2017 ANNUAL ENGINEERING INSPECTION REPORT

ENTERGY WHITE BLUFF PLANT CLASS 3N LANDFILL

PERMIT NO. 0199-S3N-R3
AFIN: 35-00110

JANUARY 17, 2018

2017 Landfill Inspection Report

Entergy White Bluff Plant
Class 3N Landfill
Redfield, Arkansas

Permit No. 0199-S3N-R3
AFIN: 35-00110

January 2018
Project No. 35177247

Prepared for:
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PROFESSIONAL ENGINEER'S CERTIFICATION

This report on the annual engineering inspection of the Entergy White Bluff Plant Class 3N Landfill and supporting documentation was prepared under the direction and supervision of a qualified, State of Arkansas-registered Professional Engineer. Mr. David McCormick, PE, of Terracon Consultants, Inc. (Terracon), was responsible for the overall preparation of this report. The report has been prepared to fulfill the requirements of §257.84(b). Based on the inspection of the landfill facility and review of available landfill documents the design, construction, operation, and maintenance of the landfill is consistent with recognized and generally accepted good engineering standards.

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No.9199
DAVID C. McCORMICK

1/17/2018

David C. McCormick, P.E.
Arkansas Professional Engineer No. 9199

Date

CERTIFICATE OF AUTHORIZATION
TERRACON CONSULTANTS, INC.
No.223
ARKANSAS

Expires 12.31.19

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1.0 INTRODUCTION

1.1 Purpose of Report

The purpose of this report is to document the annual inspection of the Entergy White Bluff Landfill facility in accordance with 40 CFR *§257, Subpart D - Disposal of Coal Combustion Residuals From Electric Utilities* (the CCR Rule). In particular, the report has been prepared to comply with §257.84(b), which requires an inspection to be conducted by a qualified professional engineer to ensure that the design, construction, operation, and maintenance of the landfill is consistent with recognized and generally accepted good engineering standards.

The report includes:

- Information on the current layout of the landfill,
- Waste volume estimates for the amount of waste contained in the landfill and remaining disposal capacity, and
- An assessment of the landfill including structural integrity and overall operations with respect to the CCR Rule and the facility permit requirements.

1.2 White Bluff Power Plant Information

The Plant is located on the west bank of the Arkansas River, near Redfield in Jefferson County, Arkansas, as shown on **FIGURE 1** (all figures are located in **APPENDIX A**). The 3,400-acre site is situated on a bluff overlooking the relatively flat alluvial plain east of the Arkansas River.

The Plant generates electricity through the combustion of coal and has been in operation since 1981. Coal combustion by-products (residues) (CCRs) that are generated during the electrical generation process are disposed in the on-site landfill. The ash is generally segregated into two categories, "fly" and "bottom."

Approximately 80% of the ash produced is classified as fly ash, which is derived from the boiler exhaust gas and is collected in electrostatic precipitators. The fly ash is composed of very fine particles similar to glass and has the consistency of a powder. Collected fly ash is pneumatically transferred to silos for short-term storage. A subcategory of the fly ash is known as economizer ash. This material is the coarsest fraction of the fly ash, which drops out before the electrostatic precipitators, and represents approximately 2% of the fly ash production. The Plant collects this material in a separate silo system.

The bottom ash is composed of angular, glassy particles with a porous surface texture and has the consistency of coarse sand. The bottom ash is sluiced to dewatering hoppers for removal of water and for storage.

Historically, approximately 60 to 70 % of the two types of ash have been marketed regionally to construction-related industries. The remaining amount of ash is placed in the on-site landfill for disposal.

1.3 Permit History

The Landfill was initially issued a permit in 1982 by the Arkansas Department of Pollution Control and Ecology (now the Arkansas Department of Environmental Quality (ADEQ) and has received three permit modifications to date. The facility permit history is as follows:

1. In October 1982, Chem-Ash, Inc. (Chem-Ash), the on-site landfill contractor which managed coal ash sales and landfill disposal operations for Arkansas Power & Light (AP&L), was granted a permit (No. 199-S) from the Arkansas Department of Environmental Quality ((ADEQ) to construct and operate a solid waste disposal facility at the White Bluff Plant (Entergy Arkansas, Inc. became AP&L's successor in interest as of April 1996).

2. In March 1983, ADEQ granted among other provisions a permit modification request to transfer the landfill permit from Chem-Ash to AP&L and revised the permit number to 199-SR-1.

3. In June 1984, AP&L submitted an application for permit modification requesting operational changes and other provisions to include an increase of the permitted landfill area from 110 acres to 177 acres, with 153 acres for waste disposal. ADEQ granted the permit modification request in September 1985. The permit number was revised to 199-SR-2.

4. Entergy Arkansas submitted a permit modification application to the ADEQ-SWMD to upgrade the Landfill to Arkansas Regulation No. 22 (Regulation No. 22) standards in December 1997. The ADEQ issued the permit November 2000.

5. Entergy Arkansas submitted a minor permit modification in April 2011 and the ADEQ approved the request in May 2011 to reconfigure the waste disposal areas into five disposal cells, which is the current landfill configuration.

2.0 LANDFILL LAYOUT

2.1 Existing Conditions of Landfill

The permitted landfill area consists of approximately 177 acres (153 acres for solid waste disposal) and is located in the southwestern portion of the plant site as shown on **FIGURE 2**.

The current layout of the Landfill includes a total of 5 disposal cells and has a permitted waste capacity of approximately 4,688,200 cubic yards (cy). Waste Cells 1 through 3 have been constructed and comprise the active disposal area of the Landfill having received CCR materials after October 19, 2015. Waste Cell 4 construction was completed in January 2016.

Construction of the disposal cells has followed the numerical sequence of the cell numbers with all design, construction, operation and maintenance in compliance with the requirements of APCEC Regulation 22. Cells 1 through 3 are existing landfill CCR units and will be operated in accordance with requirements of the CCR Rule. Waste Cell 4 was constructed in accordance with Regulation No. 22 Class 3N landfill standards (i.e., 2-ft thick compacted clay liner with a hydraulic conductivity of no more than 1×10^{-7} cm/sec and a leachate collection system). Construction on the cell began prior to October 19, 2015 and will be operated as an existing CCR landfill.

No final cover system has been installed on Waste Cells 1 through 3. As shown on **FIGURE 2**, older portions of the landfill facility that received CCR material prior to the issuance of the 2000 permit have been closed and covered in accordance with the original facility permit (1982). These areas did not receive CCR after October 2015.

TABLE 2.1 presents a summary of the disposal cells that have been constructed at the White Bluff Landfill.

TABLE 2.1. Construction Summary of White Bluff Plant Class 3N Landfill

Cell Number	Year Built	Year Closed	Final Cover System	Status
1	2005	N/A	N/A	Open
2	2007	N/A	N/A	Open
3	2010	N/A	N/A	Open
4	2016	N/A	N/A	Open

2.2 Changes Made to Landfill Configuration During Reporting Period

The facility finished construction of Cell 4, a 6.5-acre waste cell, in January 2016. As shown on **FIGURE 2**, Cell 4 is located south of Cell 3 and west of Cell 2. Utilization of the new cell will eventually allow waste to be placed at higher elevations in the adjacent cells, increasing the operational capacity of those cells.

Cell 4 was designed with a 24-inch thick compacted clay liner with 1 x 10^{-7} cm/sec maximum permeability and a leachate collection and transmission system. New collection lines were installed in the existing Cell 3. These new collection lines were connected to the new Cell 4 leachate collection system, which was designed to handle leachate from both cells.

The landfill manager that works for the contracted landfill management company, Headwaters Resources, Inc. (HRI), reported additional improvements during the year including repairs to slopes exhibiting rills and gullies, cleaning stormwater ditches, washing and collecting resulting material from paved roads.

3.0 WASTE VOLUME CALCULATIONS

The landfill facility has been surveyed annually since 1996. Each year's survey is compared to the previous year to compute the amount of CCR disposed. The current survey is also compared to the permitted top of waste elevations to determine remaining capacity, or airspace. Additionally, the current survey is compared to an estimated "operational" top of waste to determine the remaining operational capacity. The operational top of waste is the maximum disposal elevation that can be achieved within the open cells while maintaining the required 4:1 exterior and 3:1 interior slopes along with a top width sufficient for disposal activities. If additional operational capacity is needed, construction of an adjacent disposal cell will be required.

Disposal rates for the facility are calculated using the average of the disposal rates from the five most recent years. Disposal rates depend upon CCR production at the plant and sales of the ash. These can vary significantly year to year based upon the current economic climate, weather, and how much the plant is operational.

For the reporting year of 2017, the active disposal areas of the landfill were surveyed on December 13, 2016 and again on December 11, 2017, a period of approximately twelve months. A comparison of surface models developed from these surveys as well as the operational top of waste is summarized in **TABLE 3.1**, below.

TABLE 3.1 Summary of Waste Volume Calculations.

Cell Number	Status	Area (ac)	ADEQ Permitted Waste Capacity (cy)	2017 Volume Placed* (cy)	Total Volume Placed (cy)	Operational Remaining Disposal Capacity (cy)	Operational Remaining Life (years)
Cell 1	Active	6.0	307,500	-2,900	185,900	121,600	1.7
Cell 2	Active	9.0	712,100	1,000	394,100	252,400	3.4
Cell 3	Active	9.4	557,200	14,200	291,700	265,500	3.6
Cell 4	Active	6.5	501,800	65,600	65,600	382,200	5.2
Totals		**30.9**	**2,394,300**	**77,900**	**937,300**	**1,021,700**	**13.9**

* Volume cut or filled during the 12-month period between December 2016 and December 2017.

The 5-year average disposal rate, including 2017, is approximately 73,600 cubic yards per year, in-place. At this rate, the calculated available airspace, 1,021,700 cubic yards, provides approximately 13.9 years of remaining operation capacity before a new disposal cell must be opened.

4.0 ASSESSMENT OF LANDFILL FACILITY

This section of the report provides a summary of the inspection of the White Bluff Landfill facility that was conducted on December 11, 2017. The assessment included an interview with the landfill operating company (HRI) personnel and Entergy personnel, review of weekly inspections of the facility, review of documents pertaining to the operation and compliance of the landfill, and an on-site inspection of the landfill facility. Photographs of the site inspection are included in **APPENDIX B**.

4.1 General Operations

The operator uses Cell 1 for production of a product named “flex-base”. CCR materials including bottom-ash and fly-ash are stockpiled, blended to make the “flex-base” and loaded to trucks in this area. Active disposal was conducted primarily in the Cell 2 and Cell 3 areas.

The side-slopes of the landfill are generally at the required 4:1 external and 3:1 interior slope requirements. The slopes in the larger Cells 2 and 3 are set back from the landfill perimeter berm. This allows stormwater runoff from the slopes to be collected and routed to the cell discharge points. Cell 3, as noted in Section 2.2, was modified to discharge leachate to Cell, 4 which contains a leachate collection system.

No tension cracks, seeps, or other features that indicate a potential slope failure were observed during the site inspection. In addition, no active seeps were noted

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The general operations of the landfill facility are being done in a safe manner and the overall maintenance of the facility is in good condition.

4.2 Landfill Cover System

As noted, no final cover system has been installed on Waste Cells 1 through 4. However, as shown on **FIGURE 2**, older portions of the landfill facility that received CCR material prior to the issuance of the 2000 permit have been closed and covered in accordance with the original facility permit (1982). **FIGURE 3** presents contours for the currently permitted final cover system.

All four active cells remain open. Interim cover soil has not been placed on any of the existing side slopes. A large quantity of soil has been stockpiled near the landfill during previous construction projects for future interim cover placement.

4.3 Leachate Collection System

Waste Cells 1 through 3 do not have leachate collection systems. Cells 1 and 2 are graded to drain to the southeast corner of Cell 2 where leachate discharges to an adjacent stormwater channel, as required by the 2000 permit under which they were constructed.

Cell 4 was designed with leachate collection and transmission systems. Additionally, new collection lines were installed along the west and south sides of the existing Cell 3. These new collection lines were connected to the new Cell 4 leachate collection system, which was designed to handle leachate from both cells. The automated pumping system will remove the Cell 3 and Cell 4 leachate from a sump in the southwest corner of Cell 4. The leachate is pumped via a dual-contained underground pipeline and discharged to the plant's Surge Pond. During the site inspection the leachate sump was in working order and the leachate levels were below the 36-inches allowed.

4.4 Storm water Control System

Storm water at the landfill site flows south and then east to the plant Surge Pond. To prevent run-on, a lined storm water channel was constructed along the north side of the landfill, routing storm water east or west around the landfill. Additionally, clay perimeter berms prevent both run-on and run-off, except at designated discharge points as described in Section 4.3.

The White Bluff plant is permitted to discharge storm water to the Arkansas River under NPDES Permit No. AR0036331, as issued by the ADEQ effective June 1, 2012. Ash disposal runoff is listed as a potential constituent of discharges from Outfall 002, overflow from the plant Clear Water Holding Pond. Discharges, when they occur, are monitored daily for total suspended solids (TSS), oil and grease (O&G), total iron, total copper and pH. Discharges, if they occur, are also monitored quarterly for E-coli and require acute WET testing.

4.5 Facility Roads

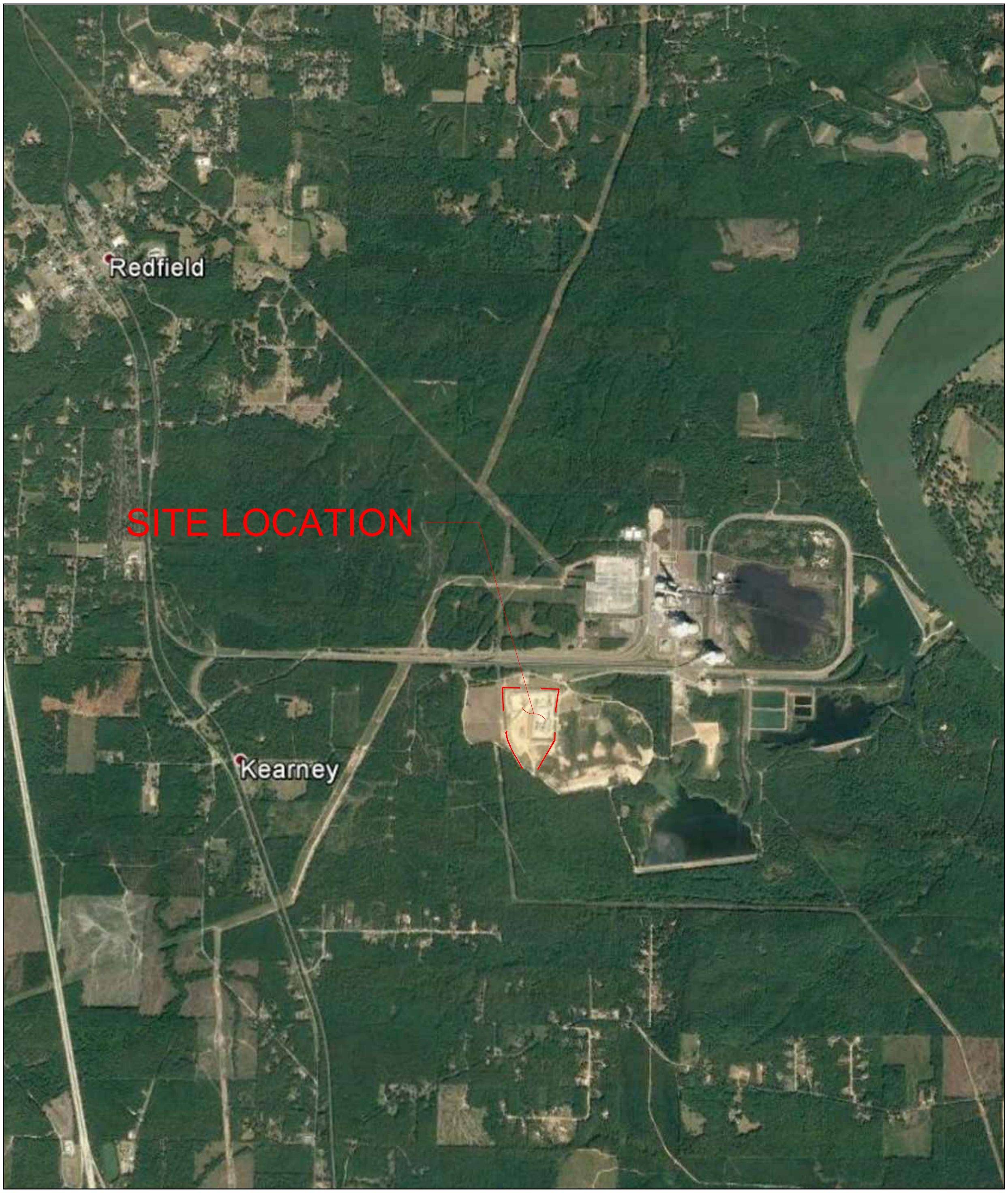
The facility roads were well maintained at the time of the inspection. The disposal access road to the active cells is paved, and it was in excellent condition at the time of the inspection. The perimeter access road has an all-weather surface coarse and was in good condition.

4.6 Fugitive Dust Control

The facility is operated as outlined by the CCR Fugitive Dust Control Plan, prepared in October 2015.

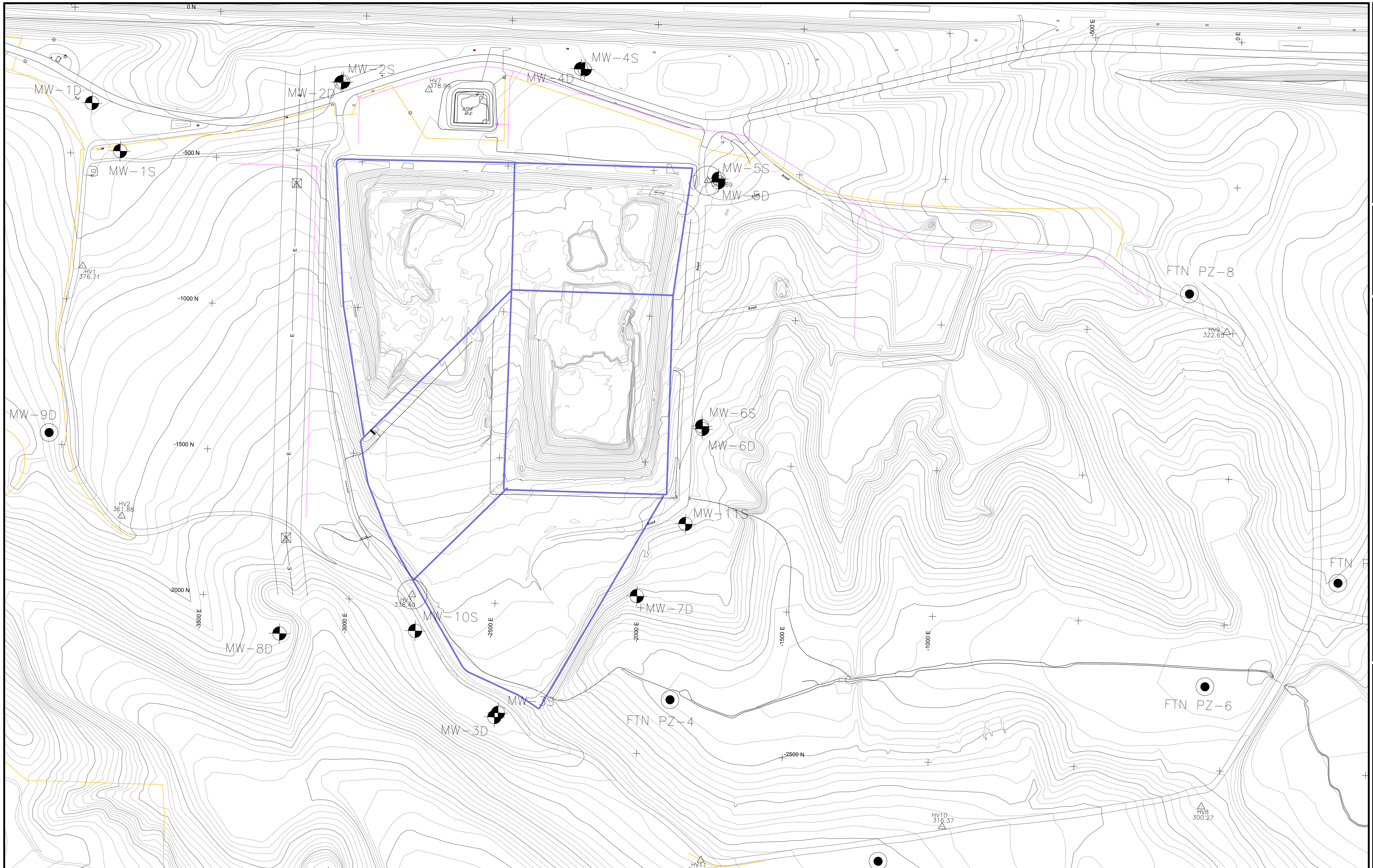
The landfill was actively disposing of CCR during the December site visit. Fly ash is transported to the landfill and dumped using bottom-dump trailers to minimize fugitive dust issues. Bottom ash, in a moist condition, is hauled to the landfill using dump trucks. Economizer ash is loaded to covered dump truck prior to transfer to the landfill. A windsock is used to visually gauge wind direction and intensity. Water is applied, when necessary, for dust suppression on roads and the landfill using a water truck. The landfill access roads have enforced posted speed limit of 25 mph. Within the landfill boundary, a 5 mph speed limit is enforced.

APPENDIX A
Figures



SITE MAP

Project Mngr: TLB	Project No. 026-001-35177247	Terracon Consulting Engineers and Scientists	SITE MAP	FIG. No.
Drawn By: SRE	Scale: N.T.S.		2017 LANDFILL INSPECTION REPORT	
Checked By: DCM	File No. 001	25809 I-30 SOUTH BRYANT, AR 72022	ENTERGY WHITE BLUFF PLANT CLASS 3N LANDFILL	1
Approved By: DCM	Date: 01/05/2018	PH. (501) 847-9292 FAX. (501) 847-9210	REDFIELD ARKANSAS	



LEGEND

EXISTING INDEX CONTOUR (10')	PAVED ROAD
EXISTING INTERMEDIATE CONTOUR (2')	UNPAVED ROAD
CELL BOUNDARIES (EXISTING PERMIT)	HV11 327.17 SURVEY CONTROL POINT
WATER LINE	400 PROPOSED TOP OF FINAL COVER (10')
E ELECTRIC TRANSMISSION LINE	

NOTES:

1. TOPOGRAPHIC INFORMATION WITHIN THE ACTIVE LANDFILL AREA (CELLS 1-3) IS FROM A FIELD SURVEY BY HARMON SURVEYING, INC. (DECEMBER 2017). ADDITIONAL SITE TOPOGRAPHIC INFORMATION IS FROM AN AERIAL SURVEY BY AMI ENGINEERING, INC. (NOVEMBER 2011) AND FIELD SURVEYS BY HARMON SURVEYING, INC. (FEBRUARY 2012, MARCH 2015 AND DECEMBER 2016).

150 0 50 100 150

SCALE IN FEET

N

REV.	DATE	BY	DESCRIPTION

EXISTING CONDITIONS

2017 LANDFILL INSPECTION REPORT

ENTERGY WHITE BLUFF PLANT

CLASS 3N LANDFILL

REDFIELD ARKANSAS

Terracon
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FIGURE 2

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARS
DATE:	1/5/2018
JOB NO.	026-001-35177247
ACAD NO.	002
SHEET NO.:	2 OF 3

LEGEND

	EXISTING INDEX CONTOUR (10')
	EXISTING INTERMEDIATE CONTOUR (2')
	CELL BOUNDARIES (EXISTING PERMIT)
	WATER LINE
E	ELECTRIC TRANSMISSION LINE
	PAVED ROAD
	UNPAVED ROAD
HV11 327.17	SURVEY CONTROL POINT
400	PROPOSED TOP OF FINAL COVER (10')
	PROPOSED ACCESS ROAD
	PROPOSED MID-SLOPE SWALE
	PROPOSED RIP-RAP LETDOWN

NOTES:

1. TOPOGRAPHIC INFORMATION WITHIN THE ACTIVE LANDFILL AREA (CELLS 1-3) IS FROM A FIELD SURVEY BY HARMON SURVEYING, INC. (DECEMBER 2017). ADDITIONAL SITE TOPOGRAPHIC INFORMATION IS FROM AN AERIAL SURVEY BY AMI ENGINEERING, INC. (NOVEMBER 2011) AND FIELD SURVEYS BY HARMON SURVEYING, INC. (FEBRUARY 2012, MARCH 2015 AND DECEMBER 2016).

150 0 50 100 150

SCALE IN FEET

N

REV.	DATE	BY	DESCRIPTION

FINAL PERMIT CONTOURS

2017 LANDFILL INSPECTION REPORT

ENTERGY WHITE BLUFF PLANT

CLASS 3N LANDFILL

REDFIELD ARKANSAS

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FIGURE 3

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARS
DATE:	1/5/2018
JOB NO.	026-001-35177247
ACAD NO.	002
SHEET NO.:	3 OF 3

APPENDIX B
Photos of Annual Engineering Inspection

1. Top of Cell 3 looking southeast towards Cell 1.

2. Top of Cell 3 looking southwest.

3. The west sideslope of Cell 3.

4. The southeast side of Cell 4 looking to the North.

5. Leachate pumping system on the southeast corner of Cell 4.

6. East slope of Cells 1 & 2 looking to the northwest.