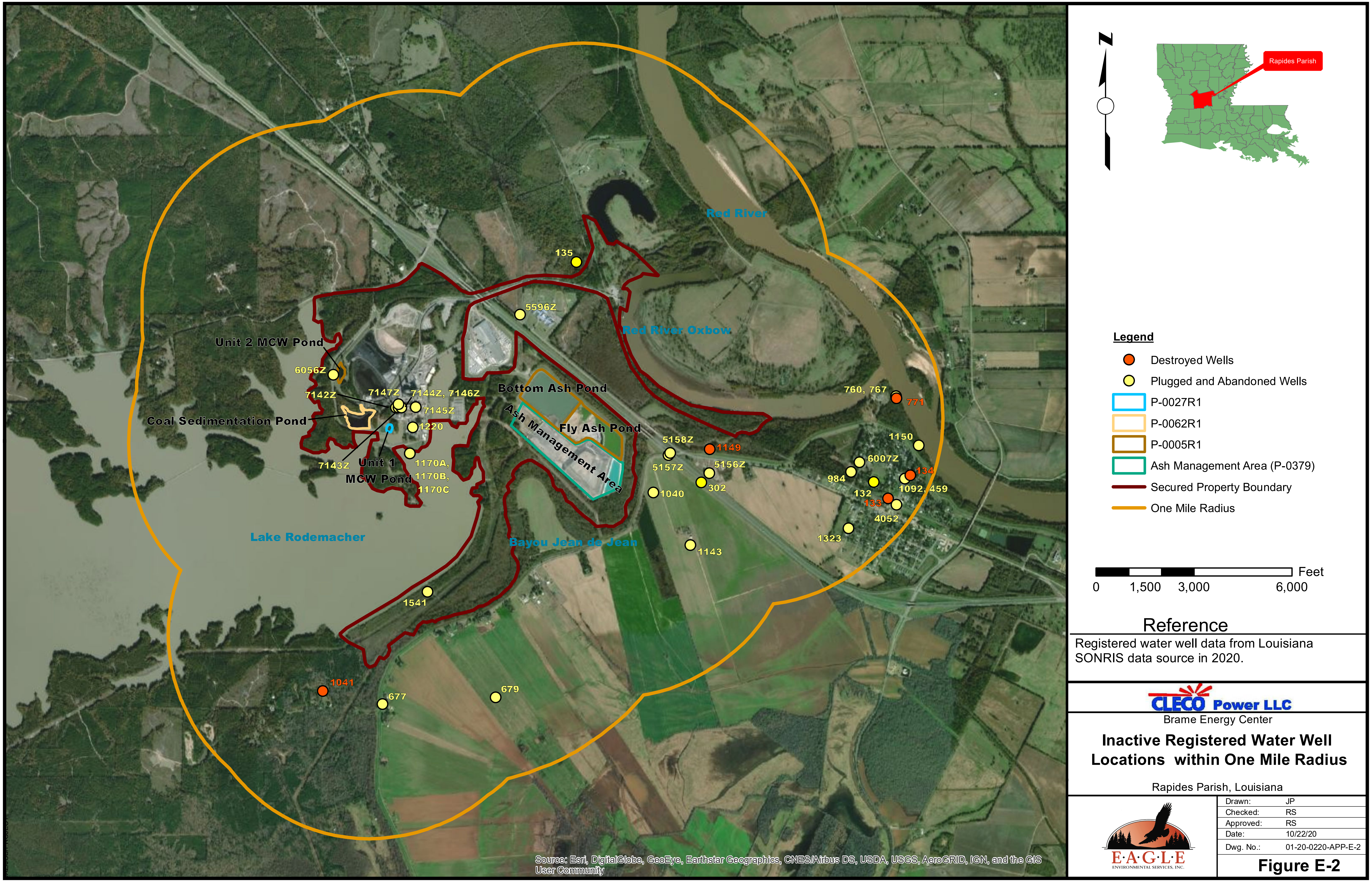
Active Registered Water Well Locations within One Mile Radius

Rapides Parish, Louisiana

EAGLE ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RS
Approved:	RS
Date:	11/10/20
Dwg. No.:	01-20-0220-APP-E-1

Figure E-1



Legend

- ● Destroyed Wells
- ● Plugged and Abandoned Wells
- ☐ P-0027R1
- ☐ P-0062R1
- ☐ P-0005R1
- ☐ Ash Management Area (P-0379)
- — Secured Property Boundary
- — One Mile Radius

Reference

Registered water well data from Louisiana SONRIS data source in 2020.

CLECO Power LLC

Brame Energy Center

Inactive Registered Water Well Locations within One Mile Radius

Rapides Parish, Louisiana

E·A·G·L·E
ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RS
Approved:	RS
Date:	10/22/20
Dwg. No.:	01-20-0220-APP-E-2

Figure E-2

Water Well Survey Results

Please note: Discrepancies are common between the former Louisiana Department of Transportation and Development (LDOTD) database and the current LDNR database regarding the exact locations of the permitted water wells. The locations of some water wells may appear to be in error due to rounding of latitude and longitude positions or other sources of inaccuracy. Another consideration is that this database only includes registered water wells, and usage description information is only as accurate as was provided by the owners/drillers. No attempt was made to confirm the exact locations of wells located a distance beyond a one-mile radius of the Bottom Ash Pond at BEC or the underlying geologic units.

CHAPTER 4.0

Appendices

A	Owner’s Certification
B	Monitoring Well Locations/Monitoring Well Network Certification
C	Monitoring Well Details and Soil Boring Logs
D	Potentiometric Surface Maps
E	Groundwater Quality Data
F	Site Hydrogeology and Geologic Cross Sections
G	Structural Stability Assessment
H	Safety Factor Assessment

November 25, 2020

APPENDIX A

OWNER'S CERTIFICATION

OWNER'S CERTIFICATION OF COMPLIANCE
40 C.F.R. § 257.103(f)(2)(v)(C)(1)

I hereby certify that, based on the information provided to me by and inquiry of the persons immediately responsible for compliance with the CCR rule, the Brame Energy Center (BEC) facility, including the Bottom Ash Pond, is in compliance with 40 C.F.R. Part 257, Subpart D—Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. Cleco's CCR Rule Compliance Website is up-to-date and contains all necessary documentation and notifications.

Shane Hilton 11-4-20

Shane Hilton
President, Cleco Power LLC

Date

APPENDIX B

MONITORING WELL INFORMATION / MONITORING WELL NETWORK CERTIFICATION

CLECO

BRAME ENERGY CENTER
LENA, LOUISIANA

MONITORING WELL NETWORK CERTIFICATION

MONITORING WELL NETWORK

1.0 Introduction

The U.S. Environmental Protection Agency (EPA) published a final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA). The rule applies to the Cleco Power LLC Brame Energy Center (BEC). A site location map is provided in Figure 1. BEC has two permitted facilities that accept CCR: the Bottom Ash and Fly Ash Ponds, as shown in Figure 2.

The CCR Rule, 40 CFR Subpart D-Standards for the Disposal of CCRs, Section §257.91 requires a groundwater monitoring system that consists of sufficient number of wells at appropriate locations and depths based on site-specific technical information, to yield groundwater samples from the uppermost aquifer that:

- Accurately represent the quality of both background groundwater, and groundwater passing the boundary of the CCR unit; and
- Monitor potential contaminant pathways.

The groundwater monitoring system at BEC meets those requirements, as described below.

2.0 Site Hydrogeology Summary

The Bottom Ash and Fly Ash Ponds are situated on the aquifer recharge area for the Red River natural levee and/or Alluvial Aquifer, as well as Lake Rodemacher. Since the Bottom Ash and Fly Ash Ponds are located in the Red River Alluvium, all upgradient and downgradient monitoring wells for these CCR facilities have been installed in these deposits.

Review of geological reports indicates that Louisiana Alluvial Aquifer groundwater quality is reported by the USGS to be primarily limited to use for industrial and agricultural purposes. This is due to excessive concentrations of dissolved solids, hardness, iron, or localized salinity. The natural groundwater quality of these aquifer systems is generally considered not suitable for drinking water supply purposes without first undergoing appropriate water treatment. The Louisiana Department of Natural Resources (LDNR) issued an advisory in 2009 addressing the recommended uses of these alluvial aquifers. Furthermore, it is reported that dissolved metals, namely arsenic, have been, and are expected to be, detected in groundwater in localized areas of these aquifers (LDNR, 2009).

Louisiana Department of Natural Resources, Office of Conservation, 2009. "General Water Quality Summary, Louisiana Groundwater - Alluvial Aquifer Systems", Louisiana Department of Natural Resources, Baton Rouge, LA, 1 sheet.

3.0 Groundwater Monitoring System

Groundwater monitoring wells have been installed in the uppermost, laterally continuous water bearing zone present beneath the CCR facilities at BEC. Since the areas immediately upgradient of the Bottom Ash and Fly Ash Ponds are situated on Terrace deposits, the background monitoring wells have been installed in alternative locations, per §257.91.1. Thus, all background and compliance monitoring wells are screened in the Red River Alluvial deposits. Monitoring well information is included in Table 1, and the monitoring well locations are provided in Figure 2.

CERTIFICATION

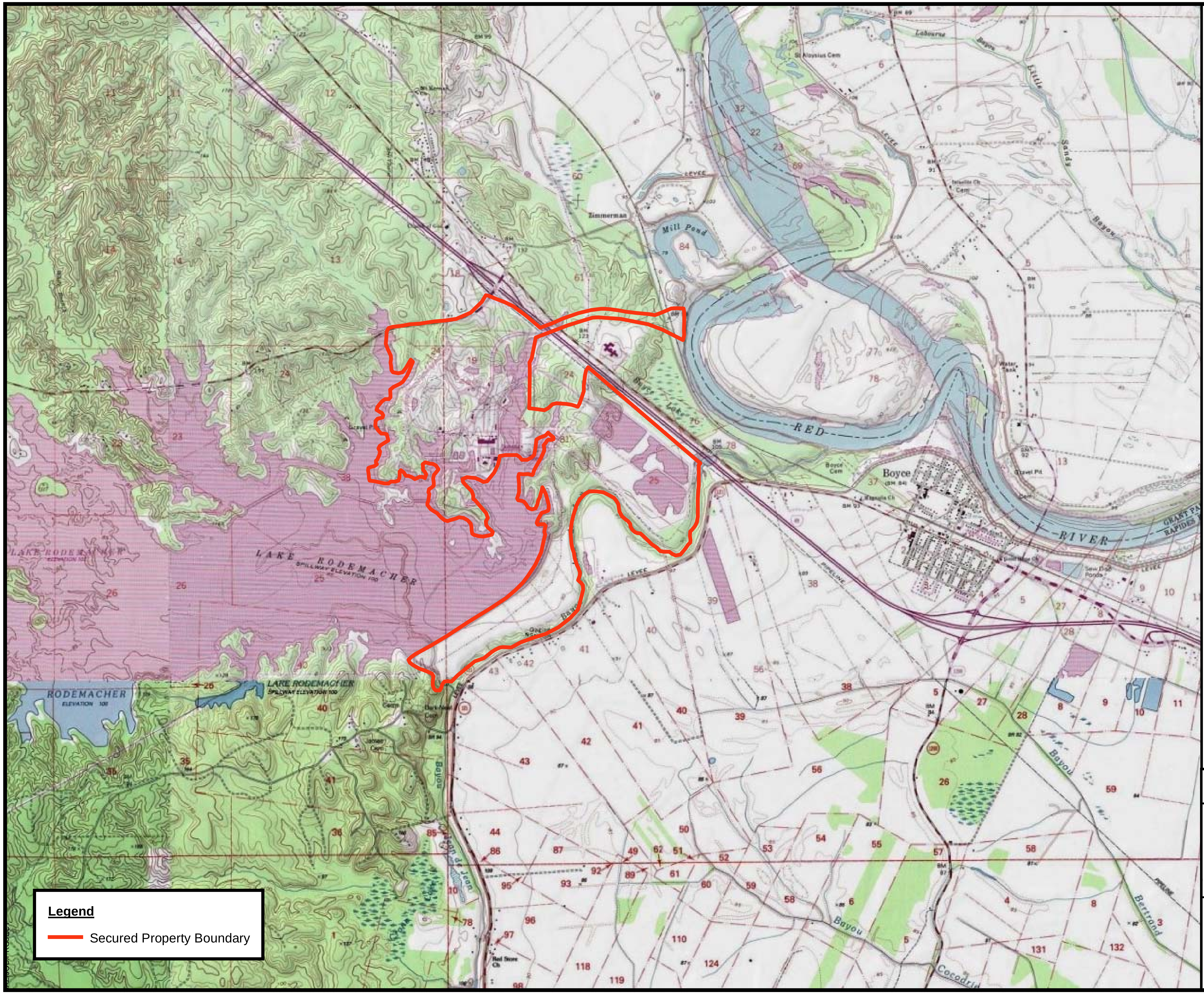
I hereby certify that the groundwater monitoring system described in this report for the Brame Energy Center, owned and operated by Cleco Power, LLC, has been designed and constructed to meet the requirements of the Coal Combustion Residual Rule 40 CFR §257.91. I am a duly licensed Professional Engineer under the laws of the State of Louisiana.

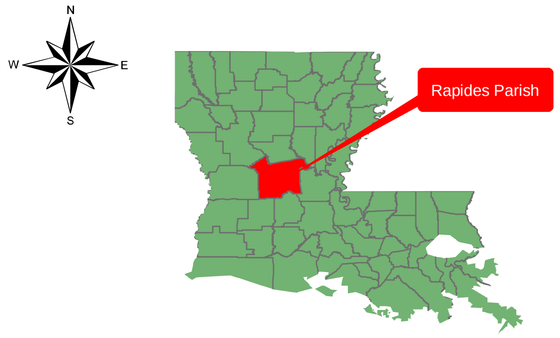
BRADLEY E. BATES
LIC. NO. 27124

________________________________, P.E.

Date: 3/7/17

Louisiana Registration No.: 27124





Reference

U.S.G.S. TOPOGRAPHIC MAPS "LENA, LOUISIANA", "BOYCE, LOUISIANA", "JERICHO, LOUISIANA", AND "GARDNER, LOUISIANA."

CLECO Power LLC

Brame Energy Center

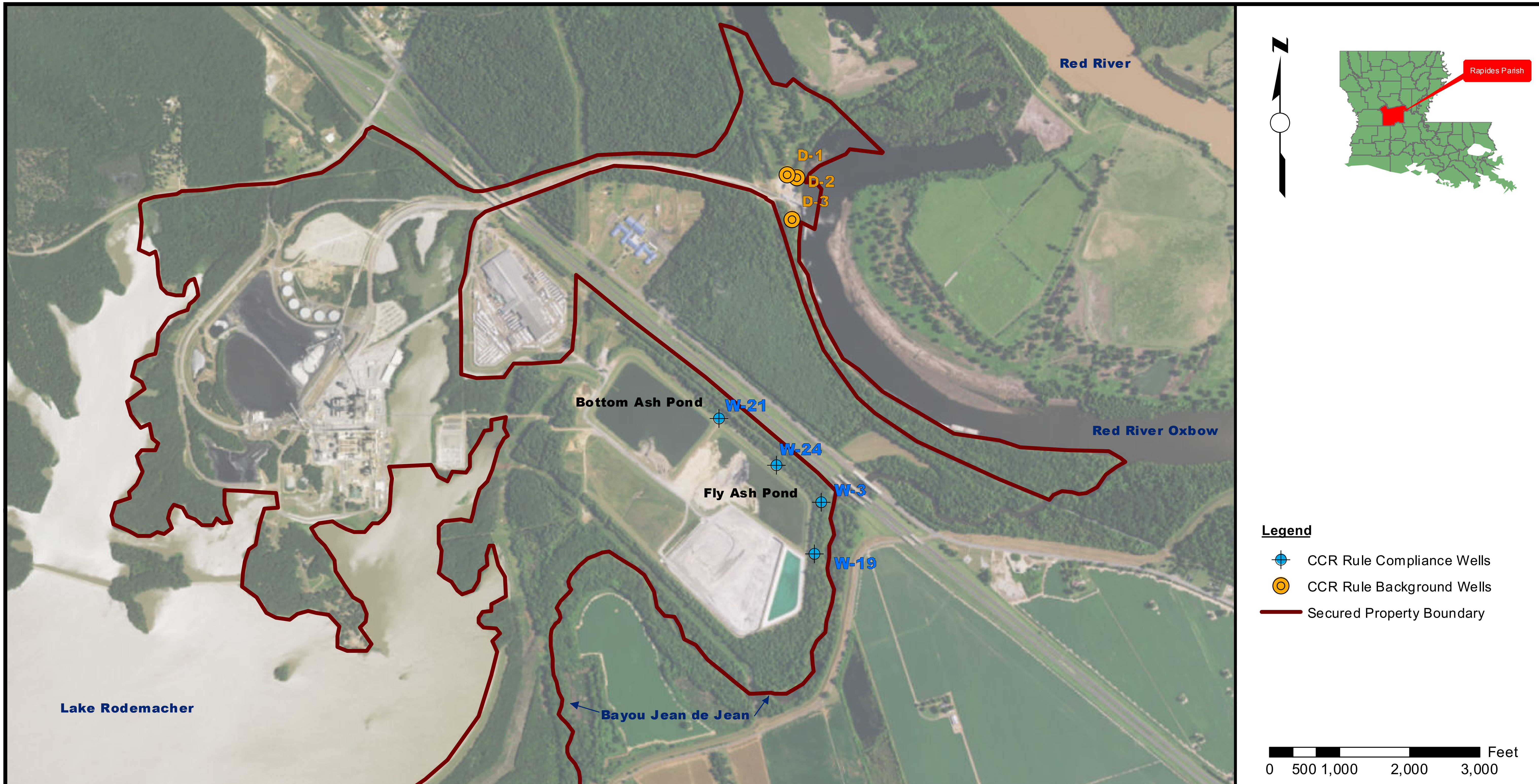
Site Location Map

Rapides Parish, Louisiana

Drawn:	jbh
Checked:	JM
Approved:	RS
Date:	11/08/10
Dwg. No.:	01-10-0071-A003

E·A·G·L·E ENVIRONMENTAL SERVICES

Figure 1



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

CLECO Power LLC

Brame Energy Center

CCR Rule
Monitoring Well Location Map

Rapides Parish, Louisiana

E·A·G·L·E ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RS
Approved:	JM
Date:	10/4/16
Dwg. No.:	01-16-0160-A003

Figure 2

Table 1
Monitoring Well Construction Data

Well Number	D-1	D-2	D-3	L-1	L-2
Background (B) or Compliance (C)	B	B	B	B	B
Latitude (dd°mm'ss")	31°24'23.84"	31°24'23.41"	31°24'17.52"	31°22'47.68"	31°22'48.17"
Longitude (dd°mm'ss")	92°41' 53.62"	92°41'52.12"	92°41'52.95"	92°42'53.61"	92°42'55.01"
Casing Elevation (ft NGVD)	99.38	99.36	97.37	86.15	86.68
Concrete Pad Elevation (ft NGVD)	96.59	97.10	94.50	83.05	83.73
Well Depth (ft bgs)	40	46	35.5	36	40
Screen Length (ft)	10	10	10	10	10
Top of Screen (ft NGVD)	67.2	61.7	69.3	58.8	54.6
Bottom of Screen (ft NGVD)	57.2	51.7	59.3	48.8	44.6
Screen Slot Size (inches)	0.010	0.010	0.010	0.010	0.010
Casing Diameter (inches) & Material	2" PVC	2" PVC	2" PVC	2" PVC	2" PVC

Well Number	W-3	W-19	W-21	W-24
Background (B) or Compliance (C)	C	C	C	C
Latitude (dd°mm'ss")	31°23'37.79"	31°23'30.48"	31°23'49.57"	31°23'43.05"
Longitude (dd°mm'ss")	92°41'48.33"	92°41'50.26"	92°42'05.00"	92°41'55.61"
Casing Elevation (ft NGVD)	92.07	94.99	87.86	83.71
Concrete Pad Elevation (ft NGVD)	88.87	92.47	85.23	81.03
Well Depth (ft bgs)	77	55	54.5	55
Screen Length (ft)	10	10	10	10
Top of Screen (ft NGVD)	25.7	48.0	41.2	38.4
Bottom of Screen (ft NGVD)	15.7	38.0	31.2	28.4
Screen Slot Size (inches)	0.010	0.010	0.010	0.010
Casing Diameter (inches) & Material	2" PVC	2" PVC	2" PVC	2" PVC

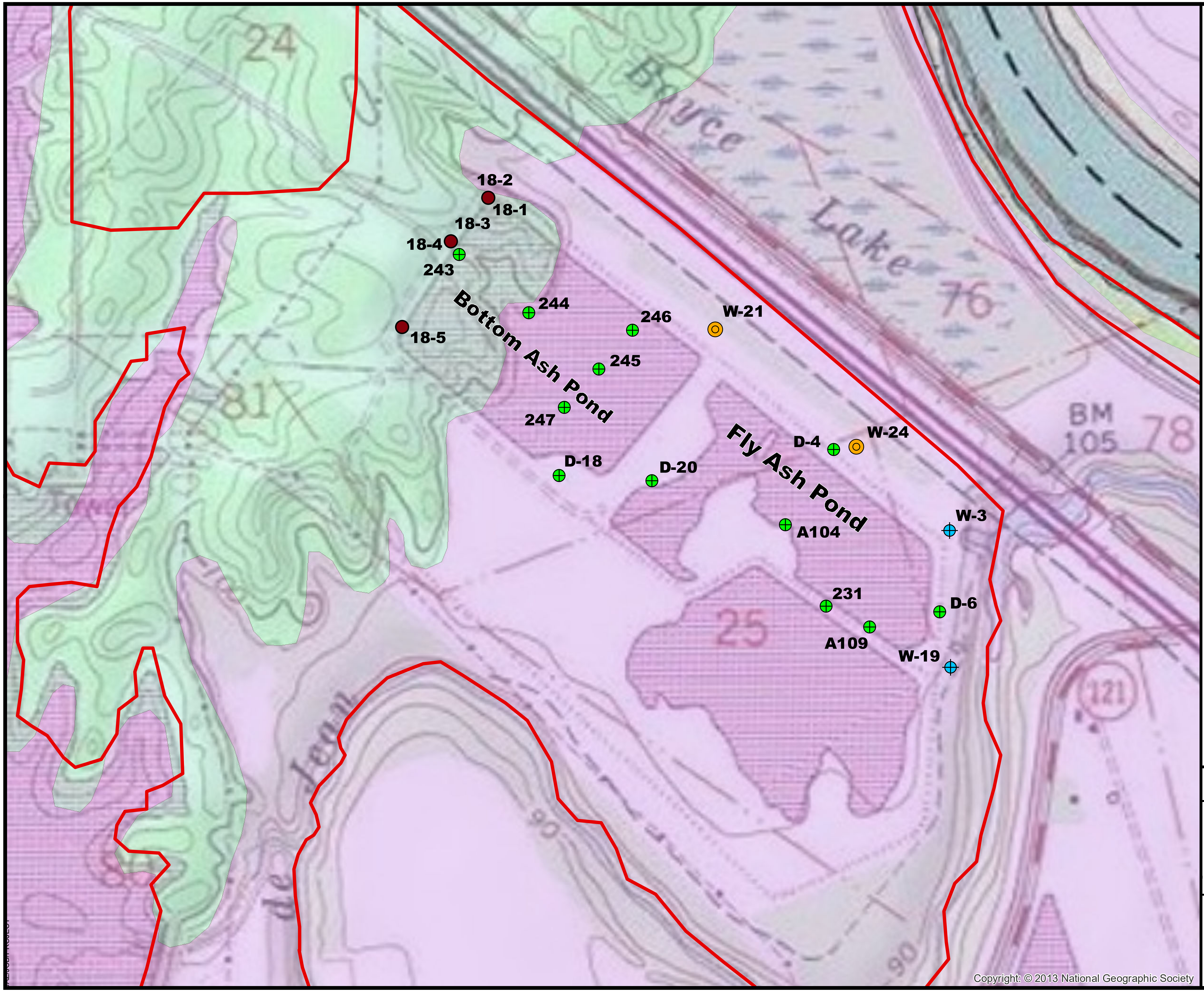
Notes:

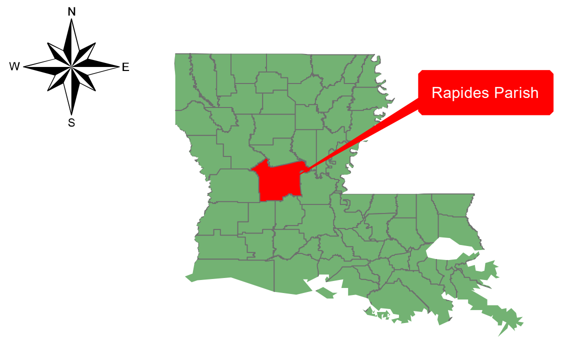
bgs = below ground surface

PVC = polyvinyl chloride

APPENDIX C

MONITORING WELL DETAILS AND SOIL BORING LOGS





Terraces

🟧 Qtp - Prairie Terrace
🟥 Mfcb - Carnahan Bayou Member
🟩 Qth - High Terrace
🟦 Qti - Intermediate Terrace

Alluvial

🟪 Qal - Alluvium; Qnl - Natural Levees

Wells

⊕ Boring Locations (Sargent & Lundy,1981)
● Boring Locations (Eagle, 2018)
⊕ Compliance Monitoring Well
◎ Background Monitoring Well

0 200 400 800 1,200 Feet

Reference

U.S.G.S. TOPOGRAPHIC MAPS "LENA, LOUISIANA", "BOYCE, LOUISIANA", "JERICHO, LOUISIANA", AND "GARDNER, LOUISIANA."

CLECO Power LLC
Brame Energy Center

Geomorphology Features with Boring Locations

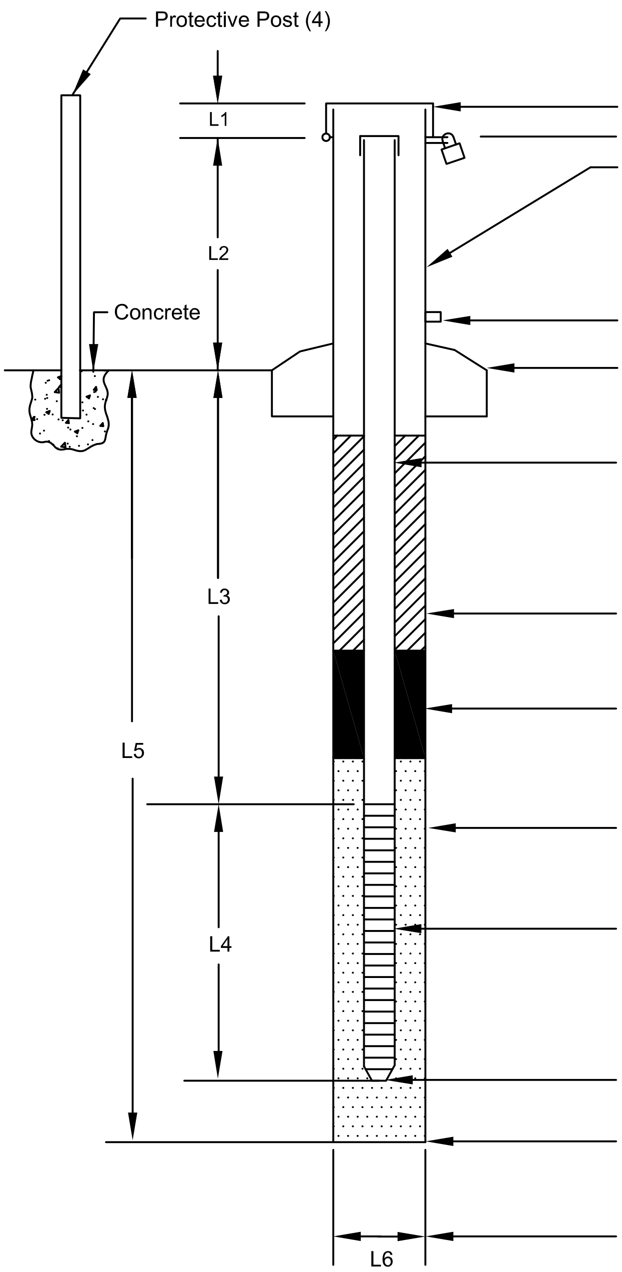
Rapides Parish, Louisiana

EAGLE
ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RS
Approved:	RS
Date:	8/23/18
Dwg. No.:	01-20-0220-APP-C-1

Figure C-1

Monitoring Well Construction Diagram
Above Grade Well



Lockable Cap	
Casing Elevation	92.12 ft NAVD88
Protective Casing and Concrete	
Casing Material	neat cement
Casing Diameter	4"
Casing Length	3.5'
Pad Dimensions	4'x4'
Height Above Ground	3.3'
Drain with Threaded Plug	
Concrete Slab Elevation	88.97'
Well Casing	
Material	PVC
Diameter	2"
Joint Type	flush thread
Length	67'
Backfill Around Casing	
Material	neat cement
Seal	
Type Of Seal	bentonite
Filter Pack	
Type Of Filter	sand pack
Well Screen	
Screen Material	PVC
Diameter	2"
Length	10'
Slot Size	.010"
Depth To Bottom Of Monitoring Well	77'
Depth To Bottom Of Filter Sand	77'
Diameter Of Borehole	8"

Cross-Sectional View

Project: Brame Energy Center

Project No: 01-14-0136

Monitoring Well: **W-3**

Diagram Not To Scale

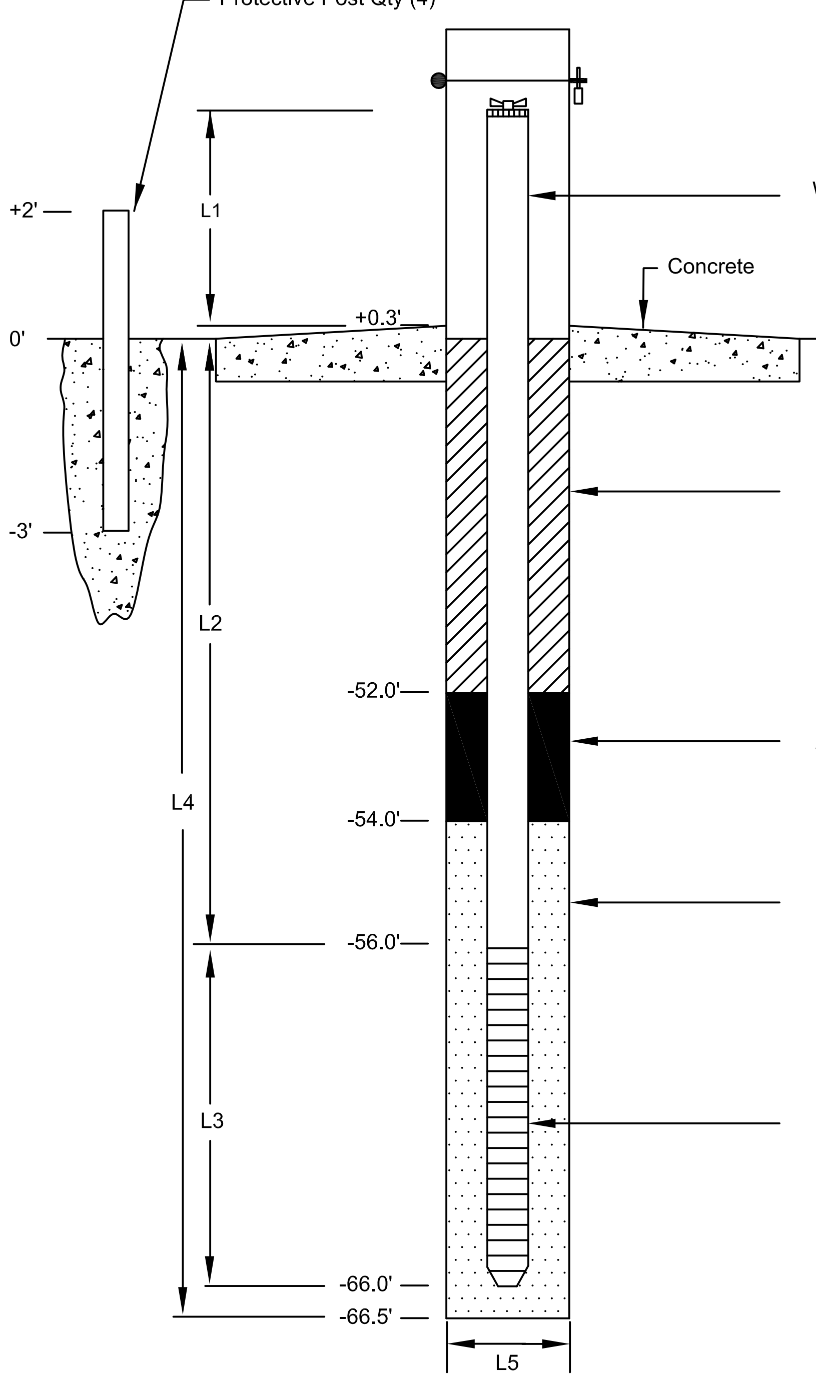
L1 = 0.2 Ft
L2 = 3.3 Ft
L3 = 67 Ft
L4 = 10 Ft
L5 = 77 Ft
L6 = 0.75 Ft

CLECO

File No: 01-14-0136-W3

Monitoring Well - W-14

Monitoring Well Construction Diagram
Above Grade Well
Cross-Sectional View



Well Casing	145.06 ft NAVD88
Material	PVC
Diameter	2"
Joint Type	Flush Thread
Length	58.83'
Ground Surface	142.48'
Backfill Around Casing	
Material	Cement-Bentonite Grout
Thickness	52.0' Thick
Seal	
Type Of Seal	Bentonite Pellet Crumbles
Thickness	2'
Filter Pack	
Type Of Filter	20/40 Sand Pack
Distance Above Screen	2' Fine Sand
Well Screen	
Screen Material	PVC
Diameter	2"
Length	10'
Slot Size	0.01"

Project: Brame Energy Center

Project No: 01-16-0162

Monitoring Well: **W-14**

Diagram Not To Scale

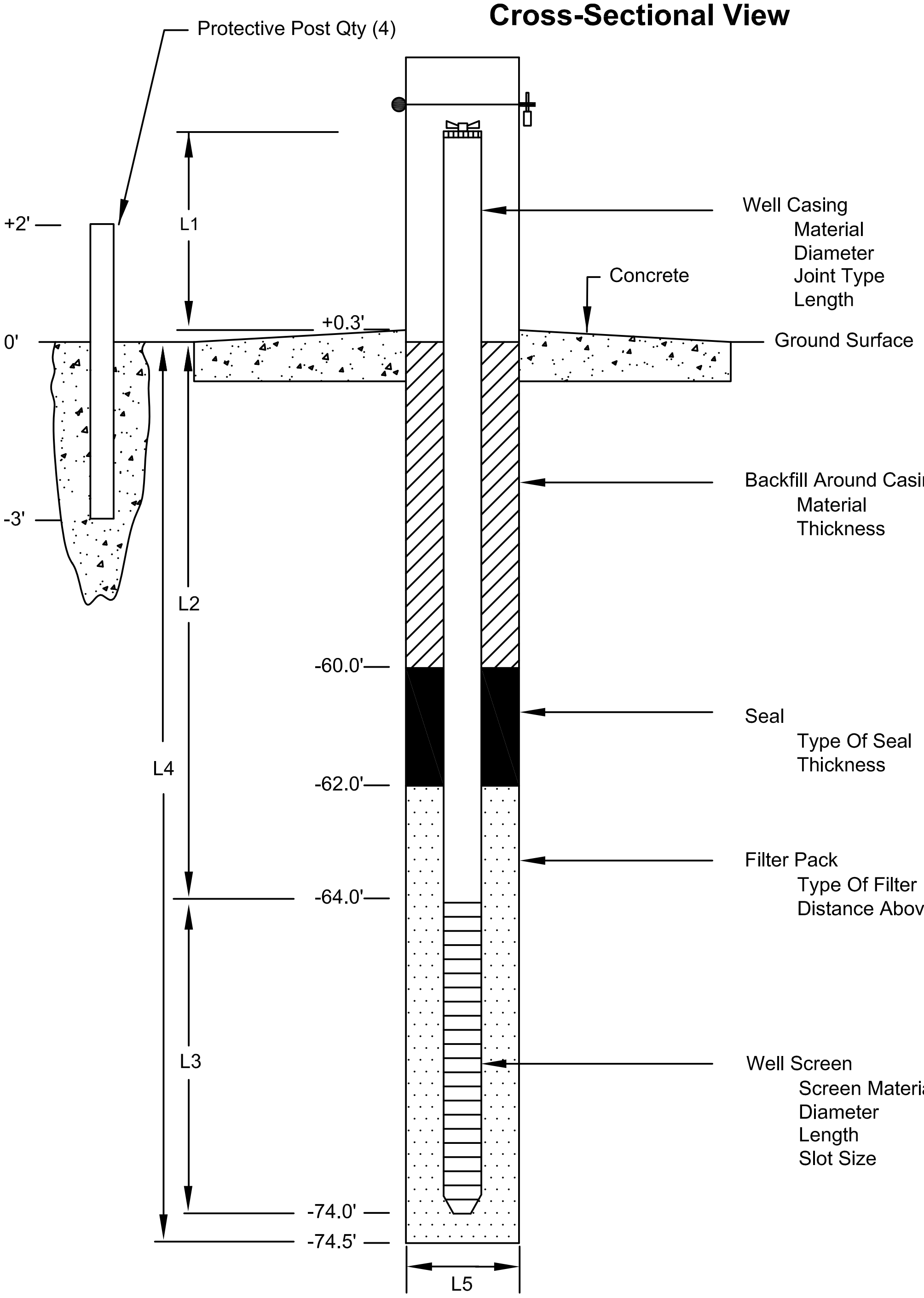
L1 = 2.53 Ft
L2 = 56.0 Ft
L3 = 10 Ft
L4 = 66.5 Ft
L5 = 0.75 Ft.

CLECO

File No: 01-16-0162-W14

Monitoring Well - W-15

Monitoring Well Construction Diagram
Above Grade Well
Cross-Sectional View



Well Casing 94.95 ft NAVD88
Material PVC
Diameter 2"
Joint Type Flush Thread
Length 66.88'

Ground Surface 92.36'

Backfill Around Casing
Material Cement-Bentonite Grout
Thickness 60.0' Thick

Seal
Type Of Seal Bentonite Pellet Crumbles
Thickness 2'

Filter Pack
Type Of Filter 20/40 Sand Pack
Distance Above Screen 2' Fine Sand

Well Screen
Screen Material PVC
Diameter 2"
Length 10'
Slot Size 0.01"

Project: Brame Energy Center
Project No: 01-16-0162
Monitoring Well: **W-15**
Diagram Not To Scale

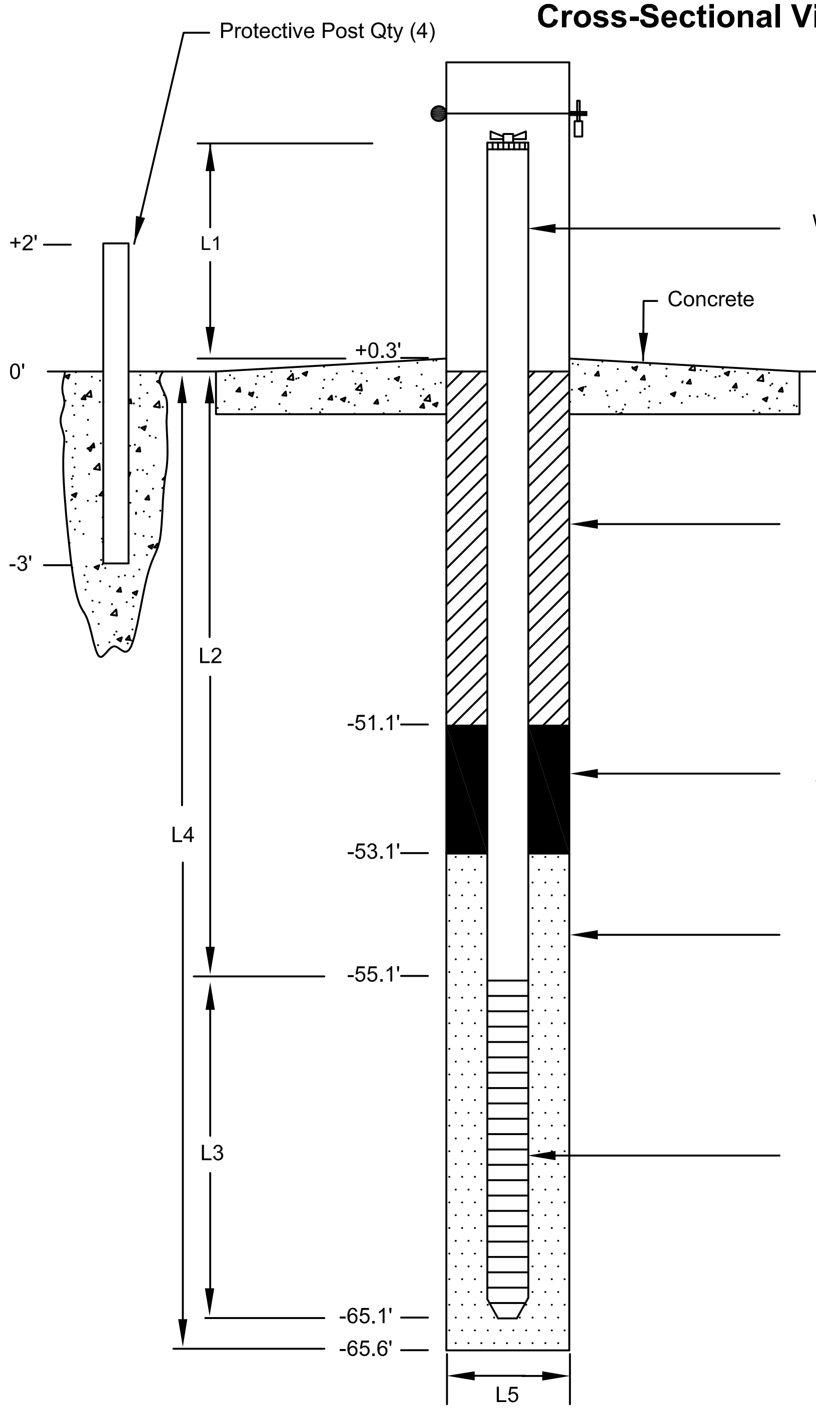
L1 = 2.58 Ft
L2 = 64.0 Ft
L3 = 10 Ft
L4 = 74.5 Ft
L5 = 0.75 Ft.

CLECO

File No: 01-16-0162-W15

Monitoring Well - W-16

Monitoring Well Construction Diagram
Above Grade Well
Cross-Sectional View



Well Casing	98.32 ft NAVD88
Material	PVC
Diameter	2"
Joint Type	Flush Thread
Length	57.7'
Ground Surface	96.04'
Backfill Around Casing	
Material	Cement-Bentonite Grout
Thickness	51.1' Thick
Seal	
Type Of Seal	Bentonite Pellet Crumbles
Thickness	2'
Filter Pack	
Type Of Filter	20/40 Sand Pack
Distance Above Screen	2' Fine Sand
Well Screen	
Screen Material	PVC
Diameter	2"
Length	10'
Slot Size	0.01"

Project: Brame Energy Center

Project No: 01-16-0162

Monitoring Well: **W-16**

Diagram Not To Scale

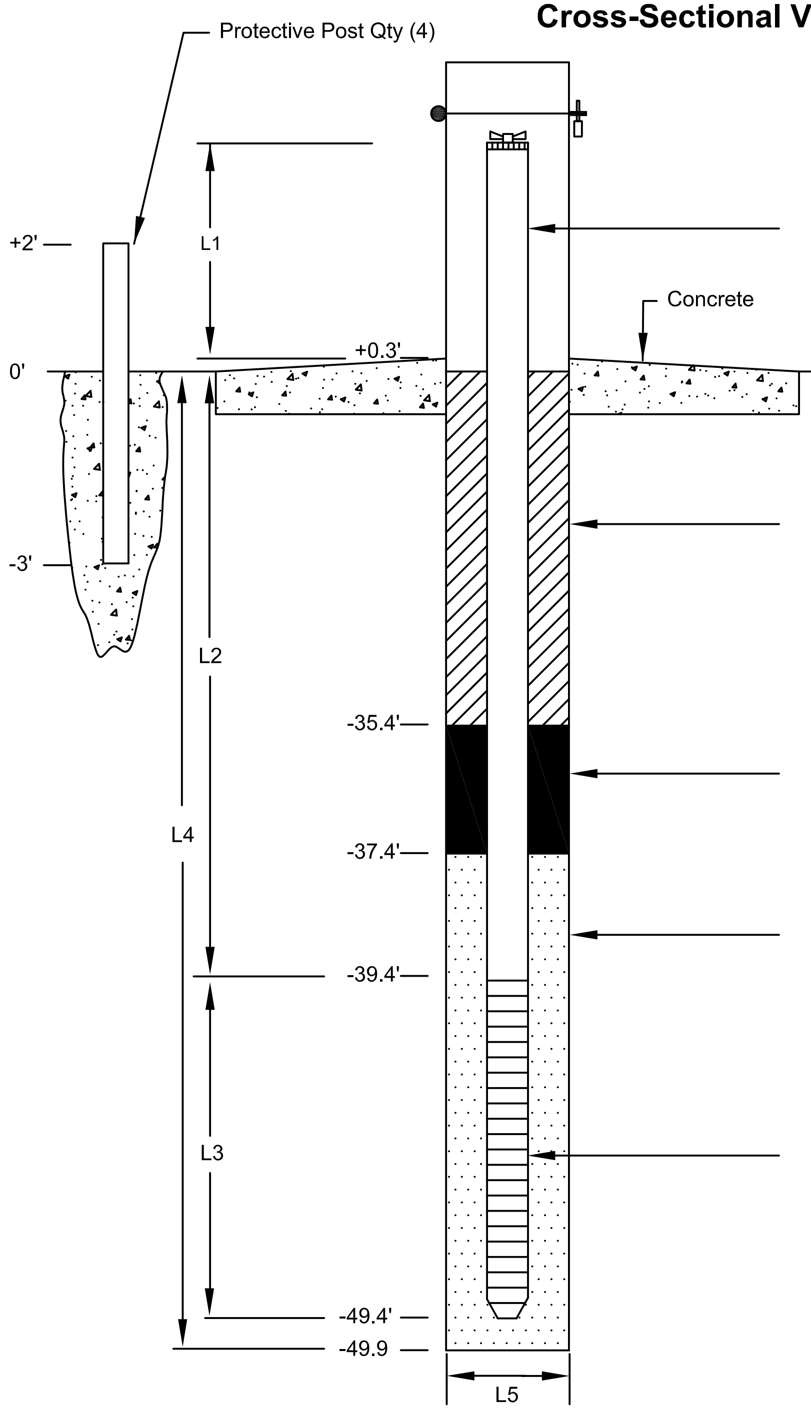
L1 = 2.30 Ft
L2 = 55.1 Ft
L3 = 10 Ft
L4 = 65.6 Ft
L5 = 0.75 Ft.

CLECO

File No: 01-16-0162-W16

Monitoring Well - W-17

Monitoring Well Construction Diagram
Above Grade Well
Cross-Sectional View



Well Casing: 94.77 ft NAVD88
Material: PVC
Diameter: 2"
Joint Type: Flush Thread
Length: 42.45'

Ground Surface: 91.99'

Backfill Around Casing
Material: Cement-Bentonite Grout
Thickness: 35.4' Thick

Seal
Type Of Seal: Bentonite Pellet Crumbles
Thickness: 2'

Filter Pack
Type Of Filter: 20/40 Sand Pack
Distance Above Screen: 2' Fine Sand

Well Screen
Screen Material: PVC
Diameter: 2"
Length: 10'
Slot Size: 0.01"

Project: Brame Energy Center

Project No: 01-16-0162

Monitoring Well: **W-17**

Diagram Not To Scale

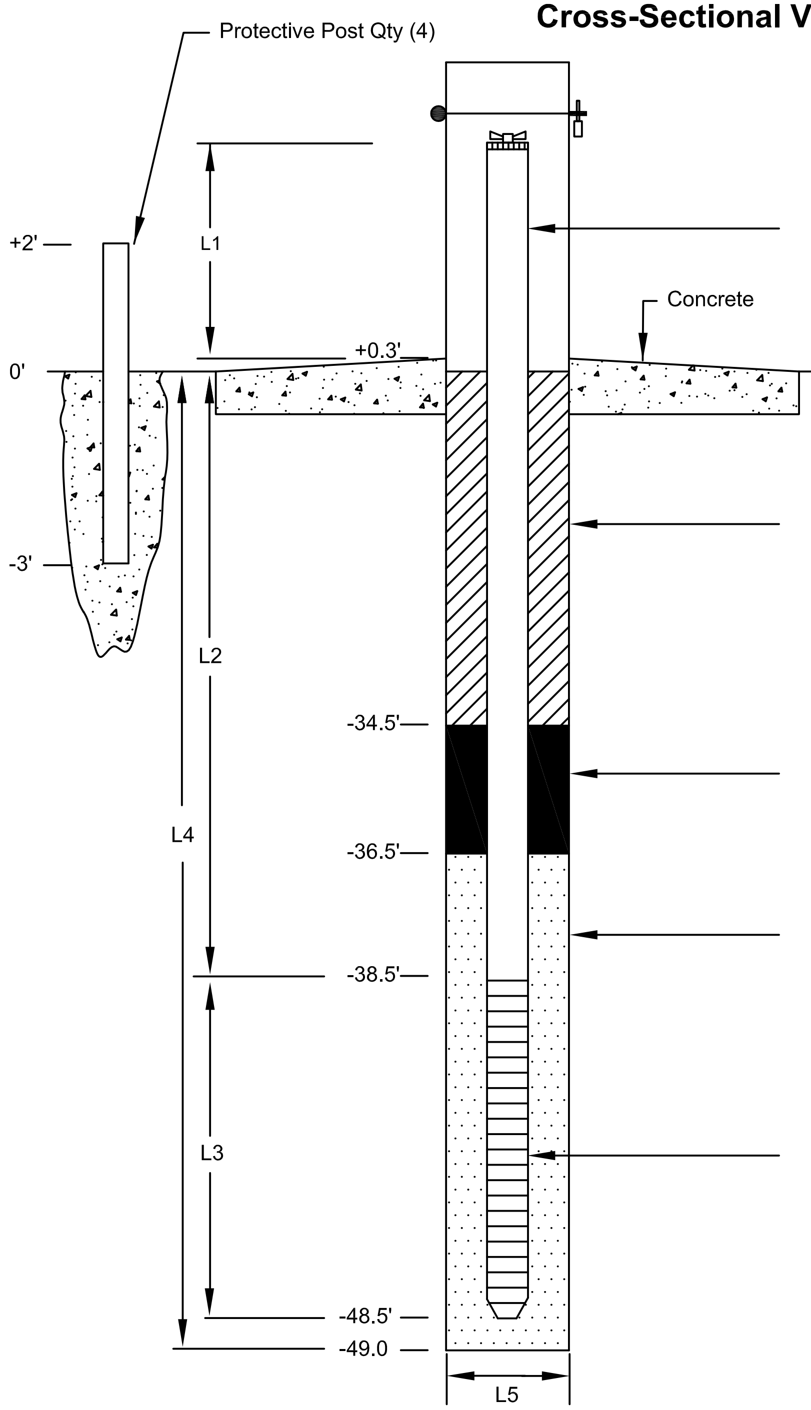
L1 = 2.75 Ft
L2 = 39.4 Ft
L3 = 10 Ft
L4 = 49.9 Ft
L5 = 0.75 Ft.

CLECO

File No: 01-16-0162-W17

Monitoring Well - W-18

Monitoring Well Construction Diagram
Above Grade Well
Cross-Sectional View



Well Casing	95.61 ft NAVD88
Material	PVC
Diameter	2"
Joint Type	Flush Thread
Length	41.56'
Ground Surface	92.9'

Backfill Around Casing	
Material	Cement-Bentonite Grout
Thickness	34.5' Thick

Seal	
Type Of Seal	Bentonite Pellet Crumbles
Thickness	2'

Filter Pack	
Type Of Filter	20/40 Sand Pack
Distance Above Screen	2' Fine Sand

Well Screen	
Screen Material	PVC
Diameter	2"
Length	10'
Slot Size	0.01"

Project: Brame Energy Center

Project No: 01-16-0162

Monitoring Well: **W-18**

Diagram Not To Scale

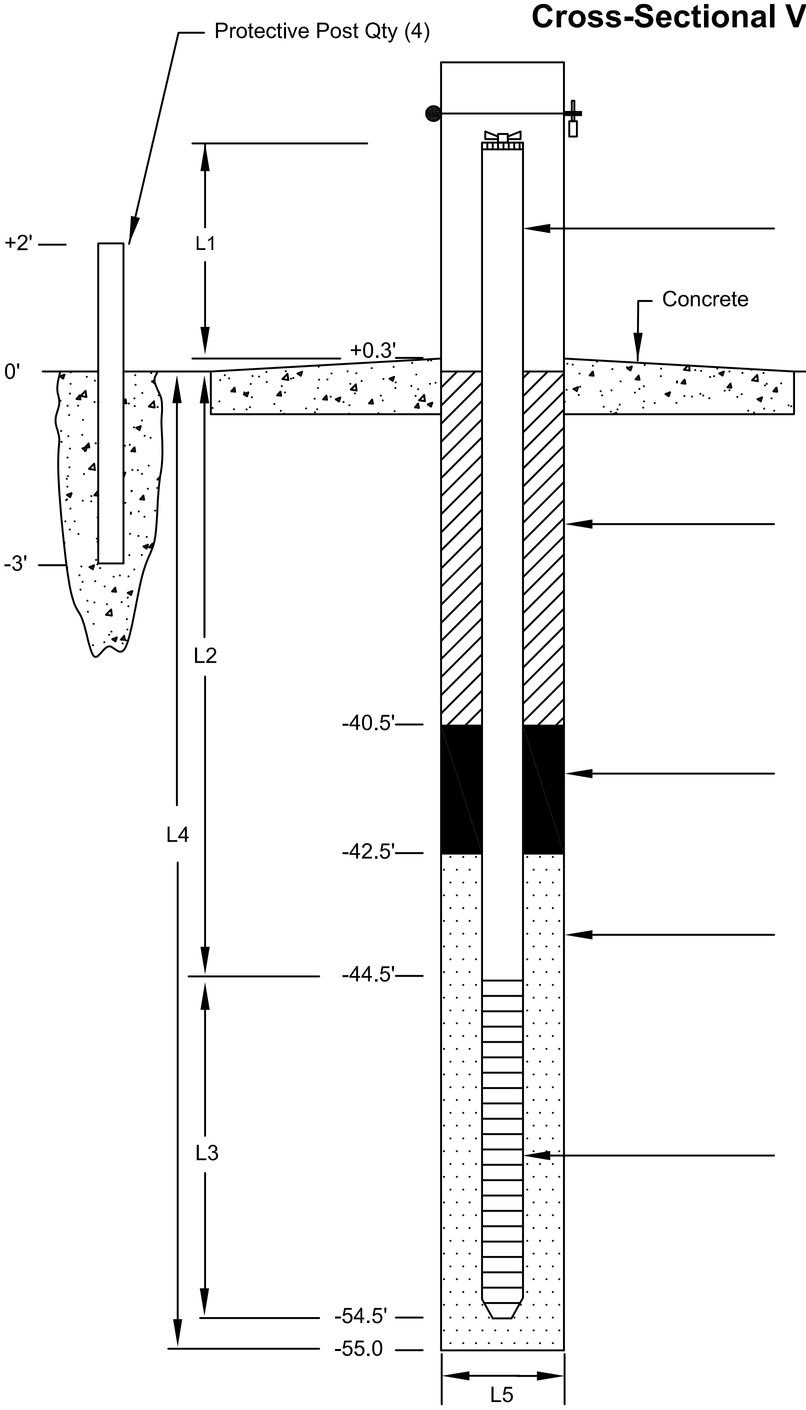
L1 = 2.76 Ft
L2 = 38.5 Ft
L3 = 10 Ft
L4 = 49.0 Ft
L5 = 0.75 Ft.

CLECO

File No: 01-16-0162-W18

Monitoring Well - W-19

Monitoring Well Construction Diagram
Above Grade Well
Cross-Sectional View



Well Casing	94.99 ft NAVD88
Material	PVC
Diameter	2"
Joint Type	Flush Thread
Length	47.28'
Ground Surface	92.47'
Backfill Around Casing	
Material	Cement-Bentonite Grout
Thickness	40.5' Thick
Seal	
Type Of Seal	Bentonite Pellet Crumbles
Thickness	2'
Filter Pack	
Type Of Filter	20/40 Sand Pack
Distance Above Screen	2' Fine Sand
Well Screen	
Screen Material	PVC
Diameter	2"
Length	10'
Slot Size	0.01"

Project: Brame Energy Center

Project No: 01-14-0136

Monitoring Well: **W-19**

Diagram Not To Scale

L1 = 2.48 Ft
L2 = 44.5 Ft
L3 = 10 Ft
L4 = 55.0 Ft
L5 = 0.75 Ft.

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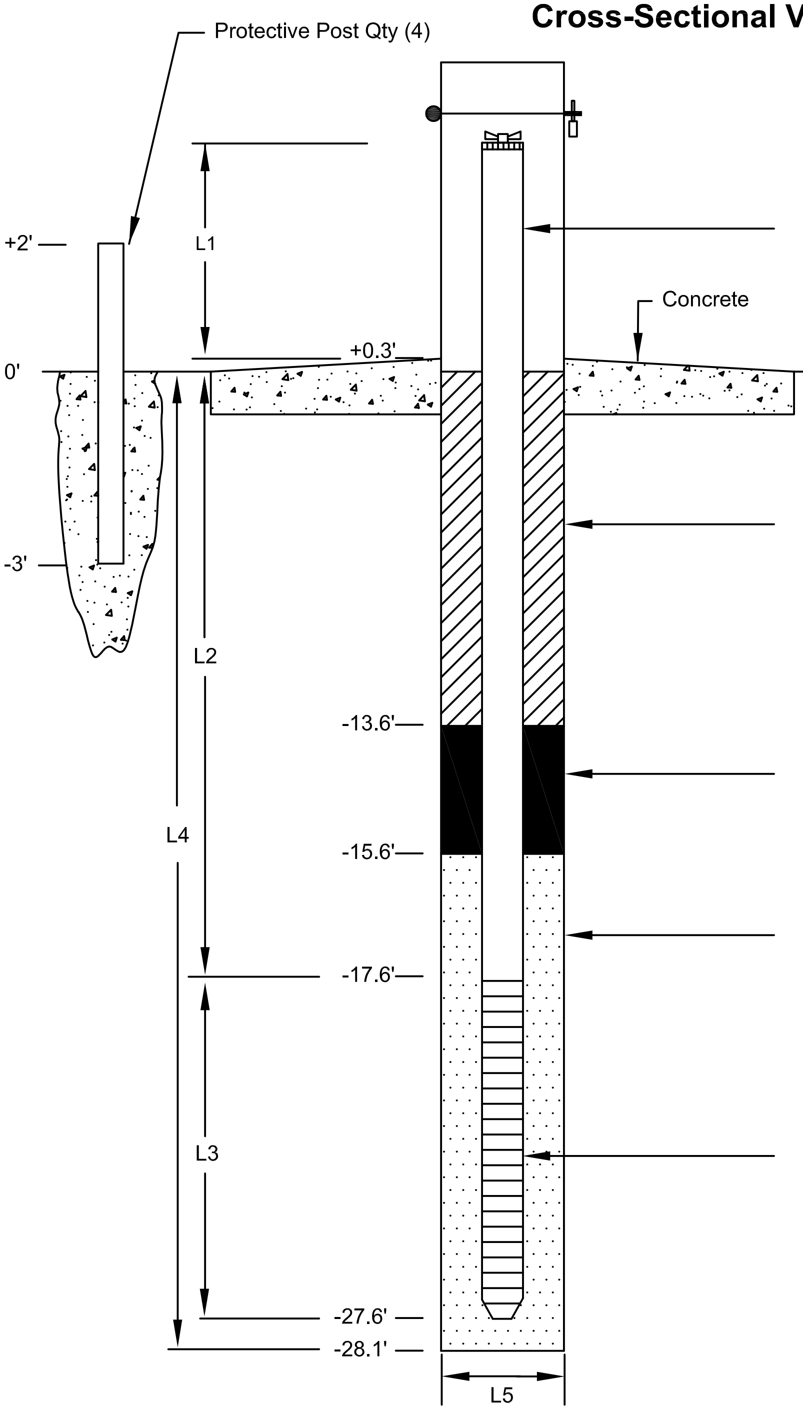
ENVIRONMENTAL SERVICES, INC.

File No: 01-14-0136-W19

Monitoring Well - W-20

Monitoring Well Construction Diagram
Above Grade Well
Cross-Sectional View



Well Casing	116.68 ft NAVD88
Material	PVC
Diameter	2"
Joint Type	Flush Thread
Length	17.77'
Ground Surface	113.99'
Backfill Around Casing	
Material	Cement-Bentonite Grout
Thickness	10.7' Thick
Seal	
Type Of Seal	Bentonite Pellet Crumbles
Thickness	2'
Filter Pack	
Type Of Filter	20/40 Sand Pack
Distance Above Screen	2' Fine Sand
Well Screen	
Screen Material	PVC
Diameter	2"
Length	10'
Slot Size	0.01"

Project: Brame Energy Center

Project No: 01-16-0162

Monitoring Well: **W-20**

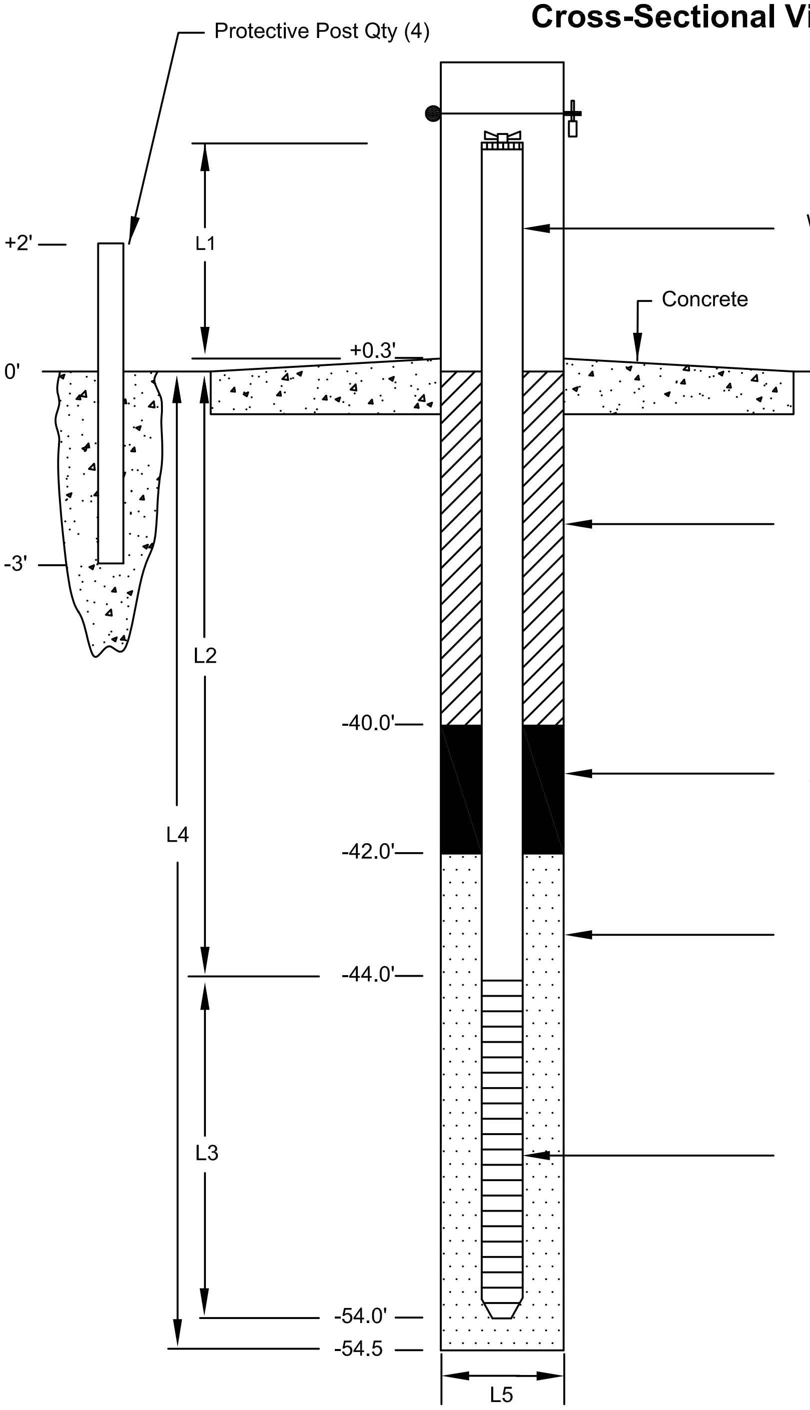
Diagram Not To Scale

L1 = 2.67 Ft
L2 = 14.8 Ft
L3 = 10 Ft
L4 = 28.1 Ft
L5 = 0.75 Ft.

File No: 01-16-0162-W20

Monitoring Well - W-21

Monitoring Well Construction Diagram
Above Grade Well
Cross-Sectional View



Well Casing	87.86 ft NAVD88
Material	PVC
Diameter	2"
Joint Type	Flush Thread
Length	46.89'
Ground Surface	85.23'
Backfill Around Casing	
Material	Cement-Bentonite Grout
Thickness	40.0' Thick
Seal	
Type Of Seal	Bentonite Pellet Crumbles
Thickness	2'
Filter Pack	
Type Of Filter	20/40 Sand Pack
Distance Above Screen	2' Fine Sand
Well Screen	
Screen Material	PVC
Diameter	2"
Length	10'
Slot Size	0.01"

Project: Brame Energy Center

Project No: 01-14-0136

Monitoring Well: **W-21**

Diagram Not To Scale

L1 = 2.59 Ft
L2 = 44.0 Ft
L3 = 10 Ft
L4 = 54.5 Ft
L5 = 0.75 Ft.

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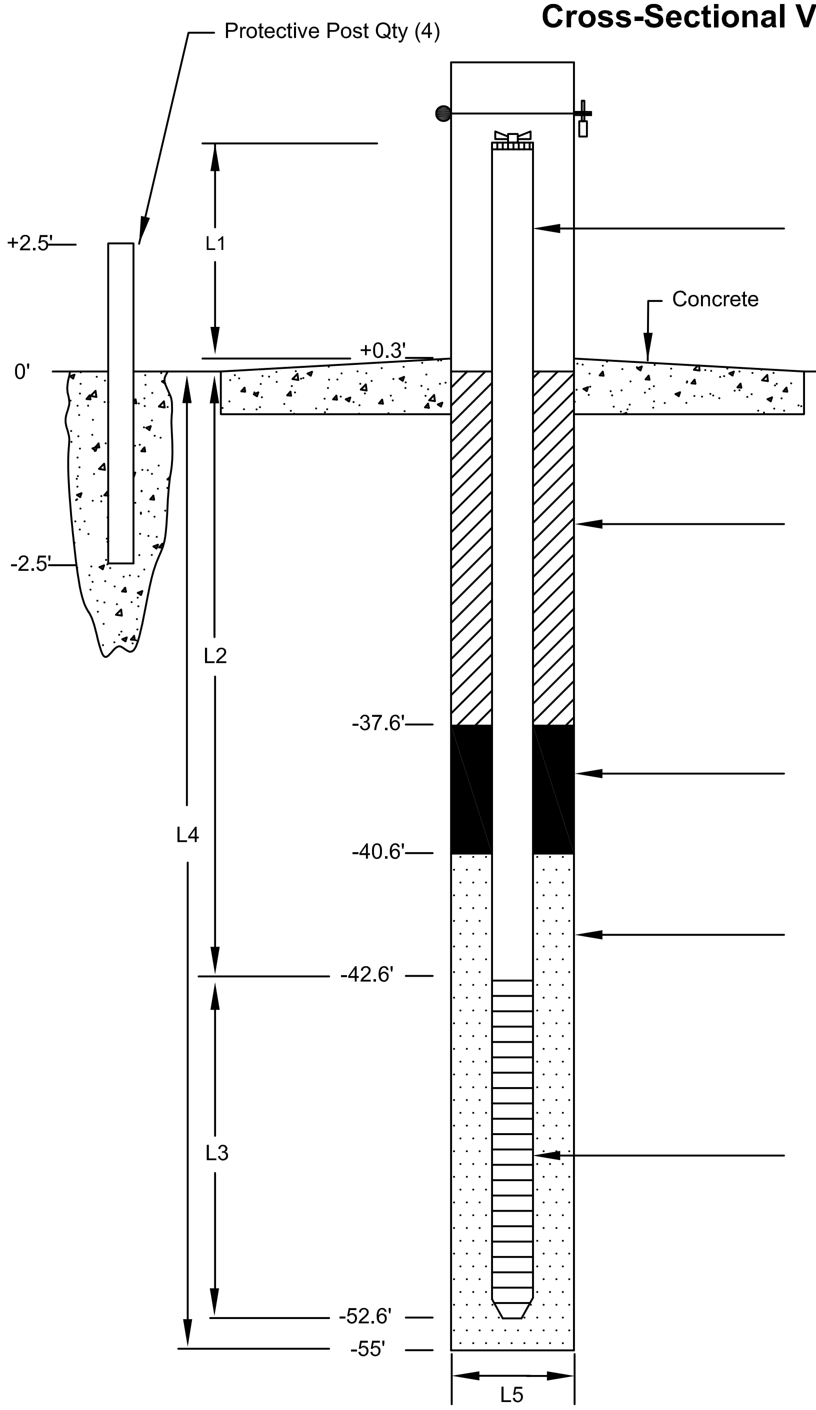
ENVIRONMENTAL SERVICES, INC.

File No: 01-14-0136-W21

Monitoring Well - W-24

Monitoring Well Construction Diagram
Above Grade Well
Cross-Sectional View



Well Casing	83.71 ft NAVD88
Material	PVC
Diameter	2"
Joint Type	Flush Thread
Length	2.68'
Ground Surface	81.03' NAVD 88
Backfill Around Casing	
Material	Cement-Bentonite Grout
Thickness	37.6' Thick
Seal	
Type Of Seal	Bentonite Pellet Crumbles
Thickness	3'
Filter Pack	
Type Of Filter	20/40 Sand Pack
Distance Above Screen	2' Fine Sand
Well Screen	
Screen Material	PVC
Diameter	2"
Length	10'
Slot Size	0.01"

Project: Brame Energy Center

Project No: 01-16-0162

Monitoring Well: **W-24**

Diagram Not To Scale

L1 = 2.68 Ft

L2 = 42.6 Ft

L3 = 10 Ft

L4 = 55 Ft

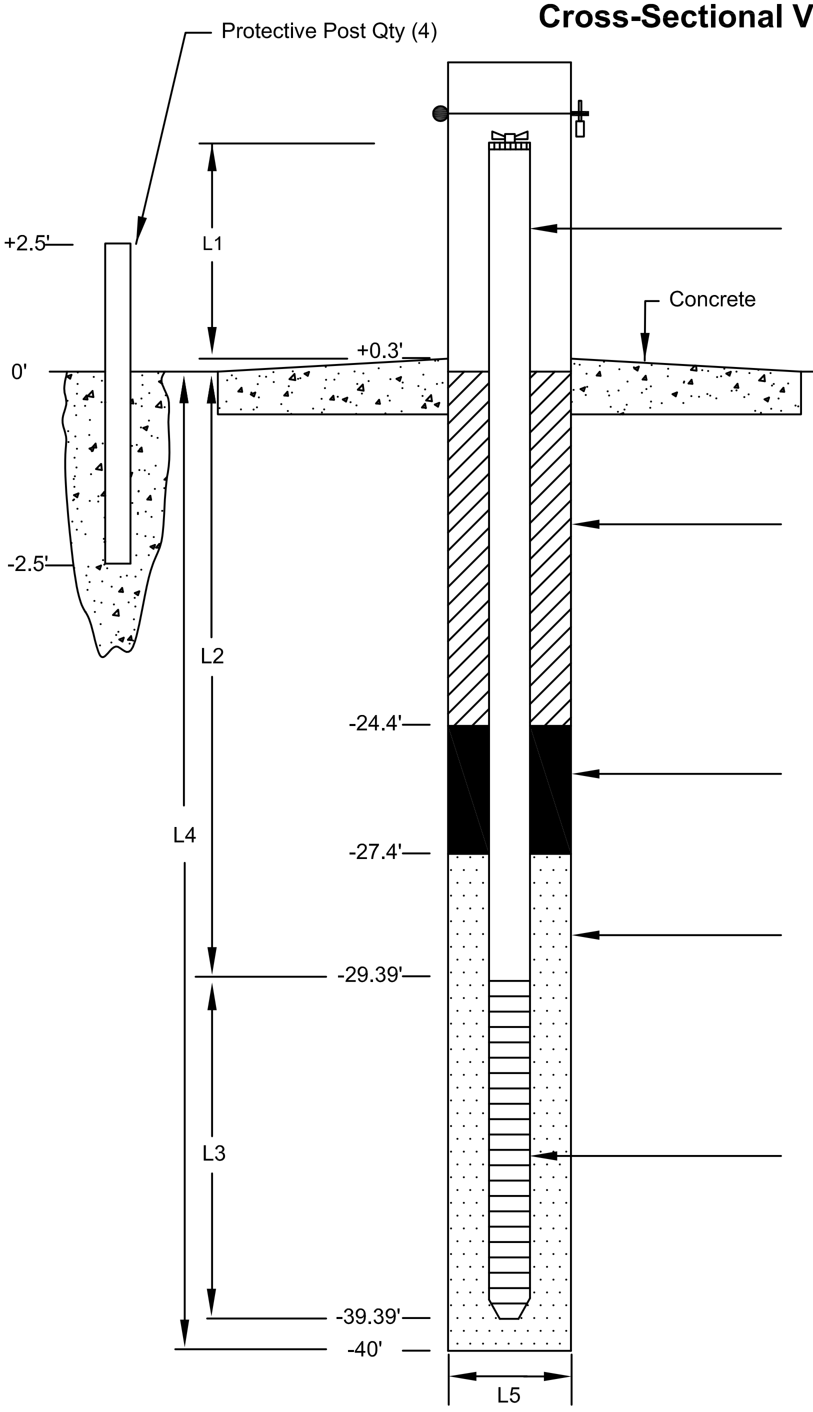
L5 = 0.75 Ft.

CLECO

File No: 01-16-0162-W-24

Monitoring Well - D-1

Monitoring Well Construction Diagram
Above Grade Well
Cross-Sectional View



Well Casing 99.38 ft NAVD88
Material PVC
Diameter 2"
Joint Type Flush Thread
Length 2.79'

Ground Surface 96.59' NAVD 88

Backfill Around Casing
Material Cement-Bentonite Grout
Thickness 24.4' Thick

Seal
Type Of Seal Bentonite Pellet Crumbles
Thickness 3'

Filter Pack
Type Of Filter 20/40 Sand Pack
Distance Above Screen 2' Fine Sand

Well Screen
Screen Material PVC
Diameter 2"
Length 10'
Slot Size 0.01"

Project: Brame Energy Center
Project No: 01-16-0162
Monitoring Well: **D-1**

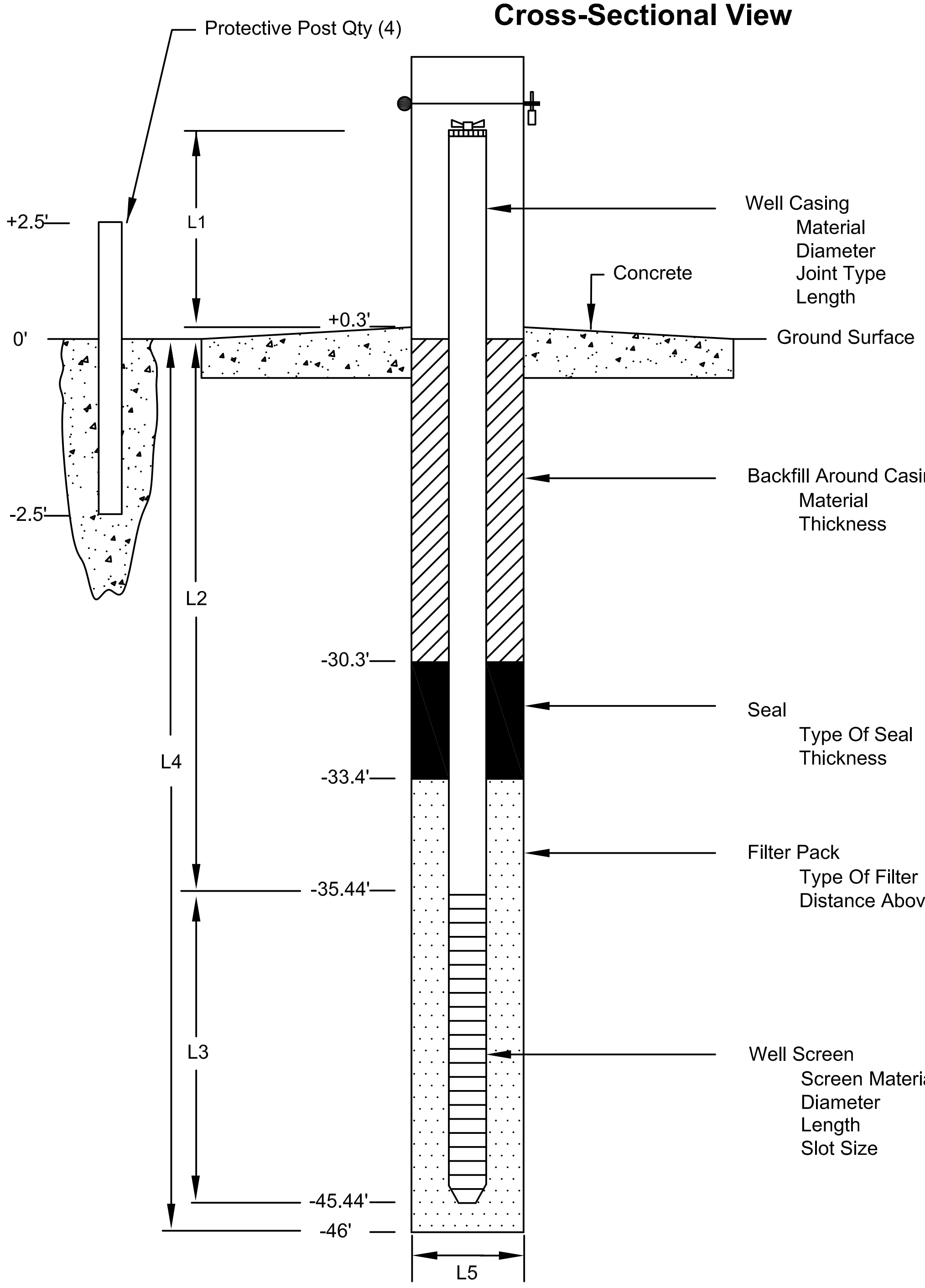
Diagram Not To Scale

L1 = 2.79 Ft
L2 = 29.39 Ft
L3 = 10 Ft
L4 = 40.0 Ft
L5 = 0.75 Ft.

File No: 01-16-0162-D-1

Monitoring Well - D-2

Monitoring Well Construction Diagram
Above Grade Well
Cross-Sectional View



Well Casing	99.36 ft NAVD88
Material	PVC
Diameter	2"
Joint Type	Flush Thread
Length	2.26'
Ground Surface	97.10' NAVD 88
Backfill Around Casing	
Material	Cement-Bentonite Grout
Thickness	30.3' Thick
Seal	
Type Of Seal	Bentonite Pellet Crumbles
Thickness	3'
Filter Pack	
Type Of Filter	20/40 Sand Pack
Distance Above Screen	2' Fine Sand
Well Screen	
Screen Material	PVC
Diameter	2"
Length	10'
Slot Size	0.01"

Project: Brame Energy Center

Project No: 01-16-0162

Monitoring Well: **D-2**

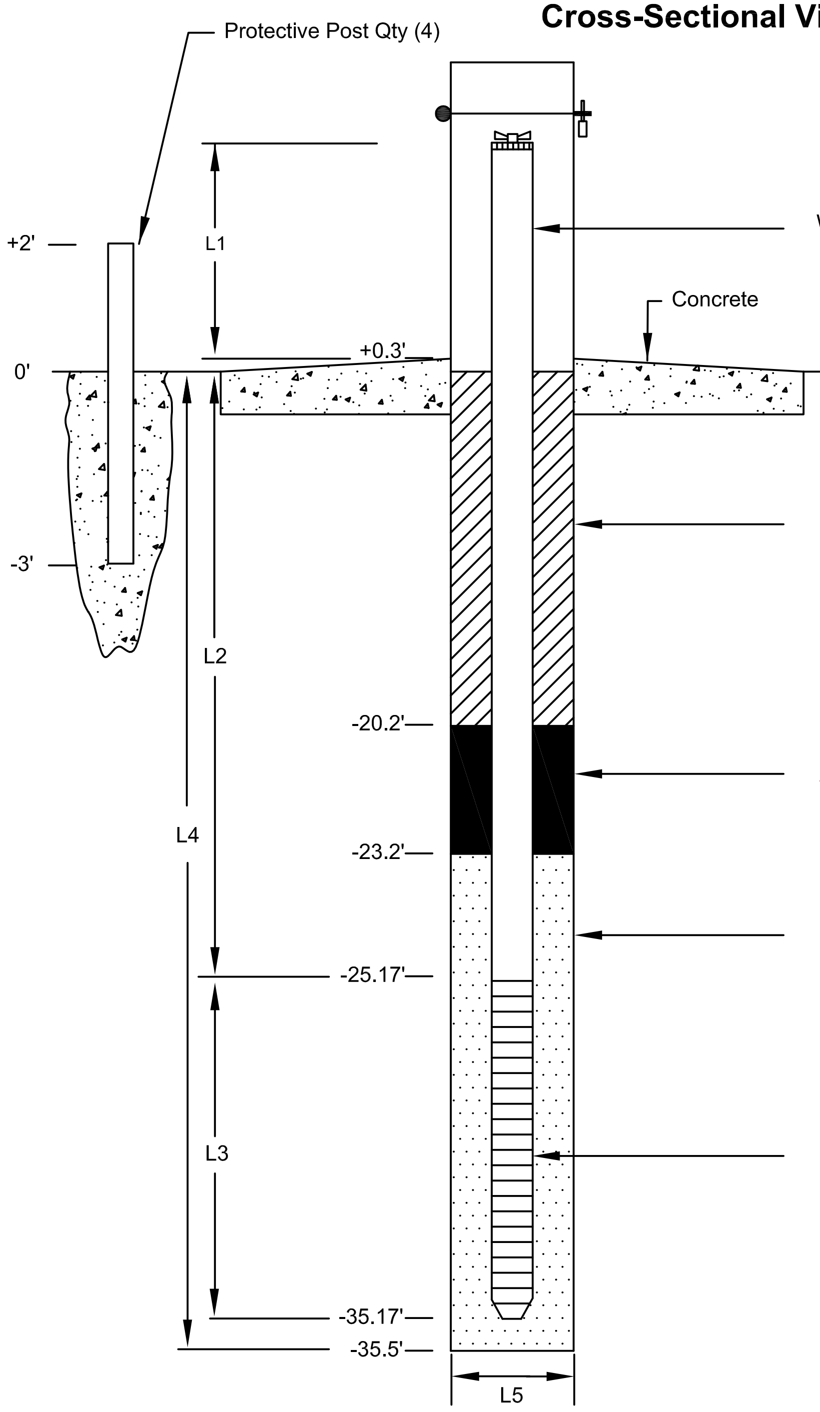
Diagram Not To Scale

L1 = 2.77 Ft
L2 = 35.44 Ft
L3 = 10 Ft
L4 = 46 Ft
L5 = 0.75 Ft.

CLECO

Monitoring Well - D-3

Monitoring Well Construction Diagram
Above Grade Well
Cross-Sectional View



Well Casing	97.37 ft NAVD88
Material	PVC
Diameter	2"
Joint Type	Flush Thread
Length	2.87'
Ground Surface	94.50' NAVD 88
Backfill Around Casing	
Material	Cement-Bentonite Grout
Thickness	20.2' Thick
Seal	
Type Of Seal	Bentonite Pellet Crumbles
Thickness	3'
Filter Pack	
Type Of Filter	20/40 Sand Pack
Distance Above Screen	2' Fine Sand
Well Screen	
Screen Material	PVC
Diameter	2"
Length	10'
Slot Size	0.01"

Project: Brame Energy Center

Project No: 01-16-0162

Monitoring Well: **D-3**

Diagram Not To Scale

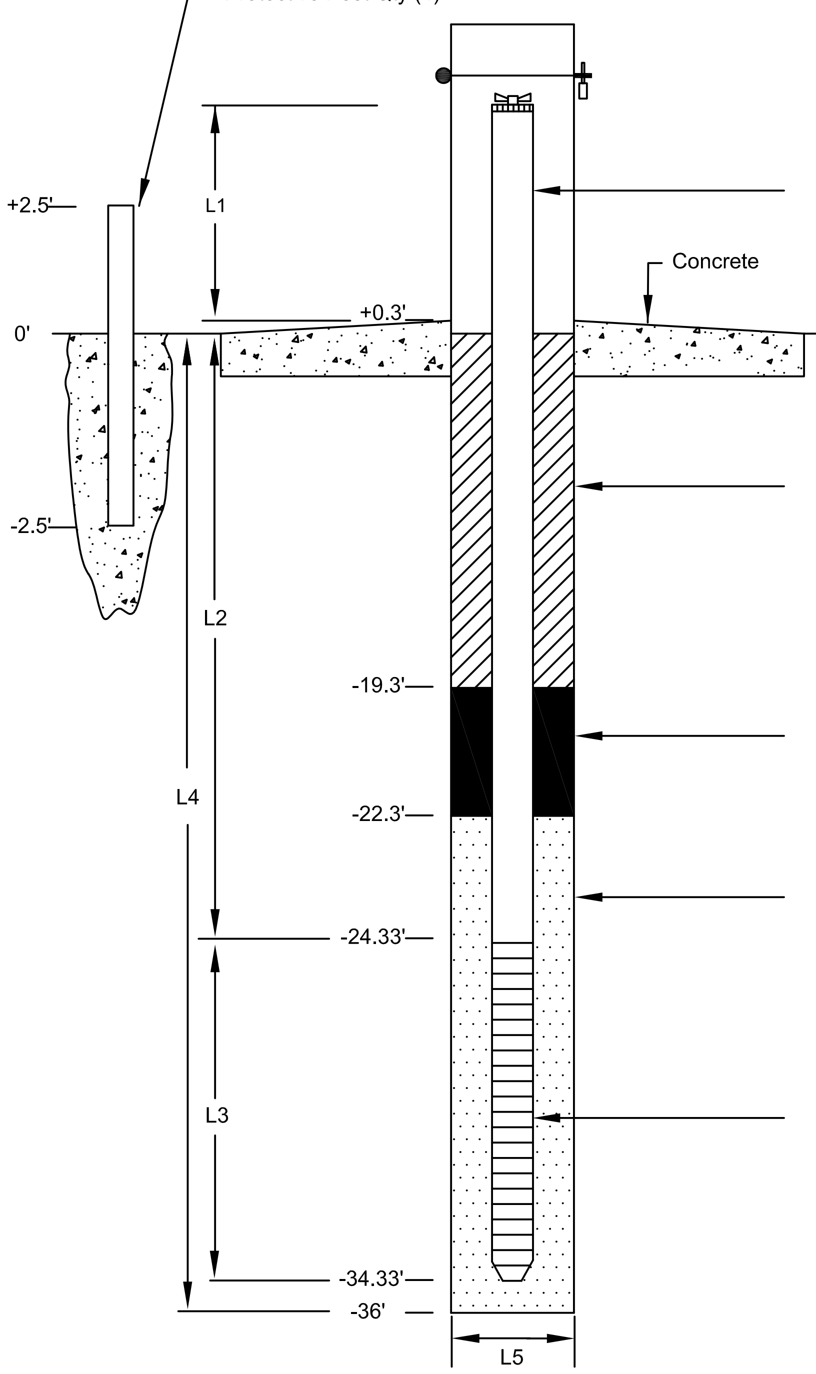
L1 = 2.87 Ft
L2 = 25.17 Ft
L3 = 10 Ft
L4 = 35.5 Ft
L5 = 0.75 Ft.

CLECO

File No: 01-16-0162-D-3

Monitoring Well - L-1

Monitoring Well Construction Diagram
Above Grade Well
Cross-Sectional View



Well Casing	86.15 ft NAVD88
Material	PVC
Diameter	2"
Joint Type	Flush Thread
Length	3.10'
Ground Surface	83.05' NAVD 88
Backfill Around Casing	
Material	Cement-Bentonite Grout
Thickness	19.3' Thick
Seal	
Type Of Seal	Bentonite Pellet Crumbles
Thickness	3'
Filter Pack	
Type Of Filter	20/40 Sand Pack
Distance Above Screen	2' Fine Sand
Well Screen	
Screen Material	PVC
Diameter	2"
Length	10'
Slot Size	0.01"

Project: Brame Energy Center

Project No: 01-16-0162

Monitoring Well: **L-1**

Diagram Not To Scale

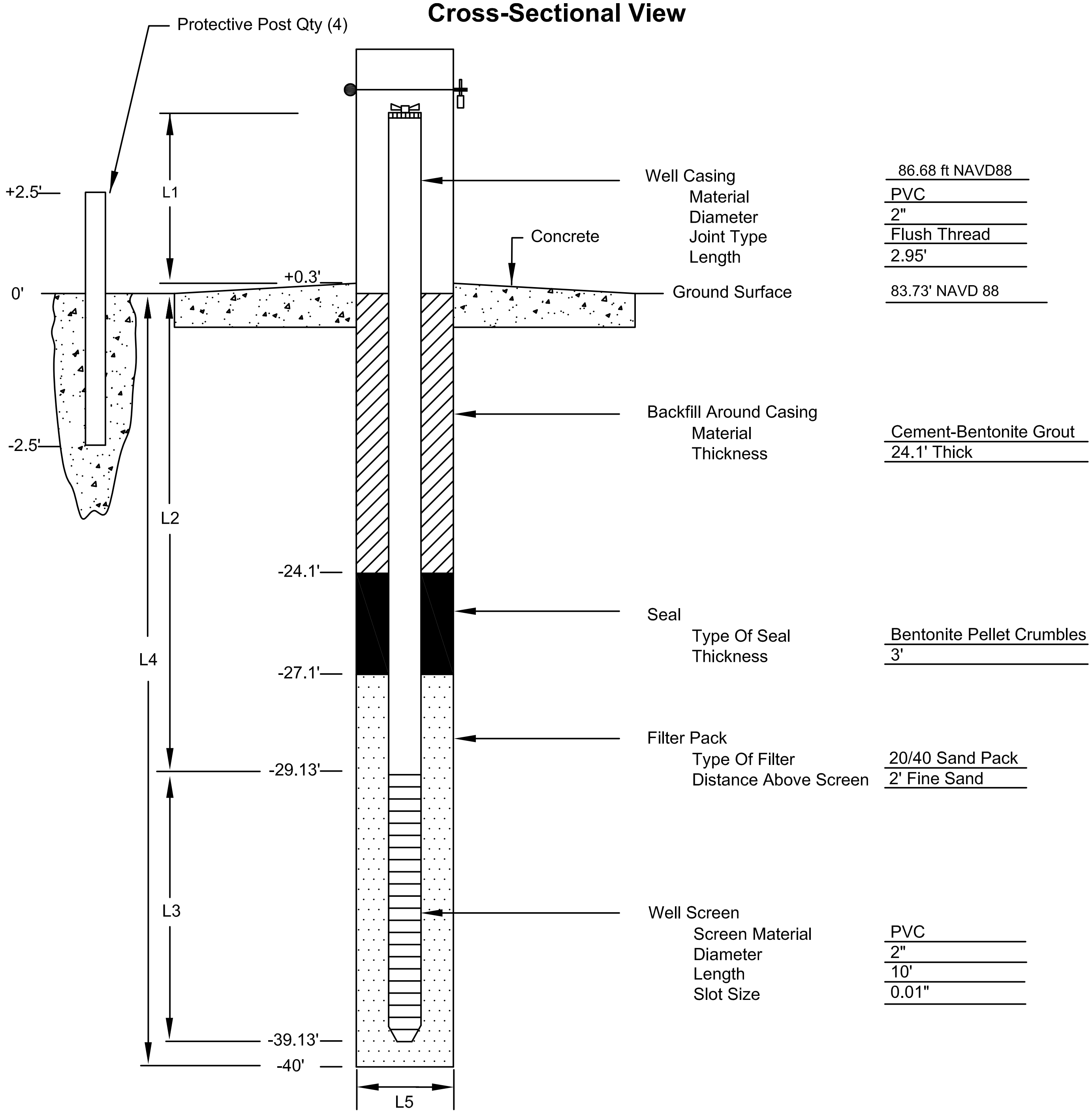
L1 = 3.1 Ft
L2 = 24.3 Ft
L3 = 10 Ft
L4 = 36 Ft
L5 = 0.75 Ft.

CLECO

File No: 01-16-0162-L-1

Monitoring Well - L-2

Monitoring Well Construction Diagram
Above Grade Well
Cross-Sectional View



Well Casing	86.68 ft NAVD88
Material	PVC
Diameter	2"
Joint Type	Flush Thread
Length	2.95'
Ground Surface	83.73' NAVD 88
Backfill Around Casing	
Material	Cement-Bentonite Grout
Thickness	24.1' Thick
Seal	
Type Of Seal	Bentonite Pellet Crumbles
Thickness	3'
Filter Pack	
Type Of Filter	20/40 Sand Pack
Distance Above Screen	2' Fine Sand
Well Screen	
Screen Material	PVC
Diameter	2"
Length	10'
Slot Size	0.01"

Project: Brame Energy Center

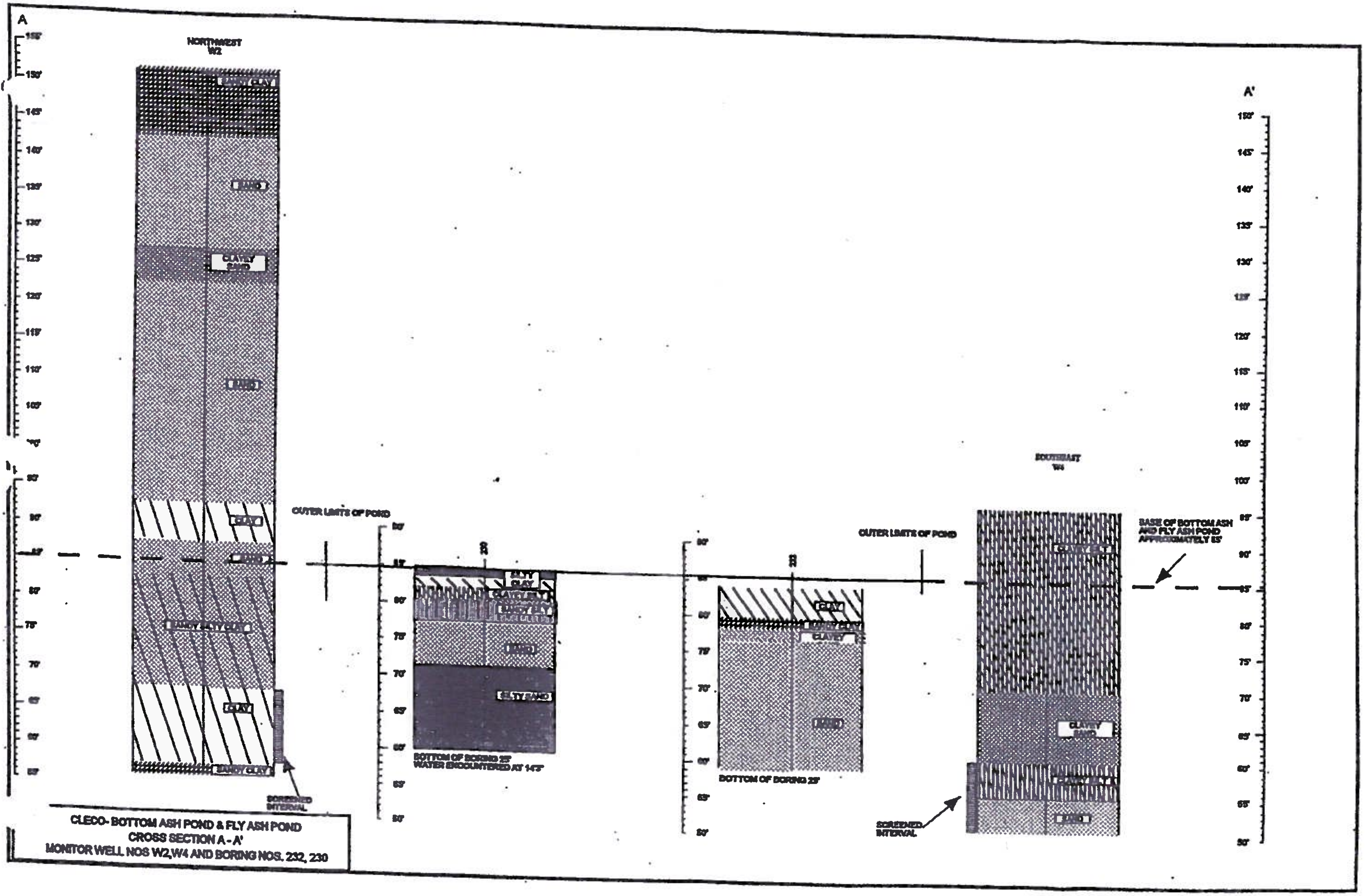
Project No: 01-16-0162

Monitoring Well: **L-2**

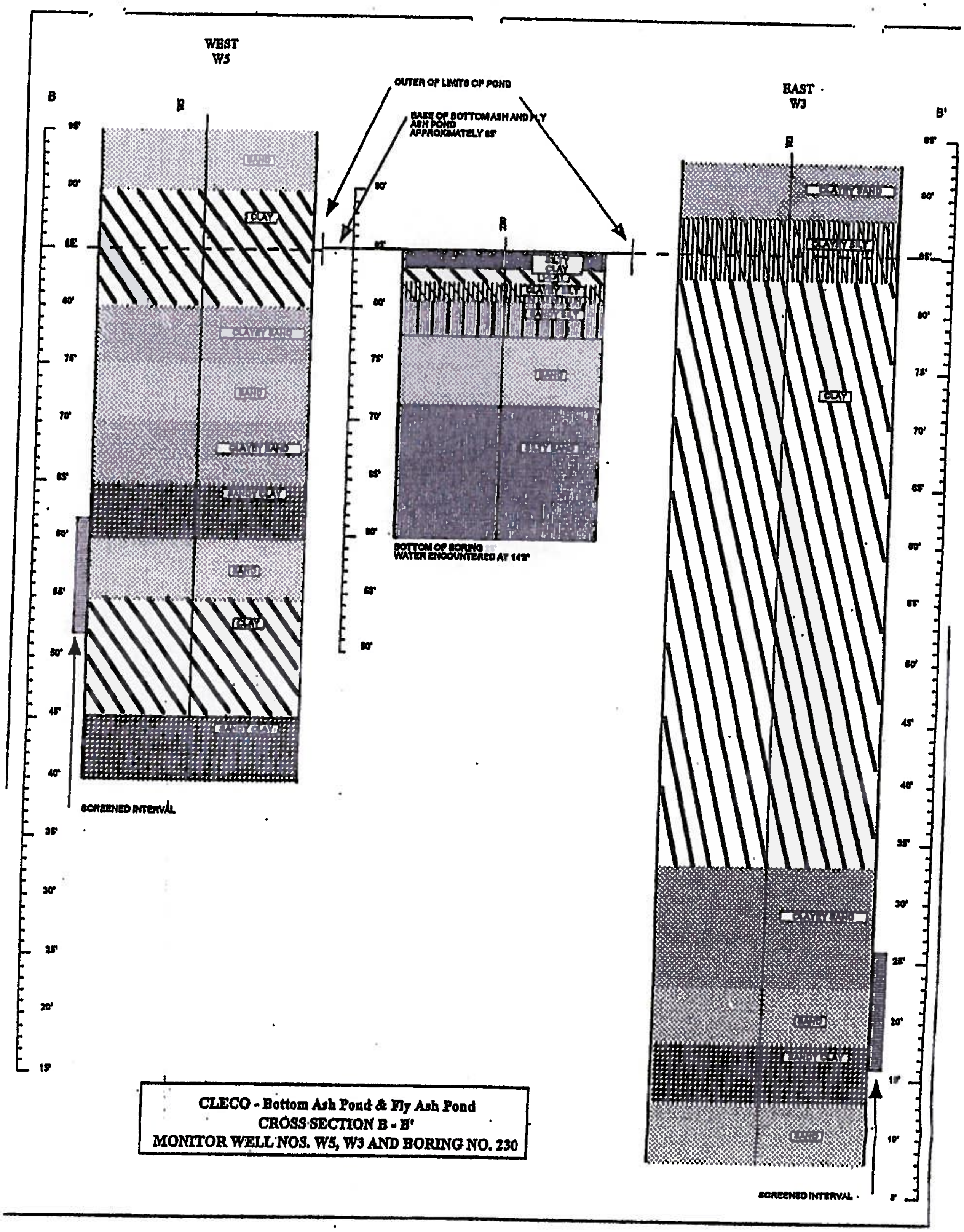
Diagram Not To Scale

L1 = 2.95 Ft
L2 = 29.13 Ft
L3 = 10 Ft
L4 = 40 Ft
L5 = 0.75 Ft.

CLECO



CLECO- BOTTOM ASH POND & FLY ASH POND
CROSS SECTION A - A'
MONITOR WELL NOS W2,W4 AND BORING NOS. 232, 230



CLECO - Bottom Ash Pond & Fly Ash Pond
CROSS SECTION B - B'
MONITOR WELL NOS. W5, W3 AND BORING NO. 230

LOG OF SOIL BORING:

File: W-19
Date: April 3, 2008
Logged By: Joseph Harrer
Driller: The Devonian Group
Rig: 6620 DT

Page 1 of 2

FIELD DATA

Location: Cleco - Rodemacher

Surface Elevation:

Ground Water Level	Depth (feet)	Time	USCS	Color	Hardness	Soil Description
		14:15	CH	Red-brown	Stiff	Dry clay
B						
	5	14:30	CL	Red-brown	Firm	Wet, silty clay
			CH	Grey and Tan	Stiff	Dry, clay
	10	14:35	CH			
	15	14:40	CH			
			ML	Grey	Dense	Wet, very fine sandy silt
	20	14:45	CH	Grey	Stiff	Dry, Clay
	25	14:47	CH	Grey		
	30	15:00	CH	Grey		- - with roots
	35	15:05	CH	Grey		
			ML	Brown	Soft	Wet, clayey silt
	40					

Boring Completed at:

Ground Water Level Data

B-First occurrence of H_2O in soil

E-Equilibrated level of H_2O

Boring Advancement Method

Boring Abandonment Method

Notes

LOG OF SOIL BORING:

File: W-19
Date: April 1, 2008
Logged By: Joseph Harrer
Driller: The Devonian Group
Rig: 6620 DT

FIELD DATA

Location: Cleco - Rodemacher

Surface Elevation:

Ground Water Level	Depth (feet)	Time	USCS	Color	Hardness	Soil Description
		15:15	CH	Grey	Stiff	Dry, clay
	45					
		15:25	SC	Lt. Brown	Dense	Wet, silty, clayey very fine sand
	50					
		14:42	SC	Brown	Dense	
	55					
						Boring Terminated at 55 Feet - bgs
	60					
	65					
	70					
	75					
	80					

Boring Completed at:

Ground Water Level Data

B-First occurrence of H_2O in soil

E-Equilibrated level of H_2O

Boring Advancement Method

Boring Abandonment Method

Notes

LOG OF SOIL BORING:

File: W-21
Date: April 2, 2008
Logged By: Joseph Harrer
Driller: The Devonian Group
Rig: 6620 DT

Page 1 of 2

FIELD DATA

Location: Cleco - Rodemacher

Surface Elevation:

Ground Water Level	Depth (feet)	Time	USCS	Color	Hardness	Soil Description
		14:15	SP	Tan	Dense	Damp, sand with very little gravel
	5					
		14:17	SP	Tan	Dense	Ver, sand grading to silty sand
		14:20	CH	Grey	Medium	Dry, clay with wood fragments
	10					
		14:25	SM	Tan	Loose	Wet, silty sand
		14:28	CL	Grey	Soft	Wet, sandy, silty clay
	15					
		14:35	CH	Red-brown	Very stiff	Dry Clay
	20					
		14:45	CH	Red-brown	Very stiff	
	25					
		14:47	CH	Red-brown	Very stiff	
	30					
		14:55	CH	Red-brown	Very stiff	
	35					
		15:05	CH	Red-brown	Very stiff	
	40					

Boring Completed at:

Ground Water Level Data

B-First occurrence of H_2O in soil

E-Equilibrated level of H_2O

Boring Advancement Method

Boring Abandonment Method

Notes

LOG OF SOIL BORING:

File: W-21
Date: April 2, 2008
Logged By: Joseph Harrer
Driller: The Devonian Group
Rig: 6620 DT

FIELD DATA

Location: Cleco - Rodemacher

Surface Elevation:

Ground Water Level	Depth (feet)	Time	USCS	Color	Hardness	Soil Description
		15:20	SM-CL	Tan and blue/green	Dense	Wet silty very find sand alternating with sandy clay
	45	15:40	SM	Tan	Dense	Wet silty sand with a couple of 2" clay parts
	50	16:00	SM	Tan	Dense	- - no parts
	55					
						Boring Terminated at 55 Feet - bgs
	60					
	65					
	70					
	75					
	80					

Boring Completed at:

Ground Water Level Data

B-First occurrence of H_2O in soil

E-Equilibrated level of H_2O

Boring Advancement Method

Boring Abandonment Method

Notes

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ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG

BORING/WELL NO.: **W-23**
TOTAL DEPTH: **57 Feet**
TOP OF CASING ELEV.: **136.28 Ft NGVD**
GROUND SURFACE ELEV.: **133.58 Ft NGVD**

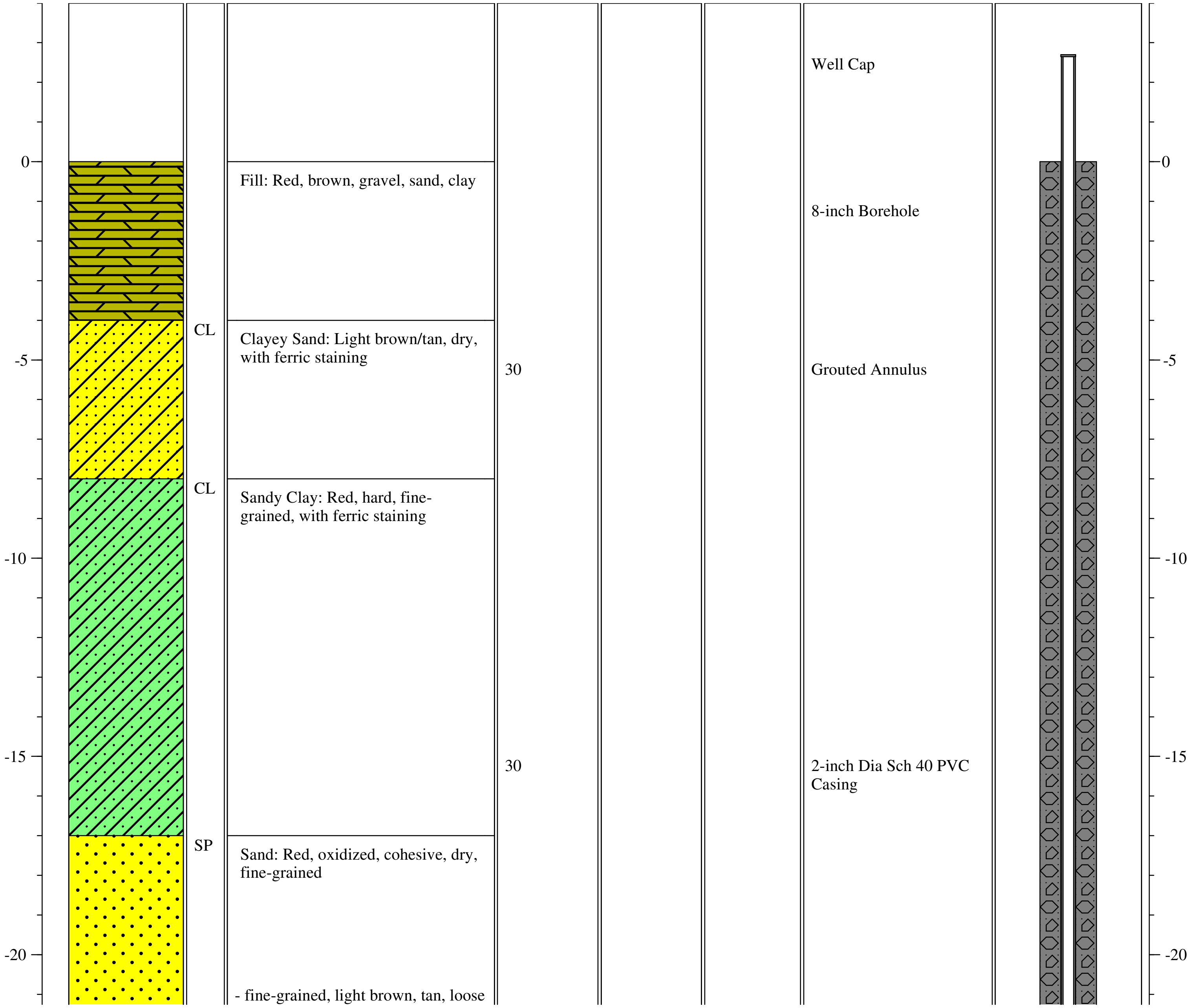
CLIENT: **Cleco BEC**
PROJECT: **SW Permitting**
SITE LOCATION: **Boyce, Louisiana**
PROJECT NO.: **01-16-0162**
LOGGED BY: **R Sturdivant**

DRILLING CO.: **Walker Hill Environmental**
DRILLER: **Rodney LaBrosse**
METHOD OF DRILLING: **Rotosonic**
SAMPLING METHODS: **Rotosonic**
DATES DRILLED: **06/15/2016**

Notes:

▽ Water level during drilling: 30 ft bgs
▼ Water level in completed well: 31.90 ft bgs

DEPTH	SOIL SYMBOLS	USCS	SOIL DESCRIPTION	CORE RECOVERY (Percent)	STIFFNESS (Kg/cm^2)	SAMPLE TAKEN	BORING DESCRIPTION	WELL CONSTRUCTION



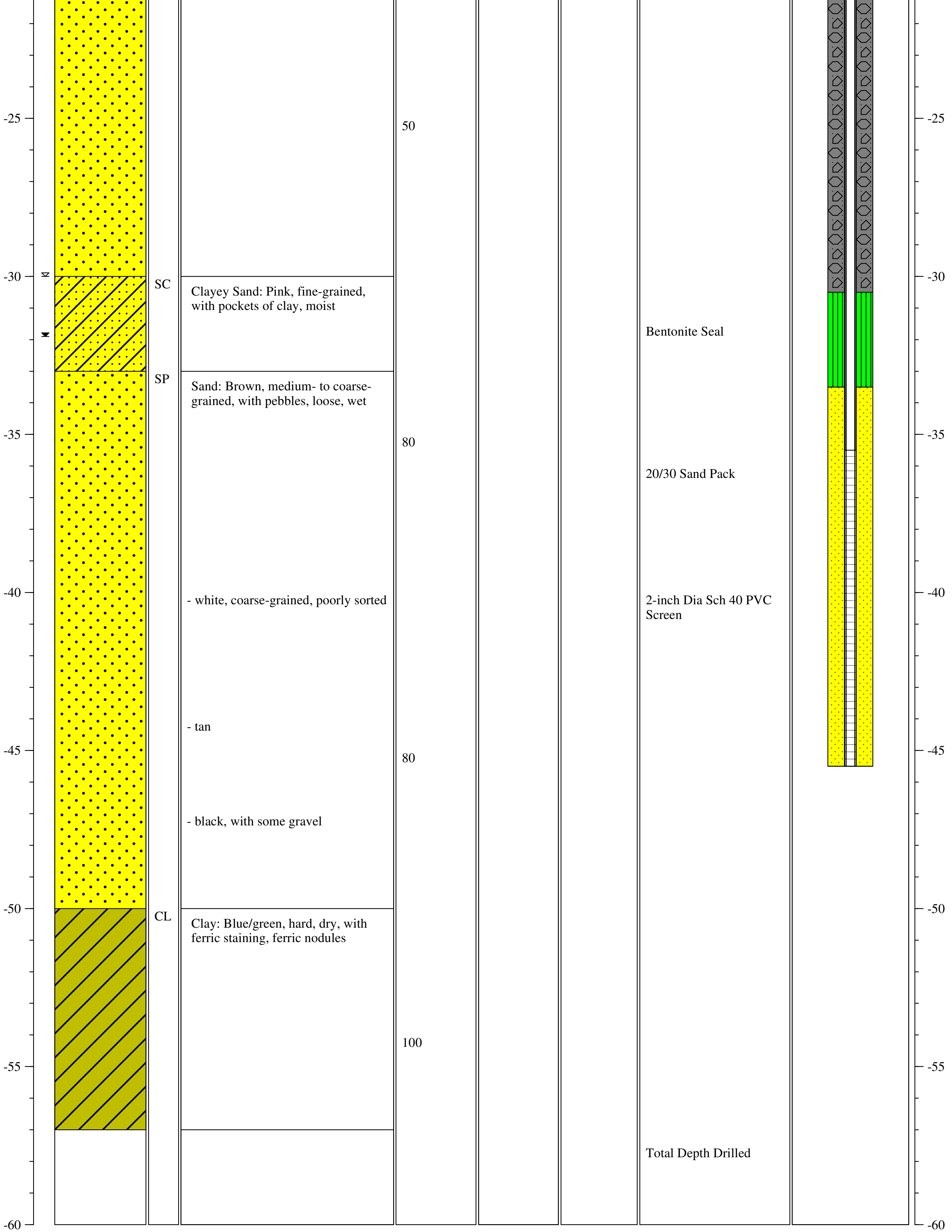
Fill: Red, brown, gravel, sand, clay

Clayey Sand: Light brown/tan, dry, with ferric staining

Sandy Clay: Red, hard, fine-grained, with ferric staining

Sand: Red, oxidized, cohesive, dry, fine-grained

- fine-grained, light brown, tan, loose



Clayey Sand: Pink, fine-grained, with pockets of clay, moist

Sand: Brown, medium- to coarse-grained, with pebbles, loose, wet

- white, coarse-grained, poorly sorted

- tan

- black, with some gravel

Clay: Blue/green, hard, dry, with ferric staining, ferric nodules

Bentonite Seal

20/30 Sand Pack

2-inch Dia Sch 40 PVC Screen

Total Depth Drilled

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SOIL BORING LOG

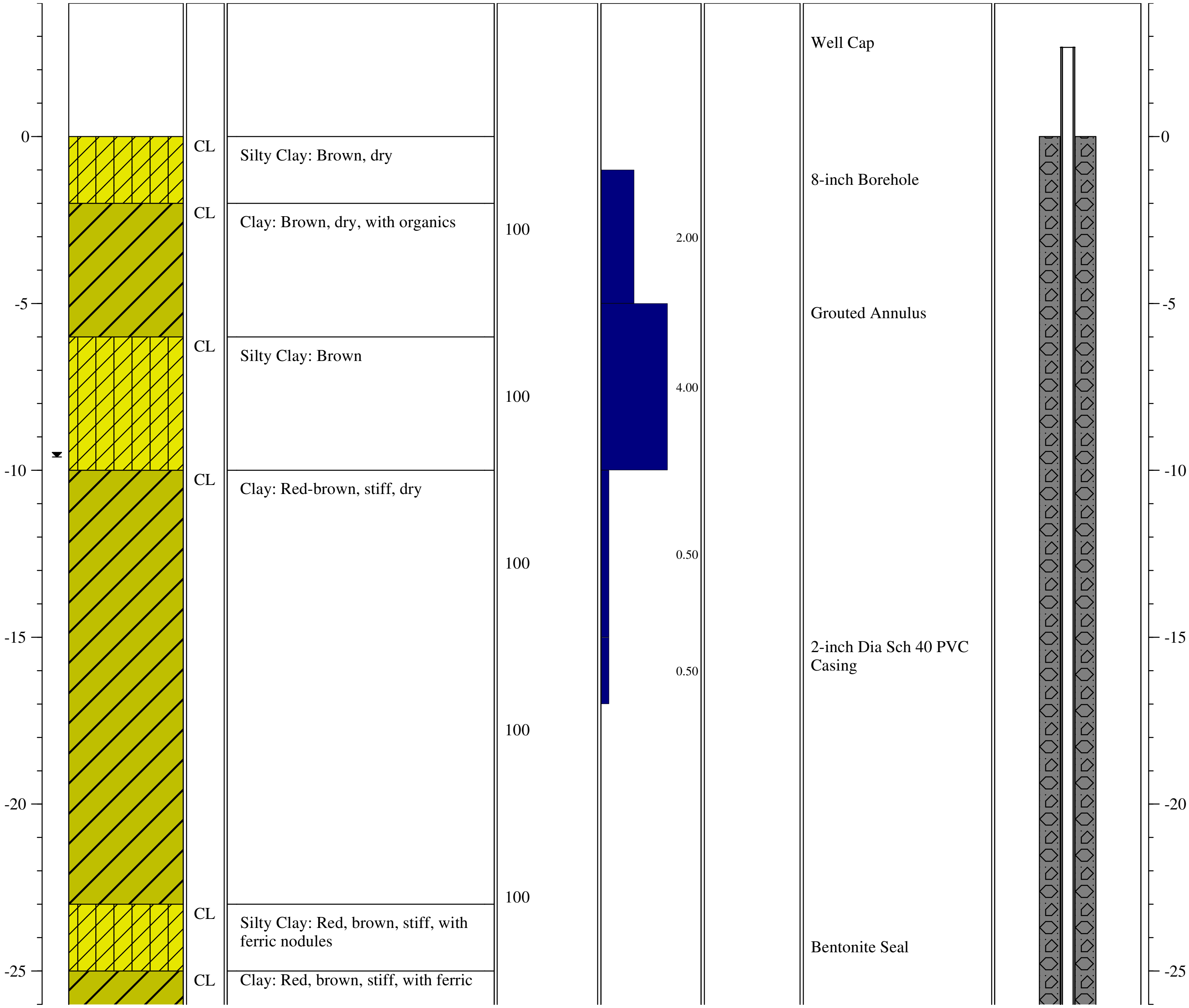
BORING/WELL NO.:	**W-24**
TOTAL DEPTH:	**55 Feet**
TOP OF CASING ELEV.:	**83.71 Ft NGVD**
GROUND SURFACE ELEV.:	**81.03 Ft NGVD**

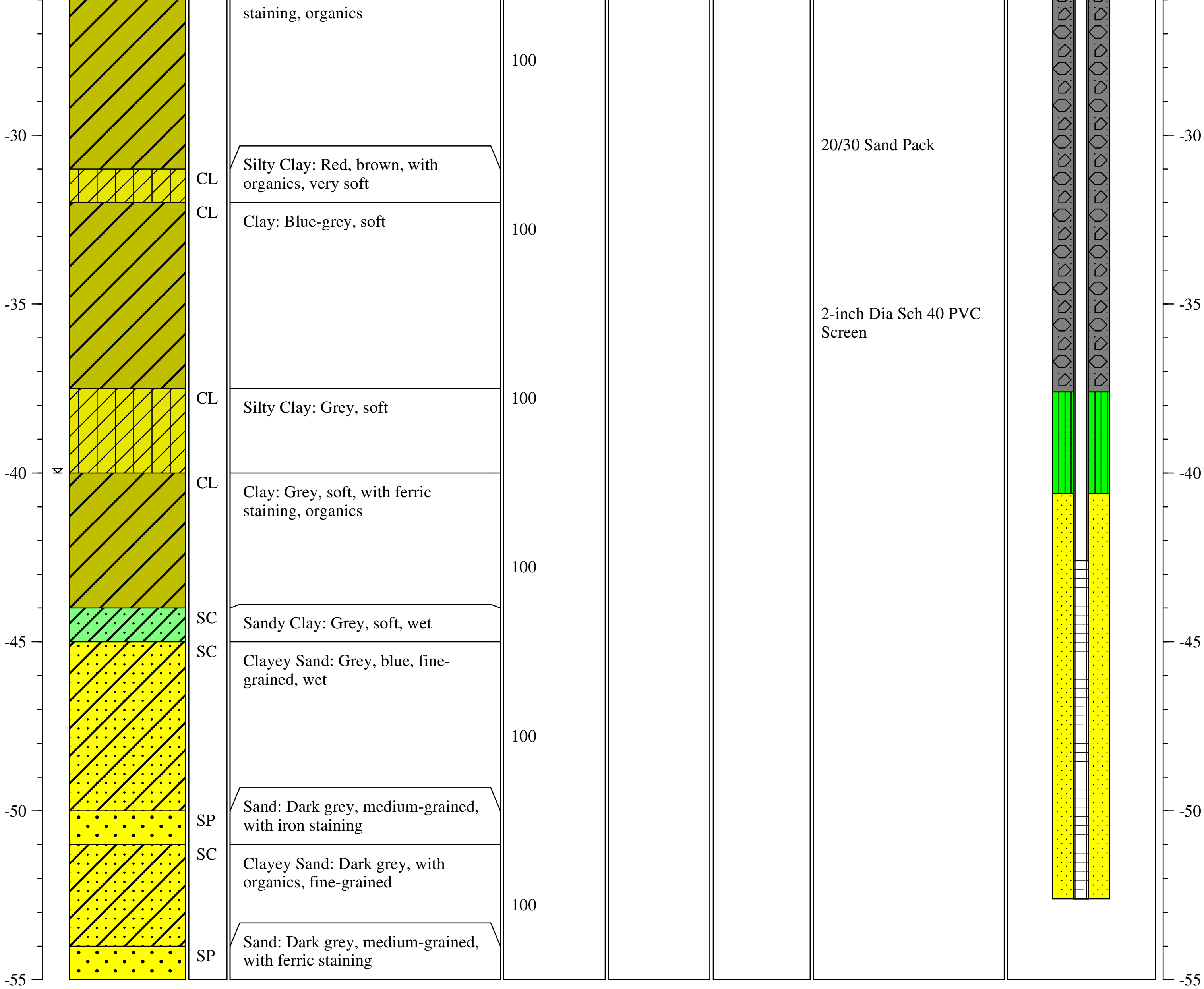
CLIENT:	**Cleco BEC**	DRILLING CO.:	**Devonian Group**
PROJECT:	**SW Permitting**	DRILLER:	**C Hebert**
SITE LOCATION:	**Boyce, Louisiana**	METHOD OF DRILLING:	**Hollow Stem Auger**
PROJECT NO.:	**01-16-0162**	SAMPLING METHODS:	**DPT**
LOGGED BY:	**R Sturdivant**	DATES DRILLED:	**06/27/2016**

Notes:

▽ Water level during drilling: 40 ft bgs
▼ Water level in completed well: 9.60 ft bgs

DEPTH	SOIL SYMBOLS	USCS	SOIL DESCRIPTION	CORE RECOVERY (Percent)	STIFFNESS (Kg/cm^2)	SAMPLE TAKEN	BORING DESCRIPTION	WELL CONSTRUCTION





staining, organics

CL Silty Clay: Red, brown, with organics, very soft

CL Clay: Blue-grey, soft

CL Silty Clay: Grey, soft

CL Clay: Grey, soft, with ferric staining, organics

SC Sandy Clay: Grey, soft, wet

SC Clayey Sand: Grey, blue, fine-grained, wet

SP Sand: Dark grey, medium-grained, with iron staining

SC Clayey Sand: Dark grey, with organics, fine-grained

SP Sand: Dark grey, medium-grained, with ferric staining

20/30 Sand Pack

2-inch Dia Sch 40 PVC Screen

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SOIL BORING LOG

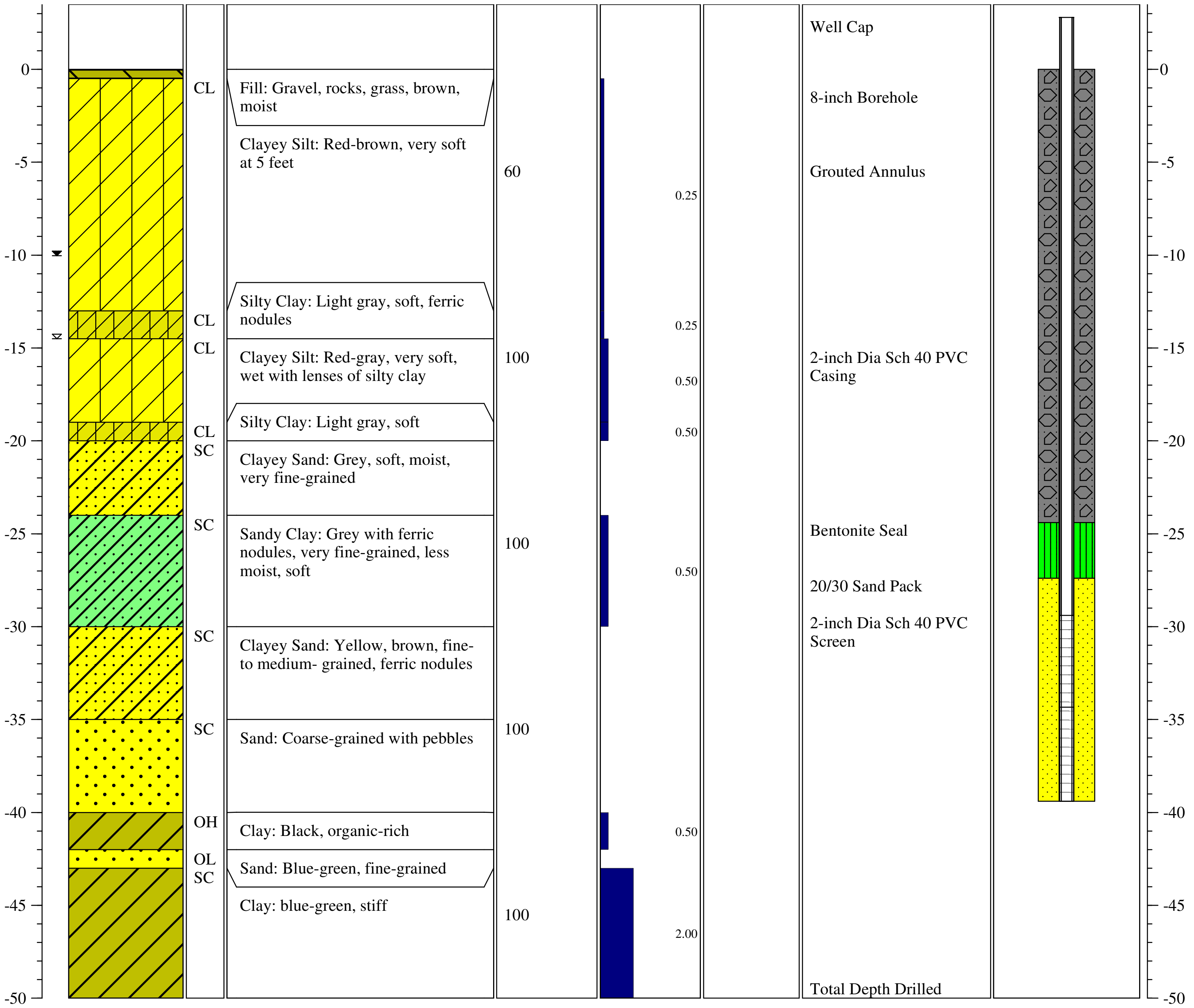
BORING/WELL NO.: **D-1**
TOTAL DEPTH: **50 Feet**
TOP OF CASING ELEV.: **99.38 Ft NGVD**
GROUND SURFACE ELEV.: **96.59 Ft NGVD**

CLIENT: **Cleco BEC**
PROJECT: **SW Permitting**
SITE LOCATION: **Boyce, Louisiana**
PROJECT NO.: **01-16-0162**
LOGGED BY: **R Sturdivant**

DRILLING CO.: **Walker Hill Environmental**
DRILLER: **Rodney LaBrosse**
METHOD OF DRILLING: **Rotosonic**
SAMPLING METHODS: **Rotosonic**
DATES DRILLED: **06/14/2016**

Notes:

▽ Water level during drilling: -14.5 ft bgs
▼ Water level in completed well: 10.04 ft bgs



DEPTH	SOIL SYMBOLS	USCS	SOIL DESCRIPTION	CORE RECOVERY (Percent)	STIFFNESS (Kg/cm^2)	SAMPLE TAKEN	BORING DESCRIPTION	WELL CONSTRUCTION
							Well Cap	
		CL	Fill: Gravel, rocks, grass, brown, moist				8-inch Borehole	
			Clayey Silt: Red-brown, very soft at 5 feet	60	0.25		Grouted Annulus	
		CL	Silty Clay: Light gray, soft, ferric nodules		0.25			
		CL	Clayey Silt: Red-gray, very soft, wet with lenses of silty clay	100	0.50		2-inch Dia Sch 40 PVC Casing	
		CL	Silty Clay: Light gray, soft		0.50			
		SC	Clayey Sand: Grey, soft, moist, very fine-grained					
		SC	Sandy Clay: Grey with ferric nodules, very fine-grained, less moist, soft	100	0.50		Bentonite Seal 20/30 Sand Pack	
		SC	Clayey Sand: Yellow, brown, fine- to medium- grained, ferric nodules				2-inch Dia Sch 40 PVC Screen	
		SC	Sand: Coarse-grained with pebbles	100				
		OH	Clay: Black, organic-rich		0.50			
		OL	Sand: Blue-green, fine-grained					
		SC	Clay: blue-green, stiff	100	2.00		Total Depth Drilled	

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SOIL BORING LOG

BORING/WELL NO.: **D-2**
TOTAL DEPTH: **47 Feet**
TOP OF CASING ELEV.: **99.36 Ft NGVD**
GROUND SURFACE ELEV.: **97.10 Ft NGVD**

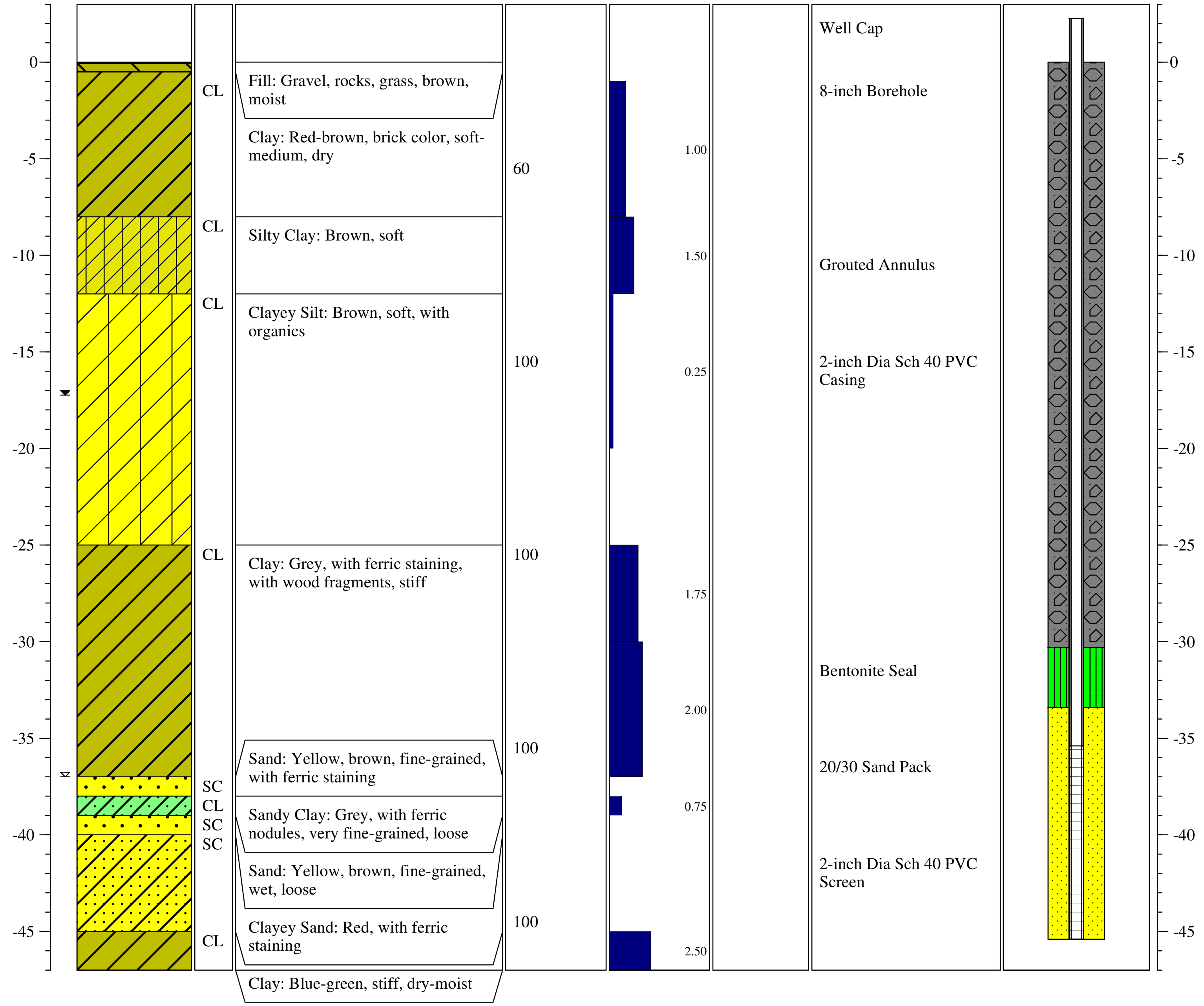
CLIENT: **Cleco BEC**
PROJECT: **SW Permitting**
SITE LOCATION: **Boyce, Louisiana**
PROJECT NO.: **01-16-0162**
LOGGED BY: **R Sturdivant**

DRILLING CO.: **Walker Hill Environmental**
DRILLER: **Rodney LaBrosse**
METHOD OF DRILLING: **Rotosonic**
SAMPLING METHODS: **Rotosonic**
DATES DRILLED: **06/14/2016**

Notes:

▽ Water level during drilling: 37 ft bgs
▼ Water level in completed well: 17.23 ft bgs

DEPTH	SOIL SYMBOLS	USCS	SOIL DESCRIPTION	CORE RECOVERY (Percent)	STIFFNESS (Kg/cm^2)	SAMPLE TAKEN	BORING DESCRIPTION	WELL CONSTRUCTION



Fill: Gravel, rocks, grass, brown, moist

Clay: Red-brown, brick color, soft-medium, dry

Silty Clay: Brown, soft

Clayey Silt: Brown, soft, with organics

Clay: Grey, with ferric staining, with wood fragments, stiff

Sand: Yellow, brown, fine-grained, with ferric staining

Sandy Clay: Grey, with ferric nodules, very fine-grained, loose

Sand: Yellow, brown, fine-grained, wet, loose

Clayey Sand: Red, with ferric staining

Clay: Blue-green, stiff, dry-moist

Well Cap

8-inch Borehole

Grouted Annulus

2-inch Dia Sch 40 PVC Casing

Bentonite Seal

20/30 Sand Pack

2-inch Dia Sch 40 PVC Screen

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SOIL BORING LOG

BORING/WELL NO.: **D-3**
TOTAL DEPTH: **50 Feet**
TOP OF CASING ELEV.: **97.37 Ft NGVD**
GROUND SURFACE ELEV.: **94.50 Ft NGVD**

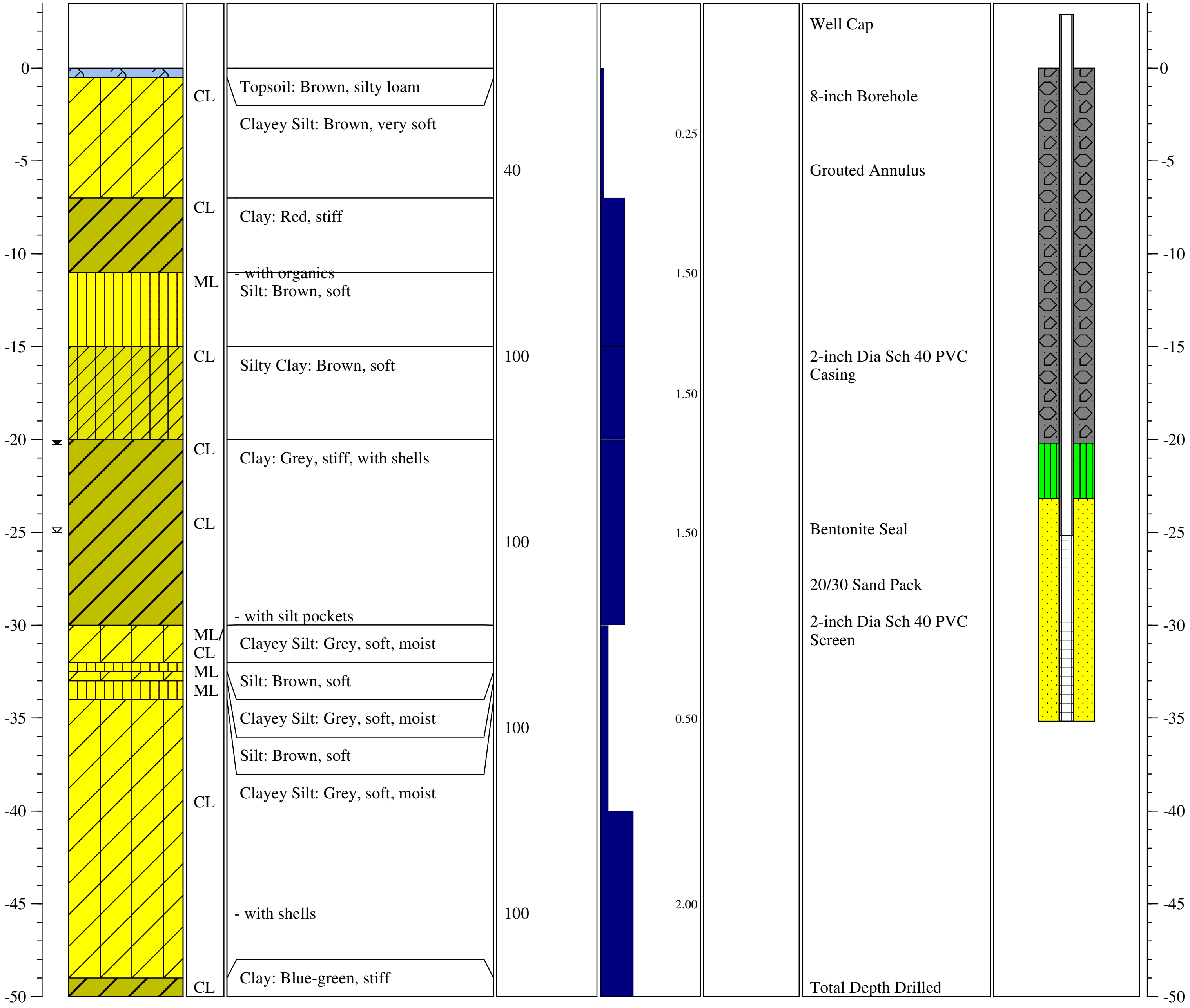
CLIENT: **Cleco BEC**
PROJECT: **SW Permitting**
SITE LOCATION: **Boyce, Louisiana**
PROJECT NO.: **01-16-0162**
LOGGED BY: **R Sturdivant**

DRILLING CO.: **Walker Hill Environmental**
DRILLER: **Rodney LaBrosse**
METHOD OF DRILLING: **Rotosonic**
SAMPLING METHODS: **Rotosonic**
DATES DRILLED: **06/15/2016**

Notes:

▽ Water level during drilling: 25 ft bgs
▼ Water level in completed well: 20.28 ft bgs

DEPTH	SOIL SYMBOLS	USCS	SOIL DESCRIPTION	CORE RECOVERY (Percent)	STIFFNESS (Kg/cm^2)	SAMPLE TAKEN	BORING DESCRIPTION	WELL CONSTRUCTION



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SOIL BORING LOG

BORING/WELL NO.:	**L-1**
TOTAL DEPTH:	**36 feet**
TOP OF CASING ELEV.:	**86.15 Ft NGVD**
GROUND SURFACE ELEV.:	**83.05 Ft NGVD**

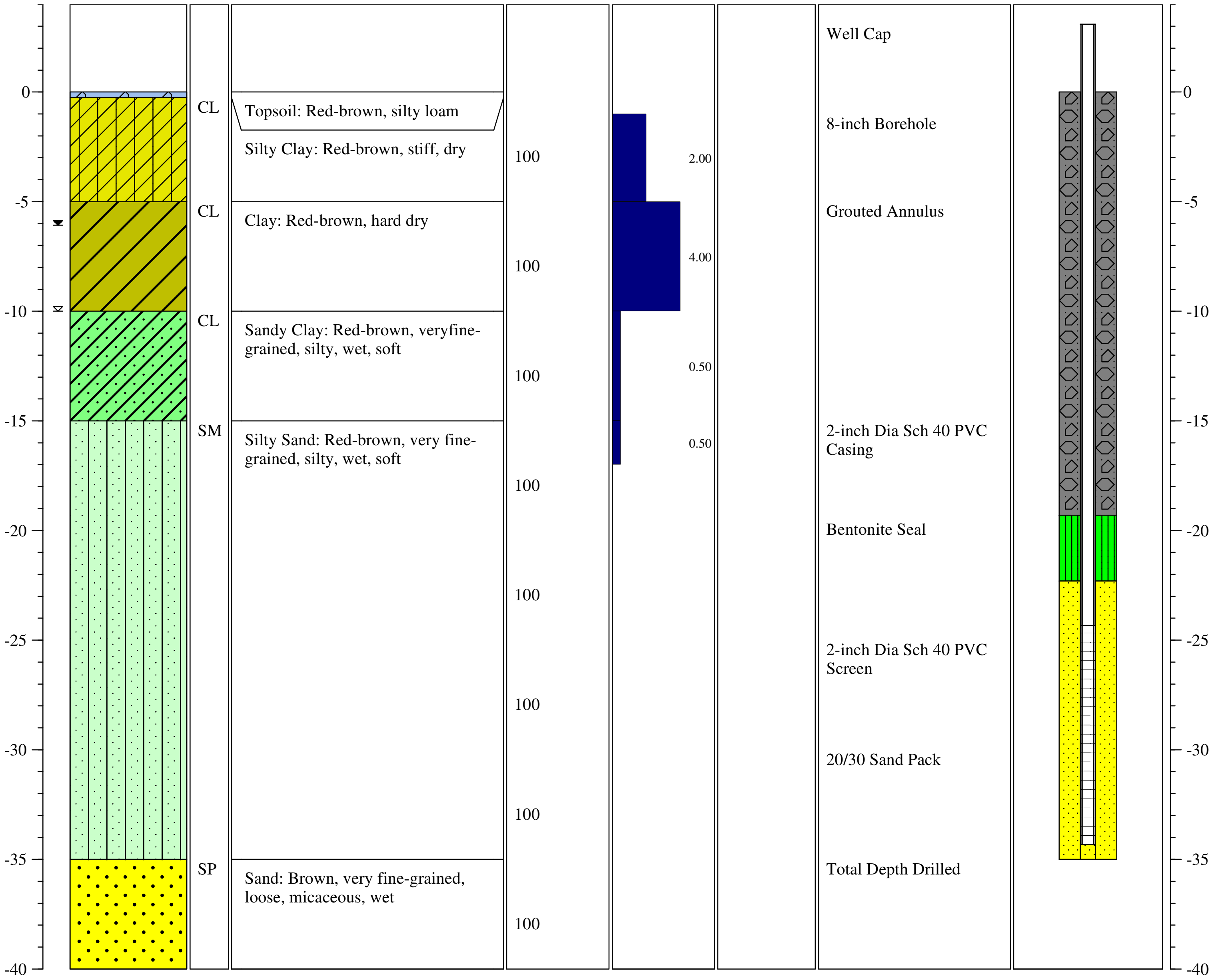
CLIENT:	**Cleco BEC**	DRILLING CO.:	**Devonian Group**
PROJECT:	**SW Permitting**	DRILLER:	**C Hebert**
SITE LOCATION:	**Boyce, Louisiana**	METHOD OF DRILLING:	**Hollow Stem Auger**
PROJECT NO.:	**01-16-0162**	SAMPLING METHODS:	**DPT**
LOGGED BY:	**R Sturdivant**	DATES DRILLED:	**06/28/2016**

Notes:

▽ Water level during drilling: 10 ft bgs

▼ Water level in completed well: 6.08 ft bgs

DEPTH	SOIL SYMBOLS	USCS	SOIL DESCRIPTION	CORE RECOVERY (Percent)	STIFFNESS (Kg/cm^2)	SAMPLE TAKEN	BORING DESCRIPTION	WELL CONSTRUCTION



Topsoil: Red-brown, silty loam

Silty Clay: Red-brown, stiff, dry

Clay: Red-brown, hard dry

Sandy Clay: Red-brown, veryfine-grained, silty, wet, soft

Silty Sand: Red-brown, very fine-grained, silty, wet, soft

Sand: Brown, very fine-grained, loose, micaceous, wet

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SOIL BORING LOG

BORING/WELL NO.:	**L-2**
TOTAL DEPTH:	**40 feet**
TOP OF CASING ELEV.:	**86.68 Ft NGVD**
GROUND SURFACE ELEV.:	**83.73 Ft NGVD**

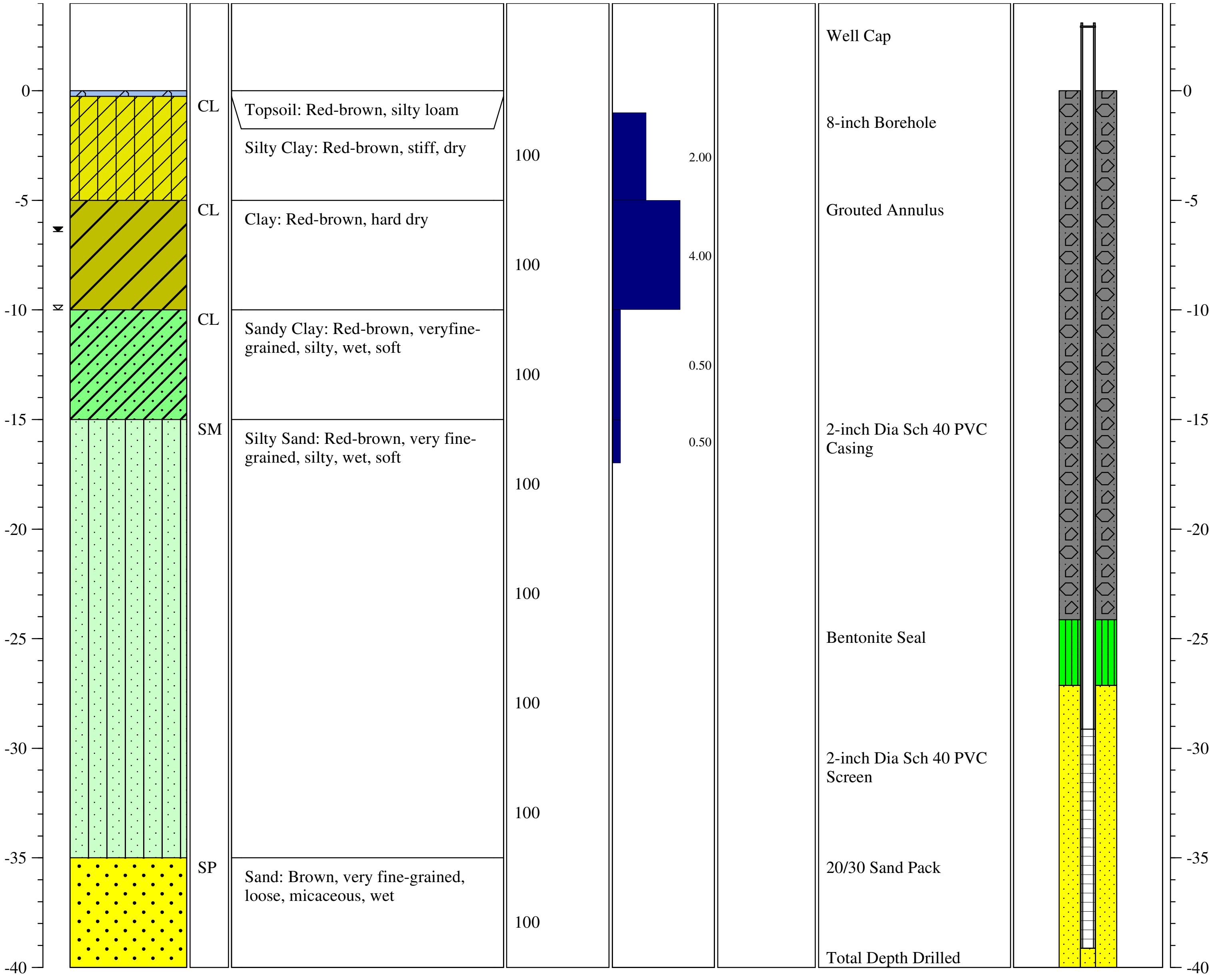
CLIENT:	**Cleco BEC**	DRILLING CO.:	**Devonian Group**
PROJECT:	**SW Permitting**	DRILLER:	**C Hebert**
SITE LOCATION:	**Boyce, Louisiana**	METHOD OF DRILLING:	**Hollow Stem Auger**
PROJECT NO.:	**01-16-0162**	SAMPLING METHODS:	**DPT**
LOGGED BY:	**R Sturdivant**	DATES DRILLED:	**06/29/2016**

Notes:

▽ Water level during drilling: 10 ft bgs

▼ Water level in completed well: 6.43 ft bgs

DEPTH	SOIL SYMBOLS	USCS	SOIL DESCRIPTION	CORE RECOVERY (Percent)	STIFFNESS (Kg/cm^2)	SAMPLE TAKEN	BORING DESCRIPTION	WELL CONSTRUCTION



Topsoil: Red-brown, silty loam

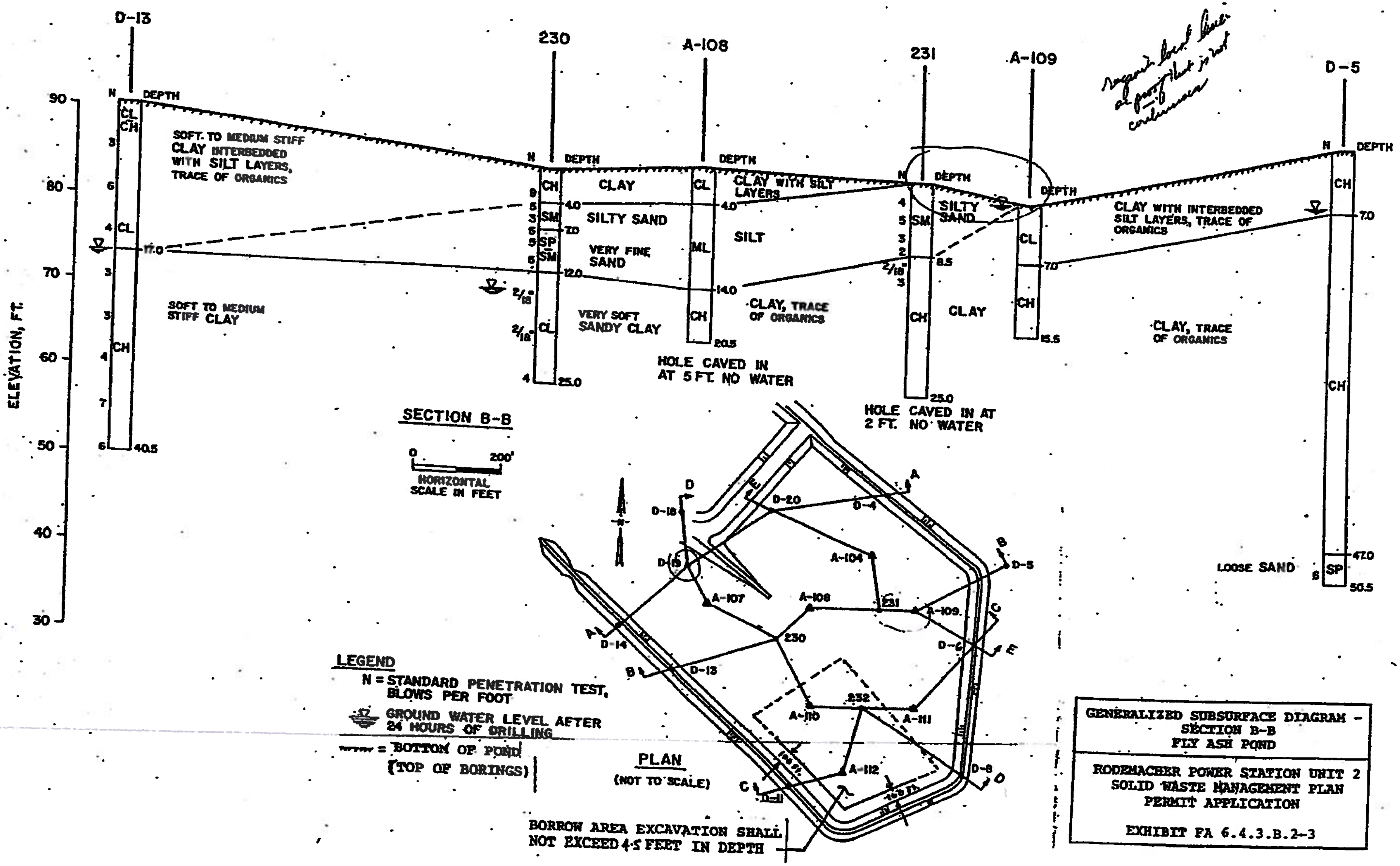
Silty Clay: Red-brown, stiff, dry

Clay: Red-brown, hard dry

Sandy Clay: Red-brown, veryfine-grained, silty, wet, soft

Silty Sand: Red-brown, very fine-grained, silty, wet, soft

Sand: Brown, very fine-grained, loose, micaceous, wet

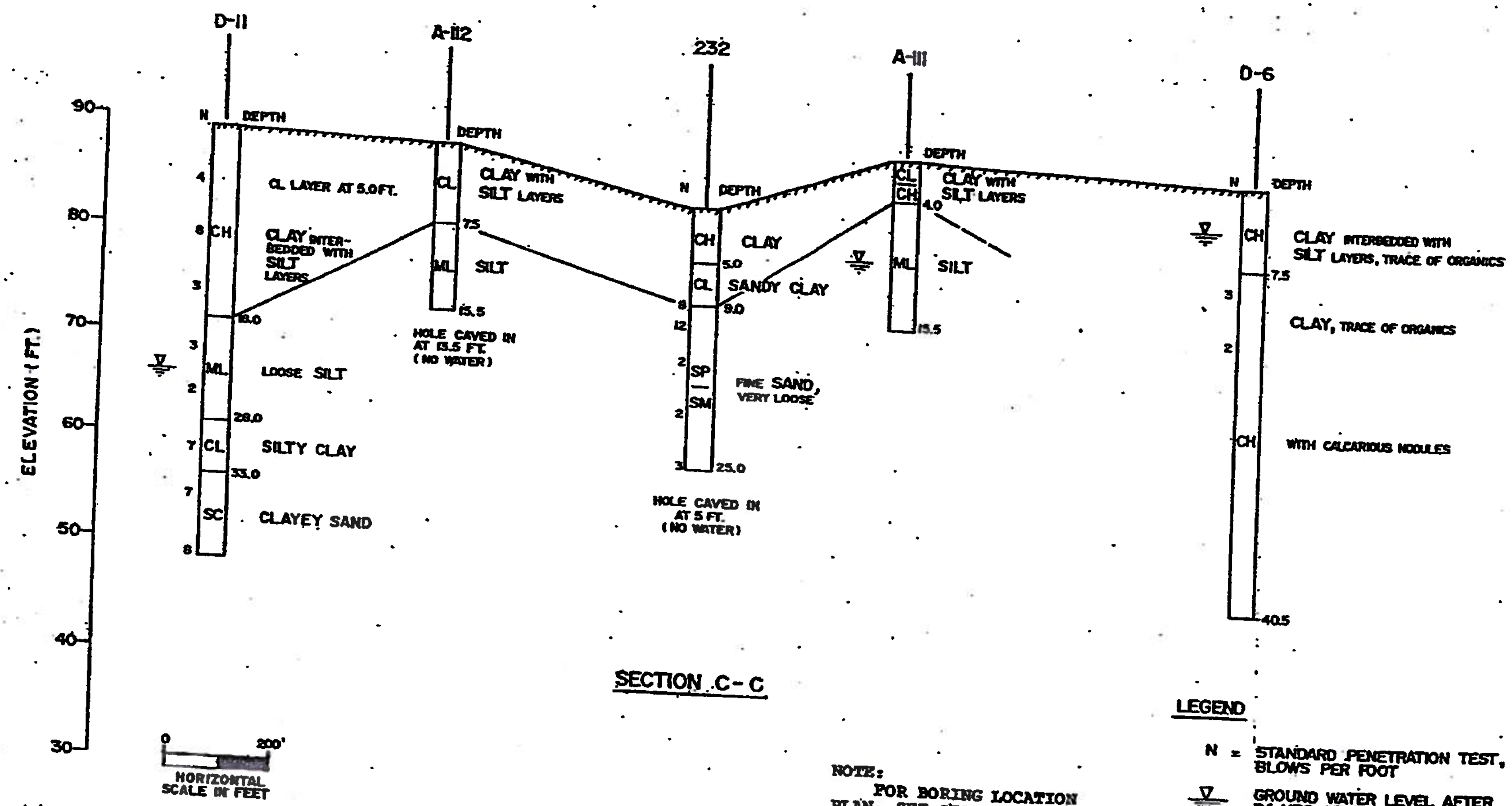


Suggests local lens of peat that is not continuous

GENERALIZED SUBSURFACE DIAGRAM - SECTION B-B
FLY ASH POND

RODEMACHER POWER STATION UNIT 2
SOLID WASTE MANAGEMENT PLAN
PERMIT APPLICATION

EXHIBIT FA 6.4.3.B.2-3



SECTION C-C

NOTE:
FOR BORING LOCATION PLAN, SEE SECTION B-B

LEGEND

N = STANDARD PENETRATION TEST, BLOWS PER FOOT

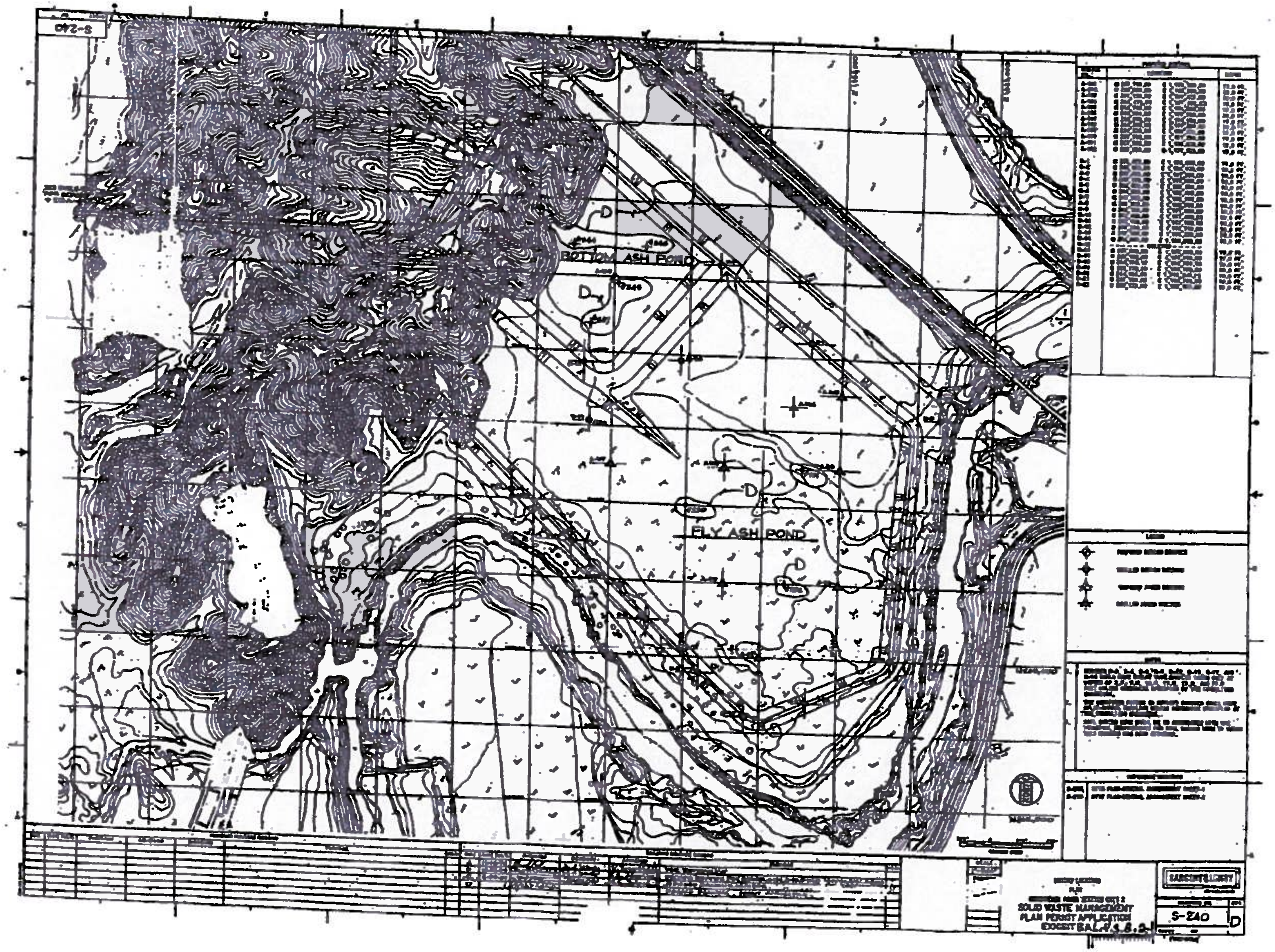
▽ = GROUND WATER LEVEL AFTER 24 HRS OF DRILLING

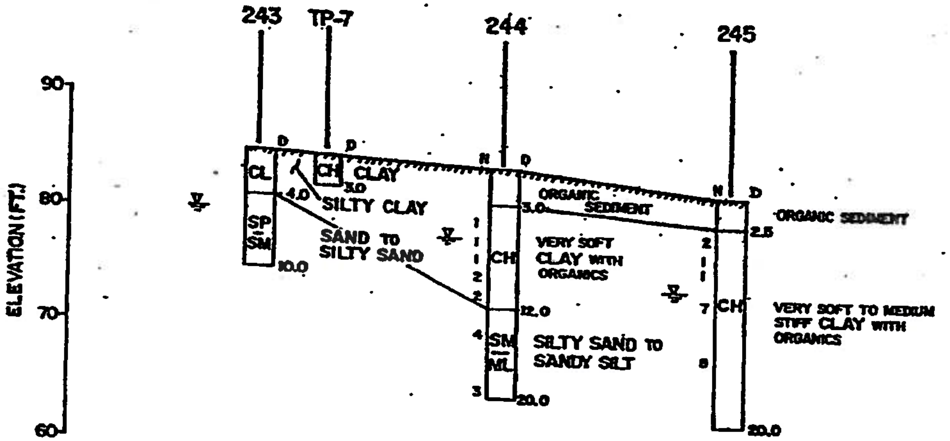
⫶⫶⫶⫶ = BOTTOM OF POND (TOP OF BORINGS)

GENERALIZED SUBSURFACE DIAGRAM -
SECTION C-C
FLY ASH POND

RODEMACHER POWER STATION UNIT 2
SOLID WASTE MANAGEMENT PLAN
PERMIT APPLICATION

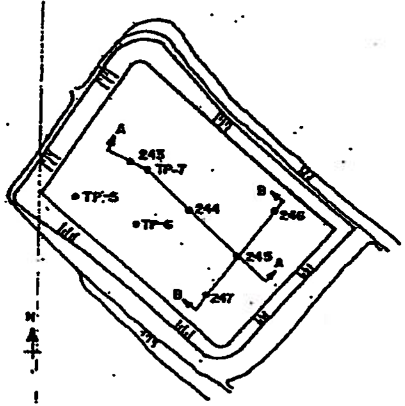
EXHIBIT FA 6.4.3.B.2-4


S-240
BOTTOM ASH POND
FLY ASH POND
D
SOLID WASTE MANAGEMENT
PLAN PERMIT APPLICATION
EXHIBIT B.A.I.V.3.8.2-1
SARGENT & LUNDY
S-240
D



SECTION A-A

0 200'
HORIZONTAL
SCALE IN FEET



PLAN
N.T.S.

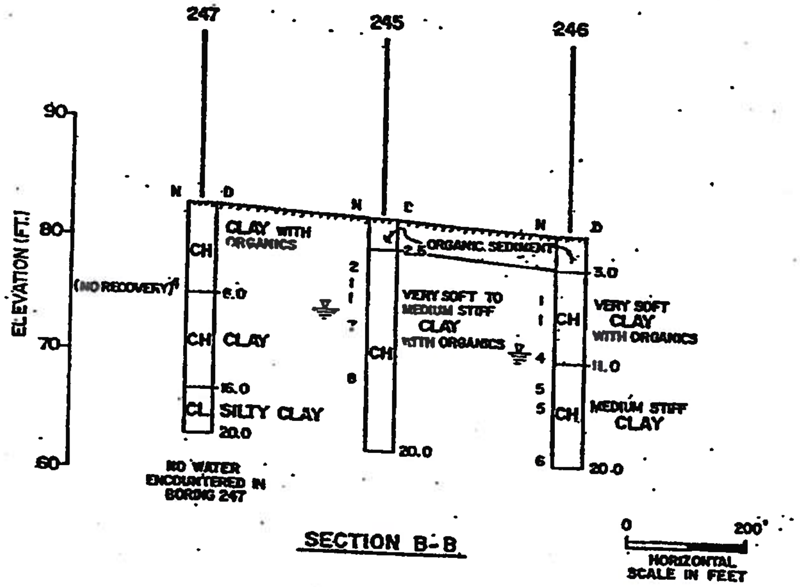
LEGEND

TP = TEST PIT
D = DEPT IN FEET
N = STANDARD PENETRATION TEST, BLOWS PER FOOT
▽ = GROUND WATER LEVEL
⩘⩘⩘ = BOTTOM OF POND (TOP OF BORINGS)

GENERALIZED SUBSURFACE DIAGRAM -
SECTION A-A
BOTTOM ASH POND

RODEMACHER POWER STATION UNIT 2
SOLID WASTE MANAGEMENT PLAN
PERMIT APPLICATION

EXHIBIT BA 6.4.3.B.2-2



SECTION B-B

LEGEND

D = DEPTH IN FEET

N = STANDARD PENETRATION TEST, BLOWS PER FOOT

⊽ = GROUND WATER LEVEL

⌇⌇⌇ = BOTTOM OF POND (TOP OF BORINGS)

NOTE

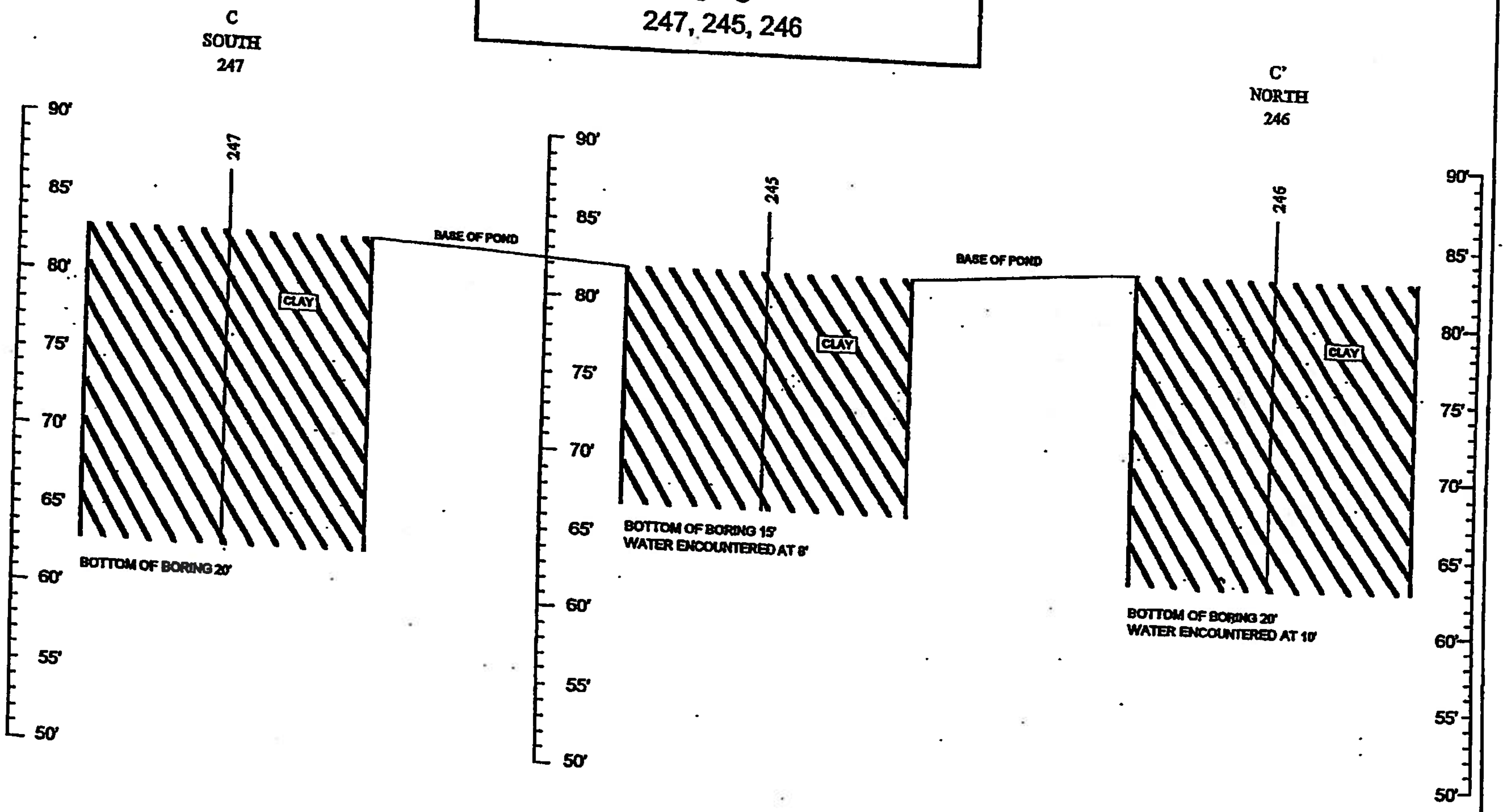
1. FOR BORING LOCATION PLAN, SEE SECTION A-A.

GENERALIZED SUBSURFACE DIAGRAM - SECTION B-B. BOTTOM ASH POND

RODEMACHER POWER STATION UNIT 2
SOLID WASTE MANAGEMENT PLAN
PERMIT APPLICATION

EXHIBIT BA 6.4.3.B.2-3

CROSS SECTION
C - C'
247, 245, 246

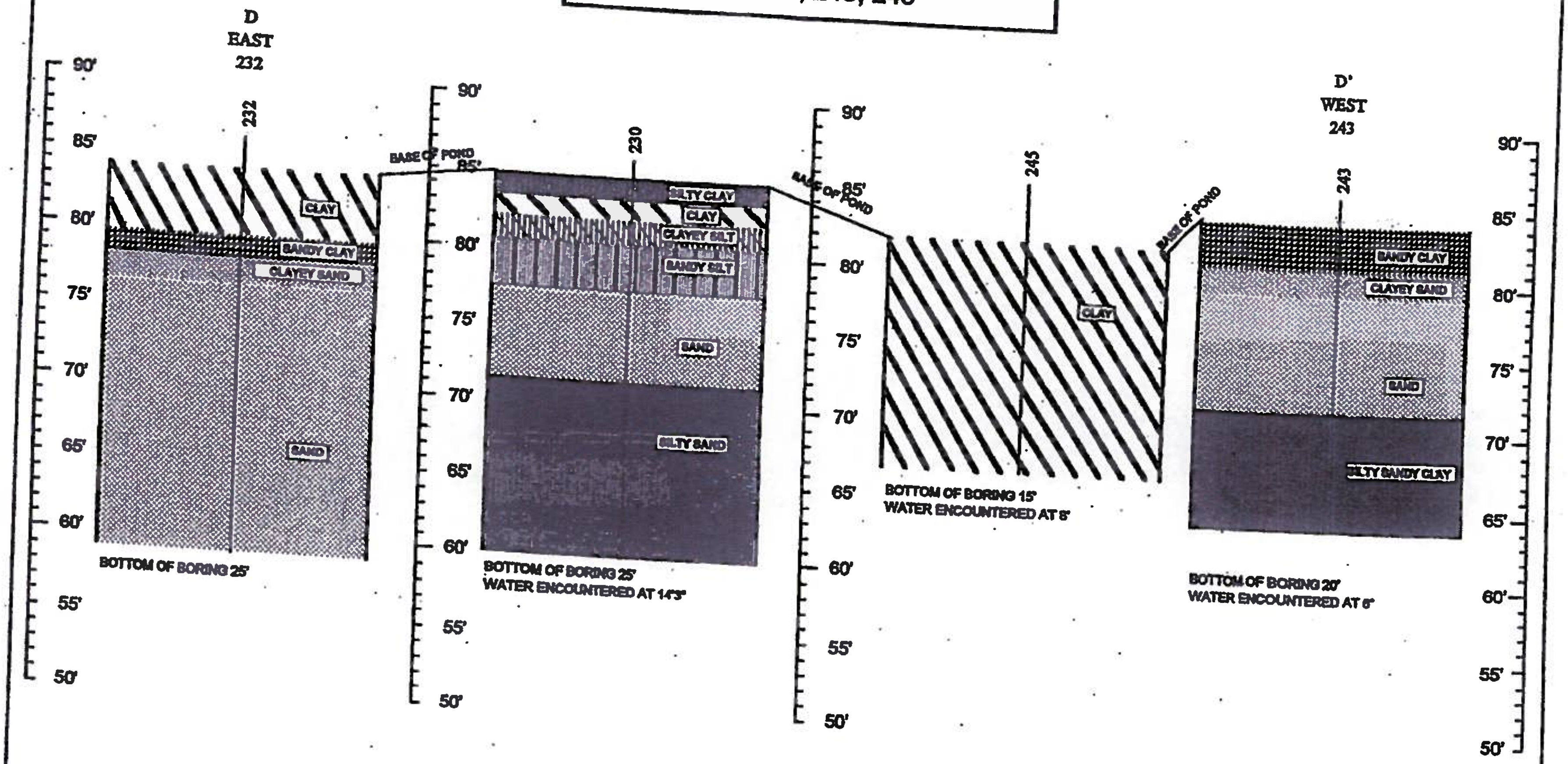


VERTICAL SCALE: 1" = 5'

DATE: 10/15/99

CLECO - Bottom Ash Pond
CROSS SECTION C - C'
BORING NOS. 247, 245, 246

CROSS SECTION
D - D'
232, 230, 245, 243



VERTICAL SCALE: 1" = 5'

CLECO - Fly Ash Pond & Bottom Ash Pond
CROSS SECTION D - D'
BORING NOS. 232, 230, 245, 243

DATE: 10/15/99

SOIL BORING LOG

BORING/WELL NO.: **EE-1**
TOTAL DEPTH: **75 Feet**
TOP OF CASING ELEV.: **NA Ft NGVD**
GROUND SURFACE ELEV.: **90 Ft NGVD**

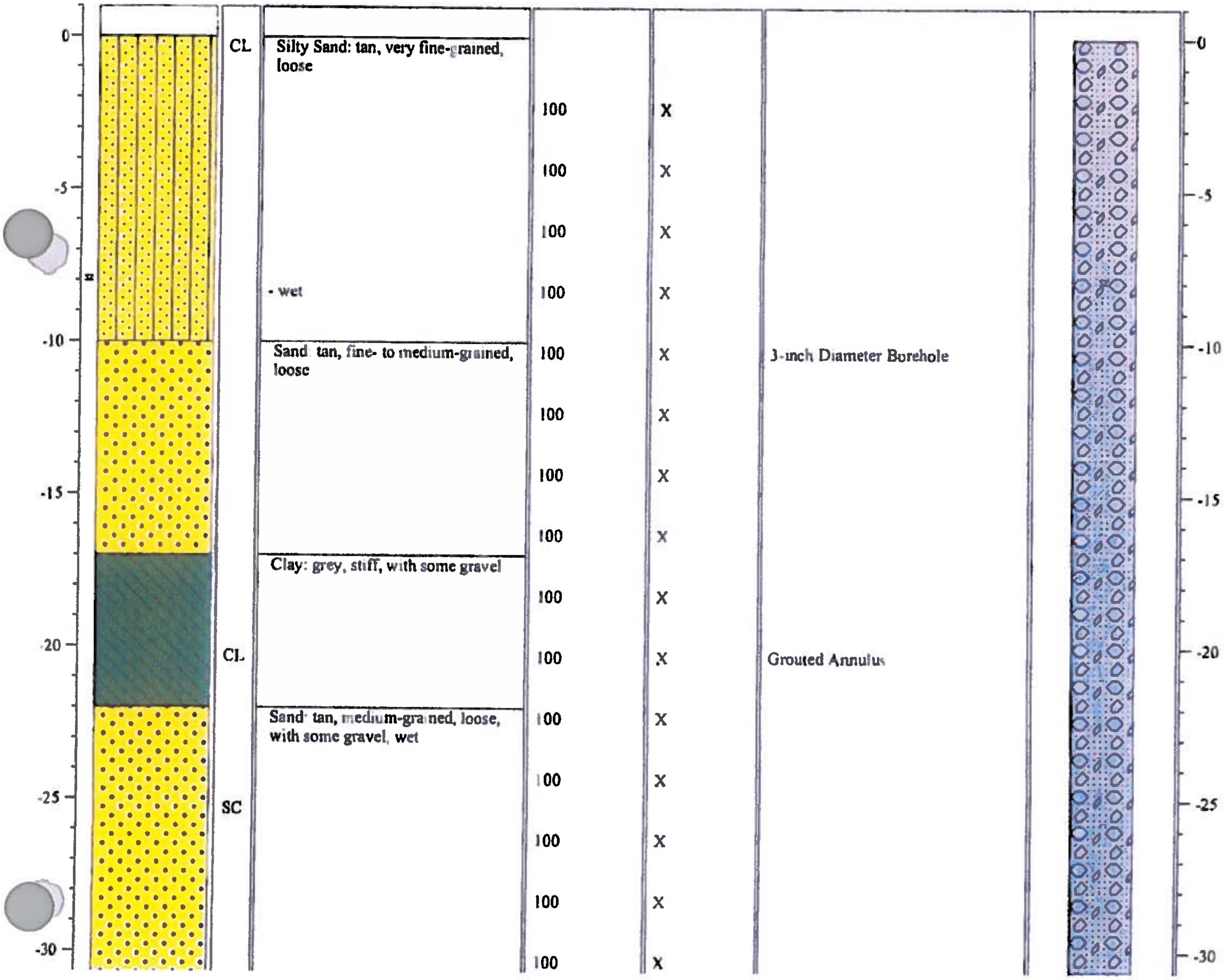
CLIENT: **Cleco Power, LLC**
PROJECT: **Rodemacher Power Station**
SITE LOCATION: **Boyce, Louisiana**
PROJECT NO.: **01-0009**
LOGGED BY: **J. Mayeux**

DRILLING CO.: **EDI Environmental**
DRILLER: **D. Sandoz**
METHOD OF DRILLING: **DPT / HSA**
SAMPLING METHODS: **DPT / Split Spoon**
DATES DRILLED: **04/13/2005**

NOTES:

- Water level during drilling: 8.0 feet bgs

DEPTH	SOIL SYMBOLS	USCS	SOIL DESCRIPTION	CORE RECOVERY (Percent)	SAMPLE TAKEN	WELL DESCRIPTION	WELL CONSTRUCTION



Silty Sand: tan, very fine-grained, loose

- wet

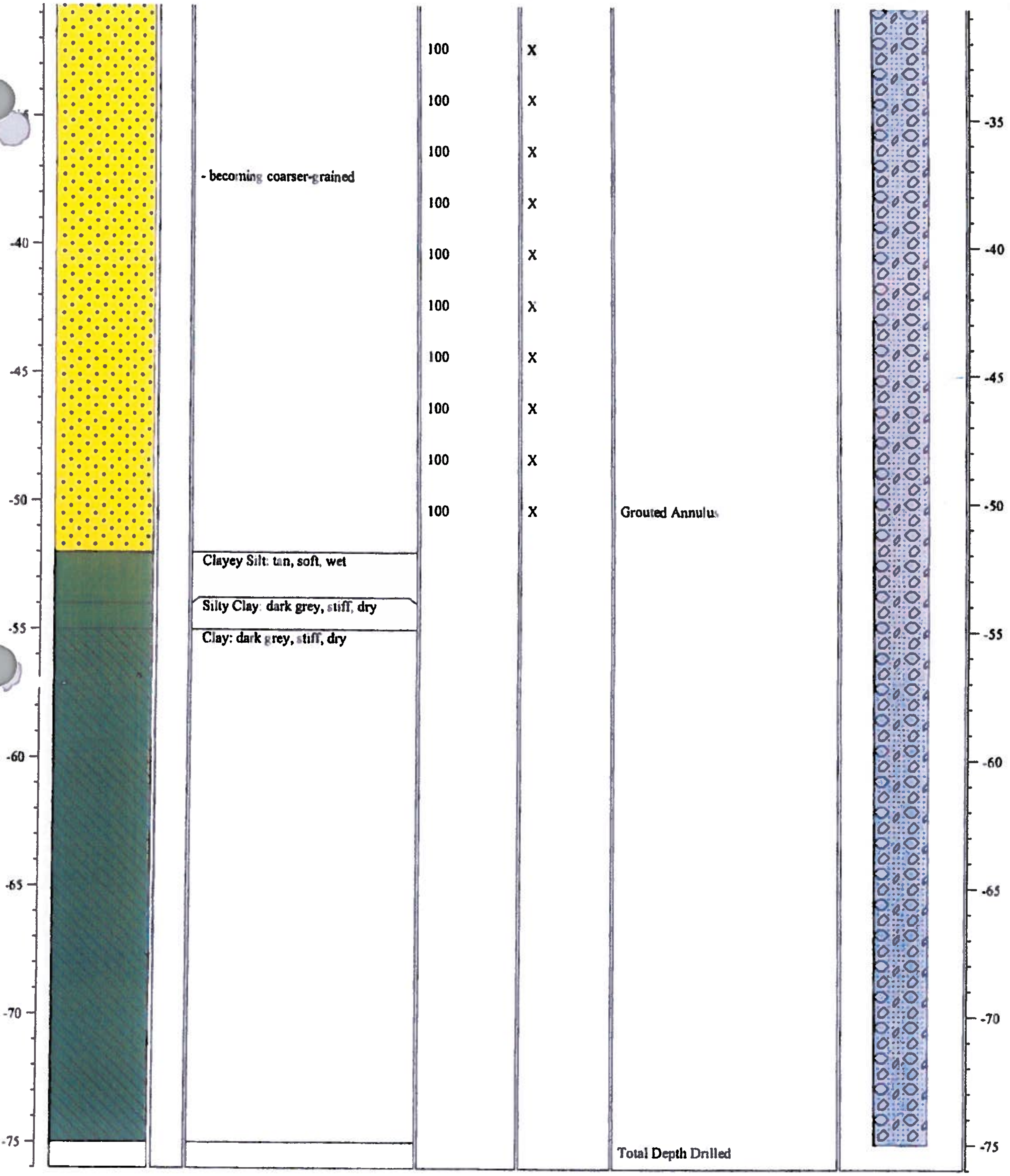
Sand: tan, fine- to medium-grained, loose

Clay: grey, stiff, with some gravel

Sand: tan, medium-grained, loose, with some gravel, wet

3-inch Diameter Borehole

Grouted Annulus



- becoming coarser-grained

Clayey Silt: tan, soft, wet

Silty Clay: dark grey, stiff, dry

Clay: dark grey, stiff, dry

100	X
100	X
100	X
100	X
100	X
100	X
100	X
100	X
100	X
100	X

Grouted Annulus

Total Depth Drilled

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SOIL BORING LOG

BORING/WELL NO.: **W-25**
TOTAL DEPTH: **60 Feet**
TOP OF CASING ELEV.: **124.74 Ft NGVD**
GROUND SURFACE ELEV.: **121.32 Ft NGVD**

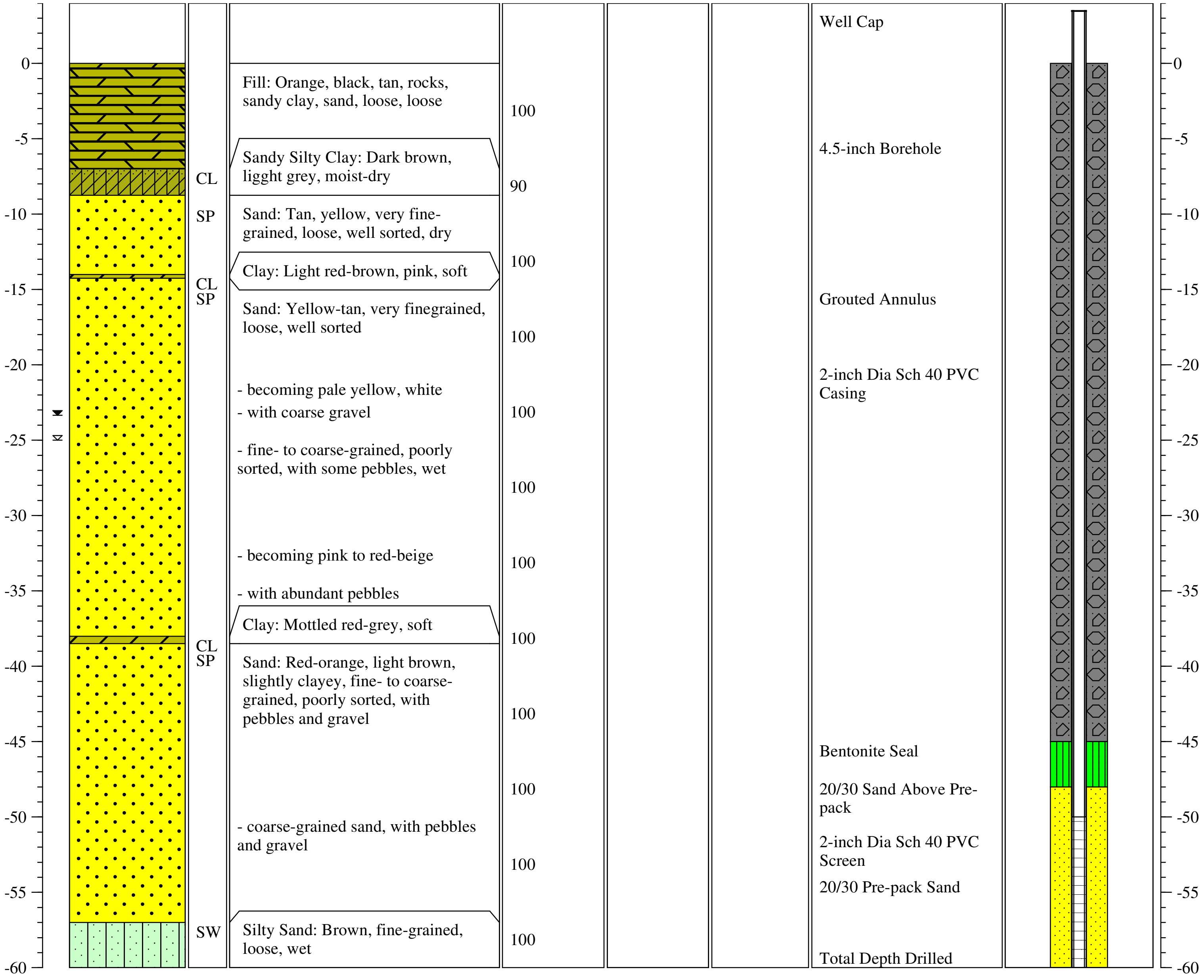
CLIENT: **Cleco BEC**
PROJECT: **Ash Ponds**
SITE LOCATION: **Boyce, Louisiana**
PROJECT NO.: **01-17-0173**
LOGGED BY: **R Sturdivant**

DRILLING CO.: **C&S Lease Service**
DRILLER: **Michael Dodson**
METHOD OF DRILLING: **DPT**
SAMPLING METHODS: **DPT**
DATES DRILLED: **11/06/2017**

Notes:

▽ Water level during drilling: 25 ft bgs
▼ Water level in completed well: 23.35 ft bgs

DEPTH	SOIL SYMBOLS	USCS	SOIL DESCRIPTION	CORE RECOVERY (Percent)	STIFFNESS (Kg/cm^2)	SAMPLE TAKEN	BORING DESCRIPTION	WELL CONSTRUCTION



Fill: Orange, black, tan, rocks, sandy clay, sand, loose, loose

Sandy Silty Clay: Dark brown, ligg
ht grey, moist-dry

Sand: Tan, yellow, very fine-grained, loose, well sorted, dry

Clay: Light red-brown, pink, soft

Sand: Yellow-tan, very finegrained, loose, well sorted

- becoming pale yellow, white
- with coarse gravel
- fine- to coarse-grained, poorly sorted, with some pebbles, wet
- becoming pink to red-beige
- with abundant pebbles

Clay: Mottled red-grey, soft

Sand: Red-orange, light brown, slightly clayey, fine- to coarse-grained, poorly sorted, with pebbles and gravel

- coarse-grained sand, with pebbles and gravel

Silty Sand: Brown, fine-grained, loose, wet

Well Cap

4.5-inch Borehole

Grouted Annulus

2-inch Dia Sch 40 PVC Casing

Bentonite Seal

20/30 Sand Above Pre-pack

2-inch Dia Sch 40 PVC Screen

20/30 Pre-pack Sand

Total Depth Drilled

SOIL BORING LOG

BORING/WELL NO.:	**W-26**
TOTAL DEPTH:	**60 Feet**
TOP OF CASING ELEV.:	**129.42 Ft NGVD**
GROUND SURFACE ELEV.:	**125.89 Ft NGVD**

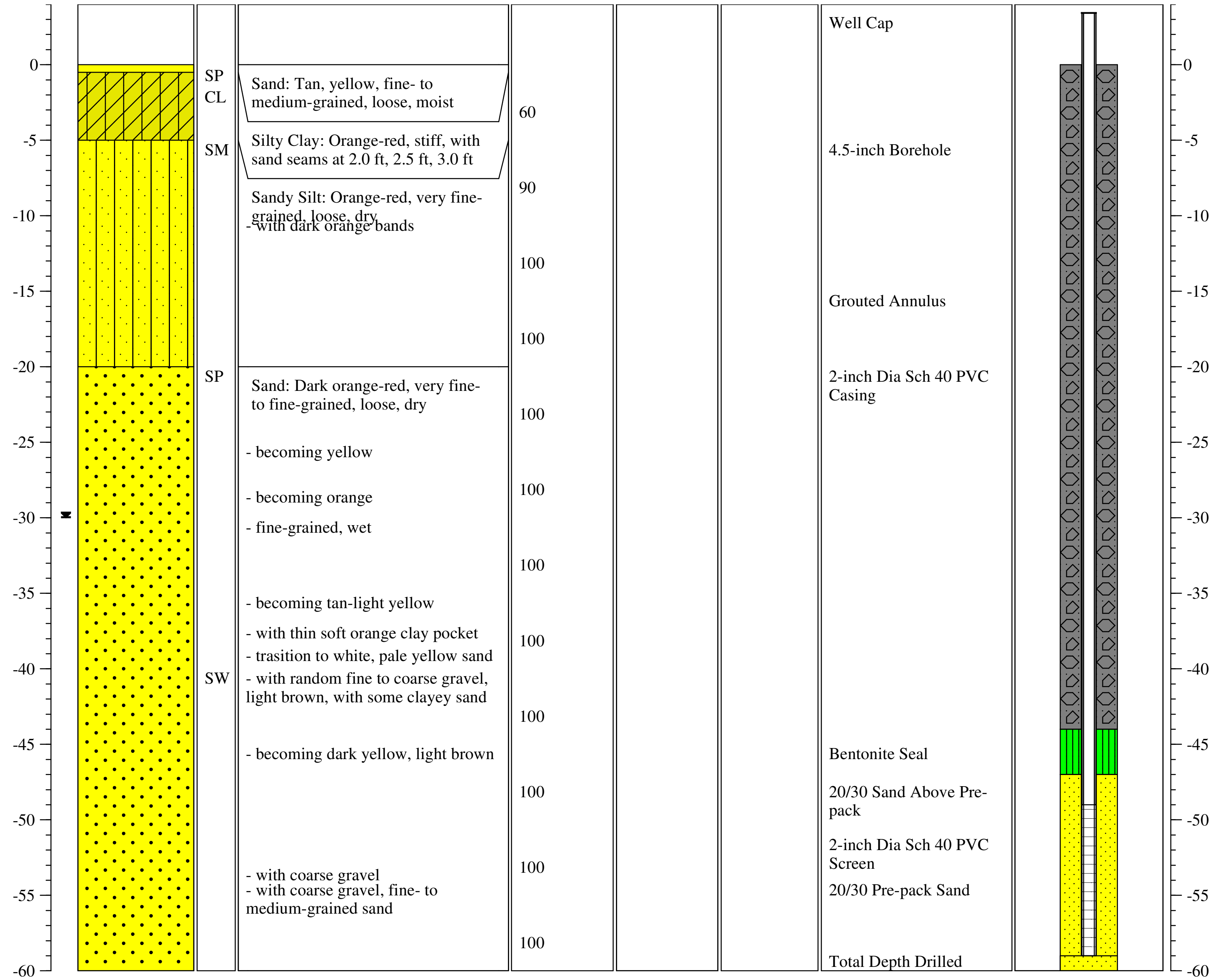
CLIENT:	**Cleco BEC**	DRILLING CO.:	**C&S Lease Service**
PROJECT:	**Ash Ponds**	DRILLER:	**Michael Dodson**
SITE LOCATION:	**Boyce, Louisiana**	METHOD OF DRILLING:	**DPT**
PROJECT NO.:	**01-17-0173**	SAMPLING METHODS:	**DPT**
LOGGED BY:	**R Sturdivant**	DATES DRILLED:	**11/07/2017**

Notes:

▽ Water level during drilling: 30 ft bgs

▼ Water level in completed well: 29.93 ft bgs

DEPTH	SOIL SYMBOLS	USCS	SOIL DESCRIPTION	CORE RECOVERY (Percent)	STIFFNESS (Kg/cm^2)	SAMPLE TAKEN	BORING DESCRIPTION	WELL CONSTRUCTION



Sand: Tan, yellow, fine- to medium-grained, loose, moist

Silty Clay: Orange-red, stiff, with sand seams at 2.0 ft, 2.5 ft, 3.0 ft

Sandy Silt: Orange-red, very fine-grained, loose, dry

- with dark orange bands

Sand: Dark orange-red, very fine- to fine-grained, loose, dry

- becoming yellow
- becoming orange
- fine-grained, wet
- becoming tan-light yellow
- with thin soft orange clay pocket
- trasition to white, pale yellow sand
- with random fine to coarse gravel, light brown, with some clayey sand
- becoming dark yellow, light brown
- with coarse gravel
- with coarse gravel, fine- to medium-grained sand

60
90
100
100
100
100
100
100
100
100
100
100

Well Cap

4.5-inch Borehole

Grouted Annulus

2-inch Dia Sch 40 PVC Casing

Bentonite Seal

20/30 Sand Above Pre-pack

2-inch Dia Sch 40 PVC Screen

20/30 Pre-pack Sand

Total Depth Drilled

SOIL BORING LOG

BORING/WELL NO.: **W-27**
TOTAL DEPTH: **60 Feet**
TOP OF CASING ELEV.: **119.43 Ft NGVD**
GROUND SURFACE ELEV.: **116.92 Ft NGVD**

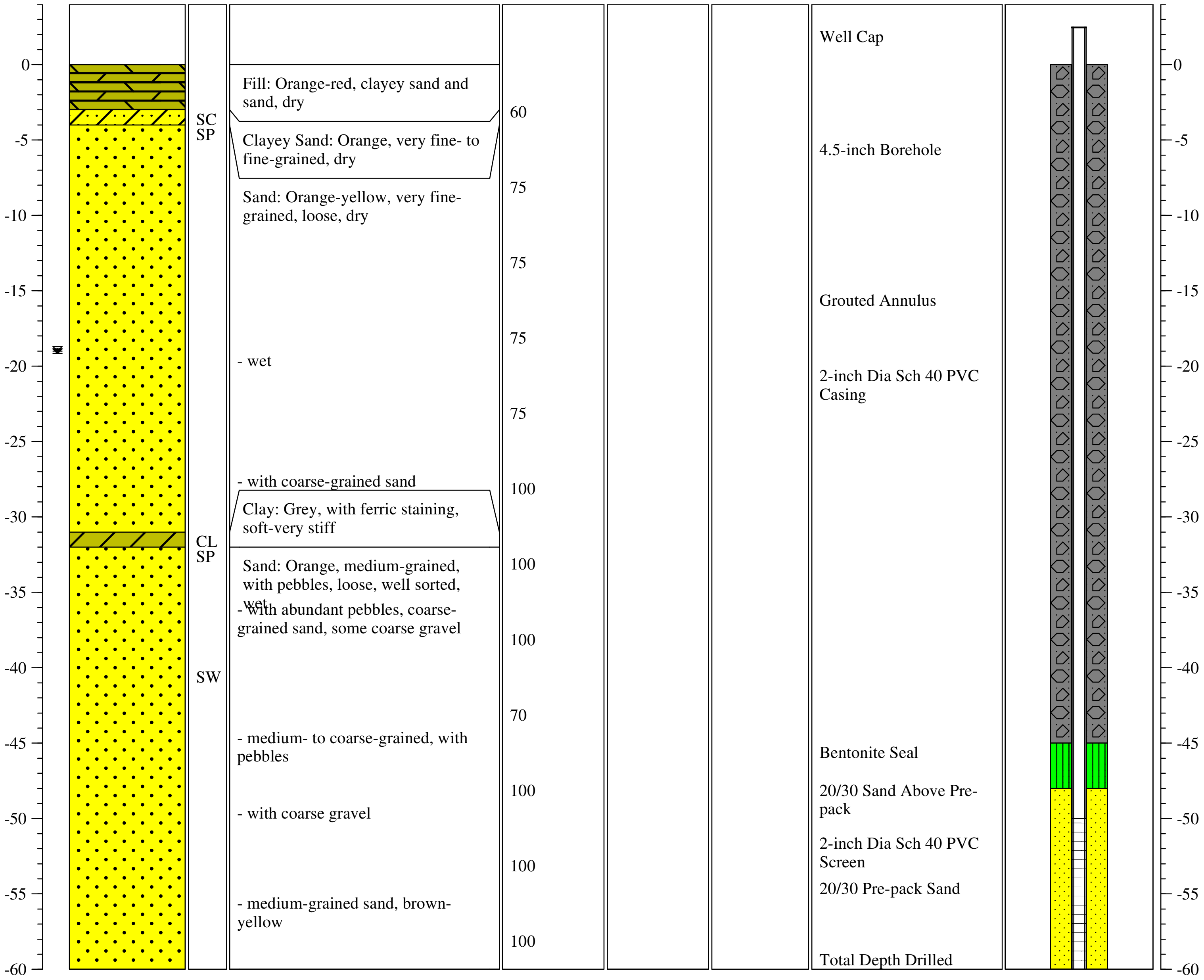
CLIENT: **Cleco BEC**
PROJECT: **Ash Ponds**
SITE LOCATION: **Boyce, Louisiana**
PROJECT NO.: **01-17-0173**
LOGGED BY: **R Sturdivant**

DRILLING CO.: **C&S Lease Service**
DRILLER: **Michael Dodson**
METHOD OF DRILLING: **DPT**
SAMPLING METHODS: **DPT**
DATES DRILLED: **11/08/2017**

Notes:

▽ Water level during drilling: 19 ft bgs
▼ Water level in completed well: 19.15 ft bgs

DEPTH	SOIL SYMBOLS	USCS	SOIL DESCRIPTION	CORE RECOVERY (Percent)	STIFFNESS (Kg/cm^2)	SAMPLE TAKEN	BORING DESCRIPTION	WELL CONSTRUCTION



Fill: Orange-red, clayey sand and sand, dry

Clayey Sand: Orange, very fine- to fine-grained, dry

Sand: Orange-yellow, very fine-grained, loose, dry

- wet

- with coarse-grained sand

Clay: Grey, with ferric staining, soft-very stiff

Sand: Orange, medium-grained, with pebbles, loose, well sorted, wet

- with abundant pebbles, coarse-grained sand, some coarse gravel

- medium- to coarse-grained, with pebbles

- with coarse gravel

- medium-grained sand, brown-yellow

Well Cap

4.5-inch Borehole

Grouted Annulus

2-inch Dia Sch 40 PVC Casing

Bentonite Seal

20/30 Sand Above Pre-pack

2-inch Dia Sch 40 PVC Screen

20/30 Pre-pack Sand

Total Depth Drilled

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ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG

BORING/WELL NO.: **B-18-1**
TOTAL DEPTH: **12.5 Feet**
TOP OF CASING ELEV.: **NA**
GROUND SURFACE ELEV.: **89.98 Ft NGVD**

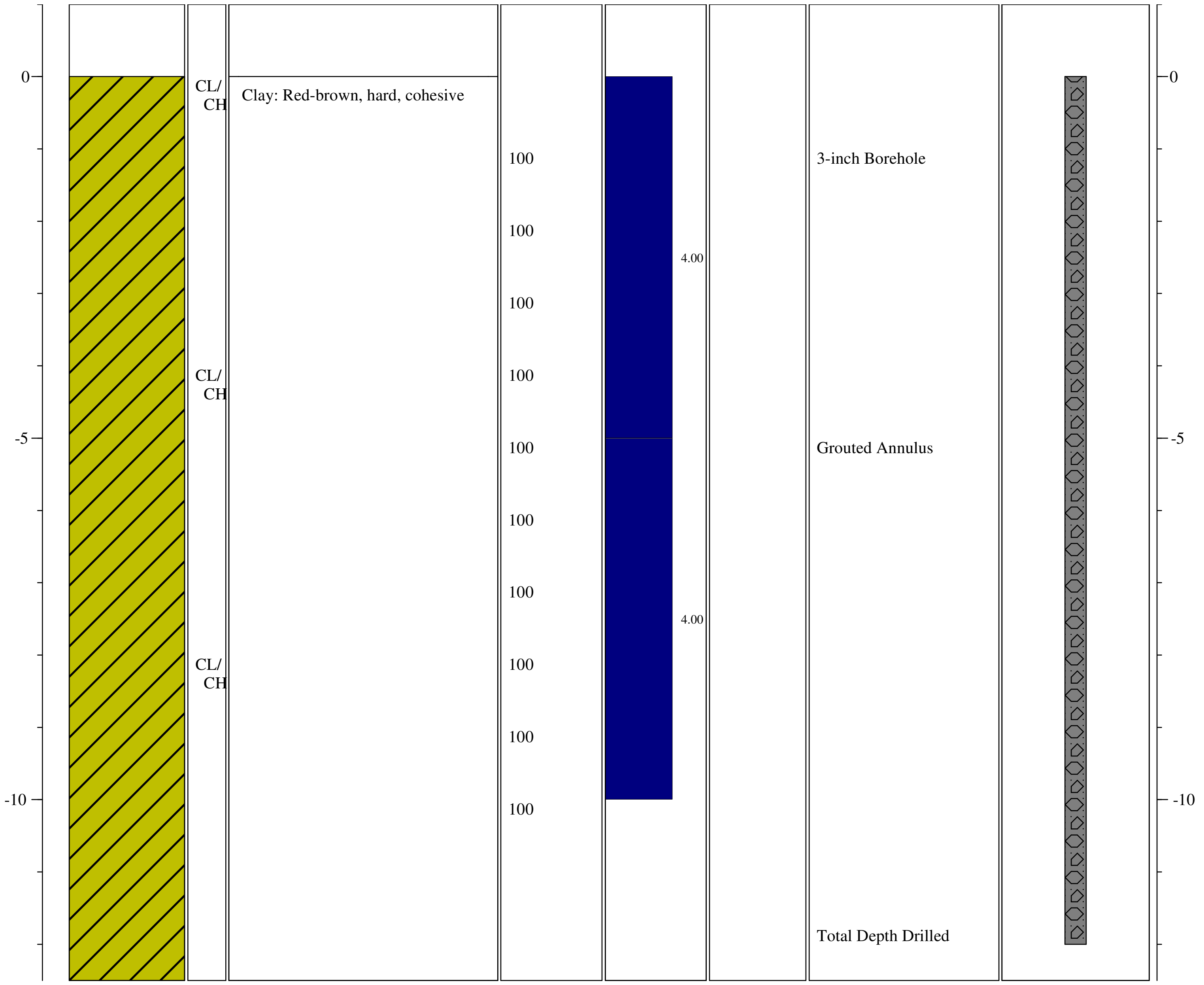
CLIENT: **Cleco BEC**
PROJECT: **SW Permitting**
SITE LOCATION: **Boyce, Louisiana**
PROJECT NO.: **01-16-0162**
LOGGED BY: **R Sturdivant**

DRILLING CO.: **Devonian Group**
DRILLER: **C Hebert**
METHOD OF DRILLING: **Hand Auger**
SAMPLING METHODS: **Hand Auger**
DATES DRILLED: **12-18-2017**

Notes:

▽ Water level during drilling: >TD
▼ Water level in completed well: NA

DEPTH	SOIL SYMBOLS	USCS	SOIL DESCRIPTION	CORE RECOVERY (Percent)	STIFFNESS (Kg/cm^2)	SAMPLE TAKEN	BORING DESCRIPTION	WELL CONSTRUCTION



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SOIL BORING LOG

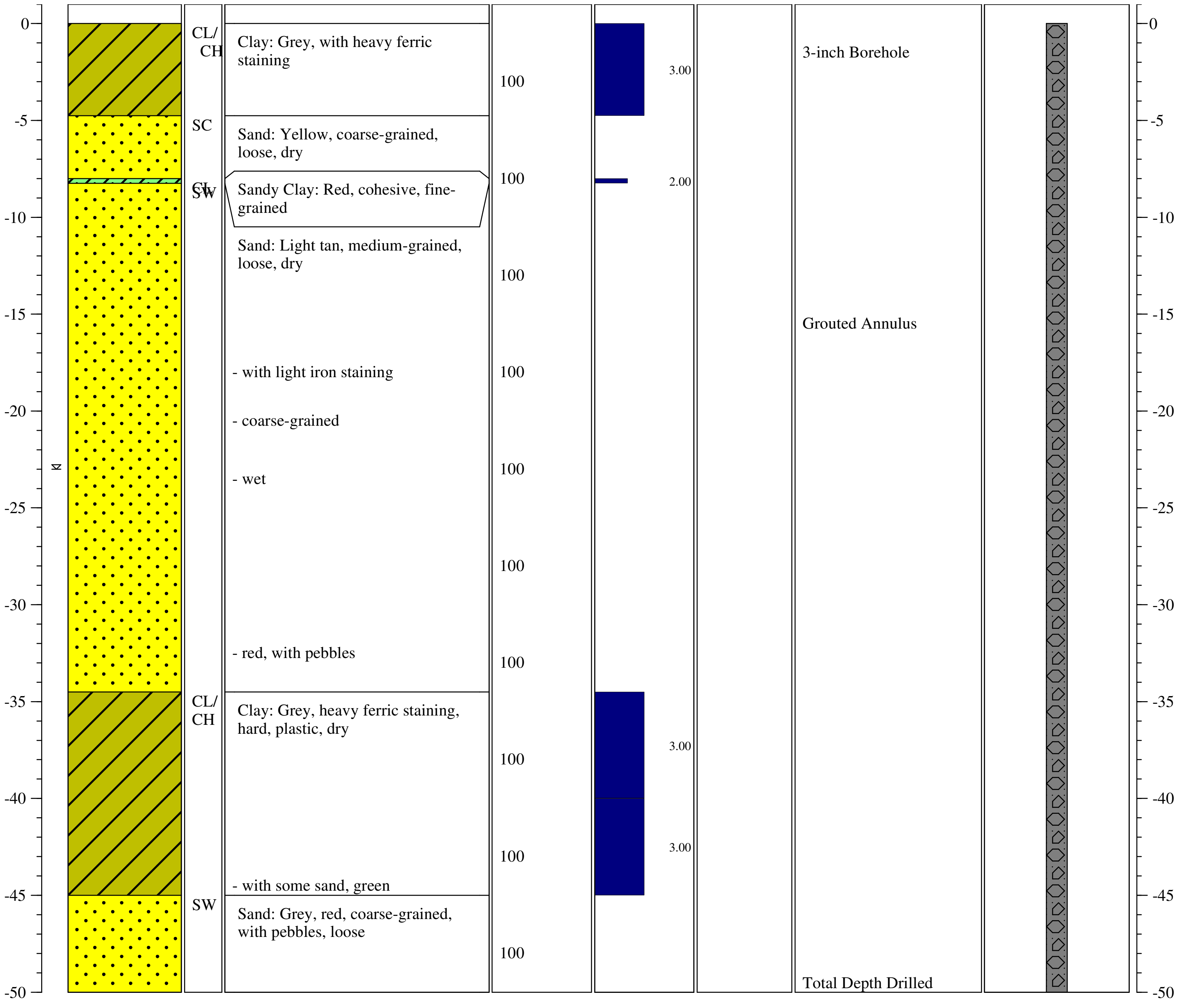
BORING/WELL NO.: **B-18-2**
TOTAL DEPTH: **50 Feet**
TOP OF CASING ELEV.: **NA**
GROUND SURFACE ELEV.: **120.04 Ft NGVD**

CLIENT: **Cleco BEC**
PROJECT: **SW Permitting**
SITE LOCATION: **Boyce, Louisiana**
PROJECT NO.: **01-16-0162**
LOGGED BY: **R Sturdivant**

DRILLING CO.: **Devonian Group**
DRILLER: **C Hebert**
METHOD OF DRILLING: **Direct-Push Technology**
SAMPLING METHODS: **Direct-Push Technology**
DATES DRILLED: **01-08-2018**

Notes:

▽ Water level during drilling: >TD
▼ Water level in completed well: NA



DEPTH	SOIL SYMBOLS	USCS	SOIL DESCRIPTION	CORE RECOVERY (Percent)	STIFFNESS (Kg/cm^2)	SAMPLE TAKEN	BORING DESCRIPTION	WELL CONSTRUCTION
0		CL/ CH	Clay: Grey, with heavy ferric staining	100	3.00		3-inch Borehole	
-5		SC	Sand: Yellow, coarse-grained, loose, dry	100	2.00			
		CL	Sandy Clay: Red, cohesive, fine-grained					
-10		SW	Sand: Light tan, medium-grained, loose, dry	100				
-15							Grouted Annulus	
			- with light iron staining	100				
-20			- coarse-grained					
			- wet	100				
-25				100				
-30			- red, with pebbles	100				
-35		CL/ CH	Clay: Grey, heavy ferric staining, hard, plastic, dry	100	3.00			
-40				100	3.00			
			- with some sand, green					
-45		SW	Sand: Grey, red, coarse-grained, with pebbles, loose	100				
-50							Total Depth Drilled	

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SOIL BORING LOG

BORING/WELL NO.:	**B-18-3**
TOTAL DEPTH:	**50 Feet**
TOP OF CASING ELEV.:	**NA**
GROUND SURFACE ELEV.:	**121.14 Ft NGVD**

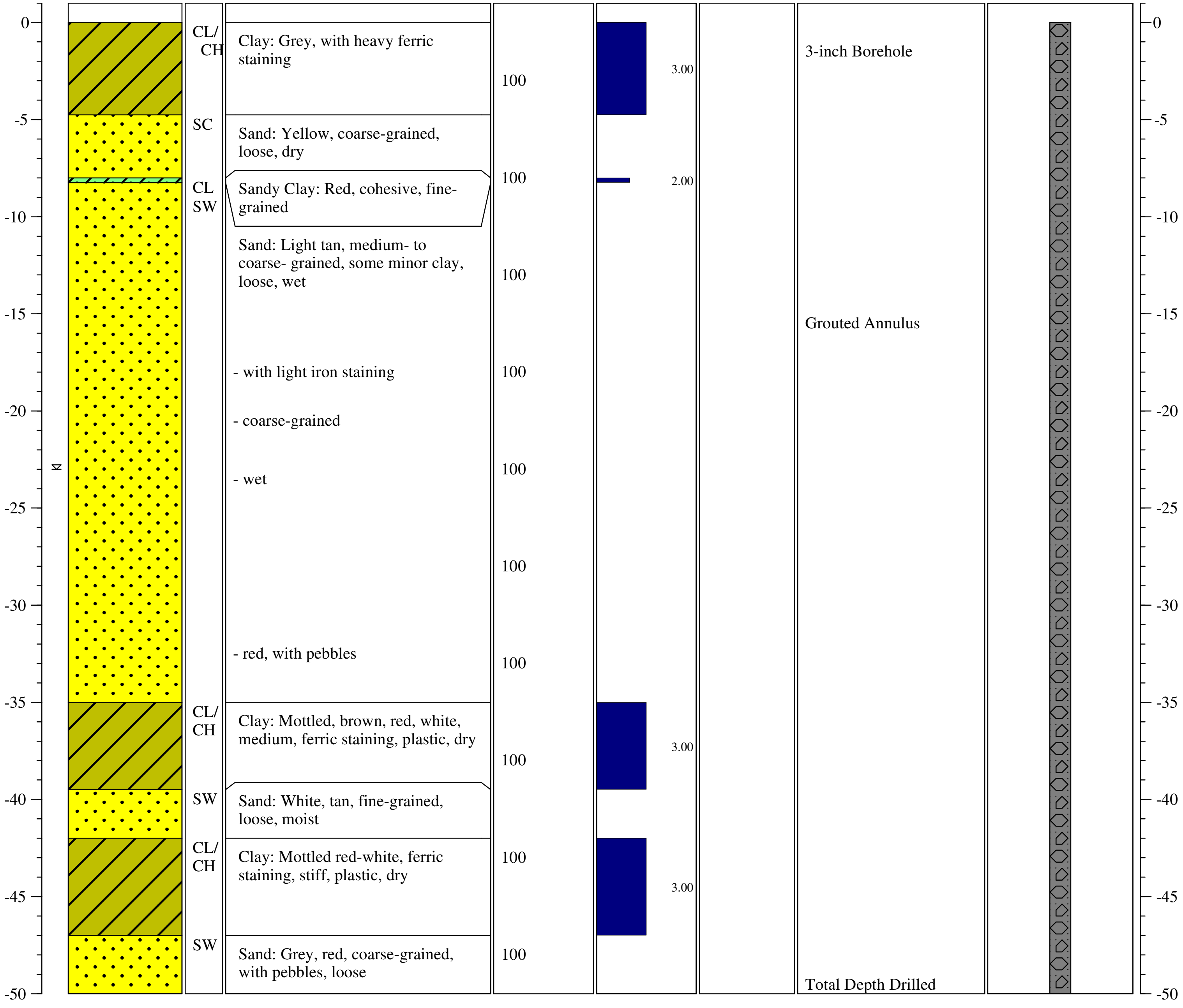
CLIENT:	**Cleco BEC**	DRILLING CO.:	**Devonian Group**
PROJECT:	**SW Permitting**	DRILLER:	**C Hebert**
SITE LOCATION:	**Boyce, Louisiana**	METHOD OF DRILLING:	**Direct-Push Technology**
PROJECT NO.:	**01-16-0162**	SAMPLING METHODS:	**Direct-Push Technology**
LOGGED BY:	**R Sturdivant**	DATES DRILLED:	**01-09-2018**

Notes:

▽ Water level during drilling: >TD

▼ Water level in completed well: NA

DEPTH	SOIL SYMBOLS	USCS	SOIL DESCRIPTION	CORE RECOVERY (Percent)	STIFFNESS (Kg/cm^2)	SAMPLE TAKEN	BORING DESCRIPTION	WELL CONSTRUCTION



Clay: Grey, with heavy ferric staining

Sand: Yellow, coarse-grained, loose, dry

Sandy Clay: Red, cohesive, fine-grained

Sand: Light tan, medium- to coarse- grained, some minor clay, loose, wet

- with light iron staining

- coarse-grained

- wet

- red, with pebbles

Clay: Mottled, brown, red, white, medium, ferric staining, plastic, dry

Sand: White, tan, fine-grained, loose, moist

Clay: Mottled red-white, ferric staining, stiff, plastic, dry

Sand: Grey, red, coarse-grained, with pebbles, loose

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SOIL BORING LOG

BORING/WELL NO.: **B-18-4**
TOTAL DEPTH: **14 Feet**
TOP OF CASING ELEV.: **NA**
GROUND SURFACE ELEV.: **91.47 Ft NGVD**

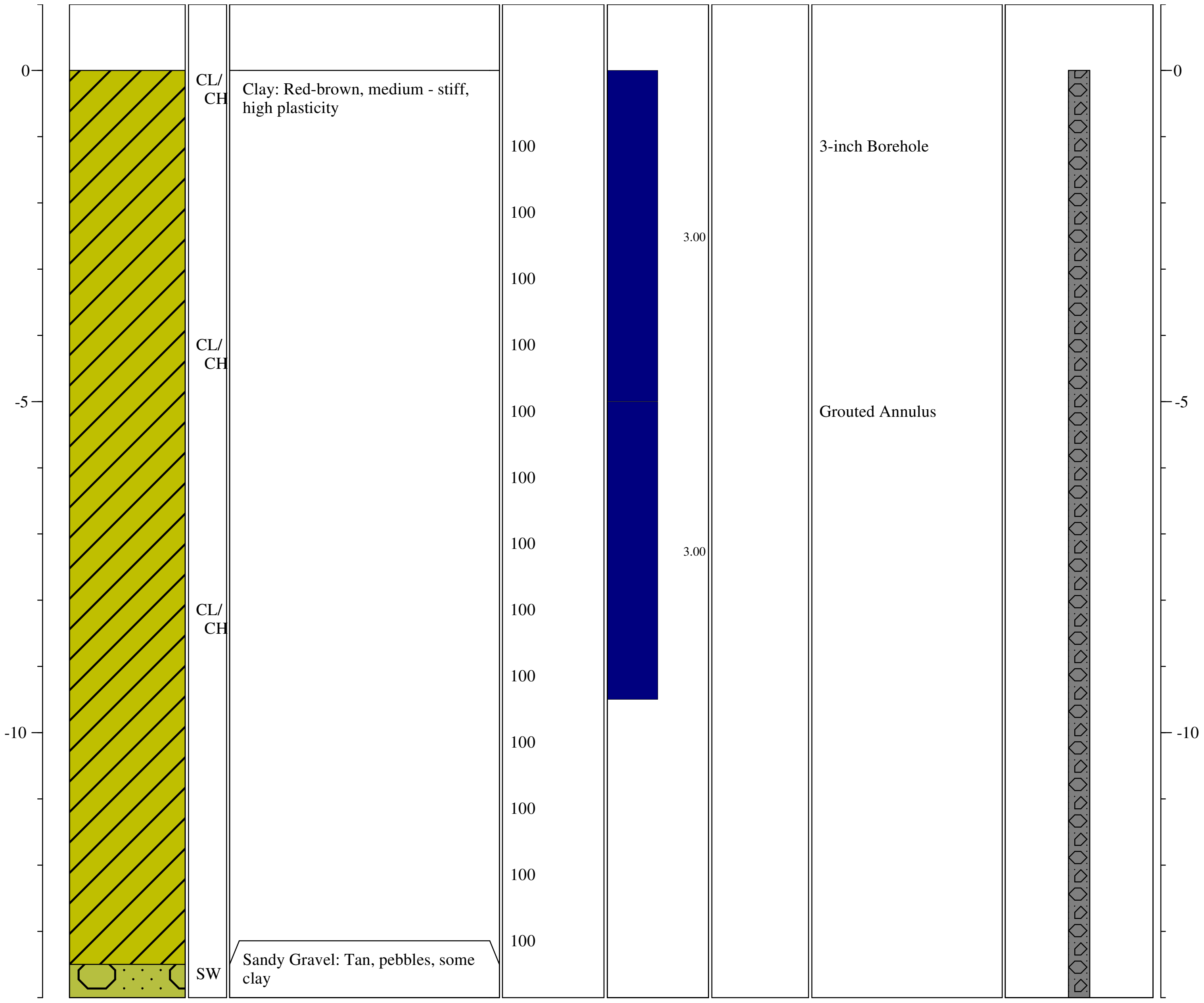
CLIENT: **Cleco BEC**
PROJECT: **SW Permitting**
SITE LOCATION: **Boyce, Louisiana**
PROJECT NO.: **01-16-0162**
LOGGED BY: **R Sturdivant**

DRILLING CO.: **Devonian Group**
DRILLER: **C Hebert**
METHOD OF DRILLING: **Hand Auger**
SAMPLING METHODS: **Hand Auger**
DATES DRILLED: **01-08-2018**

Notes:

▽ Water level during drilling: >TD
▼ Water level in completed well: NA

DEPTH	SOIL SYMBOLS	USCS	SOIL DESCRIPTION	CORE RECOVERY (Percent)	STIFFNESS (Kg/cm^2)	SAMPLE TAKEN	BORING DESCRIPTION	WELL CONSTRUCTION



Clay: Red-brown, medium - stiff, high plasticity

Sandy Gravel: Tan, pebbles, some clay

3-inch Borehole

Grouted Annulus

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SOIL BORING LOG

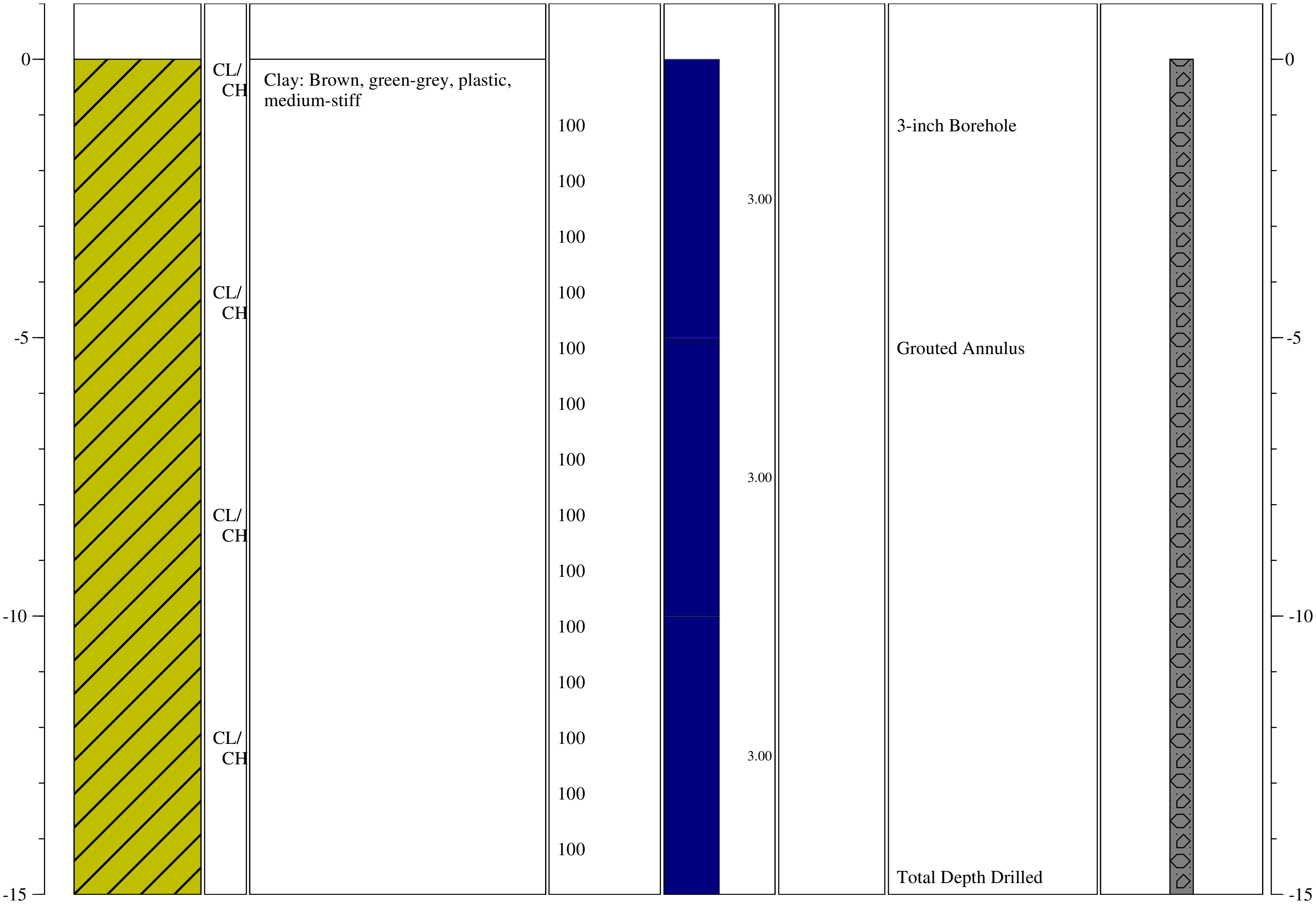
BORING/WELL NO.: **B-18-5**
TOTAL DEPTH: **15 Feet**
TOP OF CASING ELEV.: **NA**
GROUND SURFACE ELEV.: **92.32 Ft NGVD**

CLIENT: **Cleco BEC**
PROJECT: **SW Permitting**
SITE LOCATION: **Boyce, Louisiana**
PROJECT NO.: **01-16-0162**
LOGGED BY: **R Sturdivant**

DRILLING CO.: **Devonian Group**
DRILLER: **C Hebert**
METHOD OF DRILLING: **Hand Auger**
SAMPLING METHODS: **Hand Auger**
DATES DRILLED: **01-09-2018**

Notes:

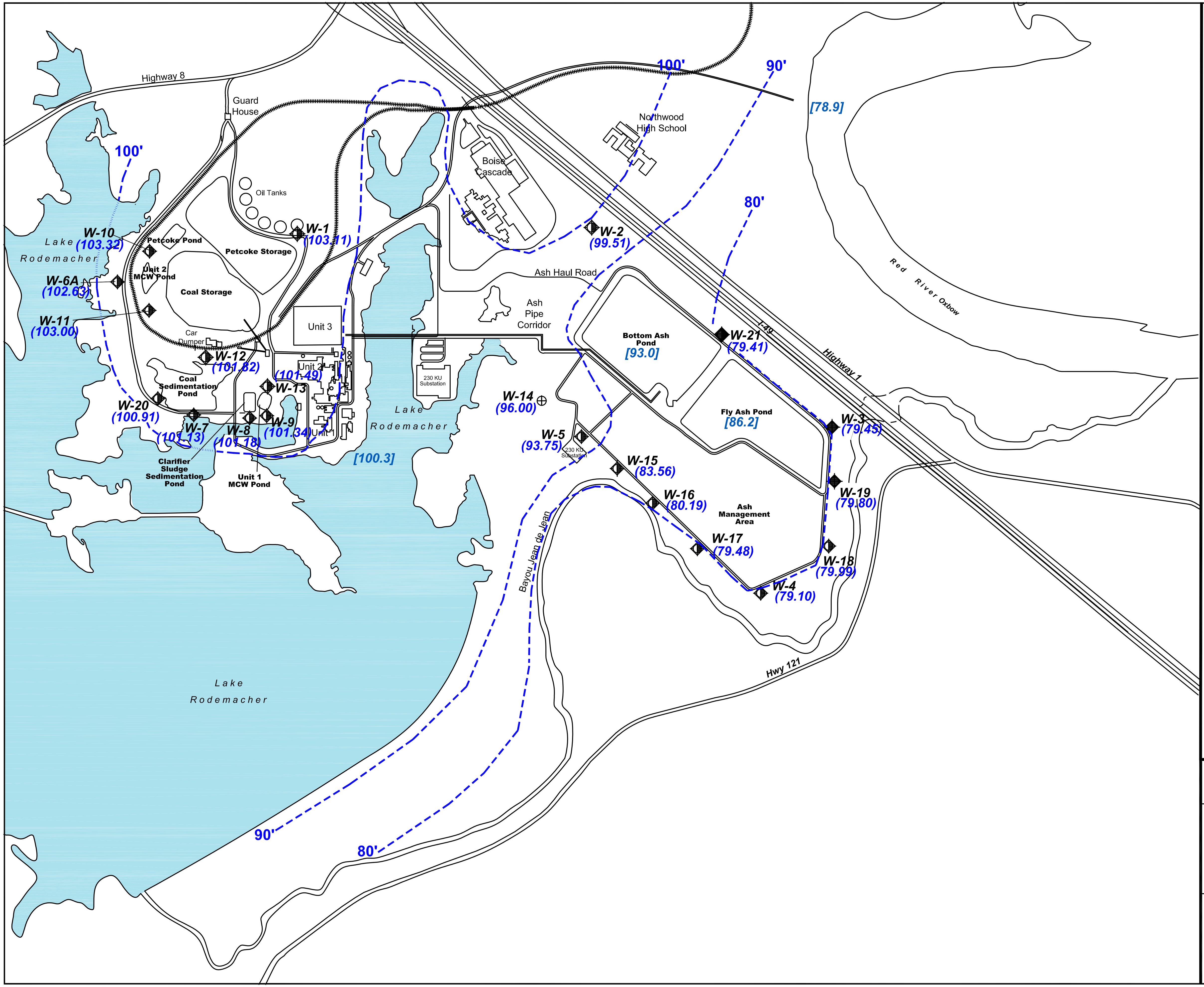
▽ Water level during drilling: >TD
▼ Water level in completed well: NA



DEPTH	SOIL SYMBOLS	USCS	SOIL DESCRIPTION	CORE RECOVERY (Percent)	STIFFNESS (Kg/cm^2)	SAMPLE TAKEN	BORING DESCRIPTION	WELL CONSTRUCTION
		CL/ CH CL/ CH CL/ CH CL/ CH	Clay: Brown, green-grey, plastic, medium-stiff	100 100 100 100 100 100 100 100 100 100 100 100 100 100	3.00 3.00 3.00		3-inch Borehole Grouted Annulus Total Depth Drilled	

APPENDIX D

POTENTIOMETRIC SURFACE MAPS



N

Legend

ⵣ Railroad Tracks

◆ CCR Compliance Well Location

◈ Non-CCR Piezometer Location

(79.10) Potentiometric Surface Elevation, Ft. NGVD

70'— Potentiometric Surface Elevation Contour, Ft. NGVD

– – – Inferred Potentiometric Surface Contour, Ft. NGVD

[93.0] Surface Water Elevation ft. NGVD

1,200 0 1,200

Scale: 1" = 1,200'

CLECO Corporation

Brame Energy Center

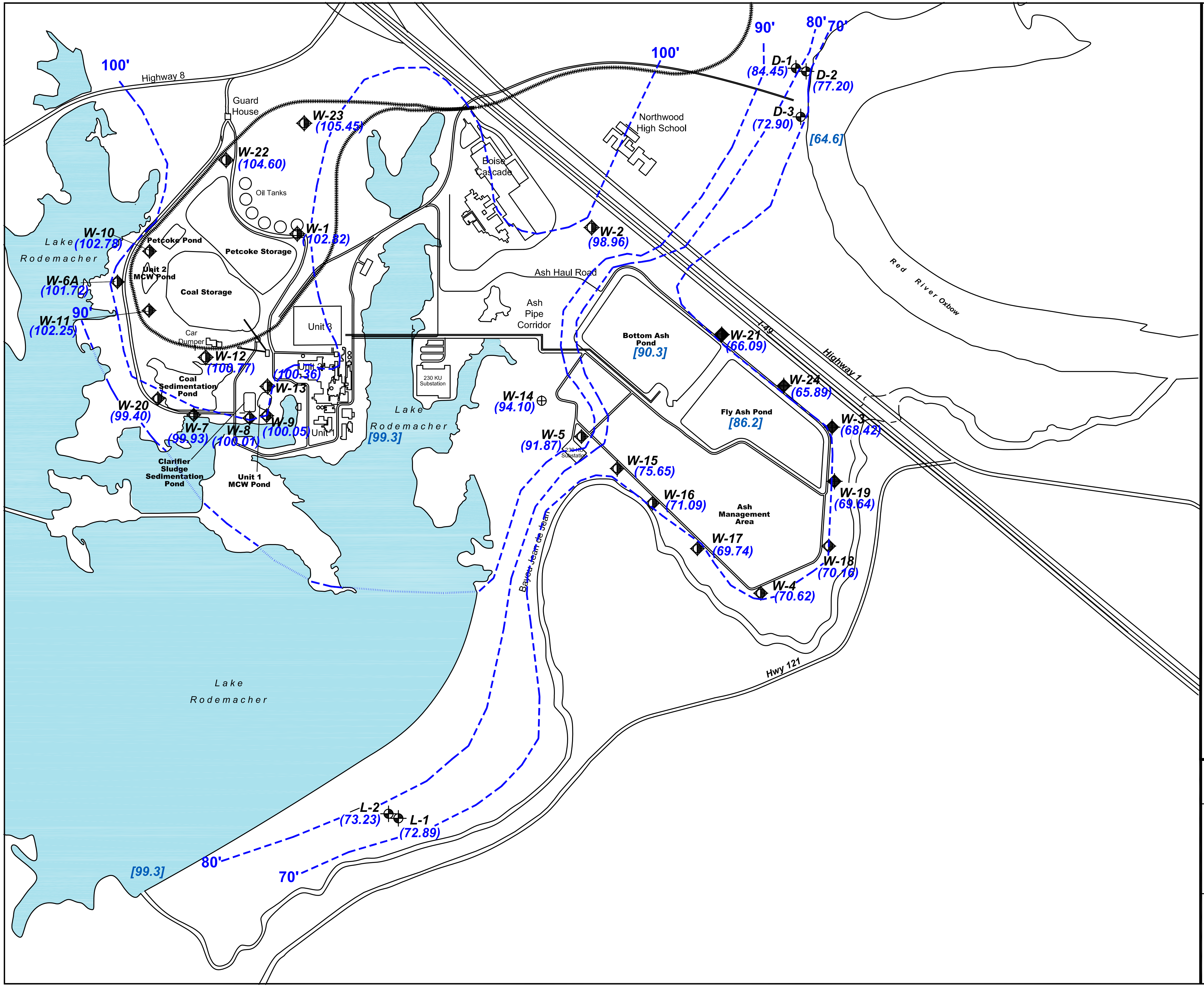
Cleco Brame
Potentiometric Surface Contour Map
April 2016

Rapides Parish, Louisiana

E·A·G·L·E
ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RB
Approved:	JM
Date:	2/22/17
Dwg. No.:	01-20-0220-APP-D-1

Figure D-1



N

Legend

Railroad Tracks

CCR Background Well Location

CCR Compliance Well Location

Non-CCR Piezometer Location

(70.62) Potentiometric Surface Elevation, Ft. NGVD

70' Potentiometric Surface Elevation Contour, Ft. NGVD

Inferred Potentiometric Surface Contour, Ft. NGVD

[90.3] Surface Water Elevation, ft. NGVD

1,200 0 1,200

Scale: 1" = 1,200'

CLECO Corporation

Brame Energy Center

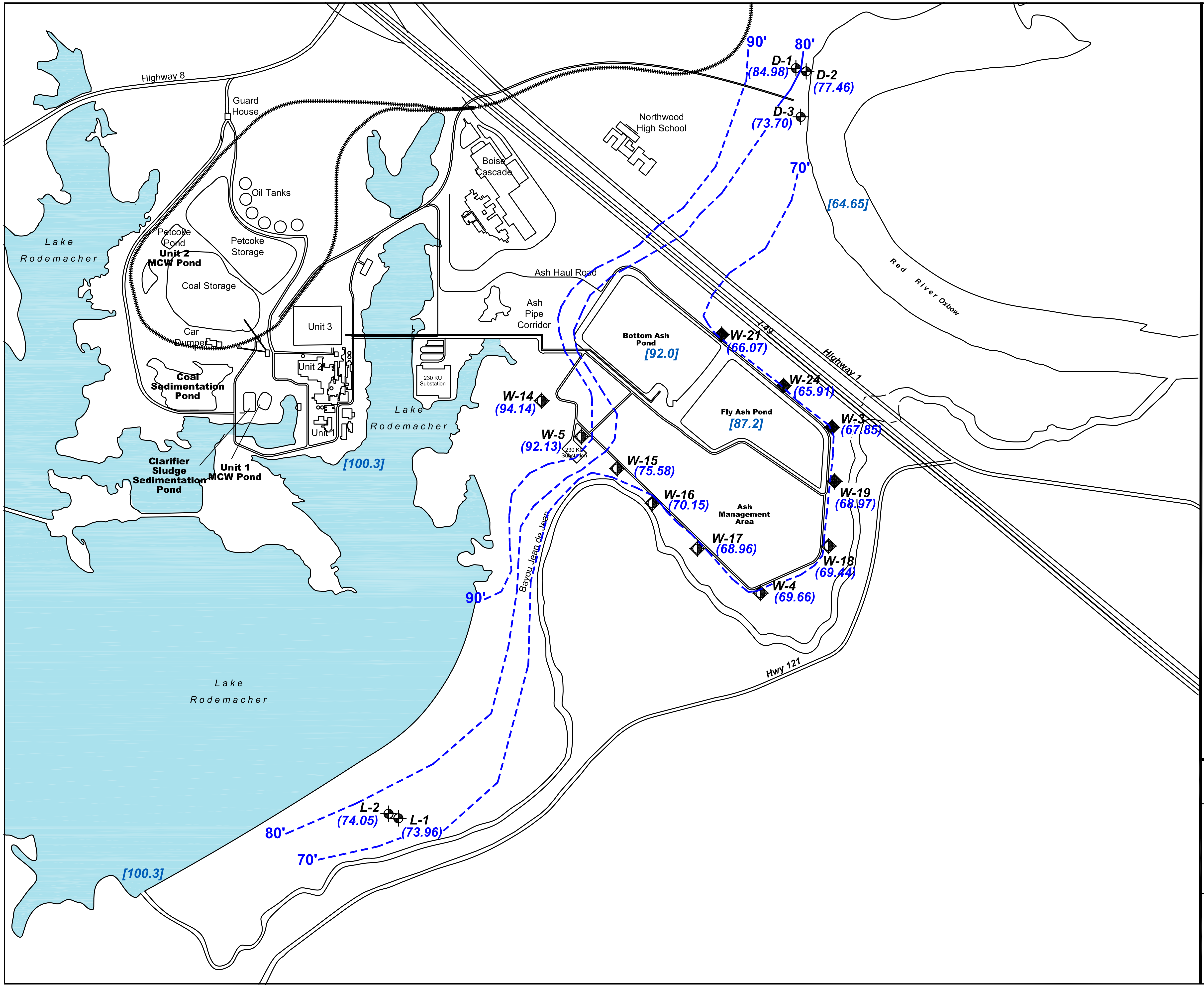
Cleco Brame
Potentiometric Surface Contour Map
October 2016

Rapides Parish, Louisiana

E·A·G·L·E
ENVIRONMENTAL SERVICES, INC.

Drawn: JP
Checked: RB
Approved: JM
Date: 2/22/17
Dwg. No.: 01-20-0220-APP-D-2

Figure D-2



Legend

Railroad Tracks

CCR Background Well Location

CCR Compliance Well Location

Non-CCR Piezometer Location

(68.97) Potentiometric Surface Elevation, Ft. NGVD

70' Potentiometric Surface Elevation Contour, Ft. NGVD

Inferred Potentiometric Surface Contour, Ft. NGVD

[92.0] Surface Water Elevation ft. NGVD

1,200 0 1,200

Scale: 1" = 1,200'

CLECO Corporation

Brame Energy Center

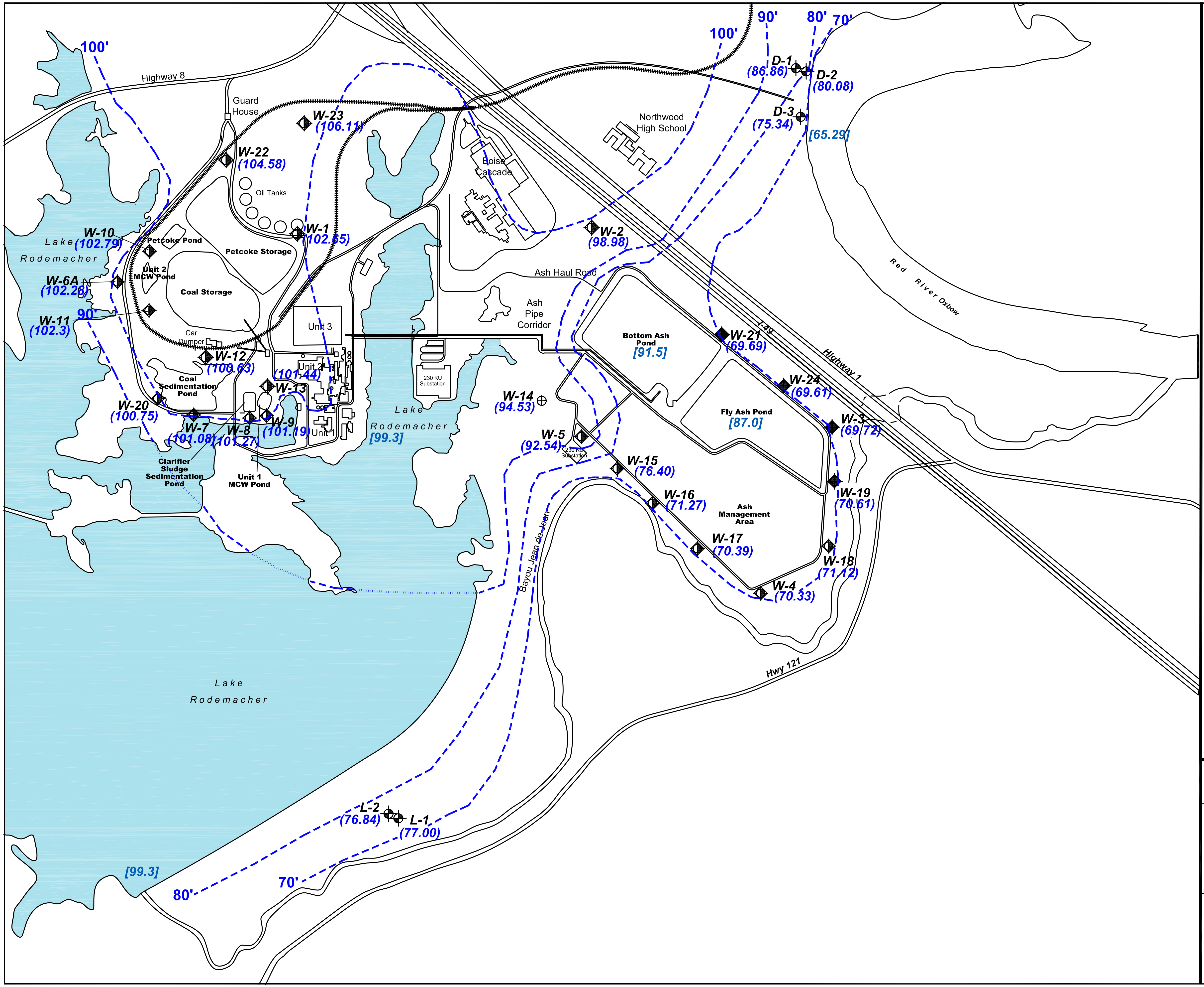
CCR Rule Wells
Potentiometric Surface Contour Map
December 2016

Rapides Parish, Louisiana

E·A·G·L·E ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RB
Approved:	JM
Date:	3/1/17
Dwg. No.:	01-20-0220-APP-D-3

Figure D-3



N

Legend

++++++++++	Railroad Tracks
⊕	CCR Background Well Location
◆	CCR Compliance Well Location
◈	Non-CCR Piezometer Location
(70.33)	Potentiometric Surface Elevation, Ft. NGVD
70' —	Potentiometric Surface Elevation Contour, Ft. NGVD
- -	Inferred Potentiometric Surface Contour, Ft. NGVD
[91.5]	Surface Water Elevation ft. NGVD

1,200 0 1,200

Scale: 1" = 1,200'

CLECO Corporation

Brame Energy Center

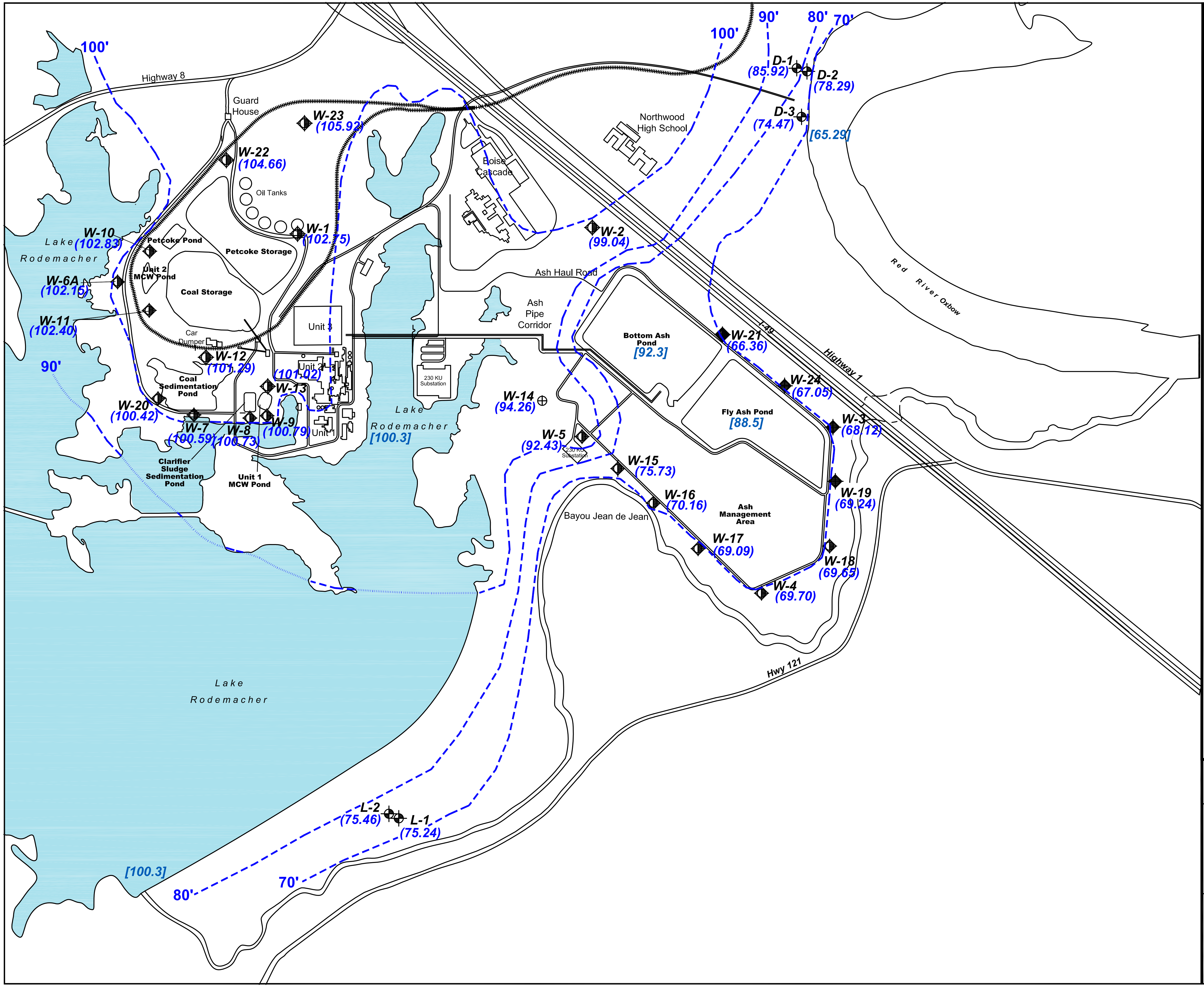
Cleco Brame
Potentiometric Surface Contour Map
January 2017

Rapides Parish, Louisiana

E·A·G·L·E
ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RB
Approved:	JM
Date:	2/22/17
Dwg. No.:	01-20-0220-APP-D-4

Figure D-4



Legend

- Railroad Tracks
- CCR Background Well Location
- CCR Compliance Well Location
- Non-CCR Piezometer Location
- (69.24) Potentiometric Surface Elevation, Ft. NGVD
- 70' Potentiometric Surface Elevation Contour, Ft. NGVD
- Inferred Potentiometric Surface Contour, Ft. NGVD
- [65.29] Surface Water Elevation ft. NGVD

1,200 0 1,200

Scale: 1" = 1,200'

CLECO Corporation

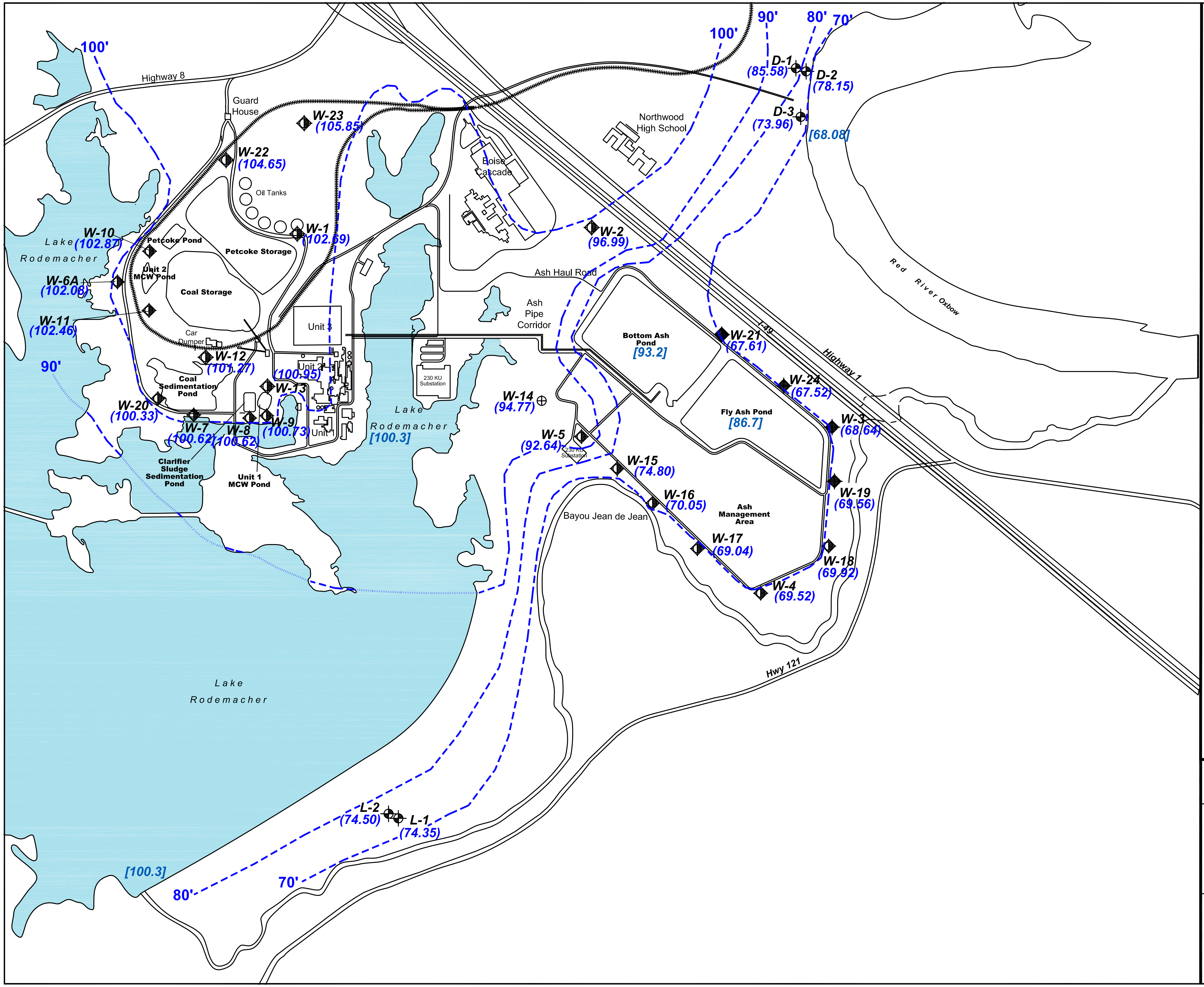
Brame Energy Center

Cleco Brame
Potentiometric Surface Contour Map
February 2017
Rapides Parish, Louisiana

E·A·G·L·E ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RS
Approved:	JM
Date:	3/23/17
Dwg. No.:	01-20-0220-APP-D-5

Figure D-5



N

Legend

- Railroad Tracks
- ⌖ CCR Background Well Location
- ◆ CCR Compliance Well Location
- ◈ Non-CCR Piezometer Location
- **(69.52)** Potentiometric Surface Elevation, Ft. NGVD
- **70'—** Potentiometric Surface Elevation Contour, Ft. NGVD
- Inferred Potentiometric Surface Contour, Ft. NGVD
- **[68.08]** Surface Water Elevation ft. NGVD

1,200 0 1,200

Scale: 1" = 1,200'

CLECO Corporation

Brame Energy Center

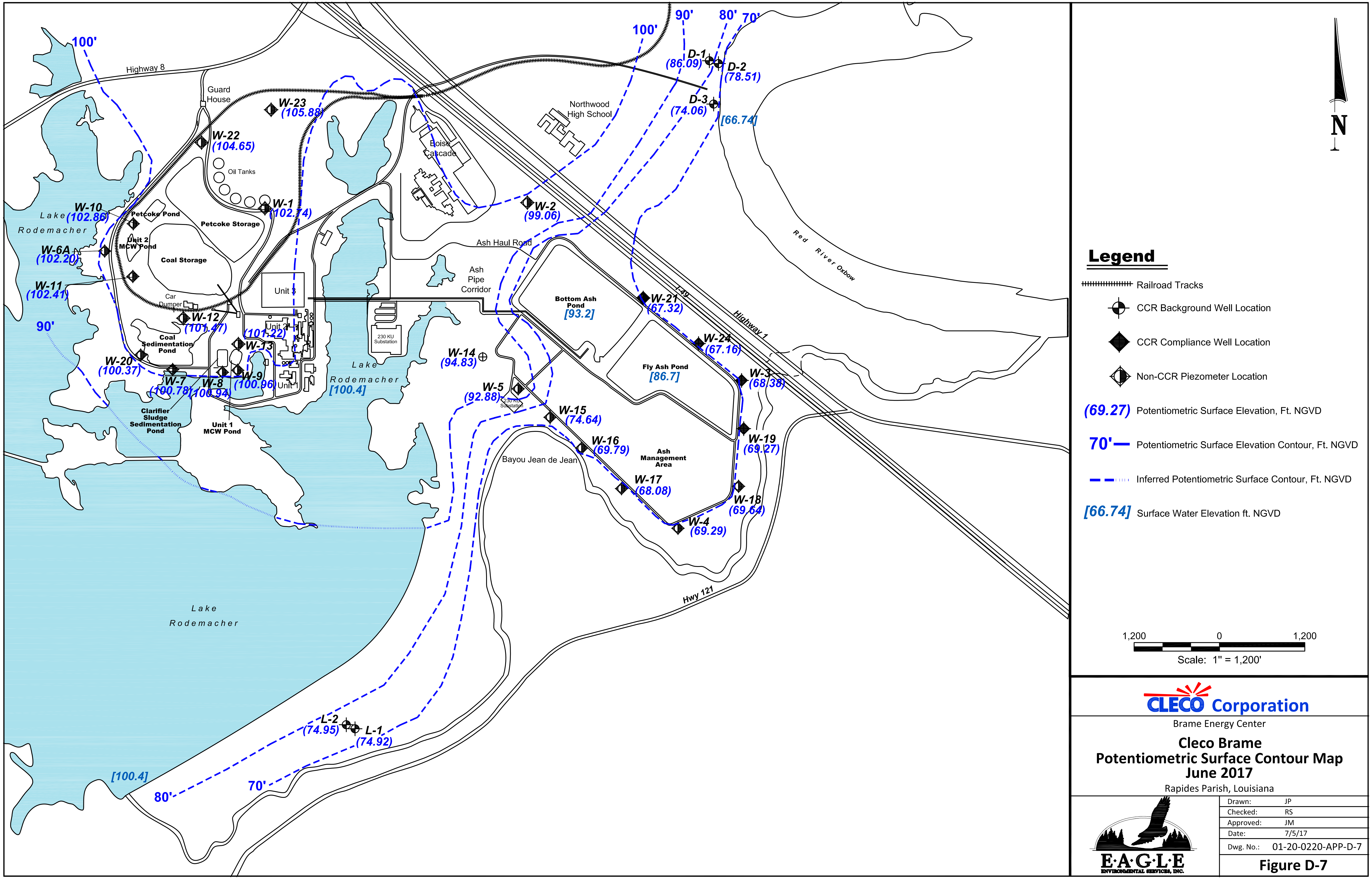
Cleco Brame
Potentiometric Surface Contour Map
May 2017

Rapides Parish, Louisiana

E·A·G·L·E ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RS
Approved:	JM
Date:	6/23/17
Dwg. No.:	01-20-0220-APP-D-6

Figure D-6



CLECO Corporation

Brame Energy Center

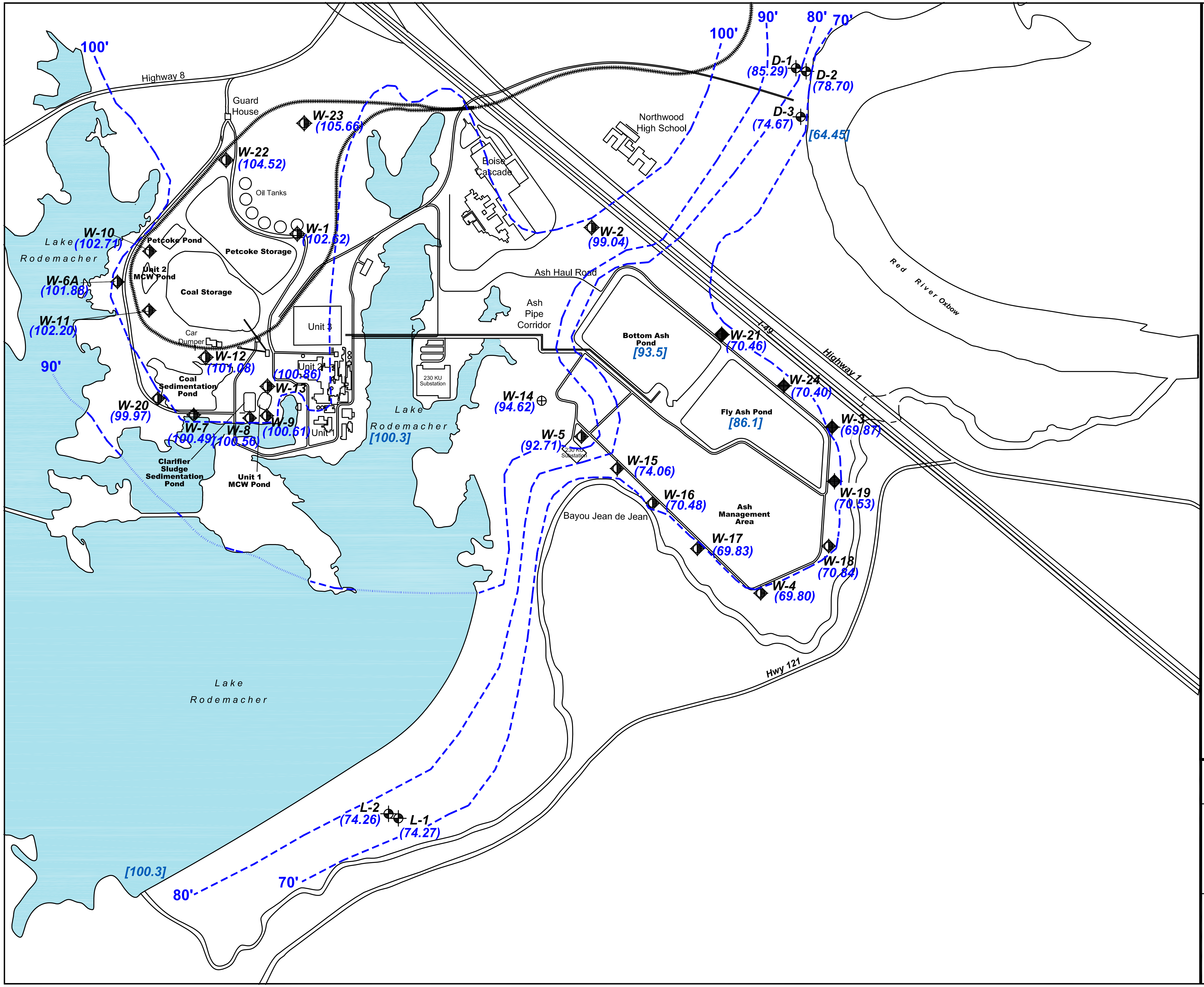
Cleco Brame
Potentiometric Surface Contour Map
June 2017

Rapides Parish, Louisiana

E·A·G·L·E
ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RS
Approved:	JM
Date:	7/5/17
Dwg. No.:	01-20-0220-APP-D-7

Figure D-7



Legend

ǂǂǂǂǂǂǂǂǂǂ Railroad Tracks

⊕ CCR Background Well Location

◆ CCR Compliance Well Location

◈ Non-CCR Piezometer Location

(70.46) Potentiometric Surface Elevation, Ft. NGVD

70'— Potentiometric Surface Elevation Contour, Ft. NGVD

- - - Inferred Potentiometric Surface Contour, Ft. NGVD

[64.45] Surface Water Elevation ft. NGVD

1,200 0 1,200

Scale: 1" = 1,200'

CLECO Corporation

Brame Energy Center

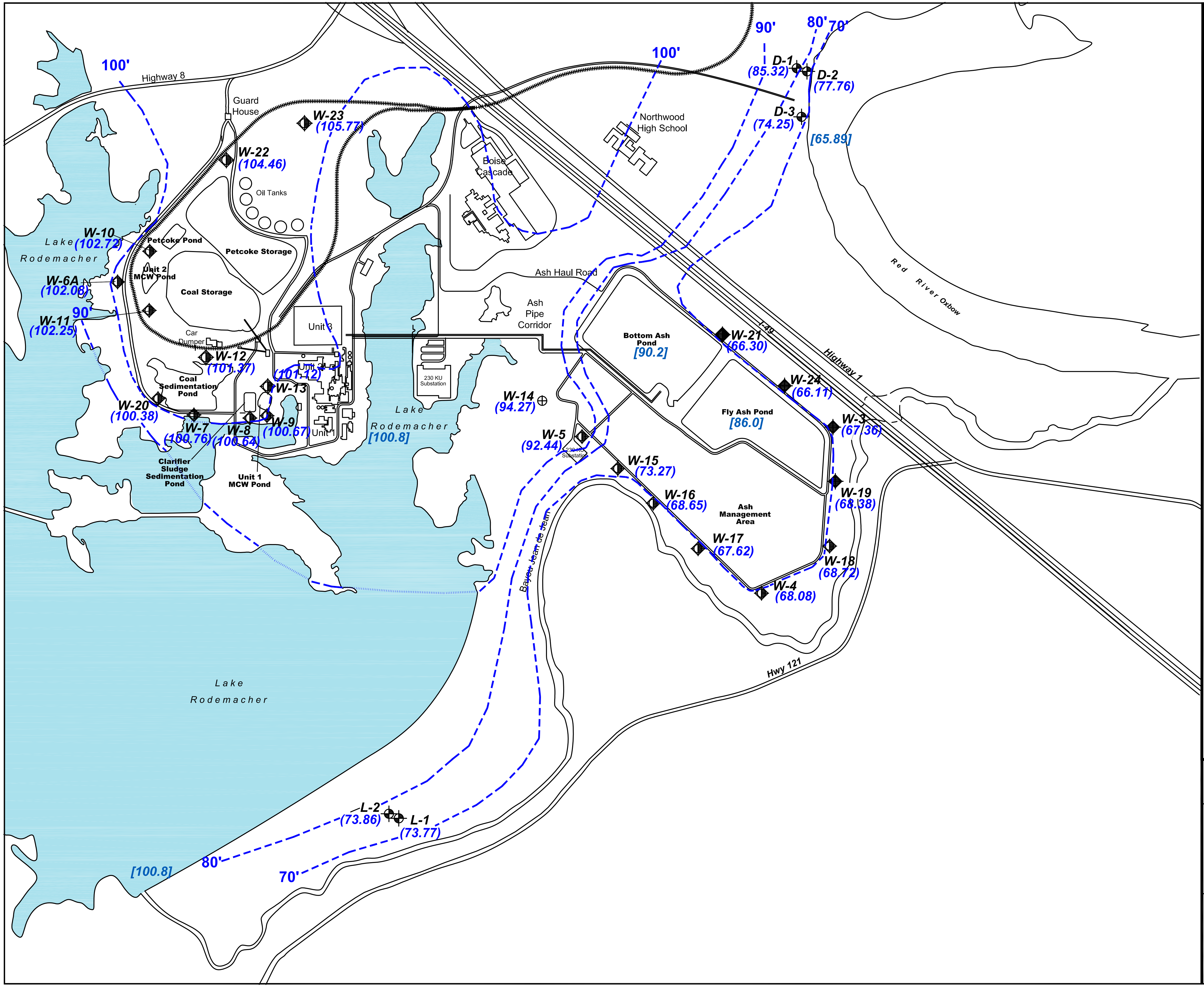
Cleco Brame
Potentiometric Surface Contour Map
August 2017

Rapides Parish, Louisiana

E·A·G·L·E
ENVIRONMENTAL SERVICES, INC.

Drawn: JP
Checked: RS
Approved: JM
Date: 8/30/17
Dwg. No.: 01-20-0220-APP-D-8

Figure D-8



N

Legend

- Railroad Tracks
- CCR Background Well Location
- CCR Compliance Well Location
- Non-CCR Piezometer Location
- (68.08) Potentiometric Surface Elevation, Ft. NGVD
- 70' Potentiometric Surface Elevation Contour, Ft. NGVD
- Inferred Potentiometric Surface Contour, Ft. NGVD
- [90.2] Surface Water Elevation, ft. NGVD

1,200 0 1,200

Scale: 1" = 1,200'

CLECO Corporation

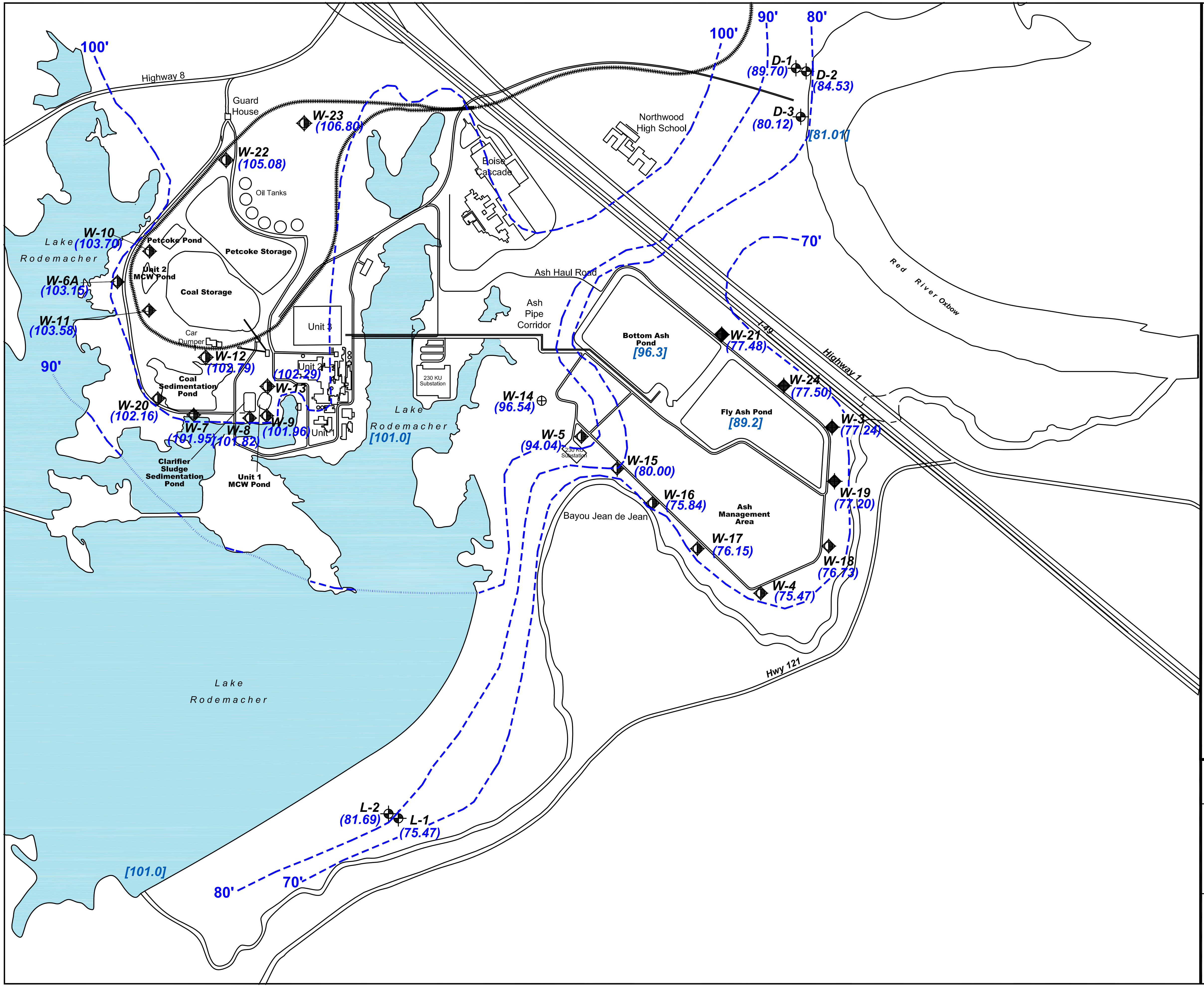
Brame Energy Center

Cleco Brame
Potentiometric Surface Contour Map
January 2018
Rapides Parish, Louisiana

E·A·G·L·E ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RB
Approved:	JM
Date:	1/24/18
Dwg. No.:	01-20-0220-APP-D-9

Figure D-9



Legend

Railroad Tracks
CCR Background Well Location
CCR Compliance Well Location
Non-CCR Piezometer Location
(77.48) Potentiometric Surface Elevation, Ft. NGVD
70' Potentiometric Surface Elevation Contour, Ft. NGVD
Inferred Potentiometric Surface Contour, Ft. NGVD
[81.01] Surface Water Elevation ft. NGVD

1,200 0 1,200
Scale: 1" = 1,200'

CLECO Corporation

Brame Energy Center

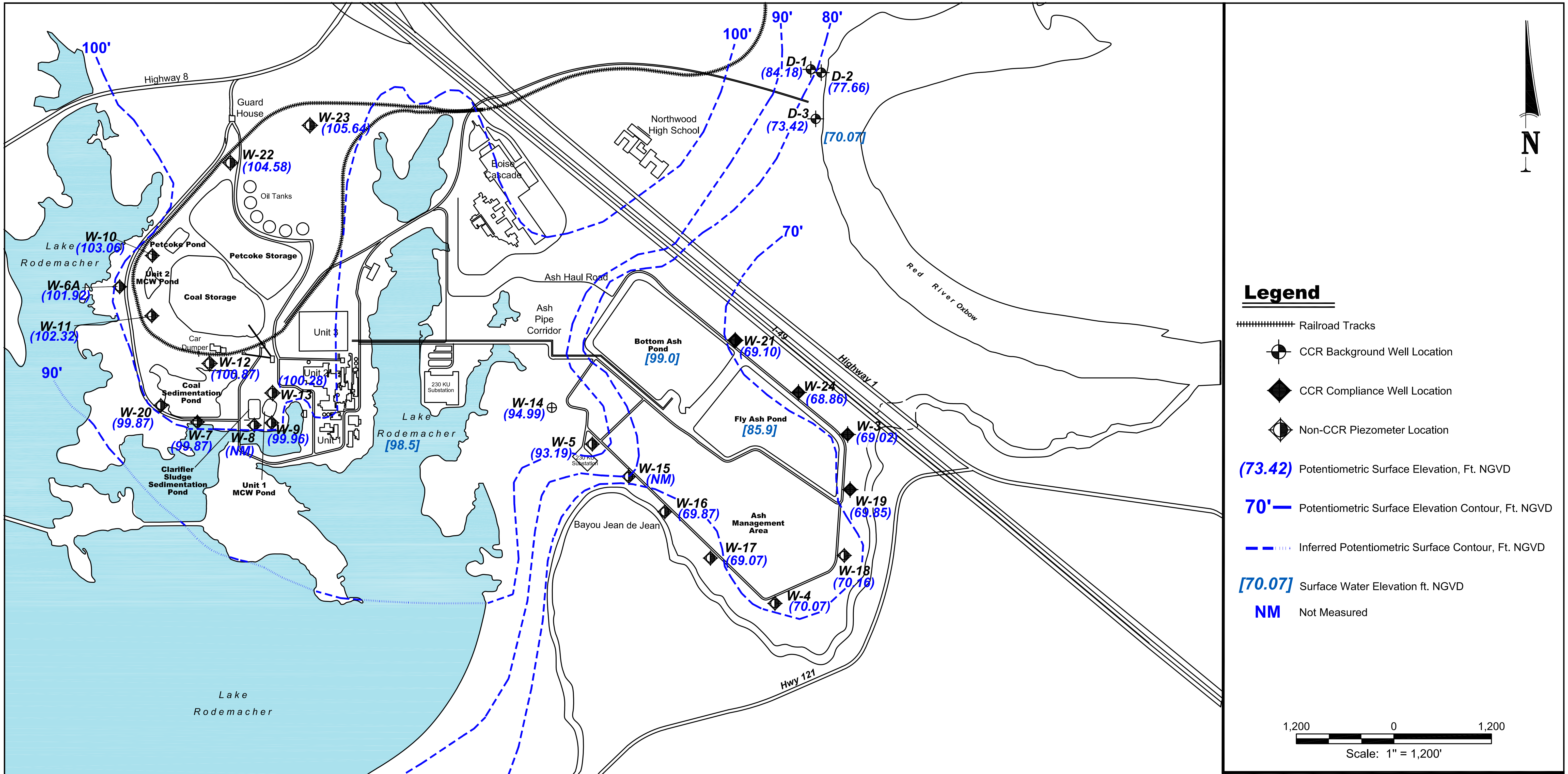
Cleco Brame
Potentiometric Surface Contour Map
April 2018

Rapides Parish, Louisiana

E·A·G·L·E
ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RS
Approved:	JM
Date:	5/10/18
Dwg. No.:	01-20-0220-APP-D-10

Figure D-10



CLECO Corporation

Brame Energy Center

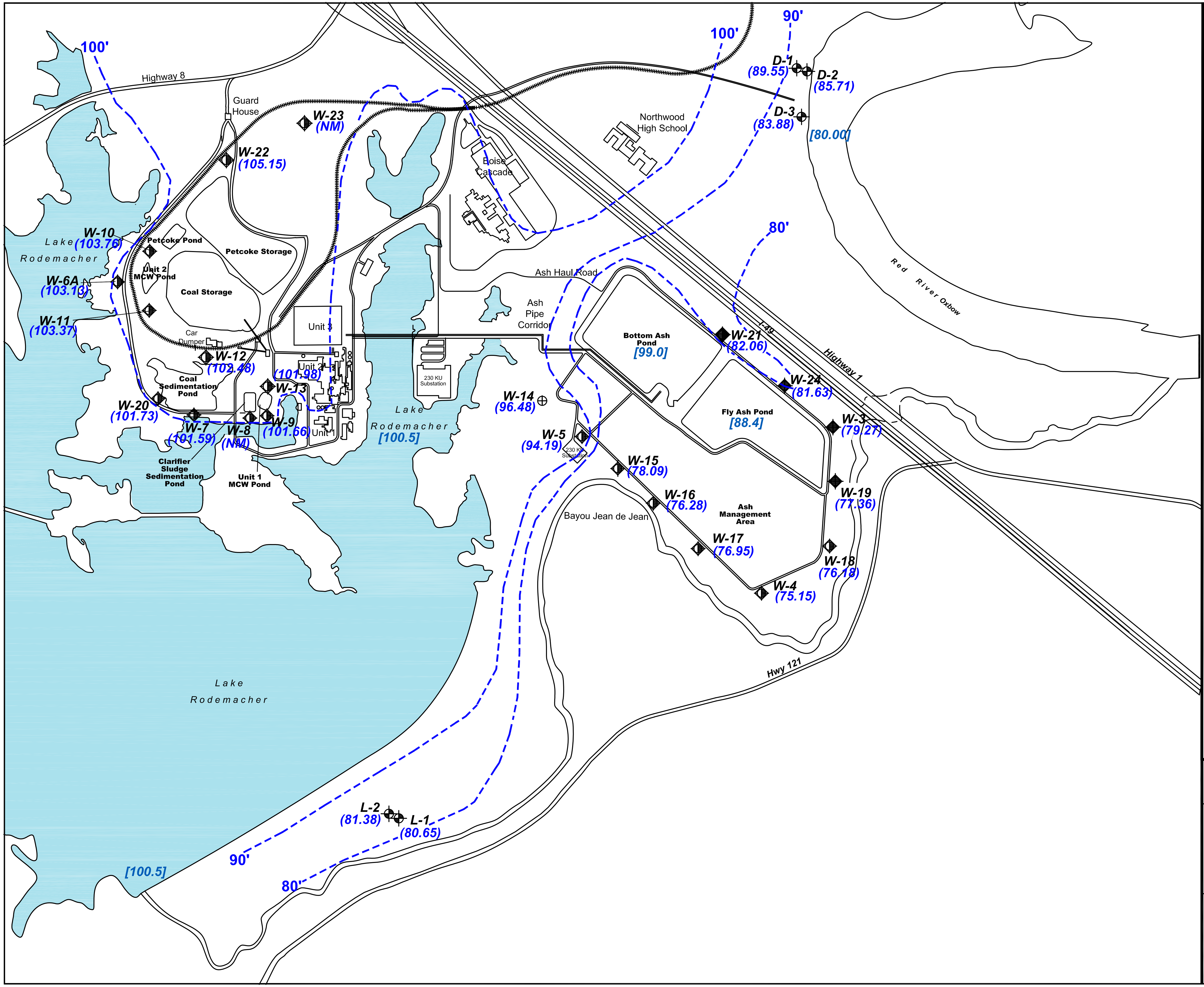
Cleco Brame
Potentiometric Surface Contour Map
October 2018

Rapides Parish, Louisiana

E·A·G·L·E ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RS
Approved:	JM
Date:	10/22/18
Dwg. No.:	01-20-0220-APP-D-11

Figure D-11



Legend

++++++++++	Railroad Tracks
⊕	CCR Background Well Location
◆	CCR Compliance Well Location
◈	Non-CCR Piezometer Location
(80.65)	Potentiometric Surface Elevation, Ft. NGVD
80'—	Potentiometric Surface Elevation Contour, Ft. NGVD
- - -	Inferred Potentiometric Surface Contour, Ft. NGVD
[80.00]	Surface Water Elevation ft. NGVD
NM	Not Measured

Note: Red River elevation reflects difference of Red River at Lock & Dam No. 3 Lower and Red River at Alexandria, LA.

1,200 0 1,200

Scale: 1" = 1,200'

CLECO Corporation

Brame Energy Center

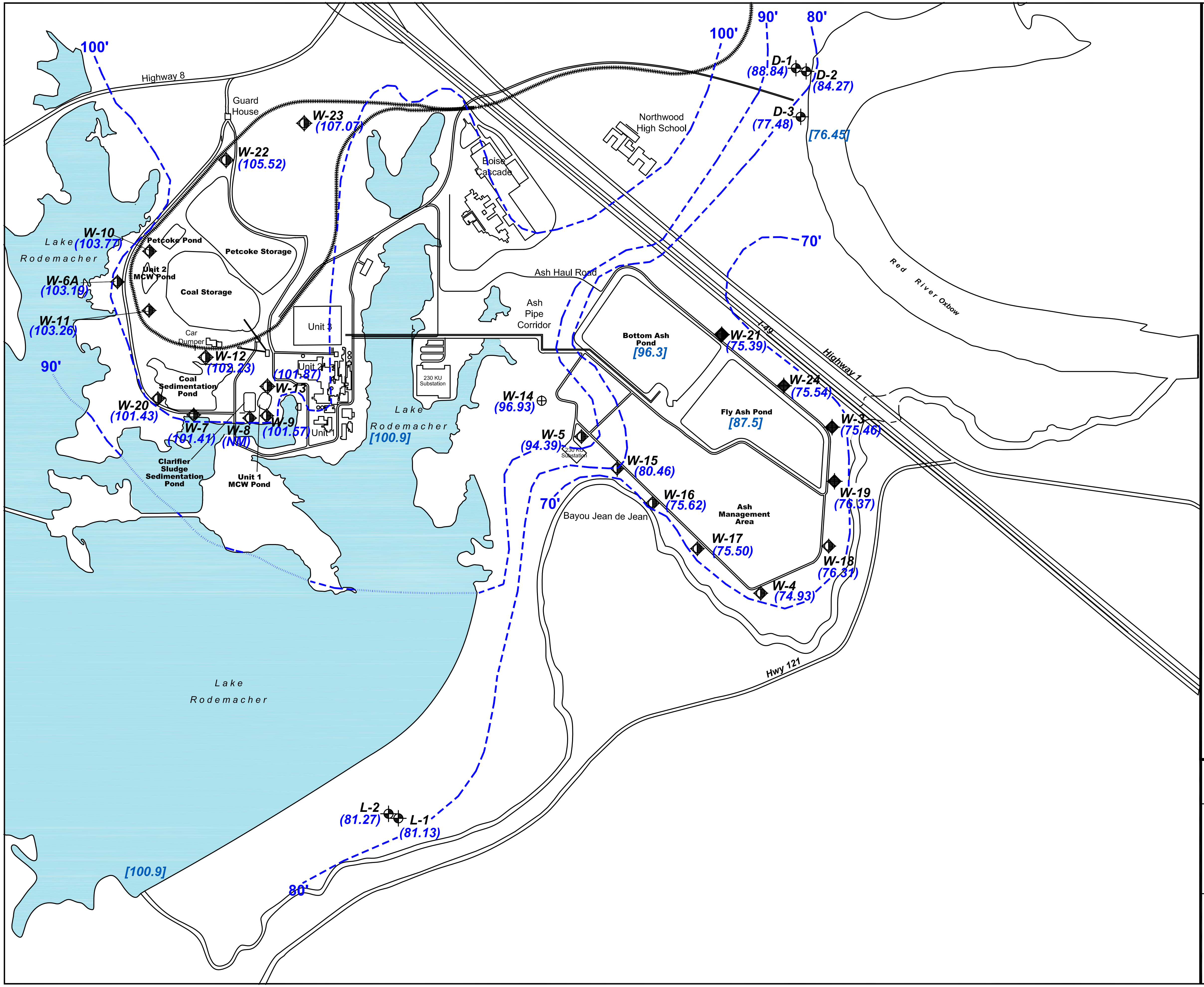
Cleco Brame Potentiometric Surface Contour Map January 2019

Rapides Parish, Louisiana

E·A·G·L·E
ENVIRONMENTAL SERVICES, INC.

Drawn: JP
Checked: RB
Approved: JM
Date: 5/9/19
Dwg. No.: 01-20-0220-APP-D-12

Figure D-12



N

Legend

++++++++++	Railroad Tracks
⊕	CCR Background Well Location
◆	CCR Compliance Well Location
◈	Non-CCR Piezometer Location
(75.46)	Potentiometric Surface Elevation, Ft. NGVD
70' —	Potentiometric Surface Elevation Contour, Ft. NGVD
- - -	Inferred Potentiometric Surface Contour, Ft. NGVD
[76.45]	Surface Water Elevation ft. NGVD
NM	Not Measured

Note: Red River elevation reflects difference of Red River at Lock & Dam No. 3 Lower and Red River at Alexandria, LA.

1,200 0 1,200

Scale: 1" = 1,200'

CLECO Corporation

Brame Energy Center

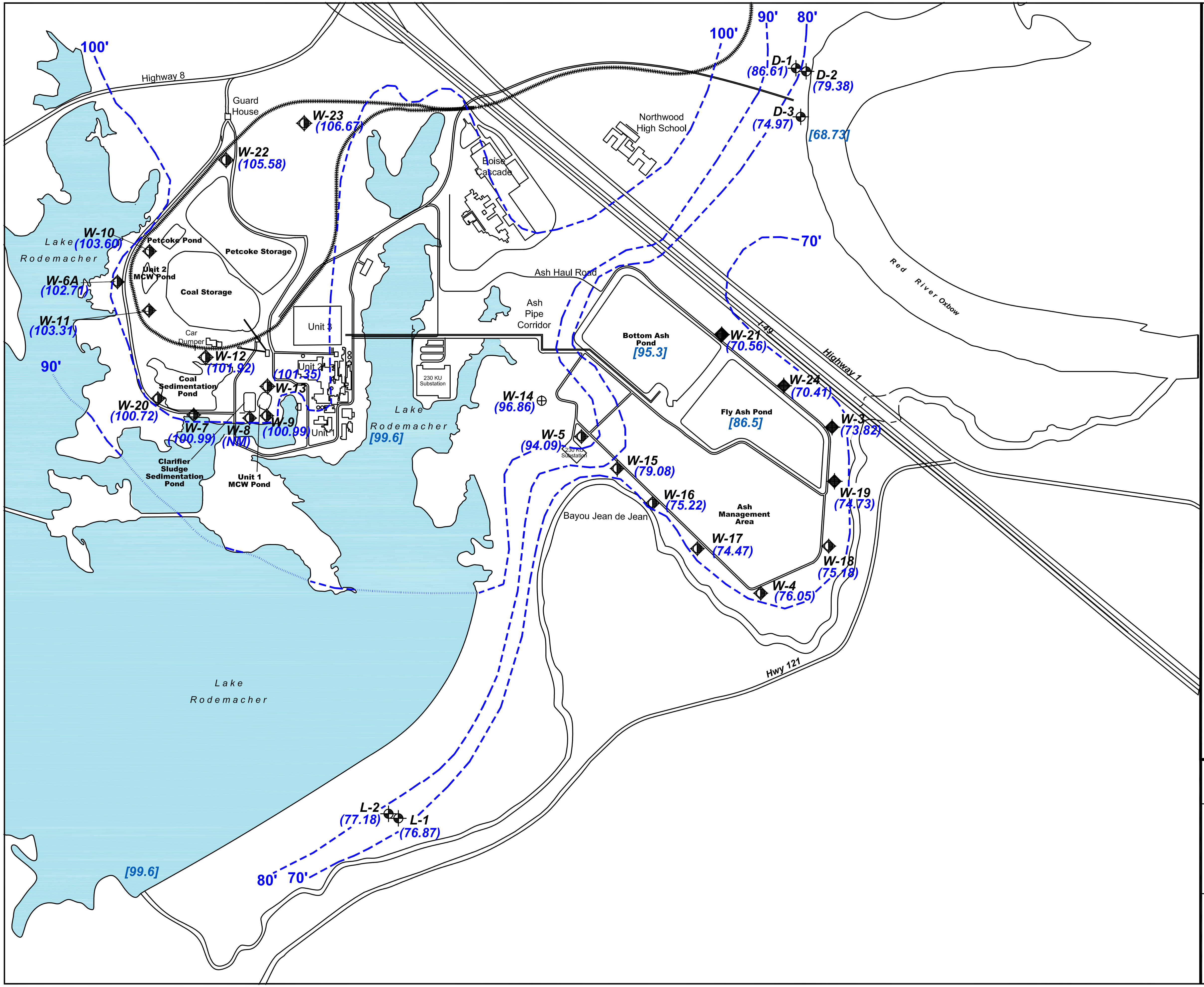
Cleco Brame
Potentiometric Surface Contour Map
April 2019

Rapides Parish, Louisiana

E·A·G·L·E
ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RS
Approved:	JM
Date:	5/9/19
Dwg. No.:	01-20-0220-APP-D-13

Figure D-13



N

Legend

++++++++	Railroad Tracks
⊕	CCR Background Well Location
◆	CCR Compliance Well Location
◈	Non-CCR Piezometer Location
(75.18)	Potentiometric Surface Elevation, Ft. NGVD
70' —	Potentiometric Surface Elevation Contour, Ft. NGVD
– –	Inferred Potentiometric Surface Contour, Ft. NGVD
[68.73]	Surface Water Elevation ft. NGVD
NM	Not Measured

Note: Red River elevation reflects difference of Red River at Lock & Dam No. 3 Lower and Red River at Alexandria, LA.

1,200 0 1,200

Scale: 1" = 1,200'

CLECO Corporation

Brame Energy Center

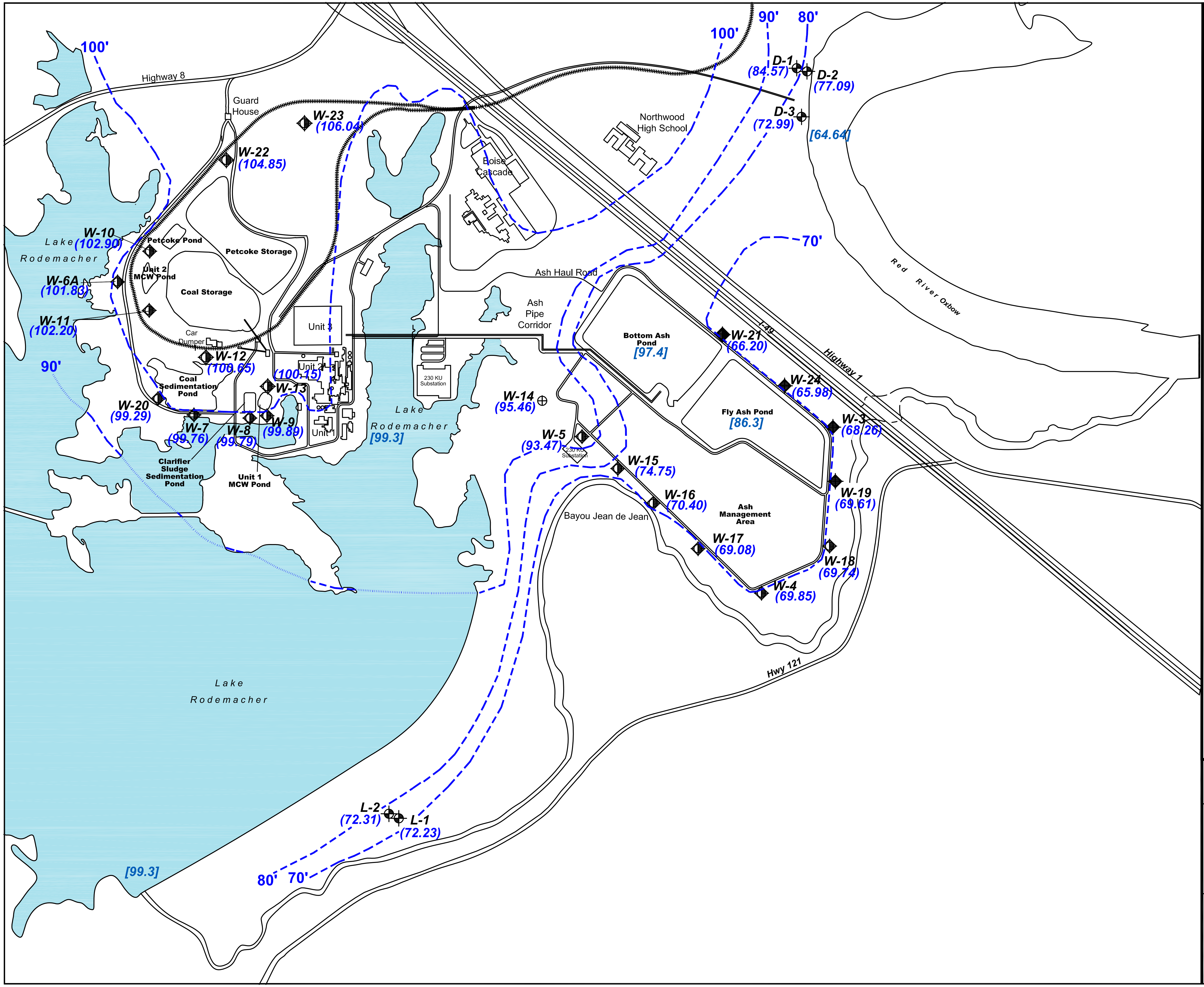
Cleco Brame
Potentiometric Surface Contour Map
July 2019

Rapides Parish, Louisiana

E·A·G·L·E
ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RS
Approved:	JM
Date:	7/25/19
Dwg. No.:	01-20-0220-APP-D-14

Figure D-14



Legend

▦ Railroad Tracks
⊕ CCR Background Well Location
◆ CCR Compliance Well Location
◐ Non-CCR Piezometer Location
(69.61) Potentiometric Surface Elevation, Ft. NGVD
70'— Potentiometric Surface Elevation Contour, Ft. NGVD
- - - Inferred Potentiometric Surface Contour, Ft. NGVD
[64.64] Surface Water Elevation ft. NGVD
NM Not Measured

Note: Red River elevation reflects difference of Red River at Lock & Dam No. 3 Lower and Red River at Alexandria, LA.

1,200 0 1,200
Scale: 1" = 1,200'

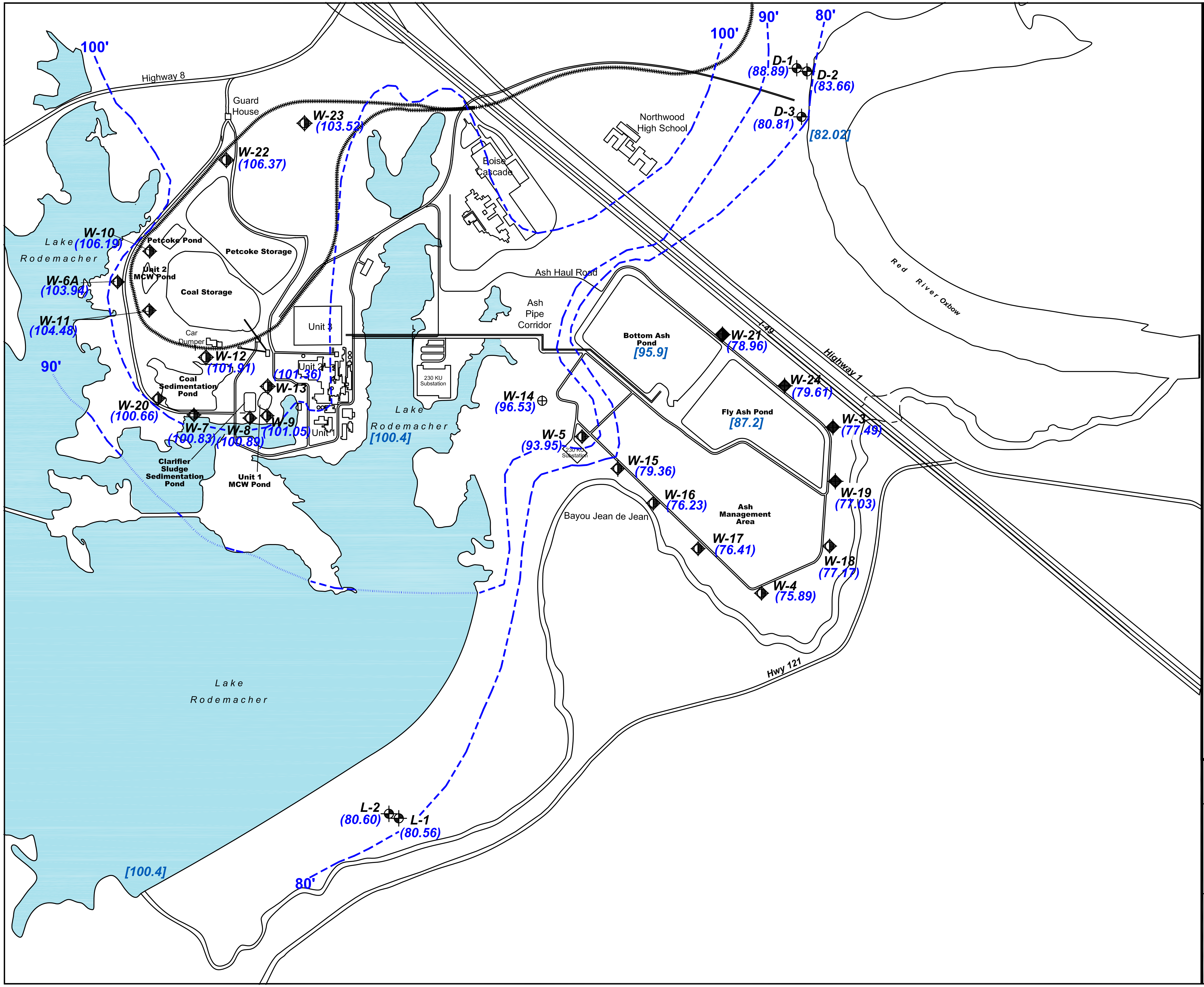
CLECO Corporation
Brame Energy Center

Cleco Brame
Potentiometric Surface Contour Map
October 2019
Rapides Parish, Louisiana

E·A·G·L·E ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RS
Approved:	JM
Date:	12/12/19
Dwg. No.:	01-20-0220-APP-D-15

Figure D-15



Legend

- Railroad Tracks
- ⊕ CCR Background Well Location
- ◆ CCR Compliance Well Location
- ◐ Non-CCR Piezometer Location
- *(78.96)* Potentiometric Surface Elevation, Ft. NGVD
- **70'—** Potentiometric Surface Elevation Contour, Ft. NGVD
- Inferred Potentiometric Surface Contour, Ft. NGVD
- *[82.02]* Surface Water Elevation ft. NGVD
- *NM* Not Measured

Note: Red River elevation reflects difference of Red River at Lock & Dam No. 3 Lower and Red River at Alexandria, LA.

1,200 0 1,200

Scale: 1" = 1,200'

CLECO Corporation

Brame Energy Center

Cleco Brame
Potentiometric Surface Contour Map
April 2020

Rapides Parish, Louisiana

E·A·G·L·E ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RS
Approved:	JM
Date:	6/2/20
Dwg. No.:	01-20-0220-APP-D-16

Figure D-16

APPENDIX E

GROUNDWATER QUALITY DATA

Table 2
April 2016 Analytical Data Summary

Parameter/Well/ Date	MCL	W-3 4/29/16	W-19 4/29/16	W-21 4/29/16
Detection Monitoring Parameters				
Boron (mg/l)	NA	0.075	0.18	0.063
Calcium (mg/l)	NA	25	126	22.8
Chloride (mg/l)	NA	45	43.8	8.7
Fluoride (mg/l)	4	<0.5	<0.5	<0.5
pH (S.U.)	NA	7.01	7.07	7
Sulfate (mg/l)	NA	9.6	14.5	32.9
TDS (mg/l)	NA	245	695	215
Assessment Monitoring Parameters				
Antimony (mg/l)	0.006	0.0026	0.0044	<0.001
Arsenic (mg/l)	0.01	0.0034	0.022	0.0031
Barium (mg/l)	2	0.23	0.66	0.094
Beryllium (mg/l)	0.004	<0.001	<0.001	<0.001
Cadmium (mg/l)	0.005	<0.001	<0.001	<0.001
Chromium (mg/l)	0.1	0.0017	0.0013	<0.001
Cobalt (mg/l)	NA	<0.001	<0.001	<0.001
Lead (mg/l)	0.015	0.0021	0.0026	0.0011
Lithium (mg/l)	NA	0.0056	0.008	0.0037
Mercury (mg/l)	0.002	<0.0002	<0.0002	<0.0002
Molybdenum (mg/l)	NA	<0.003	<0.003	<0.003
Selenium (mg/l)	0.05	<0.001	<0.001	<0.001
Thallium (mg/l)	0.002	<0.0005	<0.0005	<0.0005
Radium-226 (pCi/l)	5	0.719	0.177	0.217
Radium-228 (pCi/l)	5	0.785	0.74	0.434

Notes:
mg/l = milligrams per liter
S.U. = standard units
pCi/l = picocuries per liter

Cleco Brame Energy Center
Bottom Ash and Fly Ash Ponds

Table 3
July 2016 Analytical Data Summary

Parameter/Well/ Date	MCL	D-1 (BG)	D-2 (BG)	D-3 (BG)	L-1 (BG)	L-2 (BG)	W-3	W-19	W-21	W-24
		7/6/16	7/6/16	7/6/16	7/6/16	7/6/16	7/6/16	7/6/16	7/6/16	7/6/16
Detection Monitoring Parameters										
Boron (mg/l)	NA	0.12	0.14	0.28	0.12	0.087	0.14	0.19	0.093	0.21
Calcium (mg/l)	NA	16.8	99.3	95.2	120	80.4	54.1	122	37.2	111
Chloride (mg/l)	NA	20.2	12.4	13.3	10.7	6.7	109	48	13	120
Fluoride (mg/l)	4	0.28	0.63	0.52	0.25	0.4	0.2	0.31	0.19	0.5
pH (S.U.)	NA	8.33	7.92	7.92	8.04	8.07	7.44	7.45	7.82	7.91
Sulfate (mg/l)	NA	11.9	71.9	46	21.5	25.4	3.9	2.3	49.4	3.3
TDS (mg/l)	NA	260	585	705	425	355	565	695	435	880
Assessment Monitoring Parameters										
Antimony (mg/l)	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0014	<0.001
Arsenic (mg/l)	0.01	0.0031	0.009	0.0022	0.0025	0.029	0.001	0.0045	0.0045	0.0049
Barium (mg/l)	2	0.15	0.25	0.21	0.4	0.2	0.38	0.45	0.13	0.56
Beryllium (mg/l)	0.004	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Cadmium (mg/l)	0.005	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Chromium (mg/l)	0.1	0.0025	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0037	<0.001
Cobalt (mg/l)	NA	0.0057	0.0025	0.0021	0.0021	<0.001	<0.001	<0.001	0.0014	0.0012
Lead (mg/l)	0.015	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
Lithium (mg/l)	NA	0.012	0.016	0.023	0.013	0.0049	0.012	0.0082	0.007	0.0087
Mercury (mg/l)	0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum (mg/l)	NA	0.0081	0.0045	0.0045	0.0039	0.0034	<0.003	<0.003	<0.003	0.01
Selenium (mg/l)	0.05	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Thallium (mg/l)	0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Radium-226 (pCi/l)	5	0.258	-0.351	0.132	0.166	0.283	0.554	0.218	0.506	0.998
Radium-228 (pCi/l)	5	0.758	0.977	1.36	0.62	1.16	0.812	0.662	0.404	1.28

Notes:
mg/l = milligrams per liter
S.U. = standard units
pCi/l = picocuries per liter

Table 4
October 2016 Analytical Data Summary

Parameter/Well/ Date	MCL	D-1 (BG)	D-2 (BG)	D-3 (BG)	L-1 (BG)	L-2 (BG)	W-3	W-19	W-21	W-24
		10/27/16	10/27/16	10/27/16	10/25/16	10/25/16	10/25/16	10/25/16	10/25/16	10/25/16
Detection Monitoring Parameters										
Boron (mg/l)	NA	0.057	0.13	0.27	0.11	0.085	0.16	0.18	0.24	0.14
Calcium (mg/l)	NA	8.6	92.2	87.6	107	65.7	62	96.4	81.8	13.7
Chloride (mg/l)	NA	13.9	8.8	11.5	9.4	5.9	178	53.6	43	65.9
Fluoride (mg/l)	4	<0.5	<0.5	0.52	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
pH (S.U.)	NA	6.7	7.4	7.1	7	7.2	6.9	7.1	6.9	7.3
Sulfate (mg/l)	NA	11.6	73.7	45.5	15.4	30.3	<1.0	<1.0	177	1.8
TDS (mg/l)	NA	150	600	745	475	370	700	640	920	440
Assessment Monitoring Parameters										
Antimony (mg/l)	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0021	0.0014
Arsenic (mg/l)	0.01	0.0021	0.012	0.0047	0.0053	0.052	0.0026	0.0016	0.0067	0.0026
Barium (mg/l)	2	0.12	0.29	0.27	0.43	0.15	0.52	0.42	0.14	0.061
Beryllium (mg/l)	0.004	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Cadmium (mg/l)	0.005	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Chromium (mg/l)	0.1	<0.001	<0.001	0.011	<0.001	0.0011	<0.001	<0.001	<0.001	0.0013
Cobalt (mg/l)	NA	0.0077	0.0021	0.0074	0.0016	<0.001	<0.001	<0.001	0.0015	<0.001
Lead (mg/l)	0.015	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
Lithium (mg/l)	NA	0.0079	0.015	0.038	0.011	0.0061	0.014	0.0084	0.013	0.022
Mercury (mg/l)	0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum (mg/l)	NA	0.0031	<0.003	0.0031	0.0037	0.01	<0.003	<0.003	<0.003	0.056
Selenium (mg/l)	0.05	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Thallium (mg/l)	0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Radium-226 (pCi/l)	5	0.592	0.188	0.291	0.3	0.314	0.428	0.235	0	0.2
Radium-228 (pCi/l)	5	1.05	1.25	0.176	0.971	0.211	0.784	0.96	1.44	0.422

Notes:
mg/l = milligrams per liter
S.U. = standard units
pCi/l = picocuries per liter

CLECO

Cleco Brame Energy Center
Bottom Ash and Fly Ash Ponds

Table 5
December 2016 Analytical Data Summary

Parameter/Well/	MCL	D-1 (BG)	D-2 (BG)	D-3 (BG)	L-1 (BG)	L-2 (BG)	W-3	W-19	W-21	W-24
Date		12/20/16	12/20/16	12/20/16	12/19/16	12/19/16	12/19/16	12/19/16	12/19/16	12/19/16
Detection Monitoring Parameters										
Boron (mg/l)	NA	0.053	0.12	0.3	0.12	0.1	0.16	0.18	0.35	0.19
Calcium (mg/l)	NA	5.9	91.8	90.3	119	79.2	64.4	111	121	127
Chloride (mg/l)	NA	13.5	9.5	13.1	8.6	6.1	174	59.4	52.9	156
Fluoride (mg/l)	4	0.13	0.42	0.48	0.15	0.44	<0.50	0.26	0.68	0.46
pH (S.U.)	NA	6.8	7.04	7.25	7.44	7.46	6.74	7	7	6.9
Sulfate (mg/l)	NA	10.4	75.2	49.2	9	29.4	<1	<1	163	1.8
TDS (mg/l)	NA	145	715	805	360	400	695	705	1230	1100
Assessment Monitoring Parameters										
Antimony (mg/l)	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001
Arsenic (mg/l)	0.01	<0.001	0.011	0.0069	0.0067	0.047	0.0028	0.0058	0.015	0.027
Barium (mg/l)	2	0.15	0.4	0.2	0.57	0.34	0.57	0.65	0.13	1.4
Beryllium (mg/l)	0.004	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.0046
Cadmium (mg/l)	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium (mg/l)	0.1	<0.001	0.0076	0.0048	0.0073	0.015	<0.001	0.008	<0.001	0.058
Cobalt (mg/l)	NA	0.0069	0.0073	0.0035	0.0049	0.01	<0.001	0.0036	0.0017	0.021
Lead (mg/l)	0.015	<0.001	0.0056	0.003	0.0053	0.013	<0.001	0.0096	<0.001	0.081
Lithium (mg/l)	NA	0.0082	0.015	0.025	0.022	0.025	0.014	0.014	0.017	0.056
Mercury (mg/l)	0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum (mg/l)	NA	<0.003	<0.003	0.0031	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Selenium (mg/l)	0.05	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0015
Thallium (mg/l)	0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Radium-226 (pCi/l)	5	0.0769	0.637	0.482	-0.073	0.365	0.159	1.12	0.75	3.28
Radium-228 (pCi/l)	5	0.823	1.39	0.605	0.997	1.08	0.645	0.427	0.43	3.56

Notes:
mg/l = milligrams per liter
S.U. = standard units
pCi/l = picocuries per liter

Table 6
January 2017 Analytical Data Summary

Cleco Brame Energy Center
Bottom Ash and Fly Ash Ponds

Parameter/Well/	MCL	D-1 (BG)	D-2 (BG)	D-3 (BG)	L-1 (BG)	L-2 (BG)	W-3	W-19	W-21	W-24
Date		1/25/17	1/25/17	1/25/17	1/24/17	1/24/17	1/24/17	1/24/17	1/24/17	1/24/17
Detection Monitoring Parameters										
Boron (mg/l)	NA	0.053	0.11	0.29	0.11	0.11	0.17	0.19	0.36	0.2
Calcium (mg/l)	NA	6.6	95.3	86.2	109	82.7	64.5	103	112	107
Chloride (mg/l)	NA	13.5	8.1	11.8	8.3	5.9	151	54.2	52.2	131
Fluoride (mg/l)	4	<0.1	0.48	0.52	0.27	0.53	0.35	0.31	0.67	1.4
pH (S.U.)	NA	7.05	7.08	7.35	7.18	7.19	6.64	7	7.07	6.97
Sulfate (mg/l)	NA	9.8	86.4	48.3	7.9	28.9	<1	<1	168	1.1
TDS (mg/l)	NA	165	595	805	500	445	710	675	1,220	1,060
Assessment Monitoring Parameters										
Antimony (mg/l)	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic (mg/l)	0.01	0.0023	0.014	0.005	0.0079	0.051	0.0033	0.0025	0.016	0.011
Barium (mg/l)	2	0.13	0.34	0.2	0.51	0.39	0.61	0.46	0.14	0.87
Beryllium (mg/l)	0.004	<0.001	<0.001	<0.001	<0.001	0.0012	<0.001	<0.001	<0.001	<0.001
Cadmium (mg/l)	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium (mg/l)	0.1	<0.001	0.0023	0.0083	<0.001	0.016	<0.001	0.0026	<0.001	0.0083
Cobalt (mg/l)	NA	0.0042	0.0034	0.004	0.0015	0.0092	<0.001	<0.001	0.0017	0.0038
Lead (mg/l)	0.015	<0.001	<0.001	0.0037	<0.001	0.013	<0.001	<0.001	<0.001	0.0085
Lithium (mg/l)	NA	0.0072	0.012	0.029	0.012	0.028	0.014	0.0071	0.018	0.014
Mercury (mg/l)	0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum (mg/l)	NA	<0.003	<0.003	0.0035	0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Selenium (mg/l)	0.05	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Thallium (mg/l)	0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Radium-226 (pCi/l)	5	0.256	0.27	0.6	0	0.777	0.583	0.382	0.571	0.926
Radium-228 (pCi/l)	5	0.668	0.504	2.31	2.36	3.24	2.23	0.396	0.239	2.94

Notes:
mg/l = milligrams per liter
S.U. = standard units
pCi/l = picocuries per liter

Table 7
February 2017 Analytical Data Summary

Parameter/Well/ Date	MCL	D-1 (BG)	D-2 (BG)	D-3 (BG)	L-1 (BG)	L-2 (BG)	W-3	W-19	W-21	W-24
		2/17/17	2/17/17	2/17/17	2/16/17	2/16/17	2/16/17	2/16/17	2/16/17	2/16/17
Detection Monitoring Parameters										
Boron (mg/l)	NA	0.052	0.12	0.3	0.12	0.093	0.18	0.19	0.38	0.18
Calcium (mg/l)	NA	6.2	103	91.2	150	126	66.6	102	146	158
Chloride (mg/l)	NA	13.3	8.6	11.4	7.7	6.3	149	54.4	51.2	139
Fluoride (mg/l)	4	<0.10	0.43	0.48	0.21	0.37	0.25	0.28	0.61	0.45
pH (S.U.)	NA	6.68	7	7.33	7.15	7.18	6.72	7	7.1	7.08
Sulfate (mg/l)	NA	9.8	80.7	47.2	9.3	35.9	<1	<1	162	6.3
TDS (mg/l)	NA	130	530	665	500	490	700	620	1,240	1,040
Assessment Monitoring Parameters										
Antimony (mg/l)	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic (mg/l)	0.01	<0.001	0.013	0.0033	0.0073	0.036	0.0033	0.0021	0.015	0.036
Barium (mg/l)	2	0.12	0.34	0.19	0.63	0.33	0.59	0.44	0.13	2.7
Beryllium (mg/l)	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.012
Cadmium (mg/l)	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium (mg/l)	0.1	<0.001	0.0013	0.0082	0.011	0.0092	<0.001	<0.001	<0.001	0.09
Cobalt (mg/l)	NA	0.0046	0.0033	0.0044	0.008	0.0074	<0.001	<0.001	0.0017	0.045
Lead (mg/l)	0.015	<0.001	<0.001	0.0049	0.0089	0.0081	<0.001	<0.001	<0.001	0.16
Lithium (mg/l)	NA	0.0077	0.0098	0.032	0.028	0.019	0.014	0.0068	0.018	0.086
Mercury (mg/l)	0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0002
Molybdenum (mg/l)	NA	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Selenium (mg/l)	0.05	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0025
Thallium (mg/l)	0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00058
Radium-226 (pCi/l)	5	0.611	0.759	-0.511	1.21	0.346	0.733	0.347	4	-0.212
Radium-228 (pCi/l)	5	-0.14	0.907	1.59	0.832	1.04	0.765	0.644	0.391	6.65

Notes:
mg/l = milligrams per liter
S.U. = standard units
pCi/l = picocuries per liter

Table 8
April 2017 Analytical Data Summary

Parameter/Well/ Date	MCL	D-1 (BG)	D-2 (BG)	D-3 (BG)	L-1 (BG)	L-2 (BG)	W-24
		4/6/17	4/6/17	4/6/17	4/6/17	4/6/17	4/6/17
Detection Monitoring Parameters							
Boron (mg/l)	NA	0.051	0.12	0.31	0.12	0.098	0.2
Calcium (mg/l)	NA	5.8	111	88.2	121	83.3	129
Chloride (mg/l)	NA	13	6.6	12.7	6.9	5.9	155
Fluoride (mg/l)	4	<0.1	0.52	0.46	0.2	0.45	0.54
pH (S.U.)	NA	5.48	6.08	5.76	6.4	6.37	6.01
Sulfate (mg/l)	NA	10.7	102	53.8	10.6	33.3	1.2
TDS (mg/l)	NA	80	645	740	510	405	610
Assessment Monitoring Parameters							
Antimony (mg/l)	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic (mg/l)	0.01	<0.001	0.014	0.0081	0.01	0.062	0.019
Barium (mg/l)	2	0.12	0.32	0.19	0.56	0.23	1.5
Beryllium (mg/l)	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	0.0042
Cadmium (mg/l)	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium (mg/l)	0.1	<0.001	<0.001	0.006	0.0083	0.0034	0.057
Cobalt (mg/l)	NA	0.0051	0.0022	0.0039	0.0052	0.002	0.019
Lead (mg/l)	0.015	<0.001	<0.001	0.0052	0.0049	0.0023	0.073
Lithium (mg/l)	NA	0.0082	0.014	0.026	0.021	0.0087	0.052
Mercury (mg/l)	0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum (mg/l)	NA	<0.003	<0.003	<0.003	0.0042	0.0034	<0.003
Selenium (mg/l)	0.05	<0.001	<0.001	<0.001	<0.001	<0.001	0.0025
Thallium (mg/l)	0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Radium-226 (pCi/l)	5	0.342	0.678	0.533	0.572	0.775	2.44
Radium-228 (pCi/l)	5	0.199	0.684	0.314	0.974	0.482	2.86

Notes:
mg/l = milligrams per liter
S.U. = standard units
pCi/l = picocuries per liter

Table 9
May 2017 Analytical Data Summary

Parameter/Well/ Date	MCL	D-1 (BG)	D-2 (BG)	D-3 (BG)	L-1 (BG)	L-2 (BG)	W-3	W-19	W-21	W-24
		5/31/17	5/31/17	5/31/17	5/30/17	5/30/17	5/31/17	5/31/17	5/31/17	5/31/17
Detection Monitoring Parameters										
Boron (mg/l)	NA	0.043	1.1	0.029	0.11	0.11	0.15	0.17	0.37	0.17
Calcium (mg/l)	NA	5.2	101	79.6	103	72.7	66.3	91.5	111	125
Chloride (mg/l)	NA	13.1	8.1	11.3	8.7	5.8	195	56.2	54.8	166
Fluoride (mg/l)	4	0.93	0.43	0.53	0.29	0.52	0.33	0.32	0.79	0.47
pH (S.U.)	NA	6.33	6.74	6.8	5.87	6.22	6.52	6.62	6.86	6.67
Sulfate (mg/l)	NA	10.3	97.8	46.6	15.6	30.8	<1	<1	171	<1
TDS (mg/l)	NA	125	595	780	445	380	715	600	1,200	1,220
Assessment Monitoring Parameters										
Antimony (mg/l)	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic (mg/l)	0.01	0.0012	0.011	0.0025	0.0067	0.045	0.0018	0.0015	0.014	0.0093
Barium (mg/l)	2	0.096	0.28	0.18	0.44	0.39	0.53	0.4	0.15	0.97
Beryllium (mg/l)	0.004	<0.001	<0.001	<0.001	<0.001	0.0017	<0.001	<0.001	<0.001	<0.001
Cadmium (mg/l)	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium (mg/l)	0.1	0.0015	<0.001	0.0091	0.0026	0.021	<0.001	<0.001	<0.001	0.0092
Cobalt (mg/l)	NA	0.0044	0.0017	0.0052	0.002	0.014	<0.001	<0.001	0.0018	0.0035
Lead (mg/l)	0.015	<0.001	0.0016	0.0058	0.0016	0.018	<0.001	<0.001	<0.001	0.0084
Lithium (mg/l)	NA	0.0089	0.015	0.036	0.014	0.039	0.016	0.0081	0.019	0.019
Mercury (mg/l)	0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum (mg/l)	NA	<0.003	<0.003	<0.003	0.005	<0.003	<0.003	<0.003	<0.003	0.0068
Selenium (mg/l)	0.05	<0.001	<0.001	<0.001	<0.001	0.0017	<0.001	<0.001	<0.001	<0.001
Thallium (mg/l)	0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Radium-226 (pCi/l)	5	0.0793	0.495	0.876	0.693	1.61	1.06	0.683	0.727	0.835
Radium-228 (pCi/l)	5	0.6	0.584	1.29	0.86	1.44	0.376	0.726	0.892	1.99

Notes:
mg/l = milligrams per liter
S.U. = standard units
pCi/l = picocuries per liter

Cleco Brame Energy Center
Bottom Ash and Fly Ash Ponds

Table 10
June 2017 Analytical Data Summary

Parameter/Well/ Date	MCL	D-1 (BG)	D-2 (BG)	D-3 (BG)	L-1 (BG)	L-2 (BG)	W-3	W-19	W-21	W-24
		6/28/17	6/28/17	6/28/17	6/27/17	6/27/17	6/28/17	6/27/17	6/28/17	6/27/17
Detection Monitoring Parameters										
Boron (mg/l)	NA	0.048	0.5	0.47	0.12	0.12	0.18	0.19	0.47	0.19
Calcium (mg/l)	NA	5.2	102	92.2	117	80.8	64.9	99.2	125	137
Chloride (mg/l)	NA	12.9	8.3	10.5	7	5.3	159	55.9	52.4	175
Fluoride (mg/l)	4	0.84	0.47	0.53	0.29	0.51	0.29	0.28	0.83	0.5
pH (S.U.)	NA	6.99	7.18	7.39	7.07	7.22	6.79	7.01	7.15	7.2
Sulfate (mg/l)	NA	10.5	80.5	46	5.5	29	<1	<1	167	<1
TDS (mg/l)	NA	125	585	805	535	375	675	620	1,280	1,360
Assessment Monitoring Parameters										
Antimony (mg/l)	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic (mg/l)	0.01	<0.001	0.013	0.0029	0.0081	0.041	0.0029	0.0024	0.015	0.017
Barium (mg/l)	2	0.13	0.37	0.2	0.58	0.57	0.6	0.46	0.13	1.3
Beryllium (mg/l)	0.004	<0.001	<0.001	<0.001	<0.001	0.0025	<0.001	<0.001	<0.001	0.0013
Cadmium (mg/l)	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium (mg/l)	0.1	0.0016	0.0019	0.0081	0.011	0.032	<0.001	<0.001	<0.001	0.019
Cobalt (mg/l)	NA	0.004	0.0024	0.0044	0.0063	0.026	<0.001	<0.001	0.0017	0.0081
Lead (mg/l)	0.015	<0.001	<0.001	0.0054	0.0068	0.033	<0.001	<0.001	<0.001	0.023
Lithium (mg/l)	NA	0.0087	0.01	0.035	0.025	0.058	0.015	0.007	0.018	0.025
Mercury (mg/l)	0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum (mg/l)	NA	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Selenium (mg/l)	0.05	<0.001	<0.001	<0.001	<0.001	0.0027	<0.001	<0.001	<0.001	0.0014
Thallium (mg/l)	0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Radium-226 (pCi/l)	5	0.602	0.444	1.93	0.152	0.396	0.0622	0.777	0.37	1.47
Radium-228 (pCi/l)	5	0.962	1.19	1.88	1.13	2.95	1.57	1.05	0.892	1.78

Notes:
mg/l = milligrams per liter
S.U. = standard units
pCi/l = picocuries per liter

Table 11
August 2017 Analytical Data Summary

Parameter/Well/ Date	MCL	D-1 (BG)	D-2 (BG)	D-3 (BG)	L-1 (BG)	L-2 (BG)	W-3	W-19	W-21	W-24
		8/23/17	8/23/17	8/23/17	8/23/17	8/23/17	8/23/17	8/23/17	8/23/17	8/23/17
Detection Monitoring Parameters										
Boron (mg/l)	NA	0.046	0.11	0.27	0.11	0.095	0.17	0.18	0.35	0.19
Calcium (mg/l)	NA	6	106	88.3	115	66.4	64	96.7	113	115
Chloride (mg/l)	NA	13.6	7.6	10.9	7	5.2	156	60.7	54.5	130
Fluoride (mg/l)	4	<0.2	0.61	0.68	0.32	0.64	0.37	0.37	0.63	0.51
pH (S.U.)	NA	6.4	7.15	7.28	7.25	7.28	6.77	7.07	7.11	7.06
Sulfate (mg/l)	NA	11.1	95.3	49.1	5.7	27.9	1.2	<1	166	<1
TDS (mg/l)	NA	145	615	745	495	395	690	640	1,190	1,080
Assessment Monitoring Parameters										
Antimony (mg/l)	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic (mg/l)	0.01	<0.001	0.009	0.0016	0.0074	0.057	0.0025	0.0013	0.01	0.0064
Barium (mg/l)	2	0.097	0.36	0.13	0.45	0.16	0.53	0.42	0.14	0.79
Beryllium (mg/l)	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium (mg/l)	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium (mg/l)	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt (mg/l)	NA	0.0049	0.0019	<0.001	0.0012	<0.001	<0.001	<0.001	0.0024	<0.001
Lead (mg/l)	0.015	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lithium (mg/l)	NA	0.0075	0.013	0.025	0.01	0.0051	0.014	0.0078	0.017	0.0083
Mercury (mg/l)	0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum (mg/l)	NA	<0.003	<0.003	0.0039	<0.003	0.0044	<0.003	<0.003	<0.003	0.0036
Selenium (mg/l)	0.05	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Thallium (mg/l)	0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Radium-226 (pCi/l)	5	0.175	0.344	0.0679	0.159	0.182	0.53	0.571	0.317	0.886
Radium-228 (pCi/l)	5	0.559	0.695	0.627	0.565	0.747	1.65	0.502	0.285	0.905

Notes:
mg/l = milligrams per liter
S.U. = standard units
pCi/l = picocuries per liter

Cleco Brame Energy Center
Bottom Ash and Fly Ash Ponds

Table 2
2018 Analytical Data Summary

Parameter/Well/Date		Boron (mg/l)	Calcium (mg/l)	Chloride (mg/l)	Fluoride (mg/l)	pH (S.U.)	Sulfate (mg/l)	TDS (mg/l)
D-1 (BG)	1/22/18	0.047	4.9	13.4	0.1	6.84	10.8	135
	4/10/18	0.049	8.7	13.3	0.15	7.55	8.8	120
	8/8/18	0.044	5.2	12.2	<0.1	7.61	10.5	150
	10/4/18	0.046	5.8	12.3	<0.1	6.57	10.7	110
D-2 (BG)	1/22/18	0.095	96	11.4	0.5	7.19	57.5	475
	4/10/18	0.11	109	8.3	0.35	7.35	89.1	435
	8/8/18	0.11	104	8.2	0.38	7.41	78.7	575
	10/4/18	0.11	108	6.8	0.4	6.81	88.4	525
D-3 (BG)	1/22/18	0.31	91.5	11.2	0.49	7.28	50.2	915
	4/10/18	0.31	93.2	12.6	0.54	7.58	53.5	740
	8/8/18	0.29	86.4	10.7	1	7.4	49.1	680
	10/4/18	0.26	87	10.4	0.6	7.01	47.9	455
L-1 (BG)	1/22/18	0.12	121	5.3	0.28	7.52	13.1	475
	4/11/18	0.11	106	5.2	0.16	8.22	29.6	200
	8/8/18	0.13	117	6	0.18	7.34	11.6	500
	10/4/18	0.12	110	5.9	0.21	6	4.8	440
L-2 (BG)	1/22/18	0.1	70.4	3.9	0.47	7.27	19.9	315
	4/11/18	0.092	74.7	3.5	0.24	7.9	20.4	235
	8/8/18	0.099	62.5	3.3	0.47	7.18	20.3	340
	10/4/18	0.093	62.8	3.2	0.48	6.87	20.4	370
W-3	1/23/18	0.17	67.5	161	0.43	7	<1	685
	4/11/18	0.18	69.9 / 65.2*	164	0.25	6.73	<1	595
	8/8/18	0.17	66.1	206	<1	7.31	3.9	910
	10/4/18	0.18	64	179	0.26	6.5	2.4	700
W-19	1/23/18	0.19	99.6	59.5	0.38	7.24	<1	620
	4/11/18	0.2 / 0.18*	110	58.1	0.41	7.37	1.3	495
	8/8/18	0.19	102	59.5	0.22	7.06	<1	690
	10/4/18	0.19	97.4	64.7	0.24	6.72	<1	630
W-21	1/23/18	0.36	125	56.8	0.51	7.17	180	1,280
	4/11/18	0.35	124	54.3	0.41	7.51	160	1,110
	8/8/18	0.39	124	51.3	0.42	7.73	172	1,120
	10/4/18	0.35	122	54	1.1	6.91	177	1,130
W-24	1/23/18	0.19	138	175	0.34	7.21	1	1,310
	4/11/18	0.18	140	108	0.56	7.5	2.5	750
	8/8/18	0.2	117	96.2	0.27	7.51	2.4	920
	10/4/18	0.2	122	145	0.37	7.11	1	1,150

* 5/25/18 resampling result.

Notes:
mg/l = milligrams per liter
S.U. = standard units

Table 2
2019 Analytical Data Summary

Cleco Brame Energy Center
Bottom Ash and Fly Ash Ponds

Parameter/Well/Date		Boron (mg/l)	Calcium (mg/l)	Chloride (mg/l)	Fluoride (mg/l)	pH (S.U.)	Sulfate (mg/l)	TDS (mg/l)
D-1 (BG)	1/16/19	0.042	5.7	13.5	<0.1	6.29	10.1	60
	4/17/19	0.045	12.6	11.9	0.48	6.32	5.9	105
	7/19/19	0.045	8.2	11.9	0.23	6.28	9.3	145
	10/30/19	0.036	5	12.7	<0.1	5.92	10.4	175
D-2 (BG)	1/16/19	0.11	82.2	13.2	0.61	6.87	39.4	420
	4/17/19	0.25	88.3	11.4	0.91	6.68	53.2	630
	7/19/19	0.11	94.4	6.9	0.48	6.9	78.2	530
	10/30/19	0.092	93.4	9.6	0.54	6.87	69.6	405
D-3 (BG)	1/16/19	0.35	90.9	13.6	1.1	7.16	58.6	700
	4/17/19	0.11	105	7.3	0.45	7.06	96.9	465
	7/19/19	0.27	79.7	10.9	0.98	7.13	48.7	710
	10/30/19	0.24	85.2	11.8	0.51	6.92	48.6	625
L-1 (BG)	1/15/19	0.088	66.9	3.7	0.2	6.89	23	600
	4/17/19	0.1	104	5.2	0.29	6.74	13.9	370
	7/19/19	0.099	84.4	4.8	0.27	7.19	10.2	445
	10/29/19	0.1	109	5.8	0.21	7.06	4.5	460
L-2 (BG)	1/15/19	0.084	125	7.8	0.59	6.97	68	940
	4/17/19	0.086	150	10	0.43	6.83	98.2	565
	7/19/19	0.082	80.9	5.1	0.41	7.15	33.9	400
	10/29/19	0.082	79.4	2.4	0.52	7.06	15.9	435
W-3	1/15/19	0.18	58.1	144	0.28	6.67	3	900
	4/17/19	0.17	67.5	189	0.32	6.45	3.7	660
	7/19/19	0.18	59.8	154	0.31	6.57	4	640
	10/29/19	0.13	65.6	206	0.2	6.65	1.2	660
W-19	1/15/19	0.21	95.9	66.7	0.59	6.91	<1	400
	4/17/19	0.19	113	58.7	0.31	6.65	<1	640
	7/19/19	0.2	101	52.1	0.33	6.87	<1	725
	10/29/19	0.16	96.9	74.7 / 52.8*	0.38	6.83	<1	605
W-21	1/15/19	0.38	114	54.2	0.75	7.06	166	1,120
	4/17/19	0.3	109	54.2	0.8	6.77	158	1,020
	7/19/19	0.36	108	37.3	0.62	6.93	113	940
	10/29/19	0.32	118	67.4 / 40.5*	0.48	6.92	173	1,080
W-24	1/15/19	0.086	62.6	27.2	0.15	7.43	11.2	540
	4/17/19	0.19	110	85.6	0.89	6.99	6.7	950
	7/19/19	0.23	95.2	89.2	0.58	7.14	3	910
	10/29/19	0.17	120	143	0.3	6.76	4.5	1,030

* 12/17/19 Resampling event.

Notes:
mg/l = milligrams per liter
S.U. = standard units

APPENDIX F

SITE HYDROGEOLOGY AND GEOLOGIC CROSS SECTIONS

SITE HYDROGEOLOGY AND GEOLOGIC CROSS SECTIONS

HYDROGEOLOGIC SETTING

BEC straddles two different geomorphologic features: Intermediate Terrace deposits of Pleistocene age to the north and northwest and alluvium and natural levee deposits of Holocene age to the south and southeast. The Intermediate Terraces include terraces formerly designated as Montgomery, Irene, and Bentley (LGS, 1984).

The mapped boundary of the Intermediate Terrace and the alluvium/natural levee deposits follows part of the northeast edge of the Bottom Ash Pond. The northern/northwestern portion of BEC is located on the Intermediate Terrace deposits and the remainder of BEC is located on the alluvium/natural levee deposits. Most of the Bottom Ash Pond is situated on the alluvium/natural levee deposits, with only its northeastern end on the Intermediate Terrace deposits while the Fly Ash Pond is situated entirely on the alluvium deposits. The uppermost aquifer is a fining upward sequence, with fine sand grading downward to coarse sand and gravel within the Intermediate Terrace deposits, and with silt and silty sand underlain by gravel within the alluvium/natural levee deposits. The aquifer is continuous beneath the site.

SITE GEOLOGY

Geologic cross sections illustrate the difference in stratigraphy and depth to the uppermost water bearing zone between the Intermediate Terrace and alluvium/natural levee deposits. These geologic cross sections are constructed from soil borings trending in a general northwest-southeast direction across both the Bottom Ash and Fly Ash Pond units. The profiles of these geologic cross sections and the geologic cross sections are included in **Appendix F**.

The uppermost water bearing zone has some gravel at its base, overlain by silt and silty sand within the alluvium/natural levee deposits beneath the Fly Ash Pond and the southeastern half of the Bottom Ash Pond. Within the Intermediate Terrace, beneath most of the northwestern half of the Bottom Ash Pond, the uppermost water bearing sand also has gravel at its base, with coarse sand fining upward to fine sand.

GROUNDWATER FLOW EVALUATION

Horizontal groundwater flow was evaluated in the uppermost aquifer by construction of potentiometric surface maps (**Appendix D**) from data measured in monitoring wells at BEC in 2017 to 2019. An evaluation of groundwater potentiometric gradients indicates that horizontal groundwater flow at BEC is consistently towards local surface water bodies with flow towards Lake Rodemacher in the power station portion of the property and towards Bayou Jean de Jean in the area of the Bottom Ash Pond, Fly Ash Pond, and Ash Management Area. Based on USGS topographic quadrangles of the Lake Rodemacher area, the spillway elevation of Lake Rodemacher is 100 feet NGVD. Groundwater elevations determined in monitoring wells near the lake are generally higher than this maximum lake elevation, supporting groundwater flow towards the lake.

The groundwater flow velocity is an average linear flow velocity that is calculated using the groundwater flow equation, $v = [k\ (dh/dl)] / n_e$. For this equation, v is groundwater flow velocity in ft/day, k is hydraulic conductivity in ft/day, dh/dl is hydraulic gradient in ft/ft, and n_e is effective porosity (unitless). Hydraulic conductivity (k) value ranging from 10 to 100 ft/day was assumed (Heath, 1989) based on the silty sand and fine- to coarse-grained sand observed in soil cuttings from soil borings completed at the site. Hydraulic gradient (dh/dl) value estimates from potentiometric surface maps representing each sampling event for the Ash Ponds areas are summarized below. An effective porosity (n_e) of 0.2 was assumed based on the soil types of the uppermost water bearing zone (Fetter, 2001). Using these values, the groundwater flow rates (v) are listed below.

Date	Hydraulic Gradient (feet/feet)	Estimated Groundwater Flow Velocity (feet/day)
January 2019	0.002	0.01 to 1.0
April 2019	0.00004 to 0.0002	0.0002 to 0.1
July 2019	0.0009 to 0.002	0.045 to 1.0
October 2019	0.0007 to 0.001	0.0035 to 0.5

It is important to note that this is an advective rate and does not account for potential geological heterogeneities, causing significant variability in geochemical and hydrogeologic parameters including adsorption, biodegradation, dispersion, fraction of organic carbon, and other retarding factors affecting groundwater fate and transport in this zone. Additionally, lateral geological heterogeneities may cause variations in advective flow.

UPPERMOST AQUIFER CHARACTERIZATION

A summary of results of the uppermost aquifer characterization include the following:

- The mapped boundary of the Intermediate Terrace and the alluvium/natural levee deposits follows part of the northeast edge of the Bottom Ash Pond. The northern/northwestern portion of BEC is located on the Intermediate Terrace deposits and the remainder of BEC is located on the alluvium/natural levee deposits. Most of the Bottom Ash Pond is situated on the alluvium/natural levee deposits, with only its northeastern end on the Intermediate Terrace deposits. The Fly Ash Pond is situated entirely on the alluvium deposits.
- The uppermost aquifer is laterally continuous and consists of Holocene alluvium and Pleistocene terrace deposits. The uppermost aquifer is a fining upward sequence, with fine sand grading downward to coarse sand and gravel within the Intermediate Terrace deposits, and with silt and silty sand underlain by gravel within the alluvium/natural levee deposits. The aquifer is continuous beneath the site.
- Water use in the vicinity of the unit is via groundwater and surface water. Groundwater is primarily used from deeper aquifers for power supply operations.

- The LDNR issued an advisory in 2009 addressing the recommended uses of these alluvial aquifers. Furthermore, it is reported that dissolved metals, including arsenic, have been, and are expected to be, detected in groundwater in localized areas of these aquifers (LDNR, 2009).

Cleco concludes that groundwater monitoring of the uppermost aquifer underlying the Bottom Ash Pond and the Fly Ash Pond is conducted per applicable portions of 40 C.F.R. § 257.93.

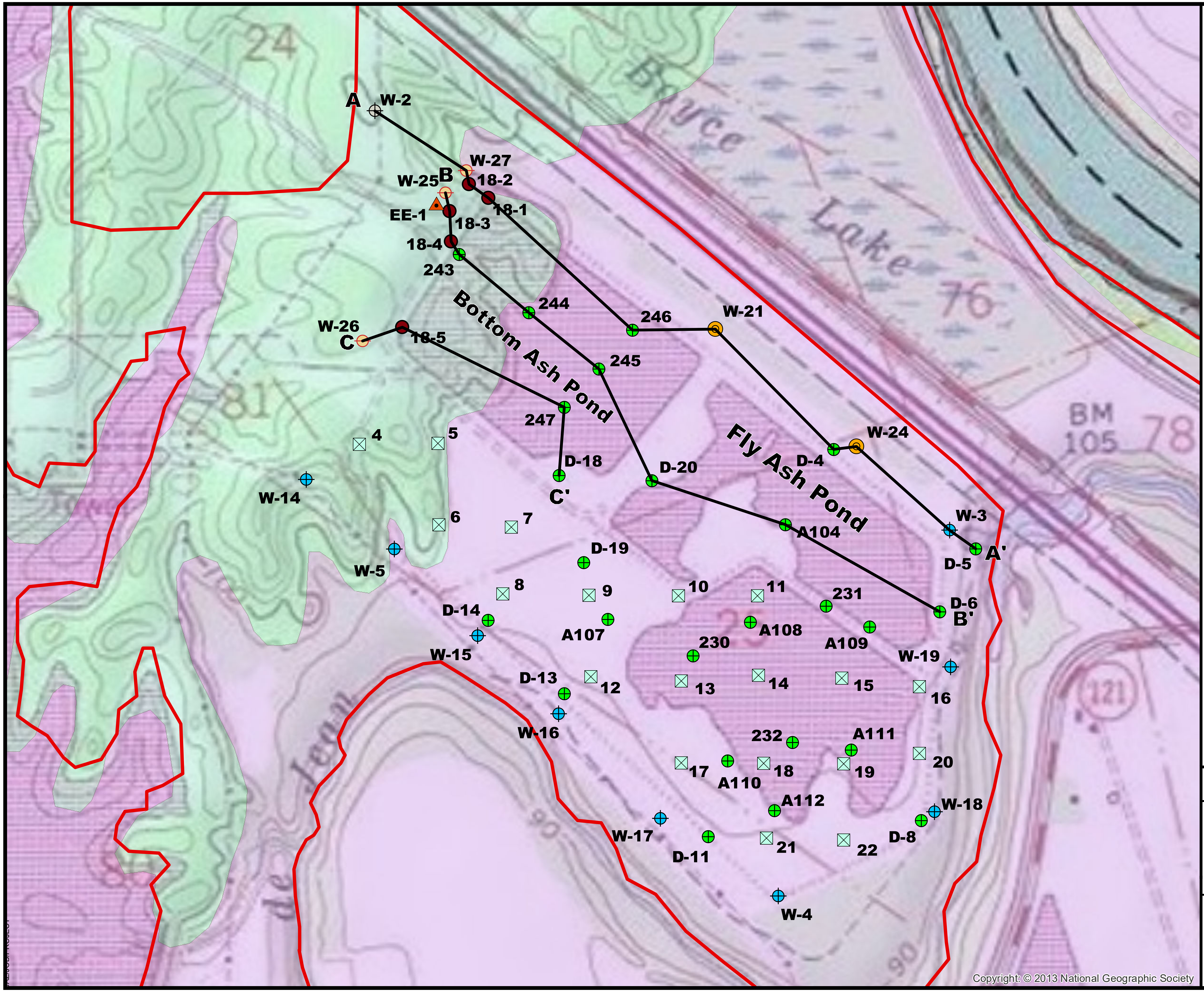
REFERENCES

Fetter, C.W., 2001. Applied Hydrogeology. 4th Edition, Prentice Hall, Upper Saddle River.

Heath, R.C., 1989, Basic ground-water hydrology: U.S. Geological Survey Water Supply Paper 2220, 84 p

Louisiana Department of Natural Resources, Office of Conservation, 2009. "*General Water Quality Summary, Louisiana Groundwater - Alluvial Aquifer Systems,*" *available at* http://www.dnr.louisiana.gov/assets/docs/conservation/documents/Alluvial-Aquifer-Water-Quality-Summary.pdf.

Louisiana Geological Survey (LGS), Snead, J.I., and McCulloh, R.P., 1984, Geologic Map of Louisiana: Louisiana Geological Survey, scale 1:500,000.



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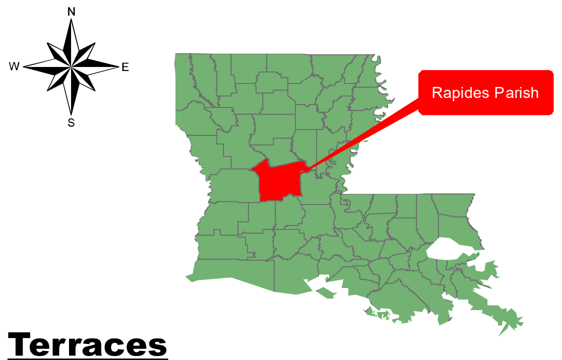


Terraces

- 🟧 Qtp - Prairie Terrace
- 🟥 Mfcb - Carnahan Bayou Member
- 🟩 Qth - High Terrace
- 🟩 Qti - Intermediate Terrace

Alluvial

- 🟪 Qal - Alluvium; Qnl - Natural Levees

Wells

- ⊖ Piezometer
- ⊕ Boring Locations (Sargent & Lundy,1981)
- ☒ Boring Locations (Aquaterra, 2004)
- ▲ Boring Locations (Eagle,2005)
- ● Boring Locations (Eagle, 2018)
- ⊕ Plugged and Abandoned Well
- ⊕ Compliance Monitoring Well
- ◎ Background Monitoring Well

Feet
0 200 400 800 1,200

Reference

U.S.G.S. TOPOGRAPHIC MAPS "LENA, LOUISIANA", "BOYCE, LOUISIANA", "JERICHO, LOUISIANA", AND "GARDNER, LOUISIANA."

CLECO Power LLC

Brame Energy Center

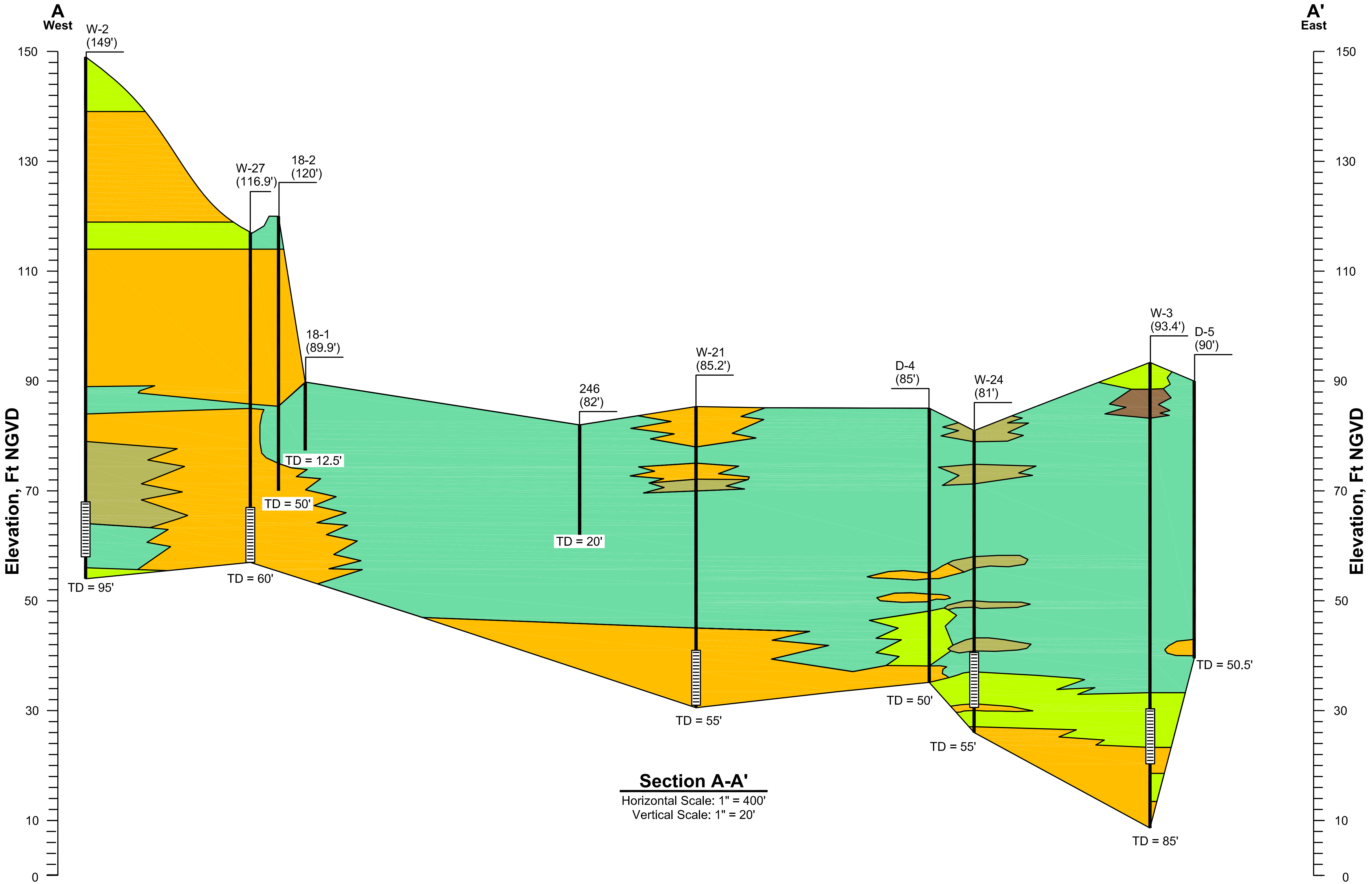
Geologic Cross Section Profiles Map

Rapides Parish, Louisiana

E·A·G·L·E
ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	RS
Approved:	RS
Date:	5/17/18
Dwg. No.:	01-20-0220-APP-F-1

Figure F-1



Section A-A'

Horizontal Scale: 1" = 400'
Vertical Scale: 1" = 20'

Legend

🟧	Sand
🟨	Sandy Clay / Clayey Sand
▨	Silty Clay
🟩	Clay
🟫	Clayey Silt
▥	Screen Interval
(90')	Elevation, Ft NGVD
TD	Total Depth

Reference

Stratigraphy between borings are inferred. Actual conditions may vary.

CLECO Power LLC

Brame Energy Center

Geologic Cross Section A-A'

Rapides Parish, Louisiana

E·A·G·L·E
ENVIRONMENTAL SERVICES, INC.

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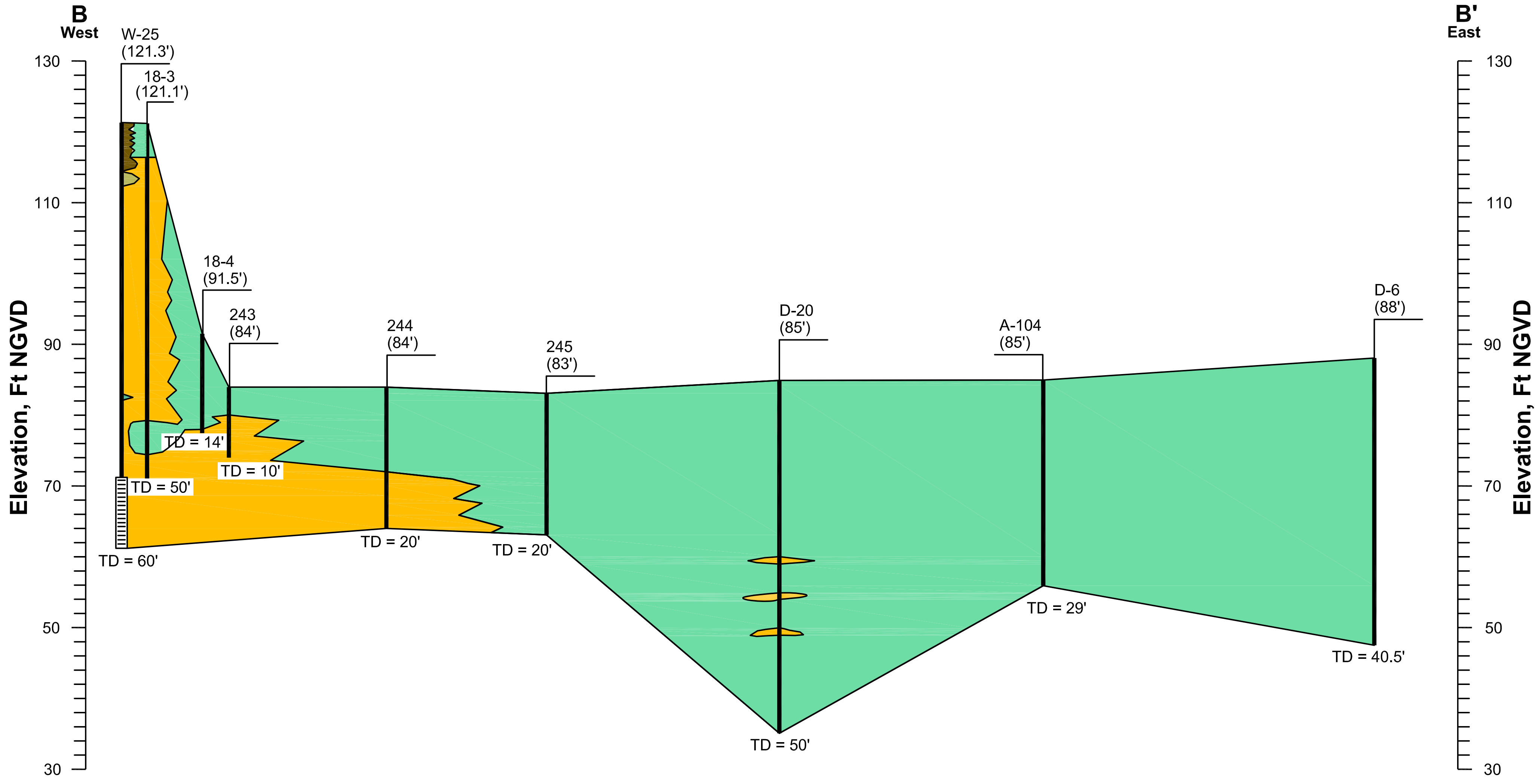
Approved:	RS
Date:	5/17/18
Dwg. No.:	01-20-0220-APP-F-2

Figure F-2



Section B-B'

Horizontal Scale: 1" = 400'
Vertical Scale: 1" = 20'

Legend

🟧	Sand
🟩	Sandy Clay / Clayey Sand
▨	Silty Clay
🟩	Clay
🟫	Clayey Silt
🟫	Fill
▤	Screen Interval
(90')	Elevation, Ft NGVD
TD	Total Depth

Reference

Stratigraphy between borings are inferred. Actual conditions may vary.

CLECO Power LLC

Brame Energy Center

Geologic Cross Section B-B'

Rapides Parish, Louisiana

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ENVIRONMENTAL SERVICES, INC.

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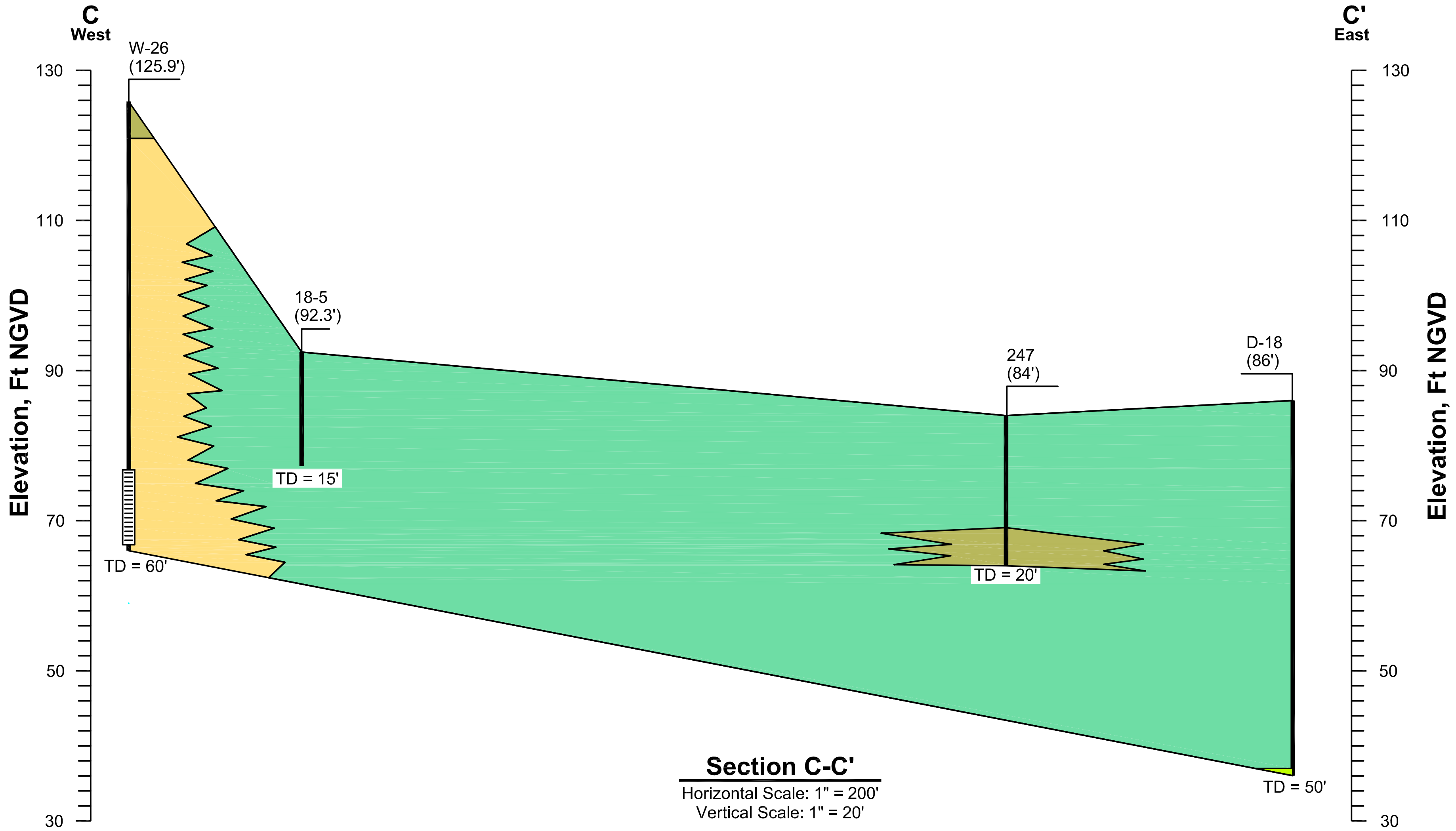
Checked:	RS
Approved:	RS
Date:	5/17/18
Dwg. No.:	01-20-0220-APP-F-3

Figure F-3



Section C-C'

Horizontal Scale: 1" = 200'
Vertical Scale: 1" = 20'

Legend

🟧 Sand
🟩 Sandy Clay / Clayey Sand
🟨 Silty Clay
🟩 Clay
🟫 Clayey Silt
🟫 Fill
▤ Screen Interval
(90') Elevation, Ft NGVD
TD Total Depth

Reference

Stratigraphy between borings are inferred. Actual conditions may vary.

CLECO Power LLC

Brame Energy Center

Geologic Cross Section C-C'

Rapides Parish, Louisiana

Drawn:	JP
Checked:	BS
Approved:	RS
Date:	5/17/18
Dwg. No.:	01-20-0220-APP-F-4

E·A·G·L·E
ENVIRONMENTAL SERVICES, INC.

Figure F-4

APPENDIX G

STRUCTURAL STABILITY ASSESSMENT

OCTOBER 2016

CLECO POWER LLC
BRAME ENERGY CENTER

STRUCTURAL STABILITY ASSESSMENT:

BOTTOM ASH POND

Prepared By:

Providence Engineering and Environmental Group LLC
1201 Main Street
Baton Rouge, Louisiana 70802
(225) 766-7400
www.providenceeng.com

Project Number 002-186

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LIST OF APPENDICES

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

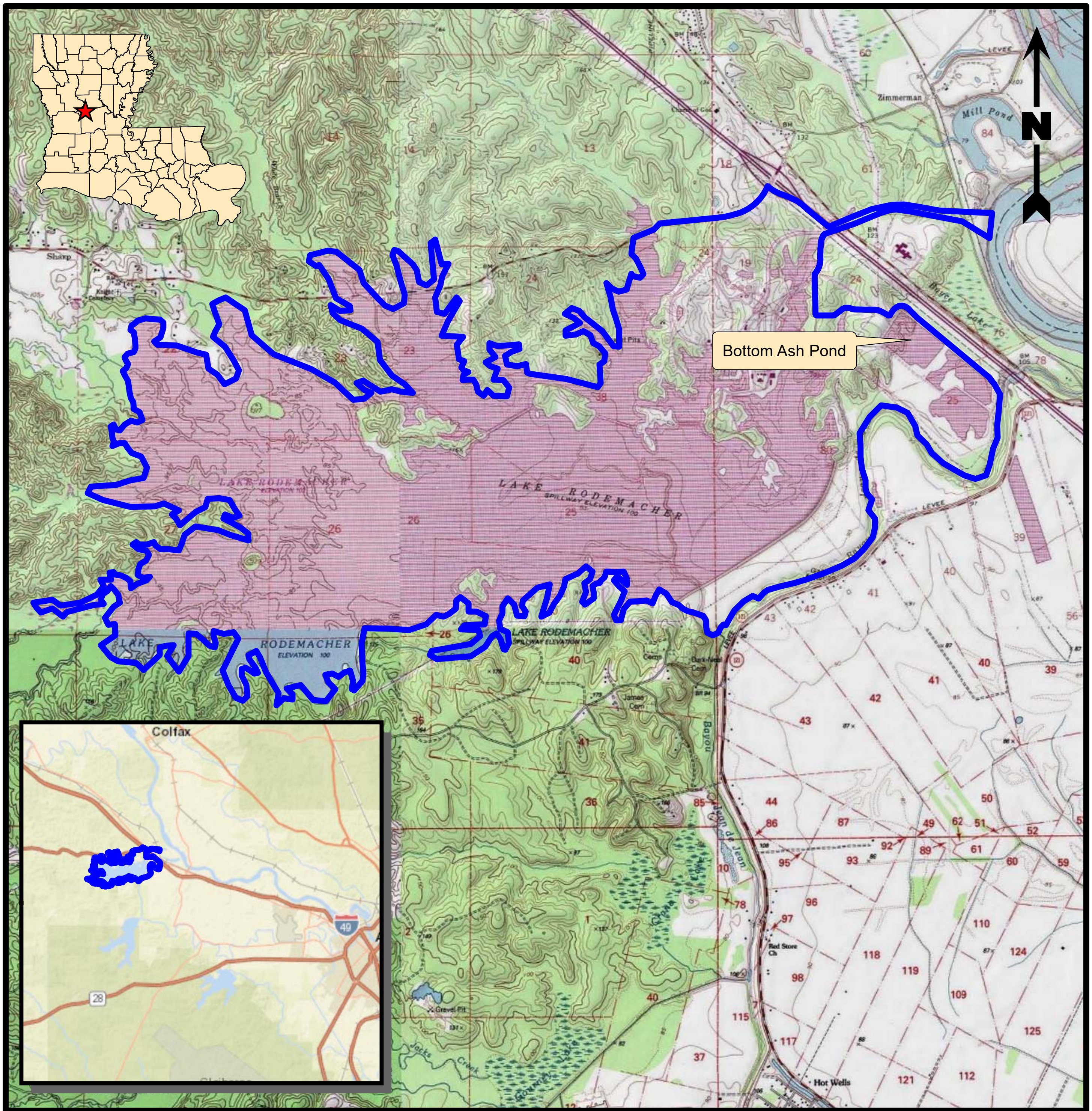
During normal operation of the Bottom Ash Pond, the levees are not inundated by surface waters from adjacent features. Occasionally, Bayou Jean de Jean will cause water to backup along the northernmost levee during high water events. However, when it does happen, the backwater levels occur as a gradual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



4,000 2,000 0 4,000 Feet

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

2
Figure

Providence Engineering and Environmental Group LLC

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.

James C. Van Hoof
Name

24630 **LA**
Registration No. State

James C. Van Hoof, P.E.
Signature

10/16/2016
Date

STATE OF LOUISIANA
JAMES C. VAN HOOF
REG. No. 24630
REGISTERED
PROFESSIONAL ENGINEER
IN
CIVIL ENGINEERING

(Seal)

OCTOBER 2016

CLECO POWER LLC

BRAME ENERGY CENTER

STRUCTURAL STABILTY ASSESSMENT:

FLY ASH POND

Prepared By:

Providence Engineering and Environmental Group LLC
1201 Main Street
Baton Rouge, Louisiana 70802

(225) 766-7400

www.providenceeng.com

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 Fly 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 1000-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 Fly Ash surface impoundment (Pond) utilized for the Unit 2 coal-fired generation unit. A site map for the Fly Ash Pond is included as **Figure 2**. Providence reviewed the construction drawings and operational plan, and reviewed the inspection and maintenance procedures for the Fly 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 Fly 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
Fly Ash	Section 1	B-15	102.5	Spencer Method Deep Failure	1.56
Fly Ash	Section 2	B-6	102.5	Spencer Method Deep Failure	1.80
Fly Ash	Section 3	B-8	102.5	Spencer Method Deep Failure	2.71

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 Fly 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 Fly Ash Pond. The normal operating water level in the Fly Ash Pond ranges from 86 to 92 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 Fly Ash Pond by means of a pumping system (normal operating pump discharges 250 gpm and the backup pump discharges 1,600 gpm) that pumps through a pipe in the western levee to the Bottom Ash Pond with its own pumps on the northern end of the pond. This water discharges into Lake Rodemacher, thence to Bayou Jean de Jean, thence to the Red River. These impoundments do not have an emergency spillway, but the water elevation is controlled through the Fly Ash Pond pumping system. An emergency pump is also available to reduce the pond water level, if needed. 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 Fly 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 Fly 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.
- Metal Pipe in southeast corner of the Fly Ash Pond. This pipe previously drained towards the Leachate Pond/Landfill area. This pipe was capped and does not pose a risk to the Fly Ash Pond.

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

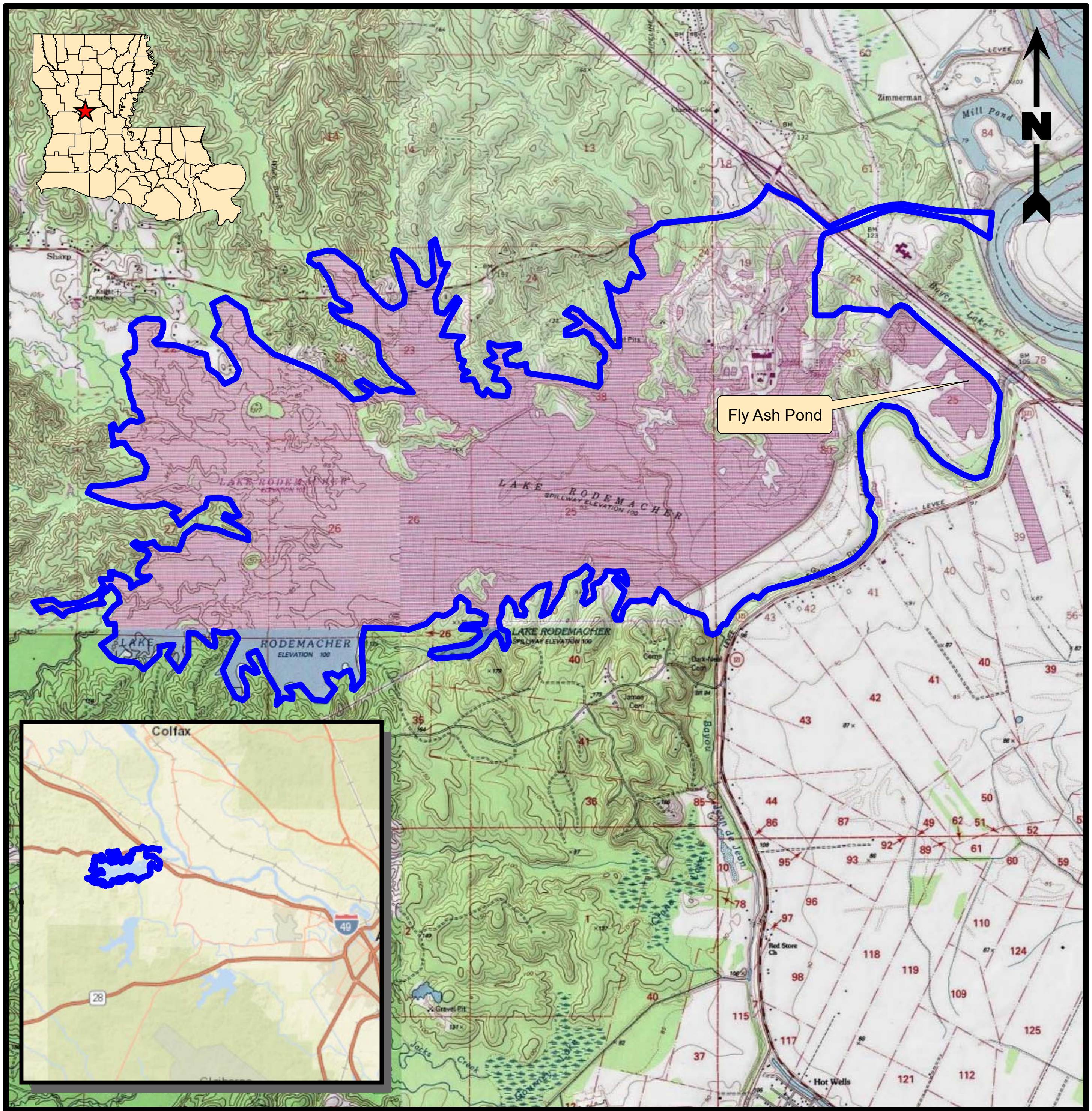
During normal operation of the Fly Ash Pond, the levees are not inundated by surface waters from adjacent features. Occasionally, Bayou Jean de Jean will cause water to backup along the northernmost levee during high water events. However, when it does happen, the backwater levels occur as a gradual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

3.0 CONCLUSION

Based on the results from the structural stability assessment, the Fly Ash Pond's design, construction, operation and maintenance is consistent with recognized and generally accepted good engineering practices. The Fly 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



4,000 2,000 0 4,000
Feet

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 - Fly 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-A019

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 - Fly 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-B020

2
Figure

Providence Engineering and Environmental Group LLC

APPENDIX A

P.E. CERTIFICATION

CLECO BRAME ENERGY CENTER
FLY 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 Fly Ash Pond in accordance with the 40 CFR 257.73(d)(1) CCR requirements. This structural stability assessment has determined that the Fly 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.
- A discharge pumping system 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.

James C. Van Hoof
Name

24630 **LA**
Registration No. State

James C. Van Hoof, P.E.
Signature

10/16/2016
Date

STATE OF LOUISIANA
JAMES C. VAN HOOF
REG. No. 24630

(Seal)

APPENDIX H

SAFETY FACTOR ASSESSMENT

OCTOBER 2016

CLECO POWER LLC
BRAME ENERGY CENTER

SAFETY FACTOR ASSESSMENT:

BOTTOM ASH POND

Prepared By:

Providence Engineering and
Environmental Group LLC
1201 Main Street
Baton Rouge, Louisiana 70802

(225) 766-7400

www.providenceeng.com

Project Number 002-186

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1.0 INTRODUCTION

Providence was contracted by Cleco Power LLC (Cleco) to conduct safety factor assessments of the Bottom Ash Pond at Cleco's Brame Energy Center located in Lena, Louisiana. Recent Coal Combustion Residual (CCR) regulations at 40 CFR 257.73(e)(1) established requirements for owners and operators to conduct safety factor assessments to document whether the calculated factors of safety for the Bottom Ash Pond achieve the minimum safety factors specified below:

- The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.
- The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.
- The calculated seismic factor of safety must equal or exceed 1.00.
- For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

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 safety factor 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**.

2.0 FACTORS OF SAFETY

Providence performed a safety factor analysis (slope stability analysis) for the levees surrounding the Bottom Ash Pond. This analysis required a review of the original permit and construction drawings for the Bottom Ash Pond, a detailed topographic survey of the perimeter levees of the Bottom Ash Pond, and installation of borings in the perimeter levees to determine the soil conditions that exist within the perimeter levee system for these ponds.

Providence mobilized to the Brame Energy Center in June of 2011 and again in April of 2016 to install geotechnical borings in the perimeter levees of the Bottom Ash Pond. Geotechnical testing Laboratory, Inc. installed 4 borings spaced approximately 500 feet apart along the center line of the levee in 2011 and 3 additional borings in 2016. Soil profiles were generated for sections along the Bottom Ash Pond that shows the results of the geotechnical borings and the laboratory analysis. **Table 1** shows the soil profiles for each section and the characteristics used for the safety factor modeling.

Table 1 Subsurface Soil Classification and Parameters

	Soil	**Depth (ft)**	**Unit Wt. (lb/ft^3)**	**Cohesion (lb/ft^2)**	**Friction Angle(Φ)**
Bottom Ash Pond Section 1 B-13	**CL**	1.5	120	1,100	-
	CL-CH	2.0	120	550	-
	CH	9.5	106	250	-
	SP-SM	19.5	115	0	30
	SM	23.5	115	0	30
	CL	16.5	120	1,760	-
	SP-SM	6.5	115	0	30
Bottom Ash Pond Section 2 B-12	**Soil**	**Depth (ft)**	**Unit Wt. (lb/ft^3)**	**Cohesion (lb/ft^2)**	**Friction Angle(Φ)**
	SM	4.0	115	0	30
	CL	2.0	115	1,500	-
	SM	6.0	115	0	30
	SP-SM	11.5	115	0	30
	SP	8.5	115	0	30
	CL-CH	6.0	120	1,500	-
	SP	24.0	115	0	30
Bottom Ash Pond Section 3 B-3	**Soil**	**Depth (ft)**	**Unit Wt. (lb/ft^3)**	**Cohesion (lb/ft^2)**	**Friction Angle(Φ)**
	Cl-ML	7.5	130	375	-
	SM-SC	9.0	115	250	24
	SP-SM	15.5	115	350	20
	CH	40.0	133	850	-
	SC	11.0	130	750	-
	CL-CH	17.0	121	1,000	-

The safety factor analysis uses the strength of the soil material of which the levee is made of and subgrade to assess levee stability in accordance to the existing conditions. The Spencer Method for slope stability was used since it is the most conservative approach. The Spencer Method is a general method of slices developed on the basis of limit equilibrium. It requires satisfying equilibrium of forces and moments acting on individual blocks. The blocks are created by dividing the soil above the slip surface by dividing planes. Deep failure analysis evaluates the potential of the levees to fail through the bottom of the levees into the existing native soils. The analysis was based upon the following assumptions and input parameters.

- The subgrade stratigraphy was modeled using soil profiles from completed soil borings at the site with the soil profile condition at each section for each pond through the entire levee system.

- The height and exterior slope of the levees were determined based on actual field surveys and previously permitted design data and the bottom elevation and the interior slope of the levees below the water line was determined based on the previously permitted design provided by Cleco.
- The input parameters used in our analyses were based upon results from geotechnical investigations conducted for this safety factor analysis. **Appendix A** includes a copy of the geotechnical results as provided by the geotechnical contractor.
- The fill material in the pond was assumed to be water for the Bottom Ash Pond. Maximum water elevation in the Bottom Ash Pond is 103.5 feet NAVD 88.

<u>The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50</u>

Providence modeled the pond under the long-term, maximum storage to the freeboard level for the Bottom Ash surface impoundment. Based on the results of the slope stability analysis, the following minimum factors of safety were obtained:

Table 2 Long-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	1.68
Bottom Ash	Section 2	B-12	103.5	Spencer Method Deep Failure	2.32
Bottom Ash	Section 3	B-3	103.5	Spencer Method Deep Failure	1.60

The calculated long-term static factor of safety under maximum storage pool loading conditions is greater than 1.50, therefore these safety factors are adequate.

<u>The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40</u>

Providence modeled 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 slope stability analysis, the following minimum factors of safety were obtained:

Table 3 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 Model Deep Failure	1.52
Bottom Ash	Section 2	B-12	103.5	Spencer Model Deep Failure	1.52
Bottom Ash	Section 3	B-3	103.5	Spencer Model 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.

<u>The calculated seismic factor of safety must equal or exceed 1.00</u>

The Brame Energy Center is not located in a seismic area. The Louisiana Geological Survey and the United States Geological Survey classifies the entire state of Louisiana as a low seismic risk area. This low seismic risk classification denotes that the levels of horizontal shaking that have a 2 in 100 chance of being exceed in in a 50-year period range from 0-8% g where g is the acceleration of a falling object due to gravity. The nearest published fault system to the Brame Energy Center is approximately 100 miles away. Therefore, the calculated seismic factor of safety is not applicable to the Bottom Ash Pond.

<u>For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.2</u>

The clayey sands and poorly graded sands in the Bottom Ash Pond levees have greater N values to resist earthquake motions and acceleration; and the relative densities are greater than 35 to 40 percent, therefore these soils are not subject to liquefaction.

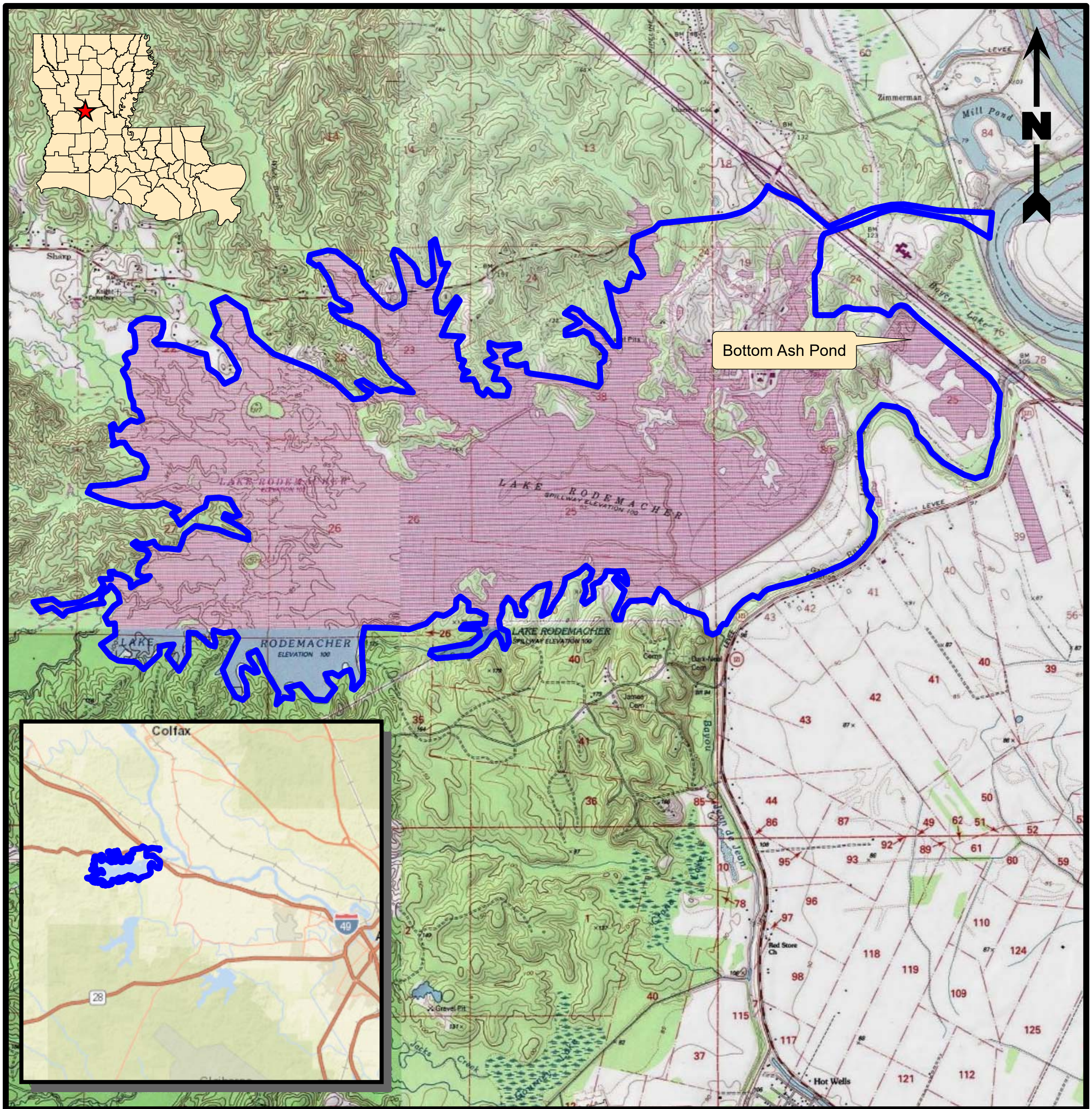
It must be noted that Cleco keeps the operating water levels in the Bottom Ash Pond at lower levels. The low operating levels for this pond will not adversely affect the structural stability of the perimeter levees around the Bottom Ash Pond. The normal operating water level in the Bottom Ash Pond ranges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

3.0 CONCLUSIONS

Based on the results from the safety factor analysis, the existing levee design for the Bottom Ash Pond achieves the minimum safety factor requirements of the 40 CFR 257.73(e)(1) CCR regulations. Results of the safety factor analysis and model input parameters can be found in **Appendix A**. **Appendix B** contains a P.E. Certification that attests to the safety factor assessment.

FIGURE 1

SITE LOCATION MAP



4,000 2,000 0 4,000
Feet

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

Safety Factor 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-A013

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

Safety Factor 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-B014

2
Figure

Providence Engineering and Environmental Group LLC

APPENDIX A

SAFETY FACTOR ANALYSIS

APS Engineering and Testing

October 16, 2016

PROVIDENCE
1201 Main Street
Baton Rouge, LA 70802

Attn: **Mr. Gary Leonards, P.E.**

Re: **Slope Stability Analysis of Bottom Ash Pond**
Cleco Brame Energy Center
Lena, Louisiana

Dear Mr. Leonards:

APS Engineering and Testing, LLC has completed slope stability analysis of the Bottom Ash Pond located at Cleco Brame Energy Center in Lena, Louisiana. Authorization to proceed with this work was received from **Mr. Gary Leonards** via email on July 18, 2016. Our analysis was performed based on the soil boring log data provided by the client. Our scope of services included performing landside stability of the existing levee with maximum water elevation, as requested by the client. All sections were modeled and analyzed based on the survey data and soil boring data provided by the client. This report presents the results of Sections 1, 2 and 3 of the Bottom Ash Pond.

Background

The Bottom Ash Pond at the Brame Energy Center was initially constructed in 1981. The facility was expanded in 1982 when an additional coal fired boiler system (Unit #2) came on line. The bottom ash is sluiced to the Bottom Ash Pond. The Bottom Ash Pond is an existing unit that is essential for the management of solid residuals generated at the Brame Energy Center.

TABLE 1.0

Pond	Section #	Soil boring # (Report No.) *	Boring Depth (Feet)	Average Top of Levee Elevation (feet, NAVD88)	Pond Max. Water Elevation (feet, NAVD 88)
Bottom Ash	Section 1	B-13 (04-16-061)	80	109.8	103.5
	Section 2	B-12 (04-16-061)	80	123.3	103.5
	Section 3	B-3 (06-11-090)	80	107.9	103.5

*Boring data was obtained from Reports prepared by Geotechnical Testing Laboratory (GTL), Inc.

All three sections achieved the minimum desired factor of safety of 1.50. Please refer to *Attachments* of this report.

Assumptions and Observations:

- Soil layers are horizontal with uniform thickness.
- Soil layers encountered in Levee Centerline boring were used for the analysis.
- Cross section profiles limits were extended horizontally on the land side, whenever the failure plane passes the limits.

Slope Stability Analysis Results

Slope stability analysis was performed using Spencer method for both the short term and long term conditions as requested by the client. Changes in slopes, structural loadings, and other conditions may affect the results of slope stability analysis. Factors of safety (FoS) obtained from slope stability analysis results do meet 1.50 according to HSDRRS guidelines for Steady Water Level conditions.

TABLE 2.0

Soil Type	Phi	Cohesion (psf)
Silt (ML)	28°	0
Clay (CL/CH)	28°	0
Sand (SP / SM)	37°	0

TABLE 3.0

Pond	Section #	Condition	Flood Side Water Elevation (feet, NAVD88)	Factor of Safety Obtained	Notes
Bottom Ash Pond	1	Short Term	103.5	1.53	--
	1	Long Term	103.5	1.68	--
	2	Short Term	103.5	2.27	--
	2	Long Term	103.5	2.32	--
	3	Short Term	103.5	1.58	--
	3	Long Term	103.5	1.60	--

Based on the results presented in the above table, all three sections of the Bottom Ash Pond meet minimum required factor of safety with the projected maximum water elevation as shown in above table for both short term and long term conditions. This is based on the soil boring data provided by the client.

Liquefaction

Clayey sands and poorly graded sands present at the bottom ash project site have greater N values to resist the earthquake motions and acceleration. Also, the relative densities are more than 35 to 40 percent and therefore do not present susceptibility to liquefaction.

If you have any questions pertaining to this report, or if we may be of further service, please contact our office.

Respectfully submitted,
APS ENGINEERING AND TESTING, LLC

Sairam Eddanapudi, P.E.
Project Manager

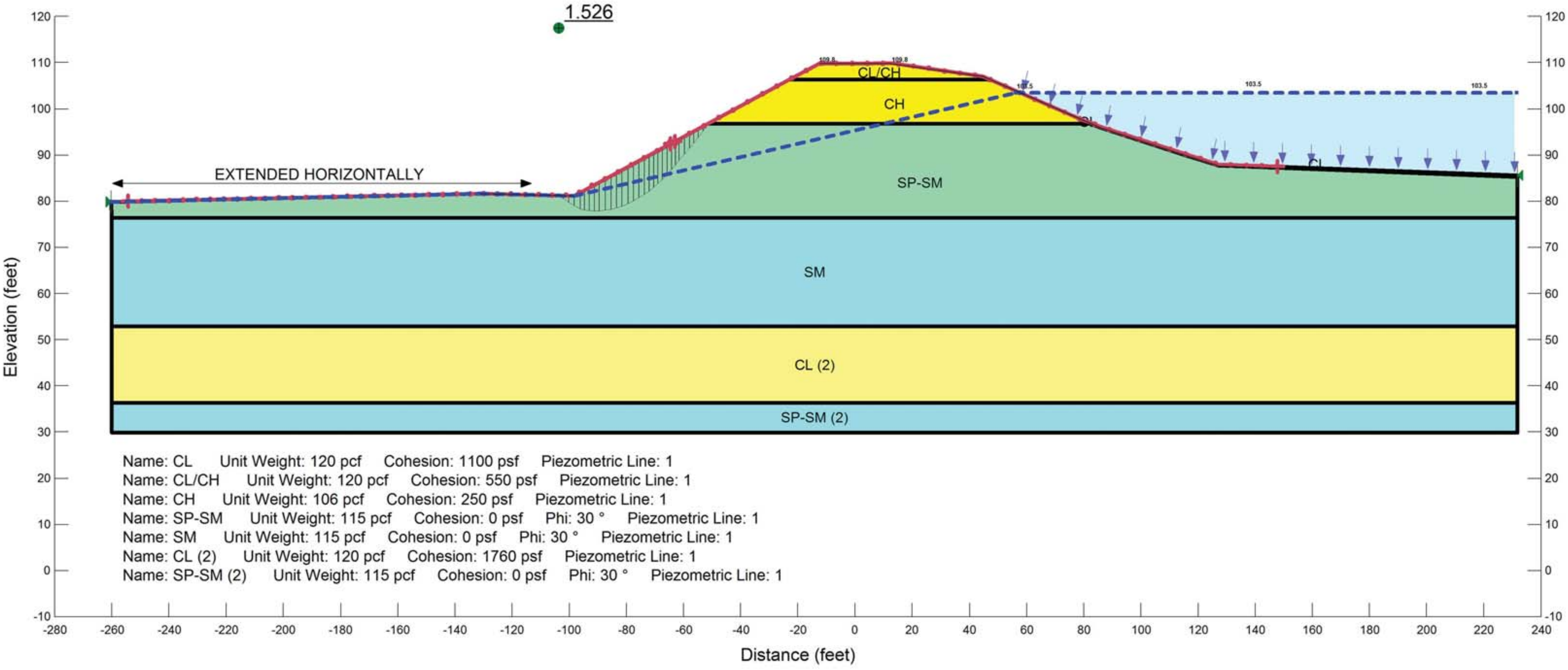
Sergio Aviles, P.E.
President

Attachments

Boring Location Plan
Slope stability Analysis Results


B-1
TWO
B-2
THREE
B-3
B-12
LA Highway 1
Interstate 49
B-4
Bottom Ash Pond
B-5
B-13
ONE
B-6
B-14
B-7
Fly Ash Pond
B-8
B-15
Ash Management Area
B-9
Leachate & Contact
Sorm Water Pond
B-10
LA Highway 121
B-11
Image USDA Farm Service Agency

CLECO BRAME ENERGY CENTER
BOTTOM ASH POND - SECTION 1
SHORT TERM SLOPE STABILITY ANALYSIS
SOIL BORING B-13 (FROM GTL REPORT NO.: 04-16-061)



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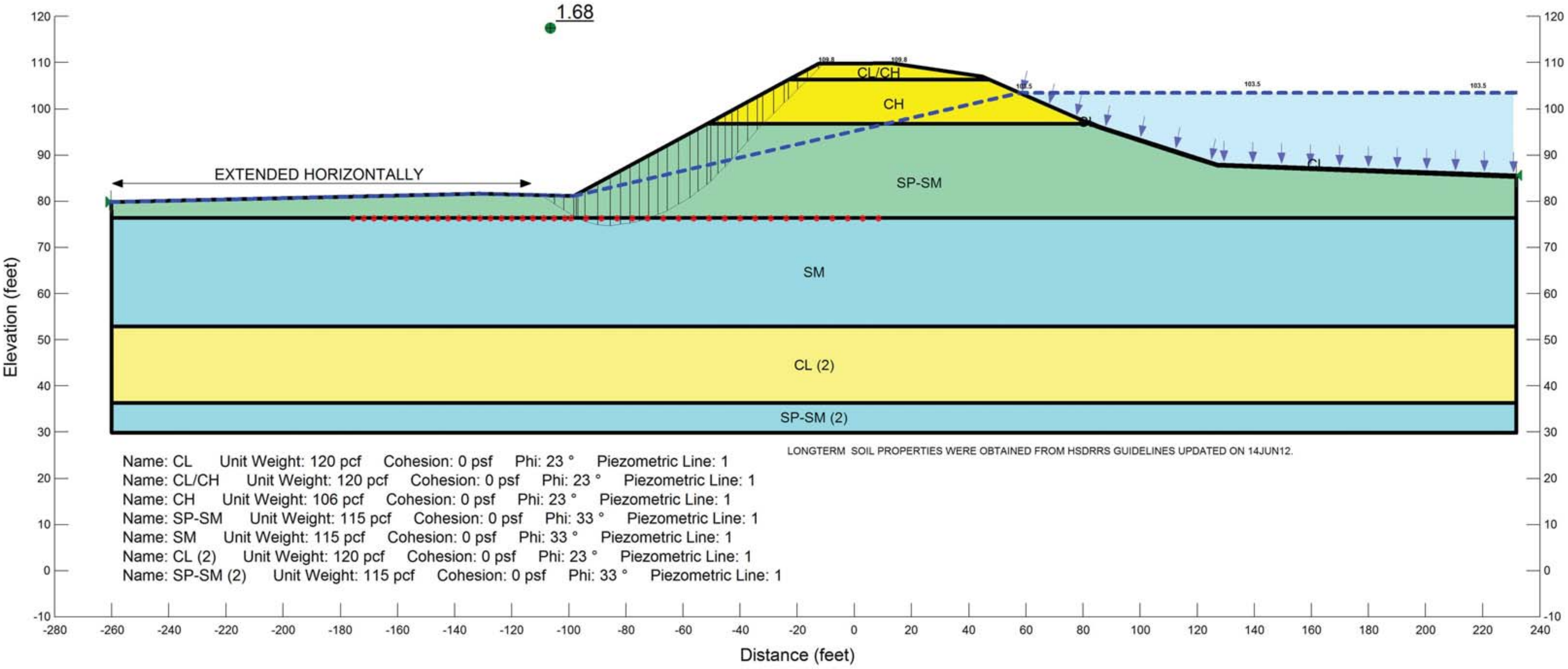
Name: CL/CH Unit Weight: 120 pcf Cohesion: 550 psf Piezometric Line: 1
Name: CH Unit Weight: 106 pcf Cohesion: 250 psf Piezometric Line: 1
Name: SP-SM Unit Weight: 115 pcf Cohesion: 0 psf Phi: 30 ° Piezometric Line: 1
Name: SM Unit Weight: 115 pcf Cohesion: 0 psf Phi: 30 ° Piezometric Line: 1
Name: CL (2) Unit Weight: 120 pcf Cohesion: 1760 psf Piezometric Line: 1
Name: SP-SM (2) Unit Weight: 115 pcf Cohesion: 0 psf Phi: 30 ° Piezometric Line: 1

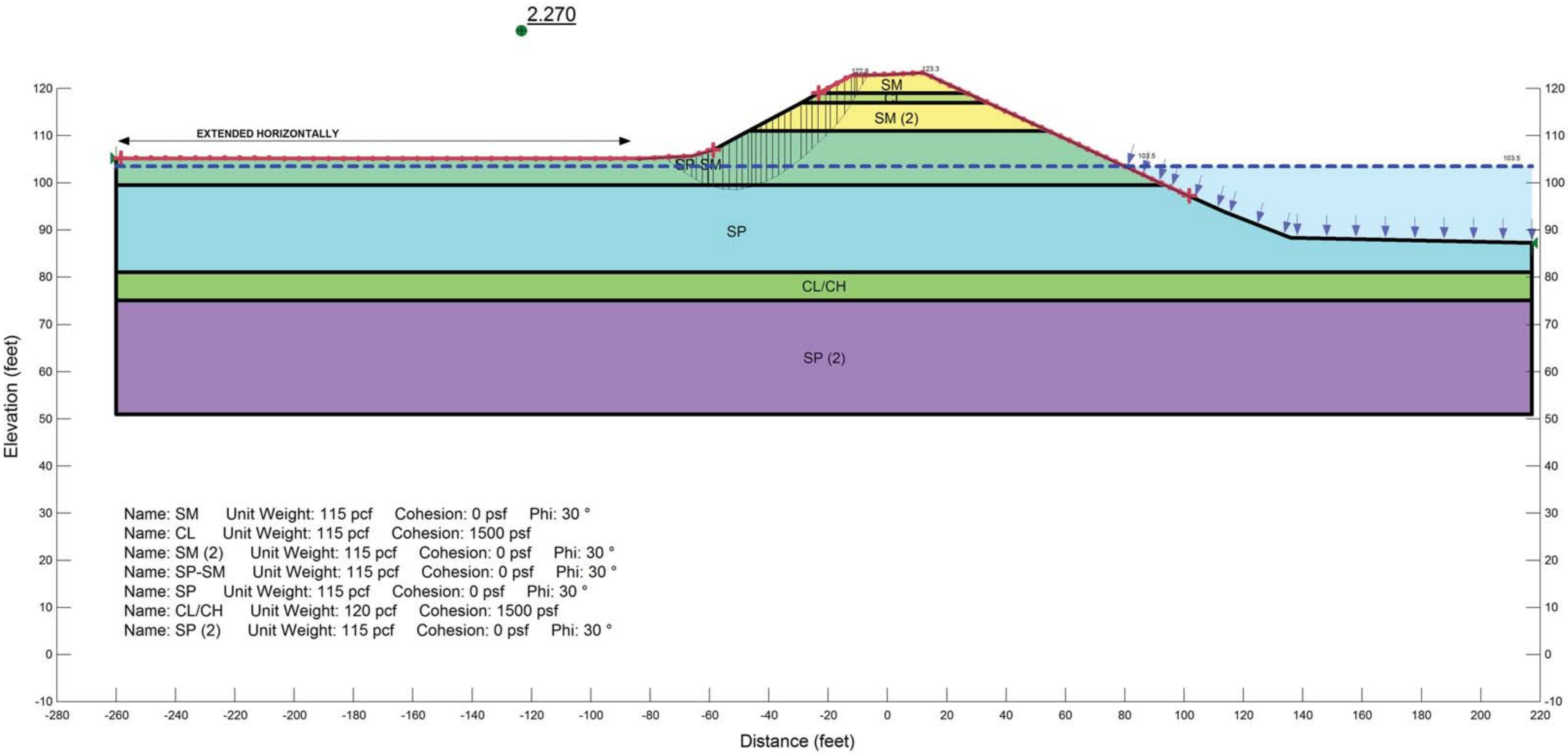
CLECO BRAME ENERGY CENTER
BOTTOM ASH POND - SECTION 1
LONG TERM SLOPE STABILITY ANALYSIS (S-CASE)
SOIL BORING B-13 (FROM GTL REPORT NO.: 04-16-061)



Name: CL Unit Weight: 120 pcf Cohesion: 0 psf Phi: 23 ° Piezometric Line: 1
Name: CL/CH Unit Weight: 120 pcf Cohesion: 0 psf Phi: 23 ° Piezometric Line: 1
Name: CH Unit Weight: 106 pcf Cohesion: 0 psf Phi: 23 ° Piezometric Line: 1
Name: SP-SM Unit Weight: 115 pcf Cohesion: 0 psf Phi: 33 ° Piezometric Line: 1
Name: SM Unit Weight: 115 pcf Cohesion: 0 psf Phi: 33 ° Piezometric Line: 1
Name: CL (2) Unit Weight: 120 pcf Cohesion: 0 psf Phi: 23 ° Piezometric Line: 1
Name: SP-SM (2) Unit Weight: 115 pcf Cohesion: 0 psf Phi: 33 ° Piezometric Line: 1

LONGTERM SOIL PROPERTIES WERE OBTAINED FROM HSDRRS GUIDELINES UPDATED ON 14JUN12.

CLECO BRAME ENERGY CENTER
BOTTOM ASH POND - SECTION 2
SHORT TERM SLOPE STABILITY ANALYSIS
SOIL BORING B-12 (FROM GTL REPORT NO.: 04-16-061)



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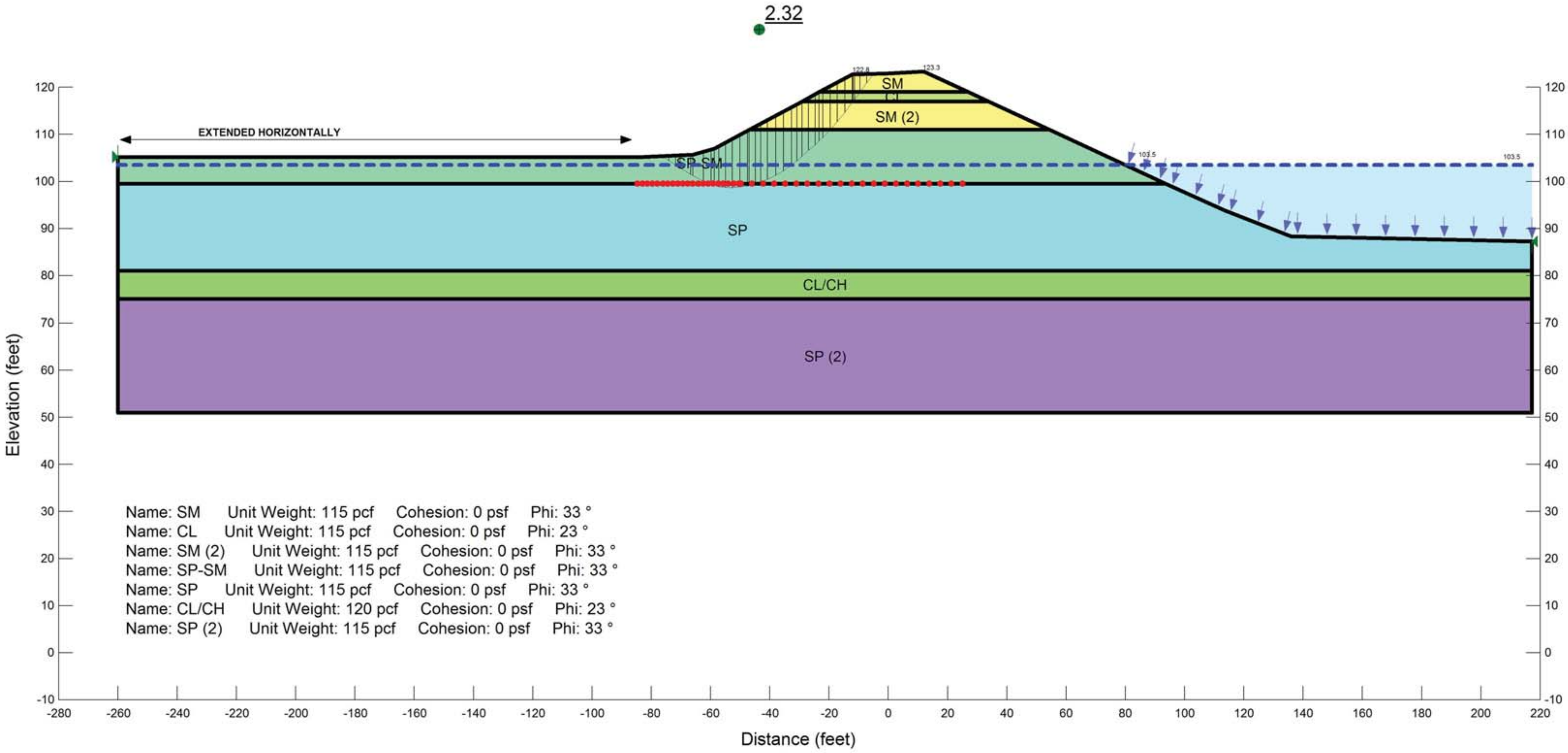
Name: CL Unit Weight: 115 pcf Cohesion: 1500 psf
Name: SM (2) Unit Weight: 115 pcf Cohesion: 0 psf Phi: 30 °
Name: SP-SM Unit Weight: 115 pcf Cohesion: 0 psf Phi: 30 °
Name: SP Unit Weight: 115 pcf Cohesion: 0 psf Phi: 30 °
Name: CL/CH Unit Weight: 120 pcf Cohesion: 1500 psf
Name: SP (2) Unit Weight: 115 pcf Cohesion: 0 psf Phi: 30 °

CLECO BRAME ENERGY CENTER
BOTTOM ASH POND - SECTION 2
LONG TERM SLOPE STABILITY ANALYSIS (S-CASE)
SOIL BORING B-12 (FROM GTL REPORT NO.: 04-16-061)



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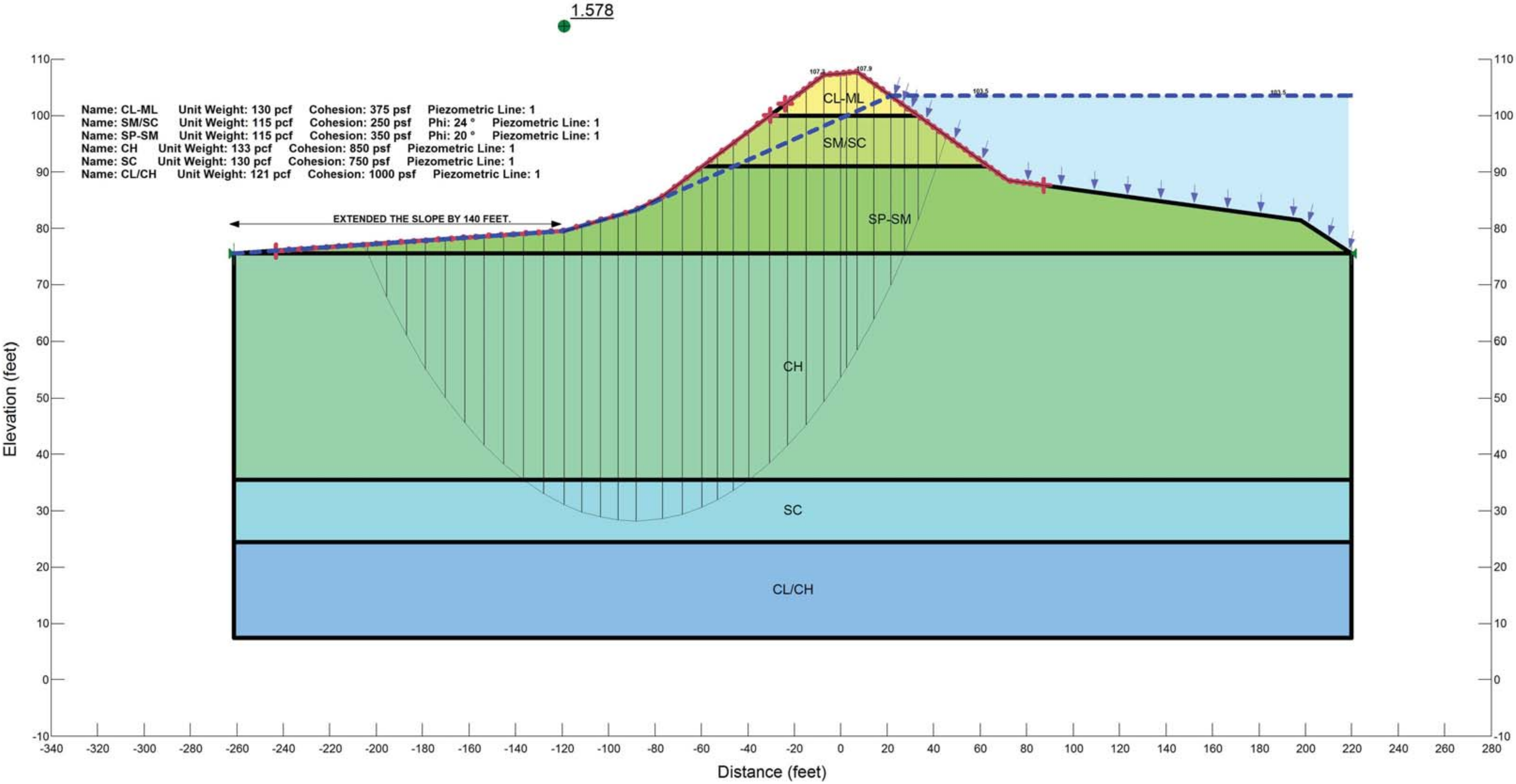
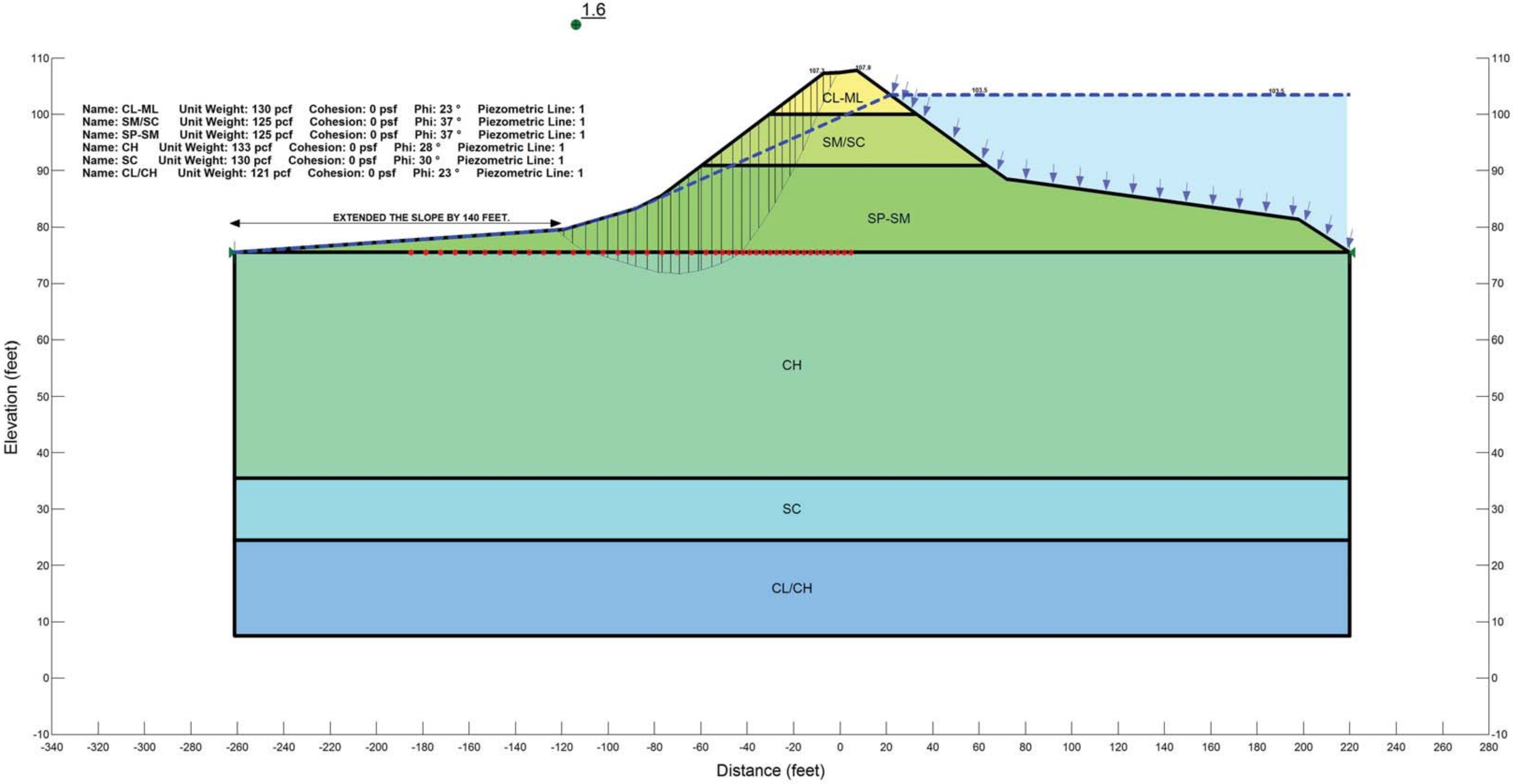
Name: CL	Unit Weight: 115 pcf	Cohesion: 0 psf	Phi: 23 °
Name: SM (2)	Unit Weight: 115 pcf	Cohesion: 0 psf	Phi: 33 °
Name: SP-SM	Unit Weight: 115 pcf	Cohesion: 0 psf	Phi: 33 °
Name: SP	Unit Weight: 115 pcf	Cohesion: 0 psf	Phi: 33 °
Name: CL/CH	Unit Weight: 120 pcf	Cohesion: 0 psf	Phi: 23 °
Name: SP (2)	Unit Weight: 115 pcf	Cohesion: 0 psf	Phi: 33 °

CLECO BRAME ENERGY CENTER
BOTTOM ASH POND - SECTION 3
SHORT TERM SLOPE STABILITY ANALYSIS
SOIL BORING B-3 (FROM GTL REPORT NO.: 06-11-090)



CLECO BRAME ENERGY CENTER
BOTTOM ASH POND - SECTION 3
LONG TERM SLOPE STABILITY ANALYSIS (S-CASE)
SOIL BORING B-3 (FROM GTL REPORT NO.: 06-11-090)



Name: CL-ML	Unit Weight: 130 pcf	Cohesion: 0 psf	Phi: 23 °	Piezometric Line: 1
Name: SM/SC	Unit Weight: 125 pcf	Cohesion: 0 psf	Phi: 37 °	Piezometric Line: 1
Name: SP-SM	Unit Weight: 125 pcf	Cohesion: 0 psf	Phi: 37 °	Piezometric Line: 1
Name: CH	Unit Weight: 133 pcf	Cohesion: 0 psf	Phi: 28 °	Piezometric Line: 1
Name: SC	Unit Weight: 130 pcf	Cohesion: 0 psf	Phi: 30 °	Piezometric Line: 1
Name: CL/CH	Unit Weight: 121 pcf	Cohesion: 0 psf	Phi: 23 °	Piezometric Line: 1

APPENDIX B

P.E. CERTIFICATION

CLECO BRAME ENERGY CENTER
BOTTOM ASH POND
CCR SAFETY FACTOR ASSESSMENT

PROFESSIONAL ENGINEER CERTIFICATION

I hereby certify that I have performed a safety factor assessment for Cleco's Brame Energy Center Bottom Ash Pond in accordance with the 40 CFR 257.73(e)(1) CCR requirements. This safety factor assessment has determined that the Bottom Ash Pond has met the following requirements:

- The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.
- The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.

And that these requirements were not applicable based on the findings:

- The calculated seismic factor of safety must equal or exceed 1.00.
- For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

James C. Van Hoof
Name

24630 **LA**
Registration No. State

James C. Van Hoof, P.E.
Signature

10/17/2016
Date

JAMES C. VAN HOOF
REG. No. 24630
(Seal)

OCTOBER 2016

CLECO POWER LLC
BRAME ENERGY CENTER

SAFETY FACTOR ASSESSMENT:

FLY ASH POND

Prepared By:

Providence Engineering and Environmental Group LLC
1201 Main Street
Baton Rouge, Louisiana 70802

(225) 766-7400

www.providenceeng.com

Project Number 002-186

TABLE OF CONTENTS

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1.0 INTRODUCTION

Providence was contracted by Cleco Power LLC (Cleco) to conduct safety factor assessments of the Fly Ash Pond at Cleco's Brame Energy Center located in Lena, Louisiana. Recent Coal Combustion Residual (CCR) regulations at 40 CFR 257.73(e)(1) established requirements for owners and operators to conduct safety factor assessments to document whether the calculated factors of safety for the Fly Ash Pond achieve the minimum safety factors specified below:

- The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.
- The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.
- The calculated seismic factor of safety must equal or exceed 1.00.
- For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

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 safety factor assessment pertains to the Fly Ash surface impoundment (Pond) utilized for the Unit 2 coal-fired generation unit. A site map for the Fly Ash Pond is included as **Figure 2**.

2.0 FACTORS OF SAFETY

Providence performed a safety factor analysis (slope stability analysis) for the levees surrounding the Fly Ash Pond. This analysis required a review of the original permit and construction drawings for the Fly Ash Pond, a detailed topographic survey of the perimeter levees of the Fly Ash Pond, and installation of borings in the perimeter levees to determine the soil conditions that exist within the perimeter levee system for the pond.

Providence mobilized to the Brame Energy Center in June of 2011 and again in April of 2016 to install geotechnical borings in the perimeter levees of the Fly Ash Pond. Geotechnical Testing Laboratory, Inc. installed 6 borings spaced approximately 500 feet apart along the center line of the levee in 2011 and 1 additional boring in 2016. Soil profiles were generated for sections along the Fly Ash Pond that shows the results of the geotechnical borings and the laboratory analysis. **Table 1** shows the soil profiles for each section and the characteristics used for the safety factor modeling.

Table 1 Subsurface Soil Classification and Parameters

Fly Ash Pond Section 1 B-15	**Soil**	**Depth (ft)**	**Unit Wt. (lb/ft^3)**	**Cohesion (lb/ft^2)**	**Friction Angle(Φ)**
	ML	2.0	118	250	20
	CL-CH	6.5	120	1,000	-
	CL-ML	3.5	115	600	-
	SM	5.0	115	0	36
	CH	11.5	117	440	-
	CL	19.5	117	375	-
	SM	6.5	115	0	28
	CH	14.0	112	550	-
	SM	11.5	115	0	30
	Landfill Material	-	75	20	-
Fly Ash Pond Section 2 B-6	**Soil**	**Depth (ft)**	**Unit Wt. (lb/ft^3)**	**Cohesion (lb/ft^2)**	**Friction Angle(Φ)**
	CL	4.0	120	2,500	-
	SM-SC	21.0	115	500	30
	CH	32.0	120	950	-
	SP-SM	23.0	115	900	27
Fly Ash Pond Section 3 B-8	**Soil**	**Depth (ft)**	**Unit Wt. (lb/ft^3)**	**Cohesion (lb/ft^2)**	**Friction Angle(Φ)**
	CL	7.0	105	1,050	-
	SP-SM	15.0	115	475	31
	CH	33.0	108	800	-
	CH	25.0	97	475	-

The safety factor analysis uses the strength of the soil material of which the levee is made of and subgrade to assess levee stability in accordance to the existing conditions. The Spencer Method for slope stability was used since it is the most conservative approach. The Spencer Method is a general method of slices developed on the basis of limit equilibrium. It requires satisfying equilibrium of forces and moments acting on individual blocks. The blocks are created by dividing the soil above the slip surface by dividing planes. Deep failure analysis evaluates the potential of the levees to fail through the bottom of the levees into the existing native soils. The analysis was based upon the following assumptions and input parameters.

- The subgrade stratigraphy was modeled using soil profiles from completed soil borings at the site with the soil profile condition at each section for this pond through the entire levee system.
- The height and exterior slope of the levees were determined based on actual field surveys and previously permitted design data and the bottom

elevation and the interior slope of the levees below the water line was determined based on the previously permitted design provided by Cleco.

- The input parameters used in our analyses were based upon results from geotechnical investigations conducted for this safety factor analysis. **Appendix A** includes a copy of the geotechnical results as provided by the geotechnical contractor.
- The fill material in the pond was assumed to be water for the Fly Ash Pond. Maximum water elevation in the Fly Ash Pond is 102.5 feet NAVD 88.

<u>The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50</u>

Providence modeled the pond under the long-term, maximum storage to the freeboard level for the Fly Ash surface impoundment. Based on the results of the slope stability analysis, the following minimum factors of safety were obtained:

Table 2 Long-Term Factors of Safety

Surface Impoundment	Section Number	Soil Boring No.	Maximum Water Elevation (feet NAVD 88)	Analysis	Factor of Safety
Fly Ash	Section 1	B-15	102.5	Spencer Method Deep Failure	2.48
Fly Ash	Section 2	B-6	102.5	Spencer Method Deep Failure	1.53
Fly Ash	Section 3	B-8	102.5	Spencer Method Deep Failure	1.79

The calculated long-term static factor of safety under maximum storage pool loading conditions is greater than 1.50, therefore these safety factors are adequate.

<u>The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40</u>

Providence modeled the pond under the short-term scenario where the facility allows the pond to fill to the freeboard level for the Fly 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 each pond.

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

Table 3 Short-Term Factors of Safety

Surface Impoundment	Section Number	Soil Boring No.	Maximum Water Elevation (feet NAVD 88)	Analysis	Factor of Safety
Fly Ash	Section 1	B-15	102.5	Spencer Method Deep Failure	1.56
Fly Ash	Section 2	B-6	102.5	Spencer Method Deep Failure	1.82
Fly Ash	Section 3	B-8	102.5	Spencer Method Deep Failure	2.75

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.

<u>The calculated seismic factor of safety must equal or exceed 1.00</u>

The Brame Energy Center is not located in a seismic area. The Louisiana Geological Survey and the United States Geological Survey classifies the entire state of Louisiana as a low seismic risk area. This low seismic risk classification denotes that the levels of horizontal shaking that have a 2 in 100 chance of being exceed in in a 50-year period range from 0-8% g where g is the acceleration of a falling object due to gravity. The nearest published fault system to the Brame Energy Center is approximately 100 miles away. Therefore, the calculated seismic factor of safety is not applicable to the Fly Ash Pond.

<u>For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.2</u>

The clayey soils encountered at the Fly Ash Pond are not susceptible to liquefaction.

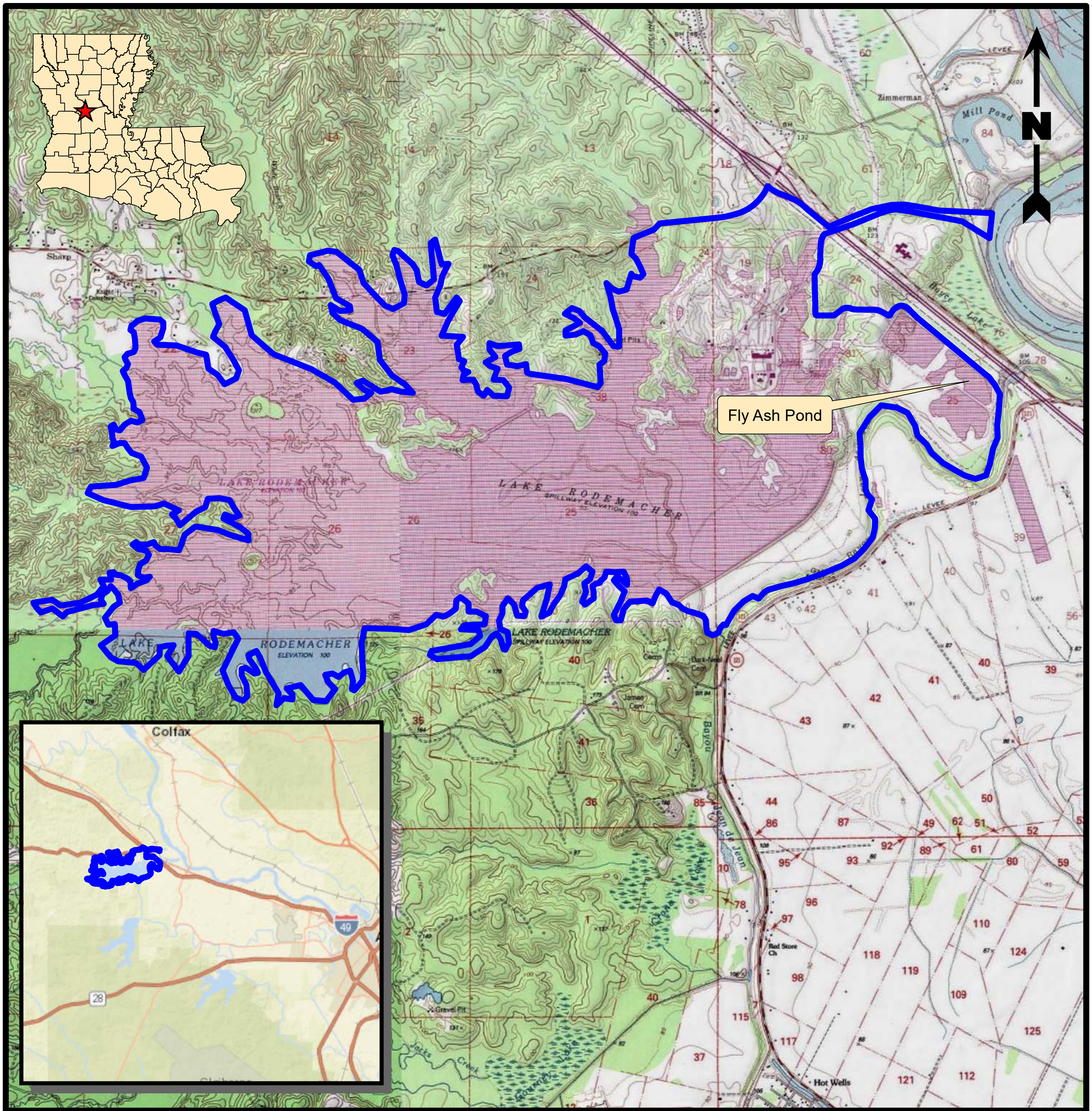
It must be noted that Cleco keeps the operating water levels in the Fly Ash Pond at lower levels. The low operating levels for this pond will not adversely affect the structural stability of the perimeter levees around the Fly Ash Pond. The normal operating water level in the Fly Ash Pond ranges from 86 to 92 feet NAVD 88. These levels are significantly lower than the modeled flooded/heavy rainfall conditions.

3.0 CONCLUSIONS

Based on the results from the safety factor analysis, the existing levee design for the Fly Ash Pond achieves the minimum safety factor requirements of the 40 CFR 257.73(e)(1) CCR regulations. Results of the safety factor analysis and model input parameters can be found in **Appendix A**. **Appendix B** contains a P.E. Certification that attests to the safety factor assessment.

FIGURE 1

SITE LOCATION MAP



4,000 2,000 0 4,000
Feet

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

Safety Factor Assessment - Fly 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-A015

1
Figure

Providence Engineering and Environmental Group LLC

FIGURE 2

SITE MAP

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

Safety Factor Assessment - Fly 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-B016

2
Figure

Providence Engineering and Environmental Group LLC

APPENDIX A

SAFETY FACTOR ANALYSIS

APS Engineering and Testing

October 16, 2016

PROVIDENCE
1201 Main Street
Baton Rouge, LA 70802

Attn: Mr. Gary Leonards, P.E.

Re: Slope Stability Analysis of Fly Ash Pond
Cleco Brame Energy Center
Lena, Louisiana

Dear Mr. Leonards:

APS Engineering and Testing, LLC has completed slope stability analysis of the Fly Ash Pond located at Cleco Brame Energy Center in Lena, Louisiana. Authorization to proceed with this work was received from **Mr. Gary Leonards** via email on July 18, 2016. Our analysis was performed based on the soil boring log data provided by the client. Our scope of services included performing landside stability of the existing levee with maximum water elevation, as requested by the client. All sections were modeled and analyzed based on the survey data and soil boring data provided by the client. This report presents the results of Sections 1, 2 and 3 of the Fly Ash Pond.

Background

The Fly Ash Pond at the Brame Energy Center was initially constructed in 1981. The facility was expanded in 1982 when an additional coal fired boiler system (Unit #2) came on line. The Fly Ash Pond levee along the southern side was added in 1984 to reduce the size of the original pond. The fly ash is trucked to the Fly Ash Pond. The Fly Ash Pond is an existing unit that is essential for the management of solid residuals generated at the Brame Energy Center.

TABLE 1.0

Pond	Section #	Soil boring # (Report No.) *	Boring Depth (Feet)	Average Top of Levee Elevation (feet, NAVD88)	Pond Max. Water Elevation (feet, NAVD88)
Fly Ash	Section 1	B-15 (04-16-061)	80	105.0	102.5
	Section 2	B-6 (06-11-090)	80	104.0	102.5
	Section 3	B-8 (06-11-090)	80	103.5	102.5

*Boring data was obtained from Reports prepared by Geotechnical Testing Laboratory (GTL), Inc.

All three sections achieved the minimum desired factor of safety of 1.50. Please refer to *Attachments* of this report.

Assumptions and Observations:

- Soil layers are horizontal with uniform thickness.
- Soil layers encountered in Levee Centerline boring were used for the analysis.
- Cross section profiles limits were extended horizontally on the land side, whenever the failure plane passes the limits.

Slope Stability Analysis Results

Slope stability analysis was performed using Spencer method for both the short term and long term conditions as requested by the client. Changes in slopes, structural loadings, and other conditions may affect the results of slope stability analysis. Factors of safety (FoS) obtained from slope stability analysis results do meet 1.50 according to HSDRRS guidelines for Steady Water Level conditions.

TABLE 2.0

Soil Type	Phi	Cohesion (psf)
Silt (ML)	28°	0
Clay (CL/CH)	28°	0
Sand (SP / SM)	37°	0

TABLE 3.0

Pond	Section #	Condition	Flood Side Water Elevation (feet, NAVD88)	Factor of Safety Obtained	Notes
Fly Ash Pond	1	Short Term	102.5	1.56	Landfill Material is required on the protected side of the levee to achieve min. FS.
	1	Long Term	102.5	2.48	--
	2	Short Term	102.5	1.80	--
	2	Long Term	102.5	1.53	--
	3	Short Term	102.5	2.71	--
	3	Long Term	102.5	1.79	--

Based on the results presented in the above table, all three sections of the Fly Ash Pond meet minimum required factor of safety with the projected maximum water elevation as shown in above table for both short term and long term conditions. This is based on the soil boring data provided by the client.

Liquefaction

Clayey soils encountered at the Fly Ash Pond site are not susceptible to liquefaction.

If you have any questions pertaining to this report, or if we may be of further service, please contact our office.

Respectfully submitted,
APS ENGINEERING AND TESTING, LLC

Sairam Eddanapudi, P.E.
Project Manager

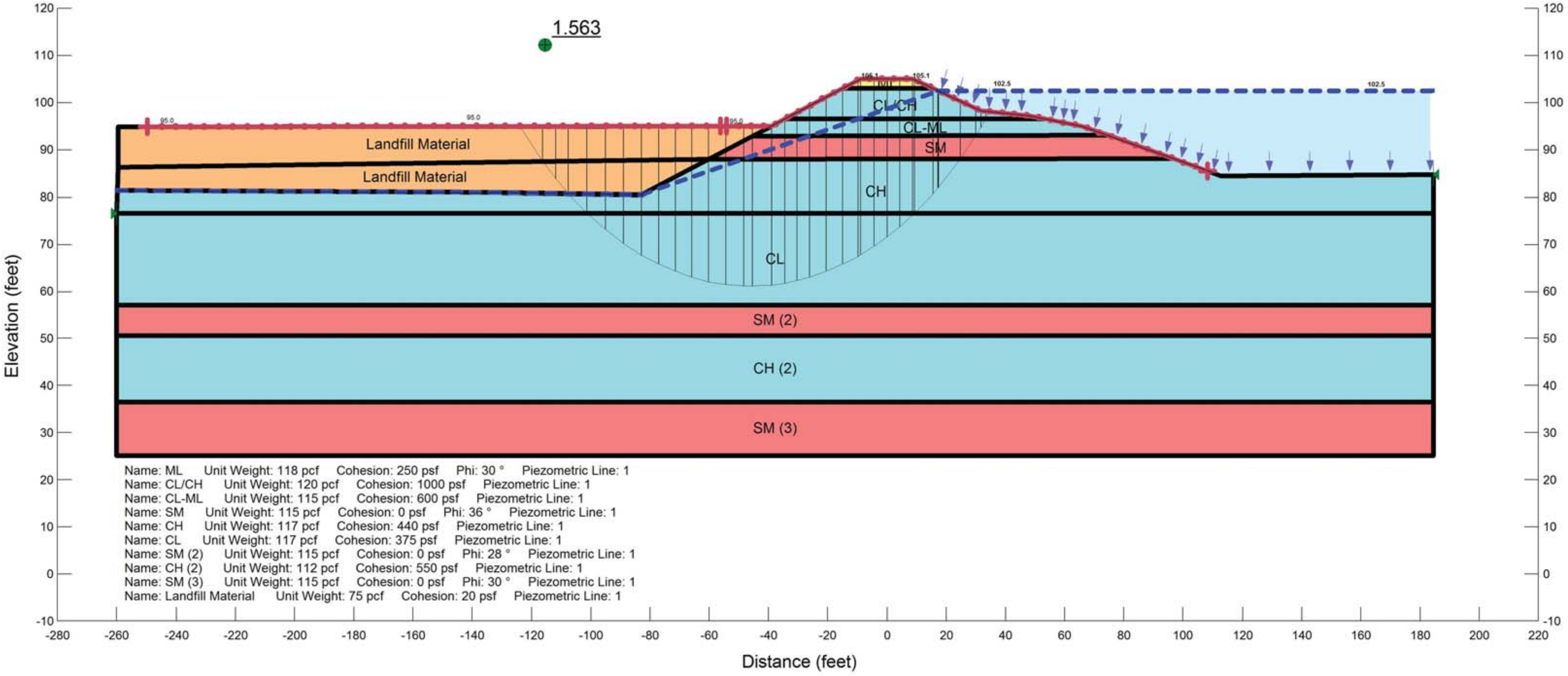
Sergio Aviles, P.E.
President

Attachments

Boring Location Plan
Slope Stability Analysis Results

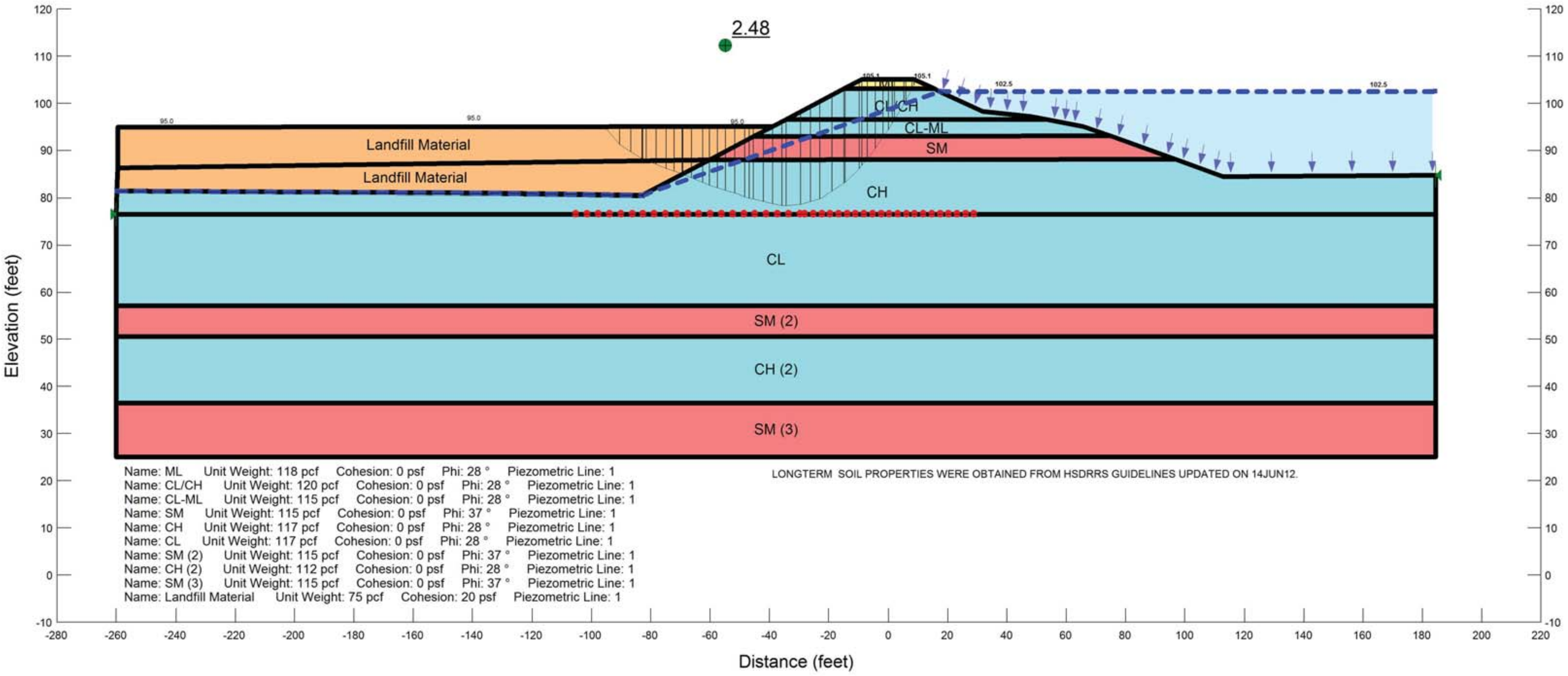

LA Highway 1
Interstate 49
LA Highway 121
B-1
B-2
B-3
B-4
B-5
B-6
B-7
B-8
B-9
B-10
B-11
B-12
B-14
B-15
Bottom Ash Pond
Fly Ash Pond
Ash Management Area
Leachate & Contact
Sorm Water Pond
ONE
TWO
THREE
Image USDA Farm Service Agency

CLECO BRAME ENERGY CENTER
FLY ASH POND - SECTION 1
SHORT TERM SLOPE STABILITY ANALYSIS
SOIL BORING B-15 (FROM GTL REPORT NO.: 04-16-061)



Name: ML Unit Weight: 118 pcf Cohesion: 250 psf Phi: 30 ° Piezometric Line: 1
Name: CL/CH Unit Weight: 120 pcf Cohesion: 1000 psf Piezometric Line: 1
Name: CL-ML Unit Weight: 115 pcf Cohesion: 600 psf Piezometric Line: 1
Name: SM Unit Weight: 115 pcf Cohesion: 0 psf Phi: 36 ° Piezometric Line: 1
Name: CH Unit Weight: 117 pcf Cohesion: 440 psf Piezometric Line: 1
Name: CL Unit Weight: 117 pcf Cohesion: 375 psf Piezometric Line: 1
Name: SM (2) Unit Weight: 115 pcf Cohesion: 0 psf Phi: 28 ° Piezometric Line: 1
Name: CH (2) Unit Weight: 112 pcf Cohesion: 550 psf Piezometric Line: 1
Name: SM (3) Unit Weight: 115 pcf Cohesion: 0 psf Phi: 30 ° Piezometric Line: 1
Name: Landfill Material Unit Weight: 75 pcf Cohesion: 20 psf Piezometric Line: 1

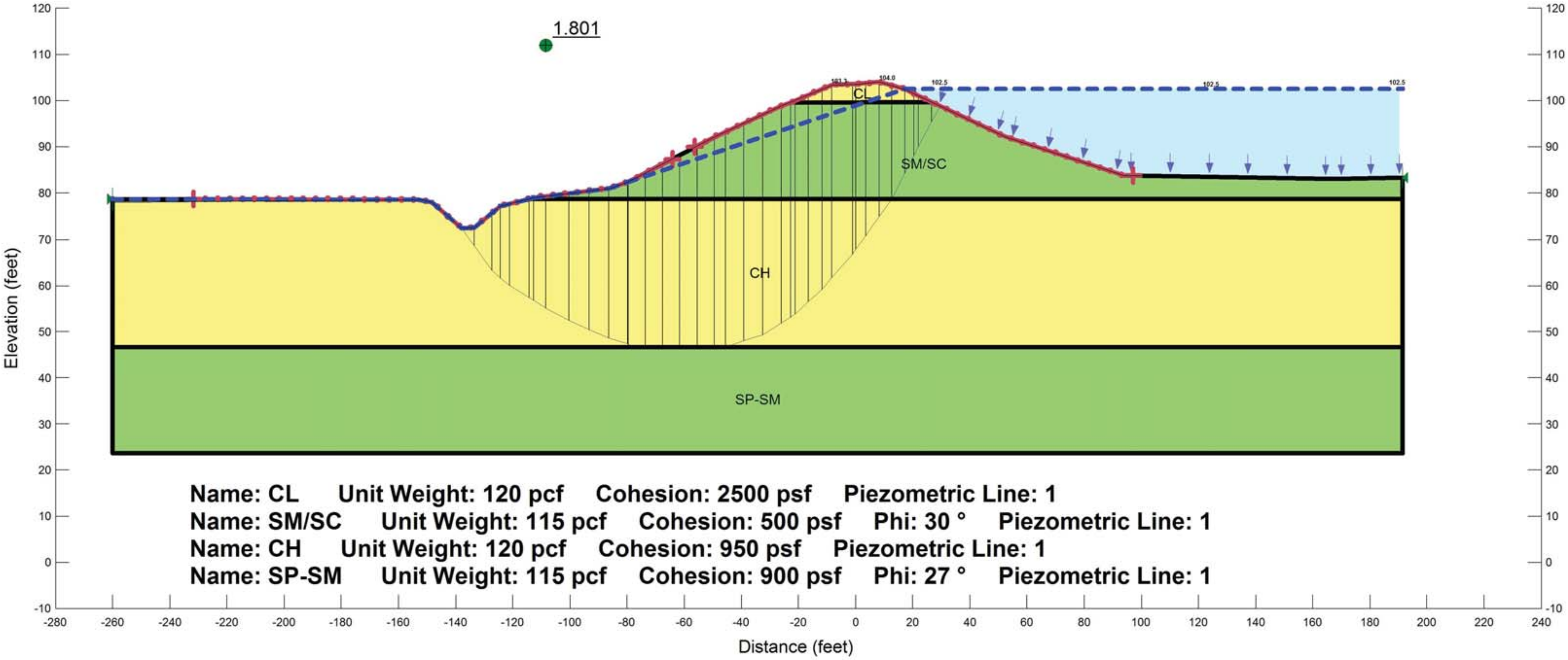
CLECO BRAME ENERGY CENTER
FLY ASH POND - SECTION 1
LONG TERM SLOPE STABILITY ANALYSIS (S-CASE)
SOIL BORING B-15 (FROM GTL REPORT NO.: 04-16-061)



Name: ML	Unit Weight: 118 pcf	Cohesion: 0 psf	Phi: 28 °	Piezometric Line: 1
Name: CL/CH	Unit Weight: 120 pcf	Cohesion: 0 psf	Phi: 28 °	Piezometric Line: 1
Name: CL-ML	Unit Weight: 115 pcf	Cohesion: 0 psf	Phi: 28 °	Piezometric Line: 1
Name: SM	Unit Weight: 115 pcf	Cohesion: 0 psf	Phi: 37 °	Piezometric Line: 1
Name: CH	Unit Weight: 117 pcf	Cohesion: 0 psf	Phi: 28 °	Piezometric Line: 1
Name: CL	Unit Weight: 117 pcf	Cohesion: 0 psf	Phi: 28 °	Piezometric Line: 1
Name: SM (2)	Unit Weight: 115 pcf	Cohesion: 0 psf	Phi: 37 °	Piezometric Line: 1
Name: CH (2)	Unit Weight: 112 pcf	Cohesion: 0 psf	Phi: 28 °	Piezometric Line: 1
Name: SM (3)	Unit Weight: 115 pcf	Cohesion: 0 psf	Phi: 37 °	Piezometric Line: 1
Name: Landfill Material	Unit Weight: 75 pcf	Cohesion: 20 psf		Piezometric Line: 1

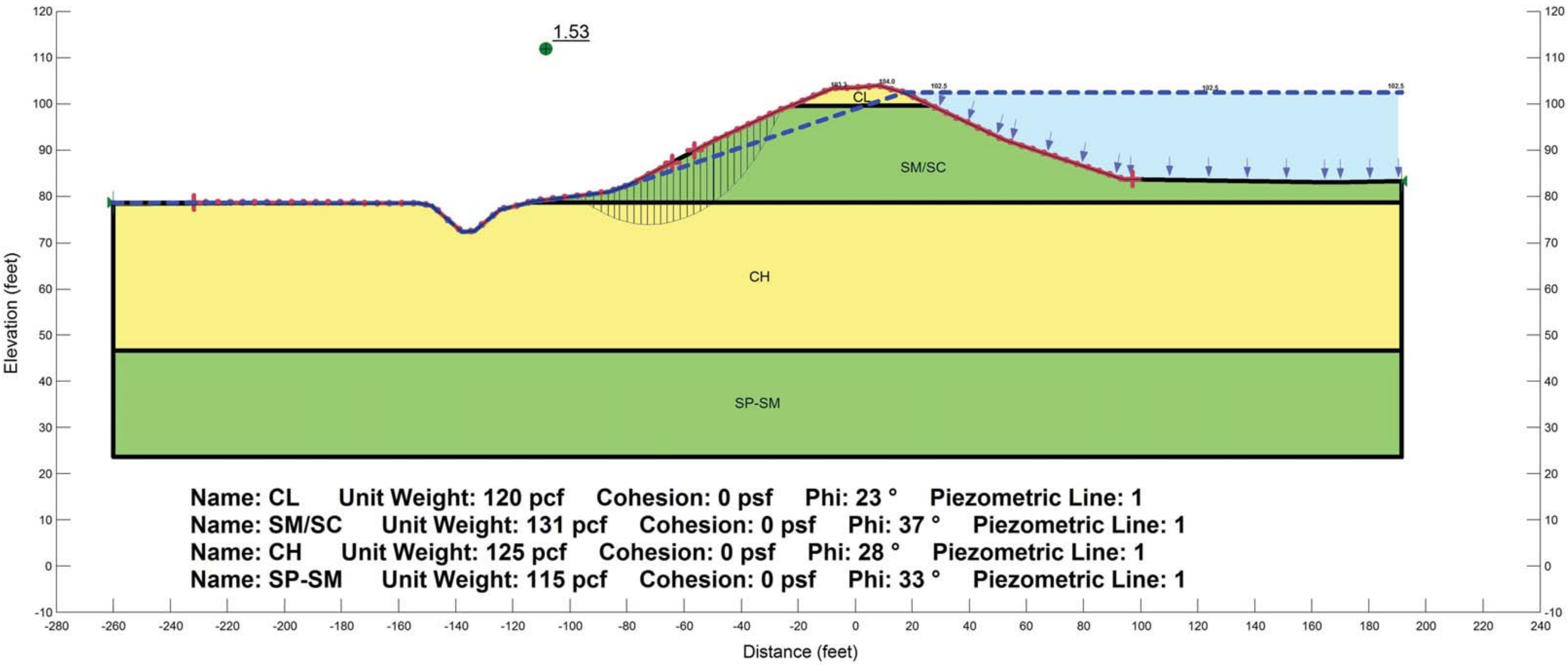
LONGTERM SOIL PROPERTIES WERE OBTAINED FROM HSDRRS GUIDELINES UPDATED ON 14JUN12.

CLECO BRAME ENERGY CENTER
FLY ASH POND - SECTION 2
SHORT TERM SLOPE STABILITY ANALYSIS
SOIL BORING B-6 (FROM GTL REPORT NO.: 06-11-090)



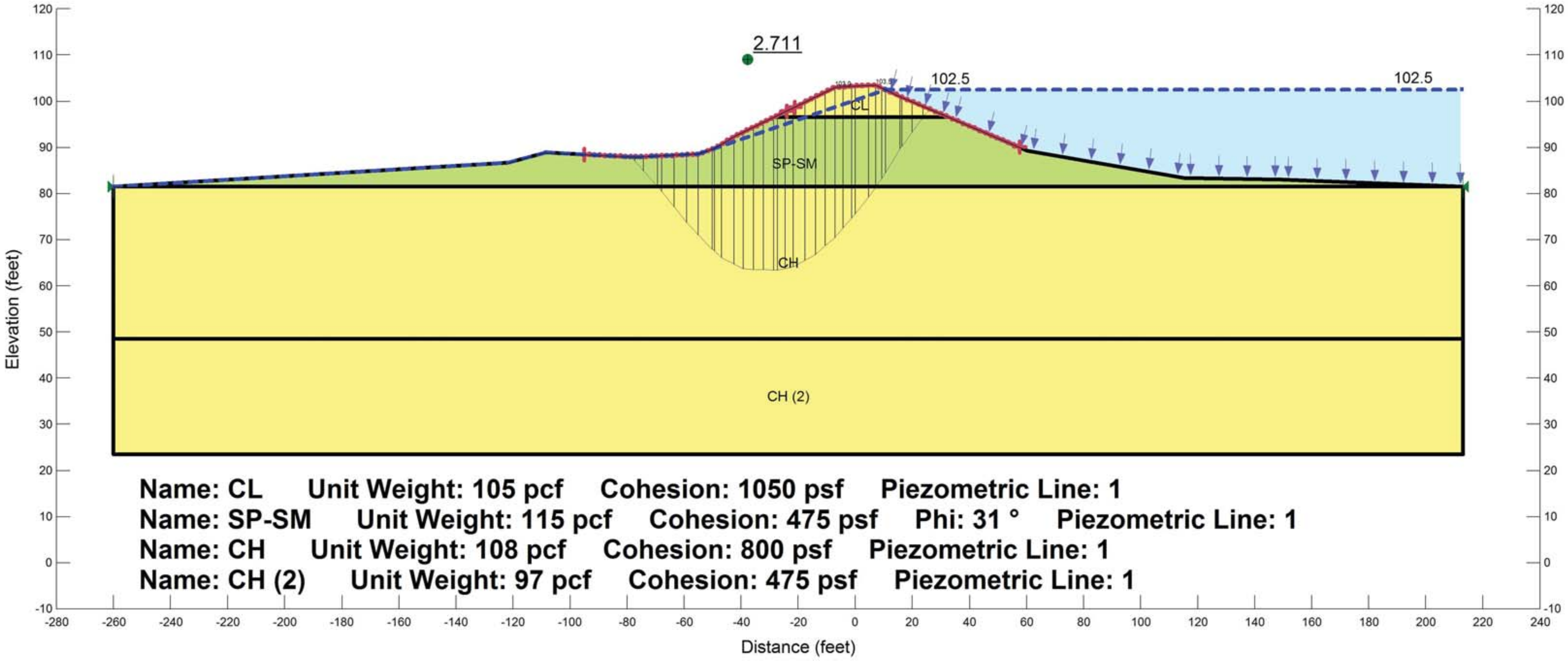
Name: CL Unit Weight: 120 pcf Cohesion: 2500 psf Piezometric Line: 1
Name: SM/SC Unit Weight: 115 pcf Cohesion: 500 psf Phi: 30 ° Piezometric Line: 1
Name: CH Unit Weight: 120 pcf Cohesion: 950 psf Piezometric Line: 1
Name: SP-SM Unit Weight: 115 pcf Cohesion: 900 psf Phi: 27 ° Piezometric Line: 1

CLECO BRAME ENERGY CENTER
FLY ASH POND - SECTION 2
LONG TERM SLOPE STABILITY ANALYSIS (S-CASE)
SOIL BORING B-6 (FROM GTL REPORT NO.: 06-11-090)



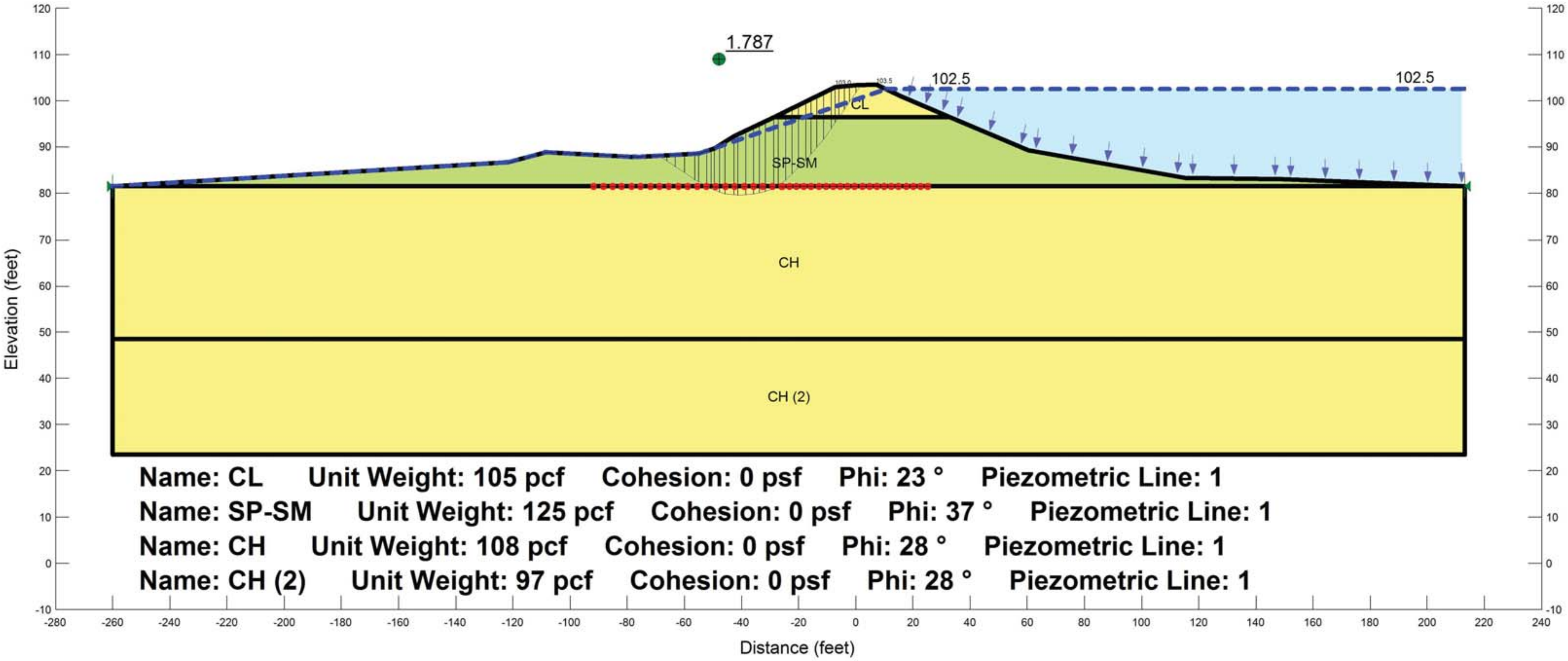
Name: CL Unit Weight: 120 pcf Cohesion: 0 psf Phi: 23 ° Piezometric Line: 1
Name: SM/SC Unit Weight: 131 pcf Cohesion: 0 psf Phi: 37 ° Piezometric Line: 1
Name: CH Unit Weight: 125 pcf Cohesion: 0 psf Phi: 28 ° Piezometric Line: 1
Name: SP-SM Unit Weight: 115 pcf Cohesion: 0 psf Phi: 33 ° Piezometric Line: 1

CLECO BRAME ENERGY CENTER
FLY ASH POND - SECTION 3
SHORT TERM SLOPE STABILITY ANALYSIS
SOIL BORING B-8 (FROM GTL REPORT NO.: 06-11-090)



Name: CL Unit Weight: 105 pcf Cohesion: 1050 psf Piezometric Line: 1
Name: SP-SM Unit Weight: 115 pcf Cohesion: 475 psf Phi: 31 ° Piezometric Line: 1
Name: CH Unit Weight: 108 pcf Cohesion: 800 psf Piezometric Line: 1
Name: CH (2) Unit Weight: 97 pcf Cohesion: 475 psf Piezometric Line: 1

CLECO BRAME ENERGY CENTER
FLY ASH POND - SECTION 3
LONG TERM SLOPE STABILITY ANALYSIS (S-CASE)
SOIL BORING B-8 (FROM GTL REPORT NO.: 06-11-090)



Name: CL Unit Weight: 105 pcf Cohesion: 0 psf Phi: 23 ° Piezometric Line: 1
Name: SP-SM Unit Weight: 125 pcf Cohesion: 0 psf Phi: 37 ° Piezometric Line: 1
Name: CH Unit Weight: 108 pcf Cohesion: 0 psf Phi: 28 ° Piezometric Line: 1
Name: CH (2) Unit Weight: 97 pcf Cohesion: 0 psf Phi: 28 ° Piezometric Line: 1

APPENDIX B

P.E. CERTIFICATION

CLECO BRAME ENERGY CENTER
FLY ASH POND
CCR SAFETY FACTOR ASSESSMENT

PROFESSIONAL ENGINEER CERTIFICATION

I hereby certify that I have performed a safety factor assessment for Cleco's Brame Energy Center Fly Ash Pond in accordance with the 40 CFR 257.73(e)(1) CCR requirements. This safety factor assessment has determined that the Fly Ash Pond has met the following requirements:

- The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.
- The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.

And that these requirements were not applicable based on the findings:

- The calculated seismic factor of safety must equal or exceed 1.00.
- For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

James C. Van Hoof
Name

24630 **LA**
Registration No. State

James C. Van Hoof, P.E.
Signature

10/17/2016
Date

JAMES C. VAN HOOF
REG. No. 24630
(Seal)

CHAPTER 5.0

Appendices

A Closure Plan
B Closure Plan Addendum

November 25, 2020

CLECO

ATTACHMENT A

Closure Plan
Brame Bottom Ash Pond

CLECO Corporation

Rodemacher Unit 2
Project No. 90965

Revision 0
10/14/2016

Closure Plan
Brame Bottom Ash Pond

prepared for

CLECO Corporation
Rodemacher Unit 2
Rapides Parish, Louisiana

Project No. 90965

Revision 0
10/14/2016

prepared by

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

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INDEX AND CERTIFICATION

CLECO Corporation
Closure Plan
Brame Bottom Ash Pond
Project No. 90965

Report Index

Certification

I hereby certify, as a Professional Engineer in the state of Louisiana, that the information in this document was assembled under my direct personal charge. This report is not intended or represented to be suitable for reuse by the CLECO Corporation or others without specific verification or adaptation by the Engineer.

Randell L Sedlacek

Randell L Sedlacek, P.E.
Louisiana License #38408

Date: 10/14/16

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Page No.

LIST OF TABLES

LIST OF ABBREVIATIONS

Abbreviation	**Term/Phrase/Name**
BMcD	Burns & McDonnell
Brame	Brame Energy Center
CCR	Coal Combustion Residual
CFR	Code of Federal Regulations
CLECO	CLECO Corporation
cm/sec	Centimeters/Second
CY	Cubic Yards
EPA	Environmental Protection Agency
LDEQ	Louisiana Department of Environmental Quality
RCRA	Resource Conservation and Recovery Act
U.S.C.	United States Code

1.0 INTRODUCTION

On April 17, 2015, the Environmental Protection Agency (EPA) issued the final version of the federal Coal Combustion Residual Rule (CCR Rule) to regulate the disposal of coal combustion residual (CCR) materials generated at coal-fired units. The rule will be administered as part of the Resource Conservation and Recovery Act ([RCRA, 42 United States Code [(U.S.C.]) §6901 et seq.)], using the Subtitle D approach.

The existing CCR impoundments at CLECO Corporation's (CLECO's) Brame Energy Center (Brame) are subject to the CCR Rule and as such CLECO is required to develop a Closure Plan per 40 Code of Federal Regulations (CFR) §257.102. This report serves as the Closure Plan for the Bottom Ash Pond at Brame.

This closure plan is in addition to, not in place of, any other applicable site permits, environmental standards, or work safety practices.

2.0 PLAN OBJECTIVES

Per 40 CFR §257.102, the Closure Plan must contain the following:

- A description of how the CCR unit will be closed.
    - For closure through leaving CCR in place:
        - A description of the final cover system and methods used to install the final cover, including methods for achieving performance standards specified in 40 CFR §257.102(d).
- An estimate of the maximum inventory of CCR material ever stored in the CCR unit over its active life.
- An estimate of the largest area of the CCR unit ever requiring a final cover.
- A schedule for completing closure activities, including the anticipated year of closure and major milestones for permitting and construction activities.

Additionally, CLECO is required to develop a Post-Closure Plan per 40 CFR §257.104, which will be covered in a separate document.

Per 40 CFR §257.102(b)(4), CLECO must obtain certification from a qualified professional engineer that the closure plan, and subsequent updates to the plan, meet the requirements of 40 CFR §257.102. This sealed document serves as that certification.

3.0 EXISTING CONDITIONS

Brame is located northwest of Alexandria in Rapides Parish, Louisiana. The Bottom Ash Pond receives bottom ash, economizer ash, sluice water, and other process flows from Rodemacher Unit 2.

3.1 CCR Inventory

The Bottom Ash Pond is permitted as a 42.25-acre pond with approximately 1,100,000 cubic yards (CY) of ash capacity. This volume is also an estimate of the maximum inventory of material that could potentially be stored in the impoundment over its active life. This estimated area is the largest area of the impoundment that should ever require a final cover. A site plan is included in Appendix A. CLECO dewaters and removes CCR material from the Bottom Ash Pond periodically for beneficial use.

4.0 CLOSURE METHOD

The Bottom Ash Pond will be closed through leaving CCR material in place as noted in the most recent version of the permit documentation. Procedures planned for closing the surface impoundment are described in detail herein.

4.1 Final Cover System Requirements

Per the CCR Rule, the final cover system must be designed and constructed to meet the following criteria pursuant to 40 CFR §257.102(d):

- Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than $1x10^{-5}$ centimeters per second (cm/sec), whichever is less.
- The infiltration of liquids through the closed CCR unit must be minimized by the use of an infiltration layer that contains a minimum of 18 inches of earthen material.
- The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.
- The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.
- The owner or operator may select an alternative final cover system design, provided the alternative final cover system meets the above requirements.

4.1.1 Drainage / Stabilization of CCR Material

Prior to installing the final cover system, Cleco must perform the following activities outlined in 40 CFR §257.102(d) of the CCR Rule:

- Eliminate free liquids by removing liquid wastes or solidifying the remaining wastes and waste residues
- Stabilize remaining wastes sufficiently in order to support the final cover system.

Free liquids will be removed initially, with excess water discharged via Outfall 401. Free liquid removal will be performed throughout construction, as necessary, to manage surface water and storm water runoff.

Additional dewatering may be required to remove entrained water. This can be accomplished through mechanical means such as double-handling and/or discing, or potentially through methods such as the use of a well point system, wick drains, or other means determined by the Contractor, Engineer, or Owner.

4.1.2 Geometry and Stormwater Management

Once stabilized, the impoundment will be backfilled, compacted, and graded to drain to the existing ditch outside the northwest embankment. The geometry and stormwater management controls of the closed impoundment will allow the CCR unit to meet the following requirements as outlined in 40 CFR §257.102(d) of the CCR Rule:

- Control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere.
- Prevent future impoundment of water.
- Provide for slope stability to protect against sloughing or movement of the final cover system.

The closure system will be designed to provide adequate drainage during storm events. Material will be graded in order to promote stability of the cover system, to prevent the collection of standing water, to limit the velocity of storm water runoff, and to reduce the potential for soil erosion.

4.1.3 Permeability and Infiltration

Once the grade of the backfilled CCR impoundment is established, the final cover system will be placed over the maximum extents of the impoundment to minimize infiltration into the consolidated waste material and erosion of the cap. Per 40 CFR §257.102(d), the final cover system will consist of, at minimum, an 18-inch infiltration layer and 6-inch erosion layer. The permeability of the final cover system will be will be equal to that of the bottom liner system and natural subsoils present, or no greater than 1x10^{-5} cm/sec, whichever is less. Per the current permit, CLECO may select an alternative final cover system design, provided the alternative cover system is designed and constructed to meet the criteria of the CCR Rule and is approved by LDEQ.

During installation of the cover soils, proper quality control methods will be used to ensure the following:

- The selected cover material is suitable;
- The material meets the minimum federal and state thickness and permeability requirements;
- The material is properly placed and compacted; and
- The material is properly protected before, during, and after construction.

The erosion layer will consist of topsoil and will be seeded with native vegetation. The period of time for greatest soil erosion concern will be immediately after placement of the topsoil material, before vegetation is established. Manufactured erosion control products, as well as a seed mix containing quick-growth seed varieties, will aid in erosion prevention during this critical timeframe.

4.1.4 Integrity of the Final Cover

Settling and subsidence of the final cover system will need to be evaluated during the final design phase, and will vary depending on the amount of CCR material present at the time of closure. The underlying natural subsoils are lean to fat clays and loose silts. Depending on the variability of these soils across the covered area, any settlement may or may not be uniform. Settlement would potentially be caused by consolidation of the CCR material, general fill material, or underlying natural subsoils under new loads from construction activities, and site conditions could be monitored during construction to confirm whether settlement is occurring and if it is slowing prior to installation of the cover soils. General fill, if necessary, will be installed in a controlled manner to minimize post-fill installation settlement.

5.0 CLOSURE SCHEDULE

Burns & McDonnell developed a preliminary schedule (see Table 5-1) outlining the critical scope and timeline necessary for the CCR surface impoundment closure at Brame. Per 40 CFR §257.102(f) of the CCR Rule, closure must be completed within five years of initiating closure activities. At this time, the anticipated closure trigger for the Bottom Ash Pond is the final receipt of waste, including either CCR or non-CCR streams. Per the 2007 Permit Renewal, the anticipated date of closure for the Bottom Ash Pond is no sooner than 2020, with the actual closure date dependent on plant operations.

Table 5-1: Preliminary Closure Schedule

Closure Activity	Timeframe (Working Days)	Accumulated Duration (Working Days)
Preparation for Closure		
Permitting / design	120	120
Submit Notification of Intent to Close to LDEQ	20	140
Design documents issued for bid	0	140
Bid period	15	155
Bid evaluation	10	165
Contract Award	20	185
Final placement of CCR material	0	185
Commence construction / mobilization	30	215
Closure Construction		
Dewatering / stabilization	90	305
Grading / backfill of impoundment	60	365
Install infiltration layer	90	455
Install erosion layer (topsoil)	20	475
LDEQ inspection	20	495
Seeding	20	515
Site clean-up / demobilization	10	525
Closure Completion		
Submit Notification of Completion of Closure	20	545

Closure of the existing CCR surface impoundment will commence no later than 30 days after the known final receipt of waste. No later than the date CLECO initiates closure of the existing CCR surface impoundment, a Notification of Intent to Close the CCR surface impoundment certified by a qualified professional engineer will be placed in the facility’s CCR Operating Record. The notification will then be placed on CLECO’s CCR public website within 30 days.

For the purposes of this Closure Plan, closure of the Bottom Ash Pond is considered complete after the erosion layer has been seeded and stabilized. From there, the Post-Closure Care Period for the Bottom Ash Pond will commence.

Within 30 days of completion of closure of the CCR surface impoundment, a Notification of Closure of the CCR surface impoundment will be prepared and placed in the facility’s CCR Operating Record and on CLECO’s CCR public website. This notification will include a certification by a qualified professional engineer in the State of Louisiana verifying that closure has been completed in accordance with this Closure Plan and the requirements of 40 CFR §257.102.

6.0 REVISIONS AND AMENDMENTS

The initial Closure Plan will be placed in the CCR Operating Record by October 17, 2016. The plan will be amended whenever there is a change in operation of the CCR unit that affects the current or planned closure operations. The Closure Plan will be amended 60 days prior to a planned change in operation, or within 60 days following an unplanned change in operation. If a written Closure Plan is revised after closure activities have commenced, the written Closure Plan will be amended no later than 30 days following the triggering event. The initial Closure Plan and any amendment will be certified by a qualified professional engineer in the State of Louisiana for meeting the requirements of 40 CFR §257.102 of the CCR Rule. All amendments and revisions will be placed on the CCR public website within 30 days following placement in the facility's CCR Operating Record. A record of revisions made to this document is included in Section 7.0 of this document.

7.0 RECORD OF AMENDMENTS

Revision Number	**Date**	**Revisions Made**	**By Whom**
0	10/14/2016	Initial Closure Plan	Burns & McDonnell

APPENDIX A – SITE LAYOUT

BURNS McDONNELL

date 8/10/2016

designed A. MYERS

CLECO CORPORATION

CCR COMPLIANCE DOCUMENTATION

SITE LAYOUT

project	90965
contract	-
drawing no.	**SK - CIVIL - 001**
rev.	**0**

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BURNS & McDONNELL

CREATE AMAZING.

Burns & McDonnell World Headquarters
9400 Ward Parkway
Kansas City, MO 64114
O 816-333-9400
F 816-333-3690
www.burnsmcd.com

ATTACHMENT B

Addendum to Closure Plan for the Brame Energy Center (BEC) Bottom Ash Pond

This Addendum to the October 14, 2016 BEC Bottom Ash Pond Closure Plan (Closure Plan) is being made for purposes of qualifying for the coal combustion residuals (CCR) rule's alternative closure requirements delineated at 40 C.F.R. § 257.103(f)(2)—"Permanent Cessation of a Coal-Fired Boiler(s) by a Date Certain." For a CCR surface impoundment to qualify for these alternative closure requirements, an owner or operator must submit a closure plan required by 40 C.F.R. § 257.102(b) showing that the surface impoundment will cease receipt of waste into a CCR surface impoundment in enough time to meet the alternative closure deadline. 40 C.F.R. § 257.103(f)(2)(v)(D).

As detailed in the Alternative Closure Demonstration for the BEC Bottom Ash Pond, the Bottom Ash Pond will cease receipt of wastestreams in approximately August/September 2027. In addition, the Bottom Ash Pond will complete closure by no later than October 17, 2028.

All other aspects of the Closure Plan are unchanged.

This Addendum will become effective upon EPA's approval of the BEC Bottom Ash Pond Alternative Closure Demonstration.