

# **CLECO POWER LLC BRAME ENERGY CENTER**

**BOTTOM ASH POND AND  
FLY ASH POND  
LENA, LA**

**2019 Annual Groundwater Monitoring Report  
for the Coal Combustion Residuals Rule**

**January 2020**



**TABLE OF CONTENTS**

<u>Section</u>	<u>Page No.</u>
<b>1.0 INTRODUCTION.....</b>	<b>1</b>
<b>2.0 FACILITY INFORMATION .....</b>	<b>1</b>
<b>3.0 FIELD ACTIVITIES .....</b>	<b>1</b>
<b>4.0 GROUNDWATER FLOW EVALUATION .....</b>	<b>2</b>
<b>5.0 ANALYTICAL RESULTS .....</b>	<b>2</b>
<b>6.0 STATISTICAL EVALUATION .....</b>	<b>2</b>
<b>7.0 CONCLUSIONS AND RECOMMENDATIONS.....</b>	<b>3</b>
<b>8.0 CERTIFICATION .....</b>	<b>4</b>

**Figures**

- 1 Site Location Map
- 2 Monitoring Well Location Map
- 3 Potentiometric Surface Map – January 2019
- 4 Potentiometric Surface Map – April 2019
- 5 Potentiometric Surface Map – July 2019
- 6 Potentiometric Surface Map – October 2019

**Tables**

- 1 Monitoring Well Information
- 2 2019 Analytical Data Summary

## 1.0 INTRODUCTION

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

## 2.0 FACILITY INFORMATION

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

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

## 3.0 FIELD ACTIVITIES

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

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

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

during sample collection, transportation, and analysis. Sample shipment/transport procedures were conducted per Sections 9.9 through 9.11 of ASTM D4448.

#### 4.0 GROUNDWATER FLOW EVALUATION

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

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

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

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

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

#### 5.0 ANALYTICAL RESULTS

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

#### 6.0 STATISTICAL EVALUATION

Statistical evaluations of groundwater data have been performed per applicable portions of §257.93.f. The goal of the statistical evaluation is to determine if there is statistically significant evidence to show that facility operations may have adversely affected groundwater quality. Statistical evaluations are

conducted to determine if there are any statistically significant increases (SSIs) between groundwater quality upgradient and groundwater quality downgradient of the Bottom Ash and Fly Ash Ponds.

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

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

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

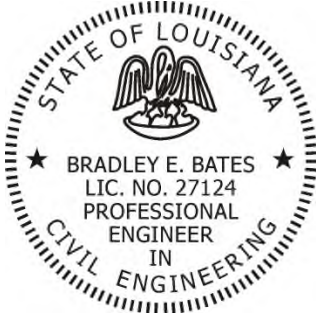
Intrawell statistical analysis of the 2019 detection monitoring groundwater data showed that SSIs were generated for chloride in downgradient/compliance wells W-19 and W-21. A verification resampling event was conducted for these well/parameter pairs in December 2019. The resampling results indicate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

## **7.0 CONCLUSIONS AND RECOMMENDATIONS**

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

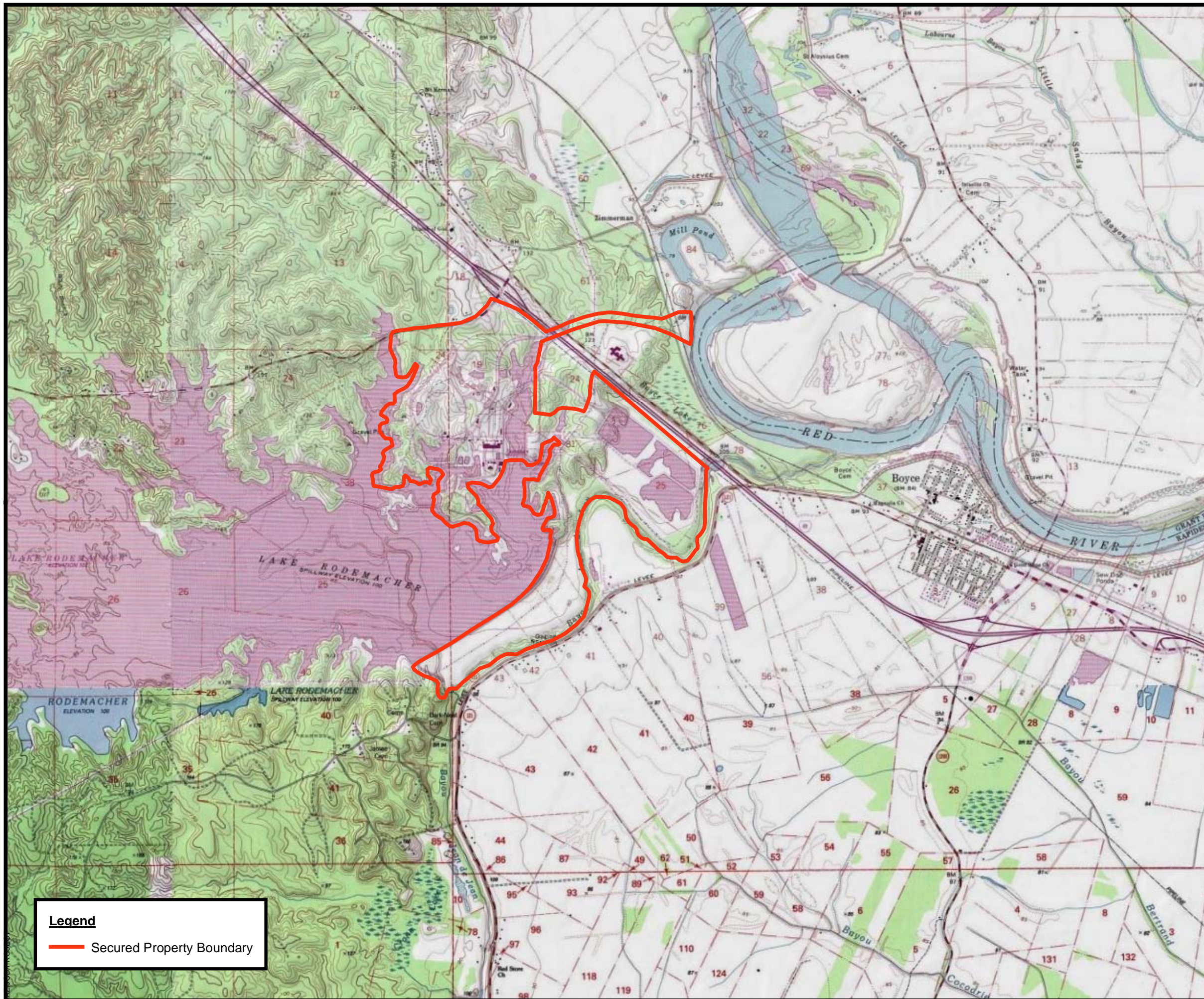
**8.0 CERTIFICATION**

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

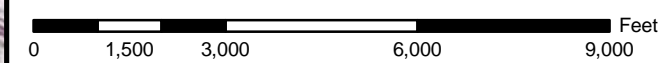
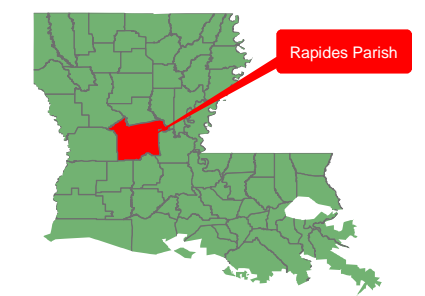
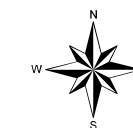


_____ <b>Signature</b>	_____ 27124 <b>PE Registration Number</b>
_____ <i>Bradley E. Bates</i> <b>Name</b>	_____ <i>Professional Engineer</i> <b>Title</b>
_____ <i>Eagle Environmental Services, Inc.</i> <b>Company</b>	_____ <i>1/9/2020</i> <b>Date</b>





**Legend**  
 — Secured Property Boundary



**Reference**  
 U.S.G.S. TOPOGRAPHIC MAPS "LENA, LOUISIANA", "BOYCE, LOUISIANA",  
 "JERICO, LOUISIANA", AND "GARDNER, LOUISIANA."



**Site Location Map**

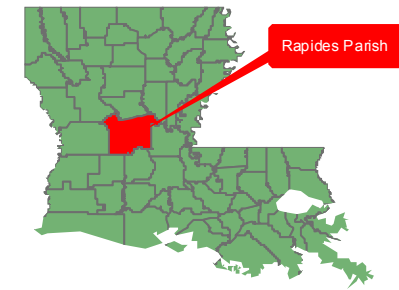
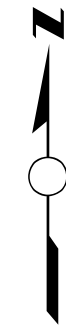
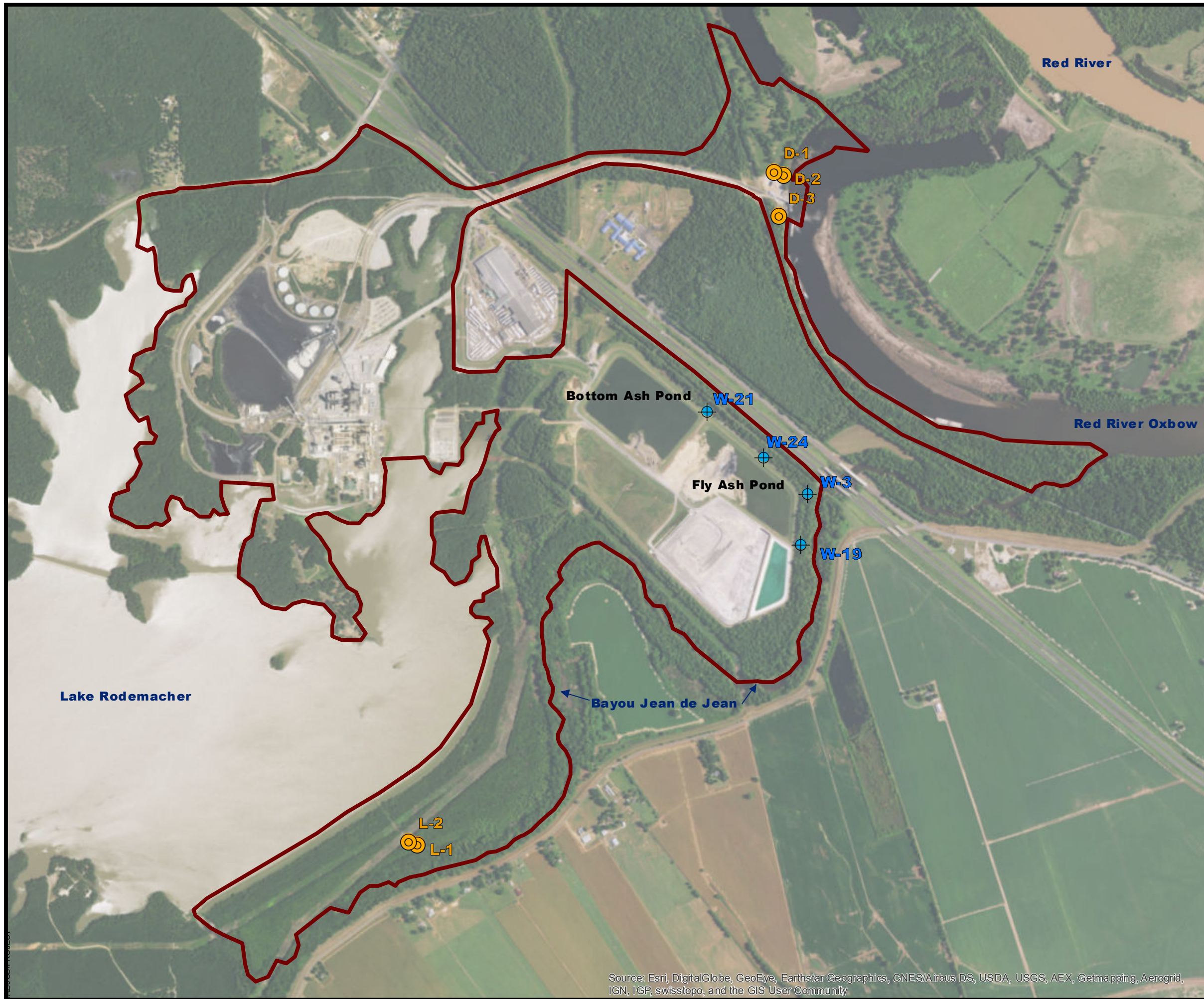
Rapides Parish, Louisiana






Drawn:	jbh
Checked:	JM
Approved:	RS
Date:	11/08/10
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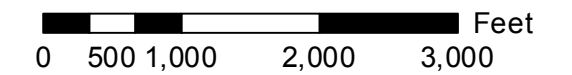
**Figure 1**





**Legend**

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



**CLECO Power LLC**  
Brame Energy Center

**CCR Rule  
Monitoring Well Location Map**  
Rapides Parish, Louisiana

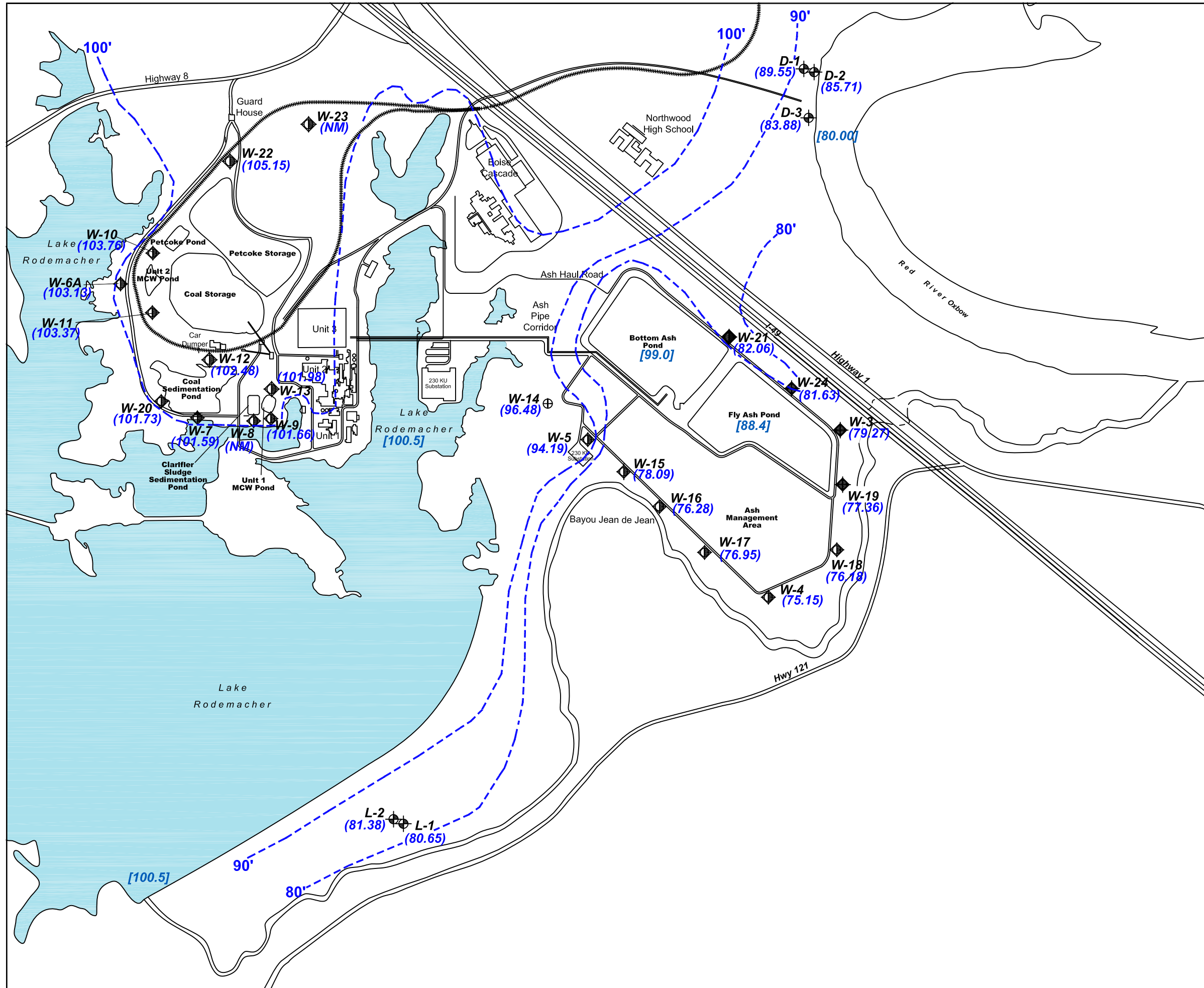


Drawn:	JP
Checked:	RS
Approved:	JM
Date:	10/4/16
Dwg. No.:	01-16-0160-A003

**Figure 2**

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

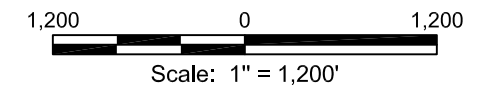




### Legend

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

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



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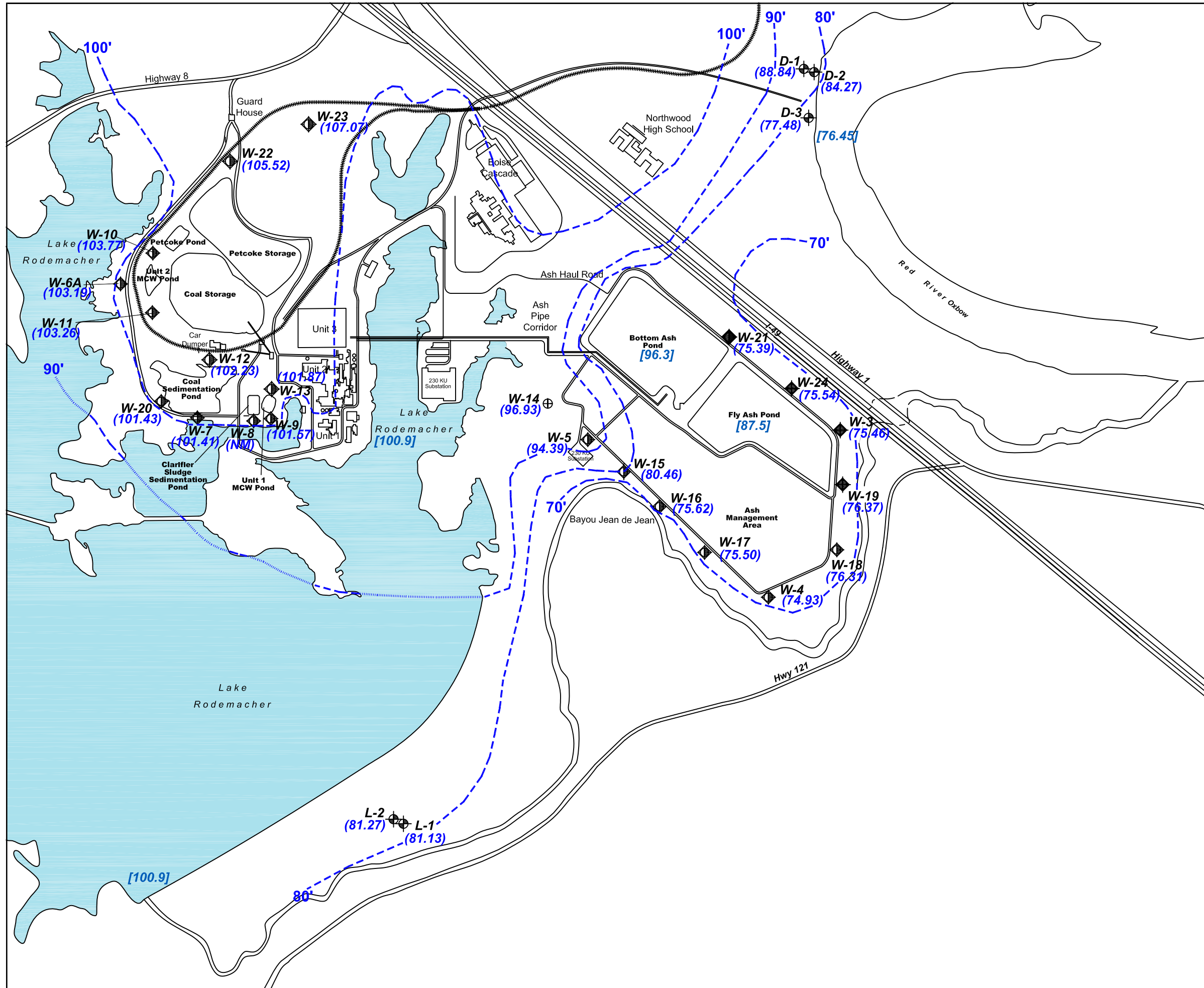
## Cleco Brame Potentiometric Surface Contour Map January 2019

Rapides Parish, Louisiana



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

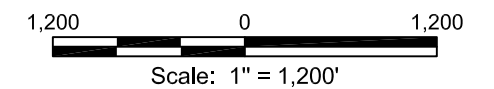
Figure 3



### Legend

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

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



**CLECO Corporation**

Brame Energy Center

## Cleco Brame Potentiometric Surface Contour Map April 2019

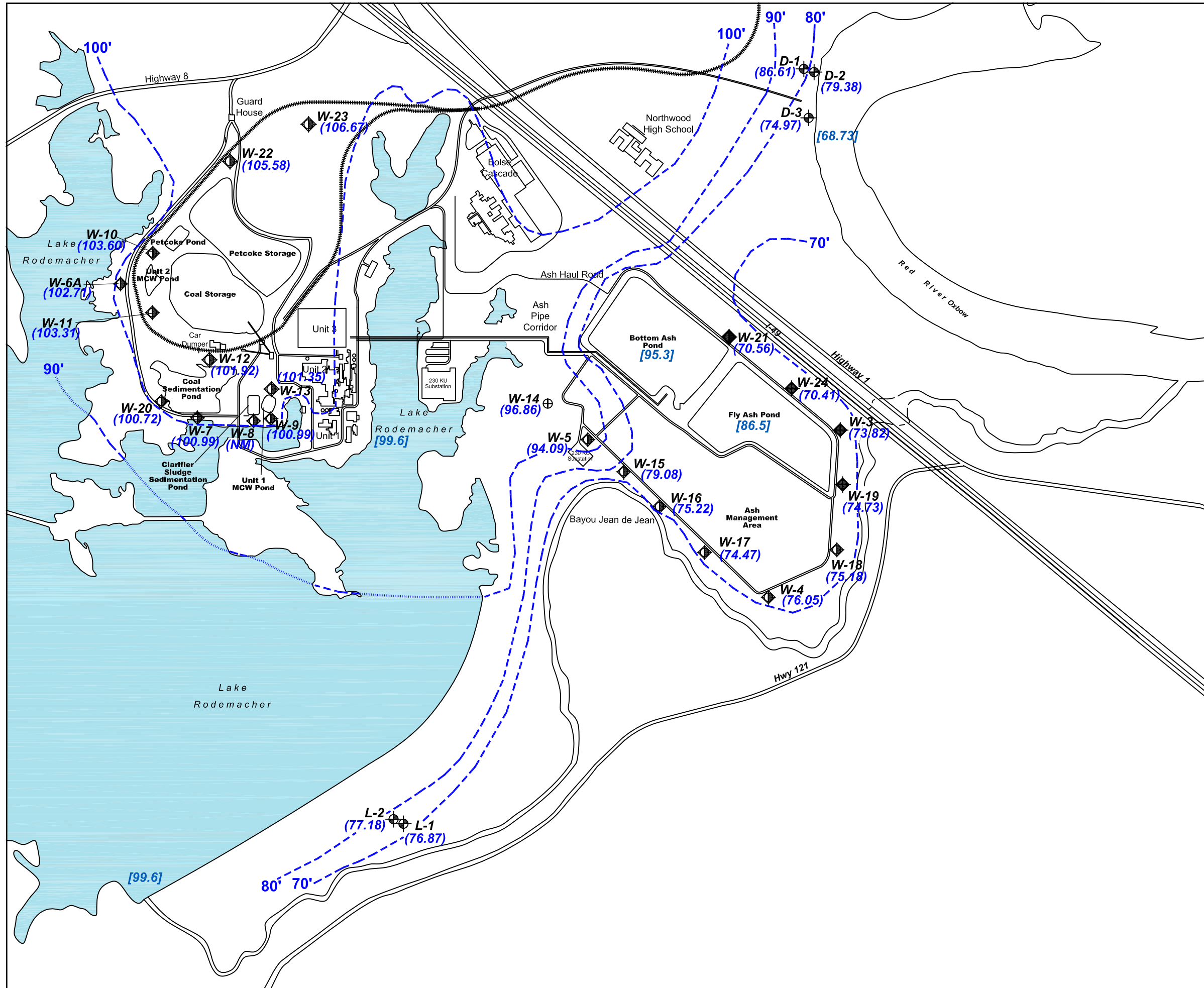
Rapides Parish, Louisiana



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

**Figure 4**

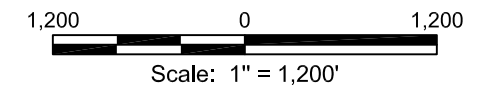




**Legend**

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

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



Brame Energy Center

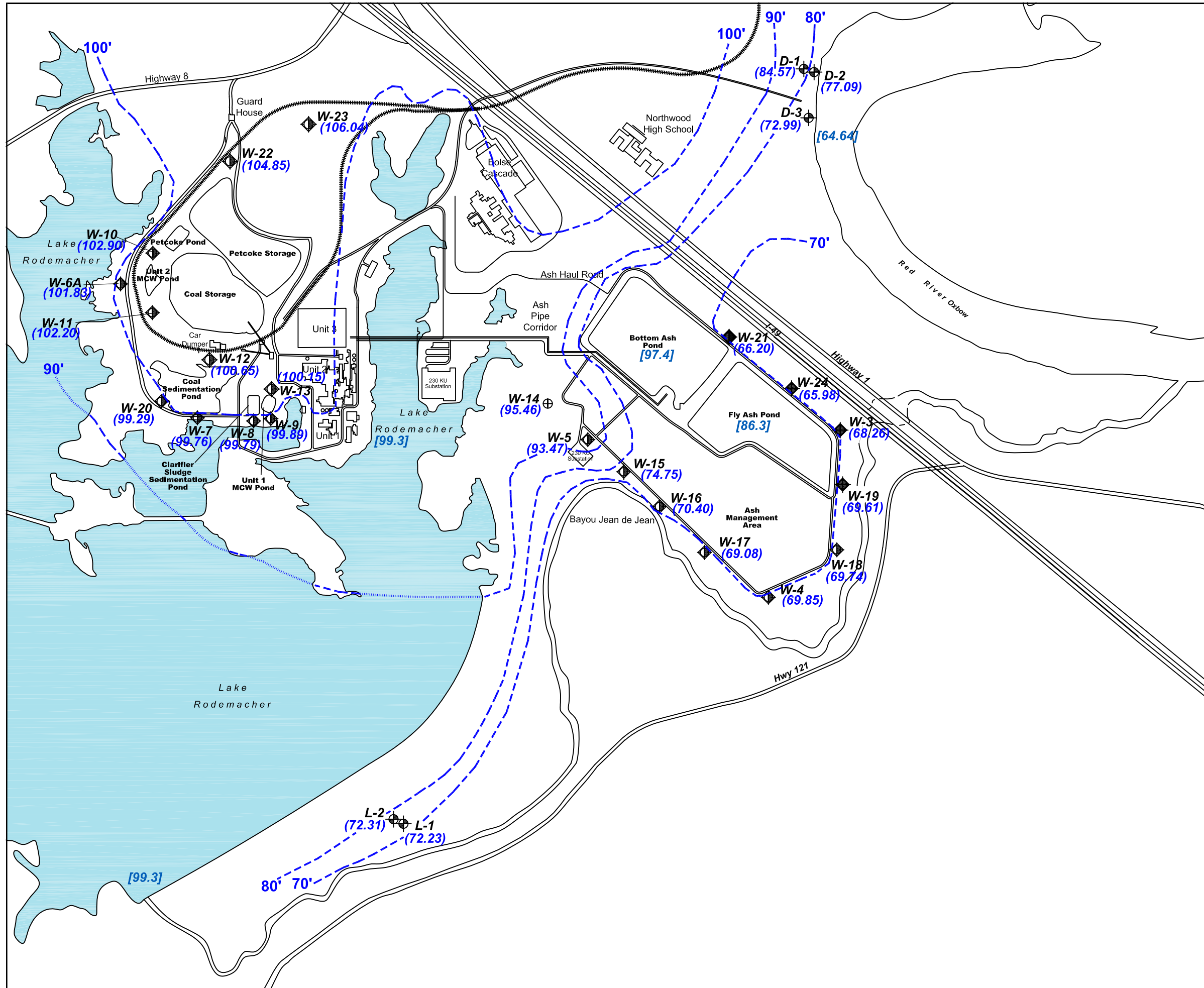
**Cleco Brame  
Potentiometric Surface Contour Map  
July 2019**

Rapides Parish, Louisiana



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

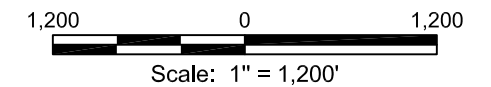
**Figure 5**



**Legend**

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

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



Brame Energy Center

**Cleco Brame  
Potentiometric Surface Contour Map  
October 2019**

Rapides Parish, Louisiana



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

**Figure 6**





Table 1  
Monitoring Well Information

Cleco Brame Energy Center  
Bottom Ash and Fly Ash Ponds

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

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

Notes:

bgs = below ground surface

PVC = polyvinyl chloride



Table 2  
2019 Analytical Data Summary

Cleco Brame Energy Center  
Bottom Ash and Fly Ash Ponds

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

\* 12/17/19 Resampling event.

Notes:

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