



**Second Semiannual Report on the
Progress of Remedy Selection**

**TVA Allen Fossil Plant, Shelby
County, Memphis, Tennessee**

July 15, 2020

Prepared for:

Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:

Stantec Consulting Services Inc.

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TVA Allen Fossil Plant, Memphis, Tennessee**

July 15, 2020

1.0 Introduction

In accordance with 40 CFR § 257.97(a), the Tennessee Valley Authority (TVA) has prepared this second semiannual report to document progress toward remedy selection and design at the East Ash Disposal Area (EADA) at the Allen Fossil Plant (ALF) in Memphis, Shelby County, Tennessee.

1.1 Regulatory Background

On April 17, 2015, the United States Environmental Protection Agency (U.S. EPA) published a rule that sets forth national criteria for the management of coal combustion residuals (CCR) produced by electric utilities. The requirements can be found in Title 40, Code of Federal Regulations (CFR) Part 257, Subpart D. The rule includes requirements for monitoring groundwater and assessing corrective measures if constituents listed in Appendix IV of the rule are detected in groundwater samples collected from downgradient monitoring wells at statistically significant levels (SSLs) greater than established groundwater protection standards (GWPS).

In January 2019, TVA completed an evaluation of whether there were SSLs over established GWPS as defined in 40 CFR § 257.95(h) for one or more Appendix IV constituents in accordance with 40 CFR § 257.95(g). At the EADA, assessment monitoring in 2018 detected SSLs greater than the GWPS for arsenic at monitoring wells ALF-202, ALF-203, and ALF-204; fluoride at monitoring well ALF-203; lead at monitoring well ALF-203; and molybdenum at monitoring wells ALF-202, ALF-203, and ALF-205. Since this time, TVA has updated the statistical analysis.

- During late-2019, TVA recalculated the statistical analysis incorporating additional groundwater monitoring data from the second assessment monitoring event.
- During mid-2020, TVA updated the statistical analysis after incorporating results from the second assessment monitoring retest event from 2019 and the first semiannual assessment monitoring event and retest event in 2020.

There continues to be SSLs above the GWPS for arsenic in wells AFL-202, ALF-203, and ALF-204; for lead in well ALF-203; and for molybdenum in wells ALF 202 and ALF-203. However, unlike during 2018, there was not an SSL above the GWPS for fluoride in well ALF-203 or molybdenum in well ALF-205. As of the date of this report, TVA has not completed a demonstration that a source other than the EADA caused the SSLs, as provided for under 40 CFR § 257.95(g)(3)(ii). In accordance with 40 CFR § 257.96(a), TVA prepared the 2019 Assessment of Corrective Measures (ACM) Report for the EADA at ALF, placed it in the facility operating record on July 15, 2019, and uploaded it to the TVA CCR Rule Compliance Data and Information website on August 14, 2019. The ACM Report provided an assessment of the effectiveness of potential corrective measures in achieving the criteria provided in 40 CFR § 257.96(c). Three primary strategies were evaluated to address groundwater exhibiting statistical exceedances above the GWPS:

- Monitored Natural Attenuation (MNA);
- Hydraulic Containment and Treatment; and,
- Enhanced In-Situ Treatment (EIST).

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Following preparation of the ACM Report, TVA has initiated the remedy selection process. Semiannual reports are required pursuant to 40 CFR § 257.97(a) to document progress toward remedy selection and design. The CCR Rule contemplates that more investigation and consideration may be needed to evaluate and design the remedy before making the final selection. TVA placed the first Semiannual Report on the Progress of Remedy Selection into the facility operating record on January 15, 2020 pursuant to 40 CFR § 257.97(a) and § 257.105(h)(12). TVA provided notification of the availability of the semiannual report describing the progress in selecting and designing the remedy and placed it on the TVA CCR Rule Compliance Data and Information website on February 14, 2020, in accordance with 40 CFR § 257.106(h)(9) and § 257.107(h)(9). TVA will continue to review new data as it becomes available and implement changes to the groundwater monitoring and corrective action program as necessary to maintain compliance with 40 CFR § 257.90 through § 257.98.

At least 30 days prior to final groundwater remedy selection pursuant to the CCR Rule, a public meeting will be held with interested and affected parties to discuss the results of the corrective measures assessment in accordance with 40 CFR § 257.96(e). The selected remedy must meet the requirements of 40 CFR § 257.97(b) and must consider the evaluation factors set forth in 40 CFR § 257.97(c). Once a final remedy is chosen, a final report describing the remedy and how it meets the standards set forth in 40 CFR § 257.97(b) will be prepared. The owner/operator must provide a schedule for implementing the selected remedy that considers the factors set forth in 40 CFR § 257.97(d).

1.2 Summary of State Required Investigation and Remedy Selection Process

TVA is currently conducting an additional environmental investigation (EI) of ALF under the oversight of the Tennessee Department of Environment and Conservation (TDEC) through the TDEC Commissioner's Order, OGC 15-0177, issued on August 6, 2015 (TDEC Order). In response to the detection of atypical arsenic concentrations in monitoring wells ALF-202, ALF-203 and ALF-204, TVA initiated site characterization actions at the EADA in advance of the TDEC Order, and later initiated a Remedial Investigation (RI) in coordination with the TDEC Division of Remediation. The events are summarized below:

- In May 2017, TVA began an investigation to delineate constituents of interest (COIs) in groundwater around the EADA.
- In June 2017, TDEC requested that TVA investigate arsenic-impacted groundwater outside the scope of the TDEC Order under the oversight of the TDEC Division of Remediation.
- On July 18, 2017, TDEC requested that TVA develop an RI Work Plan (RIWP) with respect to TVA's ongoing investigation.
- On September 15, 2017, TVA submitted final RIWP to TDEC.
- On March 6, 2018, TVA submitted a draft RI Report (RIR) to TDEC.
- On December 18, 2018, TVA submitted a final Supplemental RIWP to TDEC.
- On March 1, 2019, TVA submitted a draft Updated RIR to TDEC.
- On May 31, 2019, TVA submitted the final Updated RIR to TDEC.

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Once the environmental investigation under the TDEC Order is complete TVA will submit an environmental assessment report (EAR) that provides an analysis of the extent of CCR contamination based on data from both the environmental investigation and RI, including groundwater contamination, at the site to TDEC for approval. Then, as part of the TDEC Order process, TVA will submit a Corrective Action/Risk Assessment (CARA) Plan that specifies actions that TVA plans to take at the site, including corrective measures for groundwater remediation. TDEC must approve the CARA Plan, including the CCR unit closure methodology, selected final remedy(s) and corrective measures for groundwater remediation. The TDEC Order process includes a public comment period for the public to provide comments on the CARA Plans.

1.3 Report Contents

This second semiannual progress report provides a summary of ALF site characteristics, the groundwater assessment monitoring program, the findings of the ACM process, and the current progress of selecting and designing a final remedy for statistically significant GWPS exceedances.

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2.0 Site Background and Characteristics

ALF is located in Memphis, Shelby County, Tennessee. The facility lies on the south bank of McKellar Lake and the eastern bank of the Mississippi River. **Figure 1** shows an overview map of ALF including the EADA. Construction of ALF began in 1956, and ALF was fully operational by 1959. Coal-fired power generation ceased in March of 2018. The coal combustion process at ALF resulted in the production of fly ash and bottom ash. The plant most recently managed these materials in the EADA.

The EADA at ALF encompasses approximately 85 acres and is formed by perimeter dikes (including the United States Army Corps of Engineers [USACE] levee) that rise approximately 25 feet above surrounding land. Soil borings indicate that a clay layer is largely present at the base of the EADA. During plant operations, the EADA received sluiced fly ash and bottom ash, plant effluent, and stormwater runoff from the Coal Storage Area and the Coal Yard Runoff Pond. Flows to the EADA ceased in April 2019.

2.1 Conceptual Site Model Summary

The hydrogeologic conceptual site model (CSM) is one of the primary tools that can be used to support decisions on corrective measures. The geology and hydrogeology of the ALF site have been characterized during implementation of multiple investigations. These investigations provide a detailed understanding of site geology and the water-bearing zones.

The subsurface geology at ALF is characterized by three hydro-stratigraphic units, which, in descending order, include the Alluvial aquifer (also known as Mississippi River Valley Alluvium), the upper Claiborne confining unit (also known locally as the Cook Mountain Formation), and the Memphis aquifer (also known as Memphis Sand). The Alluvial aquifer is the upper-most aquifer at ALF and groundwater from this hydro-stratigraphic unit is monitored in accordance with 40 CFR § 257.91. A typical conceptual cross-section view of the subsurface geology is shown on **Figure 2**.

Groundwater flow in the Alluvial aquifer is predominately horizontal and the flow direction is influenced by the McKellar Lake stage. During periods of low surface water elevation in McKellar Lake, groundwater flow is to the north, toward the lake. During periods of high surface water elevation in McKellar Lake, groundwater flow direction is towards the south. **Figure 3** presents a groundwater flow direction map at ALF during February 2020 which represents a period of high surface water elevation in McKellar Lake.

The Memphis aquifer is a source of high-quality drinking water for the City of Memphis. Although the Memphis aquifer is isolated from the Alluvial aquifer under most of the East Ash Disposal Area by the intervening upper Claiborne confining unit, the Alluvial and Memphis aquifers are physically offset in the southeastern corner of the disposal area by an inferred fault. The Alluvial aquifer directly overlies the Memphis aquifer in a localized area near ALF-202, as a result of the upper Claiborne confining unit having been removed by erosional scouring. This means that in the southeast corner of the EADA, the Alluvial aquifer and the Memphis aquifer appear to be physically connected. A groundwater pumping test by the United States Geological Survey (USGS) also indicated a discernible hydraulic connection between the Memphis and Alluvial aquifers in the southeastern corner of ALF. Groundwater samples from the Memphis aquifer were collected four times during the RI for analysis of CCR constituents. The results indicated no effect on the groundwater quality of the Memphis aquifer due to the EADA.

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2.2 Potential Receptor Review

The Memphis aquifer is the primary source of drinking water in the area. The City of Memphis obtains its water supply from multiple well fields that withdraw water from the Memphis aquifer. Except for the Davis Well Field, the other well fields are more than 5.5 miles east of ALF. The Davis Well Field is located approximately two miles south of ALF.

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3.0 Groundwater Assessment Monitoring Program

Groundwater assessment monitoring for the EADA is conducted at ALF in accordance with 40 CFR § 257.95.

3.1 Groundwater Monitoring Well Network

In compliance with 40 CFR § 257.91, one background well (ALF-210) was established upgradient and eight monitoring wells (ALF-201, ALF-202, ALF-203, ALF-204, ALF-205, ALF-206, ALF-212, and ALF-213) were installed downgradient of the EADA. The locations of these monitoring wells, as well as locations for several additional monitoring wells related to the RI and TDEC Order Environmental Investigation, are presented on **Figure 1**.

3.2 Groundwater Characterization

Groundwater assessment monitoring was conducted during 2018 and 2019, and at the time of this report, the first semiannual assessment monitoring event and retest event in 2020 had been conducted. Appendix IV constituents including arsenic, lead, and molybdenum were detected at SSLs above the GWPS. The following summarizes the 2018, 2019, and 2020 Appendix IV SSLs above GWPSs at the EADA.

- Arsenic
 - SSLs for arsenic were identified at monitoring wells ALF-202, ALF-203, and ALF-204
 - The GWPS for arsenic is 20.3 µg/L¹
- Fluoride
 - An SSL for fluoride was identified at monitoring well ALF-203 in 2018; however, this apparent SSL was not evident in the statistical analysis after inclusion of groundwater monitoring data collected during 2019 and for the first semiannual assessment monitoring event and retest event in 2020
- Lead
 - An SSL for lead was identified at ALF-203
 - The lead GWPS is 15 µg/L

¹ The baseline datasets collected since Year-One of the CCR-Rule Groundwater Quality Monitoring Program were evaluated in order to establish updated GWPS on upgradient background data, and then to compare Year-Four compliance measurements against these statistical limits to assess any statistically significant increases (SSI) above the GWPS. At the ALF network, the sampling results used to compute the background statistics and identify potential SSIs were obtained from a designated background well (ALF-210) using data collected from November 2016 until May 2020. TVA is evaluating potential changes to background wells at ALF which are used in the calculation of GWPSs.

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- Molybdenum
 - An SSL for molybdenum was identified at monitoring well ALF-205 in 2018; however, this apparent SSL was not evident in the statistical analysis after inclusion of groundwater monitoring data collected during 2019 and for the first semiannual assessment monitoring event and retest event in 2020
 - SSLs for molybdenum were identified at ALF-202 and ALF-203
 - The molybdenum GWPS is 100 µg/L

The extent of COIs above the GWPS along the unit perimeter is illustrated on **Figure 4**, and the facility-wide monitoring well network is provided as **Figure 5**. The work performed under the 2019 RI and the TDEC Order process will further inform the evaluation and selection of the remedy(s) under 40 CFR § 257.97 of the CCR Rule.

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4.0 Assessment of Corrective Measures

TVA prepared the 2019 ACM Report for the EADA and placed it in the operating record on July 15, 2019. The report was posted to the TVA CCR Rule Compliance Data and Information website on August 14, 2019. The ACM Report provided an assessment of the effectiveness of potential corrective measures in achieving the criteria provided in 40 CFR § 257.96(c).

4.1 Planned Source Control Measures

The objectives of corrective measures under 40 CFR § 257.96(a) are to “prevent further releases [from the CCR units], to remediate any releases, and to restore affected areas to original conditions.” Ultimately, in accordance with 40 CFR § 257.97(b)(3), the selected corrective measure must at a minimum “[c]ontrol the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents of appendix IV to this part into the environment.”

The Preamble (80 Fed. Reg. 21302, 21406) to the CCR Rule discusses that source control measures may include modifying operational procedures. To comply with regulatory requirements and timeframes under the CCR Rule, TVA has removed the EADA from service and has initiated closure. After conducting the necessary environmental review, TVA has decided to close the EADA by removing the CCR material in accordance with 40 CFR § 257.102(c) (Stantec, 2019a). Through the Interim Response Action (IRA) process overseen by TDEC’s Division of Remediation, TVA has initiated measures to control and begin treating impacted groundwater, and to remove free water and ash pore water from the EADA.

These measures will reduce the potential for migration of CCR constituents to groundwater. Continued semiannual groundwater assessment monitoring will be conducted to track changes in groundwater conditions as a result of these closures and operational changes. These data will also be considered in the selection and design of a remedy in accordance with 40 CFR § 257.97. Groundwater assessment monitoring as required by 40 CFR § 257.96(b) will continue until a final groundwater remedy is selected. Long-term groundwater assessment monitoring is a component of the corrective measure implementation.

4.2 Potential Remedial Technologies

Having completed the necessary environmental review, the EADA will be closed by removing the CCR material in accordance with the requirements set forth in 40 CFR § 257.102(c).

In addition to source control measures, three primary strategies were evaluated to address groundwater exhibiting concentrations of COIs above the GWPS including:

- MNA
- Hydraulic Containment and Treatment and,
- EIST.

The ACM Report provides a more detailed description of these corrective measures. The potential effectiveness of each corrective measure identified above was assessed in accordance with 40 CFR § 257.96(c) and each is currently considered feasible for remediating the groundwater at the EADA.

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5.0 Selection of Remedy: Current Progress

A remedy to address SSLs in groundwater will be selected in accordance with 40 CFR § 257.97. Upon selection of a remedy under the CCR Rule, the owner or operator must prepare a final report (i.e., Remedy Selection Report) describing the selected remedy and how it meets the standards specified below pursuant to 40 CFR §257.97(b)(1)-(5). Remedies must: (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 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; (5) Comply with standards for management of wastes as specified in §257.98(d).

In support of the remedy selection process, additional investigation may be needed and is described below in Section 5.1. Through the IRA process, TVA has initiated corrective measures to control and begin treating impacted groundwater, and to remove free water and ash porewater from the EADA through a dewatering process. The following activities have been completed to date as part of the interim corrective measures:

- Completed the installation of one extraction well (EW-N02) situated on the north side of the EADA (**Figure 6**)
- Completed the installation of three performance monitoring well triplets screened in the shallow, intermediate, and deep intervals of the Alluvial aquifer (PMW-02A/B/C, PMW-04A/B/C, and PMW-07A/B/C) around the northern extraction well (**Figure 6**)
- Completed the installation of one extraction well (EW-S03) situated on the south side of the EADA (**Figure 7**)
- Completed the installation of three performance monitoring well triplets screened in the shallow, intermediate, and deep intervals of the Alluvial aquifer (PMW-10A/B/C, PMW-11A/B/C, and PMW-14A/B/C) around the southern extraction well (**Figure 7**)
- Characterized extracted groundwater (influent) for purposes of evaluating treatment options
- Evaluated three treatment processes including: 1) chemical coagulation using ferric chloride with subsequent settling and filtration; 2) electrocoagulation; and, 3) alumina adsorption media
- Finalized the design of a groundwater treatment system based on coagulation, settling and filtration with an estimated 93% removal rate for arsenic
- Initiated procurement of long lead process equipment the groundwater treatment system and,
- Obtained a connection permit from the City of Memphis for discharge to the publicly owned treatment works (POTW) with a permitted maximum flow rate of 360 gallons per minute (gpm).

Data collected to support the design and implementation of the IRA corrective measures will also be used to support the selection of a final remedy for groundwater pursuant to the CCR Rule.

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Source control measures are being implemented for the EADA. In April 2019, the unit ceased receipt of flows from the plant and ponded free water has been pumped from the EADA. This drawdown is substantially complete and will facilitate removal of the CCR material from the EADA. A second stage of porewater removal will commence when the contractor mobilizes to the site for the closure by removal project. Stormwater management activities in the area of the EADA are ongoing.

5.1 Data Requirements for Design of Groundwater Corrective Action

The horizontal and vertical extent of Appendix IV COI (arsenic, lead and molybdenum) impacts at the EADA has been largely characterized as a result of the 2017-2018 RI, as reported in the May 2019 RIR (Stantec, 2019b). In order to further refine the targeted area for corrective measures, develop remedial cost estimates, and finalize the selected method for the EADA, additional site-specific data may be required. It is noted that additional data collection requirements may include ongoing EI work that is reported separately.

Potential future activities to further evaluate MNA:

- Supplemental Groundwater Fate and Transport Modeling Simulations – The refined groundwater flow model will first be calibrated to site conditions following implementation of source control measures following dewatering of the EADA and after removal of the CCR material. The calibrated groundwater flow model will then be used as the basis for development of a fate and transport model to further evaluate COI migration potential and support evaluation of MNA as a potential component of the remedy.

Recent activities completed to further evaluate hydraulic containment and treatment:

- Wastewater Treatment Plant Capacity Evaluation - the City of Memphis T.E. Maxson Wastewater Treatment Plant was determined to have ample capacity to accept extracted, treated groundwater during the implementation of source control measures.
- Groundwater modeling to evaluate extraction rates for the corrective measure has been completed. Based on these simulations, it is estimated that capture of the area of COIs in groundwater greater than the GWPS can be achieved by operating four extraction wells situated north of the EADA and five extraction wells situated south of the EADA.

Future activities to further evaluate hydraulic containment and treatment:

- Three additional extraction wells and four additional performance monitoring well pairs are proposed for installation, development, and hydraulic testing on the north side of the EADA (**Figure 6**).
- Four additional extraction wells and four additional performance monitoring well pairs are proposed for installation, development, and hydraulic testing on the south side of the EADA (**Figure 7**).

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5.2 Semiannual Reporting, Public Meeting, Remedy Selection and Final Report

Progress toward the selection and design of the remedy will be documented in semiannual reports in accordance with 40 CFR § 257.97(a). Semiannual reports will be placed into the facility operating record pursuant to 40 CFR § 257.105(h)(12). TVA will provide notifications of the availability of the semiannual reports describing the progress in selecting and designing the remedy and will place the reports on the TVA CCR Rule Compliance Data and Information website in accordance with 40 CFR § 257.106(h)(9) and § 257.107(h)(9) respectively 30 days after placement in the facility operating record. At least 30 days prior to selecting a remedy, a public meeting to discuss the results of the corrective measures assessment will be conducted as required by 40 CFR § 257.96(e). A final report will be prepared after the remedy is selected. This final report will describe the remedy and how it meets the standards specified in 40 CFR § 257.97(b) and 257.97(c). Recordkeeping requirements specified in 40 CFR § 257.105(h), notification requirements specified in 40 CFR § 257.106(h), and internet requirements specified in 40 CFR § 257.107(h) will be complied with as required by 40 CFR § 257.96(f).

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6.0 References

Stantec Consulting Services Inc. (2019a). *Notice of Intent to Close – CCR Surface Impoundment, EOA Final CCR Rule 40 CFR 257.102, East Ash Disposal Area, TVA Allen Fossil Plant*. April 23.

Stantec Consulting Services Inc. (2019b). *Updated TVA Allen Fossil Plant – East Ash Disposal Area – Remedial Investigation Report*, May 31, 2019.

Attachments:

Figures

Figure 1 – CCR Unit with Background and Downgradient Wells

Figure 2 – Conceptual Geological Cross-Section

Figure 3 – Alluvial Aquifer Groundwater Elevation Map Sandy Zone Shallow Wells

Figure 4 – Monitoring Wells and Limits of COI Impacts

Figure 5 – Allen Fossil Plant and ACC Plant Well Locations

Figure 6 – North Area IRA EW-PMW Location Map

Figure 7 – South Area IRA EW-PMW Location Map

FIGURE 1
CCR UNIT WITH BACKGROUND AND
DOWNGRADIENT WELLS



DRAFT



Legend

- Piezometers or Geoprobe Borings
- Investigation Well
- Background Well (CCR Rule)
- Downgradient Well (CCR Rule)
- CCR Unit Subject to CCR Rule
- TVA Property Boundary



0 500 1,000 Feet
(At original document size of 8.5x11)
1:12,000

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Background: ESRI & Imagery for West Ash Disposal Area provided by TVA and is dated March 15, 2018 and June 4, 2019.



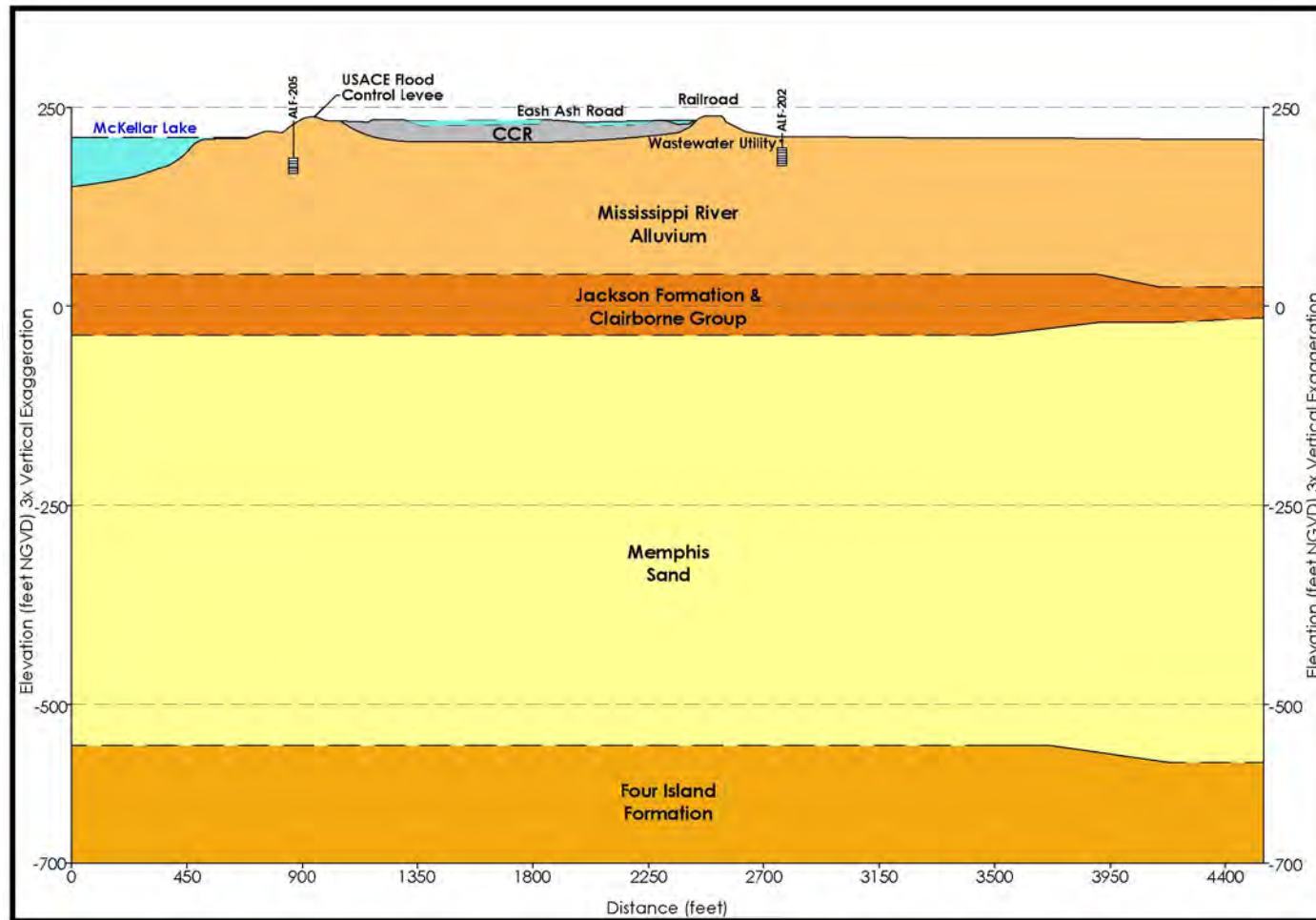
Project Location
City of Memphis
Shelby County, TN
Client/Project
Tennessee Valley Authority
Allen Fossil Plant
CCR Rule
Prepared by LMB on 2020-06-09
Technical Review by EP on 2020-06-09
Independent Review by JB on 2020-06-09
182603528

Figure No.

Figure 1

Title
CCR Unit with Background and Downgradient Wells

FIGURE 2
CONCEPTUAL GEOLOGICAL CROSS-SECTION



Project Location Prepared by LMB on 2020-06-09
City of Memphis Technical Review by EP on 2020-06-09
Shelby County, TN Independent Review by JB on 2020-06-09
Client/Project 182603528
Tennessee Valley Authority
Allen Fossil Plant
CCR Rule

Figure No.

Figure 2

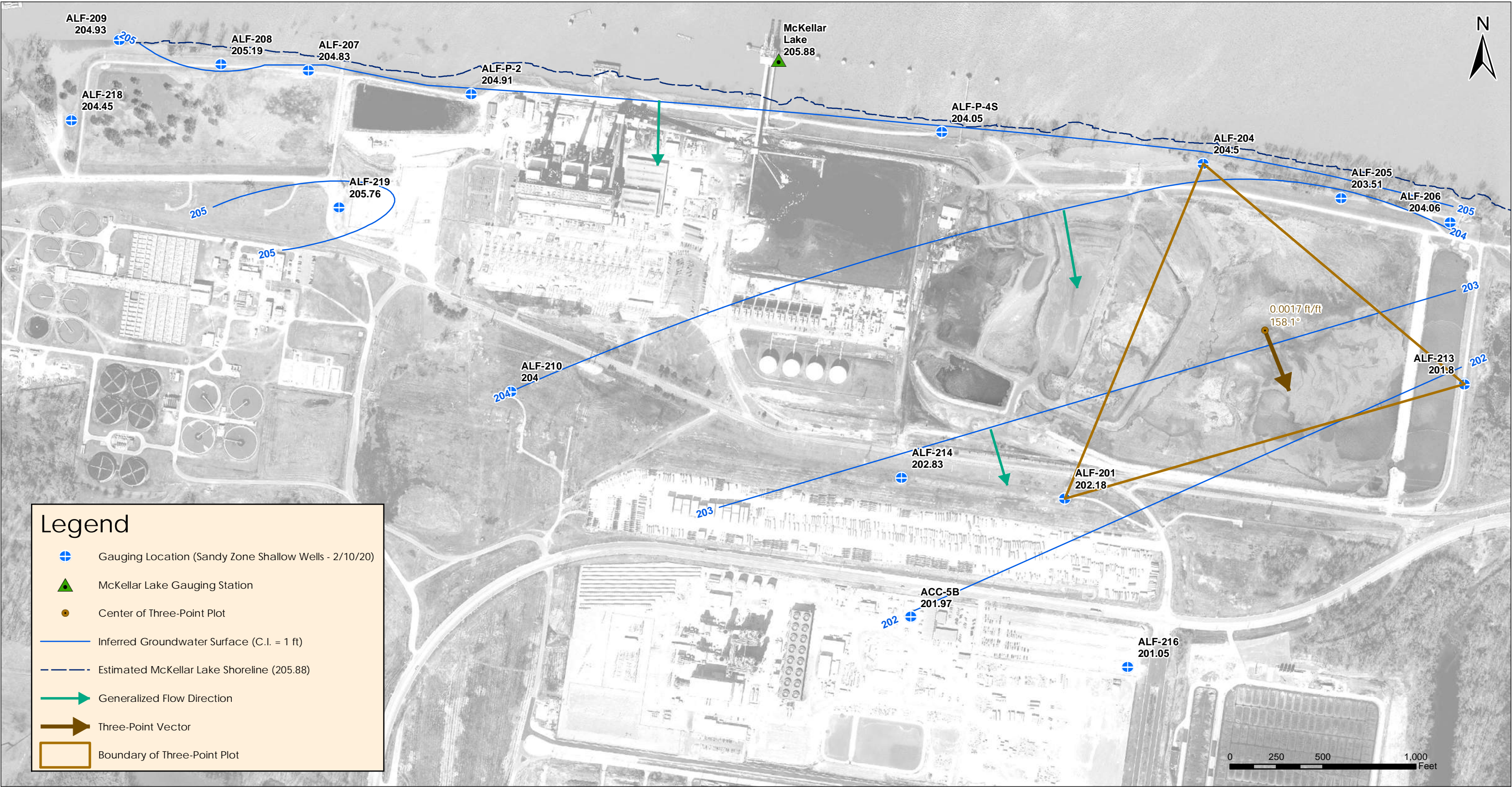
Title

Conceptual Geologic Cross-Section



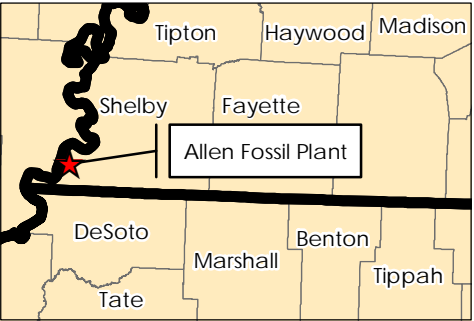
FIGURE 3
ALLUVIAL AQUIFER GROUNDWATER
ELEVATION MAP SANDY ZONE
SHALLOW WELLS

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Revised: 2020-06-10 By: blackman



Notes

1. Horizontal Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet. Elevations listed are in feet above North American Vertical Datum of 1929.
2. Imagery provided by client (dated 2018 & 2019)
3. The McKellar Lake elevation listed corresponds to the value measured at 11:00 on the date listed. The estimated shoreline indicated is based on interpretation of the United States Geological Survey (USGS) National Elevation Dataset (NED).
4. Water table surface contours were inferred based on gauging results at the locations indicated and estimated surface water elevation of McKellar Lake as indicated.
5. Groundwater elevations from ALF-202, ALF-203, and ALF-212, and the EW-series and PMW-series wells were excluded from interpolation of the sandy zone shallow Alluvial aquifer water table surface. Review of hydrographs and lithology indicate that the water levels in these wells may be mounded above a semi-confining layer, and thus, are not well correlated with the water levels in the other unconfined shallow wells. June 2019 groundwater elevations from these wells are included in Figure 2a.

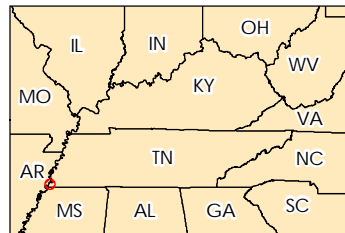


Client/Project
Tennessee Valley Authority
Allen Fossil Plant
Memphis, Shelby County, Tennessee

Figure No.
3

Title
**Alluvial Aquifer
Groundwater Elevation Map
Sandy Zone Shallow Wells**

FIGURE 4
MONITORING WELLS AND LIMITS OF
COI IMPACTS



Legend

- Piezometers or Geoprobe Borings
- Investigation Well
- ▲ Staff Gauge
- Background Well (CCR Rule)
- Downgradient Well (CCR Rule)
- GWPS Exceedance Well
- CCR Unit Subject to CCR Rule
- TVA Property Boundary
- Potential Treatment Zones
- (Arsenic, Lead, Molybdenum)



1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Background: ESRI & Imagery for West Ash Disposal Area provided by TVA and is dated March 15, 2018 and June 4, 2019.

0 500 1,000 Feet
(At original document size of 8.5x11)
1:12,000



Project Location
City of Memphis
Shelby County, TN
Client/Project
Tennessee Valley Authority
Allen Fossil Plant
CCR Rule
Prepared by LMB on 2020-06-09
Technical Review by EP on 2020-06-09
Independent Review by JB on 2020-06-09
182603528

Figure No.
Figure 4

Title
**Monitoring Wells and
Limits of COI Impacts**

FIGURE 5
ALLEN FOSSIL PLANT AND ACC PLANT
WELL LOCATIONS



Figure No.
5

Title
Allen Fossil Plant and
ACC Plant Well Locations

Client/Project
Tennessee Valley Authority
Allen Fossil Plant

Project Location
Memphis, Tennessee

182603528
Prepared by LT on 2020-06-10
Technical Review by JJ on 2020-06-10

0 250 500 750 1,000 Feet
1:3,000 (At original document size of 22x34)

Legend

- Inactive Harsco Production Wells (PW)
- McKellar Lake Gauging Station
- Performance Monitoring Well (PMW) (Shallow)
- Performance Monitoring Well (PMW) (Intermediate)
- Performance Monitoring Well (PMW) (Deep)
- IRA Extraction Well (EW)
- Monitoring Well (Shallow)
- Monitoring Well (Intermediate)
- Monitoring Well (Deep)
- Production Well (Memphis Sand)
- Sewer Manhole Location of Force Main Transition to Gravity
- Sanitary Sewer Pipes
- East Ash Pond Boundary
- 2019 Imagery Boundary

Wells are screened in the Alluvial Aquifer unless otherwise noted.

- Notes
1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet

2. Imagery Provided by TVA dated 3/15/2018 and 6/4/2019



FIGURE 6
NORTH AREA IRA EW-PMW LOCATION
MAP



Figure No.

6

Title

North Area IRA EW-PMW Location Map

Client/Project

Tennessee Valley Authority
Allen Fossil Plant

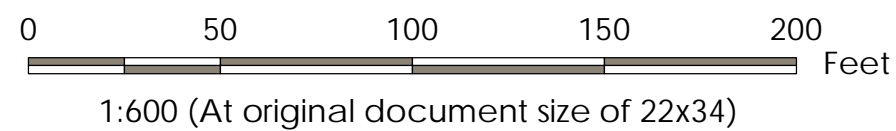
Project Location

Memphis, Tennessee










182603528

Prepared by MB on 2020-06-10

Technical Review by JJ on 2020-06-10



Legend

-  IRA System Extraction Well (EW)
 -  Proposed IRA System Extraction Well (EW)
 -  Proposed Performance Monitoring Well (PMW) Location
 -  Performance Monitoring Well (PMW) (Shallow)
 -  Performance Monitoring Well (PMW) (Intermediate)
 -  Performance Monitoring Well (PMW) (Deep)
 -  Monitoring Well (Shallow)
 -  Monitoring Well (Intermediate)
 -  Monitoring Well (Deep)
- East Ash Pond Boundary
- 2019 Imagery Boundary

Wells are screened in the Alluvial Aquifer unless otherwise noted.

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by TerraServer (2016) and TVA 6/4/2019



FIGURE 7
SOUTH AREA IRA EW-PMW LOCATION
MAP



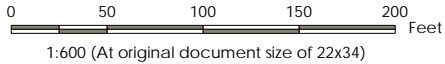
Figure No.
7

Title
South Area IRA EW-PMW
Location Map

Client/Project
Tennessee Valley Authority
Allen Fossil Plant

Project Location
Memphis, Tennessee

182603528
Prepared by MB on 2020-06-10
Technical Review by JJ on 2020-06-10



- Legend**
- IRA System Extraction Well (EW)
 - ⊙ Proposed IRA System Extraction Well (EW)
 - Proposed Performance Monitoring Well (PMW) Location
 - Performance Monitoring Well (PMW) (Shallow)
 - Performance Monitoring Well (PMW) (Intermediate)
 - Performance Monitoring Well (PMW) (Deep)
 - ⊕ Monitoring Well (Shallow)
 - ⊕ Monitoring Well (Intermediate)
 - ⊕ Monitoring Well (Deep)
 - ⬜ East Ash Pond Boundary
 - ⬜ 2019 Imagery Boundary

Wells are screened in the Alluvial Aquifer unless otherwise noted.

- Notes
1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
 2. Imagery Provided by TVA dated 3/15/2018 and 6/4/2019

