www.haleyaldrich.com

2020 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
UTILITY WASTE LANDFILL
NEW MADRID POWER PLANT
NEW MADRID, MISSOURI

by Haley & Aldrich, Inc.
Cleveland, Ohio

for Associated Electric Cooperative, Inc.
Springfield, Missouri

File No. 129342-020
February 2021

Table of Contents

Page

List of Tables ii
List of Figures ii
List of Attachments ii

1. Introduction 1

1.1 40 CFR § 257.90(E)(6) SUMMARY 1
1.1.1 40 CFR § 257.90(e)(6)(i) – Initial Monitoring Program 1
1.1.2 40 CFR § 257.90(e)(6)(ii) – Final Monitoring Program 1
1.1.3 40 CFR § 257.90(e)(6)(iii) – Statistically Significant Increases 1
1.1.4 40 CFR § 257.90(e)(6)(iv) – Statistically Significant Levels 2
1.1.5 40 CFR § 257.90(e)(6)(v) – Selection of Remedy 2
1.1.6 40 CFR § 257.90(e)(6)(vi) – Remedial Activities 3

2. 40 CFR § 257.90 Applicability 4

2.1 40 CFR § 257.90(A) 4
2.2 40 CFR § 257.90(E) – SUMMARY 4
2.2.1 Status of the Groundwater Monitoring Program 4
2.2.2 Key Actions Completed 4
2.2.3 Problems Encountered 5
2.2.4 Actions to Resolve Problems 5
2.2.5 Project Key Activities for Upcoming Year 5
2.3 40 CFR § 257.90(E) – INFORMATION 5
2.3.1 40 CFR § 257.90(e)(1) 5
2.3.2 40 CFR § 257.90(e)(2) – Monitoring System Changes 5
2.3.3 40 CFR § 257.90(e)(3) – Summary of Sampling Events 6
2.3.4 40 CFR § 257.90(e)(4) – Monitoring Transition Narrative 6
2.3.5 40 CFR § 257.90(e)(5) – Other Requirements 6
2.4 40 CFR § 257.90(F) 9

Mark Nicholls, PG
Name

Signature

Senior Hydrogeologist
Title

February 1, 2021
Date

HALEY ALDRICH

List of Tables

Table No.	Title
I	Summary of Analytical Results – 2020 Detection Monitoring

List of Figures

Figure No.	Title
1	Utility Waste Landfill Monitoring Well Location Map

List of Attachments

Attachment No.	Title
1	Appendix III SSI Alternate Source Demonstration for the Utility Waste Landfill – February 2020

1. Introduction

This 2020 Annual Groundwater Monitoring and Corrective Action Report (Annual Report) addresses the Utility Waste Landfill (UWL) at the New Madrid Power Plant (NMPP), operated by the 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 UWL 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 January 2020), the UWL was operating under a detection monitoring program in compliance with 40 CFR § 257.94.

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 (31 December 2020), the UWL was operating under a detection monitoring program in compliance with 40 CFR § 257.94.

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

A statistically significant increase (SSI) over background for boron was identified at monitoring well B-2 for the February 2020 semi-annual detection monitoring sampling event.

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 alternative source demonstration (ASD) pursuant to 40 CFR § 257.94(e)(2) was completed in October 2020 for boron at monitoring well B-2. The underlying data supported the conclusion that a source other than the CCR unit was the cause of the SSI over background levels for boron at the monitoring well during the February 2020 semi-annual detection monitoring sampling event. A copy of the ASD is provided as Attachment 1 to this report. An assessment monitoring program was not initiated for the UWL in 2020.

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;

The UWL remains in detection monitoring and no appendix IV constituents were collected or analyzed in 2020. Therefore, no statistically significant levels above the groundwater protection standard were identified for the UWL.

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 in 2020 for this unit. The UWL remained in detection monitoring during 2020.

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 required for the UWL in 2020; 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 initiated in 2020 for this unit. The UWL remained in detection monitoring during 2020.

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 UWL remains in detection 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 were required to be initiated in 2020; therefore, no demonstration or certification is applicable for this unit.

2. 40 CFR § 257.90 Applicability

2.1 40 CFR § 257.90(a)

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) [Suspension of groundwater monitoring requirements] of this section.

AECI has installed and certified a groundwater monitoring system at the NMPP UWL. The UWL is the CCR management unit addressed in this report and 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).

This Annual Report describes monitoring completed and actions taken at the NMPP UWL 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 in the calendar year 2020.

2.2.1 Status of the Groundwater Monitoring Program

Statistical analyses of semi-annual detection monitoring data collected in August 2019 and February 2020 were completed in 2020. Monitoring well B-2 indicated a statistically significant increase (SSI) for boron at the UWL during the February 2020 semi-annual detection monitoring sampling event. A successful ASD was completed in October 2020. The UWL remains in a detection monitoring program.

2.2.2 Key Actions Completed

The 2019 Annual Groundwater Monitoring and Corrective Action Report was completed in January 2020. Statistical analysis was completed in January 2020 on analytical data from the

August 2019 semi-annual detection monitoring sampling event. The statistical analyses indicated no SSIs for appendix III constituents for the August 2019 sampling event. Semi-annual detection monitoring events were completed in February and August 2020. Statistical analysis was completed within 90 days of receipt of verified laboratory data for the February 2020 sampling event. Boron was identified as an SSI at monitoring well B-2 for the sampling event. A successful ASD was completed in October 2020 for boron at monitoring well B-2. Statistical analysis of the results from the August 2020 semi-annual detection monitoring sampling event are due to be completed in January 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, and problems with analytical analysis) were encountered at the NMPP UWL in 2020.

2.2.4 Actions to Resolve Problems

No problems were encountered at the NMPP UWL in 2020; therefore, no actions to resolve problems were required.

2.2.5 Project Key Activities for Upcoming Year

Key activities planned for 2021 include completion of the 2020 Annual Groundwater Monitoring and Corrective Action Report, statistical analysis of detection monitoring analytical data collected in August 2020, and semi-annual detection monitoring and subsequent statistical analyses.

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 UWL 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 October 2017 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 during 2020.

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 § 257.94(b), two independent detection monitoring samples from each background and downgradient monitoring well were collected in 2020. A summary including the sample names, sample dates, field parameters, and analytical data obtained for the groundwater monitoring program for the UWL is presented in Table I 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

Data from the groundwater sampling events for the downgradient wells were compared to the calculated prediction limit (PL) for the appendix III constituents. Once the data is verified, a sample concentration greater than the PL is considered to represent an SSI. The statistical analyses completed in 2020 for the August 2019 and February 2020 semi-annual detection monitoring sampling events indicated an SSI for boron at monitoring well B-2 from the February 2020 sampling event. A successful ASD was completed for boron at monitoring well B-2 in October 2020. No additional SSIs were identified at this unit for appendix III constituents in 2020. The UWL remains in detection monitoring; therefore, there was no transition between monitoring programs in 2020.

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 in calendar year 2020.

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.

An SSI over background levels for boron was identified at monitoring well B-2 during the February 2020 semi-annual detection monitoring sampling event. A successful ASD was completed and certified by a qualified professional engineer in October 2020, within 90 days of the SSI determination in accordance with 40 CFR § 257.94(e)(2), and the UWL continued in the detection monitoring program. The ASD is included as Attachment 1 to this report.

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).

The UWL remains in detection monitoring and 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).

The UWL remains in detection monitoring and no assessment monitoring samples were collected or analyzed in 2020. Consequently, AECI is not required to establish groundwater protection standards for this CCR unit and this criterion is not applicable.

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.

Assessment monitoring statistical analyses were not required or completed in 2020. Therefore, this criterion is not applicable.

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.

Assessment monitoring statistical analyses were not required or completed in 2020. Therefore, this criterion is not applicable to the CCR unit at this time.

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 on 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 on the facility's operating record [§ 257.107(d)].

TABLE

TABLE I
SUMMARY OF ANALYTICAL RESULTS - 2020 DETECTION MONITORING
ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT - UTILITY WASTE LANDFILL
NEW MADRID, MISSOURI

Location	Upgradient						Downgradient			
	B-123		B-126		MW-16		B-2		B-41	
Measure Point (TOC)	292.7		293.63		292.85		291.91		294.58	
Sample Name	B-123	B-123	B-126	B-126	MW-16	MW-16	B-2	B-2	B-41	B-41
Sample Date	02/21/2020	8/10/2020	02/21/2020	8/10/2020	02/21/2020	8/10/2020	02/20/2020	8/4/2020	02/20/2020	8/4/2020
Final Lab Report Date	4/3/2020	9/29/2020	4/3/2020	9/29/2020	4/3/2020	9/29/2020	3/17/2020	9/11/2020	3/17/2020	9/11/2020
Final Lab Report Revision Date	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lab Data Reviewed and Accepted	4/8/2020	10/19/2020	4/8/2020	10/19/2020	4/8/2020	10/19/2020	4/8/2020	10/19/2020	4/8/2020	10/19/2020
Depth to Water (ft btoc)	11.00	12.89	12.68	13.85	10.90	18.58	11.23	11.67	14.12	13.62
Temperature (Deg C)	16.26	17.71	16.56	18.75	16.95	18.46	15.96	17.25	16.16	17.34
Conductivity, Field (µS/cm)	616	675	417	575	804	872	672	677	373	275
Turbidity, Field (NTU)	90.7	10.0	98.7	34.6	0	0.0	9	0.0	9	0.0
Boron, Total (mg/L)	**0.029**	**0.059**	**0.031**	**0.058**	**0.064**	**0.13**	**0.092**	**0.062**	**0.019**	**0.016**
Calcium, Total (mg/L)	**62**	**75**	**62**	**74**	**120**	**120**	**110**	**94**	**49**	**32**
Chloride (mg/L)	**3.1**	**3.1**	**3.9**	**11**	**13**	**14**	**4.2**	**3.9**	**4.0**	**3.5**
Fluoride (mg/L)	**0.457**	**0.415**	**0.376**	**0.329**	**1.68**	**1.58**	**0.308**	**0.290**	< 0.250	< 0.250
Sulfate (mg/L)	**28**	**29**	**27**	**46**	**56**	**74**	**110**	**110**	**21**	**11**
pH (lab) (su)	**7.43**	**7.51**	**7.07**	**7.27**	**7.08**	**7.18**	**7.05**	**6.99**	**7.28**	**6.90**
TDS (mg/L)	**270**	**380**	**230**	**370**	**510**	**490**	**380**	**390**	**180**	**170**

Notes:

Bold value: *Detection above laboratory reporting limit.*
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
TDS = total dissolved solids
TOC = top of casing

TABLE I
SUMMARY OF ANALYTICAL RESULTS - 2020 DETECTION MONITORING
ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT - UTILITY WASTE LANDFILL
NEW MADRID, MISSOURI

Location	Downgradient									
	B-5R			MW-1		MW-2			MW-3	
Measure Point (TOC)	288.69			298.08		297.69			292.98	
Sample Name	B-5R	B-5R	B-5R	MW-1	MW-1	MW-2	DUPLICATE	MW-2	MW-3	MW-3
Sample Date	02/20/2020	8/4/2020	8/4/2020	02/20/2020	8/5/2020	02/20/2020	02/20/2020	8/4/2020	02/21/2020	8/5/2020
Final Lab Report Date	3/17/2020	9/11/2020	9/11/2020	3/17/2020	9/11/2020	3/17/2020	3/17/2020	9/11/2020	3/17/2020	9/11/2020
Final Lab Report Revision Date	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lab Data Reviewed and Accepted	4/8/2020	10/19/2020	10/19/2020	4/8/2020	10/19/2020	4/8/2020	4/8/2020	10/19/2020	4/8/2020	10/19/2020
Depth to Water (ft btoc)	10.82	11.50	-	17.85	18.03	17.50	**-**	18.04	16.50	16.72
Temperature (Deg C)	17.42	17.98	-	16.16	17.37	16.79	-	17.59	15.96	16.89
Conductivity, Field (µS/cm)	262	263	-	309	443	345	-	437	474	503
Turbidity, Field (NTU)	0	0.0	-	9	3.6	0	-	0.0	0	10.0
Boron, Total (mg/L)	**0.023**	**0.018**	**0.019**	**0.023**	**0.022**	**0.028**	**0.029**	**0.032**	**0.026**	**0.027**
Calcium, Total (mg/L)	**23**	**22**	**22**	**42**	**55**	**40**	**40**	**48**	**65**	**66**
Chloride (mg/L)	**7.3**	**6.3**	**6.3**	**7.4**	**8.0**	**6.7**	**6.6**	**6.3**	**5.5**	**5.1**
Fluoride (mg/L)	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	**0.260**	**0.256**	< 0.250	**0.306**	**0.287**
Sulfate (mg/L)	**17**	**14**	**15**	**22**	**37**	**22**	**22**	**38**	**26**	**24**
pH (lab) (su)	**6.51**	**6.64**	**6.54**	**6.95**	**6.89**	**6.78**	**6.77**	**6.79**	**6.90**	**6.93**
TDS (mg/L)	**130**	**130**	**140**	**130**	**250**	**170**	**180**	**210**	**220**	**270**

TABLE I
SUMMARY OF ANALYTICAL RESULTS - 2020 DETECTION MONITORING
ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT - UTILITY WASTE LANDFILL
NEW MADRID, MISSOURI

Location	Downgradient			
	MW-4		MW-5	
Measure Point (TOC)	293.94		296.63	
Sample Name	MW-4	MW-4	MW-5	MW-5
Sample Date	02/21/2020	8/5/2020	02/21/2020	8/5/2020
Final Lab Report Date	3/17/2020	9/11/2020	3/17/2020	9/11/2020
Final Lab Report Revision Date	N/A	N/A	N/A	N/A
Lab Data Reviewed and Accepted	4/8/2020	10/19/2020	4/8/2020	10/19/2020
Depth to Water (ft btoc)	16.83	17.30	16.33	16.75
Temperature (Deg C)	15.59	16.96	16.3	17.31
Conductivity, Field (µS/cm)	563	530	453	481
Turbidity, Field (NTU)	69.4	5.6	0	0.0
Boron, Total (mg/L)	**0.020**	**0.020**	**0.022**	**0.020**
Calcium, Total (mg/L)	**59**	**57**	**67**	**65**
Chloride (mg/L)	**5.2**	**4.9**	**12**	**11**
Fluoride (mg/L)	**0.407**	**0.382**	**0.255**	**0.258**
Sulfate (mg/L)	< 1.0	**4.4**	**23**	**21**
pH (lab) (su)	**6.88**	**7.03**	**7.07**	**7.25**
TDS (mg/L)	**190**	**250**	**280**	**250**

FIGURE

GIS FILE PATH: G:\Projects\AECI\New Madrid\GIS\MXDs\2020_12\ANNUAL_REPORT\129342_020_0001_UWL_WELL_LOCATION_MAP.mxd — USER: khensen — LAST SAVED: 12/24/2020 12:26:18 PM

LEGEND

MONITORING WELL

UTILITY WASTE LANDFILL (UWL)

NOTES

1. ALL DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

4. AERIAL IMAGERY SOURCE: ESRI, 21 APRIL 2019

N

0 1,200 2,400

SCALE IN FEET

HALEY ALDRICH

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

UTILITY WASTE LANDFILL
MONITORING WELL LOCATION MAP

aeci Associated Electric Cooperative, Inc.

FEBRUARY 2021

FIGURE 1

ATTACHMENT 1

Appendix III SSI Alternate Source Demonstration for the Utility Waste Landfill – February 2020

HALEY ALDRICH

www.haleyaldrich.com

SUMMARY REPORT
APPENDIX III SSI
ALTERNATE SOURCE DEMONSTRATION
FOR THE UTILITY WASTE LANDFILL
NEW MADRID POWER PLANT
NEW MADRID, MISSOURI

By Haley & Aldrich, Inc.
Cleveland, Ohio

For Associated Electric Cooperative, Inc.
Springfield, Missouri

File No. 129342-016
October 2020

Table of Contents

STATE OF MISSOURI
STEVEN F.
PUTRICH
NUMBER
PE-2014
10/12/20
PROFESSIONAL ENGINEER

STATE OF MISSOURI
MARK D NICHOLS
RG
2015014902
10/12/20
REGISTERED GEOLOGIST

		Page
List of Tables		**ii**
List of Figures		**ii**
1.	**Introduction**	**1**
1.1	BACKGROUND	1
1.2	SITE SETTING	1
1.3	SITE DESCRIPTION	2
2.	**Site Geology and Hydrogeology**	**3**
2.1	SITE GEOLOGY	3
2.2	SITE HYDROGEOLOGY AND HYDROLOGY	3
2.2.1	Mississippi River Stage Effect on Groundwater Flow	4
2.3	BORON GEOCHEMISTRY	4
3.	**Alternative Source Demonstration**	**5**
3.1	REVIEW OF SAMPLING, ANALYSIS, AND STATISTICAL PROCEDURES	5
3.1.1	Field Sampling Procedures	5
3.1.2	Laboratory Quality Control	5
3.1.3	Analytical Data	5
3.1.4	Statistical Evaluation	6
3.2	POTENTIAL POINT AND NON-POINT SOURCES	6
3.2.1	Point Sources	6
3.2.2	Non-Point Sources	6
3.3	HISTORICAL LAND USE REVIEW	7
3.3.1	Historical Aerial Photographs	7
3.3.2	Historical Topographic Maps	8
3.4	LOCAL AND REGIONAL WATER QUALITY OBSERVATIONS	8
3.4.1	Boron Values in Regional Groundwater	8
3.4.2	Site pH Conditions	8
4.	**Findings and Conclusions**	**9**
5.	**Closing**	**11**
6.	**References**	**12**

Tables
Figures
Appendix A – EDR Historical Aerial Photograph Report
Appendix B – EDR Topographic Map Research Results

HALEY ALDRICH

List of Tables

Table No.	Title
I	Summary of Well B-2 Boron Analytical Results

List of Figures

Figure No.	Title
1	Utility Waste Landfill Monitoring Well Location Map
2A	Utility Waste Landfill Groundwater Contour Map, February 2020
2B	Utility Waste Landfill Groundwater Contour Map, August 2020
3	Temporal Record Comparing (A) Boron Concentrations (µg/L) and (B) Well B-2 Hydrograph
4	Mississippi River Stage Height Versus Boron Concentrations (µg/L)
5	Aqueous Geochemistry or Boron Showing (A) Site Specific Boron Eh-pH Diagram and (B) Boron Stability Phase Diagram
6	pH Dependence on Boron Concentrations (µg/L)

1. Introduction

Haley & Aldrich, Inc. (Haley & Aldrich) was retained by Associated Electric Cooperative Inc. (AECI) to perform an evaluation of groundwater quality at the Utility Waste Landfill (UWL) combustion coal residual (CCR) management unit at the New Madrid Power Plant (NMPP) located in New Madrid, Missouri. The purpose of the evaluation is to identify the source of elevated boron concentrations detected in a groundwater sample collected from monitoring well B-2 located down gradient of the UWL.

1.1 BACKGROUND

Consistent with Code of Federal Regulations (CFR) Title 40 § 257.90 through § 257.94 (CCR Rule, or Rule), AECI has installed and certified a groundwater monitoring network for the UWL at the NMPP and collected 10 rounds of groundwater samples for the analysis of Appendix III and Appendix IV baseline constituents, and 6 rounds of Appendix III detection monitoring samples. In July 2020, AECI conducted statistical analyses of the groundwater quality results collected in February 2020, with data reviewed and accepted in April 2020, to determine if any of the Appendix III constituents were present in groundwater samples collected from down-gradient monitoring wells at concentrations at a statistically significant increase (SSI) above background. The statistical evaluation of the Appendix III constituents detected a potential SSI for boron above background at monitoring well B-2, down gradient of the UWL. The analyses described in this report were conducted to identify the source of the elevated boron concentration at monitoring well B-2.

Pursuant to 40 CFR § 257.94(e)(2), ***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 a SSI over background exists to complete an Alternate Source Demonstration (ASD) for Appendix III constituents. If a successful demonstration is completed and certified by a qualified professional engineer, the CCR unit may continue in detection monitoring. If, however, an alternate source of the Appendix III SSI is not identified, the owner or operator must initiate an assessment monitoring program within 90 days following the ASD period. This report documents the findings and conclusions of an ASD completed for boron at the UWL 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 with extensive agricultural use. The UWL is a CCR landfill that encompasses approximately 50 acres and is located approximately 1.7 miles southwest of the NMPP site. The UWL has ground surface elevations varying from 290 to 320 feet above mean sea level. The UWL and associated groundwater monitoring network are shown on Figure 1.

1.3 SITE DESCRIPTION

NMPP is an active energy production facility that generates electricity through coal combustion. The CCR generated are byproducts of the combustion process and include fly ash and boiler slag material.

The UWL was constructed with a liner system that is consistent with the Missouri Department of Natural Resources permit and includes a 2-foot thick layer of clay with a hydraulic conductivity of $1x10^{-5}$ centimeters per second. The clay layer is overlain by a 60-mil high-density polyethylene (HDPE) geomembrane layer. The liner system includes a leachate collection system consisting of a geo-composite drainage layer, perforated HDPE leachate collection pipes wrapped with a filter sock and embedded in granular sand drainage material with a geotextile layer over the leachate pipe trenches to provide separation between the granular sand drainage material and the overlying protective soil layer (Haley & Aldrich, 2017). The leachate collection system discharges to the leachate collection pond, located approximately 0.35 mile to the east of the UWL.

2. Site Geology and Hydrogeology

Geologic and hydrogeologic conditions beneath the UWL have been characterized based on information from published sources, information obtained during installation and testing of the monitoring wells installed around the UWL in 2004, and monitoring wells installed as part of the CCR groundwater monitoring network.

2.1 SITE GEOLOGY

The UWL (Figure 1) is 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 UWL are underlain by an unconsolidated alluvium which constitutes a regionally extensive aquifer.

In order from ground surface downward, the UWL 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 aquifer and represent the regional aquifer system.

Surficial geologic materials in the vicinity of and beneath the UWL 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 in the vicinity of the UWL (Gredell Engineering Resources Inc. [Gredell], 2003). Alluvial sediments were predominantly deposited by the Mississippi and Ohio river systems. The alluvium yields water to shallow wells, 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 UWL. 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 nearest the natural ground surface at the UWL 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 a domestic water supply. Known existing water wells are located upgradient of the UWL, and no water wells are located down gradient of the UWL. Water levels in the uppermost aquifer are influenced by the Mississippi River stage.

Based on groundwater elevations measured between November 2016 and August 2017, the groundwater gradient in the upper aquifer unit is approximately 0.0005 to 0.006 and is unconfined. The groundwater flow direction is primarily to the northeast but at times flows to the east. The UWL is located approximately 1.75 miles from the Mississippi River. Seasonal changes in river stage cause the groundwater flow direction to change periodically indicating that the river is in hydraulic communication with the local groundwater system.

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 53 to 101 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 groundwater. The clay and lignite present within the Wilcox Formation represent lower hydraulic conductivity than the overlying alluvial aquifer. Published hydraulic conductivity values for the Wilcox Formation indicate the hydraulic conductivity ranges from 9 to 25 feet per day (Office of Nuclear Waste Isolation, 1982 and Prudic, 1991).

2.2.1 Mississippi River Stage Effect on Groundwater Flow

Localized groundwater flow in the shallow aquifer near the UWL is affected by the Mississippi River stage and correlates strongly with the variability of boron concentrations in groundwater. This hydraulic relationship and the resulting water quality effect is demonstrated by the following:

- The change in groundwater flow direction in response to base-flow and high-flow conditions (Figure 2A and 2B);
- The correlation between boron concentrations and the water-level hydrograph in monitoring well B-2 (Figure 3); and
- The positive correlation between boron concentrations in monitoring well B-2 and the Mississippi River stage (Figure 4).

2.3 BORON GEOCHEMISTRY

In natural waters, boron exists primarily as undissociated boric acid with some borate ions. Mance et al. (1988) described boron as a significant constituent of seawater, with an average boron concentration of 4,500 micrograms per kilogram. The natural borate content of groundwater and surface water is usually small and is a result of leaching from rocks and soils containing borates and borosilicates. Naturally occurring concentrations of boron in groundwater throughout the world range widely from <0.3 to > 100 milligrams per liter (mg/L; Kochkodan et al., 2015).

The mobility of boron in surface and groundwater is pH dependent due to boron adsorption and precipitation kinetics. The aqueous geochemistry and site-specific mobility of boron was evaluated by comparing measure pH values in a phase diagram and speciation diagram in Figure 5. At low pH conditions (<7.5 standard unit [s.u.]), boron is anticipated to be in the form of boric acid (($B(OH)_3$). Boric acid is a very weak Lewis acid and does not dissociate in aqueous solutions. At higher pH conditions (>8 s.u.), boric acid converts to the borate ion $B(OH)_4^-$. This geochemical transition between boron forms is controlled by the natural variability and seasonal fluctuation in pH and appears to control the mobility and high degree of variability of boron concentrations observed in monitoring well B-2.

3. Alternative 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 SSI of boron down gradient of the UWL. Haley & Aldrich also evaluated potential point and non-point sources of contamination in the vicinity of the UWL and evaluated natural geologic conditions and the effect of those conditions on native groundwater chemistry. 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 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 UWL. 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 SSI for boron down gradient of the UWL.

3.1.2 Laboratory Quality Control

The groundwater samples collected down gradient of the UWL were initially analyzed using standard analytical 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 UWL and has not identified apparent errors that would result in a potential SSI for boron down gradient of the UWL.

3.1.3 Analytical Data

Eighteen groundwater samples, including one duplicate, have been collected at B-2 since November 2016. Boron concentrations at B-2 have fluctuated over time, with concentrations ranging from 0.0405 milligrams per liter (mg/L) to 0.14 mg/L. The boron concentration of 0.14 mg/L was detected in September 2018, but the result was identified as an outlier during statistical analyses. A summary of field parameters and boron results are provided in Table I.

During the February 2020 sampling event, the boron concentration at monitoring well B-2 was detected at 0.092 mg/L, which was above the upper prediction limit (UPL) of 0.078 mg/L for the UWL; therefore, a potential SSI was recorded. Subsequent groundwater sampling completed at well B-2 in August 2020 produced a boron concentration of 0.062 mg/L, which is below the boron UPL. A graphical depiction of boron values over time at monitoring well B-2 are presented in Figure 3.

3.1.4 Statistical Evaluation

AECI collected a total of 16 groundwater samples from each of the up-gradient (MW-16, B-123, and B-126) and down-gradient (MW-1, MW-2, MW-3, MW-4, MW-5, B-2, B-5R, and B-41) monitoring wells at the UWL over a period spanning from November 2016 through February 2020 for CCR Rule compliance. Statistical analysis of the analytical results was completed in accordance with the CCR Rule.

Haley & Aldrich has reviewed the statistical analysis of groundwater quality data for the up-gradient and down-gradient wells at the UWL and has not identified apparent errors that would result in a potential SSI for boron down gradient of the UWL. The statistical test method used met the performance standard established in the CCR Rule, and the statistical evaluation complies with the requirements of the Rule.

3.2 POTENTIAL POINT AND NON-POINT SOURCES

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

3.2.1 Point Sources

Prior to construction of the UWL, the landfill 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 the UWL. No known industrial, mining, or other activities were conducted at the UWL site prior to construction of the landfill that would potentially constitute a point source to concentrate boron in groundwater in the vicinity of the observed SSI.

3.2.2 Non-Point Sources

Agricultural activities have been identified in the vicinity of the UWL that might constitute a non-point source of boron at the location of the observed SSI. Boron is an essential element in plants and is commonly present in relatively high concentrations in nitrogen (N) and boron fertilizers. Xie et al. (2011) found a slow release N-based fertilizer contains 0.65 percent (6,500 milligrams per kilogram) boron. Since monitoring well B-2 is located in a low-lying area within a historic agricultural field that often floods during high flow conditions, the potential for boron leaching from historic land application of fertilizers is present.

3.3 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, 1952, 1969, 1988, 1992, 1996, 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.

3.3.1 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 Department of Agriculture, United States Geological Survey (USGS), Digital Orthophoto Quarter Quads, National Aerial Photography Program, and the National Agriculture Information Program and are included in Appendix A.

Photographs suggest that the site was undeveloped up until at least 1996. Aerial photographs from 2006 through 2016 show the growth of the landfill to its current footprint.

Historical Aerial Photograph Review Summary

Dates	Description of Site and Adjacent Properties	Sources
1950 – 1996	Agricultural use of site and adjacent properties with some road use.	Aerial photos – DOQQ, NAPP, USGS
2006	Potential development at the site. Abundant grading and potential development across the site. Agricultural use of site and adjacent properties surrounding the site.	Aerial photos – USDA, NAIP
2009 – 2016	The UWL is active. Expansion of the unit to the south. Agricultural use of site and adjacent properties surrounding the UWL.	Aerial photos – USDA, NAIP

Notes:

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
UWL = Utility Waste Landfill

3.3.2 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
1934 – 1954	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 – 2015	The map shows no development at the UWL site. The plant site and adjacent industrial facility are shown on the map.	7.5-Minute Series, New Madrid, Missouri Quadrangle
Notes: *UWL = Utility Waste Landfill*		

3.4 LOCAL AND REGIONAL WATER QUALITY OBSERVATIONS

3.4.1 Boron Values in Regional Groundwater

The NMPP site is located in the southeast Missouri groundwater province, which includes aquifers composed of Missouri and Mississippi river alluvium and deeper groundwater aquifers (Brookshire, 1997). Elevated boron concentrations are observed regionally in two deeper wells lactated near the site. Dissolved boron concentrations in these wells were 270 micrograms per liter (µg/L) and 140 µg/L, which are greater than the maximum boron concentrations observed in monitoring well B-2. The presence of alternative sources of boron in the region are apparent.

3.4.2 Site pH Conditions

As discussed in Section 2.3, there is a strong correlation between pH and the mobility of boron in groundwater underlying the Site (Figure 6). This section discusses the observed variability in pH conditions in the Mississippi River and groundwater.

The Mississippi River has a distinct hydraulic relationship with the uppermost aquifer. When the river is at high stage, it locally recharges the uppermost aquifer. Consequently, groundwater quality in the uppermost aquifer is partly influenced by the water quality of the Mississippi River. Analysis of Mississippi River water quality, up-stream from NMPP near Cape Girardeau, indicate that the pH range of the river ranges between 7.8 and 8.5 (USGS, 2018). Groundwater in the uppermost aquifer near the Mississippi River has a pH of 7.5 or higher. The pH values reported for the Lower Mississippi River tributaries in Missouri near New Madrid County are generally above 7.5 (Brookshire, 1997), consistent with the pH range observed in Mississippi River water.

The pH values observed at UWL monitoring well B-2 ranged from 6.23 to 8.43 and are similar to the range of values observed in the Mississippi River. The natural seasonal variability in pH conditions created by the influence of the Mississippi River creates geochemical conditions conducive to the seasonal mobility of boron, and correlate strongly to the high natural variability in boron concentrations observed at well B-2. This conclusion is further reinforced by the fact that no actions have been taken to reduce the boron concentration at monitoring well B-2, but the boron concentration has declined below the UPL under natural conditions alone.

4. Findings and Conclusions

Haley & Aldrich conducted an evaluation of groundwater quality at the NMPP UWL to identify the source of the SSI of boron values detected in one monitoring well (B-2) located down gradient of the UWL. 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 SSI of boron down gradient of the UWL. Haley & Aldrich also evaluated potential point and non-point sources of contamination in the vicinity of the UWL and evaluated natural geologic conditions and the effect of those conditions on native groundwater chemistry.

Haley & Aldrich found no apparent errors in sampling, laboratory analysis, data management, or statistical analysis that would result in a potential SSI for pH down gradient of the UWL. Haley & Aldrich found no apparent evidence of historical point sources of potential boron values in the vicinity of the UWL.

Haley & Aldrich evaluated data and information describing the surface water quality of the Mississippi River and regional water quality of the shallow alluvial groundwater aquifer. The evaluation also included a review of data describing the natural variability of boron values in the uppermost aquifer beneath the UWL. Key findings regarding the regional groundwater boron variability and natural groundwater quality variability due to the Mississippi River are summarized below:

- The UWL is constructed with a composite liner, consisting of a low permeable clay, HDPE geomembrane layer, leachate collection system, geotextile layer, and natural soil cover. This construction reduces the likelihood of seepage of leachate from the UWL into the uppermost aquifer.
- The shallow aquifer beneath the UWL is part of the Mississippi River alluvium and is in direct communication with the Mississippi River which has a higher pH than groundwater in the uppermost aquifer.
- Agricultural nitrogen-based fertilizers are a potential alternative source for boron in groundwater due to the proximity to active and former agricultural fields.
- The Mississippi River stage correlates closely to the boron concentration observed in groundwater at monitoring well B-2.
- The pH values observed in monitoring well B-2 are highly variable within the range of background groundwater (6.2 and 7.5) and the pH values of Mississippi River water (between 7.5 and 8.5). The seasonal fluctuation of the Mississippi River stage has the potential to affect groundwater pH and the resulting mobility of naturally occurring boron contained in sediments.
- The concentration of boron observed at well B-2 has naturally declined below the UPL following the observed SSI, demonstrating that the observed fluctuation in boron concentrations in groundwater is the result of natural variability.

Based on these findings, it is evident that the boron concentrations observed at monitoring well B-2 are influenced as a result of natural variability arising from pH changes influenced by the changing stage of the Mississippi River.

Based on the data, information, research, and analyses conducted to date and presented in this document, Haley & Aldrich concludes that the source of boron resulting in a SSI at monitoring well B-2, down gradient of the UWL, is the natural variation in groundwater quality at the site and is not associated with the subject UWL.

5. Closing

Pursuant to 40 CFR § 257.94(e)(2), AECI conducted an alternate source evaluation to demonstrate that a source other than the UWL caused the SSI over background identified during detection monitoring. This demonstration and the underlying data support the conclusion that a source other than the CCR unit is the cause of the SSI over background levels for Appendix III constituents detected during detection monitoring of this unit.

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

HALEY & ALDRICH, INC.

Steven F. Putrich, P.E.
Project Principal

Mark Nicholls, P.G.
Lead Hydrogeologist

6. References

1. Brookshire C.N., 1997. Missouri Water Quality Assessment, Missouri State Water Plan Series Volume III, Water Resources Report Number 47. Missouri Department of Natural Resources.

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

3. Environmental Data Resources, Inc., 2020. Database Report, August 2020.

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

5. Haley & Aldrich, Inc., 2017. Report on Phase III (Cell 2) Utility Waste Landfill Authorization to Operate Application, New Madrid Power Plant. September 2017.

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

7. Haley & Aldrich, Inc., 2019b. Groundwater Sampling and Analysis Plan Revision 1, New Madrid Power Plant. December 2019.

8. Kochkodan, V., Darwish, N.B., and Hilal, N., 2015. The Chemistry of Boron in Water. Centre for Water Advanced Technologies and Environmental Research (CWATER), College of Engineering, Swansea University, SA2 8PP, UK. January.

9. Mance, G., O'Donnell, A.R., and Smith, P.R., 1988. Proposed environmental quality standards for List II substances in water: Boron. Medmenham, Water Research Centre (Report TR 256, March 1988; ISBN 0-902-15663-2).

10. 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.

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

12. 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.

13. USGS, 2018. pH Data at the USGS Station – 07020850 Mississippi River at Cape Girardeau, MO. Accessed on 13 March 2018.

14. Xie, L., Liu, M, Ni, B. Zhang, X. and Wang, Y., 2011. *Slow-release nitrogen and boron fertilizer from a functional superabsorbent formulation based on wheat straw and attapulgite.* Chemical Engineering Journal, Volume 167, Issue 1, Pages 342-348. 15 February.

TABLE

TABLE I

SUMMARY OF Well B-2 BORON ANALYTICAL RESULTS

ASSOCIATED ELECTRIC COOPERATIVE, INC.

NEW MADRID POWER PLANT - UTILITY WASTE LANDFILL

NEW MADRID, MISSOURI

Sample ID	Sample Date	Depth to Water (ft btoc)	Groundwater Elevation (ft amsl)	Field Paramters				Boron, Total (mg/L)
				Temperature (Deg C)	Conductivity (µS/cm)	Turbidity (NTU)	pH (su)	
B-2-11062016	11/6/2016	20.1	271.81	17.09	468	1.72	6.66	0.0405
B-2-121216	12/12/2016	20.89	271.02	14.7	568.1	1.27	6.79	0.0276
B-2-010817	1/8/2017	21.52	270.39	12.6	591	1.42	6.61	0.052
B-2-012517	1/25/2017	21.69	270.22	16.4	630	2.03	6.67	0.060
B-2-022417	2/24/2017	21.58	270.33	16.6	600	2.85	6.67	0.052
B-2-032917	3/29/2017	21.49	270.42	16.8	768	4.43	6.71	**0.087**
B-2-042517	4/25/2017	20.97	270.94	17.5	610	6.93	6.8	0.038
B-2-051617	5/16/2017	20.34	271.57	18.5	691	4.44	6.8	0.071
B-2-062417	6/24/2017	18.34	273.57	17.2	649	2.04	6.8	0.047
B-2-082817	8/28/2017	19.5	272.41	18.68	583	9.4	7.04	0.037
B-2	3/14/2018	22.02	269.89	16.39	716	13.6	6.98	0.076
B-2	7/25/2018	--	--	--	--	--	--	0.039
B-2	9/12/2018	19.35	272.56	16.38	618	3.4	6.66	**0.14***
B-2	3/12/2019	14.2	277.71	15.80	657	21.0	6.74	0.057
DUPLICATE LANDFILL APP3	3/12/2019	--	--	--	--	--	--	0.049
B-2	8/28/2019	10.8	281.11	16.98	659	47.5	7.58	0.057
B-2	2/20/2020	11.23	280.68	15.96	672	9.8	8.43	**0.092**
B-2	8/4/2020	11.67	280.24	17.25	677	0.0	7.12	0.062

Notes:

BOLD value: *Detection above Upper Prediction Limit (UPL) of 0.078 mg/L*

** Boron concentration was determined to be an outlier during statistical analysis*

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

UTILITY WASTE LANDFILL (UWL) BOUNDARY

N

0 1,250 2,500
SCALE IN FEET

NOTE
1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. AERIAL IMAGERY SOURCE: ESRI, 19 MAY 2016.

HALEY ALDRICH

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

UTILITY WASTE LANDFILL
MONITORING WELL
LOCATION MAP

aeci

OCTOBER 2020
SCALE: AS SHOWN

FIGURE 1

GIS FILE PATH: G:\Projects\AECI\New Madrid\GIS\MXDs\2019_12\Figure 1_UWL LOCATION MAP_REV1.mxd — USER: DZinsmaster — LAST SAVED: 12/13/2019 9:59:15 AM

LEGEND

- MONITORING WELL
- B-2 280.24 — MONITORING WELL ID AND GROUNDWATER ELEVATION (FEET)
- GROUNDWATER ELEVATION CONTOUR (0.5-FT INTERVAL)
- GROUNDWATER FLOW DIRECTION
- UTILITY WASTE LANDFILL (UWL)

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. WATER LEVELS MEASURED FEBRUARY 18, 2020.
3. AERIAL IMAGERY SOURCE: ESRI, OCTOBER 29, 2018.

N

0 500 1,000
SCALE IN FEET

HALEY ALDRICH

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

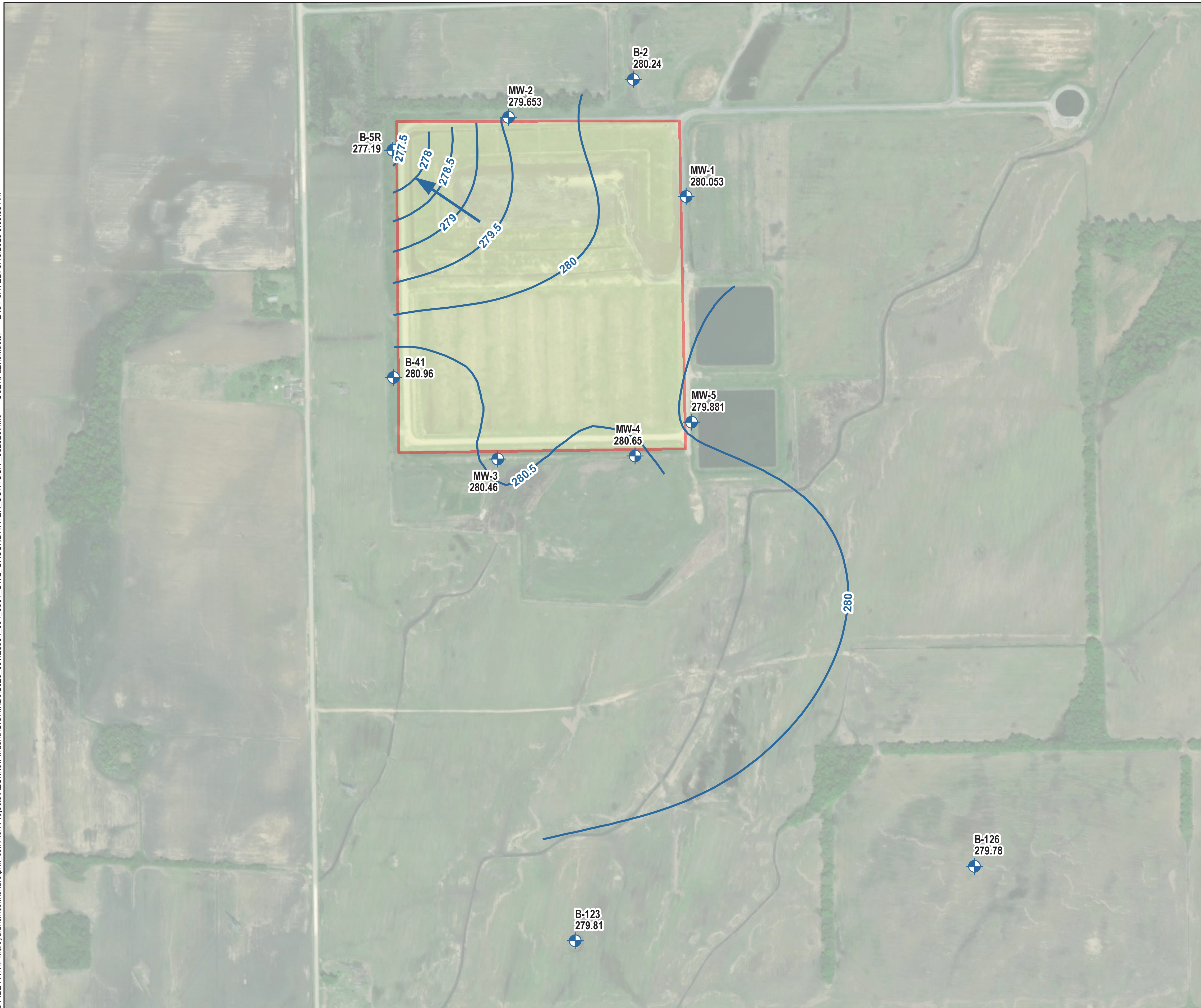
UTILITY WASTE LANDFILL
GROUNDWATER CONTOUR
MAP, FEBRUARY 2020

aeci

OCTOBER 2020

FIGURE 2A

GIS FILE PATH: \\haleyaldrich.com\share\phx_common\Projects\AECI\New Madrid\GIS\MXDs\GW CONTOUR MAPS\UWL_02_2020_GW_CONTOURS.mxd — USER: dzinsmaster — LAST SAVED: 9/16/2020 8:57:28 AM



LEGEND

MONITORING WELL

B-2 280.24 MONITORING WELL ID AND GROUNDWATER ELEVATION (FEET)

GROUNDWATER ELEVATION CONTOUR (0.5-FT INTERVAL)

GROUNDWATER FLOW

UTILITY WASTE LANDFILL

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. WATER ELEVATIONS MEASURED AUGUST 4, 2020.
3. AERIAL IMAGERY SOURCE: ESRI, APRIL 21, 2019

N

0 500 1,000

SCALE IN FEET

HALEY ALDRICH

ASSOCIATED ELECTRIC COPPERATIVE, INC.
NEW MADRID POWER GENERATING FACILITY
MARSTON, MISSOURI

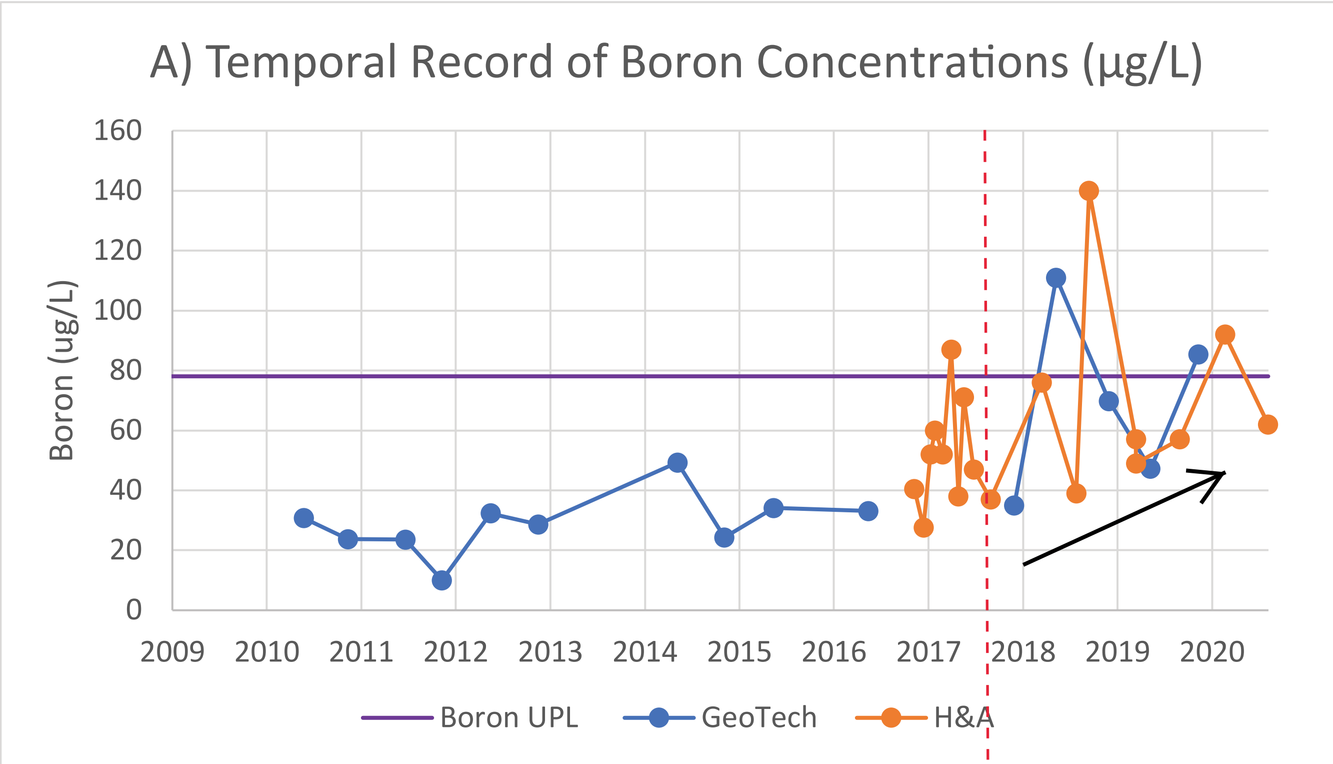
UTILITY WASTE LANDFILL
GROUNDWATER CONTOUR
MAP, AUGUST 2020

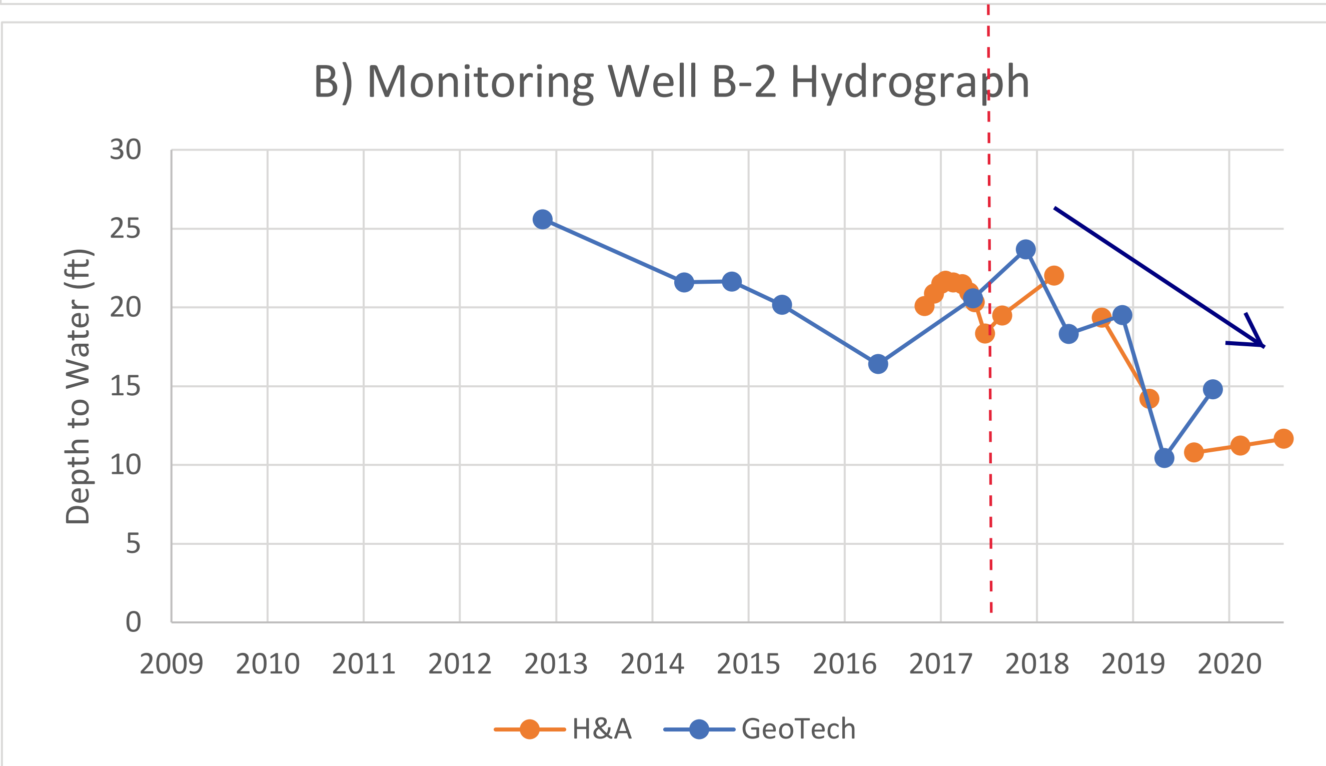
aeci

OCTOBER 2020

FIGURE 2B

GIS FILE PATH: \\haleyaldrich.com\share\phx_common\Projects\AECI\New Madrid\GIS\MXDs\2020_09\128064_001_0001_UWL_GROUNDWATER_CONTOUR _082020.mxd — USER: dzinsmaster — LAST SAVED: 9/16/2020 9:09:05 AM





\\haleyaldrich.com\share\phx_common\Projects\AEC\New Madrid\GIS\MXDs\2020_09

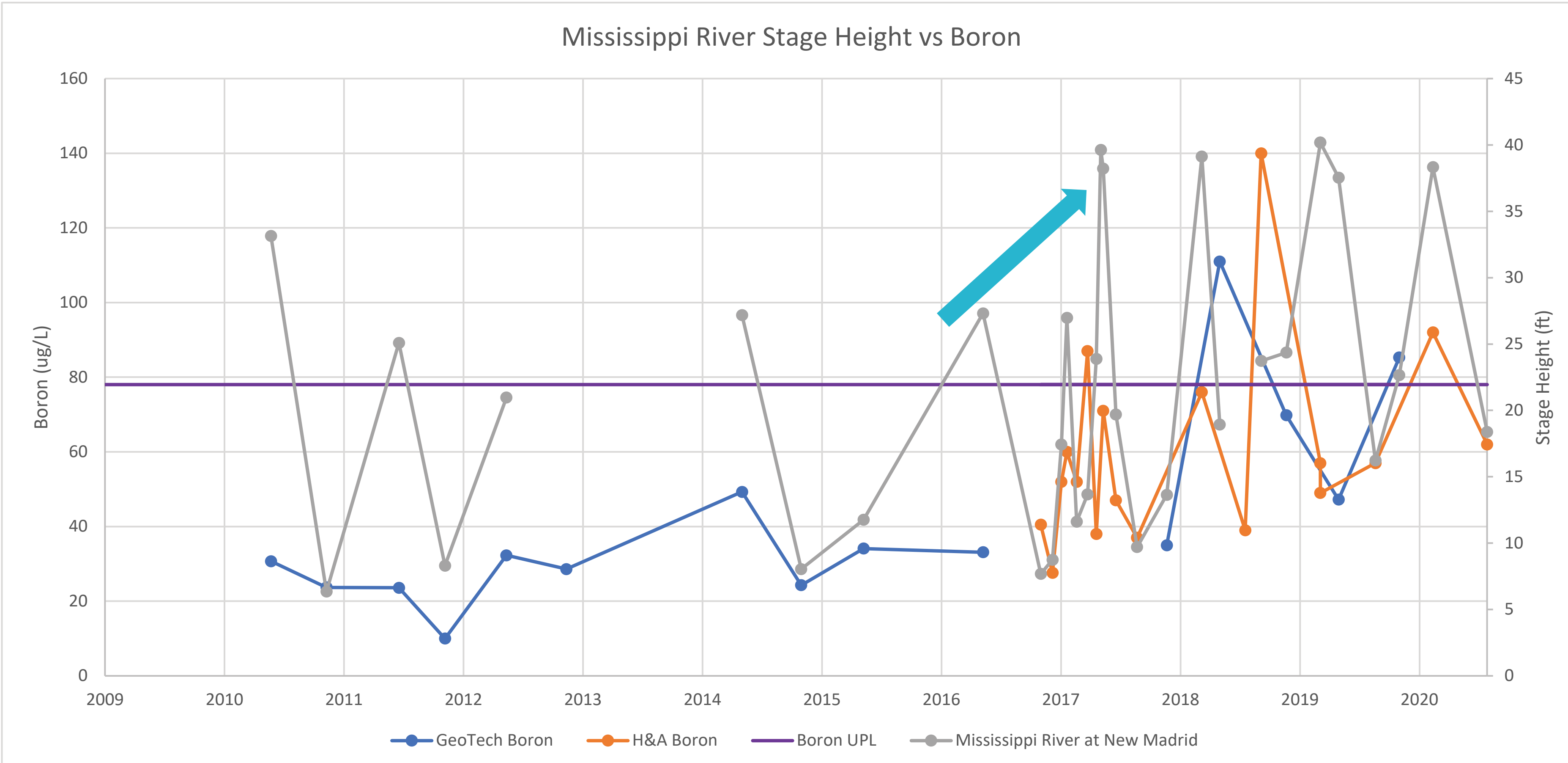
HALEY ALDRICH

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

TEMPORAL RECORD COMPARING (A) BORON CONCENTRATIONS (µg/L) AND (B) WELL B-2 HYDROGRAPH

OCTOBER 2020

FIGURE 3



HALEY ALDRICH

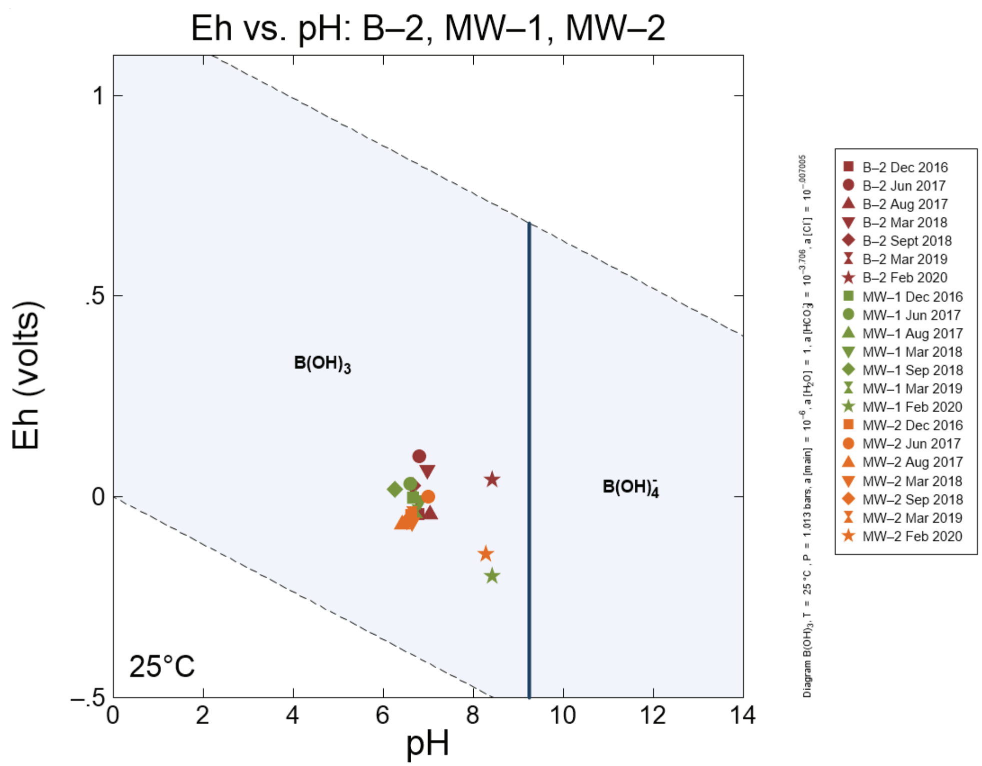
ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT
MARSTON, MISSOURI

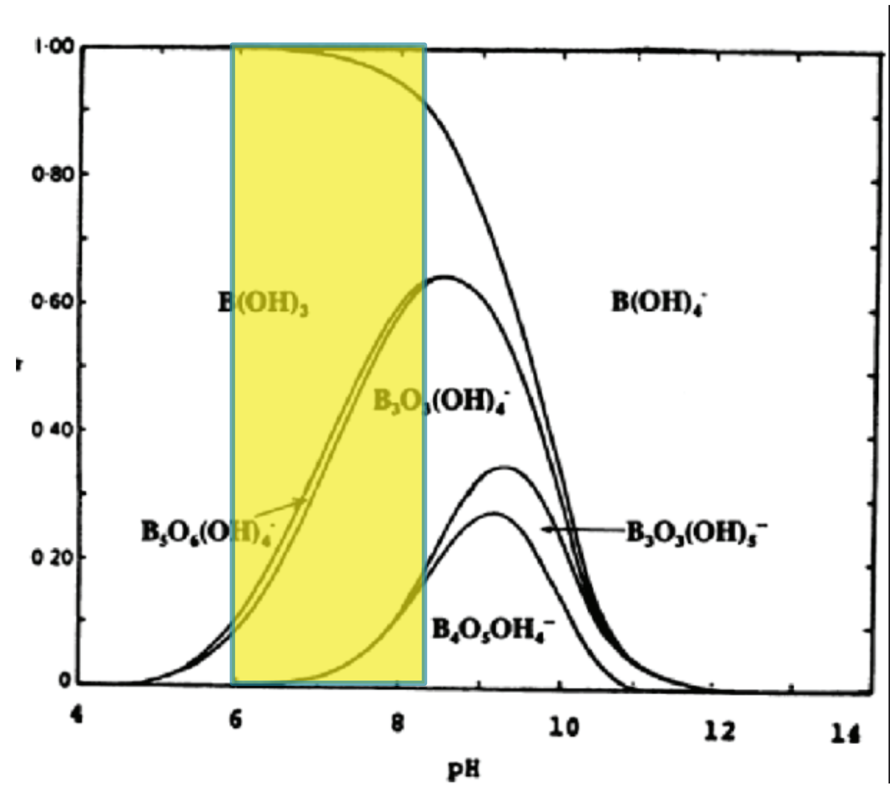
MISSISSIPPI RIVER STAGE HEIGHT VERSUS BORON CONCENTRATIONS (µg/L)

OCTOBER 2020

FIGURE 4

\\haleyaldrich.com\share\phx_common\Projects\AECI\New Madrid\GIS\MXDs\2020_09





MORE MOBILE IN GROUNDWATER

LESS MOBILE IN GROUNDWATER

HALEY ALDRICH

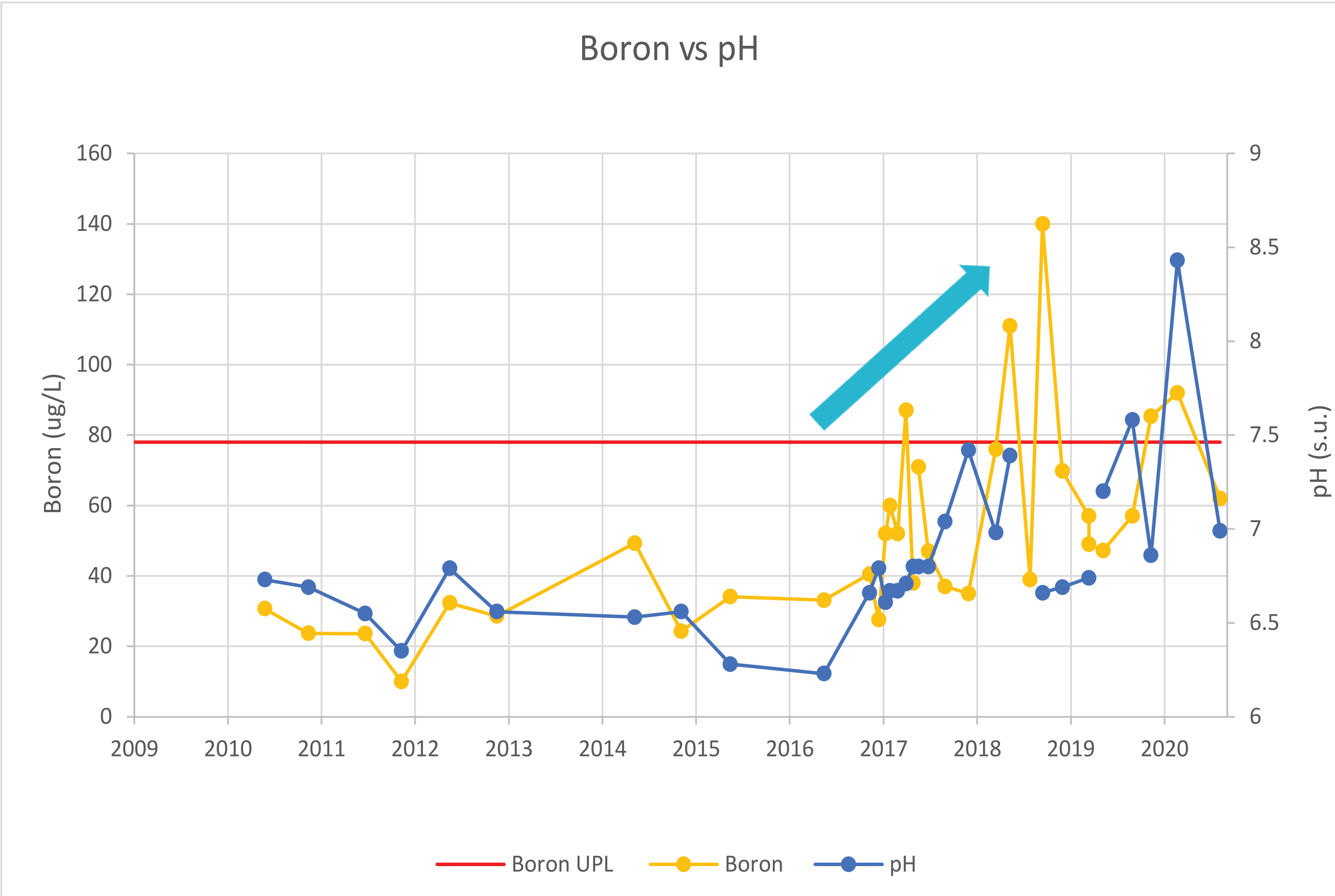
ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT
MARSTON, MISSOURI

AQUEOUS GEOCHEMISTRY OR BORON SHOWING (A) SITE SPECIFIC BORON Eh-pH DIAGRAM AND (B) BORON STABILITY PHASE DIAGRAM

OCTOBER 2020

FIGURE 5

\\haleyaldrich.com\share\phx_common\Projects\AECI\New Madrid\GIS\MXDs\2020_09



HALEY ALDRICH

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

pH DEPENDENCE ON BORON CONCENTRATIONS (μg/L)

OCTOBER 2020

FIGURE 6

\\haleyaldrich.com\share\phx_common\Projects\AECI\New Madrid\GIS\MXDs\2020_09

APPENDIX A

ERIS Historical Aerial Photograph Report

AECI New Madrid

1400-1498 St Jude Rd

Portageville, MO 63873

Inquiry Number: 6131953.2

July 28, 2020

The EDR Aerial Photo Decade Package

EDR®

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

EDR Aerial Photo Decade Package

07/28/20

Site Name:

AECI New Madrid
1400-1498 St Jude Rd
Portageville, MO 63873
EDR Inquiry # 6131953.2

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.

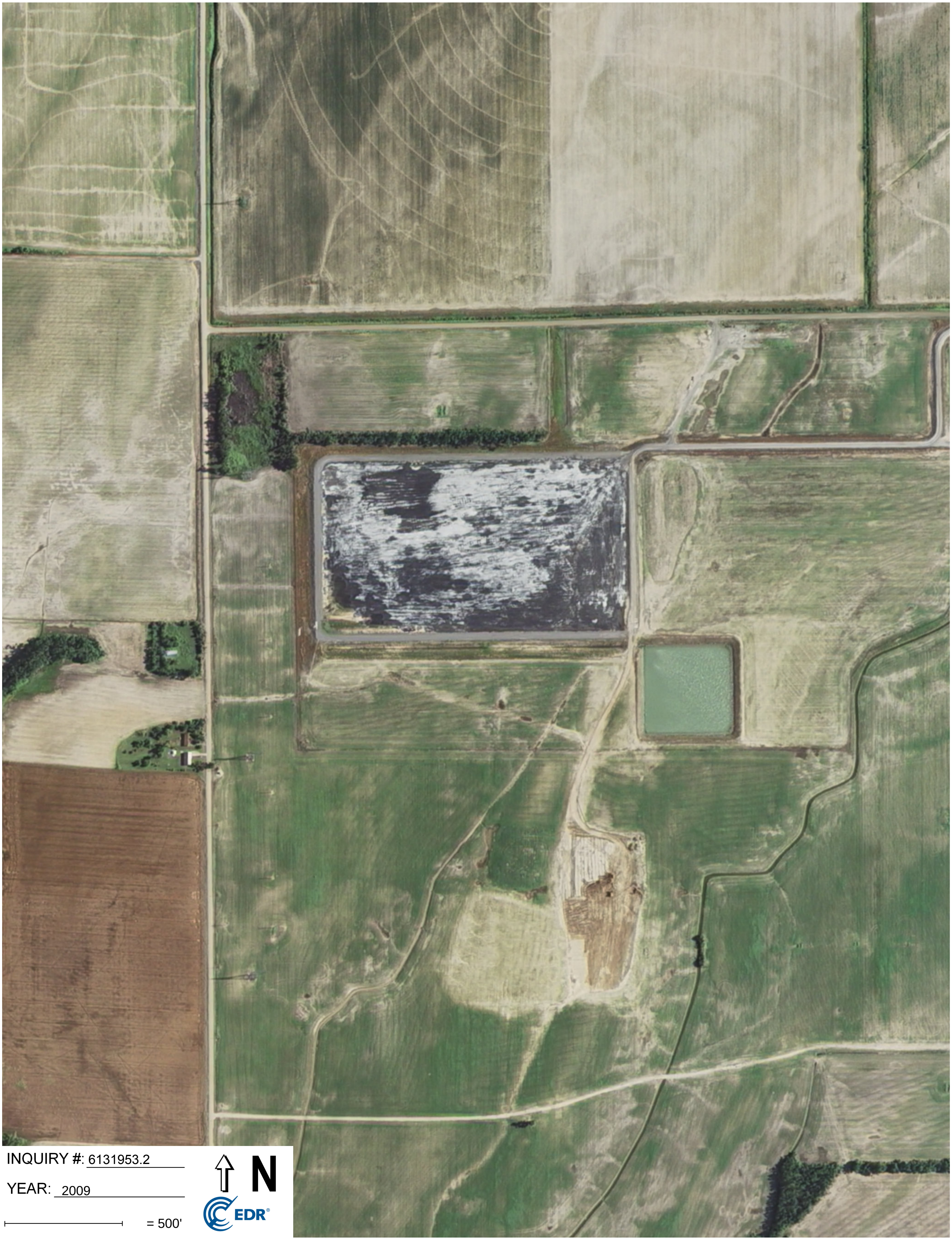
Search Results:

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
1992	1"=500'	Flight Date: March 07, 1992	NAPP
1988	1"=1000'	Flight Date: March 22, 1988	USGS
1969	1"=500'	Flight Date: March 17, 1969	USGS
1952	1"=500'	Flight Date: October 24, 1952	USGS
1950	1"=500'	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 #: 6131953.2
YEAR: 2016
= 500'
N


INQUIRY #: 6131953.2
YEAR: 2012
= 500'
N
EDR


INQUIRY #: 6131953.2
YEAR: 2009
= 500'
N
EDR


INQUIRY #: 6131953.2
YEAR: 2006
= 500'
N
EDR

INQUIRY #: 6131953.2

YEAR: 1996

= 500'

N

EDR®

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

INQUIRY #: 6131953.2

YEAR: 1992

= 500'

N

INQUIRY #: 6131953.2

YEAR: 1988

= 1000'

N

INQUIRY #: 6131953.2

YEAR: 1969

= 500'

N

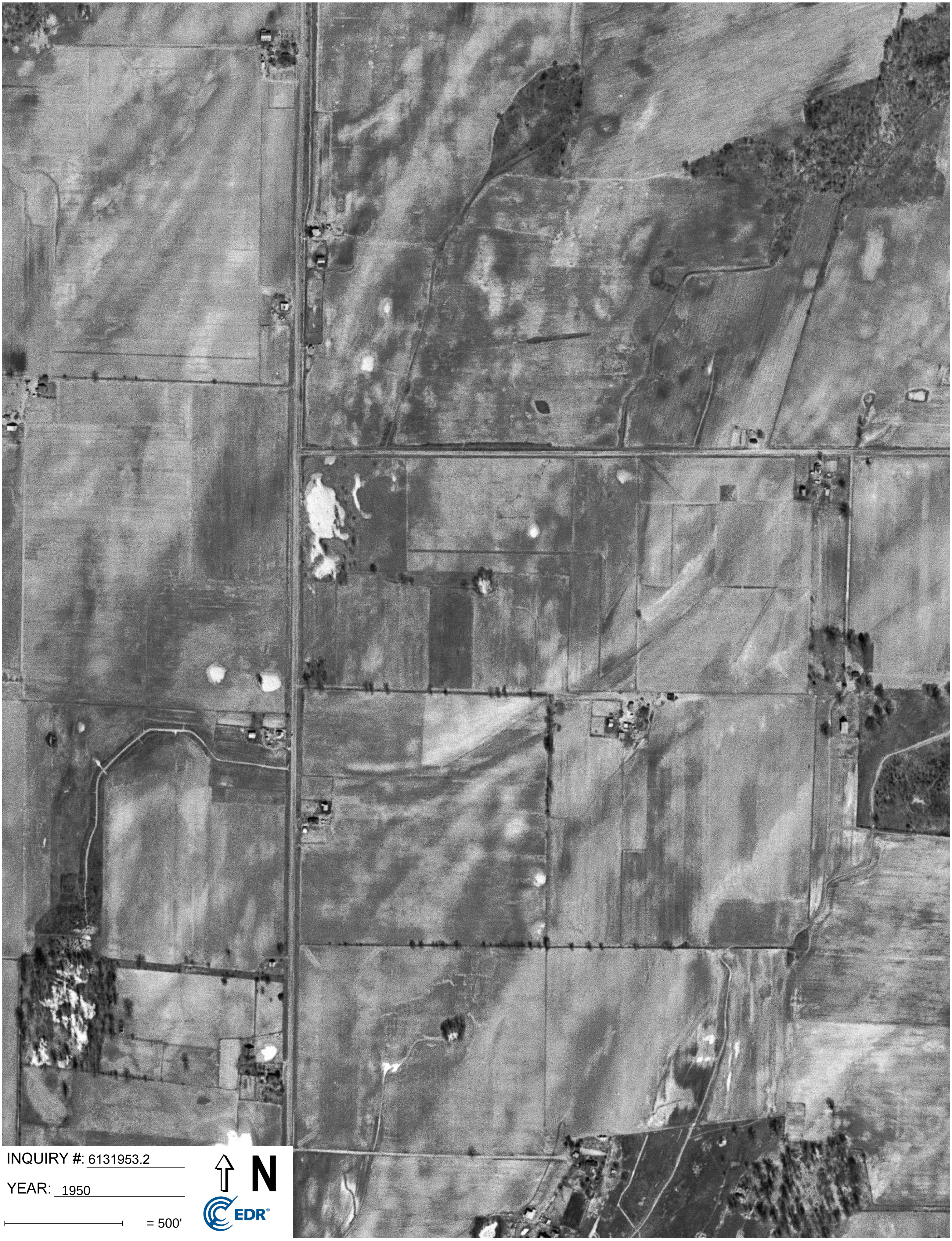
INQUIRY #: 6131953.2

YEAR: 1952

= 500'

N

EDR



INQUIRY #: 6131953.2

YEAR: 1950

= 500'

N

APPENDIX B

ERIS Topographic Map Research Results

AECI New Madrid

1400-1498 St Jude Rd

Portageville, MO 63873

Inquiry Number: 6131953.1

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:	**Client Name:**
AECI New Madrid	Haley & Aldrich
1400-1498 St Jude Rd	600 South Meyer Ave Suite 100
Portageville, MO 63873	Tucson, AZ 85701-0000
EDR Inquiry # 6131953.1	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:		***Coordinates:***	
P.O.#	129342-020	**Latitude:**	36.493418 36° 29' 36" North
Project:	AECI NMPP	**Longitude:**	-89.587183 -89° 35' 14" West
		UTM Zone:	Zone 16 North
		UTM X Meters:	268261.29
		UTM Y Meters:	4041790.87
		Elevation:	290.00' above sea level

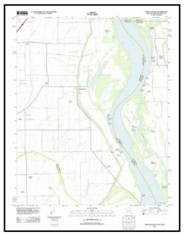
Maps Provided:

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

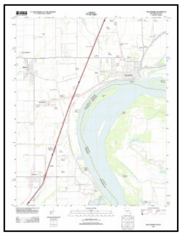
Topo Sheet Key

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

2015 Source Sheets



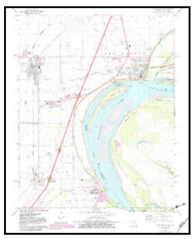
Point Pleasant
2015
7.5-minute, 24000



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

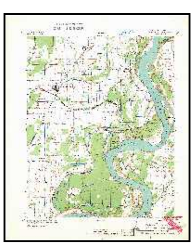
New Madrid SE
1951
7.5-minute, 24000
Aerial Photo Revised 1950

1939 Source Sheets

New Madrid
1939
15-minute, 62500

Portageville
1939
15-minute, 62500

1931, 1934 Source Sheets



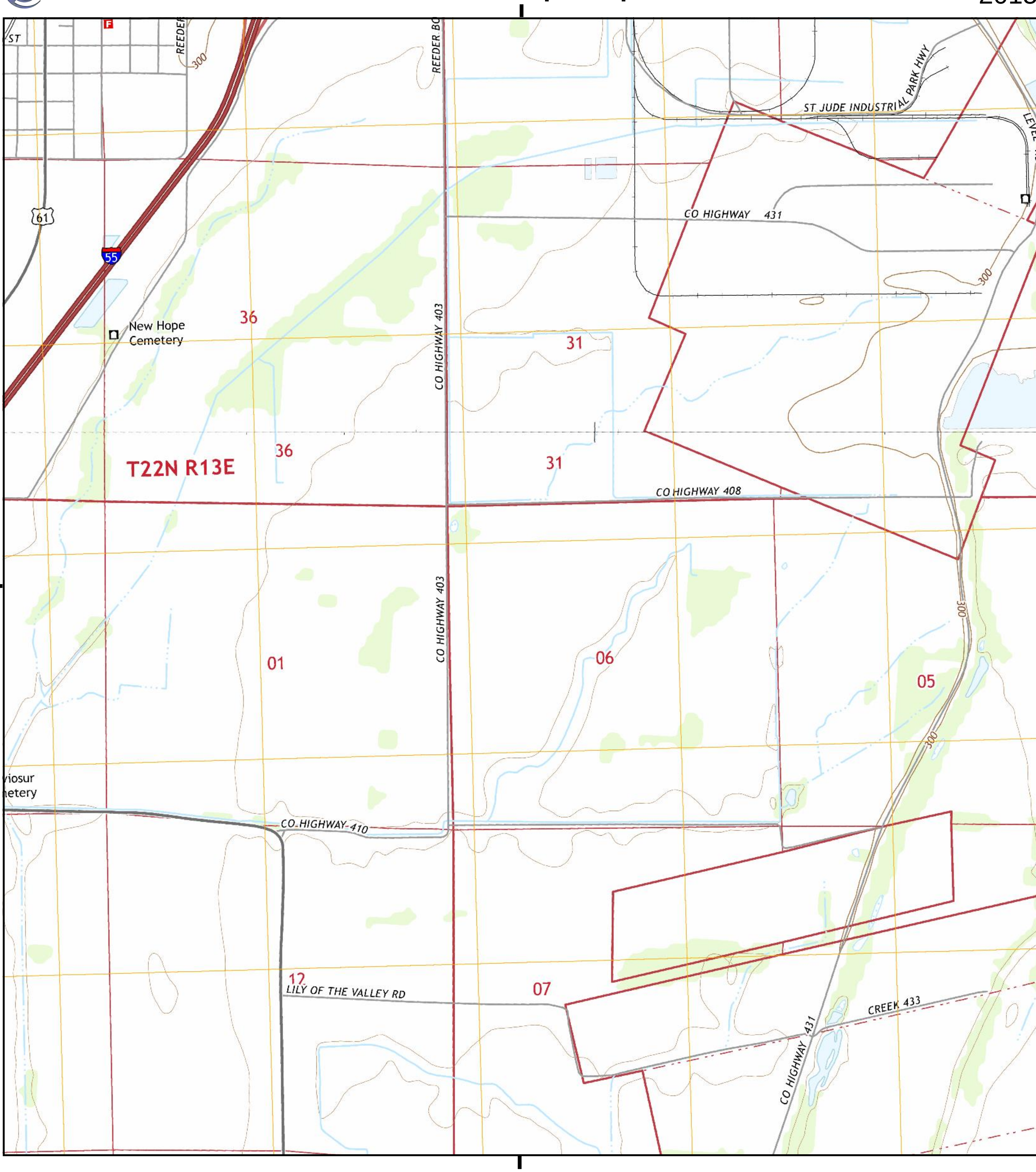
PORTAGEVILLE
1931
15-minute, 62500

NEW MADRID
1934
15-minute, 62500

EDR

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

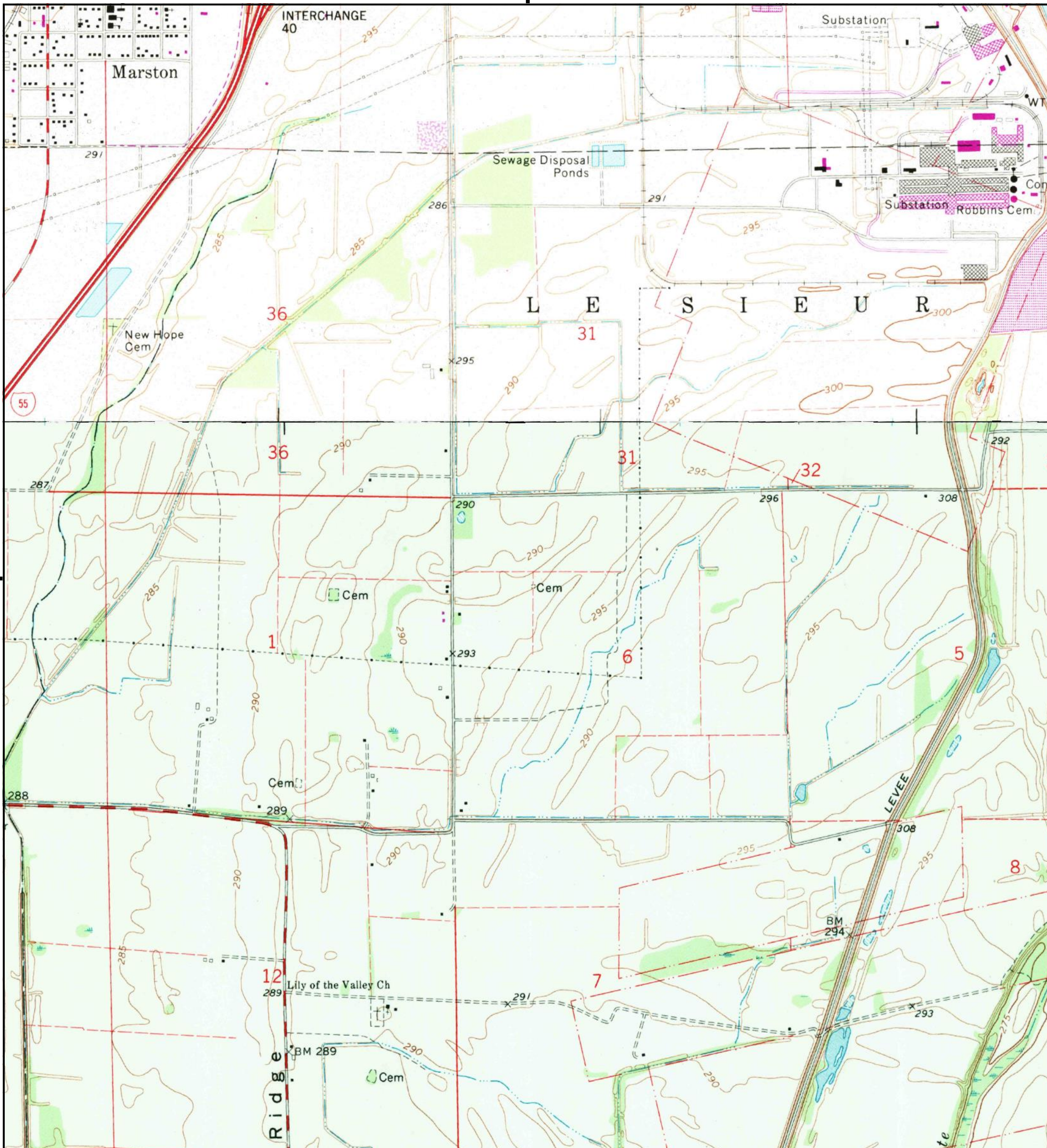
TP, Point Pleasant, 2015, 7.5-minute
N, New Madrid, 2015, 7.5-minute

SITE NAME: AECI New Madrid
ADDRESS: 1400-1498 St Jude Rd
Portageville, MO 63873
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

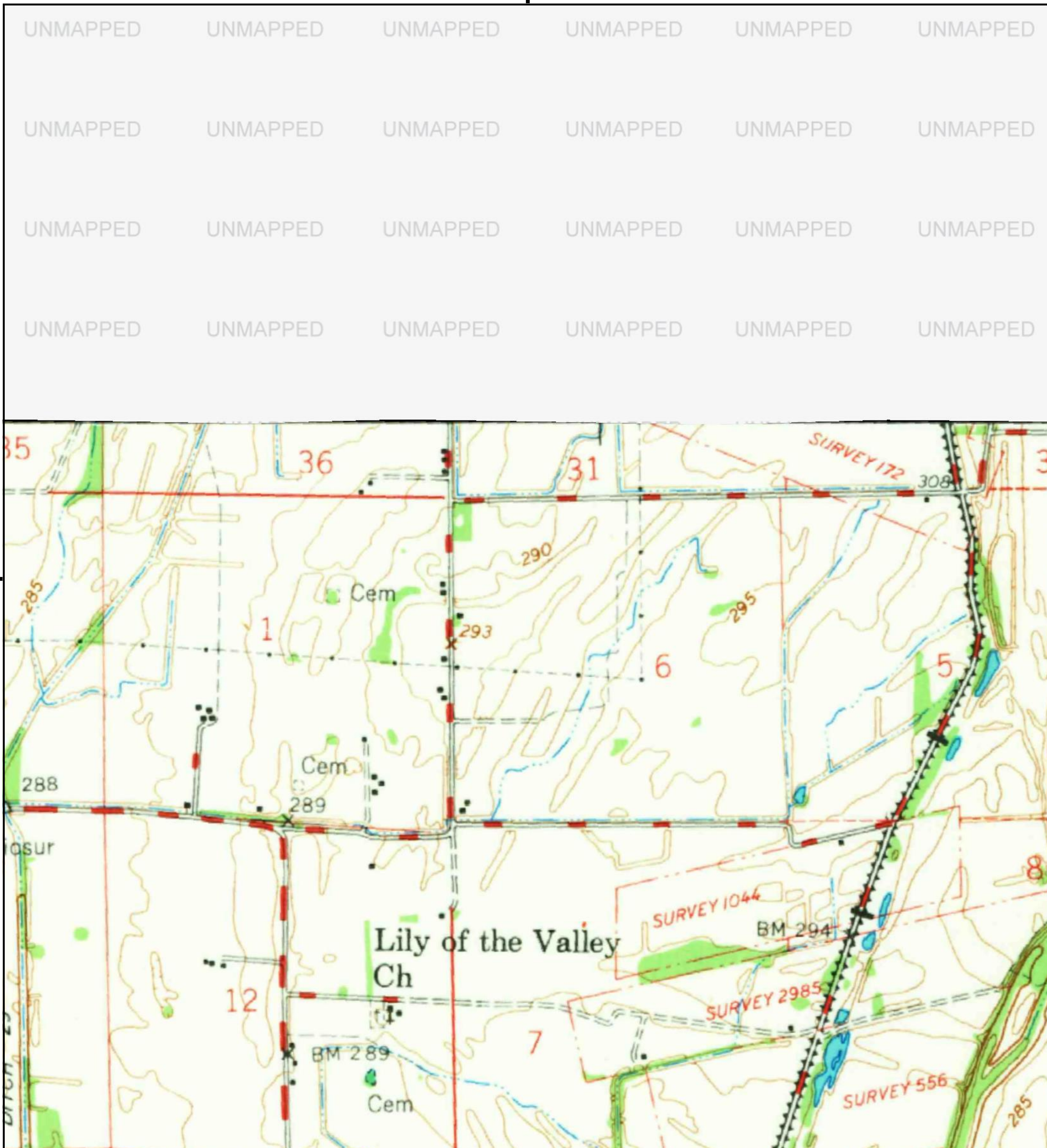
TP, Point Pleasant, 1982, 7.5-minute
N, New Madrid, 1982, 7.5-minute

SITE NAME: AECI New Madrid
ADDRESS: 1400-1498 St Jude Rd
Portageville, MO 63873
CLIENT: Haley & Aldrich

N

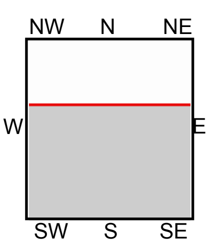
Historical Topo Map

1973



0 Miles 0.25 0.5 1 1.5

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

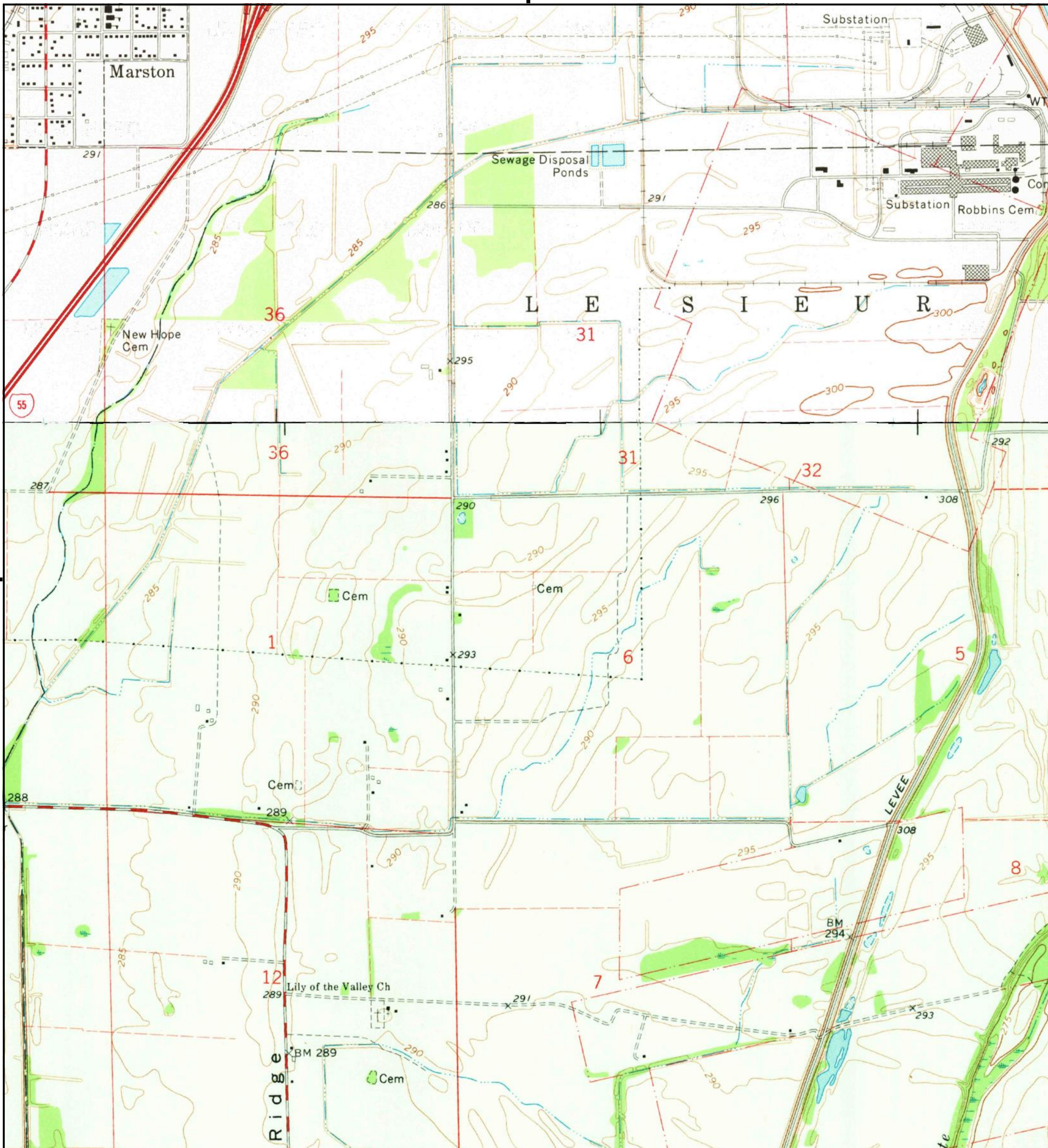


TP, Portageville, 1973, 15-minute

SITE NAME: AECI New Madrid
ADDRESS: 1400-1498 St Jude Rd
Portageville, MO 63873
CLIENT: Haley & Aldrich

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

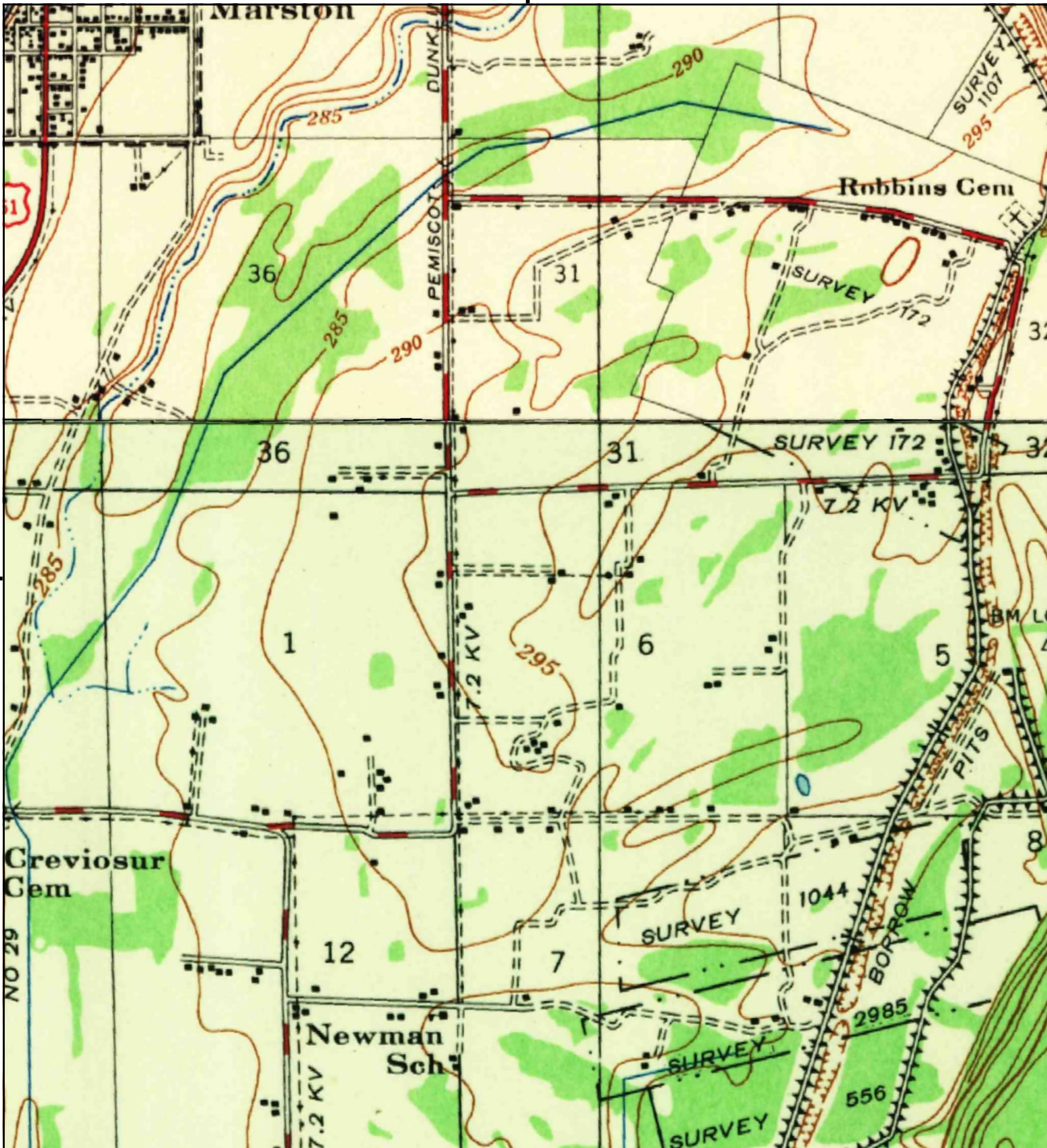
TP, Point Pleasant, 1971, 7.5-minute
N, New Madrid, 1971, 7.5-minute

SITE NAME: AECI New Madrid
ADDRESS: 1400-1498 St Jude Rd
Portageville, MO 63873
CLIENT: Haley & Aldrich

N

Historical Topo Map

1954, 1955



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

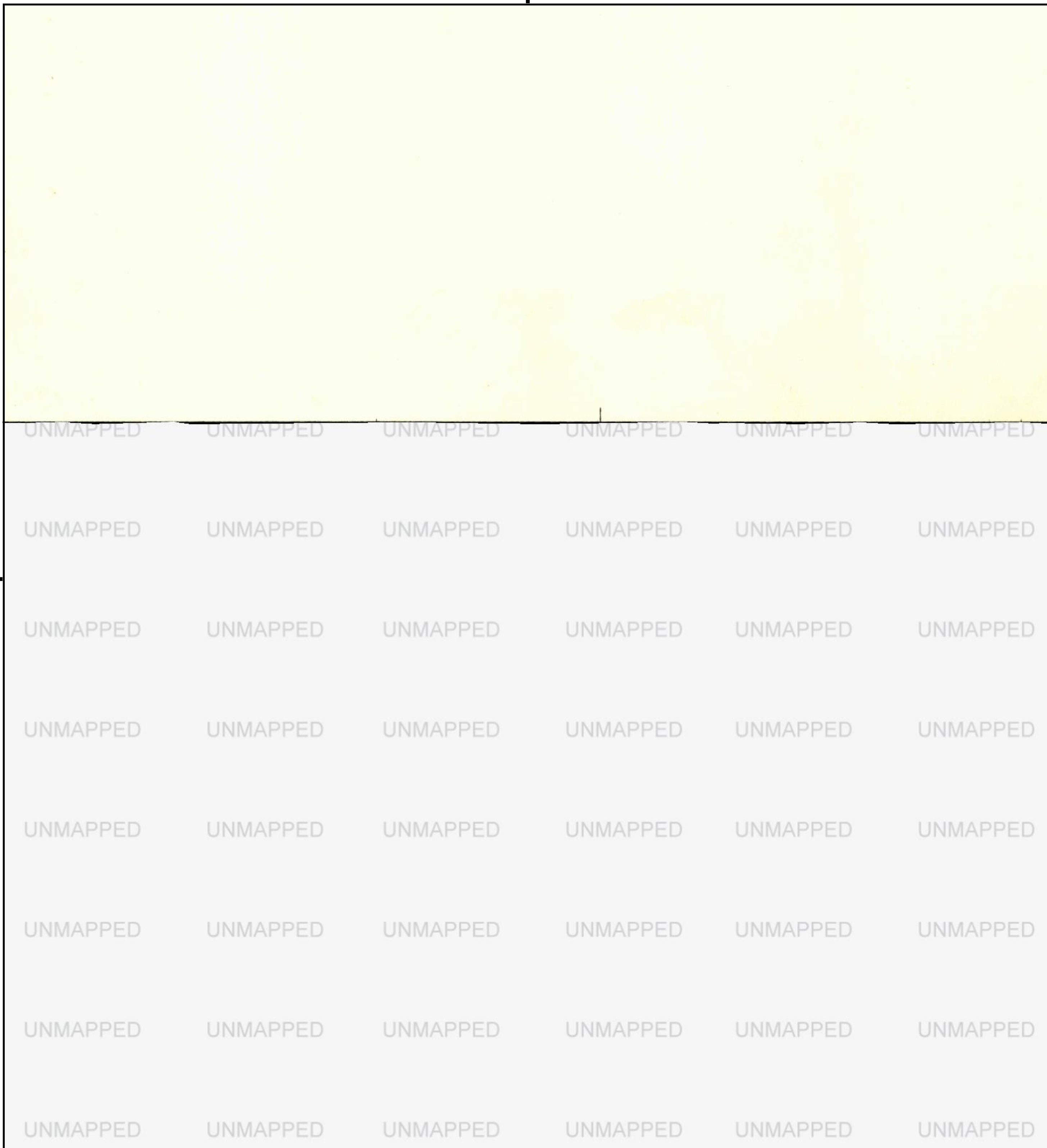
TP, Portageville, 1955, 15-minute
N, New Madrid, 1954, 15-minute

SITE NAME: AECI New Madrid
ADDRESS: 1400-1498 St Jude Rd
Portageville, MO 63873
CLIENT: Haley & Aldrich

N

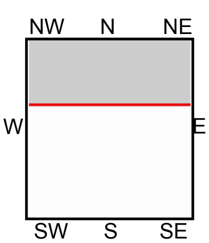
Historical Topo Map

1951



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

0 Miles 0.25 0.5 1 1.5



N, New Madrid SE, 1951, 7.5-minute

SITE NAME: AECI New Madrid
ADDRESS: 1400-1498 St Jude Rd
Portageville, MO 63873
CLIENT: Haley & Aldrich

N

Historical Topo Map

1939

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, Portageville, 1939, 15-minute
N, New Madrid, 1939, 15-minute

SITE NAME: AECI New Madrid
ADDRESS: 1400-1498 St Jude Rd
Portageville, MO 63873
CLIENT: Haley & Aldrich

N

EDR

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, PORTAGEVILLE, 1931, 15-minute
N, NEW MADRID, 1934, 15-minute

SITE NAME: AECI New Madrid
ADDRESS: 1400-1498 St Jude Rd
Portageville, MO 63873
CLIENT: Haley & Aldrich

N