



water resources / environmental consultants

LANDFILL CLOSURE PLAN

ENTERGY ARKANSAS, INC. WHITE BLUFF PLANT CLASS 3N CCR LANDFILL

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

OCTOBER 12, 2016

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Prepared for

Entergy Arkansas, Inc. White Bluff Plant
1100 White Bluff Road
Redfield, AR 72132

Prepared by

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

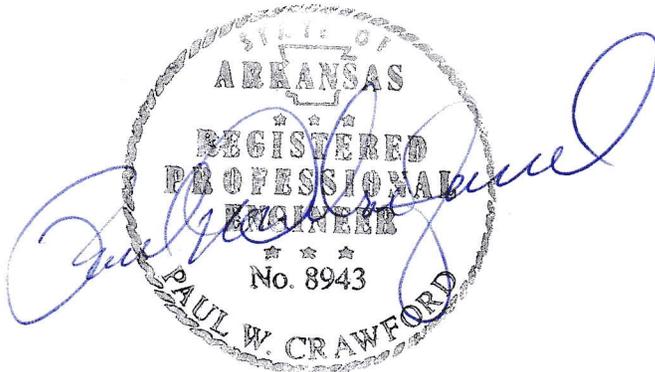
FTN No. R06040-1231-001

October 30, 2016

PROFESSIONAL ENGINEER'S CERTIFICATION

In accordance with §257.102 , I certify under penalty of law that I have personally examined and am familiar with the information submitted in this demonstration and all attached documents, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

This Landfill Closure Plan for the Entergy Arkansas, Inc. White Bluff Plant Class 3N CCR Landfill was prepared under the direction and supervision of a qualified, State of Arkansas-registered Professional Engineer. Mr. Paul Crawford, PE, PG of FTN Associates, Ltd., was responsible for the overall preparation of the plan.



Paul Crawford, PE #8943

October 12, 2016
Date

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1.0 INTRODUCTION

1.1 Purpose of Plan

In accordance with 40 CFR §257, *Subpart D - Disposal of Coal Combustion Residuals From Electric Utilities* (the CCR Rule), the purpose of this plan is to provide information on the procedures required for closure of a CCR unit at any point during its active life at the Entergy Arkansas, Inc. White Bluff Plant (the Plant) Class 3N CCR Landfill (the Landfill). This Closure Plan (the Plan) includes:

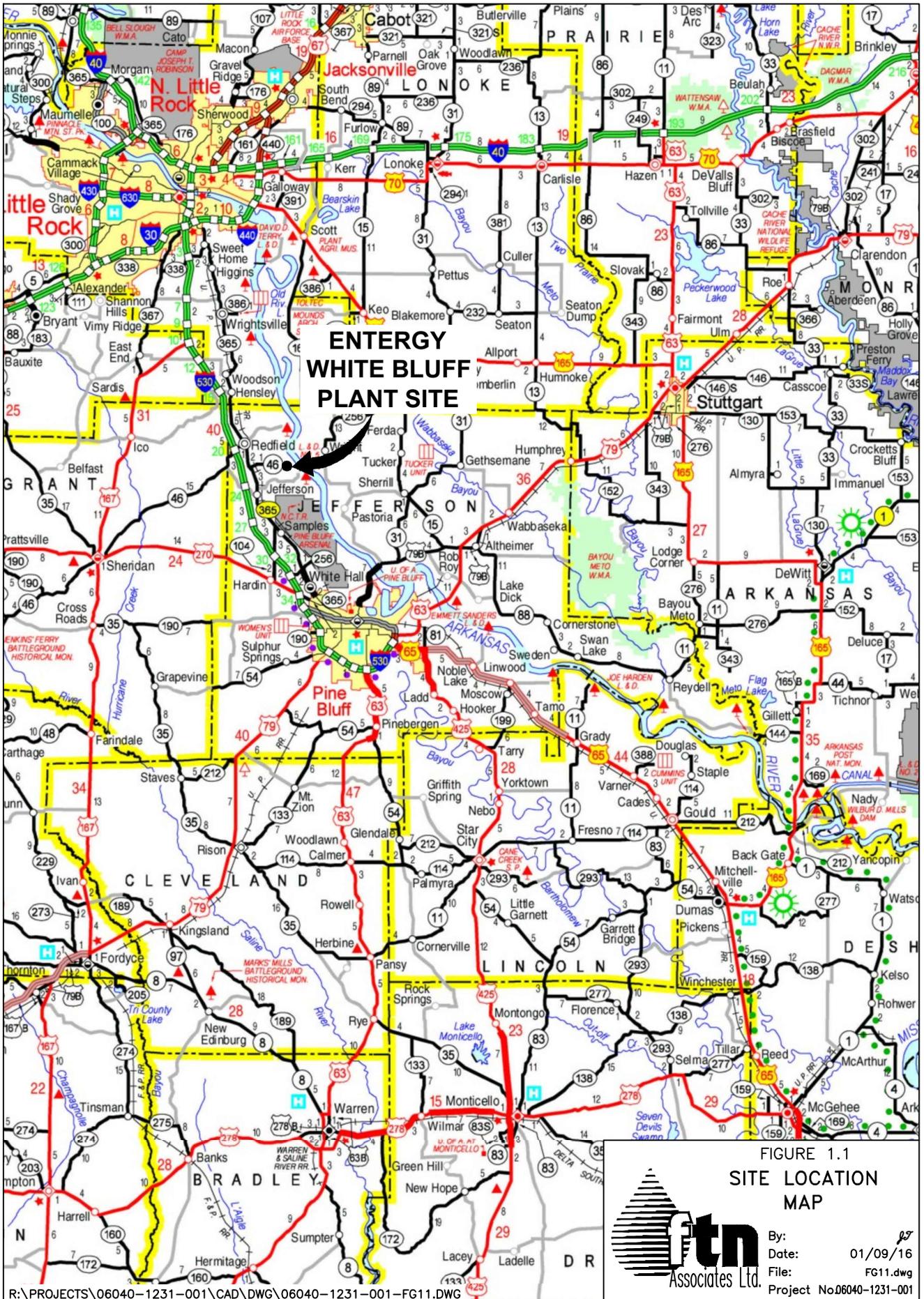
1. A description of the steps that will be taken to close each CCR unit that has not been closed;
2. A description of the final cover system and the methods used to install the cover;
3. An estimate of the maximum inventory of CCR ever onsite over the active life of the CCR unit;
4. An estimate of the largest area of the CCR unit ever requiring a final cover; and
5. A general schedule for closure.

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 1.1. 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 onsite landfill. The CCR is generally segregated into two categories, “fly” and “bottom.”

Approximately 80% of the CCR 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



**ENTERGY
WHITE BLUFF
PLANT SITE**

FIGURE 1.1
SITE LOCATION
MAP



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the electrostatic precipitators, and represents approximately 2% of the total CCR production. The Plant collects this material in a separate silo system.

The remaining 18% of CCR produced from the combustion of coal is comprised of bottom ash, which 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 CCR have been marketed regionally to construction-related industries. The remaining amount of CCR is placed in the onsite landfill for disposal. The amount placed in the Landfill varies from year to year, but the average for the past five years is approximately 100,000 cubic yards (cy).

1.3 Permit History

The CCR Landfill was initially issued a solid waste 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 onsite 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, Inc. 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 revised permit (0199-S3N-R3) November 2000.
 5. Entergy Arkansas, Inc. 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.

1.4 Existing Conditions of Landfill

The ADEQ-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 1.2.

The current ADEQ-permitted layout of the CCR Landfill includes a total of five disposal cells (Cells 1 through 5) and has a permitted waste capacity of approximately 2,600,000 cubic yards (cy). Waste Cells 1 through 4 have been constructed and comprise the active disposal area of the CCR Landfill that received CCR materials after October 19, 2015 (Figure 1.3).

Construction of the CCR units has followed the numerical sequence of the cell numbers. Cells 1 through 4 are active landfill CCR units and will be operated in accordance with requirements of the CCR Rule.

No final cover system has been installed on the active CCR units, Cells 1 through 4. As shown on Figure 1.3, 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 ADEQ-issued permit (1982). These areas did not receive CCR after October 2015.

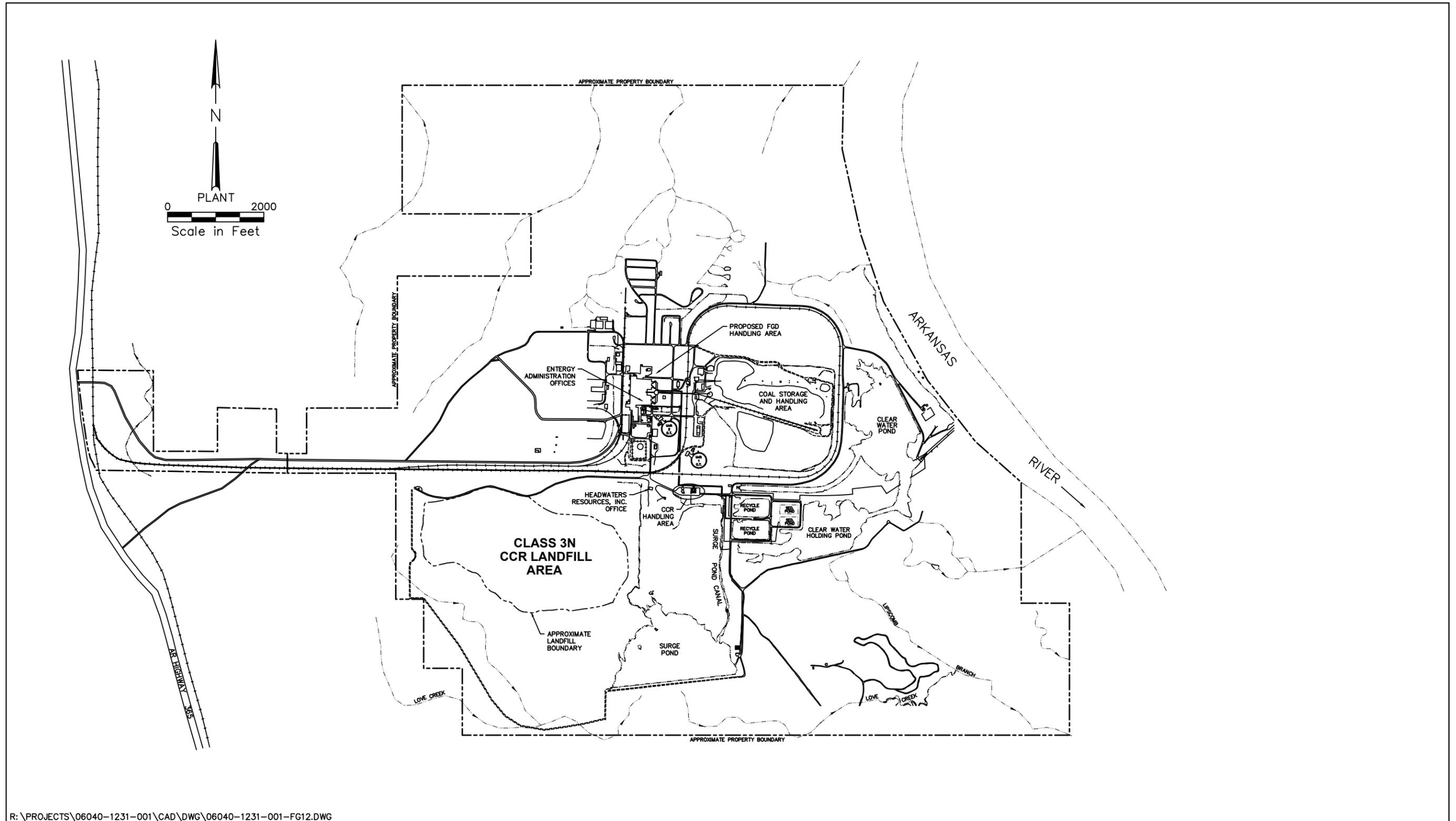


Figure 1.2. Plant site map.

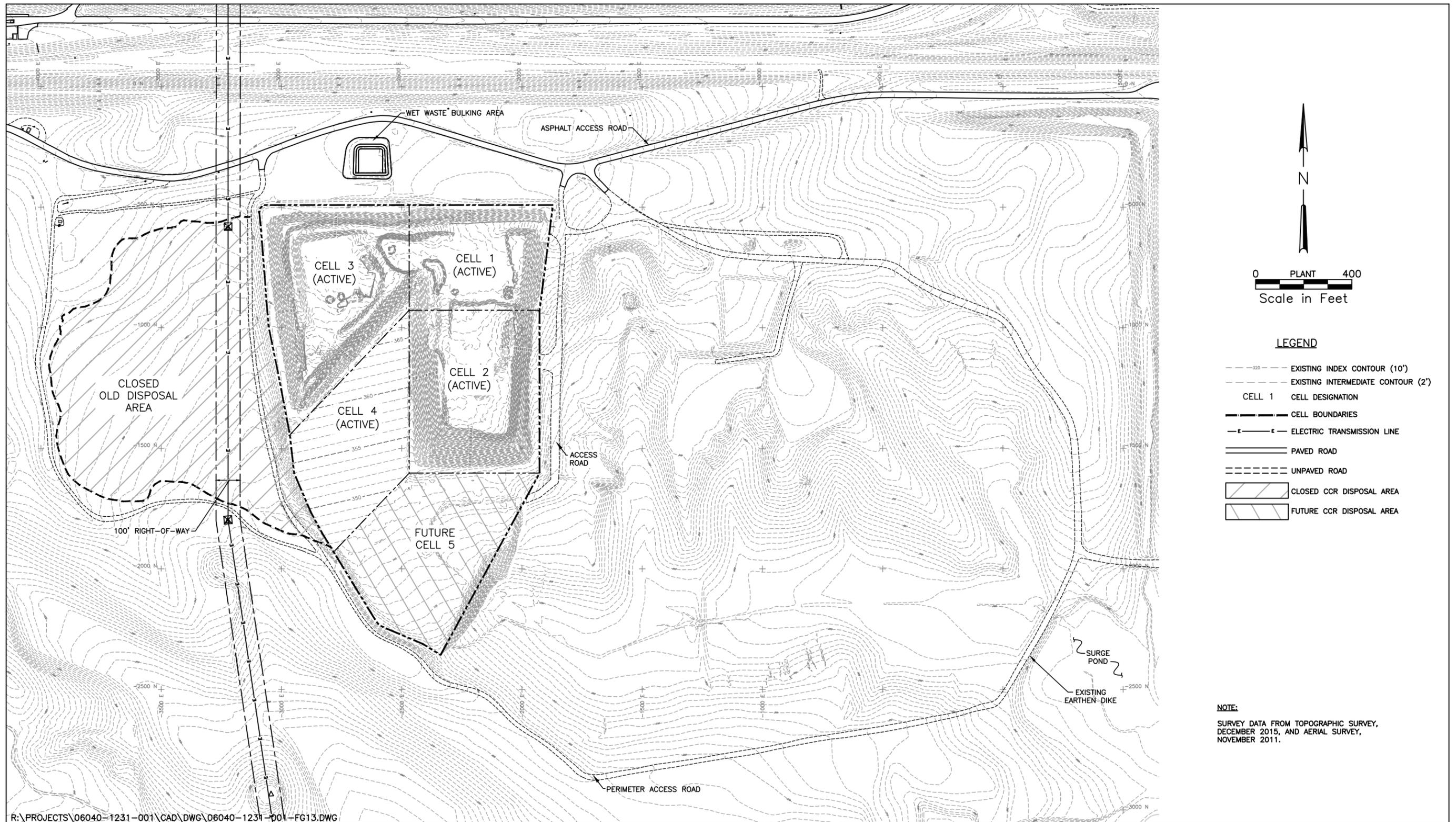


Figure 1.3. Layout of White Bluff Class 3N CCR Landfill.

2.0 CLOSURE PLAN

2.1 Closure Requirements

According to §257.102(b), the closure plan must include information on how the CCR unit will be closed, the design of the final cover system, the methods for installation of the final cover system, an estimate of the maximum inventory of CCR ever onsite over the active life of the CCR unit, an estimate of the largest area of the CCR unit ever requiring a final cover, and a schedule for completing all the closure activities.

2.2 Closure Activities

The White Bluff Plant CCR Landfill cover system will be installed in phases. Closure activities will include preparation of the area to be closed, installation of the barrier and erosion layers, establishment of vegetative cover, and preparation of a certification that the closure activities were conducted in accordance with §257.102 and the facility Construction Quality Assurance (CQA) Plan.

As each CCR unit reaches its design disposal capacity, the waste will be graded to the permitted waste grades. The 18-inch thick compacted clay layer (infiltration layer) will be constructed in three 9-inch thick loose lifts by placing excavated or stockpiled soils across the waste material and then compacting to achieve the required permeability of 1×10^{-7} cm/sec and a compacted thickness of 6 inches per lift. After the compacted clay layer is completed, the 12-inch thick erosion layer will be installed. The erosion layer will be seeded with native grasses.

Upon completion of installation of the cover system, erosion control devices such as rock check dams, silt fences, or erosion control matting will be installed in areas where excessive erosion may occur such as on side slopes, discharge locations of stormwater structures and drainage channels.

2.3 Design of Final Cover System

In accordance with §257.102(d)(3)(i), the final cover system for the CCR Landfill consists of the following configuration from bottom to top (Figure 2.1):

- Eighteen inches of compacted clay (infiltration layer) having a hydraulic conductivity of 1×10^{-7} cm/sec or less;
- Twelve inches of topsoil (erosion layer); and
- A vegetative layer of native perennial grasses.

As allowed by §257.102(d)(3)(ii), an alternative cover consisting of a geosynthetic clay liner (GCL) in place of the compacted clay layer may also be constructed (Figure 2.1). If the GCL used in place of the compacted clay layer, a protective cover layer consisting of compacted onsite soils will be installed between the CCR and the GCL. The protective cover layer provides a foundation and damage protection for the overlying synthetic materials. The soil shall be free of rocks, roots, and debris that could damage the synthetics and will be installed in accordance with the CQA Plan.

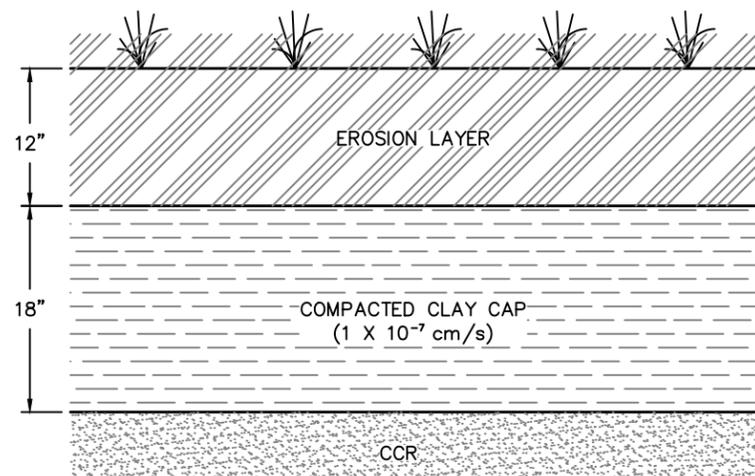
2.4 Construction of Final Cover System

The landfill cover system will be installed during the spring, summer, or fall months to minimize wet weather problems for the construction activities. Prior to installing the cover system, the Entergy Arkansas, Inc.-contracted landfill management company or earthwork contractor will grade the side slopes of the waste area to meet the design requirements.

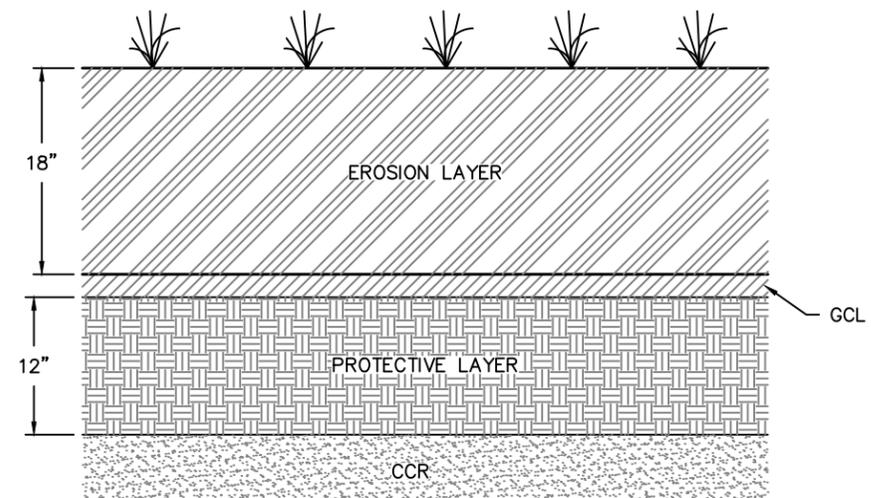
The cover materials will come from excavated soils from previous waste cell construction projects or from onsite borrow sources. The cover materials will be placed on the area requiring cover, graded, and compacted to meet the requirements of the construction documents and the facility CQA Plan. After installation of the cover soils, the vegetative cover will be established.

Cover system installation activities will include:

- The installation and testing of the infiltration layer of the cover system in accordance with the facility CQA Plan;
- The installation of the erosion layer;
- The establishment of vegetation over completed areas; and,



**STANDARD FINAL
COVER DESIGN**



**ALTERNATE FINAL
COVER DESIGN**

NOTE:

MATERIALS SHALL BE
INSTALLED IN ACCORDANCE
WITH FACILITY CQA PLAN.

SCALE: 3/4"=1'-0"

Figure 2.1. Final cover options.

- The development of a certification report by a registered professional engineer which will include a summary of all construction activities, a description of installed items and materials used, an “as-built” plan, and a summary statement signed and sealed by the certifying professional.

Soil borrow areas will be managed with best management practices (BMPs) during its active operation. The area will be closed with maximum slopes of 33.3% (three horizontal to one vertical) and re-vegetated with a good stand of grass.

2.4.1 Construction Quality Assurance

Construction of the final cover system is outlined in the facility CQA Plan. It describes the steps necessary for closure construction activities of the CCR Landfill at any point during its active life in accordance with the final cover design requirements.

In accordance with the CQA Plan, all cover system construction activities will be monitored and documented to assure that the system complies with the permit requirements. The certification document of the construction activities will be placed in the facility operating record and website when completed.

2.4.2 Erosion Control Measures

Upon conclusion of the final cover system construction activities, erosion control measures such as check dams, straw wattles, silt fences, or erosion control matting will be installed in areas where excessive erosion may occur such as side slopes, discharge locations of stormwater structures and drainage channels. These devices will be periodically monitored and maintained until a good stand of vegetation has been established in the construction area.

2.5 Maximum Inventory of CCR in Landfill Facility

The estimated maximum inventory of CCR in the Landfill facility is 2,087,200 cy when the active CCR units (Cells 1 through 4) have been filled to the maximum disposal capacity as shown on Figure 2.2. This volume includes CCR placed in the landfill prior to October 19, 2015.

2.6 Largest Area Requiring Closure

The largest area of the CCR Landfill requiring a final cover at any time during the active life is under current conditions when Cells 1 through 4 must be closed, which is approximately 31.1 acres in area. Figure 2.2 presents the proposed closure plan, including stormwater control facilities, for Cells 1 through 4.

2.7 Closure Schedule

Closure of the CCR Landfill will generally begin within 30 days following the final receipt of waste; or, if the landfill has remaining capacity and there is a reasonable likelihood that it will receive additional wastes or the CCR may be removed for beneficial use, no later than two years after the most recent receipt of waste as allowed by §257.102(f)(2). An estimated schedule for completing all activities necessary for closure of the largest estimated area (31.1 acres) is presented in Table 2.1. Closure of the landfill will be completed no later than six months following the beginning of closure activities. In accordance with §257.102(f)(2)(ii)(C), Entergy Arkansas, Inc. may extend the closure timeframe multiple times, in one-year extensions. No more than a total of two one-year extensions may be allowed.

For each extension, Entergy Arkansas, Inc. must substantiate the circumstances for the need of the extension(s) in accordance with §257.102(f)(2)(i) and place a the demonstration and a statement in the facility operating record and website.

In accordance with §257.102(g), whenever closure activities are initiated at the Landfill, Entergy Arkansas, Inc. will place a notification in the facility operating record and website that closure activities will be performed. The notification must include the certification by an Arkansas-registered professional engineer for the design of the cover system.

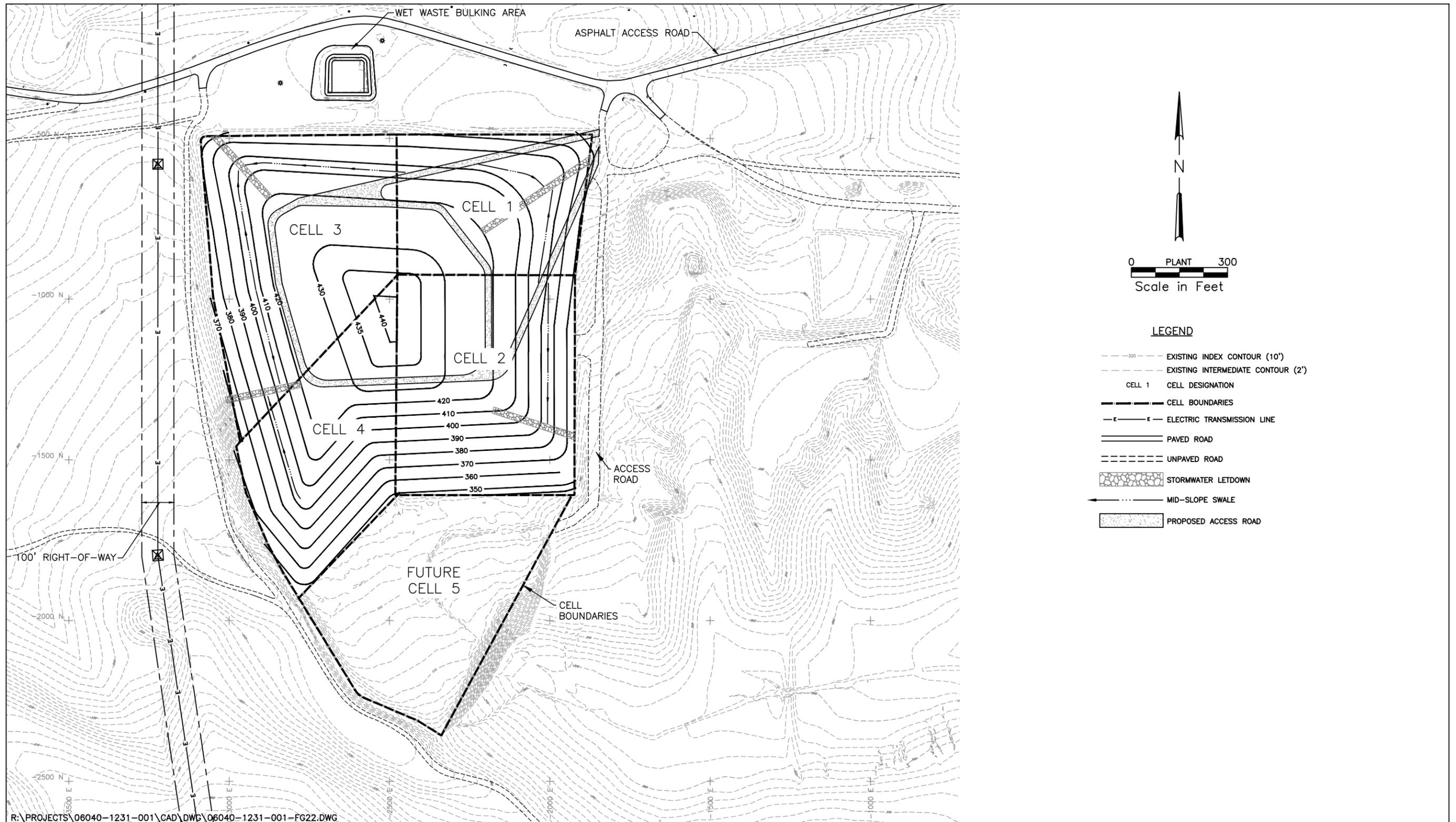


Figure 2.2. Closure Plan for Cells 1 through 4.

Table 2.1. Estimated closure schedule for largest landfill area open (Cells 1 through 4).

Closure Activity/Tasks	Number of Days to Complete
Perform grading of waste	30
Install final cover system	90
Grade soil borrow areas and prepare for seeding	10
Seed and mulch	10
Installation of erosion and sediment control structures	20
Estimated Total Time to Complete Closure	160

2.8 Closure Certification

In accordance with §257.102(h), within 30 days of completion of the closure activities, Entergy Arkansas, Inc. will place a notification in the facility operating record and website that the closure activities have been completed. The notification must include the certification by an Arkansas-registered professional engineer, verifying that closure has been completed in accordance with closure construction documents.

2.9 Deed Restriction

In accordance with §257.102(i), following placement of final cover over the entire landfill, Entergy Arkansas, Inc. will record a notation on the deed to the property. The notation on the deed must inform any potential purchaser of the property of the following:

- The past use of the land was used as a CCR unit, and
- Its use is restricted under the post-closure care requirements as provided by §257.104(d)(1)(iii).

Within 30 days of completing the deed restriction, Entergy Arkansas, Inc. will record a notification in the facility operating record and website that the deed restriction has been recorded.

2.10 Amendment of the Closure Plan

In accordance with §257.102(b)(3), Entergy Arkansas, Inc. may amend this closure plan at any time. Specifically, Entergy Arkansas, Inc. must amend the written closure plan whenever:

1. There is a change in the operation of the CCR unit that would substantially affect the written closure plan in effect; or
2. After closure activities have commenced, unanticipated events necessitate a revision of the written closure plan.

The closure plan must be amended at least 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 the plan. If the plan is revised after closure activities have commenced for a CCR unit, the owner or operator must amend the written closure plan no later than 30 days following the triggering event.

Entergy Arkansas, Inc. will obtain a written certification from a qualified professional engineer that the initial and any amendment of the written closure plan meets the requirements of §257.102(b)(3). The amended plan and certification will be placed in the facility operating record and website.

APPENDIX A

Definitions

DEFINITIONS

The following definitions are from §257.53 of the CCR Rule and used in this Plan:

Active Life or In Operation: the period of operation beginning with the initial placement of CCR in the CCR unit and ending at completion of closure activities in accordance with §257.102.

Active portion: that part of the CCR unit that has received or is receiving CCR or non-CCR waste and that has not completed closure in accordance with §257.102.

Coal Combustion Residuals (CCR): fly ash, bottom ash, boiler slag, and flue gas desulfurization materials generated from burning coal for the purpose of generating electricity by electric utilities and independent power producers.

CCR Landfill: an area of land or land excavation that receives CCR and which is not a surface impoundment, an underground injection well, a salt dome formation, a salt bed formation, an underground or surface coal mine, or a cave. It also includes sand and gravel pits and quarries that receive CCR, CCR piles, and any practice that does not meet the definition of a beneficial use of CCR.

CCR Unit: any CCR landfill, CCR surface impoundment, or lateral expansion of a CCR unit, or a combination of more than one of these units based on the context of the paragraph(s) in which it is used. This term includes both new and existing units, unless otherwise specified.

Closed Unit or Landfill: placement of CCR in a CCR unit has ceased, and the owner or operator has completed closure of the CCR unit in accordance with § 257.102 and has initiated post-closure care in accordance with § 257.104.

Existing CCR Landfill: a CCR Landfill that receives CCR both before and after October 15, 2015, or for which construction commenced prior to October 14, 2015 and receives CCR on or after October 14, 2015. A CCR landfill has commenced construction if the owner or operator has obtained the federal, state, and local approvals or permits necessary to begin physical construction and a continuous onsite physical construction program had begun prior to October 14, 2015.

Hydraulic Conductivity: the rate at which water can move through a permeable medium (i.e., the coefficient of permeability).

Lateral Expansion: a horizontal expansion of the waste boundaries of an existing CCR landfill or existing CCR surface impoundment made after October 14, 2015.

New CCR Landfill: a CCR landfill or lateral expansion of a CCR landfill that first receives CCR or commences construction after October 14, 2015. A CCR landfill has commenced construction if the owner or operator has obtained the federal, state, and local approvals or

permits necessary to begin physical construction and a continuous onsite physical construction program had begun after to October 14, 2015.

Operator: the person(s) responsible for the overall operation of a CCR unit.

Qualified Professional Engineer: an individual who is licensed by a state as a Professional Engineer to practice one or more disciplines of engineering and who is qualified by education, technical knowledge and experience to make the specific technical certifications required under this subpart. Professional engineers making these certifications must be currently licensed in the state where the CCR unit(s) is located.

Recognized and Generally Accepted Good Engineering Practices: engineering maintenance or operation activities based on established codes, widely accepted standards, published technical reports, or a practice widely recommended throughout the industry. Such practices generally detail approved ways to perform specific engineering, inspection, or mechanical integrity activities.

Run-Off: any rainwater, leachate, or other liquid that drains over land from any part of a CCR landfill or lateral expansion of a CCR landfill.

Run-On: any rainwater, leachate, or other liquid that drains over land onto any part of a CCR landfill or lateral expansion of a CCR landfill.

Structural Components: liners, leachate collection and removal systems, final covers, run-on and run-off systems, inflow design flood control systems, and any other component used in the construction and operation of the CCR unit that is necessary to ensure the integrity of the unit and that the contents of the unit are not released into the environment.