

**ANNUAL INSPECTION BY PROFESSIONAL ENGINEER  
CCR RULE, SECTION 257.83(b)  
EMPIRE DISTRICT ELECTRIC COMPANY  
ASBURY POWER PLANT  
EXISTING CCR IMPOUNDMENTS  
ASBURY, MISSOURI**

Prepared for:

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PROJECT NUMBER: 231518

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Empire District Electric Company

RE: Annual Inspection by Professional Engineer  
CCR Rule, Section 257.83(b)  
Empire District Electric Company  
Asbury Power Plant . Existing CCR Impoundments  
Asbury, Missouri  
PPI Project Number: 231518

To Whom it May Concern:


The attached Report presents the results of Palmerton & Parrish, Inc. (PPI) Annual Inspection of the levee embankments of the existing CCR Surface Impoundments at the Empire District Electric Company (Empire) Asbury Power Plant in Asbury, Missouri.


PPI has been involved with several projects at the Asbury Power Plant since 2011, and has been able to observe and study the condition of the existing CCR Surface Impoundments periodically throughout that time. Based upon historic information provided by Empire; PPI's professional training and experience; and PPI's observations and studies of Empire's Asbury CCR Impoundments, the Asbury CCR Impoundments were designed and constructed, and are operated and maintained, in general accordance with recognized and generally accepted good engineering standards.

Please contact PPI at our Springfield, Missouri headquarters at (417) 864-6000 if you have any questions regarding this Inspection Report. In accordance with CCR Rule Section 257.83, the next Annual Inspection by a Professional Engineer should be completed and published on or around January 18, 2017.

PALMERTON & PARRISH, INC.

By:

  
Rachel J. Goeke, P.E.  
Geotechnical Engineer



Submitted: One (1) Electronic .pdf Copy  
One (1) Bound Copy

BRP:RJG:TA/rjg:ta

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**ANNUAL INSPECTION BY PROFESSIONAL ENGINEER**  
**CCR RULE, SECTION 257.83(B)**  
**EMPIRE DISTRICT ELECTRIC COMPANY**  
**ASBURY POWER PLANT – EXISTING CCR IMPOUNDMENTS**  
**ASBURY, MISSOURI**

## **1.0 INTRODUCTION**

Palmerton & Parrish, Inc. (PPI) has been retained by the Empire District Electric Company (Empire) to assist with various compliance tasks related to the EPA's Coal Combustion Residuals (CCR) Rule. This Annual Inspection Report of Empire's existing CCR Impoundments at the Asbury Power Plant in Asbury, Missouri has been prepared in general accordance with the requirements of CCR Rule Section **257.83 Inspection requirements for CCR surface impoundments**, subpart (b) *Annual inspections by a qualified professional engineer*.

## **2.0 REVIEW OF AVAILABLE INFORMATION – CCR RULE SECTION 257.83(b)(i)**

PPI has worked on numerous Projects at the Asbury Power Plant throughout the years. Since 2010, PPI has been involved as the Geotechnical Engineer of Record for projects including the Asbury Environmental Retrofit, Asbury Office Building, Asbury Railroad Embankment Repair, and the Asbury Coal Ash Site Structural Assessment. Pertinent to the CCR Rule, PPI assisted Empire with preparation of a weekly inspection report form, and is coordinating monthly monitoring of the existing settlement monuments and piezometers at the CCR Impoundments.

PPI reviewed our internal files pertaining to Asbury's CCR Impoundments as part of this Levee Inspection Report. Information pertaining to the original design and construction of the Asbury CCR Impoundments is summarized in PPI's Report entitled "Coal Ash Site Structural Assessment Report", dated December 28, 2012. In general, the Asbury CCR Impoundments are subdivided into three (3) ponds: the Lower Pond, South Pond, and Upper Pond. The Upper Pond is subdivided into two (2) cells, identified as Upper Pond . A and Upper Pond . B.

Operating conditions at the Asbury Power Plant have changed considerably since PPI's 2012 Report, as Empire transitioned to a dry hauling system when the Asbury Environmental Retrofit Project was commissioned in November 2014. The amount of impounded water has decreased significantly since 2012, and the volume of stored CCR has increased in correlation to the volume of CCR byproduct that has been produced and stored in the CCR Impoundments since that time.

### **3.0 VISUAL INSPECTION – CCR RULE SECTIONS 257.83(b)(ii) AND (iii)**

PPI completed a visual inspection of the CCR levee impoundments and hydraulic structures in general accordance with the requirements of CCR Rule Sections 257.83(b)(ii) and 257.83(b)(iii). The completed Levee Inspection Form is included in Appendix I.

The initial levee inspection was completed by Mr. Taylor Anderson, E.I. on December 14 and 15, 2015. Mr. Anderson prepared a draft Levee Inspection Report, which was reviewed by Ms. Rachel Goeke, P.E. Ms. Goeke, P.E. visited the Asbury CCR Impoundments on January 14, 2016, observed existing conditions, and confirmed Mr. Anderson's observations.

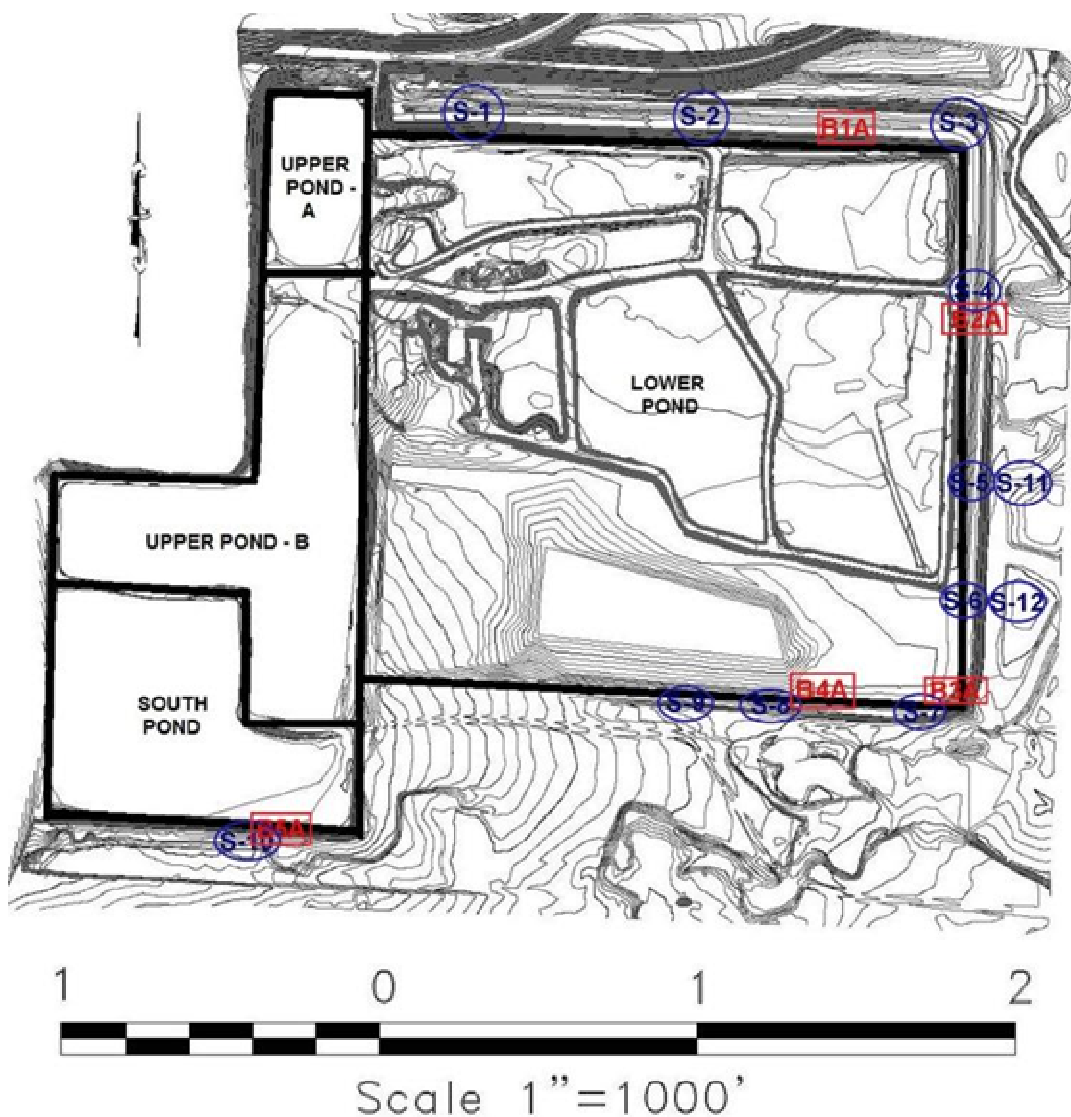
### **4.0 CCR RULE SECTION 257.83 (2) INSPECTION REPORT**

Section 257.83(2) lists specific information that is required in the Inspection Report. This entire Report document, including Appendix I constitutes the Inspection Report for the purposes of the CCR Rule. The requirements of Section 257.83(2) are summarized in the list below, along with supplemental information as appropriate.

#### **1. Changes in impoundment structure geometry since the previous annual inspection:**

The last formal inspection of the CCR Impoundments, by a licensed third-party Professional Engineer, was completed in 2012. Since that time, the geometry of the perimeter levee impoundment embankments is essentially unchanged. Additional CCR has been placed within portions of the Lower Pond, typically resulting in decreased interior embankment height and more gradual side slopes for the interior embankments.

2. Locations and type of any existing instrumentation and the maximum recorded readings of each instrument since the previous annual inspection: Existing instrumentation pertinent to structural stability at the Asbury CCR Impoundments includes five (5) groundwater piezometers and twelve (12) settlement monuments. This instrumentation has been monitored monthly since October 2015, in accordance with Section 257.83(a) of the CCR Rule. The general configuration of the CCR Impoundments and the approximate locations of the instrumentation are shown in the figure below.



Water level readings in the piezometers have been relatively stable since they were installed in 2012. The settlement monuments have also been stable since they were

installed in 2012. SM-1 was disturbed by truck traffic shortly after installation. The tables below summarize baseline and recent readings for the piezometers and settlement monuments.

<b>Table 4.0-1 - Piezometer Groundwater Level Readings, by PPI</b>									
<b>Piezometer</b>	<b>Rim Elev.</b>	<b>Water Elevation</b>							
		3/7/12	4/18/12	5/15/14	8/13/14	10/1/15	11/5/15	12/4/15	1/4/16
B1-A	932.35	929.52	929.52	929.81	931.35	-	920.89	925.01	927.22
B2-A	931.87	929.37	929.87	929.45	-	929.42	929.44	930.74	930.77
B3-A	931.2	924.7	927.7	925.53	926.8	-	923.35	926.32	927.5
B4-A	932.15	925.82	928.48	926.6	928.63	922.97	926.28	928.19	928.94
B5-A	956.22	948.22	948.39	948.42	947.82	946.47	948.9	949.03	949.13

<b>Table 4.0-2: Settlement Monument Readings, by AMA</b>						
<b>Settlement Monument</b>	<b>Elevation (ft.), on Surveyed Date</b>					
	5/25/12	5/13/14	9/29/15	10/28/15	11/24/15	12/31/15
SM-1	929.17	929.26	929.23	929.27	929.26	929.29
SM-2	929.13	929.16	929.16	929.17	929.16	929.19
SM-3	927.39	927.44	927.40	927.46	927.44	927.46
SM-4	930.65	930.69	930.68	930.70	930.67	930.69
SM-5	930.91	930.94	930.94	930.94	930.97	930.93
SM-6	931.05	931.05	931.05	931.06	931.04	931.05
SM-7	931.95	931.95	931.95	931.95	931.94	931.96
SM-8	931.77	931.75	931.76	931.75	931.75	931.76
SM-9	933.86	933.89	933.87	933.87	933.87	933.86
SM-10	956.38	956.39	956.41	956.41	956.44	956.40
SM-11	926.33	926.36	926.37	926.37	926.35	926.36
SM-12	926.69	926.67	926.66	926.68	926.66	926.67
* SM-1 was disturbed by truck traffic shortly after installation.						

3. Approximate minimum, maximum, and present elevation of impounded water and CCR since the previous annual inspection: Empire typically maintains the impounded water elevation within the Upper Pond and South Pond at approximately 953 feet. The Upper Pond and South Pond can be cut off from each other, but are typically hydraulically connected. Empire has the capability to pump the water level down, but typically leaves it high for operating purposes.



The maximum impounded water elevation in the Lower Pond is controlled by the spillway elevation, which is 930.35 feet. Normal pool elevation of the Lower Pond is maintained around 928.8 feet, and maximum pool during overflow is 931.5 feet.

Maximum impounded water elevations are generally unchanged since PPI's 2012 Report. There is a considerably smaller volume of impounded water in the Lower Pond due to changes in Empire's operating practices.

The CCR elevation within the Lower Pond is variable, as the interior dike embankments are typically constructed of CCR. The maximum elevation of the interior dikes is on the order of 950 feet near the north end of the Lower Pond. The top surface of the area where Empire is actively filling is on the order of 947 to 948 feet. The uppermost elevation of the CCR within the southern third of the Lower Pond is around 943 feet, after which it drops off to form the bottom of the water impoundment at the south end of the Lower Pond.

CCR elevations are largely unchanged since 2012, with the exception of the additional CCR that has been placed within the active filling area of the Lower Pond. Filling of this area has resulted in increased buttressing of interior CCR dikes, and generally flatter conditions.

4. The storage capacity of the impounding structure at the time of the inspection:  
Conservatively, the remaining storage capacity at the Asbury CCR Impoundments is estimated to be approximately 900,000 cubic yards. This storage capacity estimate is based upon topographic survey data collected during 2012; baseline computations made in 2012; and periodic estimates of CCR production and placement volumes provided by Empire. The computation of storage capacity is based upon the following assumptions: (1) no CCR is placed in the Upper Pond, South Pond, or standing water portion of the Lower Pond; and (2) the maximum fill line, or finished ground surface elevation, was assumed to be approximate elevation 959.25 feet.

5. The approximate volume of impounded water and CCR at the time of the inspection:  
The approximate volume of impounded CCR is 2,130,000 cubic yards. This volume

was computed using data from PPI's 2012 studies and the approximate volume of CCR placed since that time.

Estimation of the volume of impounded water is difficult. Empire does not have good topographic survey information pertaining to the bottom elevations of the Upper Pond, South Pond, or Lower Pond.

As a generalized estimate only, PPI computed the approximate volume of impounded water as:

- The surface area of the Upper Pond (approximately 700,000 square feet mid-interior slope) multiplied by an approximated average depth of water (Elev. 953.5 ft. minus 930 ft. = 23.5 ft) equals 16,450,000 cubic feet;
- Plus the surface area of the South Pond (approximately 435,000 square feet mid-interior slope) multiplied by an approximated average depth of water (Elev. 953.5 ft. . Elev. 942 ft. = 11.5 ft.) equals approximately 5,000,000 cubic feet;
- Plus the surface area of the impounded water portion Lower Pond (approximately 164,000 square feet mid-interior slope) multiplied by an approximated average depth of water (Elev. 930 ft. . Elev. 926 ft. = 4 ft.) equals approximately 656,000 cubic feet.

The resultant computed volume of impounded water is approximately 22,000,000 cubic feet.

6. Any appearances of an actual or potential structural weakness of the CCR unit, in addition to any existing conditions that are disrupting or have the potential to disrupt the operation and safety of the CCR unit and appurtenant structures: Evidence of structural weakness was not observed at the time of the inspection. There are several areas where water has established a channel at the levee crest. These channels are vegetated and are not actively eroding. Empire's maintenance staff is proactively monitoring the levee embankments for increased erosion.

7 Any other change(s) which may have affected the stability or operation of the impounding structure since the previous annual inspection: The condition of the Asbury CCR Impoundments is largely unchanged since PPI's 2012 studies. There is less

impounded water and more solid CCR in place, which should be a benefit to the overall stability of the CCR Impoundments.

## **5.0 REPORT LIMITATIONS**

This report has been prepared in accordance with generally accepted practices of other consultants undertaking similar studies at the same time and in the same geographical area. Palmerton & Parrish, Inc. (PPI) observed that degree of care and skill generally exercised by other consultants under similar circumstances and conditions. PPI's findings and conclusions must be considered not as scientific certainties, but as opinions based on our professional judgment concerning the significance of the data gathered during the course of this investigation. Other than this, no warranty is implied or intended.

**APPENDIX I**  
**LEEVE INSPECTION FORM**

**LEVEE INSPECTION FORM****Date:** 12/14-15-15 (TA)

1/14/16 (RG)

**Inspection By:** Taylor Anderson, E.I., PPI

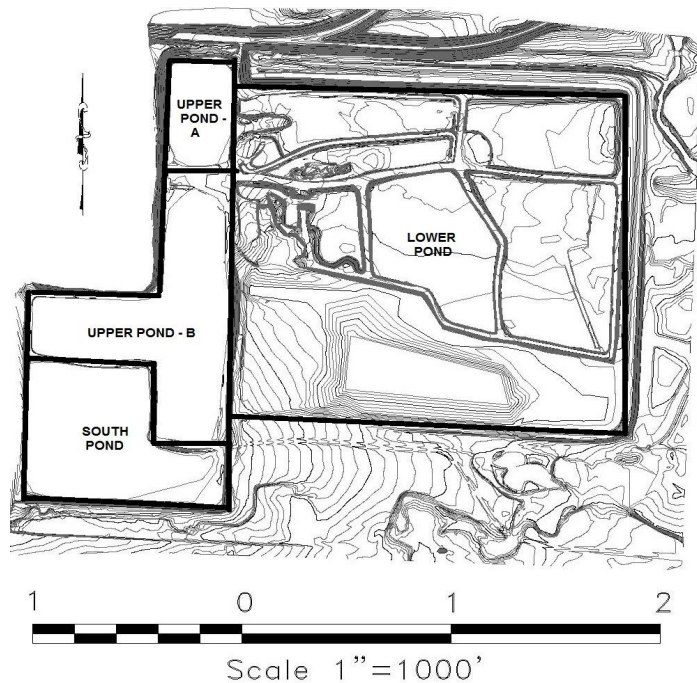
Rachel Goeke, P.E., PPI

**Dam Name:** Asbury Power Plant

CCR Impoundment Levees

**Dam Location:** Asbury Missouri

Jasper County

**Weather:** Sunny**Temperature:** 49 deg & 67 deg

**Notes / Instructions:** Reference previous Annual Levee Inspection prior to commencement of field work. Observe entire perimeter levee of East and West Ponds. Use a separate checklist form for each Pond and/or levee embankment length as appropriate.

Summarize Overall Condition of Levee Embankments: Overall, the perimeter levees of the Upper Pond - A & B, South Pond and Lower Pond appear to be in good condition. A small area of shallow sloughing or past erosion was observed along the northern exterior levee of Upper Pond - A, but was very minor. No other evidence of shallow sloughing or seepage was observed. Areas of active erosion were not noted. Animal burrows were not found within the Upper Pond - A & B, South Pond or Lower Pond Levees at the time of inspection.

Summarize Areas of Concern / Recommended Action Items: The small area of shallow sloughing should be remediated located along the northern exterior levee of the Upper Pond. In addition, any animal burrows found, if present during weekly inspections, should be remediated. Areas where water has established a channelized conditions should be monitored.

**LEVEE INSPECTION FORM**

Checklist Pg. 1 of 2

ITEM	YES	NO	REMARKS
1. CREST			
a. Any visual Settlement?		X	
b. Misalignment?		X	
c. Cracking?		X	
2. INTERIOR LEVEE SLOPES			
a. Adequate grass cover?	X		
b. Any erosion?		X	
c. Trees growing on slope?		X	
d. Longitudinal cracks?		X	
e. Transverse cracks?		X	
f. Adequate rip rap protection?	X		
g. Visual depressions or bulges?		X	
h. Visual Settlements?		X	
j. Debris or trash present?		X	
3. EXTERIOR LEVEE SLOPES			
a. Adequate grass cover?	X		
b. Any erosion?		X	
c. Trees growing on slope?		X	
d. Longitudinal cracks?		X	
e. Transverse cracks?		X	
f. Visual depressions or bulges?		X	
g. Visual Settlements?		X	
h. Debris or trash present?		X	
i. Boils or seepage at toe?		X	
j. Seepage on slope face?		X	
k. Soft or spongy zones?		X	

**LEEVE INSPECTION FORM**

Checklist Pg. 2 of 2

ITEM	YES	NO	REMARKS
4 SPILLWAY OUTLET			
a. Is the conduit concrete?	X		
b. Do concrete surfaces show:			
(1.) Spalling?		X	
(2.) Cracking?		X	
(3.) Erosion?		X	
(4.) Scaling?		X	
(5.) Exposed Reinforcement?		X	
(6.) Other?		X	
c. Do the joints show:			
(1.) Displacement or offset?		X	
(2.) Loss of joint material?		X	
(3.) Leakage?		X	
d. Is the conduit metal?		X	
(1.) Corrosion present?		X	
(2.) Protective coatings adequate?		X	
(3.) Leakage?		X	
e. Seepage around the conduit?		X	
5 DITCHES / SITE DRAINAGE	X		
a. Describe ditch function:			Drainage channels around site perimeter
b. Are ditches free of debris?	X		
c. Is adequate erosion protection present at the toe of slope around the perimeter?	X		
6 PHOTOGRAPHS TAKEN:	X		
7 INSTRUMENTATION IN TACT:	X		Monitoring wells are present throughout Lower Pond