CLECO CAJUN LLC
LOUISIANA GENERATING LLC
BIG CAJUN II POWER PLANT

BOTTOM ASH BASIN AND
FLY ASH BASIN
NEW ROADS, LA

2022 Annual Groundwater Monitoring Report for the Coal Combustion Residuals Rule

January 2023

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EXECUTIVE SUMMARY

- Current groundwater monitoring program status: assessment monitoring.
- Date of initiation of assessment monitoring: September 26, 2018.
- Confirmed exceedances of groundwater protection standards at statistically significant levels for this reporting period: None.

1.0 INTRODUCTION

Louisiana Generating LLC hereby presents the 2022 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 twenty 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 March and August of 2022.

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 or electric submersible pumps. These activities were conducted in accordance with applicable portions of Sections 6.1, 6.2, 6.3, 6.5 through 6.8, and 8.1.3 and 8.1.4 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 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 containers with appropriate preservatives, per Section 9 of ASTM D4448.

Samples were properly preserved on ice in the field and shipped to Eurofins Environment Testing America's Pensacola, Florida laboratory. Samples were analyzed for the CCR groundwater monitoring parameters by the following methods: chloride, fluoride and sulfate by 300.0; total dissolved solids by 2540C; metals by 6020 and 7470; and radium by 903 and 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)
March 2022	0.0002 to 0.006	0.01 to 3
August 2022	0.0003 to 0.004	0.015 to 2

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 numerous parameters in both up- and downgradient monitoring wells at BC2. Analytical results are compared to Groundwater Protection Standards (GWPS). Analytical results are provided in **Tables 2 and 3**.

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 statistically significant increases (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 are 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 has a GWPS based on background [0.1001 milligrams per liter (mg/l)], and total radium 226 & 228 has a GWPS based on background of 5.14 picocuries per liter (pCi/l).

On an annual basis (first semi-annual event), all Appendix IV parameters are sampled (§257.95.b), and the detected parameters are added to the list of parameters sampled in the second semi-annual event (§257.95.d).

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 most recent eight sampling 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 2022 groundwater monitoring data at BC2 indicate that no Appendix IV parameters are present at statistically significant levels (SSLs) above the parameters' GWPS.

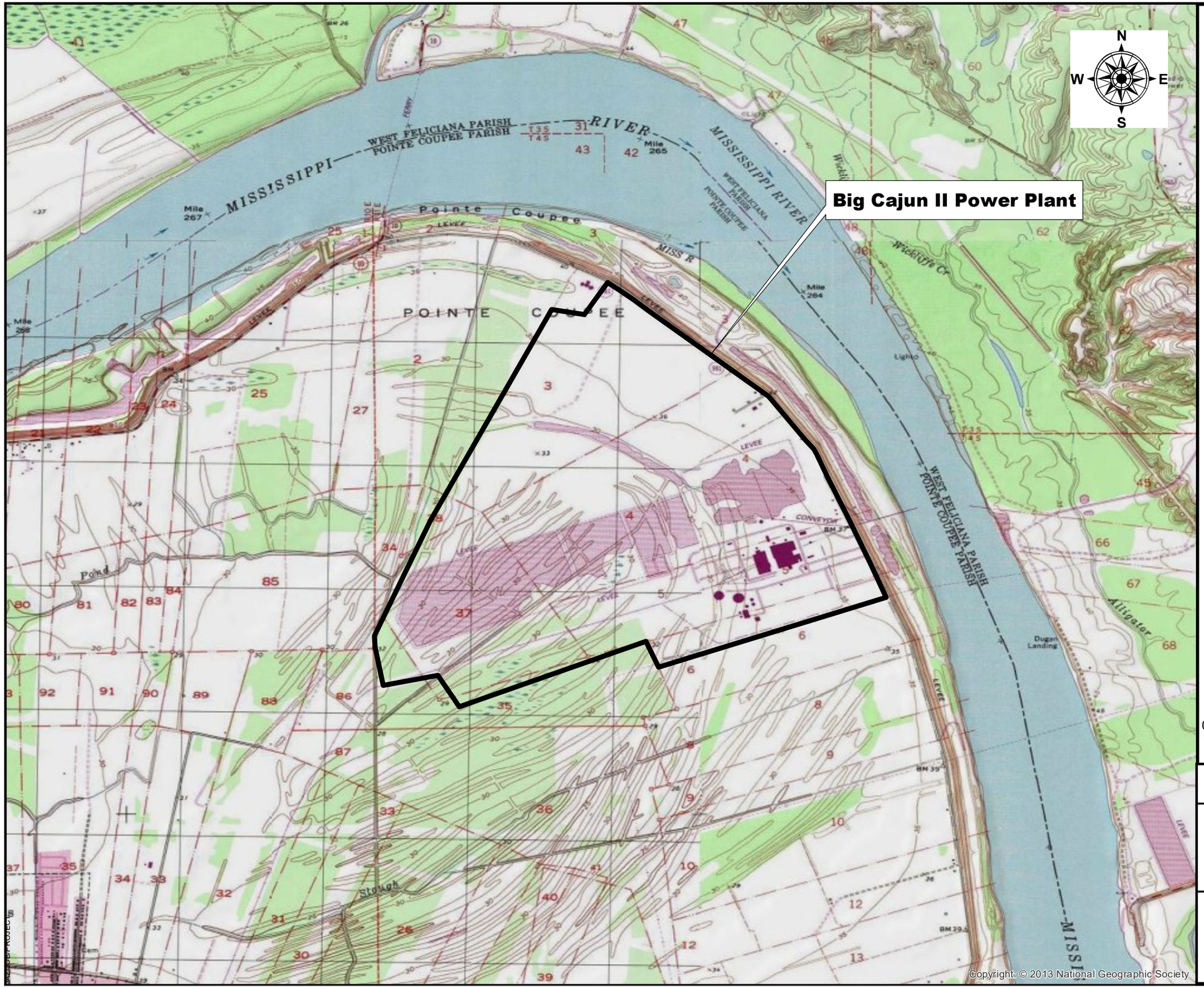
7.0 CONCLUSIONS AND RECOMMENDATIONS

- 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 six 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 groundwater data conducted per applicable portions of §257.93 indicate that no Appendix IV parameters are present at SSLs above the parameters' GWPS.
- Semi-annual assessment monitoring sampling events are tentatively scheduled for February and August of 2023. 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.	*11/3/2022*
Company	**Date**



Legend

Approximate Property Boundary

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

CLECO Cajun, LLC

Big Cajun II Power Plant

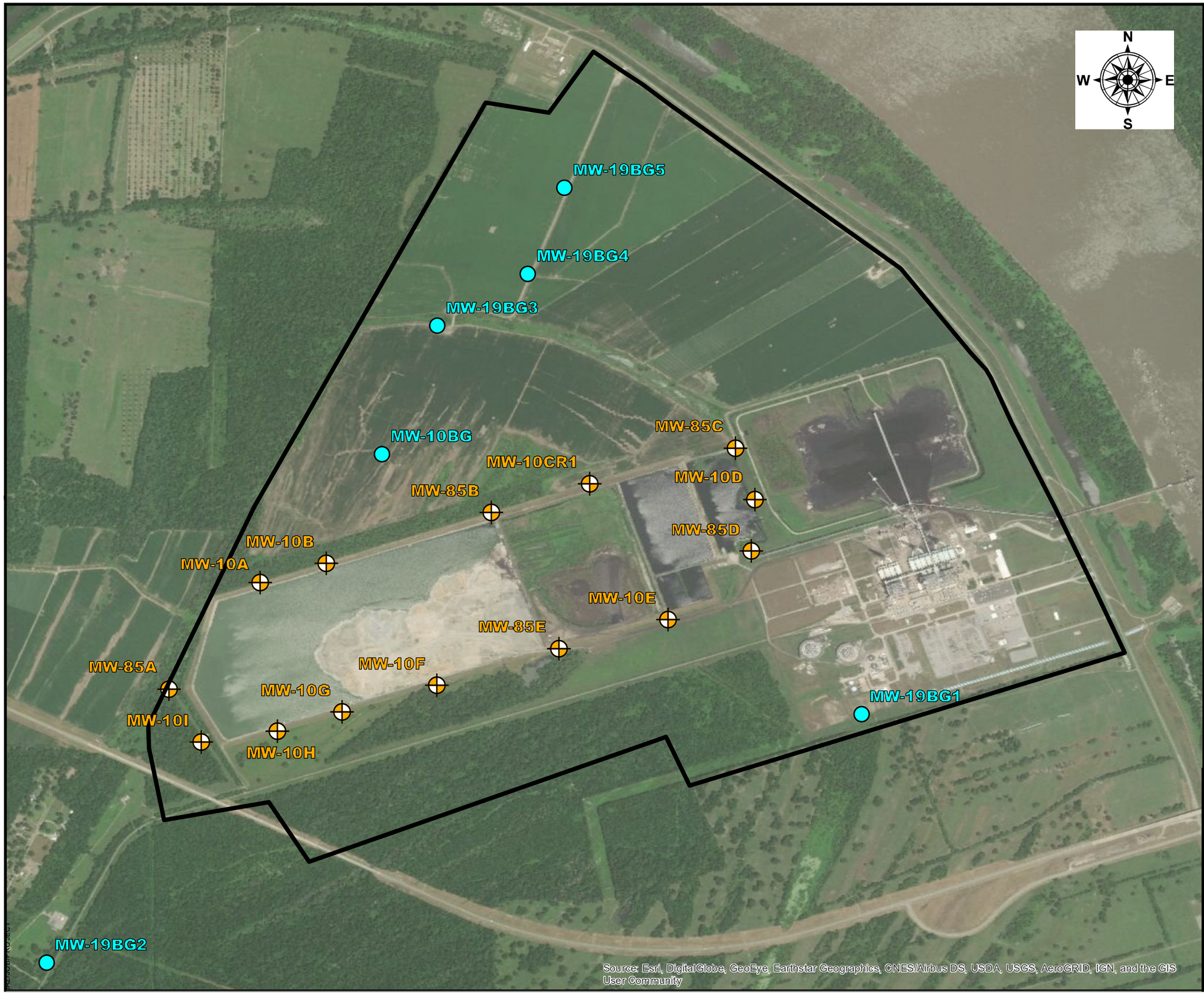
Site Location Map

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

- 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

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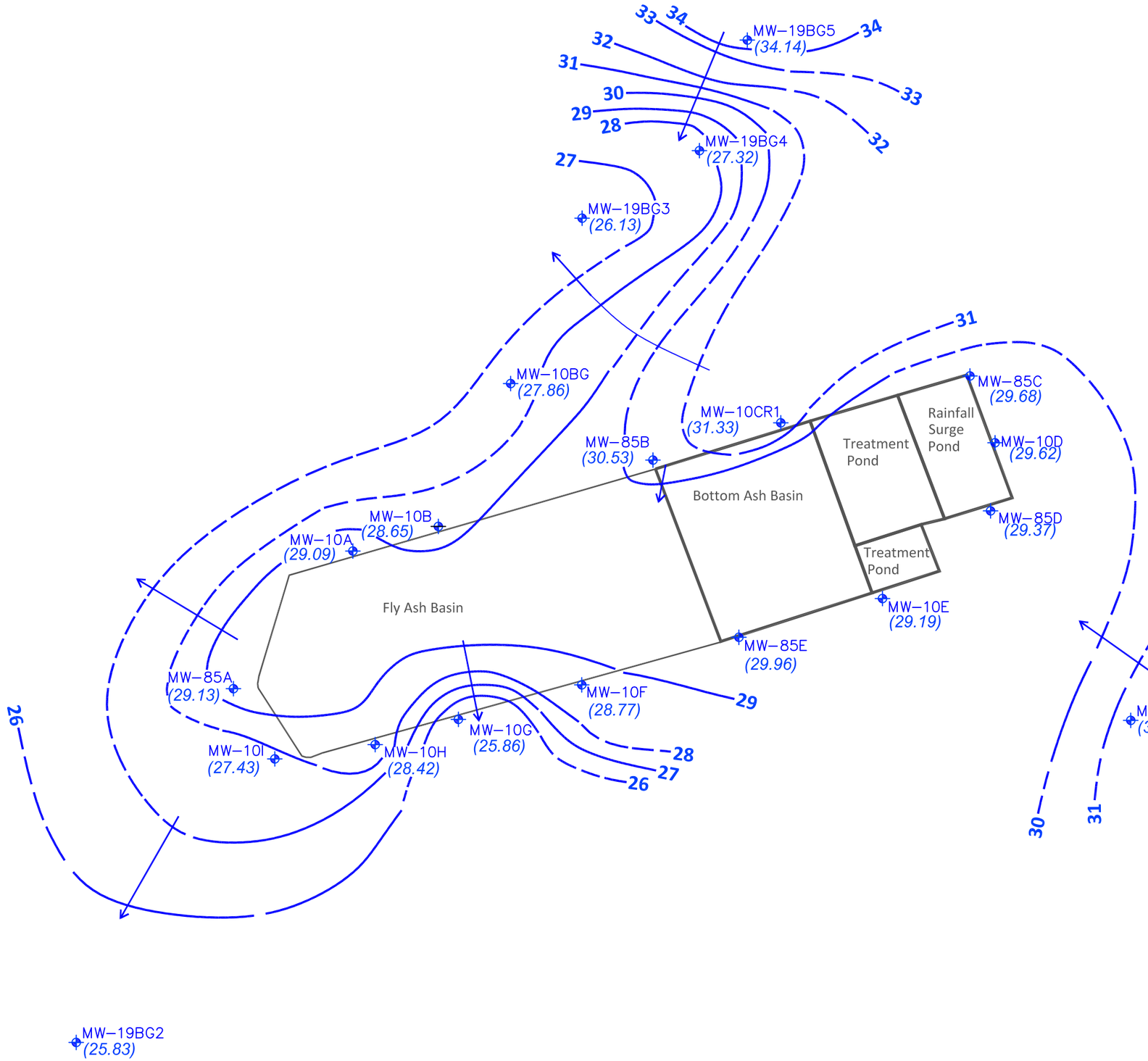
Approved:	JM
Date:	4/16/20
Dwg. No.:	367-20-0003-A001-CCR

Figure 2



Legend

- MW-10B — Monitoring Well
- (29.13) — Measured Potentiometric Elevation (ft. NGVD)
- 30 — Potentiometric Surface Elevation (ft. NGVD)

0 500 1,000 2,000 Feet

CLECO Cajun, LLC

Big Cajun II Power Plant

Potentiometric Surface Map March 2022

Pointe Coupee Parish

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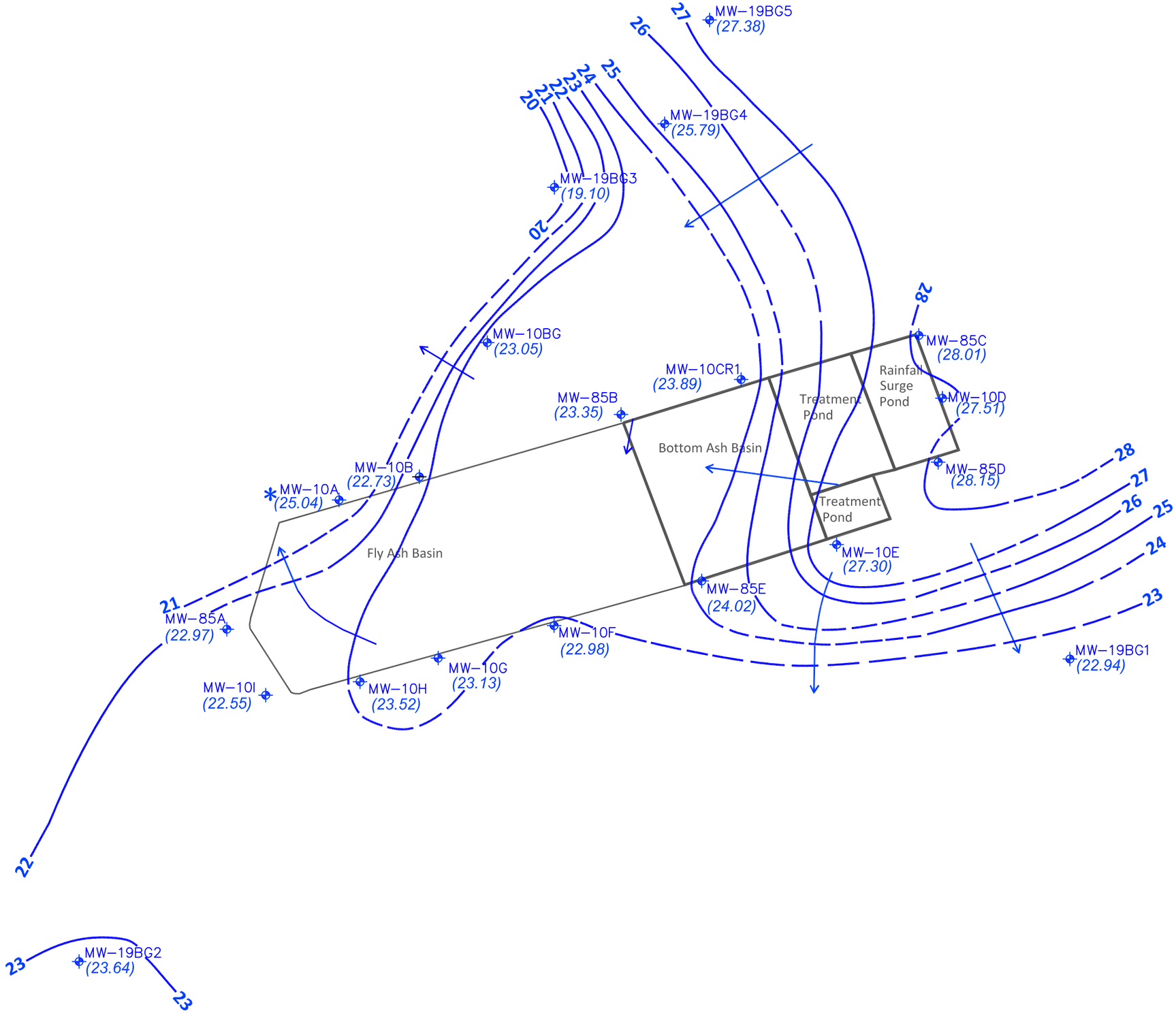
Drawn:	JP
Checked:	RS
Approved:	JM
Date:	08/29/22
Dwg. No.:	367-22-0003-A002-CCR

Figure 3



CLECO Cajun, LLC

Big Cajun II Power Plant

Potentiometric Surface Map August 2022

Pointe Coupee Parish

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

Drawn:	JP
Checked:	JM
Approved:	JM
Date:	08/25/22
Dwg. No.:	367-22-0003-B002-CCR

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
MW-19BG1	30°43'19"	91°22'17"	Sep 2019	Uppermost	Up	38.15	34.54	7.04	-2.96	42.54	2
MW-19BG2	30°42'45"	91°24'09"	Sep 2019	Uppermost	Up	31.99	28.88	0.18	-9.82	39.24	2
MW-19BG3	30°44'12"	91°23'15"	Sep 2019	Uppermost	Up	34.57	31.65	2.95	-7.05	39.21	2
MW-19BG4	30°44'20"	91°23'03"	Sep 2019	Uppermost	Up	33.62	30.61	10.91	0.91	30.23	2
MW-19BG5	30°44'31"	91°22'58"	Sep 2019	Uppermost	Up	37.60	34.23	5.05	-4.95	39.68	2

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

TABLE 2

March 2022 Analytical Data Summary

Parameter/Well	MW-85A	MW-85B	MW-85C	MW-85D	MW-85E	MW-10A	MW-10B	MW-10CR1	MW-10D	MW-10E	MW-10F
	3/14/22	3/15/22	3/15/22	3/14/22	3/14/22	3/15/22	3/15/22	3/15/22	3/14/22	3/14/22	3/14/22
Boron	0.0865	0.0751	0.307	0.239	6.54	0.747	0.608	0.322	0.248	0.246	5.08
Calcium	70.5	101	133	133	154	123	90.9	122	148	132	248
Chloride	15.2	53.2	56.9	21.7	80.2	71.6	82.5	65.2	69.4	55.3	33.5
pH	7.44	7.71	7.77	7.57	7.48	7.65	7.22	7.79	7.77	7.6	7.42
Sulfate	<1	173	249	157	674	290	138	190	296	183	885
TDS	336	630	710	788	1,470	800	422	738	860	792	1,670
Antimony	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Arsenic	0.00795	<0.00125	0.0248	0.00918	0.0184	0.0151	0.0122	0.0134	0.0102	0.0129	0.0157
Barium	0.307	0.503	0.496	0.253	0.0651	0.266	0.511	0.357	0.211	0.372	0.032
Beryllium	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Cadmium	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Chromium	<0.0025	<0.0025	0.0107	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Cobalt	<0.0025	<0.0025	0.00935	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	0.00296
Fluoride	0.402	<2	<2	<2	<4	<2	<2	<2	<2	<2	<4
Lead	<0.00125	<0.00125	0.00701	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125
Lithium	0.0145	0.0179	0.021	0.0186	0.0155	0.0107	0.0126	0.017	0.0119	0.0167	0.0212
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum	<0.015	<0.015	<0.015	<0.015	0.0589	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Selenium	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125
Thallium	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Combined Radium-226,228	0.66	0.832	0.977	0.52	0.732	0.525	1.34	0.843	0.355	0.629	0.106

Notes:
pH in standard units
Radium in picocuries per liter
All other parameters in milligrams per liter

TABLE 2

March 2022 Analytical Data Summary

Parameter/Well	MW-10G	MW-10H	MW-10I	MW-10BG	MW-19BG1	MW-19BG2	MW-19BG3	MW-19BG4	MW-19BG5
	3/14/22	3/14/22	3/14/22	3/16/22	3/14/22	3/14/22	3/14/22	3/14/22	3/14/22
Boron	0.83	0.171	0.207	0.0974	<0.25	<0.25	0.175	0.168	0.0809
Calcium	105	140	116	82.8	89.1	102	89.8	99.8	93.5
Chloride	85.1	28.9	53.6	4.77	16.6	7.75	6.17	9.28	3.68
pH	7.66	7.64	7.46	7.73	7.32	7.92	7.45	7.68	7.52
Sulfate	132	17	117	<1	16.6	<1	<1	<1	<1
TDS	654	606	554	646	414	478	390	436	352
Antimony	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Arsenic	0.00635	0.0112	<0.00125	0.0442	<0.00125	0.00341	0.0662	0.0399	0.0234
Barium	0.381	0.443	0.409	0.34	0.336	0.385	0.257	0.26	0.265
Beryllium	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Cadmium	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Chromium	<0.0025	<0.0025	<0.0025	0.00283	<0.0025	0.00377	0.00642	0.00294	<0.0025
Cobalt	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Fluoride	<2	<0.4	<0.4	<0.4	<1	<1	<1	<1	<1
Lead	<0.00125	<0.00125	<0.00125	0.00192	<0.00125	0.00232	<0.00125	0.00144	<0.00125
Lithium	0.0175	0.0192	0.0248	0.0125	<0.025	0.0105	0.0102	0.0107	0.00689
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Selenium	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125
Thallium	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Combined Radium-226,228	0.657	1.52	0.959	0.832	1.04	1.54	2.5	2.25	1.37

Notes:
pH in standard units
Radium in picocuries per liter
All other parameters in milligrams per liter

TABLE 3

August 2022 Analytical Data Summary

Parameter/Well	MW-85A	MW-85B	MW-85C	MW-85D	MW-85E	MW-10A	MW-10B	MW-10CR1	MW-10D	MW-10E	MW-10F
	8/16/22	8/17/22	8/17/22	8/17/22	8/16/22	8/17/22	8/17/22	8/17/22	8/17/22	8/16/22	8/16/22
Boron	0.0997	0.0805	0.309	0.23	6.52	0.728	0.656	0.323	0.228	0.233	9
Calcium	67.5	143	124	132	130	122	86.2	127	142	136	363
Chloride	15.2	54.9	56.1	21.3	69.1	71.5	80	71.5	69.5	58.6	34.3
pH	7.64	7.97	8.01	7.78	7.57	7.93	7.44	8.01	8.02	7.76	7.55
Sulfate	<1	204	288	172	680	338	162	274	359	219	1,740
TDS	304	716	752	768	1,380	868	648	732	888	884	2,500
Arsenic	0.00181	0.00166	0.0061	0.00582	0.00974	0.00318	0.0119	0.00481	0.00684	0.0134	<0.0313
Barium	0.299	0.754	0.257	0.258	0.0594	0.256	0.466	0.337	0.222	0.395	0.0589
Chromium	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.05
Cobalt	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	0.00493
Fluoride	0.437	<0.4	<0.4	<0.4	<0.4	0.468	<0.4	<0.4	<0.4	<0.4	<0.4
Lead	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125
Lithium	0.0122	0.0201	0.00812	0.0136	0.00917	0.00954	0.00924	0.0154	0.0115	0.0141	0.029
Molybdenum	<0.015	<0.015	<0.015	<0.015	0.058	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Combined Radium-226,228	0.697	0.888	0.65	0.805	0.482	0.61	1.25	1.1	0.971	1.4	1.25

Notes:
pH in standard units
Radium in picocuries per liter
All other parameters in milligrams per liter

TABLE 3

August 2022 Analytical Data Summary

Parameter/Well	MW-10G	MW-10H	MW-10I	MW-10BG	MW-19BG1	MW-19BG2	MW-19BG3	MW-19BG4	MW-19BG5
	8/16/22	8/16/22	8/16/22	8/17/22	8/15/22	8/15/22	8/15/22	8/15/22	8/15/22
Boron	0.844	0.141	0.123	0.0858	0.0629	0.0774	0.0662	0.17	0.16
Calcium	98.9	139	93.7	74.6	85.7	108	104	114	98.9
Chloride	81.4	56.6	27	4.96	18	7.52	3.7	11.4	5.81
pH	7.9	7.82	7.6	8.57	6.85	7.3	7.2	7.05	7.16
Sulfate	142	30.2	8	<1	3.79	<1	<1	<1	6.96
TDS	672	640	474	394	464	484	510	644	456
Arsenic	0.00174	0.00941	<0.00125	0.0458	0.0015	0.00664	0.031	0.108	0.0705
Barium	0.383	0.443	0.333	0.224	0.324	0.426	0.439	0.35	0.654
Chromium	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	0.00419	0.0111	<0.0025	0.00985
Cobalt	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	0.00289	0.00498	<0.0025	0.00537
Fluoride	<0.4	<0.4	<0.4	0.445	<0.4	<0.4	<0.4	<0.4	<0.4
Lead	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	0.00384	0.00619	0.00127	0.00649
Lithium	0.0163	0.0155	0.0177	0.00856	<0.005	0.00834	0.00602	0.00532	0.00889
Molybdenum	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Combined Radium-226,228	0.478	0.998	0.461	1.01	0.919	2.37	3.61	1.54	5.14

Notes:
pH in standard units
Radium in picocuries per liter
All other parameters in milligrams per liter