CLECO CAJUN LLC
LOUISIANA GENERATING LLC
BIG CAJUN II POWER PLANT

BOTTOM ASH BASIN
NEW ROADS, LA

Demonstration for a Site-Specific Alternative to Initiation of Closure Deadline for the Coal Combustion Residuals Rule

CLECO

INDEX AND CERTIFICATION

Cleco Cajun LLC
Louisiana Generating LLC
Big Cajun II Power Plant, New Roads, LA
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Project No. 367-20-0004

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 Louisiana Generating 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.

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CHAPTER 1.0

Executive Summary and Introduction

November 30, 2020

CLECO

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EXECUTIVE SUMMARY

Cleco Cajun 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 Basin located at the Big Cajun II Power Plant in New Roads, Louisiana. The Bottom Ash Basin is a 66-acre surface impoundment that is used to manage both CCR and non-CCR wastestreams.

In accordance with a 2013 Consent Decree between the EPA, the U.S. Department of Justice, the Louisiana Department of Environmental Quality, and Louisiana Generating LLC, Big Cajun II Unit 1 boiler will cease generation of coal-fired energy by no later than April 1, 2025.[1] In the meantime, the Bottom Ash Basin must continue to receive CCR and non-CCR wastestreams due to a lack of on-site and off-site alternative disposal capacity.[2] Accordingly, Cleco is requesting approval of an alternative deadline to initiate closure so the Bottom Ash Basin may continue to receive CCR and non-CCR wastestreams after April 11, 2021 and complete closure by no later than October 17, 2028.

[1] Consent Decree at 15, United States v. La. Generating LLC, Civ. Action No. 09-100-JJB-DLD (2012).

[2] Note that another CCR surface impoundment, the Big Cajun II Fly Ash Pond, is also located onsite. As discussed in Chapter 4.0, the Fly Ash Pond is currently in compliance with the CCR rule's requirements. Fly ash from this unit is currently being reclaimed and marketed for sale. In 2019, Cleco sold 40,372.76 tons of fly ash reclaimed from the Fly Ash Pond. Through August of 2020, Cleco has sold 38,628.36 tons of reclaimed fly ash from the Fly Ash Pond. The Fly Ash Pond is not within the scope of this demonstration.

INTRODUCTION

The Big Cajun II Power Plant is located in New Roads, Louisiana. Three units at Big Cajun II generate power. Units 1 and 3 are fueled by sub-bituminous coal, and Unit 2 is fueled by natural gas. The Bottom Ash Basin currently receives wet-sluiced bottom ash from Unit 1. Bottom ash from Unit 3 is dry handled and taken off-site. Bottom ash from Unit 1 is sent to the Bottom Ash Basin via bottom ash sumps and sluice piping. In addition to this CCR wastestream from Unit 1, the Bottom Ash Basin also receives clarifier/softener underflow from all three Units. These non-CCR wastestreams are combined in a single pipe that leads from the Clarifiers located near the onsite water treatment plant to the Bottom Ash Pond.

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.[3] The CCR rule also includes, however, site-specific alternative deadlines for surface impoundments to cease receipt of waste and initiate closure.[4] One of these alternative closure provisions provides a closure extension if a coal-fired boiler(s) at a facility will cease operation and the associated impoundment(s) is closed 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/or non-CCR wastestreams.[5] Surface impoundments that qualify for this extension and are larger than 40 acres must complete closure, and the boiler must cease coal-fired energy production, by October 17, 2028.[6] Qualifying surface impoundments that are 40 acres or smaller must complete closure, and the boiler must cease coal-fired energy production, by October 17, 2023.[7]

[3] 85 Fed. Reg. 53,516 (Sept. 28, 2020); 40 C.F.R. § 257.101(a)(1).
[4] 40 C.F.R.. § 257.103(f).
[5] *Id.* § 257.103(f)(2).
[6] *Id.* § 257.103(f)(2)(iv)(B).
[7] *Id.* § 257.103(f)(2)(iv)(A).

Pursuant to the 2013 Consent Decree, Big Cajun II Unit 1 will cease generating coal-fired electricity by April 1, 2025.[8] Prior to the cessation of coal-fired generation,, the Bottom Ash Basin must continue to receive the CCR and non-CCR wastestreams discussed above given the lack of alternative on-site and off-site disposal capacity. Further, the Bottom Ash Basin will continue to receive non-CCR wastestreams after Big Cajun II Unit 1 ceases generation of coal-fired energy given the lack of on-site and off-site disposal capacity. Accordingly, Cleco is requesting a site-specific extension for the Bottom Ash Basin to cease receipt and initiate closure, 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;[9]
2. A risk management plan describing the measures that will be taken to expedite any required corrective action;[10] 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 Basin to meet the closure deadline.[11]

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8 As stated in the Executive Summary, this date is mandated by a Consent Decree entered into by EPA, LDEQ, US Dept of Justice, and Louisiana Generating LLC.

9 *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

10 *Id.* § 257.103(f)(2)(v)(B). The purpose of the risk mitigation plan is to demonstrate the criteria in § 257.103(f)(2)(ii) have been met. Pursuant to this requirement, the risk management plan includes (1) A discussion of any physical or chemical measures a facility can take to limit any future releases to groundwater during operation; (2) 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 (3) a plan to expedite and maintain the containment of any contaminant plume that is either present or identified during continued operation of the unit.

11 *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 Big Cajun II is in compliance with all other requirements of the CCR rule.[12]

12 This additional information also addresses the Fly Ash Pond located at Big Cajun II, which is also in compliance with the CCR rule.

CHAPTER 2.0

Documentation of No Alternative Disposal Capacity

November 30, 2020

CLECO

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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 and non-CCR wastestreams that are currently disposed in the Big Cajun II Bottom Ash Basin, (2) discuss the options Cleco considered to obtain alternative disposal capacity for these wastestreams, and (3) explain why these wastestreams must continue to be disposed in the Big Cajun II Bottom Ash Basin 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 at Big Cajun II

The Big Cajun II Bottom Ash Basin currently receives bottom ash from Unit 1, a CCR wastestream, and clarifier/softener underflow from Units 1, 2, and 3, a non-CCR wastestream. Bottom ash is sent to the Bottom Ash Basin via bottom ash sumps and sluice piping. The clarifier/softener underflows from Units 1, 2, and 3 are combined in a single pipe that leads to the Bottom Ash Pond.[6]

3.0 Options Considered for On-Site and/or Off-Site Alternative Disposal Capacity for Bottom Ash from Unit 1

The Big Cajun II Bottom Ash Basin currently receives wet-sluiced bottom ash from Big Cajun II Unit 1.[7] 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."[8] Cleco considered several alternative disposal options for this wastestream. Consistent with EPA's statement, however, none of these options are viable. Additionally, since the Unit 1 will cease coal-fired energy production by a date certain, the CCR rule does not require Cleco to create alternative disposal capacity for the wastestream.[9]

Cleco considered disposing the bottom ash in other on-site impoundments or other on-site tanks. However, there are no tanks or other impoundments available to receive the bottom ash. Unit 1's piping network and sluicing infrastructure does not allow for bottom ash to pump anywhere (on-site or off-site) other than the Bottom Ash Basin. Additionally, the other

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[6] Note that another CCR surface impoundment, the Big Cajun II Fly Ash Pond, is also located onsite. As discussed in Chapter 4.0, the Fly Ash Pond is currently in compliance with the CCR rule's requirements. Fly ash from this unit is currently being reclaimed and marketed for sale. In 2019, Cleco sold 40,372.76 tons of fly ash reclaimed from the Fly Ash Pond. Through August of 2020, Cleco has sold 38,628.36 tons of reclaimed fly ash from the Fly Ash Pond. The Fly Ash Pond is not within the scope of this demonstration.

[7] As explained in the Executive Summary, bottom ash produced by Big Cajun Unit 3 is dry handled and taken offsite.

[8] 85 Fed. Reg. at 54,541.

[9] *See id.* at 53,547.

impoundments at Big Cajun II 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[10]	• 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.
Rainfall Sure 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.
Primary Treatment 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.
Secondary Treatment 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.

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 1.2 million gallons per day (MGD)—is too large for this to be a

[10] 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.

viable option. In addition, tanks currently located at Big Cajun II lack the needed storage capacity and infrastructure for removal of accumulated solids. In light of these factors, disposing the bottom ash from Unit 1 in other on-site impoundments or tanks is not a viable option.

Cleco also considered transporting the bottom ash off-site via trucking and/or pipelines. EPA recognized the infeasibility of this option 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."[11] EPA further recognized that facilities cannot "immediately convert to dry handling systems."[12]

For trucking, the volume of water needed to truck the CCR wastestream off-site—approximately 1.2 MGD—is too large for this to be a viable option. Additionally, there are no facilities within a reasonable distance from Big Cajun II that is able to accept the CCR wastestream. Further, the number of trucks required for such a project 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, Big Cajun Unit 1's piping network and sluicing infrastructure does not allow for bottom ash to be transported off-site. And since Big Cajun Unit 1 will cease coal-fired energy generation in the near future, it would be "illogical" for Cleco to create new capacity to manage this wastestream.[13] 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."[14]

[11] 80 Fed. Reg. 21,302, 21,423 (Apr. 17, 2015).
[12] *Id.*
[13] 85 Fed. Reg. at 53,547.
[14] 80 Fed. Reg. at 21,424.

Despite Cleco's efforts to obtain on-site and off-site alternative disposal capacity for the bottom ash that is currently wet-sluiced in the Bottom Ash Basin, no other options are currently available. Additionally, since Unit 1 will cease coal-fired energy generation in the near future, it would be "illogical" for Cleco to create new capacity to manage the bottom ash.[15] As a result, Cleco must continue to dispose this wastestream in the Bottom Ash Pond after April 11, 2021.

4.0 Options Considered for On-Site and/or Off-Site Alternative Disposal Capacity for Clarifier/Softener Underflow from Units 1, 2, and 3

The Bottom Ash Basin also receives clarifier/softener underflow from Units 1, 2, and 3 .[16] The clarifier/softener underflows from Units 1, 2, and 3 are combined in a single pipe that leads to the Bottom Ash Pond. Cleco considered several alternative disposal options for this wastestream, but none are presently available. Additionally, since the Unit 1 will cease coal-fired energy production by a date certain, the CCR rule does not require Cleco to create alternative disposal capacity for the wastestream.

Cleco considered disposing the clarifier underflow stream in tanks or other impoundments. However, there are no tanks or other impoundments available to receive and treat the clarifier underflow stream, since the piping that would be required to divert this wastestream to other impoundments does not exist. In addition, the other on-site impoundments are not able to treat this wastestream due to the lack of a process in place for removing settled materials and the lack of sufficient storage capacity. Further, even if there were other on-site impoundments that could receive this wastestream, as reflected in Table 1, state permit modifications would be necessary to allow the material to be sent to other impoundments.

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[15] 85 Fed. Reg. at 53,547.

[16] As discussed in the Executive Summary Unit 2 is a gas boiler and bottom ash generated by Unit 3 is dry handled and disposed offsite.

With respect to tanks, there are currently no tanks on-site that could be used for storing this wastestream. 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—76,000 gallons per day—is too large for this to be a viable option. In light of these factors, disposing this wastestream in other on-site impoundments or tanks is not a viable option.

Cleco also considered transporting the clarifier underflow stream off-site via trucking and/or piping. For trucking, the significant volume of the non-CCR wastestreams—76,000 gallons per day—is too large for this to be a viable option. Additionally, there are no facilities within a reasonable distance from Big Cajun II that is able to accept the non-CCR wastestreams. Further, the number of trucks required for such a project 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, Big Cajun II's piping network and sluicing infrastructure does not allow for the non-CCR wastestreams to be transported off-site. And since Big Cajun II Unit 1 will cease coal-fired energy generation in the near future, it would be "illogical" for Cleco to create new capacity to manage these wastestreams.[17] 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."[18]

Despite Cleco's efforts to obtain on-site and/or off-site alternative disposal capacity for the clarifier that is currently disposed in the Bottom Ash Basin, no other options are currently available. Additionally, since Unit 1 will cease coal-fired energy generation in the near future, it

[17] 85 Fed. Reg. at 53,547.
[18] 80 Fed. Reg. at 21,424.

would be "illogical" for Cleco to create new capacity to manage the clarifier.[19] As a result, Cleco must continue to dispose this wastestream in the Bottom Ash Basin after April 11, 2021.

[19] 85 Fed. Reg. at 53,547.

CHAPTER 3.0

Risk Mitigation Plan

November 30, 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 environmental from the continued operation of the CCR surface impoundment have been adequately mitigated."[4]

Pursuant to this requirement, Louisiana Generating LLC has developed this Risk Mitigation Plan (Plan) for the Bottom Ash Basin at the Big Cajun II Power Station (BCII) (**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

BCII is a 580 MW facility located at 10431 Cajun II Road, New Roads, Louisiana 70760. The surface impoundments in service at BCII are the Bottom Ash Basin and Fly Ash Basin. The Bottom Ash Basin, which is the subject of this demonstration, is 66 acres. The Fly Ash Basin, which is not within the scope of this demonstration, is 175 acres. As Figure A-2 in Appendix A shows, the Bottom Ash Basin and Fly Ash Basin are contiguous to one another. Both units operate in accordance with permit issued by the Louisiana Department of Environmental Quality (LDEQ) Waste Permits Division, Permit No. P-0108.

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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).

The waste streams disposed in the Bottom Ash Basin are non-hazardous, on-site-generated materials. This includes bottom ash, clarifier and softener underflows, and liquid wastes covered under the facility's LPDES permit.

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 BCII has not indicated releases to groundwater from the Bottom Ash Basin or the Fly Ash Basin. 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 basins since their construction demonstrates this commitment.

The groundwater monitoring program for the Bottom Ash Basin is a multi-unit groundwater monitoring program as the well network also includes the Fly Ash Basin footprint. Review of the groundwater monitoring program in place for the Bottom Ash Basin indicates that implementation of corrective action measures to address groundwater quality for the Bottom Ash Basin or Fly Ash Basin has not been required. The Bottom Ash Basin is in compliance with the CCR rule, as well as requirements of its LDEQ-issued solid waste permit.

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 monitoring programs in place and continued adherence to the EPA CCR Rule and LDEQ-approved solid waste permit. Additional 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 inspections of perimeter levees, maintenance of vegetation growth on the perimeter levees, adequate freeboard protection, stormwater controls, 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 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

5 *Id.* § 257.103(f)(2)(v)(B)(1).
6 Louisiana Administrative Code (LAC) 33:VII. Solid Waste.

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 Basin'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

As required by the CCR Rule 40 C.F.R. § 257.91, BCII has a groundwater monitoring well system to evaluate the groundwater quality conditions near the Bottom Ash Basin. The groundwater monitoring program for the Bottom Ash Basin is a multi-unit groundwater monitoring program as the well network also includes the Fly Ash Basin footprint. The monitoring system consists of monitoring wells installed previously to conduct groundwater monitoring required by BCII's LDEQ solid waste permit. A total of twenty monitoring wells have been installed per applicable portions of 40 C.F.R. § 257.91.

The Mississippi River Valley Alluvial aquifer (MRVA) consists of dense to very dense grey sand and gravel with interbedded silts and clays (Shaw, 2010). Overlying the MRVA at land surface is an approximately 35 foot sequence of interbedded clays, silts, and fine sands and is situated entirely on the alluvium deposits of the Mississippi River. Locations

[7] *Id.* § 257.103(f)(2)(v)(B)(2).

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 Basin are included as Appendix B.

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 applicable portions of 40 C.F.R. § 257.93. Semi-annual detection monitoring and assessment monitoring sampling events are conducted normally in April and October. The most recent annual groundwater report was posted on January 31, 2019. This report is included as **Appendix C** and is also 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 Basin for analysis of the CCR Rule detection and assessment monitoring parameters. Laboratory analysis follows 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 and on October 21, 2019. The 2019 Certification is included as **Appendix D** and is also available here. Natural spatial variability is evident in groundwater quality at the BCII 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[8] that use intrawell prediction limits. Intrawell limit-based tests are recommended when there is evidence of natural spatial variability in groundwater quality, particularly among unimpacted upgradient wells.

4.2.4 Groundwater Monitoring Conclusions

[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.

Cleco has conducted sufficient groundwater monitoring sampling events in accordance with 40 C.F.R. §§ 257.93 and .95. Potentiometric surface evaluation at BCII indicates variable groundwater flow patterns due to BCII's close proximity to the Mississippi River. Statistical evaluations of the detection and assessment data conducted pursuant to 40 C.F.R. § 257.93 indicate that no Appendix IV constituents are present at SSLs above the constituents' GWPS.

4.3 RECEPTORS

Water supply in Pointe Coupee 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 data base. All registered water wells identified within a one-mile radius of BCII have been summarized and are included in **Appendix E.**

BCII obtains water for its operations from power supply wells located on-site. A total of 34 LDNR registered water wells were identified within an approximate one-mile radius of the ash basins. Of these, 29 are active water wells and 5 have been plugged and abandoned. The usage descriptions of water wells identified in the LDNR data base search includes the following:

- 3 power supply wells;
- 1 domestic water wells;
- 0 public supply water wells;
- 1 industrial water wells;
- 1 irrigation water wells;
- 0 recovery water wells;
- 0 rig supply wells;
- 0 dewatering water wells;
- 0 test wells; and
- 23 monitoring/observation/piezometer wells.

The uppermost aquifer monitored at the BCII facility is in the MRVA, 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]

4.3.1 Surface Water at BCII

The site lies west of a Mississippi River meander that runs north and east of the BCII facility. The shortest distance from the ash basins to the west bank of the Mississippi River exceeds 5,650 feet east-northeast of the eastern edge of the Bottom Ash Basin. The Mississippi River is leveed which would prevent discharge into this surface water feature. The Mississippi River is included in Subsegment 070291 of the "*Mississippi River—From Old River Control Structure to Monte Sano Bayou*". The listed designated uses are:

- Primary contact recreation,
- Secondary contact recreation,
- Fish and wildlife propagation, and
- Drinking water supply.[10]

The groundwater flow direction in the uppermost aquifer determines the pathway for potential releases from the Bottom Ash Basin to potential receptors. The relative distances of the Mississippi River and domestic and irrigation wells to the Bottom Ash Basin indicate that the water wells are the closest potential receptors for a potential release from the Bottom Ash Basin. Groundwater flow is seasonally influenced by changes in the Mississippi River stage.

Mississippi river stage fluctuations cause reversals in the groundwater flow direction at BCII . Stormwater and potential groundwater seepage to surface water downgradient of the Bottom Ash Basin is monitored by Final Outfall 401 discharging into the Mississippi River, permitted by LPDES Permit No. LA0054135. A stormwater outfall, Outfall SW1, is maintained through the facility's storm water pollution prevention plan (SWP3). The stormwater outfall facilitates runoff from non-process areas to a drainage system that discharges into False River lake to the west. Cleco maintains compliance with these permits, thus safeguarding the water quality of the primary receiving water body from facility operations, the Mississippi River.

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 Basin prior to impacting any potential surface water or groundwater withdrawal receptors. In addition, potential future impacts may also be

[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] LAC 33:IX. Water Quality.

addressed by groundwater mitigation measures that include groundwater withdrawal or immobilization technologies such as permeable reactive barriers (PRB) and/or groundwater cutoff walls. Mitigation of future potential exposures to nearby receptors from groundwater impacted from continued operation is 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."[11] 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."[12] 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"[13]

The Bottom Ash Basin is currently subject to the CCR rule's detection and assessment monitoring program.[14] As discussed above, groundwater quality data has not identified any Appendix IV constituents being present at SSLs above the constituents' GWPS. Therefore, no corrective measures are currently warranted for the Bottom Ash Basin.[15]

Although Cleco has not to date identified a contaminant plume associated with the Bottom Ash Basin, 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 Basin. 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

11 40 C.F.R. § 257.103(f)(2)(v)(B)(3).
12 85 Fed. Reg. 53,516, 53,549 (Sept. 28, 2020).
13 *Id.*
14 40 C.F.R. § 257.94.
15 *See id.* § 257.94–.98.

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.[16]

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
- 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.[17]

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

[16] 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.

[17] *Id.*

- 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 selected reactive media at the site [18]

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:

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18 *Id.*

- 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:[19]

- Demonstrate that the area of groundwater impacts is not expanding;
- Evaluate mechanisms and rates of attenuation;
- 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 Basin 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 unit. Site hydrogeologic characterization indicates that groundwater withdrawal is a leading potential corrective measure that can be implemented expeditiously.

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 to further understand heterogeneity and anisotropy in three dimensions, in support of remedial alternatives evaluation and corrective measure design,

[19] 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

including:

- Additional aquifer testing, including pumping test(s) and slug tests,
- Higher horizontal and vertical resolution of geological and chemical data, and
- Numerical modeling of the fate and transport of constituents of concern potentially migrating along routes of exposure

The CSM will be refined to the extent necessary to safeguard potential receptors identified in this plan.

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. 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 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 30, 2020

CLECO

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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 Basin at the Louisiana Generating LLC Big Cajun II (BCII) Power Plant. The information for the other CCR unit, the Fly Ash Basin, 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)

BCII has attached the following items to this demonstration:

- Maps of groundwater monitoring well locations in relation to the CCR units (**Appendix B**),
- Well construction diagrams and drilling logs for all groundwater monitoring wells (**Appendix C**), and
- 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**.

[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 units were prepared in October 2016 and is included in **Appendix G.** The website link for the Bottom Ash Basin and the Fly Ash Basin 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 initial safety factor assessment for the units were prepared in October 2016 and is included in **Appendix H.** The website link for the Bottom Ash Basin and the Fly Ash Basin are provided here.

CHAPTER 5.0

Documentation of Closure Plan Timeframe

November 30, 2020

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Appendices

DOCUMENTATION OF CLOSURE COMPLETION TIMEFRAME

I. 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]

In accordance with a 2013 Consent Decree between the EPA, the U.S. Department of Justice, the Louisiana Department of Environmental Quality (LDEQ), and Louisiana Generating LLC, Big Cajun II Unit 1 boiler will cease generation of coal-fired energy by no later than April 1, 2025.[3] In the meantime, the Bottom Ash Basin must continue to receive CCR and non-CCR wastestreams due to a lack of on-site and off-site alternative disposal capacity.[4] Further, the Bottom Ash Basin will continue to receive non-CCR wastestreams after Big Cajun II Unit 1 ceases generation of coal-fired energy.

The Big Cajun II Power Plant Bottom Ash Basin is approximately 66 acres (and thus larger than 40 acres), Cleco must cease operation of the Big Cajun II Unit 1 boiler and complete closure of the Bottom Ash Basin by no later than October 17, 2028.[5] To meet the October 17, 2028 closure

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1 40 C.F.R. § 257.103(f)(2)(v)(D).

2 *Id.*

3 Consent Decree at 15, United States v. La. Generating LLC, Civ. Action No. 09-100-JJB-DLD (2012).

4 Note that another CCR surface impoundment, the Big Cajun II Fly Ash Pond, is also located onsite. As discussed in Chapter 4.0, the Fly Ash Pond is currently in compliance with the CCR rule's requirements. Fly ash from this unit is currently being reclaimed and marketed for sale. In 2019, Cleco sold 40,372.76 tons of fly ash reclaimed from the Fly Ash Pond. Through August of 2020, Cleco has sold 38,628.36 tons of reclaimed fly ash from the Fly Ash Pond. The Fly Ash Pond is not within the scope of this demonstration.

5 *Id.* § 257.103(f)(2)(iv)(B).

deadline, the Bottom Ash Basin will cease receipt of wastestreams in approximately March/April 2027. The closure plan for the Bottom Ash Basin is included as **Appendix A** and is also available here (Closure Plan).[6]

II. Closure-In-Place Process

Pursuant to the Closure Plan, Cleco will close the Bottom Ash Basin 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 Basin by removing liquid wastes or solidifying remaining wastes and waste residues, and (2) stabilize remaining wastes sufficiently to support the final cover system. These activities will take approximately four months and will be completed in approximately August/September 2027.

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.

These activities will take approximately four months and will be completed in approximately December 2027/January 2028.

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[6] 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).

Once the Bottom Ash Basin is backfilled and graded, Cleco will place the final cover system over the maximum extents of the Bottom Ash Basin to minimize infiltration and cap erosion. This will involve installing an infiltration layer, an erosion layer, drainage features, and erosion control measures. Following the installation of these features, the Bottom Ash Basin will be seeded. These activities will take approximately eight months and will be completed in approximately mid-September 2028.

Once the final cover is installed, it will be inspected by LDEQ and certified by a professional engineer. These activities will be completed in approximately early 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 found on Cleco's CCR website upon EPA's approval of this demonstration.

Table 1. Big Cajun II Bottom Ash Basin Closure Plan Schedule

Closure Activity[7]	Working Days Needed	Approx. Completion Date
Preparation for Closure		
Permitting/Design	150	November 2026/December 2026
Send Notice of Intent to Close to LDEQ	20	December 2026/January 2027
Bid Process/Contract Award	45	January/February 2027
Final Placement of Wastestreams	-	March/April 2027
Closure Construction		
Commence Construction/Mobilization	30	April/May 2027
Dewatering/Stabilization	120	August/September 2027
Grading/Backfill of Bottom Ash Pond	120	December 2027/January 2028
Final Cover Installation and LDEQ Inspections	240	Mid-September 2028
Certifying Inspection by a P.E./Site Clean-up	20	Early October 2028
Site Clean-Up/Demobilization	10	Mid-October 2028
Closure Completion		**October 17, 2028**
Submit Notification of Completion of Closure	20	October 17, 2028

[7] Note that pursuant to the 2012 Consent Decree between the EPA, the U.S. Department of Justice, the Louisiana Department of Environmental Quality, and Louisiana Generating LLC, Big Cajun II Unit 1 boiler will cease generation of coal-fired energy by no later than April 1, 2025. And while the Bottom Ash Basin will cease receiving CCR wastestreams at that time, it must continue to receive non-CCR wastestreams after Big Cajun II Unit 1 ceases generation of coal-fired energy given the lack of on-site and off-site alternative disposal capacity.

CHAPTER 3.0

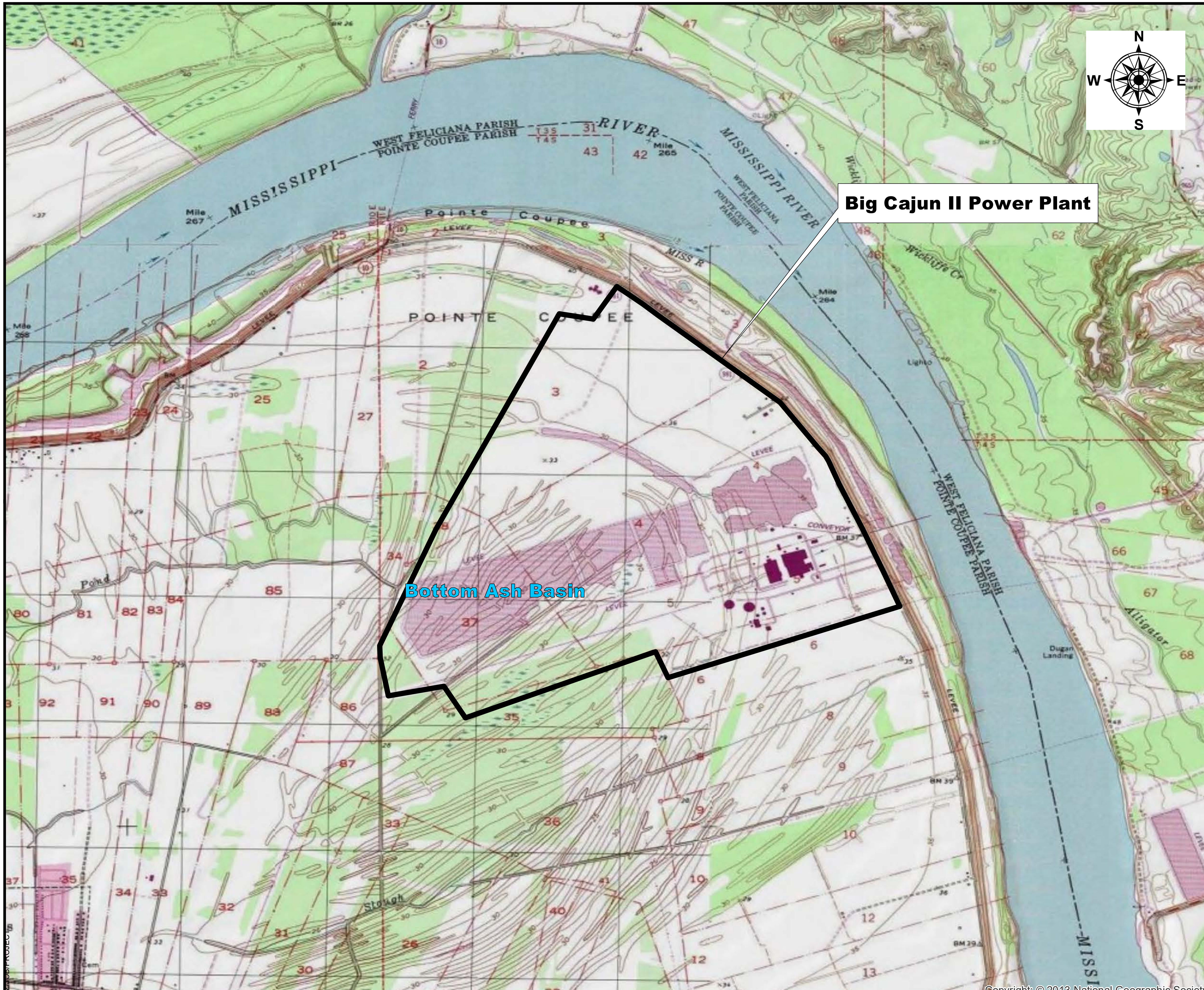
Appendices

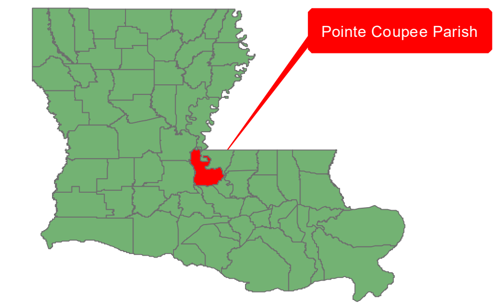
A Figures
B Monitoring Well Network Certification
C 2019 Annual Groundwater Report
D Certification of Statistical Methodology
E Water Use Survey

November 30, 2020

APPENDIX A

FIGURES





Legend

Approximate Property Boundary

0 1,250 2,500 5,000 7,500 Feet

CLECO Cajun, LLC

Big Cajun II Power Plant

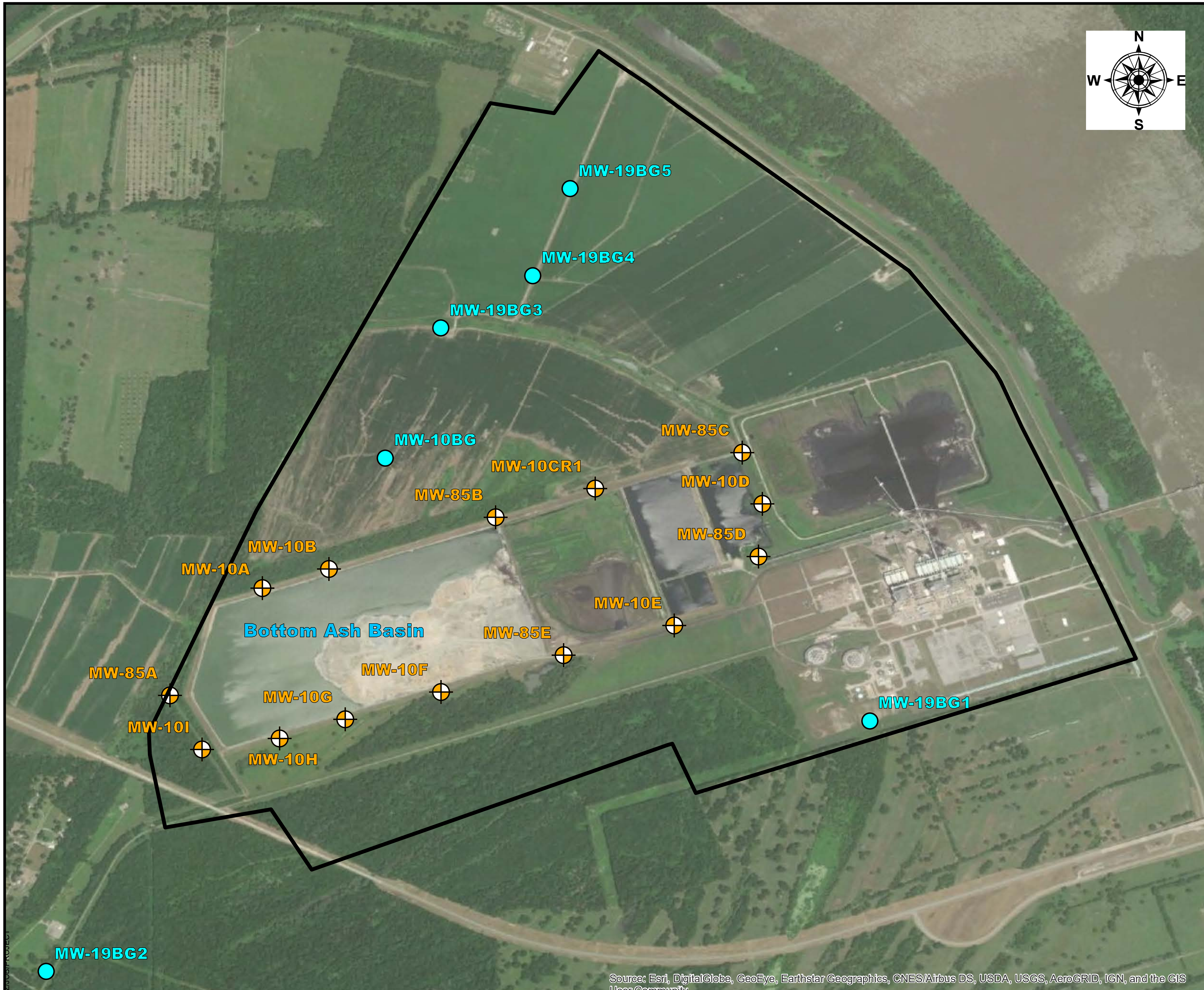
Site Location Map

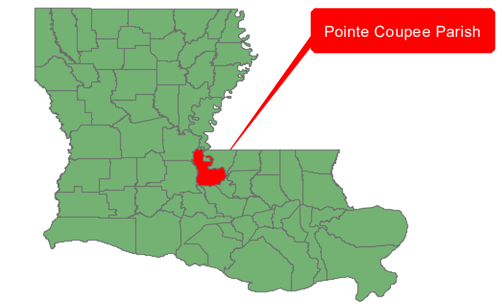
Pointe Coupee Parish

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

Drawn:	JP
Checked:	JM
Approved:	RS
Date:	10/30/20
Dwg. No.:	367-20-0004-APP- A-1

Figure A-1





Legend

- Background Well Locations
- Compliance Well Locations
- Approximate Property Boundary

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

CLECO Cajun, LLC

Big Cajun II Power Plant

Monitoring Well Location Map

Pointe Coupee Parish

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

Drawn:	JP
Checked:	JM
Approved:	JM
Date:	10/30/20
Dwg. No.: 367-20-0004-APP- A-2 CCR	

Figure A-2

APPENDIX B

MONITORING WELL NETWORK CERTIFICATION

Geosyntec consultants

Certification for Groundwater Monitoring System

CCR Units: Fly Ash and Bottom Ash Basins

Certification:

I, **Scott M. Graves**, a qualified professional engineer registered in the state of **Louisiana**, have reviewed the information on the groundwater monitoring network and well construction details for the CCR Unit at the LaGen Big Cajun II Power Plant as presented in the *Basis for Groundwater Monitoring System Certification* and based on my review, in my professional opinion, find that the multi-unit Groundwater Monitoring System for the Fly Ash and Bottom Ash Basins has been designed and constructed to meet the requirements of 40 CFR §257.91.

STATE OF LOUISIANA
SCOTT M. GRAVES
License No. 31181
PROFESSIONAL ENGINEER

10/11/2017

Seal and Signature: ______________________

Printed Name: Scott M. Graves

PE License Number: 31181 State: Louisiana

APPENDIX C

2019 ANNUAL GROUNDWATER MONITORING REPORT

CLECO CAJUN LLC
LOUISIANA GENERATING LLC
BIG CAJUN II POWER PLANT

BOTTOM ASH BASIN AND
FLY ASH BASIN
NEW ROADS, LA

2019 Annual Groundwater Monitoring Report for the Coal Combustion Residuals Rule

January 2020

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1.0 INTRODUCTION

Louisiana Generating LLC hereby presents the 2019 Annual Groundwater Monitoring report for the Bottom Ash and Fly Ash Basins at the Big Cajun II Power Plant (BC2) located in New Roads, 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

Louisiana Generating LLC owns and operates BC2 located at 10431 Cajun II Road, New Roads, Louisiana 70760. The Bottom Ash and Fly Ash Basins 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, BC2 has a groundwater monitoring well system to evaluate the groundwater quality conditions near the Bottom Ash and Fly Ash Basins. The monitoring system has been historically used to conduct groundwater monitoring required by BC2's LDEQ approved solid waste permits. A total of fifteen 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 is provided in Table 1.

3.0 FIELD ACTIVITIES

Groundwater sampling events were conducted by approved contract personnel in accordance with applicable portions of §257.93. Semi-annual assessment monitoring sampling events were conducted in April and October 2019.

The depth-to-water below the top of each well casing was measured and recorded prior to purging and sampling 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 suction lift pumps. These activities were conducted in accordance with applicable portions of Sections 6.1, 6.2, 6.5 through 6.8, and 8.1.3 of the *Standard Guide for Sampling Groundwater Monitoring Wells* (ASTM International, Publication D4448). 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 collected in April 2019 were properly preserved on ice in the field and shipped to Eurofins TestAmerica in Pensacola, Florida. Samples were analyzed for the CCR groundwater monitoring parameters by the following methods: chloride, fluoride and sulfate by 4500; total dissolved solids by 2540C; metals by 6020/7470; and radium by 9315/9320.

Samples collected in October 2019 were properly preserved on ice in the field and shipped to Pace Analytical Services, LLC in St. Rose, Louisiana. Samples were analyzed for the CCR groundwater monitoring parameters by the following methods: chloride by 4500, sulfate by D516, fluoride by 300.0, total dissolved solids by 2540C; metals by 6020/7470, and radium by 903.1/904.

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 water bearing zone by construction of potentiometric surface maps (Figures 3 and 4) from data measured in monitoring wells at BC2. An evaluation of groundwater flow indicates that, similar to previous monitoring, the groundwater flow direction varied but was predominantly away from the Mississippi River (east to west) with localized variability in the area of the Bottom Ash Basin and eastern portion of the Fly Ash Basin.

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 Basins 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)
April 2019	0.0004 to 0.005	0.0001 to 0.135
October 2019	0.0002 to 0.0027	0.0002 to 0.25

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 BC2 were analyzed for the CCR Rule groundwater monitoring parameters using appropriate EPA approved analytical methods. Results show frequent detections of all parameters in both up- and downgradient monitoring wells at BC2. Analytical results are compared to Groundwater Protection Standards (GWPS) which are presented in Table 2. Analytical results are provided in Table 3 (April 2019) and Table 4 (October 2019).

6.0 DATA EVALUATION

Statistical evaluations of groundwater data have been performed per applicable portions of §257.93.f. When Assessment Monitoring is initiated because of confirmed SSIs observed during the Detection Monitoring program, detected Appendix IV parameters are compared to Groundwater Protection Standards (GWPS) through the use of Confidence Intervals. The GWPS will be either the Maximum

Contaminant Level (MCL) or a statistical limit based on background, whichever is higher (§257.95.h). CCR Rule specified levels are used for parameters without MCLs (unless background is higher) which include: cobalt, lithium and molybdenum. Alternate contaminant levels (ACLs) will be established from upgradient wells through the use of Tolerance Limits. For this monitoring period, arsenic is the only parameter which has a GWPS based on background.

On an annual basis, all Appendix IV parameters will be sampled (§257.95.b) and newly detected parameters added to the list of parameters sampled semi-annually (§257.95.d). Note that during the April 2019 sampling event, mercury was detected at an estimated concentration of 0.00008 milligrams per liter (mg/l) in the laboratory method blank; therefore, in accordance with EPA *National Functional Guidelines for Inorganic Superfund Data Review*, the estimated concentrations (0.00015 mg/l) at compliance wells MW-10B and MW-10CR1 were considered non-detects.

Confidence intervals have been calculated to evaluate data for parameters which have been detected above the GWPS in at least one discrete sample collected from a downgradient/compliance well during the baseline or assessment monitoring program events. Confidence intervals require a minimum of four samples; however, eight samples are recommended.

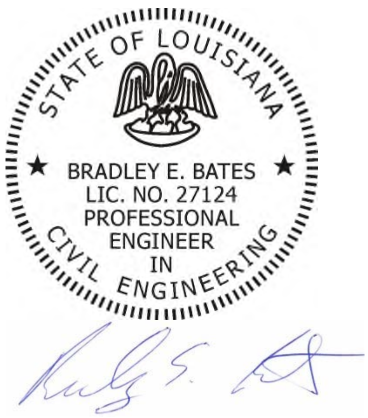
In Assessment Monitoring, a well is determined to be out of compliance when the Lower Confidence Limit (LCL), or the entire interval, exceeds the GWPS. Evaluation of the 2019 groundwater monitoring data at BC2 indicate that no Appendix IV constituents are present at Statistically Significant Levels (SSLs) above the constituents' GWPS.

7.0 CONCLUSIONS AND RECOMMENDATIONS

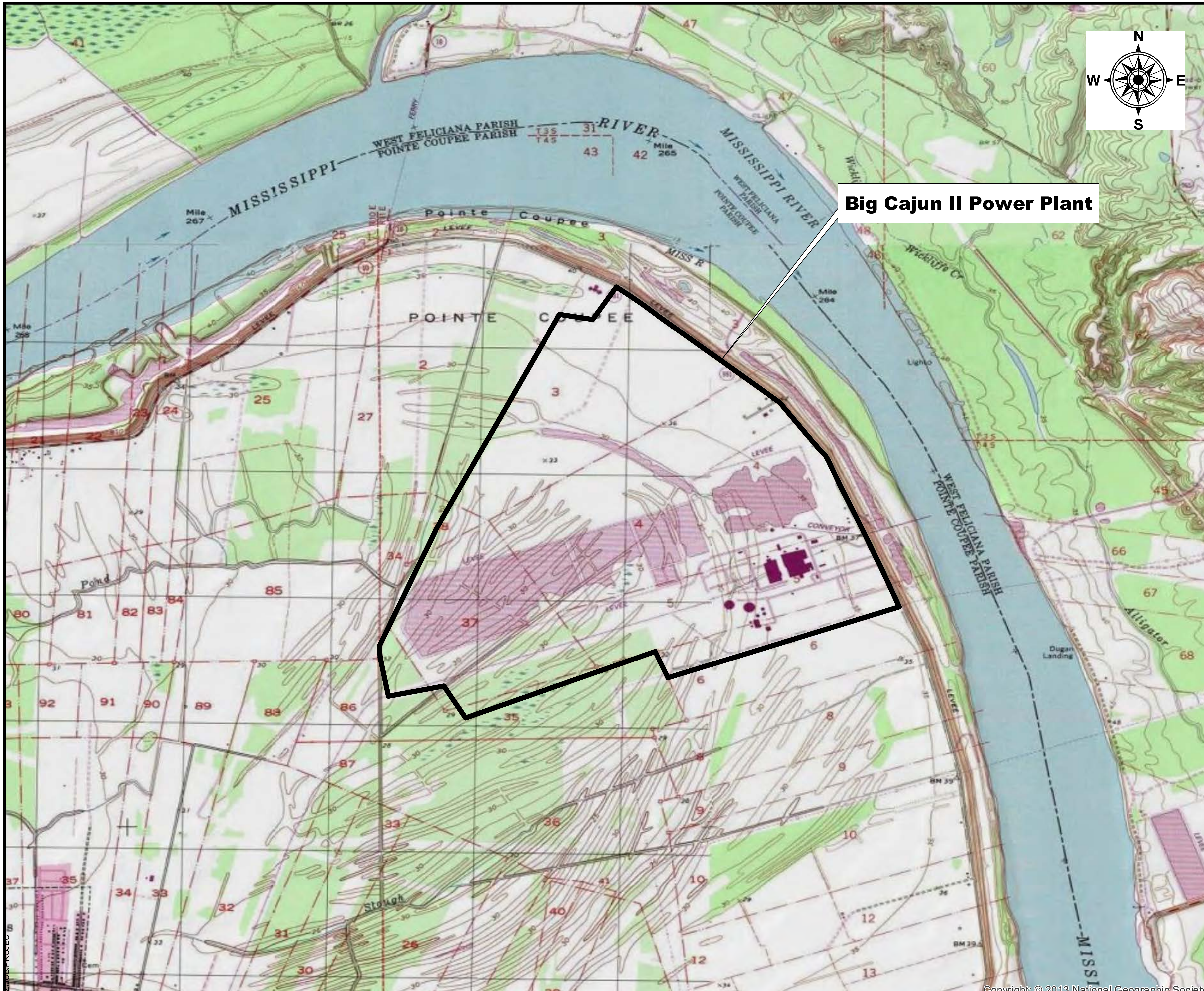
- BC2 has a monitoring well system to monitor groundwater quality at the Bottom Ash and Fly Ash Basins per applicable portions of §257.91. The network consists of one upgradient and fourteen downgradient monitoring wells.
- BC2 conducted sufficient groundwater monitoring sampling events, per applicable portions of §257.93 and §257.95.
- Potentiometric surface evaluation at BC2 indicates variable groundwater flow patterns due to the site's close proximity to the Mississippi River.
- Statistical evaluations of data conducted per applicable portions of §257.93 indicate that no Appendix IV constituents are present at SSLs above the constituents' GWPS.
- Semi-annual assessment monitoring sampling events are tentatively scheduled for April and October of 2020. Data generated during these sampling events will be included in the next annual report.

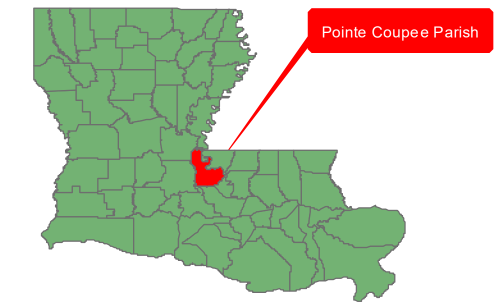
8.0 CERTIFICATION

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



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





Legend

Approximate Property Boundary

0 1,250 2,500 5,000 7,500 Feet

CLECO Cajun, LLC

Big Cajun II Power Plant

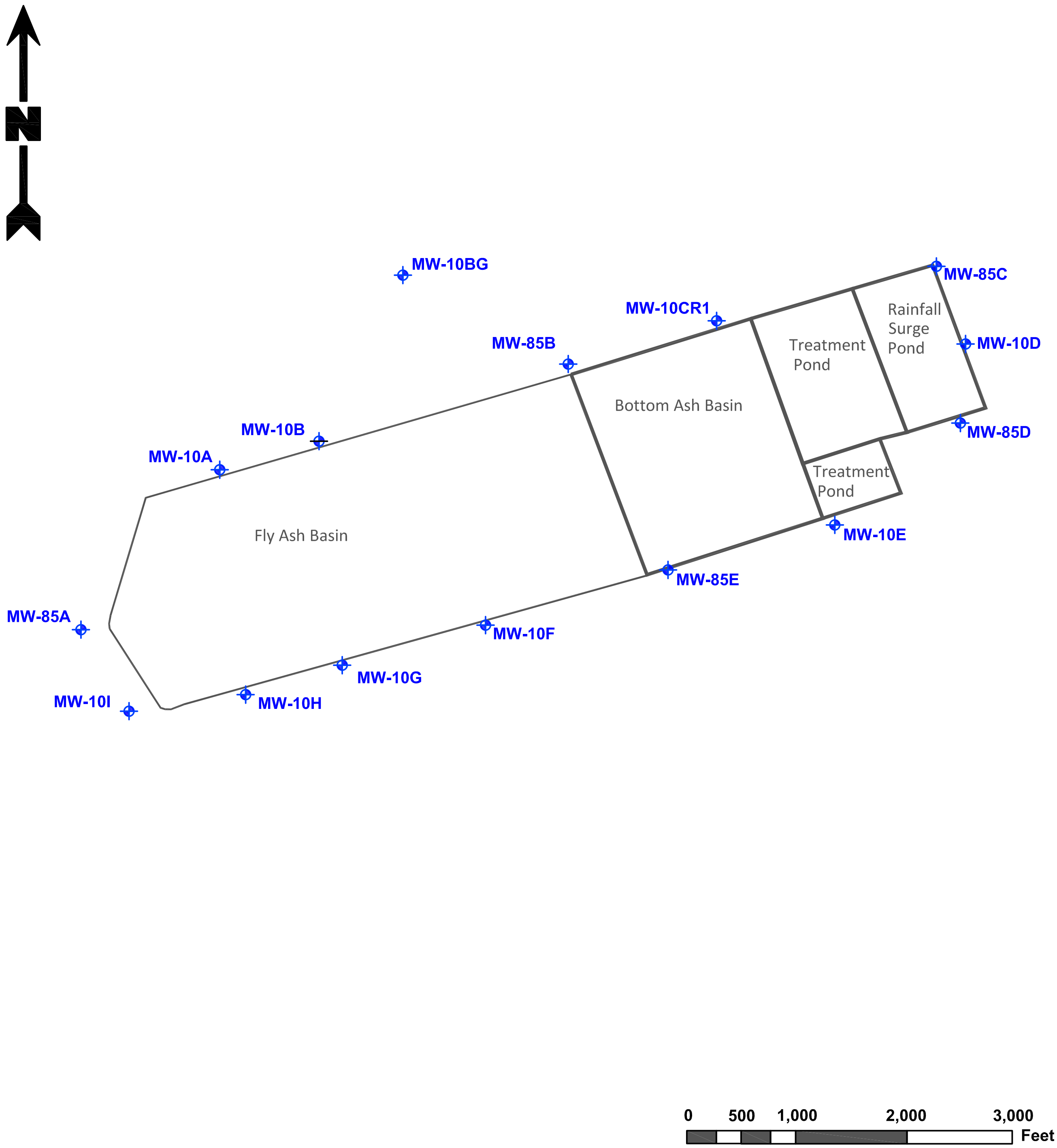
Site Location Map

Pointe Coupee Parish

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

Drawn:	JP
Checked:	JM
Approved:	RS
Date:	7/11/19
Dwg. No.:	367-19-0001-A001

Figure 1



Legend

MW-10B Monitoring Well

CLECO Cajun, LLC

Big Cajun II Power Plant

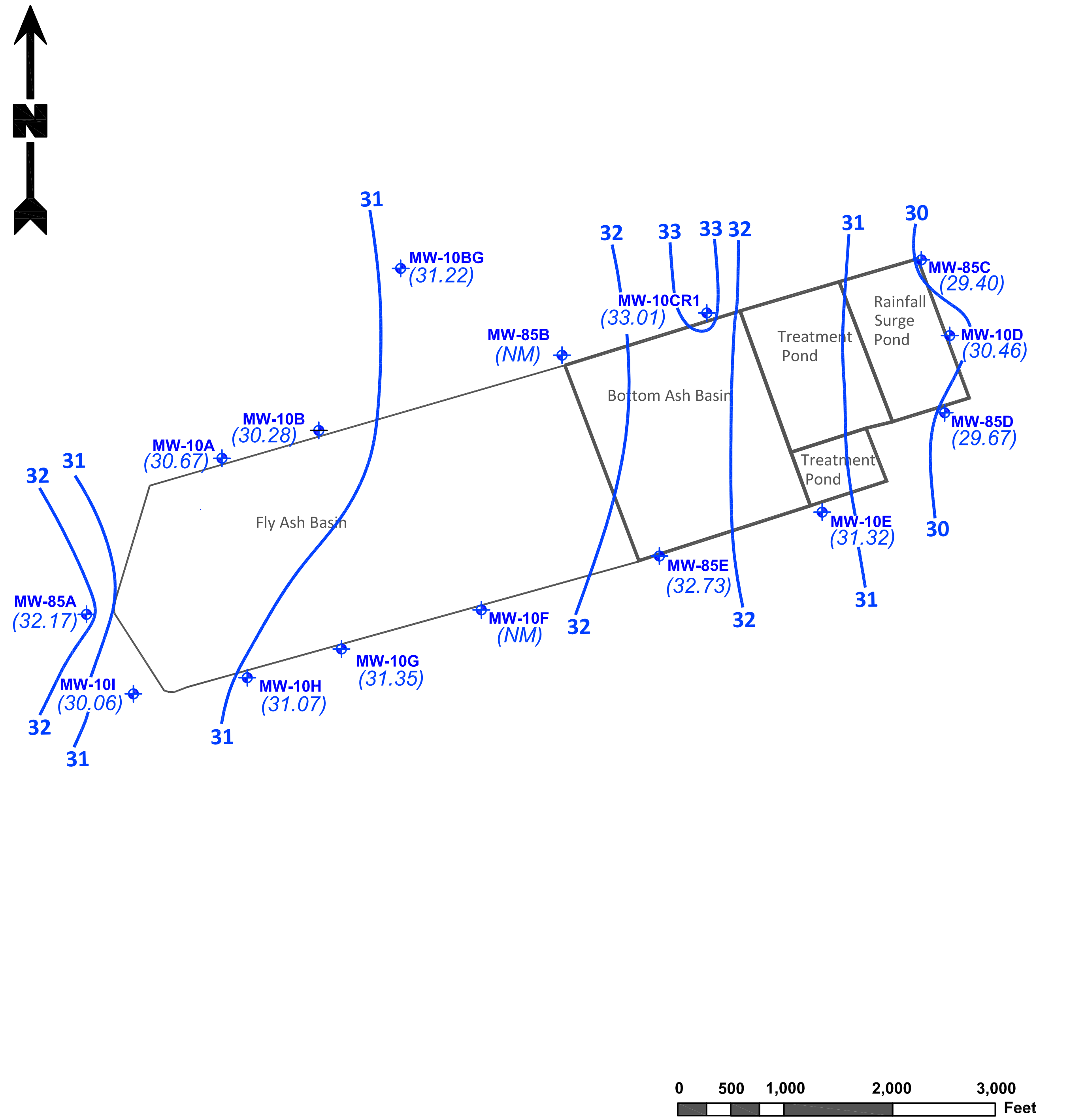
Monitoring Well Location Map

Pointe Coupee Parish

Drawn:	JP
Checked:	JM
Approved:	JM
Date:	10/11/19
Dwg. No.:	367-19-0002-A001

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

Figure 2



Legend

MW-10B Monitoring Well

(32.17) Measured Potentiometric Elevation (ft. NGVD)

31 —— Potentiometric Surface Elevation (ft. NGVD)

NM Not Measured. Flowing Well Conditions

CLECO Cajun, LLC

Big Cajun II Power Plant

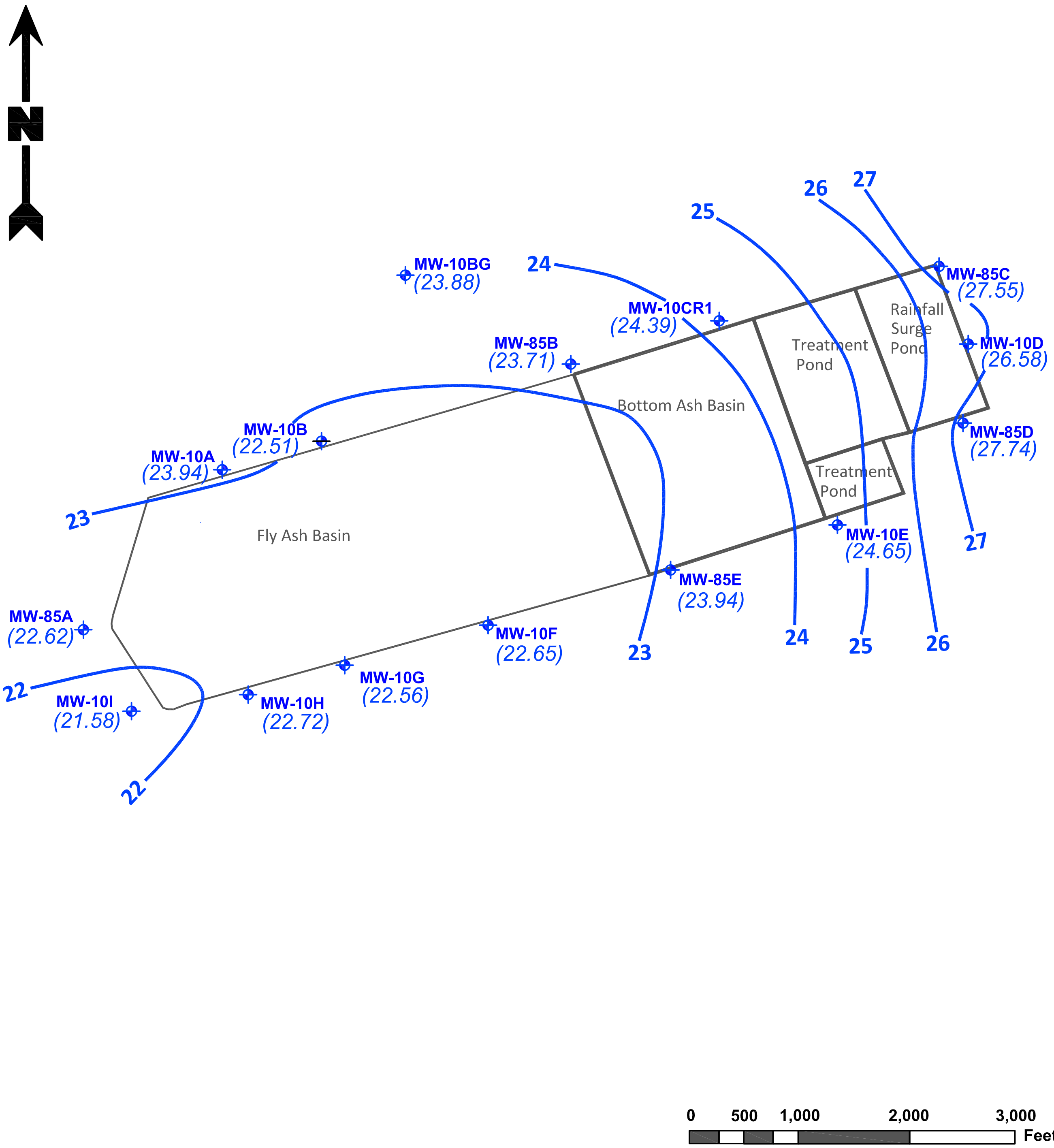
Potentiometric Surface Map
April 2019

Pointe Coupee Parish

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

Drawn:	JP
Checked:	JM
Approved:	JM
Date:	10/11/19
Dwg. No.:	367-19-0002-B001

Figure 3



Legend

MW-10B	Monitoring Well
(23.94)	Measured Potentiometric Elevation (ft. NGVD)
25	Potentiometric Surface Elevation (ft. NGVD)

CLECO Cajun, LLC

Big Cajun II Power Plant

Potentiometric Surface Map
October 2019

Pointe Coupee Parish

EAGLE ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	JM
Approved:	JM
Date:	10/11/19
Dwg. No.:	367-19-0002-B002

Figure 4

TABLE 1

Monitoring Well Information

Well ID	Latitude (DMS)	Longitude (DMS)	Installation Date	Zone Monitored	Gradient	Top of Casing Elevation (ft NGVD)	Ground Surface Elevation (ft NGVD)	Top of Screen Elevation (ft NGVD)	Bottom of Screen Elevation (ft NGVD)	Well Depth (ft bgs)	Well Diameter (in)
MW-85A	30°43'44"	91°23'50"	Jun 1985	Uppermost	Down	34.82	33.17	-1.58	-21.58	55.75	2
MW-85B	30°43'47"	91°22'37"	Jun 1985	Uppermost	Down	32.25	30.60	21.55	1.15	30.45	2
MW-85C	30°43'57"	91°22'37"	Jun 1985	Uppermost	Down	35.05	33.46	15.61	-4.74	39.20	2
MW-85D	30°43'44"	91°22'25"	Jun 1985	Uppermost	Down	35.71	34.20	16.20	-3.80	39.00	2
MW-85E	30°43'30"	91°23'01"	Jun 1985	Uppermost	Down	33.52	32.07	22.97	2.67	30.40	2
MW-10A	30°43'37"	91°23'40"	Jun 2011	Uppermost	Down	32.97	29.89	10.57	0.57	29.57	2
MW-10B	30°43'39"	91°23'31"	Jun 2011	Uppermost	Down	31.13	27.86	7.98	-2.02	30.13	2
MW-10CR1	30°43'50"	91°22'55"	Oct 2016	Uppermost	Down	35.48	32.43	12.95	2.95	29.73	2
MW-10D	30°43'48"	91°22'32"	Jun 2011	Uppermost	Down	33.18	30.22	9.83	-0.17	30.64	2
MW-10E	30°43'23"	91°23'15"	May 2011	Uppermost	Down	33.54	30.42	9.94	-0.06	30.74	2
MW-10F	30°43'32"	91°22'44"	May 2011	Uppermost	Down	31.27	28.97	2.92	-7.08	36.30	2
MW-10G	30°43'19"	91°23'28"	Jun 2011	Uppermost	Down	32.17	29.30	0.42	-9.58	39.13	2
MW-10H	30°43'17"	91°23'37"	Jun 2011	Uppermost	Down	32.01	29.21	-9.74	-19.74	49.20	2
MW-10I	30°43'15"	91°23'48"	Jun 2011	Uppermost	Down	33.12	30.06	0.31	-9.69	40.00	2
MW-10BG	30°43'55"	91°23'23"	Jun 2011	Uppermost	Up	33.74	30.79	10.39	0.39	30.65	2

Notes:
DMS = Degrees Minutes Seconds
NGVS = National Geodetic Vertical Datum
BGS = Below Ground Surface

TABLE 2

April 2019 Analytical Data Summary

Parameter/Well	MW-85A	MW-85B	MW-85C	MW-85D	MW-85E	MW-10A	MW-10B	MW-10CR1	MW-10D
	4/15/19	4/17/19	4/17/19	4/16/19	4/15/19	4/16/19	4/17/19	4/17/19	4/17/19
Boron (mg/l)	0.076	0.051	0.21	0.15	5.7	0.76	0.53	0.3	0.23
Calcium (mg/l)	72	94	110	110	160	110	97	110	150
Chloride (mg/l)	17	44	56	27	96	78	67	57	79
pH (S.U.)	6.84	7.87	7.86	7.51	7.26	7.61	7.68	7.89	7.9
Sulfate (mg/l)	<5	160	190	79	770	280	87	150	360
TDS (mg/l)	290	610	670	590	1,500	800	590	670	960
Antimony (mg/l)	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Arsenic (mg/l)	0.0022	0.0011 J	0.0052	0.0049	0.0096	0.0027	0.0026	0.012	0.0029
Barium (mg/l)	0.29	0.47	0.24	0.22	0.06	0.24	0.45	0.37	0.22
Beryllium (mg/l)	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Cadmium (mg/l)	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Chromium (mg/l)	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Cobalt (mg/l)	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	0.00061 J	<0.0025
Fluoride (mg/l)	0.37	0.2	0.3	0.32	0.28	0.4	0.19	0.31	0.16
Lead (mg/l)	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013
Lithium (mg/l)	0.016	0.016	0.013	0.018	0.018	0.014	0.017	0.018	0.014
Mercury (mg/l)	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.00015 J	0.00015 J	<0.0002
Molybdenum (mg/l)	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.0025 J	0.0022 J	<0.015
Selenium (mg/l)	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013
Thallium (mg/l)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Combined Radium-226,228 (pCi/l)	0.655	0.697	0.56	0.412	0.652	0.697	0.681	0.412	0.642

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

TABLE 2

April 2019 Analytical Data Summary

Parameter/Well	MW-10E	MW-10F	MW-10G	MW-10H	MW-10I	MW-10BG
	4/15/19	4/16/19	4/16/19	4/16/19	4/15/19	4/15/19
Boron (mg/l)	0.21	2.1	0.82	0.18	0.14	0.066
Calcium (mg/l)	100	150	87	120	88	71
Chloride (mg/l)	42	35	81	56	25	5.4
pH (S.U.)	7.08	7.53	7.49	7.51	7.33	7.54
Sulfate (mg/l)	140	390	120	55	3.7 J	<5
TDS (mg/l)	620	910	600	600	450	350
Antimony (mg/l)	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Arsenic (mg/l)	0.01	0.0026	0.0021	0.0094	0.00058 J	0.0046
Barium (mg/l)	0.28	0.055	0.33	0.41	0.32	0.22
Beryllium (mg/l)	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Cadmium (mg/l)	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Chromium (mg/l)	0.0011 J	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Cobalt (mg/l)	0.00077 J	0.00053 J	<0.0025	<0.0025	<0.0025	<0.0025
Fluoride (mg/l)	0.27	0.29	0.24	0.28	0.21	0.39
Lead (mg/l)	0.00037 J	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013
Lithium (mg/l)	0.018	0.018	0.021	0.019	0.024	0.012
Mercury (mg/l)	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum (mg/l)	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Selenium (mg/l)	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013
Thallium (mg/l)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Combined Radium-226,228 (pCi/l)	0.567	0.208	0.699	0.564	0.177	0.796

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

TABLE 3

October 2019 Analytical Data Summary

Parameter/Well	MW-85A	MW-85B	MW-85C	MW-85D	MW-85E	MW-10A	MW-10B	MW-10CR1	MW-10D
	10/8/19	10/8/19	10/8/19	10/9/19	10/8/19	10/8/19	10/8/19	10/8/19	10/8/19
Boron (mg/l)	0.07	0.046	0.18	0.13	5.9	0.79	0.74	0.35	0.15
Calcium (mg/l)	60.8	85	111	109	158	109	92.8	118	130
Chloride (mg/l)	15.7	51	57	25.9	9.4	8.6	83.6	69.8	76.4
pH (S.U.)	6.12	7.51	7.35	6.57	6.5	6.93	6.9	7.16	7.56
Sulfate (mg/l)	<1	180	197	67.5	737	293	97.9	246	323
TDS (mg/l)	320	6,500	540	1,390	775	645	735	855	4,040
Arsenic (mg/l)	0.0016	0.0011	0.0045	0.0047	0.0099	0.002	0.006	0.007	0.0026
Barium (mg/l)	0.3	0.46	0.25	0.22	0.061	0.26	0.48	0.41	0.19
Chromium (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.0012	<0.001
Fluoride (mg/l)	0.37	0.31	0.41	0.47	0.15	0.52	0.32	0.46	0.44
Lead (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lithium (mg/l)	0.015	0.014	0.012	<0.001	0.015	0.012	0.016	0.015	<0.001
Molybdenum (mg/l)	<0.003	<0.003	<0.003	<0.003	0.014	<0.003	<0.003	0.003	<0.003
Combined Radium-226,228 (pCi/l)	0.766	1.919	1.954	1.683	1.811	1.07	0.772	1.155	1.29

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

TABLE 3

October 2019 Analytical Data Summary

Parameter/Well	MW-10E	MW-10F	MW-10G	MW-10H	MW-10I	MW-10BG
	10/9/19	10/8/19	10/8/19	10/8/19	10/8/19	10/9/19
Boron (mg/l)	0.19	5.1	0.94	0.11	0.094	0.066
Calcium (mg/l)	118	359	81.7	124	81.2	68.5
Chloride (mg/l)	50.3	46.9	77.8	57.7	25.7	5.7
pH (S.U.)	6.57	6.73	6.49	6.38	6.21	6.52
Sulfate (mg/l)	200	1,510	141	35.1	4.1	<1
TDS (mg/l)	2,340	620	805	575	370	340
Arsenic (mg/l)	0.0091	0.0052	0.0016	0.0072	<0.001	0.025
Barium (mg/l)	0.33	0.076	0.35	0.41	0.32	0.23
Chromium (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt (mg/l)	<0.001	0.0021	<0.001	<0.001	<0.001	<0.001
Fluoride (mg/l)	0.16	<0.10	0.23	0.18	0.2	0.36
Lead (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lithium (mg/l)	<0.001	0.027	0.018	<0.001	<0.001	<0.001
Molybdenum (mg/l)	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Combined Radium-226,228 (pCi/l)	0.794	0.924	0.621	2.119	1.2148	-0.265

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

APPENDIX D

CERTIFICATION OF STATISTICAL METHODOLOGY

CLECO CAJUN LLC
BIG CAJUN II POWER PLANT

Groundwater Monitoring
Certification of Statistical Method

October 2019

INTRODUCTION

This certification of statistical method has been prepared and certified per §257.93.f.6 for the groundwater monitoring program conducted at the Cleco Cajun, LLC Big Cajun II Power Plant. Groundwater monitoring is conducted to evaluate groundwater quality for the facilities which handle wastes regulated by the Environmental Protection Agency (EPA) Coal Combustion Residuals (CCR) Rule. The following describes statistical analysis procedures to be followed at Big Cajun II for the various monitoring regimes outlined in the CCR Rule.

DETECTION MONITORING STATISTICAL ANALYSIS

While conducting a Detection Monitoring program, statistical evaluations of groundwater monitoring data for the permitted 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* (EPA, 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 Detection Monitoring 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. 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. 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. 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. (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 Detection Monitoring data is the selection of a verification resampling strategy. For this site, 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 Detection Monitoring 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.

ASSESSMENT MONITORING STATISTICAL ANALYSIS

When Assessment Monitoring is initiated because of confirmed SSIs observed during the Detection Monitoring program, detected Appendix IV parameters are compared to Groundwater Protection Standards (GWPS) through the use of Confidence Intervals. The GWPS will be either the Maximum Contaminant Level (MCL) or a statistical limit based on background, whichever is higher (§257.95.h). CCR Rule specified levels are used for parameters without MCLs (unless background is higher) which include: cobalt, lithium and molybdenum. Alternate contaminant levels (ACLs) will be established from upgradient wells through the use of Tolerance Limits. On an annual basis, all Appendix IV parameters will be sampled (§257.95.b) and newly detected parameters added to the list of parameters sampled semi-annually (§257.95.d).

Confidence intervals require a minimum of four samples; however, eight samples are recommended. When a well/constituent pair does not have the minimum sample requirement, the well/constituent pair will continue to be reported and tracked using time series plots and/or trend tests until such time that enough data are available to calculate a confidence interval.

In Assessment Monitoring, a well is determined to be out of compliance when the Lower Confidence Limit (LCL), or the entire interval, exceeds the GWPS as discussed in the EPA *Unified Guidance*. Assessment of corrective measures will be initiated at that time (§257.95.g) and remediation efforts will continue to be evaluated through the use of Confidence Intervals to determine the effectiveness of the selected remediation method.

CORRECTIVE ACTION STATISTICAL ANALYSIS

If Corrective Action Monitoring is initiated, this information will be placed in the operating record and, if possible, an alternative source demonstration (ASD) will be made (§257.95.g.3.ii). If there is evidence of a release or if an ASD is not made for the exceedances of GWPS, efforts will be made to characterize the nature and extent of the release and initiate the assessment of corrective action measures.

Once remediation activities begin, semi-annual sampling will continue (§257.98.a.1) and Confidence Intervals will monitor the progress of remediation efforts. Confidence Intervals are compared to GWPS, which are determined as described in the preceding section.

In Corrective Action, a well/parameter pair is declared clean when the entire interval falls below a specified clean-up limit (i.e., the Upper Confidence Limit [UCL] falls below the limit). Alternatively, compliance is achieved when the Lower Confidence Limit (LCL) of the Appendix IV parameters does not exceed the GWPS for a period of three consecutive years (§257.98.c).

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 Cajun, LLC Big Cajun II Power Plant. I am a duly licensed Professional Engineer under the laws of the State of Louisiana.

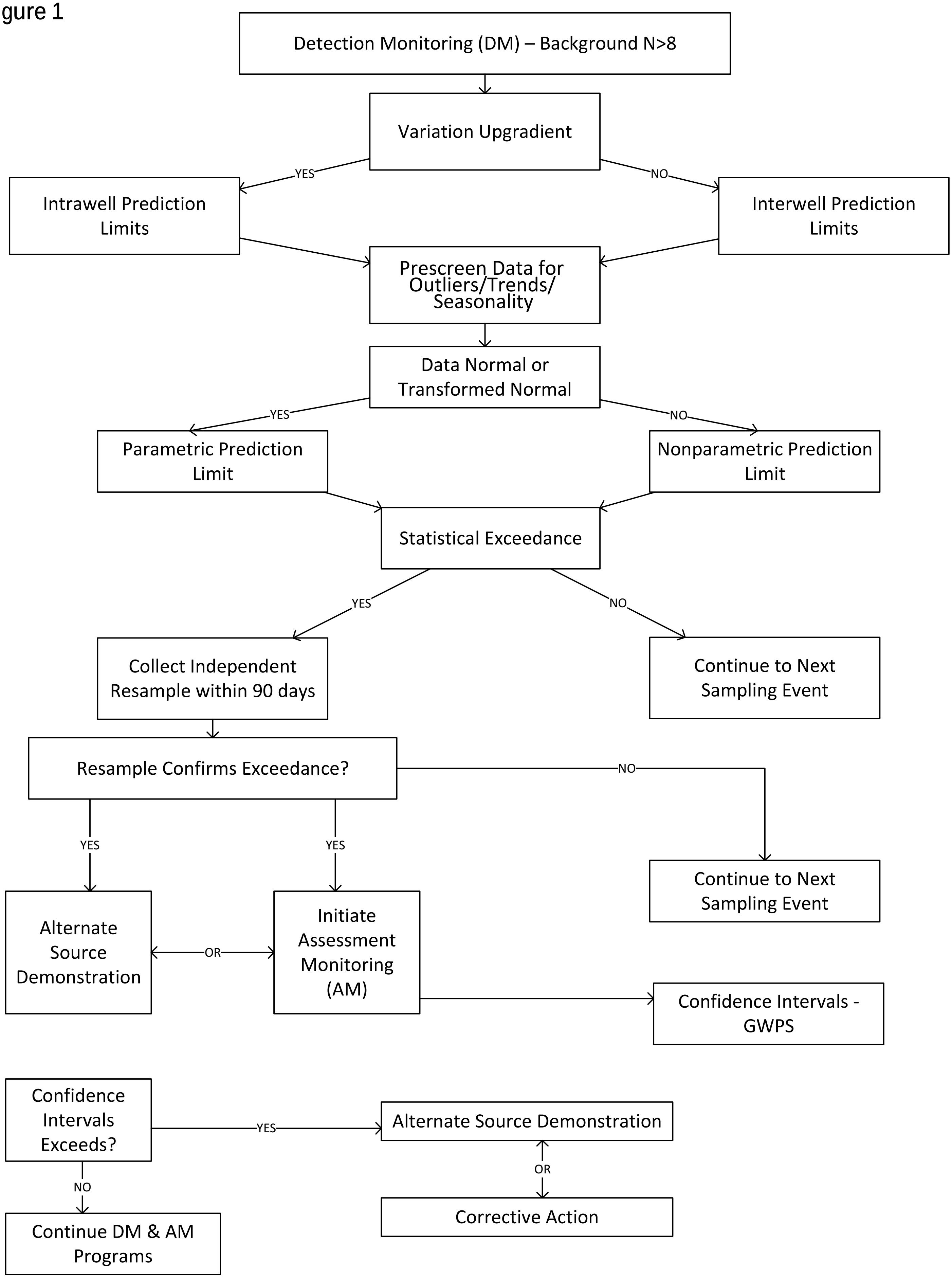
STATE OF LOUISIANA
BRADLEY E. BATES
LIC. NO. 27124
PROFESSIONAL
ENGINEER
IN
CIVIL ENGINEERING

________________________________, P.E.

Date: 9/30/2019

Louisiana Registration No.: 27124

Figure 1



Detection Monitoring (DM) – Background N>8
Variation Upgradient
YES
NO
Intrawell Prediction Limits
Interwell Prediction Limits
Prescreen 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

Legend

- Monitor Well Locations
- Domestic Well
- Power Generation
- Irrigation Well
- Industrial Well
- One Mile Radius
- Facility Boundaries
- Property Boundary

0 1,500 3,000 6,000 Feet

Reference

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

CLECO Cajun, LLC

Big Cajun II Power Plant

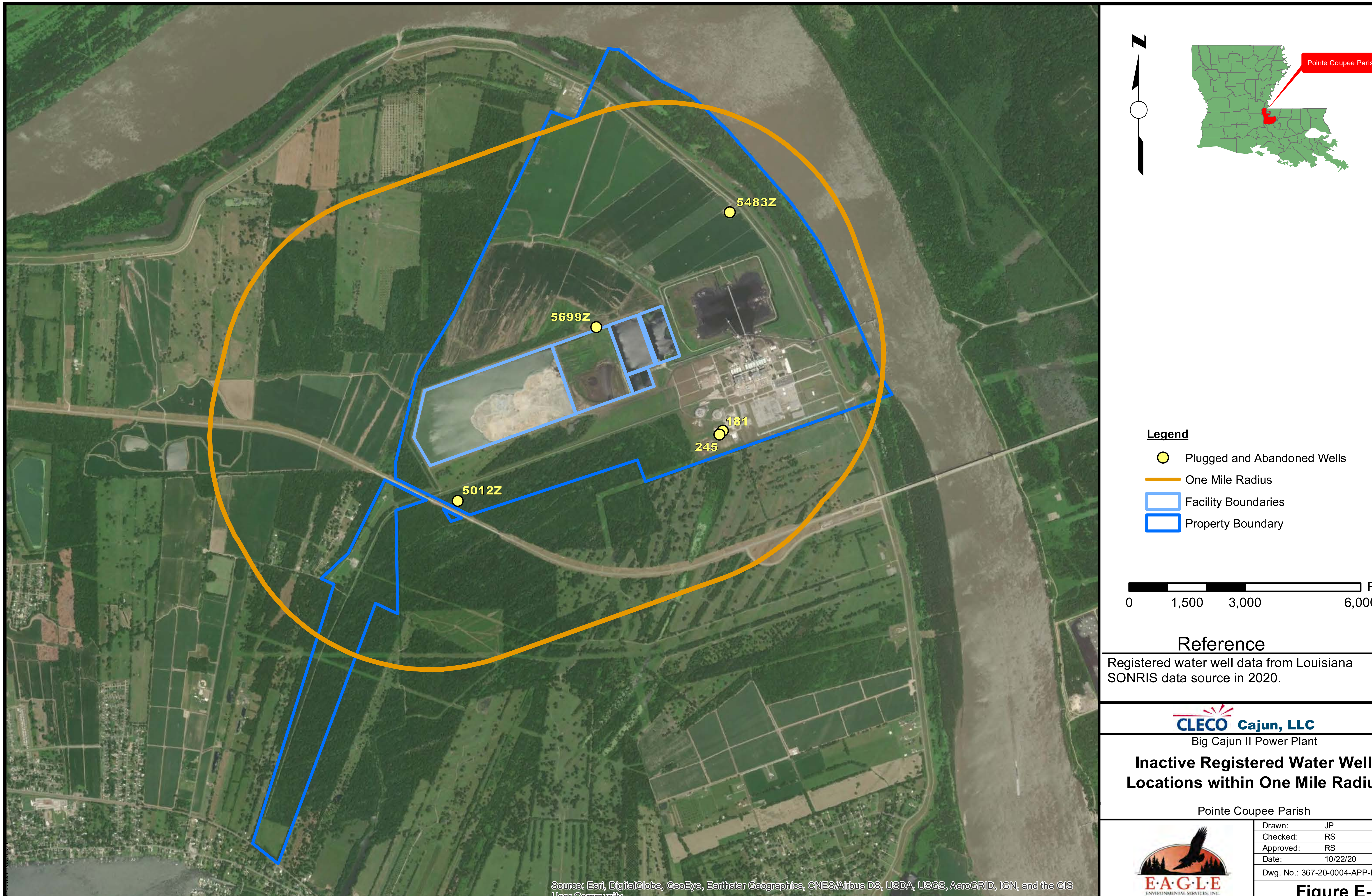
Active Registered Water Well Locations within One Mile Radius

Pointe Coupee Parish

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

Drawn:	JP
Checked:	RS
Approved:	RS
Date:	10/22/20
Dwg. No.:	367-20-0004-APP-E-1

Figure E-1



Legend

- Plugged and Abandoned Wells
- One Mile Radius
- Facility Boundaries
- Property Boundary

Feet: 0, 1,500, 3,000, 6,000

Reference

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

CLECO Cajun, LLC

Big Cajun II Power Plant

Inactive Registered Water Well Locations within One Mile Radius

Pointe Coupee Parish

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

Drawn:	JP
Checked:	RS
Approved:	RS
Date:	10/22/20
Dwg. No.: 367-20-0004-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 Basin at BCII or the underlying geologic units.

CHAPTER 4.0

Appendices

A Owner's Certification
B Monitoring Well Information/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 30, 2020

CLECO

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 Big Cajun II facility, including the Bottom Ash Basin, 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.

Kristin Guillory 11/4/20

Kristin Guillory
President, Cleco Cajun LLC

Date

Signature: Kristin Guillory (Nov 4, 2020 10:43 CST)

Email: kristin.guillory@clecocajun.com

APPENDIX B

MONITORING WELL INFORMATION / MONITORING WELL NETWORK CERTIFICATION

Geosyntec consultants

Certification for Groundwater Monitoring System

CCR Units: Fly Ash and Bottom Ash Basins

Certification:

I, **Scott M. Graves**, a qualified professional engineer registered in the state of **Louisiana**, have reviewed the information on the groundwater monitoring network and well construction details for the CCR Unit at the LaGen Big Cajun II Power Plant as presented in the *Basis for Groundwater Monitoring System Certification* and based on my review, in my professional opinion, find that the multi-unit Groundwater Monitoring System for the Fly Ash and Bottom Ash Basins has been designed and constructed to meet the requirements of 40 CFR §257.91.

STATE OF LOUISIANA
SCOTT M. GRAVES
License No. 31181
PROFESSIONAL ENGINEER

10/11/2017

Seal and Signature: ______________________

Printed Name: Scott M. Graves

PE License Number: 31181 State: Louisiana

Shaw E & I, Inc.

Well Construction Diagram

Project:	NRG - Big Cajun II	Well Number:	MW-10A
Project Number:	1005494020	Installation Date	6/2/2011
Subcontractor:	Walker - Hill Environmental	Northing:	809876.342
Driller:	Bo Barnes	Easting:	3261662.301
Field Geologist:	Kevin Simoneaux		

Protective Cover Elevation (ft): 35.967

Top of Casing Elv. (ft): 32.967

Top of Casing Stickup (ft): 3.081

Land Surface Elv. (ft): 29.886

Approximate Diameter of Borehole (in): 6.75

Well Casing Diameter (in): 2

Depth to Water (ft):

- During Drilling: 6
- Date: 6/2/2011
- Post Development: 5.30 TOC
- Date: 7/6/2011

Top of Bentonite Seal (ft): 15

Top of Filter Pack (ft): 17

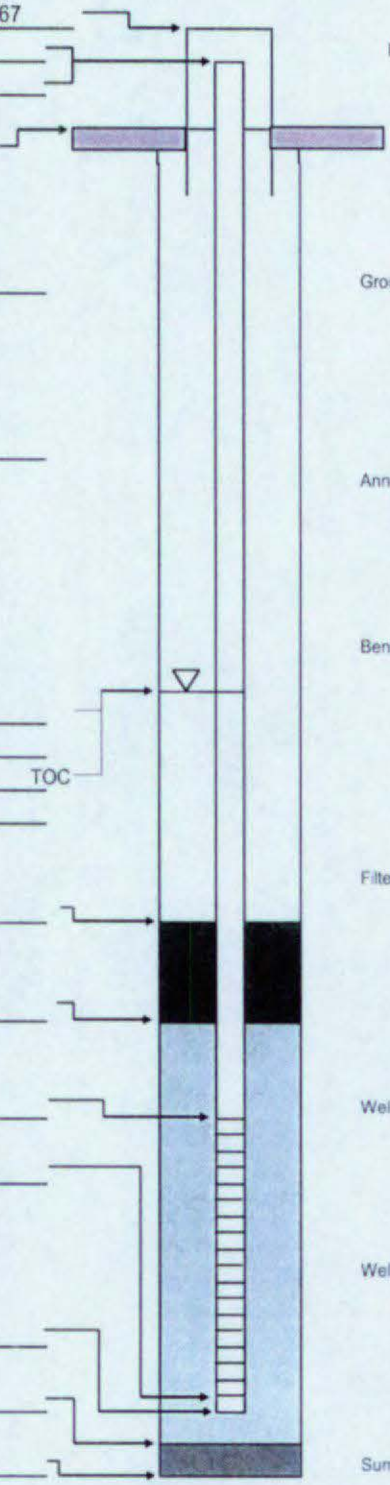
Top of Screen Interval (ft): 19.5

Bottom of Screen Interval (ft): 29.5

Bottom of Well (ft): 29.5

Bottom of Filter Pack (ft): 30

Bottom of Borehole (ft): 30



Protective Casing:

- Type: Carbon Steel Hinged Top
- Dimensions (in): 4' X4'
- Length (ft): 5'
- Guard Post: 3" Carbon steel X 4

Ground Seal (Surface Pad)

- Dimensions: 4' X4'
- Type: Concrete

Annular Space Seal:

- Type: Bentonite-Cement Grout
- Installation: Gravity Tremie Pumped

Bentonite Seal:

- Manufacturer: CETCO
- Type: Pellets Slurry
- Installation: 6-in lifts One Section
- Gravity Tremie Pumped
- Hydration time (hrs):

Filter Pack Material:

- Manufacturer: Southern Filter Media, Inc.
- Product Name: Filter Sand
- Size: 20/40
- Volume Added (ft^3): 13
- Installation: Gravity Tremie

Well Casing:

- Manufacturer: Environmental Manufacturing, Inc
- Type: PVC
- Diameter (in): 2"

Well Screen Casing:

- Manufacturer: Environmental Manufacturing, Inc
- Type: PVC
- Slot Size (in): 0.01 %Open
- Slot Type: Continuous wrap Factory slot

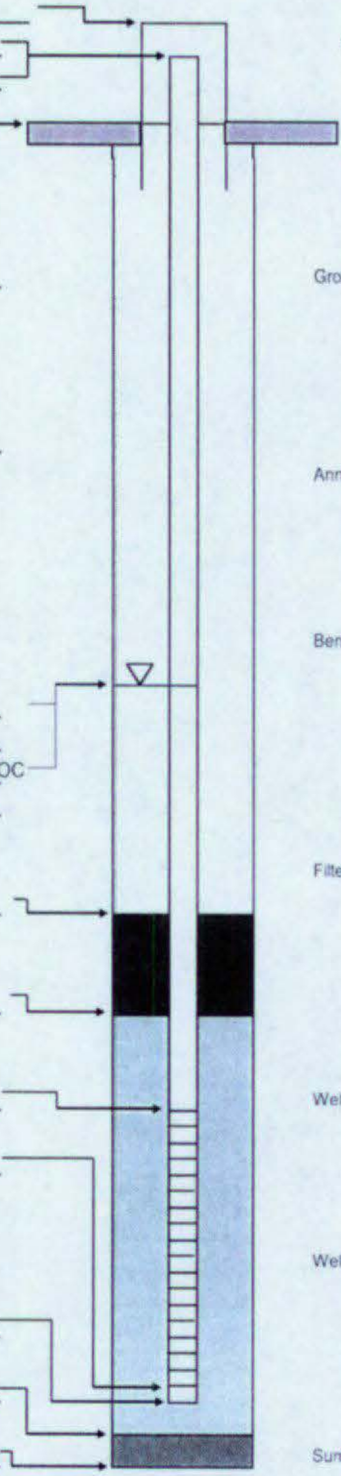
Sump/End Cap: 3"

Backfill Material:

Shaw
Shaw E & I, Inc.

Well Construction Diagram

Project:	NRG - Big Cajun II	Well Number:	MW-10B
Project Number:	1005494020	Installation Date	6/2/2011
Subcontractor:	Walker - Hill Environmental	Northing:	810132.688
Driller:	Bo Barnes	Easting:	3262447.284
Field Geologist:	Kevin Simoneaux		



Protective Cover Elevation (ft): 34.126
Top of Casing Elv. (ft): 31.126
Top of Casing Stickup (ft): 3.266
Land Surface Elv. (ft): 27.86

Approximate Diameter of Borehole (in): 6.75

Well Casing Diameter (in): 2

Depth to Water (ft):
During Drilling: 8
Date: 6/2/2011
Post Development: 3.42 TOC
Date: 7/6/2011

Top of Bentonite Seal (ft): 15
Top of Filter Pack (ft): 17
Top of Screen Interval (ft): 20
Bottom of Screen Interval (ft): 30
Bottom of Well (ft): 30
Bottom of Filter Pack (ft): 30
Bottom of Borehole (ft): 30

Protective Casing:
Type: Carbon Steel Hinged Top
Dimensions (in): 4' X4'
Length (ft): 5'
Guard Post: 3" Carbon steel X 4

Ground Seal (Surface Pad)
Dimensions: 4' X4'
Type: Concrete

Annular Space Seal:
Type: Bentonite-Cement Grout
Installation: Gravity Tremie Pumped

Bentonite Seal:
Manufacturer: CETCO
Type: Pellets Slurry
Installation: 6-in lifts One Section
Gravity Tremie Pumped
Hydration time (hrs):

Filter Pack Material:
Manufacturer: Southern Filter Media, Inc.
Product Name: Filter Sand
Size: 20/40
Volume Added (ft^3): 13
Installation: Gravity Tremie

Well Casing:
Manufacturer: Environmental Manufacturing, Inc
Type: PVC
Diameter (in): 2"

Well Screen Casing:
Manufacturer: Environmental Manufacturing, Inc
Type: PVC
Slot Size (in): 0.01 %Open
Slot Type: Continuous wrap Factory slot

Sump/End Cap: 3"

Backfill Material:

Well Construction Diagram

Project	**NRG - Big Cajun II**	Well Number	MW-10CR1
Project Number	**631220742**	Installation Date	10/6/2016
Subcontractor	Walker - Hill Environmental, Inc.	Latitude	30° 43' 50.4149" N
Driller	Taylor Cale	Longitude	91° 22' 54.6337" W
Field Scientist	Kevin Simoneaux		

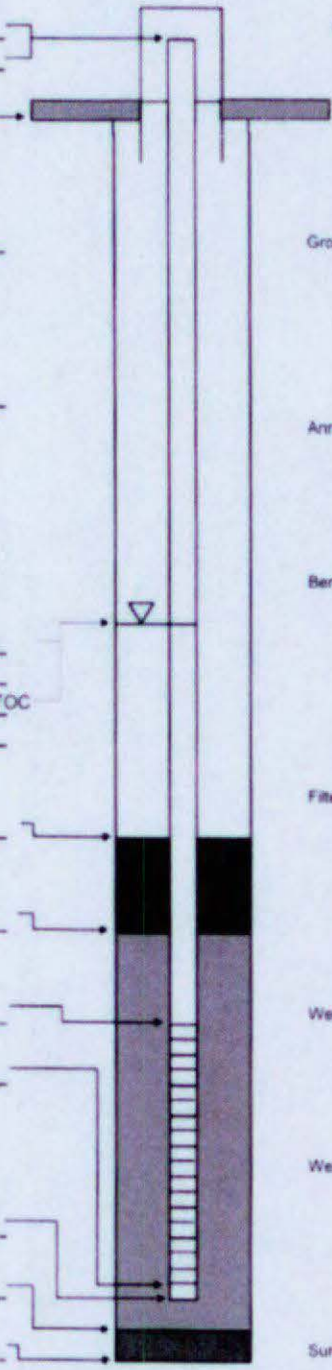
Top of Casing Elv (ft): 35.475
Top of Casing Stickup (ft): 3.050
Land Surface Elv (ft): 32.425

Approximate Diameter of Borehole (in): 6.75

Well Casing Diameter (in): 2

Depth to Water (ft)
During Drilling: NA
Date: 10/6/2016
Post Development: 12.01 TOC
Date: 10/12/2016

Top of Bentonite Seal (ft): 14.43
Top of Filter Pack (ft): 16.43
Top of Screen Interval (ft): 19.43
Bottom of Screen Interval (ft): 29.43
Bottom of Well (ft): 29.73
Bottom of Filter Pack (ft): 30
Bottom of Borehole (ft): 30



Protective Casing
Type: Aluminum-Hinged Top
Dimensions (in): 6" X 6"
Length (ft): 5'
Guard Post: 5' X 3" steel

Ground Seal (Surface Pad)
Dimensions: 3' X 3'
Type: Concrete

Annular Space Seal
Type: Bentonite-Cement Grout
Installation: Gravity Tremie Pumped

Bentonite Seal
Manufacturer: CETCO
Type: Pellets Slurry
Installation: 6-in lifts One Section
Gravity Tremie Pumped
Hydration time (hrs):

Filter Pack Material
Manufacturer: Consolidated Aggregate
Product Name: Filter Sand
Size: 20/40
Volume Added (ft^3): 13.5
Installation: Gravity Tremie

Well Casing
Manufacturer: Environmental Manufacturing, Inc.
Type: PVC
Diameter (in): 2"

Well Screen Casing
Manufacturer: Environmental Manufacturing, Inc.
Type: PVC
Slot Size (in): 0.01 %Open
Slot Type: Continuous wrap Factory slot

Sump/End Cap: 3"

Backfill Material: NA

MW-10CR1 Well Construction diagram.xlsx

Shaw™
Shaw E & I, Inc.

Well Construction Diagram

Project:	NRG - Big Cajun II	Well Number:	MW-10D
Project Number:	1005494020	Installation Date	6/3/2011
Subcontractor:	Walker - Hill Environmental	Northing:	811026.11
Driller:	Bo Barnes	Easting:	3267568.097
Field Geologist:	Kevin Simoneaux		

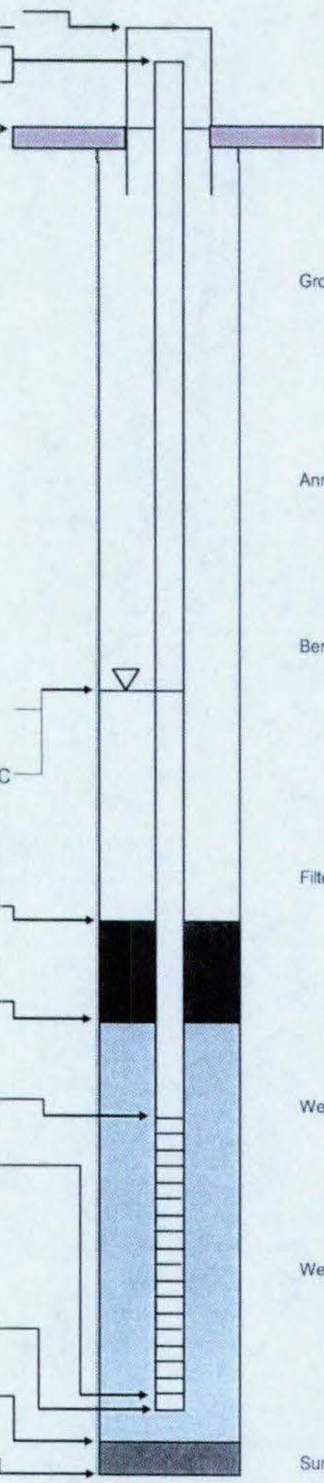
Protective Cover Elevation (ft): 36.177
Top of Casing Elv. (ft): 33.177
Top of Casing Stickup (ft): 2.956
Land Surface Elv. (ft): 30.221

Approximate Diameter of Borehole (in): 6.75

Well Casing Diameter (in): 2

Depth to Water (ft):
During Drilling: 12
Date: 6/3/2011
Post Development: 4.71 TOC
Date: 7/7/2011

Top of Bentonite Seal (ft): 16
Top of Filter Pack (ft): 18
Top of Screen Interval (ft): 20
Bottom of Screen Interval (ft): 30
Bottom of Well (ft): 30
Bottom of Filter Pack (ft): 30
Bottom of Borehole (ft): 30



Protective Casing:
Type: Carbon Steel Hinged Top
Dimensions (in): 4' X4'
Length (ft): 5'
Guard Post: 3" Carbon steel X 4

Ground Seal (Surface Pad)
Dimensions: 4' X4'
Type: Concrete

Annular Space Seal:
Type: Bentonite-Cement Grout
Installation: Gravity Tremie Pumped

Bentonite Seal:
Manufacturer: CETCO
Type: Pellets Slurry
Installation: 6-in lifts One Section
Gravity Tremie Pumped
Hydration time (hrs):

Filter Pack Material:
Manufacturer: Southern Filter Media, Inc.
Product Name: Filter Sand
Size: 20/40
Volume Added (ft^3): 12
Installation: Gravity Tremie

Well Casing:
Manufacturer: Environmental Manufacturing, Inc
Type: PVC
Diameter (in): 2"

Well Screen Casing:
Manufacturer: Environmental Manufacturing, Inc
Type: PVC
Slot Size (in): 0.01 %Open
Slot Type: Continuous wrap Factory slot

Sump/End Cap: 3"

Backfill Material:

Shaw
Shaw E & I, Inc.

Well Construction Diagram

Project:	NRG - Big Cajun II	Well Number:	MW-10E
Project Number:	1005494020	Installation Date	5/31/2011
Subcontractor:	Walker - Hill Environmental	Northing:	809380.754
Driller:	Bo Barnes	Easting:	3266529.169
Field Geologist:	Kevin Simoneaux		

Protective Cover Elevation (ft): 36.536

Top of Casing Elv. (ft): 33.536

Top of Casing Stickup (ft): 3.115

Land Surface Elv. (ft): 30.421

Approximate Diameter of Borehole (in): 6.75

Well Casing Diameter (in): 2

Depth to Water (ft):

During Drilling: 8

Date: 5/31/2011

Post Development: 3.90 TOC

Date: 7/7/2011

Top of Bentonite Seal (ft): 15

Top of Filter Pack (ft): 17.5

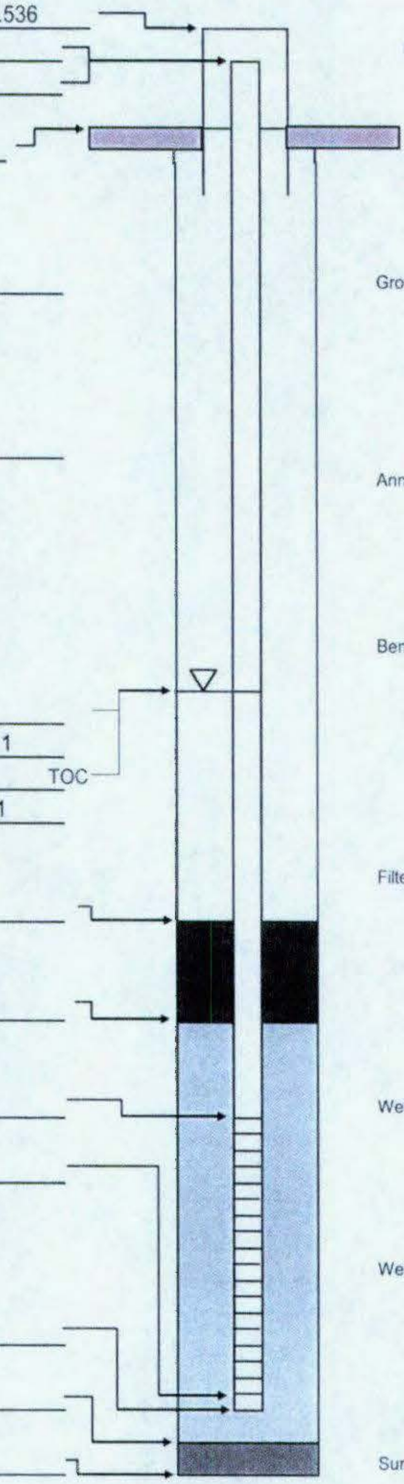
Top of Screen Interval (ft): 20

Bottom of Screen Interval (ft): 30

Bottom of Well (ft): 30

Bottom of Filter Pack (ft): 30

Bottom of Borehole (ft): 30



Protective Casing:

- Type: Carbon Steel Hinged Top
- Dimensions (in): 4' X4'
- Length (ft): 5'
- Guard Post: 3" Carbon steel X 4

Ground Seal (Surface Pad)

- Dimensions: 4' X4'
- Type: Concrete

Annular Space Seal:

- Type: Bentonite-Cement Grout
- Installation: Gravity Tremie Pumped

Bentonite Seal:

- Manufacturer: CETCO
- Type: Pellets Slurry
- Installation: 6-in lifts One Section
- Gravity Tremie Pumped
- Hydration time (hrs):

Filter Pack Material:

- Manufacturer: Southern Filter Media, Inc.
- Product Name: Filter Sand
- Size: 20/40
- Volume Added (ft^3): 12.5
- Installation: Gravity Tremie

Well Casing:

- Manufacturer: Environmental Manufacturing, Inc
- Type: PVC
- Diameter (in): 2"

Well Screen Casing:

- Manufacturer: Environmental Manufacturing, Inc
- Type: PVC
- Slot Size (in): 0.01 %Open
- Slot Type: Continuous wrap Factory slot

Sump/End Cap: 3"

Backfill Material:

Shaw™
Shaw E & I, Inc.

Well Construction Diagram

Project:	NRG - Big Cajun II	Well Number:	MW-10F
Project Number:	1005494020	Installation Date	5/31/2011
Subcontractor:	Walker - Hill Environmental	Northing:	808475.497
Driller:	Bo Barnes	Easting:	3263789.581
Field Geologist:	Kevin Simoneaux		

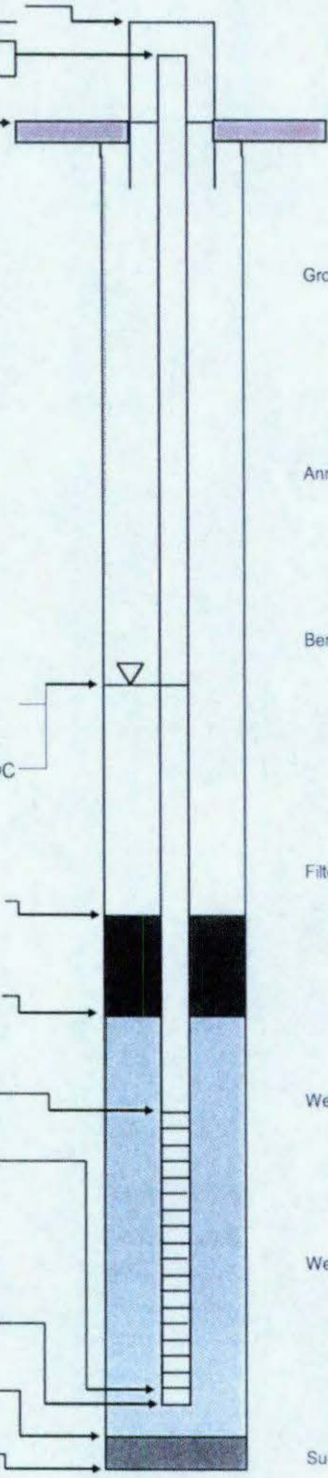
Protective Cover Elevation (ft): 34.265
Top of Casing Elv. (ft): 31.265
Top of Casing Stickup (ft): 2.297
Land Surface Elv. (ft): 28.968

Approximate Diameter of Borehole (in): 6.75

Well Casing Diameter (in): 2

Depth to Water (ft):
During Drilling: 8
Date: 5/31/2011
Post Development: 3.69 TOC
Date: 7/6/2011

Top of Bentonite Seal (ft): 20
Top of Filter Pack (ft): 22
Top of Screen Interval (ft): 25
Bottom of Screen Interval (ft): 35
Bottom of Well (ft): 35
Bottom of Filter Pack (ft): 35
Bottom of Borehole (ft): 40



Protective Casing:
Type: Carbon Steel Hinged Top
Dimensions (in): 4' X4'
Length (ft): 5'
Guard Post: 3" Carbon steel X 4

Ground Seal (Surface Pad)
Dimensions: 4' X4'
Type: Concrete

Annular Space Seal:
Type: Bentonite-Cement Grout
Installation: Gravity Tremie Pumped

Bentonite Seal:
Manufacturer: CETCO
Type: Pellets Slurry
Installation: 6-in lifts One Section
Gravity Tremie Pumped
Hydration time (hrs):

Filter Pack Material:
Manufacturer: Southern Filter Media, Inc.
Product Name: Filter Sand
Size: 20/40
Volume Added (ft^3): 13
Installation: Gravity Tremie

Well Casing:
Manufacturer: Environmental Manufacturing, Inc
Type: PVC
Diameter (in): 2"

Well Screen Casing:
Manufacturer: Environmental Manufacturing, Inc
Type: PVC
Slot Size (in): 0.01 %Open
Slot Type: Continuous wrap Factory slot

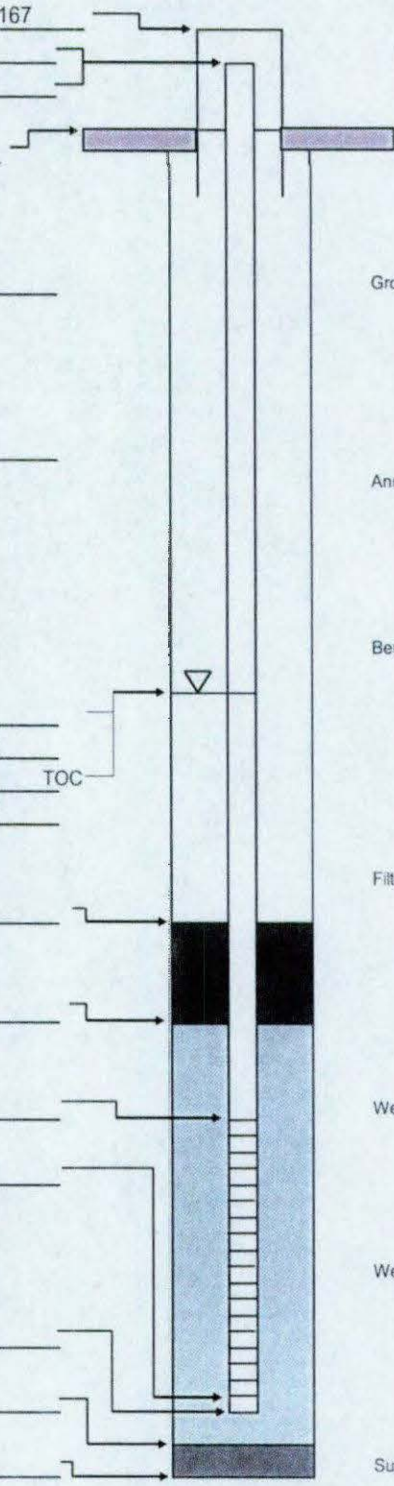
Sump/End Cap: 3"

Backfill Material:

Shaw E & I, Inc.

Well Construction Diagram

Project:	NRG - Big Cajun II	Well Number:	MW-10G
Project Number:	1005494020	Installation Date	6/1/2011
Subcontractor:	Walker - Hill Environmental	Northing:	808086.613
Driller:	Bo Barnes	Easting:	3262636.414
Field Geologist:	Kevin Simoneaux		



Protective Cover Elevation (ft): 35.167

Top of Casing Elv. (ft): 32.167

Top of Casing Stickup (ft): 2.869

Land Surface Elv. (ft): 29.298

Approximate Diameter of Borehole (in): 6.75

Well Casing Diameter (in): 2

Depth to Water (ft):

- During Drilling: 8
- Date: 6/1/2011
- Post Development: 4.85 TOC
- Date: 7/6/2011

Top of Bentonite Seal (ft): 24

Top of Filter Pack (ft): 26

Top of Screen Interval (ft): 29

Bottom of Screen Interval (ft): 39

Bottom of Well (ft): 39

Bottom of Filter Pack (ft): 40

Bottom of Borehole (ft): 40

Protective Casing:

- Type: Carbon Steel Hinged Top
- Dimensions (in): 4' X4'
- Length (ft): 5'
- Guard Post: 3" Carbon steel X 4

Ground Seal (Surface Pad)

- Dimensions: 4' X4'
- Type: Concrete

Annular Space Seal:

- Type: Bentonite-Cement Grout
- Installation: Gravity Tremie Pumped

Bentonite Seal:

- Manufacturer: CETCO
- Type: Pellets Slurry
- Installation: 6-in lifts One Section
- Gravity Tremie Pumped
- Hydration time (hrs):

Filter Pack Material:

- Manufacturer: Southern Filter Media, Inc.
- Product Name: Filter Sand
- Size: 20/40
- Volume Added (ft^3): 14
- Installation: Gravity Tremie

Well Casing:

- Manufacturer: Environmental Manufacturing, Inc
- Type: PVC
- Diameter (in): 2"

Well Screen Casing:

- Manufacturer: Environmental Manufacturing, Inc
- Type: PVC
- Slot Size (in): 0.01 %Open
- Slot Type: Continuous wrap Factory slot

Sump/End Cap: 3"

Backfill Material:

Shaw
Shaw E & I, Inc.

Well Construction Diagram

Project:	**NRG - Big Cajun II**	Well Number:	MW-10H
Project Number:	**1005494020**	Installation Date	6/1/2011
Subcontractor:	Walker - Hill Environmental	Northing:	807825.098
Driller:	Bo Barnes	Easting:	3261862.293
Field Geologist:	Kevin Simoneaux		

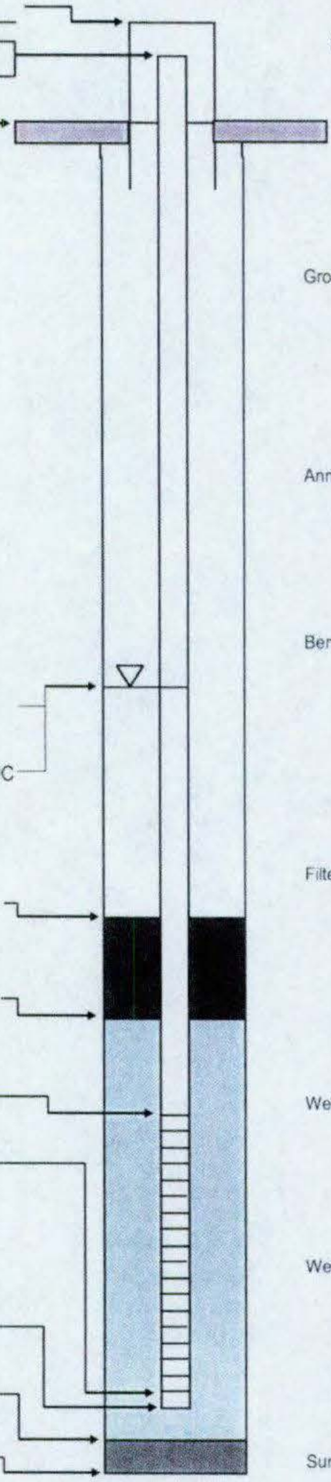
Protective Cover Elevation (ft): 35.013
Top of Casing Elv. (ft): 32.013
Top of Casing Stickup (ft): 2.805
Land Surface Elv. (ft): 29.208

Approximate Diameter of Borehole (in): 6.75

Well Casing Diameter (in): 2

Depth to Water (ft):
During Drilling: 5
Date: 6/1/2011
Post Development: 4.65 TOC
Date: 7/6/2011

Top of Bentonite Seal (ft): 34
Top of Filter Pack (ft): 36
Top of Screen Interval (ft): 38
Bottom of Screen Interval (ft): 48
Bottom of Well (ft): 48
Bottom of Filter Pack (ft): 48
Bottom of Borehole (ft): 50



Protective Casing:
Type: Carbon Steel Hinged Top
Dimensions (in): 4' X4'
Length (ft): 5'
Guard Post: 3" Carbon steel X 4

Ground Seal (Surface Pad)
Dimensions: 4' X4'
Type: Concrete

Annular Space Seal:
Type: Bentonite-Cement Grout
Installation: Gravity Tremie Pumped

Bentonite Seal:
Manufacturer: CETCO
Type: Pellets Slurry
Installation: 6-in lifts One Section
Gravity Tremie Pumped
Hydration time (hrs):

Filter Pack Material:
Manufacturer: Southern Filter Media, Inc.
Product Name: Filter Sand
Size: 20/40
Volume Added (ft^3): 14
Installation: Gravity Tremie

Well Casing:
Manufacturer: Environmental Manufacturing, Inc
Type: PVC
Diameter (in): 2"

Well Screen Casing:
Manufacturer: Environmental Manufacturing, Inc
Type: PVC
Slot Size (in): 0.01 %Open
Slot Type: Continuous wrap Factory slot

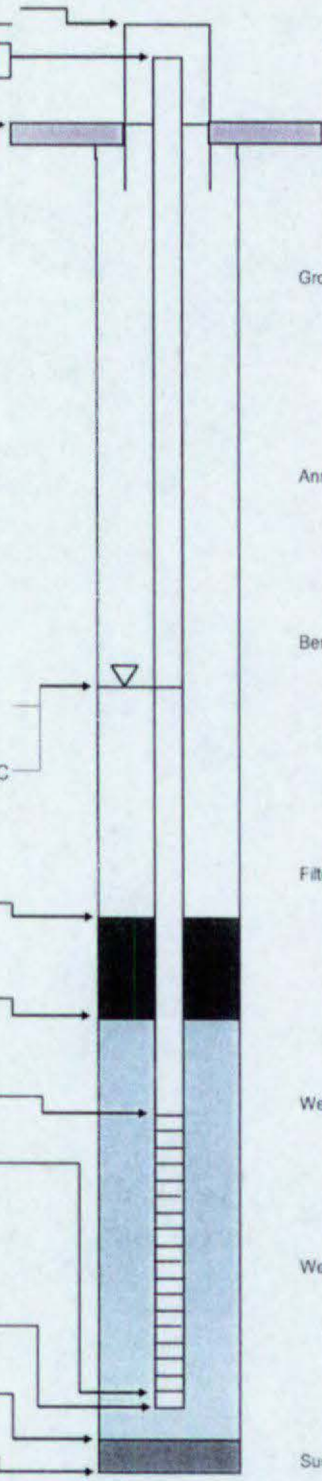
Sump/End Cap: 3"

Backfill Material:

Well Construction Diagram

Shaw E & I, Inc.

Project:	NRG - Big Cajun II	Well Number:	MW-10I
Project Number:	1005494020	Installation Date	6/1/2011
Subcontractor:	Walker - Hill Environmental	Northing:	807669.221
Driller:	Bo Barnes	Easting:	3260947.517
Field Geologist:	Kevin Simoneaux		



Protective Cover Elevation (ft): 36.121

Top of Casing Elv. (ft): 33.121

Top of Casing Stickup (ft): 3.061

Land Surface Elv. (ft): 30.06

Approximate Diameter of Borehole (in): 6.75

Well Casing Diameter (in): 2

Depth to Water (ft):

- During Drilling: 10
- Date: 6/1/2011
- Post Development: 7.17 TOC
- Date: 7/6/2011

Top of Bentonite Seal (ft): 25.5

Top of Filter Pack (ft): 27.5

Top of Screen Interval (ft): 30

Bottom of Screen Interval (ft): 40

Bottom of Well (ft): 40

Bottom of Filter Pack (ft): 40

Bottom of Borehole (ft): 40

Protective Casing:

- Type: Carbon Steel Hinged Top
- Dimensions (in): 4' X4'
- Length (ft): 5'
- Guard Post: 3" Carbon steel X 4

Ground Seal (Surface Pad)

- Dimensions: 4' X4'
- Type: Concrete

Annular Space Seal:

- Type: Bentonite-Cement Grout
- Installation: Gravity Tremie Pumped

Bentonite Seal:

- Manufacturer: CETCO
- Type: Pellets Slurry
- Installation: 6-in lifts One Section
- Gravity Tremie Pumped
- Hydration time (hrs):

Filter Pack Material:

- Manufacturer: Southern Filter Media, Inc.
- Product Name: Filter Sand
- Size: 20/40
- Volume Added (ft^3): 12.5
- Installation: Gravity Tremie

Well Casing:

- Manufacturer: Environmental Manufacturing, Inc
- Type: PVC
- Diameter (in): 2"

Well Screen Casing:

- Manufacturer: Environmental Manufacturing, Inc
- Type: PVC
- Slot Size (in): 0.01 %Open
- Slot Type: Continuous wrap Factory slot

Sump/End Cap: 3"

Backfill Material:

Shaw™
Shaw E & I, Inc.

Well Construction Diagram

Project:	NRG - Big Cajun II	Well Number:	MW-10BG
Project Number:	1005494020	Installation Date	6/3/2011
Subcontractor:	Walker - Hill Environmental	Northing:	811649.993
Driller:	Bo Barnes	Easting:	3263114.472
Field Geologist:	Kevin Simoneaux		

Protective Cover Elevation (ft): 36.740

Top of Casing Elv. (ft): 33.740

Top of Casing Stickup (ft): 2.952

Land Surface Elv. (ft): 30.788

Approximate Diameter of Borehole (in): 6.75

Well Casing Diameter (in): 2

Depth to Water (ft):

- During Drilling: 12
- Date: 6/3/2011
- Post Development: 6.84 TOC
- Date: 7/6/2011

Top of Bentonite Seal (ft): 16

Top of Filter Pack (ft): 18

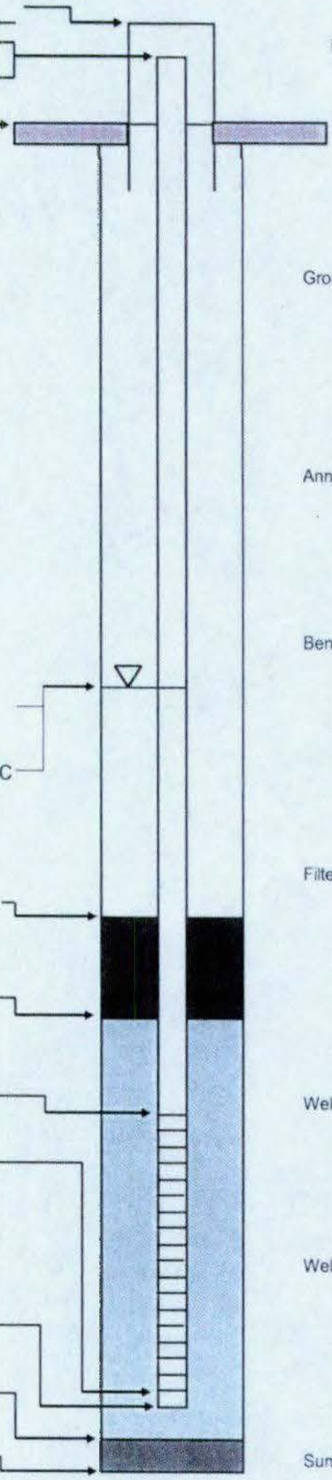
Top of Screen Interval (ft): 20.5

Bottom of Screen Interval (ft): 30.5

Bottom of Well (ft): 30.5

Bottom of Filter Pack (ft): 30.5

Bottom of Borehole (ft): 30.5



Protective Casing:

- Type: Carbon Steel Hinged Top
- Dimensions (in): 4' X4'
- Length (ft): 5'
- Guard Post: 3" Carbon steel X 4

Ground Seal (Surface Pad)

- Dimensions: 4' X4'
- Type: Concrete

Annular Space Seal:

- Type: Bentonite-Cement Grout
- Installation: Gravity Tremie Pumped

Bentonite Seal:

- Manufacturer: CETCO
- Type: Pellets Slurry
- Installation: 6-in lifts One Section
- Gravity Tremie Pumped
- Hydration time (hrs):

Filter Pack Material:

- Manufacturer: Southern Filter Media, Inc.
- Product Name: Filter Sand
- Size: 20/40
- Volume Added (ft^3): 12.5
- Installation: Gravity Tremie

Well Casing:

- Manufacturer: Environmental Manufacturing, Inc
- Type: PVC
- Diameter (in): 2"

Well Screen Casing:

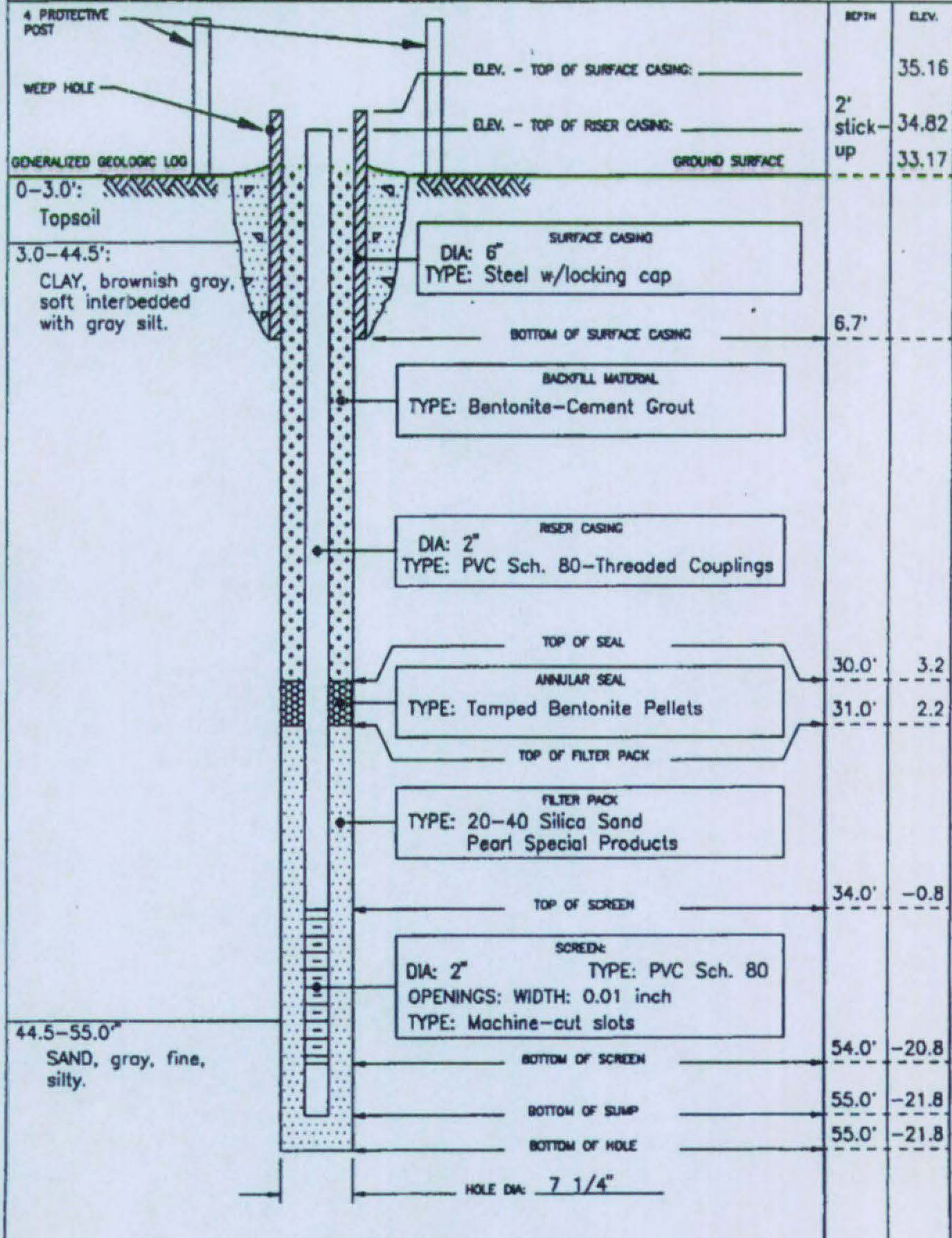
- Manufacturer: Environmental Manufacturing, Inc
- Type: PVC
- Slot Size (in): 0.01 %Open
- Slot Type: Continuous wrap Factory slot

Sump/End Cap: 3"

Backfill Material:

OBSERVATION WELL

PROJECT			COORDINATES	WELL NO.
CEPCO - BIG CAJUN II				85A
JOB NO. 14630	SITE Fly Ash Pond		E 2030, N 4190	
BEGUN 6/18/85	COMPLETED 6/18/85	PREPARED BY D. R. Beissel	REFERENCE POINT FOR MEASUREMENTS Top of PVC	



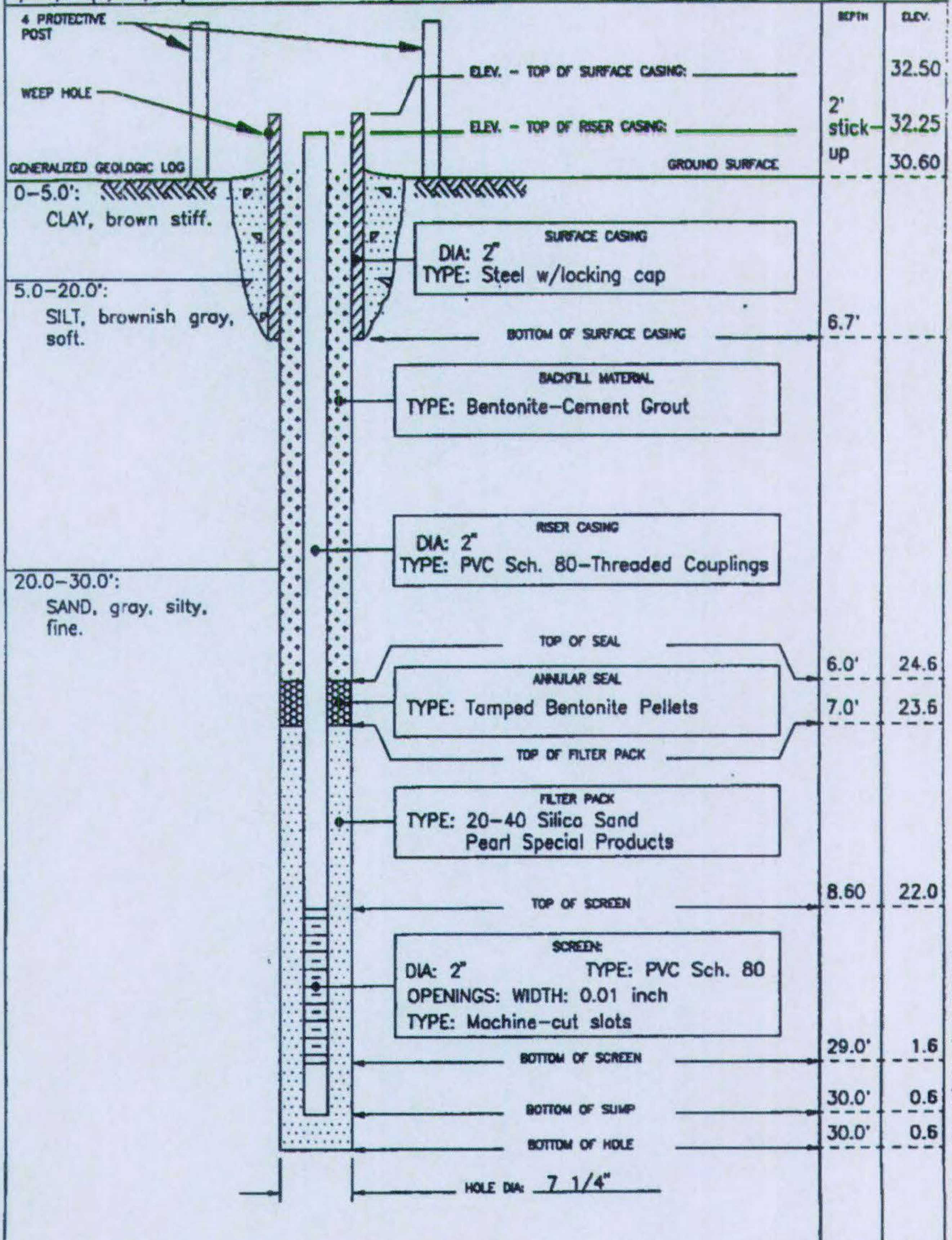
AutoCADD Drwg. NO.: D:\CAJUN\WELL85A.DWG

OBSERVATION WELL

PROJECT	WELL NO.
CEPCO – BIG CAJUN II	85B

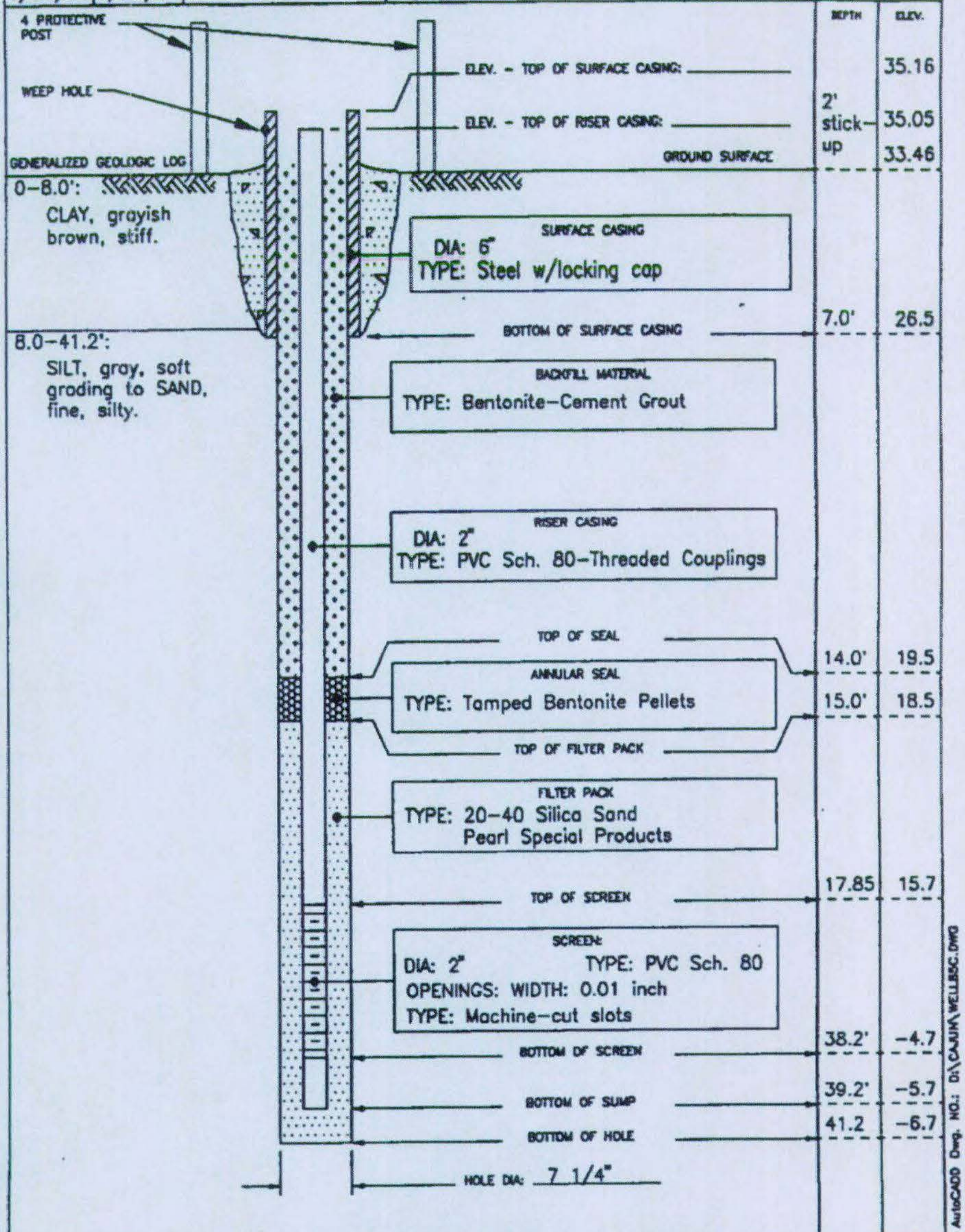
JOB NO.	SITE	COORDINATES
14630	North Bottom Ash Pond	E 6449, N 5262

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
6/20/85	6/20/85	D. R. Beissel	Top of PVC



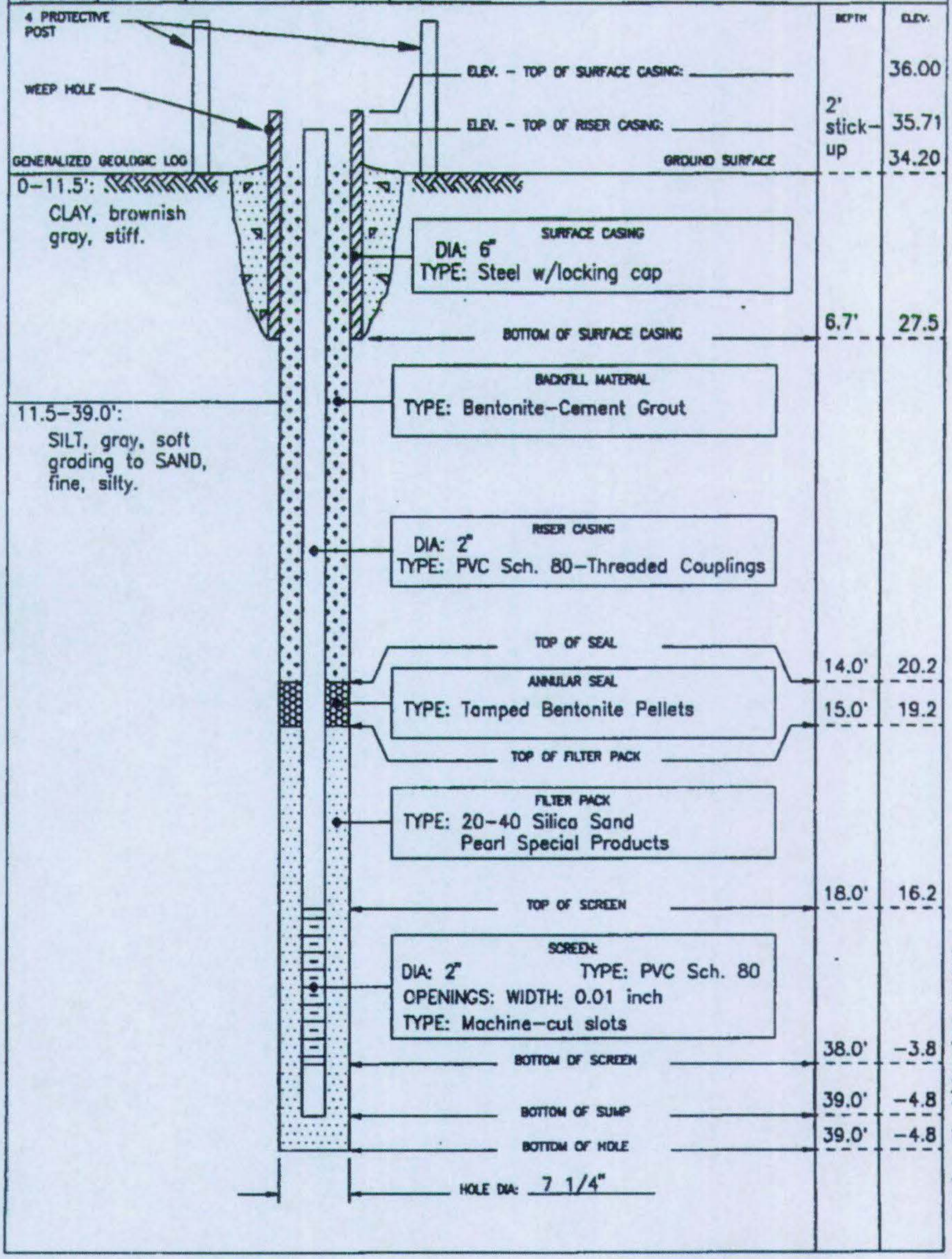
AutoCADD Drwg. NO.: D:\CAJUN\WELL85B.DWG

OBSERVATION WELL	PROJECT: CEPCO -- BIG CAJUN II		WELL NO.: 85C
JOB NO.: 14630	SITE: North Rainfall Pond	COORDINATES: E 9490, N 5167	
BEGUN: 6/20/85	COMPLETED: 6/20/85	PREPARED BY: D. R. Beissel	REFERENCE POINT FOR MEASUREMENTS: Top of PVC



OBSERVATION WELL

PROJECT	CEPCO – BIG CAJUN II	WELL NO.	85D
JOB NO. 14630	SITE South Rainfall Pond	COORDINATES	E 9210, N 3780
BEGUN 6/20/85	COMPLETED 6/20/85	PREPARED BY D. R. Beissel	REFERENCE POINT FOR MEASUREMENTS Top of PVC



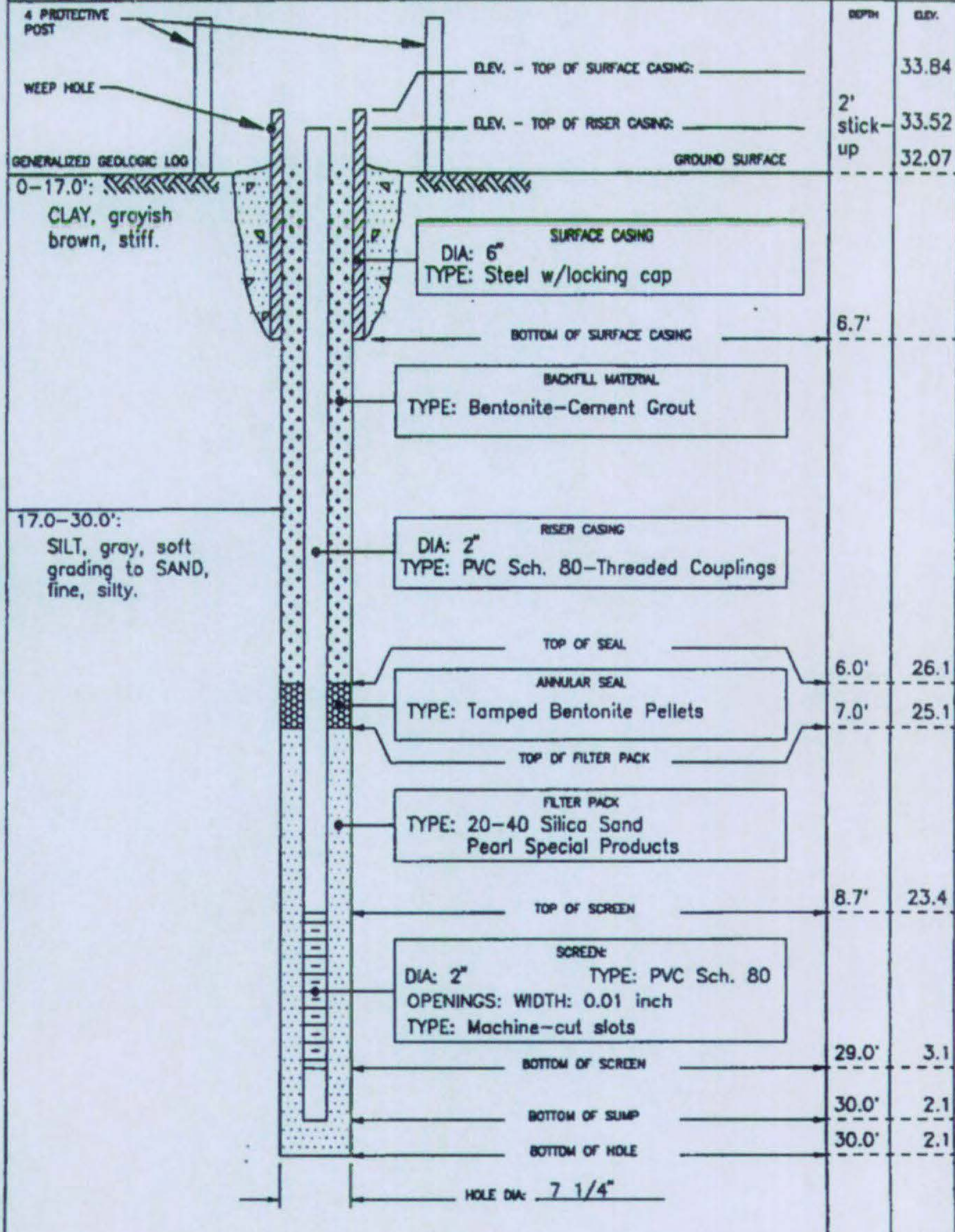
AutoCADD Dwg. NO.: D:\CAJUN\WELL85D.DWG

OBSERVATION WELL

PROJECT	WELL NO.
CEPCO - BIG CAJUN II	85E

JOB NO.	SITE	COORDINATES
14630	South Bottom Ash Pond	E 6550, N 3245

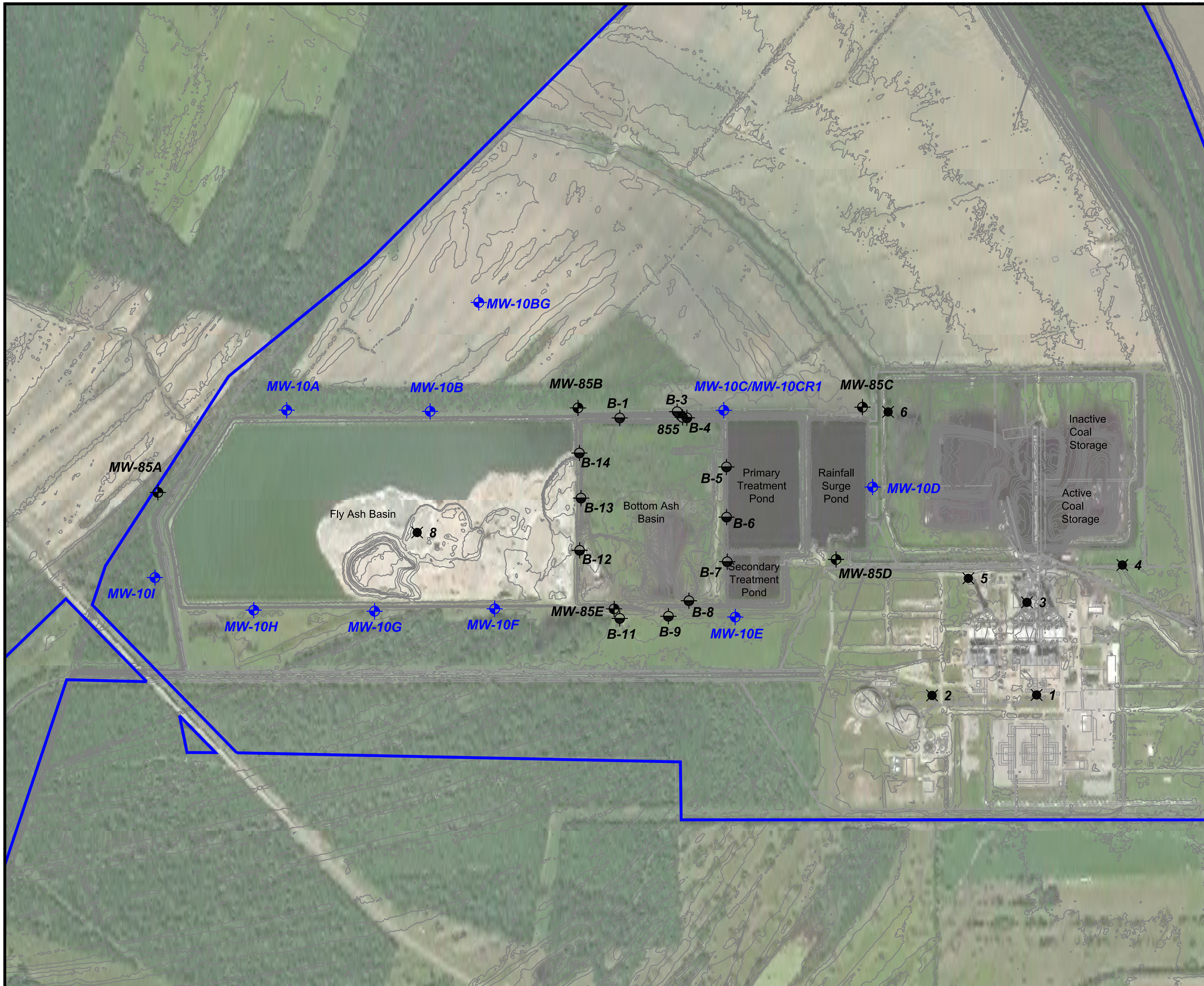
BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
6/19/85	6/19/85	D. R. Beissel	Top of PVC



AutoCADD Dwg. NO.: D:\CAJUN\WELL85E.DWG

APPENDIX C

SOIL BORING LOGS



Legend

MW-10CR1	Monitor Well - 2011
MW-85C	Monitor Well - 1985
6	Boring Log - 1974
B-3	Boring Log - 2005

Reference

Base map comprised of Big Maps aerial imagery from (c) 2019 Microsoft Corporation and its data suppliers.

Base map comprised of client provided drawing number 996-011-B018.

1,000 0 1,000

Scale: 1" = 1,000'

CLECO Cajun, LLC

Big Cajun II Power Plant

Soil Boring Location Map

Pointe Coupee Parish

Drawn:	JP
Checked:	RS
Approved:	RS
Date:	10/21/20
Dwg. No.:	367-20-0004-APP-C-1

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

Figure C-1

LOUIS J. CAPOZZOLI & ASSOCIATES, INC. Geotechnical Engineers

James M. Aronstein, Jr. P.E.
Charles L. Eustis, P.E.
David P. Sauls, P.E.

Louis J. Capozzoli, ScD, P.E.
Consultant

19 December 2005

Shaw Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809

Attention: Ms. Elif Chiasson, P.E., Project Manager

Re: Geotechnical Investigation
Bottom Ash Storage Pond Expansion
Big Cajun No. II
Pointe Coupee Parish, Louisiana
LJC&A File: 05-58

Gentlemen:

This report presents the geotechnical basis for expanding your existing bottom ash storage facility. Geotechnically based design particulars plus construction recommendations - stemming from analysis of both furnished/published data as well as field exploration and laboratory testing results - constitute the text. Supporting details including laboratory and field work phase specifics are presented in the enclosures. Under auspices of your 1 August 2005 authorization, this study was initiated per our 13 July 2005 *Geotechnical Investigation proposal*.

PROJECT DESCRIPTION

Facilities. The existing bottom ash pond is nominally 1950 feet by 1500 feet in plan dimension. The existing perimeter dike height is 18 feet and the planned vertical expansion will be to raise the dike height to 38 feet. This will add nominally 86,571,228 cubic feet of additional storage volume. The anticipated bottom ash load will be 5,265,035 tons. A variety of geotechnical engineering factors are required for this vertical expansion, primarily the slope stability of the surrounding levee system, both internal stability into the pond and external outside (levee slopes). Also the analysis of pond settlement due to the increased load of the bottom ash stacking operation will be required. These two factors will also contribute to the overall selection of alternatives to increase the levee height configuration.

Numerous soil borings were drilled by our firm for the original plant in this area under job number LJC&A File No. 74-30. The nature of our engagement under that commission was to provide field and laboratory data to in-house engineers for Cajun Electric. We do not have engineering analyses related to the original slope stability analysis and/or settlement computations in our files. Of the approximately 60 borings in the vicinity of the bottom ash pond, only 4 extend beyond the 10 foot depth. Four borings along the northwestern levee line, nominally along North 6000 between W4000 and N5300, extend to the 50 foot depth.

INVESTIGATION OBJECTIVES

The geotechnical investigations recently conducted were to:

1) Characterize the underlying stratigraphy of the bottom ash area to assess the viability of bottom ash expansion in the described location.

2) Recommend bottom ash embankment geometry, operational conduct, and earthwork construction procedures to insure surface and subsurface containment.

The remainder of this report's text presents geotechnical findings, conclusions and recommendations for accomplishing the above investigation goals.

SITE CONDITONS

Geology. Site formation characteristics for the bottom ash storage pond are related to an alluvial deposit of point bar origin. Point bar deposits flank the present river or abandoned courses of the river and normally occur on the insides of bends to which the sandy deposits accretes as the bends grow. Typically consisting of bedded top stratum of 25 to 75 foot thick layers of silty sands, sandy silts, and sand coarsening with depth. The substratum consists of essentially clean sand. The underlying Tertiary deposit is encountered at approximately 150 to 200 foot depth below original ground surface.

Surface. The existing ground surface of the bottom ash storage was originally near elevation 30 feet, National Geodetic Vertical Datum (NGVD). Existing containment levees were built up 18 feet to elevation 48 feet, NGVD. The new expansion plan would include increasing the height of the levees 38 feet high to elevation 68 feet, NGVD.

Subsurface. Subsurface profiles cut through the soil borings as shown by the plan on sheet 1 are also presented on sheet 1. For more details, see the soil profiles and individual boring logs. For this investigation, 14 borings were conducted ranging between 50 and 70 feet in depth.

The subsurface underlying the area of the existing bottom ash storage pond consists of 20 feet of very loose to loose clayey silt overlying alternate 5 foot strata of soft silty clay and firm to dense sand and silty sand to approximately the 40 foot depth. The strata are underlain by dense to very dense sand and gravel to the bottom of the explored boring depth at 70 foot depth.

Groundwater. The groundwater table is typically within 3 feet of the site surface, as indicated by water levels in area ditches. The groundwater table will rise to the ground surface during periods of rain or high river stage. Since the underlying granular soils are hydraulically connected to the Mississippi River, groundwater flow will be away from the river, west during high stages, and toward the river (east during normal and low stages).

GEOTECHNICAL ENGINEERING

Primary consideration for the expansion of existing bottom ash is overall slope geometry. Confinement is dependent on structural soundness as well - land slides, slope failures, etc. must be prevented.

Subsoil Strength. The in situ clays beneath the existing bottom ash storage have been subjected to surcharge loading over the last quarter century and have experienced the strength gain due to imposed stress regime. Native soil lying outside the levee embankment area is at the original native strength level and can be the governing factor for outward lateral slope stability. The additional stacking height of the bottom ash will create additional strength gains and imperviousness will improve with time as the overlying bottom ash weight squeezes out water from the soil pores. The site has the structural ability to support the selected bottom ash successfully as has been experienced previously.

Bottom Ash. For the purposes of this study, the bottom ash was assigned a granular internal friction angle with no internal cohesion value. We used bottom ash weights of 110 pcf total weight; 48 pcf submerged with an internal angle of friction of 30 degrees.

Slope Stability. Described in the attached appendix, *Embankment Integrity*, the slope factor of safety of sliding will vary with the height of bottom ash. Table 1, presents the specifics of the analysis. The computed factors of safety will increase with time as the foundation soils consolidate and strengthen.

The analyses of the increased ash storage stacking for the global slope stability considered a variety of conditions. Primary variables addressed can be grouped into the following factors:

- Perimeter embankment configuration
- Water level in the embankment/ash stack, and
- Soil strength parameters

In the consideration of various perimeter dike geometry, initial configuration of one large perimeter berm up to elevation 38 feet high was evaluated. The outside slope of this berm had a 3H:1V side slope. The interior face towards the bottom ash stack had a 2H:1V side slope. We evaluated the slope stability of the 3H:1V outward facing slope as well as the inward facing 2H:1V side slope. We then evaluated a 2 berm geometry configuration. The outside perimeter berm would be the existing 18 foot high embankment with a 38 foot high embankment built at the interior toe of this existing embankment. The side slopes of the new 38 foot high embankment would be 2H:1V. We also evaluated a 2 berm system using a 3H:1V outside slope for the 38 foot tall embankment and a 2H:1V interior side slopes. This geometry of 2 berms and 3H:1V exterior side slope was evaluated with the full 38 foot high ash stack interior load as well as a half embankment height (19 foot high ash stack on the interior) of ash.

We evaluated the water level for all of the geometry scenarios with both a horizontal water level surface equal to the existing ground water surface as well as a fully saturated groundwater equal to the embankment/ash stack height.

Soil strength conditions were evaluated using both the native soil strength determined from borings conducted from the native ground surface elevation. These soil strengths are lower than the soil strengths measured under the existing perimeter embankment and most certainly underneath the ash stack load. We also used a 25 percent increase in these native soil strengths to represent the shear strength increase as a result of the ash stack loading for slopes on the interior of the stack following consolidation. The 25 percent increase in soil strength was reflected of the soil conditions encountered underneath the existing 18 foot levee embankment. Soil strengths would increase with higher ash stack loads and earthen embankments.

Table 1 summarizes the 13 cases analyzed for the global slope stability analyses. The attached sheets 4 through 16 illustrate the individual analyses. The first five runs shown on sheets 4 through 8 address the analyses of 1 berm to 38 feet above existing ground surface. For exterior side slope of 3H:1V with an interior slope of 2H:1V for the fully saturated groundwater condition and the unimproved native soil strength, the global stability factor of safety is 1.22 (as shown on sheet 4). If there were a level water condition underneath the embankment and through the stack, the factor of safety would increase to 1.31. Sheet 6 shows a 2H:1V slope with the native soil strength and a factor of safety of 1.15 which would be inadequate. Sheet 8 shows a 2H:1V side slope if placed on the strength gain under ash load with level water condition would have a factor safety of 1.32.

Because of these relatively low factors of safety, we then addressed a 2 berm system with the interior berm to 38 foot height built inside of the existing 18 foot high embankment. We initially evaluated a 38 foot high interior berm with 2H:1V side slopes on both the exterior and interior faces. These factors of safety shown on sheets 9 through 12 likewise show low factors of safety. The approach using 2 berms with the interior berm to 38 foot height and the exterior face of this berm being built with a 3H:1V side slope and an interior face of 2H:1V produced suitable factors of safety even under extreme loadings of the full 38 foot ash stack height as well as fully saturated conditions. Sheet 15 shows the scenario with a fully saturated condition and no increase in native soil strength still provides a factor of safety of 1.24 for a 19 foot high ash stack. The soil strengths underneath the ash stack have increased beyond those measured under the perimeter and the factor of safety would be higher.

Subsoil Deformation. The stress/strain characteristics of these point bar deposits as well as the moduli for the more rigid silts and sands developed from detailed strength and deformation testing depicted in the field and laboratory appendix. The soils potential for settlement as load pressurized pure water is squeezed from the clay was measured via consolidation tests also included in the field and laboratory appendix.

The cohesive strata underlying the Bottom Ash Storage Pad site are susceptible to volume changes from net changes in stress applied at foundation level. Before construction, the foundation soils are, for practical purposes, in equilibrium under a state known as overburden pressure (the effective weight of the soil itself). Activities such as adding the weight of the new ash stack make positive changes in the applied stress that cause volume changes in the compressible strata, resulting in settlement at the foundation level. The net pressure (the positive change in applied stress) applied at foundation level is defined as the difference between the total applied pressure (gross pressure) and the previously existing overburden pressure at that level.

The movement responses associated with stress changes have both short term (elastic) and long term (consolidation/swell) components. The elastic movements occur almost immediately, while consolidation movements generally occur over many months or years. The compressible soils at this particular site include silt partings and seams that promote drainage and increase the rate of settlement (consolidation). In our analyses of settlement, short-term elastic movements have been discounted because the accuracy with which they can be estimated is usually within the range of error for our estimates of long-term consolidation movements, and because elastic settlements will occur rapidly at this site.

This Ash stack with all of its load cannot be wished into place. Therefore, movements caused by different loading sequences are computed separately and then combined. The first movements in the sequence are the result of excavation for construction of the embankment. The weight of the overburden removed is treated as a negative load (where downward loads and movements are considered positive). This condition produces an upward movement (heave) at foundation level. The next movements in the sequence are associated with the filling of the Ash pad, which generally results a net increase in load and a downward movement (settlement). This condition is modelled by applying the area load at appropriate depths and computing the associated settlement. Because the structure will produce a net increase in load in an excavation that has experienced some heave, the total "observable" movement that the foundation will experience will be the recompression of the heave that occurs during construction plus the settlement caused by the structural load.

We estimated long term heave and settlement of the foundation soil resulting from change sin stresses caused by applied loads using an in-house computer program. This program first computes net stress changes at selected locations and depths using Boussinesq theories of stress distribution. The program then uses soil compressibility parameters developed by applying one-dimensional consolidation theory to field and laboratory test results to evaluate the change in thickness of individual layers and compute the overall movement of the foundation level at selected locations.

Settlement analyses were performed for three major loading conditions. Consolidation settlement analysis for spread footings and drilled shaft foundation elements were performed for the following range of sustained column loads.

Feature	Description	Center Settlement, Feet	Edge Settlement, Feet
Perimeter Embankment	38 feet high	1½ - 2	1 - 1½
Ash stack	19 feet high	3 feet	1½ feet
Ash stack	38 feet high	6 feet	3 feet

A rectangular stack of uniform ash height will experience a dishing or tilting shape: perimeter will settle less than the center. This would amount to less than ¼ (center settlement) at the corners, less than ½ (center settlement) at the perimeter.

FACILITY DESIGN

A design of the new containment dikes for the bottom ash storage have been developed by Shaw Environmental & Infrastructure, Inc. The following paragraphs provide relevant geotechnical comments for these facilities.

Bottom Ash Plan. The footprint of the original bottom ash storage pond will be maintained and any additional expansion will be inside the existing levee system.

Impermeability. Based on previous borings in 1977 for the existing bottom ash storage facility documented the sites overall impervious nature. The increased loading from additional stacking of raising the height of the impounded bottom ash will further improve the impermeability of the underlying native subsurface soils.

Dikes. If interior interceptor dikes are set inside the existing levee system, dike construction can be of semi-compacted-non-organic clay. Semi-compaction is defined as a minimum of three passes per lift by the tracks of a D-6 or equivalent or larger bulldozer. Loose lift can be a maximum of 12 inches thick. The objective is to remove the air spaces, which will result in a relatively impervious clay layer.

Construction inspection should entail full time observation by a qualified soil technician who will also conduct field density testing and sample collection. Periodic samples collected will be subjected to Atterberg limit determinations for material classification.

Operation. The bottom ash stack should consider leveling out the existing deposition of bottom ash to provide a more uniform stress distribution. Obviously downslope geometry will result eventually from the discharge spout northward across the pond. This will likely result in the northern end perpetually being above the southern end of the bottom ash storage bed as is currently observed. While there are no specific geotechnical integrity requirements, operation to maintain a somewhat uniform surface loading would seem prudent.

Monitoring. With the overall slope stability in a stable analyzed condition, it would not appear warranted to install inclinometers to read lateral deformations for containment embankments. However, they can be used for documenting performance.

Site Suitability. The previous work at the bottom ash storage facility has proven adequate to meet the current and anticipated regulations of the State of Louisiana. The new bottom ash storage expansion will likewise provide geotechnical requirements for permitting agencies. The site as planned and geometry is suitable for bottom ash expansion.

Very truly yours,

Louis J. Capozzoli & Associates, Inc.

David P. Sauls

DPS/cc

Enclosures: Appendix A, Field and Laboratory Analyses
Appendix B, Embankment Integrity
Sheet 1, Site Location
Sheet 2, Site Vicinity
Sheet 3, Site Plan and Subsurface Profile
Table 1, Global Stability Analyses Summary
Sheets 4 through 16, Individual Stability Cases

FIELD AND LABORATORY ANALYSES

As-executed particulars of the site-specific reconnaissance, field exploration, and laboratory testing program performed by us to support this project are discussed below. Bases for such work was several telephone conversations, our 13 July 2005 *Geotechnical Investigation* proposal letter, and the *Shaw Environmental, Inc. Work Agreement, Attachment 12.3.1B.*

Site Reconnaissance. On 12 August 2005, our chief engineer and driller made a site reconnaissance prior to beginning the field exploration phase of our work. The purpose of the visit was to determine borehole accessibility and coordinate drilling activities. On 16 August 2005, our Engineer Assistant and Chief Driller staked borehole locations at site.

Field Exploration. Fourteen soil sample borings - ranging from 50 to 70 feet in depth - were site-specifically performed by our drill crew utilizing our all-terrain vehicle-mounted rotary washbore drilling equipment between 22 August and 1 September 2005. Borehole positioning was by our field crew. Your personnel assisted in locating underground utilities. Relatively hard soil conditions produced adequate traction for our highway type vehicles throughout the entire site. Approximate as-drilled borehole locations are graphically depicted on the *sheet 3* enclosure.

Full depth advancement of the 4 inch nominal diameter borings was via rotary washbore methodology applicable to non-lithified (non-rock) earth materials. Borehole footage was measured from ground level. The holes were terminated upon penetrating to a predetermined depth. Such a drilling extent resulted in exploration of stratification relevant to bottom ash storage pond expansion foundation design/construction. Surface casing requirements/drilling mud usages were commensurate with what would normally be expected of the inplace stratification - i.e. abnormally high volumes of mud and extensive casing were not necessary for drill-hole maintenance. Immediately upon completion, the borings were sealed as per statutory requirements. Prior to departure, our crew performed a thorough clean-up of each drill site.

Borehole sampling was conducted in accordance with applicable ASTM specifications. High quality undisturbed cohesive (clay) specimens - suitable for laboratory strength testing - were obtained using a 30 inch long, 3.0 inch O.D. tube system. The sampler was hydraulically pushed into the ground a distance not exceeding 24 inches per specimen. Cohesive/semi-cohesive/cohesionless soils were also sampled via the Standard Penetration Test (SPT). This consists of driving a 24 inch long, 2 inch O.D. splitspoon sampler with blows from a 140 pound hammer falling 30 inches per blow. The penetration resistance (N) is the number of blows required to drive the sampler 12 inches after first seating it for 6 inches. Sampling frequency of each boring was on 5 foot and 10 foot centers to borehole termination, except borings 3, 9, and 11 which were sampled continuously in the top 10 feet.

Tabularized field work particulars are:

Boring Number	Total Depth (Feet)	Sampling: Continuous (Feet)	Sampling: On 5 Ft. Centers (Feet)	Sampling: On 10 Ft. Centers (Feet)	Sampling: Below 50 Ft. (Feet)	Grout Plug Depth (Feet)
1	70	–	70	–	20	70
3	50	10	40	–	–	50
4	70	–	40	30	20	70
5	70	–	50	20	20	70
6	55	–	55	–	5	55
7	70	–	40	30	20	70
8	55	–	55	–	5	55

Boring Number	Total Depth (Feet)	Sampling				Grout Plug Depth (Feet)
		Continuous (Feet)	On 5 Ft. Centers (Feet)	On 10 Ft. Centers (Feet)	Below 50 Ft. (Feet)	
9	50	10	40	–	–	50
11	50	10	40	–	–	50
12	70	–	70	–	20	50
13	50	–	40	10	–	50
14	60	–	60	–	10	60
Totals	720	30	600	90	120	720

Detailed boring logs are a part of this appendix. The resultant subsurface profile is portrayed by the *sheet* 3 enclosure.

<u>Laboratory Testing.</u> Immediately upon recovery; each sample was removed from its' sampling device, field classified by our technician, and then prepared for transport to our Baton Rouge laboratory. There; the undisturbed specimens and testable SPT plugs were lab classified plus subjected to strength and unit weight/moisture content determinations. In sum, laboratory efforts encompassed: 69 unconfined and 14 unconsolidated, drained/undrained triaxial compression tests (each with a unit weight/moisture content determination); 65 dry sieve analyses; 6 moisture content determinations, 6 consolidation tests with rebound, plus 26 Atterberg limit determinations. As per the borehole sampling techniques, all laboratory procedures conformed to appropriate ASTM standards. Detailed test results are presented by the tables, sheets, and figures attached to this appendix.

Compression testing yielded soil shear strength values. Unit weight/moisture content, Atterberg limit, and sieve data provided earth material identification plus produced more precise material classifications than obtainable through field methods. Deformation under load data was obtained from consolidation tests. Taken together, results of all laboratory evaluations were used to delineate the in situ stratigraphy's origins as well as its' relationship to the bottom ash storage pond expansion foundation design/construction.

Attachments: Tables 1 through 5, Laboratory Data
Figures 1 through 65, Grain Size Curves
Figures 66 through 71, Consolidation Test Curves
Log of Borings 1 through 14

BOTTOM ASH STORAGE POND EXPANSION

LABORATORY DATA

TABLE 1

FILE NO: 05-58

BORING NUMBER	DEPTH FEET	MOISTURE %	UNIT WEIGHT WET PCF	UNIT WEIGHT DRY PCF	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	COMPRESSION TEST TSF	COMPRESSION TEST % STRAIN	COMPRESSION TEST START PRESSURE KSF	COMPRESSION TEST TYPE FAILURE	TEST TYPE
1	0.0 - 2.0											Dry Sieve
1	3.0 - 5.0	22	118.3	96.9				1.60	6		Multiple Shear	U
1	8.0 - 10.0	30	122.7	94.2	60	24	36	2.76	10		Multiple Shear	U
1	13.0 - 15.0	26	122.5	97.4				1.37	15		Yield	U
1	18.0 - 20.0	28	122.3	95.4				1.92	15		Yield	U
1	23.0 - 25.0	34	120.5	90.0				0.49	15		Yield	U
1	28.0 - 30.0	30	119.6	92.1				0.93	4	1.68	Bulge	QD
1	33.0 - 35.0	34	121.0	90.2	43	23	20	0.45	15		Yield	U
1	38.5 - 40.0											Dry Sieve
1	43.5 - 45.0											Dry Sieve
1	48.5 - 50.0											Dry Sieve
1	53.5 - 55.0											Dry Sieve
1	58.5 - 60.0											Dry Sieve
1	63.5 - 65.0											Dry Sieve
1	68.5 - 70.0											Dry Sieve
3	0.0 - 2.0	22	124.5	102.4				5.65	4		Multiple Shear	U
3	2.0 - 4.0	20	122.1	101.9				3.47	10		Multiple Shear	U
3	4.0 - 6.0	18	122.2	103.2				2.34	8		Multiple Shear	U
3	6.0 - 8.0	28	118.0	92.5				0.42	10		Multiple Shear	U
3	8.0 - 10.0	26	118.0	93.8				0.33	10	.52	Multiple Shear	QD
3	13.0 - 15.0	31			27	24	3					MC
3	13.0 - 15.0											Dry Sieve
3	15.5 - 17.0											Dry Sieve
3	20.5 - 22.0											Dry Sieve
3	23.5 - 25.0											Dry Sieve
3	28.5 - 30.0											Dry Sieve
3	33.5 - 35.0											Dry Sieve
3	38.5 - 40.0											Dry Sieve
3	43.5 - 45.0											Dry Sieve
3	48.5 - 50.0											Dry Sieve
4	0.0 - 2.0	13										MC
4	3.0 - 5.0	23	123.2	100.1				5.84	7		Multiple Shear	U
4	8.0 - 10.0	22	125.1	102.1	46	20	26	1.78	12		Multiple Shear	U
4	13.0 - 15.0	31	126.8	97.2				2.31	12		Multiple Shear	U
4	18.0 - 20.0	31	120.4	92.0				1.48	11		Multiple Shear	U
4	23.0 - 25.0	34	120.1	89.5				1.53	14		Multiple Shear	U

BOTTOM ASH STORAGE POND EXPANSION

LABORATORY DATA TABLE 2 FILE NO: 05-58

BORING NUMBER	DEPTH FEET		MOISTURE %	UNIT WEIGHT		ATTERBERG LIMITS			COMPRESSION TEST				TEST TYPE
				WET PCF	DRY PCF	LL	PL	PI	TSF	% STRAIN	START PRESSURE KSF	TYPE FAILURE	
4	28.0 -	30.0	36	118.9	87.1	36	21	15	0.21	15		Yield	U
4	33.0 -	35.0	36	116.3	85.6				0.32	15		Yield	U
4	38.0 -	40.0	35	120.7	89.5	28	21	7	0.71	12	2.26	Bulge	QD
4	40.5 -	42.0											Dry Sieve
4	48.5 -	50.0											Dry Sieve
4	58.5 -	60.0											Dry Sieve
4	68.5 -	70.0											Dry Sieve
5	0.0 -	2.0	17	118.9	101.8				3.39	8		Multiple Shear	U
5	3.0 -	5.0	17	120.4	103.3				2.13	5		Multiple Shear	U
5	8.0 -	10.0	30	118.6	91.5				1.83	15		Yield	U
5	13.0 -	15.0	31	115.8	88.3				1.25	15		Yield	U
5	18.0 -	20.0	29	116.8	90.3	48	24	24	0.72	15		Yield	U
5	23.0 -	25.0	32	117.2	89.0				0.62	15		Yield	U
5	28.0 -	30.0	33	116.5	87.8				0.16	5	1.68	Bulge	QD
5	33.0 -	35.0	33	117.6	88.3	32	18	14	0.44	14	1.97	Bulge	QD
5	38.0 -	40.0	33	119.2	89.5				0.58	13	2.26	Bulge	QD
5	43.0 -	45.0	42	117.4	82.7	45	22	23	0.55	15		Yield	U
5	48.5 -	50.0											Dry Sieve
5	58.5 -	60.0											Dry Sieve
5	68.5 -	70.0											Dry Sieve
6	3.0 -	5.0	18	120.6	102.5	48	25	23	5.18	6		Multiple Shear	U
6	8.0 -	10.0	30	122.4	93.8				1.95	14		Multiple Shear	U
6	13.0 -	15.0	31	121.8	92.7				1.53	15		Yield	U
6	18.0 -	20.0	34	117.4	87.4				1.46	13		Multiple Shear	U
6	23.0 -	25.0	33	117.4	88.2	74	26	48	1.13	14		Multiple Shear	U
6	28.0 -	30.0	35	122.1	90.6				0.17	13		Multiple Shear	U
6	33.0 -	35.0	31	119.4	91.3				0.58	15	1.97	Yield	QD
6	40.5 -	42.0											Dry Sieve
6	43.5 -	45.0											Dry Sieve
6	48.5 -	50.0											Dry Sieve
6	53.5 -	55.0											Dry Sieve
7	3.0 -	5.0	19	128.1	107.7				4.36	9		Multiple Shear	U
7	8.0 -	10.0	23	129.7	105.5				2.36	15		Yield	U
7	13.0 -	15.0	23	125.4	101.8	57	24	33	1.79	8		Multiple Shear	U
7	18.0 -	20.0	33	119.0	89.6				1.73	11		Multiple Shear	U
7	23.0 -	25.0	33	59.7	44.9				0.60	3		Multiple Shear	U

BOTTOM ASH STORAGE POND EXPANSION

LABORATORY DATA

TABLE 3

FILE NO: 05-58

BORING NUMBER	DEPTH FEET	MOISTURE %	UNIT WEIGHT WET PCF	UNIT WEIGHT DRY PCF	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	COMPRESSION TEST TSF	COMPRESSION TEST % STRAIN	COMPRESSION TEST START PRESSURE KSF	TYPE FAILURE	TEST TYPE
7	28.0 - 30.0	36	117.9	87.0	55	24	31	0.69	11		Multiple Shear	U
7	33.0 - 35.0	35	113.9	84.2				0.41	8	1.97	Bulge	QD
7	40.5 - 42.0	34										MC
7	48.0 - 50.0	37	117.5	85.9				0.86	12		Multiple Shear	U
7	60.5 - 62.0											Dry Sieve
7	68.5 - 70.0											Dry Sieve
8	3.0 - 5.0	20										MC
8	8.0 - 10.0	32	123.2	93.4	44	18	26	1.35	11		Multiple Shear	U
8	13.0 - 15.0	41	110.0	78.0				1.25	15		Yield	U
8	18.0 - 20.0	35	114.3	84.6				1.26	15		Yield	U
8	23.0 - 25.0	34	117.9	87.7	31	18	13	0.44	9		Multiple Shear	U
8	28.0 - 30.0	32	119.1	90.0				0.29	7	1.68	Bulge	QD
8	33.0 - 35.0	36	106.2	78.4				0.97	10	1.97	Bulge	QD
8	38.0 - 40.0											Dry Sieve
8	40.5 - 42.0											Dry Sieve
8	43.5 - 45.0											Dry Sieve
8	48.5 - 50.0											Dry Sieve
8	53.5 - 55.0											Dry Sieve
9	0.0 - 2.0	9										MC
9	2.0 - 4.0	24	117.7	95.2				2.07	6		Multiple Shear	U
9	4.0 - 6.0	19	119.1	100.0				1.47	14		Multiple Shear	U
9	6.0 - 8.0	23	126.4	102.4				0.71	6		Multiple Shear	U
9	8.0 - 10.0	24	116.1	93.8	35	18	17	1.08	14		Multiple Shear	U
9	13.0 - 15.0	31	124.9	95.0	26	25	1	0.25	5	.82	Bulge	QD
9	20.5 - 22.0											Dry Sieve
9	23.5 - 25.0											Dry Sieve
9	30.5 - 32.0											Dry Sieve
9	33.5 - 35.0											Dry Sieve
9	38.5 - 40.0											Dry Sieve
9	43.5 - 45.0											Dry Sieve
9	48.5 - 50.0											Dry Sieve
11	0.0 - 2.0	25	118.1	94.6				4.43	5		Multiple Shear	U
11	2.0 - 4.0	24	120.7	97.7	75	22	53	5.12	5		Multiple Shear	U
11	4.0 - 6.0	26	119.2	94.7				2.38	10		Multiple Shear	U
11	6.0 - 8.0	29	112.4	86.9				0.54	10		Multiple Shear	U
11	8.0 - 10.0	38	112.4	81.6				0.93	13		Multiple Shear	U

BOTTOM ASH STORAGE POND EXPANSION

LABORATORY DATA

TABLE 4

FILE NO: 05-58

BORING NUMBER	DEPTH FEET		MOISTURE %	UNIT WEIGHT		ATTERBERG LIMITS			COMPRESSION TEST				TEST TYPE
				WET PCF	DRY PCF	LL	PL	PI	TSF	% STRAIN	START PRESSURE KSF	TYPE FAILURE	
11	13.0 -	15.0	45	110.2	76.1	102	32	70	0.80	6		SLS (45 Degrees)	U
11	18.0 -	20.0	28	115.1	89.7				0.18	5	1.09	Bulge	QD
11	25.5 -	27.0											Dry Sieve
11	28.5 -	30.0											Dry Sieve
11	33.5 -	35.0											Dry Sieve
11	38.5 -	40.0											Dry Sieve
11	43.5 -	45.0											Dry Sieve
11	48.5 -	50.0											Dry Sieve
12	3.0 -	5.0	19	130.2	109.6				2.16	6		Multiple Shear	U
12	8.0 -	10.0	30	119.2	91.6	54	18	36	1.10	9		Multiple Shear	U
12	13.0 -	15.0	33	119.1	89.6				1.42	15		Yield	U
12	18.0 -	20.0	33	116.5	87.8				1.13	5		Multiple Shear	U
12	23.0 -	25.0	32	108.8	82.2	34	20	14	0.38	15		Yield	U
12	28.0 -	30.0	32	118.9	90.0				0.31	15		Yield	U
12	35.5 -	37.0											Dry Sieve
12	38.5 -	40.0											Dry Sieve
12	43.5 -	45.0											Dry Sieve
12	48.5 -	50.0											Dry Sieve
12	53.5 -	55.0											Dry Sieve
12	58.5 -	60.0											Dry Sieve
12	63.5 -	65.0											Dry Sieve
12	68.5 -	70.0											Dry Sieve
13	0.0 -	2.0											Dry Sieve
13	3.0 -	5.0											Dry Sieve
13	8.0 -	10.0	14	115.5	101.3				1.16	6		Multiple Shear	U
13	13.0 -	15.0	30	119.4	91.9				1.50	15		Multiple Shear	U
13	18.0 -	20.0	37	116.9	85.5				1.40	8		Multiple Shear	U
13	23.0 -	25.0	39	114.3	82.2				0.92	7		Multiple Shear	U
13	28.0 -	30.0	36	115.8	84.9				0.84	15		Multiple Shear	U
13	33.0 -	35.0	30	120.6	92.6	30	18	12	0.64	8	1.97	Bulge	QD
13	40.5 -	42.0											Dry Sieve
13	48.5 -	50.0											Dry Sieve
14	3.0 -	5.0	15										MC
14	8.0 -	10.0	29	117.8	91.3	78	27	51	1.27	13		Multiple Shear	U
14	13.0 -	15.0	32	118.2	89.8				0.85	15		Yield	U
14	18.0 -	20.0	26	130.3	103.2	61	22	39	2.13	6		Multiple Shear	U

BOTTOM ASH STORAGE POND EXPANSION

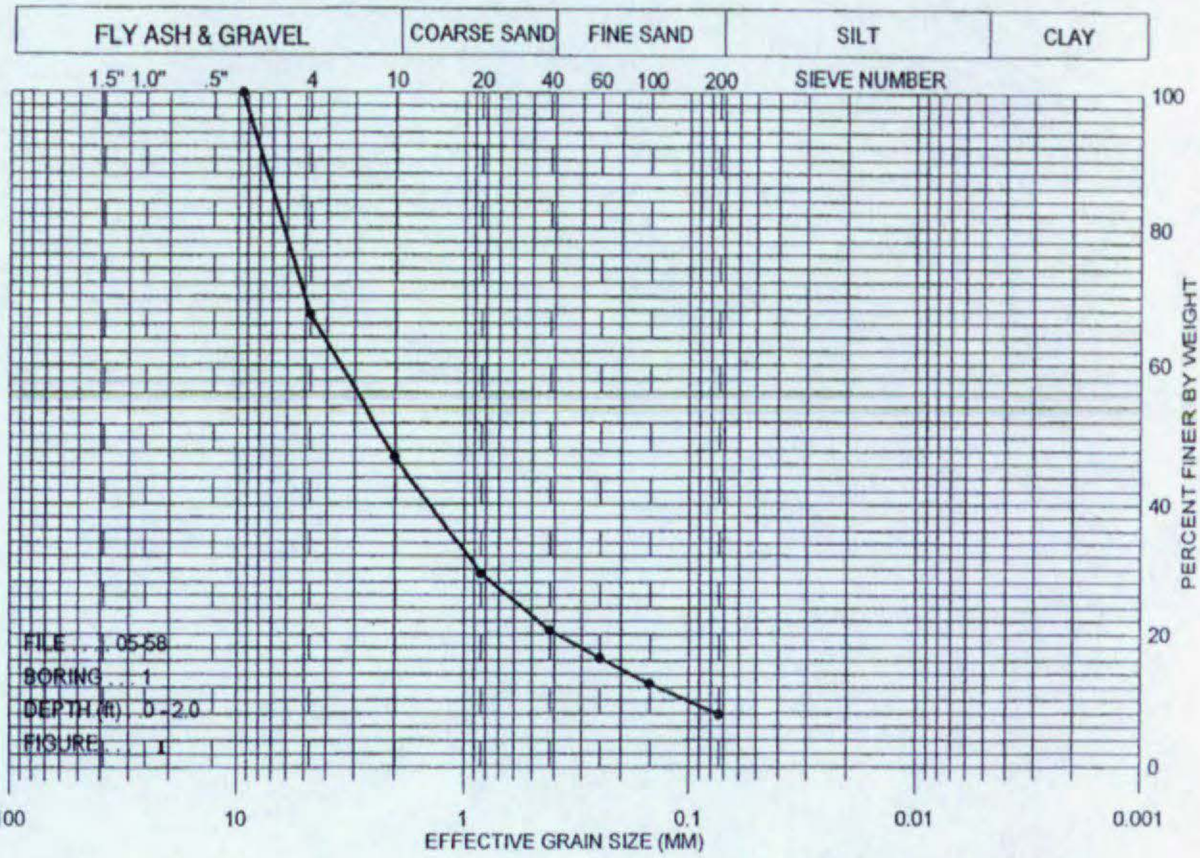
LABORATORY DATA

TABLE 5

FILE NO: 05-58

BORING NUMBER	DEPTH FEET		MOISTURE %	UNIT WEIGHT		ATTERBERG LIMITS			COMPRESSION TEST				
				WET PCF	DRY PCF	LL	PL	PI	TSF	% STRAIN	START PRESSURE KSF	TYPE FAILURE	TEST TYPE
14	23.0 -	25.0	25	120.4	96.2				1.09	15		Yield	U
14	28.0 -	30.0	36	119.2	87.8	32	20	12	0.27	8		Bulge	U
14	33.0 -	35.0	30	118.9	91.5	29	18	11	0.44	5		Bulge	U
14	38.5 -	40.0											Dry Sieve
14	43.0 -	45.0	26	120.4	95.2				0.41	7	2.56	Bulge	QD
14	45.5 -	47.0											Dry Sieve
14	48.5 -	50.0											Dry Sieve
14	53.5 -	55.0											Dry Sieve
14	58.5 -	60.0											Dry Sieve

GRAIN SIZE CURVE



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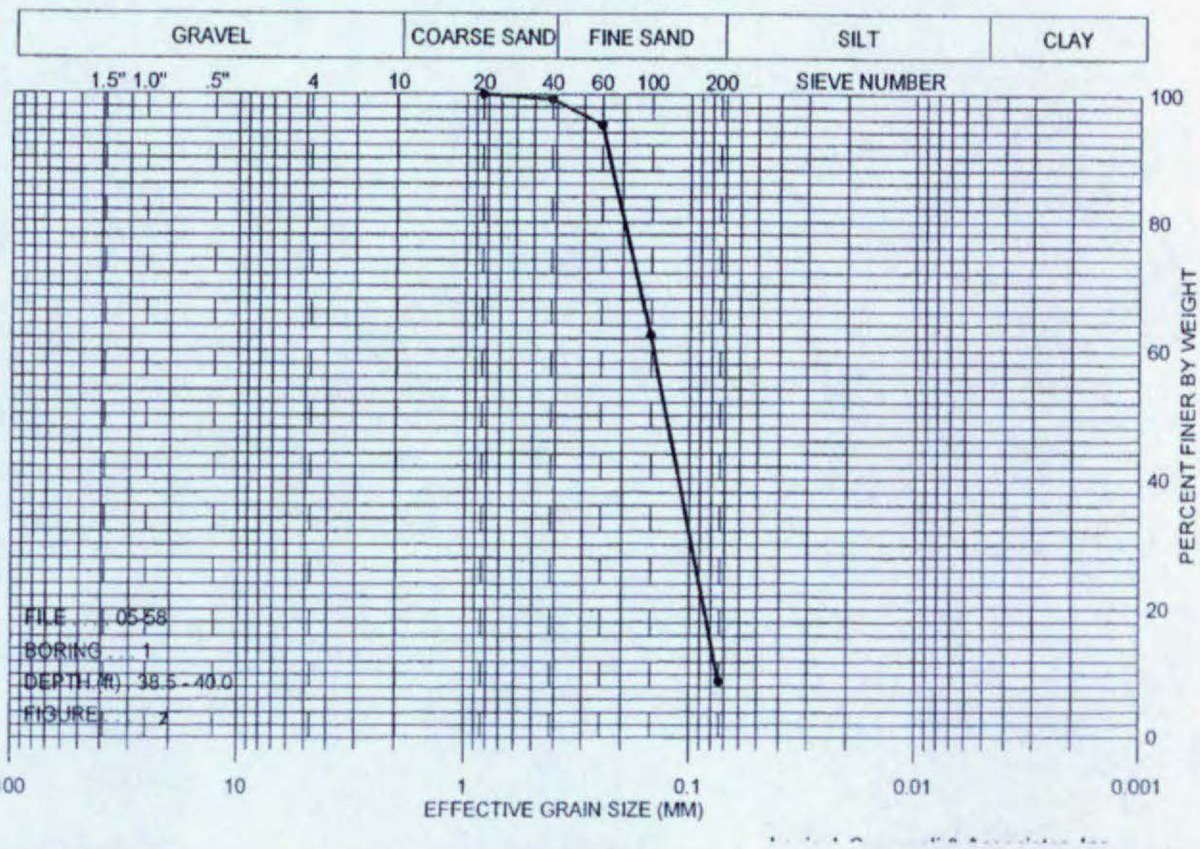

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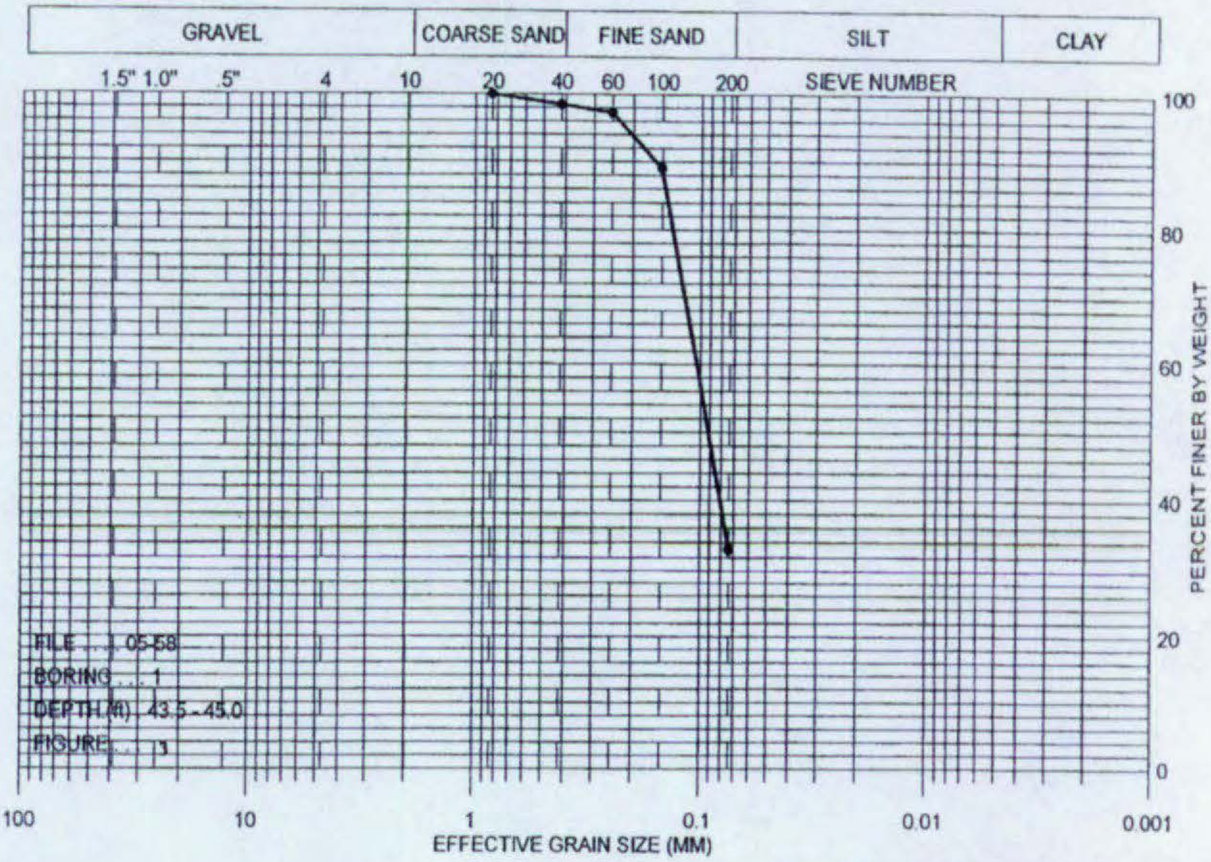

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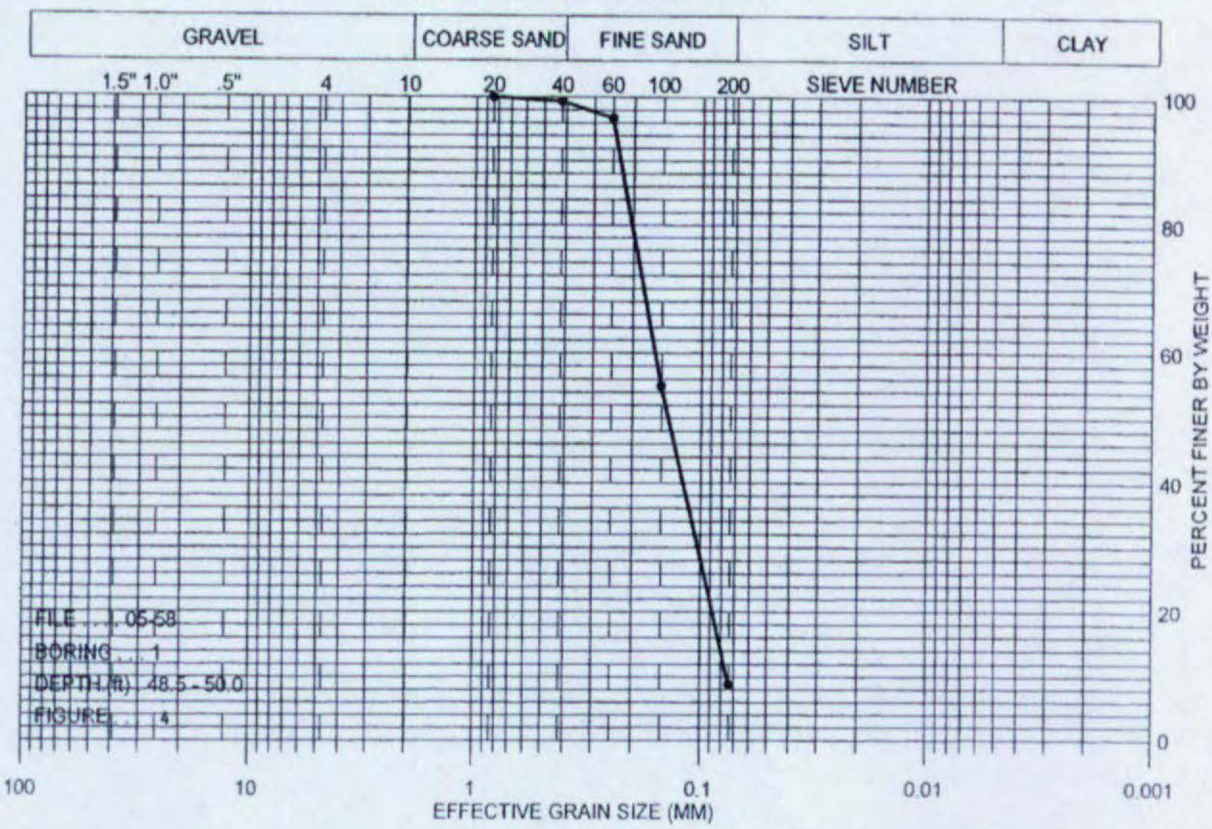

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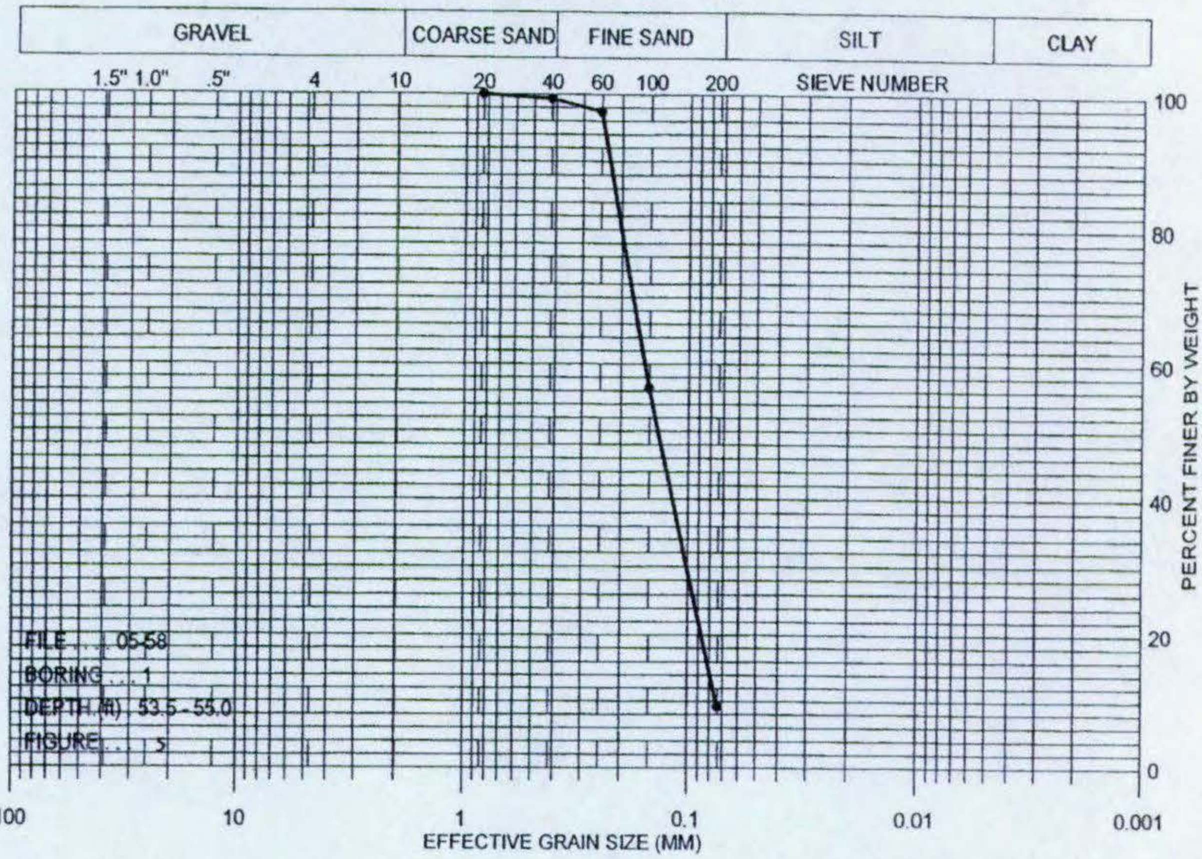

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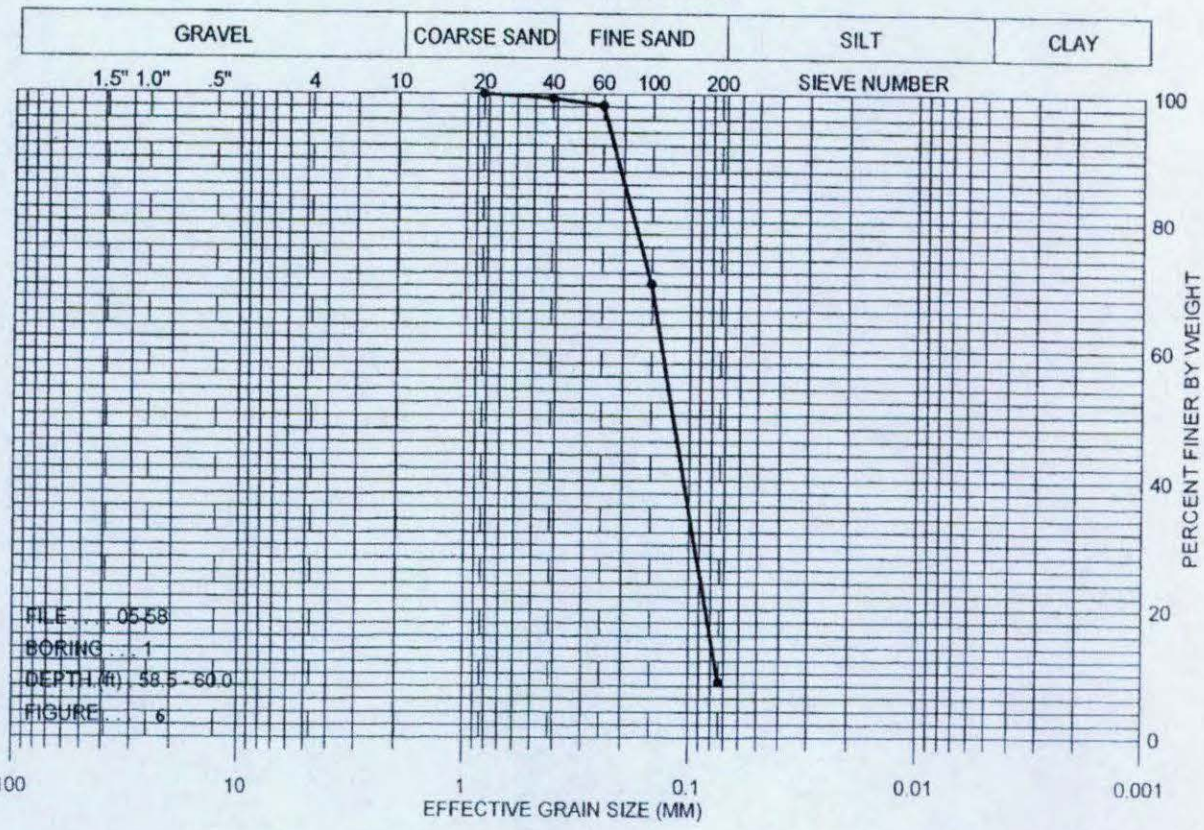

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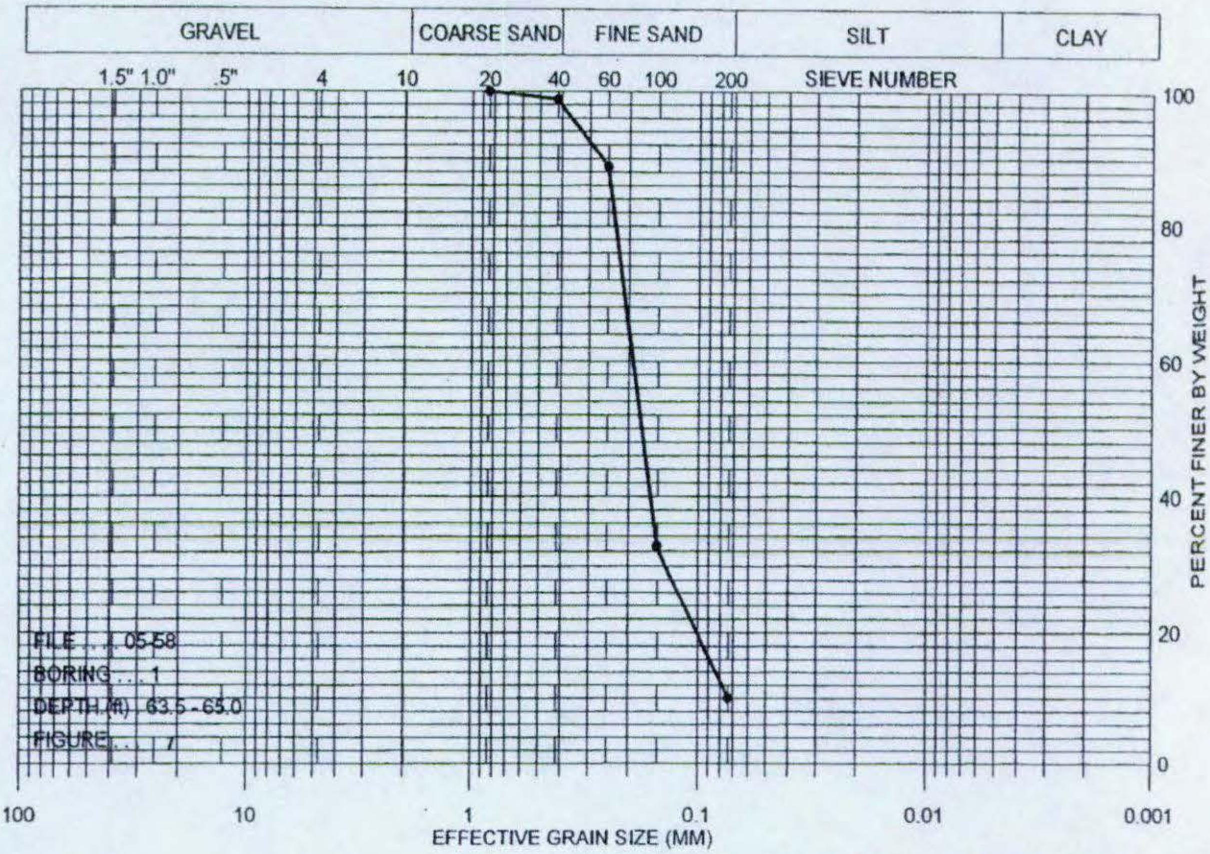

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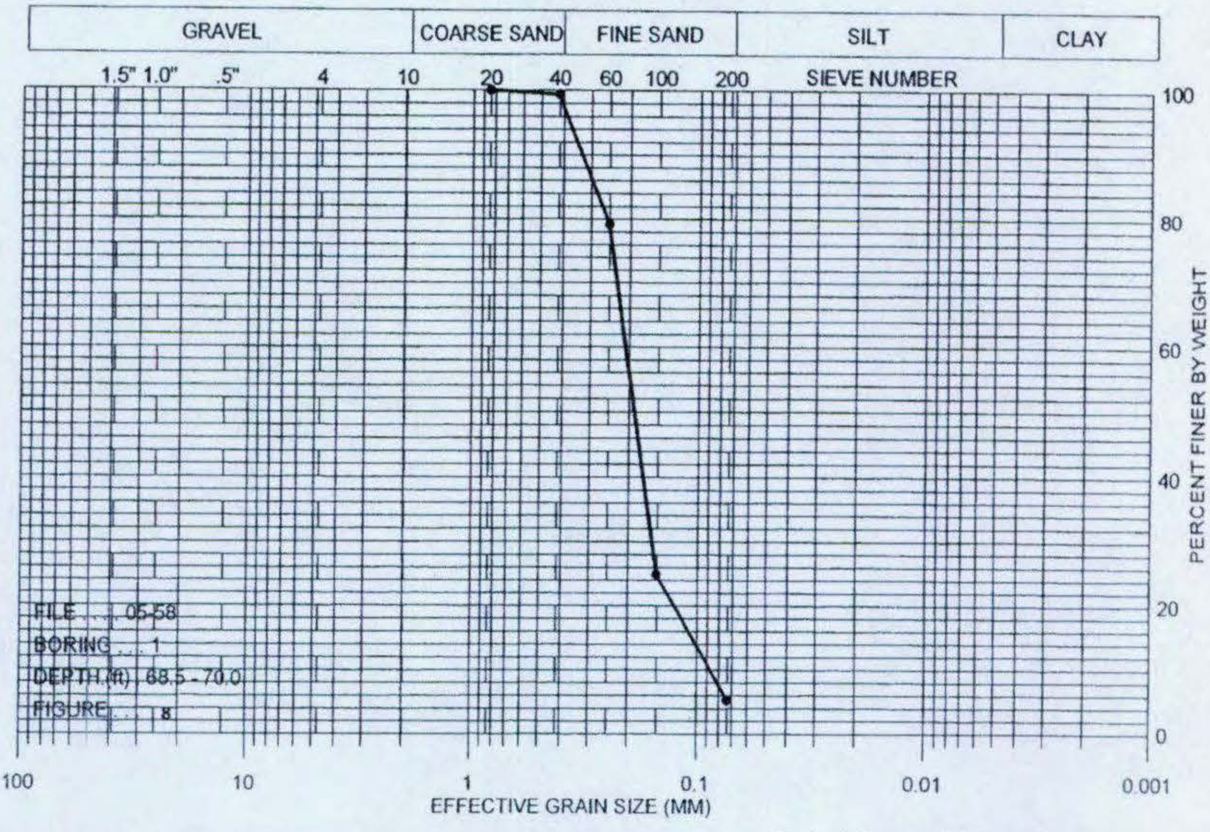

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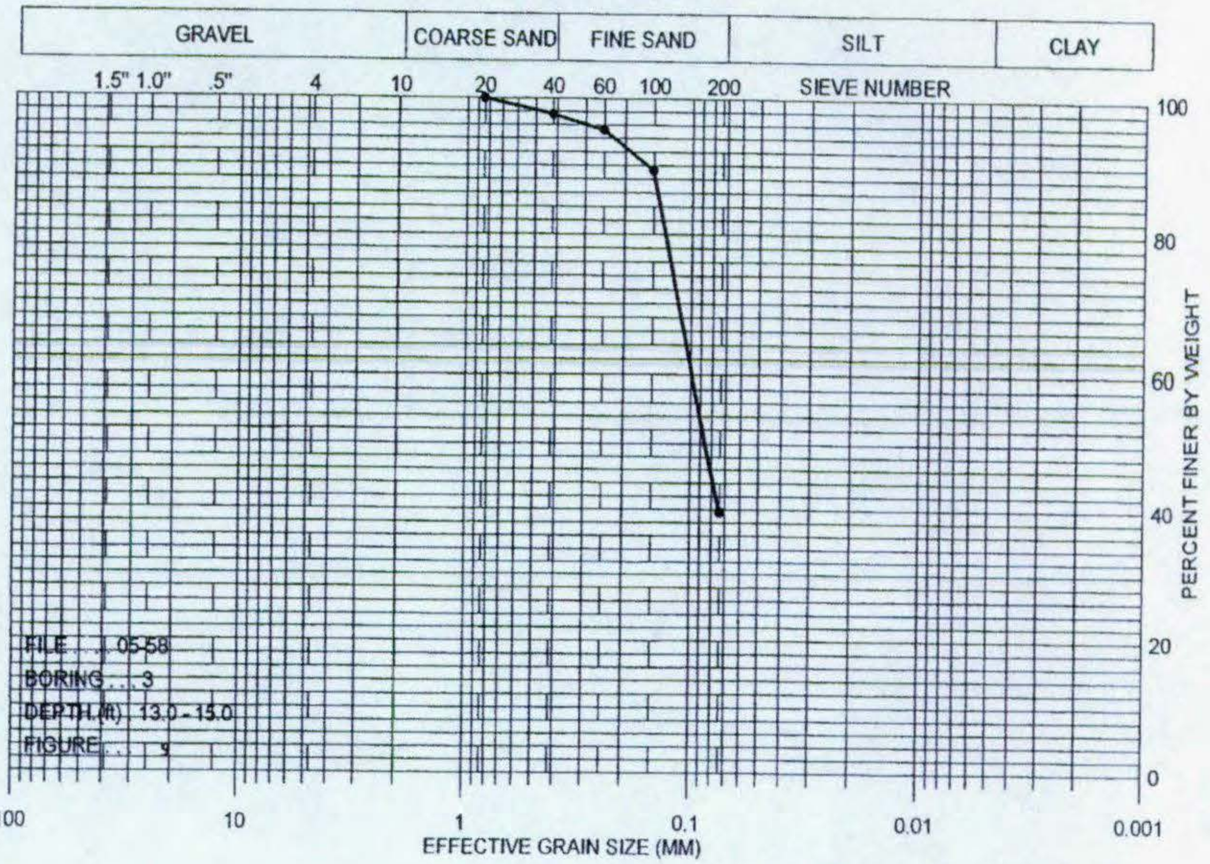

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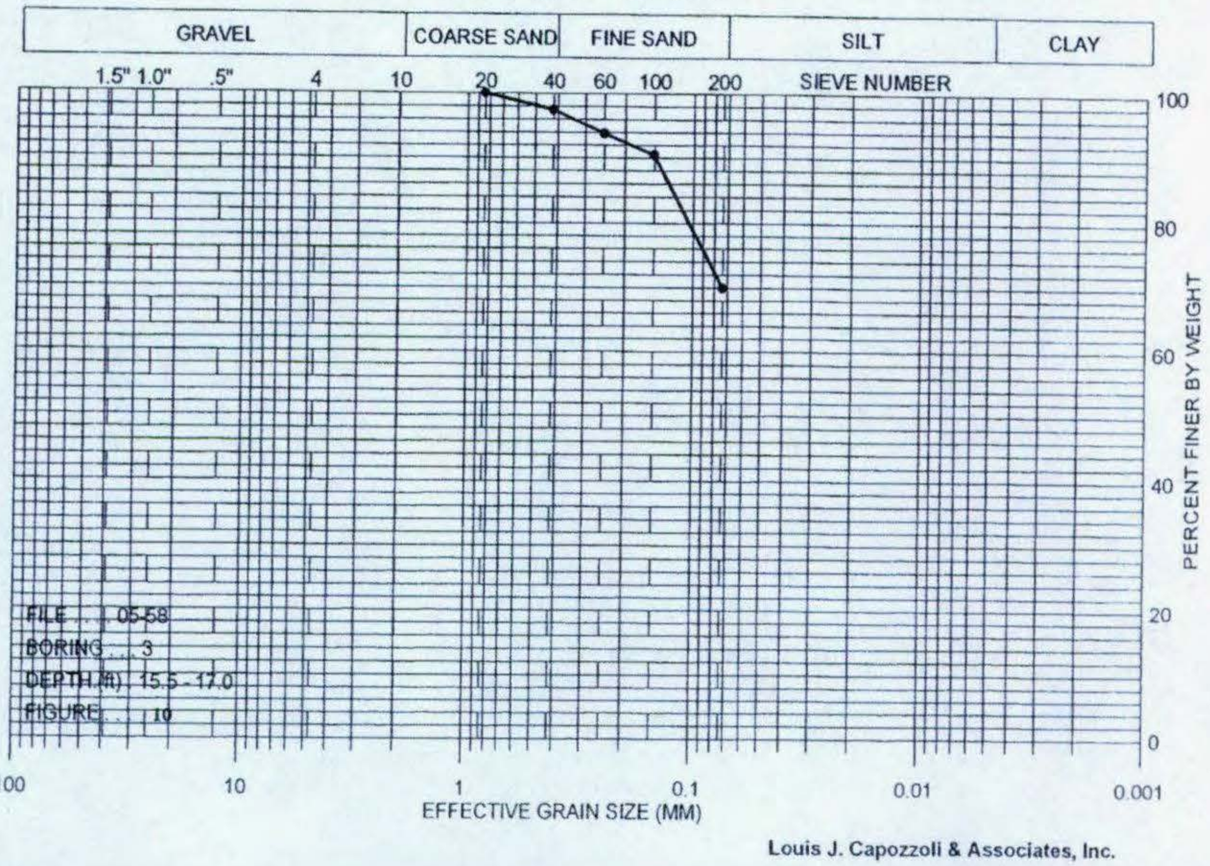

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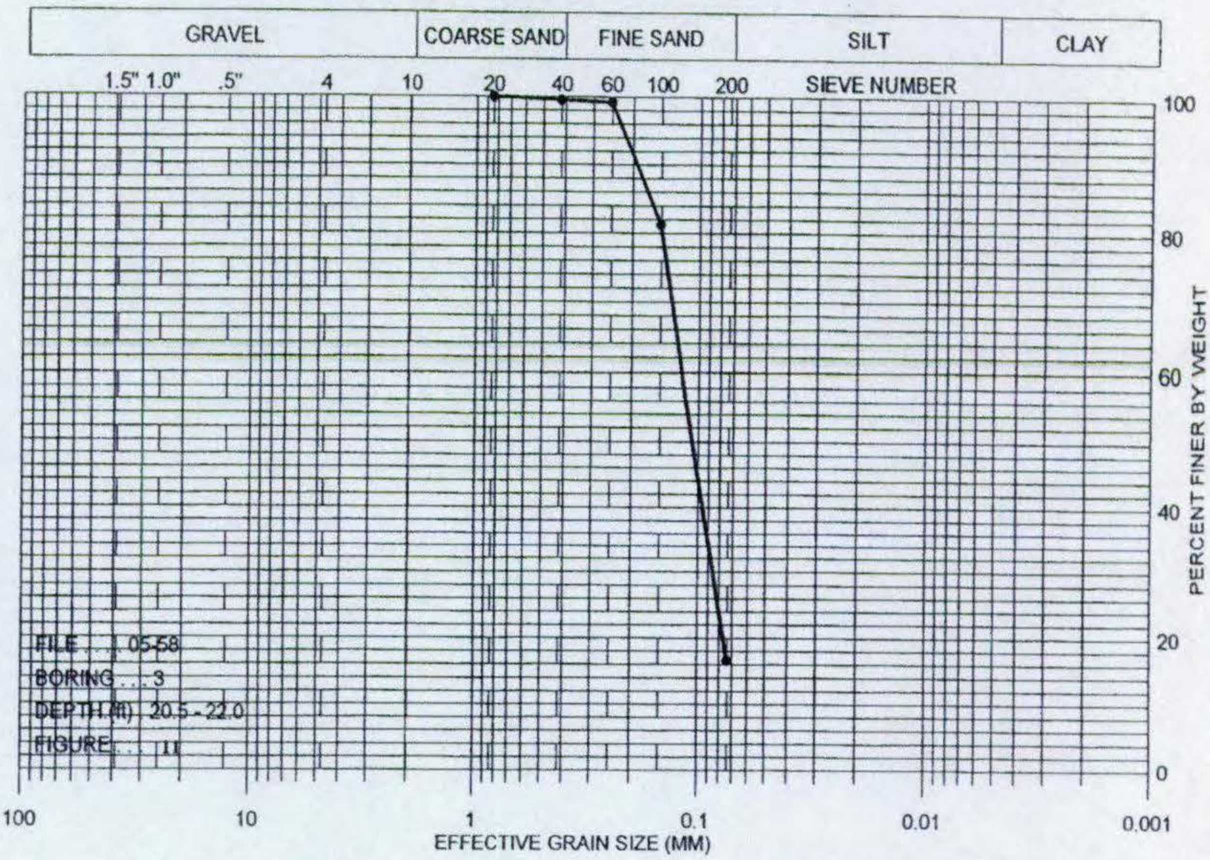

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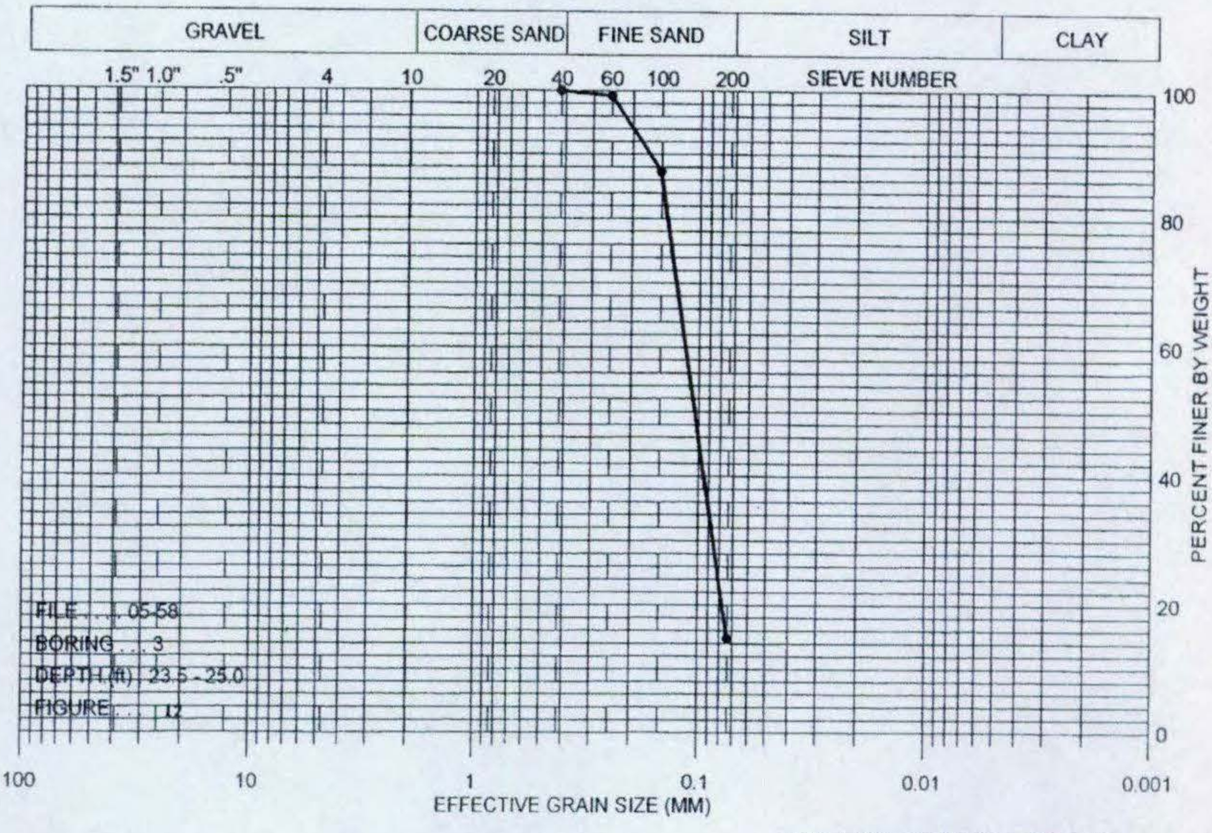

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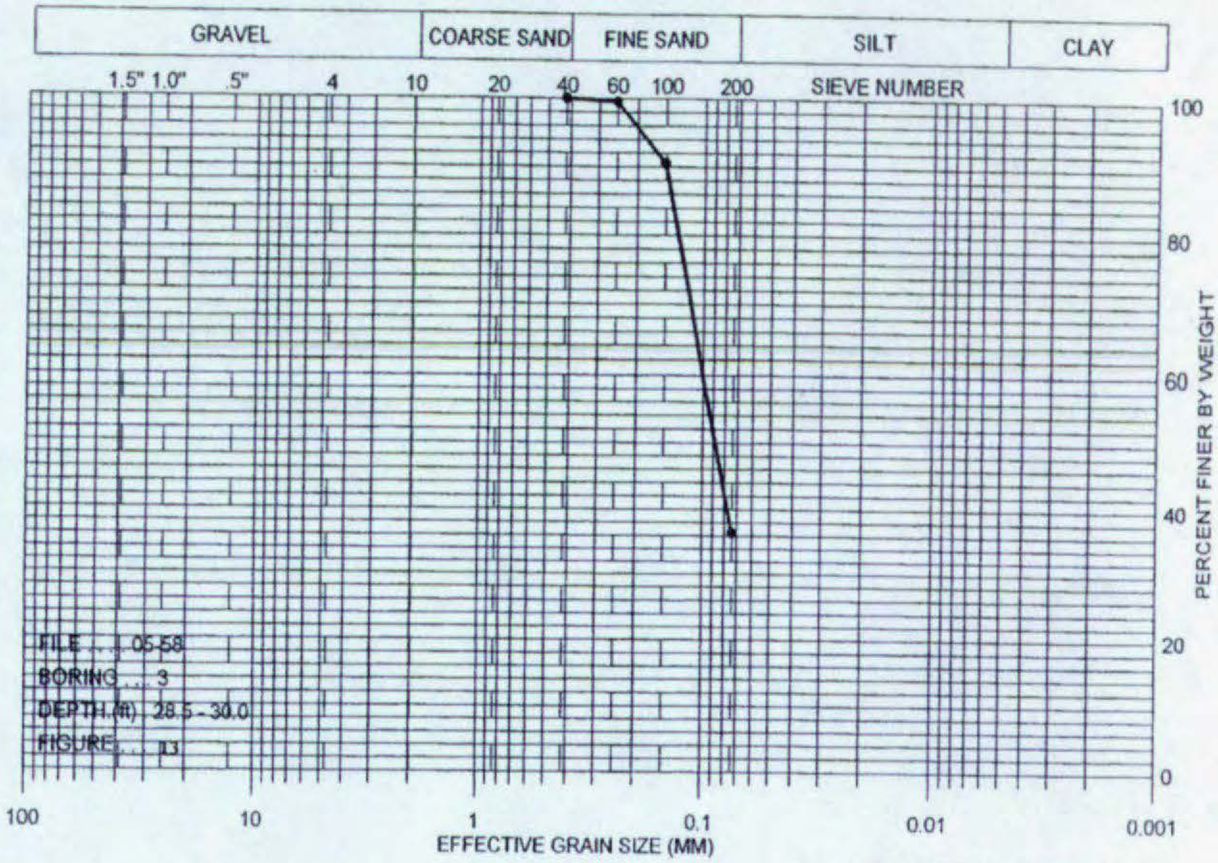

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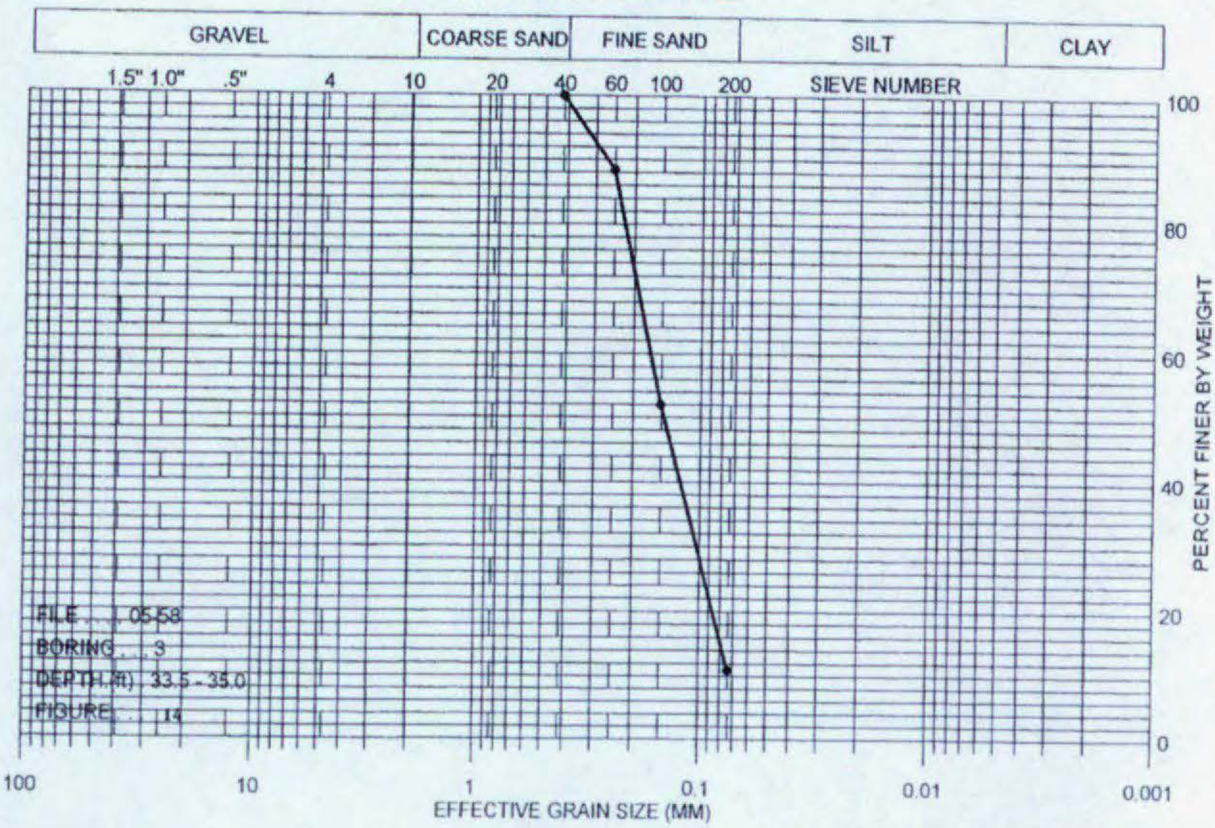

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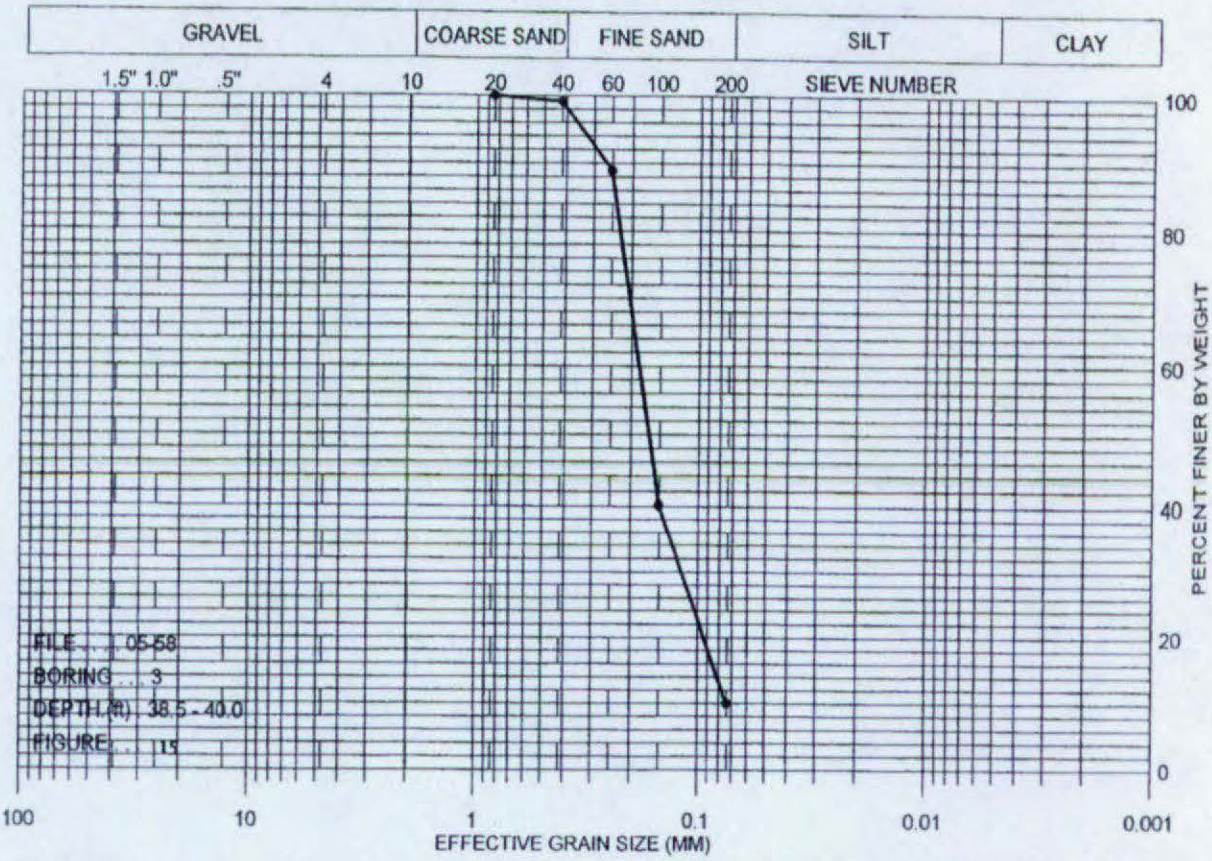

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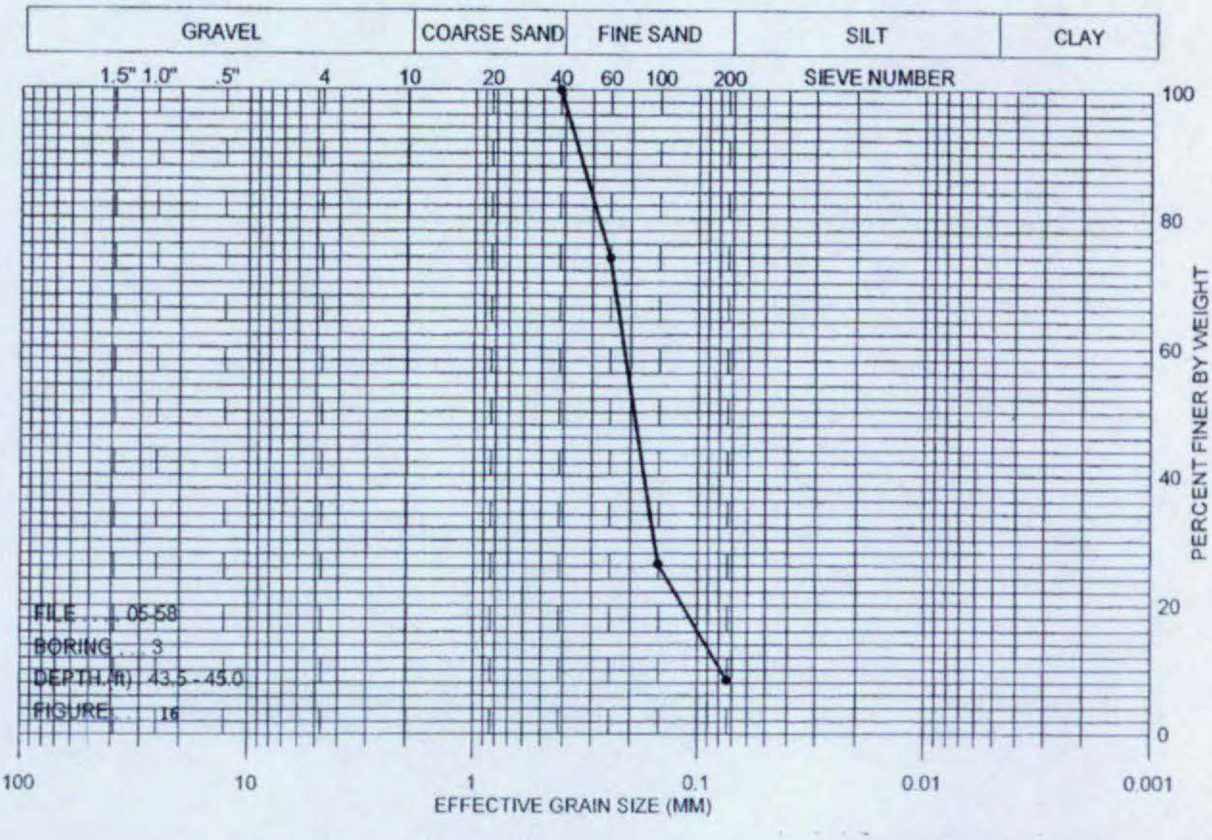

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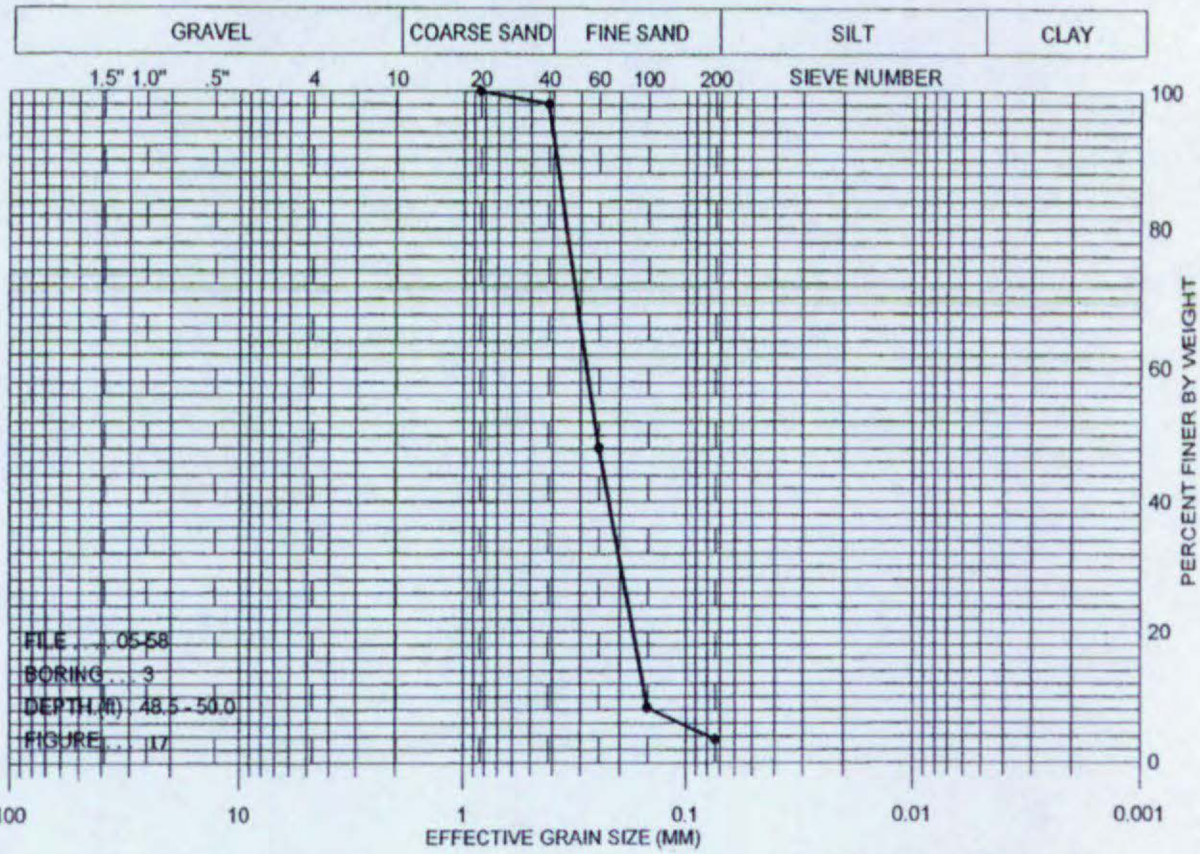

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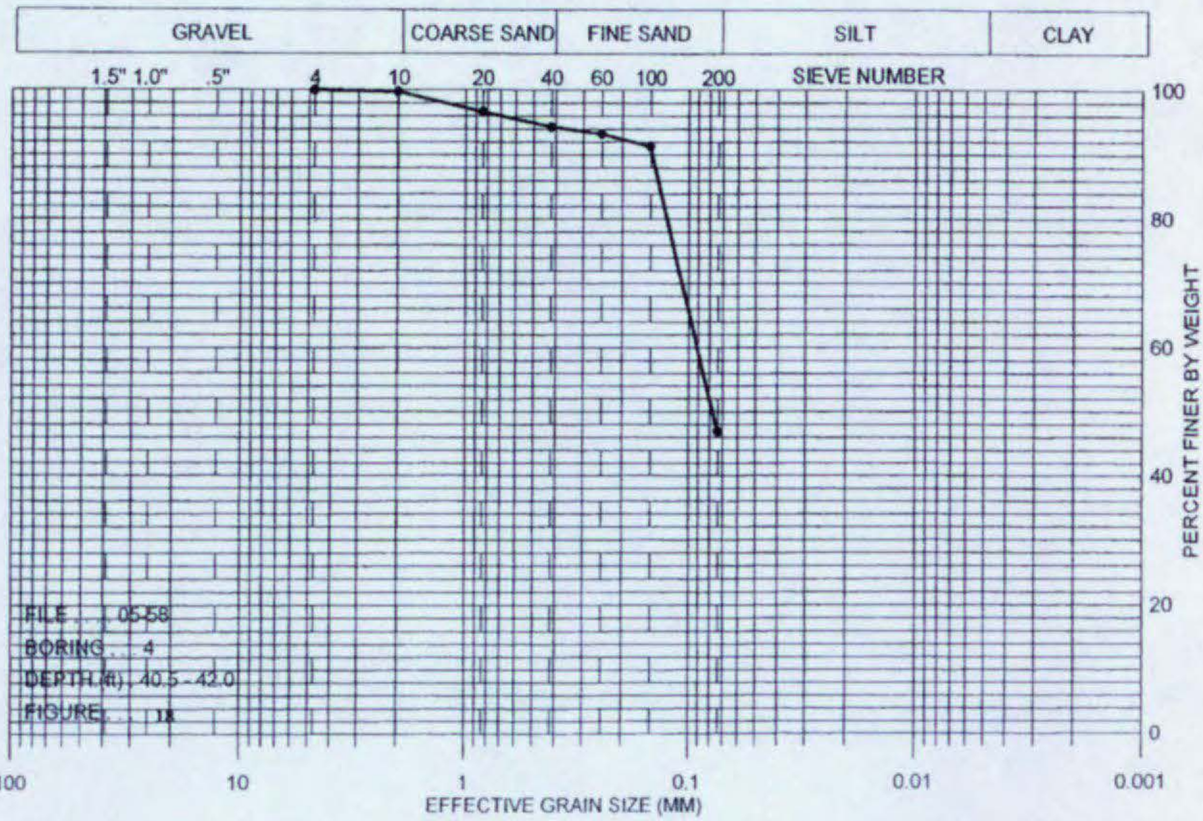

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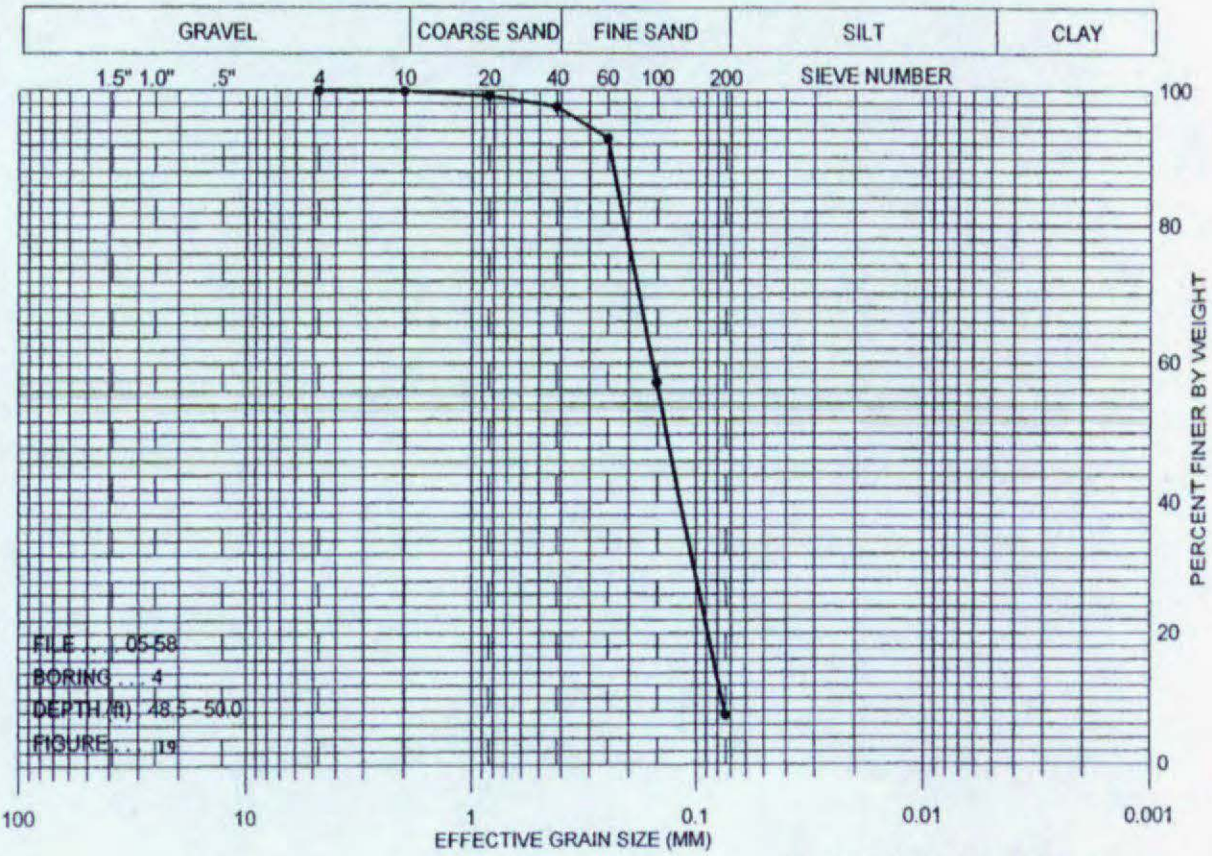

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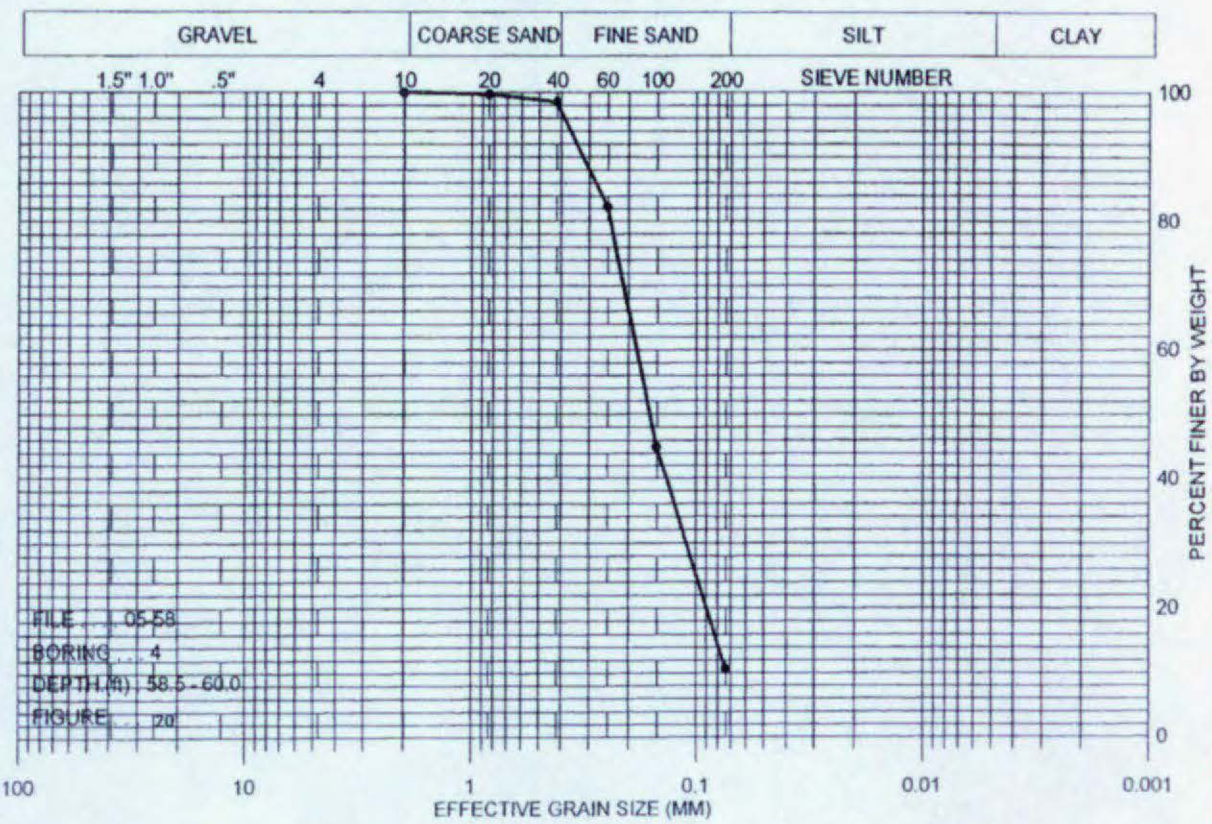

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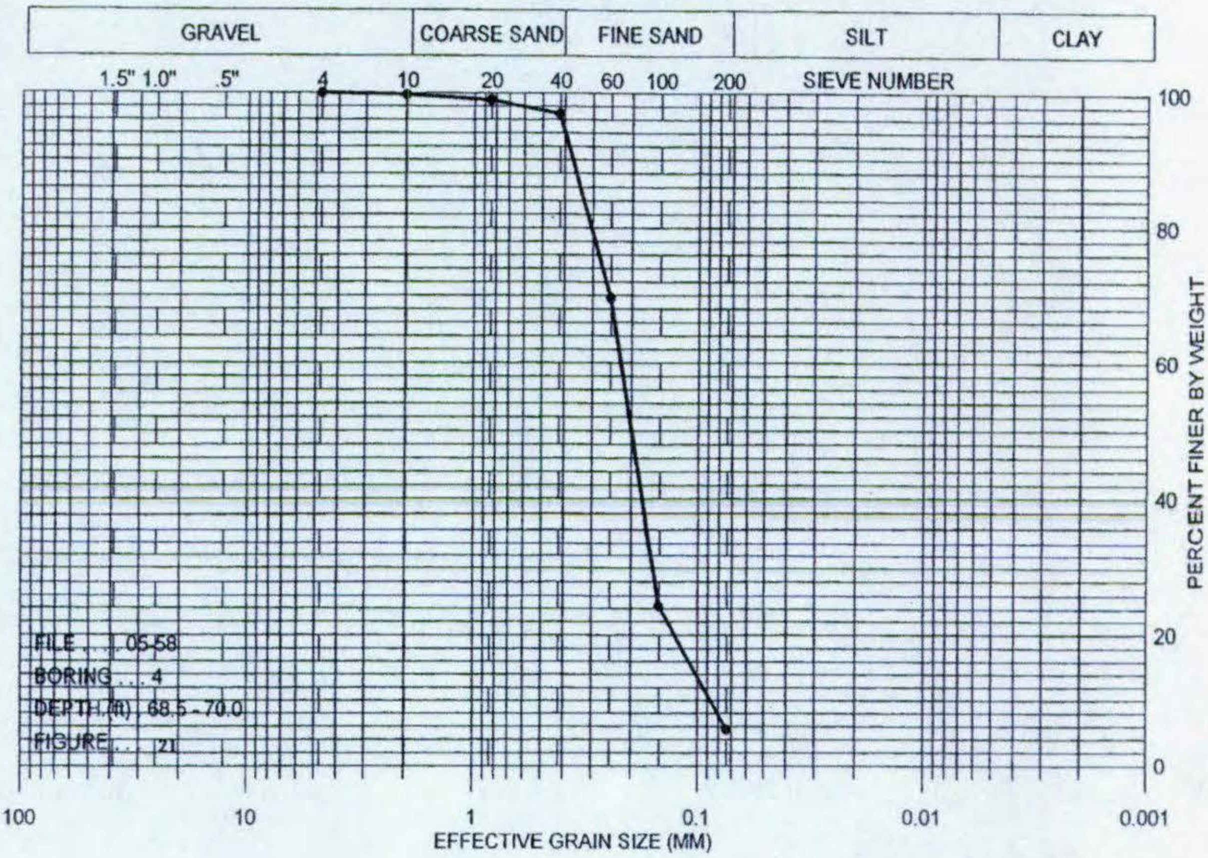

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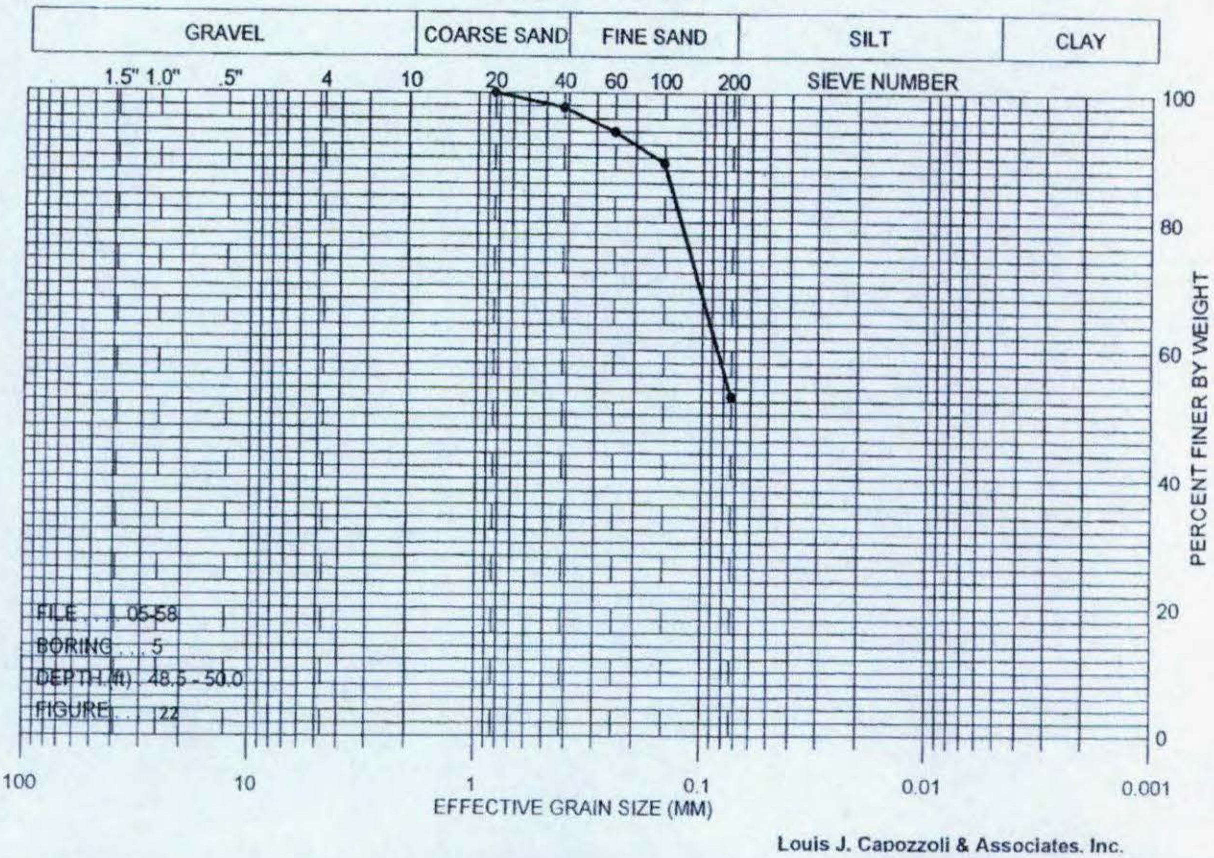

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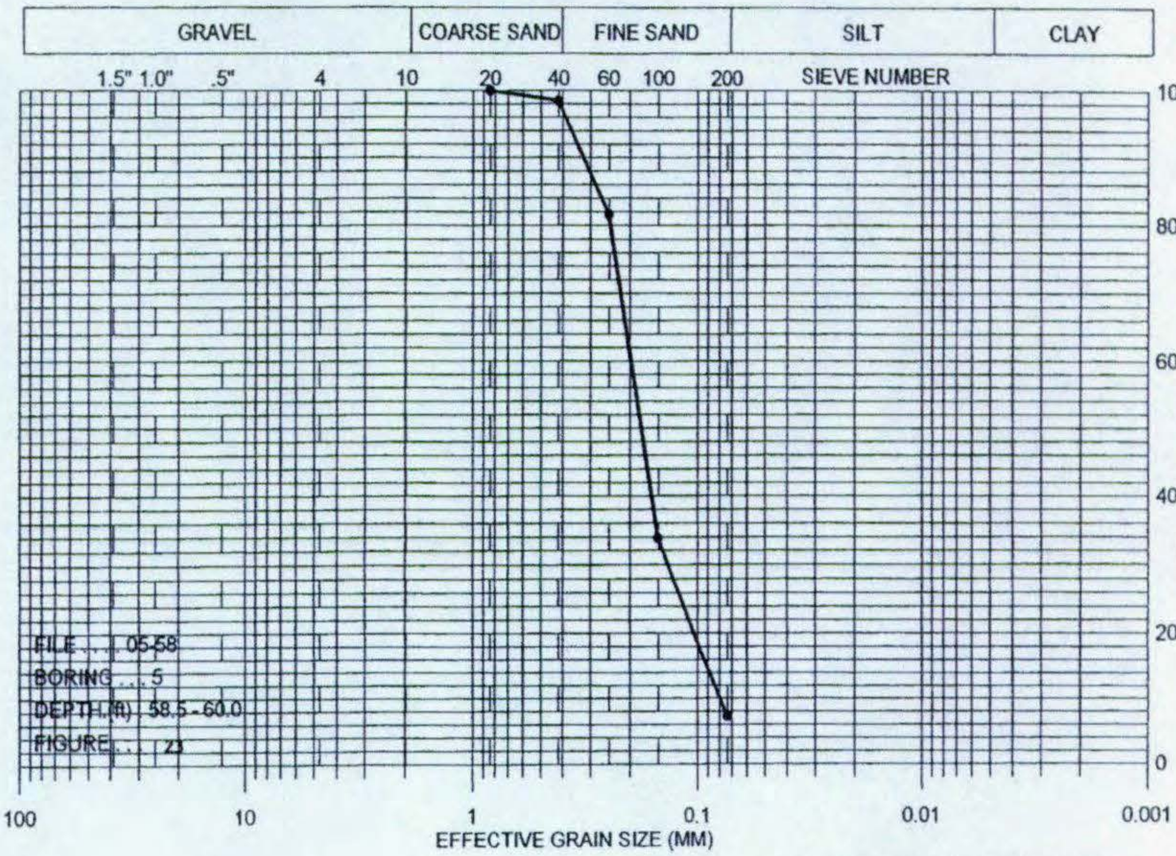

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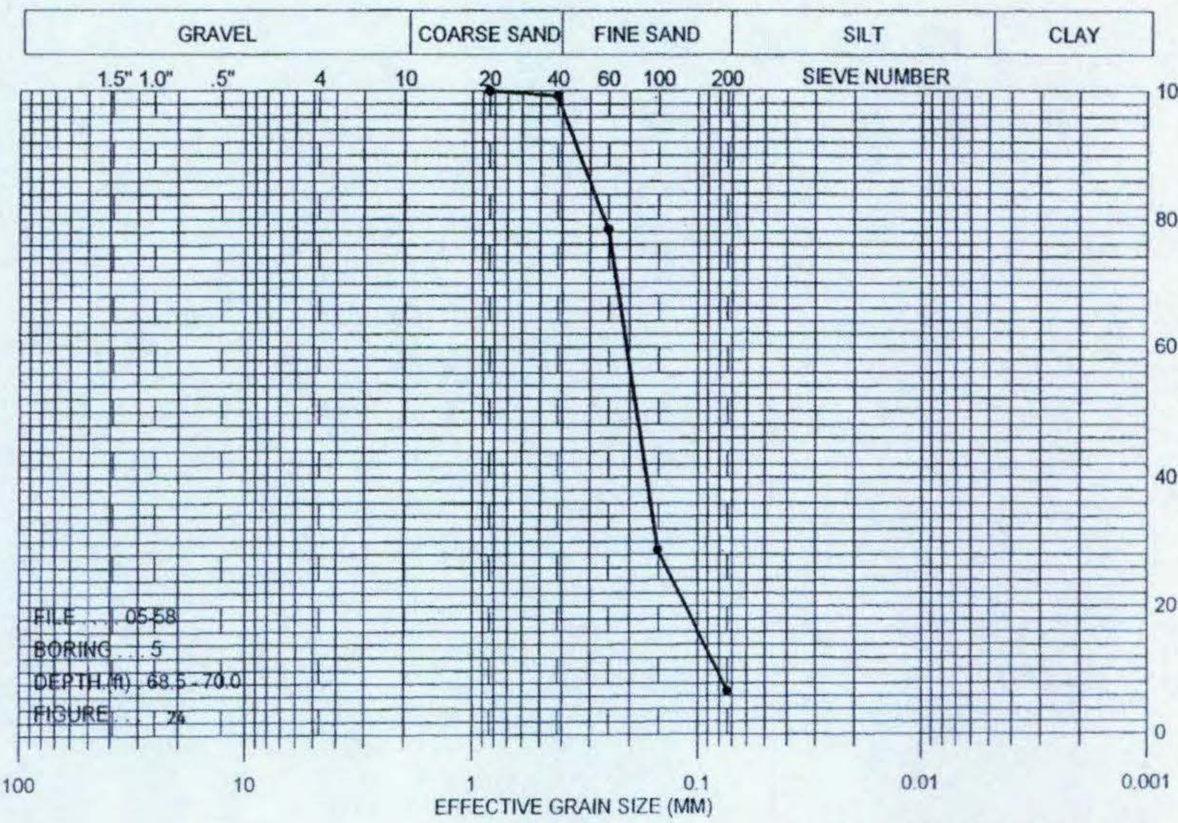

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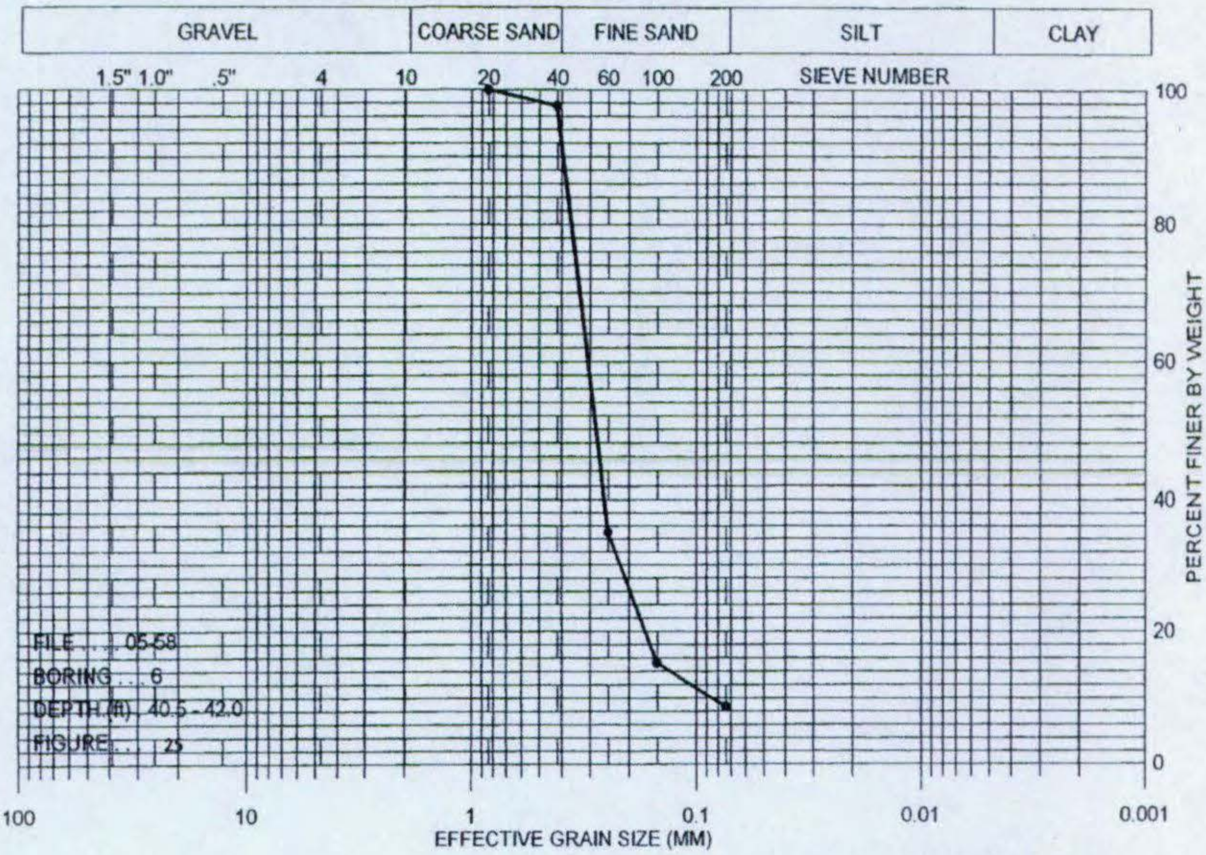

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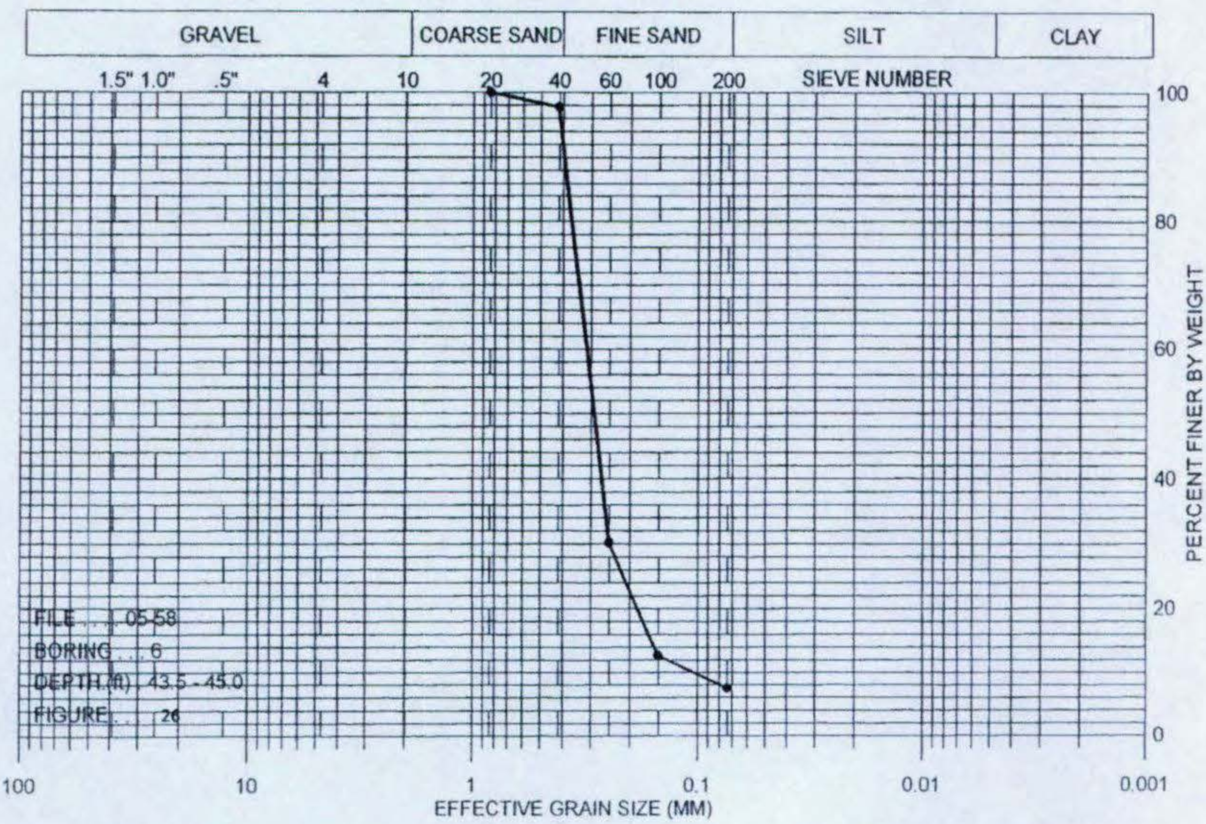
GRAIN SIZE CURVE



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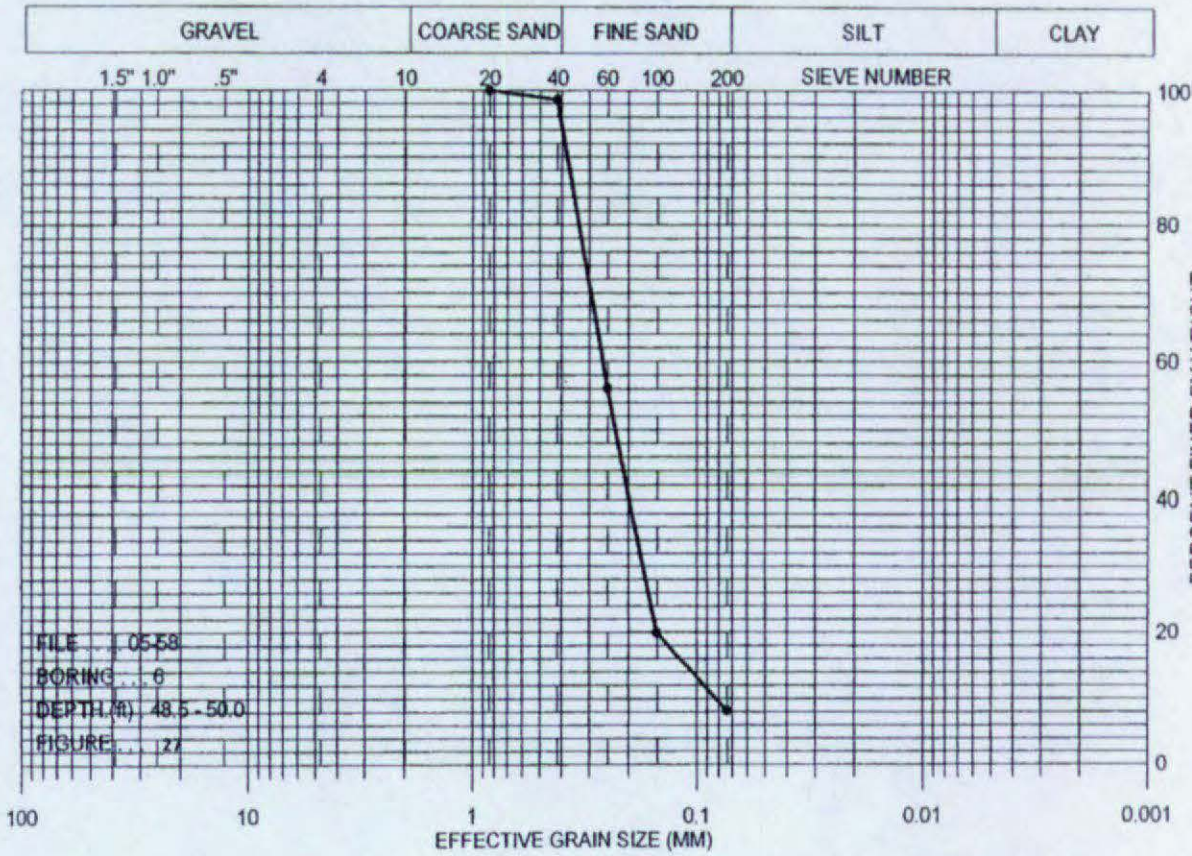
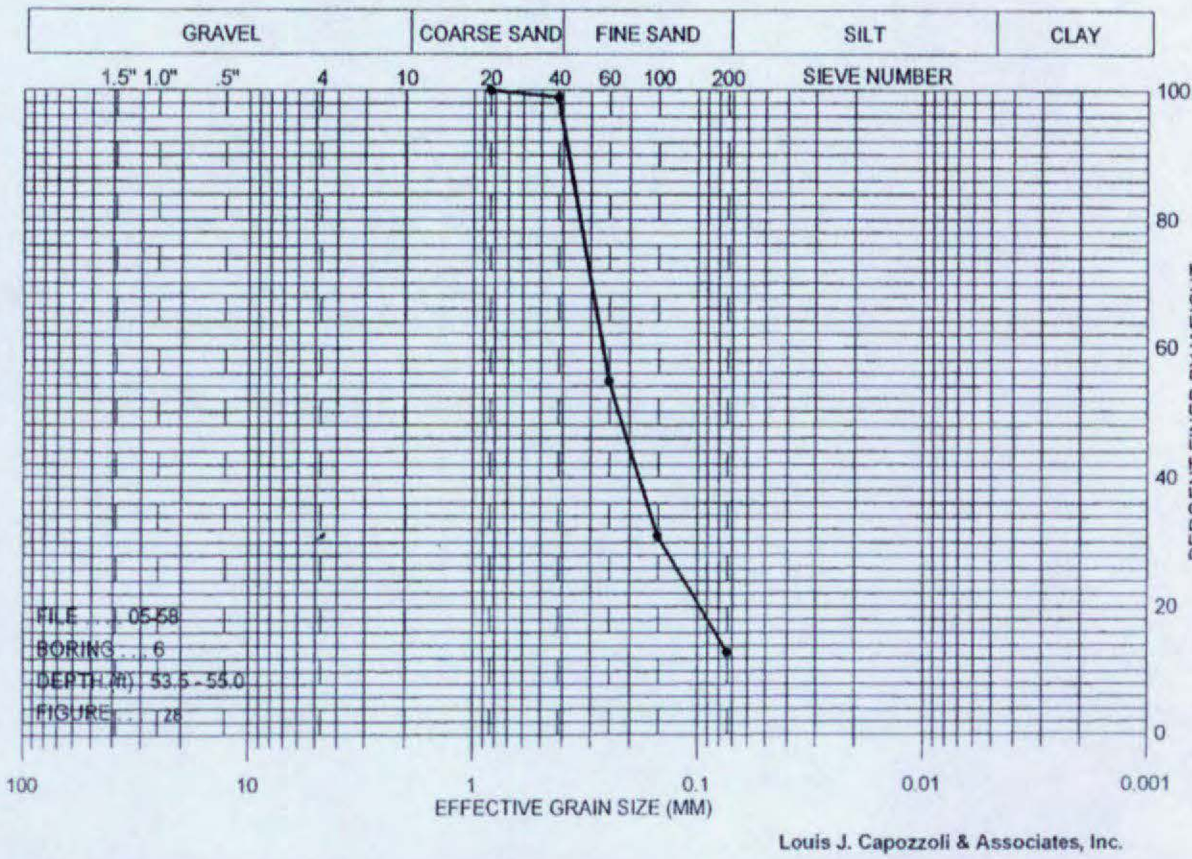


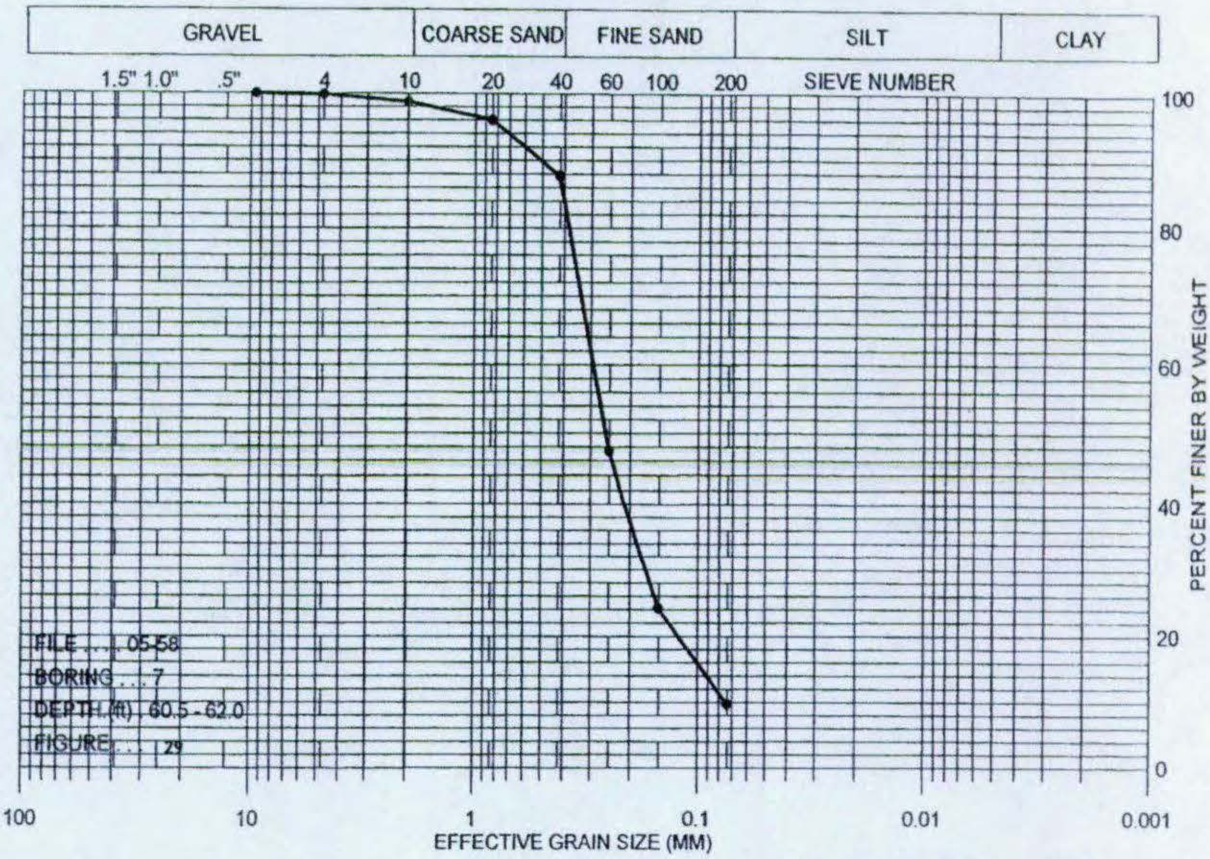
Louis J. Capozzoli & Associates, Inc.
Geotechnical Engineers

GRAIN SIZE CURVE



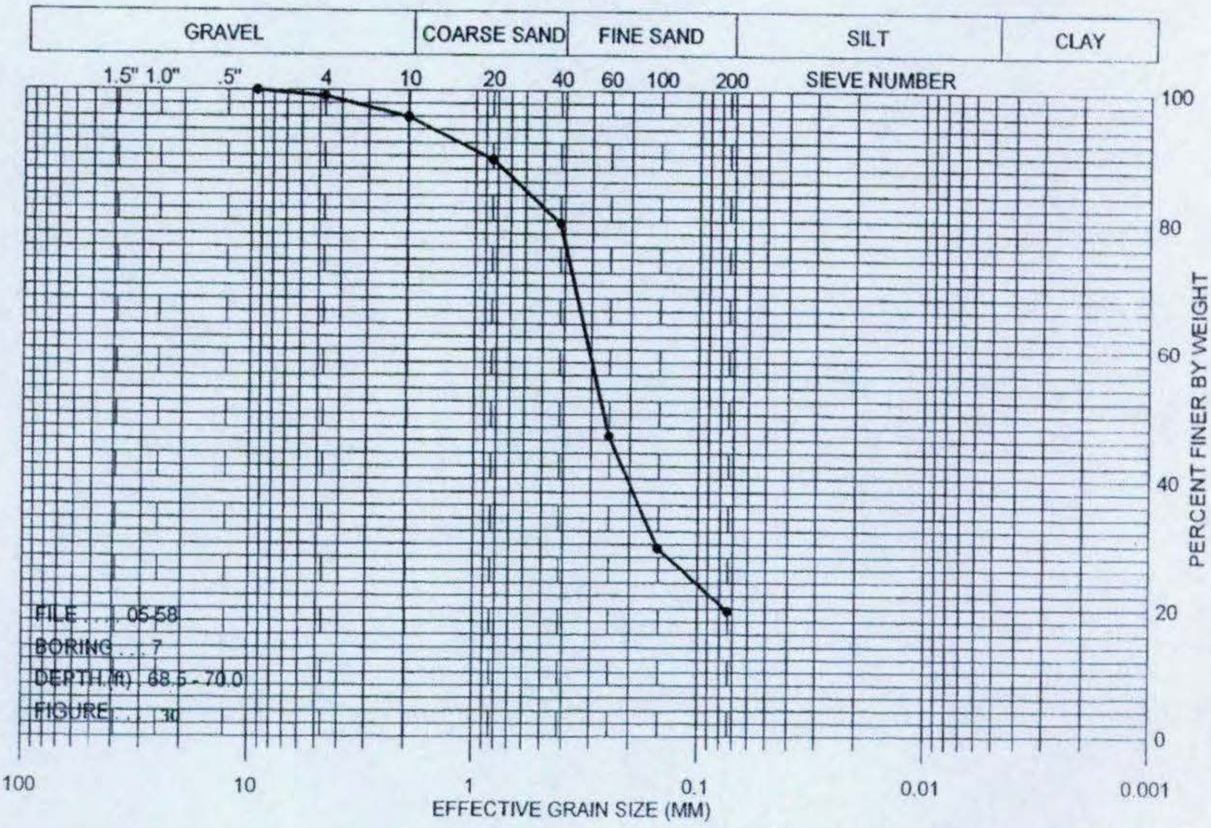
Louis J. Capozzoli & Associates, Inc.

GRAIN SIZE CURVE



Louis J. Capozzoli & Associates, Inc.
Geotechnical Engineers

GRAIN SIZE CURVE



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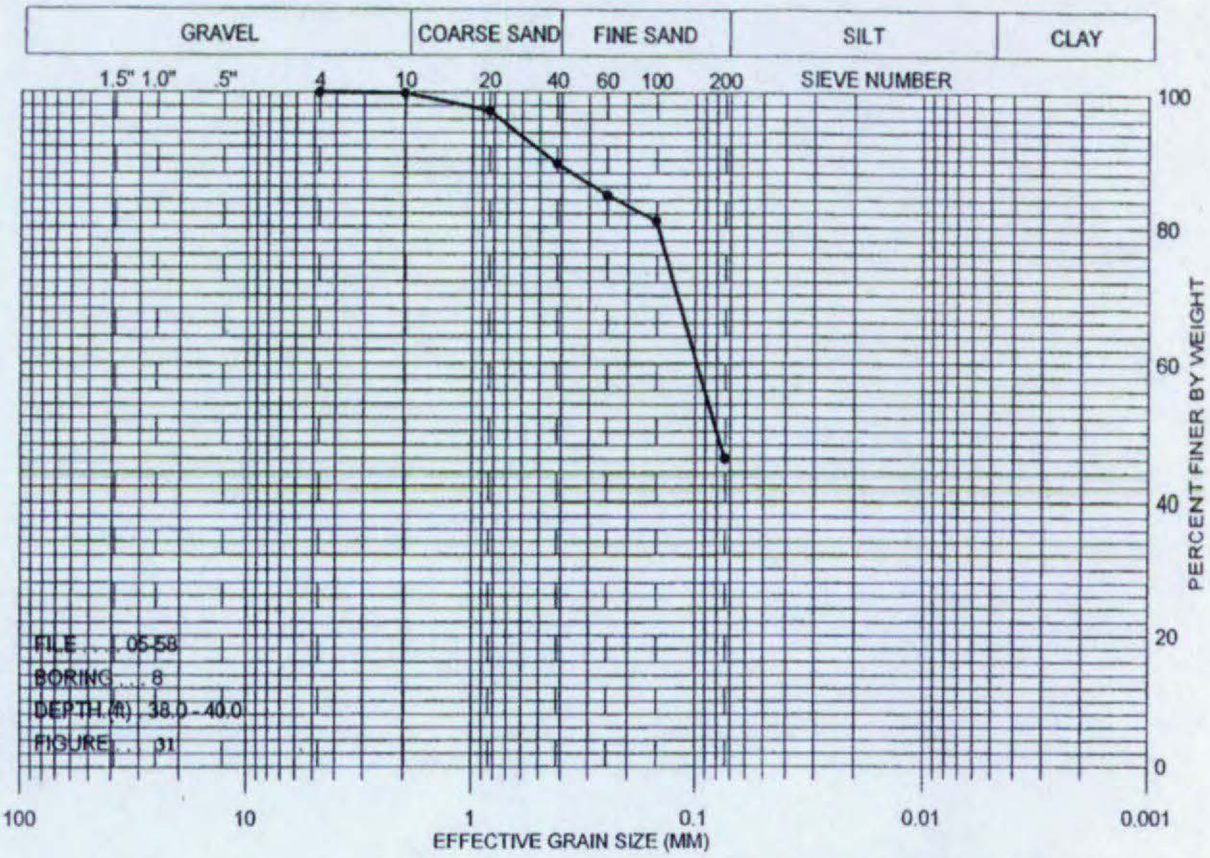

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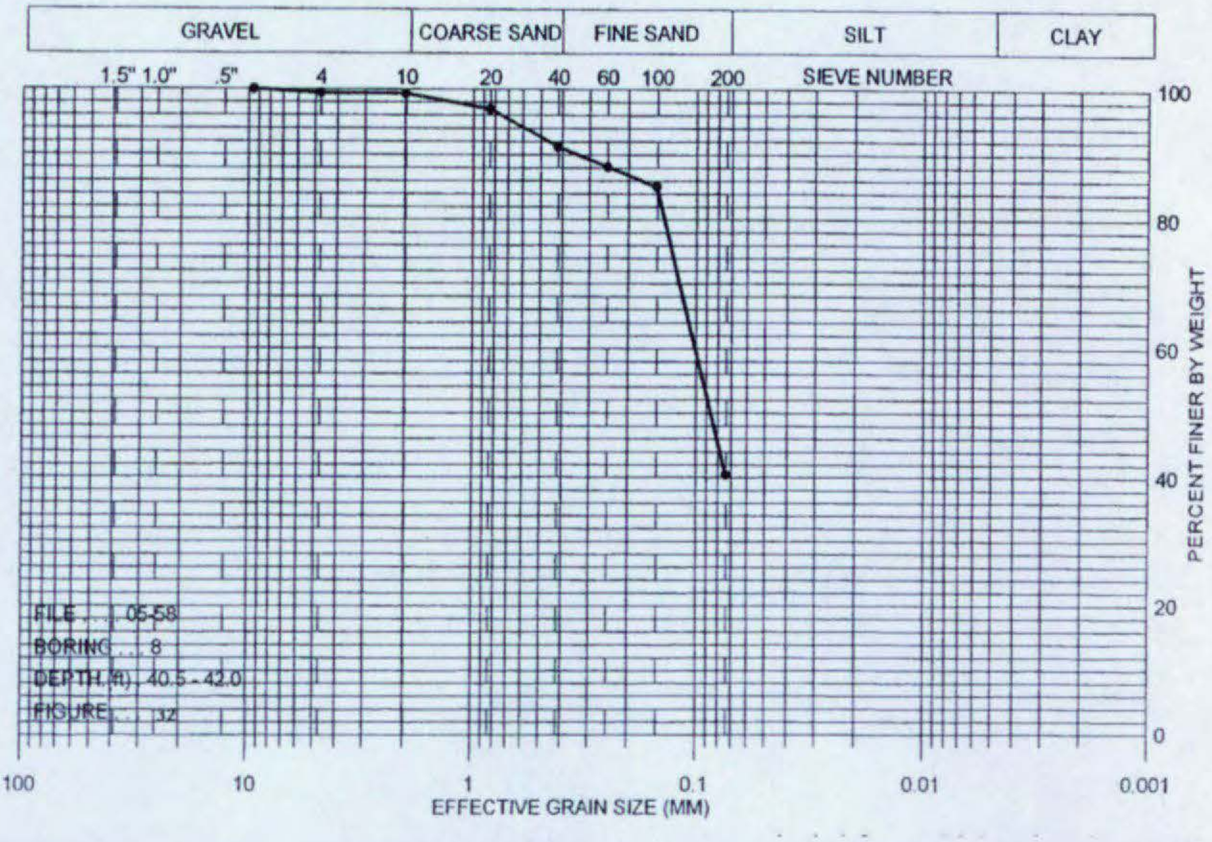
GRAIN SIZE CURVE



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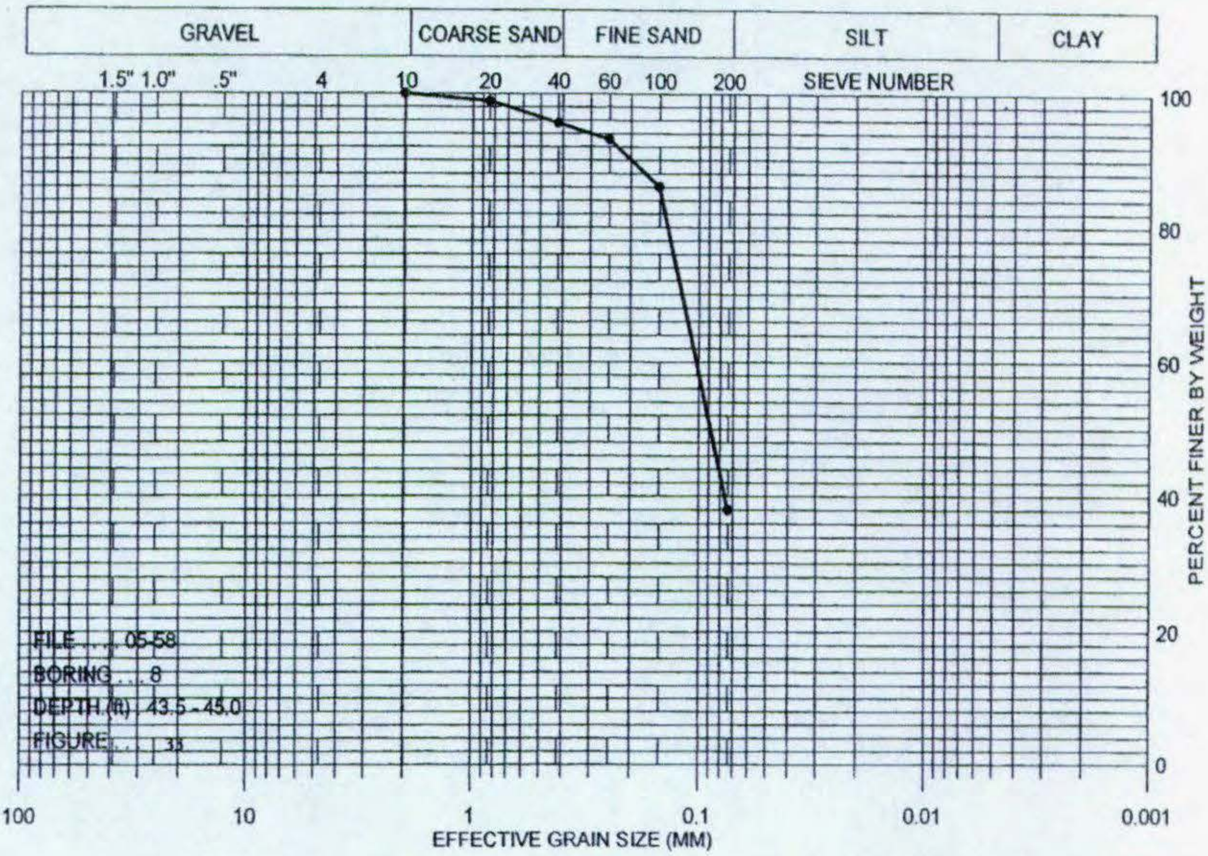

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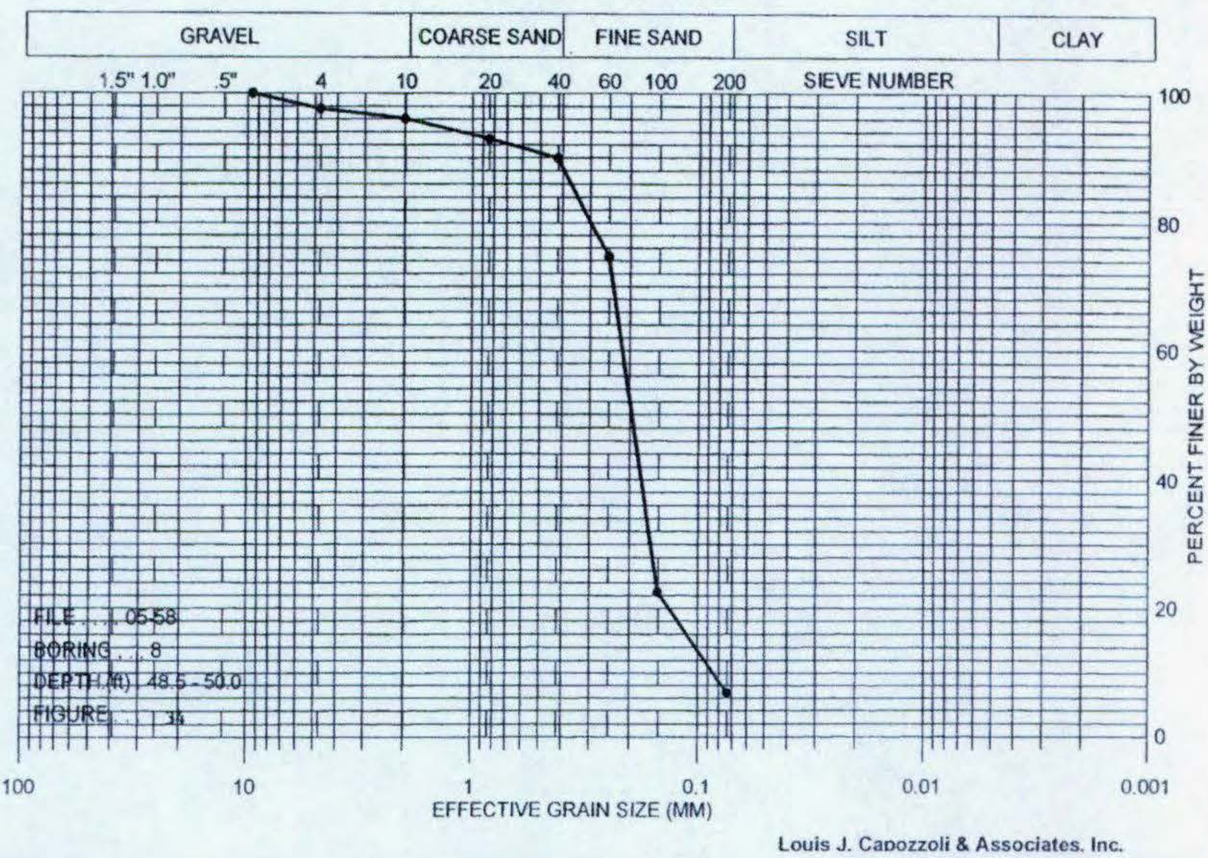
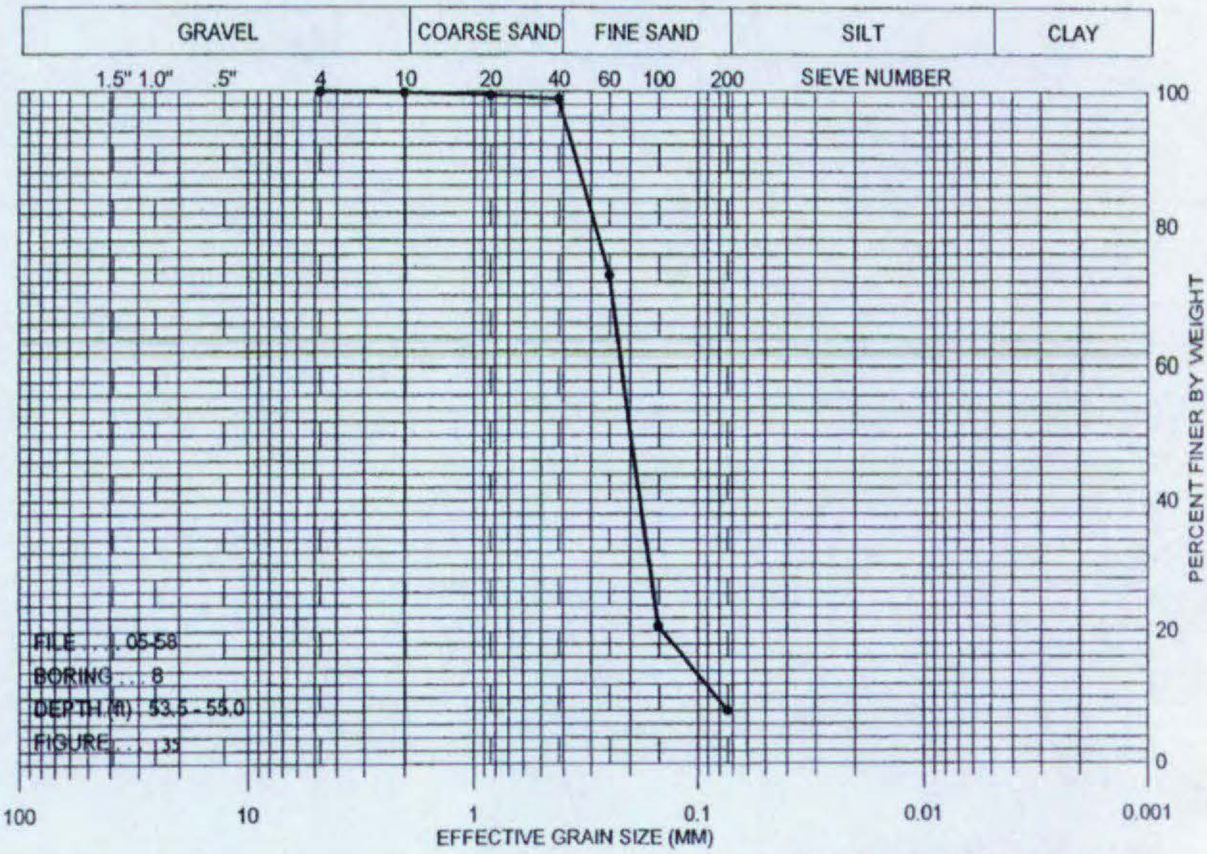
GRAIN SIZE CURVE



Louis J. Capozzoli & Associates, Inc.

GRAIN SIZE CURVE



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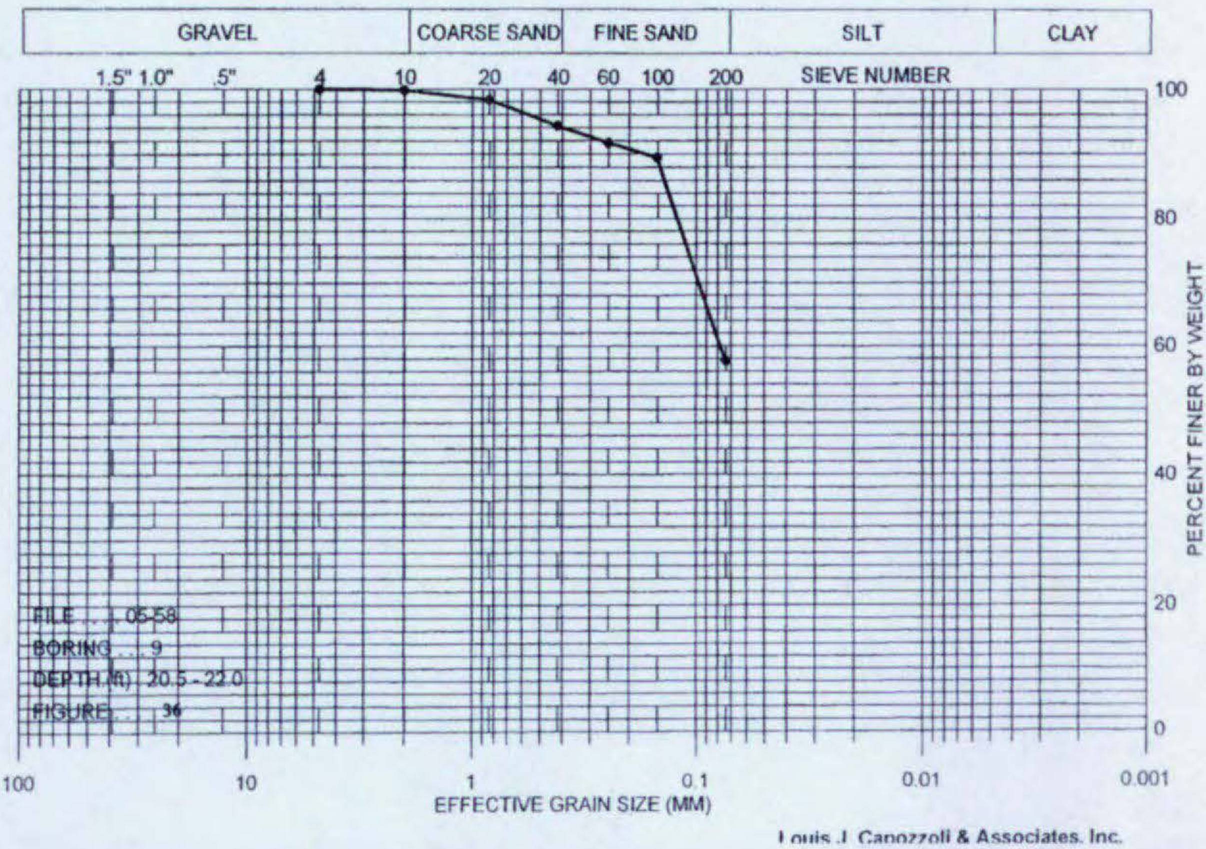
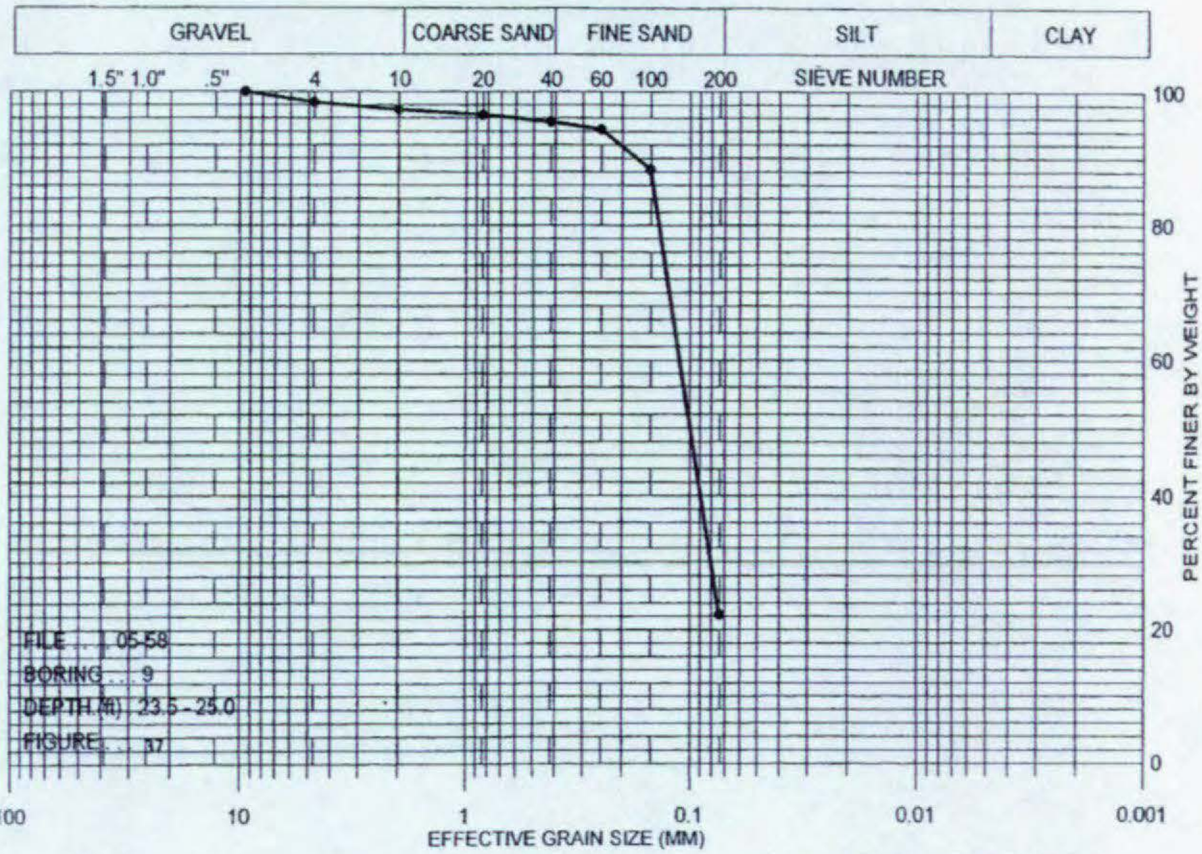


Louis J. Capozzoli & Associates, Inc.

GRAIN SIZE CURVE



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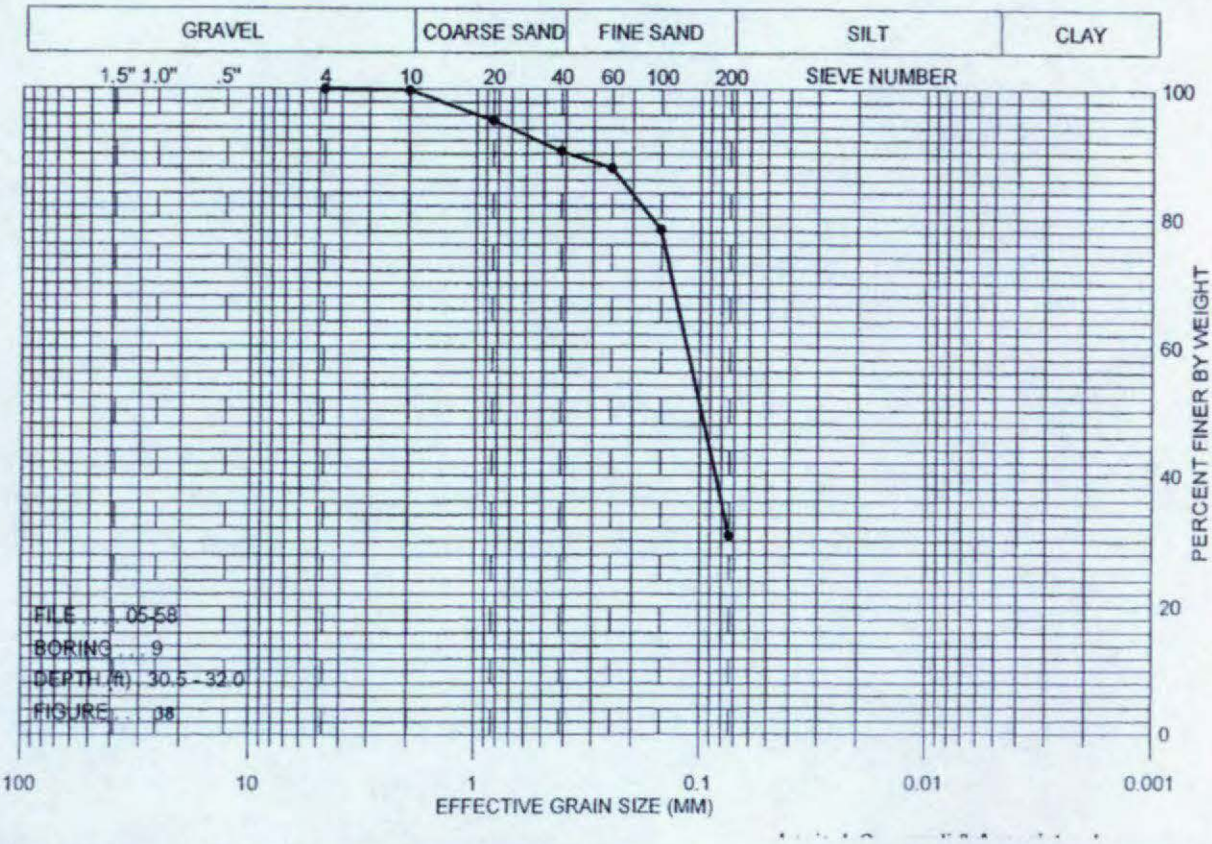
GRAIN SIZE CURVE



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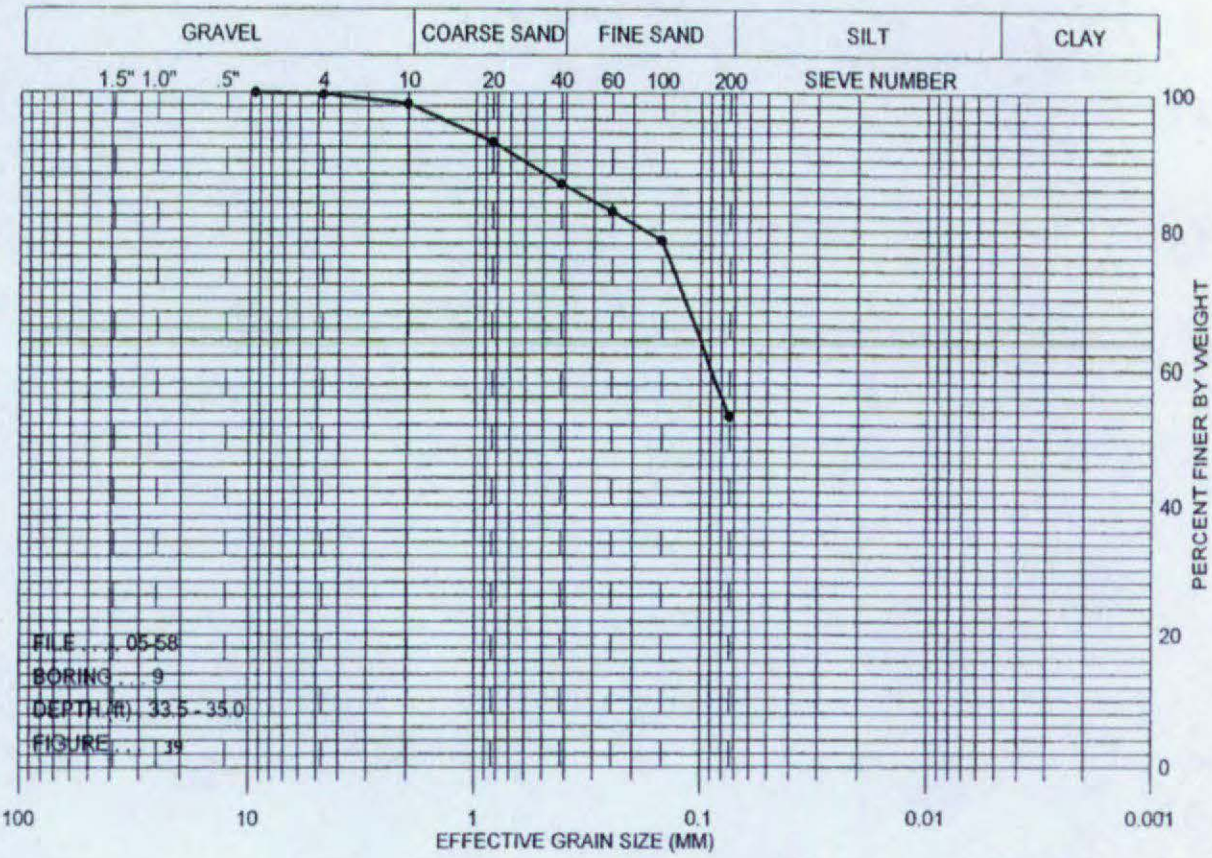

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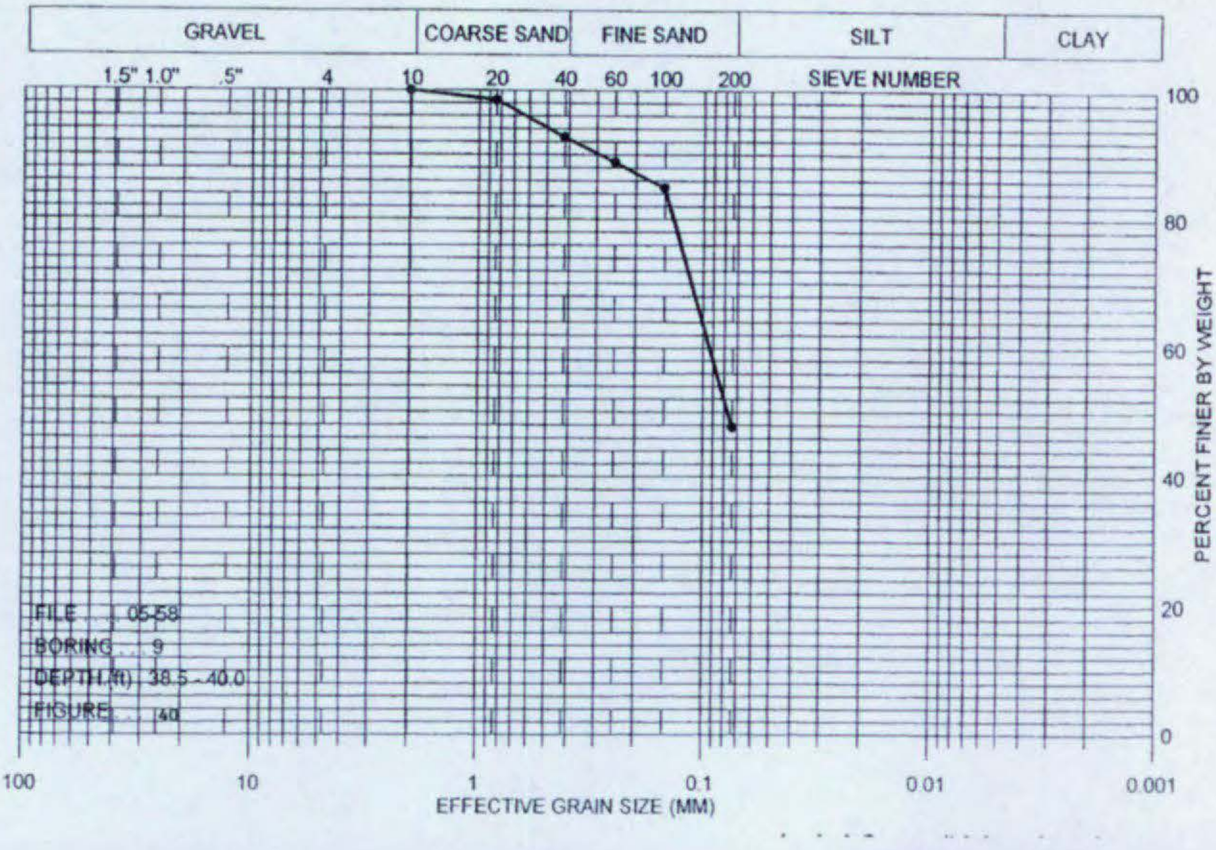
GRAIN SIZE CURVE



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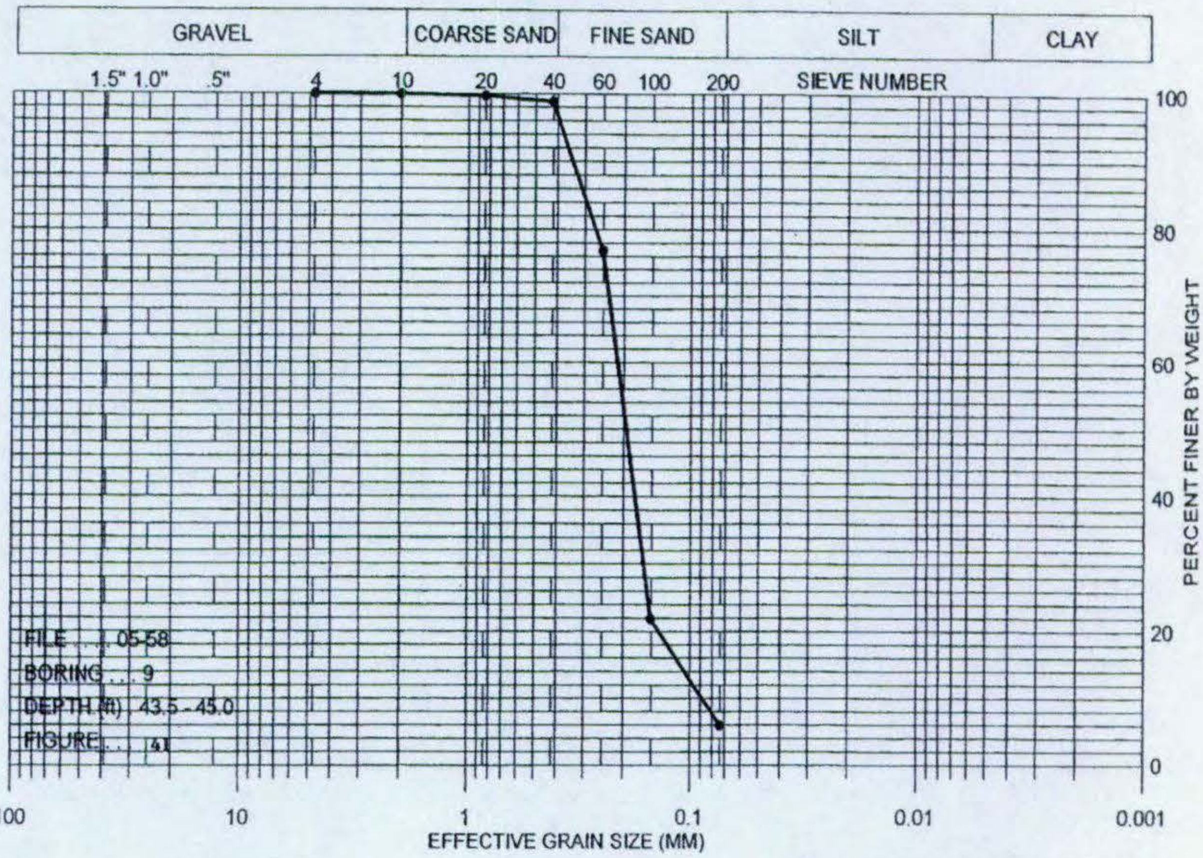

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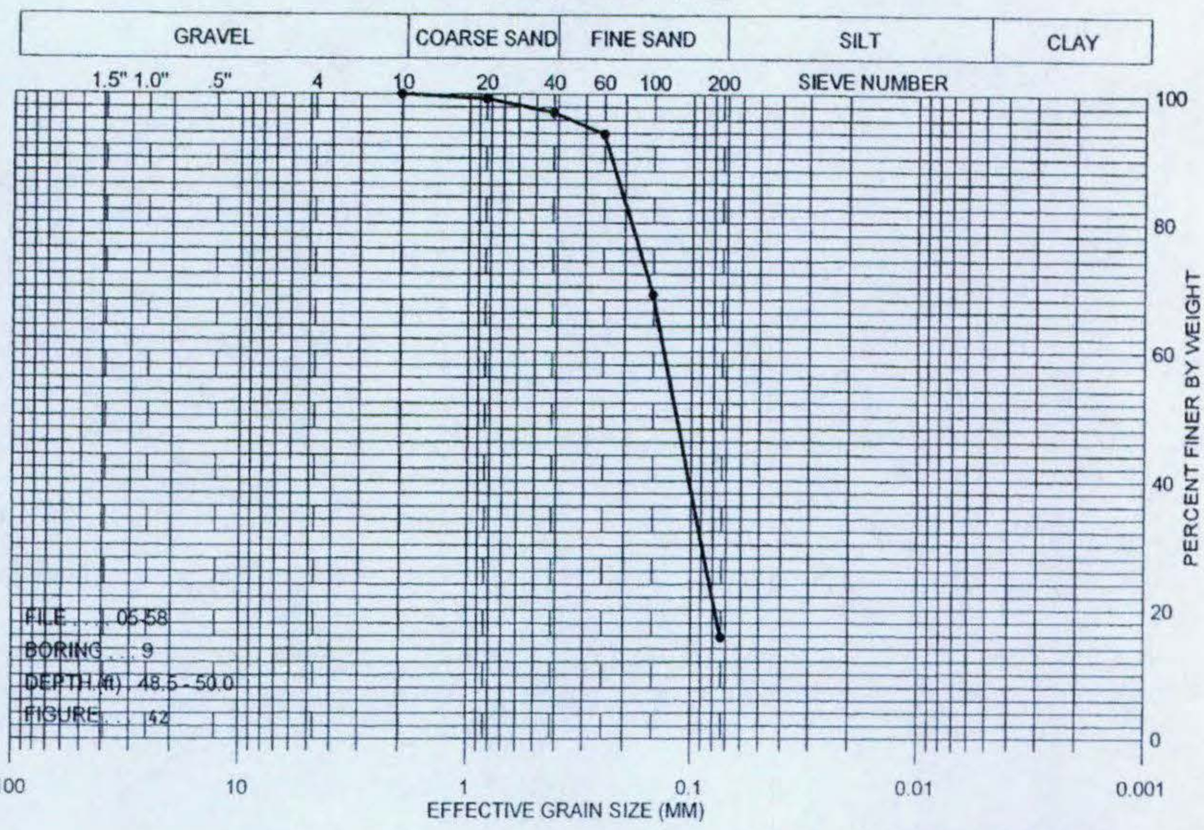
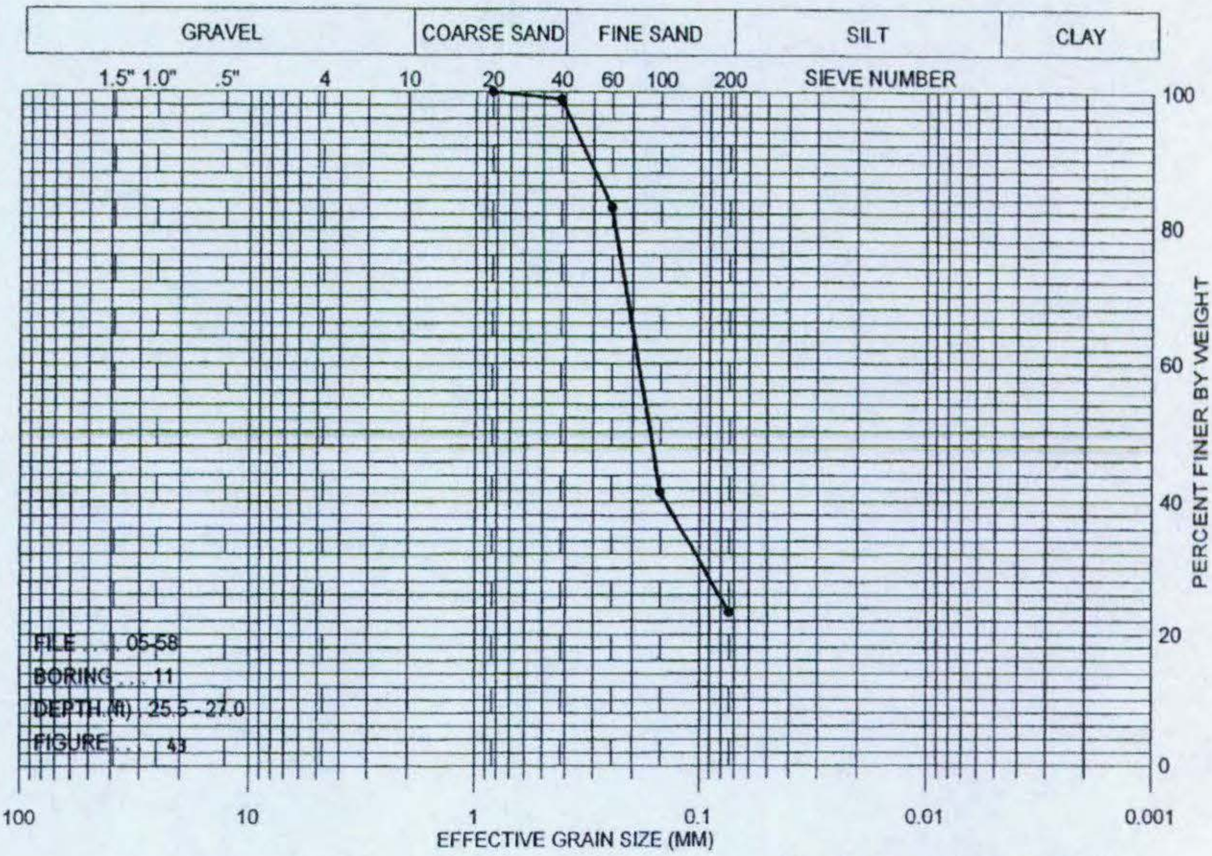
GRAIN SIZE CURVE



Louis J. Capozzoli & Associates, Inc.

GRAIN SIZE CURVE



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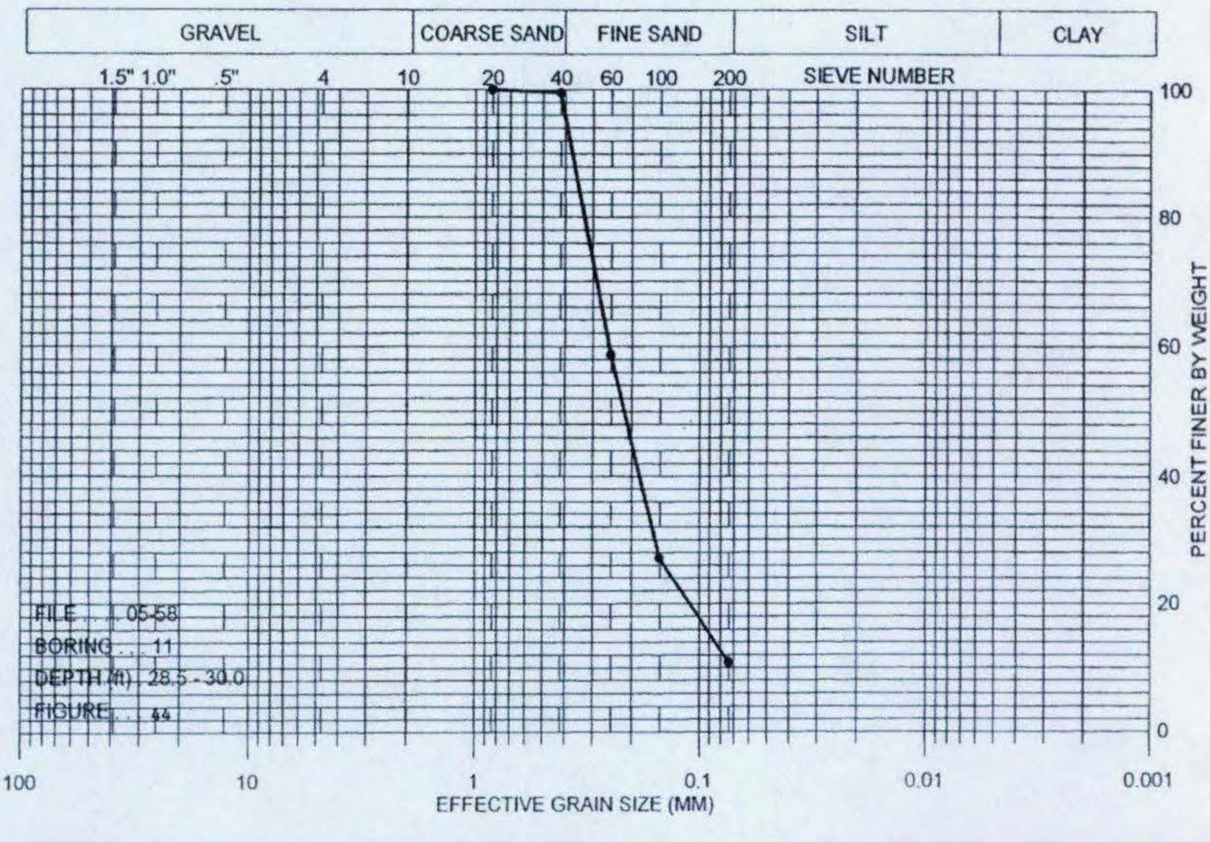
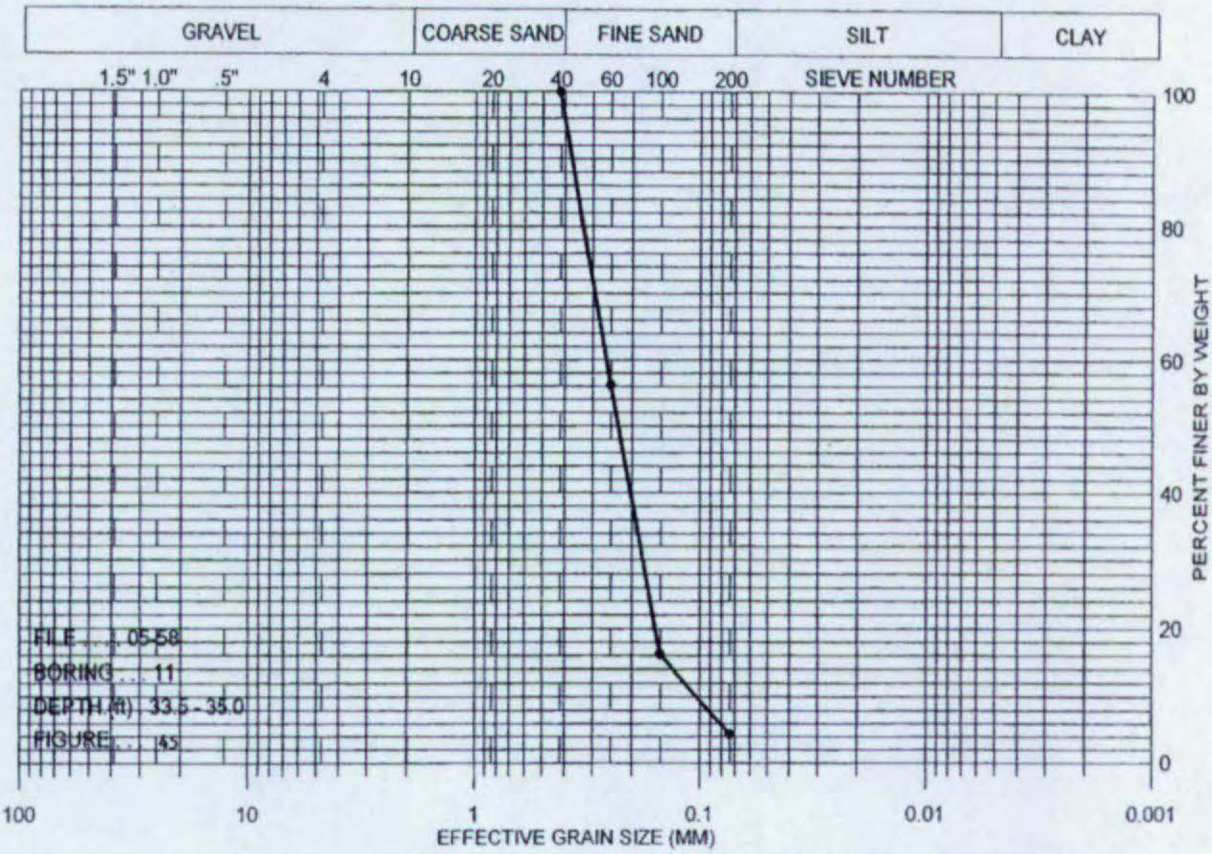
GRAIN SIZE CURVE



GRAIN SIZE CURVE



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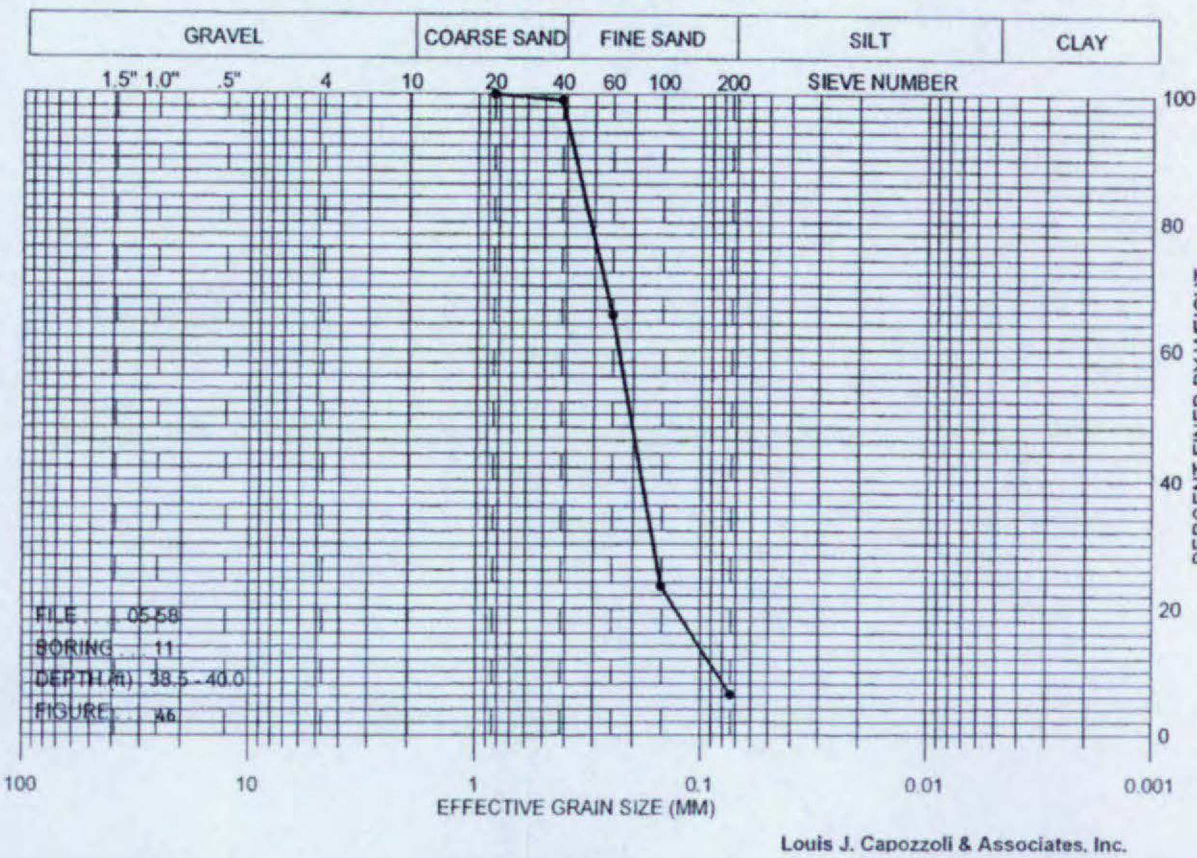
Geotechnical Engineers

GRAIN SIZE CURVE



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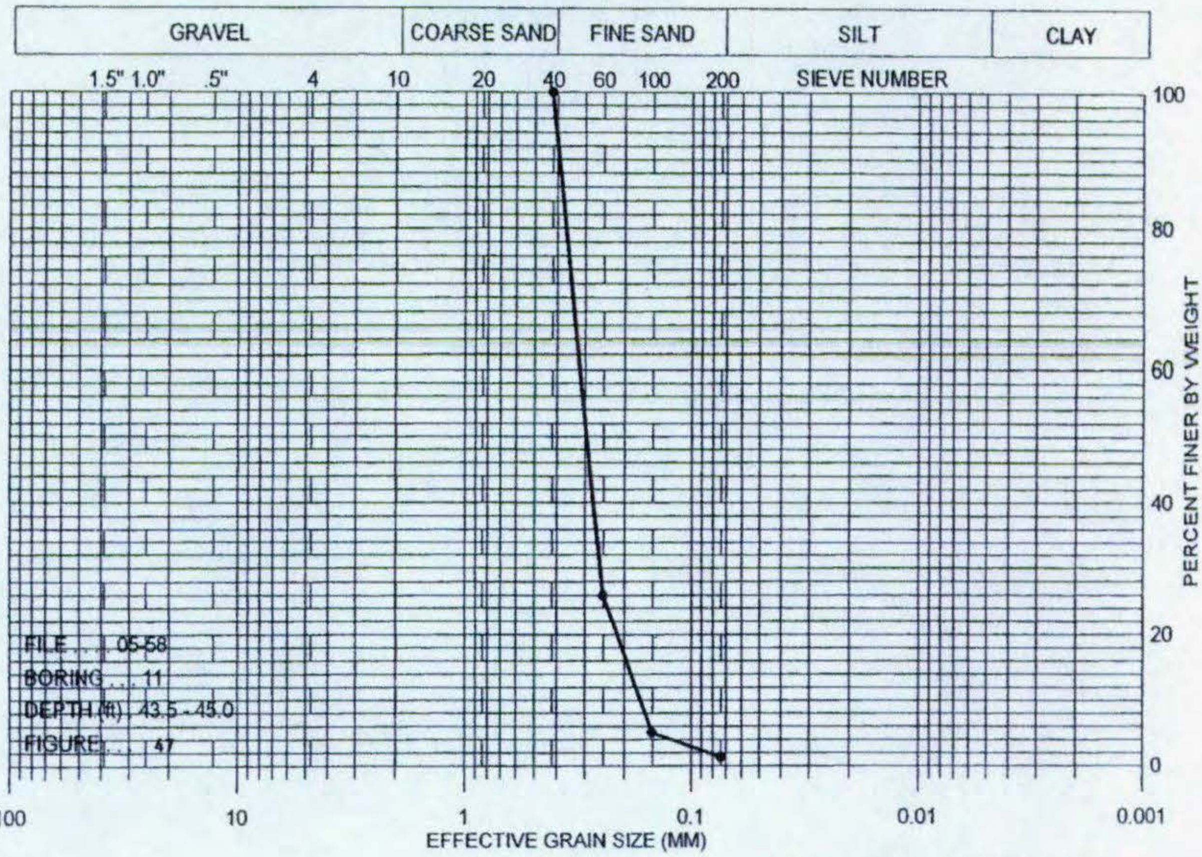
GRAIN SIZE CURVE



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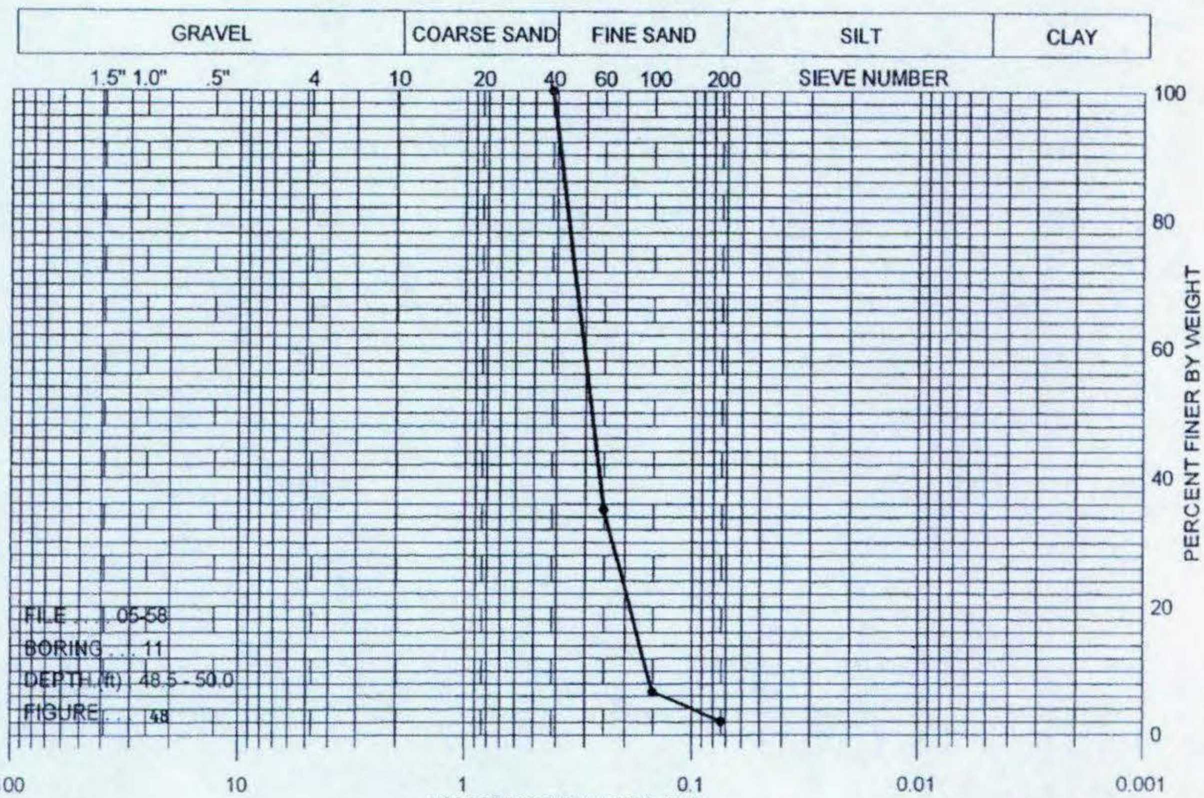
GRAIN SIZE CURVE



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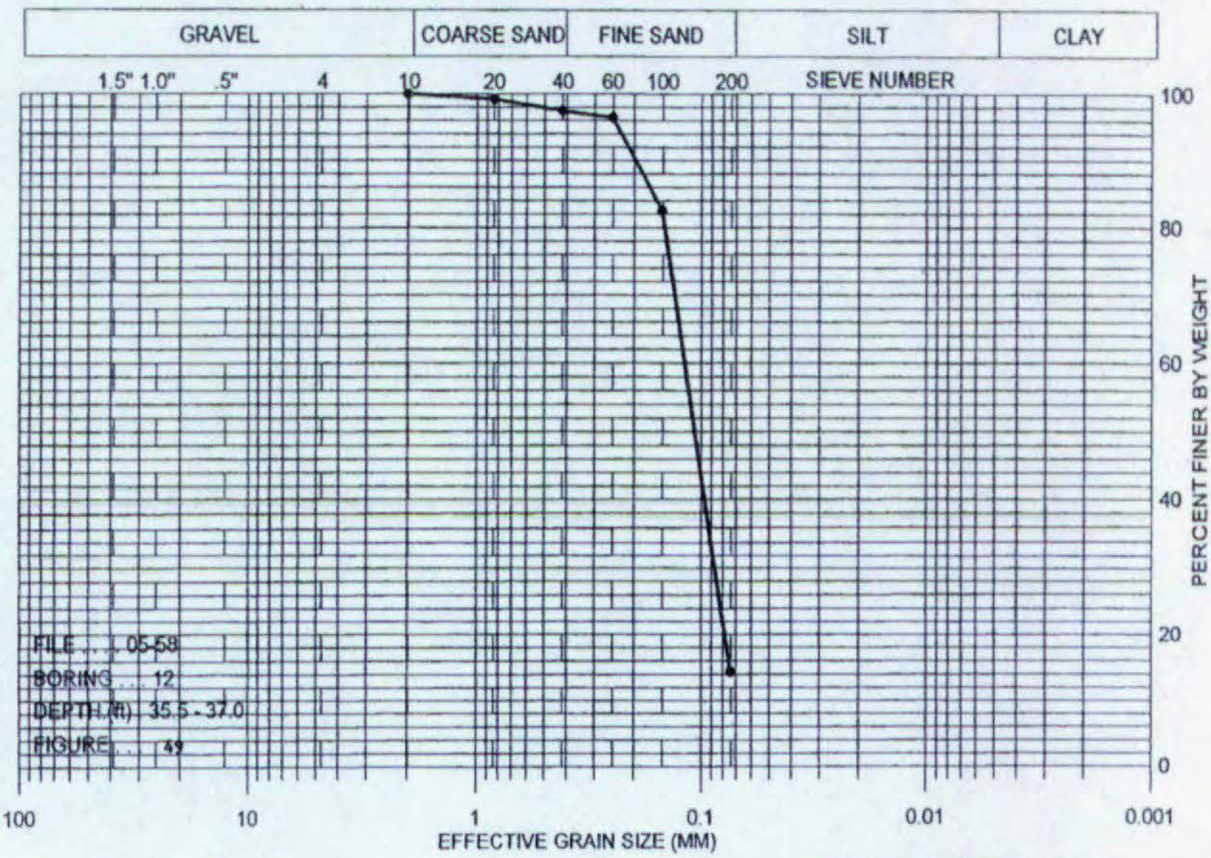
GRAIN SIZE CURVE



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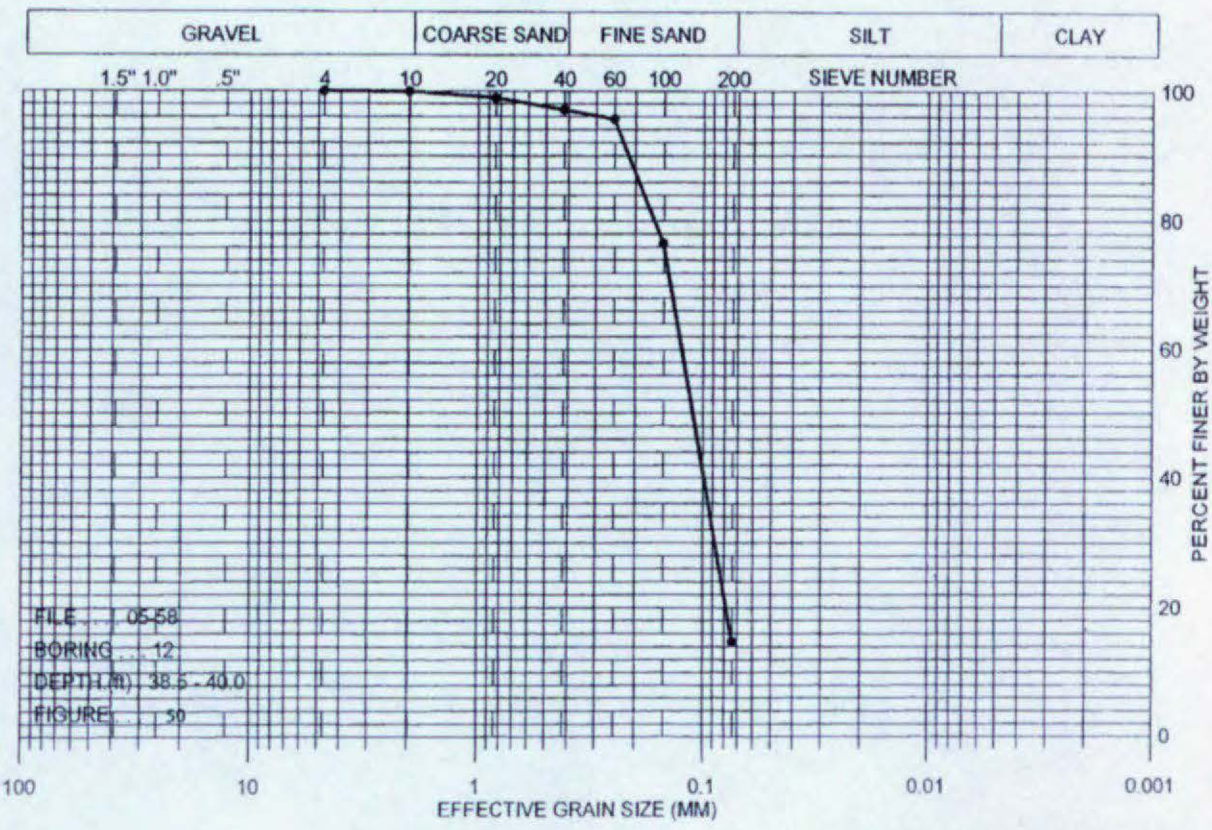
Geotechnical Engineers

GRAIN SIZE CURVE



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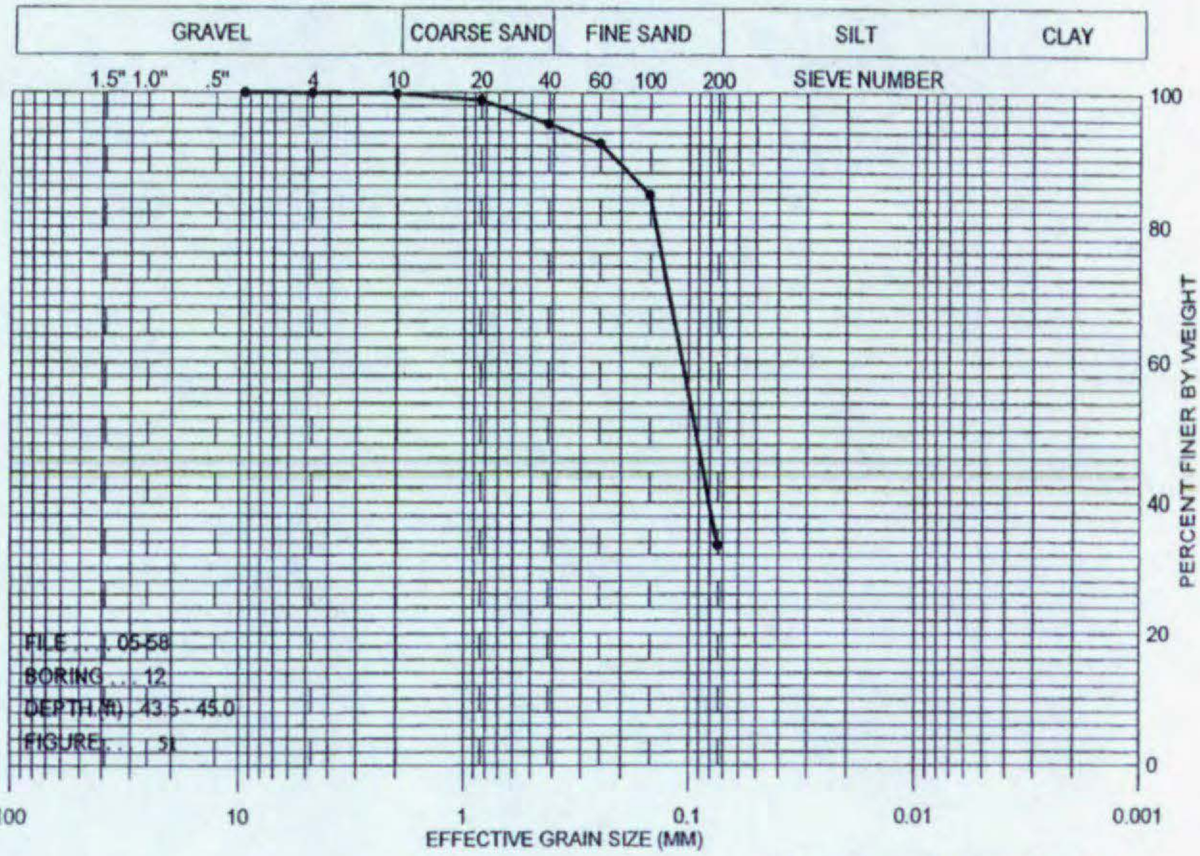
GRAIN SIZE CURVE



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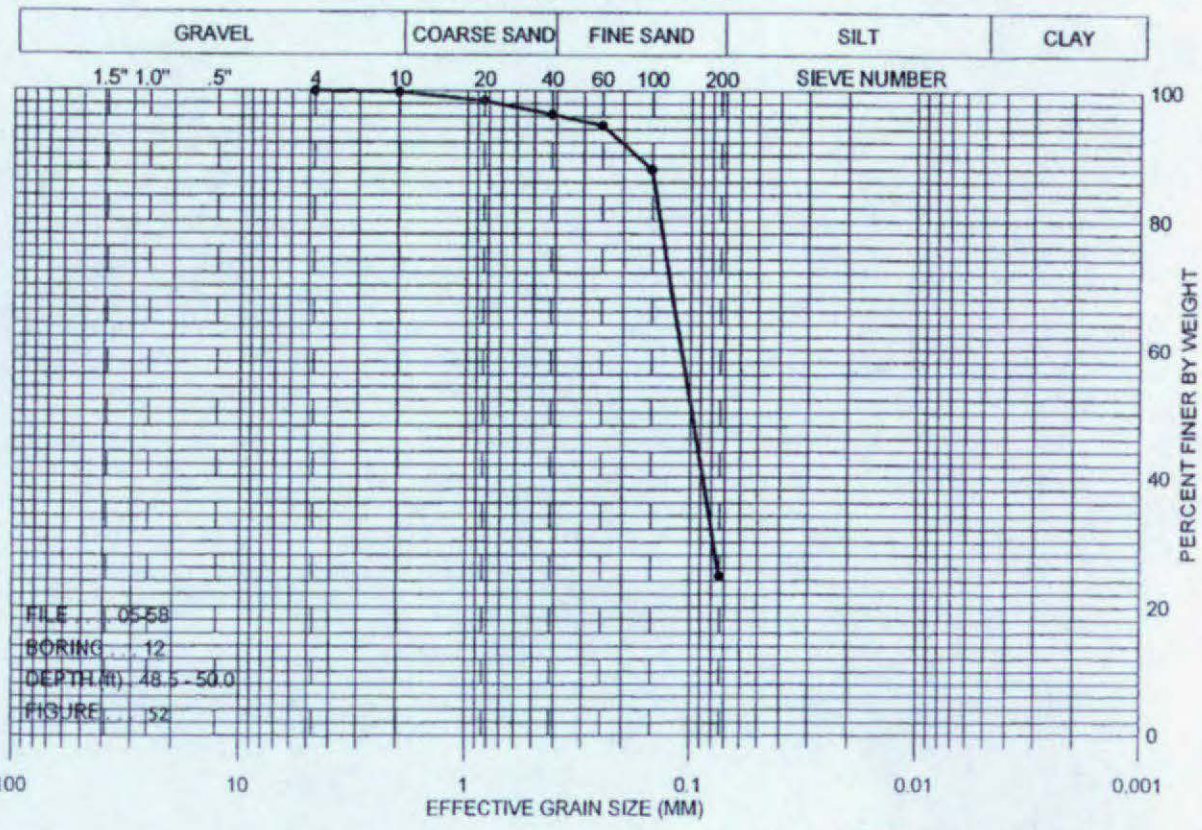
GRAIN SIZE CURVE



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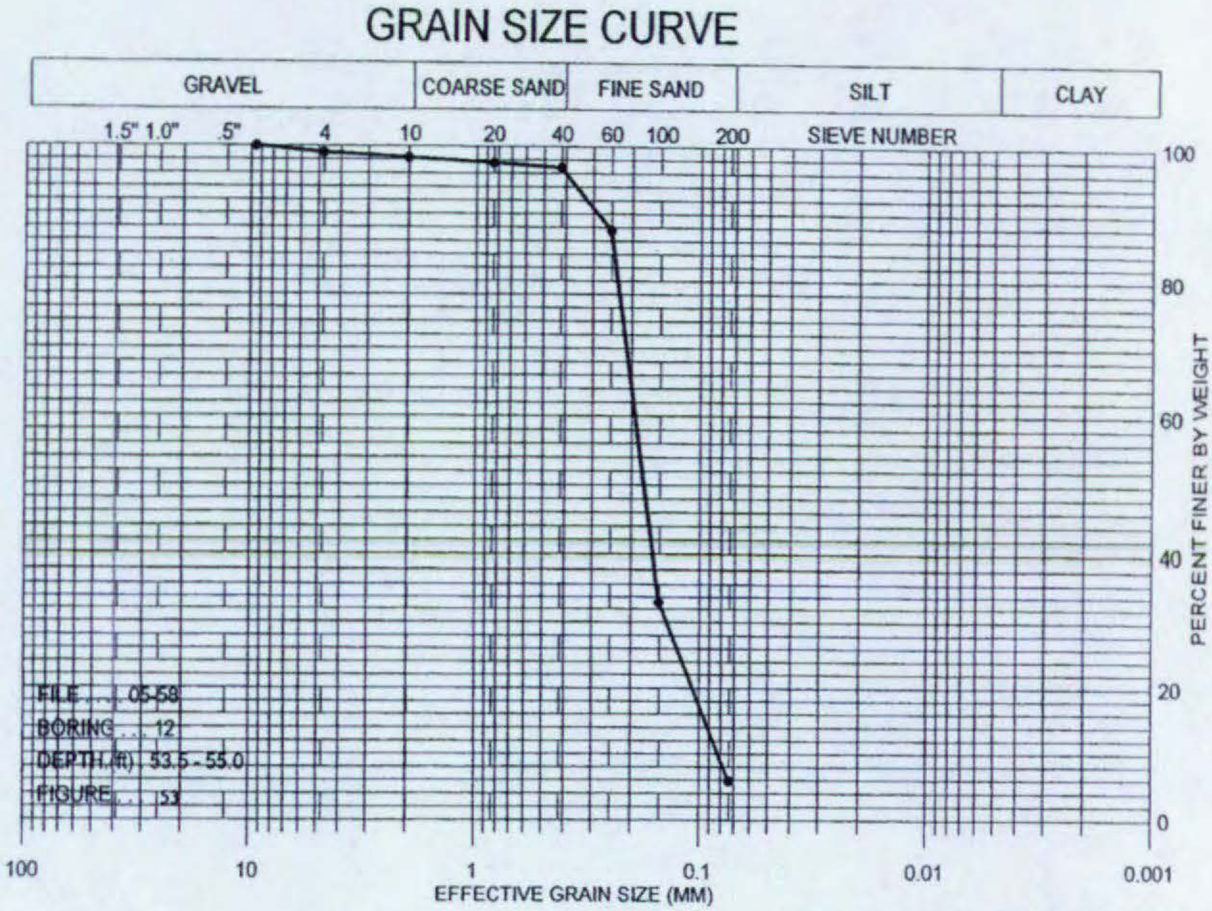

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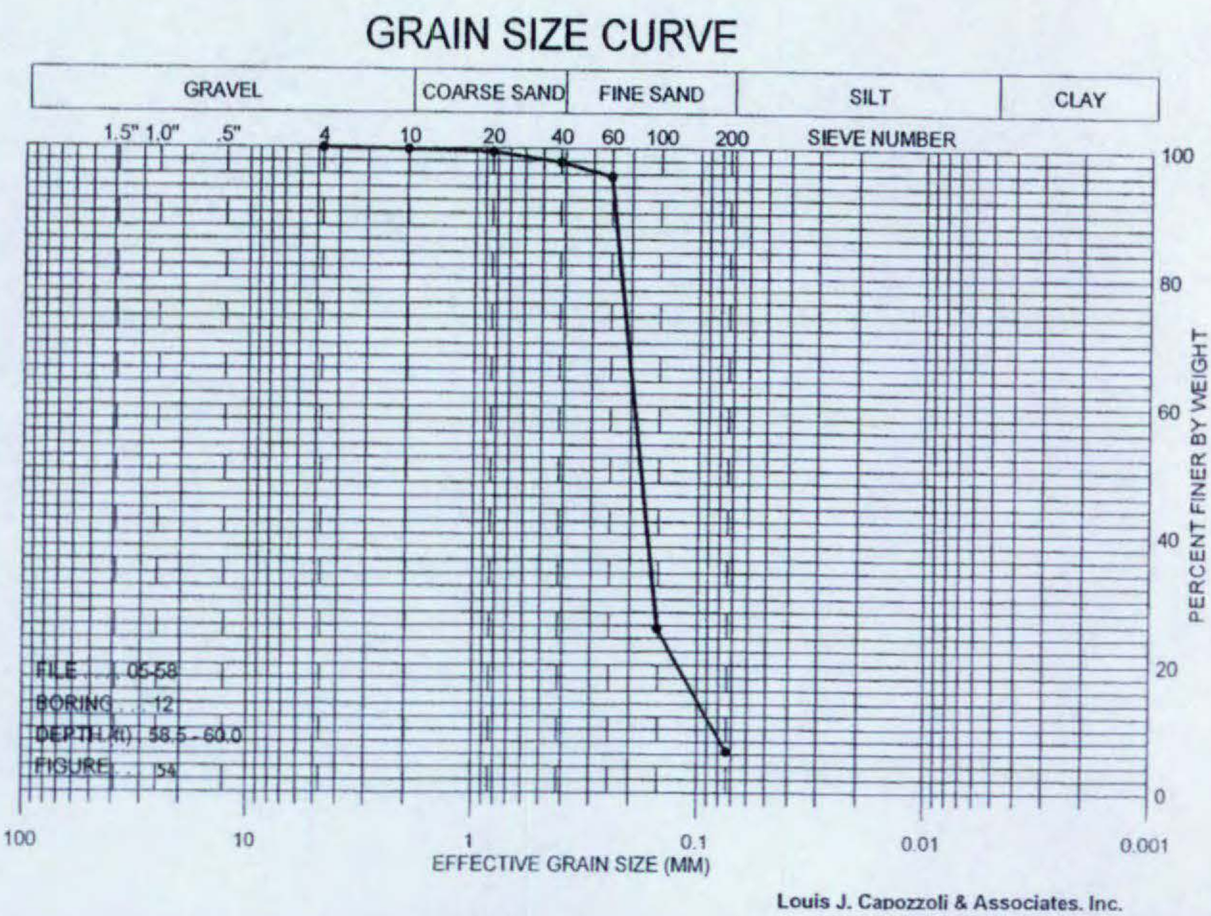

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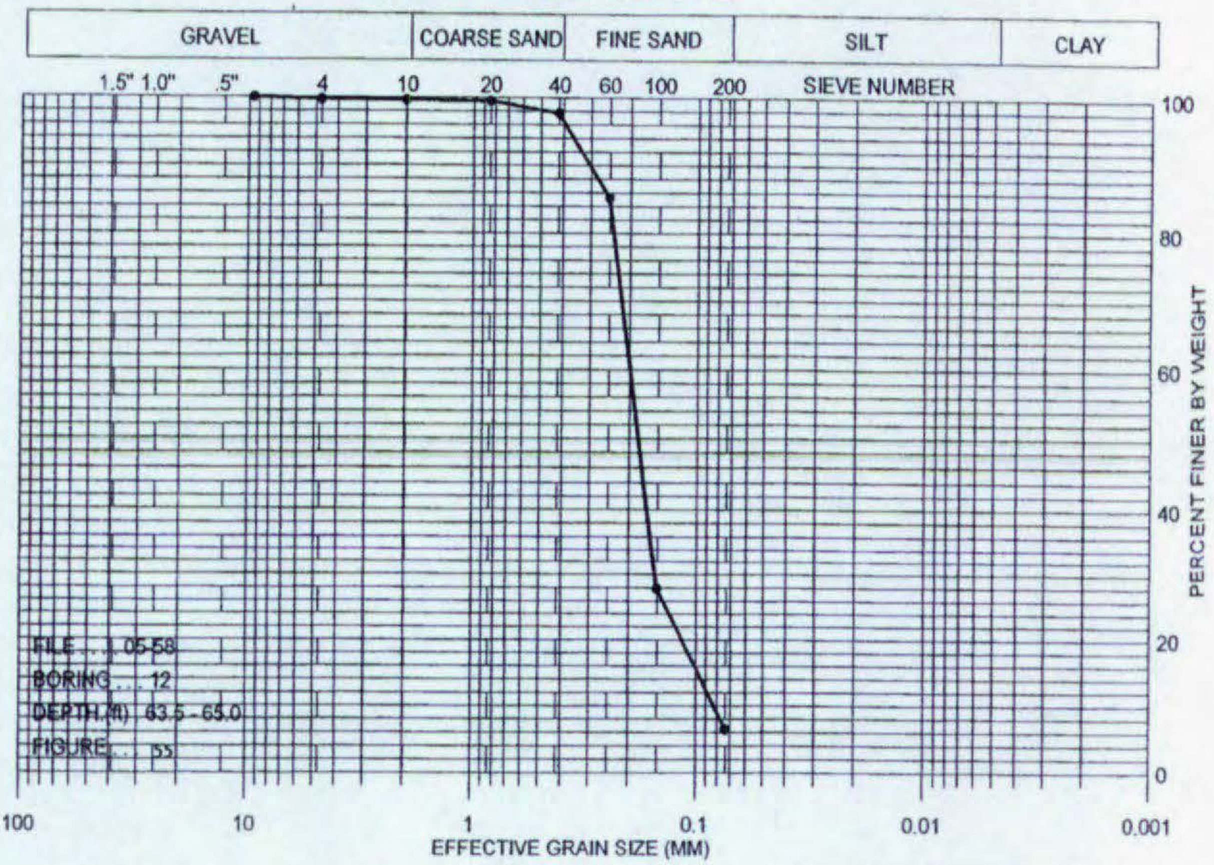
GRAIN SIZE CURVE



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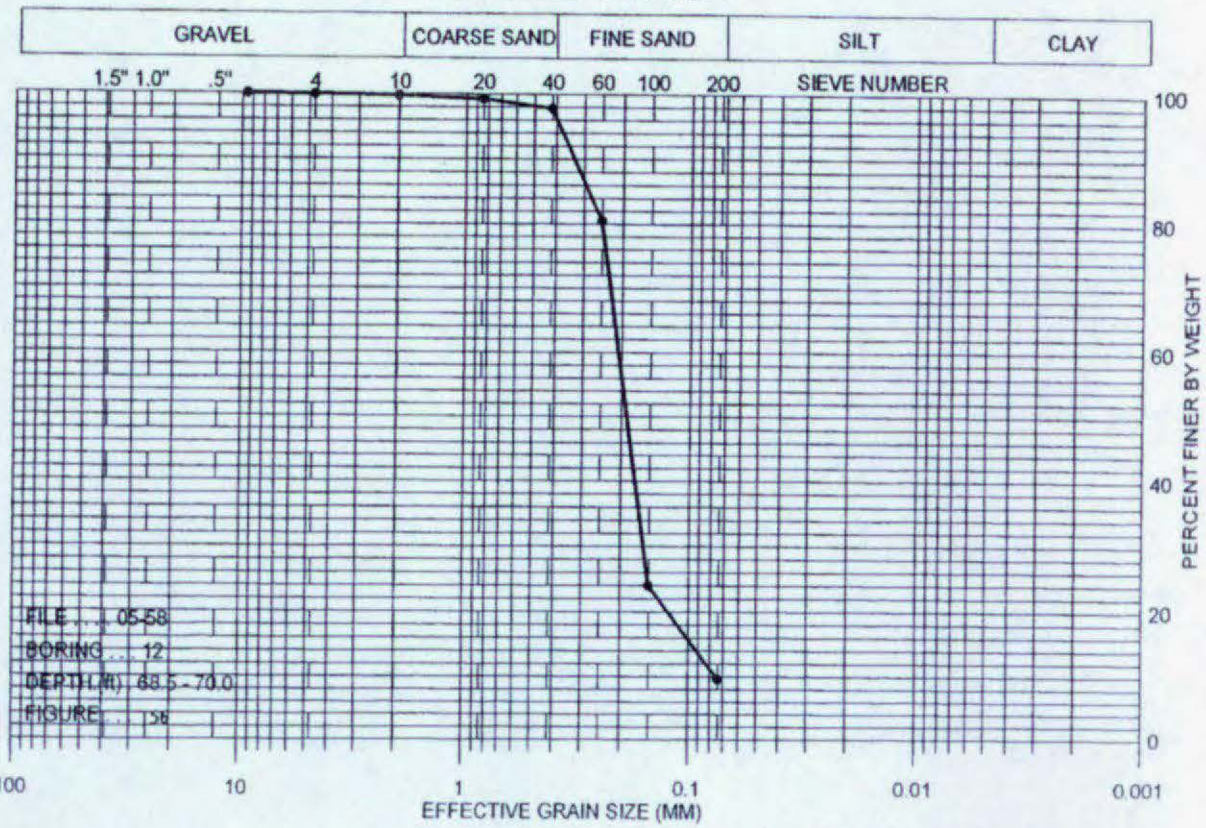
GRAIN SIZE CURVE



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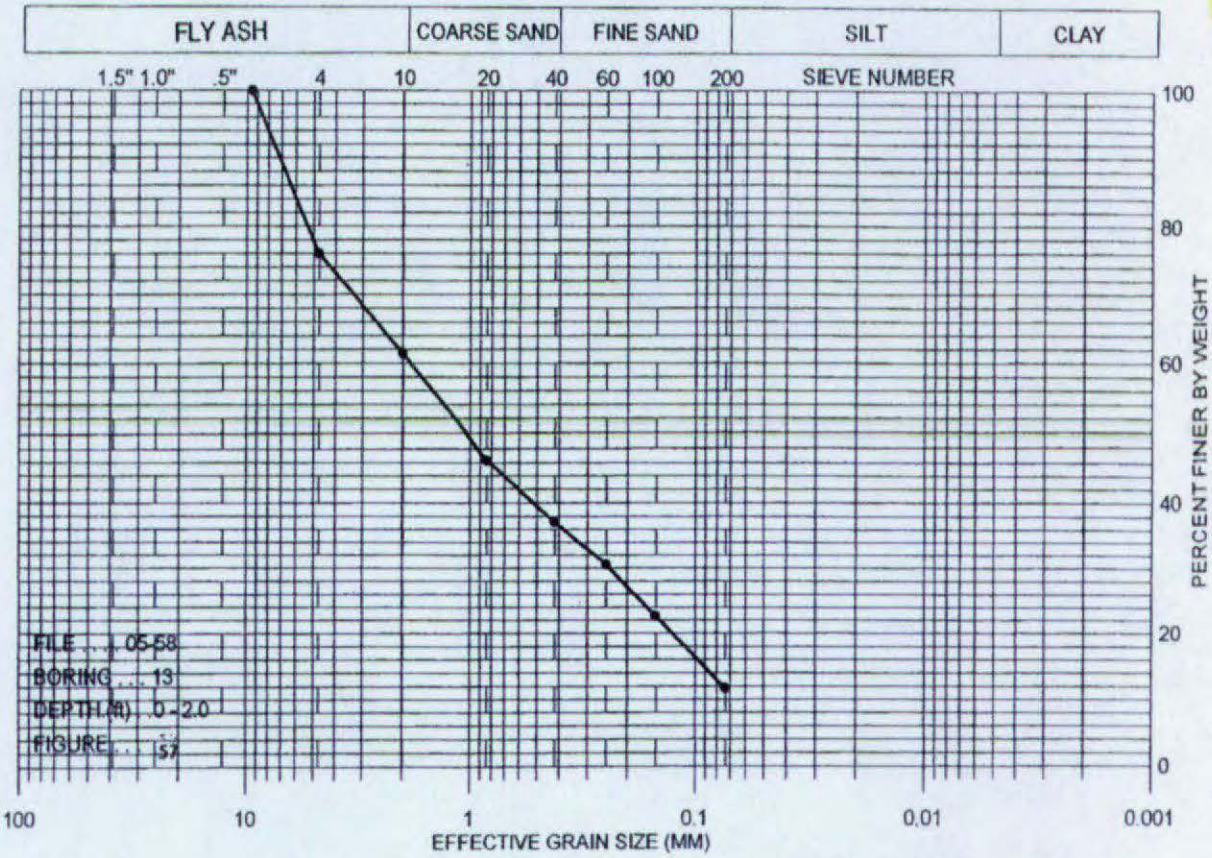
GRAIN SIZE CURVE



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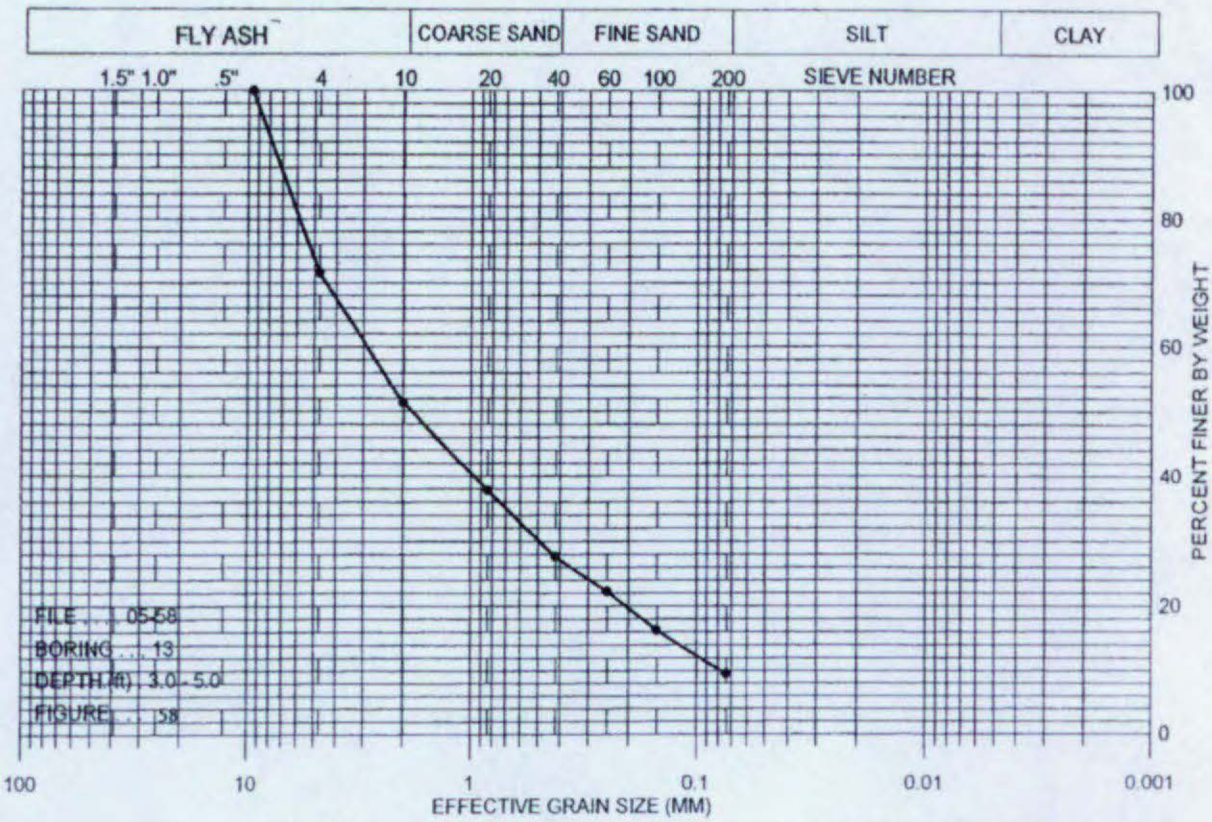
GRAIN SIZE CURVE



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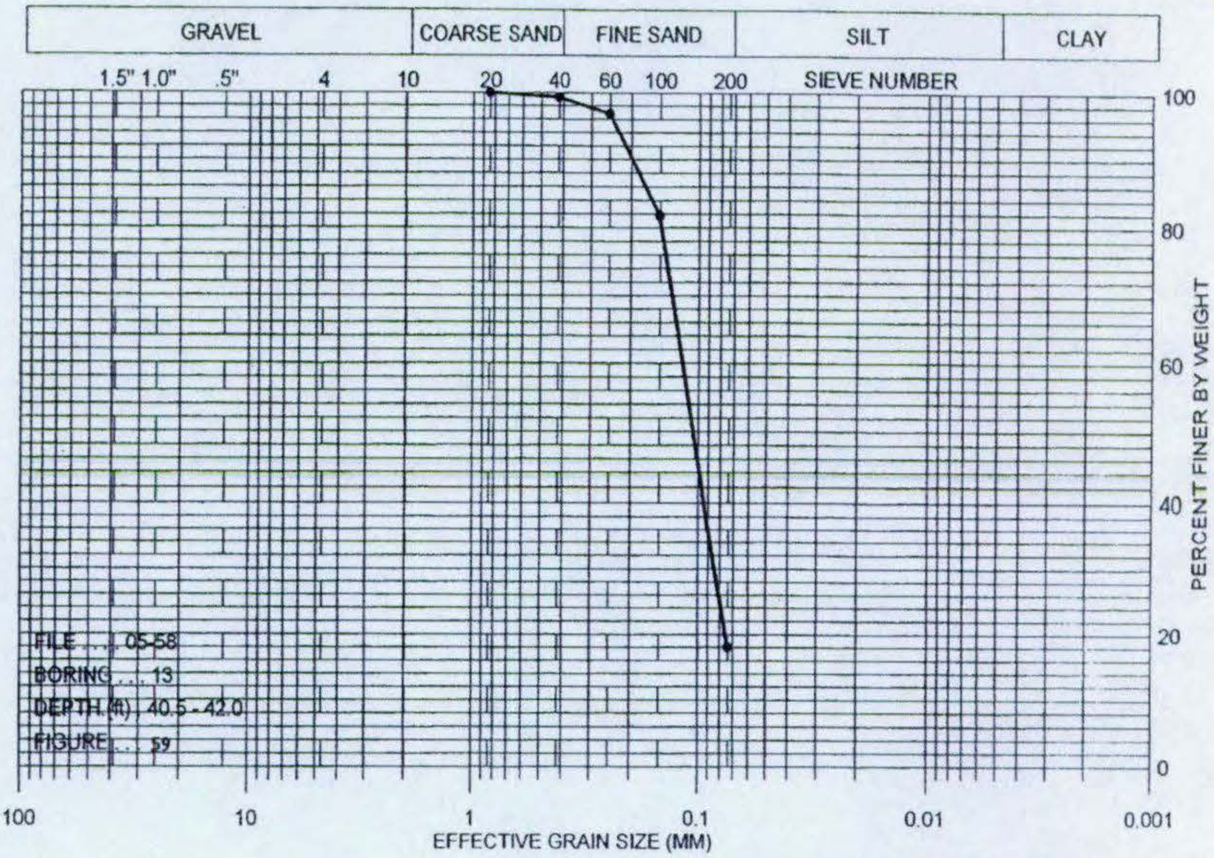
GRAIN SIZE CURVE



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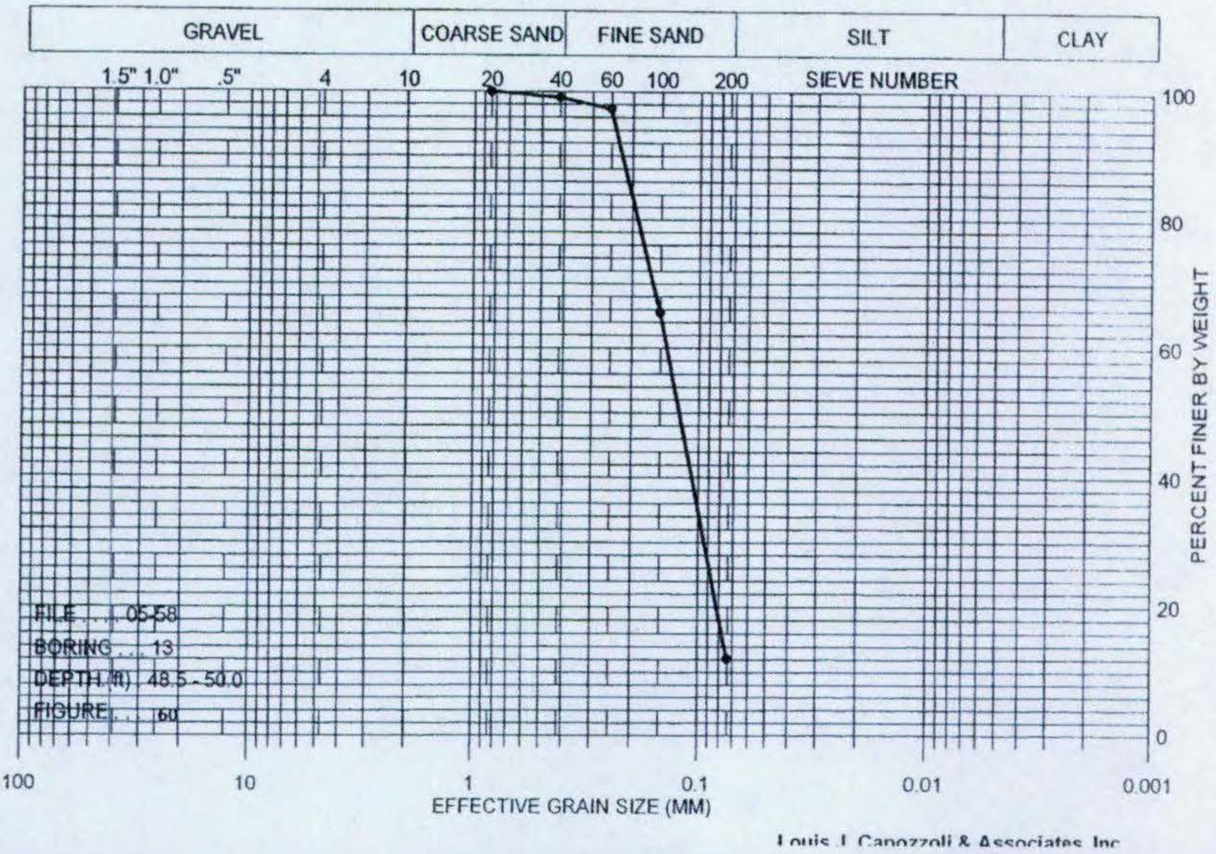
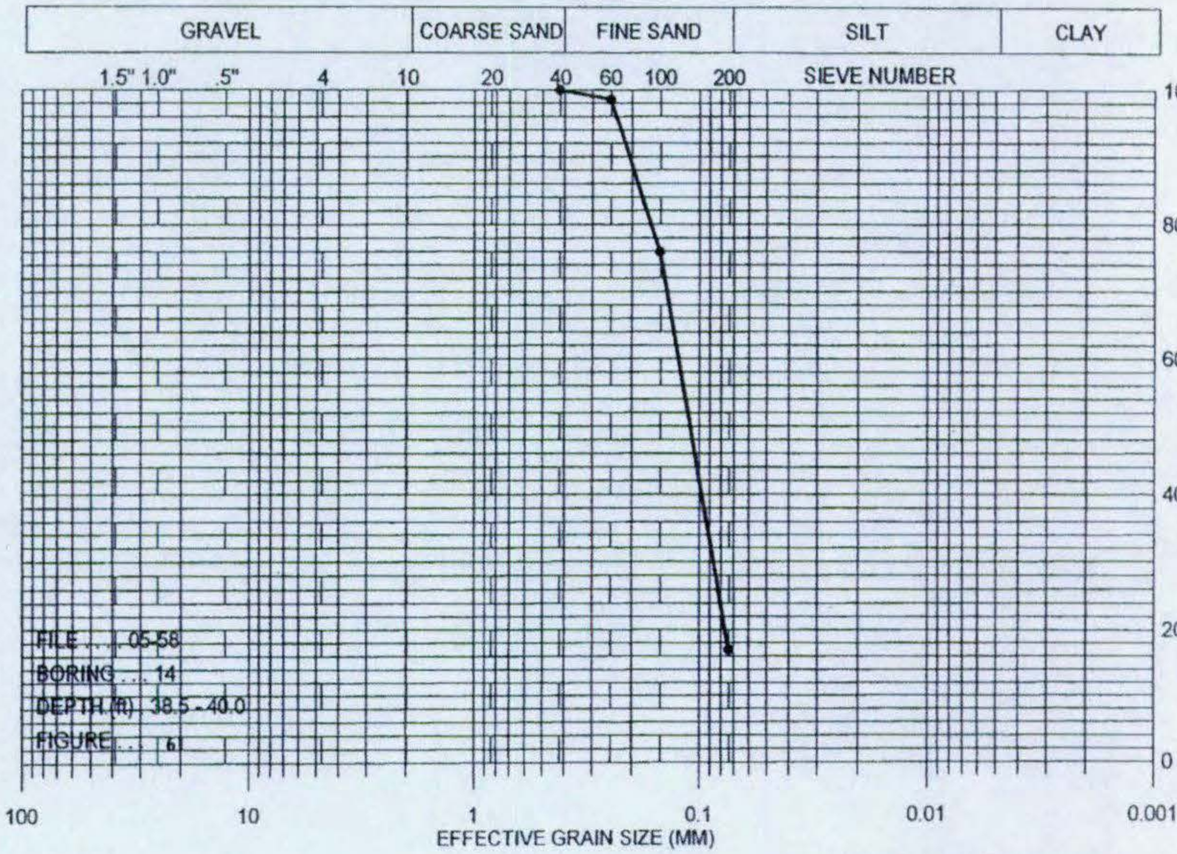
GRAIN SIZE CURVE



Louis J. Capozzoli & Associates, Inc.

GRAIN SIZE CURVE



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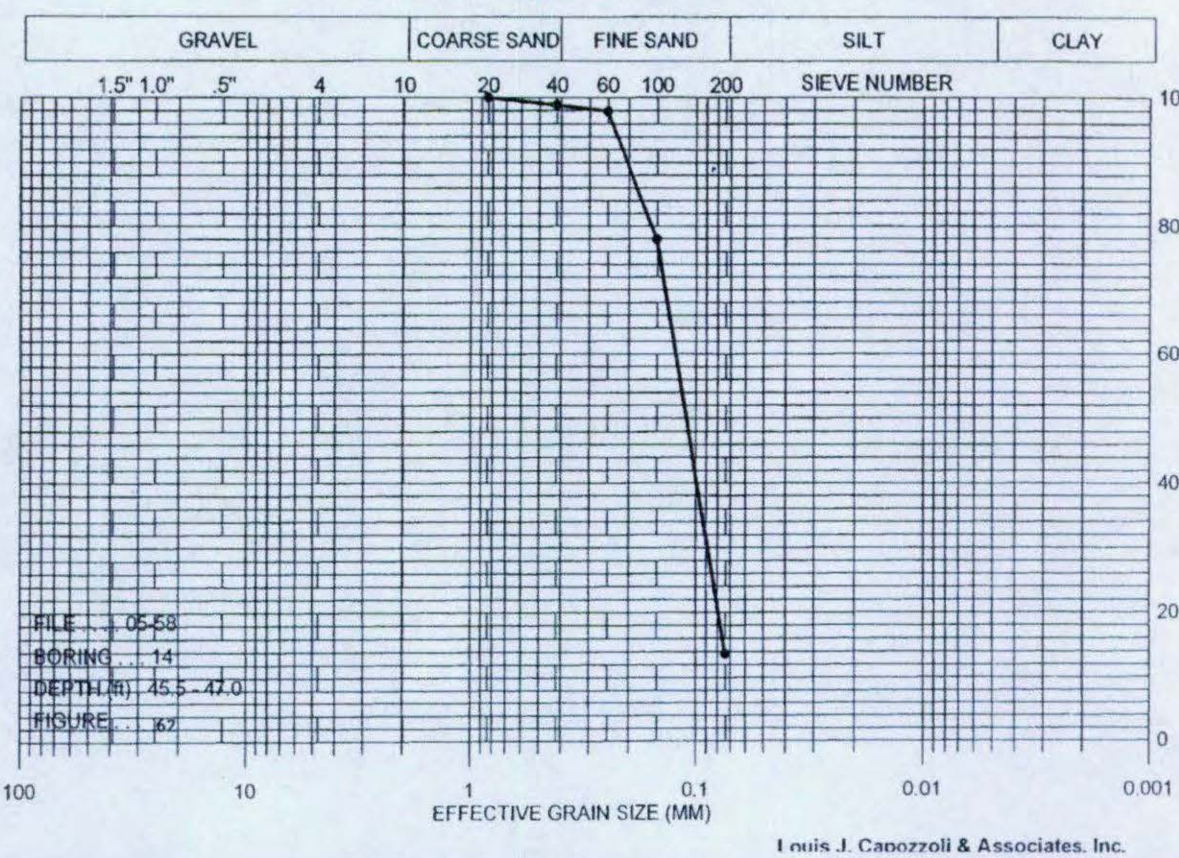
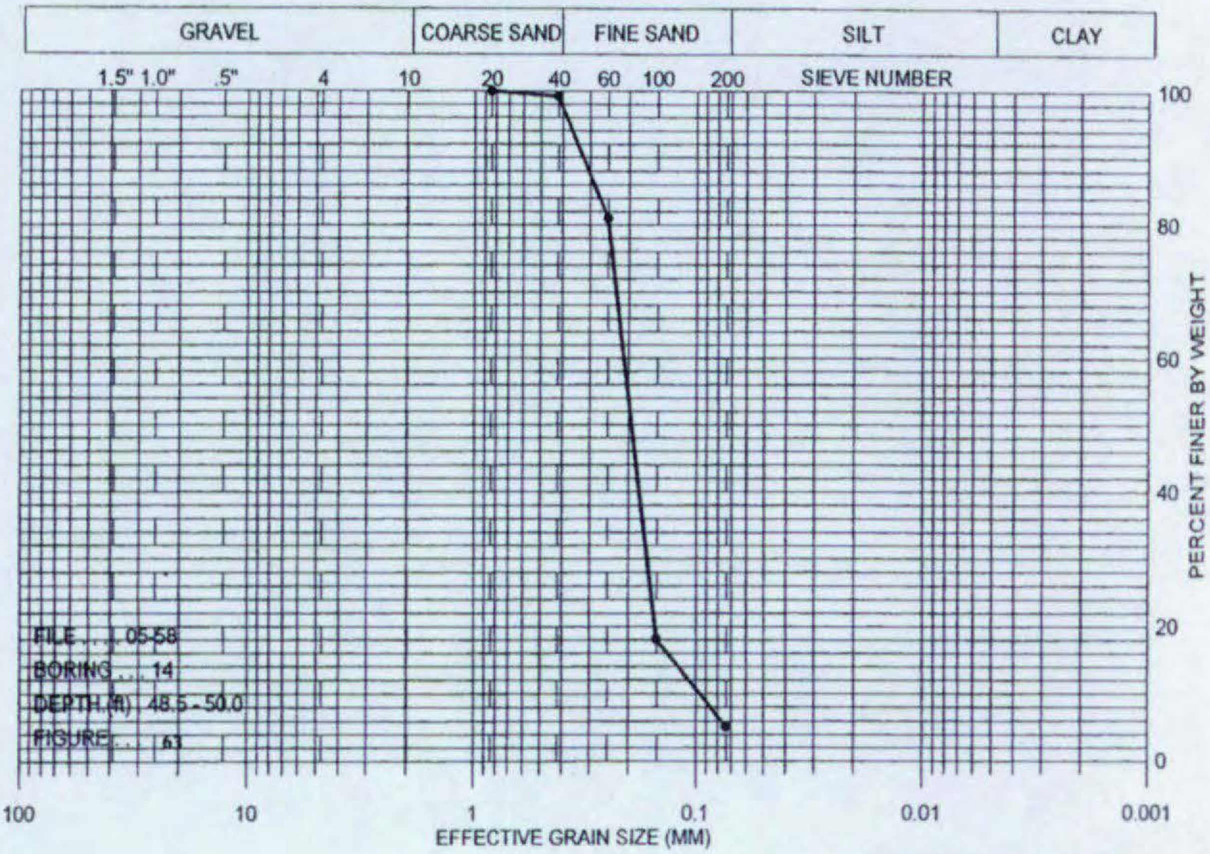
GRAIN SIZE CURVE



Louis J. Capozzoli & Associates, Inc.

GRAIN SIZE CURVE



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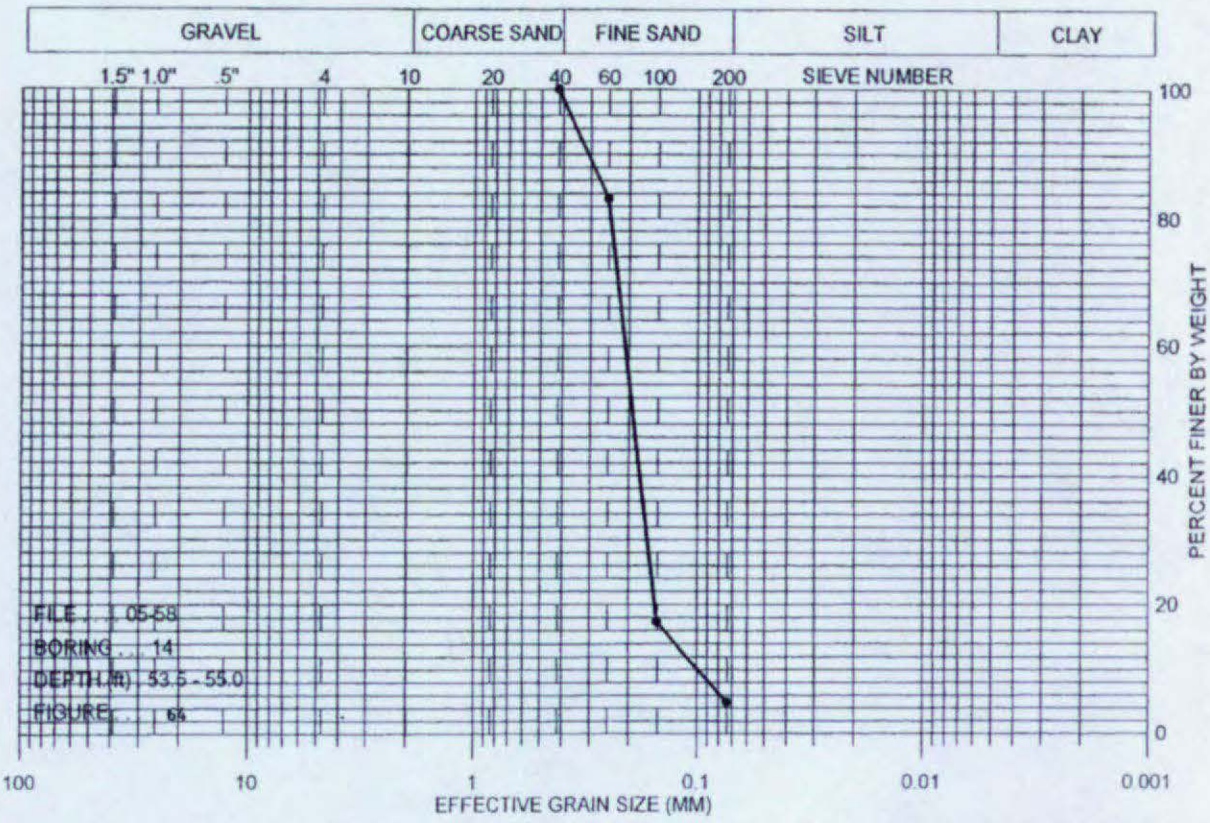
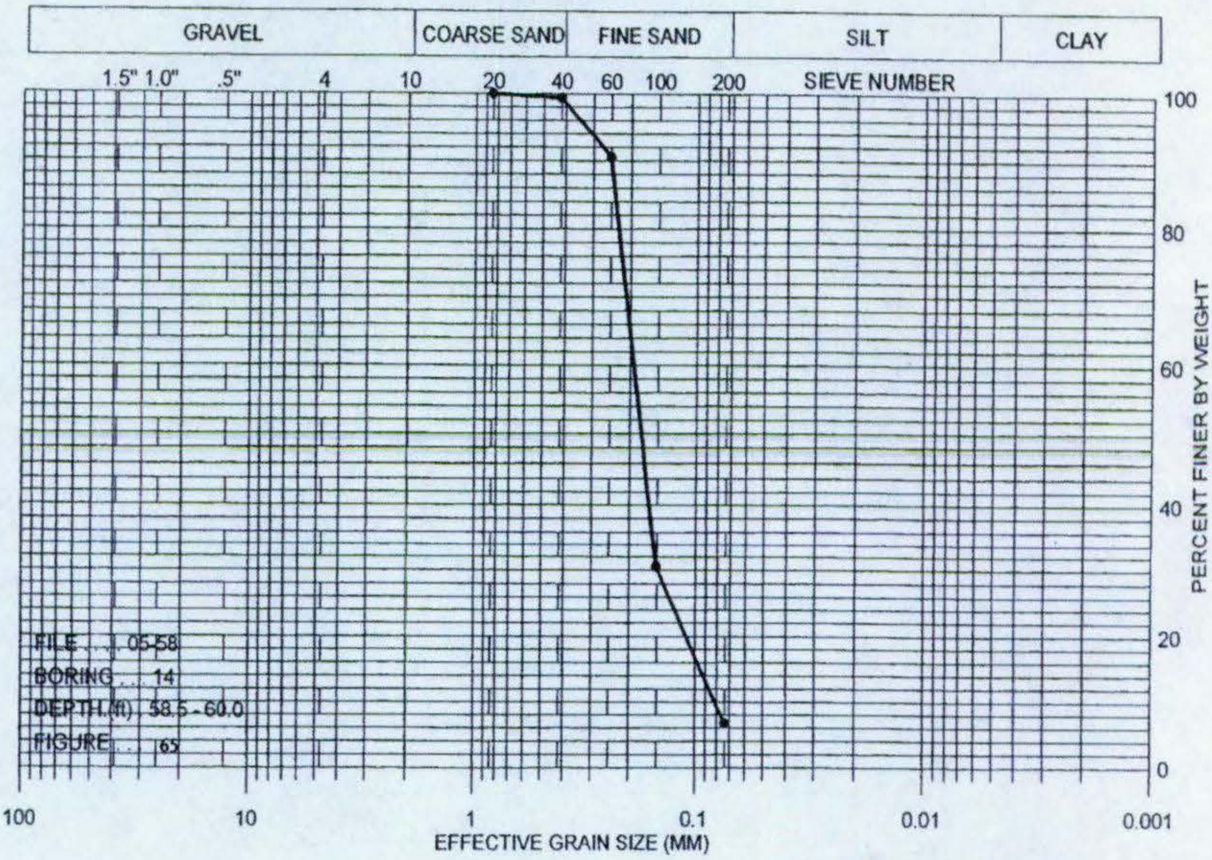
GRAIN SIZE CURVE



Louis J. Capozzoli & Associates, Inc.

GRAIN SIZE CURVE



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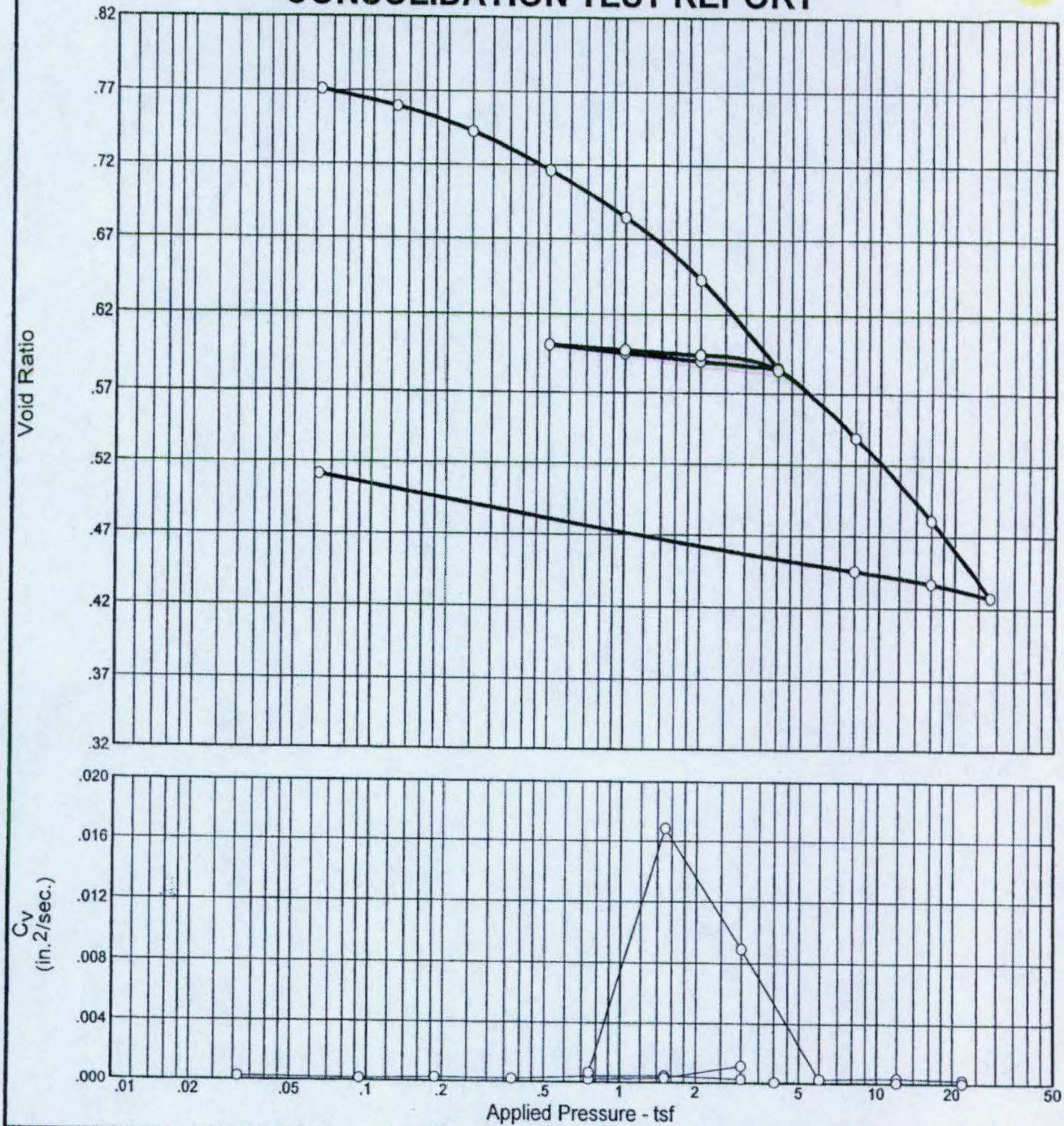
CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
97.0 %	28.6 %	92.8	48	24	2.65			0.782

MATERIAL DESCRIPTION

Project No. 05-58 **Client:** Shaw

Project: Ash Pond Expansion
Big Cajun II

Source: Boring 5 **Sample No.:** 18 - 20 feet

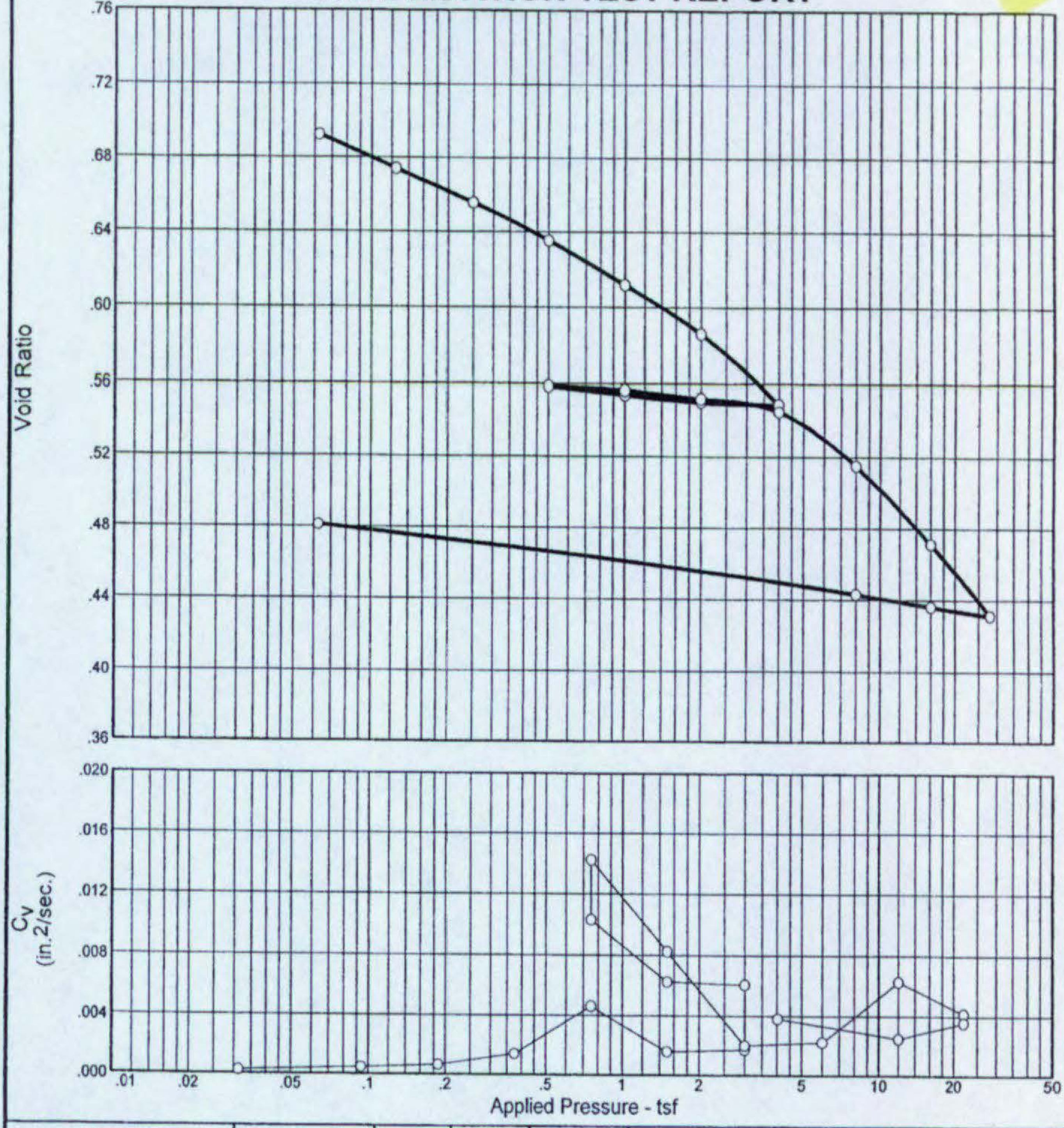
CONSOLIDATION TEST REPORT

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.

Remarks:

Figure Number: 66

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
100.0 %	32.4 %	94.2	32	14	2.65			0.756

MATERIAL DESCRIPTION

Project No. 05-58 **Client:** Shaw

Project: Ash Pond Expansion
Big Cajun II

Source: Boring 5 **Sample No.:** 33 - 35 feet

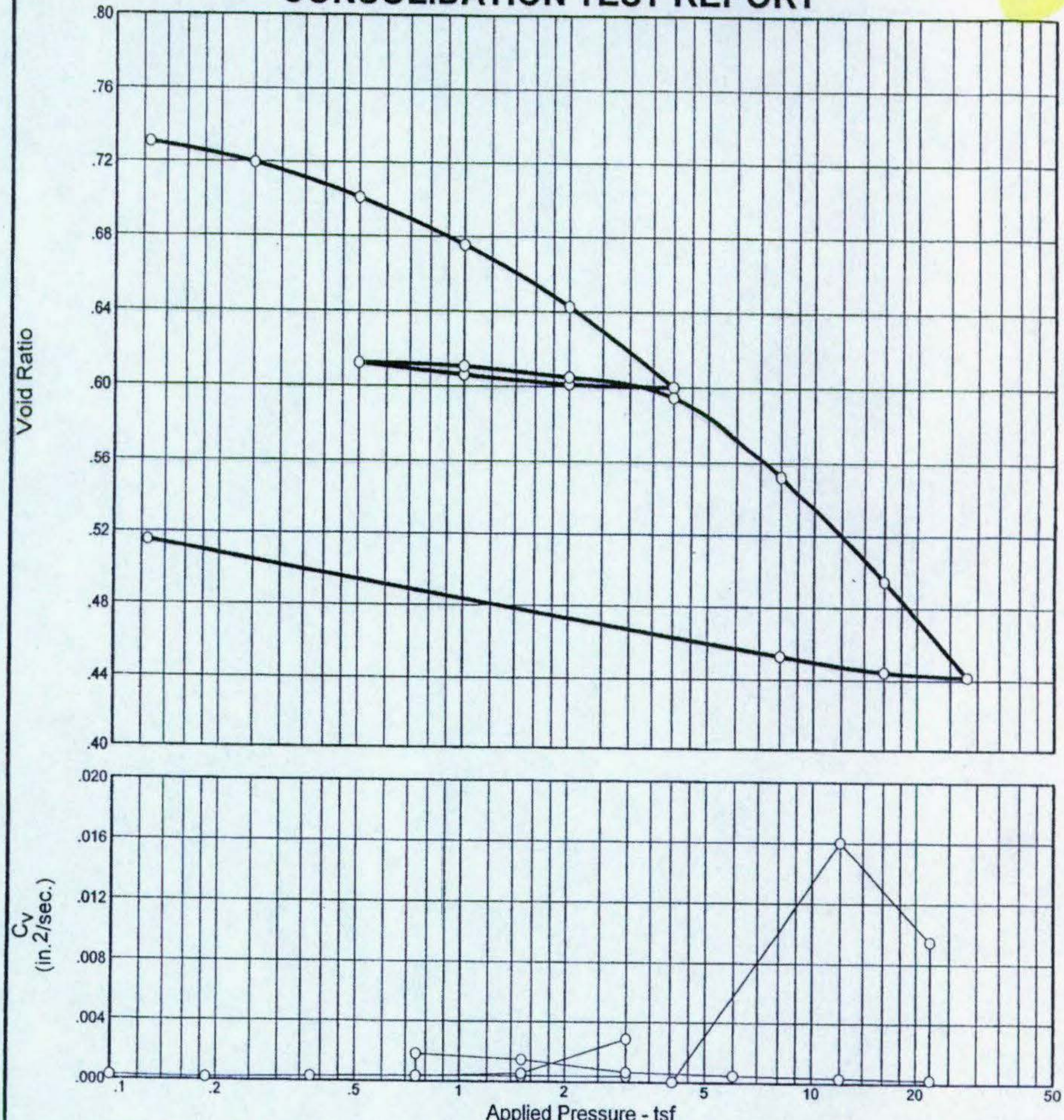
CONSOLIDATION TEST REPORT

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.

Remarks:

Figure Number: 67

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
100.0 %	28.5 %	95.3	31	10	2.65			0.736

MATERIAL DESCRIPTION

Project No. 05-58 **Client:** Shaw

Project: Ash Pond Expansion
Big Cajun II

Source: Boring 8 **Sample No.:** 23 - 25 feet

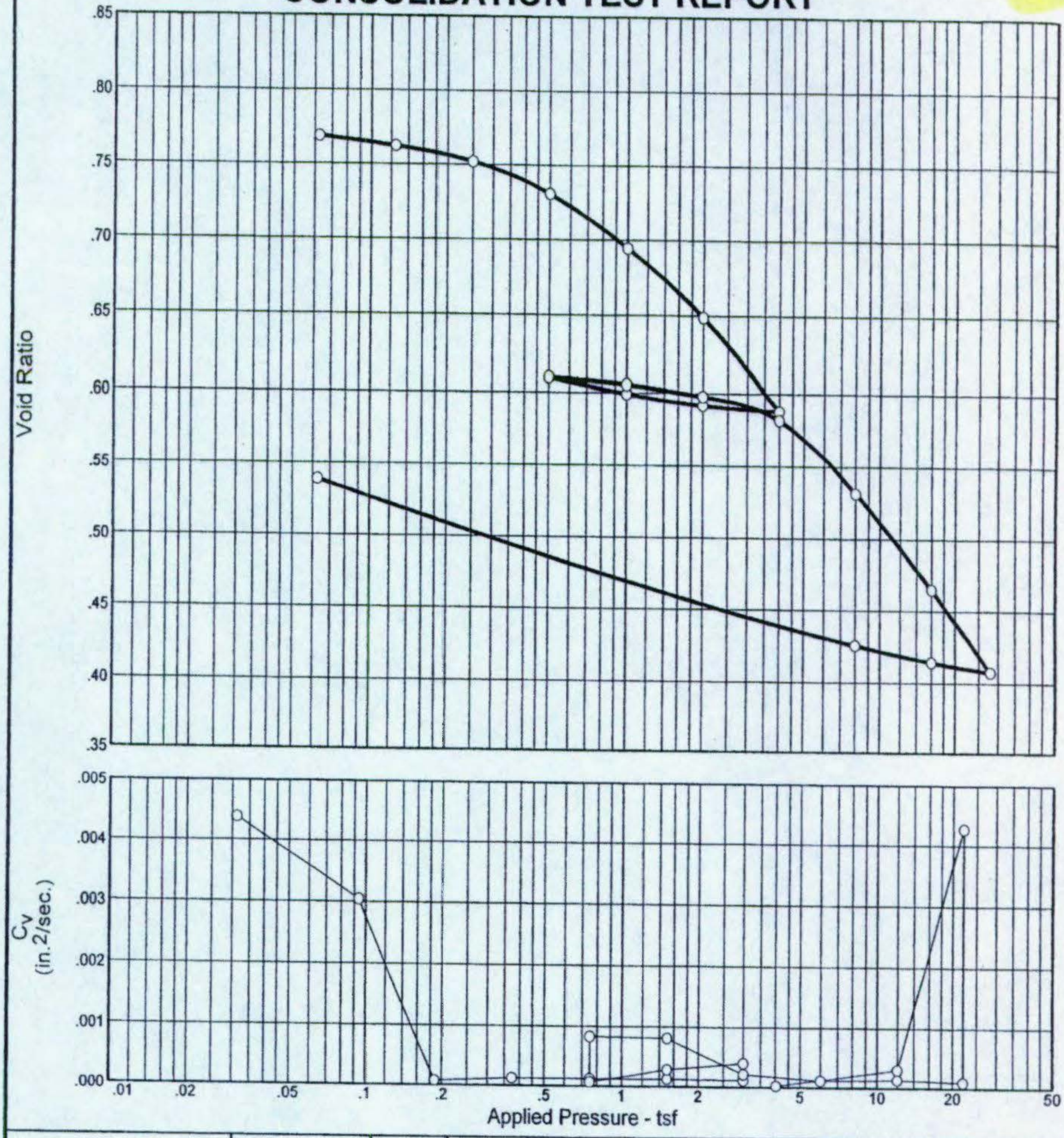
CONSOLIDATION TEST REPORT

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.

Remarks:

Figure Number: 68

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
98.1 %	28.6 %	93.4	35	14	2.65			0.772

MATERIAL DESCRIPTION

Project No. 05-58 **Client:** Shaw

Project: Ash Pond Expansion
Big Cajun II

Source: Boring 9 **Sample No.:** 8 - 10 feet

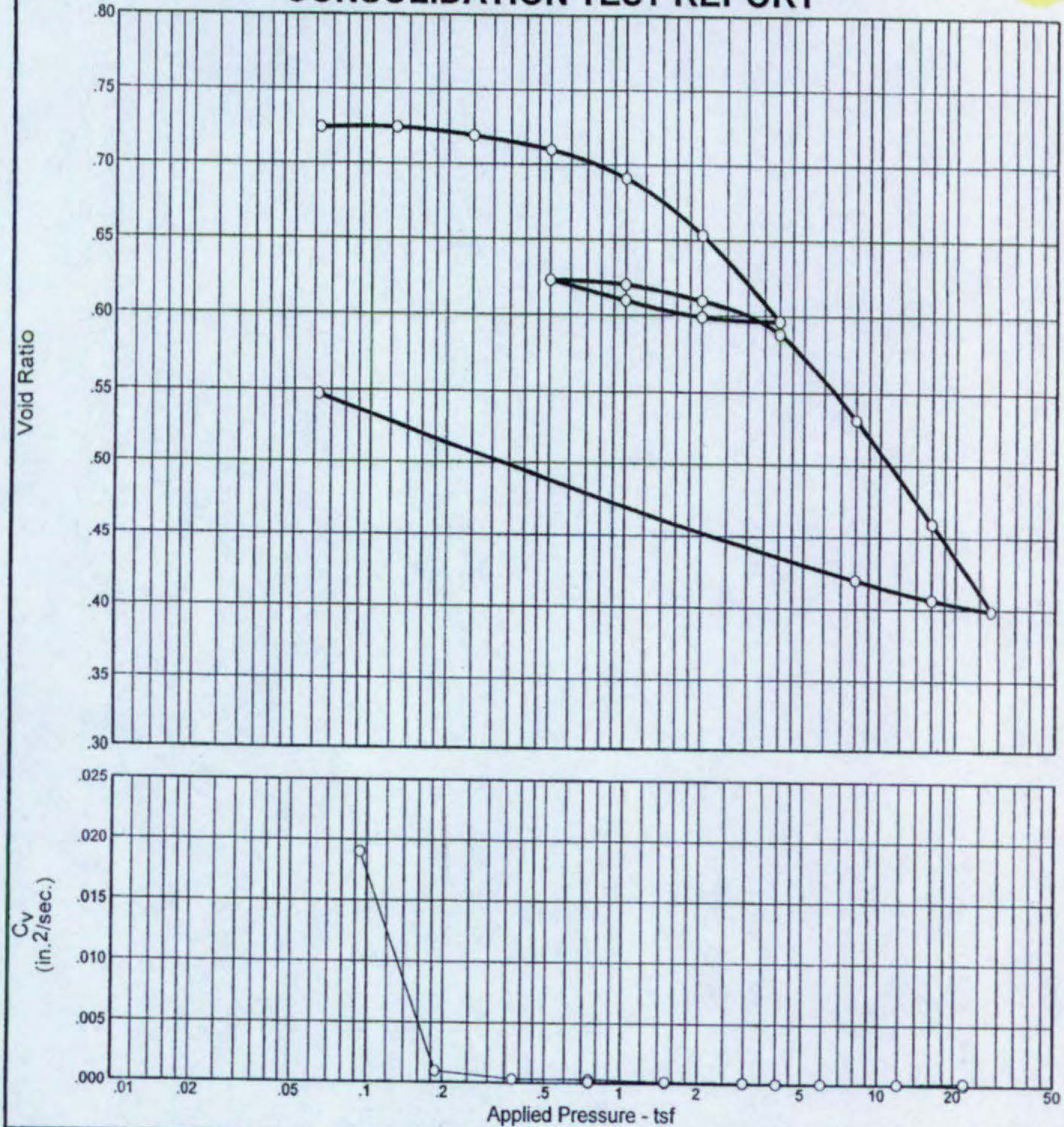
Remarks:

CONSOLIDATION TEST REPORT

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.

Figure Number: 69

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
98.6 %	27.2 %	95.6	61	39	2.65			0.730

MATERIAL DESCRIPTION

Project No. 05-58 **Client:** Shaw

Project: Ash Pond Expansion
Big Cajun II

Source: Boring 14 **Sample No.:** 18 - 20 feet

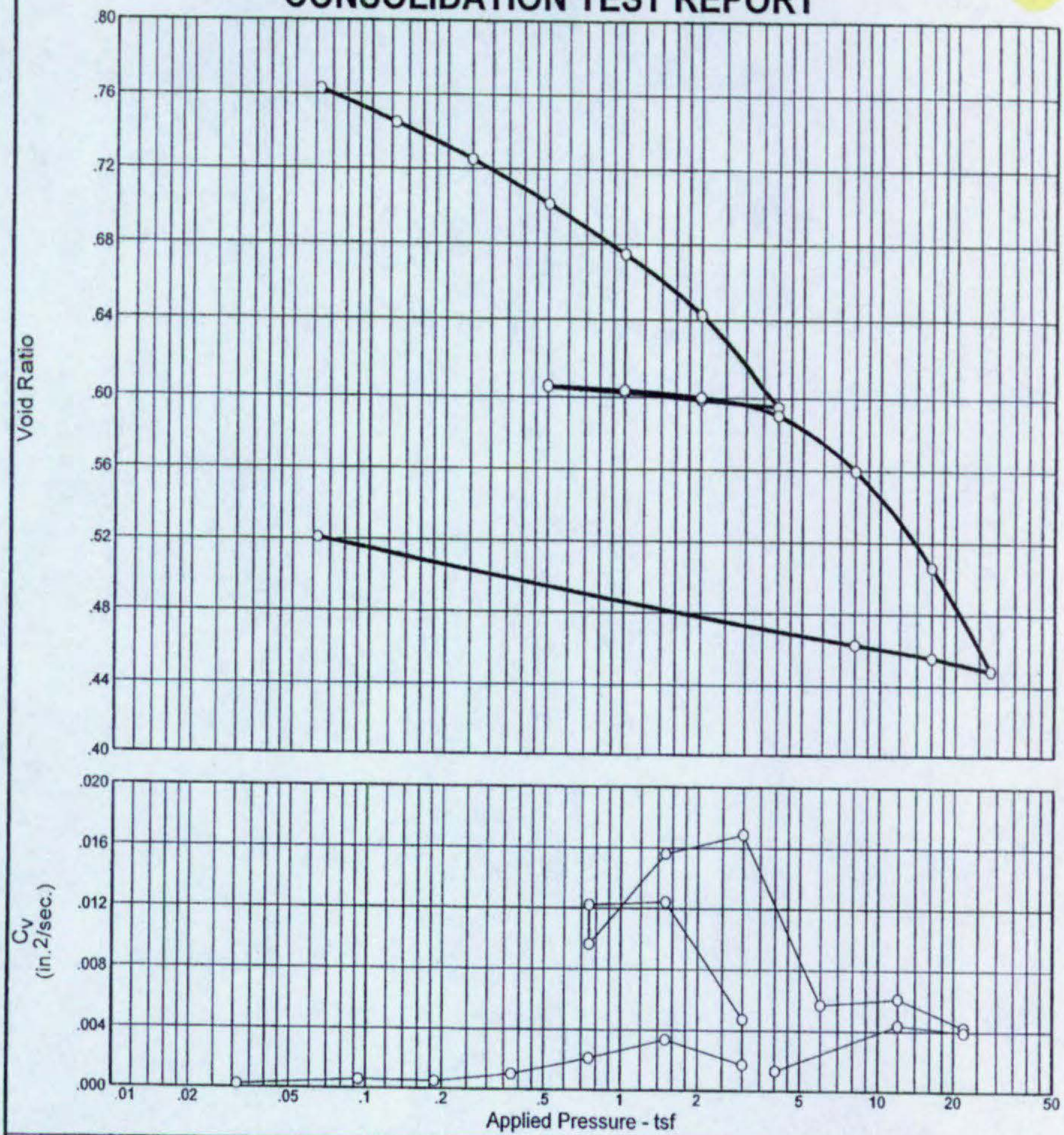
Remarks:

CONSOLIDATION TEST REPORT

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.

Figure Number: 70

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
100.0 %	34.4 %	90.9	32	9	2.65			0.819

MATERIAL DESCRIPTION

Project No. 05-58 **Client:** Shaw

Project: Ash Pond Expansion
Big Cajun II

Source: Boring 14 **Sample No.:** 28 - 30 feet

Remarks:

CONSOLIDATION TEST REPORT

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.

Figure Number: 71

LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	1
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	24-Aug-05
	Baton Rouge, Louisiana	Technician:	PN

Undisturbed Sample
Standard Penetration Test
Classification Sample
(SLS) Slickensided

Boring Depth: 70 Feet

Depth Feet	SAMPLES	Description	Remarks
0	Classification Sample	Fly ash and gravel with clay traces	Cement-bentonite grout backfill full depth
5	Undisturbed Sample	Stiff gray clay with gravel and fly ash	
10	Undisturbed Sample	Very stiff gray clay	
15	Undisturbed Sample	Stiff tan and gray clay	
20	Undisturbed Sample	Stiff tan and gray clay	
25	Undisturbed Sample	Soft gray silty clay	
30	Undisturbed Sample	Firm brown silty fine sand	
35	Undisturbed Sample	Soft gray slightly silty clay	
40	Standard Penetration Test	Firm gray fine sand with silt traces	19 blows per foot (11/11/8)
45	Standard Penetration Test	Firm gray silty fine sand	24 blows per foot (10/11/13)
50	Standard Penetration Test	Firm gray fine sand with silt traces	25 blows per foot (10/12/13)

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.
Geotechnical Engineers

LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	1
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	24-Aug-05
	Baton Rouge, Louisiana	Technician:	PN

Undisturbed Sample
Standard Penetration Test
Classification Sample
(SLS) Slickensided

Boring Depth: 70 Feet

Depth Feet	SAMPLES	Description	Blows
50			
55	Standard Penetration Test	Firm gray fine sand with silt traces	21 blows per foot (6/9/12)
60	Standard Penetration Test	Firm light gray fine sand with silt traces	23 blows per foot (7/12/11)
65	Standard Penetration Test	Firm light gray fine sand with silt traces	20 blows per foot (9/5/15)
70	Standard Penetration Test	Dense light gray fine sand with silt traces	37 blows per foot (12/17/20)

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.
Geotechnical Engineers

LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	3
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	24-Aug-05
	Baton Rouge, Louisiana	Technician:	PN

Legend: Undisturbed Sample; Standard Penetration Test; Classification Sample; (SLS) Slickensided

Boring Depth: 50 Feet

Depth Feet	Samples	Description	Remarks
0–1	Undisturbed	Hard tan and gray clay with roots	Cement-bentonite grout backfill full depth
2–3	Undisturbed	Very stiff tan and gray clay with ferrous nodules	
4–5	Undisturbed	Very stiff tan and gray clay with sand streaks and pockets	
6–7	Undisturbed	Soft tan sandy clay with sand pockets	
8–10	Undisturbed	Very soft tan and gray very sandy clay	
13–15	Classification	Tan silty fine sand with clay traces	
17–18.5	SPT	Loose brown sandy silt	8 blows per foot (2/2/6)
19		No sample recovered	
20–21.5	SPT	Firm brown fine sand with silt traces	14 blows per foot (6/8/6)
23–24.5	SPT	Dense light gray fine sand with silt traces	31 blows per foot (5/15/16)
28–29.5	SPT	Firm light gray silty fine sand	23 blows per foot (9/11/12)
33–34.5	SPT	Dense light gray fine sand with silt traces	46 blows per foot (16/24/22)
38–39.5	SPT	Dense light gray fine sand with silt traces	34 blows per foot (11/17/17)
43–44.5	SPT	Very dense light gray fine sand with silt traces	40 blows per foot (15/19/21)
48–49.5	SPT	Dense light gray fine sand	34 blows per foot (17/18/16)

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.
Geotechnical Engineers

LOG OF BORING

Project: Bottom Ash Storage Pond Expansion
Big Cajun II, Pointe Coupee Parish, Louisiana
For: Shaw Environmental & Infrastructure, Inc.
Baton Rouge, Louisiana

Boring: 4
File: 05-58
Date: 24-Aug-05
Technician: JP

Legend:
- Undisturbed Sample
- Standard Penetration Test
- Classification Sample
- (SLS) Slickensided

Boring Depth: 70 Feet

Depth Feet	SAMPLES	Description	Remarks
0	Classification Sample	Tan and gray fly ash and sand	Cement-bentonite grout backfill full depth
5	Undisturbed Sample	Hard brown, tan, and gray clay	
10	Undisturbed Sample	Stiff tan and gray slightly sandy clay	
15	Undisturbed Sample	Very stiff tan and gray clay with sand streaks and pockets	
20	Undisturbed Sample	Stiff gray clay	
25	Undisturbed Sample	Stiff tan and gray clay	
30	Undisturbed Sample	Very soft tan and gray silty clay with 3 inch clayey silt layer	
35	Undisturbed Sample	Soft tan and gray very silty clay with 1 inch clayey silt layer	
40	Undisturbed Sample	Firm tan silty fine sand	
40	Standard Penetration Test	Firm tan and gray silty fine sand	11 blows per foot (7/5/6)
45			
50	Standard Penetration Test	Firm gray fine sand with silt traces	26 blows per foot (11/13/13)

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LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	4
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	25-Aug-05
	Baton Rouge, Louisiana	Technician:	JP

Legend:
- ■ Undisturbed Sample
- ☒ Standard Penetration Test
- ▯ Classification Sample
- (SLS) Slickensided

Boring Depth: 70 Feet

Depth Feet	SAMPLES	Description	Remarks
50			
55			
60	☒	Dense gray fine sand with silt traces	34 blows per foot (15/16/18)
65			
70	☒	Dense gray fine sand with silt traces	36 blows per foot (16/17/19)

LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	5
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	25-Aug-05
	Baton Rouge, Louisiana	Technician:	JP

Legend: ■ Undisturbed Sample; ☒ Standard Penetration Test; ▯ Classification Sample; (SLS) Slickensided

Boring Depth: 70 Feet

Depth Feet	SAMPLES	Description	Remarks
0–2	Undisturbed	Very stiff brown slightly silty clay with fly ash	Cement-bentonite grout backfill full depth
3–5	Undisturbed	Very stiff brown silty clay	
8–10	Undisturbed	Stiff tan and gray clay	
13–15	Undisturbed	Stiff tan and gray clay with ferrous nodules	
18–20	Undisturbed	Medium tan and gray slightly silty clay	
23–25	Undisturbed	Medium gray silty clay	
28–30	Undisturbed	Loose tan and gray clayey silt	
33–35	Undisturbed	Soft tan and gray very silty clay	
38–40	Undisturbed	Loose gray silty fine sand with clay lenses	
43–45	Undisturbed	Medium gray slightly sandy clay with sand lenses	
48–50	Standard Penetration Test	Firm gray sandy silt	12 blows per foot (3/6/6)

LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	5
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	25-Aug-05
	Baton Rouge, Louisiana	Technician:	JP

Depth Feet | SAMPLES

■ Undisturbed Sample
☒ Standard Penetration Test
◫ Classification Sample
(SLS) Slickensided

Boring Depth: 70 Feet

Depth (Feet)	Sample	Description	Remarks
50			
55			
58–60	☒	Dense gray fine sand with silt traces	35 blows per foot (15/17/18)
65			
68–70	☒	Dense gray fine sand with silt traces	36 blows per foot (14/18/18)

LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	6
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	26-Aug-05
	Baton Rouge, Louisiana	Technician:	JP

Depth Feet | SAMPLES

- Undisturbed Sample
- Standard Penetration Test
- Classification Sample
- (SLS) Slickensided

Boring Depth: 55 Feet

Depth (Feet)	Description	Remarks
0	Brown fly ash with clayey sand pockets and roots	Cement-bentonite grout backfill full depth
5	Hard tan and gray slightly silty clay	
10	Stiff tan and gray clay	
15	Stiff tan and gray clay	
20	Stiff gray clay	
25	Stiff tan and gray clay	
30	Very soft tan and gray very silty clay with 3 inch clayey silt layer	
35	Loose tan and gray clayey silt	
	No sample recovered	
40	Dense tan and gray fine sand with silt and clay traces	39 blows per foot (13/13/26)
45	Very dense tan and gray fine sand with silt traces	53 blows per foot (12/22/31)
50	Dense gray fine sand with silt traces	43 blows per foot (17/21/22)

LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	6
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	26-Aug-05
	Baton Rouge, Louisiana	Technician:	JP

Depth Feet | SAMPLES

■ Undisturbed Sample
☒ Standard Penetration Test
▯ Classification Sample
(SLS) Slickensided

Boring Depth: 55 Feet

Depth Feet	Sample	Description	
50			
55	☒	Dense gray fine sand with silt traces	45 blows per foot (20/18/27)

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LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	7
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	26-Aug-05
	Baton Rouge, Louisiana	Technician:	JP

■ Undisturbed Sample
☒ Standard Penetration Test
▯ Classification Sample
(SLS) Slickensided

Boring Depth: 70 Feet

Depth Feet	SAMPLES	Description	Remarks
0	Classification Sample	Black and brown fly ash	Cement-bentonite grout backfill full depth
5	Undisturbed Sample	Hard tan and gray clay	
10	Undisturbed Sample	Very stiff tan and gray slightly silty clay	
15	Undisturbed Sample	Very stiff tan and gray clay with silt pockets	
20	Undisturbed Sample	Stiff gray clay	
25	Undisturbed Sample	Stiff tan and gray clay with silt pockets	
30	Undisturbed Sample	Medium tan and gray clay with ferrous nodules	
35	Undisturbed Sample	Very soft tan and gray very silty clay with ferrous nodules	
40		No sample recovered	
	Standard Penetration Test	Very stiff gray silty clay	17 blows per foot (4/7/10)
45			
50	Undisturbed Sample	Medium gray very silty clay	

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LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	7
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	26-Aug-05
	Baton Rouge, Louisiana	Technician:	JP

Undisturbed Sample
Standard Penetration Test
Classification Sample
(SLS) Slickensided

Boring Depth: 70 Feet

Depth Feet	SAMPLES	Description	
50			
55			
60	Standard Penetration Test	Dense gray fine sand with silt traces	34 blows per foot (10/16/18)
65			
70	Standard Penetration Test	Very dense gray sand with silt traces	78 blows per foot (18/36/42)

LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	8
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	1-Sep-05
	Baton Rouge, Louisiana	Technician:	PN

Undisturbed Sample
Standard Penetration Test
Classification Sample
(SLS) Slickensided

Boring Depth: 55 Feet

Depth Feet	SAMPLES	Description	Remarks
0	Classification Sample	Brown and black coal and fly ash	Cement-bentonite grout backfill full depth
5	Undisturbed Sample	Brown and black fly ash with clay pockets	
10	Undisturbed Sample	Stiff tan and gray slightly sandy clay	
15	Undisturbed Sample	Stiff tan and gray clay	
20	Undisturbed Sample	Stiff tan and gray clay	
25	Undisturbed Sample	Soft tan and gray very silty clay	
30	Undisturbed Sample	Loose tan and gray clayey sand	
35	Undisturbed Sample	Loose tan sandy silt	
40	Classification Sample	Gray silty fine sand	
	Standard Penetration Test	Firm light gray silty fine sand	23 blows per foot (7/10/13)
45	Standard Penetration Test	Dense light gray silty fine sand	34 blows per foot (10/17/17)
50	Standard Penetration Test	Dense light gray fine sand with silt traces	35 blows per foot (7/17/18)

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LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	8
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	1-Sep-05
	Baton Rouge, Louisiana	Technician:	PN

Depth Feet | SAMPLES

■ Undisturbed Sample
⊠ Standard Penetration Test
▯ Classification Sample
(SLS) Slickensided

Boring Depth: 55 Feet

Depth Feet	Samples	Description	
50			
55	⊠	Dense light gray fine sand with silt traces	32 blows per foot (10/15/17)

LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	9
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	1-Sep-05
	Baton Rouge, Louisiana	Technician:	PN

Depth Feet | SAMPLES

Undisturbed Sample
Standard Penetration Test
Classification Sample
(SLS) Slickensided

Boring Depth: 50 Feet

Depth Feet	Description	Remarks
0	Brown sand with roots	Cement-bentonite grout backfill full depth
	Very stiff gray sandy clay	
5	Stiff tan and gray clay	
	Medium tan and gray clay with ferrous nodules	
	Stiff tan and gray silty clay with ferrous nodules	
10		
	Loose tan and gray silty fine sand with clay pockets	
15		
	No sample recovered	
20	Loose light gray sandy silt	6 blows per foot (4/4/2)
	Firm light gray silty fine sand with clay traces	18 blows per foot (8/10/8)
25		
	No sample recovered	
30	Firm light gray silty fine sand	11 blows per foot (4/5/6)
	Firm light gray clayey fine sand with organic matter traces	18 blows per foot (4/9/9)
35		
	Firm light gray clayey fine sand	28 blows per foot (7/14/14)
40		
	Dense light gray fine sand with silt traces	30 blows per foot (10/12/18)
45		
	Firm light gray fine sand with silt traces	27 blows per foot (9/13/14)
50		

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LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	11
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	23-Aug-05
	Baton Rouge, Louisiana	Technician:	JP

Legend: Undisturbed Sample; Standard Penetration Test; Classification Sample; (SLS) Slickensided

Boring Depth: 50 Feet

Depth (Feet)	Sample	Description	Remarks
0–2	Undisturbed	Hard brown and gray clay with ferrous nodules	Cement-bentonite grout backfill full depth
2–4	Undisturbed	Hard brown clay	
4–6	Undisturbed	Very stiff brown and gray clay with silt streaks and organic matter	
6–8	Undisturbed	Medium gray clay	
8–10	Undisturbed	Medium gray clay	
13–15	Undisturbed	Medium gray clay	(SLS)
18–20	Undisturbed	Loose gray clayey sand	
23–25		No sample recovered	
25–27	SPT	Firm gray silty fine sand	28 blows per foot (7/12/16)
28–30	SPT	Firm gray fine sand with silt traces	15 blows per foot (5/7/8)
33–35	SPT	Dense gray fine sand with silt traces	37 blows per foot (18/18/19)
38–40	SPT	Dense gray fine sand with silt traces	36 blows per foot (17/19/17)
43–45	SPT	Dense gray fine sand	37 blows per foot (13/17/20)
48–50	SPT	Dense gray fine sand	37 blows per foot (16/18/21)

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LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	12
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	22-Aug-05
	Baton Rouge, Louisiana	Technician:	JP

Undisturbed Sample
Standard Penetration Test
Classification Sample
(SLS) Slickensided

Boring Depth: 70 Feet

Depth Feet	Samples	Description	Remarks
0	Classification Sample	Black fly ash	Cement-bentonite grout backfill full depth
5	Undisturbed Sample	Very stiff brown clay with fly ash	
10	Undisturbed Sample	Stiff tan and gray clay	
15	Undisturbed Sample	Stiff tan and gray clay with silt streaks and ferrous nodules	
20	Undisturbed Sample	Stiff gray clay	
25	Undisturbed Sample	Soft gray very silty clay	
30	Undisturbed Sample	Soft tan and gray silty clay	
35		No sample recovered	
	Standard Penetration Test	Firm tan and gray fine sand with silt traces	29 blows per foot (10/10/19)
40	Standard Penetration Test	Firm tan and gray fine sand with silt traces	16 blows per foot (8/8/8)
45	Standard Penetration Test	Firm gray silty fine sand with clay traces	11 blows per foot (6/3/8)
50	Standard Penetration Test	Firm gray silty fine sand with clay traces	22 blows per foot (10/16/16)

LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	12
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	22-Aug-05
	Baton Rouge, Louisiana	Technician:	JP

Undisturbed Sample
Standard Penetration Test
Classification Sample
(SLS) Slickensided

Boring Depth: 70 Feet

Depth Feet	SAMPLES	Description	
50			
55	SPT	Dense gray fine sand with shells and silt traces	30 blows per foot (15/14/16)
60	SPT	Dense gray fine sand with shells and silt traces	30 blows per foot (15/13/17)
65	SPT	Dense gray fine sand with silt traces	30 blows per foot (12/14/16)
70	SPT	Dense gray fine sand with silt traces	43 blows per foot (17/20/23)

LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	13
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	23-Aug-05
	Baton Rouge, Louisiana	Technician:	JP

Legend: ■ Undisturbed Sample; ⊠ Standard Penetration Test; ◫ Classification Sample; (SLS) Slickensided

Boring Depth: 50 Feet

Depth Feet	SAMPLES	Description	Remarks
0–2	Undisturbed Sample	Black and brown fly ash and sand	Cement-bentonite grout backfill full depth
3–5	Undisturbed Sample	Soft black and brown fly ash and clay	
5		← Fly ash/soil interference at 5 feet	
8–10	Undisturbed Sample	Stiff tan and gray clay	
13–15	Undisturbed Sample	Stiff tan and gray silty clay with ferrous nodules	
18–20	Undisturbed Sample	Stiff tan and gray clay	
23–25	Undisturbed Sample	Medium tan and gray clay with ferrous nodules	
28–30	Undisturbed Sample	Medium tan and gray clay with ferrous nodules	
33–35	Undisturbed Sample	Medium tan and gray very sandy clay	
38–40		No sample recovered	
40–42	Standard Penetration Test	Firm tan and gray silty fine sand	25 blows per foot (9/11/14)
48–50	Standard Penetration Test	Dense gray fine sand with silt traces	31 blows per foot (12/16/15)

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LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	14
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	23-Aug-05
	Baton Rouge, Louisiana	Technician:	JP

Undisturbed Sample
Standard Penetration Test
Classification Sample
(SLS) Slickensided

Boring Depth: 60 Feet

Depth Feet	SAMPLES	Description	Remarks
0	Classification Sample	Black and brown fly ash	Cement-bentonite grout backfill full depth
	Classification Sample	Brown fly ash with clay pockets	
5		← Fly ash/clay interference at 5 feet	
10	Undisturbed Sample	Stiff tan and gray clay	
15	Undisturbed Sample	Medium tan and gray silty clay	
20	Undisturbed Sample	Very stiff tan and gray clay with sand streaks	
25	Undisturbed Sample	Stiff tan and gray clay	
30	Undisturbed Sample	Soft tan and gray very silty clay	
35	Undisturbed Sample	Soft tan and gray very sandy clay	
40	Standard Penetration Test	Loose tan and gray silty fine sand	4 blows per foot (6/2/2)
45	Undisturbed Sample	Loose gray fine sand with silt traces	
	Standard Penetration Test	Firm gray fine sand with silt traces	25 blows per foot (12/12/13)
50	Standard Penetration Test	Dense gray fine sand with silt traces	32 blows per foot (15/16/16)

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LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	14
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	23-Aug-05
	Baton Rouge, Louisiana	Technician:	JP

Undisturbed Sample
Standard Penetration Test
Classification Sample
(SLS) Slickensided

Boring Depth: 60 Feet

Depth Feet	SAMPLES	Description	Remarks
50			
55	Standard Penetration Test	Dense gray fine sand with silt traces	31 blows per foot (12/16/15)
60	Standard Penetration Test	Dense gray fine sand with silt traces	46 blows per foot (22/24/22)

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EMBANKMENT INTEGRITY

Theory. For a safe, economical embankment, two criteria must be met.

1. A structurally sound embankment/foundation soil system must be obtained - an adequate factor of safety, as outlined below, must be achieved.

2. Only acceptable embankment and subsoil deformations must be experienced - acceptable in this case means that embankment settlements and lateral deformation of the subsoil are predictable, or decreasing rate with time, and do not result in distress or damage to the embankment.

Structural Soundness. Embankment structural soundness is expressed by the factor of safety against foundation soil bearing capacity failure. The factor of safety is a number obtained by dividing the soil's maximum supportive capacity by the imposed loading of the overlying embankment. A factor of safety of 1.0 indicates that such forces are exactly balanced and a critical condition is in effect. A factor of safety less than 1.0 indicates failure will occur while a factor of safety greater than 1.0 indicates a safe foundation.

The soil's maximum resistive force, or bearing capacity, is reflected in its shear strength. A low initial shear strength will result in a foundation factor of safety less than or equal to 1.0 for the completed embankment. Therefore, if the embankment is built "instantaneously", an unsafe or (at least) "critical" foundation will result. Relatively slow "normal" embankment construction allows time for the soil's shear strength to increase and thereby improves the foundation factor of safety.

As the embankment is built, the water contained in the spaces (pores) between the soil grains is pressurized. Such pressure causes an outflow of pore water. The moisture content of the soil is thus decreased and the soil "dries". Since the shear strength of clay soil is inversely proportional to moisture content (the clay becomes stronger as it dries), outflow of pore water results in the soil shear strength increase required for a safe foundation. Because the outflow of pore water is a time dependent process, the embankment must be built at such a rate so as not to exceed at any time the shear strength gain required for an acceptable factor of safety.

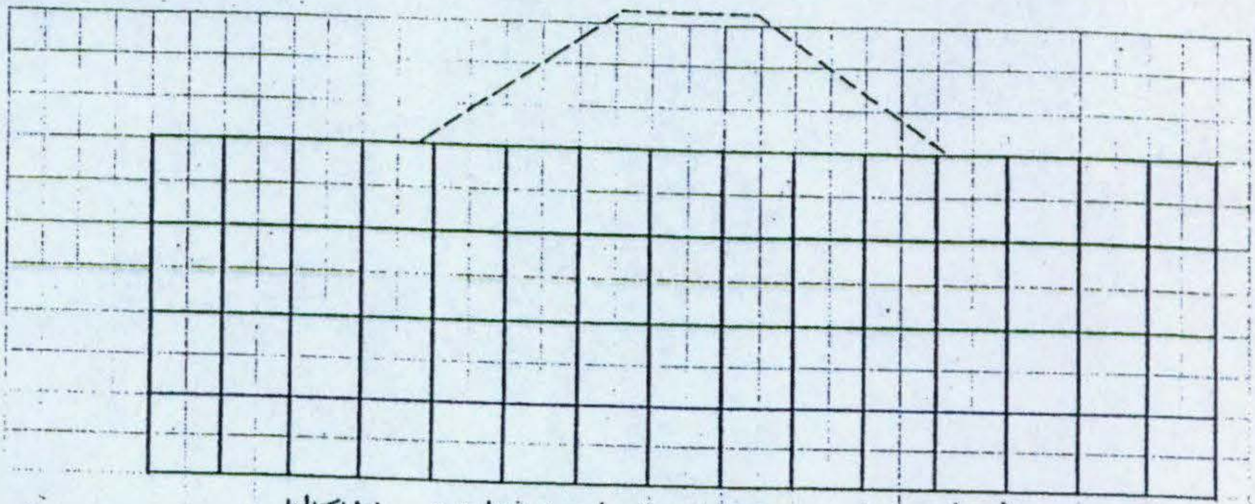
Acceptable Movements. Page 3 depicts two types of subsoil deformations. The top figure shows the soil prior to loading. The middle diagram indicates initial soil reaction to the applied load. In this stage, the soil beneath the embankment "flows" laterally outward with as yet no corresponding outflow of pressurized pore water (this is termed undrained or constant volume deformation). The soil can be compared to a block of rubber which tends to move downward and outward under load. Since no additional soil shear strength has been developed, this is the most critical stage during embankment construction. If the soil experiences enough deformation, its shear strength will be exceeded and the embankment foundation will fail.

Immediate subsoil deformations are dependent on the soil's stiffness as characterized by its undrained (Youngs) stress-strain modules, Eu. Like shear strength, this parameter is inversely proportional to the clay's moisture content, i.e., the clay "stiffens" as it dries. Therefore, if a given load is incrementally applied to the soil, allowing time for load pressurized pore water to drain, Eu will increase during the loading period. Overall result will be less immediate deformation than if the same given load is applied at one time (with consequently no Eu increase during the loading period).

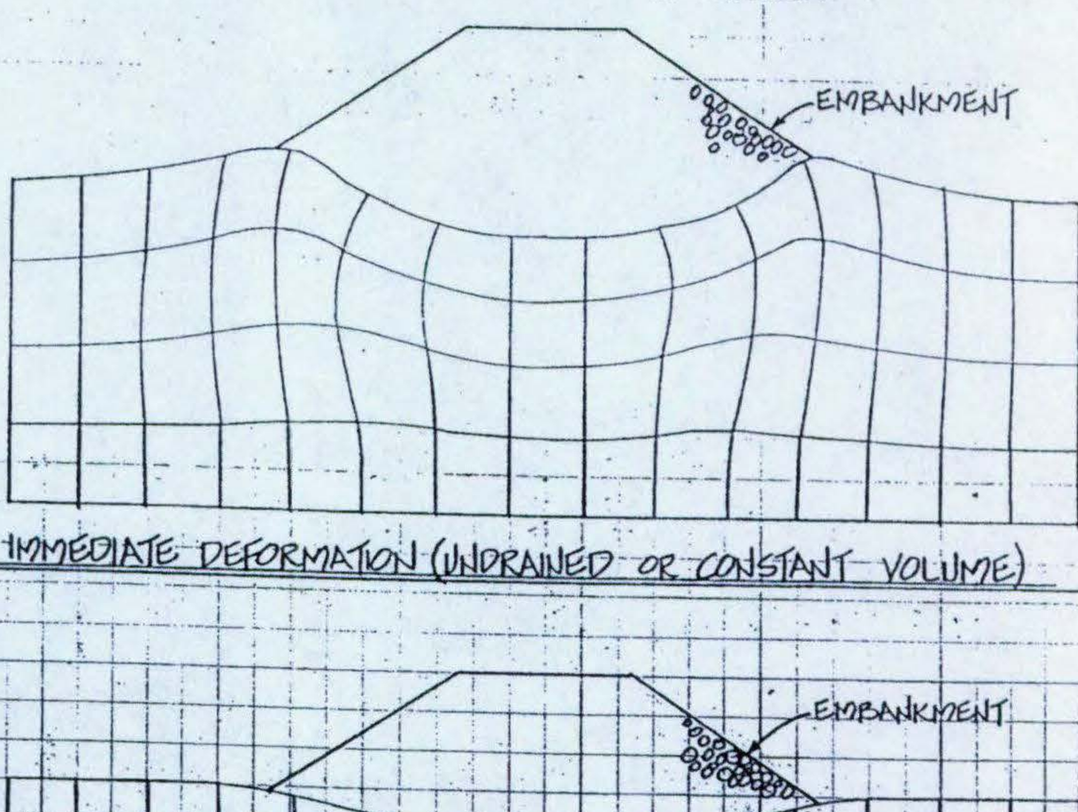
The third figure indicates long term or "consolidation" settlement. This results from outflow of the pressurized pore water and is characterized by slight horizontal movement of the subsoil toward (rather than away from) the embankment centerline. Consolidation occurrence is responsible for subsoil shear strength and Eu increase. This type of movement (termed drained or reduced volume deformation) is time dependent.

Not shown on page 3 is movement potentially occurring subsequent to consolidation completion, i.e. after all load generated pore water pressure has dissipated. The complex mechanism responsible - called undrained creep - is characterized by continued subsoil deformation (both horizontal and vertical) under a constant load. Creep is time dependent and basically caused by high stress levels (the ratio of applied shear stress to the soil's shear strength) in the foundation subsoils. High stress levels are induced by an excessively "critical" loading intensity: safety factor only slightly above 1.0 upon completion of the loading. For "end of loading" safety factors between 1.00 and 1.10, creep movement will increase with time, eventually loading to a slope failure. Safety factors between 1.10 and 1.25 may result in creep terminating before slope failure. Greater end of loading safety factor values will generally produce no creep.

Method of Analysis. Data obtained from the geotechnical site exploration is combined in a computerized limiting equilibrium stability analysis to determine the embankment's short and long term factors of safety. The embankment is designed to keep the end of construction (short term) safety factor at or above 1.25. Such value offers the best trade off between loading efficiency (maximizing use of the soil's available shear strength) and protection against long term creep inducement. Computer prediction of immediate soil deformation is made using a finite element technique. This, combined with standard consolidation settlement computation, serves to determine whether or not acceptable movements will occur. The concurrent computer generated soil stress field (based on revised soil strength, Eu, and measured movement) provides a backup to the above described stability analysis and allows assessment of the potential for long term creep.



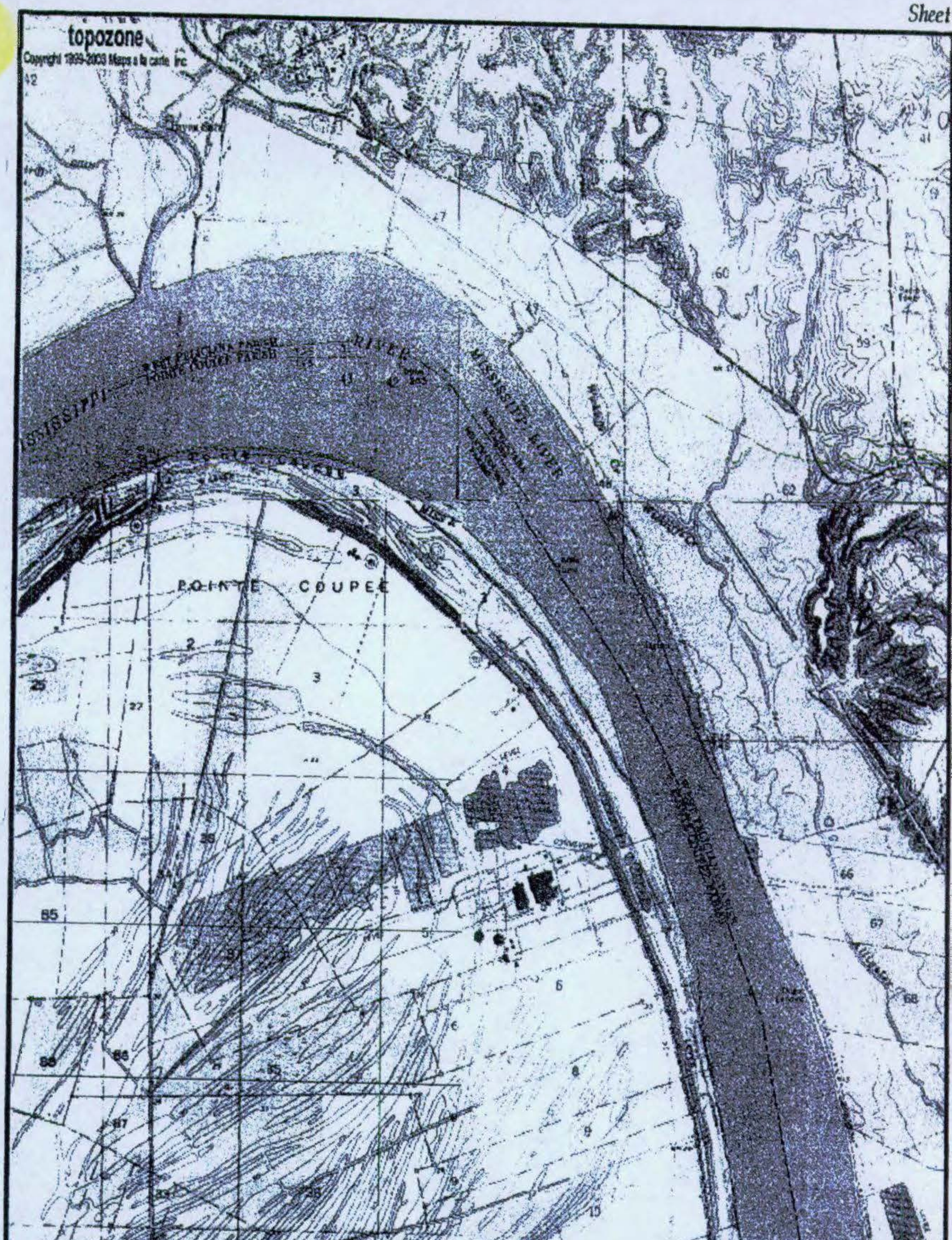
INITIAL CONDITION (BEFORE LOADING)



IMMEDIATE DEFORMATION (UNDRAINED OR CONSTANT VOLUME)

CONSOLIDATION DEFORMATION (DRAINED OR LONGTERM)

NOTE: COMBINE THESE TWO DEFORMATIONS TO OBTAIN TOTAL DEFORMATION.



Map center is UTM 15 655723E 3402018N (WGS84/NAD83)
Port Hudson quadrangle
Projection is UTM Zone 15 NAD83 Datum

Bottom Ash Storage Pond Expansion
Global Stability Analyses Summary
Perimeter Embankment Configurations

Shown on Sheet No.	Condition Description: Embankment Geometry	Groundwater Level	Strength Parameters	Global Slope Stability Factor of Safety
4	One Berm 38 feet high 3H:1V slope	Fully saturated	Native soil strength	1.22
5	One Berm 28 feet high 3H:1V slope	Level with ground surface	Native soil strength	1.31
6	One Berm 38 feet high 2H:1V slope	Fully saturated	Native soil strength	1.15
7	One Berm 38 feet high 2H:1V slope	Level with ground surface	Native soil strength	1.15
8	One Berm 38 feet high 2H:1V slope	Level with ground surface	S_u increased under Ash load	1.32
9	Two Berms 18 & 38 feet high 2H:1V slope	Level with ground surface	S_u increased under Ash load	1.42
10	Two Berms 18 & 38 feet high 2H:1V slope	Level with ground surface	S_u increased under Ash load	1.16
11	Two Berms 38 foot Ash Stack 18 & 38 feet high 2H:1V	Fully saturated	S_u increased under Ash load	1.13
12	Two Berms 38 foot Ash Stack 18 & 38 feet high 2H:1V	Fully saturated	Find Su to reach F.S. = 1.4	1.39
13	Two Berms 38 foot Ash Stack 18 & 38 feet high 3H:1V outside	Fully saturated	S_u increased under Ash load	1.22

Shown on Sheet No.	Condition Description: Embankment Geometry	Condition Description: Groundwater Level	Condition Description: Strength Parameters	Global Slope Stability Factor of Safety
14	Two Berms 38 foot Ash Stack 18 & 38 feet high 3H:1V outside	Fully saturated	S_u increased under Ash load	1.38
15	Two Berms 19 foot Ash Stack 18 & 38 feet high 3H:1V outside	Fully saturated	Native soil strength	1.24
16	Two Berms 19 foot Ash Stack 18 & 38 feet high 3H:1V outside	Level with ground surface	Native soil strength	1.30

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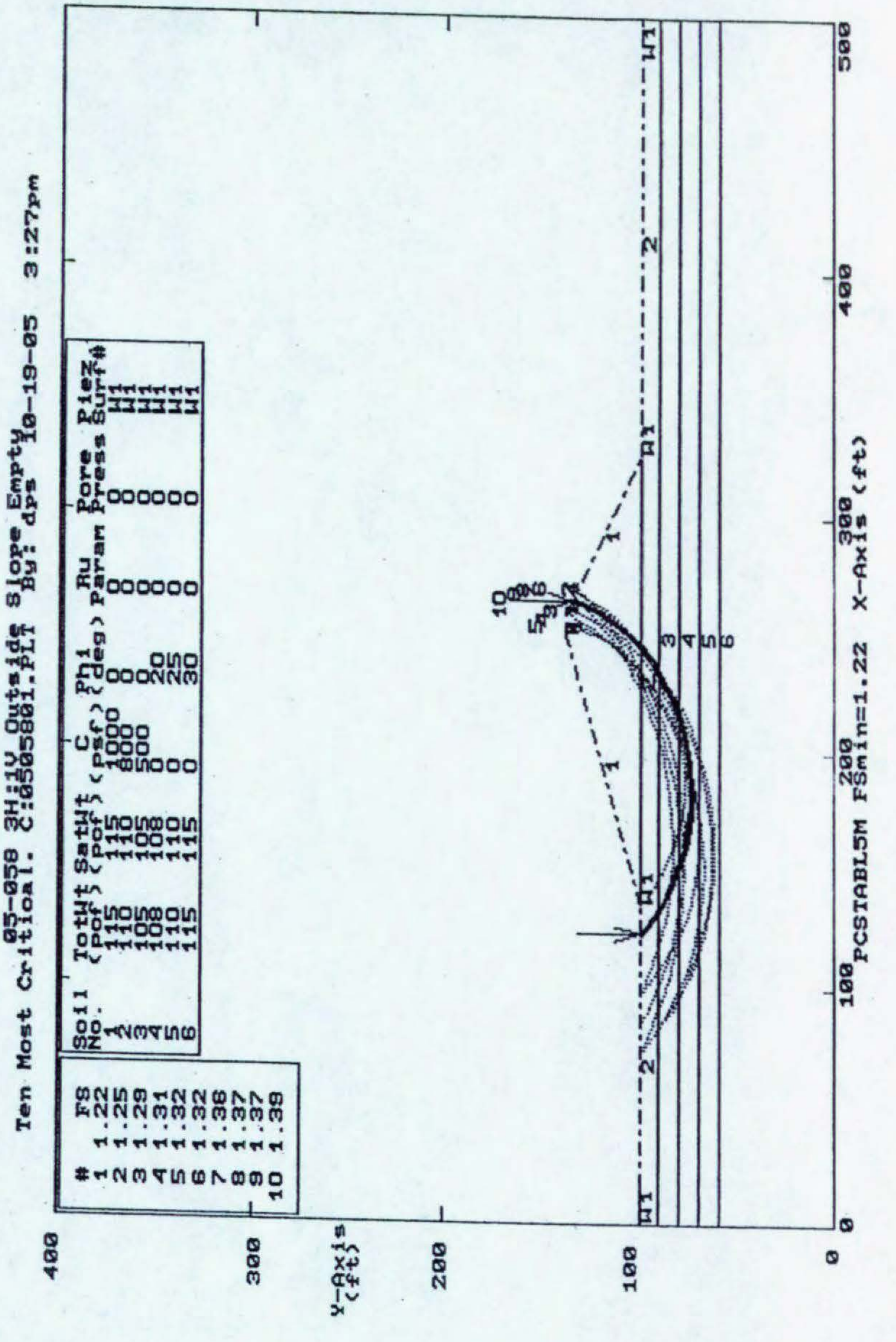

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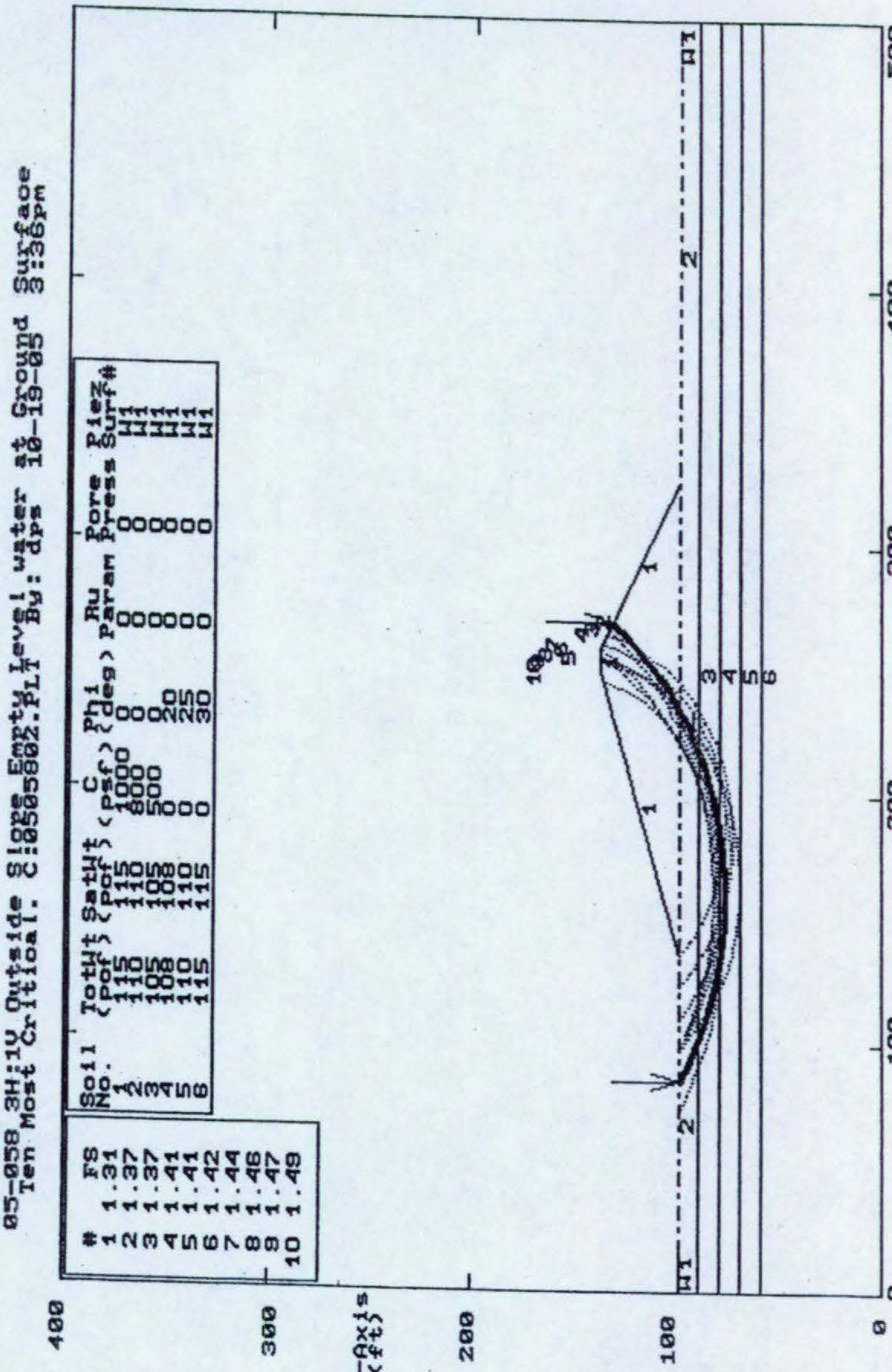

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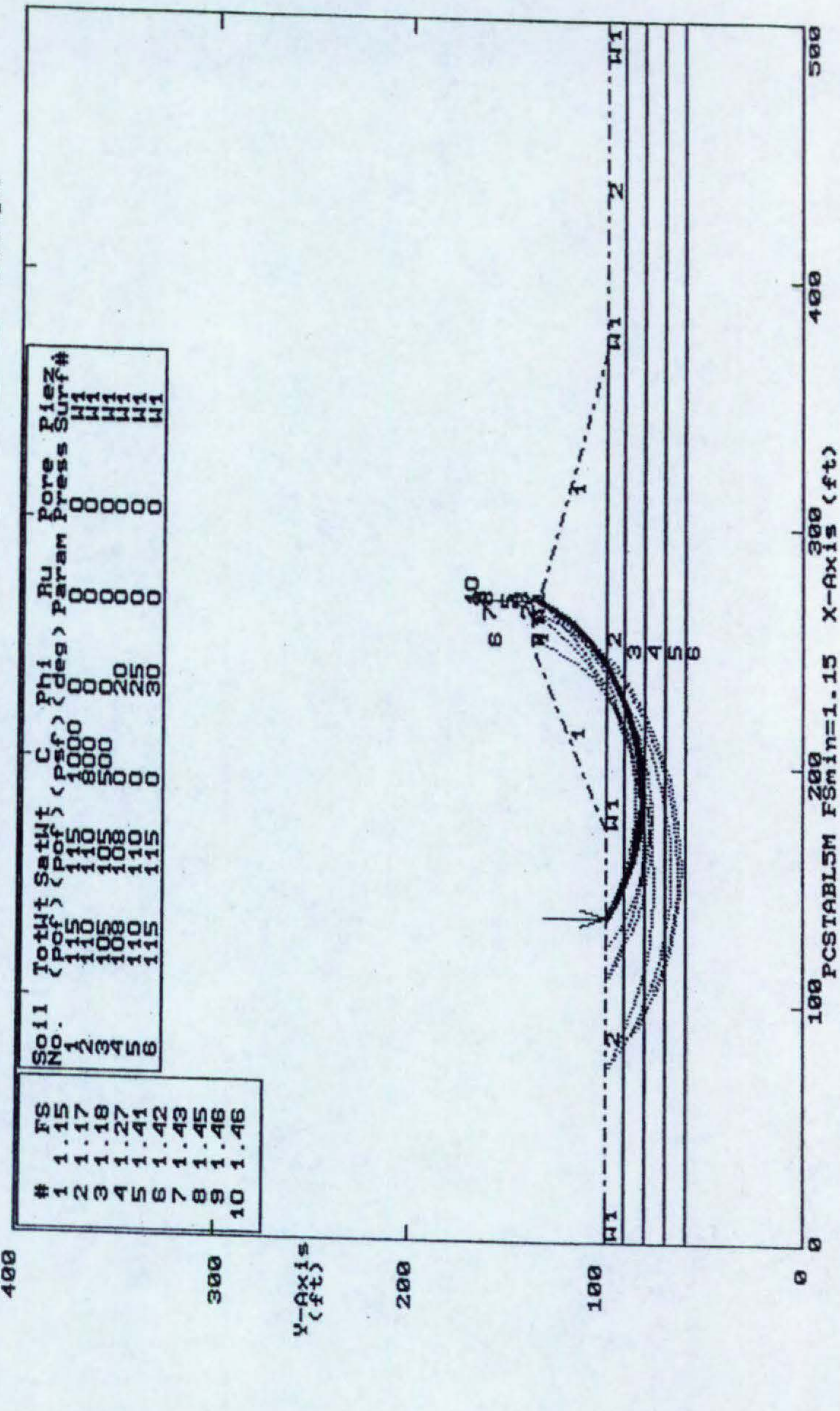

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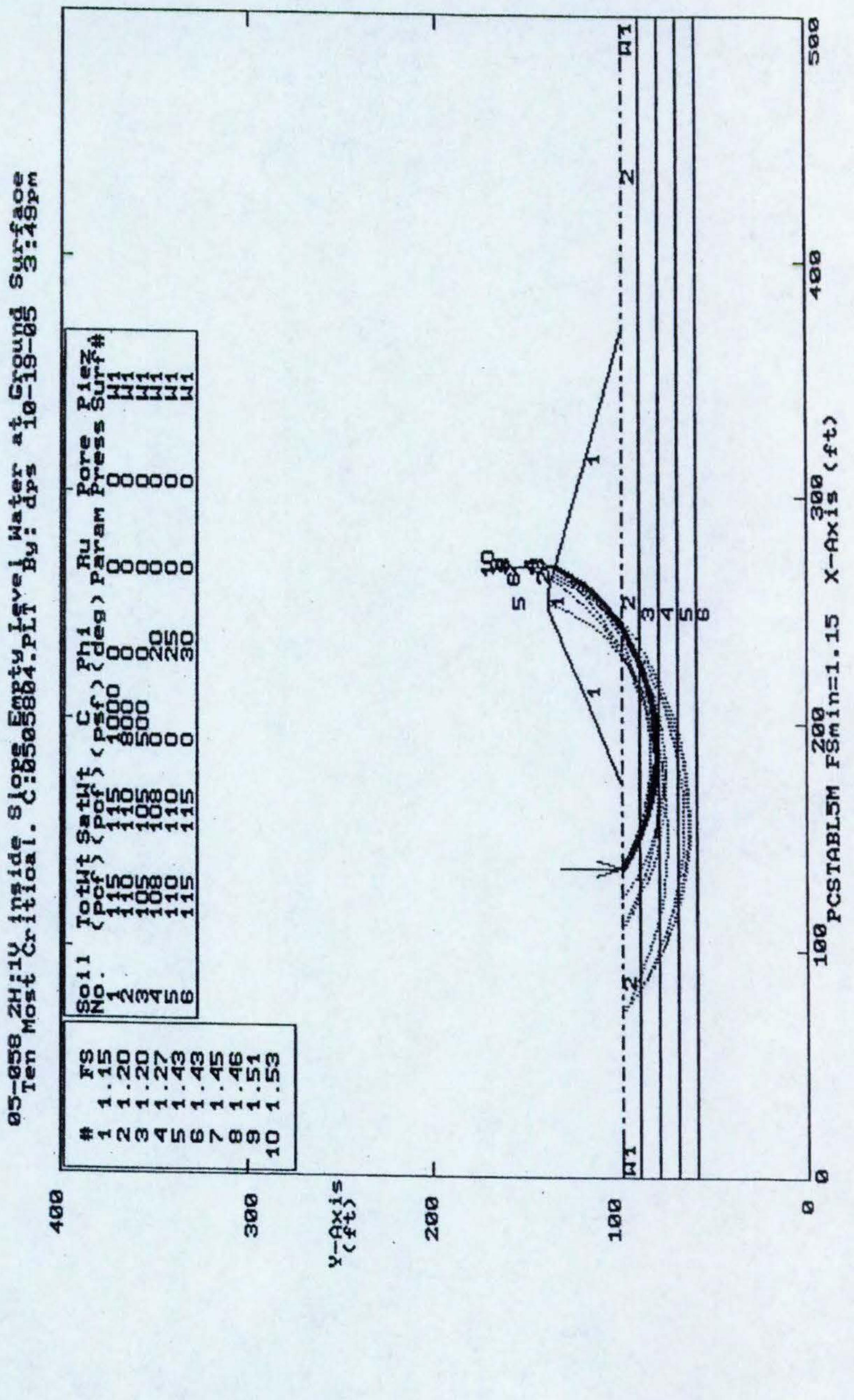
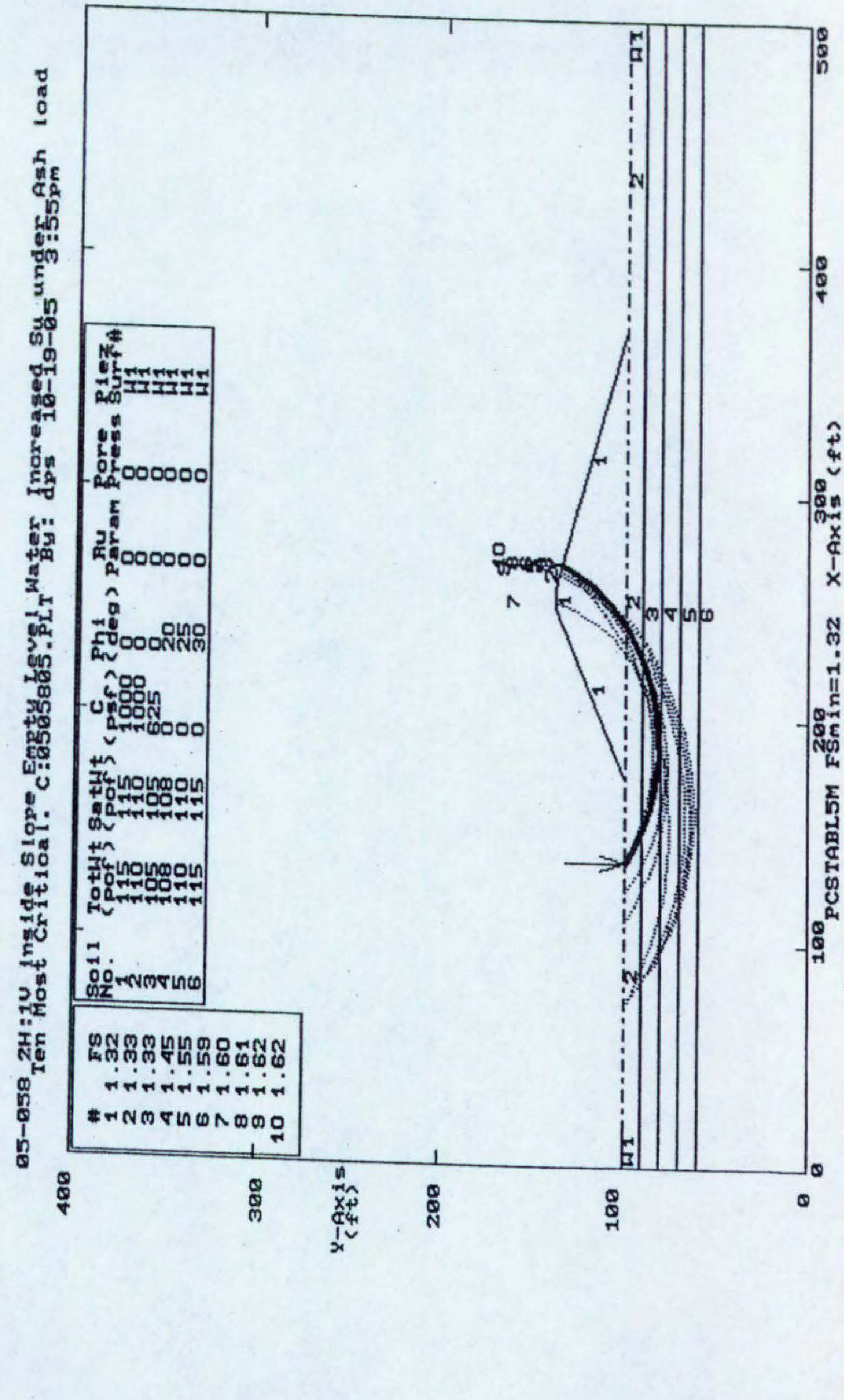
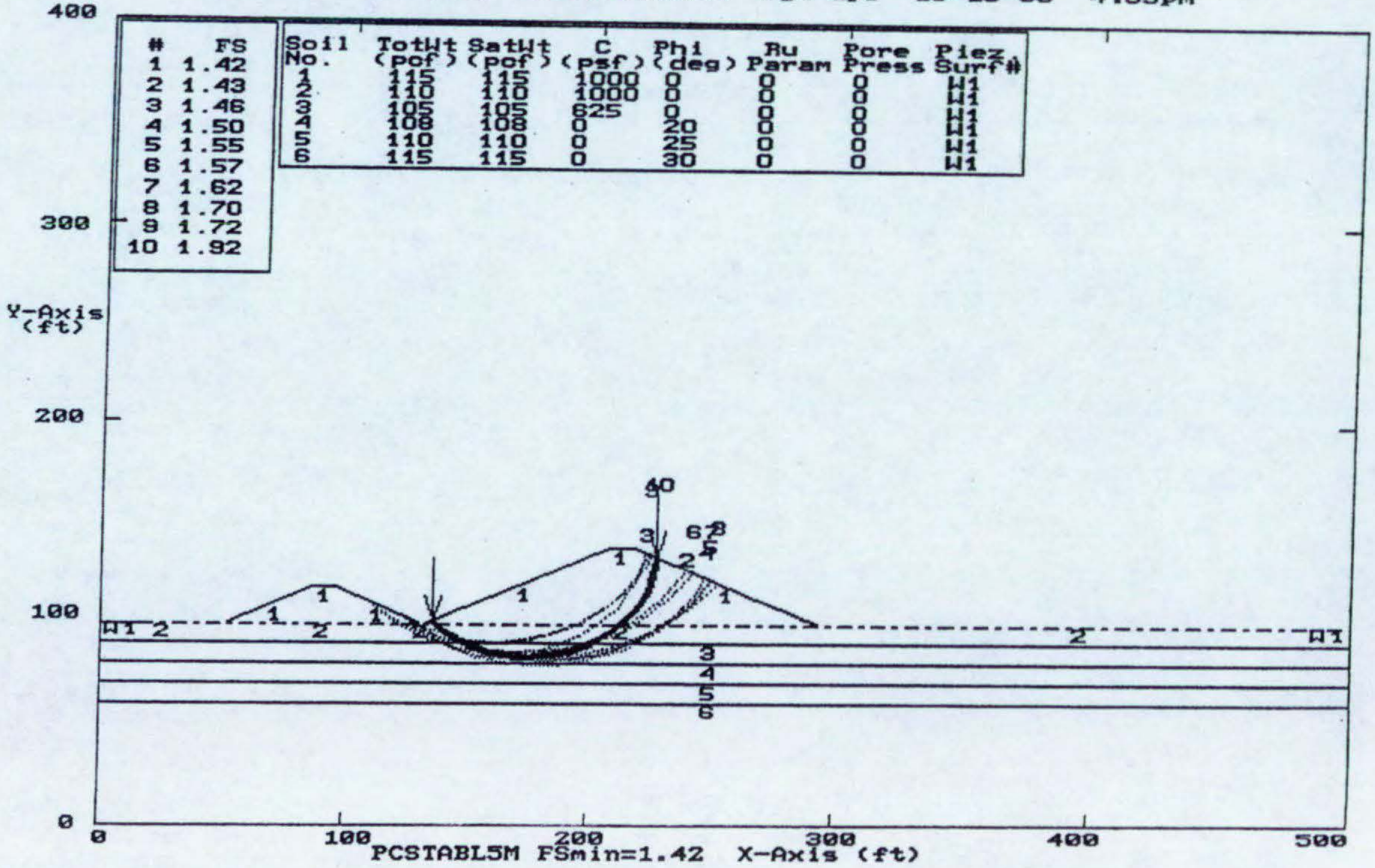


LOUIS J. CAPOZZOLI & ASSOCIATES, INC.



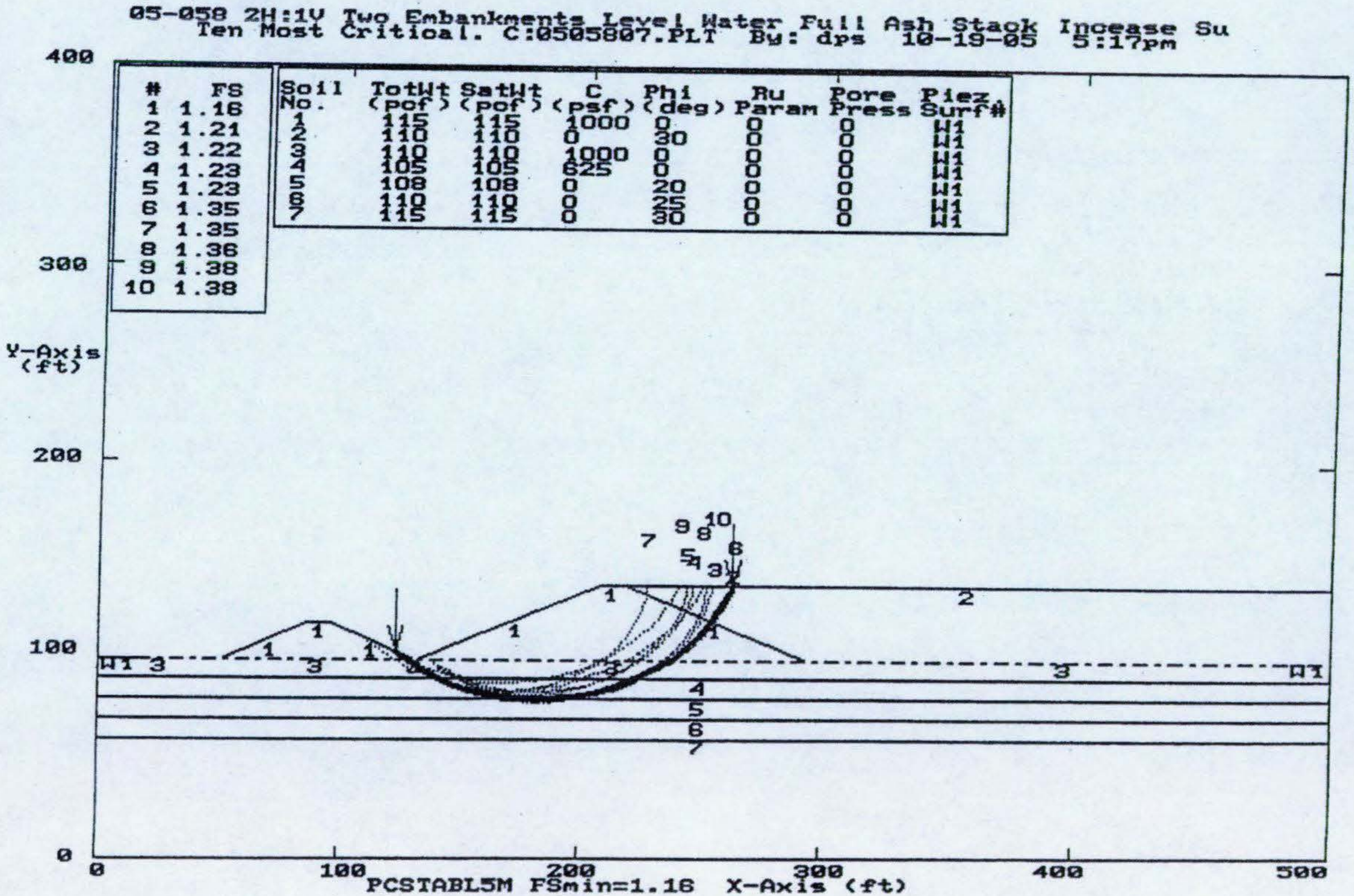
LOUIS J. CAPOZZOLI & ASSOCIATES, INC.

05-058 2H:1V Two Embankments Level Water
Ten Most Critical. C:0505806.PLT By: dps 10-19-05 4:39pm

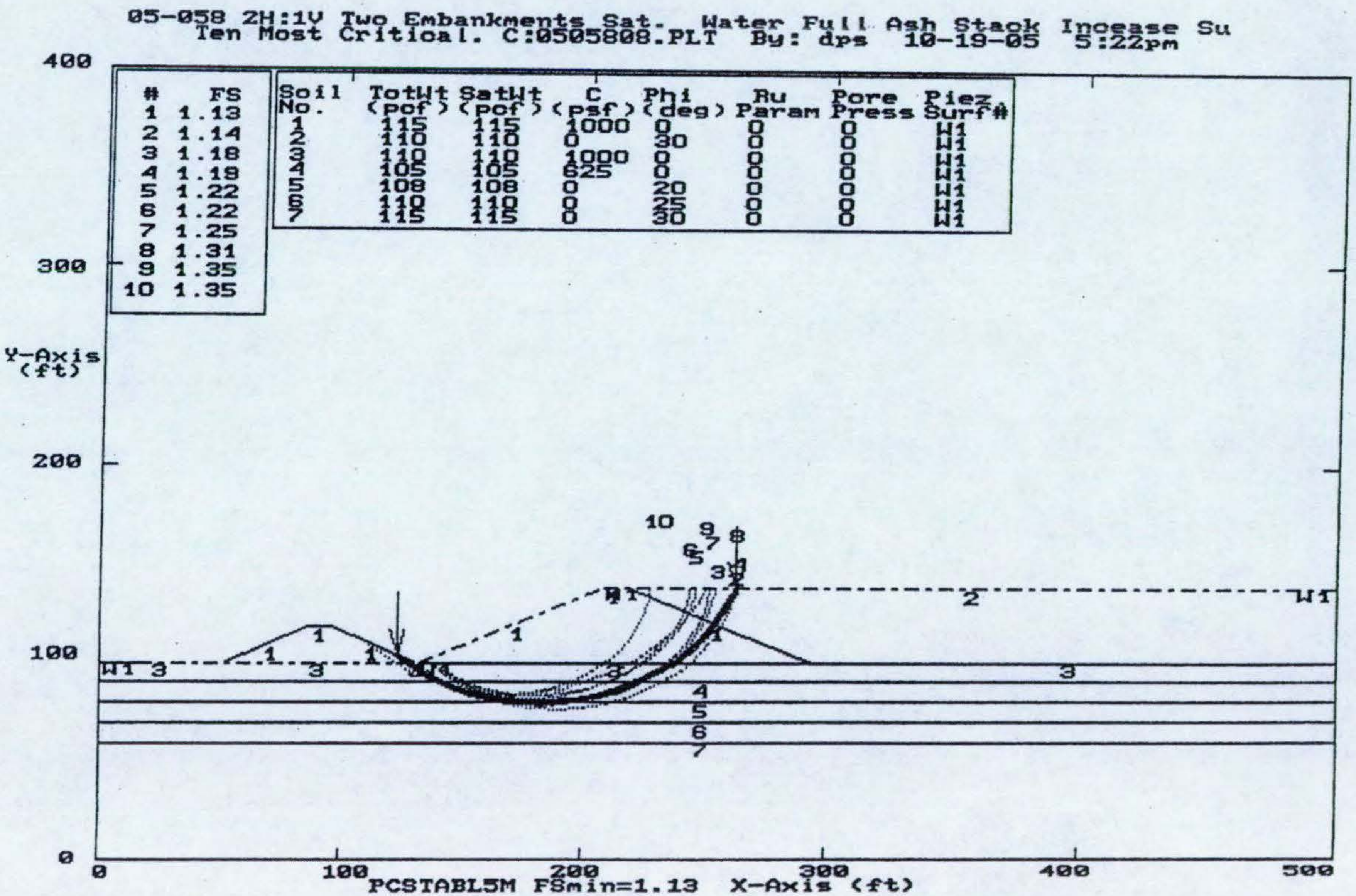


#	FS
1	1.42
2	1.43
3	1.46
4	1.50
5	1.55
6	1.57
7	1.62
8	1.70
9	1.72
10	1.92

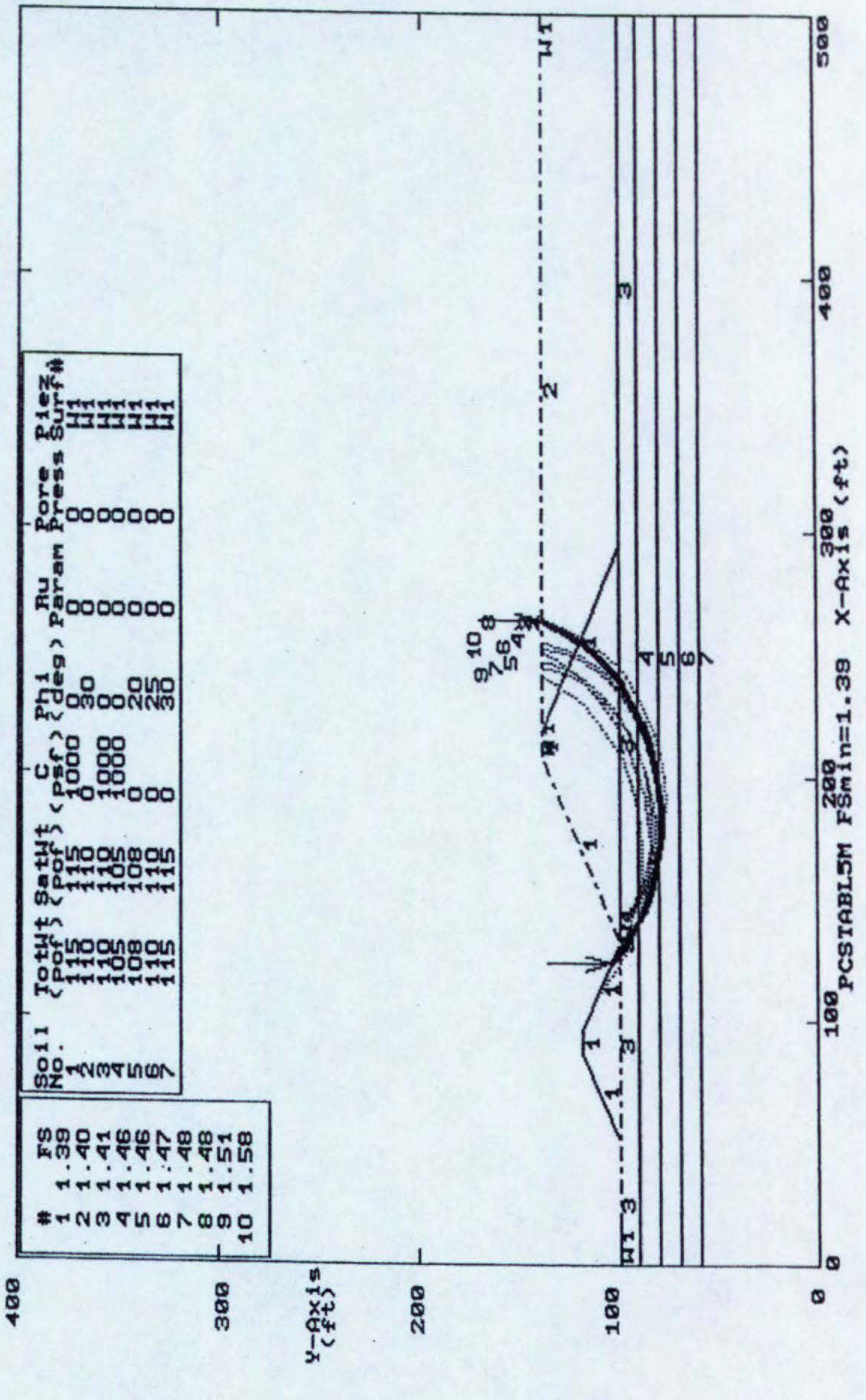
Soil No.	TotWt (pcf)	SatWt (pcf)	C (psf)	Phi (deg)	Ru Param	Pore Press	Piez. Surf#
1	115	115	1000	0	0	0	W1
2	110	110	1000	0	0	0	W1
3	105	105	625	0	0	0	W1
4	108	108	0	20	0	0	W1
5	110	110	0	25	0	0	W1
6	115	115	0	30	0	0	W1


05-058 2H:1V Two Embankments Level Water Full Ash Stack Incease Su
Ten Most Critical. C:0505807.PLT By: dps 10-19-05 5:17pm
FS
1 1.16
2 1.21
3 1.22
4 1.23
5 1.23
6 1.35
7 1.35
8 1.36
9 1.38
10 1.38
Soil No. TotWt (pcf) SatWt (pcf) C (psf) Phi (deg) Ru Param Pore Press Piez Surf#
1 115 115 1000 0 0 0 W1
2 110 110 0 30 0 0 W1
3 110 110 1000 0 0 0 W1
4 105 105 625 0 0 0 W1
5 108 108 0 20 0 0 W1
6 110 110 0 25 0 0 W1
7 115 115 0 30 0 0 W1
Y-Axis (ft)
400
300
200
100
0
0
100
200
300
400
500
PCSTABL5M FSmin=1.16 X-Axis (ft)

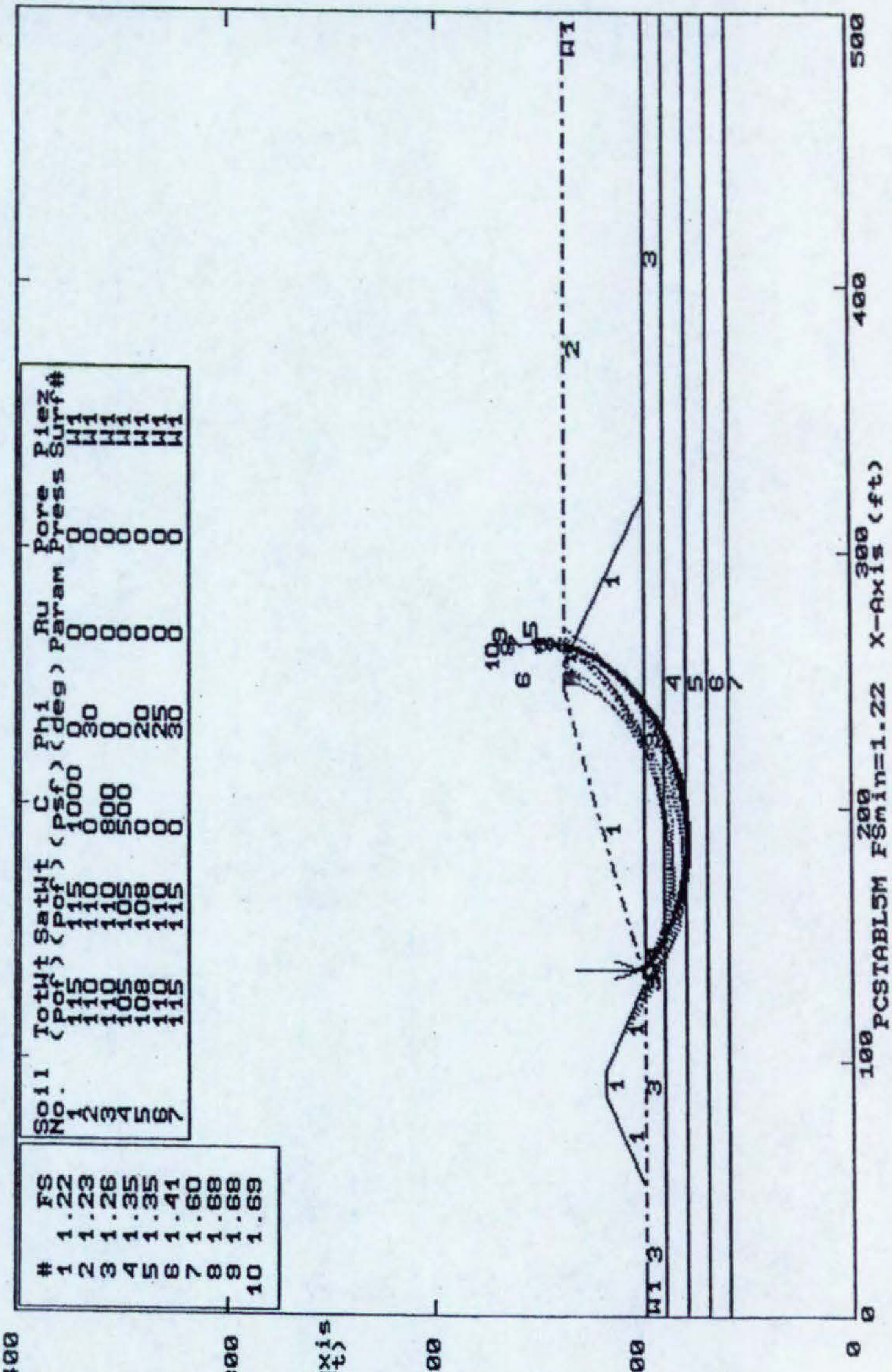
LOUIS J. CAPOZZOLI & ASSOCIATES, INC.



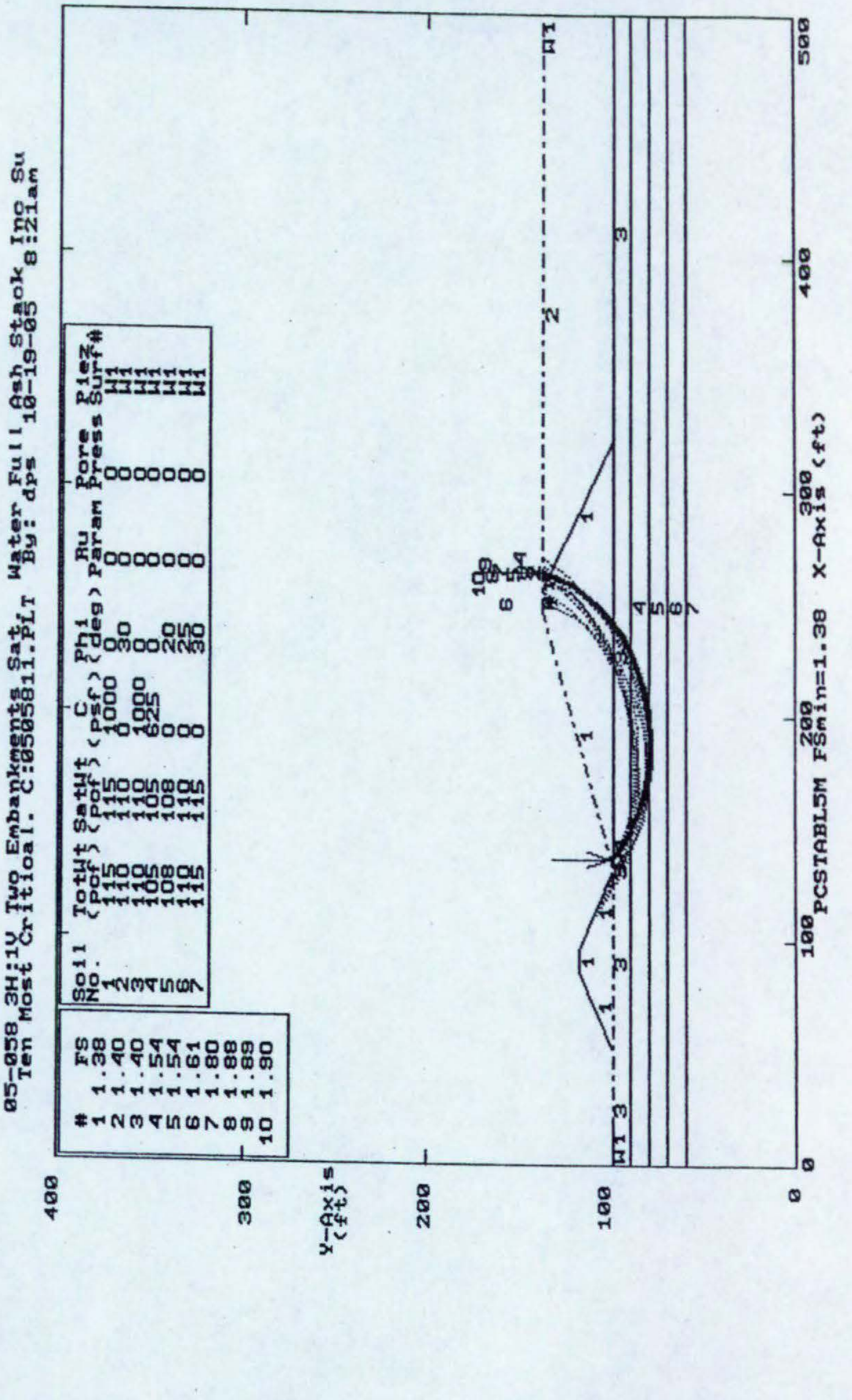
LOUIS J. CAPOZZOLI & ASSOCIATES, INC.



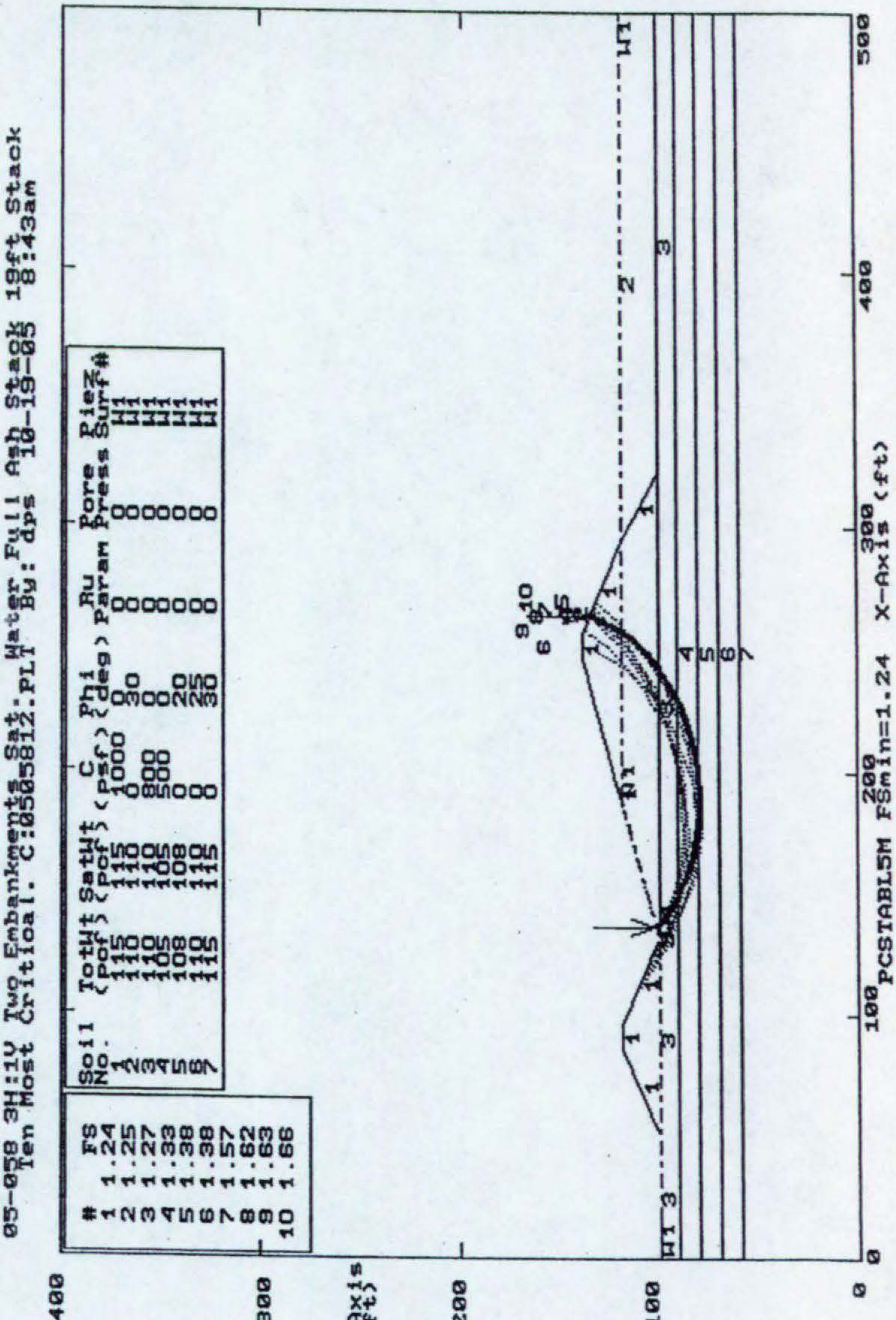
LOUIS J. CAPOZZOLI & ASSOCIATES, INC.



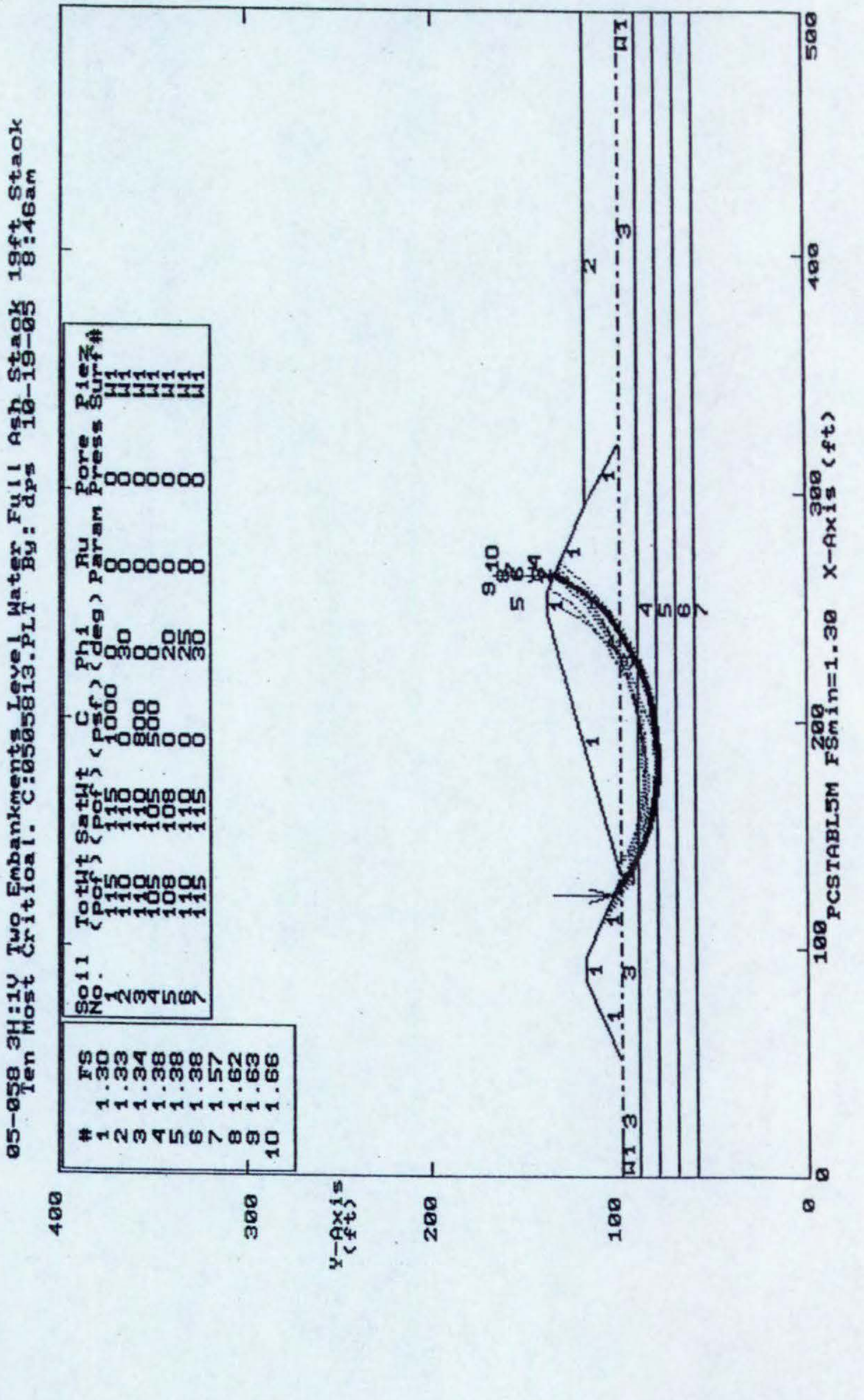
LOUIS J. CAPOZZOLI & ASSOCIATES, INC.



LOUIS J. CAPOZZOLI & ASSOCIATES, INC.



LOUIS J. CAPOZZOLI & ASSOCIATES, INC.



Tassin, Jennifer

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m: Chiasson, Elif
nt: Monday, April 10, 2006 1:46 PM
To: Tassin, Jennifer
Subject: FW: NRG 28ft Slope FS 1.5
Attachments: NRG 28ft Slope Stability Analyses.pdf

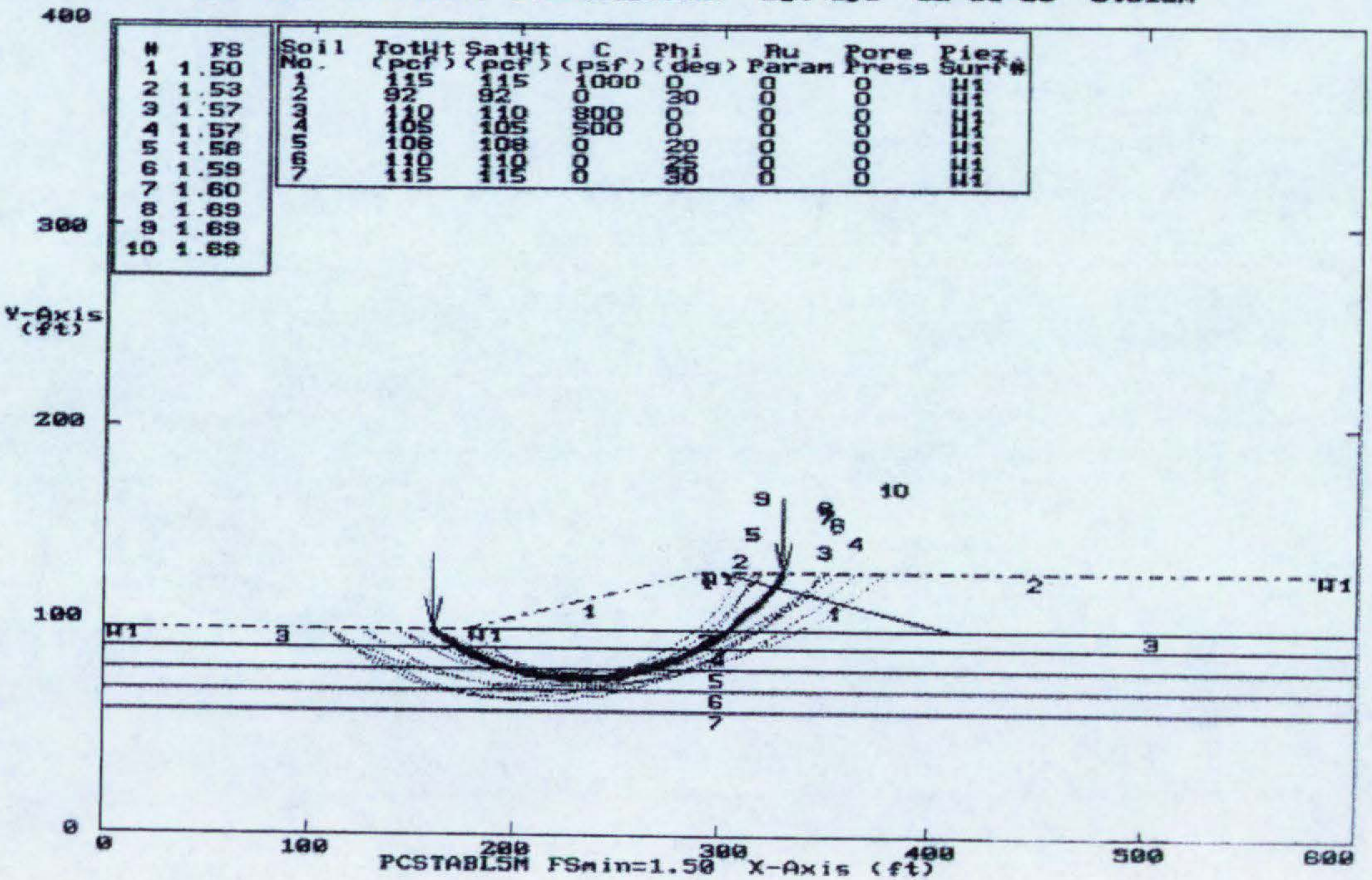
Elif Acar-Chiasson, P.E.
Project Manager
Shaw Environmental & Infrastructure
4171 Essen Lane
Baton Rouge, LA 70809
225.987.7331 direct
225.235.6219 mobile
225.987.3146 fax
www.shawgrp.com

From: Louis J Capozzoli & Associates Inc [mailto:ljca@mindspring.com]
Sent: Wednesday, February 08, 2006 9:36 AM
To: Chiasson, Elif
Subject: NRG 28ft Slope FS 1.5

...ched is the results for the 28 ft high embankment with FS = 1.50 on the number. I will recommend 30 ft FS=1.44 as a max height. I don't know if DEQ will consider below 1.50, just from a regulatory perspective.

David

05-056 4H:1V Both Slopes Ash 20ft High 20ft Berm Saturated Natural Strengths
Ten Most Critical. C:0505021.PLT By: dps 02-01-06 8:51am



Chiasson, Elif

From: Louis J Capozzoli & Associates Inc [ljca@mindspring.com]
Sent: Tuesday, April 25, 2006 4:43 PM
To: Chiasson, Elif
Subject: Final Slope Stability Analyses
Attachments: 05-58 28 Foot Berm Profiles AA and BB.pdf

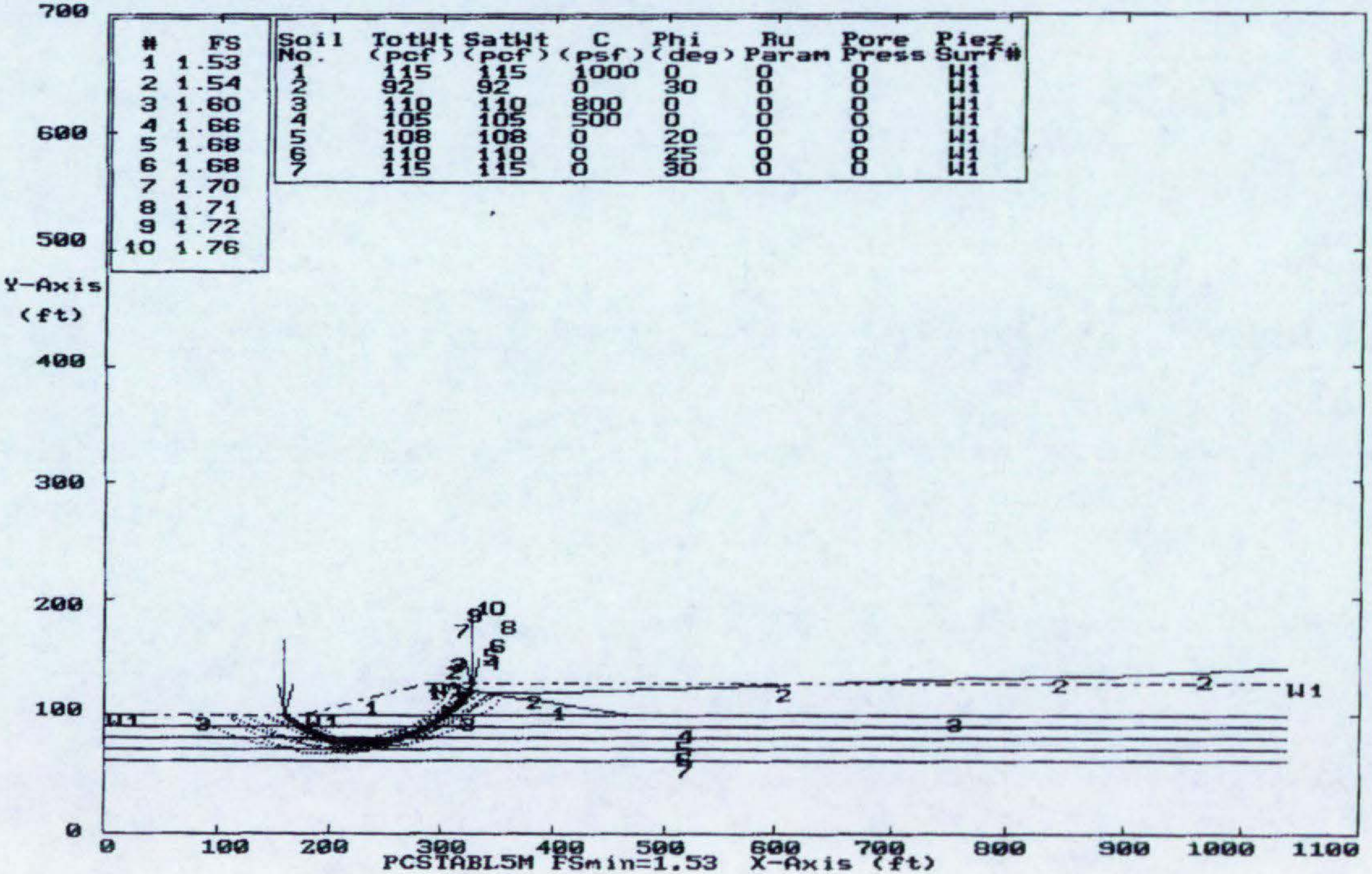
Elif,
Attached are the two runs. In both cases the FS = 1.53.

I used the natural existing shear strength values. The berm and stack are saturated. I also used a water behind the berm collected all the way up to the top of the berm for additional potential driving forces.

I include these runs in the final report, and call to review.

Thanks
David P. Sauls, P.E.
Louis J. Capozzoli & Associates, Inc.
10555 Airline Highway
Baton Rouge, Louisiana 70816
Office: 225-293-2460
Fax: 225-293-2463
ljca@mindspring.com

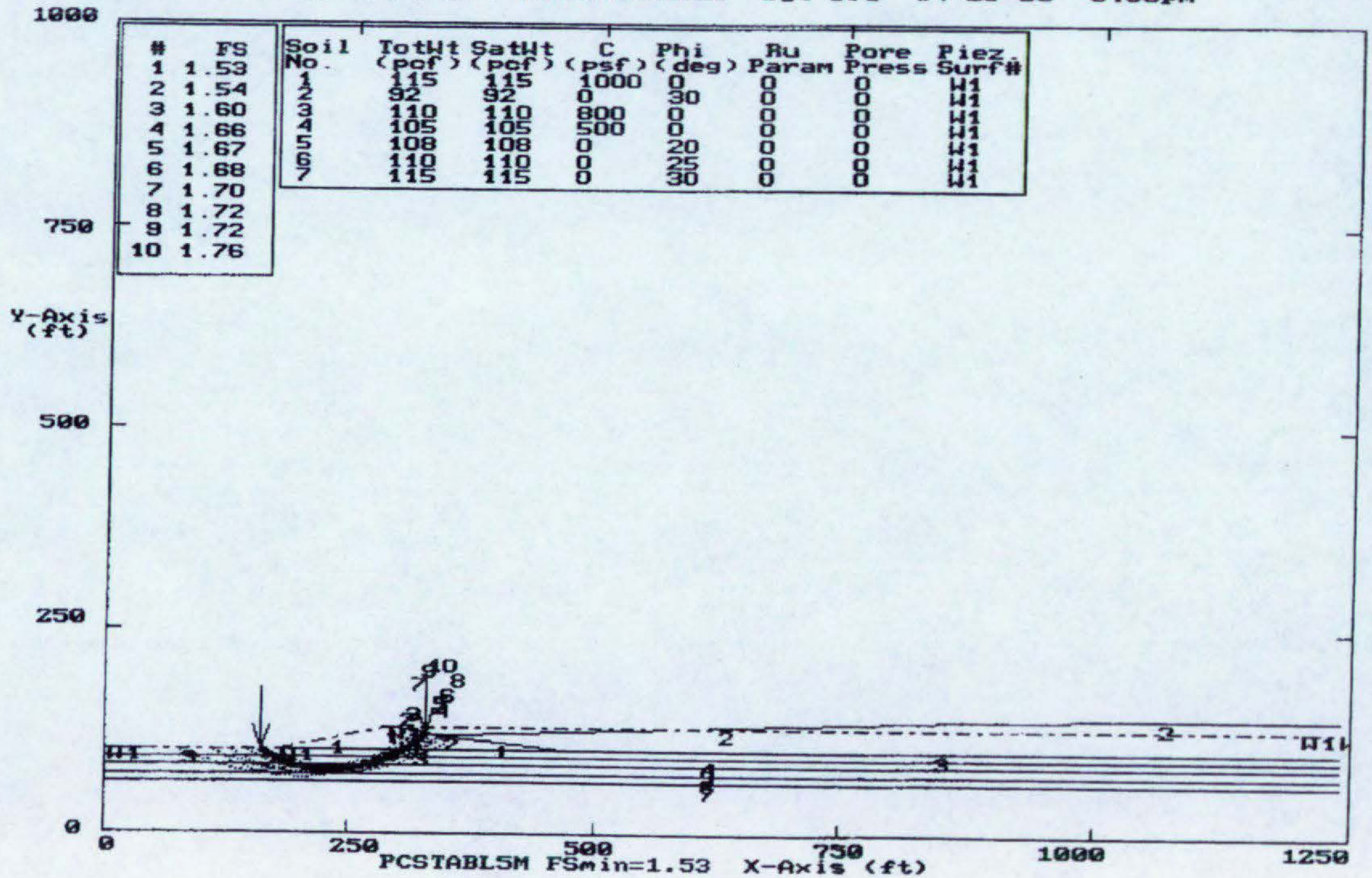
05-058 4H:1V Both Slopes Ash 28ft High 28ft Berm Sat Natural Su Short Side AA
Ten Most Critical. C:0505822.PLT By: DPS 04-25-06 3:49pm



#	FS
1	1.53
2	1.54
3	1.60
4	1.66
5	1.68
6	1.68
7	1.70
8	1.71
9	1.72
10	1.76

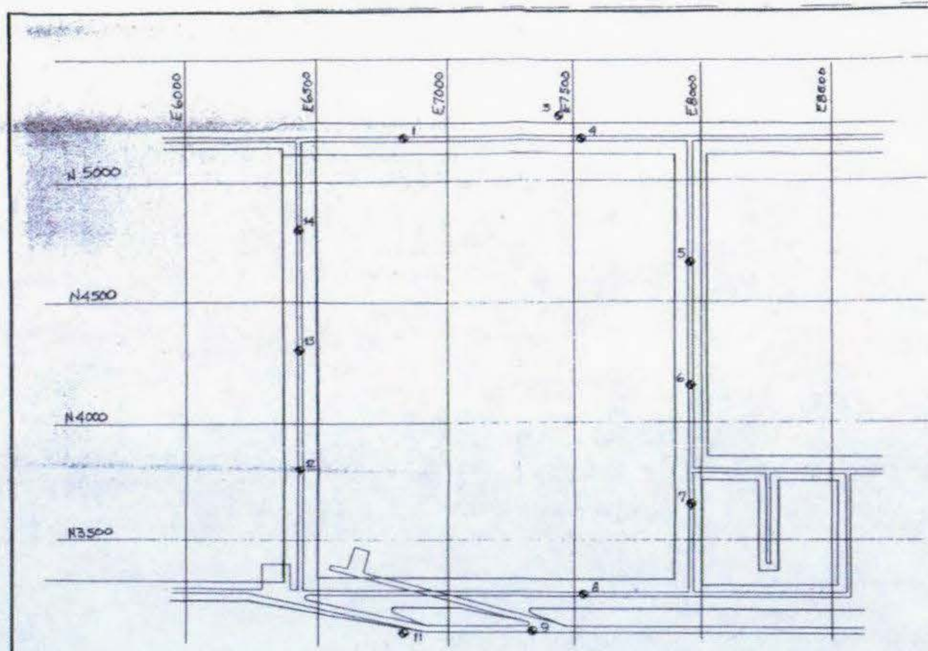
Soil No.	TotWt (pcf)	SatWt (pcf)	C (psf)	Phi (deg)	Ru Param	Pore Press	Piez. Surf#
1	115	115	1000	0	0	0	W1
2	92	92	0	30	0	0	W1
3	110	110	800	0	0	0	W1
4	105	105	500	0	0	0	W1
5	108	108	0	20	0	0	W1
6	110	110	0	25	0	0	W1
7	115	115	0	30	0	0	W1

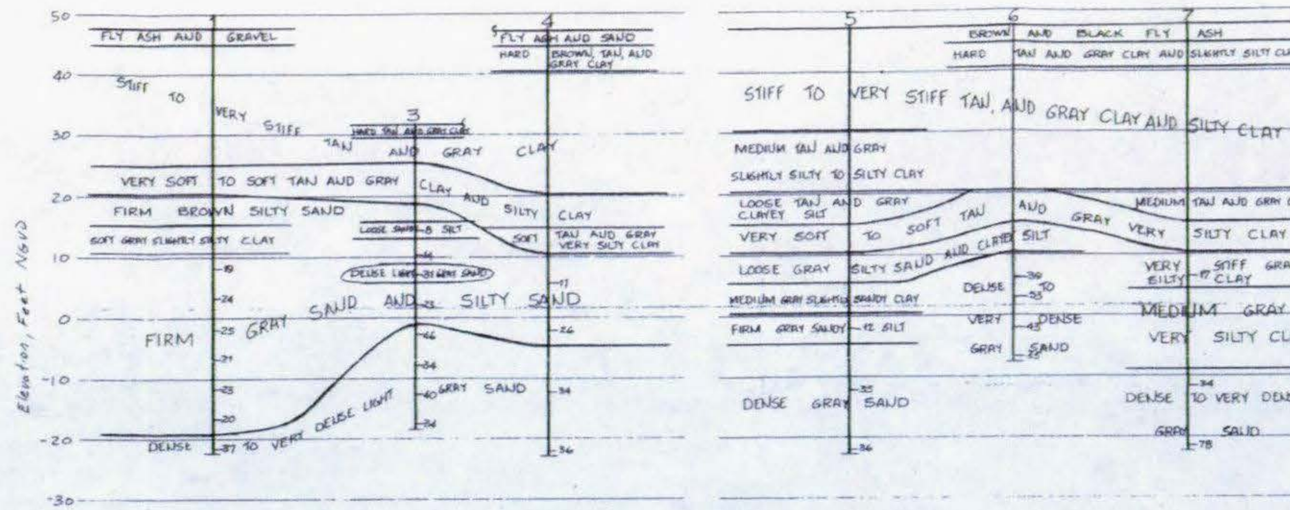
05-058 4H:1V Both Slopes Ash 28ft High 28ft Berm Sat Natural Su Long Side BB
Ten Most Critical. C:0505823.PLT By: DPS 04-25-06 3:58pm

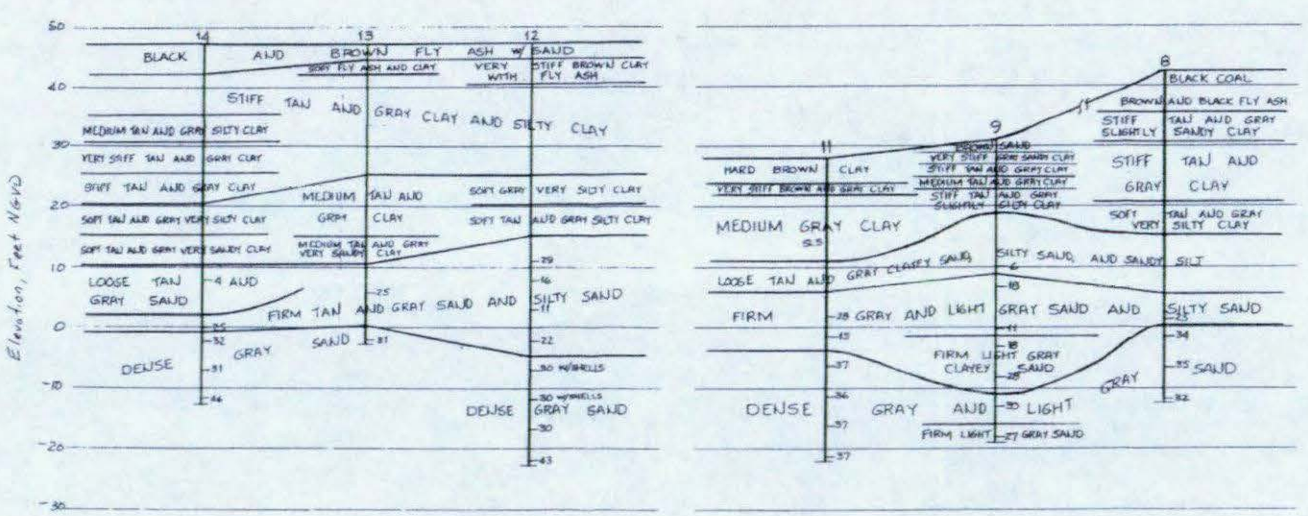


#	FS
1	1.53
2	1.54
3	1.60
4	1.66
5	1.67
6	1.68
7	1.70
8	1.72
9	1.72
10	1.76

Soil No.	TotWt (pcf)	SatWt (pcf)	C (psf)	Phi (deg)	Ru Param	Pore Press	Piez. Surf#
1	115	115	1000	0	0	0	W1
2	92	92	0	30	0	0	W1
3	110	110	800	0	0	0	W1
4	105	105	500	0	0	0	W1
5	108	108	0	20	0	0	W1
6	110	110	0	25	0	0	W1
7	115	115	0	30	0	0	W1







Bottom Ash Storage Pond Expansion
Big Cajun, Pointe Coupee Parish, LA

Shaw Environmental & Infrastructure, Inc.
Baton Rouge, LA

Louis J. Capozzoli & Associates, Inc.
Geotechnical Engineers
Baton Rouge, Louisiana

Scale Shown

Site Plan and Subsurface Profile

Sheet No. 5

ATTACHMENT 45

BORING LOGS FOR BOREHOLES, MONITORING WELLS, AND PIEZOMETERS

LOG OF BORING

Project: Bottom Ash Storage Pond Expansion
Big Cajun II, Pointe Coupee Parish, Louisiana
For: Shaw Environmental & Infrastructure, Inc.
Baton Rouge, Louisiana

Boring: 1
File: 05-58
Date: 24-Aug-05
Technician: PN

Undisturbed Sample
Standard Penetration Test
Classification Sample
(SLS) Slickensided

Boring Depth: 70 Feet

Depth Feet	SAMPLES	Description	Remarks
0	Classification Sample	Fly ash and gravel with clay traces	Cement-bentonite grout backfill full depth
5	Undisturbed Sample	Stiff gray clay with gravel and fly ash	
10	Undisturbed Sample	Very stiff gray clay	
15	Undisturbed Sample	Stiff tan and gray clay	
20	Undisturbed Sample	Stiff tan and gray clay	
25	Undisturbed Sample	Soft gray silty clay	
30	Undisturbed Sample	Firm brown silty fine sand	
35	Undisturbed Sample	Soft gray slightly silty clay	
40	Standard Penetration Test	Firm gray fine sand with silt traces	19 blows per foot (11/11/8)
45	Standard Penetration Test	Firm gray silty fine sand	24 blows per foot (10/11/13)
50	Standard Penetration Test	Firm gray fine sand with silt traces	25 blows per foot (10/12/13)

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.
Geotechnical Engineers

LOG OF BORING

Project: Bottom Ash Storage Pond Expansion	Boring: 1
Big Cajun II, Pointe Coupee Parish, Louisiana	File: 05-58
For: Shaw Environmental & Infrastructure, Inc.	Date: 24-Aug-05
Baton Rouge, Louisiana	Technician: PN

■ Undisturbed Sample
☒ Standard Penetration Test
◫ Classification Sample
(SLS) Slickensided

Boring Depth: 70 Feet

Depth Feet	SAMPLES	Description	
50			
55	☒	Firm gray fine sand with silt traces	21 blows per foot (6/9/12)
60	☒	Firm light gray fine sand with silt traces	23 blows per foot (7/12/11)
65	☒	Firm light gray fine sand with silt traces	20 blows per foot (9/5/15)
70	☒	Dense light gray fine sand with silt traces	37 blows per foot (12/17/20)

LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	3
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	24-Aug-05
	Baton Rouge, Louisiana	Technician:	PN

Legend:
- Undisturbed Sample
- Standard Penetration Test
- Classification Sample
- (SLS) Slickensided

Boring Depth: 50 Feet

Depth Feet	SAMPLES	Description	Remarks
0	Undisturbed Sample	Hard tan and gray clay with roots	Cement-bentonite grout backfill full depth
	Undisturbed Sample	Very stiff tan and gray clay with ferrous nodules	
5	Undisturbed Sample	Very stiff tan and gray clay with sand streaks and pockets	
	Undisturbed Sample	Soft tan sandy clay with sand pockets	
10	Undisturbed Sample	Very soft tan and gray very sandy clay	
15	Classification Sample	Tan silty fine sand with clay traces	
	Standard Penetration Test	Loose brown sandy silt	8 blows per foot (2/2/6)
20		No sample recovered	
	Standard Penetration Test	Firm brown fine sand with silt traces	14 blows per foot (6/8/6)
25	Standard Penetration Test	Dense light gray fine sand with silt traces	31 blows per foot (5/15/16)
30	Standard Penetration Test	Firm light gray silty fine sand	23 blows per foot (9/11/12)
35	Standard Penetration Test	Dense light gray fine sand with silt traces	46 blows per foot (16/24/22)
40	Standard Penetration Test	Dense light gray fine sand with silt traces	34 blows per foot (11/17/17)
45	Standard Penetration Test	Very dense light gray fine sand with silt traces	40 blows per foot (15/19/21)
50	Standard Penetration Test	Dense light gray fine sand	34 blows per foot (17/18/16)

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.

Geotechnical Engineers

LOG OF BORING

Project: Bottom Ash Storage Pond Expansion
Big Cajun II, Pointe Coupee Parish, Louisiana
For: Shaw Environmental & Infrastructure, Inc.
Baton Rouge, Louisiana

Boring: 4
File: 05-58
Date: 24-Aug-05
Technician: JP

Undisturbed Sample
Standard Penetration Test
Classification Sample
(SLS) Slickensided

Boring Depth: 70 Feet

Depth Feet	SAMPLES	Description	Remarks
0	Classification Sample	Tan and gray fly ash and sand	Cement-bentonite grout backfill full depth
5	Undisturbed Sample	Hard brown, tan, and gray clay	
10	Undisturbed Sample	Stiff tan and gray slightly sandy clay	
15	Undisturbed Sample	Very stiff tan and gray clay with sand streaks and pockets	
20	Undisturbed Sample	Stiff gray clay	
25	Undisturbed Sample	Stiff tan and gray clay	
30	Undisturbed Sample	Very soft tan and gray silty clay with 3 inch clayey silt layer	
35	Undisturbed Sample	Soft tan and gray very silty clay with 1 inch clayey silt layer	
40	Undisturbed Sample	Firm tan silty fine sand	
	Standard Penetration Test	Firm tan and gray silty fine sand	11 blows per foot (7/5/6)
45			
50	Standard Penetration Test	Firm gray fine sand with silt traces	26 blows per foot (11/13/13)

LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion
	Big Cajun II, Pointe Coupee Parish, Louisiana
For:	Shaw Environmental & Infrastructure, Inc.
	Baton Rouge, Louisiana

Boring:	4
File:	05-58
Date:	25-Aug-05
Technician:	JP
Boring Depth:	70 Feet

Legend: Undisturbed Sample; ☒ Standard Penetration Test; Classification Sample; (SLS) Slickensided

Depth Feet	SAMPLES	Description	Blows
50			
55			
60	☒	Dense gray fine sand with silt traces	34 blows per foot (15/16/18)
65			
70	☒	Dense gray fine sand with silt traces	36 blows per foot (16/17/19)

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.

Geotechnical Engineers

LOG OF BORING

Project: Bottom Ash Storage Pond Expansion
Big Cajun II, Pointe Coupee Parish, Louisiana
For: Shaw Environmental & Infrastructure, Inc.
Baton Rouge, Louisiana

Boring: 5
File: 05-58
Date: 25-Aug-05
Technician: JP

Undisturbed Sample
Standard Penetration Test
Classification Sample
(SLS) Slickensided

Boring Depth: 70 Feet

Depth Feet	SAMPLES	Description	Remarks
0	Undisturbed	Very stiff brown slightly silty clay with fly ash	Cement-bentonite grout backfill full depth
5	Undisturbed	Very stiff brown silty clay	
10	Undisturbed	Stiff tan and gray clay	
15	Undisturbed	Stiff tan and gray clay with ferrous nodules	
20	Undisturbed	Medium tan and gray slightly silty clay	
25	Undisturbed	Medium gray silty clay	
30	Undisturbed	Loose tan and gray clayey silt	
35	Undisturbed	Soft tan and gray very silty clay	
40	Undisturbed	Loose gray silty fine sand with clay lenses	
45	Undisturbed	Medium gray slightly sandy clay with sand lenses	
50	Standard Penetration Test	Firm gray sandy silt	12 blows per foot (3/6/6)

LOG OF BORING

Project: Bottom Ash Storage Pond Expansion
Big Cajun II, Pointe Coupee Parish, Louisiana
For: Shaw Environmental & Infrastructure, Inc.
Baton Rouge, Louisiana

Boring: 5
File: 05-58
Date: 25-Aug-05
Technician: JP

Depth Feet | SAMPLES

■ Undisturbed Sample
☒ Standard Penetration Test
▯ Classification Sample
(SLS) Slickensided

Boring Depth: 70 Feet

Depth (Feet)	Samples	Description	Remarks
50			
55			
60	☒	Dense gray fine sand with silt traces	35 blows per foot (15/17/18)
65			
70	☒	Dense gray fine sand with silt traces	36 blows per foot (14/18/18)

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.
Geotechnical Engineers

LOG OF BORING

Project: Bottom Ash Storage Pond Expansion
Big Cajun II, Pointe Coupee Parish, Louisiana
For: Shaw Environmental & Infrastructure, Inc.
Baton Rouge, Louisiana

Boring: 6
File: 05-58
Date: 26-Aug-05
Technician: JP

Undisturbed Sample
Standard Penetration Test
Classification Sample
(SLS) Slickensided

Boring Depth: 55 Feet

Depth Feet	SAMPLES	Description	Remarks
0	Classification Sample	Brown fly ash with clayey sand pockets and roots	Cement-bentonite grout backfill full depth
5	Undisturbed Sample	Hard tan and gray slightly silty clay	
10	Undisturbed Sample	Stiff tan and gray clay	
15	Undisturbed Sample	Stiff tan and gray clay	
20	Undisturbed Sample	Stiff gray clay	
25	Undisturbed Sample	Stiff tan and gray clay	
30	Undisturbed Sample	Very soft tan and gray very silty clay with 3 inch clayey silt layer	
35	Undisturbed Sample	Loose tan and gray clayey silt	
40		No sample recovered	
	Standard Penetration Test	Dense tan and gray fine sand with silt and clay traces	39 blows per foot (13/13/26)
45	Standard Penetration Test	Very dense tan and gray fine sand with silt traces	53 blows per foot (12/22/31)
50	Standard Penetration Test	Dense gray fine sand with silt traces	43 blows per foot (17/21/22)

LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	6
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	26-Aug-05
	Baton Rouge, Louisiana	Technician:	JP

Depth Feet | SAMPLES

■ Undisturbed Sample
☒ Standard Penetration Test
◫ Classification Sample
(SLS) Slickensided

Boring Depth: 55 Feet

Depth (Feet)	Sample	Description	Remarks
50			
55	☒	Dense gray fine sand with silt traces	45 blows per foot (20/18/27)

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.
Geotechnical Engineers

LOG OF BORING

Project: Bottom Ash Storage Pond Expansion
Big Cajun II, Pointe Coupee Parish, Louisiana
For: Shaw Environmental & Infrastructure, Inc.
Baton Rouge, Louisiana

Boring: 7
File: 05-58
Date: 26-Aug-05
Technician: JP

Undisturbed Sample
Standard Penetration Test
Classification Sample
(SLS) Slickensided

Boring Depth: 70 Feet

Depth Feet	SAMPLES	Description	Remarks
0	Classification	Black and brown fly ash	Cement-bentonite grout backfill full depth
5	Undisturbed	Hard tan and gray clay	
10	Undisturbed	Very stiff tan and gray slightly silty clay	
15	Undisturbed	Very stiff tan and gray clay with silt pockets	
20	Undisturbed	Stiff gray clay	
25	Undisturbed	Stiff tan and gray clay with silt pockets	
30	Undisturbed	Medium tan and gray clay with ferrous nodules	
35	Undisturbed	Very soft tan and gray very silty clay with ferrous nodules	
40		No sample recovered	
40	Standard Penetration Test	Very stiff gray silty clay	17 blows per foot (4/7/10)
45			
50	Undisturbed	Medium gray very silty clay	

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.
Geotechnical Engineers

LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	7
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	26-Aug-05
	Baton Rouge, Louisiana	Technician:	JP

Undisturbed Sample
Standard Penetration Test
Classification Sample
(SLS) Slickensided

Boring Depth: 70 Feet

Depth Feet	SAMPLES	Description	
50			
55			
60	☒	Dense gray fine sand with silt traces	34 blows per foot (10/16/18)
65			
70	☒	Very dense gray sand with silt traces	78 blows per foot (18/36/42)

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.
Geotechnical Engineers

LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	8
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	1-Sep-05
	Baton Rouge, Louisiana	Technician:	PN

■ Undisturbed Sample
☒ Standard Penetration Test
▯ Classification Sample
(SLS) Slickensided

Boring Depth: 55 Feet

Depth Feet	SAMPLES	Description	Remarks
0	Classification Sample	Brown and black coal and fly ash	Cement-bentonite grout backfill full depth
5	Undisturbed Sample	Brown and black fly ash with clay pockets	
10	Undisturbed Sample	Stiff tan and gray slightly sandy clay	
15	Undisturbed Sample	Stiff tan and gray clay	
20	Undisturbed Sample	Stiff tan and gray clay	
25	Undisturbed Sample	Soft tan and gray very silty clay	
30	Undisturbed Sample	Loose tan and gray clayey sand	
35	Undisturbed Sample	Loose tan sandy silt	
40	Classification Sample	Gray silty fine sand	
	Standard Penetration Test	Firm light gray silty fine sand	23 blows per foot (7/10/13)
45	Standard Penetration Test	Dense light gray silty fine sand	34 blows per foot (10/17/17)
50	Standard Penetration Test	Dense light gray fine sand with silt traces	35 blows per foot (7/17/18)

LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	8
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	1-Sep-05
	Baton Rouge, Louisiana	Technician:	PN

Depth Feet | SAMPLES

■ Undisturbed Sample
☒ Standard Penetration Test
◫ Classification Sample
(SLS) Slickensided

Boring Depth: 55 Feet

Depth Feet	Samples	Description	
50			
55	☒	Dense light gray fine sand with silt traces	32 blows per foot (10/15/17)

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.
Geotechnical Engineers

LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	9
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	1-Sep-05
	Baton Rouge, Louisiana	Technician:	PN

Legend: Undisturbed Sample; Standard Penetration Test; Classification Sample; (SLS) Slickensided

Boring Depth: 50 Feet

Depth Feet	SAMPLES	Description	Remarks
0–1	Classification Sample	Brown sand with roots	Cement-bentonite grout backfill full depth
2–4	Undisturbed Sample	Very stiff gray sandy clay	
4–6	Undisturbed Sample	Stiff tan and gray clay	
6–8	Undisturbed Sample	Medium tan and gray clay with ferrous nodules	
8–10	Undisturbed Sample	Stiff tan and gray silty clay with ferrous nodules	
13–15	Undisturbed Sample	Loose tan and gray silty fine sand with clay pockets	
18–20		No sample recovered	
21–22.5	Standard Penetration Test	Loose light gray sandy silt	6 blows per foot (4/4/2)
23.5–25	Standard Penetration Test	Firm light gray silty fine sand with clay traces	18 blows per foot (8/10/8)
28–30		No sample recovered	
31–32.5	Standard Penetration Test	Firm light gray silty fine sand	11 blows per foot (4/5/6)
33.5–35	Standard Penetration Test	Firm light gray clayey fine sand with organic matter traces	18 blows per foot (4/9/9)
38.5–40	Standard Penetration Test	Firm light gray clayey fine sand	28 blows per foot (7/14/14)
43.5–45	Standard Penetration Test	Dense light gray fine sand with silt traces	30 blows per foot (10/12/18)
48.5–50	Standard Penetration Test	Firm light gray fine sand with silt traces	27 blows per foot (9/13/14)

LOG OF BORING

Project: Bottom Ash Storage Pond Expansion
Big Cajun II, Pointe Coupee Parish, Louisiana
For: Shaw Environmental & Infrastructure, Inc.
Baton Rouge, Louisiana

Boring: 11
File: 05-58
Date: 23-Aug-05
Technician: JP

Legend (SAMPLES column):
- Undisturbed Sample
- Standard Penetration Test
- Classification Sample
- (SLS) Slickensided

Boring Depth: 50 Feet

Depth Feet	Description	Remarks
0	Hard brown and gray clay with ferrous nodules	Cement-bentonite grout backfill full depth
	Hard brown clay	
5	Very stiff brown and gray clay with silt streaks and organic matter	
	Medium gray clay	
10	Medium gray clay	
15	Medium gray clay	(SLS)
20	Loose gray clayey sand	
25	No sample recovered	
	Firm gray silty fine sand	28 blows per foot (7/12/16)
30	Firm gray fine sand with silt traces	15 blows per foot (5/7/8)
35	Dense gray fine sand with silt traces	37 blows per foot (18/18/19)
40	Dense gray fine sand with silt traces	36 blows per foot (17/19/17)
45	Dense gray fine sand	37 blows per foot (13/17/20)
50	Dense gray fine sand	37 blows per foot (16/18/21)

LOG OF BORING

Project: Bottom Ash Storage Pond Expansion
Big Cajun II, Pointe Coupee Parish, Louisiana
For: Shaw Environmental & Infrastructure, Inc.
Baton Rouge, Louisiana

Boring: 12
File: 05-58
Date: 22-Aug-05
Technician: JP

Undisturbed Sample
Standard Penetration Test
Classification Sample
(SLS) Slickensided

Boring Depth: 70 Feet

Depth Feet	SAMPLES	Description	Notes
0	Classification	Black fly ash	Cement-bentonite grout backfill full depth
5	Undisturbed	Very stiff brown clay with fly ash	
10	Undisturbed	Stiff tan and gray clay	
15	Undisturbed	Stiff tan and gray clay with silt streaks and ferrous nodules	
20	Undisturbed	Stiff gray clay	
25	Undisturbed	Soft gray very silty clay	
30	Undisturbed	Soft tan and gray silty clay	
35		No sample recovered	
	SPT	Firm tan and gray fine sand with silt traces	29 blows per foot (10/10/19)
40	SPT	Firm tan and gray fine sand with silt traces	16 blows per foot (8/8/8)
45	SPT	Firm gray silty fine sand with clay traces	11 blows per foot (6/3/8)
50	SPT	Firm gray silty fine sand with clay traces	22 blows per foot (10/16/16)

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.
Geotechnical Engineers

LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	12
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	22-Aug-05
	Baton Rouge, Louisiana	Technician:	JP

Undisturbed Sample
Standard Penetration Test
Classification Sample
(SLS) Slickensided

Boring Depth: 70 Feet

Depth Feet	SAMPLES	Description	Blows
50			
55	Standard Penetration Test	Dense gray fine sand with shells and silt traces	30 blows per foot (15/14/16)
60	Standard Penetration Test	Dense gray fine sand with shells and silt traces	30 blows per foot (15/13/17)
65	Standard Penetration Test	Dense gray fine sand with silt traces	30 blows per foot (12/14/16)
70	Standard Penetration Test	Dense gray fine sand with silt traces	43 blows per foot (17/20/23)

LOG OF BORING

Project: Bottom Ash Storage Pond Expansion
Big Cajun II, Pointe Coupee Parish, Louisiana
For: Shaw Environmental & Infrastructure, Inc.
Baton Rouge, Louisiana

Boring: 13
File: 05-58
Date: 23-Aug-05
Technician: JP

Undisturbed Sample
Standard Penetration Test
Classification Sample
(SLS) Slickensided

Boring Depth: 50 Feet

Depth Feet	SAMPLES	Description	Remarks
0	Undisturbed Sample	Black and brown fly ash and sand	Cement-bentonite grout backfill full depth
	Undisturbed Sample	Soft black and brown fly ash and clay	
5		← Fly ash/soil interference at 5 feet	
10	Undisturbed Sample	Stiff tan and gray clay	
15	Undisturbed Sample	Stiff tan and gray silty clay with ferrous nodules	
20	Undisturbed Sample	Stiff tan and gray clay	
25	Undisturbed Sample	Medium tan and gray clay with ferrous nodules	
30	Undisturbed Sample	Medium tan and gray clay with ferrous nodules	
35	Undisturbed Sample	Medium tan and gray very sandy clay	
40		No sample recovered	
	Standard Penetration Test	Firm tan and gray silty fine sand	25 blows per foot (9/11/14)
45			
50	Standard Penetration Test	Dense gray fine sand with silt traces	31 blows per foot (12/16/15)

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.
Geotechnical Engineers

LOG OF BORING

Project: Bottom Ash Storage Pond Expansion
Big Cajun II, Pointe Coupee Parish, Louisiana
For: Shaw Environmental & Infrastructure, Inc.
Baton Rouge, Louisiana

Boring: 14
File: 05-58
Date: 23-Aug-05
Technician: JP

Legend: ■ Undisturbed Sample; ☒ Standard Penetration Test; ▯ Classification Sample; (SLS) Slickensided

Boring Depth: 60 Feet

Depth Feet	SAMPLES	Description	Remarks
0	Classification Sample	Black and brown fly ash	Cement-bentonite grout backfill full depth
	Classification Sample	Brown fly ash with clay pockets	
5		← Fly ash/clay interference at 5 feet	
10	Undisturbed Sample	Stiff tan and gray clay	
15	Undisturbed Sample	Medium tan and gray silty clay	
20	Undisturbed Sample	Very stiff tan and gray clay with sand streaks	
25	Undisturbed Sample	Stiff tan and gray clay	
30	Undisturbed Sample	Soft tan and gray very silty clay	
35	Undisturbed Sample	Soft tan and gray very sandy clay	
40	Standard Penetration Test	Loose tan and gray silty fine sand	4 blows per foot (6/2/2)
45	Undisturbed Sample	Loose gray fine sand with silt traces	
	Standard Penetration Test	Firm gray fine sand with silt traces	25 blows per foot (12/12/13)
50	Standard Penetration Test	Dense gray fine sand with silt traces	32 blows per foot (15/16/16)

LOG OF BORING

Project:	Bottom Ash Storage Pond Expansion	Boring:	14
	Big Cajun II, Pointe Coupee Parish, Louisiana	File:	05-58
For:	Shaw Environmental & Infrastructure, Inc.	Date:	23-Aug-05
	Baton Rouge, Louisiana	Technician:	JP

Depth Feet | SAMPLES

■ Undisturbed Sample

☒ Standard Penetration Test

▯ Classification Sample

(SLS) Slickensided

Boring Depth: 60 Feet

Depth Feet	Samples	Description	Remarks
50			
55	☒	Dense gray fine sand with silt traces	31 blows per foot (12/16/15)
60	☒	Dense gray fine sand with silt traces	46 blows per foot (22/24/22)

LOG OF BORING

PROJECT Big Cajun No. 2, Site C-2
New Roads, Louisiana
Cajun Electric Power Cooperative, Inc.

FOR Bovay Engineers, Inc., Consulting Engineers
Burns and Roe, Inc., Consulting Engineers

BORING 3
FILE 74-30
DATE 14 May 1974
TECHNICIAN MJK

■ UNDISTURBED SAMPLE ☒ STANDARD PENETRATION TEST BORING DEPTH 200 feet

DEPTH FEET	Description		
0			
5	Soft brown silty clay with 10 inch layer loose brown clayey silt		
10	Medium gray clay with silt traces Penetration resistance	5 blows for 1 foot	(2/2/3)
15	Soft gray slightly silty clay		
20	Medium gray clay Penetration resistance	5 blows for 1 foot	(3/2/3)
25	No recovery Firm gray sand with 8 inch layer very loose gray sand		
30	Firm gray clayey silt with traces of organic material Penetration resistance	12 blows for 1 foot	(5/5/7)
35	No recovery Loose gray sand		
40	Firm gray sand Penetration resistance	27 blows for 1 foot	(8/9/18)
45	Dense gray sand Penetration resistance	44 blows for 1 foot	(17/21/23)
50	Dense gray sand with clay traces Penetration resistance	39 blows for 1 foot	(16/20/19)

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.
Consulting Engineers

LOG OF BORING

PROJECT Big Cajun No. 2, Site C-2
New Roads, Louisiana
Cajun Electric Power Cooperative, Inc.

FOR Bovay Engineers, Inc., Consulting Engineers
Burns and Roe, Inc., Consulting Engineers

BORING 3
FILE 74-30
DATE 14 May 1974
TECHNICIAN MJK

DEPTH FEET | SAMPLES | ■ UNDISTURBED SAMPLE | ⊠ STANDARD PENETRATION TEST | BORING DEPTH 200 feet

Depth (feet)	Description	Penetration	
50			
55	Dense gray slightly clayey sand Penetration resistance	41 blows for 1 foot	(13/19/22)
60	Very dense gray clayey sand Penetration resistance	26 blows for 6 inches	(18/26)
65	Very dense gray sand Penetration resistance	33 blows for 6 inches	
70	Very dense gray sand Penetration resistance	26 blows for 4 inches	(28/26 for 4")
75	Very dense gray sand Penetration resistance	36 blows for 6 inches	
80	Very dense gray sand Penetration resistance	32 blows for 6 inches	
85	Very dense gray sand with clay traces Penetration resistance	25 blows for 4 inches	(25/25 for 4")
90	Very dense gray sand with clay traces Penetration resistance	50 blows for 6 inches	
95	Very dense gray sand Penetration resistance	70 blows for 6 inches	
100	Very dense gray sand Penetration resistance	25 blows for 4 inches	(28/25 for 4")

LOG OF BORING

PROJECT Big Cajun No. 2, Site C-2
New Roads, Louisiana
Cajun Electric Power Cooperative, Inc.
FOR Bovay Engineers, Inc., Consulting Engineers
Burns and Roe, Inc., Consulting Engineers

BORING 3
FILE 74-30
DATE 14 May 1974
TECHNICIAN TZ

DEPTH FEET | SAMPLES | UNDISTURBED SAMPLE | STANDARD PENETRATION TEST | BORING DEPTH 200 feet

Depth (feet)	Description	Penetration	
100			
105	Very dense gray sand Penetration resistance	25 blows for 4 inches	(20/25 for 4")
110	Very dense gray sand Penetration resistance	25 blows for 6 inches	(29/25)
115	Very dense gray sand Penetration resistance	36 blows for 6 inches	
120	Very dense gray sand Penetration resistance	32 blows for 4 inches	
125	Very dense gray coarse sand with gravel Penetration resistance	33 blows for 6 inches	
130	Very dense gray coarse sand with gravel Penetration resistance	26 blows for 6 inches	(22/26)
135	Very dense gray coarse sand and gravel Penetration resistance	31 blows for 6 inches	
140	Very dense gray coarse sand with gravel Penetration resistance	35 blows for 6 inches	
145	Very dense gray sand with gravel Penetration resistance	30 blows for 5 inches	
150	Dense gray sand and traces of gravel Penetration resistance	32 blows for 1 foot	(21/17/15)

LOG OF BORING

PROJECT Big Cajun No. 2, Site C-2 New Roads, Louisiana	BORING 3 FILE 74-30
FOR Cajun Electric Power Cooperative, Inc. Bovay Engineers, Inc., Consulting Engineers Burns and Roe, Inc., Consulting Engineers	DATE 15 May 1974 TECHNICIAN MJK

UNDISTURBED SAMPLE — STANDARD PENETRATION TEST — BORING DEPTH 200 feet

DEPTH FEET	Description		
150			
155	No recovery Penetration resistance	25 blows for 4 inches	(28/25 for 4")
160	Very dense gray coarse sand Penetration resistance	35 blows for 4 inches	
165	Very dense gray coarse sand Penetration resistance	35 blows for 4 inches	
170	Hard tan clay Penetration resistance	44 blows for 1 foot	(9/19/25)
175	Hard tan clay Penetration resistance	39 blows for 1 foot	(11/14/25)
180	Very stiff light gray sandy clay		
185	Very stiff light gray sandy clay		
190	Hard green marine clay Penetration resistance	53 blows for 1 foot	(13/22/31)
195	Hard light gray sandy clay		
200	Hard green marine clay Penetration resistance	37 blows for 1 foot	(11/15/22)

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.

LOG OF BORING

PROJECT	Big Cajun No. 2, Site C-2 New Roads, Louisiana Cajun Electric Power Cooperative, Inc.
FOR	Bovay Engineers, Inc., Consulting Engineers Burns and Roe, Inc., Consulting Engineers
BORING	5
FILE	74-30
DATE	10 May 1974
TECHNICIAN	MJK

UNDISTURBED SAMPLE — STANDARD PENETRATION TEST — BORING DEPTH 150 feet

DEPTH FEET	SAMPLES	Description		
0				
5	Undisturbed	Soft brown clay with silt traces		
10	SPT	Medium brown light gray clay with silt traces Penetration resistance	5 blows for 1 foot	(2/2/3)
15	Undisturbed	Loose brown slightly clayey silt		
20	SPT	Firm gray slightly clayey silt Penetration resistance	10 blows for 1 foot	(3/4/6)
25	SPT	No recovery		
	SPT	Loose gray sand with clay traces Penetration resistance	7 blows for 1 foot	(2/2/5)
30	Undisturbed	Firm gray fine sand		
35	SPT	Firm gray sand with 3 inch layer gray clay Penetration resistance	28 blows for 1 foot	(6/10/18)
40	SPT	Dense gray sand Penetration resistance	32 blows for 1 foot	(9/15/17)
45	SPT	Dense gray sand with wood traces Penetration resistance	34 blows for 1 foot	(9/14/20)
50	SPT	No recovery Penetration resistance	6 blows for 1 foot	(3/3/3)

LOG OF BORING

PROJECT Big Cajun No. 2, Site C-2
New Roads, Louisiana
Cajun Electric Power Cooperative, Inc.
FOR Bovay Engineers, Inc., Consulting Engineers
Burns and Roe, Inc., Consulting Engineers

BORING 5
FILE 74-30
DATE 10 May 1974
TECHNICIAN MJK

UNDISTURBED SAMPLE — STANDARD PENETRATION TEST — BORING DEPTH 150 feet

DEPTH FEET	SAMPLES	Description		
50	Undisturbed	Firm gray sand		
55	SPT	Firm gray sand with 4 inch gray sandy clay layer Penetration resistance	21 blows for 1 foot	(7/7/14)
	Undisturbed	Firm gray silt		
60	SPT	Dense gray coarse sand Penetration resistance	44 blows for 1 foot	(10/20/24)
65	SPT	Dense gray sand Penetration resistance	42 blows for 1 foot	(15/20/22)
70	SPT	Dense gray coarse sand Penetration resistance	47 blows for 1 foot	(12/23/24)
75	SPT	Very dense gray coarse sand Penetration resistance	32 blows for 6 inches	
80	SPT	Very dense gray sand Penetration resistance	26 blows for 4 inches	(14/26 for 4")
85	SPT	Very dense gray fine sand Penetration resistance	28 blow for 6 inches	(-18/28)
90	SPT	Dense gray sand Penetration resistance	48 blows for 1 foot	(15/20/28)
95	SPT	Very dense gray sand Penetration resistance	25 blows for 6 inches	(15/25)
100	SPT	Very dense gray coarse sand Penetration resistance	25 blows for 3 inches	(15/25 for 3")

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.

LOG OF BORING

PROJECT Big Cajun No.2, Site C-2
New Roads, Louisiana
FOR Cajun Electric Power Cooperative, Inc.
Bovay Engineers, Inc., Consulting Engineers
Burns and Roe, Inc., Consulting Engineers

BORING 5
FILE 74-30
DATE 13 May 1974
TECHNICIAN MJK

UNDISTURBED SAMPLE | STANDARD PENETRATION TEST | BORING DEPTH 150 feet

DEPTH FEET	Description		
100			
105	Very dense gray coarse sand Penetration resistance	25 blows for 6 inches	(15/25)
110	Very dense gray sand Penetration resistance	25 blows for 3 inches	(15/25 for 3")
115	Very dense gray sand Penetration resistance	25 blows for 4 inches	(29/25 for 4")
120	Very dense gray coarse sand Penetration resistance	30 blows for 4 inches	
125	Very dense gray fine sand with gravel traces Penetration resistance	25 blows for 6 inches	(20/25)
130	Dense gray coarse sand Penetration resistance	30 blows for 1 foot	(25/14/16)
135	Very dense gray and fine sand with traces gravel and 1 inch sand clay layer Penetration resistance	25 blows for 6 inches	(15/25)
140	Very dense gray sand Penetration resistance	50 blows for 1 foot	(15/25/25)
145	Very dense gray sand with gravel traces Penetration resistance	30 blows for 6 inches	
150	Very dense gray sand Penetration resistance	25 blows for 6 inches	(11/25)

LOG OF BORING

PROJECT	Big Cajun No. 2, Site C-2 New Roads, Louisiana
FOR	Cajun Electric Power Cooperative, Inc. Bovay Engineers, Inc., Consulting Engineers Burns and Roe, Inc., Consulting Engineers
BORING	6
FILE	74-30
DATE	24 May 1974
TECHNICIAN	MD

DEPTH FEET — SAMPLES — ■ UNDISTURBED SAMPLE — ☒ STANDARD PENETRATION TEST — BORING DEPTH 151½ feet

Depth (feet)	Sample	Description		
0				
5	☒	Medium tan and gray clay Penetration resistance	5 blows for 1 foot	(2/2/3)
10	■	Loose gray silt with clay traces		
15	☒	Medium tan silty clay Penetration resistance	6 blows for 1 foot	(3/3/3)
20	■	Firm gray sandy silt		
25	☒	Medium gray silty clay with traces of organic matter Penetration resistance	7 blows for 1 foot	(2/2/5)
30	■	Medium gray silty clay with 2 inch very silty clay layer		
35	☒	Firm gray silty sand Penetration resistance	18 blows for 1 foot	(7/8/10)
	■	Dense gray silty sand		
40	☒	Dense gray silty sand Penetration resistance	41 blows for 1 foot	(11/20/21)
45	☒	Very stiff gray slightly silty clay Penetration resistance	19 blows for 1 foot	(6/10/9)
50	■	Medium gray silty clay with silt lenses		

LOG OF BORING

PROJECT Big Cajun No. 2, Site C-2
New Roads, Louisiana
Cajun Electric Power Cooperative, Inc.
FOR Bovay Engineers, Inc., Consulting Engineers
Burns and Roe, Inc., Consulting Engineers

BORING 6
FILE 74-30
DATE 24 May 1974
TECHNICIAN MD

DEPTH FEET | SAMPLES | ■ UNDISTURBED SAMPLE | ⊠ STANDARD PENETRATION TEST | BORING DEPTH 151½ feet

Depth (feet)	Description		
50			
55	Firm gray sand Penetration resistance	25 blows for 1 foot	(8/12/13)
60	Stiff gray clay with 4 inch sandy silt layer Penetration resistance	11 blows for 1 foot	(3/6/5)
	Medium gray clay with silt lenses and sand streaks		
65	Stiff gray clay with 6 inch very dense gray sand layer Penetration resistance	26 blows for 6 inches	
70	Dense gray sand Penetration resistance	37 blows for 1 foot	(25/21/16)
75	Very stiff gray slightly silty clay Penetration resistance	25 blows for 1 foot	(8/11/14)
80	Loose gray coarse sand		
	Dense gray coarse sand Penetration resistance	45 blows for 1 foot	(10/22/23)
85	Very dense gray sand Penetration resistance	28 blows for 6 inches	(14/28)
90	Very dense gray coarse sand Penetration resistance	25 blows for 5 inches	(24/25 for 5")
95	Dense gray fine sand Penetration resistance	27 blows for 1 foot	(15/11/16)
100	Dense gray fine sand Penetration resistance	25 blows for 5 inches	(15/25 for 5")

LOG OF BORING

PROJECT: Big Cajun No. 2, Site C-2
New Roads, Louisiana
Cajun Electric Power Cooperative, Inc.

FOR: Bovay Engineers, Inc., Consulting Engineers
Burns and Roe, Inc., Consulting Engineers

BORING 6
FILE 74-30
DATE 27 May 1974
TECHNICIAN TZ

DEPTH FEET	SAMPLES	UNDISTURBED SAMPLE / STANDARD PENETRATION TEST	BORING DEPTH 151½ feet	
100				
105	⊠	Very dense gray fine sand with gravel traces Penetration resistance	25 blows for 5 inches	(15/25 for 5")
110	⊠	Dense gray fine sand with gravel Penetration resistance	40 blows for 1 foot	(15/20/25)
115	⊠	Very dense gray fine sand with gravel traces Penetration resistance	25 blows for 3 inches	(30/25 for 3")
120	⊠	Very dense gray fine sand Penetration resistance	25 blows for 4 inches	(25/25/4")
125	⊠	Very dense gray fine sand Penetration resistance	25 blows for 4 inches	(25/25 for 4")
130	⊠	Very dense gray fine sand Penetration resistance	36 blows for 6 inches	
135	⊠	Very dense fine sand with gravel Penetration resistance	36 blows for 6 inches	
140	⊠	Very dense fine sand with gravel traces Penetration resistance	35 blows for 5 inches	
145	⊠	Very dense fine sand Penetration resistance	40 blows for 6 inches	(25/40)
150	⊠	No recovery Penetration resistance	36 blows for 5 inches	

LOUIS J. CAPOZZOLI & ASSOCIATES, INC.

PP18125

LOG OF BORING

PROJECT Big Cajun No. 2, Site C-2 New Roads, Louisiana Cajun Electric Power Cooperative, Inc. FOR Bovay Engineers, Inc., Consulting Engineers Burns and Roe, Inc., Consulting Engineers	BORING 6 FILE 74-30 DATE 27 May 1974 TECHNICIAN TZ

DEPTH FEET | SAMPLES | UNDISTURBED SAMPLE | STANDARD PENETRATION TEST | BORING DEPTH 151½ feet

DEPTH FEET	SAMPLES	DESCRIPTION
150	X	No recovery Penetration resistance 36 blows for 5 inches
155		

rr-10125

LOG OF BORING

PROJECT Big Cajun No. 2, Site C-2
New Roads, Louisiana
Cajun Electric Power Cooperative, Inc.
FOR Bovay Engineers, Inc., Consulting Engineers
Burns and Roe, Inc., Consulting Engineers

BORING 8
FILE 74-30
DATE 23 May 1974
TECHNICIAN MD

DEPTH FEET | SAMPLES | UNDISTURBED SAMPLE | STANDARD PENETRATION TEST | BORING DEPTH 150 feet

Depth (feet)	Description	Penetration resistance	Blows
5	Very loose brown clayey silt Penetration resistance	3 blows for 1 foot	(2/1/2)
10	Very loose brown slightly clayey silt		
15	Loose brown clayey silt Penetration resistance	4 blows for 1 foot	(2/2/2)
20	Soft gray very silty clay with 3 inch sand layer		
25	Firm gray sandy silt Penetration resistance	20 blows for 1 foot	(7/7/13)
30	Soft gray clay with silt streaks and ¼ to 4 inch silt layer		
35	Dense gray sand with ¼ inch clay layer Penetration resistance	38 blows for 1 foot	(10/18/20)
40	No recovery Firm gray fine sand Penetration resistance	25 blows for 1 foot	(6/9/16)
45	Dense gray fine sand Penetration resistance	32 blows for 1 foot	(12/15/17)
50	Dense gray fine sand Penetration resistance	33 blows for 1 foot	(12/16/17)

LOG OF BORING

PROJECT Big Cajun No. 2, Site C-2 New Roads, Louisiana Cajun Electric Power Cooperative, Inc. FOR Bovay Engineers, Inc., Consulting Engineers Burns and Roe, Inc., Consulting Engineers	BORING 8 FILE 74-30 DATE 23 May 1974 TECHNICIAN MD

UNDISTURBED SAMPLE — STANDARD PENETRATION TEST — BORING DEPTH 150 feet

DEPTH FEET	SAMPLES	Description	Penetration	Blow counts
50				
55	☒	Dense gray fine sand Penetration resistance	38 blows for 1 foot	(9/18/20)
60	☒	Very dense gray fine sand Penetration resistance	28 blows for 6 inches	(17/28 for 6")
65	☒	Dense gray fine sand Penetration resistance	36 blows for 1 foot	(19/17/19)
70	☒	Dense gray fine sand Penetration resistance	46 blows for 1 foot	(14/20/26)
75	☒	Dense gray fine sand Penetration resistance	41 blows for 1 foot	(15/19/22)
80	☒	Very dense gray sand with traces of organic matter Penetration resistance	32 blows for 6 inches	
85	☒	Very dense gray sand Penetration resistance	32 blows for 5 inches	
90	☒	Very dense gray sand Penetration resistance	27 blows for 5 inches	(23/27 for 5")
95	☒	Very dense gray sand Penetration resistance	26 blows for 6 inches	(20/26)
100	☒	Very dense gray sand Penetration resistance	30 blows for 5 inches	

LOG OF BORING

PROJECT Big Cajun No. 2, Site C-2
New Roads, Louisiana
Cajun Electric Power Cooperative, Inc.
FOR Bovay Engineers, Inc., Consulting Engineers
Burns and Roe, Inc., Consulting Engineers

BORING 8
FILE 74-30
DATE 23 May 1974
TECHNICIAN MD

UNDISTURBED SAMPLE — STANDARD PENETRATION TEST — BORING DEPTH 150 feet

DEPTH FEET	SAMPLES	Description		
100				
105	☒	Very dense gray sand Penetration resistance	32 blows for 5 inches	
110	☒	Very dense gray sand with organic matter Penetration resistance	33 blows for 5 inches	
115	☒	Very dense gray sand Penetration resistance	35 blows for 6 inches	
120	☒	Very dense gray sand Penetration resistance	35 blows for 6 inches	
125	☒	Very dense gray sand Penetration resistance	35 blows for 6 inches	
130	☒	Very dense sand and gravel Penetration resistance	35 blows for 5 inches	
135	☒	Very dense slightly sandy gravel Penetration resistance	28 blows for 6 inches	(19/28)
140	☒	Dense slightly sandy gravel Penetration resistance	34 blows for 1 foot	(11/15/19)
145	☒	Dense slightly sandy gravel Penetration resistance	34 blows for 1 foot	(11/15/19)
150	☒	Dense slightly sandy gravel Penetration resistance	32 blows for 1 foot	(24/15/17)

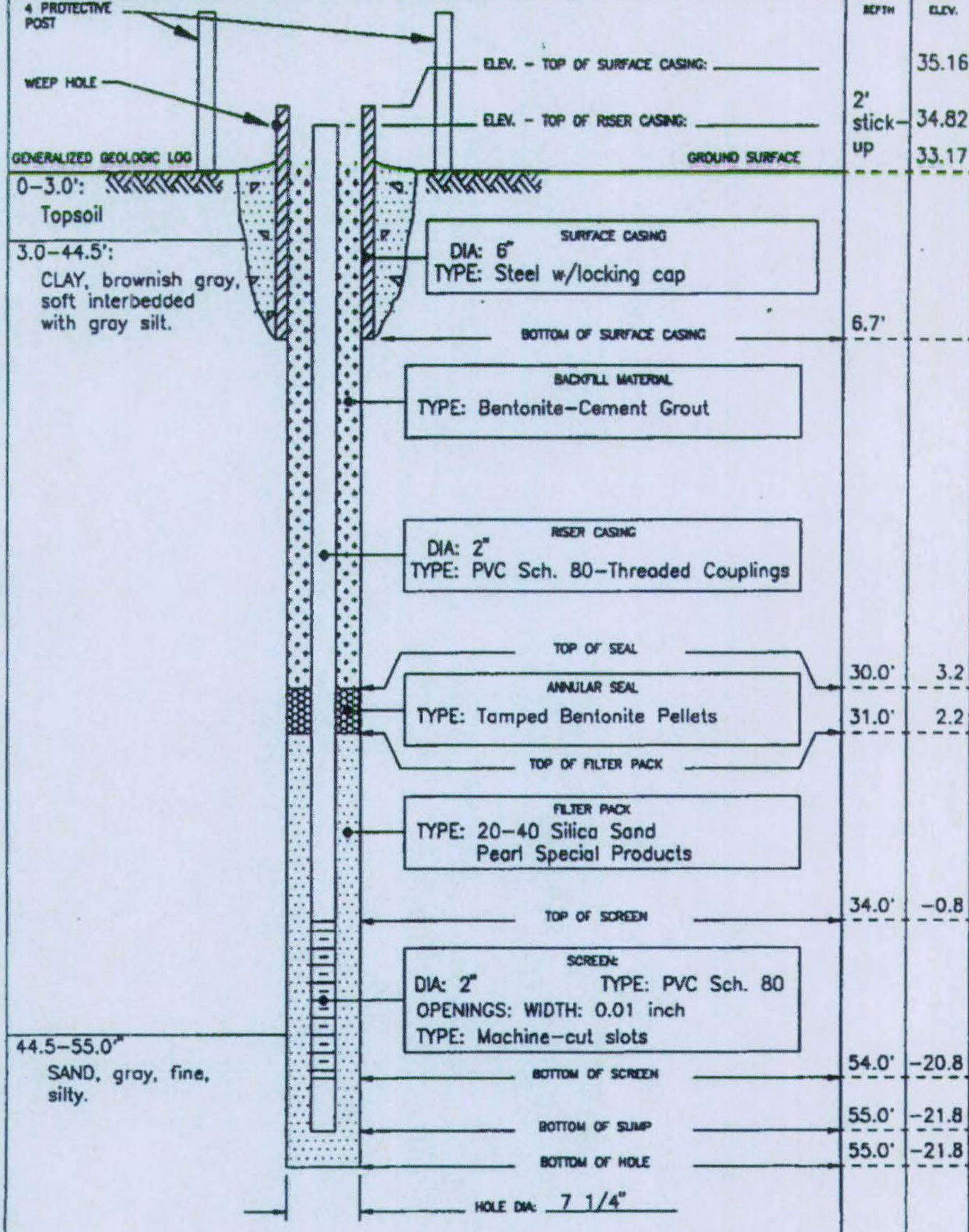
LOUIS J. CAPOZZOLI & ASSOCIATES, INC.

OBSERVATION WELL

PROJECT	WELL NO.
CEPCO - BIG CAJUN II	85A

JOB NO.	SITE	COORDINATES
14630	Fly Ash Pond	E 2030, N 4190

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
6/18/85	6/18/85	D. R. Beissel	Top of PVC



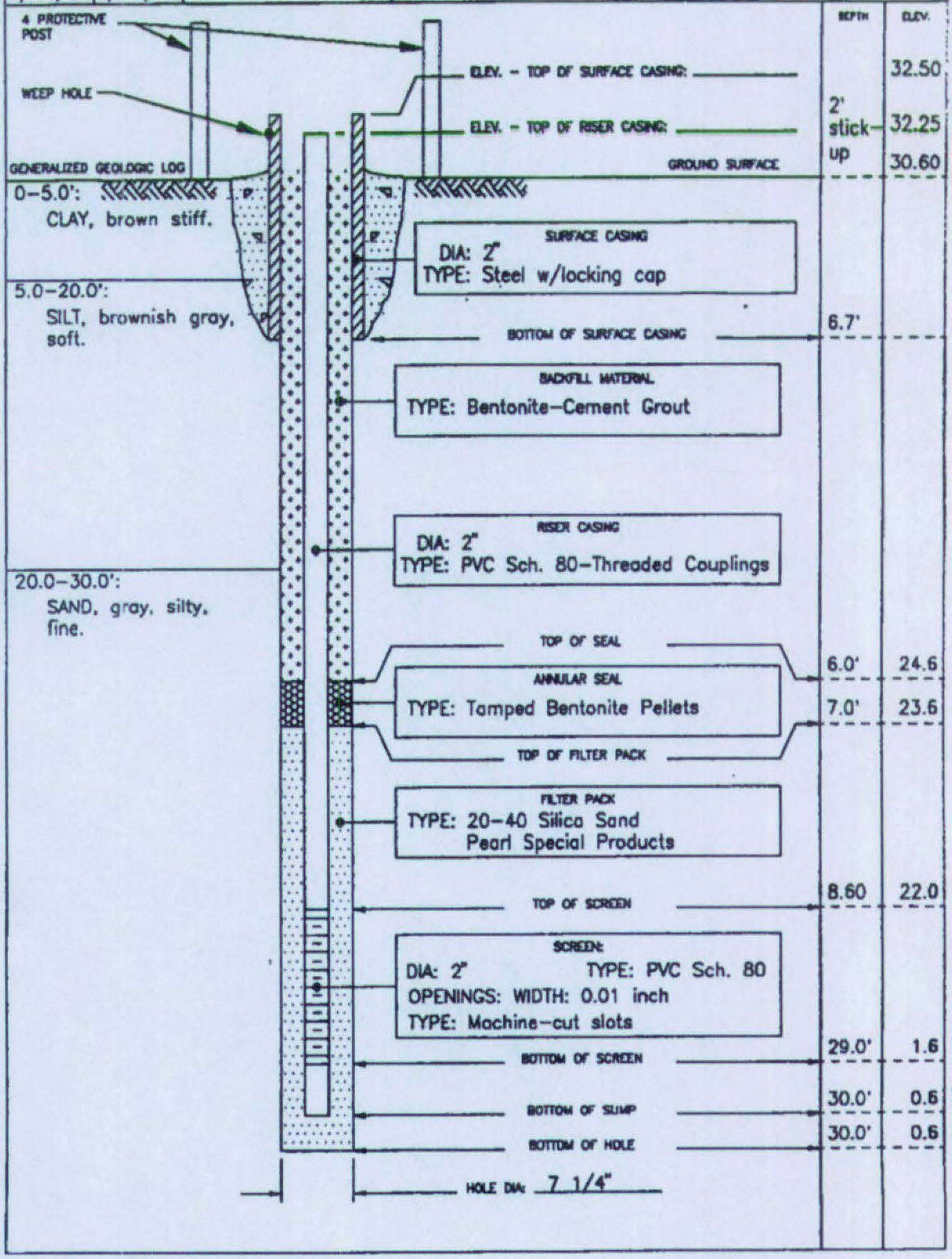
AutoCADD Dwg. NO.: D:\CAJUN\WELL85A.DWG

OBSERVATION WELL

PROJECT			WELL NO.
CEPCO – BIG CAJUN II			85B

JOB NO.	SITE	COORDINATES
14630	North Bottom Ash Pond	E 6449, N 5262

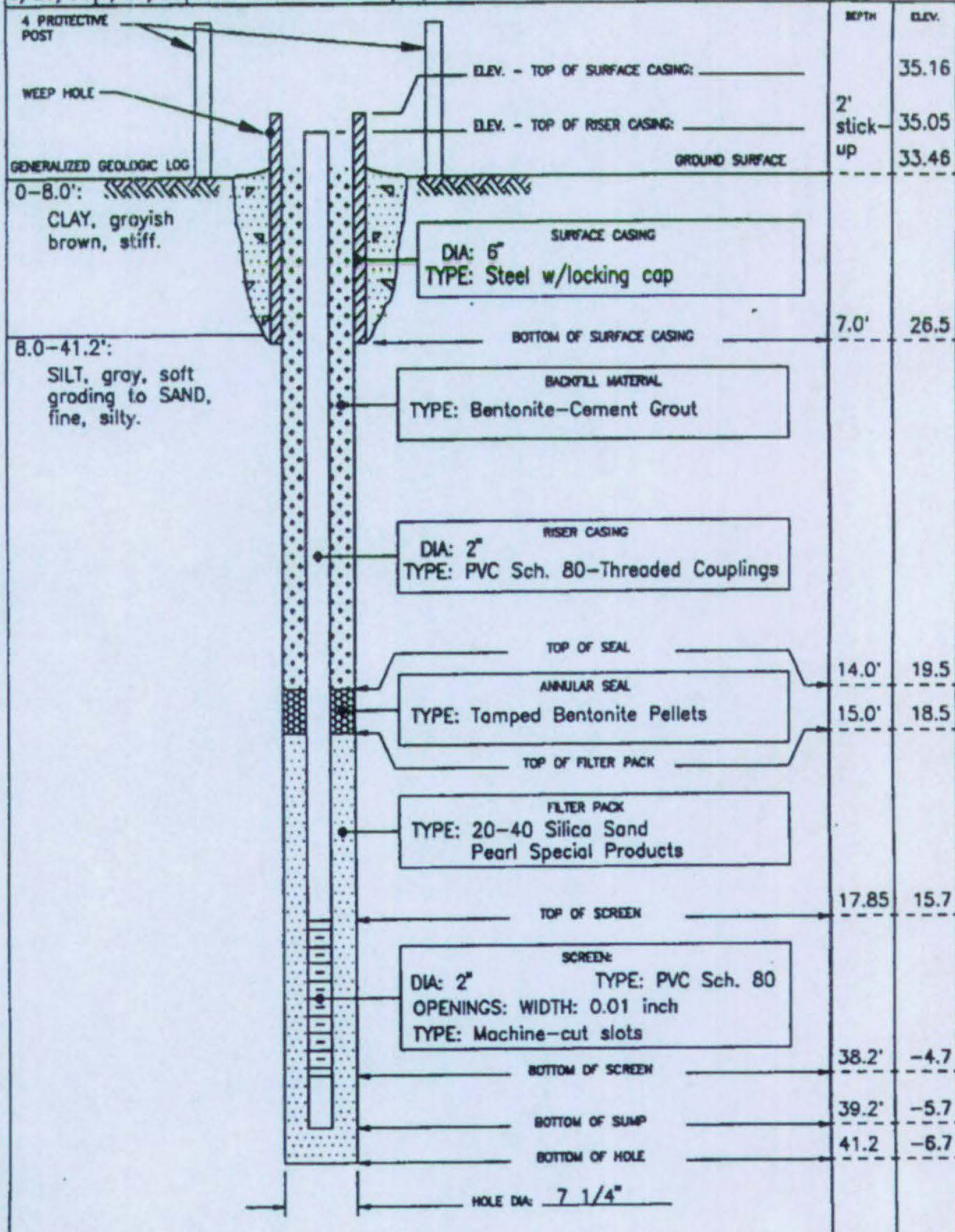
BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
6/20/85	6/20/85	D. R. Beissel	Top of PVC



AutoCADD Drwg. NO.: D:\CAJUN\WELL85B.DWG

OBSERVATION WELL

PROJECT	CEPCO – BIG CAJUN II	WELL NO.	85C
JOB NO.	14630	SITE	North Rainfall Pond
COORDINATES	E 9490, N 5167		
BEGUN	6/20/85	COMPLETED	6/20/85
PREPARED BY	D. R. Beissel	REFERENCE POINT FOR MEASUREMENTS	Top of PVC



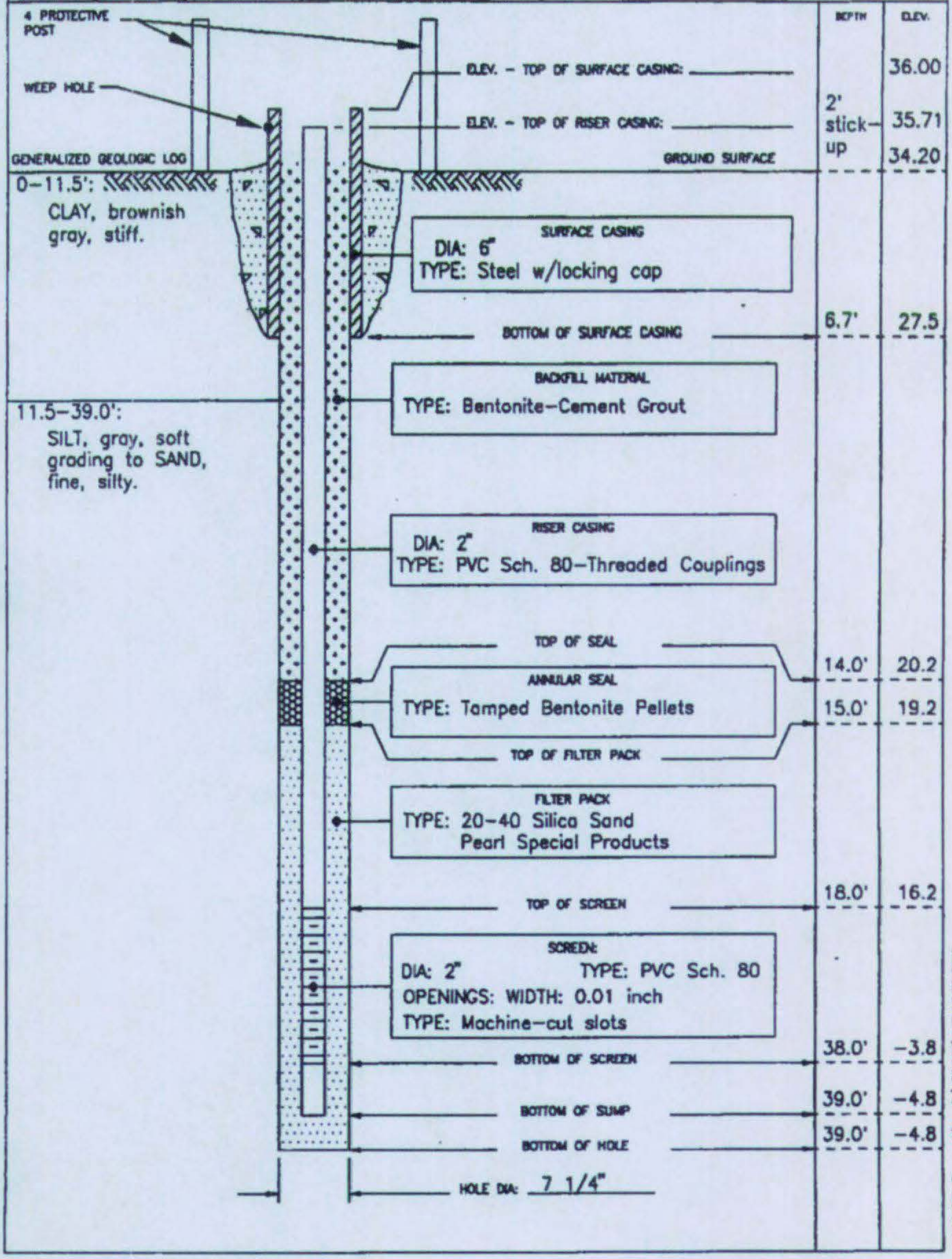
AutoCADD Dwg. NO.: D:\CAJUN\WELL85C.DWG

OBSERVATION WELL

PROJECT	WELL NO.
CEPCO – BIG CAJUN II	85D

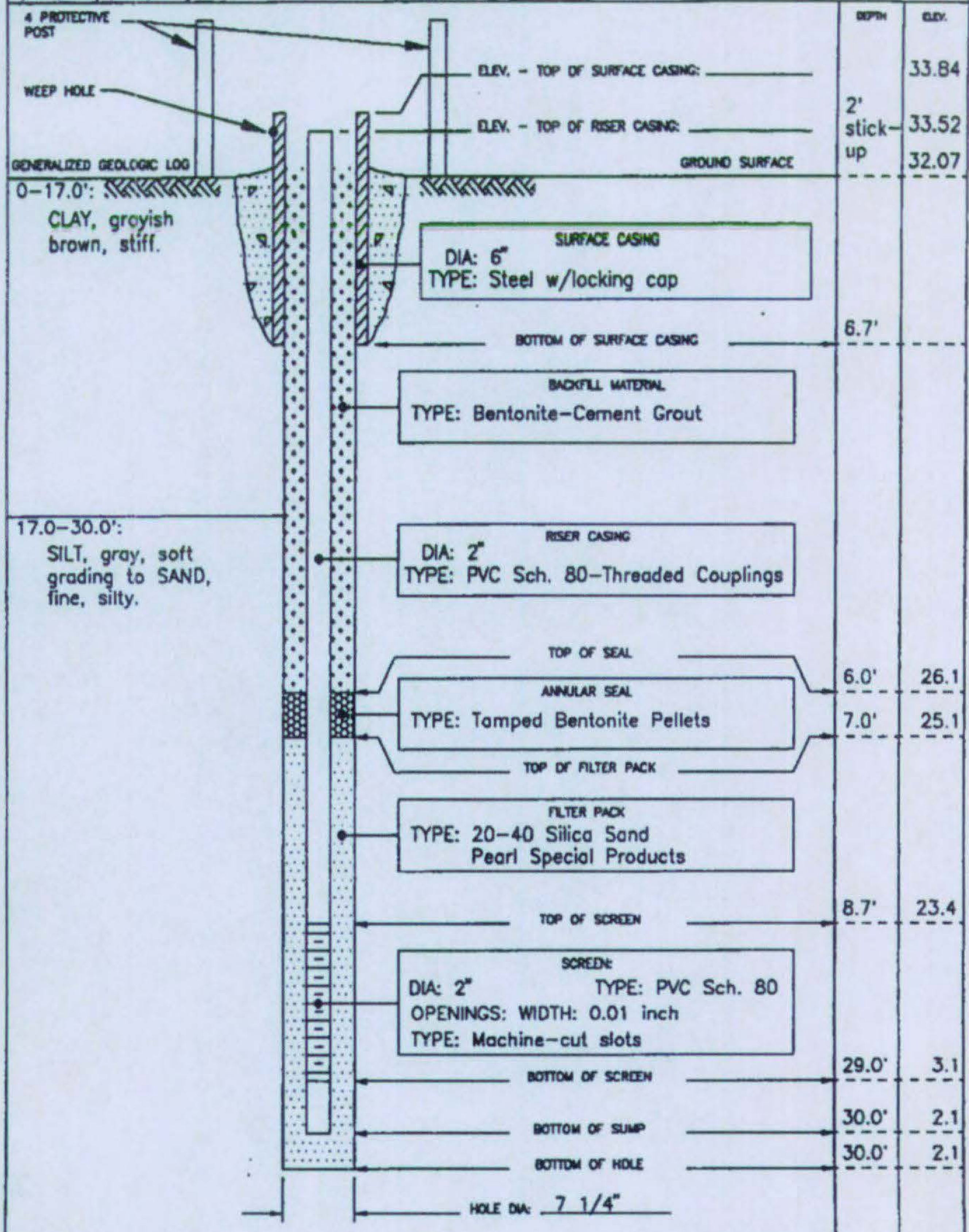
JOB NO.	SITE	COORDINATES
14630	South Rainfall Pond	E 9210, N 3780

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
6/20/85	6/20/85	D. R. Beissel	Top of PVC



AutoCADD Dwg. NO.: D:\CAJUN\WELL85D.DWG

OBSERVATION WELL	PROJECT: CEPCO - BIG CAJUN II		WELL NO: 85E
JOB NO.: 14630	SITE: South Bottom Ash Pond	COORDINATES: E 6550, N 3245	
BEGUN: 6/19/85	COMPLETED: 6/19/85	PREPARED BY: D. R. Beissel	REFERENCE POINT FOR MEASUREMENTS: Top of PVC



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BORING LOG - MW-10A

(Pages 1 of 1)

Louisiana Generating, LLC.
Big Cajun II Power Plant
Point Coupee Parish
New Roads, LA.

Date of installation	: 6/2/11	Logged By	: Kevin Simoneaux
Borehole Diameter	: 6.75"	Northing	: 809876.342
Drilling Method	: Roto Sonic	Easting	: 3261662.301
Sampling Method	: 4" X 10' Sonic Casing Sampler	Well Diameter	: 2"
Drilling Agency	: Walker-Hill Environmental	Well Total Depth-BGS	: 29.5'

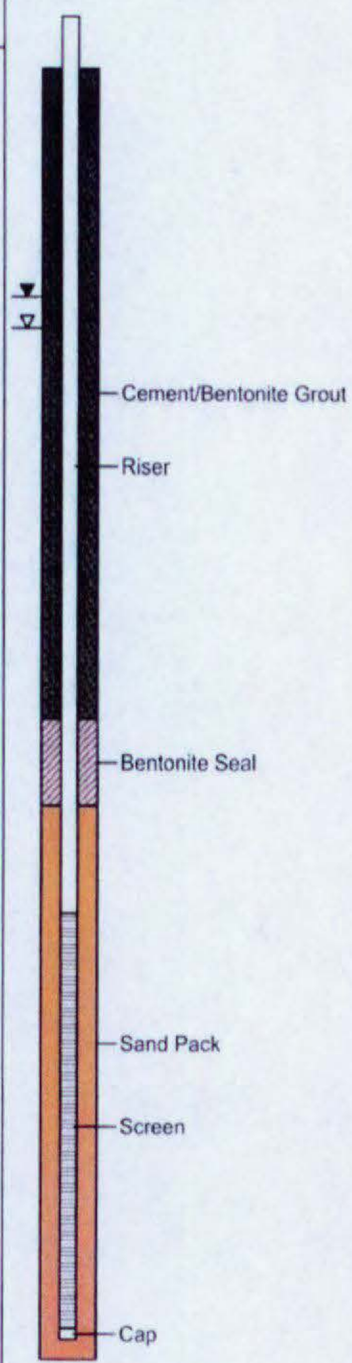
Sample Condition: Undisturbed; No Recovery

Water Levels: ▼ Static (from TOC); ▽ Initial

Well ID: MW-10A
TOC Elev: 32.967

Surface Elevation 29.886

Depth in Feet	USCS	DESCRIPTION	Time	Surface Elevation
0	CL	stiff, gray-brown, SILTY CLAY, with orange-brown mottling and roots to 1'	8:20	29
5		more silt		25
6	MH	soft, light brown, CLAYEY SILT, with some sand, wet		23
11			08:29	19
12		4" silty clay layer		
15	MH	grades to dark gray		15
17		stiff, with more clay		13
20		soft, dark gray, silt, with some clay and sand		
21			08:38	9
22		more sand, wet		
25		wood fragment		5
30		Terminated boring at 30 ft-bgs. Install 2" PVC well using 10' screen to 30 ft-bgs. Complete as monitor well MW-10A.		



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BORING LOG - MW-10B

Louisiana Generating, LLC.
Big Cajun II Power Plant
Point Coupee Parish
New Roads, LA.

Date of installation	: 6/2/11	Logged By	: Kevin Simoneaux
Borehole Diameter	: 6.75"	Northing	: 810132.688
Drilling Method	: Roto Sonic Drilling	Easting	: 3262447.284
Sampling Method	: 4" x 10' Sonic Casing Sampler	Well Diameter	: 2"
Drilling Agency	: Walker-Hill Environmental	Well Total Depth-BGS	: 30'

Sample Condition
- Undisturbed
- No Recovery

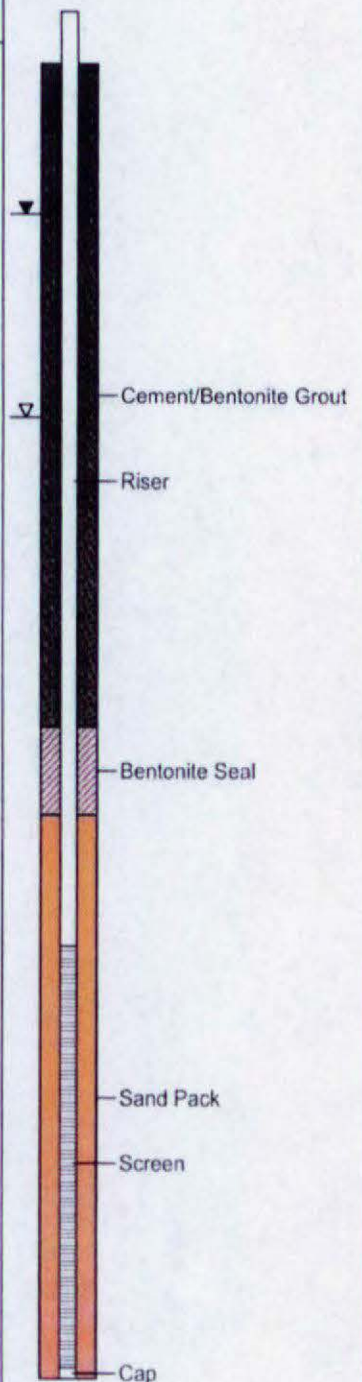
Water Levels
- ▼ Static (from TOC)
- ▽ Initial

Surface Elevation 27.860

Depth in Feet	USCS	DESCRIPTION	Time	Surface Elevation
0	CH	stiff, brown, CLAY, with orange-brown mottling	11:11	27
2				25
4				23
6		silty clay		21
8	MH	soft, light brown, CLAYEY SILT, moist		19
10			11:18	17
12	ML	gray, fine grained, SANDY SILT, with less clay, wet		15
14				13
16				11
18				9
20		1' lense of dark gray	11:23	7
22				5
24		organic matter to 25' wood fragment		3
26		some clay		1
28		interbedded silt and clay		-1
30	SM	dark gray, fine grained, SAND		

Terminated boring at 30 ft-bgs. Install 2" PVC well using 10' screen to 30 ft-bgs. Complete as monitor well MW-10B.

Well ID: MW-10B
TOC Elev: 31.126



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BORING LOG - MW-10C

Louisiana Generating, LLC.
Big Cajun II Power Plant
Point Coupee Parish
New Roads, LA.

Date of installation	: 6/2/11
Borehole Diameter	: 6.75"
Drilling Method	: Roto Sonic Drilling
Sampling Method	: 4" x 10' Sonic Casing Sampler
Drilling Agency	: Walker-Hill Environmental
Logged By	: Kevin Simoneaux
Northing	: 811239.167
Easting	: 3265598.105
Well Diameter	: 2"
Well Total Depth-BGS	: 30'

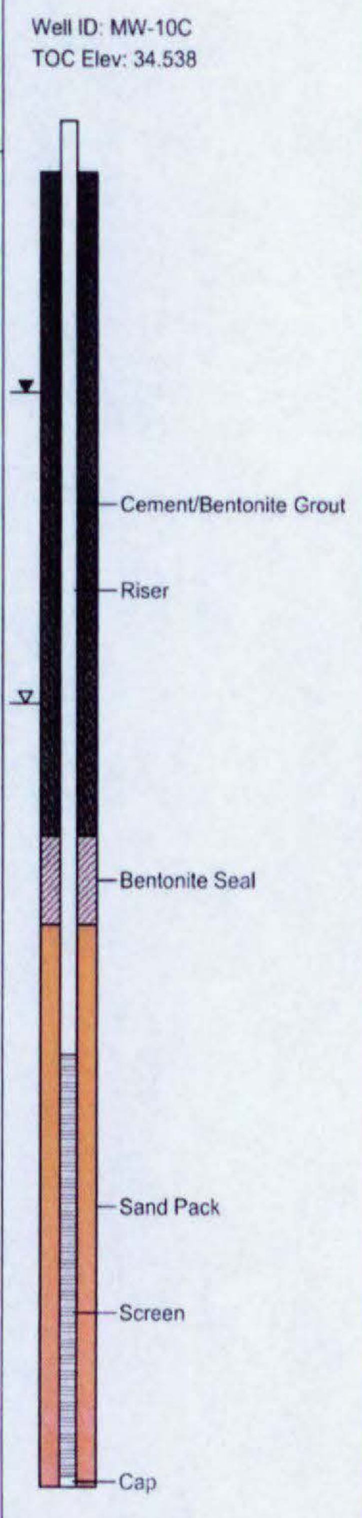
Sample Condition: Undisturbed; No Recovery

Water Levels: ▼ Static; ▽ Initial

Surface Elevation 31.503

Depth in Feet	USCS	DESCRIPTION	Time
0	ML	dark brown, top soil, SILT, with roots and organics	
1	CL	stiff, gray-brown, SILTY CLAY	15:30
9	MH	soft, gray-brown, CLAYEY SILT, with some sand	15:36
12	ML	stiff, gray-brown, fine grained, SANDY SILT, wet	
		some clay	
		some clay, and organic matter	15:43
22	ML	grades to dark gray, some clay mixed	
23	SM	loose, dark gray, silty fine grained SAND, wet	
		1" dark gray, stiff, clayey silt layer	
26	SP	soft, loose, dark gray SAND, wet	
30			

Terminated boring at 30 ft-bgs. Install 2" PVC well using 10' screen to 30 ft-bgs. Complete as monitor well MW-10C.



ENTNRG\working\Field Notes - AJZ\Borings\MW-10C.bor

08-12-2011

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BORING LOG - MW-10D

(Pages 1 of 1)

Louisiana Generating, LLC.
Big Cajun II Power Plant
Point Coupee Parish
New Roads, LA.

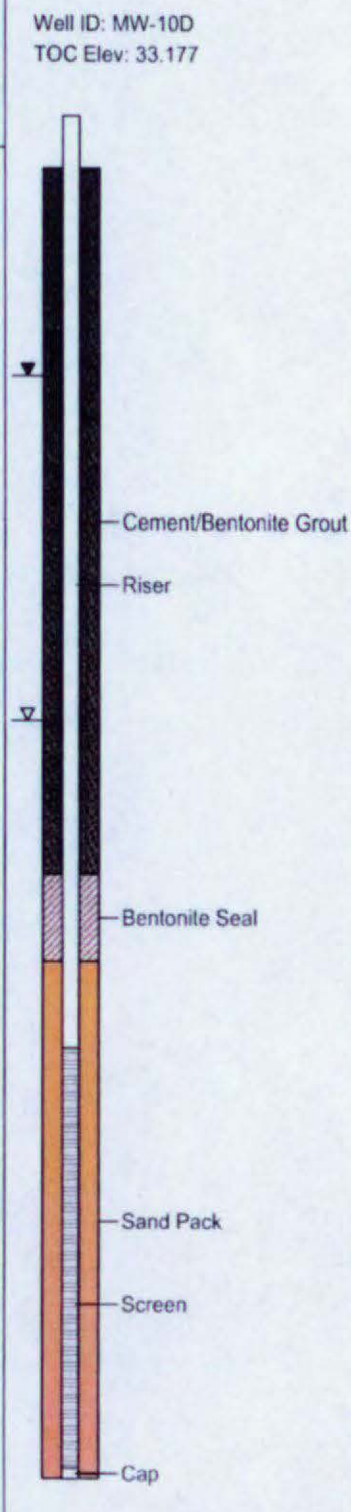
Date of installation	: 6/2/11	Logged By	: Kevin Simoneaux
Borehole Diameter	: 6.75"	Northing	: 811026.11
Drilling Method	: Roto Sonic Drilling	Easting	: 3267568.097
Sampling Method	: 4" x 10' Sonic Casing Sampler	Well Diameter	: 2"
Drilling Agency	: Walker-Hill Environmental	Well Total Depth-BGS	: 30'

Sample Condition: Undisturbed; No Recovery

Water Levels: ▼ Static (from TOC); ▽ Initial

Surface Elevation 30.221

Depth in Feet	USCS	DESCRIPTION	Sample	Time
0–10		No Recovery	No Recovery	13:24
10–13	MH	stiff, gray-brown, CLAYEY SILT, moist wet (~12.5)	Undisturbed	13:36
13–17	ML	soft, gray-brown, SANDY SILT, wet some interbedded clay	Undisturbed	
17–30	ML	dark gray in color 1" silty clay layer (~25.5)	Undisturbed	13:41
30		Terminated boring at 30 ft-bgs. Install 2" PVC well using 10' screen to 30 ft-bgs. Complete as monitor well MW-10D.		



NTNRG\working\Field Notes - AJZ\Borings\MW-10D.bor

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BORING LOG - MW-10E

Louisiana Generating, LLC.
Big Cajun II Power Plant
Point Coupee Parish
New Roads, LA.

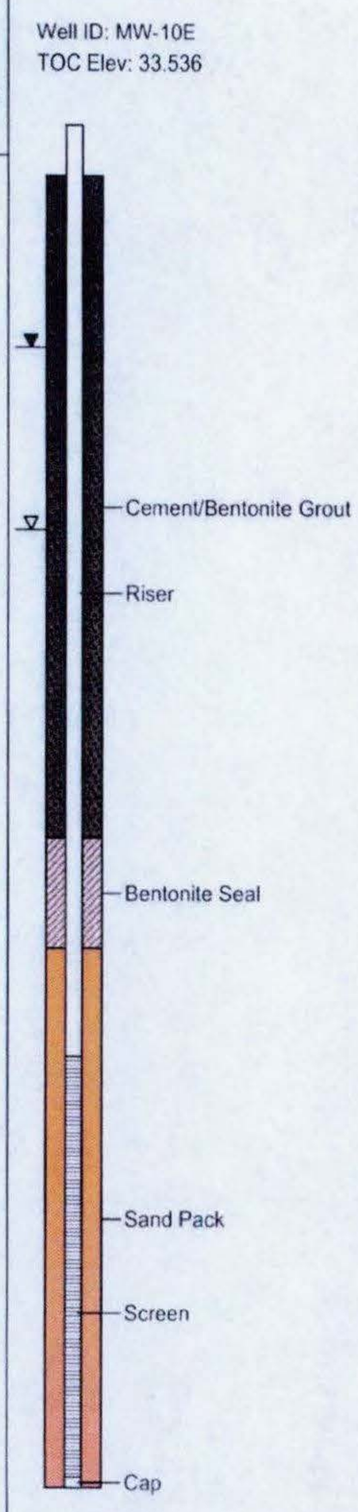
Date of installation	: 5/31/11	Logged By	: Kevin Simoneaux
Borehole Diameter	: 6.75"	Northing	: 809380.754
Drilling Method	: Roto Sonic Drilling	Easting	: 3266529.169
Sampling Method	: 4" x 10' Sonic Casing Sampler	Well Diameter	: 2"
Drilling Agency	: Walker-Hill Environmental	Well Total Depth-BGS	: 30'

Sample Condition: Undisturbed; No Recovery

Water Levels: ▼ Static; ▽ Initial

Surface Elevation 30.421

Depth in Feet	USCS	DESCRIPTION	Time
0	ML	dark brown/black, SILT, with organics	
0.5–5	CL	stiff, light brown, SILTY CLAY, with some gray mottling	13:46
5	ML	soft, light brown, SILT, slightly moist	
5.5		6" stiff, clay, layer with some silt	
8		sandy silt, moist	
10		same as above based on small amount of recovery	13:58
20	ML	gray in color, with brown mottling, wet	14:05
27		3" gray, silty clay layer	
30		Terminated boring at 30 ft-bgs. Install 2" PVC well using 10' screen to 20 ft-bgs. Complete as monitor well MW-10E.	



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BORING LOG - MW-10F

Louisiana Generating, LLC.
Big Cajun II Power Plant
Point Coupee Parish
New Roads, LA.

Date of installation	: 5/31/11	Logged By	: Kevin Simoneaux
Borehole Diameter	: 6.75"	Northing	: 808475.497
Drilling Method	: Roto Sonic Drilling	Easting	: 3263789.581
Sampling Method	: 4" x 10' Sonic Casing Sampler	Well Diameter	: 2"
Drilling Agency	: Walker-Hill Environmental	Well Total Depth-BGS	: 40'

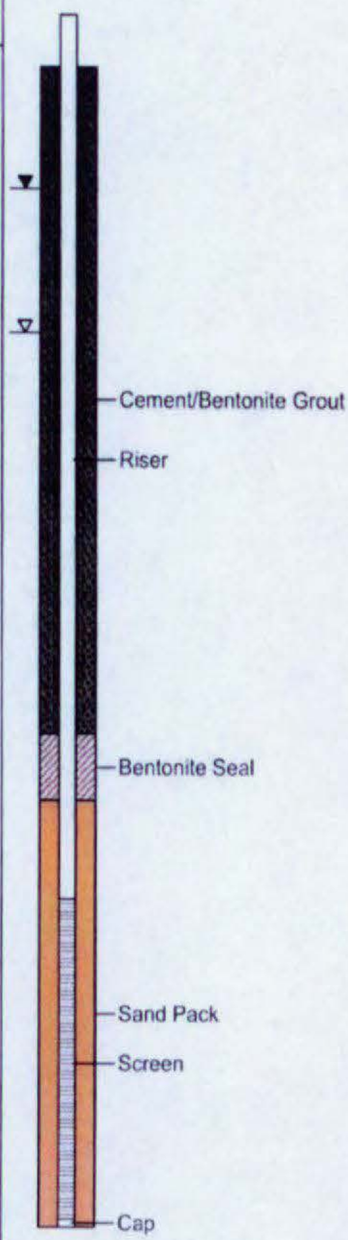
Sample Condition: Undisturbed; No Recovery

Water Levels: ▼ Static (from TOC); ▽ Initial

Depth in Feet	USCS	DESCRIPTION	Sample	Time	Surface Elevation 28.968
0–8		No Recovery	No Recovery	16:00	28
8–9	CL	stiff, gray-brown, SILTY CLAY, moist	Undisturbed		
9–13	ML	soft, light brown, SILT, with some clay, moist	Undisturbed	16:07	18
13–15	ML	grades to grey	Undisturbed		
15–23	ML	grades back to light brown, sandy silt, moist	Undisturbed	16:10	8
23–35	SM	soft, dark gray, SILTY SAND, wet; 3" stiff, gray clay layer (at ~31.5 ft)	Undisturbed	16:25	-2
35–40	CH	stiff, gray CLAY; stiff, gray sand, moist	Undisturbed		

Terminated boring at 40 ft-bgs. Install 2" PVC well using 10' screen to 35 ft-bgs. Complete as monitor well MW-10F.

Well ID: MW-10F
TOC Elev: 31.265



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BORING LOG - MW-10G

Louisiana Generating, LLC.
Big Cajun II Power Plant
Point Coupee Parish
New Roads, LA.

Date of installation	: 6/1/11	Logged By	: Kevin Simoneaux
Borehole Diameter	: 6.75"	Northing	: 808086.613
Drilling Method	: Roto Sonic Drilling	Easting	: 3262636.414
Sampling Method	: 4" x 10' Sonic Casing Sampler	Well Diameter	: 2"
Drilling Agency	: Walker-Hill Environmental	Well Total Depth-BGS	: 39'

Sample Condition: Undisturbed; No Recovery

Water Levels: ▼ Static (from TOC); ▽ Initial

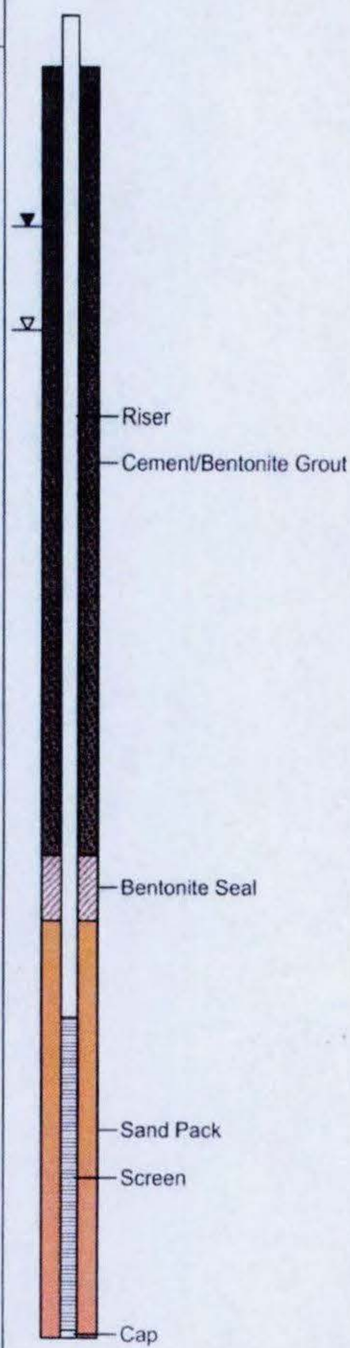
Surface Elevation 29.298

Depth in Feet	USCS	DESCRIPTION	Time
0	CL	stiff, gray-brown, SILTY CLAY, with orange-brown, mottling	08:05
2		organic nodules	
4–5		more silt	
8		moist	
10		some sand	08:13
16	MH	stiff, gray CLAYEY SILT	
21	ML	stiff, dark gray, fine grained SANDY SILT, wet	08:25
26	SP	stiff, dark gray, fine grained SAND, wet,	
31	CH	stiff, dark gray, CLAY	08:34
32	SP	stiff, dark gray, fine grained SAND, wet	
40		Terminated boring at 40 ft-bgs. Install 2" PVC well using 10' screen to 39 ft-bgs. Complete as monitor well MW-10G.	

Depth in Feet: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40

Elevation: 29, 27, 25, 23, 21, 19, 17, 15, 13, 11, 9, 7, 5, 3, 1, -1, -3, -5, -7, -9

Well ID: MW-10G
Toc Elev: 32.167



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BORING LOG - MW-10H

(Pages 1 of 1)

Louisiana Generating, LLC.
Big Cajun II Power Plant
Point Coupee Parish
New Roads, LA.

Date of installation	: 6/1/11
Borehole Diameter	: 6.75"
Drilling Method	: Roto Sonic Drilling
Sampling Method	: 4" x 10' Sonic Casing Sampler
Drilling Agency	: Walker-Hill Environmental
Logged By	: Kevin Simoneaux
Northing	: 807825.098
Easting	: 3261862.293
Well Diameter	: 2"
Well Total Depth-BGS	: 48'

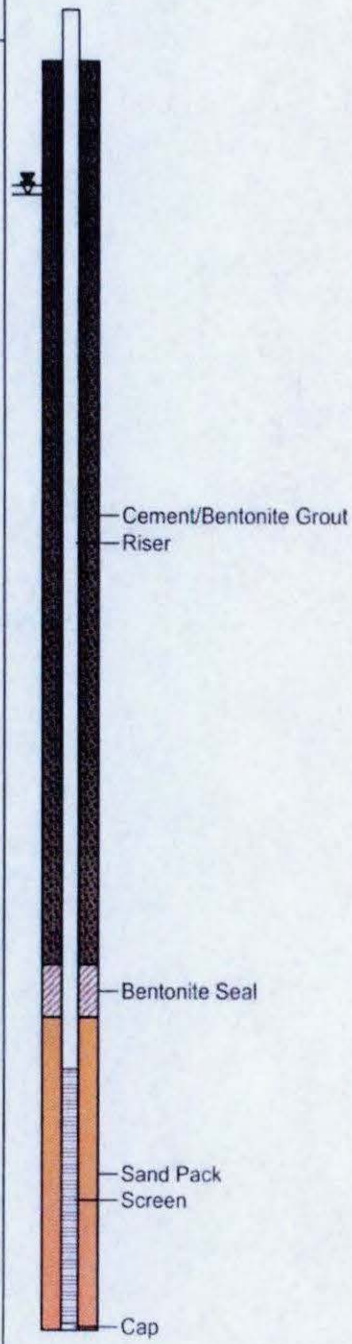
Sample Condition
▨ Undisturbed
■ No Recovery

Water Levels
▼ Static
▽ Initial

Depth in Feet	USCS	DESCRIPTION	Time	Surface Elevation 29.208
0		stiff, gray-brown, SILTY CLAY, with roots to 2'	09:52	29
2	CL			27
4		soft, gray-brown, CLAYEY SILT moist		25
6				23
8	MH			21
10			09:57	19
12		grades to dark grey		17
14				15
16				13
18	MH	wood fragments		11
20		3" stiff silt layer, moist	10:03	9
22				7
24		stiff, dark gray, SILT, wet		5
26	ML	some clay 6" stiff, silty clay layer		3
28		stiff, dark gray, CLAYEY SILT		1
30	MH		10:12	-1
32		stiff, dark gray, SILTY CLAY		-3
34	CL			-5
36				-7
38	SP	soft, dark gray, SILTY SAND		-9
40	CL	stiff, dark gray, SILTY CLAY 3" dark gray, fine grained, silty sand 3" sandy silt layer	11:23	-11
42				-13
44	SM	loose, dark gray, SILTY SAND		-15
46	CL	stiff, dark gray, SILTY CLAY		-17
48	SM	loose, dark gray, fine grained SAND		-19
50	CL	stiff, dark gray, SILTY CLAY		

Terminated boring at 50 ft-bgs. Install 2" PVC well using 10' screen to 48 ft-bgs. Complete as monitor well MW-10H.

Well ID: MW-10H
TOC Elev: 32.013



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BORING LOG - MW-10I

(Pages 1 of 1)

Louisiana Generating, LLC.
Big Cajun II Power Plant
Point Coupee Parish
New Roads, LA.

Date of installation	: 6/1/11	Logged By	: Kevin Simoneaux
Borehole Diameter	: 6.75"	Northing	: 807669.221
Drilling Method	: Roto Sonic Drilling	Easting	: 3260947.517
Sampling Method	: 4" x 10' Sonic Casing Sampler	Well Diameter	: 2"
Drilling Agency	: Walker-Hill Environmental	Well Total Depth-BGS	: 40'

Sample Condition: Undisturbed; No Recovery

Water Levels: ▼ Static (from TOC); ▽ Initial

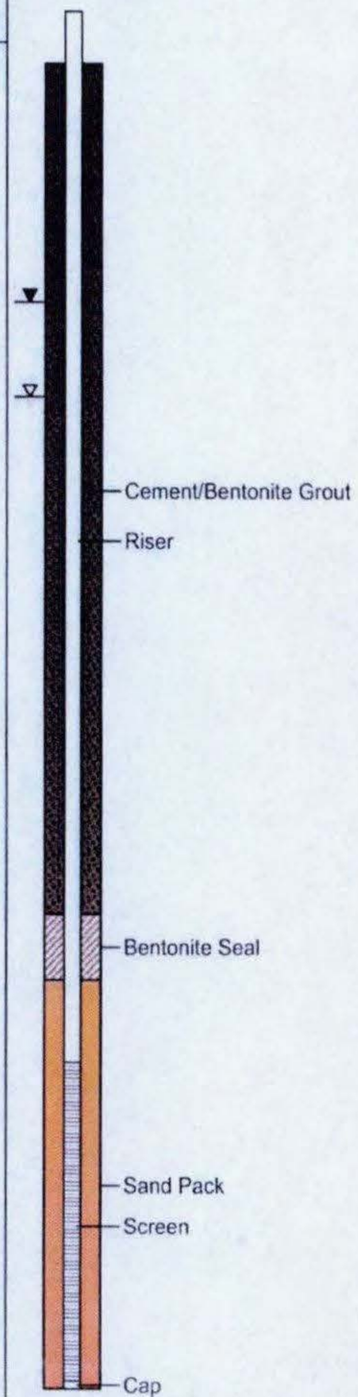
Surface Elevation 30.060

Depth in Feet	USCS	DESCRIPTION	Sample	Time
0		No Recovery	No Recovery	16:06
10	ML	soft, dark gray, slightly SANDY SILT, wet	Undisturbed	16:11
14		some clay		
21.5		more clay		16:15
22	CL	stiff, dark gray, SILTY CLAY		
25		3" stiff, clay layer 6" clay layer		
26.5	SM	loose, soft, dark gray, SILTY fine grained SAND		
31.5	CL	stiff, dark gray, SILTY CLAY		16:25
34	SM	loose, dark gray, SILTY SAND, with clay lenses to 37'		
40		Terminated boring at 40 ft-bgs. Install 2" PVC well using 10' screen to 40 ft-bgs. Complete as monitor well MW-10I.		

Depth scale (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40

Elevation scale: 30, 28, 26, 24, 22, 20, 18, 16, 14, 12, 10, 8, 6, 4, 2, 0, -2, -4, -6, -8

Well ID: MW-10I
TOC Elev: 33.121



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08-12-2011 1

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BORING LOG - MW-10BG

Louisiana Generating, LLC.
Big Cajun II Power Plant
Point Coupee Parish
New Roads, LA.

Date of installation	: 6/3/11	Logged By	: Kevin Simoneaux
Borehole Diameter	: 6.75"	Northing	: 811649.993
Drilling Method	: Roto Sonic Drilling	Easting	: 3263114.472
Sampling Method	: 4" x 10' Sonic Casing Sampler	Well Diameter	: 2"
Drilling Agency	: Walker-Hill Environmental	Well Total Depth-BGS	: 30.5'

Sample Condition: Undisturbed; No Recovery

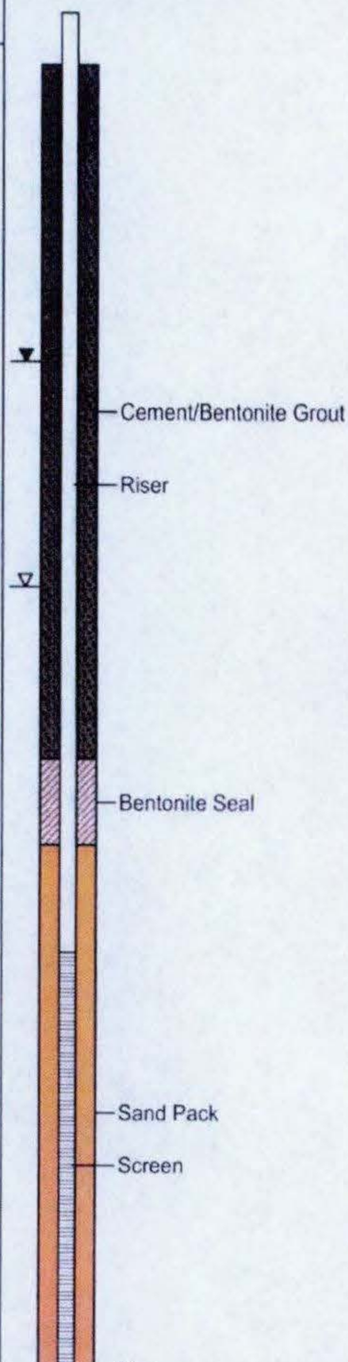
Water Levels: ▼ Static; ▽ Initial

Surface Elevation 30.788

Depth in Feet	USCS	DESCRIPTION	Time
0–5		No Recovery	08:41
5–14	CL	stiff, gray-brown, SILTY CLAY	08:45
14–19	MH	soft, gray-brown, CLAYEY SILT, moist	
19–21.5	ML	soft, loose, gray-brown, SANDY SILT, moist	
21.5–26	ML	grades to dark gray some clay; 1" silt and clay mix	08:50
26–30	SM	soft, loose, fine grained, SILTY SAND, wet	

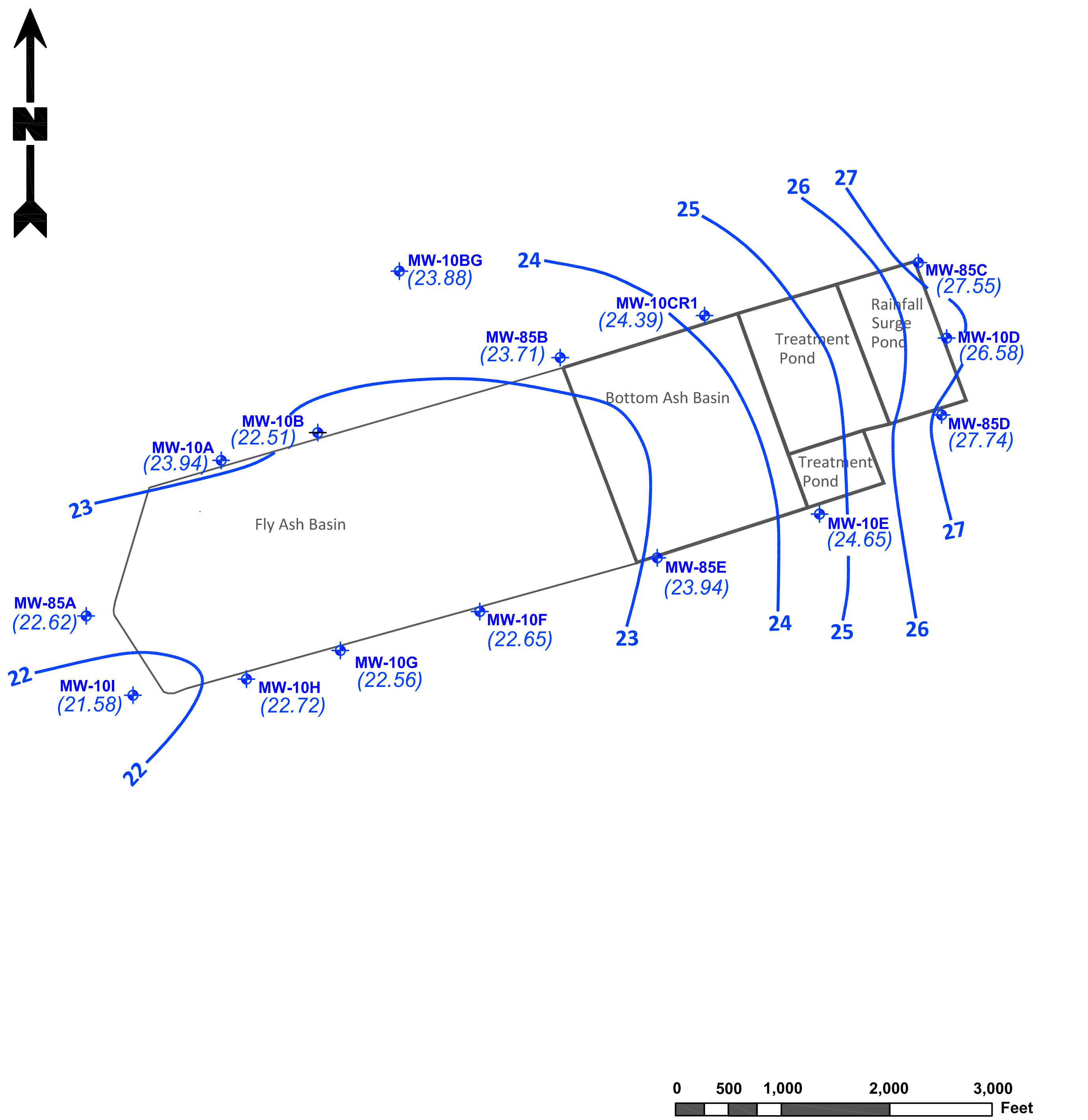
Terminated boring at 30 ft-bgs. Install 2" PVC well using 10' screen to 30 ft-bgs. Complete as background monitor well MW-10BG.

Well ID: MW-10BG
TOC Elev: 33.740



APPENDIX D

POTENTIOMETRIC SURFACE MAPS



Legend

MW-10B Monitoring Well

(23.94) Measured Potentiometric Elevation (ft. NGVD)

25 —— Potentiometric Surface Elevation (ft. NGVD)

CLECO Cajun, LLC

Big Cajun II Power Plant

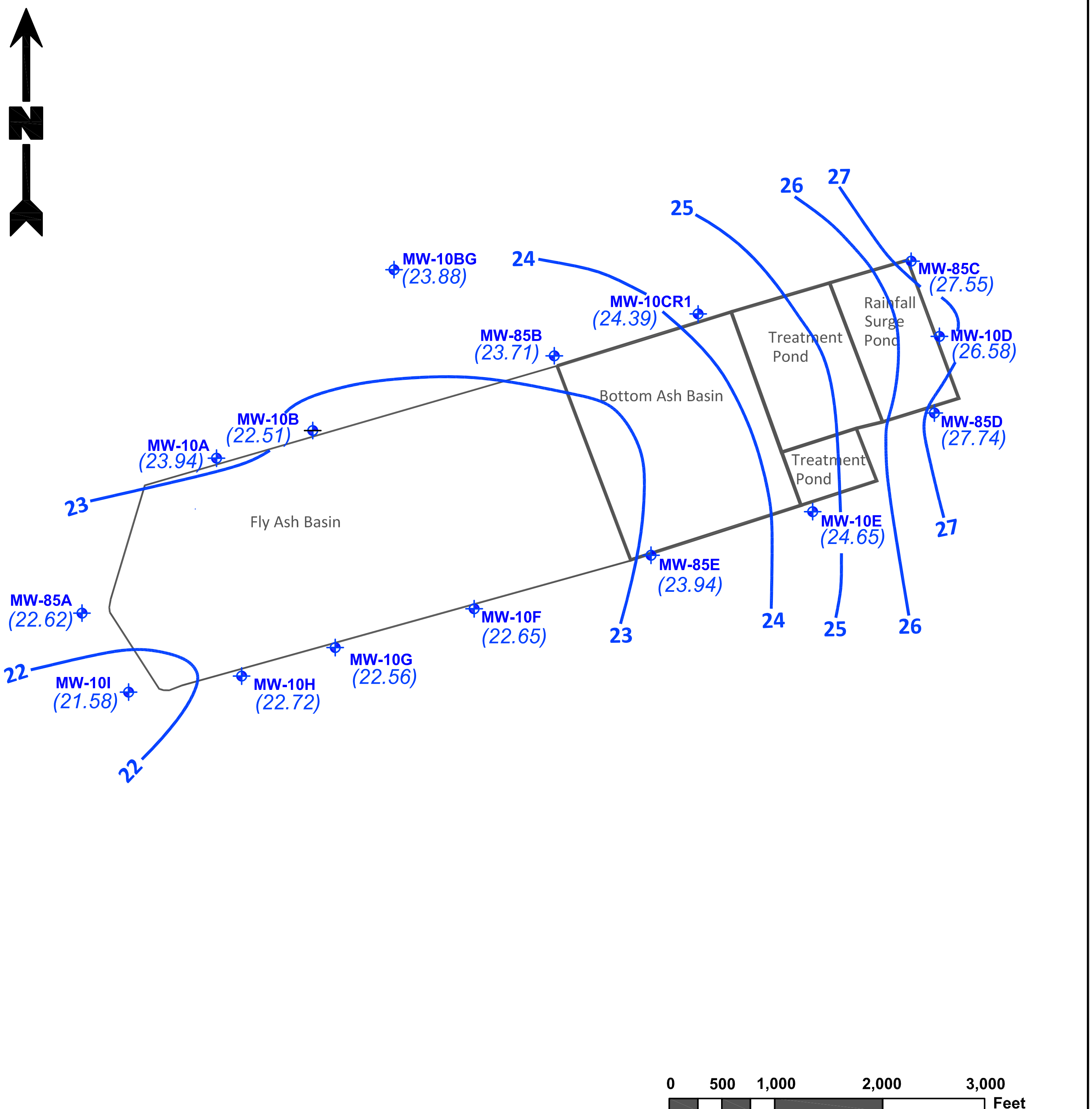
Potentiometric Surface Map
October 2019

Pointe Coupee Parish

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

Drawn:	JP
Checked:	JM
Approved:	JM
Date:	10/11/19
Dwg. No.:	**367-20-0004-APP- D-1**

Figure D-1



Legend

MW-10B Monitoring Well

(23.94) Measured Potentiometric Elevation (ft. NGVD)

25 —— Potentiometric Surface Elevation (ft. NGVD)

CLECO Cajun, LLC

Big Cajun II Power Plant

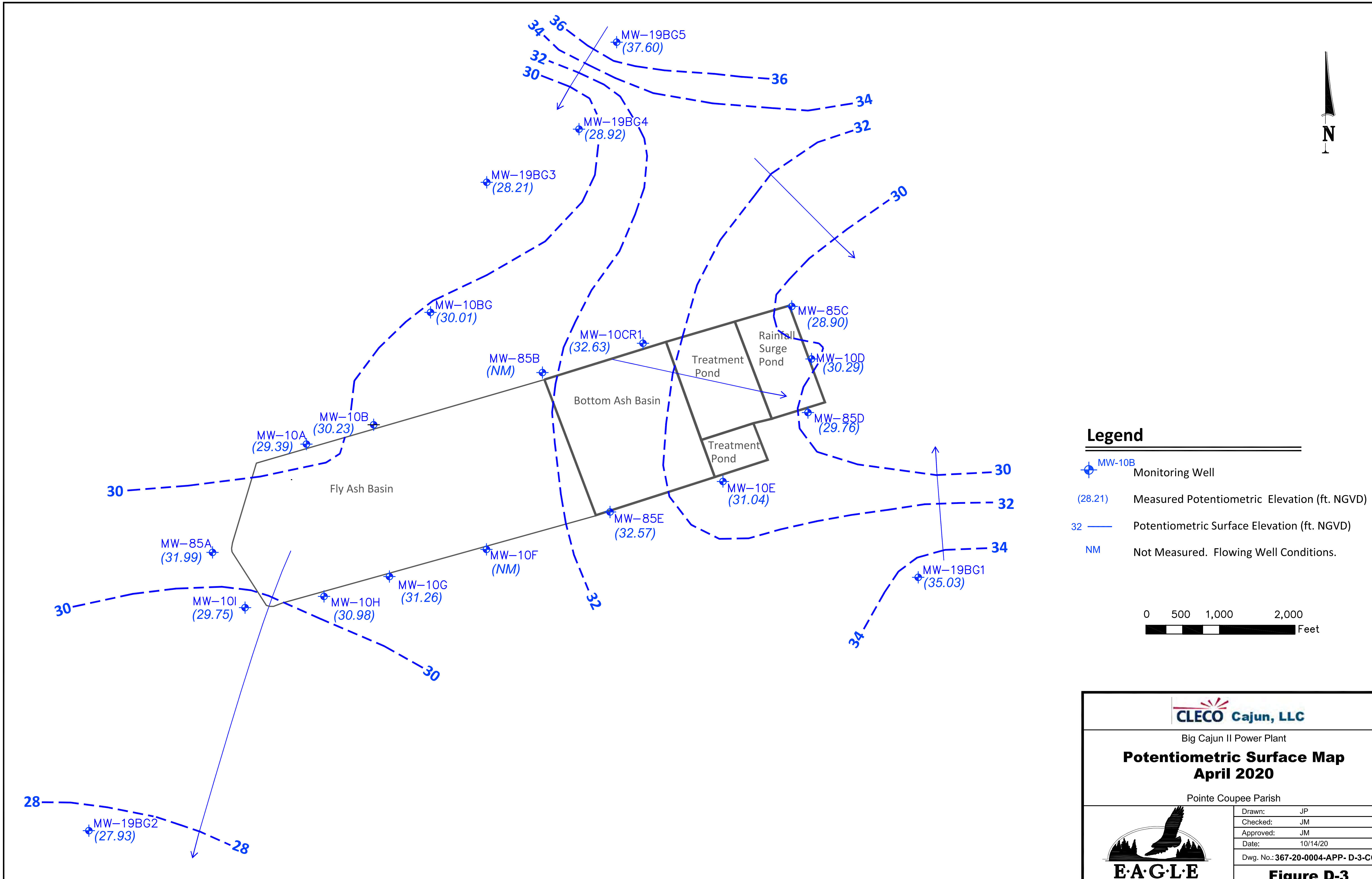
Potentiometric Surface Map
October 2019

Pointe Coupee Parish

Drawn:	JP
Checked:	JM
Approved:	JM
Date:	10/11/19
Dwg. No.:	**367-20-0004-APP- D-2**

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

Figure D-2



CLECO Cajun, LLC

Big Cajun II Power Plant

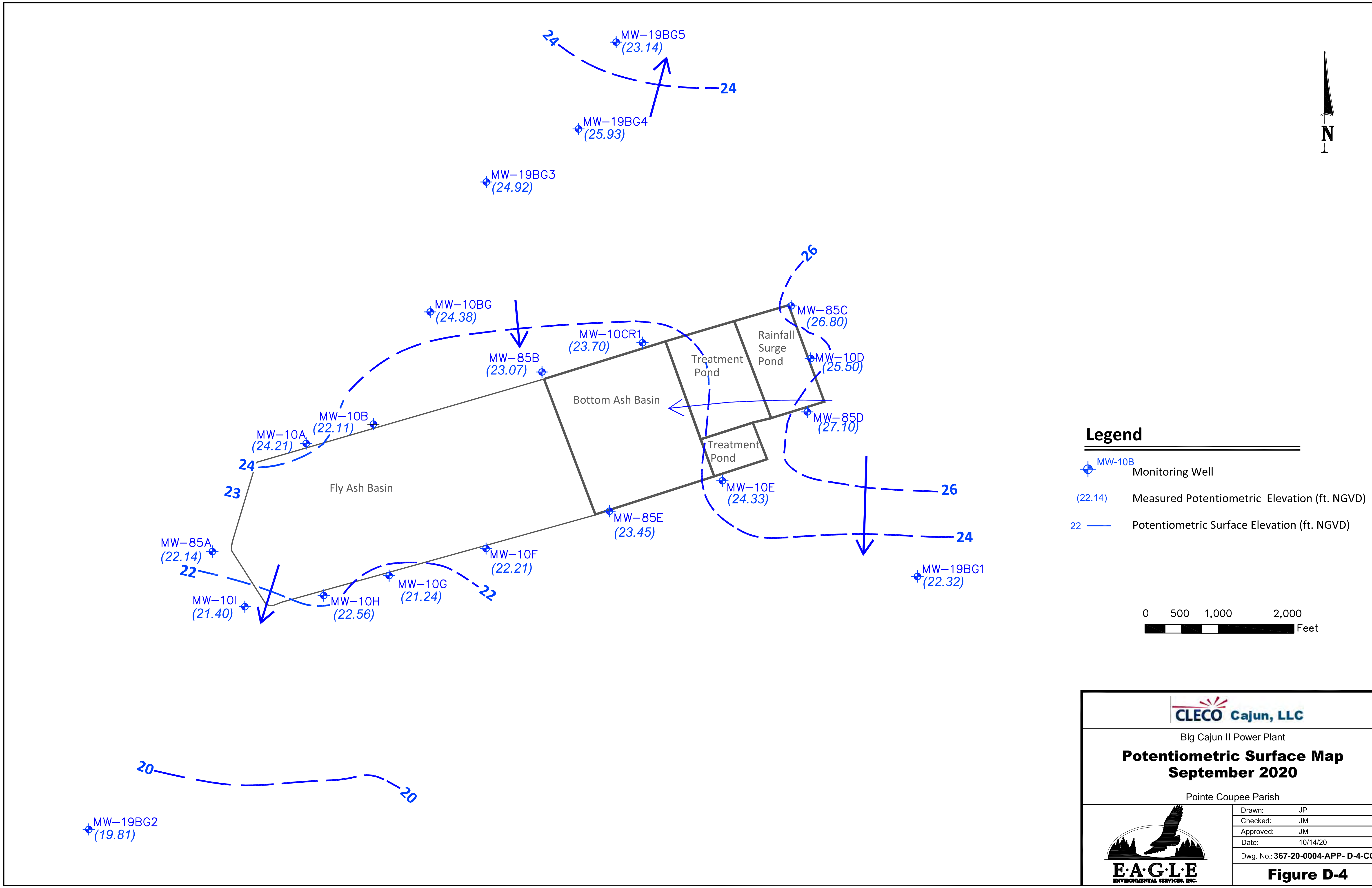
Potentiometric Surface Map
April 2020

Pointe Coupee Parish

EAGLE ENVIRONMENTAL SERVICES, INC.

Drawn:	JP
Checked:	JM
Approved:	JM
Date:	10/14/20
Dwg. No.:	367-20-0004-APP- D-3-CCR

Figure D-3



CLECO Cajun, LLC

Big Cajun II Power Plant

Potentiometric Surface Map
September 2020

Pointe Coupee Parish

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

Drawn:	JP
Checked:	JM
Approved:	JM
Date:	10/14/20
Dwg. No.:	367-20-0004-APP- D-4-CCR

Figure D-4

APPENDIX E

GROUNDWATER QUALITY DATA

TABLE 4
BASELINE MONITORING PROGRAM APPENDIX III ANALYTICAL DATA - BACKGROUND WELL MW-10BG
Big Cajun II Power Station CCR Rule Monitoring System
New Roads, Louisiana

Constituents	11-Apr-16	27-Jun-16	16-Sep-16	17-Oct-16	13-Feb-17	10-Apr-17	20-Jun-17	22-Aug-17
Boron	0.075	0.068	0.076	0.076	0.066	0.024	0.075	0.075
Calcium	74.6	73.2	70.1	72.4	74	21.1	63	66.6
Chloride	5.0	5.3	5.6	5.5	5.5	6	6.4	6.2
Fluoride	<0.5	0.35	<0.5	<0.5	0.26	0.34	0.32	0.45
Sulfate	<1.0	1.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
pH (std.)	6.67	6.28	6.81	6.70	6.99	6.93	7.62	7.17
TDS	345	385	410	345	355	100	395	390

Notes:
For September 2016 monitoring event, the highest value for the routine and duplicate sample from MW-10BG is provided in the table.
TDS - total dissolved solids
All units are in milligrams per liter (mg/L) unless otherwise noted.
std - standard units
< - concentration less than the method detection limit (MDL)

TABLE 5
BASELINE MONITORING PROGRAM APPENDIX III ANALYTICAL DATA - COMPLIANCE WELLS
Big Cajun II Power Station CCR Rule Monitoring System
New Roads, Louisiana

Well ID	Constituents	11-Apr-16	27-Jun-16	16-Sep-16	17-Oct-16	13-Feb-17	10-Apr-17	June 21, 2017 July 18, 2017	22-Aug-17
MW-85A	Boron	0.086	0.076	0.081	0.081	0.081	<0.0012	0.084	0.078
	Calcium	70.5	69.9	67.5	72.1	74	<0.025	70.2	62
	Chloride	11.0	11.3	12.3	19.8	12.1	12.7	14	13.7
	Fluoride	<0.5	0.37	<0.12	<0.12	0.24	0.34	0.29	0.39
	Sulfate	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	pH (std.)	6.47	6.48	6.52	6.42	6.75	6.87	7.15	6.67
	TDS	310	360	475	345	390	325	380	370
MW-85B	Boron	0.062	0.054	0.060	0.060	0.061	<0.0012	0.062	0.068
	Calcium	95.1	97.6	86.8	94.4	95.3	<0.025	94.1	79.1
	Chloride	42.5	44.5	39.1	43.4	34.1	28.2	44.8	26.7
	Fluoride	<0.5	0.17	<0.12	<0.12	0.16	0.17	0.2	0.23
	Sulfate	130	154	135	111	92.5	78.2	182	94.9
	pH (std.)	6.43	7.32	6.76	6.98	6.8	6.81	7.18	6.76
	TDS	525	615	615	580	510	450	630	520
MW-85C	Boron	0.24	0.21	0.25	0.28	0.3	0.25	0.24	0.21
	Calcium	128	132	123	140	166	61	125	115
	Chloride	60.7	60.3	68.2	71.1	70.7	71.5	64.9	62.3
	Fluoride	<0.5	0.31	<0.12	<0.12	0.25	0.28	0.35	0.37
	Sulfate	256	272	353	324	196	283	293	254
	pH (std.)	6.78	7.28	6.85	6.69	6.91	6.88	7.18	7.00
	TDS	820	870	905	880	960	900	845	730
MW-85D	Boron	0.18	0.13	0.17	0.19	0.21	0.23	0.2	0.15
	Calcium	125	132	120	136	154	60.8	129	115
	Chloride	35.6	27.3	37.8	39.9	45.3	40.6	39.6	30.6
	Fluoride	<0.5	0.31	<0.12	<0.12	0.22	0.3	0.28	0.36
	Sulfate	137	90	165	169	168	203	185	117
	pH (std.)	6.51	7.10	6.65	6.64	6.73	6.70	7.03	6.92
	TDS	730	715	850	705	855	810	765	750
MW-85E	Boron	4.4	4.4	4.1	4.0	4.1	0.26	4	4.3
	Calcium	216	246	200	199	223	62.8	218	208
	Chloride	69.5	72.0	65.4	59.1	64.6	71.6	75.5	68.2
	Fluoride	<0.5	0.39	<0.12	<0.12	0.24	0.23	0.18	0.3
	Sulfate	957	945	1010	681	798	908	997	922
	pH (std.)	6.19	6.17	6.42	6.23	6.43	6.47	6.86	6.55
	TDS	1600	1780	1740	1400	1600	1630	1800	1820
MW-10A	Boron	0.77	0.69	0.71	0.71	0.71	<0.0012	0.73	0.68
	Calcium	115	118	110	124	128	<0.025	113	110
	Chloride	77.8	79.3	86.3	85.7	85.3	86.6	84	80.7
	Fluoride	<0.5	0.29	<0.12	<0.12	0.33	0.33	0.38	0.44
	Sulfate	314	319	383	293	271	378	305	270
	pH (std.)	6.70	7.15	6.89	6.87	7.0	6.96	7.22	6.98
	TDS	815	880	945	825	885	815	875	860
MW-10B	Boron	0.54	0.49	0.65	0.67	0.62	0.048	0.41	0.43
	Calcium	98.1	99.2	77.9	79.9	92.5	12.1	93.2	88.4
	Chloride	68.2	73.1	85.5	85.4	82.2	83.2	68.1	66.1
	Fluoride	<0.5	0.19	<0.12	<0.12	<0.025	0.22	0.21	0.21
	Sulfate	94.9	106	117	96.6	138	102	101	91.2
	pH (std.)	6.15	6.85	6.26	6.47	6.39	6.53	7.18	6.75
	TDS	595	710	655	595	625	535	605	595

TABLE 5
BASELINE MONITORING PROGRAM APPENDIX III ANALYTICAL DATA - COMPLIANCE WELLS
Big Cajun II Power Station CCR Rule Monitoring System
New Roads, Louisiana

Well ID	Constituents	11-Apr-16	27-Jun-16	16-Sep-16	17-Oct-16	13-Feb-17	10-Apr-17	June 21, 2017 July 18, 2017	22-Aug-17
[1] MW-10CR1	Boron	0.25	0.24	0.28	0.30	0.28	0.019	0.25	0.17
	Calcium	124	124	122	129	133	25.6	110	72.3
	Chloride	51.4	53.0	49.7	57.3	54.3	52.9	50.9	49.8
	Fluoride	<0.5	0.29	0.29	<0.12	0.24	0.29	0.29	0.25
	Sulfate	129	152	187	160	156	201	167	164
	pH (std.)	6.47	7.29	6.98	7.01	6.95	6.81	7.14	6.95
	TDS	690	825	745	740	745	750	780	795
MW-10D	Boron	0.26	0.23	0.013	0.28	0.27	0.04	0.26	0.22
	Calcium	172	177	<0.050	170	169	27.4	139	131
	Chloride	85.9	84.3	90.3	90.6	80.8	49.9	74.5	66.4
	Fluoride	<0.5	0.30	<0.12	<0.12	0.19	0.22	0.22	0.32
	Sulfate	400	496	591	417	353	282	366	303
	pH (std.)	6.68	7.31	6.87	7.04	6.93	6.97	7.61	7.06
	TDS	1100	1140	1160	1180	1090	715	1040	785
MW-10E	Boron	0.22	0.20	0.22	0.23	0.22	0.054	0.22	0.23
	Calcium	92.6	89.6	88.1	92.1	88.4	6.6	83.8	77.2
	Chloride	31.9	30.7	31.4	29.9	26.3	26.9	30.5	26.3
	Fluoride	<0.5	0.23	<0.12	<0.12	0.18	0.3	0.26	0.29
	Sulfate	153	167	187	162	149	120	170	138
	pH (std.)	6.56	6.33	6.82	6.68	7.08	6.65	6.96	6.92
	TDS	610	685	680	565	500	510	620	515
MW-10F	Boron	2.2	1.9	3.8	3.7	2.6	0.22	2.2	1.8
	Calcium	200	191	366	347	281	61.9	185	148
	Chloride	37.0	36.5	50.4	50.7	44.1	36.3	37.2	35.2
	Fluoride	<0.5	0.22	<0.12	<0.12	0.27	0.23	0.22	0.24
	Sulfate	563	574	1520	1120	741	281	685	4190
	pH (std.)	6.51	6.39	6.45	6.44	6.43	6.68	6.98	6.88
	TDS	1320	1240	2400	2120	1750	1020	1440	1040
MW-10G	Boron	0.76	0.72	0.80	0.80	0.77	0.077	0.74	0.75
	Calcium	93.2	93.2	89.2	95.3	101	54.9	86.3	83.2
	Chloride	74.3	72.7	73.5	73.7	73.5	74.1	77	74.2
	Fluoride	<0.5	0.36	<0.12	<0.12	0.18	0.25	0.27	0.34
	Sulfate	129	162	177	152	150	119	158	1310
	pH (std.)	6.37	6.62	6.76	6.81	6.81	6.97	7.28	6.96
	TDS	665	725	790	670	675	625	690	725
MW-10H	Boron	0.17	0.14	0.16	0.14	0.13	0.034	0.16	0.13
	Calcium	144	142	136	139	155	16.1	121	123
	Chloride	54.0	54.7	55.9	55.6	55.5	56.3	56.2	50.6
	Fluoride	<0.5	0.23	<0.12	<0.12	0.24	0.25	0.28	0.34
	Sulfate	47.9	52.9	58.6	47.8	45.8	53.6	56.9	28.8
	pH (std.)	6.51	6.70	6.74	6.68	7.01	6.79	7.20	6.88
	TDS	700	710	725	680	680	695	700	685
MW-10I	Boron	0.16	0.13	0.14	0.15	0.2	0.031	0.15	0.13
	Calcium	97.9	92.1	90.0	109	121	30.6	90.2	85.1
	Chloride	32.1	28.7	25.4	44.1	56.1	37.6	29.7	24.6
	Fluoride	<0.5	0.20	<0.12	<0.12	0.17	0.33	0.28	0.3
	Sulfate	32.9	31.3	26.6	115	158	75.6	49.3	21.1
	pH (std.)	6.56	6.77	6.62	6.63	6.82	7.04	7.22	6.74
	TDS	535	505	500	610	625	525	515	495

Notes:
TDS - total dissolved solids
All units are in milligrams per liter (mg/L) unless otherwise noted.
std - standard units
[1] Monitoring well MW-10C was damaged at time of 16 September 2016 sampling and replaced by MW-10CR1. Analytical results from 6 September 2017 sampling event posted on the 16 September 2016 date.

< - concentration less than the method detection limit (MDL)

TABLE 6
BASELINE MONITORING PROGRAM APPENDIX IV ANALYTICAL DATA - BACKGROUND WELL MW-10BG
Big Cajun II Power Station CCR Rule Monitoring System
New Roads, Louisiana

Constituents	11-Apr-16	27-Jun-16	16-Sep-16	17-Oct-16	13-Feb-17	10-Apr-17	June 21, 2017 July 18, 2017	22-Aug-17
Antimony	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0033	<0.001
Arsenic	0.0032	0.0071	0.0052	0.010	0.0076	0.0012	0.0039	0.0068
Barium	0.23	0.23	0.23	0.23	0.24	0.072	0.18	0.24
Beryllium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	0.0019	<0.001	<0.001
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	0.0039	<0.001	<0.001
Fluoride	<0.5	0.35	<0.5	<0.5	0.26	0.34	0.32	0.45
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	0.0027	<0.001	<0.001
Lithium	0.012	0.011	0.012	0.012	0.014	0.0066	0.012	0.012
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Radium 226 (pCi/L)	0.221	<0.899	1.600	0.532	0.063	0.348	0.339*	0.832
Radium 228 (pCi/L)	<0.701	0.654	0.504	0.385	0.386	0.488	0.466*	0.563
Radium 226 and 228 Combined (pCi/L)	<0.922	<1.553	2.104	0.917	0.449	0.836	0.805*	1.395
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Thallium	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Notes:
For September 2016 monitoring event, the highest value for the routine and duplicate sample from MW-10BG is provided in the table.

TDS - total dissolved solids
All units are in milligrams per liter (mg/L) unless otherwise noted.
std - standard units
* Sampled on 7/18/2017
pCi/L - picocurries per liter
< - concentration less than the method detection limit (MDL)

TABLE 7
BASELINE MONITORING PROGRAM APPENDIX IV ANALYTICAL DATA - COMPLIANCE WELLS
Big Cajun II Power Station CCR Rule Monitoring System
New Roads, Louisiana

Well ID	Constituents	11/12 April 2016	27-Jun-16	16-Sep-16	17-Oct-16	13-Feb-17	11-Apr-17	June 20, 2017 July 18, 2017	22-Aug-17
MW-10A	Antimony	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Arsenic	0.0019	0.0025	0.0023	0.0030	0.0031	<0.00025	0.0014	0.0024
	Barium	0.29	0.31	0.28	0.33	0.34	<0.00025	0.26	0.26
	Beryllium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Cadmium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Chromium	<0.0005	<0.0005	<0.0005	0.0029	<0.00025	<0.00025	<0.00025	<0.00025
	Cobalt	<0.0005	<0.0005	<0.0005	0.0027	<0.00025	<0.00025	<0.00025	<0.00025
	Fluoride	<0.50	0.29	<0.12	<0.12	0.33	0.33	0.38	0.44
	Lead	<0.0005	<0.0005	<0.0005	0.0025	<0.00025	<0.00025	<0.00025	<0.00025
	Lithium	0.013	0.012	0.011	0.015	0.014	<0.00025	0.012	0.011
	Mercury	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
	Molybdenum	<0.0015	<0.0015	<0.0015	<0.00075	<0.00075	<0.00075	<0.00075	<0.00075
	Radium 226 (pCi/L)	0.359	0.539	0.549	0.392	0.402	0.508	0.402*	0.266
	Radium 228 (pCi/L)	0.802	0.759	0.603	0.839	0.528	0.454	0.375*	0.32
	Selenium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Thallium	<0.00025	<0.00025	<0.00025	<0.00012	<0.00012	<0.00012	<0.00012	<0.00012
MW-10B	Antimony	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Arsenic	0.0054	0.0061	0.010	0.011	0.01	<0.00025	0.0013	0.003
	Barium	0.47	0.46	0.45	0.47	0.5	0.0071	0.33	0.34
	Beryllium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Cadmium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Chromium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Cobalt	<0.0005	<0.0005	0.0011	0.0011	0.0013	<0.00025	<0.00025	<0.00025
	Fluoride	<0.50	0.19	<0.12	<0.12	<.025	0.22	0.21	0.21
	Lead	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Lithium	0.015	0.014	0.011	0.012	0.014	0.0025	0.015	0.014
	Mercury	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
	Molybdenum	<0.0015	<0.0015	<0.0015	<0.00075	<0.00075	<0.00075	<0.00075	<0.00075
	Radium 226 (pCi/L)	0.524	0.507	0.646	1.51	0.197	0.434	0.784*	0.0635
	Radium 228 (pCi/L)	0.668	0.687	0.602	1.15	0.425	0.951	0.688*	0.695
	Selenium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Thallium	<0.00025	<0.00025	<0.00025	<0.00012	<0.00012	<0.00012	<0.00012	<0.00012
MW-10CR1[1]	Antimony	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Arsenic	0.0077	0.0064	0.0055	0.0092	0.013	0.0011	0.0046	0.0025
	Barium	0.40	0.39	0.38	0.49	0.47	0.012	0.37	0.2
	Beryllium	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	0.0011	<0.00025	<0.00025
	Cadmium	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Chromium	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	0.013	<0.00025	<0.00025
	Cobalt	0.0014	0.0017	0.0016	0.0016	0.0014	0.0049	0.0012	<0.00025
	Fluoride	<0.5	0.29	0.29	<0.12	0.24	0.29	0.29	0.25
	Lead	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	0.0017	<0.00025	<0.00025
	Lithium	0.018	0.016	0.019	0.017	0.02	0.007	0.016	0.027
	Mercury	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
	Molybdenum	0.0036	0.0035	0.0041	0.0040	0.0045	<0.00075	0.0038	0.0048
	Radium 226 (pCi/L)	0.371	0.736	0.0951	0.381	0.942	-0.066	0.737*	0.743
	Radium 228 (pCi/L)	0.712	0.726	1.56	1.36	0.728	0.392	0.19*	1.09
	Selenium	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Thallium	<0.00025	<0.00025	<0.00012	<0.00012	<0.00012	<0.00012	<0.00012	<0.00012

TABLE 7
BASELINE MONITORING PROGRAM APPENDIX IV ANALYTICAL DATA - COMPLIANCE WELLS
Big Cajun II Power Station CCR Rule Monitoring System
New Roads, Louisiana

Well ID	Constituents	11/12 April 2016	27-Jun-16	16-Sep-16	17-Oct-16	13-Feb-17	11-Apr-17	June 20, 2017 July 18, 2017	22-Aug-17
MW-10D	Antimony	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	0.02	<0.00025	<0.00025
	Arsenic	0.0031	0.0034	<0.0005	0.0046	0.0063	0.018	0.0027	0.0028
	Barium	0.27	0.25	<0.0005	0.25	0.24	0.032	0.18	0.18
	Beryllium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	0.021	<0.00025	<0.00025
	Cadmium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	0.02	<0.00025	<0.00025
	Chromium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	0.032	<0.00025	<0.00025
	Cobalt	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	0.024	<0.00025	<0.00025
	Fluoride	<0.5	0.30	<0.12	<0.12	0.19	0.22	0.22	0.32
	Lead	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	0.022	<0.00025	<0.00025
	Lithium	0.016	0.014	<0.0005	0.015	0.018	0.026	0.015	0.014
	Mercury	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	0.0041	<0.00005	<0.00005
	Molybdenum	<0.0015	<0.0015	<0.0015	<0.00075	<0.00075	0.018	<0.00075	<0.00075
	Radium 226 (pCi/L)	0.416	0.523	0.165	1.31	0.285	0.508	0.227*	0.409
	Radium 228 (pCi/L)	0.669	0.756	0.559	1.20	0.622	0.517	0.819*	0.217
	Selenium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	0.018	<0.00025	<0.00025
	Thallium	<0.00025	<0.00025	<0.00025	<0.00012	<0.00012	0.02	<0.00012	<0.00012
MW-10E	Antimony	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Arsenic	0.010	0.010	0.010	0.011	0.011	<0.00025	0.009	0.0089
	Barium	0.24	0.24	0.26	0.27	0.26	0.021	0.23	0.24
	Beryllium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Cadmium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Chromium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	0.0011	<0.00025	<0.00025
	Cobalt	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Fluoride	<0.5	0.23	<0.12	<0.12	0.18	0.3	0.26	0.29
	Lead	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	0.0011	<0.00025	<0.00025
	Lithium	0.014	0.014	0.014	0.015	0.016	<0.00025	0.013	0.013
	Mercury	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
	Molybdenum	<0.0015	<0.0015	<0.0015	<0.00075	<0.00075	<0.00075	<0.00075	<0.00075
	Radium 226 (pCi/L)	0.525	1.41	0.641	1.51	-0.32	-0.307	0.208*	0.586
	Radium 228 (pCi/L)	0.847	0.707	0.746	1.44	1.07	0.75	0.547*	0.144
	Selenium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Thallium	<0.00025	<0.00025	<0.00025	<0.00012	<0.00012	<0.00012	<0.00012	<0.00012
MW-10F	Antimony	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Arsenic	0.0036	0.0037	0.0078	0.0091	0.011	<0.00025	0.004	0.0059
	Barium	0.11	0.13	0.069	0.066	0.059	0.013	0.073	0.072
	Beryllium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Cadmium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Chromium	<0.0005	0.0010	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Cobalt	<0.0005	<0.0005	0.0035	0.0036	0.0034	<0.00025	<0.00025	<0.00025
	Fluoride	<0.5	0.22	<0.12	<0.12	0.27	0.23	0.22	0.24
	Lead	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Lithium	0.021	0.018	0.027	0.028	0.03	0.014	0.019	0.017
	Mercury	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
	Molybdenum	<0.0015	<0.0015	<0.0015	<0.00075	<0.00075	<0.00075	<0.00075	<0.00075
	Radium 226 (pCi/L)	0.330	0.507	0.587	0.929	0.576	0.13	0.393*	0.487
	Radium 228 (pCi/L)	0.732	0.696	0.825	1.11	0.253	0.691	1.06*	0.51
	Selenium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Thallium	<0.00025	<0.00025	<0.00025	<0.00012	<0.00012	<0.00012	<0.00012	<0.00012

TABLE 7
BASELINE MONITORING PROGRAM APPENDIX IV ANALYTICAL DATA - COMPLIANCE WELLS
Big Cajun II Power Station CCR Rule Monitoring System
New Roads, Louisiana

Well ID	Constituents	11/12 April 2016	27-Jun-16	16-Sep-16	17-Oct-16	13-Feb-17	11-Apr-17	June 20, 2017 July 18, 2017	22-Aug-17
MW-10G	Antimony	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	0.0011	<0.00025	<0.00025
	Arsenic	0.0016	0.0015	0.0013	0.0012	0.0018	0.0019	0.0016	0.0022
	Barium	0.36	0.35	0.35	0.36	0.38	0.075	0.34	0.32
	Beryllium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Cadmium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Chromium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	0.0078	<0.00025	<0.00025
	Cobalt	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	0.0016	<0.00025	<0.00025
	Fluoride	<0.5	0.36	<0.12	<0.12	0.18	0.25	0.27	0.34
	Lead	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	0.0075	<0.00025	<0.00025
	Lithium	0.020	0.018	0.017	0.017	0.02	0.0076	0.018	0.017
	Mercury	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
	Molybdenum	<0.0015	<0.0015	<0.0015	<0.00075	<0.00075	0.0032	<0.00075	<0.00075
	Radium 226 (pCi/L)	0.486	1.34	0.627	1.52	0.133	0.357	0.595*	0.344
	Radium 228 (pCi/L)	0.686	0.836	1.50	1.18	0.683	0.289	0.438*	0.681
	Selenium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Thallium	<0.00025	<0.00025	<0.00025	<0.00012	<0.00012	<0.00012	<0.00012	<0.00012
MW-10H	Antimony	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Arsenic	0.0079	0.0080	0.0085	0.0087	0.0092	0.0011	0.0064	0.011
	Barium	0.46	0.44	0.44	0.44	0.5	0.069	0.36	0.37
	Beryllium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Cadmium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Chromium	<0.0005	0.0022	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Cobalt	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	0.0015	<0.00025	<0.00025
	Fluoride	<0.5	0.23	<0.12	<0.12	0.24	0.25	0.28	0.34
	Lead	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	0.0013	<0.00025	<0.00025
	Lithium	0.020	0.018	0.018	0.018	0.022	0.0081	0.018	0.017
	Mercury	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
	Molybdenum	<0.0015	<0.0015	<0.0015	<0.00075	<0.00075	<0.00075	<0.00075	<0.00075
	Radium 226 (pCi/L)	0.394	0.516	0.568	1.01	0	0.201	0.296*	0.635
	Radium 228 (pCi/L)	0.607	0.581	0.808	1.31	0.229	0.936	1.18*	0.475
	Selenium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Thallium	<0.00025	<0.00025	<0.00025	<0.00012	<0.00012	<0.00012	<0.00012	<0.00012

TABLE 7
BASELINE MONITORING PROGRAM APPENDIX IV ANALYTICAL DATA - COMPLIANCE WELLS
Big Cajun II Power Station CCR Rule Monitoring System
New Roads, Louisiana

Well ID	Constituents	11/12 April 2016	27-Jun-16	16-Sep-16	17-Oct-16	13-Feb-17	11-Apr-17	June 20, 2017 July 18, 2017	22-Aug-17
MW-10I	Antimony	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	0.0012	<0.00025
	Arsenic	<0.0005	<0.0005	<0.0005	<0.00025	0.0012	<0.00025	<0.00025	<0.00025
	Barium	0.38	0.36	0.36	0.43	0.5	0.076	0.21	0.36
	Beryllium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Cadmium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Chromium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	0.0016	<0.00025	<0.00025
	Cobalt	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	0.0035	<0.00025	<0.00025
	Fluoride	<0.5	0.20	<0.12	<0.12	0.17	0.33	0.28	0.3
	Lead	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	0.0013	<0.00025	<0.00025
	Lithium	0.023	0.022	0.022	0.024	0.028	0.016	0.022	0.021
	Mercury	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
	Molybdenum	<0.0015	<0.0015	<0.0015	<0.00075	<0.00075	<0.00075	<0.00075	<0.00075
	Radium 226 (pCi/L)	0.551	0.748	0.607	1.51	0.467	0.283	0.642*	0.908
	Radium 228 (pCi/L)	0.662	0.559	0.710	1.69	0.934	0.185	0.42*	1.3
	Selenium	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
	Thallium	<0.00025	<0.00025	<0.00025	<0.00012	<0.00012	<0.00012	<0.00012	<0.00012

Notes:
* Sampled on 7/18/2017
All units are in milligrams per liter (mg/L) unless otherwise noted.
[1] Monitoring well MW-10C was damaged at time of 16 September 2016 sampling and replaced by MW-10CR1. Analytical results from 6 September 2017 sampling event posted on the 16 September 2016 date.
pCi/L - picocurries per liter
< - concentration less than the method detection limit (MDL)

TABLE 8
BACKGROUND CONCENTRATIONS FOR APPENDIX III CONSTITUENTS
Big Cajun II Power Station CCR Rule Monitoring System
New Roads, Louisiana

Appendix III Parameter	Unit	UPL[1]
Boron	mg/L	0.076
Calcium	mg/L	164
Chloride	mg/L	8.3
Fluoride	mg/L	0.7
pH	S.U.	4.60 - 9.19[2]
Sulfate	mg/L	1.4
Total Dissolved Solids	mg/L	895

Notes:

UPL Upper Prediction Limit
µg/L micrograms per Liter
mg/L milligrams per Liter
S.U. Standard Units
[1] Subject to change as additional data are generated. Calculations provided in Sampling and Analysis Plan - Coal Combustion Rule - Big Cajun II Power Station (Geosyntec, 2017)
[2] Upper Prediction limit (UPL) for high pH range.

TABLE 9
DETECTION MONITORING PROGRAM APPENDIX III DATA - BACKGROUND WELL MW-10BG
Big Cajun II Power Station CCR Rule Monitoring System
New Roads, Louisiana

Constituents	17-Oct-17
Boron	0.068
Calcium	71.4
Chloride	4.6
Fluoride	0.32
Sulfate	<1.0
pH (std.)	6.87
TDS	340

Notes:
TDS - total dissolved solids
All units are in milligrams per liter (mg/L) unless otherwise noted.
std - standard units
< - concentration less than the method detection limit (MDL)

TABLE 10
DETECTION MONITORING PROGRAM APPENDIX III DATA - COMPLIANCE WELLS
Big Cajun II Power Station CCR Rule Monitoring System
New Roads, Louisiana

Constituents	MW-85A	MW-85B	MW-85C	MW-85D	MW-85E	MW-10A	MW-10B	MW-10CR1	MW-10D	MW-10E	MW-10F	MW-10G	MW-10H	MW-10I
Boron	0.080	0.06	0.3	0.19	3.7	0.66	0.62	0.28	0.26	0.21	2.5	0.77	0.11	0.15
Calcium	72.4	93	140	146	201	120	88.5	127	165	87	262	97.3	140	105
Chloride	20.8	39.6	70.5	42	57.4	82.8	80.5	49.7	78.7	27.5	42.2	72.9	52.5	42.1
Fluoride	0.32	0.2	0.36	0.29	0.14	0.43	0.13	0.4	0.24	0.24	0.12	0.24	0.19	0.45
Sulfate	1.8	225	476	338	890	453	244	289	1800	254	1000	391	39.8	112
pH (std.)	6.63	6.85	6.94	6.71	6.31	6.91	6.41	6.83	6.95	6.89	6.39	6.91	6.85	6.69
TDS	365	615	800	805	1560	855	640	805	1040	505	1570	635	735	630

Notes:
TDS - total dissolved solids
All units are in milligrams per liter (mg/L) unless otherwise noted.
std - standard units
Samples collected on 17 October 2017 and 18 October 2017

TABLE 3
2018 GROUNDWATER MONITORING ANALYTICAL DATA SUMMARY
Big Cajun II Power Station CCR Rule Monitoring System
New Roads, Louisiana

Well ID	Constituents	16-Apr-18	25-Jun-18	15-Oct-18
MW-85A	Boron	0.085	NA	0.082
	Calcium	69	NA	71
	Chloride	12	NA	14
	Fluoride	0.35	0.36	0.39
	Sulfate	<1.4	NA	<1.4
	pH (std.)	5.98	6.38	6.71
	TDS	320	NA	330
	Antimony	NA	<0.0010	NA
	Arsenic	NA	0.0023	0.002
	Barium	NA	0.33	0.3
	Beryllium	NA	<0.00034	NA
	Cadmium	NA	<0.00034	NA
	Chromium	NA	<0.0011	NA
	Cobalt	NA	<0.00040	<0.0004
	Lead	NA	0.0015	<0.00035
	Lithium	NA	0.015	0.017
	Mercury	NA	<0.000070	NA
	Molybdenum	NA	0.0016 J	<0.002
	Selenium	NA	0.00079 JB	<0.00071
	Thallium	NA	<0.000085	NA
	Radium-226 (pCi/L)	NA	0.312	0.565
	Radium-228 (PCi/L)	NA	<0.00234	<0.218
MW-85B	Boron	0.062	NA	0.055
	Calcium	93	NA	100
	Chloride	43	NA	46
	Fluoride	0.18	0.20	0.21
	Sulfate	140	NA	160
	pH (std.)	6.59	6.80	7.08
	TDS	550	NA	610
	Antimony	NA	<0.0010	NA
	Arsenic	NA	0.0011 J	0.00061 J
	Barium	NA	0.5	0.48
	Beryllium	NA	<0.00034	NA
	Cadmium	NA	<0.00034	NA
	Chromium	NA	<0.0011	NA
	Cobalt	NA	0.00094 J	<0.0004
	Lead	NA	<0.00035	<0.00035
	Lithium	NA	0.013	0.015
	Mercury	NA	<0.000070	NA
	Molybdenum	NA	0.00091 J	<0.002
	Selenium	NA	0.00046 JB	<0.00071
	Thallium	NA	<0.000085	NA
	Radium-226	NA	0.413	0.892
	Radium-228	NA	0.586	2.26

TABLE 3
2018 GROUNDWATER MONITORING ANALYTICAL DATA SUMMARY
Big Cajun II Power Station CCR Rule Monitoring System
New Roads, Louisiana

Well ID	Constituents	16-Apr-18	25-Jun-18	15-Oct-18
MW-85C	Boron	0.24	NA	0.36
	Calcium	130	NA	130
	Chloride	62 F1	NA	68
	Fluoride	0.33	0.33	0.34
	Sulfate	260 F1	NA	330
	pH (std.)	7.12	6.86	7.17
	TDS	690	NA	880
	Antimony	NA	<0.0010	NA
	Arsenic	NA	0.0053	0.0061
	Barium	NA	0.25	0.24
	Beryllium	NA	<0.00034	NA
	Cadmium	NA	<0.00034	NA
	Chromium	NA	<0.0011	NA
	Cobalt	NA	<0.00040	0.00054 J
	Lead	NA	<0.00035	<0.00035
	Lithium	NA	0.012	0.015
	Mercury	NA	<0.000070	NA
	Molybdenum	NA	0.0014 J	<0.002
	Selenium	NA	0.00027 JB	<0.00071
	Thallium	NA	<0.000085	NA
	Radium-226	NA	0.316	0.390
	Radium-228	NA	<0.313	1.45
MW-85D	Boron	0.2	NA	0.22
	Calcium	140	NA	140
	Chloride	34	NA	39
	Fluoride	0.32	0.33	0.32
	Sulfate	150	NA	180
	pH (std.)	6.89	6.96	7.18
	TDS	660	NA	890
	Antimony	NA	<0.0010	NA
	Arsenic	NA	0.0055	0.0055
	Barium	NA	0.24	0.23
	Beryllium	NA	<0.00034	NA
	Cadmium	NA	<0.00034	NA
	Chromium	NA	<0.0011	NA
	Cobalt	NA	<0.00040	0.00078 J
	Lead	NA	<0.00035	0.00089 J
	Lithium	NA	0.017	0.023
	Mercury	NA	<0.000070	NA
	Molybdenum	NA	0.0012 J	<0.002
	Selenium	NA	<0.00024	<0.00071
	Thallium	NA	<0.000085	NA
	Radium-226	NA	0.235	0.401
	Radium-228	NA	0.352	0.562

TABLE 3
2018 GROUNDWATER MONITORING ANALYTICAL DATA SUMMARY
Big Cajun II Power Station CCR Rule Monitoring System
New Roads, Louisiana

Well ID	Constituents	16-Apr-18	25-Jun-18	15-Oct-18
MW-85E	Boron	4.7	NA	4.2
	Calcium	220	NA	200
	Chloride	78	NA	88
	Fluoride	0.24	0.26	0.27
	Sulfate	880	NA	760
	pH (std.)	6.24	6.52	6.70
	TDS	1300	NA	1700
	Antimony	NA	<0.0010	NA
	Arsenic	NA	0.011	0.012
	Barium	NA	0.073	0.077
	Beryllium	NA	<0.00034	NA
	Cadmium	NA	<0.00034	NA
	Chromium	NA	<0.0011	NA
	Cobalt	NA	0.0007 J	0.0007 J
	Lead	NA	<0.00035	<0.00035
	Lithium	NA	0.018	0.021
	Mercury	NA	<0.000070	NA
	Molybdenum	NA	0.0021 J	<0.002
	Selenium	NA	<0.00024	<0.00071
	Thallium	NA	<0.000085	NA
	Radium-226	NA	<0.2	0.518
	Radium-228	NA	0.420	<0.316
MW-10A	Boron	0.76	NA	0.72
	Calcium	130	NA	120
	Chloride	82	NA	82
	Fluoride	0.44	0.44	0.45
	Sulfate	310	NA	310
	pH (std.)	6.64	6.76	7.13
	TDS	770	NA	810
	Antimony	NA	<0.0010	NA
	Arsenic	NA	0.0033	0.0033
	Barium	NA	0.26	0.24
	Beryllium	NA	<0.00034	NA
	Cadmium	NA	<0.00034	NA
	Chromium	NA	<0.0011	NA
	Cobalt	NA	<0.00040	<0.0004
	Lead	NA	<0.00035	<0.00035
	Lithium	NA	0.012	0.013
	Mercury	NA	<0.000070	NA
	Molybdenum	NA	0.0018 J	<0.002
	Selenium	NA	<0.00024	<0.00071
	Thallium	NA	<0.000085	NA
	Radium-226	NA	0.441	0.341
	Radium-228	NA	0.392	<0.0602

TABLE 3
2018 GROUNDWATER MONITORING ANALYTICAL DATA SUMMARY
Big Cajun II Power Station CCR Rule Monitoring System
New Roads, Louisiana

Well ID	Constituents	16-Apr-18	25-Jun-18	15-Oct-18
MW-10B	Boron	0.55	NA	0.48
	Calcium	92	NA	99
	Chloride	73	NA	70
	Fluoride	0.16	0.16	0.19
	Sulfate	110	NA	83
	pH (std.)	6.32	6.59	6.76
	TDS	570	NA	650
	Antimony	NA	<0.0010	NA
	Arsenic	NA	0.0083	0.0062
	Barium	NA	0.49	0.46
	Beryllium	NA	<0.00034	NA
	Cadmium	NA	<0.00034	NA
	Chromium	NA	<0.0011	NA
	Cobalt	NA	0.00069 J	0.00067 J
	Lead	NA	<0.00035	<0.00035
	Lithium	NA	0.014	0.016
	Mercury	NA	<0.000070	NA
	Molybdenum	NA	<0.00085	<0.002
	Selenium	NA	<0.00024	<0.00071
	Thallium	NA	<0.000085	NA
	Radium-226	NA	0.405	0.652
	Radium-228	NA	0.404	0.503
MW-10CR1	Boron	0.29	NA	0.3
	Calcium	100	NA	110
	Chloride	40	NA	44
	Fluoride	0.3	0.32	0.34
	Sulfate	110	NA	120
	pH (std.)	6.69	6.74	7.02
	TDS	590	NA	660
	Antimony	NA	<0.0010	NA
	Arsenic	NA	0.0076	0.0078
	Barium	NA	0.35	0.34
	Beryllium	NA	<0.00034	NA
	Cadmium	NA	<0.00034	NA
	Chromium	NA	<0.0011	NA
	Cobalt	NA	0.0012 J	0.0014 J
	Lead	NA	<0.00035	0.00073 J
	Lithium	NA	0.015	0.02
	Mercury	NA	<0.000070	NA
	Molybdenum	NA	0.0035 J	0.0023 J
	Selenium	NA	<0.00024	<0.00071
	Thallium	NA	<0.000085	NA
	Radium-226	NA	0.360	0.491
	Radium-228	NA	0.439	1.18

TABLE 3
2018 GROUNDWATER MONITORING ANALYTICAL DATA SUMMARY
Big Cajun II Power Station CCR Rule Monitoring System
New Roads, Louisiana

Well ID	Constituents	16-Apr-18	25-Jun-18	15-Oct-18
MW-10D	Boron	0.28	NA	0.29
	Calcium	150	NA	150
	Chloride	72	NA	75
	Fluoride	0.27	0.29	0.3
	Sulfate	360	NA	360
	pH (std.)	6.27	7.10	7.21
	TDS	680	NA	950
	Antimony	NA	<0.0010	NA
	Arsenic	NA	0.005	0.0048
	Barium	NA	0.21	0.21
	Beryllium	NA	<0.00034	NA
	Cadmium	NA	<0.00034	NA
	Chromium	NA	<0.0011	NA
	Cobalt	NA	<0.00040	<0.0004
	Lead	NA	<0.00035	0.00037 J
	Lithium	NA	0.014	0.017
	Mercury	NA	<0.000070	NA
	Molybdenum	NA	<0.00085	<0.002
	Selenium	NA	<0.00024	<0.00071
	Thallium	NA	<0.000085	NA
	Radium-226	NA	0.285	0.228
	Radium-228	NA	<0.335	1.63
MW-10E	Boron	0.25	NA	0.24
	Calcium	77	NA	92
	Chloride	27	NA	30
	Fluoride	0.27	0.29	0.3
	Sulfate	120	NA	120
	pH (std.)	6.54	7.01	7.07
	TDS	490	NA	590
	Antimony	NA	<0.0010	NA
	Arsenic	NA	0.01	0.012
	Barium	NA	0.23	0.24
	Beryllium	NA	<0.00034	NA
	Cadmium	NA	<0.00034	NA
	Chromium	NA	<0.0011	NA
	Cobalt	NA	0.00055 J	<0.0004
	Lead	NA	<0.00035	<0.00035
	Lithium	NA	0.013	0.015
	Mercury	NA	<0.000070	NA
	Molybdenum	NA	<0.00085	<0.002
	Selenium	NA	<0.00024	<0.00071
	Thallium	NA	<0.000085	NA
	Radium-226	NA	0.364	0.292
	Radium-228	NA	<0.063	0.678

TABLE 3
2018 GROUNDWATER MONITORING ANALYTICAL DATA SUMMARY
Big Cajun II Power Station CCR Rule Monitoring System
New Roads, Louisiana

Well ID	Constituents	16-Apr-18	25-Jun-18	15-Oct-18
MW-10F	Boron	0.25	NA	2.3
	Calcium	75	NA	190
	Chloride	40	NA	37
	Fluoride	0.25	0.28	0.29
	Sulfate	910	NA	460
	pH (std.)	6.29	6.85	7.04
	TDS	1700	NA	1200
	Antimony	NA	<0.0010	NA
	Arsenic	NA	0.0066	0.0067
	Barium	NA	0.073	0.048
	Beryllium	NA	<0.00034	NA
	Cadmium	NA	<0.00034	NA
	Chromium	NA	<0.0011	NA
	Cobalt	NA	0.0011 J	0.0017 J
	Lead	NA	<0.00035	<0.00035
	Lithium	NA	0.02	0.023
	Mercury	NA	<0.000070	NA
	Molybdenum	NA	<0.00085	<0.002
	Selenium	NA	<0.00024	<0.00071
	Thallium	NA	<0.000085	NA
	Radium-226	NA	0.310	0.406
	Radium-228	NA	<0.273	2.24
MW-10G	Boron	0.83	NA	0.85
	Calcium	94	NA	96
	Chloride	77	NA	76
	Fluoride	0.26	0.27	0.29
	Sulfate	130	NA	130
	pH (std.)	6.52	7.08	7.37
	TDS	570	NA	660
	Antimony	NA	<0.0010	NA
	Arsenic	NA	0.002	0.0011 J
	Barium	NA	0.37	0.36
	Beryllium	NA	<0.00034	NA
	Cadmium	NA	<0.00034	NA
	Chromium	NA	<0.0011	NA
	Cobalt	NA	<0.00040	<0.0004
	Lead	NA	<0.00035	<0.00035
	Lithium	NA	0.017	0.019
	Mercury	NA	<0.000070	NA
	Molybdenum	NA	<0.00085	<0.002
	Selenium	NA	<0.00024	<0.00071
	Thallium	NA	<0.000085	NA
	Radium-226	NA	0.387	0.672
	Radium-228	NA	0.410	<0.260

TABLE 3
2018 GROUNDWATER MONITORING ANALYTICAL DATA SUMMARY
Big Cajun II Power Station CCR Rule Monitoring System
New Roads, Louisiana

Well ID	Constituents	16-Apr-18	25-Jun-18	15-Oct-18
MW-10H	Boron	0.19	NA	0.11
	Calcium	130	NA	130
	Chloride	53	NA	54
	Fluoride	0.28	0.28	0.3
	Sulfate	46	NA	30
	pH (std.)	6.51	7.05	7.32
	TDS	570	NA	620
	Antimony	NA	<0.0010	NA
	Arsenic	NA	0.011	0.011
	Barium	NA	0.43	0.42
	Beryllium	NA	<0.00034	NA
	Cadmium	NA	<0.00034	NA
	Chromium	NA	<0.0011	NA
	Cobalt	NA	<0.00040	<0.0004
	Lead	NA	<0.00035	<0.00035
	Lithium	NA	0.018	0.019
	Mercury	NA	<0.000070	NA
	Molybdenum	NA	<0.00085	<0.002
	Selenium	NA	<0.00024	<0.00071
	Thallium	NA	<0.000085	NA
	Radium-226	NA	0.242	0.542
	Radium-228	NA	1.05	0.408
MW-10I	Boron	0.17	NA	0.11
	Calcium	93	NA	94
	Chloride	37	NA	26
	Fluoride	0.23	0.24	0.24
	Sulfate	62	NA	9.7
	pH (std.)	6.08	6.86	6.83
	TDS	540	NA	430
	Antimony	NA	<0.0010	NA
	Arsenic	NA	0.00062 J	0.00068 J
	Barium	NA	0.42	0.35
	Beryllium	NA	<0.00034	NA
	Cadmium	NA	<0.00034	NA
	Chromium	NA	<0.0011	NA
	Cobalt	NA	<0.00040	<0.0004
	Lead	NA	<0.00035	<0.00035
	Lithium	NA	0.022	0.024
	Mercury	NA	<0.000070	NA
	Molybdenum	NA	<0.00085	<0.002
	Selenium	NA	0.00028 JB	<0.00071
	Thallium	NA	<0.000085	NA
	Radium-226	NA	<0.171	0.410
	Radium-228	NA	0.786	<0.277

TABLE 3
2018 GROUNDWATER MONITORING ANALYTICAL DATA SUMMARY
Big Cajun II Power Station CCR Rule Monitoring System
New Roads, Louisiana

Well ID	Constituents	16-Apr-18	25-Jun-18	15-Oct-18
MW-10BG	**Boron**	0.069	NA	0.059
	Calcium	66	NA	71
	Chloride	5.1	NA	5.4
	Fluoride	0.39	0.40	0.43
	Sulfate	<1.4	NA	<1.4
	pH (std.)	7.09	7.13	7.09
	TDS	340	NA	370
	Antimony	NA	<0.0010	NA
	Arsenic	NA	0.015	0.01
	Barium	NA	0.23	0.22
	Beryllium	NA	<0.00034	NA
	Cadmium	NA	<0.00034	NA
	Chromium	NA	<0.0011	NA
	Cobalt	NA	0.00067 J	0.00044 J
	Lead	NA	<0.00035	<0.00035
	Lithium	NA	0.012	0.013
	Mercury	NA	<0.000070	NA
	Molybdenum	NA	0.0022 J	<0.002
	Selenium	NA	<0.00024	<0.00071
	Thallium	NA	<0.000085	NA
	Radium-226	NA	<0.0319	0.302
	Radium-228	NA	0.501	<0.157

Notes:
TDS - total dissolved solids
All units are in milligrams per liter (mg/L) unless otherwise noted.
std - standard units
pCi/L - picocuries per liter
< - concentration less than the method detection limit (MDL)
J - result is less than the Reporting Limit but greater than or equal to the Method Detection Limit and the concentration is an approximate value.
B - compound was found in the blank and sample.
NA - Not analyzed

TABLE 4
DETECTION MONITORING ANALYTICAL DATA COMPARED TO BACKGROUND
Big Cajun II Power Station CCR Rule Monitoring System
New Roads, Louisiana

October 2017																
Constituents	**Unit**	**UPL[1]**	**MW-85A**	**MW-85B**	**MW-85C**	**MW-85D**	**MW-85E**	**MW-10A**	**MW-10B**	**MW-10CR1**	**MW-10D**	**MW-10E**	**MW-10F**	**MW-10G**	**MW-10H**	**MW-10I**
Boron	mg/L	0.076	**0.080**	0.06	**0.3**	**0.19**	**3.7**	**0.66**	**0.62**	**0.28**	**0.26**	**0.21**	**2.5**	**0.77**	**0.11**	**0.15**
Calcium	mg/L	164	72.4	93	140	146	**201**	120	88.5	127	**165**	87	**262**	97.3	140	105
Chloride	mg/L	8.3	**20.8**	**39.6**	**70.5**	**42**	**57.4**	**82.8**	**80.5**	**49.7**	**78.7**	**27.5**	**42.2**	**72.9**	**52.5**	**42.1**
Fluoride	mg/L	0.7	0.32	0.2	0.36	0.29	0.14	0.43	0.13	0.4	0.24	0.24	0.12	0.24	0.19	0.45
Sulfate	mg/L	1.4	**1.8**	**225**	**476**	**338**	**890**	**453**	**244**	**289**	**1800**	**254**	**1000**	**391**	**39.8**	**112**
pH (std.)	S.U.	4.60 - 9.19[2]	6.63	6.85	6.94	6.71	6.31	6.91	6.41	6.83	6.95	6.89	6.39	6.91	6.85	6.69
TDS	mg/L	895	365	615	800	805	**1560**	855	640	805	**1040**	505	**1570**	635	735	630

April 2018																
Constituents	**Unit**	**UPL[1]**	**MW-85A**	**MW-85B**	**MW-85C**	**MW-85D**	**MW-85E**	**MW-10A**	**MW-10B**	**MW-10CR1**	**MW-10D**	**MW-10E**	**MW-10F**	**MW-10G**	**MW-10H**	**MW-10I**
Boron	mg/L	0.076	**0.085**	0.062	**0.24**	**0.2**	**4.7**	**0.76**	**0.55**	**0.29**	**0.28**	**0.25**	**0.25**	**0.83**	**0.19**	**0.17**
Calcium	mg/L	164	69.0	93	130	140	**220**	130	92	100	150	77	75	94	130	93
Chloride	mg/L	8.3	**12.0**	**43**	**62**	**34**	**78**	**82**	**73**	**40**	**72**	**27**	**40**	**77**	**53**	**37**
Fluoride	mg/L	0.7	0.35	0.18	0.33	0.32	0.24	0.44	0.16	0.3	0.27	0.27	0.25	0.26	0.28	0.23
Sulfate	mg/L	1.4	<1.4	**140**	**260**	**150**	**880**	**310**	**110**	**110**	**360**	**120**	**910**	**130**	**46**	**62**
pH (std.)	S.U.	4.60 - 9.19[2]	5.98	6.59	7.12	6.89	6.24	6.64	6.32	6.69	6.27	6.54	6.29	6.52	6.51	6.08
TDS	mg/L	895	320	550	690	660	**1300**	770	570	590	680	490	**1700**	570	570	540

Notes:
TDS - total dissolved solids
mg/L - milligrams per liter
S.U. - standard units
October 2017 samples collected on 17 and 18 October
April 2018 samples collected on 16 and 17 April
[1] - UPL background values identified in the 2017 Annual Groundwater Monitoring and Corrective Action Report, Geosyntec, January 2018
[2] - Upper Prediction Limit (UPL) for high pH range
Bold value indicates exceedance of UPL

TABLE 2

April 2019 Analytical Data Summary

Parameter/Well	MW-85A	MW-85B	MW-85C	MW-85D	MW-85E	MW-10A	MW-10B	MW-10CR1	MW-10D
	4/15/19	4/17/19	4/17/19	4/16/19	4/15/19	4/16/19	4/17/19	4/17/19	4/17/19
Boron (mg/l)	0.076	0.051	0.21	0.15	5.7	0.76	0.53	0.3	0.23
Calcium (mg/l)	72	94	110	110	160	110	97	110	150
Chloride (mg/l)	17	44	56	27	96	78	67	57	79
pH (S.U.)	6.84	7.87	7.86	7.51	7.26	7.61	7.68	7.89	7.9
Sulfate (mg/l)	<5	160	190	79	770	280	87	150	360
TDS (mg/l)	290	610	670	590	1,500	800	590	670	960
Antimony (mg/l)	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Arsenic (mg/l)	0.0022	0.0011 J	0.0052	0.0049	0.0096	0.0027	0.0026	0.012	0.0029
Barium (mg/l)	0.29	0.47	0.24	0.22	0.06	0.24	0.45	0.37	0.22
Beryllium (mg/l)	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Cadmium (mg/l)	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Chromium (mg/l)	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Cobalt (mg/l)	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	0.00061 J	<0.0025
Fluoride (mg/l)	0.37	0.2	0.3	0.32	0.28	0.4	0.19	0.31	0.16
Lead (mg/l)	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013
Lithium (mg/l)	0.016	0.016	0.013	0.018	0.018	0.014	0.017	0.018	0.014
Mercury (mg/l)	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.00015 J	0.00015 J	<0.0002
Molybdenum (mg/l)	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.0025 J	0.0022 J	<0.015
Selenium (mg/l)	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013
Thallium (mg/l)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Combined Radium-226,228 (pCi/l)	0.655	0.697	0.56	0.412	0.652	0.697	0.681	0.412	0.642

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

TABLE 2

April 2019 Analytical Data Summary

Parameter/Well	MW-10E	MW-10F	MW-10G	MW-10H	MW-10I	MW-10BG
	4/15/19	4/16/19	4/16/19	4/16/19	4/15/19	4/15/19
Boron (mg/l)	0.21	2.1	0.82	0.18	0.14	0.066
Calcium (mg/l)	100	150	87	120	88	71
Chloride (mg/l)	42	35	81	56	25	5.4
pH (S.U.)	7.08	7.53	7.49	7.51	7.33	7.54
Sulfate (mg/l)	140	390	120	55	3.7 J	<5
TDS (mg/l)	620	910	600	600	450	350
Antimony (mg/l)	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Arsenic (mg/l)	0.01	0.0026	0.0021	0.0094	0.00058 J	0.0046
Barium (mg/l)	0.28	0.055	0.33	0.41	0.32	0.22
Beryllium (mg/l)	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Cadmium (mg/l)	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Chromium (mg/l)	0.0011 J	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Cobalt (mg/l)	0.00077 J	0.00053 J	<0.0025	<0.0025	<0.0025	<0.0025
Fluoride (mg/l)	0.27	0.29	0.24	0.28	0.21	0.39
Lead (mg/l)	0.00037 J	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013
Lithium (mg/l)	0.018	0.018	0.021	0.019	0.024	0.012
Mercury (mg/l)	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum (mg/l)	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Selenium (mg/l)	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013
Thallium (mg/l)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Combined Radium-226,228 (pCi/l)	0.567	0.208	0.699	0.564	0.177	0.796

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

TABLE 3

October 2019 Analytical Data Summary

Parameter/Well	MW-85A	MW-85B	MW-85C	MW-85D	MW-85E	MW-10A	MW-10B	MW-10CR1	MW-10D
	10/8/19	10/8/19	10/8/19	10/9/19	10/8/19	10/8/19	10/8/19	10/8/19	10/8/19
Boron (mg/l)	0.07	0.046	0.18	0.13	5.9	0.79	0.74	0.35	0.15
Calcium (mg/l)	60.8	85	111	109	158	109	92.8	118	130
Chloride (mg/l)	15.7	51	57	25.9	9.4	8.6	83.6	69.8	76.4
pH (S.U.)	6.12	7.51	7.35	6.57	6.5	6.93	6.9	7.16	7.56
Sulfate (mg/l)	<1	180	197	67.5	737	293	97.9	246	323
TDS (mg/l)	320	6,500	540	1,390	775	645	735	855	4,040
Arsenic (mg/l)	0.0016	0.0011	0.0045	0.0047	0.0099	0.002	0.006	0.007	0.0026
Barium (mg/l)	0.3	0.46	0.25	0.22	0.061	0.26	0.48	0.41	0.19
Chromium (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.0012	<0.001
Fluoride (mg/l)	0.37	0.31	0.41	0.47	0.15	0.52	0.32	0.46	0.44
Lead (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lithium (mg/l)	0.015	0.014	0.012	<0.001	0.015	0.012	0.016	0.015	<0.001
Molybdenum (mg/l)	<0.003	<0.003	<0.003	<0.003	0.014	<0.003	<0.003	0.003	<0.003
Combined Radium-226,228 (pCi/l)	0.766	1.919	1.954	1.683	1.811	1.07	0.772	1.155	1.29

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

TABLE 3

October 2019 Analytical Data Summary

Parameter/Well	MW-10E	MW-10F	MW-10G	MW-10H	MW-10I	MW-10BG
	10/9/19	10/8/19	10/8/19	10/8/19	10/8/19	10/9/19
Boron (mg/l)	0.19	5.1	0.94	0.11	0.094	0.066
Calcium (mg/l)	118	359	81.7	124	81.2	68.5
Chloride (mg/l)	50.3	46.9	77.8	57.7	25.7	5.7
pH (S.U.)	6.57	6.73	6.49	6.38	6.21	6.52
Sulfate (mg/l)	200	1,510	141	35.1	4.1	<1
TDS (mg/l)	2,340	620	805	575	370	340
Arsenic (mg/l)	0.0091	0.0052	0.0016	0.0072	<0.001	0.025
Barium (mg/l)	0.33	0.076	0.35	0.41	0.32	0.23
Chromium (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt (mg/l)	<0.001	0.0021	<0.001	<0.001	<0.001	<0.001
Fluoride (mg/l)	0.16	<0.10	0.23	0.18	0.2	0.36
Lead (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lithium (mg/l)	<0.001	0.027	0.018	<0.001	<0.001	<0.001
Molybdenum (mg/l)	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Combined Radium-226,228 (pCi/l)	0.794	0.924	0.621	2.119	1.2148	-0.265

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

APPENDIX F

SITE HYDROGEOLOGY AND GEOLOGIC CROSS SECTIONS

SITE HYDROGEOLOGY AND GEOLOGIC CROSS SECTIONS

HYDROGEOLOGIC SETTING

Big Cajun II (BCII) is situated on Mississippi River alluvial valley soils along the west bank of the Mississippi River near New Roads in Pointe Coupee Parish, Louisiana. A complex series of southerly dipping, interbedded clay, silt, fine sand, sand, and gravel deposits that coarsen with depth comprise the Holocene age alluvium underlying the site. Braided outwash deposits of Pleistocene age underlying the Holocene age alluvium (Shaw, 2011) complete the approximately 35-foot interbedded sequence of alluvial and outwash sediments. The Mississippi River Valley alluvial aquifer (MRVA) is the first permeable deposit below the Pleistocene outwash sediments and approaches an aquifer thickness of 200 feet (Geosyntec Consultants, 2018). The MRVA consists of dense to very dense grey sand and gravel with interbedded silts and clays (Shaw, 2010). The groundwater quality of the MRVA is noted for being marginal since it has relatively high concentrations of total dissolved solids (TDS), iron and manganese. Consequently, the MRVA is not used for fresh groundwater except for some small diameter, low yield stock wells. The alluvium is in hydraulic communication with the Mississippi River, and groundwater flow is normally from the plant towards the river to the east.

The MRVA is separated from deeper aquifers by about 100 feet of clay and silt with very low permeability (Louis J. Capozzoli & Associates, 1974). This provides an effective hydraulic flow barrier between the MRVA and deeper aquifers.

The Bottom Ash Basin and the Fly Ash Basin at BCII were constructed above natural grade.

SITE GEOLOGY

Geologic cross sections included in **Appendix F**, traverse the site along lines shown in **Figures F-1**, **F-4**, and **F-7**, **Appendix F**, and illustrate the heterogeneous stratigraphy and variable depths to the water bearing zone in the alluvium/natural levee deposits. These geologic cross sections are constructed from soil borings trending in west-east and north-south profiles encompassing the Bottom Ash Basin unit.

The MRVA consists of dense to very dense grey sand and gravel with interbedded silts and clays (Shaw, 2010). Overlying the MRVA at land surface is an approximately 35-foot sequence of interbedded clays, silts, and fine sands, sands, and gravels.

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 BCII in 2018 and 2019. An evaluation of potentiometric gradients indicates that, similar to previous monitoring, the groundwater flow direction varied but was predominantly away from the Mississippi River (east to west) with localized variability in the areas of the Bottom Ash Basin and eastern portion of the Fly Ash Basin.

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 Basins 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)**
April 2019	0.0004 to 0.005	0.0001 to 0.135
October 2019	0.0002 to 0.0027	0.0002 to 0.25

It is important to note that this is an advective rate and does not account for potential geological heterogeneities which may cause significant variability in geochemical and hydrologic 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 Bottom Ash Basin and Fly Ash Basin are situated entirely over MRVA alluvium deposits and overlying Holocene and Pleistocene alluvium and outwash.
- The uppermost aquifer is laterally continuous within the 35-foot thick Holocene and Pleistocene alluvium and outwash deposits.
- 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.
- Groundwater quality is generally poor with naturally high TDS.
- 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 Big Cajun II concludes that groundwater monitoring of the uppermost aquifer underlying the Bottom Ash Basin and the Fly Ash Basin is conducted per applicable portions of 40 C.F.R. § 257.93.

REFERENCES

Louis J. Capozzoli & Associates, 1974. Preliminary Subsoil Investigation and Foundation Design Data, Big Cajun No. 2 Site C-2, New Roads, Louisiana, prepared by Louis J. Capozzoli & Associates, Inc.

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

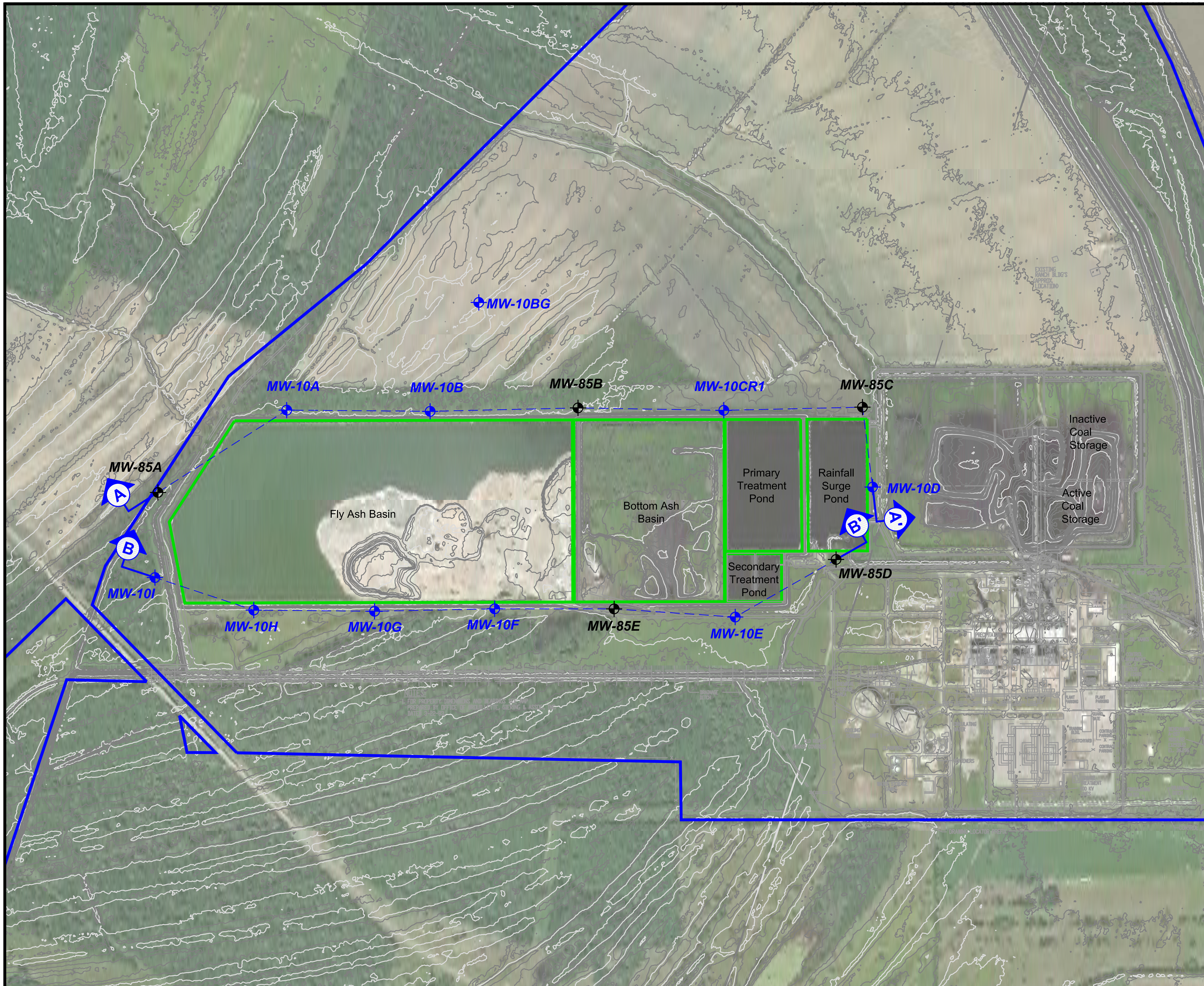
Geosyntec, 2018. Locations Restrictions Compliance Demonstration, Louisiana Generating, LLC, Big Cajun II Power Plant, Geosyntec, 5420 Corporate Boulevard, Suite 202, Baton Rouge, Louisiana 70808 at here.

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 here.

Shaw Environmental & Infrastructure, Inc. (Shaw), 2010. Type I Solid Waste Facility Permit Renewal and Modification Application – Final Copies, November 2010, Louisiana Generating, LLC, Big Cajun II Power Plant, Shaw Environmental & Infrastructure, Inc., 4171 Essen Lane, Baton Rouge, LA 70809.

Shaw, 2011. Completion Report – Monitoring Well Installation Solid Waste Impoundment Monitoring System, August 2011. Louisiana Generating, LLC, Big Cajun II Power Plant, Shaw Environmental & Infrastructure, Inc., 4171 Essen Lane, Baton Rouge, LA 70809.



Legend

MW-10CR1	Monitor Well - 2011
MW-85C	Monitor Well - 1985
B-3	Boring Log - 2005

Reference

Base map comprised of Big Maps aerial imagery from (c) 2019 Microsoft Corporation and its data suppliers.

1,000 0 1,000

Scale: 1" = 1,000'

CLECO Cajun, LLC

Big Cajun II Power Plant

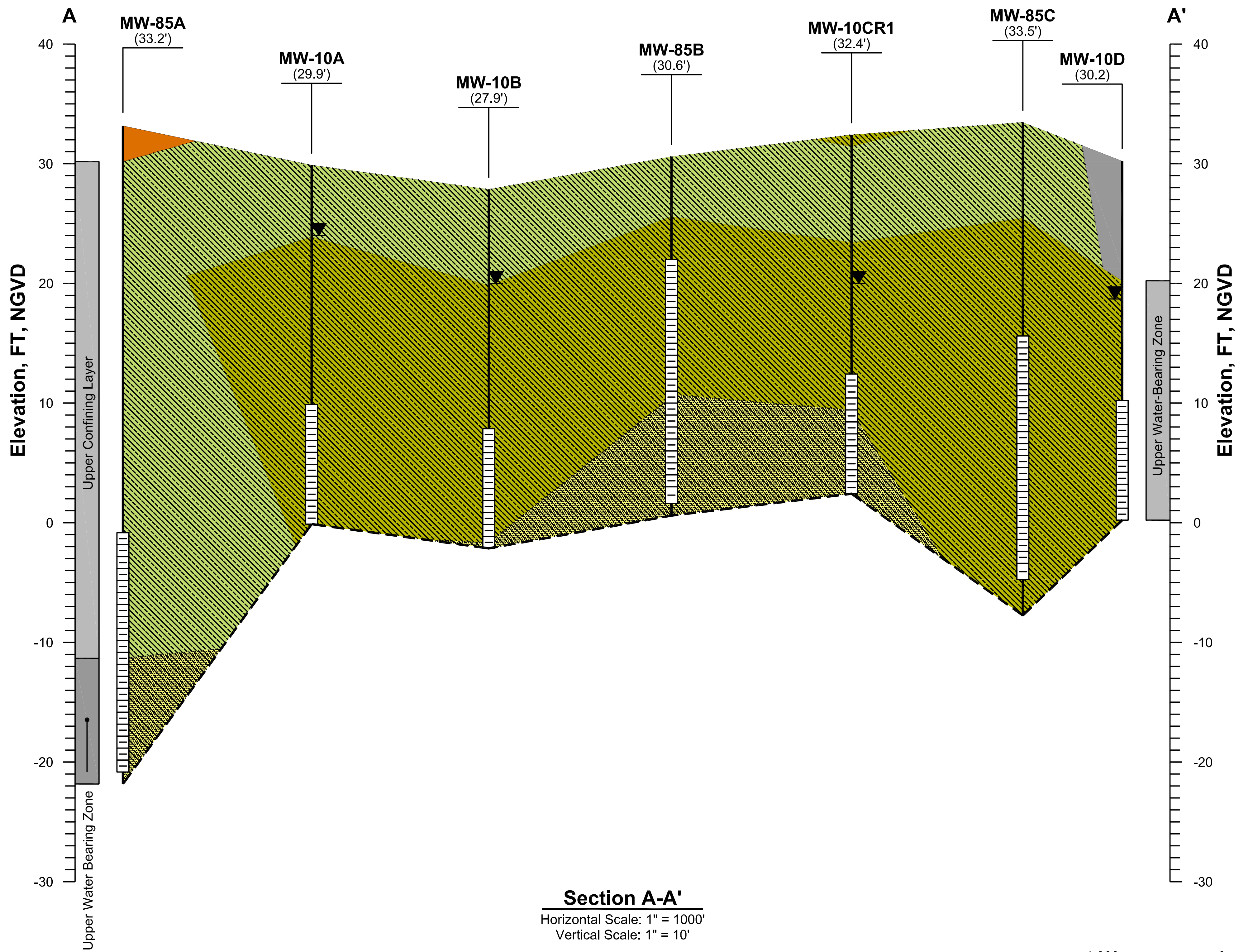
Cross Section Location Map

Pointe Coupee Parish

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

Drawn:	JP
Checked:	RS
Approved:	RS
Date:	10/21/20
Dwg. No.:	367-20-0004-APP-F-1

Figure F-1



Section A-A'

Horizontal Scale: 1" = 1000'
Vertical Scale: 1" = 10'

1,000 0 1,000
Scale: 1" = 1,000'

10 0 10
Scale: 1" = 10'

Legend

- Clay, Silty Clay, Sandy Clay
- Fill
- Sand, Silty Sand, Clayey Sand
- Silt, Sandy Silt, Clayey Silt
- No Recovery
- (30.2) Approximate Ground Surface Elevation (FT, NGVD)
- Screen Interval
- Initial Groundwater

Reference

Base map comprised of client provided drawing number 996-011-B021.

CLECO Cajun, LLC

Big Cajun II Power Plant

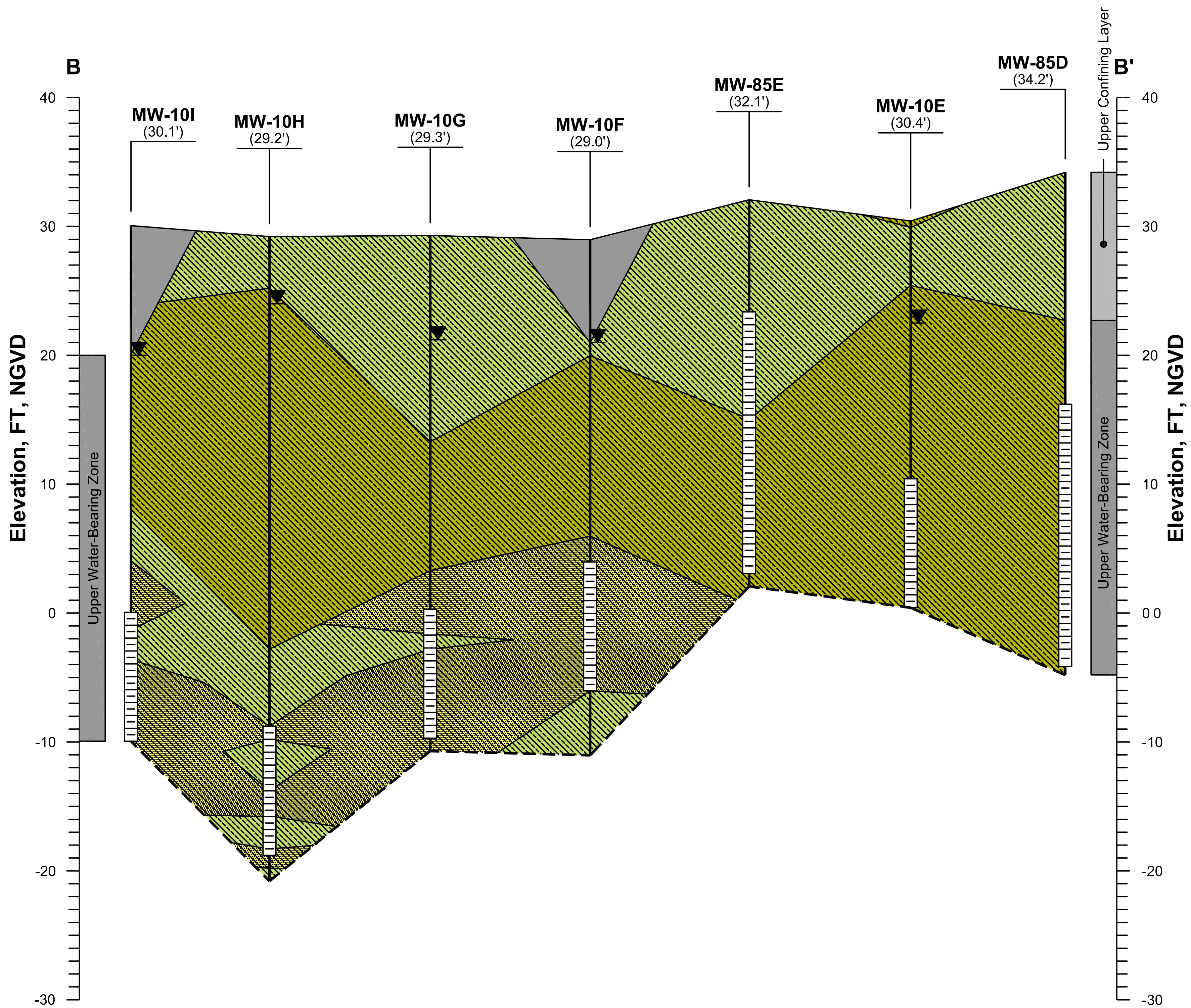
Geologic Cross Section A-A'

Pointe Coupee Parish

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

Drawn:	JP
Checked:	RS
Approved:	RS
Date:	10/21/20
Dwg. No.:	367-20-0004-APP-F-2

Figure F-2



Section B-B'
Horizontal Scale: 1" = 1000'
Vertical Scale: 1" = 10'

Legend

- Clay, Silty Clay, Sandy Clay
- Sand, Silty Sand, Clayey Sand
- Silt, Sandy Silt, Clayey Silt
- No Recovery
- (34.2') Approximate Ground Surface Elevation (FT, NGVD)
- Screen Interval
- Initial Groundwater

Reference

Base map comprised of client provided drawing number 996-011-B022.

1,000 0 1,000
Scale: 1" = 1,000'

10 0 10
Scale: 1" = 10'

CLECO Cajun, LLC

Big Cajun II Power Plant

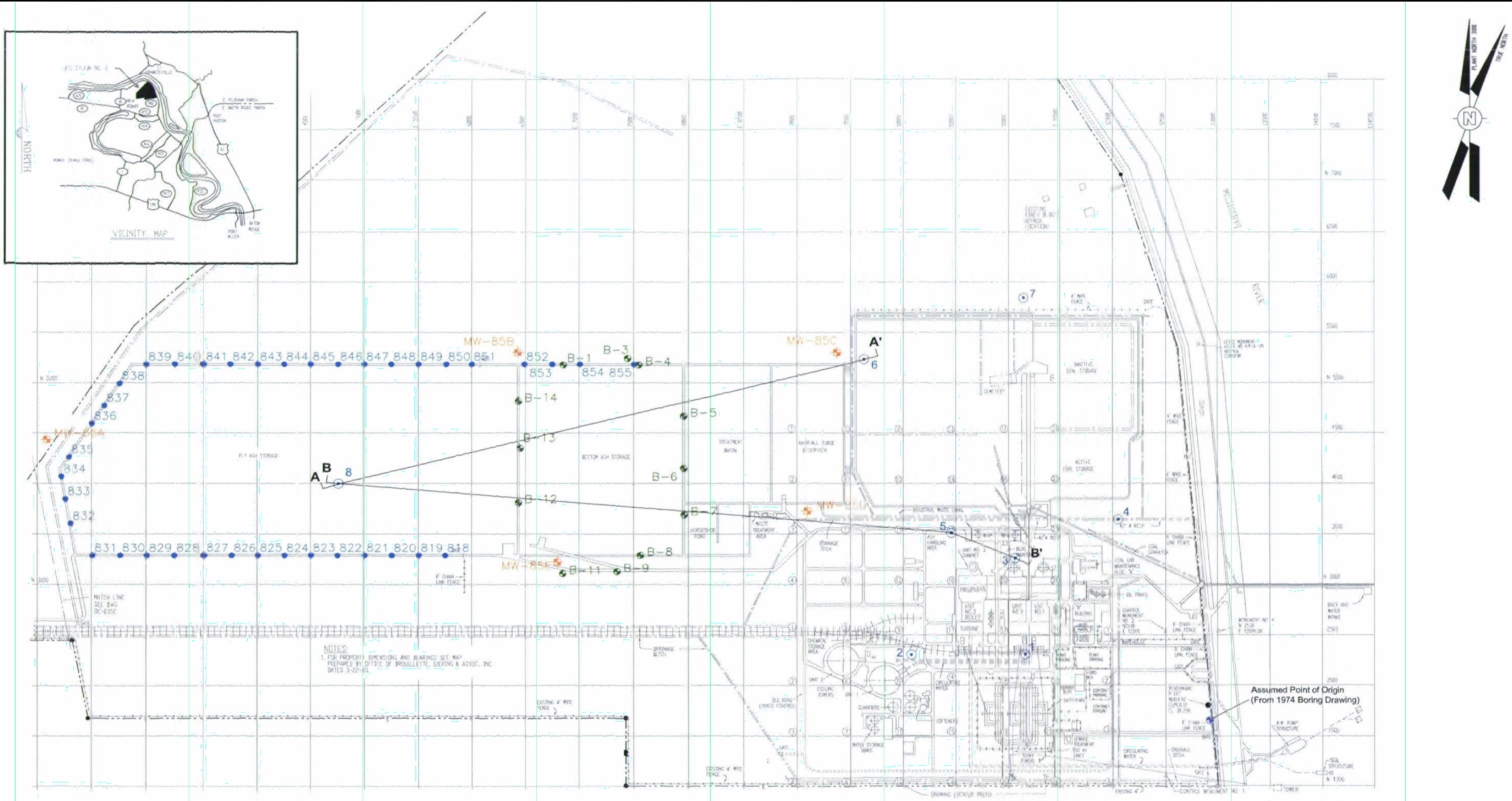
Geologic Cross Section B-B'

Pointe Coupee Parish

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

Drawn:	JP
Checked:	RS
Approved:	RS
Date:	10/21/20
Dwg. No.:	367-20-0004-APP-F-3

Figure F-3



NOTE: SEE FIGURE 25a FOR CROSS-SECTION A - A' AND FIGURE 25b FOR CROSS-SECTION B - B'.

LEGEND

- PROPERTY LINE
- SOIL BORINGS ADVANCED IN 2005
- SOIL BORINGS ADVANCED PRIOR TO 1997
- MONITORING WELL LOCATION
- SOIL BORINGS ADVANCED IN 1974

SCALE
0 1000 2000 FEET

Reference

Base map comprised of client provided drawing number 996-011-B037.

CLECO Cajun, LLC

Big Cajun II Power Plant

Historical Soil Boring Locations

Pointe Coupee Parish

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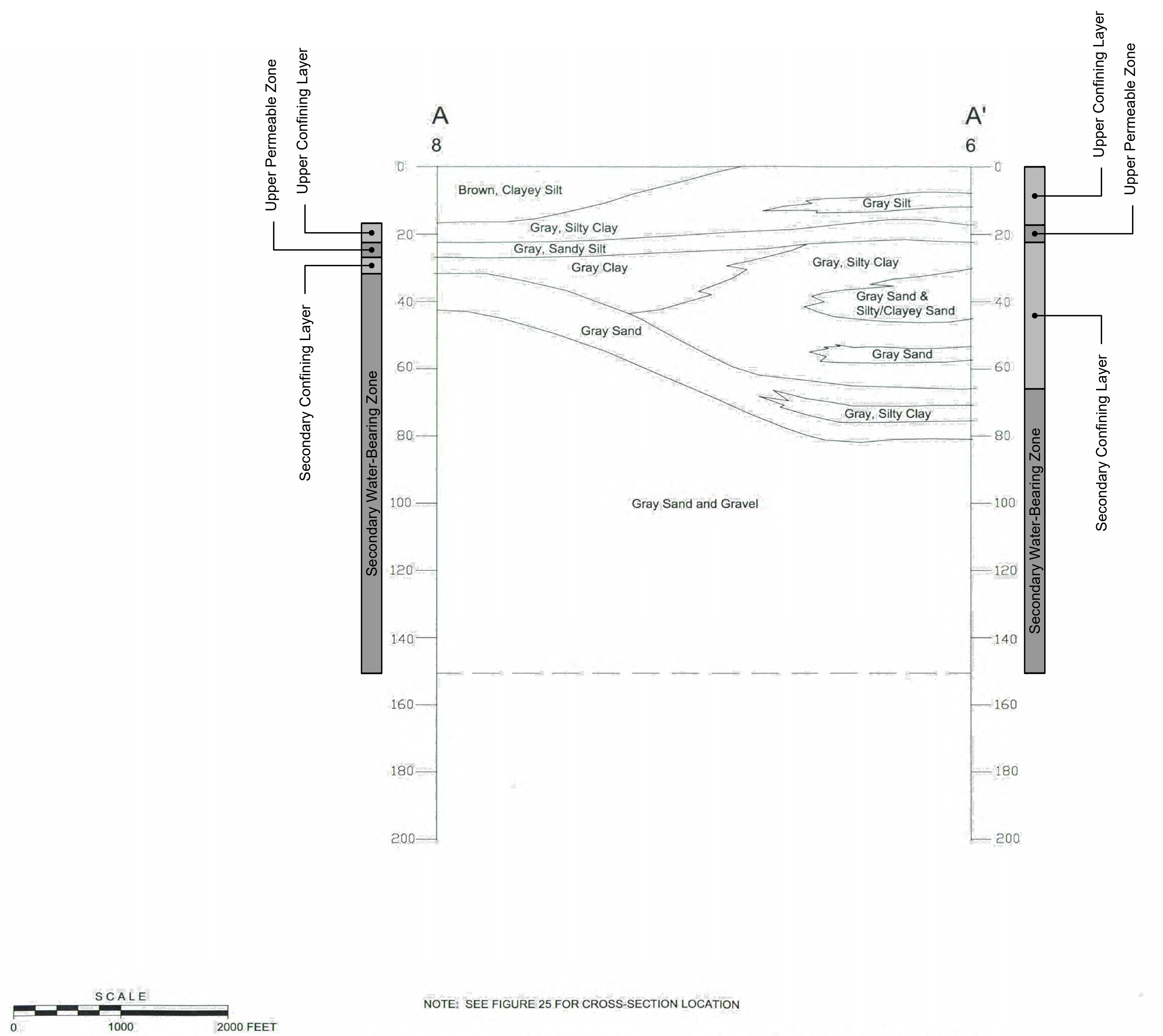
Date:	10/21/20
Dwg. No.:	367-20-0004-APP-F-4

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

Figure F-4



NOTE: SEE FIGURE 25 FOR CROSS-SECTION LOCATION

Reference

Base map comprised of client provided drawing number 996-011-B038.

CLECO Cajun, LLC

Big Cajun II Power Plant

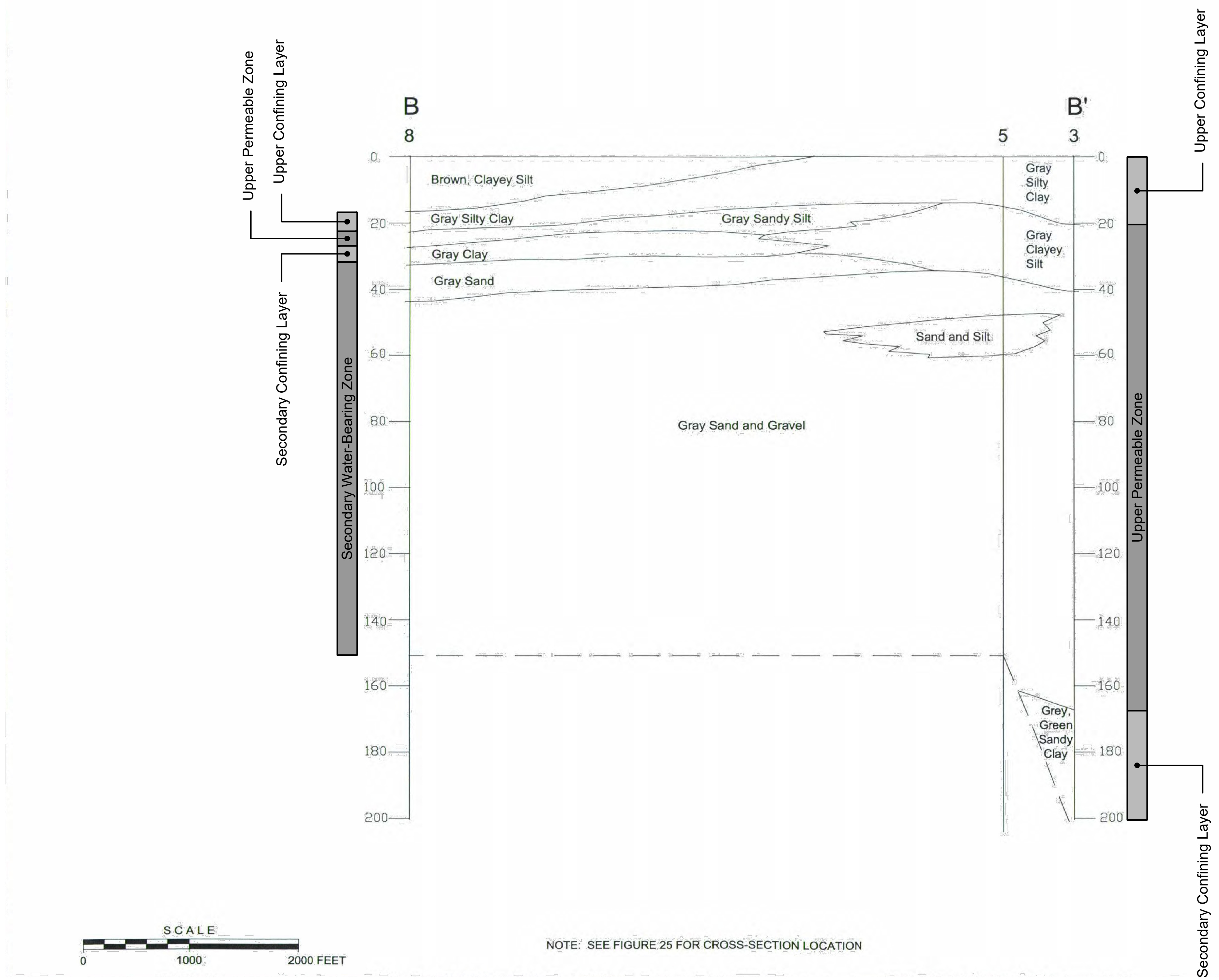
Cross Section A-A'

Pointe Coupee Parish

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

Drawn:	JP
Checked:	RS
Approved:	RS
Date:	10/21/20
Dwg. No.:	367-20-0004-APP-F-5

Figure F-5



NOTE: SEE FIGURE 25 FOR CROSS-SECTION LOCATION

Reference

Base map comprised of client provided drawing number 996-011-B039.

CLECO Cajun, LLC

Big Cajun II Power Plant

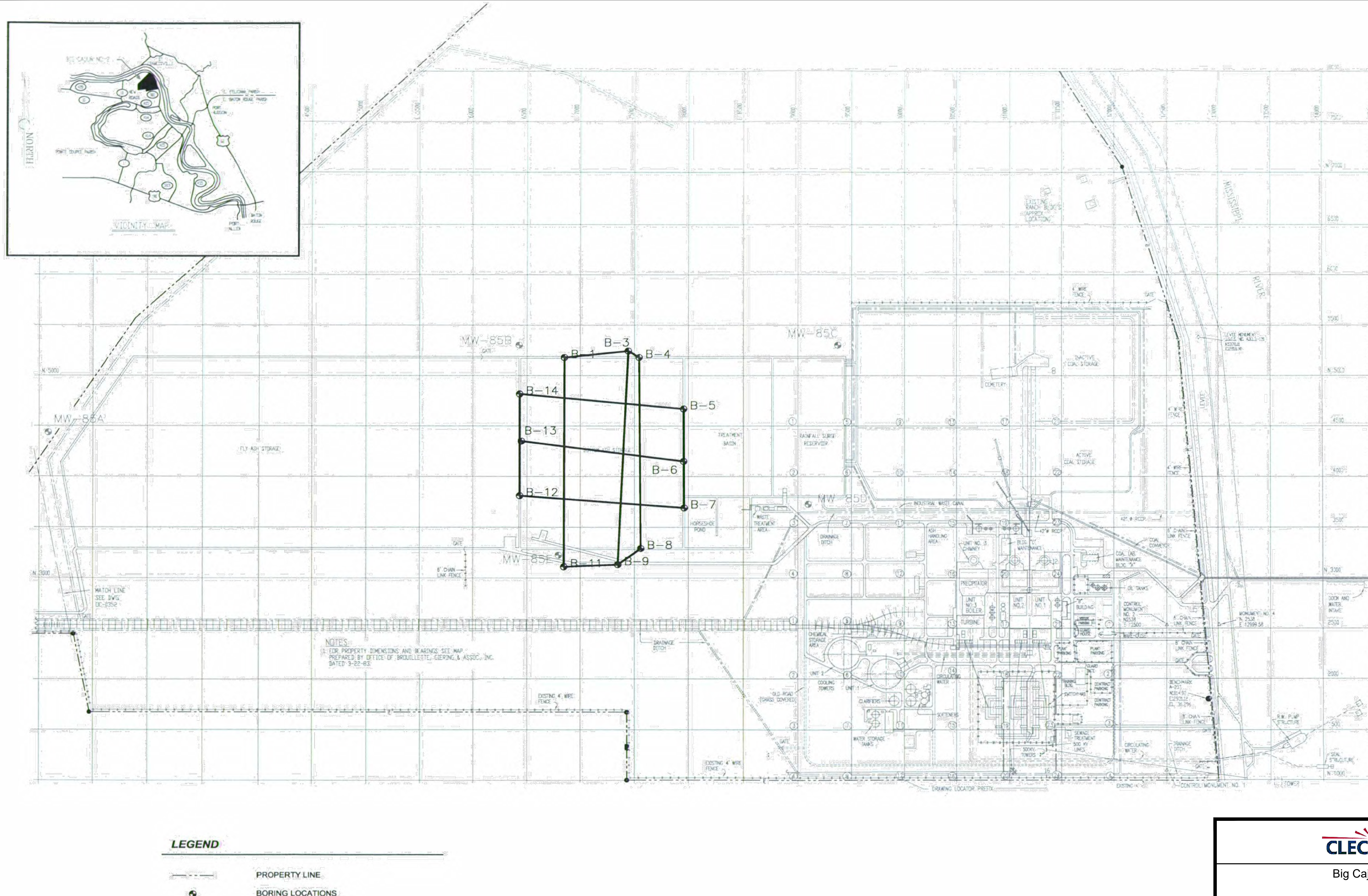
Cross Section B-B'

Pointe Coupee Parish

Drawn:	JP
Checked:	RS
Approved:	RS
Date:	10/21/20
Dwg. No.:	367-20-0004-APP-F-6

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

Figure F-6



Reference

Base map comprised of client provided drawing number 996-011-B031.

CLECO Cajun, LLC

Big Cajun II Power Plant

Cross Section/Boring Location Map

Pointe Coupee Parish

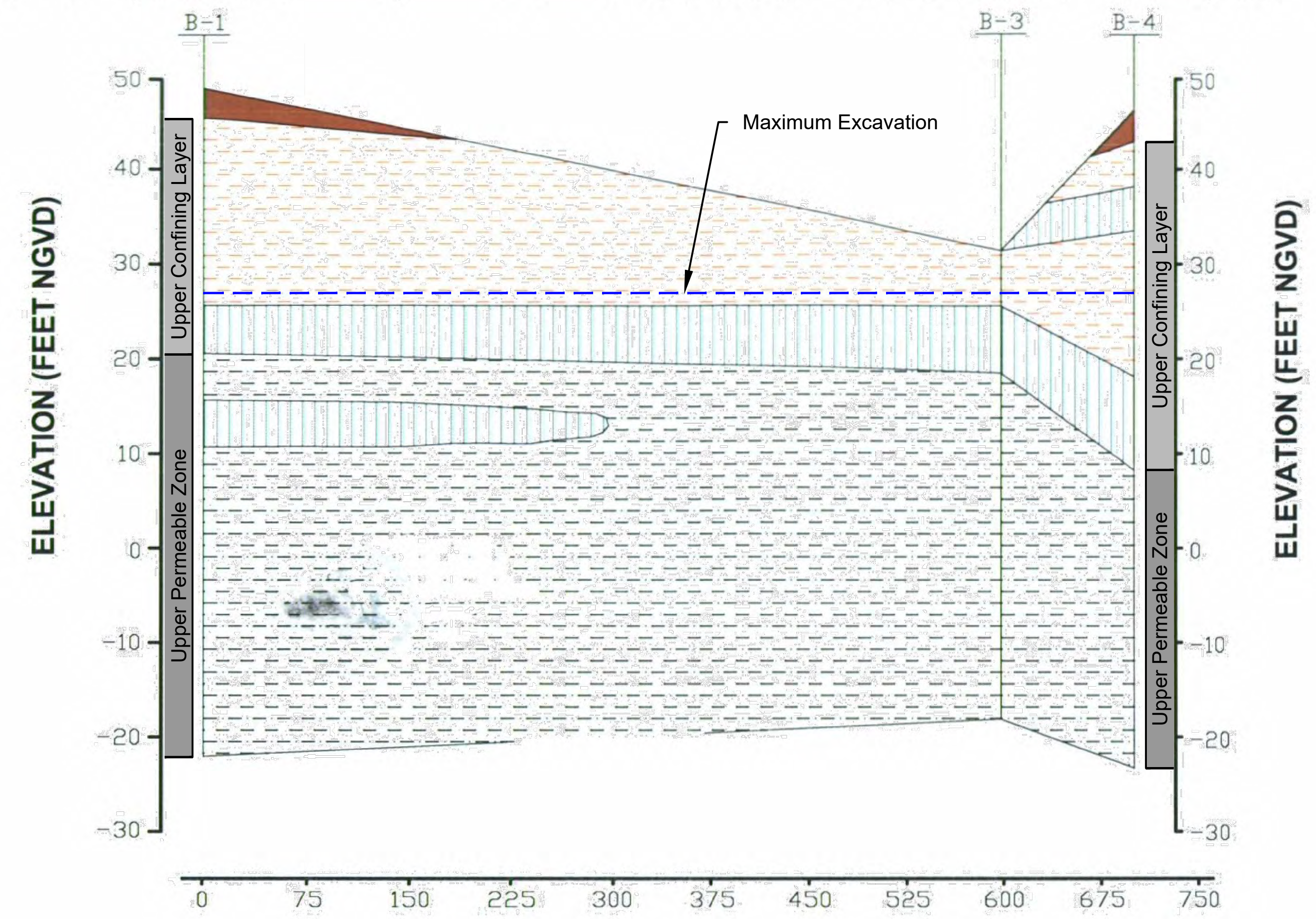
Drawn:	JP
Checked:	RS
Approved:	RS
Date:	10/21/20
Dwg. No.:	367-20-0004-APP-F-7

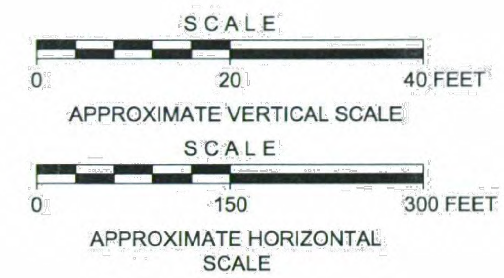
E·A·G·L·E ENVIRONMENTAL SERVICES, INC.

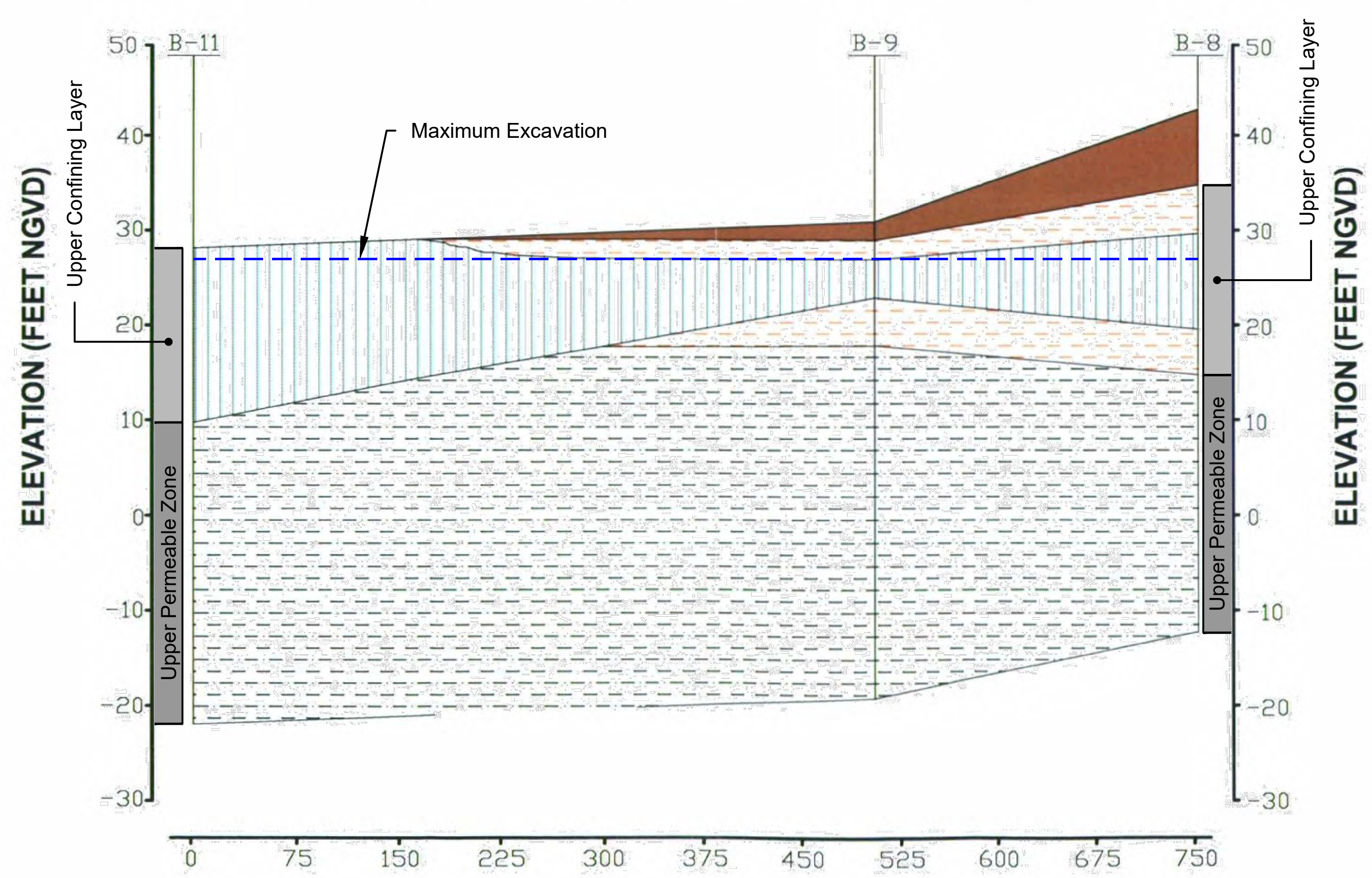
Figure F-7

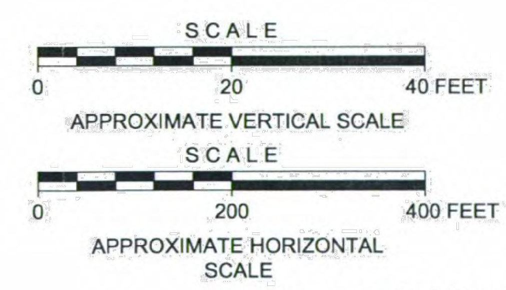
Reference

Base map comprised of client provided drawing number 996-011-B032.









LEGEND

- FILL MATERIAL
- SM — SILTY SAND OR SILT AND SAND MIXTURE
- CL — NON-HUMUS CLAY, SANDY CLAY, SILTY CLAY, LOW TO MEDIUM PLASTICITY
- CH — INORGANIC CLAY, HIGH PLASTICITY

NOTE: SEE FIGURE 18 FOR CROSS-SECTION LOCATIONS.

CLECO Cajun, LLC

Big Cajun II Power Plant

Cross Sections - 1

Pointe Coupee Parish

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

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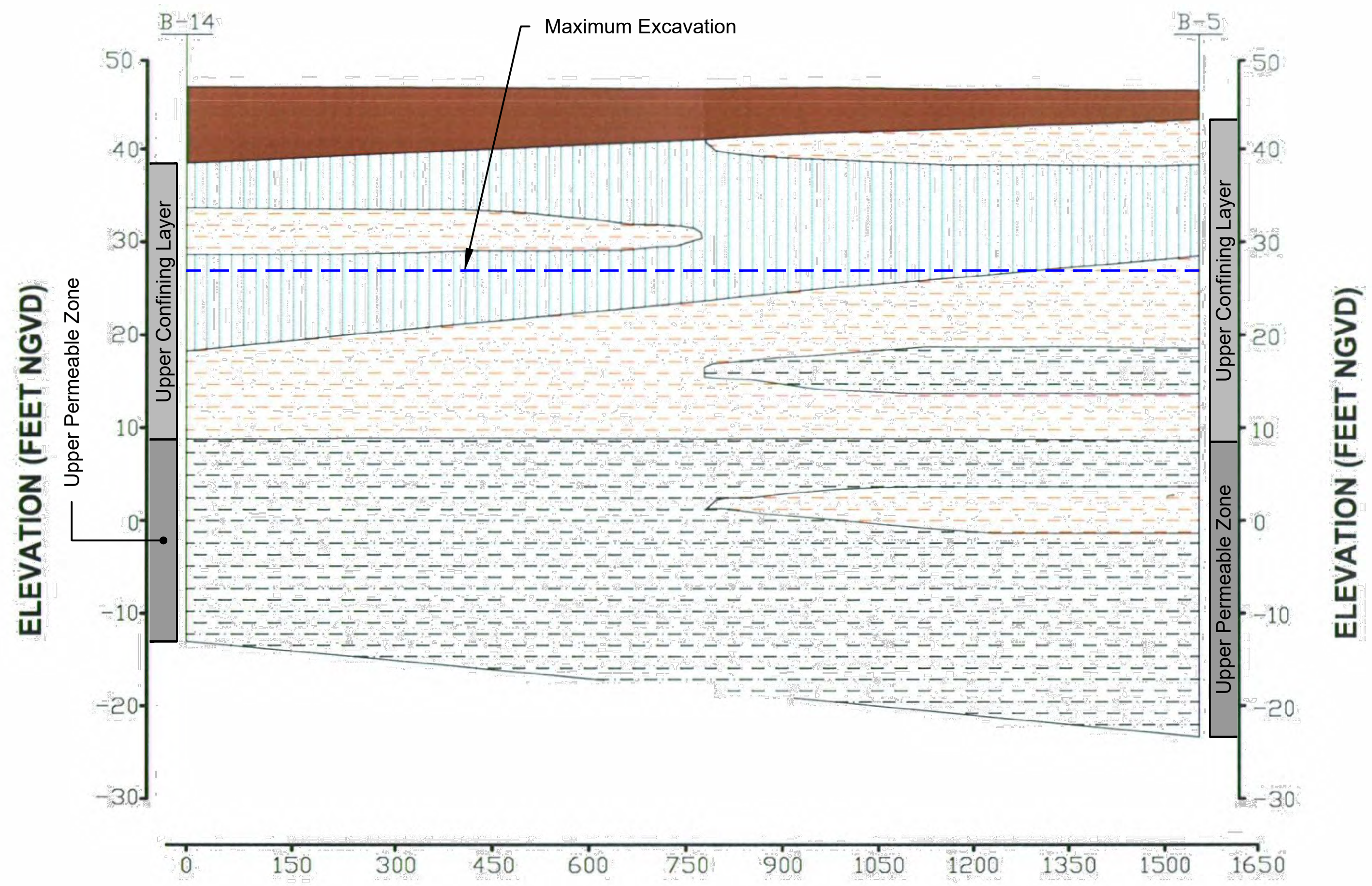
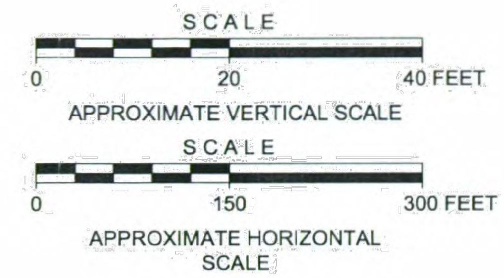
Approved:	RS
Date:	10/21/20
Dwg. No.:	367-20-0004-APP-F-8

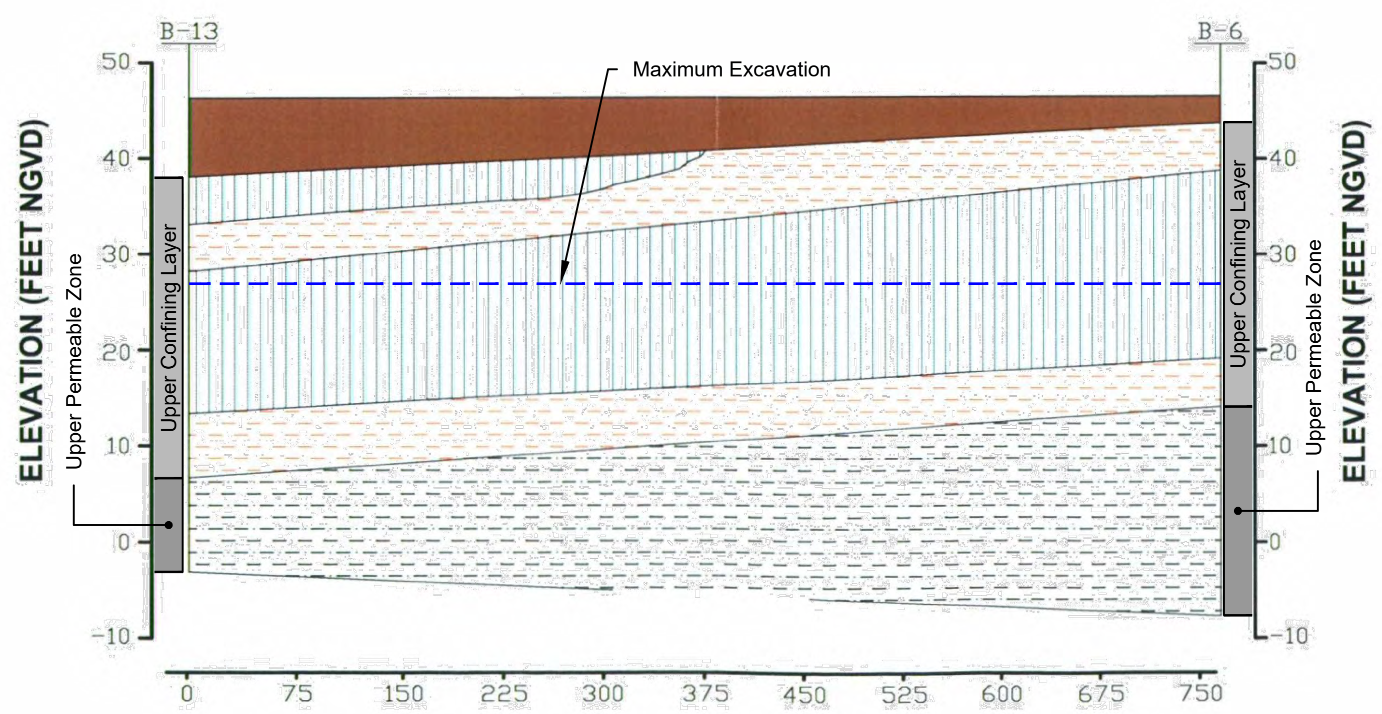
Figure F-8

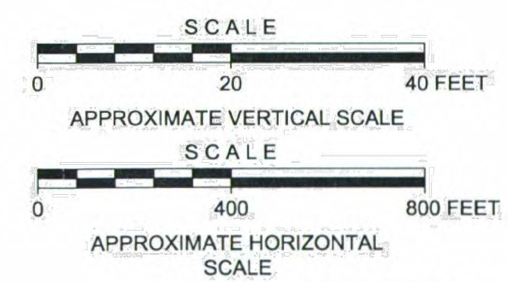
Reference

Base map comprised of client provided drawing number 996-011-B033.









LEGEND

- FILL MATERIAL
- SM — SILTY SAND OR SILT AND SAND MIXTURE
- CL — NON-HUMUS CLAY, SANDY CLAY, SILTY CLAY, LOW TO MEDIUM PLASTICITY
- CH — INORGANIC CLAY, HIGH PLASTICITY

NOTE: SEE FIGURE 18 FOR CROSS-SECTION LOCATIONS.

CLECO Cajun, LLC

Big Cajun II Power Plant

Cross Sections - 2

Pointe Coupee Parish

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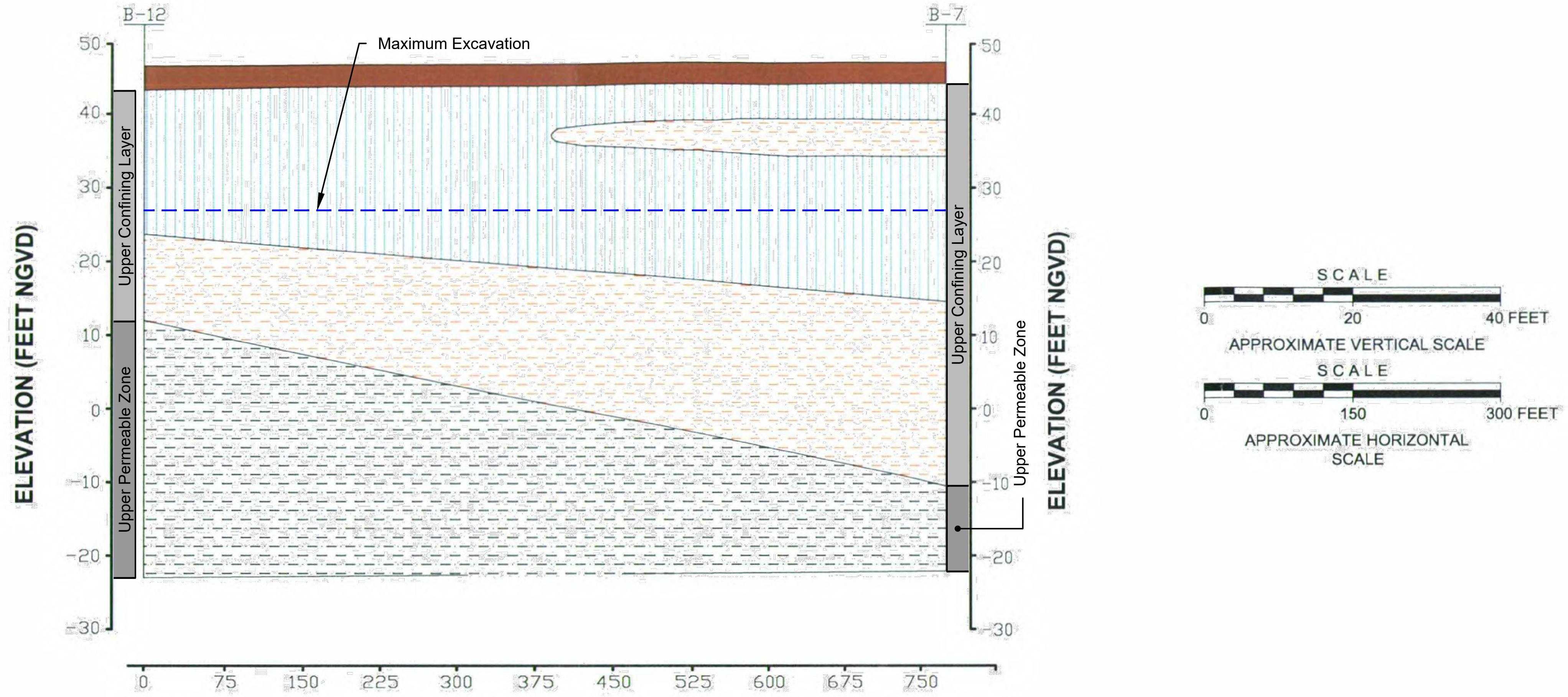
Date:	10/21/20
Dwg. No.:	367-20-0004-APP-F-9

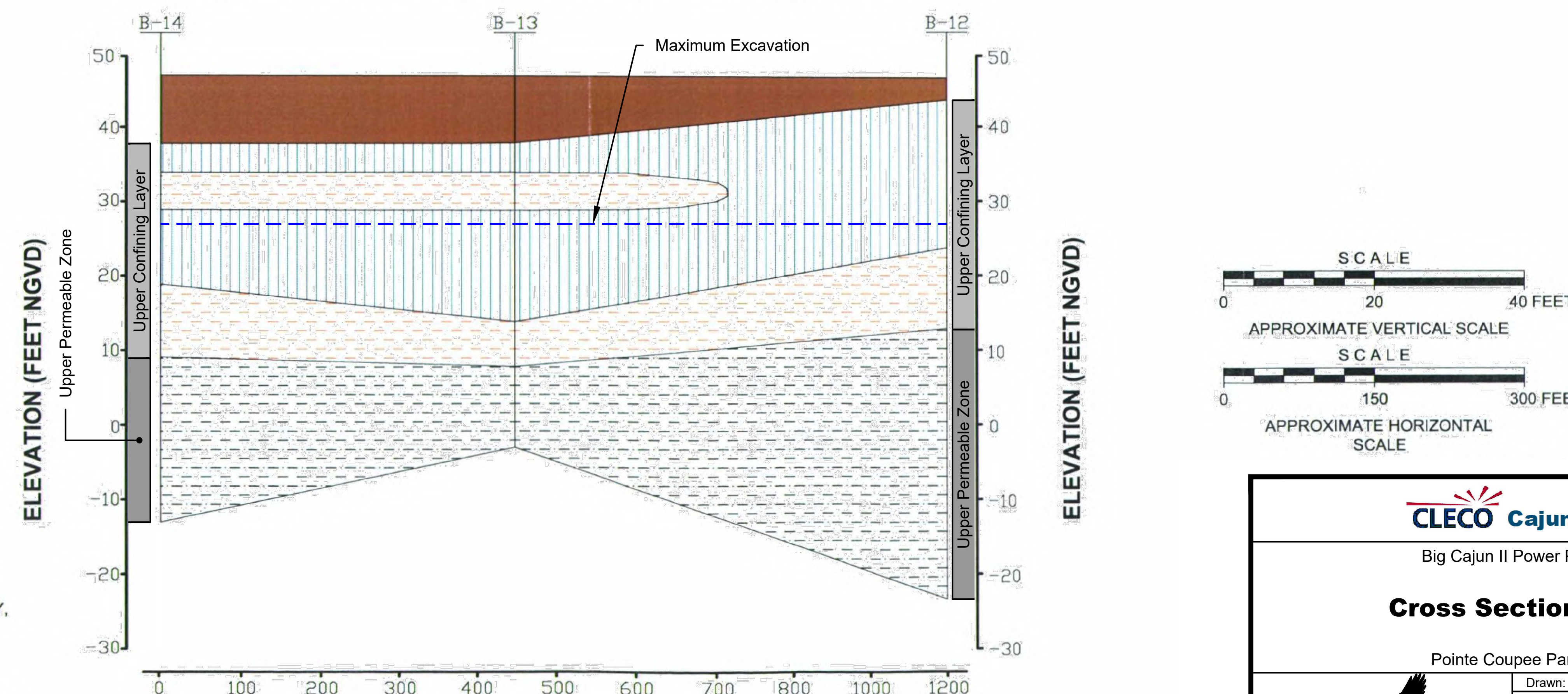
E·A·G·L·E ENVIRONMENTAL SERVICES, INC.

Figure F-9

Reference

Base map comprised of client provided drawing number 996-011-B034.





LEGEND

- FILL MATERIAL
- SM — SILTY SAND OR SILT AND SAND MIXTURE
- CL — NON-HUMUS CLAY, SANDY CLAY, SILTY CLAY, LOW TO MEDIUM PLASTICITY
- CH — INORGANIC CLAY, HIGH PLASTICITY

NOTE: SEE FIGURE 18 FOR CROSS-SECTION LOCATIONS.

CLECO Cajun, LLC

Big Cajun II Power Plant

Cross Sections - 3

Pointe Coupee Parish

Drawn:	JP
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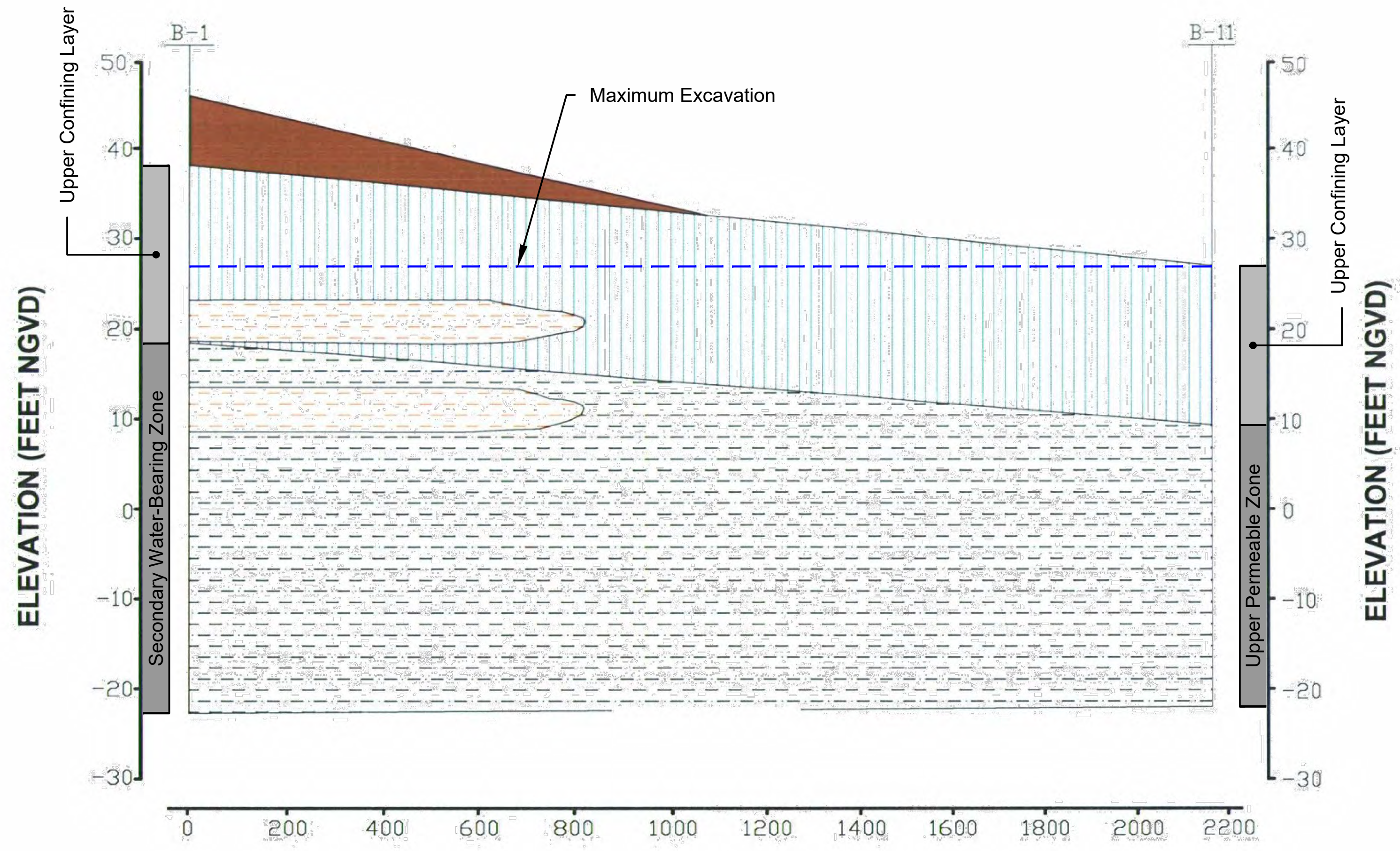
Approved:	RS
Date:	10/21/20
Dwg. No.:	367-20-0004-APP-F-10

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

Figure F-10

Reference

Base map comprised of client provided drawing number 996-011-B035.



SCALE

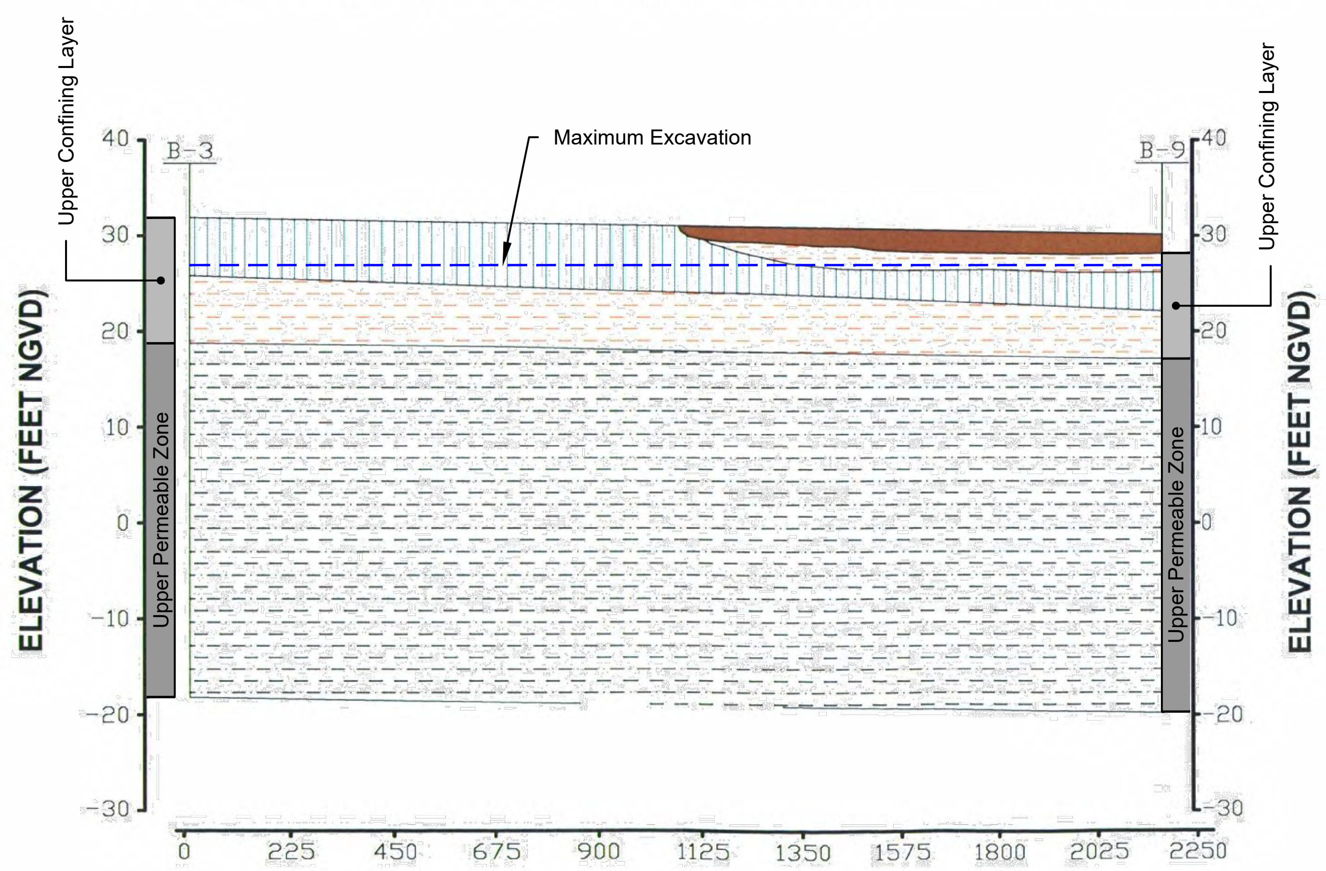
0 20 40 FEET

APPROXIMATE VERTICAL SCALE

SCALE

0 400 800 FEET

APPROXIMATE HORIZONTAL SCALE



SCALE

0 20 40 FEET

APPROXIMATE VERTICAL SCALE

SCALE

0 450 900 FEET

APPROXIMATE HORIZONTAL SCALE

LEGEND

- FILL MATERIAL
- SM — SILTY SAND OR SILT AND SAND MIXTURE
- CL — NON-HUMUS CLAY, SANDY CLAY, SILTY CLAY, LOW TO MEDIUM PLASTICITY
- CH — INORGANIC CLAY, HIGH PLASTICITY

NOTE: SEE FIGURE 18 FOR CROSS-SECTION LOCATIONS.

CLECO Cajun, LLC

Big Cajun II Power Plant

Cross Sections - 4

Pointe Coupee Parish

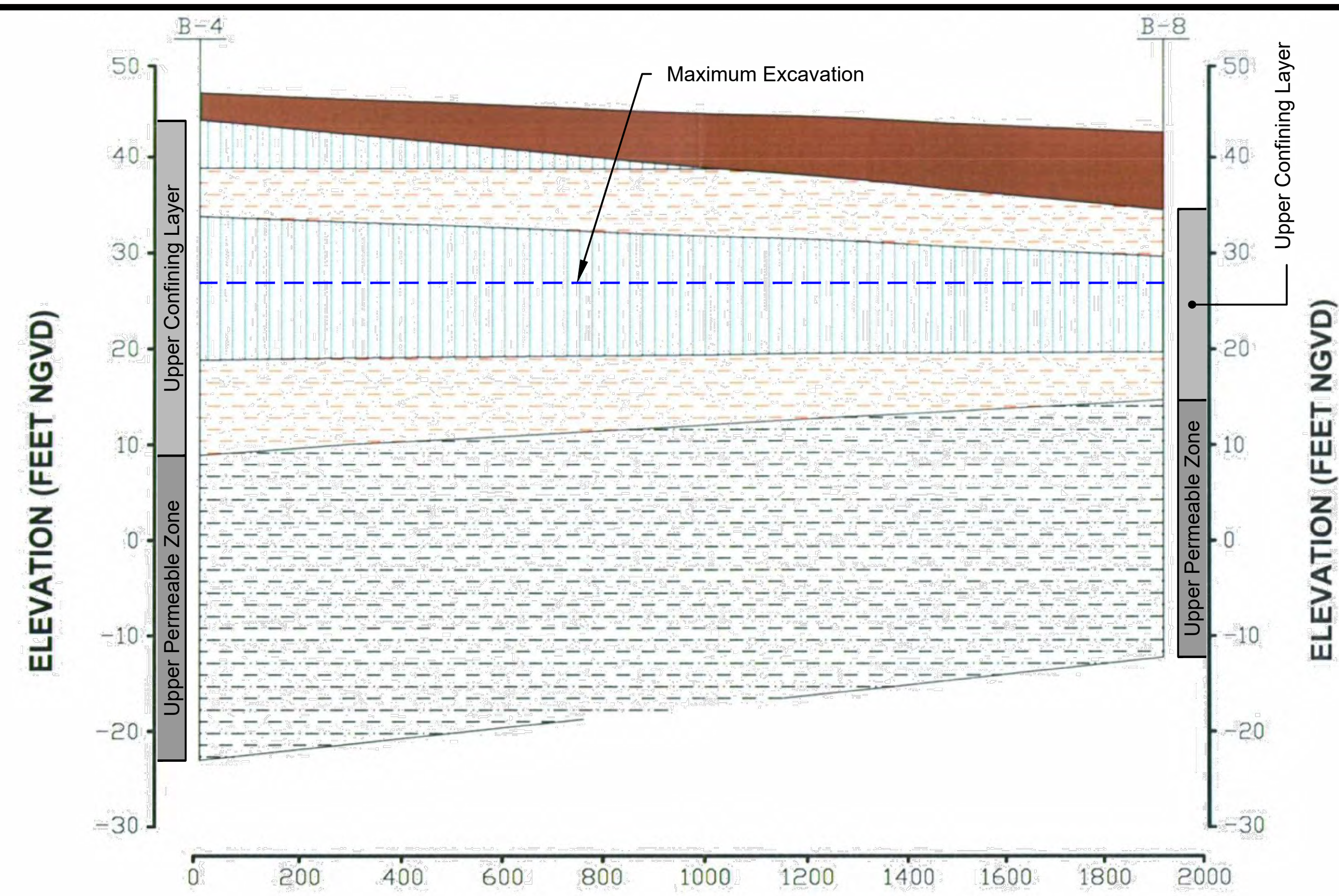
Drawn:	JP
Checked:	RS
Approved:	RS
Date:	10/21/20
Dwg. No.:	367-20-0004-APP-F-11

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

Figure F-11

Reference

Base map comprised of client provided drawing number 996-011-B036.



SCALE

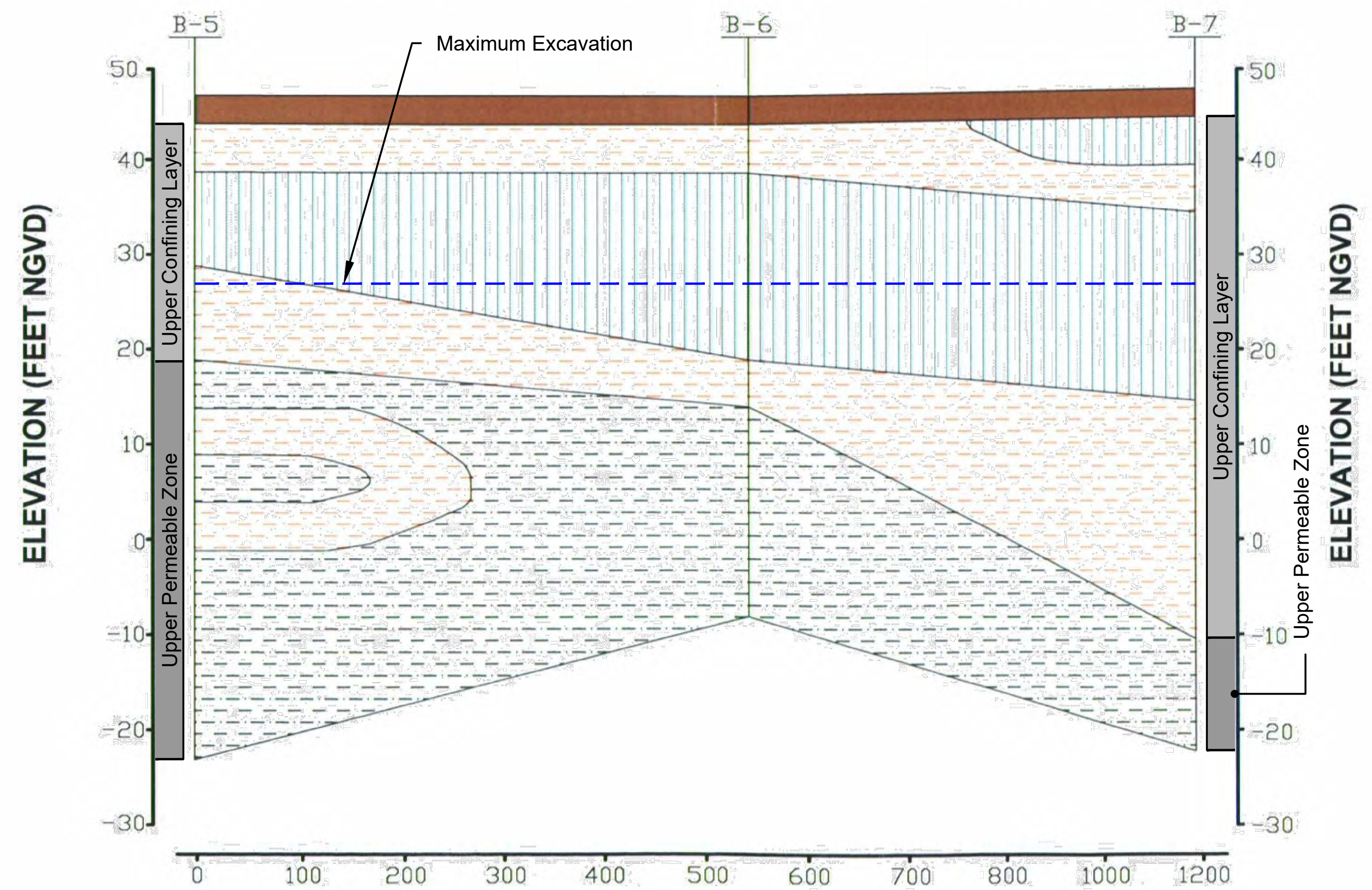
0 20 40 FEET

APPROXIMATE VERTICAL SCALE

SCALE

0 200 400 FEET

APPROXIMATE HORIZONTAL SCALE



SCALE

0 20 40 FEET

APPROXIMATE VERTICAL SCALE

SCALE

0 300 600 FEET

APPROXIMATE HORIZONTAL SCALE

LEGEND

- FILL MATERIAL
- SM — SILTY SAND OR SILT AND SAND MIXTURE
- CL — NON-HUMUS CLAY, SANDY CLAY, SILTY CLAY, LOW TO MEDIUM PLASTICITY
- CH — INORGANIC CLAY, HIGH PLASTICITY

NOTE: SEE FIGURE 18 FOR CROSS-SECTION LOCATION.

CLECO Cajun, LLC

Big Cajun II Power Plant

Cross Sections - 5

Pointe Coupee Parish

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

Drawn:	JP
Checked:	RS
Approved:	RS
Date:	10/21/20
Dwg. No.:	367-20-0004-APP-F-12

Figure F-12

APPENDIX G

STRUCTURAL STABILITY ASSESSMENT

CCR COMPLIANCE

FLY ASH BASIN AND BOTTOM ASH BASIN STRUCTURAL INTEGRITY ASSESSMENT REPORT

Prepared for:

Louisiana Generating LLC, a subsidiary of NRG
Big Cajun II
10431 Cajun II Road
New Roads, LA 70760

Prepared by:

CB&I Environmental & Infrastructure, Inc.
Baton Rouge, LA 70809

October 2016

Table of Contents

List of Figures

List of Appendices

List of Acronyms

CB&I	CB&I Environmental and Infrastructure, Inc.
BC II	Big Cajun II Plant
CCR	Coal Combustion Residuals
cm/sec	centimeters per second
EAP	Emergency Action Plan
EPA	U.S. Environmental Protection Agency
FOS	Factor of Safety
LAC	Louisiana Administrative Code
LaGen	Louisiana Generating, LLC
LDEQ	Louisiana Department of Environmental Quality
LPDES	Louisiana Pollutant Discharge Elimination System
MSL	Mean Sea Level
NRG	NRG Energy, Inc.
RCRA	Resource Conservation and Recovery Act
SWMU	Solid Waste Management Units
USGS	U.S. Geological Survey
yd^3	cubic yards

Structural Integrity Assessment Report/Amendment Log §257.73

Date of Review	Reviewer Name	Amendment Required (YES/NO)	Sections Amended and Reason

CCR Regulatory Requirements

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(a)(1) stipulates: *No later than, December 17, 2015, the owner or operator of the CCR unit must place on or immediately adjacent to the CCR unit a permanent identification marker, at least six feet high showing the identification number of the CCR unit, if one has been assigned by the state, the name associated with the CCR unit and the name of the owner or operator of the CCR unit.*	Section 4.1.1
§257.73(a)(2)(i)stipulates: *(i) The owner or operator of the CCR unit must conduct initial and periodic hazard potential classification assessments of the CCR unit according to the timeframes specified in paragraph (f) of this section. The owner or operator must document the hazard potential classification of each CCR unit as either a high hazard potential CCR surface impoundment, a significant hazard potential CCR surface impoundment, or a low hazard potential CCR surface impoundment. The owner or operator must also document the basis for each hazard potential classification.*	Section 4.1.2

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(a)(2)(ii)stipulates: *(ii) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial hazard potential classification and each subsequent periodic classification specified in paragraph (a)(2)(i) of this section was conducted in accordance with the requirements of this section.*	Section 4.1.2

USEPA CCR Criteria **40 CFR 257.73**	**NRG Big Cajun II Power Plant** **Structural Integrity Review**
§257.73(a)(2)(iii) & (iv) stipulates: *(iii) Changes in hazard potential classification.* *(A) If the owner or operator of a CCR unit determines during a periodic hazard potential assessment that the CCR unit is no longer classified as either a high hazard potential CCR surface impoundment or a significant hazard potential CCR surface impoundment, then the owner or operator of the CCR unit is no longer subject to the requirement to prepare and maintain a written Emergency Action Plan (EAP) beginning on the date the periodic hazard potential assessment documentation is placed in the facility's operating record as required by § 257.105(f)(5).* *(B) If the owner or operator of a CCR unit classified as a low hazard potential CCR surface impoundment subsequently determines that the CCR unit is properly re-classified as either a high hazard potential CCR surface impoundment or a significant hazard potential CCR surface impoundment, then the owner or operator of the CCR unit must prepare a written EAP for the CCR unit as required by paragraph (a)(3)(i) of this section within six months of completing such periodic hazard potential assessment.* *(iv) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the written EAP, and any subsequent amendment of the EAP, meets the requirements of paragraph (a)(3) of this section.*	Sections 4.1.2 and 4.1.3

USEPA CCR Criteria **40 CFR 257.73**	**NRG Big Cajun II Power Plant** **Structural Integrity Review**
§257.73(a)(2)(v) stipulates: *(v) Activation of the EAP. The EAP must be implemented once events or circumstances involving the CCR unit that represent a safety emergency are detected, including conditions identified during periodic structural stability assessments, annual inspections, and inspections by a qualified person.*	Section 4.1.3

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(a)(4)(c) stipulates: *(4) The CCR unit and surrounding areas must be designed, constructed, operated, and maintained with vegetated slopes of dikes not to exceed a height of 6 inches above the slope of the dike, except for slopes which are protected with an alternate form(s) of slope protection.* *(c)(1) No later than October 17, 2016, the owner or operator of the CCR unit must compile a history of construction, which shall contain, to the extent feasible, the information specified in* *(i) The name and address of the person(s) owning or operating the CCR unit; the name associated with the CCR unit; and the identification number of the CCR unit if one has been assigned by the state.* *(ii) The location of the CCR unit identified on the most recent U.S. Geological Survey (USGS) 7½ minute or 15 minute topographic quadrangle map, or a topographic map of equivalent scale if a USGS map is not available.* *(iii) A statement of the purpose for which the CCR unit is being used.* *(iv) The name and size in acres of the watershed within which the CCR unit is located.* *(v) A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is constructed.*	Sections 4.1.4 and 4.1.5

USEPA CCR Criteria **40 CFR 257.73**	**NRG Big Cajun II Power Plant** **Structural Integrity Review**
§257.73(a)(4)(c) stipulates: *(vi) A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit; the method of site preparation and construction of each zone of the CCR unit; and the approximate dates of construction of each successive stage of construction of the CCR unit.* *(vii) At a scale that details engineering structures and appurtenances relevant to the design, construction, operation, and maintenance of the CCR unit, detailed dimensional drawings of the CCR unit, including a plan view and cross sections of the length and width of the CCR unit, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the normal operating pool surface elevation and the maximum pool surface elevation following peak discharge from the inflow design flood, the expected maximum depth of CCR within the CCR surface impoundment, and any identifiable natural or manmade features that could adversely affect operation of the CCR unit due to malfunction or mis-operation.* *(viii) A description of the type, purpose, and location of existing instrumentation.* *(ix) Area-capacity curves for the CCR unit.* *(x) A description of each spillway and diversion design features and capacities and calculations used in their determination.* *(xi) The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.*	Section 4.1.5

USEPA CCR Criteria 40 CFR 257.73	**NRG Big Cajun II Power Plant Structural Integrity Review**
§257.73(a)(4)(c) stipulates: *(xii) Any record or knowledge of structural instability of the CCR unit.*	Section 4.1.5

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(d)(1) stipulates: *(d) Periodic structural stability assessments. (1) The owner or operator of the CCR unit must conduct initial and periodic structural stability assessments and document whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein. The assessment must, at a minimum, document whether the CCR unit has been designed, constructed, operated, and maintained with:* *(i) Stable foundations and abutments;* *(ii) Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown;* *(iii) Dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit;* *(iv) Vegetated slopes of dikes and surrounding areas not to exceed a height of six inches above the slope of the dike, except for slopes which have an alternate form or forms of slope protection;* *(v) A single spillway or a combination of spillways configured as specified in paragraph (d)(1)(v)(A) of this section. The combined capacity of all spillways must be designed, constructed, operated, and maintained to adequately manage flow during and following the peak discharge from the event specified in paragraph (d)(1)(v)(B) of this section;*	Section 4.1.6

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(d)(1) stipulates: *(A) All spillways must be either:* *(1) Of non-erodible construction and designed to carry sustained flows; or* *(2) Earth- or grass-lined and designed to carry short-term, infrequent flows at non-erosive velocities where sustained flows are not expected.* *(B) The combined capacity of all spillways must adequately manage flow during and following the peak discharge from a:* *(1) Probable maximum flood (PMF) for a high hazard potential CCR surface impoundment; or* *(2) 1000-year flood for a significant hazard potential CCR surface impoundment; or* *(3) 100-year flood for a low hazard potential CCR surface impoundment.* §257.73(d) stipulates: *(vi) 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; and* *(vii) 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.*	Section 4.1.6

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(d)(2) & (3) stipulate: *(2) The periodic assessment described in paragraph (d)(1) of this section must identify any structural stability deficiencies associated with the CCR unit in addition to recommending corrective measures. If a deficiency or a release is identified during the periodic assessment, the owner or operator unit must remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measures taken.* *(3) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial assessment and each subsequent periodic assessment was conducted in accordance with the requirements of this section.*	Section 4.1.6

USEPA CCR Criteria 40 CFR 257.73	**NRG Big Cajun II Power Plant Structural Integrity Review**
§257.73(e)(1) stipulates: *(e) Periodic safety factor assessments. (1) The owner or operator must conduct an initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety for each CCR unit achieve the minimum safety factors specified in paragraphs (e)(1)(i) through (iv) of this section for the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations* *(i) The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.* *(ii) The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.* *(iii) The calculated seismic factor of safety must equal or exceed 1.00.* *(iv) For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.*	Section 4.1.7

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(e)(2) stipulates: *(2) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial assessment and each subsequent periodic assessment specified in paragraph (e)(1) of this section meets the requirements of this section.*	Section 4.1.6
§257.73(f)(1) stipulates: *(f) Timeframes for periodic assessments—(1) Initial assessments. Except as provided by paragraph (f)(2) of this section, the owner or operator of the CCR unit must complete the initial assessments required by paragraphs (a)(2), (d), and (e) of this section no later than October 17, 2016. The owner or operator has completed an initial assessment when the owner or operator has placed the assessment required by paragraphs (a)(2), (d), and (e) of this section in the facility's operating record as required by § 257.105(f)(5), (10), and (12).* *(3) Frequency for conducting periodic assessments. The owner or operator of the CCR unit must conduct and complete the assessments required by paragraphs (a)(2), (d), and (e) of this section every five years. The date of completing the initial assessment is the basis for establishing the deadline to complete the first subsequent assessment. The owner or operator has completed an assessment when the relevant assessment(s) required by paragraphs (a)(2), (d), and (e) of this section has been placed in the facility's operating record as required by § 257.105(f)(5), (10), and (12).*	Sections 4.1.2, 4.1.6, 4.1.7, and 5.0

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(f)(4) stipulates: *(4) Closure of the CCR unit. An owner or operator of a CCR unit who either fails to complete a timely safety factor assessment or fails to demonstrate minimum safety factors as required by paragraph (e) of this section is subject to the requirements of §257.101(b)(2).*	Section 4.1.7
§257.73(g) stipulates: *(g) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(f), the notification requirements specified in §257.106(f), and the internet requirements specified in § 257.107(f).*	Section 5.0

1.0 *INTRODUCTION*

CB&I Environmental and Infrastructure, Inc. (CB&I) has prepared the following Structural Integrity Assessment documentation at the request of Louisiana Generating, LLC (LaGen) (a subsidiary of NRG Energy, Inc. [NRG]) for the Fly Ash Basin and Bottom Ash Basin (Ash Basins) at the Big Cajun II Power Plant (BC II Plant) located near New Roads, Pointe Coupee Parish, Louisiana (**Figure 1**). The BC II Plant is a coal-fired and natural gas-fired power plant that has been in operation since 1980. The Fly Ash Basin and Bottom Ash Basin have been deemed to be regulated coal combustion residual (CCR) units by the U. S. Environmental Protection Agency (EPA), through the Disposal of Coal Combustion Residuals from Electric Utilities Final Rule (CCR Rule) 40 CFR §257 and §261.

There are five solid waste management units (SWMUs) at the BC II Plant that are operated as industrial surface impoundments in accordance with the Louisiana Department of Environmental Quality (LDEQ), Louisiana Solid Waste Regulations (Louisiana Administrative Code [LAC] Title 33: part VII) under Permit Number P-0108R1 for Facility Identification Number GD-077-0583. Two of the five WMUs are required to comply with the requirements of the CCR Rule, which include the Fly Ash Basin and Bottom Ash Basin. The other three LDEQ-permitted surface impoundments at the BC II Plant that are not subject to the CCR Rule requirements include the Primary Louisiana Pollutant Discharge Elimination System (LPDES) Treatment Pond, Secondary LPDES Treatment Pond, and Rainfall Surge Pond (**Figure 2**).

LaGen has completed an initial structural integrity assessment of the Fly Ash Basin and Bottom Ash Basin in line with the requirements outlined in §257.73 for Structural Integrity Criteria for Existing CCR Surface Impoundments. This assessment document is presented to provide supporting documentation of the evaluation of the structural stability for the Fly Ash Basin and Bottom Ash Basin at LaGen's BC II Plant. The following Plan meets all the structural integrity assessment requirements outlined in the Rule, which are further described in Section 2.0.

2.0 *REGULATORY OVERVIEW OF CCR STRUCTURAL INTEGRITY REQUIREMENTS*

On April 17, 2015, the EPA published the CCR Rule under Subtitle D of the Resource Conservation and Recovery Act (RCRA) as 40 CFR Parts 257 and 261. The purpose of the CCR Rule is to regulate the management of coal combustion residuals in regulated units for landfill and surface impoundments. Section 257.73 of the CCR Rule requires owners or operators of CCR units to meet and document specific requirements related to the structural integrity criteria for existing CCR surface impoundments, including providing the following:

- Permanent identification marker for each CCR unit
- A summary of the history of construction for each CCR unit
- Initial and periodic assessments to determine the CCR unit hazard potential classification
- Initial and periodic CCR Unit structural stability assessments
- Initial and periodic CCR unit safety factor assessments

The following citations from the Rule are applicable for the Ash Basins as discussed in this document:

§257.73(a)(1) stipulates:

(1) No later than December 17, 2015, the owner or operator of the CCR unit must place on or immediately adjacent to the CCR unit a permanent identification marker, at least six feet high showing the identification number of the CCR unit, if one has been assigned by the state, the name associated with the CCR unit and the name of the owner or operator of the CCR unit.

§257.73(a)(2)(i) through (v) stipulate:

(2) Periodic hazard potential classification assessments.

(i) The owner or operator of the CCR unit must conduct initial and periodic hazard potential classification assessments of the CCR unit according to the timeframes specified in paragraph (f) of this section. The owner or operator must document the hazard potential classification of each CCR unit as either a high hazard potential CCR surface impoundment, a significant hazard potential CCR surface impoundment, or a low hazard potential CCR surface impoundment. The owner or operator must also document the basis for each hazard potential classification.

(ii) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial hazard potential classification and each subsequent periodic classification specified in paragraph (a)(2)(i) of this section was conducted in accordance with the requirements of this section.

(iii) Changes in hazard potential classification.

(A) If the owner or operator of a CCR unit determines during a periodic hazard potential assessment that the CCR unit is no longer classified as either a high hazard potential CCR surface impoundment or a significant hazard potential CCR surface impoundment, then the owner or operator of the CCR unit is no longer subject to the requirement to prepare and maintain a written Emergency Action Plan (EAP) beginning on the date the periodic hazard potential assessment documentation is placed in the facility's operating record as required by §257.105(f)(5).

(B) If the owner or operator of a CCR unit classified as a low hazard potential CCR surface impoundment subsequently determines that the CCR unit is properly re-classified as either a high hazard potential CCR surface impoundment or a significant hazard potential CCR surface impoundment, then the owner or operator of the CCR unit must prepare a written EAP for the CCR unit as required by paragraph (a)(3)(i) of this section within six months of completing such periodic hazard potential assessment.

(iv) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the written EAP, and any subsequent amendment of the EAP, meets the requirements of paragraph (a)(3) of this section.

(v) Activation of the EAP. The EAP must be implemented once events or circumstances involving the CCR unit that represent a safety emergency are detected, including conditions identified during periodic structural stability assessments, annual inspections, and inspections by a qualified person.

§257.73(a)(4)(c)(i) through (xii) stipulates:

(4) The CCR unit and surrounding areas must be designed, constructed, operated, and maintained with vegetated slopes of dikes not to exceed a height of 6 inches above the slope of the dike, except for slopes which are protected with an alternate form(s) of slope protection.

(c)(1) No later than October 17, 2016, the owner or operator of the CCR unit must compile a history of construction, which shall contain, to the extent feasible, the information specified below:

(i) The name and address of the person(s) owning or operating the CCR unit; the name associated with the CCR unit; and the identification number of the CCR unit if one has been assigned by the state.

(ii) The location of the CCR unit identified on the most recent U.S. Geological Survey (USGS) 7 1⁄2 minute or 15 minute topographic quadrangle map, or a topographic map of equivalent scale if a USGS map is not available.

(iii) A statement of the purpose for which the CCR unit is being used.

(iv) The name and size in acres of the watershed within which the CCR unit is located.

(v) A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is constructed.

(vi) A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit; the method of site preparation and construction of each zone of the CCR unit; and the approximate dates of construction of each successive stage of construction of the CCR unit.

(vii) At a scale that details engineering structures and appurtenances relevant to the design, construction, operation, and maintenance of the CCR unit, detailed dimensional drawings of the CCR unit, including a plan view and cross sections of the length and width of the CCR unit, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the normal operating pool surface elevation and the maximum pool surface elevation following peak discharge from the inflow design flood, the expected maximum depth of CCR within the CCR surface impoundment, and any identifiable natural or manmade features that could adversely affect operation of the CCR unit due to malfunction or mis-operation.

(viii) A description of the type, purpose, and location of existing instrumentation.

(ix) Area-capacity curves for the CCR unit.

(x) A description of each spillway and diversion design features and capacities and calculations used in their determination.

(xi) The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.

(xii) Any record or knowledge of structural instability of the CCR unit.

§257.73(d)(1)(i) through (vii) stipulates:

(d) Periodic structural stability assessments.

(1) The owner or operator of the CCR unit must conduct initial and periodic structural stability assessments and document whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein. The assessment must, at a minimum, document whether the CCR unit has been designed, constructed, operated, and maintained with:

(i) Stable foundations and abutments;

(ii) Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown;

(iii) Dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit;

(iv) Vegetated slopes of dikes and surrounding areas not to exceed a height of six inches above the slope of the dike, except for slopes which have an alternate form or forms of slope protection;

(v) A single spillway or a combination of spillways configured as specified in paragraph (d)(1)(v)(A) of this section. The combined capacity of all spillways must be designed, constructed, operated, and maintained to adequately manage flow during and following the peak discharge from the event specified in paragraph (d)(1)(v)(B) of this section;

(A) All spillways must be either:

(*1*) Of non-erodible construction and designed to carry sustained flows; or

(*2*) Earth- or grass-lined and designed to carry short-term, infrequent flows at non-erosive velocities where sustained flows are not expected.

(B) The combined capacity of all spillways must adequately manage flow during and following the peak discharge from a:

(*1*) Probable maximum flood (PMF) for a high hazard potential CCR surface impoundment; or

(*2*) 1000-year flood for a significant hazard potential CCR surface impoundment; or

(*3*) 100-year flood for a low hazard potential CCR surface impoundment.

(vi) 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; and

(vii) 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.

§257.73(d)(2) & (3) stipulate:

(2) The periodic assessment described in paragraph (d)(1) of this section must identify any structural stability deficiencies associated with the CCR unit in addition to recommending corrective measures. If a deficiency or a release is identified during the periodic assessment, the owner or operator unit must remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measures taken.

(3) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial assessment and each subsequent periodic assessment was conducted in accordance with the requirements of this section.

§257.73(e)(1)(i) through (iv) stipulates:

(e) Periodic safety factor assessments.

(1) The owner or operator must conduct an initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety for each CCR unit achieve the minimum safety factors specified in paragraphs (e)(1)(i) through (iv) of this section for the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations.

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

(ii) The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.

(iii) The calculated seismic factor of safety must equal or exceed 1.00.

(iv) For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

§257.73(e)(2) stipulates:

(2) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial assessment and each subsequent periodic assessment specified in paragraph (e)(1) of this section meets the requirements of this section.

§257.73(f)(1) stipulates:

(f) Timeframes for periodic assessments

(1) Initial assessments. Except as provided by paragraph (f)(2) of this section, the owner or operator of the CCR unit must complete the initial assessments required by paragraphs (a)(2), (d), and (e) of this section no later than October 17, 2016. The owner or operator has completed an initial assessment when the owner or operator has placed the assessment required by paragraphs (a)(2), (d), and (e) of this section in the facility's operating record as required by § 257.105(f)(5), (10), and (12).

§257.73(f)(3) stipulates:

(3) Frequency for conducting periodic assessments. The owner or operator of the CCR unit must conduct and complete the assessments required by paragraphs (a)(2), (d), and (e) of this section every five years. The date of completing the initial assessment is the basis for establishing the deadline to complete the first subsequent assessment. The owner or operator has completed an assessment when the relevant assessment(s) required by paragraphs (a)(2), (d), and (e) of this section has been placed in the facility's operating record as required by § 257.105(f)(5), (10), and (12).

§257.73(f)(4) stipulates:

(4) Closure of the CCR unit. An owner or operator of a CCR unit who either fails to complete a timely safety factor assessment or fails to demonstrate minimum safety factors as required by paragraph (e) of this section is subject to the requirements of § 257.101(b)(2).

§257.73(g) stipulates:

(g) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(f), the notification requirements specified in § 257.106(f), and the internet requirements specified in § 257.107(f).

3.0 *ASH BASINS OVERVIEW*

Pertinent site information and history related to the installation and operation of the Ash Basins are presented below to address the requirement of the documentation of the history of the CCR units and to provide context for the CCR Rule structural integrity documentation that follows.

3.1 Location, Topography, and Character

The LaGen BC II Plant is located at 10431 Cajun II Road, New Roads, Pointe Coupee Parish, Louisiana. The BC II Plant is situated in Sections 4, 5, and 37 in Township 4 South and Range 11 East. The Fly Ash Basin is located on the southwest end of the surface impoundments west of the BC II Plant and is bordered on the east by the Bottom Ash Basin; on the west by wooded property, a drainage ditch, and agricultural land; on the north by wooded property and agricultural land; and on the south by wooded property and grassy fields. The Fly Ash Basin and surrounding area are shown on **Figures 1 and 2**. The Bottom Ash Basin is located west of the BC II Plant. The Bottom Ash Basin is bordered on the west by the Fly Ash Basin; on the north by wooded property and agricultural land; on the east by the Treatment Ponds; and on the south by wooded property and grassy fields (**Figures 1 and 2**).

The Fly Ash Basin currently being filled has an area of approximately 175 acres. It was constructed above natural grade with a base of approximately 30 feet Mean Sea Level (MSL) and a surrounding berm with a design crest of 40-foot MSL. The existing site topography adjacent to the Fly Ash Basin is depicted on **Figure 3**. The Fly Ash Basin has an approximate capacity of 1,750 acre-feet with a permitted total ash storage capacity of 3,905,000 cubic yards [yd^3]). The soils underlying the Fly Ash Basin consist of naturally occurring and/or recompacted clayey soil that is a minimum of 3 feet thick to over 10 feet thick in some areas.

The Bottom Ash Basin currently being filled has an area of approximately 66 acres. It was constructed above natural grade with a base of approximately 30 feet MSL and a surrounding berm with a design crest of 48-foot MSL. The existing site topography adjacent to the Bottom Ash Basin is depicted on **Figure 3**. The Bottom Ash Basin has an approximate capacity of 1,188 acre-feet with a permitted total ash storage capacity of 2,585,000 yd^3. Similar to the Fly Ash Basin, the soils underlying the Bottom Ash Basin consist of naturally occurring and/or recompacted clayey soil that is a minimum of 3 feet thick to over 10 feet thick in some areas.

3.2 Existing Regulatory Permits

The Ash Basins have been granted and are currently operating under a LDEQ Solid Waste Permit as an industrial surface impoundment in accordance with the Louisiana Solid Waste

Regulations (LAC 33:VII) under Permit Number P-0108R1 and Facility Identification Number GD-077-0583. The Solid Waste Permit renewal was issued by the LDEQ on February 24, 2011 and allows CCR materials generated on-site at the LaGen BC II Plant to be properly disposed of within the boundaries of the Ash Basins.

3.3 Ash Generation, Recycling, and Disposal

Fly ash and bottom ash have been generated at the BC II Plant since they were constructed and became operational in 1980. Fly ash is generated from the burning of finely pulverized coal in high efficiency boilers. The fly ash is composed primarily of oxides of silicon, aluminum, calcium, sulfur, and iron and is typically a fine, spherical particle ranging in diameter from 0.5 to 100 microns, which can be used as a soil or aggregate stabilization agent.

Fly ash that is generated at the BC II Plant has historically been recycled (sold for beneficial reuse as a cement additive, for road base, and/or for soil stabilization applications) and/or transported to the Fly Ash Basin for disposal. Recycled fly ash rates depend on the market demand and can affect the life of the basin due to the variability in the amount of recycled material. Disposal rates therefore vary based on recycling opportunities, which vary between years. When the demand for ash exceeds production, the fly ash in the basin can be removed and sold.

Bottom ash is generated concurrently with fly ash during the combustion of coal in the boilers when particles of ash fuse together. These fused particles become too large to remain entrained in the rising flue gas and fall to the bottom of the boiler. Particles of bottom ash vary in diameter but approximate the size of coarse sand. Due to their similar origins, bottom ash and fly ash have the same approximate chemical makeup. The Bottom Ash Basin receives bottom ash from Units 1 and 3, as well as sediment from the clarifier beds associated with the cooling towers and boilers. Unit 2 is currently a gas-fired unit; therefore, ash is no longer generated by this unit. The clarifier sediments are piped to the southeast corner of the Bottom Ash Basin. The clarifier sediments are produced when water from the Mississippi River is clarified and softened for use as cooling water or boiler water. These sediments consist primarily of Mississippi River water naturally occurring silts and clays. They also contain some lime, sodium aluminate, and trace amounts of a water treatment polymer. The filling of the basin started along the south levee and proceeded northward.

3.4 Ash Basin Operations

3.4.1 Fly Ash Basin

Fly ash that is placed in the Fly Ash Basin for disposal is collected, stored in a silo, and transported by truck in dry powdered form to the Fly Ash Basin. Currently transport trucks discharge their loads of fly ash in the Fly Ash Basin and dozer equipment then spreads the fill evenly. The fly ash is hydrated by rainfall and compacted so that it will harden as it dries. Straight hardened fly ash has a theoretical hydraulic conductivity range of 10^{-6} centimeters per second (cm/sec) to 10^{-7} cm/sec. Periodic dozing of the fly ash material occurs as needed, within the active area to maintain a relatively uniform height.

Daily cover is not applied in the active area of fly ash disposal due to the fly ash being wetted (by rainfall) and hardened, and thereby minimizing potential dust generation. Additionally, no intermediate cover is applied to the basin due to the rapid hardening of the fly ash. Weekly (7-day) inspections and annual reporting are undertaken for the Fly Ash Basin in line with site inspection requirements for CCR units (§257.83[b] Inspection Requirements for CCR Surface Impoundments) to identify any stability, operational, and/or safety issues which require attention.

During the 2015 annual inspection of the Fly Ash Basin, observations indicated the water level inside the basin was approximately 5 feet below the crest of the levee and approximately two-thirds of the Fly Ash Basin was covered with open water. Rainfall runoff is removed from the basin by a stormwater runoff collection system. Flood control is managed in accordance with the CCR Rule Inflow Design Flood Control System Plan for the site.

Under current operations, the Fly Ash Basin surface water runoff is directed by an interior drainage swale to a pipe connection into the Bottom Ash Basin. The Bottom Ash Basin process water and surface water, combined with storm water from the Fly Ash Basin, are directed by an interior swale to a weir located at the northeast corner of the Bottom Ash Basin. A 30-inch diameter pipe carries the combined water by gravity flow to the Rainfall Surge Pond. Water from the Rainfall Surge Pond is then pumped into the Primary Treatment Basin for further treatment. Water flows by gravity from the Primary Treatment Basin to the Secondary Treatment Basin. A pump station moves water from the Secondary Treatment Basin to the Mississippi River discharge point in accordance with the Plant's LPDES permit (Permit No. LA0054135).

3.4.2 Bottom Ash Basin

The bottom ash from Unit 1 is collected in hoppers at the base of the boiler of Unit 1 and then transported hydraulically (sluiced) through a pipe directly to the Bottom Ash Basin. Bottom ash from Unit 3 is collected in hoppers at the base of the boiler and trucked in a hydrated state to the southwest corner of the Bottom Ash Basin for disposal. The clarifier sediments are piped to the southeast corner of the Bottom Ash Basin. The filling of the basin started along the south levee and proceeded northward.

Periodic dozing of the bottom ash material occurs as needed, within the active area to maintain a relatively uniform height. Daily and/or interim cover is not applied in the active area of bottom ash disposal. The bottom ash is wet and/or transported in hydrated form that prevents potential dust generation. Weekly (7-day) inspections and annual reporting are undertaken for the Bottom Ash Basin in line with site inspection requirements for CCR units (§257.83[b]: Inspection Requirements for CCR Surface Impoundments) to identify any stability, operational, and/or safety issues which require attention.

During the 2015 annual inspection of the Bottom Ash Basin, observations indicated there was minimal open water in the Bottom Ash Unit and the bottom of the unit was covered with bottom ash. The north half of the Basin was covered to a level of about 15 feet below the crest of the levee, while the southern half was filled to about the level of the levee. The southern half also had a large stockpile of ash at the ash disposal location. The stockpile was approximately 15 to 20 feet tall, but was no closer than approximately 50 feet from the levee. Rainfall runoff is removed from the basin by a stormwater runoff collection system.

As previously described, the Bottom Ash Basin sluice water and surface water is combined with storm water from the Fly Ash Basin and is treated and discharged to the Mississippi River in accordance with the Plant's LPDES permit (Permit No. LA0054135).

4.0 *STUCTURAL SATABILITY DOCUMENTATION*

4.1 *Structural Stability Criteria and Requirements*

Supporting documentation for the structural integrity criteria for the Fly Ash Basin and Bottom Ash Basin are presented below in accordance with the CCR Rule requirements. The applicable structural stability criteria and certification/recordkeeping requirements are as follows:

4.1.1 Ash Basin Identification Marker

In December 2015, identification markers were installed at the Fly Ash and Bottom Ash Basins in accordance with the applicable CCR Rule requirements. The markers include the name associated with the CCR unit, the name of the facility, and the name of the owner/operator of the CCR unit. The location of each of the markers was surveyed and documentation/certification of the installation and survey is maintained at the BC II Plant, and placed in the facilities operating records in December 2015. A copy of the marker installation documentation is included in **Appendix A**.

4.1.2 Periodic Hazard Potential Classification Assessments

The initial hazard potential classification assessments of the Fly Ash Basin and Bottom Ash Basin were completed in accordance with the CCR Rule requirement. The basis for the criteria used to evaluate the hazard potential assessment was in accordance with the ‘‘Guidelines for Inspections of Existing Dams.’’ New Jersey Department of Environmental Protection—Dam Safety (January 2008). EPA modeled its impoundment condition rating criteria on those developed by the State of New Jersey. In developing the criteria that were used to conduct the assessments, a standard rating system was developed to classify the units’ suitability for continued safe and reliable operation.

The potential hazard classes defined in the CCR Rule are as follows:

- **High hazard potential** CCR surface impoundment means a diked surface impoundment where failure or mis-operation will probably cause loss of human life.
- **Significant hazard potential** CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.
- **Low hazard potential** CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life and low economic

and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.

An evaluation of the possible adverse incremental consequences that could result from the release of water or stored contents due to failure of the diked CCR surface impoundments or mis-operation of the diked surface impoundments was performed. It was determined that failure or mis-operation of the diked surface impoundments was unlikely to cause: loss of human life, economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns. This determination was based on the materials stored in the impoundments and the impoundment's capacity and physical location relative to downgradient inhabitants/structures and environmental systems. Specifically, it was determined that:

- The fly ash stored in the Fly Ash Basin is a pozzolanic material, which forms a slow hardening cement in the presence of water. This produces a hard, structurally stable compound with very low permeability that has a low susceptibility to flow beyond the basin levees. The rainwater runoff that is also impounded in the Basin is more susceptible to flow from the basin if the basin levee were to fail.
- The bottom ash stored in the Bottom Ash Basin consists of particles that are the approximate size of coarse sand, which makes this material less susceptible to flow over long distances. The volume of rainwater stored in the Bottom Ash Basin is much less than in the Fly Ash Basin resulting in less potential for discharge from the basin if the basin levee were to fail.
- If failure or mis-operation of the diked surface impoundments occurred, topographic control would generally direct flow away from inhabitants and sensitive structures (**Figure 4**).
- Power plant structures are more than 1,500 feet away and are not downgradient from the impoundments.
- Flow would generally initially proceed in a southerly direction until reaching an unnamed drainage ditch located about 750 feet south of the impoundments.
- The nearest downgradient infrastructure is a railroad track that is located on the opposite side of the drainage ditch.
- Flow would then proceed southwesterly in the drainage ditch, flowing under Louisiana (La) Highway 10, which is located approximately 1,200 feet away along the shortest flow path from the nearest impoundment.
- Approximately 700 feet downgradient from La Highway 10, the flow would turn south and go under the railroad track.
- Flow would then proceed south through a 1.75-mile stretch of wooded area.
- The nearest water body is Lake Pattin, located over 2 miles away from the impoundments.

- The impoundment capacities are insufficient to cause physical damage to the railroad track, highway, or environmental damage to the nearest water body, even under complete and sudden failure conditions.
- Due to levees and topographic control, a release would not impact the Mississippi River.
- Losses would likely be principally limited to the facility property.
- Engineering analyses indicate the basin is designed to contain a 100-year storm event. Documentation of this analysis is provided under separate cover in the CCR Rule Fly Ash Basin and Bottom Ash Basin Inflow Design Flood Control System Plan.
- Slope stability engineering analyses indicate the basin design meets the applicable safety factor requirements as specified in the CCR Rule. Documentation of these engineering analyses is provided in Section 4.1.7.

Based on this information, the Fly Ash and Bottom Ash Basins were assigned a low hazard potential. The hazard potential classification assessment for the Ash Basins includes a certification from a qualified professional engineer stating that the initial hazard potential classification was conducted in accordance with the requirements of the applicable CCR Rule. The certification is provided in Section 6.0 of this document.

In accordance with the CCR Rule, the next hazard potential classification assessment will be completed 5 years from the date of the completion of the initial assessment.

4.1.3 Emergency Action Plan

Based on the low hazard potential assigned to the Fly Ash Basin and Bottom Ash Basin, it is not required to develop and implement an EAP for these CCR units at this time. If in the future the CCR unit is properly re-classified as either a high hazard potential or a significant hazard potential, a written EAP will be prepared for the CCR unit within 6 months of completing the subsequent hazard potential assessment. The EAP must be implemented once events or circumstances involving the CCR unit that represent a safety emergency are detected, including conditions identified during periodic structural stability assessments, annual inspections, and inspections by a qualified person.

Although the Fly Ash and Bottom Ash Basins are not required to have an EAP, LaGen has prepared emergency action procedures for the BC II Plant as part of the regulatory permitting of the surface impoundments under the Louisiana Solid Waste Rules and Regulations.

4.1.4 Vegetated Slope Protection

The Fly Ash Basin and Bottom Ash Basin levees and surrounding areas are designed, constructed, operated, and maintained with a protective vegetative cover on the slopes of the levees that is maintained such that it does not exceed a height of 6 inches above the slope of the levee.

4.1.5 History of Construction

A history of the Fly Ash Basin and Bottom Ash Basin construction, to the extent feasible, has been compiled in accordance with the CCR Rule requirements of §257.73(a)(4)(c)(i) through (xii) as follows:

- The name and address of the person(s) owning or operating the CCR unit: LaGen, a subsidiary of NRG Energy, Inc.
- The name associated with the CCR units: Fly Ash Basin and Bottom Ash Basin
- The identification number of the CCR unit (if one has been assigned by the state): Not applicable (numbers have not been assigned by the state).
- The locations of the Fly Ash Basin and Bottom Ash Basin: The locations of the Ash Basins are identified on the US Geological Survey (USGS) topographic map on **Figure 1**.
- The purposes for which the Fly Ash Basin and the Bottom Ash Basin are being used: The Fly Ash Basin is used to collect and store fly ash generated from the burning of finely pulverized coal in a high efficiency boiler. The Bottom Ash Basin is used to store bottom ash from Power Generating Units 1, 2, and 3, as well as sediment from the clarifier beds associated with the cooling towers and boilers.
- The name and size (in acres) of the watershed within which the Fly Ash Basin and the Bottom Ash Basin are located: The False River watershed (Hydrologic Unit Code 080703000101) with an area of 34,640 acres. A map showing the location of the watershed is included in **Appendix B**. However, due to the construction of the Ash Basins, the watershed for the Basins is limited to the Basins themselves.
- The physical and engineering properties of the foundation and abutment materials on which the Fly Ash and the Bottom Ash Basins were constructed: Between 1974 and 1977, prior to construction, an extensive geotechnical soil survey was conducted at the location of the Fly Ash Basin and Bottom Ash Basin to determine the properties of the soil foundation. Soil borings were laid out in a square pattern with a spacing of 250 feet. Classification tests such as the Atterberg Limits Determination, grain size analysis, and compression tests were conducted. Void ratios and permeabilities were also determined at that time. The results of the soil investigation indicated that both of the Ash Basins have a foundation of at least 3 feet of clayey soils, with permeabilities less than 1.0 $X10^{-7}$ cm/sec. In areas where naturally-occurring clayey soils were less than 3 feet thick, recompacted clay was added during construction of the impoundments to ensure a minimum clayey soil thickness of 3 feet below the impoundments.

  The levee system surrounding the Fly Ash and Bottom Ash basins were constructed of compacted earthen, clay material sloped to a ratio of 3:1 (horizontal:vertical) ratio, with a base of approximately 30 feet MSL. The levee system that surrounds the Fly Ash Basin has a design elevation of 40 feet MSL, which is approximately 10 feet above grade. The Fly Ash Basin has an approximate capacity of 1,750 acre-feet with a permitted total fly ash capacity of 3,905,000 yd^3. The levee system that surrounds the Bottom Ash Basin has a design elevation of 48 feet MSL, which is approximately 18 feet above grade. The Bottom Ash Basin has an approximate capacity of 1,188 acre-feet with a permitted total bottom ash capacity of 2,585,000 yd^3.

- The type, size, range, and physical and engineering properties of the materials used in constructing, the method of site preparation and construction, and the date of construction of the Fly Ash and the Bottom Ash Basins: After clearing and grubbing exposed the existing land surface, the Ash Basins were constructed by surrounding the naturally existing clay grade with compacted clay (lifts of approximately 10 to 12 inches) until the designed slope and crest height was reached. Construction of both Ash Basins was completed in 1980.
- Scaled drawings and cross sections that detail the engineering structures and appurtenances relevant to the design, construction, operation, and maintenance of the Fly Ash Bain and the Bottom Ash Basin: The applicable features are included on **Figures 2** through **8**. These drawings include detailed dimensions of the basins, including plan view and cross sections of the basin lengths and widths, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the normal operating pool surface elevation and the maximum pool surface elevation following peak discharge from the inflow design flood, plus the expected maximum depth of CCR within the basins, and any identifiable natural or manmade features that could adversely affect operation of the basins due to malfunction or mis-operation.
- The type, purpose, and location of existing instrumentation for the Fly Ash Basin and the Bottom Ash Basin are as follows: The only instrumentation installed in either of the ash basins is a weir and valve located on the downstream side of the Bottom Ash Basin to control gravity flow into the Rainfall Surge Pond.
- The area-capacity curves for the Fly Ash Basin and the Bottom Ash Basin: The area-capacity curves for the Ash Basins are included in **Appendix C**.
- The spillway and diversion design features and capacities and calculations used in area-capacity curves determinations: Water in the Fly Ash Basin is directed by an interior drainage swale to a 30-inch diameter gravity flow pipe connection into the Bottom Ash Basin. The water in the Bottom Ash Basin is directed by an interior swale to a weir located at the northeast corner of the Bottom Ash Basin. The combined water from the Fly Ash and Bottom Ash Basins is transported by a 30-inch diameter gravity flow pipe to the Rainfall Surge Pond. There is a flow control valve between the Bottom Ash Unit and the Rainfall Surge Pond.

  The design capacity of the 30-inch pipe to transfer water from the Fly Ash Basin to the Bottom Ash Basin was evaluated/calculated in conjunction with the transfer of water from the Bottom Ash Basin to the Rainwater Surge Pond to determine if the capacity is sufficient to prevent overtopping of the levee from a 100-year rain event. This evaluation was conducted using HydroCAD®. Based on the existing hydraulic storage capacity of the Basins and the design storm, it is calculated that the peak water level rises 1.3 feet in the Fly Ash Basin and 2 feet in the Bottom Ash Basin. The general operating procedure is to maintain a minimum freeboard in the Fly Ash Basin of 2 feet. The freeboard on the Bottom Ash Basin is much larger due to the higher berm elevation. Therefore, this minimum 2 feet of freeboard is sufficient to prevent overtopping of the Fly Ash Basin. The calculation indicated the existing storage capacity is sufficient to prevent overtopping of the levee from a 100-year rain event. Additional details on the spillway and diversion design features and capacities and calculations are provided under separate cover in the CCR Rule Fly Ash Basin and Bottom Ash Basin Inflow Design Flood Control System Plan.

- The construction specifications and provisions for surveillance, maintenance, and repair of the Fly Ash and the Bottom Ash Basins: The Facility Operational Plan indicates that daily inspections are performed to detect evidence of leaks, odors, or structural failure, and to verify that a minimum 2.0 feet of freeboard is maintained. If leaks are detected, the LDEQ Waste Permits Division will be notified immediately.

  A more involved weekly inspection looks for surface cracking, low areas, sliding/sloughing/bulging, soft/wet areas, vegetation, animal burrow holes, and erosion. The condition of the interior drainage swale and exit weir are also observed weekly.

  Historically, maintenance and repair has included, but was not limited to: frequent mowing of the crest and outside embankment face, limited areas of regrading/repair of the crest, repairing/rebuilding the inside embankment slope, erosion protection, and removing trees that have grown near the outside dike toe.

  In 2011, the facility implemented a program of regular inspections by dam safety engineers to identify changes in the performance of the embankments in a timely manner.

- Previous records or knowledge of any structural instability of the Fly Ash and the Bottom Ash Basins: Previous geotechnical reconnaissance and assessments/evaluations of the CCR units and other impoundments were conducted by GeoEngineers, Inc. (GeoEngineers) of Baton Rouge, Louisiana at the BC II Plant in 2011, 2012, 2014, and 2015. Summaries of the most recently completed GeoEngineers geotechnical evaluations of the Fly Ash and Bottom Ash Basins from 2014 and 2015 are presented below.

  The GeoEngineers report (GeoEngineers, 2014) titled “Embankment Dike Inspection Services”, August 13, 2014 concluded that the dikes are generally stable, but several areas for consideration were identified, including:

  - Erosion along inside of levees
  - Excessive vegetation growth
  - Desiccation cracking
  - Animal burrows
  - Sloughing or slope instability areas and
  - Toe seepage areas.

The GeoEngineers report (GeoEngineers, 2015) titled “Dike Slope Failure Evaluation”, July 1, 2015 identified three locations where the dikes were potentially unstable, if actions were not taken to address the current conditions.

- North dike of Bottom Ash Unit
- South dike of Fly Ash Unit near west end
- South dike of Fly Ash Unit near center of south dike.

As a result of recommendations detailed in the above 2015 GeoEngineers report, the following actions were undertaken and completed by LaGen in the 4th quarter 2015.

- Removal of the failure slip-plane through excavation of the dike soil to behind and below the failure
- Rebuilding of dike slope with geogrid-reinforced layers to resist the failure plane shear and increase slope stability
- Rebuilding of the outside half of the dike crest where it had settled

CB&I conducted a CCR Annual Inspection of the Fly Ash Basin and Bottom Ash Basin in October 2015. The inspection noted minor erosion, some animal burrows, and some small desiccation cracks, however, there were no signs of distress or malfunction that would indicate actual or potential structural weakness of either ash basin.

4.1.6 Periodic Structural Stability Assessment

The initial structural stability assessment of the Fly Ash and Bottom Ash Basins is included herein in accordance with the applicable CCR Rule requirements. The structural stability assessment for the Fly Ash and Bottom Ash Basins includes documentation that the Basins have been designed, constructed, operated, and maintained consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein. Applicable documentation of the stability assessment with respect to the CCR Rule follows.

During the most recent CCR Annual Inspection conducted in October 2015, the following CCR criteria were observed and found to be adequate, with respect to the design, construction, operation, and maintenance of the Ash Basins:

- Stable foundations
- 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

- Vegetated slopes of dikes and surrounding areas that do not exceed a height of 6 inches above the slope of the dike
- A 30-inch diameter gravity flow pipe (used instead of a spillway) constructed of non-erodible material that is designed to carry sustained flows, with a capacity designed, constructed, operated, and maintained to adequately manage flow during and following the peak discharge from a 100-year flood (as required for the low hazard potential Fly Ash Basin and Bottom Ash Basin)
- A 30-inch gravity flow pipe (used in place of hydraulic structures underlying the base of the CCR unit) that passes through the dike of the Fly Ash Basin and Bottom Ash Basin is maintained with structural integrity and is free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure
- A location not adjacent to a water body, such as a river, stream or lake, such that the slopes are not inundated by water which could affect structural stability

In accordance with the CCR Rule, the periodic structural stability assessment must identify any structural stability deficiencies associated with the CCR unit in addition to recommending corrective measures. If a deficiency or a release is identified during the periodic assessment, the owner or operator must remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measures taken. The previous and current structural stability assessments for the Fly Ash Basin and Bottom Ash Basin noted any observed structural stability deficiencies and recommended corrective measures. Corrective measures completed to date have been documented, the most recent of which were previously described in Section 4.1.5

In accordance with the CCR Rule, the next structural stability assessment will be completed 5 years from the date of the completion of the initial assessment.

The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial structural stability assessment and each subsequent periodic assessment was conducted in accordance with the requirements of this section. As required, the previous assessment has been, and future assessments will be, certified by a qualified professional engineer. The certification is provided in Section 6.0 of this document.

4.1.7 Periodic Safety Factor Assessment

In accordance with the CCR Rule, the owner or operator of the CCR unit must conduct initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety (FOS) for each CCR unit achieve the minimum safety factors specified in paragraphs (e)(1)(i) through (iv) of this section for the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations. A slope stability analysis was performed for the Fly Ash Basin and the Bottom Ash Basin, the details of which is presented in **Appendix D** and summarized below.

The critical cross-section of the embankment for the Fly Ash Basin is located on the southeast corner at the location of the fly ash disposal area. The critical section considered the current emplaced fly ash and the final designed section. Similarly, the location of the Bottom Ash Basin is located along the southern berm. The critical section considered the current stockpiled bottom ash and the final design section. The geometry of the ash piles, ash basin berms, soil strength profiles, and ash strength characteristics were obtained from the GeoEngineers (2011) geotechnical engineering report. The slope stability analyses were performed using the computer program SLOPE/W by GEO-SLOPE International Ltd. The search for the minimum FOS was performed using the automated search routine in SLOPE/W. The analyses also considered the effect of long-term basin water levels and the water level surcharge due to the 100-year design storm. For the purpose of the stability analysis, the elevations of the design elevation of the berms (40 feet for the Fly Ash Basin and 48 feet for the Bottom ash Basin), a freeboard of 2 feet in the Fly Ash Basin (elevation 38 feet), and storm surcharge of 1.3 feet and 1.93 feet in the Fly Ash Basin and Bottom Ash Basin, respectively, were used. Finally, these scenarios were evaluated for non-seismic and seismic effects. A horizontal seismic acceleration coefficient of 0.05 is used which relates to a 2% chance of experiencing peak acceleration in rock in a 50-year period (USGS Seismic Hazard Map, revised May, 2003). A total of 16 scenarios were evaluated and summarized in the tables below. Figures showing each slope stability section and the location of the minimum failure surface are presented in **Appendix D**.

Slope Stability Results Without Seismic Effects				
Area	**Slope Scenario**	**Storage pool elevation, feet**	**Calculated FOS**	**Required FOS**
Fly Ash Basin	Existing Slope	38	2.31	1.5
		39.3	2.29	1.4
	Proposed Capped Slope	38	2.74	1.5
		39.3	2.71	1.4
Bottom Ash Basin	Existing Slope	38	1.50	1.5
		39.9	1.48	1.4
	Proposed Capped Slope	38	1.60	1.5
		39.9	1.58	1.4

The safety factor assessments for the critical cross-sections of the embankments for the Ash Basins have been completed as follows:

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

  The results of the assessment for the Fly Ash Basin indicate minimum FOS for the current ash pile and the design stack for long term water pool are 2.31 and 2.74, respectively. Similarly, the results of the assessment for the Bottom Ash Basin indicate minimum FOS of 1.50 and 1.60, respectively. For these scenarios, the minimum FOS is greater than or equal to the required FOS.

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

  The results of the assessment for the Fly Ash Basin indicate minimum FOS for the current ash pile and the design stack for short term surcharge water pool are 2.29 and 2.71, respectively. Similarly, the results of the assessment for the Bottom Ash Basin indicate minimum FOS of 1.48 and 1.58, respectively. For these scenarios, the minimum FOS is greater than the required FOS.

Slope Stability Results With Seismic Effects (Kh = 0.05				
Area	**Slope Scenario**	**Storage pool elevation, feet**	**Calculated FOS**	**Required FOS**
Fly Ash Basin	Existing Slope	38	1.68	1.0
		39.3	1.66	
	Proposed Capped Slope	38	1.75	
		39.3	1.74	
Bottom Ash Basin	Existing Slope	38	1.12	
		39.9	1.11	
	Proposed Capped Slope	38	1.19	
		39.9	1.18	

- The calculated seismic factor of safety must equal or exceed 1.00.

  The results of the seismic assessment for the Fly Ash Basin indicate minimum FOS for the current ash pile and the design stack for long term water pool are 1.68 and 1.75, respectively. Similarly, the results of the assessment for the Bottom Ash Basin indicate minimum FOS of 1.12 and 1.19, respectively. For these scenarios, the minimum FOS is greater than the required FOS.

The results of the seismic assessment for the Fly Ash Basin indicate minimum FOS for the current ash pile and the design stack for short term surcharge water pool are 1.66 and 1.74, respectively. Similarly, the results of the assessment for the Bottom Ash Basin indicate minimum FOS of 1.11 and 1.18, respectively. For these scenarios, the minimum FOS is greater than the required FOS.

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

  The clayey soils used for construction of the Ash Basins and which comprise the foundation for the berms are not susceptible to liquefaction; therefore, no liquefaction safety factor was calculated.

The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial safety factor assessment and each subsequent periodic assessment specified in paragraph (e)(1) of this section meets the requirements of this section. As required, the previous assessment has been, and future assessments will be, certified by a qualified professional engineer. The certification is provided in Section 6.0 of this document.

An owner or operator of a CCR unit who either fails to complete a timely safety factor assessment or fails to demonstrate minimum safety factors as required by paragraph (e) of this section is subject to the CCR unit closure requirements of § 257.101(b)(2).

In accordance with the CCR Rule, the next safety factor assessment will be completed 5 years from the date of the completion of the initial assessment.

5.0 *RECORD KEEPING/NOTIFICATION REQUIREMENTS*

The BC II Plant will maintain files of all information related to the Stability Integrity Assessment of the Fly Ash Basin and Bottom Ash Basin in a written operating record at the BC II Plant as required by the CCR Rule. This will include documentation of the permanent CCR Unit identification marker, the initial and periodic hazard potential classification assessments, the history of construction and any revisions to it, the initial and periodic structural stability assessments, documentation detailing with corrective measures taken to remedy a deficiency or release, and the initial and periodic safety factor assessments. The files will be retained until closure of the units and/or for at least 5 years following the date of each occurrence, measurement, maintenance, corrective action, report, record, or study. The files for separate CCR units at the Plant will be maintained in one recordkeeping system with files separated by the name or identification number of each CCR unit. It is understood the files may be maintained on microfilm, on a computer, on computer disks, on a storage system accessible by a computer, on magnetic tape disks, or on microfiche.

The CCR Rule also requires that the owner or operator of a CCR unit maintain a publicly accessible Internet site (CCR Web site) that contains specific information related to the CCR unit initial and subsequent Structural Integrity Assessments.

In accordance with the CCR Rule, the BC II Plant will place the Structural Integrity Assessment documentation for the Fly Ash Basin and Bottom Ash Basin, as it becomes available, in the facility's operating record and post it to the CCR Web site (within 30 days of placing the pertinent information in the BC II Plant operating record).

6.0 QUALIFIED PROFESSIOINAL ENGINEER CERTIFICATION

The undersigned registered professional engineer is familiar with the requirements of §257.73 and has visited and examined the BC II Plant Fly Ash Basin and Bottom Ash Basin or has supervised examination of the Big Cajun II Fly Ash Basin and Bottom Ash Basin by appropriately qualified personnel. The undersigned registered professional engineer attests that:

- the initial hazard potential classification and each subsequent periodic hazard potential classification specified in paragraph (a)(2)(i) of section § 257.73 was conducted in accordance with the requirements of this section.
- the initial structural stability assessment and each subsequent periodic assessment in paragraph (d)(1) of section § 257.73 was conducted in accordance with the requirements of this section.
- the initial safety factor assessment and each subsequent periodic assessment specified in paragraph (e)(1) of section § 257.73 meets the requirements of this section.

The CCR Structural Integrity Assessment activities have been prepared in accordance with the requirements of §257.73 and that this assessment is adequate for the Big Cajun II Plant. This certification was prepared as required by §257.73(a)(2)(ii), §257.73(d)(3), and §257.73(e)(2).

Name of Professional Engineer:	Glen R. Landry
Company:	CB&I Environmental, Inc
Signature:	Glen R. Landry
Date:	10/5/16
PE Registration State:	Louisiana
PE Registration Number:	18931

Professional Engineer Seal:

STATE OF LOUISIANA
GLEN R. LANDRY
License No. 18931
PROFESSIONAL ENGINEER
IN
CIVIL ENGINEERING

10/5/16

7.0 *REFERENCES*

CB&I Environmental & Infrastructure, Inc.; 2016; Big Cajun II, Coal Combustion Residual (CCR), Annual Inspection Report, NRG Louisiana Generating, LLC; NRG Energy, Inc.; New Roads, Louisiana.

Environmental Protection Agency; 2015; 40 CFR Parts 257 and 261 Rules and Regulations, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Volume 80, No. 74; Final Rule.

GeoEngineers, Inc.; 2011 (May); Preliminary Geotechnical Engineering Services, Ash Basins/Wastewater Treatment Ponds, Big Cajun II Generating Site, New Roads, Pointe Coupee Parish, Louisiana.

GeoEngineers, Inc.; 2011 (September); Embankment Dike Inspection Services, Ash Basins/Wastewater Treatment Ponds, Big Cajun II Generating Site, New Roads, Pointe Coupee Parish, Louisiana.

GeoEngineers, Inc.; 2012; Geotechnical Engineering Services Report, Dike Seepage Repair, Big Cajun II Generating Site, New Roads, Pointe Coupee Parish, Louisiana.

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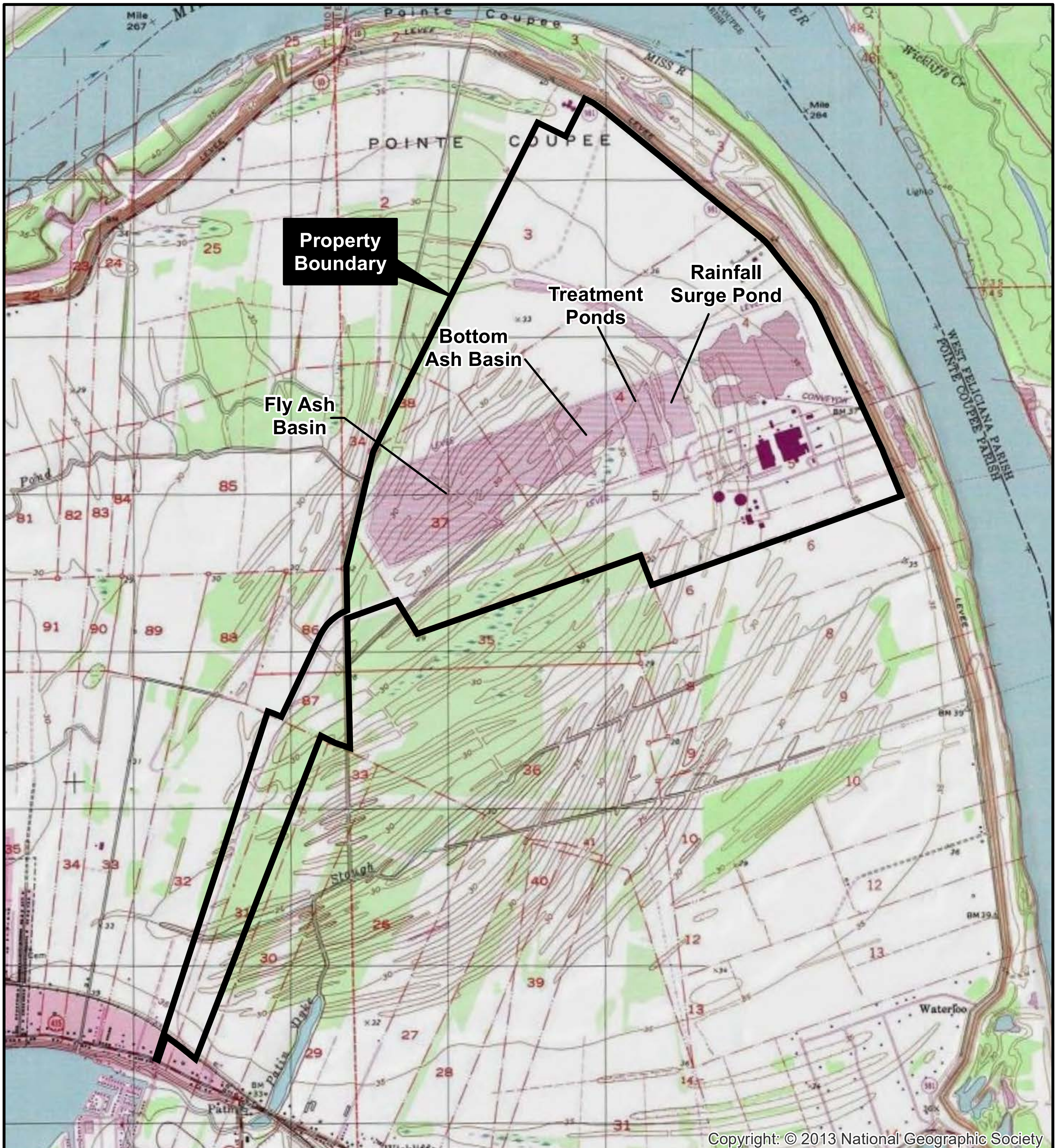
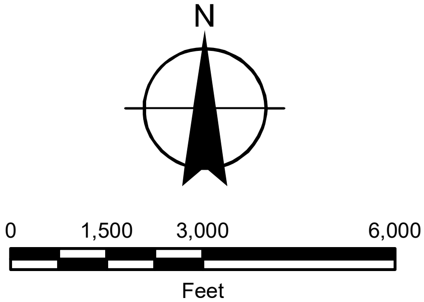
Louis J. Capozzoli and Associates, Inc.; 2006; Geotechnical Investigation, Bottom Ash Storage Pond Expansion, Big Cajun No. 2, Pointe Coupee Parish Plant Site, Louisiana; LJC&A File: 0558.

Shaw Environmental & Infrastructure, Inc.; 2010; Type I Solid Waste Facility Permit, Renewal and Modification Application, Final Copies, Permit No. P-0108 (Volumes 1 of 2 and 2of 2), Louisiana Generating, LLC, Big Cajun II Power Plant, New Roads, Pointe Coupee Parish, Louisiana.

FIGURES



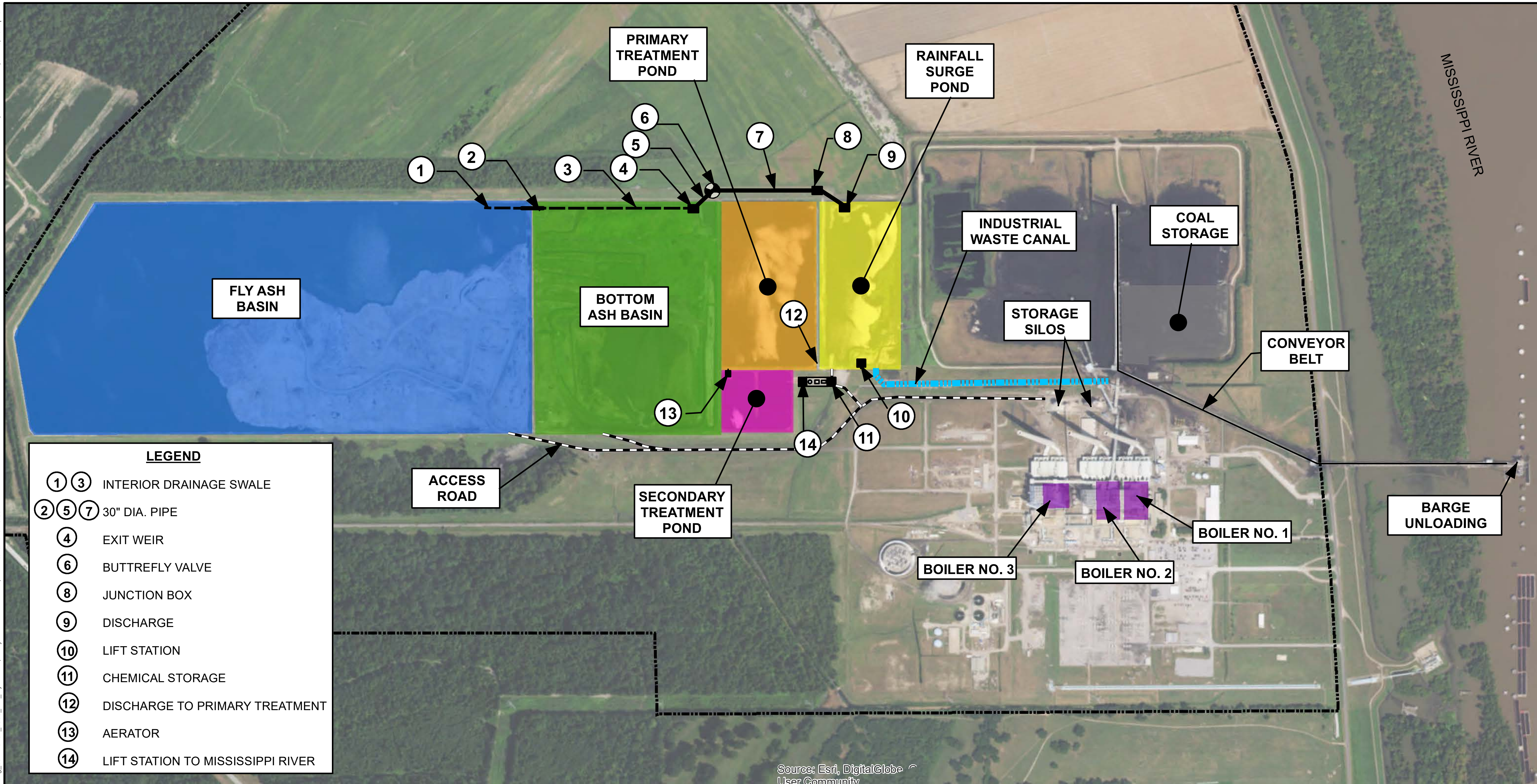


LOUISIANA GENERATING, LLC
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

FIGURE NUMBER	
1	**SITE LOCATION**

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809



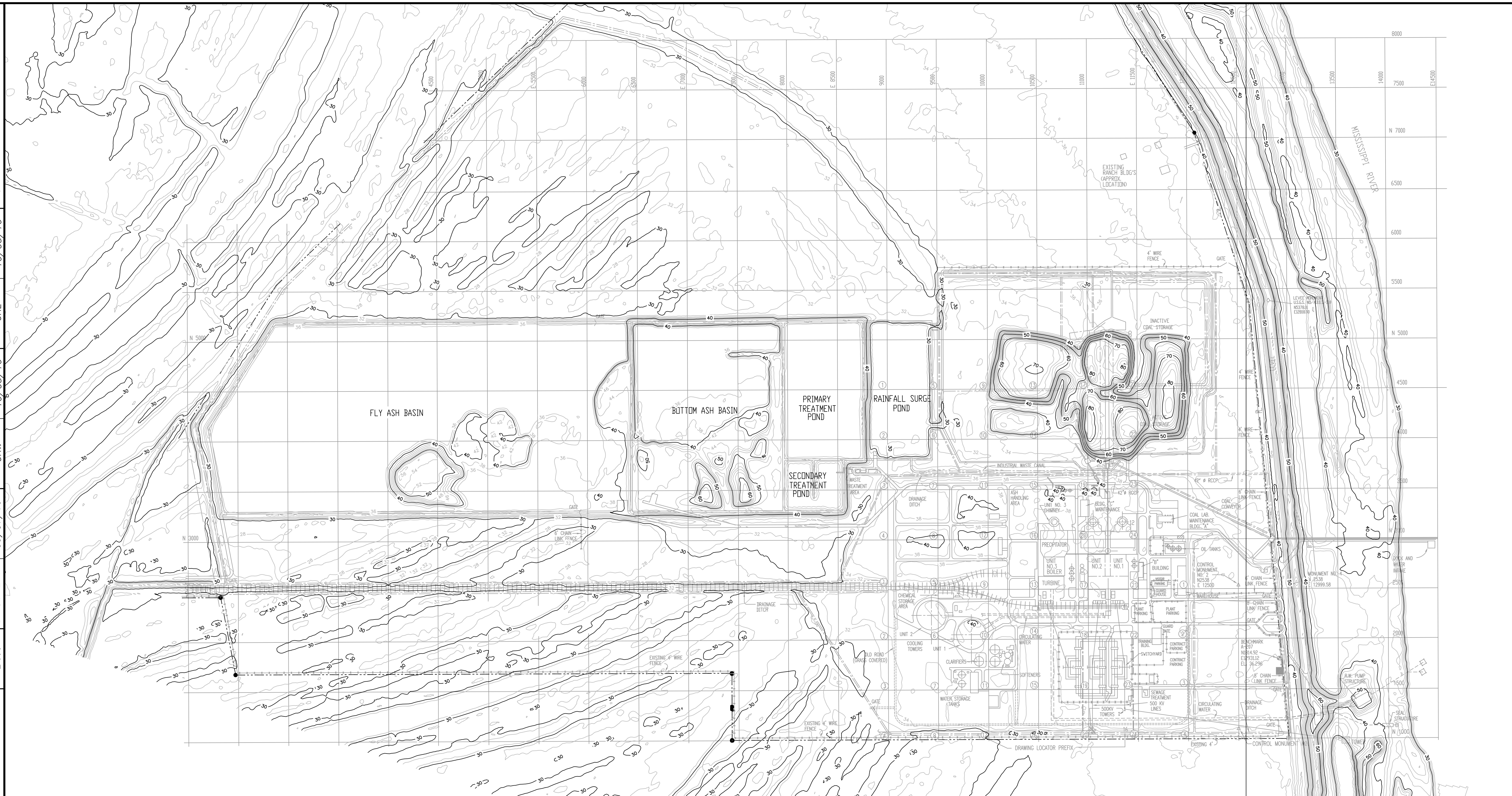
LOUISIANA GENERATING, LLC
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

FIGURE NUMBER 2

SITE LAYOUT

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809



DRAWING NUMBER	APPROVED BY	CHECKED BY	DRAWN BY	OFFICE
631215151_B10	GRL 10/03/16	CRW 10/03/16	D. COMEAUX 09/07/16	BTR

LEGEND

PROPERTY LINE

30 TOPOGRAPHIC CONTOUR (FEET, NGVD 29) WITH 2-FOOT CONTOUR INTERVAL

PLANT NORTH 3000
TRUE NORTH
N

SCALE
0 1000 2000 FEET

LOUISIANA GENERATING, L.L.C.
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

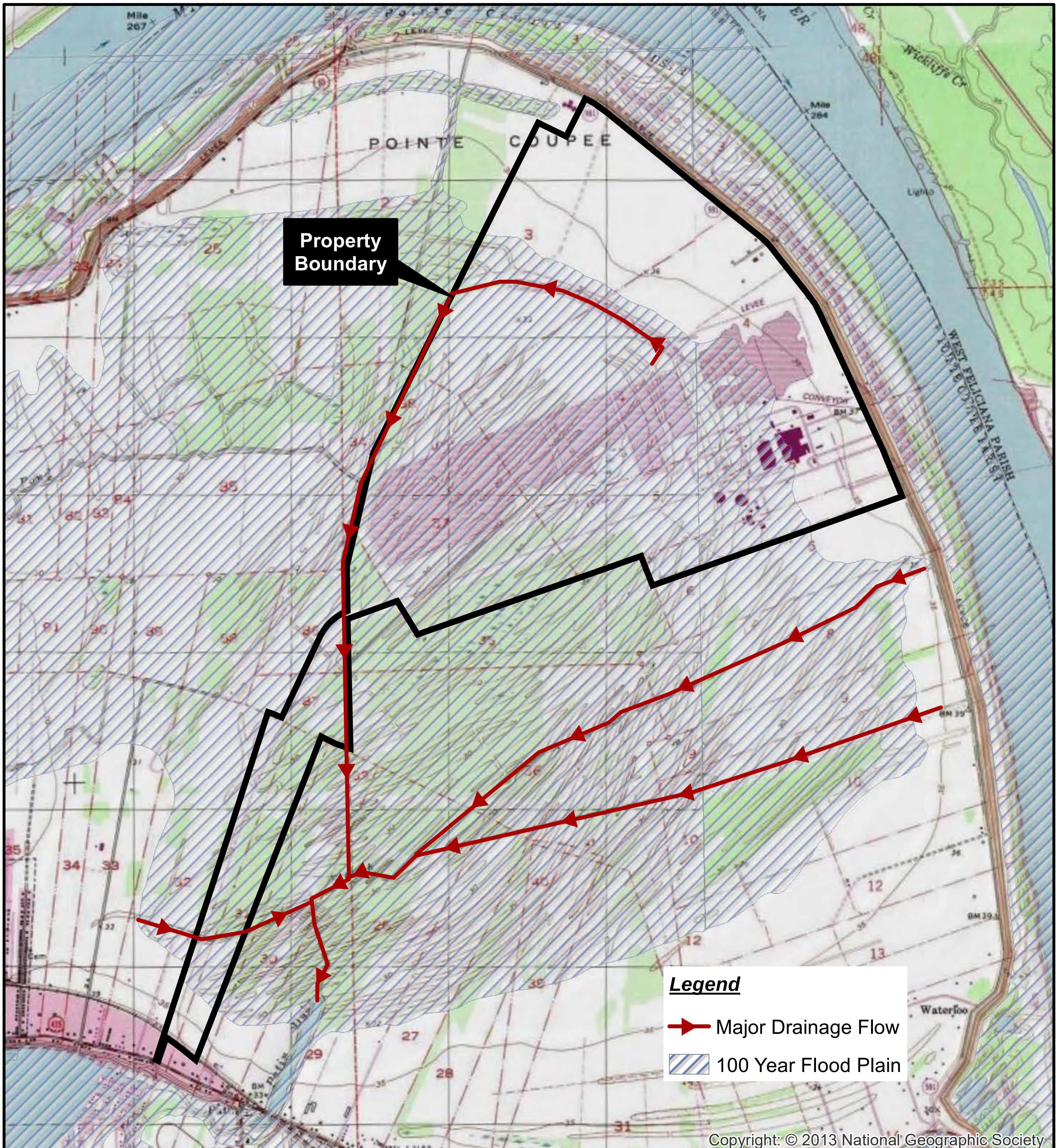
BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

FIGURE NUMBER 3

EXISTING SITE TOPOGRAPHY

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809

REFERENCE: Louisiana Oil Spill Coordinator's Office (LOSCO), LiDAR Digital Elevation Map (DEM) of Louisiana, 2009.



N

0 1,500 3,000 6,000

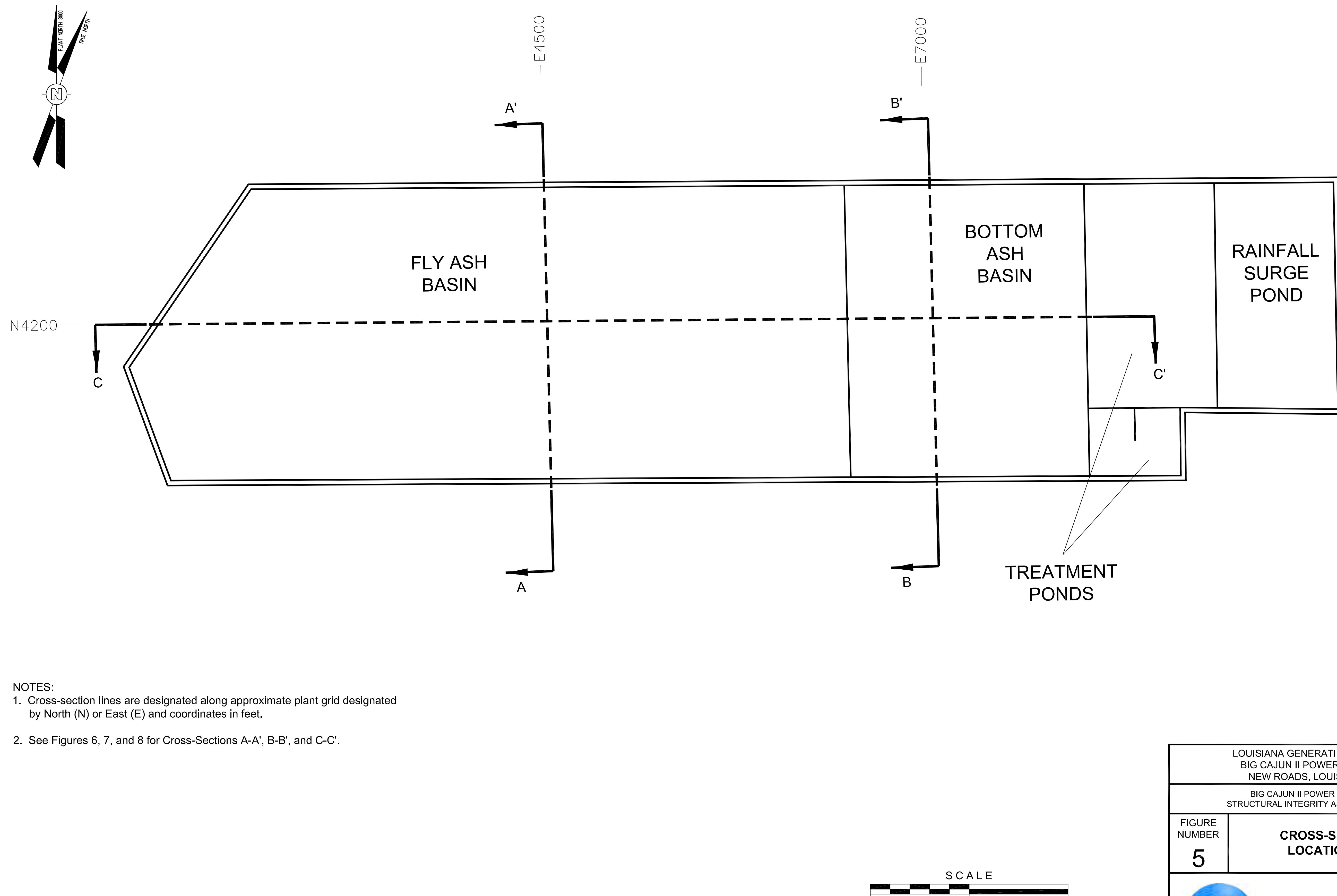
Feet

LOUISIANA GENERATING, LLC
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

FIGURE NUMBER	**DRAINAGE AND FLOOD PLAIN MAP**
4	

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809



NOTES:
1. Cross-section lines are designated along approximate plant grid designated by North (N) or East (E) and coordinates in feet.

2. See Figures 6, 7, and 8 for Cross-Sections A-A', B-B', and C-C'.

RE: SOURCE DRAWING PROVIDED BY C-K ASSOCATES, INC., DWG. NO. A05-268-02, 1/20/1994.

OFFICE	BTR
DRAWN BY	D. COMEAUX 09/14/16
CHECKED BY	CRW 10/03/16
APPROVED BY	GRL 10/03/16
DRAWING NUMBER	631215151_B15

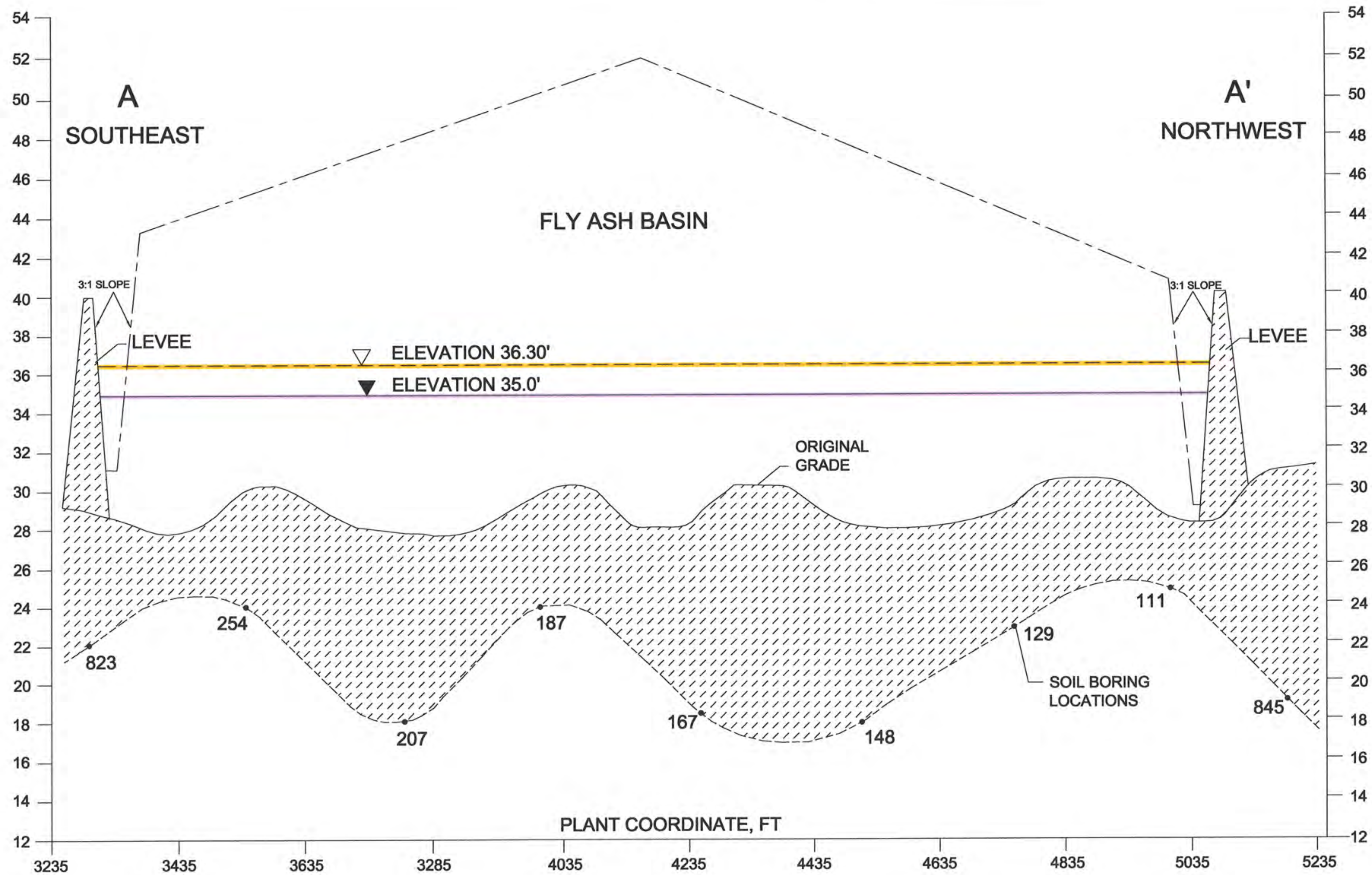
LOUISIANA GENERATING, L.L.C.
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

FIGURE NUMBER 5

CROSS-SECTIONS LOCATION MAP

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809



LEGEND:

Native clayey soils

Maximum elevation of Coal Combustion Residual (CCR) materials stored in the Fly Ash Basin (based on potential maximum ash volume at time of basin closure)

Fly Ash Basin maximum surface water elevation based on inflow design flood

Fly Ash Basin normal operating surface water elevation

RE: SOURCE DRAWING PROVIDED BY C-K ASSOCATES, INC.

NOTES:

1. Base information taken from Big Cajun's original 1986 Solid Waste Permit Application.
2. See Figure 5 for location of Cross-Section A-A'.
3. Slopes of basin levees are vegetated to minimize/prevent potential erosion.

10/4/2016

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DRAWN BY	D. COMEAUX 09/14/16
CHECKED BY	CRW 10/03/16
APPROVED BY	GRL 10/03/16
DRAWING NUMBER	631215151_B16

LOUISIANA GENERATING, L.L.C.
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

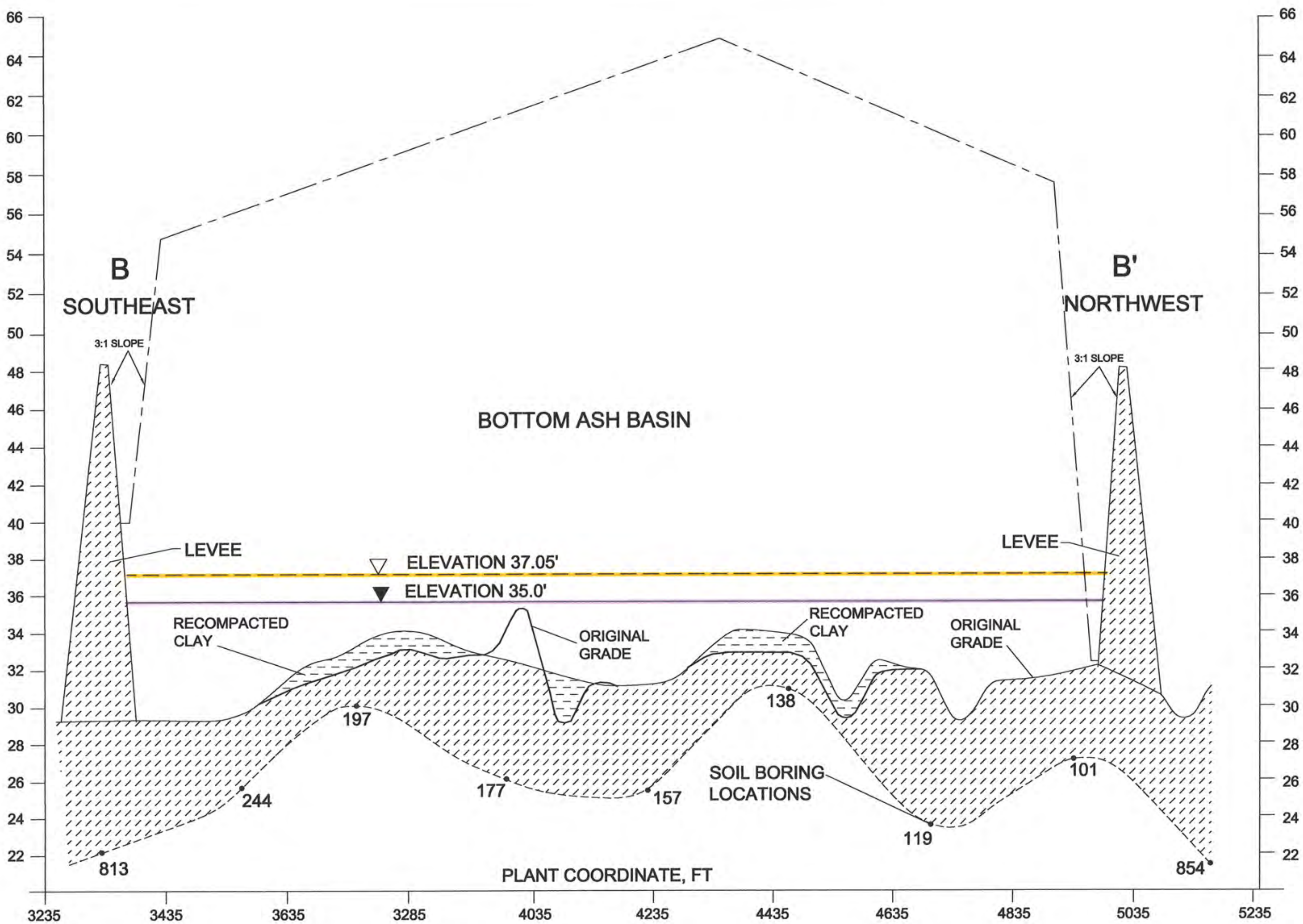
BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

FIGURE NUMBER 6

FLY ASH BASIN CROSS-SECTION A-A'

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809

OFFICE BTR | DRAWN BY D. COMEAUX 09/14/16 | CHECKED BY CRW 10/03/16 | APPROVED BY GRL 10/03/16 | DRAWING NUMBER 631215151_B17



LEGEND:

Native clayey soils at bottom of Basin

Recompacted clay

Maximum elevation of Coal Combustion Residual (CCR) materials stored in the Bottom Ash Basin (based on potential maximum as volume at time of basin closure)

Bottom Ash Basin maximum surface water elevation based on inflow design flood

Bottom Ash Basin normal operating surface water elevation

RE: SOURCE DRAWING PROVIDED BY C-K ASSOCATES, INC.

NOTES:

1. Base information taken from Big Cajun's original 1986 Solid Waste Permit Application.
2. See Figure 5 for location of Cross-Section B-B'.
3. Slopes of basin levees are vegetated to minimize/prevent potential erosion.

Louisiana Board of Professional Geoscientists — Calvin R. Wiggs — License Number 511 — Est. 2011

Calvin R. Wiggs 10/4/2016

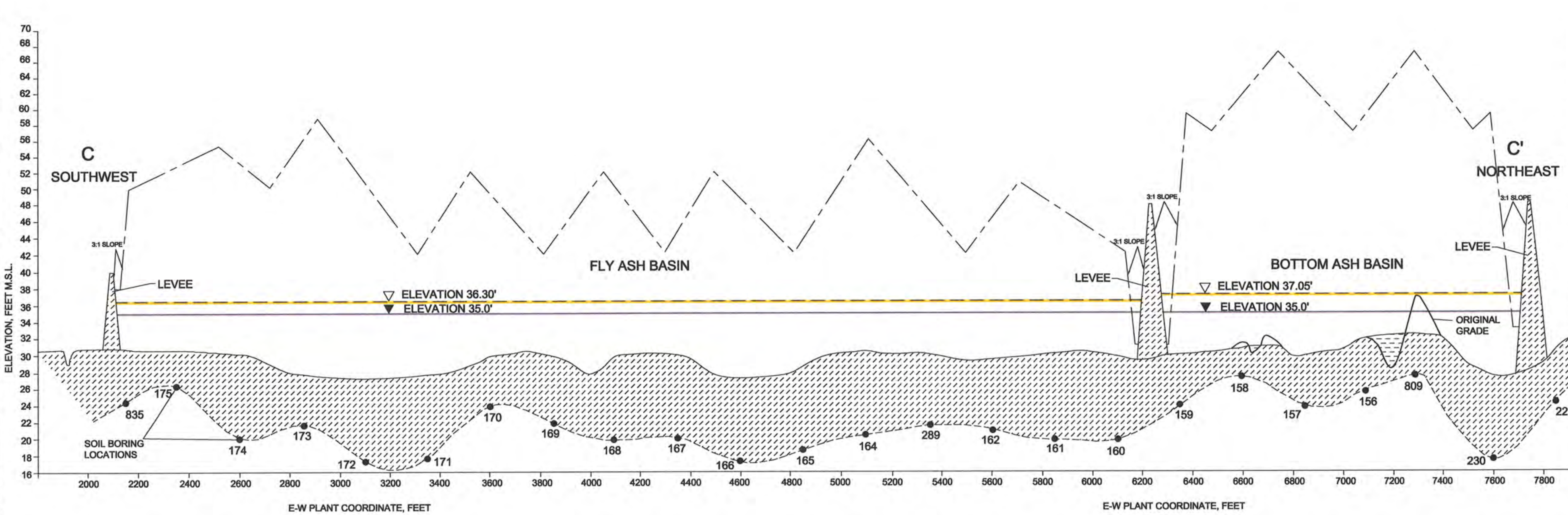
LOUISIANA GENERATING, L.L.C.
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

FIGURE NUMBER 7

BOTTOM ASH BASIN CROSS-SECTION B-B'

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809



LEGEND:

- Native clayey soils at bottom of Basin
- Recompacted clay
- Maximum Depth of Coal Combustion Residual (CCR) materials stored in the Bottom Ash Basin (based on potential maximum ash volume at time of basin closure)
- Bottom Ash Basin maximum surface water elevation based on inflow design flood
- Bottom Ash Basin normal operating surface water elevation

NOTES:

1. Base information taken from Big Cajun's original 1986 Solid Waste Permit Application.
2. See Figure 5 for location of Cross-Section C-C'.
3. Slopes of basin levees are vegetated to minimize/prevent potential erosion.

LOUISIANA GENERATING, L.L.C. BIG CAJUN II POWER PLANT NEW ROADS, LOUISIANA	
BIG CAJUN II POWER PLANT STRUCTURAL INTEGRITY ASSESSMENT	
FIGURE NUMBER 8	FLY ASH BASIN AND BOTTOM ASH BASIN CROSS-SECTION C-C'
CBI	CB&I Environmental & Infrastructure, Inc. 4171 Essen Lane Baton Rouge, Louisiana 70809

DRAWING NUMBER	631215151_B18
APPROVED BY	GRL 10/03/16
CHECKED BY	CRW 10/03/16
DRAWN BY	D. COMEAUX 09/14/16
OFFICE	BTR

APPENDIX A

4171 Essen Lane
Baton Rouge, LA 70809
Tel: 412.372.7701
Fax: 412.373.7135
www.CBI.com

December 11, 2015

Mr. Gary Ellender
Regional Environmental Manager
Louisiana Generating, LLC (LaGen)

Subject: Installation of Permanent Identification Marker (40 CFR Part 257.73(a)(1))
Big Cajun II
10431 Cajun II Road
New Roads, LA 70760

Dear Mr. Ellender:

CB&I Environment & Infrastructure (CB&I) arranged for the acquisition and installation of permanent identification markers for the Bottom Ash and Fly Ash Units for compliance with the above referenced regulation. A photo log documenting the installation is attached. In conjunction with the installation, a location survey was conducted of the referenced markers resulting in the following data:

	NAD'83 – LA NORTH		NAD'83 – GEODETIC	
Marker ID	Northing	Easting	Latitude	Longitude
Bottom Ash Unit marker	809,135.84	3,265,630.61	30° 43' 29.652"	91° 22' 54.185"
Fly Ash Unit marker	808,875.71	3,264,794.97	30° 43' 27.090"	91° 23' 03.753"

NAD 83 Coordinate data is reported in Louisiana State Plane South Zone grid coordinate.

I hereby certify that on the 10th day of December, 2015, the hereon described survey was completed under my supervision, to the best of my knowledge and ability.

Date: December 11, 2015

Glen R. Landry

Glen R. Landry, PLS #4445
Project Manager 3
CB&I Environmental & Infrastructure, Inc.

STATE OF LOUISIANA
GLEN R. LANDRY
REG. No. 4445
REGISTERED
LAND SURVEYOR

Photographic Record

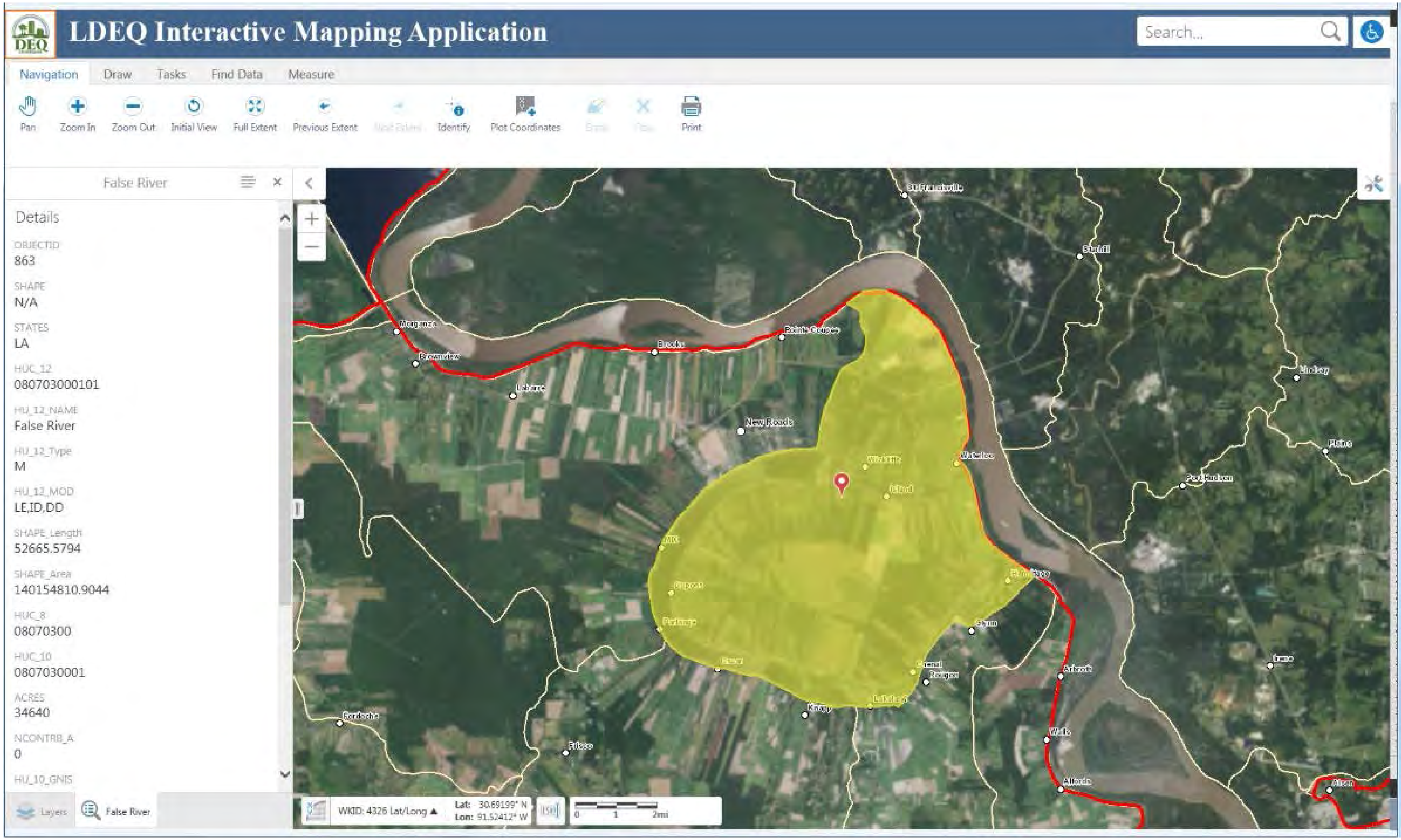
Client: NRG-Big Cajun II
Location: 10431 Cajun II Rd. New Roads, LA. 70807
Project No. 1005494026

Photographer: Kevin Simoneaux
Photograph Date: 12/10/2015

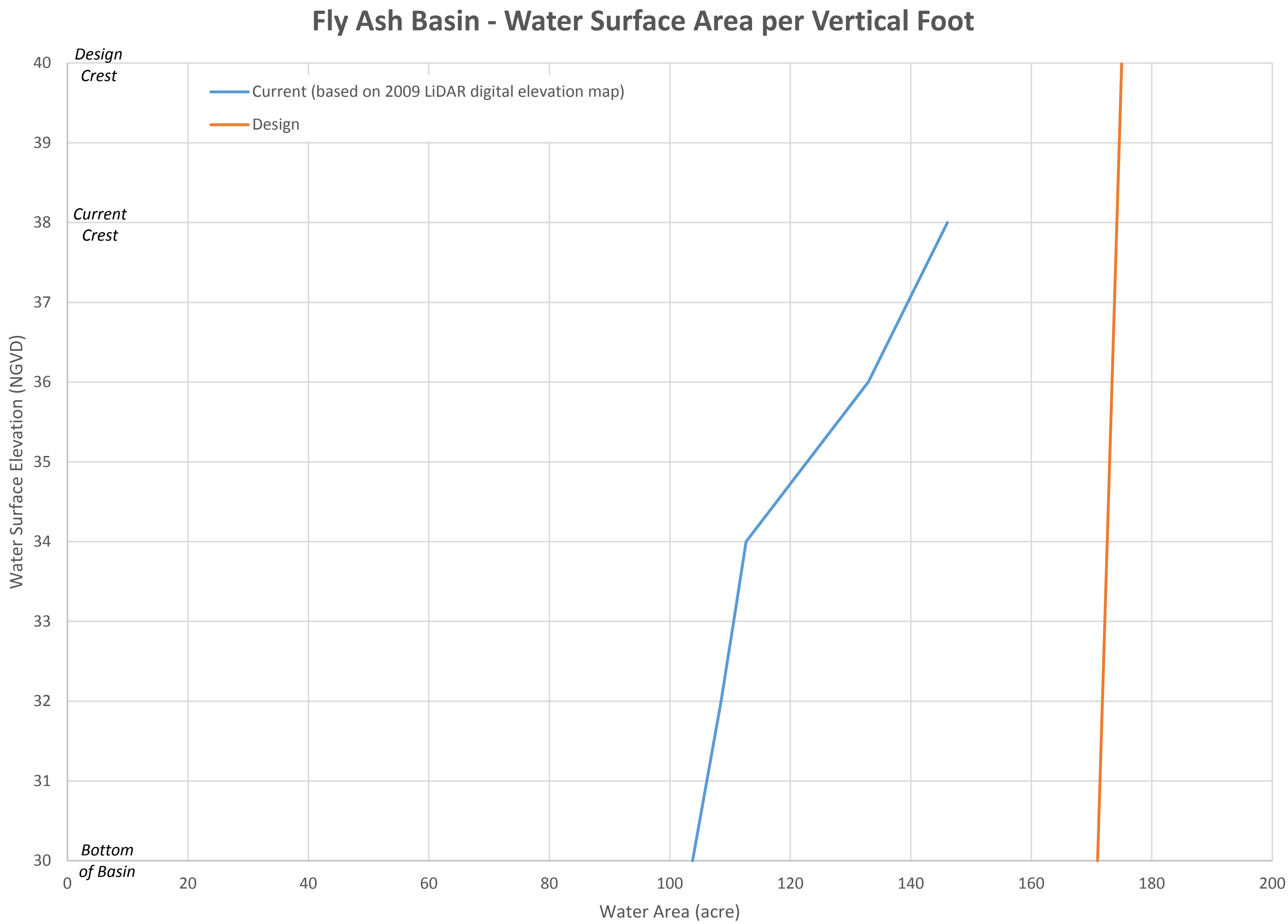
	
Photo No: 3125 **Picture Direction**: SW	**Photo No:** 3123 **Picture Direction**: SW
Description: Installed Bottom Ash Unit sign	**Description**: Installed Fly Ash Unit sign

APPENDIX B

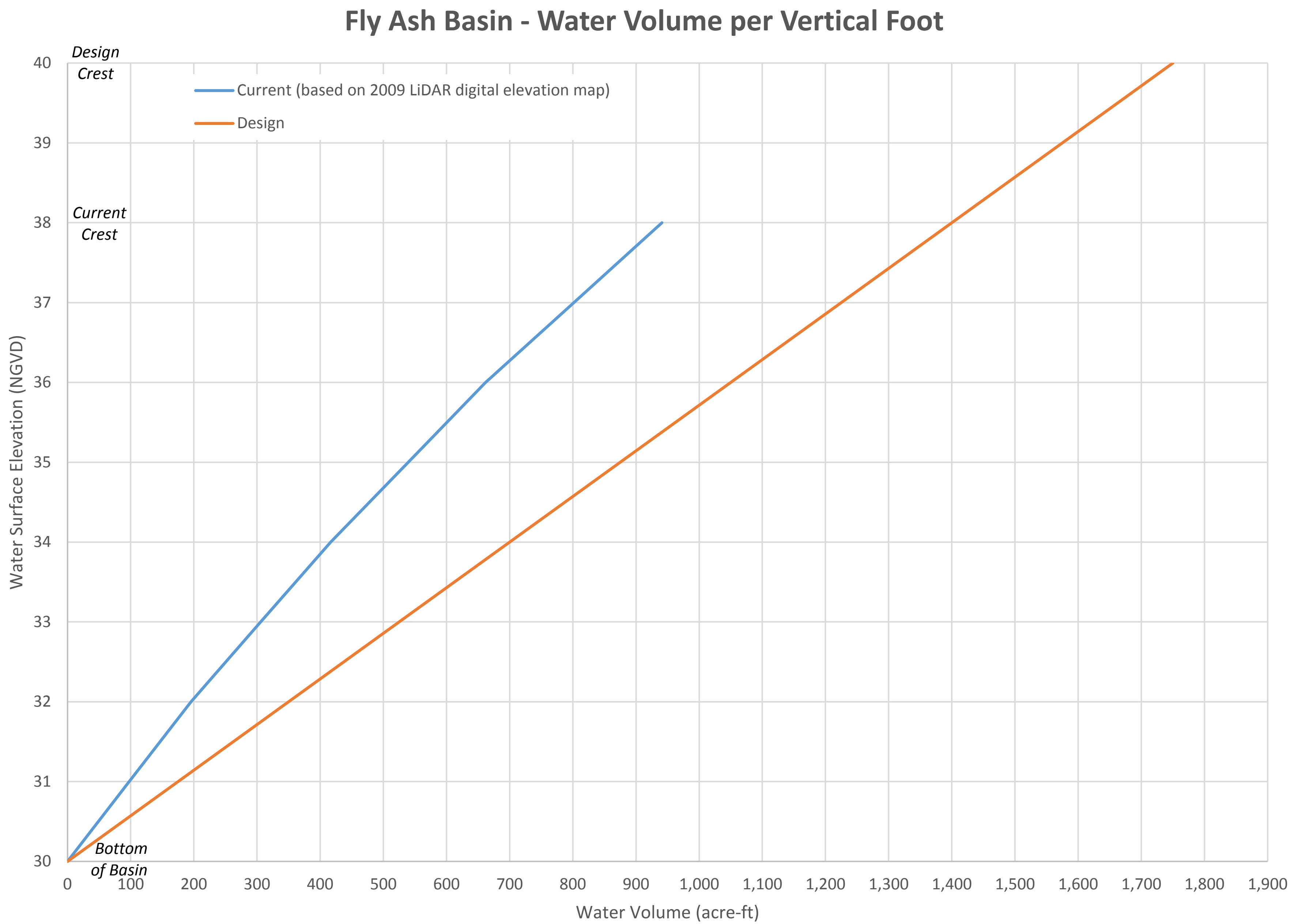
APPENDIX B
Watershed Map
NRG Big Cajun II Plant
New Roads, Louisiana

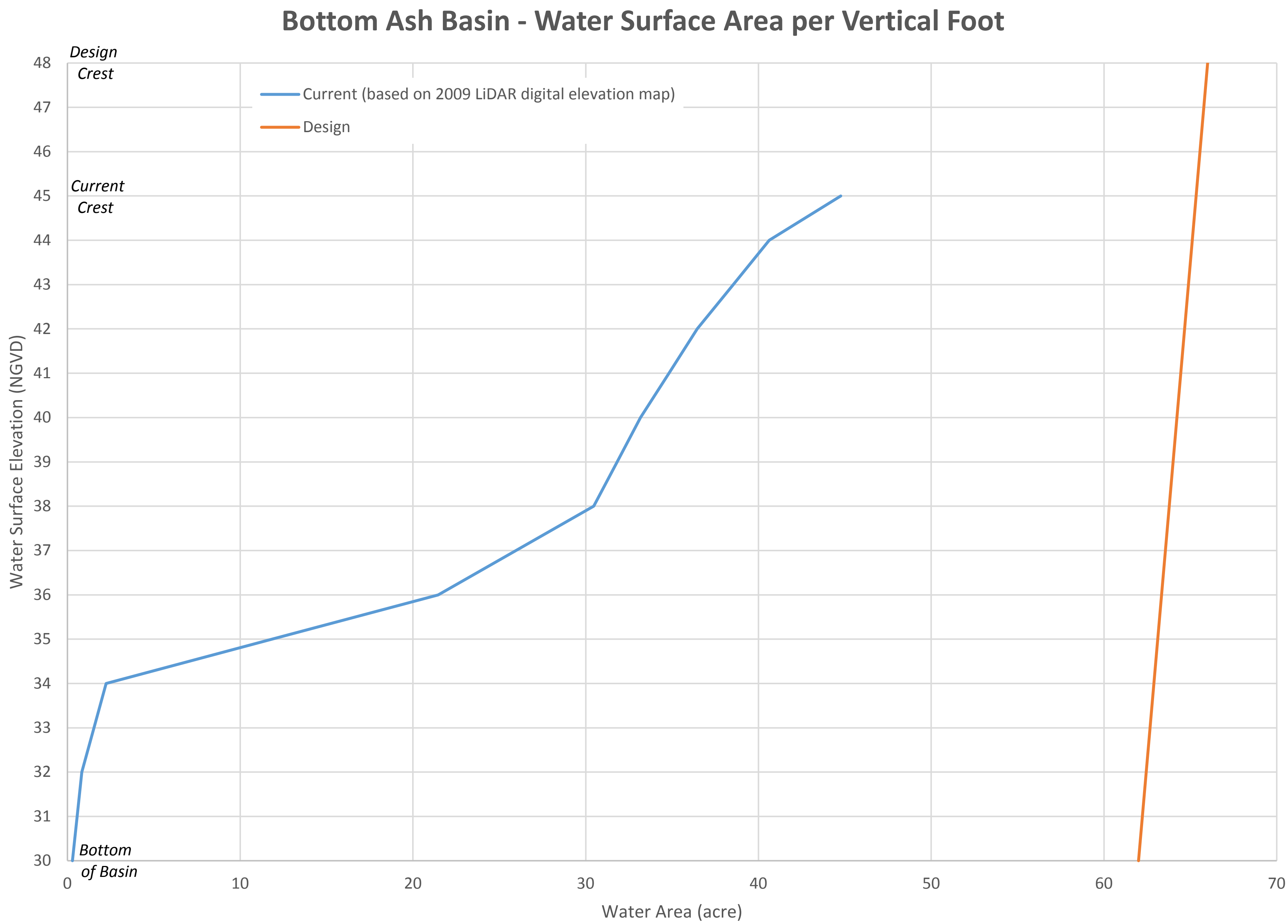


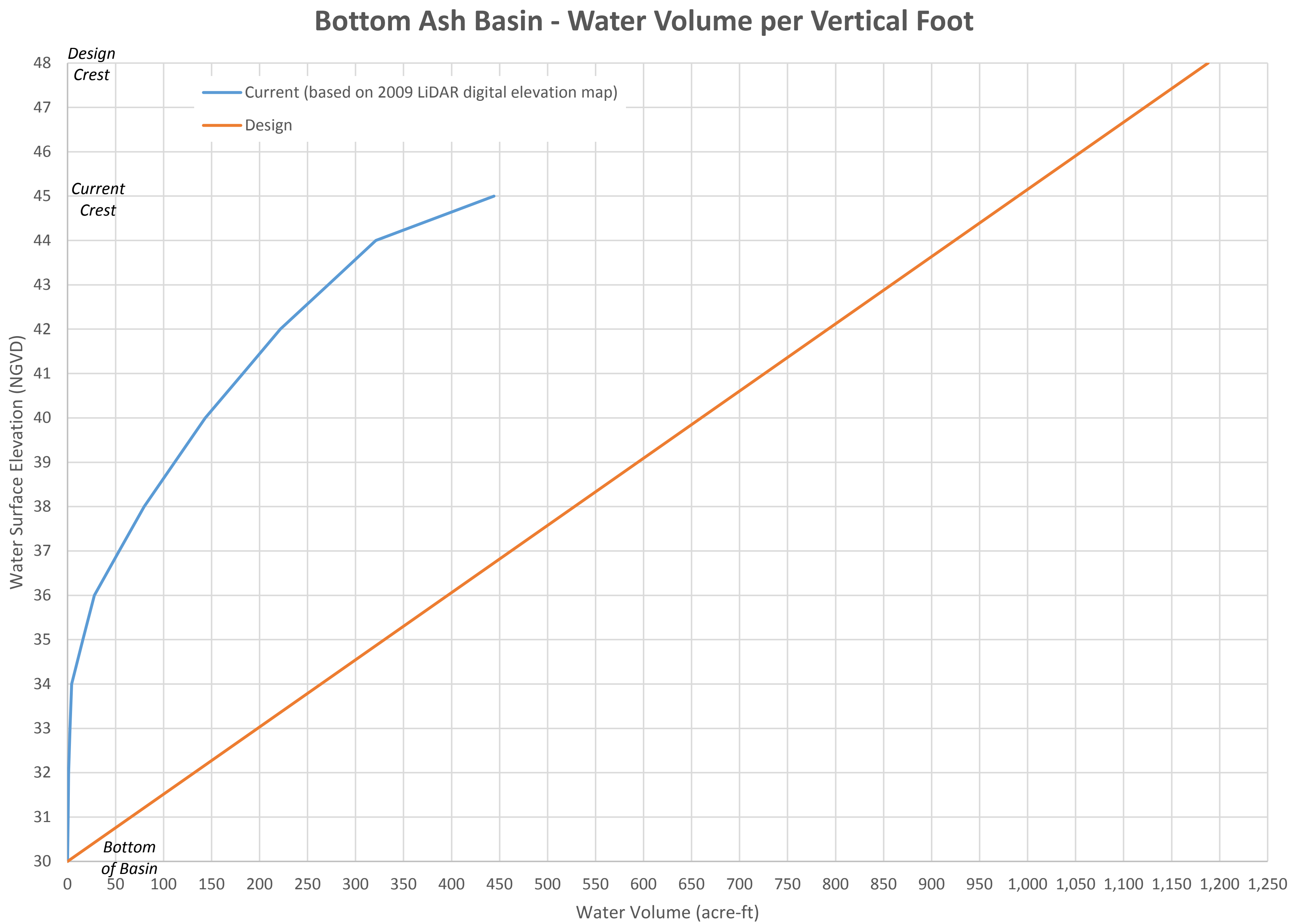
APPENDIX C



Fly Ash Basin - Water Surface Area per Vertical Foot
Current (based on 2009 LiDAR digital elevation map)
Design
Design Crest
Current Crest
Bottom of Basin
Water Surface Elevation (NGVD)
Water Area (acre)
40
39
38
37
36
35
34
33
32
31
30
0
20
40
60
80
100
120
140
160
180
200


Fly Ash Basin - Water Volume per Vertical Foot
Design Crest
Current Crest
Bottom of Basin
Current (based on 2009 LiDAR digital elevation map)
Design
Water Surface Elevation (NGVD)
Water Volume (acre-ft)
30
31
32
33
34
35
36
37
38
39
40
0
100
200
300
400
500
600
700
800
900
1,000
1,100
1,200
1,300
1,400
1,500
1,600
1,700
1,800
1,900


Bottom Ash Basin - Water Surface Area per Vertical Foot
Current (based on 2009 LiDAR digital elevation map)
Design
Design Crest
Current Crest
Bottom of Basin
Water Surface Elevation (NGVD)
Water Area (acre)
48
47
46
45
44
43
42
41
40
39
38
37
36
35
34
33
32
31
30
0
10
20
30
40
50
60
70


Bottom Ash Basin - Water Volume per Vertical Foot
Current (based on 2009 LiDAR digital elevation map)
Design
Design Crest
Current Crest
Bottom of Basin
Water Surface Elevation (NGVD)
Water Volume (acre-ft)
48
47
46
45
44
43
42
41
40
39
38
37
36
35
34
33
32
31
30
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1,000
1,050
1,100
1,150
1,200
1,250

APPENDIX D

GEOTECHNICAL DESIGN MEMORANDUM

TO: BRAD C. BARRE

FROM: GLEN LANDRY, PE, AND FIROUZ ROSTI, PHD, EI

SUBJECT: SLOPE STABILIY ANALYSES FOR BIG CAJUN II GENERATION SITE

DATE: SEPTEMBER 2, 2016

ATTCHEMENTS: Attachment A (Stability Results)

1. PROJECT DESCRIPTION

The Big Cajun II Generating Station is located near the town of New Roads, Louisiana, approximately 35 miles northwest of Baton Rouge, Louisiana. The site is approximately 1500 feet from the west bank of the Mississippi River (Figure 1), with the closest ash basin being approximately 2750 feet from the river.

Figure 1: Project Site Plan

2. CALCULATION OBJECTIVE/PURPOSES

The objective of this analysis is to calculate factor of safety (FOS) for the existing and proposed final slopes for the Fly Ash (FA) and Bottom Ash (BA) basins at the site. This memorandum includes the results of our analyses of the requested slopes considering both static and seismic loads.

3. INPUTS

Data from the preliminary geotechnical Report (GeoEngineers, 2011) was used in our calculations, and includes the following:

1. Geometries of the existing and proposed slopes
2. The site stratigraphy and soil properties in the site area as described below

4. SOIL PROPERTIES

Soil properties were obtained from the provided report. A summary of soil properties is presented below in Table 1.

Table 1: General soil profile used in the evaluation

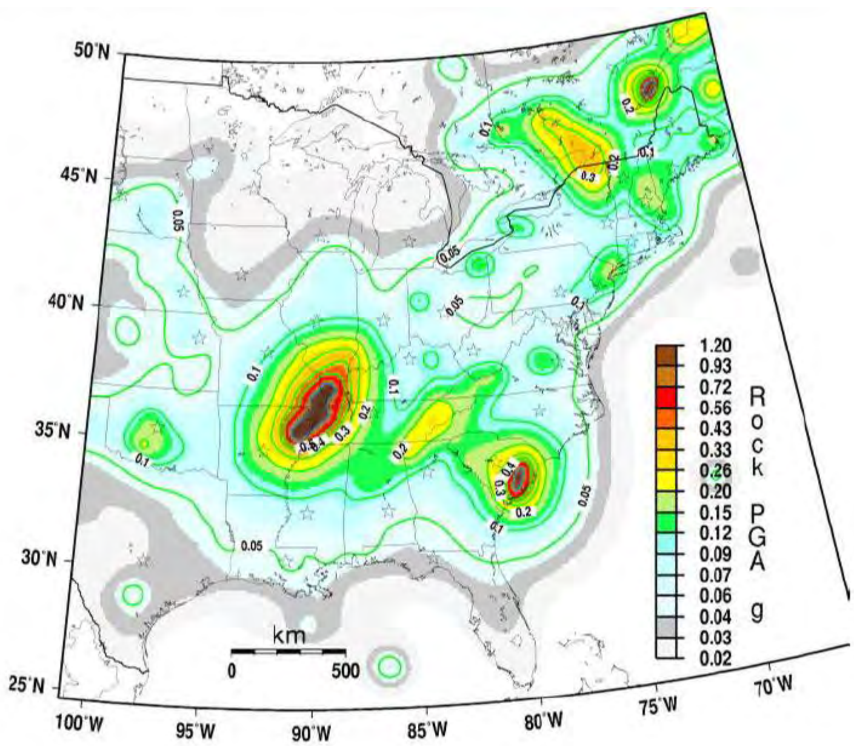
Layer	*Elevation, feet*	*Soil Type*	*Unit weight (pcf)*	*C (psf)*	*Friction Angle*
1	30 to 26	Stiff Clay	114	1000	0
2	26 to 20	Soft Clay	114	500	0
3	20 to 10	Soft Clay	114	400	0
4	10 to 0	Medium Sand	117	0	20
5	0 to -10	Medium to Dense Sand	117	0	25
6	-10 to -50	Dense Sand	117	0	30

5. GROUNDWATER:

The groundwater table was assumed to be at the ground level with an approximate elevation of 30 feet.

6. ASSUMPTIONS

1. It is assumed that there are no surcharge loads on the top of the slopes.
2. Evaluation of liquefaction of the underlying sandy layers is beyond the scope of this analysis.
3. A horizontal seismic acceleration was obtained from national survey of seismicity. A coefficient of 0.05 is used which relates to a 2% chance of experiencing peak acceleration in rock in a 50-years period (USGS Seismic Hazard Map, revised May, 2003) as shown below.



USGS prediction of Peak Ground acceleration in rock with a 2% chance of exceedance in 50 years

4. Natural groundwater level assumed to be at the ground level.
5. Only short-term response using undrained soil parameters was considered in this study.

7. ANALYSIS

Global slope stability analyses were conducted for slopes at four (4) cross-sections with and without consideration of seismic loads, including:

1. Slope stability analysis of the *existing slope* at the FA basin
2. Slope stability analysis of the *proposed final slope* at the FA basin
3. Slope stability analysis of the *existing slope* at the BA basin
4. Slope stability analysis of the *proposed final slo*pe at the BA basin

In each of the abovementioned cases, the slope was evaluated under two (2) different water elevations named as "static maximum storage pool" and "static maximum surcharge pool". According to the provided information, the former one was considered to be at elevation +38 feet for both FA and BA basins, while the latter one was considered to be at elevations +39.9 feet and 39.3 feet for BA and FA basins, respectively.

The analyses were performed using the computer program SLOPE/W, which analyzes the stability utilizing the limit equilibrium method. For this study, the Spencer method (Spencer 1967) was used for a rigorous analysis in order to calculate the minimum factor of safety (FOS) of the selected cross-sections for the existing conditions, as well for the proposed final design slope.

8. RESULTS & CONCLUSIONS

8.1. SLOPE STABILITY ANALYSIS WITHOUT SEISMIC EFFECTS

The stability analyses for both FA and BA basins were conducted under static loads, and the obtained results for the factor of safety (FOS) correspond to each slope are presented in Table 2. The calculated FOS values vary between 1.48 and 2.74 under static load conditions. Comparing the obtained FOS values with the minimum allowable values in Table 2 under static loads (FOS=1.4 & 1.5), indicates that slope for all cases are stable under static loads. Details of the slope geometry, soil layering and obtained results are presented in Attachment A.

Table 2: Slope stability results without seismic effects (Kh=0).

<table>
<tr><th>Area</th><th>Slope Scenario</th><th>Storage pool elevation, feet</th><th>Calculated FOS</th><th>Required FOS</th></tr>
<tr><td rowspan="4">Fly Ash Basin</td><td rowspan="2">Existing Slope</td><td>38</td><td>2.31</td><td>1.5</td></tr>
<tr><td>39.3</td><td>2.29</td><td>1.4</td></tr>
<tr><td rowspan="2">Proposed Capped Slope</td><td>38</td><td>2.74</td><td>1.5</td></tr>
<tr><td>39.3</td><td>2.71</td><td>1.4</td></tr>
<tr><td rowspan="4">Bottom Ash Basin</td><td rowspan="2">Existing Slope</td><td>38</td><td>1.50</td><td>1.5</td></tr>
<tr><td>39.9</td><td>1.48</td><td>1.4</td></tr>
<tr><td rowspan="2">Proposed Capped Slope</td><td>38</td><td>1.60</td><td>1.5</td></tr>
<tr><td>39.9</td><td>1.58</td><td>1.4</td></tr>
</table>

8.2. SLOPE STABILITY ANALYSIS WITH SEISMIC EFFECTS

The stability analyses for both FA and BA basins were conducted under additional seismic loads, and the results obtained for the factor of safety (FOS) correspond to each slope are presented in Table 3. The calculated FOS values vary between 1.1 and 1.75 under static load conditions. Comparing the obtained FOS values with the minimum allowable value under seismic loads (FOS=1.1), indicates that slope at the all cases are stable under seismic loads. Details of the slope geometry, soil layering and obtained results are also presented in Attachment A.

Table 3: Slope stability results with seismic effects (Kh=0.05).

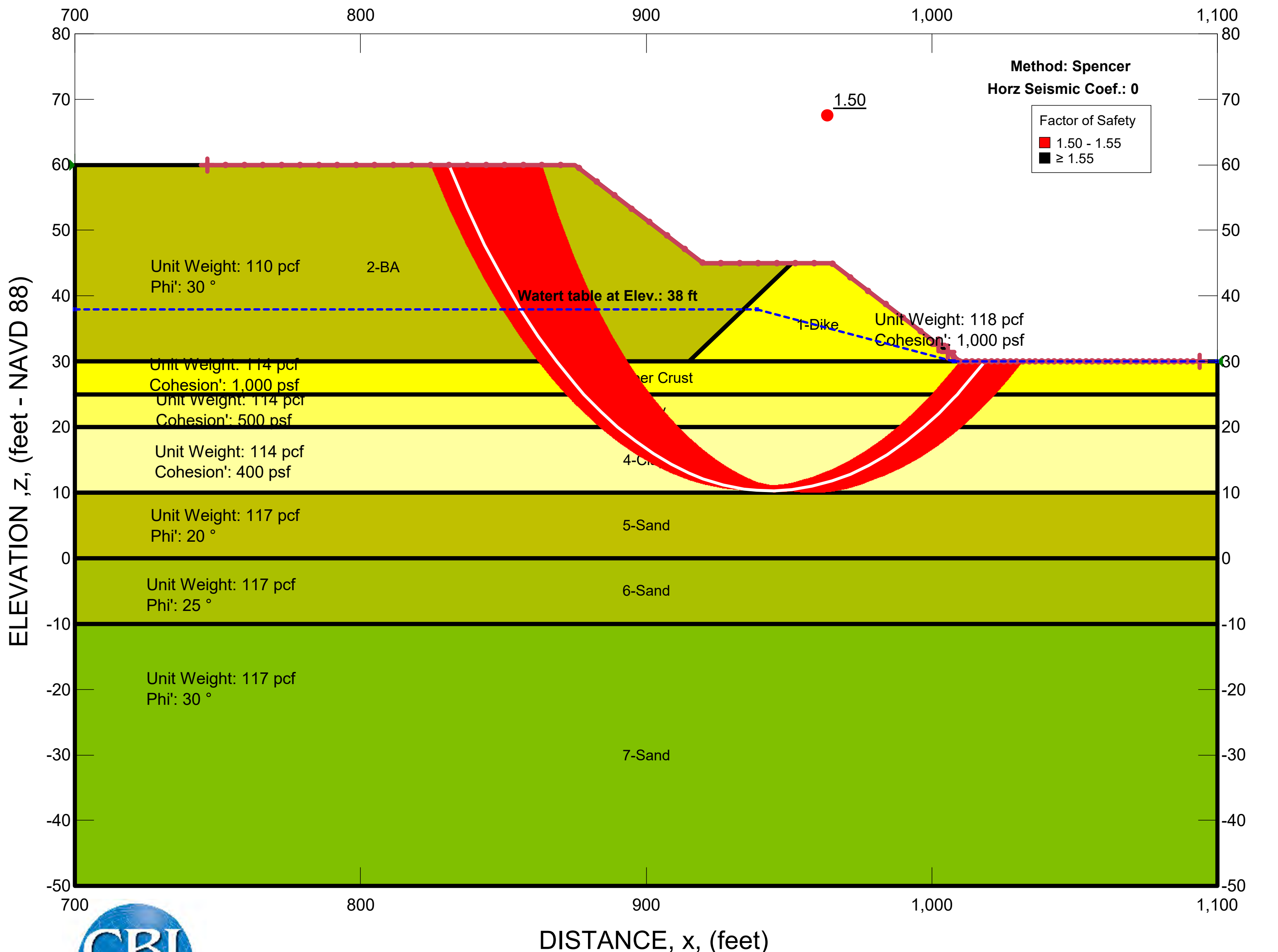
Area	Slope Scenario	Storage pool elevation, feet	Calculated FOS	Required FOS
Fly Ash Basin	Existing Slope	38	1.68	1.0
		39.3	1.66	
	Proposed Capped Slope	38	1.75	
		39.3	1.74	
Bottom Ash Basin	Existing Slope	38	1.12	
		39.9	1.11	
	Proposed Capped Slope	38	1.19	
		39.9	1.18	

References:

1- GeoEngineers, 2011. "Ash Basins/Wastewater Treatment Ponds, Big Cajun II Generation Site." Preliminary geotechnical engineering service.
2- USGS Seismic Design Map, Revised May, 2003, http://earthquake.usgs.gov/hazards/designmaps/usdesign.php

Attachment A

Slope Stability Results



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File Name: Cajun-BA-Existing.gsz
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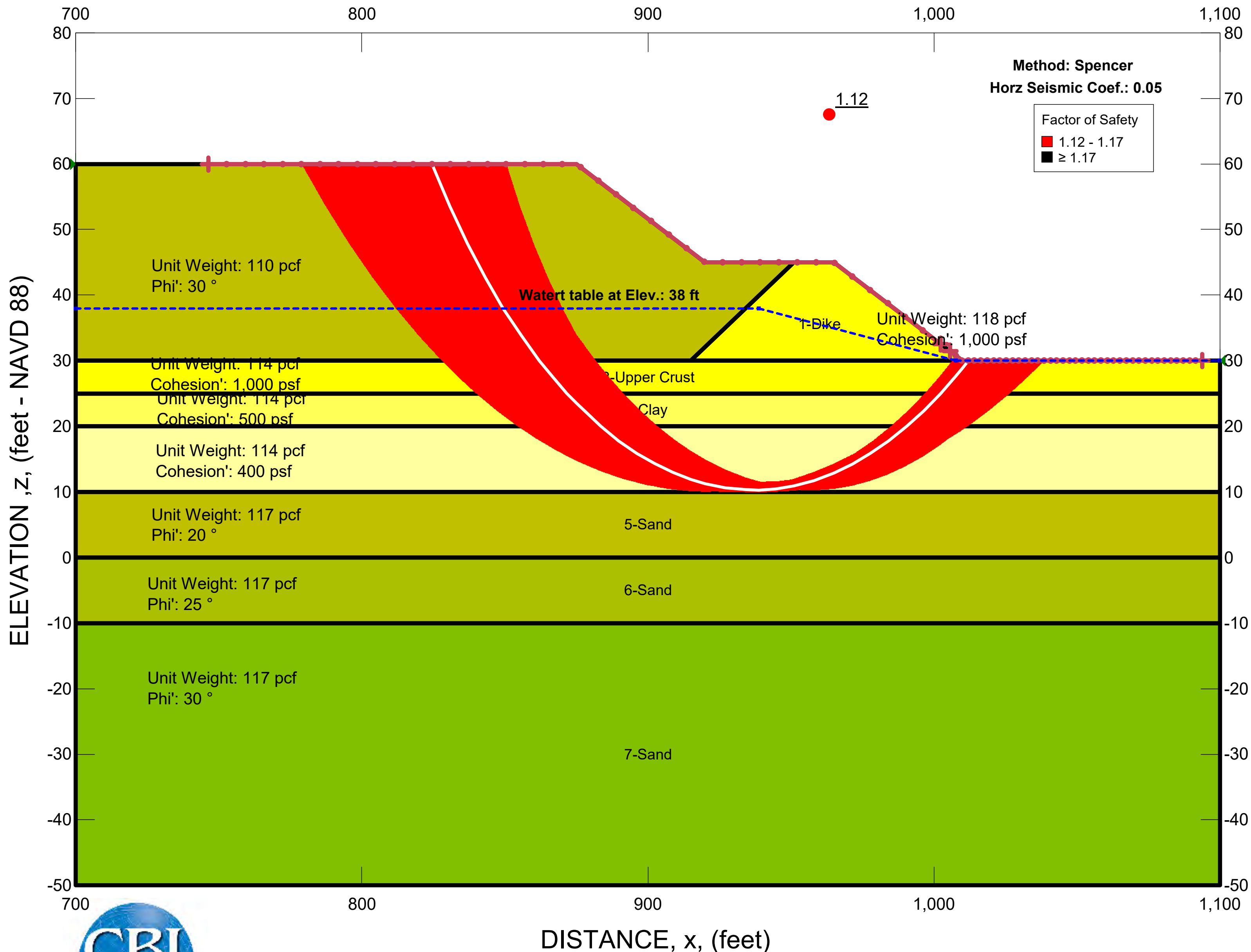
Last Edited By: Rosti, Firouz

SLOPE STABILITY ANALYSIS
GLOBAL STABILITY
GEOMETRY: Existing Slope w./ Bottom Ash (BA)

PROJECT NO. 631215151
Big Cajun II Pond
New Raods, Louisiana

FIGURE



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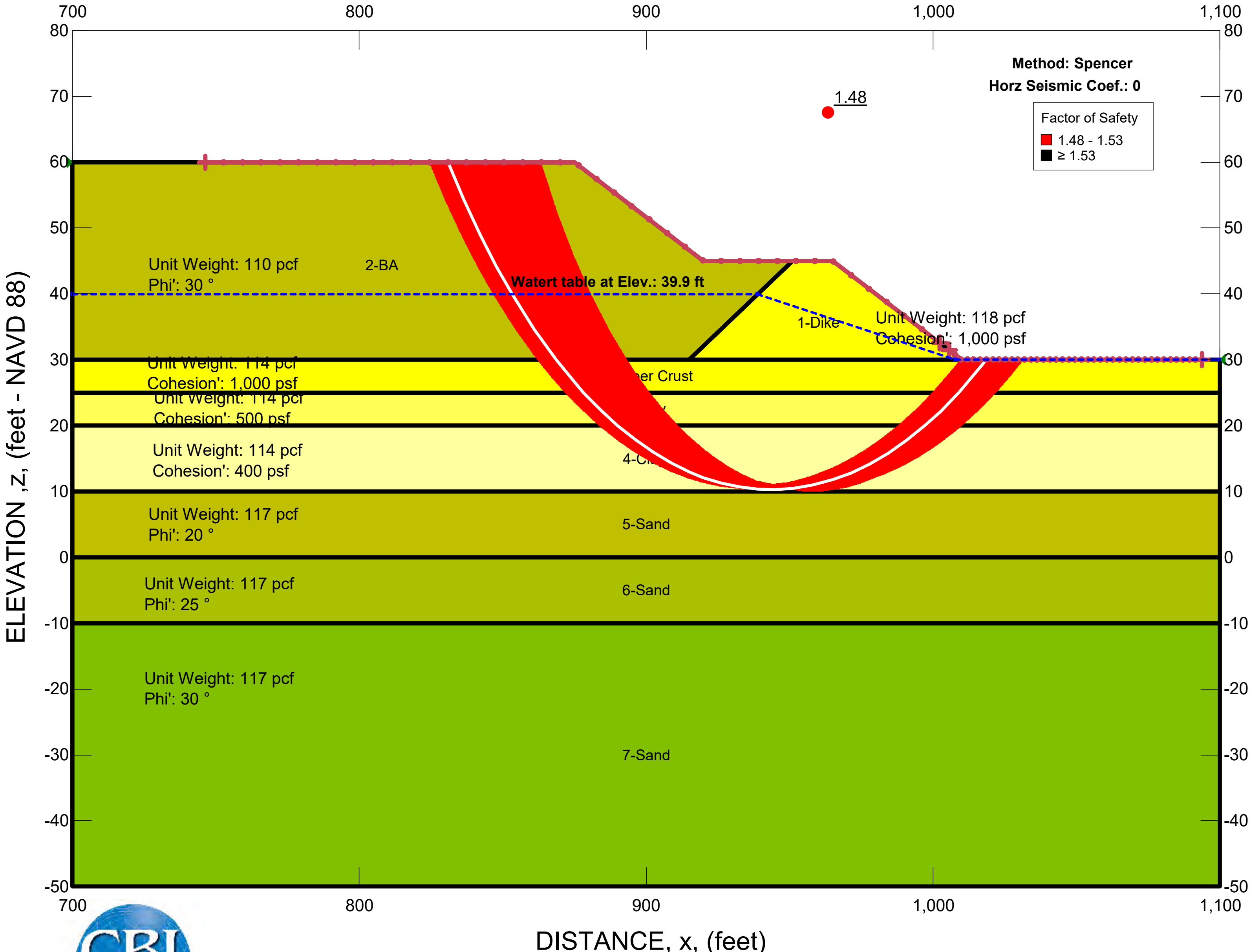
Last Edited By: Rosti, Firouz

SLOPE STABILITY ANALYSIS
GLOBAL STABILITY
GEOMETRY: Existing Slope w./ Bottom Ash (BA)

PROJECT NO. 631215151
Big Cajun II Pond
New Raods, Louisiana

FIGURE



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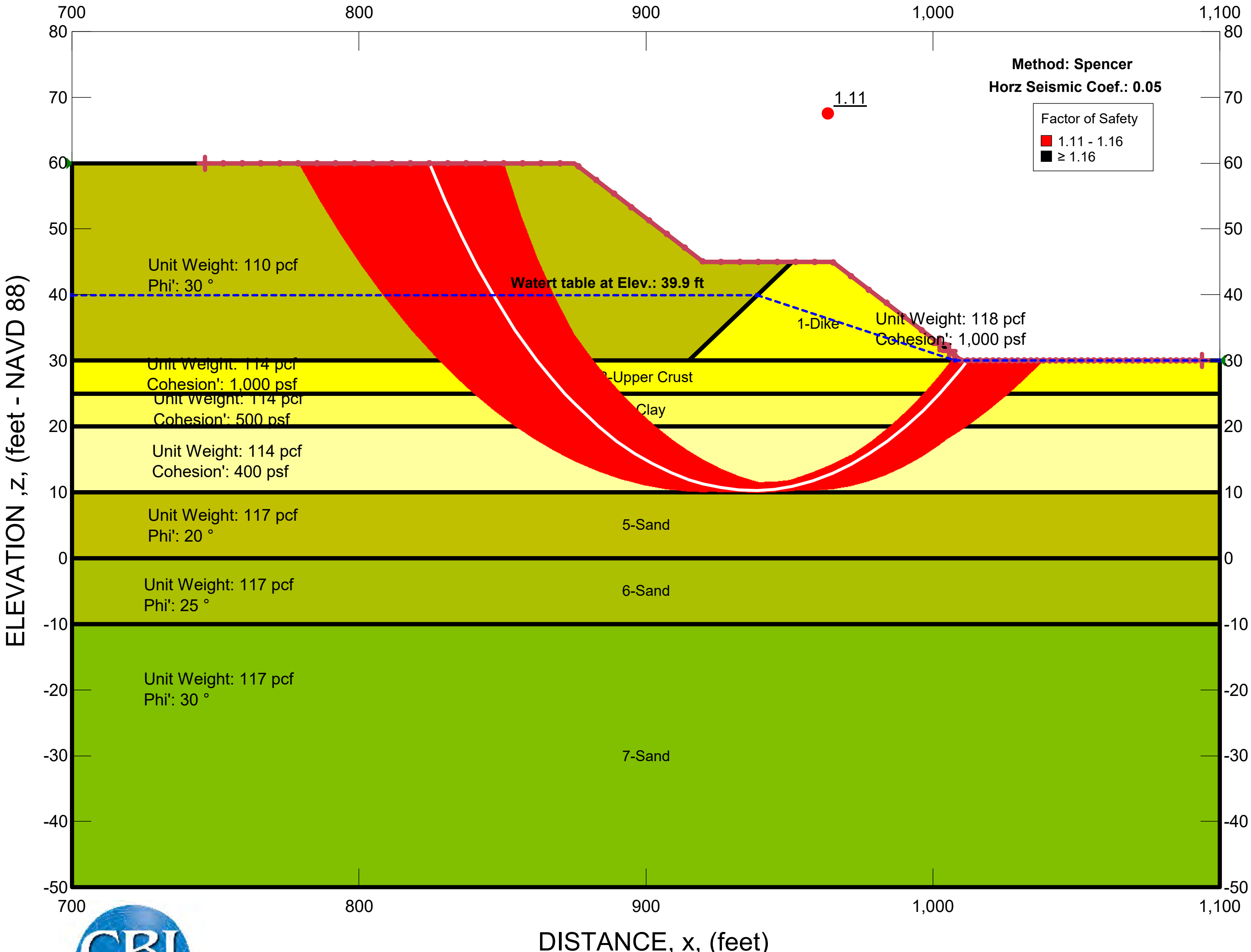
File Name: Cajun-BA-Existing.gsz
Directory: C:\Users\firouz.rosti\Desktop\Documents\PROJECTS\Cajun II\Calculations\
Last Edited By: Rosti, Firouz

SLOPE STABILITY ANALYSIS
GLOBAL STABILITY
GEOMETRY: Existing Slope w./ Bottom Ash (BA)

PROJECT NO. 631215151
Big Cajun II Pond
New Raods, Louisiana

FIGURE



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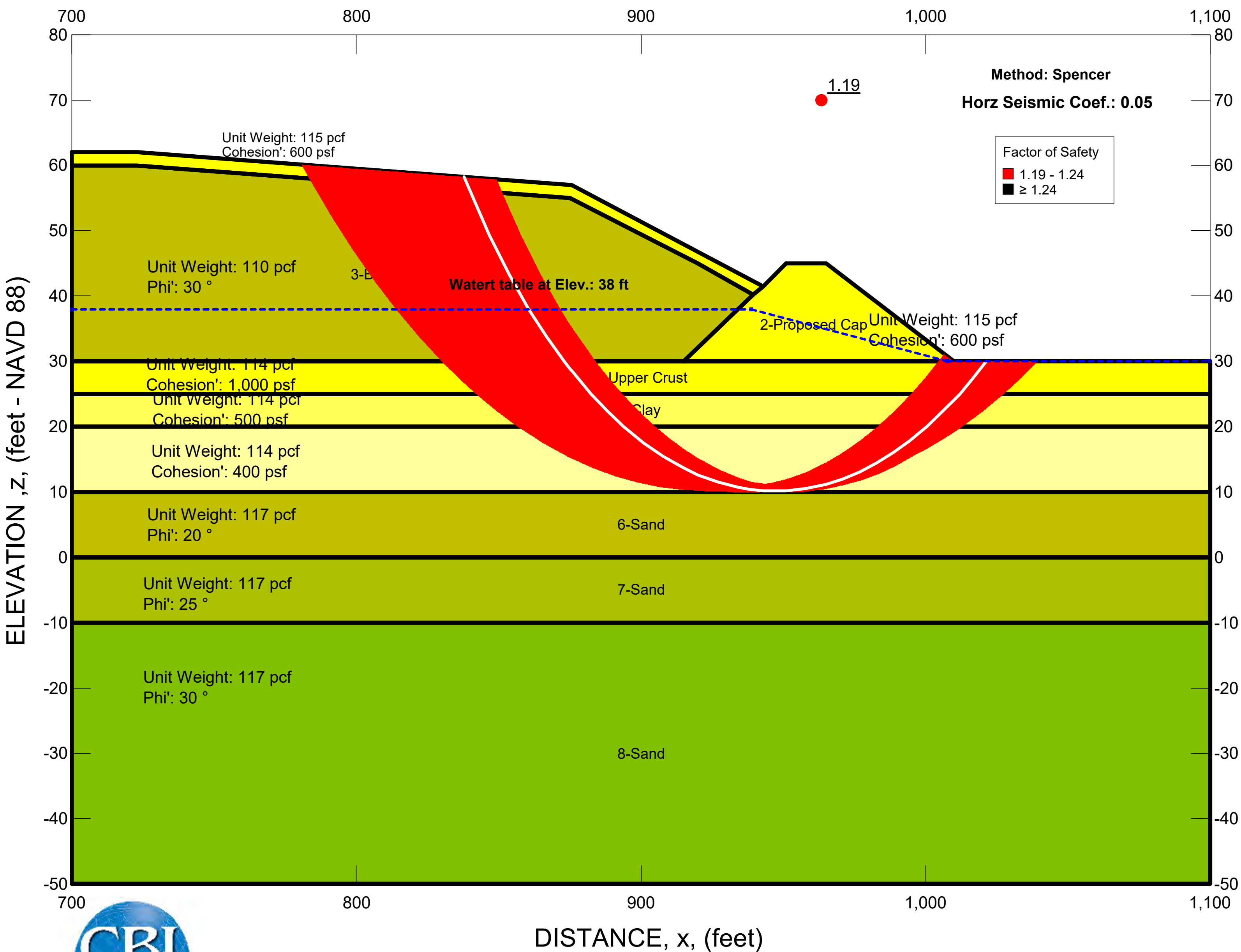
File Name: Cajun-BA-Existing.gsz
Directory: C:\Users\firouz.rosti\Desktop\Documents\PROJECTS\Cajun II\Calculations\
Last Edited By: Rosti, Firouz

SLOPE STABILITY ANALYSIS
GLOBAL STABILITY
GEOMETRY: Existing Slope w./ Bottom Ash (BA)

PROJECT NO. 631215151
Big Cajun II Pond
New Raods, Louisiana

FIGURE



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File Name: Cajun-BA-Proposed.gsz
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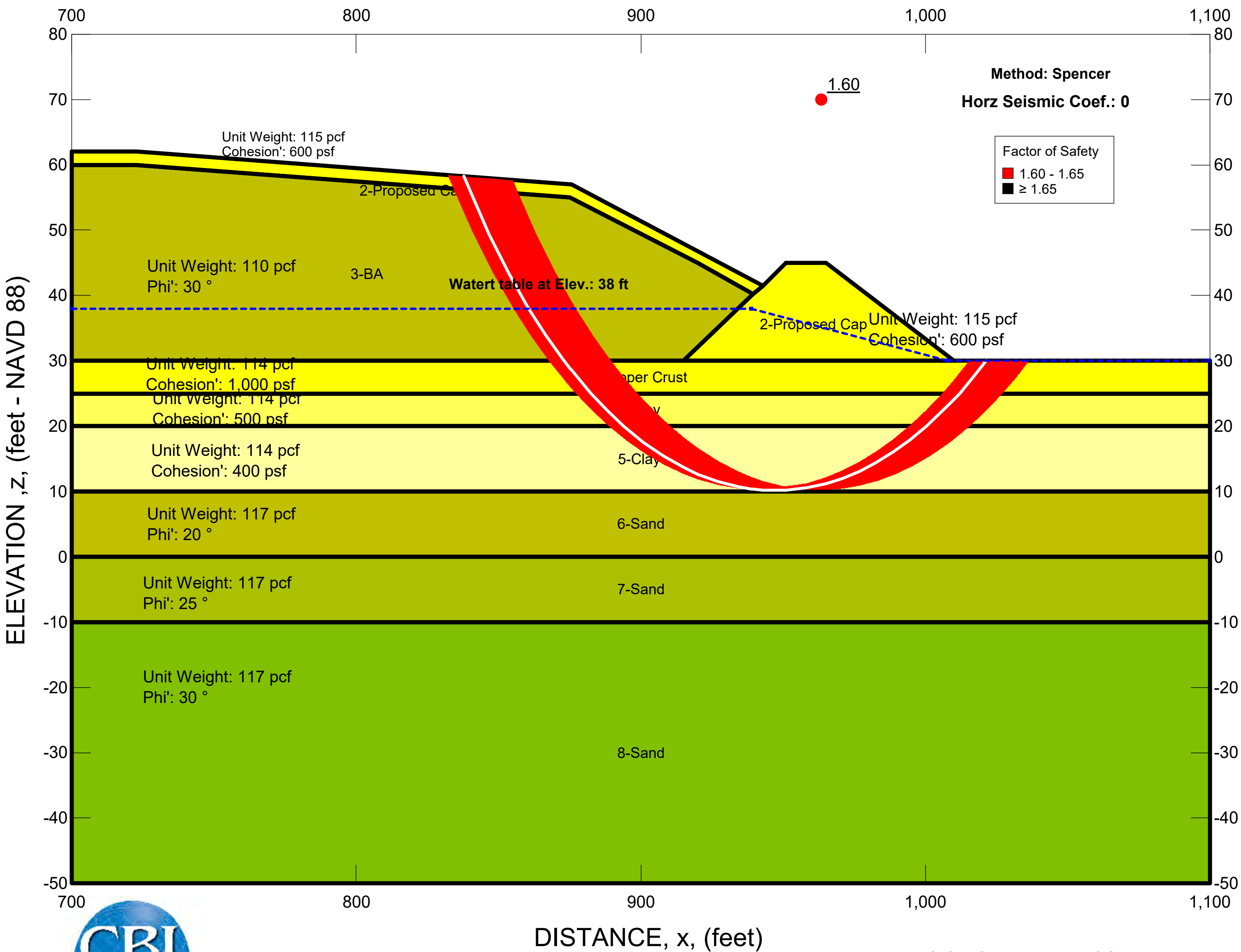
Last Edited By: Rosti, Firouz

SLOPE STABILITY ANALYSIS
GLOBAL STABILITY
GEOMETRY:Proposed Slope w./ Bottom Ash (BA)

PROJECT NO. 631215151
Big Cajun II Pond
New Raods, Louisiana

FIGURE



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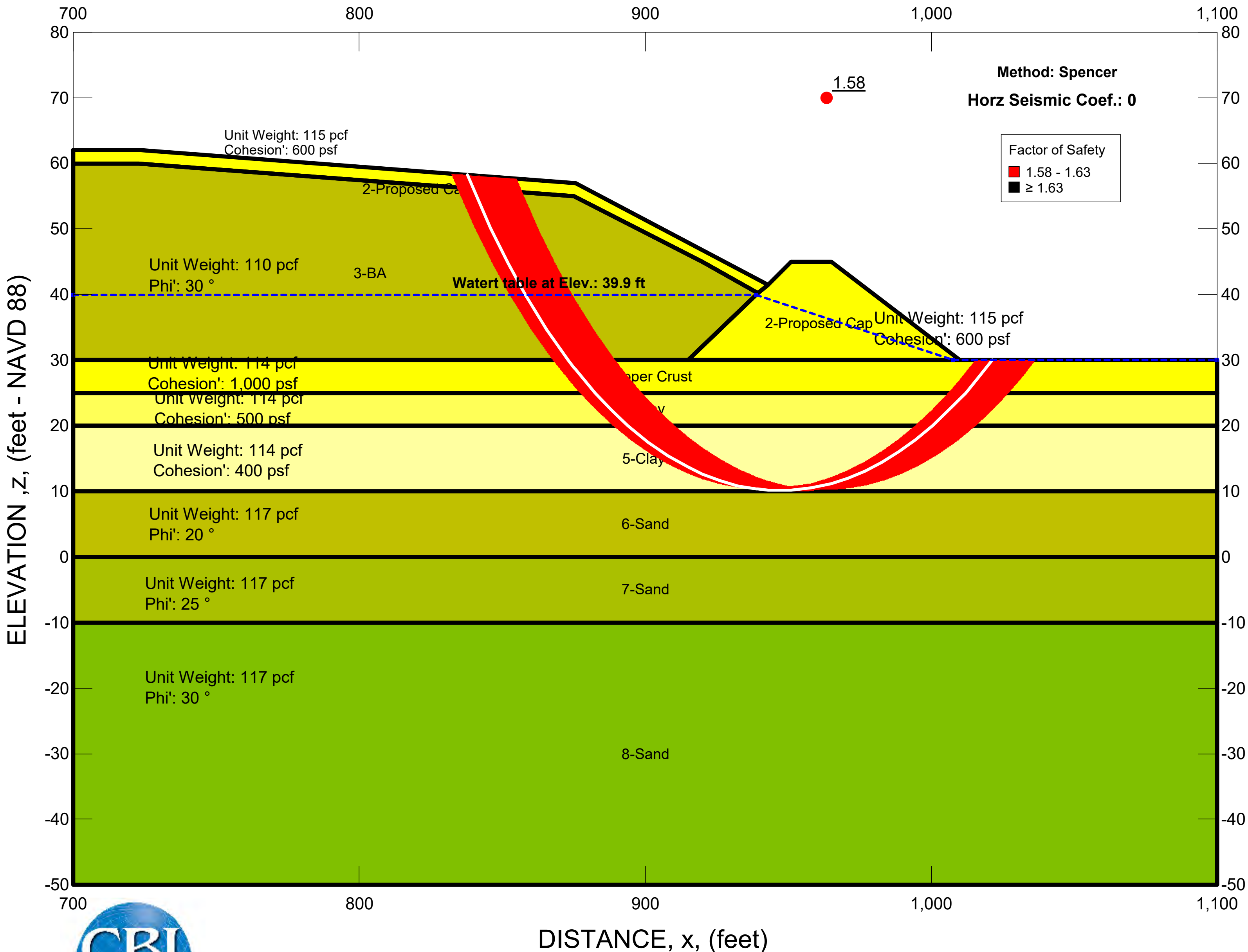
Last Edited By: Rosti, Firouz

SLOPE STABILITY ANALYSIS
GLOBAL STABILITY
GEOMETRY:Proposed Slope w./ Bottom Ash (BA)

PROJECT NO. 631215151
Big Cajun II Pond
New Raods, Louisiana

FIGURE



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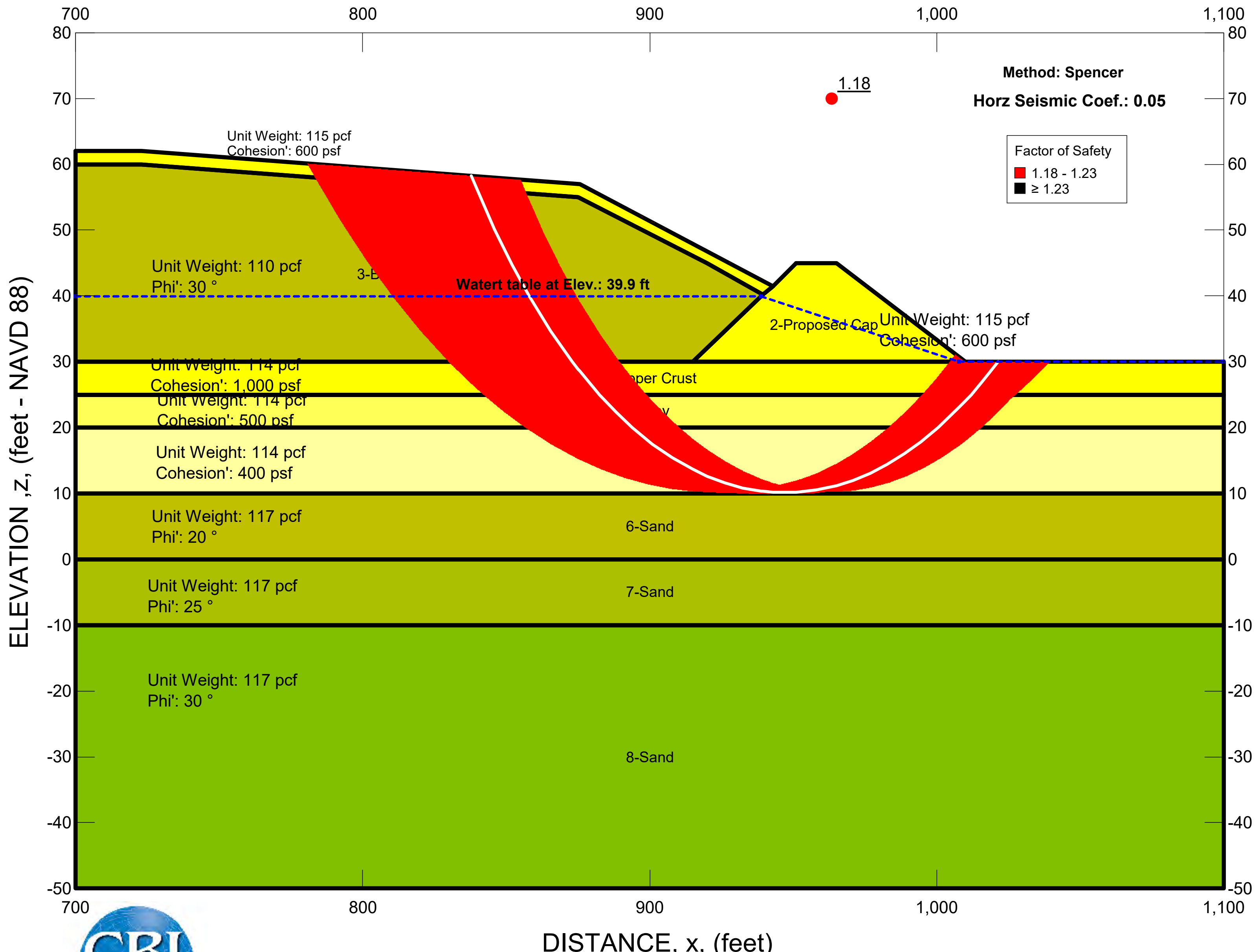
Last Edited By: Rosti, Firouz

SLOPE STABILITY ANALYSIS
GLOBAL STABILITY
GEOMETRY:Proposed Slope w./ Bottom Ash (BA)

PROJECT NO. 631215151
Big Cajun II Pond
New Raods, Louisiana

FIGURE



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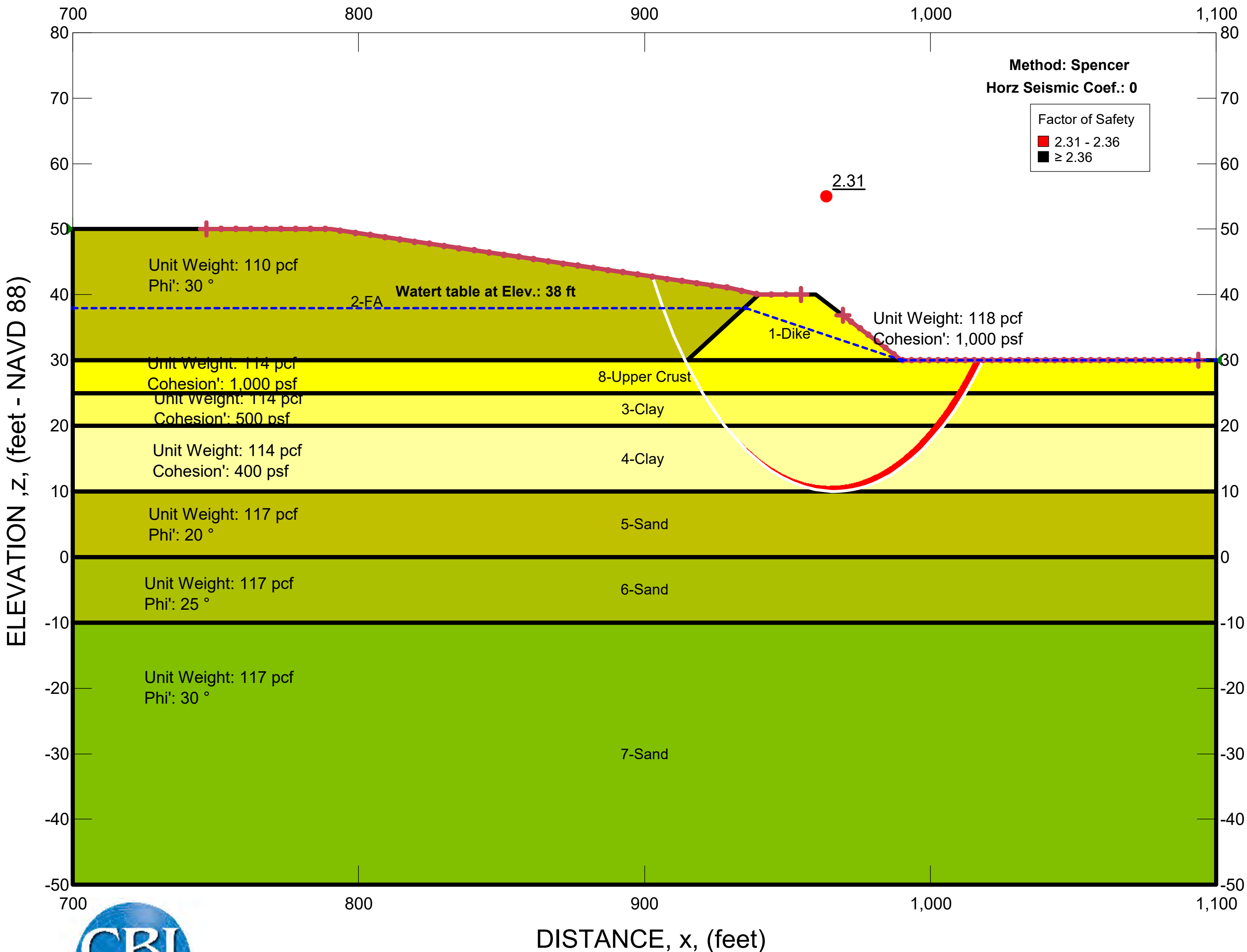
Last Edited By: Rosti, Firouz

SLOPE STABILITY ANALYSIS
GLOBAL STABILITY
GEOMETRY:Proposed Slope w./ Bottom Ash (BA)

PROJECT NO. 631215151
Big Cajun II Pond
New Raods, Louisiana

FIGURE



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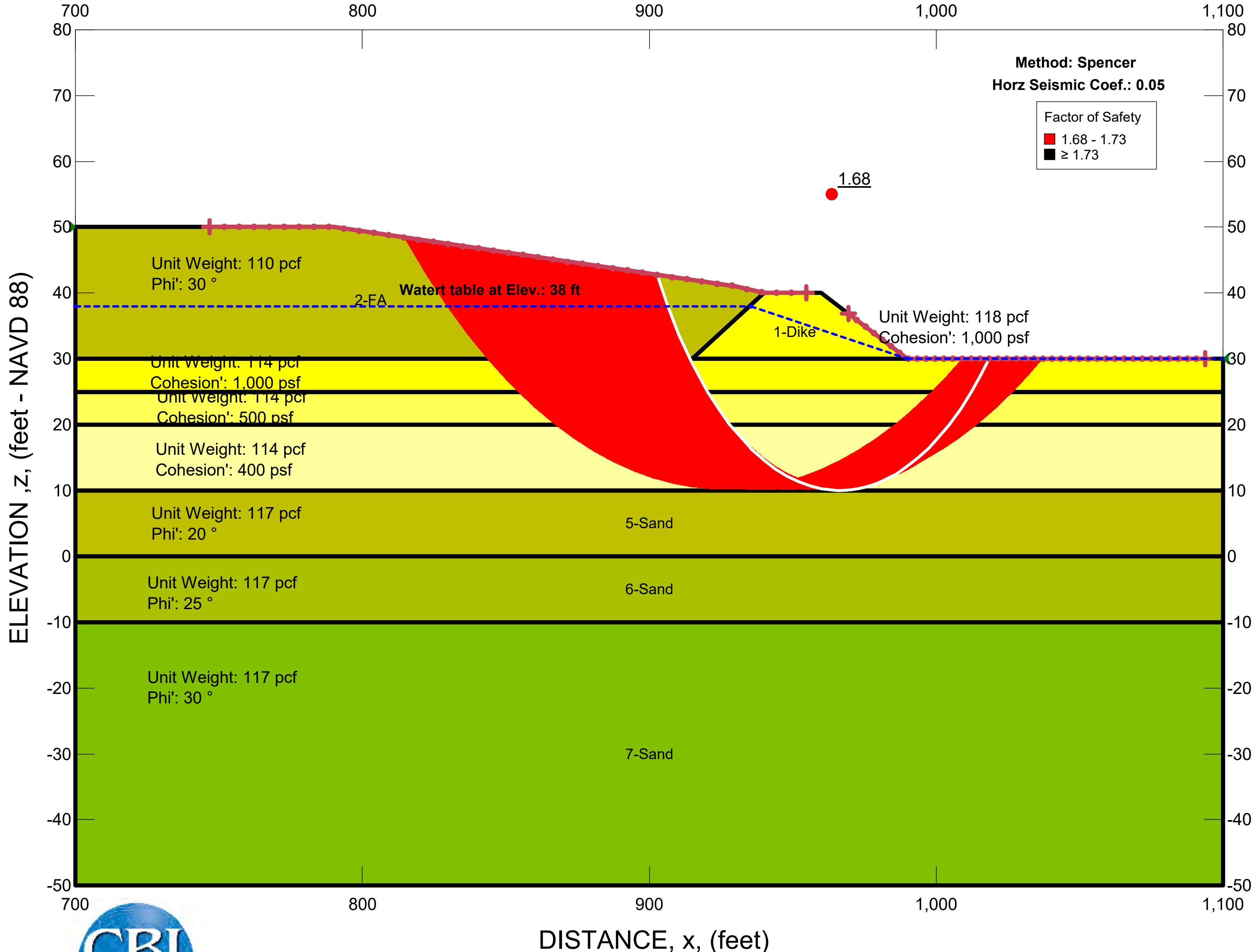
File Name: Cajun-FA-Existing.gsz
Directory: C:\Users\firouz.rosti\Desktop\Documents\PROJECTS\Cajun II\Calculations\
Last Edited By: Rosti, Firouz

SLOPE STABILITY ANALYSIS
GLOBAL STABILITY
GEOMETRY: Existing Slope w./ Fly Ash (FA)

PROJECT NO. 631215151
Big Cajun II Pond
New Raods, Louisiana

FIGURE



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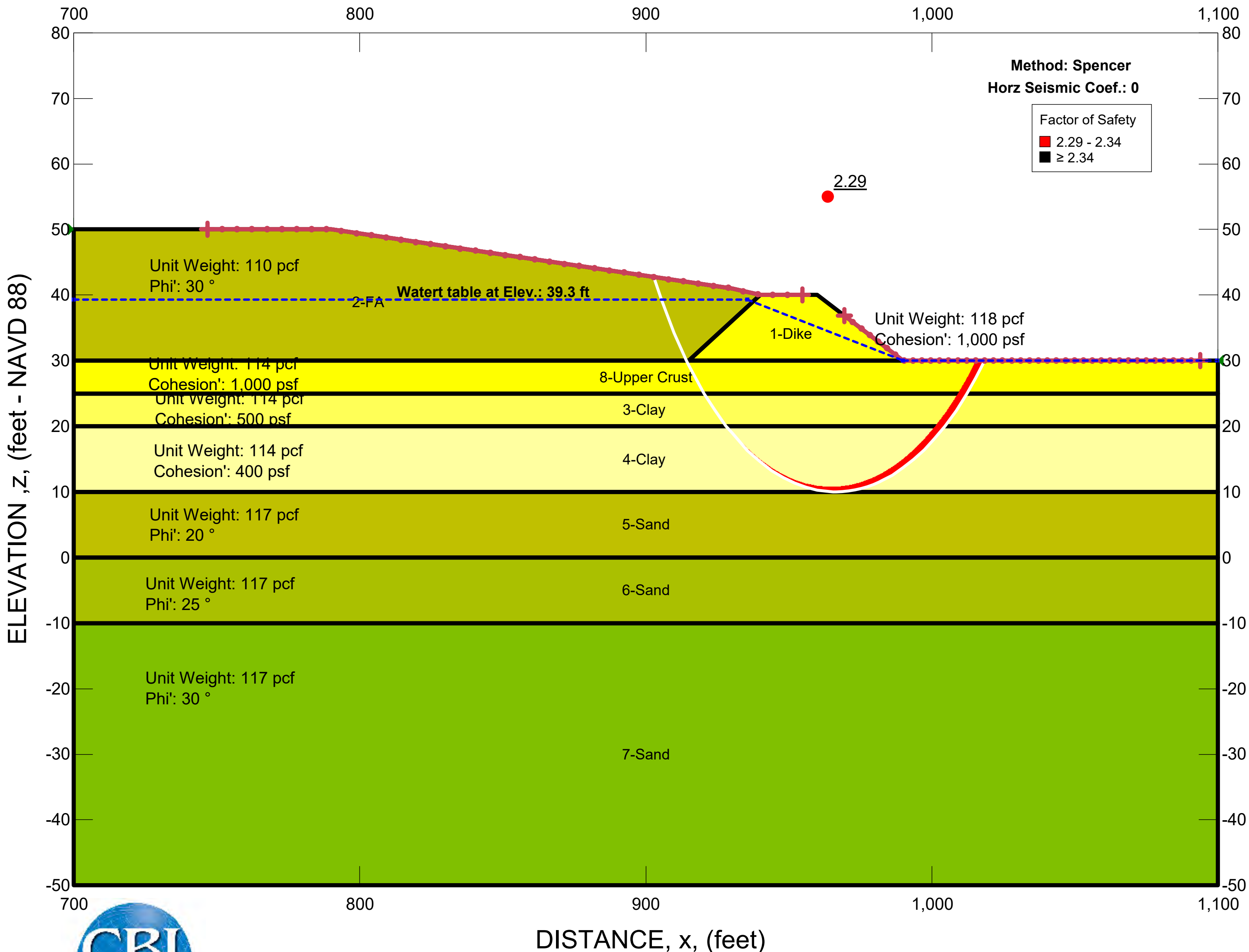
File Name: Cajun-FA-Existing.gsz
Directory: C:\Users\firouz.rosti\Desktop\Documents\PROJECTS\Cajun II\Calculations\
Last Edited By: Rosti, Firouz

SLOPE STABILITY ANALYSIS
GLOBAL STABILITY
GEOMETRY: Existing Slope w./ Fly Ash (FA)

PROJECT NO. 631215151
Big Cajun II Pond
New Raods, Louisiana

FIGURE



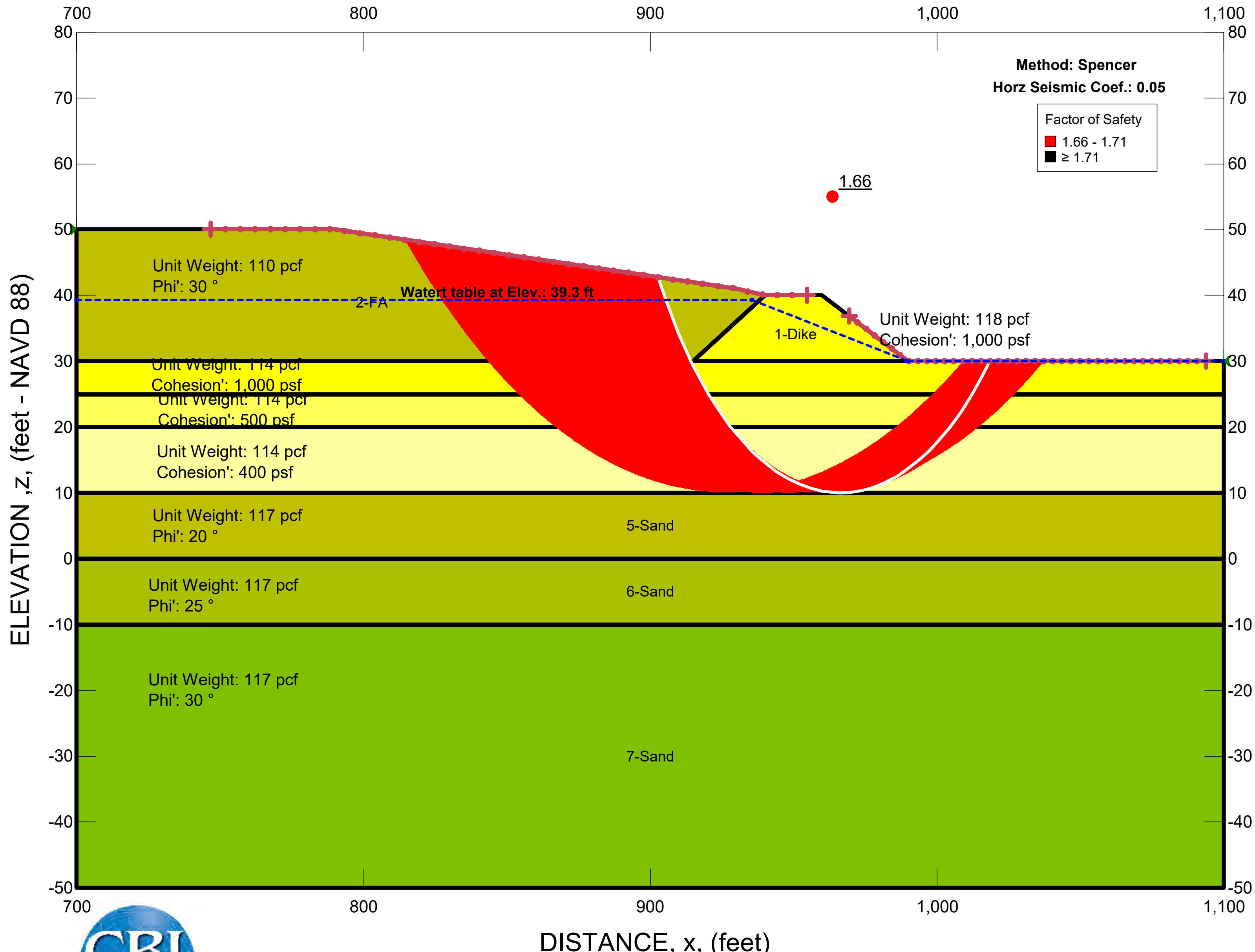
CB&I

Name: FA-Existing Slope
File Name: Cajun-FA-Existing.gsz
Directory: C:\Users\firouz.rosti\Desktop\Documents\PROJECTS\Cajun II\Calculations\
Last Edited By: Rosti, Firouz

SLOPE STABILITY ANALYSIS
GLOBAL STABILITY
GEOMETRY: Existing Slope w./ Fly Ash (FA)

PROJECT NO. 631215151
Big Cajun II Pond
New Raods, Louisiana

FIGURE



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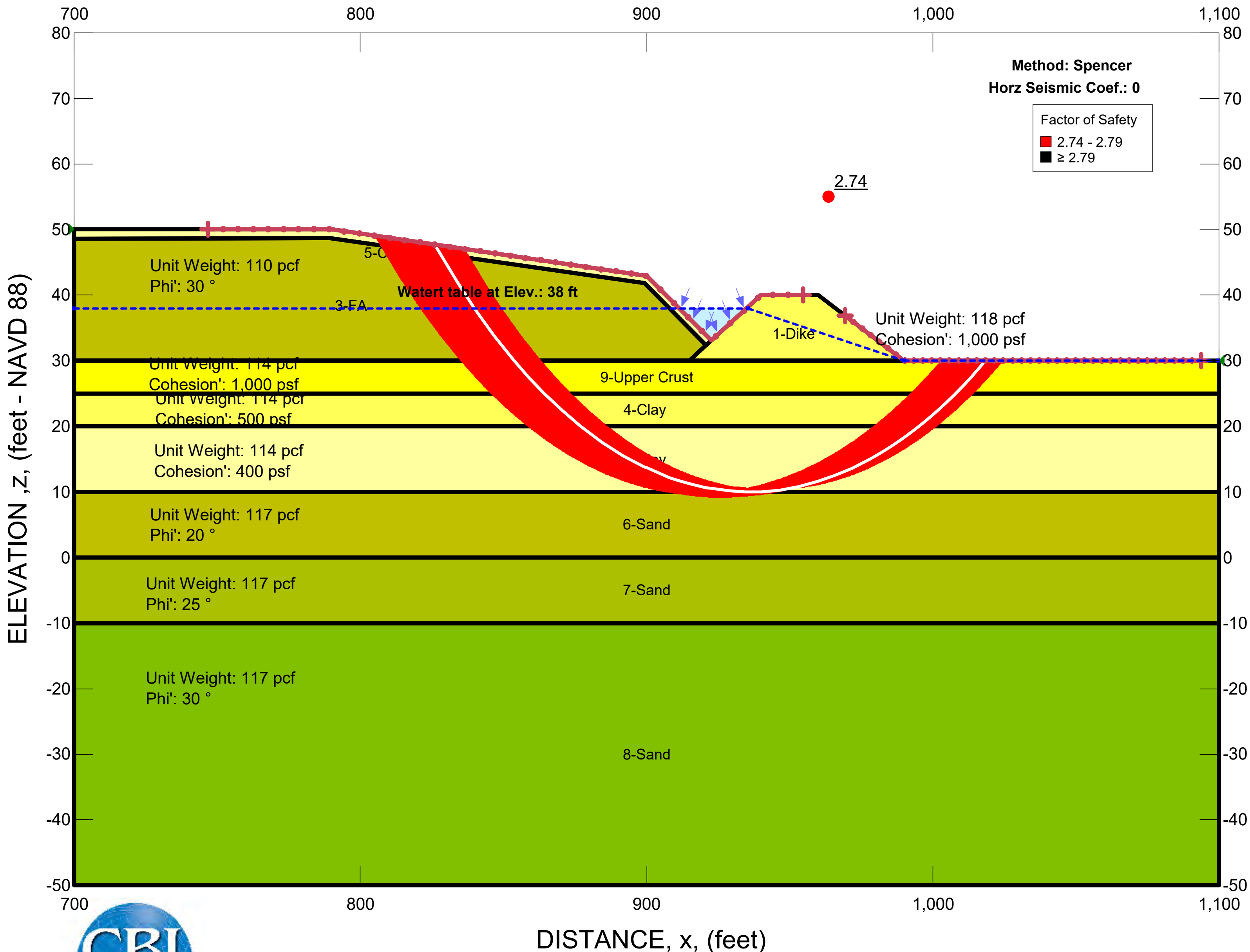
SLOPE STABILITY ANALYSIS
GLOBAL STABILITY
GEOMETRY: Existing Slope w./ Fly Ash (FA)

PROJECT NO. 631215151
Big Cajun II Pond
New Raods, Louisiana

FIGURE



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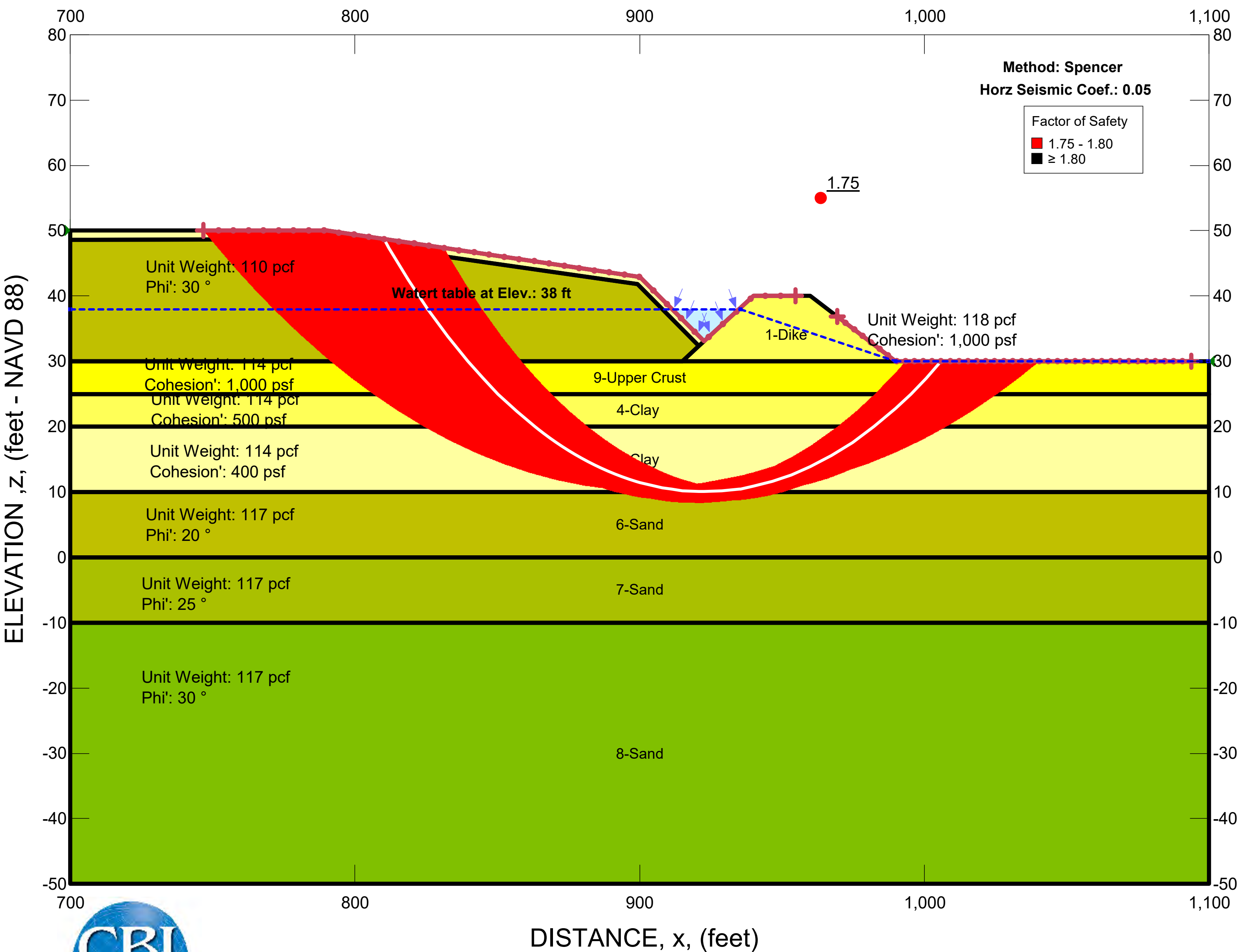
File Name: Cajun-FA-Proposed.gsz
Directory: C:\Users\firouz.rosti\Desktop\Documents\PROJECTS\Cajun II\Calculations\
Last Edited By: Rosti, Firouz

SLOPE STABILITY ANALYSIS
GLOBAL STABILITY
GEOMETRY: Proposed Slope w./ Fly Ash (FA)

PROJECT NO. 631215151
Big Cajun II Pond
New Raods, Louisiana

FIGURE



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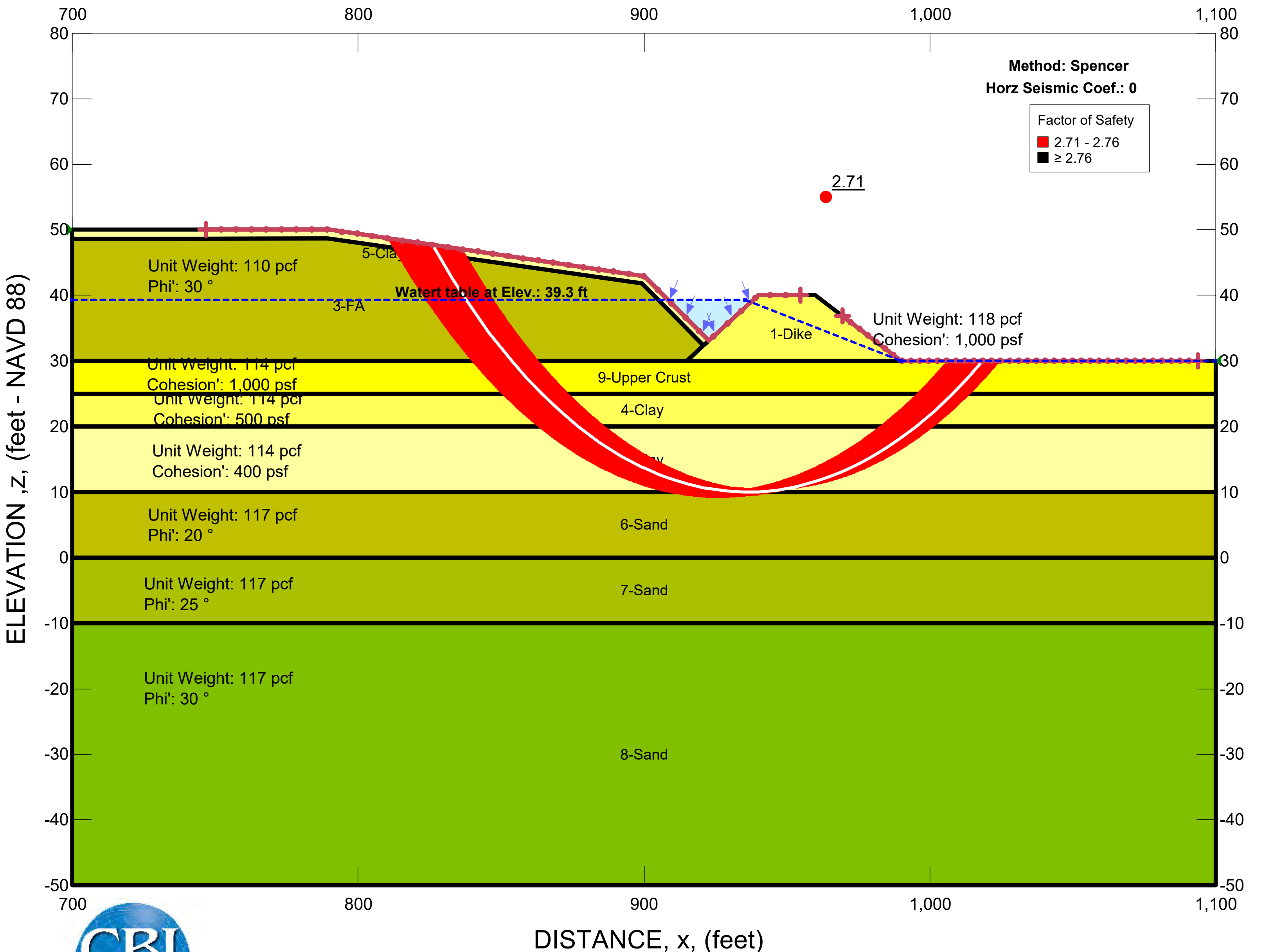
SLOPE STABILITY ANALYSIS
GLOBAL STABILITY
GEOMETRY: Proposed Slope w./ Fly Ash (FA)

PROJECT NO. 631215151
Big Cajun II Pond
New Raods, Louisiana

FIGURE



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SLOPE STABILITY ANALYSIS
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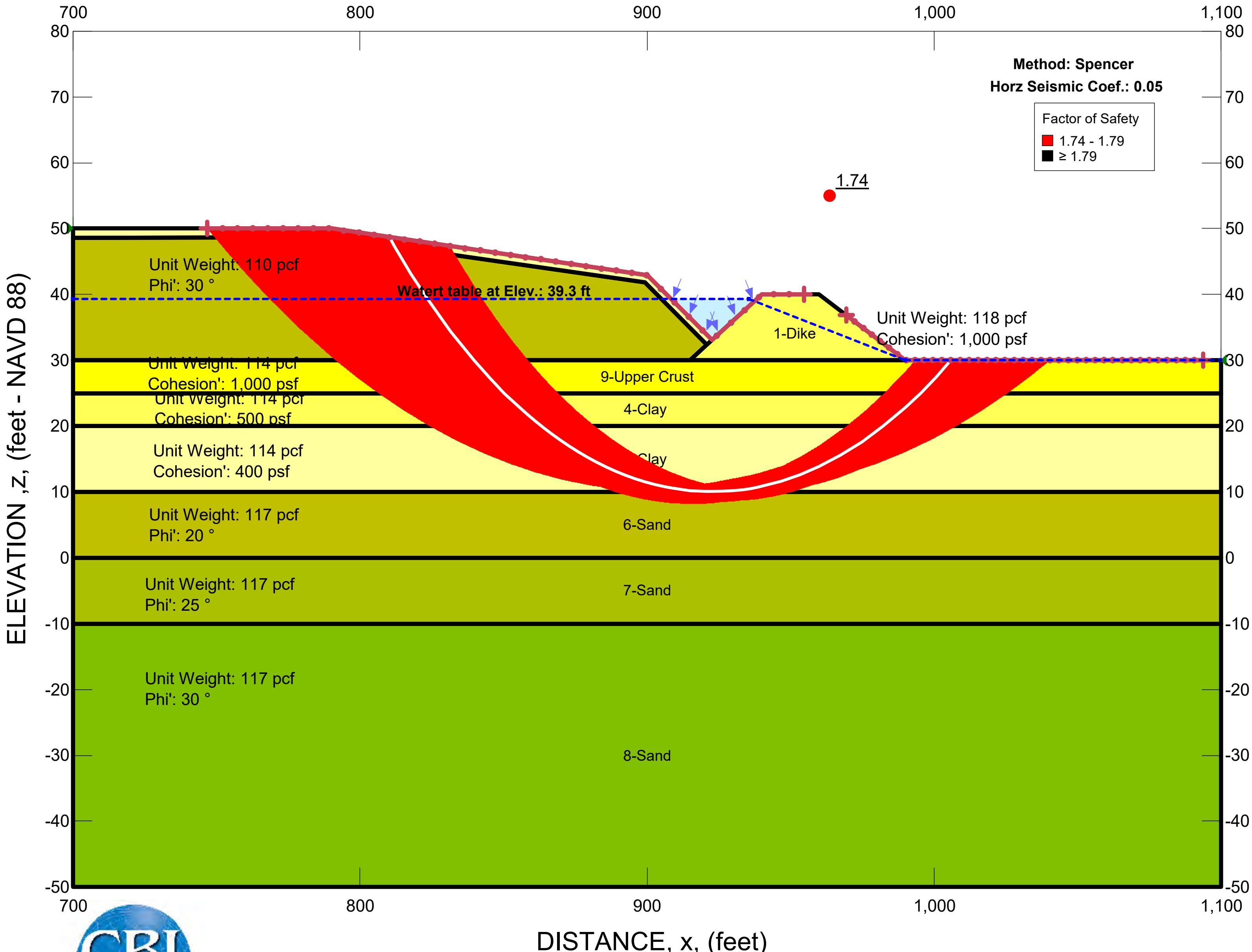
GEOMETRY: Proposed Slope w./ Fly Ash (FA)

PROJECT NO. 631215151
Big Cajun II Pond
New Raods, Louisiana

FIGURE



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SLOPE STABILITY ANALYSIS
GLOBAL STABILITY
GEOMETRY: Proposed Slope w./ Fly Ash (FA)

PROJECT NO. 631215151
Big Cajun II Pond
New Raods, Louisiana

FIGURE

APPENDIX H

SAFETY FACTOR ASSESSMENT

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List of Acronyms

CB&I	CB&I Environmental and Infrastructure, Inc.
BC II	Big Cajun II Plant
CCR	Coal Combustion Residuals
cm/sec	centimeters per second
EAP	Emergency Action Plan
EPA	U.S. Environmental Protection Agency
FOS	Factor of Safety
LAC	Louisiana Administrative Code
LaGen	Louisiana Generating, LLC
LDEQ	Louisiana Department of Environmental Quality
LPDES	Louisiana Pollutant Discharge Elimination System
MSL	Mean Sea Level
NRG	NRG Energy, Inc.
RCRA	Resource Conservation and Recovery Act
SWMU	Solid Waste Management Units
USGS	U.S. Geological Survey
yd^3	cubic yards

Structural Integrity Assessment Report/Amendment Log §257.73

Date of Review	Reviewer Name	Amendment Required (YES/NO)	Sections Amended and Reason

CCR Regulatory Requirements

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(a)(1) stipulates: *No later than, December 17, 2015, the owner or operator of the CCR unit must place on or immediately adjacent to the CCR unit a permanent identification marker, at least six feet high showing the identification number of the CCR unit, if one has been assigned by the state, the name associated with the CCR unit and the name of the owner or operator of the CCR unit.*	Section 4.1.1
§257.73(a)(2)(i)stipulates: *(i) The owner or operator of the CCR unit must conduct initial and periodic hazard potential classification assessments of the CCR unit according to the timeframes specified in paragraph (f) of this section. The owner or operator must document the hazard potential classification of each CCR unit as either a high hazard potential CCR surface impoundment, a significant hazard potential CCR surface impoundment, or a low hazard potential CCR surface impoundment. The owner or operator must also document the basis for each hazard potential classification.*	Section 4.1.2

USEPA CCR Criteria 40 CFR 257.73	**NRG Big Cajun II Power Plant Structural Integrity Review**
§257.73(a)(2)(ii)stipulates: *(ii) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial hazard potential classification and each subsequent periodic classification specified in paragraph (a)(2)(i) of this section was conducted in accordance with the requirements of this section.*	Section 4.1.2

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(a)(2)(iii) & (iv) stipulates: *(iii) Changes in hazard potential classification.* *(A) If the owner or operator of a CCR unit determines during a periodic hazard potential assessment that the CCR unit is no longer classified as either a high hazard potential CCR surface impoundment or a significant hazard potential CCR surface impoundment, then the owner or operator of the CCR unit is no longer subject to the requirement to prepare and maintain a written Emergency Action Plan (EAP) beginning on the date the periodic hazard potential assessment documentation is placed in the facility's operating record as required by § 257.105(f)(5).* *(B) If the owner or operator of a CCR unit classified as a low hazard potential CCR surface impoundment subsequently determines that the CCR unit is properly re-classified as either a high hazard potential CCR surface impoundment or a significant hazard potential CCR surface impoundment, then the owner or operator of the CCR unit must prepare a written EAP for the CCR unit as required by paragraph (a)(3)(i) of this section within six months of completing such periodic hazard potential assessment.* *(iv) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the written EAP, and any subsequent amendment of the EAP, meets the requirements of paragraph (a)(3) of this section.*	Sections 4.1.2 and 4.1.3

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(a)(2)(v) stipulates: *(v) Activation of the EAP. The EAP must be implemented once events or circumstances involving the CCR unit that represent a safety emergency are detected, including conditions identified during periodic structural stability assessments, annual inspections, and inspections by a qualified person.*	Section 4.1.3

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(a)(4)(c) stipulates: *(4) The CCR unit and surrounding areas must be designed, constructed, operated, and maintained with vegetated slopes of dikes not to exceed a height of 6 inches above the slope of the dike, except for slopes which are protected with an alternate form(s) of slope protection.* *(c)(1) No later than October 17, 2016, the owner or operator of the CCR unit must compile a history of construction, which shall contain, to the extent feasible, the information specified in* *(i) The name and address of the person(s) owning or operating the CCR unit; the name associated with the CCR unit; and the identification number of the CCR unit if one has been assigned by the state.* *(ii) The location of the CCR unit identified on the most recent U.S. Geological Survey (USGS) 71⁄2 minute or 15 minute topographic quadrangle map, or a topographic map of equivalent scale if a USGS map is not available.* *(iii) A statement of the purpose for which the CCR unit is being used.* *(iv) The name and size in acres of the watershed within which the CCR unit is located.* *(v) A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is constructed.*	Sections 4.1.4 and 4.1.5

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(a)(4)(c) stipulates: *(vi) A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit; the method of site preparation and construction of each zone of the CCR unit; and the approximate dates of construction of each successive stage of construction of the CCR unit.* *(vii) At a scale that details engineering structures and appurtenances relevant to the design, construction, operation, and maintenance of the CCR unit, detailed dimensional drawings of the CCR unit, including a plan view and cross sections of the length and width of the CCR unit, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the normal operating pool surface elevation and the maximum pool surface elevation following peak discharge from the inflow design flood, the expected maximum depth of CCR within the CCR surface impoundment, and any identifiable natural or manmade features that could adversely affect operation of the CCR unit due to malfunction or mis-operation.* *(viii) A description of the type, purpose, and location of existing instrumentation.* *(ix) Area-capacity curves for the CCR unit.* *(x) A description of each spillway and diversion design features and capacities and calculations used in their determination.* *(xi) The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.*	Section 4.1.5

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(a)(4)(c) stipulates: *(xii) Any record or knowledge of structural instability of the CCR unit.*	Section 4.1.5

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(d)(1) stipulates: *(d) Periodic structural stability assessments. (1) The owner or operator of the CCR unit must conduct initial and periodic structural stability assessments and document whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein. The assessment must, at a minimum, document whether the CCR unit has been designed, constructed, operated, and maintained with:* *(i) Stable foundations and abutments;* *(ii) Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown;* *(iii) Dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit;* *(iv) Vegetated slopes of dikes and surrounding areas not to exceed a height of six inches above the slope of the dike, except for slopes which have an alternate form or forms of slope protection;* *(v) A single spillway or a combination of spillways configured as specified in paragraph (d)(1)(v)(A) of this section. The combined capacity of all spillways must be designed, constructed, operated, and maintained to adequately manage flow during and following the peak discharge from the event specified in paragraph (d)(1)(v)(B) of this section;*	Section 4.1.6

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(d)(1) stipulates: *(A) All spillways must be either:* *(1) Of non-erodible construction and designed to carry sustained flows; or* *(2) Earth- or grass-lined and designed to carry short-term, infrequent flows at non-erosive velocities where sustained flows are not expected.* *(B) The combined capacity of all spillways must adequately manage flow during and following the peak discharge from a:* *(1) Probable maximum flood (PMF) for a high hazard potential CCR surface impoundment; or* *(2) 1000-year flood for a significant hazard potential CCR surface impoundment; or* *(3) 100-year flood for a low hazard potential CCR surface impoundment.* §257.73(d) stipulates: *(vi) 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; and* *(vii) 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.*	Section 4.1.6

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(d)(2) & (3) stipulate: *(2) The periodic assessment described in paragraph (d)(1) of this section must identify any structural stability deficiencies associated with the CCR unit in addition to recommending corrective measures. If a deficiency or a release is identified during the periodic assessment, the owner or operator unit must remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measures taken.* *(3) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial assessment and each subsequent periodic assessment was conducted in accordance with the requirements of this section.*	Section 4.1.6

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(e)(1) stipulates: *(e) Periodic safety factor assessments. (1) The owner or operator must conduct an initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety for each CCR unit achieve the minimum safety factors specified in paragraphs (e)(1)(i) through (iv) of this section for the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations* *(i) The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.* *(ii) The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.* *(iii) The calculated seismic factor of safety must equal or exceed 1.00.* *(iv) For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.*	Section 4.1.7

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(e)(2) stipulates: *(2) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial assessment and each subsequent periodic assessment specified in paragraph (e)(1) of this section meets the requirements of this section.*	Section 4.1.6
§257.73(f)(1) stipulates: *(f) Timeframes for periodic assessments—(1) Initial assessments. Except as provided by paragraph (f)(2) of this section, the owner or operator of the CCR unit must complete the initial assessments required by paragraphs (a)(2), (d), and (e) of this section no later than October 17, 2016. The owner or operator has completed an initial assessment when the owner or operator has placed the assessment required by paragraphs (a)(2), (d), and (e) of this section in the facility's operating record as required by § 257.105(f)(5), (10), and (12).* *(3) Frequency for conducting periodic assessments. The owner or operator of the CCR unit must conduct and complete the assessments required by paragraphs (a)(2), (d), and (e) of this section every five years. The date of completing the initial assessment is the basis for establishing the deadline to complete the first subsequent assessment. The owner or operator has completed an assessment when the relevant assessment(s) required by paragraphs (a)(2), (d), and (e) of this section has been placed in the facility's operating record as required by § 257.105(f)(5), (10), and (12).*	Sections 4.1.2, 4.1.6, 4.1.7, and 5.0

USEPA CCR Criteria 40 CFR 257.73	NRG Big Cajun II Power Plant Structural Integrity Review
§257.73(f)(4) stipulates: *(4) Closure of the CCR unit. An owner or operator of a CCR unit who either fails to complete a timely safety factor assessment or fails to demonstrate minimum safety factors as required by paragraph (e) of this section is subject to the requirements of §257.101(b)(2).*	Section 4.1.7
§257.73(g) stipulates: *(g) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(f), the notification requirements specified in §257.106(f), and the internet requirements specified in § 257.107(f).*	Section 5.0

1.0 *INTRODUCTION*

CB&I Environmental and Infrastructure, Inc. (CB&I) has prepared the following Structural Integrity Assessment documentation at the request of Louisiana Generating, LLC (LaGen) (a subsidiary of NRG Energy, Inc. [NRG]) for the Fly Ash Basin and Bottom Ash Basin (Ash Basins) at the Big Cajun II Power Plant (BC II Plant) located near New Roads, Pointe Coupee Parish, Louisiana (**Figure 1**). The BC II Plant is a coal-fired and natural gas-fired power plant that has been in operation since 1980. The Fly Ash Basin and Bottom Ash Basin have been deemed to be regulated coal combustion residual (CCR) units by the U. S. Environmental Protection Agency (EPA), through the Disposal of Coal Combustion Residuals from Electric Utilities Final Rule (CCR Rule) 40 CFR §257 and §261.

There are five solid waste management units (SWMUs) at the BC II Plant that are operated as industrial surface impoundments in accordance with the Louisiana Department of Environmental Quality (LDEQ), Louisiana Solid Waste Regulations (Louisiana Administrative Code [LAC] Title 33: part VII) under Permit Number P-0108R1 for Facility Identification Number GD-077-0583. Two of the five WMUs are required to comply with the requirements of the CCR Rule, which include the Fly Ash Basin and Bottom Ash Basin. The other three LDEQ-permitted surface impoundments at the BC II Plant that are not subject to the CCR Rule requirements include the Primary Louisiana Pollutant Discharge Elimination System (LPDES) Treatment Pond, Secondary LPDES Treatment Pond, and Rainfall Surge Pond (**Figure 2**).

LaGen has completed an initial structural integrity assessment of the Fly Ash Basin and Bottom Ash Basin in line with the requirements outlined in §257.73 for Structural Integrity Criteria for Existing CCR Surface Impoundments. This assessment document is presented to provide supporting documentation of the evaluation of the structural stability for the Fly Ash Basin and Bottom Ash Basin at LaGen's BC II Plant. The following Plan meets all the structural integrity assessment requirements outlined in the Rule, which are further described in Section 2.0.

2.0 *REGULATORY OVERVIEW OF CCR STRUCTURAL INTEGRITY REQUIREMENTS*

On April 17, 2015, the EPA published the CCR Rule under Subtitle D of the Resource Conservation and Recovery Act (RCRA) as 40 CFR Parts 257 and 261. The purpose of the CCR Rule is to regulate the management of coal combustion residuals in regulated units for landfill and surface impoundments. Section 257.73 of the CCR Rule requires owners or operators of CCR units to meet and document specific requirements related to the structural integrity criteria for existing CCR surface impoundments, including providing the following:

- Permanent identification marker for each CCR unit
- A summary of the history of construction for each CCR unit
- Initial and periodic assessments to determine the CCR unit hazard potential classification
- Initial and periodic CCR Unit structural stability assessments
- Initial and periodic CCR unit safety factor assessments

The following citations from the Rule are applicable for the Ash Basins as discussed in this document:

§257.73(a)(1) stipulates:

(1) No later than December 17, 2015, the owner or operator of the CCR unit must place on or immediately adjacent to the CCR unit a permanent identification marker, at least six feet high showing the identification number of the CCR unit, if one has been assigned by the state, the name associated with the CCR unit and the name of the owner or operator of the CCR unit.

§257.73(a)(2)(i) through (v) stipulate:

(2) Periodic hazard potential classification assessments.

(i) The owner or operator of the CCR unit must conduct initial and periodic hazard potential classification assessments of the CCR unit according to the timeframes specified in paragraph (f) of this section. The owner or operator must document the hazard potential classification of each CCR unit as either a high hazard potential CCR surface impoundment, a significant hazard potential CCR surface impoundment, or a low hazard potential CCR surface impoundment. The owner or operator must also document the basis for each hazard potential classification.

(ii) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial hazard potential classification and each subsequent periodic classification specified in paragraph (a)(2)(i) of this section was conducted in accordance with the requirements of this section.

(iii) Changes in hazard potential classification.

(A) If the owner or operator of a CCR unit determines during a periodic hazard potential assessment that the CCR unit is no longer classified as either a high hazard potential CCR surface impoundment or a significant hazard potential CCR surface impoundment, then the owner or operator of the CCR unit is no longer subject to the requirement to prepare and maintain a written Emergency Action Plan (EAP) beginning on the date the periodic hazard potential assessment documentation is placed in the facility's operating record as required by §257.105(f)(5).

(B) If the owner or operator of a CCR unit classified as a low hazard potential CCR surface impoundment subsequently determines that the CCR unit is properly re-classified as either a high hazard potential CCR surface impoundment or a significant hazard potential CCR surface impoundment, then the owner or operator of the CCR unit must prepare a written EAP for the CCR unit as required by paragraph (a)(3)(i) of this section within six months of completing such periodic hazard potential assessment.

(iv) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the written EAP, and any subsequent amendment of the EAP, meets the requirements of paragraph (a)(3) of this section.

(v) Activation of the EAP. The EAP must be implemented once events or circumstances involving the CCR unit that represent a safety emergency are detected, including conditions identified during periodic structural stability assessments, annual inspections, and inspections by a qualified person.

§257.73(a)(4)(c)(i) through (xii) stipulates:

(4) The CCR unit and surrounding areas must be designed, constructed, operated, and maintained with vegetated slopes of dikes not to exceed a height of 6 inches above the slope of the dike, except for slopes which are protected with an alternate form(s) of slope protection.

(c)(1) No later than October 17, 2016, the owner or operator of the CCR unit must compile a history of construction, which shall contain, to the extent feasible, the information specified below:

(i) The name and address of the person(s) owning or operating the CCR unit; the name associated with the CCR unit; and the identification number of the CCR unit if one has been assigned by the state.

(ii) The location of the CCR unit identified on the most recent U.S. Geological Survey (USGS) 7 1⁄2 minute or 15 minute topographic quadrangle map, or a topographic map of equivalent scale if a USGS map is not available.

(iii) A statement of the purpose for which the CCR unit is being used.

(iv) The name and size in acres of the watershed within which the CCR unit is located.

(v) A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is constructed.

(vi) A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit; the method of site preparation and construction of each zone of the CCR unit; and the approximate dates of construction of each successive stage of construction of the CCR unit.

(vii) At a scale that details engineering structures and appurtenances relevant to the design, construction, operation, and maintenance of the CCR unit, detailed dimensional drawings of the CCR unit, including a plan view and cross sections of the length and width of the CCR unit, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the normal operating pool surface elevation and the maximum pool surface elevation following peak discharge from the inflow design flood, the expected maximum depth of CCR within the CCR surface impoundment, and any identifiable natural or manmade features that could adversely affect operation of the CCR unit due to malfunction or mis-operation.

(viii) A description of the type, purpose, and location of existing instrumentation.

(ix) Area-capacity curves for the CCR unit.

(x) A description of each spillway and diversion design features and capacities and calculations used in their determination.

(xi) The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.

(xii) Any record or knowledge of structural instability of the CCR unit.

§257.73(d)(1)(i) through (vii) stipulates:

(d) Periodic structural stability assessments.

(1) The owner or operator of the CCR unit must conduct initial and periodic structural stability assessments and document whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein. The assessment must, at a minimum, document whether the CCR unit has been designed, constructed, operated, and maintained with:

(i) Stable foundations and abutments;

(ii) Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown;

(iii) Dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit;

(iv) Vegetated slopes of dikes and surrounding areas not to exceed a height of six inches above the slope of the dike, except for slopes which have an alternate form or forms of slope protection;

(v) A single spillway or a combination of spillways configured as specified in paragraph (d)(1)(v)(A) of this section. The combined capacity of all spillways must be designed, constructed, operated, and maintained to adequately manage flow during and following the peak discharge from the event specified in paragraph (d)(1)(v)(B) of this section;

(A) All spillways must be either:

(*1*) Of non-erodible construction and designed to carry sustained flows; or

(*2*) Earth- or grass-lined and designed to carry short-term, infrequent flows at non-erosive velocities where sustained flows are not expected.

(B) The combined capacity of all spillways must adequately manage flow during and following the peak discharge from a:

(*1*) Probable maximum flood (PMF) for a high hazard potential CCR surface impoundment; or

(*2*) 1000-year flood for a significant hazard potential CCR surface impoundment; or

(*3*) 100-year flood for a low hazard potential CCR surface impoundment.

(vi) 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; and

(vii) 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.

§257.73(d)(2) & (3) stipulate:

(2) The periodic assessment described in paragraph (d)(1) of this section must identify any structural stability deficiencies associated with the CCR unit in addition to recommending corrective measures. If a deficiency or a release is identified during the periodic assessment, the owner or operator unit must remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measures taken.

(3) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial assessment and each subsequent periodic assessment was conducted in accordance with the requirements of this section.

§257.73(e)(1)(i) through (iv) stipulates:

(e) Periodic safety factor assessments.

(1) The owner or operator must conduct an initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety for each CCR unit achieve the minimum safety factors specified in paragraphs (e)(1)(i) through (iv) of this section for the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations.

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

(ii) The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.

(iii) The calculated seismic factor of safety must equal or exceed 1.00.

(iv) For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

§257.73(e)(2) stipulates:

(2) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial assessment and each subsequent periodic assessment specified in paragraph (e)(1) of this section meets the requirements of this section.

§257.73(f)(1) stipulates:

(f) Timeframes for periodic assessments

(1) Initial assessments. Except as provided by paragraph (f)(2) of this section, the owner or operator of the CCR unit must complete the initial assessments required by paragraphs (a)(2), (d), and (e) of this section no later than October 17, 2016. The owner or operator has completed an initial assessment when the owner or operator has placed the assessment required by paragraphs (a)(2), (d), and (e) of this section in the facility's operating record as required by § 257.105(f)(5), (10), and (12).

§257.73(f)(3) stipulates:

(3) Frequency for conducting periodic assessments. The owner or operator of the CCR unit must conduct and complete the assessments required by paragraphs (a)(2), (d), and (e) of this section every five years. The date of completing the initial assessment is the basis for establishing the deadline to complete the first subsequent assessment. The owner or operator has completed an assessment when the relevant assessment(s) required by paragraphs (a)(2), (d), and (e) of this section has been placed in the facility's operating record as required by § 257.105(f)(5), (10), and (12).

§257.73(f)(4) stipulates:

(4) Closure of the CCR unit. An owner or operator of a CCR unit who either fails to complete a timely safety factor assessment or fails to demonstrate minimum safety factors as required by paragraph (e) of this section is subject to the requirements of § 257.101(b)(2).

§257.73(g) stipulates:

(g) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(f), the notification requirements specified in § 257.106(f), and the internet requirements specified in § 257.107(f).

3.0 *ASH BASINS OVERVIEW*

Pertinent site information and history related to the installation and operation of the Ash Basins are presented below to address the requirement of the documentation of the history of the CCR units and to provide context for the CCR Rule structural integrity documentation that follows.

3.1 Location, Topography, and Character

The LaGen BC II Plant is located at 10431 Cajun II Road, New Roads, Pointe Coupee Parish, Louisiana. The BC II Plant is situated in Sections 4, 5, and 37 in Township 4 South and Range 11 East. The Fly Ash Basin is located on the southwest end of the surface impoundments west of the BC II Plant and is bordered on the east by the Bottom Ash Basin; on the west by wooded property, a drainage ditch, and agricultural land; on the north by wooded property and agricultural land; and on the south by wooded property and grassy fields. The Fly Ash Basin and surrounding area are shown on **Figures 1 and 2**. The Bottom Ash Basin is located west of the BC II Plant. The Bottom Ash Basin is bordered on the west by the Fly Ash Basin; on the north by wooded property and agricultural land; on the east by the Treatment Ponds; and on the south by wooded property and grassy fields (**Figures 1 and 2**).

The Fly Ash Basin currently being filled has an area of approximately 175 acres. It was constructed above natural grade with a base of approximately 30 feet Mean Sea Level (MSL) and a surrounding berm with a design crest of 40-foot MSL. The existing site topography adjacent to the Fly Ash Basin is depicted on **Figure 3**. The Fly Ash Basin has an approximate capacity of 1,750 acre-feet with a permitted total ash storage capacity of 3,905,000 cubic yards [yd^3]). The soils underlying the Fly Ash Basin consist of naturally occurring and/or recompacted clayey soil that is a minimum of 3 feet thick to over 10 feet thick in some areas.

The Bottom Ash Basin currently being filled has an area of approximately 66 acres. It was constructed above natural grade with a base of approximately 30 feet MSL and a surrounding berm with a design crest of 48-foot MSL. The existing site topography adjacent to the Bottom Ash Basin is depicted on **Figure 3**. The Bottom Ash Basin has an approximate capacity of 1,188 acre-feet with a permitted total ash storage capacity of 2,585,000 yd^3. Similar to the Fly Ash Basin, the soils underlying the Bottom Ash Basin consist of naturally occurring and/or recompacted clayey soil that is a minimum of 3 feet thick to over 10 feet thick in some areas.

3.2 Existing Regulatory Permits

The Ash Basins have been granted and are currently operating under a LDEQ Solid Waste Permit as an industrial surface impoundment in accordance with the Louisiana Solid Waste

Regulations (LAC 33:VII) under Permit Number P-0108R1 and Facility Identification Number GD-077-0583. The Solid Waste Permit renewal was issued by the LDEQ on February 24, 2011 and allows CCR materials generated on-site at the LaGen BC II Plant to be properly disposed of within the boundaries of the Ash Basins.

3.3 Ash Generation, Recycling, and Disposal

Fly ash and bottom ash have been generated at the BC II Plant since they were constructed and became operational in 1980. Fly ash is generated from the burning of finely pulverized coal in high efficiency boilers. The fly ash is composed primarily of oxides of silicon, aluminum, calcium, sulfur, and iron and is typically a fine, spherical particle ranging in diameter from 0.5 to 100 microns, which can be used as a soil or aggregate stabilization agent.

Fly ash that is generated at the BC II Plant has historically been recycled (sold for beneficial reuse as a cement additive, for road base, and/or for soil stabilization applications) and/or transported to the Fly Ash Basin for disposal. Recycled fly ash rates depend on the market demand and can affect the life of the basin due to the variability in the amount of recycled material. Disposal rates therefore vary based on recycling opportunities, which vary between years. When the demand for ash exceeds production, the fly ash in the basin can be removed and sold.

Bottom ash is generated concurrently with fly ash during the combustion of coal in the boilers when particles of ash fuse together. These fused particles become too large to remain entrained in the rising flue gas and fall to the bottom of the boiler. Particles of bottom ash vary in diameter but approximate the size of coarse sand. Due to their similar origins, bottom ash and fly ash have the same approximate chemical makeup. The Bottom Ash Basin receives bottom ash from Units 1 and 3, as well as sediment from the clarifier beds associated with the cooling towers and boilers. Unit 2 is currently a gas-fired unit; therefore, ash is no longer generated by this unit. The clarifier sediments are piped to the southeast corner of the Bottom Ash Basin. The clarifier sediments are produced when water from the Mississippi River is clarified and softened for use as cooling water or boiler water. These sediments consist primarily of Mississippi River water naturally occurring silts and clays. They also contain some lime, sodium aluminate, and trace amounts of a water treatment polymer. The filling of the basin started along the south levee and proceeded northward.

3.4 Ash Basin Operations

3.4.1 Fly Ash Basin

Fly ash that is placed in the Fly Ash Basin for disposal is collected, stored in a silo, and transported by truck in dry powdered form to the Fly Ash Basin. Currently transport trucks discharge their loads of fly ash in the Fly Ash Basin and dozer equipment then spreads the fill evenly. The fly ash is hydrated by rainfall and compacted so that it will harden as it dries. Straight hardened fly ash has a theoretical hydraulic conductivity range of 10^{-6} centimeters per second (cm/sec) to 10^{-7} cm/sec. Periodic dozing of the fly ash material occurs as needed, within the active area to maintain a relatively uniform height.

Daily cover is not applied in the active area of fly ash disposal due to the fly ash being wetted (by rainfall) and hardened, and thereby minimizing potential dust generation. Additionally, no intermediate cover is applied to the basin due to the rapid hardening of the fly ash. Weekly (7-day) inspections and annual reporting are undertaken for the Fly Ash Basin in line with site inspection requirements for CCR units (§257.83[b] Inspection Requirements for CCR Surface Impoundments) to identify any stability, operational, and/or safety issues which require attention.

During the 2015 annual inspection of the Fly Ash Basin, observations indicated the water level inside the basin was approximately 5 feet below the crest of the levee and approximately two-thirds of the Fly Ash Basin was covered with open water. Rainfall runoff is removed from the basin by a stormwater runoff collection system. Flood control is managed in accordance with the CCR Rule Inflow Design Flood Control System Plan for the site.

Under current operations, the Fly Ash Basin surface water runoff is directed by an interior drainage swale to a pipe connection into the Bottom Ash Basin. The Bottom Ash Basin process water and surface water, combined with storm water from the Fly Ash Basin, are directed by an interior swale to a weir located at the northeast corner of the Bottom Ash Basin. A 30-inch diameter pipe carries the combined water by gravity flow to the Rainfall Surge Pond. Water from the Rainfall Surge Pond is then pumped into the Primary Treatment Basin for further treatment. Water flows by gravity from the Primary Treatment Basin to the Secondary Treatment Basin. A pump station moves water from the Secondary Treatment Basin to the Mississippi River discharge point in accordance with the Plant's LPDES permit (Permit No. LA0054135).

3.4.2 Bottom Ash Basin

The bottom ash from Unit 1 is collected in hoppers at the base of the boiler of Unit 1 and then transported hydraulically (sluiced) through a pipe directly to the Bottom Ash Basin. Bottom ash from Unit 3 is collected in hoppers at the base of the boiler and trucked in a hydrated state to the southwest corner of the Bottom Ash Basin for disposal. The clarifier sediments are piped to the southeast corner of the Bottom Ash Basin. The filling of the basin started along the south levee and proceeded northward.

Periodic dozing of the bottom ash material occurs as needed, within the active area to maintain a relatively uniform height. Daily and/or interim cover is not applied in the active area of bottom ash disposal. The bottom ash is wet and/or transported in hydrated form that prevents potential dust generation. Weekly (7-day) inspections and annual reporting are undertaken for the Bottom Ash Basin in line with site inspection requirements for CCR units (§257.83[b]: Inspection Requirements for CCR Surface Impoundments) to identify any stability, operational, and/or safety issues which require attention.

During the 2015 annual inspection of the Bottom Ash Basin, observations indicated there was minimal open water in the Bottom Ash Unit and the bottom of the unit was covered with bottom ash. The north half of the Basin was covered to a level of about 15 feet below the crest of the levee, while the southern half was filled to about the level of the levee. The southern half also had a large stockpile of ash at the ash disposal location. The stockpile was approximately 15 to 20 feet tall, but was no closer than approximately 50 feet from the levee. Rainfall runoff is removed from the basin by a stormwater runoff collection system.

As previously described, the Bottom Ash Basin sluice water and surface water is combined with storm water from the Fly Ash Basin and is treated and discharged to the Mississippi River in accordance with the Plant's LPDES permit (Permit No. LA0054135).

4.0 *STUCTURAL SATABILITY DOCUMENTATION*

4.1 *Structural Stability Criteria and Requirements*

Supporting documentation for the structural integrity criteria for the Fly Ash Basin and Bottom Ash Basin are presented below in accordance with the CCR Rule requirements. The applicable structural stability criteria and certification/recordkeeping requirements are as follows:

4.1.1 Ash Basin Identification Marker

In December 2015, identification markers were installed at the Fly Ash and Bottom Ash Basins in accordance with the applicable CCR Rule requirements. The markers include the name associated with the CCR unit, the name of the facility, and the name of the owner/operator of the CCR unit. The location of each of the markers was surveyed and documentation/certification of the installation and survey is maintained at the BC II Plant, and placed in the facilities operating records in December 2015. A copy of the marker installation documentation is included in **Appendix A**.

4.1.2 Periodic Hazard Potential Classification Assessments

The initial hazard potential classification assessments of the Fly Ash Basin and Bottom Ash Basin were completed in accordance with the CCR Rule requirement. The basis for the criteria used to evaluate the hazard potential assessment was in accordance with the ‘‘Guidelines for Inspections of Existing Dams.’’ New Jersey Department of Environmental Protection—Dam Safety (January 2008). EPA modeled its impoundment condition rating criteria on those developed by the State of New Jersey. In developing the criteria that were used to conduct the assessments, a standard rating system was developed to classify the units’ suitability for continued safe and reliable operation.

The potential hazard classes defined in the CCR Rule are as follows:

- **High hazard potential** CCR surface impoundment means a diked surface impoundment where failure or mis-operation will probably cause loss of human life.
- **Significant hazard potential** CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.
- **Low hazard potential** CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life and low economic

and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.

An evaluation of the possible adverse incremental consequences that could result from the release of water or stored contents due to failure of the diked CCR surface impoundments or mis-operation of the diked surface impoundments was performed. It was determined that failure or mis-operation of the diked surface impoundments was unlikely to cause: loss of human life, economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns. This determination was based on the materials stored in the impoundments and the impoundment's capacity and physical location relative to downgradient inhabitants/structures and environmental systems. Specifically, it was determined that:

- The fly ash stored in the Fly Ash Basin is a pozzolanic material, which forms a slow hardening cement in the presence of water. This produces a hard, structurally stable compound with very low permeability that has a low susceptibility to flow beyond the basin levees. The rainwater runoff that is also impounded in the Basin is more susceptible to flow from the basin if the basin levee were to fail.
- The bottom ash stored in the Bottom Ash Basin consists of particles that are the approximate size of coarse sand, which makes this material less susceptible to flow over long distances. The volume of rainwater stored in the Bottom Ash Basin is much less than in the Fly Ash Basin resulting in less potential for discharge from the basin if the basin levee were to fail.
- If failure or mis-operation of the diked surface impoundments occurred, topographic control would generally direct flow away from inhabitants and sensitive structures (**Figure 4**).
- Power plant structures are more than 1,500 feet away and are not downgradient from the impoundments.
- Flow would generally initially proceed in a southerly direction until reaching an unnamed drainage ditch located about 750 feet south of the impoundments.
- The nearest downgradient infrastructure is a railroad track that is located on the opposite side of the drainage ditch.
- Flow would then proceed southwesterly in the drainage ditch, flowing under Louisiana (La) Highway 10, which is located approximately 1,200 feet away along the shortest flow path from the nearest impoundment.
- Approximately 700 feet downgradient from La Highway 10, the flow would turn south and go under the railroad track.
- Flow would then proceed south through a 1.75-mile stretch of wooded area.
- The nearest water body is Lake Pattin, located over 2 miles away from the impoundments.

- The impoundment capacities are insufficient to cause physical damage to the railroad track, highway, or environmental damage to the nearest water body, even under complete and sudden failure conditions.
- Due to levees and topographic control, a release would not impact the Mississippi River.
- Losses would likely be principally limited to the facility property.
- Engineering analyses indicate the basin is designed to contain a 100-year storm event. Documentation of this analysis is provided under separate cover in the CCR Rule Fly Ash Basin and Bottom Ash Basin Inflow Design Flood Control System Plan.
- Slope stability engineering analyses indicate the basin design meets the applicable safety factor requirements as specified in the CCR Rule. Documentation of these engineering analyses is provided in Section 4.1.7.

Based on this information, the Fly Ash and Bottom Ash Basins were assigned a low hazard potential. The hazard potential classification assessment for the Ash Basins includes a certification from a qualified professional engineer stating that the initial hazard potential classification was conducted in accordance with the requirements of the applicable CCR Rule. The certification is provided in Section 6.0 of this document.

In accordance with the CCR Rule, the next hazard potential classification assessment will be completed 5 years from the date of the completion of the initial assessment.

4.1.3 Emergency Action Plan

Based on the low hazard potential assigned to the Fly Ash Basin and Bottom Ash Basin, it is not required to develop and implement an EAP for these CCR units at this time. If in the future the CCR unit is properly re-classified as either a high hazard potential or a significant hazard potential, a written EAP will be prepared for the CCR unit within 6 months of completing the subsequent hazard potential assessment. The EAP must be implemented once events or circumstances involving the CCR unit that represent a safety emergency are detected, including conditions identified during periodic structural stability assessments, annual inspections, and inspections by a qualified person.

Although the Fly Ash and Bottom Ash Basins are not required to have an EAP, LaGen has prepared emergency action procedures for the BC II Plant as part of the regulatory permitting of the surface impoundments under the Louisiana Solid Waste Rules and Regulations.

4.1.4 Vegetated Slope Protection

The Fly Ash Basin and Bottom Ash Basin levees and surrounding areas are designed, constructed, operated, and maintained with a protective vegetative cover on the slopes of the levees that is maintained such that it does not exceed a height of 6 inches above the slope of the levee.

4.1.5 History of Construction

A history of the Fly Ash Basin and Bottom Ash Basin construction, to the extent feasible, has been compiled in accordance with the CCR Rule requirements of §257.73(a)(4)(c)(i) through (xii) as follows:

- The name and address of the person(s) owning or operating the CCR unit: LaGen, a subsidiary of NRG Energy, Inc.
- The name associated with the CCR units: Fly Ash Basin and Bottom Ash Basin
- The identification number of the CCR unit (if one has been assigned by the state): Not applicable (numbers have not been assigned by the state).
- The locations of the Fly Ash Basin and Bottom Ash Basin: The locations of the Ash Basins are identified on the US Geological Survey (USGS) topographic map on **Figure 1**.
- The purposes for which the Fly Ash Basin and the Bottom Ash Basin are being used: The Fly Ash Basin is used to collect and store fly ash generated from the burning of finely pulverized coal in a high efficiency boiler. The Bottom Ash Basin is used to store bottom ash from Power Generating Units 1, 2, and 3, as well as sediment from the clarifier beds associated with the cooling towers and boilers.
- The name and size (in acres) of the watershed within which the Fly Ash Basin and the Bottom Ash Basin are located: The False River watershed (Hydrologic Unit Code 080703000101) with an area of 34,640 acres. A map showing the location of the watershed is included in **Appendix B**. However, due to the construction of the Ash Basins, the watershed for the Basins is limited to the Basins themselves.
- The physical and engineering properties of the foundation and abutment materials on which the Fly Ash and the Bottom Ash Basins were constructed: Between 1974 and 1977, prior to construction, an extensive geotechnical soil survey was conducted at the location of the Fly Ash Basin and Bottom Ash Basin to determine the properties of the soil foundation. Soil borings were laid out in a square pattern with a spacing of 250 feet. Classification tests such as the Atterberg Limits Determination, grain size analysis, and compression tests were conducted. Void ratios and permeabilities were also determined at that time. The results of the soil investigation indicated that both of the Ash Basins have a foundation of at least 3 feet of clayey soils, with permeabilities less than 1.0 $X10^{-7}$ cm/sec. In areas where naturally-occurring clayey soils were less than 3 feet thick, recompacted clay was added during construction of the impoundments to ensure a minimum clayey soil thickness of 3 feet below the impoundments.

  The levee system surrounding the Fly Ash and Bottom Ash basins were constructed of compacted earthen, clay material sloped to a ratio of 3:1 (horizontal:vertical) ratio, with a base of approximately 30 feet MSL. The levee system that surrounds the Fly Ash Basin has a design elevation of 40 feet MSL, which is approximately 10 feet above grade. The Fly Ash Basin has an approximate capacity of 1,750 acre-feet with a permitted total fly ash capacity of 3,905,000 yd^3. The levee system that surrounds the Bottom Ash Basin has a design elevation of 48 feet MSL, which is approximately 18 feet above grade. The Bottom Ash Basin has an approximate capacity of 1,188 acre-feet with a permitted total bottom ash capacity of 2,585,000 yd^3.

- The type, size, range, and physical and engineering properties of the materials used in constructing, the method of site preparation and construction, and the date of construction of the Fly Ash and the Bottom Ash Basins: After clearing and grubbing exposed the existing land surface, the Ash Basins were constructed by surrounding the naturally existing clay grade with compacted clay (lifts of approximately 10 to 12 inches) until the designed slope and crest height was reached. Construction of both Ash Basins was completed in 1980.

- Scaled drawings and cross sections that detail the engineering structures and appurtenances relevant to the design, construction, operation, and maintenance of the Fly Ash Bain and the Bottom Ash Basin: The applicable features are included on **Figures 2** through **8**. These drawings include detailed dimensions of the basins, including plan view and cross sections of the basin lengths and widths, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the normal operating pool surface elevation and the maximum pool surface elevation following peak discharge from the inflow design flood, plus the expected maximum depth of CCR within the basins, and any identifiable natural or manmade features that could adversely affect operation of the basins due to malfunction or mis-operation.

- The type, purpose, and location of existing instrumentation for the Fly Ash Basin and the Bottom Ash Basin are as follows: The only instrumentation installed in either of the ash basins is a weir and valve located on the downstream side of the Bottom Ash Basin to control gravity flow into the Rainfall Surge Pond.

- The area-capacity curves for the Fly Ash Basin and the Bottom Ash Basin: The area-capacity curves for the Ash Basins are included in **Appendix C**.

- The spillway and diversion design features and capacities and calculations used in area-capacity curves determinations: Water in the Fly Ash Basin is directed by an interior drainage swale to a 30-inch diameter gravity flow pipe connection into the Bottom Ash Basin. The water in the Bottom Ash Basin is directed by an interior swale to a weir located at the northeast corner of the Bottom Ash Basin. The combined water from the Fly Ash and Bottom Ash Basins is transported by a 30-inch diameter gravity flow pipe to the Rainfall Surge Pond. There is a flow control valve between the Bottom Ash Unit and the Rainfall Surge Pond.

  The design capacity of the 30-inch pipe to transfer water from the Fly Ash Basin to the Bottom Ash Basin was evaluated/calculated in conjunction with the transfer of water from the Bottom Ash Basin to the Rainwater Surge Pond to determine if the capacity is sufficient to prevent overtopping of the levee from a 100-year rain event. This evaluation was conducted using HydroCAD®. Based on the existing hydraulic storage capacity of the Basins and the design storm, it is calculated that the peak water level rises 1.3 feet in the Fly Ash Basin and 2 feet in the Bottom Ash Basin. The general operating procedure is to maintain a minimum freeboard in the Fly Ash Basin of 2 feet. The freeboard on the Bottom Ash Basin is much larger due to the higher berm elevation. Therefore, this minimum 2 feet of freeboard is sufficient to prevent overtopping of the Fly Ash Basin. The calculation indicated the existing storage capacity is sufficient to prevent overtopping of the levee from a 100-year rain event. Additional details on the spillway and diversion design features and capacities and calculations are provided under separate cover in the CCR Rule Fly Ash Basin and Bottom Ash Basin Inflow Design Flood Control System Plan.

- The construction specifications and provisions for surveillance, maintenance, and repair of the Fly Ash and the Bottom Ash Basins: The Facility Operational Plan indicates that daily inspections are performed to detect evidence of leaks, odors, or structural failure, and to verify that a minimum 2.0 feet of freeboard is maintained. If leaks are detected, the LDEQ Waste Permits Division will be notified immediately.

  A more involved weekly inspection looks for surface cracking, low areas, sliding/sloughing/bulging, soft/wet areas, vegetation, animal burrow holes, and erosion. The condition of the interior drainage swale and exit weir are also observed weekly.

  Historically, maintenance and repair has included, but was not limited to: frequent mowing of the crest and outside embankment face, limited areas of regrading/repair of the crest, repairing/rebuilding the inside embankment slope, erosion protection, and removing trees that have grown near the outside dike toe.

  In 2011, the facility implemented a program of regular inspections by dam safety engineers to identify changes in the performance of the embankments in a timely manner.

- Previous records or knowledge of any structural instability of the Fly Ash and the Bottom Ash Basins: Previous geotechnical reconnaissance and assessments/evaluations of the CCR units and other impoundments were conducted by GeoEngineers, Inc. (GeoEngineers) of Baton Rouge, Louisiana at the BC II Plant in 2011, 2012, 2014, and 2015. Summaries of the most recently completed GeoEngineers geotechnical evaluations of the Fly Ash and Bottom Ash Basins from 2014 and 2015 are presented below.

  The GeoEngineers report (GeoEngineers, 2014) titled "Embankment Dike Inspection Services", August 13, 2014 concluded that the dikes are generally stable, but several areas for consideration were identified, including:

  - Erosion along inside of levees
  - Excessive vegetation growth
  - Desiccation cracking
  - Animal burrows
  - Sloughing or slope instability areas and
  - Toe seepage areas.

The GeoEngineers report (GeoEngineers, 2015) titled "Dike Slope Failure Evaluation", July 1, 2015 identified three locations where the dikes were potentially unstable, if actions were not taken to address the current conditions.

- North dike of Bottom Ash Unit
- South dike of Fly Ash Unit near west end
- South dike of Fly Ash Unit near center of south dike.

As a result of recommendations detailed in the above 2015 GeoEngineers report, the following actions were undertaken and completed by LaGen in the 4th quarter 2015.

- Removal of the failure slip-plane through excavation of the dike soil to behind and below the failure
- Rebuilding of dike slope with geogrid-reinforced layers to resist the failure plane shear and increase slope stability
- Rebuilding of the outside half of the dike crest where it had settled

CB&I conducted a CCR Annual Inspection of the Fly Ash Basin and Bottom Ash Basin in October 2015. The inspection noted minor erosion, some animal burrows, and some small desiccation cracks, however, there were no signs of distress or malfunction that would indicate actual or potential structural weakness of either ash basin.

4.1.6 Periodic Structural Stability Assessment

The initial structural stability assessment of the Fly Ash and Bottom Ash Basins is included herein in accordance with the applicable CCR Rule requirements. The structural stability assessment for the Fly Ash and Bottom Ash Basins includes documentation that the Basins have been designed, constructed, operated, and maintained consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein. Applicable documentation of the stability assessment with respect to the CCR Rule follows.

During the most recent CCR Annual Inspection conducted in October 2015, the following CCR criteria were observed and found to be adequate, with respect to the design, construction, operation, and maintenance of the Ash Basins:

- Stable foundations
- 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

- Vegetated slopes of dikes and surrounding areas that do not exceed a height of 6 inches above the slope of the dike
- A 30-inch diameter gravity flow pipe (used instead of a spillway) constructed of non-erodible material that is designed to carry sustained flows, with a capacity designed, constructed, operated, and maintained to adequately manage flow during and following the peak discharge from a 100-year flood (as required for the low hazard potential Fly Ash Basin and Bottom Ash Basin)
- A 30-inch gravity flow pipe (used in place of hydraulic structures underlying the base of the CCR unit) that passes through the dike of the Fly Ash Basin and Bottom Ash Basin is maintained with structural integrity and is free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure
- A location not adjacent to a water body, such as a river, stream or lake, such that the slopes are not inundated by water which could affect structural stability

In accordance with the CCR Rule, the periodic structural stability assessment must identify any structural stability deficiencies associated with the CCR unit in addition to recommending corrective measures. If a deficiency or a release is identified during the periodic assessment, the owner or operator must remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measures taken. The previous and current structural stability assessments for the Fly Ash Basin and Bottom Ash Basin noted any observed structural stability deficiencies and recommended corrective measures. Corrective measures completed to date have been documented, the most recent of which were previously described in Section 4.1.5

In accordance with the CCR Rule, the next structural stability assessment will be completed 5 years from the date of the completion of the initial assessment.

The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial structural stability assessment and each subsequent periodic assessment was conducted in accordance with the requirements of this section. As required, the previous assessment has been, and future assessments will be, certified by a qualified professional engineer. The certification is provided in Section 6.0 of this document.

4.1.7 Periodic Safety Factor Assessment

In accordance with the CCR Rule, the owner or operator of the CCR unit must conduct initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety (FOS) for each CCR unit achieve the minimum safety factors specified in paragraphs (e)(1)(i) through (iv) of this section for the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations. A slope stability analysis was performed for the Fly Ash Basin and the Bottom Ash Basin, the details of which is presented in **Appendix D** and summarized below.

The critical cross-section of the embankment for the Fly Ash Basin is located on the southeast corner at the location of the fly ash disposal area. The critical section considered the current emplaced fly ash and the final designed section. Similarly, the location of the Bottom Ash Basin is located along the southern berm. The critical section considered the current stockpiled bottom ash and the final design section. The geometry of the ash piles, ash basin berms, soil strength profiles, and ash strength characteristics were obtained from the GeoEngineers (2011) geotechnical engineering report. The slope stability analyses were performed using the computer program SLOPE/W by GEO-SLOPE International Ltd. The search for the minimum FOS was performed using the automated search routine in SLOPE/W. The analyses also considered the effect of long-term basin water levels and the water level surcharge due to the 100-year design storm. For the purpose of the stability analysis, the elevations of the design elevation of the berms (40 feet for the Fly Ash Basin and 48 feet for the Bottom ash Basin), a freeboard of 2 feet in the Fly Ash Basin (elevation 38 feet), and storm surcharge of 1.3 feet and 1.93 feet in the Fly Ash Basin and Bottom Ash Basin, respectively, were used. Finally, these scenarios were evaluated for non-seismic and seismic effects. A horizontal seismic acceleration coefficient of 0.05 is used which relates to a 2% chance of experiencing peak acceleration in rock in a 50-year period (USGS Seismic Hazard Map, revised May, 2003). A total of 16 scenarios were evaluated and summarized in the tables below. Figures showing each slope stability section and the location of the minimum failure surface are presented in **Appendix D**.

Slope Stability Results Without Seismic Effects				
Area	**Slope Scenario**	**Storage pool elevation, feet**	**Calculated FOS**	**Required FOS**
Fly Ash Basin	Existing Slope	38	2.31	1.5
		39.3	2.29	1.4
	Proposed Capped Slope	38	2.74	1.5
		39.3	2.71	1.4
Bottom Ash Basin	Existing Slope	38	1.50	1.5
		39.9	1.48	1.4
	Proposed Capped Slope	38	1.60	1.5
		39.9	1.58	1.4

The safety factor assessments for the critical cross-sections of the embankments for the Ash Basins have been completed as follows:

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

  The results of the assessment for the Fly Ash Basin indicate minimum FOS for the current ash pile and the design stack for long term water pool are 2.31 and 2.74, respectively. Similarly, the results of the assessment for the Bottom Ash Basin indicate minimum FOS of 1.50 and 1.60, respectively. For these scenarios, the minimum FOS is greater than or equal to the required FOS.

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

  The results of the assessment for the Fly Ash Basin indicate minimum FOS for the current ash pile and the design stack for short term surcharge water pool are 2.29 and 2.71, respectively. Similarly, the results of the assessment for the Bottom Ash Basin indicate minimum FOS of 1.48 and 1.58, respectively. For these scenarios, the minimum FOS is greater than the required FOS.

Slope Stability Results With Seismic Effects (Kh = 0.05

Area	Slope Scenario	Storage pool elevation, feet	Calculated FOS	Required FOS
Fly Ash Basin	Existing Slope	38	1.68	1.0
		39.3	1.66	
	Proposed Capped Slope	38	1.75	
		39.3	1.74	
Bottom Ash Basin	Existing Slope	38	1.12	
		39.9	1.11	
	Proposed Capped Slope	38	1.19	
		39.9	1.18	

- The calculated seismic factor of safety must equal or exceed 1.00.

  The results of the seismic assessment for the Fly Ash Basin indicate minimum FOS for the current ash pile and the design stack for long term water pool are 1.68 and 1.75, respectively. Similarly, the results of the assessment for the Bottom Ash Basin indicate minimum FOS of 1.12 and 1.19, respectively. For these scenarios, the minimum FOS is greater than the required FOS.

The results of the seismic assessment for the Fly Ash Basin indicate minimum FOS for the current ash pile and the design stack for short term surcharge water pool are 1.66 and 1.74, respectively. Similarly, the results of the assessment for the Bottom Ash Basin indicate minimum FOS of 1.11 and 1.18, respectively. For these scenarios, the minimum FOS is greater than the required FOS.

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

  The clayey soils used for construction of the Ash Basins and which comprise the foundation for the berms are not susceptible to liquefaction; therefore, no liquefaction safety factor was calculated.

The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial safety factor assessment and each subsequent periodic assessment specified in paragraph (e)(1) of this section meets the requirements of this section. As required, the previous assessment has been, and future assessments will be, certified by a qualified professional engineer. The certification is provided in Section 6.0 of this document.

An owner or operator of a CCR unit who either fails to complete a timely safety factor assessment or fails to demonstrate minimum safety factors as required by paragraph (e) of this section is subject to the CCR unit closure requirements of § 257.101(b)(2).

In accordance with the CCR Rule, the next safety factor assessment will be completed 5 years from the date of the completion of the initial assessment.

5.0 *RECORD KEEPING/NOTIFICATION REQUIREMENTS*

The BC II Plant will maintain files of all information related to the Stability Integrity Assessment of the Fly Ash Basin and Bottom Ash Basin in a written operating record at the BC II Plant as required by the CCR Rule. This will include documentation of the permanent CCR Unit identification marker, the initial and periodic hazard potential classification assessments, the history of construction and any revisions to it, the initial and periodic structural stability assessments, documentation detailing with corrective measures taken to remedy a deficiency or release, and the initial and periodic safety factor assessments. The files will be retained until closure of the units and/or for at least 5 years following the date of each occurrence, measurement, maintenance, corrective action, report, record, or study. The files for separate CCR units at the Plant will be maintained in one recordkeeping system with files separated by the name or identification number of each CCR unit. It is understood the files may be maintained on microfilm, on a computer, on computer disks, on a storage system accessible by a computer, on magnetic tape disks, or on microfiche.

The CCR Rule also requires that the owner or operator of a CCR unit maintain a publicly accessible Internet site (CCR Web site) that contains specific information related to the CCR unit initial and subsequent Structural Integrity Assessments.

In accordance with the CCR Rule, the BC II Plant will place the Structural Integrity Assessment documentation for the Fly Ash Basin and Bottom Ash Basin, as it becomes available, in the facility's operating record and post it to the CCR Web site (within 30 days of placing the pertinent information in the BC II Plant operating record).

6.0 *QUALIFIED PROFESSIOINAL ENGINEER CERTIFICATION*

The undersigned registered professional engineer is familiar with the requirements of §257.73 and has visited and examined the BC II Plant Fly Ash Basin and Bottom Ash Basin or has supervised examination of the Big Cajun II Fly Ash Basin and Bottom Ash Basin by appropriately qualified personnel. The undersigned registered professional engineer attests that:

- the initial hazard potential classification and each subsequent periodic hazard potential classification specified in paragraph (a)(2)(i) of section § 257.73 was conducted in accordance with the requirements of this section.
- the initial structural stability assessment and each subsequent periodic assessment in paragraph (d)(1) of section § 257.73 was conducted in accordance with the requirements of this section.
- the initial safety factor assessment and each subsequent periodic assessment specified in paragraph (e)(1) of section § 257.73 meets the requirements of this section.

The CCR Structural Integrity Assessment activities have been prepared in accordance with the requirements of §257.73 and that this assessment is adequate for the Big Cajun II Plant. This certification was prepared as required by §257.73(a)(2)(ii), §257.73(d)(3), and §257.73(e)(2).

Name of Professional Engineer:	Glen R. Landry
Company:	CB&I Environmental, Inc
Signature:	Glen R. Landry
Date:	10/5/16
PE Registration State:	Louisiana
PE Registration Number:	18931

Professional Engineer Seal:

STATE OF LOUISIANA
GLEN R. LANDRY
License No. 18931
PROFESSIONAL ENGINEER
IN
CIVIL ENGINEERING

Glen R. Landry
10/5/16

7.0 *REFERENCES*

CB&I Environmental & Infrastructure, Inc.; 2016; Big Cajun II, Coal Combustion Residual (CCR), Annual Inspection Report, NRG Louisiana Generating, LLC; NRG Energy, Inc.; New Roads, Louisiana.

Environmental Protection Agency; 2015; 40 CFR Parts 257 and 261 Rules and Regulations, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Volume 80, No. 74; Final Rule.

GeoEngineers, Inc.; 2011 (May); Preliminary Geotechnical Engineering Services, Ash Basins/Wastewater Treatment Ponds, Big Cajun II Generating Site, New Roads, Pointe Coupee Parish, Louisiana.

GeoEngineers, Inc.; 2011 (September); Embankment Dike Inspection Services, Ash Basins/Wastewater Treatment Ponds, Big Cajun II Generating Site, New Roads, Pointe Coupee Parish, Louisiana.

GeoEngineers, Inc.; 2012; Geotechnical Engineering Services Report, Dike Seepage Repair, Big Cajun II Generating Site, New Roads, Pointe Coupee Parish, Louisiana.

GeoEngineers, Inc.; 2014; Embankment Dike Inspection Services, Ash Basins/Wastewater Treatment Ponds, Big Cajun II Generating Site, New Roads, Pointe Coupee Parish, Louisiana.

GeoEngineers, Inc.; 2015; Dike Slope Failure Evaluations, Ash Basin Ponds, Big Cajun II Generating Site, New Roads, Pointe Coupee Parish, Louisiana.

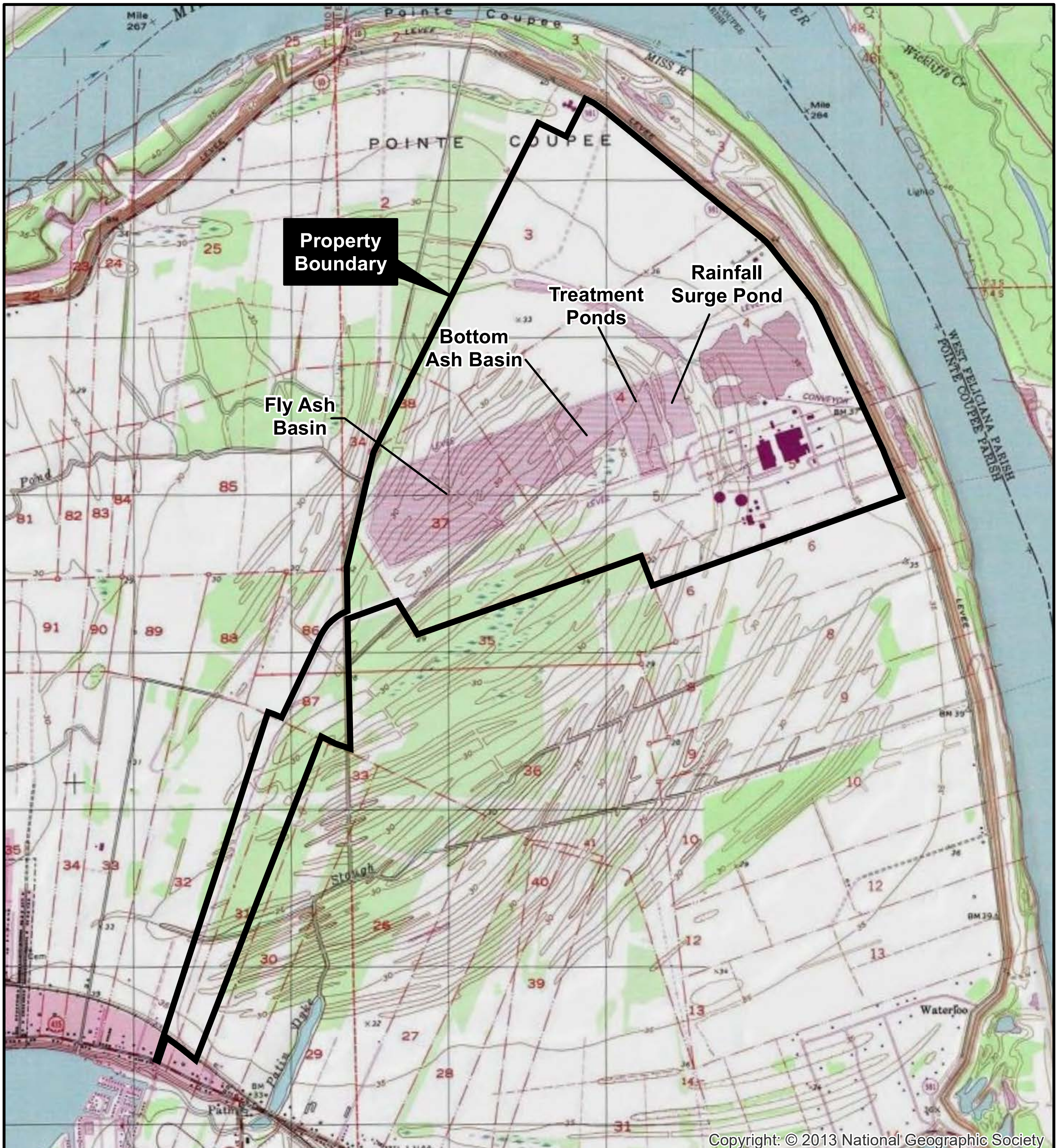
Louis J. Capozzoli and Associates, Inc.; 1974; Preliminary Subsoil Investigation and Foundation Design Data, Big Cajun No. 2, Site C-2, New Roads, Louisiana; File No. 74-30.

Louis J. Capozzoli and Associates, Inc.; 1977; Preliminary Subsurface Soil Investigation and Laboratory Testing, Ash Storage Area, CEPCO No. 2, Plant Site; New Roads, Louisiana.

Louis J. Capozzoli and Associates, Inc.; 2006; Geotechnical Investigation, Bottom Ash Storage Pond Expansion, Big Cajun No. 2, Pointe Coupee Parish Plant Site, Louisiana; LJC&A File: 0558.

Shaw Environmental & Infrastructure, Inc.; 2010; Type I Solid Waste Facility Permit, Renewal and Modification Application, Final Copies, Permit No. P-0108 (Volumes 1 of 2 and 2of 2), Louisiana Generating, LLC, Big Cajun II Power Plant, New Roads, Pointe Coupee Parish, Louisiana.

FIGURES



N

0 1,500 3,000 6,000

Feet

LOUISIANA GENERATING, LLC
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

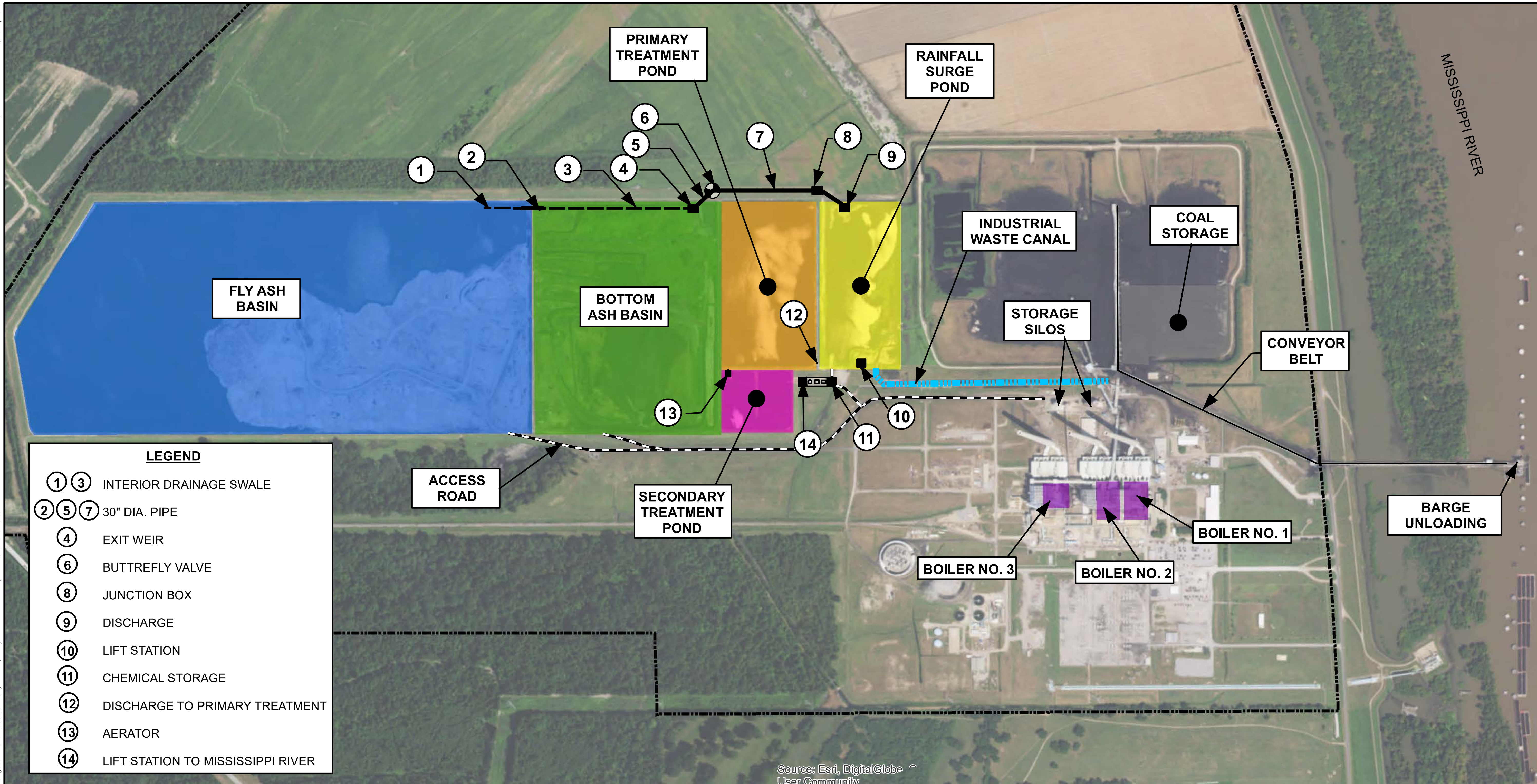
FIGURE NUMBER 1

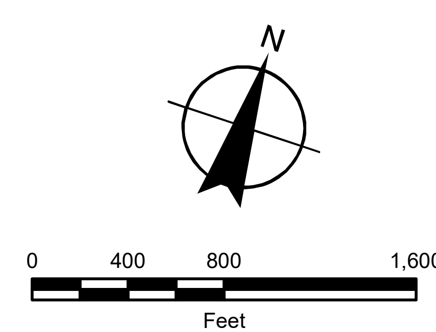
SITE LOCATION

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809

J:\Drafting\NRG\631215151\ArcView\GIS_Documents\Project_Maps\nrg_631215151_0007_site_location.mxd; Analyst: ben.holt; Date: 9/16/2016 9:52:51 AM

iDocs Document No.; Issue Statement: Rev. 0; 16Sep2016





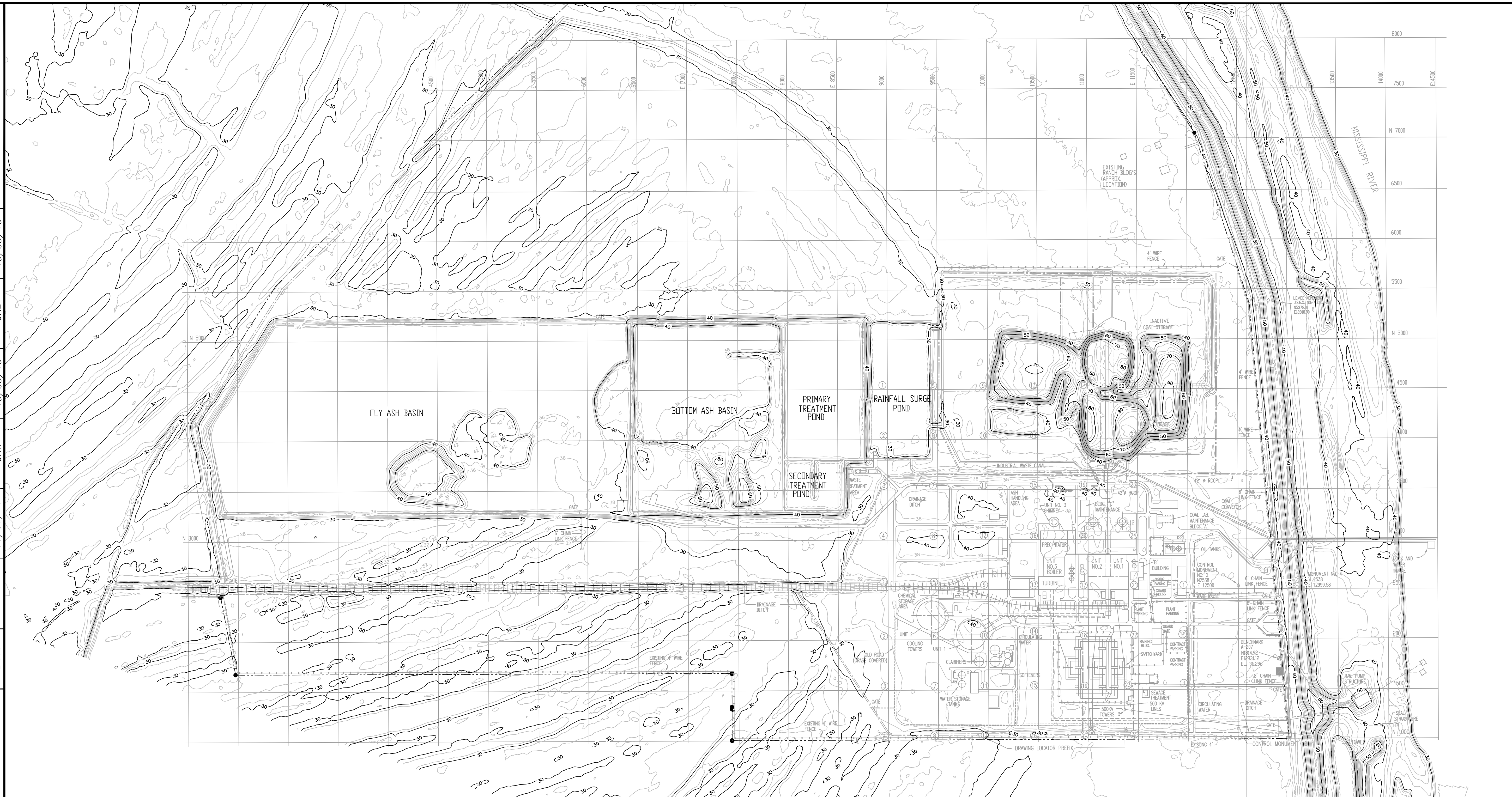
LOUISIANA GENERATING, LLC
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

FIGURE NUMBER
2

SITE LAYOUT

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809



OFFICE BTR | DRAWN BY D. COMEAUX 09/07/16 | CHECKED BY CRW 10/03/16 | APPROVED BY GRL 10/03/16 | DRAWING NUMBER 631215151_B10

LEGEND

PROPERTY LINE

TOPOGRAPHIC CONTOUR (FEET, NGVD 29) WITH 2-FOOT CONTOUR INTERVAL

PLANT NORTH 3000

TRUE NORTH

N

SCALE

0 1000 2000 FEET

REFERENCE: Louisiana Oil Spill Coordinator's Office (LOSCO), LiDAR Digital Elevation Map (DEM) of Louisiana, 2009.

LOUISIANA GENERATING, L.L.C.
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

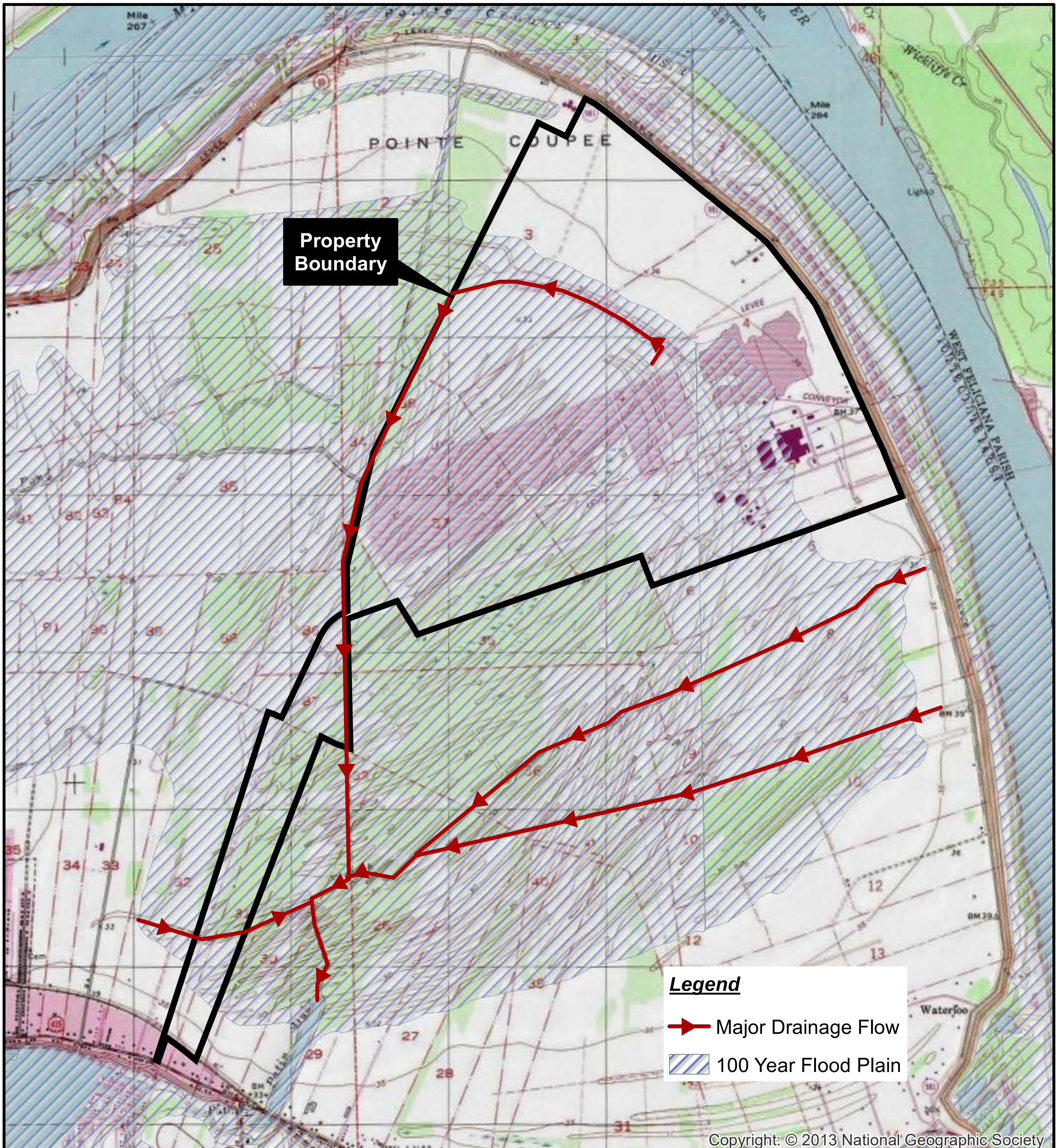
BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

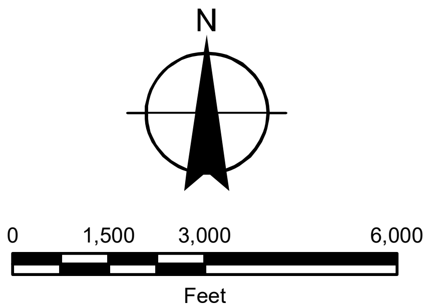
FIGURE NUMBER 3

EXISTING SITE TOPOGRAPHY

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809

iDocs Document No.; Issue Statement; Rev. 0; 19Sep2016





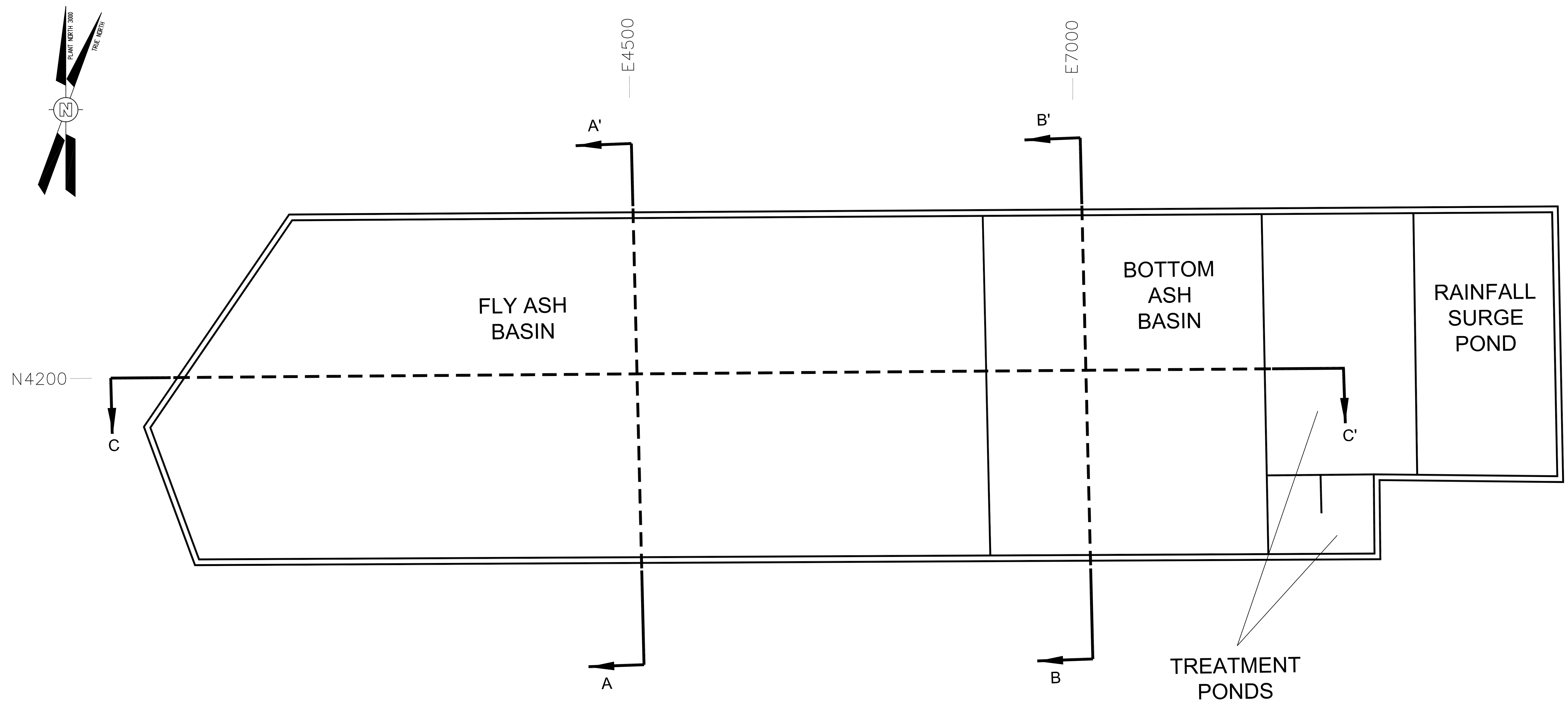
LOUISIANA GENERATING, LLC
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

FIGURE NUMBER	DRAINAGE AND FLOOD PLAIN MAP
4	

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809

J:\Drafting\NRG\631215151\ArcView\GIS_Documents\Project_Maps\ng_631215151_0009_flood_map.mxd; Analyst: ben.holt; Date: 9/19/2016 3:54:22 PM



NOTES:

1. Cross-section lines are designated along approximate plant grid designated by North (N) or East (E) and coordinates in feet.

2. See Figures 6, 7, and 8 for Cross-Sections A-A', B-B', and C-C'.

SCALE

0 50 100 FEET

RE: SOURCE DRAWING PROVIDED BY C-K ASSOCATES, INC., DWG. NO. A05-268-02, 1/20/1994.

OFFICE	BTR
DRAWN BY	D. COMEAUX 09/14/16
CHECKED BY	CRW 10/03/16
APPROVED BY	GRL 10/03/16
DRAWING NUMBER	631215151_B15

LOUISIANA GENERATING, L.L.C.
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

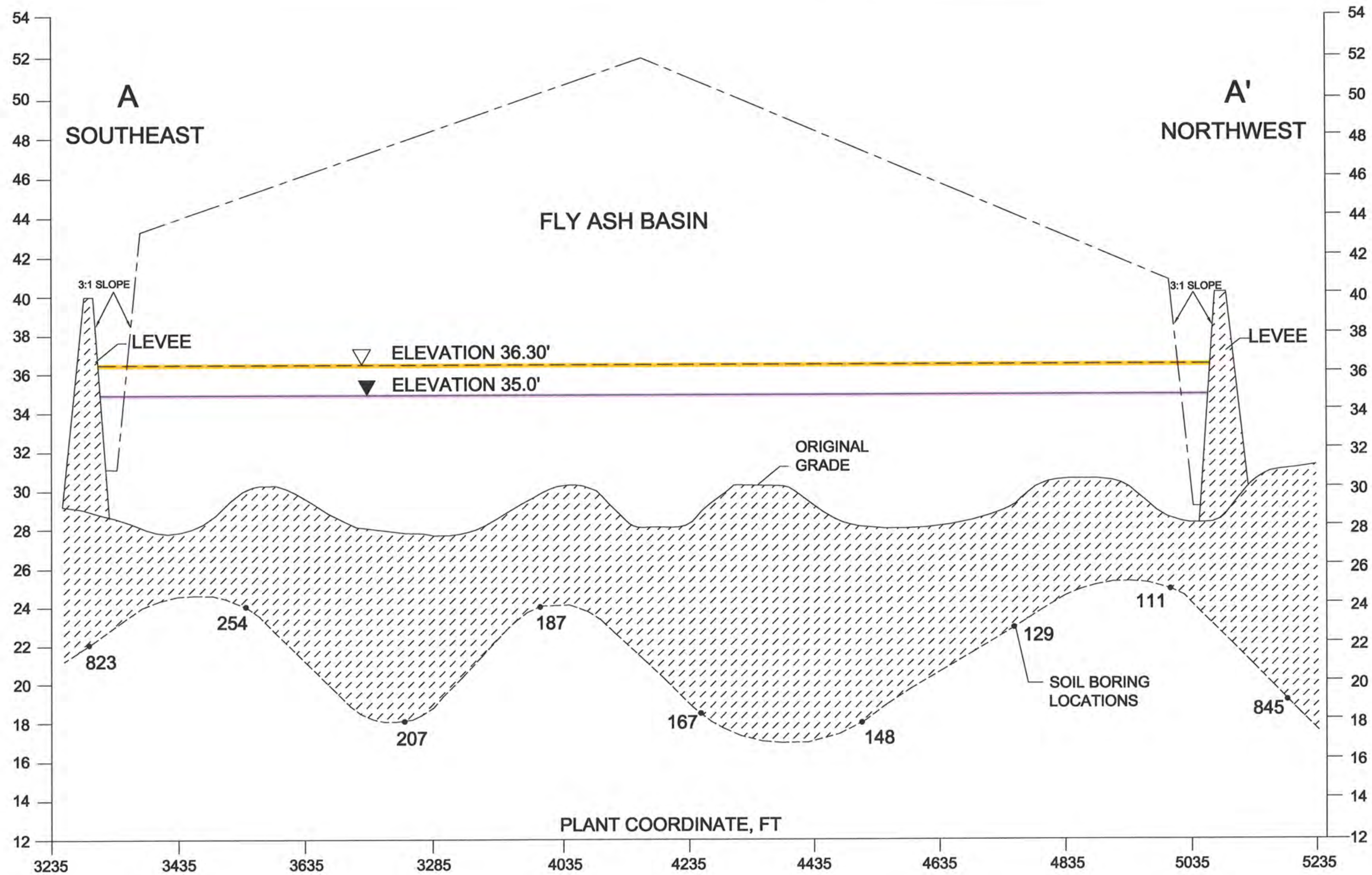
BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

FIGURE NUMBER 5

CROSS-SECTIONS LOCATION MAP

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
BTR	D. COMEAUX 09/14/16	CRW 10/03/16	GRL 10/03/16	631215151_B16



LEGEND:

Native clayey soils

Maximum elevation of Coal Combustion Residual (CCR) materials stored in the Fly Ash Basin (based on potential maximum ash volume at time of basin closure)

Fly Ash Basin maximum surface water elevation based on inflow design flood

Fly Ash Basin normal operating surface water elevation

RE: SOURCE DRAWING PROVIDED BY C-K ASSOCATES, INC.

LOUISIANA BOARD OF PROFESSIONAL GEOSCIENTISTS
CALVIN R. WIGGS
LICENSE NUMBER 13
Est. 2011
10/4/2016

NOTES:

1. Base information taken from Big Cajun's original 1986 Solid Waste Permit Application.
2. See Figure 5 for location of Cross-Section A-A'.
3. Slopes of basin levees are vegetated to minimize/prevent potential erosion.

LOUISIANA GENERATING, L.L.C.
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

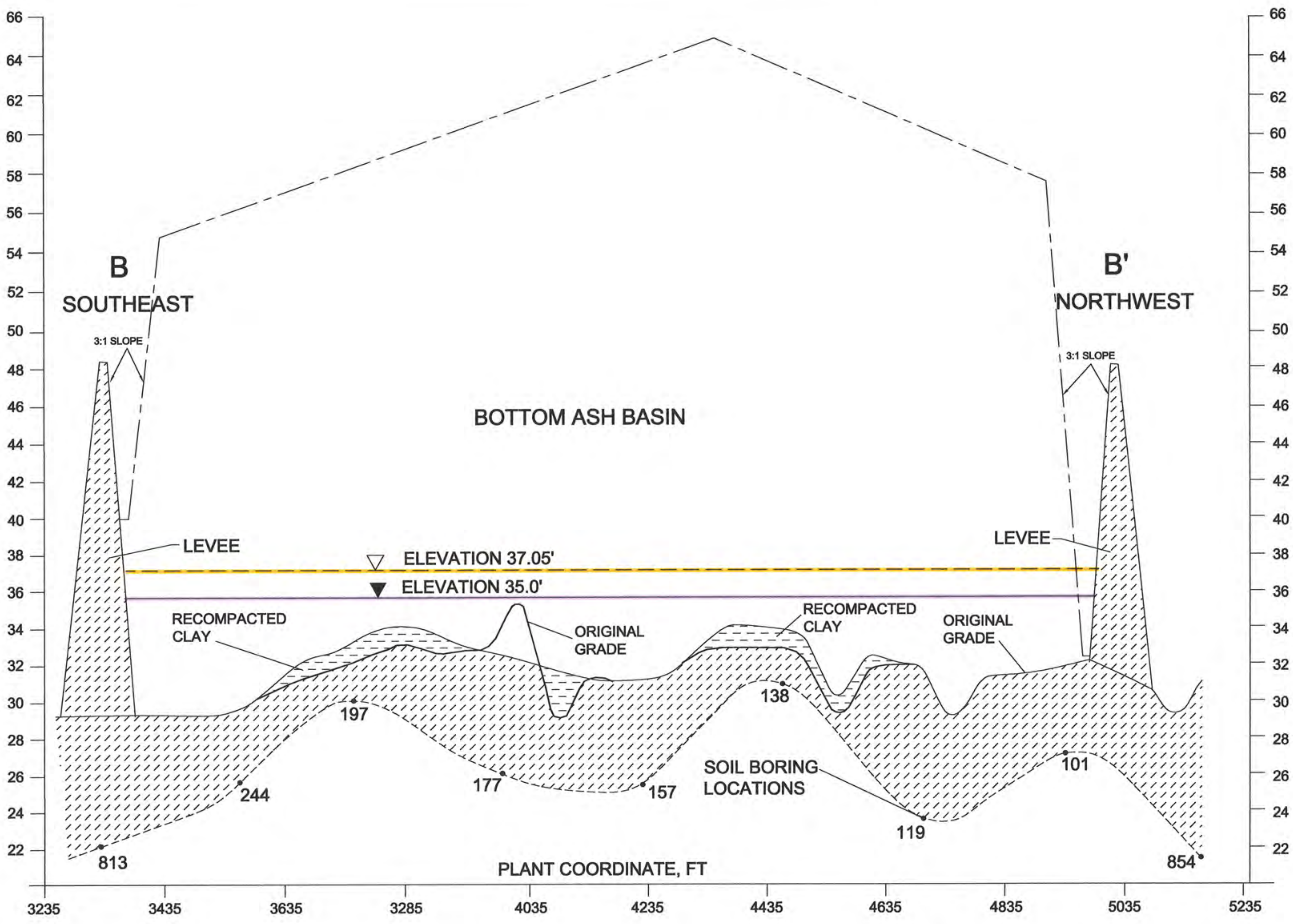
BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

FIGURE NUMBER 6

FLY ASH BASIN CROSS-SECTION A-A'

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		DRAWING NUMBER
BTR	D. COMEAUX	09/14/16	CRW	10/03/16	GRL	10/03/16	631215151_B17



LEGEND:

- Native clayey soils at bottom of Basin
- Recompacted clay
- Maximum elevation of Coal Combustion Residual (CCR) materials stored in the Bottom Ash Basin (based on potential maximum as volume at time of basin closure)
- Bottom Ash Basin maximum surface water elevation based on inflow design flood
- Bottom Ash Basin normal operating surface water elevation

RE: SOURCE DRAWING PROVIDED BY C-K ASSOCATES, INC.

NOTES:

1. Base information taken from Big Cajun's original 1986 Solid Waste Permit Application.
2. See Figure 5 for location of Cross-Section B-B'.
3. Slopes of basin levees are vegetated to minimize/prevent potential erosion.

LOUISIANA GENERATING, L.L.C.
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

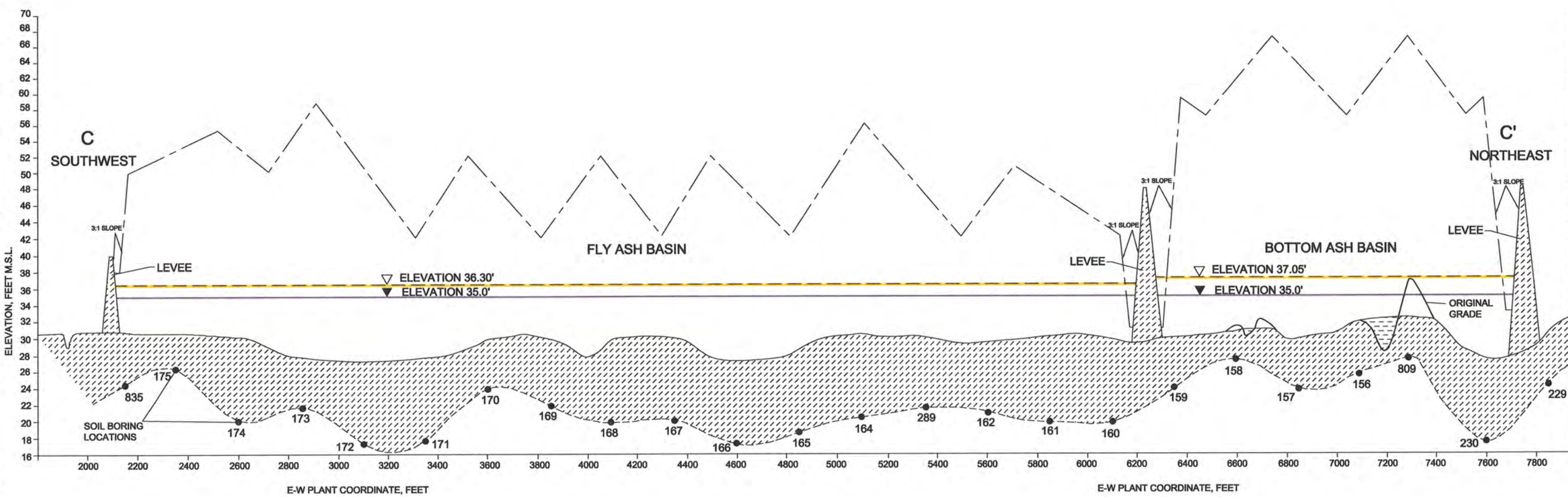
BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

FIGURE NUMBER 7

BOTTOM ASH BASIN CROSS-SECTION B-B'

CBI

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809



LEGEND:

- Native clayey soils at bottom of Basin
- Recompacted clay
- Maximum Depth of Coal Combustion Residual (CCR) materials stored in the Bottom Ash Basin (based on potential maximum ash volume at time of basin closure)
- Bottom Ash Basin maximum surface water elevation based on inflow design flood
- Bottom Ash Basin normal operating surface water elevation

NOTES:

1. Base information taken from Big Cajun's original 1986 Solid Waste Permit Application.
2. See Figure 5 for location of Cross-Section C-C'.
3. Slopes of basin levees are vegetated to minimize/prevent potential erosion.

10/4/2016

LOUISIANA GENERATING, L.L.C.
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

BIG CAJUN II POWER PLANT
STRUCTURAL INTEGRITY ASSESSMENT

FIGURE NUMBER 8

FLY ASH BASIN AND BOTTOM ASH BASIN CROSS-SECTION C-C'

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		DRAWING NUMBER
BTR	D. COMEAUX	09/14/16	CRW	10/03/16	GRL	10/03/16	631215151_B18

APPENDIX A

4171 Essen Lane
Baton Rouge, LA 70809
Tel: 412.372.7701
Fax: 412.373.7135
www.CBI.com

December 11, 2015

Mr. Gary Ellender
Regional Environmental Manager
Louisiana Generating, LLC (LaGen)

Subject: Installation of Permanent Identification Marker (40 CFR Part 257.73(a)(1))
Big Cajun II
10431 Cajun II Road
New Roads, LA 70760

Dear Mr. Ellender:

CB&I Environment & Infrastructure (CB&I) arranged for the acquisition and installation of permanent identification markers for the Bottom Ash and Fly Ash Units for compliance with the above referenced regulation. A photo log documenting the installation is attached. In conjunction with the installation, a location survey was conducted of the referenced markers resulting in the following data:

	NAD'83 – LA NORTH		NAD'83 – GEODETIC	
Marker ID	Northing	Easting	Latitude	Longitude
Bottom Ash Unit marker	809,135.84	3,265,630.61	30° 43' 29.652"	91° 22' 54.185"
Fly Ash Unit marker	808,875.71	3,264,794.97	30° 43' 27.090"	91° 23' 03.753"

NAD 83 Coordinate data is reported in Louisiana State Plane South Zone grid coordinate.

I hereby certify that on the 10th day of December, 2015, the hereon described survey was completed under my supervision, to the best of my knowledge and ability.

Date: December 11, 2015

Glen R. Landry

Glen R. Landry, PLS #4445
Project Manager 3
CB&I Environmental & Infrastructure, Inc.

STATE OF LOUISIANA
GLEN R. LANDRY
REG. No. 4445
REGISTERED
LAND SURVEYOR

Photographic Record

Client: NRG-Big Cajun II
Location: 10431 Cajun II Rd. New Roads, LA. 70807
Project No. 1005494026

Photographer: Kevin Simoneaux
Photograph Date: 12/10/2015

Photo No: 3125 **Picture Direction**: SW	**Photo No:** 3123 **Picture Direction**: SW
Description: Installed Bottom Ash Unit sign	**Description**: Installed Fly Ash Unit sign

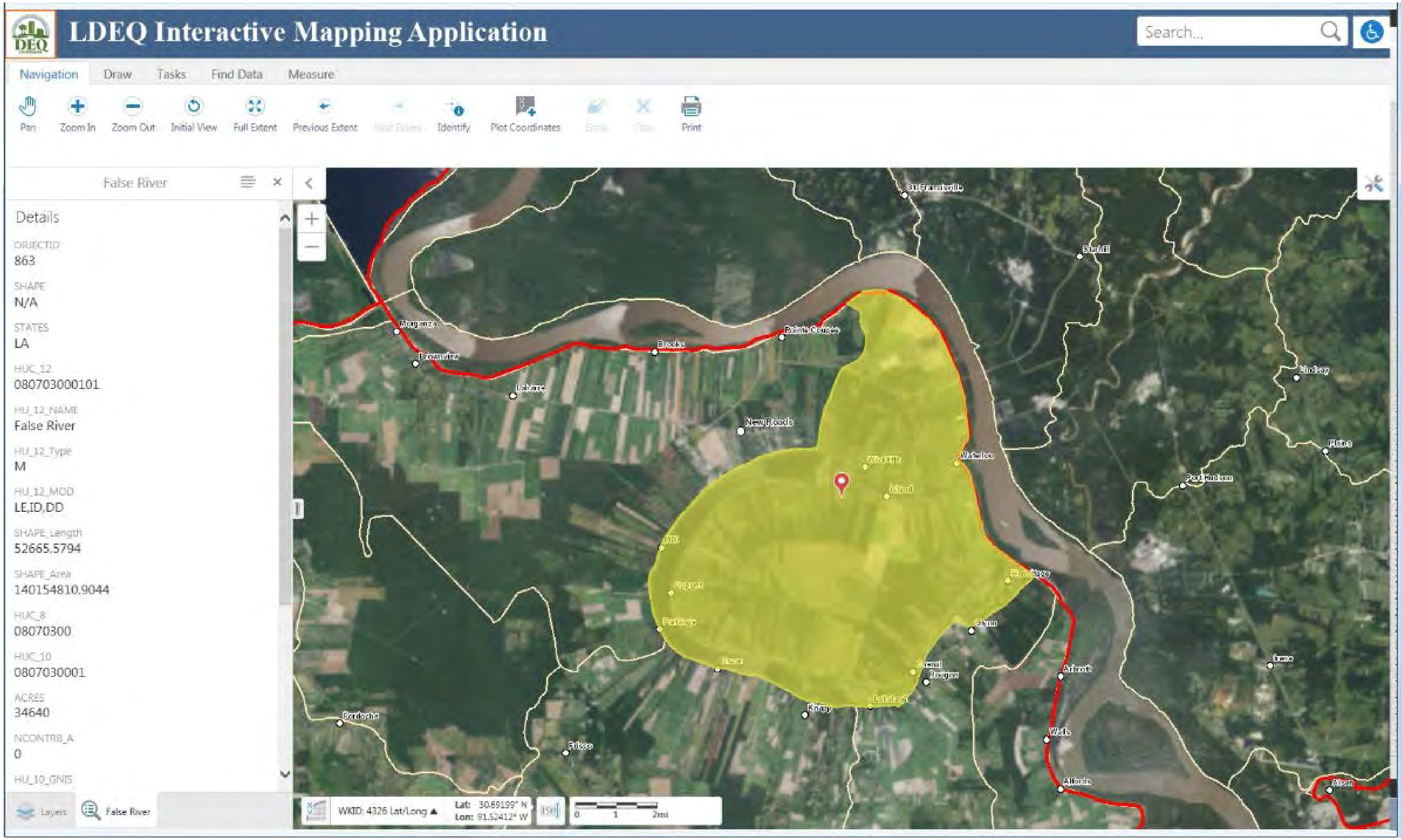
APPENDIX B

APPENDIX B

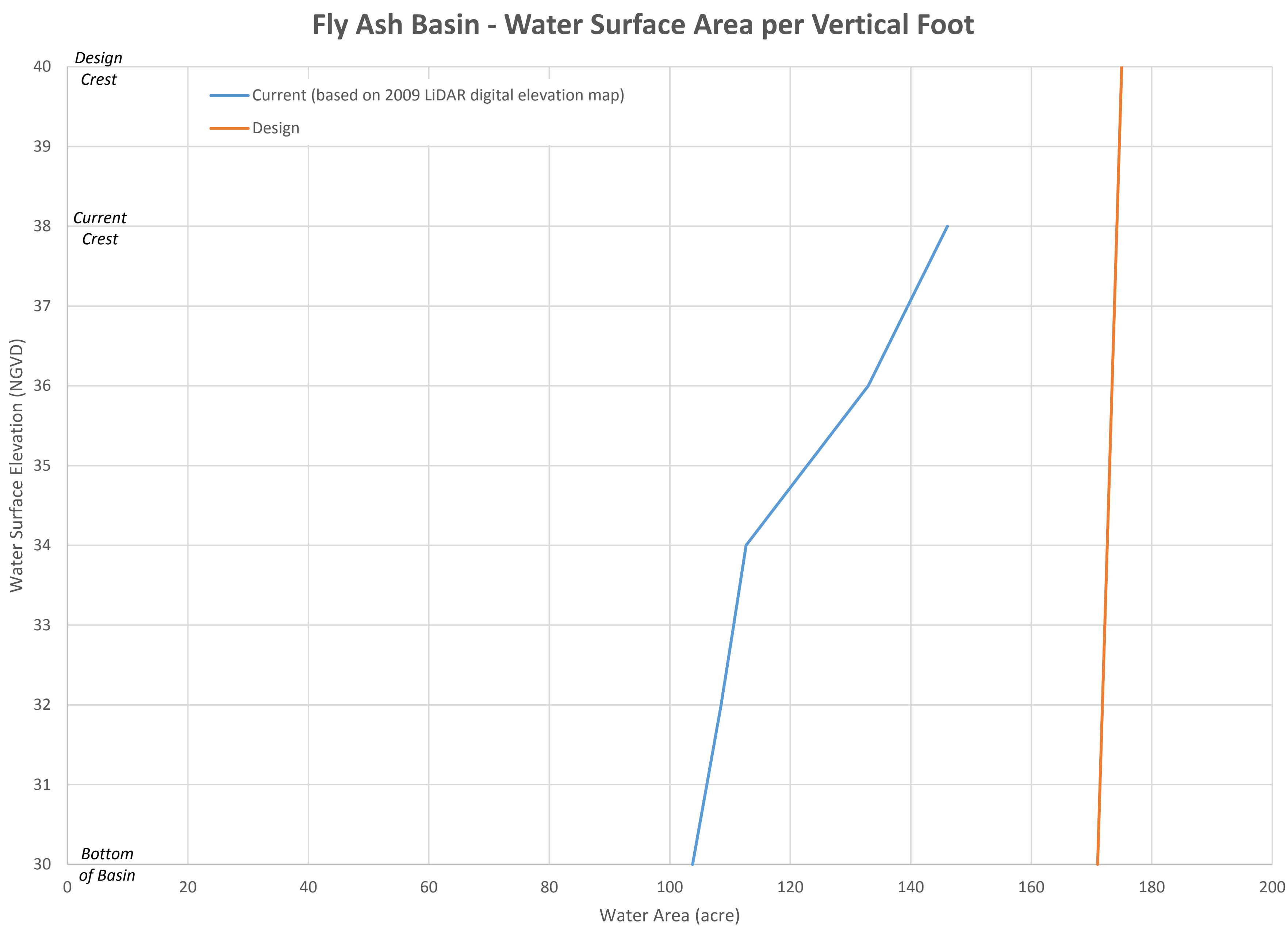
Watershed Map

NRG Big Cajun II Plant

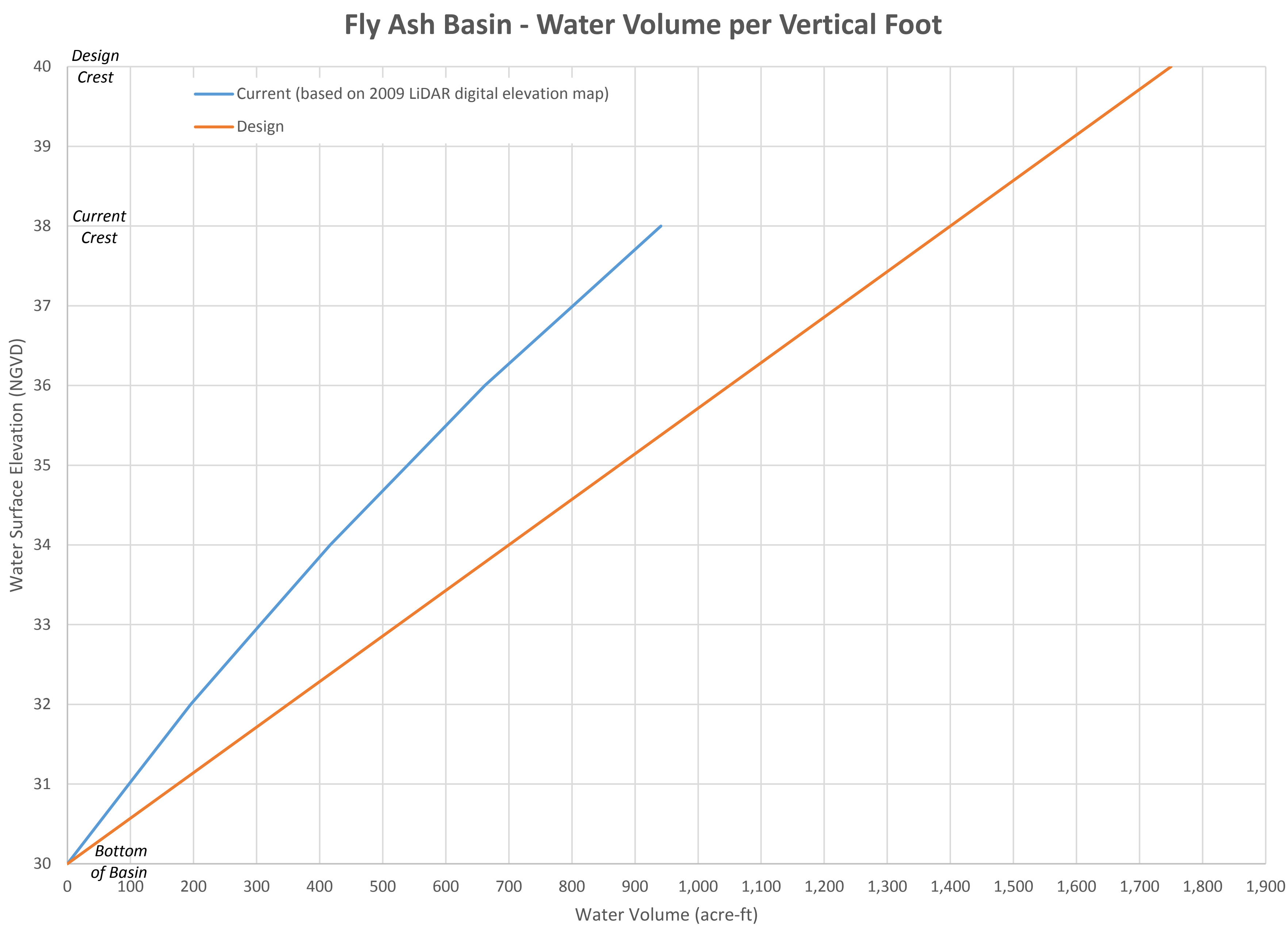
New Roads, Louisiana



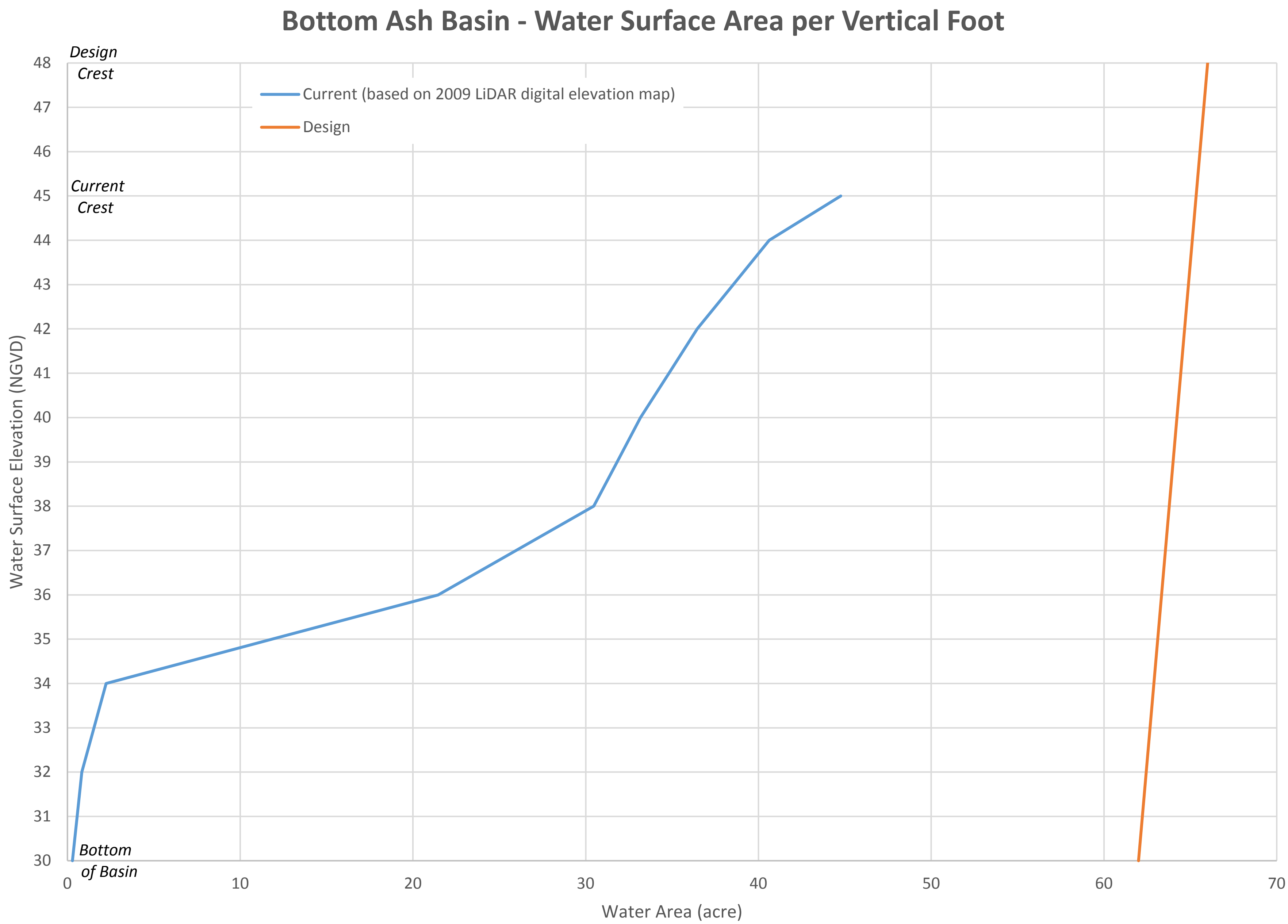
APPENDIX C



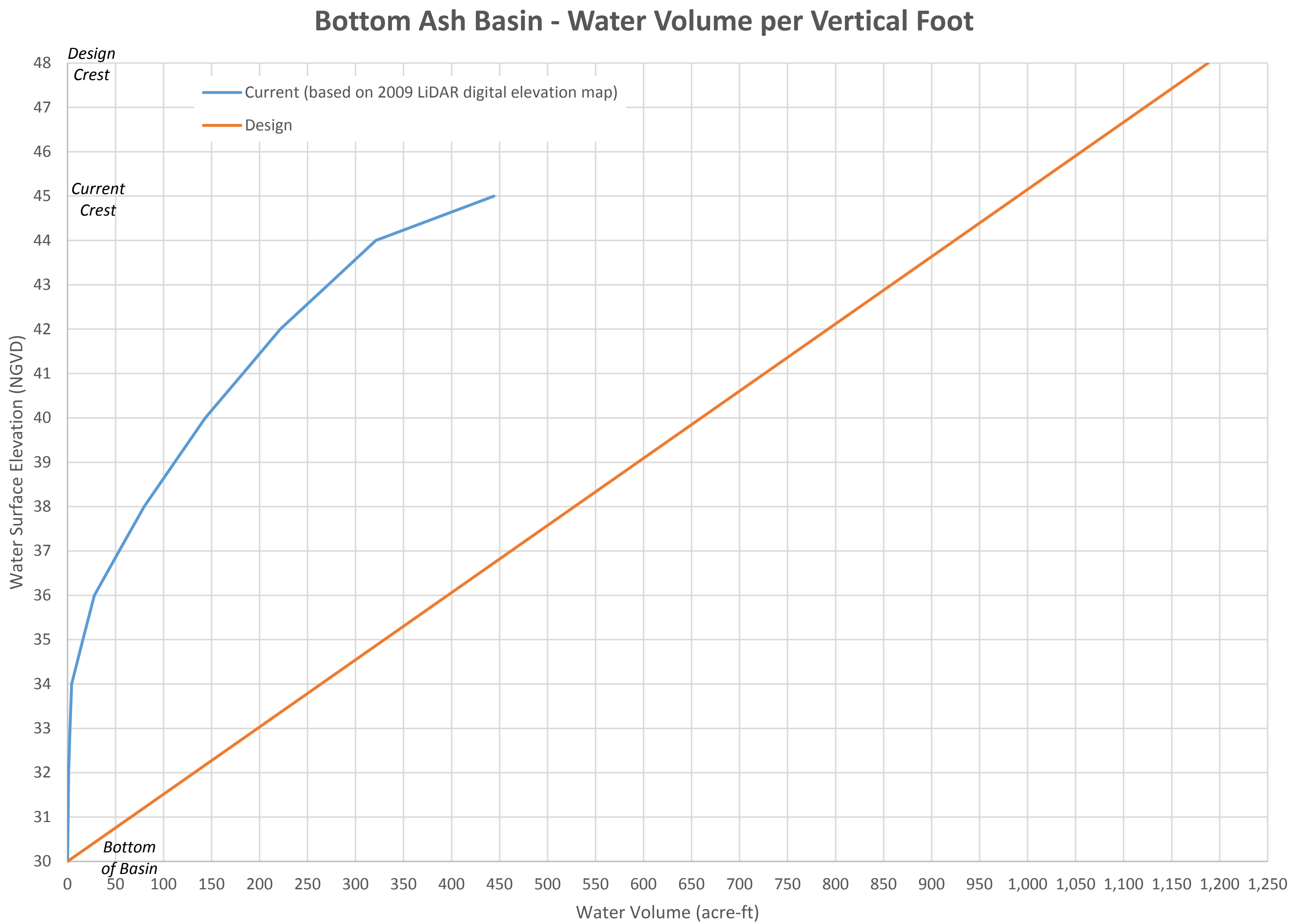
Fly Ash Basin - Water Surface Area per Vertical Foot
Design Crest
Current Crest
Bottom of Basin
Current (based on 2009 LiDAR digital elevation map)
Design
Water Surface Elevation (NGVD)
Water Area (acre)
40
39
38
37
36
35
34
33
32
31
30
0
20
40
60
80
100
120
140
160
180
200



Fly Ash Basin - Water Volume per Vertical Foot
Current (based on 2009 LiDAR digital elevation map)
Design
Design Crest
Current Crest
Bottom of Basin
Water Surface Elevation (NGVD)
40
39
38
37
36
35
34
33
32
31
30
0
100
200
300
400
500
600
700
800
900
1,000
1,100
1,200
1,300
1,400
1,500
1,600
1,700
1,800
1,900
Water Volume (acre-ft)



Bottom Ash Basin - Water Surface Area per Vertical Foot
Current (based on 2009 LiDAR digital elevation map)
Design
Design Crest
Current Crest
Bottom of Basin
Water Surface Elevation (NGVD)
Water Area (acre)
48
47
46
45
44
43
42
41
40
39
38
37
36
35
34
33
32
31
30
0
10
20
30
40
50
60
70


Bottom Ash Basin - Water Volume per Vertical Foot
Design Crest
Current (based on 2009 LiDAR digital elevation map)
Design
Current Crest
Bottom of Basin
Water Surface Elevation (NGVD)
48
47
46
45
44
43
42
41
40
39
38
37
36
35
34
33
32
31
30
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1,000
1,050
1,100
1,150
1,200
1,250
Water Volume (acre-ft)

APPENDIX D

GEOTECHNICAL DESIGN MEMORANDUM

TO: BRAD C. BARRE

FROM: GLEN LANDRY, PE, AND FIROUZ ROSTI, PHD, EI

SUBJECT: SLOPE STABILIY ANALYSES FOR BIG CAJUN II GENERATION SITE

DATE: SEPTEMBER 2, 2016

ATTCHEMENTS: Attachment A (Stability Results)

1. PROJECT DESCRIPTION

The Big Cajun II Generating Station is located near the town of New Roads, Louisiana, approximately 35 miles northwest of Baton Rouge, Louisiana. The site is approximately 1500 feet from the west bank of the Mississippi River (Figure 1), with the closest ash basin being approximately 2750 feet from the river.

Figure 1: Project Site Plan

2. CALCULATION OBJECTIVE/PURPOSES

The objective of this analysis is to calculate factor of safety (FOS) for the existing and proposed final slopes for the Fly Ash (FA) and Bottom Ash (BA) basins at the site. This memorandum includes the results of our analyses of the requested slopes considering both static and seismic loads.

3. INPUTS

Data from the preliminary geotechnical Report (GeoEngineers, 2011) was used in our calculations, and includes the following:

1. Geometries of the existing and proposed slopes
2. The site stratigraphy and soil properties in the site area as described below

4. SOIL PROPERTIES

Soil properties were obtained from the provided report. A summary of soil properties is presented below in Table 1.

Table 1: General soil profile used in the evaluation

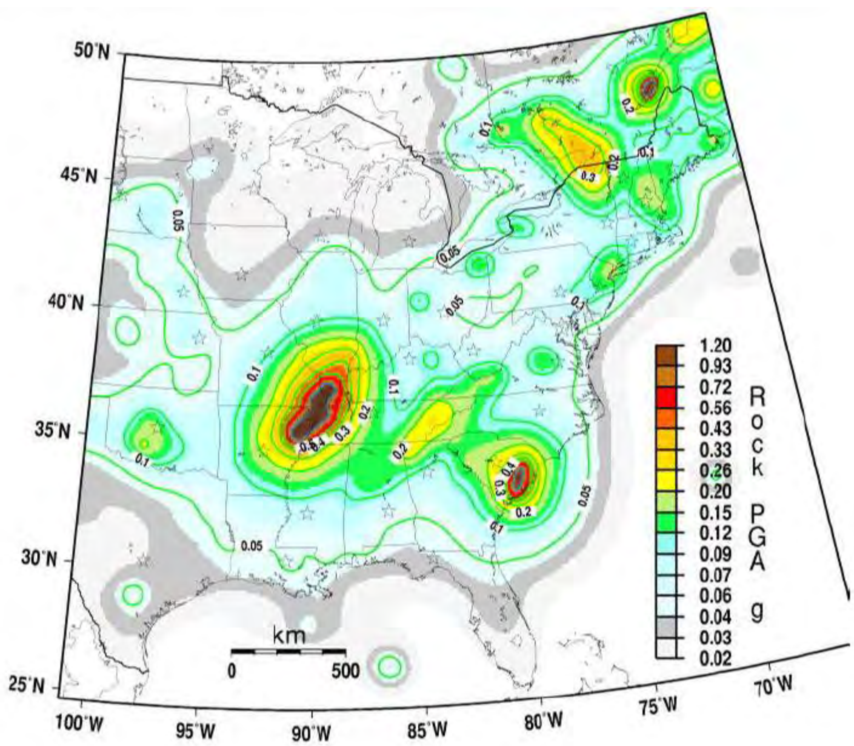
Layer	*Elevation, feet*	*Soil Type*	*Unit weight (pcf)*	*C (psf)*	*Friction Angle*
1	30 to 26	Stiff Clay	114	1000	0
2	26 to 20	Soft Clay	114	500	0
3	20 to 10	Soft Clay	114	400	0
4	10 to 0	Medium Sand	117	0	20
5	0 to -10	Medium to Dense Sand	117	0	25
6	-10 to -50	Dense Sand	117	0	30

5. GROUNDWATER:

The groundwater table was assumed to be at the ground level with an approximate elevation of 30 feet.

6. ASSUMPTIONS

1. It is assumed that there are no surcharge loads on the top of the slopes.
2. Evaluation of liquefaction of the underlying sandy layers is beyond the scope of this analysis.
3. A horizontal seismic acceleration was obtained from national survey of seismicity. A coefficient of 0.05 is used which relates to a 2% chance of experiencing peak acceleration in rock in a 50-years period (USGS Seismic Hazard Map, revised May, 2003) as shown below.



USGS prediction of Peak Ground acceleration in rock with a 2% chance of exceedance in 50 years

4. Natural groundwater level assumed to be at the ground level.
5. Only short-term response using undrained soil parameters was considered in this study.

7. ANALYSIS

Global slope stability analyses were conducted for slopes at four (4) cross-sections with and without consideration of seismic loads, including:

1. Slope stability analysis of the *existing slope* at the FA basin
2. Slope stability analysis of the *proposed final slope* at the FA basin
3. Slope stability analysis of the *existing slope* at the BA basin
4. Slope stability analysis of the *proposed final slo*pe at the BA basin

In each of the abovementioned cases, the slope was evaluated under two (2) different water elevations named as "static maximum storage pool" and "static maximum surcharge pool". According to the provided information, the former one was considered to be at elevation +38 feet for both FA and BA basins, while the latter one was considered to be at elevations +39.9 feet and 39.3 feet for BA and FA basins, respectively.

The analyses were performed using the computer program SLOPE/W, which analyzes the stability utilizing the limit equilibrium method. For this study, the Spencer method (Spencer 1967) was used for a rigorous analysis in order to calculate the minimum factor of safety (FOS) of the selected cross-sections for the existing conditions, as well for the proposed final design slope.

8. RESULTS & CONCLUSIONS

8.1. SLOPE STABILITY ANALYSIS WITHOUT SEISMIC EFFECTS

The stability analyses for both FA and BA basins were conducted under static loads, and the obtained results for the factor of safety (FOS) correspond to each slope are presented in Table 2. The calculated FOS values vary between 1.48 and 2.74 under static load conditions. Comparing the obtained FOS values with the minimum allowable values in Table 2 under static loads (FOS=1.4 & 1.5), indicates that slope for all cases are stable under static loads. Details of the slope geometry, soil layering and obtained results are presented in Attachment A.

Table 2: Slope stability results without seismic effects (Kh=0).

<table>
<tr><th>Area</th><th>Slope Scenario</th><th>Storage pool elevation, feet</th><th>Calculated FOS</th><th>Required FOS</th></tr>
<tr><td rowspan="4">Fly Ash Basin</td><td rowspan="2">Existing Slope</td><td>38</td><td>2.31</td><td>1.5</td></tr>
<tr><td>39.3</td><td>2.29</td><td>1.4</td></tr>
<tr><td rowspan="2">Proposed Capped Slope</td><td>38</td><td>2.74</td><td>1.5</td></tr>
<tr><td>39.3</td><td>2.71</td><td>1.4</td></tr>
<tr><td rowspan="4">Bottom Ash Basin</td><td rowspan="2">Existing Slope</td><td>38</td><td>1.50</td><td>1.5</td></tr>
<tr><td>39.9</td><td>1.48</td><td>1.4</td></tr>
<tr><td rowspan="2">Proposed Capped Slope</td><td>38</td><td>1.60</td><td>1.5</td></tr>
<tr><td>39.9</td><td>1.58</td><td>1.4</td></tr>
</table>

8.2. SLOPE STABILITY ANALYSIS WITH SEISMIC EFFECTS

The stability analyses for both FA and BA basins were conducted under additional seismic loads, and the results obtained for the factor of safety (FOS) correspond to each slope are presented in Table 3. The calculated FOS values vary between 1.1 and 1.75 under static load conditions. Comparing the obtained FOS values with the minimum allowable value under seismic loads (FOS=1.1), indicates that slope at the all cases are stable under seismic loads. Details of the slope geometry, soil layering and obtained results are also presented in Attachment A.

Table 3: Slope stability results with seismic effects (Kh=0.05).

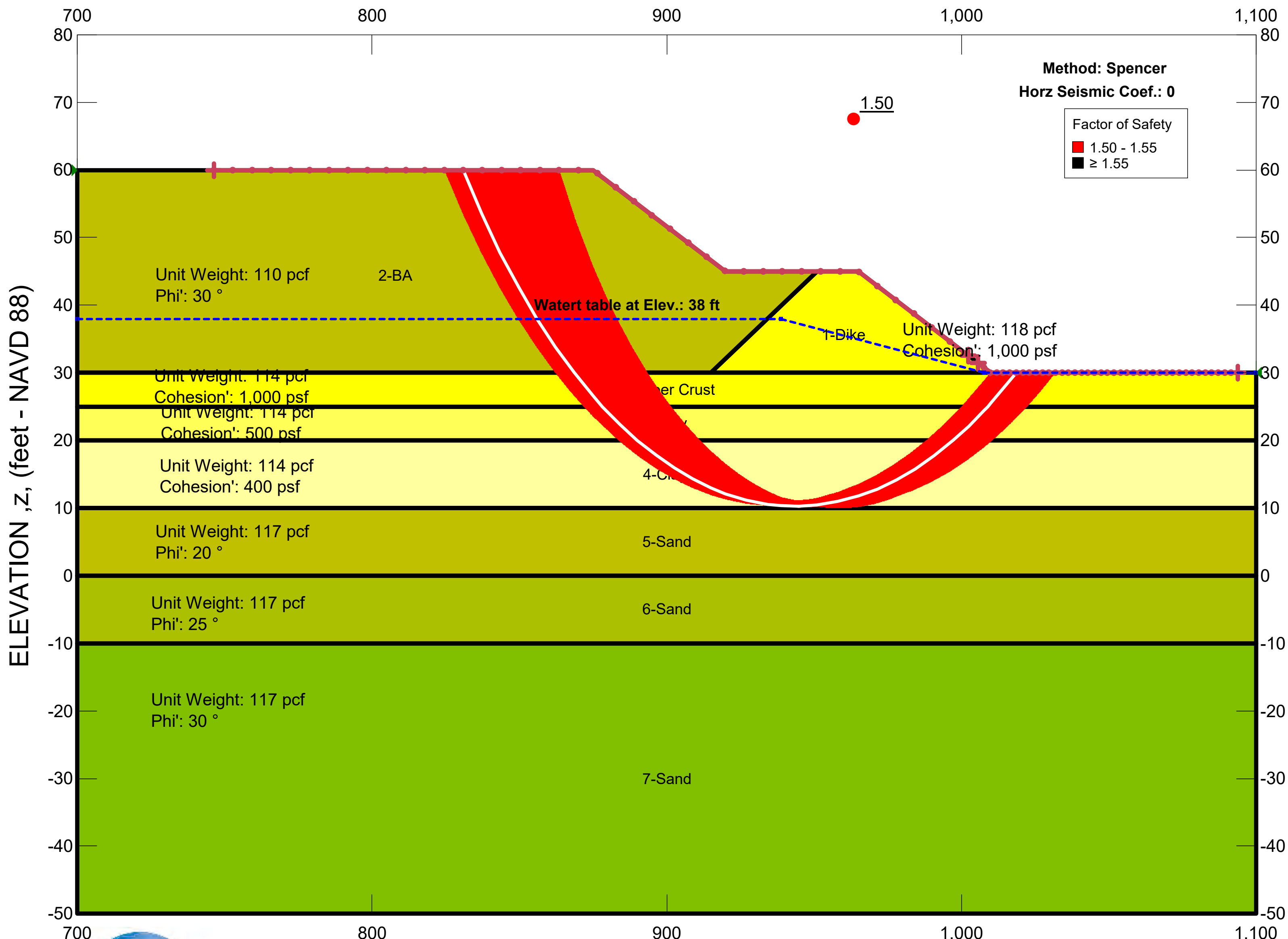
Area	Slope Scenario	Storage pool elevation, feet	Calculated FOS	Required FOS
Fly Ash Basin	Existing Slope	38	1.68	1.0
		39.3	1.66	
	Proposed Capped Slope	38	1.75	
		39.3	1.74	
Bottom Ash Basin	Existing Slope	38	1.12	
		39.9	1.11	
	Proposed Capped Slope	38	1.19	
		39.9	1.18	

References:

1- GeoEngineers, 2011. "Ash Basins/Wastewater Treatment Ponds, Big Cajun II Generation Site." Preliminary geotechnical engineering service.
2- USGS Seismic Design Map, Revised May, 2003, http://earthquake.usgs.gov/hazards/designmaps/usdesign.php

Attachment A

Slope Stability Results



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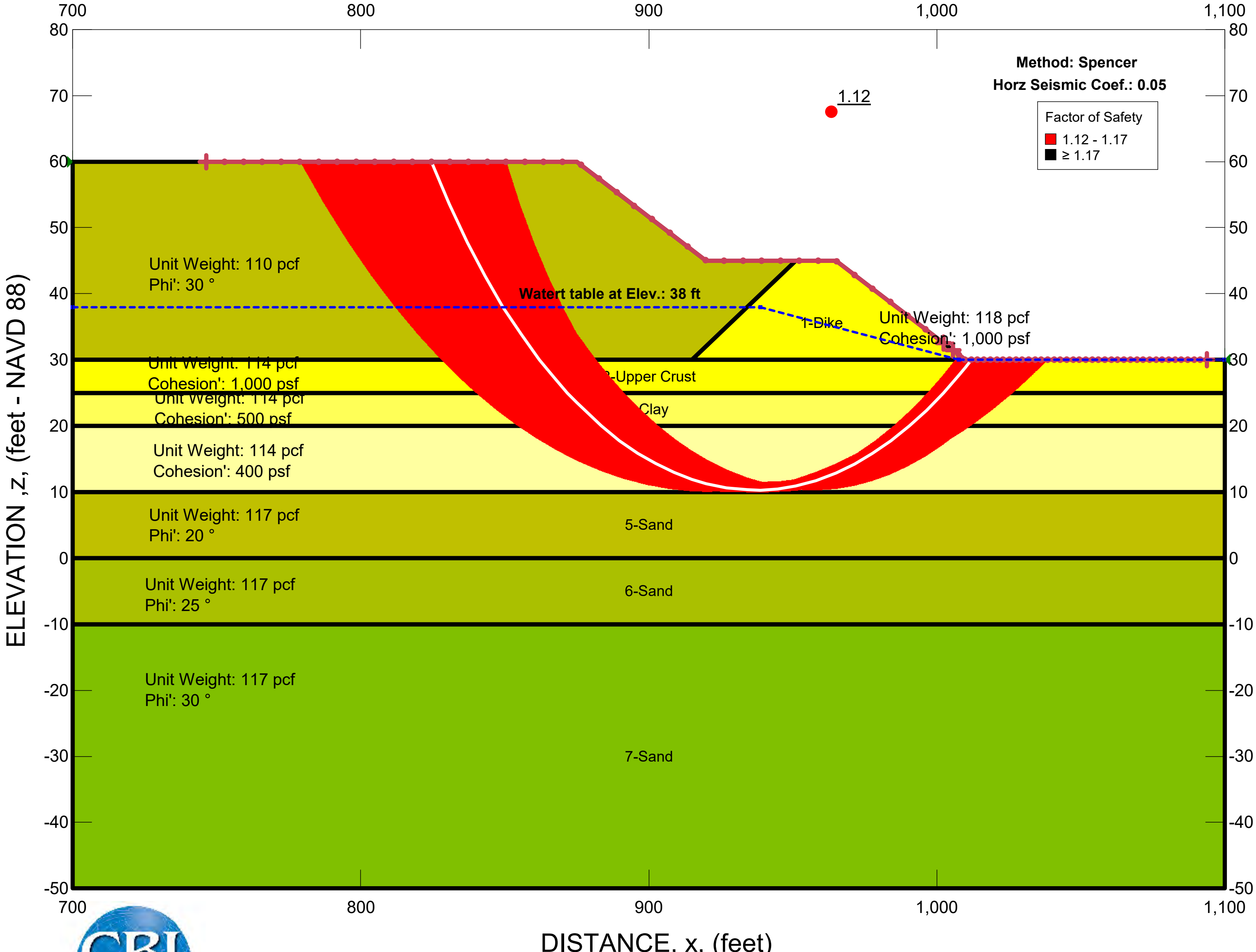
Last Edited By: Rosti, Firouz

SLOPE STABILITY ANALYSIS
GLOBAL STABILITY
GEOMETRY: Existing Slope w./ Bottom Ash (BA)

PROJECT NO. 631215151
Big Cajun II Pond
New Raods, Louisiana

FIGURE



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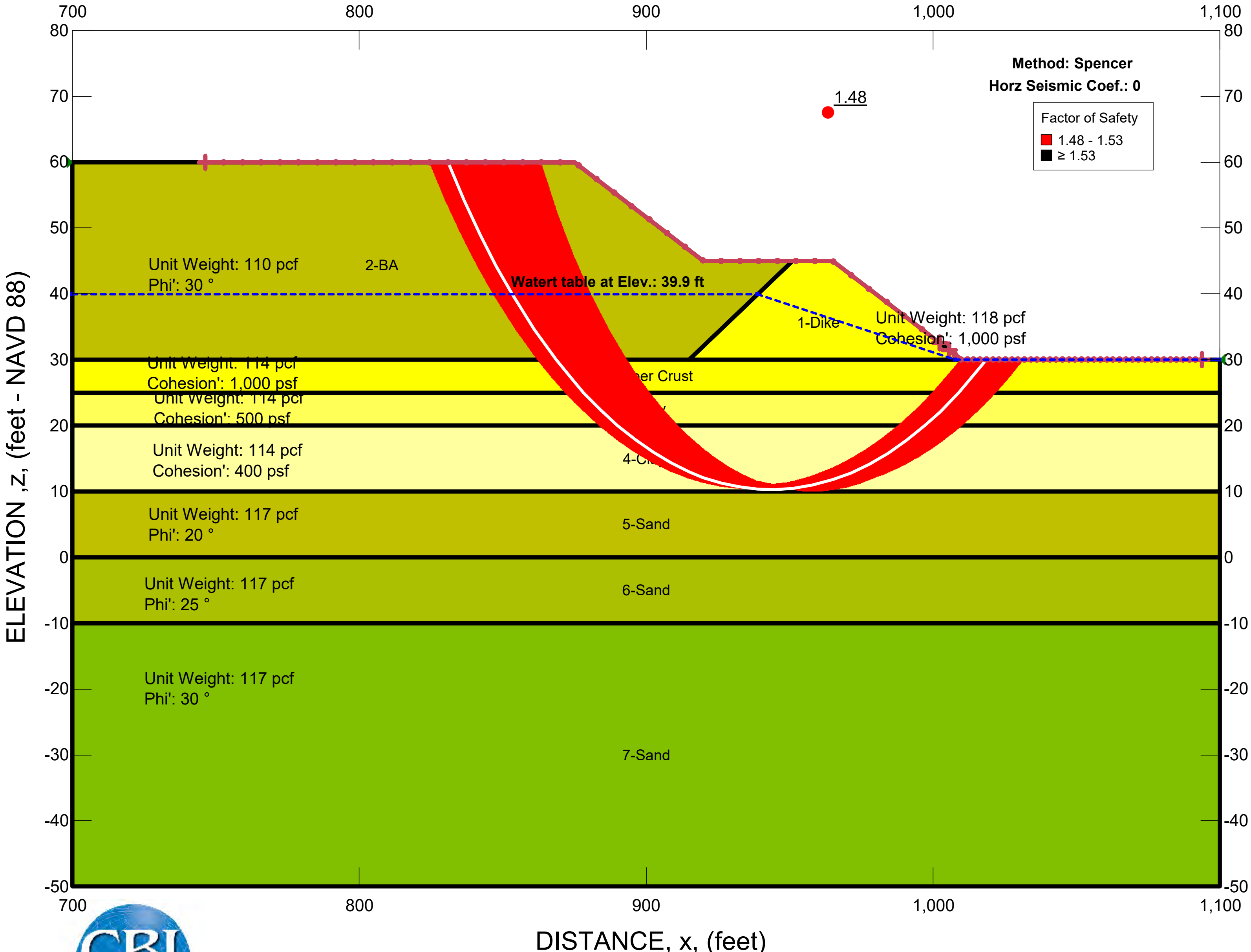

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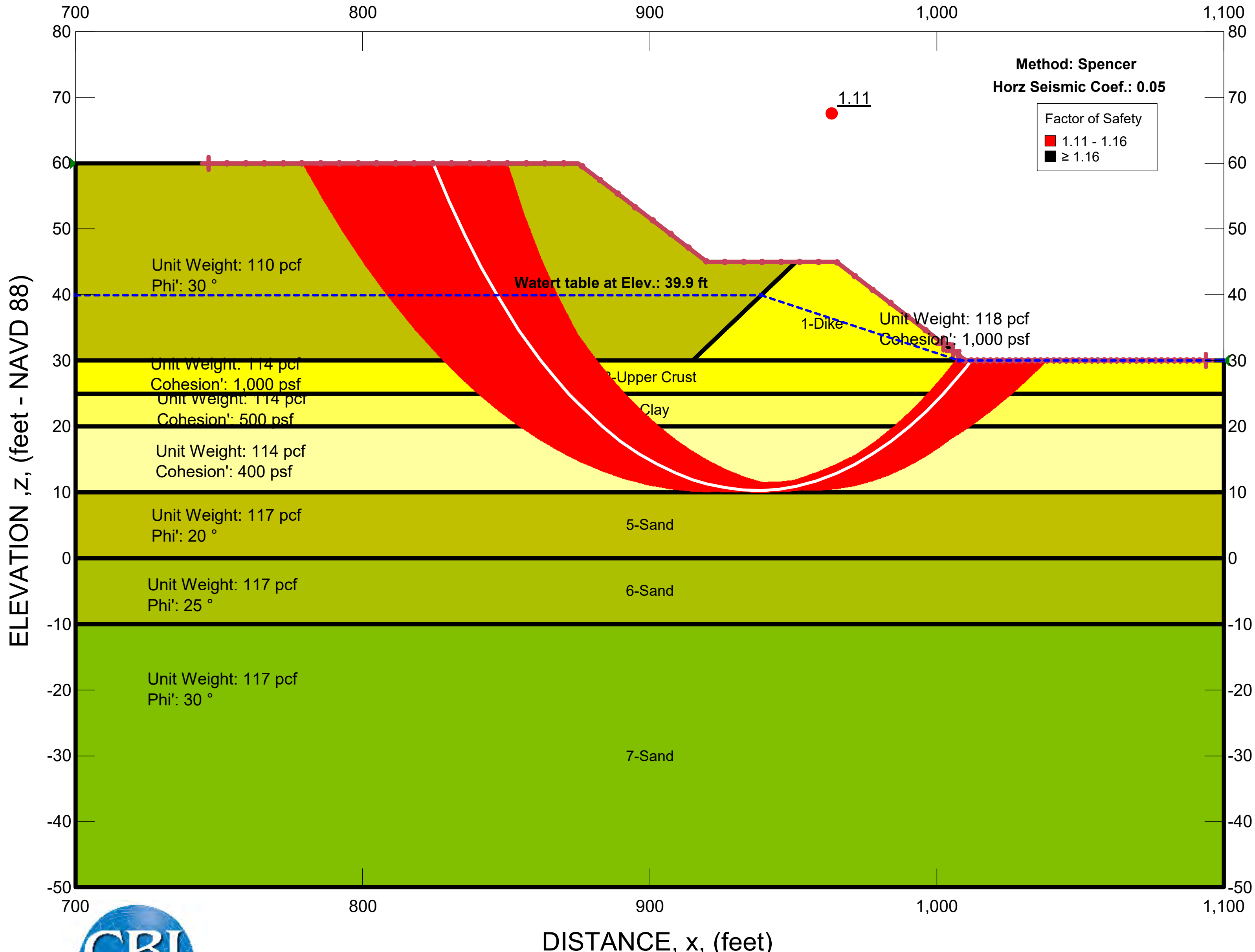

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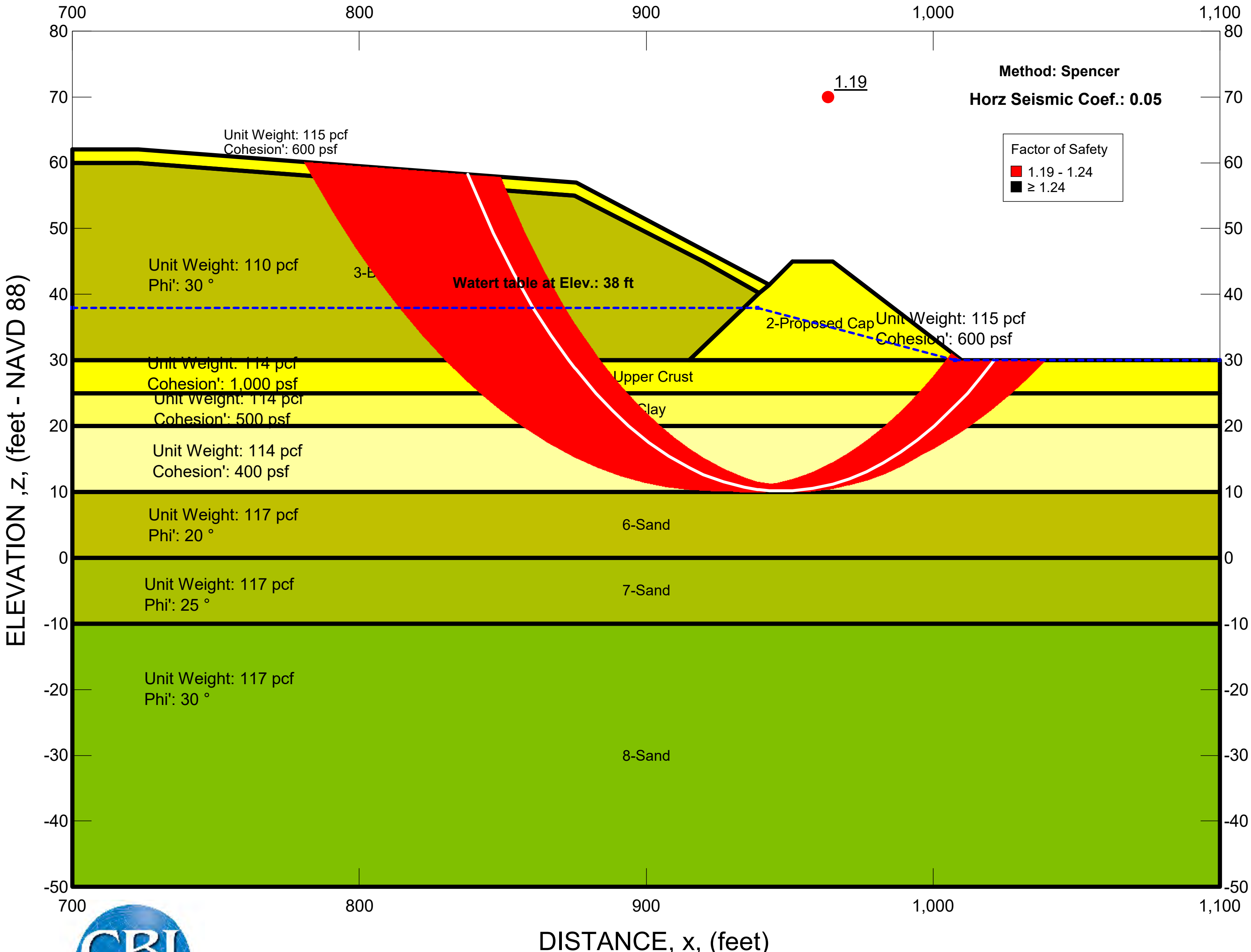

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PROJECT NO. 631215151
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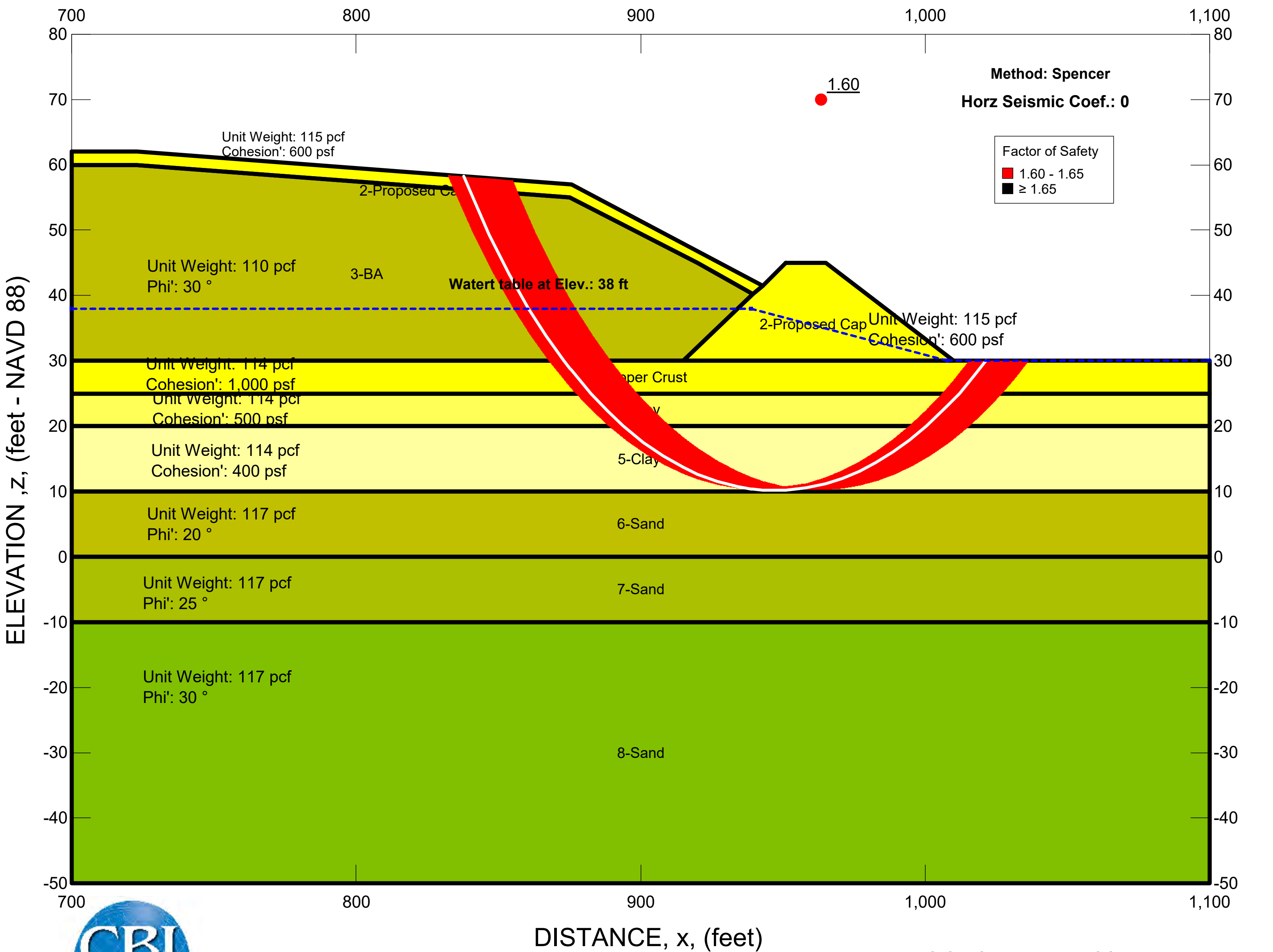

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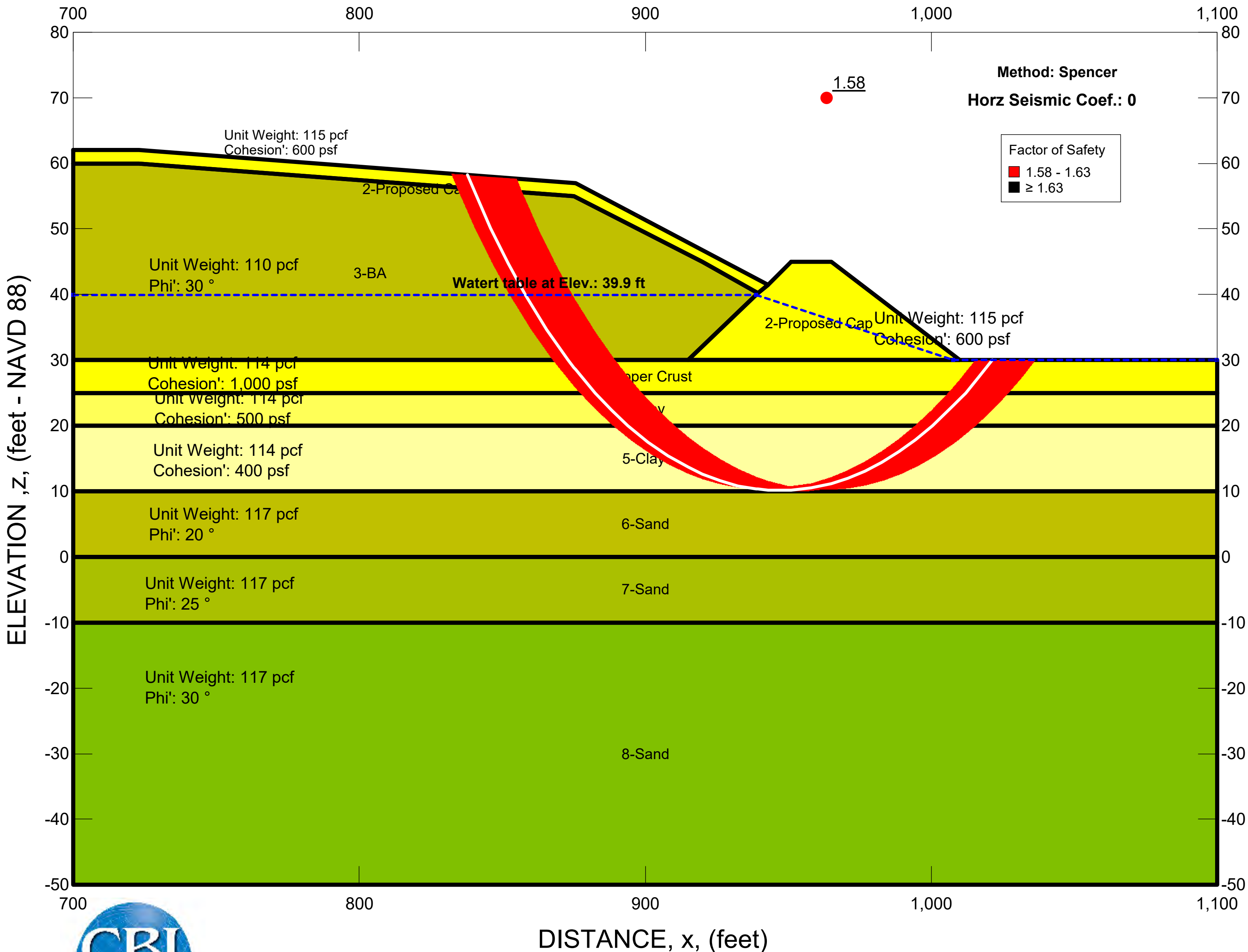

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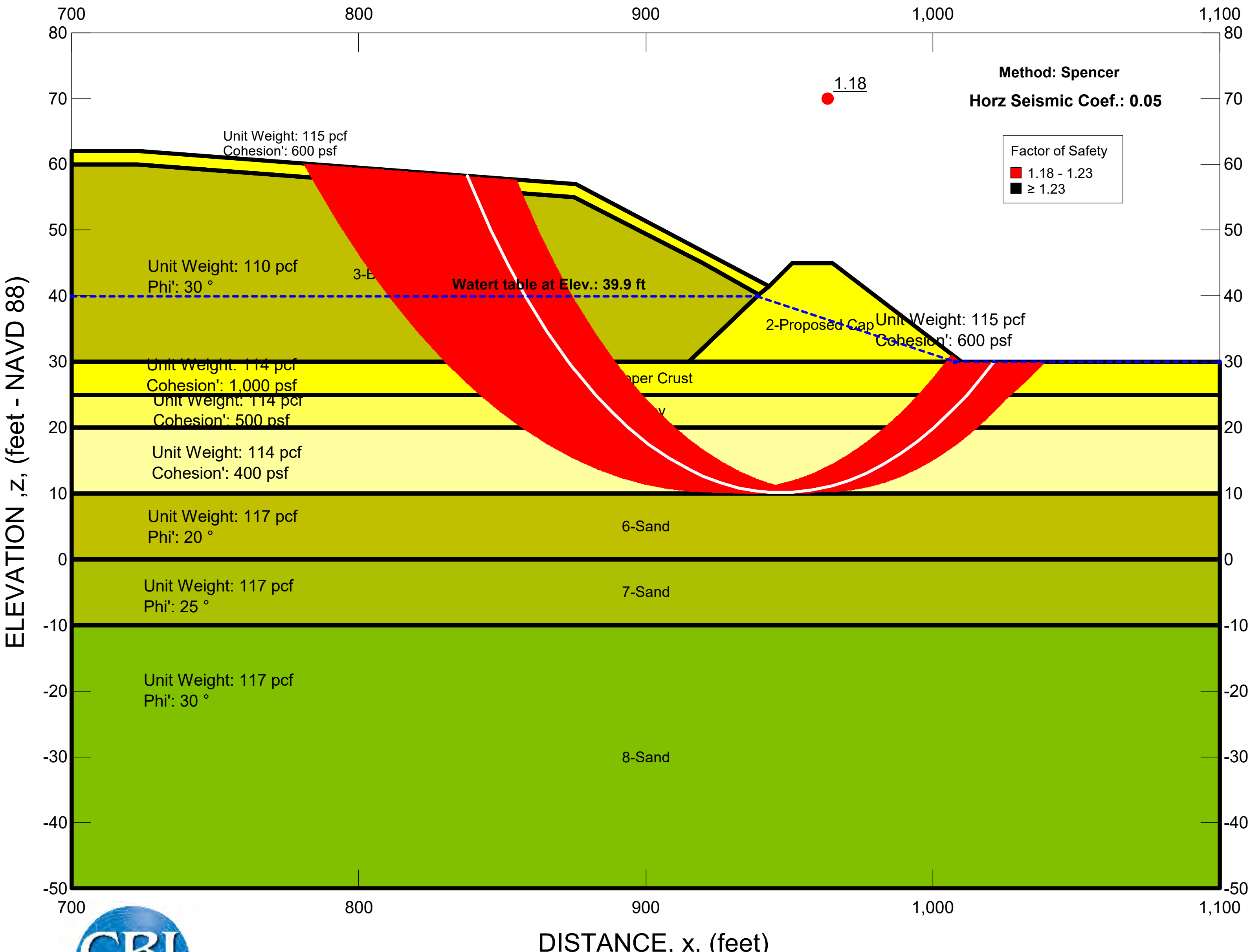

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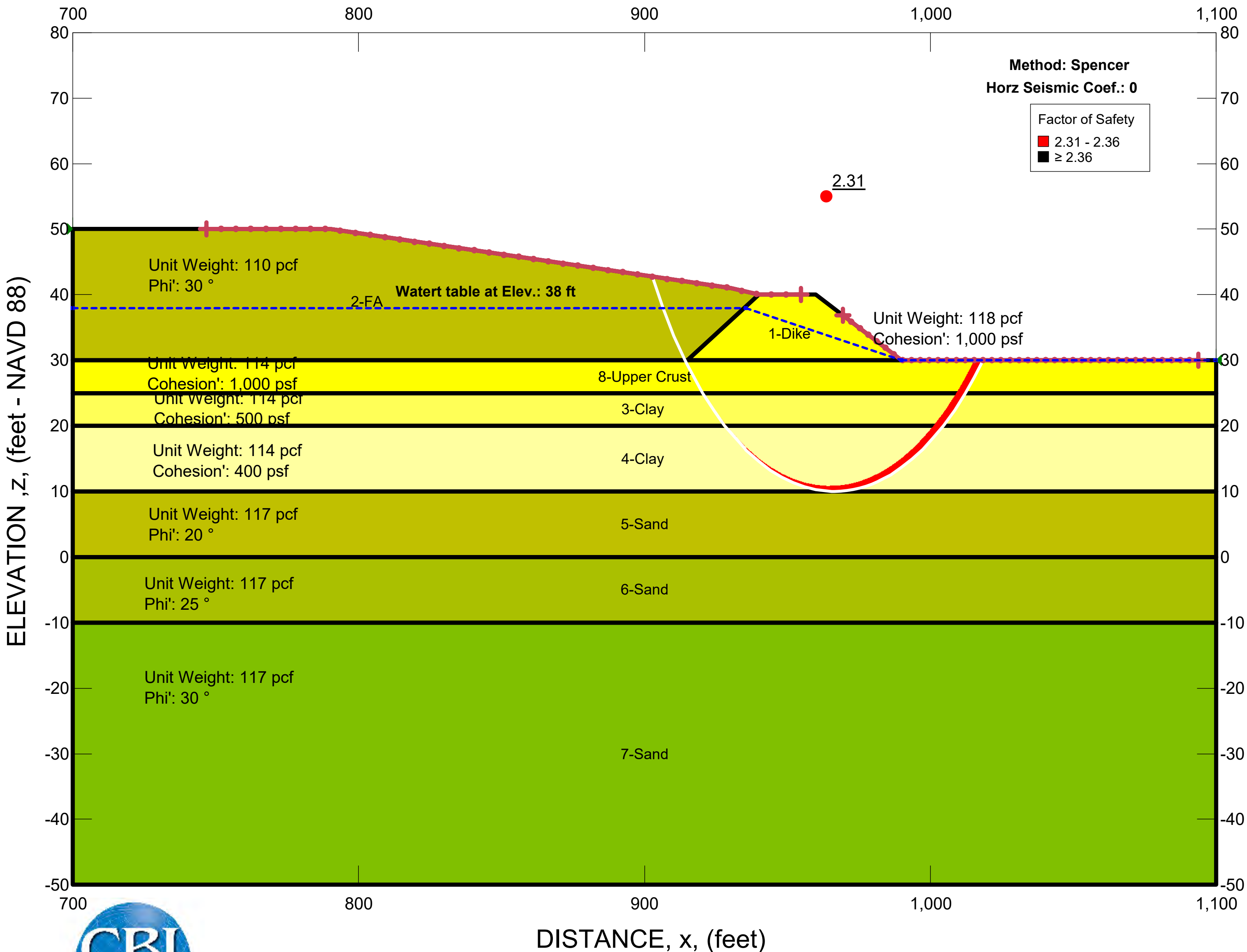

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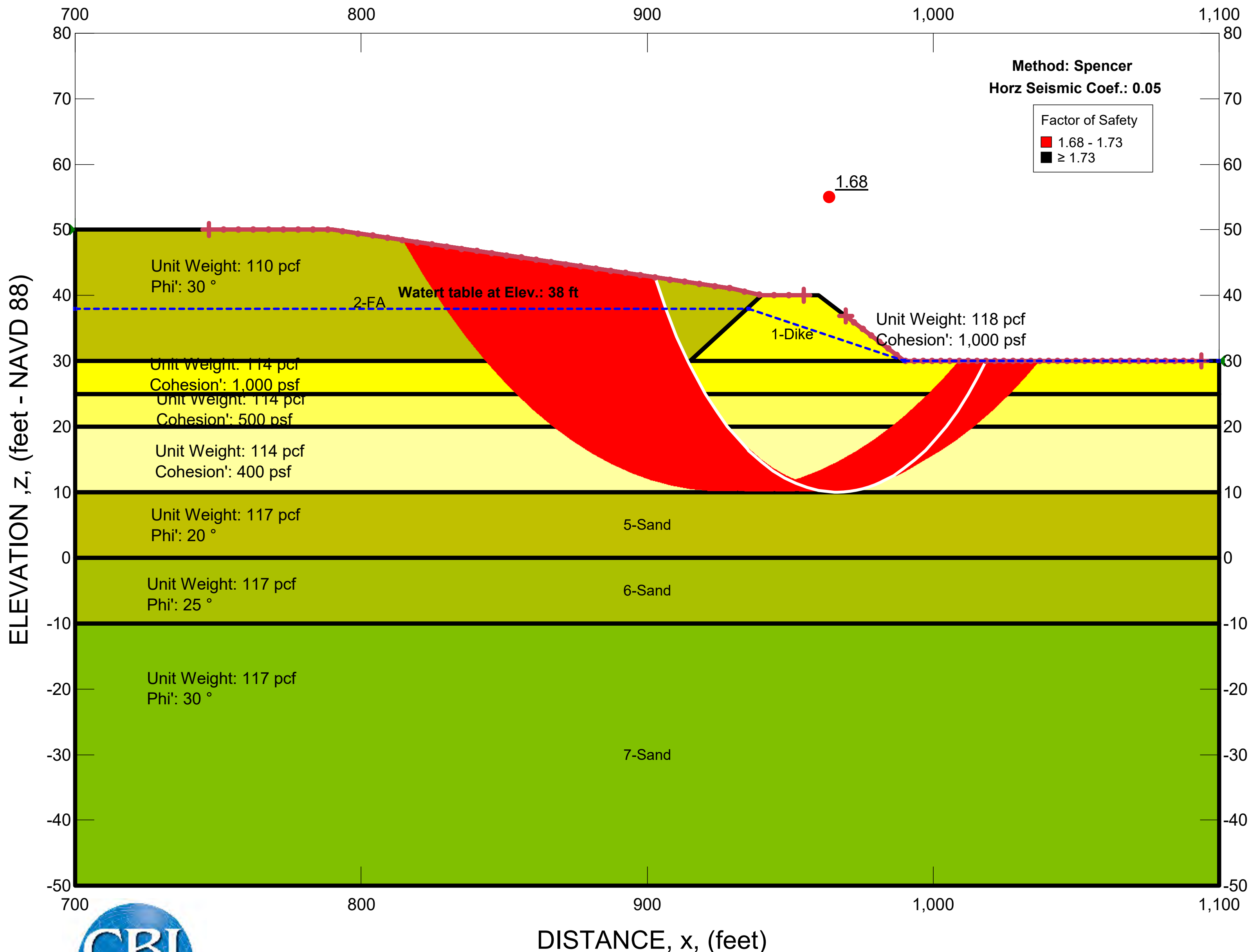

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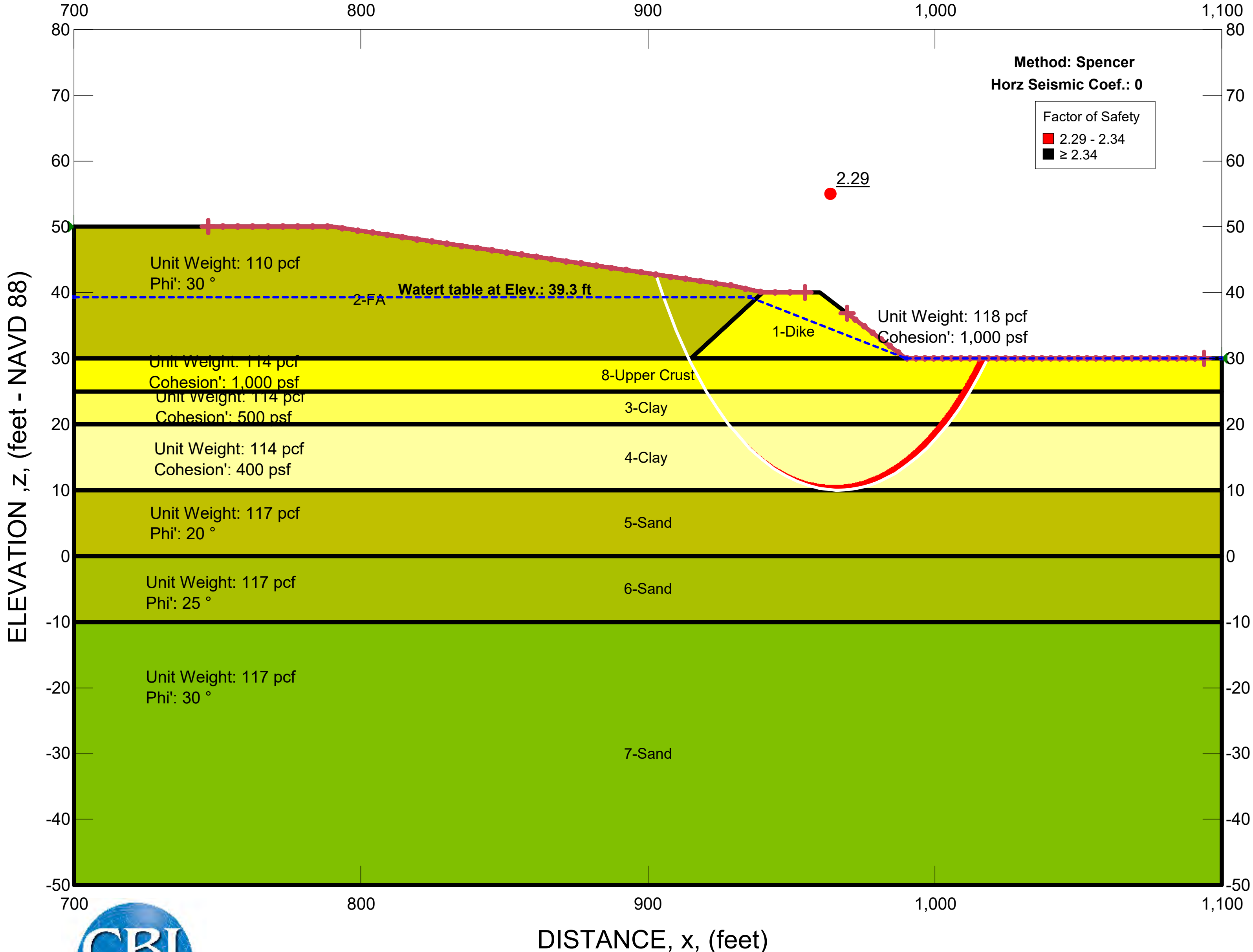

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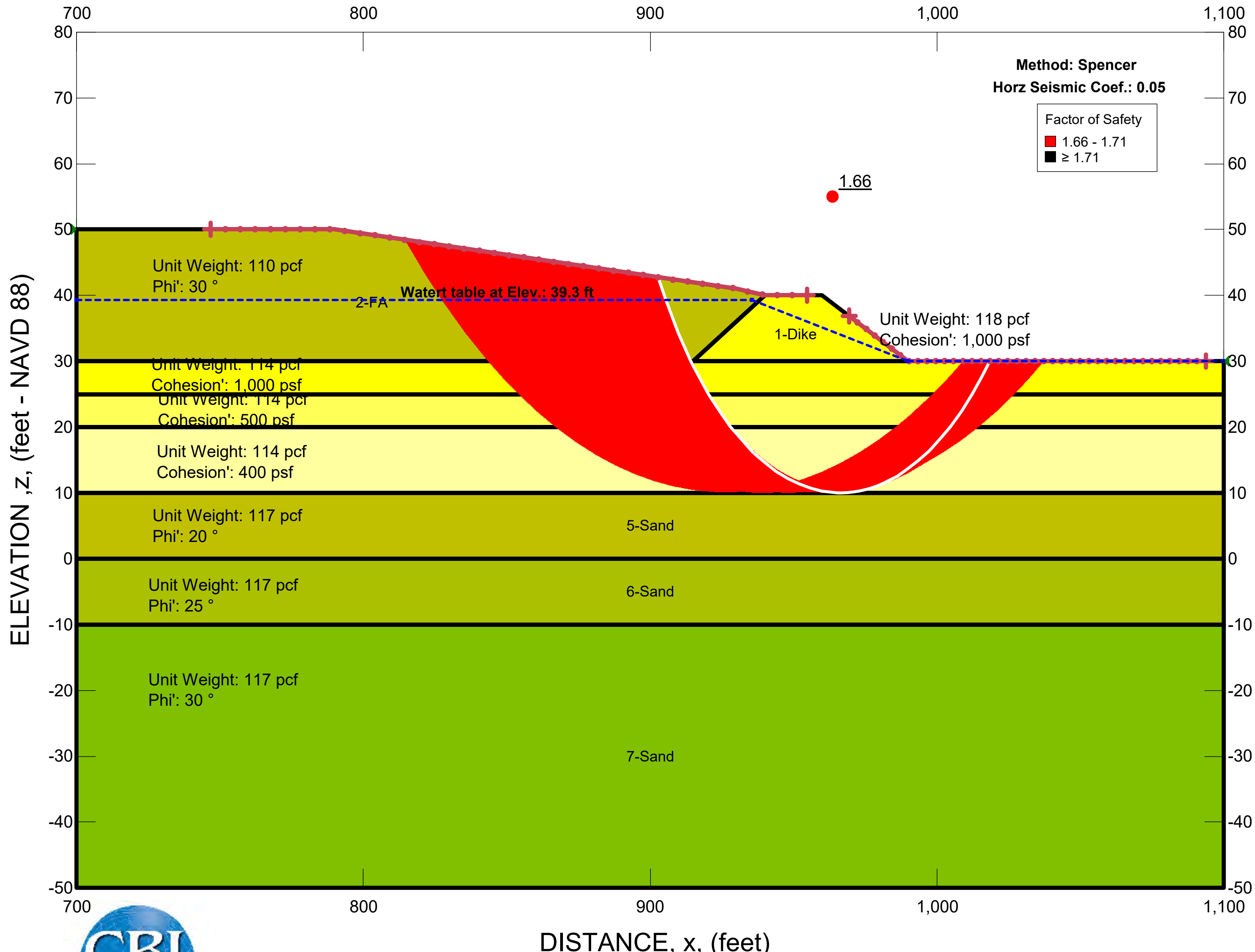

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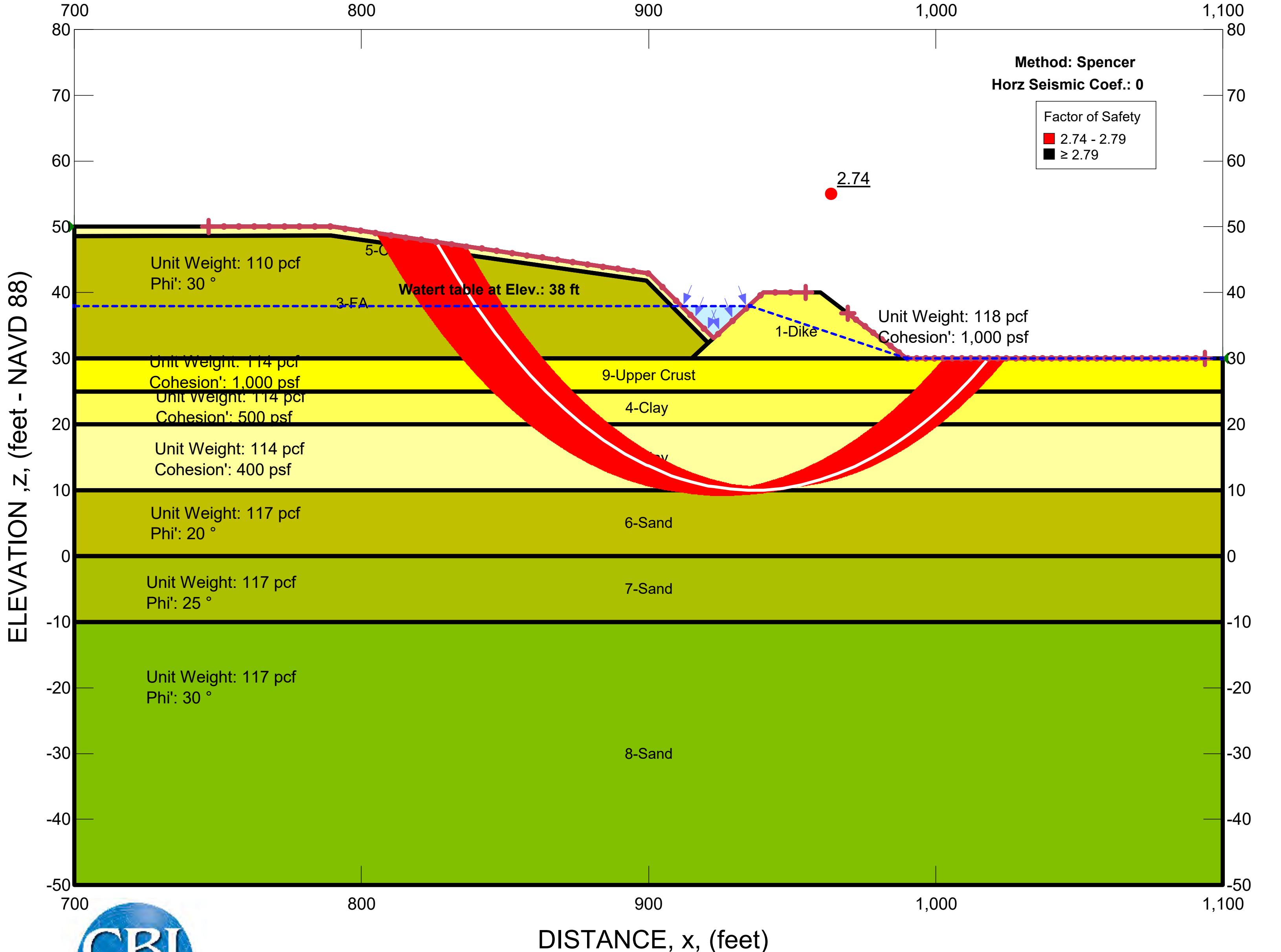

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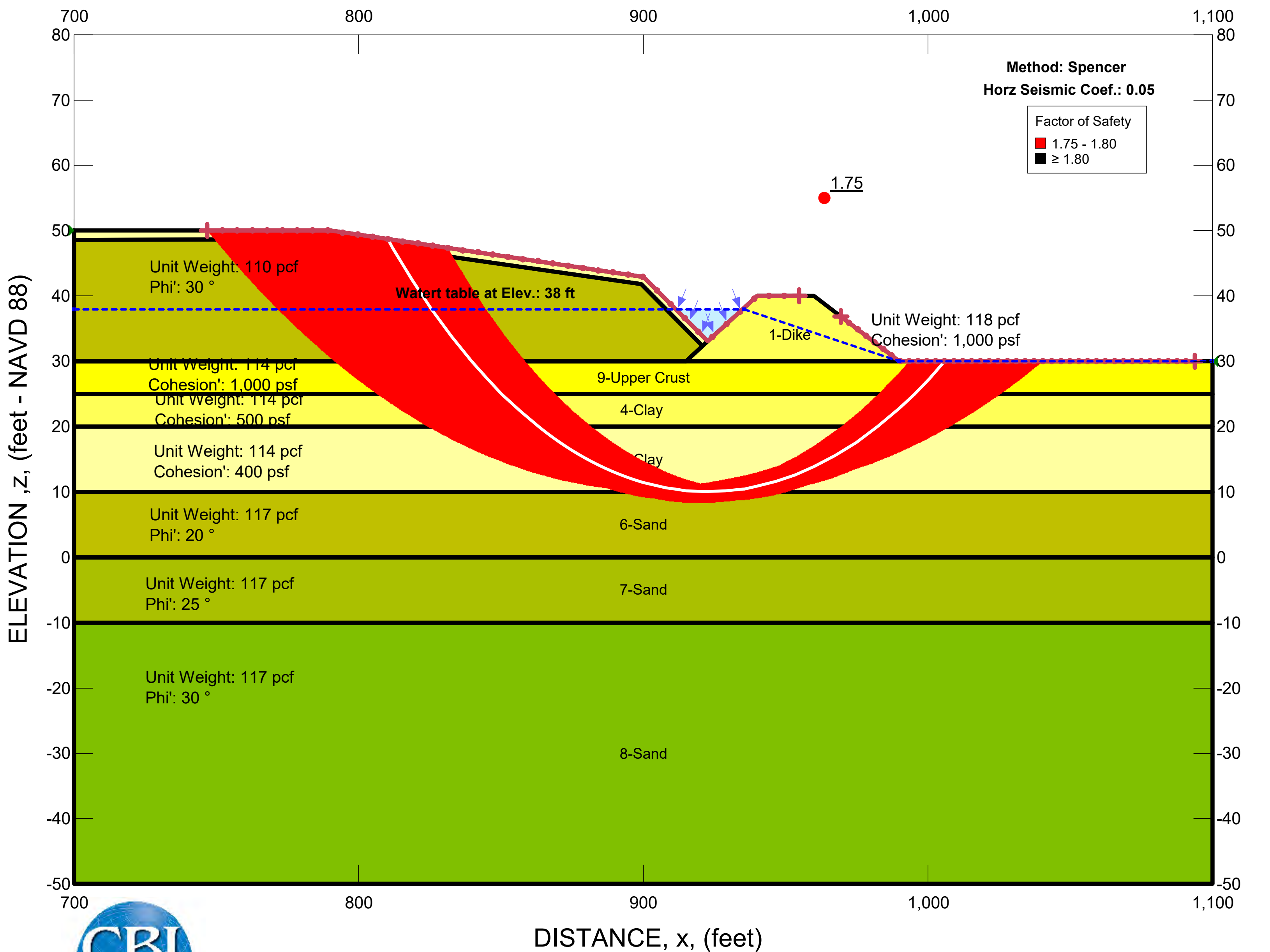

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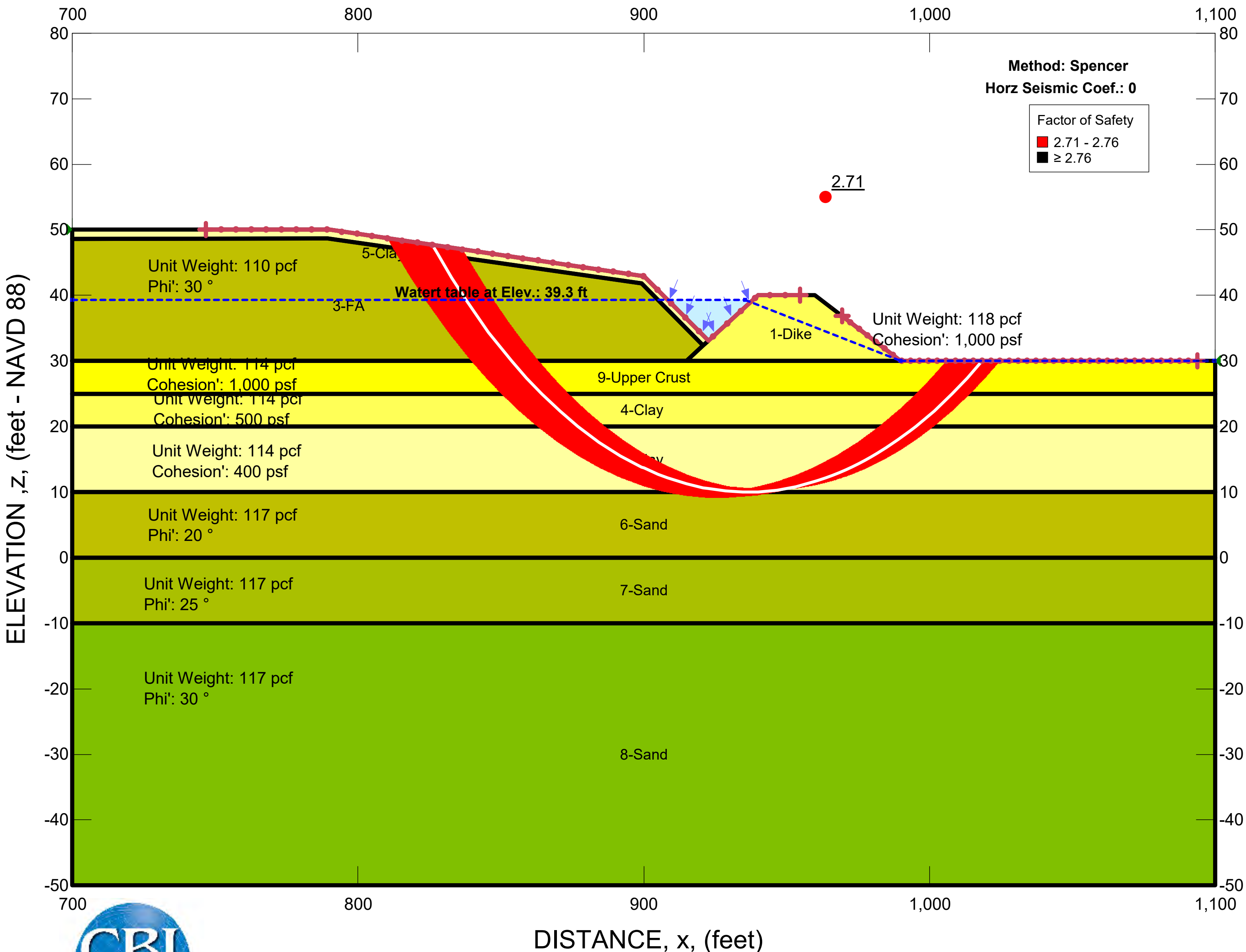

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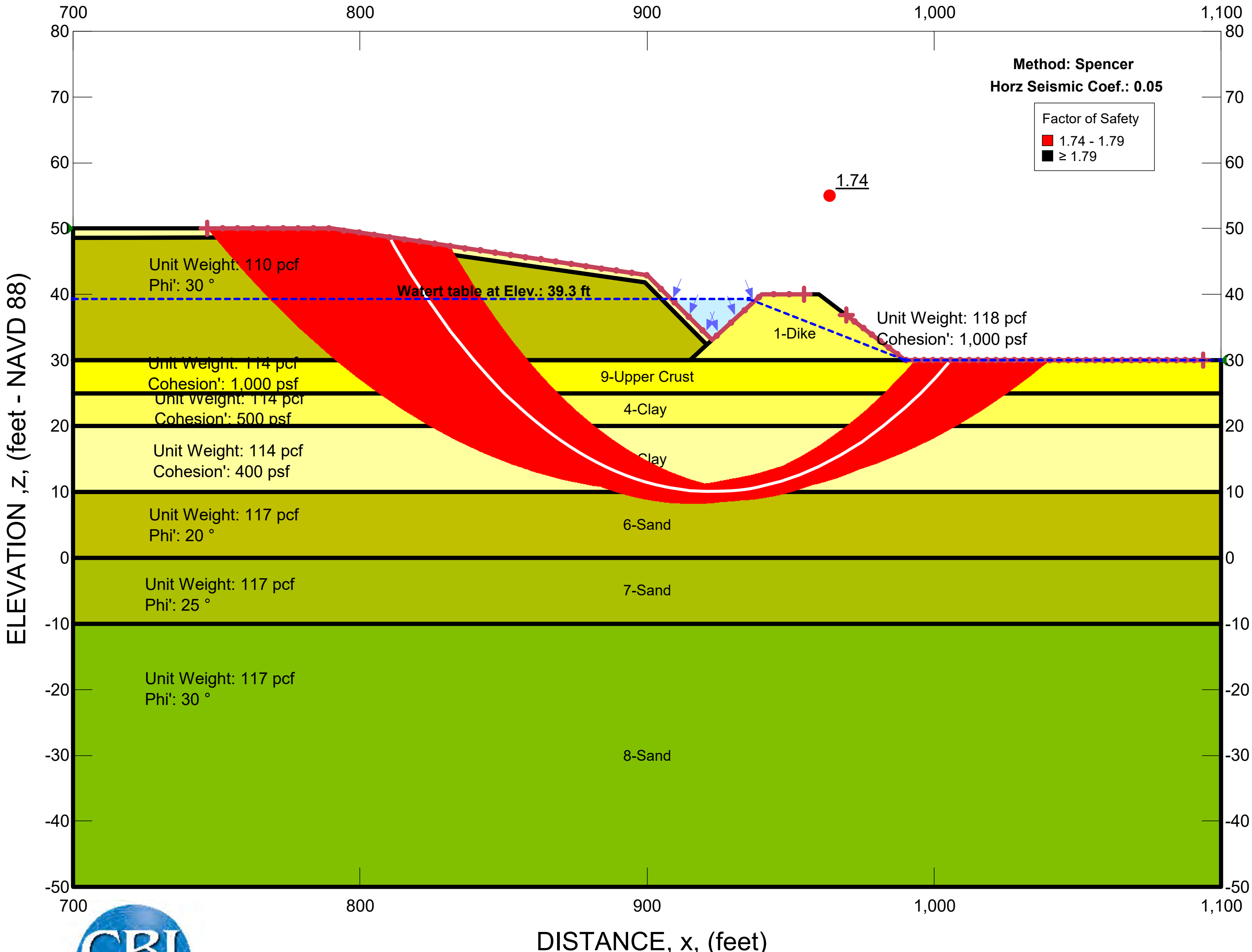

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New Raods, Louisiana

FIGURE

CHAPTER 5.0

Appendices

A Closure Plan
B Closure Plan Addendum

November 30, 2020

APPENDIX A

CCR COMPLIANCE

BOTTOM ASH BASIN CLOSURE PLAN

Prepared for:

Louisiana Generating LLC, a subsidiary of NRG
Big Cajun II
10431 Cajun II Road
New Roads, LA 70760

Prepared by:

CB&I Environmental & Infrastructure, Inc.
Baton Rouge, LA 70809

October 2016

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List of Acronyms

ASTM	American Society for Testing and Materials
CB&I	CB&I Environmental and Infrastructure
BC II	Big Cajun II Plant
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
cm/sec	centimeters per second
CQA	Construction Quality Assurance
EPA	U.S. Environmental Protection Agency
LAC	Louisiana Administrative Code
LaGen	Louisiana Generating, LLC
LDEQ	Louisiana Department of Environmental Quality
MSL	Mean Sea Level
NGVD	National Geodetic Vertical Datum
NRG	NRG Energy, Inc.
RCRA	Resource Conservation and Recovery Act
LPDES	Louisiana Pollutant Discharge Elimination System
SWMU	Solid Waste Management Units
yd^3	cubic yards
SWPPP	Stormwater Pollution Prevention Plan

Plan Review/Amendment Log §257.102(3)

Date of Review	Reviewer Name	Amendment Required (YES/NO)	Sections Amended and Reason

CCR Regulatory Requirements

USEPA CCR Criteria 40 CFR 257.102	NRG Big Cajun II Power Plant Bottom Ash Basin Closure Plan
§257.102(b)(1) stipulates: *(b) Written closure plan—(1) Content of the plan. The owner or operator of a CCR unit must prepare a written closure plan that describes the steps necessary to close the CCR unit at any point during the active life of the CCR unit consistent with recognized and generally accepted good engineering practices. The written closure plan must include, at a minimum, the information specified in paragraphs (b)(1)(i) through (vi) of this section.*	Section 4.0
§257.102(b)(1)(i) stipulates: *(i) A narrative description of how the CCR unit will be closed in accordance with this section.*	Section 4.1
§257.102(b)(1)(iii) stipulates: *(iii) If closure of the CCR unit will be accomplished by leaving CCR in place, a description of the final cover system, designed in accordance with paragraph (d) of this section, and the methods and procedures to be used to install the final cover. The closure plan must also discuss how the final cover system will achieve the performance standards specified in paragraph (d) of this section.*	Section 4.2

USEPA CCR Criteria 40 CFR 257.102	NRG Big Cajun II Power Plant Bottom Ash Basin Closure Plan
§257.102(b)(1)(iv) stipulates: *(iv) An estimate of the maximum inventory of CCR ever on-site over the active life of the CCR unit.*	Section 3.5
§257.102(b)(1)(v) stipulates: *(v) An estimate of the largest area of the CCR unit ever requiring a final cover as required by paragraph (d) of this section at any time during the CCR unit's active life*	Section 3.6

USEPA CCR Criteria 40 CFR 257.102	NRG Big Cajun II Power Plant Bottom Ash Basin Closure Plan
§257.102(b)(1)(vi) stipulates: *(vi) A schedule for completing all activities necessary to satisfy the closure criteria in this section, including an estimate of the year in which all closure activities for the CCR unit will be completed. The schedule should provide sufficient information to describe the sequential steps that will be taken to close the CCR unit, including identification of major milestones such as coordinating with and obtaining necessary approvals and permits from other agencies, the dewatering and stabilization phases of CCR surface impoundment closure, or installation of the final cover system, and the estimated timeframes to complete each step or phase of CCR unit closure. When preparing the written closure plan, if the owner or operator of a CCR unit estimates that the time required to complete closure will exceed the timeframes specified in paragraph (f)(1) of this section, the written closure plan must include the site-specific information, factors and considerations that would support any time extension sought under paragraph (f)(2) of this section.*	Sections 8.0 and 9.0

USEPA CCR Criteria 40 CFR 257.102	NRG Big Cajun II Power Plant Bottom Ash Basin Closure Plan
§257.102(d) stipulates: *(d) Closure performance standard when leaving CCR in place – (1) The owner or operator of a CCR unit must ensure that, at a minimum, the CCR unit is closed in a manner that will:* *(i) 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;* *(ii) Preclude the probability of future impoundment of water, sediment or slurry;* *(iii) Include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period;* *(iv) Minimize the need for further maintenance of the CCR unit; and* *(v) Be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices.*	Section 7.0

USEPA CCR Criteria 40 CFR 257.102	NRG Big Cajun II Power Plant Bottom Ash Basin Closure Plan
§257.102(d)(3)(i)(A)-(D) stipulates: *(3) Final cover system. If a CCR unit is closed by leaving CCR in place, the owner or operator must install a final cover system that is designed to minimize infiltration and erosion, and at a minimum, meets the requirements of paragraph (d)(3)(i) of this section, or the requirements of the alternative final cover system specified in paragraph (d)(3)(ii) of this section.(i) The final cover system must be designed and constructed to meet the criteria in paragraphs (d)(3)(i)(A) through (D) of this section. The design of the final cover system must be included in the written closure plan required by paragraph (b) of this section.* *(A) The permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1 × 10−5 cm/sec, whichever is less.* *(B) 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.* *(C) 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.* *(D) The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.*	Sections 4.2 and 5.0

USEPA CCR Criteria 40 CFR 257.102	NRG Big Cajun II Power Plant Bottom Ash Basin Closure Plan
§257.102(i) stipulates: *(i) Deed notations. (1) Except as provided by paragraph (i)(4) of this section, following closure of a CCR unit, the owner or operator must record a notation on the deed to the property, or some other instrument that is normally examined during title search. (2) The notation on the deed must in perpetuity notify any potential purchaser of the property that: (i) The land has been used as a CCR unit; and (ii) Its use is restricted under the post-closure care requirements as provided by §257.104(d)(1)(iii).*	Section 9.5

USEPA CCR Criteria 40 CFR 257.102	NRG Big Cajun II Power Plant Bottom Ash Basin Closure Plan
§257.102(3) stipulates: *(3) Amendment of a written closure plan. (i) The owner or operatory may amend the initial or any subsequent written closure plan developed pursuant to paragraph (b)(1) of this section at any time.* *(ii) The owner or operator must amend the written closure plan whenever:* *(A) There is a change in the operation of the CCR unit that would substantially affect the written closure plan in effect; or* *(B) Before or after closure activities have commenced, unanticipated events necessitate a revision of the written closure plan.* *(iii) The owner or operator must amend the closure plan at least 60 days prior to a planned change in the operation of the facility or CCR unit, or no later than 60 days prior to a planned change in the operation of the facility or CCR unit, or no later than 60 days after an unanticipated event requires the need to revise an existing written closure plan. If a written closure plan is revised after closure activities have commenced for a CCR unit, the owner or operator must amend the current closure plan no later than 30 days following the triggering event.*	Section 9.1
§257.102(4) stipulates: *(4) The owner or operator of the CCR unit must obtain written certification from a qualified professional engineer that the initial and any amendment of the written closure plan meet the requirements of this Section.*	Section 9.2

1.0 *INTRODUCTION*

CB&I Environmental and Infrastructure, Inc. (CB&I) has prepared the following Closure Plan at the request of Louisiana Generating, LLC (LaGen) (a subsidiary of NRG Energy, Inc. [NRG]) for the Bottom Ash Basin located at its Big Cajun II Power Plant (BC II Plant) near New Roads, Pointe Coupee Parish, Louisiana (**Figure 1**). The BC II Plant is a coal-fired and natural gas fired power plant that has been in operation since 1980. The Bottom Ash Basin has been deemed to be a regulated coal combustion residue (CCR) unit by the U.S. Environmental Protection Agency (EPA), through the Disposal of Coal Combustion Residuals from Electric Utilities Final Rule (CCR Rule) 40 CFR §257 and §261.

There are five solid waste management units (SWMUs) at the BC II Plant that are operated as industrial surface impoundments in accordance with the Louisiana Department of Environmental Quality (LDEQ), Louisiana Solid Waste Regulations (Louisiana Administrative Code [LAC] Title 33: part VII) under Permit Number P-0108R1 for Facility Identification Number GD-077-0583. Two of the five WMUs are required to comply with the requirements of the CCR Rule, which include the Fly Ash Basin and Bottom Ash Basin. The other three LDEQ-permitted surface impoundments at the BC II Plant that are not subject to the CCR Rule requirements include the Primary Louisiana Pollutant Discharge Elimination System (LPDES) Treatment Pond, Secondary LPDES Treatment Pond, and Rainfall Surge Pond (**Figure 2**). The Closure Plan for the Fly Ash Basin is under separate cover.

LaGen intends to close the Bottom Ash Basin in line with the requirements outlined in §257.102 for CCR units closed in place. The following Plan meets all the closure requirements outlined in the Rule, which are further described in Section 2. LaGen will also be using the necessary steps to close the Basin at any point in the active life of the Basin, based on recognized and good engineering practices.

2.0 *REGULATORY OVERVIEW OF CCR CLOSURE PLAN REQUIREMENTS*

On April 17, 2015, the EPA published the CCR Rule under Subtitle D of the Resource Conservation and Recovery Act (RCRA) as 40 CFR Parts 257 and 261. The purpose of the CCR Rule is to regulate the management of coal combustion residuals in regulated units for landfill and surface impoundments. Section 257.102(b) of the CCR Rule requires owners or operators of a CCR Unit to prepare a written closure plan describing the closure of the CCR unit and schedule for implementation of the plan.

The following citations from the Rule are applicable for the Bottom Ash Basin as discussed in this Plan:

§257.102(b)(1) stipulates:

"The owner or operator of a CCR unit must prepare a written closure plan that describes the steps necessary to close the CCR unit at any point during the active life of the CCR unit consistent with recognized and generally accepted good engineering practices. The written closure plan must include, at a minimum, the information specified in paragraphs (b)(1)(i) through (vi) of this section

(i) A narrative description that discusses how the CCR unit will be closed in accordance with §257.102.

(ii) A description of the final cover system and the methods and procedures that will be used to install the final cover are described for the unit, as CCR will be left in-place.

(iii) A description of how the final cover system will achieve performance standards.

(iv) An estimate of the maximum inventory of CCR ever on-site over the active life of the CCR unit.

(v) An estimate of the largest area of the CCR unit ever requiring a final cover as required by paragraph (d) of this section at any time during the CCR unit's active life.

(vi) A schedule for completing all activities necessary for closure of the CCR unit including estimate of the year in which closure activities will be completed, identification of major milestones as coordinating with and obtaining necessary approvals and permits with other agencies, installation of final cover system, and estimated timeframes to complete each step or phase of CCR unit closure."

Per §257.102(b)(iii) closure performance standard and §257.102(d)(1):

"If the closure of the CCR unit will be accomplished by leaving the CCR in place, a description of the final cover system, designed in accordance with paragraph (d) of this Section, and the methods, procedures and performance standards to be used to install the final cover, the following criteria must be met by the owner or operator:

(i) 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 the atmosphere;

(ii) Preclude the probability of future impoundment of water, sediment or slurry;

(iii) Include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during closure and post-closure period;

(iv) Minimize the need for further maintenance of the CCR unit; and

(v) Be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices."

Moreover, the final cover system has been planned in accordance with the following requirements of 257.102(d)(3):

"If a CCR unit is closed by leaving CCR in place the owner or operator must install a final cover system that is designed to minimize infiltration and erosion, and at a minimum, meets the requirements of paragraph (d)(3)(i) of this section, or the requirements of the alternative final cover system specified in paragraph (d)(3)(ii) of this section.

(i) The final cover system must be designed and constructed to meet the criteria in paragraphs (d)(3)(i)(A) through (D) of this section. The design of the final cover system must be included in the written closure plan required by paragraph (b) of this section.

(A) The permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1×10^{-5} centimeters per second (cm/sec), whichever is less.

(B) The infiltration of liquids through the CCR unit must be minimized by the use of an infiltration layer that contains a minimum of 18 inches of earthen material.

(C) The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of 6 inches of earthen material that is capable of sustaining native plant growth.

(D) The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.

In addition to the above, the Closure Plan must ensure compliance with the closure recordkeeping requirements specified in §257.105(i), the closure notification requirements specified in §257.106(i), and the closure intent requirements specified in §257.107(i). A written certification is provided in Section 11.0 from a qualified professional engineer in the State of Louisiana, to certify that this Closure Plan meets the requirements of the CCR Rule.

3.0 *BOTTOM ASH BASIN OVERVIEW*

Pertinent site information and history related to the installation and operation of the Bottom Ash Basin is presented below to provide context for the Closure Plan activities.

3.1 Location, Topography, and Character

The LaGen BC II Plant is located at 10431 Cajun II Road, New Roads, Pointe Coupee Parish, Louisiana. The BC II Plant is situated in Sections 4, 5, and 37 in Township 4 South and Range 11 East. The Bottom Ash Basin is located west of the BC II Plant. The Bottom Ash Basin is bordered on the west by the Fly Ash Basin; on the north by wooded property and agricultural land; on the east by the Treatment Ponds; and on the south by wooded property and grassy fields, as detailed on **Figures 1 and 2**. The Bottom Ash Basin currently being filled has an area of approximately 66 acres. The closure of the Bottom Ash Basin will be accomplished by leaving the bottom ash in place; therefore, the following Closure Plan was developed to satisfy the CCR Rule requirements for in-place closure §257.102(b)(iii).

The Bottom Ash Basin was constructed above natural grade with a base of approximately 30 feet Mean Sea Level (MSL) and a surrounding berm with a designed crest elevation of 48-foot MSL. The existing site topography is depicted on **Figure 3**. The Bottom Ash Basin has an approximate capacity of 1,188 acre-feet with a permitted total storage capacity of 2,585,000 cubic yards [yd^3]). The soils underlying the Bottom Ash Basin consist of naturally occurring and/or recompacted clayey soil that is a minimum of 3 feet thick to over 10 feet thick in some areas. This clay layer acts as a liner which prevents a release into the underlying soil and groundwater.

3.2 Existing Regulatory Permits

The Bottom Ash Basin has been granted and is currently operating under a Louisiana Department of Environmental Quality (LDEQ) Solid Waste Permit as an industrial surface impoundment in accordance with the Louisiana Solid Waste Regulations (LAC 33:VII) under Permit Number P-0108R1 and Facility Identification Number GD-077-0583. The Solid Waste Permit renewal was issued by the LDEQ on February 24, 2011 and allows CCR materials generated on-site at the LaGen BC II Plant to be properly disposed of within the boundaries of the Bottom Ash Basin. As part of this permit, the Bottom Ash Basin has previously approved final grades for closure of the site, as depicted on **Figures 4 and 5**.

3.3 Bottom Ash Generation and Disposal

Bottom ash has been generated at the BC II Plant since it was constructed and became operational in 1980. Bottom ash is generated concurrently with fly ash during the combustion of coal in the boilers when particles of ash fuse together. These fused particles become too large to remain entrained in the rising flue gas and fall to the bottom of the boiler. Particles of bottom ash vary in diameter but approximate the size of coarse sand. Due to their similar origins, bottom ash and fly ash have the same approximate chemical makeup. The Bottom Ash Basin receives bottom ash from Units 1 and 3, as well as sediment from the clarifier beds associated with the cooling towers and boilers. Unit 2 is currently a gas fired unit; therefore, ash is no longer generated by this unit. The clarifier sediments are produced when water from the Mississippi River is clarified and softened for use as cooling water or boiler water. These sediments consist primarily of Mississippi River water naturally occurring silts and clays. They also contain some lime, sodium aluminate, and trace amounts of a water treatment polymer.

3.4 Bottom Ash Basin Operations

The bottom ash from Unit 1 is collected in hoppers at the base of the boiler of Unit 1 and then transported hydraulically (sluiced) through a pipe directly to the south part of the Bottom Ash Basin. Bottom ash from Unit 3 is collected in hoppers at the base of the boiler and trucked in a hydrated state to the southwest corner of the Bottom Ash Basin for disposal. The clarifier sediments are piped to the southeast corner of the Bottom Ash Basin. The filling of the basin started along the south levee and proceeded northward.

Periodic dozing of the bottom ash material will occur as needed, within the active area to maintain a relatively uniform height. Daily and/or interim cover is not applied in the active area of bottom ash disposal. The bottom ash is wet and/or transported in hydrated form that prevents potential dust generation. Weekly (7-day) inspections and annual reporting are undertaken for the Bottom Ash Basin in line with site inspection requirements for CCR units (§257.83[b]: Inspection Requirements for CCR Surface Impoundments) to identify any stability, operational, and/or safety issues which require attention.

During the 2015 annual inspection of the Bottom Ash Basin, observations indicated there was no open water in the Bottom Ash Unit and the bottom of the unit was covered with bottom ash. The north half of the pond was covered to a level of about 15 feet below the crest of the levee, while the southern half was filled to about the level of the levee. The southern half also had a large stockpile of ash at the ash disposal location. The stockpile was approximately 15 to 20 feet tall, but was no closer than approximately 50 feet from the levee. Rainfall runoff is removed from the Basin by a stormwater runoff collection system. Construction of erosion control measures including dikes, berms, and other features takes place as necessary and will be in accordance with the Inflow Design Flood Control System Plan for the site.

Under current operations, all surface runoff from the Bottom Ash Basin is collected and transported by gravity to the Rainfall Surge Pond and finally to the Primary and Secondary Treatment Basins for treatment prior to discharge to the Mississippi River. The Bottom Ash Basin process water and surface water is combined with water from the Fly Ash Basin and directed by an interior swale to a weir located at the northeast corner of the Bottom Ash Basin. A 30-inch diameter pipe carries the combined water by gravity flow to the Rainfall Surge Pond. Water from the Rainfall Surge Pond is then pumped into the Primary Treatment Basin for further treatment. Water flows by gravity from the Primary Treatment Basin to the Secondary Treatment Basin. A pump station moves water from the Secondary Treatment Basin to the Mississippi River discharge point in accordance with the Plant's LPDES permit (Permit No. LA0054135).

Since rainfall runoff will be removed throughout the lifetime of the Bottom Ash Basin, it is anticipated that dewatering of the Basin will not be necessary prior to initiating the closure activities. It is assumed that the Bottom Ash Basin will be filled to capacity with bottom ash at the time of closure. However, any water or free liquids remaining in the Bottom Ash Basin that require removal at the time of closure will be directed/pumped to the existing wastewater treatment plant for processing and treatment and then discharged under the Plant's LPDES Permit (Permit No. LA0054135).

3.5 Remaining Site Volume and Life

The total permitted storage capacity of the Bottom Ash Basin is 2,585,000 yd^3. Based on a review of the Bottom Ash Basin operational data from 2015, the remaining capacity of the Basin is approximately 1,400,000 yd^3 (or 54 percent). The estimated current maximum inventory of CCR ever on-site over the active life of the Bottom Ash Basin was determined to be 2,585,000 yd^3 (and 3,905,000 yd^3 for the Fly Ash Basin). The estimated closure date of the Bottom Ash Basin, at a minimum, will be in 2022. As the Bottom Ash Basin is filled, this date may change depending on the amount of bottom ash that is disposed of in the Fly Ash Basin. Accordingly, this closure date will be updated in the future.

3.6 Largest Area Requiring Final Cover

The Bottom Ash Basin and adjacent Fly Ash Basin and other associated non-CCR impoundments at the BC II Plant will be operated so that contemporaneous operation and closure occurs. Therefore the final cover will be constructed in stages in order to maintain compliance. The largest area requiring final cover at any time during the operating period of the Bottom Ash Basin is estimated to be approximately 66 acres (plus approximately 175 acres for the Fly Ash Basin).

4.0 *CLOSURE PLAN*

As detailed, this Closure Plan has been prepared in accordance with requirements of the CCR Rule and includes a written certification in Section 11.0 from a qualified professional engineer for the State of Louisiana.

4.1 *Narrative Description*

Closure of the Bottom Ash Basin will be accomplished by leaving the CCR material in-place. The method of closure has been designed to minimize maintenance, leachate generation and control run-on and run-off, to ensure the protection of human health and the environment. Construction Quality Assurance (CQA) procedures have been developed to ensure the final cover is designed, constructed, and installed in accordance with recognized standards and accepted good engineering practices as detailed in the following sections.

4.2 *Final Cover and Subgrade Overview*

The final cover has been designed to meet the following objectives:

- Minimize the potential post-closure infiltration of liquids into the fly ash material
- Minimize the potential for releases of CCR, leachate, or contaminated run-off to the ground or surface waters or the atmosphere
- Provide long-term slope stability to prevent the sloughing or movement of the final cover system during closure and post-closure period
- Minimize the need for further maintenance of the CCR unit

The final cover will be installed on top of a minimum of a 12-inch subgrade layer of compacted and graded bottom ash. The ash will be graded to approximately 2.5 feet below the final grade elevations. All final grade elevations for the closed Bottom Ash Basin will be adjusted for the amount of ash actually present at the time of closure.

The final cover is comprised, from bottom to top, of the barrier/protective soils, including:

- A minimum of 18 inches of a compacted clay cap layer (24 inches will be used) with a permeability no greater than 1×10^{-5} cm/sec (permeability of 1×10^{-7} cm/sec will be used)

- A minimum 6-inch topsoil erosion control layer that is capable of sustaining vegetation

The top slope of the final cover will be a minimum of 1 percent, with the Basin exterior slopes constructed at a 3 (horizontal) to 1(vertical) slope. The slopes will assure drainage and prevent ponding of water. The positive drainage will serve to minimize the potential for the infiltration of liquids into the CCR unit. The final cover of the Bottom Ash Basin will be constructed to the final grades depicted on **Figure 4**. All final contours are being provided for “information purposes only,” and are not meant to be used as final design or construction drawings.

If an alternate liner is considered for use in lieu of the prescribed final cover system described above, the regulatory authority will be notified and appropriate permitting will be secured.

4.2.1 Low Permeability Subgrade Construction

Prior to construction of the final cover, a 12-inch subgrade area comprised of compacted bottom ash will be prepared and used to support the final cover system and the subgrade will be graded to ensure a uniform subgrade surface.

After the grading and compaction of the subgrade the area will be inspected to ensure the working surface is smooth and free from sharp objects or abrupt changes in grade, and proper sloping allowed for drainage. Upon inspection, the area will be surveyed to confirm the lines and grades specified in the design prior to the commencement of the installation of the final cover. Closure activities for the subgrade will be completed in accordance with the Closure Soils and Liner Quality Control Plan, November 2010, that has been developed for the Bottom Ash Basin (and Fly Ash Basin), a copy of which is included in **Appendix A**. The Closure Soils and Liner Quality Control Plan includes provisions for a proposed expansion of the Bottom Ash Basin. This expansion was never implemented (as noted by LaGen in correspondence to the LDEQ dated July 28, 2011); accordingly, these provisions are not applicable at this time.

4.2.2 Final Barrier Cover Soils

The final cover barrier soils include a minimum 24-inch clay cap layer comprised of compacted soil having an approximate permeability of 1 X 10^{-7} cm/sec to minimize infiltration of liquids through the closed CCR unit and a 6-inch erosion control layer that will require soil that is suitable to support the growth of vegetation. A total of approximately 212,960 yd^3 of the 24-inch thick clay cap layer will be required for the final soil cover. The 6-inch thick erosion control layer will require approximately 53,240 yd^3 of suitable material.

The 24-inch clay cap layer will be located above the compacted and graded ash. This immediate placement will prevent the infiltration of water into the underlying ash. The infiltration layer will be constructed from overburden from on-site and/or off-site borrow sources. This layer will be free of large particles or materials. All soils used in soil liner will have minimum geotechnical property values (Plasticity Index, Liquid Limit, Percent Passing 200 Sieve, Percent Passing 1-inch Screen, and Permeability) verified by testing in a soil laboratory. Following the placement of the 24-inch thick compacted clay cap, surveying will be performed to document that the finished soil liner has been constructed to the design lines and grades.

Following the survey, 6-inches of a topsoil cover will be placed over the clay cap layer in accordance with the project plans and specifications. The topsoil will be seeded and mulched to promote vegetation growth to deter erosion and return the area to a more natural appearance.

All final grade elevations for the closed Bottom Ash Basin will be adjusted for the amount of ash actually present at the time of closure. The thickness of the final topsoil layer will be verified by surveying the top surface in the same locations completed on the top of subgrade. The thicknesses of all barrier soils are considered to be nominal thicknesses. The average of actual thickness measurements shall be no less than the design thickness.

Quality-control procedures have been developed and will be implemented to ensure that final cover is designed, constructed, and installed properly in accordance with consistent recognized and generally accepted good engineering practices. Closure activities for the clay cap system and vegetated topsoil cover will be completed in accordance with a previously referenced November 2010 Closure Soils and Liner Quality Control Plan (**Appendix A**), with exception of the proposed expansion of the Bottom Ash Basin, which was never implemented.

5.0 *CONSTRUCTION CONSIDERATIONS*

5.1 *Equipment*

LaGen or its contractor is responsible for providing sufficient equipment to carry out closure operations as designed in a satisfactory manner. Equipment for closure operations of the Bottom Ash Basin may include, but not be limited to: tracked dozers, excavators, compactors, haul trucks, drum rollers, and water trucks.

5.2 *Phased Construction*

The final cover will be placed progressively as each construction phase of the closure activities is completed. Construction of the clay cap cover system, haul road, and fill placement will take place during the time of year with suitable weather for construction. The objective will be to establish the stabilized final surface as quickly as possible after the last receipt of bottom ash at the Bottom Ash Basin.

5.3 *Stormwater Run-On and Run-Off Controls*

There are three distinct types of flooding or drainage problems which could potentially affect the BC II Plant in the area surrounding New Roads, Louisiana:

(1) Widespread flooding by the Mississippi River during high water in the spring and summer months

(2) Backwater flooding caused by excessive rainfall draining into low lying areas and backing up into the drainage ways

(3) Flash floods in small streams caused by rainfall of high intensity and short duration

The current design of the Bottom Ash Basin and other SWMUs at the BC II Plant and the Mississippi River levee protection system insure that uncontaminated surface runoff will not drain through the operating areas, even in the event of excessive rainfall or any of the three types of floods. After the extreme flood of 1927, Congress adopted a comprehensive plan for flood control in the Mississippi River Alluvial Valley. The project consists of a combination of features including levees along the main channel and its tributaries to retain peak flows; floodways to divert excess flow from the River; and channel improvements such as revetments, dikes, and dredging to increase channel capacity. With the institution of these projects, flooding in this area has been limited to backwater flooding and short-term flooding from high-intensity, short duration rainfall.

Backwater flooding is the most common type of drainage problem in the vicinity of the BC II Plant. The Bottom Ash Basin and other SWMUs at the BC II Plant were designed and constructed to prevent uncontaminated runoff or backwater from flowing through the units. The clay dikes which surround the Bottom Ash Basin and other SWMUs effectively segregate on-site and off-site runoff. The facility is located within the 100-year flood plain. Dikes were constructed around the solid waste impoundments to a height greater than the 100-year floodplain elevation (approximately 35 feet National Geodetic Vertical Datum [NGVD]) to preclude any contamination of flood waters by the CCR materials. The top of the dike surrounding the Bottom Ash Basin has a designed elevation of 48 feet MSL, which is approximately 18 feet above grade. All dikes have been seeded with grass, covered with an erosion control fabric, and fertilized following construction. All dikes are sufficient height to prevent off-site drainage and floodwater from being contaminated by CCR materials.

The top of the clay cap and erosion control system for the closed Bottom Ash Basin has been designed to facilitate runoff that will be sloped to a series of collection channels. The channels will collect runoff from the top of the mounded erosion control layer and divert it to an interior ditch system adjacent to the existing Basin levees. Riprap lined letdown channels will be used to discharge the runoff down the exterior dikes slopes to natural drainage paths at the discharge points. Additional information on the management of stormwater is included in the CCR Rule Inflow Design Flood Control System Plan.

5.4 Stability

As part of the closure process, the upper 12 inches of the bottom ash subgrade will be compacted to 95 percent of standard Proctor (ASTM D698). Most of the anticipated settlement will be from compression and will occur shortly after placement of the soil cap and erosion control layers. The final cover system will experience some settlement relative to the base grade settlement due to consolidation. It is expected that the settlement rates will be small and therefore, the amount of settlement will be progressively monitored over time. In the event that non-uniform settlement occurs, minor regrading and repair of the soil cap/erosion control components may be required. The clay cap system and vegetated topsoil erosion control layer will be completed in accordance with a November 2010 Closure Soils and Liner Quality Control Plan (**Appendix A**), with exception of the proposed expansion of the Bottom Ash Basin, which was never implemented. These measures should provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period and minimize the need for further maintenance of the closed Bottom Ash Basin.

5.5 Erosion Control

Erosion control measures such as riprap, and the possible use of erosion control blankets and turf reinforcing mats, will minimize erosion in the interior and perimeter drainage channels of the closed Bottom Ash Basin. The maintained vegetated areas of the topsoil layer along with the relatively shallow slope of the top surface of the final cover will also assist in preventing erosion of the clay cover soils. Construction of any erosion control measures including dikes and berms will take place as necessary and will be in accordance with the CCR Rule Inflow Design Flood Control System Plan for the site.

6.0 *OPERATIONS AND MAINTENANCE*

Following closure, maintaining the integrity and effectiveness of the final cover will be performed to prevent and minimize any erosion or stability maintenance to ensure the final cover will not be damaged. The area will be inspected and maintained to control excessive vegetative growth. Repairs will be made as necessary to correct any effects of settlement, subsidence, erosion or other events. It has been estimated that repairs and the replacement of 6 inches of soil will be required on approximately 10 percent or less of the area of the Bottom Ash Basin, which is a maximum of approximately 6.6 acres. Annual reports on the integrity of the final cover will be prepared as part of the CCR Rule inspection requirements. The final cover will be monitored and maintained in accordance with the Post-Closure Plan for the Bottom Ash Basin.

7.0 *CLOSURE PERFORMANCE STANDARDS*

7.1 Minimization of Liquid Infiltration into CCR Waste Mass

The final cover system for the Bottom Ash Basin including the compacted subgrade, 24 inches of clay cap (with a permeability of approximately $1x10^{-7}$ cm/sec) and 6 inches of topsoil with vegetative cover will help to minimize the potential infiltration of water into the underlying bottom ash. The soil cap will convey stormwater runoff away from the underlying CCR material. The sloping of the clay cap and drainage channels will promote movement of water away from the CCR mass and help to keep the barrier soils drained to prevent pooling.

The final cover layers also assist in controlling, minimizing, and in some cases eliminating, the post-closure infiltration of liquids into the underlying CCR material. This prevents the release of CCR, leachate, or contaminated run-off to the ground or surface waters and the atmosphere, as required by the CCR performance standards.

7.2 Preclusion of Future Impoundment of Water, Sediment, or Slurry

The owner and operator of the Bottom Ash Basin does not anticipate the need for future impoundment of water, sediment, or slurry. Therefore the Bottom Ash Basin follows the required performance standards.

7.3 Measures to Maintain Slope Stability

In order to maintain slope stability of the final cover, runoff is collected and controlled in highly erodible areas such as the side slopes and graded surface. This is done by grading the final cover to a maximum slope of 3 (horizontal) to 1 (vertical), with a gentle final grade to control slope runoff velocities and volumes. The runoff control plans and shallow slopes prevent erosion, movement, and sloughing of the final cover system, and therefore fulfill the required performance standard. For further information on the stormwater management, refer to the CCR Rule Inflow Design Flood Control System Plan.

7.4 Design to Minimize Ongoing Maintenance

The incorporation of slope stability and erosion control measures help to prevent the need for maintenance on the closed Bottom Ash Basin. As a result of these measures, less regrading or soil additions to the final cover system will be necessary.

Additionally, the weekly inspections of the Bottom Ash Basin will assist in minimizing maintenance. These inspections will help in determining features that will need maintenance in the future, if there are features that can be maintained currently, and may prevent a larger maintenance project in the future.

Both the maintenance prevention measures and the weekly inspections will minimize the requirement for larger maintenance of the closed Bottom Ash Basin, and therefore fulfills the required performance standards.

7.5 Engineering Good Practices

The planned quick completion of the phased final cover will prevent large amounts of contact water from being generated. The use of time efficiency, with a high standard for quality, is an example of a good engineering practice and satisfaction of the required performance standards.

8.0 *CLOSURE ACTIVITY SCHEDULE*

The closure of the Fly Ash Basin will be completed according to the following schedule milestones:

- The estimated closure date of the Bottom Ash Basin, at a minimum, will be in 2022. As the Bottom Ash Basin is filled this date may change depending on the disposal rates of bottom ash. This closure date will be updated in the future.

- The regulatory authority will be notified in writing of the intent to close the Bottom Ash Basin at least 90 days before closure.

- The final cover installation will be initiated as soon as possible after regulatory approval, based on the time of year with suitable weather for construction.

- Clay Cap construction and analytical testing will be conducted in systematic and timely manner. Delays will be avoided in clay cap completion. Construction and testing of the soil will generally not exceed 60 working days from beginning to completion.

- Upon completion of the closure activities, a certified Louisiana Professional Engineer will provide the regulatory authority with a closure certification. This will verify that the Bottom Ash Basin closure was performed and completed in accordance with the closure plan. The certification will be provided within 30 days of the completion of closure activities.

- It is anticipated that closure activity for the Bottom Ash Basin will be completed within 120 days of last receipt of bottom ash, pending any factors beyond the facilities control.

- Post-closure monitoring of the cap and run-on/run-off controls will be conducted on a routine schedule to identify any potential stability issues with the cap and appropriate maintenance to be undertaken. A post-closure monitoring plan for the Bottom Ash Basin has been detailed in the Post-Closure Plan for the site.

9.0 *RECORD KEEPING/NOTIFICATION REQUIREMENTS*

The BC II Plant maintains a facility operating record consisting of the following documents:

- Copies of the Solid Waste Permit application and all supporting documents
- Copy of the current operating permit and any subsequent addenda
- Groundwater sampling and analysis results for the Bottom Ash Basin and related permitted basins/impoundments, records of by-product material recycled, major operational problems, complaints or difficulties, records associated with corrective measures, and employee training records
- A copy of the Storm Water Pollution Prevention Plan (SWPPP) and the SWPPP Record Forms
- Closure and post-closure plans, as well as closure CQA certification and post-closure inspection documentation
- Proof of financial assurance

All records that are relevant within the past 5 years will be maintained at the BC II Plant and/or by LaGen. The records are available to regulatory authority representatives for review upon request.

9.1 Plan Amendments

This Closure Plan will continue to undergo review as the Bottom Ash Basin continues to operate. Future amendments to the Plan will be reviewed and recertified by a registered professional engineer and will be placed in the BC II Plant operating record as required per §257.105(i)(4). The amended Plan will supersede and replace any prior versions. Availability of the amended Plan will be noticed to the regulatory authority per §257.106(i) and posted to the publicly accessible internet site per §257.107(i).

A record of Plan reviews/assessments is provided on the first page of this document, immediately following the Table of Contents.

Any subsequent amendment of a written Closure Plan will be prepared as required, such as when:

- there is a change in the operation of the CCR unit that would substantially affect the written closure plan in effect; or

- before or after closure activities have commenced, unanticipated events necessitate a revision of the written closure plan.

LaGen will amend the Bottom Ash Basin Closure Plan at least 60 days prior to a planned change in the operation of the facility or Bottom Ash Basin, or no later than 60 days after an unanticipated event requires the need to revise an existing written closure plan. If a written closure plan is revised after closure activities have commenced, LaGen will amend the closure plan no later than 30 days following the triggering event.

9.2 Amended Closure Certification

Any future amendments to the current closure plan will be tracked in the log at the beginning of this document and will be certified by a qualified professional engineer that the amended plan meets the requirements of the applicable portions of the CCR Rule.

9.3 Notice of Intent to Initiate Closure

LaGen will file a Notice of Intent for closure activities no later than the date of initiation of closure of the Bottom Ash Basin. The notification will include the certification by a registered professional engineer for the design of the final cover system as required by §257.102(d)(3)(iii).

If required, LaGen may request an extension of an additional 2 years to initiate closure of the Bottom Ash Basin, under circumstances when the Bottom Ash Basin will continue to accept CCR. It is further noted that extensions of closure timeframes for completing closure of a CCR unit may be extended if the owner or operator can demonstrate that it is not feasible to complete closure of the CCR unit within the required timeframes due to factors beyond the facility's control. If the owner or operator is seeking a time extension beyond the time specified in the written closure plan, specific written documentation, as specified in the CCR Rule, must be provided to justify the basis for additional time beyond that specified in the closure plan. The factors that may support such a demonstration are not included in the current closure plan at this time. If such an extension is needed in the future, the plan will be amended to address this issue at a later date.

9.4 Notice of Completion of Closure

LaGen will complete a Notice of Completion of closure activities within 30 days of completion of closure of the Bottom Ash Basin. The notification will include the certification by a registered professional engineer as required by §257.102(f)(3).

9.5 Deed Notation

As per §257.102(i), a notation on the deed to the property, or some other instrument, that is normally examined during a title search will be recorded to notify any potential purchaser of the property that the land has been used as a CCR unit and its use is restricted under the post-closure care requirements provided within §257.104(d)(1)(iii). The following information will be recorded in accordance with the CCR Rule:

- The name and address of the person with knowledge of the contents of the facility
- The prior land use as a CCR unit
- The restrictions of future land use under the post-closure care requirements

9.6 Record Keeping Requirements

The BC II Plant will maintain files of all information related to the closure of the Bottom Ash Basin in a written operating record at the BC II Plant as required by the CCR Rule. The files will be retained for at least 5 years following the date of each occurrence, measurement, maintenance, corrective action, report, record, or study. The files for separate CCR units undergoing closure at the Plant will be maintained in one recordkeeping system with files separated by the name or identification number of each CCR unit. It is understood the files may be maintained on microfilm, on a computer, on computer disks, on a storage system accessible by a computer, on magnetic tape disks, or on microfiche.

The CCR Rule also requires that the owner or operator of a CCR unit maintain a publicly accessible Internet site (CCR Web site) that contains specific information related to the CCR unit closure.

In accordance with the CCR Rule, the BC II Plant will place the following information for closure of the Bottom Ash Basin, as it becomes available, in the facility's operating record and post it to the CCR Web site (within 30 days of placing the pertinent information in the BC II Plant operating record):

- Written closure plan, and any amendment of the plan (only the most recent closure plan must be maintained in the facility's operating record irrespective of the 5-year time requirement previously specified)
- Written demonstration(s), including the certification requirement for a time extension for initiating closure, as applicable

- Written demonstration(s), including the certification requirement for a time extension for completing closure, as applicable
- Notification of intent to close a CCR unit
- Notification of completion of closure of a CCR unit
- Notification recording a notation on the deed

10.0 *CLOSURE COST ESTIMATE*

The closure cost for the Bottom Ash Basin is estimated to be approximately $1,001,741, as of March 2016. This includes preparing the site for construction of the final cover, the cost of the actual final cover, and the implementation of erosion control measures. The closure cost estimate is included in **Appendix B**.

In providing these cost estimates, it is recognized that LaGen does not have control over the costs of labor, equipment, or materials, or over a Contractor's method(s) of determining prices or bidding.

11.0 *PROFESSIONAL ENGINEER CERTIFICATION*

The undersigned registered professional engineer is familiar with the requirements of §257.102 and has visited and examined the BC II Plant Bottom Ash Basin or has supervised examination of the Big Cajun II Bottom Ash Basin by appropriately qualified personnel. The undersigned registered professional engineer attests that this CCR Closure Plan has been prepared in accordance with good engineering practice, including consideration of applicable industry standards and meets the requirements of §257.102, and that this Plan is adequate for the Big Cajun II Plant. This certification was prepared as required by §257.102(d)(3)(iii).

Name of Professional Engineer: Glen R. Landry

Company: CBI Environmental, Inc.

Signature: Glen R. Landry

Date: 10/4/16

PE Registration State: Louisiana

PE Registration Number: 18931

Professional Engineer Seal:

STATE OF LOUISIANA
GLEN R. LANDRY
License No. 18931
PROFESSIONAL ENGINEER
IN
CIVIL ENGINEERING

10/4/16

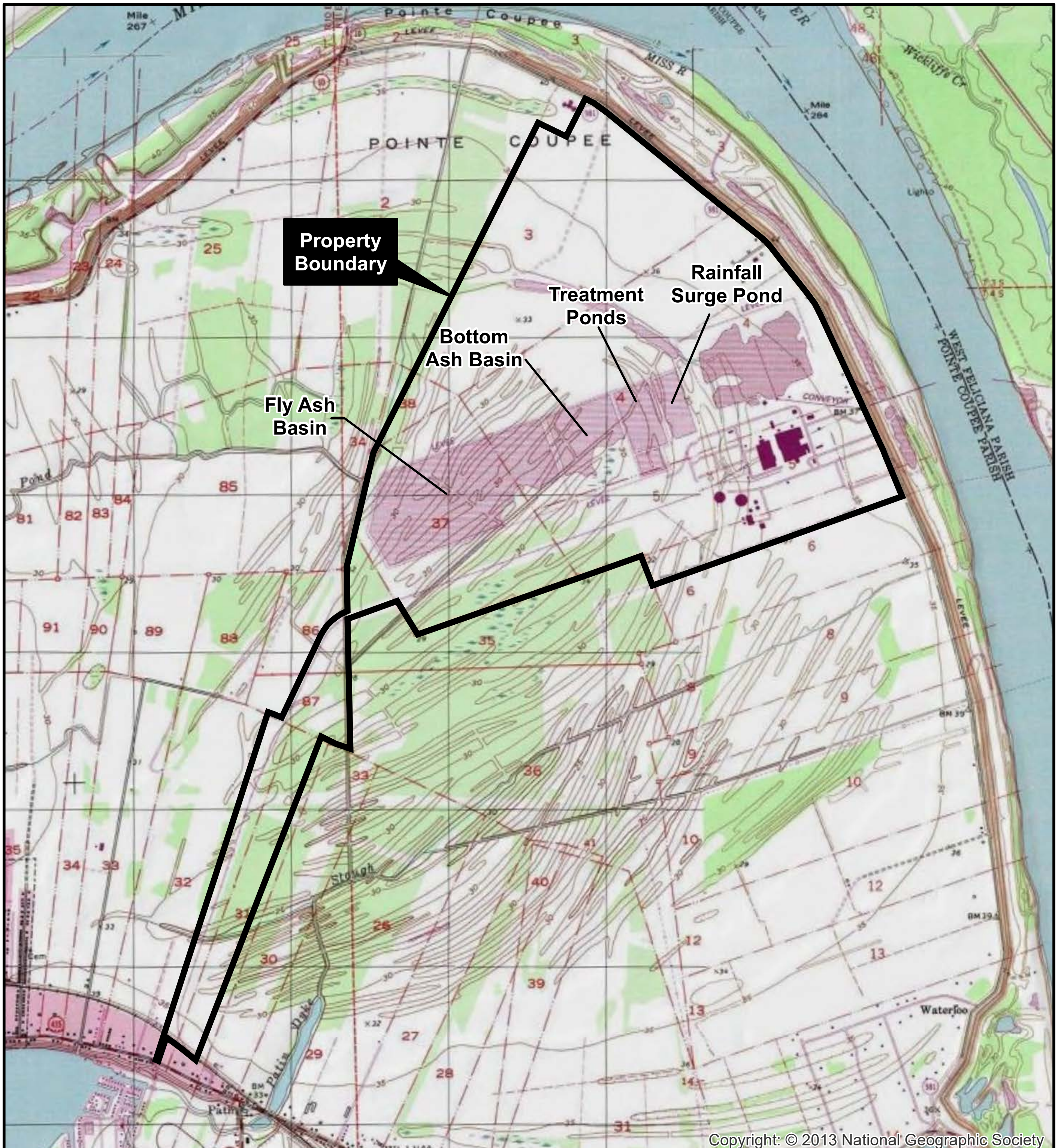
12.0 *REFERENCES*

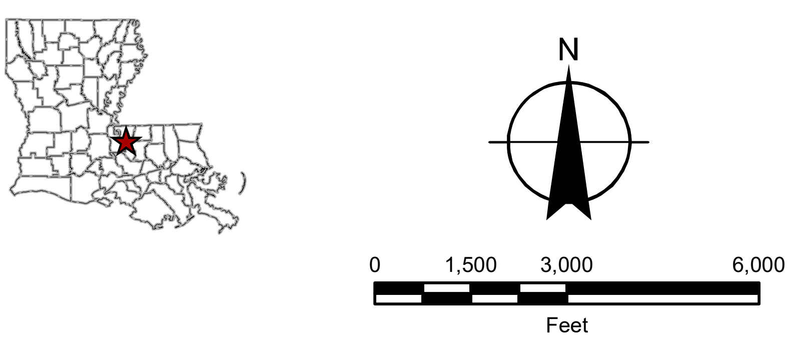
Environmental Protection Agency, April 2015, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities, 40 Code of Federal Regulations Parts 257 and 261.

Louisiana Department of Environmental Quality, November 2014, Louisiana Discharge Pollutant Elimination System, Water Discharge Permit No. LA0054135, prepared for Louisiana Generating, LLC, Big Cajun II Power Plant, New Roads, Pointe Coupee Parish, Louisiana.

Shaw Environmental and Infrastructure, Inc. November 2011, Type I Solid Waste Facility Permit Renewal and Modification Application, Permit No. P-0108, Volumes 1 and 2, prepared for Louisiana Generating, LLC, Big Cajun II Power Plant, New Roads, Pointe Coupee Parish, Louisiana.

FIGURES



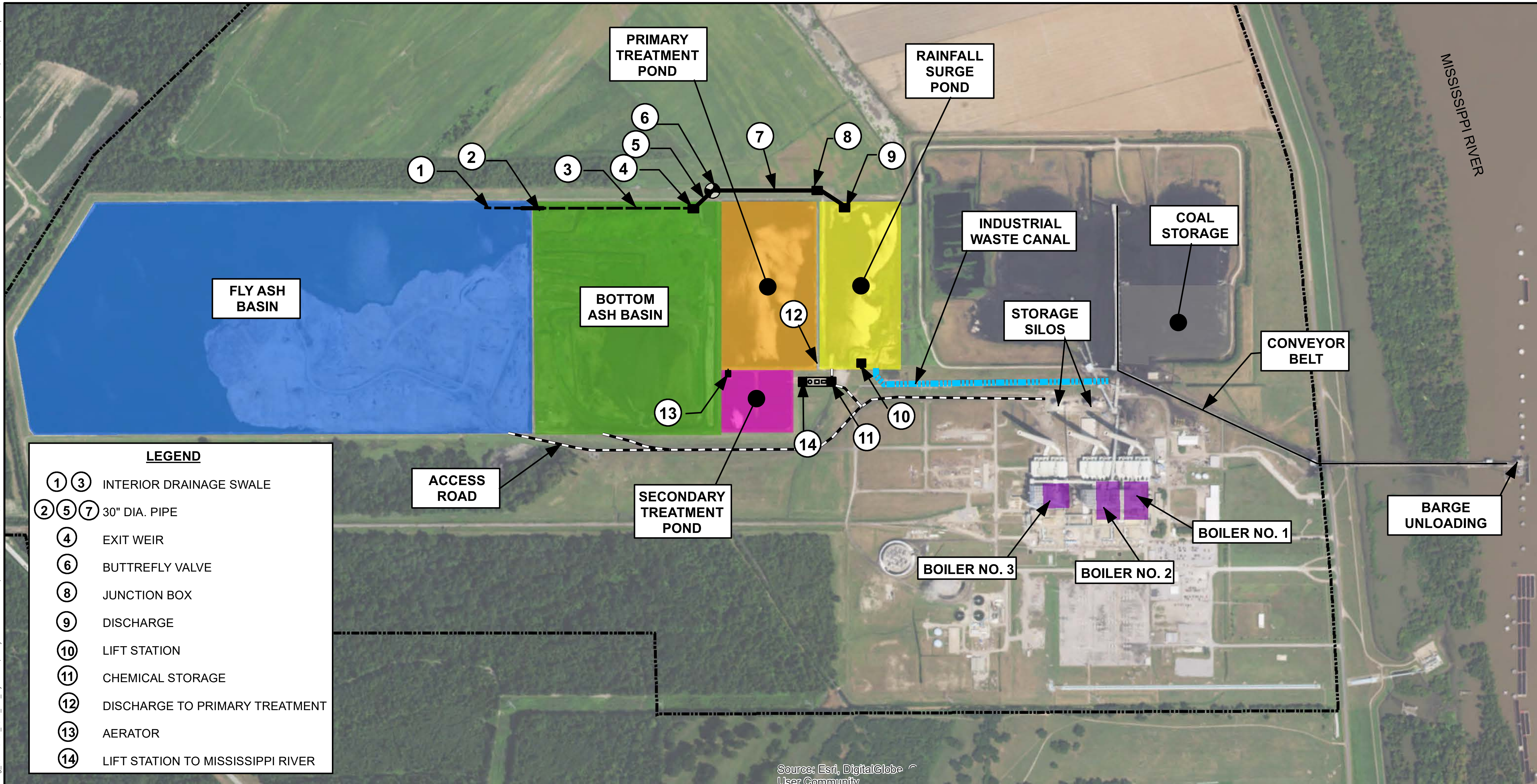


LOUISIANA GENERATING, LLC
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

BIG CAJUN II POWER PLANT
BOTTOM ASH BASIN CLOSURE PLAN

FIGURE NUMBER	
1	SITE LOCATION

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809



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0 400 800 1,600
Feet

LOUISIANA GENERATING, LLC
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

BIG CAJUN II POWER PLANT
BOTTOM ASH BASIN CLOSURE PLAN

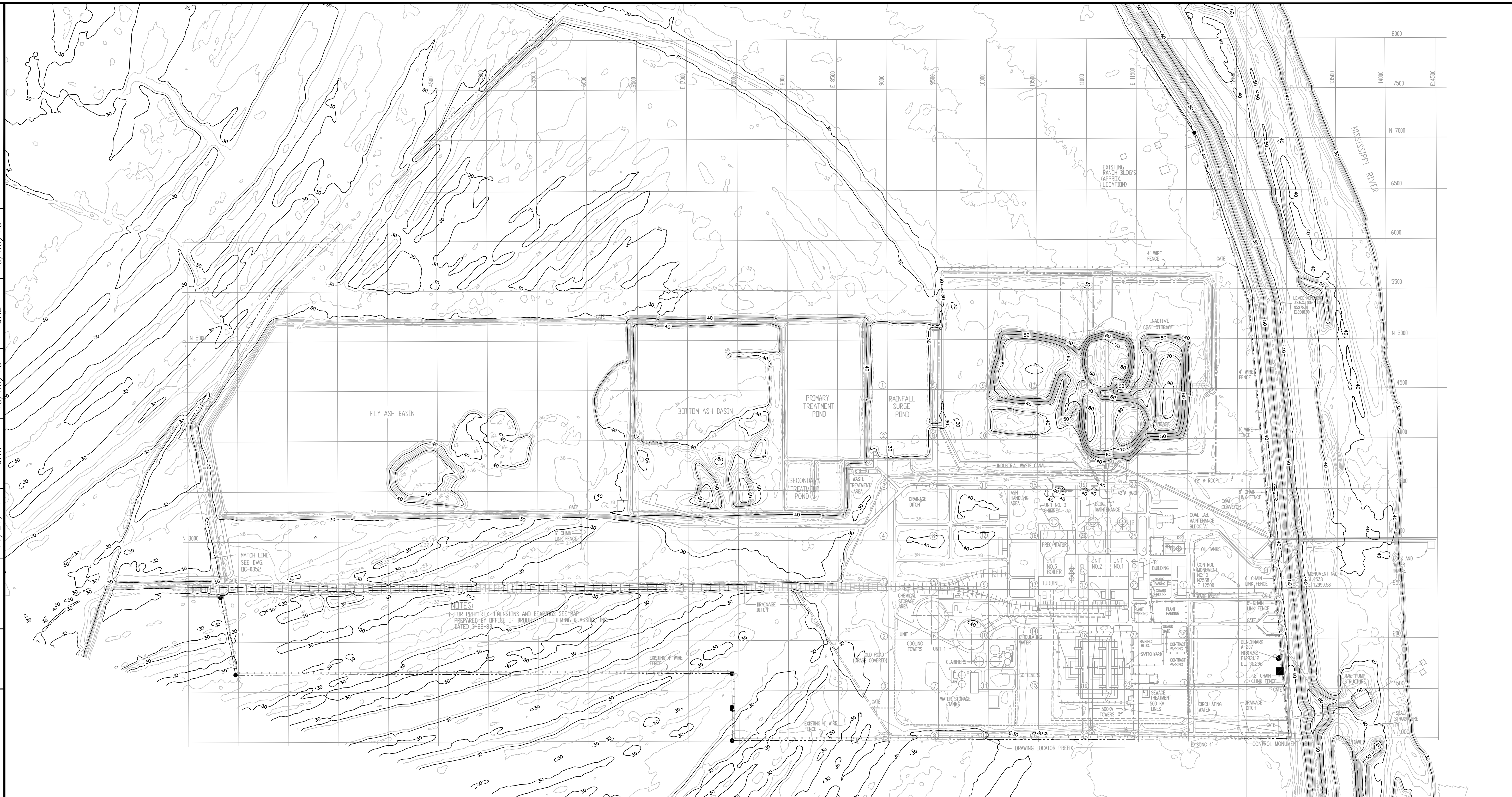
FIGURE NUMBER 2

SITE LAYOUT

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809

iDocs Document No.; Issue Statement; Rev. 0; 08Sep2016

J:\Drafting\NRG\631215151\ArcView\GIS_Documents\Project_Mapping_631215151_0010_site_layout.mxd; Analyst: debbie.comeaux; Date: 9/8/2016 10:42:38 AM



OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
BTR	D. COMEAUX 08/29/16	CRW 10/03/16	GRL 10/03/16	631215151_B04

LEGEND

PROPERTY LINE

TOPOGRAPHIC CONTOUR (FEET, NGVD 29) WITH 2-FOOT CONTOUR INTERVAL

PLANT NORTH 3000

TRUE NORTH

SCALE

0 1000 2000 FEET

REFERENCE: Louisiana Oil Spill Coordinator's Office (LOSCO), LiDAR Digital Elevation Map (DEM) of Louisiana, 2009.

LOUISIANA GENERATING, L.L.C.
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

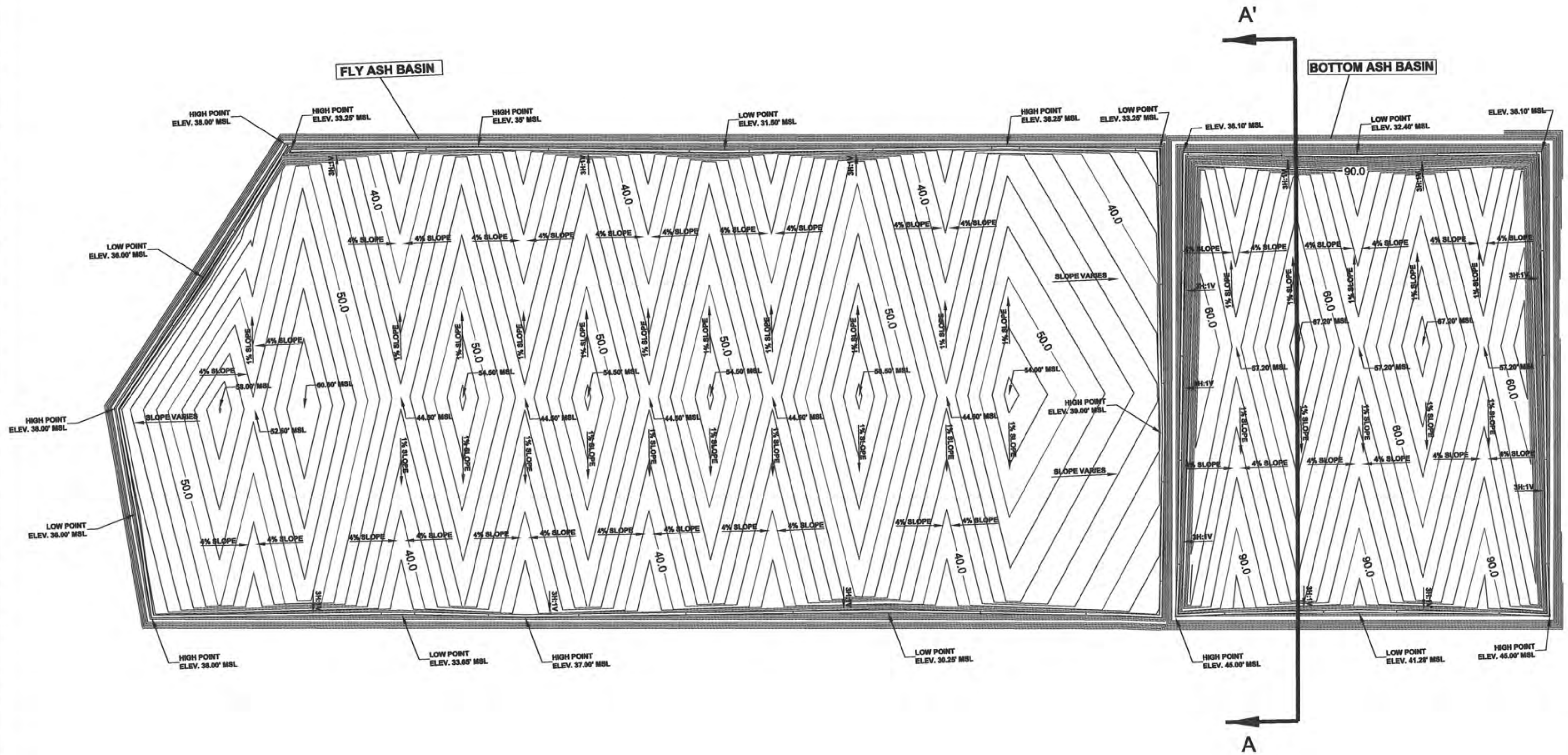
BIG CAJUN II POWER PLANT
BOTTOM ASH BASIN CLOSURE PLAN

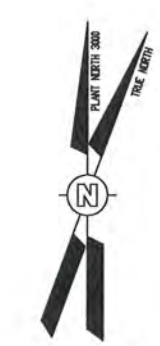
FIGURE NUMBER 3

EXISTING SITE TOPOGRAPHY

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
BTR	D. COMEAUX 08/29/16	CRW 10/03/16	GRL 10/03/16	631215151_B05





SCALE

0 500 1000 FEET

GLEN R. LANDRY
License No. 18931
PROFESSIONAL ENGINEER
IN
CIVIL ENGINEERING
STATE OF LOUISIANA

10/4/16

NOTES:

1. DRAWING IS ADAPTED FROM THE FOLLOWING SOURCES:
   a. ASH MANAGEMENT PLAN / POND CLOSURE PLAN, DRAWING NO. SK-1C, BURNS & MCDONNELL, DATED DECEMBER 1998.
   b. SURFACE IMPOUNDMENT CROSS SECTION DRAWING SET, CROSS SECTIONS A-A' THROUGH D-D', C-K ASSOCIATES, DRAWING NOS A05-268 02-06, C-K ASSOCIATES, INC., DATED JANUARY 20, 1994.
2. THIS DRAWING IS INTENDED FOR VISUAL PURPOSES ONLY. ACTUAL DESIGN GRADES IN THE SOLID WASTE STANDARD PERMIT APPLICATION MAY DIFFER FROM SHOWN.
3. ELEVATIONS, GRADES, AND LOCATIONS ARE APPROXIMATE AS SHOWN. THIS DRAWING IS NOT INTENDED FOR CONSTRUCTION PURPOSES.
4. SURFACE IMPOUNDMENTS MAY BE CONSTRUCTED DIFFERENTLY THAN SHOWN.
5. GRADES SHOWN REPRESENT FINAL CAP.
6. THE COMPACTED CLAY LINER SHALL CONSIST OF A MINIMUM THICKNESS OF 2 FEET WITH A PERMEABILTY OF LESS THAN OR EQUAL TO 1X10 -7 CM/SEC.
7. SEE FIGURE 5 FOR SECTION A-A'.

REFERENCE: Louisiana Oil Spill Coordinator's Office (LOSCO), LiDAR Digital Elevation Map (DEM) of Louisiana, 2009.

LOUISIANA GENERATING, L.L.C.
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

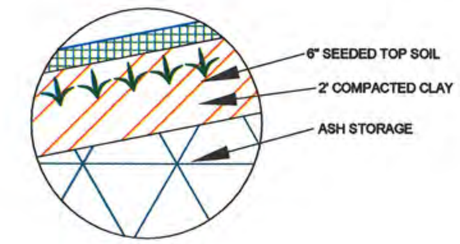
BIG CAJUN II POWER PLANT
BOTTOM ASH BASIN CLOSURE PLAN

FIGURE NUMBER 4

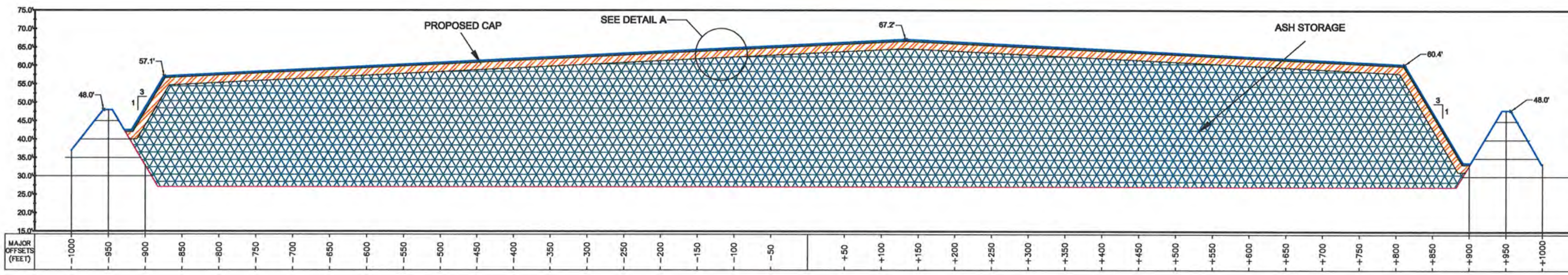
BOTTOM ASH BASIN PROPOSED CAP FINAL GRADE

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
BTR	D. COMEAUX 08/29/16	CRW 10/03/16	GRL 10/03/16	631215151_B06



DETAIL A
TYPICAL CAP CONSTRUCTION



BOTTOM ASH BASIN
SECTION A-A'

NOTES:

1. DRAWING IS ADAPTED FROM THE FOLLOWING SOURCES:
   a. ASH MANAGEMENT PLAN / POND CLOSURE PLAN, DRAWING NO. SK-1C, BURNS & MCDONNELL, DATED DECEMBER 1998.
   b. SURFACE IMPOUNDMENT CROSS SECTION DRAWING SET, CROSS SECTIONS A-A' THROUGH D-D', C-K ASSOCIATES, DRAWING NOS A05-268 02-06, C-K ASSOCIATES, INC., DATED JANUARY 20, 1994.
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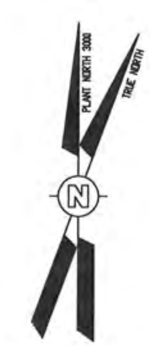
3. ELEVATIONS, GRADES, AND LOCATIONS ARE APPROXIMATE AS SHOWN. THIS DRAWING IS NOT INTENDED FOR CONSTRUCTION PURPOSES.
4. SURFACE IMPOUNDMENTS MAY BE CONSTRUCTED DIFFERENTLY THAN SHOWN.
5. GRADES SHOWN REPRESENT FINAL CAP.
6. THE COMPACTED CLAY LINER SHALL CONSIST OF A MINIMUM THICKNESS OF 2 FEET WITH A PERMEABILTY OF LESS THAN OR EQUAL TO 1X10 -7 CM/SEC.
7. SEE FIGURE 4 FOR SECTION LOCATION.



LOUISIANA GENERATING, L.L.C.
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

BIG CAJUN II POWER PLANT
BOTTOM ASH BASIN CLOSURE PLAN

FIGURE NUMBER 5

BOTTOM ASH BASIN PROPOSED CAP CROSS-SECTION A-A'

CB&I Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809

REFERENCE: Louisiana Oil Spill Coordinator's Office (LOSCO), LiDAR Digital Elevation Map (DEM) of Louisiana, 2009.

APPENDIX A

BOTTOM ASH AND FLY ASH BASIN CLOSURE SOILS AND LINER QUALITY CONTROL PLAN

POINTE COUPEE PARISH, LOUISIANA

November 2010

Prepared for:

Louisiana Generating, L.L.C.
Big Cajun II Power Plant
New Roads, Pointe Coupee Parish, Louisiana 70760

Prepared by:

Shaw® Shaw Environmental & Infrastructure, Inc.

Shaw Environmental & Infrastructure, Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809

Table of Contents

1.0 Introduction

1.1 Purpose

This Soils and Liner Quality Control Plan (SLQCP) has been prepared to provide the Owner, Design Engineer, Construction Quality Assurance Professional of Record, and the Contractor the means to govern the construction quality and to satisfy the environmental protection requirements under current Louisiana Department of Environmental Quality (LDEQ) Municipal Solid Waste Division Rules. More specifically, the SLQCP addresses the soil components of the liner system.

This SLQCP is divided into the following parts:

- Section 1 - Introduction
- Section 2 - Construction Quality Assurance for Earthwork
- Section 3 - Documentation

1.2 Definitions

Whenever the terms listed below are used, the intent and meaning shall be interpreted as indicated.

ASTM

This means the American Society for Testing and Materials.

Construction Quality Assurance (CQA)

A planned system of activities that provides the Owner and permitting agency assurance that the facility was constructed as specified in the design (EPA, 1986). Construction quality assurance includes observations and evaluations of materials, and workmanship necessary to determine and document the quality of the constructed facility. Construction quality assurance (CQA) refers to measures taken by the CQA organization to assess if the installer or contractor is in compliance with the plans and specifications for a project.

Construction Quality Assurance Professional of Record (POR)

The POR is an authorized representative of the Owner and has overall responsibility for construction quality assurance and confirming that the facility was constructed in general accordance with plans and specifications approved by the permitting agency. The POR must be registered as a Professional Engineer in Louisiana and experienced in geotechnical testing and its interpretations. Experience and education should include geotechnical engineering, engineering geology, soil mechanics, geotechnical laboratory testing, construction quality assurance, and quality control testing, and hydrogeology. The POR must show competency and experience in certifying like installations, and be approved by the permitting agency, and be presently employed by or practicing as a geotechnical engineer in a recognized geotechnical/environmental engineering organization. The credentials of the POR must meet or exceed the minimum requirements of the permitting agency. Any references to monitoring, testing, or observations to be performed by the POR should be interpreted to mean the POR or CQA monitors working under the POR's direction.

The POR may also be known in applicable regulations and guidelines as the CQA Engineer, Resident Project Representative, or the Geotechnical Professional (GP).

Construction Quality Assurance (CQA) Monitors

These are representatives of the POR who work under direct supervision of the POR. The CQA monitor is responsible for quality assurance monitoring and performing onsite tests and observations. The CQA monitor is on site full-time during construction and reports directly to the POR. The CQA monitor performing daily QA/QC observation and testing shall be NICET-certified in geotechnical engineering technology at level 2 or higher for soils; a CQA monitor with a minimum of four years of directly related experience; or a graduate engineer or geologist with one year of directly related experience. Field observations, testing, or other activities associated with CQA may be performed by the CQA monitor(s) on behalf of the POR.

Contract Documents

These are the official set of documents issued by the Owner. The documents include bidding requirements, contract forms, contract conditions, specifications, contract drawings, addenda, and contract modifications.

Contract Specifications

These are the qualitative requirements for products, materials, and workmanship upon which the contract is based.

Contractor

This is the person or persons, firm, partnership, corporation, or any combination, private or public, who, as an independent contractor, has entered into a contract with the Owner, and who is referred to throughout the contract documents by singular number and masculine gender.

Design Engineer

These individuals or firms are responsible for the design and preparation of the project construction drawings and specifications. Also referred to as "designer" or "engineer."

Earthwork

This is a construction activity involving the use of soil materials as defined in the construction specifications and Section 2.2 of this plan.

Nonconformance

This is a deficiency in characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate. Examples of non-conformances include, but are not limited to, physical defects, test failures, and inadequate documentation.

Operator

The organization that will operate the disposal unit.

Operators Representative

This is the person that is an official representative of the operator responsible for planning, organizing, and controlling the design and construction activities.

Quality Assurance

This is a planned and systematic pattern of procedures and documentation to ensure that items of work or services meet the requirements of the contract documents. Quality assurance includes quality control. Quality assurance will be performed by the POR and CQA monitor.

Quality Control

These actions provide a means to measure and regulate the characteristics of an item or service to comply with the requirements of the contract documents. Quality control will be performed by the contractor.

Closure Certification Report (CCR)

Construction report for the soil liner prepared and sealed by the POR and submitted to the LDEQ.

2.0 Construction Quality Assurance for Earthwork and Drainage Aggregates

2.1 Introduction

This section of the SLQCP addresses the construction of the soil and drainage components of the liner system and outlines the SLQCP program to be implemented with regard to materials selection and evaluation, laboratory test requirements, field test requirements and treatment of problems.

The scope of earthwork and related construction quality assurance includes the following elements:

- Subgrade preparation
- Soil liner stockpile
- Soil liner placement

2.2 Earthwork Construction

The following paragraphs describe general construction procedures to be used for various earthwork components of the Bottom Ash Basin and Fly Ash Basin final clay cap and the proposed perimeter dike vertical expansion for the Bottom Ash Basin. The earthwork construction specifications will contain more detail for specific considerations. The earthwork specifications will include details for compaction of soils, cross sections showing typical slopes, widths, and thicknesses for compacted lifts.

2.2.1 Subgrade

Subgrade refers to the stored bottom ash and fly ash surface.

Prior to beginning cap liner construction, the subgrade area will be prepared as follows:

- The top 12 inches of ash material shall be compacted to a minimum of 95% of maximum dry density as determined by ASTM D 698, and then proof rolled to determine suitability of the subgrade.
- Prior to placement of the clay cap the contractor shall inspect the subgrade for the following:
    - Moisture seeps in the base or side slopes.
    - Side slope or base softening or failure due to moisture seeps.

  - Presence of zones of high permeability that could present a pathway to seepage. Zones of high permeability can be fissures or fractures in the base or side slope or pockets of high permeability gravel or rock.

- The operator's engineer shall define the regions of high permeability requiring sealing. The contractor shall seal all regions of high permeability identified by the operator's engineer by over excavating a minimum of 2 feet and backfilling the over excavation with material meeting the requirements for satisfactory clay cover material compacted to a minimum of 95% of maximum dry density as determined by ASTM D 698. This type of work shall be performed in the presence of the operator's engineer.

- The operator's engineer shall define the work required to eliminate moisture seeps and/or repair damage due to moisture seeps.

The CQA monitor will approve the prepared subgrade prior to the placement of cap soil liner. Approval will be based on a review of test information, if applicable, and CQA monitoring of the subgrade preparation.

Surveying will be performed to verify that the finished subgrade is to the lines and grades specified in design with a vertical tolerance of -0.2 feet to +0.0 feet.

2.2.2 Clay cap soil liner

The clay cap soil liner will consist of a minimum 2 feet-thick compacted soil barrier (measured perpendicular to the subgrade surface) that will cover the regraded bottom ash pond and fly ash pond. All soils used in soil liners will have the following minimum values verified by testing in a soil laboratory:

- Plasticity Index equal to or greater than 15 percent but less than 40 percent
- Liquid Limit equal to or greater than 30 percent
- Percent passing the No. 200 mesh sieve equal to or greater than 50 percent
- Percent passing the 1-inch screen equal to 100 percent
- Permeability (hydraulic conductivity) of the clay material shall be a maximum of 1 x 10^{-7} cm/sec

The soil liner material will consist of relatively homogeneous clay, sandy clay, or clayey sand. The soil will be free of debris, rock greater than 3/4 inch in diameter, vegetative matter, frozen materials, foreign objects, and organics.

A permeability test will be conducted for each different sample of borrow soil. The permeability test specimens will be prepared by laboratory compaction to a dry density of approximately 95 percent of the standard Proctor maximum dry density at a moisture content approximately equal to the optimum moisture content. One Proctor moisture-density relationship and remolded permeability test will be required for each different material that is used to construct the clay cap liner as determined by a change in the liquid limit or plasticity index of more than 10 points. If there are any changes in where the source material is collected then it will also require a Proctor moisture-density relationship and remolded permeability test.

The soil liner material should be placed in maximum 9-inch loose lifts to produce compacted lift thickness of approximately 6 inches. The material will be compacted to a minimum of 95 percent of the maximum dry density determined by standard Proctor (ASTM D 698) at moisture content between the standard Proctor optimum and 5 percentage points above optimum. The CQA monitor, earthwork contractor, and/or Owner shall identify the clay material during excavation, and the clay material will be stockpiled separately, if stockpiling is required.

Because of some variability of the onsite materials, additional stockpile testing will be performed if different physical properties of the borrow soil (color, texture, etc.) are observed by the CQA monitor, and the materials vary by more than ten points in either liquid limit or plasticity index from previously evaluated materials.

The clay materials to be used for liner materials will require processing to achieve the required moisture content for compaction. The physical characteristics of the clay materials shall be evaluated through visual observation before and during construction. To add moisture to the material properly, the clod sizes will first be crushed into manageable sizes of 3/4 inch in diameter or less. Rocks within the liner should be less than 1 inch in diameter and will not total more than 10 percent by weight.

Clod-size reduction may be achieved using a disc harrow or soil pulverizer. In order to efficiently break down the clods and pieces of shale, multiple passes of the processing equipment in two directions are recommended. Water will be applied as necessary to the material and worked into the material with the processing or compacting equipment. If necessary to achieve even moisture distribution or break down clod size, the material will be watered and processed in the stockpile prior to placing in the liner to allow the soil adequate time to hydrate. Water used for the soil liner must be clean and not contaminated by waste or any objectionable material. Collected onsite stormwater may be utilized if it has not come into contact with the solid waste.

The soil liner must be compacted with a pad/tamping-foot (preferable) or prong-foot (sheepsfoot) roller. The lift thickness shall be controlled so that there is total penetration through the loose lift under compaction into the top of the previously compacted lift; therefore, the lift thickness must not be greater than the pad or prong length. This is necessary to achieve adequate bonding between lifts and reduce seepage pathways. Adequate cleaning devices must be in place and maintained on the compaction roller so that the prongs or pad feet do not become clogged with clay soils to the point that they cannot achieve full penetration during initial compaction. The footed roller is necessary to achieve this bonding and to reduce the individual clods and achieve a blending of the soil matrix through its kneading action. In addition to the kneading action, weight of the compaction equipment is important. The minimum weight of the compactor should be 50,000 pounds, and a minimum of 5 passes are recommended for the compaction process. A pass is defined as one pass (1 direction) of the compactor, not just an axle, over a given area. The recommended minimum of five passes is for a vehicle with front and rear drums. The Caterpillar 815B and 825C are examples of equipment typically used to achieve satisfactory results.

The soil liner shall not be compacted with a bulldozer or any track-mobilized equipment unless it is used to pull a pad-footed roller.

CQA testing of the soil liner will be performed as the liner is being constructed. Testing of the soil liner is addressed in this section.

Soil liner construction and testing will be conducted in a systematic and timely fashion on each lift. Delays will be avoided in liner completion. Construction and testing of the soil liner should generally not exceed 60 working days from beginning to completion. The LDEQ will be notified during construction if delays in excess of 60 days are anticipated. Reasons for any liner construction taking more than 60 days to complete should be fully explained in the Closure Certification Report (CCR) submittal.

Surveying will be performed to observe that the finished soil liner has been constructed to the design lines and grades, within a vertical tolerance of 0.0 feet to +0.2 feet.

The Professional of Record (POR), on behalf of the Owner, shall submit to the LDEQ a Closure Certification Report (CCR) for approval of each soil liner area.

Testing and evaluation of the soil liner during construction will be in accordance with LDEQ standards. The construction methods and test procedures documented in the CCR will be consistent with the SLQCP and LDEQ standards.

The soil liner shall be prevented from losing moisture during the CCR approval process. Preserving the moisture content of the installed soil liner will be dependent on the earthwork contractors means and methods, and is subject to POR approval.

2.2.3 Proposed Earthen Dike Expansion

This section describes the specific inspection and testing required to control, verify, and document satisfactory work performance for the construction of the proposed earthen dike expansion. These requirements are summarized in Table 2.1 which is located below.

Table 2.1
Recommended Tests and Observations on the Proposed Earthen Dike Expansion

TEST/INSPECTION METHODS	MINIMUM FREQUENCY	PURPOSE	ACCEPTANCE CRITERIA
Base (visual only)	-	Assess suitability	As per specification
Lift thickness (visual only)	-	Assure compaction	8 inch loose
Coverage and surface scarifying (visual only)	-	Assure compaction	As per specification
Height and slopes (Surveying and Verification)	-	Assure design requirements	As per specification
Visual-manual procedure (ASTM D-2488)	1 per 2,000 c.y.	Assess material consistency	As per specification
Soil Classification (ASTM D-2487)	1 per 1,000 c.y.	Assess material consistency	As per specification
Atterberg Limits (ASTM D-4318)	1 per 1,000 c.y.	Assess material consistency	-
Grain Size Analysis (ASTM D-422)	1 per 1,000 c.y.	Assess material consistency	As per specification
Specific Gravity (ASTM D-854)	1 per Standard Proctor Curve	Assess material consistency	-
Standard Proctor (ASTM D-698)	1 per 2,000 c.y. or if material varies	Assess material consistency	$\pm$2 p.c.f. for density and $\pm$2% for moisture content(one point) of preestablished curve failing which new moisture-density curve shall be established
In-Place Density (ASTM D-2922 or ASTM D-1556)	1 per 500 c.y. or 1 per day	Assess adequacy of compaction effort	98%of maximum dry density
Moisture Content (ASTM D-3017 or ASTM D-2216)	1 per 500 c.y. or 1 per day	Assess adequacy of compaction effort	$\pm$2% optimum moisture content

2.2.4 Top soil cover

Top soil cover will be placed over the clay cap soil liner in accordance with the project plans and specifications. The top soil cover shall be free of organics, foreign objects, or other deleterious materials. The physical characteristics of the top soil cover shall be evaluated through visual observation (and laboratory testing if justified by the design requirements) before construction and visual observation during construction. Additional testing during construction will be at the discretion of the CQA monitor.

The thickness of the top soil cover shall be verified with surveying procedures at a minimum of 1 survey point per 5,000 square feet of constructed area by a registered Louisiana surveyor with a minimum 2 reference points.

During construction the CQA monitor will:

- Verify that grade control is performed prior to work.
- Verify that the cover soil for side slopes is pushed from the toe up the slope.
- The POR will coordinate with the project surveyor to perform a thickness verification survey of the top soil cover materials upon completion of placement operations. Verify corrective action measures as determined by the verification survey.

2.3 Construction Testing

2.3.1 Standard Operating Procedures

CQA monitors will perform field and laboratory tests in accordance with applicable standards specified in the project technical specifications. Standard operating procedures for soil testing will be prepared that describe test procedures and methods used by site testing personnel for the following ASTM test methods. In some instances the standard operating procedure will be prepared or modified by the POR during construction.

The following test standards apply as called out in this manual and in the technical specifications:

STANDARD	TEST DESCRIPTION
ASTM D 698	Moisture-density relations of soils and soil-aggregate mixtures, using 5½-lb hammer and 12-inch drop
ASTM D 422	Particle size analysis of soils
ASTM D 1556	Density of soil-in-place by the sand cone method
ASTM D 2167	Density and unit weight of a soil in place by the rubber balloon method

STANDARD	TEST DESCRIPTION
ASTM D 2922	Density of soil and soil-aggregate in place by nuclear methods (shallow depth)
ASTM D 3017	Water content of soil and rock in place by nuclear methods (shallow depth)
ASTM D 2216	Laboratory determination of water (moisture) content of soil, rock, and soil-aggregate mixtures
ASTM D 5084	Method of test for permeability of fine-grained soils
ASTM D 4318	Atterberg limits
ASTM D 1140	Amount of material in soils finer than the No. 200 sieve
ASTM D 2487	Classification of soils for engineering purposes
ASTM D 2488	Description and identification of soils (visual-manual procedure)

2.3.2 Test Frequencies

The LDEQ standards will establish the minimum test frequencies for the soil liner construction quality assurance. The test frequencies for soil liner from the current LDEQ regulations are listed in Table 2.2. Extra testing must be conducted whenever work or materials are suspect, marginal, or of poor quality. Extra testing may also be performed to provide additional data for engineering evaluation. The minimum number of tests is interpreted to mean minimum number of passing tests, and any tests that do not meet the requirements will not contribute to the total number of tests performed to satisfy the minimum test frequency.

Table 2.2
Recommended Tests and Observations on Compacted Clay Liner

PARAMETER	FREQUENCY	TEST METHOD
Moisture density relationship	12/ac./6 in. compacted lift	ASTM D 698
Field Density and Moisture	12/ac./6 in. compacted lift	ASTM D 1556, D 2167 or D 2922; and ASTM D 2216 or ASTM D 3017
Sieve Analysis (passing no. 200)	1 per 100,000 SF with a minimum of 1 per 6 inches	ASTM D 1140
Atterberg Limits (liquid and plastic limit)	1 per acre per lift. 1 per 2000 c.y.	ASTM D 4318
Permeability (Hydraulic Conductivity)	1 per acre per compacted lift. 1 per lift per 750 c.y. [1]	ASTM D 5084 (Falling head, flex wall) Corps of Engineers
Thickness Verification	1 each 5,000 SF with a minimum of 2 reference points by a registered Louisiana surveyor	Survey subgrade and top of clay liner. Additionally, survey top of drainage aggregate or top soil cover layer

1: Multiple requirements may be necessary. Requirement resulting in most frequent testing shall be used.

2.4 Reporting

The POR on behalf of the Owner shall submit to the LDEQ a CCR for approval of each soil liner area. Section 3 describes the documentation requirements.

3.0 Documentation

The quality assurance plan depends on thorough monitoring and documentation of all construction activities. Therefore, the POR and CQA monitor will document that all quality assurance requirements have been addressed and satisfied. Documentation may consist of daily recordkeeping, testing and installation reports, nonconformance reports (if necessary), progress reports, photographic records, design and specification revisions. The appropriate documentation will be included in the CCR. Standard report forms will be provided by the POR prior to construction.

3.1 Preparation of CCR

The POR, on behalf of the Owner, shall submit to the LDEQ a CCR for approval of each soil liner.

Testing, evaluation and submission of the CCRs for the liner system during construction shall be in accordance with LDEQ regulations. The construction methods and test procedures documented in the CCR will be consistent with this SLQCP and the LDEQ regulations.

At a minimum, the CCR will contain:

- A summary of all construction activities.
- A summary of all laboratory and field test results.
- Sampling and testing location drawings.
- A description of significant construction problems and the resolution of these problems.
- As-built record drawings.
- A statement of compliance with the permit SLQCP and construction plans.
- The CCR shall be signed and stamped by a professional engineer(s) registered in the state of Louisiana.

The as-built record drawings will accurately site the constructed location of all work items. The POR will review and verify that as-built drawings are correct. As-built drawings will be included in the CCR as appropriate.

APPENDIX B

Table 1: 2016 Closure/Post-Closure Care Cost Estimates
NRG Big Cajun II Power Plant
New Roads, Louisiana

Item	Activity	UoM	QTY	Unit Cost ($)	Cost (2016) ($)	Total
1.1	Borrow Pit					
	a) Strip 4" Topsoil	CY	89,906.00	$ 1.68	$ 151,012.00	
	b) Excavate, Load, Haul - Topsoil	CY	235,951.00	$ 2.69	$ 635,817.00	
	c) Excavate, Load, Haul - Clay	CY	1,401,665.00	$ 2.73	$ 3,821,181.00	
	d) Permitting/mitigation	LS	1.00	$ 540,802.00	$ 540,802.00	
	Total				**$ 5,148,812.00**	
1.2	Fly Ash Pond					
	a) Ash Grading	CY	141,167.23	$ 0.56	$ 79,563.00	
	b) Clay Cover (2-Ft)	CY	564,668.00	$ 2.35	$ 1,324,449.00	
	c) Topsoil (6-IN)	CY	141,167.23	$ 2.51	$ 354,555.00	
	d) Culverts	LF	600.00	$ 71.95	$ 43,169.00	
	e) Trenching	CY	300.00	$ 13.18	$ 3,954.00	
	f) Riprap	CY	2,050.00	$ 126.77	$ 259,883.00	
	g) Seeding	ACRE	175.00	$ 3,052.73	$ 534,227.00	
	Total				**$ 2,599,800.00**	
1.3	Bottom Ash Pond					
	a) Ash Grading	CY	53,240.21	$ 0.57	$ 30,412.00	
	b) Clay Cover (2-Ft)	CY	212,960.00	$ 2.37	$ 505,699.00	
	c) Topsoil (6-IN)	CY	53,240.00	$ 2.14	$ 113,768.00	
	d) Culverts	LF	200.00	$ 81.84	$ 16,368.00	
	e) Trenching	CY	100.00	$ 9.69	$ 969.00	
	f) Riprap	CY	1,450.00	$ 91.76	$ 133,045.00	
	g) Seeding	ACRE	66.00	$ 3,052.73	$ 201,480.00	
	Total				**$ 1,001,741.00**	
1.4	Primary Treatment Pond					
	a) Dewatering	GAL	8,938,735.00	$ 0.005	$ 43,883.00	
	b) Sediment Stabilization (1-ft)	CY	40,978.00	$ 9.71	$ 397,707.00	
	c) Clay Cover (2-Ft)	CY	81,957.66	$ 2.35	$ 192,647.00	
	d) Topsoil (6-IN)	CY	20,489.42	$ 0.27	$ 5,453.00	
	e) Culverts	LF	75.00	$ 7.36	$ 552.00	
	f) Trenching	CY	40.00	$ 953.13	$ 38,125.00	
	g) Riprap	CY	300.00	$ 194.16	$ 58,249.00	
	h) Seeding	ACRE	25.40	$ 3,052.72	$ 77,539.00	
	Total				**$ 814,155.00**	
1.5	Secondary Treatment Pond					
	a) Dewatering	GAL	4,164,371.00	$ 0.008	$ 33,481.00	
	b) Sediment Stabilization (1-ft)	CY	11,545.00	$ 10.133	$ 116,985.00	
	c) Clay Cover (2-Ft)	CY	22,909.00	$ 3.073	$ 70,410.00	
	d) Topsoil (6-IN)	CY	5,727.00	$ 0.635	$ 3,638.00	
	e) Culverts	LF	50.00	$ 10.320	$ 516.00	
	f) Trenching	CY	20.00	$ 647.450	$ 12,949.00	
	g) Riprap	CY	100.00	$ 147.380	$ 14,738.00	
	h) Seeding	ACRE	7.10	$ 3,052.817	$ 21,675.00	
	Total				**$ 274,392.00**	
1.6	Rainfall Surge Basin					
	a) Dewatering	GAL	6,477,259.00	$ 0.006	$ 35,722.00	
	b) Sediment Stabilization (1-ft)	CY	30,653.00	$ 9.947	$ 304,908.00	
	c) Clay Cover (2-Ft)	CY	61,306.91	$ 2.357	$ 144,485.00	
	d) Topsoil (6-IN)	CY	15,326.00	$ 0.356	$ 5,453.00	
	e) Culverts	LF	75.00	$ 7.360	$ 552.00	
	f) Trenching	CY	40.00	$ 953.125	$ 38,125.00	
	g) Riprap	CY	300.00	$ 133.783	$ 40,135.00	
	h) Seeding	ACRE	19.00	$ 3,052.684	$ 58,001.00	
	I) Clay infill	CY	457,864.00	$ 2.367	$ 1,083,642.00	
	Total				**$ 1,711,023.00**	
1.7	Removal of Wastewater Treatment Plant	LS	1.00	$ 129,728.00	**$ 129,728.00**	
1.8	**Subtotal Closure**				**$ 11,679,651.00**	**$ 11,679,651.00**
2.1	Post Closure Cap Maintenance & Monitoring					
	a) Semi Annual Sampling and Monitoring	EA	60.00	$ 15,973.50	**$ 958,410.00**	
	b) Topsoil Repair/Replace 10% Every 10 Years	EA	3.00	$ 704,010.67	**$ 2,112,032.00**	
	c) Annual Seeding (10% of total Qty/YR)	YR	30.00	$ 68,182.23	**$ 2,045,467.00**	
	d) Annual Mowing (4x/Year)	EA	120.00	$ 15,049.73	**$ 1,805,967.00**	
	Total				**$ 6,921,876.00**	
2.2	Plugging & Abandonment of 15 Monitoring Wells	EA	15.00	$ 2,327.47	**$ 34,912.00**	
2.3	**Subtotal Post Closure**				**$ 6,956,788.00**	**$ 6,956,788.00**
	***Estimated Closure & Post Closure Cost**				$ 18,636,439.00	**$ 18,636,439.00**

* 30 year period, based on a 2% rate of inflation, including cover inspection and cover integrity maintenance as needed.

APPENDIX B

Addendum to Closure Plan for the Big Cajun II Bottom Ash Basin

This Addendum to the October 2016 Big Cajun II Bottom Ash Basin 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 Big Cajun II Bottom Ash Basin, the Bottom Ash Basin will cease receipt of wastestreams in approximately March/April 2027. In addition, the Bottom Ash Basin 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 Big Cajun II Bottom Ash Basin Alternative Closure Demonstration.