HALEY ALDRICH

www.haleyaldrich.com

2020 – 2021 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

LINED POND
NEW MADRID POWER PLANT
NEW MADRID, MISSOURI

by Haley & Aldrich, Inc.
Cleveland, Ohio

for Associated Electric Cooperative, Inc.
Springfield, Missouri

File No. 0129342-045
July 2021

Table of Contents

Mark Nicholls, PG
Name

Senior Hydrogeologist
Title


Signature

7/30/2021
Date

HALEY ALDRICH

List of Tables

List of Figures

List of Attachments

1. Introduction

This 2020 – 2021 Annual Groundwater Monitoring and Corrective Action Report (Annual Report) addresses the inactive Lined Pond (Lined Pond) at the New Madrid Power Plant (NMPP), operated by Associated Electric Cooperative, Inc. (AECI). This Annual Report was developed in accordance with the U.S. Environmental Protection Agency Coal Combustion Residual (CCR) Rule effective 19 October 2015 (Rule) including subsequent revisions, specifically Code of Federal Regulations Title 40 (40 CFR), subsection 257.90(e). The Annual Report documents the groundwater monitoring system for the Lined Pond consistent with applicable sections of 257.90 through 257.98, and describes activities conducted in the prior calendar year (2020) and documents compliance with the Rule. The specific requirements listed in § 257.90(e)(1)-(6) of the Rule are provided in Sections 1 and 2 of this Annual Report and are in bold italic font, followed by a short narrative describing how each Rule requirement has been met.

1.1 40 CFR § 257.90(e)(6) SUMMARY

A section at the beginning of the annual report that provides an overview of the current status of groundwater monitoring and corrective action programs for the CCR unit. At a minimum, the summary must specify all of the following:

1.1.1 40 CFR § 257.90(e)(6)(i) – Initial Monitoring Program

At the start of the current annual reporting period, whether the CCR unit was operating under the detection monitoring program in § 257.94 or the assessment monitoring program in § 257.95;

At the start of the current annual reporting period (1 July 2020), the Lined Pond was operating under an assessment monitoring program in compliance with 40 CFR § 257.95.

1.1.2 40 CFR § 257.90(e)(6)(ii) – Final Monitoring Program

At the end of the current annual reporting period, whether the CCR unit was operating under the detection monitoring program in § 257.94 or the assessment monitoring program in § 257.95;

At the end of the current annual reporting period (30 June 2021), the Lined Pond was operating under an assessment monitoring program in compliance with 40 CFR § 257.95.

1.1.3 40 CFR § 257.90(e)(6)(iii) – Statistically Significant Increases

If it was determined that there was a statistically significant increase over background for one or more constituents listed in appendix III to this part pursuant to § 257.94(e):

1.1.3.1 40 CFR § 257.90(e)(6)(iii)(a)

Identify those constituents listed in appendix III to this part and the names of the monitoring wells associated with such an increase; and

The Lined Pond at NMPP is operating under an assessment monitoring program; therefore, no statistical evaluations were conducted on Appendix III constituents from July 2020 through June 2021.

1.1.3.2 40 CFR § 257.90(e)(6)(iii)(b)

Provide the date when the assessment monitoring program was initiated for the CCR unit.

An assessment monitoring program for the Lined Pond was established on 30 December 2019 to meet the requirements of 40 CFR § 257.95. The Lined Pond remained in assessment monitoring from July 2020 through June 2021.

1.1.4 40 CFR § 257.90(e)(6)(iv) – Statistically Significant Levels

If it was determined that there was a statistically significant level above the groundwater protection standard for one or more constituents listed in appendix IV to this part pursuant to § 257.95(g) include all of the following:

1.1.4.1 40 CFR § 257.90(e)(6)(iv)(a) – Statistically Significant Level Constituents

Identify those constituents listed in appendix IV to this part and the names of the monitoring wells associated with such an increase;

Statistically significant levels (SSL) above the groundwater protection standards (GWPS) identified from July 2020 through June 2021 for the February 2020 semi-annual sampling event are listed in Table I.

1.1.4.2 40 CFR § 257.90(e)(6)(iv)(b) – Initiation of the Assessment of Corrective Measures

Provide the date when the assessment of corrective measures was initiated for the CCR unit;

No assessment of corrective measures was required to be initiated from July 2020 through June 2021 for this unit. The Lined Pond remained in assessment monitoring during this annual period.

1.1.4.3 40 CFR § 257.90(e)(6)(iv)(c) – Assessment of Corrective Measures Public Meeting

Provide the date when the public meeting was held for the assessment of corrective measures for the CCR unit; and

An assessment of corrective measures was not initiated for the Lined Pond from July 2020 through June 2021; therefore, a public meeting was not held.

1.1.4.4 40 CFR § 257.90(e)(6)(iv)(d) – Completion of the Assessment of Corrective Measures

Provide the date when the assessment of corrective measures was completed for the CCR unit.

No assessment of corrective measures was required to be completed from July 2020 through June 2021 for this unit. The Lined Pond remained in assessment monitoring during this annual period.

1.1.5 40 CFR § 257.90(e)(6)(v) – Selection of Remedy

Whether a remedy was selected pursuant to § 257.97 during the current annual reporting period, and if so, the date of remedy selection; and

The Lined Pond remains in assessment monitoring, and no remedy was required to be selected.

1.1.6 40 CFR § 257.90(e)(6)(vi) – Remedial Activities

Whether remedial activities were initiated or are ongoing pursuant to § 257.98 during the current annual reporting period.

No remedial activities have been initiated from July 2020 through June 2021; therefore, no demonstration or certification is applicable for this unit.

2. 40 CFR § 257.90 Applicability

2.1 40 CFR § 257.90(a)

Except as provided for in § 257.100 for inactive CCR surface impoundments, all CCR landfills, CCR surface impoundments, and lateral expansions of CCR units are subject to the groundwater monitoring and corrective action requirements under §§ 257.90 through 257.99, except as provided in paragraph (g) of this section.

AECI has installed and certified a groundwater monitoring system at the Lined Pond at the NMPP. The Lined Pond is subject to the groundwater monitoring and corrective action requirements described under 40 CFR §§ 257.90 through 257.98. This document addresses the requirement for the Owner/Operator to prepare an Annual Report per § 257.90(e) (Rule).

2.2 40 CFR § 257.90(e) – SUMMARY

Annual groundwater monitoring and corrective action report. For existing CCR landfills and existing CCR surface impoundments, no later than January 31, 2018, and annually thereafter, the owner or operator must prepare an annual groundwater monitoring and corrective action report. For new CCR landfills, new CCR surface impoundments, and all lateral expansions of CCR units, the owner or operator must prepare the initial annual groundwater monitoring and corrective action report no later than January 31 of the year following the calendar year a groundwater monitoring system has been established for such CCR unit as required by this subpart, and annually thereafter. For the preceding calendar year, the annual report must document the status of the groundwater monitoring and corrective action program for the CCR unit, summarize key actions completed, describe any problems encountered, discuss actions to resolve the problems, and project key activities for the upcoming year. For purposes of this section, the owner or operator has prepared the annual report when the report is placed in the facility's operating record as required by §257.105(h)(1).

40 CFR 257.100(e)(5)(ii)
No later than August 1, 2019, prepare the initial groundwater monitoring and corrective action report as set forth in § 257.90(e)

This Annual Report describes monitoring completed and actions taken at the NMPP Lined Pond as required by the Rule. Groundwater sampling and analysis was conducted in accordance with requirements described in § 257.93, and the status of the groundwater monitoring program described in § 257.94 and § 257.95 is also provided in this report. This Annual Report documents the applicable groundwater-related activities completed from July 2020 through June 2021.

2.2.1 Status of the Groundwater Monitoring Program

Results of the detection monitoring statistical analysis completed in July 2019 identified statistically significant increased (SSI) concentration of Appendix III constituents in downgradient monitoring wells relative to concentrations observed in upgradient monitoring wells. No alternative source was identified for the SSI constituents. Accordingly, the groundwater monitoring program transitioned to

assessment monitoring in December 2019, and AECI is currently implementing an assessment monitoring program.

2.2.2 Key Actions Completed

The July 2019 through June 2020 Annual Groundwater Monitoring and Corrective Action Report was completed in July 2020. Statistical analysis of analytical data from the February 2020 semi-annual assessment monitoring sampling event was completed in July 2020. A summary including the sample names, dates of sample collection, field parameters, and monitoring data obtained for the groundwater monitoring program of the NMPP Lined Pond is presented in Table II of this report. The statistical analyses completed in July 2020 indicated Appendix IV SSLs above the GWPS for molybdenum in monitoring wells MW-8 and MW-9 from the February 2020 sampling event. AECI completed and certified a successful alternative source demonstration (ASD) for molybdenum at MW-8 and MW-9 in August 2020, determining that a source other than the CCR unit caused the SSL.

A semi-annual assessment monitoring event was completed in August 2020 for detected Appendix IV constituents identified from the December 2019 annual assessment monitoring sampling event. Statistical analysis was completed within 90 days of receipt of verified laboratory data for the August 2020 sampling event, and no Appendix IV SSLs were identified.

An annual assessment monitoring sampling event was completed in November 2020 to identify detected Appendix IV constituents for subsequent semi-annual sampling events in February 2021 and planned for August 2021. GWPSs for detected Appendix IV constituents were established or updated at this time. The background concentrations (upper tolerance limits) and GWPS utilized for the statistical analyses completed for the February 2020 and August 2020 assessment monitoring sampling event are presented in Tables III and IV, respectively. Statistical analysis of the results from the February 2021 semi-annual assessment monitoring sampling event are due to be completed in July 2021 and will be reported in the next annual report.

2.2.3 Problems Encountered

No problems (i.e., problems could include damaged wells, issues with sample collection or lack of sampling, or problems with analytical analysis) were encountered at the NMPP Lined Pond from July 2020 through June 2021.

2.2.4 Actions to Resolve Problems

No problems were encountered at the NMPP Lined Pond from July 2020 through June 2021; therefore, no actions to resolve the problems were required.

2.2.5 Project Key Activities for Upcoming Year

Key activities planned for July 2021 through June 2022 include the July 2020 – June 2021 Annual Groundwater Monitoring and Corrective Action Report, statistical analysis of assessment monitoring

analytical data collected in February 2021, and conducting semi-annual assessment monitoring and subsequent statistical analyses, and annual assessment monitoring.

2.3 40 CFR § 257.90(e) – INFORMATION

At a minimum, the annual groundwater monitoring and corrective action report must contain the following information, to the extent available:

2.3.1 40 CFR § 257.90(e)(1)

A map, aerial image, or diagram showing the CCR unit and all background (or up gradient) and down gradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit;

As required by § 257.90(e)(1), a map showing the locations of the CCR unit and associated upgradient and downgradient monitoring wells for the Lined Pond is included in this report as Figure 1. In addition, this information is presented in the CCR Groundwater Monitoring Network Description Report prepared for AECI, which was placed in the facility's operating record by 17 April 2019 as required by § 257.105(h)(2).

2.3.2 40 CFR § 257.90(e)(2) – Monitoring System Changes

Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken;

No monitoring wells were installed or decommissioned from July 2020 through June 2021.

2.3.3 40 CFR § 257.90(e)(3) – Summary of Sampling Events

In addition to all the monitoring data obtained under §257.90 through §257.98, a summary including the number of groundwater samples that were collected for analysis for each background and down gradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs;

In accordance with § 257.95(b), three independent assessment monitoring samples were collected from each background and downgradient well from July 2020 through June 2021. A summary including sample names, dates of sample collection, field parameters, and monitoring data obtained for the groundwater monitoring program for the NMPP Lined Pond is presented in Table II of this report.

2.3.4 40 CFR § 257.90(e)(4) – Monitoring Transition Narrative

A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels); and

The assessment monitoring program was established on 30 December 2019 to meet the requirements of 40 CFR § 257.95. The NMPP Lined Pond remained in assessment monitoring from July 2020 through June 2021.

2.3.5 40 CFR § 257.90(e)(5) – Other Requirements

Other information required to be included in the annual report as specified in §257.90 through §257.98.

This Annual Report documents activities conducted to comply with §§ 257.90 through 257.95 of the Rule. It is understood that there are supplemental references in §§ 257.90 through 257.98 that must be placed in the Annual Report. The following requirements include relevant and required information in the Annual Report for activities completed from July 2020 through June 2021.

2.3.5.1 40 CFR § 257.94(d)(3) – Demonstration for Alternative Detection Monitoring Frequency

The owner or operator must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority stating that the demonstration for an alternative groundwater sampling and analysis frequency meets the requirements of this section. The owner or operator must include the demonstration providing the basis for the alternative monitoring frequency and the certification by a qualified professional engineer or the approval from the Participating State Director or approval from EPA where EPA is the permitting authority in the annual groundwater monitoring and corrective action report required by § 257.90(e).

An alternative groundwater detection monitoring sampling and analysis frequency has not been established for this CCR unit; therefore, no demonstration or certification is applicable.

2.3.5.2 40 CFR § 257.94(e)(2) – Detection Monitoring Alternate Source Demonstration

The owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The owner or operator must complete the written demonstration within 90 days of detecting a statistically significant increase over background levels to include obtaining a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority verifying the accuracy of the information in the report. If a successful demonstration is completed within the 90-day period, the owner or operator of the CCR unit may continue with a detection monitoring program under this section. If a successful demonstration is not completed within the 90-day period, the owner or operator of the CCR unit must initiate an assessment monitoring program as required under § 257.95. The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority.

This unit is in assessment monitoring; therefore, no detection monitoring ASD or certification is applicable.

2.3.5.3 40 CFR § 257.95(c)(3) – Demonstration for Alternative Assessment Monitoring Frequency

The owner or operator must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority stating that the demonstration for an alternative groundwater sampling and analysis frequency meets the requirements of this section. The owner or operator must include the demonstration providing the basis for the alternative monitoring frequency and the certification by a qualified professional engineer or the approval from the Participating State Director or approval from EPA where EPA is the permitting authority in the annual groundwater monitoring and corrective action report required by § 257.90(e).

An alternative groundwater assessment monitoring sampling and analysis frequency has not been established for this CCR unit; therefore, no demonstration or certification is applicable.

2.3.5.4 40 CFR § 257.95(d)(3) – Assessment Monitoring Concentrations and Groundwater Protection Standards

Include the recorded concentrations required by paragraph (d)(1) of this section, identify the background concentrations established under § 257.94(b), and identify the groundwater protection standards established under paragraph (d)(2) of this section in the annual groundwater monitoring and corrective action report required by § 257.90(e).

An assessment monitoring program is currently being implemented at the CCR unit. Three rounds of assessment monitoring sampling were completed from June 2020 through July 2021. Analytical results for both downgradient and upgradient wells are provided in Table II. The background concentrations (upper tolerance limits) and GWPSs established for the NMPP Lined Pond that were utilized for statistical analyses completed on the February 2020 and August 2020 analytical results are included in Tables III and IV, respectively.

2.3.5.5 40 CFR § 257.95(g)(3)(ii) – Assessment Monitoring Alternate Source Demonstration

Demonstrate that a source other than the CCR unit caused the contamination, or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Any such demonstration must be supported by a report that includes the factual or evidentiary basis for any conclusions and must be certified to be accurate by a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority. If a successful demonstration is made, the owner or operator must continue monitoring in accordance with the assessment monitoring program pursuant to this section and may return to detection monitoring if the constituents in appendices III and IV to this part are at or below background as specified in paragraph (e) of this section. The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer or the approval from the Participating State Director or approval from EPA where EPA is the permitting authority.

A successful assessment monitoring ASD completed in August 2020 for the February 2020 sampling event SSLs for molybdenum is included in this report as Attachment 1. The Lined Pond remained in assessment monitoring from July 2020 through June 2021.

2.3.5.6 40 CFR § 257.96(a) – Demonstration for Additional Time for Assessment of Corrective Measures

Within 90 days of finding that any constituent listed in appendix IV to this part has been detected at a statistically significant level exceeding the groundwater protection standard defined under § 257.95(h), or immediately upon detection of a release from a CCR unit, the owner or operator must initiate an assessment of corrective measures to prevent further releases, to remediate any releases and to restore affected area to original conditions. The assessment of corrective measures must be completed within 90 days, unless the owner or operator demonstrates the need for additional time to complete the assessment of corrective measures due to site-specific conditions or circumstances. The owner or operator must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority attesting that the demonstration is accurate. The 90-day deadline to complete the assessment of corrective measures may be extended for no longer than 60 days. The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer or the approval from the Participating State Director or approval from EPA where EPA is the permitting authority.

No assessment of corrective measures was required to be initiated from July 2020 through June 2021; therefore, no demonstration or certification is applicable for this unit.

2.4 40 CFR § 257.90(f)

The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the internet requirements specified in § 257.107(h).

In order to comply with the Rule recordkeeping requirements, the following actions must be completed:

- Pursuant to § 257.105(h)(1), this Annual Report must be placed in the facility's operating record.
- Pursuant to § 257.106(h)(1), notification must be sent to the relevant State Director and/or Tribal authority within 30 days of this Annual Report being placed in the facility's operating record [§ 257.106(d)].
- Pursuant to § 257.107(h)(1), this Annual Report must be posted to the AECI CCR website within 30 days of this Annual Report being placed in the facility's operating record [§ 257.107(d)].

TABLES

TABLE I
SSL SUMMARY TABLE
ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT - LINED POND
NEW MADRID, MISSOURI

Constituent	Sampling Event	Well ID	Groundwater Protection Standard (mg/L)
Molybdenum	February 2020	MW-8	0.100*
		MW-9	

Notes:

** Value obtained from U.S. Environmental Protection Agency Federal CCR Rule Title 40 Code of Federal Regulations § 257.95(h)(2)*

mg/L = milligrams per liter

SSL = statistically significant level

TABLE II
SUMMARY OF ANALYTICAL RESULTS - 2020 THROUGH 2021 ASSESSMENT MONITORING
ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT - LINED POND (INACTIVE)
NEW MADRID, MISSOURI

Location	Upgradient								
	B-123	B-123	B-123	B-126	B-126	B-126	MW-16	MW-16	MW-16
Measure Point (TOC)	292.7	292.7	292.7	293.63	293.63	293.63	292.85	292.85	292.85
Sample Name	B-123	B-123	B-123	B-126	B-126	B-126	MW-16	MW-16	MW-16
Sample Date	8/10/2020	11/9/2020	02/23/2021	8/10/2020	11/9/2020	02/23/2021	8/10/2020	11/9/2020	02/23/2021
Final Lab Report Date	9/29/2020	12/28/2020	3/30/2021	9/29/2020	12/28/2020	3/30/2021	9/29/2020	12/28/2020	3/30/2021
Final Lab Report Revision Date	-	N/A	N/A	-	N/A	N/A	-	N/A	N/A
Final Radiation Lab Report Date	9/25/2020	12/24/2020	3/29/2021	9/25/2020	12/24/2020	3/29/2021	9/25/2020	12/24/2020	3/29/2021
Final Radiation Lab Report Revision Date	-	N/A	N/A	-	N/A	N/A	-	N/A	N/A
Lab Data Reviewed and Accepted	10/19/2020	1/4/2021	4/13/2021	10/19/2020	1/4/2021	4/13/2021	10/19/2020	1/4/2021	4/13/2021
Depth to Water (ft btoc)	12.89	23.44	17.73	13.85	28.40	19.85	18.58	24.96	23.50
Temperature (Deg C)	17.71	16.73	14.91	18.75	17.52	15.26	18.46	17.73	15.78
Conductivity, Field (µS/cm)	675	665	685	575	1106	277	872	889	899
Turbidity, Field (NTU)	10.0	0.07	9.80	34.6	0.29	61.7	0.0	0.07	0.9
Boron, Total (mg/L)	**0.059**	-	**0.03**	**0.058**	-	**0.022**	**0.13**	-	**0.06**
Calcium, Total (mg/L)	**75**	-	**81**	**74**	-	**58**	**120**	-	**120**
Chloride (mg/L)	**3.1**	-	**2.8**	**11**	-	**4.2**	**14**	-	**6.9**
Fluoride (mg/L)	**0.415**	**0.527**	**0.485**	**0.329**	**0.355**	**0.52**	**1.58**	**1.54**	**1.32**
Sulfate (mg/L)	**29**	-	**28**	**46**	-	**40**	**74**	-	**75**
pH (lab) (su)	**7.51**	-	**7.34**	**7.27**	-	**7.12**	**7.18**	-	**7.05**
TDS (mg/L)	**380**	-	**310**	**370**	-	**290**	**490**	-	**490**
Antimony, Total (mg/L)		< 0.0030			< 0.0030	-	-	< 0.0030	-
Arsenic, Total (mg/L)	**0.0018**	**0.0022**	**0.0024**	**0.0039**	**0.0045**	**0.0027**	**0.0018**	**0.0025**	**0.0024**
Barium, Total (mg/L)	**0.18**	**0.18**	**0.19**	**0.22**	**0.46**	**0.21**	**0.56**	**0.59**	**0.66**
Beryllium, Total (mg/L)	-	< 0.0010	-		< 0.0010	-	-	< 0.0010	-
Cadmium, Total (mg/L)	-	< 0.00089	-		< 0.00089	-	-	< 0.00089	-
Chromium, Total (mg/L)	-	< 0.0040	-		**0.0061**	-	-	< 0.0040	-
Cobalt, Total (mg/L)	< 0.0020	< 0.0010	< 0.0020	< 0.0020	**0.0018**	< 0.0020	< 0.0020	< 0.0010	< 0.0020
Lead, Total (mg/L)	< 0.0010	< 0.0010	< 0.0010	< 0.0010	**0.0013**	**0.0019**	< 0.0010	< 0.0010	< 0.0010
Lithium, Total (mg/L)	**0.027**	**0.026**	**0.027**	**0.013**	**0.024**	**0.013**	**0.025**	**0.027**	**0.025**
Molybdenum, Total (mg/L)	**0.0036**	**0.0039**	**0.0045**	< 0.0010	< 0.0010	**0.0012**	< 0.0010	< 0.0010	< 0.0010
Selenium, Total (mg/L)	< 0.0010	< 0.0010	< 0.0010	**0.0011**	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Thallium, Total (mg/L)	-	< 0.0010	-	-	< 0.0010	-	-	< 0.0010	-
Mercury, Total (mg/L)	-	< 0.00020	-	-	< 0.00020	-	-	< 0.00020	-
Radium 226 & 228 Combined (pCi/L)	0.470 +/- 0.812 (1.75)	0.660 ± 0.882 (1.72)	0.450 ± 0.994 (2.00)	**1.25 +/- 0.728 (1.16)**	0.732 ± 1.23 (2.36)	0.0135 ± 1.08 (2.43)	**1.37 +/- 0.835 (1.35)**	**2.13 ± 1.25 (1.91)**	1.64 ± 1.02 (1.72)

TABLE II
SUMMARY OF ANALYTICAL RESULTS - 2020 THROUGH 2021 ASSESSMENT MONITORING
ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT - LINED POND (INACTIVE)
NEW MADRID, MISSOURI

Location	Downgradient (Part 1 of 3)								
	P-6	P-6 (Dup)	P-6	P-6	P-7	P-7	P-7	MW-8	MW-8
Measure Point (TOC)	310.88	310.88	310.88	310.88	308.6	308.6	308.60	310.63	310.63
Sample Name	P-6	DUP CCR LINED POND	P-6	P-6	P-7	P-7	P-7	MW-8	MW-8
Sample Date	8/17/2020	8/17/2020	11/10/2020	02/24/2021	8/17/2020	11/10/2020	02/24/2021	8/10/2020	11/10/2020
Final Lab Report Date	9/29/2020	9/29/2020	12/28/2020	3/30/2021	9/29/2020	12/28/2020	3/30/2021	9/29/2020	12/28/2020
Final Lab Report Revision Date	-	-	N/A	N/A	-	N/A	N/A	-	N/A
Final Radiation Lab Report Date	9/29/2020	9/29/2020	12/24/2020	3/29/2021	9/29/2020	12/24/2020	3/29/2021	9/29/2020	12/24/2020
Final Radiation Lab Report Revision Date	-	-	N/A	N/A	-	N/A	N/A	-	N/A
Lab Data Reviewed and Accepted	10/19/2020	10/19/2020	1/4/2021	4/13/2021	10/19/2020	1/4/2021	4/13/2021	10/19/2020	1/4/2021
Depth to Water (ft btoc)	37.87	-	43.90	40.25	33.25	39.88	38.17	36.00	42.70
Temperature (Deg C)	17.41	-	17.95	15.77	16.03	16.38	14.83	19.11	17.70
Conductivity, Field (µS/cm)	1080	-	951	1010	1030	942	970	1400	1271
Turbidity, Field (NTU)	0.0	-	0.18	0	8.7	0.19	4.2	0.0	0.07
Boron, Total (mg/L)	**1.5**	**1.5**	**-**	**1.6**	**0.088**	**-**	**0.096**	**18**	**-**
Calcium, Total (mg/L)	**150**	**160**	**-**	**170**	**140**	**-**	**150**	**200**	**-**
Chloride (mg/L)	**9.6**	**9.5**	**-**	**8.9**	**7.2**	**-**	**7.8**	**8.0**	**-**
Fluoride (mg/L)	< 0.250	< 0.250	**0.251**	< 0.250	< 0.250	**0.272**	**0.271**	**0.336**	**0.353**
Sulfate (mg/L)	**31**	**77**	**-**	**41**	**19**	**-**	**69**	**360**	**-**
pH (lab) (su)	**7.39**	**7.25**	**-**	**7.02**	**7.11**	**-**	**7.24**	**8.15**	**-**
TDS (mg/L)	**530**	**500**	**-**	**550**	**590**	**-**	**550**	**1100**	**-**
Antimony, Total (mg/L)	**-**	**-**	< 0.0030	**-**	**-**	< 0.0030	**-**	**-**	< 0.0030
Arsenic, Total (mg/L)	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	**0.0043**	**0.0061**
Barium, Total (mg/L)	**0.21**	**0.20**	**0.19**	**0.22**	**0.31**	**0.29**	**0.31**	**0.086**	**0.11**
Beryllium, Total (mg/L)	**-**	**-**	< 0.0010	**-**	**-**	< 0.0010	**-**	**-**	< 0.0010
Cadmium, Total (mg/L)	-	-	< 0.00089	-	**-**	< 0.00089	-	**-**	< 0.00089
Chromium, Total (mg/L)	-	-	< 0.0040	-	**-**	< 0.0040	-	**-**	< 0.0040
Cobalt, Total (mg/L)	< 0.0020	< 0.0020	< 0.0010	< 0.0020	< 0.0020	< 0.0010	< 0.0020	< 0.0020	**0.0034**
Lead, Total (mg/L)	< 0.0010	< 0.0010	< 0.0010	-	< 0.0010	< 0.0010	-	< 0.0010	< 0.0010
Lithium, Total (mg/L)	**0.023**	**0.025**	**0.031**	**0.027**	**0.017**	**0.024**	**0.022**	**0.036**	**0.024**
Molybdenum, Total (mg/L)	**0.0011**	< 0.0010	< 0.0010	< 0.0010	**0.0012**	< 0.0010	**0.0010**	**1.0**	**1.4**
Selenium, Total (mg/L)	< 0.0010	< 0.0010	< 0.0010	< 0.0010	**0.0035**	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Thallium, Total (mg/L)	-	-	< 0.0010	-	-	< 0.0010	-	-	< 0.0010
Mercury, Total (mg/L)	-	-	< 0.00020	-	-	< 0.00020	-	-	< 0.00020
Radium 226 & 228 Combined (pCi/L)	0.944 ± 0.807 (1.48)	0.646 ± 0.643 (1.18)	0.788 ± 0.953 (1.79)	1.10 ± 0.836 (1.57)	0.562 ± 0.880 (1.74)	1.30 ± 1.18 (2.21)	0.835 ± 0.890 (1.73)	0.320 ± 0.899 (1.85)	1.26 ± 1.08 (1.99)

TABLE II
SUMMARY OF ANALYTICAL RESULTS - 2020 THROUGH 2021 ASSESSMENT MONITORING
ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT - LINED POND (INACTIVE)
NEW MADRID, MISSOURI

Location	Downgradient (Part 2 of 3)								
	MW-8	MW-9	MW-9	MW-9	MW-17	MW-17	MW-17	MW-18	MW-18
Measure Point (TOC)	310.63	310.24	310.24	310.24	299.2	299.2	299.20	301.19	301.19
Sample Name	MW-8	MW-9	MW-9	MW-9	MW-17	MW-17	MW-17	MW-18	MW-18
Sample Date	03/01/2021	8/10/2020	11/10/2020	02/24/2021	8/18/2020	11/9/2020	02/24/2021	8/18/2020	11/9/2020
Final Lab Report Date	4/5/2021	9/29/2020	12/28/2020	3/30/2021	9/29/2020	12/28/2020	3/30/2021	9/29/2020	12/28/2020
Final Lab Report Revision Date	N/A	-	N/A	N/A	-	N/A	N/A	-	N/A
Final Radiation Lab Report Date	4/2/2021	9/29/2020	12/24/2020	3/29/2021	9/29/2020	12/24/2020	3/29/2021	9/29/2020	12/24/2020
Final Radiation Lab Report Revision Date	N/A	-	N/A	N/A	-	N/A	N/A	-	N/A
Lab Data Reviewed and Accepted	4/19/2021	10/19/2020	1/4/2021	4/13/2021	10/19/2020	1/4/2021	4/13/2021	10/19/2020	1/4/2021
Depth to Water (ft btoc)	40.45	37.05	43.25	40.85	22.64	29.70	28.65	24.54	31.53
Temperature (Deg C)	15.55	19.38	17.99	16.22	15.80	16.45	14.05	16.06	16.30
Conductivity, Field (µS/cm)	1640	997	908	877	876	721	735	490	357
Turbidity, Field (NTU)	0.1	0.0	1.29	0	0.0	0.05	0	0.0	2.01
Boron, Total (mg/L)	**18**	**2.1**	-	**2.6**	**0.050**	-	**0.040**	**0.035**	-
Calcium, Total (mg/L)	**220**	**130**	-	**120**	**100**	-	**93**	**50**	-
Chloride (mg/L)	**9.0**	**19**	-	**17**	**38**	-	**8.8**	**13**	-
Fluoride (mg/L)	**0.364**	**0.452**	**0.363**	**0.493**	< 0.250	< 0.250	< 0.250	**0.294**	< 0.250
Sulfate (mg/L)	**290**	**150**	-	**120**	**52**	-	**40**	**38**	-
pH (lab) (su)	**7.07**	**8.09**	-	**7.09**	**7.13**	-	**6.83**	**6.93**	-
TDS (mg/L)	**860**	**620**	-	**460**	**520**	-	**400**	**330**	-
Antimony, Total (mg/L)	-		< 0.0030	-		< 0.0030	-	-	< 0.0030
Arsenic, Total (mg/L)	**0.0041**	**0.0013**	< 0.0010	< 0.0010	**0.0018**	**0.0026**	**0.0024**	< 0.0010	< 0.0010
Barium, Total (mg/L)	**0.093**	**0.087**	**0.084**	**0.080**	**0.30**	**0.28**	**0.27**	**0.12**	**0.089**
Beryllium, Total (mg/L)	-	-	< 0.0010			< 0.0010	-	-	< 0.0010
Cadmium, Total (mg/L)	-	-	< 0.00089	-		< 0.00089	-	-	< 0.00089
Chromium, Total (mg/L)	-	-	< 0.0040	-		< 0.0040	-	-	< 0.0040
Cobalt, Total (mg/L)	**0.0023**	< 0.0020	< 0.0010	< 0.0020	< 0.0020	< 0.0010	< 0.0020	**0.0026**	**0.0030**
Lead, Total (mg/L)	-	< 0.0010	< 0.0010	-	< 0.0010	< 0.0010	-	< 0.0010	< 0.0010
Lithium, Total (mg/L)	**0.022**	**0.043**	**0.031**	**0.029**	**0.017**	**0.022**	**0.018**	**0.012**	**0.016**
Molybdenum, Total (mg/L)	**0.91**	**0.23**	**0.24**	**0.29**	**0.0011**	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Selenium, Total (mg/L)	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	**0.013**
Thallium, Total (mg/L)	-	-	< 0.0010	-		< 0.0010	-	-	< 0.0010
Mercury, Total (mg/L)	-	-	< 0.00020	-		< 0.00020	-	-	< 0.00020
Radium 226 & 228 Combined (pCi/L)	0.811 ± 0.707 (1.04)	1.04 ± 0.779 (1.31)	**3.18 ± 1.39 (1.97)**	1.23 ± 0.965 (1.83)	0.565 ± 0.619 (1.05)	1.45 ± 1.26 (2.14)	**1.73 ± 1.09 (1.68)**	0.891 ± 0.742 (1.15)	0.588 ± 1.18 (2.48)

TABLE II
SUMMARY OF ANALYTICAL RESULTS - 2020 THROUGH 2021 ASSESSMENT MONITORING
ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT - LINED POND (INACTIVE)
NEW MADRID, MISSOURI

Location	Downgradient (Part 3 of 3)		
	MW-18 (Dup)	MW-18	MW-18 (Dup)
Measure Point (TOC)	301.19	301.19	301.19
Sample Name	DUPLICATE	MW-18	DUPLICATE 6
Sample Date	11/9/2020	02/24/2021	02/24/2021
Final Lab Report Date	12/28/2020	3/30/2021	3/30/2021
Final Lab Report Revision Date	N/A	N/A	N/A
Final Radiation Lab Report Date	12/24/2020	3/29/2021	3/29/2021
Final Radiation Lab Report Revision Date	N/A	N/A	N/A
Lab Data Reviewed and Accepted	1/4/2021	4/13/2021	4/13/2021
Depth to Water (ft btoc)	-	30.86	-
Temperature (Deg C)	-	13.46	-
Conductivity, Field (µS/cm)	-	468	-
Turbidity, Field (NTU)	-	0	-
Boron, Total (mg/L)	**-**	**0.057**	**0.054**
Calcium, Total (mg/L)	**-**	**52**	**51**
Chloride (mg/L)	**-**	**13**	**13**
Fluoride (mg/L)	**0.284**	**0.331**	**0.324**
Sulfate (mg/L)	**-**	**38**	**38**
pH (lab) (su)	**-**	**6.96**	**6.74**
TDS (mg/L)	**-**	**230**	**250**
Antimony, Total (mg/L)	< 0.0030	**-**	**-**
Arsenic, Total (mg/L)	< 0.0010	< 0.0010	< 0.0010
Barium, Total (mg/L)	**0.088**	**0.12**	**0.12**
Beryllium, Total (mg/L)	< 0.0010	**-**	**-**
Cadmium, Total (mg/L)	< 0.00089	-	-
Chromium, Total (mg/L)	< 0.0040	-	-
Cobalt, Total (mg/L)	**0.0029**	**0.0032**	**0.0032**
Lead, Total (mg/L)	< 0.0010	-	-
Lithium, Total (mg/L)	**0.016**	**0.014**	**0.013**
Molybdenum, Total (mg/L)	< 0.0010	< 0.0010	< 0.0010
Selenium, Total (mg/L)	**0.014**	**0.0033**	**0.0035**
Thallium, Total (mg/L)	< 0.0010	**-**	**-**
Mercury, Total (mg/L)	< 0.00020	**-**	**-**
Radium 226 & 228 Combined (pCi/L)	1.34 ± 1.27 (2.19)	0.292 ± 0.767 (1.52)	0.563 ± 0.661 (1.34)

Notes and Abbreviations:

Bold value: *Detection above laboratory reporting limit or minimum detectable concentration (MDC).*
Radiological results are presented as activity plus or minus uncertainty with MDC.
µS/cm = micro Siemens per centimeter
Deg C = degrees Celsius
ft btoc = feet below top of casing
mg/L = milligrams per liter
N/A = Not Applicable
NTU = Nephelometric Turbidity Unit
pCi/L = picoCuries per liter
su = standard unit
TDS = total dissolved solids
TOC = top of casing

TABLE III
BACKGROUND CONCENTRATIONS AND GROUNDWATER PROTECTION STANDARDS
FEBRUARY 2020 ASSESSMENT MONITORING SAMPLING EVENT
ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT - LINED POND
NEW MADRID, MISSOURI

Constituent	Background Concentration (UTL) (mg/L[1])	Groundwater Protection Standard (mg/L[1])
Arsenic	0.0059	0.010*
Barium	0.69	2*
Cobalt	0.0044	0.006**
Fluoride	2.50	4.0*
Lead	0.009	0.015*
Lithium	0.029	0.04**
Molybdenum	0.0046	0.100**
Radium 226 & 228	2.55	5 pCi/L*
Selenium	0.0031	0.05*

Notes:

** Value set equal to the maximum contaminant level.*

*** Value set based on 40 CFR § 257.95(h)(1)*

[1] = unit unless otherwise noted

mg/L = milligrams per liter

pCi/L = picoCuries per liter

UTL = upper tolerance limit

TABLE IV
BACKGROUND CONCENTRATIONS AND GROUNDWATER PROTECTION STANDARDS
AUGUST 2020 ASSESSMENT MONITORING SAMPLING EVENT
ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT - LINED POND
NEW MADRID, MISSOURI

Constituent	Background Concentration (UTL) (mg/L[1])	Groundwater Protection Standard (mg/L[1])
Arsenic	0.0059	0.010*
Barium	0.69	2*
Cobalt	0.0044	0.006**
Fluoride	2.50	4.0*
Lead	0.009	0.015*
Lithium	0.032	0.04**
Molybdenum	0.0046	0.100**
Radium 226 & 228	2.42	5 pCi/L*
Selenium	0.0031	0.05*

Notes:

** Value set equal to the maximum contaminant level.*

*** Value set based on 40 CFR § 257.95(h)(1)*

[1] = unit unless otherwise noted

mg/L = milligrams per liter

pCi/L = picoCuries per liter

UTL = upper tolerance limit

FIGURE

LEGEND

MONITORING WELL

LINED ASH POND

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. AERIAL IMAGERY SOURCE: ESRI, APRIL 21, 2019

N

0 1,100 2,200

SCALE IN FEET

HALEY ALDRICH

ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER GENERATING FACILITY
NEW MADRID COUNTY, MISSOURI

INACTIVE LINED POND MONITORING WELL LOCATION MAP

aeci
Associated Electric Cooperative, Inc.

JULY 2021
SCALE AS SHOWN

FIGURE 1

ATTACHMENT 1

Appendix IV SSL Alternate Source Demonstration for Lined Pond, August 2020

HALEY ALDRICH

www.haleyaldrich.com

SUMMARY REPORT
ALTERNATE SOURCE DEMONSTRATION
FOR LINED POND
NEW MADRID POWER PLANT
MARSTON, MISSOURI

By Haley & Aldrich, Inc.
Cleveland, Ohio

For Associated Electric Cooperative, Inc.
Springfield, Missouri

File No. 129342-029
August 2020

Table of Contents

List of Tables

List of Figures

List of Appendices

1. Introduction

Haley & Aldrich, Inc. (Haley & Aldrich) was retained by Associated Electric Cooperative, Inc. (AECI) to perform an evaluation of groundwater quality at the inactive Lined Pond combustion coal residual (CCR) management unit at the New Madrid Power Plant (NMPP) located in Marston, Missouri. The purpose of the evaluation is to identify the source of elevated molybdenum concentrations detected in groundwater samples collected from monitoring wells MW-8 and MW-9 located down gradient of the Lined Pond.

1.1 BACKGROUND

Consistent with Code of Federal Regulations Title 40 (40 CFR) §257.90 through §257.95, AECI has installed and certified a groundwater monitoring network for the Lined Pond at NMPP and collected 10 rounds of groundwater samples for the analysis of Appendix III and Appendix IV baseline constituents. Results of the detection monitoring statistical analyses completed in July 2019 identified statistically significant increases (SSI) of Appendix III constituents in down-gradient monitoring wells relative to concentrations observed in up-gradient monitoring wells. No alternative source was identified for the Appendix III constituents with SSIs within 90 days. Accordingly, the groundwater monitoring program transitioned to assessment monitoring in December 2019, and AECI is currently implementing an assessment monitoring program.

In July 2020, AECI completed statistical analyses of groundwater quality results collected in February 2020, with data reviewed and accepted in April 2020, to determine if any of the Appendix IV constituents were present in groundwater samples collected from down-gradient monitoring wells at concentrations at a statistically significant level (SSL) above background. The statistical evaluation of the Appendix IV constituents detected potential SSLs for molybdenum above the groundwater protection standard (GWPS) at monitoring wells MW-8 and MW-9, down gradient of the Lined Pond. The analyses described in this report were conducted to identify the source of the elevated molybdenum concentrations.

Pursuant to 40 CFR §257.95(g)(3)(ii), ***the owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality***. The Rule provides 90 days from determination that an SSL over background exists to complete an Alternate Source Demonstration (ASD) for Appendix IV constituents. If a successful demonstration is completed and certified by a qualified professional engineer, the CCR unit may continue in assessment monitoring. If, however, an alternate source of the Appendix IV SSL is not identified, the owner or operator must initiate the assessment of corrective measures. This report documents the findings and conclusions of an ASD completed for molybdenum at the Lined Pond at the NMPP.

1.2 SITE SETTING

The NMPP is located approximately 2 miles east of Marston on the western bank of the Mississippi River in New Madrid County, Missouri. The location of the NMPP is shown on Figure 1. The site is located within the Southern Lowlands physiographic province which is the northernmost extent of the larger Mississippi Alluvial Plain and is characterized as a relatively flat alluvial plain which is used extensively

for agricultural production. The Lined Pond is a geomembrane lined surface impoundment that encompasses approximately 80 acres and is located approximately 0.5 mile south-southeast of the NMPP plant site. The Lined Pond has ground surface elevations varying from approximately 300 to 310 feet above mean sea level. The Lined Pond and the associated groundwater monitoring network are shown on Figure 1.

1.3 SITE DESCRIPTION

The NMPP is an active energy production facility that generates electricity through coal combustion. The CCR materials are generated as byproducts of the combustion process and include fly ash and boiler slag material. The Lined Pond was constructed in the early 1990s for the purpose of managing fly ash for the NMPP. Fly ash was pneumatically conveyed to the northwestern side of the Lined Pond, and a wetting head sluiced the fly ash into the Lined Pond. The Lined Pond was active until the mid-2000s at which point AECI permitted and constructed an on-site utility waste landfill for disposal of CCRs including fly ash.

2. Site Geology and Hydrogeology

Geologic and hydrogeologic conditions beneath the Lined Pond have been characterized based on information obtained during monitoring well installation and geologic information from published sources

2.1 SITE GEOLOGY

The Lined Pond (Figure 1) and the NMPP are located in the Southeastern Lowlands physiographic province. The Southeastern Lowlands is the northernmost extent of the larger Mississippi Alluvial Plain and is characterized by alluvial, fluvial, and deltaic deposits ranging in age from Cretaceous to Holocene. The plant site and the Lined Pond are underlain by an unconsolidated alluvium which constitutes a regionally extensive aquifer.

In order from ground surface downward, the Lined Pond is underlain by unconsolidated alluvium, the Wilcox Group, the Porters Creek Clay, the Clayton, Owl Creek, and McNairy formations. Only the Tertiary formations (unconsolidated alluvium, Wilcox Group, and Porters Creek formation) are described below because they represent the uppermost and regional aquifer system.

According to lithologic records from borings completed near the Lined Pond, the lithology below the liner include alluvium consisting of moderate to poorly sorted clay, silt, sand, and gravel of Holocene age (Miller and Vandike, 1997). The alluvium varies from approximately 250 to 300 feet thick (Gredell Engineering Resources, Inc. [Gredell], 2003). Alluvial sediments were predominantly deposited by the Mississippi and Ohio River systems. The alluvium yields substantial quantities of water to shallow wells installed primarily for irrigation use and is considered the primary local aquifer (Burns & McDonnell, 2006).

The Holocene alluvium is underlain by unconsolidated Tertiary strata representing transgressions and regressions of marine, near-shore, and onshore depositional environments. The uppermost Tertiary unit is the Wilcox Group consisting primarily of sand deposits with some interbedded clays and lignites (Burns & McDonnell, 2006). The Wilcox Group is 400 to 500 feet thick at the plant site, lying approximately 250 to 300 feet below ground surface, and stratigraphically overlies the Porters Creek Clay.

The Porters Creek Clay is approximately 650 feet in thickness in the vicinity of the Lined Pond. The Porters Creek Clay is composed entirely of light grey to black clay (Burns & McDonnell, 2006). The clay is a groundwater flow barrier and barrier to infiltration (Miller and Vandike, 1997). The Porters Creek Clay overlies the Clayton Formation. The Clayton Formation has a total thickness of approximately 30 feet near the plant site and is comprised of sand and limestone (Burns & McDonnell, 2006).

2.2 SITE HYDROGEOLOGY AND HYDROLOGY

The water-bearing geologic formation underlying the Lined Pond is alluvium consisting of moderately to poorly sorted clay, silt, sand, and gravel of Holocene age. The aquifer is used locally for irrigation and is locally treated for use as domestic water supply, but known existing wells are located upgradient of the Lined Pond, and no water wells are located down gradient of the Lined Pond. Water levels in the uppermost aquifer are influenced by the Mississippi River stage.

Based on groundwater elevations measured between October 2018 and March 2019, the groundwater gradient in the upper aquifer unit is approximately 0.0008 to 0.001 feet per foot (feet/foot) and is unconfined. The predominate groundwater flow direction beneath the Lined Pond is to the northeast (Figure 2A and Figure 2B); however, since the Lined Pond lies adjacent to the Mississippi River and the alluvial aquifer within the study area is in communication with the river, seasonal fluctuations in river stage cause the groundwater flow direction to change and occasionally reverse (Figure 2C). During baseflow conditions, when the Mississippi River stage is low, groundwater flow in the alluvial aquifer is generally to the north /northeast. During wet weather conditions, when the Mississippi River stage is high, groundwater flow direction is generally to the southwest. Due to the changing groundwater flow directions, monitoring wells were sited at locations to encircle the Lined Pond, with MW-17 and MW-18 to the West, P-7 to the South, P-6 to the East, and wells MW-8 and MW-9 to the North. It is important to note that wells MW-8 and MW-9 are shared between two separate CCR units, the Lined Pond and unlined Pond 003 to the North (Figure 1).

Hydraulic conductivity of the uppermost aquifer is based on data collected during slug testing of wells installed during development of the CCR monitoring network. The hydraulic conductivity was calculated to be 75 to 81 feet per day (Haley & Aldrich, 2019a).

The Wilcox Formation underlying the alluvial aquifer is comprised of sand deposits with interbedded clay and lignite. Because the alluvial aquifer provides a more accessible resource for groundwater production in the area, the Wilcox Formation has not been developed locally as a source of water supply. The clay and lignite present within the Wilcox Formation have lower hydraulic conductivity than the overlying alluvial aquifer. Published hydraulic conductivity values for the Wilcox Formation are available from areas where it has been investigated that indicate the hydraulic conductivity ranges from 9 to 25 feet per day (Office of Nuclear Waste Isolation [ONWI], 1982; Prudic, 1991). The Wilcox Formation in the vicinity of the Lined Pond is estimated to be approximately 400 to 500 feet thick (Gredell, 2003).

2.2.1 Lined Pond

Although leakage from the Lined Pond is unlikely, the hydrology and potential surface water/ groundwater interaction beneath the Lined Pond plays an important role in determining the potential for molybdenum in the groundwater. Analysis of the potential for leakage and source loading to groundwater provides a useful line of evidence to rule out the Lined Pond as a source of molybdenum to groundwater.

The Lined Pond has an 80-mil high density polyethylene geomembrane liner with a base low elevation of 284 feet above mean sea level. The bottom of the liner overlies alluvium within the vadose zone approximately 8 feet above the alluvial groundwater table during normal groundwater conditions, except for seasonal periods where elevated Mississippi River water levels raise the groundwater table. The relationship of the liner with respect to the groundwater table impacts the fate and transport of any potential constituent of potential concern that may be migrating from this potential source area.

Unlike the Lined Pond, the two adjacent ponds to the East and North of the Lined Pond are unlined and in potential communication with the aquifer. Because the base liner elevation was completed within the vadose zone, potential leakage from the Lined Pond would manifest as radial flow outward from a compromised portion of the liner. Mounding from two adjacent unlined ponds (Pond 003 to the North,

and the Raw Water Pond to the East) would control the fate and direction travelled for seepage from the Lined Pond. As a result, seepage from the Lined Pond would be directed towards the West and South of the pond, especially during wet weather conditions and an elevated river stage. These potential fate and transport mechanisms from the Lined Pond are thoroughly examined in subsequent sections of the current document and ruled out (see Section 3.3).

3. Alternate Source Demonstration

Haley & Aldrich conducted an evaluation of potential alternative sources that included review of sampling procedures, laboratory procedures, and statistical analyses to determine if potential errors may have been made that would result in the apparent SSL of molybdenum down gradient of the Lined Pond. Haley & Aldrich also evaluated potential point and non-point sources of contamination in the vicinity of the Lined Pond. Each of these analyses and the resulting findings are described below.

3.1 REVIEW OF SAMPLING, ANALYSIS, AND STATISTICAL PROCEDURES

3.1.1 Field Sampling Procedures

AECI and Haley & Aldrich conducted the field sampling activities in accordance with a Groundwater Sampling and Analysis Plan (SAP; Haley & Aldrich, 2019b) that was prepared in accordance with § 257.93 of the CCR Rule. The SAP prescribes the site-specific activities and methodologies for groundwater sampling and included procedures for field data collection, sample collection, sample preservation and shipment, interpretation, laboratory analytical methods, and reporting for groundwater sampling for the Lined Pond. The administrative procedures and frequency for collection of groundwater elevation measurements, determination of flow directions, and gradients were also provided in the SAP.

Haley & Aldrich reviewed the field sampling and equipment calibration logs and the field indicator parameters and did not identify apparent deviations or errors in sampling that would result in a potential SSL for molybdenum down gradient of the Lined Pond.

3.1.2 Laboratory Quality Control

The groundwater samples collected down gradient of the Lined Pond were initially analyzed using standard methods. The data generated from these laboratory analyses are stored in a project database that incorporates hydrogeologic and groundwater quality data and was established to allow efficient management of chemical and physical data collected in the field and produced in the laboratory. The analytes, analytical methods, sample containers, field preservation, and maximum analytical holding times for monitoring are summarized in the SAP (Haley & Aldrich, 2019b).

Haley & Aldrich conducted a quality assurance/quality control review of each groundwater quality dataset generated for the Lined Pond and has not identified apparent errors that would result in a potential SSL for molybdenum down gradient of the Lined Pond.

3.1.3 Analytical Data

Haley & Aldrich reviewed analytical results from 12 sampling events that occurred between September 2018 and February 2020; the Lined Pond monitoring network included molybdenum concentration results from compliance wells MW-123, MW-126, MW-16, MW-8, MW-9, MW-17, MW-18, P-6, and P-7. Results from only two wells, MW-8 and MW-9, exceed the molybdenum groundwater protection standard (GWPS) of 0.100 milligrams per liter (mg/L). Sample results from all 12 samples exceeded the molybdenum GWPS in both wells, with concentrations ranging from 0.29 to 0.35 mg/L in MW-9, and concentrations ranging from 0.86 to 1.5 mg/L in MW-8. The highest concentration of molybdenum was

detected in February 2020 in MW-8 and September 2018 in MW-9. A summary of field parameters and molybdenum results are provided in Table I.

Molybdenum concentrations in all other Lined Pond monitoring wells were near or below the method detection level for molybdenum (0.001 mg/L). Concentrations observed in wells MW-17, MW-18, P-7, and P-6 were consistent with molybdenum concentration results from background locations B-123 (<0.0010 – 0.0046 mg/L), B-126 (all samples below detection), and MW-16 (all samples below detection).

3.2 GEOCHEMICAL SIGNATURE OF OBSERVED MOLYBDENUM

This section describes groundwater quality from wells P-2 and P-3 (Figure 1) to geochemically fingerprint the molybdenum source emanating from a plume located to the north of the Lined Pond (the northern plume), and uses various acceptable comparative and differentiation techniques to demonstrate that there is a singular source of molybdenum to groundwater originating outside of the Lined Pond. Geochemically, groundwater samples collected from wells MW-8 and MW-9 possess almost identical chemical signatures and are nearly indistinguishable from the water quality of two wells (P-2 and P-3) directly underlying the northern plume core (Figure 3).

A piper plot provided in Figure 4 demonstrates the bilinear mixing between a single, calcium sulfate-type source (the northern plume) and a calcium carbonate-type background groundwater quality (Wells B-123 and B-126). Piper plots are powerful tools for visualizing the relative abundance of major cations and anions in water samples. Source water from northern plume plots as a $CaSO_4$-type water, while background samples plot as a $CaCO_3$-type water. The blue arrow plotted on the trilinear plot signifies the mixing line between the source and background groundwater. Wells MW-8 and MW-9 water quality results from four events plot consistently along the source: groundwater mixing trend, suggesting that the northern plume is the single source of molybdenum to groundwater.

Total dissolved solids (TDS) versus molybdenum bilinear plots are provided on Figure 5 for wells MW-8, MW-9, P-2, and P-3. Since TDS is a general indicator for overall water quality, it is a reliable indicator of plume core dynamics and geochemistry when used in combination with constituents of potential concern. The bivariate relationship between TDS and molybdenum provides an important line of evidence to demonstrate that the northern plume is the sole source of molybdenum for all four wells. Figure 4 shows that wells with similar molybdenum concentration have similar TDS concentrations (e.g., P-3 and MW-8; P-2 and MW-7). This would not be the case if two or more molybdenum sources were actively leaching to groundwater.

Temporal changes in molybdenum concentration provide important insight into historical mass source loading. By adding the fourth dimension (time), assessment of temporal changes provides an important analysis needed for source determination. Temporal trends in groundwater level and molybdenum concentrations provided in Figure 6 show consistency between trends for well MW-9 with P-2, and MW-8 with P-3 (as indicated by red dashed lines). The consistency of temporal trends between plots is a significant line of evidence that not only supports the other geochemical lines of evidence provided in this section but demonstrates that there is a single plume core from a single source (the northern plume).

3.3 HYDROGEOLOGIC VARIABILITY

The variability and fluctuations in groundwater flow direction, as described in Section 2.2, supports the conclusion that the Lined Pond does not leach molybdenum to groundwater. Given the hydrogeologic complexity in the conceptual site model (CSM), if the Lined Pond were leaching molybdenum to groundwater, the following conditions would be observed in monitoring well data:

- Consistent with groundwater flow direction, wells to the East (P-6), West (MW-17 and MW-18), and South (P-7) of the Lined Pond would be expected to show concentrations of molybdenum elevated above background.
- Seasonal and/or temporal variation in molybdenum concentrations would be expected in these wells, consistent with seasonal changes in groundwater flow direction.

Although these conditions are not observed for the Lined Pond, they are observed for other monitoring wells onsite with elevated, temporally variable concentrations of molybdenum observed in wells adjacent to Pond 003 in all directions of groundwater flow. The hydrologic CSM, as described in Section 2.2, strongly supports the single northern plume core hypothesis, with molybdenum concentrations elevated in monitoring wells to the East (MW-26 S, MW-7, P-5), South (MW-8, MW-9), and West (MW-20S, P-2, MW-21S, P-3, MW-22S) of Pond 003.

3.4 POTENTIAL POINT AND NON-POINT SOURCES

Haley & Aldrich conducted a review of potential point and non-point sources of elevated molybdenum values in the vicinity of the Lined Pond to determine if previous or adjacent site activities, land uses, or practices might have caused elevated molybdenum values to occur down gradient of the Lined Pond. Potential point sources would include discharging activities or other activities occurring at a discrete location in the vicinity of the observed SSL that may potentially concentrate molybdenum in that area. Non-point sources would include diffuse discharging activities or practices that may result in a low level but widespread increase in molybdenum concentrations detected at the down gradient side of the Lined Pond.

3.4.1 Potential Point Sources

3.4.1.1 Past Land Usage

Prior to construction of the Lined Pond, the site and the surrounding vicinity was agricultural land. Review of historical aerial photographs and topographic maps show undeveloped land prior to the construction of the plant site and Lined Pond. No discrete point sources have been identified; however, local industrial activity and past CCR management practices at in adjacent areas constitute potential sources. Agricultural land use is not expected to constitute a point source of molybdenum at the location of the observed SSL.

3.4.2 Non-Point Sources

No mining, industrial, or other activities have been documented in the vicinity of Pond 003 that might constitute a non-point source of lithium at the location of the observed SSL. Agricultural land use is not expected to constitute a non-point source of lithium at the location of the observed SSL.

3.5 HISTORICAL LAND USE REVIEW

Haley & Aldrich assessed past usage of the site and adjoining properties through a review of the following records:

- Environmental Data Resources, Inc. (EDR) – Aerial Photographs dated 1950, 1969, 1985, 1988, 1991, 1993, 2006, 2009, 2012, and 2016 (Appendix A); and
- EDR – Topographic Maps dated 1931/1934, 1939, 1951, 1954/1955, 1971, 1973, 1982, and 2015 (Appendix B).

Unless otherwise noted below, sources were reviewed dating back to 1940 or first developed use, whichever is earlier, and at 5-year intervals if the use of the property has changed within the time period. This review was completed to assess potential alternate sources based on land use.

3.5.1 Historical Aerial Photographs

Haley & Aldrich reviewed aerial photographs depicting the development of the site and vicinity as summarized in the table below. The historical aerial photograph search includes photographs from the United States Geological Survey, United States Department of Agriculture, Digital Orthophoto Quarter Quads, National Aerial Photography Program, and the National Agriculture Information Program (EDR, 2020) and are included in Appendix A.

Photographs suggest that the site was undeveloped up until at least 1988. Aerial photos from 2007 through 2016 show the history of Pond 003 activities and configuration through to its current footprint.

Historical Aerial Photograph Review Summary

Dates	Description of Site and Adjacent Properties	Sources
1950 – 1969	Agricultural use of site and adjacent properties with some road use.	USGS
1985 – 1991	The plant site is active. CCR ponds appear present at subject site. Agricultural use of adjacent properties surrounding the subject site.	USGS, NAPP
1996	Extension of the Lined Pond to the west toward road, and development of addition pond to the east of the Lined Pond.	USGS, DOQQ
2006	No apparent changes observed.	USDA, NAIP
2009 – 2016	The plant site and Pond 003 are active. No apparent changes observed.	USDA, NAIP

Notes:

CCR = coal combustion residuals
DOQQ = Digital Orthophoto Quarter Quads
NAIP = National Agriculture Information Program
NAPP = National Aerial Photography Program
USDA = United States Department of Agriculture
USGS = United States Geological Survey

3.5.2 Historical Topographic Maps

Haley & Aldrich reviewed historical topographic maps depicting the development of the site and vicinity, as summarized in the table below. The topographic maps were provided for review by EDR. Copies of the topographic maps are included in Appendix B.

Historical Topographic Map Review Summary		
Dates	**Description of Site and Adjacent Properties**	**Map Name**
1931 – 1955	The map shows the site as undeveloped land with several roads and a railroad within the site vicinity.	15-Minute Series, New Madrid, Missouri Quadrangle
1971	Plant site appears to be active.	7.5-Minute Series, New Madrid SE, Missouri Quadrangle
1982	Additional development of the plant and apparent Pond 003 development to the north of the Lined Pond.	7.5-Minute Series, New Madrid, Missouri Quadrangle
2015	Development of the Lined Pond prior to 2015	7.5-Minute Series, New Madrid, Missouri Quadrangle

4. Findings and Conclusions

Haley & Aldrich conducted an evaluation of groundwater quality at the NMPP Lined Pond to identify the potential source(s) of the SSLs of molybdenum detected in the groundwater sample collected from monitoring wells MW-8 and MW-9 located to the North of the Lined Pond. The evaluation included review of sampling procedures, laboratory procedures, and statistical analyses to determine if potential errors may have been made that would result in the apparent SSL of molybdenum down gradient of the Lined Pond. Haley & Aldrich also evaluated potential point and non-point sources of contamination in the vicinity of the Lined Pond.

Haley & Aldrich found no apparent errors in sampling, laboratory analysis, data management, or statistical analysis that would result in a potential SSLs for molybdenum down gradient of the Lined Pond. Haley & Aldrich found no apparent evidence of historical non-point sources of potential molybdenum values in the vicinity of the Lined Pond; however, active point sources that provide evidence of elevated molybdenum values was observed.

Haley & Aldrich evaluated data and information describing the historical regional water quality, reviewed the historical molybdenum data, and confirmed statistical analyses of molybdenum concentrations. Key findings regarding the molybdenum in groundwater at MW-8 and MW-9 are summarized below:

- The northern plume core is responsible for elevated molybdenum concentrations at MW-8 and MW-9.
- Concentrations of molybdenum in several downgradient wells located in the primary and seasonal direction of groundwater flow directions are consistent with background.
- Multiple geochemical fingerprinting techniques support the conclusion that the Lined Pond is not leaching molybdenum to groundwater. The geochemical fingerprinting techniques strongly support the demonstration of an alternative source of molybdenum.
- The hydrogeologic CSM supports the conclusion that the Lined Pond is not leaching molybdenum to groundwater. The complex hydrogeologic CSM does strongly support the demonstration for an alternative source of molybdenum

Based on these findings, it is evident that the Lined Pond is not the source of molybdenum in groundwater. The alternate source of molybdenum observed at wells MW-8 and MW-9 is the northern plume which originates outside the Lined Pond. The methods and analyses employed in this ASD comply with 40 CFR §257.95(g)(3)(ii) to ***demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent***.

5. Closing

Pursuant to 40 CFR § 257.94(e)(2), AECI conducted an alternate source evaluation to demonstrate that a source other than the Lined Pond caused the SSL over background identified during assessment monitoring. This demonstration and the underlying data support the conclusion that a source other than the CCR unit is the cause of the SSL over background levels for the Appendix IV constituent (molybdenum) detected during assessment monitoring of this unit.

The information contained in this evaluation is, to the best of our knowledge, true, accurate, and complete.

Steven F. Putrich, P.E.
Project Principal

Mark Nicholls, P.G.
Lead Hydrogeologist

6. References

1. Burns & McDonnell, 2006. Groundwater Monitoring Program. 2006.

2. Environmental Data Resources, Inc., 2020. Database Report, July 2020.

3. Gredell Engineering Resources, Inc., 2003. Detailed Site Investigation Work Plan, Proposed AECI New Madrid Utility Waste Landfill. 13 June.

4. Haley & Aldrich, Inc., 2019a. CCR Groundwater Monitoring Network Description for the New Madrid Power Plant, New Madrid, Missouri. 17 April.

5. Haley & Aldrich, Inc., 2019b. Groundwater Sampling and Analysis Pan, New Madrid Power Plant. April.

6. Miller, Don E., and Vandike, James E., 1997. *Missouri State Water Plan Series Volume II, Groundwater Resources of Missouri,* Missouri Department of Natural Resources Division of Geology and Land Survey, Water Resources Report No. 46, 1997.

7. Office of Nuclear Waste Isolation (ONWI), 1982. Gulf Coast Salt Domes Geologic Area Characterization Report Mississippi Study Area, Volume VI Technical Report.

8. Prudic, David E., United States Geological Survey, 1991. Estimates of Hydraulic Conductivity from Aquifer-Test Analyses and Specific-Capacity Data, Gulf Coast Regional Aquifer Systems, South-Central United States. Water Resources Investigations Report 90-4121.

TABLE

TABLE I

SUMMARY OF LINED POND MOLYBDENUM ANALYTICAL RESULTS

ASSOCIATED ELECTRIC COOPERATIVE, INC.

NEW MADRID POWER PLANT - LINED POND

MARSTON, MISSOURI

Well ID	Sample Date	Depth to Water (ft btoc)	Groundwater Elevation (ft amsl)	Field Paramters				Molybdenum Total (mg/L)
				Temperature (Deg C)	Conductivity (µS/cm)	Turbidity (NTU)	pH (su)	
MW-16	9/12/2018	24.80	268.053	17.13	880	4.90	6.73	<0.0010
	10/25/2018	19.82	273.033	16.73	828	3.39	6.71	<0.0010
	12/4/2018	18.88	273.973	14.77	748	3.92	6.91	<0.0010
	12/17/2018	17.94	274.913	17.38	847	1.17	6.84	<0.0010
	1/7/2019	14.80	278.053	16.73	767	1.17	7.04	<0.0010
	1/15/2019	14.32	278.533	15.94	828	1.56	6.77	<0.0010
	1/21/2019	15.75	277.103	13.73	886	2.69	6.90	<0.0010
	2/9/2019	14.77	278.083	14.13	763	1.74	6.79	<0.0010
	2/22/2019	10.90	281.953	14.28	863	1.03	6.83	<0.0010
	3/5/2019	8.52	284.333	15.57	783	3.47	6.47	<0.0010
	12/19/2019	17.18	275.673	17.25	869	0.0	7.14	<0.0010
	2/21/2020	10.90	281.953	16.95	804	0.0	7.08	<0.0010
B-123	9/11/2018	20.65	272.05	16.41	684	30.90	7.18	0.0040
	10/24/2018	20.74	271.96	17.05	618	28.3	6.93	0.0041
	12/4/2018	19.25	273.45	13.84	526	9.94	7.09	0.0038
	12/17/2018	18.51	274.19	16.55	568	5.40	7.05	0.0046
	1/9/2019	20.69	272.01	15.84	602	14.8	7.05	0.0037
	1/14/2019	17.93	274.77	14.56	603	21.0	5.23	0.0040
	1/21/2019	17.33	275.37	10.45	581	4.35	7.11	0.0042
	2/8/2019	16.71	275.99	11.62	489	5.23	7.03	0.0044
	2/22/2019	15.30	277.4	11.61	565	8.07	7.03	0.0040
	3/4/2019	15.30	277.4	14.18	851	39.6	7.02	0.0041
	12/18/2019	13.78	278.92	16.46	640	0.0	7.53	0.0040
	2/21/2020	11.00	281.7	16.26	616	90.7	7.43	<0.0010
B-126	9/11/2018	21.32	272.31	17.23	1017	90.3	6.86	<0.0010
	10/24/2018	21.62	272.01	17.88	330	117	6.49	0.0038
	12/4/2018	21.05	272.58	13.06	272	70	6.71	0.0016
	12/18/2018	20.64	272.99	17.30	219	86.4	6.68	<0.0010
	1/8/2019	20.09	273.54	16.79	320	227	6.58	0.0018
	1/14/2019	19.78	273.85	14.49	145	140	5.84	0.0011
	1/22/2019	18.91	274.72	12.10	130	69.2	6.43	<0.0010
	2/8/2019	18.90	274.73	12.42	98	195	6.44	<0.0010
	3/4/2019	16.55	277.08	12.76	134	249	6.17	< 0.0010
	12/18/2019	18.85	274.78	16.84	444	99.9	7.02	< 0.0010
	2/21/2020	12.68	280.95	16.56	417	98.7	7.07	<0.0010
P-6	9/13/2018	41.60	269.28	18.79	924	0.4	6.84	<0.0010
	10/25/2018	34.76	276.12	16.71	771	1.2	6.50	<0.0010
	12/4/2018	33.85	277.03	14.15	727	5.0	6.62	<0.0010
	12/17/2018	32.87	278.01	17.18	823	1.0	6.58	<0.0010
	1/7/2019	26.85	284.03	16.21	676	1.9	6.83	<0.0010
	1/14/2019	26.43	284.45	15.92	782	2.0	5.25	<0.0010
	1/21/2019	29.82	281.06	12.28	762	2.8	6.71	<0.0010
	2/5/2019	27.88	283.00	14.69	633	3.4	6.69	<0.0010
	2/22/2019	21.00	289.88	13.49	727	2.0	6.63	< 0.0010
	3/5/2019	18.27	292.61	16.14	702	3.1	6.49	< 0.0010
	12/18/2019	33.70	277.18	16.62	960	0.0	6.87	< 0.0010
	2/19/2020	25.40	285.48	16.99	795	0.0	6.98	<0.0010
P-7	9/13/2018	38.60	270.00	16.61	980	2.8	7.22	<0.0010
	10/25/2018	33.86	274.74	16.44	827	1.2	6.57	<0.0010
	12/4/2018	32.44	276.16	14.36	708	2.6	6.87	0.0012
	12/17/2018	31.49	277.11	16.47	754	2.2	6.74	0.0013
	1/7/2019	27.37	281.23	15.92	750	1.8	6.80	<0.0010
	1/14/2019	26.45	282.15	15.28	865	2.7	6.55	<0.0010
	1/21/2019	28.01	280.59	13.52	758	2.8	6.80	0.0011
	2/5/2019	27.05	281.55	14.17	692	257	6.73	<0.0010
	2/22/2019	20.36	288.24	13.58	774	1.5	6.70	<0.0010
	3/5/2019	17.35	291.25	15.74	787	1.8	6.49	0.0010
	12/18/2019	31.24	277.36	15.81	927	0.00	6.97	0.0011
	2/19/2020	24.13	284.47	15.93	899	0.0	6.97	0.0010

TABLE I

SUMMARY OF LINED POND MOLYBDENUM ANALYTICAL RESULTS

ASSOCIATED ELECTRIC COOPERATIVE, INC.

NEW MADRID POWER PLANT - LINED POND

MARSTON, MISSOURI

Well ID	Sample Date	Depth to Water (ft btoc)	Groundwater Elevation (ft amsl)	Field Paramters				Molybdenum Total (mg/L)
				Temperature (Deg C)	Conductivity (µS/cm)	Turbidity (NTU)	pH (su)	
MW-8	9/12/2018	42.30	268.328	17.64	1170	0.0	7.06	**0.86**
	10/24/2018	36.10	274.528	17.56	990	0.4	6.86	**0.92**
	12/3/2018	34.90	275.728	15.22	998	2.6	6.94	**0.92**
	12/17/2018	33.96	276.668	16.75	1044	1.8	6.97	**0.99**
	1/7/2019	30.32	280.308	16.90	1015	1.9	7.06	**1.0**
	1/15/2019	29.21	281.418	16.27	1141	1.1	5.39	**0.91**
	1/22/2019	30.72	279.908	14.34	1054	1.9	6.95	**0.88**
	2/5/2018	29.52	281.108	14.75	1021	2.2	6.99	**1.0**
	2/22/2019	21.76	288.868	14.46	1249	1.8	6.95	**1.1**
	3/5/2019	21.49	289.138	15.16	1124	1.4	6.73	**1.1**
	12/19/2019	33.78	276.848	16.82	1358	0.0	7.32	**0.87**
	2/19/2020	27.10	283.528	17.00	1305	0.0	7.21	**1.5**
MW-9	9/12/2018	42.90	267.337	17.97	724	0.8	7.30	**0.34**
	10/25/2018	34.76	275.477	17.70	693	0.6	7.42	**0.34**
	12/3/2018	33.85	276.387	14.01	706	1.6	6.94	**0.35**
	12/17/2018	32.82	277.417	17.32	723	1.1	6.96	**0.35**
	1/7/2019	27.65	282.587	6.97	657	0.9	16.99	**0.33**
	1/15/2019	27.03	283.207	16.74	718	2.6	6.33	**0.30**
	1/21/2019	29.91	280.327	13.68	751	2.5	6.98	**0.33**
	2/5/2019	27.88	282.357	0.65	647	1.4	6.94	**0.32**
	2/22/2019	21.76	288.477	14.91	825	0.6	6.84	**0.30**
	3/5/2019	18.80	291.437	16.82	776	2.1	6.68	**0.31**
	12/18/2019	33.48	276.757	17.10	832	0.0	7.20	**0.29**
	2/19/2020	25.53	284.707	17.39	883	0.0	7.12	**0.30**
MW-17	12/7/2018	23.64	275.557	14.66	564	2.51	6.64	0.0012
	12/18/2018	23.14	276.057	16.3	10.5	9.62	6.67	<0.0010
	1/8/2019	20.61	278.587	16.12	562	9.12	6.58	<0.0010
	1/15/2019	19.49	279.707	14.37	552	9.57	7.27	0.0049
	1/22/2019	20.07	279.127	13.52	544	7.29	6.8	0.0038
	2/8/2019	19.65	279.547	13.02	507	12.70	6.69	0.0011
	2/22/2019	15.98	283.217	14.01	628	3.76	6.72	0.0017
	3/4/2019	12.66	286.537	13.92	854	2.77	6.76	< 0.0010
	12/18/2019	22.08	277.117	15.06	656	46.00	7.09	< 0.0010
	2/19/2020	16.72	282.477	16.17	629	0.00	6.97	<0.0010
MW-18	12/7/2018	26.46	274.73	14.7	381	3.49	6.42	<0.0010
	12/18/2018	25.9	275.29	16.38	451	9.26	6.58	<0.0010
	1/8/2019	23.74	277.45	16.75	436	6.38	6.37	<0.0010
	1/15/2019	22.57	278.62	14.12	428	10.08	7.68	<0.0010
	1/22/2019	22.85	278.34	13.69	433	7.23	6.65	0.0021
	2/8/2019	22.44	278.75	12.68	411	9.09	6.56	<0.0010
	2/22/2019	18.99	282.2	12.66	493	4.55	6.62	< 0.0010
	3/4/2019	15.72	285.47	14.88	734	12.21	6.65	0.0012
	12/19/2019	24.48	276.71	15.25	528	99.9	6.56	< 0.0010
	2/19/2020	26.43	274.76	16.3	491	0.0	6.91	<0.0010

Notes:

BOLD value: *Detection above Groundwater Protection Standard*

µS/cm = micro Siemens per centimeter

Deg C = degrees Celsius

ft amsl = feet above mean sea level

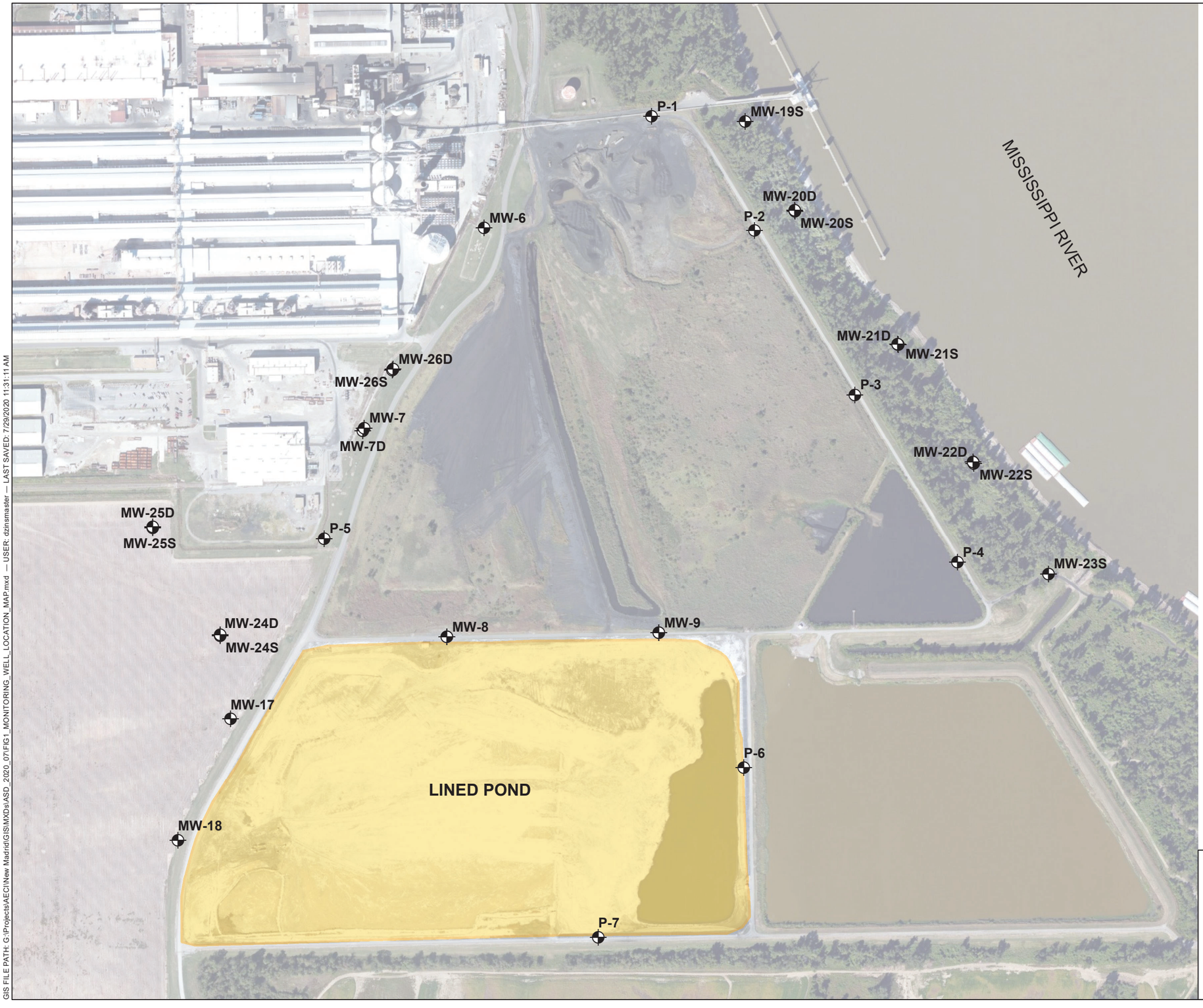
ft btoc = feet below top of casing

mg/L = milligrams per liter

NTU = Nephelometric Turbidity Unit

su = standard unit

FIGURES



LEGEND

MONITORING WELL

LINED POND

NOTES

1. ALL LOCATIONS ARE APPROXIMATE
2. REFER TO TABLE I FOR GROUNDWATER ANALYTICAL RESULTS.
3. AERIAL IMAGERY SOURCE: ESRI, APRIL 21, 2019.

N

0 470 940

SCALE IN FEET

HALEY ALDRICH

ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT
NEW MADRID, MISSOURI

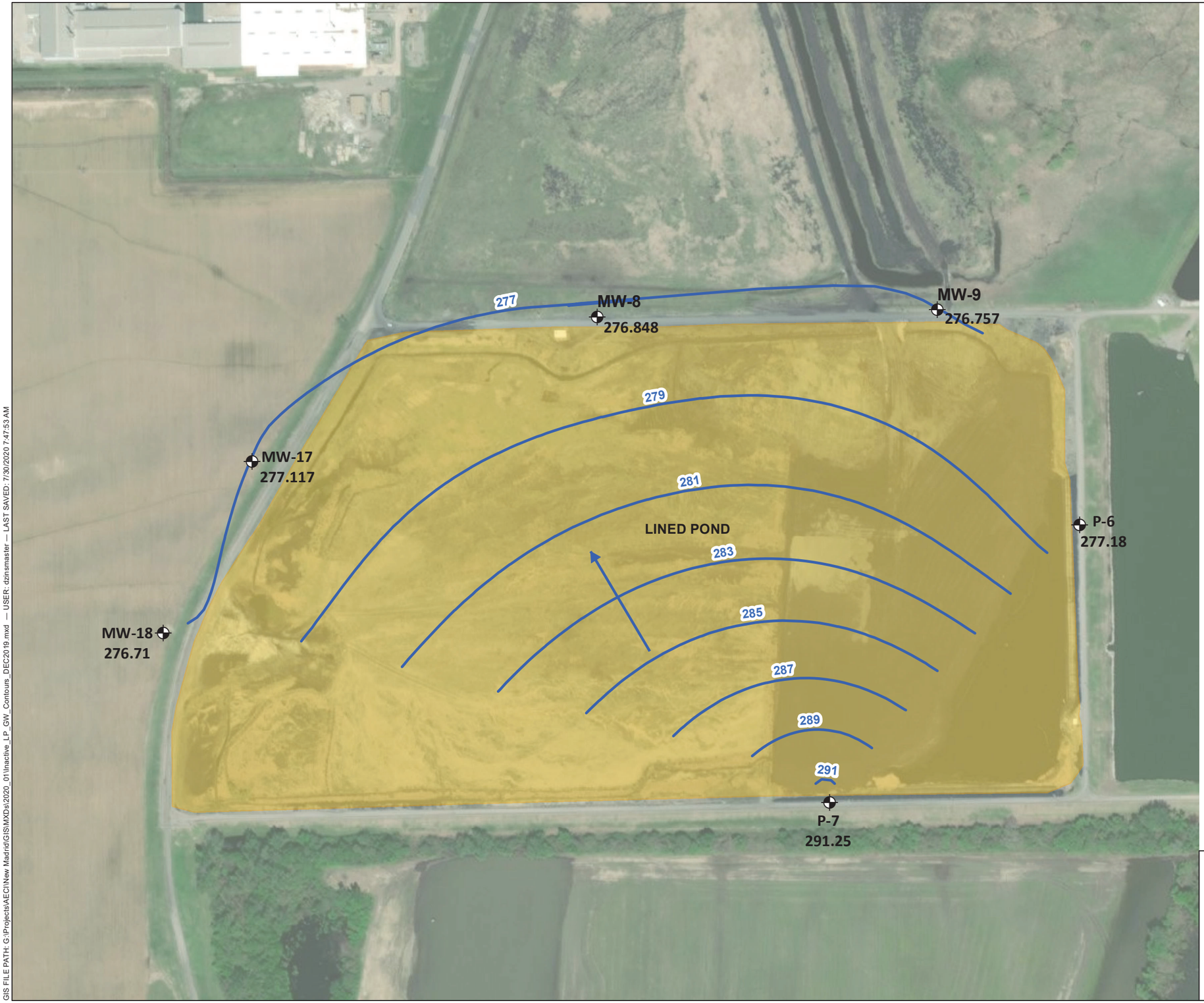
MONITORING WELL NETWORK

aeci

AUGUST 2020

FIGURE 1

GIS FILE PATH: G:\Projects\AECI\New Madrid\GIS\MXDs\ASD_2020_07\FIG1_MONITORING_WELL_LOCATION_MAP.mxd — USER: dzinsmaster — LAST SAVED: 7/29/2020 11:31:11 AM



LEGEND

- 265 GROUNDWATER ELEVATION CONTOURS (FT ASML)
- LINED POND
- MONITORING WELL
- 265.12 WATER ELEVATION (FEET, AMSL)
- GROUNDWATER FLOW DIRECTION

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

2. AERIAL IMAGERY SOURCE: ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE, APRIL 21, 2019.

3. WATER ELEVATIONS MEASURED DECEMBER 18, 2019. ALL GROUNDWATER CONTOUR LINES ARE APPROXIMATE.

4. AMSL = ABOVE MEAN SEA LEVEL.

N

0 290 580

SCALE IN FEET

HALEY ALDRICH

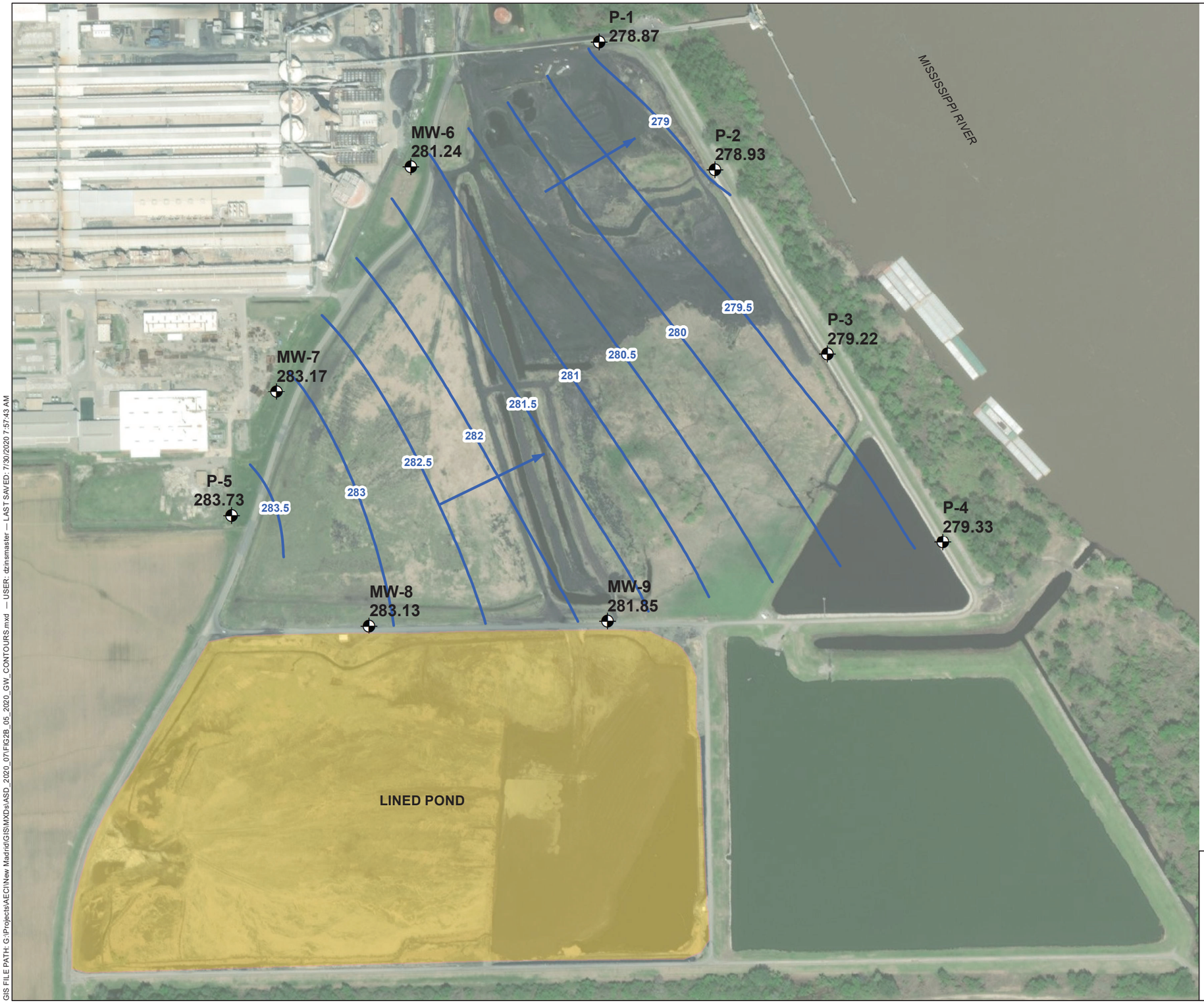
ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT
NEW MADRID COUNTY, MISSOURI

GROUNDWATER FLOW DIRECTION MAP DECEMBER 18, 2019

aeci

AUGUST 2020

FIGURE 2A



LEGEND

- 265 GROUNDWATER ELEVATION CONTOURS (FEET, AMSL)
- LINED POND
- MONITORING WELL
- 288.5 WATER ELEVATION (FEET, AMSL)
- GROUNDWATER FLOW DIRECTION

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. AERIAL IMAGERY SOURCE ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE, OCTOBER 29, 2018.
3. WATER ELEVATIONS MEASURED MAY 20, 2020. GROUNDWATER CONTOUR LINES ARE APPROXIMATE.
4. AMSL = ABOVE MEAN SEA LEVEL.

N

0 420 840
SCALE IN FEET

HALEY ALDRICH

ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT
NEW MADRID COUNTY, MISSOURI

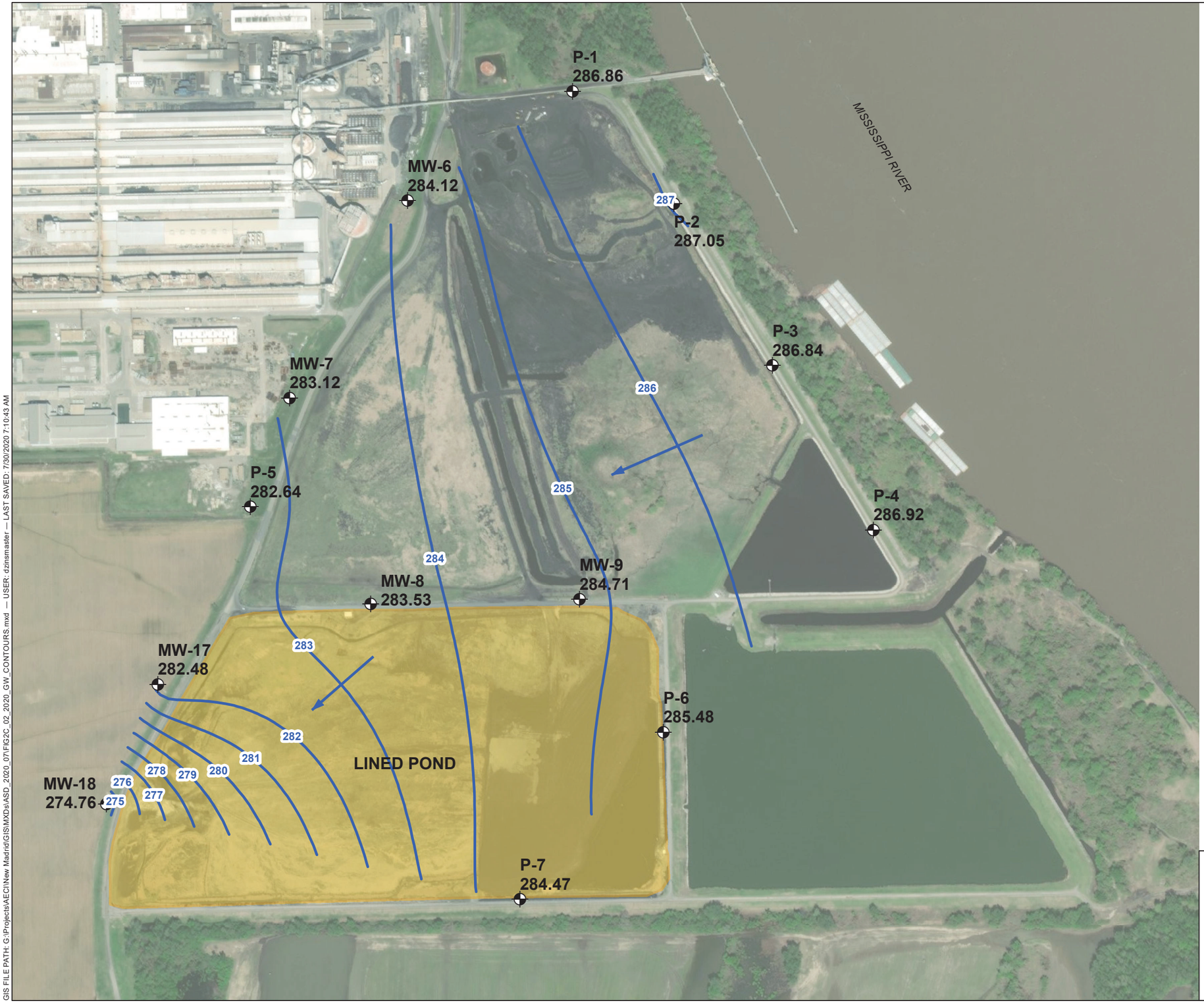
GROUNDWATER ELEVATION CONTOUR MAP MAY 20, 2020

aeci

AUGUST 2020

FIGURE 2B

GIS FILE PATH: G:\Projects\AECI\New Madrid\GIS\MXDs\ASD_2020_07\FIG2B_05_2020_GW_CONTOURS.mxd — USER: dzinsmaster — LAST SAVED: 7/30/2020 7:57:43 AM



LEGEND

- 265 GOUNDWATER ELEVATION CONTOURS
- LINED POND
- MONITORING WELL
- 265.12 WATER ELEVATION (FEET, AMSL)
- GROUNDWATER FLOW DIRECTION

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. AERIAL IMAGERY SOURCE ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE, APRIL 14, 2019.
3. WATER ELEVATIONS MEASURED FBRUARY 18-19, 2020. GROUNDWATER CONTOUR LINES ARE APPROXIMATE.
4. AMSL = ABOVE MEAN SEA LEVEL.

N

0 480 960
SCALE IN FEET

HALEY ALDRICH

ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT
NEW MADRID COUNTY, MISSOURI

GROUNDWATER ELEVATION CONTOUR MAP FEBRUARY 18-19, 2020

aeci

AUGUST 2020

FIGURE 2C

LEGEND

- MONITORING WELL
- 2.0 mg/L ISOPATCH LINE
- EPA RSL BOUNDARY (0.1 mg/L) BOLD VAULES EXCEED RSL
- LINED POND

NOTES

1. ALL LOCATIONS ARE APPROXIMATE
2. REFER TO TABLE I FOR GROUNDWATER ANALYTICAL RESULTS.
3. AERIAL IMAGERY SOURCE: ESRI, APRIL 21, 2019.
4. EPA = ENVIRONMENTAL PROTECTION AGENCY.
5. RSL = REGIONAL SCREENING LEVEL.

N

0 470 940

SCALE IN FEET

HALEY ALDRICH

ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT
NEW MADRID, MISSOURI

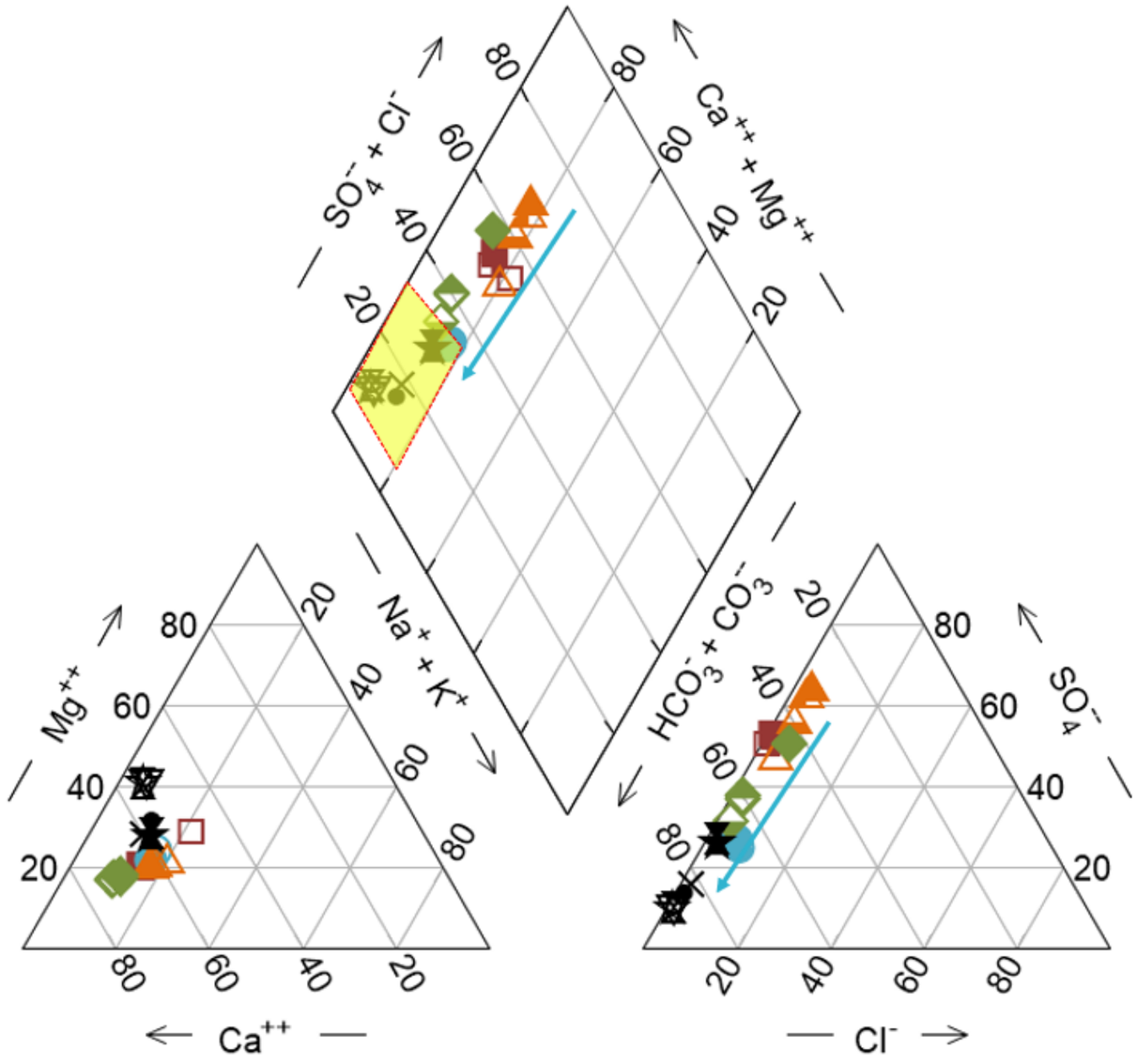
TOTAL MOLYBDENUM CONCENTRATION, MAY 2020

aeci

AUGUST 2020

FIGURE 3

GIS FILE PATH: G:\Projects\AEC\New Madrid\GIS\MXDs\ASD_2020_07\FIG2_LP_MOLY_TOTALS.mxd — USER: dzinsmaster — LAST SAVED: 7/30/2020 9:07:34 AM



LEGEND

Background Conditions

Bilinear Mixing Trend showing mixing between singular source and background conditions

ASD Wells
- MW–8 (09/2019)
- MW–8 (10/4/2019)
- MW–8 (10/16/2019)
- MW–8 (11/6/2019)
- MW–9 (09/2019)
- MW–9 (10/4/2019)
- MW–9 (10/16/2019)
- MW–9 (11/6/2019)

Wells with known alternate sources of molybdenum
- P–2 (09/2019)
- P–2 (10/2/2019)
- P–2 (10/16/2019)
- P–2 (11/9/2019)
- P–3 (09/2019)
- P–3 (10/2/2019)
- P–3 (10/16/2019)
- P–3 (11/9/2019)

Background Wells
- B–123 (8/2019)
- B–123 (10/4/2019)
- B–123 (10/16/2019)
- B–123 (11/6/2019)
- B–126 (8/2019)
- B–126 (10/4/2019)
- B–126 (10/16/2019)
- B–126 (11/6/2019)

HALEY ALDRICH

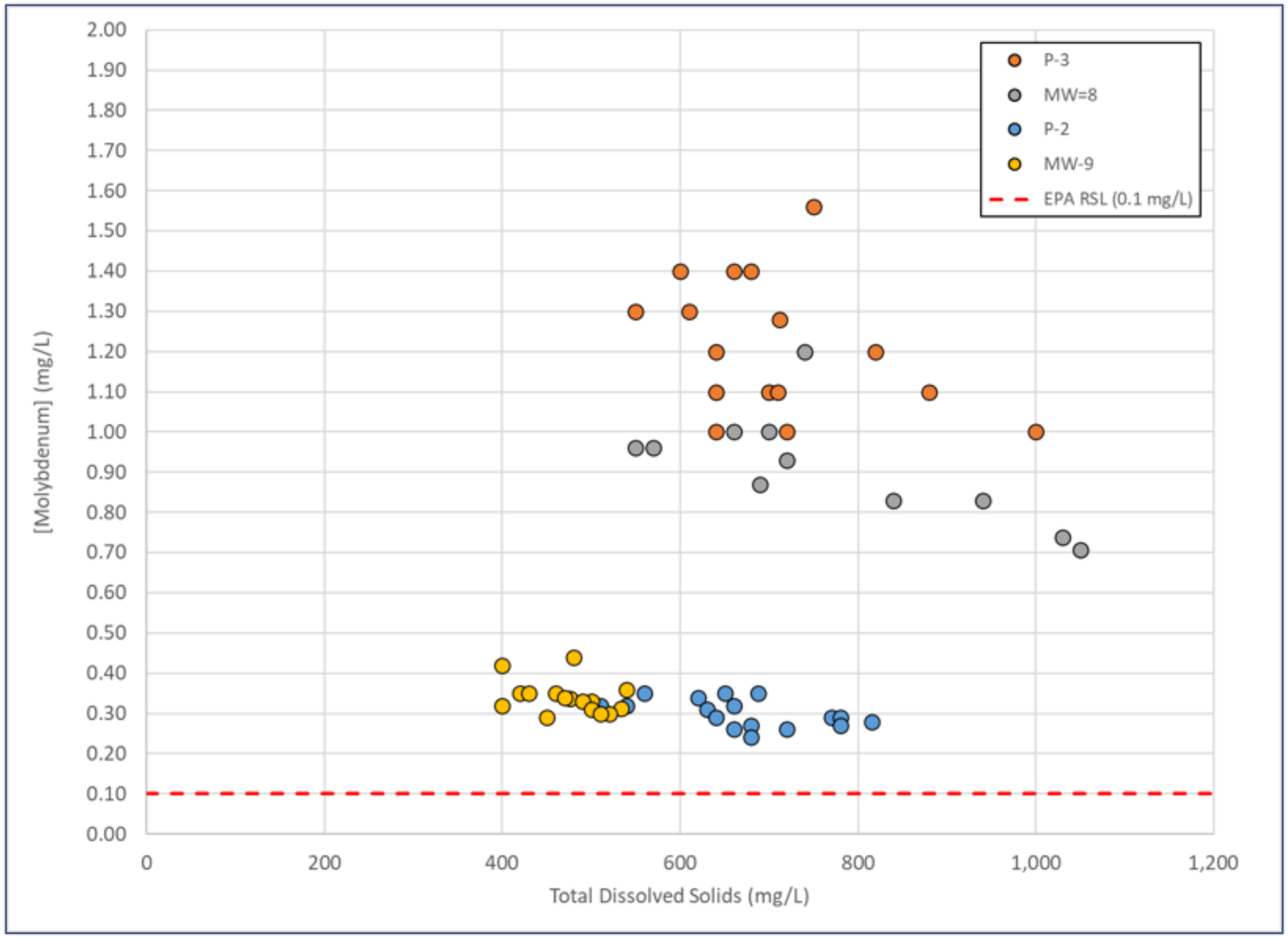
ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT
NEW MADRID, MISSOURI

LINED POND ASD

aeci

AUGUST 2020

FIGURE 4



HALEY ALDRICH

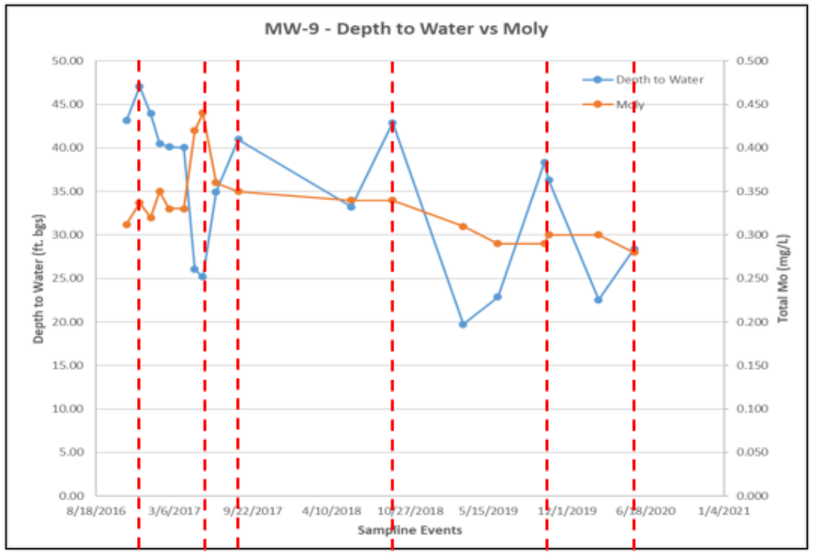
ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT
NEW MADRID, MISSOURI

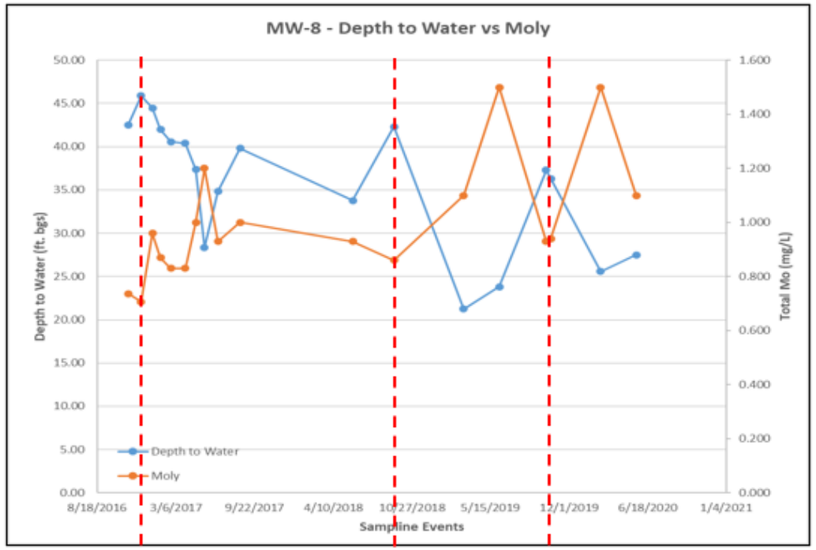
TDS VERSUS MOLYBDENUM
BIVARIATE PLOT

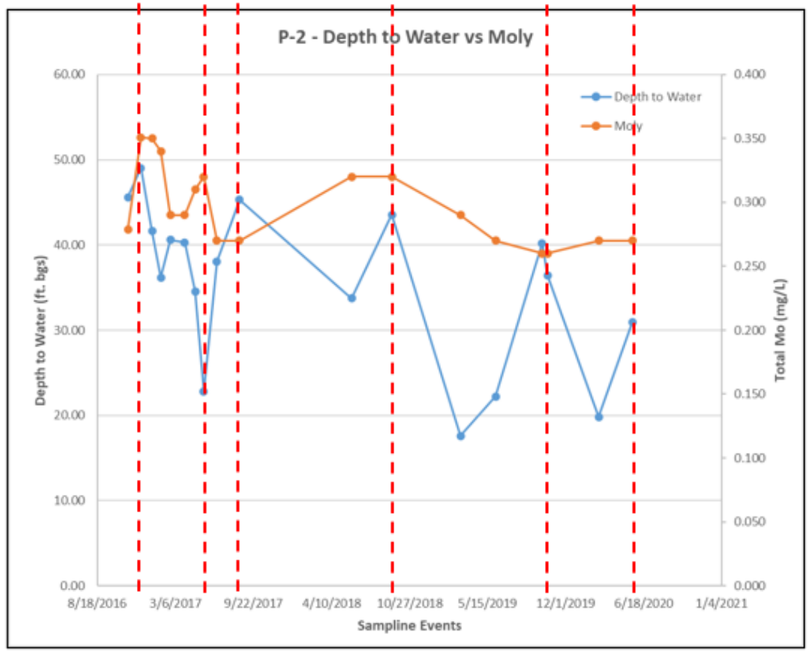
aeci

AUGUST 2020

FIGURE 5







HALEY ALDRICH

ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT
NEW MADRID, MISSOURI

MOLYBDENUM
TEMPORAL PLOT

aeci

AUGUST 2020

FIGURE 6

APPENDIX A

EDR Historical Aerial Photograph Report

AECI New Madrid

1400-1498 St Jude Rd

Marston, MO 63866

Inquiry Number: 6131944.2

July 24, 2020

The EDR Aerial Photo Decade Package

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

07/24/20

Site Name:

AECI New Madrid
1400-1498 St Jude Rd
Marston, MO 63866
EDR Inquiry # 6131944.2

Client Name:

Haley & Aldrich
600 South Meyer Ave Suite 100
Tucson, AZ 85701-0000
Contact: Samantha Kaney

Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

Search Results:

Year	Scale	Details	Source
2016	1"=500'	Flight Year: 2016	USDA/NAIP
2012	1"=500'	Flight Year: 2012	USDA/NAIP
2009	1"=500'	Flight Year: 2009	USDA/NAIP
2006	1"=500'	Flight Year: 2006	USDA/NAIP
1996	1"=500'	Acquisition Date: March 22, 1996	USGS/DOQQ
1991	1"=500'	Flight Date: March 25, 1991	NAPP
1988	1"=1000'	Flight Date: March 22, 1988	USGS
1985	1"=1000'	Flight Date: September 28, 1985	USGS
1969	1"=500'	Flight Date: March 17, 1969	USGS
1950	1"=750'	Flight Date: April 01, 1950	USGS

When delivered electronically by EDR, the aerial photo images included with this report are for ONE TIME USE ONLY. Further reproduction of these aerial photo images is prohibited without permission from EDR. For more information contact your EDR Account Executive.


INQUIRY #: 6131944.2
YEAR: 2016
= 500'
N
EDR

INQUIRY #: 6131944.2

YEAR: 2012

= 500'

N

EDR


INQUIRY #: 6131944.2
YEAR: 2009
= 500'
N
EDR

INQUIRY #: 6131944.2

YEAR: 2006

= 500'

N

EDR

INQUIRY #: 6131944.2

YEAR: 1996

= 500'

N

EDR

Subject boundary not shown because it exceeds image extent or image is not georeferenced.

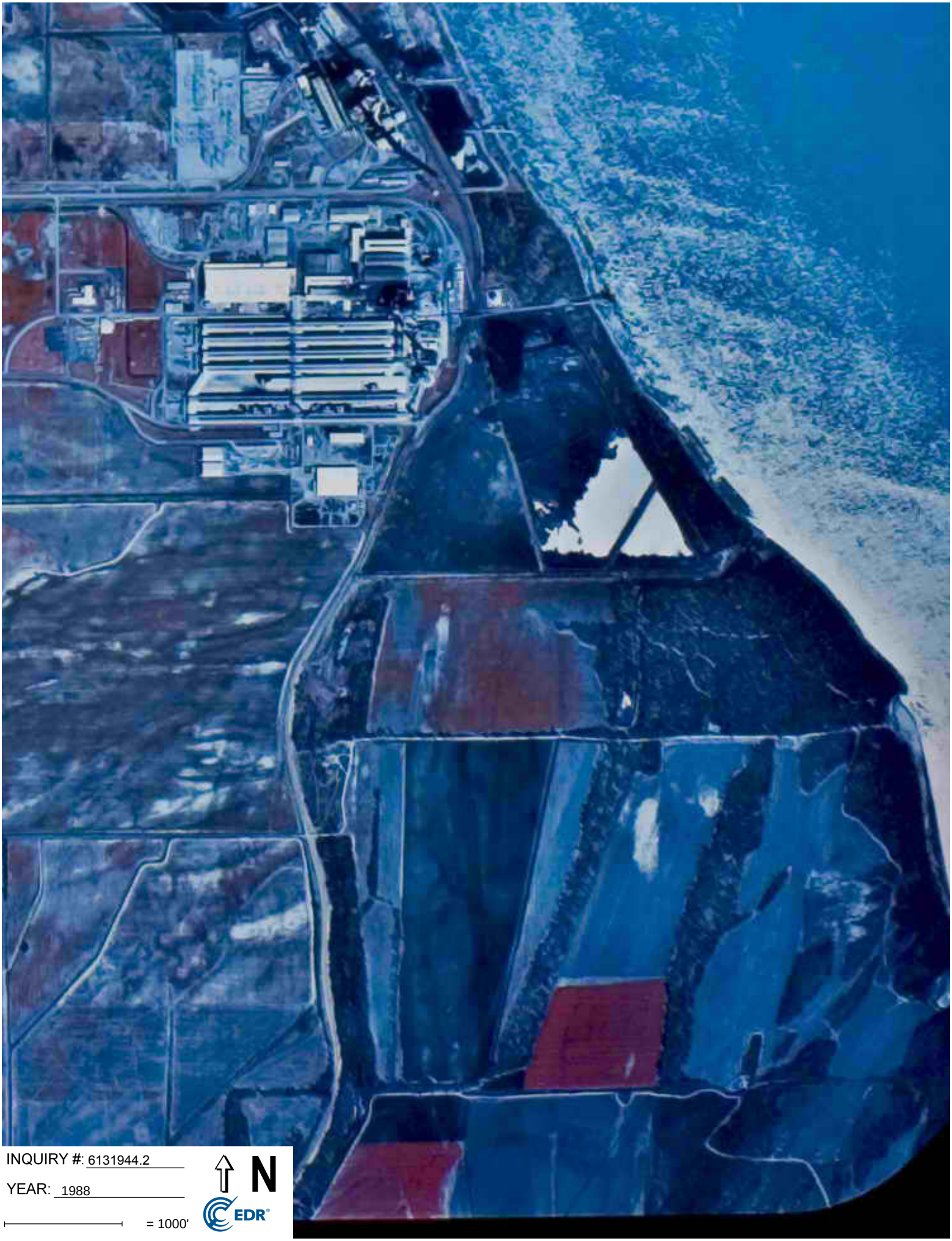
INQUIRY #: 6131944.2

YEAR: 1991

= 500'

N

EDR


INQUIRY #: 6131944.2
YEAR: 1988
= 1000'
N
EDR


INQUIRY #: 6131944.2
YEAR: 1985
= 1000'
N
EDR

INQUIRY #: 6131944.2

YEAR: 1969

= 500'

N

EDR

INQUIRY #: 6131944.2

YEAR: 1950

= 750'

N

EDR

APPENDIX B

EDR Topographic Map Research Results

AECI New Madrid
1400-1498 St Jude Rd
Marston, MO 63866

Inquiry Number: 6131944.1
July 23, 2020

EDR Historical Topo Map Report

with QuadMatch™

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Historical Topo Map Report

07/23/20

Site Name:

AECI New Madrid
1400-1498 St Jude Rd
Marston, MO 63866
EDR Inquiry # 6131944.1

Client Name:

Haley & Aldrich
600 South Meyer Ave Suite 100
Tucson, AZ 85701-0000
Contact: Samantha Kaney

EDR Topographic Map Library has been searched by EDR and maps covering the target property location as provided by Haley & Aldrich were identified for the years listed below. EDR's Historical Topo Map Report is designed to assist professionals in evaluating potential liability on a target property resulting from past activities. EDRs Historical Topo Map Report includes a search of a collection of public and private color historical topographic maps, dating back to the late 1800s.

Search Results:

P.O.# 129342-020
Project: AECI NMPP

Coordinates:

Latitude:	36.502129 36° 30' 8" North
Longitude:	-89.559889 -89° 33' 36" West
UTM Zone:	Zone 16 North
UTM X Meters:	270732.25
UTM Y Meters:	4042692.05
Elevation:	291.00' above sea level

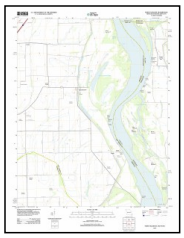
Maps Provided:

2015
1982
1973
1971
1954, 1955
1951
1939
1931, 1934

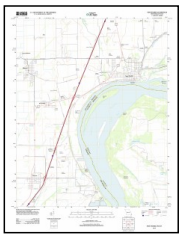
Topo Sheet Key

This EDR Topo Map Report is based upon the following USGS topographic map sheets.

2015 Source Sheets



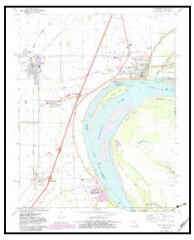
Point Pleasant
2015
7.5-minute, 24000



New Madrid
2015
7.5-minute, 24000

1982 Source Sheets

Point Pleasant
1982
7.5-minute, 24000
Aerial Photo Revised 1981



New Madrid
1982
7.5-minute, 24000
Aerial Photo Revised 1981

1973 Source Sheets

Portageville
1973
15-minute, 62500
Aerial Photo Revised 1969

1971 Source Sheets

New Madrid
1971
7.5-minute, 24000
Aerial Photo Revised 1969

Point Pleasant
1971
7.5-minute, 24000
Aerial Photo Revised 1969

Topo Sheet Key

This EDR Topo Map Report is based upon the following USGS topographic map sheets.

1954, 1955 Source Sheets

New Madrid
1954
15-minute, 62500
Aerial Photo Revised 1950

Portageville
1955
15-minute, 62500
Aerial Photo Revised 1950

1951 Source Sheets

New Madrid SE
1951
7.5-minute, 24000
Aerial Photo Revised 1950

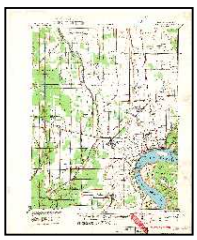
1939 Source Sheets

New Madrid
1939
15-minute, 62500

Portageville
1939
15-minute, 62500

1931, 1934 Source Sheets

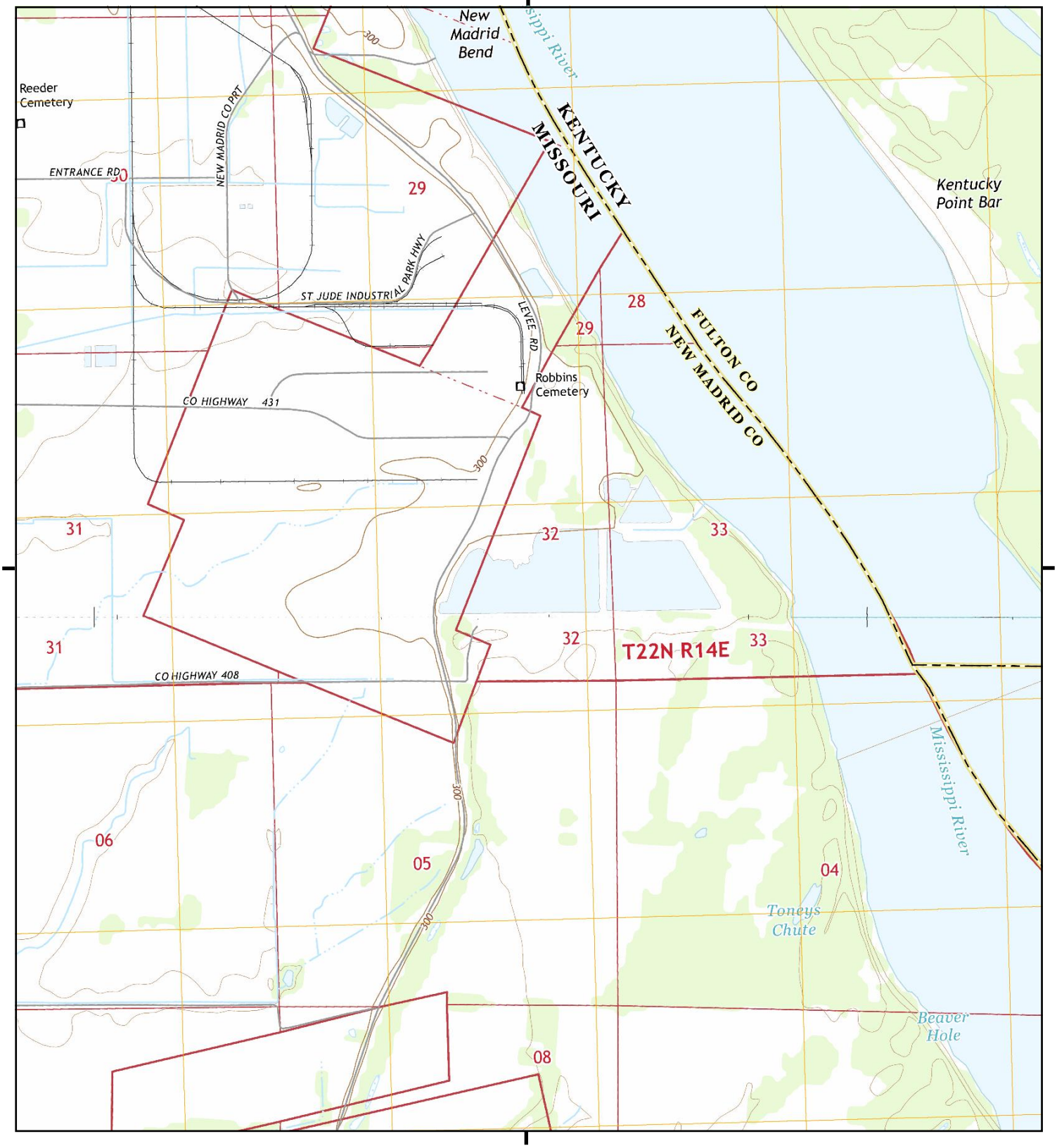
PORTAGEVILLE
1931
15-minute, 62500



NEW MADRID
1934
15-minute, 62500

Historical Topo Map

2015



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

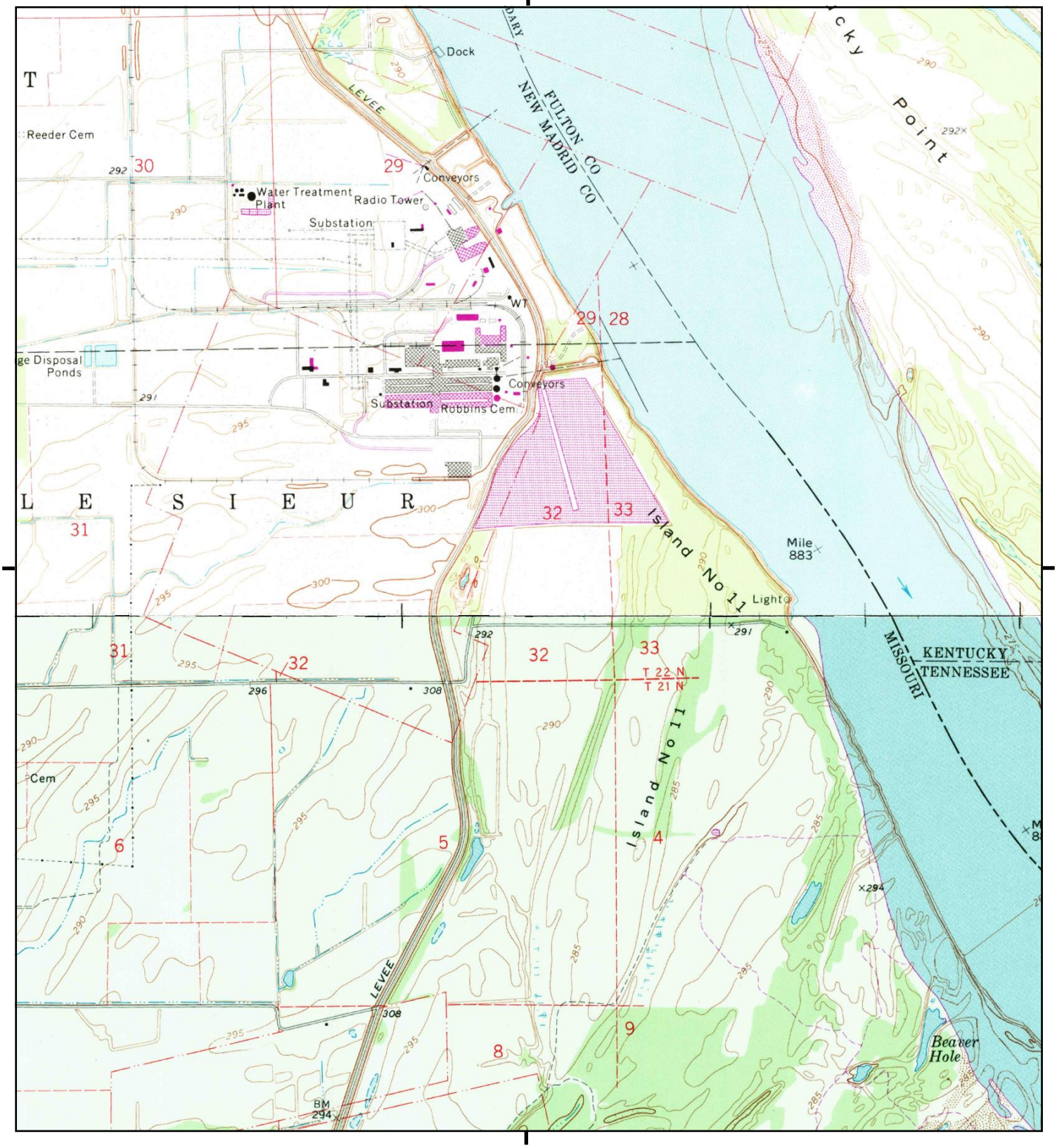
TP, New Madrid, 2015, 7.5-minute
S, Point Pleasant, 2015, 7.5-minute

SITE NAME: AECI New Madrid
ADDRESS: 1400-1498 St Jude Rd
Marston, MO 63866
CLIENT: Haley & Aldrich

N

Historical Topo Map

1982



This report includes information from the following map sheet(s).

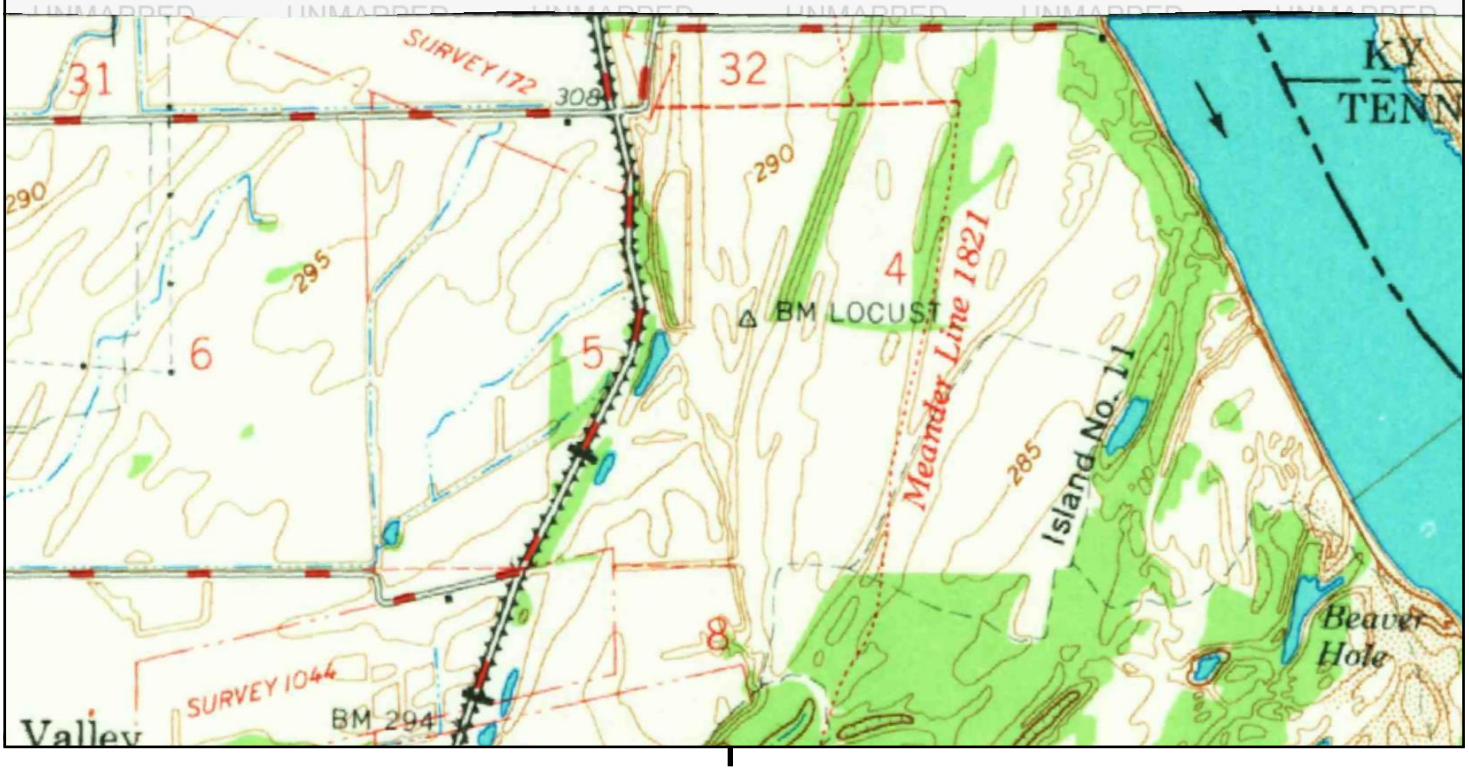
0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

TP, New Madrid, 1982, 7.5-minute
S, Point Pleasant, 1982, 7.5-minute

SITE NAME: AECI New Madrid
ADDRESS: 1400-1498 St Jude Rd
Marston, MO 63866
CLIENT: Haley & Aldrich

N



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

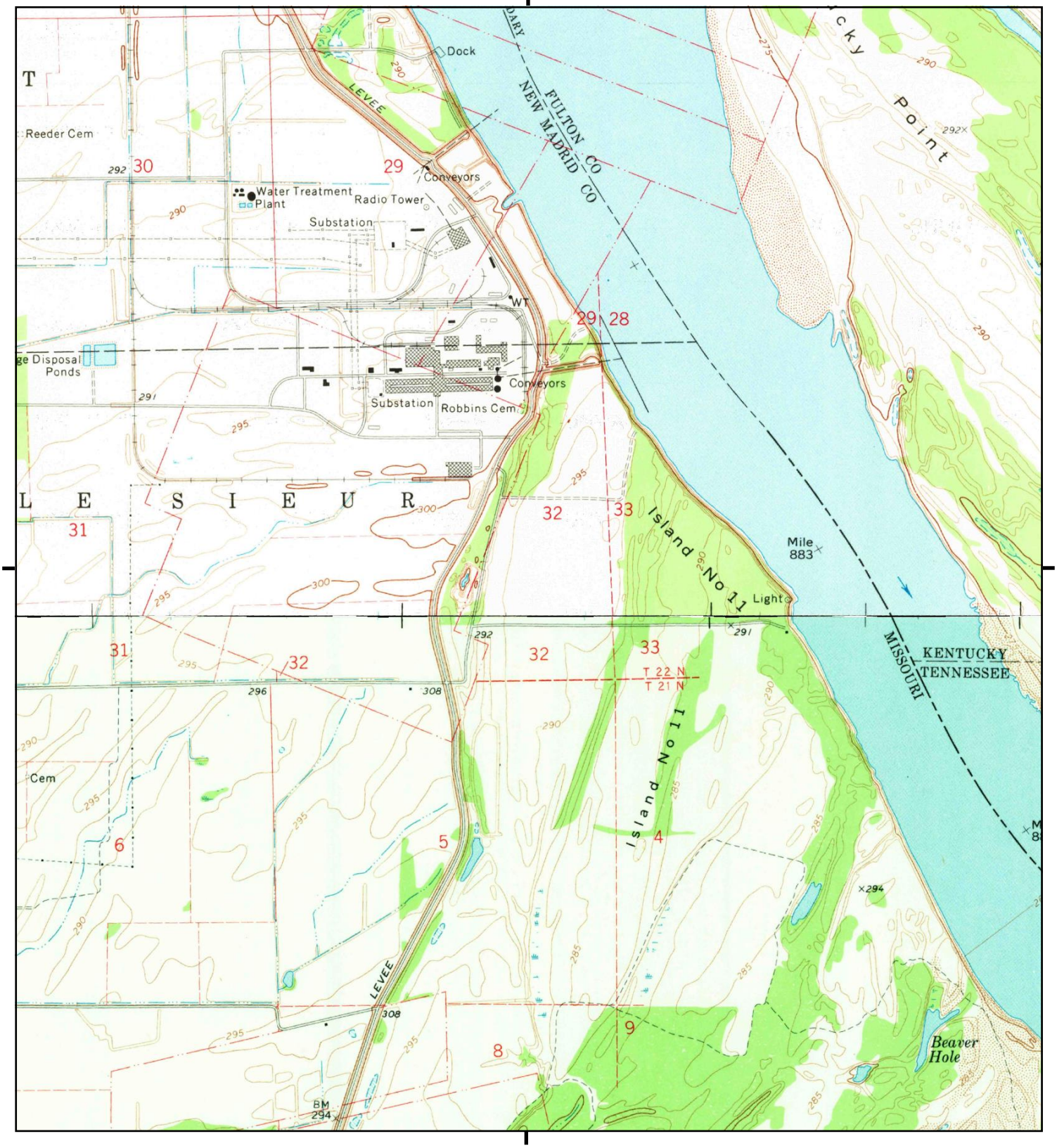
S, Portageville, 1973, 15-minute

SITE NAME: AECI New Madrid
ADDRESS: 1400-1498 St Jude Rd
Marston, MO 63866
CLIENT: Haley & Aldrich

N

Historical Topo Map

1971



This report includes information from the following map sheet(s).

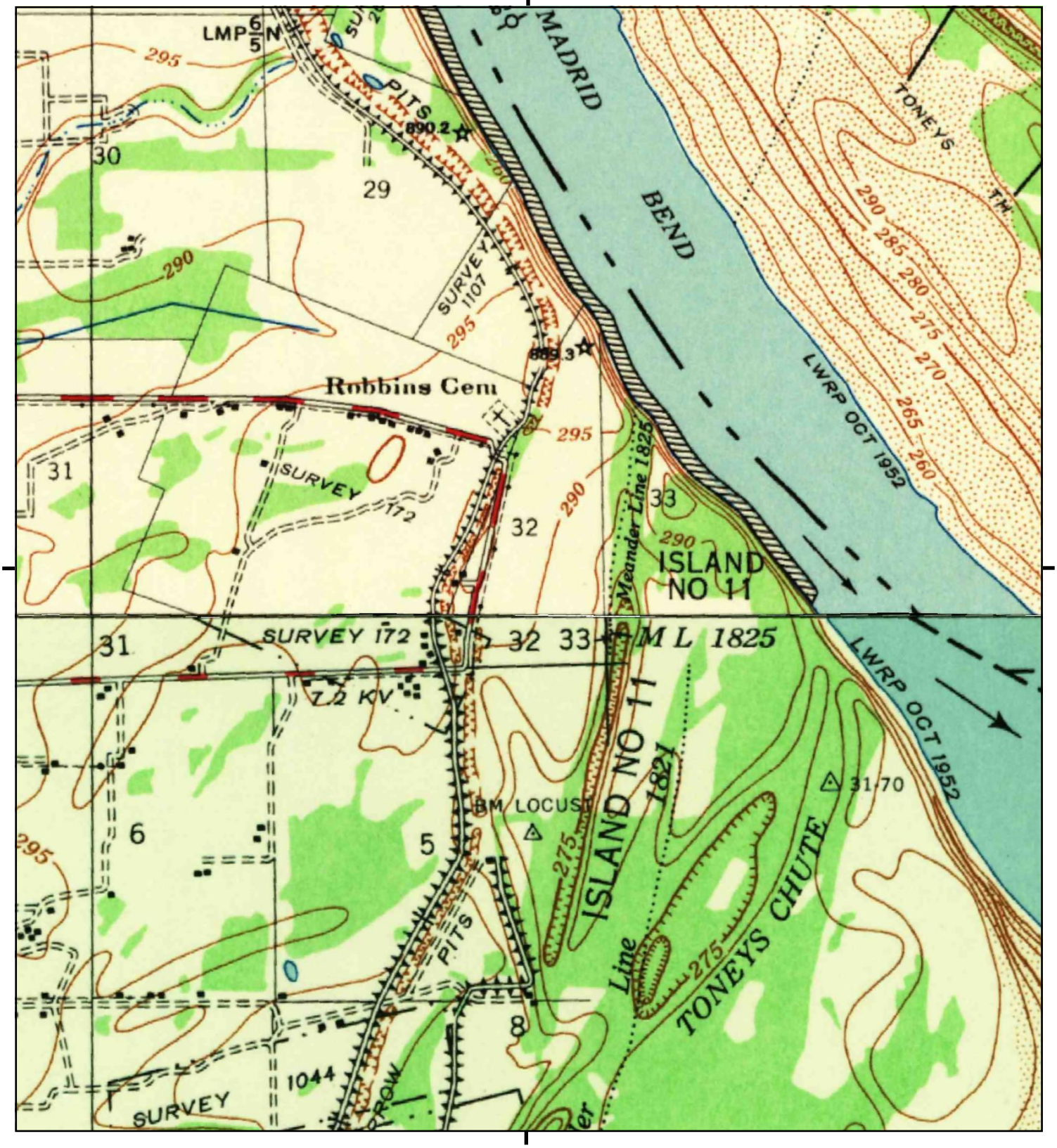
0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

TP, New Madrid, 1971, 7.5-minute
S, Point Pleasant, 1971, 7.5-minute

SITE NAME: AECI New Madrid
ADDRESS: 1400-1498 St Jude Rd
Marston, MO 63866
CLIENT: Haley & Aldrich

N



This report includes information from the following map sheet(s).

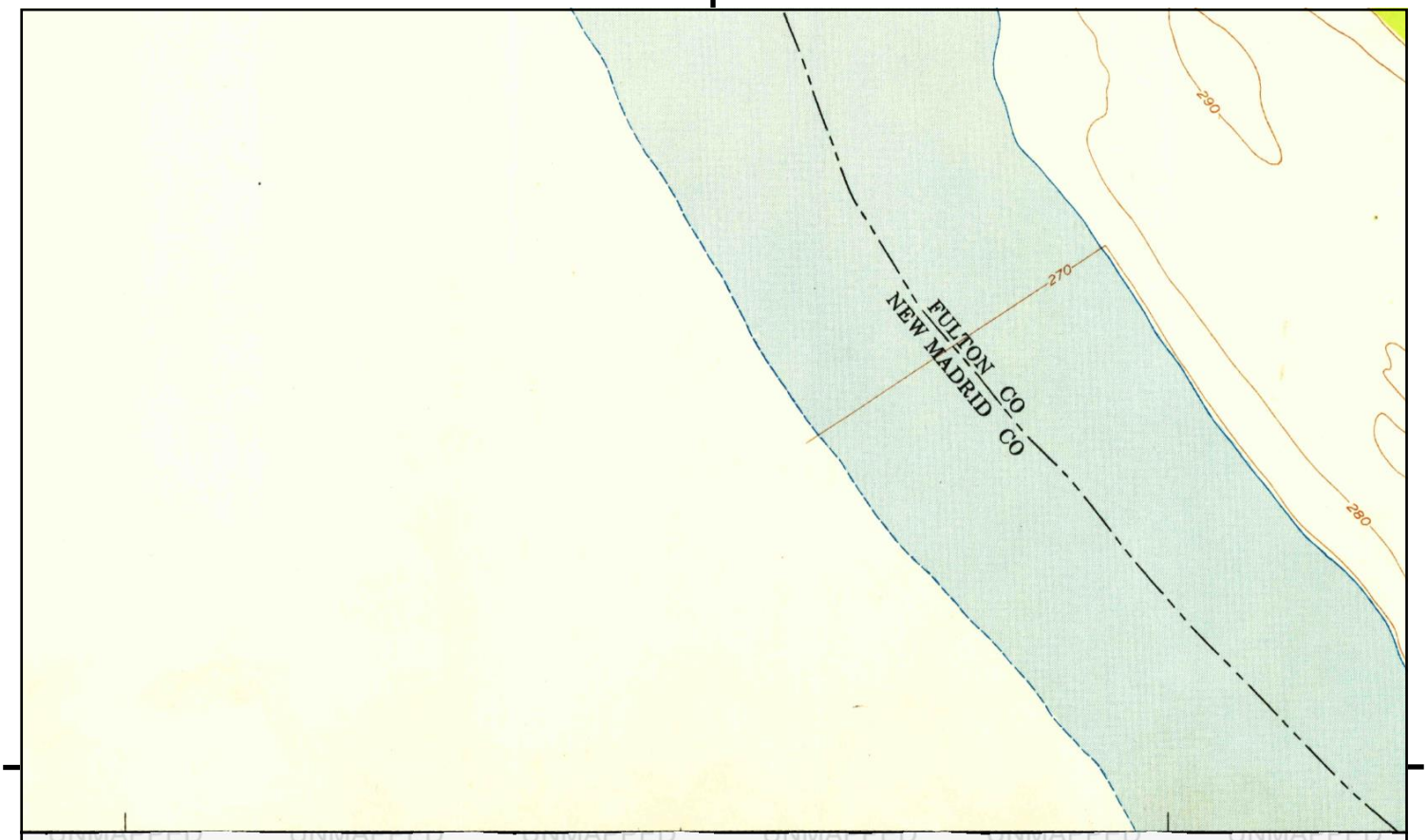
0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

TP, New Madrid, 1954, 15-minute
S, Portageville, 1955, 15-minute

SITE NAME: AECI New Madrid
ADDRESS: 1400-1498 St Jude Rd
Marston, MO 63866
CLIENT: Haley & Aldrich

N



This report includes information from the following map sheet(s).

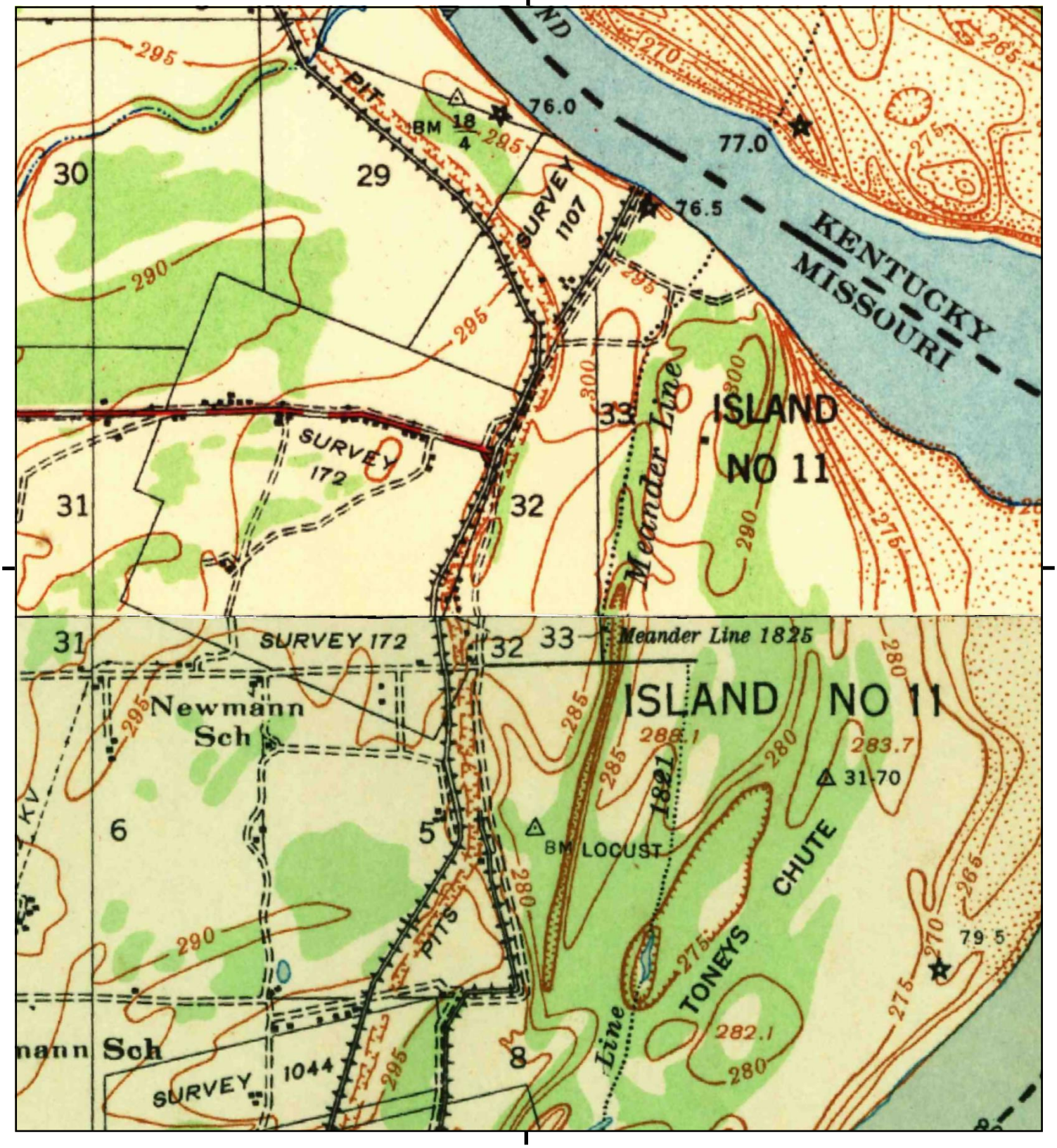
0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

TP, New Madrid SE, 1951, 7.5-minute

SITE NAME: AECI New Madrid
ADDRESS: 1400-1498 St Jude Rd
Marston, MO 63866
CLIENT: Haley & Aldrich

N



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

TP, New Madrid, 1939, 15-minute
S, Portageville, 1939, 15-minute

SITE NAME: AECI New Madrid
ADDRESS: 1400-1498 St Jude Rd
Marston, MO 63866
CLIENT: Haley & Aldrich

N

Historical Topo Map

1931, 1934

This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

TP, NEW MADRID, 1934, 15-minute
S, PORTAGEVILLE, 1931, 15-minute

SITE NAME: AECI New Madrid
ADDRESS: 1400-1498 St Jude Rd
Marston, MO 63866
CLIENT: Haley & Aldrich

N