Prepared for:

Gavin Power, LLC

Bottom Ash Complex

Location Restriction Report

James M. Gavin Power Plant

17 October 2018

Project No.: 0469558

The business of sustainability

ERM

Signature Page

October 2018

Bottom Ash Complex

Location Restriction Report

ERM Project No. 0469558

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Acronyms and Abbreviations

BAC	Bottom Ash Complex
BAP	Bottom Ash Pond
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
ERM	Environmental Resources Management
Gavin	Gavin Power, LLC
NPDES	National Pollutant Discharge Elimination System
OEPA	Ohio Environmental Protection Agency
PMP	Probable Maximum Precipitation
Site	Bottom Ash Complex, located at the Gavin Power Plant at 7397 State Road 7 in the Village of Cheshire, Gallia County, Ohio.
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey

Certification

I hereby certify that I or an agent under my review has prepared this Location Restriction Report for the Bottom Ash Complex in accordance with 40 CFR 257.60 through 257.64. To the best of my knowledge, the information contained in this Report is true, complete, and accurate.

_____

James Hemme, P.E.

State of Ohio License No: 72851

Principal Consultant, ERM

1. INTRODUCTION

The General James M. Gavin Power Plant (the "Plant") is a coal-fired generating station located in Gallia County in Cheshire, Ohio, along the Ohio River. The Plant includes the Bottom Ash Complex (BAC), which is used to manage coal combustion residuals (CCR) generated by the Plant. As such, the BAC is subject to regulation under Title 40, Code of Federal Regulations, Part 257 (40 CFR Part 257) (also known as the CCR Rule). The location of the BAC is shown in Figure 1-1.

The BAC has been in operation since 1974 and receives bottom ash and miscellaneous Plant wastewaters including coal-pile runoff, cooling-tower blowdown, pyrites, and various Plant sump wastewaters. The BAC consists of two ponds: the larger pond is the Bottom Ash Pond (BAP) and the smaller pond is the Reclaim Pond. The perimeter dikes of the BAC are approximately 6,600 feet in length and range in height from approximately 25 feet to 35 feet above the surrounding grade. The BAC is considered an existing CCR surface impoundment under the CCR Rule.

This report was produced by Environmental Resource Management, Inc. (ERM) to evaluate the following location restrictions for the BAC:

- Placement above the uppermost aquifer (40 CFR 257.60);
- Wetlands (40 CFR 257.61);
- Fault areas (40 CFR 257.62);
- Seismic areas (40 CFR 257.63); and
- Unstable areas (40 CFR 257.64).

2. LOCATION RESTRICTIONS

2.1 Documentation Reviewed

ERM has relied primarily on reports and information prepared by others to evaluate compliance with the CCR Rule location restrictions, and in particular has relied upon the following sources:

- National Pollution Discharge Elimination System (NPDES) Fact Sheet for Permit 0IB00006*ND (OEPA 2013);
- NPDES Permit 0IB00006*ND, modification issued 17 April 2018 (OEPA 2018);
- Gavin Generating Plant Bottom Ash Investigation (BBCM Engineering 2009);
- Gavin Site—Bottom Ash Complex Groundwater Monitoring Network Evaluation (Geosyntec 2016);
- Structural Stability Assessment (American Electric Power 2016a);
- Initial Hazard Assessment (American Electric Power 2016b);
- Initial Design Flood Control Plan (American Electric Power 2016c);
- Initial Safety Factor Assessment (S&ME, Inc. 2016);
- 2017 Annual Inspection Report Bottom Ash Complex and Stingy Run Fly Ash Reservoir (ERM 2018a);
- 2017 Annual Groundwater Monitoring and Corrective Action Report (ERM 2018b); and
- U.S. Quaternary Faults and Folds Database (USGS).

2.2 Placement above the Uppermost Aquifer (40 CFR 257.60)

The natural soils at the BAC consist of a layer of alluvial silt, clay, and fine sand over glacial outwash deposits of variable thickness. The alluvium clays and silts were deposited in the backwater of the Ohio River, while the outwash materials typically consist of sand, gravel, and silt that were deposited during the last ice age (BBC&M 2009). Soil borings advanced at the BAC (Geosyntec 2016a) revealed that the outwash materials are 25 to 35 feet thick, consist of fine to coarse sand, and form the uppermost aquifer. The overlying alluvial silt, clay, and fine sands form a confining layer over the outwash aquifer. Geosyntec (2016a) reported that the thickness of this confining layer ranges from 7.7 feet to 34.4 feet with an average of 20.0 feet.

The base of the BAC is located at an approximate elevation of 560 feet above sea level (BBCM 2009) and the top of the uppermost aquifer is located at an approximate elevation of 532 feet above sea level. As shown in Figure 2-1, therefore, the base of the BAC is located more than 5 feet above the upper limit of the uppermost aquifer, and therefore the Gavin BAC is in compliance with 40 CFR 257.60.

2.3 Wetlands (40 CFR 257.61)

The CCR Rule requires that surface impoundments such as the BAC not be located in wetlands, as defined by 40 CFR 232.2, unless the owner or operator demonstrates that the CCR unit meets the requirements in 40 CFR 257.61(a)(1)-(5) (40 CFR 257.61(a)).

The Plant is located in the Kyger Creek Watershed. Therefore, with respect to the requirements of 40 CFR 257.61(a)(2)(iii) and (iv) regarding compliance with the Endangered Species Act and protections of marine sanctuaries, ERM reviewed the National Wetland Inventory map provided by the U.S. Fish and Wildlife Service for the Kyger Creek Watershed (HUC12 050302020901) to identify potential wetland areas adjacent to the BAC (Figure 2-2). The BAC is classified as a lacustrine littoral, unconsolidated

bottom, artificially flooded wetland (L2UBK). However, it is not considered a federal jurisdictional wetland, per rules published by the USACE and United States Environmental Protection Agency (33 CFR 328.3(b)(1), and 40 CFR 230.3(2)(i), respectively.

There are wetlands mapped to the west, south, and east of the BAC. The wetlands to the west are classified as palustrine unconsolidated bottom (PUB). The wetland to the south is also classified as L2UBK. The wetlands adjacent to the Ohio River to the east of the Site are classified as riverine lower perennial, unconsolidated bottom, permanently flooded (R2UBH).

ERM reviewed the soil map near the BAC from the Natural Resources Conservation Service Web Soil Survey (Figure 2-3). The Natural Resources Conservation Service has mapped the Site as predominantly water (W) and dumps, mine (Dm). Other soil series found surrounding the Site include Elkinsville silt loam, 1–6 percent slopes (EkB); Kyger loamy sand, frequently flooded (Kg); and Taggart silt loam, 0–3 percent slopes (TgA).

An ERM Senior Wetlands Scientist conducted a field investigation on 20 August 2018 to observe existing conditions and confirm or identify any wetlands within (or near) the BAC. No wetlands were identified within the BAC, although we could not rule out their former existence based on historical documentation. Several wetlands were noted around the perimeter of the BAC; however they were not hydraulically connected and drain away from the BAC.

Even if wetlands formerly existed within the BAC, the BAC meets the requirements of 40 CFR 257.61(a)(1)-(5). The process streams that are currently managed in the BAC include bottom ash, cooling tower blowdown, pyrite sluice, and various plant sumps. Considering these process streams, and the need for the BAC to be located near the cooling towers and the boilers, there is no alternate location reasonably available that meets the size (approximately 50 acres) and proximity requirements that would not involve wetlands, per 40 CFR 257.61(a)(1).

With respect to the requirements of 40 CFR 257.61(a)(2)(i) and (ii) regarding compliance with water quality standards, discharge of water from the BAC via Outfall 006 to the Ohio River is conducted in accordance with the current NPDES permit 0IB00006*ND. The permit requires routine effluent sampling and testing, comparison of test results to discharge limitations, and reporting. OEPA removed the requirement for effluent toxicity testing at Outfall 006 in the 2013 renewal because there was “no reasonable potential for these outfalls to contribute to exceedances of toxicity water quality standards” (OEPA 2013). Based on these considerations, operation of the BAC is not expected to cause or contribute to a violation of applicable water quality standards or toxic effluent standards in compliance with 40 CFR 257.61(a)(2)(i) and (ii).

With respect to the requirements of 40 CFR 257.61(a)(2)(iii) and (iv) regarding compliance with the Endangered Species Act and protections of marine sanctuaries, ERM reviewed the United States Fish and Wildlife Service Information for Planning and Consultation to confirm the current list of known species and or habitat protected under the Endangered Species Act of 1973. The Information for Planning and Consultation results indicated that no critical habitats are located within or near the Site. No destruction or adverse modification of a critical habitat is anticipated. Although the Northern Long-Eared Bat is an endangered species potentially occurring in the area, the continued operation of the BAC in its current configuration is not expected to jeopardize this species. Surface water from the Site is not hydrologically connected to the Ohio River, therefore marine species do not exist within the Site. The BAC is therefore compliant with 40 CFR 257.61(a)(2)(iii) and (iv).

With respect to the requirements of 40 CFR 257.61(a)(3)(i)-(vi), the BAC is not expected to cause or contribute to significant degradation of wetlands, for the following reasons:

- The BAC perimeter dikes were constructed primarily of compacted silty clay (BBCM Engineering 2009) and not wetland soils, muds, and deposits, or dredged material;

- Based on a review of previous structural stability assessments, inspections by a qualified person, and results of previous annual inspections, there have been no past indications of potential structural weakness, slope instability, drainage or seepage issues, or other adverse conditions that would impact the stability of the materials used to construct the BAC (ERM 2018a).
- CCR materials and storm water runoff within the BAC are not expected to migrate into wetland areas.
- Regular ongoing inspections are performed to promptly identify and resolve potential erosion or soil migration issues.
- BAC effluent continues to be monitored to remain in compliance with the Clean Water Act and water quality standards, which includes discharge limitations intended to be protective for fish, wildlife, and other aquatic resources. No observed adverse visual impacts to fish, wildlife or other aquatic resources and their habitats were observed during ERM's 20 August 2018 visit.
- The Initial Safety Factor Assessment concluded the BAC exceeded the minimum safety factors for long-term maximum storage, maximum surcharge pool, seismic loading, and embankment liquefaction (S&ME 2015). These findings, and the regular inspections performed to detect potential structural weakness, slope instability, drainage or seepage issues, or other adverse conditions, reduce the risk of catastrophic release of CCR materials to nearby wetlands. Based on the preceding considerations, ERM does not believe a catastrophic release from the BAC is a likely scenario.

With respect to the requirements of 40 CFR 257.61(a)(4), ERM has no evidence to confirm or refute if the BAC was constructed in a former wetland area, and even if it were, Gavin has avoided impacts to adjacent wetlands as required by 40 CFR 257.61(a)(1)-(3), through the measures described in the preceding paragraphs of this section.

Finally, in accordance with the requirement of 40 CFR 257.61(a)(5), ERM believes sufficient information was available to make a reasoned determination with respect to the demonstrations required by 40 CFR 257.61(a)(1)-(4). Based on the foregoing discussion, the Gavin BAC is in compliance with the requirements of 40 CFR 257.61.

2.4 Fault Areas (40 CFR 257.62)

The CCR Rule requires that CCR units not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time (11,700 years ago) unless the owner or operator demonstrates that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR unit (40 CFR 257.62(a)). Based on the USGS Quaternary Faults and Folds Database, there are no known faults within 60 meters (200 feet) of the Gavin Plant. Therefore, the BAC is in compliance with the requirements of 40 CFR 257.62.

2.5 Seismic Impact Zones (40 CFR 257.63)

The CCR Rule requires that CCR units not be located in seismic impact zones unless the owner or operator demonstrates 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 (40 CFR 257.63(a)). The CCR Rule defines a "seismic impact zone" as "an area having a 2% or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitation pull (g), will exceed 0.10 g in 50 years" (40 CFR 257.53). Based on information from the USGS Earthquake Hazards Program, the Gavin Plant is located in an area where the peak horizontal acceleration, based on 2 percent probability in 50 years, is less than 0.1 g (Figure 2-4). Therefore the BAC is not located in a "seismic impact zone," and is in compliance with the requirements of 40 CFR 257.63.

2.6 Unstable Areas (40 CFR 257.64)

The CCR Rule provides the following definition for an "unstable area" (40 CFR 257.53):

> *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 CCR Rule requires that CCR units not be located in an unstable area unless the owner or operator demonstrates 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 (40 CFR 257.64(a)). This evaluation of unstable areas addresses the definitional requirements noted above and specifically includes the following factors from 40 CFR 257.64(b):

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).

The evaluation of Unstable Areas for the BAC is provided in the following sections.

2.6.1 Evaluation of On-site or Local Soil Conditions that May Result in Significant Differential Settling

To evaluate on-side or local soil conditions that may result in significant differential settling at the BAC, ERM reviewed the geotechnical stability evaluations which were performed to provide an assessment of unstable areas (BBC&M Engineering, 2009; S&ME, 2009; and S&ME, 2015).

BBC&M performed a subsurface investigation at the BAC that consisted of 1) the performance of soil borings at the toe of the embankment of three sides of the BAC, and four additional soil borings at the crest of the embankment, one on each side; 2) conversion of four of the soil borings into observation wells; 3) laboratory testing on the recovered soil samples; and, 4) engineering analyses of the existing embankments at the investigated sections with consideration to seepage, steady-state slope stability and seismic slope stability. BBC&M evaluated the information in general accordance with the US Army Corps of Engineer's Engineering Manual 1110-2-1902 entitled *Slope Stability,* and BBC&M concluded that the BAC embankments and underlying soils provide adequate factors of safety relative to typical US Army Corps of Engineers (US ACOE) requirements. The results of the BBC&M analysis are presented in Table 2-1.

Table 2-1: Summary of BBC&M Stability Analysis Summary

Analysis Case	USACE Minimum Factor of Safety	Computed Safety Factor	
		Section A	Section B
Static (Steady State Seepage)	1.5	1.73	1.53
Pseudo-Static	1.00	1.40	1.24

In addition to these analyses, survey data collected by BBC&M confirmed the actual outboard slope angles of the BAC embankments to be 1.8H:1V to 2.2H:1V, which bracket the design slope angles of 2H:1V.

The Initial Safety Factor Assessment (S&ME 2015) included: 1) a review of previously conducted assessment work, including additional soil borings and analysis performed by BBC&M in 2010; and 2) a hydrologic and hydraulic analysis performed in accordance with 40 CFR 257.73(d)(1)(v)(B). Although the hydrologic and hydraulic analysis is not strictly an evaluation of soil conditions, the evaluation is directly relevant to the stability of the BAC. The study utilized probable maximum precipitation (PMP) input data obtained from the Ohio Department of Natural Resources, and evaluated two scenarios: 1) application of the PMP to the BAC under normal pool stage and normal operating conditions; and 2) application of the PMP to the BAC with an inoperable spillway. The study found that the Bottom Ash Pond and the Reclaim Pond can adequately store and pass the design storm. The Safety Factor Assessment also included an updated seepage and slope stability analysis, which evaluated both the inboard and outboard slopes of the BAC, an evaluation of seismic loading, and an evaluation of the liquefaction potential of embankment soils. Results of the S&ME analysis are presented in Table 2-2.

Table 2-2: Summary of Safety Factors Developed by S&ME

Analysis Case	Minimum Safety Factor Case	Computed Safety Factor Case
Long-term, maximum pool storage	1.50	1.76
Maximum surcharge pool	1.40	1.75
Pseudo-static seismic loading	1.00	1.39
Embankment liquefaction	1.20	Non-liquefiable

As required by the CCR Rule, the BAC is inspected at least every 7 days by a qualified person and annually by professional engineer. Piezometers are gauged at least every 30 days for the purpose of determining the phreatic water levels within the BAC dikes. The 2017 Annual Engineering Inspection Report concluded there were no past indications of potential structural weakness, slope instability, drainage or seepage issues, or other adverse conditions that would impact the stability and operation of the BAC (ERM 2018a).

Thus, an evaluation of on-site and local soil conditions at the BAC does not indicate a potential for significant differential settling.

2.6.2 On-Site or Local Geologic or Geomorphologic Features

The natural soils at the Site consist of a layer of alluvium silt, clay, and fine sand over glacial outwash deposits of variable thickness overlying the bedrock surface. Based on available geologic literature, the glacial outwash extends to the bedrock surface, estimated to be roughly 60 feet below the natural ground surface at the pond (BBC&M 2009). Based on generalized geologic maps from the USGS, the upper most bedrock underlying the BAC consists of shale and/or sandstone belonging to the Conemaugh Group of Pennsylvanian Age. These sedimentary rocks dip gently to the east and southeast. Based on an extrapolation of information from bedrock borings drilled throughout the Gavin Plant, karst conditions are not expected to exist within the upper most bedrock strata underlying the BAC.

The 2017 Annual Engineering Inspection Report (ERM 2018a) concluded that the BAC appeared to be in satisfactory condition (i.e., appeared to be vegetated and in stable condition) and there were no significant signs of settlement, rutting, or misaligned terrain. A review of historical topographic maps concluded that changes in landforms that might indicate mass movement of earth materials are not present surrounding the BAC. In addition, the generally flat or gently sloping terrain surrounding the BAC indicates the conditions conducive to downslope movement of soil, rock, and/or debris (alone or mixed with water) under the influence of gravity do not appear to be present.

Thus, an evaluation of on-site or local geologic or geomorphological features at the BAC does not indicate that the BAC is located in an unstable area.

2.6.3 On-Site or Local Human-Made Features or Events (Both Surface and Subsurface).

Geotechnical site investigations were performed to identify conditions which could potentially cause a significant amount of post-construction differential settlement, or downslope movement of soil, rock, and/or debris under the influence of gravity, unless improved. These evaluations (BBC&M Engineering, 2009; S&ME, 2009; and S&ME, 2015) were certified by a qualified professional engineer and are summarized in Section 2.6.1 of this report.

Activities that could induce instability, such as mining, cut and fill activities during construction, or excessive drawdown of groundwater do not currently exist at the BAC. According to the Ohio Department of Natural Resources (https://gis.ohiodnr.gov/MapViewer/?config=OhioMines), historical coal surface mines exist northwest of the BAC; however, these are located several thousand feet away and do not exist within the alluvial deposits along the Ohio River. There have been no recent construction activities that included cut and fill operations near the BAC. Regarding groundwater, monitoring performed during the groundwater sampling events demonstrates there is not significant drawdown in the uppermost aquifer near the BAC (ERM 2018b). Based on these considerations, local human-made features or events are not expected to cause excessive settlement or reduce the bearing capacity of BAC foundation soils.

Thus, an evaluation of on-site or local human-made features or events (both surface and subsurface) at the BAC does not indicate that the BAC is located in an unstable area.

3. CONCLUSIONS

The conclusions for each of the five location restrictions for the BAC are as follows:

- The base of the BAC is located more than 5 feet above the upper limit of the uppermost aquifer, and therefore the BAC is in compliance with the requirements of 40 CFR 257.60.
- Regarding wetlands, ERM believes sufficient information is available that demonstrates compliance with 40 CFR 257.61.
- Based on information from the USGS, the BAC is not located within 200 feet of the outermost damage zone of a fault that has had displacement in Holocene time, and thus meets the requirements of 40 CFR 257.62.
- Based on information from the USGS, the BAC is not located in a seismic impact zone, and thus meets the requirements of 40 CFR 257.63.
- Based on information from geotechnical studies performed by BBC&M Engineering and S&ME, the BAC is not located in an unstable area and thus meets the requirements of 40 CFR 257. 64.

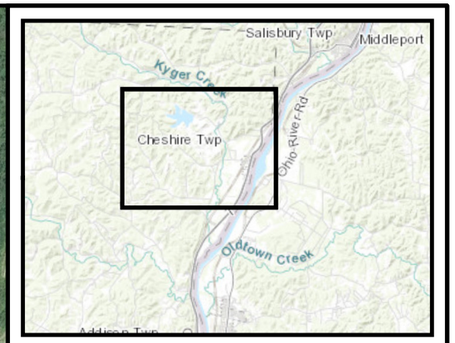
FIGURES

Fly Ash Reservoir

Residual Waste Landfill

Bottom Ash Complex

Ohio River



Legend

CCR Unit

N

0 550 1,100 2,200 3,300

Feet

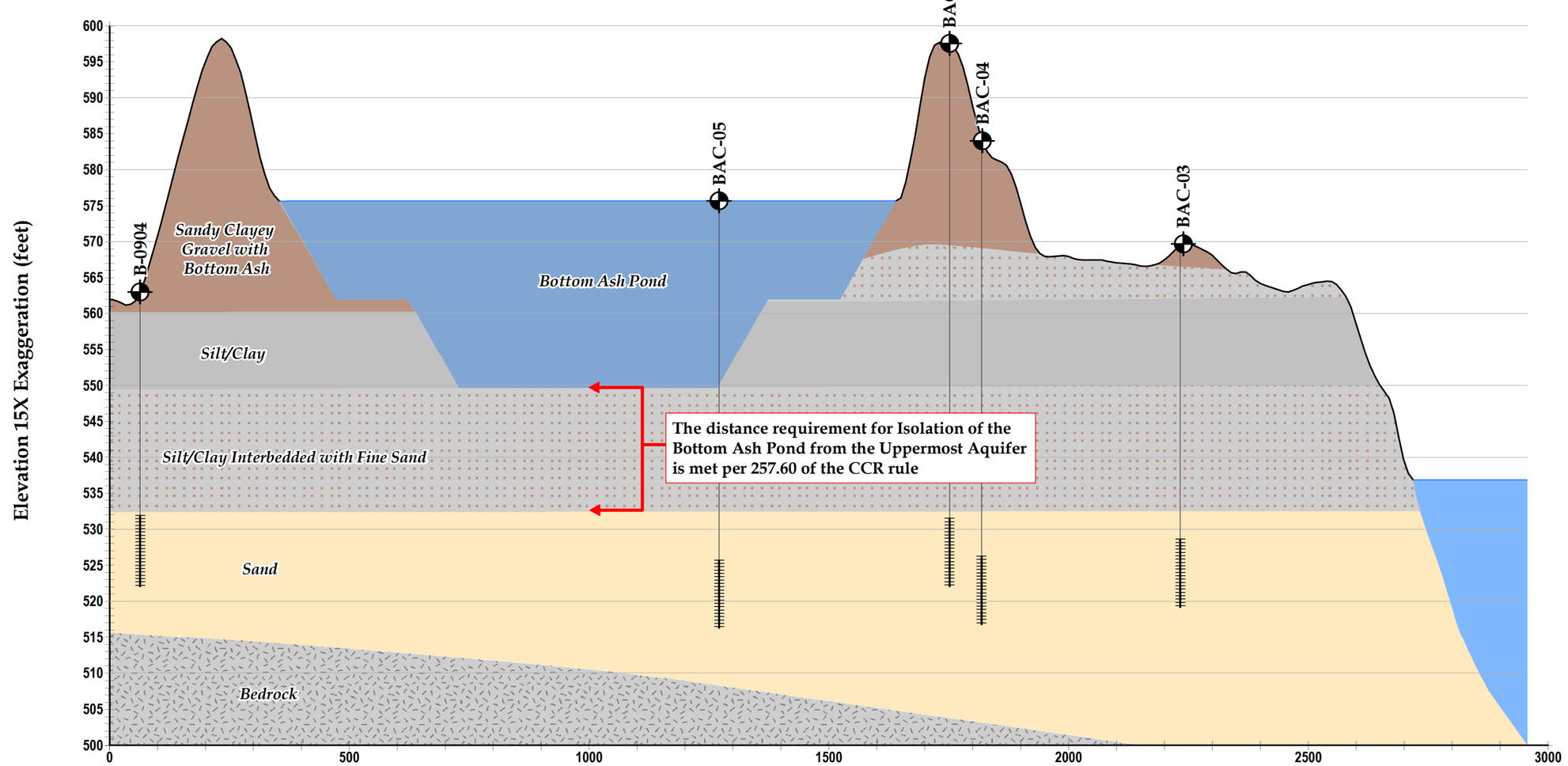
Figure 1-1: Site Layout and CCR Unit Location

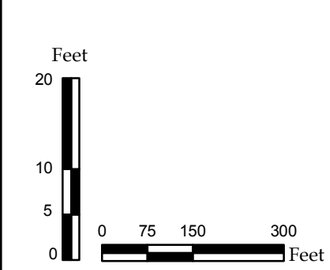
Bottom Ash Complex
Location Restriction Report
Gavin Generating Station
Cheshire, Ohio

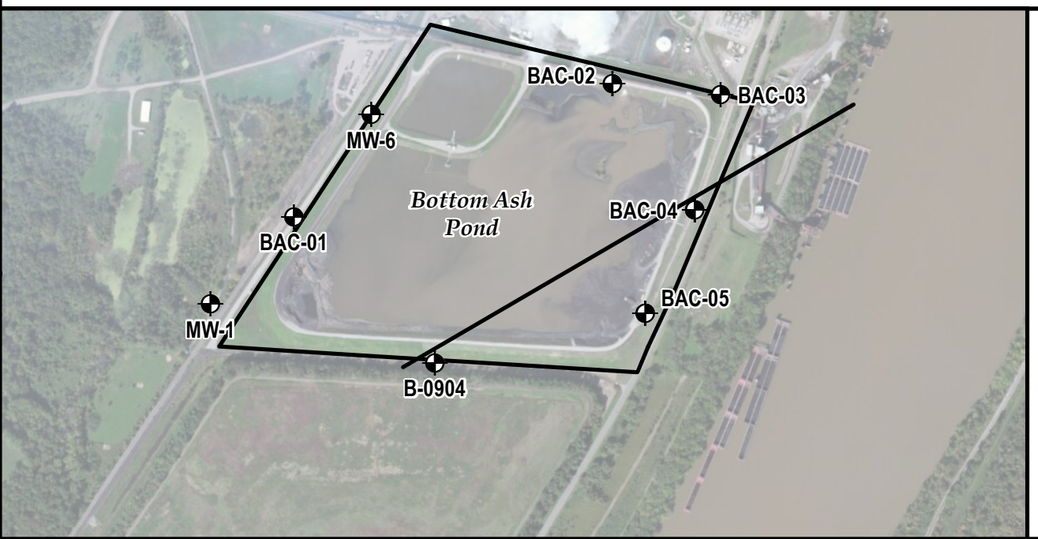
ERM

SOUTHWEST

NORTHEAST







Legend

- Monitoring Well
- Cross Section Location
- Borehole
- Well Screen

Figure 2-1: CCR Unit Location and the Uppermost Aquifer
Bottom Ash Complex
Location Restriction Report
Gavin Generating Station
Cheshire, Ohio

ERM

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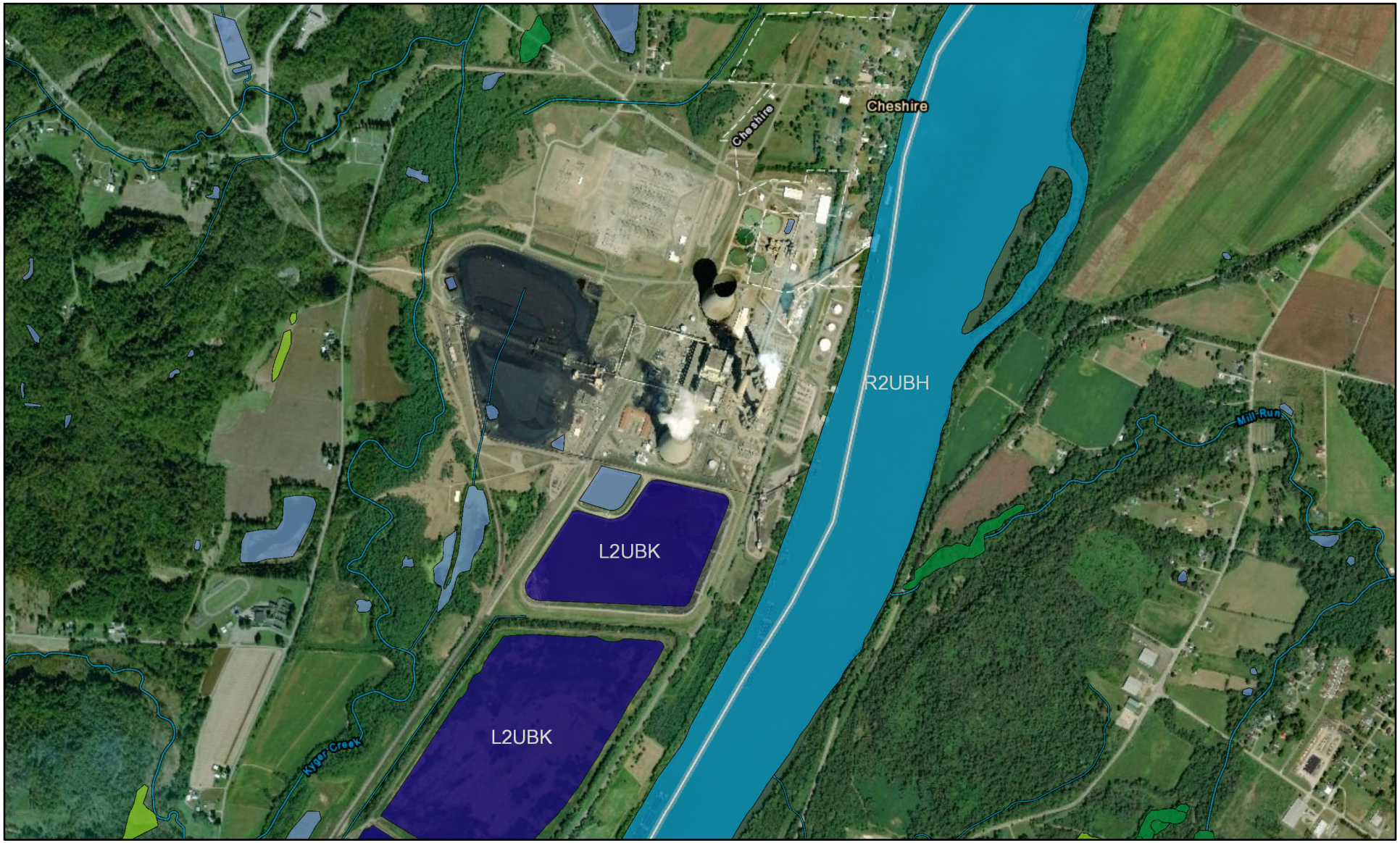

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond (PUB)
- Lake
- Other
- Riverine

1:23,943

0 0.2 0.4 0.8 mi

0 0.325 0.65 1.3 km

NOTE:
Data from National Wetlands Inventory (NWI) and is for general reference only.

Figure 2-2: National Wetland Inventory Map
Bottom Ash Complex Location Restriction Report
Gavin Generating Station
Cheshire, Ohio

ERM

Soil Type Symbol	Soil Type Name	Acres in AOI	Percent of AOI
Dm	Dumps, mine	100.4	23.4%
EkB	Elkinsville silt loam, 1 to 6 percent slopes	258.3	60.2%
GbB	Gallipolis silt loam, 1 to 6 percent slopes	6.3	1.5%
Kg	Kyger loamy sand, frequently flooded	10.3	2.4%
New1AF	Newark silt loam, 0 to 3 percent slopes, frequently flooded	0.3	0.1%
No	Nolin silt loam, 0 to 3 percent slopes, occasionally flooded	1.4	0.3%
TgA	Taggart silt loam, 0 to 3 percent slopes	7.8	1.8%
W	Water	44.4	9.6%
	TOTAL	**429.3**	**100.0%**

NOTE: Data from the National Cooperative Soil Survey (USDA, NRCS)

Figure 2-3: Soils Map
Bottom Ash Complex
Location Restriction Report
Gavin Generating Station
Cheshire, Ohio

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