LOCATION RESTRICTION EVALUATION
U.S. EPA COAL COMBUSTION RESIDUAL RULES

COAL ASH PONDS
ELMER SMITH STATION
DAVIESS COUNTY
OWENSBORO, KENTUCKY

Prepared for:

OWENSBORO MUNICIPAL UTILITIES
OWENSBORO, KENTUCKY

Prepared by:

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
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CEC Project 164-014.0016

OCTOBER 2018

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FIGURES

1.0 OBJECTIVE

The United States Environmental Protection Agency (USEPA) issued 40 Code of Regulations (CFR) 257, Subpart D, *Disposal of Coal Combustion Residuals from Electric Utilities* (CCR Rule) dated April 17, 2015. The CCR Rule regulates disposal of coal combustion residuals (CCR) in new and active landfills and surface impoundments.

On behalf of Owensboro Municipal Utilities (OMU), Civil & Environmental Consultants, Inc. (CEC) has evaluated the Location Restrictions for the Elmer Smith Station (ESS) Coal Ash Ponds as required by the CCR Rule. The Coal Ash Ponds are classified as an existing CCR surface impoundment by definition in §257.53. §257.60 through §257.64 require the following Location Restrictions be evaluated for an existing CCR surface impoundment:

- §257.60 - Placement above the uppermost aquifer
- §257.61 - Wetlands
- §257.62 - Fault areas
- §257.63 - Seismic impact zones
- §257.64 - Unstable areas

The applicable sections of §257.60 through §257.64 are presented in Sections 3.0 through 7.0, respectively. The regulation is stated in bold, italic font. The responses follow each section of the rule and are provided in normal font.

A qualified professional engineer must certify compliance with the Location Restrictions and is provided in Section 8.0.

2.0 SITE DESCRIPTION

The Ash Pond area associated with the ESS is less than 10 acres in size and consists of three separate unlined ash settling basins (Ponds 1, 2, and 3). A site location map and a site and vicinity aerial map showing the location of the Ash Ponds are provided as Figures 1 and 2, respectively. The basins are not used for the disposal of CCR but for the temporary storage of CCR material prior to being excavated and transported off-site for disposal or beneficial re-use. Pond 1 is used for Unit 1 boiler slag; Pond 2 receives other ash and water plant blowdown (lime softening sludge); and, Pond 3 receives no ash directly and is used for final settling prior to discharge. Other plant discharges, including coal pile runoff, Flue Gas Desulfurization (FGD) blowdown, roof and floor drains, etc. are also conveyed through the ponds. Based on a review of aerial images, contour data from the USGS National Map, Owensboro East Quadrangle, and a site map prepared by others labeled "Structural Fill Finish Grading" dated August 28, 1962[1], the Ash Ponds appear to be incised in the native soils to a depth of approximately 8 feet below ground surface (bgs). This was confirmed through knowledge of site personnel.

[1] Drawing No. S-7 "Structural Finish Grading", prepared by Black & Veatch, dated August 28, 1962.

3.0 §257.60 REQUIRED ISOLATION FROM UPPERMOST AQUIFER

3.1 §257.60 RULE DESCRIPTION

40 CFR §257.60(a) states:

(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must be constructed with a base that is located no less than 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table).

3.2 INFORMATION REGARDING RULE COMPLIANCE

3.2.1 Hydrogeologic and Uppermost Aquifer Descriptions

CEC assisted OMU with the design and installation of a permanent Groundwater Monitoring System (GMS) network to comply with the GMS performance standard contained within the Federal CCR Rule (Section 257.91), as documented in the GMS Certification Report dated October 17, 2017. Based on the hydrogeologic information obtained during a Preliminary Hydrogeologic Investigation conducted in December 2016 and during the installation of the permanent GMS wells, subsurface conditions encountered are consistent with Quaternary-aged alluvium, and buried outwash (Tazewell age) typically found within the Ohio River Valley[2]. Variable thicknesses of fine-grained silt and clay lenses are interbedded with deposits of coarser-grained, poorly-graded sand beneath a thin veneer of topsoil, crushed stone fill, or other fill material. The near-surface fine-grained deposits are thicker near the Ohio River, and decrease in thickness away from the river towards the southeast, where sand becomes the predominant soil type. A low permeability clay layer was encountered at depths ranging from 26 to 43 feet bgs, varying in thickness from approximately 1 foot to over 16 feet, with an increasing trend in the thickness of this layer towards the south/southeast. The clay layer is underlain by saturated, coarse-grained deposits that comprise the uppermost aquifer at the site. Aquifer saturated thickness in the vicinity of the site ranges from approximately 60 to 100 feet[2]. Based on the depth

[2] *Geohydrology and Simulation of Ground-Water Flow for the Ohio River Alluvial Aquifer near Owensboro, Northwestern Kentucky.* U.S. Geological Survey Water-Resources Investigation Report 96-4274. 1997. Figure 7.

to groundwater and the depth of the Ash Ponds, it does not appear that groundwater is in direct communication with the Ash Ponds. Refer to the GMS Certification Report for a geologic cross-section and boring logs for the site.

Groundwater occurs within the coarse-grained deposits that constitute the uppermost aquifer at the site. Depth to water measurements, which were collected on a monthly basis during 2017 and during April and June of 2018, have ranged from 74.31 feet below top of casing (BTOC) at MW-7 to 40.68 feet BTOC at MW-1. Static groundwater elevations on-site have ranged from 346.80 feet above mean sea level (AMSL) at MW-7 to 364.75 feet AMSL at MW-3. The normal pool elevation of the adjacent Ohio River in the vicinity of ESS is approximately 358 feet AMSL[3]. Potentiometric data for the October 10, 2017, groundwater monitoring event are shown on Figure 3.

Groundwater elevation measurements haven been consistent and indicate that the groundwater flow direction is to the southeast at an approximate average hydraulic gradient of 0.004. This flow direction is contrary to the hydrogeologic setting where groundwater flow is typically towards the Ohio River. The southeasterly flow direction is interpreted to be a result of the pumping influence from the 11 nearby water production wells (Figure 2) associated with municipal water production operations at OMU's Cavin Water Treatment Plant, which has a capacity of up to 10 million gallons per day. Between the Cavin Plant and Water Plant A, which is located west of the Cavin Plant and draws from the same well field, OMU's total treatment capacity is 28 million gallons per day. Absent operation of the production wells, groundwater flow direction is likely to the northwest towards the Ohio River; however, some combination of pumping wells is always in operation and the observed groundwater levels measured since the installation of the GMS indicate a southeasterly groundwater flow direction.

Hydraulic conductivity of the uppermost aquifer was not evaluated as part of the GMS installation process; however, based on published scientific reports, the site is located in an area where horizontal hydraulic conductivity values are estimated to range from 126 to 157 feet per day[4].

[3]Ohio River Navigation Charts from Cairo, Illinois to Foster, Kentucky (June 2010). U.S. Army Corps of Engineers, Louisville District. Chart No. 53.
[4]*Geohydrology and Simulation of Ground-Water Flow for the Ohio River Alluvial Aquifer near Owensboro, Northwestern Kentucky.* U.S. Geological Survey Water-Resources Investigation Report 96-4274. 1997. Figure 11.

3.3 COMPLIANCE WITH 40 CFR 257.60 REQUIREMENTS

The elevation of the water within the Coal Ash Ponds is a few feet below the ground surface (approximately 402 feet AMSL). Based on the information contained in the Structural Finish Grading drawing prepared by others, the bottom of the ponds is approximately 394 feet AMSL. During the groundwater monitoring period spanning from January 2017 through June 2018, hydraulic connectivity between the uppermost aquifer and the bottom of the Coal Ash Ponds has not been observed. Average groundwater elevation of the uppermost aquifer in the vicinity of the Coal Ash Ponds is approximately 355 feet AMSL with a seasonal high elevation of approximately 365 feet AMSL, indicating that sufficient separation is present to comply with 40 CFR §257.60. Based on review of the relevant information, the base of CCR placement in the Coal Ash Ponds is greater than 1.52 meters (5 feet) above the uppermost aquifer. Therefore, the Coal Ash Ponds meet the minimum requirements for placement above the uppermost aquifer.

4.0 §257.61 WETLANDS IMPACTS

4.1 §257.61 RULE DESCRIPTION

40 CFR §257.61 states:

New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in wetlands, as defined in §232.2 of this chapter, unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that the CCR unit meets the requirements of paragraphs (a)(1) through (a)(5) of this section.

(a)(1) Where applicable under section 404 of the Clean Water Act or applicable state wetlands laws, a clear and objective rebuttal of the presumption that an alternative to the CCR unit is reasonably available that does not involve wetlands.

(a)(2) The construction and operation of the CCR unit will not cause or contribute to any of the following:

(a)(2)(i) A violation of any applicable state or federal water quality standard;

(a)(2)(ii) A violation of any applicable toxic effluent standard or prohibition under section 307 of the Clean Water Act;

(a)(2)(iii) Jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of a critical habitat, protected under the Endangered Species Act of 1973; and

(a)(2)(iv) A violation of any requirement under the Marine Protection, Research, and Sanctuaries Act of 1972 for the protection of a marine sanctuary.

(a)(3) The CCR unit will not cause or contribute to significant degradation of wetlands by addressing all of the following factors:

(a)(3)(i) Erosion, stability, and migration potential of native wetland soils, muds and deposits used to support the CCR unit;

(a)(3)(ii) Erosion, stability, and migration potential of dredged and fill materials used to support the CCR unit;

(a)(3)(iii) The volume and chemical nature of the CCR;

(a)(3)(iv) Impacts on fish, wildlife, and other aquatic resources and their habitat from release of CCR;

(a)(3)(v) The potential effects of catastrophic release of CCR to the wetland and the resulting impacts on the environment; and

(a)(3)(vi) Any additional factors, as necessary, to demonstrate that ecological resources in the wetland are sufficiently protected.

(a)(4) To the extent required under section 404 of the Clean Water Act or applicable state wetlands laws, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function) by first avoiding impacts to wetlands to the maximum extent reasonable as required by paragraphs (a)(1) through (3) of this section, then minimizing unavoidable impacts to the maximum extent reasonable, and finally offsetting remaining unavoidable wetland impacts through all appropriate and reasonable compensatory mitigation actions (e.g., restoration of existing degraded wetlands or creation of man-made wetlands); and

(a)(5) Sufficient information is available to make a reasoned determination with respect to the demonstrations in paragraphs (a)(1) through (4) of this section.

4.2 COMPLIANCE WITH §257.61 REQUIREMENTS

As described above, the Ash Pond area associated with the ESS is less than 10 acres in size and consists of three separate unlined ash settling basins (Ponds 1, 2, and 3). The basins are used for temporary storage of CCR material prior to being excavated and transported off-site for disposal or beneficial re-use. The Ash Ponds are incised in the native soils to a depth of approximately 8 feet bgs.

The Ash Ponds are not located within wetland areas, and the continued operation and closure of the Ash Ponds will not result in direct impacts to wetlands, therefore, no additional permit approvals for wetland impacts are required.

The original construction of the Ash Basins (1962) predates even the Clean Water Act, which was passed in 1972 as an amendment to the Federal Water Pollution Control Act. Therefore, documentation that the CCR unit meets the requirements of paragraphs (a)(1) through (a)(5) of this section is not required.

5.0 §257.62 FAULT AREAS

5.1 §257.62 RULE DESCRIPTION

40 CFR §257.62 states:

(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR unit.

5.2 INFORMATION SUPPORTING RULE COMPLIANCE

5.2.1 Determination of Potential Faults

The regional and local geologic setting for the ESS was evaluated with respect to potential faults in the vicinity. The nearest Quaternary fault zones identified by the USGS Quaternary Fault and Fold Database (http://earthquake.usgs.gov/hazards/qfaults/) are: 1) the Wabash Valley liquefaction features; 2) the Fluorspar Area fault complex; 3) the St. Louis-Cape Griardeau liquefaction features; 4) the Faults of Thebes Gap area; 5) the Kentucky River fault system; and, 6) the New Madrid seismic zone. The closest is the Wabash Valley liquefaction features which is located approximately 33 miles to the northwest of the Coal Ash Ponds. Figure 4 – Fault Zone Map depicts location of the above-referenced faults with respect to the Coal Ash Ponds. In addition, the site investigations and explorations performed did not indicate evidence of faulting at the site.

5.3 COMPLIANCE WITH §257.62 REQUIREMENTS

The available USGS data demonstrates that the Coal Ash Ponds at ESS are not located within 60 meters (200 feet) of a fault that has displaced within Holocene time and complies with the requirement in §257.62 Fault Areas.

6.0 §257.63 SEISMIC IMPACT ZONES

6.1 §257.63 RULE DESCRIPTION

40 CFR §257.63 states:

(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in seismic impact zones unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

6.2 INFORMATION SUPPORTING RULE COMPLIANCE

6.2.1 Seismic Impact Zone Determination

A seismic impact zone, as defined in the §257.53, is an area having 2% or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10 g (10% of standard gravity) in 50 years. The peak ground (horizontal) acceleration for the Coal Ash Ponds at ESS is estimated to be between 20% and 30% of the earth's gravitational pull according to the USGS "National Seismic Hazard Map – 2014 Peak Ground Acceleration (%g) with 2% Probability of Exceedance in 50 years." Figure 5 - Seismic Hazard Map depicts the Coal Ash Ponds at ESS with respect to the National Seismic Hazard Map.

6.3 COMPLIANCE WITH §257.63 REQUIREMENTS

Because the estimated peak horizontal acceleration from a potential seismic event exceeds 10% of standard gravity for the Coal Ash Ponds, the site does not meet the requirements of §257.63 Seismic Impact Zones.

7.0 §257.64 UNSTABLE AREAS

7.1 §257.64 RULE DESCRIPTION

40 CFR §257.64 states:

(a) An existing or new CCR landfill, existing or new CCR surface impoundment, or any lateral expansion of a CCR unit must not be located in an unstable area unless the owner or operator demonstrates by the dates specified in paragraph (d) of this section that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted.
(b) The owner or operator must consider all of the following factors, at a minimum, when determining whether an area is unstable:
(1) On-site or local soil conditions that may result in significant differential settling;
(2) On-site or local geologic or geomorphologic features; and,
(3) On-site or local human-made features or events (both surface and subsurface).
(c) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of paragraph (a) of this section.

7.2 INFORMATION SUPPORTING RULE COMPLIANCE

40 CFR §257.53 provides the following definition of Unstable Areas: "Unstable area means a location that is susceptible to natural or human induced events or forces capable of impairing the integrity, including structural components of some or all of the CCR unit that are responsible for preventing releases from such unit. Unstable areas can include poor foundation conditions, areas susceptible to mass movements, and karst terrains." The following sections summarize the unstable area evaluations that were completed for the Coal Ash Ponds.

7.2.1 Previous Investigations and Analyses

CEC reviewed information gathered during a Preliminary Hydrogeologic Investigation conducted in December 2016 and during the installation of the permanent GMS wells at the Coal Ash Pond area, as well as information from previous geotechnical site investigations performed by Vector Engineering in December 2015, and ATEC Associates in July 1991 for expansion of the nearby OMU Calvin Wastewater Treatment Plant. CEC evaluated the information gathered from these investigations and determined that that soils in the upper 15 to 20 feet of the subsurface in the vicinity of the Coal Ash Ponds consist predominantly of variable thicknesses of fine-grained silt and clay interbedded with lenses of coarser-grained, poorly-graded sand beneath a thin layer of fill

material (2-feet thick or less) containing topsoil, crushed stone and/or other fill material. Poorly-graded sand was encountered to depths ranging from 26 to 38 feet bgs where a low permeability clay layer was encountered. This clay layer appears to be laterally continuous, varies in thickness from approximately 1 foot to over 10 feet, and is underlain by saturated, coarse-grained deposits that comprise the uppermost aquifer at the site.

The Vector Engineering report references a review of well information supplied by the Kentucky Geological Survey, as well as ATEC's geotechnical report, which identified that depth to bedrock is approximately 130 feet bgs in the vicinity of the site.

7.2.2 Structural Integrity the Coal Ash Ponds

40 CFR §257.73 defines the structural integrity criteria for existing CCR surface impoundments. A CCR surface impoundment is defined as a "natural topographic depression, man-made excavation, or diked area, which is designed to hold an accumulation of CCR and liquids, and the unit treats, stores, or disposes of CCR". An incised CCR surface impoundment is defined as "a CCR surface impoundment which is constructed by excavating entirely below the natural ground surface, holds an accumulation of CCR entirely below the adjacent natural ground surface, and does not consist of any constructed diked portion". 40 CFR §257.73 states that the structural integrity criteria for existing CCR surface impoundments does not apply to those existing CCR surface impoundments that are incised CCR units.

As described in Section 2.0, a review of aerial images, contour data from the USGS National Map, Owensboro East Quadrangle, and Drawing No. S-7 "Structural Finish Grading", prepared by Black & Veatch, dated August 28, 1962, the Coal Ash Ponds appear to be incised in the native soils to a depth of approximately 8 feet bgs, which was confirmed through knowledge of site personnel. Therefore, CEC concludes that the existing Coal Ash Ponds are incised and exempt from the structural integrity criteria for existing CCR surface impoundments.

7.2.3 Underground Mine Workings

The Kentucky Permitted Mine Boundaries Map (2012) which depicts the locations of underground mines within Kentucky was reviewed to assess Coal Ash Ponds at ESS. Attached Figure 6, Mined Areas Overview Map, shows that no underground mines exist below the Coal Ash Ponds.

7.3 COMPLIANCE WITH §257.64 REQUIREMENTS

The information presented above demonstrates that the Coal Ash Ponds have been designed and constructed so that the integrity of the structural components of the facility will not be disrupted by unstable areas in compliance with §257.64 Unstable Areas.

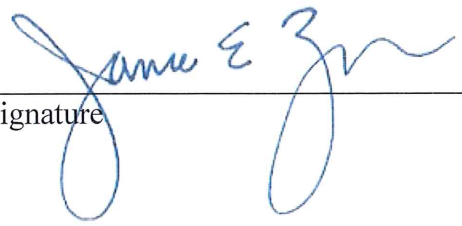
8.0 SUMMARY AND PROFESSIONAL ENGINEER CERTIFICATION

This Location Restriction Evaluation addresses compliance with the Location Restrictions for the ESS Coal Ash Ponds. The ESS Coal Ash Ponds do not meet the CCR Rule Location Restrictions requirement for Seismic Impact Zones (§257.63). The Coal Ash Ponds do meet the CCR Rule Location Restrictions requirements for Placement Above Uppermost Aquifer (§257.60), Wetlands (§257.61), Fault Areas (§257.62), and Unstable Areas (§257.64). Sections 3.0 through 7.0 of this report provide supporting information and conclusions regarding each Location Restriction.

Professional Engineer's Certification

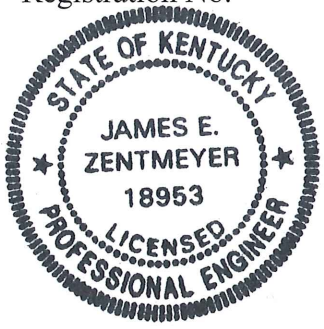
By means of this certification, I certify that I have reviewed this CCR Location Restriction Evaluation for the Coal Ash Ponds located at the Elmer Smith Station, and the design and construction of the Coal Ash Ponds meets the requirements of 40 CFR 257.60, 257.61, 257.62, and 257.64. The ESS Coal Ash Ponds do not meet the requirements of 40 CFR 257.63 for Seismic Impact Zones.

James E. Zentmeyer
Printed Name of Professional Engineer

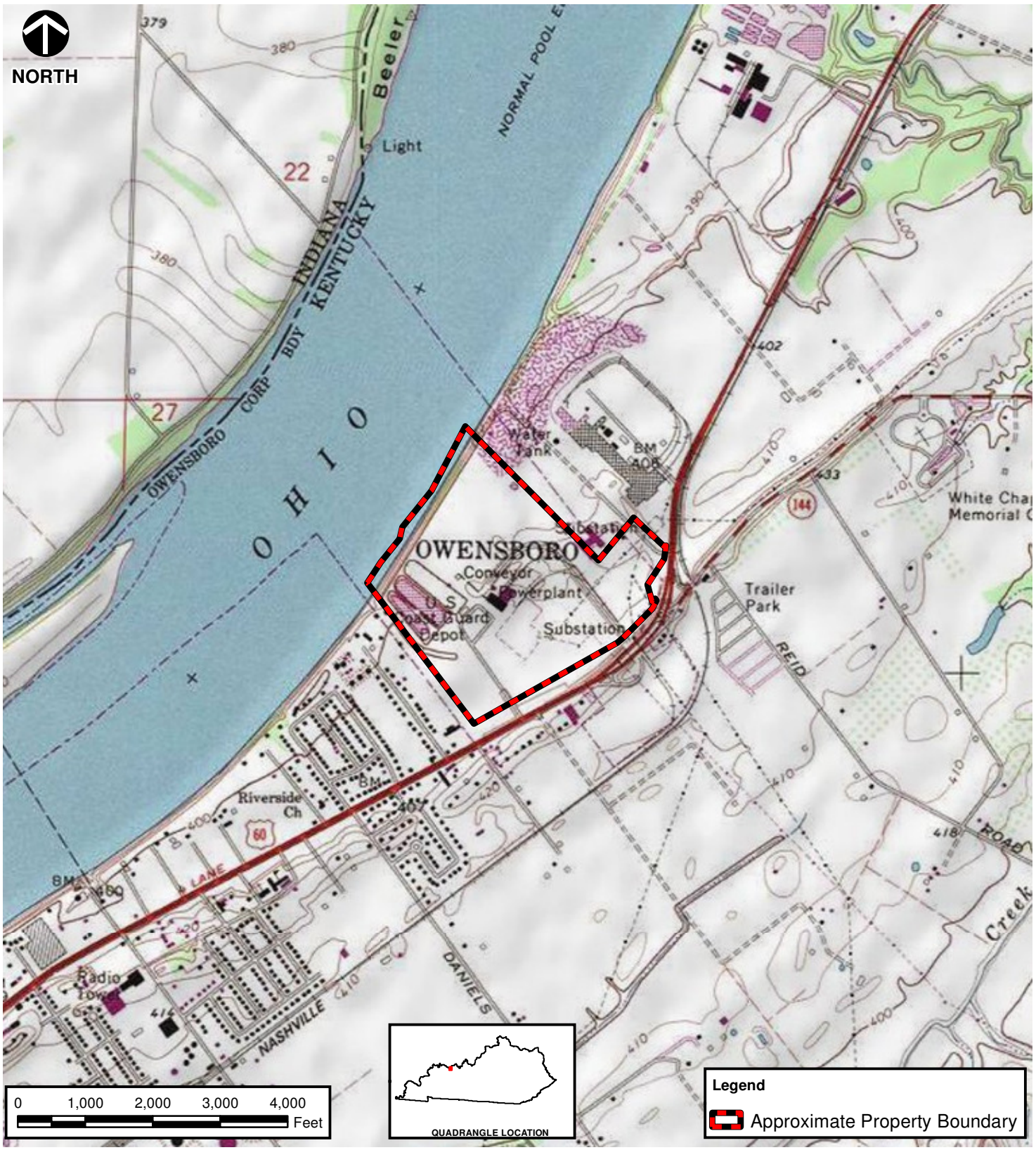


Signature

18953	Kentucky	October 2018
Registration No.	Registration State	Date



FIGURES



SOURCE: PORTION OF THE USGS 7.5-MINUTE SERIES TOPOGRAPHIC QUADRANGLE MAPS - OWENSBORO EAST, KENTUCKY - 1983

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LOCATION RESTRICTION EVALUATION
OWENSBORO MUNICIPAL UTILITIES
ELMER SMITH STATION
OWENSBORO, DAVIESS COUNTY, KY

SITE LOCATION MAP

DRAWN BY:	MGN	CHECKED BY:	DMT	APPROVED BY:	JEZ*	FIGURE NO:	1
DATE:	OCTOBER 2018	DWG SCALE:	1 " = 2,000 '	PROJECT NO:	164-014.0016		

Signature on File *

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NORTH

Ohio River

Pond 1

Pond 2

Pond 3

MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7

49
48
50
63
61
66
65
69
64
68
67

Coast Guard Lane

Ellis Smeathers Road

2830

144

Cooling Water Discharge Canal (channelized)

Cavin Water Treatment Plant

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Legend

- Approximate Site Boundary
- OMU Municipal Production Well
- GMS Monitoring Well

PROJECT LOCATION

200 0 200 400 Feet

SOURCE: ESRI WORLD IMAGERY / ARCGIS MAP SERVICE: HTTP://GOTO.ARCGISONLINE.COM/MAPS/WORLD_IMAGERY. LAST ACCESSED: 10/29/2018
IMAGE DATE: 4/10/2017

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SITE AND VICINITY AERIAL MAP

DRAWN BY: MGN	CHECKED BY: DMT	APPROVED BY: JEZ*	FIGURE NO: 2
DATE: OCTOBER 2018	SCALE: 1 " = 400 '	PROJECT NO: 164-014	

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NORTH

Ohio River

MW-3
355.565
MW-2
355.346
MW-1
354.982
Pond 1
Pond 2
Pond 3
Inferred Groundwater Flow Direction
354
353
352
351
350
349
348
355
MW-4
350.87
MW-6
350.514
MW-5
350.647
MW-7
347.41
49
48
50
63
61
66
65
69
64
68
67
Cooling Water Discharge Canal (channelized)
Cavin Water Treatment Plant

NOTE: THE WATER LEVELS PRESENTED HEREIN ARE APPLICABLE TO THE LOCATION AND TIME OF MEASUREMENT. WATER LEVELS MAY FLUCTUATE THROUGH TIME. POTENTIOMETRIC CONTOURS GENERATED FROM THIS DATA ARE CONSTRUCTED BY INTERPOLATION BETWEEN POINTS OF KNOWN STATIC WATER LEVEL ELEVATIONS AND USING KNOWLEDGE OF SPECIFIC SITE CONDITIONS. ACTUALSTATIC WATER LEVELS AT LOCATIONS BETWEEN THE MONITORING POINTS MAY DIFFER FROM THOSE DEPICTED.

Legend

- Approximate Site Boundary
- OMU Municipal Production Well
- Equipotential Line
- MW-1 GMS Monitoring Well
- 579.45 Groundwater Elevation (feet above mean sea level)

PROJECT LOCATION

200 0 200 400 Feet

SOURCE: ESRI WORLD IMAGERY / ARCGIS MAP SERVICE: HTTP://GOTO.ARCGISONLINE.COM/MAPS/WORLD_IMAGERY. LAST ACCESSED: 10/29/2018
IMAGE DATE: 4/10/2017

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POTENTIOMETRIC SURFACE MAP
OCTOBER 10, 2017

DRAWN BY: MGN	CHECKED BY: DMT	APPROVED BY: JEZ*	FIGURE NO: 3
DATE: OCTOBER 2018	SCALE: 1 " = 400 '	PROJECT NO: 164-014	

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NORTH

Wabash Valley Liquefaction Features

St. Louis-Cape Girardeau liquefaction features

Site Location

33 MILES

145 MILES

Faults of Thebes Gap Area

90 MILES

Kentucky River fault system

Fluorspar Area fault complex

New Madrid Seismic Zone

Legend

Fault Areas

- Class B
- historic
- late Quaternary
- latest Quaternary
- middle and late Quaternary

0 50 100 Miles

REFERENCE: U.S. GEOLOGIC SURVEY QUATERNARY FAULT AREAS

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OWENSBORO, DAVIESS COUNTY, KY

FAULT ZONE MAP

DRAWN BY:	MGN	CHECKED BY:	DMT	APPROVED BY:	JEZ*	FIGURE NO:	4
DATE:	OCTOBER 2018	DWG SCALE:	1 " = 50 miles	PROJECT NO:	164-014.0016		

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NORTH

Site Location

EXPLANATION
Peak acceleration expressed as a percent of gravity (%g)

%g

> 160
120–160
80–120
60–80
50–60
40–50
30–40
20–30
18–20
16–18
14–16
12–14
10–12
8–10
6–8
4–6
2–4
0–2

Contours of peak acceleration expressed as a percent of gravity (%g)

10 Onshore

10 Offshore

Point values of peak acceleration expressed as a percent of gravity (%g)

2.6 Local maximum

4.5 Local minimum

6.6 Saddle point

0 50 100 Miles

REFERENCE: SEISMIC INFORMATION FROM SEISMIC-HAZARD MAPS FOR CONTERMINOUS UNITED STATES, 2014, PEAK HORIZONTAL ACCELERATION WITH 2 PERCENT PROBABLITY OF EXCEEDANCE IN 50 YEARS, SCIENCE INVESTIGATIOON MAP 3325, SHEET 2 OF 6

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SEISMIC HAZARD MAP

DRAWN BY:	MGN	CHECKED BY:	DMT	APPROVED BY:	JEZ*	FIGURE NO:	5
DATE:	OCTOBER 2018	DWG SCALE:	1 " = 50 miles	PROJECT NO:	164-014.0016		

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Legend

Permitted Mine Boundaries

Underground Mine

Approximate Site Location

State Boundary

County Boundary

0 1 2 Miles

REFERENCES: ESRI WORLD IMAGERY / ARCGIS MAP SERVICE: HTTP://GOTO.ARCGISONLINE.COM/MAPS/WORLD_IMAGERY. LAST ACCESSED: 10/29/2018 IMAGE DATE: 9/21/2015
PERMITTED MINE BOUNDARIES FROM KENTUCKY DIVISION OF MINE PERMITS, PUBLISHED 7/30/2012.

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LOCATION RESTRICTION EVALUATION
OWENSBORO MUNICIPAL UTILITIES
ELMER SMITH STATION
OWENSBORO, DAVIESS COUNTY, KY

MINED AREAS OVERVIEW MAP

DRAWN BY:	MGN	CHECKED BY:	DMT	APPROVED BY:	JEZ*	FIGURE NO:	6
DATE:	OCTOBER 2018	DWG SCALE:	1 " = 2 miles	PROJECT NO:	164-014.0016		

Signature on File *

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