REPORT ON

CLOSURE ALTERNATIVE ASSESSMENT FORMER WOOD RIVER POWER STATION ALTON, ILLINOIS

by
Gemini Engineering, LLC

for
CTI Development, LLC
Former Wood River Power Station Alton, Illinois

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List of Acronyms and Abbreviations

Abbreviation	Definition
bgs	Below ground surface
CAA	Corrective Action Assessment
CBR	Closure by removal
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
cm/sec	Centimeters per second
COC	Constituents of concern
CSM	Conceptual Site Model
PEAP	Primary East Ash Pond
ft	Feet
GWPS	Groundwater protection standard
IEPA	Illinois Environmental Protection Agency
ILGA	Illinois General Assembly
MCL	Maximum contaminant level
MNA	Monitored natural attenuation
MSL	Mean sea level
NPDES	National Pollutant Discharge Elimination System
NRT	Natural Resources Technology
RCRA	Resource Conservation and Recovery Act
SR	State Road
SSI	Statistically Significant Increase
USEPA	United States Environmental Protection Agency

1. Introduction

Gemini Engineering, LLC (Gemini) is providing this Closure Alternative Analysis (CAA) on behalf of CTI Development (CTI LLC) for the Former Wood River Power Station in Alton, Illinois. This CAA is for the Coal Combustion Residual (CCR) units and specifically for the CCR unit / impoundment consisting of the Primary East Ash Pond (PEAP). The Wood River Power Station ceased operations in 2019, and the PEAP has been inactive since that time. The PEAP recently changed ownership and is now owned by CTI LLC, and this CAA deals exclusively with the impoundments of the PEAP.

Applications were filed for Initial Operating Permits (Permits) for the CCR unit of the PEAP. The previous geologic and hydrogeologic investigations and information necessary for the Permit applications and this CAA were conducted under the U.S. Environmental Protection Agency's (USEPA's) Final Rule to regulate the disposal of CCR as solid waste under Subtitle D of the Resource Conservation and Recovery Act (RCRA) [40 CFR 257 Subpart D; published in 80 FS 21302-21501, April 17, 2015].

This CAA is guided in large part by USEPA's *Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals from Electric Utilities*; *A Holistic Approach to Closure Part A: Deadline to Initiate Closure* (85 FR 53516 - effective 28 September 2020) and subsequent regulatory revisions and related rulings including the CCR Rule. This CAA evaluates potential corrective action alternatives intended to satisfy the closure criteria for the impoundments of the PEAP in compliance with the Illinois General Assembly (ILGA) Administrative Code Title 35 Section 845.710.

1.1 FACILITY DESCRIPTION/BACKGROUND

The Former Wood River Power Station is owned CTI LLC and is situated on the east bank of the Mississippi River, about six river miles upstream from the confluence of the Mississippi and Missouri Rivers (NRT, 2006 and AECOM, 2016). The Wood River Creek, a perennial stream that discharges into the Mississippi River, lies on the eastern edge of Former Wood River Power Station. The Wood River Primary East Ash Pond (CCR Unit ID 901), or the site, is located to the north of the power plant (ceased operation in June 2016) and adjacent to the Wood River Creek, which discharges into the Mississippi River. The Wood River West Ponds 1, 2E, 2W (CCR Multi-Unit ID 902) are located to the northwest of the power plant. This CAA applies specifically to the PEAP (CCR Unit ID 901) which is part of the East Ash Pond Complex. The East Ash Pond Complex includes the PEAP, Secondary East Polishing Pond (non-CCR unit) and historical closed ash disposal areas used prior to completion of Wood River West Ponds 1, 2E, 2W.

The PEAP is located within Section 20 Township 5 North and Range 9 West. The cities of Alton, East Alton, and Wood River are within 2 miles of the impoundments (NRT, 2006 and AECOM, 2016). Former Wood River Power Station is located in an area of heavy industrial activity, such as: a federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site, metals recycling, metal refining, a steel mill, an aluminum smelter, vinegar production, cardboard manufacturing, glass manufacturing and sewage treatment. The site location is shown on Figure 1. Figure 2 is a site plan showing the location of the PEAP and CCR monitoring wells. The Former Wood River Power Station property is bordered on the south by State Route 143 and the Mississippi River, the east by the Wood River Creek, the north by vacant/abandoned industrial property and railroad tracks, and the west by vacant land/water retention ponds of the Mississippi River levee system operated by the U.S. Army Corps of Engineers (USACE).

Former Wood River Power Station began operation in 1949 and ash from the first coal fired unit was disposed of in historical ash disposal areas which now underlie the existing PEAP (NRT, 2006 and AECOM, 2016). The historical ash disposal areas were located on the eastern edge of the site along the Wood River Creek and they were utilized for approximately 30 years until the West Ash Pond Complex was constructed in 1978. The Wood River West Ash Pond Complex includes the Wood River West Ash Ponds 1, 2E, 2W (CCR Unit ID 902), and Pond 3 (a lined non-CCR unit used as a polishing pond for the Wood River West Ash Pond Complex prior to 2006).

The PEAP and Secondary East Polishing Pond were constructed from 2005 through 2006 and are lined with a geomembrane on top of a compacted clay liner layer. Ash was handled through the West Ash Pond Complex until 2006-2007, at which time it was redirected to the PEAP (also called the New East Ash Pond) following its construction. Ash was disposed of in the PEAP until June 2016, when the power plant was shut down. A Closure and Post-Closure Care Plan (Closure Plan) for the Wood River West Ash Pond Complex was submitted to the Illinois Environmental Protection Agency (IEPA) on November 28, 2016 (AECOM, 2016) followed by an Addenda to the Closure Plan dated April 28, 2017 and subsequent Revision to the Addenda dated May 18, 2017. The Closure Plan was approved by the IEPA on May 25, 2017.

1.2 GROUNDWATER MONITORING

Detection monitoring in the Uppermost Aquifer, per 40 C.F.R. § 257.90, was initiated in October 2017; statistically significant increases (SSIs) of Appendix III parameters over background concentrations were detected in October 2017. Alternate source evaluations were inconclusive for one or more of the SSIs. Therefore, in accordance with 40 C.F.R. § 257.94(e)(2), an Assessment Monitoring Program was established for the PEAP on April 9, 2018. Assessment Monitoring results identified statistically significant levels (SSLs) of the Appendix IV parameter molybdenum over the groundwater protection standard (GWPS) of 0.10 milligrams per Liter (mg/L). SSLs for total molybdenum were identified in downgradient monitoring well 39S, where total molybdenum concentrations ranged from 0.0723 mg/L to 0.128 mg/L. No other SSLs have been identified for the PEAP.

1.2.1 Primary East Ash Pond Groundwater Monitoring

Monitoring wells were installed mainly in 2004 with only monitoring well 21 installed in 1994; all in accordance with the Assessment Monitoring Program requirements outlined in 40 CFR § 257.94(e)(2). The CCR groundwater monitoring network includes two background wells (Wells 21 and 37) that are located north of the PEAP and four downgradient monitoring wells (Wells 38, 39S, 40S, & 41) located around the east and south perimeter of the PEAP. Monitoring well locations are shown on Figure 2. Monitoring wells and their respective locations in the uppermost aquifer are as follows:

- Monitoring Wells 21, 37, 39S, and 40S are screened in the upper part of the saturated zone;
- Monitoring Wells 38 and 41are screened in the lower part of the saturated zone.

1.3 CLOSURE ALTERNATIVE ASSESSMENT PROCESS

This CAA is provided for the inactive ash ponds of the Site to meet requirements and objectives of the remedy per 40 CFR §257.96(c). Each remedy must meet the following threshold criteria as stated in the CCR Rule:

(1) Be protective of human health and the environment.
(2) Attain the groundwater protection standard as specified pursuant to §257.95(h); (3) Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in Appendix IV into the environment. (4) Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems.
(5) Comply with standards for management of wastes as specified in §257.98(d).

The guidelines for selecting the corrective measure for surface impoundments are provided in Illinois Administrative Code 35 § 845.710 for Closure Alternatives, and they are summarized as follows:

a) Closure of a CCR surface impoundment, or any lateral expansion of a CCR surface impoundment, must be completed either by leaving the CCR in place and installing a final cover system or through removal of the CCR and decontamination of the CCR surface impoundment, as described in Sections 845.720 through 845.760.
b) Before selecting a closure method, the owner or operator of each CCR surface impoundment must complete a closure alternatives analysis. The closure alternatives analysis must examine the following for each closure alternative, and these become the criteria to evaluate the alternatives:
   1) The long-term and short-term effectiveness and protectiveness of the closure alternative, including identification and analyses of the following factors:
      A) The magnitude of reduction of existing risks;
      B) The magnitude of residual risks in terms of likelihood of future releases of CCR;
      C) The type and degree of long-term management required, including monitoring, operation, and maintenance;
      D) The potential short-term risks that might be posed to the community or the environment during implementation of a closure, including potential threats to human health
      and the environment associated with excavation, transportation, and re-disposal of contaminants; E) The time until closure and post-closure care or the completion of groundwater monitoring under Section 845.740(b) is completed;
      F) The potential for exposure of human and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, re-disposal, containment or changes in groundwater flow;
      G) The long-term reliability of the engineering and institutional controls, including an analysis of any off-site, nearby destabilizing activities; and
      H) Potential need for future corrective action of the closure alternative.

   2) The effectiveness of the closure method in controlling future releases based on analyses of the

following factors:

A) The extent to which containment practices will reduce further releases; and
B) The extent to which treatment technologies may be used.

3) The ease or difficulty of implementing a potential closure method based on analyses of the following types of factors:

A) Degree of difficulty associated with constructing the technology;
B) Expected operational reliability of the technologies;
C) Need to coordinate with and obtain necessary approvals and permits from other agencies; D) Availability of necessary equipment and specialists; and
E) Available capacity and location of needed treatment, storage, and disposal services.

4) The degree to which the concerns of the residents living within communities where the CCR will be handled, transported through, and disposed of are addressed by the closure method.

5) The cost for implementing the corrective action is considered an important criterion, especially for the owner of the facility. Although this factor is not explicitly provided in the guidelines, it is added herein in recognition of its realistic and relative importance to selection of the corrective action.

c) In the closure alternatives analysis, the owner or operator of the CCR surface impoundment must:
1) Analyze complete removal of the CCR as one closure alternative, along with the modes for transporting the removed CCR, including by rail, barge, low-polluting trucks, or a combination of these transportation modes;
2) Identify whether the facility has an onsite landfill with remaining capacity that can legally accept CCR, and, if not, whether constructing an onsite landfill is possible; and
3) Include any other closure method in the alternatives analysis if requested by the Agency.

d) The analysis for each alternative completed under this Section must:
1) Meet or exceed a class 4 estimate under the AACE Classification Standard, incorporated by reference in Section 845.150, or a comparable classification practice as provided in the AACE Classification Standard;
2) Contain the results of groundwater contaminant transport modeling and calculations showing how the closure alternative will achieve compliance with the applicable groundwater protective standards;
3) Include a description of the fate and transport of contaminants with the closure alternative over time, including consideration of seasonal variations; and
4) Assess impacts to waters in the State.

Since impacts to groundwater are below groundwater protective standards, the potential groundwater pathways for exposure to contaminants is not present. This alleviates the need for modeling and calculations of groundwater transport.

e) At least 30 days before submission of a construction permit application for closure, the owner or operator of the CCR surface impoundment must discuss the results of the closure alternatives analysis in a public meeting with interested and affective parties (Section 845.240).

f) After completion of the public meeting under subsection e), the owner or operator of a CCR surface impoundment must select a closure method and submit a final closure plan to the Agency under Section 845.720(b). All materials demonstrating completion of the closure alternatives analysis specified in this Section must be submitted with the final closure plan.

g) The selected closure method must meet the requirements and standards of this Part, ensure the protection of human health and the environment, and achieve compliance with the groundwater protection standards in Section 845.600.

The intentions of threshold criteria from Federal guidelines overlap the intentions within the Illinois guidelines. With each alternative considered herein, the above criteria are met, or will be met as the process for review, design, and implementation is completed. The focus for this CAA becomes the discretionary evaluation best captured by comparing alternative using the criteria identified in paragraph b) above. These five criteria are the focus of the selection of the specific alternatives which each meet the intentions that are provided in each of the above criteria.

1.4 PURPOSE OF CAA

The purpose of this CAA document is to provide the basis for selection of the corrective measures to implement for closure of the impoundments of the PEAP. Once the alternative is selected and approved by IEPA, an engineering design will be prepared and submitted to IEPA.

2. CONCEPTUAL SITE MODEL

To assist in the evaluation of potential remedy options, a conceptual site model (CSM) is presented that takes into account regional and site geology and hydrogeology, groundwater data and related protective standards, and the nature and extent of constituents of concern (COC) across the Site. The CSM is also utilized to evaluate potential pathways of exposure and risks associated with those potential exposures.

2.1 SITE SETTING

The Former Wood River Power Station is owned by CTI LLC and is situated on the east bank of the Mississippi River, about six river miles upstream from the confluence of the Mississippi and Missouri Rivers (NRT, 2006 and AECOM, 2016). The Wood River Creek, a perennial stream that discharges into the Mississippi River, lies on the eastern edge of Former Wood River Power Station. The Wood River Primary East Ash Pond (CCR Unit ID 901) is located to the north of the power plant (ceased operation in June 2016) and adjacent to the Wood River Creek, which discharges into the Mississippi River. The Wood River West Ponds 1, 2E, 2W (CCR Multi-Unit ID 902) are located to the northwest of the power plant. This CMA applies specifically to the PEAP (CCR Unit ID 901) which is part of the East Ash Pond (EAP) Complex. The EAP Complex includes the PEAP, Secondary East Polishing Pond (non-CCR unit) and historical ash disposal areas used prior to completion of Wood River West Ponds 1, 2E, 2W.

The PEAP is located within Section 20 Township 5 North and Range 9 West. The cities of Alton, East Alton, and Wood River are within 2 miles of the impoundments (NRT, 2006 and AECOM, 2016). Former Wood River Power Station is located in an area of heavy industrial activity, such as: a federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site, metals recycling, metal refining, a steel mill, an aluminum smelter, vinegar production, cardboard manufacturing, glass manufacturing and sewage treatment. The site location is shown on Figure 1. Figure 2 is a site plan showing the location of the PEAP and CCR monitoring wells. The Former Wood River Power Station property is bordered on the south by State Route 143 and the Mississippi River, the east by the Wood River Creek, the north by vacant/abandoned industrial property and railroad tracks, and the west by vacant land/water retention ponds of the Mississippi River levee system operated by the U.S. Army Corps of Engineers (USACE).

2.2 GEOLOGY AND HYDROGEOLOGY

The Former Wood River Power Station and associated ash pond complexes are situated in the northern end of an area of extensive alluvial deposits known as the American Bottoms (NRT, 2006 and AECOM, 2016). The geology of this area was described by Bergstrom and Walker (1987) and is summarized here. Alluvial and glacial sediments fill the Mississippi River valley in this area commonly to depths of 100 feet but can extend to more than 140 feet. The sediments generally coarsen downward; the contact between the alluvium and glacial sediments is typically indistinguishable in the Wood River area. Very coarse sediments generally occur near the base of these valley-fill materials and form a highly productive aquifer.

The sand and gravel in the Wood River area is overlain by low-permeability alluvial silt and clay and is underlain in places by low-permeability clay (NRT, 2006 and AECOM, 2016). Bedrock in the region consists of Pennsylvanian and Mississippian age shale, sandstone and limestone. The bedrock formations yield relatively little water compared to the overlying sand and gravel formation.

The geology at Former Wood River Power Station consists of the following units (beginning at the ground surface) (NRT, 2006 and AECOM, 2016):

- Fill (consisting of clay, sand, and silt mixtures) and coal ash: primarily occurs within the impoundments and the impoundment berms.
- Upper silty clay unit: Clay and silty clay alluvial deposits of the Mississippi River and Wood River Creek.
- Inter-sand unit: a thin (generally 5 feet or less) silty sand/ sand unit above the lower silty clay unit that is continuous across most of the Former Wood River Power Station and may intersect the primary sand unit in the northern and southern portions of the Former Wood River Power Station.
- Lower silty clay unit: Clay and silty clay alluvial deposits of the Mississippi River and Wood River Creek.
- Primary sand unit (Uppermost Aquifer): Sand and gravel deposits that are highly variable, well to poorly sorted, with intermittent layers of clay and silt. This unit is the Uppermost Aquifer unit.
- Silt and sandy silt, and silty clay diamicton only observed at depth near the east side of the PEAP.
- The bedrock at the Former Wood River Power Station may be the Mississippian-age St. Genevieve limestone, which dips gently to the east. Elevation of the bedrock surface at the Former Wood

River Power Station is estimated at approximately 300 feet above mean sea level (Hampton and O'Hearn, 1984).

Beneath areas of fill and coal ash lies the silty clay unit (NRT, 2006 and AECOM, 2016). Across most of the Former Wood River Power Station the silty clay unit is split into an upper and lower unit. The units are separated by the inter-sand unit. The inter-sand unit is composed of heterogeneous fine to medium-grained sand and silty sand that ranges from well to poorly sorted. Near the southeast portion of the PEAP the upper silty clay unit is thin or absent (either naturally, or it was removed during operational activities). In locations where the upper silty clay is absent, the remaining thickness of the lower silty clay unit separates the historical ash fill from the Uppermost Aquifer. The silty clay unit and the liner beneath the PEAP separate the PEAP from the Uppermost Aquifer.

Based on the lateral extent and thickness of the silty clay unit, it appears clay and silt alluvial sediments were deposited in a historical channel of the Mississippi River or Wood River Creek which trends east-west across the center of the East Ash Pond Complex. The thickness of the silty clay unit decreases to the north and the south of the East Ash Pond Complex as the base of the unit approaches the ground surface. The top of the inter-sand unit that occurs between the upper and lower silty clay units is deepest at the center of the historical channel and rises to the north and to the south (NRT, 2006 and AECOM, 2016).

The primary sand unit underlies the silty clay unit in the vicinity of the Former Wood River Power Station(NRT, 2006 and AECOM, 2016). The primary sand unit is the Uppermost Aquifer of the American Bottoms area and has been extensively developed for water supply. The estimated thickness of the permeable valley fill at Former Wood River Power Station is approximately 120 to 140 feet and the sand and gravel constitute 80 to 100 feet of this thickness. According to the Illinois State Geological Survey (ISGS), the upper 80 feet of the valley fill has been extensively reworked due to river flooding events (Bergstrom and Walker, 1987). Below this depth, the deposits are glacial outwash and older alluvium. Large boulders are encountered below 80 feet, which can sometimes limit drill penetration and are likely remnants of older Illinoian till.

Groundwater is present at depth in the Uppermost Aquifer (primary sand unit) and, during periods of high river stage, it is also present in the inter-sand layer (NRT, 2006 and AECOM, 2016). In general, the Mississippi River and Wood River Creek stages strongly influence and control the elevations in the groundwater within the Uppermost Aquifer. Water levels are elevated within the PEAP relative to groundwater elevations measured both outside and below the impoundment in the Uppermost Aquifer. Groundwater elevations in the Uppermost Aquifer are generally 10 to 20 feet lower than those measured within the impoundment.

Groundwater flow directions within the Uppermost Aquifer (primary sand unit) are variable and are significantly influenced by the Mississippi River and Wood River Creek stages (NRT, 2006 and AECOM, 2016). During base stage or low river levels, groundwater flow occurs in both a southwesterly direction toward the Mississippi River and southeasterly toward the Wood River Creek. During spring flooding and high Mississippi River stages, groundwater flow is northerly, with either an easterly or westerly component. After flood levels subside, the flow direction reverts to more normal conditions and groundwater again discharges to the rivers. The flooding and high river stages only occur periodically and the dominant flow direction during any given year is toward the rivers. Historical groundwater elevations measured at the northeast corner of the West Ash Pond Complex and northeast corner of the East Ash Pond Complex indicated downward vertical gradients and flow of groundwater from the silty clay into the Uppermost Aquifer. Groundwater elevations measured near the river's indicated gradients are flat to upward.

2.3 GROUNDWATER MONITORING

Groundwater is being monitored at the PEAP in accordance with the Assessment Monitoring Program requirements outlined in 40 CFR § 257.94€(2), and as described in NRT documents (2017A and 2017B). Groundwater monitoring has been occurring at the Site since 2017, and the monitoring well network was formerly evaluated and accepted in NRT's *Hydrogeologic Monitoring Plan* (2017A). NRT's *Statistical Analysis Plan* (2017B) provided the framework for evaluating groundwater monitoring by the CCR Rules with four phases of groundwater monitoring:

- Background Monitoring in accordance with 40 CFR 257.90(b)(iii) and 257.94(b)
- Detection Monitoring in accordance with 40 CFR 257.94
- Assessment Monitoring in accordance with 40 CFR 257.95
- Corrective Action Monitoring in accordance with 40 CFR 257.95(g) and 257.98.

Each phase of groundwater monitoring required specific statistical procedures as defined in the *Statistical Analysis Plan* (NRT, 2017B). Based on groundwater monitoring performed through 2021 for the PEAP, Boron has exceeded the background concentration in all down-gradient monitoring wells, while Calcium, Sulfate, and Total Dissolved Solids (TDS) have exceeded background levels in monitoring wells 39S, 40S, and 41. Assessment Monitoring has been on-going based on GWPS established for Appendix IV constituents listed below.

The GWPS used to evaluate the Appendix IV constituents are defined in the CCR Rule at §257.95 Assessment Monitoring Program:

> (h) The owner or operator of the CCR unit must establish a GWPS for each constituent in Appendix IV to this part detected in the groundwater. The groundwater protection standard shall be:
>
> > (1) For constituents for which a maximum contaminant level (MCL) has been established under §§141.62 and 141.66 of this title, the MCL for that constituent;
> >
> > (2) For constituents for which an MCL has not been established, the background concentration for the constituent established from wells in accordance with §257.91; or
> > (3) For constituents for which the background level is higher than the MCL identified under paragraph (h)(1) of this section, the background concentration.

Assessment monitoring of both upgradient and downgradient wells were compared to Appendix IV parameters in relation to GWPS (NTR, 2017B). The GWPS for the Appendix IV constituents are established as follows:

- Antimony- 0.006 mg/L
- Arsenic- 0.01 mg/L
- Barium- 2 mg/L
- Beryllium- 0.004 mg/L

- Cadmium- 0.005 mg/L
- Chromium- 0.1 mg/L
- Cobalt- 0.006 mg/L
- Fluoride- 4 mg/L
- Lead- 0.015 mg/L
- Lithium- 0.04 mg/L
- Mercury- 0.002 mg/L
- Molybdenum- 0.1 mg/L
- Radium 226+228- 5 pCi/L
- Selenium- 0.05 mg/L
- Thallium- 0.002 mg/

The 2022 analysis of the groundwater data collected for PEAP will incorporate the IEPA GWPS from IAC 845.600.

2.4 NATURE AND EXTENT OF GROUNDWATER IMPACTS

Groundwater monitoring has occurred since 2017 with sampling results summarized in yearly Groundwater Monitoring and Corrective Action reports. During each sampling event, one sample is collected from each background and downgradient well in the monitoring system. Analytical data are evaluated after each event in accordance with the *Statistical Analysis Plan* (NTR, 2017B) which identified statistically significant increases (SSIs) of Appendix III parameters over background concentrations. As detailed in the 2021 Annual Groundwater Monitoring and Corrective Action Report for PEAP, wells were sampled for all Appendix IV parameters due to Boron, Calcium, Sulfate and TDS being detected above background.

Appendix IV SSL determinations in the statistical analysis of the PEAP down-gradient wells were initiated in 2019. Molybdenum upper control limit (UCL) was found above the GWPS in all the down-gradient wells (38, 39S, 40S, & 41). Lithium UCL was only found above GWPS in monitoring wells 40S and 41. These chemical constituents have continued to be found in the same wells until 2021, when Lithium UCL was not found above GWPS in monitoring well 40S. No statistical trends in the data could be determined, until the 2021 analysis. Molybdenum was found to have a decreasing trend in monitoring well 38, otherwise all trends have remained statistically insignificant.

The PEAP remains in active Assessment Monitoring according to the *Hydrogeologic Monitoring Plan* (NTR, 2017A) in the Assessment Monitoring Program described in *Statistical Analysis Plan* for the Site (NTR, 2017B).

2.5 EVALUATION OF POTENTIAL EXPOSURE PATHWAYS AND RISK

The presence of CCR units indicate the presence of CCR that potentially come into contact with human or environment receptors through direct or indirect contact. The evaluation of the exposure pathways is based on the risk characterization principle that a risk can only occur if there is a complete exposure pathway, linking the source(s) of exposure and people or ecological receptors. In summary, three elements are required:

- Potential source or chemical release from a source.
- A receptor at the exposure point (e.g., people, plants, or aquatic animals); and
- An exposure route by which contact can occur (e.g., ingestion).

In the absence of any one of these elements, the exposure pathway is incomplete and therefore the potential for risks is not significant from the prospective CCR unit that is evaluated. The identification of these three elements is the first step of the risk characterization process, also known as the problem formulation. The remaining components in the process are exposure assessment, toxicity assessment, and risk characterization. Brief descriptions of these components are presented below, followed by the qualitative risk characterization results for the CCR units in the EAP. It is important to note that this CAA will identify a corrective action that fundamentally changes the current site conditions.

2.5.1 Problem Formulation

Problem formulation is used to identify COC, potential human and ecological receptors and exposure pathways applicable for current and potential future land use. It is used to determine whether potential concerns are present and whether a risk assessment is required. Evaluation of potential exposure pathways was conducted to determine the applicability of the respective exposure pathway to Site conditions.

The COCs were identified as the Appendix IV constituent (metals) associated with CCR sites. The potential exposure pathways were considered for each media.

2.5.2 Comparison to CCR Standards

In a qualitative risk assessment, the exposure assessment and toxicity assessment components of the process are intrinsic in the comparison to regulatory guidelines. The derivation of generic guidelines use default assumptions of how receptors are exposed to chemicals. Chemical toxicity values are also used in the guideline derivation. Consequently, although the exposure and toxicity assessment components were not implicitly assessed as part of the qualitative risk assessment, they are indirectly incorporated when comparing COC concentrations to the applicable guidelines based on the site-specific human and ecological receptors identified for current and future site use. The GWPS for metals serve as the screening level criteria for CCR sites.

2.5.3 Risk Characterization and Management

Risk characterization integrates information obtained from the risk assessment components, described above, with professional judgement to identify those exposure pathways which may result in adverse health effects for human health and ecological receptors. Should potential risks be identified for site conditions then the corrective actions for the CCR units should address these potential risks normally through elimination of pathways of exposure or management of source areas.

2.5.4 Identification of Receptors

Potential receptors can include trespassers, workers (on the pond structures, for example), and ecological receptors including free-ranging animals and riparian fauna and vegetation surrounding the Site. The future conditions for the Site are not expected to include occupations by residences or businesses.

2.5.5 Identification of Exposure Pathways

An evaluation of the exposure pathways and their applicability to the Site is presented as follows.

- Direct Contact Pathway. The open CCR unit make possible direct exposure to CCR materials.

- Vapor Inhalation Pathway. By nature, CCR material does not contain COC that can volatilize into the surrounding environment. The need to consider this pathway is therefore eliminated.
- Potable Groundwater Pathway. Groundwater flows beneath the CCR cells, and possible leakage from the cells can potentially affect underlying groundwater. The groundwater monitoring program has shown impacts from boron (an Appendix III constituent) above background concentrations but none of the metal show concentrations above their respective GWPS. From groundwater modeling performed at other CCR sites in similar settings, capping the CCR material can return COC to background concentrations. It can be noted that there are no current users of groundwater at the Site, and it is likely that groundwater usage will be restricted for the Site in the future.
- Offsite Migration. Offsite migration can occur through leaching of dissolved COC into groundwater and subsequent groundwater migration or through airborne processes that move CCR particulate material. The groundwater monitoring program evaluates the potential for offsite migration through groundwater flow. Similarly, a dust survey evaluates the potential for particulate migration through airborne process.
- Ecological Direct Contact Pathway. Most of the Site's surface is covered by the cells with fringing embankments covered with grasses. Ecological exposures can occur by direct contact with the CCR material in the open cells.
- Freshwater Aquatic Life Pathway. Groundwater flow beneath the Site is toward the Mississippi River with ultimate discharge into the river.

Although the PEAP is no longer active, potential exposures are possible, as noted above. The remedies considered in this CAA are all protective of human health and environment, and if implemented would significantly reduce if not eliminate potential exposure pathways and related risks in the present and extending into the future.

3. Corrective Action Alternatives

3.1 CLOSURE ALTERNATIVE ASSESSMENT GOALS

The overall goal for selection of the closure alternative is to select the one that best meets the following criteria. For the PEAP only a singular alternative is being evaluated.

3.2 CORRECTIVE MEASURES ALTERNATIVES

Corrective measures (remedies) are considered complete when pathways of exposure are addressed to reduce potential risks to acceptable conditions and when groundwater occurring beneath the Site does not show exceedances of any Appendix IV constituent above GWPS for three consecutive years of groundwater monitoring pursuant to §257.98(c)(2).

In accordance with §257.97(b), for the groundwater remedies to be considered, they must meet, at a minimum, the following threshold criteria (provided in more detail in **Section 1.3**):

1. Be protective of human health and the environment;
2. Attain the GWPS as specified pursuant to §257.95(h);
3. Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in Appendix IV to this part into the environment;
4. Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems; and
5. Comply with standards (regulations) for management of waste as specified in §257.98(d).

It can be noted that data from the groundwater monitoring program show that none of the Appendix IV constituents is found at concentrations above the GWPS over the past 5 years. Each of the remedial alternatives assembled as part of this CAA meet the requirements of the threshold criteria for groundwater listed above.

This CAA has been prepared based on closure for the PEAP. Once selected and potential review comments incorporated, Gemini intends to present closure plans to the IEPA which can be initiated and implemented within the allowable timeframes as stated in §257.101 of the CCR Rule. The remedial alternatives presented, herein, contemplate closure by removal (CBR) (Alternative 1) for the CCR units of the PEAP.

Monitored Natural Attenuation. Monitored natural attenuation (MNA) is a viable remedial technology for groundwater where the source is remediated, and it is recognized by both state and federal regulators for organic and inorganic constituents. It is anticipated that MNA will be a component of the selected remedy. The USEPA defines MNA as “the reliance on natural attenuation processes to achieve site-specific remediation objectives within a time frame that is reasonable compared to that offered by other more active methods.” The “natural attenuation processes” that are at work in such a remediation approach include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater.

These *in situ* processes include biodegradation, dispersion, dilution, sorption, volatilization, radioactive decay, and chemical or biological stabilization, transformation, or destruction of contaminants (USEPA, 2015). When combined with encapsulated CCR material between an engineered low-permeability cover system and an existing engineered bottom, the potential for dissolution of Appendix III and IV constituents in groundwater is reduced or eliminated. Where existing infiltration water or potential future groundwater includes Appendix III and IV constituents, MNA can reduce residual concentrations in groundwater at and beyond the PEAP boundary. It is recognized that a few additional monitoring wells may be needed to focus groundwater monitoring after implementation of the remedy.

3.2.1 Alternative 1 – Ash Pond Closure by Removal of All CCR Material and Groundwater by Monitored Natural Attenuation

This alternative evaluates the removal of CCR from the PEAP and transporting the CCR material to an offsite engineered landfill. The CCR material would be completely removed, and the vacated cells would be backfilled using berms and supplemental borrow material to blend with ambient conditions. The offsite landfill would presumably meet appropriate standards to receive the CCR material consistent with the CCR Rule.

Removal activities would likely require dewatering and temporary staging/stockpiling of material for drying prior to transportation, which would affect the overall timeframe for complete removal. During periods of rain and inclement weather, the removal schedule would be negatively impacted. Excavation and construction safety during the removal duration is another concern due to heavy equipment (e.g., bulldozers, excavators, front -end loaders, and transportation vehicles).

There are several potential community impacts, safety concerns, and challenges associated with the off-site disposal CBR alternative. Given the magnitude of the total estimated truck trips (>350,000 trips) along with the combined travel distance required to transport the CCR to one or more landfills, there are increased exposures to transportation-related incidents. In addition, due to the volume and duration of loaded trucks travelling on public roads, it is anticipated that improvements to these roads may be necessary before or during large-scale removal of CCR. This could result in additional traffic flow disruptions and congestion due to road construction activities and delay in implementation or completion of this alternative. Fossil fuel consumption and vehicle emissions from transporting the CCR to a regional landfill are also significant in order to complete the off-site CBR alternative.

Assuming that a regional landfill is used for this alternative, it is presumed that the landfill owner already has a program for monitoring that would not require input or continued action from Finch. Following removal of the CCR material from the PEAP, groundwater would be addressed through continued monitoring using MNA. It is anticipated that a demonstration of MNA could be obtained within 5 years of completion of this remedial action.

4. Comparison of Corrective Action Alternatives

4.1 EVALUATION CRITERIA

This section provides discussion of the corrective action alternatives that are summarized, above, in meeting the requirements and objectives of remedies for CCR impoundments as described under §257.97 and provided in Section 1, above.

The following five criteria, presented in Section 1.3, satisfy the threshold criteria and serve as the primary guidelines for selecting the corrective actions for ultimate closure of this Site. The five criteria [see Section 1.3(b)(1) through (5)] used to compare closure methods are summarized as follows:

1. The long-term and short-term effectiveness and protectiveness.
2. The control of future potential releases.
3. The implementability of the closure alternative.
4. Community acceptance of the closure alternative.
5. The overall estimated cost to implement the closure alternative.

4.2 COMPARISON OF CRITERIA FOR EACH ALTERNATIVE

4.2.1 Criterion 1 - Long- and Short-Term Effectiveness and Protectiveness

The relative success for this criterion depends on the alternative reducing or eliminating exposure pathways and hence potential contact with CCR material or dissolved metals in groundwater that may develop from contact with surface infiltration water and groundwater. Alternative 1 removes the waste thereby eliminating the pathway except for potential residual impacts in groundwater and hence the long-term potential risk. Since results from the groundwater monitoring program do not show groundwater impacts above GWPS for the Appendix IV metals, there does not appear to be a short-term advantage for any of the alternatives. However, by complete removal of CCR material (Alternative 1), it can be presumed that Alternative 1 is the best at diminishing or eliminating potential groundwater impacts.

4.2.2 Criterion 2 – Control of Future Potential Releases

The distinction between this criterion and the first criterion is mostly related to potential physical releases from breaches in construction. The removal of all waste to an onsite or offsite landfill (Alternative 1) is considered to eliminate potential releases altogether by ultimately restoring the property to open ground. As a result, Alternative 1 (i.e., complete removal of CCR material) is the most favorable and thus a score of 3.

4.2.3 Criterion 3 - Implementability

The relative favorability for this criterion depends on the degree of difficulty implementing the alternative, the availability of equipment and manpower to implement, the coordination / permitting with state and local agencies, and the relative ease of the Site in staging the alternative.

4.2.4 Criterion 4 – Community Acceptance

Part of the review process on the CAA report is a public meeting process to better identify public concern regarding possible closure alternatives. The degree to which the concerns of residents living within the community where the CCR material will be handled and disposed is accepted depends on the overall time it takes to complete the remedial activities and the relative disturbances experienced in the community. Traditionally, clean closure of a CCR unit (removal of all CCR waste from the unit) is seen as the most desirable approach and community support is anticipated if public impact can be minimized and project cost allows for timely completion. Community support of CCR waste removal is anticipated.

4.2.5 Criterion 5 – Overall Cost

The costs for the alternative derive primarily from engineering and implementation. With engineering costs secondary to implementation costs, the volume of CCR material requiring excavation and transportation primarily determines the overall costs. The cost for removal of the CCR waste is estimated to be approximately $700,000.

5. Summary

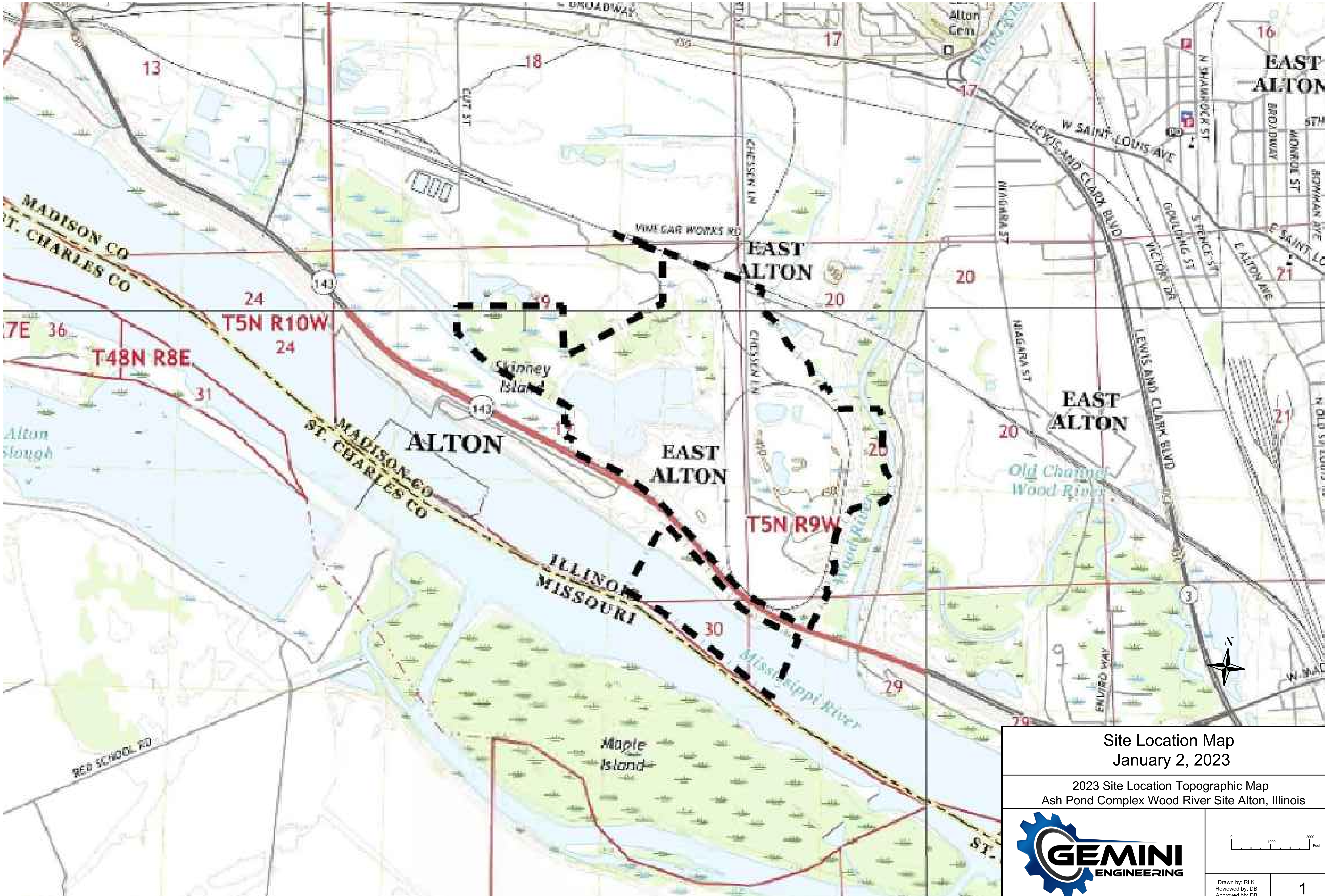
This Corrective Measures Assessment has evaluated the following alternatives:

- Alternative 1: Closure by removal of CCR and MNA for potential groundwater issues.

In accordance with §257.97(b), each of these alternatives has been confirmed to meet the following threshold criteria:

1. Be protective of human health and the environment;
2. Attain the GWPS as specified pursuant to §257.95(h);
3. Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in Appendix IV to this part into the environment;
4. Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems; and
5. Comply with standards (regulations) for management of waste as specified in §257.98(d).

This Closure Alternative Assessment selected a remedy (Alternative 1) that allows for removal of the CCR material and addressing potential groundwater issues via MNA. In accordance with the CCR Rule. §257.97(a), a semi-annual report is required to document progress toward remedy selection and design. Once a remedy is selected, a final remedy selection report must be prepared to document details of the selected remedy and how the selected remedy meets §257.97(b) and Section 845.710 requirements. The final selected remedy report will also be certified by a professional engineer and posted to the CCR website.



Site Location Map

January 2, 2023

2023 Site Location Topographic Map

Ash Pond Complex Wood River Site Alton, Illinois

GEMINI ENGINEERING

Drawn by: RLK
Reviewed by: DB
Approved bb: DB

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20R
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35R
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39S
41
40S
43S/43M
44
45
Outlet to Channel
Inlet Drop Structure
Outlet to Culvert
Secondary Pond
Inlet Drop Structure
Primary East Ash Pond
N
CLOSURE PLAN MONITORING WELL LOCATION (WEST ASH POND COMPLEX)
MONITORING WELL LOCATION
PIEZOMETER LOCATION
GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
INFERRED GW ELEVATION CONTOUR
PROPERTY BOUNDARY (BASED ON 2017 SURVEY)
CCR MONITORED-MULTI UNIT
CCR UNIT
SITE FEATURES
Ground Water Monitoring Locations And Site Overview
2022 Monitoring Well Location Map
Ash Pond Complex Wood River Site Alton, Illinois
GEMINI ENGINEERING
Drawn by: RLK
Reviewed by: DB
Approved bb: DB
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