

**CERTIFICATION OF LINED CONSTRUCTION
BIG BROWN STEAM ELECTRIC STATION
NORTH AND SOUTH BOTTOM ASH PONDS
FREESTONE COUNTY, TEXAS**

October 2016

Prepared for:

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PBW Project No. 5196C

PROFESSIONAL CERTIFICATION

This document and all attachments were prepared by Pastor, Behling & Wheeler, LLC under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete and satisfies the liner design requirements for existing CCR surface impoundments as listed in Section 257.71(a)(1) of the CCR Rule.



Pat J. Behling 10/05/16
Patrick J. Behling, P.E.
Principal Engineer
PASTOR, BEHLING & WHEELER, LLC

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1.0 INTRODUCTION

Luminant Generation Company, LLC (Luminant) operates the Big Brown Steam Electric Station (BBSES) located approximately 10 miles northeast of Fairfield, Freestone County, Texas (see Figure 1). The BBSES consists of two coal/lignite-fired units with a combined operating capacity of approximately 1,150 megawatts. Coal Combustion Residuals (CCR) including fly ash, bottom ash and boiler slag are generated as part of BBSES unit operation. The CCRs are transported off-site for beneficial use by third-parties or are beneficially used or disposed of by Luminant at the BBSES.

The CCR Rule (40 CFR 257 Subpart D - *Standards for the Receipt of Coal Combustion Residuals in Landfills and Surface Impoundments*) has been promulgated by EPA to regulate the management and disposal of CCRs as solid waste under Resource Conservation and Recovery Act (RCRA) Subtitle D. The final CCR Rule was published in the Federal Register on April 17, 2015. The effective date of the CCR Rule was October 19, 2015.

The CCR Rule establishes national operating criteria for existing CCR surface impoundments and landfills, including a requirement to certify that the liners in existing CCR surface impoundments comply with the liner design criteria specified in Section 257.71(a)(1) of the CCR Rule. This report was prepared by Pastor, Behling & Wheeler, LLC (PBW) to document that the evaluation of the liners for the existing CCR surface impoundments at the BBSES.

1.1 Liner Design Criteria – Existing CCR Surface Impoundments

As described in Section 257.71(a)(1) of the CCR Rule, existing CCR surface impoundments are considered lined impoundments as long as the units are constructed with one of the following liner systems:

- A liner consisting of a minimum of two feet of compacted soil with a hydraulic conductivity of no more than 1×10^{-7} cm/sec;
- A composite liner system consisting of the following two components:
 - An upper liner component consisting of a minimum 30-mil GM liner. GM components consisting of HDPE must be at least 60-mil thick.
 - A lower liner component consisting of at least a two-foot layer of compacted soil with a hydraulic conductivity of no more than 1×10^{-7} cm/sec. The GM upper liner component

- must be installed in direct and uniform contact with the compacted soil or lower liner component.
- An alternative composite liner that meets the requirements of Section 257.70(c) of the rule:
 - An upper liner component consisting of a minimum 30-mil GM liner. GM components consisting of HDPE must be at least 60-mil thick.
 - A lower liner component that is not a geomembrane, with a liquid flow rate no greater than the liquid flow rate of two feet of compacted soil with a hydraulic conductivity of no more than 1×10^{-7} cm/sec. The preamble to the CCR Rule states that a GCL is the preferred option for the lower component of the alternative composite liner.

An existing CCR surface impoundment is considered an unlined CCR surface impoundment if either:

- The CCR impoundment is determined to not be constructed with a liner that meets the above requirements; or
- Insufficient documentation exists to confirm that the CCR impoundment is constructed with a liner that meets the above requirements.

Documentation of compliance with the liner requirements of Section 257.71(a)(1) of the CCR Rule must be placed in the facility operating record no later than October 17, 2016.

1.2 BBSSES Surface Impoundments Subject to CCR Rule Liner Design Criteria

The CCR Rule defines coal combustion residuals such as fly ash, bottom ash, boiler slag, flue gas desulfurization (FGD) materials (gypsum), and related solids generated from burning coal for the purpose of generating electricity by electric utilities and independent power producers. The liner design requirements of Section 257.71(a)(1) of the CCR Rule apply to all existing CCR surface impoundments.

The following existing surface impoundments at the BBSSES have been identified as CCR Units subject to the liner design requirements of Section 257.71(a)(1):

- North Bottom Ash Pond (NBAP); and
- South Bottom Ash Pond (SBAP).

The NBAP and SBAP (collectively “Bottom Ash Ponds” or “BAPs”) are located northwest of the BBSSES power plant (Figure 2). The NBAP and SBAP are located immediately adjacent to each other and share an interior earthen embankment. Due to their proximity to each other, the NBAP and SBAP are considered one CCR surface impoundment (identified as the “BAPs) under the CCR Rule.

2.0 DOCUMENTATION OF BAP LINER CONSTRUCTION

A compacted clay liner was installed in the NBAP and SBAP in 1989-1990. As-built engineering drawings dated February 8, 1991 showing details of the clay liner are reproduced in Appendix A (TXU, 1991). The as-built drawings for the BAPs were recertified in 1998 as part of a Texas Commission on Environmental Quality (TCEQ) industrial waste permit application (TUEC, 1998). Based on these as-built drawings, the clay liner installed in the ponds complied with the following specifications:

- Liner Type: Compacted Clay
- Liner Thickness: 3 feet
- Hydraulic Conductivity: $<1 \times 10^{-7}$ cm/sec
- Liquid Limit: >30
- Plasticity Index: >15
- Percent Passing No. 200 Sieve: >50

In addition, Luminant has periodically collected geotechnical samples of the clay liner when one of the BAPs is taken out of service for cleaning/inspection (QC, 2010a; QC, 2010b). Liner sample data from representative inspection reports has historically confirmed that the liner was at least 3 feet thick and the hydraulic conductivity was $<1 \times 10^{-7}$ cm/sec. In February 2014, a liner sample collected from the SBAP indicated the presence of unacceptable, coarser grained material in a small area of the liner on the east side of the pond. The material was removed and replaced with a minimum of 3 feet of compacted clay complying with the $<1 \times 10^{-7}$ cm/sec hydraulic conductivity specification (QC, 2014).

Based on this information, the liners installed in the NBAP and SBAP comply with the liner design criteria of Section 257.71(a)(1)(i) and the hydraulic conductivity requirements of Section 257.71(a)(2) of the CCR Rule. As a result, the BAPs are considered a lined CCR surface impoundment.

3.0 REFERENCES

Quality Consultants (QC), 2010a. Field Inspection Report – Luminant Big Brown South Bottom Ash Pond, February 1.

QC, 2010b. Field Inspection Report – Luminant Big Brown North Bottom Ash Pond, September 22.

QC, 2014. Field Inspection Report – Luminant Big Brown South Bottom Ash Pond, March 24.

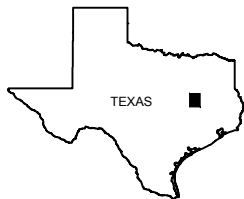
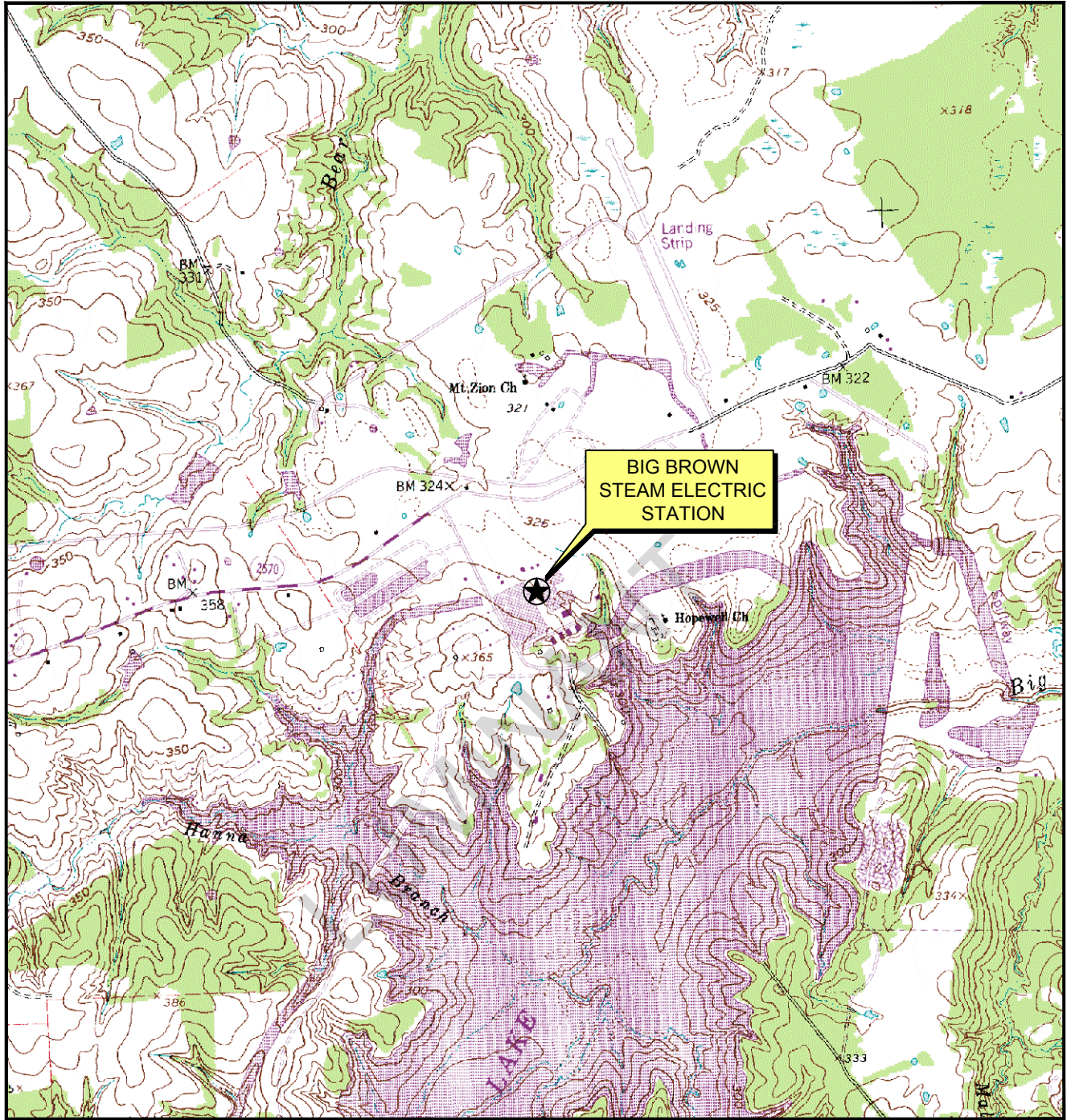
Texas Utilities Electric Company (TUEC), 1998. *Application for Permit to Receive and Process Non-Hazardous Solid Waste, Big Brown Steam Electric Station, Freestone County, Texas*. February.

TXU Electric Company (TXU), 1991. As-Built Engineering Drawings 119-1134-301-01, 119-1134-301-02, and 119-1134-301-03, Big Brown Steam Electric Station – Bottom Ash Ponds, February 8.

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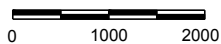
Figures



□ QUADRANGLE LOCATION



Scale in Feet



LUMINANT GENERATION COMPANY, LLC
BIG BROWN STEAM ELECTRIC STATION

Figure 1

SITE LOCATION MAP

PROJECT: 5196C

BY: ADJ

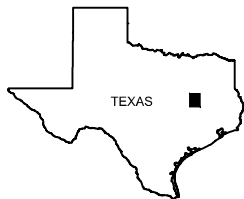
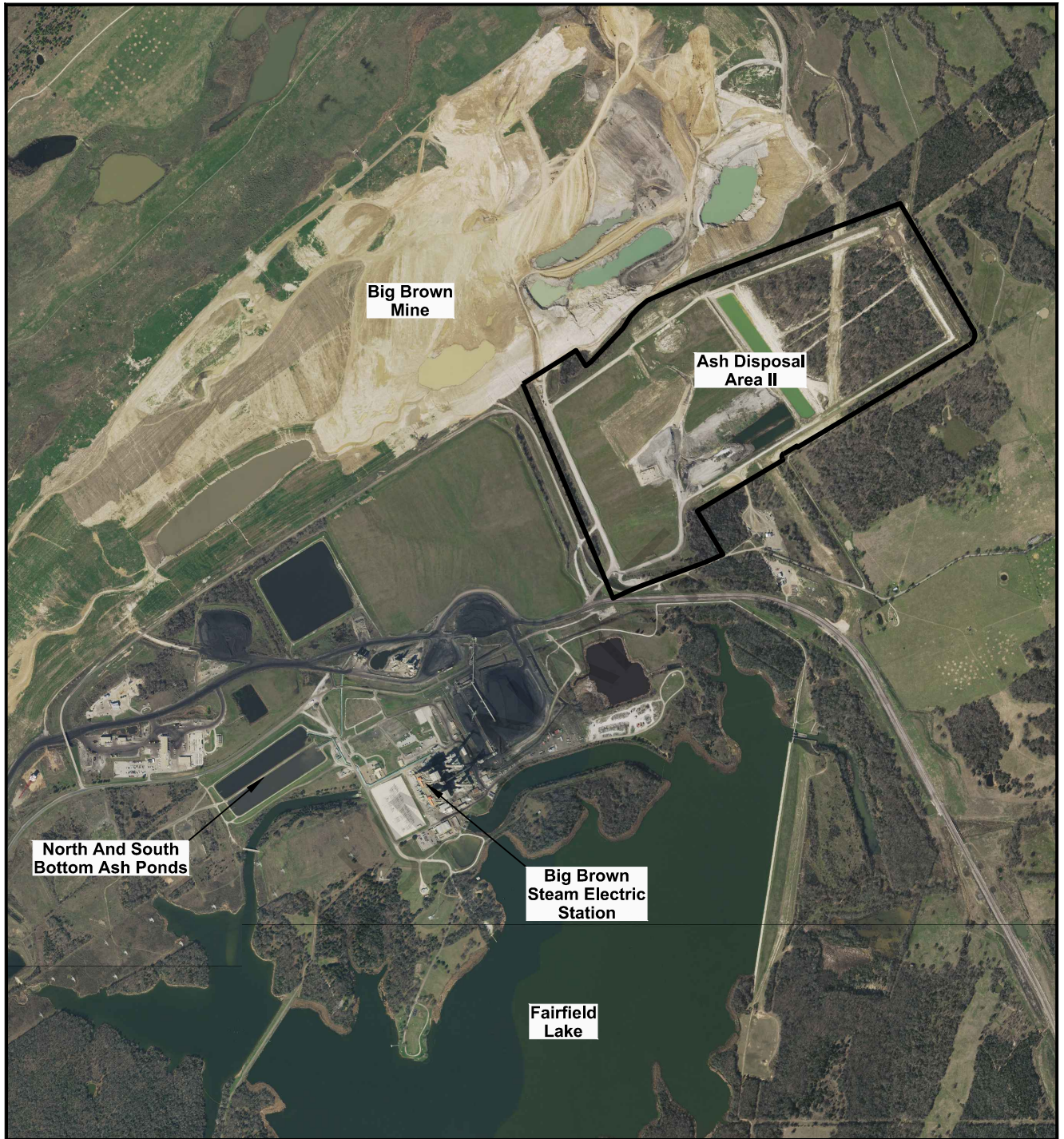
REVISIONS

DATE: APRIL, 2016

CHECKED: PJB

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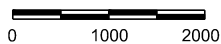
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 Base map from www.tnris.gov, Young, TX 15 min. USGS 1:250,000 quadrangle dated 1961,
 revised 1972.



PHOTOGRAPH LOCATION



Scale in Feet



LUMINANT GENERATION COMPANY, LLC
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Figure 2

SITE VICINITY MAP

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BY: ADJ

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DATE: OCT., 2016

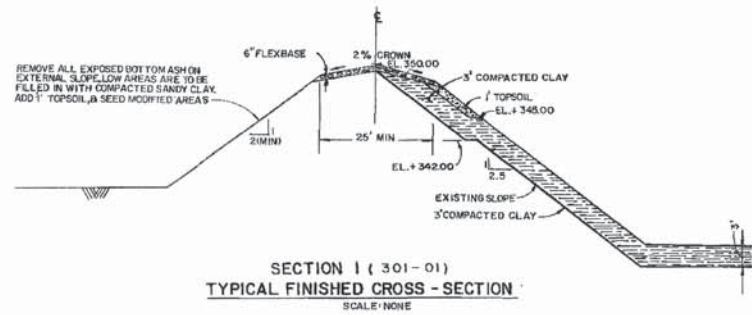
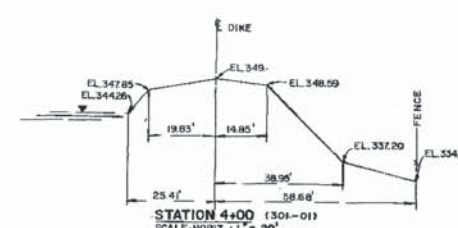
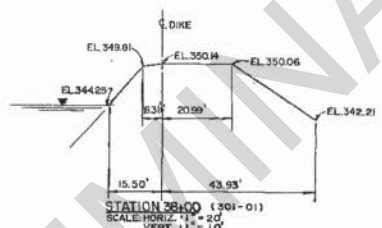
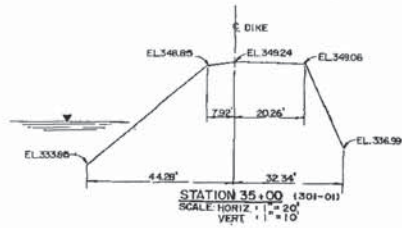
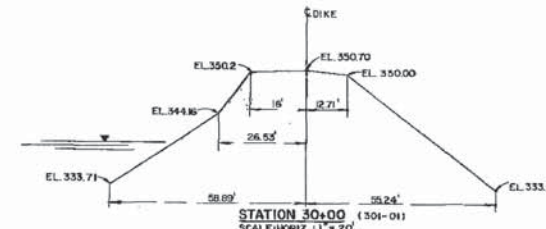
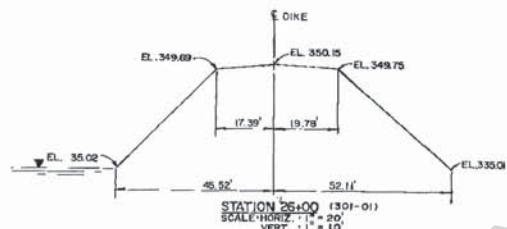
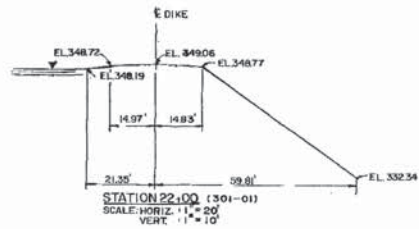
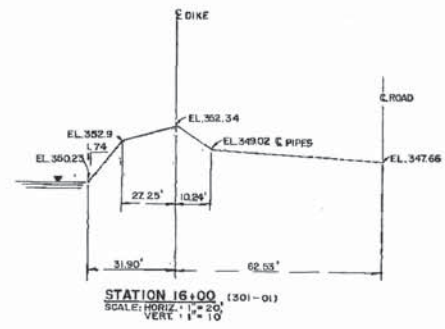
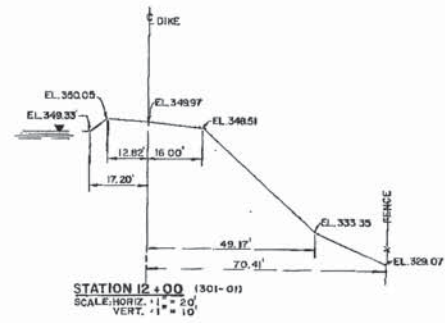
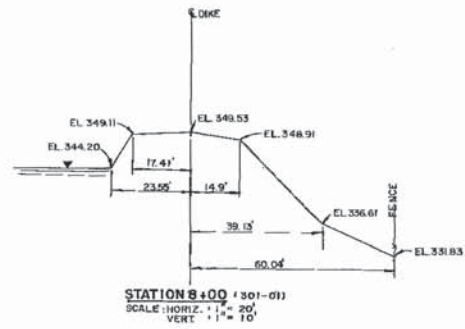
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SOURCE:
 Imagery from www.tnris.gov, Young, aerial photographs, 2015.

Appendix A

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SECTION 1 (301-01)
TYPICAL FINISHED CROSS-SECTION
SCALE: NONE

NOTES:
1. FOR GENERAL NOTES SEE DWG. 301-01

2 This document has been prepared by me or under my supervision and is being released for the purpose of ISM Permit Application under the authority of R.F. Vrie, JR., P.E. 53267 on 3/1/99.

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BIG BROWN S.E.S. UNITS 1, 2 & 3

BOTTOM ASH POND

3	04/09/99	ADDED LUMINANT LOGO	JMS	RBW	RBW	DESIGNED BY	WLR	APPROVED	<i>[Signature]</i>
2	3/1/99	ISSUED FOR TNRC ISM PERMIT APPLICATION LOG	JMS	RBW	RBW	DATE	2-1-89	SCALE	AS NOTED
1	1/1/99	AS-BUILT FOR PLO. 119-1134	JMS	RBW	RBW	DATE	2-1-89	SCALE	AS NOTED
0	2-1-89	FOR BIDS	JMS	RBW	RBW	DATE	2-1-89	SCALE	AS NOTED
REV.	DATE	DESCRIPTION	BY	CHK	APP	PROJECT NO.	119-1134-301	SHEET	03

THIS DRAWING CREATED ELECTRONICALLY