STRUCTURAL STABILITY ASSESSMENT REPORT

PONDS 1 & 2, JR WHITING PLANT
ERIE, MICHIGAN

OCTOBER 13, 2016

PREPARED FOR:
CONSUMERS ENERGY COMPANY

Mannik Smith GROUP

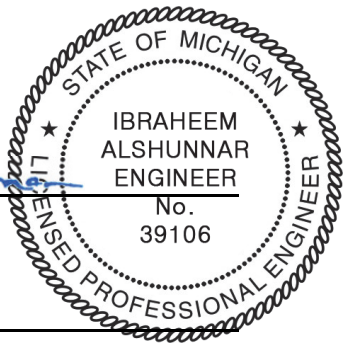
TABLE OF CONTENTS

CERTIFICATION

Professional Engineer Certification Statement [40 CFR 257.73(b)]

I hereby certify that, having reviewed the attached documentation and being familiar with the provisions of Title 40 of the Code of Federal Regulations 40 CFR Part 257.73(d)), I attest that this Structural Stability Assessment is accurate and has been prepared in accordance with good engineering practices, including the consideration of applicable industry standards, and with the requirements of 40 CFR Part 257.73(d).

The Mannik Smith Group, Inc.



Ibraheem Shunnar
Signature

October 13, 2016
Date of Report Certification

Ibraheem Shunnar, PE
Name

6201039106
Professional Engineer Certification Number

1.0 INTRODUCTION

On April 17, 2015, the United States Environmental Protection Agency (EPA) issued the Coal Combustion Residual (CCR) Resource Conservation and Recovery Act (RCRA) Rule (40 CFR 257 Subpart D) ("CCR RCRA Rule") to regulate the beneficial use and disposal of CCR materials generated at coal-fired electrical power generating complexes. In accordance with the CCR RCRA Rule, any CCR surface impoundment or CCR landfill that was actively receiving CCRs on the effective date of the CCR RCRA Rule (October 19, 2015) was deemed to be an "Existing CCR Unit" on that date and subject to self-implementing compliance standards and schedules. Consumers Energy identified two CCR surface impoundments at the JR Whiting Generating Facility (JR Whiting) located in Erie, Michigan:

- Ponds 1 & 2 (Existing CCR surface impoundment)
- Pond 6 (Inactive CCR surface impoundment)

The CCR RCRA Rule requires that existing CCR surface impoundments meeting the requirements of Section 257.73(b) conduct initial and periodic structural stability assessments in accordance with Section 257.73(d), and safety factor assessments in accordance with Section 257.73(e). This report provides the initial structural stability assessment for Ponds 1 & 2. The factor of safety assessment is submitted under a separate cover.

2.0 SITE DESCRIPTION AND BACKGROUND

JR Whiting is a coal-fired power generation facility located in Erie, Michigan as presented on Figure 1 – Site Location Map. JR Whiting formerly operated coal-burning baseload units but ceased electrical generation on April 15, 2016. Ponds 1 & 2 as presented in Figure 2 – General Site Plan, served two primary functions:

- Received outflow of bottom ash for primary detention and settlement
- Received intermittent sluiced fly ash and low-volume wastewater from the generating facility for detention and settlement.

The two ponds comprising the CCR surface impoundment are no longer receiving CCRs from an active power generating plant but are managing stormwater run-on (non-CCR wastewater) per the Site National Pollutant Discharge Elimination System (NPDES) Permit. The pond system is underlain by clay soils and contained by a perimeter dike which has, generally, a 20-foot wide crest and a crest elevation of about 590.1 (NAVD88). The perimeter dikes are designed and constructed of native materials and historic coal ash beneficially reutilized as fill. The crest of the dike structure is graded to allow flow of stormwater from the crest into the ponds. The elevation of water in Ponds 1 & 2 is about 584 ft. (NAVD88).

Hydraulically, Ponds 1 & 2 is interconnected by a subsurface pipe. Any discharge from Ponds 1 & 2 is combined in Pond 1 and routed through permitted National Pollutant Discharge Elimination System (NPDES) Outfall 001B into the forebay. This discharge pipe was grouted on May 24, 2016.

Based on previous investigations including borings completed along the perimeter dike and within the ponds, the site is underlain by layers of soft to medium stiff clay underlain by layers of stiff to hard clay.

A hazard potential classification was conducted for Ponds 1 & 2 pursuant to Section 257.73, which resulted in a significant hazard classification. As a result of the hazard classification potential, the 1000-year flood elevation (enter elevation) NAVD88 was used in the models to prepare this report.

3.0 PREVIOUS STABILITY ASSESSMENTS

Several investigations, assessments and inspections were completed to assess the structural stability of Ponds 1 & 2. A list of documents related to Ponds 1 & 2 that were reviewed for the structural stability assessment is provided in Table 1. Based on our review, there is no evidence of structural deficiencies at Ponds 1 & 2. A brief summary of the previous assessments is provided below.

In 2009, a dike inspection and a potential mode failure analysis (PMFA) were completed for the Ponds 1 & 2. The inspection and the PMFA provided operational and maintenance recommendations and recommended the completion of additional stability analysis. As a follow up to these recommendations, CEC developed a Surveillance Monitoring Program (SMP) and contracted NTH Consultants to complete additional stability evaluations. The results of these evaluations indicated that the existing slopes have adequate factor of safety. In 2012, 2014, and 2015 dike assessments were completed by AECOM, Barr Engineering, and Golder Associates, respectively. These assessments provided additional maintenance and operational recommendations regarding erosion, vegetation, animal burrows and the potential for seepage along the west slope of Pond 2, among others. Following these assessments, CEC updated the SMP. None of these studies identified any structural deficiencies that will require immediate action or repair.

TABLE 1
SUMMARY OF BACKGROUND DOCUMENT REVIEW

No	DOCUMENT	DATE	AUTHOR
1	Weekly Inspection Reports	11/2015-09/2016	Consumers Energy Company J.R. Whiting Generating Facility Qualified Persons
2	J. R. Whiting Ponds 1 and 2 - Annual RCRA CCR Surface Impoundment Inspection Report	10/2016	Mannik Smith Group, Inc.
3	J. R. Whiting Ponds 1 and 2 - Annual RCRA CCR Surface Impoundment Inspection Report	01/2016	Golder Associates, Inc.
4	Fossil Fuel Generation, Solid Waste Disposal Area - Surveillance Monitoring Programs (SMPs)	12/2010, Revised 2015	Consumers Energy Company
5	J.R. Whiting Ash Disposal Area Triennial Ash Dike Assessment Report – Spring 2014	12/2014	Barr Engineering Company
6	J.R. Whiting Ash Disposal Area, 2012 Ash Dike Risk Assessment Final Inspection Report	07/2012	AECOM Technical Services, Inc.
7	Dam Safety Assessment of CCW Impoundments J.R. Whiting Plant	06/2011	USEPA, O'Brien and Gere Engineers, Inc.
8	Slope Stability Analysis, Ponds 1,2 and 6, J,R. Whiting Ash Disposal Facility	11/2011	NTH Consultants
9	J.R. Whiting Generating Facility Ash Dike Risk Assessment, Inspection Report	12/2009	AECOM, Inc.
10	J.R. Whiting Generating Facility Ash Dike Risk Assessment, Potential Failure Mode Analysis (PFMA) Report	December 2009	AECOM Technical Services, Inc.

4.0 STRUCTURAL STABILITY ASSESSMENT

40 CFR 257.73(d)(1) of the CCR RCRA Rule requires conducting an initial and periodic structural stability assessments by a qualified professional engineer to document whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater that can be impounded therein. The following sections provide documentation on the initial structural stability assessment and rely mainly on the current and historic annual inspections performed at the site as well as the weekly field inspections performed by Consumers Energy Company (CEC). The complete summary for the 2016 inspection is provided under a separate report. Field inspection observations focus on structural failure mechanisms including erosion, beaching, seepage, slides/sloughing, settlement, structural movement, and cracks.

4.1 Foundations and Abutments

No certified documents were available on the original construction of the embankments or the conditions of the foundations and abutments. Recent investigations revealed that the foundation soils consist of stable native clay soils. There has been no indication of foundational or abutment instability in recent or historic site inspections and recent assessments and stability evaluations indicated that the foundations of Ponds 1 & 2 are stable. Therefore, the foundation soils and abutments are considered stable.

4.2 Slope Protection

Water surface elevations can vary in Lake Erie due to wind setup and storms. Moderate size waves have been observed by plant personnel in the event of a strong easterly wind but no observations have been made of waves reaching the perimeter dikes. The eastern face of the ponds is protected through vegetation and riprap that consist primarily of concrete debris. Additionally, the slopes are inspected weekly for erosion, signs of seepage, animal burrows, sloughing, and vegetation condition that could negatively impact the embankment. The 2016 Annual Inspection Report did not identify items relating to slope protection that required investigation or repair. The existing slope protection measures are considered adequate to provide protection against surface erosion, wave action, and adverse effects of sudden drawdown.

4.3 Dikes (Embankment)

No certified documents were available on the original construction of the embankments or the conditions of the foundations and abutments. It is believed that the perimeter dike was constructed with standard earthwork equipment and compacted and/or proof rolled before subsequent lifts were placed based on the compact relative density of the CCR material generally observed from Standard Penetration Test (SPT) sampling during recent subsurface investigations. Results of the stability analysis as well as inspections indicated that the existing dikes have adequate factor of safety and do not exhibit signs of instability. Based on the relative density of the material encountered during the investigations, historic inspections, recent observations, and results of the stability analysis; the embankment dikes are considered stable.

4.4 Vegetated Slopes

The EPA has vacated the requirement that vegetative cover on surface impoundment dikes be maintained at no more than six inches. A new rule establishing requirements relating to the use of vegetation as slope protection for CCR surface impoundments is still pending. However, at the time of the most recent inspection completed by MSG, large woody vegetation was removed and vegetation was removed to allow inspection of the CCR unit.

4.5 Spillways

There are no spillways on the CCR surface impoundments. Flow is conveyed between ponds via an interconnected subsurface pipe.

4.6 Hydraulic Structures

The ponds are interconnected by a subsurface pipe. There is only one pipe that crosses the external dikes at the western side but it has been grouted since May 24, 2016.

4.7 Downstream Slopes Adjacent to Water Body

The east side of Ponds 1 & 2 borders Lake Erie. The south side of Ponds 1 & 2 borders the discharge channel, which discharges into Lake Erie. The top of dike elevation is about 590.1 (NAVD88). Based on the US Army Corps of Engineers, the 100 and 500 year flood elevations for Lake Erie in the vicinity of the JR Whiting Plants are 577.5 ft. and 578.4 ft. (NVAD88), respectively. On that basis, it is anticipated that a 1000 year flood elevation in Lake Erie will not cause flooding of the ponds.

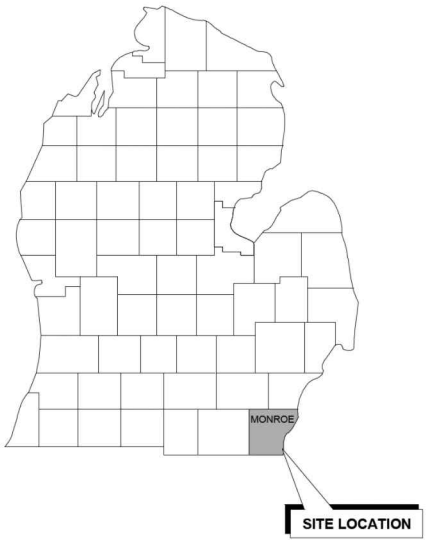
The flood control system evaluation submitted under a separate cover revealed that the ponds have the capacity to manage a 24 hour/1000 year storm without flooding. In addition, the factor of safety assessment submitted under a separate cover indicated that the downstream slope for Ponds 1 & 2 has adequate factor of safety under extreme water conditions including low lake levels and high levels in the pond as well as sudden draw down conditions.

Furthermore, the slope has adequate protection and did not reveal any sign of erosion or instability. On that basis, the downstream slope adjacent to Lake Erie has adequate structural stability.

5.0 STRUCTURAL STABILITY DEFICIENCIES

Based on the 2016 site inspection, structural stability assessment contained herein and the safety factor assessment report prepared by Mannik Smith Group and dated October 13, 2016, no structural stability deficiencies were identified.

FIGURES



MONROE COUNTY

NOT TO SCALE

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

FIGURE 1

SITE LOCATION MAP

PONDS 1 & 2
JR Whiting Generating Facility
Erie, Monroe County, Michigan

DATE	DRAWN BY	DESIGNED BY	PROJECT NO.
9/30/2016	RAR	ISS	C1790015

9/30/2016 2:36:49 PM
W:\Projects\Projects A-E\C1790015\CAD\BASE\Pond 1&2\BASE\C1790015_Exhibits_MIF.dgn

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

FIGURE 2

GENERAL SITE PLAN

PONDS 1 & 2
JR Whiting Generating Facility
Erie, Monroe County, Michigan

DATE	DRAWN BY	DESIGNED BY	PROJECT NO.
9/30/2016	RAR	ISS	C1790015

9/30/2016 3:16:50 PM
W:\Projects\Projects A-E\C1790015\CAD\BASE\Pond 1&2\BASE\C1790015_Exhibits_MIF.dgn