Form CCR 1	Illinois Environmental Protection Agency CCR Residual Surface Impoundment Permit Application CCR Form 1 – General Provisions

Bureau of Water ID Number: **CCR Permit Number:** **Facility Name:** Waukegan Generating Station	For IEPA Use Only

SECTION 1: FACILITY, OPERATOR, AND OWNER INFORMATION (35 IAC 845.210(b))

Facility, Operator, and Owner Information

1.1	**Facility Name**		
	Waukegan Generating Station		
1.2	**Illinois EPA CCR Permit Number (if applicable)**		
1.3	**Facility Contact Information**		
	Name (first and last) Mark Wehling	Title Environmental Specialist	Phone Number 847-599-2201
	Email address Mark.Wehling@NRG.com		
1.4	**Facility Mailing Address**		
	Street or P.O. box 401 E. Greenwood Ave		
	City or town Waukegan	State IL	Zip Code 60087
1.5	**Facility Location**		
	Street, route number, or other specific identifier 401 E. Greenwood Ave		
	County name Lake	County code (if known)	
	City or town Waukegan	State IL	Zip Code 60087
1.6	**Name of Owner/Operator**		
	Midwest Generation, LLC		

Facility, Operator, and Owner Info

1.7	**Owner/Operator Contact Information**		
	Name (first and last): Paulo Rocha	Title: Plant Manager	Phone Number: 847-599-2212
	Email address: Paulo.Rocha@NRG.com		
1.8	**Owner/Operator Mailing Address**		
	Street or P.O. box: 804 Carnegie Center		
	City or town: Princeton	State: NJ	Zip Code: 08540

SECTION 2: LEGAL DESCRIPTION (35 IAC 845.210(c))

Legal Description

2.1 **Legal Description of the facility boundary**

AN IRREGULAR PARCEL AS DESCRIBED BY DOC 4468499 FRACTIONAL SECTION 15 TOWNSHIP 45 RANGE 12

SECTION 3: PUBLICLY ACCESSIBLE INTERNET SITE REQUIREMENTS (35 IAC 845.810)

Internet Site

3.1 **Web Address(es) to publicly accessible internet site(s) (CCR website)**

https://midwestgenerationllc.com/illinois-ccr-rule-compliance-data-and-information/

3.2 **Is/are the website(s) titled "Illinois CCR Rule Compliance Data and Information"**

(Yes) [circled] No

SECTION 4: IMPOUNDMENT IDENTIFICATION

Impoundment Identification

4.1 **List all the Impoundment Identification numbers for your facility and check the corresponding box to indicate that you have attached a written description for each impoundment.**

Impoundment ID	Checked	
W0971900021-01	☑	Attached written description
W0971900021-02	☑	Attached written description
	☐	Attached written description
	☐	Attached written description
	☐	Attached written description
	☐	Attached written description
	☐	Attached written description

			☐	Attached written description
			☐	Attached written description
			☐	Attached written description

SECTION 5: CHECKLIST AND CERTIFICATION STATEMENT

Checklist and Certification Statement

5.1 In Colum 1 below, mark the sections of Form 1 that you have completed and are submitting with your application. For each section, specify in Column 2 any attachments that you are enclosing.

Column 1		**Column 2**	
Section 1: Facility, Operator, and Owner Information	☑	w/attachments	☑
Section 2: Legal Description	☑	w/attachments	☐
Section 3: Publicly Accessible Internet Site Requirement	☑	w/attachments	☐
Section 4: Impoundment Identification	☑	w/attachments	☑

5.2 **Certification Statement**

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name (print or type first and last name) of Owner/Operator	Official Title
Paulo Rocha	Plant Manager
Signature [signature]	Date Signed 10/26/21

Form CCR 2E

Illinois Environmental Protection Agency

CCR Surface Impoundment Permit Application

Form CCR 2E – Initial Operating Permit for Existing or Inactive CCR Surface Impoundments That Have Not Completed an Agency-approved Closure Before July 30, 2021

Bureau of Water ID Number:

CCR Permit Number:

Facility Name:
Waukegan Generating Station

For IEPA Use Only

SECTION 1: CONSTRUCTION HISTORY (35 Ill. Adm. Code 845.220 AND 35 Ill. Adm. Code 845.230)

Construction History

1.1	CCR surface impoundment name.
	East Ash Pond
1.2	Identification number of the CCR surface impoundment (if one has been assigned by the Agency).
	W0971900021-01
1.3	Description of the boundaries of the CCR surface impoundment (35 Ill. Adm. Code 845.210(c)).
	SECTION 15 TOWNSHIP 45 RANGE 12
1.4	State the purpose for which the CCR surface impoundment is being used.
	Used as a settling pond for sluiced CCR and other process waters associated with the electrical power generating process.
1.5	How long has the CCR surface impoundment been in operation?
	43 years
1.6	List the types of CCR that have been placed in the CCR surface impoundment.
	Bottom ash, economizer ash, boiler slag

Construction History (Continued)

1.7	List name of the watershed within which the CCR surface impoundment is located.	
	Waukegan River - Frontal Lake Michigan watershed	
1.8	Size in acres of the watershed within which the CCR surface impoundment is located.	
	31,245	
1.9	Check the corresponding box to indicate that you have attached the following:	
	☑	Description of the physical and engineering properties of the foundation and abutment materials on which the CCR surface impoundment is constructed.
	☑	Description of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR surface impoundment.
	☑	Describe the method of site preparation and construction of each zone of the CCR surface impoundment.
	☑	A listing of the approximate dates of construction of each successive stage of construction of the CCR surface impoundment.
	☑	Drawing satisfying the requirements of 35 Ill. Adm. Code 845.220(a)(1)(F).
	☑	Description of the type, purpose, and location of existing instrumentation.
	☑	Area capacity curves for the CCR Impoundment.
	☑	Description of each spillway and diversion design features and capacities and provide the calculations used in their determination.
	☑	Construction specifications and provisions for surveillance, maintenance, and repair of the CCR surface impoundment.
1.10.1	Is there any record or knowledge of structural instability of the CCR surface impoundment?	
	☑ Yes	☐ No
1.10.2	If you answered yes to Item 1.10.1, provide detailed explanation of the structural instability.	

In 2002, Raymond Professional Group, Inc. (RPG) prepared a report of engineering study to propose repairs to the instabilities observed in the interior embankments of the ponds. During the liner replacements in 2003 and 2005, the recommendation of flattening the interior slopes to 2.5H:1V was completed.

In 2002 and 2003, RPG inspected the east and south embankments of the East Ash Pond. The inspections "indicated areas of undercutting and soft soil at the downstream toe of the embankment, observations of some seepage from the embankment, and localized erosion of the perimeter access road east of the East Ash Pond." These areas were addressed during the 2003 and 2005 liner replacement projects. These areas, as well as the eastern and southeastern slopes of the East Ash Pond, were re-graded in 2016.

In 2009, 2014, and 2015, Valdes Engineering, also hired by Midwest Generation, performed inspections of the East and West Ash Ponds and did not document any structural instability. The initial structural stability assessment completed pursuant to 40 CFR Part 257.73(c), dated October 2016, did not identify structural instabilities. Subsequent impoundment periodic inspections (inspections performed through 2020) did not identify any structural deficiencies that would affect the stability of the East Ash Pond and the West Ash Pond. The 2018 inspection identified an area of minor erosion that did not compromise the stability of the East Ash Pond and the station revegetated this area.

SECTION 2: ANALYSIS OF CHEMICAL CONSTITUENTS (35 Ill. Adm. Code 845.230(d)(2)(B))

Constituents

2.1	Check the corresponding boxes to indicate you have attached the following:	
	☑	An analysis of the chemical constituents found within the CCR to be placed in the CCR surface impoundment.
	☑	An analysis of the chemical constituents of all waste streams, chemical additives and sorbent materials entering or contained in the CCR surface impoundment.

SECTION 3: DEMONSTRATIONS AND CERTIFICATIONS (35 Ill. Adm. Code 845.230(d)(2)(D))						
Demonstrations	3.1	Indicate whether you have attached a demonstration that the CCR surface impoundment, as built, meets, or an explanation of how the CCR surface impoundments fails to meet, the location standards in the following sections:				
		35 Ill. Adm. Code 845.300 (Placement Above the Uppermost Aquifer)	☑	Demonstration	☐	Explanation
		35 Ill. Adm. Code 845.310 (Wetlands)	☑	Demonstration	☐	Explanation
		35 Ill. Adm. Code 845.320 (Fault Areas)	☑	Demonstration	☐	Explanation
		35 Ill. Adm. Code 845.330 (Seismic Impact Zones)	☑	Demonstration	☐	Explanation
		35 Ill. Adm. Code 845.340 (Unstable Areas and Floodplains)	☑	Demonstration	☐	Explanation

SECTION 4: ATTACHMENTS			
Attachments	4.1	Check the corresponding boxes to indicate that you have attached the following:	
		☑	Evidence that the permanent markers required by 35 Ill. Adm. Code 845.130 have been installed.
		☑	Documentation that the CCR surface impoundment, if not incised, will be operated and maintained with one of the forms of slope protection specified in 35 Ill. Adm. Code 845.430.
		☑	Initial Emergency Action Plan and accompanying certification required by 35 Ill. Adm. Code 845.520(e).
		☑	Fugitive dust control plan and accompanying certification required by 35 Ill. Adm. Code 845.500(b)(7).
		☑	Preliminary written closure plan as specified in 35 Ill. Adm. Code 845.720(a).
		☑	Initial written post-closure care plan as specified in 35 Ill. Adm. Code 845.780(d), if applicable.
		☑	A certification as specified in 35 Ill. Adm. Code 845.400(h), or a statement that the CCR surface impoundment does not have a liner than meets the requirements of 35 Ill. Adm. Code 845.400(b) or (c).
		☑	History of known exceedances of the groundwater protection standards in 35 Ill. Adm. Code 845.600, and any corrective action taken to remediate the groundwater.
		☑	Safety and health plan, as required by 35 Ill. Adm. Code 845.530.
		☑	For CCR surface impoundments required to close under 35 Ill. Adm. Code 845.700, the proposed closure priority categorization required by 35 Ill. Adm. Code 845.700(g).

SECTION 5: GROUNDWATER MONITORING			
Groundwater	5.1	Check the corresponding boxes to indicate you have attached the following groundwater monitoring information:	
		☑	A hydrogeologic site characterization meeting the requirements of 35 Ill. Adm. Code 845.620.
		☑	Design and construction plans of a groundwater monitoring system meeting the requirements of 35 Ill. Adm. Code 845.630.

		☑	A groundwater sampling and analysis program that includes section of the statistical procedures to be used for evaluating groundwater monitoring data, required by 35 Ill. Adm. Code 845.640.
		☑	Proposed groundwater monitoring program that includes a minimum of eight independent samples for each background and downgradient well, required by 35 Ill. Adm. Code 845.650(b).
SECTION 6: CERTIFICATIONS			
Certifications	6.1	Check the corresponding boxes to indicate you have attached the following certifications:	
		☑	A certification that the owner or operator meets the financial assurance requirements of Subpart I, as required by 35 Ill. Adm. Code 845.230(d)(2)(N).
		☑	Hazard potential classification assessment and accompanying certifications required by 35 Ill. Adm. Code 845.440(a)(2).
		☑	Structural stability assessment and accompanying certification, required by 35 Ill. Adm. Code 845.450(c).
		☑	Safety factor assessment and accompanying certification, as required by 35 Ill. Adm. Code 845.460(b).
		☑	Inflow design flood control system plan and accompanying certification, as required by 35 Ill. Adm. Code 845.510(c)(3).

Form CCR 2E	**Illinois Environmental Protection Agency** **CCR Surface Impoundment Permit Application** **Form CCR 2E – Initial Operating Permit for Existing or Inactive CCR Surface Impoundments That Have Not Completed an Agency-approved Closure Before July 30, 2021**

Bureau of Water ID Number: **CCR Permit Number:** **Facility Name:** Waukegan Generating Station	For IEPA Use Only

SECTION 1: CONSTRUCTION HISTORY (35 Ill. Adm. Code 845.220 AND 35 Ill. Adm. Code 845.230)

Construction History

1.1	CCR surface impoundment name.	
	West Ash Pond	
1.2	Identification number of the CCR surface impoundment (if one has been assigned by the Agency).	
	W0971900021-02	
1.3	Description of the boundaries of the CCR surface impoundment (35 Ill. Adm. Code 845.210(c)).	
	SECTION 15 TOWNSHIP 45 RANGE 12	
1.4	State the purpose for which the CCR surface impoundment is being used.	
	The West Ash Pond formerly served as a settling pond for sluiced CCR and other process water associated with the electrical power generating process at the Waukegan Station. As of April 11, 2021, the West Ash Pond is not in service and will not be used in the future for CCR storage.	
1.5	How long has the CCR surface impoundment been in operation?	
	43 years	
1.6	List the types of CCR that have been placed in the CCR surface impoundment.	
	All CCR has been removed but previously held bottom ash, economizer ash, and boiler slag.	

Construction History (Continued)			
1.7	List name of the watershed within which the CCR surface impoundment is located.		
	Waukegan River - Frontal Lake Michigan watershed		
1.8	Size in acres of the watershed within which the CCR surface impoundment is located.		
	31,245		
1.9	Check the corresponding box to indicate that you have attached the following:		
	☑	Description of the physical and engineering properties of the foundation and abutment materials on which the CCR surface impoundment is constructed.	
	☑	Description of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR surface impoundment.	
	☑	Describe the method of site preparation and construction of each zone of the CCR surface impoundment.	
	☑	A listing of the approximate dates of construction of each successive stage of construction of the CCR surface impoundment.	
	☑	Drawing satisfying the requirements of 35 Ill. Adm. Code 845.220(a)(1)(F).	
	☑	Description of the type, purpose, and location of existing instrumentation.	
	☑	Area capacity curves for the CCR Impoundment.	
	☑	Description of each spillway and diversion design features and capacities and provide the calculations used in their determination.	
	☑	Construction specifications and provisions for surveillance, maintenance, and repair of the CCR surface impoundment.	
1.10.1	Is there any record or knowledge of structural instability of the CCR surface impoundment?		
	☐ Yes	☑ No	
1.10.2	If you answered yes to Item 1.10.1, provide detailed explanation of the structural instability.		

SECTION 2: ANALYSIS OF CHEMICAL CONSTITUENTS (35 Ill. Adm. Code 845.230(d)(2)(B))

Constituents			
2.1	Check the corresponding boxes to indicate you have attached the following:		
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		35 Ill. Adm. Code 845.320 (Fault Areas)	☑	Demonstration	☐	Explanation
		35 Ill. Adm. Code 845.330 (Seismic Impact Zones)	☑	Demonstration	☐	Explanation
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		☑	Fugitive dust control plan and accompanying certification required by 35 Ill. Adm. Code 845.500(b)(7).
		☑	Preliminary written closure plan as specified in 35 Ill. Adm. Code 845.720(a).
		☑	Initial written post-closure care plan as specified in 35 Ill. Adm. Code 845.780(d), if applicable.
		☑	A certification as specified in 35 Ill. Adm. Code 845.400(h), or a statement that the CCR surface impoundment does not have a liner than meets the requirements of 35 Ill. Adm. Code 845.400(b) or (c).
		☑	History of known exceedances of the groundwater protection standards in 35 Ill. Adm. Code 845.600, and any corrective action taken to remediate the groundwater.
		☑	Safety and health plan, as required by 35 Ill. Adm. Code 845.530.
		☑	For CCR surface impoundments required to close under 35 Ill. Adm. Code 845.700, the proposed closure priority categorization required by 35 Ill. Adm. Code 845.700(g).

SECTION 5: GROUNDWATER MONITORING

Groundwater	5.1	Check the corresponding boxes to indicate you have attached the following groundwater monitoring information:	
		☑	A hydrogeologic site characterization meeting the requirements of 35 Ill. Adm. Code 845.620.
		☑	Design and construction plans of a groundwater monitoring system meeting the requirements of 35 Ill. Adm. Code 845.630.

		☑	A groundwater sampling and analysis program that includes section of the statistical procedures to be used for evaluating groundwater monitoring data, required by 35 Ill. Adm. Code 845.640.
		☑	Proposed groundwater monitoring program that includes a minimum of eight independent samples for each background and downgradient well, required by 35 Ill. Adm. Code 845.650(b).
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		☑	A certification that the owner or operator meets the financial assurance requirements of Subpart I, as required by 35 Ill. Adm. Code 845.230(d)(2)(N).
		☑	Hazard potential classification assessment and accompanying certifications required by 35 Ill. Adm. Code 845.440(a)(2).
		☑	Structural stability assessment and accompanying certification, required by 35 Ill. Adm. Code 845.450(c).
		☑	Safety factor assessment and accompanying certification, as required by 35 Ill. Adm. Code 845.460(b).
		☑	Inflow design flood control system plan and accompanying certification, as required by 35 Ill. Adm. Code 845.510(c)(3).

K P R G

ENVIRONMENTAL CONSULTATION & REMEDIATION

KPRG and Associates, Inc.

APPLICATION FOR INITIAL OPERATING PERMIT

WAUKEGAN GENERATING STATION
MIDWEST GENERATION, LLC
WAUKEGAN, ILLINOIS

Illinois EPA Site No. 0971905013

October 29, 2021

Submitted To:

Illinois Environmental Protection Agency
1021 North Grand Avenue East
Springfield, Illinois 62702

Prepared For:

Midwest Generation, LLC
401 E Greenwood Ave.
Waukegan, IL 60087

Prepared By:

KPRG and Associates, Inc.
14665 West Lisbon Road, Suite 1A
Brookfield, WI 53005

Table of Contents

TABLES

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ATTACHMENTS

Introduction

Midwest Generation, LLC ("Midwest Generation") currently operates the coal-fired generating station, referred to as Waukegan Station, located in Waukegan, Illinois ("site" or "generating station"). As part of generating electricity and managing the coal combustion residuals (CCR), the station operates a set of surface impoundments, the East Ash Pond and the West Ash Pond. As part of complying with the 40 CFR Part 257 (Federal CCR Rule), it was determined that the East Ash Pond and the West Ash Pond did not comply with the liner design requirements of 40 CFR Part 257 Subpart D. As a result, Midwest Generation was required to cease placing CCR in the East Ash Pond and the West Ash Pond as soon as technically feasible but no later than April 11, 2021, unless an alternative deadline could be granted by the EPA.

Midwest Generation does not need to use both the East Ash Pond and the West Ash Pond simultaneously to manage CCR as of the date on this permit application, but will need to use one of the surface impoundments to continue operating the generating station going forward to manage non-CCR wastestreams. Midwest Generation has ceased sending CCR and non-CCR to the West Ash Pond and initiated closure. An alternative disposal capacity evaluation determined that no on-site or off-site disposal options were available for the East Ash Pond and it was technically infeasible to obtain alternative disposal capacity for the CCR either on-site or off-site by April 11, 2021. Because of this, Midwest Generation prepared and submitted a Demonstration for a Site Specific Alternative Deadline to Initiate Closure ("Alternate Closure Demonstration" or "ACD") to the US EPA on November 30, 2020 that requests utilization of the East Pond while alternative disposal capacity to replace the East Ash Pond is established.

The objective of this submittal is to apply for the initial operating permit for the East Ash Pond and the West Ash Pond at the Waukegan Generating Station, continue operating both in compliance with the Ill. Adm. Code Title 35, Part 845: Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (State CCR Rule).

This submittal provides the information as required in accordance 35 Ill. Adm. Code 845.230. This permit application is organized to discuss each section of 35 Ill. Adm. Code 845.230, as necessary. Some of the sections below along with the attachments reference the East Ash Basin and the West Ash Basin; these are the same surface impoundments as the East Ash Pond and the West Ash Pond referenced in this operating permit application. The documents referencing the East Ash Basin and the West Ash Basin were created prior to the enacting of the 35 Ill. Adm. Code 845. As part of complying with 35 Ill. Adm. Code 845, the surface impoundments were named East Ash Pond and West Ash Pond. Therefore, the surface impoundments are referred to as the East Ash Pond and the West Ash Pond in this application except when quoted information, which is denoted with quotation marks, is presented in this operating permit application.

This permit application is organized with supporting Tables and Figures that are referenced in the discussions being provided at the end of the full Permit text with the table numbers and figures tied to the Section number within which they are referenced with sequential numbering (e.g., Tables referenced in Section 9 are numbered 9-1, 9-2, etc. Figures referenced in Section 9 are numbered Figure 9-1, 9-2, etc.). Specific Attachments referenced within each Section are provided in a similar fashion (e.g., Attachment 1 information is tied to Section 1 of the Permit text, Attachment 2 information is tied to Section 2 of the Permit text, etc.). It should be noted that if a Section does not reference an Attachment then that Attachment number is not included as part of the permit application. For example, Section 13 does not reference an Attachment; therefore, there is no Attachment 13 in this permit application.

1.0 History of Construction, 845.230(d)(2)(A)

The history of construction of the CCR surface impoundment as specified in Section 845.220(a)(1) is presented below.

1.1 CCR Surface Impoundment Identifying Information

The identifying information associated with the CCR surface impoundments at the generating station are listed in the table below.

Name	Owner/Operator	Impoundment ID Number
East Ash Pond	Midwest Generation 804 Carnegie Center Princeton, NJ 08540	W0971900021-01
West Ash Pond	Midwest Generation 804 Carnegie Center Princeton, NJ 08540	W0971900021-02

1.2 Purpose of CCR Surface Impoundment

1.2.1 East Ash Pond

The East Ash Pond is used as a settling pond for sluiced CCR and other process water associated with the electrical power generating process at the Waukegan Station.

1.2.2 West Ash Pond

The West Ash Pond formerly served as a settling pond for sluiced CCR and other process water associated with the electrical power generating process at the Waukegan Station. As of April 11, 2021, the West Ash Pond is not in service and will not be used in the future for CCR storage.

1.3 CCR Surface Impoundment Length of Operation

1.3.1 East Ash Pond

The exact dates of the construction are unknown, but construction drawings for the East Ash Pond are dated 1977 and 1978. The East Ash Pond has operated since it was constructed per the dates of the drawings. Based on this, the East Ash Pond has been operating for approximately 43 years based on a construction year of 1978.

1.3.2 West Ash Pond

The exact dates of the construction are unknown, but construction drawings for the West Ash Pond are dated 1977 and 1978. The West Ash Pond has operated since it was constructed per the dates of the drawings. Based on this the West Ash Pond has been operating for approximately 43 years based on a construction year of 1978. The notification of Intent to Close the West Ash Pond was posted on April 9, 2021.

1.4 Type of CCR in Surface Impoundment

1.4.1 East Ash Pond

The types of CCR in the East Ash Pond are bottom ash, economizer ash, and boiler slag. The chemical constituents that make up the CCR is explained in further detail in Section 2.

1.4.2 West Ash Pond

Most of the CCR in the West Ash Pond has been removed. The types of CCR that were in the West Ash Pond are bottom ash, economizer ash, and boiler slag. The chemical constituents that make up the CCR is explained in further detail in Section 2.

1.5 Name and Size of the Watershed

The East Ash Pond and the West Ash Pond are located within the Waukegan River – Frontal Lake Michigan watershed, which is approximately 31,245 acres. The East Ash Pond and the West Ash Pond are constructed with elevated embankment crests or run-on diversion berms, which limits any surface water run-on into the ponds to the immediate area within the embankments.

1.6 Description of CCR Surface Impoundment Foundation

The Geosyntec October 2016 Federal CCR Rule History of Construction submittal summarized the foundations for the East Ash Pond and the West Ash Pond as follows:

"The East and West Ash Basins [Ponds] consist of fill embankments on all sides. Because no formational materials provide lateral structural support for the embankments, the basins do not contain abutments. The area west of the West Ash Basin [Pond] is at approximately the same elevation as the west embankment crest, such that there is not a downstream slope of the west embankment. A divider berm separates the two basins [ponds] and acts as the west embankment for the East Ash Basin [Pond] and the east embankment for the West Ash Basin [Pond]."

The following sections discuss the foundation materials' physical and engineering properties. KPRG reviewed the previously developed History of Construction for the East Ash Pond and the West Ash Pond, along with previously completed site investigations and concurred with Geosyntec's observations and conclusions.

1.6.1 Physical Properties of Foundation Materials

The East Ash Pond and the West Ash Pond are located directly above the Henry Formation. The physical properties of the foundation materials in which the East Ash Pond and the West Ash Pond are constructed from consists of dense poorly graded sand with some gravel and silt and silty sand. Beneath the Henry Formation is the Wadsworth formation, which consists of very hard low plasticity clay. This information was obtained from published geologic information and field investigations performed by KPRG (2005 and 2015), Patrick Engineering (2011), and Geosyntec (2015).

1.6.2 Engineering Properties of Foundation Materials

The engineering properties for the foundation materials listed in the following table are from the safety factor assessment performed by Geosyntec for the East Ash Pond and the West Ash Pond. The properties were determined from the site investigation, published correlations, and laboratory testing of samples collected during the site investigations.

Material	Unit Weight (pcf)	Drained friction angle (degrees)	Effective cohesion (psf)
Henry Formation	125	37	0

1.7 Description of the Construction Materials, Methods, and Dates

The descriptions of the construction materials, methods, and dates are based on the construction drawings created by NUS dated 1977 and 1978, the liner replacement drawing dated 2002, and the site investigations. As-built drawings and construction completion reports were not available for review at the time of preparing this operating permit. The drawings discussed in the following sections are located in Attachment 1.

1.7.1 Physical and Engineering Properties of Construction Materials

The East Ash Pond and West Ash Pond physical properties for the construction materials for this section are the same as the physical properties of the foundation materials. As described in Section 1.6.1, the physical properties for the foundation materials were described as poorly graded sand with some gravel and silt and silty sand.

Based on construction documents available from NUS in 1977 and 1978, dikes existed in the area prior to construction. During construction, these dikes were raised and widened with compacted fill material. The interior slopes and pond floor were originally lined with a geomembrane (Hypalon) liner. The Hypalon liner was removed and replaced with a 60-mil smooth high-density polyethylene (HDPE) geomembrane liner in 2003 and 2005 for the East Ash Pond and the West Ash Pond, respectively. Inspections of the liners in the summer of 2005 identified the geomembrane liner overtopped with a warning layer consisting of 12 inches of sand and 6 inches of limestone screenings.

Engineering properties used for the design and construction of the East Ash Pond and the West Ash Pond were not available. Engineering properties were estimated by Geosyntec for use in the factor of safety assessment performed for the East Ash Pond and the West Ash Pond. This estimate was based on site investigations, published correlations and laboratory testing of the embankment materials, which were presented in Geosyntec’s soil properties calculations. Those engineering properties are listed below:

Material	Unit Weight (pcf)	Drained friction angle (degrees)	Effective cohesion (psf)
Upper Fill	125	37	25
Lower Fill	115	32	25

To perform the analyses, Geosyntec divided the embankments into two different materials, Upper Fill and Lower Fill. The Upper Fill is defined as the material from the embankment surface to approximately 10 to 12 feet below the embankment top and the Lower Fill is defined as the material from the bottom of the Upper Fill to the foundation material. As identified in Section 1.6.1 above, the foundation material is the Henry Formation.

1.7.2 Construction Methods

Based on construction documents available from NUS, dated 1977 and 1978, dikes existed in the area prior to construction. During construction, these dikes were raised and widened with compacted fill. This compacted fill was required to be placed at 95% relative compaction and any unsuitable material identified within the existing foundations was specified to be removed based on the construction drawings.

The side slopes were designed with 2H:1V (horizontal:vertical) interior slopes and 2H:1V or shallower exterior slopes. During the replacement of the Hypalon liners in 2003 and 2005, the interior slopes were flattened to 2.5H:1V. 2015 aerial photography identified that the existing exterior/downstream slopes ranged from approximately 1.4H:1V to 3H:1V or shallower. In 2016, exterior slopes along the eastern and southeastern side of the East Ash Pond were flattened to 2H:1V.

1.7.3 Construction Dates

The available construction drawings created by NUS were approved in 1977 and 1978, with the East Ash Pond and the West Ash Pond being constructed shortly thereafter. As stated above, the original Hypalon liners were replaced with HDPE liners in 2003 and 2005 for the East and West Ash Ponds, respectively. The eastern and southeastern slopes of the East Ash Pond were modified in 2016 based upon inspections conducted by a third-party consultant. These inspections are discussed later in Section 1.13.

1.8 Detailed Dimensional Drawings

Detailed dimensional drawings for the ponds are provided in Attachment 1. Attachment 1-1 contains construction drawings prepared by NUS, dated 1977 and 1978. The drawing for the liner replacement prepared by Midwest Generation, dated 2002, are included in Attachment 1-2, and Attachment 1-3 contains the 2016 slope modifications construction drawings.

1.9 Instrumentation

Water level monitoring instrumentation was installed in the East and West Ash Ponds in 2016 along the pond (outboard) side of the concrete weir walls. Included in the instrumentation is ultrasonic level detectors with automated remote sensors that notify station operators of the pond water level conditions. Because West Ash Pond is not in service, process wastewater is not directed to it and the water in the pond is either rainfall or runoff.

1.10 Area-Capacity Curve

An area-capacity curve for each pond created by Geosyntec is included as Figure 1-1 and 1-2.

1.11 Spillway and Diversion Capacities and Calculations

The East and West Ash Ponds do not contain spillways.

1.12 Surveillance, Maintenance, and Repair Construction Specifications

Written specifications for the original construction of the ponds were not available for this application, but the original construction drawings are provided in Attachment 1-1. The written specifications for the earthwork and HDPE geomembrane for the liner replacement of the East and West Ash Ponds, performed in 2003 and 2005, respectively, are included in Attachment 1-4 and Attachment 1-5. Warning posts were installed at the toe of interior pond slopes above the geomembrane liner system in 2003 and 2005 as a visual guide to limit potential damage to the liner system. The technical specifications for the slope modification, which included earthwork and geosynthetics, of the East Ash Pond in 2016 are included in Attachment 1-6.

1.13 Record of Structural Instability

In 2002, Raymond Professional Group, Inc. (RPG) prepared a report of engineering study to propose repairs to the instabilities observed in the interior embankments of the ponds. During the liner replacements in 2003 and 2005, the recommendation of flattening the interior slopes to 2.5H:1V was completed.

In 2002 and 2003, RPG inspected the east and south embankments of the East Ash Pond. The inspections "indicated areas of undercutting and soft soil at the downstream toe of the embankment, observations of some seepage from the embankment, and localized erosion of the perimeter access road east of the East Ash Pond." These areas were addressed during the 2003 and 2005 liner replacement projects. These areas, as well as the eastern and southeastern slopes of the East Ash Pond, were re-graded in 2016.

In 2009, 2014, and 2015, Valdes Engineering, also hired by Midwest Generation, performed inspections of the East and West Ash Ponds and did not document any structural instability. The initial structural stability assessment completed pursuant to 40 CFR Part 257.73(c), dated October 2016, did not identify structural instabilities. Subsequent impoundment periodic inspections (inspections performed through 2020) did not identify any structural deficiencies that would affect the stability of the East Ash Pond and the West Ash Pond. The 2018 inspection identified an area of minor erosion that did not compromise the stability of the East Ash Pond and the station revegetated this area.

2.0 CCR Chemical Constituents Analysis, 845.230(d)(2)(B)

The East Ash Pond and the West Ash Pond both contained bottom ash, economizer ash, and boiler slag. This occurs because one pond is used at a time and the ponds' usage are alternated. When one pond was full, that pond was taken out of service for accumulated ash removal for off-site disposal, and during that time, the other pond was used for CCR accumulation. The CCR in the West Ash Pond was removed, and CCR is no longer sluiced to it. The CCR in the East Ash Pond and the West Ash Pond were sampled and analyzed and the results are shown in Table 2. The laboratory data package is included in Attachment 2.

3.0 Chemical Constituents Analysis of Other Waste Streams, 845.230(d)(2)(C)

According to the Alternate Closure Demonstration, Waukegan has not sent CCR or non-CCR waste streams to the West Ash Pond as of April 11, 2021, and does not plan to send any waste streams to that basin in the interim.

Midwest Generation has submitted a request to the USEPA to continue sending all CCR and non-CCR waste streams to the East Ash Pond while they develop alternative capacity to replace the East Ash Pond. The request is under USEPA review. Currently, the East Ash Pond is receiving waste streams from the following:

- Unit 7 and Unit 8 ash sluice water;
- Overflow from the Unit 7 Ash Sluice Overflow Tank;
- Overflow from the Station's Coal Yard Runoff Basin;
- Effluent from the Station's Main Collection Tank.

The waste stream from the Unit 7 and Unit 8 ash sluice water and the overflow from the Unit 7 Ash Sluice Overflow Tank are the CCR waste streams currently entering the East Ash Pond. The overflow from the station's coal yard runoff basin and the effluent from the station's main collection tank are non-CCR waste streams.

The chemical constituents from the non-CCR waste streams listed in the previous paragraph are anticipated to be total suspended solids (TSS) and oil and grease as based on the sampling requirements in the stations NPDES Permit No. IL0002259. The Waukegan Flow Diagram is included in Attachment 3.

4.0 Location Standards Demonstration, 845.230(d)(2)(D)

4.1 Placement Above the Uppermost Aquifer

According to the Location Restrictions Compliance Demonstration performed by Geosyntec dated October of 2018, The East and West Ash Basins are so located that there will not be intermittent, recurring, or sustained hydraulic connection between any portion of the base of the Basins and the uppermost aquifer due to normal fluctuations in groundwater elevations. Therefore, the locations of the East and West Ash Pond comply with Section 845.300. This determination is included in Attachment 4. KPRG concurs with this determination.

4.2 Wetlands

According to the Location Restrictions Compliance Demonstration performed by Geosyntec in October of 2018, the East Ash Basin and the West Ash Basin are not located in mapped wetlands included in the National Wetlands Inventory-Version 2 presented by the U.S. Fish and Wildlife Service (USFW) [USFW, 2018]. Therefore, the locations of the East and West Ash Ponds comply with Section 845.310. This determination is included in Attachment 4. KPRG concurs with this determination.

4.3 Fault Areas

According to the Location Restrictions Compliance Demonstration performed by Geosyntec in October of 2018, the East Ash Basin and West Ash Basin are not located within 200 feet (60 meters) of a mapped Holocene-aged fault, as mapped by the United States Geological Survey (USGS) Quaternary Fault Database [USGS, 2018]. Therefore, the locations of the East and West Ash Ponds comply with Section 845.320. This determination is included in Attachment 4. KPRG concurs with this determination.

4.4 Seismic Impact Zones

According to the Location Restrictions Compliance Demonstration performed by Geosyntec in October of 2018, the East Ash Basin and West Ash Basin are not located within a seismic impact zone" as defined in Section 845.120 "and as mapped by the United States Geological Survey (USGS) [USGS, 2014]. Therefore, the locations of the East and West Ash Ponds comply with Section 845.330. This determination is included in Attachment 4. KPRG concurs with this determination.

4.5 Unstable Areas

According to the Location Restrictions Compliance Demonstration performed by Geosyntec in October of 2018, the East Ash Basin and the West Ash Basin are not located in unstable areas [Geosyntec, 2016]. Therefore, the locations of the East Ash Pond and the West Ash Pond comply with Section 845.340. This determination is included in Attachment 4. KPRG concurs with this determination.

4.6 Floodplains

The East Ash Pond and West Ash Pond are not located in a floodplain according to the National Flood Hazard Layer FIRMettes Map No. 17097C0089K and Map No. 17097C0095K as mapped by the Federal Emergency Management Agency. Therefore, the locations of the East Ash Pond and the West Ash Pond comply with Section 845.340. The relevant FIRMettes are located in Attachment 4.

5.0 Permanent Markers, 845.230(d)(2)(E)

The permanent markers in accordance with 35 Ill. Adm Code 845.230(d)(2)(D) have been installed. Photographic documentation of this requirement is included in Attachment 5.

6.0 Incised/Slope Protection Documentation, 845.230(d)(2)(F)

The East and West Ash Ponds were constructed with fill embankments on all sides. The area west of the West Ash Pond is at approximately the same elevation of the pond's west embankment crest, which means there is little to no downslope on the west embankment. The northern and southern exterior downstream slopes of the ponds' embankments are covered with established vegetation and a retaining wall is present. The eastern exterior downstream embankment of the East Pond is covered with vegetation that was placed as part of a reconstruction project that occurred in 2016. The eastern embankment of the West Pond and the western embankment of the East Pond are the same embankment that divides the two ponds. These embankments are the interior embankments of their respective pond and are covered with a geomembrane liner. The established vegetation is adequate to protect the slopes of the ponds in accordance with 845.430(b). Photo documentation is included in Attachment 6.

7.0 Emergency Action Plan, 845.230(d)(2)(G)

The Emergency Action Plan for the East and West Ash Ponds were completed by Civil and Environmental Consultants, Inc. (CEC) to comply with 40 CFR Part 257 to identify safety emergencies and the proper responses in relation to each basin. KPRG reviewed the EAP for compliance with Section 845.520. KPRG's review ensured that all the necessary sections required by Section 845.520 are included within the EAP. This review neither accepts nor rejects the safety emergencies identified by CEC. The safety emergencies identified along with the responses are the product of CEC and seem reasonable to KPRG. KPRG has not altered the safety emergencies or the responses associated with each emergency.

The Emergency Action Plan ("EAP") is included in Attachment 7. This plan was originally developed in April 2017 by CEC and was reviewed and updated by KPRG for compliance with Section 845.520. The only update necessary was to revise the contacts list included in the EAP. In accordance with 845.520(e), a certification of compliance is included in Attachment 7.

8.0 Fugitive Dust Control Plan, 845.230(d)(2)(H)

The Fugitive Dust Plan is included in Attachment 8. This plan was originally developed in September 2015 and was reviewed and updated in October 2021 by KPRG for compliance with Section 845.500(b). Updates include references to 35 Ill. Adm. Code 845.500(b), updated the station contact, and updated reporting requirements. The attached Fugitive Dust Plan complies with Section 845.500(b).

9.0 Groundwater Monitoring Information, 845.230(d)(2)(I)

9.1 Hydrogeologic Site Characterization

The following subsections provide information on the geology and hydrogeology of the site as required under Section 845.620(b). Site geology and hydrogeology are discussed separately below. Referenced Tables and Figures are provided at the end of this report. Other supporting documentation is provided with the referenced Attachment.

9.1.1 Geology

The physiography of Lake County is made up of moraines, outwash plains, lake plains, kames, stream terraces, flood plains, beaches and bogs. It is in the Wheaton Morainal country of the Great Lakes section of the Central Lowland province with the natural topographic relief being primarily associated with differences in deposition thickness resulting from the most recent glaciation. Near surface soils in the general vicinity of the subject impoundments have been grouped as the Orthents loamy, undulating. These soils are well drained with organic content ranging from 0.2 to 2 percent. They have a moderate corrosivity rate and a pH range from slightly acidic to slightly basic (5.6 to 8.4). Surface runoff class is medium (Soil Survey of Lake County Illinois). Based on the Surficial Geology Map of the Chicago Region (ISGS Circular No. 460, 1971) the surficial deposits in the vicinity of the subject surface impoundment are identified as part of the Henry Formation which is generally described as sand and gravel with local beds of silt and/or exposed Silurian dolomite bedrock.

The general stratigraphy in the area of the generating station consists of fill surrounded by Henry Formation Parkland facies sediments intermixed with Grayslake peat, muck, marl and organic rich sediments. Local beach sand deposits include fine to medium, well-sorted sands mixed with organics and may include lenses of clay and peat (Surficial Geology of the Zion Quadrangle, 2009; Surficial Geology of the Waukegan Quadrangle, 2010). These unconsolidated deposits overlay Silurian dolomite with top of bedrock estimated between 90 and 115 feet below ground surface (bgs). The Silurian dolomite is underlain by the Maquoketa Group, which includes the Scales Shale which is considered a regional aquitard separating the overlying Silurian dolomite from the deeper Cambro-Ordovician sandstone and limestone aquifers.

To evaluate local stratigraphy, logs were obtained for borings in the vicinity of the Waukegan Generation Station (it is noted that all of these log locations are upgradient or side gradient of the Station and include two wells on property [see Section 9.1.2]). The depths of these borings range from 9.5 feet to 1,540 feet. The stratigraphic data from these borings is summarized in Attachment 9-1. In addition, well logs from 10 monitoring wells that were installed in the vicinity of the subject surface impoundment (MW-1 through MW-9 and MW-16; see Figure 9-1) were evaluated, with those borings ranging in depth from 18 feet to 32 feet. This information is also included in Attachment 9-1. Boring logs for these monitoring wells are included in Attachment 9-2. It is noted that monitoring wells MW-10 through MW-15 were installed by another company as part of Environmental Land Use Control (ELUC) definition associated with a site investigation of the former Giess-Pfleger Tannery site investigation/remediation, located immediately west of the Waukegan Generation Station, which extended onto the facility property. Several Freedom of Information Act (FOIA) requests have been submitted to Illinois EPA for the logs for these wells, however, to date those files are not available. Therefore, KPRG completed soil borings to 15 feet bgs at each location to develop the stratigraphic logs for each of these well locations. These boring logs are included in Attachment 9-2.

Based on an evaluation of on-site monitoring well logs, the following general site-specific stratigraphy is defined and geologic cross-sections are provided as Figures 9-2 and 9-5 based on the on-site monitoring well boring logs:

- Fill (9.5’ to 24’ thick) – Consisting of brown and black fine to medium sand with some gravel and silt seams. The fill includes ash, black cinders, slag and occasional coal and wood fragments.

- Organic clayey silts, silty sand and/or peat (0’ to 3.5’ thick) – Localized, discontinuous lenses of organic black to gray clayey silts and silty sands or peat separating the fill from underlying sand.

- Sand (thickness undetermined; borings terminate within unit) – Consisting of generally light brown to brown or gray, well graded, fine to medium sands with some localized more gravelly seams/layers.

Based on a review of three old water well boring logs (1920 vintage) obtained from the Johns-Manville site located immediately to the north of the Waukegan Generating Station (see Attachment 9-1, Well Count Numbers 10, 62 and 63), the above noted sand unit is underlain by 25 to 30 feet of “hard pan”, another 40 to 50 feet of lacustrine clays (blue clay) and 3 to 15 feet of sand/gravel at which point top of bedrock was documented.

Although no specific chemistry information is available for the Henry Formation deposits, the sands in the area tend to be dominated by quartz, feldspars and micas and include whole rock fragments associated with glacially derived erratics (including igneous, metamorphic and sedimentary). With depth, it would be anticipated to see an increase in calcareous fragments associated with the underlying dolomite bedrock.

The underlying Silurian dolomite is estimated at approximately 360 feet thick (Patrick Engineering, 2011). Beneath the Silurian dolomite is the Ordovician age Maquoketa Group including the Scales Shale, which is a recognized regional aquitard which hydraulically isolates the deeper bedrock aquifers from the shallower Silurian dolomite.

Silurian dolomite is a calcium-magnesium carbonate rock that includes horizons of cherty (silica) nodules and is documented both regionally and locally to include mineralization along fractures and within vugs. The mineralization includes, but is not limited to calcite (calcium carbonate) and various sulfide minerals such as pyrite, marcasite, etc. As such, the presence of these minerals and associated weathering products can also be expected within the overlying unconsolidated materials.

There are no underground mines beneath the subject CCR surface impoundment.

9.1.2 Hydrogeology

Based on information from the Soil Survey of Lake County, the average annual precipitation is approximately 34 inches with about 60% of that total falling between May and October of any given year. The average seasonal snowfall is approximately just over 37 inches. More site-proximal precipitation data is provided in Table 9-1.

The nearest surface water body is Lake Michigan located to the east of the subject CCR units (see Figure 9-1). Groundwater beneath the subject unit occurs under water table conditions. Saturated conditions in the immediate vicinity of the subject surface impoundments (wells MW-1 though MW-5, MW-7 and MW-16) range from between approximately 11.75 and 24.61 feet bgs, depending on the well location. Wells to the west along the western property border have shallower groundwater (e.g., well MW-6 located adjacent to a drainage channel). Table 9-2 provides groundwater elevation measurements obtained for the on-site monitoring wells in the vicinity of the subject CCR surface impoundment which includes data for the CCR monitoring wells associated specifically with the subject impoundments (MW-01 though MW-04, MW-09, MW-11, MW-14 and MW-16). A hydrograph of water levels is provided as Figure 9-6. A review of the hydrograph shows some temporal fluctuations with the highest water levels generally occurring in the spring timeframe (April thru June).

Groundwater flow maps for the four quarters from 3rd quarter 2020 through the 2nd quarter 2021 are provided as Figures 9-7 through 9-10. The maps include groundwater elevation data from all 15 wells in the area, including the specific CCR monitoring wells associated with the subject surface impoundment. Based on a review of the maps groundwater flow is in an east-southeasterly direction. These maps are consistent with historical flow data for the site. Table 9-3 provides a summary of the flow direction, gradient and an estimated rate of groundwater flow for each sampling event. The flow rate was calculated using the following equation:

$$V_s = \frac{\mathrm{K}dh}{n_e dl}$$

Where

V_s = seepage velocity (distance/time)
K = hydraulic conductivity (distance/time)
dh/dl = hydraulic gradient (unitless)
n_e = effective porosity (unitless)

Hydraulic conductivity values were initially estimated for monitor wells MW-1, MW-3 and MW-5 from slug tests completed by Patrick Engineering in 2011. The geometric mean of the data for these wells was approximately 350 feet per day (ft/d; 4.05 $\times 10^{-3}$ ft/sec) for each well, as calculated by Patrick Engineering (Hydrogeologic Assessment Report – Waukegan Generating Station, February 2011). The slug test data were reviewed as part of the modeling study being completed for the Construction Permit application and the data were reanalyzed using corrected input values for the well casing and borehole dimensions, effective porosity of the sand filter pack material and minor line fitting refinement. The revised geometric mean of the test data for these wells decreased to approximately 155 ft/d (1.79$\times 10^{-3}$ ft/sec) for each well. This revised value was used in Table 9-

3. The estimated effective porosity of the aquifer materials (0.35) was obtained from literature (Applied Hydrogeology, Fetter, 1980).

At this time, based on the geology discussion in Section 9.1.1 and the site-specific hydrogeology discussions above, the groundwater beneath the CCR surface impoundment is considered as Class I Potable Resource Groundwater in accordance with Section 620.210. However, an ELUC is established where the CCR surface impoundments are located as part of a Compliance Commitment Agreement (CCA) between Midwest Generation and Illinois EPA. The ELUC states that the groundwater shall not be used as potable water. The extent of the established and approved ELUC is provided on Figure 9-11.

The Waukegan Station does not have any potable water supply wells on the property. All water used at the Station is obtained from Lake Michigan. A survey of potable water sources within a 2,500 feet radius of the Midwest Generation Waukegan Generating Station was completed by Natural Resources Technology (NRT) in 2009. The following databases and sources of information were utilized in order to determine community water source and water well locations and construction in the vicinity of the ash pond wastewater treatment systems:

- Illinois State Geological Survey (ISGS) -Water Well Database Query;
- Illinois State Water Survey (ISWS) Private Well Database and water well construction report request; and
- Illinois Division of Public Water Supply web-based Geographic System (GIS) files;

As part of this permit preparation, KPRG evaluated the NRT information and reviewed the new Illinois State Geological Survey database and interactive map references as “ILWATER”. The survey results are provided on Figure 9-12. There are no potable use water wells downgradient of the subject surface impoundments. Two water wells were identified within a 2,500-foot radius of the Station's subject CCR surface impoundment. The two wells noted to the west (upgradient) of the subject site on Figure 9-12 are former Giess-Pfleger Tannery wells circa 1917 vintage. The tannery and these wells are also no longer present. It is noted that the above-mentioned NRT evaluation identified two water wells to the north-northwest (upgradient), which would be just past the 2,500-foot radius shown on Figure 9-12. Those wells were owned by the Johns-Manville Corporation and were circa 1920 vintage. They are no longer present (entire Johns-Manville site decommissioned as part of a cleanup).

A search of the Illinois Department of Natural Resources dedicated nature preserve database (https://www2.illinois.gov/dnr/INPC/Pages/NaturePreserveDirectory.aspx) was performed to determine whether there may be a nearby-dedicated nature preserve. There were no identified dedicated nature preserves in the immediate vicinity of the subject surface impoundments. Illinois Beach State Park is located approximately three-quarters of a mile to the north.

Based on the geology of the site presented in Section 9.1.1 and the above hydrogeology discussions, the primary contaminant migration pathway for a potential release from the subject CCR surface impoundment would be downward migration to groundwater within the unconsolidated sandy aquifer. Due to its proximity to Lake Michigan, which is a hydrogeologic flow boundary, minimal to no downward vertical flow mixing would be anticipated. There are no other utility or man-made preferential pathway corridors that would act to potentially intercept the flow to move any contamination in a direction other than to east-southeast. There are no potable water wells downgradient of the subject CCR surface impoundment as previously discussed. The City of Waukegan does obtain its drinking water from Lake Michigan. The water utility is located approximately one mile south of the subject surface impoundments. A Freedom of Information Act (FOIA) request was made to the utility for an approximate location of the water intakes within the lake, however, the request was denied due to security reasons.

There is quarterly groundwater quality data associated with the subject CCR surface impoundments dating back to December 2010. However, the parameter list established in 2010 was slightly different from that specified in Section 845.600 and also included analysis of dissolved inorganic parameters rather than total inorganic parameters. That historical water quality data is provided in Attachment 9-3. These historical data tables include monitoring data from 2010 through fourth quarter 2016 which included dissolved parameter analysis and then from first quarter 2017 through second quarter 2021 which included a slightly different list of parameters associated with a construction modification permit issued by Illinois EPA.

The East and West Ponds are subject to the federal requirements under Federal Register, Environmental Protection Agency, 40 CFR Parts 257.94, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule dated April 17, 2015 (Federal CCR Rule). As required under the Federal CCR Rule, eight rounds of background sampling were completed for the monitoring wells within the monitoring network for the subject CCR surface impoundment (MW-01 though MW-04, MW-09, MW-11, MW-14 and MW-16). Wells MW-09, MW-11 and MW-14 are considered upgradient monitoring wells and the remainder of the monitoring points are downgradient wells. This sampling included the full list of Appendix III (detection monitoring) and IV (assessment monitoring) parameters. Subsequently, quarterly groundwater monitoring of these wells was continued for only Appendix III detection monitoring parameters since there were no detections of Appendix III parameters above the established statistical background for those wells and/or an Alternate Source Demonstrations (ASDs) were completed indicating a source of impacts other than the subject surface impoundments. Since the effective date of the State CCR Rule, quarterly groundwater monitoring for the full list of parameters specified in 845.600, which includes all parameters in the Federal CCR Rule Appendix III/IV, has continued. This data is provided in Table 9-4. In addition, it is noted that Illinois EPA added turbidity measurements to the list with a required eight rounds of background of that parameter for each well in the monitoring network for the subject CCR surface impoundment. This data is provided in Table 9-5.

9.2 Groundwater Monitoring System Design and Construction Plans

A comprehensive monitoring well network in the vicinity of the East and West Ponds was established in 2010, the CCA, as well as other work in the area (e.g., the ELUC wells installed as part of Giess-Pfleger Tannery site investigation/remediation located immediately west of the Waukegan Generation Station). The well spacing for the downgradient wells was developed as part of a previous hydrogeologic assessment. The well depths were determined based on depth to groundwater and the base elevations of the ponds being monitored and were approved by Illinois EPA. Groundwater flow in the area is generally to the east-southeast towards Lake Michigan. Monitoring wells MW-09, MW-11 and MW-14 (see Figure 9-1) are the established upgradient water quality monitoring points. Groundwater data from these wells will be evaluated to provide a statistically representative upgradient water quality prior to that water passing beneath the regulated units. Wells MW-01 through, MW-04 and MW-16, which are located essentially at the pond boundaries, will serve as down-gradient monitoring points. This proposed monitoring well network will be utilized for determining whether potential pond leakage may be causing or contributing to groundwater impacts in the vicinity of the units. Other monitoring wells in the area may be used for subsequent supplemental evaluations, as needed.

Monitoring wells MW-01 through MW-04 were installed in 2010 by Patrick Engineering, Inc. and wells MW-09 and MW-16 were installed by KPRG and Associates, Inc. in 2014 and 2015, respectively. The wells were drilled using 4.25-inch hollow stem augers. The wells were completed with standard 2-inch inner-diameter PVC casing with 10-feet of 0.010 slot PVC screen. Filter sand pack around each screen was extended to approximately 2-feet above the top of the well screen. The remainder of the annulus was backfilled with bentonite. Current surface completions include stick-up (above grade two to three feet) locking protector casings set in concrete aprons. The wells are further protected by traffic bollards, as necessary. Boring logs and well construction summaries for these wells are provided in Attachment 9-2. Ground surface and top-of-casing elevations were surveyed by an Illinois licensed surveyor and are included in the previously referenced groundwater elevation table (Table 9-2). As previously stated, monitoring wells MW-11 and MW-14 were installed by another company as part of ELUC definition associated with a site investigation of the former Giess-Pfleger Tannery site investigation/remediation, located immediately west of the Waukegan Generation Station, which extended onto the facility property. Several FOIA requests have been submitted to Illinois EPA for the logs for these wells, however, to date those files are not available. Therefore, KPRG completed soil borings adjacent to the wells at each location to develop the stratigraphic logs for each of these well locations (see Attachment 9-2). Well MW-11 is completed with an above ground protective casing and well MW-14 is completed as a flush-mount well.

Each monitoring well within the sampling network is outfitted with a dedicated sampling system. Specifically, each well has a QED Environmental Systems (QED) Well Wizard Model P1101M dedicated sampling pump with Model No. 37789 intake screens (0.010-inch slot). The screens are set within approximately one-foot of the base of the monitoring well.

In accordance with requirements under Section 845.630(g), Attachment 9-4 includes an Illinois licensed Professional Engineer certification of the above-defined monitoring system.

9.3 Groundwater Sampling and Analysis Program

9.3.1 Sample Frequency

The East and West Ponds are regulated under the Federal CCR Rule. As such, all of the above defined monitoring wells (upgradient and down-gradient) have been sampled on a quarterly basis starting the 4^{th} quarter of 2015 for eight consecutive quarters for both Appendix III and Appendix IV parameters specified in the Federal CCR Rule which is the same parameter listing as provided under the State CCR Rule Section 845.600(a). This dataset will facilitate the development of proper statistical evaluation procedures for the site and use in development of applicable GWPSs for each constituent pursuant to Section 845.600(b). Illinois EPA added turbidity as an additional parameter that will require development of a statistical background. Since this parameter was not included within the Federal CCR Rule, eight rounds of turbidity measurements were obtained within the 180-day period since the effective date of the State Rule. However, this restricted period of background data collection does not facilitate evaluation of potential seasonal variations during the development of statistical background for this parameter.

Currently, all wells within this CCR monitoring network are being sampled on a quarterly basis for all parameters specified in Section 845.600(a) plus calcium and turbidity. Between quarterly monitoring events, monthly groundwater level measurements from all designated CCR monitoring wells will be also obtained and recorded. The subject ponds are outfitted with ultra-sonic transducers, which provide for a measure of water within the impoundments. A survey reference point will be established to facilitate conversion of the water level readings to elevations for recording concurrent with monthly water level measurements.

Quarterly groundwater monitoring will continue during the active life of the impoundment and the post-closure care period or, if closure is by removal, then in accordance with monitoring frequency requirements under Section 845.740(b). It is noted that if after 5 years of quarterly monitoring it can be demonstrated that the facility meets the requirements specified in Section 845.650(b)(4), the owner can petition Illinois EPA to shift the monitoring frequency to semi-annual.

9.3.2 Sampling Preparation and Calibrations

Prior to any sampling event, the Station's designated Environmental Specialist shall be notified in advance of sampling crew arrival so that any arrangements can be made, including security clearance and training.

Prior to sampling activities, and at intervals recommended by the manufacturer, all non-dedicated equipment shall be cleaned and calibrated. Specifically, the field parameter water quality meter to be used for pH, specific conductance, turbidity and temperature will be calibrated using standard reference solutions. In addition, an operational check of the electronic water level probe will also be performed by placing the probe into a bucket of water and ensuring that the audio signal is triggered when the sensor meets the water interface. The associated tape measure of the probe will also be checked for wear.

The monitoring network consists of all dedicated sampling equipment (QED Well Wizard P1101M). The controller used to operate individual bladder pumps will be checked and maintained prior to arrival at the site based on manufacturer specifications.

All lab ware shall be obtained directly from an Illinois certified laboratory. Upon arrival to the site, the monitoring wells will be assessed for structural integrity. Each well cover (either stick-up or flush mount) will be inspected for proper labels, locks, any damage and be cleared of any flora or fauna that may be on the well or in the vicinity that would affect the sample or the sampling operation. In addition to any other notable observations, all of the above shall be entered on the sampling sheets. Once the well is uncovered and unlocked, and the well casing inspected, the wellhead shall be inspected for damage and cleanliness. At that point, the well will be considered ready for sampling per procedures described below.

9.3.3 Groundwater Sample Collection

Prior to initiating sampling, a round of groundwater levels will be collected from each monitoring well using an electronic water level probe. The timeframe over which these water levels are collected should be minimized and should not exceed 8 hours. The depth to water will be measured to the nearest one-hundredth of a foot from the top of casing using an electronic water level meter. The water level probe should be properly decontaminated between each reading using procedures specified in Section 9.3.4.

All of the monitoring wells at this Station are equipped with dedicated, down-hole, bladder pumps. At the top of casing for each well is a manifold with air and water quick connects and a port for a water level meter probe to fit so that an undisturbed water level can be obtained. Immediately prior to sampling, the depth to water will be measured again to the nearest one-hundredth of a foot from the top of casing using an electronic water level indicator and recorded onto the sampling sheets. Once recorded, an air compressor and flow controller will be attached to the air-side quick connect and disposable tubing attached to the discharge connection. The discharge tubing will be run to a flow-through cell of the water quality meter. A discharge line from the flow-through cell will be placed into a vessel to allow for the measurement of the volume of groundwater removed. The water quality meter will be attached within the flow-through cell that allows for real time readings of pH, specific conductivity and temperature. It is noted that a calibration check of the water quality meter should be performed at the start and end of each day of sampling and recorded in the field notes. If the meter calibration-check shows drift outside of manufacturer specifications, the meter should be recalibrated in the field using standard solutions per manufacturer requirements.

The air controller will be set to the necessary pressure and to the slowest pumping interval, approximately 50 second refill and 10 second pump (flow rates at this setting tend to be less than 100 milliliters/minute), and the compressor will be started. The intent of the low flow pumping will be to minimize drawdown in the well with an ideal goal of keeping the drawdown to 0.30 feet or less. Once the water has filled the flow-through cell, a reading of the parameters will be recorded. Readings will continue to be recorded until such time as all parameters are deemed stable for three consecutive measurements at which point a sample will be collected from the tubing prior to the flow-through cell. An unfiltered groundwater sample shall be collected directly from the water tubing after it is disconnected from the flow-through cell. The laboratory provided bottles shall be properly filled. Once the sample is collected, the bottles shall be properly labeled and placed on ice as necessary.

If the well would pump dry prior to stabilized field parameter readings, the well will be allowed to recover for up to 24-hours at which point water sample collection will be initiated.

In the event that a dedicated bladder pump fails to work, the following procedures should be implemented:

- Pull the dedicated tubing and pump from the well and ensure that the tubing does not come in contact with the ground.

- Visually inspect the intake of the pump for clogging from sedimentation. If clogging is noted, clean the intake with distilled water. If there is no clogging, dismantle the pump casing and inspect the bladder for any holes, cracks or tears.

- If the bladder is determined to be compromised (i.e., wear has resulted in cracking or tearing), remove the bladder and replace it with a new bladder. Properly clean all parts of the pump using procedures described in Section 9.3.4, reassemble the pump and slowly lower it back down hole. Continue sampling as described above.

- If the entire pump is determined to have failed, a new pump will need to be ordered for replacement and a modified sampling procedure will be implemented as described below.

In the case of bladder pump failure at a specific well during a sampling event, the alternate sampling method will be the use of a portable peristaltic pump (the pump itself does not go down-hole) assuming depth to water is less than 23 feet bgs. Clean disposable polyethylene tubing will be attached to the pump and the tubing will be slowly lowered down hole along with the water level probe. The pump will be operated at the lowest rate possible to achieve the same goals as for sampling described above (generally below 300 milliliters/minute, which is within the range of standard low flow protocols). Water will be collected in a clean glass jar for field parameter readings. Once stable field parameters are recorded, the sample will be collected directly into laboratory prepared containers for analysis. Upon completion of sample collection, the water level meter and tubing should be removed from the well. The polyethylene tubing should be disconnected from the pump and discarded. The water level meter should be properly decontaminated as specified in Section 9.3.4. If depth to water is such that a peristaltic pump cannot be used, a submersible pump will need to be used. The submersible pump must be properly cleaned as specified in Section 9.3.4 prior to placement down the well. All subsequent procedures will be the same as above. The alternate sampling pump use will be recorded on the field data sheet for that well and noted in any subsequent reporting summary.

9.3.4 Equipment Decontamination

Any equipment that is used down-hole at more than one sampling location must be thoroughly decontaminated between uses. Based on procedures described above, only the water level meter is anticipated to be in this category, however, if a submersible pump needs to be used during a particular sampling event due to dedicated pump failure (see Section 9.3.3), these procedures will also apply. The water level meter probe and any measuring tape, or any other non-dedicated equipment that may need to be placed down the well, that extended below the water surface, will need to be cleaned with an Alconox solution, or equivalent, wash followed by a double rinse with distilled water. Any pump tubing that is not dedicated should be discarded and only clean tubing should be used down-hole.

9.3.5 Sample Preservation, Chain-of-Custody and Shipment

Since measurement of total recoverable metals is required by the State CCR Rule, the samples will not be filtered prior to collection. This will facilitate the analysis to capture both the particulate fraction and dissolved fraction of metals in natural groundwater. Groundwater samples will be collected directly into Illinois certified laboratory provided containers. Those containers will be prepared by the laboratory to contain any necessary chemical preservation. The samples shall be stored at temperatures required by the lab following sample collection. Table 9-6 includes a summary of sample bottle requirements, preservatives and holding times

All groundwater samples collected shall be transferred to the laboratory under proper COC procedures. The laboratory provided COC, completed with all pertinent information, shall be maintained from sample collection through receipt by the laboratory. The information shall include, but is not limited to, the following:

- project name and number, state samples collected in, sample name and type, time and date collected, analysis requested, and printed name and signatures of person(s) sampling.

The COC shall be completed and properly relinquished by the field sampler(s) with all samples clearly printed or typed.

All samples will be either delivered directly to the laboratory or be shipped using Federal Express or a similar overnight service. It should be noted that Total Dissolved Solids (TDS) analysis has a 7-day holding time. TDS samples should be shipped to the laboratory within 72 hours after collection. All other holding times for the specified parameters are long enough to facilitate one shipment after the full round of sampling is complete.

9.3.6 Analytical Methods

A list of the analytical methods to be used by the laboratory for each specified parameter is included in the above referenced Table 9-6. Individual detection limits for the parameters may change slightly from sample to sample depending on potential matrix interferences with a sample (e.g., amount of suspended solids/sediment) and/or the concentration of the constituent in the sample. However, the base detection limits will be set below the applicable Illinois Class I Drinking Water Standards as defined in Section 845.600(a)(1) for that compound which are also provided in Table 9-6.

9.3.7 Quality Assurance and Quality Control

Laboratory

Only an Illinois certified analytical laboratory will be used for sample analysis. The laboratory will be conducting their work under their specific approved Quality Assurance and Quality Control (QA/QC) program. A copy of their program can be available upon request. A standard Level II data documentation package will be included in all subsequent reporting, however, the lab will be requested to also provide a Level IV data documentation package (i.e., U.S. EPA Contract Laboratory Protocol equivalent) in the event more detailed data validation/evaluation is deemed necessary.

Field

The QA/QC program for fieldwork will include the collection of blind duplicates and the use of a laboratory supplied trip blank. The blind duplicate will be collected from a random well during every sampling event in which more than three (3) samples are collected. The duplicate will be blind in the manner that there will be no way for the laboratory to determine from which well or point the sample was collected.

Upon receipt of the analytical data, a determination will be made if the duplicate is consistent with the sample collected from the well/point. A generally acceptable range for groundwater samples is +/- 30 percent. If outside the acceptable range, a resample may be determined to be necessary and reanalyzed. The trip blank analytical data will be reviewed for any values other than non-detect. If there are any questions regarding the duplicate, trip blank, or other reported analytical QA/QC runs, the laboratory will be contacted to determine the effect on data quality, if any, and usability. If necessary, a specific well may need to be re-sampled.

9.3.8 Statistical Methods
A proposed statistical evaluation plan meeting the requirements specified in Section 845.640(f) is provided in Attachment 9-5 along with a certification of the plan by an Illinois licensed Professional Engineer.

9.4 Groundwater Monitoring Program Section

The groundwater sample and water level collection frequency is discussed in Section 9.3.1 above.

As previously noted, the monitoring well system for the subject unit consists of following monitoring wells:

- MW-09, MW-11 and MW-14 – Upgradient
- MW-01 through MW-04 and MW-16 – Downgradient

Eight rounds of background sampling for the purposes of statistical evaluation and background determination is available from the initial groundwater sampling which occurred starting in 2015 in compliance with the Federal CCR Rule requirements. Subsequent groundwater sampling has also occurred on a quarterly basis for the seven detection monitoring parameters listed under Appendix III of the Federal CCR Rule detection monitoring requirements. All available CCR monitoring data through the end of the second quarter 2021 is summarized in Table 9-4 and the eight (8) rounds of turbidity data collected since the enactment of the State CCR Rule in April 2021 in Table 9-5.

Using the currently available data for the subject CCR surface impoundments, site specific Groundwater Protection Standards (GWPSs) have been established in accordance with Section 845.600(b) and are summarized in Table 9-7. The background concentrations noted in Table 9-7 were calculated using the statistical evaluation approach noted in Section 9.3.8 and provided in Attachment 9-5. A presentation of the statistical evaluations which resulted in the background concentration calculations is provided in Attachment 9-6.

Once the proposed GWPSs presented in this permit application are approved by Illinois EPA, these values will be used for all subsequent groundwater monitoring data comparisons. Monitoring will continue on a quarterly basis for all constituents specified in Section 845.600(a)(1) plus calcium and turbidity. In accordance with Section 845.610(b)(3)(D), a data summary report will be submitted to Illinois EPA within 60-days of receipt of all analytical data which will include a groundwater flow map for the quarterly sampling event, summary of water level elevations collected during the reporting period (monthly measurements), and a data summary including summary data tables with a comparison against the established/approved GWPSs. This report must be placed the facility's operating record.

If during a monitoring event, a constituent(s) is/are detected above an established/approved GWPS, that well will be resampled for the specific constituent(s). If the resample data confirms that the constituent(s) concentration(s) is/are above the GWPS then the following will occur:

- Characterize the nature and extent of the potential release and any relevant site conditions that may affect the remedy evaluation/selection. This characterization must meet the requirements set forth under Section 845.650(d)(1).

- If groundwater impacts extend off-site, provide off-site landowner/resident notifications as specified under Section 845.650(d)(2) and place the notifications into the facility's operating record. This must occur within no more than 30-days of determination that a GWPS has been exceeded.

- An Alternate Source Demonstration (ASD) may be initiated and completed for submittal to Illinois EPA review/approval as allowed under Section 845.650(e). Place the ASD into the facility's operating record.

- Within 90-days of determining that a constituent(s) was detected above an established/approved GWPS at a downgradient waste boundary monitoring point, initiate an assessment of corrective measures meeting the requirements specified under Section 845.660 unless an ASD is submitted in accordance with Section 845.650(d)(2) and subsequently approved by the Illinois EPA.

By no later January 31st of each year, an Annual Groundwater Monitoring and Corrective Action Report will be prepared for inclusion as part of an Annual Consolidated Report for the facility. The Annual Groundwater Monitoring and Corrective Action Report will meet the requirements set forth under Section 845.610(e)(1 through 4). The Annual Consolidated Report will be placed into the facility's operating record.

10.0 Written Closure Plan, 845.230(d)(2)(J)

10.1 East Ash Pond

The East Ash Pond will be closed with the CCR remaining in place and constructing a final cover system in accordance with Section 845.750. A final cover system will be constructed consisting of a HDPE geomembrane infiltration-control layer and vegetated, earthen erosion-control layer. The written closure plan complies with 845.720 and is included as Attachment 10-1.

10.2 West Ash Pond

The West Ash Pond will be clean closed in accordance with Section 845.740 and repurposed as a low volume waste pond to hold non-CCR process water. The written closure plan complies with 845.720 and is included as Attachment 10-2.

11.0 Post-Closure Care Plan, 845.230(d)(2)(K)

Closure of the West Ash Pond will be conducted by removing the CCR and decontaminating any areas affected by CCR in accordance with 845.740(a). A post-closure plan is not required for the West Ash Pond based on 845.780(a)(2), but groundwater monitoring around the West Ash Pond will occur in accordance with 845.740(b). Closure of the East Ash Pond will occur by leaving the CCR in place and constructing a compliant final cover system. The Post-Closure Plan for the East Ash Pond is included in Attachment 11.

12.0 Liner Certification, 845.230(d)(2)(L)

As part of the Alternative Closure Demonstration, it was identified that the liners for the East Ash Pond and the West Ash Pond do not comply with the liner requirements of Section 845.400. The upper liner component for the East Ash Pond and the West Ash Pond consists of white 60-mil high-density polyethylene (HDPE) topped with 12-inches of sand, which is then topped with 6-inches of screenings. The lower liner component below the 60-mil HDPE liner is at least five feet of sand with traces of gravel. This composition of the liner components of the East Ash Pond and the West Ash Pond were evaluated against the liner design criteria using the process outlined in Section 845.400(c) to determine if the East Ash Pond and the West Ash Pond is considered lined or unlined. The calculations showing the flow rate calculations and comparison are provided in Attachment 12. The calculations indicate that the liner components for the East Ash Pond and the West Ash Pond do not comply with the requirements of Section 845.400 and the surface impoundment is considered unlined.

13.0 History of Known Exceedances, 845.230(d)(2)(M)

As previously noted in the introduction, there is no Attachment with supporting documentation for this Section since the referenced data is provided in Attachment 9 documentation. In the fourth quarter 2010, Midwest Generation voluntarily initiated groundwater monitoring in the vicinity of the West and East Ash Ponds which are the subject of this Operating Permit Application. As discussed in Section 9 of this permit application, the combined CCR groundwater monitoring network for the West and East Ash Ponds is as follows:

- Upgradient monitoring wells: MW-09, MW-11 and MW-14
- Downgradient Monitoring wells: MW-01 through MW-04 and MW-16.

The existing CCR data for the West and East Ash Ponds groundwater monitoring network was presented and discussed in Section 9 of this permit application. Relative to the most recent round of CCR groundwater monitoring data referenced in that Section (second quarter 2021; see Table 9-4), the following are noted above the standards provided in Section 845.600(a):

- MW-09 (upgradient): Boron, sulfate and molybdenum.
- MW-11 (upgradient): Boron and arsenic.
- MW-14 (upgradient): Arsenic.
- MW-01 (downgradient): Boron and arsenic.
- MW-02 (downgradient): Boron.
- MW-03 (downgradient): Boron.
- MW-04 (downgradient): Boron.
- MW-16 (downgradient): Boron.

All of the above wells are within the existing ELUC. Proposed GWPSs developed in accordance with Section 845.600(b) are presented in Section 9.4 above. Once Illinois EPA reviews and approves those proposed GWPSs, those values will be used for subsequent groundwater monitoring data comparisons.

Pursuant to Part 257.95(g)(3) of the Federal CCR Rule, MWG conducted two Alternate Source Demonstrations (ASDs) for the two ponds which concluded that the noted potential SSIs for the subject Federal CCR Rule Appendix III parameters were not the result of leakage of leachate from the regulated units (West and East Ash Ponds) but rather from other potential source(s). Because the GWPSs are under review, there are no approved GWPSs for the constituents in the groundwater and accordingly it cannot be determined if there is an exceedance of the groundwater protection standards in Section 845.600.

14.0 Financial Assurance, 845.230(d)(2)(N)

The financial assurance certification is included in Attachment 14.

15.0 Hazard Potential Classification Assessment, 845.230(d)(2)(O) & 845.440

The initial hazard potential classification was performed for the East and West Ponds in October of 2016 and has been reviewed and updated by Sargent & Lundy, LLC and is included in Attachment 15.

16.0 Structural Stability Assessment, 845.230(d)(2)(P) & 845.450

The initial structural stability assessment was performed for the East and West Ponds in October of 2016 and has been reviewed and updated by Sargent & Lundy, LLC in accordance with Section 845.540. The structural stability assessment is included in Attachment 16.

17.0 Safety Factor Assessment, 845.230(d)(2)(Q) & 845.460(b)

The initial safety factor assessment was performed for the East and West Ponds in October of 2016 and has been reviewed and updated by Sargent & Lundy, LLC in accordance with 845.460(b) and is included in Attachment 17.

18.0 Inflow Design Flood Control System Plan, 845.230(d)(2)(R) & 845.510(c)(3)

An Inflow Design Flood Control System Plan was previously completed for the East and West Ponds in October of 2016 and has been reviewed and updated by Sargent & Lundy, LLC in accordance with 845.460(b) and is included in Attachment 18.

19.0 Safety and Health Plan, 845.230(d)(2)(S) & 845.530

A Safety and Health Plan in accordance with Section 845.530 has been completed and included in Attachment 19.

20.0 Closure Priority Categorization, 845.230(d)(2)(T) & 845.700(g)

20.1 East Ash Pond

In accordance with the requirements of Section 845.700(c), the category designation for the East Ash Pond is Category 3. The Category 3 designation for the East Ash Pond is based on the following:

- The East Ash Pond is an active CCR surface impoundment.
- There are no potable water supply wells or setbacks of existing potable water supply wells downgradient of the East Ash Pond. As such, Midwest Generation is not aware of any imminent threat to human health or the environment.
- Midwest Generation used the Illinois EPA EJ Start tool found at https://illinois-epa.maps.arcgis.com/apps/webappviewer/index.html?id=f154845da68a4a3f837cd3b880b0233c to determine that the Waukegan Generating Station (401 E. Greenwood Ave., Waukegan 60087) East Ash Pond is within one mile of an area of environmental justice concern.

20.2 West Ash Pond

In accordance with the requirements of Section 845.700(c), the category designation for the West Ash Pond is Category 3. The Category 3 designation for the West Ash Pond is based on the following:

- The West Ash Pond is an inactive CCR surface impoundment.
- There are no potable water supply wells or setbacks of existing potable water supply wells downgradient of the West Ash Pond. As such, Midwest Generation is not aware of any imminent threat to human health or the environment.
- Midwest Generation used the Illinois EPA EJ Start tool found at https://illinois-epa.maps.arcgis.com/apps/webappviewer/index.html?id=f154845da68a4a3f837cd3b880b0233c to determine that the Waukegan Generating Station (401 E. Greenwood Ave., Waukegan 60087) West Ash Pond is within one mile of an area of environmental justice concern.

OPERATING PERMIT TABLES

Table 2. Waukegan Generating Station
CCR Chemical Constituents Analytical Results

Parameter Name	Bottom Ash Sample 7/1/2021
Antimony	<9.5
Arsenic	4.2 J
Barium	2600
Beryllium	1.9
Boron	170
Cadmium	0.24 J B
Chloride	28
Chromium	20
Cobalt	9.4 J
Fluoride	2.7
Lead	8.1
Lithium	19
Mercury	0.077
Molybdenum	<4.7
Percent Solids (%)	74.6
pH (Standard Unit)	10 H
Selenium	<4.7
Sulfate	1500
Thallium	2.6 J

Notes:
All results are in milligrams per kilogram (mg/kg), unless otherwise noted
B - Compound was found in the blank and sample
J - Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value
RL - Reporting Limit
MDL - Method Detection Limit

Table 9-1. Summary of Local Precipitation Data - Midwest Generation, LLC, Waukegan Generating Station, Waukegan, Illinois.

Waukegan Station	
Month	**Average Monthly Precipitation* (inches)**
January	1.66
February	1.20
March	2.35
April	3.94
May	3.61
June	3.77
July	3.78
August	3.30
September	3.62
October	2.93
November	2.55
December	2.00

Notes:
* - Historical precipitation data was obtained from the National Oceanic and Atmospheric Administration. Precipitation data was averaged from three stations located within Waukegan, Illinois. Dates of precipitation data range from 1923-2020.

Table 9-2. Groundwater Elevations - Midwest Generation, LLC, Waukegan Station, Waukegan, IL

Well ID	Date	Top of Casing Elevation (ft above MSL)	Depth to Groundwater (ft below TOC)	Groundwater Elevation (ft above MSL)
MW-01	11/2/2015	603.12	20.75	582.37
	2/29/2016	603.12	20.71	582.41
	5/2/2016	603.12	20.89	582.23
	8/23/2016	603.12	22.01	581.11
	12/2/2016	603.62	22.27	581.35
	2/21/2017	603.62	22.42	581.20
	5/15/2017	603.62	20.52	583.10
	7/5/2017	603.62	21.81	581.81
	9/11/2017	603.62	21.47	582.15
	11/27/2017	603.62	21.82	581.80
	5/29/2018	603.62	19.43	584.19
	11/5/2018	603.62	20.45	583.17
	5/14/2019	603.62	19.81	583.81
	11/18/2019	603.62	19.89	583.73
	4/21/2020	603.62	20.81	582.81
	11/17/2020	603.62	21.51	582.11
	3/1/2021	603.62	21.19	582.43
	3/30/2021	603.62	21.34	582.28
	5/5/2021	603.62	21.76	581.86
MW-02	11/2/2015	603.04	20.71	582.33
	2/29/2016	603.04	20.59	582.45
	5/2/2016	603.04	20.82	582.22
	8/23/2016	603.04	22.04	581.00
	12/2/2016	603.39	22.13	581.26
	2/21/2017	603.39	22.24	581.15
	5/15/2017	603.39	20.25	583.14
	7/5/2017	603.39	21.59	581.80
	9/11/2017	603.39	21.21	582.18
	11/27/2017	603.39	21.63	581.76
	5/29/2018	603.39	19.12	584.27
	11/5/2018	603.39	20.19	583.20
	5/14/2019	603.39	19.55	583.84
	11/18/2019	603.39	19.60	583.79
	4/21/2020	603.39	20.57	582.82
	11/17/2020	603.39	21.32	582.07
	3/1/2021	603.39	21.04	582.35
	3/30/2021	603.39	21.13	582.26
	5/5/2021	603.39	21.56	581.83
MW-03	11/2/2015	602.91	20.37	582.54
	2/29/2016	602.91	20.43	582.48
	5/2/2016	602.91	20.66	582.25
	8/23/2016	602.91	22.12	580.79
	12/2/2016	603.70	22.52	581.18
	2/21/2017	603.70	22.64	581.06
	5/15/2017	603.70	20.55	583.15
	7/5/2017	603.70	21.92	581.78
	9/11/2017	603.70	21.55	582.15
	11/28/2017	603.70	21.96	581.74
	5/29/2018	603.70	19.40	584.30
	11/5/2018	603.70	20.48	583.22
	5/14/2019	603.70	19.80	583.90
	11/18/2019	603.70	20.05	583.65
	4/21/2020	603.70	20.82	582.88
	11/17/2020	603.70	21.60	582.10
	3/1/2021	603.70	21.30	582.40
	3/30/2021	603.70	21.40	582.30
	5/5/2021	603.70	21.83	581.87

Table 9-2. Groundwater Elevations - Midwest Generation, LLC, Waukegan Station, Waukegan, IL

Well ID	Date	Top of Casing Elevation (ft above MSL)	Depth to Groundwater (ft below TOC)	Groundwater Elevation (ft above MSL)
MW-04	11/2/2015	603.19	20.83	582.36
	2/29/2016	603.19	20.70	582.49
	5/2/2016	603.19	20.94	582.25
	8/23/2016	603.19	22.69	580.50
	12/2/2016	603.17	22.18	580.99
	2/21/2017	603.17	22.36	580.81
	5/15/2017	603.17	20.04	583.13
	7/5/2017	603.17	21.46	581.71
	9/11/2017	603.17	21.05	582.12
	11/28/2017	603.17	21.54	581.63
	5/30/2018	603.17	18.88	584.29
	11/6/2018	603.17	19.96	583.21
	5/14/2019	603.17	19.35	583.82
	11/18/2019	603.17	19.36	583.81
	4/21/2020	603.17	20.40	582.77
	11/18/2020	603.17	21.23	581.94
	3/1/2021	603.17	20.95	582.22
	3/30/2021	603.17	21.02	582.15
	5/5/2021	603.17	21.52	581.65
MW-09	11/2/2015	594.00	9.78	584.22
	2/29/2016	594.00	9.89	584.11
	5/2/2016	594.00	9.59	584.41
	8/23/2016	594.00	10.58	583.42
	12/2/2016	594.00	10.27	583.73
	2/21/2017	594.00	10.21	583.79
	5/15/2017	594.00	9.57	584.43
	7/6/2017	594.00	9.81	584.19
	9/11/2017	594.00	10.25	583.75
	11/29/2017	594.00	9.98	584.02
	5/31/2018	594.00	9.38	584.62
	11/6/2018	594.00	9.52	584.48
	5/14/2019	594.00	9.50	584.50
	11/18/2019	594.00	9.62	584.38
	4/21/2020	594.00	9.84	584.16
	11/18/2020	594.00	10.83	583.17
	3/1/2021	594.00	9.90	584.10
	3/30/2021	594.00	10.46	583.54
	5/5/2021	594.00	10.80	583.20
MW-11	11/2/2015	590.35	5.27	585.08
	2/29/2016	590.35	5.54	584.81
	5/2/2016	590.35	5.17	585.18
	8/23/2016	590.35	6.04	584.31
	12/2/2016	590.35	5.86	584.49
	2/21/2017	590.35	5.87	584.48
	5/15/2017	590.35	5.33	585.02
	7/6/2017	590.35	5.62	584.73
	9/11/2017	590.35	5.61	584.74
	11/30/2017	590.35	5.68	584.67
	5/31/2018	590.35	5.41	584.94
	11/6/2018	590.35	5.29	585.06
	5/14/2019	590.35	5.55	584.80
	11/18/2019	590.35	5.80	584.55
	4/21/2020	590.35	5.85	584.50
	11/19/2020	590.35	6.66	583.69
	3/1/2021	590.35	5.46	584.89
	3/30/2021	590.35	6.54	583.81
	5/5/2021	590.35	6.81	583.54

Table 9-2. Groundwater Elevations - Midwest Generation, LLC, Waukegan Station, Waukegan, IL

Well ID	Date	Top of Casing Elevation (ft above MSL)	Depth to Groundwater (ft below TOC)	Groundwater Elevation (ft above MSL)
MW-14	11/2/2015	590.24	5.17	585.07
	2/29/2016	590.24	5.01	585.23
	5/2/2016	590.24	4.49	585.75
	8/23/2016	590.24	6.07	584.17
	12/2/2016	590.24	5.49	584.75
	2/21/2017	590.24	5.33	584.91
	5/15/2017	590.24	4.67	585.57
	7/6/2017	590.24	5.27	584.97
	9/11/2017	590.24	5.78	584.46
	11/30/2017	590.24	5.19	585.05
	6/1/2018	590.24	4.45	585.79
	11/6/2018	590.24	4.32	585.92
	5/14/2019	590.24	4.20	586.04
	11/18/2019	590.24	4.75	585.49
	4/21/2020	590.24	5.00	585.24
	11/19/2020	590.24	5.98	584.26
	3/1/2021	590.24	4.55	585.69
	3/30/2021	590.24	5.60	584.64
	5/5/2021	590.24	6.20	584.04
MW-16	11/2/2015	607.41	25.13	582.28
	2/29/2016	607.41	24.91	582.50
	5/2/2016	607.41	25.23	582.18
	8/23/2016	607.41	28.33	579.08
	12/2/2016	607.41	28.22	579.19
	2/21/2017	607.41	27.71	579.70
	5/15/2017	607.41	23.99	583.42
	7/6/2017	607.41	27.03	580.38
	9/11/2017	607.41	26.74	580.67
	11/27/2017	607.41	27.49	579.92
	6/1/2018	607.41	23.22	584.19
	11/6/2018	607.41	23.65	583.76
	5/14/2019	607.41	23.40	584.01
	11/18/2019	607.41	23.60	583.81
	4/21/2020	607.41	25.26	582.15
	11/17/2020	607.41	27.50	579.91
	3/1/2021	607.41	27.25	580.16
	3/30/2021	607.41	26.96	580.45
	5/5/2021	607.41	27.50	579.91

MSL - Mean Sea Level
TOC - Top of Casing

Table 9-3. Hydraulic Gradient, Direction and Seepage Velocity. Midwest Generation, LLC, Waukegan Generation Station, Waukegan, IL.

DATE	Groundwater Flow Direction	K_{avg} (ft/sec)*	Average Hydraulic Gradient (ft/ft)	Porosity (unitless)**	Estimated Seepage Velocity (ft/day)
11/2/2015	Southeast	4.040E-03	0.0018	0.35	1.75
2/29/2016	Southeast	4.040E-03	0.0013	0.35	1.30
5/2/2016	Southeast	4.040E-03	0.0015	0.35	1.45
8/23/2016	East-Southeast	4.040E-03	0.0017	0.35	1.65
12/2/2016	East-Southeast	4.040E-03	0.0021	0.35	2.09
2/21/2017	East-Southeast	4.040E-03	0.0022	0.35	2.14
5/15/2017	East-Southeast	4.040E-03	0.0008	0.35	0.80
7/5/2017	East-Southeast	4.040E-03	0.0049	0.35	4.84
9/11/2017	East-Southeast	4.040E-03	0.0018	0.35	1.75
11/27/2017	East-Southeast	4.040E-03	0.0024	0.35	2.39
5/29/2018	East-Southeast	4.040E-03	0.0008	0.35	0.80
11/5/2018	East-Southeast	4.040E-03	0.0014	0.35	1.40
5/14/2019	East-Southeast	4.040E-03	0.0014	0.35	1.40
11/18/2019	East-Southeast	4.040E-03	0.0013	0.35	1.30
4/21/2020	East-Southeast	4.040E-03	0.0013	0.35	1.30
11/17/2020	East-Southeast	4.040E-03	0.0017	0.35	1.70
5/5/2021	East-Southeast	4.040E-03	0.0014	0.35	1.40

* K_{avg} - Average hydraulic conductivity (feet/second) from Hydrogeologic Assessment Report, Patrick Engineering, February 2011.

** - Porosity estimate from Applied Hydrogeology, Fetter, 1980.

Table 9-4. Groundwater Analytical Results - Midwest Generation, LLC, Waukegan Station, Waukegan, IL.

Well	Date	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Radium 226 + 228	Selenium	Thallium
MW-09 up-gradient	11/4/2015	13	210	450	0.14	6.60	370	1700	< 0.003	< 0.001	0.015	^ < 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	0.081	< 0.0002	0.260	0.1818	< 0.0025	< 0.002
	3/2/2016	35	380	720	0.11	7.02	970	2800	< 0.003	0.06	0.05	< 0.001	< 0.0005	0.043	< 0.001	0.00061	0.094	< 0.0002	0.51	< 0.36	0.025	< 0.002
	5/3/2016	16	310	620	0.12	7.02	740	2500	< 0.003	0.0014	0.025	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	0.083	< 0.0002	0.63	< 0.512	0.024	< 0.002
	8/25/2016	4.5	130	270	0.21	7.13	190	1100	0.0041	0.042	0.024	< 0.001	0.0011	0.056	0.0027	0.0012	0.049	< 0.0002	0.063	0.482	0.039	< 0.002
	12/8/2016	15	200	330	0.18	7.01	270	1300	< 0.003	0.004	0.016	< 0.001	0.00052	< 0.005	< 0.001	< 0.0005	0.077	< 0.0002	0.24	< 0.72	0.038	< 0.002
	2/23/2017	14	190	290	0.12	7.68	320	1300	< 0.003	0.0027	0.014	< 0.001	< 0.0005	0.059	0.0018	< 0.0005	0.068	< 0.0002	0.26	< 0.461	0.016	< 0.002
	5/16/2017	27	160	67	0.29	8.15	420	970	< 0.003	< 0.001	0.0094	^< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	0.045	< 0.0002	0.51	< 0.342	0.0085	< 0.002
	7/6/2017	21	220	430	0.13	7.18	610	1800	< 0.003	0.002	0.018	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	0.089	< 0.0002	0.31	< 0.316	0.021	< 0.002
	9/13/2017	21	250	420	0.14	7.17	520	1800	< 0.003	0.0067	0.019	< 0.001	< 0.0005	0.0052	0.0017	< 0.0005	0.069	< 0.0002	0.33	0.944	0.0041	< 0.002
	11/29/2017	26	200	390	0.13	7.05	390	1600	< 0.003	0.0017	0.015	< ^ 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	0.086	< 0.0002	0.47	0.625	0.042	< 0.002
	5/31/2018	32	200	29	0.1	6.85	490	1000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	11/6/2018	30	170	23	0.11	7.33	290	930	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5/15/2019	26	120	260	0.13	7.53	31	1000	< 0.003	< 0.001	0.0073	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	0.035	< 0.0002	0.54	< 0.433	< 0.0025	< 0.002
	11/19/2019	22	160	17	0.16	8.04	300	750	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/22/2020	22	140	9.2	0.18	7.81	360	700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	11/18/2020	28	250	290	0.18	7.43	420	1700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5/6/2021	31	170	35	0.12	7.51	420	910	< 0.003	< 0.001	0.0075	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	0.04	< 0.0002	0.47	< 0.614	0.023	< 0.002
MW-11 up-gradient	11/5/2015	5.2	140	240	0.13	6.51	190	1100	< 0.003	0.77	0.039	^ < 0.001	< 0.0005	< 0.005	< 0.001	0.001	0.055	< 0.0002	< 0.0050	0.656	< 0.0025	< 0.002
	3/2/2016	4.0	170	240	0.1	7.16	210	1200	< 0.003	0.55	0.048	< 0.001	< 0.0005	0.0058	< 0.001	0.0011	0.049	< 0.0002	< 0.0050	1.09	< 0.0025	< 0.002
	5/5/2016	5.0	140	280	0.11	7.17	160	1000	< 0.003	0.51	0.038	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	0.057	< 0.0002	< 0.005	1.24	< 0.0025	< 0.002
	8/26/2016	3.5	180	240	0.13	6.97	110	1100	< 0.003	1.1	0.05	< 0.001	< 0.0005	0.0055	< 0.001	0.0005	0.055	< 0.0002	< 0.005	1.04	< 0.0025	< 0.002
	12/7/2016	3.0	170	270	0.12	7.06	110	1200	< 0.003	0.87	0.049	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	0.038	< 0.0002	< 0.005	1.87	< 0.0025	< 0.002
	2/24/2017	2.4	180	220	4.9	6.61	170	1200	< 0.003	0.58	0.047	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	0.039	< 0.0002	< 0.005	0.982	< 0.0025	< 0.002
	5/18/2017	1.8	160	170	0.12	7.42	120	1000	< 0.003	0.5	0.047	^< 0.001	< 0.0005	0.0056	< 0.001	< 0.0005	0.036	< 0.0002	< 0.005	1.31	< 0.0025	< 0.002
	7/6/2017	2.4	160	190	0.14	7.33	130	1100	< 0.003	0.69	0.056	< 0.001	< 0.0005	0.0057	< 0.001	< 0.0005	0.041	< 0.0002	< 0.005	0.889	< 0.0025	< 0.002
	9/13/2017	1.9	140	150	0.26	7.16	96	870	< 0.003	0.86	0.036	< 0.001	< 0.0005	0.008	< 0.001	0.00071	0.037	< 0.0002	0.0054	0.718	< 0.0025	< 0.002
	11/30/2017	2.2	170	200	0.14	6.99	93	1100	< 0.003	0.59	0.05	< ^ 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	0.041	< 0.0002	< 0.005	1.21	< 0.0025	< 0.002
	5/31/2018	1.5	210	160	0.1	6.74	130	1100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	11/6/2018	2.3	170	150	0.12	7.21	78	990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5/15/2019	3.2	120	260	0.13	7.14	31	1000	< 0.003	0.3	0.048	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	0.038	< 0.0002	< 0.005	1.5	< 0.0025	< 0.002
	11/19/2019	4.1	130	200	0.15	7.51	29	860	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/22/2020	3.2	110	150	0.15	7.16	47	740	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	11/19/2020	2.3	140	130	0.2	7.00	28	800	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5/6/2021	2.4	130	120	0.15	7.13	45	770	< 0.003	0.440	0.044	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	0.038	< 0.0002	< 0.005	1.7	< 0.0025	< 0.002
MW-14 up-gradient	11/5/2015	1.4	150	190	0.19	6.78	140	1000	< 0.003	0.19	0.052	^ < 0.001	< 0.0005	0.01	0.0012	< 0.0005	0.025	< 0.0002	< 0.005	0.7087	< 0.0025	< 0.002
	3/2/2016	0.93	150	110	0.17	7.24	150	870	0.015	4.3	0.12	< 0.001	< 0.0005	1.1	0.0036	0.00068	0.019	< 0.0002	< 0.005	1.36	< 0.0025	< 0.002
	5/5/2016	1.2	170	120	0.18	7.17	190	980	< 0.003	0.35	0.054	< 0.001	< 0.0005	0.017	0.0014	< 0.0005	0.021	< 0.0002	< 0.005	< 0.488	< 0.0025	< 0.002
	8/26/2016	1.5	200	210	0.12	7.00	190	1300	< 0.003	1.0	0.058	< 0.001	< 0.0005	0.021	< 0.001	< 0.0005	0.026	< 0.0002	< 0.005	0.75	< 0.0025	< 0.002
	12/7/2016	0.95	240	340	0.25	6.81	120	1100	0.0096	19	0.42	< 0.001	0.00089	4.6	0.0025	0.00084	0.022	< 0.0002	0.0094	< 0.866	0.014	< 0.002
	2/23/2017	0.73	150	99	0.19	6.88	110	730	0.0061	9.3	0.36	< 0.001	0.001	4.6	0.0070	0.00095	0.017	< 0.0002	< 0.005	< 0.514	0.0031	< 0.002
	5/18/2017	0.81	120	130	0.3	7.62	70	590	0.0035	3.3	0.44	^< 0.001	0.002	4.8	0.0041	0.00054	0.013	0.00043	< 0.005	0.779	< 0.0025	< 0.002
	7/6/2017	1.2	190	180	0.13	7.29	190	1300	< 0.003	0.4	0.071	< 0.001	< 0.0005	0.026	0.0013	< 0.0005	0.034	< 0.0002	< 0.005	0.549	< 0.0025	< 0.002
	9/13/2017	2.3	180	190	0.15	7.20	270	1200	< 0.003	0.52	0.065	< 0.001	< 0.0005	0.0078	< 0.0010	< 0.0005	0.025	< 0.0002	< 0.005	< 0.359	< 0.0025	< 0.002
	11/30/2017	0.85	170	130	0.19	7.33	99	940	0.0093	21	0.27	< ^ 0.001	0.00068	3.2	0.0021	< 0.0005	0.023	< 0.0002	0.0055	1.01	0.0072	< 0.002
	6/1/2018	0.54	100	57	0.28	6.89	42	410	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	11/6/2018	0.98	160	110	0.24	7.36	53	610	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5/15/2019	0.69	110	190	0.23	7.25	35	780	0.0036	2.7	0.091	< 0.001	< 0.0005	0.71	< 0.0010	< 0.0005	0.014	< 0.0002	< 0.005	0.766	< 0.0025	< 0.002
	11/19/2019	0.62	130	68	0.16	7.58	21	630	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/22/2020	0.43	120	20	0.21	7.16	9.5	500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	11/19/2020	0.71	130	40	0.2	7.09	20	520	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5/6/2021	0.45	130	41	0.19	7.16	28	390	< 0.003	0.91	0.05	< 0.001	< 0.0005	0.037	< 0.0010	< 0.0005	0.015	< 0.0002	< 0.005	< 0.739	< 0.0025	< 0.002
MW-01 down-gradient	11/2/2015	1.8	64	71	0.46	10.93	310	560	< 0.003	0.074	0.025	^ < 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.04	0.0683	0.0047	< 0.002
	3/1/2016	V 1.9	58	63	0.26	11.13	270	570	< 0.003	0.1	0.026	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.059	< 0.317	< 0.0025	< 0.002
	5/4/2016	2.0	45	60	0.3	11.09	210	490	< 0.003	0.11	0.017	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.069	< 0.40	< 0.0025	< 0.002
	8/23/2016	2.0	42	60	0.26	10.49	240	550	< 0.003	0.074	0.012	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.065	< 0.478	0.0042	< 0.002
	12/5/2016	2.2	55	65	0.34	10.46	180	560	< 0.003	0.13	0.017	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.07	< 0.465	0.0025	< 0.002
	2/21/2017	2.2	50	61	0.29	11.30	250	540	< 0.003	0.15	0.016	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.069	0.516	< 0.0025	< 0.002
	5/15/2017	2.1	52	59	0.37	10.69	330	570	< 0.003	0.14	0.017	^< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.062	< 0.424	0.0036	< 0.002
	7/5/2017	2.3	44	51	0.34	10.83	320	570	< 0.003	0.066	0.014	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.059	< 0.289	0.0095	< 0.002
	9/14/2017	2.4	71	47	0.24	10.45	430	770	< 0.003	0.04	0.033	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.047	< 0.383	0.0096	< 0.002
	11/27/2017	2.7	84	43	0.11	7.85	330	840	< 0.003	0.021	0.055	< ^ 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.034	0.568	0.023	< 0.002
	5/29/2018	2.4	54	58	0.33	8.44	350	610	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	11/5/2018	2.0	38	43	0.25	8.70	210	630	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5/14/2019	2.2	56	45	0.18	9.85	250	560	< 0.003	0.067	0.032	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.053	0.36	< 0.0025	< 0.002
	11/19/2019	2.3	38	39	0.24	10.58	240	530	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/21/2020	2.8	55	25	0.22	9.40	240	470	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	11/17/2020	3.3	120	95	0.14	7.97	250	640	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5/5/2021	< 5.0	66	67	0.22	9.00	180	430	< 0.003	0.025	0.04	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.016	< 0.602	< 0.0025	< 0.002

Notes: All units are in mg/l except pH is in standard units.
V- Serial dilution exceeds the control limits.
R- Resampling event
NA - Not analyzed.
H - Sample preped or analyzed beyond specific holding time.
^ - Denotes instrument related QC exceeds the control limits

Table 9-4. Groundwater Analytical Results - Midwest Generation, LLC, Waukegan Station, Waukegan, IL.

Well	Date	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Radium 226 + 228	Selenium	Thallium
	11/2/2015	3.0	32	47	0.78	8.27	230	460	< 0.003	0.014	0.016	^ < 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.0630	0.4628	< 0.0025	< 0.002
	3/1/2016	4.1	39	47	1.3	8.57	220	510	< 0.003	0.011	0.02	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.078	0.529	< 0.0025	< 0.002
	5/4/2016	3.3	34	51	1.5	8.19	180	440	< 0.003	0.0081	0.018	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.069	< 0.425	< 0.0025	< 0.002
	8/23/2016	3.1	42	59	1.3	7.52	250	500	< 0.003	0.0082	0.016	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.010	< 0.0002	0.056	< 0.439	< 0.0025	< 0.002
	12/5/2016	3.1	28	56	1.0	8.62	160	430	< 0.003	0.018	0.015	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.071	0.509	< 0.0025	< 0.002
	2/21/2017	3.3	31	52	0.76	8.75	190	420	< 0.003	0.028	0.012	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.051	< 0.416	0.0038	< 0.002
	5/15/2017	3.6	85	48	0.64	8.33	320	640	< 0.003	0.02	0.029	^< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.047	0.425	0.023	< 0.002
MW-02 down-gradient	7/5/2017	4.2	100	52	0.42	7.92	300	710	< 0.003	0.0094	0.031	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.047	< 0.295	0.017	< 0.002
	9/14/2017	2.5	87	54	0.44	8.19	340	780	< 0.003	0.012	0.035	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.049	0.769	0.0052	< 0.002
	11/27/2017	3.4	69	57	0.62	7.34	200	570	< 0.003	0.011	0.022	< ^ 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.048	< 0.442	< 0.0025	< 0.002
	5/29/2018	4.5	160	43	0.40	6.85	420	990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	11/5/2018	3.1	77	59	0.61	8.06	180	610	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5/14/2019	2.9	47	49	1.0	8.30	140	430	< 0.003	0.0094	0.013	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.069	0.37	< 0.0025	< 0.002
	11/19/2019	4.7	140	43	0.7	7.37	270	900	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/21/2020	3.4	86	48	1.0	8.02	250	580	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	11/17/2020	4.0	79	20	0.8	7.67	310	610	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5/5/2021	4.6	70	37	0.72	8.39	190	420	< 0.003	0.008	0.03	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.023	0.97	< 0.0025	< 0.002
	11/2/2015	2.3	72	87	0.51	9.26	270	570	< 0.003	0.0068	0.011	^ < 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.0370	0.071	< 0.0025	< 0.002
	3/1/2016	2.9	61	70	0.33	7.33	220	530	< 0.003	0.0069	0.015	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.0560	< 0.332	0.0043	< 0.002
	5/4/2016	2.4	42	74	0.56	7.25	170	470	< 0.003	0.007	0.011	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.058	< 0.48	< 0.0025	< 0.002
	8/24/2016	2.0	70	59	0.3	9.13	200	430	< 0.003	0.010	0.0069	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.042	< 0.428	< 0.0025	< 0.002
	12/5/2016	2.4	57	60	0.41	7.62	120	440	< 0.003	0.0065	0.0094	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.010	< 0.0002	0.044	< 0.526	< 0.0025	< 0.002
	2/21/2017	2.2	56	65	0.33	7.56	180	460	< 0.003	0.011	0.0067	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.010	< 0.0002	0.043	0.437	< 0.0025	< 0.002
	5/16/2017	3.9	110	61	0.27	7.90	320	820	< 0.003	0.0087	0.039	^< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.010	< 0.0002	0.041	< 0.461	0.014	< 0.002
MW-03 down-gradient	7/5/2017	3.0	60	60	0.28	7.46	200	470	< 0.003	0.0029	0.017	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.010	< 0.0002	0.058	< 0.304	0.0045	< 0.002
	9/14/2017	2.1	86	57	0.26	7.53	260	680	< 0.003	0.0024	0.026	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.010	< 0.0002	0.056	0.462	0.0081	< 0.002
	11/28/2017	2.6	69	63	0.56	6.96	120	500	< 0.003	0.0025	0.016	< ^ 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.010	< 0.0002	0.057	1.17	< 0.0025	< 0.002
	5/29/2018	2.4	67	61	0.38	6.84	190	480	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	11/5/2018	2.4	54	54	0.5	8.99	150	500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5/14/2019	4.2	86	17	0.59	7.21	270	660	< 0.003	0.0059	0.022	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.010	< 0.0002	0.053	0.657	0.0061	< 0.002
	11/19/2019	4.2	130	15	0.25	7.47	300	740	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/21/2020	3.8	120	23	0.29	6.87	270	660	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	11/17/2020	3.8	120	53	0.29	7.05	240	650	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5/5/2021	3.3	110	43	0.23	7.18	210	550	< 0.003	0.0066	0.035	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.010	< 0.0002	0.016	0.689	0.0065	< 0.002
	11/3/2015	1.8	66	62	0.51	6.68	240	480	< 0.003	0.0066	0.032	^ < 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.031	0.2732	< 0.0025	< 0.002
	3/1/2016	2.0	58	51	0.5	7.17	170	450	< 0.003	0.0083	0.033	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.048	0.478	< 0.0025	< 0.002
	5/4/2016	1.6	44	49	0.61	6.92	140	340	< 0.003	0.0083	0.017	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.046	< 0.542	< 0.0025	< 0.002
	8/24/2016	2.0	46	58	0.56	7.01	120	370	< 0.003	0.0099	0.019	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.049	< 0.461	< 0.0025	< 0.002
	12/5/2016	3.4	200	60	0.21	7.40	300	1000	< 0.003	0.019	0.13	< 0.001	< 0.0005	< 0.005	< 0.0010	< 0.0005	< 0.01	< 0.0002	0.0097	1.04	0.02	< 0.002
	2/22/2017	2.4	150	41	0.17	7.44	290	850	< 0.003	0.036	0.093	< 0.001	< 0.0005	< 0.005	< 0.0010	< 0.0005	< 0.01	< 0.0002	0.015	0.886	0.0042	< 0.002
	5/16/2017	2.5	170	29	0.32	7.94	400	970	< 0.003	0.024	0.072	^< 0.001	< 0.0005	< 0.005	< 0.0010	< 0.0005	< 0.01	< 0.0002	0.017	0.55	0.032	< 0.002
MW-04 down-gradient	7/5/2017	3.6	200	51	0.29	7.09	520	1100	< 0.003	0.0034	0.076	< 0.001	< 0.0005	< 0.005	< 0.0010	< 0.0005	< 0.01	< 0.0002	0.017	0.515	0.062	< 0.002
	9/14/2017	2.5	180	45	0.28	7.04	480	1100	< 0.003	0.0028	0.076	< 0.001	< 0.0005	< 0.005	< 0.0010	< 0.0005	< 0.01	< 0.0002	0.021	0.794	0.026	< 0.002
	11/28/2017	2.3	110	32	0.28	7.04	130	560	< 0.003	0.0027	0.053	< ^ 0.001	< 0.0005	< 0.005	< 0.0010	< 0.0005	< 0.01	< 0.0002	0.032	0.872	0.0069	< 0.002
	5/30/2018	3.0	150	21	0.38	6.57	200	700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	11/6/2018	2.5	150	58	0.37	6.83	240	900	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5/14/2019	3.3	100	58	0.64	7.30	200	730	< 0.003	0.0026	0.039	< 0.001	< 0.0005	< 0.005	< 0.0010	< 0.0005	< 0.01	< 0.0002	0.07	0.69	0.004	< 0.002
	11/19/2019	2.9	120	44	0.75	7.27	270	680	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/21/2020	2.9	100	33	0.9	7.18	290	670	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	11/18/2020	3.1	100	18	1.1	7.17	250	690	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5/5/2021	3.3	75	17	0.91	7.46	190	530	< 0.003	0.0069	0.032	< 0.001	< 0.0005	< 0.005	< 0.0010	< 0.0005	< 0.01	< 0.0002	0.056	< 0.781	0.0041	< 0.002
	11/3/2015	4.1	230	87	0.43	6.24	610	1400	< 0.003	0.001	0.047	^ < 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	0.071	< 0.0002	0.021	0.865	0.0074	< 0.002
	3/2/2016	3.1	360	130	0.35	6.76	990	1700	< 0.003	0.0015	0.035	< 0.001	0.001	< 0.005	< 0.001	< 0.0005	0.13	< 0.0002	0.013	< 0.396	0.0052	0.002
	5/2/2016	4.9	250	150	0.49	6.99	620	1600	< 0.003	0.0011	0.052	< 0.001	0.00053	< 0.005	< 0.001	< 0.0005	0.024	< 0.0002	0.014	0.70	< 0.0025	< 0.002
	8/24/2016	3.6	130	53	0.71	7.00	330	830	< 0.003	< 0.001	0.028	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	0.014	< 0.0002	0.022	< 0.462	< 0.0025	< 0.002
	12/5/2016	3.8	160	52	0.51	7.03	280	920	< 0.003	0.036	0.062	< 0.001	< 0.0005	< 0.005	0.0012	0.00054	0.011	< 0.0002	0.021	0.791	< 0.0025	< 0.002
	2/24/2017	6.5	200	67	0.2	5.76	570	1100	< 0.003	0.027	0.067	< 0.001	< 0.0005	0.005	0.0011	< 0.0005	0.012	< 0.0002	0.023	0.54	0.0037	< 0.002
	5/16/2017	2.6	340	130	0.15	7.57	760	1700	< 0.003	0.043	0.045	^< 0.001	0.0043	0.0076	< 0.001	0.00057	0.13	< 0.0002	0.016	0.441	0.016	0.0021
	7/6/2017	9.5	190	70	0.57	7.35	480	1100	< 0.003	0.0029	0.029	< 0.001	0.00069	< 0.005	< 0.001	< 0.0005	0.017	< 0.0002	0.017	< 0.382	< 0.0025	< 0.002
	9/13/2017	2.8	190	55	0.61	7.33	460	970	< 0.003	< 0.001	0.024	< 0.001	0.0005	< 0.005	< 0.001	< 0.0005	< 0.01	< 0.0002	0.024	< 0.335	< 0.0025	< 0.002
MW-16 down-gradient	11/27/2017	4.2	140	58	0.71	7.16	270	760	< 0.003	0.0031	0.026	< ^ 0.001	0.00097	< 0.005	< 0.001	< 0.0005	0.01	< 0.0002	0.026	0.557	< 0.0025	< 0.002
	6/1/2018	3	380	130	0.32	6.53	890	1900	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/22/2018 (R)	NA	190	NA	NA	NA	NA	1200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	11/6/2018	3.9	380	150	0.39	6.78	550	1900	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/4/2018 (R)	NA	320	NA	NA	NA	NA	1600	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5/15/2019	2.9	400	65	0.31	6.67	990	2000	< 0.003	0.0011	0.029	< 0.001	0.003	< 0.005	< 0.001	< 0.0005	0.15	< 0.0002	0.0086	< 0.491	0.0039	< 0.002
	11/19/2019	7.2	410	480	0.46	6.89	680	3100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/27/2019 (R)	NA	NA	NA	NA	NA	NA	2800	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/21/2020	7.7	420	200	0.5	6.79	1100	2400	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	11/17/2020	3.2	130	54	0.71	7.22	320	990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5/6/2021	3.1	120	55	0.68	7.33	300	740	< 0.003	< 0.001	0.024	< 0.001	< 0.0005	< 0.005	< 0.001	< 0.0005	0.014	< 0.0002	0.019	< 0.919	< 0.0025	< 0.002

Notes: All units are in mg/l except pH is in standard units.
V- Serial dilution exceeds the control limits.
R- Resampling event
NA - Not analyzed.
H - Sample preped or analyzed beyond specific holding time.
^ - Denotes instrument related QC exceeds the control limits

Table 9-5 Turbidity Measurement Data - Midwest Generation, LLC, Waukegan Station

Well	Date	Turbidity (NTU)
MW-09	3/3/2021	4.70
	3/30/2021	10.15
	5/6/2021	3.44
	5/27/2021	12.41
	6/18/2021	27.7
	7/8/2021	28.77
	8/19/2021	77.36
	9/29/2021	18.41
MW-11	3/2/2021	2.20
	3/30/2021	6.08
	5/6/2021	2.34
	5/27/2021	2.69
	6/18/2021	13.7
	7/8/2021	4.71
	8/19/2021	139.34
	9/29/2021	402.9
MW-14	3/2/2021	2035
	3/30/2021	151.5
	5/6/2021	901.4
	5/27/2021	2385.61
	6/18/2021	69.25
	7/8/2021	73.18
	8/19/2021	77.04
	9/29/2021	8.42
MW-01	3/1/2021	0.59
	3/30/2021	5.72
	5/5/2021	1.42
	5/27/2021	2.02
	6/18/2021	2.33
	7/8/2021	3.6
	8/18/2021	2.33
	9/29/2021	3.03
MW-02	3/1/2021	0.69
	3/30/2021	5.66
	5/5/2021	1.65
	5/27/2021	2.95
	6/18/2021	2.71
	7/8/2021	4.2
	8/18/2021	9.03
	9/29/2021	3.42
MW-03	3/1/2021	0.75
	3/30/2021	5.73
	5/5/2021	1.71
	5/27/2021	2.02
	6/18/2021	2.56
	7/8/2021	3.74
	8/18/2021	2.6
	9/29/2021	2.82
MW-04	3/1/2021	1.30
	3/30/2021	6.21
	5/5/2021	1.77
	5/27/2021	2.73
	6/18/2021	3.69
	7/8/2021	5.36
	8/18/2021	40.61
	9/29/2021	3.48
MW-16	3/1/2021	0.77
	3/30/2021	6.07
	5/6/2021	1.63
	5/27/2021	2.00
	6/18/2021	2.59
	7/8/2021	3.58
	8/18/2021	3.22
	9/29/2021	6.05

Table 9-6. Summary of Sample Bottles, Preservation Holding Time, and Analytical Methods. Midwest Generation, LLC, Waukegan Generating Station, Waukegan, IL.

PARAMETER	ANALYTICAL METHOD	CONTAINER	PRESERVATION	HOLD TIME	METHOD DETECTION LIMIT (MG/L)	Section 845.600(a) Standards
Boron	6020 A	250 mL plastic	HNO_3, < 6 °C	6 months	0.0245	2
Calcium	6020 A	250 mL plastic	HNO_3, < 6 °C	6 months	0.106	NS
Chloride	SM4500 Cl-E	1 L plastic	None, < 6 °C	28 days	1.22	200
Fluoride	SM4500 F-C	1 L plastic	None, < 6 °C	28 days	0.019	4
pH	SM4500 H^+ -B	1 L plastic	None, < 6 °C	immediate *	Field Parameter	6.5 - 9.0 (secondary standard)
Sulfate	SM4500 SO_4 -E	1 L plastic	None, < 6 °C	28 days	2	400
Total Dissolved Solids	SM2400 C	1 L plastic	None, < 6 °C	7 days	6.1	1200
Antimony	6020 A	250 mL plastic	HNO_3, < 6 °C	6 months	0.00101	0.006
Arsenic	6020 A	250 mL plastic	HNO_3, < 6 °C	6 months	0.000439	0.01
Barium	6020 A	250 mL plastic	HNO_3, < 6 °C	6 months	0.000841	2
Beryllium	6020 A	250 mL plastic	HNO_3, < 6 °C	6 months	0.000237	0.004
Cadmium	6020 A	250 mL plastic	HNO_3, < 6 °C	6 months	0.00019	0.005
Chromium	6020 A	250 mL plastic	HNO_3, < 6 °C	6 months	0.000608	0.1
Cobalt	6020 A	250 mL plastic	HNO_3, < 6 °C	6 months	0.000189	0.006
Lead	6020 A	250 mL plastic	HNO_3, < 6 °C	6 months	0.000141	0.0075
Lithium	6010 C	250 mL plastic	HNO_3, < 6 °C	6 months	0.00215	0.04
Mercury	7470 A	250 mL plastic	HNO_3, < 6 °C	28 days	0.0000611	0.002
Molybdenum	6020 A	250 mL plastic	HNO_3, < 6 °C	6 months	0.00162	0.1
Selenium	6020 A	250 mL plastic	HNO_3, < 6 °C	6 months	0.000834	0.05
Thallium	6020 A	250 mL plastic	HNO_3, < 6 °C	6 months	0.000591	0.002
Radium 226	903.0	1 L plastic	HNO_3	180 days	1 pCi/L	5 pCi/L **
Radium 228	904.0	2 L plastic	HNO_3	180 days	1 pCi/L	5 pCi/L **

Notes: It is noted that some parameters may be combined with others within the same container.
* - The result for pH is obtained in the field and is not submitted to the laboratory.
** - Combined Radium 226/228
mL - milliliters
L - liters
°C - degrees Celsius
HNO_3 - Nitric Acid
NS- No Standard

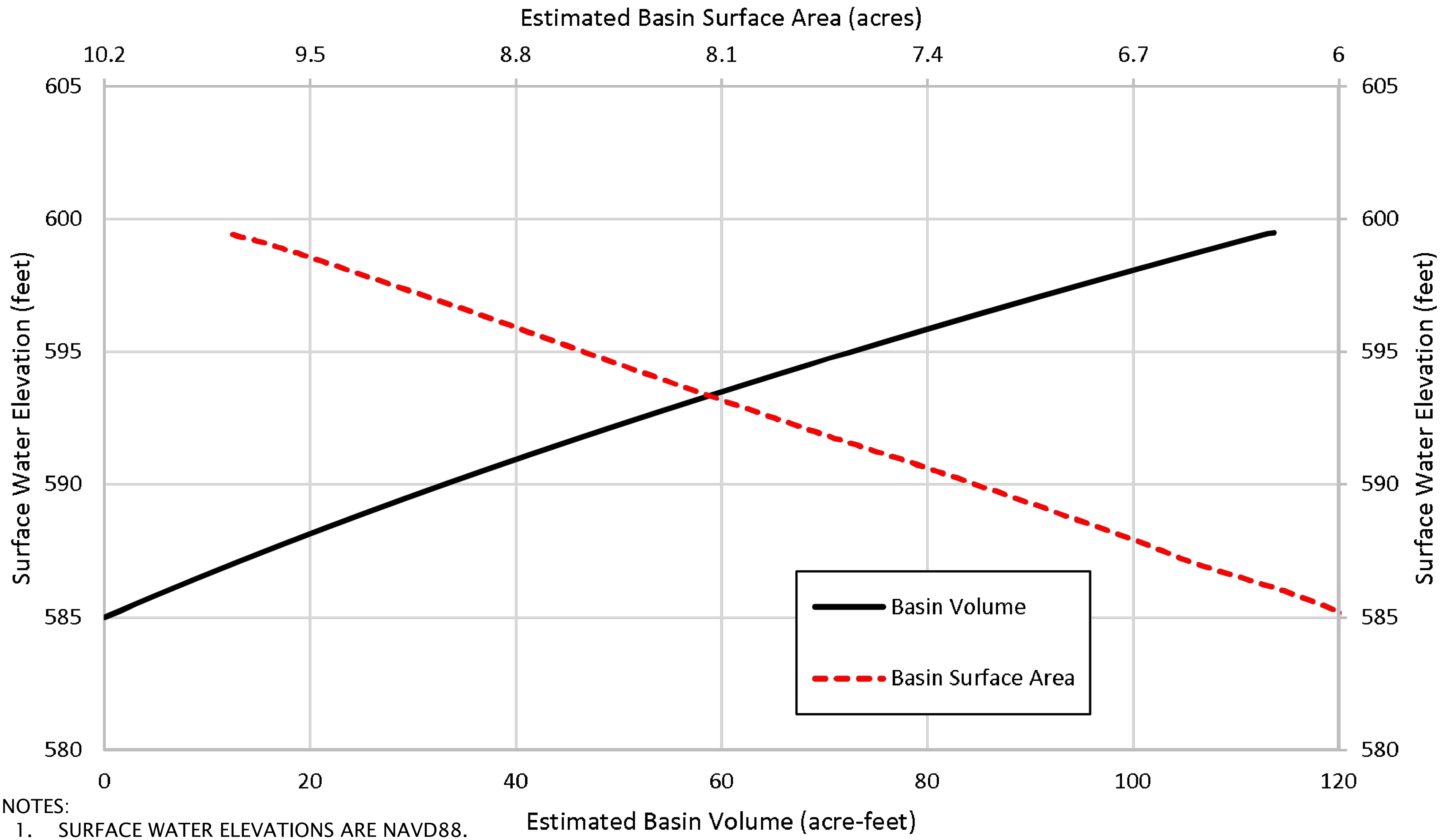
Table 9-7. Proposed Site-Specific Groundwater Protection Standards - Waukegan Generating Station

Upgradient Well(s)	Parameter	Section 845.600 Standards	Interwell Background Prediction Limit	**Proposed GWPS**
MW-14	Antimony	0.006	0.015	**0.015**
MW-11/MW-14 Pooled	Arsenic	0.01	21	**21**
MW-11	Barium	2	0.064	**2**
MW-9/MW-11/MW-14 Pooled	Beryllium	0.004	0.001	**0.004**
MW-11	Boron	2.0	5.965	**5.965**
MW-14	Cadmium	0.005	0.002	**0.005**
MW-11/MW-14 Pooled*	Chloride	200	389	**389**
MW-14	Chromium	0.1	4.8	**4.8**
MW-14	Cobalt	0.006	0.007	**0.007**
MW-14	Combined Radium 226 + 228 (pCi/L)	5.0	1.566	**5.0**
MW-14	Fluoride	4.0	0.334	**4.0**
MW-9/MW-11/MW-14 Pooled	Lead	0.0075	0.0011	**0.0075**
MW-14	Lithium	0.04	0.040	**0.040**
MW-14	Mercury	0.002	0.0004	**0.002**
MW-11/MW-14 Pooled	Molybdenum	0.10	0.009	**0.100**
MW-11/MW-14 Pooled	pH (standard units)	6.5-9.0	6.51-7.74	**6.5-9.0**
MW-11/MW-14 Pooled	Selenium	0.05	0.014	**0.050**
MW-11/MW-14 Pooled*	Sulfate	400	259.1	**400**
MW-9/MW-11/MW-14 Pooled	Thallium	0.002	0.002	**0.002**
MW-11/MW-14 Pooled*	Total Dissolved Solids	1200	1589	**1589**
MW-11	Calcium	NE	225.1	**225.1**
MW-14	Turbidity (NTU)	NE	12,436	**12,436**

All values are in mg/L (ppm) unless otherwise noted.
* - Limited to original 8 background samples.
NE - Not Established
Bold - Site-specific Groundwater Protection Standard based on Section 845.600(a)(2)

OPERATING PERMIT FIGURES

East Ash Basin



NOTES:
1. SURFACE WATER ELEVATIONS ARE NAVD88.
2. BASIN VOLUMES ARE ESTIMATED BASED ON AS-BUILT INFORMATION AND 2015 SITE TOPOGRAPHY.
3. AREA-CAPACITY CURVE CREATED BY GEOSYNTEC AS PART OF COMPLETING THE HISTORY OF CONSTRUCTION IN ACCORDANCE WITH 40 CFR PART 257.

ENVIRONMENTAL CONSULTATION & REMEDIATION

KPRG

KPRG and Associates, inc.

14665 West Lisbon Road, Suite 1A Brookfield, Wisconsin 53005 Telephone 262-781-0475 Facsimile 262-781-0478

414 Plaza Drive, Suite 106 Westmont, Illinois 60559 Telephone 630-325-1300 Facsimile 630-325-1593

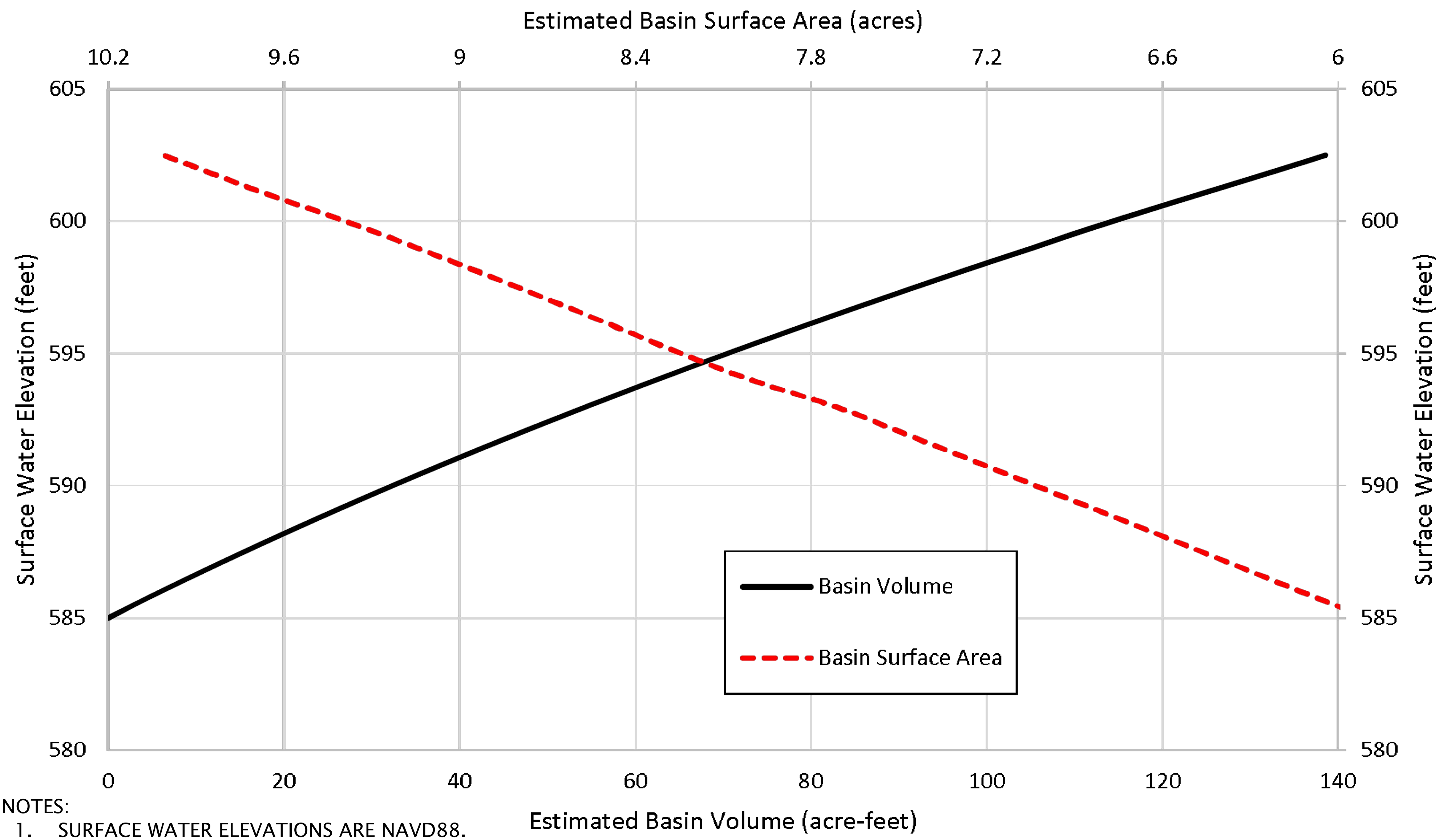
EAST ASH BASIN AREA-CAPACITY CURVE

WAUKEGAN GENERATING STATION
WAUKEGAN, ILLINOIS

Scale: NTS	Date: September 15, 2021
KPRG Project No. 19520.2	FIGURE 1-1

W:\projects\midwest generation\operating and constr permit\waukegan\waukegan station.dwg

West Ash Basin



NOTES:

1. SURFACE WATER ELEVATIONS ARE NAVD88.
2. BASIN VOLUMES ARE ESTIMATED BASED ON AS-BUILT INFORMATION AND 2015 SITE TOPOGRAPHY.
3. AREA-CAPACITY CURVE CREATED BY GEOSYNTEC AS PART OF COMPLETING THE HISTORY OF CONSTRUCTION IN ACCORDANCE WITH 40 CFR PART 257.

ENVIRONMENTAL CONSULTATION & REMEDIATION

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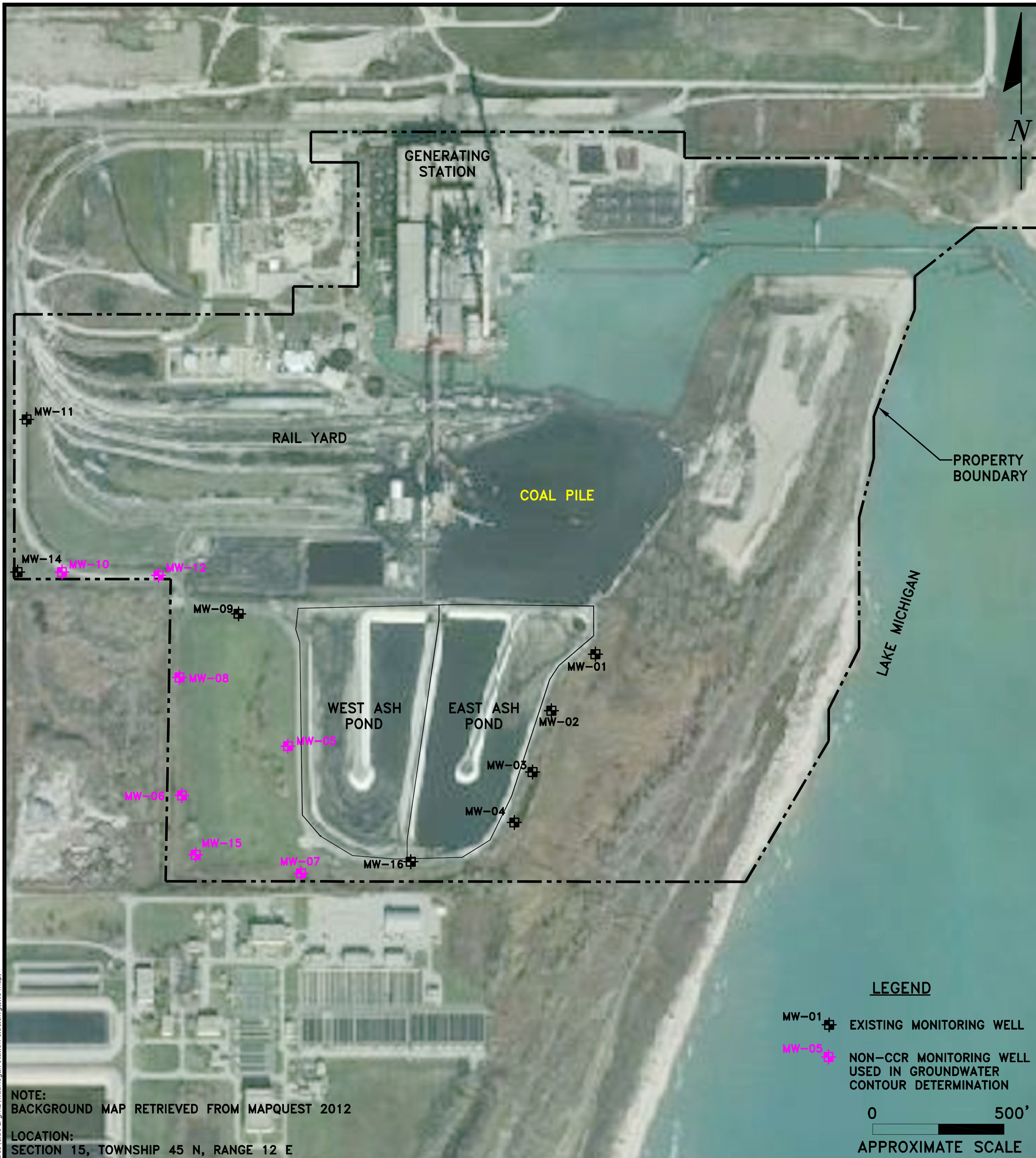
WEST ASH BASIN AREA-CAPACITY CURVE

WAUKEGAN GENERATING STATION
WAUKEGAN, ILLINOIS

Scale: NTS	Date: September 15, 2021
KPRG Project No. 19520.2	FIGURE 1-2

W:\projects\midwest generation\operating and constr permit\waukegan\waukegan station.dwg



W:\c-p&p\projects\midwest generation\ash pond issues\eluc & gmz\waukegan station eluc.dwg(site map)

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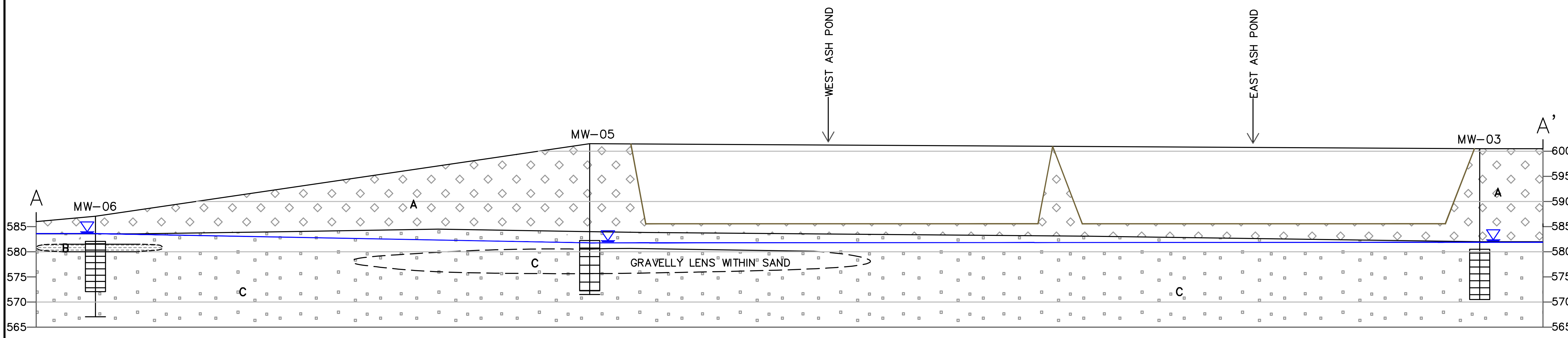
MONITORING WELL MAP

WAUKEGAN STATION
WAUKEGAN, ILLINOIS

Scale: 1" = 500' | Date: August 31, 2021

KPRG Project No. 19520.2 | FIGURE 9-1



FILL: CONSISTING OF BROWN AND BLACK FINE TO MEDIUM SAND WITH SOME GRAVEL AND SILT SEAMS. THE FILL MAY INCLUDE ASH, BLACK CINDERS, SLAG, AND OCCASIONAL COAL AND WOOD FRAGMENTS. (A)

ORGANIC CLAYEY SILTS, SILTY SAND AND/OR PEAT: LOCALIZED, DISCONTINUOUS LENSES OF ORGANIC BLACK TO GRAY CLAYEY SILTS AND SILTY SANDS OR PEAT SEPARATING THE FILL FROM UNDERLYING SAND. (B)

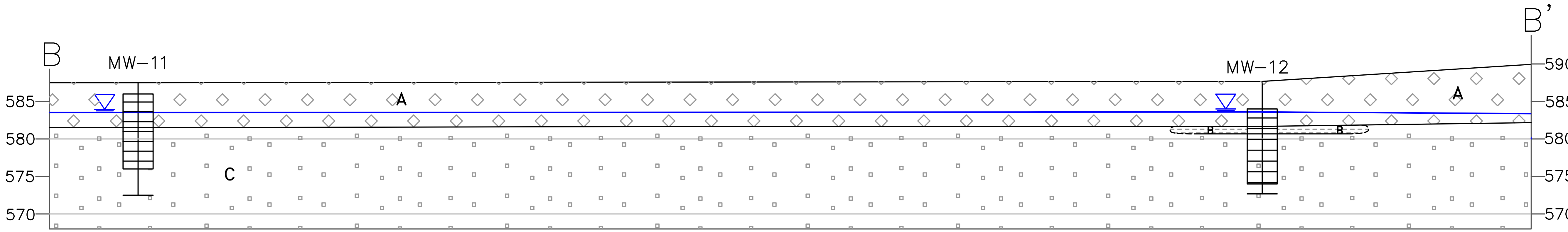
SAND: CONSISTING OF GENERALLY LIGHT BROWN TO BROWN OR GRAY, WELL GRADED, FINE TO MEDIUM SANDS WITH SOME LOCALIZED MORE GRAVELLY SEAMS/LAYERS. (C)

WATER LEVEL (5/21)

POND OUTLINE

20'
0
100'
APPROXIMATE SCALE

ENVIRONMENTAL CONSULTATION & REMEDIATION KPRG KPRG and Associates, inc. 14665 West Lisbon Road, Suite 1A Brookfield, Wisconsin 53005 Telephone 262-781-0475 Facsimile 262-781-0478 414 Plaza Drive, Suite 106 Westmont, Illinois 60559 Telephone 630-325-1300 Facsimile 630-325-1593	CROSS SECTION A-A' WAUKEGAN STATION WAUKEGAN, ILLINOIS SEE SCALE — Date: September 21, 2021 KPRG Project No. 19520.2 — FIGURE 9-2



A — FILL: CONSISTING OF BROWN AND BLACK FINE TO MEDIUM SAND WITH SOME GRAVEL AND SILT SEAMS. THE FILL MAY INCLUDE ASH, BLACK CINDERS, SLAG, AND OCCASIONAL COAL AND WOOD FRAGMENTS.

B — ORGANIC CLAYEY SILTS, SILTY SAND AND/OR PEAT: LOCALIZED, DISCONTINUOUS LENSES OF ORGANIC BLACK TO GRAY CLAYEY SILTS AND SILTY SANDS OR PEAT SEPARATING THE FILL FROM UNDERLYING SAND.

C — SAND: CONSISTING OF GENERALLY LIGHT BROWN TO BROWN OR GRAY, WELL GRADED, FINE TO MEDIUM SANDS WITH SOME LOCALIZED MORE GRAVELLY SEAMS/LAYERS.

WATER LEVEL (5/21)

15'
80'
0
APPROXIMATE SCALE

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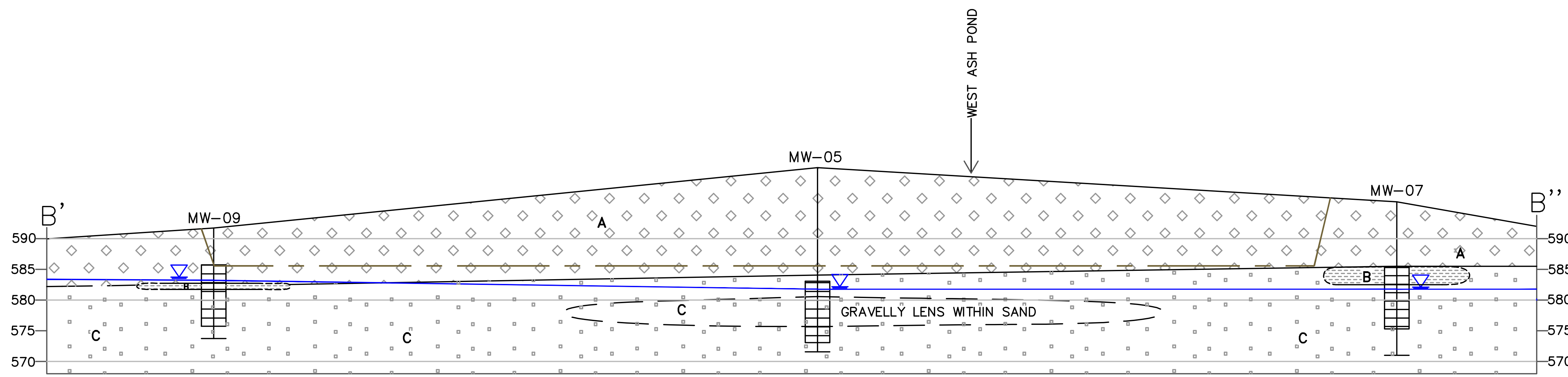
414 Plaza Drive, Suite 106 Westmont, Illinois 60559 Telephone 630-325-1300 Facsimile 630-325-1593

CROSS SECTION B–B'	
WAUKEGAN STATION WAUKEGAN, ILLINOIS	
SEE SCALE	Date: September 21, 2021
KPRG Project No. 19520.2	FIGURE 9–3



A	FILL: CONSISTING OF BROWN AND BLACK FINE TO MEDIUM SAND WITH SOME GRAVEL AND SILT SEAMS. THE FILL MAY INCLUDE ASH, BLACK CINDERS, SLAG, AND OCCASIONAL COAL AND WOOD FRAGMENTS.
B	ORGANIC CLAYEY SILTS, SILTY SAND AND/OR PEAT: LOCALIZED, DISCONTINUOUS LENSES OF ORGANIC BLACK TO GRAY CLAYEY SILTS AND SILTY SANDS OR PEAT SEPARATING THE FILL FROM UNDERLYING SAND.
C	SAND: CONSISTING OF GENERALLY LIGHT BROWN TO BROWN OR GRAY, WELL GRADED, FINE TO MEDIUM SANDS WITH SOME LOCALIZED MORE GRAVELLY SEAMS/LAYERS.
	WATER LEVEL (5/21)
	PROJECTED POND OUTLINE

20'
80'
0
APPROXIMATE SCALE

ENVIRONMENTAL CONSULTATION & REMEDIATION

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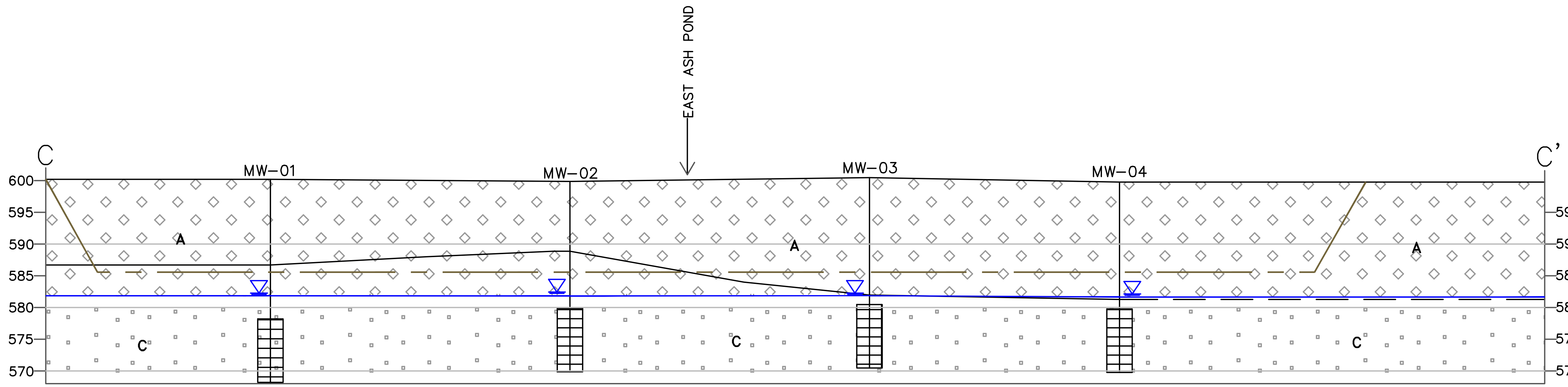
CROSS SECTION B'-B''

WAUKEGAN STATION
WAUKEGAN, ILLINOIS

SEE SCALE	Date: September 21, 2021
KPRG Project No. 19520.2	FIGURE 9-4



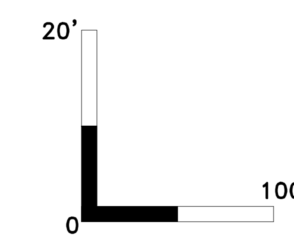
A — FILL: CONSISTING OF BROWN AND BLACK FINE TO MEDIUM SAND WITH SOME GRAVEL AND SILT SEAMS. THE FILL MAY INCLUDE ASH, BLACK CINDERS, SLAG, AND OCCASIONAL COAL AND WOOD FRAGMENTS.

B — ORGANIC CLAYEY SILTS, SILTY SAND AND/OR PEAT: LOCALIZED, DISCONTINUOUS LENSES OF ORGANIC BLACK TO GRAY CLAYEY SILTS AND SILTY SANDS OR PEAT SEPARATING THE FILL FROM UNDERLYING SAND.

C — SAND: CONSISTING OF GENERALLY LIGHT BROWN TO BROWN OR GRAY, WELL GRADED, FINE TO MEDIUM SANDS WITH SOME LOCALIZED MORE GRAVELLY SEAMS/LAYERS.

WATER LEVEL (5/21)

PROJECTED POND OUTLINE



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KPRG and Associates, inc.
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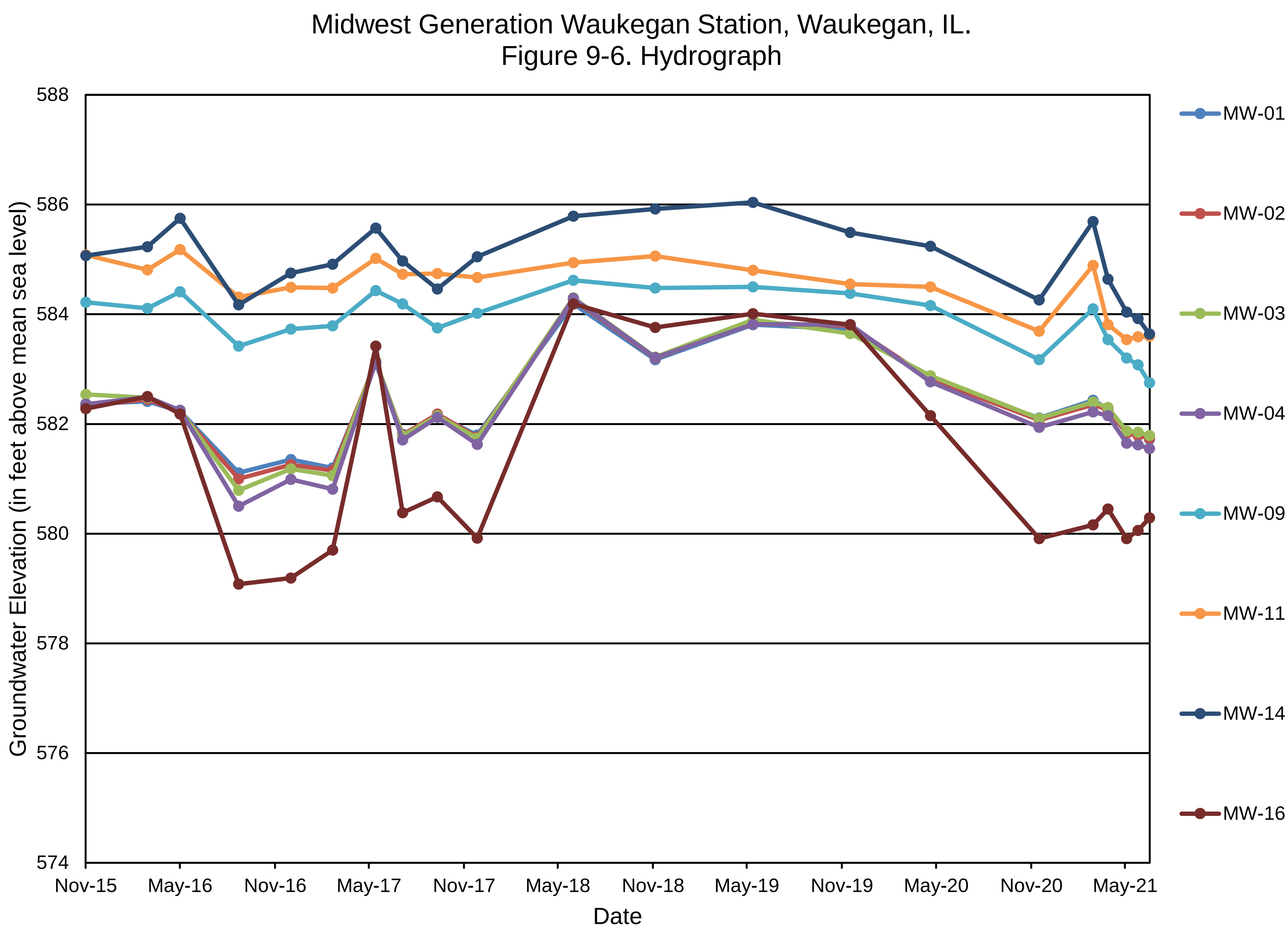
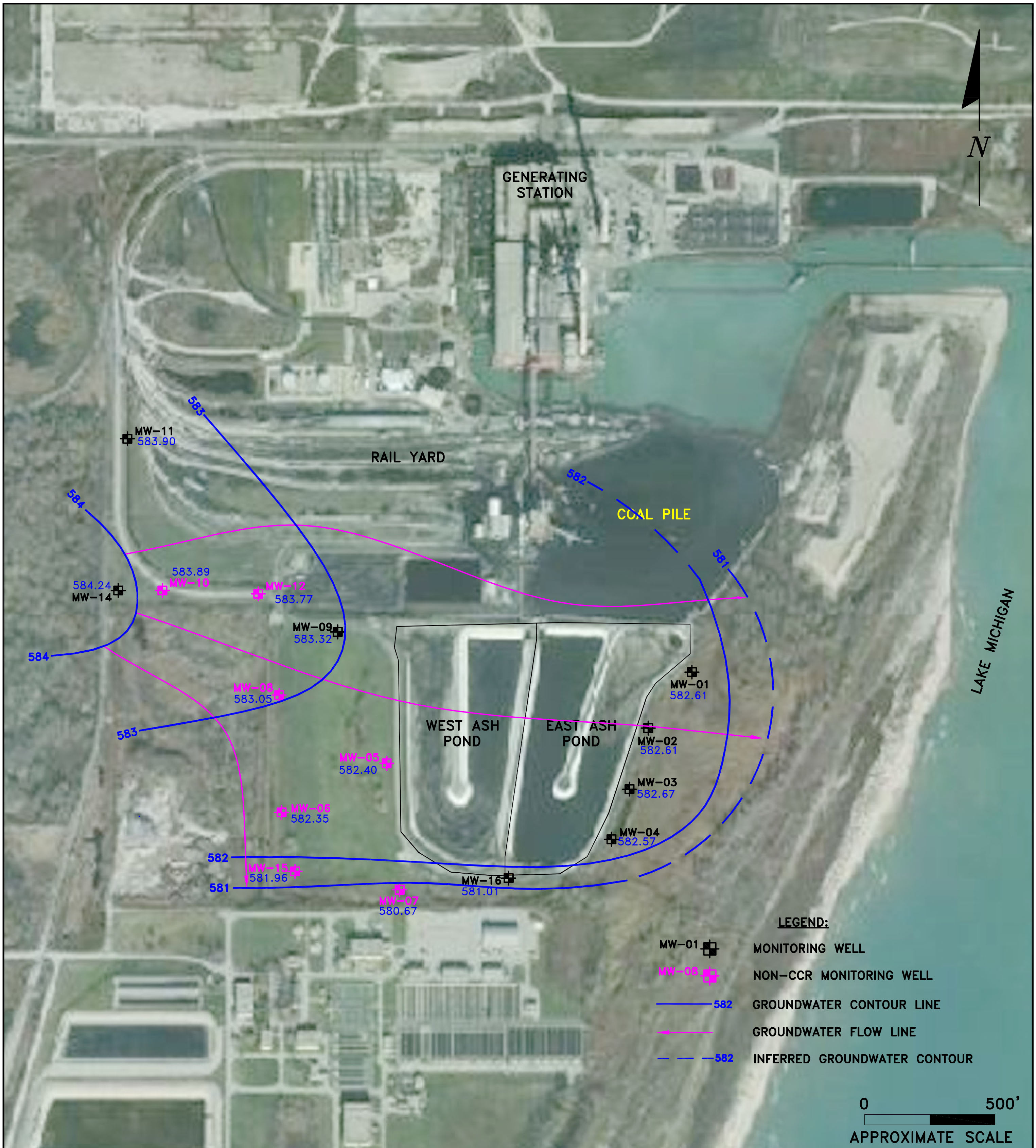
CROSS SECTION C–C'

WAUKEGAN STATION
WAUKEGAN, ILLINOIS

SEE SCALE	Date: September 21, 2021
KPRG Project No. 19520.2	FIGURE 9-5



Midwest Generation Waukegan Station, Waukegan, IL.
Figure 9-6. Hydrograph
Groundwater Elevation (in feet above mean sea level)
588
586
584
582
580
578
576
574
Nov-15
May-16
Nov-16
May-17
Nov-17
May-18
Nov-18
May-19
Nov-19
May-20
Nov-20
May-21
Date
MW-01
MW-02
MW-03
MW-04
MW-09
MW-11
MW-14
MW-16



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GROUNDWATER CONTOUR MAP 08/2020

WAUKEGAN STATION
WAUKEGAN, ILLINOIS

Scale: 1" = 500'	Date: August 31, 2021
KPRG Project No. 19520.2	FIGURE 9-7

ENVIRONMENTAL CONSULTATION & REMEDIATION

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GROUNDWATER CONTOUR MAP 11/2020

WAUKEGAN STATION
WAUKEGAN, ILLINOIS

Scale: 1" = 500'	Date: August 31, 2021
KPRG Project No. 19520.2	FIGURE 9-8

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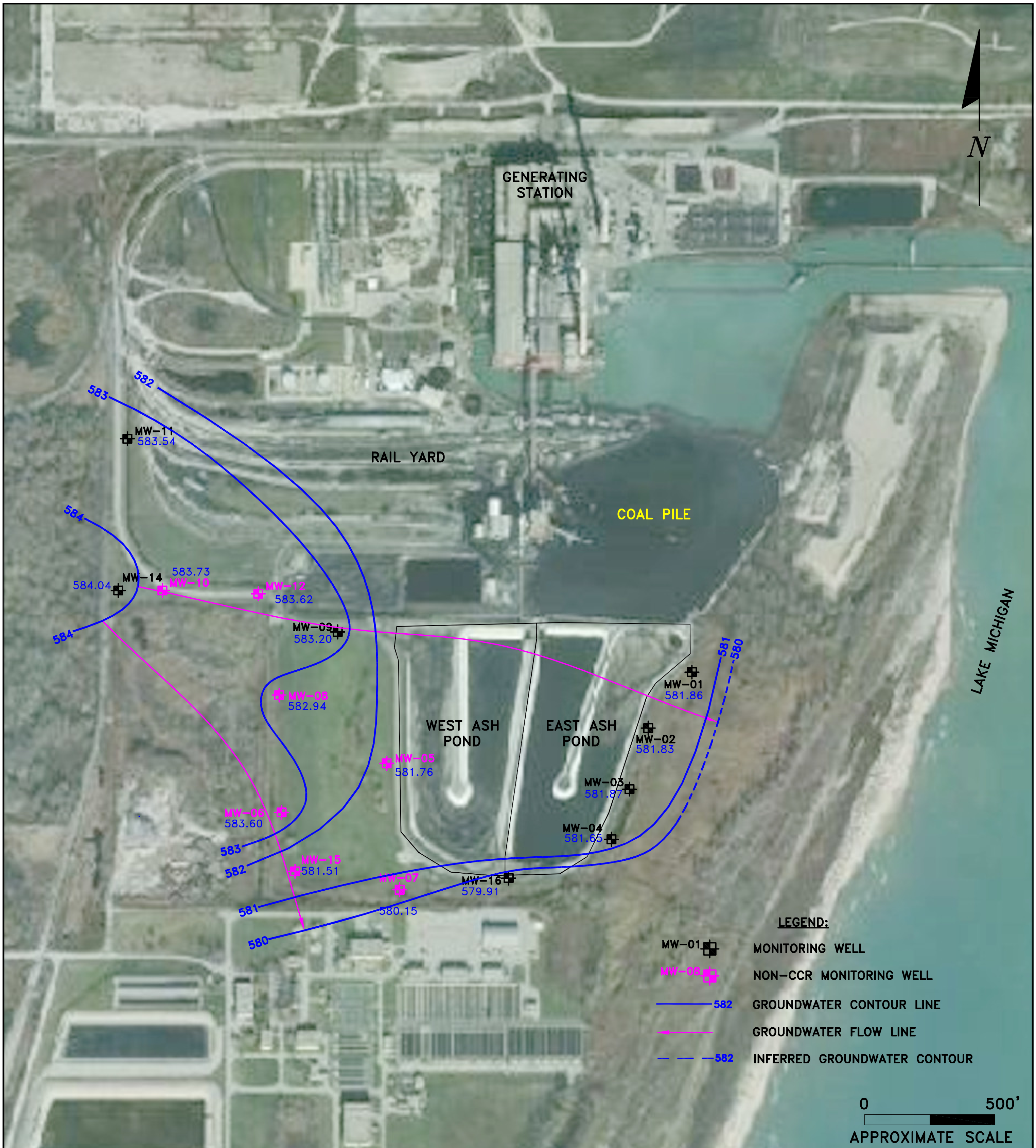
GROUNDWATER CONTOUR MAP 03/2021

WAUKEGAN STATION
WAUKEGAN, ILLINOIS

Scale: 1" = 500'	Date: August 31, 2021
KPRG Project No. 19520.2	FIGURE 9-9



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GROUNDWATER CONTOUR MAP 05/2021

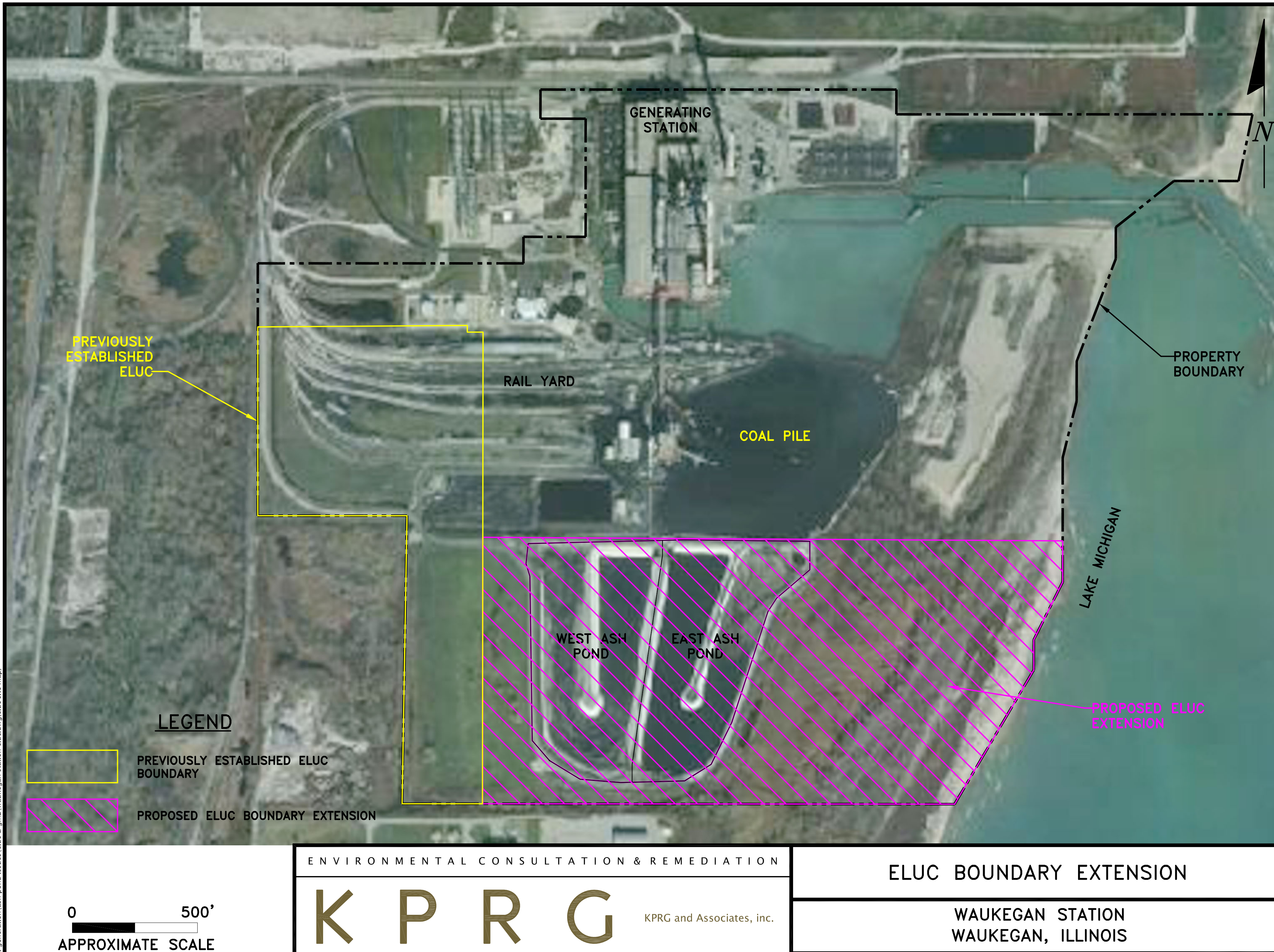
WAUKEGAN STATION
WAUKEGAN, ILLINOIS

Scale: 1" = 500'

Date: August 31, 2021

KPRG Project No. 19520.2

FIGURE 9-10



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ELUC BOUNDARY EXTENSION

WAUKEGAN STATION
WAUKEGAN, ILLINOIS

Scale: 1" = 500'	Date: September 17, 2021
KPRG Project No. 19520.2	FIGURE 9-11

W:\projects\midwest generation\ash pond issues\eluc & gmz\waukegan station eluc.dwg(eluc site map)

W:\projects\midwest generation\operating and constr permit\waukegan\waukegan station.dwg

LEGEND

● WATER WELL
41204 SHORT API WELL ID
1540 TOTAL WELL DEPTH

0 800'

APPROXIMATE SCALE

ENVIRONMENTAL CONSULTATION & REMEDIATION

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KPRG and Associates, inc.

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2500' RADIUS POTABLE WELL MAP

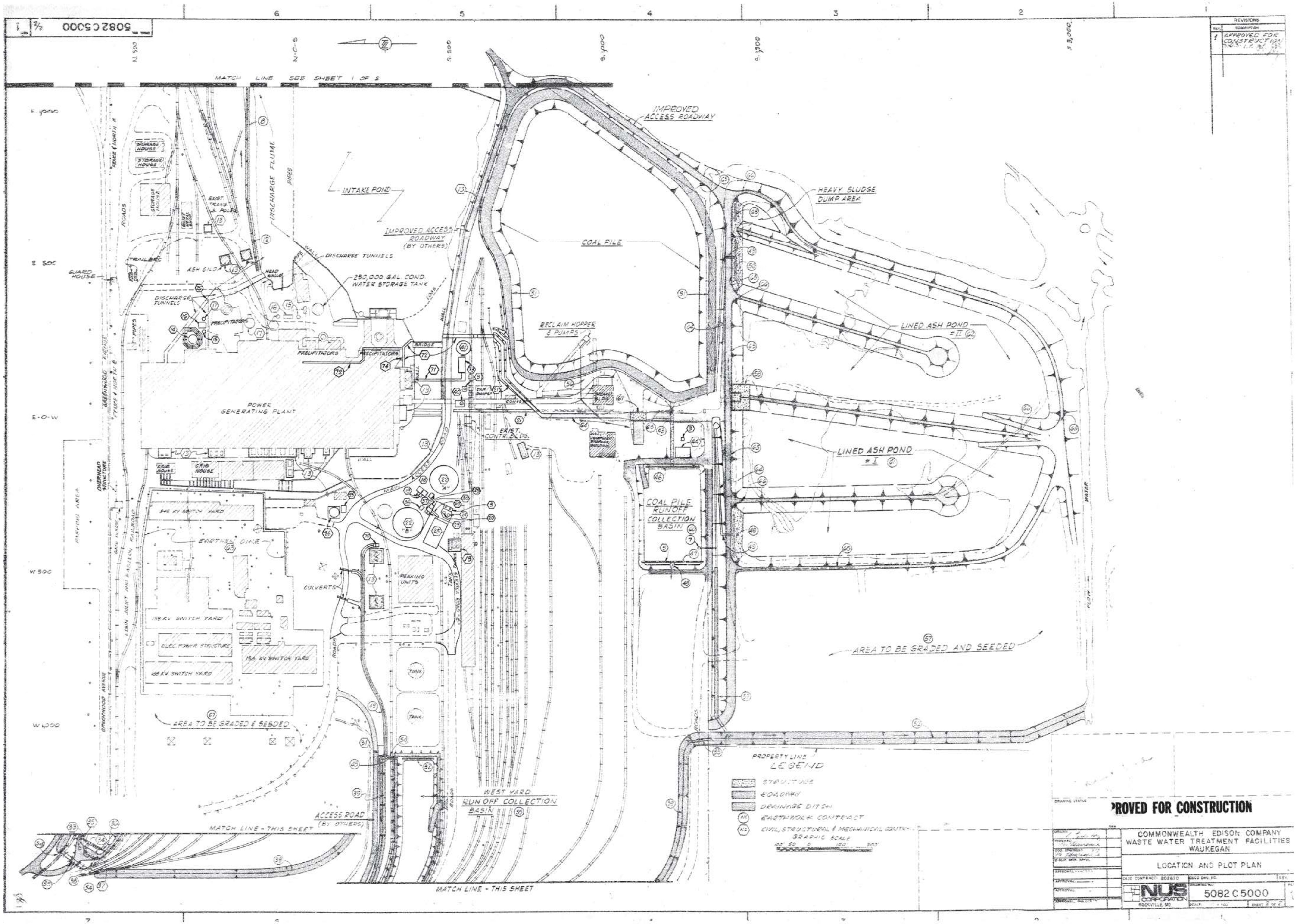
WAUKEGAN GENERATING STATION
WAUKEGAN, ILLINOIS

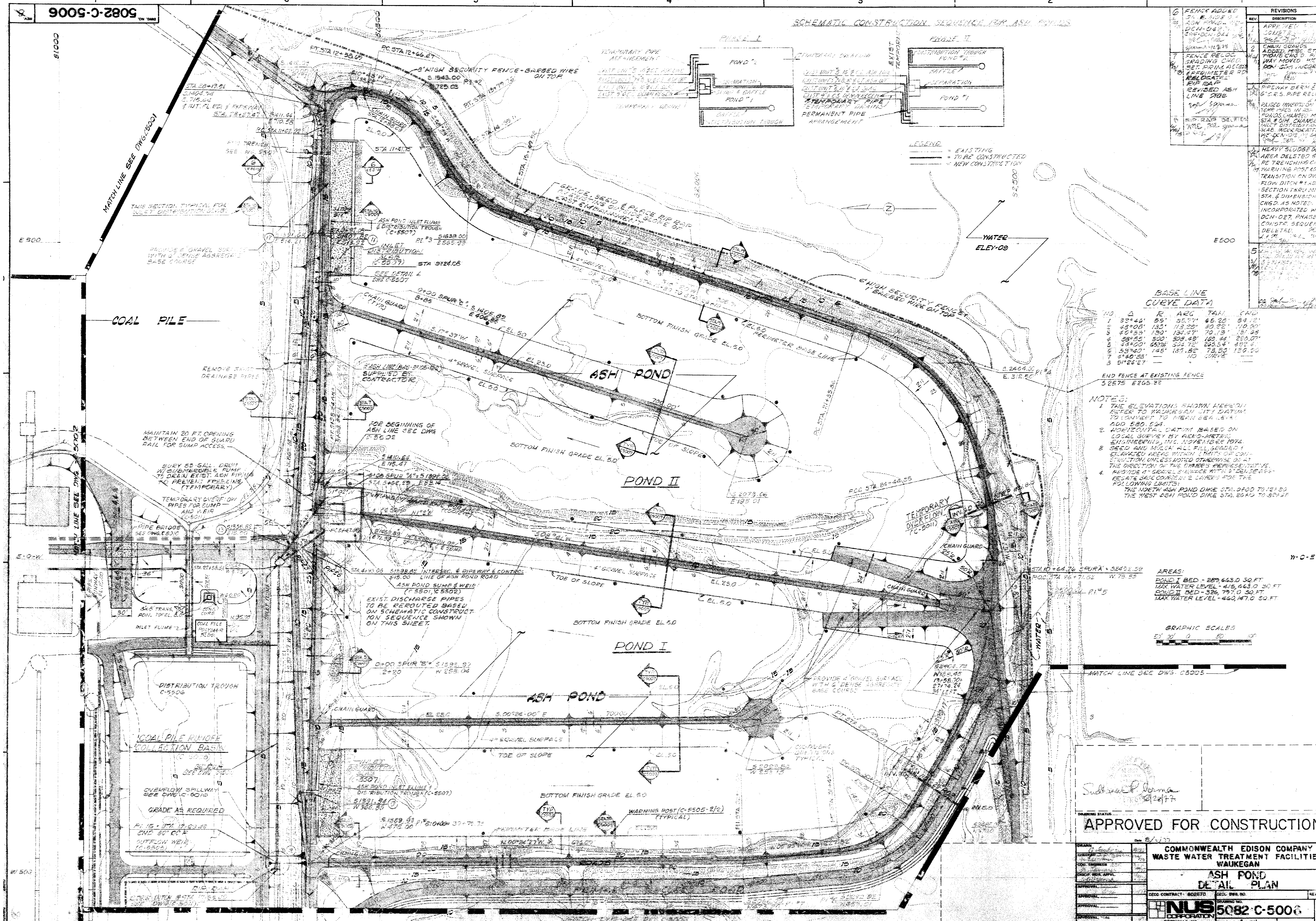
Scale: 1" = 800'	Date: August 25, 2021
KPRG Project No. 19520.2	FIGURE 9-12

OPERATING PERMIT ATTACHMENTS

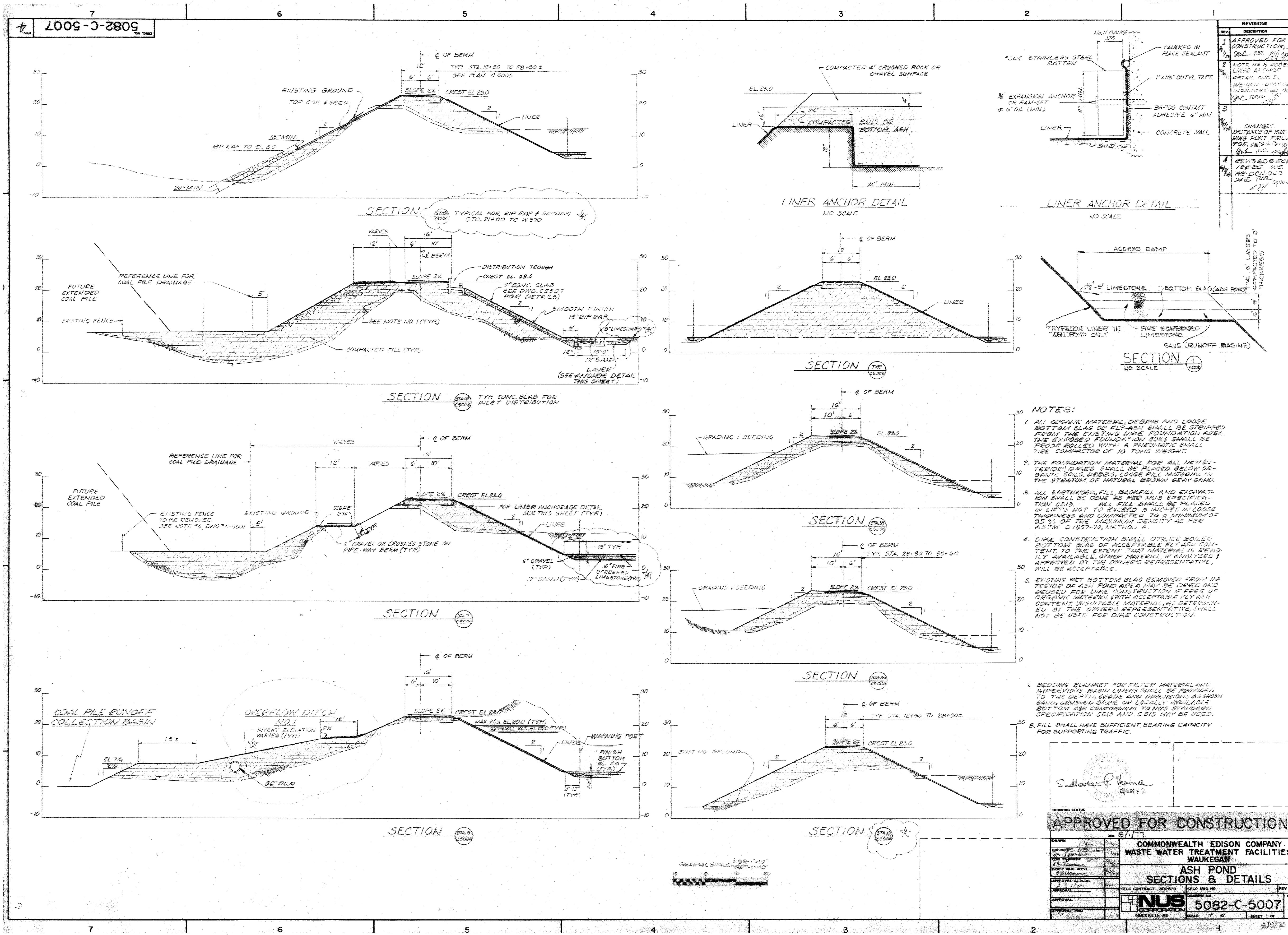
ATTACHMENT 1
HISTORY OF CONSTRUCTION

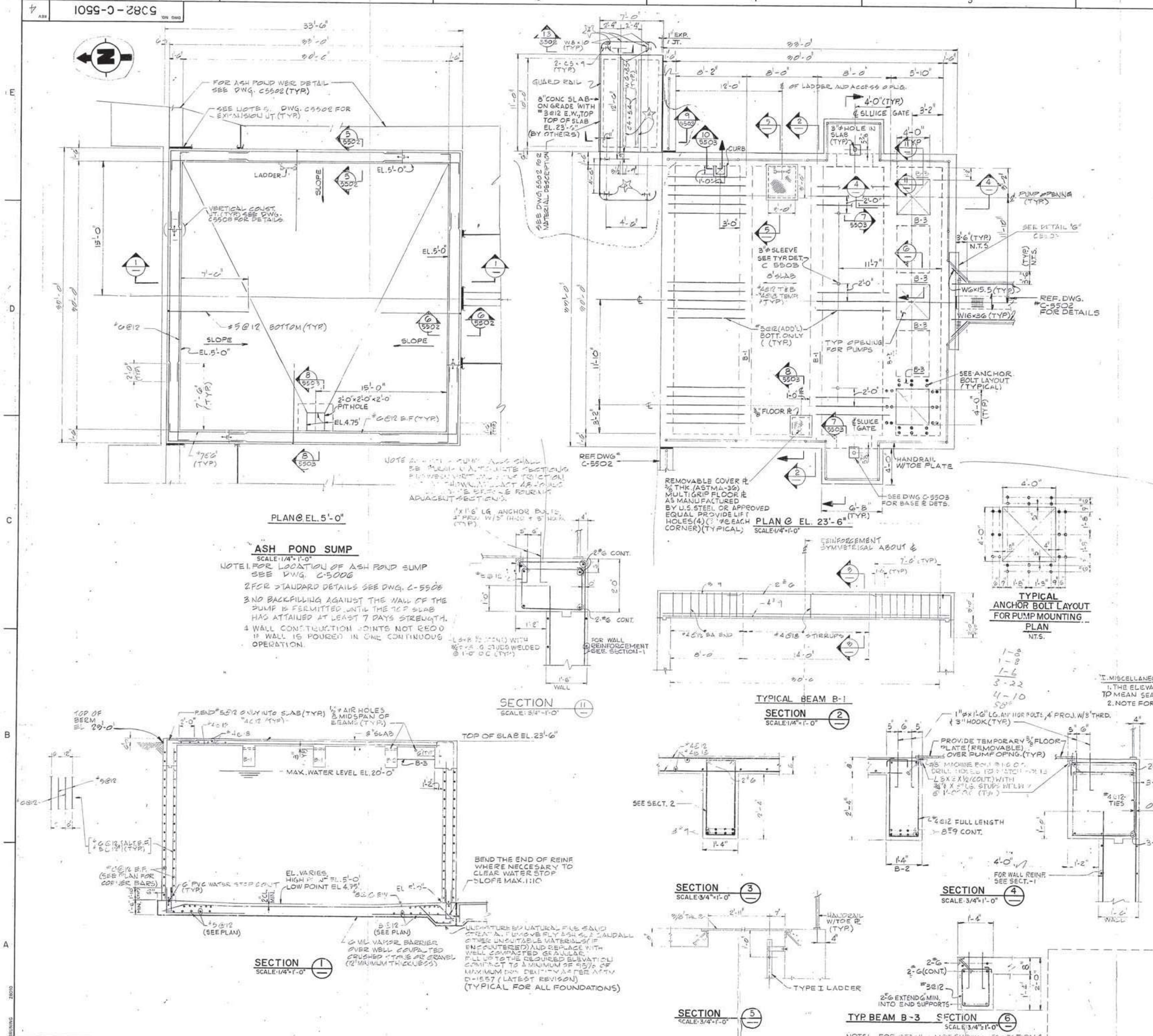
Attachment 1-1 – NUS Construction Drawings

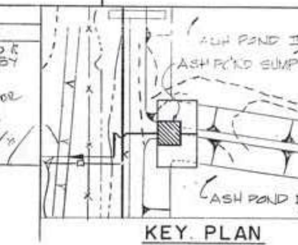

MATCH LINE SEE SHEET 1 OF 2
IMPROVED ACCESS ROADWAY
INTAKE POND
DISCHARGE FLUME
IMPROVED ACCESS ROADWAY (BY OTHERS)
DISCHARGE TUNNELS
250,000 GAL. COND. WATER STORAGE TANK
COAL PILE
HEAVY SLUDGE DUMP AREA
LINED ASH POND #II
RECLAIM HOPPER & PUMPS
PRECIPITATORS
POWER GENERATING PLANT
EXIST. CONTR. BLDG.
LINED ASH POND #I
COAL PILE RUNOFF COLLECTION BASIN
345 KV SWITCH YARD
EARTHEN DIKE
CULVERTS
PEAKING UNITS
138 KV SWITCH YARD
ELEC. POWER STRUCTURE
AREA TO BE GRADED AND SEEDED
AREA TO BE GRADED & SEEDED
WEST YARD RUN OFF COLLECTION BASIN
ACCESS ROAD (BY OTHERS)
MATCH LINE - THIS SHEET
PROPERTY LINE
LEGEND
STRUCTURE
ROADWAY
DRAINAGE DITCH
EARTHWORK CONTRACT
CIVIL, STRUCTURAL & MECHANICAL CONTRACT
GRAPHIC SCALE
REVISIONS
APPROVED FOR CONSTRUCTION
DRAWING STATUS
PROVED FOR CONSTRUCTION
COMMONWEALTH EDISON COMPANY
WASTE WATER TREATMENT FACILITIES
WAUKEGAN
LOCATION AND PLOT PLAN
CECO CONTRACT: 802670
NUS CORPORATION
ROCKVILLE, MD
DRAWING NO. 5082 C 5000
SHEET 2 OF 2



5082-C-5006
SCHEMATIC CONSTRUCTION SEQUENCE FOR ASH PONDS
PHASE I
PHASE II
POND I
POND II
LEGEND
BASE LINE
CURVE DATA
NOTES:
COAL PILE
ASH POND
POND II
POND I
ASH POND
COAL PILE RUNOFF COLLECTION BASIN
DISTRIBUTION TROUGH
GRADE AS REQUIRED
BOTTOM FINISH GRADE EL. 5.0
TOE OF SLOPE
TEMPORARY OVERFLOW
AREAS:
GRAPHIC SCALES
MATCH LINE SEE DWG. C-5005
APPROVED FOR CONSTRUCTION
COMMONWEALTH EDISON COMPANY
WASTE WATER TREATMENT FACILITIES
WAUKEGAN
ASH POND
DETAIL PLAN
NUS CORPORATION
ROCKVILLE, MD.
5082-C-5006


5082-C-5007
REVISIONS
APPROVED FOR CONSTRUCTION
SECTION
TYPICAL FOR RIP RAP & SEEDING STA. 21+00 TO W 370
EXISTING GROUND
TOP SOIL & SEED
SLOPE 2%
CREST EL 23.0
LINER
18" MIN.
RIP RAP TO EL 3.0
24" MIN.
SECTION
TYP. CONC. SLAB FOR INLET DISTRIBUTION
REFERENCE LINE FOR COAL PILE DRAINAGE
FUTURE EXTENDED COAL PILE
EXISTING FENCE
DISTRIBUTION TROUGH
SEE NOTE NO. 1 (TYP.)
COMPACTED FILL (TYP.)
SMOOTH FINISH
18" RIP RAP
SECTION
EXISTING FENCE TO BE REMOVED
EXISTING GROUND
FOR LINER ANCHORAGE DETAIL SEE THIS SHEET (TYP)
2" GRAVEL OR CRUSHED STONE ON PIPE-WAY BERM (TYP)
6" GRAVEL (TYP)
6" FINE SCREENED LIMESTONE (TYP)
12" SAND (TYP)
SECTION
COAL PILE RUNOFF COLLECTION BASIN
OVERFLOW DITCH NO.1
INVERT ELEVATION VARIES (TYP)
MAX. W.S. EL 20.0 (TYP)
NORMAL W.S. EL 15.0 (TYP)
WARNING POST
FINISH BOTTOM
SECTION
LINER ANCHOR DETAIL
NO SCALE
COMPACTED 4" CRUSHED ROCK OR GRAVEL SURFACE
COMPACTED SAND OR BOTTOM ASH
LINER ANCHOR DETAIL
NO SCALE
#304 STAINLESS STEEL BATTEN
CAULKED IN PLACE SEALANT
1"x1/16" BUTYL TAPE
BR-700 CONTACT ADHESIVE 6" MIN.
CONCRETE WALL
SECTION
SECTION
SECTION
SECTION
GRADING & SEEDING
ACCESS RAMP
LIMESTONE
BOTTOM SLAG (ASH POND)
HYPALON LINER IN ASH POND ONLY
FINE SCREENED LIMESTONE
SAND (RUNOFF BASINS)
SECTION
NO SCALE
GRAPHIC SCALE
NOTES:
1. ALL ORGANIC MATERIAL, DEBRIS AND LOOSE BOTTOM SLAG OR FLY-ASH SHALL BE STRIPPED FROM THE EXISTING DIKE FOUNDATION AREA. THE EXPOSED FOUNDATION SOILS SHALL BE PROOF ROLLED WITH A PNEUMATIC SMALL TIRE COMPACTOR OF 10 TONS WEIGHT.
2. THE FOUNDATION MATERIAL FOR ALL NEW (INTERIOR) DIKES SHALL BE PLACED BELOW ORGANIC SOILS, DEBRIS, LOOSE FILL MATERIAL IN THE STRATUM OF NATURAL BROWN GRAY SAND.
3. ALL EARTHWORK, FILL, BACKFILL AND EXCAVATION SHALL BE DONE AS PER NUS SPECIFICATION C513. ALL FILL SHALL BE PLACED IN LIFTS NOT TO EXCEED 9 INCHES IN LOOSE THICKNESS AND COMPACTED TO A MINIMUM OF 95 % OF THE MAXIMUM DENSITY AS PER ASTM D1557-70, METHOD A.
4. DIKE CONSTRUCTION SHALL UTILIZE BOILER BOTTOM SLAG OF ACCEPTABLE FLY ASH CONTENT, TO THE EXTENT THAT MATERIAL IS READILY AVAILABLE. OTHER MATERIAL, IF ANALYSED & APPROVED BY THE OWNER'S REPRESENTATIVE, WILL BE ACCEPTABLE.
5. EXISTING WET BOTTOM SLAG REMOVED FROM INTERIOR OF ASH POND AREA MAY BE DRIED AND REUSED FOR DIKE CONSTRUCTION IF FREE OF ORGANIC MATERIAL & WITH ACCEPTABLE FLY ASH CONTENT. UNSUITABLE MATERIAL, AS DETERMINED BY THE OWNER'S REPRESENTATIVE, SHALL NOT BE USED FOR DIKE CONSTRUCTION.
7. BEDDING BLANKET FOR FILTER MATERIAL AND IMPERVIOUS BASIN LINERS SHALL BE PROVIDED TO THE DEPTH, GRADE AND DIMENSIONS AS SHOWN. SAND, CRUSHED STONE OR LOCALLY AVAILABLE BOTTOM ASH CONFORMING TO NUS STANDARD SPECIFICATION C613 AND C515 MAY BE USED.
8. FILL SHALL HAVE SUFFICIENT BEARING CAPACITY FOR SUPPORTING TRAFFIC.
Sudhakar P. Verma 9-21-77
DRAWING STATUS
APPROVED FOR CONSTRUCTION
Date 8/1/77
DRAWN
CHECKED
CDG. ENGINEER
DISCIP. MGR. APPVL.
APPROVAL
COMMONWEALTH EDISON COMPANY
WASTE WATER TREATMENT FACILITIES
WAUKEGAN
ASH POND
SECTIONS & DETAILS
CECO CONTRACT: 802670
CECO DWG NO.
REV.
NUS CORPORATION
ROCKVILLE, MD.
DRAWING NO.
5082-C-5007
SCALE: 1" = 10'
SHEET OF





GENERAL NOTES

THESE NOTES SHALL BE USED AS A SUPPLEMENT TO THE NOTES SHOWN ON INDIVIDUAL DRAWINGS

I. FOUNDATION

1. THE BOTTOM OF ALL EXCAVATIONS SHALL BE INSPECTED AND APPROVED BY THE OWNER OR HIS AUTHORIZED REPRESENTATIVE
2. THE DESIGN BEARING CAPACITY OF SOIL IS ASSUMED TO BE 3000 P.S.F.
3. ALL SLABS ON GRADE INCLUDING FOUNDATION PADS FOR EQUIPMENT SHALL BE PLACED ON 6 MIL POLYETHYLENE VAPOR BARRIER PLACED OVER WELL COMPACTED CRUSHED STONE OR GRAVEL (8" MINIMUM). UNLESS OTHERWISE NOTED ON DRAWING
4. ALL FOUNDATIONS SHALL BEAR UPON UNDISTURBED SOIL AND WELL PREPARED COMPACTED SOIL

II. CONCRETE

1. ALL STRUCTURAL CONCRETE SHALL BE STONE CONCRETE AND SHALL DEVELOP A MINIMUM COMPRESSIVE STRENGTH OF 4000 P.S.I. AT 28 DAYS
2. ALL REINFORCING BARS SHALL BE DEFORMED BARS OF NEW BILLET STEEL CONFORMING TO A.S.T.M. A-615 GRADE 40 AND SHALL HAVE A MINIMUM YIELD STRESS OF 40,000 P.S.I.
3. UNLESS OTHERWISE NOTED, ALL DOWELS SHALL BE SAME IN NUMBER AND SIZE AS THE VERTICAL BARS TO WHICH THEY ARE SPLICED.
4. MINIMUM CONCRETE PROTECTION FOR REINFORCING BARS SHALL BE AS INDICATED BELOW. PLACING OF ALL REINFORCING BARS SHALL CONFORM TO ACI 381-71, SECTION 7.3.

Cast-In-Place Concrete	Min. Cover, In	Cast-In-Place Concrete	Min. Cover, In
Cast against and permanently exposed to earth	3	Exposed to earth or weather:	
Not exposed to weather or in contact with the ground:		No 6 through No.18 Bars	2
Slabs, walls, joists:		No 5 Bars, 5/8 In. wire, and smaller	1-1/2
No.14 and No.18 Bars	1-1/2	Beams, girders, columns:	
No.11 and smaller	3/4	Principal reinforcement, ties, stirrups or spirals	1-1/2

5. UNLESS OTHERWISE NOTED ALL SPLICES, BENDS, STANDARD HOOKS AND OTHER DETAILING OF REINFORCING BARS SHALL BE DONE AS RECOMMENDED IN THE "MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES" (ACI 315 74).
6. CONTRACTOR SHALL VERIFY DIMENSIONS & LOCATIONS OF ALL OPENINGS, PIPE SLEEVES, ANCHOR BOLTS, ETC., AS REQUIRED BY OTHER TRADES BEFORE PLACING ANY CONCRETE
7. CONSTRUCTION JOINTS OF LIQUID CONTAINING STRUCTURES SHALL HAVE 6" P.V.C CONTINUOUS WATER STOP UNLESS NOTED OTHERWISE ON THE CONTRACT DRAWINGS
8. W.W.F. SHALL CONFORM TO REQUIREMENTS OF ASTM 185

III. STRUCTURAL STEEL

1. ALL STRUCTURAL STEEL SHALL CONFORM TO THE REQUIREMENTS OF ASTM A-36
2. THE DESIGN, FABRICATION AND ERECTION OF ALL STRUCTURAL STEEL SHALL BE DONE IN ACCORDANCE WITH THE AISC MANUAL OF STEEL CONSTRUCTION (SEVENTH EDITION)
3. ALL STRUCTURAL BOLTS SHALL BE 3/4" Ø HIGH STRENGTH TYPE ASTM A 325-X.
4. UNLESS OTHERWISE NOTED, ALL CONNECTIONS SHALL BE SELECTED TO SUPPORT HALF THE TOTAL UNIFORM LOAD CAPACITY SHOWN IN "TABLES FOR ALLOWABLE LOADS ON BEAMS" (AISC MANUAL OF STEEL CONSTRUCTION – SEVENTH EDITION) + 5 KIPS FOR THE SHAPE AND SPAN SHOWN ON DRAWINGS
5. ALL WELDING SHALL BE DONE IN ACCORDANCE WITH THE REQUIREMENTS OF "STRUCTURAL WELDING CODE, AWS D1.1–REV 1-73" WELDING ELECTRODES SHALL BE E70XX

IV. EARTHWORK.

1. ONE FOOT OF POROUS BACKFILL SHALL BE PLACED ALONG ALL WALLS FROM TOP OF FOUNDATION TO 1'–0" BELOW FINISHED GRADE WHERE SHOWN ON CONTRACT DRAWINGS
2. BACKFILLING SHALL NOT BE DONE UNTIL ALL CONCRETE HAS ATTAINED ITS' FULL DESIGN COMPRESSIVE STRENGTH
3. BACKFILLING SHALL BE DONE AND COMPACTED IN EQUAL LAYERS ALONG ALL SIDES OF STRUCTURE
4. CONTRACTOR SHALL ADEQUATELY PROTECT ALL WALLS DURING BACKFILLING OPERATIONS

V. MISCELLANEOUS.

1. THE ELEVATIONS SHOWN ON THESE DRAWINGS REFER TO WAUKEGAN CITY DATUM. TO CONVERT TO MEAN SEA LEVEL, ADD 580.364
2. NOTE FOR COVER SLAB, DESIGN LIVE LOAD = 200 PSF, DESIGN PUMP WT [illegible] K.

REVISIONS	
REV	DESCRIPTION
	APPROVED FOR CONSTRUCTION
	REVISE [illegible] ADDED & CHANGED NOTES
3	ADDED SECTION 11 & NOTES [illegible]

DRAWING STATUS

APPROVED FOR CONSTRUCTION

Date 6/28/78

DRAWN	
CHECKED	
COG ENGINEER	
DISCIP MGR APPVL.	
APPROVAL	
APPROVAL	
APPROVAL	
APPROVAL	

COMMONWEALTH EDISON COMPANY
WASTE WATER TREATMENT FACILITIES
WAUKEGAN

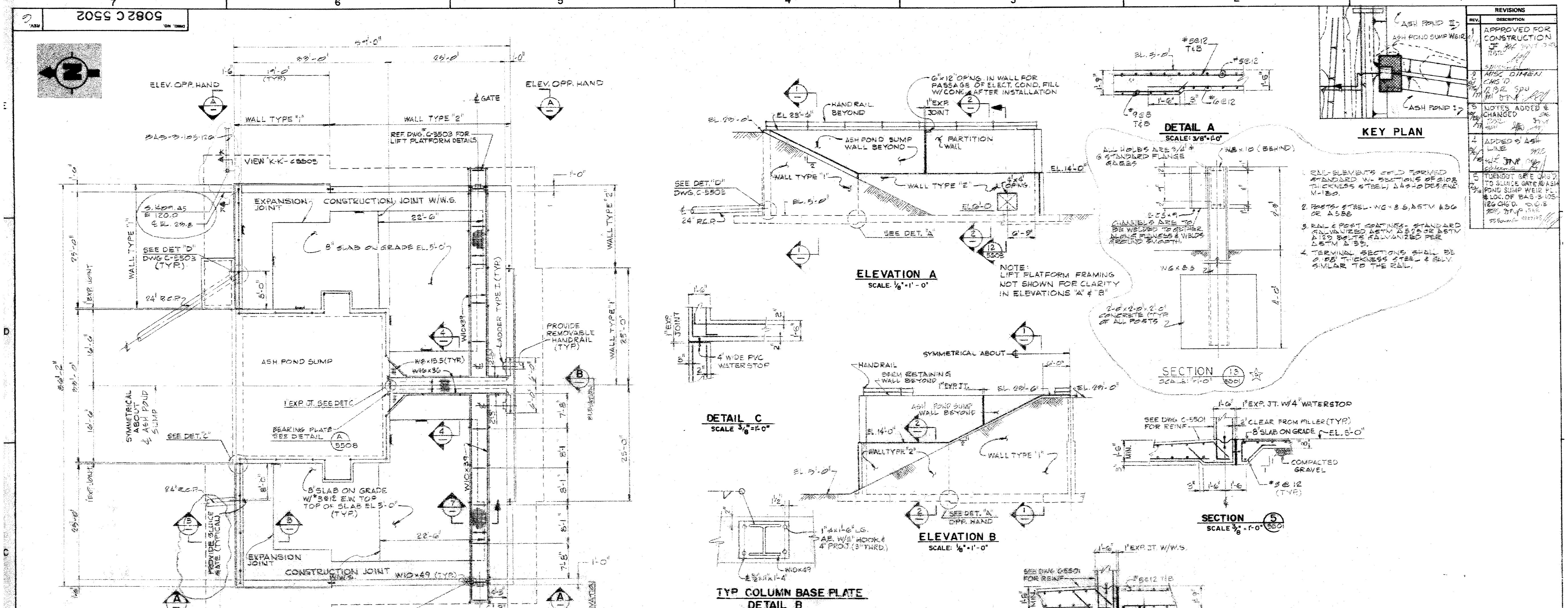
ASH POND SUMP
PLAN, SECTIONS AND DETAILS

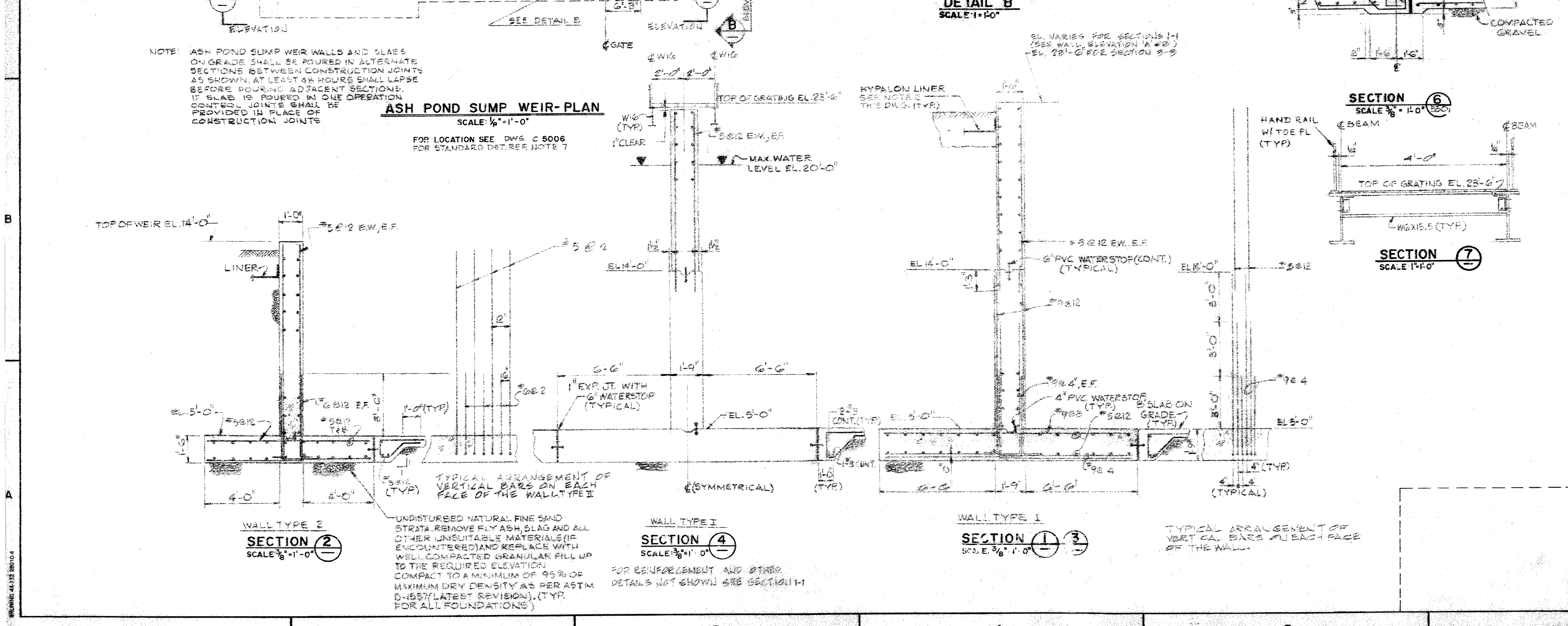
CECO CONTRACT #02670 — CECO DWG NO

NUS CORPORATION
ROCKVILLE, MD

DRAWING NO 5082 C 5501 — REV

SCALE AS NOTED — SHEET 1 OF 1





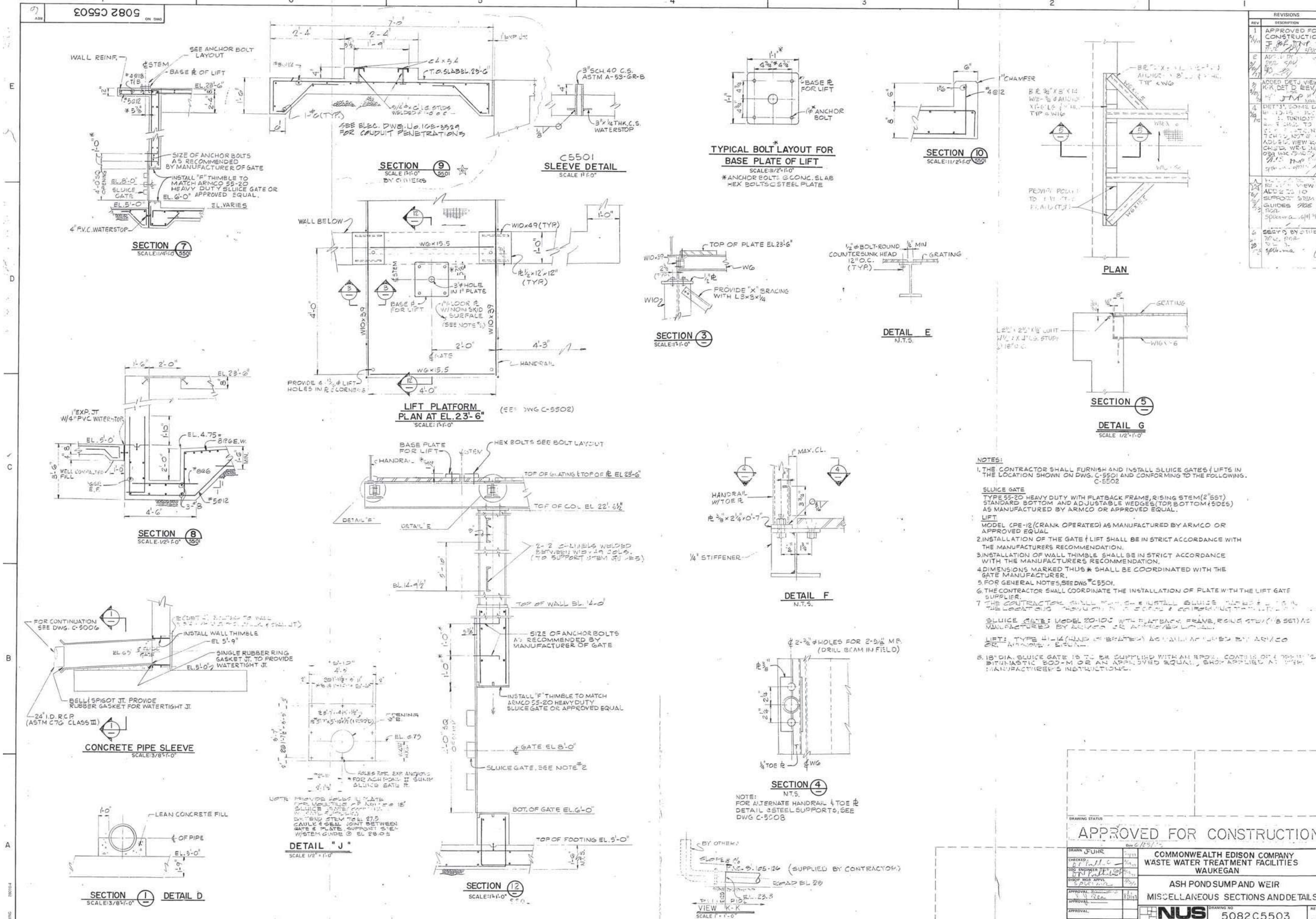
NOTES

1. FOR GENERAL NOTES SEE DWG. C5501.
2. FOR LINER ATTACHMENT DETAIL AT WALLS, SEE DWG C5007
3. FOR ASH POND SUMP DETAILS SEE DWG C5501.
4. WORK THIS SHEET WITH DWG C5006 & C5007.
5. ALL EXPANSION JOINTS SHOWN IN THIS DWG SHALL BE OF THE PREMOLDED FILLER TYPE. NUS STANDARD SPEC #588
6. STEEL GRATING SHALL BE "IRVING" WELDED RECTANGULAR DESIGN, TYPE IHB-2 WITH 1"x1/8" MAINBARS AS MANUFACTURED BY IKG INDUSTRIES, OR APPROVED EQUAL (TACK WELD TO STEEL SUPPORT IN FIELD.)
7. FOR CORNER DETAIL, EXP. JT., CONSTRUCTION JOINT AND OTHER STANDARD DETAILS REF. DWG. C5503.

DRAWING STATUS

APPROVED FOR CONSTRUCTION

DRAWN	COMMONWEALTH EDISON COMPANY WASTE WATER TREATMENT FACILITIES WAUKEGAN
CHECKED	
COG. ENGINEER	ASH POND SUMP WEIR PLAN, SECTIONS & DETAILS
DISCP. MGR. APPVL.	
APPROVAL	CECO CONTRACT: 802670 — CECO DWG. NO. — REV.
APPROVAL	NUS CORPORATION, ROCKVILLE, MD. — DRAWING NO. 5082 C5502 — REV. 5
APPROVAL	SCALE: AS NOTED — SHEET OF



NOTES:

1. THE CONTRACTOR SHALL FURNISH AND INSTALL SLUICE GATES & LIFTS IN THE LOCATION SHOWN ON DWG. C-5501 C-5502 AND CONFORMING TO THE FOLLOWING.

SLUICE GATE

TYPE 55-20 HEAVY DUTY WITH FLATBACK FRAME, RISING STEM (2" SST) STANDARD BOTTOM AND ADJUSTABLE WEDGES (TOP, BOTTOM & SIDES) AS MANUFACTURED BY ARMCO OR APPROVED EQUAL.

LIFT

MODEL CPE-12 (CRANK OPERATED) AS MANUFACTURED BY ARMCO OR APPROVED EQUAL

2. INSTALLATION OF THE GATE & LIFT SHALL BE IN STRICT ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATION.
3. INSTALLATION OF WALL THIMBLE SHALL BE IN STRICT ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATION.
4. DIMENSIONS MARKED THUS * SHALL BE COORDINATED WITH THE GATE MANUFACTURER.
5. FOR GENERAL NOTES, SEE DWG # C5501.
6. THE CONTRACTOR SHALL COORDINATE THE INSTALLATION OF PLATE WITH THE LIFT GATE SUPPLIER.
7. THE CONTRACTOR SHALL FURNISH & INSTALL SLUICE GATES & LIFTS IN

SLUICE GATE: MODEL 20-10C WITH FLATBACK FRAME, RISING STEM (1 1/8 SST) AS MANUFACTURED BY ARMCO OR APPROVED EQUAL.

LIFT: TYPE 41-14 (HAND OPERATED) AS MANUFACTURED BY ARMCO OR APPROVED EQUAL.

8. 18" DIA. SLUICE GATE IS TO BE SUPPLIED WITH AN EPOXY COATING OF BITUMASTIC 300-M OR AN APPROVED EQUAL, SHOP APPLIED AT THE MANUFACTURER'S INSTRUCTIONS.

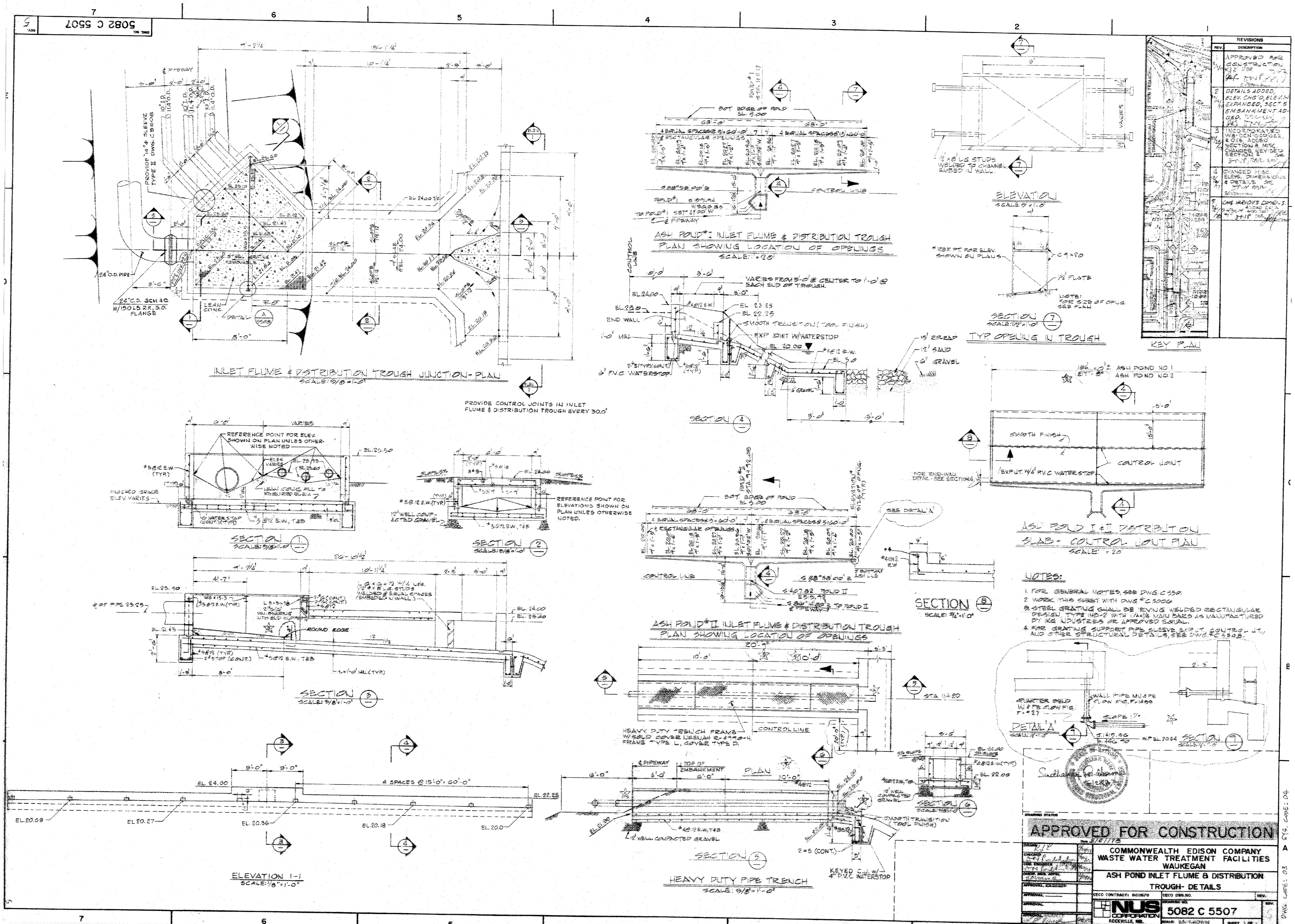
APPROVED FOR CONSTRUCTION

COMMONWEALTH EDISON COMPANY
WASTE WATER TREATMENT FACILITIES
WAUKEGAN

ASH POND SUMP AND WEIR
MISCELLANEOUS SECTIONS AND DETAILS

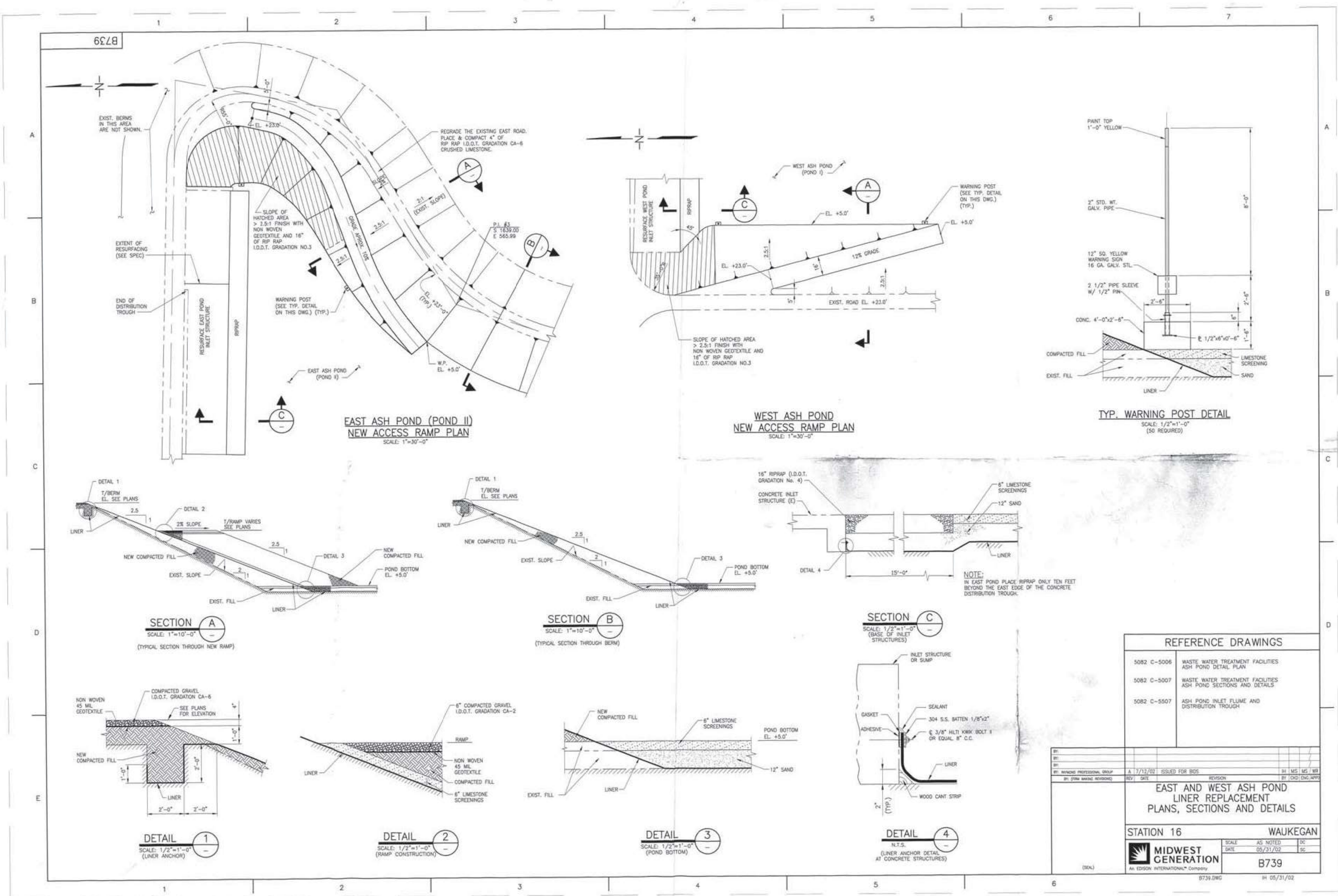
NUS CORPORATION
ROCKVILLE, MD

5082C5503



5082 C 5507
INLET FLUME & DISTRIBUTION TROUGH JUNCTION-PLAN
PROVIDE CONTROL JOINTS IN INLET FLUME & DISTRIBUTION TROUGH EVERY 30.0'
ASH POND #1 INLET FLUME & DISTRIBUTION TROUGH PLAN SHOWING LOCATION OF OPENINGS
SECTION 4
ELEVATION
SECTION 7
TYP OPENING IN TROUGH
KEY PLAN
REVISIONS
SECTION 1
SECTION 2
SECTION 3
ASH POND #II INLET FLUME & DISTRIBUTION TROUGH PLAN SHOWING LOCATION OF OPENINGS
SECTION 8
ASH POND I & II DISTRIBUTION SLAB - CONTROL JOINT PLAN
NOTES:
1. FOR GENERAL NOTES, SEE DWG. C 5501
2. WORK THIS SHEET WITH DWG. # C 5006
3. STEEL GRATING SHALL BE IRVING WELDED RECTANGULAR DESIGN, TYPE WD-2 WITH 1¼x¼ MAIN BARS AS MANUFACTURED BY IKG INDUSTRIES OR APPROVED EQUAL.
4. FOR GRATING SUPPORT PIPE SLEEVE, EXP. JT., CONTROL JT., AND OTHER STRUCTURAL DETAILS, SEE DWG. # C 5505.
DETAIL 'A'
SECTION 7
ELEVATION 1-1
SECTION 5
HEAVY DUTY PIPE TRENCH
SECTION 6
PLAN
APPROVED FOR CONSTRUCTION
COMMONWEALTH EDISON COMPANY
WASTE WATER TREATMENT FACILITIES
WAUKEGAN
ASH POND INLET FLUME & DISTRIBUTION TROUGH- DETAILS
NUS CORPORATION
ROCKVILLE, MD.
5082 C 5507

Attachment 1-2 – Liner Replacement Drawing


EAST ASH POND (POND II)
NEW ACCESS RAMP PLAN
SCALE: 1"=30'-0"
WEST ASH POND
NEW ACCESS RAMP PLAN
SCALE: 1"=30'-0"
TYP. WARNING POST DETAIL
SCALE: 1/2"=1'-0"
(50 REQUIRED)
EXIST. BERMS IN THIS AREA ARE NOT SHOWN.
REGRADE THE EXISTING EAST ROAD. PLACE & COMPACT 4" OF RIP RAP I.D.O.T. GRADATION CA-6 CRUSHED LIMESTONE.
SLOPE OF HATCHED AREA > 2.5:1 FINISH WITH NON WOVEN GEOTEXTILE AND 16" OF RIP RAP I.D.O.T. GRADATION NO.3
EXTENT OF RESURFACING (SEE SPEC)
END OF DISTRIBUTION TROUGH
RESURFACE EAST POND INLET STRUCTURE
RIPRAP
WARNING POST (SEE TYP. DETAIL ON THIS DWG.) (TYP.)
EAST ASH POND (POND II)
WEST ASH POND (POND I)
RESURFACE WEST POND INLET STRUCTURE
EXIST. ROAD EL. +23.0'
12% GRADE
EL. +5.0'
EL. +23.0'
PAINT TOP 1'-0" YELLOW
2" STD. WT. GALV. PIPE
12" SQ. YELLOW WARNING SIGN 16 GA. GALV. STL.
2 1/2" PIPE SLEEVE W/ 1/2" PIN
CONC. 4'-0"x2'-6"
COMPACTED FILL
EXIST. FILL
LIMESTONE SCREENING
SAND
LINER
SECTION A
SCALE: 1"=10'-0"
(TYPICAL SECTION THROUGH NEW RAMP)
SECTION B
SCALE: 1"=10'-0"
(TYPICAL SECTION THROUGH BERM)
SECTION C
SCALE: 1/2"=1'-0"
(BASE OF INLET STRUCTURES)
DETAIL 1
T/BERM EL. SEE PLANS
DETAIL 2
2% SLOPE
T/RAMP VARIES SEE PLANS
DETAIL 3
NEW COMPACTED FILL
EXIST. SLOPE
POND BOTTOM EL. +5.0'
16" RIPRAP (I.D.O.T. GRADATION No. 4)
CONCRETE INLET STRUCTURE (E)
6" LIMESTONE SCREENINGS
12" SAND
DETAIL 4
NOTE:
IN EAST POND PLACE RIPRAP ONLY TEN FEET BEYOND THE EAST EDGE OF THE CONCRETE DISTRIBUTION TROUGH.
NON WOVEN 45 MIL GEOTEXTILE
COMPACTED GRAVEL I.D.O.T. GRADATION CA-6
SEE PLANS FOR ELEVATION
6" COMPACTED GRAVEL I.D.O.T. GRADATION CA-2
RAMP
INLET STRUCTURE OR SUMP
SEALANT
GASKET
ADHESIVE
304 S.S. BATTEN 1/8"x2"
℄ 3/8" HILTI KWIK BOLT II OR EQUAL, 8" C.C.
WOOD CANT STRIP
DETAIL 1
SCALE: 1/2"=1'-0"
(LINER ANCHOR)
DETAIL 2
SCALE: 1/2"=1'-0"
(RAMP CONSTRUCTION)
DETAIL 3
SCALE: 1/2"=1'-0"
(POND BOTTOM)
DETAIL 4
N.T.S.
(LINER ANCHOR DETAIL AT CONCRETE STRUCTURES)
REFERENCE DRAWINGS
5082 C-5006 WASTE WATER TREATMENT FACILITIES ASH POND DETAIL PLAN
5082 C-5007 WASTE WATER TREATMENT FACILITIES ASH POND SECTIONS AND DETAILS
5082 C-5507 ASH POND INLET FLUME AND DISTRIBUTION TROUGH
A 7/12/02 ISSUED FOR BIDS IH MS MS WR
EAST AND WEST ASH POND
LINER REPLACEMENT
PLANS, SECTIONS AND DETAILS
STATION 16 WAUKEGAN
MIDWEST GENERATION
An EDISON INTERNATIONAL Company
SCALE AS NOTED
DATE 05/31/02
B739
B739.DWG IH 05/31/02

Attachment 1-3 – Slope Modifications Construction Drawings

PLANS FOR THE CONSTRUCTION OF:

EAST ASH BASIN SLOPE MODIFICATION

JULY 2016

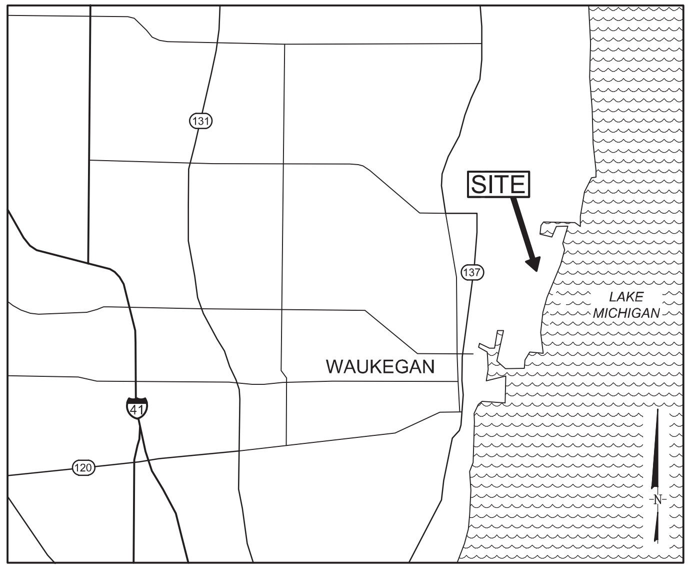
WAUKEGAN GENERATING STATION
LAKE COUNTY, ILLINOIS

PREPARED FOR:

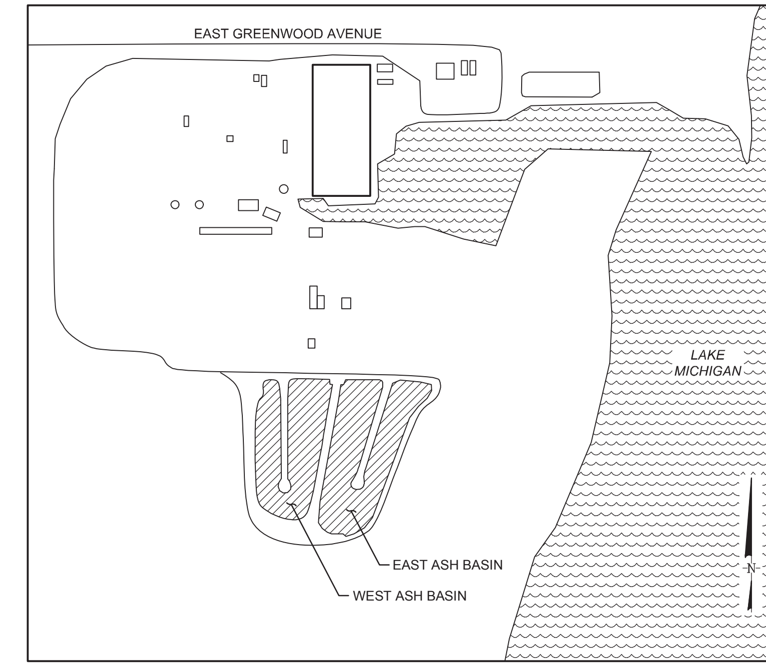
MIDWEST GENERATION, LLC

PREPARED BY:

Geosyntec Consultants
3990 OLD TOWN AVENUE, SUITE A-101
SAN DIEGO, CALIFORNIA 92110
(619) 810-4000
www.geosyntec.com



VICINITY MAP
NOT TO SCALE



SITE LOCATION MAP
NOT TO SCALE

DETAIL IDENTIFICATION LEGEND

DETAIL IDENTIFICATION (2 / 5)
SHEET ON WHICH ABOVE DETAIL IS PRESENTED

DETAIL NUMBER (2)
SHEET ON WHICH ABOVE DETAIL WAS REFERENCED (3)

DETAIL
TITLE OF DETAIL
SCALE: 1" = 1'

EXAMPLE: DETAIL NUMBER 2 PRESENTED ON SHEET NO. 5 WAS REFERENCED ON SHEET NO. 3.

NOTE: ABOVE REFERENCING SYSTEM ALSO APPLIES TO SECTION IDENTIFICATIONS.

DRAWING INDEX

DRAWING NO.	DRAWING TITLE	FILE NAME
1	TITLE INDEX AND LEGEND	SW0251-11-01
2	SITE PLAN	SW0251-11-02
3	GRADING PLAN	SW0251-11-03
4	CROSS SECTIONS	SW0251-11-04
5	DETAILS	SW0251-11-05
6	SWPPP	SW0251-11-06
7	SURVEY CONTROL POINTS	SW0251-11-07

GENERAL NOTES

1. THE WORK UNDERTAKEN BY THIS DOCUMENT IS FOR MIDWEST GENERATION, LLC, HEREAFTER REFERRED TO AS OWNER. GEOSYNTEC CONSULTANTS, HEREAFTER REFERRED TO AS ENGINEER, PERFORMED DESIGN.
2. THE PLANS AND OTHER DOCUMENTS SHALL GOVERN THE WORK AND SHALL BE CONSIDERED COMPLIMENTARY. ANYTHING FOUND IN THE PLANS AND NOT IN ANOTHER DOCUMENT OR FOUND IN ANOTHER DOCUMENT AND NOT IN THE PLANS SHALL BE CONSIDERED TO BE IN BOTH.
3. CONTRACTOR SHALL, UPON DISCOVERING ANY ERROR OR OMISSION IN THE PLANS, IMMEDIATELY BRING IT TO THE ATTENTION OF ENGINEER.
4. CONSTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF PUBLIC AND PRIVATE PROPERTY ADJACENT TO THE WORK, AND EXERCISE DUE CAUTION TO AVOID DAMAGE TO SUCH PROPERTY. CONTRACTOR SHALL NOT PERFORM ANY WORK OR DISTURBANCE OUTSIDE OF THE WORK ZONE AND APPROVED SITE ACCESS ROUTES WITHOUT PREAPPROVAL BY THE OWNER.
5. THROUGHOUT ALL PHASES OF CONSTRUCTION, INCLUDING SUSPENSION OF WORK, AND UNTIL FINAL ACCEPTANCE OF THE PROJECT, CONTRACTOR SHALL KEEP THE WORK SITE CLEAN AND FREE FROM RUBBISH AND DEBRIS.
6. THE WORK SHALL BE CONDUCTED TO MINIMIZE DISTURBANCE TO ONGOING PLANT OPERATIONS. WORK THAT IMPACTS PLANT OPERATIONS SHALL BE COORDINATED THROUGH THE OWNER.
7. CONTRACTOR SHALL KEEP A COPY OF THE PLANS AND OTHER DOCUMENTS AT THE WORK SITE, TO WHICH THE OWNER SHALL HAVE ACCESS UPON REQUEST.
8. CONTRACTOR SHALL ASCERTAIN THE EXISTENCE OF ANY CONDITIONS AFFECTING THE COST OF THE WORK WHICH WOULD HAVE BEEN DISCLOSED BY REASONABLE EXAMINATION OF THE SITE.
9. EXISTING IMPROVEMENT VISIBLE AT THE JOB SITE, FOR WHICH NO SPECIFIC DISPOSITION IS MADE ON THE PLANS, BUT WHICH COULD REASONABLY BE ASSUMED TO INTERFERE WITH SATISFACTORY COMPLETION OF THE WORK, SHALL BE BROUGHT TO THE ATTENTION OF OWNER.
10. ALL MATERIALS, PARTS, AND EQUIPMENT FURNISHED BY CONTRACTOR SHALL BE NEW, HIGH GRADE, AND FREE OF DEFECTS. QUALITY OF WORK SHALL BE IN ACCORDANCE WITH GENERALLY ACCEPTED STANDARDS. MATERIALS AND WORK QUALITY SHALL BE SUBJECT TO APPROVAL BY ENGINEER.
11. DEFECTIVE WORK OR MATERIAL SHALL BE REMOVED IMMEDIATELY FROM THE SITE BY CONTRACTOR, AT CONTRACTOR'S EXPENSE, WHEN SO DIRECTED.
12. SOIL AND ROCK MATERIALS, REQURIED FOR THE WORK, SHALL BE STOCKPILED AT LOCATIONS DESIGNATED BY THE OWNER AND APPROVED BY ENGINEER.
13. CONTRACTOR SHALL PROVIDE AND MAINTAIN FACILITIES TO PROTECT ALL WORK AND EQUIPMENT WHETHER IN PLACE OR NOT.
14. CONTRACTOR MAY SUPPLY EQUIVALENT REPLACEMENTS FOR ANY MATERIALS REQUIRED FOR COMPLETION FO THE WORK, SUBJECT TO APPROVAL BY ENGINEER.
15. CONTRACTOR SHALL NOT INTERRUPT THE SERVICE FUNCTION OR DISTURB THE SUPPORT OF ANY UTILITY WITHOUT AUTHORIZATION FROM OWNER.
16. UPON LEARNING OF THE EXISTENCE OF ANY UTILITY OMITTED FROM OR SHOWN INCORRECTLY ON THE PLANS, CONTRACTOR SHALL IMMEDIATELY NOTIFY ENGINEER IN WRITING.
17. DRAWINGS ARE SCALED TO SIZE 22X34 INCH SHEETS. REPRODUCTION OF SHEETS MAY DISTORT DRAWINGS AND SCALE.

LEGEND

- PROOF ROLLED SUBGRADE
- SELECT FILL
- EXISTING GRADE
- AGGREGATE BASE
- GEOTEXTILE
- GEOMEMBRANE
- ×125 PROPOSED GRADE POINT

GENERAL LINES

- 600 PROPOSED GRADING CONTOUR (10')
- PROPOSED GRADING CONTOUR (2')
- 600 EXISTING GRADE CONTOUR (10')
- EXISTING GRADE CONTOUR (2')
- LIMITS OF PROPOSED GRADING
- FLOW LINE

ABBREVIATIONS

AC	ASPHALT CONCRETE	L	LENGTH
APPROX.	APPROXIMATE	LF	LINEAL FEET
C	CENTER LINE	MH	MANHOLE
CF	CUBIC FOOT	MIN.	MINIMUM
DIA.	DIAMETER	N	NORTHING
DIM.	DIMENSION	NTS	NOT TO SCALE
E	EASTING	NO.	NUMBER
EL.	ELEVATION	OC	ON CENTER
EW	EACH WAY	oz.	OUNCE
FG	FINISH GRADE	OD	OUTSIDE DIAMETER
F	FLOW LINE	R	RADIUS
GALV.	GALVANIZED	SCH.	SCHEDULE
HDPE	HIGH DENSITY POLYETHYLENE	STD.	STANDARD
INV.	INVERT	TYP.	TYPICAL

(1in) (2in) (3in) (4in)
SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

ISSUED FOR BID

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
3990 OLD TOWN AVENUE, SUITE A-101
SAN DIEGO, CA 92110
PHONE: 619.810.4000

TITLE: TITLE, INDEX, AND LEGEND

PROJECT: EAST ASH BASIN SLOPE MODIFICATION

SITE: WAUKEGAN GENERATING STATION, LAKE COUNTY, ILLINOIS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

Jane Soule
SIGNATURE
7/1/16
DATE

JANE W. SOULE 062-067766 LICENSED PROFESSIONAL ENGINEER STATE OF ILLINOIS

DESIGN BY:	JG	DATE:	JULY 2016
DRAWN BY:	JA	PROJECT NO.:	SW0251-11
CHECKED BY:	GC	FILE:	SW0251-11-01
REVIEWED BY:	JS	DRAWING NO.:	1 OF 7
APPROVED BY:	JS		

Z:\CADD\Plansets\SW0251-11 Slope Adjust_Current Set\SW0251-11-01.dwg Last Edited by: jamos on 7/6/2016 10:59 AM

LEGEND

- 1400 — EXISTING GROUND MAJOR CONTOUR (10') [NOTE 2]
- EXISTING GROUND MINOR CONTOUR (2') [NOTE 2]
- x — x — EXISTING FENCE
- MW-01 — MONITORING WELL
- LIMITS OF GRADING

NOTES

1. ALL PLANS IN THIS PLAN SET WERE DRAWN BASED ON THE FOLLOWING DATUM SOURCE:
   HORIZONTAL CONTROL - NAD83 ILLINOIS STATE PLANE EAST, U.S. feet
   VERTICAL CONTROL - NAVD 88., U.S. feet
2. EXISTING PHOTOGRAMMETRIC SURVEY DATA PROVIDED BY GEO TERRA. FLIGHT DATE: 4 DECEMBER 2015.
3. BASINS ARE CURRENTLY LINED WITH A SMOOTH HDPE GEOMEMBRANE ANCHORED NEAR THE INTERIOR CREST OF THE EMBANKMENT.
4. EXISTING TOPOGRAPHY ABOVE APPROXIMATE ELEVATION OF 587 FT REPRESENTS APPROXIMATE CCR DEPOSITS WITHIN EASTERN ASH BASIN.
5. SENSITIVE HABITAT IS PRESENT AT THE DOWNSTREAM TOE OF THE EASTERN AND SOUTHERN EMBANKMENTS.

ISSUED FOR BID

SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

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REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
3990 OLD TOWN AVENUE, SUITE A-101
SAN DIEGO, CA 92110
PHONE: 619.810.4000

TITLE: SITE PLAN

PROJECT: EAST ASH BASIN SLOPE MODIFICATION

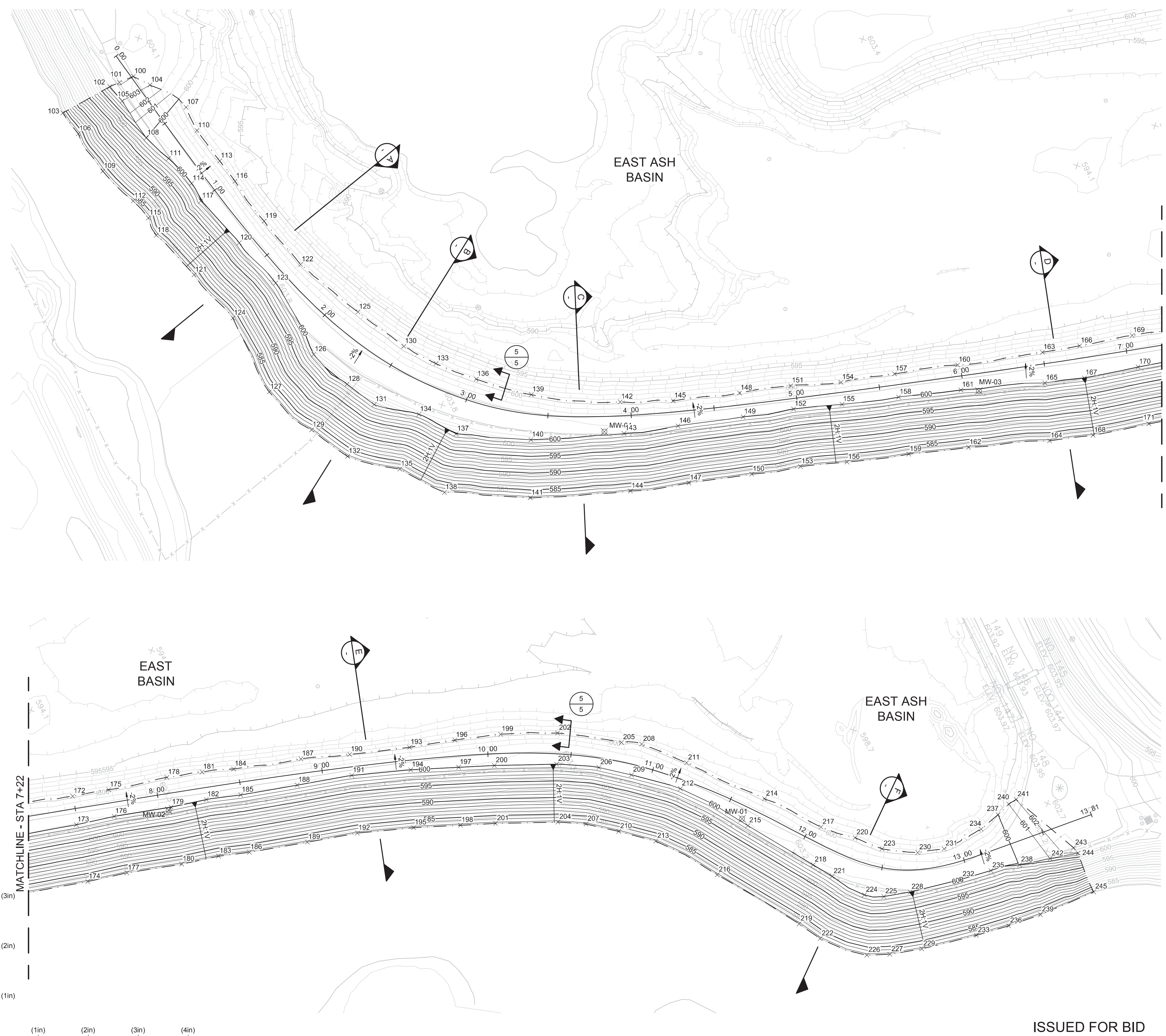
SITE: WAUKEGAN GENERATING STATION
LAKE COUNTY, ILLINOIS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE: Jane Soule — 7/1/16 DATE

JANE W. SOULE 062-067766 LICENSED PROFESSIONAL ENGINEER STATE OF ILLINOIS

DESIGN BY:	JG	DATE:	JULY 2016
DRAWN BY:	JA	PROJECT NO.:	SW0251-11
CHECKED BY:	GC	FILE:	SW0251-11-02
REVIEWED BY:	JS	DRAWING NO.:	
APPROVED BY:	JS	2 OF 7	



LEGEND

- EXISTING GROUND MAJOR CONTOUR (10') [NOTE 2]
- EXISTING GROUND MINOR CONTOUR (2') [NOTE 2]
- EXISTING FENCE
- PROPOSED GRADE MAJOR CONTOUR (10')
- PROPOSED GRADE MINOR CONTOUR (2')
- LIMITS OF GRADING
- MW-01 MONITORING WELL
- CROSS SECTION LOCATION
- 125 SURVEY CONTROL POINT

NOTES

1. ALL PLANS IN THIS PLAN SET WERE DRAWN BASED ON THE FOLLOWING DATUM SOURCE:
   HORIZONTAL CONTROL - NAD83 ILLINOIS STATE PLANE EAST, U.S. feet
   VERTICAL CONTROL - NAVD 88., U.S. feet
2. EXISTING PHOTOGRAMMETRIC SURVEY DATA PROVIDED BY GEO TERRA. FLIGHT DATE: 4 DECEMBER 2015.
3. CONTRACTOR SHALL REMOVE EXISTING FENCE AND GATES WITHIN WORK AREA AND PROPERLY DISPOSE OF OFFSITE.
4. CONTRACTOR SHALL INSTALL AND MAINTAIN 4-FT HIGH ORANGE BARRIER FENCING AT THE TOE OF THE SLOPE DURING THE DURATION OF THE WORK.
5. GRADING ELEVATIONS AT CREST OF EMBANKMENT REPRESENT TOP OF ROAD SURFACING LAYER.

0 30' 60'
SCALE IN FEET

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
3990 OLD TOWN AVENUE, SUITE A-101
SAN DIEGO, CA 92110
PHONE: 619.810.4000

TITLE: GRADING PLAN

PROJECT: EAST ASH BASIN SLOPE MODIFICATION

SITE: WAUKEGAN GENERATING STATION LAKE COUNTY, ILLINOIS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE: Jane Soule
DATE: 7/1/16

JANE W. SOULE 062-067766 LICENSED PROFESSIONAL ENGINEER STATE OF ILLINOIS

DESIGN BY:	JG	DATE:	JULY 2016
DRAWN BY:	JA	PROJECT NO.:	SW0251-11
CHECKED BY:	GC	FILE:	SW0251-11-03
REVIEWED BY:	JS	DRAWING NO.:	
APPROVED BY:	JS	3 OF 7	

ISSUED FOR BID

SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

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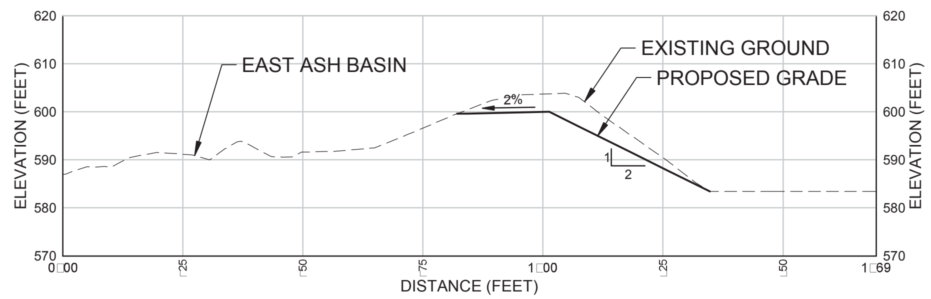
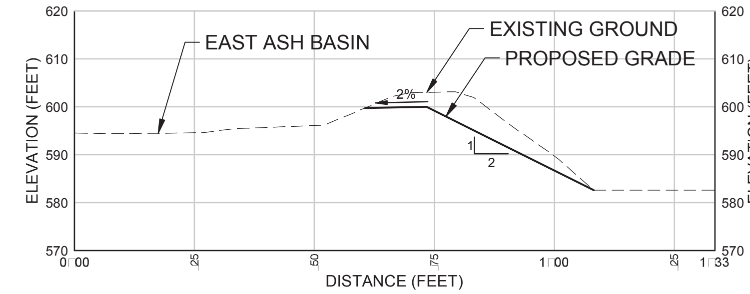
LEGEND

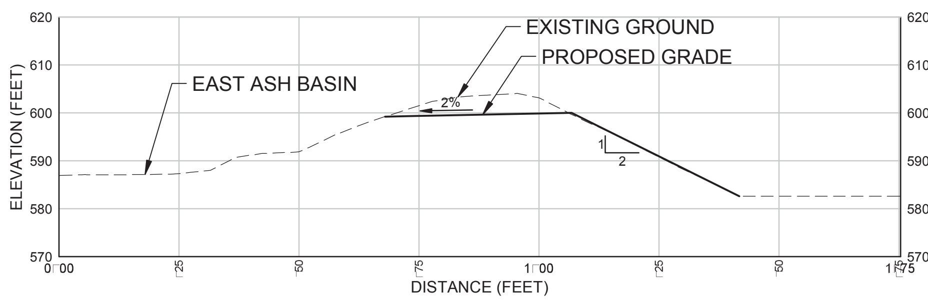
- - - - EXISTING GROUND
——— PROPOSED GRADE



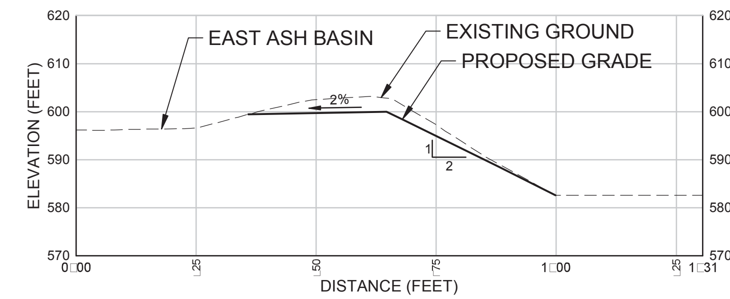
SECTION A
(STA. 1+49)



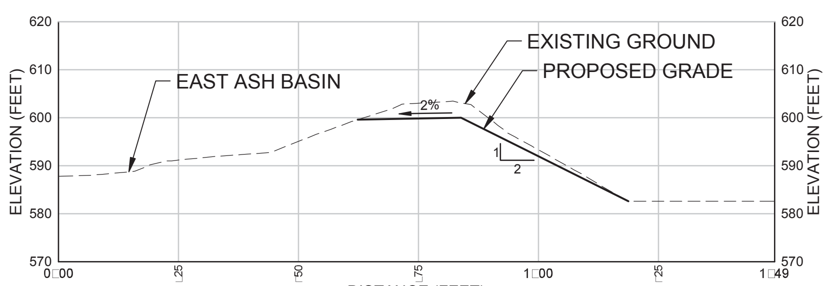
SECTION E
(STA. 9+29)



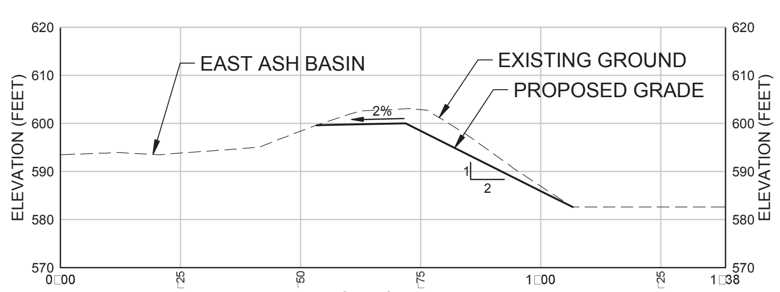
SECTION B
(STA. 2+50)



SECTION F
(STA. 12+35)



SECTION C
(STA. 3+70)



SECTION D
(STA. 6+58)

NOTES

1. ALL PLANS IN THIS PLAN SET WERE DRAWN BASED ON THE FOLLOWING DATUM SOURCE:
   HORIZONTAL CONTROL - NAD83 ILLINOIS STATE PLANE EAST, U.S. feet
   VERTICAL CONTROL - NAVD 88., U.S. feet
2. EXISTING PHOTOGRAMMETRIC SURVEY DATA PROVIDED BY GEO TERRA. FLIGHT DATE: 4 DECEMBER 2015.
3. FOR SECTION LOCATIONS, SEE SHT 3.

0 20' 40'
SCALE IN FEET

ISSUED FOR BID

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
3990 OLD TOWN AVENUE, SUITE A-101
SAN DIEGO, CA 92110
PHONE: 619.810.4000

TITLE: CROSS SECTIONS

PROJECT: EAST ASH BASIN SLOPE MODIFICATION

SITE: WAUKEGAN GENERATING STATION
LAKE COUNTY, ILLINOIS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

Jane Soule
SIGNATURE

7/1/16
DATE

JANE W. SOULE
062-067766
LICENSED PROFESSIONAL ENGINEER
STATE OF ILLINOIS

DESIGN BY:	JG	DATE:	JULY 2016
DRAWN BY:	JA	PROJECT NO.:	SW0251-11
CHECKED BY:	GC	FILE:	SW0251-11-04
REVIEWED BY:	JS	DRAWING NO.:	
APPROVED BY:	JS	4 OF 7	

SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

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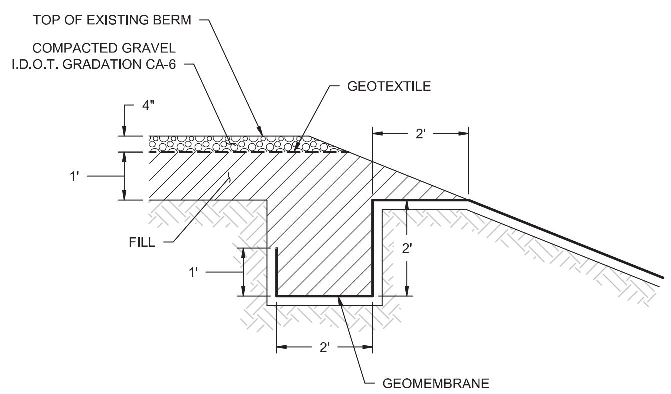
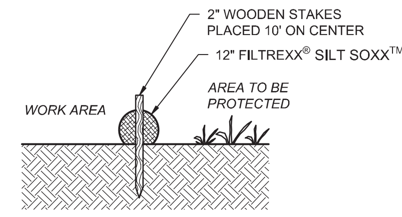
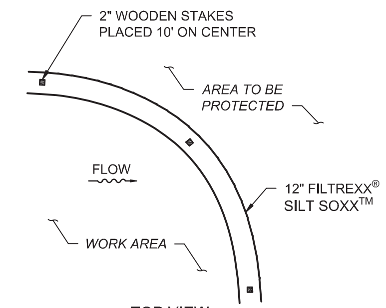
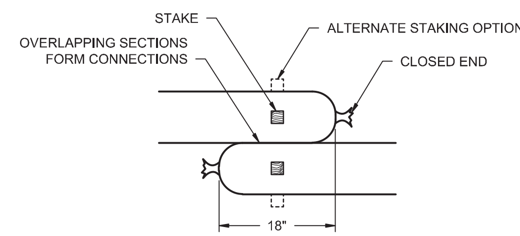


1 / 2 DETAIL
EXISTING ANCHOR TRENCH
SCALE: NTS



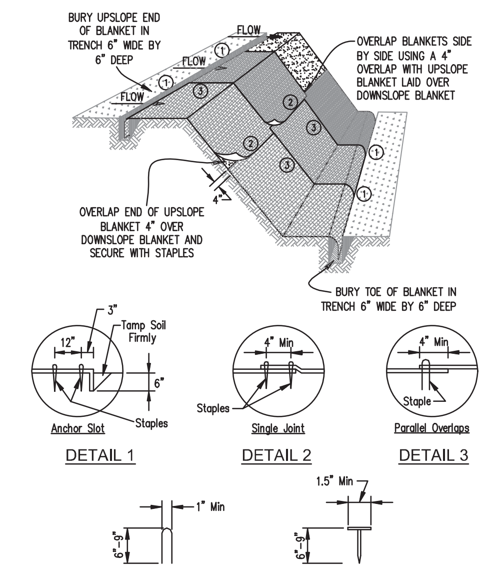




COMPOST SOCK CONNECTION/ATTACHMENT DETAIL

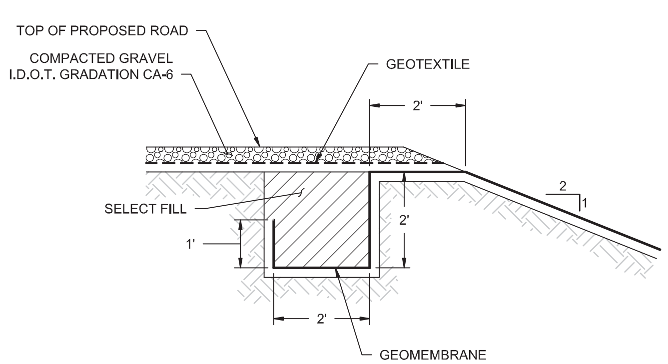
NOTES:
1. ALL MATERIAL TO MEET FILTREXX® SPECIFICATIONS.
2. SILT SOXX™ FILL TO MEET APPLICATION REQUIREMENTS.
3. COMPOST MATERIAL TO BE DISPERSED ON SITE, AS DETERMINED BY ENGINEER.

2 / 6 DETAIL
COMPOST SOCK
SCALE: NTS



NOTES:
1. Staples shall be placed in a diamond pattern at 2 per s.y. for stitched blankets. Non-stiched shall use 4 staples per s.y. of material. This equates to 200 staples with stitched blanket and 400 staples with non-stitched blanket per 100 s.y. of material.
2. Staple or push pin lengths shall be selected based on soil type and conditions. (minimum staple length is 6").
3. Erosion control material shall be placed in contact with the soil over a prepared seedbed.
4. All anchor slots shall be stapled at approximately 12" intervals.
5. Erosion Control Blanket shall be BioNet™ SC150BN® Erosion Control Blanket or approved equivalent. Blanket must be made of 100% biodegradable materials (i.e. no plastic netting).
6. Anchor trench shall be be 2' from top of slope.

3 / 6 DETAIL
EROSION CONTROL BLANKET INSTALLATION
SCALE: NTS



NOTES:
1. Grading shown on Sheet 3 represents the top of the road surfacing layer.
2. Geotextile shall be Propex 200ST or equivalent.

4 / 3 DETAIL
ANCHOR TRENCH
SCALE: NTS

(3in) (2in) (1in)
(1in) (2in) (3in) (4in)
SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

Z:\CADD\Plansets\SW0251-11 Slope Adjust_Current Set\SW0251-11-05.dwg Last Edited by: jamos on 7/6/2016 3:28 PM

ISSUED FOR BID

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
3990 OLD TOWN AVENUE, SUITE A-101
SAN DIEGO, CA 92110
PHONE: 619.810.4000

TITLE: DETAILS

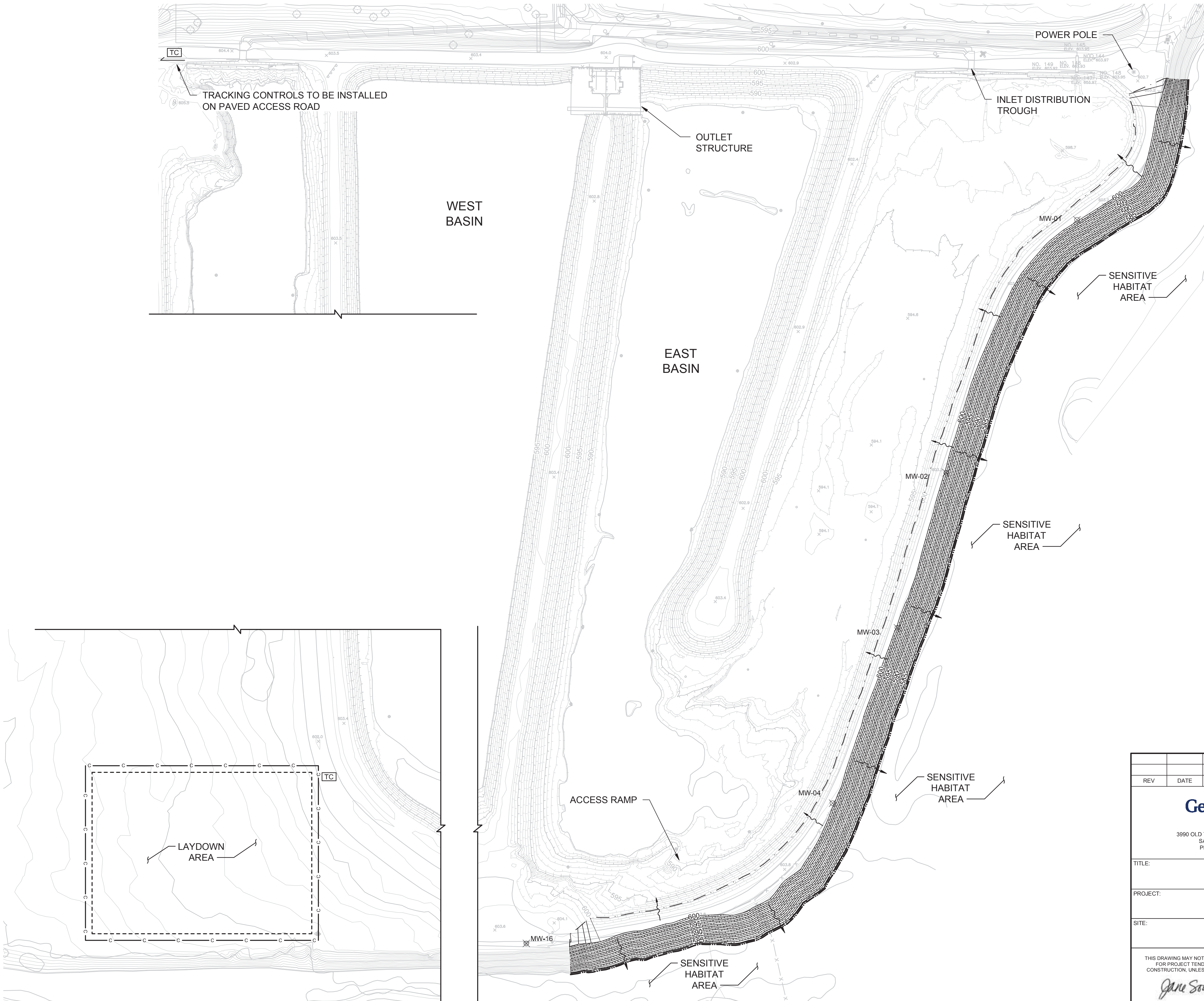
PROJECT: EAST ASH BASIN SLOPE MODIFICATION

SITE: WAUKEGAN GENERATING STATION
LAKE COUNTY, ILLINOIS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.
SIGNATURE: Jane Soule
DATE: 7/1/16

JANE W. SOULE 062-067766 LICENSED PROFESSIONAL ENGINEER STATE OF ILLINOIS

DESIGN BY:	JG	DATE:	JULY 2016
DRAWN BY:	JA	PROJECT NO.:	SW0251-11
CHECKED BY:	GC	FILE:	SW0251-11-05
REVIEWED BY:	JS	DRAWING NO.:	
APPROVED BY:	JS	5 OF 7	



LEGEND

- EXISTING GROUND MAJOR CONTOUR (10') [NOTE 2]
- EXISTING GROUND MINOR CONTOUR (2') [NOTE 2]
- 1400 — PROPOSED GRADE MAJOR CONTOUR (10')
- PROPOSED GRADE MINOR CONTOUR (2')
- LIMITS OF GRADING
- MW-01 MONITORING WELL
- FLOW DIRECTION
- COMPOST SOCK (2/5)
- HABITAT SENSITIVE AREA BOUNDARY (NOTE 3)
- STABILIZATION (SEE NOTE 6) (3/5)
- TC TRACKING CONTROLS (SEE NOTE 7)

NOTES

1. ALL PLANS IN THIS PLAN SET WERE DRAWN BASED ON THE FOLLOWING DATUM SOURCE:
   HORIZONTAL CONTROL - NAD83 ILLINOIS STATE PLANE EAST, U.S. feet
   VERTICAL CONTROL - NAVD 88., U.S. feet
2. EXISTING PHOTOGRAMMETRIC SURVEY DATA PROVIDED BY GEO TERRA. FLIGHT DATE: 4 DECEMBER 2015.
3. EARTH DISTURBING ACTIVITIES ARE PROHIBITED OUTSIDE OF THE LIMITS OF DISTURBANCE.
4. DOWNGRADIENT PROTECTIVE MEASURES MUST BE IN PLACE PRIOR TO EARTH DISTURBANCES.
5. CONSTRUCTION SHOULD BE SEQUENCED SUCH THAT EXPOSED AREAS ARE LIMITED TO WHAT CAN BE STABILIZED PRIOR TO FORECAST RAIN.
6. STABILIZATION MEASURE MUST BE IMPLEMENTED WITHIN 1 WORKING DAY OF CESSATION OF EARTH DISTURBING ACTIVITIES, FOR PORTIONS OF THE SITE THAT HAVE REACHED FINAL GRADE OR WHERE CONSTRUCTION ACTIVITIES HAVE PERMANENTLY CEASED, AND COMPLETED WITHIN 14 DAYS.
7. STREET SWEEPING SHALL BE IMPLEMENTED AS NEEDED AT THE NEAREST PAVED SURFACE, APPROXIMATELY 1300-FT FROM CONSTRUCTION ACTIVITY.
8. CONTRACTOR SHALL COMPLY WITH REQUIREMENTS OF 'STORMWATER POLLUTION PREVENTION PLAN, EAST ASH BASIN SLOPE MODIFICATION' BY GEOSYNTEC, JULY 2016.

N

0 60' 120'
SCALE IN FEET

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
3990 OLD TOWN AVENUE, SUITE A-101
SAN DIEGO, CA 92110
PHONE: 619.810.4000

TITLE: SWPPP

PROJECT: EAST ASH BASIN SLOPE MODIFICATION

SITE: WAUKEGAN GENERATING STATION
LAKE COUNTY, ILLINOIS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

7/1/16
DATE

JANE W. SOULE 062-067766 LICENSED PROFESSIONAL ENGINEER STATE OF ILLINOIS

DESIGN BY:	JG	DATE:	JULY 2016
DRAWN BY:	JA	PROJECT NO.:	SW0251-11
CHECKED BY:	GC	FILE:	SW0251-11-06
REVIEWED BY:	JS	DRAWING NO.:	
APPROVED BY:	JS	6 OF 7	

ISSUED FOR BID

(1in) (2in) (3in) (4in) SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

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SURVEY CONTROL POINTS

PT NO.	NORTHING	EASTING	ELEV
100	2080081.36	1124398.00	604.00
101	2080072.25	1124397.50	604.19
102	2080066.08	1124397.19	603.33
103	2080033.65	1124398.72	583.40
104	2080087.98	1124407.11	603.00
105	2080068.79	1124408.21	603.00
106	2080036.43	1124414.03	583.40
107	2080101.42	1124428.72	599.40
108	2080071.84	1124434.52	600.00
109	2080039.57	1124440.76	583.40
110	2080101.02	1124444.16	599.52
111	2080078.27	1124451.51	600.00
112	2080047.90	1124464.91	583.40
113	2080105.13	1124466.59	599.57
114	2080083.99	1124471.13	600.00
115	2080051.53	1124478.09	583.40
116	2080107.88	1124481.58	599.55
117	2080084.37	1124483.01	600.00
118	2080051.09	1124489.55	583.40
119	2080112.86	1124510.84	599.60
120	2080093.64	1124515.78	600.00
121	2080060.84	1124520.90	583.40
122	2080120.84	1124543.90	599.63
123	2080102.49	1124547.18	600.00
124	2080070.12	1124554.54	583.40
125	2080138.95	1124584.79	599.31
126	2080103.78	1124595.75	600.00
127	2080069.83	1124603.94	582.60
128	2080113.78	1124620.67	600.00
129	2080082.40	1124635.73	582.60
130	2080154.39	1124615.57	599.23
131	2080122.89	1124638.85	600.00
132	2080094.66	1124659.61	582.60
133	2080167.03	1124633.47	599.36
134	2080144.24	1124656.14	600.00
135	2080119.32	1124680.43	582.60
136	2080184.50	1124652.60	599.33
137	2080159.01	1124676.65	600.00
138	2080137.02	1124704.92	582.60
139	2080209.88	1124675.70	599.46
140	2080197.56	1124699.83	600.00
141	2080181.73	1124730.88	582.60
142	2080255.71	1124703.37	599.62
143	2080249.34	1124721.36	600.00
144	2080237.38	1124754.04	582.60
145	2080284.53	1124717.03	599.69
146	2080280.35	1124731.84	600.00
147	2080270.89	1124765.33	582.60
148	2080322.19	1124730.64	599.71
149	2080317.74	1124744.37	600.00
150	2080307.02	1124777.48	582.60
151	2080351.75	1124740.47	599.72
152	2080346.98	1124753.72	600.00
153	2080335.21	1124786.47	582.60

PT NO.	NORTHING	EASTING	ELEV
154	2080379.65	1124752.08	599.74
155	2080374.25	1124764.16	600.00
156	2080361.52	1124796.55	582.60
157	2080410.64	1124761.84	599.72
158	2080406.61	1124775.44	600.00
159	2080396.74	1124808.81	582.60
160	2080446.96	1124773.99	599.70
161	2080442.02	1124788.33	600.00
162	2080430.67	1124821.23	582.60
163	2080495.87	1124789.90	599.63
164	2080476.01	1124839.43	582.60
165	2080488.99	1124807.05	600.00
166	2080517.66	1124796.42	599.61
167	2080511.62	1124814.96	600.00
168	2080500.83	1124848.07	582.60
169	2080548.62	1124804.88	599.61
170	2080543.36	1124823.44	600.00
171	2080533.87	1124856.92	582.60
172	2080591.08	1124819.10	599.65
173	2080585.43	1124835.48	600.00
174	2080576.30	1124869.06	582.60
175	2080612.22	1124825.36	599.67
176	2080608.01	1124841.09	600.00
177	2080599.61	1124874.87	582.60
178	2080646.78	1124834.29	599.64
179	2080640.97	1124851.38	600.00
180	2080631.45	1124884.87	582.60
181	2080667.10	1124840.80	599.67
182	2080662.01	1124856.75	600.00
183	2080653.40	1124890.47	582.60
184	2080684.90	1124847.68	599.68
185	2080681.74	1124863.52	600.00
186	2080671.00	1124896.63	582.60
187	2080723.78	1124860.22	599.70
188	2080714.72	1124873.38	600.00
189	2080704.88	1124906.76	582.60
190	2080751.18	1124870.99	599.75
191	2080746.65	1124882.79	600.00
192	2080734.17	1124915.27	582.60
193	2080785.20	1124883.14	599.73
194	2080779.79	1124895.56	600.00
195	2080765.90	1124927.46	582.60
196	2080811.48	1124891.47	599.67
197	2080806.25	1124907.08	600.00
198	2080791.67	1124938.69	582.60
199	2080837.64	1124900.56	599.63
200	2080825.88	1124915.65	600.00
201	2080811.02	1124947.12	582.60
202	2080868.55	1124915.15	599.63
203	2080859.71	1124931.63	600.00
204	2080844.85	1124963.10	582.60
205	2080900.45	1124937.39	599.65
206	2080881.52	1124944.75	600.00
207	2080859.48	1124971.68	582.60

PT NO.	NORTHING	EASTING	ELEV
208	2080910.75	1124943.66	599.61
209	2080897.09	1124957.50	600.00
210	2080875.04	1124984.43	582.60
211	2080929.94	1124965.68	599.68
212	2080919.62	1124977.96	600.00
213	2080892.35	1124999.58	582.60
214	2080962.13	1125005.97	599.62
215	2080945.99	1125015.91	600.00
216	2080916.36	1125034.16	582.60
217	2080984.92	1125036.30	599.56
218	2080970.60	1125054.50	600.00
219	2080947.16	1125082.42	582.60
220	2081000.35	1125051.10	599.46
221	2080977.71	1125065.76	600.00
222	2080954.57	1125096.01	582.60
223	2081011.89	1125064.39	599.43
224	2080990.03	1125084.39	600.00
225	2081000.04	1125090.47	600.00
226	2080975.23	1125117.45	582.60
227	2080987.80	1125123.13	582.60
228	2081015.31	1125095.09	600.00
229	2081006.42	1125128.75	582.60
230	2081030.06	1125075.92	599.56
231	2081045.21	1125080.97	599.59
232	2081046.14	1125101.99	600.00
233	2081039.38	1125136.13	582.60
234	2081070.37	1125080.32	599.49
235	2081064.50	1125105.23	600.00
236	2081059.28	1125139.65	582.60
237	2081083.36	1125077.08	600.00
238	2081081.49	1125109.79	600.02
239	2081079.32	1125142.19	582.60
240	2081091.91	1125074.28	601.00
241	2081097.13	1125073.74	602.00
242	2081099.55	1125114.69	601.00
243	2081115.13	1125115.22	603.00
244	2081116.09	1125119.17	601.90
245	2081114.11	1125144.19	582.60

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
3990 OLD TOWN AVENUE, SUITE A-101
SAN DIEGO, CA 92110
PHONE: 619.810.4000

TITLE: SURVEY CONTROL POINTS

PROJECT: EAST ASH BASIN SLOPE MODIFICATION

SITE: WAUKEGAN GENERATING STATION
LAKE COUNTY, ILLINOIS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

Jane Soule
SIGNATURE

7/1/16
DATE

JANE W. SOULE 062-067766 LICENSED PROFESSIONAL ENGINEER STATE OF ILLINOIS

DESIGN BY:	JG	DATE:	JULY 2016
DRAWN BY:	JA	PROJECT NO.:	SW0251-11
CHECKED BY:	GC	FILE:	SW0251-11-07
REVIEWED BY:	JS	DRAWING NO.:	7 OF 7
APPROVED BY:	JS		

ISSUED FOR BID

SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

(1in) (2in) (3in) (4in)

Attachment 1-4 – East Ash Pond HDPE Liner Replacement Specifications

1.0 WORK INCLUDED

1.1 This work includes furnishing materials, tools, equipment, and labor to perform bulk and structural excavation, grading, dewatering and place and compact fill, backfill, and bedding materials.

1.2 Excavation includes, sheeting and bracing required for proper execution of the work, loosening, digging, wedging, ripping, loading, hauling, stockpiling, dumping, and disposal of excavated materials in legal disposal areas approved by Owner's Representative.

1.3 Excavation is unclassified and includes, but is not limited to soil, ash and rock materials, abandoned underground conduits or pipes, and buried concrete and masonry structures.

2.0 QUALITY CONTROL

2.1 Existing and new materials to be used as fill, backfill or bedding are subject to the approval of Owner's Representative.

2.2 Bottom ash from the site may be incorporated in the fill material if the Contractor provides tests results and a statement from a geotechnical engineer that use of the bottom ash in conjunction with the other proposed fill materials will not compromise the stability of the 2.5:1 slope.

2.3 To obtain approval of fill, backfill, and bedding materials, designate the proposed borrow area and notify the Owner's Site Representative for a visual inspection prior to placing the material.

3.0 REFERENCES

3.1 Occupational Safety and Health Administration (OSHA)

A. OSHA 2206 General Industry Standards

B. OSHA 2207 Construction Industry Standards

3.2 Illinois Department of Transportation (IDOT) - Standard Specifications for Road and Bridge Construction.

3.3 American Society for Testing and Materials (ASTM)

A. ASTM D 1556- Test for Density of Soil in place by Sand Cone Method

B. ASTM D 1557- Tests for Moisture-Density Relations of Soils Using 10 lb. Hammer and 18 inch drop.

C. ASTM D 2167- Test for Density of Soil in place by Rubber Balloon Method

3.4 The above references shall be the current revision for each.

4.0 SUBMITTALS

4.1 With Contractors' Proposals

A. Submit product data sheets for the chosen liner material.

B. Submit the estimated quantities of materials required to complete the work.

4.2 Two weeks prior to the start of the work, submit to the Owner's Engineer for review, procedures for placing and compacting fill on top of the new liner without damaging the liner material. Include a statement from the liner manufacture that says the procedure is acceptable.

5.0 SITE CONDITIONS

5.1 Prior to start of work become thoroughly familiar with the site, site access, the site conditions, and all portions of the work.

5.2 One pond will be operational while the work on the second pond is being performed.

6.0 MATERIALS

6.1 Make maximum use of suitable on site material for fill when building the pond slopes and entrance ramps. Suitable on site fill material is granular soil or soil/rock mixture that is free from organic matter and other deleterious substances. Material containing rocks or lumps over 1½" in greatest dimension, or containing 15% rocks or lumps larger than ½" in greatest dimension is not acceptable. The material shall have an angle of repose of 30° or greater.

6.2 Imported fill and backfill material shall meet the requirements of Item 6.1 above and, in addition, shall contain predominantly granular material with a maximum particle size of 2".

6.3 Sand used as the protective layer for the pond liners shall be approved by the liner manufacturer.

6.4 Rip rap, coarse aggregate and limestone screenings shall comply with I.D.O.T. specifications.

7.0 BULK AND STRUCTURAL EXCAVATION

7.1 Perform bulk and structural excavation in accordance with the most recent revision of the OSHA General Industry Standards (OSHA 2206) and the OSHA Construction Industry Standards (OSHA 2207).

7.2 Provide temporary grading, ditches and other means as required to drain the areas of the work.

7.3 Perform excavation to lines and grades shown on the contract drawings and as directed by Owner's Representative.

7.4 When the sides of an excavation are five feet or more in depth or when employees are required to enter the excavated area where danger from moving ground exists, perform excavation by open cut to a stable slope or by sheeting and bracing.

7.5 Remove unstable subsoil material, where encountered at the bottom of excavation, to a depth required to obtain satisfactory bearing conditions. Contractor is responsible for bringing the excavation back to the proper elevation by installing compacted bedding material as specified in this section.

7.6 Remove spoil from areas of excavation and stockpile for later use at locations no closer than 2'-0" from edge of excavation unless otherwise approved by Owner's Representative. Remove excess spoil and excavated materials not specifically approved by Owner's Representative for fill, backfill or stockpiling from the site and dispose of these materials at locations and in a manner approved by Federal, State and Local Authorities.

7.7 Properly grade bottom of bulk and structural excavations, remove loose materials, and maintain excavations in good condition, keeping them dry in accordance with Article 8.0 Dewatering, of this section, and free from debris, ice, and frost until completion of the work.

8.0 DEWATERING

8.1 Provide and maintain in operation adequate pumping capacity from sumps, deep wells, or well point installation and perform all other work necessary to keep excavations dry and free of groundwater or surface water during the progress of the work.

8.2 Construction is not permitted in flowing or standing water.

8.3 Dispose of water pumped or drained from the work area in a manner satisfactory to the Owner's Representative, without damage to adjacent property or to other work under construction.

8.4 Take necessary precautions to protect the work against flooding.

9.0 COMPACTION

9.1 Determine the types of equipment and the number of passes required to obtain the required compaction. A pass is defined as one complete coverage of the area by the compaction equipment being used.

9.2 Compact fill and backfill materials to a minimum of 90% of maximum dry density in all areas except in road areas where a minimum of 95% of maximum dry density is required.

9.3 Compact surfaces that are scarified along with and as part of the first lift of fill material that is spread thereon.

9.4 Maximum dry density is defined as the maximum density that can be produced when the same material is compacted in the laboratory in accordance with ASTM D 698 (Standard Proctor).

10.0 INSTALLATION OF FILL AND BACKFILL

10.1 Install fill and backfill material by placing fill and backfill material in uniform layers not to exceed 6" loose measurement unless otherwise noted on the contract drawings or elsewhere in this specification. Compact to minimum specified compaction as set forth in Article 9.2 of this Section.

10.2 Install the 12" protective sand layer on top of the liner material in a single layer.

10.3 Moisten and scarify surfaces to a depth of 4", against which new fill or roadway material is to be placed.

10.4 Remove shoring as backfill progresses only when banks are safe from caving or collapse.

10.5 Water or aerate the material as necessary, and thoroughly mix to obtain a moisture content that will permit proper compaction.

10.6 Do not place fill or backfill materials on a frozen surface. Do not incorporate snow, ice or frozen earth with the fill. Distribute and grade fill and backfill materials throughout the work such that fill will be free from lenses, pockets, streaks or layers of materials differing in texture or gradation from the surrounding material. Do not place successive layers until the layer under construction has been satisfactorily compacted. Place materials in horizontal lifts.

10.7 Remove, dispose and replace any material that Owner's Representative considers objectionable without additional cost to Owner.

10.8 Bring subgrades to a plus or minus tolerance of 0.10 feet.

11.0 FIELD QUALITY CONTROL

11.1 Do not allow or cause any of the work performed or installed to be covered up or enclosed prior to required inspections, tests, and approvals.

11.2 Should any of the work be enclosed or covered up before it has been approved, uncover such work at no additional cost to Owner.

11.3 After the work has been completed, tested, inspected, and approved, make repairs and replacements necessary to restore the work to the condition in which it was found at the time of uncovering, at no additional cost to the Owner.

11.4 Owner may engage (at his own expense), a testing laboratory to inspect and perform tests on all fill, backfill, and bedding materials.

A. The testing laboratory shall conduct and interpret the following ASTM tests to determine the degree of compaction achieved by compaction operations:

1. ASTM D 1556 Test for Density of Soil in place by Sand Cone Method

2. ASTM D 2167 Test for Density of Soil in place by Rubber Balloon Method

3. ASTM D 2922 Test for Density of Soil in place by Nuclear Methods

B. The testing laboratory shall prepare a test report stating whether the test specimens comply with the work requirements, and specifically state any deviations therefrom.

C. Contractor shall provide access for Owner's testing personnel to all required areas so that required inspection and testing can be accomplished.

D. The Owner shall have the right to reject any materials or work not complying with the requirements of the Specification.

E. Contractor shall be responsible for all costs associated with the removal and replacement of all materials determined by Owner's testing personnel to have failed the testing acceptance standards.

END OF SECTION

1.0 WORK INCLUDED

This work includes furnishing materials, tools, equipment, and labor to install a 60-mil thick, high-density polyethylene liner with a reflective white coating.

2.0 REFERENCES

2.1 American Society for Testing and Materials (ASTM)

- D 638 Standard Test Method for Tensile Properties of Plastics
- D 1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
- D 1238 Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
- D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
- D 1603 Test Method for Carbon Black in Olefin Plastics
- D 3895 Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
- D 4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
- D 5199 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
- D 5397 Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
- D 5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
- D 6392 Standard Test Method for Determining the Integrity of Non-reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods

2.2 Geosynthetic Research Institute

- GM9 Cold Weather Seaming of Geomembranes
- GM13 Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
- GM19 Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes

3.0 DEFINITIONS

3.1 Lot - A quantity of resin (usually the capacity of one rail car) used in the manufacture of polyethylene geomembrane rolls. The finished roll will be identified by a roll number traceable to the resin lot used.

3.2 Construction Quality Assurance Consultant (consultant) - Party, independent from manufacturer and installer that is responsible for observing and documenting activities related to quality assurance during the lining system construction.

3.3 Engineer - The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.

3.4 Geomembrane Manufacturer (manufacturer) - The party responsible for manufacturing the geomembrane rolls.

3.5 Geosynthetic Quality Assurance Laboratory (testing laboratory) - Party, independent from the owner, manufacturer and installer, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the owner.

3.6 Installer - Party responsible for field handling, transporting, storing, deploying, seaming and testing of the geomembrane seams.

3.7 Panel - Unit area of a geomembrane that will be seamed in the field that is larger than 100 square feet.

3.8 Patch - Unit area of a geomembrane that will be seamed in the field that is less than 100 square feet.

3.9 Subgrade Surface - Soil layer surface which immediately underlies the geosynthetic material.

4.0 <u>SUBMITTALS POST-AWARD</u>

4.1 Furnish the following product data, in writing, to engineer prior to installation of the geomembrane material:

A. Resin Data shall include certification stating that the resin meets the specification requirements (see Section 8.0).

B. Statement certifying no more than 10% reclaimed polymer (of the same type) is added to the resin (product run may be recycled) per GRI GM 13.

4.2 The installer shall furnish the following information to the engineer and owner prior to installation:

A. Installation layout drawings

1. Must show proposed panel layout including field seams and details

2. Must be approved prior to installing the geomembrane (Approved drawings will be for concept only and actual panel placement will be determined by site conditions).

B. Installer's Geosynthetic Field Installation Quality Assurance Plan

4.3 The installer will submit the following to the engineer upon completion of installation:

A. Certificate stating the geomembrane has been installed in accordance with the Contract Documents

B. Material and installation warranties

C. As-built drawings showing actual geomembrane placement and seams including typical anchor trench detail/

5.0 QUALITY ASSURANCE

5.1 The Owner may engage and pay for the services of a Quality Assurance Consultant to monitor geomembrane installation.

5.2 Qualifications

A. Manufacturer

1. Geomembrane shall be manufactured by GSE Lining Technology, Inc. or an approved equal.

2. Manufacturer shall have manufactured a minimum of 10,000,000 square feet of polyethylene geomembrane during the last year.

B. Installer

1. The liner manufacturer shall install the liner.

2. Installer shall have installed a minimum of 3,000,000 square feet of HDPE geomembrane during the last five years.

3. Installer shall have worked in a similar capacity on at least three projects similar in complexity to the project described in the contract documents.

4. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.

5. The installer shall provide a minimum of one Master Seamer for work on the project.

6. Must have completed a minimum of 1,000,000 square feet of geomembrane seaming work using the type of seaming apparatus proposed for the use on this Project.

6.0 MATERIAL LABELING, DELIVERY, STORAGE AND HANDLING

6.1 Labeling - Each roll of geomembrane delivered to the site shall be labeled by the manufacturer. The label will identify:

A. Manufacturer's name

B. Product identification

C. Roll number

6.2 Delivery - Rolls of liner will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.

6.3 Storage - The on-site storage location for geomembrane material, provided by the contractor to protect the geomembrane from punctures, abrasions and excessive dirt and moisture for should have the following characteristics:

A. Level (no wooden pallets)

B. Smooth

C. Dry

D. Protected from theft and vandalism

E. Adjacent to the area being lined

6.4 Handling - Materials are to be handled so as to prevent damage.

7.0 WARRANTY

7.1 Material shall be warranted, on a pro-rata basis against Manufacturer's defects for a period of five years from the date of geomembrane installation.

7.2 Installation shall be warranted against defects in workmanship for a period of one year from the date of geomembrane completion.

8.0 GEOMEMBRANE

8.1 Material shall be smooth/textured polyethylene geomembrane as shown on the drawings.

8.2 Resin

A. Resin shall be new, first quality, compounded and manufactured specifically for producing geomembrane.

B. Natural resin (without carbon black) shall meet the following additional minimum requirements:

Property	Test Method[1]	HDPE
Density [g/cm^3]	ASTM D 1505	0.932
Melt Flow Index [g/10 min.]	ASTM D 1238 (190/2.16)	≤ 1.0
OIT [minutes]	ASTM D 3895 (1 atm/200°C)	100

8.3 Geomembrane Rolls

A. Do not exceed a combined maximum total of one percent by weight of additives other than carbon black.

B. Geomembrane shall be free of holes, pinholes as verified by on-line electrical detection, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.

C. Geomembrane material is to be supplied in roll form. Each roll is to be identified with labels indicating both number, thickness, length, width and manufacturer.

D. All liner sheets produced at the factory shall be inspected prior to shipment for compliance with the physical property requirements listed in Section 8.2, and be tested by an acceptable method of inspecting for pinholes. If pinholes are located, identified and indicated during manufacturing, these pinholes may be corrected during installation.

8.4 Smooth, white surfaced geomembrane shall meet the requirements shown in Table 1.2

The geomembrane shall be a white-surfaced, coextruded geomembrane. The white surface shall be installed upwards.

8.5 Extrudate Rod or Bead

A. Extrudate material shall be made from same type resin as the geomembrane.

B. Additives shall be thoroughly dispersed.

C. Materials shall be free of contamination by moisture or foreign matter.

9.0 EQUIPMENT

Welding equipment and accessories shall meet the following requirements:

9.1 Gauges showing temperatures in apparatus (extrusion welder) or wedge (wedge welder) shall be present.

9.2 An adequate number of welding apparatus shall be available to avoid delaying work.

9.3 Power source capable of providing constant voltage under combined line load shall be used.

10.0 DEPLOYMENT

10.1 Assign each panel a simple and logical identifying code. The coding system shall be subject to approval and shall be determined at the job site.

10.2 Visually inspect the geomembrane during deployment for imperfections and mark faulty or suspect areas.

10.3 Deployment of geomembrane panels shall be performed in a manner that will comply with the following guidelines:

A. Unroll geomembrane panels using methods that will not damage geomembrane and will protect underlying surface from damage (i.e., spreader bar, protected equipment bucket).

B. Place ballast (commonly sandbags) on geomembrane that will not damage geomembrane to prevent wind uplift.

C. Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage the geomembrane. Smoking will not be permitted on the geomembrane.

D. Do not allow heavy vehicular traffic directly on geomembrane. Rubber-tired ATV's and trucks are acceptable if wheel contact is less than six psi.

E. Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane.

10.4 Sufficient material (slack) shall be provided to allow for thermal expansion and contraction of the material.

11.0 FIELD SEAMING

11.1 Seams shall meet the following requirements:

A. To the maximum extent possible, orient seams parallel to line of slope, i.e., down and not across slope.

B. Minimize number of field seams in corners, odd shaped geometric locations and outside corners.

C. Slope seams (panels) shall extend a minimum of five-feet beyond the grade break into the flat area.

D. Use a sequential seam numbering system compatible with panel numbering system that is agreeable to the consultant and installer.

E. Align seam overlaps consistent with the requirements of the welding equipment being used. A six-inch overlap is commonly suggested.

11.2 During Welding Operations provide at least one Master Seamer who shall provide direct supervision over other welders as necessary.

11.3 Extrusion Welding

A. Hot-air tack adjacent pieces together using procedures that do not damage geomembrane.

B. Clean geomembrane surfaces by disc grinder or equivalent.

C. Purge welding apparatus of heat degraded extrudate before welding.

11.4 Hot Wedge Welding

A. Welding apparatus shall be a self-propelled device equipped with an electronic controller that displays applicable temperatures.

B. Clean seam area of dust, mud, moisture and debris immediately ahead of the hot wedge welder.

C. Protect against moisture build up between sheets.

12.0 Trial Welds

A. Perform trial welds on geomembrane samples to verify welding equipment is operating properly.

B. Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature.

C. Minimum of two trial welds per day, per welding apparatus, one made prior to the start of work and one completed at mid shift.

D. Cut four, one-inch wide by six-inch long test strips from the trial weld.

E. Quantitatively test specimens for peel adhesion, and then for bonded seam strength (shear).

F. Trial weld specimens shall pass when the results shown in Table 3 are achieved in both peel and shear test.

1. The break, when peel testing, occurs in the liner material itself, not through peel separation (FTB).

2. The break is ductile.

G. Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.

H. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld.

12.2 Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the liner installation. Installer shall demonstrate that acceptable seaming can be performed by completing acceptable trial welds.

12.3 Defects and Repairs

A. Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.

B. Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

13.0 FIELD QUALITY ASSURANCE

13.1 Manufacturer/installer shall participate in and conform to all terms and requirements of the Owner's quality assurance program. Contractor shall be responsible for assuring this participation.

13.2 Field Testing

A. Non-destructive testing shall be carried out as the seaming progresses.

1. Vacuum Testing - Shall be performed in accordance with ASTM D 5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.

2. Air Pressure Testing - Shall be performed in accordance with ASTM D 5820, Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.

13.3 Destructive Testing (performed by the installer witnessed by the consultant)

A. Location and Frequency of Testing

1. Collect destructive test samples at a frequency of one per every 1500 lineal feet of seam length.

2. Test locations will be determined after seaming.

3. Exercise Method of Attributes as described by GRI GM-14 (Geosynthetics Institute, http://www.geosynthetic-institute.org) to minimize test samples taken.

B. Sampling Procedures are performed as follows:

1. Installer shall cut samples at locations designated by the consultant as the seaming progresses in order to obtain field laboratory test results before the geomembrane is covered.

2. Consultant will number each sample, and the location will be noted on the installation as built.

3. Samples shall be twelve inches wide by minimal length with the seam centered lengthwise.

4. Cut a two-inch wide strip from each end of the sample for field-testing.

5. Cut the remaining sample into two parts for distribution as follows:

   a. One portion for installer, twelve -inches by twelve inches

   b. One portion for the third party laboratory, 12-inches by 18-inches

   c. Additional samples may be archived if required.

C. Destructive testing shall be performed in accordance with ASTM D 6392, Standard Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.

D. Installer shall repair all holes in the geomembrane resulting from destructive sampling.

E. Repair and test the continuity of the repair in accordance with these Specifications.

13.4 Failed Seam Procedures

A. If the seam fails, installer shall follow one of two options:

1. Reconstruct the seam between any two passed test locations.

2. Trace the weld to an intermediate location at least ten feet minimum or to where the seam ends in both directions from the location of the failed test.

B. The next seam welded using the same welding device is required to obtain an additional sample, i.e., if one side of the seam is less than ten feet long.

C. If sample passes, then the seam shall be reconstructed or capped between the test sample locations.

D. If any sample fails, the process shall be repeated to establish the zone in which the seam shall be reconstructed.

14.0 REPAIR PROCEDURES

14.1 Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.

14.2 Repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test.

14.3 Installer shall be responsible for repair of defective areas.

14.4 Agreement upon the appropriate repair method shall be decided between consultant and installer by using one of the following repair methods:

A. Patching - Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.

B. Abrading and Rewelding - Used to repair short section of a seam.

C. Spot Welding - Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.

D. Capping - Used to repair long lengths of failed seams.

E. Flap Welding - Used to extrusion weld the flap (excess outer portion) of a fusion weld in lieu of a full cap.

F. Remove the unacceptable seam and replace with new material.

14.5 The following procedures shall be observed when a repair method is used:

A. All geomembrane surfaces shall be clean and dry at the time of repair.

B. Surfaces of the polyethylene that are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.

C. Extend patches or caps at least six inches for extrusion welds and four inches for wedge welds beyond the edge of the defect, and around all corners of patch material.

14.6 Repair Verification

A. Number and log each patch repair (performed by consultant).

B. Non-destructively test each repair using methods specified in this Specification.

Table 3.1: Minimum Weld Values for Smooth HDPE Geomembranes

Property	**Test Method**	**60 (1.5)**
Peel Strength (fusion), ppi (kN/m)	ASTM D 6392	98 (17)
Peel Strength (extrusion), ppi (kN/m)	ASTM D 6392	78 (14)
Shear Strength (fusion & ext.), ppi (kN/m)	ASTM D 6392	121 (21)

Table 1.2: Minimum Values for Smooth White-Surfaced HDPE Geomembranes

Property	Test Method	
Thickness, mil (mm)	ASTM D 5199	
Minimum Average		60 (1.5)
Lowest Individual Reading		54 (1.4)
Density, g/cm^3	ASTM D 1505	0.94
Carbon Black Content(2), %	ASTM D 1603	2.0
Carbon Black Dispersion	ASTM D 5596	*Note 3*
Tensile Properties:	ASTM D 638	
(each direction)	Type IV, 2 ipm	
Strength at Yield, lb/in (kN/m)		130 (23)
Strength at Break, lb/in (kN/m)		243 (43)
Elongation at Yield, %	(1.3" gauge length)	13
Elongation at Break, %	(2.0" gauge length)	700
Tear Resistance, lb (N)	ASTM D 1004	42 (187)
Puncture Resistance, lb (N)	ASTM D 4833	119 (530)
Notched Constant Tensile Load, hours	ASTM D 5397,	400
Oxidative Induction Time, min.	ASTM D 3895	100

Geomenbrane may have an overall ash content greater than 3.0% due to the white layer.

The OIT values apply to the black layer only.

Only near spherical agglomerates are considered. 9 of 10 views shall be Category 1 or 2. No more than one view Category 3.

END OF SECTION

1.0 SCOPE OF WORK

1.1 The work to be performed under this section of the specification shall consist of furnishing all necessary supervision, materials, labor, and equipment to design a shotcrete mix, prepare the surface and install the repair/wear layer on the ash pond inlet structures as specified herein.

1.2 Shotcrete Mix: The shotcrete mix selected by the contractor shall be designed to minimize shrinkage cracking and to provide an abrasion resistant surface.

A. Option 1: Use a mix design of Portland cement, hard natural aggregates and admixtures that data and references show to be abrasion resistant.

B. Option 2: Incorporate silica fume into the mix design at a rate of not less than 4%.

2.0 REFERENCES

2.1 American Concrete Institute

A. ACI 308 Standard Practice for Curing Concrete

B. ACU 506R Guide to Shotcreting

C. ACI 506.2 Specification for Shotcrete

2.2 American Society for Testing and Materials

A. ASTM C33 Standard Specification for Concrete Aggregates

B. ASTM C150 Standard Specification for Portland Cement

C. ASTM C309 Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete

D. ASTM C685 Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing

E. ASTM C1116 Standard Specification for Fiber Reinforced Concrete and Shotcrete

3.0 MATERIALS

3.1 Cement: Portland Cement conforming to ASTM C150 Type I.

3.2 Aggregate: Shall conform to ASTM C33.

3.3 Mixing Water: Shall conform to the requirements of ASTM C-94.

3.4 Silica Fume: "Force 10,000D" microsilica as manufactured by W.R. Grace or an approved equal.

3.5 Synthetic Reinforcing Fibers: "Strux 85/50" fibers as manufactured by W.R. Grace or an approved equal.

3.6 Curing Compounds: Wax based (Type I) or water emulsified, resin base (Type II)

4.0 SUBMITTALS

4.1 The contractors shall submit the proposed mix designs and test data with their proposal. If test data is not available prior to award, the contractor shall be responsible for performing preconstruction testing of the mix after award. The mix shall have a 28-day strength of not less than 6,000 psi.

4.2 Two weeks before starting the shotcreting work, the contractor shall submit the qualifications of the nozzlemen who will be performing the work. Every nozzelman shall be certified and have a minimum of 3000 hours of experience as a nozzleman.

5.0 SURFACE PREPARATION

5.1 Inspect surfaces and conditions where shotcrete is to be placed. Notify the Owner's Representative immediately of any unsatisfactory conditions and do not proceed until those unsatisfactory conditions have been corrected.

5.2 Remove previously applied patching materials.

5.3 Chip or scarify the edges of the eroded areas of the concrete slab such that the change in thickness of the shotcrete application will be no greater than ... per linear foot. Scarify the remainder of the existing structure to allow for a minimum shotcrete application of —". Taper edges to leave no square shoulders at the perimeter of a cavity. Perform these procedures with equipment and in a manner that leaves the maximum reveal to insure excellent bonding.

5.4 Inspect the surface upon completing the scarifying to insure no residual fractured fragments from the scarifying process remain.

5.5 Thoroughly clean the surfaces to be repaired by water blasting to remove any traces of dirt, dust, grease, oil or other substances that could effect the bond of the shotcrete to the existing concrete.

5.6 Adequately saturate the repair surface before beginning the shotcreting process.

6.0 INSTALLATION

6.1 Shotcrete shall be applied using the dry mix process.

6.2 Batching and Mixing:

A. Materials shall be volume proportioned by a calibrated screw conveyor or other approved methods.

B. Batching tolerances shall not exceed 1% for water, 1 | % for cementitious materials, 2% for sand and coarse aggregates and 3% for reinforcing fibers.

C. The percentage of surface moisture in the sand shall be maintained within 3% to 6% by weight.

D. Shotcrete batches that have been in contact with damp aggregate or other moisture for more than two hours shall be wasted at the contractor's expense.

E. Mixers for the mixing the dry ingredients shall be capable of mixing and discharging a uniform product without segregation of ingredients.

F. The discharge nozzle of the applicator shall be equipped with a manual water injection system capable of ready adjustment and convenient to the nozzleman.

6.3 Placing of Shotcrete:

A. Shotcrete shall be placed, starting at the bottom of the Work and proceeding upward, using nozzles and air compressors capable of supplying clean and dry air adequate for maintaining uniform and sufficient nozzle velocity for the Work.

B. The minimum thickness of shotcrete shall be — in. per layer. The maximum total thickness shall not exceed 3" per layer, unless otherwise indicated on the Contract Drawings.

C. The surface of freshly placed shotcrete shall be broomed or cleaned to remove laitance. Shotcrete shall be placed in one layer; where shotcrete is placed over existing cementitious surfaces, such surfaces shall be dampened prior to application of the new shotcrete.

D. The finished repair surface shall not very from smooth by more than +/- ..." within any ten feet.

E. Fill corners filled first with sound material so as to prevent rebound collecting therein. Corners, or any area where rebound cannot easily escape or be blown out, are the most likely places for "sand pockets" to develop.

F. If placement results in sagging or sloughing off of materials, shotcreting shall be halted until causes have been determined and corrections have been made. If wind or air currents cause separation of nozzle stream during placement, or if rain occurs and it may wash cement out of the freshly placed material, shotcreting shall be discontinued or suitable means shall be provided to eliminate the problem. Shotcreting shall not be performed when ambient temperature is below 40°F at the pump or at the placement area.

G. The contractor shall provide and maintain sufficient standby equipment to assure continuous production and application of shotcrete.

6.4 All construction, placement and other joints shall be tapered with a height of at least twice the shotcrete thickness.

6.5 Any placed shotcrete which is damaged, or lacks uniformity, exhibits segregation, honeycomb or lamination, or contains dry patches, slugs, voids or sand pockets, shall be removed and replaced with dry mixed mortar.

6.6 Under no circumstances shall any rebound or previously expended material be used in the shotcrete mix.

6.7 Curing:

A. Curing shall commence immediately after the concrete has attained enough set to prevent damage to the concrete surface. Water curing shall be continued for seven days after shotcreting. During this curing period, the shotcrete work shall be maintained above 50°F.

B. After water curing, final curing may be performed by apply curing compounds. The rate of application shall be at least twice that recommended by the manufacturer for smooth concrete surfaces.

7.0 INSPECTION AND TESTING

7.1 Contractor shall be responsible for all inspection and testing work as required or as needed, unless otherwise indicated. Owner's Representative may, during the course of the Work, observe the various phases of the Work for full compliance with all requirements of this Specification and the Contract Drawings. Any work failing to meet the specified requirements shall be rectified or replaced by Contractor at his expense at no additional cost to Owner.

7.2 Test Specimens:

A. Test specimens shall be made by each shotcrete application crew using the materials, equipment, and mix proportions used for the subject work.

B. A test panel of at least 30" x 30" shall be made with suitable backing material for each mix design being considered, and also for each shooting position to be encountered in the Work (i.e., horizontal, vertical and overhead positions). At least half of each panel to be tested for proper embedment of reinforcement shall contain the same reinforcement as the structure. The thickness of test panels shall be the same as the structure.

C. At least five cores shall be taken from each test panel for testing. All cored surfaces shall be dense and free from laminations and sand pockets. Embedment of reinforcement shall be examined in each panel.

7.3 Test specimens shall be obtained and tested in accordance with ASTM C42 and C39 for compressive strength only.

END OF SECTION

Attachment 1-5 – West Ash Pond HDPE Liner Replacement Specifications

1.0 WORK INCLUDED

1.1 This work includes furnishing materials, tools, equipment, and labor to perform bulk and structural excavation, grading, dewatering and place and compact fill, backfill, and bedding materials.

1.2 Excavation includes, sheeting and bracing required for proper execution of the work, loosening, digging, wedging, ripping, loading, hauling, stockpiling, dumping, and disposal of excavated materials in legal disposal areas approved by Owner's Representative.

1.3 Excavation is unclassified and includes, but is not limited to soil, ash and rock materials, abandoned underground conduits or pipes, and buried concrete and masonry structures.

2.0 QUALITY CONTROL

2.1 Existing and new materials to be used as fill, backfill or bedding are subject to the approval of Owner's Representative.

2.2 To obtain approval of fill, backfill, and bedding materials, designate the proposed borrow area and notify the Owner's Site Representative for a visual inspection prior to placing the material.

3.0 REFERENCES

3.1 Occupational Safety and Health Administration (OSHA)

A. OSHA 2206 General Industry Standards

B. OSHA 2207 Construction Industry Standards

3.2 Illinois Department of Transportation (IDOT) - Standard Specifications for Road and Bridge Construction.

3.3 American Society for Testing and Materials (ASTM)

A. ASTM D 1556- Test for Density of Soil in place by Sand Cone Method

B. ASTM D 1557- Tests for Moisture-Density Relations of Soils Using 10 lb. Hammer and 18 inch drop.

C. ASTM D 2167- Test for Density of Soil in place by Rubber Balloon Method

3.4 The above references shall be the current revision for each.

4.0 SUBMITTALS

4.1 With Contractors' Proposals

A. Submit product data sheets for the chosen liner material.

B. Submit the estimated quantities of materials required to complete the work.

4.2 Two weeks prior to the start of the work, submit to the Owner's Engineer for review, procedures for placing and compacting fill on top of the new liner without damaging the liner material. Include a statement from the liner manufacture that says the procedure is acceptable.

5.0 SITE CONDITIONS

5.1 Prior to start of work become thoroughly familiar with the site, site access, the site conditions, and all portions of the work.

5.2 One pond will be operational while the work on the second pond is being performed.

6.0 MATERIALS

6.1 Make maximum use of suitable on site material for fill when building the pond slopes and entrance ramps. Suitable on site fill material is granular soil or soil/rock mixture that is free from organic matter and other deleterious substances. Material containing rocks or lumps over 1½" in greatest dimension, or containing 15% rocks or lumps larger than ½" in greatest dimension is not acceptable. The material shall have an angle of repose of 30° or greater.

6.2 Imported fill and backfill material shall meet the requirements of Item 6.1 above and, in addition, shall contain predominantly granular material with a maximum particle size of 2".

6.3 Sand used as the protective layer for the pond liners shall be approved by the liner manufacturer.

6.4 Rip rap, coarse aggregate and limestone screenings shall comply with I.D.O.T. specifications.

7.0 BULK AND STRUCTURAL EXCAVATION

7.1 Perform bulk and structural excavation in accordance with the most recent revision of the OSHA General Industry Standards (OSHA 2206) and the OSHA Construction Industry Standards (OSHA 2207).

7.2 Provide temporary grading, ditches and other means as required to drain the areas of the work.

7.3 Perform excavation to lines and grades shown on the contract drawings and as directed by Owner's Representative.

7.4 When the sides of an excavation are five feet or more in depth or when employees are required to enter the excavated area where danger from moving ground exists, perform excavation by open cut to a stable slope or by sheeting and bracing.

7.5 Remove unstable subsoil material, where encountered at the bottom of excavation, to a depth required to obtain satisfactory bearing conditions. Contractor is responsible for bringing the excavation back to the proper elevation by installing compacted bedding material as specified in this section.

7.6 Remove spoil from areas of excavation and stockpile for later use at locations no closer than 2'-0" from edge of excavation unless otherwise approved by Owner's Representative. Remove excess spoil and excavated materials not specifically approved by Owner's Representative for fill, backfill or stockpiling from the site and dispose of these materials at locations and in a manner approved by Federal, State and Local Authorities.

7.7 Properly grade bottom of bulk and structural excavations, remove loose materials, and maintain excavations in good condition, keeping them dry in accordance with Article 8.0 Dewatering, of this section, and free from debris, ice, and frost until completion of the work.

8.0 DEWATERING

8.1 Provide and maintain in operation adequate pumping capacity from sumps, deep wells, or well point installation and perform all other work necessary to keep excavations dry and free of groundwater or surface water during the progress of the work.

8.2 Construction is not permitted in flowing or standing water.

8.3 Dispose of water pumped or drained from the work area in a manner satisfactory to the Owner's Representative, without damage to adjacent property or to other work under construction.

8.4 Take necessary precautions to protect the work against flooding.

9.0 COMPACTION

9.1 Determine the types of equipment and the number of passes required to obtain the required compaction. A pass is defined as one complete coverage of the area by the compaction equipment being used.

9.2 Compact fill and backfill materials to a minimum of 90% of maximum dry density in all areas except in road areas where a minimum of 95% of maximum dry density is required.

9.3 Compact surfaces that are scarified along with and as part of the first lift of fill material that is spread thereon.

9.4 Maximum dry density is defined as the maximum density that can be produced when the same material is compacted in the laboratory in accordance with ASTM D 698 (Standard Proctor).

10.0 INSTALLATION OF FILL AND BACKFILL

10.1 Install fill and backfill material by placing fill and backfill material in uniform layers not to exceed 6" loose measurement unless otherwise noted on the contract drawings or elsewhere in this specification. Compact to minimum specified compaction as set forth in Article 9.2 of this Section.

10.2 Install the 12" protective sand layer on top of the liner material in a single layer.

10.3 Moisten and scarify surfaces to a depth of 4", against which new fill or roadway material is to be placed.

10.4 Remove shoring as backfill progresses only when banks are safe from caving or collapse.

10.5 Water or aerate the material as necessary, and thoroughly mix to obtain a moisture content that will permit proper compaction.

10.6 Do not place fill or backfill materials on a frozen surface. Do not incorporate snow, ice or frozen earth with the fill. Distribute and grade fill and backfill materials throughout the work such that fill will be free from lenses, pockets, streaks or layers of materials differing in texture or gradation from the surrounding material. Do not place successive layers until the layer under construction has been satisfactorily compacted. Place materials in horizontal lifts.

10.7 Remove, dispose and replace any material that Owner's Representative considers objectionable without additional cost to Owner.

10.8 Bring subgrades to a plus or minus tolerance of 0.10 feet.

11.0 FIELD QUALITY CONTROL

11.1 Do not allow or cause any of the work performed or installed to be covered up or enclosed prior to required inspections, tests, and approvals.

11.2 Should any of the work be enclosed or covered up before it has been approved, uncover such work at no additional cost to Owner.

11.3 After the work has been completed, tested, inspected, and approved, make repairs and replacements necessary to restore the work to the condition in which it was found at the time of uncovering, at no additional cost to the Owner.

11.4 Contractor shall engage a testing laboratory to inspect and perform tests on all fill, backfill, and bedding materials.

A. The testing laboratory shall conduct and interpret the following ASTM tests to determine the degree of compaction achieved by compaction operations:

1. ASTM D 1556 Test for Density of Soil in place by Sand Cone Method

2. ASTM D 2167 Test for Density of Soil in place by Rubber Balloon Method

3. ASTM D 2922 Test for Density of Soil in place by Nuclear Methods

B. The testing laboratory shall prepare a test report stating whether the test specimens comply with the work requirements, and specifically state any deviations therefrom.

C. The Owner shall have the right to reject any materials or work not complying with the requirements of the Specification.

D. Contractor shall be responsible for all costs associated with the removal and replacement of all materials determined by testing personnel to have failed the testing acceptance standards.

END OF SECTION

1.0 WORK INCLUDED

This work includes furnishing materials, tools, equipment, and labor to install a 60-mil thick. high-density polyethylene liner with a reflective white coating.

2.0 REFERENCES

2.1 American Society for Testing and Materials (ASTM)

- D 638 Standard Test Method for Tensile Properties of Plastics
- D 1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
- D 1238 Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
- D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
- D 1603 Test Method for Carbon Black in Olefin Plastics
- D 3895 Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
- D 4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
- D 5199 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
- D 5397 Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
- D 5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
- D 6392 Standard Test Method for Determining the Integrity of Non-reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods

2.2 Geosynthetic Research Institute

- GM9 Cold Weather Seaming of Geomembranes
- GM13 Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
- GM19 Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes

3.0 DEFINITIONS

3.1 Lot - A quantity of resin (usually the capacity of one rail car) used in the manufacture of polyethylene geomembrane rolls. The finished roll will be identified by a roll number traceable to the resin lot used.

3.2 Construction Quality Assurance Consultant (consultant) - Party, independent from manufacturer and installer that is responsible for observing and documenting activities related to quality assurance during the lining system construction.

3.3 Engineer - The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.

3.4 Geomembrane Manufacturer (manufacturer) - The party responsible for manufacturing the geomembrane rolls.

3.5 Geosynthetic Quality Assurance Laboratory (testing laboratory) - Party, independent from the owner, manufacturer and installer, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the owner.

3.6 Installer - Party responsible for field handling, transporting, storing, deploying, seaming and testing of the geomembrane seams.

3.7 Panel - Unit area of a geomembrane that will be seamed in the field that is larger than 100 square feet.

3.8 Patch - Unit area of a geomembrane that will be seamed in the field that is less than 100 square feet.

3.9 Subgrade Surface - Soil layer surface which immediately underlies the geosynthetic material.

4.0 SUBMITTALS POST-AWARD

4.1 Furnish the following product data, in writing, to engineer prior to installation of the geomembrane material:

A. Resin Data shall include certification stating that the resin meets the specification requirements (see Section 8.0).

B. Statement certifying no more than 10% reclaimed polymer (of the same type) is added to the resin (product run may be recycled) per GRI GM 13.

4.2 The installer shall furnish the following information to the engineer and owner prior to installation:

A. Installation layout drawings

1. Must show proposed panel layout including field seams and details

2. Must be approved prior to installing the geomembrane (Approved drawings will be for concept only and actual panel placement will be determined by site conditions).

B. Installer's Geosynthetic Field Installation Quality Assurance Plan

4.3 The installer will submit the following to the engineer upon completion of installation:

A. Certificate stating the geomembrane has been installed in accordance with the Contract Documents

B. Material and installation warranties

C. As-built drawings showing actual geomembrane placement and seams including typical anchor trench detail/

5.0 QUALITY ASSURANCE

5.1 The Contractor shall engage and pay for the services of a Quality Assurance Consultant to monitor geomembrane installation.

5.2 Qualifications

A. Manufacturer

1. Geomembrane shall be manufactured by GSE Lining Technology, Inc. or an approved equal.

2. Manufacturer shall have manufactured a minimum of 10,000,000 square feet of polyethylene geomembrane during the last year.

B. Installer

1. The liner manufacturer shall install the liner.

2. Installer shall have installed a minimum of 3,000,000 square feet of HDPE geomembrane during the last five years.

3. Installer shall have worked in a similar capacity on at least three projects similar in complexity to the project described in the contract documents.

4. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.

5. The installer shall provide a minimum of one Master Seamer for work on the project.

6. Must have completed a minimum of 1,000,000 square feet of geomembrane seaming work using the type of seaming apparatus proposed for the use on this Project.

6.0 <u>MATERIAL LABELING, DELIVERY, STORAGE AND HANDLING</u>

6.1 Labeling - Each roll of geomembrane delivered to the site shall be labeled by the manufacturer. The label will identify:

A. Manufacturer's name

B. Product identification

C. Roll number

6.2 Delivery - Rolls of liner will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.

6.3 Storage - The on-site storage location for geomembrane material, provided by the contractor to protect the geomembrane from punctures, abrasions and excessive dirt and moisture for should have the following characteristics:

A. Level (no wooden pallets)

B. Smooth

C. Dry

D. Protected from theft and vandalism

E. Adjacent to the area being lined

6.4 Handling - Materials are to be handled so as to prevent damage.

7.0 WARRANTY

7.1 Material shall be warranted, on a pro-rata basis against Manufacturer's defects for a period of five years from the date of geomembrane installation.

7.2 Installation shall be warranted against defects in workmanship for a period of one year from the date of geomembrane completion.

8.0 GEOMEMBRANE

8.1 Material shall be smooth/textured polyethylene geomembrane as shown on the drawings.

8.2 Resin

A. Resin shall be new, first quality, compounded and manufactured specifically for producing geomembrane.

B. Natural resin (without carbon black) shall meet the following additional minimum requirements:

Property	**Test Method**[(1)]	**HDPE**
Density [g/cm^3]	ASTM D 1505	0.932
Melt Flow Index [g/10 min.]	ASTM D 1238 (190/2.16)	≤ 1.0
OIT [minutes]	ASTM D 3895 (1 atm/200°C)	100

8.3 Geomembrane Rolls

A. Do not exceed a combined maximum total of one percent by weight of additives other than carbon black.

B. Geomembrane shall be free of holes, pinholes as verified by on-line electrical detection, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.

C. Geomembrane material is to be supplied in roll form. Each roll is to be identified with labels indicating both number, thickness, length, width and manufacturer.

D. All liner sheets produced at the factory shall be inspected prior to shipment for compliance with the physical property requirements listed in Section 8.2, and be tested by an acceptable method of inspecting for pinholes. If pinholes are located, identified and indicated during manufacturing, these pinholes may be corrected during installation.

8.4 Smooth, white surfaced geomembrane shall meet the requirements shown in Table 1.2

The geomembrane shall be a white-surfaced, coextruded geomembrane. The white surface shall be installed upwards.

8.5 Extrudate Rod or Bead

A. Extrudate material shall be made from same type resin as the geomembrane.

B. Additives shall be thoroughly dispersed.

C. Materials shall be free of contamination by moisture or foreign matter.

9.0 EQUIPMENT

Welding equipment and accessories shall meet the following requirements:

9.1 Gauges showing temperatures in apparatus (extrusion welder) or wedge (wedge welder) shall be present.

9.2 An adequate number of welding apparatus shall be available to avoid delaying work.

9.3 Power source capable of providing constant voltage under combined line load shall be used.

10.0 DEPLOYMENT

10.1 Assign each panel a simple and logical identifying code. The coding system shall be subject to approval and shall be determined at the job site.

10.2 Visually inspect the geomembrane during deployment for imperfections and mark faulty or suspect areas.

10.3 Deployment of geomembrane panels shall be performed in a manner that will comply with the following guidelines:

A. Unroll geomembrane panels using methods that will not damage geomembrane and will protect underlying surface from damage (i.e., spreader bar, protected equipment bucket).

B. Place ballast (commonly sandbags) on geomembrane that will not damage geomembrane to prevent wind uplift.

C. Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage the geomembrane. Smoking will not be permitted on the geomembrane.

D. Do not allow heavy vehicular traffic directly on geomembrane. Rubber-tired ATV's and trucks are acceptable if wheel contact is less than six psi.

E. Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane.

10.4 Sufficient material (slack) shall be provided to allow for thermal expansion and contraction of the material.

11.0 FIELD SEAMING

11.1 Seams shall meet the following requirements:

A. To the maximum extent possible, orient seams parallel to line of slope, i.e., down and not across slope.

B. Minimize number of field seams in corners, odd shaped geometric locations and outside corners.

C. Slope seams (panels) shall extend a minimum of five-feet beyond the grade break into the flat area.

D. Use a sequential seam numbering system compatible with panel numbering system that is agreeable to the consultant and installer.

E. Align seam overlaps consistent with the requirements of the welding equipment being used. A six-inch overlap is commonly suggested.

11.2 During Welding Operations provide at least one Master Seamer who shall provide direct supervision over other welders as necessary.

11.3 Extrusion Welding

A. Hot-air tack adjacent pieces together using procedures that do not damage geomembrane.

B. Clean geomembrane surfaces by disc grinder or equivalent.

C. Purge welding apparatus of heat degraded extrudate before welding.

11.4 Hot Wedge Welding

A. Welding apparatus shall be a self-propelled device equipped with an electronic controller that displays applicable temperatures.

B. Clean seam area of dust, mud, moisture and debris immediately ahead of the hot wedge welder.

C. Protect against moisture build up between sheets.

12.0 Trial Welds

A. Perform trial welds on geomembrane samples to verify welding equipment is operating properly.

B. Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature.

C. Minimum of two trial welds per day, per welding apparatus, one made prior to the start of work and one completed at mid shift.

D. Cut four, one-inch wide by six-inch long test strips from the trial weld.

E. Quantitatively test specimens for peel adhesion, and then for bonded seam strength (shear).

F. Trial weld specimens shall pass when the results shown in Table 3 are achieved in both peel and shear test.

1. The break, when peel testing, occurs in the liner material itself, not through peel separation (FTB).

2. The break is ductile.

G. Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.

H. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld.

12.2 Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the liner installation. Installer shall demonstrate that acceptable seaming can be performed by completing acceptable trial welds.

12.3 Defects and Repairs

A. Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.

B. Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

13.0 FIELD QUALITY ASSURANCE

13.1 Manufacturer/installer shall participate in and conform to all terms and requirements of the Owner's quality assurance program. Contractor shall be responsible for assuring this participation.

13.2 Field Testing

A. Non-destructive testing shall be carried out as the seaming progresses.

1. Vacuum Testing - Shall be performed in accordance with ASTM D 5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.

2. Air Pressure Testing - Shall be performed in accordance with ASTM D 5820, Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.

13.3 Destructive Testing (performed by the installer witnessed by the consultant)

A. Location and Frequency of Testing

1. Collect destructive test samples at a frequency of one per every 1500 lineal feet of seam length.

2. Test locations will be determined after seaming.

3. Exercise Method of Attributes as described by GRI GM-14 (Geosynthetics Institute, http://www.geosynthetic-institute.org) to minimize test samples taken.

B. Sampling Procedures are performed as follows:

1. Installer shall cut samples at locations designated by the consultant as the seaming progresses in order to obtain field laboratory test results before the geomembrane is covered.

2. Consultant will number each sample, and the location will be noted on the installation as built.

3. Samples shall be twelve inches wide by minimal length with the seam centered lengthwise.

4. Cut a two-inch wide strip from each end of the sample for field-testing.

5. Cut the remaining sample into two parts for distribution as follows:

   a. One portion for installer, twelve -inches by twelve inches

   b. One portion for the third party laboratory, 12-inches by 18-inches

   c. Additional samples may be archived if required.

C. Destructive testing shall be performed in accordance with ASTM D 6392, Standard Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.

D. Installer shall repair all holes in the geomembrane resulting from destructive sampling.

E. Repair and test the continuity of the repair in accordance with these Specifications.

13.4 Failed Seam Procedures

A. If the seam fails, installer shall follow one of two options:

1. Reconstruct the seam between any two passed test locations.

2. Trace the weld to an intermediate location at least ten feet minimum or to where the seam ends in both directions from the location of the failed test.

B. The next seam welded using the same welding device is required to obtain an additional sample, i.e., if one side of the seam is less than ten feet long.

C. If sample passes, then the seam shall be reconstructed or capped between the test sample locations.

D. If any sample fails, the process shall be repeated to establish the zone in which the seam shall be reconstructed.

14.0 REPAIR PROCEDURES

14.1 Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.

14.2 Repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test.

14.3 Installer shall be responsible for repair of defective areas.

14.4 Agreement upon the appropriate repair method shall be decided between consultant and installer by using one of the following repair methods:

A. Patching - Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.

B. Abrading and Rewelding - Used to repair short section of a seam.

C. Spot Welding - Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.

D. Capping - Used to repair long lengths of failed seams.

E. Flap Welding - Used to extrusion weld the flap (excess outer portion) of a fusion weld in lieu of a full cap.

F. Remove the unacceptable seam and replace with new material.

14.5 The following procedures shall be observed when a repair method is used:

A. All geomembrane surfaces shall be clean and dry at the time of repair.

B. Surfaces of the polyethylene that are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.

C. Extend patches or caps at least six inches for extrusion welds and four inches for wedge welds beyond the edge of the defect, and around all corners of patch material.

14.6 Repair Verification

A. Number and log each patch repair (performed by consultant).

B. Non-destructively test each repair using methods specified in this Specification.

Table 3.1: Minimum Weld Values for Smooth HDPE Geomembranes

Property	Test Method	60 (1.5)
Peel Strength (fusion), ppi (kN/m)	ASTM D 6392	98 (17)
Peel Strength (extrusion), ppi (kN/m)	ASTM D 6392	78 (14)
Shear Strength (fusion & ext.), ppi (kN/m)	ASTM D 6392	121 (21)

Table 1.2: Minimum Values for Smooth White-Surfaced HDPE Geomembranes

Property	**Test Method**	
Thickness, mil (mm)	ASTM D 5199	
Minimum Average		60 (1.5)
Lowest Individual Reading		54 (1.4)
Density, g/cm^3	ASTM D 1505	0.94
Carbon Black Content(2), %	ASTM D 1603	2.0
Carbon Black Dispersion	ASTM D 5596	*Note 3*
Tensile Properties:	ASTM D 638	
(each direction)	Type IV, 2 ipm	
Strength at Yield, lb/in (kN/m)		130 (23)
Strength at Break, lb/in (kN/m)		243 (43)
Elongation at Yield, %	(1.3" gauge length)	13
Elongation at Break, %	(2.0" gauge length)	700
Tear Resistance, lb (N)	ASTM D 1004	42 (187)
Puncture Resistance, lb (N)	ASTM D 4833	119 (530)
Notched Constant Tensile Load, hours	ASTM D 5397,	400
Oxidative Induction Time, min.	ASTM D 3895	100

Geomenbrane may have an overall ash content greater than 3.0% due to the white layer.

The OIT values apply to the black layer only.

Only near spherical agglomerates are considered. 9 of 10 views shall be Category 1 or 2. No more than one view Category 3.

END OF SECTION

1.0 SCOPE OF WORK

1.1 The work to be performed under this section of the specification shall consist of furnishing all necessary supervision, materials, labor, and equipment to design a shotcrete mix, prepare the surface and install the repair/wear layer on the ash pond inlet structures as specified herein.

1.2 Shotcrete Mix: The shotcrete mix selected by the contractor shall be designed to minimize shrinkage cracking and to provide an abrasion resistant surface.

A. Option 1: Use a mix design of Portland cement, hard natural aggregates and admixtures that data and references show to be abrasion resistant.

B. Option 2: Incorporate silica fume into the mix design at a rate of not less than 4%.

2.0 REFERENCES

2.1 American Concrete Institute

A. ACI 308 Standard Practice for Curing Concrete

B. ACU 506R Guide to Shotcreting

C. ACI 506.2 Specification for Shotcrete

2.2 American Society for Testing and Materials

A. ASTM C33 Standard Specification for Concrete Aggregates

B. ASTM C150 Standard Specification for Portland Cement

C. ASTM C309 Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete

D. ASTM C685 Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing

E. ASTM C1116 Standard Specification for Fiber Reinforced Concrete and Shotcrete

3.0 MATERIALS

3.1 Cement: Portland Cement conforming to ASTM C150 Type I.

3.2 Aggregate: Shall conform to ASTM C33.

3.3 Mixing Water: Shall conform to the requirements of ASTM C-94.

3.4 Silica Fume: "Force 10,000D" microsilica as manufactured by W.R. Grace or an approved equal.

3.5 Synthetic Reinforcing Fibers: "Strux 85/50" fibers as manufactured by W.R. Grace or an approved equal.

3.6 Curing Compounds: Wax based (Type I) or water emulsified, resin base (Type II)

4.0 SUBMITTALS

4.1 The contractors shall submit the proposed mix designs and test data with their proposal. If test data is not available prior to award, the contractor shall be responsible for performing preconstruction testing of the mix after award. The mix shall have a 28-day strength of not less than 6,000 psi.

4.2 Two weeks before starting the shotcreting work, the contractor shall submit the qualifications of the nozzlemen who will be performing the work. Every nozzelman shall be certified and have a minimum of 3000 hours of experience as a nozzleman.

5.0 SURFACE PREPARATION

5.1 Inspect surfaces and conditions where shotcrete is to be placed. Notify the Owner's Representative immediately of any unsatisfactory conditions and do not proceed until those unsatisfactory conditions have been corrected.

5.2 Remove previously applied patching materials.

5.3 Chip or scarify the edges of the eroded areas of the concrete slab such that the change in thickness of the shotcrete application will be no greater than ¼" per linear foot. Scarify the remainder of the existing structure to allow for a minimum shotcrete application of ¾". Taper edges to leave no square shoulders at the perimeter of a cavity. Perform these procedures with equipment and in a manner that leaves the maximum reveal to insure excellent bonding.

5.4 Inspect the surface upon completing the scarifying to insure no residual fractured fragments from the scarifying process remain.

5.5 Thoroughly clean the surfaces to be repaired by water blasting to remove any traces of dirt, dust, grease, oil or other substances that could effect the bond of the shotcrete to the existing concrete.

5.6 Adequately saturate the repair surface before beginning the shotcreting process.

6.0 INSTALLATION

6.1 Shotcrete shall be applied using the dry mix process.

6.2 Batching and Mixing:

A. Materials shall be volume proportioned by a calibrated screw conveyor or other approved methods.

B. Batching tolerances shall not exceed 1% for water, 1 1/2% for cementitious materials, 2% for sand and coarse aggregates and 3% for reinforcing fibers.

C. The percentage of surface moisture in the sand shall be maintained within 3% to 6% by weight.

D. Shotcrete batches that have been in contact with damp aggregate or other moisture for more than two hours shall be wasted at the contractor's expense.

E. Mixers for the mixing the dry ingredients shall be capable of mixing and discharging a uniform product without segregation of ingredients.

F. The discharge nozzle of the applicator shall be equipped with a manual water injection system capable of ready adjustment and convenient to the nozzleman.

6.3 Placing of Shotcrete:

A. Shotcrete shall be placed, starting at the bottom of the Work and proceeding upward, using nozzles and air compressors capable of supplying clean and dry air adequate for maintaining uniform and sufficient nozzle velocity for the Work.

B. The minimum thickness of shotcrete shall be ¾" per layer. The maximum total thickness shall not exceed 3" per layer, unless otherwise indicated on the Contract Drawings.

C. The surface of freshly placed shotcrete shall be broomed or cleaned to remove laitance. Shotcrete shall be placed in one layer; where shotcrete is placed over existing cementitious surfaces, such surfaces shall be dampened prior to application of the new shotcrete.

D. The finished repair surface shall not very from smooth by more than +/- ¼" within any ten feet.

E. Fill corners filled first with sound material so as to prevent rebound collecting therein. Corners, or any area where rebound cannot easily escape or be blown out, are the most likely places for "sand pockets" to develop.

F. If placement results in sagging or sloughing off of materials, shotcreting shall be halted until causes have been determined and corrections have been made. If wind or air currents cause separation of nozzle stream during placement, or if rain occurs and it may wash cement out of the freshly placed material, shotcreting shall be discontinued or suitable means shall be provided to eliminate the problem. Shotcreting shall not be performed when ambient temperature is below 40°F at the pump or at the placement area.

G. The contractor shall provide and maintain sufficient standby equipment to assure continuous production and application of shotcrete.

6.4 All construction, placement and other joints shall be tapered with a height of at least twice the shotcrete thickness.

6.5 Any placed shotcrete which is damaged, or lacks uniformity, exhibits segregation, honeycomb or lamination, or contains dry patches, slugs, voids or sand pockets, shall be removed and replaced with dry mixed mortar.

6.6 Under no circumstances shall any rebound or previously expended material be used in the shotcrete mix.

6.7 Curing:

A. Curing shall commence immediately after the concrete has attained enough set to prevent damage to the concrete surface. Water curing shall be continued for seven days after shotcreting. During this curing period, the shotcrete work shall be maintained above 50°F.

B. After water curing, final curing may be performed by apply curing compounds. The rate of application shall be at least twice that recommended by the manufacturer for smooth concrete surfaces.

7.0 INSPECTION AND TESTING

7.1 Contractor shall be responsible for all inspection and testing work as required or as needed, unless otherwise indicated. Owner's Representative may, during the course of the Work, observe the various phases of the Work for full compliance with all requirements of this Specification and the Contract Drawings. Any work failing to meet the specified requirements shall be rectified or replaced by Contractor at his expense at no additional cost to Owner.

7.2 Test Specimens:

A. Test specimens shall be made by each shotcrete application crew using the materials, equipment, and mix proportions used for the subject work.

B. A test panel of at least 30" x 30" shall be made with suitable backing material for each mix design being considered, and also for each shooting position to be encountered in the Work (i.e., horizontal, vertical and overhead positions). At least half of each panel to be tested for proper embedment of reinforcement shall contain the same reinforcement as the structure. The thickness of test panels shall be the same as the structure.

C. At least five cores shall be taken from each test panel for testing. All cored surfaces shall be dense and free from laminations and sand pockets. Embedment of reinforcement shall be examined in each panel.

7.3 Test specimens shall be obtained and tested in accordance with ASTM C42 and C39 for compressive strength only.

END OF SECTION

Attachment 1-6 – East Ash Pond Technical Specifications

SECTION 02200

EARTHWORK

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The Contractor shall furnish all labor, materials, tools, supervision, transportation, equipment, and incidentals necessary to perform all Earthwork. The Work shall be carried out as specified herein and in accordance with the Construction Drawings.

B. The Work shall include, but not be limited to clearing and grubbing, excavating, hauling, placing, moisture conditioning, backfilling, compacting, grading, and subgrade preparation. Earthwork shall conform to the dimensions, lines, grades and sections shown on the Construction Drawings or as directed by the Construction Manager.

1.02 RELATED SECTIONS

A. Section 02770 – Geosynthetics

1.03 REFERENCES

A. Construction Drawings

B. Latest version of the Occupational Safety and Health Administration (OSHA) rules and regulations.

C. "Stormwater Pollution Prevention Plan, East Ash Basin Slope Modification", Geosyntec, July 2016.

D. 2015 Standard Specifications for Public Works Construction "Greenbook" (Greenbook)

E. "Construction Quality Assurance (CQA) Plan, East Ash Basin Slope Modification, Waukegan Generating Station" by Geosyntec, dated June 2016

F. Illinois Department of Transportation (IDOT), Standard Specifications for Road and Bridge Construction, January 2012.

G. Latest version of the American Society for Testing and Materials (ASTM) standards:

ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D422	Standard Method for Particle-Size Analysis of Soils
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))
ASTM D2487	Standard Test Method for Classification of Soils for Engineering Purposes
ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth)

H. Submittals

I. The Contractor shall submit to the Construction Manager a description of equipment and methods proposed for all earthwork components including excavation, ash relocation, select and engineered fill placement, moisture conditioning, and compaction, stockpiling, road subgrade preparation and road surfacing placement and compaction at least 5 days prior to the start of activities covered by this Section.

J. The Contractor shall submit copies of all permits obtained for site work. The permits shall be provided prior to initiating the applicable site activities.

K. The Contractor shall submit as-built Record Drawing electronic files and data, to the Construction Manager, within 7 days of project substantial completion, in accordance with this Section. The Record Drawings shall be submitted in AutoCAD version 2015 format or newer, or in a DXF format that can be converted to AutoCAD.

1.04 QUALITY ASSURANCE

A. The Contractor shall ensure that the materials and methods used for Earthwork meet the requirements of the Construction Drawings and this Section. Any material or method that does not conform to these documents, or to alternatives approved in writing by the Construction Manager will be rejected and shall be repaired or replaced by the Contractor at the Contractor's expense.

B. The Contractor shall be aware of and accommodate all monitoring and field/laboratory conformance testing required by the CQA Plan. This monitoring and testing, including random conformance testing of construction materials and completed Work, will be performed by the CQA Consultant. If nonconformances or other deficiencies are found in the materials or completed Work, the Contractor will be required to repair the deficiency or replace the deficient materials at no additional cost to the Owner.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Engineered Fill – Engineered Fill shall consist of relatively homogeneous soils that contain no debris, foreign objects, large rock fragments (greater than 6 inches in maximum dimension), roots, and organics. No materials larger than 6 inches shall be allowed within the Engineered Fill. The Engineered Fill shall be classified according to the Unified Soil Classification System (per ASTM D2487) as, ML, CL, CL-ML, SM, SC, SW, SP, GW, GP, GM, GC, or combinations of these materials. The Contractor may propose the use of other soil types as Engineered Fill, but such use shall be at the sole discretion of the Engineer.

B. Select Soil – Select Soil shall have at least 40 percent material smaller than ¼-inch in size, no particles larger than 3 inches, and not having any sharp, angular pieces greater than ¼-inch or perishable, spongy, deleterious, or otherwise unsuitable material. Select soil shall be utilized to backfill geomembrane anchor trenches.

C. Aggregate Base – Aggregate Base shall meet the requirements of Illinois Department of Transportation Gradation CA 6.

D. CCR – CCR (Coal Combustion Residuals) are materials located within the geomembrane lined areas of the West and East Ash Basins.

2.02 EQUIPMENT

A. The Contractor shall furnish, operate, and maintain compaction equipment as necessary to produce the required in-place soil density and moisture content.

B. The Contractor shall furnish, operate and maintain tank trucks, pressure distributors, or other equipment designed to apply water uniformly and in controlled quantities to variable surface widths.

C. The Contractor shall furnish, operate, and maintain miscellaneous equipment such as scarifiers or disks, earth excavating equipment, earth hauling equipment, and other equipment, as necessary for Earthwork construction.

D. When relocating CCR Deposits or placing excavated material within the basin in areas lined with a geomembrane, the Contractor shall use equipment which will not damage the underlying geomembrane in accordance with the Geomembrane Manufacturer's recommendations.

PART 3 – EXECUTION

3.01 GENERAL

A. The Contractor shall not disturb or impact areas outside of the limits of work as defined on the Construction Drawings without prior approval from the Construction Manager. If work outside of the limit cannot be avoided, the Contractor shall notify the Construction Manager a minimum of 3 days prior to disturbance outside of the limits for approval prior to starting the work.

B. Prior to initiating earthwork activities, the Contractor shall have implemented the site SWPPP.

C. The Contractor shall obtain all applicable grading permits, or other applicable work permits, prior to initiating the work covered by the permit.

D. When hauling is done over roadways or city streets, the loads shall comply with legal load requirements, all material shall be removed from shelf areas of vehicles in order to eliminate spilling of material, and loads shall be watered or covered to eliminate dust.

E. Under this Work, the Contractor shall apply water for dust control, for compaction purposes, and for such other purposes (not provided for in other Sections) called for on the Construction Drawings or as directed by the Construction Manager. Contractor shall coordinate with Owner for access to onsite water source. Contractor shall not waste water or allow water application to create erosion or other deleterious conditions to the work area or adjacent areas.

F. Well heads for existing groundwater wells within the work area will removed by others and wells will be capped prior to work. The Contractor shall provide protection to existing groundwater monitoring wells throughout construction. Any damage to these items shall be repaired or replaced to the Construction Manager's satisfaction at the Contractor's sole expense.

3.02 FAMILIARIZATION

A. Prior to implementing any of the Work in this Section, the Contractor shall become thoroughly familiar with the Site, the Site conditions, and all portions of the Work falling within this and other related Sections.

3.03 CLEARING AND GRUBBING

A. Prior to Site clearing, Contractor shall have implemented the SWPPP.

B. The Contractor shall remove and properly dispose of all vegetation, debris, organic and deleterious material that exist along the crest of the embankment and eastern and southern facing slopes of the embankment within the work area.

C. No burning of combustible materials shall be allowed.

D. Clearing and grubbing shall include, but not be limited to removal and disposal of trees, plants and shrubs and vegetation as well as rocks, and surficial and shallow debris.

E. Vegetation, debris and organic matter shall be properly disposed of offsite.

F. Remove all tree root balls associated with trees with a diameter greater than 4-inches. Tree root ball holes in non-excavation areas shall be backfilled in accordance with Section 3.07.

3.04 EXCAVATION

A. CCR located on top of the geomembrane along the slope area within the East Ash Basin shall be relocated, as necessary, to accommodate grading of the embankment. Excavated CCR materials shall be placed within the western portion of the East Ash Basin. CCR shall not be placed at inclinations greater than 5H:1V (Horizontal:Vertical). Excavation of CCR shall be performed with care to ensure no damage to the underlying geomembrane. Damage to the underlying geomembrane shall be repaired to the Construction Manager's satisfaction at the Contractor's expense.

B. Perform all excavations, regardless of the type, nature, or condition of material encountered, as specified, shown, required or implied to accomplish the construction. Excavated soil shall be placed within the western portion of the East Ash Basin at inclinations no greater than 5H:1V.

C. Allow for working space, overlying materials, and finish grades as shown or required. Do not carry excavations deeper than the elevation shown, unless soft or wet materials are encountered. Excavation carried below the grade lines in areas of unsuitable materials, including root balls, shall be replaced with over excavated material compacted to at least 90% relative compaction and to -3 percent to +1 percent of optimum moisture. Cuts below grade shall be corrected by filling and compacting soil material to at least 90% relative compaction and -3 percent to +1 percent of optimum moisture, and creating a smooth transition. All overexcavation in areas of suitable materials will be filled and compacted at the Contractor's expense.

D. After completion of excavation, and prior to placement of aggregate base on the embankment crest (Section 3.06), proof-roll the berm crest to detect soft, wet, or loose materials. Notify the Owner or Owner's Representative prior to commencement of proof rolling. If soft, wet, or loose materials are found, excavate the soft or loose material to a depth accepted by the Engineer, then fill and compact in accordance with Section 3.07.

E. Perform all earthwork to the lines and grades as shown and/or established by the Owner or Owner's Representative. Make slopes free of all exposed roots and stones exceeding 3-inch diameter which are loose and liable to fall. Neatly blend all new grading into surrounding, existing terrain. The Owner or Owner's Representative shall review finished site grading.

F. After excavating existing aggregate base materials on the embankment crest within the work area, Contractor shall remove existing geotextile and properly dispose of offsite.

3.05 ANCHOR TRENCH EXCAVATION AND BACKFILL

A. The Contractor shall excavate 2 ft by 2 ft anchor trenches to secure the geomembrane prior to placement of the geotextile and aggregate base material.

B. Anchor trenches shall be backfilled with select fill and compacted in accordance with Subpart 3.07, below.

3.06 ACCESS ROAD SURFACING

A. The Contractor shall grade access road along the crest of the embankment to the widths and minimum slope inclinations as shown on the Construction Drawings.

B. Prior to placing aggregate base, the Contractor shall moisten the area to be covered. The area shall be kept moist, but not wet (i.e. no ponding water or saturated soils), until the geotextile and overlying aggregate base is installed.

C. Geotextile shall be placed prior to aggregate base placement in accordance with Section 02770.

D. The access road shall be surfaced with 4 inches of aggregate base to the lines and grades shown on the Construction Drawings. Aggregate base shall be as described in Section 2.01 and in locations indicated on the Construction Drawings.

E. The aggregate base shall be compacted to a minimum of 95 percent relative compaction and within ± 2 percent of the optimum moisture content as determined by ASTM D1557.

F. After initial compaction, the Contractor shall trim off high spots to within tolerance wherever the finished surface is higher than the specified tolerance. Following trimming, the Contractor shall compact trimmed areas with one complete coverage so the entire layer complies with compaction requirements. Loose material at the surface and tear marks shall not be permitted.

3.07 ENGINEERED AND SELECT FILL

A. Prior to placing engineered fill, the soil subgrade shall be scarified to a depth of 6 inches and recompacted.

B. Engineered fill and select fill shall be compacted to a minimum of 90 percent relative compaction and -3 percent to +1 percent of optimum moisture percent as measured in accordance with ASTM D1557.

3.08 STOCKPILING

A. If deemed acceptable for reuse, existing aggregate base material may be stockpiled within the laydown area or an area approved by the Owner. Stockpiles shall be no steeper than 2.5H:1V (Horizontal:Vertical), unless stockpiles are to be created within the East Ash Basin in which case the stockpiles shall be no steeper than 5H:1V, or other slope approved by the Engineer, graded to drain, sealed by tracking parallel to the slope with a dozer or other means approved by the Construction Manager, and dressed daily during periods when fill is taken from the stockpile. The Contractor shall employ temporary erosion and sediment control measures (i.e. silt fence) around stockpile areas in accordance with Construction Drawings.

B. There are no compaction requirements for temporary stockpiled materials.

3.09 FIELD TESTING

A. The minimum frequency and details of quality control testing are provided below. This testing will be performed by the CQA Consultant. Additional testing may be performed at the discretion of the CQA Consultant, Construction Manager or Owner. The Contractor shall consider this testing frequency when preparing the construction schedule.

1. The CQA Consultant will perform conformance tests on placed and compacted engineered fill, select soil and aggregate base to evaluate compliance with these Specifications. These tests will include in-situ moisture content and dry density. The frequency and procedures for moisture-density testing are provided in the CQA Plan. At a minimum, the dry density and moisture content of the soil will be measured in-situ in accordance with ASTM D6938. The CQA Consultant shall approve the material prior to placement of overlying materials.

2. Increased testing frequencies may be used by the CQA Consultant when visual observations of construction performance indicate a potential problem. Additional testing will be considered when:

   a. The rollers slip during rolling operation

   b. The lift thickness is greater than specified

   c. The fill is at improper and/or variable moisture content

   d. Fewer than the specified number of roller passes are made

   e. Dirt-clogged rollers are used to compact the material

   f. The rollers do not have optimum ballast

   g. The degree of compaction is doubtful

3. During construction, the frequency of testing will be increased by the CQA Consultant in the following situations:

   a. Adverse weather conditions

   b. Breakdown of equipment

   c. At the start and finish of grading

   d. If the material fails to meet specifications

   e. The Work area is reduced

B. Defective Areas:

1. If a defective area is discovered in the Earthwork, the CQA Consultant will evaluate the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Consultant will determine the extent of the defective area by additional tests, observations, a review of records, or other means that the CQA Consultant deems appropriate. If the defect is related to adverse Site conditions, such as overly wet soils or surface desiccation, the CQA Consultant shall define the limits and nature of the

defect. The CQA Consultant shall notify the Construction Manager within 1 day of defective area discovery.

2. Once the extent and nature of a defect is determined, the Contractor shall correct the deficiency to the satisfaction of the CQA Consultant and Construction Manager. The Contractor shall not perform additional Work in the area until the CQA Consultant and Construction Manager approve the correction of the defect.

3. Additional testing may be performed by the CQA Consultant to verify that the defect has been corrected. This additional testing will be performed before any additional Work is allowed in the area of deficiency. The cost of the additional testing shall be borne by the Contractor.

3.10 SURVEY CONTROL

A. The Contractor shall perform all surveys necessary for construction layout and control.

1. At a minimum, all surfaces should be surveyed on a square grid not wider spaced than 50 ft and shall include additional points for grade breaks (top and toe of slope).

3.11 CONSTRUCTION TOLERANCE

A. Tolerances for designed thicknesses shown on Construction Drawings and for elevations shown on Construction Drawings are ±0.10 foot unless otherwise specified.

3.12 AS-BUILT SURVEY

A. The Contractor shall produce complete electronic as-built Record Drawings in conformance with the requirements set forth in this Section. This electronic file shall be provided to the Construction Manager for verification. Surveys shall be submitted for the following:

1. Existing topography;

2. Anchor trench;

3. Finish grade and limits of the access road;

4. Final topography.

A. Record survey shall be performed, at a minimum, at all grade breaks, flow lines, and on a 50-foot grid.

3.13 PROTECTION OF WORK

A. The Contractor shall use all means necessary to protect completed Work of this Section.

B. At the end of each day, the Contractor shall verify that the entire Work area is left in a state that promotes drainage of surface water away from the area and from finished Work. If threatening weather conditions are forecast, at a minimum, compacted surfaces shall be seal-rolled to protect finished Work.

C. In the event of damage to prior Work, the Contractor shall make repairs and replacements to the satisfaction of the Construction Manager, at the expense of the Contractor.

[END OF SECTION]

SECTION 02770
GEOSYNTHETICS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The Contractor shall furnish all labor, materials, tools, supervision, transportation, equipment, and incidentals necessary for the repair of the existing geomembrane and installation of geotextile. The Work shall be carried out as specified herein and in accordance with the Drawings.

B. The Work shall include, but not be limited to, delivery, storage, and placement of the various geosynthetic components of the project.

C. The intent is for the Contractor to re-use existing geomembrane by cutting the existing geomembrane in sections to facilitate folding the geomembrane down the slope to allow excavation of the underlying soils. Contractor shall exercise caution while folding geomembrane and excavating soil to not damage the existing geomembrane. Once excavation is complete and the new anchor trench has been excavated, the intent is to pull the sections of geomembrane back up the slope, cut the geomembrane to the appropriate length, and place the geomembrane into the new anchor trench. Vertical cuts in the existing geomembrane, along with other damage, will be repaired with new geomembrane, in accordance with this section.

D. Geotextile shall be placed beneath the aggregate base surfacing on the embankment crest.

E. Existing geomembrane shall be repaired/patched as necessary to achieve the lines and grades shown on the Drawings.

1.02 RELATED SECTIONS

Section 02200 – Earthwork

1.03 REFERENCES

A. Drawings

B. "Construction Quality Assurance (CQA) Plan, East Ash Basin Slope Modification, Waukegan Generating Station" by Geosyntec, dated June 2016

C. Latest version of ASTM International (ASTM) standards:

ASTM D792	Standard Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement
ASTM D1004	Standard Test Method for Initial Tear Resistance (Graves Tear) of Plastic Film and Sheeting
ASTM D1238	Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
ASTM D1505	Standard Test Methods for Density of Plastics by Density-Gradient Technique

ASTM D1603 Standard Test Method for Carbon Black in Olefin Plastics

ASTM D4355 Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus

ASTM D4439 Terminology for Geosynthetics

ASTM D4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

ASTM D4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products

ASTM D4873 Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples

ASTM D5199 Standard Test Method for Measuring the Nominal Thickness of Geosynthetics

ASTM D5397 Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test

ASTM D5641 Practice for Geomembrane Seam Evaluation by Vacuum Chamber

ASTM D5820 Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes

ASTM D6241 Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products using a 50-mm Probe

ASTM D6392 Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced using Thermo-Fusion Methods.

ASTM D6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes

D. GRI GM9 Cold Weather Seaming of Geomembranes

E. GRI GM10 The Stress Crack Resistance of HDPE Geomembrane Sheet

F. GRI GM13 Test Methods, Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes

G. GRI GM19 Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes

1.04 WARRANTY

A. The Geosynthetic Installer shall furnish the Owner with a 1-year written warranty against defects in workmanship. Warranty conditions concerning limits of liability will be evaluated by, and must be acceptable to, the Owner.

1.05 SUBMITTALS

A. The Contractor shall submit to the Construction Manager, at least 7 days prior to commencement of work, the following information regarding the proposed geomembrane and geotextile:

1. Manufacturer and product name
2. Minimum property values of the proposed geotextile and the corresponding test procedures
3. Minimum property values of the proposed geomembrane and the corresponding test procedures
4. Projected delivery dates
5. List of roll numbers for rolls to be delivered to the Site

B. Upon completion of the installation, the Contractor shall be responsible for the submission to the Construction Manager of a warranty as specified in Subpart 1.04 of this Section.

C. Upon completion of the installation of the geomembrane repair, the Contractor shall be responsible for the submission to the Construction Manager of a Record Drawing showing the locations and numbers of repairs.

1.06 QUALITY ASSURANCE

A. The Contractor shall ensure that the geomembrane and geotextile materials, and installation methods used meet the requirements of the Drawings and this Section. Any material or method that does not conform to these documents, or to alternatives approved in writing by the Construction Manager, will be rejected and shall be repaired or replaced by the Contractor.

B. The Contractor shall be aware of and accommodate all monitoring and conformance testing required by the CQA Plan. This monitoring and testing, including random conformance testing of construction materials and completed Work, will be performed by the CQA Consultant. If non-conformances or other deficiencies are found in the Contractor's materials or completed Work, the Contractor will be required to repair the deficiency or replace the deficient materials, at the expense of the Contractor.

PART 2 – PRODUCTS

2.01 GEOTEXTILE

A. Geotextile shall be GEOTEX® 200ST woven polypropylene manufactured by Propex GeoSolutions or equivalent as approved by the Engineer.

B. Geotextile suppliers shall furnish materials, which meet or exceed the criteria specified in Table 02770-1 in accordance with the minimum average roll value (MARV), as defined by ASTM D4439.

2.02 GEOMEMBRANE

A. The geomembrane shall be a 60-mil smooth or textured high density polyethylene (HDPE) geomembrane.

B. Geomembranes shall be produced in rolls free of holes, blisters, striations, undispersed raw materials, or any sign of contamination by foreign matter.

C. Resin used in the manufacturing of the geomembrane shall be new, first-quality, virgin polyethylene resin. The addition of reworked polymer (from the manufacturing process) to resin shall be permitted if it does not exceed 2% by weight, contains no encapsulated scrim, and is performed with appropriate cleanliness. The addition of post-consumer resin shall not be permitted.

D. Geomembrane resin shall be mixed with the specified amount of carbon black. The carbon black shall be pre-blended with the resin.

E. The geomembrane shall exhibit the minimum physical properties listed in Table 02770-2 (smooth geomembrane) or Table 02770-3 (textured geomembrane). Manufacturer quality control testing shall be performed in accordance with the frequencies presented in Table 02770-2 or 02770-3, accordingly.

F. The geomembrane shall be a white-surface geomembrane. The white surface shall be installed upwards.

G. Geomembrane trials seams shall meet the minimum requirements listed in GRI Test Method GM-19, shown in Table 02770-4. Frequency of trial seam testing shall be in accordance with Section 3.05H

H. Resin used for extrusion welding shall be produced from same resin type as the geomembrane and shall be the same color as the geomembrane surface to be exposed (i.e. white). Physical properties of the welding resin shall be the same as those of the resin used in the geomembrane.

2.03 MANUFACTURING QUALITY CONTROL (MQC)

A. The geotextile and geomembrane shall be manufactured with MQC procedures that meet or exceed generally accepted industry standards.

2.04 PACKING AND LABELING

A. Geotextile shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers.

B. Geomembrane and geotextile rolls shall be marked or tagged with the following information:

1. Manufacturer's name
2. Product identification
3. Lot or batch number
4. Roll number

5. Roll dimensions

2.05 TRANSPORTATION, HANDLING, AND STORAGE

A. The Contractor shall be liable for any damage to the materials incurred prior to and during transportation to the Site.

B. Handling, unloading, storage, and care of the geomembrane and geotextile prior to and following installation at the Site, is the responsibility of the Contractor and shall be performed in accordance with ASTM D4873.

C. The geotextile shall be protected from sunlight, puncture, or other damaging or deleterious conditions.

D. The geomembrane shall be protected from excessive puncture, cutting, or other damaging or deleterious conditions. Any additional storage procedures required by the Geomembrane Manufacturer shall be the Contractor's responsibility.

2.06 EQUIPMENT

A. The Contractor shall furnish all necessary equipment required to accomplish the installation of the geosynthetics specified herein.

PART 3 – EXECUTION

3.01 FAMILIARIZATION

A. Prior to implementing any of the work described in this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the Work described in this Section.

B. If the Contractor has any concerns regarding the installed work of other Sections or the site, the Construction Manager shall be notified, in writing, prior to commencing the work. Failure to notify the Construction Manager or commencing installation of the geomembrane or geotextile will be construed as the Contractor's acceptance of the related work of all other Sections.

3.02 GEOTEXTILE PLACEMENT

A. The Contractor shall handle all geotextile in such a manner as to ensure it is not damaged in any way.

B. All geotextiles shall be deployed in accordance with the Manufacturer's recommendations, standards, and guidelines.

C. The Contractor shall ballast or anchor all geotextile with sandbags, or equivalent, to prevent wind uplift.

D. The Contractor shall examine the entire geotextile surface after installation to ensure that no foreign objects are present that may damage the geotextile. The Contractor shall remove any such foreign objects and shall replace any damaged geotextile.

E. Adjacent geotextile panels shall be overlapped a minimum of 12 inches.

3.03 GEOTEXTILE REPAIR

A. Holes or tears in the geotextile shall be repaired as follows: A patch made from the same geotextile shall be overlapped a minimum of 12 inches in each direction.

3.04 GEOMEMBRANE PLACEMENT

A. Cuts to existing geomembrane will be minimized to only those needed to facilitate temporary movement. Horizontal cuts on the side slope will not be allowed. Panel seams shall be installed at an angle of at least 45 degrees from vertical.

B. The geomembrane shall be weighted with sandbags or the equivalent ballast materials, to prevent movement caused by wind. In case of high winds, continuous loading is recommended along edges of panels to minimize risk of wind uplift of panels.

C. Geomembrane shall not be placed when the ambient temperature is below 32°F or above 122°F unless otherwise authorized in writing by the Engineer. Geomembrane panels shall be allowed to equilibrate to temperature of adjacent panels prior to seaming.

D. Geomembrane shall not be placed during any precipitation, in the presence of excessive moisture (e.g., fog, dew), in an area of ponded water, or in the presence of wind speeds greater than 20 mph.

E. The Contractor shall ensure that:

1. No vehicular traffic is allowed on the geomembrane with the exception of ATV's with a contact pressures less than 6 psi.

2. Equipment used does not damage the geomembrane by handling, trafficking, or leakage of hydrocarbons (i.e., fuels).

3. Personnel working on the geomembrane do not smoke, wear damaging shoes, bring glass onto the geomembrane, or engage in other activities that could damage the geomembrane.

4. The method used to unroll the panels does not scratch or crimp the geomembrane and does not damage the supporting soil or geosynthetics.

5. The geomembrane shall be securely anchored and then rolled in such a manner as to continually keep the geomembrane in tension to preclude folding.

6. The method used to place the panels minimizes wrinkles (especially differential wrinkles between adjacent panels). The method used to place the panels results in intimate contact between the geomembrane and adjacent components.

7. The geomembrane is especially protected from damage in heavily trafficked areas.

8. Any field panel or portion thereof that becomes seriously damaged (torn, twisted, or crimped) shall be replaced with new material. Less serious damage to the geomembrane may be repaired, as approved by the Construction Manager and CQA Site Manager. Damaged panels or portions of damaged panels that have been rejected shall be removed from the work area and not reused.

F. If the Contractor intends to install geomembrane between one hour before sunset and one hour after sunrise, he shall notify the Construction Manager in writing prior to the start of the work. The Contractor shall indicate additional precautions that shall be taken during these installation hours. The Contractor shall provide proper illumination for work during this time period.

3.05 FIELD SEAMING

A. Seam Layout:

1. In corners and at odd-shaped geometric locations, the number of field seams shall be minimized. No seams shall be located in an area of potential stress concentration.

B. Weather Conditions for Seaming:

1. No seaming shall be attempted below 32°F or above 122°F without approval of the Owner or Owner's Representative.

2. Geomembrane seaming below 32°F, if approved by the Owner or Owner's Representative, shall be performed in accordance with GRI Test Method GM9.

3. Preheating of the geomembrane is not required for temperatures above 32°F.

4. Geomembrane shall be dry and protected from wind.

5. In the event of seaming below 32°F or above 122°F, certify in writing that low-temperature or high-temperature seaming procedures does not cause any physical or chemical modification to geomembrane that will generate any short or long-term damage to geomembrane.

C. Seam Preparation:

1. Prior to seaming, seam shall be clean and free of moisture, dust, dirt, debris of any kind, and foreign material.

2. If seam overlap grinding is required, process shall be completed according to the Manufacturer's instructions and in a way not damaging to the geomembrane.

3. Align seams with least possible number of wrinkles and "fish mouths".

D. General Seaming Requirements:

1. Fishmouths or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle to achieve a flat overlap, ending the cut with circular cut-out. The cut fishmouths or wrinkles shall be seamed and any portion where the overlap is insufficient shall be patched with an oval or round patch of geomembrane that extends a minimum of 6 inches beyond the cut in all directions.

2. Place electric generator on smooth base. Place smooth insulating plate or fabric beneath hot welding apparatus after use. When protective material is in place, sudden stops or starts, sharp turns, and stationary churning of vehicles shall be strictly prohibited. Only use apparatus specifically approved by geomembrane Manufacturer.

3. Use double-track fusion welding for installation seaming wherever possible.

4. Seams shall extend to the top of the anchor trench.

E. Seaming Process:

1. Approved processes for field seaming are fusion welding and extrusion welding. Proposed alternate processes shall be documented and submitted to the Design Engineer and/CQA Engineer for approval prior to use. Extrusion welding shall be restricted to repairs and welding applications not possible by the fusion process.

2. Extrusion Equipment and Procedures:

   a. The Contractor shall maintain at least one spare operable seaming apparatus on site.

   b. Extrusion welding apparatuses shall be equipped with gauges giving the temperatures in the apparatuses.

   c. Prior to beginning an extrusion seam, the extruder shall be purged until all heat-degraded extrudate has been removed from the barrel.

   d. Grind edges of cross seams to an incline prior to welding.

F. Trial Seams:

1. Trial seams shall be made on fragment pieces of geomembrane to verify that seaming conditions are adequate. Trial seams shall be conducted on the same material to be installed and under similar field conditions as production seams. Such trial seams shall be made at the beginning of each seaming period, typically at the beginning of the day and after lunch, for each seaming apparatus used each day, but no less frequently than once every 5 hours. The trial seam sample shall be a minimum of 5 feet long by 1 foot wide (after seaming) with the seam centered lengthwise for fusion equipment and at least 3 feet long by 1 foot wide for extrusion equipment. Seam overlap shall be as indicated in Subpart 3.05.C of this Section.

2. Four coupon specimens, each 1-inch wide, shall be cut from the trial seam sample by the Geosynthetics Installer using a die cutter to ensure precise 1-inch wide coupons. The coupons shall be tested, by the Contractor, with the CQA Site Manager present, in peel (both the outside and inside track for fusion welded seams) and in shear using an electronic readout field tensiometer in accordance with ASTM D 6392, at a strain rate of 2 inches/minute. The samples shall not exhibit failure in the seam, i.e., they shall exhibit a Film Tear Bond (FTB), which is a failure (yield) in the parent material. The required peel and shear seam strength values are listed in Table 02770-4. At no time shall specimens be soaked in water.

3. An additional trial weld shall be performed if a wide change in temperature (± 30ºF), humidity, or wind speed occurs since the previous trial weld.

4. If any coupon specimen fails, the trial seam shall be considered failing and the entire operation shall be repeated. If any of the additional coupon specimens fail, the seaming apparatus and seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive successful trial seams are achieved.

G. Nondestructive Seam Continuity Testing:

1. The Contractor shall nondestructively test for continuity on all field seams over their full length. Continuity testing shall be carried out as the seaming work progresses, not

at the completion of all field seaming. The Contractor shall complete any required repairs in accordance with Subpart 3.05.I of this Section. The following procedures shall apply:

a. Vacuum testing in accordance with ASTM D 5641.

b. Air channel pressure testing for double-track fusion seams in accordance with ASTM D 5820 and the following:

i. Insert needle, or other approved pressure feed device, from pressure gauge and inflation device into the air channel at one end of a double track seam.

ii. Energize the air pump and inflate air channel to a pressure between 25 and 30 pounds per square inch (psi). Close valve and sustain the pressure for not less than 5 minutes.

iii. If loss of pressure exceeds 3 psi over 5 minutes, or if the pressure does not stabilize, locate the faulty area(s) and repair seam in accordance with Subpart 3.05.I of this Section.

iv. After 5 minutes, cut the end of air channel opposite from the end with the pressure gauge and observe release of pressure to ensure air channel is not blocked. If the channel does not depressurize, find and repair the portion of the seam containing the blockage per Subpart 3.05.I of this Section. Repeat the air pressure test on the resulting segments of the original seam created by the repair and the ends of the seam. Repeat the process until the entire length of seam has successfully passed pressure testing or contains a repair. Repairs shall also be non-destructively tested per Subpart 3.05.I.5 of this Section.

v. Remove needle, or other approved pressure feed device, and seal repair in accordance with Subpart 3.05.I of this Section.

H. Defects and Repairs:

1. The geomembrane will be inspected before and after seaming for evidence of defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of inspection. The geomembrane surface shall be swept or washed by the Contractor if surface contamination inhibits inspection.

2. At observed suspected flawed location, both in seamed and non-seamed areas, shall be nondestructively tested using the methods described herein. Each location that fails nondestructive testing shall be marked by the CQA Site Manager and repaired by the Contractor.

3. When seaming of a geomembrane is completed (or when seaming of a large area of a geomembrane is completed) and prior to placing overlying materials, the CQA Site Manager shall identify all excessive geomembrane wrinkles. The Contractor shall cut and reseam all wrinkles so identified. The seams thus produced shall be tested.

4. Repair Procedures:

a. Any portion of the geomembrane exhibiting a flaw, or failing a destructive or nondestructive test, shall be repaired by the Contractor. Several repair procedures are acceptable. The final decision as to the appropriate repair procedure shall be agreed upon between the Design Engineer and the Contractor. The procedures available include:

i. Patching – extrusion welding a patch to repair holes larger than 1/16 inch, tears, undispersed raw materials, and contamination by foreign matter;

ii. Abrading and re-seaming – applying an extrusion seam to repair very small sections of faulty extruded seams;

iii. Spot seaming – applying an extrusion bead to repair minor, localized flaws such as scratches and scuffs;

iv. Capping – extrusion welding a geomembrane cap over long lengths of failed seams; and

v. Strip repairing – cutting out bad seams and replacing with a strip of new material seamed into place on both sides with fusion welding.

b. In addition, the following criteria shall be satisfied:

i. Surfaces of the geomembrane that are to be repaired shall be abraded no more than 20 minutes prior to the repair;

ii. The grind depth around the repair shall not exceed ten percent of the core geomembrane thickness;

iii. All surfaces must be clean and dry at the time of repair;

iv. All seaming equipment used in repair procedures must be approved by trial seaming;

v. Any other potential repair procedures shall be approved in advance, for the specific repair, by the design engineer;

vi. Patches or caps shall extend at least 6 inches beyond the edge of the defect, and all corners of patches and holes shall be rounded with a radius of at least 3 inches;

vii. All ends of wrinkle or relief cuts should be cut to a rounded hole and patched or capped; and

viii. Extrudate shall extend a minimum of 3 inches beyond the edge of the patch.

ix. Cap strips shall not be installed on top of existing cap strips. In the event that a cap strip is required in proximity to an existing repair, the existing cap strip should be removed and a single new cap strip should be installed over the entire repair area.

x.

5. Repair Verification:

a. Repairs shall be nondestructively tested using the methods described in Subpart 3.05.H of this Section, as appropriate. Repairs that pass nondestructive testing shall be considered acceptable repairs. Repairs that failed nondestructive or destructive testing will require the repair to be reconstructed and retested until passing test results are observed. At the discretion of the CQA Consultant, destructive testing may be required on any caps.

3.06 PROTECTION OF WORK

A. The Contractor shall protect all Work of this Section.

B. In the event of damage, the Contractor shall make repairs and replacements to the satisfaction of the CQA Consultant at the expense of the Contractor.

TABLE 02770-1
WOVEN GEOTEXTILE PROPERTIES

Properties	Test Method	Manufacturer QC Test Frequency	Required Test Values
Grab Strength (min. avg.)	ASTM D4632	1 per 100,000 sf	200 lbs
Puncture Strength (min. avg.)	ASTM D6241	1 per 100,000 sf	700 lbs
UV Resistance	ASTM D4355	1 per resin formulation	70%(1)

Notes: (1) After 500 hours of exposure.

TABLE 02770-2
60-MIL SMOOTH HDPE GEOMEMBRANE PROPERTIES

Properties	Test Method	Manufacturer QC Test Frequency	Required Test Values[9]
Thickness (min. avg.) • Lowest individual of 10 values	ASTM D5199	1 per Roll	54 mil
Density (min ave.)	ASTM D792 or ASTM D1505	1 per 200,000 lb	0.940 g/cc
Tensile Properties[1] (min. avg.) • Yield strength • Break strength • Yield elongation • Break elongation	ASTM D6693 Type IV	1 per 20,000 lb	126 lb/in 228 lb/in 12% 700%
Tear Resistance (min. avg.)	ASTM D1004 Die C	1 per 45,000 lb	42 lbs
Puncture Resistance (min. avg.)	ASTM D4833	1 per 45,000 lb	108 lbs
Stress Crack Resistance[2]	ASTM D5397 (App.)	Per GRI-GM10	500 hr
Carbon Black Content	ASTM D4218	1 per 20,000 lb	2.0-3.0%
Carbon Black Dispersion	ASTM D5596	1 per 45,000 lb	Note 3
Oxidative Induction Time (OIT)[4] (a) Standard OIT (min avg.) or (b) High Pressure OIT (min avg.)	ASTM D3895 ASTM D5885	1 per 200,000 lb	100 400
Oven Aging at 85°C [4][5] (a) Standard OIT (min avg.) or (b) High Pressure OIT (min avg.)	ASTM D5721 ASTM D3895 ASTM D5885	1 per Formulation	55% retained after 90d 80% retained after 90d
UV Resistance[6] (a) Standard OIT (min avg.) or (b) High Pressure OIT (min avg.)[8]	ASTM D7238 ASTM D3895 ASTM D5885	1 per Formulation	N.R. (7) 50% retained after 1600 hrs

Notes:

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
- Yield elongation is calculated using a gage length of 1.3 inches
- Break elongation is calculated using a gage length of 2.0 inches

(2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQA testing.

(3) Carbon black dispersion (only near spherical agglomerates) for 10 different views. 9 in Categories 1 or 2 and 1 in Category 3.

(4) The manufacturer has the option to select either one of the OIT methods listed to evaluation the antioxidant content in the geomembrane.

(5) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(6) The condition of the test should be 20hr. UV cycle at 75 °C followed by 4 hr. condensation at 60°C.

(7) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed sample.

(8) UV resistance is based on percent retained value regardless of the original HP-OIT value.

(9) Based on GRI GM13, Rev. 14, 1/6/16

TABLE 02770-3
60-MIL TEXTURED HDPE GEOMEMBRANE PROPERTIES

Properties	Test Method	Manufacturer QC Test Frequency	Required Test Values[9]
Thickness (min. avg.) • Lowest individual for 8 out of 10 values • Lowest individual for any of the 10 values	ASTM D5199	1 per Roll	57 mil 54 mil 51 mil
Asperity Height (min. avg.)	ASTM D7466	Every 2nd Roll	16 mil
Density (min ave.)	ASTM D792 or ASTM D1505	1 per 200,000 lb	0.940 g/cc
Tensile Properties[1] (min. avg.) • Yield strength • Break strength • Yield elongation • Break elongation	ASTM D6693 Type IV	1 per 20,000 lb	126 lb/in 90 lb/in 12% 100%
Tear Resistance (min. avg.)	ASTM D1004 Die C	1 per 45,000 lb	42 lbs
Puncture Resistance (min. avg.)	ASTM D4833	1 per 45,000 lb	90 lbs
Stress Crack Resistance[2]	ASTM D5397 (App.)	Per GRI-GM10	500 hr
Carbon Black Content	ASTM D4218	1 per 20,000 lb	2.0-3.0%
Carbon Black Dispersion	ASTM D5596	1 per 45,000 lb	Note 3
Oxidative Induction Time (OIT)[4] (c) Standard OIT (min avg.) or (d) High Pressure OIT (min avg.)	ASTM D3895 ASTM D5885	1 per 200,000 lb	100 400
Oven Aging at 85°C [4][5] (c) Standard OIT (min avg.) or (d) High Pressure OIT (min avg.)	ASTM D5721 ASTM D3895 ASTM D5885	1 per Formulation	55% retained after 90d 80% retained after 90d
UV Resistance[6] (c) Standard OIT (min avg.), or (d) High Pressure OIT (min avg.)[8]	ASTM D7238 ASTM D3895 ASTM D5885	1 per Formulation	N.R. (7) 50% retained after 1600 hrs

Notes:

(10) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
- Yield elongation is calculated using a gage length of 1.3 inches
- Break elongation is calculated using a gage length of 2.0 inches

(11) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQA testing.

(12) Carbon black dispersion (only near spherical agglomerates) for 10 different views. 9 in Categories 1 or 2 and 1 in Category 3.

(13) The manufacturer has the option to select either one of the OIT methods listed to evaluation the antioxidant content in the geomembrane.

(14) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(15) The condition of the test should be 20hr. UV cycle at 75 °C followed by 4 hr. condensation at 60°C.

(16) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed sample.

(17) UV resistance is based on percent retained value regardless of the original HP-OIT value.

(18) Based on GRI GM13, Rev. 14, 1/6/16

TABLE 02770-4
MINIMUM 60-MIL HDPE SEAM PROPERTIES

Property	Qualifier	Unit	Specified Value(1)	Test Method
Shear Strength (at yield point)	Minimum	lb./in. width	120	ASTM D6392
Peel Adhesion Fusion	Minimum	lb./in. width	91	ASTM D6392
Peel Adhesion Extrusion	Minimum	lb./in. width	78	ASTM D6392

(1) Value listed for shear and peel strengths are for 4 out of 5 test specimens; the 5th specimen can be as low as 80% of the listed values

[END OF SECTION]

<u>ATTACHMENT 2</u>
<u>CCR CHEMICAL CONSTITUENTS ANALYSIS</u>

eurofins | Environment Testing America

ANALYTICAL REPORT

Eurofins TestAmerica, Chicago
2417 Bond Street
University Park, IL 60484
Tel: (708)534-5200

Laboratory Job ID: 500-202047-1
Client Project/Site: Waukegan - Bottom Ash

For:
Midwest Generation EME LLC
401 E Greenwood Avenue
Waukegan, Illinois 60087-5197

Attn: Mr. Mark Wehling

Authorized for release by:
7/19/2021 3:37:24 PM

Diana Mockler, Project Manager I
(219)252-7570
Diana.Mockler@Eurofinset.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

1 2 3 4 5 6 7 8 9 10 11 12 13

Table of Contents

Case Narrative

Job ID: 500-202047-1

Laboratory: Eurofins TestAmerica, Chicago

Narrative

Job Narrative
500-202047-1

Comments
No additional comments.

Receipt
The sample was received on 7/8/2021 1:15 PM. Unless otherwise noted below, the sample arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was 19.4º C.

Receipt Exceptions
The following sample(s) was received at the laboratory outside the required temperature criteria. There was no cooling media present in the cooler.

Metals
Method 6010B: The following sample was diluted due to the nature of the sample matrix: Waukegan Bottom Ash (500-202047-1). Elevated reporting limits (RLs) are provided.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

General Chemistry
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Method Summary

Client: Midwest Generation EME LLC
Project/Site: Waukegan - Bottom Ash

Job ID: 500-202047-1

Method	Method Description	Protocol	Laboratory
6010B	Metals (ICP)	SW846	TAL CHI
7471A	Mercury (CVAA)	SW846	TAL CHI
9045C	pH	SW846	TAL CHI
9056A	Anions, Ion Chromatography	SW846	TAL CHI
Moisture	Percent Moisture	EPA	TAL CHI
SM 4500 F C	Fluoride	SM	TAL CHI
300_Prep	Anions, Ion Chromatography, 10% Wt/Vol	MCAWW	TAL CHI
3050B	Preparation, Metals	SW846	TAL CHI
7471A	Preparation, Mercury	SW846	TAL CHI

Protocol References:

EPA = US Environmental Protection Agency

MCAWW = "Methods For Chemical Analysis Of Water And Wastes", EPA-600/4-79-020, March 1983 And Subsequent Revisions.

SM = "Standard Methods For The Examination Of Water And Wastewater"

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL CHI = Eurofins TestAmerica, Chicago, 2417 Bond Street, University Park, IL 60484, TEL (708)534-5200

Lab Sample ID	Client Sample ID	Matrix	Collected	Received	Asset ID
500-202047-1	Waukegan Bottom Ash	Solid	07/01/21 14:55	07/08/21 13:15	

Client: Midwest Generation EME LLC
Project/Site: Waukegan - Bottom Ash

Job ID: 500-202047-1

Client Sample ID: Waukegan Bottom Ash

Lab Sample ID: 500-202047-1
Date Collected: 07/01/21 14:55
Date Received: 07/08/21 13:15
Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	<9.5		9.5	1.8	mg/Kg		07/13/21 17:34	07/14/21 13:12	5
Arsenic	**4.2**	**J**	4.7	1.6	mg/Kg		07/13/21 17:34	07/14/21 13:12	5
Barium	**2600**		4.7	0.54	mg/Kg		07/13/21 17:34	07/14/21 13:12	5
Beryllium	**1.9**		1.9	0.44	mg/Kg		07/13/21 17:34	07/14/21 13:12	5
Boron	**170**		24	2.2	mg/Kg		07/13/21 17:34	07/15/21 12:00	5
Cadmium	**0.24**	**J B**	0.95	0.17	mg/Kg		07/13/21 17:34	07/14/21 13:12	5
Chromium	**20**		4.7	2.3	mg/Kg		07/13/21 17:34	07/14/21 13:12	5
Cobalt	**9.4**	**J**	12	3.1	mg/Kg		07/13/21 17:34	07/15/21 12:04	25
Lead	**8.1**		2.4	1.1	mg/Kg		07/13/21 17:34	07/14/21 13:12	5
Lithium	**19**		4.7	1.4	mg/Kg		07/13/21 17:34	07/14/21 13:12	5
Molybdenum	<4.7		4.7	2.0	mg/Kg		07/13/21 17:34	07/14/21 13:12	5
Selenium	<4.7		4.7	2.8	mg/Kg		07/13/21 17:34	07/14/21 13:12	5
Thallium	**2.6**	**J**	4.7	2.4	mg/Kg		07/13/21 17:34	07/14/21 13:12	5

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.077**		0.015	0.0049	mg/Kg		07/13/21 14:05	07/14/21 08:38	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**10**	**H**	0.2	0.2	SU			07/13/21 19:06	1
Chloride	**28**		1.8	1.6	mg/Kg		07/12/21 11:07	07/12/21 15:18	1
Sulfate	**1500**		46	22	mg/Kg		07/12/21 11:07	07/13/21 14:25	25
Fluoride	**2.7**		1.0	0.56	mg/Kg		07/19/21 11:11	07/19/21 14:16	1

1 2 3 4 5 6 7 8 9 10 11 12 13

Qualifiers

Metals

Qualifier	Qualifier Description
B	Compound was found in the blank and sample.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

General Chemistry

Qualifier	Qualifier Description
H	Sample was prepped or analyzed beyond the specified holding time

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

QC Association Summary

Metals

Prep Batch: 609137

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
500-202047-1	Waukegan Bottom Ash	Total/NA	Solid	7471A	
MB 500-609137/12-A	Method Blank	Total/NA	Solid	7471A	
LCS 500-609137/13-A	Lab Control Sample	Total/NA	Solid	7471A	

Prep Batch: 609197

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
500-202047-1	Waukegan Bottom Ash	Total/NA	Solid	3050B	
MB 500-609197/1-A	Method Blank	Total/NA	Solid	3050B	
LCS 500-609197/2-A	Lab Control Sample	Total/NA	Solid	3050B	

Analysis Batch: 609346

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
500-202047-1	Waukegan Bottom Ash	Total/NA	Solid	7471A	609137
MB 500-609137/12-A	Method Blank	Total/NA	Solid	7471A	609137
LCS 500-609137/13-A	Lab Control Sample	Total/NA	Solid	7471A	609137

Analysis Batch: 609487

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
500-202047-1	Waukegan Bottom Ash	Total/NA	Solid	6010B	609197
MB 500-609197/1-A	Method Blank	Total/NA	Solid	6010B	609197
LCS 500-609197/2-A	Lab Control Sample	Total/NA	Solid	6010B	609197

Analysis Batch: 609576

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
500-202047-1	Waukegan Bottom Ash	Total/NA	Solid	6010B	609197
500-202047-1	Waukegan Bottom Ash	Total/NA	Solid	6010B	609197
MB 500-609197/1-A	Method Blank	Total/NA	Solid	6010B	609197
LCS 500-609197/2-A	Lab Control Sample	Total/NA	Solid	6010B	609197

General Chemistry

Analysis Batch: 608877

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
500-202047-1	Waukegan Bottom Ash	Total/NA	Solid	Moisture	
500-202047-1 DU	Waukegan Bottom Ash	Total/NA	Solid	Moisture	

Prep Batch: 608902

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
500-202047-1	Waukegan Bottom Ash	Total/NA	Solid	300_Prep	
MB 500-608902/1-A	Method Blank	Total/NA	Solid	300_Prep	
LCS 500-608902/2-A	Lab Control Sample	Total/NA	Solid	300_Prep	

Analysis Batch: 608919

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
500-202047-1	Waukegan Bottom Ash	Total/NA	Solid	9056A	608902
MB 500-608902/1-A	Method Blank	Total/NA	Solid	9056A	608902
LCS 500-608902/2-A	Lab Control Sample	Total/NA	Solid	9056A	608902

Analysis Batch: 609151

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
500-202047-1	Waukegan Bottom Ash	Total/NA	Solid	9056A	608902

General Chemistry (Continued)

Analysis Batch: 609151 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 500-608902/1-A	Method Blank	Total/NA	Solid	9056A	608902
LCS 500-608902/2-A	Lab Control Sample	Total/NA	Solid	9056A	608902

Analysis Batch: 609236

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
500-202047-1	Waukegan Bottom Ash	Total/NA	Solid	9045C	
LCS 500-609236/2	Lab Control Sample	Total/NA	Solid	9045C	
LCSD 500-609236/3	Lab Control Sample Dup	Total/NA	Solid	9045C	

Prep Batch: 609998

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
500-202047-1	Waukegan Bottom Ash	Total/NA	Solid	300_Prep	
MB 500-609998/1-A	Method Blank	Total/NA	Solid	300_Prep	
LCS 500-609998/2-A	Lab Control Sample	Total/NA	Solid	300_Prep	
500-202047-1 MS	Waukegan Bottom Ash	Total/NA	Solid	300_Prep	
500-202047-1 MSD	Waukegan Bottom Ash	Total/NA	Solid	300_Prep	

Analysis Batch: 610037

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
500-202047-1	Waukegan Bottom Ash	Total/NA	Solid	SM 4500 F C	609998
MB 500-609998/1-A	Method Blank	Total/NA	Solid	SM 4500 F C	609998
LCS 500-609998/2-A	Lab Control Sample	Total/NA	Solid	SM 4500 F C	609998
500-202047-1 MS	Waukegan Bottom Ash	Total/NA	Solid	SM 4500 F C	609998
500-202047-1 MSD	Waukegan Bottom Ash	Total/NA	Solid	SM 4500 F C	609998

QC Sample Results

Client: Midwest Generation EME LLC
Project/Site: Waukegan - Bottom Ash

Job ID: 500-202047-1

Method: 6010B - Metals (ICP)

Lab Sample ID: MB 500-609197/1-A
Matrix: Solid
Analysis Batch: 609487

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 609197

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	<2.0		2.0	0.39	mg/Kg		07/13/21 17:34	07/14/21 12:02	1
Arsenic	<1.0		1.0	0.34	mg/Kg		07/13/21 17:34	07/14/21 12:02	1
Barium	<1.0		1.0	0.11	mg/Kg		07/13/21 17:34	07/14/21 12:02	1
Beryllium	<0.40		0.40	0.093	mg/Kg		07/13/21 17:34	07/14/21 12:02	1
Cadmium	0.0486	J	0.20	0.036	mg/Kg		07/13/21 17:34	07/14/21 12:02	1
Chromium	<1.0		1.0	0.50	mg/Kg		07/13/21 17:34	07/14/21 12:02	1
Cobalt	<0.50		0.50	0.13	mg/Kg		07/13/21 17:34	07/14/21 12:02	1
Lead	<0.50		0.50	0.23	mg/Kg		07/13/21 17:34	07/14/21 12:02	1
Lithium	<1.0		1.0	0.30	mg/Kg		07/13/21 17:34	07/14/21 12:02	1
Molybdenum	<1.0		1.0	0.42	mg/Kg		07/13/21 17:34	07/14/21 12:02	1
Selenium	<1.0		1.0	0.59	mg/Kg		07/13/21 17:34	07/14/21 12:02	1
Thallium	<1.0		1.0	0.50	mg/Kg		07/13/21 17:34	07/14/21 12:02	1

Lab Sample ID: MB 500-609197/1-A
Matrix: Solid
Analysis Batch: 609576

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 609197

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	<5.0		5.0	0.47	mg/Kg		07/13/21 17:34	07/15/21 11:53	1

Lab Sample ID: LCS 500-609197/2-A
Matrix: Solid
Analysis Batch: 609487

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 609197

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Antimony	50.0	52.3		mg/Kg		105	80 - 120
Arsenic	10.0	9.92		mg/Kg		99	80 - 120
Barium	200	204		mg/Kg		102	80 - 120
Beryllium	5.00	4.80		mg/Kg		96	80 - 120
Cadmium	5.00	4.86		mg/Kg		97	80 - 120
Chromium	20.0	19.3		mg/Kg		97	80 - 120
Cobalt	50.0	49.0		mg/Kg		98	80 - 120
Lead	10.0	9.72		mg/Kg		97	80 - 120
Lithium	50.0	54.2		mg/Kg		108	80 - 120
Molybdenum	100	102		mg/Kg		102	80 - 120
Selenium	10.0	8.96		mg/Kg		90	80 - 120
Thallium	10.0	9.68		mg/Kg		97	80 - 120

Lab Sample ID: LCS 500-609197/2-A
Matrix: Solid
Analysis Batch: 609576

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 609197

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Boron	100	86.7		mg/Kg		87	80 - 120

QC Sample Results

Client: Midwest Generation EME LLC
Project/Site: Waukegan - Bottom Ash

Job ID: 500-202047-1

Method: 7471A - Mercury (CVAA)

Lab Sample ID: MB 500-609137/12-A
Matrix: Solid
Analysis Batch: 609346

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 609137

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.017		0.017	0.0056	mg/Kg		07/13/21 14:05	07/14/21 07:47	1

Lab Sample ID: LCS 500-609137/13-A
Matrix: Solid
Analysis Batch: 609346

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 609137

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.167	0.183		mg/Kg		109	80 - 120

Method: 9056A - Anions, Ion Chromatography

Lab Sample ID: MB 500-608902/1-A
Matrix: Solid
Analysis Batch: 608919

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 608902

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	<2.0		2.0	1.7	mg/Kg		07/12/21 11:07	07/12/21 12:20	1

Lab Sample ID: MB 500-608902/1-A
Matrix: Solid
Analysis Batch: 609151

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 608902

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	<2.0		2.0	1.7	mg/Kg		07/12/21 11:07	07/13/21 12:36	1
Sulfate	<2.0		2.0	0.95	mg/Kg		07/12/21 11:07	07/13/21 12:36	1

Lab Sample ID: LCS 500-608902/2-A
Matrix: Solid
Analysis Batch: 608919

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 608902

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	30.0	30.2		mg/Kg		101	80 - 120

Lab Sample ID: LCS 500-608902/2-A
Matrix: Solid
Analysis Batch: 609151

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 608902

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	30.0	30.5		mg/Kg		102	80 - 120
Sulfate	50.0	54.4		mg/Kg		109	80 - 120

Method: SM 4500 F C - Fluoride

Lab Sample ID: MB 500-609998/1-A
Matrix: Solid
Analysis Batch: 610037

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 609998

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<1.0		1.0	0.56	mg/Kg		07/19/21 11:11	07/19/21 14:07	1

Method: SM 4500 F C - Fluoride (Continued)

Lab Sample ID: LCS 500-609998/2-A
Matrix: Solid
Analysis Batch: 610037

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 609998

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Fluoride			100	110		mg/Kg		110	80 - 120		

Lab Sample ID: 500-202047-1 MS
Matrix: Solid
Analysis Batch: 610037

Client Sample ID: Waukegan Bottom Ash
Prep Type: Total/NA
Prep Batch: 609998

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Fluoride	2.7		49.9	46.1		mg/Kg		87	75 - 125		

Lab Sample ID: 500-202047-1 MSD
Matrix: Solid
Analysis Batch: 610037

Client Sample ID: Waukegan Bottom Ash
Prep Type: Total/NA
Prep Batch: 609998

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Fluoride	2.7		49.8	47.6		mg/Kg		90	75 - 125	3	20

Eurofins TestAmerica, Chicago
2417 Bond Street
University Park, IL 60484
Phone (708) 534-5200 Phone (708) 534-5211

Chain of Custody Record

eurofins Environment Testing America

Client Information	Sampler: Mark Wehling	Lab PM: Mockler Diana J	Carrier Tracking No(s):	COC No:
Client Contact: Mark Wehling	Phone: 847-599-2201	E-Mail: Diana Mockler@Eurofinset.com	State of Origin: Illinois	Page: Page 1 of 1
Company: Midwest Generation EME LLC	PWSID:	**Analysis Requested**		Job #: 500-202047
Address: 401 E Greenwood Avenue	**Due Date Requested:**			
City: Waukegan	**TAT Requested (days):** 7			
State Zip: IL, 60087	**Compliance Project:** Δ Yes Δ No			
Phone: 847-662-6201	PO #: 4502042830			
Email: mark wehling@nrg com	WO #:			
Project Name: Waukegan Bottom Ash	Project #: 50001112			
Site:	SSOW#:			

500-202047 COC

Preservation Codes
A - HCL, B NaOH, C Zn Acetate, D - Nitric Acid, E - NaHSO4, F MeOH, G Amchlor, H Ascorbic Acid, I Ice, J - DI Water, K - EDTA, L EDA
M Hexane, N - None, O AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S H2SO4, T - TSP Dodecahydrate, U Acetone, V - MCAA, W pH 4-5, Z - other (specify)
Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	903.0 - Rad 226, 904.0 - Rad 228, Combined Rad 226/228	6010 - Metals (13 elements) + 7470 - Mercury	9056 - Sulfate	SM4500CLE - Chloride	4500FC - Fluoride	9045C - pH	Total Number of containers	Special Instructions/Note
			Preservation Code:				N	N	N					
Waukegan Bottom Ash	7/1/21	2 55 PM	C	Solid			X	X	X	X	X	X		

Possible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☒ Disposal By Lab ☐ Archive For ______ Months

Deliverable Requested I II III, IV Other (specify)

Special Instructions/QC Requirements

Empty Kit Relinquished by:		Date:	Time:	Method of Shipment:	
Relinquished by: [signature]	Date/Time: 7-8-21 /	Company: MWG	Received by: [signature]	Date/Time: 7/8/21 1110	Company: TA
Relinquished by: [signature]	Date/Time: 7/8/21 / 1315	Company: TA	Received by: Stephanie Hernandez	Date/Time: 7/8/21 1315	Company: ETA-CHI
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:

Custody Seals Intact: Δ Yes Δ No	Custody Seal No:	Cooler Temperature(s) °C and Other Remarks: 19.4

Ver 01/16/2019

Login Sample Receipt Checklist

Client: Midwest Generation EME LLC

Job Number: 500-202047-1

Login Number: 202047
List Number: 1
Creator: Hernandez, Stephanie

List Source: Eurofins TestAmerica, Chicago

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	
Cooler Temperature is acceptable.	False	
Cooler Temperature is recorded.	True	19.4
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Lab Chronicle

Client: Midwest Generation EME LLC
Project/Site: Waukegan - Bottom Ash

Job ID: 500-202047-1

Client Sample ID: Waukegan Bottom Ash
Date Collected: 07/01/21 14:55
Date Received: 07/08/21 13:15

Lab Sample ID: 500-202047-1
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			609197	07/13/21 17:34	LMN	TAL CHI
Total/NA	Analysis	6010B		5	609487	07/14/21 13:12	JJB	TAL CHI
Total/NA	Prep	3050B			609197	07/13/21 17:34	LMN	TAL CHI
Total/NA	Analysis	6010B		5	609576	07/15/21 12:00	JJB	TAL CHI
Total/NA	Prep	3050B			609197	07/13/21 17:34	LMN	TAL CHI
Total/NA	Analysis	6010B		25	609576	07/15/21 12:04	JJB	TAL CHI
Total/NA	Prep	7471A			609137	07/13/21 14:05	MJG	TAL CHI
Total/NA	Analysis	7471A		1	609346	07/14/21 08:38	MJG	TAL CHI
Total/NA	Analysis	9045C		1	609236	07/13/21 19:06	LWN	TAL CHI
Total/NA	Prep	300_Prep			608902	07/12/21 11:07	PSP	TAL CHI
Total/NA	Analysis	9056A		1	608919	07/12/21 15:18	EAT	TAL CHI
Total/NA	Prep	300_Prep			608902	07/12/21 11:07	PSP	TAL CHI
Total/NA	Analysis	9056A		25	609151	07/13/21 14:25	EAT	TAL CHI
Total/NA	Analysis	Moisture		1	608877	07/12/21 10:22	LWN	TAL CHI
Total/NA	Prep	300_Prep			609998	07/19/21 11:11	MS	TAL CHI
Total/NA	Analysis	SM 4500 F C		1	610037	07/19/21 14:16	MS	TAL CHI

Laboratory References:

TAL CHI = Eurofins TestAmerica, Chicago, 2417 Bond Street, University Park, IL 60484, TEL (708)534-5200

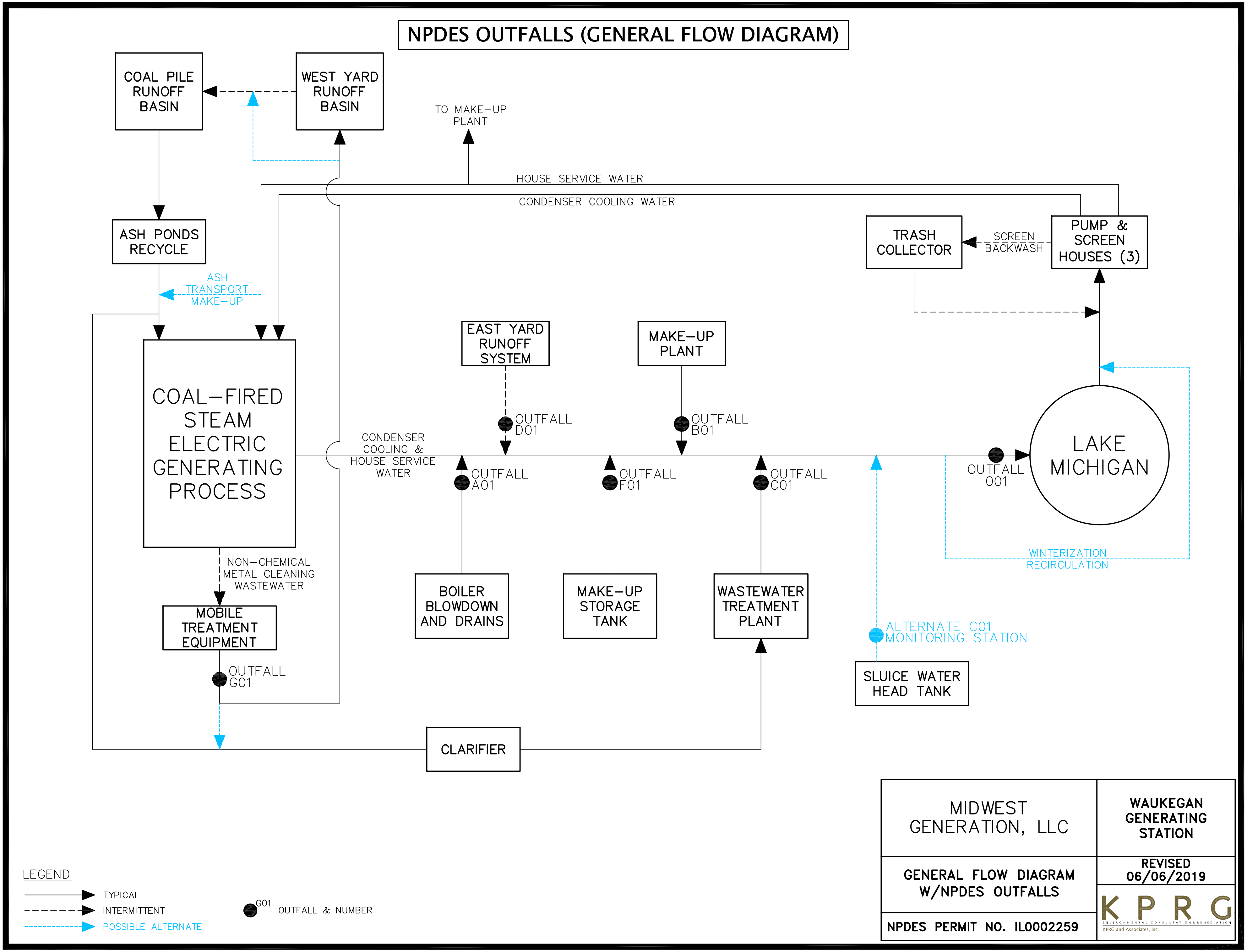
Accreditation/Certification Summary

Laboratory: Eurofins TestAmerica, Chicago

The accreditations/certifications listed below are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Illinois	NELAP	IL00035	04-29-22

ATTACHMENT 3
CHEMICAL CONSTITUENTS ANALYSIS OF OTHER WASTE STREAMS


NPDES OUTFALLS (GENERAL FLOW DIAGRAM)
COAL PILE RUNOFF BASIN
WEST YARD RUNOFF BASIN
TO MAKE-UP PLANT
HOUSE SERVICE WATER
CONDENSER COOLING WATER
ASH PONDS RECYCLE
ASH TRANSPORT MAKE-UP
TRASH COLLECTOR
SCREEN BACKWASH
PUMP & SCREEN HOUSES (3)
EAST YARD RUNOFF SYSTEM
MAKE-UP PLANT
COAL-FIRED STEAM ELECTRIC GENERATING PROCESS
CONDENSER COOLING & HOUSE SERVICE WATER
OUTFALL D01
OUTFALL B01
OUTFALL A01
OUTFALL F01
OUTFALL C01
OUTFALL 001
LAKE MICHIGAN
WINTERIZATION RECIRCULATION
NON-CHEMICAL METAL CLEANING WASTEWATER
MOBILE TREATMENT EQUIPMENT
OUTFALL G01
BOILER BLOWDOWN AND DRAINS
MAKE-UP STORAGE TANK
WASTEWATER TREATMENT PLANT
ALTERNATE C01 MONITORING STATION
SLUICE WATER HEAD TANK
CLARIFIER
LEGEND
TYPICAL
INTERMITTENT
POSSIBLE ALTERNATE
G01 OUTFALL & NUMBER
MIDWEST GENERATION, LLC
WAUKEGAN GENERATING STATION
GENERAL FLOW DIAGRAM W/NPDES OUTFALLS
REVISED 06/06/2019
KPRG
NPDES PERMIT NO. IL0002259

ATTACHMENT 4
LOCATION STANDARDS DEMONSTRATION

Geosyntec consultants

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Oak Brook, Illinois 60523
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PLACEMENT ABOVE THE UPPERMOST AQUIFER LOCATION RESTRICTIONS
EAST AND WEST ASH BASINS
WAUKEGAN STATION
OCTOBER 2018

Pursuant to Code of Federal Regulations Title 40, Part 257, Subpart D (40 CFR), Section 257.60 (Rule), Geosyntec Consultants (Geosyntec) prepared this report to document compliance with location restrictions related to placement above the uppermost aquifer for the existing East Ash Basin and West Ash Basin (the Basins) at the Waukegan Station (Site) in Waukegan, Illinois.

The work presented in this report was performed under the direction of Mr. Jesse Varsho, P.G., P.E., of Geosyntec in accordance with Section 257.60 of the Federal Coal Combustion Residual (CCR) rule. Ms. Jane Soule, P.E., reviewed this report in accordance with Geosyntec's senior review policy.

1. Federal Coal Combustion Residual Rule, 40 CRF 257

Section 257.60(a) of the Federal CCR rule states:

> "New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must be constructed with a base that is located no less than 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table)." *40 CFR §257.60(a)*

"Normal Fluctuations" of the groundwater elevation is defined in the Preamble of the Federal CCR rule as:

> "including, but not limited to, seasonal or temporal variations, groundwater withdrawal, mounding effects, etc.…The phrase "normal fluctuations" has been used to clarify that EPA does not intend for the facility to account for extraordinary or highly aberrant conditions…Normal fluctuations can include those resulting from natural as well as anthropogenic sources. Natural sources that could affect groundwater levels include, but are not limited to precipitation, run-off, and high river levels." (80 Fed Reg. 74 at pg. 21362 (April 17, 2015) *Federal Register: Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule*)

2. Placement Above the Uppermost Aquifer Restriction Determination

The East and West Basins are so located so that there will not be intermittent, recurring, or sustained hydraulic connection between any portion of the base of the Basins and the uppermost aquifer due to normal fluctuations in groundwater elevations. Analysis that support this conclusion include:

- The 95 percent upper confidence limit (UCL), the seasonal high monthly average and the maximum uppermost aquifer groundwater elevations are below the base of the Basins and therefore do not intersect their base.

- Low permeability geomembrane liners (engineered liner systems) were constructed on the base and side slopes of the East and West Basins. The engineered liner systems will provide additional protection to prevent hydraulic connection between the base of the Basins and the uppermost aquifer in the event of unusually high fluctuations in groundwater elevation.

The locations of the East and West Basin are in compliance with the requirements in §257.60.

3. Limitations and Certification

This report was prepared in accordance with current practices and the standard of care exercised by scientists and engineers performing similar tasks in the field of civil engineering. The contents of this report are based solely on the observations of the conditions observed by Geosyntec personnel and information provided to Geosyntec by Midwest Generation. Consistent with applicable professional standards of care, our opinions and recommendations were based in part on data furnished by others, which was consistent with other information that we developed in the course of our performance of the scope of services. The information contained in this report is intended for use solely by Midwest Generation and their subconsultants.

Jesse Varsho, P.E.
Illinois Professional Engineer No. 062.067766
License Expires: 11/30/19

Geosyntec consultants

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WETLANDS LOCATION RESTRICTIONS
EAST AND WEST ASH BASINS
WAUKEGAN STATION
OCTOBER 2018

Pursuant to Code of Federal Regulations Title 40, Part 257, Subpart D (40 CFR), Section 257.61, Geosyntec Consultants (Geosyntec) prepared this report to document compliance with location restrictions related to wetlands for the existing East Ash Basin and West Ash Basin (the Basins) at the Waukegan Station (Site) in Waukegan, Illinois.

The work presented in this report was performed under the direction of Mr. Jesse Varsho, P.G., P.E., of Geosyntec in accordance with §257.61. Ms. Jane Soule, P.E., reviewed this report in accordance with Geosyntec's senior review policy.

1. Wetlands Location Restriction Determination

The East Ash Basin and West Ash Basin are not located in mapped wetlands included in the National Wetlands Inventory – Version 2 presented by the U.S. Fish and Wildlife Service (USFW) [USFW, 2018]. Therefore, the locations of the Basins are in compliance with the requirements outlined in §257.61(a).

2. Limitations and Certification

This report was prepared in accordance with current practices and the standard of care exercised by scientists and engineers performing similar tasks in the field of civil engineering. The contents of this report are based solely on the observations of the conditions observed by Geosyntec personnel and information provided to Geosyntec by Midwest Generation. Consistent with applicable professional standards of care, our opinions and recommendations were based in part on data furnished by others, which was consistent with other information that we developed in the course of our performance of the scope of services. The information contained in this report is intended for use solely by Midwest Generation and their subconsultants.

Jesse Varsho, P.E.
Illinois Professional Engineer No. 062.067766
License Expires: 11/30/19

3. References

USFS, 2018. "National Wetlands Inventory, Version 2," https://www.fws.gov/wetlands/data/Mapper.html, updated 1 May 2018, accessed 28 August 2018.

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FAULT AREAS LOCATION RESTRICTIONS
EAST AND WEST ASH BASINS
WAUKEGAN STATION
OCTOBER 2018

Pursuant to Code of Federal Regulations Title 40, Part 257, Subpart D (40 CFR), Section 257.62, Geosyntec Consultants (Geosyntec) prepared this report to document compliance with location restrictions related to fault areas for the existing East Ash Basin and West Ash Basin (the Basins) at the Waukegan Station (Site) in Waukegan, Illinois.

The work presented in this report was performed under the direction of Mr. Jesse Varsho, P.G., P.E., of Geosyntec in accordance with §257.62. Ms. Jane Soule, P.E., reviewed this report in accordance with Geosyntec's senior review policy.

1. Fault Areas Location Restriction Determination

The East Ash Basin and West Ash Basin are not located within 200 feet (60 meters) of a mapped Holocene-aged fault, as mapped by the United States Geological Survey (USGS) Quaternary Fault Database [USGS, 2018]. Therefore, the locations of the Basins are in compliance with the requirements outlined in §257.62(a).

2. Limitations and Certification

This report was prepared in accordance with current practices and the standard of care exercised by scientists and engineers performing similar tasks in the field of civil engineering. The contents of this report are based solely on the observations of the conditions observed by Geosyntec personnel and information provided to Geosyntec by Midwest Generation. Consistent with applicable professional standards of care, our opinions and recommendations were based in part on data furnished by others, which was consistent with other information that we developed in the course of our performance of the scope of services. The information contained in this report is intended for use solely by Midwest Generation and their subconsultants.

LICENSED PROFESSIONAL ENGINEER
JESSE PAUL
VARSHO
062-059069
STATE OF ILLINOIS

Jesse Varsho, P.E.
Illinois Professional Engineer No. 062.067766
License Expires: 11/30/19

3. References

USGS, 2018. "Quaternary Fault and Fold Database," https://earthquake.usgs.gov/hazards/qfaults/, accessed 28 August 2018.

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SEISMIC IMPACT ZONES LOCATION RESTRICTIONS
EAST AND WEST ASH BASINS
WAUKEGAN STATION
OCTOBER 2018

Pursuant to Code of Federal Regulations Title 40, Part 257, Subpart D (40 CFR), Section 257.63, Geosyntec Consultants (Geosyntec) prepared this report to document compliance with location restrictions related to seismic impact areas for the existing East Ash Basin and West Ash Basin (the Basins) at the Waukegan Station (Site) in Waukegan, Illinois.

The work presented in this report was performed under the direction of Mr. Jesse Varsho, P.G., P.E., of Geosyntec in accordance with §257.63. Ms. Jane Soule, P.E., reviewed this report in accordance with Geosyntec's senior review policy.

1. Seismic Impact Zones Restriction Determination

The East Ash Basin and West Ash Basin are not located within a seismic impact zone as defined in §257.53 and as mapped by the United States Geological Survey (USGS) [USGS, 2014]. Therefore, the locations of the Basins are in compliance with the requirements outlined in §257.63(a).

2. Limitations and Certification

This report was prepared in accordance with current practices and the standard of care exercised by scientists and engineers performing similar tasks in the field of civil engineering. The contents of this report are based solely on the observations of the conditions observed by Geosyntec personnel and information provided to Geosyntec by Midwest Generation. Consistent with applicable professional standards of care, our opinions and recommendations were based in part on data furnished by others, which was consistent with other information that we developed in the course of our performance of the scope of services. The information contained in this report is intended for use solely by Midwest Generation and their subconsultants.

LICENSED PROFESSIONAL ENGINEER
JESSE PAUL
VARSHO
062-059069
STATE OF ILLINOIS

Jesse Varsho, P.E.
Illinois Professional Engineer No. 062.067766
License Expires: 11/30/19

3. References

USGS, 2014. "2014 U.S. Geological Survey National Seismic Hazard Maps, PGA 2% in 50 Years," https://earthquake.usgs.gov/hazards/hazmaps/conterminous/index.php#2014, accessed 28 August 2018.

Geosyntec consultants

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UNSTABLE AREAS LOCATION RESTRICTIONS
EAST AND WEST ASH BASINS
WAUKEGAN STATION
OCTOBER 2018

Pursuant to Code of Federal Regulations Title 40, Part 257, Subpart D (40 CFR), Section 257.64, Geosyntec Consultants (Geosyntec) prepared this report to document compliance with location restrictions related to unstable areas for the existing East Ash Basin and West Ash Basin (the Basins) at the Waukegan Station (Site) in Waukegan, Illinois.

The work presented in this report was performed under the direction of Mr. Jesse Varsho, P.G., P.E., of Geosyntec in accordance with §257.64. Ms. Jane Soule, P.E., reviewed this report in accordance with Geosyntec's senior review policy.

1. Unstable Areas Restriction Determination

The East Ash Basin and West Ash Basin are not located in unstable areas [Geosyntec, 2016]. Therefore, the locations of the Basins are in compliance with the requirements outlined in §257.64(a).

2. Limitations and Certification

This report was prepared in accordance with current practices and the standard of care exercised by scientists and engineers performing similar tasks in the field of civil engineering. The contents of this report are based solely on the observations of the conditions observed by Geosyntec personnel and information provided to Geosyntec by Midwest Generation. Consistent with applicable professional standards of care, our opinions and recommendations were based in part on data furnished by others, which was consistent with other information that we developed in the course of our performance of the scope of services. The information contained in this report is intended for use solely by Midwest Generation and their subconsultants.

LICENSED PROFESSIONAL ENGINEER
JESSE PAUL VARSHO
062-059069
STATE OF ILLINOIS

Jesse Varsho, P.E.
Illinois Professional Engineer No. 062.067766
License Expires: 11/30/19

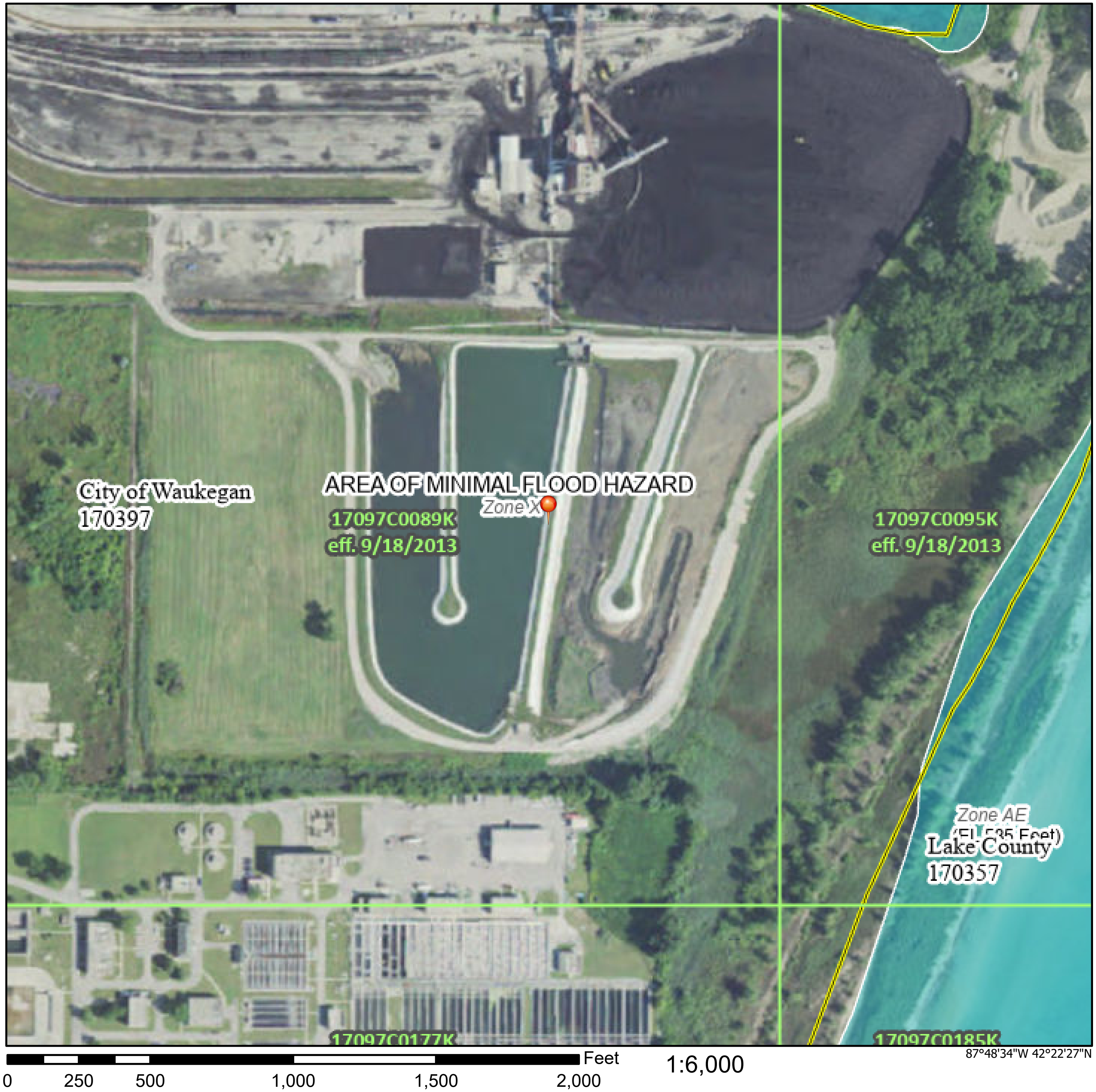
3. References

Geosyntec, 2016. Structural Stability and Factor of Safety Assessment, Ash Surge Basin and Bypass Basin, Powerton Station, October.

National Flood Hazard Layer FIRMette

FEMA

87°49'12"W 42°22'53"N



87°48'34"W 42°22'27"N

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 9/22/2021 at 3:58 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

ATTACHMENT 5
PERMANENT MARKERS

Photo documentation – East & West Ash Ponds Permanent Markers, Waukegan Generating Station, Waukegan, IL.

1. East Pond Permanent Marker

2. West Pond Permanent Marker

ATTACHMENT 6
INCISED/SLOPE PROTECTION DOCUMENTATION

Photo documentation – Slope Protection, Waukegan Station


1. Slope protection near MW-1


2. Slope protection near MW-1


3. Slope protection near MW-2


4. Slope protection near MW-2

Photo documentation – Slope Protection, Waukegan Station

5. Slope protection near MW-3

6. Slope protection near MW-3

7. Slope protection near MW-4

8. Slope protection near MW-4

ATTACHMENT 7
EMERGENCY ACTION PLAN

SECTION 845.520 CERTIFICATION

The West Ash Basin [Pond] and the East Ash Basin [Pond] Emergency Action Plan included as part of this operating permit application was initially prepared by Civil & Environmental Consultants, Inc. in April 2017 and was reviewed by KPRG for compliance with 35 Ill. Adm. Code 845.520(b). KPRG's review of the EAP is based solely on the observations of the conditions observed by KPRG personnel and information provided to KPRG by Midwest Generation. This review neither accepts nor rejects the safety emergencies identified by CEC. The safety emergencies identified along with the responses are the product of CEC. KPRG has not altered the safety emergencies or the responses associated with each emergency. As part of the review process, the contact list included as part of the original Emergency Action Plan required being updated and the updated contact list is included along with the original contact list. As such, the Emergency Action Plan complies with 35 Ill. Adm. Code 845.520(b).

Joshua D. Davenport, P.E. 10/29/21

Illinois Professional Engineer No. 062.061945

License Expires: 11/30/2021

EMERGENCY ACTION PLAN
EAST AND WEST ASH BASINS
WAUKEGAN STATION
APRIL 2017

This Emergency Action Plan (EAP) has been prepared pursuant to Title 40 of the Code of Federal Regulations (CFR) Part 257, Subpart D, §257.73(a)(3) for the East and West Ash Basins at the Midwest Generation, LLC (MWG) Waukegan Station (Station) in Waukegan, Illinois. Previous assessments performed in accordance with §257.73(a)(2) have resulted in the classification of the East and West Ash Basins as significant hazard potential Coal Combustion Residual (CCR) surface impoundments, and as a result, this written EAP has been prepared to address potential failure of the East and West Ash Ponds. The EAP is presented as follows:

Section 1.0: §257.73(a)(3)(i)(A) Definition of the events or circumstances involving the CCR unit(s) that represent a safety emergency, along with a description of the procedures that will be followed to detect a safety emergency in a timely manner;

Section 2.0: §257.73(a)(3)(i)(B) Definition of the responsible persons, their respective responsibilities, and notification procedures in the event of a safety emergency involving the CCR unit(s);

Section 3.0: §257.73(a)(3)(i)(C) Contact information of emergency responders;

Section 4.0: §257.73(a)(3)(i)(D) Provide Site Maps which delineate the downstream areas which would be affected in the event of an East and West Ash Basins failure and a physical description of the CCR Units;

Section 5.0: §257.73(a)(3)(i)(E) Include provisions for an annual face-to-face meeting or exercise between representatives of Waukegan Station, and local emergency responders; and

Section 6.0: §257.73(a)(3)(iv) The owner or operator of the CCR unit(s) must obtain a certification from a qualified professional engineer stating that the written EAP, and any subsequent amendment of the EAP, meets the requirements of paragraph (a)(3) of this section.

1.0 DEFINITION OF THE EVENTS THAT REPRESENT A SAFETY EMERGENCY

In accordance with Section 257.73(a)(3)(i)(A), the following tables define the events and/or circumstances involving the East and West Ash Basins that represent a safety emergency, along with a description of the procedures that will be followed to detect a safety emergency in a timely manner.

The information provided in Tables 1 through 4 provides a listing of problems which may occur at the East and West Ash Basins, how to make a rapid evaluation of the problem, and what action should be taken in response to the problem. This section presents only generalized information to aid in first response to a given problem. Suspected problems should be reported as soon as possible, as discussed in Section 2.0, and assistance from a qualified engineer should be obtained if necessary.

The problems outlined in this Section are related to above grade, earthen type embankment dams similar in construction to the East and West Ash Basins. The problems discussed herein include:

- Table 1: Seepage
- Table 2: Sliding
- Table 3: Cracking
- Table 4: Animal Burrows and Holes

For each problem, the indicators are discussed followed by evaluation techniques and then by action items for each problem.

Table 1: East and West Ash Basins Event Definition, Evaluation and Action: Seepage

Definition	Evaluation	Action
1A: Wet area on downstream embankment slope or other area downstream of the embankment, with very little or no surface water or very minor seeps.	1B: Condition may be caused by infiltration of rain water, which is not serious; or may be the start of a serious seepage problem, which would be indicated by a quick change to one of the conditions below.	1C: No immediate action required. Note the location for future comparison.
2A: Same wet area as above, with moderate seeps of clear or relatively clear water and the rate of flow not increasing.	2B: Measure the flow periodically and note changes in clarity.	2C: No immediate action required. Note the location, flow rate, and clarity for future comparison. During reservoir flood stages, the seepage area should be watched for changes.
3A: Same wet area as above, with moderate seeps of clear or relatively clear water and rate of flow increasing.	3B: Measure the flow periodically and note changes in clarity. Inspect downstream area for new seeps.	3C: Contact a qualified engineer (see Table 5) for immediate inspection. Observe the condition constantly for further changes in flow rate or clarity, unless notified otherwise by the engineer.
4A: Piping (seepage with the removal of materials from the foundation or embankment), moderate to active flows of cloudy to muddy water.	4B: If the water is cloudy to muddy, and the rate of flow is increasing, this condition could lead to failure of the dam. If, along the piping, there is an upstream swirl (whirlpool) caused by water entering through the abutments of embankment, failure is imminent.	4C: Immediate action is necessary. Notify the appropriate agencies (see Table 5).
5A: Boils (soil particles deposited around a water exit forming a cone, varying from a few inches in diameter spaced 2 to 3 feet apart to isolated locations several feet in diameter in the floodplain downstream of the dam) may show the types of flow as noted above.	5B: Evaluation of the problem is the same as noted above for the various flow conditions, i.e., clear and constant, clear and increasing, and cloudy or muddy and increasing.	5C: Actions to be taken are essentially the same as those noted above.

Table 2: East and West Ash Basins Event Definition, Evaluation and Action: Sliding

Indicator	Evaluation	Action
1A: Movement of a portion of the embankment, either the upstream or downstream slope, toward the toe of the dam.	1B: Various degrees of severity of a slide require different responses. The first condition is that the slide does not pass through the crest and does not extend into the embankment for more than 5 ft., measured perpendicular to the slope.	1C: For this condition, a qualified engineer (see Table 5) should be consulted before repairs are initiated to determine the cause of the slide and to recommend modifications to prevent future slides. The downstream side of the dam should be watched for the emergence of water, either through the slide or opposite the slide. If water is noted discharging, the area should be treated as a seepage location and monitored as noted above.
2A: Slide passes is the second condition.	2B: In this condition, the slide passes through the crest and that the reservoir elevation is more than 10 ft. below the lowered crest.	2C: Use the same actions as noted above, and notify the appropriate MWG personnel (see Table 5) of the situation so they may be prepared to act if the condition worsens.
3A: Slide passes is also the third condition.	3B: In this condition, the slide passes through the crest and that the reservoir elevation is less than 10 ft. below the lowered crest.	3C: This condition is critical, and failure of the dam should be considered imminent. Notify the appropriate agencies (see Table 5).

Table 3: East and West Ash Basins Event Definition, Evaluation and Action: Cracking

Indicator	Evaluation	Action
1A: Cracks in the embankment can occur either in the longitudinal (along the length of the dam) or transverse (across the dam from upstream to downstream directions).	1B: Some cracking of the surface soils may occur when they become dry. This cracking is to be expected, and no further action is required.	1C: No further action is required.
2A: Longitudinal cracking can indicate the beginning of a slide or be an uneven settlement of the embankment.	2B: Monitor the crack for future changes, and contact a qualified engineer for assistance in the evaluation of the crack and recommended repairs.	2C: Contact a qualified engineer for assistance and recommendations (see Table 5).
3A: Transverse cracking can indicate uneven settlement or the loss of support below the crack. Such cracks usually occur over an outlet conduit, near the abutments, or in the taller portion of the embankment.	3B: Monitor the crack for future changes, and contact a qualified engineer for assistance in the evaluation of the crack and recommended repairs.	3C: Contact a qualified engineer for assistance and recommendations (see Table 5).

Table 4: East and West Ash Basins Event Definition, Evaluation and Action: Animal Burrows and Holes

Indicator	Evaluation	Action
1A: Holes in the embankment, varying in size from about one inch in diameter to one foot in diameter caused by animals.	1B: If the holes do not penetrate through the embankment, the situation is usually not serious. Some animal holes will have soil pushed out around the hole in a circular fashion, which may look like a boil (crayfish or crawdad). Watch for the movement of water and soil particles from these holes to determine whether they are boils.	1C: Backfill as deeply as possible with impervious material. If rodents become a nuisance, an effective rodent control program, as approved by the Illinois Department of Natural Resources District Wildlife Biologist, should be implemented.

2.0 RESPONSIBLE PERSONS, RESPECTIVE RESPONSIBILITIES AND NOTIFICATION PROCEDURES

The EAP must be implemented once events or circumstances involving the CCR unit that represent a safety emergency are detected, including conditions identified during periodic structural stability assessments, annual inspections, and inspections by a qualified person. In accordance with §257.73(a)(3)(i)(B), the following sections define responsible persons, their respective responsibilities, and notification procedures in the event of a safety emergency involving the Basins. Contact information is provided in Table 5, attached.

2.1 Responsible Persons and Responsibilities

Appropriate parties will be notified based on the nature and severity of the incident as determined by the Station Environmental Specialist or Chemical Specialist. If failure is imminent or has occurred, notification and mitigation procedures are a top priority, particularly for a potentially hazardous situation. The Station Environmental Specialist or Chemical Specialist, in conjunction with the Station Director, is responsible for this determination.

2.2 Notification Sequence

The following notification procedures shall be used by employees in the event of a safety emergency with the East and West Ash Basins.

(1) Notify the Shift Supervisor and Environmental Specialist, Chemical Specialist or alternate.

(2) If unsafe conditions exist, the employee should evacuate the area.

(3) Only the Environmental Specialist, Chemical Specialist or designated alternate shall have any official communication with non-employees or regulatory agencies, and only the Communications Director shall have any contact with the media.

The Environmental Specialist, Chemical Specialist, or designated alternate should follow these procedures in the event of a safety emergency involving the East and West Ash Basins:

(1) Organize appropriately trained Station personnel and/or other employees or contractors as necessary to assist with the safety emergency.

(2) After consultation with appropriately trained Station personnel, contact the proper civil authorities (e.g., fire, police, etc.) if necessary. Notify the appropriate agencies where there has been a reportable release of material(s) into the environment. See Table 5, attached for contact information. Notify MWG Corporate via the Intelex online

notification system within 24 hours in the event of a reportable release. A reportable release is a Material Release defined as a spill or leak that materialized in the waterway. A Non-Material Release is a spill or leak that did not come into contact with the waterway.

(3) Be prepared to evacuate the potential inundation areas at any time during the safety emergency response.

(4) If the emergency is beyond the Facility's response capabilities, contact one or more emergency response contractors as necessary.

(5) Corrective actions should only be performed by properly trained individuals.

2.3 Emergency Responders Contact Information

In accordance with §257.73(a)(3)(i)(C), Table 5, attached, provides contact information of emergency responders. The Station Environmental Specialist, Chemical Specialist, or alternate will determine who to notify, including any affected residents and/or businesses, in the case of an imminent or actual CCR surface impoundment dam failure. The Station Environmental Specialist, Chemical Specialist, or alternate will ensure proper notifications are made.

Appropriate contractors will be utilized to assist the Station Environmental Specialist, Chemical Specialist, or alternate with mitigated actions being undertaken in order to minimize the impact of an event that has occurred. Contact information for contractors and consultants are provided in Table 5, attached.

3.0 SITE MAP AND A SITE MAP DELINEATING THE DOWNSTREAM AREA

In accordance with §257.73(a)(3)(i)(D), the following section provides a physical description of the East and West Ash Basins. A Site Vicinity Map is provided as Figure 1, attached. Drawings depicting the locations of, and the downstream areas affected by, a potential failure of East and West Ash Basins were prepared by Geosyntec in October 16, 2016 and are provided in Attachment A.

3.1 Basin Locations and Descriptions

The East and West Ash Basins are located in the southeastern portion of Waukegan Station (see Figure 1). The Basins are south of the Power Block Building and Coal Pile.

From our observations and review of construction and engineering documentation provided by MWG, the Basins are formed by embankments to the south, east and west with abroad at grade fill areas to the west. An earthen berm is located west of the West Ash Basin, which diverts storm water from areas west of the Basins toward the south. Due to the topographic constraints, run-on to the Basins is generally limited to the embankment crests. Physical characteristics of the East and West Ash Basins are provided in Table 6, below.

Table 6 – Basin Characteristics

	East Ash Basin	West Ash Basin
Estimated Capacity (acre-feet)	113.7	138.5
Estimated Maximum Basin Depth (feet)	14.5	17.5
Elevation – Maximum Crest (ft msl.)	603	603

3.2 Delineation of Downstream Areas

The potential impacts from failure of the East and West Ash Basins were evaluated and reported by Geosyntec in the Hazard Potential Classification Assessment (HPCA), dated October 2016. A copy of the HPCA is contained on the CCR Rule Compliance Data and Information web site (http://www.nrg.com/legal/coal-combustion-residuals/).

Results of the HPCA indicate that both the East and West Ash Basins are classified as significant hazard potential CCR surface impoundments. The evaluation reports the East and West Basins are classified as significant hazard potential surface impoundments because their failure would not results in probable loss of life, but could result in impacts to Lake Michigan, creating potential economic loss and environmental damage. Occupied buildings affected as a result of an embankment failure are considered in a low danger zzone which corresponds to zero lives in serious danger from a release. Inundation Maps are provided in Appendix A.

4.0 ANNUAL FACE-TO-FACE MEETING

In accordance with §257.73(a)(3)(i)(E), a face-to-face meeting or an exercise between representatives Waukegan Station and the local emergency responders shall be offered and, if accepted, held on an annual basis. The purpose of the annual meeting is to review the EAP to assure that contacts, addresses, telephone numbers, etc. are current. The annual meeting will be held whether or not an incident occurred in the previous year. In the event an incident occurs, the annual meeting date may be moved up in order to discuss the incident closer to the date of occurrence. If no incidents have occurred, the annual meeting will be held to inform local emergency responders on the contents of the EAP and changes from the previous year. Documentation of the annual face to face meeting will be recorded and placed in the operating record for the Station.

Pursuant to §257.73(a)(3)(ii)(B), the EAP requires modification whenever there is a change in conditions that would substantially affect the EAP in effect. Changes to the plan shall be made as appropriate, and a copy of the changes will be kept at the station, with the revised EAP placed in the facility's operating record as required by §257.105(f)(6). The written EAP must be evaluated, at a minimum, every five years to ensure the information required in §257.73(a)(3) is accurate.

5.0 LIMITATIONS AND CERTIFICATION

This emergency action plan was prepared to meet the requirements of §257.73(a)(3) and was prepared under the direction of Mr. M. Dean Jones, P.E.

By affixing my seal to this, I do hereby certify to the best of my knowledge, information, and belief that the information contained in this report is true and correct. I further certify I am licensed to practice in the State of Illinois and that it is within my professional expertise to verify the correctness of the information. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment.

Seal:

MAURICE DEAN JONES, JR.
0062-051317
REGISTERED PROFESSIONAL ENGINEER OF ILLINOIS

Signature: ______________________

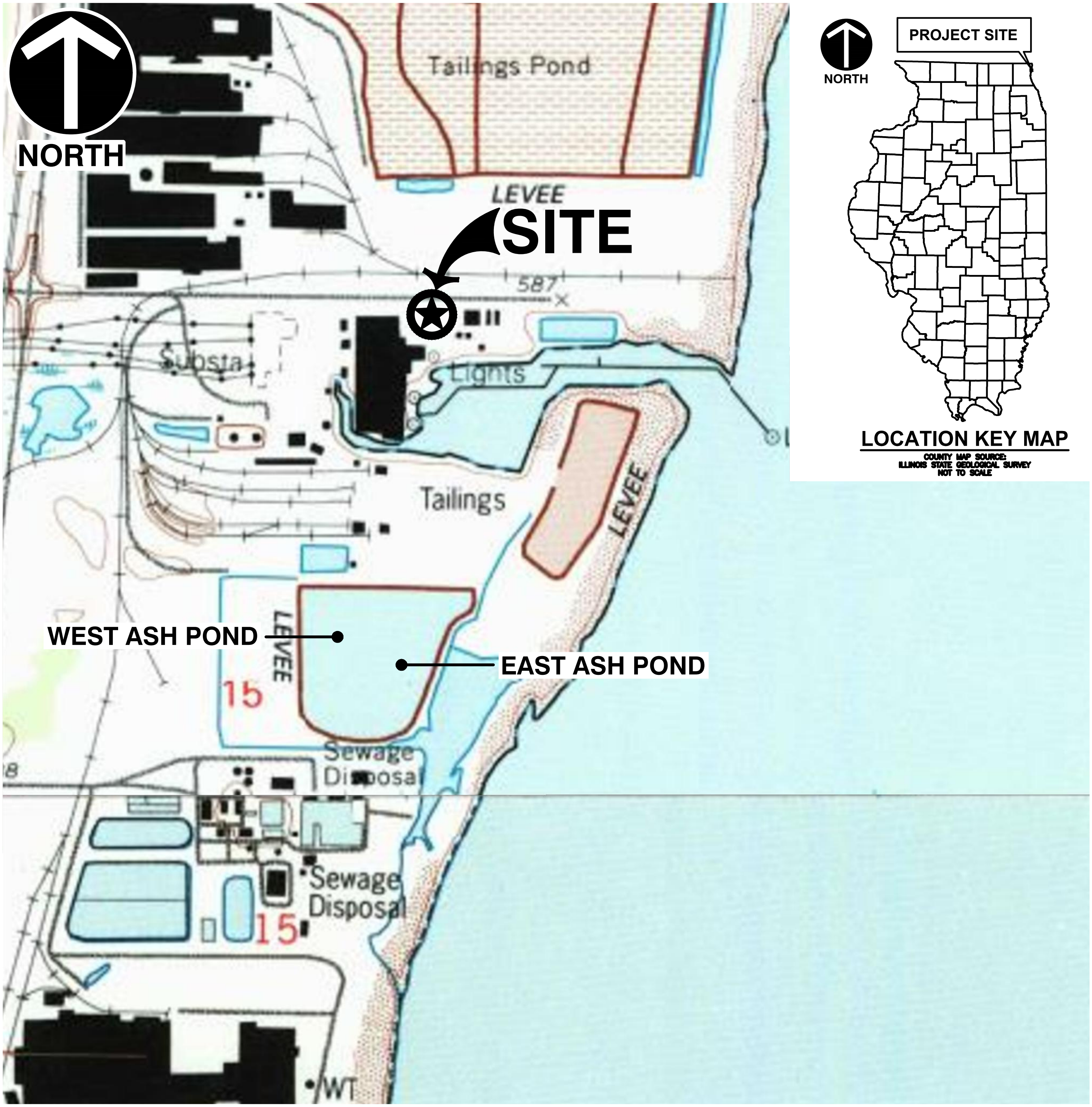
Name: M. Dean Jones, P.E.

Date of Certification: 04/13/17

Illinois Professional Engineer No.: 062-051317

Expiration Date: November 30, 2017

FIGURES



REFERENCE

1. U.S.G.S. 7.5' TOPOGRAPHIC MAP, ZION QUADRANGLE, ILLINOIS–WISCONSIN DATED: 1993.

*HAND SIGNATURE ON FILE

SCALE IN FEET

0 1000 2000

Civil & Environmental Consultants, Inc.

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630-963-6026 · 877-963-6026
www.cecinc.com

WAUKEGAN STATION
EAST AND WEST ASH PONDS
WAUKEGAN, ILLINOIS

SITE VICINITY MAP

DRAWN BY: MSK	CHECKED BY: MDJ	APPROVED BY: MDJ*	FIGURE NO.: 1
DATE: 04/05/2017	DWG SCALE: 1"=1000'	PROJECT NO: 170-204.0100	

P:\2017\170-204\-CADD\Dwg\CV01\CV01-Waukegan Station\170204-CV01-C101-Site Vicinity Map.dwg{LAYOUT1} LS:(4/5/2017 - mkarpf) - LP: 4/5/2017 1:28 PM

TABLE 5

EAP NOTIFICATION LIST

Table 5: Midwest Generation Waukegan Station CCR Surface Impoundment EAP Notification List-Updated September 2021

Waukegan Plant Contacts:

Name	Title	Contact Info
Mark Wehling	Environmental Specialist Chemical Specialist Class K WWT Operator	(O) 847-599-2201 (C) 847-456-9631
Paulo Rocha	Plant Manager	(O) 847-599-2212 (C) 847-421-7095
Steve Wibel	Operations Manager	(O) 847-599-2215 (C) 813-464-5295
Stanley Konopacki	Maintenance Manager	(O) 847-599-2214 (C) 847-875-8382

Corporate Support:

Name	Title	Contact Info
Sharene Shealey	Director, Environmental	(C) 724-255-3220
Jill Buckley	Environmental Manager	(C) 724-448-9732
Tony Shea	Sr. Director, Environmental	(O) 609-524-4923 (C) 609-651-6478
Dave Schrader	Sr. Manager, Communications (public point of contact)	(O) 267-295-5768 (C) 267-294-2860

Emergency Response Agencies:

Name	Address	Contact Info
National Response Center (NRC)	NA	800-424-8802
Illinois Department of Natural Resources, Office of Water Resources	One Natural Resources Way, 2nd Floor Springfield, IL 62702-1271	8:30AM – 5:00PM 217-785-3334
Illinois Emergency Management Agency (IEMA)	110 East Adams Springfield, IL 62701	800-782-7860
Illinois Environmental Protection Agency (IEPA)	Bureau of Water 1021 North Grand Avenue East Springfield, IL 62794	217-782-3637
Lake County Emergency Management Agency Operations Center	1303 N Milwaukee Ave Libertyville, IL 60048	Phone: 847-377-7100 24-Hr: 911
Lake County ETSB: Dispatches to Fire, Police, and Emergency Medical Services	1300 Gilmer Rd Volo, IL 60073	Emergency: 911 Non-Emergency: 847-487-8163
Waukegan Police Department	1101 Belvidere St Waukegan, IL 60085	Emergency: 911 Non-Emergency: 847-360-9000
Waukegan Fire Department	101 N West St Waukegan, IL 60085	Emergency: 911 Non-Emergency: 847-249-5410

Environmental Response Contractors/Consultants:

Name	Address	Contact Info
Civil & Environmental Consultants, Inc.	555 Butterfield Rd, Suite 300 Lombard, IL 60148	630-963-6026
SET Environmental – Project Manager – JR Bonnot	450 Sumac Rd Wheeling, IL 60090	847-850-1056
SET Environmental 24-Hr Emergency Response		877-437-7455

Table 5: Midwest Generation Waukegan Station CCR Surface Impoundment EAP Notification List

Emergency Coordinators **Phone Number**

Plant Contacts:

Name	Title	Contact Info
Fred Veenbaas	Senior Environmental Compliance Specialist	Office: 847-599-2289 Cell: 815-315-2764
Mark Wehling	Chemical Specialist	Office: 847-599-2201 Cell: 847-456-9631
Michael Munroe	Station Director	Office: 847-599-2212 Cell: 312-533-9246
Todd Mundorf	Operations Manager	Office: 847-599-2215 Cell: 847-456-4642
Don Fawcett	Maintenance Manager	Office: 847-599-2221 Cell: 815-671-1060
Chris Lux	Engineering Manager	Office: 847-599-2243 Cell: 847-456-4641
Mark Wehling	Class K WWT Operator	Office: 847-599-2201 Cell: 847-456-9631

Corporate Support:

Name	Title	Contact Info (Cell Phone #)
Sharene Shealey	Environmental Manager - Midwest Region	724-255-3220
Keith Schmidt	Manager - East Region	814-242-9447
Tony Shea	Director - Environmental Compliance	609-651-6478
Dave Gaier	Stations Communications Director (point of public contact)	609-524-4529

Emergency Response Agencies:

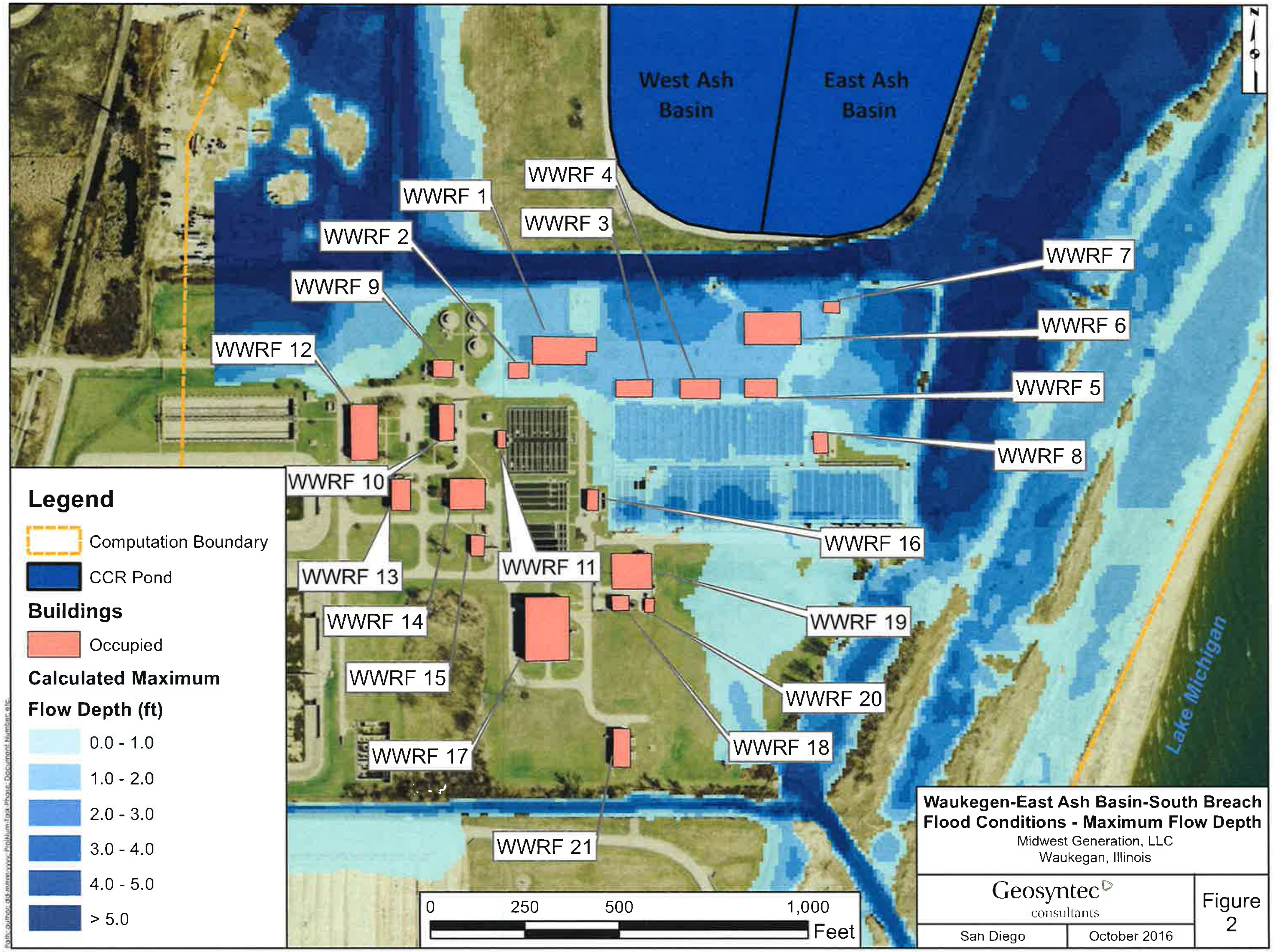
Agency	Address	Contact Info
National Response Center (NRC)	NA	800-424-8802
Illinois Department of Natural Resources, Office of Water Resources	One Natural Resources Way, 2nd Floor Springfield, IL 62702-1271	8:30AM-5:00PM 217-785-3334
Illinois Emergency Management Agency (IEMA)	110 East Adams Springfield, IL 62701	800-782-7860
Illinois Environmental Protection Agency (IEPA)	Bureau of Water 1021 North Grand Avenue East Springfield, IL 62794	217-782-3637
Lake County Emergency Management Agency Operations Center	1303 N Milwaukee Ave Libertyville, IL 60048	Phone: 847-377-7100 24-Hr: 911
Lake County ETSB: Dispatches to Fire, Police and Emergency Medical services	1300, Gilmer Rd Volo, IL 60073	Emergency: 9-1-1 Non-Emergency: 847-487-8163
Waukegan Police Department	1101 Belvidere St. Waukegan, IL 60085	Emergency: 9-1-1 Non-Emergency: 847-360-9000
Waukegan Fire Department	101 N West St. Waukegan, IL 60085	Emergency: 9-1-1 Non-Emergency: 847-249-5410

Environmental Response Contractors/Consultants:

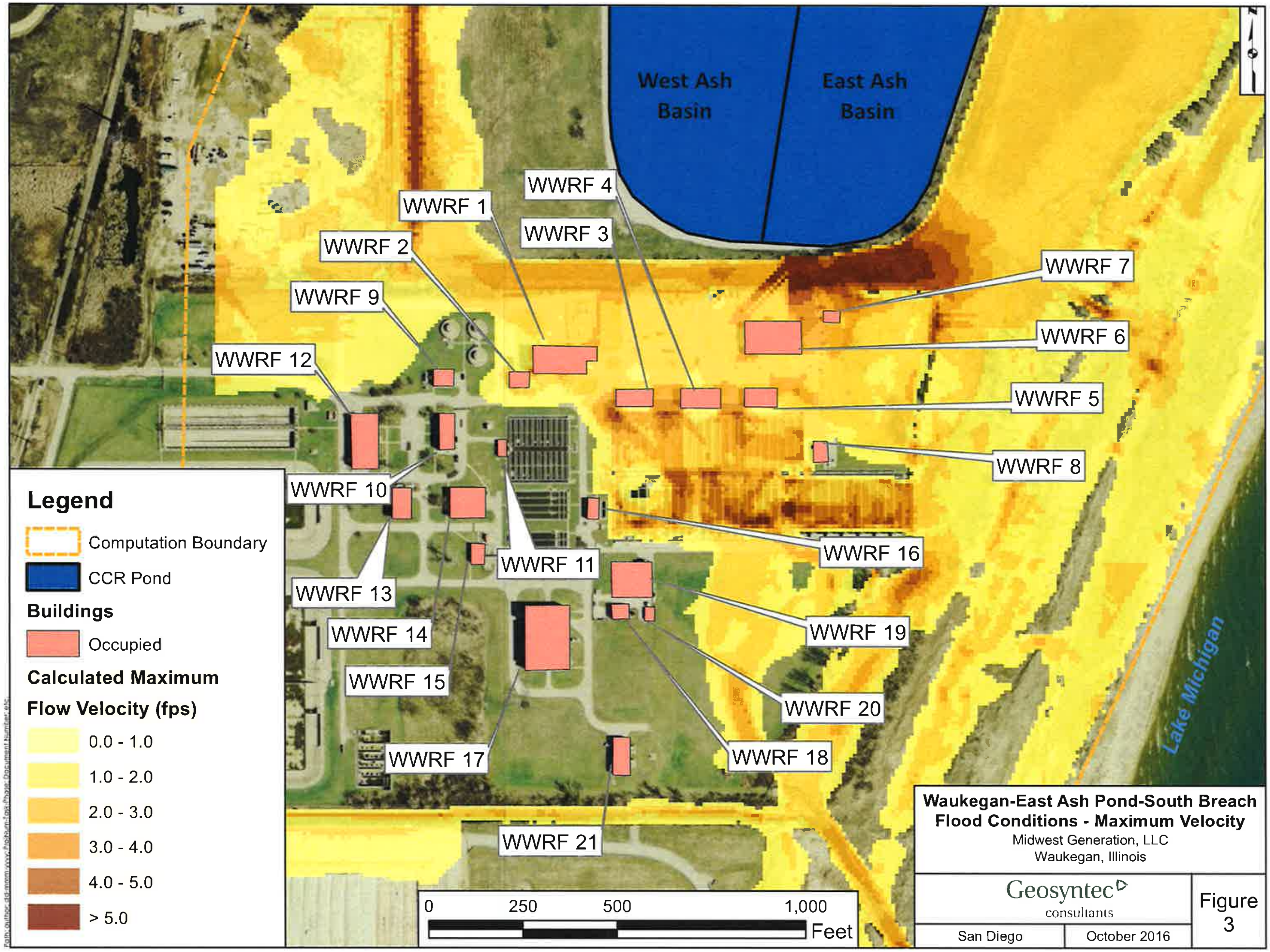
Contractor/Consultant	Address	Contact Info
Civil & Environmental Consultants, Inc.	555 Butterfield Road, Suite 300 Lombard, IL 60148	630-963-6026
SET Environmental - Project Manager - JR Bonnot	450 Sumac Road Wheeling, IL 60090	847-850-1056
SET Enviromental 24 hr Emergency Response		877-437-7455

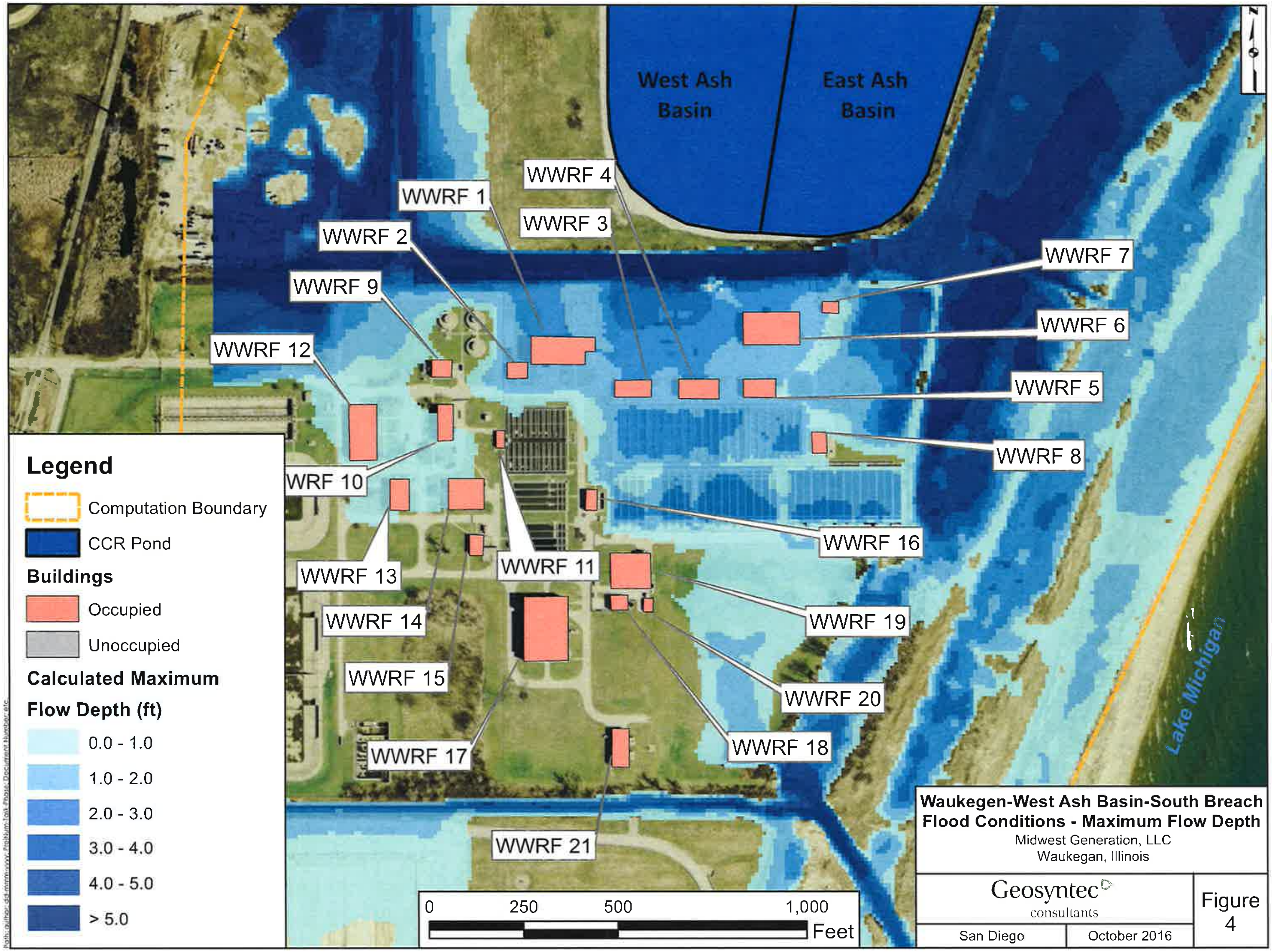
APPENDIX A

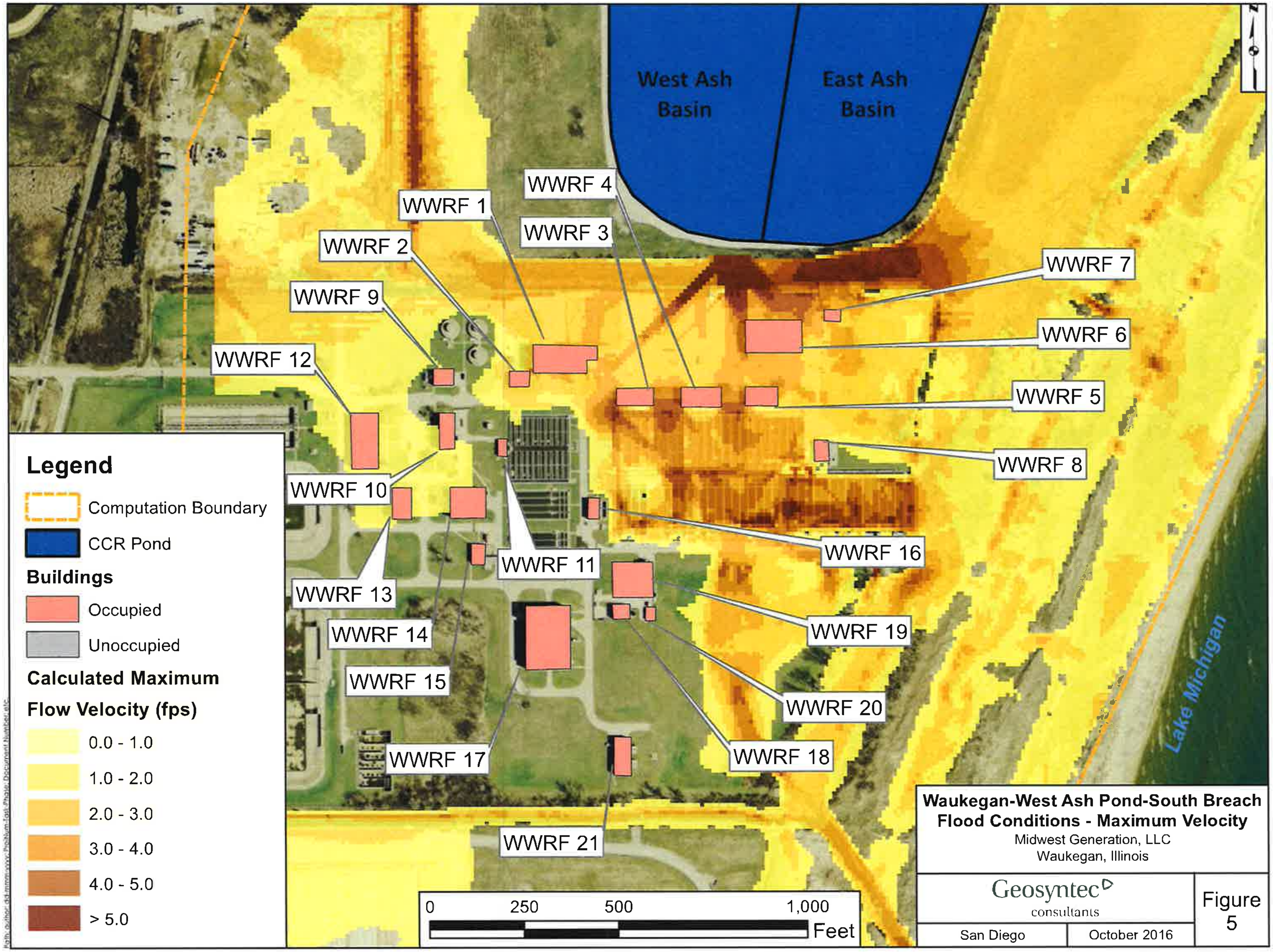
GEOSYNTEC HPCA INUNDATION MAPS



West Ash Basin
East Ash Basin
WWRF 1
WWRF 2
WWRF 3
WWRF 4
WWRF 5
WWRF 6
WWRF 7
WWRF 8
WWRF 9
WWRF 10
WWRF 11
WWRF 12
WWRF 13
WWRF 14
WWRF 15
WWRF 16
WWRF 17
WWRF 18
WWRF 19
WWRF 20
WWRF 21
Lake Michigan
Legend
Computation Boundary
CCR Pond
Buildings
Occupied
Calculated Maximum Flow Depth (ft)
0.0 - 1.0
1.0 - 2.0
2.0 - 3.0
3.0 - 4.0
4.0 - 5.0
> 5.0
0
250
500
1,000
Feet
Waukegen-East Ash Basin-South Breach
Flood Conditions - Maximum Flow Depth
Midwest Generation, LLC
Waukegan, Illinois
Geosyntec consultants
San Diego
October 2016
Figure 2


West Ash Basin
East Ash Basin
WWRF 1
WWRF 2
WWRF 3
WWRF 4
WWRF 5
WWRF 6
WWRF 7
WWRF 8
WWRF 9
WWRF 10
WWRF 11
WWRF 12
WWRF 13
WWRF 14
WWRF 15
WWRF 16
WWRF 17
WWRF 18
WWRF 19
WWRF 20
WWRF 21
Lake Michigan
Legend
Computation Boundary
CCR Pond
Buildings
Occupied
Calculated Maximum Flow Velocity (fps)
0.0 - 1.0
1.0 - 2.0
2.0 - 3.0
3.0 - 4.0
4.0 - 5.0
> 5.0
0
250
500
1,000
Feet
Waukegan-East Ash Pond-South Breach
Flood Conditions - Maximum Velocity
Midwest Generation, LLC
Waukegan, Illinois
Geosyntec consultants
San Diego
October 2016
Figure 3


West Ash Basin
East Ash Basin
WWRF 1
WWRF 2
WWRF 3
WWRF 4
WWRF 5
WWRF 6
WWRF 7
WWRF 8
WWRF 9
WRF 10
WWRF 11
WWRF 12
WWRF 13
WWRF 14
WWRF 15
WWRF 16
WWRF 17
WWRF 18
WWRF 19
WWRF 20
WWRF 21
Lake Michigan
Legend
Computation Boundary
CCR Pond
Buildings
Occupied
Unoccupied
Calculated Maximum Flow Depth (ft)
0.0 - 1.0
1.0 - 2.0
2.0 - 3.0
3.0 - 4.0
4.0 - 5.0
> 5.0
0
250
500
1,000
Feet
Waukegen-West Ash Basin-South Breach
Flood Conditions - Maximum Flow Depth
Midwest Generation, LLC
Waukegan, Illinois
Geosyntec
consultants
San Diego
October 2016
Figure
4



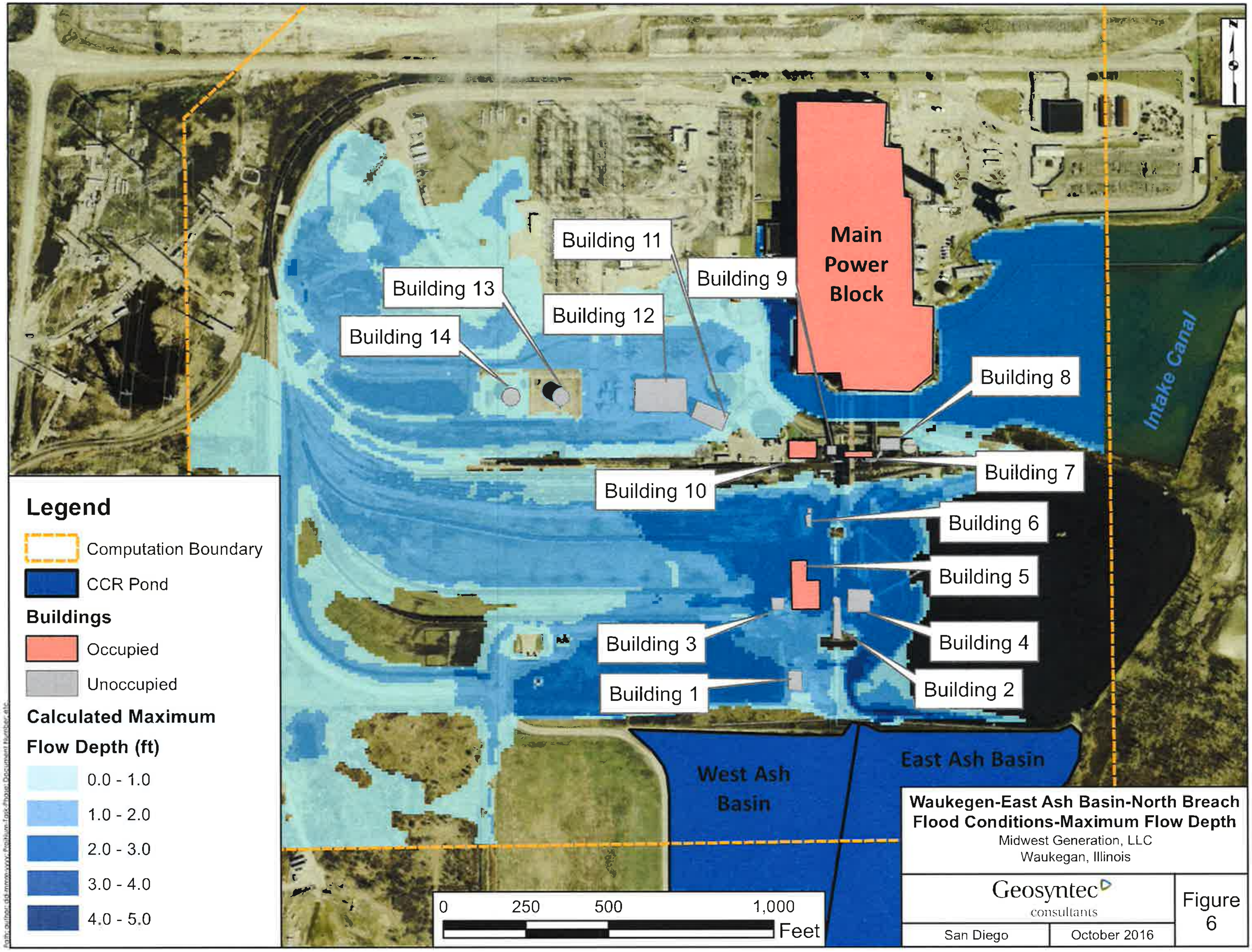
Waukegan-West Ash Pond-South Breach Flood Conditions - Maximum Velocity

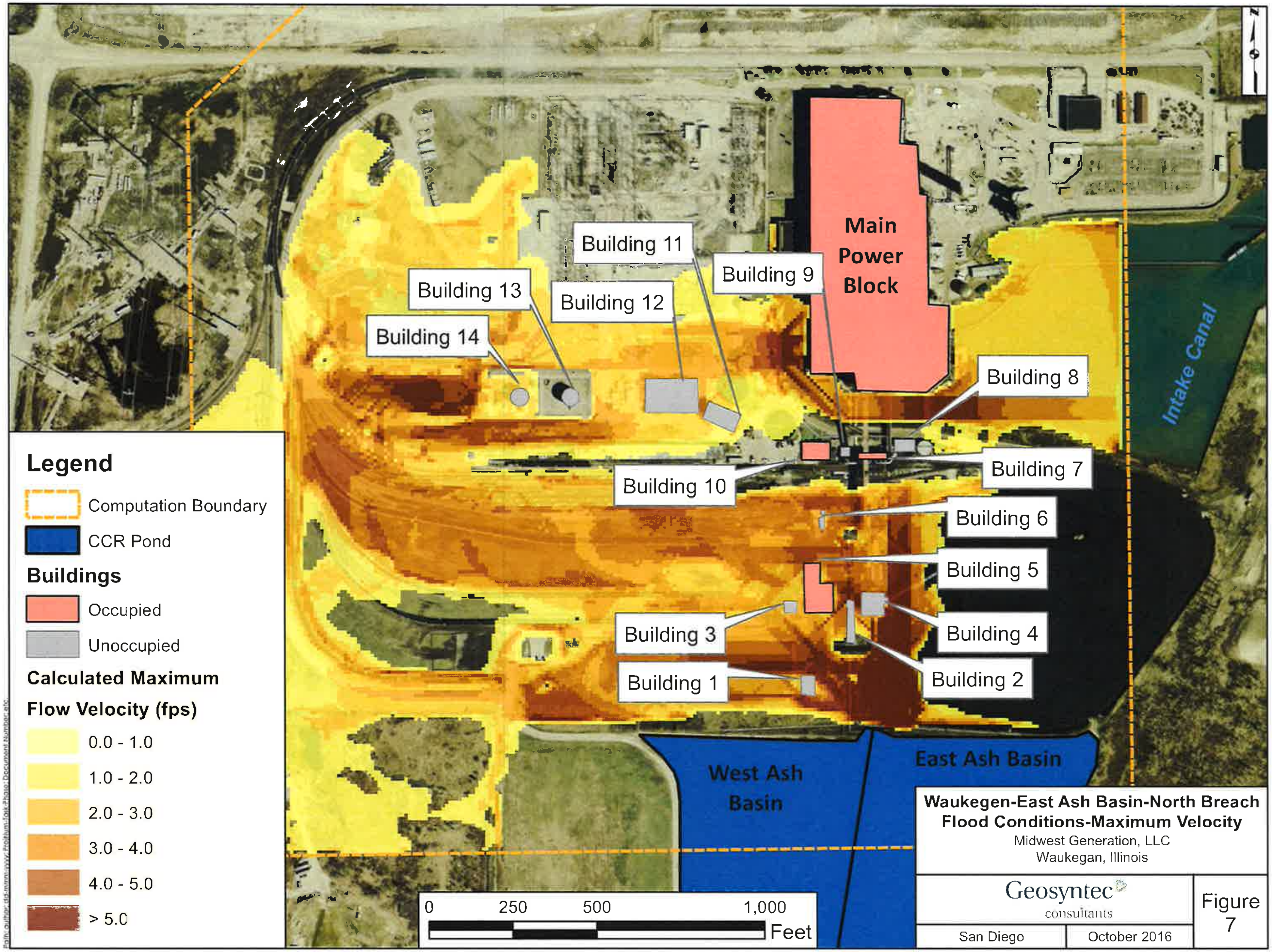
Midwest Generation, LLC
Waukegan, Illinois

Geosyntec consultants

San Diego | October 2016

Figure 5


Main Power Block
Building 1
Building 2
Building 3
Building 4
Building 5
Building 6
Building 7
Building 8
Building 9
Building 10
Building 11
Building 12
Building 13
Building 14
Intake Canal
West Ash Basin
East Ash Basin
Legend
Computation Boundary
CCR Pond
Buildings
Occupied
Unoccupied
Calculated Maximum Flow Depth (ft)
0.0 - 1.0
1.0 - 2.0
2.0 - 3.0
3.0 - 4.0
4.0 - 5.0
0 250 500 1,000
Feet
Waukegen-East Ash Basin-North Breach
Flood Conditions-Maximum Flow Depth
Midwest Generation, LLC
Waukegan, Illinois
Geosyntec consultants
San Diego
October 2016
Figure 6

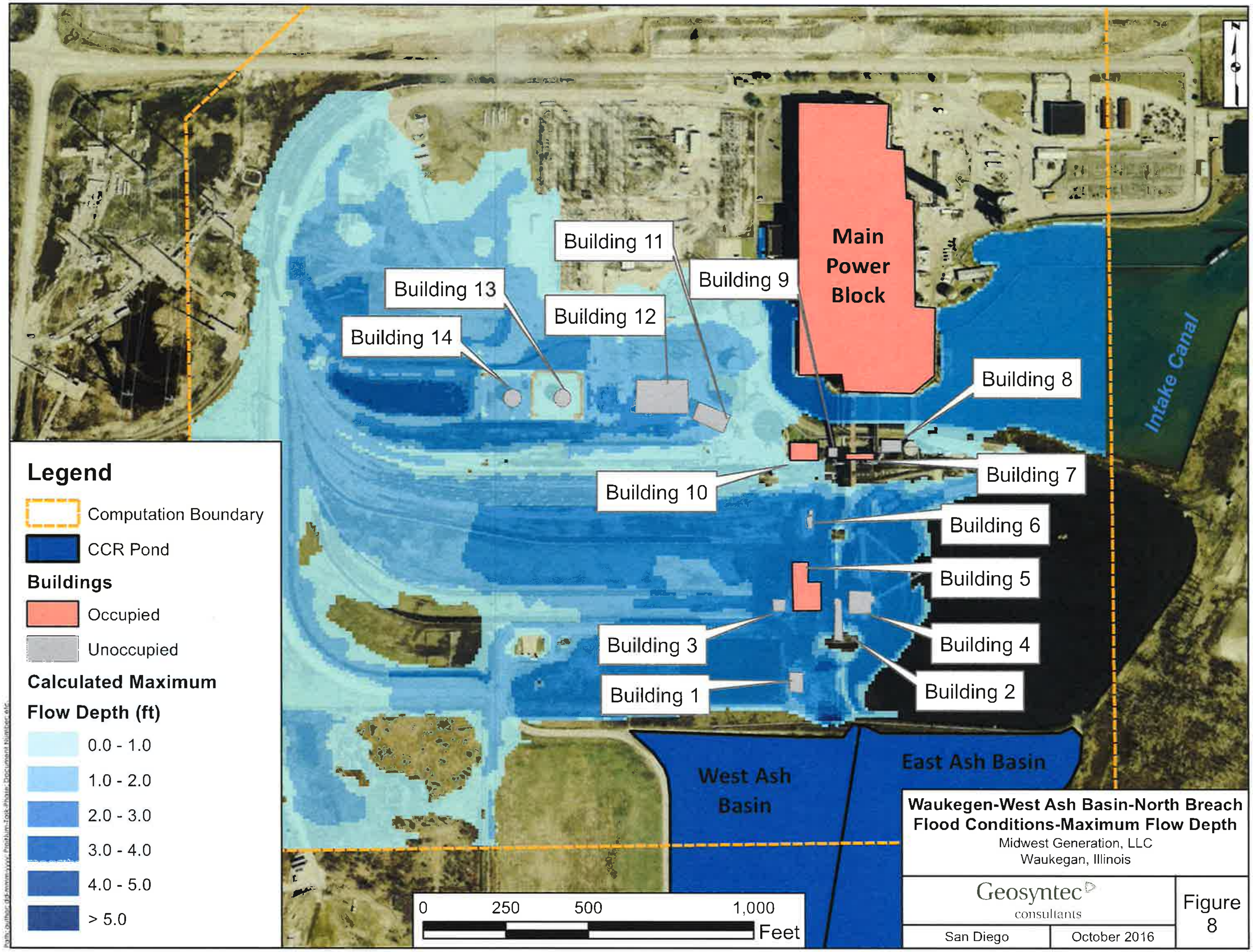


Waukegen-East Ash Basin-North Breach
Flood Conditions-Maximum Velocity
Midwest Generation, LLC
Waukegan, Illinois

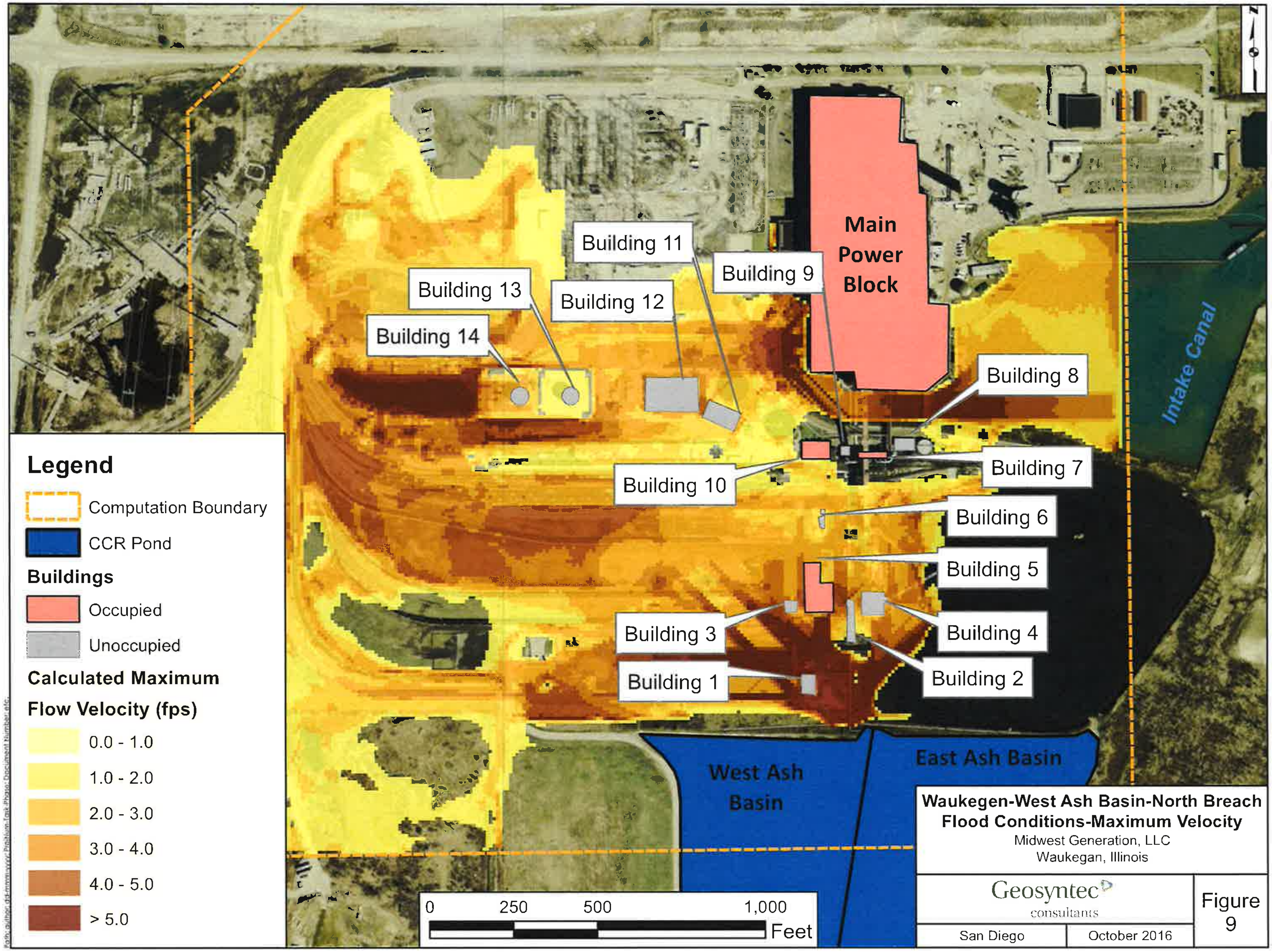
Geosyntec consultants

San Diego | October 2016

Figure 7



Main Power Block
Building 11
Building 9
Building 13
Building 12
Building 14
Building 8
Intake Canal
Building 7
Building 10
Building 6
Building 5
Building 3
Building 4
Building 1
Building 2
West Ash Basin
East Ash Basin
Legend
Computation Boundary
CCR Pond
Buildings
Occupied
Unoccupied
Calculated Maximum Flow Depth (ft)
0.0 - 1.0
1.0 - 2.0
2.0 - 3.0
3.0 - 4.0
4.0 - 5.0
> 5.0
0
250
500
1,000
Feet
Waukegen-West Ash Basin-North Breach
Flood Conditions-Maximum Flow Depth
Midwest Generation, LLC
Waukegan, Illinois
Geosyntec consultants
San Diego
October 2016
Figure 8



Waukegen-West Ash Basin-North Breach Flood Conditions-Maximum Velocity

Midwest Generation, LLC
Waukegan, Illinois

Geosyntec consultants

San Diego | October 2016

Figure 9

ATTACHMENT 8
FUGITIVE DUST CONTROL PLAN

CCR COMPLIANCE
FUGITIVE DUST CONTROL PLAN

Midwest Generation, LLC
Waukegan Generating Station
401 East Greenwood Avenue
Waukegan, Illinois

PREPARED BY: KPRG and Associates, Inc.
14665 W. Lisbon Road, Suite 1A
Brookfield, Wisconsin 53005

October 5, 2021

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SECTION/DESCRIPTION **PAGE**

APPENDICES

1.0 INTRODUCTION

On April 15, 2021, the Illinois Environmental Protection Agency adopted a new Part 845 of its waste disposal regulations creating statewide standards for the disposal of coal combustion residuals (CCR) in surface impoundments, created by the generation of electricity by coal-fired power plants. Part 845 specifically requires that "the owner or operator of a CCR surface impoundment, or any lateral expansion of a CCR surface impoundment, must adopt measures that will effectively minimize CCR from becoming airborne at the facility, including CCR fugitive dust originating from CCR surface impoundments, roads, and other CCR management and material handling activities". As a result, each regulated facility must develop a CCR fugitive dust control plan that complies with 35 Ill. Adm. Code 845.500(b).

This site specific Fugitive Dust Control Plan (Plan) has been developed to comply with the requirements specified in Section 845.500. In general, the Plan identifies the potential CCR fugitive dust sources and describes the control measures that will be implemented to minimize CCR fugitive dust emissions. The Plan also includes a procedure for the periodic assessment of the Plan's effectiveness, documentation of any Plan amendments deemed necessary to assure continued compliance, a record of any citizen complaints received pertaining to CCR fugitive dust emissions, and an outline of the required reporting and recordkeeping requirements in 35 Ill. Adm. Code 845.500.

2.0 SITE INFORMATION

2.1 Owner/Operator and Address:

Midwest Generation, LLC
Waukegan Generating Station
401 East Greenwood Avenue
Waukegan, Illinois

2.2 Owner Representative/Responsible Person Contact Information:

Mr. Mark Nagel
Station Manager
847-599-2212

2.3 Location and Description of Facility Operations

The Midwest Generation Waukegan Generating Station is located at 401 East Greenwood Avenue, Waukegan, Lake County, Illinois. The facility is a coal-fired electric power generating station currently occupying approximately 200 acres. There are currently two operating units, Units 7 and 8. There are four peaker units at the site, fired primarily by fuel oil. Electrical power is transmitted from the site to the area grid through overhead transmission power lines.

The general vicinity includes other commercial and industrial facilities, limited residential development and Lake Michigan.

3.0 POTENTIAL FUGITIVE DUST SOURCES

Potential fugitive dust sources associated with the bottom ash and slag and fly ash systems have been identified at the facility; however, some of these are regulated by the facility's operating permit and are adequately addressed within the required fugitive dust operating program. The potential CCR fugitive dust sources generally include exterior ash distribution systems, temporary ash storage locations, ash bulk loading/unloading operations and ash truck transportation routes. Fugitive dust could potentially be generated from these sources as a result of equipment malfunctions, wind erosion, housekeeping issues and/or the nature of the operation. Specifically, these identified sources were further evaluated to determine the probability of CCR fugitive dust being generated and to determine the level of emission controls that are warranted to mitigate fugitive dust emissions. The findings of the evaluation are individually discussed in the following sections.

3.1 Bottom Ash and Slag Distribution System

Collected bottom ash and slag in the boilers is transported as a liquid mixture through an enclosed piping system to the East Ash Pond. The West Ash Pond is currently inactive. Some of this piping is located inside a building; however, a portion is situated above ground and in the outside environment. Although not an anticipated occurrence, a breach in the exterior piping could result in the accidental release of bottom ash and slag and potential fugitive dust emissions if the material were to accumulate and dry out.

3.2 West Ash Pond and East Ash Pond

After settling occurs, water from the East Ash Pond is recycled for reuse in the distribution system. Both of these ponds are filled with water; however, dredging occasionally will be required to remove the settled material from the East Ash Pond. The West Ash Pond will remain filled with water until closure is initiated. When dredging is necessary, because either the East Ash Pond is full and removal is required or closure is initiated for the West Ash Pond, the pond will be dewatered and the dredged material is allowed to dry. When the material is suitable for transport, it is loaded into open top trucks, covered and sent off site to a licensed landfill. Potential fugitive dust emissions could occur if dry bottom ash and slag residual is exposed or loaded during excessive windy and dry weather conditions.

3.3 Fly Ash Handling Equipment

Collected fly ash in the precipitator hoppers is initially transported in a closed vacuum piping system to a cyclone and bag filter where it is mechanically separated from the air stream within an enclosed building. Fly ash is then sent to the fly ash silos through exterior piping. At the silos, the fly ash is drop loaded into trucks through a drop chute. The loading of fly ash occurs within a partially enclosed structure. After the trucks containing fly ash have been loaded, they proceed to a nearby platform to allow the truck driver to secure the truck and to broom sweep any residual fly ash remaining on the truck. This entire process is covered by the fugitive dust operating program for the facility.

3.4 Maintenance Storage Area

Bottom ash and slag and fly ash generated as a result of routine ash-related equipment maintenance are temporarily stored in dedicated roll-off boxes in the Maintenance Storage Area. The materials are placed within the lined roll-off boxes until the container is full. The roll-off boxes are covered and transported to a licensed landfill. Any material that accumulates outside the roll-off box or dry material in an uncovered container that is exposed to excessive windy and dry weather conditions has the potential for becoming fugitive dust emissions.

3.5 Ash Transport Roadways

Both gravel covered and asphalt paved roads within the facility are used by trucks hauling both bottom ash and slag and fly ash to off-site landfills as well as by other vehicles entering and exiting the facility. Fugitive CCR dust emissions could occur during transit if the roll-off boxes are not covered and secured, if ash material is not properly cleaned from the boxes and trucks, or if there is a release of ash material due to a malfunction or accident.

These potential fugitive dust sources are identified on the Site Diagram included in Appendix A.

4.0 DESCRIPTION OF CONTROL MEASURES

4.1 Purpose

The purpose of developing appropriate control measures is to minimize and reduce the emissions of CCR fugitive dust from the identified potential emission sources. The control measures and work practices implemented at the facility are described in the following sections.

4.2 Bottom Ash and Slag Distribution System

Bottom ash and slag is in a liquid mixture within a closed system until the point of discharge at the East Ash Pond. A significant portion of the piping system is contained within a building, which eliminates dust emissions to the outside environment. An assessment of the exterior distribution system will be performed on a quarterly basis to verify the integrity of the system or when a breach in the system is detected. If a leak is noted, resulting in the release of bottom ash and slag, the affected area will be restored to original conditions and repair of the pipe will be performed as soon as feasible. The ash will be sent off site to a licensed landfill.

4.3 West Ash Pond and East Ash Pond

During normal operations, the East Ash Pond is filled with water thereby suppressing any potential fugitive dust emissions. The West Ash Pond was previously filled with water when it was operational and continues to remain filled with water despite being inactive. As needed, the East Ash Pond will need to be dewatered and the sediment removed off site to a licensed landfill. When the West Ash Pond closure is initiated, it will be dewatered and the sediment removed off site to a licensed landfill. While the bottom ash and slag residue is drying, there is the potential for this material to become airborne especially during excessively dry and windy conditions. Loading of this material under these conditions also has the potential for generating fugitive dust. Dewatered ponds will be assessed on a quarterly basis or more frequently during excessively dry and windy conditions. To minimize fugitive dust emissions from exposed dry bottom ash and slag, the height of the staged material will be minimized and the material piles will be either sprayed with water or covered. Loading activities also will be limited during such occasions. Haul trucks are covered with tarps once they have been loaded.

4.4 Ash Handling Equipment

Fly ash from the mechanical separators is sent to the silos within enclosed piping. At the silos, the fly ash is drop loaded into a tank truck through a drop chute. This loading mechanism minimizes the potential for fly ash to become airborne during the loading process. The loading of trucks also occurs within a partial enclosure. At the completion of loading, the truck moves a short distance to an elevated truck stand where it is broom swept to remove any accumulated fly ash. Accumulated ash is promptly transferred to the Maintenance Storage Area.

This process is covered by the facility's fugitive dust operating program. Under the program, the facility must maintain control measures, including enclosures, covers and dust collection devices. Additionally, the facility is required to conduct weekly inspections of the process to confirm compliance. A record of the inspections is maintained at the facility.

4.5 Maintenance Storage Area

The roll-off boxes in the Maintenance Storage Area only periodically contain bottom ash and slag, fly ash and other ash-related materials generated from routine maintenance activities. Typically the bottom ash and slag is in a wet state when placed into the containers but fly ash is in a dry state. When the roll-off boxes are filled, the material is promptly removed to an off-site licensed landfill. The Maintenance Storage Area will be assessed on a quarterly basis or more frequently during excessively dry and windy conditions. If ash material is observed outside a roll-off box, it will be collected and placed into the container. All roll-off boxes will be covered while staged in the Maintenance Storage Area and during removal off site.

4.6 Ash Transport Roadways

Truck drivers are instructed on the proper procedure for cleaning trucks and roll-off boxes before removal and a vehicle speed limit is enforced at the facility. Ash material that may not have been adequately removed from the trucks or roll-off boxes has the potential to become airborne and ultimately be deposited on haul roads. To minimize fugitive dust emissions, these roads will be assessed on a quarterly basis and any observed accumulated ash material will be promptly cleaned up and collected for off-site removal to a licensed landfill.

5.0 PLAN ASSESSMENTS/AMENDMENTS

To assure that the work practices being implemented adequately control the dust from the identified potential CCR fugitive dust emission sources at the facility, routine assessments and record keeping are performed. These procedures include the following:

5.1 Fugitive CCR Dust Assessments

Pursuant to 845.500(b)(3), assessments of the potential CCR fugitive dust emission sources identified within this Plan will be conducted to assess the effectiveness of this Plan. The assessment will include observation of ash removal from ponds, temporary storage and transport activities at the facility to confirm the adequacy of the control measures. The assessments will be conducted on a quarterly basis by an individual designated by the contact identified in Section 2.2 of this Plan. Observations made during each assessment will be recorded on a form similar to the one included in Appendix B, however, the station may create their own form.

If the results of the assessment determine that ash-related equipment has malfunctioned or the integrity of the equipment has been compromised, the necessary repairs or replacement will be performed as soon as feasible. If the assessment finds that this Plan does not effectively minimize the CCR from becoming airborne, this Plan will be amended to include additional control measures.

5.2 Plan Amendments

This Fugitive Dust Plan will be reviewed whenever there is a change in conditions that would substantially affect the written Plan currently in place. A record of the reviews and any modifications or amendments made to the Plan currently in place will be kept on a form similar to the one included in Appendix C. The amended Plan will be reviewed by a Registered Professional Engineer and, if deemed acceptable, will be recertified.

5.3 Citizen Complaints

Any written or verbal complaints received from a citizen involving alleged CCR fugitive dust emission events at the facility will be recorded by an individual designated by the contact identified in Section 2.2 of this Plan. The complaints will be recorded on a form similar to the one included in Appendix D. Upon receipt of the complaint, an investigation of the alleged source of the fugitive dust emissions will be performed and the results of that investigation recorded on the form. If the fugitive dust emission event is confirmed, any necessary repairs or changes in operation required to mitigate the fugitive dust emissions will be implemented as soon as practicable.

6.0 FUGITIVE DUST PLAN REPORTING/RECORDKEEPING REQUIREMENTS

This section outlines the Plan reports that must be prepared and records that must be maintained to meet the requirements specified in 35 Ill. Adm. Code Section 845.500. These requirements include the following:

- Place the Plan in the facility's operating record and publicly accessible internet site. If the Plan is amended, replace the initial Plan with the amended Plan. Only the most recent amended Plan will be maintained in the facility's operating record and internet site.

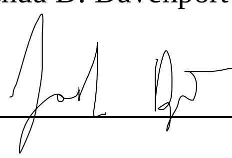
- Prepare an annual CCR Fugitive Dust Control Report and submit to the IEPA as part of the annual consolidated report required by 845.550. The annual report will include:
  - A description of the actions taken to control CCR fugitive dust,
  - A record of all citizen complaints, and
  - A summary of any corrective measures taken.
  - Placement of this report in the operating record and publicly accessible internet site.

- Provide notification to the IEPA and, if applicable, the Tribal authority when the Plan and reports are placed in the facility's operating record and publicly accessible internet site.

7.0 PROFESSIONAL ENGINEER CERTIFICATION

The undersigned Registered Professional Engineer is familiar with the requirements of 845.500 and has visited and examined the facility or has supervised examination of the facility by appropriately qualified personnel. The undersigned Registered Professional Engineer attests that this CCR Fugitive Dust Control Plan has been prepared in accordance with good engineering practice, including consideration of applicable industry standards and meets the requirements of 845.500, and that this Plan is adequate for the facility. This certification was prepared as required by 845.500(b)(7).

Engineer: Joshua D. Davenport

Signature: 

Date: 10/5/21

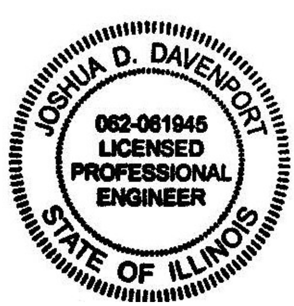
Company: KPRG and Associates, Inc.

Registration State: Illinois

Registration Number: 062.061945

License Expiration Date: November 30, 2021

Professional Engineer Stamp:



APPENDIX A

SITE DIAGRAM
POTENTIAL FUGITIVE DUST SOURCES

W:\projects\midwest generation\attorney-client privilege\fugitive dust plans\waukegan dust map.dwg

ENVIRONMENTAL CONSULTATION & REMEDIATION

KPRG

KPRG and Associates, inc.

414 Plaza Drive, Suite 106 Westmont, Illinois 60559 Telephone 630-325-1300 Facsimile 630-325-1593

14665 West Lisbon Road, Suite 2B Brookfield, Wisconsin 53005 Telephone 262-781-0475 Facsimile 262-781-0478

SITE DIAGRAM/FUGITIVE DUST SOURCES

WAUKEGAN STATION
WAUKEGAN, ILLINOIS

Scale: 1" = 550'

Date: September 17, 2015

KPRG Project No. 15315

APPENDIX A

APPENDIX B

ASSESSMENT RECORD

APPENDIX B

WAUKEGAN STATION

EXAMPLE ASSESSMENT RECORD

Date	Inspector	Unit Inspected (See Key Below)	Maintenance/Cleanup Required (yes/no)	Response Action Performed (completion date)	Inspector Signature

Unit Key:
1 - Exterior Bottom Ash/Slag Piping
2 - West Ash Pond
3 - East Ash Pond
4 - Maintenance Storage Area
5 - Ash Roadways

APPENDIX C

PLAN REVIEW AND AMENDMENT RECORD

APPENDIX C

WAUKEGAN STATION

EXAMPLE CCR PLAN REVIEW/AMENDMENT RECORD

Date of Review	Reason for Review	Section Amended	P.E. Certification (Name/Date)

APPENDIX D

CITIZEN COMPLAINT LOG

APPENDIX D

WAUKEGAN STATION

EXAMPLE CITIZEN COMPLAINT LOG

Date	Time	Citizen Information (Name, Address, Phone No., Email)	Summary of Complaint	Action Taken	Recorded By

ATTACHMENT 9
GROUNDWATER MONITORING INFORMATION

Attachment 9-1 – Local Well Stratigraphy Information

Attachment 9-1.
Local Well Stratigraphy Information. Midwest Generation, LLC, Waukegan Generating Station, Waukegan, IL.

ID	Well_Count	Well_ID	From	To	Description
1	1	120974156100	0	5	gray sand loam w/gravel fill
2		120974156100	5	7	mucky black sandy loam w/fibers
3		120974156100	7	9	medium dense fine grained brown sandy loam
4		120974156100	9	11	very dense medium grained brown sand
5		120974156100	11	14	very dense fine to medium grained gray sandy loam
6		120974156100	14	16.5	medium dense fine grained gray sandy loam
7		120974156100	16.5	25.5	very dense fine to medium grained gray sand
8		120974156100	25.5	26	very dense gray silty loam
9	2	120974156700	0	3.5	black cinders fill
10		120974156700	3.5	4.5	brown gravel fill w/broken concrete
11		120974156700	4.5	7	very loose brown cinders fill
12		120974156700	7	9.5	very loose brown peat
13		120974156700	9.5	12	loose fine grained brown sand loam
14		120974156700	12	17	very dense fine grained gray sand
15		120974156700	17	19.5	dense fine grained gray sand
16		120974156700	19.5	24.5	very dense fine grained gray sand
17		120974156700	24.5	26.5	hard pebbly gray silt loam till
18	3	120974156800	0	6.5	very loose cinders fill
19		120974156800	6.5	9.5	very loose sandy fill
20		120974156800	9.5	11.5	loose medium grained brown sand loam
21		120974156800	11.5	14	medium dense fine grained gray gravel
22		120974156800	14	16.5	dense fine to medium grained brown sand
23		120974156800	16.5	19.5	medium dense fine grained brown sand
24		120974156800	19.5	21.5	loose fine grained brown sand
25		120974156800	21.5	24	very dense fine to medium grained brown sand
26		120974156800	24	26	very dense gray silt
27	4	120974156500	0	9.5	very loose black cinders fill
28		120974156500	9.5	12	very soft brown peat
29		120974156500	12	14.5	medium dense fine grained gray sand
30		120974156500	14.5	19.5	very dense fine to medium grained gray sand
31		120974156500	19.5	22	dense fine to medium grained brown sand
32		120974156500	22	26.5	very dense fine to medium grained brown sand
33	5	120974156600	0	6.5	very loose black cinders fill
34		120974156600	6.5	9	very loose brown sand loam
35		120974156600	9	11.5	loose brown sand loam
36		120974156600	11.5	14	medium dense medium grained brown sand
37		120974156600	14	16.5	dense medium grained brown sand
38		120974156600	16.5	19	very dense medium grained brown sand
39		120974156600	19	21.5	medium dense medium grained brown sand
40		120974156600	21.5	24	hard pebbly gray silty clay loam till
41		120974156600	24	26	hard gray silt loam
42	6	120974157200	0	1.5	cinder & fly ash fill
43		120974157200	1.5	4.5	loose red cinders fill
44		120974157200	4.5	7.5	loose brown & black cinder fill
45		120974157200	7.5	12.5	medium dense brown sandy loam
46		120974157200	12.5	22.5	dense brown sand
47		120974157200	22.5	23.5	dense gray silt loam
48	7	120974157300	0	7	very loose cinders fill
49		120974157300	7	9.5	medium dense brown sand
50		120974157300	9.5	12	loose brown sand
51		120974157300	12	14.5	dense brown sand
52		120974157300	14.5	17	medium dense brown sand
53		120974157300	17	19.5	very dense brown sand
54		120974157300	19.5	26.5	very dense gray silt
55	8	120974156900	0	1	black cinders fill
56		120974156900	1	6	very soft black peat
57		120974156900	6	9.5	loose fine grained gray sand loam
58		120974156900	9.5	12	medium dense fine grained gray sand loam
59		120974156900	12	14.5	very dense fine to medium grained gray sand
60		120974156900	14.5	17.5	dense fine to medium grained gray sand
61		120974156900	17.5	19.5	hard pebbly gray silty clay
62		120974156900	19.5	26.5	hard gray silt loam
63	9	120974157000	0	7.5	loose black cinders & flyash fill
64		120974157000	7.5	10	very loose brown cinder fill
65		120974157000	10	12.5	loose black organic sandy loam mixed with cinders
66		120974157000	12.5	17.5	medium dense brown sandy loam with some cinders inter mixed
67		120974157000	17.5	22.5	dense brown sand
68		120974157000	22.5	25	very dense brown sand
69		120974157000	25	27.5	very dense gray silt loam
70		120974157000	27.5	30	hard gray silt loam
71		120974157000	30	32	very dense gray silt loam

72	10	120970172800	0	30	sand
73		120970172800	30	55	hardpan
74		120970172800	55	105	clay, blue
75		120970172800	105	108	sand
76		120970172800	108	108	rock at
77	11	120970172900	0	34	sand
78		120970172900	34	55	hardpan
79		120970172900	55	98	clay, blue
80		120970172900	98	112	sand & gravel
81		120970172900	112	127	rock
82	12	120974157100	0	7.5	black cinder fill
83		120974157100	7.5	9.5	very soft black & brown muck w/sand seams
84		120974157100	9.5	17.5	medium dense brown sand
85		120974157100	17.5	20	dense brown sand
86		120974157100	20	24	medium dense brown sand
87		120974157100	24	27	very dense gray silt loam
88	13	120974156400	0	3.5	black cindery fill
89		120974156400	3.5	7	medium dense brown sandy loam topsoil
90		120974156400	7	14	medium dense fine grained brown sandy loam
91		120974156400	14	20	dense fine to medium grained brown sand
92		120974156400	20	25	very dense fine grained brown sand
93		120974156400	25	32	hard gray silty loam
94	14	120974120400	0	112	no record
95		120974120400	112	840	limestone
96		120974120400	840	1150	St. Peter
97		120974120400	1150	1540	Dresback
98		120974120400	1540	1540	Mt. Simon
99	15	120973561700	0	12	light brown, fine/medium sand
100		120973561700	12	15	gray, fine/medium sand w/fine gravel
101	16	120973561800	0	5	black fine/medium sand
102		120973561800	5	13	brown fine/medium sand
103	17	120974802700	0	2	Silty sand, trace clay and organic matter, dark gray, moist, loose
104		120974802700	2	6	Fine to medium sand, trace gravel - brown, wet, medium dense
105		120974802700	6	13	Fine to medium sand, trace gravel - brown to brown-gray - wet - dense to very dense
106	18	120974802800	0	4	Fill
107		120974802800	4	10	Fine to medium sand, wet, medium
108		120974802800	10	17	Fine to medium sand, trace gravel, very dense
109	19	120973562100	0	23	gray fine/medium sand
110		120973562100	23	40	gray very fine sand & silt
111	20	120974645500	0	0.5	4" asphalt
112		120974645500	0.5	1	sand,dark gray
113		120974645500	1	6	silty clay,gray,tough
114		120974645500	6	11	silt,trace gravel & clay,gray,hard(estimated),moist to wet
115		120974645500	11	38	silty & sandy clay,trace gravel,with horizontal seams of sand & light gray silt
116		120974645500	38	41	silty,very fine sand,gray,hard(estimated),moist
117	21	120973561900	0	4	black fine/medium sand w/debris fill mat
118		120973561900	4	14	brown fine/medium sand
119	22	120973562000	0	14	fn/med grayish sand w/trace of gvl
120	23	120970264200	0	4.5	black cinders fill
121		120970264200	4.5	6	soft black peat
122		120970264200	6	12	medium dense fine to medium grained gray sand loam
123		120970264200	12	14.5	dense medium grained gray sand
124		120970264200	14.5	17	very dense medium grained brown sand
125		120970264200	17	19.5	medium dense medium grained brown sand
126		120970264200	19.5	22	very dense medium grained brown sand
127		120970264200	22	26.5	hard gray silt loam
128	24	120975335000	0	1	Miscellaneous fill
129		120975335000	1	38	Gray silty clay till, horizontal seams of silt and fine sand tough to hard
130		120975335000	38	41	Gray, silty, very fine sand
131	25	120974646200	0	0.5	1" asphalt, 5" concrete
132		120974646200	0.5	18	fine to medium sand,trace gravel,& silt,brown & slightly gray,dense to very dense,moist to wet
133		120974646200	18	42	silty clay,trace to some sand,trace gravel,with pockets of light gray silt, hard

134	26	120970173400	0	112	lake sand
135		120970173400	112	303	lime hard
136		120970173400	303	320	red rock
137		120970173400	320	365	lime sandy, water here
138		120970173400	365	550	shale blue
139		120970173400	550	600	lime hard
140		120970173400	600	650	lime brn, sndy, water here-hole 1/2 full
141		120970173400	650	700	lime brown, fairly hard
142		120970173400	700	750	lime gray, hard
143		120970173400	750	800	lime gray, very hard
144		120970173400	800	840	lime grayish-blue, hard
145		120970173400	840	900	sand coarse, water here
146		120970173400	900	950	sand wht f, more water-hole nearly full
147		120970173400	950	1000	sand f, water bearing, well running over
148		120970173400	1000	1010	red rock
149		120970173400	1010	1040	lime, sandy, brown, hard
150		120970173400	1040	1050	red rock
151		120970173400	1050	1100	lime, sandy, gray
152		120970173400	1100	1105	shale green
153		120970173400	1105	1150	lime, sandy, firm
154		120970173400	1150	1255	sand white
155		120970173400	1255	1270	lime, brown, sandy, firm, water here
156		120970173400	1270	1275	slate green
157		120970173400	1275	1345	12 1/2" hole; lime, gray, very hard
158	27	120975335100	0	8	Gray fine, sand, fill trace clay
159		120975335100	8	16	Gray, fine sand, trace clay
160		120975335100	16	21	Gray brown, fine sand, trace silt and gravel, medium dense
161	28	120974801200	0	14	Fill
162	29	120974750300	0	9.5	black-brown fine to coarse sand w/fine gravel
163	30	120974799000	0	5	fill
164		120974799000	7	11	sand
165		120974799000	11	13	sand and gravel
166		120974799000	13	17	sand
167		120974799000	17	23	sand and gravel
168	31	120974799100	10	25	sand
169	32	120974799900	0	0.5	Silty clayey topsoil, trace roots and sand
170		120974799900	0.5	2	Fine to med. sand, trace to some gravel, silt, clay
171		120974799900	2	6	Fine to medium sand, trace silt, organic material
172		120974799900	6	9.5	Fine to med. sand, trace silt, gravel
173		120974799900	9.5	18	Fine to medium sand trace silt
174		120974799900	18	26.5	Fine sand, trace silt
175	33	120974800000	0	1	topsoil
176		120974800000	1	9.5	Fine sand, trace silt, and gravel
177		120974800000	9.5	18.5	sand and gravel
178		120974800000	18.5	26.5	sand, silt, gravel
179	34	120974799500	0	3.5	topsoil
180		120974799500	3.5	8.5	sand and silt
181		120974799500	8.5	18	sand and gravel
182		120974799500	18	26.5	sand and silt
183	35	120974799600	0	0.5	topsoil
184		120974799600	0.5	18	sand and gravel
185		120974799600	18	26.5	sand and silt
186	36	120974800300	0	0.5	topsoil
187		120974800300	2	3.5	sand and organic materials
188		120974800300	3.5	9.5	sand
189		120974800300	9.5	18.5	sand and gravel
190		120974800300	18.5	26.5	sand and silt
191	37	120974800400	0	1	topsoil
192		120974800400	1	2	sand
193		120974800400	2	26.5	sand and gravel
194	38	120974800100	0	0.5	topsoil
195		120974800100	0.5	3	cinder and clay
196		120974800100	3	18.5	sand and gravel
197		120974800100	18.5	27	sand and silt
198	39	120974753700	0	9	sludge, brick, concrete (6.5-9 moist)
199		120974753700	9	13	wood
200		120974753700	13	15.5	sand, fine, black, waterbearing
201	40	120974754200	0	14	sludge
202		120974754200	14	20	sludge, moist w/wet lense like areas
203		120974754200	20	22.8	gravel fine to medium, fill
204		120974754200	22.8	23	shingles
205		120974754200	23	29	shingles, gravel, sludge
206		120974754200	29	30.5	sand, fine, black, waterbearing

207	41	120970173700	0	166	drift
208		120970173700	166	174	rock
209	42	120970173500	0	95	drift rock at 95'
210		120970173500	95	95	drift rock at 95'
211	43	120970173200	0	95	drift rock at 95'
212		120970173200	95	95	drift rock at 95'
213	44	120970173300	0	100	drift
214		120970173300	100	101	rock
215	45	120974805200	0.5	13.5	fill
216		120974805200	13.5	16.5	peat
217		120974805200	16.5	18.5	sand and clay
218		120974805200	18.5	25.5	sand and silt
219		120974805200	25.5	27	silt, clay, and sand - wet
220	46	120974799800	0	1	topsoil
221		120974799800	1	24	sand and gravel
222		120974799800	24	41.5	sand and silt
223	47	120974751900	0	29	sand
224		120974751900	29	40	sand and clay
225	48	120974758100	0	11	sand and gravel
226		120974758100	11	31.5	sand and gravel - Saturated
227		120974758100	31.5	34	silt and gravel
228		120974758100	34	36	clay, gravel, and silt
229	49	120974755700	0	8	gray, fine sand, fill trace clay
230		120974755700	8	16	gray, fine sand, trace clay
231		120974755700	16	21	Gray brown, fine sand, trace silt and gravel, medium dense
232	50	120974755800	0	1	topsoil
233		120974755800	1	31	sand and gravel
234		120974755800	31	43	clay and gravel
235	51	120974759000	0	3.5	fill
236		120974759000	3.5	23	sand and gravel
237		120974759000	23	38.5	sand and silt
238		120974759000	38.5	40	silt and clay
239	52	120974758800	0	23	sand
240		120974758800	23	39.5	sand and silt
241	53	120974759500	0	4	fill
242		120974759500	4	39.5	sand and gravel
243		120974759500	39.5	40.2	silt and clay
244	54	120974759200	0	3	fill
245		120974759200	3	15	sand and gravel
246	55	120974753500	0	16.5	sludge
247		120974753500	16.5	19	sand, fine, shingle sand, moist
248		120974753500	19	26.5	sludge, moist
249		120974753500	26.8	28	sludge w/2" layer of shingle sand
250		120974753500	28	31.5	sludge
251		120974753500	31.5	34	sludge, marl, sand, layered
252		120974753500	34	35.5	sand & gravel layers, black
253	56	120974753600	0	2.5	road gravel, cinders
254		120974753600	2.5	5	sand fine to medium, black, waterbearing
255		120974753600	5	9	sand fine to medium, tan, waterbearing
256		120974753600	9	14	sand fine to medium & gravel fine to medium, waterbearing
257		120974753600	14	37	sand fine to medium, waterbearing
258		120974753600	37	39.5	sand fine to very fine, silty, waterbearing
259		120974753600	39.5	40	clay, occasional stone, gray
260	57	120974755000	0	0.5	asphalt
261		120974755000	0.5	3	fill-tan/brown silty sand w/some gravel
262		120974755000	3	5	fill-gray silty clay w/gravel
263		120974755000	5	15	gray fine silty sand w/trace gravel
264	58	120974753400	0	9	sludge, fiber
265		120974753400	9	26.5	sludge, fiber, moist
266		120974753400	26.5	30.5	sand, black tar like w/some stones & service board
267	59	120974750500	0	1.5	cinder fill material
268		120974750500	1.5	10	light gray-green fine to medium sand
269	60	120974758000	0	2.5	silt and clay
270		120974758000	2.5	6	sand
271		120974758000	6	15	sand and gravel
272	61	120970173000	0	30	sand
273		120970173000	30	55	hardpan
274		120970173000	55	102	clay, blue
275		120970173000	102	115	sand & gravel
276		120970173000	115	132	rock

277	62	120970173100	0	50	sand
278		120970173100	50	60	hardpan
279		120970173100	60	97	clay, blue
280		120970173100	97	115	sand & gravel
281		120970173100	115	132	rock
282	63	MW-01	0	13.5	FILL: Brown fine sand, fine gravel, black, cinders, ash
283		MW-01	13.5	16	FILL: Light Brown fine and medium sand, dry
284		MW-01	16	18	FILL: Occasional black coal, cinders
285		MW-01	18	20	FILL: Brown fine sand, occasional black cinders
286		MW-01	20	25	SM: Light brown fine sand, trace medium sand, medium dense, moist
287		MW-01	25	29	SM: Trace fine gravel
288		MW-01	29	32	SM: Fine Sand, trace coarse to medium sand, medium dense, saturated
289	64	MW-02	0	11	FILL: Black coal cinders, ash, fine sand, fine gravel, gray silt
290		MW-02	11	18.5	SM: Light brown fine sand, gray fine sand
291		MW-02	18.5	21.5	SM: Light brown fine sand, trace medium sand, well graded
292		MW-02	21.5	24.5	SM: Medium dense, dry
293		MW-02	24.5	30	Trace fine gravel and coarse sand
294	65	MW-03	0	7	FILL: Brown silty sand, fine gravel, black coal cinders, ash
295		MW-03	7	15	FILL: Gray silt, cinders, ash, sand
296		MW-03	15	16	FILL: Light brown fine sand
297		MW-03	16	18.5	FILL: Black coarse coal cinders
298		MW-03	18.5	20	SM: Light Brown fine sand
299		MW-03	20	24	SM: Light brown fine sand, trace medium sand, well graded, medium dense
300		MW-03	24	30	SM: Trace fine gravel
301	66	MW-04	0	9	FILL: Dark brown silt, coarse gravel, black coal cinders, dry
302		MW-04	9	13	FILL: Wood, gray silt, cinders, dry
303		MW-04	13	15	FILL: Some medium sand
304		MW-04	15	18.5	FILL: Cinders mixed with brown fine sand
305		MW-04	18.5	29.58	SM: Light brown fine sand, well graded, medium dense
306		MW-04	29	30	SM: Trace fine gravel, trace coarse sand
307	67	MW-05	0	0.5	FILL: Dark brown silty clay topsoil
308		MW-05	0.5	7	FILL: Brown fine to medium sand, with black coal cinders
309		MW-05	7	9	FILL: Loose
310		MW-05	9	11	FILL: Brick
311		MW-05	11	14	FILL: Black coal cinders
312		MW-05	14	16	FILL: Dark gray silt
313		MW-05	16	17	FILL: Gray medium sand, black coal cinders
314		MW-05	17	21	SM: Gray fine sand, trace medium to coarse sand, wel graded, loose to medium dense, saturated
315		MW-05	21	26	GP: Gray fine gravel, coarse sand, poorly graded, medium dense, saturated
316		MW-05	26	31.92	SM: Gray fine sand, trace medium sand, trace fine gravel, well graded, medium dense
317	68	MW-09	0	0.5	FILL: Black Clay/Silt/Fine grained Sand mix, moist
318		MW-09	0.5	4	FILL: Gray Silt, dry
319		MW-09	4	6	FILL: Begin dark gray
320		MW-09	6	9.5	FILL: Black slag
321		MW-09	9.5	10.5	Peat, black silty clay with organics, wet
322		MW-09	10.5	13	light gray silty sand, fine to medium grained with trace coarse grained, organics
323		MW-09	13	18	brown silty sand, fine to medium grained with trace coarse grained
324	69	MW-16	0	0.5	FILL: Dark brown clayey top soil, dry
325		MW-16	0.5	1	FILL: Brown Sand/Silt/gravel mix, dry
326		MW-16	1	2.5	FILL: Brown Silty Sand, slighly moist
327		MW-16	2.5	9	FILL: Brown and dark gray silt, and fine sand, some cinders, slightly moist
328		MW-16	9	11	FILL: Orange brown SILTY SAND, medium grained, slightyly moist
329		MW-16	11	16	FILL: Dark Brown to Black SAND, fine to medium, cinders, trace silt, slightly moist
330		MW-16	16	17	FILL: Tan SILTY SAND, with gray SILT layers, slightly moist
331		MW-16	17	18	FILL: Gray SILT, some black, very moist
332		MW-16	18	24	FILL: Black SAND, fine to medium, cinders, slightly moist
333		MW-16	24	30	Brown SILTY SAND, fine to medium, moist

Attachment 9-2 – Boring Logs

PATRICK ENGINEERING INC.

BORING NUMBER **B-MW-1-Wa** SHEET **1** OF **2**
CLIENT **Midwest Generation**
PROJECT & NO. **21053.070**
LOCATION **Waukegan**

LOGGED BY **MPG**
GROUND ELEVATION **23.5**

ELEVATION	DEPTH (FT)	STRATA	SOIL/ROCK DESCRIPTION	SAMPLE TYPE & NO. DEPTH (FT) RECOVERY(IN)	BLOW COUNTS	Water Content PL □ - - ○ - - △ LL (10 20 30 40 50) / Unconfined Compressive Strength (TSF) ✱ (1 2 3 4 5)	NOTES & TEST RESULTS
23.5	0.0		Brown fine sand, fine gravel, black cinders, ash FILL				
				SS-1 1.0-2.5 16"R	3 5 7		qu=NT Bentonite seal 2.0'-20.0'. Stickup protective cover installed.
			Dry	SS-2 3.5-5.0 18"R	6 10 13		qu=NT
				SS-3 6.0-7.5 14"R	6 11 16		qu=NT
			Dry	SS-4 8.5-10.0 12"R	4 9 10		qu=NT
				SS-5 11.0-12.5 16"R	2 3 3		qu=NT
10.0	13.5		Light brown fine and medium sand, dry FILL	SS-6 13.5-15.0 18"R	2 4 3		qu=NT
			Occasional black coal, cinders	SS-7 16.0-17.5 18"R	3 4 4		qu=NT
			Brown fine sand, occasional black cinders	SS-8 18.5-20.0 18"R	6 7 9		qu=NT
3.5	20.0						

DRILLING CONTRACTOR **Groff Testing**
DRILLING METHOD **4.25" I.D. HSA**
DRILLING EQUIPMENT **CME 550 ATV**
DRILLING STARTED **10/13/10** ENDED **10/13/10**

REMARKS
Installed 2" diameter PVC monitoring well.

WATER LEVEL (ft.)
∇ **23.5**
▼
▼

PATRICK ENGINEERING INC.

BORING NUMBER **B-MW-1-Wa** SHEET **2** OF **2**
CLIENT **Midwest Generation**
PROJECT & NO. **21053.070**
LOCATION **Waukegan**

LOGGED BY **MPG**
GROUND ELEVATION **23.5**

ELEVATION	DEPTH (FT)	STRATA	SOIL/ROCK DESCRIPTION	SAMPLE TYPE & NO. DEPTH (FT) RECOVERY(IN)	BLOW COUNTS	PL — Water Content — LL (10 20 30 40 50) / Unconfined Compressive Strength (TSF) ✳ (1 2 3 4 5)	NOTES & TEST RESULTS
3.5	20.0		Light brown fine sand, trace medium sand, medium dense, moist SM				Sand pack 20.0'-32.0'
				SS-9 21.0-22.5 18"R	5 8 10		qu=NT Set screen (slot 0.010") 22.0'-32.0'
0.0	23.5		∇ Saturated	SS-10 23.5-25.0 18"R	6 9 10		qu=NT
			Trace fine gravel				
				SS-11 26.0-27.5 18"R	5 6 12		qu=NT
			Fine sand, trace coarse to medium sand, medium dense, saturated	SS-12 28.5-30.0 18"R	6 9 13		qu=NT
-8.5	32.0						
			End of Boring at 32.0'				

DRILLING CONTRACTOR **Groff Testing**
DRILLING METHOD **4.25" I.D. HSA**
DRILLING EQUIPMENT **CME 550 ATV**
DRILLING STARTED **10/13/10** ENDED **10/13/10**

REMARKS
Installed 2" diameter PVC monitoring well.

WATER LEVEL (ft.)
∇ 23.5
∇
▼

PATRICK ENGINEERING INC.

BORING NUMBER **B-MW-2-Wa** SHEET **1** OF **2**
CLIENT **Midwest Generation**
PROJECT & NO. **21053.070**
LOCATION **Waukegan**

LOGGED BY **MPG**
GROUND ELEVATION **23.0**

ELEVATION	DEPTH (FT)	STRATA	SOIL/ROCK DESCRIPTION	SAMPLE TYPE & NO. DEPTH (FT) RECOVERY(IN)	BLOW COUNTS	Water Content (PL □ ○ △ LL; 10 20 30 40 50) / Unconfined Compressive Strength (TSF) ✳ (1 2 3 4 5)	NOTES & TEST RESULTS
23.0	0.0		Black coal cinders, ash, fine sand, fine gravel, gray silt FILL				
				SS-1 1.0-2.5 14"R	4 10 15		qu=NT
							Bentonite seal 2.0'-19.0'. Stickup protective cover installed.
			Dry	SS-2 3.5-5.0 14"R	8 10 23		qu=NT
				SS-3 6.0-7.5 14"R	12 11 16		qu=NT
			Dry	SS-4 8.5-10.0 18"R	7 12 14		qu=NT
12.0	11.0		Light brown fine sand, gray fine sand	SS-5 11.0-12.5 18"R	12 13 13		qu=NT
				SS-6 13.5-15.0 18"R	1 3 6		qu=NT
				SS-7 16.0-17.5 18"R	8 10 10		qu=NT
			Dry				
4.5	18.5		Light brown fine sand, trace medium sand, well graded SM	SS-8 18.5-20.0 18"R	9 12 14		qu=NT Sand pack 19.0'-30.0'

DRILLING CONTRACTOR **Groff Testing**
DRILLING METHOD **4.25" I.D. HSA**
DRILLING EQUIPMENT **CME 550 ATV**
DRILLING STARTED **10/13/10** ENDED **10/13/10**

REMARKS
Installed 2" diameter PVC monitoring well.

WATER LEVEL (ft.)
▽ **21.5**
▼
▼

PATRICK ENGINEERING INC.	
BORING NUMBER	B-MW-2-Wa
SHEET	2 OF 2
CLIENT	Midwest Generation
PROJECT & NO.	21053.070
LOCATION	Waukegan
LOGGED BY	MPG
GROUND ELEVATION	23.0

ELEVATION	DEPTH (FT)	STRATA	SOIL/ROCK DESCRIPTION	SAMPLE TYPE & NO. DEPTH (FT) RECOVERY(IN)	BLOW COUNTS	PL □ Water Content ○ LL △ (10 20 30 40 50) / Unconfined Compressive Strength (TSF) ✳ (1 2 3 4 5)	NOTES & TEST RESULTS
3.0	20.0						Set screen (slot 0.010") 20.0'-30.0'
1.5	21.5		∇ Saturated	SS-9 21.0-22.5 18"R	6 10 11		qu=NT
			Medium dense, dry				
			Trace fine gravel and coarse sand	SS-10 23.5-25.0 18"R	3 7 12		qu=NT
				SS-11 26.0-27.5 18"R	4 7 13		qu=NT
				SS-12 28.5-30.0 18"R	2 8 12		qu=NT
-7.0	30.0		End of Boring at 30.0'				

DRILLING CONTRACTOR **Groff Testing**
DRILLING METHOD **4.25" I.D. HSA**
DRILLING EQUIPMENT **CME 550 ATV**
DRILLING STARTED **10/13/10** ENDED **10/13/10**

REMARKS
Installed 2" diameter PVC monitoring well.

WATER LEVEL (ft.)
∇ **21.5**
▼
▼

PATRICK ENGINEERING INC.

BORING NUMBER **B-MW-3-Wa** SHEET **1** OF **2**
CLIENT **Midwest Generation**
PROJECT & NO. **21053.070**
LOCATION **Waukegan**

LOGGED BY **MPG**
GROUND ELEVATION **23.2**

ELEVATION	DEPTH (FT)	STRATA	SOIL/ROCK DESCRIPTION	SAMPLE TYPE & NO. DEPTH (FT) RECOVERY(IN)	BLOW COUNTS	Water Content (PL □ — ○ — △ LL; 10 20 30 40 50) / Unconfined Compressive Strength (TSF) ✳ (1 2 3 4 5)	NOTES & TEST RESULTS
23.2	0.0		Brown silty sand, fine gravel, black coal cinders, ash FILL				
				SS-1 1.0-2.5 16"R	7 13 16		qu=NT Bentonite seal 2.0'-19.0'. Stickup protective cover installed.
			Dry	SS-2 3.5-5.0 18"R	9 16 18		qu=NT
			Gray silt, cinders, ash, sand	SS-3 6.0-7.5 14"R	15 20 26/4.5"		qu=NT
				SS-4 8.5-10.0 18"R	9 16 18		qu=NT
				SS-5 11.0-12.5 18"R	6 10 12		qu=NT
				SS-6 13.5-15.0 18"R	3 4 9		qu=NT
			Light brown fine sand Black coarse coal cinders	SS-7 16.0-17.5 18"R	7 7 9		qu=NT
4.7	18.5		Light brown fine sand SM	SS-8 18.5-20.0 18"R	6 7 12		Sand pack 19.0'-20.0'
3.2	20.0						

DRILLING CONTRACTOR **Groff Testing**
DRILLING METHOD **4.25" I.D. HSA**
DRILLING EQUIPMENT **CME 550 ATV**
DRILLING STARTED **10/13/10** ENDED **10/13/10**

REMARKS
Installed 2" diameter PVC monitoring well.

WATER LEVEL (ft.)
▽ **21.0**
▼
▼

PATRICK ENGINEERING INC.

BORING NUMBER **B-MW-3-Wa** SHEET **2** OF **2**
CLIENT **Midwest Generation**
PROJECT & NO. **21053.070**
LOCATION **Waukegan**

LOGGED BY **MPG**
GROUND ELEVATION **23.2**

ELEVATION	DEPTH (FT)	STRATA	SOIL/ROCK DESCRIPTION	SAMPLE TYPE & NO. DEPTH (FT) RECOVERY(IN)	BLOW COUNTS	Water Content: PL □ – – ○ – – △ LL (10, 20, 30, 40, 50); Unconfined Compressive Strength (TSF) ✳ (1, 2, 3, 4, 5)	NOTES & TEST RESULTS
3.2	20.0		Light brown fine sand, trace medium sand, well graded, medium dense				Set screen (slot 0.010") 20.0'-30.0'
2.2	21.0		∇ SM Saturated	SS-9 21.0-22.5 18"R	4 6 10		qu=NT
			Trace fine gravel	SS-10 23.5-25.0 18"R	4 6 10		qu=NT
				SS-11 26.0-27.5 18"R	6 7 16		qu=NT
				SS-12 28.5-30.0 18"R	6 12 14		qu=NT
-6.8	30.0		End of Boring at 30.0'				

DRILLING CONTRACTOR **Groff Testing**
DRILLING METHOD **4.25" I.D. HSA**
DRILLING EQUIPMENT **CME 550 ATV**
DRILLING STARTED **10/13/10** ENDED **10/13/10**

REMARKS
Installed 2" diameter PVC monitoring well.

WATER LEVEL (ft.)
∇ **21.0**
▼
▼

PATRICK ENGINEERING INC.

BORING NUMBER **B-MW-4-Wa** SHEET **1** OF **2**
CLIENT **Midwest Generation**
PROJECT & NO. **21053.070**
LOCATION **Waukegan**

LOGGED BY **MPG**
GROUND ELEVATION **23.6**

ELEVATION	DEPTH (FT)	STRATA	SOIL/ROCK DESCRIPTION	SAMPLE TYPE & NO. DEPTH (FT) RECOVERY(IN)	BLOW COUNTS	PL □ Water Content ○ LL △ (10 20 30 40 50) / Unconfined Compressive Strength (TSF) ✳ (1 2 3 4 5)	NOTES & TEST RESULTS
23.6	0.0		Dark brown silt, coarse gravel, black coal cinders, dry FILL				
				SS-1 1.0-2.5 18"R	6 13 19		qu=NT
							Bentonite seal 2.0'-19.0'. Stickup protective cover installed.
				SS-2 3.5-5.0 17"R	8 24 21		qu=NT
				SS-3 6.0-7.5 6"R	13 31/4"		qu=NT
			Wood, gray silt, cinders, dry	SS-4 8.5-10.0 18"R	14 26 26		qu=NT
			Some medium sand	SS-5 11.0-12.5 18"R	11 14 13		qu=NT
			Cinders mixed with brown fine sand	SS-6 13.5-15.0 18"R	5 8 8		qu=NT
				SS-7 16.0-17.5 18"R	7 10 12		qu=NT
5.1	18.5		Light brown fine sand, well graded, medium dense SM	SS-8 18.5-20.0 18"R	7 11 13		qu=NT Sand pack 19.0'-30.0'

DRILLING CONTRACTOR **Groff Testing**
DRILLING METHOD **4.25" I.D. HSA**
DRILLING EQUIPMENT **CME 550 ATV**
DRILLING STARTED **10/12/10** ENDED **10/12/10**

REMARKS
Installed 2" diameter PVC monitoring well.

WATER LEVEL (ft.)
∇ 23.0
▼
▼

PATRICK ENGINEERING INC.

BORING NUMBER **B-MW-4-Wa** SHEET **2** OF **2**
CLIENT **Midwest Generation**
PROJECT & NO. **21053.070**
LOCATION **Waukegan**

LOGGED BY **MPG**
GROUND ELEVATION **23.6**

ELEVATION	DEPTH (FT)	STRATA	SOIL/ROCK DESCRIPTION	SAMPLE TYPE & NO. DEPTH (FT) RECOVERY(IN)	BLOW COUNTS	Water Content PL □ --- ○ --- △ LL (10 20 30 40 50) / Unconfined Compressive Strength (TSF) ✳ (1 2 3 4 5)	NOTES & TEST RESULTS
3.6	20.0						Set screen (slot 0.010") 20.0'-30.0'
			Moist	SS-9 21.0-22.5 18"R	4 6 6		qu=NT
0.6	23.0		⊻ Saturated				
				SS-10 23.5-25.0 18"R	4 4 8		qu=NT
				SS-11 26.0-27.5 18"R	8 8 10		qu=NT
			Trace fine gravel, trace coarse sand	SS-12 28.5-30.0 18"R	7 8 12		qu=NT
-6.4	30.0		End of Boring at 30.0'				

DRILLING CONTRACTOR **Groff Testing**
DRILLING METHOD **4.25" I.D. HSA**
DRILLING EQUIPMENT **CME 550 ATV**
DRILLING STARTED **10/12/10** ENDED **10/12/10**

REMARKS
Installed 2" diameter PVC monitoring well.

WATER LEVEL (ft.)
⊻ 23.0
⊻
⊻

PATRICK ENGINEERING INC.

BORING NUMBER **B-MW-5-Wa** SHEET **1** OF **2**
CLIENT **Midwest Generation**
PROJECT & NO. **21053.070**
LOCATION **Waukegan**

LOGGED BY **MPG**
GROUND ELEVATION **21.5**

ELEVATION	DEPTH (FT)	STRATA	SOIL/ROCK DESCRIPTION	SAMPLE TYPE & NO. DEPTH (FT) RECOVERY(IN)	BLOW COUNTS	PL □ Water Content ○ LL △ (10 20 30 40 50) / Unconfined Compressive Strength (TSF) ✳ (1 2 3 4 5)	NOTES & TEST RESULTS
21.5 21.0	0.0 0.5		Dark brown silty clay topsoil FILL				
			Black coal cinders, medium sand FILL	SS-1 1.0-2.5 14"R	6 10 10		qu=NT Bentonite seal 2.0'-18.0'. Stickup protective cover installed.
			Dry	SS-2 3.5-5.0 14"R	4 6 5		qu=NT
			Brown fine to medium sand, with black coal cinders	SS-3 6.0-7.5 16"R	2 6 8		qu=NT
			Loose	SS-4 8.5-10.0 18"R	2 2 2		qu=NT
			Brick Moist	SS-5 11.0-12.5 18"R	1 2 1		qu=NT
			Black coal cinders	SS-6 13.5-15.0 17"R	1 2 1		qu=NT
			Dark gray silt	SS-7 16.0-17.5 18"R	4 2 2		qu=NT
4.5	17.0		Gray medium sand, black coal cinders				
			Gray fine sand, trace medium to coarse sand, well graded, loose to medium dense, saturated SM	SS-8 18.5-20.0	4 4 5		Sand pack 18.0'-30.0' Set screen (slot 0.010") 18.5'-28.5'

DRILLING CONTRACTOR **Groff Testing**
DRILLING METHOD **4.25" I.D. HSA**
DRILLING EQUIPMENT **CME 550 ATV**
DRILLING STARTED **10/12/10** ENDED **10/12/10**

REMARKS
Installed 2" diameter PVC monitoring well.

WATER LEVEL (ft.)
∇ **21.0**
▼
▼

PATRICK ENGINEERING INC.

BORING NUMBER **B-MW-5-Wa** SHEET **2** OF **2**
CLIENT **Midwest Generation**
PROJECT & NO. **21053.070**
LOCATION **Waukegan**
LOGGED BY **MPG**
GROUND ELEVATION **21.5**

ELEVATION	DEPTH (FT)	STRATA	SOIL/ROCK DESCRIPTION	SAMPLE TYPE & NO. DEPTH (FT) RECOVERY(IN)	BLOW COUNTS	Water Content (PL □ 10 20 30 40 50 LL △) / Unconfined Compressive Strength (TSF) ✳ 1 2 3 4 5	NOTES & TEST RESULTS
1.5	20.0						
0.5	21.0	▽					
			Gray fine gravel, coarse sand, poorly graded, medium dense, saturated GP	SS-9 21.0-22.5 16"R	5 7 8		qu=NT
				SS-10 23.5-25.0 18"R	6 9 8		qu=NT
-4.5	26.0						
			Gray fine sand, trace medium sand, trace fine gravel, well graded, medium dense SM	SS-11 26.0-27.5 16"R	6 8 13		qu=NT
				SS-12 28.5-30.0 18"R	7 10 13		qu=NT
-8.5	30.0		End of Boring at 30.0'				

DRILLING CONTRACTOR **Groff Testing**
DRILLING METHOD **4.25" I.D. HSA**
DRILLING EQUIPMENT **CME 550 ATV**
DRILLING STARTED **10/12/10** ENDED **10/12/10**

REMARKS
Installed 2" diameter PVC monitoring well.

WATER LEVEL (ft.)
▽ **21.0**
▼
▼

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GEOLOGIC LOG OF MW-6

(Page 1 of 1)

Midwest Generation, LLC
Waukegan Station
Waukegan, Illinois

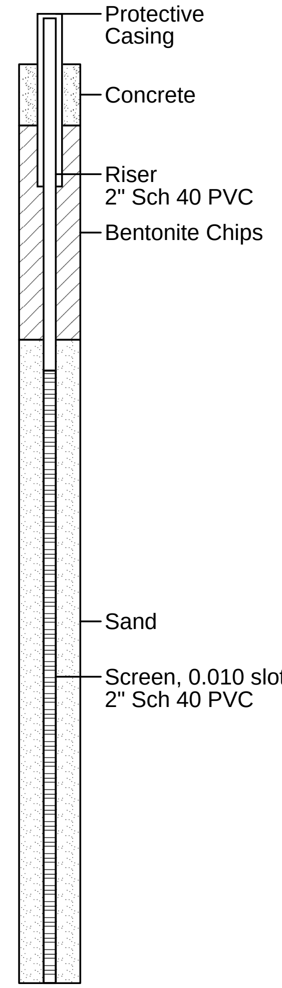
Project No. 18311.31

Date Started	: 11/19/2012
Date Well Set	: 11/19/2012
Rock Coring Tools	: Not cored
Drilling Tools	: 4.25 ID HSA
Drill Rig	: Geoprobe
Driller Name/Co	: T. Brown/Cabeno

Total Boring Depth	: 20 feet
Well Bottom Depth	: 15 feet
Surface Elev.	: 586.75 feet above MSL
TOC Elev.	: 589.73 feet above MSL
Groundwater Elev.	: 580.89 feet above MSL
Riser Material	: 2" Sch 40 PVC
Screen Material	: 2" Sch 40 PVC, 0.010 slot
Coordinate N	: 42 22' 36.90" N
Coordinate E	: 087 49' 6.7" W
Logged By	: P. Allenstein

Depth in Feet	Surf. Elev. 586.75	DESCRIPTION	% PID	% Recovery
0		FILL: Dark brown silty clay, slightly moist	0	
	585		0	
2		FILL: Brown to dark brown fine SILTY SAND, moist	0	
	583		0	
4		Black SILTY CLAY, organics, slightly moist	0	80
	581	Brown medium to fine grained SILTY SAND	0	
6		- Wet	0	
8	579		0	80
10	577		0	
12	575		0	100
14	573	- Some coarse sand	0	
16	571		0	80
18	569		0	
20	567	End of Geoprobe boring at 20', end HSA boring at 15'		
22	565			

Well Diagram: MW-6



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GEOLOGIC LOG OF MW-7

Midwest Generation, LLC
Waukegan Station
Waukegan, Illinois

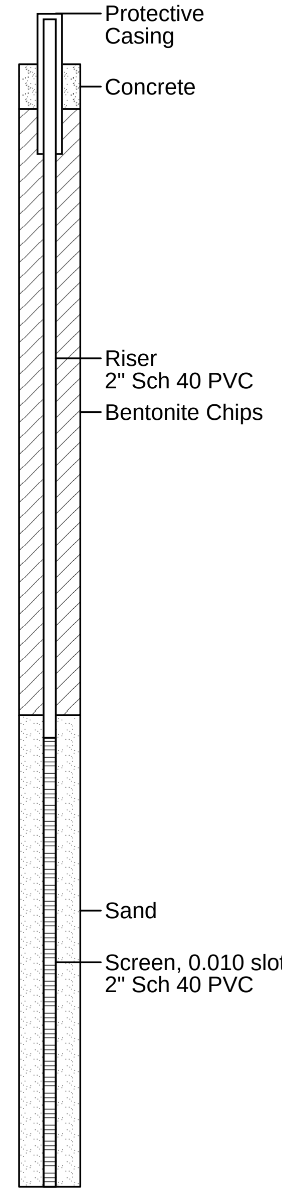
Project No. 18311.31

Date Started	: 11/19/2012
Date Well Set	: 11/19/2012
Rock Coring Tools	: Not cored
Drilling Tools	: 4.25 ID HSA
Drill Rig	: Geoprobe
Driller Name/Co	: T. Brown/Cabeno

Total Boring Depth	: 25 feet
Well Bottom Depth	: 25 feet
Surface Elev.	: 595.87 feet above MSL
TOC Elev.	: 598.29 feet above MSL
Groundwater Elev.	: 579.57 feet above MSL
Riser Material	: 2" Sch 40 PVC
Screen Material	: 2" Sch 40 PVC, 0.010 slot
Coordinate N	: 42 22' 34.00" N
Coordinate E	: 087 48' 59.70" W
Logged By	: P. Allenstein

Depth in Feet	Surf. Elev. 595.87	DESCRIPTION	PID	% Recovery
0		FILL: Brown to dark brown clay approximately 3" thick	0	
		FILL: Black medium grained sand with some reddish and gray layers, some silty layers, slightly moist	0	
2	594		0	
			0	
4	592		0	80
		FILL: Tan fine to medium grained sand with thin black layers	0	
6	590		0	
8	588		0	80
10	586	FILL: Gray silt with thin banding light to dark, slightly moist		
		Black CLAYEY SILT with organics, soft, wet	0	
12	584		0	100
14	582	Brown fine to medium grained SAND with traces of silt, slightly moist	0	
16	580	- Some gravel	0	80
		- Wet		
18	578		0	
20	576	- Some coarse gravel	0	
22	574	- Some coarse gravel	0	
24	572			
		End of boring at 25'		
26	570			
28	568			
30	566			

Well Diagram: MW-7



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Midwest Generation, LLC
Waukegan Station
Waukegan, Illinois

Project No. 20013

GEOLOGIC LOG OF MW-8

(Page 1 of 1)

Date Started	: 04/29/2014
Date Well Set	: 04/29/2014
Rock Coring Tools	: Not cored
Drilling Tools	: 4.25 ID HSA
Drill Rig	: Geoprobe
Driller Name/Co	: J. Martin/TSC

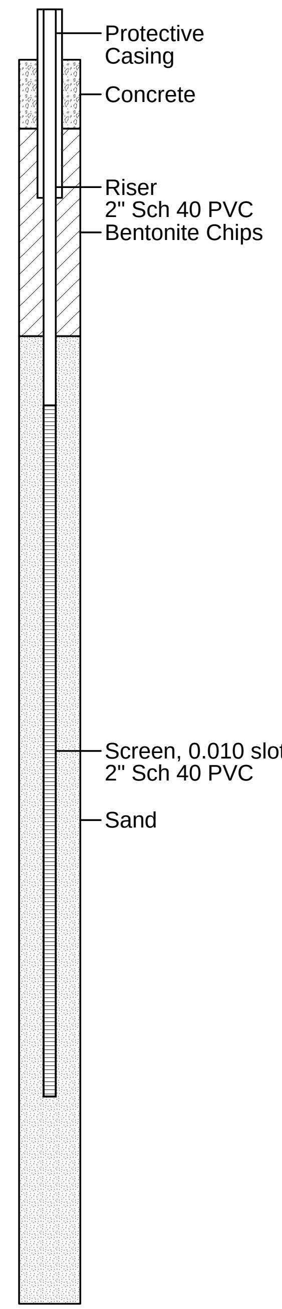
Total Boring Depth	: 18 feet
Well Bottom Depth	: 15 feet
Surface Elev.	: 588.42 feet above MSL
TOC Elev.	: 590.99 feet above MSL
Groundwater Elev.	: feet above MSL
Riser Material	: 2" Sch 40 PVC
Screen Material	: 2" Sch 40 PVC, 0.010 slot
Coordinate N	: 2080826 N
Coordinate E	: 1123351 E
Logged By	: P. Allenstein

Depth scale (Depth in Feet): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18
Surf. Elev. 588.42 scale: 586, 584, 582, 580, 578, 576, 574, 572, 570

DESCRIPTION	PID
Grass, Black clayey TOP SOIL	
FILL: Gray SILT with traces fine sand, very moist	
FILL: Brown SILT with black sandy SLAG layered	
FILL: Greenish gray SILTY SAND - thin slag layer	
Black SILT and CLAY, wet	
6" PEAT	
Gray SILTY SAND, fine to coarse grained, wet	
Brown SILTY SAND, fine to medium grained	
End of Boring at 18'	

% Recovery (by 2-ft interval, top to bottom): 100, 100, 100, 100, 50, 50, 50, 50, 50

Well Diagram: MW-8



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Midwest Generation, LLC
Waukegan Station
Waukegan, Illinois

Project No. 20013

GEOLOGIC LOG OF MW-9

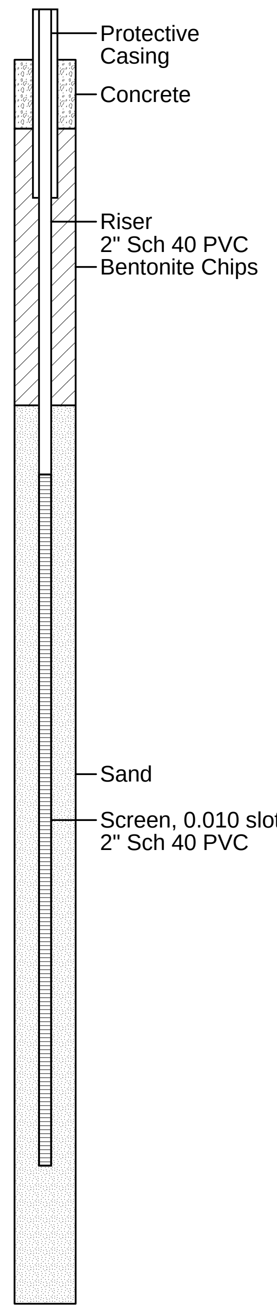
(Page 1 of 1)

Date Started	: 04/29/2014
Date Well Set	: 04/29/2014
Rock Coring Tools	: Not cored
Drilling Tools	: 4.25 ID HSA
Drill Rig	: Geoprobe
Driller Name/Co	: J. Martin/TSC

Total Boring Depth	: 18 feet
Well Bottom Depth	: 16 feet
Surface Elev.	: 591.58 feet above MSL
TOC Elev.	: 594.09 feet above MSL
Groundwater Elev.	: feet above MSL
Riser Material	: 2" Sch 40 PVC
Screen Material	: 2" Sch 40 PVC, 0.010 slot
Coordinate N	: 2081118 N
Coordinate E	: 1123540 E
Logged By	: P. Allenstein

Depth in Feet	Surf. Elev. 591.58	DESCRIPTION	PID	% Recovery
0		FILL: Black CLAY/SILT/fine grained SAND mix, moist		
0.5		FILL: Gray SILT, dry		100
2	590			75
4	588	- Begin dark gray		75
6	586	FILL: Black SLAG		100
8	584			100
9.5	582	PEAT, black SILTY CLAY with organics, wet		
10.5		Light gray SILTY SAND, fine to medium grained with trace coarse grained, organics		100
13	578	Brown SILTY SAND, fine to medium grained with trace coarse grained		
18	574	End of Boring at 18'		

Well Diagram: MW-9



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GEOLOGIC LOG OF GP MW-10

Midwest Generation, LLC
Waukegan Station
Waukegan, Illinois

Project No. 18721

Date	: 09/02/2021
Drill Rig	: Geoprobe 7822 DT
Driller	: Cabeno Environmental
Total Boring Depth	: 15 feet
Logged By	: M. Dolan

Depth in Feet	DESCRIPTION	% Recovery	REMARKS
0–2	FILL: Gray fine grained SAND, trace gravel, dry	50	
2–4	FILL: Black SLAG, medium to coarse grained, slightly moist		
4–5.5	FILL: Black/gray SILTY SAND, wet		
5.5–15	Tan/gray medium to coarse grained SILTY SAND, trace gravel, wet	65	
		100	
15	End of boring at 15'		

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

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GEOLOGIC LOG OF GP MW-11

Midwest Generation, LLC
Waukegan Station
Waukegan, Illinois

Project No. 18721

Date	: 09/02/2021
Drill Rig	: Geoprobe 7822 DT
Driller	: Cabeno Environmental
Total Boring Depth	: 15 feet
Logged By	: M. Dolan

Depth in Feet	DESCRIPTION	% Recovery	REMARKS
0	FILL: Dark brown/gray SILTY CLAY, top soil, slightly moist		
0.5	FILL: Gray fine grained SILTY SAND, slightly moist		
1.5	FILL: Black SLAG, medium to coarse grained, slightly moist		
2.5		50	
3	- wet		
6	Gray fine to medium grained SILTY SAND, trace gravel, wet		
7.5		70	
12.5		40	
15	End of boring at 15'		

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

GEOLOGIC LOG OF GP MW-12

(Page 1 of 1)

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Midwest Generation, LLC
Waukegan Station
Waukegan, Illinois

Project No. 18721

Date	: 09/02/2021
Drill Rig	: Geoprobe 7822 DT
Driller	: Cabeno Environmental
Total Boring Depth	: 15 feet
Logged By	: M. Dolan

Depth in Feet	DESCRIPTION	% Recovery	REMARKS
0	FILL: Dark brown SILTY CLAY top soil, dry		
0.5	FILL: Light brown/tan coarse SAND and GRAVEL, dry		
2	FILL: Black SLAG, medium to coarse grained, slightly moist	50	
4	- wet		
6	Peat, gray SILT, trace sand and organics, wet		
7	Tan/gray medium to coarse grained SILTY SAND, trace gravel, wet	70	
12.5		50	
15	End of boring at 15'		

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GEOLOGIC LOG OF GP MW-14

Midwest Generation, LLC
Waukegan Station
Waukegan, Illinois

Project No. 18721

Date	: 09/02/2021
Drill Rig	: Geoprobe 7822 DT
Driller	: Cabeno Environmental
Total Boring Depth	: 15 feet
Logged By	: M. Dolan

Depth in Feet	DESCRIPTION	% Recovery	REMARKS
0	FILL: Dark brown/gray SILTY CLAY, top soil, slightly moist		
0.5–3	Tan/light brown fine to medium grained SAND, trace gravel, slightly moist	50	
3–5	PEAT, red-brown SILT, trace sand and organics, wet		
5–15	Tan/gray fine to medium grained SILTY SAND, trace gravel, wet	75	
		95	
15	End of boring at 15'		

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GEOLOGIC LOG OF GP MW-15

Midwest Generation, LLC
Waukegan Station
Waukegan, Illinois

Project No. 18721

Date	: 09/02/2021
Drill Rig	: Geoprobe 7822 DT
Driller	: Cabeno Environmental
Total Boring Depth	: 15 feet
Logged By	: M. Dolan

Depth in Feet	DESCRIPTION	% Recovery	REMARKS
0	FILL: Gray/Dark Gray SILT, trace coarse sand, slightly moist	70	
4	Tan SILTY SAND, fine to medium grained, trace gravel, slightly moist		
6	- wet	50	
8.5	Tan SAND and GRAVEL, coarse grained, wet	95	
15	End of Boring at 15'		

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Midwest Generation, LLC
Waukegan Station
Waukegan, Illinois

GEOLOGIC LOG OF MW-16

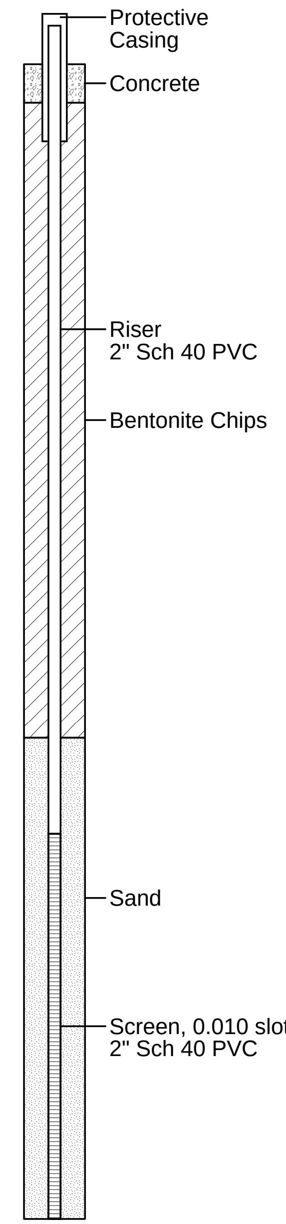
(Page 1 of 1)

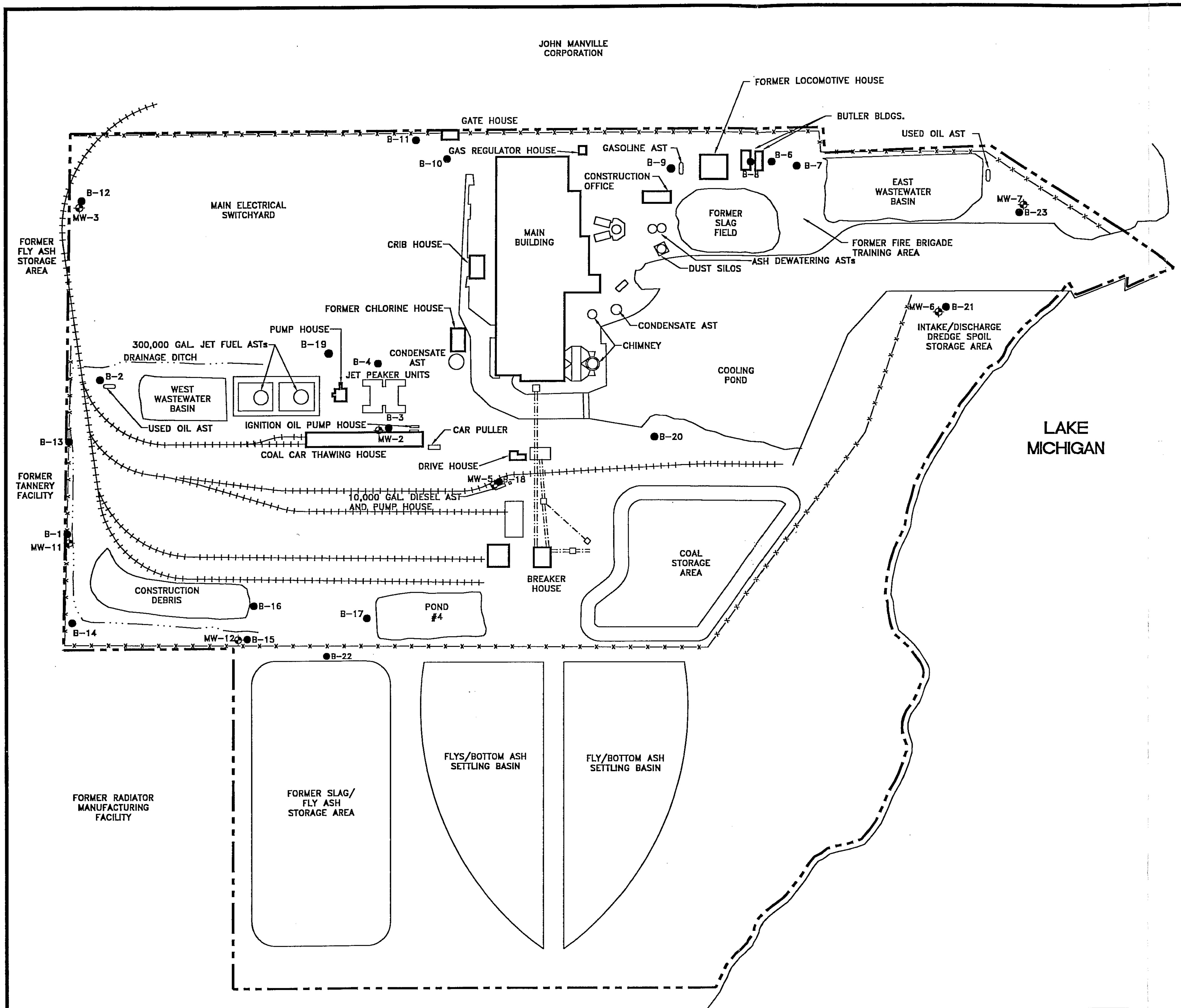
Date Started	: 10/20/2015
Date Well Set	: 10/20/2015
Rock Coring Tools	: Not cored
Drilling Tools	: 4.25 ID HSA
Drill Rig	: Geoprobe
Driller Name/Co	: N. Vissman / Cabeno

Total Boring Depth	: 35 feet
Well Bottom Depth	: 30.4 feet
Surface Elev.	: 604.52 feet above MSL
TOC Elev.	: 607.41 feet above MSL
Groundwater Elev.	: feet above MSL
Riser Material	: 2" Sch 40 PVC
Screen Material	: 2" Sch 40 PVC, 0.010 slot
Coordinate N	: 2080069.664
Coordinate E	: 1124344.912
Logged By	: P. Allenstein

Depth in Feet	Surf. Elev. 604.52	DESCRIPTION	PID	% Recovery
0	604	FILL: Dark Brown Clayey Top Soil, dry.		
		FILL: Brown SAND/SILT/GRAVEL mix, dry.		
2	602	FILL: Brown SILTY SAND, slightly moist.		75
		FILL: Brown and Dark Gray SILT, and FINE SAND, some cinders, slightly moist.		
4	600			
6	598			
8	596			100
		FILL: Orange Brown SILTY SAND, medium grained, slightly moist.		
10	594			
		FILL: Dark Brown to Black SAND, fine to medium, cinders, trace silt, slightly moist.		
12	592			100
14	590			
16	588	FILL: Tan SILTY SAND, with Gray SILT layers, slightly moist.		
		FILL: Gray SILT, some black, very moist.		75
18	586	FILL: Black SAND, fine to medium, cinders, slightly moist.		
20	584			
22	582			10
24	580	Brown SILTY SAND, fine to medium, moist.		
26	578			
28	576			10
30	574	End of Boring at 30'		
32	572			
34				

Well Diagram: MW-16





LEGEND:

- PROPERTY BOUNDARY
- RAILROAD LINE
- FENCE
- CONVEYOR LINE
- MW-2 MONITORING WELL
- B-1 SOIL BORING

Note:
• All dimensions and locations are approximate.

Source:
• ENSR field observations.

Dwg No: WAUKEGANSB

WAUKEGAN GENERATING STATION
10 GREENLAND AVENUE
WAUKEGAN, ILLINOIS

COMMONWEALTH EDISON COMPANY

November 1998 · File No: 1801-023-610

SOIL BORING/ MONITORING WELL SITE PLAN

FIGURE 5

N

NOT TO SCALE

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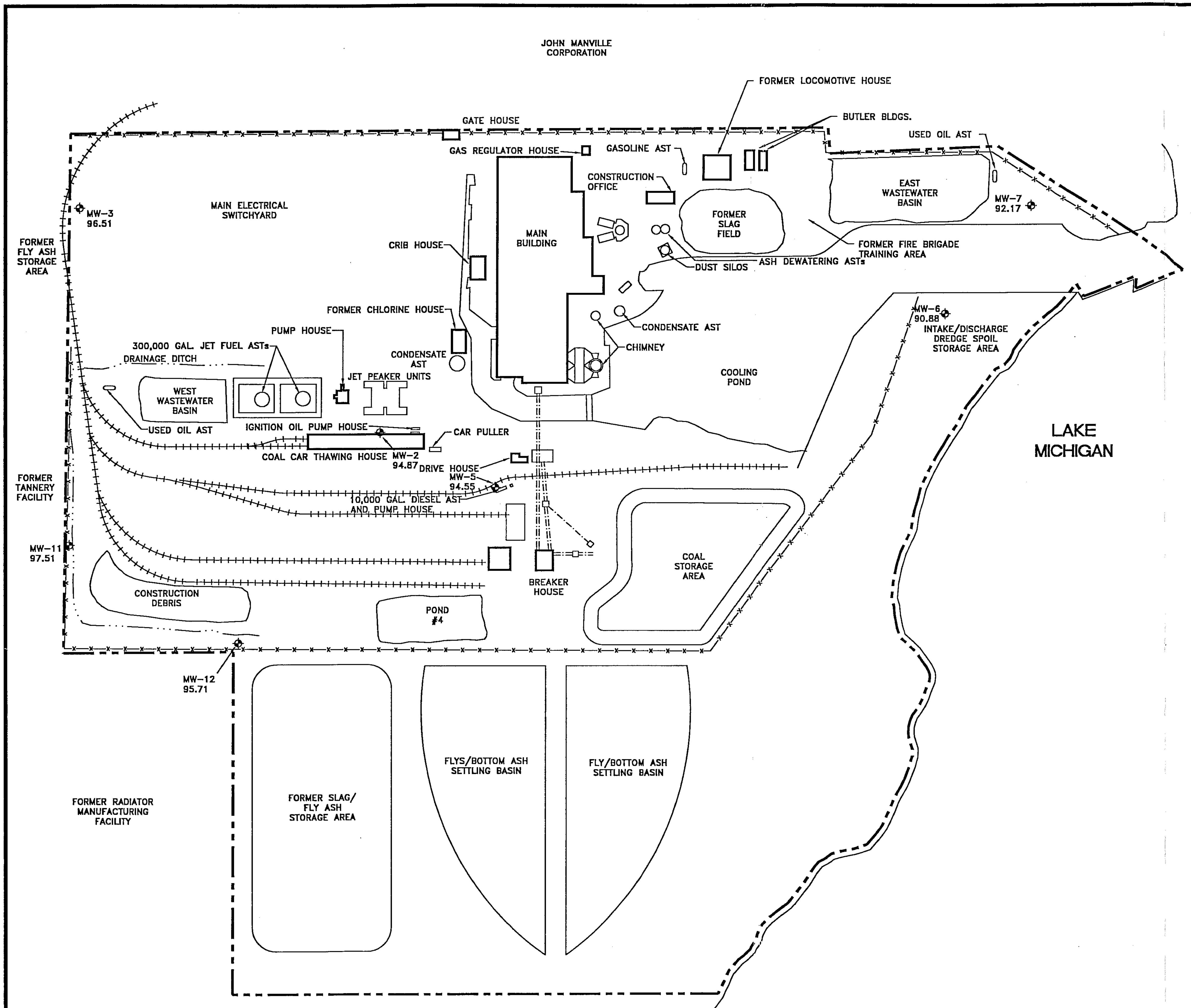

LEGEND:

- PROPERTY BOUNDARY
- RAILROAD LINE
- FENCE
- CONVEYOR LINE
- MW-2 94.87 — MONITORING WELL WITH GROUND WATER ELEVATION IN FEET.

Note:
- All dimensions and locations are approximate.

Source:
- ENSR field observations.

Dwg No: WAUKEGANGW1

WAUKEGAN GENERATING STATION
10 GREENLAND AVENUE
WAUKEGAN, ILLINOIS

COMMONWEALTH EDISON COMPANY

November 1998 File No: 1801-023-610

GROUNDWATER ELEVATION MAP

FIGURE 6

N

NOT TO SCALE

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APPENDIX A

Boring Logs and Monitoring Well Construction Diagrams

Phase II Environmental Site Assessment
Commonwealth Edison Company
December 7, 1998

Waukegan Generating Station
10 Greenwood Avenue
Waukegan, Illinois

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Log of Borehole B-1

Project No:1801-023-610

Project: Phase II Investigation

Client: Commonwealth Edison

Location: Waukegan Power Station

Geologist: BB

SUBSURFACE PROFILE			SAMPLE				Lab Analysis
Depth (ft / m)	Symbol	Description / Classification	Number	Type	Recovery(%)	PID Reading	
0		Ground Surface					
0–4		2' Light brown, medium grain, sand 2' Coal	1	GP	100	< 1	0 - 4 PNAs/BETX/pH/PCBs/ RCRA Metals
4		End of Borehole					

Depth scale: ft 0–15; m 0–4

Drilled By:Fox Drilling

Drill Method: **Geoprobe**

Drill Date: **10/29/98**

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Log of Borehole B-2

Project No:1801-023-610

Project: Phase II Investigation

Client: Commonwealth Edison

Location: Waukegan Power Station

Geologist: BB

SUBSURFACE PROFILE			SAMPLE				
Depth (ft / m)	Symbol	Description / Classification	Number	Type	Recovery(%)	PID Reading	Lab Analysis
0		Ground Surface					
0–4		Light brown sand with gravel	1	GP	80	11.5	0 - 4 PNAs/BETX/pH/PCBs/ RCRA Metals
4		End of Borehole					

Drilled By:Fox Drilling

Drill Method: **Geoprobe**

Drill Date: **10/29/98**

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Log of Borehole B-3

Project No:1801-023-610

Project: Phase II Investigation

Client: Commonwealth Edison

Location: Waukegan Power Station

Geologist: BB

Depth (ft)	Depth (m)	Symbol	Description / Classification	Number	Type	Recovery(%)	PID Reading	Lab Analysis
0	0		Ground Surface					
0-4	0-1	sand	Dark brown-black, sand, saturated	1	GP	100	18.7	0 - 4 PNA/BETX/pH/PCBs/ RCRA Metals
4-8	1-2	sand		2	SS	100	15.6	
8			End of Borehole					

Depth scale: 0–15 ft; 0–4 m.

Drilled By:Fox Drilling

Drill Method: **Geoprobe**

Drill Date: **10/27/98**

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Project No:1801-023-610

Project: Phase II Investigation

Client: Commonwealth Edison

Location: Waukegan Power Station

Log of Borehole B-4

Geologist: BB

SUBSURFACE PROFILE			SAMPLE				
Depth (ft / m)	Symbol	Description / Classification	Number	Type	Recovery(%)	PID Reading	Lab Analysis
0 / 0		Ground Surface					
0–4		1.5' Gravel 6" Clay and silt, wet with gravel 2' Orange black coal with sand	1	GP	100	4.2	0 - 4 PNA/BETX/pH/PCBs/ RCRA Metals
4		End of Borehole					

Depth scale: ft 0–15; m 0–4

Drilled By:Fox Drilling

Drill Method: **Geoprobe**

Drill Date: **10/26/98**

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Log of Borehole B-6

Project No:1801-023-610

Project: Phase II Investigation

Client: Commonwealth Edison

Location: Waukegan Power Station

Geologist: BB

SUBSURFACE PROFILE			SAMPLE				Lab Analysis
Depth (ft / m)	Symbol	Description / Classification	Number	Type	Recovery(%)	PID Reading	
0 / 0		Ground Surface					
0–4		.5' Gravel .5' Coal 3' Light brown sand, medium grained, wet	1	GP	100	9.5	0 - 4 PNAs/BETX/pH/PCBs/ RCRA Metals
4		End of Borehole					

Drilled By:Fox Drilling

Drill Method: **Geoprobe**

Drill Date: **10/29/98**

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Log of Borehole B-7

Project No:1801-023-610

Project: Phase II Investigation

Client: Commonwealth Edison

Location: Waukegan Power Station

Geologist: BB

SUBSURFACE PROFILE			SAMPLE				Lab Analysis
Depth (ft / m)	Symbol	Description / Classification	Number	Type	Recovery(%)	PID Reading	
0 / 0		Ground Surface					
0–4		1' Coal 2.5' Light brown, sand, medium grained, wet .5' Gray sand, medium grained, wet	1	GP	100	5.8	0 - 4 PNAs/BETX/pH/PCBs RCRA Metals
4		End of Borehole					

Drilled By:Fox Drilling

Drill Method: **Geoprobe**

Drill Date: **10/29/98**

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Log of Borehole B-8

Project No:1801-023-610

Project: Phase II Investigation

Client: Commonwealth Edison

Location: Waukegan Power Station

Geologist: BB

SUBSURFACE PROFILE			SAMPLE				Lab Analysis
Depth (ft / m)	Symbol	Description / Classification	Number	Type	Recovery(%)	PID Reading	
0 / 0		Ground Surface					
0–4		Coal to 2' 2' Light brown, sand, moist to wet, with fines	1	GP	100	9.7	0 - 4 PNAs/BETX/pH/PCBs/ RCRA Metals
4		End of Borehole					

Depth scale: ft 0–15; m 0–4

Drilled By:Fox Drilling

Drill Method: **Geoprobe**

Drill Date: **10/29/98**

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Log of Borehole B-9

Project No:1801-023-610

Project: Phase II Investigation

Client: Commonwealth Edison

Location: Waukegan Power Station

Geologist: BB

SUBSURFACE PROFILE			SAMPLE				
Depth (ft / m)	Symbol	Description / Classification	Number	Type	Recovery(%)	PID Reading	Lab Analysis
0 / 0		Ground Surface					
0–4		Coal to 3' 1' Light brown, sand, wet	1	GP	100	10.8	0 - 4 PNAS/BETX/PCBs RCRA Metals
4		End of Borehole					

Depth scale: ft 0–15; m 0–4

Drilled By:Fox Drilling

Drill Method: **Geoprobe**

Drill Date: **10/29/98**

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Project No:1801-023-610

Project: Phase II Investigation

Client: Commonwealth Edison

Location: Waukegan Power Station

Log of Borehole B-10

Geologist: BB

SUBSURFACE PROFILE			SAMPLE				Lab Analysis
Depth (ft / m)	Symbol	Description / Classification	Number	Type	Recovery(%)	PID Reading	
0 / 0		Ground Surface					
0–4		Coal to 2' 6" Brown sandy clay 1' Light brown sand, fine to medium grained	1	GP	80	9.0	0 - 4 PNAs/BETX/pH/PCBs/ RCRA Metals
4–8		Light brown sand, fine grained, wet with 1" gravel seam at 7'	2	SS	75	9.6	
8		End of Borehole					

Depth scale: ft 0–15; m 0–4

Drilled By:Fox Drilling

Drill Method: **Geoprobe**

Drill Date: **10/29/98**

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Log of Borehole B-11

Project No:1801-023-610

Project: Phase II Investigation

Client: Commonwealth Edison

Location: Waukegan Power Station

Geologist: BB

SUBSURFACE PROFILE			SAMPLE				Lab Analysis
Depth (ft / m)	Symbol	Description / Classification	Number	Type	Recovery(%)	PID Reading	
0 / 0		Ground Surface					
0–4		6" Gravel 2.5' Coal slag with sand	1	GP	100	8.5	0 - 4 PNAs/BETX/pH/PCBs/ RCRA Metals
4		End of Borehole					

Depth scale: ft 0–15; m 0–4

Drilled By:Fox Drilling

Drill Method: **Geoprobe**

Drill Date: **10/29/98**

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Log of Borehole B-12

Project No:1801-023-610

Project: Phase II Investigation

Client: Commonwealth Edison

Location: Waukegan Power Station

Geologist: BB

SUBSURFACE PROFILE			SAMPLE				Lab Analysis
Depth (ft / m)	Symbol	Description / Classification	Number	Type	Recovery(%)	PID Reading	
0 / 0		Ground Surface					
0–8 ft		Borehole not logged.	1	GP	100	12.3	0 - 4 PNAs/BETX/pH/PCBs/ RCRA Metals
8 ft		End of Borehole					

Depth scale: ft 0–15; m 0–4.

Drilled By:Fox Drilling

Drill Method: **Geoprobe**

Drill Date: **10/28/98**

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Project No:1801-023-610

Project: Phase II Investigation

Client: Commonwealth Edison

Location: Waukegan Power Station

Log of Borehole B-13

Geologist: BB

SUBSURFACE PROFILE			SAMPLE				Lab Analysis
Depth (ft / m)	Symbol	Description / Classification	Number	Type	Recovery(%)	PID Reading	
0 ft / 0 m		Ground Surface					
0–4 ft		Coal with fine gravel bottom 1.5' wet	1	GP	60	1.4	0 - 4 PNAs/BETX/pH/PCBs/ RCRA Metals
4 ft		End of Borehole					

Drilled By:Fox Drilling

Drill Method: **Geoprobe**

Drill Date: **10/26/98**

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Log of Borehole B-14

Project No:1801-023-610

Project: Phase II Investigation

Client: Commonwealth Edison

Location: Waukegan Power Station

Geologist: BB

SUBSURFACE PROFILE			SAMPLE				Lab Analysis
Depth (ft / m)	Symbol	Description / Classification	Number	Type	Recovery(%)	PID Reading	
0		Ground Surface					
0–4		3' Wet coal Sand and gravel saturated	1	GP	100	1.4	0 - 4 PNAs/BETX/pH/PCBs/ RCRA Metals
4		End of Borehole					

Depth scale: ft 0–15; m 0–4

Drilled By:Fox Drilling

Drill Method: **Geoprobe**

Drill Date: **10/26/98**

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Log of Borehole B-15

Project No:1801-023-610

Project: Phase II Investigation

Client: Commonwealth Edison

Location: Waukegan Power Station

Geologist: BB

SUBSURFACE PROFILE			SAMPLE				
Depth (ft / m)	Symbol	Description / Classification	Number	Type	Recovery(%)	PID Reading	Lab Analysis
0 / 0		Ground Surface					
0–4		2' Coal 2' Light brown, medium grain, sand, wet	1	GP	100	< 1	0 - 4 PNAs/BETX/pH/PCBs/ RCRA Metals
4		End of Borehole					

Depth scale: ft 0–15; m 0–4

Drilled By:Fox Drilling

Drill Method: **Geoprobe**

Drill Date: **10/29/98**

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Log of Borehole B-16

Project No:1801-023-610

Project: Phase II Investigation

Client: Commonwealth Edison

Location: Waukegan Power Station

Geologist: BB

SUBSURFACE PROFILE			SAMPLE				Lab Analysis
Depth (ft / m)	Symbol	Description / Classification	Number	Type	Recovery(%)	PID Reading	
0 / 0		Ground Surface					
0–2		Coal/Slag	1	GP	50	2.3	0 - 2 PNAs/BETX/pH/PCBs/ RCRA Metals
2		End of Borehole					

Depth scale: ft 0–15; m 0–4

Drilled By:Fox Drilling

Drill Method: **Geoprobe**

Drill Date: **10/26/98**

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Project No:1801-023-610

Project: Phase II Investigation

Client: Commonwealth Edison

Location: Waukegan Power Station

Log of Borehole B-17

Geologist: BB

SUBSURFACE PROFILE			SAMPLE				Lab Analysis
Depth (ft / m)	Symbol	Description / Classification	Number	Type	Recovery(%)	PID Reading	
0		Ground Surface					
0–4		1' Coal 1' Light brown-black, medium grain, sand 2' Coal	1	GP	100	5.4	0 - 4 PNAs/BETX/pH/PCBs/ RCRA Metals
4		End of Borehole					

Depth scale: ft 0–15; m 0–4

Drilled By:Fox Drilling

Drill Method: **Geoprobe**

Drill Date: **10/29/98**

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Log of Borehole B-18

Project No:1801-023-610

Project: Phase II Investigation

Client: Commonwealth Edison

Location: Waukegan Power Station

Geologist: BB

SUBSURFACE PROFILE			SAMPLE				Lab Analysis
Depth (ft / m)	Symbol	Description / Classification	Number	Type	Recovery(%)	PID Reading	
0 / 0		Ground Surface					
0–4 ft	sand	Brown-black sand, with odor saturated	1	GP	100	123	0 - 4 PNAs/BETX/pH/PCBs/ RCRA Metals
4		End of Borehole					

Depth scale: ft 0–15; m 0–4

Drilled By:Fox Drilling

Drill Method: **Geoprobe**

Drill Date: **10/27/98**

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Project No:1801-023-610

Project: Phase II Investigation

Client: Commonwealth Edison

Location: Waukegan Power Station

Log of Borehole B-19

Geologist: BB

SUBSURFACE PROFILE			SAMPLE				Lab Analysis
Depth (ft / m)	Symbol	Description / Classification	Number	Type	Recovery(%)	PID Reading	
0		Ground Surface					
0 - 4		1' Loose sand and coal 1' Rusty orange caol consolidated Coal, moist to wet	1	GP	75	19.3	0 - 4 PNAs/BETX/pH/PCBs/ RCRA Metals
4		End of Borehole					

Drilled By:Fox Drilling

Drill Method: **Geoprobe**

Drill Date: **10/26/98**

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Project No:1801-023-610

Project: Phase II Investigation

Client: Commonwealth Edison

Location: Waukegan Power Station

Log of Borehole B-20

Geologist: BB

Depth (ft)	Depth (m)	Symbol	SUBSURFACE PROFILE Description / Classification	SAMPLE Number	Type	Recovery(%)	PID Reading	Lab Analysis
0	0		Ground Surface					
0-4			Black coal consolidated .5' Sand and gravel seam at 2.5' Same with silt, wet at 3.5'	1	GP	100	19.4	0 - 4 PNAs/BETX/pH/PCBs/ RCRA Metals
4-6			Black coal, consolidated, moist	2	GP	50	16.0	
6			End of Borehole					

Depth scale: ft 0–15; m 0–4

Drilled By:Fox Drilling

Drill Method: **Geoprobe**

Drill Date: **10/26/98**

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Project No:1801-023-610

Project: Phase II Investigation

Client: Commonwealth Edison

Location: Waukegan Power Station

Log of Borehole B-21

Geologist: BB

SUBSURFACE PROFILE			SAMPLE				Lab Analysis
Depth (ft / m)	Symbol	Description / Classification	Number	Type	Recovery(%)	PID Reading	
0		Ground Surface					
0–4	Sand (dotted)	Sand, medium grained, dry to moist, loose 1' Sand, medium grained, wet	1	GP	80	16.4	0 - 4 PNAs/BETX/pH/PCBs/ RCRA Metals
4–6	Sand (dotted)	Light brown-gray, sand, medium grained, wet	2	GP	20	20.3	
6		End of Borehole					

Drilled By:Fox Drilling

Drill Method: Geoprobe

Drill Date: 10/26/98

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Location: Waukegan Power Station

Log of Borehole B-22

Geologist: BB

SUBSURFACE PROFILE			SAMPLE				
Depth (ft / m)	Symbol	Description / Classification	Number	Type	Recovery(%)	PID Reading	Lab Analysis
0 / 0		Ground Surface					
0–1.5		Coal and gray coal ash	1	GP	30	< 1	0 - 2 PNAs/BETX/pH/PCBs/ RCRA Metals
		End of Borehole					

Depth scale: ft 0–15; m 0–4

Drilled By:Fox Drilling

Drill Method: **Geoprobe**

Drill Date: **10/26/98**

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Project No:1801-023-610

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Client: Commonwealth Edison

Location: Waukegan Power Station

Log of Borehole B-23

Geologist: BB

SUBSURFACE PROFILE			SAMPLE				Lab Analysis
Depth (ft / m)	Symbol	Description / Classification	Number	Type	Recovery(%)	PID Reading	
0		Ground Surface					
0–4		Light brown sand, loose, with gravel 2' Same, wet	1	GP	100	12.4	0 - 4 PNAs/BETX/pH/PCBs/ RCRA Metals
4		End of Borehole					

Drilled By:Fox Drilling

Drill Method: **Geoprobe**

Drill Date: **10/27/98**

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Attachment 9-3 – Historical CCA Groundwater Data

Attachment 9-3. CCA Groundwater Analytical Results - Midwest Generation LLC, Waukegan Station, Waukegan, IL

Sample: MW-01	Date	10/25/2010		3/24/2011		6/13/2011		9/13/2011		12/6/2011		3/14/2012		6/18/2012	
Parameter	Standards	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.006	0.0030	0.0052	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	0.0056
Arsenic	0.010	0.0010	0.054	0.0010	0.040	0.0010	0.17	0.0010	0.077	0.0010	0.057	0.0010	0.078	0.0010	0.070
Barium	2.0	0.0025	0.023	0.0025	0.022	0.0025	0.020	0.0025	0.038	0.0025	0.051	0.0025	0.034	0.0025	0.028
Beryllium	0.004	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Boron	2.0	0.050	2.6	0.050	2.0	0.50	2.6	0.050	2.5	0.050	2.8	0.50	2.5	0.50	2.0
Cadmium	0.005	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Chloride	200.0	2.0	39	2.0	48	2.0	52	2.0	41	2.0	32	2.0	47	2.0	46
Chromium	0.1	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Cobalt	1.0	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Copper	0.65	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Cyanide	0.2	0.010	ND	0.010	ND	0.010	0.020	0.010	0.013	0.010	ND	0.010	ND	0.010	0.012
Fluoride	4.0	0.10	0.45	0.10	0.59	0.10	0.71	0.10	0.33	0.10	0.46	0.10	0.46	0.10	0.39
Iron	5.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Lead	0.0075	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Manganese	0.15	0.0025	ND	0.0025	0.0027	0.0025	0.0086	0.0025	0.020	0.0025	0.011	0.0025	0.0052 ^	0.0025	ND
Mercury	0.002	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND
Nickel	0.1	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Nitrogen/Nitrate	10.0	0.10	ND	0.10	ND	0.10	ND	0.10	0.52	0.10	0.30	0.10	ND	0.10	ND
Nitrogen/Nitrate, Nitrite	NA	0.10	ND	0.10	ND	0.10	ND	0.10	0.52	0.10	0.32	0.10	ND	0.10	ND
Nitrogen/Nitrite	NA	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	0.021	0.020	0.10	0.020	0.023
Perchlorate	0.0049	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Selenium	0.05	0.0025	0.031	0.0025	0.030	0.0025	0.016	0.0025	0.039	0.0025	0.032	0.0025	0.037	0.0025	0.013
Silver	0.05	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Sulfate	400.0	50	350	50	230	50	260	50	280	100	330	100	390	50	300
Thallium	0.002	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Total Dissolved Solids	1,200	10	460	10	470	10	460	10	570	10	750	10	630	10	630
Vanadium	0.049	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Zinc	5.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Benzene	0.005	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
BETX	11.705	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
pH	6.5 - 9.0	NA	10.41	NA	9.92	NA	9.97	NA	8.78	NA	8.62	NA	9.54	NA	9.75
Temperature	NA	NA	17.38	NA	14.81	NA	15.98	NA	15.82	NA	14.18	NA	15.88	NA	18.27
Conductivity	NA	NA	0.698	NA	0.74	NA	0.74	NA	0.67	NA	0.79	NA	0.77	NA	0.72
Dissolved Oxygen	NA	NA	NM	NA	0.33	NA	0.24	NA	0.1	NA	0.3	NA	0.16	NA	0.41
ORP	NA	NA	NM	NA	-52.8	NA	-126.2	NA	-313	NA	-274	NA	-173	NA	-198

Sample: MW-01	Date	9/28/2012		12/19/2012		3/7/2013		6/7/2013		7/25/2013		11/4/2013		3/10/2014		5/16/2014	
Parameter	Standards	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.006	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND
Arsenic	0.010	0.0010	0.070	0.0010	0.091	0.0010	0.098	0.0010	0.036	0.0010	0.055	0.0010	0.046	0.0010	0.031	0.0010	0.036
Barium	2.0	0.0025	0.013	0.0025	0.013	0.0025	0.033	0.0025	0.052	0.0025	0.040	0.0025	0.065	0.0025	0.031	0.0025	0.025
Beryllium	0.004	0.0050	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Boron	2.0	0.25	1.9	0.050	1.9	0.50	2.2	0.50	2.2	0.50	2.3	0.25	3.1	0.25	1.9	0.050	2.0
Cadmium	0.005	0.00050	ND ^	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Chloride	200.0	2.0	47	2.0	48	2.0	45	2.0	34	2.0	42	2.0	28	2.0	33	2.0	31
Chromium	0.1	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Cobalt	1.0	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Copper	0.65	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0022	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Cyanide	0.2	0.010	0.019	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	0.013	0.010	0.029
Fluoride	4.0	0.10	0.34	0.10	0.41 ^	0.10	0.50	0.10	0.41	0.10	0.45	0.10	0.28	0.10	0.27	0.10	0.46
Iron	5.0	0.10	ND ^	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Lead	0.0075	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Manganese	0.15	0.0025	ND	0.0025	ND	0.0025	0.0047	0.0025	0.011	0.0025	0.011	0.0025	0.021	0.0025	0.0073	0.0025	ND
Mercury	0.002	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND
Nickel	0.1	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Nitrogen/Nitrate	10.0	0.10	ND	0.10	ND	0.10	ND	0.10	1.0	0.10	0.10	0.10	ND	0.10	ND	0.10	ND
Nitrogen/Nitrate, Nitrite	NA	0.10	ND ^	0.10	ND	0.10	ND	0.10	1.1	0.10	0.10	0.10	ND	0.10	ND	0.10	ND
Nitrogen/Nitrite	NA	0.020	ND	0.020	0.055	0.020	ND	0.020	0.058	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Perchlorate	0.0049	NR	NR	0.004	ND	0.004	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND
Selenium	0.05	0.0025	0.0093	0.0025	ND	0.0025	0.056	0.0025	0.043	0.0025	0.031	0.0025	0.013	0.0025	ND	0.0025	ND
Silver	0.05	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Sulfate	400.0	50	240	50	200	50	250	100	260	100	300	50	260	50	130	50	170
Thallium	0.002	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Total Dissolved Solids	1,200	10	450	10	460	10	510	10	660	10	580	10	580	10	290	10	300
Vanadium	0.049	NR	NR	0.0050	0.026	0.0050	0.018	0.0050	0.056	0.0050	0.042	0.0050	0.0067	0.0050	ND	0.0050	ND
Zinc	5.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Benzene	0.005	NR	NR	0.0005	ND	0.0005	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
BETX	11.705	NR	NR	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND
pH	6.5 - 9.0	NA	10.78	NA	10.47	NA	9.85	NA	8.37	NA	8.81	NA	8.42	NA	8.99	NA	8.88
Temperature	NA	NA	15.45	NA	14.17	NA	12.8	NA	12.94	NA	14.93	NA	13.41	NA	13.79	NA	9.41
Conductivity	NA	NA	0.58	NA	0.53	NA	0.6	NA	0.655	NA	0.65	NA	0.51	NA	0.41	NA	0.36
Dissolved Oxygen	NA	NA	0.06	NA	0.45	NA	0.36	NA	0.39	NA	0.28	NA	0.55	NA	1.21	NA	1.46
ORP	NA	NA	-179	NA	-205	NA	-98.2	NA	-109.4	NA	-133.6	NA	-213.3	NA	-98.4	NA	42.7

Sample: MW-01	Date	8/21/2014		11/6/2014		2/17/2015		4/21/2015		8/12/2015		11/2/2015		3/1/2016		5/4/2016		8/23/2016		12/5/2016	
Parameter	Standards	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.006	0.0030	ND	0.0030	ND ^	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND
Arsenic	0.010	0.0010	0.019	0.0010	0.21	0.0010	0.050	0.0010	0.056	0.0010	0.034	0.0010	0.073	0.0010	0.12	0.0010	0.11	0.0010	0.12	0.0010	0.15
Barium	2.0	0.0025	0.032	0.0025	0.0094	0.0025	0.018	0.0025	0.020	0.0025	0.019	0.0025	0.020	0.0025	0.029	0.0025	0.016	0.0025	0.015	0.0025	0.014
Beryllium	0.004	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND ^	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND ^
Boron	2.0	0.25	2.0	0.50	2.2	0.25	1.7	0.050	1.5	0.25	1.2	0.50	1.7	0.50	1.9	0.25	2.1	0.50	2.1	0.050	1.9
Cadmium	0.005	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Chloride	200.0	10	79	2.0	70	2.0	54	2.0	52	2.0	64	2.0	69	2.0	62	2.0	59	2.0	62	2.0	65
Chromium	0.1	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Cobalt	1.0	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Copper	0.65	0.0020	ND	0.0020	0.0024	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND ^	0.0020	ND	0.0020	ND ^
Cyanide	0.2	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	0.013	0.010	0.010	0.010	0.012	0.010	0.029	0.010	0.030	0.010	0.015
Fluoride	4.0	0.10	0.76	0.10	0.56	0.10	0.21	0.10	0.18	0.10	0.42	0.10	0.43	0.10	0.29	0.10	0.29	0.10	0.26	0.10	0.34
Iron	5.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND^	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Lead	0.0075	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Manganese	0.15	0.0025	0.026	0.0025	0.0054	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND
Mercury	0.002	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND
Nickel	0.1	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Nitrogen/Nitrate	10.0	0.10	ND	0.10	ND	0.10	0.24	0.10	ND	0.10	ND	0.10	ND	0.10	0.17	0.10	ND	0.10	0.12	0.10	ND
Nitrogen/Nitrate, Nitrite	NA	0.10	ND	0.10	ND	0.10	0.41	0.10	0.26	0.10	ND	0.10	ND	0.10	0.17	0.10	ND ^	0.10	0.12	0.10	ND
Nitrogen/Nitrite	NA	0.020	0.024	0.020	0.078	0.020	0.17	0.040	0.23	0.020	0.10	0.020	0.036	0.020	ND	0.020	0.026	0.020	ND	0.020	0.056
Perchlorate	0.0049	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND
Selenium	0.05	0.0025	ND	0.0025	0.035	0.0025	0.0095	0.0025	0.0081	0.0025	0.017	0.0025	0.0099	0.0025	0.0090	0.0025	0.013	0.0025	0.014	0.0025	0.0073
Silver	0.05	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND^	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Sulfate	400.0	50	130	50	270	50	200	50	250	50	260	50	320	50	260	50	210	50	230	50	200
Thallium	0.002	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Total Dissolved Solids	1,200	10	460	10	450	10	560	10	500	10	600	10	560	10	570	10	460	10	550	10	570
Vanadium	0.049	0.0050	ND	0.0050	0.49	0.0050	0.12	0.0050	0.091	0.0050	0.092	0.0050	0.10	0.0050	0.071	0.0050	0.071	0.0050	0.095	0.0050	0.091
Zinc	5.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Benzene	0.005	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
BETX	11.705	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	0.001	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND
pH	6.5 - 9.0	NA	7.92	NA	10.54	NA	12.01	NA	11.69	NA	11.83	NA	10.93	NA	11.13	NA	11.09	NA	10.49	NA	10.46
Temperature	NA	NA	16.04	NA	11.91	NA	7.73	NA	8.44	NA	17.78	NA	17.17	NA	8.43	NA	11.96	NA	19.68	NA	10.73
Conductivity	NA	NA	0.638	NA	0.616	NA	0.63	NA	0.617	NA	0.918	NA	1.054	NA	0.58	NA	0.67	NA	0.88	NA	0.71
Dissolved Oxygen	NA	NA	0.43	NA	1.75	NA	1.06	NA	3.31	NA	2.04	NA	0.45	NA	1.05	NA	0.67	NA	1.53	NA	1.27
ORP	NA	NA	22.7	NA	-37.2	NA	-74.9	NA	-73.2	NA	-44.5	NA	88.7	NA	-177.8	NA	-202.1	NA	-218.6	NA	-150.4

Notes: Standards obtained from IAC, Title 35, Chapter I, Part 620, Subpart D, Section 620.410 - Groundwater Quality Standards for Class I: Potable Resource Groundwater.
All values are in mg/L (ppm) unless otherwise noted.

DL - Detection limit
NA - Not Applicable
ND - Not Detected
NM - Not Measured

NR - Not Required
NS - Not Sampled
^ - Denotes instrument related QC exceeds the control limits

Temperature °C degrees Celcius
Conductivity ms/cm^c millisiemens/centimeters
Dissolved Oxygen mg/L milligrams/liter
Oxygen Reduction Potential (ORP) mV millivolts

Attachment 9-3. CCA Groundwater Analytical Results - Midwest Generation LLC, Waukegan Station, Waukegan, IL

Sample: MW-02	Date	10/25/2010		3/24/2011		6/13/2011		9/13/2011		12/6/2011		3/14/2012		6/18/2012		9/28/2012	
Parameter	Standards	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.006	0.0030	0.015	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND
Arsenic	0.010	0.0010	0.025	0.0010	0.016	0.0010	0.012	0.0010	0.0087	0.0010	0.0094	0.0010	0.0094	0.0010	0.011	0.0010	0.011
Barium	2.0	0.0025	0.0091	0.0025	0.014	0.0025	0.024	0.0025	0.020	0.0025	0.023	0.0025	0.017	0.0025	0.016	0.0025	0.019
Beryllium	0.004	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0050	ND
Boron	2.0	0.050	2.2	0.050	2.2	0.50	2.0	0.050	1.7	0.050	1.9	0.50	2.0	0.50	2.6	0.25	2.1
Cadmium	0.005	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND ^
Chloride	200.0	2.0	42	2.0	45	2.0	46	2.0	45	2.0	50	2.0	53	2.0	48	2.0	55
Chromium	0.1	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Cobalt	1.0	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Copper	0.65	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Cyanide	0.2	0.010	ND	0.010	ND	0.010	0.014	0.010	0.019	0.010	ND	0.010	ND	0.010	ND	0.010	ND
Fluoride	4.0	0.10	0.35	0.10	0.53	0.10	0.80	0.10	0.56	0.10	0.67	0.10	0.88	0.10	1.1	0.10	1.1
Iron	5.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND ^
Lead	0.0075	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Manganese	0.15	0.0025	0.0034	0.0025	0.018	0.0025	0.032	0.0025	0.038	0.0025	0.035	0.0025	0.028 ^	0.0025	0.031	0.0025	0.025
Mercury	0.002	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND
Nickel	0.1	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0025
Nitrogen/Nitrate	10.0	0.10	ND	0.10	ND	0.10	0.23	0.10	0.12	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Nitrogen/Nitrate, Nitrite	NA	0.10	ND	0.10	ND	0.10	0.23	0.10	0.12	0.10	ND	0.10	ND	0.10	ND	0.10	ND ^
Nitrogen/Nitrite	NA	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Perchlorate	0.0049	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Selenium	0.05	0.0025	0.026	0.0025	0.0085	0.0025	0.028	0.0025	0.022	0.0025	0.0086	0.0025	0.0046	0.0025	ND	0.0025	0.0027
Silver	0.05	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Sulfate	400.0	50	230	50	160	50	150	50	200	50	180	50	200	50	210	50	270
Thallium	0.002	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Total Dissolved Solids	1,200	10	410	10	400	10	410	10	460	10	490	10	400	10	520	10	540
Vanadium	0.049	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Zinc	5.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Benzene	0.005	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
BETX	11.705	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
pH	6.5 - 9.0	NA	9.98	NA	9.31	NA	8.65	NA	7.82	NA	7.77	NA	7.82	NA	7.90	NA	8.24
Temperature	NA	NA	15.3	NA	13.42	NA	14.58	NA	14.46	NA	13.5	NA	14.79	NA	16.22	NA	14.24
Conductivity	NA	NA	0.61	NA	0.62	NA	0.69	NA	0.56	NA	0.55	NA	0.55	NA	0.63	NA	0.66
Dissolved Oxygen	NA	NA	NM	NA	0.29	NA	0.22	NA	0.14	NA	0.24	NA	0.12	NA	0.17	NA	0.07
ORP	NA	NA	NM	NA	28.4	NA	93	NA	-206	NA	-119	NA	-76	NA	-87	NA	-116

Sample: MW-02	Date	12/19/2012		3/7/2013		6/7/2013		7/25/2013		11/4/2013		3/10/2014		5/15/2014		8/21/2014	
Parameter	Standards	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.006	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND
Arsenic	0.010	0.0010	0.0089	0.0010	0.012	0.0010	0.0090	0.0010	0.0087	0.0010	0.0091	0.0010	0.0085	0.0010	0.0062	0.0010	0.0081
Barium	2.0	0.0025	0.016	0.0025	0.020	0.0025	0.021	0.0025	0.026	0.0025	0.028	0.0025	0.046	0.0025	0.086	0.0025	0.029
Beryllium	0.004	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Boron	2.0	0.050	1.9	0.50	2.2	0.50	1.9	0.50	2.1	0.25	2.2	0.25	2.8	0.25	2.6	0.25	3.0
Cadmium	0.005	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Chloride	200.0	2.0	54	2.0	50	2.0	52	2.0	47	2.0	55	2.0	51	2.0	57	2.0	47
Chromium	0.1	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Cobalt	1.0	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Copper	0.65	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Cyanide	0.2	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND
Fluoride	4.0	0.10	1.3 ^	0.10	1.2	0.10	1.3	0.10	0.93	0.10	0.60	0.10	0.60	0.10	0.70	0.10	0.76
Iron	5.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.16	0.10	ND
Lead	0.0075	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Manganese	0.15	0.0025	0.023	0.0025	0.039	0.0025	0.051	0.0025	0.069	0.0025	0.034	0.0025	0.085	0.0025	0.16	0.0025	0.050
Mercury	0.002	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND
Nickel	0.1	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Nitrogen/Nitrate	10.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Nitrogen/Nitrate, Nitrite	NA	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Nitrogen/Nitrite	NA	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Perchlorate	0.0049	0.004	ND	0.004	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND
Selenium	0.05	0.0025	ND	0.0025	0.0084	0.0025	ND	0.0025	0.015	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	0.0060
Silver	0.05	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Sulfate	400.0	50	210	50	230	50	220	50	260	100	290	50	370	100	280	50	210
Thallium	0.002	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Total Dissolved Solids	1,200	10	500	10	520	10	550	10	530	10	770	10	670	10	710	10	550
Vanadium	0.049	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Zinc	5.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Benzene	0.005	0.0005	ND	0.0005	ND	0.0005	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
BETX	11.705	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND
pH	6.5 - 9.0	NA	7.94	NA	8.95	NA	7.63	NA	7.61	NA	7.97	NA	8.38	NA	7.65	NA	8.13
Temperature	NA	NA	13.01	NA	12.2	NA	12.99	NA	14.79	NA	13.16	NA	12.72	NA	11.00	NA	15.15
Conductivity	NA	NA	0.54	NA	0.62	NA	0.550	NA	0.59	NA	0.62	NA	0.72	NA	0.79	NA	0.684
Dissolved Oxygen	NA	NA	0.33	NA	0.18	NA	0.32	NA	0.42	NA	0.60	NA	0.81	NA	0.79	NA	0.32
ORP	NA	NA	-43	NA	-66.4	NA	-124.3	NA	-90.4	NA	-129.8	NA	-121.9	NA	-18.2	NA	-58.2

Sample: MW-02	Date	11/6/2014		2/17/2015		4/21/2015		8/12/2015		11/2/2015		3/1/2016		5/4/2016		8/23/2016		12/5/2016	
Parameter	Standards	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.006	0.0030	ND ^	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND
Arsenic	0.010	0.0010	0.0095	0.0010	0.0089	0.0010	0.0089	0.0010	0.042	0.0010	0.015	0.0010	0.010	0.0010	0.0071	0.0010	0.0088	0.0010	0.015
Barium	2.0	0.0025	0.029	0.0025	0.024	0.0025	0.027	0.0025	0.012	0.0025	0.013	0.0025	0.020	0.0025	0.019	0.0025	0.016	0.0025	0.014
Beryllium	0.004	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND ^	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Boron	2.0	0.50	3.0	0.25	3.2	0.25	2.9	0.25	2.5	0.50	2.5	0.50	3.6	0.25	3.3	0.50	3.0	0.25	3.0
Cadmium	0.005	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Chloride	200.0	2.0	48	2.0	29	2.0	45	2.0	43	2.0	49	2.0	46	2.0	51	2.0	57	2.0	51
Chromium	0.1	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Cobalt	1.0	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Copper	0.65	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND ^	0.0020	ND	0.0020	ND
Cyanide	0.2	0.010	ND	0.010	ND	0.010	0.025	0.010	ND	0.010	0.011	0.010	0.020	0.010	0.017	0.010	0.023	0.010	0.017
Fluoride	4.0	0.10	0.61	0.10	0.99	0.10	1.1	0.10	1.1	0.10	0.79	0.10	1.3	0.10	1.6	0.10	1.3	0.10	0.98 F1
Iron	5.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND^	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Lead	0.0075	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Manganese	0.15	0.0025	0.041	0.0025	0.043	0.0025	0.068	0.0025	0.028	0.0025	0.035	0.0025	0.038	0.0025	0.040	0.0025	0.021	0.0025	0.023
Mercury	0.002	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND
Nickel	0.1	0.0020	ND	0.0020	0.0030	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Nitrogen/Nitrate	10.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Nitrogen/Nitrate, Nitrite	NA	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND ^	0.10	ND	0.10	ND
Nitrogen/Nitrite	NA	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Perchlorate	0.0049	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND
Selenium	0.05	0.0025	0.0045	0.0025	ND	0.0025	ND	0.0025	0.0085	0.0025	0.0044	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	0.0033
Silver	0.05	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND^	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Sulfate	400.0	50	350	50	150	50	190	50	230	50	230	50	220	50	160	50	220	50	160
Thallium	0.002	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Total Dissolved Solids	1,200	10	510	10	440	10	430	10	490	10	380	10	500	10	430	10	490	10	470
Vanadium	0.049	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	0.0096	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Zinc	5.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Benzene	0.005	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00061	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
BETX	11.705	0.0025	0.00077	0.0025	0.00077	0.0025	ND	0.0025	0.0006	0.0025	0.00251	0.0025	ND	0.0025	0.0019	0.0025	ND	0.0025	ND
pH	6.5 - 9.0	NA	8.61	NA	8.79	NA	7.95	NA	10.13	NA	8.27	NA	8.57	NA	8.19	NA	7.52	NA	8.62
Temperature	NA	NA	11.87	NA	8.01	NA	9.19	NA	18.47	NA	16.44	NA	6.48	NA	11.43	NA	20.96	NA	8.79
Conductivity	NA	NA	0.647	NA	0.43	NA	0.511	NA	0.638	NA	0.629	NA	0.44	NA	0.53	NA	0.69	NA	0.44
Dissolved Oxygen	NA	NA	0.47	NA	0.89	NA	3.09	NA	0.73	NA	0.56	NA	0.95	NA	0.87	NA	2.54	NA	2.20
ORP	NA	NA	-145.3	NA	-162.8	NA	-128.5	NA	-88.7	NA	52.9	NA	-101.2	NA	-128.2	NA	-119.5	NA	-29.6

Notes: Standards obtained from IAC, Title 35, Chapter I, Part 620, Subpart D, Section 620.410 - Groundwater Quality Standards for Class I: Potable Resource Groundwater.
All values are in mg/L (ppm) unless otherwise noted.

DL - Detection limit
NA - Not Applicable
ND - Not Detected
NM - Not Measured

NR - Not Required
NS - Not Sampled
^ - Denotes instrument related QC exceeds the control limits

Temperature °C degrees Celcius
Conductivity ms/cm^c millisiemens/centimeters
Dissolved Oxygen mg/L milligrams/liter
Oxygen Reduction Potential (ORP) mV millivolts

Sample: MW-03	Date	10/25/2010		3/24/2011		6/13/2011		9/13/2011		12/6/2011		3/14/2012		6/18/2012		9/28/2012	
Parameter	Standards	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.006	0.0030	0.0051	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND
Arsenic	0.010	0.0010	0.0043	0.0010	0.0041	0.0010	0.0049	0.0010	0.0077	0.0010	0.0049	0.0010	0.0071	0.0010	0.0030	0.0010	0.0044
Barium	2.0	0.0025	0.0057	0.0025	0.0086	0.0025	0.018	0.0025	0.0044	0.0025	0.0058	0.0025	0.0049	0.0025	0.0067	0.0025	0.010
Beryllium	0.004	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0050	ND
Boron	2.0	0.050	1.7	0.050	2.2	0.50	2.3	0.050	1.6	0.050	1.6	0.50	1.5	0.25	1.3	0.25	1.4
Cadmium	0.005	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND ^
Chloride	200.0	2.0	53	2.0	49	2.0	53	2.0	49	2.0	51	2.0	52	2.0	41	2.0	47
Chromium	0.1	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Cobalt	1.0	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Copper	0.65	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Cyanide	0.2	0.010	ND	0.010	ND	0.010	ND	0.010	0.030	0.010	ND	0.010	ND	0.010	ND	0.010	ND
Fluoride	4.0	0.10	0.27	0.10	0.47	0.10	0.39	0.10	0.24	0.10	0.67	0.10	0.64	0.10	0.76	0.10	0.96
Iron	5.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND ^
Lead	0.0075	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Manganese	0.15	0.0025	ND	0.0025	0.0059	0.0025	0.0044	0.0025	ND	0.0025	0.0054	0.0025	0.0036 ^	0.0025	0.0070	0.0025	0.0034
Mercury	0.002	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND
Nickel	0.1	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Nitrogen/Nitrate	10.0	0.10	ND	0.10	ND	0.10	0.29	0.10	ND	0.10	ND	0.10	ND	0.10	0.17	0.10	0.42
Nitrogen/Nitrate, Nitrite	NA	0.10	ND	0.10	ND	0.10	0.29	0.10	ND	0.10	ND	0.10	ND	0.10	0.17	0.10	0.50
Nitrogen/Nitrite	NA	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	0.076
Perchlorate	0.0049	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Selenium	0.05	0.0025	0.0094	0.0025	0.016	0.0025	0.030	0.0025	0.012	0.0025	0.011	0.0025	0.0064	0.0025	0.017	0.0025	0.0072
Silver	0.05	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Sulfate	400.0	20	120	25	130	25	130	25	97	25	110	50	140	50	150	50	260
Thallium	0.002	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Total Dissolved Solids	1,200	10	280	10	350	10	340	10	300	10	380	10	340	10	420	10	480
Vanadium	0.049	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Zinc	5.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Benzene	0.005	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
BETX	11.705	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
pH	6.5 - 9.0	NA	9.21	NA	8.58	NA	8.64	NA	9.20	NA	8.61	NA	8.89	NA	7.58	NA	9.14
Temperature	NA	NA	17.98	NA	14.27	NA	15.5	NA	14.32	NA	13.62	NA	14.89	NA	16.32	NA	13.83
Conductivity	NA	NA	0.455	NA	0.55	NA	0.59	NA	0.34	NA	0.41	NA	0.44	NA	0.53	NA	0.58
Dissolved Oxygen	NA	NA	NM	NA	0.53	NA	0.16	NA	0.06	NA	0.17	NA	0.13	NA	0.47	NA	0.07
ORP	NA	NA	NM	NA	87	NA	163.2	NA	-199	NA	-52	NA	-47	NA	78	NA	2

Sample: MW-03	Date	12/19/2012		3/7/2013		6/7/2013		7/25/2013		11/4/2013		3/10/2014		5/15/2014		8/21/2014	
Parameter	Standards	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.006	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND
Arsenic	0.010	0.0010	0.0031	0.0010	0.0018	0.0010	0.0014	0.0010	0.0025	0.0010	0.0050	0.0010	0.0013	0.0010	0.0020	0.0010	0.0041
Barium	2.0	0.0025	0.011	0.0025	0.015	0.0025	0.039	0.0025	0.017	0.0025	0.015	0.0025	0.012	0.0025	0.0061	0.0025	0.012
Beryllium	0.004	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Boron	2.0	0.050	1.9	0.50	2.0	0.50	2.5	0.50	1.8	0.25	1.9	0.25	1.1	0.050	1.2	0.25	2.3
Cadmium	0.005	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Chloride	200.0	2.0	49	2.0	45	2.0	39	2.0	43	2.0	25	2.0	37	2.0	37	10	89
Chromium	0.1	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Cobalt	1.0	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Copper	0.65	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Cyanide	0.2	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND
Fluoride	4.0	0.10	1.1 ^	0.10	0.99	0.10	0.48	0.10	0.83	0.10	0.63	0.10	0.74	0.10	0.57	0.10	0.55
Iron	5.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Lead	0.0075	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Manganese	0.15	0.0025	0.0034	0.0025	0.015	0.0025	0.0062	0.0025	0.0031	0.0025	0.0082	0.0025	0.0069	0.0025	0.0028	0.0025	0.0083
Mercury	0.002	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND
Nickel	0.1	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Nitrogen/Nitrate	10.0	0.10	ND	0.10	ND	0.10	13	0.10	ND	0.10	ND	0.10	0.11	0.10	ND	0.10	ND
Nitrogen/Nitrate, Nitrite	NA	0.10	ND	0.10	ND	0.50	13	0.10	ND	0.10	ND	0.10	0.11	0.10	0.15	0.10	ND
Nitrogen/Nitrite	NA	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	0.072	0.020	ND
Perchlorate	0.0049	0.004	ND	0.004	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND
Selenium	0.05	0.0025	ND	0.0025	0.011	0.0025	0.067	0.0025	0.0085	0.0025	0.0045	0.0025	0.0028	0.0025	ND	0.0025	ND
Silver	0.05	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Sulfate	400.0	50	240	50	240	100	290	100	240	50	140	50	170	25	100	50	110
Thallium	0.002	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Total Dissolved Solids	1,200	10	520	10	470	10	860	10	530	10	380	10	340	10	210	10	470
Vanadium	0.049	0.0050	ND	0.0050	ND	0.0050	0.0055	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Zinc	5.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Benzene	0.005	0.0005	ND	0.0005	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
BETX	11.705	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND
pH	6.5 - 9.0	NA	8.22	NA	8.55	NA	7.13	NA	7.46	NA	7.26	NA	7.38	NA	8.47	NA	7.82
Temperature	NA	NA	13.02	NA	12.6	NA	12.87	NA	13.95	NA	15.35	NA	11.89	NA	8.47	NA	18.83
Conductivity	NA	NA	0.55	NA	0.61	NA	0.860	NA	0.580	NA	0.40	NA	0.37	NA	0.27	NA	0.600
Dissolved Oxygen	NA	NA	0.27	NA	0.4	NA	0.59	NA	0.31	NA	0.54	NA	0.78	NA	0.40	NA	1.05
ORP	NA	NA	17	NA	40.8	NA	-84.1	NA	0.80	NA	-128.2	NA	-78.5	NA	90.5	NA	4.2

Sample: MW-03	Date	11/6/2014		2/17/2015		4/21/2015		8/12/2015		11/2/2015		3/1/2016		5/4/2016		8/24/2016		12/5/2016	
Parameter	Standards	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.006	0.0030	ND ^	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND
Arsenic	0.010	0.0010	0.0029	0.0010	0.0031	0.0010	0.0039	0.0010	0.0039	0.0010	0.0090	0.0010	0.0062	0.0010	0.0021	0.0010	0.0081	0.0010	0.0056
Barium	2.0	0.0025	0.013	0.0025	0.013	0.0025	0.0082	0.0025	0.012	0.0025	0.011	0.0025	0.016	0.0025	0.0097	0.0025	0.0055	0.0025	0.014
Beryllium	0.004	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND ^	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Boron	2.0	0.50	2.3	0.25	1.6	0.050	1.2	0.25	1.6	0.50	2.0	0.50	2.7	0.25	2.4	0.50	1.8	0.25	2.7
Cadmium	0.005	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Chloride	200.0	2.0	64	2.0	72	2.0	64	2.0	72	10	88	2.0	73	2.0	71	2.0	67	2.0	68
Chromium	0.1	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Cobalt	1.0	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Copper	0.65	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND ^	0.0020	ND	0.0020	ND
Cyanide	0.2	0.010	ND	0.010	0.014	0.010	ND	0.010	ND	0.010	ND	0.010	0.034	0.010	0.015	0.010	ND	0.010	ND
Fluoride	4.0	0.10	0.65	0.10	0.67	0.10	0.60	0.10	0.50	0.10	0.49	0.10	0.36	0.10	0.59	0.10	0.22	0.10	0.38
Iron	5.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND^	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Lead	0.0075	0.00050	0.0015	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Manganese	0.15	0.0025	0.0035	0.0025	0.0032	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	0.015	0.0025	0.0070	0.0025	ND	0.0025	0.011
Mercury	0.002	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND
Nickel	0.1	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Nitrogen/Nitrate	10.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.22	0.10	0.16	0.10	ND	0.10	0.17
Nitrogen/Nitrate, Nitrite	NA	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.22	0.10	0.16	0.10	ND	0.10	0.17
Nitrogen/Nitrite	NA	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Perchlorate	0.0049	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND
Selenium	0.05	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	0.0035	0.0025	0.013	0.0025	0.0039	0.0025	0.0044	0.0025	ND	0.0025	0.0033
Silver	0.05	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND^	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Sulfate	400.0	50	240	50	110	50	200	50	200	50	260	50	240	50	160	50	180	50	150
Thallium	0.002	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Total Dissolved Solids	1,200	10	400	10	430	10	420	10	480	10	490	10	580	10	470	10	430	10	530
Vanadium	0.049	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	0.016	0.0050	0.014	0.0050	0.013	0.0050	0.018
Zinc	5.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Benzene	0.005	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00073	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
BETX	11.705	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	0.00056	0.0025	0.00293	0.0025	ND	0.0025	0.0020	0.0025	ND	0.0025	ND
pH	6.5 - 9.0	NA	6.95	NA	7.12	NA	6.67	NA	9.22	NA	9.26	NA	7.33	NA	7.25	NA	9.13	NA	7.62
Temperature	NA	NA	13.28	NA	8.19	NA	9.94	NA	16.64	NA	18.38	NA	4.33	NA	11.40	NA	19.01	NA	9.64
Conductivity	NA	NA	0.513	NA	0.46	NA	0.497	NA	0.628	NA	0.803	NA	0.48	NA	0.59	NA	0.57	NA	0.43
Dissolved Oxygen	NA	NA	1.43	NA	1.02	NA	3.32	NA	0.93	NA	0.41	NA	1.84	NA	1.06	NA	1.17	NA	1.17
ORP	NA	NA	13.2	NA	64.6	NA	43.0	NA	-52.0	NA	-7.0	NA	-7.7	NA	-72.7	NA	-163.3	NA	-7.4

Notes: Standards obtained from IAC, Title 35, Chapter I, Part 620, Subpart D, Section 620.410 - Groundwater Quality Standards for Class I: Potable Resource Groundwater.
All values are in mg/L (ppm) unless otherwise noted.

DL - Detection limit
NA - Not Applicable
ND - Not Detected
NM - Not Measured

NR - Not Required
NS - Not Sampled
^ - Denotes instrument related QC exceeds the control limits

Temperature	°C	degrees Celcius
Conductivity	ms/cm[c]	millisiemens/centimeters
Dissolved Oxygen	mg/L	milligrams/liter
Oxygen Reduction Potential (ORP)	mV	millivolts

Sample: MW-04

Parameter	Standards	10/25/2010 DL	10/25/2010 Result	3/24/2011 DL	3/24/2011 Result	6/13/2011 DL	6/13/2011 Result	9/13/2011 DL	9/13/2011 Result	12/6/2011 DL	12/6/2011 Result	3/14/2012 DL	3/14/2012 Result	6/18/2012 DL	6/18/2012 Result
Antimony	0.006	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND
Arsenic	0.010	0.0010	0.0060	0.0010	0.0077	0.0010	0.0059	0.0010	0.0058	0.0010	0.0065	0.0010	0.0068	0.0010	0.0091
Barium	2.0	0.0025	0.026	0.0025	0.025	0.0025	0.034	0.0025	0.039	0.0025	0.036	0.0025	0.038	0.0025	0.025
Beryllium	0.004	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Boron	2.0	0.050	2.0	0.050	2.1	0.50	2.0	0.050	1.8	0.050	2.1	0.50	2.2	0.50	2.5
Cadmium	0.005	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Chloride	200.0	2.0	39	2.0	47	2.0	45	2.0	59	2.0	60	2.0	71	2.0	53
Chromium	0.1	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Cobalt	1.0	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Copper	0.65	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Cyanide	0.2	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND
Fluoride	4.0	0.10	0.60	0.10	0.84	0.10	0.97	0.10	0.67	0.10	0.82	0.10	0.73	0.10	0.82
Iron	5.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Lead	0.0075	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Manganese	0.15	0.0025	0.058	0.0025	0.035	0.0025	0.028	0.0025	0.36	0.0025	0.025	0.0025	0.038 ^	0.0025	0.041
Mercury	0.002	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND
Nickel	0.1	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Nitrogen/Nitrate	10.0	0.10	ND	0.10	ND	0.10	0.18	0.10	0.14	0.10	ND	0.10	ND	0.10	ND
Nitrogen/Nitrate, Nitrite	NA	0.10	ND	0.10	ND	0.10	0.18	0.10	0.14	0.10	ND	0.10	ND	0.10	ND
Nitrogen/Nitrite	NA	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Perchlorate	0.0049	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Selenium	0.05	0.0025	0.0039	0.0025	ND	0.0025	0.022	0.0025	0.025	0.0025	0.015	0.0025	0.0091	0.0025	ND
Silver	0.05	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Sulfate	400.0	50	250	50	170	50	160	25	160	50	160	50	280	50	250
Thallium	0.002	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Total Dissolved Solids	1,200	10	430	10	400	10	380	10	470	10	480	10	490	10	540
Vanadium	0.049	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Zinc	5.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Benzene	0.005	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
BETX	11.705	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
pH	6.5 - 9.0	NA	7.80	NA	8.54	NA	7.69	NA	7.42	NA	7.35	NA	7.25	NA	7.51
Temperature	NA	NA	16.00	NA	13.14	NA	14.07	NA	13.38	NA	12.35	NA	13.78	NA	15.78
Conductivity	NA	NA	0.637	NA	0.62	NA	0.6	NA	0.56	NA	0.52	NA	0.58	NA	0.61
Dissolved Oxygen	NA	NA	NM	NA	0.3	NA	0.31	NA	0.23	NA	0.45	NA	0.33	NA	0.25
ORP	NA	NA	NM	NA	-10.6	NA	115.3	NA	-85	NA	38	NA	43	NA	17

Parameter	Standards	9/28/2012 DL	9/28/2012 Result	12/19/2012 DL	12/19/2012 Result	3/7/2013 DL	3/7/2013 Result	6/6/2013 DL	6/6/2013 Result	7/25/2013 DL	7/25/2013 Result	11/4/2013 DL	11/4/2013 Result	3/11/2014 DL	3/11/2014 Result	5/16/2014 DL	5/16/2014 Result	8/21/2014 DL	8/21/2014 Result
Antimony	0.006	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND
Arsenic	0.010	0.0010	0.0079	0.0010	0.0080	0.0010	0.0081	0.0010	0.0032	0.0010	0.0044	0.0010	0.0055	0.0010	0.0062	0.0010	0.0061	0.0010	0.0064
Barium	2.0	0.0025	0.024	0.0025	0.031	0.0025	0.031	0.0025	0.049	0.0025	0.049	0.0025	0.047	0.0025	0.071	0.0025	0.053	0.0025	0.029
Beryllium	0.004	0.0050	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Boron	2.0	0.25	2.2	0.50	2.5	0.50	2.4	0.50	2.3	0.50	2.5	0.25	2.8	0.25	3.0	0.25	2.7	0.25	1.5
Cadmium	0.005	0.00050	ND ^	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Chloride	200.0	2.0	55	2.0	55	2.0	50	2.0	51	2.0	42	2.0	46	2.0	41	2.0	34	2.0	33
Chromium	0.1	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Cobalt	1.0	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Copper	0.65	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Cyanide	0.2	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND
Fluoride	4.0	0.10	0.85	0.10	0.72 ^	0.10	0.73	0.10	0.67	0.10	0.60	0.10	0.48	0.10	0.28	0.10	0.27	0.10	0.26
Iron	5.0	0.10	ND ^	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Lead	0.0075	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Manganese	0.15	0.0025	0.028	0.0025	0.031	0.0025	0.034	0.0025	0.016	0.0025	0.024	0.0025	0.036	0.0025	0.074	0.0025	0.052	0.0025	0.046
Mercury	0.002	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND
Nickel	0.1	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Nitrogen/Nitrate	10.0	0.10	ND	0.10	0.31	0.10	ND	0.10	0.21	0.10	0.12	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Nitrogen/Nitrate, Nitrite	NA	0.10	ND ^	0.10	0.31	0.10	ND	0.10	0.21	0.10	0.12	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Nitrogen/Nitrite	NA	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Perchlorate	0.0049	NR	NR	0.004	ND	0.004	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND
Selenium	0.05	0.0025	0.0061	0.0025	ND	0.0025	0.0043	0.0025	0.028	0.0025	0.050	0.0025	0.011	0.0025	0.0034	0.0025	ND	0.0025	ND
Silver	0.05	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Sulfate	400.0	50	210	50	220	50	230	50	260	100	300	50	270	100	360	50	140	25	130
Thallium	0.002	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Total Dissolved Solids	1,200	10	440	10	510	10	460	10	660	10	610	10	630	10	680	10	470	10	370
Vanadium	0.049	NR	NR	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Zinc	5.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Benzene	0.005	NR	NR	0.0005	ND	0.0005	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
BETX	11.705	NR	NR	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND
pH	6.5 - 9.0	NA	8.63	NA	8.41	NA	8.93	NA	7.25	NA	7.18	NA	7.35	NA	7.99	NA	7.76	NA	7.74
Temperature	NA	NA	13.28	NA	13.11	NA	11.9	NA	12.91	NA	14.1	NA	13.17	NA	10.93	NA	10.27	NA	16.85
Conductivity	NA	NA	0.53	NA	0.57	NA	0.56	NA	0.666	NA	0.70	NA	0.59	NA	0.65	NA	0.59	NA	0.43
Dissolved Oxygen	NA	NA	0.49	NA	0.07	NA	0.14	NA	0.37	NA	0.35	NA	0.37	NA	1.28	NA	0.52	NA	0.43
ORP	NA	NA	-123	NA	-151	NA	-54.3	NA	-55.9	NA	13.7	NA	-166.2	NA	-99.2	NA	13.8	NA	-48.2

Parameter	Standards	11/6/2014 DL	11/6/2014 Result	2/17/2015 DL	2/17/2015 Result	4/21/2015 DL	4/21/2015 Result	8/12/2015 DL	8/12/2015 Result	11/3/2015 DL	11/3/2015 Result	3/1/2016 DL	3/1/2016 Result	5/4/2016 DL	5/4/2016 Result	8/24/2016 DL	8/24/2016 Result	12/5/2016 DL	12/5/2016 Result
Antimony	0.006	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND
Arsenic	0.010	0.0010	0.0080	0.0010	0.0080	0.0010	0.0075	0.0010	0.0072	0.0010	0.0069	0.0010	0.0065	0.0010	0.0067	0.0010	0.010	0.0010	0.010
Barium	2.0	0.0025	0.024	0.0025	0.031	0.0025	0.033	0.0025	0.034	0.0025	0.035	0.0025	0.033	0.0025	0.018	0.0025	0.018	0.0025	0.11
Beryllium	0.004	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND ^	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Boron	2.0	0.50	1.6	0.25	2.0	0.25	1.8	0.25	1.6	0.50	1.5	0.50	1.9	0.25	1.6	0.50	1.7	0.25	2.9
Cadmium	0.005	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Chloride	200.0	2.0	36	2.0	53	2.0	70	2.0	65	2.0	63	2.0	51	2.0	49	2.0	58	2.0	56
Chromium	0.1	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Cobalt	1.0	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Copper	0.65	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND ^	0.0020	ND	0.0020	ND
Cyanide	0.2	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND
Fluoride	4.0	0.10	0.23	0.10	0.26	0.10	0.28	0.10	0.41	0.10	0.44	0.10	0.56	0.10	0.59	0.10	0.52	0.10	0.21
Iron	5.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND^	0.10	ND	0.10	ND	0.10	ND	0.10	0.15
Lead	0.0075	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Manganese	0.15	0.0025	0.035	0.0025	0.058	0.0025	0.056	0.0025	0.060	0.0025	0.061	0.0025	0.053	0.0025	0.021	0.0025	0.033	0.0025	0.14
Mercury	0.002	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND
Nickel	0.1	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Nitrogen/Nitrate	10.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Nitrogen/Nitrate, Nitrite	NA	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Nitrogen/Nitrite	NA	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Perchlorate	0.0049	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND
Selenium	0.05	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	0.023
Silver	0.05	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND^	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Sulfate	400.0	50	200	50	140	50	130	50	210	50	240	50	180	50	150	20	130	100	340
Thallium	0.002	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Total Dissolved Solids	1,200	10	280	10	440	10	400	10	480	10	390	10	450	10	330	10	330	10	990
Vanadium	0.049	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Zinc	5.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Benzene	0.005	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
BETX	11.705	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	0.00083	0.0025	ND	0.0025	0.0015	0.0025	ND	0.0025	ND
pH	6.5 - 9.0	NA	7.53	NA	7.99	NA	7.18	NA	8.38	NA	6.68	NA	7.17	NA	6.92	NA	7.01	NA	7.40
Temperature	NA	NA	10.41	NA	4.49	NA	11.22	NA	19.57	NA	14.98	NA	5.27	NA	9.49	NA	17.84	NA	9.93
Conductivity	NA	NA	0.374	NA	0.39	NA	0.457	NA	0.676	NA	0.68	NA	0.40	NA	0.48	NA	0.49	NA	0.89
Dissolved Oxygen	NA	NA	4.55	NA	1.02	NA	3.77	NA	0.66	NA	1.40	NA	0.99	NA	1.62	NA	2.78	NA	2.34
ORP	NA	NA	-56.8	NA	-74.7	NA	-73.4	NA	-62.6	NA	33.4	NA	-52.8	NA	-103.0	NA	-113.3	NA	4.6

Notes: Standards obtained from IAC, Title 35, Chapter I, Part 620, Subpart D, Section 620.410 - Groundwater Quality Standards for Class I: Potable Resource Groundwater.
All values are in mg/L (ppm) unless otherwise noted.

DL - Detection limit
NA - Not Applicable
ND - Not Detected
NM - Not Measured

NR - Not Required
NS - Not Sampled
^ - Denotes instrument related QC exceeds the control limits

Temperature	°C	degrees Celcius
Conductivity	ms/cm[c]	millisiemens/centimeters
Dissolved Oxygen	mg/L	milligrams/liter
Oxygen Reduction Potential (ORP)	mV	millivolts

Attachment 9-3. CCA Groundwater Analytical Results - Midwest Generation LLC, Waukegan Station, Waukegan, IL

Sample: MW-05	Date	10/25/2010		3/24/2011		6/13/2011		9/13/2011		12/6/2011		3/14/2012		6/18/2012		9/28/2012		12/19/2012		3/7/2013		6/6/2013		7/25/2013	
Parameter	Standards	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.006	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND
Arsenic	0.010	0.0010	0.0076	0.0010	0.0082	0.0010	0.0013	0.0010	ND	0.0010	0.010	0.0010	0.010	0.0010	0.0098	0.0010	0.012	0.0010	0.011	0.0010	0.012	0.0010	ND	0.0010	0.0013
Barium	2.0	0.0025	0.060	0.0025	0.066	0.0025	0.057	0.0025	0.041	0.0025	0.073	0.0025	0.063	0.0025	0.051	0.0025	0.067	0.0025	0.070	0.0025	0.060	0.0025	0.045	0.0025	0.037
Beryllium	0.004	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0050	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Boron	2.0	5.0	28	5.0	33	2.5	12	5.0	30	1.0	37	5.0	44	5.0	47	5.0	41	5.0	27	5.0	33	5.0	12	5.0	29
Cadmium	0.005	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND ^	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Chloride	200.0	10	100	10	120	50	540	50	220	10	110	2.0	50	2.0	50	10	170	10	220	2.0	68	50	600	10	210
Chromium	0.1	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Cobalt	1.0	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Copper	0.65	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0021	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Cyanide	0.2	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND
Fluoride	4.0	0.10	0.29	0.10	0.34	0.10	0.24	0.10	0.18	0.10	0.29	0.10	0.29	0.10	0.31	0.10	0.32	0.10	0.36 ^	0.10	0.36	0.10	0.21	0.10	0.32
Iron	5.0	0.10	3.5	0.10	2.8	0.10	0.95	0.10	0.42	0.10	5.6	0.10	6.6	0.10	5.9	0.10	5.1 ^	0.10	3.9	0.10	4.0	0.10	0.41	0.10	1.1
Lead	0.0075	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Manganese	0.15	0.0025	0.71	0.0025	0.60	0.0025	0.28	0.0025	0.030	0.0025	0.99	0.0025	0.76 ^	0.0025	0.75	0.0025	0.57	0.0025	0.48	0.0025	0.51	0.0025	0.17	0.0025	0.44
Mercury	0.002	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND
Nickel	0.1	0.0020	ND	0.0020	ND	0.0020	0.0026	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0026	0.0020	ND
Nitrogen/Nitrate	10.0	0.10	ND	0.10	0.27	0.10	0.20	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.45	0.10	ND
Nitrogen/Nitrate, Nitrite	NA	0.10	ND	0.10	0.27	0.10	0.20	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND ^	0.10	ND	0.10	ND	0.10	0.45	0.10	ND
Nitrogen/Nitrite	NA	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	0.033
Perchlorate	0.0049	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.004	ND	0.004	ND	0.0040	ND	0.0040	ND
Selenium	0.05	0.0025	0.0028	0.0025	ND	0.0025	0.0094	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	0.0037	0.0025	ND
Silver	0.05	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Sulfate	400.0	200	920	250	780	250	1100	250	810	250	1100	250	980	250	800	250	710	250	550	250	650	250	1200	250	890
Thallium	0.002	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Total Dissolved Solids	1,200	10	1500	10	1800	10	3300	10	2300	10	2300	10	2000	10	2000	10	1900	10	1800	10	1600	17	3500	10	2000
Vanadium	0.049	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Zinc	5.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Benzene	0.005	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.0005	ND	0.0005	ND	0.00050	ND	0.00050	ND
BETX	11.705	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND
pH	6.5 - 9.0	NA	7.21	NA	7.56	NA	6.72	NA	6.87	NA	7.15	NA	7.45	NA	6.97	NA	7.32	NA	7.36	NA	7.33	NA	6.61	NA	6.74
Temperature	NA	NA	15.23	NA	12.13	NA	13.41	NA	13.37	NA	11.63	NA	14.23	NA	15.74	NA	13.17	NA	12.46	NA	12.5	NA	13.12	NA	15.7
Conductivity	NA	NA	1.801	NA	2.16	NA	4.34	NA	2.26	NA	1.87	NA	0.52	NA	1.68	NA	1.76	NA	1.74	NA	1.48	NA	3.118	NA	2.18
Dissolved Oxygen	NA	NA	NM	NA	0.45	NA	0.49	NA	0.04	NA	0.35	NA	0.16	NA	0.12	NA	0.13	NA	0.1	NA	0.22	NA	0.63	NA	0.50
ORP	NA	NA	NM	NA	-72.1	NA	81.8	NA	-40	NA	-84	NA	-39	NA	-76	NA	-108	NA	-101	NA	-129.7	NA	18.4	NA	22.3

Sample: MW-05	11/5/2013		3/11/2014		5/16/2014		8/21/2014		11/5/2014		2/17/2015		4/20/2015		8/13/2015		11/3/2015		3/2/2016		5/2/2016		8/24/2016		12/7/2016	
Parameter	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND ^	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND
Arsenic	0.0010	0.0086	0.0010	0.0097	0.0010	0.0090	0.0010	0.0019	0.0010	0.0097	0.0010	0.010	0.0010	0.017 ^	0.0010	ND	0.0010	ND	0.0010	0.0023	0.0010	ND ^	0.0010	0.0075	0.0010	0.013
Barium	0.0025	0.054	0.0025	0.051	0.0025	0.036	0.0025	0.031	0.0025	0.046	0.0025	0.046	0.0025	0.068	0.0025	0.041	0.0025	0.039	0.0025	0.036	0.0025	0.036	0.0025	0.074	0.0025	0.071
Beryllium	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND ^	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Boron	1.0	32	2.5	31	5.0	36	5.0	35	5.0	36	5.0	32	2.5	24	2.5	11	5.0	12	5.0	14	5.0	23	2.5	43	5.0	49
Cadmium	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Chloride	2.0	49	2.0	45	2.0	47	2.0	47	2.0	42	2.0	41	10	270	50	720	10	370	10	300	10	140	10	150	2.0	68
Chromium	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Cobalt	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Copper	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND ^	0.0020	ND	0.0020	ND
Cyanide	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND
Fluoride	0.10	0.32	0.10	0.29	0.10	0.31	0.10	0.31	0.10	0.29	0.10	0.26	0.10	0.23	0.10	0.19	0.10	0.20	0.10	0.19	0.10	0.22	0.10	0.28	0.10	0.29
Iron	0.10	4.6	0.10	5.5	0.10	5.5	0.10	4.0	0.10	8.6	0.10	7.2	0.10	6.9	0.10	0.28	0.10	0.58	0.10	2.3	0.10	1.8	0.10	13	0.10	8.9
Lead	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Manganese	0.0025	0.54	0.0025	0.62	0.0025	0.49	0.0025	0.65	0.0025	0.62	0.0025	0.46	0.0025	0.63	0.0025	0.18	0.0025	0.20	0.0025	0.17	0.0025	0.32	0.0025	0.65	0.0025	0.53
Mercury	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND
Nickel	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0020	0.0020	ND	0.0020	0.0037	0.0020	0.0026	0.0020	ND	0.0020	0.0046	0.0020	0.0045	0.0020	ND	0.0020	ND
Nitrogen/Nitrate	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Nitrogen/Nitrate, Nitrite	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND ^	0.10	ND	0.10	ND
Nitrogen/Nitrite	0.020	ND	0.020	ND	0.020	ND	0.020	0.047	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Perchlorate	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND ^	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND
Selenium	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	0.0030 ^	0.0025	0.024	0.0025	0.014	0.0025	0.0054	0.0050	ND	0.0025	ND	0.0025	ND
Silver	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND^	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Sulfate	250	870	250	640	100	630	130	640	200	840	250	660	250	700	250	1200	200	910	500	1200	250	1000	250	1100	250	610
Thallium	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Total Dissolved Solids	10	1600	10	1400	10	1500	10	1600	10	1500	10	1700	13	2200	17	3500	13	2700	10	2800	10	2400	10	2200	10	2000
Vanadium	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Zinc	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Benzene	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00079	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
BETX	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	0.00259	0.0025	ND	0.0025	0.00054	0.0025	ND	0.0025	ND
pH	NA	7.20	NA	7.64	NA	7.07	NA	7.06	NA	7.30	NA	7.46	NA	6.73	NA	7.03	NA	6.18	NA	6.71	NA	6.73	NA	6.80	NA	6.82
Temperature	NA	13.34	NA	10.19	NA	10.13	NA	19.08	NA	11.27	NA	7.51	NA	10.27	NA	19.55	NA	14.09	NA	7.82	NA	13.27	NA	20.78	NA	7.90
Conductivity	NA	1.24	NA	0.86	NA	1.33	NA	1.509	NA	1.316	NA	1.28	NA	2.095	NA	3.582	NA	3.073	NA	2.52	NA	2.38	NA	2.17	NA	1.41
Dissolved Oxygen	NA	0.47	NA	1.45	NA	0.59	NA	4.09	NA	1.61	NA	1.97	NA	2.75	NA	1.11	NA	1.42	NA	2.24	NA	1.66	NA	2.05	NA	1.15
ORP	NA	-107.0	NA	-94.3	NA	-28.2	NA	-80	NA	-53	NA	-100.6	NA	-58.6	NA	-34.2	NA	46.2	NA	12.1	NA	-20.6	NA	-72.7	NA	-59.3

Notes: Standards obtained from IAC, Title 35, Chapter I, Part 620, Subpart D, Section 620.410 - Groundwater Quality Standards for Class I: Potable Resource Groundwater.
All values are in mg/L (ppm) unless otherwise noted.

DL - Detection limit
NA - Not Applicable
ND - Not Detected
NM - Not Measured

NR - Not Required
NS - Not Sampled
^ - Denotes instrument related QC exceeds the control limits

Temperature °C degrees Celcius
Conductivity ms/cm[c] millisiemens/centimeters
Dissolved Oxygen mg/L milligrams/liter
Oxygen Reduction Potential (ORP) mV millivolts

Attachment 9-3. CCA Groundwater Analytical Results - Midwest Generation LLC, Waukegan Station, Waukegan, IL

Sample: MW-06	Date	10/25/2010		3/24/2011		6/13/2011		9/13/2011		12/6/2011		3/14/2012		6/18/2012		9/28/2012	
Parameter	Standards	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.006	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Arsenic	0.010	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Barium	2.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Beryllium	0.004	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Boron	2.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Cadmium	0.005	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Chloride	200.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Chromium	0.1	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Cobalt	1.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Copper	0.65	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Cyanide	0.2	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fluoride	4.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Iron	5.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Lead	0.0075	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Manganese	0.15	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Mercury	0.002	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Nickel	0.1	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Nitrogen/Nitrate	10.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Nitrogen/Nitrate, Nitrite	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Nitrogen/Nitrite	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Perchlorate	0.0049	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Selenium	0.05	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Silver	0.05	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Sulfate	400.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Thallium	0.002	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Total Dissolved Solids	1,200	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Vanadium	0.049	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Zinc	5.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Benzene	0.005	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
BETX	11.705	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
pH	6.5 - 9.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Temperature	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Conductivity	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Dissolved Oxygen	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
ORP	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Sample: MW-06	12/19/2012		3/7/2013		6/6/2013		7/25/2013		11/5/2013		3/10/2014		5/15/2014		8/21/2014		11/5/2014	
Parameter	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND ^
Arsenic	0.0010	0.0029	0.0010	0.0019	0.0010	0.0065	0.0010	0.0096	0.0010	0.0034	0.0010	0.0017	0.0010	0.0043	0.0010	0.0083	0.0010	0.0045
Barium	0.0025	0.11	0.0025	0.088	0.0025	0.077	0.0025	0.092	0.0025	0.13	0.0025	0.012	0.0025	0.061	0.0025	0.089	0.0025	0.10
Beryllium	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Boron	0.25	1.1	0.50	2.8	0.50	6.7	2.5	4.3	0.25	2.4	0.25	2.0	0.25	2.2	0.25	2.9	0.50	3.7
Cadmium	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Chloride	10	110	2.0	61	2.0	48	2.0	69	10	85	2.0	8.0	10	84	10	98	10	97
Chromium	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Cobalt	0.0010	ND	0.0010	ND	0.0010	0.0015	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Copper	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0025	0.0020	ND	0.0020	ND	0.0020	ND
Cyanide	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND
Fluoride	0.10	0.43 ^	0.10	0.27	0.10	0.30	0.10	0.34	0.10	0.30	0.10	0.17	0.10	0.22	0.10	0.35	0.10	0.29
Iron	0.10	2.6	0.10	2.0	0.10	6.2	0.10	16	0.10	4.1	0.10	0.19	0.10	3.0	0.10	9.2	0.10	6.7
Lead	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Manganese	0.0025	0.21	0.0025	0.36	0.0025	0.75	0.0025	0.72	0.0025	0.44	0.0025	0.0073	0.0025	0.17	0.0025	0.38	0.0025	0.44
Mercury	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND
Nickel	0.0020	ND	0.0020	ND	0.0020	0.0039	0.0020	0.0029	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Nitrogen/Nitrate	0.10	ND	0.10	ND	0.10	1.1	0.10	ND	0.10	ND	0.10	0.54	0.10	ND	0.10	ND	0.10	ND
Nitrogen/Nitrate, Nitrite	0.10	ND	0.10	ND	0.10	1.1	0.10	ND	0.10	ND	0.10	0.54	0.10	ND	0.10	ND	0.10	ND
Nitrogen/Nitrite	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Perchlorate	0.004	ND	0.004	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND
Selenium	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	0.014	0.0025	ND	0.0025	0.0033	0.0025	0.0034
Silver	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Sulfate	50	160	100	380	100	390	100	360	100	350	25	93	50	170	50	120	50	240
Thallium	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Total Dissolved Solids	10	940	10	1100	10	1100	10	1100	10	1200	10	190	10	870	10	950	10	890
Vanadium	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	0.0050	0.0050	ND	0.0050	ND	0.0050	ND
Zinc	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Benzene	0.0005	ND	0.0005	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
BETX	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND
pH	NA	7.52	NA	7.42	NA	6.83	NA	6.88	NA	7.24	NA	7.94	NA	7.18	NA	7.11	NA	7.33
Temperature	NA	11.32	NA	7.1	NA	9.68	NA	12.92	NA	13.14	NA	5.14	NA	8.91	NA	17.83	NA	12.69
Conductivity	NA	1.05	NA	1.01	NA	0.911	NA	1.18	NA	1.10	NA	0.21	NA	0.9	NA	1.179	NA	1.092
Dissolved Oxygen	NA	0.07	NA	0.33	NA	0.4	NA	0.28	NA	0.22	NA	7.07	NA	0.51	NA	0.97	NA	1.37
ORP	NA	-128	NA	-99.4	NA	-72.7	NA	-109.7	NA	-126.3	NA	-9.90	NA	-36.7	NA	-116.9	NA	-94.1

Sample: MW-06	2/18/2015		4/20/2015		8/12/2015		11/3/2015		2/29/2016		5/3/2016		8/25/2016		12/6/2016	
Parameter	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND
Arsenic	0.0010	0.0030	0.0010	0.0027	0.0010	0.0037	0.0010	0.0039	0.0010	0.0016	0.0020	0.0023	0.0010	0.0022	0.0010	0.0012
Barium	0.0025	0.063	0.0025	0.066	0.0025	0.084	0.0025	0.096	0.0025	0.093	0.0025	0.074	0.0025	0.11	0.0025	0.089
Beryllium	0.0010	ND	0.0010	ND	0.0010	ND ^	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Boron	0.50	3.5	0.050	1.4	0.25	2.0	0.50	1.9	0.50	2.8	5.0	10	0.50	1.6	0.50	5.8
Cadmium	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Chloride	10	81	10	100	10	110	10	120	10	100	10	77	10	140	10	100
Chromium	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Cobalt	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Copper	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0023	0.0020	ND ^	0.0020	ND	0.0020	ND
Cyanide	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND
Fluoride	0.10	0.23	0.10	0.32	0.10	0.36	0.10	0.36	0.10	0.34	0.10	0.33	0.10	0.35	0.10	0.29
Iron	0.10	7.6	0.10	0.62	0.10	4.2	0.10	5.2	0.10	5.9	0.10	5.8	0.10	5.2	0.10	4.8
Lead	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Manganese	0.0025	0.38	0.0025	0.19	0.0025	0.24	0.0025	0.26	0.0025	0.26	0.0025	0.26	0.0025	0.28	0.0025	0.39
Mercury	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND
Nickel	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Nitrogen/Nitrate	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Nitrogen/Nitrate, Nitrite	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND ^	0.10	ND	0.10	ND
Nitrogen/Nitrite	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Perchlorate	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND
Selenium	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0050	ND	0.0025	ND	0.0025	ND
Silver	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND^	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Sulfate	50	190	50	160	50	170	50	180	50	250	50	300	50	180	100	250
Thallium	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Total Dissolved Solids	10	900	10	850	10	1100	10	870	10	960	10	1000	10	1000	10	1100
Vanadium	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Zinc	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Benzene	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00068	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
BETX	0.0025	0.00078	0.0025	ND	0.0025	ND	0.0025	0.00398	0.0025	ND	0.0025	0.00071	0.0025	ND	0.0025	ND
pH	NA	7.45	NA	6.76	NA	7.69	NA	6.81	NA	7.24	NA	7.22	NA	6.90	NA	6.79
Temperature	NA	4.41	NA	7.68	NA	19.07	NA	13.96	NA	8.01	NA	12.41	NA	18.68	NA	8.54
Conductivity	NA	0.85	NA	0.905	NA	1.246	NA	1.294	NA	0.96	NA	1.13	NA	1.34	NA	1.03
Dissolved Oxygen	NA	3.00	NA	4.67	NA	2.11	NA	0.96	NA	1.44	NA	2.12	NA	2.00	NA	1.45
ORP	NA	-104.5	NA	-45.6	NA	-130.8	NA	-55.1	NA	-90.1	NA	-107.3	NA	-86.0	NA	-82.7

Notes: Standards obtained from IAC, Title 35, Chapter I, Part 620, Subpart D, Section 620.410 - Groundwater Quality Standards for Class I: Potable Resource Groundwater.
All values are in mg/L (ppm) unless otherwise noted.

DL - Detection limit
NA - Not Applicable
ND - Not Detected
NM - Not Measured

NR - Not Required
NS - Not Sampled
^ - Denotes instrument related QC exceeds the control limits

Temperature °C degrees Celcius
Conductivity ms/cm^c millisiemens/centimeters
Dissolved Oxygen mg/L milligrams/liter
Oxygen Reduction Potential (ORP) mV millivolts

Attachment 9-3. CCA Groundwater Analytical Results - Midwest Generation LLC, Waukegan Station, Waukegan, IL

Sample: MW-07	Date	10/25/2010		3/24/2011		6/13/2011		9/13/2011		12/6/2011		3/14/2012		6/18/2012		9/28/2012	
Parameter	Standards	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.006	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Arsenic	0.010	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Barium	2.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Beryllium	0.004	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Boron	2.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Cadmium	0.005	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Chloride	200.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Chromium	0.1	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Cobalt	1.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Copper	0.65	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Cyanide	0.2	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fluoride	4.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Iron	5.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Lead	0.0075	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Manganese	0.15	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Mercury	0.002	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Nickel	0.1	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Nitrogen/Nitrate	10.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Nitrogen/Nitrate, Nitrite	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Nitrogen/Nitrite	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Perchlorate	0.0049	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Selenium	0.05	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Silver	0.05	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Sulfate	400.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Thallium	0.002	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Total Dissolved Solids	1,200	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Vanadium	0.049	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Zinc	5.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Benzene	0.005	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
BETX	11.705	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
pH	6.5 - 9.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Temperature	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Conductivity	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Dissolved Oxygen	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
ORP	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Sample: MW-07	12/19/2012		3/7/2013		6/6/2013		7/25/2013		11/4/2013		3/10/2014		5/15/2014		8/21/2014	
Parameter	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND
Arsenic	0.0010	0.0099	0.0010	0.012	0.0010	0.010	0.0010	0.011	0.0010	0.012	0.0010	0.0096	0.0010	0.0098	0.0010	0.011
Barium	0.0025	0.080	0.0025	0.082	0.0025	0.082	0.0025	0.083	0.0025	0.082	0.0025	0.073	0.0025	0.089	0.0025	0.072
Beryllium	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Boron	5.0	43	5.0	49	5.0	42	5.0	44	1.0	45	2.5	39	5.0	27	5.0	40
Cadmium	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Chloride	2.0	60	2.0	54	2.0	44	2.0	33	2.0	53	2.0	34	2.0	35	2.0	36
Chromium	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Cobalt	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Copper	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Cyanide	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND
Fluoride	0.10	0.48	0.10	0.50	0.10	0.46	0.10	0.46	0.10	0.44	0.10	0.39	0.10	0.30	0.10	0.47
Iron	0.10	12	0.10	12	0.10	13	0.10	13	0.10	13	0.10	11	0.10	12	0.10	11
Lead	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Manganese	0.0025	0.46	0.0025	0.49	0.0025	0.48	0.0025	0.46	0.0025	0.46	0.0025	0.46	0.0025	0.60	0.0025	0.40
Mercury	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND
Nickel	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Nitrogen/Nitrate	0.10	ND	0.10	ND	0.10	0.11	0.10	ND	0.10	ND	0.10	ND	0.10	0.11	0.10	ND
Nitrogen/Nitrate, Nitrite	0.10	ND	0.10	ND	0.10	0.11	0.10	ND	0.10	ND	0.10	ND	0.10	0.11	0.10	ND
Nitrogen/Nitrite	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Perchlorate	0.004	ND	0.004	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND
Selenium	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	0.0025	0.0025	ND	0.0025	ND	0.0025	ND
Silver	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Sulfate	250	630	250	710	250	650	250	860	250	770	250	540	100	330	130	690
Thallium	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Total Dissolved Solids	10	1800	10	1800	10	1800	10	1800	10	1800	10	1600	10	1300	10	1600
Vanadium	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Zinc	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Benzene	0.0005	ND	0.0005	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
BETX	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND
pH	NA	7.27	NA	8.24	NA	7.09	NA	7.10	NA	7.18	NA	7.67	NA	6.89	NA	7.25
Temperature	NA	12.99	NA	1.5	NA	12.46	NA	13.99	NA	12.92	NA	12.33	NA	9.89	NA	18.25
Conductivity	NA	1.54	NA	1.17	NA	1.385	NA	1.52	NA	1.01	NA	0.98	NA	1.26	NA	1.607
Dissolved Oxygen	NA	0.05	NA	0.33	NA	0.80	NA	0.28	NA	0.54	NA	1.19	NA	0.62	NA	1.18
ORP	NA	-129	NA	-111.6	NA	-151.7	NA	-125.8	NA	-127.7	NA	-116.8	NA	-16.9	NA	-143.6

Sample: MW-07	11/5/2014		2/17/2015		4/20/2015		8/12/2015		11/3/2015		2/29/2016		5/2/2016		8/24/2016		12/7/2016	
Parameter	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.0030	ND ^	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND
Arsenic	0.0010	0.0095	0.0010	0.011	0.0010	0.014	0.0010	0.010	0.0010	0.011	0.0010	0.0079	0.0020	0.0078	0.0010	0.0074	0.0010	0.0088
Barium	0.0025	0.062	0.0025	0.069	0.0025	0.071	0.0025	0.065	0.0025	0.063	0.0025	0.053	0.0025	0.066	0.0025	0.081	0.0025	0.087
Beryllium	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND ^	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Boron	5.0	41	5.0	37	2.5	37	5.0	32	5.0	26	5.0	22	5.0	24	2.5	26	5.0	33
Cadmium	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Chloride	2.0	48	2.0	48	2.0	46	2.0	64	10	85	2.0	59	2.0	54	2.0	49	2.0	36
Chromium	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Cobalt	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND
Copper	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND ^	0.0020	ND	0.0020	ND
Cyanide	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND
Fluoride	0.10	0.45	0.10	0.38	0.10	0.34	0.10	0.47	0.10	0.45	0.10	0.57	0.10	0.37	0.10	0.38	0.10	0.32
Iron	0.10	9.4	0.10	12	0.10	14	0.10	11	0.10	11	0.10	8.3	0.10	14	0.10	11	0.10	16
Lead	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Manganese	0.0025	0.34	0.0025	0.45	0.0025	0.62	0.0025	0.43	0.0025	0.40	0.0025	0.30	0.0025	0.48	0.0025	0.52	0.0025	0.55
Mercury	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND
Nickel	0.0020	ND	0.0020	ND	0.0020	0.0021	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0022	0.0020	ND	0.0020	ND
Nitrogen/Nitrate	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Nitrogen/Nitrate, Nitrite	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND ^	0.10	ND	0.10	ND
Nitrogen/Nitrite	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	0.020	0.020	ND	0.020	ND
Perchlorate	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND	0.0040	ND
Selenium	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0050	ND	0.0025	ND	0.0025	ND
Silver	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND^	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
Sulfate	200	880	250	710	130	470	200	760	200	770	100	580	130	610	100	620	250	510
Thallium	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND
Total Dissolved Solids	10	1500	10	1600	10	1400	10	1700	10	1500	10	1300	10	1500	10	1500	10	1800
Vanadium	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND
Zinc	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Benzene	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND
BETX	0.0025	ND	0.0025	0.0012	0.0025	ND	0.0025	ND	0.0025	0.0015	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND
pH	NA	7.46	NA	7.56	NA	6.59	NA	7.38	NA	6.80	NA	7.31	NA	7.02	NA	6.99	NA	6.83
Temperature	NA	13.37	NA	5.67	NA	10.80	NA	16.66	NA	15.05	NA	11.51	NA	12.08	NA	20.24	NA	7.26
Conductivity	NA	1.394	NA	1.20	NA	1.34	NA	1.62	NA	1.65	NA	1.17	NA	1.45	NA	1.63	NA	1.26
Dissolved Oxygen	NA	2.35	NA	1.31	NA	3.14	NA	0.87	NA	0.53	NA	0.90	NA	1.07	NA	2.46	NA	1.34
ORP	NA	-112.5	NA	-137.2	NA	-73.9	NA	-135.5	NA	-69.4	NA	-97.4	NA	-118.4	NA	-94.4	NA	-92.4

Notes: Standards obtained from IAC, Title 35, Chapter I, Part 620, Subpart D, Section 620.410 - Groundwater Quality Standards for Class I: Potable Resource Groundwater.
All values are in mg/L (ppm) unless otherwise noted.

DL - Detection limit
NA - Not Applicable
ND - Not Detected
NM - Not Measured

NR - Not Required
NS - Not Sampled
^ - Denotes instrument related QC exceeds the control limits

Temperature °C degrees Celcius
Conductivity ms/cm[c] millisiemens/centimeters
Dissolved Oxygen mg/L milligrams/liter
Oxygen Reduction Potential (ORP) mV millivolts

MW-01	Date	2/21/2017		5/15/2017		9/14/2017		11/27/2017		2/7/2018		5/29/2018		8/20/2018		11/5/2018	
Parameter	Standards	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.006	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	0.0030	0.0030	0.0030	0.003	ND
Arsenic	0.010	0.0010	0.14	0.0010	0.11	0.0010	0.039	0.0010	0.048	0.0010	0.12	0.0010	0.17	0.0010	0.012	0.001	0.075
Barium	2.0	0.0025	0.015	0.0025	0.016	0.0025	0.033	0.0025	0.053	0.0025	0.021	0.0025	0.022	0.0025	0.11	0.0025	0.029
Beryllium	0.004	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	0.0010	0.0010	0.0010	0.001	ND ^
Boron	2.0	0.25	2.1	0.25	2.3	0.25	2.9	0.25	2.5	0.50	2.2	0.50	2.3	0.50	3.6	0.25	2.1
Cadmium	0.005	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00050	0.00050	0.00050	0.0005	ND
Chloride	200.0	2.0	61	2.0	58	2.0	49	2.0	45	2.0	53	2.0	53	2.0	30	2	40
Chromium	0.1	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	0.0050	0.0050	0.0050	0.005	ND
Cobalt	1.0	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	0.0010	0.0010	0.0010	0.001	ND
Copper	0.65	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0020	0.0020	0.0020	0.002	ND
Cyanide, Total	0.2	0.010	0.014	0.010	0.018	0.010	ND	0.010	ND	0.010	ND	0.010	0.010	0.010	0.010	0.01	ND F2
Fluoride	4.0	0.10	0.30	0.10	0.29	0.10	0.24	0.10	0.17	0.10	0.27	0.10	0.31	0.10	0.10	0.10	0.26
Iron	5.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.10	0.10	0.10	0.10	ND
Lead	0.0075	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00079	0.00050	0.00050	0.0005	ND
Manganese	0.15	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	0.0072	0.0025	ND	0.0025	0.0025	0.0025	0.035	0.0025	ND
Mercury	0.002	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	0.00020	0.00020	0.00020	0.0002	ND
Nickel	0.1	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0020	0.0020	0.0020	0.002	ND
Nitrogen, Nitrate	10.0	0.10	ND	0.10	0.11	0.10	0.29	0.10	2.2	0.10	ND	0.10	0.10	0.10	0.67	0.10	0.22
Nitrogen, Nitrate Nitrite	NA	0.10	ND	0.10	0.19	0.10	0.48	0.20	2.9	0.10	0.12	0.10	0.22	0.10	0.67	0.10	0.22
Nitrogen, Nitrite	NA	0.020	0.038	0.020	0.078	0.020	0.19	0.20	0.72	0.020	0.035	0.020	0.15	0.020	0.020	0.02	ND
Radium 226	20	0.119	ND	0.0943	0.114	0.0567	0.109	0.0628	ND	0.0636	0.0858	0.126	0.17	0.0793	0.388	0.259	ND
Radium 228	20	0.518	ND *	0.474	ND	0.398	ND	0.396	0.619	0.381	ND	0.546	ND	0.373	ND	0.539	ND
Selenium	0.05	0.0025	0.0025	0.0025	0.0055	0.0025	0.0099	0.0025	0.021	0.0025	0.0059	0.0025	0.0064	0.0025	0.0063	0.0025	ND
Silver	0.05	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00050	0.00050	0.00050	0.0005	ND
Sulfate	400.0	50	260	50	330	100	410	50	280	50	350	50	360	130	420	50	270
Thallium	0.002	0.0020	ND	0.0020	ND	0.0020	ND ^	0.0020	ND	0.0020	ND	0.0020	0.0020	0.0020	0.0020	0.002	ND
Total Dissolved Solids	1,200	10	550	10	600	10	750	10	800	10	580	10	570	10	1200	10	540
Vanadium	0.049	0.0050	0.077	0.0050	0.088	0.0050	0.077	0.0050	0.038	0.0050	0.062	0.0050	0.049	0.0050	0.0055	0.005	0.023
Zinc	5.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	0.020	0.020	0.020	0.02	ND
pH	6.5 - 9.0	NA	11.30	NA	10.69	NA	10.45	NA	7.85	NA	11.13	NA	8.44	NA	6.94	NA	8.70
Temperature	NA	NA	14.8	NA	15.1	NA	14.9	NA	12.9	NA	12.1	NA	14.2	NA	18.4	NA	12.34
Conductivity	NA	NA	0.81	NA	0.71	NA	0.96	NA	0.82	NA	0.69	NA	0.65	NA	0.96	NA	0.543
Dissolved Oxygen	NA	NA	1.98	NA	2.73	NA	0.22	NA	3.97	NA	0.74	NA	5.32	NA	5.34	NA	2.84
ORP	NA	NA	65.2	NA	-22.1	NA	-1.1	NA	-9.0	NA	-171.8	NA	-23.9	NA	154.0	NA	-61.7

MW-01	Date	2/11/2019		5/14/2019		8/14/2019		11/19/2019		3/2/2020		4/21/2020		8/17/2020		11/17/2020		3/1/2021		5/5/2021	
Parameter	Standards	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.006	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND
Arsenic	0.010	0.001	0.094	0.001	0.063	0.001	0.052	0.001	0.069	0.001	0.042	0.001	0.043	0.001	0.022	0.001	0.022	0.001	0.026	0.001	0.024
Barium	2.0	0.0025	0.024	0.0025	0.029	0.0025	0.027	0.0025	0.02	0.0025	0.033	0.0025	0.041	0.0025	0.046	0.0025	0.068	0.0025	0.05	0.0025	0.04
Beryllium	0.004	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND
Boron	2.0	0.25	2.2	0.05	2.1	0.25	2.4	0.5	2.4	0.5	2.4	0.05	2.7	0.25	2.5	0.5	3.2	0.5	3.7	0.5	3.2
Cadmium	0.005	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.005	ND	0.0005	ND
Chloride	200.0	2	53	2	46	2	47	2	35	2	28	2	25	2	48	10	92	10	110	6	70
Chromium	0.1	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND
Cobalt	1.0	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND
Copper	0.65	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND
Cyanide, Total	0.2	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND F1	0.01	ND	0.005	ND	0.005	ND	0.005	0.0059	0.005	ND
Fluoride	4.0	0.1	0.22	0.1	0.18	0.1	0.19	0.1	0.25	0.1	0.17	0.1	0.22	0.1	0.27	0.1	0.15	0.1	0.16	0.1	0.2
Iron	5.0	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND
Lead	0.0075	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND
Manganese	0.15	0.0025	ND	0.0025	0.005	0.0025	0.0056	0.0025	0.0025	0.0025	0.0093	0.0025	0.003	0.0025	0.011	0.0025	0.023	0.0025	0.0095	0.0025	0.0076
Mercury	0.002	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND
Nickel	0.1	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND
Nitrogen, Nitrate	10.0	0.1	ND	0.1	0.17	0.1	ND	0.1	0.1	0.1	0.11	0.1	0.17	0.1	ND	0.1	ND	0.1	ND	0.1	ND
Nitrogen, Nitrate Nitrite	NA	0.1	ND	0.1	0.17	0.1	ND	0.1	0.1	0.1	0.17	0.1	0.17	0.1	ND	0.1	ND	0.1	ND	0.1	ND
Nitrogen, Nitrite	NA	0.02	ND	0.02	ND	0.02	ND	0.02	ND ^	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND
Radium 226	20	0.228	ND	0.109	ND	0.241	ND	0.112	ND	0.127	ND	0.0912	ND	0.0768	0.115	0.528	ND	0.102	ND	0.149	ND
Radium 228	20	0.395	ND	0.426	ND	0.609	ND	0.581	ND	0.395	ND	0.452	ND	0.393	ND	0.557	ND	0.565	ND	0.342	0.407
Selenium	0.05	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND
Silver	0.05	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND
Sulfate	400.0	50	320	20	260	20	250	500	ND	500	ND	500	ND	25	210	25	240	25	210	25	190
Thallium	0.002	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND
Total Dissolved Solids	1,200	10	540	10	580	10	560	10	520	10	610	10	450	30	470	30	650	10	560	10	460
Vanadium	0.049	0.005	0.02	0.005	0.013	0.005	0.015	0.005	0.032	0.005	0.0097	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND
Zinc	5.0	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND
pH	6.5 - 9.0	NA	9.98	NA	9.85	NA	9.11	NA	10.58	NA	8.83	NA	9.40	NA	8.48	NA	7.97	NA	8.92	NA	9.00
Temperature	NA	NA	12.90	NA	12.20	NA	133.00	NA	12.82	NA	12.60	NA	12.50	NA	13.40	NA	13.60	NA	13.40	NA	13.50
Conductivity	NA	NA	0.775	NA	0.670	NA	0.900	NA	0.763	NA	0.306	NA	0.633	NA	0.738	NA	1.090	NA	1.151	NA	0.706
Dissolved Oxygen	NA	NA	0.75	NA	0.71	NA	0.29	NA	0.55	NA	0.74	NA	0.46	NA	0.37	NA	1.78	NA	-1.85	NA	1.40
ORP	NA	NA	-151.5	NA	17.8	NA	81.2	NA	-93.7	NA	126.8	NA	25.0	NA	75.6	NA	6.3	NA	56.6	NA	69.1

Notes: Standards obtained from IAC, Title 35, Chapter I, Part 620, Subpart D, Section 620.410 - Groundwater Quality Standards for Class I: Potable Resource Groundwater
All values are in mg/L (ppm) unless otherwise noted.

B- Compound also detected in blank
DL - Detection limit
NA - Not Applicable
ND - Not Detected

* - LCS or LCSD is outside acceptable limits.
^ - Instrument related QC outside limits.
F1 - MS and/or MSD Recovery outside of limits.

Temperature	°C	degrees Celsius
Conductivity	ms/cm[c]	millisiemens/centimeters
Dissolved Oxygen	mg/L	milligrams/liter
Oxygen Reduction Potential (ORP)	mV	millivolts

MW-02	Date	2/21/2017		5/15/2017		9/14/2017		11/27/2017		2/7/2018		5/29/2018		8/20/2018		11/5/2018	
Parameter	Standards	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.006	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	0.0030	0.0030	0.0030	0.003	ND
Arsenic	0.010	0.0010	0.026	0.0010	0.016	0.0010	0.011	0.0010	0.012	0.0010	0.014	0.0010	0.0054	0.0010	0.0070	0.001	0.0091
Barium	2.0	0.0025	0.010	0.0025	0.027	0.0025	0.035	0.0025	0.024	0.0025	0.024	0.0025	0.038	0.0025	0.034	0.0025	0.016
Beryllium	0.004	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	0.0010	0.0010	0.0010	0.001	ND ^
Boron	2.0	0.25	2.9	0.50	3.4	0.50	4.0	0.50	3.6	0.50	3.7	0.50	4.6	0.50	3.6	0.25	2.9
Cadmium	0.005	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00050	0.00050	0.00050	0.0005	ND
Chloride	200.0	2.0	51	2.0	50	2.0	54	2.0	57	2.0	53	2.0	41	2.0	50	2	54
Chromium	0.1	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	0.0050	0.0050	0.0050	0.005	ND
Cobalt	1.0	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	0.0010	0.0010	0.0010	0.001	ND
Copper	0.65	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0021	0.0020	0.0020	0.0020	0.0020	0.002	ND
Cyanide, Total	0.2	0.010	0.019	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	0.010	0.010	0.010	0.01	ND
Fluoride	4.0	0.10	0.78	0.10	0.38	0.10	0.44	0.10	0.58	0.10	0.38	0.10	0.39	0.10	0.48	0.10	0.69
Iron	5.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.24	0.10	0.10	0.10	0.10	0.10	ND
Lead	0.0075	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00050	0.00050	0.00050	0.0005	ND
Manganese	0.15	0.0025	0.017	0.0025	0.019	0.0025	0.029	0.0025	0.020	0.0025	0.018	0.0025	0.032	0.0025	0.031	0.0025	0.018
Mercury	0.002	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	0.00020	0.00020	0.00020	0.0002	ND
Nickel	0.1	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0020	0.0020	0.0020	0.002	ND
Nitrogen, Nitrate	10.0	0.10	ND	0.10	0.67	0.10	0.26	0.10	ND	0.10	ND	0.10	1.3	0.10	0.37	0.10	ND
Nitrogen, Nitrate Nitrite	NA	0.10	ND	0.10	0.73	0.10	0.26	0.10	ND	0.10	ND	0.10	1.3	0.10	0.37	0.10	ND
Nitrogen, Nitrite	NA	0.020	ND	0.020	0.057	0.020	ND	0.020	ND	0.020	ND	0.020	0.020	0.020	0.020	0.02	ND
Radium 226	20	0.144	ND	0.108	ND	0.0616	0.102	0.0578	0.169	0.0679	0.0887	0.0907	0.178	0.0805	0.326	0.199	ND
Radium 228	20	0.406	ND *	0.518	ND	0.361	0.492	0.395	0.924	0.36	ND	0.433	ND	0.354	ND	0.383	ND
Selenium	0.05	0.0025	ND	0.0025	0.022	0.0025	0.0054	0.0025	ND	0.0025	ND	0.0025	0.0086	0.0025	0.0067	0.0025	ND
Silver	0.05	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00050	0.00050	0.00050	0.0005	ND
Sulfate	400.0	50	210	50	350	100	330	50	200	50	290	100	420	100	230	50	170
Thallium	0.002	0.0020	ND	0.0020	ND	0.0020	ND ^	0.0020	ND	0.0020	ND	0.0020	0.0020	0.0020	0.0020	0.002	ND
Total Dissolved Solids	1,200	10	380	10	630	10	730	10	620	10	580	10	930	10	730	10	500
Vanadium	0.049	0.0050	0.0066	0.0050	0.0091	0.0050	0.0075	0.0050	ND	0.0050	ND	0.0050	0.0050	0.0050	0.0070	0.005	ND
Zinc	5.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	0.020	0.020	0.020	0.02	ND
pH	6.5 - 9.0	NA	8.75	NA	8.33	NA	8.19	NA	7.34	NA	12.34	NA	6.85	NA	7.22	NA	8.06
Temperature	NA	NA	12.8	NA	18.3	NA	14.5	NA	12.4	NA	12.3	NA	14.1	NA	17.2	NA	12.41
Conductivity	NA	NA	0.50	NA	0.68	NA	0.85	NA	0.62	NA	0.63	NA	0.88	NA	0.76	NA	0.539
Dissolved Oxygen	NA	NA	2.19	NA	5.13	NA	0.19	NA	4.22	NA	0.68	NA	6.78	NA	3.08	NA	3.76
ORP	NA	NA	67.4	NA	-49.2	NA	35.2	NA	-42.3	NA	-337.5	NA	20.4	NA	96.1	NA	-23.8

MW-02	2/11/2019		5/14/2019		8/14/2019		11/19/2019		3/2/2020		4/21/2020		8/17/2020		11/17/2020		3/1/2021		5/5/2021	
Parameter	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND
Arsenic	0.001	0.0091	0.001	0.0087	0.001	0.0085	0.001	0.0073	0.001	0.0079	0.001	0.008	0.001	0.0087	0.001	0.0066	0.001	0.013	0.001	0.0083
Barium	0.0025	0.038	0.0025	0.012	0.0025	0.027	0.0025	0.05	0.0025	0.028	0.0025	0.032	0.0025	0.021	0.0025	0.028	0.0025	0.032	0.0025	0.03
Beryllium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND
Boron	0.5	3.8	0.05	2.4	0.25	3.1	1	4.9	1	3.1	0.05	3.3	0.25	2.8	0.5	3.8	0.5	4.6	1	4.6
Cadmium	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND
Chloride	2	51	2	52	2	41	2	43	2	49	2	50	2	50	2	23	2	34	2	38
Chromium	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND
Cobalt	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND
Copper	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND
Cyanide, Total	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.005	ND	0.005	ND	0.005	0.0054	0.005	ND
Fluoride	0.1	0.86	0.1	0.97	0.1	0.84	0.1	0.67	0.1	1	0.1	1	0.1	0.94	0.1	0.78	0.1	0.84	0.1	0.72
Iron	0.1	0.22	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	0.19	0.1	ND	0.1	0.36	0.1	ND
Lead	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND
Manganese	0.0025	0.052	0.0025	0.015	0.0025	0.062	0.0025	0.069	0.0025	0.045	0.0025	0.037	0.0025	0.034	0.0025	0.048	0.0025	0.042	0.0025	0.042
Mercury	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND
Nickel	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND
Nitrogen, Nitrate	0.1	0.46	0.1	ND	0.1	ND	0.1	1.2	0.1	ND	0.1	0.1	0.1	0.2	0.1	ND	0.1	ND	0.1	ND
Nitrogen, Nitrate Nitrite	0.1	0.46	0.1	ND	0.1	ND	0.1	1.2	0.1	0.14	0.1	0.1	0.1	0.2	0.1	ND	0.1	ND	0.1	ND
Nitrogen, Nitrite	0.02	ND	0.02	ND	0.02	ND	0.02	ND ^	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND
Radium 226	0.257	ND	0.123	ND	0.212	ND	0.0921	0.172	0.109	ND	0.105	ND	0.0806	ND	0.54	ND	0.0997	ND	0.15	ND
Radium 228	0.424	0.5	0.443	0.493	0.623	ND	0.483	ND	0.394	ND	0.424	ND	0.372	ND	0.532	ND	0.586	0.586	0.463	ND
Selenium	0.0025	0.0048	0.0025	ND	0.0025	0.003	0.0025	0.0074	0.0025	ND	0.0025	0.0028	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND
Silver	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND
Sulfate	50	350	20	150	20	200	500	ND	500	ND	500	ND	25	230	100	300	25	190	25	200
Thallium	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND
Total Dissolved Solids	10	720	10	460	10	530	10	850	10	580	10	600	30	550	30	610	10	450	10	410
Vanadium	0.005	0.0059	0.005	ND	0.005	0.0055	0.005	0.008	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND
Zinc	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND
pH	NA	7.46	NA	8.30	NA	7.96	NA	7.37	NA	7.57	NA	8.02	NA	7.89	NA	7.67	NA	8.54	NA	8.39
Temperature	NA	11.40	NA	12.00	NA	13.40	NA	12.79	NA	12.20	NA	12.10	NA	13.60	NA	13.10	NA	12.10	NA	12.50
Conductivity	NA	0.969	NA	0.611	NA	0.900	NA	1.235	NA	0.311	NA	0.305	NA	0.830	NA	0.990	NA	0.861	NA	0.690
Dissolved Oxygen	NA	0.30	NA	0.19	NA	0.27	NA	8.12	NA	0.21	NA	0.31	NA	1.72	NA	2.25	NA	-0.04	NA	1.10
ORP	NA	-17.2	NA	31.4	NA	110.4	NA	-45.2	NA	-8.9	NA	-87.6	NA	-0.6	NA	-45.7	NA	-80.3	NA	11.9

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All values are in mg/L (ppm) unless otherwise noted.

B- Compound also detected in blank
DL - Detection limit
NA - Not Applicable
ND - Not Detected

* - LCS or LCSD is outside acceptable limits.
^ - Instrument related QC outside limits.
F1 - MS and/or MSD Recovery outside of limits.

Temperature °C degrees Celsius
Conductivity ms/cm[c] millisiemens/centimeters
Dissolved Oxygen mg/L milligrams/liter
Oxygen Reduction Potential (ORP) mV millivolts

MW-03	Date	2/21/2017		5/16/2017		9/14/2017		11/28/2017		2/8/2018		5/29/2018		8/20/2018		11/5/2018	
Parameter	Standards	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.006	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	0.0030	0.003	ND
Arsenic	0.010	0.0010	0.016	0.0010	0.0036	0.0010	0.0026	0.0010	0.0021	0.0010	0.0065	0.0010	0.0065	0.0010	0.0040	0.001	0.012
Barium	2.0	0.0025	0.0064	0.0025	0.028	0.0025	0.027	0.0025	0.016	0.0025	0.012	0.0025	0.012	0.0025	0.0098	0.0025	0.0086
Beryllium	0.004	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND ^	0.0010	ND ^	0.0010	0.0010	0.001	ND ^
Boron	2.0	0.25	2.1	0.25	3.5	0.50	3.6	0.25	2.1	0.25	2.4	0.25	2.4	0.25	2.7	0.25	2.6
Cadmium	0.005	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00050	0.0005	ND
Chloride	200.0	2.0	67	2.0	60	2.0	58	2.0	68	2.0	60	2.0	60	2.0	54	2	48
Chromium	0.1	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	0.0050	0.005	ND
Cobalt	1.0	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	0.0010	0.001	ND
Copper	0.65	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0041	0.0020	0.0041	0.0020	0.0020	0.002	ND
Cyanide, Total	0.2	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	0.010	0.01	ND
Fluoride	4.0	0.10	0.36	0.10	0.27	0.10	0.26	0.10	0.54	0.10	0.41	0.10	0.41	0.10	0.53	0.10	0.5
Iron	5.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.10	0.10	ND
Lead	0.0075	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00050	0.0005	ND
Manganese	0.15	0.0025	0.0025	0.0025	0.010	0.0025	0.026	0.0025	0.0092	0.0025	0.0048	0.0025	0.0048	0.0025	0.0076	0.0025	0.0067
Mercury	0.002	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	0.00022	0.00020	ND	0.00020	ND	0.00020	0.00020	0.0002	ND
Nickel	0.1	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0020	0.002	ND
Nitrogen, Nitrate	10.0	0.10	0.10	0.10	0.72	0.10	0.56	0.10	0.19	0.10	0.12	0.10	0.12	0.10	0.20	0.10	0.13
Nitrogen, Nitrate Nitrite	NA	0.10	0.10	0.10	0.72	0.10	0.56	0.10	0.19	0.10	0.12	0.10	0.12	0.10	0.20	0.10	0.13
Nitrogen, Nitrite	NA	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	0.020	0.02	ND
Radium 226	20	0.122	ND	0.110	0.159	0.0681	0.203	0.0649	ND	0.123	ND	0.105	ND	0.113	0.17	0.18	ND
Radium 228	20	0.389	ND *	0.402	ND	0.366	ND	0.34	0.682	0.468	ND	0.386	ND	0.365	0.408	0.379	ND
Selenium	0.05	0.0025	ND	0.0025	0.0088	0.0025	0.0085	0.0025	ND	0.0025	0.0042	0.0025	0.0042	0.0025	0.0025	0.0025	0.003
Silver	0.05	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00050	0.0005	ND
Sulfate	400.0	50	170	50	280	50	290	25	110	50	190	50	190	50	210	50	220
Thallium	0.002	0.0020	ND	0.0020	ND	0.0020	ND ^	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0020	0.002	ND
Total Dissolved Solids	1,200	10	440	10	690	10	650	10	460	10	500	10	500	10	450	10	490
Vanadium	0.049	0.0050	0.028	0.0050	0.013	0.0050	0.0092	0.0050	0.011	0.0050	0.034	0.0050	0.034	0.0050	0.017	0.005	0.021
Zinc	5.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	0.020	0.02	ND
pH	6.5 - 9.0	NA	7.56	NA	7.90	NA	7.53	NA	6.96	NA	7.74	NA	6.84	NA	7.52	NA	8.99
Temperature	NA	NA	11.4	NA	14.5	NA	14.7	NA	13.2	NA	11.6	NA	16.96	NA	17.11	NA	11.47
Conductivity	NA	NA	0.53	NA	0.78	NA	0.78	NA	0.52	NA	0.521	NA	0.59	NA	0.529	NA	0.395
Dissolved Oxygen	NA	NA	1.64	NA	5.46	NA	0.32	NA	2.80	NA	0.35	NA	4.18	NA	2.08	NA	8.53
ORP	NA	NA	83.5	NA	-30.5	NA	81.3	NA	-62.4	NA	313.7	NA	11.7	NA	72.9	NA	-101.3

MW-03	2/11/2019		5/14/2019		8/14/2019		11/19/2019		3/2/2020		4/21/2020		8/17/2020		11/17/2020		3/1/2021		5/5/2021	
Parameter	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND
Arsenic	0.001	0.01	0.001	0.0056	0.001	0.052	0.001	0.0066	0.001	0.0053	0.001	0.0066	0.001	0.0041	0.001	0.0071	0.001	0.0073	0.001	0.007
Barium	0.0025	0.026	0.0025	0.023	0.0025	0.0096	0.0025	0.033	0.0025	0.031	0.0025	0.033	0.0025	0.046	0.0025	0.033	0.0025	0.042	0.0025	0.038
Beryllium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND
Boron	0.25	3.6	0.05	3.4	0.25	3	1	4.3	1	3.7	1	4.3	0.25	2.9	0.5	3.7	0.5	4.8	0.5	5.8
Cadmium	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND
Chloride	2	28	2	16	2	13	2	17	2	21	2	17	2	45	2	54	2	45	2	45
Chromium	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND
Cobalt	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND
Copper	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND
Cyanide, Total	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.005	ND	0.005	ND	0.005	0.0057	0.005	ND
Fluoride	0.1	0.59	0.1	0.55	0.1	0.6	0.1	0.28	0.1	0.29	0.1	0.28	0.1	0.22	0.1	0.26	0.1	0.2	0.1	0.21
Iron	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND
Lead	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND
Manganese	0.0025	0.04	0.0025	0.031	0.0025	0.018	0.0025	0.065	0.0025	0.055	0.0025	0.065	0.0025	0.1	0.0025	0.072	0.0025	0.09	0.0025	0.096
Mercury	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND
Nickel	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND
Nitrogen, Nitrate	0.1	0.4	0.1	0.5	0.1	0.14	0.1	0.51	0.1	0.11	0.1	0.51	0.1	0.31	0.1	0.14	0.1	0.3	0.1	0.19
Nitrogen, Nitrate Nitrite	0.1	0.4	0.1	0.5	0.1	0.14	0.1	0.51	0.1	0.15	0.1	0.51	0.1	0.31	0.1	0.14	0.1	0.3	0.1	0.19
Nitrogen, Nitrite	0.02	ND	0.02	ND	0.02	ND	0.02	ND ^	0.02	ND	0.02	ND ^	0.02	ND	0.02	ND	0.02	ND	0.02	ND
Radium 226	0.255	ND	0.100	ND	0.189	ND	0.117	0.178	0.127	ND	0.114	0.166	0.0848	0.228	0.531	ND	0.11	ND	0.131	0.201
Radium 228	0.424	ND	0.439	ND	0.540	ND	0.472	ND	0.46	ND	0.462	ND	0.355	0.426	0.484	0.51	0.717	ND	0.381	0.503
Selenium	0.0025	0.012	0.0025	0.0067	0.0025	0.0049	0.0025	0.013	0.0025	ND	0.0025	0.013	0.0025	0.011	0.0025	0.0033	0.0025	0.01	0.0025	0.0078
Silver	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND
Sulfate	100	290	40	280	20	220	500	ND	500	ND	500	ND	100	290	50	250	100	290	25	220
Thallium	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND
Total Dissolved Solids	10	690	10	700	10	480	10	720	10	760	10	720	30	870	30	640	10	700	10	560
Vanadium	0.005	0.011	0.005	0.0086	0.005	0.035	0.005	0.012	0.005	0.0085	0.005	0.012	0.005	0.0077	0.005	0.0051	0.005	0.0076	0.005	0.0058
Zinc	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	0.11	0.02	ND	0.02	ND	0.02	ND
pH	NA	7.31	NA	7.21	NA	9.22	NA	7.47	NA	7.02	NA	6.87	NA	6.9	NA	7.05	NA	7.19	NA	7.18
Temperature	NA	10.9	NA	12.9	NA	13.3	NA	12.75	NA	12.9	NA	13	NA	12.5	NA	13.7	NA	14.2	NA	13.8
Conductivity	NA	1.003	NA	0.92	NA	0.77	NA	1.061	NA	0.329	NA	0.85	NA	1.314	NA	1.09	NA	1.496	NA	0.967
Dissolved Oxygen	NA	0.27	NA	0.33	NA	0.3	NA	0.51	NA	0.25	NA	0.32	NA	0.28	NA	2.21	NA	0.59	NA	0.56
ORP	NA	-112.3	NA	84.7	NA	-8.1	NA	-52.9	NA	40.6	NA	20.1	NA	88.5	NA	19.6	NA	86.3	NA	134.2

Notes: Standards obtained from IAC, Title 35, Chapter I, Part 620, Subpart D, Section 620.410 - Groundwater Quality Standards for Class I: Potable Resource Groundwater
All values are in mg/L (ppm) unless otherwise noted.

B- Compound also detected in blank
DL - Detection limit
NA - Not Applicable
ND - Not Detected

* - LCS or LCSD is outside acceptable limits.
^ - Instrument related QC outside limits.
F1 - MS and/or MSD Recovery outside of limits.

Temperature	°C	degrees Celsius
Conductivity	ms/cm^c	millisiemens/centimeters
Dissolved Oxygen	mg/L	milligrams/liter
Oxygen Reduction Potential (ORP)	mV	millivolts

Attachment 9-3. Permit Groundwater Analytical Results - Midwest Generation LLC, Waukegan Station, Waukegan, IL

MW-04	Date	2/22/2017		5/16/2017		9/14/2017		11/28/2017		2/8/2018		5/30/2018		8/20/2018		11/6/2018	
Parameter	Standards	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.006	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	0.0030	0.0030	0.0030	0.003	ND
Arsenic	0.010	0.0010	0.018	0.0010	0.0058	0.0010	0.0027	0.0010	0.0048	0.0010	0.049	0.0010	0.0050	0.0010	0.0023	0.001	0.003
Barium	2.0	0.0025	0.092	0.0025	0.075	0.0025	0.084	0.0025	0.059	0.0025	0.085	0.0025	0.052	0.0025	0.071	0.0025	0.071
Beryllium	0.004	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND ^	0.0010	0.0010	0.0010	0.0010	0.001	ND ^
Boron	2.0	0.25	2.4	0.25	2.6	0.50	4.0	0.50	2.9	0.25	2.3	0.50	3.0	0.25	2.8	0.25	2.4
Cadmium	0.005	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00050	0.00050	0.00050	0.0005	ND
Chloride	200.0	2.0	41	2.0	34	2.0	46	2.0	35	2.0	34	2.0	21	2.0	20	2	56
Chromium	0.1	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	0.0050	0.0050	0.0050	0.005	ND
Cobalt	1.0	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	0.0012	0.0010	0.0058	0.0010	0.0010	0.0010	0.0010	0.001	ND
Copper	0.65	0.0020	ND	0.0020	ND	0.0020	0.0037	0.0020	ND	0.0020	ND	0.0020	0.0020	0.0020	0.0020	0.002	ND
Cyanide, Total	0.2	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	0.010	0.010	0.010	0.01	ND
Fluoride	4.0	0.10	0.14	0.10	0.26	0.10	0.27	0.10	0.25	0.10	0.18	0.10	0.38	0.10	0.25	0.10	0.4
Iron	5.0	0.10	0.56	0.10	0.13	0.10	0.32	0.10	0.18	0.10	2.8	0.10	0.22	0.10	0.10	0.10	ND
Lead	0.0075	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00050	0.00050	0.00050	0.0005	ND
Manganese	0.15	0.0025	0.14	0.0025	0.032	0.0025	0.037	0.0025	0.26	0.0025	0.58	0.0025	0.049	0.0025	0.065	0.0025	0.086
Mercury	0.002	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	0.00024	0.00020	ND	0.00020	0.00020	0.00020	0.00020	0.0002	ND
Nickel	0.1	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0020	0.0020	0.0020	0.002	ND
Nitrogen, Nitrate	10.0	0.10	ND	0.10	0.58	0.10	0.69	0.10	ND	0.10	ND	0.10	0.28	0.10	0.80	0.10	0.37
Nitrogen, Nitrate Nitrite	NA	0.10	ND	0.10	0.58	0.10	0.69	0.10	ND	0.10	ND	0.10	0.28	0.10	0.80	0.10	0.37
Nitrogen, Nitrite	NA	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	0.020	0.020	0.020	0.02	ND
Radium 226	20	0.125	0.376	0.0831	0.198	0.0881	0.214	0.0985	0.155	0.0826	0.253	0.125	0.129	0.0977	0.354	0.182	ND
Radium 228	20	0.395	0.624 *	0.336	0.521	0.410	0.568	0.352	0.694	0.385	0.497	0.445	ND	0.381	ND	0.337	ND
Selenium	0.05	0.0025	0.0043	0.0025	0.021	0.0025	0.026	0.0025	0.0028	0.0025	ND	0.0025	0.0091	0.0025	0.020	0.0025	0.011
Silver	0.05	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00050	0.00050	0.00050	0.0005	ND
Sulfate	400.0	100	350	100	350	100	500	25	120	50	180	50	230	50	200	100	420
Thallium	0.002	0.0020	ND	0.0020	ND	0.0020	ND ^	0.0020	ND	0.0020	ND	0.0020	0.0020	0.0020	0.0020	0.002	ND
Total Dissolved Solids	1,200	10	850	10	950	10	1200	10	570	10	660	10	730	10	680	10	820
Vanadium	0.049	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	0.0051	0.0050	0.0050	0.0050	0.0050	0.005	ND
Zinc	5.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	0.020	0.020	0.020	0.02	ND
pH	6.5 - 9.0	NA	7.44	NA	7.94	NA	7.04	NA	7.04	NA	7.48	NA	6.57	NA	7.25	NA	6.83
Temperature	NA	NA	11.9	NA	13.4	NA	14.4	NA	13.3	NA	10.9	NA	13.2	NA	18.7	NA	10.60
Conductivity	NA	NA	0.92	NA	0.89	NA	1.17	NA	0.83	NA	0.71	NA	0.72	NA	0.77	NA	0.823
Dissolved Oxygen	NA	NA	2.82	NA	3.89	NA	1.05	NA	1.25	NA	0.34	NA	5.18	NA	6.38	NA	8.74
ORP	NA	NA	99.9	NA	-15.8	NA	95.2	NA	-55.3	NA	2.1	NA	9.7	NA	92.0	NA	69.1

MW-04 Date	2/11/2019		5/14/2019		8/14/2019		11/19/2019		3/2/2020		4/21/2020		8/17/2020		11/18/2020		3/1/2020		5/5/2021	
Parameter	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND
Arsenic	0.001	0.011	0.001	0.0028	0.001	0.0034	0.001	0.004	0.001	0.0045	0.001	0.0051	0.001	0.004	0.001	0.0054	0.001	0.016	0.001	0.0089
Barium	0.0025	0.061	0.0025	0.039	0.0025	0.046	0.0025	0.048	0.0025	0.044	0.0025	0.043	0.0025	0.039	0.0025	0.042	0.0025	0.036	0.0025	0.032
Beryllium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND
Boron	0.25	2.9	0.05	2.6	0.25	2.8	0.5	3.1	0.5	3.2	0.05	2.7	0.5	3.7	0.5	3.2	0.5	3.3	0.5	3.2
Cadmium	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND
Chloride	2	62	2	60	2	56	2	43	2	38	2	34	2	21	2	19	2	17	2	17
Chromium	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND
Cobalt	0.001	0.0013	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	0.0013	0.001	0.0011
Copper	0.002	ND	0.002	ND	0.002	0.0025	0.002	ND	0.002	ND	0.002	ND	0.002	0.0043	0.002	ND	0.002	ND	0.002	ND
Cyanide, Total	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.005	ND	0.005	ND	0.005	0.0055	0.005	ND
Fluoride	0.1	0.48	0.1	0.62	0.1	0.82	0.1	0.79	0.1	0.88	0.1	0.91	0.1	1.1	0.1	0.99	0.1	0.89	0.1	0.92
Iron	0.1	0.49	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	0.42	0.1	0.2
Lead	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND
Manganese	0.0025	0.41	0.0025	0.049	0.0025	0.091	0.0025	0.1	0.0025	0.11	0.0025	0.13	0.0025	0.1	0.0025	0.16	0.0025	0.2	0.0025	0.18
Mercury	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND F1	0.0002	ND	0.0002	ND
Nickel	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND
Nitrogen, Nitrate	0.1	0.25	0.1	0.29	0.1	0.34	0.1	0.22	0.1	0.49	0.1	0.14	0.1	0.3	0.1	0.15	0.1	0.14	0.1	0.23
Nitrogen, Nitrate Nitrite	0.1	0.25	0.1	0.29	0.1	0.34	0.1	0.22	0.1	0.49	0.1	0.14	0.1	0.3	0.1	0.15	0.1	0.14	0.1	0.23
Nitrogen, Nitrite	0.02	ND	0.02	ND	0.02	ND	0.02	ND ^	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND
Radium 226	0.212	ND	0.0979	ND	0.176	ND	0.118	ND	0.114	ND	0.136	0.217	0.0815	0.114	0.469	ND	0.122	0.19	0.147	ND
Radium 228	0.375	0.715	0.352	0.425	0.534	ND	0.452	ND	0.409	ND	0.572	ND	0.32	ND	0.631	0.631	0.51	ND	0.401	ND
Selenium	0.0025	0.0063	0.0025	0.0043	0.0025	0.008	0.0025	0.004	0.0025	0.0045	0.0025	0.0034	0.0025	0.0061	0.0025	0.0027	0.0025	ND	0.0025	0.0042
Silver	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND
Sulfate	50	290	20	200	20	260	500	ND	500	ND	500	ND	100	290	50	250	25	230	25	190
Thallium	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND
Total Dissolved Solids	10	790	10	750	10	710	10	730	10	740	10	700	30	710	30	680	10	590	10	510
Vanadium	0.005	0.0066	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	0.0055	0.005	ND	0.005	ND	0.005	ND
Zinc	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND
pH	NA	8.05	NA	7.30	NA	7.37	NA	7.27	NA	7.09	NA	7.18	NA	7.06	NA	7.17	NA	7.66	NA	7.46
Temperature	NA	11.40	NA	11.90	NA	13.00	NA	12.83	NA	12.00	NA	11.90	NA	13.20	NA	13.70	NA	11.50	NA	10.70
Conductivity	NA	1.122	NA	1.010	NA	1.110	NA	1.039	NA	0.339	NA	0.297	NA	1.131	NA	1.120	NA	1.100	NA	0.792
Dissolved Oxygen	NA	0.39	NA	0.55	NA	0.35	NA	0.54	NA	0.22	NA	0.30	NA	2.02	NA	2.34	NA	0.54	NA	0.20
ORP	NA	23.5	NA	85.1	NA	16.6	NA	-63.2	NA	-14.7	NA	-28.5	NA	54.3	NA	-15.8	NA	-45.6	NA	81.8

Notes: Standards obtained from IAC, Title 35, Chapter I, Part 620, Subpart D, Section 620.410 - Groundwater Quality Standards for Class I: Potable Resource Groundwater
All values are in mg/L (ppm) unless otherwise noted.

B- Compound also detected in blank
DL - Detection limit
NA - Not Applicable
ND - Not Detected

* - LCS or LCSD is outside acceptable limits.
^ - Instrument related QC outside limits.
F1 - MS and/or MSD Recovery outside of limits.

Temperature °C degrees Celsius
Conductivity ms/cm[c] millisiemens/centimeters
Dissolved Oxygen mg/L milligrams/liter
Oxygen Reduction Potential (ORP) mV millivolts

MW-05	Date	2/22/2017		5/15/2017		9/11/2017		11/30/2017		2/7/2018		5/31/2018		8/21/2018		11/7/2018	
Parameter	Standards	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.006	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	0.0030	0.0030	0.0030	0.003	ND
Arsenic	0.010	0.0010	0.040	0.0010	0.0053	0.0010	0.076	0.0010	0.034	0.0010	0.017	0.0010	0.0086	0.0010	0.015	0.001	0.019
Barium	2.0	0.0025	0.061	0.0025	0.036	0.0025	0.046	0.0025	0.066	0.0025	0.067	0.0025	0.042	0.0025	0.028	0.0025	0.027
Beryllium	0.004	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	0.0010	0.0010	0.0010	0.001	ND ^
Boron	2.0	5.0	42	0.50	7.7	5.0	44	5.0	47	5.0	41	1.0	10	5.0	41	5	43
Cadmium	0.005	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00050	0.00050	0.00050	0.0005	ND
Chloride	200.0	10	82	2.0	73	2.0	71 F1	10	81	2.0	73	2.0	37	2.0	57	2	51 ^
Chromium	0.1	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	0.0050	0.0050	0.0050	0.005	ND
Cobalt	1.0	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	0.0011	0.0010	0.0014	0.001	0.001
Copper	0.65	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0021	0.0020	0.0020	0.002	ND
Cyanide, Total	0.2	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	0.010	0.010	0.010	0.01	ND
Fluoride	4.0	0.10	0.21	0.10	0.15	0.10	0.25	0.10	0.27	0.10	0.26	0.10	0.22	0.10	0.23	0.10	0.27
Iron	5.0	0.10	15	0.10	1.9	0.10	35	0.10	19	0.10	14	0.10	2.1	0.10	11	0.10	9.1
Lead	0.0075	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00050	0.00050	0.00050	0.0005	ND
Manganese	0.15	0.0025	0.54	0.0025	0.12	0.0025	0.62	0.0025	0.63	0.0025	0.58	0.0025	0.20	0.0025	0.51	0.0025	0.43
Mercury	0.002	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	0.00020	0.00020	0.00020	0.0002	ND
Nickel	0.1	0.0020	ND	0.0020	0.0038	0.0020	0.0033	0.0020	ND	0.0020	ND	0.0020	0.0053	0.0020	0.0039	0.002	0.0043
Nitrogen, Nitrate	10.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.10	0.10	0.10	0.10	ND
Nitrogen, Nitrate Nitrite	NA	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.10	0.10	0.10	0.10	ND
Nitrogen, Nitrite	NA	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	0.020	0.020	0.020	0.02	ND
Radium 226	20	0.110	0.331	0.110	ND	0.0778	0.170	0.0771	0.284	0.0699	0.359	0.109	0.141	0.115	0.545	0.194	ND
Radium 228	20	0.443	0.805	0.531	0.703	0.474	ND	0.332	1.29	0.338	1.33	0.386	0.986	0.544	ND	0.411	ND
Selenium	0.05	0.0025	ND	0.0025	0.0041	0.0025	0.0071	0.0025	ND	0.0025	ND	0.0025	0.0032	0.0025	0.0025	0.0025	ND
Silver	0.05	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00050	0.00050	0.00050	0.0005	ND
Sulfate	400.0	250	700	500	1100	250	750	100	790	250	700	250	960	250	680	250	580
Thallium	0.002	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0020	0.0020	0.0020	0.002	ND
Total Dissolved Solids	1,200	10	1700	10	2600	10	2000	10	1900	10	1900	10	2500	10	2100	10	1900
Vanadium	0.049	0.0050	ND	0.0050	ND	0.0050	0.020	0.0050	ND	0.0050	ND	0.0050	0.0050	0.0050	0.0050	0.005	ND
Zinc	5.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	0.020	0.020	0.020	0.02	ND
pH	6.5 - 9.0	NA	7.46	NA	7.78	NA	6.89	NA	7.02	NA	7.08	NA	6.95	NA	7.13	NA	6.93
Temperature	NA	NA	14.8	NA	13.9	NA	14.6	NA	11.2	NA	11.0	NA	19.0	NA	16.9	NA	9.24
Conductivity	NA	NA	1.63	NA	2.20	NA	1.79	NA	1.48	NA	1.55	NA	2.12	NA	1.55	NA	1.485
Dissolved Oxygen	NA	NA	1.46	NA	5.90	NA	0.58	NA	1.44	NA	0.23	NA	4.29	NA	1.87	NA	4.11
ORP	NA	NA	-29.1	NA	-20.7	NA	-68.1	NA	58.5	NA	52.2	NA	-10.9	NA	-15.4	NA	-15.8

MW-05	2/12/2019		5/14/2018		8/13/2019		11/20/2019		3/3/2020		4/22/2020		8/17/2020		11/19/2020		3/1/2021		5/7/2021	
Parameter	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND
Arsenic	0.001	0.018	0.001	0.014	0.001	0.14	0.001	0.0071	0.001	0.007	0.001	0.0028	0.001	0.017	0.001	0.034	0.001	0.04	0.001	0.021
Barium	0.0025	0.027	0.0025	0.026	0.0025	0.061	0.0025	0.033	0.0025	0.031	0.0025	0.031	0.0025	0.04	0.0025	0.06	0.0025	0.054	0.0025	0.049
Beryllium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND ^	0.001	ND	0.001	ND	0.001	ND	0.001	ND
Boron	5	47	1	11	0.5	4.9	1	5.4	1	17 B	1	5.4	5	31	5	29	5	33	5	33
Cadmium	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND
Chloride	2	60	2	37	2	28	2	20	2	18	2	12	2	21	2	32	2	31	2	20
Chromium	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND
Cobalt	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND
Copper	0.002	ND	0.002	ND	0.002	0.0036	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND
Cyanide, Total	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.005	ND	0.005	ND	0.005	0.0065	0.005	ND
Fluoride	0.1	0.35	0.1	0.19	0.1	0.13	0.1	0.18	0.1	0.19	0.1	0.18	0.1	0.25	0.1	0.28	0.1	0.29	0.1	0.28
Iron	0.1	9.8	0.1	3.4	0.1	64	0.1	2.3	0.1	4.7	0.1	0.87	0.1	17	0.1	19	0.1	14	0.1	12
Lead	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND
Manganese	0.0025	0.44	0.0025	0.13	0.0025	0.06	0.0025	0.086	0.0025	0.25	0.0025	0.083	0.0025	0.65	0.0025	0.64	0.0025	0.54	0.0025	0.65
Mercury	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND
Nickel	0.002	0.003	0.002	0.0069	0.002	0.0046	0.002	0.007	0.002	0.0041	0.002	0.003	0.002	0.0023	0.002	ND	0.002	ND	0.002	ND
Nitrogen, Nitrate	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND
Nitrogen, Nitrate Nitrite	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND
Nitrogen, Nitrite	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND
Radium 226	0.273	ND	0.102	ND	0.219	ND	0.131	ND	0.153	ND	0.108	ND	0.109	0.137	0.362	0.431	0.102	0.337	0.235	ND
Radium 228	0.385	ND	0.339	ND	0.554	ND	0.441	ND	0.447	ND	0.536	ND	0.414	ND	0.459	0.739	0.63	1.31	0.602	1.32
Selenium	0.0025	ND	0.0025	0.0027	0.0025	ND	0.0025	0.004	0.0025	0.0049	0.0025	0.0046	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND
Silver	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND ^	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND
Sulfate	250	890	40	1000	40	790	500	830	1300	ND	1000	ND	100	930	100	930	100	880	100	850
Thallium	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND
Total Dissolved Solids	10	1800	10	2600	10	2100	10	2100	10	2100	10	1900	150	2000	150	2100	10	1800	10	1700
Vanadium	0.005	ND	0.005	ND	0.005	0.06	0.005	ND	0.005	ND	0.005	ND	0.005	0.0072	0.005	0.0051	0.005	ND	0.005	ND
Zinc	0.02	ND	0.02	ND	0.02	ND	0.02	0.02	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND
pH	NA	7.00	NA	6.72	NA	6.75	NA	7.44	NA	6.75	NA	6.63	NA	6.58	NA	6.94	NA	7.02	NA	7.00
Temperature	NA	12.20	NA	12.30	NA	20.40	NA	12.50	NA	11.70	NA	11.90	NA	12.80	NA	12.70	NA	11.70	NA	12.00
Conductivity	NA	1.873	NA	2.520	NA	2.660	NA	2.388	NA	0.431	NA	0.370	NA	2.401	NA	2.446	NA	2.744	NA	1.996
Dissolved Oxygen	NA	0.21	NA	0.29	NA	1.50	NA	1.46	NA	0.25	NA	0.30	NA	6.00	NA	1.90	NA	0.32	NA	0.13
ORP	NA	-93.5	NA	-41.5	NA	146.9	NA	-17.1	NA	-74.1	NA	-11.3	NA	151.0	NA	-110.5	NA	-97.2	NA	-100.6

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All values are in mg/L (ppm) unless otherwise noted.

B- Compound also detected in blank
DL - Detection limit
NA - Not Applicable
ND - Not Detected

* - LCS or LCSD is outside acceptable limits.
^ - Instrument related QC outside limits.
F1 - MS and/or MSD Recovery outside of limits.

Temperature °C degrees Celsius
Conductivity ms/cm[c] millisiemens/centimeters
Dissolved Oxygen mg/L milligrams/liter
Oxygen Reduction Potential (ORP) mV millivolts

MW-06	Date	2/22/2017		5/15/2017		9/11/2017		11/28/2017		2/8/2018		5/30/2018		8/21/2018		11/7/2018	
Parameter	Standards	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.006	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	0.0030	0.0030	0.0039	0.003	ND
Arsenic	0.010	0.0010	0.0087	0.0010	0.0055	0.0010	0.0047	0.0010	0.0069	0.0010	0.0026	0.0010	0.0036	0.0010	0.0027	0.001	0.0043
Barium	2.0	0.0025	0.073	0.0025	0.086	0.0025	0.11	0.0025	0.070	0.0025	0.075	0.0025	0.087	0.0025	0.092	0.0025	0.17
Beryllium	0.004	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND ^	0.0010	0.0010	0.0010	0.0010	0.001	ND ^
Boron	2.0	1.0	8.9	0.25	1.8	0.25	3.2	1.0	6.6	0.25	2.0	0.050	0.98	0.50	0.50	0.25	1.5
Cadmium	0.005	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00050	0.00050	0.00050	0.0005	ND
Chloride	200.0	2.0	44	10	100	10	120	10	85	10	86	2.0	89	2.0	62	10	130 ^
Chromium	0.1	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	0.0050	0.0050	0.0050	0.005	ND
Cobalt	1.0	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	0.0010	0.0010	0.0010	0.001	ND
Copper	0.65	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0027	0.0020	ND	0.0020	0.0020	0.0020	0.0020	0.002	ND
Cyanide, Total	0.2	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	0.010	0.010	0.010	0.01	ND
Fluoride	4.0	0.10	0.21	0.10	0.34	0.10	0.30	0.10	0.31	0.10	0.29	0.10	0.34	0.10	0.26	0.10	0.4
Iron	5.0	0.10	12	0.10	7.7	0.10	9.2	0.10	5.6	0.10	5.3	0.10	4.3	0.10	3.1	0.10	7.6
Lead	0.0075	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00050	0.00050	0.00050	0.0005	ND
Manganese	0.15	0.0025	0.47	0.0025	0.20	0.0025	0.36	0.0025	0.25	0.0025	0.25	0.0025	0.14	0.0025	0.10	0.0025	0.21
Mercury	0.002	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	0.00020	0.00020	0.00020	0.0002	ND
Nickel	0.1	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0020	0.0020	0.0020	0.002	ND
Nitrogen, Nitrate	10.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.10	0.10	0.19	0.10	0.10	0.10	ND
Nitrogen, Nitrate Nitrite	NA	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.10 F1 F2	0.10	0.19	0.10	0.10	0.10	ND
Nitrogen, Nitrite	NA	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	0.020	0.020	0.020	0.02	ND
Radium 226	20	0.146	0.255	0.116	0.227	0.0850	0.385	0.0656	0.283	0.0749	0.416	0.105	ND	0.0917	0.0495	0.209	0.294
Radium 228	20	0.475	ND	0.413	0.651	0.381	0.566	0.435	ND	0.383	ND	0.415	0.436	0.342	ND	0.397	ND
Selenium	0.05	0.0025	0.0037	0.0025	ND	0.0025	ND	0.0025	0.0037	0.0025	ND	0.0025	0.0025	0.0025	0.029	0.0025	ND
Silver	0.05	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00050	0.00050	0.00050	0.0005	ND
Sulfate	400.0	100	290	50	130	50	190	25	100	20	150	20	89	50	170	50	110
Thallium	0.002	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0020	0.0020	0.0020	0.002	ND
Total Dissolved Solids	1,200	10	930	10	730	10	940	10	810	10	690	10	620	10	860	10	840
Vanadium	0.049	0.0050	0.0077	0.0050	0.0054	0.0050	ND	0.0050	0.0093	0.0050	ND	0.0050	0.0050	0.0050	0.0073	0.005	ND
Zinc	5.0	0.020	ND	0.020	ND	0.020	0.021	0.020	ND	0.020	ND	0.020	0.020	0.020	0.020	0.02	ND
pH	6.5 - 9.0	NA	7.35	NA	8.26	NA	7.08	NA	7.06	NA	7.52	NA	6.80	NA	7.24	NA	7.00
Temperature	NA	NA	11.4	NA	15.2	NA	13.8	NA	11.9	NA	7.5	NA	16.2	NA	19.4	NA	8.03
Conductivity	NA	NA	1.00	NA	0.87	NA	1.13	NA	0.92	NA	0.74	NA	0.85	NA	0.80	NA	1.060
Dissolved Oxygen	NA	NA	1.66	NA	8.11	NA	0.33	NA	4.29	NA	0.94	NA	7.10	NA	2.70	NA	3.12
ORP	NA	NA	7.9	NA	-116.2	NA	-113.6	NA	-45.8	NA	-81.3	NA	0.9	NA	24.6	NA	-55.8

MW-06	2/12/2019		5/16/2019		8/13/2019		11/20/2019		3/3/2020		4/22/2020		8/18/2020		11/19/2020		3/2/2021		5/7/2021	
Parameter	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND
Arsenic	0.001	0.014	0.001	0.0055	0.001	0.0037	0.001	0.0037	0.001	0.0023	0.001	0.0015	0.001	0.0028	0.001	0.0026	0.001	0.0028	0.001	0.0018
Barium	0.0025	0.25	0.0025	0.094	0.0025	0.2	0.0025	0.2	0.0025	0.16	0.0025	0.12	0.0025	0.12	0.0025	0.11	0.0025	0.082	0.0025	0.07
Beryllium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND ^	0.001	ND	0.001	ND	0.001	ND	0.001	ND
Boron	0.25	1.3	5	26	0.5	3.8	1	4.6	1	2.0	0.25	2.0	0.25	1.2	0.5	2.1	2.5	4.0	0.25	1.6
Cadmium	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND
Chloride	10	160	2	38	10	180	10	190	10	200	10	140	10	100	2	64	2	49	10	56
Chromium	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND
Cobalt	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND
Copper	0.002	ND	0.002	0.0059	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND
Cyanide, Total	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND
Fluoride	0.1	0.3	0.1	0.23	0.1	0.25	0.1	0.31	0.1	0.31	0.1	0.36	0.1	0.4	0.1	0.37	0.1	0.33	0.1	0.34
Iron	0.1	16	0.1	6.8	0.1	9.9	0.1	12	0.1	9.5	0.1	3.8	0.1	6	0.1	8.3	0.1	4.9	0.1	3.4
Lead	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND
Manganese	0.0025	0.28	0.0025	0.24	0.0025	0.34	0.0025	0.29	0.0025	0.26	0.0025	0.17	0.0025	0.14	0.0025	0.36	0.0025	0.19	0.0025	0.2
Mercury	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND
Nickel	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND
Nitrogen, Nitrate	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	0.11	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND
Nitrogen, Nitrate Nitrite	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	0.11	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND
Nitrogen, Nitrite	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND
Radium 226	0.222	0.85	0.0948	0.438	0.221	0.518	0.104	0.54	0.109	0.545	0.116	0.272	0.145	0.374	ND	0.478	0.1	0.312	0.132	0.217
Radium 228	0.395	1.27	0.408	1.18	0.660	1.16	0.419	0.734	0.443	1.37	0.698	1.1	0.534	1.48	ND	0.606	0.47	ND *	0.46	0.552
Selenium	0.0025	0.0031	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	0.03	0.0025	ND
Silver	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND
Sulfate	100	290	40	390	40	310	500	ND	500	ND	130	ND	25	58	50	350	25	190	25	99
Thallium	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND
Total Dissolved Solids	10	1200	10	1300	10	1300	10	1400	10	1300	10	880	30	590	60	1300	10	660	10	530
Vanadium	0.005	0.012	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND
Zinc	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND
pH	NA	7.17	NA	7.22	NA	7.72	NA	7.98	NA	7.09	NA	7.11	NA	6.98	NA	6.86	NA	7.16	NA	7.21
Temperature	NA	9.20	NA	11.00	NA	12.50	NA	11.84	NA	8.40	NA	7.90	NA	13.00	NA	12.30	NA	7.30	NA	8.40
Conductivity	NA	1.765	NA	1.310	NA	1.910	NA	2.163	NA	0.464	NA	0.327	NA	1.243	NA	1.866	NA	1.269	NA	1.010
Dissolved Oxygen	NA	0.19	NA	0.17	NA	0.29	NA	0.49	NA	0.21	NA	0.21	NA	0.12	NA	2.07	NA	0.44	NA	2.07
ORP	NA	-89.9	NA	-168.6	NA	-130.6	NA	-115.0	NA	-137.3	NA	-118.5	NA	-117.2	NA	-89.6	NA	-53.9	NA	-66.4

Notes: Standards obtained from IAC, Title 35, Chapter I, Part 620, Subpart D, Section 620.410 - Groundwater Quality Standards for Class I: Potable Resource Groundwater
All values are in mg/L (ppm) unless otherwise noted.

B- Compound also detected in blank
DL - Detection limit
NA - Not Applicable
ND - Not Detected

* - LCS or LCSD is outside acceptable limits.
^ - Instrument related QC outside limits.
F1 - MS and/or MSD Recovery outside of limits.

Temperature °C degrees Celsius
Conductivity ms/cm[c] millisiemens/centimeters
Dissolved Oxygen mg/L milligrams/liter
Oxygen Reduction Potential (ORP) mV millivolts

Attachment 9-3. Permit Groundwater Analytical Results - Midwest Generation LLC, Waukegan Station, Waukegan, IL

MW-07	Date	2/22/2017		5/16/2017		9/11/2017		11/28/2017		2/6/2018		5/30/2018		8/21/2018		11/7/2018	
Parameter	Standards	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.006	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	ND	0.0030	0.0030	0.0030	0.0030	0.003	ND
Arsenic	0.010	0.0010	0.010	0.0010	0.0095	0.0010	0.011	0.0010	0.0084	0.0010	0.0088	0.0010	0.0075	0.0010	0.0075	0.001	0.0088
Barium	2.0	0.0025	0.096	0.0025	0.087	0.0025	0.085	0.0025	0.076	0.0025	0.077	0.0025	0.085	0.0025	0.076	0.0025	0.085
Beryllium	0.004	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	0.0010	0.0010	0.0010	0.001	ND ^
Boron	2.0	5.0	49	1.0	50	5.0	50	5.0	38	5.0	35	5.0	41	5.0	44	5	50
Cadmium	0.005	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00050	0.00050	0.00050	0.0005	ND
Chloride	200.0	2.0	65	2.0	49	2.0	46	2.0	56	2.0	53	2.0	41	2.0	52	2	55 ^
Chromium	0.1	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	0.0050	0.0050	0.0050	0.005	ND
Cobalt	1.0	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	ND	0.0010	0.0010	0.0010	0.0010	0.001	ND
Copper	0.65	0.0020	0.0021	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0020	0.0020	0.0020	0.002	ND
Cyanide, Total	0.2	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	0.010	0.010	0.010	0.01	ND
Fluoride	4.0	0.10	0.25	0.10	0.31	0.10	0.32	0.10	0.36	0.10	0.33	0.10	0.29	0.10	0.29	0.10	0.31
Iron	5.0	0.10	18	0.10	19	0.10	16	0.10	13	0.10	14	0.10	16	0.10	16	0.10	19
Lead	0.0075	0.00050	0.0010	0.00050	0.00072	0.00050	ND	0.00050	ND	0.00050	0.00052	0.00050	0.00050	0.00050	0.00050	0.0005	0.00053
Manganese	0.15	0.0025	0.62	0.0025	0.69	0.0025	0.61	0.0025	0.48	0.0025	0.44	0.0025	0.62	0.0025	0.54	0.0025	0.63
Mercury	0.002	0.00020	ND	0.00020	ND	0.00020	ND	0.00020	0.0017	0.00020	ND	0.00020	0.00020	0.00020	0.00020	0.0002	ND
Nickel	0.1	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0020	0.0020	0.0020	0.002	ND
Nitrogen, Nitrate	10.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.10	0.10	0.10	0.10	ND
Nitrogen, Nitrate Nitrite	NA	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.10	0.10	0.10	0.10	ND
Nitrogen, Nitrite	NA	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	0.020	0.020	0.020	0.02	ND
Radium 226	20	0.127	0.738	0.112	0.548	0.0720	0.544	0.0687	0.468	0.0741	0.556	0.118	0.539	0.0881	0.732	0.193	0.919
Radium 228	20	0.454	1.38	0.360	0.875	0.351	1.53	0.325	1.94	0.362	1.44	0.428	1.32	0.335	1.18	0.377	1.39
Selenium	0.05	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	0.0025	0.0025	0.0025	0.0025	ND
Silver	0.05	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	ND	0.00050	0.00050	0.00050	0.00050	0.0005	ND
Sulfate	400.0	250	880	250	690	250	660	100	580	250	620	250	620	250	630	250	560
Thallium	0.002	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	ND	0.0020	0.0020	0.0020	0.0020	0.002	ND
Total Dissolved Solids	1,200	10	1900	10	1800	10	1800	10	1700	10	1700	10	1800	10	1900	10	1900
Vanadium	0.049	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	0.0050	0.0050	0.0050	0.005	ND
Zinc	5.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	0.020	0.020	0.020	0.02	ND
pH	6.5 - 9.0	NA	7.48	NA	7.97	NA	7.15	NA	7.31	NA	7.35	NA	6.65	NA	7.29	NA	6.50
Temperature	NA	NA	12.6	NA	15.1	NA	13.1	NA	12.9	NA	10.6	NA	15.2	NA	18.0	NA	9.07
Conductivity	NA	NA	1.57	NA	1.52	NA	1.54	NA	1.43	NA	1.41	NA	1.52	NA	1.49	NA	1.486
Dissolved Oxygen	NA	NA	1.71	NA	2.83	NA	0.46	NA	2.89	NA	6.68	NA	4.23	NA	3.22	NA	2.24
ORP	NA	NA	-26.8	NA	-93.2	NA	-126.2	NA	-57.6	NA	204.7	NA	-70.3	NA	-60.3	NA	-46.2

MW-07	2/12/2019		5/16/2019		8/13/2019		11/20/2019		3/3/2020		4/22/2020		8/18/2020		11/19/2020		3/1/2021		5/7/2021	
Parameter	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result
Antimony	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND	0.003	ND
Arsenic	0.001	0.012	0.001	0.015	0.001	0.021	0.001	0.0097	0.001	0.0093	0.001	0.0082	0.001	0.0085	0.001	0.008	0.001	0.0087	0.001	0.0086
Barium	0.0025	0.11	0.0025	0.092	0.0025	0.08	0.0025	0.062	0.0025	0.058	0.0025	0.058	0.0025	0.061	0.0025	0.066	0.0025	0.082	0.0025	0.075
Beryllium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND ^	0.001	ND	0.001	ND	0.001	ND	0.001	ND
Boron	5	35	5	23	5	36	5	21	5	23	5	20	5	21	5	27	5	39	5	48
Cadmium	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND
Chloride	2	56	10	83	10	79	2	42	2	70	2	52	2	26	2	49	2	20	4	17
Chromium	0.005	0.008	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND
Cobalt	0.001	0.0024	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND
Copper	0.002	0.01	0.002	0.0046	0.002	0.0032	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND
Cyanide, Total	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.005	ND	0.005	ND	0.005	0.0056	0.005	ND
Fluoride	0.1	0.25	0.1	0.25	0.1	0.27	0.1	0.27	0.1	0.29	0.1	0.3	0.1	0.27	0.1	0.33	0.1	0.29	0.1	0.28
Iron	0.1	22	0.1	21	0.1	23	0.1	20	0.1	15	0.1	19	0.1	22	0.1	19	0.1	27	0.1	27
Lead	0.0005	0.0062	0.0005	0.00064	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND
Manganese	0.0025	0.58	0.0025	0.61	0.0025	0.55	0.0025	0.54	0.0025	0.38	0.0025	0.56	0.0025	0.6	0.0025	0.5	0.0025	0.73	0.0025	0.67
Mercury	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND
Nickel	0.002	0.0068	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND
Nitrogen, Nitrate	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND
Nitrogen, Nitrate Nitrite	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND
Nitrogen, Nitrite	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND
Radium 226	0.288	0.779	0.0926	0.494	0.181	0.550	0.134	0.355	0.141	0.441	0.103	0.378	0.116	0.641	0.557	ND	0.11	0.584	0.19	0.429
Radium 228	0.393	1.65	0.44	1.21	0.606	1.34	0.514	0.735	0.451	1.24	0.463	1.13	0.491	1.02	0.679	ND	0.515	1.5	0.571	1.89
Selenium	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND	0.0025	ND
Silver	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND	0.0005	ND
Sulfate	250	1000	40	530	40	680	1000	ND	500	530	500	ND	100	510	100	710	100	960	250	1000
Thallium	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND	0.002	ND
Total Dissolved Solids	10	1700	10	1700	10	1700	10	1300	10	1500	10	1300	150	1100	150	1800	10	1900	10	2000
Vanadium	0.005	0.01	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND	0.005	ND
Zinc	0.02	0.033	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	0.032	0.02	ND
pH	NA	7.03	NA	7.02	NA	7.09	NA	7.84	NA	7.11	NA	6.96	NA	6.80	NA	7.01	NA	6.96	NA	6.98
Temperature	NA	10.20	NA	11.50	NA	12.20	NA	12.74	NA	11.90	NA	11.40	NA	12.00	NA	13.60	NA	11.50	NA	11.60
Conductivity	NA	1.999	NA	1.870	NA	2.230	NA	1.845	NA	0.421	NA	0.351	NA	1.982	NA	2.156	NA	2.868	NA	2.239
Dissolved Oxygen	NA	0.24	NA	0.21	NA	0.31	NA	0.49	NA	0.02	NA	0.22	NA	0.17	NA	2.10	NA	0.30	NA	0.15
ORP	NA	-108.3	NA	-158.8	NA	-145.0	NA	-116.1	NA	-155.3	NA	-156.6	NA	-118.6	NA	-129.8	NA	-104.1	NA	-110.0

Notes: Standards obtained from IAC, Title 35, Chapter I, Part 620, Subpart D, Section 620.410 - Groundwater Quality Standards for Class I: Potable Resource Groundwater
All values are in mg/L (ppm) unless otherwise noted.

B- Compound also detected in blank
DL - Detection limit
NA - Not Applicable
ND - Not Detected

* - LCS or LCSD is outside acceptable limits.
^ - Instrument related QC outside limits.
F1 - MS and/or MSD Recovery outside of limits.

Temperature	°C	degrees Celsius
Conductivity	ms/cm[c]	millisiemens/centimeters
Dissolved Oxygen	mg/L	milligrams/liter
Oxygen Reduction Potential (ORP)	mV	millivolts

Attachment 9-4 – IL PE Stamp

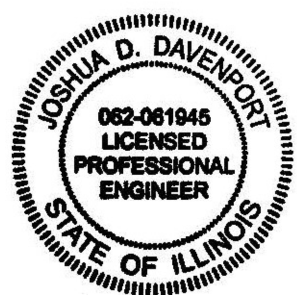
CERTIFICATION
35 Ill. Adm. Code 845.630

In accordance with Section 35 Ill. Adm. Code 845.630(g), I hereby certify based on review of the information contained within the Initial Operating Permit Application for Waukegan Station dated October 29, 2021, the groundwater monitoring system has been designed and constructed to satisfy the requirements of 35 Ill. Adm. Code 845.630. For this site the minimum number of wells required is deemed sufficient based on the following: 1) The number of wells, placement and screened intervals are based on a hydrogeologic assessment performed for the site; 2) hydrogeologic considerations included aquifer characteristics affecting flow velocity and physical transport processes; 3) available historical groundwater flow data indicate consistent flow conditions over time; and 4) Illinois Environmental Protection Agency (IEPA) approved the overall hydrogeologic assessment as part of a larger study.

Certified by: ______________________

Date: 10/29/21

Joshua Davenport, P.E.
Professional Engineer Registration No.: 062-061945
KPRG and Associates, Inc.



Attachment 9-5 – CCR Compliance Statistical Approach

ILLINOIS STATE CCR RULE COMPLIANCE STATISTICAL APPROACH FOR GROUNDWATER DATA EVALUATION

Midwest Generation, LLC
Waukegan Generating Station
401 E. Greenwood Ave.
Waukegan, Illinois

PREPARED BY: KPRG and Associates, Inc.
14665 West Lisbon Road, Suite 1A
Brookfield, WI 53005

August 23, 2021

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SECTION/DESCRIPTION **PAGE**

1.0 INTRODUCTION

On April 21, 2021, the Illinois Pollution Control Board (IPCB) and Illinois Environmental Protection Agency (Illinois EPA) enacted a final rule regulating coal combustion residuals (CCR) as part of Ill. Adm. Code Title 35, Part 845: Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (State CCR Rule). The State CCR Rule specifically requires that the owner or operator of a CCR unit must develop an Operating Permit that will specify a sampling and analysis program that includes procedures and techniques for sample collection, sample preservation and shipment, analytical procedures, chain of custody (COC) control, and quality assurance and quality control. As a result, each regulated facility must develop a program that meets the State CCR Rule. At the Waukegan facility, the East and West Ash Ponds require monitoring under the State CCR Rule. The monitoring well network around this pond consists of eight monitoring wells. Wells MW-9, MW-11 and MW-14 are upgradient monitoring locations and wells MW-01 through MW-04 and MW-16 are downgradient monitoring locations (see Figure 1).

Section 845.640(f) of the State CCR Rule requires the development of the statistical approach that will be used for assessing the data and determining whether a statistically significant increase over background concentrations in groundwater has occurred at identified downgradient monitoring points. Potential statistical methods that can be applied to the data are listed in Section 845.640(f) and performance standards are provided in 845.640(g).

This narrative of the statistical approach that will be used for the Waukegan facility's groundwater monitoring data is intended to fulfill certification requirements under Section 845.640(f)(2). The professional engineer's certification of this statistical approach is provided in Section 4.0 of this document.

2.0 STATISTICAL METHOD SELECTION and BACKGROUND DATA EVALUATION

Section 845.640(f)(1) identifies five statistical data evaluation methods that can be used for assessing site groundwater data. Relative to the subject site, the prediction interval procedure identified in 845.640(f)(1)(C) will be used. This approach is robust and conforms to varying data distributions and facilitates various non-detect frequencies. U.S. EPA identifies this method as preferred over establishment of tolerance intervals (Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance, March 2009 [Unified Guidance]).

Total recoverable metals groundwater data has been collected for this site since 2015 as part of Federal CCR Rule requirements. Under the Federal CCR Rule, the initial eight rounds of quarterly data generated were used to develop a representative background concentration with which to develop applicable prediction limits for subsequent statistical downgradient monitoring well data comparisons. Since additional data has been generated since the initial eight rounds of groundwater monitoring under the Federal CCR Rule, the full, currently available data set through the second quarter 2021 will be evaluated for potential use in developing a representative background dataset. If appending this additional data to the original eight rounds of background sampling is determined to be not statistically appropriate, then the background calculations will be reverted to using the initial eight rounds of background data for subsequent calculations. The established, representative background concentration for the upgradient well locations will be used to develop prediction limits for the regulated unit for each constituent listed in Section 845.600(a) and (b) as provided in Table 1.

Statistical evaluations will be performed with the assistance of the Sanitas™ software package.

2.1 Outlier Testing

The background dataset will be first checked for potential outliers for each constituent. Potential causes of outliers can be, but are not limited to:

- Changes in sampling technique;
- Changes in analytical methods;
- Data transcription errors;
- Unnatural localized event such as a spill; or
- Natural but extreme variations in constituent concentration.

The Unified Guidance does not recommend removing an outlier from the data set unless it can be shown that the outlier is not caused by extreme natural variation. If the outlier can be traced to other than natural causes, the data set will be adjusted appropriately.

2.2 Spatial Variability

If more than one background well is being used for the monitored unit, an evaluation of spatial variability will be performed to determine whether the mean concentration of a constituent varies statistically between the background points. This is generally accomplished by performing an Analysis of Variance (ANOVA). If statistically significant spatial variation is determined to be present, the background points will not be combined between the wells. If the spatial variability is determined to be natural, an intrawell data evaluation approach may be considered for both upgradient and downgradient wells.

2.3 Temporal Variability

Temporal variability in groundwater data from a specific monitoring point occurs when a consistent fluctuation of constituent concentrations occurs over time. The most common example is seasonal variation. If such a variation is noted in the data, the dataset should be corrected to account for the trend; however, any such corrections must be applied judiciously and would be completed in accordance with the Unified Guidance recommended procedures.

2.4 Trend Testing

As discussed above, it is intended to expand the initial background dataset collected under the Federal CCR Rule which consisted of eight rounds of quarterly sampling, with any additional data collected for a specific well since that time to facilitate a larger background data set upon which to develop subsequent interwell, and if necessary intrawell, prediction limits. The expanded background dataset for each upgradient well, for each constituent listed in Table 1, will undergo trend analysis to determine if there may be a potential statistically significant trend in the data. Linear regression will be the primary trend analysis tool, however, other methods such Sen's Slope Estimator may also be used. If a statistically significant trend is identified in the larger combined background dataset, the new data cannot be added to the initial background dataset, and only the original eight rounds of data can be used for that well in background development and associated subsequent calculations.

2.5 Test of Normality

The main underlying assumption in parametric data evaluations, such as establishing prediction limits, is that the underlying data distribution is normal. A quick approximation can be made by calculating the Coefficient of Variance (CV) which is the quotient of the standard deviation divided by the sample mean. In general, if this quotient is greater than 1, the underlying data distribution is probably not normal. The new Unified Guidance is more conservative and suggests that if this quotient is greater than 0.5, the dataset may not be normal and a more robust distribution evaluation should be performed. Therefore, for any CV value greater than 0.5 for a specific dataset, normality will be evaluated using the Shapiro-Wilk Test with an alpha (α) value of 0.05 (or 95%).

If the dataset does not pass this initial test, the data will undergo a log transformation and the test will be repeated for the natural log values of the dataset. If it is determined that this dataset is log-normal, statistical evaluations will be completed on those values and the result converted back to the standard value. If the underlying distribution is also determined not to be log-normal, the Unified Guidance provides for a number of other data transformations that can be performed to evaluate whether those underlying distributions may be normal at which point the entire dataset would be transformed for subsequent calculations.

If a normal underlying distribution can not be determined, non-parametric statistical evaluations will need to be considered which do not rely on a specific underlying distribution.

2.6 Non-Detects

It is not uncommon in environmental datasets to have parameters being detected at low concentrations during one sampling event and being not detected in other sampling events. Having a consistent approach to the handling of non-detect values is an important part of the statistical evaluation process. The handling of non-detect values will be accomplished as follows:

- 100 Percent Non-Detects – Assumed that the constituent is not present and no statistical evaluations will be performed. The upper prediction limit will be set at the Reporting Limit (RL) established by the analytical laboratory.

- 50 Percent or Greater Non-Detects – A non-parametric evaluation will be performed where the confidence interval will be constructed using the highest detected concentration as the upper prediction limit.

- 15 to 50 Percent Non-Detects – Aitchison's Adjustment will be used with subsequent parametric or non-parametric evaluations, as appropriate, based on underlying distributions.

- 0 to 15 Percent Non-Detects - The non-detect values will be replaced with RL/2 and the dataset will be evaluated for distribution normality with subsequent parametric or non-parametric evaluations, as appropriate, based on underlying distributions.

2.7 Prediction Limit Calculation for Normally Distributed Data

For datasets where the distribution or underlying transformed distribution is normal, a parametric statistical approach will be used for establishing the prediction limit at the required 95% statistical confidence. In accordance with Unified Guidance, the following equation will be used:

$$95\%\ \textit{Prediction Limit} = \bar{x} + t_{1-0.05/m,n-1}\, s\sqrt{1+\frac{1}{n}}$$

Where:

$\bar{x}$ = the sample mean of the detected or adjusted results
S = sample standard deviation of the detected or adjusted results
$t_{1-0.05/m,n-1}$ = the students t-coefficient for degrees of freedom (n-1) and confidence level (1-0.05/m)
n = the number of samples
m = the number of future samples

The number of future sampling events (*m*) will be set at 2 which will account for one sampling event and a confirmation resampling. This will assist in limiting the potential number of false positives. An acceptable site-wide false positive (SWFP) rate of 10% or less is acceptable under the Unified Guidance.

2.8 Prediction Limit Calculation for Non-Normally Distributed Data

If the dataset distribution or underlying distribution is determined not to be normal, a non-parametric approach will need to be used for the establishment of the prediction limit. The non-parametric evaluation will use the highest detected concentration as the upper prediction limit for the specific constituent.

3.0 GROUNDWATER MONITORING

The State CCR Rule does not distinguish between detection monitoring or assessment monitoring as was defined under the Federal CCR Rule. To meet the requirements set forth in Section 845.650(b), a minimum of eight rounds of groundwater data need to be collected for establishing background. As noted above, if more than eight rounds of data are available, then the larger dataset will be evaluated to determine whether the background dataset can be expanded to provide a more robust statistical assessment. At that point, statistical evaluation of the background dataset will be performed to establish the upper prediction limits for each Section 845.600(a) and (b) constituent. It is noted that in the case of pH, a lower prediction limit will also be established since this parameter has an established upper and lower value range for compliance.

Site specific Groundwater Protection Standards (GWPSs) will be developed in accordance with Section 845.600(a)(2) as follows:

- If the constituent has an established State standard listed in Section 845.600(a)(1) and the standard is greater than the calculated background upper prediction limit, then the standard will serve as the GWPS. If the background upper prediction limit is greater than the standard, the upper prediction limit will serve as the GWPS.

- If the constituent does not have an established standard (i.e., calcium and turbidity) then the calculated upper prediction limit will serve as the GWPS.

Once the proposed GWPSs are determined and approved by Illinois EPA, subsequent downgradient well concentrations will be compared against the upper prediction limit (and lower prediction limit in the case of pH), and the GWPSs. If an exceedance of the GWPS is identified during a quarterly sampling event, an immediate resampling of the specific well(s) will be completed for those specific parameters. If the exceedance is confirmed by the resampling, the Illinois EPA will be notified of the exceedance(s) and the notification will be placed in the facilities operating record in accordance with 845.800(d)(16). It is noted that there are some constituents that historically may have had no detections (i.e., 100% non-detects). In this case, in accordance with the Unified Guidance, if there is a detection of such a constituent, then the Double Quantification Rule will be applied. Under this rule, a confirmed exceedance is registered if any well-constituent pair in the 100% non-detect group exhibits quantified measurements (i.e., at or above the Reporting Limit in two consecutive sample and resample events.

If an exceedance of the GWPS is recorded and reported to Illinois EPA, an Alternate Source Demonstration (ASD) may be completed within 60-days of the confirmed exceedance in accordance with Section 845.650(e) and submitted to the Illinois EPA as well as placing the ASD on the facility's publically accessible CCR website. Illinois EPA will review and approve or disapprove the ASD.

If it is decided not to complete an ASD or if Illinois EPA does not concur with and approve the ASD, a characterization of the nature and extent of the potential release must be completed in accordance with Section 845.650(d)(1) as well as meeting the requirements of Sections 845.660, 845.670 and 845.680.

4.0 CERTIFICATION

In accordance with Section 845.640(f)(2) of the State CCR Rule, I hereby certify based on a review of the information contained within this Illinois State CCR Rule Compliance Statistical Approach for Groundwater Data Evaluation dated August 23, 2021, the statistical procedures developed and selected for evaluation of groundwater data associated with the Midwest Generation Waukegan Station CCR Units are adequate and appropriate for evaluating the groundwater data.

Certified by: ______________________

Date: 8/23/21

Joshua Davenport, P.E.

Professional Engineer Registration No. 062-061945

KPRG and Associates, Inc.

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FIGURE

ENVIRONMENTAL CONSULTATION & REMEDIATION

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CCR MONITORING WELL SITE MAP

WAUKEGAN STATION
WAUKEGAN, ILLINOIS

Scale: 1" = 550'	Date: January 2, 2018
KPRG Project No. 12313.2	FIGURE 1

W:\projects\midwest generation\attorney-client privilege\gw evaluations\waukegan map.dwg

TABLE

Table 1. Section 845.600 Groundwater Monitoring Parameter List

Parameter	Section 845.600 Standards
Antimony	0.006
Arsenic	0.01
Barium	2
Beryllium	0.004
Boron	2.0
Cadmium	0.005
Chloride	200
Chromium	0.1
Cobalt	0.006
Combined Radium 226 + 228 (pCi/L)	5.0
Fluoride	4.0
Lead	0.0075
Lithium	0.04
Mercury	0.002
Molybdenum	0.10
pH (standard units)	6.5-9.0
Selenium	0.05
Sulfate	400
Thallium	0.002
Total Dissolved Solids	1200
Calcium	NE
Turbidity	NE

All vaues in mg/l unless otherwise specified.
NE- Not Established

Attachment 9-6 – Statistical Evaluation Summary

ATTACHMENT 9-6

BACKGROUND STATISTICAL EVALUATION SUMMARY
STATE RULE CCR GROUNDWATER MONITORING
WAUKEGAN GENERATING STATION

The newly enacted Ill. Adm. Code Title 35, Part 845: Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (State CCR Rule) requires development of proposed Groundwater Protection Standards (GWPSs) for inclusion within the Operating Permit for the regulated surface impoundments at the facility. Upon Illinois Environmental Protection Agency (EPA) review, concurrence and approval of these site-specific proposed GWPSs, subsequent quarterly downgradient groundwater monitoring data will be compared against these standards to determine whether standard quarterly monitoring is to continue or whether additional evaluations need to occur to in accordance with Section 845.650(d), 845.650(e), 845.660 and 845.670. The overall statistical approach to be used for the development of the proposed GWPSs is provided in Attachment 10-5 of the Operating Permit.

The proposed site-specific GWPSs for the Waukegan Generating Station are summarized in Table 9-7 in Section 9 of this Operating Permit. The background Prediction Limit values presented in that table were developed, where possible, by combining or “pooling” as many background data points as possible from the various upgradient monitoring wells. This includes evaluating whether the initial eight rounds of data generated as part of Federal CCR Rule compliance that was completed between 2015 and 2017 can be combined with subsequent available data from ongoing groundwater monitoring since that time at a specific upgradient monitoring well location, and whether datasets from individual upgradient monitoring points can also be combined or “pooled”. The turbidity data was collected this calendar year (2021) since this was a new state requirement that was not part of the Federal CCR Rule. The following general decision process was followed to determine whether background data from within a well and/or between upgradient wells can be pooled for background calculations:

- If the combined dataset (original eight rounds of data plus any subsequent data generated since the initial background sampling) at a specific well location (intrawell evaluation) for a specific parameter does not show a statistically significant trend, the data for that specific parameter at that well location can be pooled. If a statistically significant trend in the data is noted to exist, only the original eight rounds of background sampling can be used for subsequent calculations. If there is more than one background monitoring well, and one of the combined datasets for a specific parameter shows a statistically significant trend but the other does not, then the specific parameter data for the well that did not indicate a trend can potentially be used for subsequent evaluations.

- If there is more than one upgradient monitoring well, then datasets for individual parameters between the wells (interwell evaluation) must pass an analysis of variance to determine whether there may be a statistically significant variation between the two datasets. If no statistically significant variance is noted between the two (or more) upgradient monitoring points, and the individual parameter data passes the intrawell trend evaluation noted above, then the datasets for that parameter can be pooled between the wells to establish a larger background dataset. If there is a statistically significant variation noted between the two (or more) upgradient monitoring points, then the specific parameter datasets from those wells cannot be combined.

- If it is determined that datasets from upgradient monitoring points cannot be combined, then a decision needs to be made as to which monitoring point will be used for a specific parameter for background calculations. At this point some professional judgement needs to be used by considering the number of data points within each dataset, any potential statistical outliers, any statistical seasonality, the distribution and/or underlying distribution of that data, number of detects versus non-detects, etc.

With the above decision process in mind, the various statistical evaluations performed are summarized below. The evaluations were performed with the assistance of the Sanitas® statistical software package.

Outlier Testing

Outlier tests were performed for all monitoring wells (upgradient and downgradient) in the proposed State CCR monitoring well network for all data available since the start of Federal CCR monitoring. Wells MW-9, MW-11 and MW-14 are upgradient wells. The following statistically significant outliers (dates in parentheses) were noted:

- Calcium – MW-01 (1/17/20)
- Chloride – MW-02 (11/17/20)
- Combined Radium – MW-03 (11/28/17)
- Fluoride – MW-09 (5/16/17) and MW-11 (9/13/17 and 2/4/17)
- Lead – MW-11 (3/2/16)
- pH – MW-16 (2/24/17)
- Selenium – MW-14 (12/7/16 and 11/30/17)

Since the outliers cannot be attributed to either lab error, transcription error or field sampling error, the outlier values were not removed from the datasets at this time but may be considered during subsequent data evaluations. A statistical run summary which includes the specific statistical method used for each parameter for each well is provided at the end of this discussion.

Seasonality/Temporal Variability Testing

Seasonality/temporal variability tests were performed for all monitoring wells (upgradient and downgradient) in the proposed State CCR monitoring well network for all data available since the start of Federal CCR monitoring. Wells MW-9, MW-11 and MW-14 are upgradient wells. No statistically significant seasonal/temporal variations were noted in any of the wells for any of the parameters. A statistical run summary which includes the specific statistical method used for each parameter for each well is provided at the end of this discussion. The turbidity database to date is insufficient to evaluate potential seasonal/temporal variability at this time.

Trend Analysis

To determine whether data generated since the initial eight rounds of background groundwater sampling since the enactment of the Federal CCR Rule can potentially be pooled at a specific upgradient monitoring well location (MW-9, MW-11 and MW-14), trend analysis for each constituent at each upgradient well location was performed. The results are summarized as flows:

- MW-9 – Statistically significant trends were noted for chloride, lithium, pH and total dissolved solids (TDS).
- MW-11 – Statistically significant trends were noted for chloride, lithium, sulfate, TDS and turbidity.
- MW-14 – Statistically significant trends were noted for boron, calcium, chloride, sulfate and TDS.

A statistical run summary which includes the specific statistical method used for each parameter for each well is provided at the end of this discussion.

Spatial Variability Testing

To determine whether the background data sets from background wells can be pooled to establish a representative statistical background, spatial variability testing was performed on the datasets using a parametric analysis of variance (ANOVA). This analysis was done for each of the monitoring parameters. The following observations are made:

- Upgradient wells MW-9, MW-11 and MW-14 all parameter values pooled – No statistically significant variance between the full datasets for cadmium, chloride, lead, mercury and pH.
- Upgradient wells MW-9 and MW-14 all parameter values pooled – No statistically significant variance between full datasets for cadmium, chloride, cobalt, lead, mercury and pH.
- Upgradient wells MW-9 and MW-11 all parameter values pooled – No statistically significant variance between full datasets for antimony, cadmium, chloride, chromium, cobalt, fluoride, lead and TDS.
- Upgradient wells MW-11 and MW-14 all parameter values pooled - No statistically significant variance between full datasets for arsenic, calcium, lead, mercury, molybdenum, pH, selenium and sulfate.
- Upgradient wells MW-11 and MW-14 original 8 background values pooled – No statistically significant variance between the datasets for chloride, sulfate and TDS.

It is noted that both beryllium and thallium had no detections at any of the upgradient well locations during any sampling event, therefore, although an analysis of variance cannot be formally completed, these data sets can be pooled since there is no variation in the reporting limits.

Statistical run summaries which include the specific statistical method used for each parameter for each of the dataset comparisons are provided at the end of this discussion.

Test of Normality

The Shapiro-Wilk Normality Test with an alpha (α) value of 0.05 (or 95%) was used to evaluate the distribution of the background datasets for each constituent at each upgradient well locations and the distribution of pooled datasets for various combinations of upgradient wells (i.e., all three wells pooled and various combinations of two background wells pooled). A Test of Ladders was also run to evaluate other potential underlying transformational distributions in the case that the non-transformed dataset was found not to be normally distributed. The statistical runs are provided for the various combinations of upgradient wells by parameter at the end of this discussion.

Prediction Limits

Based on the various statistical evaluations discussed above, the following background data sets were used for background prediction limit calculations:

- Upgradient wells MW-9, MW-11 and MW-14 all parameter values pooled for beryllium, thallium and lead. As noted above there were no detections of beryllium or thallium at any of the three upgradient well locations and the reporting limits were the same. Relative to lead there were no statistically significant trends within wells for the combined data observations.
- Upgradient wells MW-11 and MW-14 all parameter values were pooled for arsenic, molybdenum, pH and selenium. For each of these combine parameter datasets, there were no individual trends within each well and there was no statistically significant variance noted between the datasets. It is noted the well MW-14 did have two outlier values for selenium, however since both were substantially below the Section 845.600 standard of 0.05 mg/l and there is no indication of potential laboratory or field error, it was decided to include these values within the overall dataset.
- Upgradient well MW-14 all parameter values were used for antimony, cadmium, chromium, cobalt, combined radium, fluoride, lithium, mercury and turbidity. None of these parameters indicated statistically significant trends within this well and none of these parameters were noted as statistical outliers at this well location. All had normal or underlying normal distributions unless distributions for all upgradient wells were found to not to be normal (e.g., antimony).
- Upgradient well MW-11 all parameter values were used for barium, boron and calcium. None of these parameters indicated statistically significant trends within this well and none of these parameters were noted as statistical outliers at this well location. All had normal or underlying normal distributions.
- Upgradient wells MW-11 and MW-14 the original eight background values were pooled for chloride, sulfate and TDS. The results for one or more of the evaluation iterations discussed above precluded using the full combined dataset values due to either identified data trends or statistically significant spatial variations. The original eight background values for these three parameters within these wells have no statistically significant variance and the combined datasets are normal.

The calculated prediction limits under the various background dataset selection scenarios are summarized in Table 9-7 in Section 9 of this permit application. A prediction limit statistical run summary which includes the specific statistical method used for each parameter for each well scenario noted above are provided at the end of this discussion.

Outlier Analysis - Waukegan Station - All CCR Wells

Waukegan Generating Station Client: NRG Data: Waukegan Printed 8/4/2021, 10:17 AM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Antimony (mg/L)	MW-01	n/a	n/a	n/a	NP (nrm)	NaN	12	0.003	0	unknown	ShapiroWilk
Antimony (mg/L)	MW-02	n/a	n/a	n/a	NP (nrm)	NaN	12	0.003	0	unknown	ShapiroWilk
Antimony (mg/L)	MW-03	n/a	n/a	n/a	NP (nrm)	NaN	12	0.003	0	unknown	ShapiroWilk
Antimony (mg/L)	MW-04	n/a	n/a	n/a	NP (nrm)	NaN	12	0.003	0	unknown	ShapiroWilk
Antimony (mg/L)	MW-09 (bg)	n/a	n/a	n/a	NP (nrm)	NaN	12	0.003092	0.0003175	unknown	ShapiroWilk
Antimony (mg/L)	MW-11 (bg)	n/a	n/a	n/a	NP (nrm)	NaN	12	0.003	0	unknown	ShapiroWilk
Antimony (mg/L)	MW-14 (bg)	No	n/a	n/a	NP (nrm)	NaN	12	0.005425	0.003895	unknown	ShapiroWilk
Antimony (mg/L)	MW-16	n/a	n/a	n/a	NP (nrm)	NaN	12	0.003	0	unknown	ShapiroWilk
Arsenic (mg/L)	MW-01	No	n/a	n/a	EPA 1989	0.05	12	0.08308	0.04341	normal	ShapiroWilk
Arsenic (mg/L)	MW-02	No	n/a	n/a	EPA 1989	0.05	12	0.01309	0.006082	ln(x)	ShapiroWilk
Arsenic (mg/L)	MW-03	No	n/a	n/a	EPA 1989	0.05	12	0.006433	0.002762	normal	ShapiroWilk
Arsenic (mg/L)	MW-04	No	n/a	n/a	EPA 1989	0.05	12	0.01088	0.01033	ln(x)	ShapiroWilk
Arsenic (mg/L)	MW-09 (bg)	No	n/a	n/a	NP (nrm)	NaN	12	0.01021	0.01952	unknown	ShapiroWilk
Arsenic (mg/L)	MW-11 (bg)	No	n/a	n/a	EPA 1989	0.05	12	0.6467	0.2212	normal	ShapiroWilk
Arsenic (mg/L)	MW-14 (bg)	No	n/a	n/a	EPA 1989	0.05	12	5.248	7.368	ln(x)	ShapiroWilk
Arsenic (mg/L)	MW-16	No	n/a	n/a	NP (nrm)	NaN	12	0.00985	0.01577	unknown	ShapiroWilk
Barium (mg/L)	MW-01	No	n/a	n/a	EPA 1989	0.05	12	0.02533	0.01279	ln(x)	ShapiroWilk
Barium (mg/L)	MW-02	No	n/a	n/a	EPA 1989	0.05	12	0.02142	0.007868	normal	ShapiroWilk
Barium (mg/L)	MW-03	No	n/a	n/a	EPA 1989	0.05	12	0.01792	0.01065	normal	ShapiroWilk
Barium (mg/L)	MW-04	No	n/a	n/a	EPA 1989	0.05	12	0.056	0.03407	normal	ShapiroWilk
Barium (mg/L)	MW-09 (bg)	No	n/a	n/a	EPA 1989	0.05	12	0.01835	0.01146	ln(x)	ShapiroWilk
Barium (mg/L)	MW-11 (bg)	No	n/a	n/a	EPA 1989	0.05	12	0.046	0.005784	normal	ShapiroWilk
Barium (mg/L)	MW-14 (bg)	No	n/a	n/a	NP (nrm)	NaN	12	0.1709	0.1553	unknown	ShapiroWilk
Barium (mg/L)	MW-16	No	n/a	n/a	EPA 1989	0.05	12	0.039	0.01519	ln(x)	ShapiroWilk
Beryllium (mg/L)	MW-01	n/a	n/a	n/a	NP (nrm)	NaN	12	0.001	0	unknown	ShapiroWilk
Beryllium (mg/L)	MW-02	n/a	n/a	n/a	NP (nrm)	NaN	12	0.001	0	unknown	ShapiroWilk
Beryllium (mg/L)	MW-03	n/a	n/a	n/a	NP (nrm)	NaN	12	0.001	0	unknown	ShapiroWilk
Beryllium (mg/L)	MW-04	n/a	n/a	n/a	NP (nrm)	NaN	12	0.001	0	unknown	ShapiroWilk
Beryllium (mg/L)	MW-09 (bg)	n/a	n/a	n/a	NP (nrm)	NaN	12	0.001	0	unknown	ShapiroWilk
Beryllium (mg/L)	MW-11 (bg)	n/a	n/a	n/a	NP (nrm)	NaN	12	0.001	0	unknown	ShapiroWilk
Beryllium (mg/L)	MW-14 (bg)	n/a	n/a	n/a	NP (nrm)	NaN	12	0.001	0	unknown	ShapiroWilk
Beryllium (mg/L)	MW-16	n/a	n/a	n/a	NP (nrm)	NaN	12	0.001	0	unknown	ShapiroWilk
Boron (mg/L)	MW-01	No	n/a	n/a	EPA 1989	0.05	17	2.3	0.3725	normal	ShapiroWilk
Boron (mg/L)	MW-02	No	n/a	n/a	EPA 1989	0.05	17	3.576	0.6543	normal	ShapiroWilk
Boron (mg/L)	MW-03	No	n/a	n/a	NP (nrm)	NaN	17	2.935	0.7721	unknown	ShapiroWilk
Boron (mg/L)	MW-04	No	n/a	n/a	EPA 1989	0.05	17	2.659	0.6032	normal	ShapiroWilk
Boron (mg/L)	MW-09 (bg)	No	n/a	n/a	Dixon`s	0.05	17	22.56	8.062	normal	ShapiroWilk
Boron (mg/L)	MW-11 (bg)	No	n/a	n/a	EPA 1989	0.05	17	2.965	1.089	normal	ShapiroWilk
Boron (mg/L)	MW-14 (bg)	No	n/a	n/a	EPA 1989	0.05	17	0.9582	0.4646	ln(x)	ShapiroWilk
Boron (mg/L)	MW-16	No	n/a	n/a	NP (nrm)	NaN	17	4.476	2.023	unknown	ShapiroWilk
Cadmium (mg/L)	MW-01	n/a	n/a	n/a	NP (nrm)	NaN	12	0.0005	0	unknown	ShapiroWilk
Cadmium (mg/L)	MW-02	n/a	n/a	n/a	NP (nrm)	NaN	12	0.0005	0	unknown	ShapiroWilk
Cadmium (mg/L)	MW-03	n/a	n/a	n/a	NP (nrm)	NaN	12	0.0005	0	unknown	ShapiroWilk
Cadmium (mg/L)	MW-04	n/a	n/a	n/a	NP (nrm)	NaN	12	0.0005	0	unknown	ShapiroWilk
Cadmium (mg/L)	MW-09 (bg)	n/a	n/a	n/a	NP (nrm)	NaN	12	0.000...	0.0001728	unknown	ShapiroWilk
Cadmium (mg/L)	MW-11 (bg)	n/a	n/a	n/a	NP (nrm)	NaN	12	0.0005	0	unknown	ShapiroWilk
Cadmium (mg/L)	MW-14 (bg)	No	n/a	n/a	NP (nrm)	NaN	12	0.000...	0.0004405	unknown	ShapiroWilk
Cadmium (mg/L)	MW-16	No	n/a	n/a	NP (nrm)	NaN	12	0.001124	0.001226	unknown	ShapiroWilk
Calcium (mg/L)	**MW-01**	**Yes**	**120**	**11/17/2020**	**Dixon`s**	**0.05**	**17**	**58.35**	**19.92**	**normal**	**ShapiroWilk**
Calcium (mg/L)	MW-02	No	n/a	n/a	EPA 1989	0.05	17	70.94	37.98	ln(x)	ShapiroWilk

Outlier Analysis - Waukegan Station - All CCR Wells

Waukegan Generating Station   Client: NRG   Data: Waukegan   Printed 8/4/2021, 10:17 AM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Calcium (mg/L)	MW-03	No	n/a	n/a	EPA 1989	0.05	17	80.59	27.39	ln(x)	ShapiroWilk
Calcium (mg/L)	MW-04	No	n/a	n/a	EPA 1989	0.05	17	118.8	51.79	normal	ShapiroWilk
Calcium (mg/L)	MW-09 (bg)	No	n/a	n/a	EPA 1989	0.05	17	205.9	63.55	ln(x)	ShapiroWilk
Calcium (mg/L)	MW-11 (bg)	No	n/a	n/a	EPA 1989	0.05	17	154.1	25.75	normal	ShapiroWilk
Calcium (mg/L)	MW-14 (bg)	No	n/a	n/a	EPA 1989	0.05	17	152.9	36.19	normal	ShapiroWilk
Calcium (mg/L)	MW-16	No	n/a	n/a	NP (nrm)	NaN	19	260	108.9	unknown	ShapiroWilk
Chloride (mg/L)	MW-01	No	n/a	n/a	Dixon`s	0.05	17	56	15.58	normal	ShapiroWilk
Chloride (mg/L)	**MW-02**	**Yes**	**20**	**11/17/2020**	**Dixon`s**	**0.05**	**17**	**48.35**	**9.42**	**normal**	**ShapiroWilk**
Chloride (mg/L)	MW-03	No	n/a	n/a	NP (nrm)	NaN	17	54.24	19.56	unknown	ShapiroWilk
Chloride (mg/L)	MW-04	No	n/a	n/a	EPA 1989	0.05	17	42.76	15.2	normal	ShapiroWilk
Chloride (mg/L)	MW-09 (bg)	No	n/a	n/a	NP (nrm)	NaN	17	258.8	228.8	unknown	ShapiroWilk
Chloride (mg/L)	MW-11 (bg)	No	n/a	n/a	EPA 1989	0.05	17	198.2	50.9	normal	ShapiroWilk
Chloride (mg/L)	MW-14 (bg)	No	n/a	n/a	EPA 1989	0.05	17	130.9	80.21	normal	ShapiroWilk
Chloride (mg/L)	MW-16	No	n/a	n/a	NP (nrm)	NaN	17	116.8	104	unknown	ShapiroWilk
Chromium (mg/L)	MW-01	n/a	n/a	n/a	NP (nrm)	NaN	12	0.005	0	unknown	ShapiroWilk
Chromium (mg/L)	MW-02	n/a	n/a	n/a	NP (nrm)	NaN	12	0.005	0	unknown	ShapiroWilk
Chromium (mg/L)	MW-03	n/a	n/a	n/a	NP (nrm)	NaN	12	0.005	0	unknown	ShapiroWilk
Chromium (mg/L)	MW-04	n/a	n/a	n/a	NP (nrm)	NaN	12	0.005	0	unknown	ShapiroWilk
Chromium (mg/L)	MW-09 (bg)	No	n/a	n/a	NP (nrm)	NaN	12	0.01693	0.02185	unknown	ShapiroWilk
Chromium (mg/L)	MW-11 (bg)	No	n/a	n/a	NP (nrm)	NaN	12	0.005467	0.0008595	unknown	ShapiroWilk
Chromium (mg/L)	MW-14 (bg)	No	n/a	n/a	NP (nrm)	NaN	12	1.594	2.063	unknown	ShapiroWilk
Chromium (mg/L)	MW-16	n/a	n/a	n/a	NP (nrm)	NaN	12	0.005217	0.0007506	unknown	ShapiroWilk
Cobalt (mg/L)	MW-01	n/a	n/a	n/a	NP (nrm)	NaN	12	0.001	0	unknown	ShapiroWilk
Cobalt (mg/L)	MW-02	n/a	n/a	n/a	NP (nrm)	NaN	12	0.001	0	unknown	ShapiroWilk
Cobalt (mg/L)	MW-03	n/a	n/a	n/a	NP (nrm)	NaN	12	0.001	0	unknown	ShapiroWilk
Cobalt (mg/L)	MW-04	n/a	n/a	n/a	NP (nrm)	NaN	12	0.001	0	unknown	ShapiroWilk
Cobalt (mg/L)	MW-09 (bg)	No	n/a	n/a	NP (nrm)	NaN	12	0.001267	0.0005365	unknown	ShapiroWilk
Cobalt (mg/L)	MW-11 (bg)	n/a	n/a	n/a	NP (nrm)	NaN	12	0.001	0	unknown	ShapiroWilk
Cobalt (mg/L)	MW-14 (bg)	No	n/a	n/a	NP (nrm)	NaN	12	0.002267	0.001831	unknown	ShapiroWilk
Cobalt (mg/L)	MW-16	n/a	n/a	n/a	NP (nrm)	NaN	12	0.001025	0.0000...	unknown	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-01	No	n/a	n/a	Dixon`s	0.05	12	0.4054	0.1428	normal	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-02	No	n/a	n/a	EPA 1989	0.05	12	0.5043	0.1858	ln(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	**MW-03**	**Yes**	**1.17**	**11/28/2017**	**Dixon`s**	**0.05**	**12**	**0.5014**	**0.2651**	**normal**	**ShapiroWilk**
Combined Radium 226 + 228 (pCi/L)	MW-04	No	n/a	n/a	EPA 1989	0.05	12	0.6569	0.2222	normal	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-09 (bg)	No	n/a	n/a	EPA 1989	0.05	12	0.4992	0.2046	normal	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-11 (bg)	No	n/a	n/a	EPA 1989	0.05	12	1.184	0.3705	normal	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-14 (bg)	No	n/a	n/a	EPA 1989	0.05	12	0.7407	0.265	normal	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	MW-16	No	n/a	n/a	EPA 1989	0.05	12	0.5729	0.1977	normal	ShapiroWilk
Fluoride (mg/L)	MW-01	No	n/a	n/a	EPA 1989	0.05	17	0.2676	0.08613	normal	ShapiroWilk
Fluoride (mg/L)	MW-02	No	n/a	n/a	EPA 1989	0.05	17	0.8212	0.3204	normal	ShapiroWilk
Fluoride (mg/L)	MW-03	No	n/a	n/a	NP (nrm)	NaN	17	0.3729	0.1234	unknown	ShapiroWilk
Fluoride (mg/L)	MW-04	No	n/a	n/a	EPA 1989	0.05	17	0.5165	0.2715	normal	ShapiroWilk
Fluoride (mg/L)	**MW-09 (bg)**	**Yes**	**0.29**	**5/16/2017**	**Dixon`s**	**0.05**	**17**	**0.1488**	**0.04807**	**ln(x)**	**ShapiroWilk**
Fluoride (mg/L)	**MW-11 (bg)**	**Yes**	**0.26,4.9**	**9/13/2017...**	**Dixon`s**	**0.05**	**17**	**0.4206**	**1.155**	**ln(x)**	**ShapiroWilk**
Fluoride (mg/L)	MW-14 (bg)	No	n/a	n/a	EPA 1989	0.05	17	0.1988	0.0491	normal	ShapiroWilk
Fluoride (mg/L)	MW-16	No	n/a	n/a	EPA 1989	0.05	17	0.4765	0.1758	normal	ShapiroWilk
Lead (mg/L)	MW-01	n/a	n/a	n/a	NP (nrm)	NaN	12	0.0005	0	unknown	ShapiroWilk
Lead (mg/L)	MW-02	n/a	n/a	n/a	NP (nrm)	NaN	12	0.0005	0	unknown	ShapiroWilk
Lead (mg/L)	MW-03	n/a	n/a	n/a	NP (nrm)	NaN	12	0.0005	0	unknown	ShapiroWilk
Lead (mg/L)	MW-04	n/a	n/a	n/a	NP (nrm)	NaN	12	0.0005	0	unknown	ShapiroWilk

Outlier Analysis - Waukegan Station - All CCR Wells

Waukegan Generating Station Client: NRG Data: Waukegan Printed 8/4/2021, 10:17 AM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Lead (mg/L)	MW-09 (bg)	n/a	n/a	n/a	NP (nrm)	NaN	12	0.000...	0.0002017	unknown	ShapiroWilk
Lead (mg/L)	**MW-11 (bg)**	**Yes**	**0.0011**	**3/2/2016**	**NP (nrm)**	**NaN**	**12**	**0.000...**	**0.0002156**	**unknown**	**ShapiroWilk**
Lead (mg/L)	MW-14 (bg)	No	n/a	n/a	NP (nrm)	NaN	12	0.000...	0.0001558	unknown	ShapiroWilk
Lead (mg/L)	MW-16	n/a	n/a	n/a	NP (nrm)	NaN	12	0.000...	0.0000...	unknown	ShapiroWilk
Lithium (mg/L)	MW-01	n/a	n/a	n/a	NP (nrm)	NaN	12	0.005	0	unknown	ShapiroWilk
Lithium (mg/L)	MW-02	n/a	n/a	n/a	NP (nrm)	NaN	12	0.005	0	unknown	ShapiroWilk
Lithium (mg/L)	MW-03	n/a	n/a	n/a	NP (nrm)	NaN	12	0.005	0	unknown	ShapiroWilk
Lithium (mg/L)	MW-04	n/a	n/a	n/a	NP (nrm)	NaN	12	0.005	0	unknown	ShapiroWilk
Lithium (mg/L)	MW-09 (bg)	No	n/a	n/a	EPA 1989	0.05	12	0.068	0.02063	normal	ShapiroWilk
Lithium (mg/L)	MW-11 (bg)	No	n/a	n/a	NP (nrm)	NaN	12	0.04367	0.00797	unknown	ShapiroWilk
Lithium (mg/L)	MW-14 (bg)	No	n/a	n/a	EPA 1989	0.05	12	0.02117	0.006028	normal	ShapiroWilk
Lithium (mg/L)	MW-16	No	n/a	n/a	NP (nrm)	NaN	12	0.049	0.05574	unknown	ShapiroWilk
Mercury (mg/L)	MW-01	n/a	n/a	n/a	NP (nrm)	NaN	12	0.0002	0	unknown	ShapiroWilk
Mercury (mg/L)	MW-02	n/a	n/a	n/a	NP (nrm)	NaN	12	0.0002	0	unknown	ShapiroWilk
Mercury (mg/L)	MW-03	n/a	n/a	n/a	NP (nrm)	NaN	12	0.0002	0	unknown	ShapiroWilk
Mercury (mg/L)	MW-04	n/a	n/a	n/a	NP (nrm)	NaN	12	0.0002	0	unknown	ShapiroWilk
Mercury (mg/L)	MW-09 (bg)	n/a	n/a	n/a	NP (nrm)	NaN	12	0.0002	0	unknown	ShapiroWilk
Mercury (mg/L)	MW-11 (bg)	n/a	n/a	n/a	NP (nrm)	NaN	12	0.0002	0	unknown	ShapiroWilk
Mercury (mg/L)	MW-14 (bg)	n/a	n/a	n/a	NP (nrm)	NaN	12	0.000...	0.0000664	unknown	ShapiroWilk
Mercury (mg/L)	MW-16	n/a	n/a	n/a	NP (nrm)	NaN	12	0.0002	0	unknown	ShapiroWilk
Molybdenum (mg/L)	MW-01	No	n/a	n/a	Dixon`s	0.05	12	0.05358	0.01659	normal	ShapiroWilk
Molybdenum (mg/L)	MW-02	No	n/a	n/a	NP (nrm)	NaN	12	0.05592	0.01503	unknown	ShapiroWilk
Molybdenum (mg/L)	MW-03	No	n/a	n/a	NP (nrm)	NaN	12	0.04675	0.01238	unknown	ShapiroWilk
Molybdenum (mg/L)	MW-04	No	n/a	n/a	EPA 1989	0.05	12	0.03431	0.0192	normal	ShapiroWilk
Molybdenum (mg/L)	MW-09 (bg)	No	n/a	n/a	Dixon`s	0.05	12	0.3828	0.1636	normal	ShapiroWilk
Molybdenum (mg/L)	MW-11 (bg)	n/a	n/a	n/a	NP (nrm)	NaN	12	0.005033	0.0001155	unknown	ShapiroWilk
Molybdenum (mg/L)	MW-14 (bg)	n/a	n/a	n/a	NP (nrm)	NaN	12	0.005408	0.001265	unknown	ShapiroWilk
Molybdenum (mg/L)	MW-16	No	n/a	n/a	Dixon`s	0.05	12	0.01872	0.005119	normal	ShapiroWilk
pH (n/a)	MW-01	No	n/a	n/a	NP (nrm)	NaN	17	10	1.075	unknown	ShapiroWilk
pH (n/a)	MW-02	No	n/a	n/a	Dixon`s	0.05	17	8.064	0.4855	normal	ShapiroWilk
pH (n/a)	MW-03	No	n/a	n/a	NP (nrm)	NaN	17	7.744	0.817	unknown	ShapiroWilk
pH (n/a)	MW-04	No	n/a	n/a	EPA 1989	0.05	17	7.135	0.3309	normal	ShapiroWilk
pH (n/a)	MW-09 (bg)	No	n/a	n/a	EPA 1989	0.05	17	7.335	0.4144	normal	ShapiroWilk
pH (n/a)	MW-11 (bg)	No	n/a	n/a	EPA 1989	0.05	17	7.088	0.2633	normal	ShapiroWilk
pH (n/a)	MW-14 (bg)	No	n/a	n/a	EPA 1989	0.05	17	7.167	0.2435	normal	ShapiroWilk
pH (n/a)	**MW-16**	**Yes**	**5.76**	**2/24/2017**	**Dixon`s**	**0.05**	**17**	**6.921**	**0.4503**	**normal**	**ShapiroWilk**
Selenium (mg/L)	MW-01	No	n/a	n/a	NP (nrm)	NaN	12	0.0058	0.006015	unknown	ShapiroWilk
Selenium (mg/L)	MW-02	No	n/a	n/a	NP (nrm)	NaN	12	0.00575	0.006827	unknown	ShapiroWilk
Selenium (mg/L)	MW-03	No	n/a	n/a	NP (nrm)	NaN	12	0.004875	0.003466	unknown	ShapiroWilk
Selenium (mg/L)	MW-04	No	n/a	n/a	NP (nrm)	NaN	12	0.0141	0.01829	unknown	ShapiroWilk
Selenium (mg/L)	MW-09 (bg)	No	n/a	n/a	EPA 1989	0.05	12	0.02047	0.01424	normal	ShapiroWilk
Selenium (mg/L)	MW-11 (bg)	n/a	n/a	n/a	NP (nrm)	NaN	12	0.0025	0	unknown	ShapiroWilk
Selenium (mg/L)	**MW-14 (bg)**	**Yes**	**0.014,0.0072**	**12/7/2016...**	**NP (nrm)**	**NaN**	**12**	**0.0039**	**0.003453**	**unknown**	**ShapiroWilk**
Selenium (mg/L)	MW-16	No	n/a	n/a	NP (nrm)	NaN	12	0.004475	0.003933	unknown	ShapiroWilk
Sulfate (mg/L)	MW-01	No	n/a	n/a	EPA 1989	0.05	17	270	66.43	normal	ShapiroWilk
Sulfate (mg/L)	MW-02	No	n/a	n/a	EPA 1989	0.05	17	244.1	74.5	normal	ShapiroWilk
Sulfate (mg/L)	MW-03	No	n/a	n/a	EPA 1989	0.05	17	217.1	59.45	normal	ShapiroWilk
Sulfate (mg/L)	MW-04	No	n/a	n/a	EPA 1989	0.05	17	260.6	114.9	ln(x)	ShapiroWilk
Sulfate (mg/L)	MW-09 (bg)	No	n/a	n/a	EPA 1989	0.05	17	440	189.3	ln(x)	ShapiroWilk
Sulfate (mg/L)	MW-11 (bg)	No	n/a	n/a	EPA 1989	0.05	17	104.5	57.07	normal	ShapiroWilk

Outlier Analysis - Waukegan Station - All CCR Wells

Waukegan Generating Station   Client: NRG   Data: Waukegan   Printed 8/4/2021, 10:17 AM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Sulfate (mg/L)	MW-14 (bg)	No	n/a	n/a	EPA 1989	0.05	17	102.2	76.82	normal	ShapiroWilk
Sulfate (mg/L)	MW-16	No	n/a	n/a	EPA 1989	0.05	17	600	269.4	normal	ShapiroWilk
Thallium (mg/L)	MW-01	n/a	n/a	n/a	NP (nrm)	NaN	12	0.002	0	unknown	ShapiroWilk
Thallium (mg/L)	MW-02	n/a	n/a	n/a	NP (nrm)	NaN	12	0.002	0	unknown	ShapiroWilk
Thallium (mg/L)	MW-03	n/a	n/a	n/a	NP (nrm)	NaN	12	0.002	0	unknown	ShapiroWilk
Thallium (mg/L)	MW-04	n/a	n/a	n/a	NP (nrm)	NaN	12	0.002	0	unknown	ShapiroWilk
Thallium (mg/L)	MW-09 (bg)	n/a	n/a	n/a	NP (nrm)	NaN	12	0.002	0	unknown	ShapiroWilk
Thallium (mg/L)	MW-11 (bg)	n/a	n/a	n/a	NP (nrm)	NaN	12	0.002	0	unknown	ShapiroWilk
Thallium (mg/L)	MW-14 (bg)	n/a	n/a	n/a	NP (nrm)	NaN	12	0.002	0	unknown	ShapiroWilk
Thallium (mg/L)	MW-16	n/a	n/a	n/a	NP (nrm)	NaN	12	0.002008	0.0000...	unknown	ShapiroWilk
Total Dissolved Solids (mg/L)	MW-01	No	n/a	n/a	EPA 1989	0.05	17	581.8	99.95	ln(x)	ShapiroWilk
Total Dissolved Solids (mg/L)	MW-02	No	n/a	n/a	EPA 1989	0.05	17	588.2	172	ln(x)	ShapiroWilk
Total Dissolved Solids (mg/L)	MW-03	No	n/a	n/a	EPA 1989	0.05	17	565.3	115.7	ln(x)	ShapiroWilk
Total Dissolved Solids (mg/L)	MW-04	No	n/a	n/a	EPA 1989	0.05	17	712.9	242.7	normal	ShapiroWilk
Total Dissolved Solids (mg/L)	MW-09 (bg)	No	n/a	n/a	EPA 1989	0.05	17	1394	605.3	ln(x)	ShapiroWilk
Total Dissolved Solids (mg/L)	MW-11 (bg)	No	n/a	n/a	NP (nrm)	NaN	17	1008	151.3	unknown	ShapiroWilk
Total Dissolved Solids (mg/L)	MW-14 (bg)	No	n/a	n/a	EPA 1989	0.05	17	814.7	300.6	normal	ShapiroWilk
Total Dissolved Solids (mg/L)	MW-16	No	n/a	n/a	EPA 1989	0.05	20	1536	671.9	ln(x)	ShapiroWilk

Seasonality - Waukegan Station - All CCR Wells

Waukegan Generating Station Client: NRG Data: Waukegan Printed 8/4/2021, 10:30 AM

onstituent	Well	Sig.	K.-W.	Chi-Sq.	df	N	Alpha
ntimony (mg/L)	MW-01	No	0	0	0	12	0.05
ntimony (mg/L)	MW-02	No	0	0	0	12	0.05
ntimony (mg/L)	MW-03	No	0	0	0	12	0.05
ntimony (mg/L)	MW-04	No	0	0	0	12	0.05
ntimony (mg/L)	MW-09 (bg)	No	0	0	0	12	0.05
ntimony (mg/L)	MW-11 (bg)	No	0	0	0	12	0.05
ntimony (mg/L)	MW-14 (bg)	No	0	0	0	12	0.05
ntimony (mg/L)	MW-16	No	0	0	0	12	0.05
rsenic (mg/L)	MW-01	No	0	0	0	12	0.05
rsenic (mg/L)	MW-02	No	0	0	0	12	0.05
rsenic (mg/L)	MW-03	No	0	0	0	12	0.05
rsenic (mg/L)	MW-04	No	0	0	0	12	0.05
rsenic (mg/L)	MW-09 (bg)	No	0	0	0	12	0.05
rsenic (mg/L)	MW-11 (bg)	No	0	0	0	12	0.05
rsenic (mg/L)	MW-14 (bg)	No	0	0	0	12	0.05
rsenic (mg/L)	MW-16	No	0	0	0	12	0.05
arium (mg/L)	MW-01	No	0	0	0	12	0.05
arium (mg/L)	MW-02	No	0	0	0	12	0.05
arium (mg/L)	MW-03	No	0	0	0	12	0.05
arium (mg/L)	MW-04	No	0	0	0	12	0.05
arium (mg/L)	MW-09 (bg)	No	0	0	0	12	0.05
arium (mg/L)	MW-11 (bg)	No	0	0	0	12	0.05
arium (mg/L)	MW-14 (bg)	No	0	0	0	12	0.05
arium (mg/L)	MW-16	No	0	0	0	12	0.05
eryllium (mg/L)	MW-01	No	0	0	0	12	0.05
eryllium (mg/L)	MW-02	No	0	0	0	12	0.05
eryllium (mg/L)	MW-03	No	0	0	0	12	0.05
eryllium (mg/L)	MW-04	No	0	0	0	12	0.05
eryllium (mg/L)	MW-09 (bg)	No	0	0	0	12	0.05
eryllium (mg/L)	MW-11 (bg)	No	0	0	0	12	0.05
eryllium (mg/L)	MW-14 (bg)	No	0	0	0	12	0.05
eryllium (mg/L)	MW-16	No	0	0	0	12	0.05
oron (mg/L)	MW-01	No	0	0	0	17	0.05
oron (mg/L)	MW-02	No	0	0	0	17	0.05
oron (mg/L)	MW-03	No	0	0	0	17	0.05
oron (mg/L)	MW-04	No	0	0	0	17	0.05
oron (mg/L)	MW-09 (bg)	No	0	0	0	17	0.05
oron (mg/L)	MW-11 (bg)	No	0	0	0	17	0.05
oron (mg/L)	MW-14 (bg)	No	0	0	0	17	0.05
oron (mg/L)	MW-16	No	0	0	0	17	0.05
admium (mg/L)	MW-01	No	0	0	0	12	0.05
admium (mg/L)	MW-02	No	0	0	0	12	0.05
admium (mg/L)	MW-03	No	0	0	0	12	0.05
admium (mg/L)	MW-04	No	0	0	0	12	0.05
admium (mg/L)	MW-09 (bg)	No	0	0	0	12	0.05
admium (mg/L)	MW-11 (bg)	No	0	0	0	12	0.05
admium (mg/L)	MW-14 (bg)	No	0	0	0	12	0.05
admium (mg/L)	MW-16	No	0	0	0	12	0.05
alcium (mg/L)	MW-01	No	0	0	0	17	0.05
alcium (mg/L)	MW-02	No	0	0	0	17	0.05

Seasonality - Waukegan Station - All CCR Wells

Waukegan Generating Station Client: NRG Data: Waukegan Printed 8/4/2021, 10:30 AM

Constituent	Well	Sig.	K.-W.	Chi-Sq.	df	N	Alpha
Calcium (mg/L)	MW-03	No	0	0	0	17	0.05
Calcium (mg/L)	MW-04	No	0	0	0	17	0.05
Calcium (mg/L)	MW-09 (bg)	No	0	0	0	17	0.05
Calcium (mg/L)	MW-11 (bg)	No	0	0	0	17	0.05
Calcium (mg/L)	MW-14 (bg)	No	0	0	0	17	0.05
Calcium (mg/L)	MW-16	No	3.6	7.815	3	19	0.05
Chloride (mg/L)	MW-01	No	3.6	7.815	3	17	0.05
Chloride (mg/L)	MW-02	No	3.6	7.815	3	17	0.05
Chloride (mg/L)	MW-03	No	3.6	7.815	3	17	0.05
Chloride (mg/L)	MW-04	No	3.6	7.815	3	17	0.05
Chloride (mg/L)	MW-09 (bg)	No	3.6	7.815	3	17	0.05
Chloride (mg/L)	MW-11 (bg)	No	3.6	7.815	3	17	0.05
Chloride (mg/L)	MW-14 (bg)	No	3.6	7.815	3	17	0.05
Chloride (mg/L)	MW-16	No	3.6	7.815	3	17	0.05
Chromium (mg/L)	MW-01	No	3.6	7.815	3	12	0.05
Chromium (mg/L)	MW-02	No	3.6	7.815	3	12	0.05
Chromium (mg/L)	MW-03	No	3.6	7.815	3	12	0.05
Chromium (mg/L)	MW-04	No	3.6	7.815	3	12	0.05
Chromium (mg/L)	MW-09 (bg)	No	3.6	7.815	3	12	0.05
Chromium (mg/L)	MW-11 (bg)	No	3.6	7.815	3	12	0.05
Chromium (mg/L)	MW-14 (bg)	No	3.6	7.815	3	12	0.05
Chromium (mg/L)	MW-16	No	3.6	7.815	3	12	0.05
Cobalt (mg/L)	MW-01	No	3.6	7.815	3	12	0.05
Cobalt (mg/L)	MW-02	No	3.6	7.815	3	12	0.05
Cobalt (mg/L)	MW-03	No	3.6	7.815	3	12	0.05
Cobalt (mg/L)	MW-04	No	3.6	7.815	3	12	0.05
Cobalt (mg/L)	MW-09 (bg)	No	3.6	7.815	3	12	0.05
Cobalt (mg/L)	MW-11 (bg)	No	3.6	7.815	3	12	0.05
Cobalt (mg/L)	MW-14 (bg)	No	3.6	7.815	3	12	0.05
Cobalt (mg/L)	MW-16	No	3.6	7.815	3	12	0.05
Combined Radium 226 + 228 (pCi/L)	MW-01	No	3.6	7.815	3	12	0.05
Combined Radium 226 + 228 (pCi/L)	MW-02	No	3.6	7.815	3	12	0.05
Combined Radium 226 + 228 (pCi/L)	MW-03	No	3.6	7.815	3	12	0.05
Combined Radium 226 + 228 (pCi/L)	MW-04	No	3.6	7.815	3	12	0.05
Combined Radium 226 + 228 (pCi/L)	MW-09 (bg)	No	3.6	7.815	3	12	0.05
Combined Radium 226 + 228 (pCi/L)	MW-11 (bg)	No	3.6	7.815	3	12	0.05
Combined Radium 226 + 228 (pCi/L)	MW-14 (bg)	No	3.6	7.815	3	12	0.05
Combined Radium 226 + 228 (pCi/L)	MW-16	No	3.6	7.815	3	12	0.05
Fluoride (mg/L)	MW-01	No	3.6	7.815	3	17	0.05
Fluoride (mg/L)	MW-02	No	3.6	7.815	3	17	0.05
Fluoride (mg/L)	MW-03	No	3.6	7.815	3	17	0.05
Fluoride (mg/L)	MW-04	No	3.6	7.815	3	17	0.05
Fluoride (mg/L)	MW-09 (bg)	No	3.6	7.815	3	17	0.05
Fluoride (mg/L)	MW-11 (bg)	No	3.6	7.815	3	17	0.05
Fluoride (mg/L)	MW-14 (bg)	No	3.6	7.815	3	17	0.05
Fluoride (mg/L)	MW-16	No	3.6	7.815	3	17	0.05
Lead (mg/L)	MW-01	No	3.6	7.815	3	12	0.05
Lead (mg/L)	MW-02	No	3.6	7.815	3	12	0.05
Lead (mg/L)	MW-03	No	3.6	7.815	3	12	0.05
Lead (mg/L)	MW-04	No	3.6	7.815	3	12	0.05

Seasonality - Waukegan Station - All CCR Wells

Waukegan Generating Station   Client: NRG   Data: Waukegan   Printed 8/4/2021, 10:30 AM

Constituent	Well	Sig.	K.-W.	Chi-Sq.	df	N	Alpha
Lead (mg/L)	MW-09 (bg)	No	3.6	7.815	3	12	0.05
Lead (mg/L)	MW-11 (bg)	No	3.6	7.815	3	12	0.05
Lead (mg/L)	MW-14 (bg)	No	3.6	7.815	3	12	0.05
Lead (mg/L)	MW-16	No	3.6	7.815	3	12	0.05
Lithium (mg/L)	MW-01	No	3.6	7.815	3	12	0.05
Lithium (mg/L)	MW-02	No	3.6	7.815	3	12	0.05
Lithium (mg/L)	MW-03	No	3.6	7.815	3	12	0.05
Lithium (mg/L)	MW-04	No	3.6	7.815	3	12	0.05
Lithium (mg/L)	MW-09 (bg)	No	3.6	7.815	3	12	0.05
Lithium (mg/L)	MW-11 (bg)	No	3.6	7.815	3	12	0.05
Lithium (mg/L)	MW-14 (bg)	No	3.6	7.815	3	12	0.05
Lithium (mg/L)	MW-16	No	3.6	7.815	3	12	0.05
Mercury (mg/L)	MW-01	No	3.6	7.815	3	12	0.05
Mercury (mg/L)	MW-02	No	3.6	7.815	3	12	0.05
Mercury (mg/L)	MW-03	No	3.6	7.815	3	12	0.05
Mercury (mg/L)	MW-04	No	3.6	7.815	3	12	0.05
Mercury (mg/L)	MW-09 (bg)	No	3.6	7.815	3	12	0.05
Mercury (mg/L)	MW-11 (bg)	No	3.6	7.815	3	12	0.05
Mercury (mg/L)	MW-14 (bg)	No	3.6	7.815	3	12	0.05
Mercury (mg/L)	MW-16	No	3.6	7.815	3	12	0.05
Molybdenum (mg/L)	MW-01	No	3.6	7.815	3	12	0.05
Molybdenum (mg/L)	MW-02	No	3.6	7.815	3	12	0.05
Molybdenum (mg/L)	MW-03	No	3.6	7.815	3	12	0.05
Molybdenum (mg/L)	MW-04	No	3.6	7.815	3	12	0.05
Molybdenum (mg/L)	MW-09 (bg)	No	3.6	7.815	3	12	0.05
Molybdenum (mg/L)	MW-11 (bg)	No	3.6	7.815	3	12	0.05
Molybdenum (mg/L)	MW-14 (bg)	No	3.6	7.815	3	12	0.05
Molybdenum (mg/L)	MW-16	No	3.6	7.815	3	12	0.05
pH (n/a)	MW-01	No	3.6	7.815	3	17	0.05
pH (n/a)	MW-02	No	3.6	7.815	3	17	0.05
pH (n/a)	MW-03	No	3.6	7.815	3	17	0.05
pH (n/a)	MW-04	No	3.6	7.815	3	17	0.05
pH (n/a)	MW-09 (bg)	No	3.6	7.815	3	17	0.05
pH (n/a)	MW-11 (bg)	No	3.6	7.815	3	17	0.05
pH (n/a)	MW-14 (bg)	No	3.6	7.815	3	17	0.05
pH (n/a)	MW-16	No	3.6	7.815	3	17	0.05
Selenium (mg/L)	MW-01	No	3.6	7.815	3	12	0.05
Selenium (mg/L)	MW-02	No	3.6	7.815	3	12	0.05
Selenium (mg/L)	MW-03	No	3.6	7.815	3	12	0.05
Selenium (mg/L)	MW-04	No	3.6	7.815	3	12	0.05
Selenium (mg/L)	MW-09 (bg)	No	3.6	7.815	3	12	0.05
Selenium (mg/L)	MW-11 (bg)	No	3.6	7.815	3	12	0.05
Selenium (mg/L)	MW-14 (bg)	No	3.6	7.815	3	12	0.05
Selenium (mg/L)	MW-16	No	3.6	7.815	3	12	0.05
Sulfate (mg/L)	MW-01	No	3.6	7.815	3	17	0.05
Sulfate (mg/L)	MW-02	No	3.6	7.815	3	17	0.05
Sulfate (mg/L)	MW-03	No	3.6	7.815	3	17	0.05
Sulfate (mg/L)	MW-04	No	3.6	7.815	3	17	0.05
Sulfate (mg/L)	MW-09 (bg)	No	3.6	7.815	3	17	0.05
Sulfate (mg/L)	MW-11 (bg)	No	3.6	7.815	3	17	0.05

Seasonality - Waukegan Station - All CCR Wells

Waukegan Generating Station Client: NRG Data: Waukegan Printed 8/4/2021, 10:30 AM

Constituent	Well	Sig.	K.-W.	Chi-Sq.	df	N	Alpha
Sulfate (mg/L)	MW-14 (bg)	No	3.6	7.815	3	17	0.05
Sulfate (mg/L)	MW-16	No	3.6	7.815	3	17	0.05
Thallium (mg/L)	MW-01	No	3.6	7.815	3	12	0.05
Thallium (mg/L)	MW-02	No	3.6	7.815	3	12	0.05
Thallium (mg/L)	MW-03	No	3.6	7.815	3	12	0.05
Thallium (mg/L)	MW-04	No	3.6	7.815	3	12	0.05
Thallium (mg/L)	MW-09 (bg)	No	3.6	7.815	3	12	0.05
Thallium (mg/L)	MW-11 (bg)	No	3.6	7.815	3	12	0.05
Thallium (mg/L)	MW-14 (bg)	No	3.6	7.815	3	12	0.05
Thallium (mg/L)	MW-16	No	3.6	7.815	3	12	0.05
Total Dissolved Solids (mg/L)	MW-01	No	3.6	7.815	3	17	0.05
Total Dissolved Solids (mg/L)	MW-02	No	3.6	7.815	3	17	0.05
Total Dissolved Solids (mg/L)	MW-03	No	3.6	7.815	3	17	0.05
Total Dissolved Solids (mg/L)	MW-04	No	3.6	7.815	3	17	0.05
Total Dissolved Solids (mg/L)	MW-09 (bg)	No	3.6	7.815	3	17	0.05
Total Dissolved Solids (mg/L)	MW-11 (bg)	No	3.6	7.815	3	17	0.05
Total Dissolved Solids (mg/L)	MW-14 (bg)	No	3.6	7.815	3	17	0.05
Total Dissolved Solids (mg/L)	MW-16	No	2.646	7.815	3	20	0.05

Trend Test MW-9

Waukegan Generating Station Client: NRG Data: Waukegan Printed 8/5/2021, 1:37 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Antimony (mg/L)	MW-09 (bg)	0	-5	-35	No	12	91.67	n/a	n/a	0.02	NP (NDs)
Arsenic (mg/L)	MW-09 (bg)	-0.3869	-1.427	2.359	No	12	33.33	Yes	natura...	0.02	Param.
Barium (mg/L)	MW-09 (bg)	-0.00426	-2.171	2.359	No	12	0	Yes	no	0.02	Param.
Beryllium (mg/L)	MW-09 (bg)	0	0	35	No	12	100	n/a	n/a	0.02	NP (NDs)
Boron (mg/L)	MW-09 (bg)	2.245	2.071	2.249	No	17	0	Yes	no	0.02	Param.
Cadmium (mg/L)	MW-09 (bg)	0	-9	-35	No	12	83.33	n/a	n/a	0.02	NP (NDs)
Calcium (mg/L)	MW-09 (bg)	-15.17	-1.711	2.249	No	17	0	Yes	no	0.02	Param.
Chloride (mg/L)	**MW-09 (bg)**	**-94.18**	**-3.765**	**-2.249**	**Yes**	**17**	**0**	**Yes**	**no**	**0.02**	**Param.**
Chromium (mg/L)	MW-09 (bg)	-0.00...	-1.06	2.359	No	12	66.67	Yes	no	0.02	Param.
Cobalt (mg/L)	MW-09 (bg)	0	-4	-35	No	12	75	n/a	n/a	0.02	NP (Nor...
Combined Radium 226 + 228 (pCi/L)	MW-09 (bg)	0.04219	1.046	2.359	No	12	66.67	Yes	no	0.02	Param.
Fluoride (mg/L)	MW-09 (bg)	-0.00...	-0.04419	2.249	No	17	0	Yes	natura...	0.02	Param.
Lead (mg/L)	MW-09 (bg)	0	-13	-35	No	12	83.33	n/a	n/a	0.02	NP (NDs)
Lithium (mg/L)	**MW-09 (bg)**	**-0.00...**	**-2.629**	**-2.359**	**Yes**	**12**	**0**	**Yes**	**no**	**0.02**	**Param.**
Mercury (mg/L)	MW-09 (bg)	0	0	35	No	12	100	n/a	n/a	0.02	NP (NDs)
Molybdenum (mg/L)	MW-09 (bg)	0.03053	0.9373	2.359	No	12	0	Yes	no	0.02	Param.
pH (n/a)	**MW-09 (bg)**	**0.1244**	**2.286**	**2.249**	**Yes**	**17**	**0**	**Yes**	**no**	**0.02**	**Param.**
Selenium (mg/L)	MW-09 (bg)	-0.00...	-0.2809	2.359	No	12	16.67	Yes	no	0.02	Param.
Sulfate (mg/L)	MW-09 (bg)	-33.16	-1.203	2.249	No	17	0	Yes	no	0.02	Param.
Thallium (mg/L)	MW-09 (bg)	0	0	35	No	12	100	n/a	n/a	0.02	NP (NDs)
Total Dissolved Solids (mg/L)	**MW-09 (bg)**	**-205.8**	**-2.726**	**-2.249**	**Yes**	**17**	**0**	**Yes**	**no**	**0.02**	**Param.**

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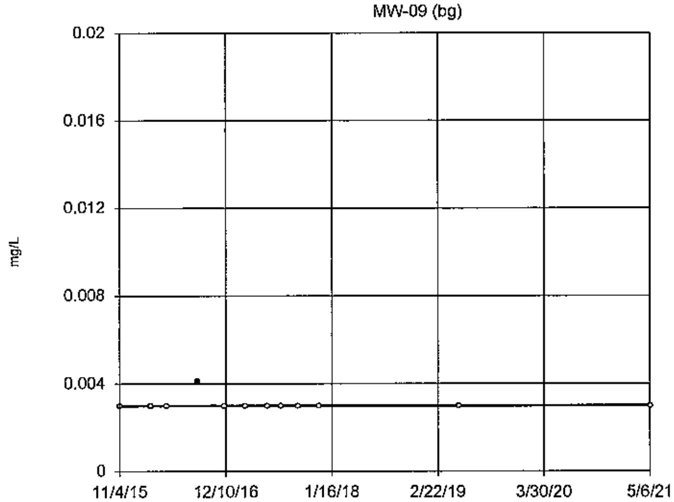
Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-09 (bg)



n = 12

Slope = 0
units per year.

Mann-Kendall
statistic = -5
critical = -35

Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because censored data exceeded 75%.

Constituent: Antimony Analysis Run 8/5/2021 1:36 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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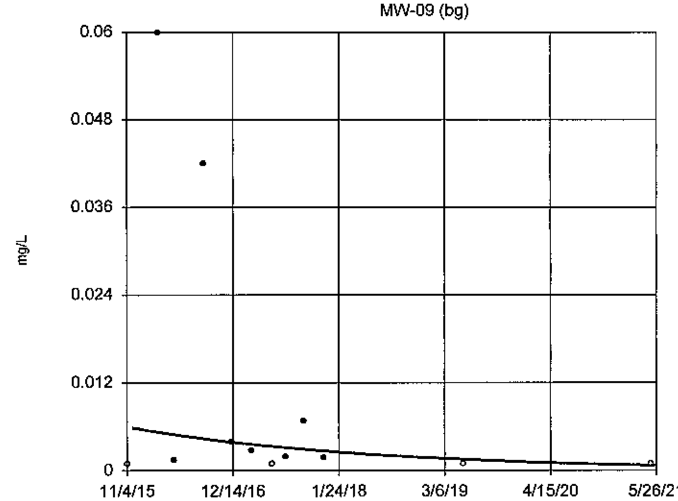
Linear Regression

MW-09 (bg)



n = 12
33.33% NDs

Slope = -0.3869
natural log units/year.

alpha = 0.02
t = -1.427
critical = 2.359

No significant trend.

Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9114 after natural log transformation, critical = 0.805.

Constituent: Arsenic Analysis Run 8/5/2021 1:36 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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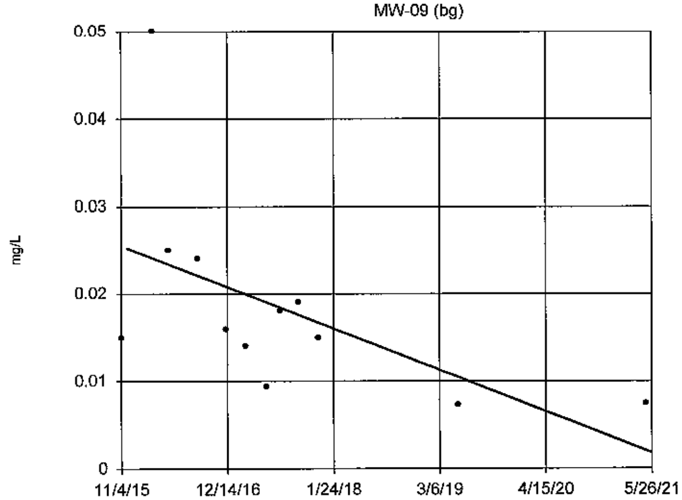
Linear Regression

MW-09 (bg)



n = 12

Slope = -0.00426
units/year.

alpha = 0.02
t = -2.171
critical = 2.359

No significant trend.

Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.8129, critical = 0.805.

Constituent: Barium Analysis Run 8/5/2021 1:36 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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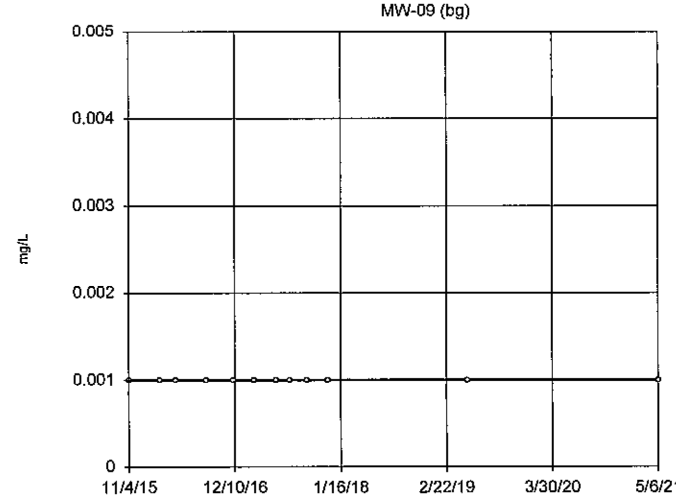
Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-09 (bg)



n = 12

Slope = 0
units per year.

Mann-Kendall
statistic = 0
critical = 35

Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because censored data exceeded 75%.

Constituent: Beryllium Analysis Run 8/5/2021 1:36 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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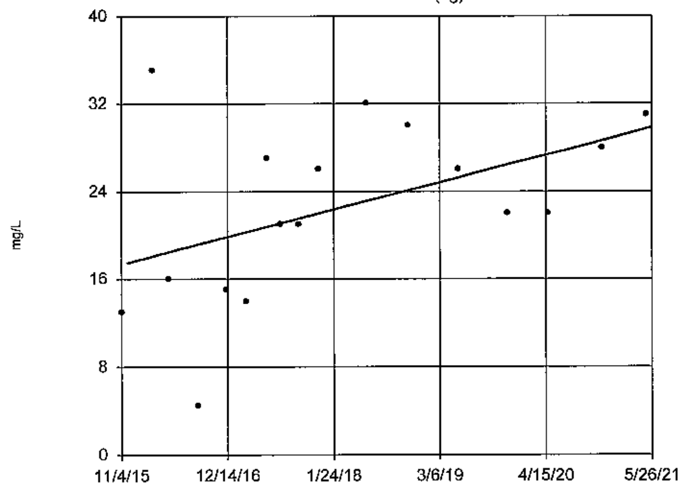
Linear Regression

MW-09 (bg)



n = 17

Slope = 2.245 units/year.

alpha = 0.02
t = 2.071
critical = 2.249

No significant trend.

Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9619, critical = 0.851.

Constituent: Boron   Analysis Run 8/5/2021 1:36 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

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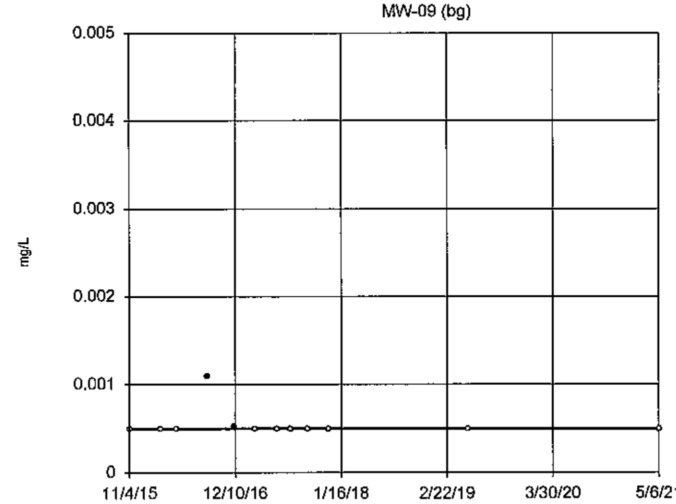
Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-09 (bg)



n = 12

Slope = 0 units per year.

Mann-Kendall statistic = -9
critical = -35

Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because censored data exceeded 75%.

Constituent: Cadmium   Analysis Run 8/5/2021 1:36 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

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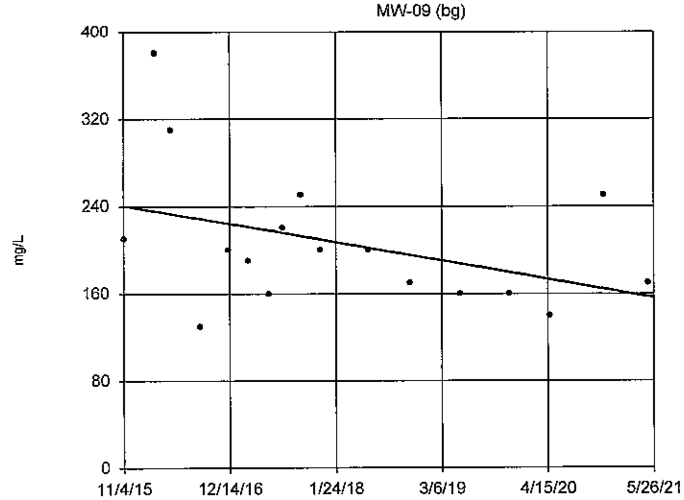
Linear Regression

MW-09 (bg)



n = 17

Slope = -15.17 units/year.

alpha = 0.02
t = -1.711
critical = 2.249

No significant trend.

Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9063, critical = 0.851.

Constituent: Calcium   Analysis Run 8/5/2021 1:36 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

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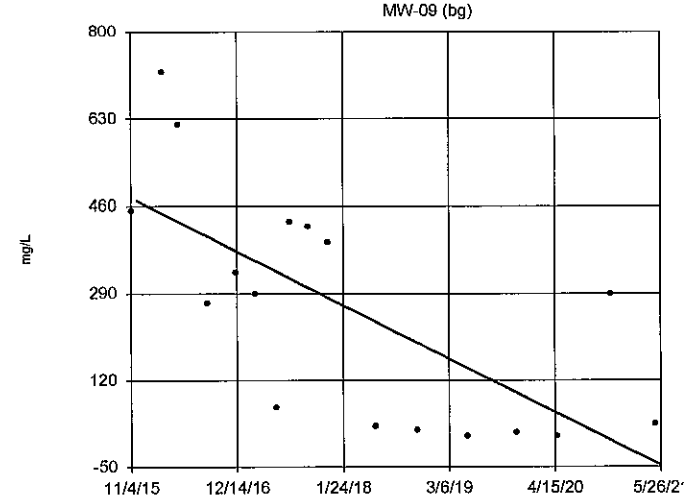
Linear Regression

MW-09 (bg)



n = 17

Slope = -94.18 units/year.

alpha = 0.02
t = -3.765
critical = -2.249

Significant decreasing trend.

Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9591, critical = 0.851.

Constituent: Chloride   Analysis Run 8/5/2021 1:36 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

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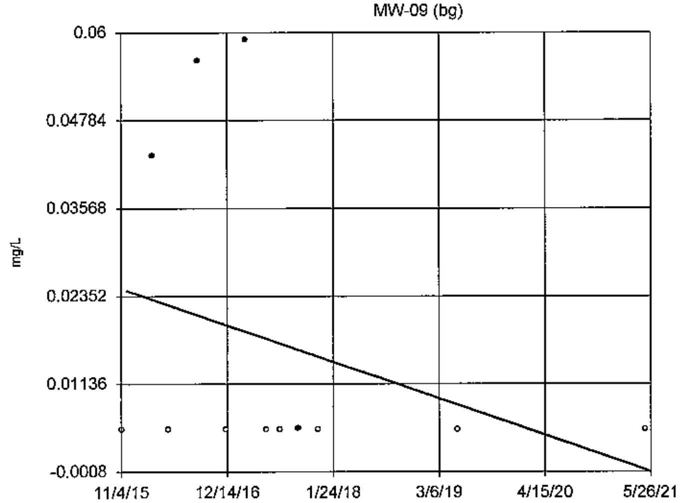
Hollow symbols indicate censored values.

Linear Regression

MW-09 (bg)



n = 12
66.67% NDs

Slope = -0.004561 units/year.

alpha = 0.02
t = -1.06
critical = 2.359

No significant trend.

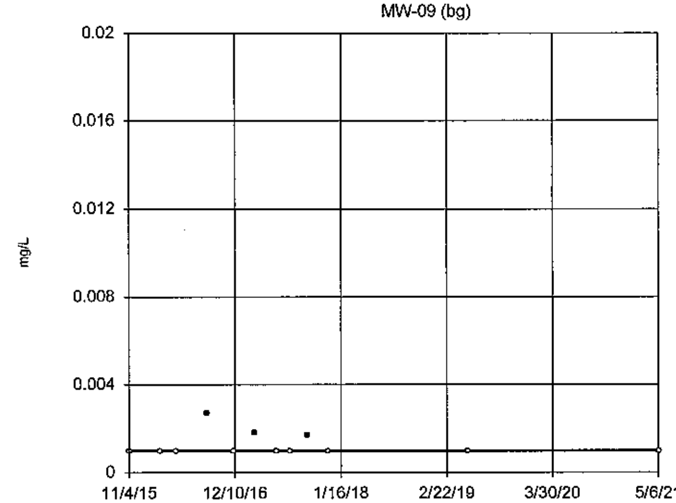
Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.815, critical = 0.805.

Constituent: Chromium Analysis Run 8/5/2021 1:36 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Sanitas™ v.9.6.09 Software licensed to KPRG and Associates, Inc. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-09 (bg)



n = 12

Slope = 0 units per year.

Mann-Kendall statistic = -4 critical = -35

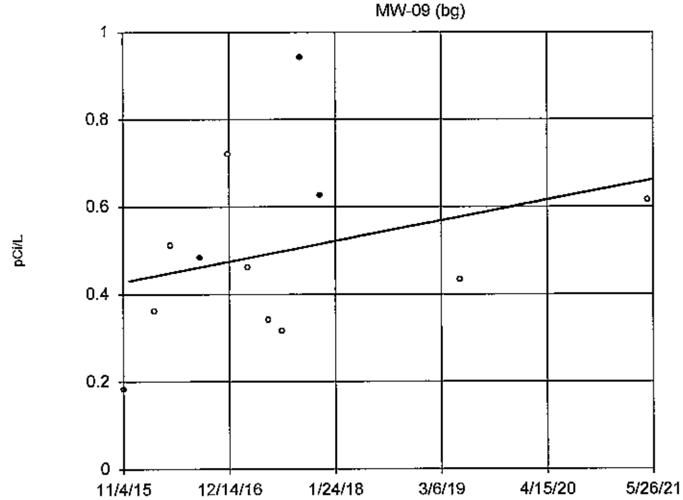
Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because the Shapiro Wilk normality test showed the residuals to be non-normal at the 0.01 alpha level, calculated = 0.7363, critical = 0.805.

Constituent: Cobalt Analysis Run 8/5/2021 1:36 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Sanitas™ v.9.6.09 Software licensed to KPRG and Associates, Inc. UG
Hollow symbols indicate censored values.

Linear Regression

MW-09 (bg)



n = 12
66.67% NDs

Slope = 0.04219 units/year.

alpha = 0.02
t = 1.046
critical = 2.359

No significant trend.

Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9289, critical = 0.805.

Constituent: Combined Radium 226 + 228 Analysis Run 8/5/2021 1:36 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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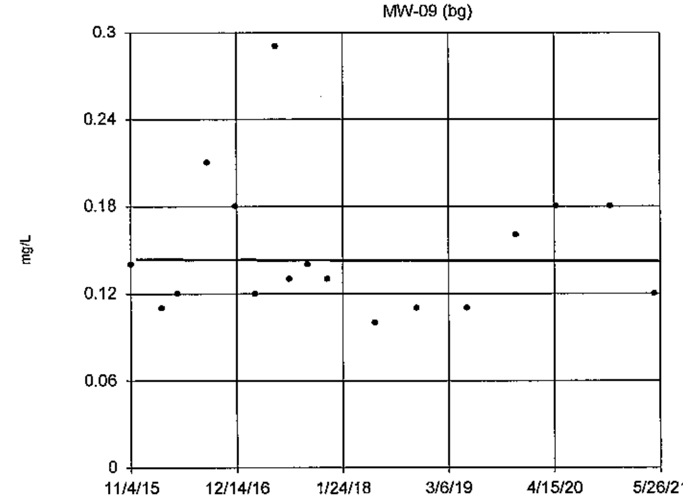
Linear Regression

MW-09 (bg)



n = 17

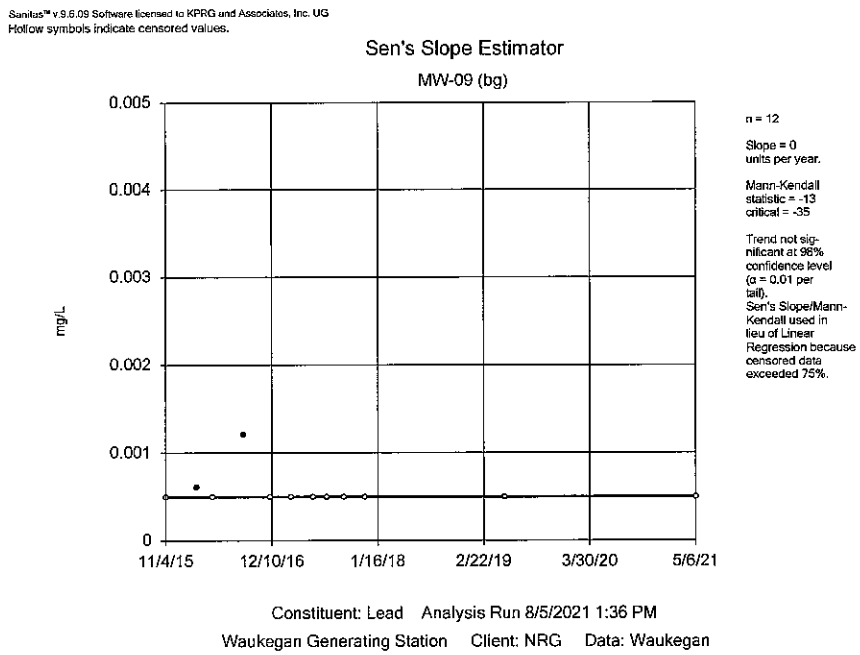
Slope = -0.001895 natural log units/year.

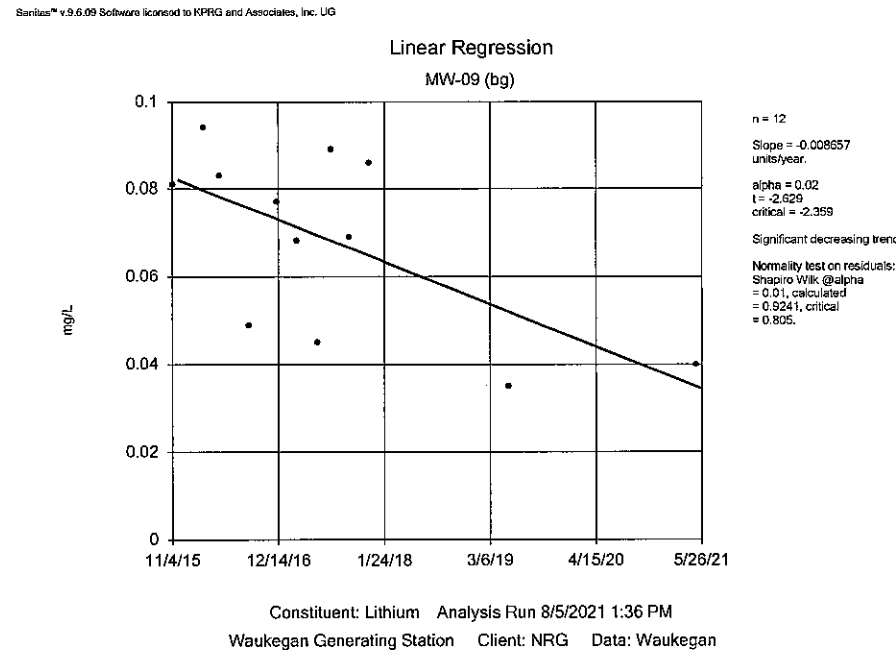
alpha = 0.02
t = -0.04419
critical = 2.249

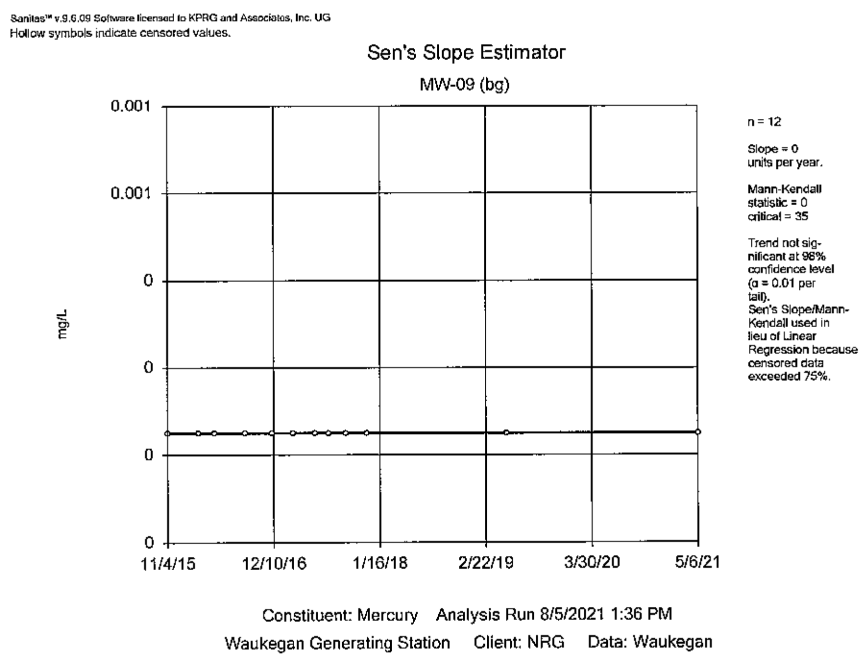
No significant trend.

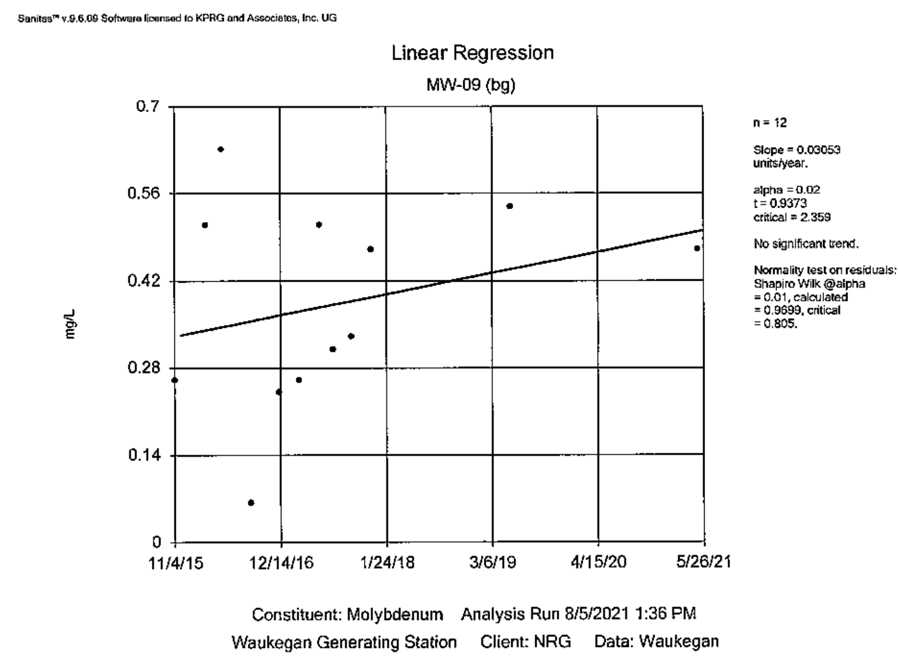
Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9086 after natural log transformation, critical = 0.851.

Constituent: Fluoride Analysis Run 8/5/2021 1:36 PM
Waukegan Generating Station Client: NRG Data: Waukegan

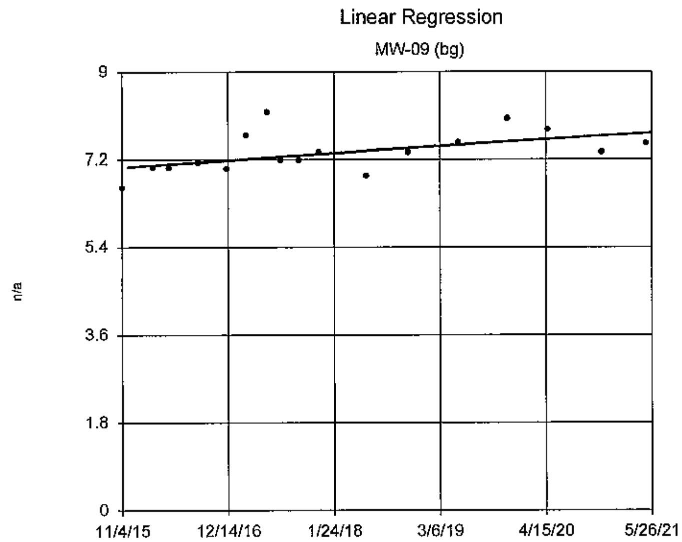

Sanitas™ v.9.6.09 Software licensed to KPRG and Associates, Inc. UG
Hollow symbols indicate censored values.
Sen's Slope Estimator
MW-09 (bg)
mg/L
0.005
0.004
0.003
0.002
0.001
0
11/4/15
12/10/16
1/16/18
2/22/19
3/30/20
5/6/21
n = 12
Slope = 0 units per year.
Mann-Kendall statistic = -13 critical = -35
Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because censored data exceeded 75%.
Constituent: Lead Analysis Run 8/5/2021 1:36 PM
Waukegan Generating Station Client: NRG Data: Waukegan


Sanitas™ v.9.6.09 Software licensed to KPRG and Associates, Inc. UG
Linear Regression
MW-09 (bg)
mg/L
0.1
0.08
0.06
0.04
0.02
0
11/4/15
12/14/16
1/24/18
3/6/19
4/15/20
5/26/21
n = 12
Slope = -0.008657 units/year.
alpha = 0.02
t = -2.629
critical = -2.359
Significant decreasing trend.
Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9241, critical = 0.805.
Constituent: Lithium Analysis Run 8/5/2021 1:36 PM
Waukegan Generating Station Client: NRG Data: Waukegan


Sanitas™ v.9.6.09 Software licensed to KPRG and Associates, Inc. UG
Hollow symbols indicate censored values.
Sen's Slope Estimator
MW-09 (bg)
mg/L
0.001
0.001
0
0
0
0
11/4/15
12/10/16
1/16/18
2/22/19
3/30/20
5/6/21
n = 12
Slope = 0 units per year.
Mann-Kendall statistic = 0 critical = 35
Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because censored data exceeded 75%.
Constituent: Mercury Analysis Run 8/5/2021 1:36 PM
Waukegan Generating Station Client: NRG Data: Waukegan


Sanitas™ v.9.6.09 Software licensed to KPRG and Associates, Inc. UG
Linear Regression
MW-09 (bg)
mg/L
0.7
0.56
0.42
0.28
0.14
0
11/4/15
12/14/16
1/24/18
3/6/19
4/15/20
5/26/21
n = 12
Slope = 0.03053 units/year.
alpha = 0.02
t = 0.9373
critical = 2.359
No significant trend.
Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9699, critical = 0.805.
Constituent: Molybdenum Analysis Run 8/5/2021 1:36 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Sanitas™ v.9.6.09 Software licensed to KPRG and Associates, Inc. UG



n = 17

Slope = 0.1244 units/year.

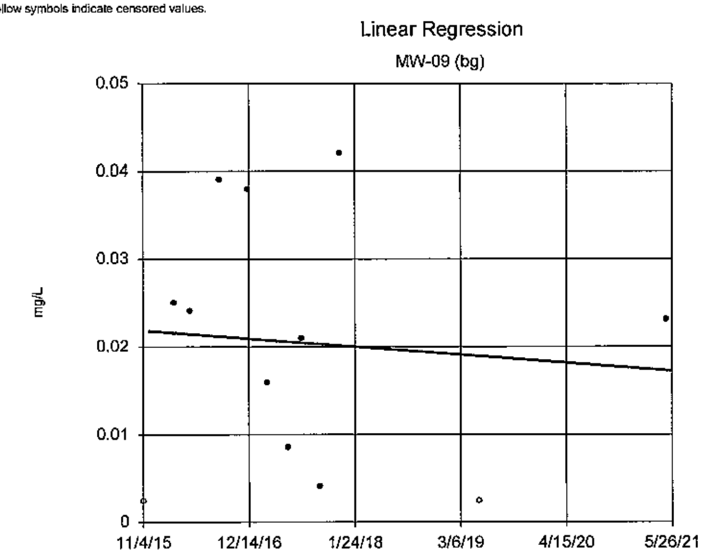
alpha = 0.02
t = 2.286
critical = 2.249

Significant increasing trend.

Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9093, critical = 0.851.

Constituent: pH Analysis Run 8/5/2021 1:36 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Sanitas™ v.9.6.09 Software licensed to KPRG and Associates, Inc. UG
Hollow symbols indicate censored values.



n = 12
16.67% NDs

Slope = -0.0008275 units/year.

alpha = 0.02
t = -0.2809
critical = 2.359

No significant trend.

Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9311, critical = 0.805.

Constituent: Selenium Analysis Run 8/5/2021 1:36 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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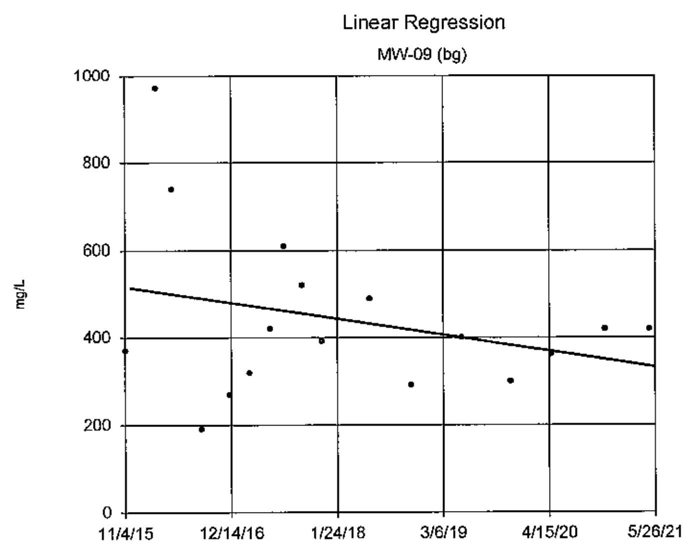

n = 17

Slope = -33.16 units/year.

alpha = 0.02
t = -1.203
critical = 2.249

No significant trend.

Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9546, critical = 0.851.

Constituent: Sulfate Analysis Run 8/5/2021 1:36 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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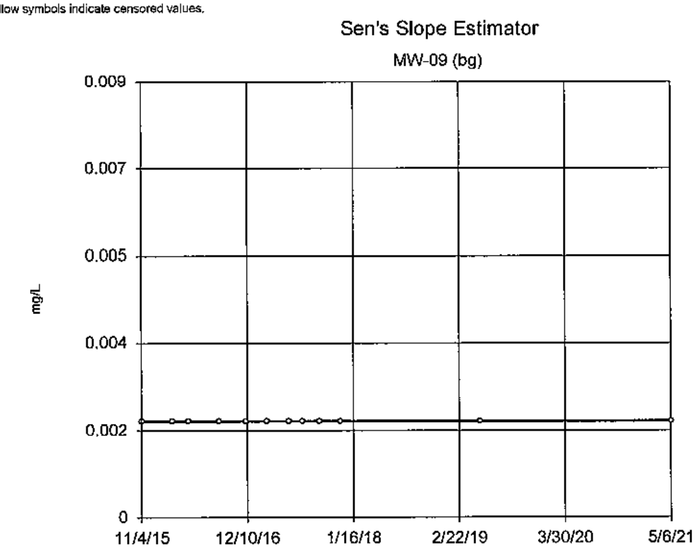
Hollow symbols indicate censored values.



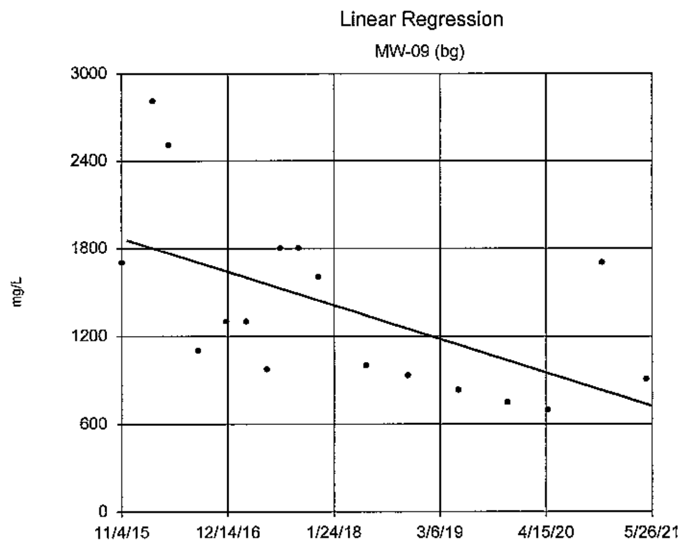
n = 12

Slope = 0 units per year.

Mann-Kendall statistic = 0
critical = 35

Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because censored data exceeded 75%.

Constituent: Thallium Analysis Run 8/5/2021 1:36 PM
Waukegan Generating Station Client: NRG Data: Waukegan



n = 17

Slope = -205.8
units/year.

alpha = 0.02
t = -2.726
critical = -2.249

Significant decreasing trend.

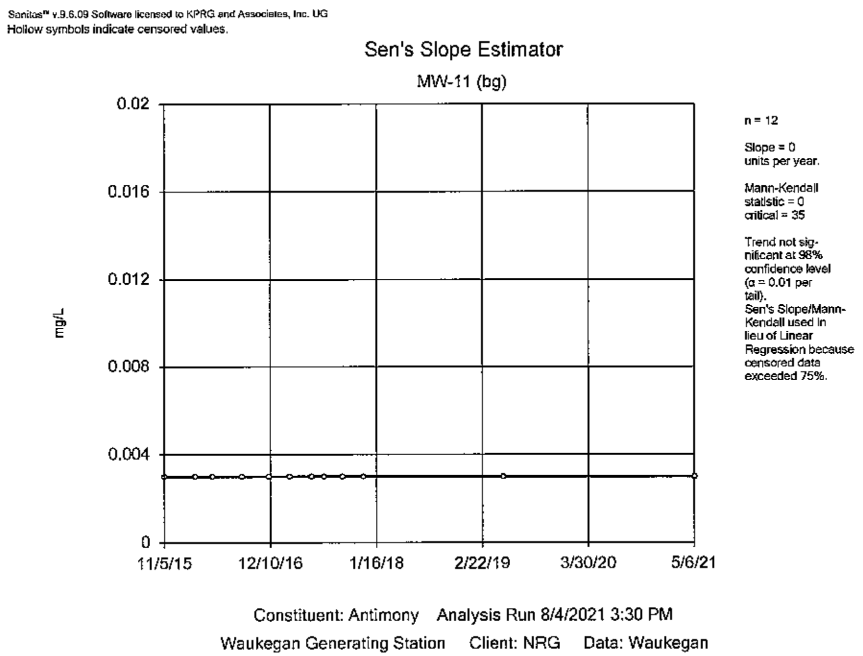
Normality test on residuals:
Shapiro Wilk @alpha
= 0.01, calculated
= 0.8792, critical
= 0.851.

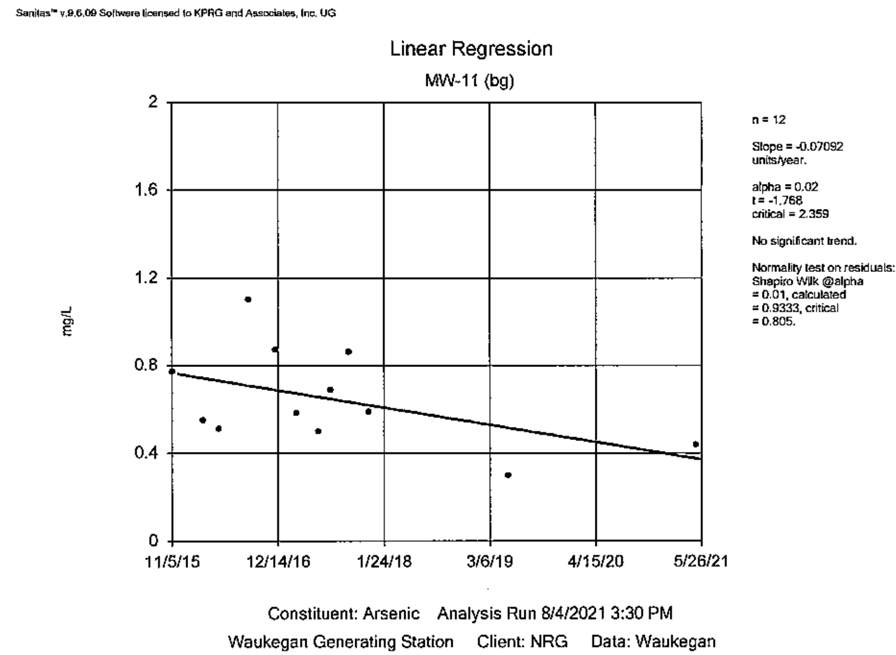
Constituent: Total Dissolved Solids Analysis Run 8/5/2021 1:36 PM
Waukegan Generating Station Client: NRG Data: Waukegan

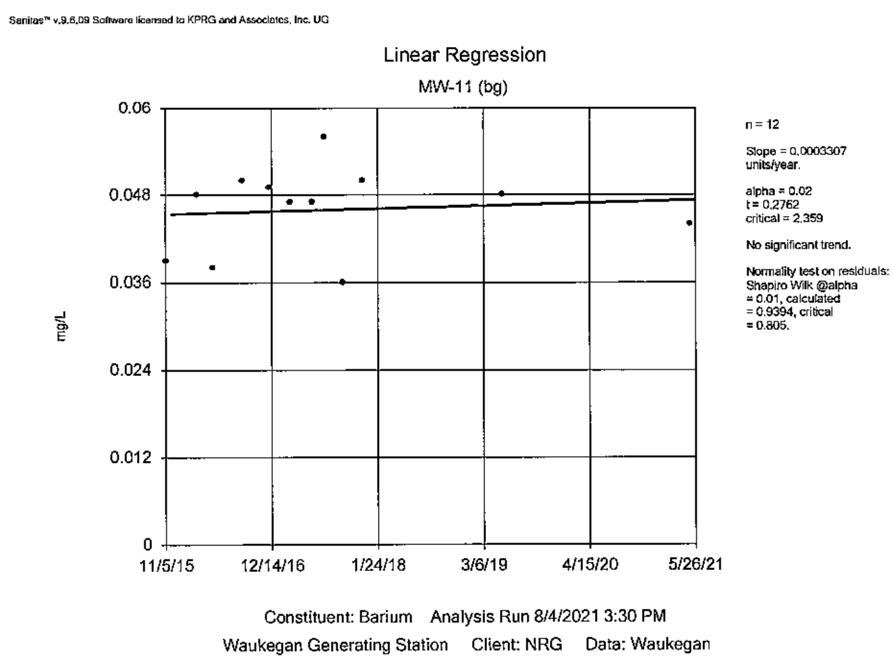
Trend Test MW-11

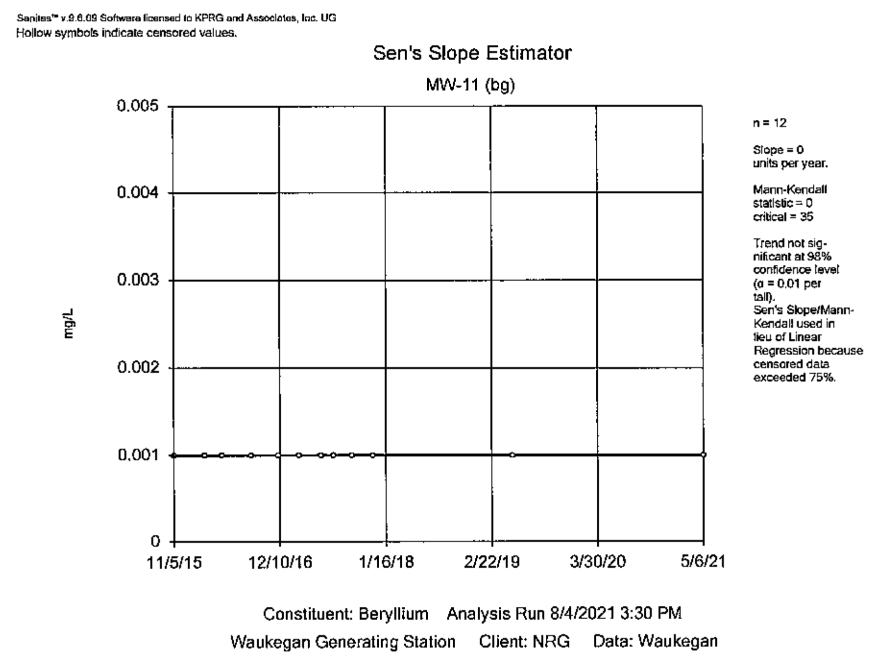
Waukegan Generating Station   Client: NRG   Data: Waukegan   Printed 8/4/2021, 3:31 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Antimony (mg/L)	MW-11 (bg)	0	0	35	No	12	100	n/a	n/a	0.02	NP (NDs)
Arsenic (mg/L)	MW-11 (bg)	-0.07092	-1.768	2.359	No	12	0	Yes	no	0.02	Param.
Barium (mg/L)	MW-11 (bg)	0.000...	0.2762	2.359	No	12	0	Yes	no	0.02	Param.
Beryllium (mg/L)	MW-11 (bg)	0	0	35	No	12	100	n/a	n/a	0.02	NP (NDs)
Boron (mg/L)	MW-11 (bg)	-0.2388	-1.549	2.249	No	17	0	Yes	no	0.02	Param.
Cadmium (mg/L)	MW-11 (bg)	0	0	35	No	12	100	n/a	n/a	0.02	NP (NDs)
Calcium (mg/L)	MW-11 (bg)	-7.226	-2.09	2.249	No	17	0	Yes	no	0.02	Param.
Chloride (mg/L)	**MW-11 (bg)**	**-20.84**	**-3.725**	**-2.249**	**Yes**	**17**	**0**	**Yes**	**no**	**0.02**	**Param.**
Chromium (mg/L)	MW-11 (bg)	0	-1	-35	No	12	58.33	n/a	n/a	0.02	NP (Nor...
Cobalt (mg/L)	MW-11 (bg)	0	0	35	No	12	100	n/a	n/a	0.02	NP (NDs)
Combined Radium 226 + 228 (pCi/L)	MW-11 (bg)	0.1259	1.912	2.359	No	12	0	Yes	no	0.02	Param.
Fluoride (mg/L)	MW-11 (bg)	0.006702	47	58	No	17	0	n/a	n/a	0.02	NP (Nor...
Lead (mg/L)	MW-11 (bg)	-0.00...	-1.585	2.359	No	12	66.67	Yes	no	0.02	Param.
Lithium (mg/L)	**MW-11 (bg)**	**-0.00...**	**-2.365**	**-2.359**	**Yes**	**12**	**0**	**Yes**	**no**	**0.02**	**Param.**
Mercury (mg/L)	MW-11 (bg)	0	0	35	No	12	100	n/a	n/a	0.02	NP (NDs)
Molybdenum (mg/L)	MW-11 (bg)	0	5	35	No	12	91.67	n/a	n/a	0.02	NP (NDs)
pH (n/a)	MW-11 (bg)	0.0456	1.187	2.249	No	17	0	Yes	no	0.02	Param.
Selenium (mg/L)	MW-11 (bg)	0	0	35	No	12	100	n/a	n/a	0.02	NP (NDs)
Sulfate (mg/L)	**MW-11 (bg)**	**-29.74**	**-7.253**	**-2.249**	**Yes**	**17**	**0**	**Yes**	**no**	**0.02**	**Param.**
Thallium (mg/L)	MW-11 (bg)	0	0	35	No	12	100	n/a	n/a	0.02	NP (NDs)
Total Dissolved Solids (mg/L)	**MW-11 (bg)**	**-72.27**	**-5.328**	**-2.249**	**Yes**	**17**	**0**	**Yes**	**no**	**0.02**	**Param.**


Sanitas™ v.9.6.09 Software licensed to KPRG and Associates, Inc. UG
Hollow symbols indicate censored values.
Sen's Slope Estimator
MW-11 (bg)
mg/L
0.02
0.016
0.012
0.008
0.004
0
11/5/15
12/10/16
1/16/18
2/22/19
3/30/20
5/6/21
n = 12
Slope = 0 units per year.
Mann-Kendall statistic = 0 critical = 35
Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because censored data exceeded 75%.
Constituent: Antimony Analysis Run 8/4/2021 3:30 PM
Waukegan Generating Station Client: NRG Data: Waukegan


Sanitas™ v.9.6.09 Software licensed to KPRG and Associates, Inc. UG
Linear Regression
MW-11 (bg)
mg/L
2
1.6
1.2
0.8
0.4
0
11/5/15
12/14/16
1/24/18
3/6/19
4/15/20
5/26/21
n = 12
Slope = -0.07092 units/year.
alpha = 0.02
t = -1.768
critical = 2.359
No significant trend.
Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9333, critical = 0.805.
Constituent: Arsenic Analysis Run 8/4/2021 3:30 PM
Waukegan Generating Station Client: NRG Data: Waukegan


Sanitas™ v.9.6.09 Software licensed to KPRG and Associates, Inc. UG
Linear Regression
MW-11 (bg)
mg/L
0.06
0.048
0.036
0.024
0.012
0
11/5/15
12/14/16
1/24/18
3/6/19
4/15/20
5/26/21
n = 12
Slope = 0.0003307 units/year.
alpha = 0.02
t = 0.2762
critical = 2.359
No significant trend.
Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9394, critical = 0.805.
Constituent: Barium Analysis Run 8/4/2021 3:30 PM
Waukegan Generating Station Client: NRG Data: Waukegan


Sanitas™ v.9.6.09 Software licensed to KPRG and Associates, Inc. UG
Hollow symbols indicate censored values.
Sen's Slope Estimator
MW-11 (bg)
mg/L
0.005
0.004
0.003
0.002
0.001
0
11/5/15
12/10/16
1/16/18
2/22/19
3/30/20
5/6/21
n = 12
Slope = 0 units per year.
Mann-Kendall statistic = 0 critical = 35
Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because censored data exceeded 75%.
Constituent: Beryllium Analysis Run 8/4/2021 3:30 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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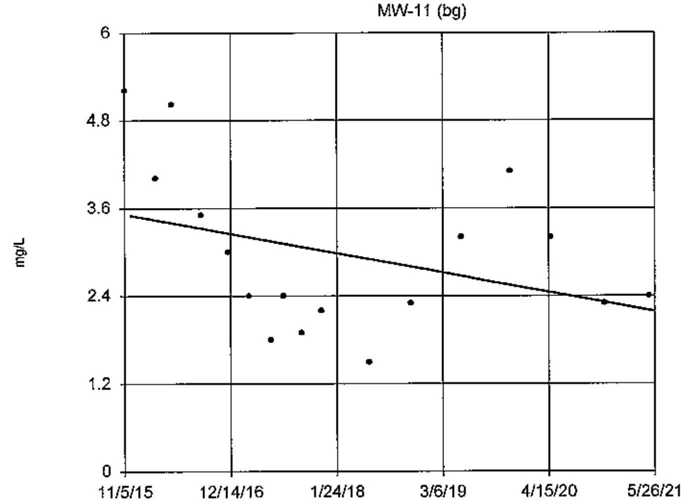
Linear Regression

MW-11 (bg)



n = 17

Slope = -0.2388 units/year.

alpha = 0.02
t = -1.549
critical = 2.249

No significant trend.

Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9381, critical = 0.851.

Constituent: Boron Analysis Run 8/4/2021 3:30 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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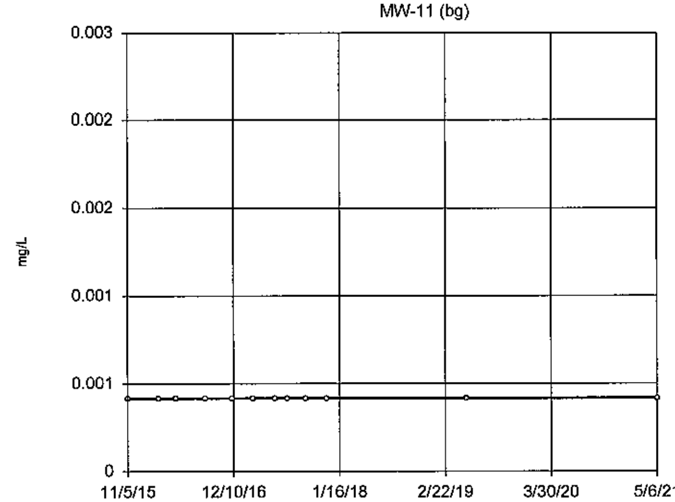
Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-11 (bg)



n = 12

Slope = 0 units per year.

Mann-Kendall statistic = 0
critical = 35

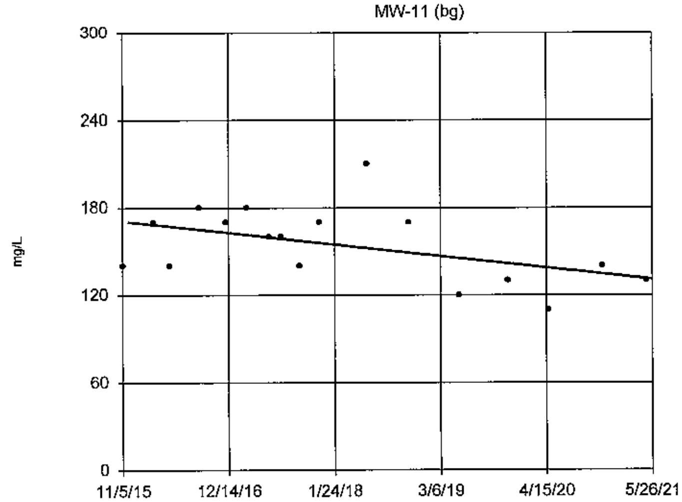
Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because censored data exceeded 75%.

Constituent: Cadmium Analysis Run 8/4/2021 3:30 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Sanitas™ v.9.6.09 Software licensed to KPRG and Associates, Inc. UG

Linear Regression

MW-11 (bg)



n = 17

Slope = -7.226 units/year.

alpha = 0.02
t = -2.09
critical = 2.249

No significant trend.

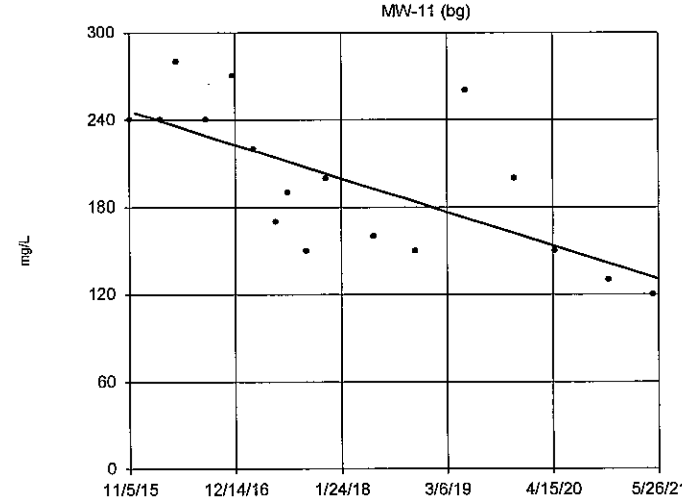
Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9267, critical = 0.851.

Constituent: Calcium Analysis Run 8/4/2021 3:30 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Sanitas™ v.9.6.09 Software licensed to KPRG and Associates, Inc. UG

Linear Regression

MW-11 (bg)



n = 17

Slope = -20.84 units/year.

alpha = 0.02
t = -3.725
critical = -2.249

Significant decreasing trend.

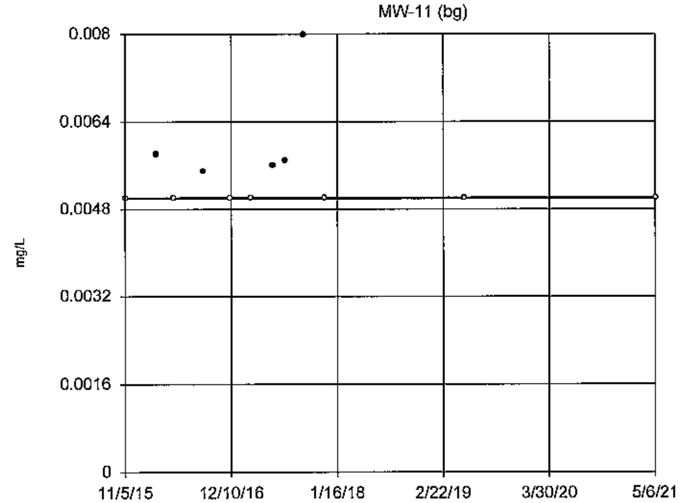
Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9458, critical = 0.851.

Constituent: Chloride Analysis Run 8/4/2021 3:30 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Sanitas™ v.9.6.09 Software licensed to KPRG and Associates, Inc. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-11 (bg)



n = 12

Slope = 0
units per year.

Mann-Kendall
statistic = -1
critical = -35

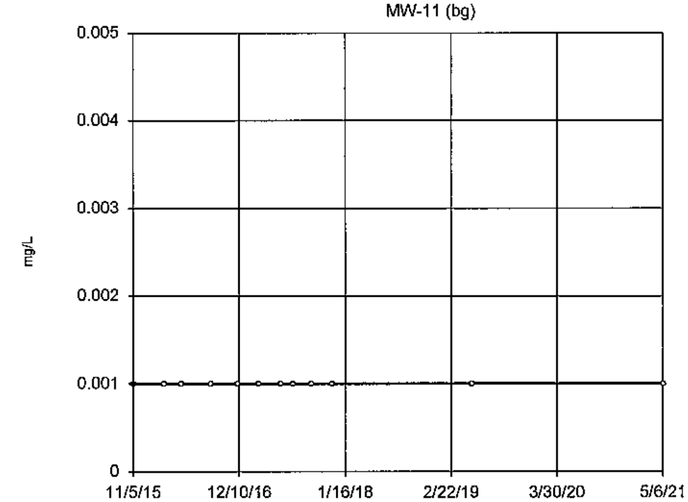
Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because the Shapiro Wilk normality test showed the residuals to be non-normal at the 0.01 alpha level, calculated = 0.6851, critical = 0.805.

Constituent: Chromium Analysis Run 8/4/2021 3:30 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Sanitas™ v.9.6.09 Software licensed to KPRG and Associates, Inc. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-11 (bg)



n = 12

Slope = 0
units per year.

Mann-Kendall
statistic = 0
critical = 35

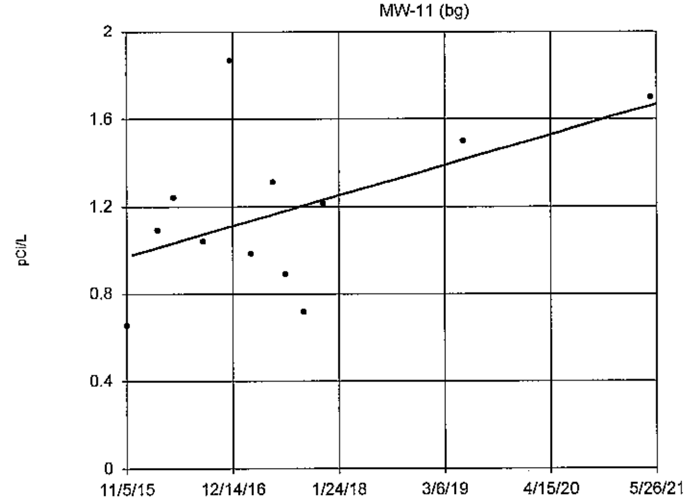
Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because censored data exceeded 75%.

Constituent: Cobalt Analysis Run 8/4/2021 3:30 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Sanitas™ v.9.6.09 Software licensed to KPRG and Associates, Inc. UG

Linear Regression

MW-11 (bg)



n = 12

Slope = 0.1259
units/year.

alpha = 0.02
t = 1.912
critical = 2.359

No significant trend.

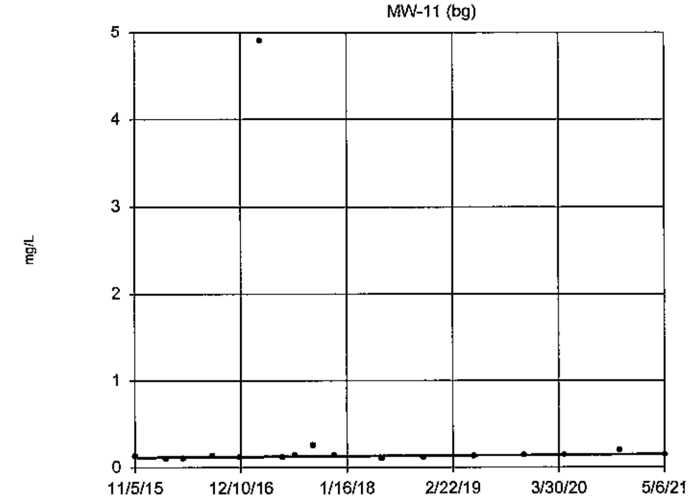
Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.922, critical = 0.805.

Constituent: Combined Radium 226 + 228 Analysis Run 8/4/2021 3:30 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Sanitas™ v.9.6.09 Software licensed to KPRG and Associates, Inc. UG

Sen's Slope Estimator

MW-11 (bg)



n = 17

Slope = 0.006702
units per year.

Mann-Kendall
statistic = 47
critical = 58

Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because the Shapiro Wilk normality test showed the residuals to be non-normal at the 0.01 alpha level, calculated = 0.5121, critical = 0.851.

Constituent: Fluoride Analysis Run 8/4/2021 3:30 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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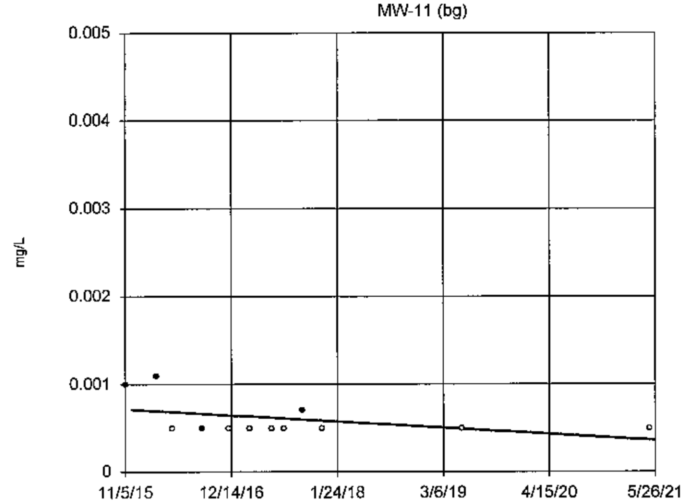
Hollow symbols indicate censored values.

Linear Regression

MW-11 (bg)



n = 12
66.67% NDs

Slope = -0.00006346
units/year.

alpha = 0.02
t = -1.585
critical = 2.359

No significant trend.

Normality test on residuals:
Shapiro Wilk @alpha
= 0.01, calculated
= 0.8483, critical
= 0.805.

Constituent: Lead Analysis Run 8/4/2021 3:30 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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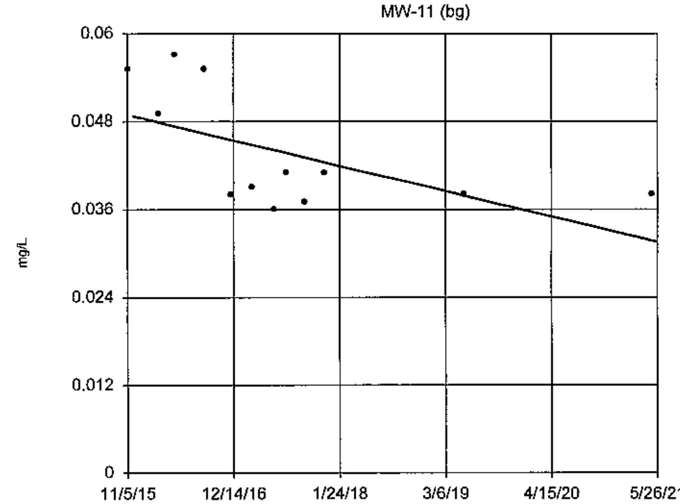
Linear Regression

MW-11 (bg)



n = 12

Slope = -0.003135
units/year.

alpha = 0.02
t = -2.365
critical = -2.359

Significant decreasing trend.

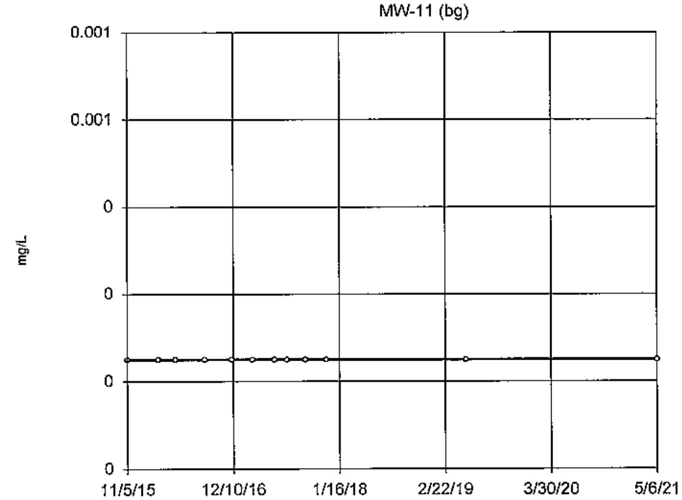
Normality test on residuals:
Shapiro Wilk @alpha
= 0.01, calculated
= 0.9183, critical
= 0.805.

Constituent: Lithium Analysis Run 8/4/2021 3:30 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Sanitas™ v.9.6.09 Software licensed to KPRG and Associates, Inc. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-11 (bg)



n = 12

Slope = 0
units per year.

Mann-Kendall
statistic = 0
critical = 35

Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because censored data exceeded 75%.

Constituent: Mercury Analysis Run 8/4/2021 3:30 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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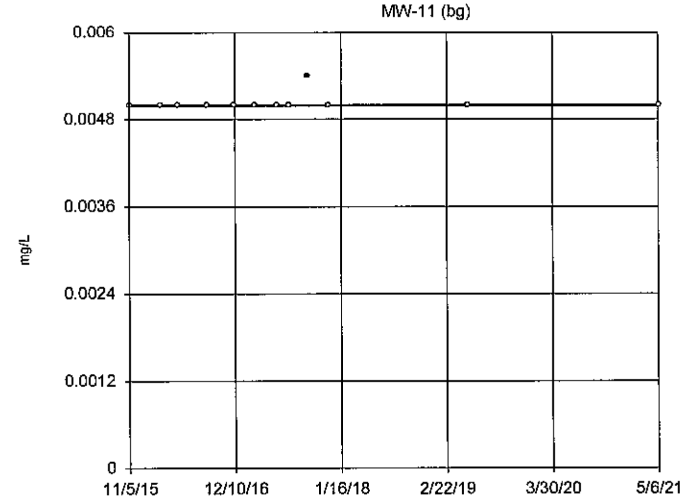
Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-11 (bg)



n = 12

Slope = 0
units per year.

Mann-Kendall
statistic = 5
critical = 35

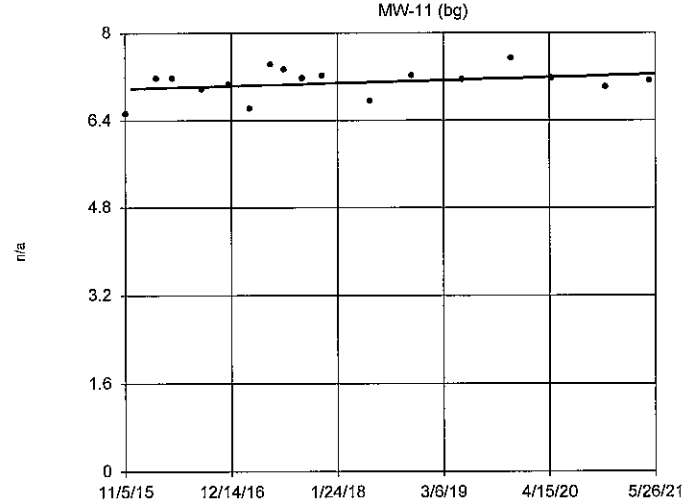
Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because censored data exceeded 75%.

Constituent: Molybdenum Analysis Run 8/4/2021 3:30 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Sanitas™ v.9.6.09 Software licensed to KPRG and Associates, Inc. UG

Linear Regression

MW-11 (bg)



n = 17

Slope = 0.0456 units/year.

alpha = 0.02
t = 1.187
critical = 2.249

No significant trend.

Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9459, critical = 0.851.

Constituent: pH Analysis Run 8/4/2021 3:30 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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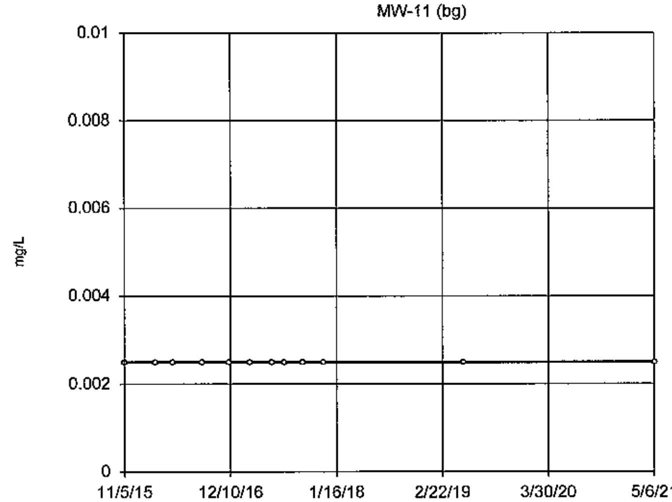
Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-11 (bg)



n = 12

Slope = 0 units per year.

Mann-Kendall statistic = 0
critical = 35

Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because censored data exceeded 75%.

Constituent: Selenium Analysis Run 8/4/2021 3:30 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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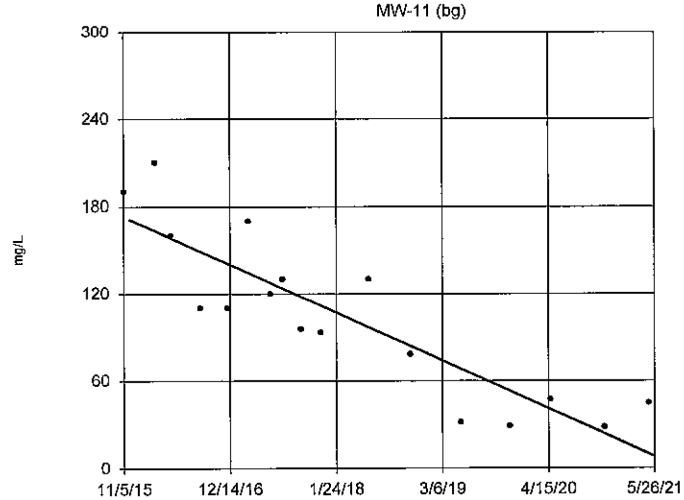
Linear Regression

MW-11 (bg)



n = 17

Slope = -29.74 units/year.

alpha = 0.02
t = -7.253
critical = -2.249

Significant decreasing trend.

Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9492, critical = 0.851.

Constituent: Sulfate Analysis Run 8/4/2021 3:30 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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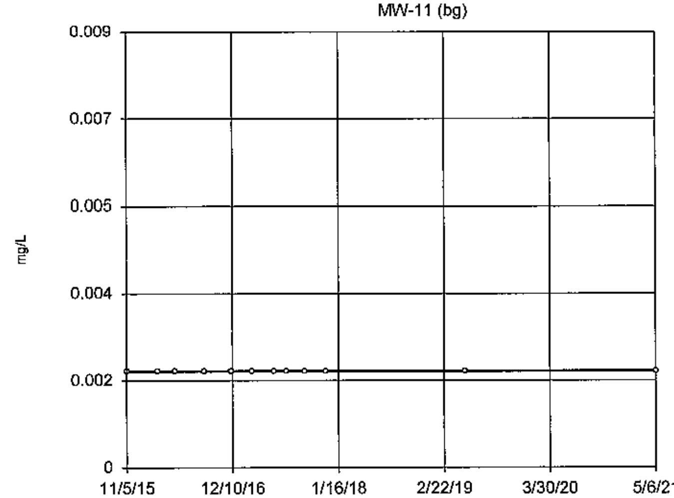
Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-11 (bg)



n = 12

Slope = 0 units per year.

Mann-Kendall statistic = 0
critical = 35

Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because censored data exceeded 75%.

Constituent: Thallium Analysis Run 8/4/2021 3:30 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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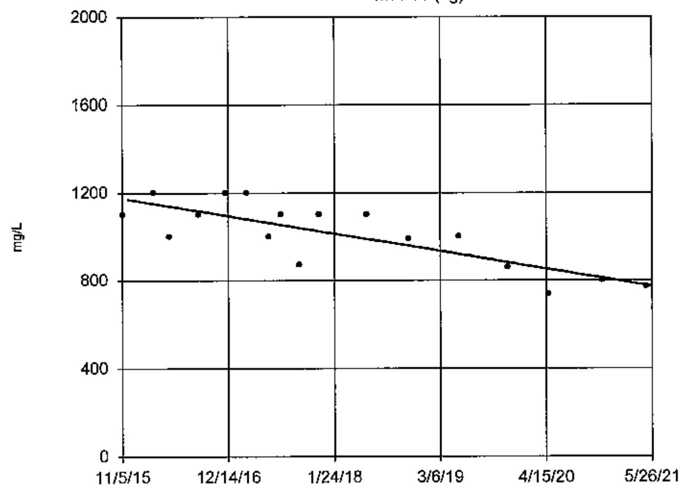
Linear Regression

MW-11 (bg)



n = 17

Slope = -72.27 units/year.

alpha = 0.02
t = -5.328
critical = -2.249

Significant decreasing trend.

Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9502, critical = 0.851.

Constituent: Total Dissolved Solids Analysis Run 8/4/2021 3:30 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Trend Test MW-14

Waukegan Generating Station Client: NRG Data: Waukegan Printed 8/4/2021, 3:29 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Antimony (mg/L)	MW-14 (bg)	-0.00...	-0.9015	2.359	No	12	50	Yes	no	0.02	Param.
Arsenic (mg/L)	MW-14 (bg)	0.07228	0.219	2.359	No	12	0	Yes	natura...	0.02	Param.
Barium (mg/L)	MW-14 (bg)	-0.07845	-0.4343	2.359	No	12	0	Yes	natura...	0.02	Param.
Beryllium (mg/L)	MW-14 (bg)	0	0	35	No	12	100	n/a	n/a	0.02	NP (NDs)
Boron (mg/L)	**MW-14 (bg)**	**-0.1794**	**-3.686**	**-2.249**	**Yes**	**17**	**0**	**Yes**	**natura...**	**0.02**	**Param.**
Cadmium (mg/L)	MW-14 (bg)	0	4	35	No	12	66.67	n/a	n/a	0.02	NP (Nor...
Calcium (mg/L)	**MW-14 (bg)**	**-11.21**	**-2.384**	**-2.249**	**Yes**	**17**	**0**	**Yes**	**no**	**0.02**	**Param.**
Chloride (mg/L)	**MW-14 (bg)**	**-28.75**	**-2.956**	**-2.249**	**Yes**	**17**	**0**	**Yes**	**no**	**0.02**	**Param.**
Chromium (mg/L)	MW-14 (bg)	0.02051	0.03673	2.359	No	12	0	Yes	natura...	0.02	Param.
Cobalt (mg/L)	MW-14 (bg)	-0.00...	-0.8009	2.359	No	12	33.33	Yes	no	0.02	Param.
Combined Radium 226 + 228 (pCi/L)	MW-14 (bg)	-0.01607	-0.2933	2.359	No	12	41.67	Yes	no	0.02	Param.
Fluoride (mg/L)	MW-14 (bg)	0.004056	0.5467	2.249	No	17	0	Yes	no	0.02	Param.
Lead (mg/L)	MW-14 (bg)	0	-12	-35	No	12	66.67	n/a	n/a	0.02	NP (Nor...
Lithium (mg/L)	MW-14 (bg)	-0.00...	-1.396	2.359	No	12	0	Yes	no	0.02	Param.
Mercury (mg/L)	MW-14 (bg)	0	1	35	No	12	91.67	n/a	n/a	0.02	NP (NDs)
Molybdenum (mg/L)	MW-14 (bg)	0	3	35	No	12	83.33	n/a	n/a	0.02	NP (NDs)
pH (n/a)	MW-14 (bg)	0.04034	1.131	2.249	No	17	0	Yes	no	0.02	Param.
Selenium (mg/L)	MW-14 (bg)	0	2	35	No	12	75	n/a	n/a	0.02	NP (Nor...
Sulfate (mg/L)	**MW-14 (bg)**	**-0.4962**	**-6.623**	**-2.249**	**Yes**	**17**	**0**	**Yes**	**natura...**	**0.02**	**Param.**
Thallium (mg/L)	MW-14 (bg)	0	0	35	No	12	100	n/a	n/a	0.02	NP (NDs)
Total Dissolved Solids (mg/L)	**MW-14 (bg)**	**-122.4**	**-3.685**	**-2.249**	**Yes**	**17**	**0**	**Yes**	**no**	**0.02**	**Param.**

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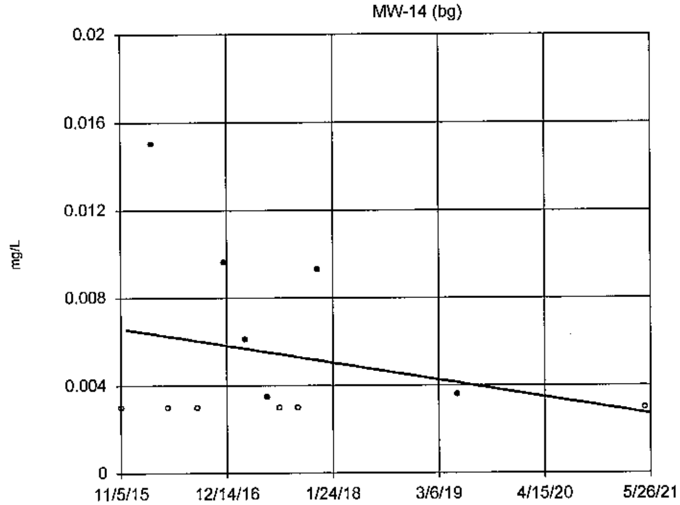
Hollow symbols indicate censored values.

Linear Regression

MW-14 (bg)



n = 12
50% NDs

Slope = -0.0007012
units/year.

alpha = 0.02
t = -0.9015
critical = 2.359

No significant trend.

Normality test on residuals:
Shapiro Wilk @alpha
= 0.01, calculated
= 0.8542, critical
= 0.805.

Constituent: Antimony Analysis Run 8/4/2021 3:26 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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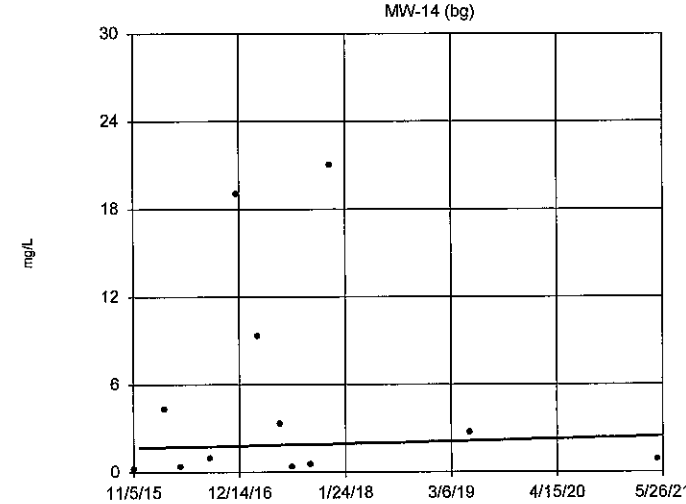
Linear Regression

MW-14 (bg)



n = 12

Slope = 0.07228
natural log units/year.

alpha = 0.02
t = 0.219
critical = 2.359

No significant trend.

Normality test on residuals:
Shapiro Wilk @alpha
= 0.01, calculated
= 0.927 after natural
log transformation,
critical = 0.805.

Constituent: Arsenic Analysis Run 8/4/2021 3:26 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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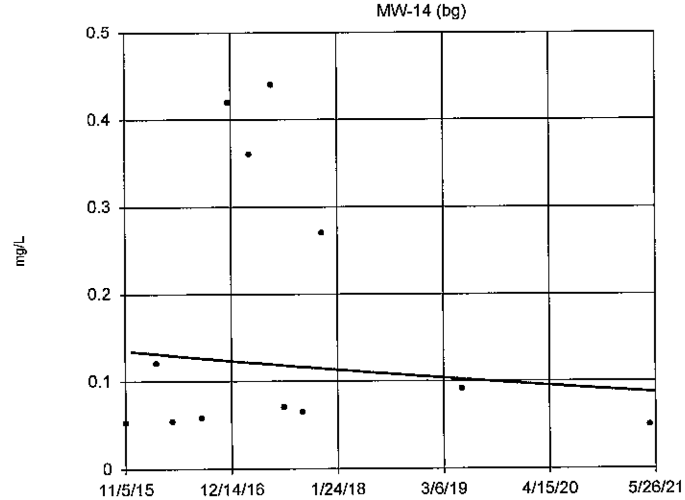
Linear Regression

MW-14 (bg)



n = 12

Slope = -0.07845
natural log units/year.

alpha = 0.02
t = -0.4343
critical = 2.359

No significant trend.

Normality test on residuals:
Shapiro Wilk @alpha
= 0.01, calculated
= 0.8463 after natural
log transformation,
critical = 0.805.

Constituent: Barium Analysis Run 8/4/2021 3:26 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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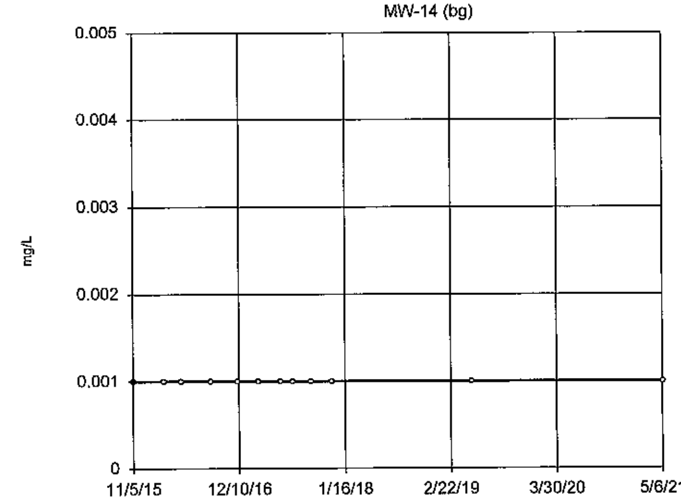
Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-14 (bg)



n = 12

Slope = 0
units per year.

Mann-Kendall
statistic = 0
critical = 35

Trend not sig-
nificant at 98%
confidence level
(α = 0.01 per
tail).
Sen's Slope/Mann-
Kendall used in
lieu of Linear
Regression because
censored data
exceeded 75%.

Constituent: Beryllium Analysis Run 8/4/2021 3:26 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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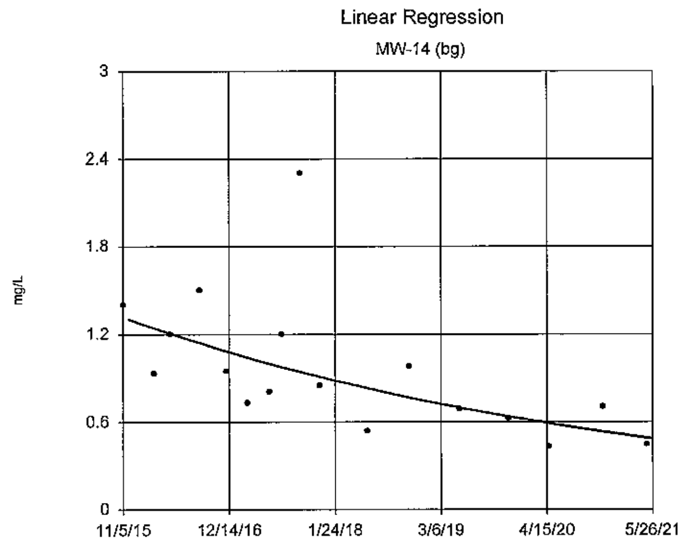

n = 17

Slope = -0.1794
natural log units/year.

alpha = 0.02
t = -3.686
critical = -2.249

Significant decreasing trend.

Normality test on residuals:
Shapiro Wilk @alpha
= 0.01, calculated
= 0.9082 after natural
log transformation,
critical = 0.851.

Constituent: Boron Analysis Run 8/4/2021 3:26 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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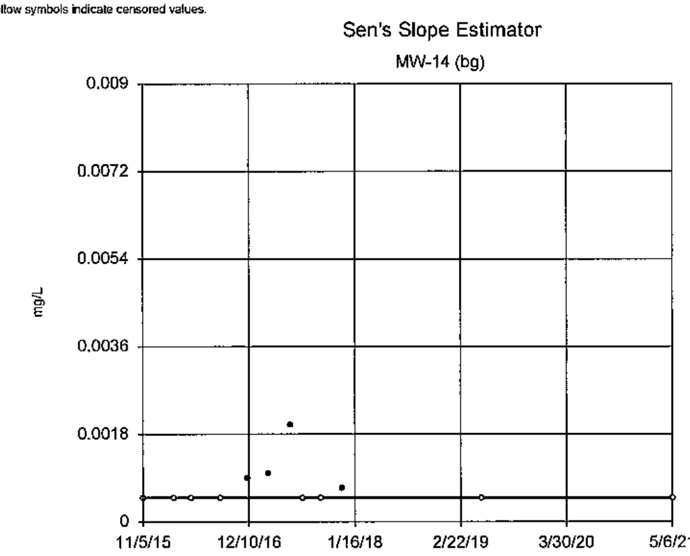
Hollow symbols indicate censored values.



n = 12

Slope = 0
units per year.

Mann-Kendall
statistic = 4
critical = 35

Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because the Shapiro Wilk normality test showed the residuals to be non-normal at the 0.01 alpha level, calculated = 0.7219, critical = 0.805.

Constituent: Cadmium Analysis Run 8/4/2021 3:26 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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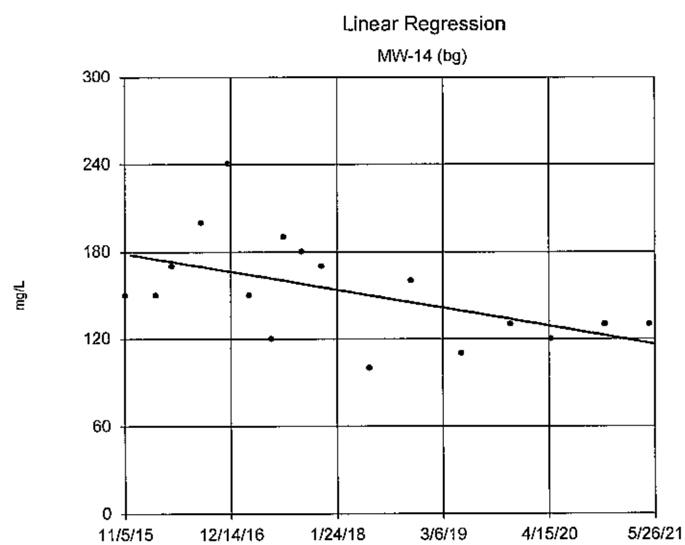

n = 17

Slope = -11.21
units/year.

alpha = 0.02
t = -2.384
critical = -2.249

Significant decreasing trend.

Normality test on residuals:
Shapiro Wilk @alpha
= 0.01, calculated
= 0.9672, critical
= 0.851.

Constituent: Calcium Analysis Run 8/4/2021 3:26 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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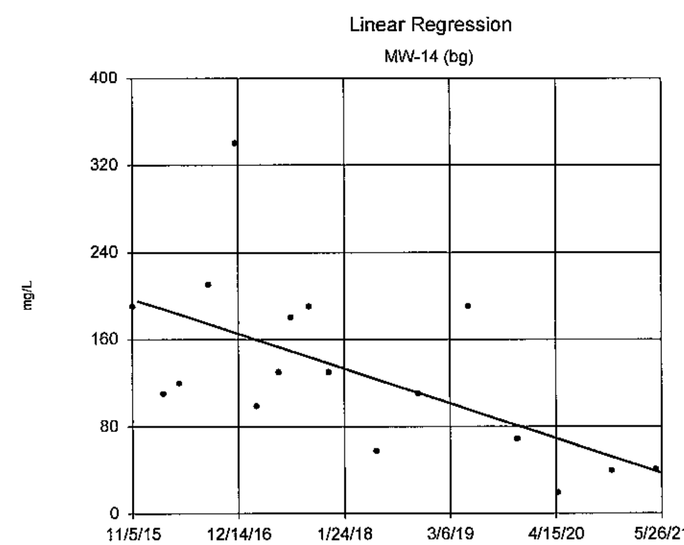

n = 17

Slope = -28.75
units/year.

alpha = 0.02
t = -2.956
critical = -2.249

Significant decreasing trend.

Normality test on residuals:
Shapiro Wilk @alpha
= 0.01, calculated
= 0.8905, critical
= 0.851.

Constituent: Chloride Analysis Run 8/4/2021 3:26 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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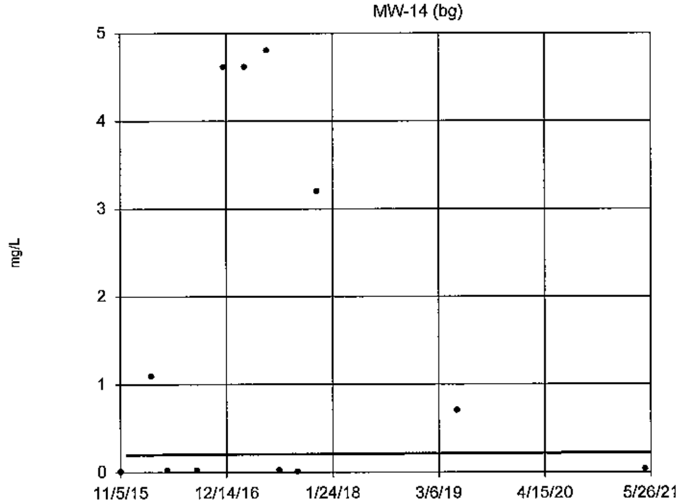
Linear Regression

MW-14 (bg)



n = 12

Slope = 0.02051 natural log units/year.

alpha = 0.02
t = 0.03673
critical = 2.359

No significant trend.

Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.8229 after natural log transformation, critical = 0.805.

Constituent: Chromium   Analysis Run 8/4/2021 3:26 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

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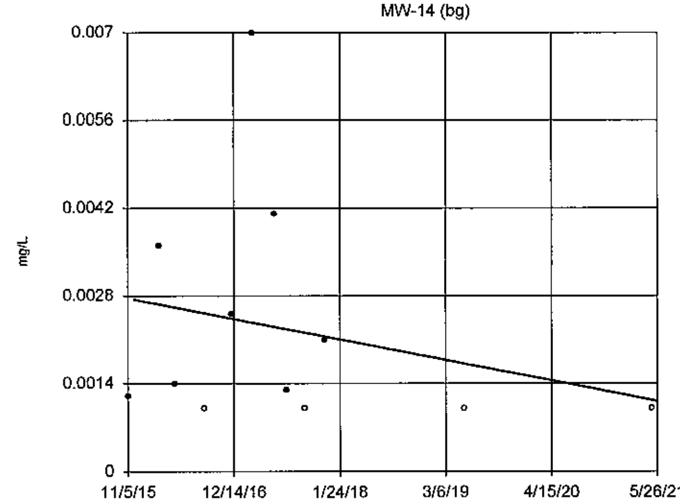
Hollow symbols indicate censored values.

Linear Regression

MW-14 (bg)



n = 12
33.33% NDs

Slope = -0.0002951 units/year.

alpha = 0.02
t = -0.8009
critical = 2.359

No significant trend.

Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.8098, critical = 0.805.

Constituent: Cobalt   Analysis Run 8/4/2021 3:26 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

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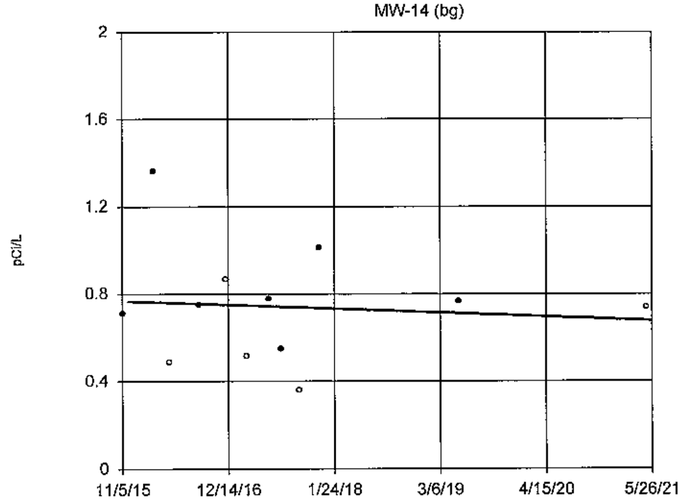
Hollow symbols indicate censored values.

Linear Regression

MW-14 (bg)



n = 12
41.67% NDs

Slope = -0.01607 units/year.

alpha = 0.02
t = -0.2933
critical = 2.359

No significant trend.

Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.943, critical = 0.805.

Constituent: Combined Radium 226 + 228   Analysis Run 8/4/2021 3:26 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

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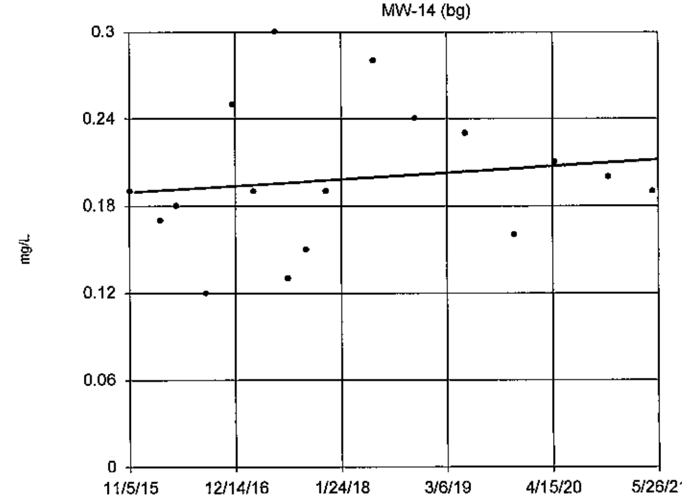
Linear Regression

MW-14 (bg)



n = 17

Slope = 0.004056 units/year.

alpha = 0.02
t = 0.5467
critical = 2.249

No significant trend.

Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9518, critical = 0.851.

Constituent: Fluoride   Analysis Run 8/4/2021 3:26 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

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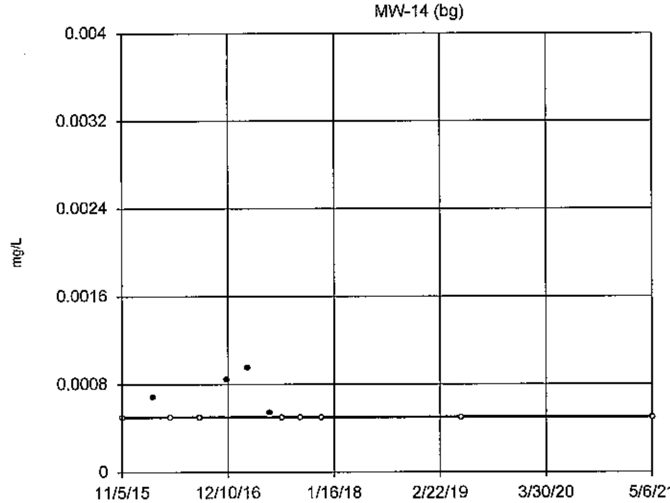
Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-14 (bg)



n = 12

Slope = 0
units per year.

Mann-Kendall
statistic = -12
critical = -35

Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because the Shapiro Wilk normality test showed the residuals to be non-normal at the 0.01 alpha level, calculated = 0.7932, critical = 0.805.

Constituent: Lead Analysis Run 8/4/2021 3:26 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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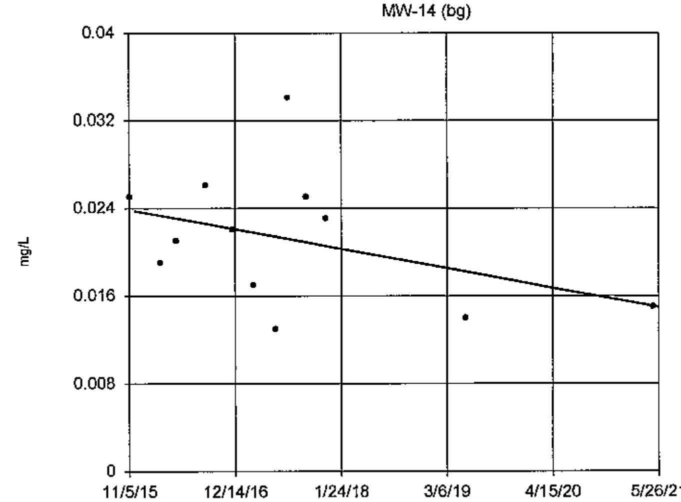
Linear Regression

MW-14 (bg)



n = 12

Slope = -0.001599
units/year.

alpha = 0.02
t = -1.396
critical = 2.359

No significant trend.

Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9419, critical = 0.805.

Constituent: Lithium Analysis Run 8/4/2021 3:26 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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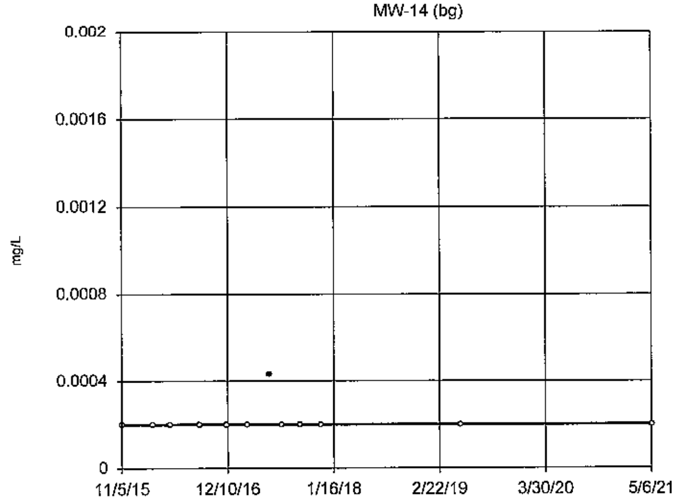
Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-14 (bg)



n = 12

Slope = 0
units per year.

Mann-Kendall
statistic = 1
critical = 35

Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because censored data exceeded 75%.

Constituent: Mercury Analysis Run 8/4/2021 3:26 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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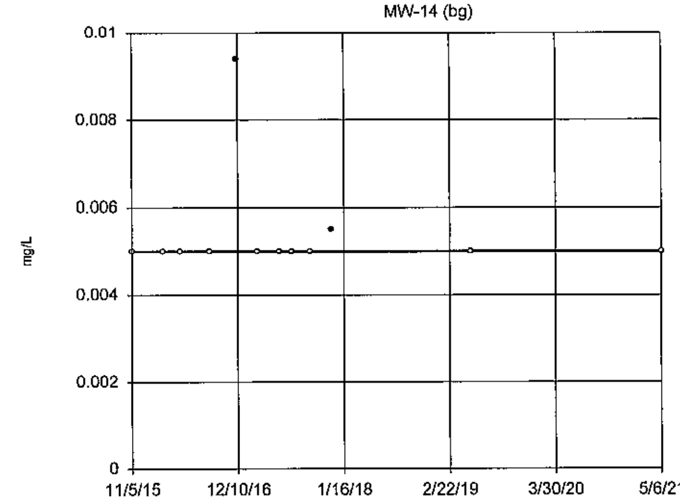
Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-14 (bg)



n = 12

Slope = 0
units per year.

Mann-Kendall
statistic = 3
critical = 35

Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because censored data exceeded 75%.

Constituent: Molybdenum Analysis Run 8/4/2021 3:26 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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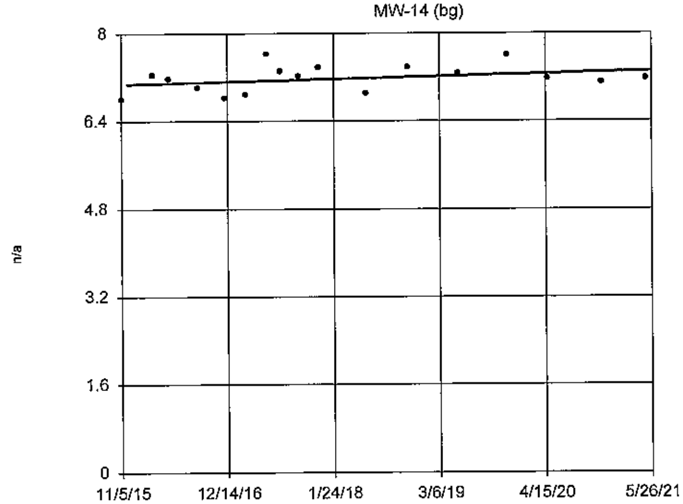
Linear Regression

MW-14 (bg)



n = 17

Slope = 0.04034 units/year.

alpha = 0.02
t = 1.131
critical = 2.249

No significant trend.

Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.948, critical = 0.851.

Constituent: pH Analysis Run 8/4/2021 3:26 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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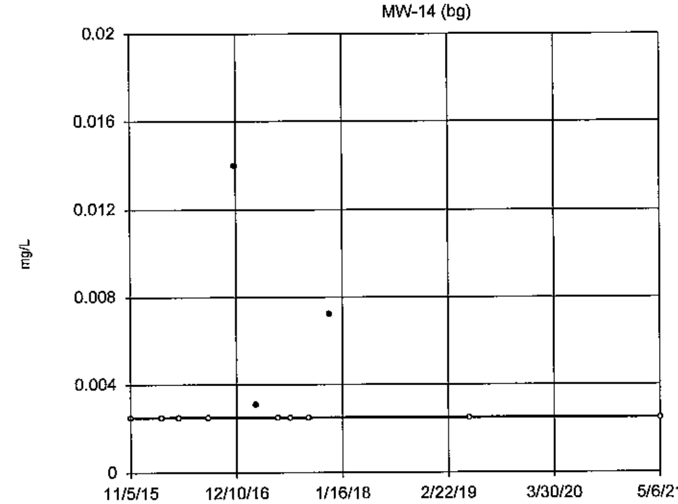
Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-14 (bg)



n = 12

Slope = 0 units per year.

Mann-Kendall statistic = 2
critical = 35

Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because the Shapiro Wilk normality test showed the residuals to be non-normal at the 0.01 alpha level, calculated = 0.5884, critical = 0.805.

Constituent: Selenium Analysis Run 8/4/2021 3:26 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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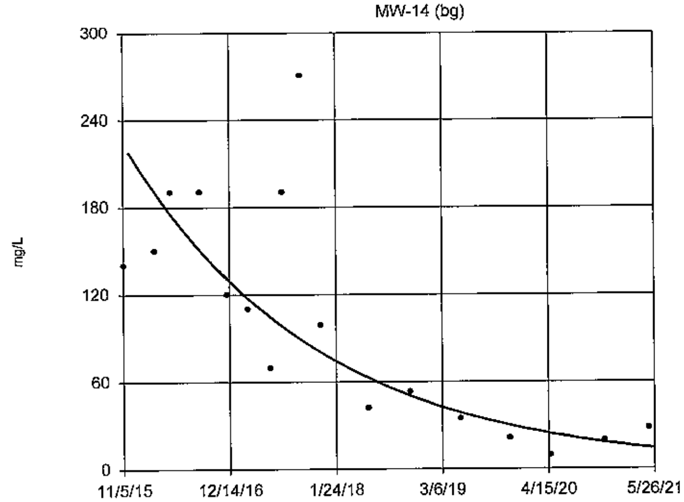
Linear Regression

MW-14 (bg)



n = 17

Slope = -0.4962 natural log units/year.

alpha = 0.02
t = -6.623
critical = -2.249

Significant decreasing trend.

Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.963 after natural log transformation, critical = 0.851.

Constituent: Sulfate Analysis Run 8/4/2021 3:26 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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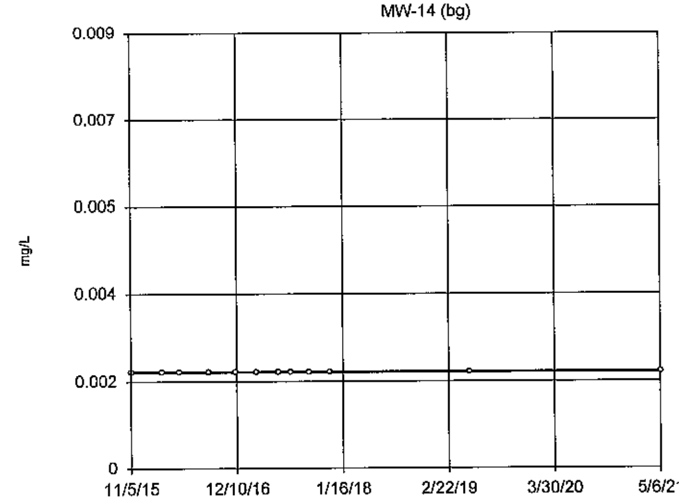
Hollow symbols indicate censored values.

Sen's Slope Estimator

MW-14 (bg)



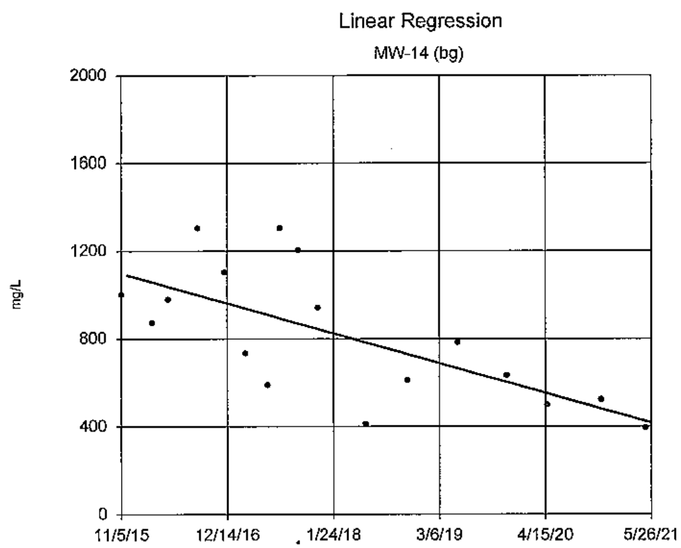
n = 12

Slope = 0 units per year.

Mann-Kendall statistic = 0
critical = 35

Trend not significant at 98% confidence level (α = 0.01 per tail).
Sen's Slope/Mann-Kendall used in lieu of Linear Regression because censored data exceeded 75%.

Constituent: Thallium Analysis Run 8/4/2021 3:26 PM
Waukegan Generating Station Client: NRG Data: Waukegan



n = 17

Slope = -122.4 units/year.

alpha = 0.02
t = -3.685
critical = -2.249

Significant decreasing trend.

Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.976, critical = 0.851.

Constituent: Total Dissolved Solids Analysis Run 8/4/2021 3:26 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Shapiro-Wilk Normality Test

Constituent: Antimony   Analysis Run 8/11/2021 10:46 AM

Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.327	0.859	No
	square root	0.327	0.859	No
	square	0.327	0.859	No
	cube root	0.327	0.859	No
	cube	0.327	0.859	No
	natural log	0.327	0.859	No
	x^4	0.327	0.859	No
	x^5	0.327	0.859	No
	x^6	0.327	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	-1	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.6995	0.859	No
	square root	0.7266	0.859	No
	square	0.6178	0.859	No
	cube root	0.7332	0.859	No
	cube	0.5282	0.859	No
	natural log	0.7431	0.859	No
	x^4	0.4573	0.859	No
	x^5	0.4094	0.859	No
	x^6	0.3788	0.859	No
Pooled Background (bg) (n = 36, alpha = 0.05)				
	no	0.4054	0.935	No
	square root	0.4305	0.935	No
	square	0.3456	0.935	No
	cube root	0.4378	0.935	No
	cube	0.2885	0.935	No
	natural log	0.4508	0.935	No
	x^4	0.2458	0.935	No
	x^5	0.2176	0.935	No
	x^6	0.1999	0.935	No

Shapiro-Wilk Normality Test

Constituent: Arsenic   Analysis Run 8/11/2021 10:46 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.5615	0.859	No
	square root	0.6865	0.859	No
	square	0.4857	0.859	No
	cube root	0.748	0.859	No
	cube	0.4531	0.859	No
	natural log	0.8622	0.859	Yes
	x^4	0.4235	0.859	No
	x^5	0.3981	0.859	No
	x^6	0.3783	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	0.9632	0.859	Yes
	square root	0.9808	0.859	Yes
	square	0.8883	0.859	Yes
	cube root	0.9824	0.859	Yes
	cube	0.7936	0.859	No
	natural log	0.9779	0.859	Yes
	x^4	0.7019	0.859	No
	x^5	0.6223	0.859	No
	x^6	0.5571	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.7075	0.859	No
	square root	0.8377	0.859	No
	square	0.5697	0.859	No
	cube root	0.8818	0.859	Yes
	cube	0.5228	0.859	No
	natural log	0.9416	0.859	Yes
	x^4	0.5039	0.859	No
	x^5	0.4941	0.859	No
	x^6	0.4871	0.859	No
Pooled Background (bg) (n = 36, alpha = 0.05)				
	no	0.4454	0.935	No
	square root	0.7144	0.935	No
	square	0.3108	0.935	No
	cube root	0.8464	0.935	No
	cube	0.2794	0.935	No
	natural log	0.8757	0.935	No
	x^4	0.2674	0.935	No
	x^5	0.2612	0.935	No
	x^6	0.2569	0.935	No

Shapiro-Wilk Normality Test

Constituent: Barium Analysis Run 8/11/2021 10:46 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.7869	0.859	No
	square root	0.8897	0.859	Yes
	square	0.5734	0.859	No
	cube root	0.915	0.859	Yes
	cube	0.4445	0.859	No
	natural log	0.946	0.859	Yes
	x^4	0.3822	0.859	No
	x^5	0.3531	0.859	No
	x^6	0.3395	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	0.9237	0.859	Yes
	square root	0.9164	0.859	Yes
	square	0.9326	0.859	Yes
	cube root	0.9135	0.859	Yes
	cube	0.9324	0.859	Yes
	natural log	0.9074	0.859	Yes
	x^4	0.9223	0.859	Yes
	x^5	0.9024	0.859	Yes
	x^6	0.874	0.859	Yes
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.7529	0.859	No
	square root	0.7863	0.859	No
	square	0.7013	0.859	No
	cube root	0.798	0.859	No
	cube	0.6658	0.859	No
	natural log	0.8211	0.859	No
	x^4	0.6383	0.859	No
	x^5	0.6153	0.859	No
	x^6	0.5957	0.859	No
Pooled Background (bg) (n = 36, alpha = 0.05)				
	no	0.5674	0.935	No
	square root	0.7472	0.935	No
	square	0.4139	0.935	No
	cube root	0.8159	0.935	No
	cube	0.37	0.935	No
	natural log	0.9193	0.935	No
	x^4	0.3487	0.935	No
	x^5	0.3334	0.935	No
	x^6	0.3211	0.935	No

Shapiro-Wilk Normality Test

Constituent: Beryllium   Analysis Run 8/11/2021 10:46 AM

Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	-1	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	-1	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	-1	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
Pooled Background (bg) (n = 36, alpha = 0.05)				
	no	-1	0.935	No
	square root	0	0.935	No
	square	-1	0.935	No
	cube root	0	0.935	No
	cube	-1	0.935	No
	natural log	0	0.935	No
	x^4	-1	0.935	No
	x^5	-1	0.935	No
	x^6	-1	0.935	No

Shapiro-Wilk Normality Test

Constituent: Boron   Analysis Run 8/11/2021 10:46 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 17, alpha = 0.05)				
	no	0.9646	0.892	Yes
	square root	0.9154	0.892	Yes
	square	0.9705	0.892	Yes
	cube root	0.8885	0.892	No
	cube	0.9304	0.892	Yes
	natural log	0.8183	0.892	No
	x^4	0.8783	0.892	No
	x^5	0.8231	0.892	No
	x^6	0.7688	0.892	No
MW-11 (bg) (n = 17, alpha = 0.05)				
	no	0.9147	0.892	Yes
	square root	0.9441	0.892	Yes
	square	0.8366	0.892	No
	cube root	0.9515	0.892	Yes
	cube	0.7521	0.892	No
	natural log	0.9624	0.892	Yes
	x^4	0.676	0.892	No
	x^5	0.6134	0.892	No
	x^6	0.5642	0.892	No
MW-14 (bg) (n = 17, alpha = 0.05)				
	no	0.8711	0.892	No
	square root	0.9416	0.892	Yes
	square	0.686	0.892	No
	cube root	0.9584	0.892	Yes
	cube	0.5247	0.892	No
	natural log	0.9798	0.892	Yes
	x^4	0.4185	0.892	No
	x^5	0.3551	0.892	No
	x^6	0.318	0.892	No
Pooled Background (bg) (n = 51 - Shapiro-Francia used, alpha = 0.05)				
	no	0.7489	0.954	No
	square root	0.8379	0.954	No
	square	0.648	0.954	No
	cube root	0.8727	0.954	No
	cube	0.5798	0.954	No
	natural log	0.9336	0.954	No
	x^4	0.5196	0.954	No
	x^5	0.466	0.954	No
	x^6	0.4188	0.954	No

Shapiro-Wilk Normality Test

Constituent: Cadmium Analysis Run 8/11/2021 10:46 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.3421	0.859	No
	square root	0.3455	0.859	No
	square	0.3367	0.859	No
	cube root	0.3467	0.859	No
	cube	0.3329	0.859	No
	natural log	0.3494	0.859	No
	x^4	0.3305	0.859	No
	x^5	0.329	0.859	No
	x^6	0.3281	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	-1	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.5748	0.859	No
	square root	0.6208	0.859	No
	square	0.4792	0.859	No
	cube root	0.6341	0.859	No
	cube	0.409	0.859	No
	natural log	0.6566	0.859	No
	x^4	0.3684	0.859	No
	x^5	0.3474	0.859	No
	x^6	0.3369	0.859	No
Pooled Background (bg) (n = 36, alpha = 0.05)				
	no	0.3764	0.935	No
	square root	0.405	0.935	No
	square	0.3079	0.935	No
	cube root	0.4128	0.935	No
	cube	0.2497	0.935	No
	natural log	0.4256	0.935	No
	x^4	0.2129	0.935	No
	x^5	0.1926	0.935	No
	x^6	0.1819	0.935	No

Shapiro-Wilk Normality Test

Constituent: Calcium Analysis Run 8/11/2021 10:46 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 17, alpha = 0.05)				
	no	0.8672	0.892	No
	square root	0.9132	0.892	Yes
	square	0.7572	0.892	No
	cube root	0.9263	0.892	Yes
	cube	0.6462	0.892	No
	natural log	0.9487	0.892	Yes
	x^4	0.5519	0.892	No
	x^5	0.479	0.892	No
	x^6	0.4251	0.892	No
MW-11 (bg) (n = 17, alpha = 0.05)				
	no	0.9568	0.892	Yes
	square root	0.9607	0.892	Yes
	square	0.9367	0.892	Yes
	cube root	0.9611	0.892	Yes
	cube	0.9012	0.892	Yes
	natural log	0.9605	0.892	Yes
	x^4	0.8526	0.892	No
	x^5	0.795	0.892	No
	x^6	0.733	0.892	No
MW-14 (bg) (n = 17, alpha = 0.05)				
	no	0.9546	0.892	Yes
	square root	0.9727	0.892	Yes
	square	0.8964	0.892	Yes
	cube root	0.977	0.892	Yes
	cube	0.8171	0.892	No
	natural log	0.9828	0.892	Yes
	x^4	0.7292	0.892	No
	x^5	0.6441	0.892	No
	x^6	0.5688	0.892	No
Pooled Background (bg) (n = 51 - Shapiro-Francia used, alpha = 0.05)				
	no	0.8343	0.954	No
	square root	0.903	0.954	No
	square	0.6591	0.954	No
	cube root	0.9215	0.954	No
	cube	0.4854	0.954	No
	natural log	0.9513	0.954	No
	x^4	0.3529	0.954	No
	x^5	0.2653	0.954	No
	x^6	0.2102	0.954	No

Shapiro-Wilk Normality Test

Constituent: Chloride Analysis Run 8/11/2021 10:46 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 17, alpha = 0.05)				
	no	0.8883	0.892	No
	square root	0.8825	0.892	No
	square	0.7863	0.892	No
	cube root	0.8731	0.892	No
	cube	0.6465	0.892	No
	natural log	0.8472	0.892	No
	x^4	0.5435	0.892	No
	x^5	0.4757	0.892	No
	x^6	0.4305	0.892	No
MW-11 (bg) (n = 17, alpha = 0.05)				
	no	0.9432	0.892	Yes
	square root	0.9452	0.892	Yes
	square	0.9288	0.892	Yes
	cube root	0.945	0.892	Yes
	cube	0.9042	0.892	Yes
	natural log	0.9432	0.892	Yes
	x^4	0.8734	0.892	No
	x^5	0.8394	0.892	No
	x^6	0.8047	0.892	No
MW-14 (bg) (n = 17, alpha = 0.05)				
	no	0.9254	0.892	Yes
	square root	0.9705	0.892	Yes
	square	0.72	0.892	No
	cube root	0.9695	0.892	Yes
	cube	0.5312	0.892	No
	natural log	0.9413	0.892	Yes
	x^4	0.4136	0.892	No
	x^5	0.3475	0.892	No
	x^6	0.3107	0.892	No
Pooled Background (bg) (n = 51 - Shapiro-Francia used, alpha = 0.05)				
	no	0.8907	0.954	No
	square root	0.9809	0.954	Yes
	square	0.5859	0.954	No
	cube root	0.9785	0.954	Yes
	cube	0.384	0.954	No
	natural log	0.9157	0.954	No
	x^4	0.2783	0.954	No
	x^5	0.2218	0.954	No
	x^6	0.1894	0.954	No

Shapiro-Wilk Normality Test

Constituent: Chromium Analysis Run 8/11/2021 10:46 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.5859	0.859	No
	square root	0.5798	0.859	No
	square	0.59	0.859	No
	cube root	0.5777	0.859	No
	cube	0.5823	0.859	No
	natural log	0.5736	0.859	No
	x^4	0.5686	0.859	No
	x^5	0.5539	0.859	No
	x^6	0.5403	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	0.6032	0.859	No
	square root	0.6246	0.859	No
	square	0.5598	0.859	No
	cube root	0.6316	0.859	No
	cube	0.5181	0.859	No
	natural log	0.6453	0.859	No
	x^4	0.4804	0.859	No
	x^5	0.4477	0.859	No
	x^6	0.4206	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.7307	0.859	No
	square root	0.7823	0.859	No
	square	0.6719	0.859	No
	cube root	0.7987	0.859	No
	cube	0.6477	0.859	No
	natural log	0.8244	0.859	No
	x^4	0.6329	0.859	No
	x^5	0.6224	0.859	No
	x^6	0.6152	0.859	No
Pooled Background (bg) (n = 36, alpha = 0.05)				
	no	0.4331	0.935	No
	square root	0.5086	0.935	No
	square	0.3844	0.935	No
	cube root	0.5539	0.935	No
	cube	0.3662	0.935	No
	natural log	0.6666	0.935	No
	x^4	0.3554	0.935	No
	x^5	0.3478	0.935	No
	x^6	0.3423	0.935	No

Shapiro-Wilk Normality Test

Constituent: Cobalt Analysis Run 8/11/2021 10:46 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.585	0.859	No
	square root	0.5955	0.859	No
	square	0.5487	0.859	No
	cube root	0.5978	0.859	No
	cube	0.5005	0.859	No
	natural log	0.6007	0.859	No
	x^4	0.4531	0.859	No
	x^5	0.4145	0.859	No
	x^6	0.386	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	-1	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.7476	0.859	No
	square root	0.8121	0.859	No
	square	0.5948	0.859	No
	cube root	0.8287	0.859	No
	cube	0.478	0.859	No
	natural log	0.8534	0.859	No
	x^4	0.4098	0.859	No
	x^5	0.3726	0.859	No
	x^6	0.3524	0.859	No
Pooled Background (bg) (n = 36, alpha = 0.05)				
	no	0.5081	0.935	No
	square root	0.5686	0.935	No
	square	0.3701	0.935	No
	cube root	0.5845	0.935	No
	cube	0.2736	0.935	No
	natural log	0.6091	0.935	No
	x^4	0.2231	0.935	No
	x^5	0.198	0.935	No
	x^6	0.1852	0.935	No

Shapiro-Wilk Normality Test

Constituent: Combined Radium 226 + 228 Analysis Run 8/11/2021 10:46 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.9644	0.859	Yes
	square root	0.9888	0.859	Yes
	square	0.8502	0.859	No
	cube root	0.9889	0.859	Yes
	cube	0.7192	0.859	No
	natural log	0.9756	0.859	Yes
	x^4	0.6101	0.859	No
	x^5	0.529	0.859	No
	x^6	0.4712	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	0.9677	0.859	Yes
	square root	0.9791	0.859	Yes
	square	0.916	0.859	Yes
	cube root	0.9802	0.859	Yes
	cube	0.8451	0.859	No
	natural log	0.9782	0.859	Yes
	x^4	0.7733	0.859	No
	x^5	0.7096	0.859	No
	x^6	0.6563	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.927	0.859	Yes
	square root	0.961	0.859	Yes
	square	0.8098	0.859	No
	cube root	0.967	0.859	Yes
	cube	0.6791	0.859	No
	natural log	0.9703	0.859	Yes
	x^4	0.5723	0.859	No
	x^5	0.4956	0.859	No
	x^6	0.4433	0.859	No
Pooled Background (bg) (n = 36, alpha = 0.05)				
	no	0.9405	0.935	Yes
	square root	0.9825	0.935	Yes
	square	0.8034	0.935	No
	cube root	0.9885	0.935	Yes
	cube	0.6644	0.935	No
	natural log	0.9845	0.935	Yes
	x^4	0.5531	0.935	No
	x^5	0.4708	0.935	No
	x^6	0.4109	0.935	No

Shapiro-Wilk Normality Test

Constituent: Fluoride Analysis Run 8/11/2021 10:46 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 17, alpha = 0.05)				
	no	0.8207	0.892	No
	square root	0.8688	0.892	No
	square	0.7053	0.892	No
	cube root	0.8827	0.892	No
	cube	0.5872	0.892	No
	natural log	0.9071	0.892	Yes
	x^4	0.4884	0.892	No
	x^5	0.4155	0.892	No
	x^6	0.3651	0.892	No
MW-11 (bg) (n = 17, alpha = 0.05)				
	no	0.287	0.892	No
	square root	0.3453	0.892	No
	square	0.2638	0.892	No
	cube root	0.3814	0.892	No
	cube	0.2623	0.892	No
	natural log	0.4859	0.892	No
	x^4	0.2622	0.892	No
	x^5	0.2622	0.892	No
	x^6	0.2622	0.892	No
MW-14 (bg) (n = 17, alpha = 0.05)				
	no	0.9658	0.892	Yes
	square root	0.9769	0.892	Yes
	square	0.9197	0.892	Yes
	cube root	0.9784	0.892	Yes
	cube	0.8548	0.892	No
	natural log	0.978	0.892	Yes
	x^4	0.7851	0.892	No
	x^5	0.7194	0.892	No
	x^6	0.6612	0.892	No
Pooled Background (bg) (n = 51 - Shapiro-Francia used, alpha = 0.05)				
	no	0.1461	0.954	No
	square root	0.2686	0.954	No
	square	0.1017	0.954	No
	cube root	0.3478	0.954	No
	cube	0.09873	0.954	No
	natural log	0.5638	0.954	No
	x^4	0.09856	0.954	No
	x^5	0.09855	0.954	No
	x^6	0.09855	0.954	No

Shapiro-Wilk Normality Test

Constituent: Lead   Analysis Run 8/11/2021 10:46 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.3939	0.859	No
	square root	0.4063	0.859	No
	square	0.3721	0.859	No
	cube root	0.4106	0.859	No
	cube	0.3554	0.859	No
	natural log	0.4191	0.859	No
	x^4	0.3441	0.859	No
	x^5	0.3368	0.859	No
	x^6	0.3325	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	0.5791	0.859	No
	square root	0.5833	0.859	No
	square	0.5676	0.859	No
	cube root	0.5844	0.859	No
	cube	0.5535	0.859	No
	natural log	0.5863	0.859	No
	x^4	0.5385	0.859	No
	x^5	0.524	0.859	No
	x^6	0.5106	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.6233	0.859	No
	square root	0.6297	0.859	No
	square	0.6078	0.859	No
	cube root	0.6316	0.859	No
	cube	0.5891	0.859	No
	natural log	0.6351	0.859	No
	x^4	0.5684	0.859	No
	x^5	0.5468	0.859	No
	x^6	0.5254	0.859	No
Pooled Background (bg) (n = 36, alpha = 0.05)				
	no	0.5377	0.935	No
	square root	0.5468	0.935	No
	square	0.5144	0.935	No
	cube root	0.5494	0.935	No
	cube	0.4858	0.935	No
	natural log	0.5541	0.935	No
	x^4	0.4549	0.935	No
	x^5	0.4242	0.935	No
	x^6	0.3954	0.935	No

Shapiro-Wilk Normality Test

Constituent: Lithium Analysis Run 8/11/2021 10:46 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.9042	0.859	Yes
	square root	0.8906	0.859	Yes
	square	0.9228	0.859	Yes
	cube root	0.8855	0.859	Yes
	cube	0.9293	0.859	Yes
	natural log	0.8744	0.859	Yes
	x^4	0.9245	0.859	Yes
	x^5	0.9104	0.859	Yes
	x^6	0.8897	0.859	Yes
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	0.7941	0.859	No
	square root	0.8031	0.859	No
	square	0.7764	0.859	No
	cube root	0.8061	0.859	No
	cube	0.7596	0.859	No
	natural log	0.8121	0.859	No
	x^4	0.7437	0.859	No
	x^5	0.729	0.859	No
	x^6	0.7156	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.9517	0.859	Yes
	square root	0.9637	0.859	Yes
	square	0.8945	0.859	Yes
	cube root	0.9652	0.859	Yes
	cube	0.8054	0.859	No
	natural log	0.9646	0.859	Yes
	x^4	0.7069	0.859	No
	x^5	0.6171	0.859	No
	x^6	0.5439	0.859	No
Pooled Background (bg) (n = 36, alpha = 0.05)				
	no	0.914	0.935	No
	square root	0.9491	0.935	Yes
	square	0.8081	0.935	No
	cube root	0.9548	0.935	Yes
	cube	0.7119	0.935	No
	natural log	0.9551	0.935	Yes
	x^4	0.6419	0.935	No
	x^5	0.5917	0.935	No
	x^6	0.5536	0.935	No

Shapiro-Wilk Normality Test

Constituent: Mercury Analysis Run 8/11/2021 10:46 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	-1	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	-1	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.327	0.859	No
	square root	0.327	0.859	No
	square	0.327	0.859	No
	cube root	0.327	0.859	No
	cube	0.327	0.859	No
	natural log	0.327	0.859	No
	x^4	0.327	0.859	No
	x^5	0.327	0.859	No
	x^6	-1	0.859	No
Pooled Background (bg) (n = 36, alpha = 0.05)				
	no	0.1702	0.935	No
	square root	0.1702	0.935	No
	square	0.1702	0.935	No
	cube root	0.1702	0.935	No
	cube	0.1702	0.935	No
	natural log	0.1702	0.935	No
	x^4	0.1702	0.935	No
	x^5	0.1702	0.935	No
	x^6	-1	0.935	No

Shapiro-Wilk Normality Test

Constituent: Molybdenum Analysis Run 8/11/2021 10:46 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.9455	0.859	Yes
	square root	0.9027	0.859	Yes
	square	0.9308	0.859	Yes
	cube root	0.8753	0.859	Yes
	cube	0.8833	0.859	Yes
	natural log	0.8009	0.859	No
	x^4	0.8295	0.859	No
	x^5	0.7709	0.859	No
	x^6	0.7106	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	0.327	0.859	No
	square root	0.327	0.859	No
	square	0.327	0.859	No
	cube root	0.327	0.859	No
	cube	0.327	0.859	No
	natural log	0.327	0.859	No
	x^4	0.327	0.859	No
	x^5	0.327	0.859	No
	x^6	0.327	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.3766	0.859	No
	square root	0.3839	0.859	No
	square	0.3637	0.859	No
	cube root	0.3864	0.859	No
	cube	0.3533	0.859	No
	natural log	0.3915	0.859	No
	x^4	0.3452	0.859	No
	x^5	0.3393	0.859	No
	x^6	0.3351	0.859	No
Pooled Background (bg) (n = 36, alpha = 0.05)				
	no	0.6573	0.935	No
	square root	0.6598	0.935	No
	square	0.6116	0.935	No
	cube root	0.6564	0.935	No
	cube	0.5554	0.935	No
	natural log	0.6461	0.935	No
	x^4	0.5047	0.935	No
	x^5	0.459	0.935	No
	x^6	0.4168	0.935	No

Shapiro-Wilk Normality Test

Constituent: pH Analysis Run 8/11/2021 10:46 AM

Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 17, alpha = 0.05)				
	no	0.9688	0.892	Yes
	square root	0.9721	0.892	Yes
	square	0.961	0.892	Yes
	cube root	0.973	0.892	Yes
	cube	0.9515	0.892	Yes
	natural log	0.9748	0.892	Yes
	x^4	0.9405	0.892	Yes
	x^5	0.9282	0.892	Yes
	x^6	0.9147	0.892	Yes
MW-11 (bg) (n = 17, alpha = 0.05)				
	no	0.9132	0.892	Yes
	square root	0.9089	0.892	Yes
	square	0.9212	0.892	Yes
	cube root	0.9074	0.892	Yes
	cube	0.9284	0.892	Yes
	natural log	0.9044	0.892	Yes
	x^4	0.9346	0.892	Yes
	x^5	0.9399	0.892	Yes
	x^6	0.9442	0.892	Yes
MW-14 (bg) (n = 17, alpha = 0.05)				
	no	0.9588	0.892	Yes
	square root	0.9592	0.892	Yes
	square	0.9576	0.892	Yes
	cube root	0.9592	0.892	Yes
	cube	0.9556	0.892	Yes
	natural log	0.9593	0.892	Yes
	x^4	0.953	0.892	Yes
	x^5	0.9496	0.892	Yes
	x^6	0.9456	0.892	Yes
Pooled Background (bg) (n = 51 - Shapiro-Francia used, alpha = 0.05)				
	no	0.9526	0.954	No
	square root	0.9571	0.954	Yes
	square	0.9417	0.954	No
	cube root	0.9584	0.954	Yes
	cube	0.928	0.954	No
	natural log	0.9608	0.954	Yes
	x^4	0.9118	0.954	No
	x^5	0.8932	0.954	No
	x^6	0.8726	0.954	No

Shapiro-Wilk Normality Test

Constituent: Selenium Analysis Run 8/11/2021 10:46 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.9131	0.859	Yes
	square root	0.9037	0.859	Yes
	square	0.8407	0.859	No
	cube root	0.89	0.859	Yes
	cube	0.7556	0.859	No
	natural log	0.849	0.859	No
	x^4	0.6973	0.859	No
	x^5	0.6609	0.859	No
	x^6	0.6376	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	-1	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.4879	0.859	No
	square root	0.514	0.859	No
	square	0.4306	0.859	No
	cube root	0.5216	0.859	No
	cube	0.3857	0.859	No
	natural log	0.5347	0.859	No
	x^4	0.3583	0.859	No
	x^5	0.3433	0.859	No
	x^6	0.3354	0.859	No
Pooled Background (bg) (n = 36, alpha = 0.05)				
	no	0.6195	0.935	No
	square root	0.6505	0.935	No
	square	0.5269	0.935	No
	cube root	0.6563	0.935	No
	cube	0.4496	0.935	No
	natural log	0.6613	0.935	No
	x^4	0.4005	0.935	No
	x^5	0.3709	0.935	No
	x^6	0.3523	0.935	No

Shapiro-Wilk Normality Test

Constituent: Sulfate Analysis Run 8/11/2021 10:46 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 17, alpha = 0.05)				
	no	0.8637	0.892	No
	square root	0.9312	0.892	Yes
	square	0.704	0.892	No
	cube root	0.9486	0.892	Yes
	cube	0.5676	0.892	No
	natural log	0.9725	0.892	Yes
	x^4	0.4711	0.892	No
	x^5	0.4066	0.892	No
	x^6	0.3638	0.892	No
MW-11 (bg) (n = 17, alpha = 0.05)				
	no	0.9469	0.892	Yes
	square root	0.9385	0.892	Yes
	square	0.8855	0.892	No
	cube root	0.9288	0.892	Yes
	cube	0.7853	0.892	No
	natural log	0.9006	0.892	Yes
	x^4	0.6955	0.892	No
	x^5	0.6248	0.892	No
	x^6	0.5697	0.892	No
MW-14 (bg) (n = 17, alpha = 0.05)				
	no	0.9208	0.892	Yes
	square root	0.9534	0.892	Yes
	square	0.7898	0.892	No
	cube root	0.9549	0.892	Yes
	cube	0.6459	0.892	No
	natural log	0.9384	0.892	Yes
	x^4	0.5293	0.892	No
	x^5	0.4453	0.892	No
	x^6	0.3875	0.892	No
Pooled Background (bg) (n = 51 - Shapiro-Francia used, alpha = 0.05)				
	no	0.8337	0.954	No
	square root	0.9635	0.954	Yes
	square	0.5254	0.954	No
	cube root	0.9849	0.954	Yes
	cube	0.3308	0.954	No
	natural log	0.9763	0.954	Yes
	x^4	0.2316	0.954	No
	x^5	0.1804	0.954	No
	x^6	0.152	0.954	No

Shapiro-Wilk Normality Test

Constituent: Thallium Analysis Run 8/11/2021 10:46 AM

Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	-1	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	-1	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	-1	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
Pooled Background (bg) (n = 36, alpha = 0.05)				
	no	-1	0.935	No
	square root	0	0.935	No
	square	-1	0.935	No
	cube root	0	0.935	No
	cube	-1	0.935	No
	natural log	0	0.935	No
	x^4	-1	0.935	No
	x^5	-1	0.935	No
	x^6	-1	0.935	No

Shapiro-Wilk Normality Test

Constituent: Total Dissolved Solids Analysis Run 8/11/2021 10:46 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 17, alpha = 0.05)				
	no	0.8932	0.892	Yes
	square root	0.9297	0.892	Yes
	square	0.7896	0.892	No
	cube root	0.9387	0.892	Yes
	cube	0.6772	0.892	No
	natural log	0.9516	0.892	Yes
	x^4	0.5834	0.892	No
	x^5	0.5145	0.892	No
	x^6	0.4661	0.892	No
MW-11 (bg) (n = 17, alpha = 0.05)				
	no	0.9083	0.892	Yes
	square root	0.9021	0.892	Yes
	square	0.916	0.892	Yes
	cube root	0.8997	0.892	Yes
	cube	0.9171	0.892	Yes
	natural log	0.8944	0.892	Yes
	x^4	0.9119	0.892	Yes
	x^5	0.9011	0.892	Yes
	x^6	0.8858	0.892	No
MW-14 (bg) (n = 17, alpha = 0.05)				
	no	0.9425	0.892	Yes
	square root	0.9508	0.892	Yes
	square	0.9027	0.892	Yes
	cube root	0.9514	0.892	Yes
	cube	0.8464	0.892	No
	natural log	0.9489	0.892	Yes
	x^4	0.7872	0.892	No
	x^5	0.7324	0.892	No
	x^6	0.6848	0.892	No
Pooled Background (bg) (n = 51 - Shapiro-Francia used, alpha = 0.05)				
	no	0.8472	0.954	No
	square root	0.9303	0.954	No
	square	0.6261	0.954	No
	cube root	0.9483	0.954	No
	cube	0.4418	0.954	No
	natural log	0.9665	0.954	Yes
	x^4	0.3253	0.954	No
	x^5	0.2568	0.954	No
	x^6	0.2161	0.954	No

Shapiro-Wilk Normality Test

Constituent: Antimony Analysis Run 8/11/2021 10:56 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.327	0.859	No
	square root	0.327	0.859	No
	square	0.327	0.859	No
	cube root	0.327	0.859	No
	cube	0.327	0.859	No
	natural log	0.327	0.859	No
	x^4	0.327	0.859	No
	x^5	0.327	0.859	No
	x^6	0.327	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	-1	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.2106	0.916	No
	square root	0.2106	0.916	No
	square	0.2106	0.916	No
	cube root	0.2106	0.916	No
	cube	0.2106	0.916	No
	natural log	0.2106	0.916	No
	x^4	0.2106	0.916	No
	x^5	0.2106	0.916	No
	x^6	0.2106	0.916	No

Shapiro-Wilk Normality Test

Constituent: Arsenic   Analysis Run 8/11/2021 10:56 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.5519	0.859	No
	square root	0.6459	0.859	No
	square	0.4855	0.859	No
	cube root	0.6911	0.859	No
	cube	0.4531	0.859	No
	natural log	0.7882	0.859	No
	x^4	0.4235	0.859	No
	x^5	0.3981	0.859	No
	x^6	0.3783	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	0.9632	0.859	Yes
	square root	0.9808	0.859	Yes
	square	0.8883	0.859	Yes
	cube root	0.9824	0.859	Yes
	cube	0.7936	0.859	No
	natural log	0.9779	0.859	Yes
	x^4	0.7019	0.859	No
	x^5	0.6223	0.859	No
	x^6	0.5571	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.8272	0.916	No
	square root	0.8185	0.916	No
	square	0.7621	0.916	No
	cube root	0.8121	0.916	No
	cube	0.6438	0.916	No
	natural log	0.796	0.916	No
	x^4	0.5368	0.916	No
	x^5	0.4544	0.916	No
	x^6	0.3933	0.916	No

Shapiro-Wilk Normality Test

Constituent: Barium Analysis Run 8/11/2021 10:56 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.7869	0.859	No
	square root	0.8897	0.859	Yes
	square	0.5734	0.859	No
	cube root	0.915	0.859	Yes
	cube	0.4445	0.859	No
	natural log	0.946	0.859	Yes
	x^4	0.3822	0.859	No
	x^5	0.3531	0.859	No
	x^6	0.3395	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	0.9237	0.859	Yes
	square root	0.9164	0.859	Yes
	square	0.9326	0.859	Yes
	cube root	0.9135	0.859	Yes
	cube	0.9324	0.859	Yes
	natural log	0.9074	0.859	Yes
	x^4	0.9223	0.859	Yes
	x^5	0.9024	0.859	Yes
	x^6	0.874	0.859	Yes
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.875	0.916	No
	square root	0.8752	0.916	No
	square	0.8623	0.916	No
	cube root	0.8727	0.916	No
	cube	0.849	0.916	No
	natural log	0.8617	0.916	No
	x^4	0.8339	0.916	No
	x^5	0.8132	0.916	No
	x^6	0.7859	0.916	No

Shapiro-Wilk Normality Test

Constituent: Beryllium Analysis Run 8/11/2021 10:56 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	-1	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	-1	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	-1	0.916	No
	square root	0	0.916	No
	square	-1	0.916	No
	cube root	0	0.916	No
	cube	-1	0.916	No
	natural log	0	0.916	No
	x^4	-1	0.916	No
	x^5	-1	0.916	No
	x^6	-1	0.916	No

Shapiro-Wilk Normality Test

Constituent: Boron   Analysis Run 8/11/2021 10:56 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 17, alpha = 0.05)				
	no	0.9646	0.892	Yes
	square root	0.9154	0.892	Yes
	square	0.9705	0.892	Yes
	cube root	0.8885	0.892	No
	cube	0.9304	0.892	Yes
	natural log	0.8183	0.892	No
	x^4	0.8783	0.892	No
	x^5	0.8231	0.892	No
	x^6	0.7688	0.892	No
MW-11 (bg) (n = 17, alpha = 0.05)				
	no	0.9147	0.892	Yes
	square root	0.9441	0.892	Yes
	square	0.8366	0.892	No
	cube root	0.9515	0.892	Yes
	cube	0.7521	0.892	No
	natural log	0.9624	0.892	Yes
	x^4	0.676	0.892	No
	x^5	0.6134	0.892	No
	x^6	0.5642	0.892	No
Pooled Background (bg) (n = 34, alpha = 0.05)				
	no	0.8195	0.933	No
	square root	0.8383	0.933	No
	square	0.7752	0.933	No
	cube root	0.8444	0.933	No
	cube	0.7211	0.933	No
	natural log	0.8555	0.933	No
	x^4	0.665	0.933	No
	x^5	0.6117	0.933	No
	x^6	0.5628	0.933	No

Shapiro-Wilk Normality Test

Constituent: Cadmium Analysis Run 8/11/2021 10:56 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.3421	0.859	No
	square root	0.3455	0.859	No
	square	0.3367	0.859	No
	cube root	0.3467	0.859	No
	cube	0.3329	0.859	No
	natural log	0.3494	0.859	No
	x^4	0.3305	0.859	No
	x^5	0.329	0.859	No
	x^6	0.3281	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	-1	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.2208	0.916	No
	square root	0.2231	0.916	No
	square	0.2172	0.916	No
	cube root	0.224	0.916	No
	cube	0.2146	0.916	No
	natural log	0.2258	0.916	No
	x^4	0.213	0.916	No
	x^5	0.212	0.916	No
	x^6	0.2114	0.916	No

Shapiro-Wilk Normality Test

Constituent: Calcium Analysis Run 8/11/2021 10:56 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 17, alpha = 0.05)				
	no	0.8672	0.892	No
	square root	0.9132	0.892	Yes
	square	0.7572	0.892	No
	cube root	0.9263	0.892	Yes
	cube	0.6462	0.892	No
	natural log	0.9487	0.892	Yes
	x^4	0.5519	0.892	No
	x^5	0.479	0.892	No
	x^6	0.4251	0.892	No
MW-11 (bg) (n = 17, alpha = 0.05)				
	no	0.9568	0.892	Yes
	square root	0.9607	0.892	Yes
	square	0.9367	0.892	Yes
	cube root	0.9611	0.892	Yes
	cube	0.9012	0.892	Yes
	natural log	0.9605	0.892	Yes
	x^4	0.8526	0.892	No
	x^5	0.795	0.892	No
	x^6	0.733	0.892	No
Pooled Background (bg) (n = 34, alpha = 0.05)				
	no	0.8338	0.933	No
	square root	0.8948	0.933	No
	square	0.6876	0.933	No
	cube root	0.9121	0.933	No
	cube	0.546	0.933	No
	natural log	0.9411	0.933	Yes
	x^4	0.4348	0.933	No
	x^5	0.3567	0.933	No
	x^6	0.3041	0.933	No

Shapiro-Wilk Normality Test

Constituent: Chloride Analysis Run 8/11/2021 10:56 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 17, alpha = 0.05)				
	no	0.8883	0.892	No
	square root	0.8825	0.892	No
	square	0.7863	0.892	No
	cube root	0.8731	0.892	No
	cube	0.6465	0.892	No
	natural log	0.8472	0.892	No
	x^4	0.5435	0.892	No
	x^5	0.4757	0.892	No
	x^6	0.4305	0.892	No
MW-11 (bg) (n = 17, alpha = 0.05)				
	no	0.9432	0.892	Yes
	square root	0.9452	0.892	Yes
	square	0.9288	0.892	Yes
	cube root	0.945	0.892	Yes
	cube	0.9042	0.892	Yes
	natural log	0.9432	0.892	Yes
	x^4	0.8734	0.892	No
	x^5	0.8394	0.892	No
	x^6	0.8047	0.892	No
Pooled Background (bg) (n = 34, alpha = 0.05)				
	no	0.9189	0.933	No
	square root	0.959	0.933	Yes
	square	0.6751	0.933	No
	cube root	0.9392	0.933	Yes
	cube	0.4947	0.933	No
	natural log	0.8522	0.933	No
	x^4	0.3911	0.933	No
	x^5	0.331	0.933	No
	x^6	0.2942	0.933	No

Shapiro-Wilk Normality Test

Constituent: Chromium Analysis Run 8/11/2021 10:56 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.5859	0.859	No
	square root	0.5798	0.859	No
	square	0.59	0.859	No
	cube root	0.5777	0.859	No
	cube	0.5823	0.859	No
	natural log	0.5736	0.859	No
	x^4	0.5686	0.859	No
	x^5	0.5539	0.859	No
	x^6	0.5403	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	0.6032	0.859	No
	square root	0.6246	0.859	No
	square	0.5598	0.859	No
	cube root	0.6316	0.859	No
	cube	0.5181	0.859	No
	natural log	0.6453	0.859	No
	x^4	0.4804	0.859	No
	x^5	0.4477	0.859	No
	x^6	0.4206	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.4266	0.916	No
	square root	0.4442	0.916	No
	square	0.4083	0.916	No
	cube root	0.452	0.916	No
	cube	0.3961	0.916	No
	natural log	0.4707	0.916	No
	x^4	0.384	0.916	No
	x^5	0.3722	0.916	No
	x^6	0.3617	0.916	No

Shapiro-Wilk Normality Test

Constituent: Cobalt Analysis Run 8/11/2021 10:56 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.585	0.859	No
	square root	0.5955	0.859	No
	square	0.5487	0.859	No
	cube root	0.5978	0.859	No
	cube	0.5005	0.859	No
	natural log	0.6007	0.859	No
	x^4	0.4531	0.859	No
	x^5	0.4145	0.859	No
	x^6	0.386	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	-1	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.3944	0.916	No
	square root	0.4032	0.916	No
	square	0.3672	0.916	No
	cube root	0.4054	0.916	No
	cube	0.3328	0.916	No
	natural log	0.4087	0.916	No
	x^4	0.2994	0.916	No
	x^5	0.2722	0.916	No
	x^6	0.2522	0.916	No

Shapiro-Wilk Normality Test

Constituent: Combined Radium 226 + 228 Analysis Run 8/11/2021 10:56 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.9644	0.859	Yes
	square root	0.9888	0.859	Yes
	square	0.8502	0.859	No
	cube root	0.9889	0.859	Yes
	cube	0.7192	0.859	No
	natural log	0.9756	0.859	Yes
	x^4	0.6101	0.859	No
	x^5	0.529	0.859	No
	x^6	0.4712	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	0.9677	0.859	Yes
	square root	0.9791	0.859	Yes
	square	0.916	0.859	Yes
	cube root	0.9802	0.859	Yes
	cube	0.8451	0.859	No
	natural log	0.9782	0.859	Yes
	x^4	0.7733	0.859	No
	x^5	0.7096	0.859	No
	x^6	0.6563	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.9462	0.916	Yes
	square root	0.9797	0.916	Yes
	square	0.8289	0.916	No
	cube root	0.9834	0.916	Yes
	cube	0.7052	0.916	No
	natural log	0.9761	0.916	Yes
	x^4	0.6035	0.916	No
	x^5	0.5267	0.916	No
	x^6	0.4699	0.916	No

Shapiro-Wilk Normality Test

Constituent: Fluoride Analysis Run 8/11/2021 10:56 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 17, alpha = 0.05)				
	no	0.8207	0.892	No
	square root	0.8688	0.892	No
	square	0.7053	0.892	No
	cube root	0.8827	0.892	No
	cube	0.5872	0.892	No
	natural log	0.9071	0.892	Yes
	x^4	0.4884	0.892	No
	x^5	0.4155	0.892	No
	x^6	0.3651	0.892	No
MW-11 (bg) (n = 17, alpha = 0.05)				
	no	0.287	0.892	No
	square root	0.3453	0.892	No
	square	0.2638	0.892	No
	cube root	0.3814	0.892	No
	cube	0.2623	0.892	No
	natural log	0.4859	0.892	No
	x^4	0.2622	0.892	No
	x^5	0.2622	0.892	No
	x^6	0.2622	0.892	No
Pooled Background (bg) (n = 34, alpha = 0.05)				
	no	0.2113	0.933	No
	square root	0.298	0.933	No
	square	0.1778	0.933	No
	cube root	0.3524	0.933	No
	cube	0.1756	0.933	No
	natural log	0.5068	0.933	No
	x^4	0.1755	0.933	No
	x^5	0.1755	0.933	No
	x^6	0.1755	0.933	No

Shapiro-Wilk Normality Test

Constituent: Lead   Analysis Run 8/11/2021 10:56 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.3939	0.859	No
	square root	0.4063	0.859	No
	square	0.3721	0.859	No
	cube root	0.4106	0.859	No
	cube	0.3554	0.859	No
	natural log	0.4191	0.859	No
	x^4	0.3441	0.859	No
	x^5	0.3368	0.859	No
	x^6	0.3325	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	0.5791	0.859	No
	square root	0.5833	0.859	No
	square	0.5676	0.859	No
	cube root	0.5844	0.859	No
	cube	0.5535	0.859	No
	natural log	0.5863	0.859	No
	x^4	0.5385	0.859	No
	x^5	0.524	0.859	No
	x^6	0.5106	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.4957	0.916	No
	square root	0.5035	0.916	No
	square	0.478	0.916	No
	cube root	0.506	0.916	No
	cube	0.4592	0.916	No
	natural log	0.5105	0.916	No
	x^4	0.4409	0.916	No
	x^5	0.4235	0.916	No
	x^6	0.4074	0.916	No

Shapiro-Wilk Normality Test

Constituent: Lithium Analysis Run 8/11/2021 10:56 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.9042	0.859	Yes
	square root	0.8906	0.859	Yes
	square	0.9228	0.859	Yes
	cube root	0.8855	0.859	Yes
	cube	0.9293	0.859	Yes
	natural log	0.8744	0.859	Yes
	x^4	0.9245	0.859	Yes
	x^5	0.9104	0.859	Yes
	x^6	0.8897	0.859	Yes
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	0.7941	0.859	No
	square root	0.8031	0.859	No
	square	0.7764	0.859	No
	cube root	0.8061	0.859	No
	cube	0.7596	0.859	No
	natural log	0.8121	0.859	No
	x^4	0.7437	0.859	No
	x^5	0.729	0.859	No
	x^6	0.7156	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.8589	0.916	No
	square root	0.8734	0.916	No
	square	0.8236	0.916	No
	cube root	0.8776	0.916	No
	cube	0.7839	0.916	No
	natural log	0.8849	0.916	No
	x^4	0.7442	0.916	No
	x^5	0.7067	0.916	No
	x^6	0.6721	0.916	No

Shapiro-Wilk Normality Test

Constituent: Mercury Analysis Run 8/11/2021 10:56 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	-1	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	-1	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	-1	0.916	No
	square root	0	0.916	No
	square	-1	0.916	No
	cube root	-1	0.916	No
	cube	-1	0.916	No
	natural log	0	0.916	No
	x^4	-1	0.916	No
	x^5	-1	0.916	No
	x^6	-1	0.916	No

Shapiro-Wilk Normality Test

Constituent: Molybdenum   Analysis Run 8/11/2021 10:56 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.9455	0.859	Yes
	square root	0.9027	0.859	Yes
	square	0.9308	0.859	Yes
	cube root	0.8753	0.859	Yes
	cube	0.8833	0.859	Yes
	natural log	0.8009	0.859	No
	x^4	0.8295	0.859	No
	x^5	0.7709	0.859	No
	x^6	0.7106	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	0.327	0.859	No
	square root	0.327	0.859	No
	square	0.327	0.859	No
	cube root	0.327	0.859	No
	cube	0.327	0.859	No
	natural log	0.327	0.859	No
	x^4	0.327	0.859	No
	x^5	0.327	0.859	No
	x^6	0.327	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.7853	0.916	No
	square root	0.7686	0.916	No
	square	0.7437	0.916	No
	cube root	0.7548	0.916	No
	cube	0.6796	0.916	No
	natural log	0.7199	0.916	No
	x^4	0.6197	0.916	No
	x^5	0.5644	0.916	No
	x^6	0.5128	0.916	No

Shapiro-Wilk Normality Test

Constituent: pH Analysis Run 8/11/2021 10:56 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 17, alpha = 0.05)				
	no	0.9688	0.892	Yes
	square root	0.9721	0.892	Yes
	square	0.961	0.892	Yes
	cube root	0.973	0.892	Yes
	cube	0.9515	0.892	Yes
	natural log	0.9748	0.892	Yes
	x^4	0.9405	0.892	Yes
	x^5	0.9282	0.892	Yes
	x^6	0.9147	0.892	Yes
MW-11 (bg) (n = 17, alpha = 0.05)				
	no	0.9132	0.892	Yes
	square root	0.9089	0.892	Yes
	square	0.9212	0.892	Yes
	cube root	0.9074	0.892	Yes
	cube	0.9284	0.892	Yes
	natural log	0.9044	0.892	Yes
	x^4	0.9346	0.892	Yes
	x^5	0.9399	0.892	Yes
	x^6	0.9442	0.892	Yes
Pooled Background (bg) (n = 34, alpha = 0.05)				
	no	0.9505	0.933	Yes
	square root	0.9544	0.933	Yes
	square	0.9408	0.933	Yes
	cube root	0.9555	0.933	Yes
	cube	0.9284	0.933	No
	natural log	0.9575	0.933	Yes
	x^4	0.9136	0.933	No
	x^5	0.8967	0.933	No
	x^6	0.8779	0.933	No

Shapiro-Wilk Normality Test

Constituent: Selenium   Analysis Run 8/11/2021 10:56 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.9131	0.859	Yes
	square root	0.9037	0.859	Yes
	square	0.8407	0.859	No
	cube root	0.89	0.859	Yes
	cube	0.7556	0.859	No
	natural log	0.849	0.859	No
	x^4	0.6973	0.859	No
	x^5	0.6609	0.859	No
	x^6	0.6376	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	-1	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.7029	0.916	No
	square root	0.7176	0.916	No
	square	0.6275	0.916	No
	cube root	0.7178	0.916	No
	cube	0.5496	0.916	No
	natural log	0.7124	0.916	No
	x^4	0.4956	0.916	No
	x^5	0.4615	0.916	No
	x^6	0.4397	0.916	No

Shapiro-Wilk Normality Test

Constituent: Sulfate   Analysis Run 8/11/2021 10:56 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 17, alpha = 0.05)				
	no	0.8637	0.892	No
	square root	0.9312	0.892	Yes
	square	0.704	0.892	No
	cube root	0.9486	0.892	Yes
	cube	0.5676	0.892	No
	natural log	0.9725	0.892	Yes
	x^4	0.4711	0.892	No
	x^5	0.4066	0.892	No
	x^6	0.3638	0.892	No
MW-11 (bg) (n = 17, alpha = 0.05)				
	no	0.9469	0.892	Yes
	square root	0.9385	0.892	Yes
	square	0.8855	0.892	No
	cube root	0.9288	0.892	Yes
	cube	0.7853	0.892	No
	natural log	0.9006	0.892	Yes
	x^4	0.6955	0.892	No
	x^5	0.6248	0.892	No
	x^6	0.5697	0.892	No
Pooled Background (bg) (n = 34, alpha = 0.05)				
	no	0.8883	0.933	No
	square root	0.9629	0.933	Yes
	square	0.6449	0.933	No
	cube root	0.9694	0.933	Yes
	cube	0.4552	0.933	No
	natural log	0.9478	0.933	Yes
	x^4	0.3459	0.933	No
	x^5	0.2848	0.933	No
	x^6	0.249	0.933	No

Shapiro-Wilk Normality Test

Constituent: Thallium Analysis Run 8/11/2021 10:56 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	-1	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	-1	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	-1	0.916	No
	square root	0	0.916	No
	square	-1	0.916	No
	cube root	0	0.916	No
	cube	-1	0.916	No
	natural log	0	0.916	No
	x^4	-1	0.916	No
	x^5	-1	0.916	No
	x^6	-1	0.916	No

Shapiro-Wilk Normality Test

Constituent: Total Dissolved Solids Analysis Run 8/11/2021 10:56 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 17, alpha = 0.05)				
	no	0.8932	0.892	Yes
	square root	0.9297	0.892	Yes
	square	0.7896	0.892	No
	cube root	0.9387	0.892	Yes
	cube	0.6772	0.892	No
	natural log	0.9516	0.892	Yes
	x^4	0.5834	0.892	No
	x^5	0.5145	0.892	No
	x^6	0.4661	0.892	No
MW-11 (bg) (n = 17, alpha = 0.05)				
	no	0.9083	0.892	Yes
	square root	0.9021	0.892	Yes
	square	0.916	0.892	Yes
	cube root	0.8997	0.892	Yes
	cube	0.9171	0.892	Yes
	natural log	0.8944	0.892	Yes
	x^4	0.9119	0.892	Yes
	x^5	0.9011	0.892	Yes
	x^6	0.8858	0.892	No
Pooled Background (bg) (n = 34, alpha = 0.05)				
	no	0.7975	0.933	No
	square root	0.8628	0.933	No
	square	0.6527	0.933	No
	cube root	0.882	0.933	No
	cube	0.5239	0.933	No
	natural log	0.9154	0.933	No
	x^4	0.429	0.933	No
	x^5	0.3652	0.933	No
	x^6	0.3233	0.933	No

Shapiro-Wilk Normality Test

Constituent: Antimony Analysis Run 8/11/2021 10:59 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.327	0.859	No
	square root	0.327	0.859	No
	square	0.327	0.859	No
	cube root	0.327	0.859	No
	cube	0.327	0.859	No
	natural log	0.327	0.859	No
	x^4	0.327	0.859	No
	x^5	0.327	0.859	No
	x^6	0.327	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.6995	0.859	No
	square root	0.7266	0.859	No
	square	0.6178	0.859	No
	cube root	0.7332	0.859	No
	cube	0.5282	0.859	No
	natural log	0.7431	0.859	No
	x^4	0.4573	0.859	No
	x^5	0.4094	0.859	No
	x^6	0.3788	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.5045	0.916	No
	square root	0.5357	0.916	No
	square	0.4297	0.916	No
	cube root	0.5447	0.916	No
	cube	0.3581	0.916	No
	natural log	0.5605	0.916	No
	x^4	0.3048	0.916	No
	x^5	0.2696	0.916	No
	x^6	0.2475	0.916	No

Shapiro-Wilk Normality Test

Constituent: Arsenic Analysis Run 8/11/2021 10:59 AM

Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.5519	0.859	No
	square root	0.6459	0.859	No
	square	0.4855	0.859	No
	cube root	0.6911	0.859	No
	cube	0.4531	0.859	No
	natural log	0.7882	0.859	No
	x^4	0.4235	0.859	No
	x^5	0.3981	0.859	No
	x^6	0.3783	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.7075	0.859	No
	square root	0.8377	0.859	No
	square	0.5697	0.859	No
	cube root	0.8818	0.859	Yes
	cube	0.5228	0.859	No
	natural log	0.9416	0.859	Yes
	x^4	0.5039	0.859	No
	x^5	0.4941	0.859	No
	x^6	0.4871	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.5203	0.916	No
	square root	0.7183	0.916	No
	square	0.3878	0.916	No
	cube root	0.8096	0.916	No
	cube	0.3501	0.916	No
	natural log	0.8873	0.916	No
	x^4	0.3351	0.916	No
	x^5	0.3272	0.916	No
	x^6	0.3215	0.916	No

Shapiro-Wilk Normality Test

Constituent: Barium Analysis Run 8/11/2021 10:59 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.7869	0.859	No
	square root	0.8897	0.859	Yes
	square	0.5734	0.859	No
	cube root	0.915	0.859	Yes
	cube	0.4445	0.859	No
	natural log	0.946	0.859	Yes
	x^4	0.3822	0.859	No
	x^5	0.3531	0.859	No
	x^6	0.3395	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.7529	0.859	No
	square root	0.7863	0.859	No
	square	0.7013	0.859	No
	cube root	0.798	0.859	No
	cube	0.6658	0.859	No
	natural log	0.8211	0.859	No
	x^4	0.6383	0.859	No
	x^5	0.6153	0.859	No
	x^6	0.5957	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.6503	0.916	No
	square root	0.7961	0.916	No
	square	0.5095	0.916	No
	cube root	0.8491	0.916	No
	cube	0.4624	0.916	No
	natural log	0.9303	0.916	Yes
	x^4	0.437	0.916	No
	x^5	0.4181	0.916	No
	x^6	0.4026	0.916	No

Shapiro-Wilk Normality Test

Constituent: Beryllium   Analysis Run 8/11/2021 10:59 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	-1	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	-1	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	-1	0.916	No
	square root	0	0.916	No
	square	-1	0.916	No
	cube root	0	0.916	No
	cube	-1	0.916	No
	natural log	0	0.916	No
	x^4	-1	0.916	No
	x^5	-1	0.916	No
	x^6	-1	0.916	No

Shapiro-Wilk Normality Test

Constituent: Boron Analysis Run 8/11/2021 10:59 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 17, alpha = 0.05)				
	no	0.9646	0.892	Yes
	square root	0.9154	0.892	Yes
	square	0.9705	0.892	Yes
	cube root	0.8885	0.892	No
	cube	0.9304	0.892	Yes
	natural log	0.8183	0.892	No
	x^4	0.8783	0.892	No
	x^5	0.8231	0.892	No
	x^6	0.7688	0.892	No
MW-14 (bg) (n = 17, alpha = 0.05)				
	no	0.8711	0.892	No
	square root	0.9416	0.892	Yes
	square	0.686	0.892	No
	cube root	0.9584	0.892	Yes
	cube	0.5247	0.892	No
	natural log	0.9798	0.892	Yes
	x^4	0.4185	0.892	No
	x^5	0.3551	0.892	No
	x^6	0.318	0.892	No
Pooled Background (bg) (n = 34, alpha = 0.05)				
	no	0.7966	0.933	No
	square root	0.8016	0.933	No
	square	0.7706	0.933	No
	cube root	0.8047	0.933	No
	cube	0.7205	0.933	No
	natural log	0.8151	0.933	No
	x^4	0.6649	0.933	No
	x^5	0.6116	0.933	No
	x^6	0.5628	0.933	No

Shapiro-Wilk Normality Test

Constituent: Cadmium Analysis Run 8/11/2021 10:59 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.3421	0.859	No
	square root	0.3455	0.859	No
	square	0.3367	0.859	No
	cube root	0.3467	0.859	No
	cube	0.3329	0.859	No
	natural log	0.3494	0.859	No
	x^4	0.3305	0.859	No
	x^5	0.329	0.859	No
	x^6	0.3281	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.5748	0.859	No
	square root	0.6208	0.859	No
	square	0.4792	0.859	No
	cube root	0.6341	0.859	No
	cube	0.409	0.859	No
	natural log	0.6566	0.859	No
	x^4	0.3684	0.859	No
	x^5	0.3474	0.859	No
	x^6	0.3369	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.4673	0.916	No
	square root	0.5036	0.916	No
	square	0.3811	0.916	No
	cube root	0.5135	0.916	No
	cube	0.3087	0.916	No
	natural log	0.5296	0.916	No
	x^4	0.2633	0.916	No
	x^5	0.2383	0.916	No
	x^6	0.2251	0.916	No

Shapiro-Wilk Normality Test

Constituent: Calcium Analysis Run 8/11/2021 10:59 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 17, alpha = 0.05)				
	no	0.8672	0.892	No
	square root	0.9132	0.892	Yes
	square	0.7572	0.892	No
	cube root	0.9263	0.892	Yes
	cube	0.6462	0.892	No
	natural log	0.9487	0.892	Yes
	x^4	0.5519	0.892	No
	x^5	0.479	0.892	No
	x^6	0.4251	0.892	No
MW-14 (bg) (n = 17, alpha = 0.05)				
	no	0.9546	0.892	Yes
	square root	0.9727	0.892	Yes
	square	0.8964	0.892	Yes
	cube root	0.977	0.892	Yes
	cube	0.8171	0.892	No
	natural log	0.9828	0.892	Yes
	x^4	0.7292	0.892	No
	x^5	0.6441	0.892	No
	x^6	0.5688	0.892	No
Pooled Background (bg) (n = 34, alpha = 0.05)				
	no	0.8819	0.933	No
	square root	0.9367	0.933	Yes
	square	0.7351	0.933	No
	cube root	0.9509	0.933	Yes
	cube	0.5825	0.933	No
	natural log	0.9725	0.933	Yes
	x^4	0.4594	0.933	No
	x^5	0.3724	0.933	No
	x^6	0.314	0.933	No

Shapiro-Wilk Normality Test

Constituent: Chloride Analysis Run 8/11/2021 10:59 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 17, alpha = 0.05)				
	no	0.8883	0.892	No
	square root	0.8825	0.892	No
	square	0.7863	0.892	No
	cube root	0.8731	0.892	No
	cube	0.6465	0.892	No
	natural log	0.8472	0.892	No
	x^4	0.5435	0.892	No
	x^5	0.4757	0.892	No
	x^6	0.4305	0.892	No
MW-14 (bg) (n = 17, alpha = 0.05)				
	no	0.9254	0.892	Yes
	square root	0.9705	0.892	Yes
	square	0.72	0.892	No
	cube root	0.9695	0.892	Yes
	cube	0.5312	0.892	No
	natural log	0.9413	0.892	Yes
	x^4	0.4136	0.892	No
	x^5	0.3475	0.892	No
	x^6	0.3107	0.892	No
Pooled Background (bg) (n = 34, alpha = 0.05)				
	no	0.8699	0.933	No
	square root	0.9539	0.933	Yes
	square	0.6504	0.933	No
	cube root	0.9647	0.933	Yes
	cube	0.4896	0.933	No
	natural log	0.946	0.933	Yes
	x^4	0.3911	0.933	No
	x^5	0.3318	0.933	No
	x^6	0.2949	0.933	No

Shapiro-Wilk Normality Test

Constituent: Chromium   Analysis Run 8/11/2021 10:59 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.5859	0.859	No
	square root	0.5798	0.859	No
	square	0.59	0.859	No
	cube root	0.5777	0.859	No
	cube	0.5823	0.859	No
	natural log	0.5736	0.859	No
	x^4	0.5686	0.859	No
	x^5	0.5539	0.859	No
	x^6	0.5403	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.7307	0.859	No
	square root	0.7823	0.859	No
	square	0.6719	0.859	No
	cube root	0.7987	0.859	No
	cube	0.6477	0.859	No
	natural log	0.8244	0.859	No
	x^4	0.6329	0.859	No
	x^5	0.6224	0.859	No
	x^6	0.6152	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.5369	0.916	No
	square root	0.6205	0.916	No
	square	0.4792	0.916	No
	cube root	0.6685	0.916	No
	cube	0.4573	0.916	No
	natural log	0.7827	0.916	No
	x^4	0.444	0.916	No
	x^5	0.4347	0.916	No
	x^6	0.4279	0.916	No

Shapiro-Wilk Normality Test

Constituent: Cobalt Analysis Run 8/11/2021 10:59 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.585	0.859	No
	square root	0.5955	0.859	No
	square	0.5487	0.859	No
	cube root	0.5978	0.859	No
	cube	0.5005	0.859	No
	natural log	0.6007	0.859	No
	x^4	0.4531	0.859	No
	x^5	0.4145	0.859	No
	x^6	0.386	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.7476	0.859	No
	square root	0.8121	0.859	No
	square	0.5948	0.859	No
	cube root	0.8287	0.859	No
	cube	0.478	0.859	No
	natural log	0.8534	0.859	No
	x^4	0.4098	0.859	No
	x^5	0.3726	0.859	No
	x^6	0.3524	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.6206	0.916	No
	square root	0.6949	0.916	No
	square	0.4527	0.916	No
	cube root	0.7143	0.916	No
	cube	0.3366	0.916	No
	natural log	0.7438	0.916	No
	x^4	0.2756	0.916	No
	x^5	0.2449	0.916	No
	x^6	0.2292	0.916	No

Shapiro-Wilk Normality Test

Constituent: Combined Radium 226 + 228 Analysis Run 8/11/2021 10:59 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.9644	0.859	Yes
	square root	0.9888	0.859	Yes
	square	0.8502	0.859	No
	cube root	0.9889	0.859	Yes
	cube	0.7192	0.859	No
	natural log	0.9756	0.859	Yes
	x^4	0.6101	0.859	No
	x^5	0.529	0.859	No
	x^6	0.4712	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.927	0.859	Yes
	square root	0.961	0.859	Yes
	square	0.8098	0.859	No
	cube root	0.967	0.859	Yes
	cube	0.6791	0.859	No
	natural log	0.9703	0.859	Yes
	x^4	0.5723	0.859	No
	x^5	0.4956	0.859	No
	x^6	0.4433	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.9513	0.916	Yes
	square root	0.9864	0.916	Yes
	square	0.8022	0.916	No
	cube root	0.9889	0.916	Yes
	cube	0.6305	0.916	No
	natural log	0.9779	0.916	Yes
	x^4	0.492	0.916	No
	x^5	0.3963	0.916	No
	x^6	0.3339	0.916	No

Shapiro-Wilk Normality Test

Constituent: Fluoride   Analysis Run 8/11/2021 10:59 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 17, alpha = 0.05)				
	no	0.8207	0.892	No
	square root	0.8688	0.892	No
	square	0.7053	0.892	No
	cube root	0.8827	0.892	No
	cube	0.5872	0.892	No
	natural log	0.9071	0.892	Yes
	x^4	0.4884	0.892	No
	x^5	0.4155	0.892	No
	x^6	0.3651	0.892	No
MW-14 (bg) (n = 17, alpha = 0.05)				
	no	0.9658	0.892	Yes
	square root	0.9769	0.892	Yes
	square	0.9197	0.892	Yes
	cube root	0.9784	0.892	Yes
	cube	0.8548	0.892	No
	natural log	0.978	0.892	Yes
	x^4	0.7851	0.892	No
	x^5	0.7194	0.892	No
	x^6	0.6612	0.892	No
Pooled Background (bg) (n = 34, alpha = 0.05)				
	no	0.9228	0.933	No
	square root	0.9433	0.933	Yes
	square	0.857	0.933	No
	cube root	0.948	0.933	Yes
	cube	0.7728	0.933	No
	natural log	0.9541	0.933	Yes
	x^4	0.6885	0.933	No
	x^5	0.6149	0.933	No
	x^6	0.5552	0.933	No

Shapiro-Wilk Normality Test

Constituent: Lead   Analysis Run 8/11/2021 10:59 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.3939	0.859	No
	square root	0.4063	0.859	No
	square	0.3721	0.859	No
	cube root	0.4106	0.859	No
	cube	0.3554	0.859	No
	natural log	0.4191	0.859	No
	x^4	0.3441	0.859	No
	x^5	0.3368	0.859	No
	x^6	0.3325	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.6233	0.859	No
	square root	0.6297	0.859	No
	square	0.6078	0.859	No
	cube root	0.6316	0.859	No
	cube	0.5891	0.859	No
	natural log	0.6351	0.859	No
	x^4	0.5684	0.859	No
	x^5	0.5468	0.859	No
	x^6	0.5254	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.5116	0.916	No
	square root	0.527	0.916	No
	square	0.474	0.916	No
	cube root	0.5315	0.916	No
	cube	0.4311	0.916	No
	natural log	0.5398	0.916	No
	x^4	0.3884	0.916	No
	x^5	0.3502	0.916	No
	x^6	0.3186	0.916	No

Shapiro-Wilk Normality Test

Constituent: Lithium Analysis Run 8/11/2021 10:59 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.9042	0.859	Yes
	square root	0.8906	0.859	Yes
	square	0.9228	0.859	Yes
	cube root	0.8855	0.859	Yes
	cube	0.9293	0.859	Yes
	natural log	0.8744	0.859	Yes
	x^4	0.9245	0.859	Yes
	x^5	0.9104	0.859	Yes
	x^6	0.8897	0.859	Yes
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.9517	0.859	Yes
	square root	0.9637	0.859	Yes
	square	0.8945	0.859	Yes
	cube root	0.9652	0.859	Yes
	cube	0.8054	0.859	No
	natural log	0.9646	0.859	Yes
	x^4	0.7069	0.859	No
	x^5	0.6171	0.859	No
	x^6	0.5439	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.8607	0.916	No
	square root	0.8928	0.916	No
	square	0.796	0.916	No
	cube root	0.9018	0.916	No
	cube	0.7469	0.916	No
	natural log	0.9153	0.916	No
	x^4	0.7111	0.916	No
	x^5	0.6819	0.916	No
	x^6	0.6553	0.916	No

Shapiro-Wilk Normality Test

Constituent: Mercury Analysis Run 8/11/2021 10:59 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	-1	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.327	0.859	No
	square root	0.327	0.859	No
	square	0.327	0.859	No
	cube root	0.327	0.859	No
	cube	0.327	0.859	No
	natural log	0.327	0.859	No
	x^4	0.327	0.859	No
	x^5	0.327	0.859	No
	x^6	-1	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.2106	0.916	No
	square root	0.2106	0.916	No
	square	0.2106	0.916	No
	cube root	0.2106	0.916	No
	cube	0.2106	0.916	No
	natural log	0.2106	0.916	No
	x^4	0.2106	0.916	No
	x^5	0.2106	0.916	No
	x^6	-1	0.916	No

Shapiro-Wilk Normality Test

Constituent: Molybdenum Analysis Run 8/11/2021 10:59 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.9455	0.859	Yes
	square root	0.9027	0.859	Yes
	square	0.9308	0.859	Yes
	cube root	0.8753	0.859	Yes
	cube	0.8833	0.859	Yes
	natural log	0.8009	0.859	No
	x^4	0.8295	0.859	No
	x^5	0.7709	0.859	No
	x^6	0.7106	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.3766	0.859	No
	square root	0.3839	0.859	No
	square	0.3637	0.859	No
	cube root	0.3864	0.859	No
	cube	0.3533	0.859	No
	natural log	0.3915	0.859	No
	x^4	0.3452	0.859	No
	x^5	0.3393	0.859	No
	x^6	0.3351	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.7864	0.916	No
	square root	0.7736	0.916	No
	square	0.7437	0.916	No
	cube root	0.7623	0.916	No
	cube	0.6796	0.916	No
	natural log	0.7342	0.916	No
	x^4	0.6197	0.916	No
	x^5	0.5644	0.916	No
	x^6	0.5128	0.916	No

Shapiro-Wilk Normality Test

Constituent: pH Analysis Run 8/11/2021 10:59 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 17, alpha = 0.05)				
	no	0.9688	0.892	Yes
	square root	0.9721	0.892	Yes
	square	0.961	0.892	Yes
	cube root	0.973	0.892	Yes
	cube	0.9515	0.892	Yes
	natural log	0.9748	0.892	Yes
	x^4	0.9405	0.892	Yes
	x^5	0.9282	0.892	Yes
	x^6	0.9147	0.892	Yes
MW-14 (bg) (n = 17, alpha = 0.05)				
	no	0.9588	0.892	Yes
	square root	0.9592	0.892	Yes
	square	0.9576	0.892	Yes
	cube root	0.9592	0.892	Yes
	cube	0.9556	0.892	Yes
	natural log	0.9593	0.892	Yes
	x^4	0.953	0.892	Yes
	x^5	0.9496	0.892	Yes
	x^6	0.9456	0.892	Yes
Pooled Background (bg) (n = 34, alpha = 0.05)				
	no	0.9605	0.933	Yes
	square root	0.9655	0.933	Yes
	square	0.9493	0.933	Yes
	cube root	0.967	0.933	Yes
	cube	0.9362	0.933	Yes
	natural log	0.97	0.933	Yes
	x^4	0.9215	0.933	No
	x^5	0.9053	0.933	No
	x^6	0.8879	0.933	No

Shapiro-Wilk Normality Test

Constituent: Selenium Analysis Run 8/11/2021 10:59 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	0.9131	0.859	Yes
	square root	0.9037	0.859	Yes
	square	0.8407	0.859	No
	cube root	0.89	0.859	Yes
	cube	0.7556	0.859	No
	natural log	0.849	0.859	No
	x^4	0.6973	0.859	No
	x^5	0.6609	0.859	No
	x^6	0.6376	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.4879	0.859	No
	square root	0.514	0.859	No
	square	0.4306	0.859	No
	cube root	0.5216	0.859	No
	cube	0.3857	0.859	No
	natural log	0.5347	0.859	No
	x^4	0.3583	0.859	No
	x^5	0.3433	0.859	No
	x^6	0.3354	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.7531	0.916	No
	square root	0.7838	0.916	No
	square	0.6468	0.916	No
	cube root	0.7875	0.916	No
	cube	0.5556	0.916	No
	natural log	0.7855	0.916	No
	x^4	0.4975	0.916	No
	x^5	0.4621	0.916	No
	x^6	0.4399	0.916	No

Shapiro-Wilk Normality Test

Constituent: Sulfate   Analysis Run 8/11/2021 10:59 AM

Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 17, alpha = 0.05)				
	no	0.8637	0.892	No
	square root	0.9312	0.892	Yes
	square	0.704	0.892	No
	cube root	0.9486	0.892	Yes
	cube	0.5676	0.892	No
	natural log	0.9725	0.892	Yes
	x^4	0.4711	0.892	No
	x^5	0.4066	0.892	No
	x^6	0.3638	0.892	No
MW-14 (bg) (n = 17, alpha = 0.05)				
	no	0.9208	0.892	Yes
	square root	0.9534	0.892	Yes
	square	0.7898	0.892	No
	cube root	0.9549	0.892	Yes
	cube	0.6459	0.892	No
	natural log	0.9384	0.892	Yes
	x^4	0.5293	0.892	No
	x^5	0.4453	0.892	No
	x^6	0.3875	0.892	No
Pooled Background (bg) (n = 34, alpha = 0.05)				
	no	0.9046	0.933	No
	square root	0.9712	0.933	Yes
	square	0.6505	0.933	No
	cube root	0.9695	0.933	Yes
	cube	0.4561	0.933	No
	natural log	0.9223	0.933	No
	x^4	0.3461	0.933	No
	x^5	0.2849	0.933	No
	x^6	0.249	0.933	No

Shapiro-Wilk Normality Test

Constituent: Thallium   Analysis Run 8/11/2021 10:59 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	-1	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	-1	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	-1	0.916	No
	square root	0	0.916	No
	square	-1	0.916	No
	cube root	0	0.916	No
	cube	-1	0.916	No
	natural log	0	0.916	No
	x^4	-1	0.916	No
	x^5	-1	0.916	No
	x^6	-1	0.916	No

Shapiro-Wilk Normality Test

Constituent: Total Dissolved Solids   Analysis Run 8/11/2021 10:59 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 17, alpha = 0.05)				
	no	0.8932	0.892	Yes
	square root	0.9297	0.892	Yes
	square	0.7896	0.892	No
	cube root	0.9387	0.892	Yes
	cube	0.6772	0.892	No
	natural log	0.9516	0.892	Yes
	x^4	0.5834	0.892	No
	x^5	0.5145	0.892	No
	x^6	0.4661	0.892	No
MW-14 (bg) (n = 17, alpha = 0.05)				
	no	0.9425	0.892	Yes
	square root	0.9508	0.892	Yes
	square	0.9027	0.892	Yes
	cube root	0.9514	0.892	Yes
	cube	0.8464	0.892	No
	natural log	0.9489	0.892	Yes
	x^4	0.7872	0.892	No
	x^5	0.7324	0.892	No
	x^6	0.6848	0.892	No
Pooled Background (bg) (n = 34, alpha = 0.05)				
	no	0.8903	0.933	No
	square root	0.9548	0.933	Yes
	square	0.7117	0.933	No
	cube root	0.9688	0.933	Yes
	cube	0.5507	0.933	No
	natural log	0.983	0.933	Yes
	x^4	0.4397	0.933	No
	x^5	0.3693	0.933	No
	x^6	0.3249	0.933	No

Shapiro-Wilk Normality Test

Constituent: Antimony   Analysis Run 8/11/2021 11:02 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	-1	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.6995	0.859	No
	square root	0.7266	0.859	No
	square	0.6178	0.859	No
	cube root	0.7332	0.859	No
	cube	0.5282	0.859	No
	natural log	0.7431	0.859	No
	x^4	0.4573	0.859	No
	x^5	0.4094	0.859	No
	x^6	0.3788	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.4842	0.916	No
	square root	0.5077	0.916	No
	square	0.4212	0.916	No
	cube root	0.5141	0.916	No
	cube	0.3553	0.916	No
	natural log	0.5247	0.916	No
	x^4	0.3039	0.916	No
	x^5	0.2694	0.916	No
	x^6	0.2475	0.916	No

Shapiro-Wilk Normality Test

Constituent: Arsenic   Analysis Run 8/11/2021 11:02 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	0.9632	0.859	Yes
	square root	0.9808	0.859	Yes
	square	0.8883	0.859	Yes
	cube root	0.9824	0.859	Yes
	cube	0.7936	0.859	No
	natural log	0.9779	0.859	Yes
	x^4	0.7019	0.859	No
	x^5	0.6223	0.859	No
	x^6	0.5571	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.7075	0.859	No
	square root	0.8377	0.859	No
	square	0.5697	0.859	No
	cube root	0.8818	0.859	Yes
	cube	0.5228	0.859	No
	natural log	0.9416	0.859	Yes
	x^4	0.5039	0.859	No
	x^5	0.4941	0.859	No
	x^6	0.4871	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.5134	0.916	No
	square root	0.6611	0.916	No
	square	0.388	0.916	No
	cube root	0.7247	0.916	No
	cube	0.3502	0.916	No
	natural log	0.8538	0.916	No
	x^4	0.3351	0.916	No
	x^5	0.3272	0.916	No
	x^6	0.3215	0.916	No

Shapiro-Wilk Normality Test

Constituent: Barium Analysis Run 8/11/2021 11:02 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	0.9237	0.859	Yes
	square root	0.9164	0.859	Yes
	square	0.9326	0.859	Yes
	cube root	0.9135	0.859	Yes
	cube	0.9324	0.859	Yes
	natural log	0.9074	0.859	Yes
	x^4	0.9223	0.859	Yes
	x^5	0.9024	0.859	Yes
	x^6	0.874	0.859	Yes
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.7529	0.859	No
	square root	0.7863	0.859	No
	square	0.7013	0.859	No
	cube root	0.798	0.859	No
	cube	0.6658	0.859	No
	natural log	0.8211	0.859	No
	x^4	0.6383	0.859	No
	x^5	0.6153	0.859	No
	x^6	0.5957	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.5783	0.916	No
	square root	0.6436	0.916	No
	square	0.5	0.916	No
	cube root	0.6694	0.916	No
	cube	0.4614	0.916	No
	natural log	0.7251	0.916	No
	x^4	0.4369	0.916	No
	x^5	0.4181	0.916	No
	x^6	0.4026	0.916	No

Shapiro-Wilk Normality Test

Constituent: Beryllium Analysis Run 8/11/2021 11:02 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	-1	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	-1	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	-1	0.916	No
	square root	0	0.916	No
	square	-1	0.916	No
	cube root	0	0.916	No
	cube	-1	0.916	No
	natural log	0	0.916	No
	x^4	-1	0.916	No
	x^5	-1	0.916	No
	x^6	-1	0.916	No

Shapiro-Wilk Normality Test

Constituent: Boron Analysis Run 8/11/2021 11:02 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-11 (bg) (n = 17, alpha = 0.05)				
	no	0.9147	0.892	Yes
	square root	0.9441	0.892	Yes
	square	0.8366	0.892	No
	cube root	0.9515	0.892	Yes
	cube	0.7521	0.892	No
	natural log	0.9624	0.892	Yes
	x^4	0.676	0.892	No
	x^5	0.6134	0.892	No
	x^6	0.5642	0.892	No
MW-14 (bg) (n = 17, alpha = 0.05)				
	no	0.8711	0.892	No
	square root	0.9416	0.892	Yes
	square	0.686	0.892	No
	cube root	0.9584	0.892	Yes
	cube	0.5247	0.892	No
	natural log	0.9798	0.892	Yes
	x^4	0.4185	0.892	No
	x^5	0.3551	0.892	No
	x^6	0.318	0.892	No
Pooled Background (bg) (n = 34, alpha = 0.05)				
	no	0.8983	0.933	No
	square root	0.9452	0.933	Yes
	square	0.7503	0.933	No
	cube root	0.9531	0.933	Yes
	cube	0.6114	0.933	No
	natural log	0.9555	0.933	Yes
	x^4	0.5114	0.933	No
	x^5	0.4434	0.933	No
	x^6	0.3968	0.933	No

Shapiro-Wilk Normality Test

Constituent: Cadmium Analysis Run 8/11/2021 11:02 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	-1	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.5748	0.859	No
	square root	0.6208	0.859	No
	square	0.4792	0.859	No
	cube root	0.6341	0.859	No
	cube	0.409	0.859	No
	natural log	0.6566	0.859	No
	x^4	0.3684	0.859	No
	x^5	0.3474	0.859	No
	x^6	0.3369	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.3882	0.916	No
	square root	0.4214	0.916	No
	square	0.3196	0.916	No
	cube root	0.4313	0.916	No
	cube	0.2692	0.916	No
	natural log	0.4483	0.916	No
	x^4	0.2401	0.916	No
	x^5	0.2251	0.916	No
	x^6	0.2176	0.916	No

Shapiro-Wilk Normality Test

Constituent: Calcium   Analysis Run 8/11/2021 11:02 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-11 (bg) (n = 17, alpha = 0.05)				
	no	0.9568	0.892	Yes
	square root	0.9607	0.892	Yes
	square	0.9367	0.892	Yes
	cube root	0.9611	0.892	Yes
	cube	0.9012	0.892	Yes
	natural log	0.9605	0.892	Yes
	x^4	0.8526	0.892	No
	x^5	0.795	0.892	No
	x^6	0.733	0.892	No
MW-14 (bg) (n = 17, alpha = 0.05)				
	no	0.9546	0.892	Yes
	square root	0.9727	0.892	Yes
	square	0.8964	0.892	Yes
	cube root	0.977	0.892	Yes
	cube	0.8171	0.892	No
	natural log	0.9828	0.892	Yes
	x^4	0.7292	0.892	No
	x^5	0.6441	0.892	No
	x^6	0.5688	0.892	No
Pooled Background (bg) (n = 34, alpha = 0.05)				
	no	0.9642	0.933	Yes
	square root	0.9766	0.933	Yes
	square	0.9176	0.933	No
	cube root	0.979	0.933	Yes
	cube	0.8461	0.933	No
	natural log	0.9816	0.933	Yes
	x^4	0.759	0.933	No
	x^5	0.6675	0.933	No
	x^6	0.5811	0.933	No

Shapiro-Wilk Normality Test

Constituent: Chloride   Analysis Run 8/11/2021 11:02 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-11 (bg) (n = 17, alpha = 0.05)				
	no	0.9432	0.892	Yes
	square root	0.9452	0.892	Yes
	square	0.9288	0.892	Yes
	cube root	0.945	0.892	Yes
	cube	0.9042	0.892	Yes
	natural log	0.9432	0.892	Yes
	x^4	0.8734	0.892	No
	x^5	0.8394	0.892	No
	x^6	0.8047	0.892	No
MW-14 (bg) (n = 17, alpha = 0.05)				
	no	0.9254	0.892	Yes
	square root	0.9705	0.892	Yes
	square	0.72	0.892	No
	cube root	0.9695	0.892	Yes
	cube	0.5312	0.892	No
	natural log	0.9413	0.892	Yes
	x^4	0.4136	0.892	No
	x^5	0.3475	0.892	No
	x^6	0.3107	0.892	No
Pooled Background (bg) (n = 34, alpha = 0.05)				
	no	0.9847	0.933	Yes
	square root	0.9619	0.933	Yes
	square	0.9106	0.933	No
	cube root	0.9408	0.933	Yes
	cube	0.7805	0.933	No
	natural log	0.8767	0.933	No
	x^4	0.6508	0.933	No
	x^5	0.5399	0.933	No
	x^6	0.4518	0.933	No

Shapiro-Wilk Normality Test

Constituent: Chromium   Analysis Run 8/11/2021 11:02 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	0.6032	0.859	No
	square root	0.6246	0.859	No
	square	0.5598	0.859	No
	cube root	0.6316	0.859	No
	cube	0.5181	0.859	No
	natural log	0.6453	0.859	No
	x^4	0.4804	0.859	No
	x^5	0.4477	0.859	No
	x^6	0.4206	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.7307	0.859	No
	square root	0.7823	0.859	No
	square	0.6719	0.859	No
	cube root	0.7987	0.859	No
	cube	0.6477	0.859	No
	natural log	0.8244	0.859	No
	x^4	0.6329	0.859	No
	x^5	0.6224	0.859	No
	x^6	0.6152	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.5334	0.916	No
	square root	0.5964	0.916	No
	square	0.4792	0.916	No
	cube root	0.6281	0.916	No
	cube	0.4573	0.916	No
	natural log	0.7076	0.916	No
	x^4	0.444	0.916	No
	x^5	0.4347	0.916	No
	x^6	0.4279	0.916	No

Shapiro-Wilk Normality Test

Constituent: Cobalt Analysis Run 8/11/2021 11:02 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	-1	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.7476	0.859	No
	square root	0.8121	0.859	No
	square	0.5948	0.859	No
	cube root	0.8287	0.859	No
	cube	0.478	0.859	No
	natural log	0.8534	0.859	No
	x^4	0.4098	0.859	No
	x^5	0.3726	0.859	No
	x^6	0.3524	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.5288	0.916	No
	square root	0.581	0.916	No
	square	0.41	0.916	No
	cube root	0.5952	0.916	No
	cube	0.3209	0.916	No
	natural log	0.6183	0.916	No
	x^4	0.27	0.916	No
	x^5	0.243	0.916	No
	x^6	0.2285	0.916	No

Shapiro-Wilk Normality Test

Constituent: Combined Radium 226 + 228   Analysis Run 8/11/2021 11:02 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	0.9677	0.859	Yes
	square root	0.9791	0.859	Yes
	square	0.916	0.859	Yes
	cube root	0.9802	0.859	Yes
	cube	0.8451	0.859	No
	natural log	0.9782	0.859	Yes
	x^4	0.7733	0.859	No
	x^5	0.7096	0.859	No
	x^6	0.6563	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.927	0.859	Yes
	square root	0.961	0.859	Yes
	square	0.8098	0.859	No
	cube root	0.967	0.859	Yes
	cube	0.6791	0.859	No
	natural log	0.9703	0.859	Yes
	x^4	0.5723	0.859	No
	x^5	0.4956	0.859	No
	x^6	0.4433	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.9542	0.916	Yes
	square root	0.9821	0.916	Yes
	square	0.8564	0.916	No
	cube root	0.9865	0.916	Yes
	cube	0.744	0.916	No
	natural log	0.9864	0.916	Yes
	x^4	0.6434	0.916	No
	x^5	0.5619	0.916	No
	x^6	0.4985	0.916	No

Shapiro-Wilk Normality Test

Constituent: Fluoride   Analysis Run 8/11/2021 11:02 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-11 (bg) (n = 17, alpha = 0.05)				
	no	0.287	0.892	No
	square root	0.3453	0.892	No
	square	0.2638	0.892	No
	cube root	0.3814	0.892	No
	cube	0.2623	0.892	No
	natural log	0.4859	0.892	No
	x^4	0.2622	0.892	No
	x^5	0.2622	0.892	No
	x^6	0.2622	0.892	No
MW-14 (bg) (n = 17, alpha = 0.05)				
	no	0.9658	0.892	Yes
	square root	0.9769	0.892	Yes
	square	0.9197	0.892	Yes
	cube root	0.9784	0.892	Yes
	cube	0.8548	0.892	No
	natural log	0.978	0.892	Yes
	x^4	0.7851	0.892	No
	x^5	0.7194	0.892	No
	x^6	0.6612	0.892	No
Pooled Background (bg) (n = 34, alpha = 0.05)				
	no	0.224	0.933	No
	square root	0.3378	0.933	No
	square	0.1788	0.933	No
	cube root	0.4081	0.933	No
	cube	0.1757	0.933	No
	natural log	0.5986	0.933	No
	x^4	0.1755	0.933	No
	x^5	0.1755	0.933	No
	x^6	0.1755	0.933	No

Shapiro-Wilk Normality Test

Constituent: Lead   Analysis Run 8/11/2021 11:02 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	0.5791	0.859	No
	square root	0.5833	0.859	No
	square	0.5676	0.859	No
	cube root	0.5844	0.859	No
	cube	0.5535	0.859	No
	natural log	0.5863	0.859	No
	x^4	0.5385	0.859	No
	x^5	0.524	0.859	No
	x^6	0.5106	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.6233	0.859	No
	square root	0.6297	0.859	No
	square	0.6078	0.859	No
	cube root	0.6316	0.859	No
	cube	0.5891	0.859	No
	natural log	0.6351	0.859	No
	x^4	0.5684	0.859	No
	x^5	0.5468	0.859	No
	x^6	0.5254	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.5957	0.916	No
	square root	0.6018	0.916	No
	square	0.5785	0.916	No
	cube root	0.6035	0.916	No
	cube	0.5557	0.916	No
	natural log	0.6064	0.916	No
	x^4	0.5294	0.916	No
	x^5	0.5017	0.916	No
	x^6	0.4745	0.916	No

Shapiro-Wilk Normality Test

Constituent: Lithium Analysis Run 8/11/2021 11:02 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	0.7941	0.859	No
	square root	0.8031	0.859	No
	square	0.7764	0.859	No
	cube root	0.8061	0.859	No
	cube	0.7596	0.859	No
	natural log	0.8121	0.859	No
	x^4	0.7437	0.859	No
	x^5	0.729	0.859	No
	x^6	0.7156	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.9517	0.859	Yes
	square root	0.9637	0.859	Yes
	square	0.8945	0.859	Yes
	cube root	0.9652	0.859	Yes
	cube	0.8054	0.859	No
	natural log	0.9646	0.859	Yes
	x^4	0.7069	0.859	No
	x^5	0.6171	0.859	No
	x^6	0.5439	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.9364	0.916	Yes
	square root	0.9459	0.916	Yes
	square	0.8796	0.916	No
	cube root	0.9456	0.916	Yes
	cube	0.7979	0.916	No
	natural log	0.9398	0.916	Yes
	x^4	0.7169	0.916	No
	x^5	0.649	0.916	No
	x^6	0.5962	0.916	No

Shapiro-Wilk Normality Test

Constituent: Mercury Analysis Run 8/11/2021 11:02 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	0	0.859	No
	cube	-1	0.859	No
	natural log	-1	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.327	0.859	No
	square root	0.327	0.859	No
	square	0.327	0.859	No
	cube root	0.327	0.859	No
	cube	0.327	0.859	No
	natural log	0.327	0.859	No
	x^4	0.327	0.859	No
	x^5	0.327	0.859	No
	x^6	-1	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.2106	0.916	No
	square root	0.2106	0.916	No
	square	0.2106	0.916	No
	cube root	0.2106	0.916	No
	cube	0.2106	0.916	No
	natural log	0.2106	0.916	No
	x^4	0.2106	0.916	No
	x^5	0.2106	0.916	No
	x^6	-1	0.916	No

Shapiro-Wilk Normality Test

Constituent: Molybdenum   Analysis Run 8/11/2021 11:02 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	0.327	0.859	No
	square root	0.327	0.859	No
	square	0.327	0.859	No
	cube root	0.327	0.859	No
	cube	0.327	0.859	No
	natural log	0.327	0.859	No
	x^4	0.327	0.859	No
	x^5	0.327	0.859	No
	x^6	0.327	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.3766	0.859	No
	square root	0.3839	0.859	No
	square	0.3637	0.859	No
	cube root	0.3864	0.859	No
	cube	0.3533	0.859	No
	natural log	0.3915	0.859	No
	x^4	0.3452	0.859	No
	x^5	0.3393	0.859	No
	x^6	0.3351	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.2683	0.916	No
	square root	0.2771	0.916	No
	square	0.2529	0.916	No
	cube root	0.2802	0.916	No
	cube	0.2405	0.916	No
	natural log	0.2865	0.916	No
	x^4	0.2312	0.916	No
	x^5	0.2244	0.916	No
	x^6	0.2197	0.916	No

Shapiro-Wilk Normality Test

Constituent: pH Analysis Run 8/11/2021 11:02 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-11 (bg) (n = 17, alpha = 0.05)				
	no	0.9132	0.892	Yes
	square root	0.9089	0.892	Yes
	square	0.9212	0.892	Yes
	cube root	0.9074	0.892	Yes
	cube	0.9284	0.892	Yes
	natural log	0.9044	0.892	Yes
	x^4	0.9346	0.892	Yes
	x^5	0.9399	0.892	Yes
	x^6	0.9442	0.892	Yes
MW-14 (bg) (n = 17, alpha = 0.05)				
	no	0.9588	0.892	Yes
	square root	0.9592	0.892	Yes
	square	0.9576	0.892	Yes
	cube root	0.9592	0.892	Yes
	cube	0.9556	0.892	Yes
	natural log	0.9593	0.892	Yes
	x^4	0.953	0.892	Yes
	x^5	0.9496	0.892	Yes
	x^6	0.9456	0.892	Yes
Pooled Background (bg) (n = 34, alpha = 0.05)				
	no	0.9658	0.933	Yes
	square root	0.9635	0.933	Yes
	square	0.9695	0.933	Yes
	cube root	0.9627	0.933	Yes
	cube	0.972	0.933	Yes
	natural log	0.961	0.933	Yes
	x^4	0.9733	0.933	Yes
	x^5	0.9734	0.933	Yes
	x^6	0.9724	0.933	Yes

Shapiro-Wilk Normality Test

Constituent: Selenium Analysis Run 8/11/2021 11:02 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	-1	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	0.4879	0.859	No
	square root	0.514	0.859	No
	square	0.4306	0.859	No
	cube root	0.5216	0.859	No
	cube	0.3857	0.859	No
	natural log	0.5347	0.859	No
	x^4	0.3583	0.859	No
	x^5	0.3433	0.859	No
	x^6	0.3354	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.3212	0.916	No
	square root	0.3402	0.916	No
	square	0.2813	0.916	No
	cube root	0.3458	0.916	No
	cube	0.2505	0.916	No
	natural log	0.3559	0.916	No
	x^4	0.2318	0.916	No
	x^5	0.2217	0.916	No
	x^6	0.2163	0.916	No

Shapiro-Wilk Normality Test

Constituent: Sulfate   Analysis Run 8/11/2021 11:02 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-11 (bg) (n = 17, alpha = 0.05)				
	no	0.9469	0.892	Yes
	square root	0.9385	0.892	Yes
	square	0.8855	0.892	No
	cube root	0.9288	0.892	Yes
	cube	0.7853	0.892	No
	natural log	0.9006	0.892	Yes
	x^4	0.6955	0.892	No
	x^5	0.6248	0.892	No
	x^6	0.5697	0.892	No
MW-14 (bg) (n = 17, alpha = 0.05)				
	no	0.9208	0.892	Yes
	square root	0.9534	0.892	Yes
	square	0.7898	0.892	No
	cube root	0.9549	0.892	Yes
	cube	0.6459	0.892	No
	natural log	0.9384	0.892	Yes
	x^4	0.5293	0.892	No
	x^5	0.4453	0.892	No
	x^6	0.3875	0.892	No
Pooled Background (bg) (n = 34, alpha = 0.05)				
	no	0.9404	0.933	Yes
	square root	0.9572	0.933	Yes
	square	0.8239	0.933	No
	cube root	0.9534	0.933	Yes
	cube	0.6713	0.933	No
	natural log	0.9285	0.933	No
	x^4	0.5351	0.933	No
	x^5	0.4301	0.933	No
	x^6	0.3545	0.933	No

Shapiro-Wilk Normality Test

Constituent: Thallium Analysis Run 8/11/2021 11:02 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-11 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	-1	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
MW-14 (bg) (n = 12, alpha = 0.05)				
	no	-1	0.859	No
	square root	0	0.859	No
	square	-1	0.859	No
	cube root	-1	0.859	No
	cube	-1	0.859	No
	natural log	0	0.859	No
	x^4	-1	0.859	No
	x^5	-1	0.859	No
	x^6	-1	0.859	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	-1	0.916	No
	square root	0	0.916	No
	square	-1	0.916	No
	cube root	0	0.916	No
	cube	-1	0.916	No
	natural log	0	0.916	No
	x^4	-1	0.916	No
	x^5	-1	0.916	No
	x^6	-1	0.916	No

Shapiro-Wilk Normality Test

Constituent: Total Dissolved Solids Analysis Run 8/11/2021 11:02 AM
Waukegan Generating Station Client: NRG Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-11 (bg) (n = 17, alpha = 0.05)				
	no	0.9083	0.892	Yes
	square root	0.9021	0.892	Yes
	square	0.916	0.892	Yes
	cube root	0.8997	0.892	Yes
	cube	0.9171	0.892	Yes
	natural log	0.8944	0.892	Yes
	x^4	0.9119	0.892	Yes
	x^5	0.9011	0.892	Yes
	x^6	0.8858	0.892	No
MW-14 (bg) (n = 17, alpha = 0.05)				
	no	0.9425	0.892	Yes
	square root	0.9508	0.892	Yes
	square	0.9027	0.892	Yes
	cube root	0.9514	0.892	Yes
	cube	0.8464	0.892	No
	natural log	0.9489	0.892	Yes
	x^4	0.7872	0.892	No
	x^5	0.7324	0.892	No
	x^6	0.6848	0.892	No
Pooled Background (bg) (n = 34, alpha = 0.05)				
	no	0.9429	0.933	Yes
	square root	0.9236	0.933	No
	square	0.9536	0.933	Yes
	cube root	0.9149	0.933	No
	cube	0.9367	0.933	Yes
	natural log	0.8941	0.933	No
	x^4	0.9036	0.933	No
	x^5	0.8622	0.933	No
	x^6	0.8177	0.933	No

Waukega Analysis of Variance - UG Wells

Waukegan Generating Station   Client: NRG   Data: Waukegan   Printed 8/4/2021, 11:48 AM

Constituent	Well	Calc.	Crit.	Sig.	Alpha	Transform	ANOVA Sig.	Alpha	Method
Antimony (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (NDs)
Arsenic (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (eq. var.)
Barium (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (eq. var.)
Boron (mg/L)	n/a	n/a	n/a	n/a	n/a	ln(x)	Yes	0.05	Param.
Cadmium (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	NP (NDs)
Calcium (mg/L)	n/a	n/a	n/a	n/a	n/a	sqrt(x)	Yes	0.05	Param.
Chloride (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	NP (eq. var.)
Chromium (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (eq. var.)
Cobalt (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (eq. var.)
Combined Radium 226 + 228 (pCi/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	Param.
Fluoride (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (normality)
Lead (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	NP (normality)
Lithium (mg/L)	n/a	n/a	n/a	n/a	n/a	ln(x)	Yes	0.05	Param.
Mercury (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	NP (NDs)
Molybdenum (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (normality)
pH (n/a)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	Param.
Selenium (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (normality)
Sulfate (mg/L)	n/a	n/a	n/a	n/a	n/a	sqrt(x)	Yes	0.05	Param.
Total Dissolved Solids (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (eq. var.)

Non-Parametric ANOVA

Constituent: Antimony   Analysis Run 8/4/2021 11:48 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 10.81

Tabulated Chi-Squared value = 5.991 with 2 degrees of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 5.164
Adjusted Kruskal-Wallis statistic (H') = 10.81

Non-Parametric ANOVA

Constituent: Arsenic   Analysis Run 8/4/2021 11:48 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 24.56

Tabulated Chi-Squared value = 5.991 with 2 degrees of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 24.53
Adjusted Kruskal-Wallis statistic (H') = 24.56

Non-Parametric ANOVA

Constituent: Barium Analysis Run 8/4/2021 11:48 AM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 28.06

Tabulated Chi-Squared value = 5.991 with 2 degrees of freedom at the 5% significance level.

There were 4 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 28.02
Adjusted Kruskal-Wallis statistic (H') = 28.06

Parametric ANOVA

Constituent: Boron Analysis Run 8/4/2021 11:48 AM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021 the parametric analysis of variance test (after natural log transformation) indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 231.3

Tabulated F statistic = 3.198 with 2 and 48 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	0.5091	2	0.2545	8.627
Error Within Groups	1.416	48	0.02951	
Total	1.925	50		

The Shapiro Francia normality test on the residuals passed after natural log transformation. Alpha = 0.01, calculated = 0.9454, critical = 0.935. Levene's Equality of Variance test passed. Calculated = 0.1733, tabulated = 3.198.

Non-Parametric ANOVA

Constituent: Cadmium Analysis Run 8/4/2021 11:48 AM

Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates NO DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 4.749

Tabulated Chi-Squared value = 5.991 with 2 degrees of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 2.002
Adjusted Kruskal-Wallis statistic (H') = 4.749

Parametric ANOVA

Constituent: Calcium   Analysis Run 8/4/2021 11:48 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021 the parametric analysis of variance test (after square root transformation) indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 8.06

Tabulated F statistic = 3.198 with 2 and 48 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	0.5091	2	0.2545	8.627
Error Within Groups	1.416	48	0.02951	
Total	1.925	50		

The Shapiro Francia normality test on the residuals passed after square root transformation. Alpha = 0.01, calculated = 0.9404, critical = 0.935. Levene's Equality of Variance test passed. Calculated = 1.812, tabulated = 3.198.

Non-Parametric ANOVA

Constituent: Chloride Analysis Run 8/4/2021 11:48 AM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates NO DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 5.113

Tabulated Chi-Squared value = 5.991 with 2 degrees of freedom at the 5% significance level.

There were 9 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 5.107
Adjusted Kruskal-Wallis statistic (H') = 5.113

Non-Parametric ANOVA

Constituent: Chromium   Analysis Run 8/4/2021 11:48 AM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 19.06

Tabulated Chi-Squared value = 5.991 with 2 degrees of freedom at the 5% significance level.

There were 2 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 17.68
Adjusted Kruskal-Wallis statistic (H') = 19.06

Non-Parametric ANOVA

Constituent: Cobalt Analysis Run 8/4/2021 11:48 AM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 12.15

Tabulated Chi-Squared value = 5.991 with 2 degrees of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 8.083
Adjusted Kruskal-Wallis statistic (H') = 12.15

Parametric ANOVA

Constituent: Combined Radium 226 + 228 Analysis Run 8/4/2021 11:48 AM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021 the parametric analysis of variance test indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 17.4

Tabulated F statistic = 3.293 with 2 and 33 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	0.5091	2	0.2545	8.627
Error Within Groups	1.416	48	0.02951	
Total	1.925	50		

The Shapiro Wilk normality test on the residuals passed on the raw data. Alpha = 0.01, calculated = 0.9614, critical = 0.912. Levene's Equality of Variance test passed. Calculated = 1.867, tabulated = 3.293.

Non-Parametric ANOVA

Constituent: Fluoride Analysis Run 8/4/2021 11:48 AM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 12.03

Tabulated Chi-Squared value = 5.991 with 2 degrees of freedom at the 5% significance level.

There were 11 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 11.95
Adjusted Kruskal-Wallis statistic (H') = 12.03

Non-Parametric ANOVA

Constituent: Lead Analysis Run 8/4/2021 11:48 AM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates NO DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 0.6153

Tabulated Chi-Squared value = 5.991 with 2 degrees of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 0.3559
Adjusted Kruskal-Wallis statistic (H') = 0.6153

Parametric ANOVA

Constituent: Lithium Analysis Run 8/4/2021 11:48 AM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021 the parametric analysis of variance test (after natural log transformation) indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 53.84

Tabulated F statistic = 3.293 with 2 and 33 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	0.5091	2	0.2545	8.627
Error Within Groups	1.416	48	0.02951	
Total	1.925	50		

The Shapiro Wilk normality test on the residuals passed after natural log transformation. Alpha = 0.01, calculated = 0.9671, critical = 0.912. Levene's Equality of Variance test passed. Calculated = 3.21, tabulated = 3.293.

Non-Parametric ANOVA

Constituent: Mercury Analysis Run 8/4/2021 11:48 AM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates NO DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 2

Tabulated Chi-Squared value = 5.991 with 2 degrees of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 0.1622
Adjusted Kruskal-Wallis statistic (H') = 2

Non-Parametric ANOVA

Constituent: Molybdenum Analysis Run 8/4/2021 11:48 AM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 29.23

Tabulated Chi-Squared value = 5.991 with 2 degrees of freedom at the 5% significance level.

There were 4 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 23.42
Adjusted Kruskal-Wallis statistic (H') = 29.23

Parametric ANOVA

Constituent: pH Analysis Run 8/4/2021 11:48 AM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021 the parametric analysis of variance test indicates NO VARIATION at the 5% significance level. Because the calculated F statistic is less than or equal to the tabulated F statistic, the hypothesis of a single homogeneous population is accepted.

Calculated F statistic = 2.715

Tabulated F statistic = 3.198 with 2 and 48 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	0.5091	2	0.2545	8.627
Error Within Groups	1.416	48	0.02951	
Total	1.925	50		

The Shapiro Francia normality test on the residuals passed on the raw data. Alpha = 0.01, calculated = 0.977, critical = 0.935. Levene's Equality of Variance test passed. Calculated = 2.5, tabulated = 3.198.

Non-Parametric ANOVA

Constituent: Selenium Analysis Run 8/4/2021 11:48 AM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 20.69

Tabulated Chi-Squared value = 5.991 with 2 degrees of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 15.3
Adjusted Kruskal-Wallis statistic (H') = 20.69

Parametric ANOVA

Constituent: Sulfate Analysis Run 8/4/2021 11:48 AM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021 the parametric analysis of variance test (after square root transformation) indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 48.86

Tabulated F statistic = 3.198 with 2 and 48 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	0.5091	2	0.2545	8.627
Error Within Groups	1.416	48	0.02951	
Total	1.925	50		

The Shapiro Francia normality test on the residuals passed after square root transformation. Alpha = 0.01, calculated = 0.977, critical = 0.935. Levene's Equality of Variance test passed. Calculated = 0.9626, tabulated = 3.198.

Non-Parametric ANOVA

Constituent: Total Dissolved Solids Analysis Run 8/4/2021 11:48 AM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 10.62

Tabulated Chi-Squared value = 5.991 with 2 degrees of freedom at the 5% significance level.

There were 7 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 10.58
Adjusted Kruskal-Wallis statistic (H') = 10.62

Waukegan Analysis of Variance - UG Wells MW-9 and MW-14

Waukegan Generating Station Client: NRG Data: Waukegan Printed 8/4/2021, 2:55 PM

Constituent	Well	Calc.	Crit.	Sig.	Alpha	Transform	ANOVA Sig.	Alpha	Method
Antimony (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (eq. var.)
Arsenic (mg/L)	n/a	n/a	n/a	n/a	n/a	ln(x)	Yes	0.05	Param.
Barium (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (eq. var.)
Boron (mg/L)	n/a	n/a	n/a	n/a	n/a	ln(x)	Yes	0.05	Param.
Cadmium (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	NP (normality)
Calcium (mg/L)	n/a	n/a	n/a	n/a	n/a	sqrt(x)	Yes	0.05	Param.
Chloride (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	NP (eq. var.)
Chromium (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (eq. var.)
Cobalt (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	NP (eq. var.)
Combined Radium 226 + 228 (pCi/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	Param.
Fluoride (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	Param.
Lead (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	NP (normality)
Lithium (mg/L)	n/a	n/a	n/a	n/a	n/a	ln(x)	Yes	0.05	Param.
Mercury (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	NP (NDs)
Molybdenum (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (eq. var.)
pH (n/a)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	Param.
Selenium (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (eq. var.)
Sulfate (mg/L)	n/a	n/a	n/a	n/a	n/a	sqrt(x)	Yes	0.05	Param.
Total Dissolved Solids (mg/L)	n/a	n/a	n/a	n/a	n/a	sqrt(x)	Yes	0.05	Param.

Non-Parametric ANOVA

Constituent: Antimony   Analysis Run 8/4/2021 2:55 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 4.965

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 3.203
Adjusted Kruskal-Wallis statistic (H') = 4.965

Parametric ANOVA

Constituent: Arsenic Analysis Run 8/4/2021 2:55 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021 the parametric analysis of variance test (after natural log transformation) indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 106.9

Tabulated F statistic = 4.3 with 1 and 22 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	613.2	1	613.2	13.85
Error Within Groups	1417	32	44.28	
Total	2030	33		

The Shapiro Wilk normality test on the residuals passed after natural log transformation. Alpha = 0.01, calculated = 0.9221, critical = 0.884. Levene's Equality of Variance test passed. Calculated = 0.6293, tabulated = 4.3.

Non-Parametric ANOVA

Constituent: Barium Analysis Run 8/4/2021 2:55 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 17.06

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 2 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 17.04
Adjusted Kruskal-Wallis statistic (H') = 17.06

Parametric ANOVA

Constituent: Boron   Analysis Run 8/4/2021 2:55 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021 the parametric analysis of variance test (after natural log transformation) indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 388.4

Tabulated F statistic = 4.152 with 1 and 32 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	613.2	1	613.2	13.85
Error Within Groups	1417	32	44.28	
Total	2030	33		

The Shapiro Wilk normality test on the residuals passed after natural log transformation. Alpha = 0.01, calculated = 0.9516, critical = 0.908. Levene's Equality of Variance test passed. Calculated = 0.002989, tabulated = 4.152.

Non-Parametric ANOVA

Constituent: Cadmium Analysis Run 8/4/2021 2:55 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates NO DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 0.9735

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 0.5633
Adjusted Kruskal-Wallis statistic (H') = 0.9735

Parametric ANOVA

Constituent: Calcium Analysis Run 8/4/2021 2:55 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021 the parametric analysis of variance test (after square root transformation) indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 9.841

Tabulated F statistic = 4.152 with 1 and 32 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	613.2	1	613.2	13.85
Error Within Groups	1417	32	44.28	
Total	2030	33		

The Shapiro Wilk normality test on the residuals passed after square root transformation. Alpha = 0.01, calculated = 0.9409, critical = 0.908. Levene's Equality of Variance test passed. Calculated = 0.9627, tabulated = 4.152.

Non-Parametric ANOVA

Constituent: Chloride   Analysis Run 8/4/2021 2:55 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates NO DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 0.9647

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 4 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 0.9636
Adjusted Kruskal-Wallis statistic (H') = 0.9647

Non-Parametric ANOVA

Constituent: Chromium   Analysis Run 8/4/2021 2:55 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 10.09

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 2 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 9.72
Adjusted Kruskal-Wallis statistic (H') = 10.09

Non-Parametric ANOVA

Constituent: Cobalt   Analysis Run 8/4/2021 2:55 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates NO DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 3.806

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 3.203
Adjusted Kruskal-Wallis statistic (H') = 3.806

Parametric ANOVA

Constituent: Combined Radium 226 + 228 Analysis Run 8/4/2021 2:55 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021 the parametric analysis of variance test indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 6.243

Tabulated F statistic = 4.3 with 1 and 22 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	613.2	1	613.2	13.85
Error Within Groups	1417	32	44.28	
Total	2030	33		

The Shapiro Wilk normality test on the residuals passed on the raw data. Alpha = 0.01, calculated = 0.9495, critical = 0.884. Levene's Equality of Variance test passed. Calculated = 0.1851, tabulated = 4.3.

Parametric ANOVA

Constituent: Fluoride   Analysis Run 8/4/2021 2:55 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021 the parametric analysis of variance test indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 9

Tabulated F statistic = 4.152 with 1 and 32 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	613.2	1	613.2	13.85
Error Within Groups	1417	32	44.28	
Total	2030	33		

The Shapiro Wilk normality test on the residuals passed on the raw data. Alpha = 0.01, calculated = 0.9298, critical = 0.908. Levene's Equality of Variance test passed. Calculated = 0.01592, tabulated = 4.152.

Non-Parametric ANOVA

Constituent: Lead Analysis Run 8/4/2021 2:55 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates NO DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 0.697

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 0.4033
Adjusted Kruskal-Wallis statistic (H') = 0.697

Parametric ANOVA

Constituent: Lithium Analysis Run 8/4/2021 2:55 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021 the parametric analysis of variance test (after natural log transformation) indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 80.35

Tabulated F statistic = 4.3 with 1 and 22 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	613.2	1	613.2	13.85
Error Within Groups	1417	32	44.28	
Total	2030	33		

The Shapiro Wilk normality test on the residuals passed after natural log transformation. Alpha = 0.01, calculated = 0.9395, critical = 0.884. Levene's Equality of Variance test passed. Calculated = 0.8292, tabulated = 4.3.

Non-Parametric ANOVA

Constituent: Mercury   Analysis Run 8/4/2021 2:55 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates NO DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 1

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 0.12
Adjusted Kruskal-Wallis statistic (H') = 1

Non-Parametric ANOVA

Constituent: Molybdenum Analysis Run 8/4/2021 2:55 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 18.64

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 4 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 17.28
Adjusted Kruskal-Wallis statistic (H') = 18.64

Parametric ANOVA

Constituent: pH   Analysis Run 8/4/2021 2:55 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021 the parametric analysis of variance test indicates NO VARIATION at the 5% significance level. Because the calculated F statistic is less than or equal to the tabulated F statistic, the hypothesis of a single homogeneous population is accepted.

Calculated F statistic = 2.083

Tabulated F statistic = 4.152 with 1 and 32 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	613.2	1	613.2	13.85
Error Within Groups	1417	32	44.28	
Total	2030	33		

The Shapiro Wilk normality test on the residuals passed on the raw data. Alpha = 0.01, calculated = 0.977, critical = 0.908. Levene's Equality of Variance test passed. Calculated = 3.567, tabulated = 4.152.

Non-Parametric ANOVA

Constituent: Selenium Analysis Run 8/4/2021 2:55 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 10.75

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 9.72
Adjusted Kruskal-Wallis statistic (H') = 10.75

Parametric ANOVA

Constituent: Sulfate Analysis Run 8/4/2021 2:55 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021 the parametric analysis of variance test (after square root transformation) indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 64.33

Tabulated F statistic = 4.152 with 1 and 32 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	613.2	1	613.2	13.85
Error Within Groups	1417	32	44.28	
Total	2030	33		

The Shapiro Wilk normality test on the residuals passed after square root transformation. Alpha = 0.01, calculated = 0.9718, critical = 0.908. Levene's Equality of Variance test passed. Calculated = 0.3482, tabulated = 4.152.

Parametric ANOVA

Constituent: Total Dissolved Solids   Analysis Run 8/4/2021 2:55 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021 the parametric analysis of variance test (after square root transformation) indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 13.85

Tabulated F statistic = 4.152 with 1 and 32 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	613.2	1	613.2	13.85
Error Within Groups	1417	32	44.28	
Total	2030	33		

The Shapiro Wilk normality test on the residuals passed after square root transformation. Alpha = 0.01, calculated = 0.9547, critical = 0.908. Levene's Equality of Variance test passed. Calculated = 2.513, tabulated = 4.152.

Waukegan Analysis of Variance - UG Wells MW-9 and MW-11

Waukegan Generating Station   Client: NRG   Data: Waukegan   Printed 8/4/2021, 2:58 PM

Constituent	Well	Calc.	Crit.	Sig.	Alpha	Transform	ANOVA Sig.	Alpha	Method
Antimony (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	NP (NDs)
Arsenic (mg/L)	n/a	n/a	n/a	n/a	n/a	x^(1/3)	Yes	0.05	Param.
Barium (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (eq. var.)
Boron (mg/L)	n/a	n/a	n/a	n/a	n/a	ln(x)	Yes	0.05	Param.
Cadmium (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	NP (NDs)
Calcium (mg/L)	n/a	n/a	n/a	n/a	n/a	sqrt(x)	Yes	0.05	Param.
Chloride (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	NP (eq. var.)
Chromium (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	NP (eq. var.)
Cobalt (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	NP (NDs)
Combined Radium 226 + 228 (pCi/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	Param.
Fluoride (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	NP (normality)
Lead (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	NP (normality)
Lithium (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (eq. var.)
Molybdenum (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (eq. var.)
pH (n/a)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	Param.
Selenium (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (normality)
Sulfate (mg/L)	n/a	n/a	n/a	n/a	n/a	sqrt(x)	Yes	0.05	Param.
Total Dissolved Solids (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	NP (eq. var.)

Non-Parametric ANOVA

Constituent: Antimony Analysis Run 8/4/2021 2:58 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates NO DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 1

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 0.12
Adjusted Kruskal-Wallis statistic (H') = 1

Parametric ANOVA

Constituent: Arsenic   Analysis Run 8/4/2021 2:58 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021 the parametric analysis of variance test (after cube root transformation) indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 289.4

Tabulated F statistic = 4.3 with 1 and 22 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	0.4098	1	0.4098	15.79
Error Within Groups	0.8307	32	0.02596	
Total	1.241	33		

The Shapiro Wilk normality test on the residuals passed after cube root transformation. Alpha = 0.01, calculated = 0.8993, critical = 0.884. Levene's Equality of Variance test passed. Calculated = 0.05231, tabulated = 4.3.

Non-Parametric ANOVA

Constituent: Barium Analysis Run 8/4/2021 2:58 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 12.85

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 4 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 12.81
Adjusted Kruskal-Wallis statistic (H') = 12.85

Parametric ANOVA

Constituent: Boron Analysis Run 8/4/2021 2:58 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021 the parametric analysis of variance test (after natural log transformation) indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 183.5

Tabulated F statistic = 4.152 with 1 and 32 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	0.4098	1	0.4098	15.79
Error Within Groups	0.8307	32	0.02596	
Total	1.241	33		

The Shapiro Wilk normality test on the residuals passed after natural log transformation. Alpha = 0.01, calculated = 0.9128, critical = 0.908. Levene's Equality of Variance test passed. Calculated = 0.284, tabulated = 4.152.

Non-Parametric ANOVA

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates NO DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 2.087

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 0.48
Adjusted Kruskal-Wallis statistic (H') = 2.087

Parametric ANOVA

Constituent: Calcium   Analysis Run 8/4/2021 2:58 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021 the parametric analysis of variance test (after square root transformation) indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 10.62

Tabulated F statistic = 4.152 with 1 and 32 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	0.4098	1	0.4098	15.79
Error Within Groups	0.8307	32	0.02596	
Total	1.241	33		

The Shapiro Wilk normality test on the residuals passed after square root transformation. Alpha = 0.01, calculated = 0.9362, critical = 0.908. Levene's Equality of Variance test passed. Calculated = 3.17, tabulated = 4.152.

Non-Parametric ANOVA

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates NO DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 0.6845

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 5 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 0.6833
Adjusted Kruskal-Wallis statistic (H') = 0.6845

Non-Parametric ANOVA

Constituent: Chromium   Analysis Run 8/4/2021 2:58 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates NO DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 0.004406

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 0.003333
Adjusted Kruskal-Wallis statistic (H') = 0.004406

Non-Parametric ANOVA

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates NO DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 3.268

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 1.08
Adjusted Kruskal-Wallis statistic (H') = 3.268

Parametric ANOVA

Constituent: Combined Radium 226 + 228 Analysis Run 8/4/2021 2:58 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021 the parametric analysis of variance test indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 31.4

Tabulated F statistic = 4.3 with 1 and 22 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	0.4098	1	0.4098	15.79
Error Within Groups	0.8307	32	0.02596	
Total	1.241	33		

The Shapiro Wilk normality test on the residuals passed on the raw data. Alpha = 0.01, calculated = 0.9719, critical = 0.884. Levene's Equality of Variance test passed. Calculated = 3.456, tabulated = 4.3.

Non-Parametric ANOVA

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates NO DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 0.0003006

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 7 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 0.0002966
Adjusted Kruskal-Wallis statistic (H') = 0.0003006

Non-Parametric ANOVA

Constituent: Lead Analysis Run 8/4/2021 2:58 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates NO DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 0.2379

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 0.12
Adjusted Kruskal-Wallis statistic (H') = 0.2379

Non-Parametric ANOVA

Constituent: Lithium   Analysis Run 8/4/2021 2:58 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 7.23

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 4 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 7.208
Adjusted Kruskal-Wallis statistic (H') = 7.23

Non-Parametric ANOVA

Constituent: Molybdenum Analysis Run 8/4/2021 2:58 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 19.14

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 4 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 17.28
Adjusted Kruskal-Wallis statistic (H') = 19.14

Parametric ANOVA

Constituent: pH   Analysis Run 8/4/2021 2:58 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021 the parametric analysis of variance test indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 4.325

Tabulated F statistic = 4.152 with 1 and 32 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	0.4098	1	0.4098	15.79
Error Within Groups	0.8307	32	0.02596	
Total	1.241	33		

The Shapiro Wilk normality test on the residuals passed on the raw data. Alpha = 0.01, calculated = 0.9827, critical = 0.908. Levene's Equality of Variance test passed. Calculated = 2.92, tabulated = 4.152.

Non-Parametric ANOVA

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 14.96

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 12
Adjusted Kruskal-Wallis statistic (H') = 14.96

Parametric ANOVA

Constituent: Sulfate Analysis Run 8/4/2021 2:58 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 5/6/2021 the parametric analysis of variance test (after square root transformation) indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 75.14

Tabulated F statistic = 4.152 with 1 and 32 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	0.4098	1	0.4098	15.79
Error Within Groups	0.8307	32	0.02596	
Total	1.241	33		

The Shapiro Wilk normality test on the residuals passed after square root transformation. Alpha = 0.01, calculated = 0.9682, critical = 0.908. Levene's Equality of Variance test passed. Calculated = 0.4734, tabulated = 4.152.

Non-Parametric ANOVA

For observations made between 11/4/2015 and 5/6/2021, the non-parametric analysis of variance test indicates NO DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 2.586

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 6 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 2.565
Adjusted Kruskal-Wallis statistic (H') = 2.586

Waukegan Analysis of Variance - UG Wells MW-11 and MW-14

Waukegan Generating Station   Client: NRG   Data: Waukegan   Printed 8/4/2021, 12:03 PM

Constituent	Well	Calc.	Crit.	Sig.	Alpha	Transform	ANOVA Sig.	Alpha	Method
Antimony (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (eq. var.)
Arsenic (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	NP (eq. var.)
Barium (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (eq. var.)
Boron (mg/L)	n/a	n/a	n/a	n/a	n/a	sqrt(x)	Yes	0.05	Param.
Cadmium (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (NDs)
Calcium (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	Param.
Chloride (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	Param.
Chromium (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (eq. var.)
Cobalt (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (eq. var.)
Combined Radium 226 + 228 (pCi/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	Param.
Fluoride (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (normality)
Lead (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	NP (normality)
Lithium (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	Param.
Mercury (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	NP (NDs)
Molybdenum (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	NP (NDs)
pH (n/a)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	Param.
Selenium (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	NP (NDs)
Sulfate (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	Param.
Total Dissolved Solids (mg/L)	n/a	n/a	n/a	n/a	n/a	No	Yes	0.05	NP (eq. var.)

Non-Parametric ANOVA

Constituent: Antimony   Analysis Run 8/4/2021 12:03 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/5/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 7.465

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 4.32
Adjusted Kruskal-Wallis statistic (H') = 7.465

Non-Parametric ANOVA

Constituent: Arsenic Analysis Run 8/4/2021 12:03 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/5/2015 and 5/6/2021, the non-parametric analysis of variance test indicates NO DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 2.613

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 0 groups of ties in the data, so no adjustment to the Kruskal-Wallis statistic (H) was necessary.

Non-Parametric ANOVA

Constituent: Barium   Analysis Run 8/4/2021 12:03 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/5/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 15.45

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 3 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 15.41
Adjusted Kruskal-Wallis statistic (H') = 15.45

Parametric ANOVA

Constituent: Boron   Analysis Run 8/4/2021 12:03 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/5/2015 and 5/6/2021 the parametric analysis of variance test (after square root transformation) indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 65.52

Tabulated F statistic = 4.152 with 1 and 32 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	0.3515	1	0.3515	15.73
Error Within Groups	0.7152	32	0.02235	
Total	1.067	33		

The Shapiro Wilk normality test on the residuals passed after square root transformation. Alpha = 0.01, calculated = 0.9512, critical = 0.908. Levene's Equality of Variance test passed. Calculated = 2.961, tabulated = 4.152.

Non-Parametric ANOVA

Constituent: Cadmium Analysis Run 8/4/2021 12:03 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/5/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 4.553

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 1.92
Adjusted Kruskal-Wallis statistic (H') = 4.553

Parametric ANOVA

Constituent: Calcium Analysis Run 8/4/2021 12:03 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/5/2015 and 5/6/2021 the parametric analysis of variance test indicates NO VARIATION at the 5% significance level. Because the calculated F statistic is less than or equal to the tabulated F statistic, the hypothesis of a single homogeneous population is accepted.

Calculated F statistic = 0.01193

Tabulated F statistic = 4.152 with 1 and 32 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	0.3515	1	0.3515	15.73
Error Within Groups	0.7152	32	0.02235	
Total	1.067	33		

The Shapiro Wilk normality test on the residuals passed on the raw data. Alpha = 0.01, calculated = 0.9648, critical = 0.908. Levene's Equality of Variance test passed. Calculated = 1.177, tabulated = 4.152.

Parametric ANOVA

Constituent: Chloride Analysis Run 8/4/2021 12:03 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/5/2015 and 5/6/2021 the parametric analysis of variance test indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 8.546

Tabulated F statistic = 4.152 with 1 and 32 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	0.3515	1	0.3515	15.73
Error Within Groups	0.7152	32	0.02235	
Total	1.067	33		

The Shapiro Wilk normality test on the residuals passed on the raw data. Alpha = 0.01, calculated = 0.9481, critical = 0.908. Levene's Equality of Variance test passed. Calculated = 1.649, tabulated = 4.152.

Non-Parametric ANOVA

Constituent: Chromium   Analysis Run 8/4/2021 12:03 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/5/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 17.23

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 2 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 16.8
Adjusted Kruskal-Wallis statistic (H') = 17.23

Non-Parametric ANOVA

Constituent: Cobalt Analysis Run 8/4/2021 12:03 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/5/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 10.9

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 7.68
Adjusted Kruskal-Wallis statistic (H') = 10.9

Parametric ANOVA

Constituent: Combined Radium 226 + 228 Analysis Run 8/4/2021 12:03 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/5/2015 and 5/6/2021 the parametric analysis of variance test indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 11.35

Tabulated F statistic = 4.3 with 1 and 22 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	0.3515	1	0.3515	15.73
Error Within Groups	0.7152	32	0.02235	
Total	1.067	33		

The Shapiro Wilk normality test on the residuals passed on the raw data. Alpha = 0.01, calculated = 0.9564, critical = 0.884. Levene's Equality of Variance test passed. Calculated = 1.684, tabulated = 4.3.

Non-Parametric ANOVA

Constituent: Fluoride   Analysis Run 8/4/2021 12:03 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/5/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 8.527

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 7 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 8.471
Adjusted Kruskal-Wallis statistic (H') = 8.527

Non-Parametric ANOVA

Constituent: Lead   Analysis Run 8/4/2021 12:03 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/5/2015 and 5/6/2021, the non-parametric analysis of variance test indicates NO DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 0.02066

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 0.01333
Adjusted Kruskal-Wallis statistic (H') = 0.02066

Parametric ANOVA

Constituent: Lithium   Analysis Run 8/4/2021 12:03 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/5/2015 and 5/6/2021 the parametric analysis of variance test indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 60.84

Tabulated F statistic = 4.3 with 1 and 22 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	0.3515	1	0.3515	15.73
Error Within Groups	0.7152	32	0.02235	
Total	1.067	33		

The Shapiro Wilk normality test on the residuals passed on the raw data. Alpha = 0.01, calculated = 0.8888, critical = 0.884. Levene's Equality of Variance test passed. Calculated = 2.437, tabulated = 4.3.

Non-Parametric ANOVA

Constituent: Mercury Analysis Run 8/4/2021 12:03 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/5/2015 and 5/6/2021, the non-parametric analysis of variance test indicates NO DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 1

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 0.12
Adjusted Kruskal-Wallis statistic (H') = 1

Non-Parametric ANOVA

Constituent: Molybdenum   Analysis Run 8/4/2021 12:03 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/5/2015 and 5/6/2021, the non-parametric analysis of variance test indicates NO DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 0.4943

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 0.1633
Adjusted Kruskal-Wallis statistic (H') = 0.4943

Parametric ANOVA

Constituent: pH   Analysis Run 8/4/2021 12:03 PM

Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/5/2015 and 5/6/2021 the parametric analysis of variance test indicates NO VARIATION at the 5% significance level. Because the calculated F statistic is less than or equal to the tabulated F statistic, the hypothesis of a single homogeneous population is accepted.

Calculated F statistic = 0.8333

Tabulated F statistic = 4.152 with 1 and 32 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	0.3515	1	0.3515	15.73
Error Within Groups	0.7152	32	0.02235	
Total	1.067	33		

The Shapiro Wilk normality test on the residuals passed on the raw data. Alpha = 0.01, calculated = 0.956, critical = 0.908. Levene's Equality of Variance test passed. Calculated = 0.0213, tabulated = 4.152.

Non-Parametric ANOVA

Constituent: Selenium   Analysis Run 8/4/2021 12:03 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/5/2015 and 5/6/2021, the non-parametric analysis of variance test indicates NO DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 3.268

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 1.08
Adjusted Kruskal-Wallis statistic (H') = 3.268

Parametric ANOVA

Constituent: Sulfate Analysis Run 8/4/2021 12:03 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/5/2015 and 5/6/2021 the parametric analysis of variance test indicates NO VARIATION at the 5% significance level. Because the calculated F statistic is less than or equal to the tabulated F statistic, the hypothesis of a single homogeneous population is accepted.

Calculated F statistic = 0.01002

Tabulated F statistic = 4.152 with 1 and 32 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	0.3515	1	0.3515	15.73
Error Within Groups	0.7152	32	0.02235	
Total	1.067	33		

The Shapiro Wilk normality test on the residuals passed on the raw data. Alpha = 0.01, calculated = 0.9391, critical = 0.908. Levene's Equality of Variance test passed. Calculated = 2.117, tabulated = 4.152.

Non-Parametric ANOVA

Constituent: Total Dissolved Solids   Analysis Run 8/4/2021 12:03 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/5/2015 and 5/6/2021, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 4.237

Tabulated Chi-Squared value = 3.841 with 1 degree of freedom at the 5% significance level.

There were 5 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 4.2
Adjusted Kruskal-Wallis statistic (H') = 4.237

Waukegan Analysis of Variance - Original 8 UG Wells MW-11 and MW-14

Waukegan Generating Station   Client: NRG   Data: Waukegan   Printed 8/5/2021, 2:18 PM

Constituent	Well	Calc.	Crit.	Sig.	Alpha	Transform	ANOVA Sig.	Alpha	Method
Chloride (mg/L)	n/a	n/a	n/a	n/a	n/a	sqrt(x)	No	0.05	Param.
Sulfate (mg/L)	n/a	n/a	n/a	n/a	n/a	No	No	0.05	Param.
Total Dissolved Solids (mg/L)	n/a	n/a	n/a	n/a	n/a	x^5	No	0.05	Param.

Non-Parametric ANOVA

Constituent: Chloride   Analysis Run 8/5/2021 2:16 PM

Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/4/2015 and 7/6/2017, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 8.877

Tabulated Chi-Squared value = 5.991 with 2 degrees of freedom at the 5% significance level.

There were 3 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.

Kruskal-Wallis statistic (H) = 8.854

Adjusted Kruskal-Wallis statistic (H') = 8.877

Parametric ANOVA

Constituent: Sulfate Analysis Run 8/5/2021 2:16 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 11/4/2015 and 7/6/2017 the parametric analysis of variance test (after natural log transformation) indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 20.27

Tabulated F statistic = 3.47 with 2 and 21 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	0.2549	2	0.1274	6.267
Error Within Groups	0.427	21	0.02034	
Total	0.6819	23		

The Shapiro Wilk normality test on the residuals passed after natural log transformation. Alpha = 0.01, calculated = 0.9818, critical = 0.884. Levene's Equality of Variance test passed. Calculated = 2.228, tabulated = 3.47.

Non-Parametric ANOVA

Constituent: Total Dissolved Solids   Analysis Run 8/5/2021 2:16 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

For observations made between 11/4/2015 and 7/6/2017, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 7.585

Tabulated Chi-Squared value = 5.991 with 2 degrees of freedom at the 5% significance level.

There were 4 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 7.46
Adjusted Kruskal-Wallis statistic (H') = 7.585

Interwell Prediction Limit MW-9 MW-11 MW-14 UG

Waukegan Generating Station   Client: NRG   Data: Waukegan   Printed 8/5/2021, 2:57 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	%NDs	Transform	Alpha	Method
Beryllium (mg/L)	n/a	0.001	n/a	n/a	5 future	n/a	36	100	n/a	0.001354	NP (NDs) 1 of 2
Lead (mg/L)	n/a	0.001135	n/a	n/a	5 future	n/a	36	72.22	n/a	0.001354	NP (NDs) 1 of 2 Deseas
Thallium (mg/L)	n/a	0.002	n/a	n/a	5 future	n/a	36	100	n/a	0.001354	NP (NDs) 1 of 2

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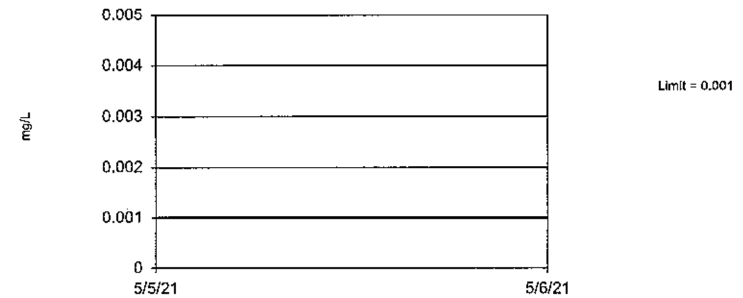
Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. All background values (n = 36) were censored; limit is most recent reporting limit. Annual per-constituent alpha = 0.02674. Individual comparison alpha = 0.001354 (1 of 2). Assumes 5 future values. Seasonality was not detected with 95% confidence.

Constituent: Beryllium Analysis Run 8/5/2021 2:56 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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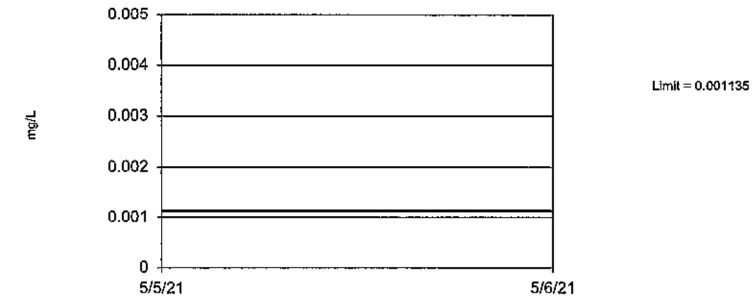
Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 36 background values. 72.22% NDs. Annual per-constituent alpha = 0.02674. Individual comparison alpha = 0.001354 (1 of 2). Assumes 5 future values. Data were deseasonalized.

Constituent: Lead Analysis Run 8/5/2021 2:56 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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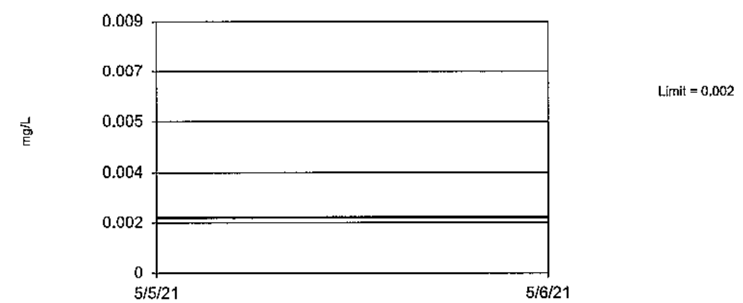
Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. All background values (n = 36) were censored; limit is most recent reporting limit. Annual per-constituent alpha = 0.02674. Individual comparison alpha = 0.001354 (1 of 2). Assumes 5 future values. Seasonality was not detected with 95% confidence.

Constituent: Thallium Analysis Run 8/5/2021 2:56 PM
Waukegan Generating Station Client: NRG Data: Waukegan

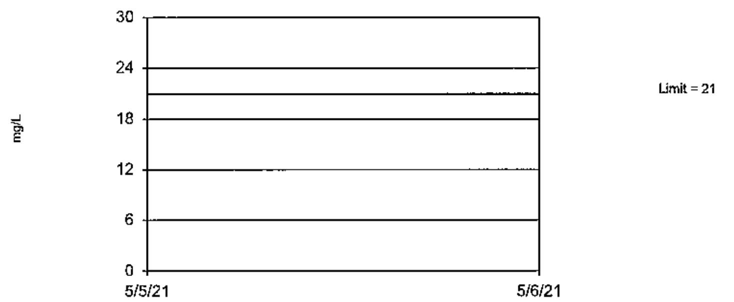
Interwell Prediction Limit Pooled MW-14/MW-11

Waukegan Generating Station Client: NRG Data: Waukegan Printed 8/5/2021, 2:38 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	%NDs	Transform	Alpha	Method
Arsenic (mg/L)	n/a	21	n/a	n/a	5 future	n/a	24	0	n/a	0.002808	NP (normality) 1 of 2
Molybdenum (mg/L)	n/a	0.0094	n/a	n/a	5 future	n/a	24	87.5	n/a	0.002808	NP (NDs) 1 of 2
pH (n/a)	n/a	7.741	6.514	n/a	5 future	n/a	34	0	No	0.000...	Param 1 of 2
Selenium (mg/L)	n/a	0.014	n/a	n/a	5 future	n/a	24	87.5	n/a	0.002808	NP (NDs) 1 of 2

Prediction Limit

Interwell Non-parametric

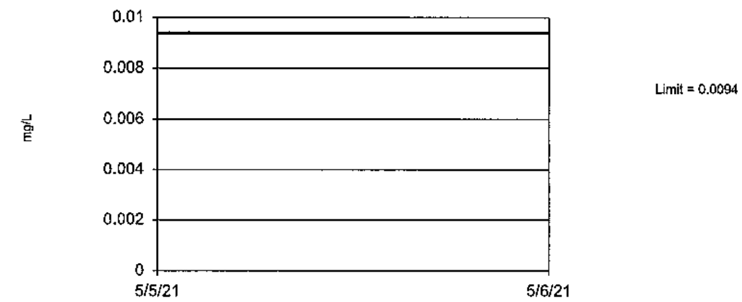


Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 24 background values. Annual per-constituent alpha = 0.0547. Individual comparison alpha = 0.002808 (1 of 2). Assumes 5 future values. Seasonality was not detected with 95% confidence.

Constituent: Arsenic Analysis Run 8/5/2021 2:34 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Prediction Limit

Interwell Non-parametric

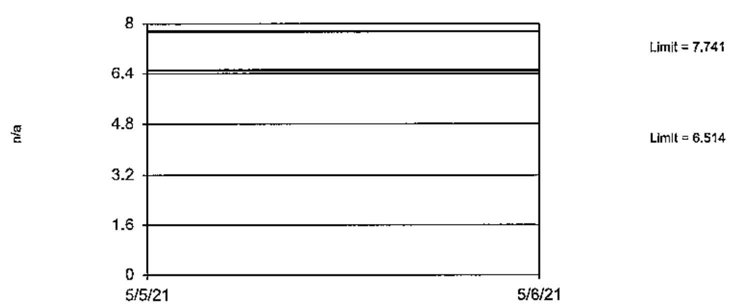


Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 24 background values. 87.5% NDs. Annual per-constituent alpha = 0.0547. Individual comparison alpha = 0.002808 (1 of 2). Assumes 5 future values. Seasonality was not detected with 95% confidence.

Constituent: Molybdenum Analysis Run 8/5/2021 2:34 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Prediction Limit

Interwell Parametric

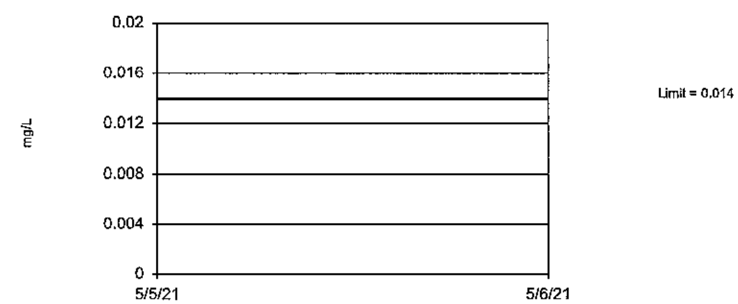


Background Data Summary: Mean=7.127, Std. Dev.=0.253, n=34. Seasonality was not detected with 95% confidence. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9658, critical = 0.933. Kappa = 2.425 (c=22, w=5, 1 of 2, event alpha = 0.026). Report alpha = 0.001197. Individual comparison alpha = 0.0001197. Assumes 5 future values.

Constituent: pH Analysis Run 8/5/2021 2:34 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 24 background values. 87.5% NDs. Annual per-constituent alpha = 0.0547. Individual comparison alpha = 0.002808 (1 of 2). Assumes 5 future values. Seasonality was not detected with 95% confidence.

Constituent: Selenium Analysis Run 8/5/2021 2:34 PM
Waukegan Generating Station Client: NRG Data: Waukegan

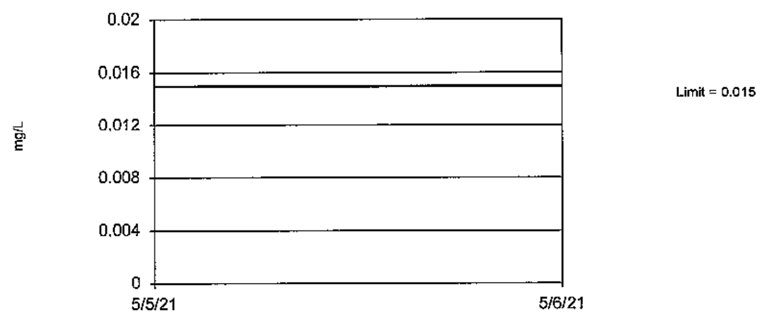
Interwell Waukegan Interwell PL UG MW-14

Waukegan Generating Station Client: NRG Data: Waukegan Printed 8/11/2021, 2:21 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	%NDs	Transform	Alpha	Method
Antimony (mg/L)	n/a	0.015	n/a	n/a	5 future	n/a	12	50	n/a	0.00828	NP (normality) 1 of 2
Cadmium (mg/L)	n/a	0.002	n/a	n/a	5 future	n/a	12	66.67	n/a	0.00828	NP (NDs) 1 of 2
Chromium (mg/L)	n/a	4.8	n/a	n/a	5 future	n/a	12	0	n/a	0.00828	NP (normality) 1 of 2
Cobalt (mg/L)	n/a	0.007	n/a	n/a	5 future	n/a	12	33.33	n/a	0.00828	NP (normality) 1 of 2
Combined Radium 226 + 228 (pCi/L)	n/a	1.566	n/a	n/a	5 future	n/a	12	41.67	No	0.000...	Param 1 of 2
Fluoride (mg/L)	n/a	0.3342	n/a	n/a	5 future	n/a	17	0	No	0.000...	Param 1 of 2
Lithium (mg/L)	n/a	0.03962	n/a	n/a	5 future	n/a	12	0	No	0.000...	Param 1 of 2
Mercury (mg/L)	n/a	0.00043	n/a	n/a	5 future	n/a	12	91.67	n/a	0.00828	NP (NDs) 1 of 2

Prediction Limit

Interwell Non-parametric

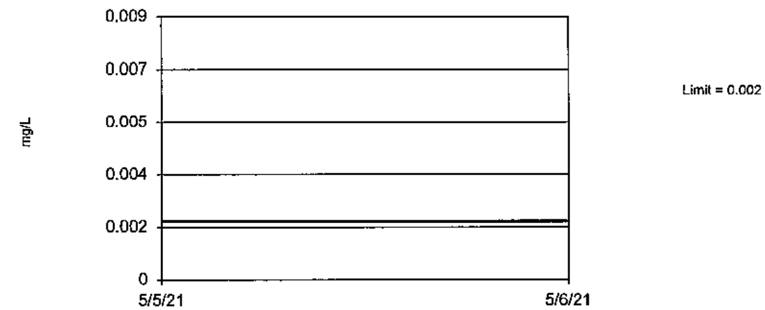


Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 12 background values. 50% NDs. Annual per-constituent alpha = 0.1532. Individual comparison alpha = 0.00828 (1 of 2). Assumes 5 future values. Insufficient data to test for seasonality; data will not be deseasonalized.

Constituent: Antimony Analysis Run 8/11/2021 2:20 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Prediction Limit

Interwell Non-parametric

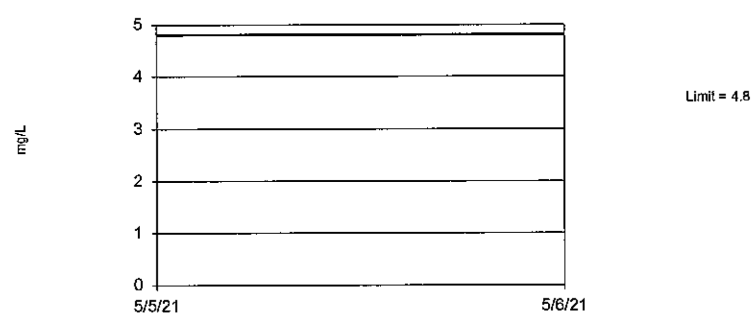


Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 12 background values. 66.67% NDs. Annual per-constituent alpha = 0.1532. Individual comparison alpha = 0.00828 (1 of 2). Assumes 5 future values. Insufficient data to test for seasonality; data will not be deseasonalized.

Constituent: Cadmium Analysis Run 8/11/2021 2:20 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Prediction Limit

Interwell Non-parametric

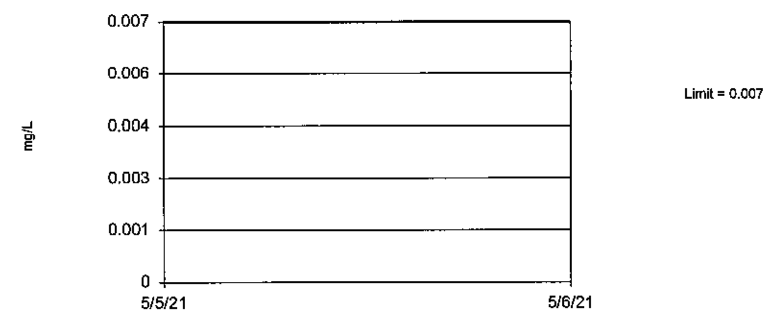


Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 12 background values. Annual per-constituent alpha = 0.1532. Individual comparison alpha = 0.00828 (1 of 2). Assumes 5 future values. Insufficient data to test for seasonality; data will not be deseasonalized.

Constituent: Chromium Analysis Run 8/11/2021 2:20 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Prediction Limit

Interwell Non-parametric

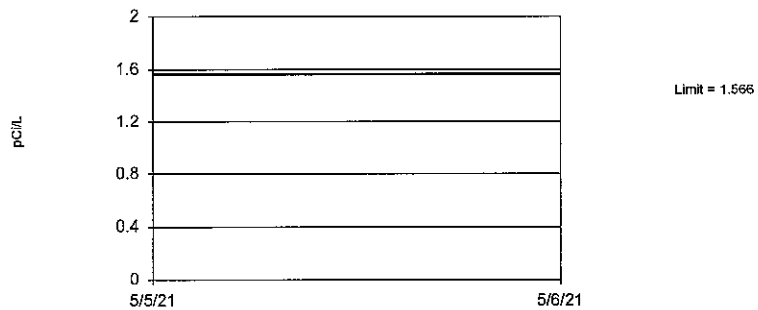


Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 12 background values. 33.33% NDs. Annual per-constituent alpha = 0.1532. Individual comparison alpha = 0.00828 (1 of 2). Assumes 5 future values. Insufficient data to test for seasonality; data will not be deseasonalized.

Constituent: Cobalt Analysis Run 8/11/2021 2:20 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Prediction Limit

Interwell Parametric



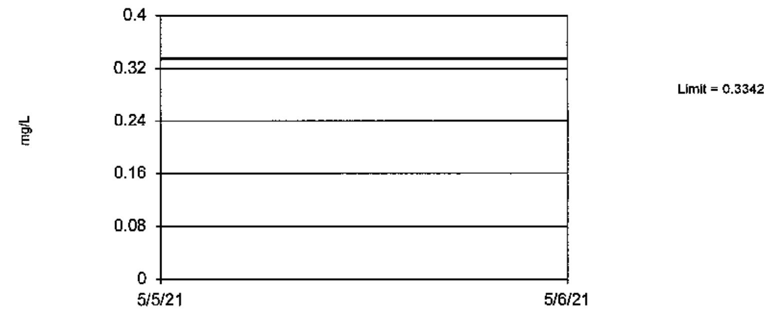
Background Data Summary (after Kaplan-Meier Adjustment): Mean=0.6694, Std. Dev.=0.2931, n=12, 41.67% NDs. Insufficient data to test for seasonality; not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.927, critical = 0.859. Kappa = 3.061 (c=22, w=5, 1 of 2, event alpha = 0.026). Report alpha = 0.001197. Individual comparison alpha = 0.0002394. Assumes 5 future values.

Constituent: Combined Radium 226 + 228 Analysis Run 8/11/2021 2:20 PM

Waukegan Generating Station Client: NRG Data: Waukegan

Prediction Limit

Interwell Parametric



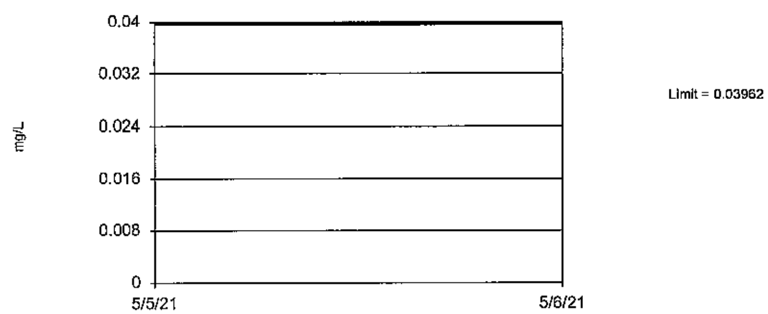
Background Data Summary: Mean=0.1988, Std. Dev.=0.0491, n=17. Insufficient data to test for seasonality; not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9658, critical = 0.892. Kappa = 2.757 (c=22, w=5, 1 of 2, event alpha = 0.026). Report alpha = 0.001197. Individual comparison alpha = 0.0002394. Assumes 5 future values.

Constituent: Fluoride Analysis Run 8/11/2021 2:20 PM

Waukegan Generating Station Client: NRG Data: Waukegan

Prediction Limit

Interwell Parametric



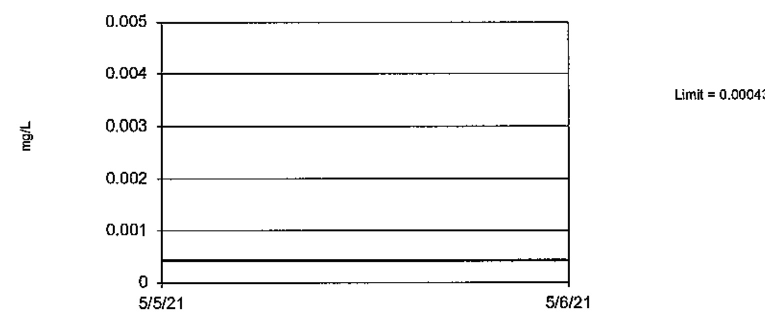
Background Data Summary: Mean=0.02117, Std. Dev.=0.006028, n=12. Insufficient data to test for seasonality; not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9517, critical = 0.859. Kappa = 3.061 (c=22, w=5, 1 of 2, event alpha = 0.026). Report alpha = 0.001197. Individual comparison alpha = 0.0002394. Assumes 5 future values.

Constituent: Lithium Analysis Run 8/11/2021 2:20 PM

Waukegan Generating Station Client: NRG Data: Waukegan

Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 12 background values. 91.67% NDs. Annual per-constituent alpha = 0.1532. Individual comparison alpha = 0.00828 (1 of 2). Assumes 5 future values. Insufficient data to test for seasonality; data will not be deseasonalized.

Constituent: Mercury Analysis Run 8/11/2021 2:20 PM

Waukegan Generating Station Client: NRG Data: Waukegan

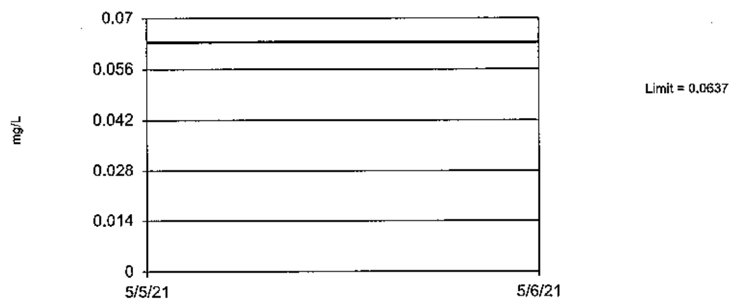
Interwell Waukegan Interwell PL UG MW-11

Waukegan Generating Station Client: NRG Data: Waukegan Printed 8/11/2021, 2:28 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	%NDs	Transform	Alpha	Method
Barium (mg/L)	n/a	0.0637	n/a	n/a	5 future	n/a	12	0	No	0.000...	Param 1 of 2
Boron (mg/L)	n/a	5.965	n/a	n/a	5 future	n/a	17	0	No	0.000...	Param 1 of 2
Calcium (mg/L)	n/a	225.1	n/a	n/a	5 future	n/a	17	0	No	0.000...	Param 1 of 2

Prediction Limit

Interwell Parametric

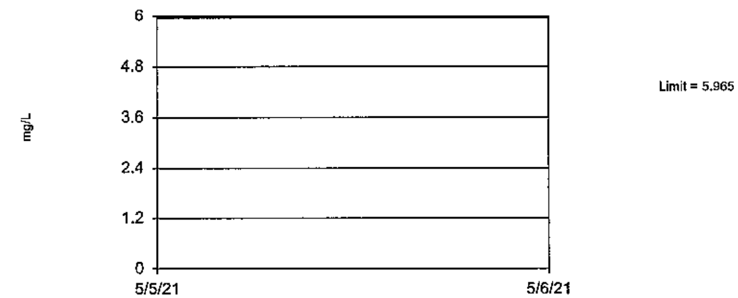


Background Data Summary: Mean=0.046, Std. Dev.=0.005784, n=12. Insufficient data to test for seasonality; not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9237, critical = 0.859. Kappa = 3.061 (c=22, w=5, 1 of 2, event alpha = 0.026). Report alpha = 0.001197. Individual comparison alpha = 0.0002394. Assumes 5 future values.

Constituent: Barium Analysis Run 8/11/2021 2:24 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Prediction Limit

Interwell Parametric

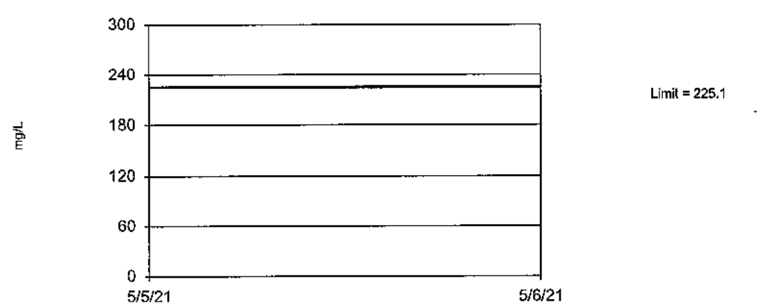


Background Data Summary: Mean=2.965, Std. Dev.=1.089, n=17. Insufficient data to test for seasonality; not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9147, critical = 0.892. Kappa = 2.757 (c=22, w=5, 1 of 2, event alpha = 0.026). Report alpha = 0.001197. Individual comparison alpha = 0.0002394. Assumes 5 future values.

Constituent: Boron Analysis Run 8/11/2021 2:24 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Prediction Limit

Interwell Parametric



Background Data Summary: Mean=154.1, Std. Dev.=25.75, n=17. Insufficient data to test for seasonality; not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9568, critical = 0.892. Kappa = 2.757 (c=22, w=5, 1 of 2, event alpha = 0.026). Report alpha = 0.001197. Individual comparison alpha = 0.0002394. Assumes 5 future values.

Constituent: Calcium Analysis Run 8/11/2021 2:24 PM
Waukegan Generating Station Client: NRG Data: Waukegan

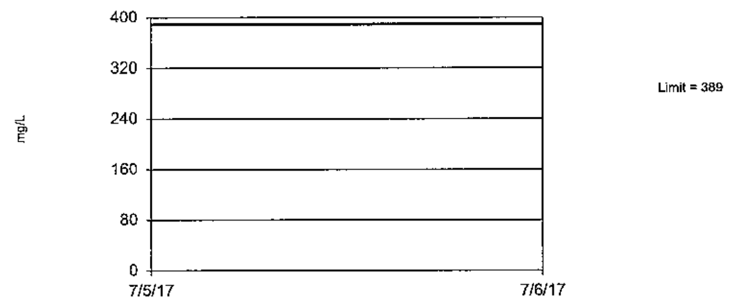
Interwell Prediction Limit Orig 8 Pooled MW-14/MW-11

Waukegan Generating Station Client: NRG Data: Waukegan Printed 8/5/2021, 2:29 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	%NDs	Transform	Alpha	Method
Chloride (mg/L)	n/a	389	n/a	n/a	5 future	n/a	16	0	No	0.000...	Param 1 of 2
Sulfate (mg/L)	n/a	259.1	n/a	n/a	5 future	n/a	16	0	No	0.000...	Param 1 of 2
Total Dissolved Solids (mg/L)	n/a	1589	n/a	n/a	5 future	n/a	16	0	No	0.000...	Param 1 of 2

Prediction Limit

Interwell Parametric

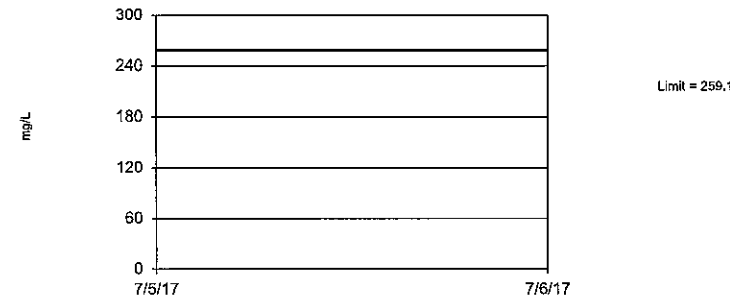


Background Data Summary: Mean=201.8, Std. Dev.=66.96, n=16. Insufficient data to test for seasonality; not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9689, critical = 0.887. Kappa = 2.795 (c=22, w=5, 1 of 2, event alpha = 0.026). Report alpha = 0.001197. Individual comparison alpha = 0.0002394. Assumes 5 future values.

Constituent: Chloride Analysis Run 8/5/2021 2:25 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Prediction Limit

Interwell Parametric

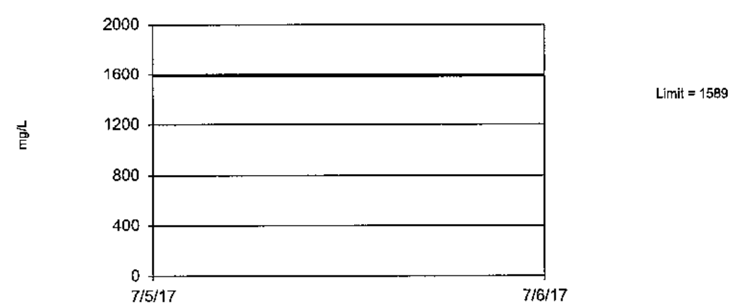


Background Data Summary: Mean=147.5, Std. Dev.=39.92, n=16. Insufficient data to test for seasonality; not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9403, critical = 0.887. Kappa = 2.795 (c=22, w=5, 1 of 2, event alpha = 0.026). Report alpha = 0.001197. Individual comparison alpha = 0.0002394. Assumes 5 future values.

Constituent: Sulfate Analysis Run 8/5/2021 2:25 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Prediction Limit

Interwell Parametric



Background Data Summary: Mean=1048, Std. Dev.=193.4, n=16. Insufficient data to test for seasonality; not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9167, critical = 0.887. Kappa = 2.795 (c=22, w=5, 1 of 2, event alpha = 0.026). Report alpha = 0.001197. Individual comparison alpha = 0.0002394. Assumes 5 future values.

Constituent: Total Dissolved Solids Analysis Run 8/5/2021 2:25 PM
Waukegan Generating Station Client: NRG Data: Waukegan

Outlier Analysis - Waukegan - UG Wells - Turbidity

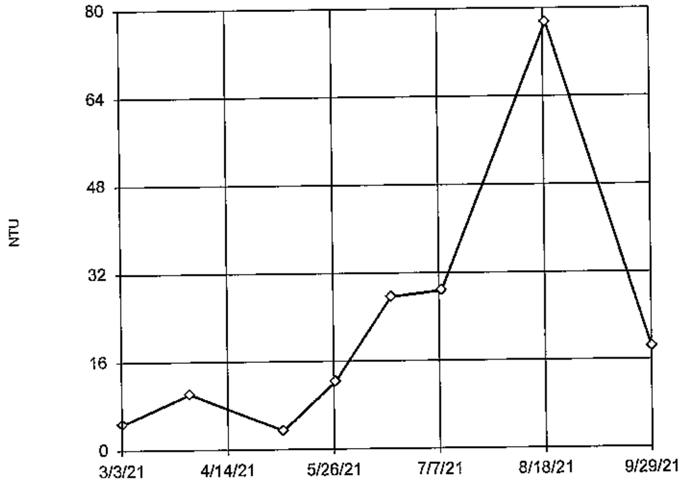
Waukegan Generating Station   Client: NRG   Data: Waukegan   Printed 10/5/2021, 3:02 PM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Turbidity (NTU)	MW-09 (bg)	No	n/a	n/a	EPA 1989	0.05	8	22.87	23.98	ln(x)	ShapiroWilk
Turbidity (NTU)	MW-11 (bg)	No	n/a	n/a	NP (nrm)	NaN	8	71.75	141.8	unknown	ShapiroWilk
Turbidity (NTU)	MW-14 (bg)	No	n/a	n/a	EPA 1989	0.05	8	712.7	972.5	ln(x)	ShapiroWilk

Sanitas™ v.9.6.09 Software licensed to KPRG and Associates, Inc. UG

EPA Screening (suspected outliers for Dixon's Test)

MW-09 (bg)



n = 8

Dixon's will not be run. No suspect values identified or unable to establish suspect values. Mean 22.87, std. dev. 23.98, critical Tn 2.032

Normality test used: Shapiro Wilk@alpha = 0.1 Calculated = 0.9737 Critical = 0.851 (after natural log transformation) The distribution was found to be log-normal.

Constituent: Turbidity Analysis Run 10/5/2021 2:58 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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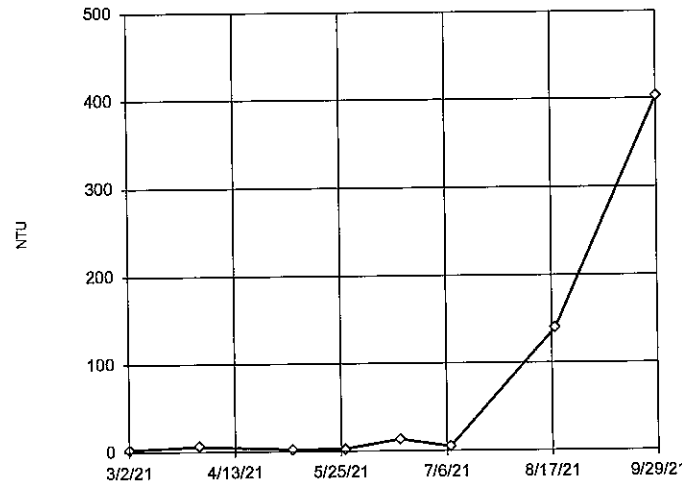
Tukey's Outlier Screening

MW-11 (bg)



n = 8

No outliers found. Tukey's method used in lieu of parametric test because the Shapiro Wilk normality test failed at the 0.1 alpha level.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 230749, low cutoff = 0.0004751, based on IQR multiplier of 3.

Constituent: Turbidity Analysis Run 10/5/2021 2:58 PM
Waukegan Generating Station Client: NRG Data: Waukegan

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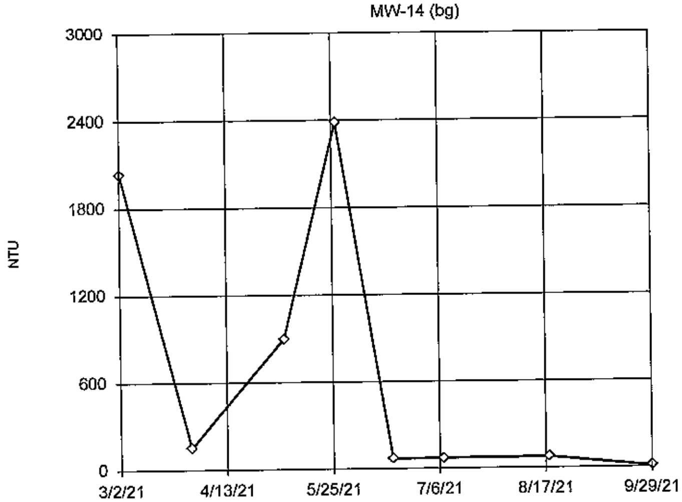
EPA Screening (suspected outliers for Dixon's Test)

MW-14 (bg)



n = 8

Dixon's will not be run. No suspect values identified or unable to establish suspect values. Mean 712.7, std. dev. 972.5, critical Tn 2.032

Normality test used: Shapiro Wilk@alpha = 0.1 Calculated = 0.9139 Critical = 0.851 (after natural log transformation) The distribution was found to be log-normal.

Constituent: Turbidity Analysis Run 10/5/2021 2:58 PM
Waukegan Generating Station Client: NRG Data: Waukegan

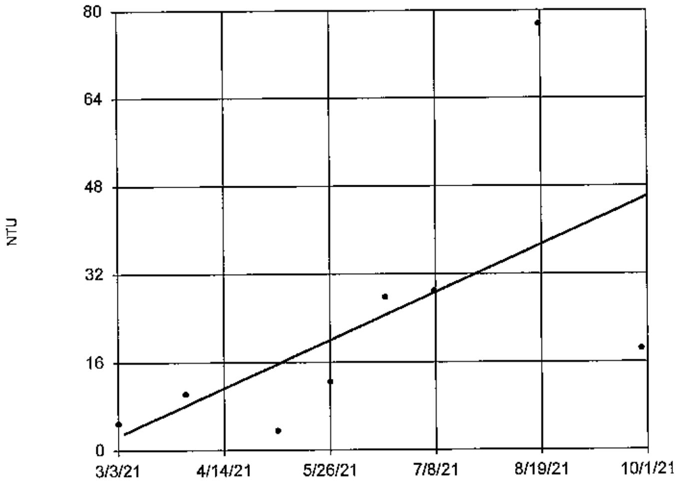
Trend Test Waukegan UG Wells Turbidity

Waukegan Generating Station Client: NRG Data: Waukegan Printed 10/5/2021, 3:07 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Turbidity (NTU)	MW-09 (bg)	74.84	1.821	2.612	No	8	0	Yes	no	0.02	Param.
Turbidity (NTU)	**MW-11 (bg)**	**571.2**	**3.001**	**2.612**	**Yes**	**8**	**0**	**Yes**	**no**	**0.02**	**Param.**
Turbidity (NTU)	MW-14 (bg)	-2819	-1.636	2.612	No	8	0	Yes	no	0.02	Param.

Linear Regression

MW-09 (bg)



n = 8

Slope = 74.84 units/year.

alpha = 0.02
t = 1.821
critical = 2.612

No significant trend.

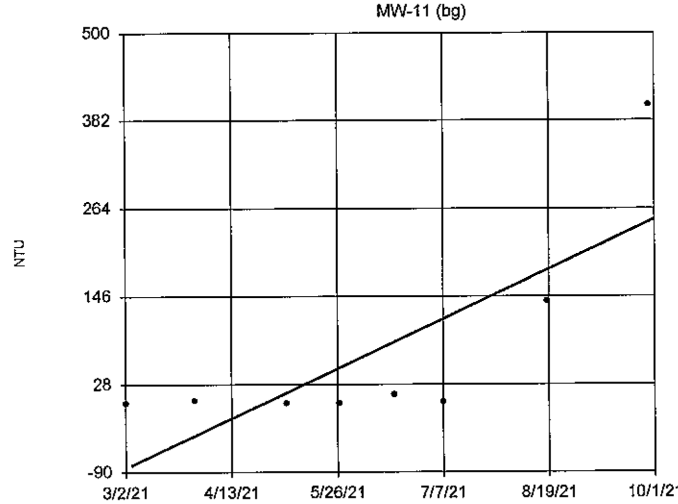
Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.873, critical = 0.749.

Constituent: Turbidity Analysis Run 10/5/2021 3:06 PM

Waukegan Generating Station Client: NRG Data: Waukegan

Linear Regression

MW-11 (bg)



n = 8

Slope = 571.2 units/year.

alpha = 0.02
t = 3.001
critical = 2.612

Significant increasing trend.

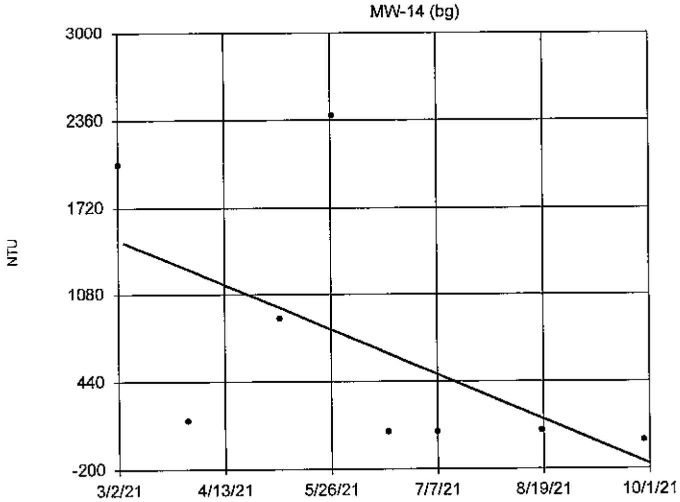
Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9456, critical = 0.749.

Constituent: Turbidity Analysis Run 10/5/2021 3:06 PM

Waukegan Generating Station Client: NRG Data: Waukegan

Linear Regression

MW-14 (bg)



n = 8

Slope = -2819 units/year.

alpha = 0.02
t = -1.636
critical = 2.612

No significant trend.

Normality test on residuals: Shapiro Wilk @alpha = 0.01, calculated = 0.9518, critical = 0.749.

Constituent: Turbidity Analysis Run 10/5/2021 3:06 PM

Waukegan Generating Station Client: NRG Data: Waukegan

ANOVA Waukegan UG Wells MW-14 & MW-9

Waukegan Generating Station   Client: NRG   Data: Waukegan   Printed 10/5/2021, 3:16 PM

Constituent	Well	Calc.	Crit.	Sig.	Alpha	Transform	ANOVA Sig.	Alpha	Method
Turbidity (NTU)	n/a	n/a	n/a	n/a	n/a	ln(x)	Yes	0.05	Param.

Parametric ANOVA

Constituent: Turbidity Analysis Run 10/5/2021 3:16 PM
Waukegan Generating Station Client: NRG Data: Waukegan

For observations made between 3/2/2021 and 9/29/2021 the parametric analysis of variance test (after natural log transformation) indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 10.93

Tabulated F statistic = 4.6 with 1 and 14 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Between Groups	26.69	1	26.69	10.93
Error Within Groups	34.18	14	2.442	
Total	60.87	15		

The Shapiro Wilk normality test on the residuals passed after natural log transformation. Alpha = 0.05, calculated = 0.9642, critical = 0.887. Levene's Equality of Variance test passed. Calculated = 4.021, tabulated = 4.6.

Shapiro-Wilk Normality Test

Constituent: Turbidity   Analysis Run 10/5/2021 3:14 PM
Waukegan Generating Station   Client: NRG   Data: Waukegan

Well	Transformation	Calculated	Critical	Normal
MW-09 (bg) (n = 8, alpha = 0.05)				
	no	0.7719	0.818	No
	square root	0.9108	0.818	Yes
	square	0.5541	0.818	No
	cube root	0.9446	0.818	Yes
	cube	0.4668	0.818	No
	natural log	0.9737	0.818	Yes
	x^4	0.4359	0.818	No
	x^5	0.4248	0.818	No
	x^6	0.4209	0.818	No
MW-11 (bg) (n = 8, alpha = 0.05)				
	no	0.5883	0.818	No
	square root	0.6866	0.818	No
	square	0.4827	0.818	No
	cube root	0.7288	0.818	No
	cube	0.4414	0.818	No
	natural log	0.8189	0.818	Yes
	x^4	0.4265	0.818	No
	x^5	0.4213	0.818	No
	x^6	0.4195	0.818	No
MW-14 (bg) (n = 8, alpha = 0.05)				
	no	0.7371	0.818	No
	square root	0.8166	0.818	No
	square	0.6668	0.818	No
	cube root	0.8546	0.818	Yes
	cube	0.6339	0.818	No
	natural log	0.9139	0.818	Yes
	x^4	0.6146	0.818	No
	x^5	0.5989	0.818	No
	x^6	0.5833	0.818	No
Pooled Background (bg) (n = 24, alpha = 0.05)				
	no	0.4767	0.916	No
	square root	0.663	0.916	No
	square	0.3695	0.916	No
	cube root	0.7609	0.916	No
	cube	0.3392	0.916	No
	natural log	0.9294	0.916	Yes
	x^4	0.3243	0.916	No
	x^5	0.3134	0.916	No
	x^6	0.3035	0.916	No

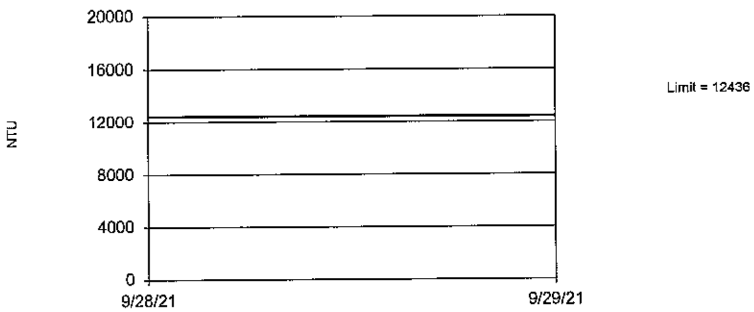
Interwell Prediction Limit Waukegan MW-14 UG Turbidity

Waukegan Generating Station   Client: NRG   Data: Waukegan   Printed 10/5/2021, 3:20 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	%NDs	Transform	Alpha	Method
Turbidity (NTU)	n/a	12436	n/a	n/a	5 future	n/a	8	0	x^(1/3)	0.000...	Param 1 of 2

Prediction Limit

Interwell Parametric



Background Data Summary (based on cube root transformation): Mean=6.95, Std. Dev.=4.326, n=8. Insufficient data to test for seasonality; not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.8546, critical = 0.818. Kappa = 3.749 (c=22, w=5, 1 of 2, event alpha = 0.026). Report alpha = 0.001197. Individual comparison alpha = 0.0002394. Assumes 5 future values.

Constituent: Turbidity Analysis Run 10/5/2021 3:19 PM

Waukegan Generating Station Client: NRG Data: Waukegan

ATTACHMENT 10
WRITTEN CLOSURE PLAN

Attachment 10-1 East Ash Pond Closure Plan

MWG

Midwest Generation, LLC
Waukegan Generating Station

Preliminary Written Closure Plan for East Ash Pond

Revision 1

October 29, 2021

Issue Purpose: Use

Project No.: 12661-123

55 East Monroe Street
Chicago, IL 60603-5780 USA
312-269-2000
www.sargentlundy.com

Sargent & Lundy

TABLE OF CONTENTS

1.0 PURPOSE & SCOPE

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)
Federal CCR Rule Reference: 40 CFR 257.102(b)

1.1 PURPOSE

The East Ash Pond at Midwest Generation, LLC's (MWG) Waukegan Generating Station ("Waukegan" or the "Station") is an existing coal combustion residual (CCR) surface impoundment that is regulated by the Illinois Pollution Control Board's "Standards for the Disposal of Coal Combustion Residuals in CCR Surface Impoundments." These regulations are codified in Part 845 to Title 35 of the Illinois Administrative Code (35 Ill. Adm. Code 845, Ref. 1) and are also referred to herein as the "Illinois CCR Rule." The East Ash Pond is also regulated by the U.S. Environmental Protection Agency's (EPA) "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments," 40 CFR Part 257 Subpart D (Ref. 2), also referred to herein as the "Federal CCR Rule."

Pursuant to 35 Ill. Adm. Code 845.720(a) and 40 CFR 257.102(b), this document provides the preliminary written closure plan for the East Ash Pond at Waukegan. MWG intends to close this CCR surface impoundment by leaving the impounded CCR in place and installing a final cover system over the impoundment in accordance with 35 Ill. Adm. Code 845.750 and 40 CFR 257.102(d). This plan describes the steps necessary to close the East Ash Pond in this manner.

1.2 SCOPE

Per the 2016 Water Infrastructure Improvements for the Nation (WIIN) Act, the East Ash Pond will continue to be subject to both the Illinois and Federal CCR Rules until the U.S. EPA approves the Illinois EPA's CCR permit program. The Illinois EPA has yet to publish a timeline for submitting its proposed CCR permit program to the U.S. EPA for approval, and so this preliminary written closure plan has been prepared pursuant to both sets of regulations.

2.0 CLOSURE PLAN NARRATIVE DESCRIPTION

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)(1)(A) & 845.750(a)
Federal CCR Rule Reference: 40 CFR 257.102(b)(1)(i) & 257.102(d)(1)

Pursuant to 35 Ill. Adm. Code 845.750(a) and 40 CFR 257.102(d), the East Ash Pond will be closed by leaving the CCR stored in the pond in place and installing a final cover system over the impoundment. The final cover system will be designed in accordance with the requirements specified in 35 Ill. Adm. Code 845.750(c) and 40 CFR 257.102(d)(3) and as described in the following sections of this closure plan.

The anticipated closure in-place of the East Ash Pond will be performed in accordance with the following sequential steps:

1. Ceasing all CCR and non-CCR inflows to the pond;
2. Drawing down the free surface water in the pond by evaporation and by draining water into the Recycle Water Sump in the northwest corner of the pond;
3. Once the water elevation is below the Recycle Water Sump's overflow weir elevation, promoting additional drainage and dewatering by:
    a. Excavating sumps and trenches within the ash material,
    b. Using portable pumps as necessary to remove additional water by pumping water over the weir into the Recycle Water Sump, and/or
    c. Utilizing earthmoving equipment to move the ash within the pond;
4. Upon completion of dewatering and stabilization of the impounded ash, establishing the slopes for the final cover system by:
    a. Grading the stabilized ash material, and
    b. Placing and grading general fill material over the stabilized ash to establish the slopes for the final cover system;
5. Installing an engineered final cover system (ClosureTurf®), which consists of:
    a. Structured geomembrane as the system's low permeability layer, and
    b. Synthetic turf and soil infill as the system's final protective layer; and
6. Initiating post-closure monitoring of groundwater and final cover system integrity.

3.0 FINAL COVER SYSTEM DESCRIPTION

Illinois CCR Rule References: 35 Ill. Adm. Code 845.720(a)(1)(C) & 845.750(a)
Federal CCR Rule References: 40 CFR 257.102(b)(1)(iii) & 257.102(d)(1)

Pursuant to the closure performance standards prescribed in 35 Ill. Adm. Code 845.750(a) and 40 CFR 257.102(d)(1), the final cover system encapsulating the CCR in the East Ash Pond will:

1. Minimize the post-closure infiltration of liquid into the CCR;
2. Minimize the risk of release of CCR or contaminated run-off to the ground or surface waters, or to the atmosphere;
3. Preclude the probability of future impoundment of water, sediment, or slurry;
4. Provide major slope stability to prevent sloughing of the final cover system during the closure and post-closure care period;
5. Minimize future maintenance; and
6. Allow closure activities to be completed as quickly as practical consistent with recognized and generally accepted good engineering practices.

In addition to the preceding performance criteria, the final cover system installed over the East Ash Pond must meet the design criteria promulgated by 35 Ill. Adm. Code 845.750(c) and 40 CFR 257.102(d)(3), both of which require the final cover system to consist of at least two layers: a lower, low-permeability layer for infiltration control and an upper, final protective layer for erosion control and for protecting the low permeability layer. MWG plans to install an engineered final cover system developed by Watershed Geosynthetics, LLC (WatershedGeo) called ClosureTurf®, which will provide the performance metrics stipulated for both the low-permeability and final protective layers promulgated by the Illinois and Federal CCR Rules. ClosureTurf® consists of a structured geomembrane, an engineered synthetic turf, and a soil infill. If a different engineered system is ultimately utilized for the East Ash Pond's final cover system, then this written closure plan will be amended accordingly (see Section 7.0).

3.1 ESTABLISH GRADE & SUPPORT FOR FINAL COVER SYSTEM

Illinois CCR Rule References: 35 Ill. Adm. Code 845.750(a)(2), 845.750(a)(3), & 845.750(c)(3))
Federal CCR Rule References: 40 CFR 257.102(d)(1)(ii), 257.102(d)(1)(iii), & 257.102(d)(3)(i)(D)

To accomplish the performance requirements stipulated by 35 Ill. Adm. Code 845.750 and 40 CFR 257.102(d), the CCR remaining in the East Ash Pond will be graded to direct non-contact storm water run-off to a new low volume waste pond being installed within the footprint of the existing West Ash Pond west of and adjacent to the East Ash Pond. General fill material will be placed over the stabilized CCR in the pond to establish the lines and grades for this storm water management scheme. The slopes of this foundation layer for the pond's final cover system will be steep enough to prevent storm water from ponding over the cap but flat enough to limit erosion caused by the storm water run-off. These slopes will also be designed to accommodate potential settling and subsidence while maintaining a positive drainage strategy. In addition, the foundation layer's slopes (and the final cover system in general) will also include measures that provide slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period. Finally, the foundation layer surface will be prepared such that it is free from large, protruding, or sharp materials that could otherwise cause damage to the overlying low permeability layer.

3.2 LOW PERMEABILITY LAYER

Illinois CCR Rule References: 35 Ill. Adm. Code 845.750(a)(1) & 845.750(c)(1)
Federal CCR Rule References: 40 CFR 257.102(d)(1)(i) & 257.102(d)(3)(ii)(A)

The structured geomembrane component of the ClosureTurf® system will be placed on top of the graded CCR and general fill in the East Ash Pond to minimize the infiltration of liquids through the pond during its post-closure life. This low permeability layer will control, minimize, and eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere.

Table 1 lists the design criteria for the low permeability layer of a final cover system installed over a CCR surface impoundment as promulgated by the Illinois and Federal CCR Rules. By comparison, the Illinois CCR Rule's design criteria for the low permeability layer are either as protective or more protective of human health and the environment than the design criteria promulgated by the Federal CCR Rule. Accordingly, the structured geomembrane component of the ClosureTurf® system for the East Ash Pond will be designed in accordance with the design criteria promulgated by the Illinois CCR Rule for a low permeability layer in a final cover system.

Table 1 – Comparison of Illinois and Federal CCR Rules' Design Criteria for Low Permeability Layer in a CCR Surface Impoundment's Final Cover System

Construction Material	Parameter	Illinois CCR Rule Design Criterion (35 Ill. Adm. Code 845.750(c)(1))	Federal CCR Rule Design Criterion (40 CFR 257.102(d)(3))
Earthen Material	Thickness	3 feet minimum	1.5 feet minimum
	Hydraulic Conductivity	Least of: • Permeability of any bottom liner system or natural subsoils • 1×10^{-7} cm/sec	Least of: • Permeability of any bottom liner system or natural subsoils • 1×10^{-5} cm/sec
	Compaction	Minimize void spaces	--
Geomembrane	Thickness	40 mil	--
	Hydraulic Flux	Equivalent or superior reduction in infiltration as a low permeability layer constructed with earthen material	Equivalent or superior reduction in infiltration as a low permeability layer constructed with earthen material
	Prepared Subgrade	Free from sharp objects and other materials that may cause damage	--

The East Ash Pond has a 60-mil HDPE geomembrane liner on its floor and sides; therefore, the low permeability layer in the pond's final cover system must have a permeability that is equal to or less than the effective permeability of the existing liner. Accordingly, MWG plans to specify a 60-mil HDPE, structured geomembrane for the ClosureTurf® system installed over the pond pursuant to 35 Ill. Adm. Code 845.750(c)(1)(B) and 40 CFR 257.102(d)(3)(ii)(A).

As required by 35 Ill. Adm. Code 845.750(c)(1)(B)(i) and 40 CFR 257.102(d)(3)(ii)(A), Table 2 demonstrates that a 60-mil HDPE geomembrane will provide a superior reduction in infiltration when compared to a 3-foot-thick layer of earthen material with a hydraulic conductivity of 1×10^{-7} cm/sec. The liquid flow rate through a 3-foot-thick layer of earthen material is calculated using the equation derived from Darcy's Law for gravity flow through porous media that is specified by the Illinois and Federal CCR Rules as the basis for demonstrating compliance with both rules' alternative composite liner design criteria (Ref. 1, §845.400(c)(3); Ref. 2, Eq. 1). Meanwhile, the liquid flow rate through a geomembrane liner is calculated using Bernoulli's equation for free flow through an orifice based on the assumption that one 2-mm-diameter hole is present in the geomembrane for every acre (4,000 m^2) of liner (Ref. 3). Both liquid flow rates calculated in Table 2 are based on the assumption that 4.37 inches (0.11 meter) of hydraulic head is present on the low permeability layer, which is the estimated 25-year, 24-hour precipitation depth at the Station (Ref. 4). This is a conservative assumption because the final cover system will be sloped to preclude the build-up of liquid on the low permeability layer.

Table 2 – Liquid Flow Rate Comparison Between Low Permeability Layers Constructed Using Geomembrane & Earthen Material

Parameter	Symbol	Value
Liquid Flow Rate Through Earthen Material		
Hydraulic Conductivity	k	1×10^{-9} m/sec
Hydraulic Head Above Layer	h	0.11 m
Layer Thickness	t	3 ft = 0.91 m
Hydraulic Gradient Through Earthen Material	$i = h / t$	0.12
Liquid Flow Rate Through Layer per Acre of Final Cover System (Ref. 1, §845.400(c)(3); Ref. 2, Eq. 1).	$q = k \times (i + 1)$	1.12×10^{-9} m^3/sec/m^2
Liquid Flow Rate Through Geomembrane		
Hole Area in Geomembrane	a	3.1 mm^2 / 4000 m^2
Acceleration Due to Gravity	g	9.81 m/sec^2
Hydraulic Head Above Layer	h	0.11 m
Liquid Flow Rate Through Layer per Unit Area (Ref. 3)	$q = 0.6a(2gh)^{0.5}$	6.83×10^{-10} m^3/sec/m^2

3.3 FINAL PROTECTIVE LAYER

Illinois CCR Rule References: 35 Ill. Adm. Code 845.750(c)(2)
Federal CCR Rule Reference: 40 CFR 257.102(d)(3)(ii)(B)

To minimize wind and water erosion, the ClosureTurf® system features an engineered synthetic turf with a thin (approximately 0.5-in. thick) layer of soil infill that is installed over the structured geomembrane. The artificial turf component consists of a double-layer, woven geotextile base through which tufts of polyethylene fibers are inserted. This engineered synthetic turf and soil infill will cover the entire low permeability layer (*i.e.*, structured geomembrane) and will be installed as soon as possible after placement of the low permeability layer. Research and testing performed by WatershedGeo has demonstrated that ClosureTurf® provides superior protection against wind and water erosion than a traditional final protective layer consisting of vegetated topsoil or other earthen materials (Ref. 5). Moreover, ClosureTurf® does not require as much maintenance as a vegetated final protective layer which needs to be mowed regularly and may need to be reseeded, refertilized, and/or regraded throughout the pond's post-closure life. Finally, it should be noted that a thicker final protective layer for frost protection is not warranted for the East Ash Pond because freezing temperatures and freeze-thaw conditions will not affect the hydraulic performance of the HDPE geomembrane liner being utilized as the low permeability layer in each pond's final cover system (Ref. 6).

4.0 ESTIMATED MAXIMUM INVENTORY OF CCR

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)(1)(D)
Federal CCR Rule Reference: 40 CFR 257.102(b)(1)(iv)

Detailed records of the maximum inventory of CCR ever stored in the East Ash Pond are not available. For the purposes of this preliminary written closure plan, the maximum CCR inventory for the East Ash Pond is conservatively based on its estimated maximum capacity, which is 184,000 cubic yards.

5.0 ESTIMATED COVER SURFACE AREA

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)(1)(E)
Federal CCR Rule Reference: 40 CFR 257.102(b)(1)(v)

The estimated final cover surface area for the East Ash Pond is 9.8 acres. It is estimated that this area represents the largest surface area that will ever require a final cover at any point over the pond's active life.

6.0 CLOSURE SCHEDULE

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)(1)(F)

Federal CCR Rule Reference: 40 CFR 257.102(b)(1)(vi)

Closure activities for the East Ash Pond are estimated to be completed in 2025. Table 3 lists the major milestones necessary for closing both ponds and the expected duration for completing each milestone.

Table 3 – Planning Level Schedule for Closing the East Ash Pond

Activity	Estimated Duration
Prepare Closure Construction Design Documents	8 Months
Obtain Closure Construction Permit from Illinois EPA	12 Months
Hire Contractor to Complete Closure Activities in Accordance with Illinois EPA Permit	4 Months
Draw Down Water & Dewater Impounded Ash	14 Months
Grade Dewatered Ash, Place and Grade General Fill	3 Months
Install Final Cover System	2 Months
Submit Closure Report and Certification to Illinois EPA	2 Weeks
Obtain Approval of Closure Report and Certification from Illinois EPA	3 Months
Complete and Certify Closure of the East Ash Pond	--

7.0 AMENDMENTS TO CLOSURE PLAN

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)(3)

Federal CCR Rule Reference: 40 CFR 257.102(b)(3)

This preliminary written closure plan will be amended in accordance with 35 Ill. Adm. Code 845.720(a)(3) and 40 CFR 257.102(b)(3) if a change in the operation of the East Ash Pond would substantially affect this closure plan or if an unanticipated event necessitates a revision to this closure plan. Any and all amendments to this closure plan will be certified by a qualified professional engineer registered in the State of Illinois in accordance with 35 Ill. Adm. Code 845.720(a)(4) and 40 CFR 257.102(b)(4).

8.0 COMPLETION OF CLOSURE ACTIVITIES

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.760
Federal CCR Rule Reference: 40 CFR 257.102(f)

Upon completion of all closure activities required by 35 Ill. Adm. Code Part 845 and 40 CFR 257.102(d) and approved by the Illinois EPA in a construction permit, a closure report and a closure certification for the East Ash Pond will be submitted to the Illinois EPA in accordance with 35 Ill. Adm. Code 845.760(e). The closure report will include (1) the engineering and hydrogeology reports containing any monitoring well completion reports, boring logs, all construction quality assurance (CQA) reports, certifications, designations of CQA officers-in-absentia required by 35 Ill. Adm. Code 845.290; (2) photographs with time, date, and location information relied upon for documentation of construction activities; (3) a written summary of the closure requirements and completed activities as stated in the closure plan in effect and 35 Ill. Adm. Code Part 845; and (4) any other information relied upon by the qualified professional engineer for certification. Pursuant to 35 Ill. Adm. Code 845.760(e)(2) and 40 CFR 257.102(f)(3), the certification will be prepared by an independent, qualified professional engineer licensed in the State of Illinois and will verify that the East Ash Pond has been closed in accordance with the closure plan in effect at the time of the closure work, the requirements of 35 Ill. Adm. Code Part 845, and the requirements of 40 CFR 257.102. Finally, within 30 days of the Illinois EPA approving the closure report and closure certification, a notification of completion of closure will be prepared in accordance with 35 Ill. Adm. Code 845.760(f).

9.0 CERTIFICATION

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)(4)

Federal CCR Rule Reference: 40 CFR 257.102(b)(4)

I certify that:

- This preliminary written closure plan for the East Ash Pond was prepared by me or under my direct supervision.
- The work was conducted in accordance with the requirements of 35 Ill. Adm. Code Part 845 and with the requirements of 40 CFR 257.102.
- I am a registered professional engineer under the laws of the State of Illinois.

Certified By: Thomas J. Dehlin Date: October 29, 2021

Seal:

LICENSED PROFESSIONAL ENGINEER
THOMAS J DEHLIN
062-069314
OF ILLINOIS

Th. Dehlin
10/29/2021
Exp. 11/30/2021

10.0 REFERENCES

1. Illinois Pollution Control Board. "Standards for Disposal of Coal Combustion Residuals in CCR Surface Impoundments." 35 Ill. Adm. Code 845. Accessed October 19, 2021.
2. U.S. Environmental Protection Agency. "Standards for Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments." 40 CFR Part 257 Subpart D. https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-257/subpart-D. Accessed October 19, 2021.
3. Giroud, J.P. and Bonaparte, R. "Leakage through liners Constructed with Geomembranes—Part I. Geomembrane Liners." *Geotextiles and Geomembranes*. Vol. 8. pp. 27–67. 1989.
4. National Oceanic and Atmospheric Administration. "Point Precipitation Frequency (PF) Estimates." NOAA Atlas 14, Volume 2, Version 3. https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html. Accessed October 25, 2021.
5. Watershed Geosynthetics, LLC. "ClosureTurf® Overview: Superior Performance When Compared to EPA Subtitle D Landfill Final Covers." https://watershedgeo.com/products/closureturf/. Accessed October 25, 2021.
6. Hsuan, Y. *et al*. "Cold Temperatures and Free[ze]-Thaw Cycling Behavior of Geomembranes and Their Seams." GSI White Paper #28. Geosynthetic Institute. June 17, 2013.

Attachment 10-2 West Ash Pond Closure Plan

MWG

Midwest Generation, LLC
Waukegan Generating Station

Preliminary Written Closure Plan for West Ash Pond

Revision 1

October 29, 2021

Issue Purpose: Use

Project No.: 12661-123

55 East Monroe Street
Chicago, IL 60603-5780 USA
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Sargent & Lundy

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1.0 PURPOSE & SCOPE

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)
Federal CCR Rule Reference: 40 CFR 257.102(b)

1.1 PURPOSE

The West Ash Pond at Midwest Generation, LLC's (MWG) Waukegan Generating Station ("Waukegan" or the "Station") is an existing coal combustion residual (CCR) surface impoundment that is regulated by the Illinois Pollution Control Board's "Standards for the Disposal of Coal Combustion Residuals in CCR Surface Impoundments." These regulations are codified in Part 845 to Title 35 of the Illinois Administrative Code (35 Ill. Adm. Code 845, Ref. 1) and are also referred to herein as the "Illinois CCR Rule." The West Ash Pond is also regulated by the U.S. Environmental Protection Agency's (EPA) "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments," 40 CFR Part 257 Subpart D (Ref. 2), also referred to herein as the "Federal CCR Rule."

Pursuant to 35 Ill. Adm. Code 845.720(a) and 40 CFR 257.102(b), this document provides the preliminary written closure plan for the West Ash Pond at Waukegan. MWG intends to close this CCR surface impoundment by removing CCR and CCR-mixed materials remaining in the pond at the time of closure and decontaminating affected areas pursuant to 35 Ill. Adm. Code 845.740(a) and 40 CFR 257.102(c). MWG then intends to repurpose the area as a new low volume waste pond for the Station. This plan describes the steps necessary to close and subsequently repurpose the West Ash Pond in this manner.

1.2 SCOPE

Per the 2016 Water Infrastructure Improvements for the Nation (WIIN) Act, the West Ash Pond will continue to be subject to both the Illinois and Federal CCR Rules until the U.S. EPA approves the Illinois EPA's CCR permit program. The Illinois EPA has yet to publish a timeline for submitting its proposed CCR permit program to the U.S. EPA for approval, and so this preliminary written closure plan has been prepared pursuant to both sets of regulations.

2.0 CLOSURE PLAN NARRATIVE DESCRIPTION

Illinois CCR Rule References: 35 Ill. Adm. Code 845.720(a)(1)(A) & 845.740(a)
Federal CCR Rule References: 40 CFR 257.102(b)(1)(i) & 257.102(c)

MWG plans to close the West Ash Pond by removing CCR and CCR-mixed materials remaining in the pond at the time of closure and decontaminating affected areas pursuant to 35 Ill. Adm. Code 845.740(a) and 40 CFR 257.102(c). The West Ash Pond closure will be executed according to the following sequential steps:

1. Removing the CCR from the pond and transporting the material to a beneficial-use facility or a permitted disposal facility in accordance with current and historic Station maintenance procedures for the pond;
2. Obtaining a construction permit from the Illinois EPA for closing the pond;
3. Removing the protective granular fill layer over the existing geomembrane liner from the pond and transporting the soil materials to a permitted disposal facility;
4. Inspecting and decontaminating the pond's existing geomembrane liner and appurtenant structures (*e.g.*, concrete inlet and outlet structures) for re-use in accordance with the closure construction permit issued by the Illinois EPA, including submittal of visual inspection documentation and analytical testing results to demonstrate the existing liner and structures are no longer contaminated with CCR constituents;
5. Sampling the groundwater at the pond site to verify the groundwater monitoring concentrations do not exceed the groundwater protection standards established for constituents in accordance with the operating permit issued by the Illinois EPA for the pond; and
6. Certifying (via a qualified professional engineer licensed in the State of Illinois) that the CCR has been removed from the pond and the CCR surface impoundment has been decontaminated in accordance with the closure plan in effect at the time of closure and in accordance with the corresponding construction permit issued by the Illinois EPA.

3.0 CCR REMOVAL & DECONTAMINATION PROCEDURES

Illinois CCR Rule References: 35 Ill. Adm. Code 845.720(a)(1)(B) & 845.740(a)
Federal CCR Rule References: 40 CFR 257.102(b)(1)(ii) & 257.102(c)

The preliminary closure plan for the West Ash Pond is to follow the sequential steps outlined in Section 2.0.

In June 2020, Waukegan took the West Ash Pond out of service for routine cleaning. MWG then began removing ash stored above the granular protective layer covering the pond's existing geomembrane liner in accordance with historical cleaning practices in the Station's ash pond maintenance program where ash is periodically removed from the pond to recover storage capacity. In September 2021, it was noted that most of the CCR previously stored in the West Ash Pond had been removed and minimal surface water remained in the pond. MWG will continue to remove the remaining ash in the pond in accordance with the Station's historical cleaning practices. Final closure activities will be performed in accordance with the closure plan in effect at the time of the closure work and the corresponding construction permit issued by the Illinois EPA.

Upon receipt of the construction permit from the Illinois EPA for closing the West Ash Pond, MWG will first remove the 18-in.-thick granular protective layer covering the pond's existing geomembrane liner. The granular materials will be loaded onto trucks and transported to a permitted disposal facility. Because the granular materials are likely to contain CCR materials, the trucks transporting the material off-site will carry manifests pursuant to 35 Ill. Adm. Code 845.740(c)(1)(A) and as specified in 35 Ill. Adm. Code 809. In addition, a CCR transportation plan will be prepared in accordance with 35 Ill. Adm. Code 845.740(c)(1)(B) which will include:

- Identification of the transportation method selected;
- The frequency, time of day, and routes of CCR transportation;
- Any measures to minimize noise, traffic, and safety concerns caused by the transportation of the CCR;
- Measures to limit fugitive dust from any transportation of CCR;
- Installation and use of a vehicle washing station;
- A means of covering the CCR for any mode of CCR transportation;
- A requirement that the CCR is transported by a permitted special waste hauler under 35 Ill. Adm. Code 809.201.

On-site fugitive dust control measures will also be implemented as necessary to minimize airborne CCR particulates while CCR and CCR-mixed materials are being handled. Pursuant to 35 Ill. Adm. Code 845.740(c)(2)(A), these dust control measures will include a water spray, commercial dust suppressant, or a combination of these.

Prior to the removal of the granular protective layer covering the West Ash Pond's existing geomembrane liner, signage will be posted at the Station's entrance warning of the hazards of CCR dust inhalation in accordance with 35 Ill. Adm. Code 845.740(c)(3)(A). Pursuant to 35 Ill. Adm. Code 845.740(c)(3)(B), a written notice will be issued to each of the local governments through which the CCR-mixed materials will be transported. This written notice will include an explanation of the hazards of CCR dust inhalation, the aforementioned CCR transportation plan, and a tentative transportation schedule.

After the granular protective layers in the pond have been removed, MWG will begin decontaminating the West Ash Pond's existing geomembrane liner to be re-used when the pond is repurposed as a new low volume waste pond for the Station. The pond's inlet trough, outlet structure, associated piping, *etc*. will also be decontaminated. Decontamination procedures may include pressure washing, scrubbing, flushing, or other generally accepted decontamination methods. Following decontamination, the existing geomembrane liner will be visually inspected to ensure the liner is competent and is no longer contaminated with CCR constituents. Analytical tests will also be conducted in accordance with the construction permit issued by the Illinois EPA at the time of the closure work to demonstrate that the liner is no longer contaminated with CCR constituents. The results from the visual inspection and analytical tests will be submitted to the Illinois EPA for approval of re-using the existing geomembrane liner when the West Ash Pond is repurposed as a new low volume waste pond.

In accordance with 35 Ill. Adm. Code 845.740(e) and 40 CFR 257.102(c), CCR removal and decontamination will be complete when constituent concentrations throughout the West Ash Pond and areas that may have been affected by releases from the pond have been removed and groundwater monitoring concentrations do not exceed the groundwater protection standards established under 35 Ill. Adm. Code 845.600. After CCR removal and decontamination of the West Ash Pond has been completed, MWG will submit a report documenting the completion of CCR removal and decontamination of the unit, which will include a certification from a qualified professional engineer licensed in the State of Illinois that CCR removal and decontamination was completed in accordance with 35 Ill. Adm. Code 845.740.

In accordance with 35 Ill. Adm. Code 845.740(b), MWG will continue groundwater monitoring in accordance with Subpart F of the Illinois CCR Rule ("Groundwater Monitoring and Corrective Action") for three years after the completion of CCR removal and decontamination. After groundwater monitoring has been completed, MWG will submit a report documenting the completion of groundwater monitoring, which will include a certification from a qualified professional engineer licensed in the State of Illinois that groundwater monitoring was completed in accordance with 35 Ill. Adm. Code 845.740.

4.0 ESTIMATED MAXIMUM INVENTORY OF CCR

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)(1)(D)
Federal CCR Rule Reference: 40 CFR 257.102(b)(1)(iv)

Detailed records of the maximum inventory of CCR ever stored in the West Ash Pond are not available. For the purposes of this preliminary written closure plan, the maximum inventory of CCR ever on-site over the active life of the West Ash Pond is conservatively based on the estimated maximum capacity of the pond: 223,000 cubic yards.

5.0 CLOSURE SCHEDULE

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)(1)(F)
Federal CCR Rule Reference: 40 CFR 257.102(b)(1)(vi)

Closure activities for the West Ash Pond are expected to be completed in 2023. Table 1 lists the major milestones necessary for closing the pond and the expected duration for completing each milestone.

Table 1 – Planning Level Schedule for Closing the West Ash Pond

Activity	Estimated Duration
Prepare Closure Construction Design Documents	6 Months
Obtain Closure Construction Permit from Illinois EPA	12 Months
Hire Contractor to Complete Closure Activities in Accordance with Illinois EPA Permit	4 Months
Remove Protective Granular Layers Above Existing Liner	1 Month
Decontaminate Existing Liner and Pond Appurtenances (Including Laboratory Testing)	2 Months
Obtain Approval from Illinois EPA to Re-Use Existing Liner for New Low Volume Waste Pond	3 Months
Submit Completion of CCR Removal and Decontamination Report and Certification to Illinois EPA	2 Weeks
Obtain Approval of Completion of CCR Removal and Decontamination Report from Illinois EPA	3 Months
Complete and Certify Closure of the West Ash Pond	--

6.0 AMENDMENTS TO CLOSURE PLAN

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)(3)
Federal CCR Rule Reference: 40 CFR 257.102(b)(3)

This closure plan will be amended in accordance with 35 Ill. Adm. Code 845.720(a)(3) and 40 CFR 257.102(b)(3) if a change in the operation of the West Ash Pond would substantially affect this closure plan or if an unanticipated event necessitates a revision to this closure plan. Any and all amendments to this closure plan will be certified by a qualified professional engineer registered in the State of Illinois in accordance with 35 Ill. Adm. Code 845.720(a)(4) and 40 CFR 257.102(b)(4).

7.0 COMPLETION OF CLOSURE ACTIVITIES

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.760
Federal CCR Rule Reference: 40 CFR 257.102(f)

Upon completion of all CCR removal and decontamination activities required by 35 Ill. Adm. Code Part 845 and 40 CFR 257.102(c) and approved by the Illinois EPA in a construction permit, a closure report and a closure certification for the West Ash Pond will be submitted to the Illinois EPA in accordance with 35 Ill. Adm. Code 845.760(e). The closure report will include (1) the engineering and hydrogeology reports containing any monitoring well completion reports, boring logs, all construction quality assurance (CQA) reports, certifications, designations of CQA officers-in-absentia required by 35 Ill. Adm. Code 845.290; (2) photographs with time, date, and location information relied upon for documentation of construction activities; (3) a written summary of the closure requirements and completed activities as stated in the closure plan in effect and 35 Ill. Adm. Code Part 845; and (4) any other information relied upon by the qualified professional engineer for the certification. Pursuant to 35 Ill. Adm. Code 845.760(e)(2) and 40 CFR 257.102(f)(3), the certification will be prepared by an independent, qualified professional engineer licensed in the State of Illinois and will verify that the West Ash Pond has been closed in accordance with the closure plan in effect at the time of the closure work, the requirements of 35 Ill. Adm. Code Part 845, and the requirements of 40 CFR 257.102. Finally, within 30 days of the Illinois EPA approving the closure report and closure certification, a notification of completion of closure will be prepared in accordance with 35 Ill. Adm. Code 845.760(f).

8.0 CERTIFICATION

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)(4)
Federal CCR Rule Reference: 40 CFR 257.102(b)(4)

I certify that:

- This preliminary written closure plan for the West Ash Pond was prepared by me or under my direct supervision.
- The work was conducted in accordance with the requirements of 35 Ill. Adm. Code Part 845 and with the requirements of 40 CFR 257.102.
- I am a registered professional engineer under the laws of the State of Illinois.

Certified By: Thomas J. Dehlin   Date: October 29, 2021

Seal:

LICENSED PROFESSIONAL ENGINEER
THOMAS J DEHLIN
062-069314
OF ILLINOIS

Th. Dehlin
10/29/2021
Exp. 11/30/2021

9.0 REFERENCES

1. Illinois Pollution Control Board. "Standards for Disposal of Coal Combustion Residuals in CCR Surface Impoundments." 35 Ill. Adm. Code 845. Accessed October 19, 2021.
2. U.S. Environmental Protection Agency. "Standards for Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments." 40 CFR Part 257 Subpart D. https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-257/subpart-D. Accessed October 19, 2021.

ATTACHMENT 11
POST-CLOSURE PLAN

MWG

Midwest Generation, LLC
Waukegan Generating Station

Post-Closure Care Plan for East Ash Pond

Revision 1

October 29, 2021

Issue Purpose: Use

Project No.: 12661-123

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1.0 PURPOSE & SCOPE

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.780(d)
Federal CCR Rule Reference: 40 CFR 257.104(d)

1.1 PURPOSE

The East Ash Pond at Midwest Generation, LLC's (MWG) Waukegan Generating Station ("Waukegan" or the "Station") is an existing coal combustion residual (CCR) surface impoundment that is regulated by the Illinois Pollution Control Board's "Standards for the Disposal of Coal Combustion Residuals in CCR Surface Impoundments." These regulations are codified in Part 845 to Title 35 of the Illinois Administrative Code (35 Ill. Adm. Code 845, Ref. 1) and are also referred to herein as the "Illinois CCR Rule." The East Ash Pond is also regulated by the U.S. Environmental Protection Agency's (EPA) "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments," 40 CFR Part 257 Subpart D (Ref. 2), also referred to herein as the "Federal CCR Rule."

Pursuant to 35 Ill. Adm. Code 845.780(d) and 40 CFR 257.104(d), this document provides the written post-closure care plan for the East Ash Pond at Waukegan. MWG intends to close this CCR surface impoundment by leaving the impounded CCR in place and installing a final cover system over the impoundment in accordance with 35 Ill. Adm. Code 845.750 and 40 CFR 257.102(d). Following completion of all closure activities, MWG will conduct post-closure care for the East Ash Pond in accordance with the requirements of 35 Ill. Adm. Code 845.780 and 40 CFR 257.104(b). This plan describes the post-closure care activities MWG anticipates performing throughout the post-closure care period for the East Ash Pond.

1.2 SCOPE

Per the 2016 Water Infrastructure Improvements for the Nation (WIIN) Act, the East Ash Pond will continue to be subject to both the Illinois and Federal CCR Rules until the U.S. EPA approves the Illinois EPA's CCR permit program. The Illinois EPA has yet to publish a timeline for submitting its proposed CCR permit program to the U.S. EPA for approval, and so this preliminary written closure plan has been prepared pursuant to both sets of regulations.

2.0 POST-CLOSURE MONITORING & MAINTENANCE ACTIVITIES

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.780(d)(1)(A)
Federal CCR Rule Reference: 40 CFR 257.104(d)(1)(i)

Post-closure monitoring for the East Ash Pond will include (1) maintaining the integrity and effectiveness of the final cover system, (2) maintaining the groundwater monitoring system, and (3) monitoring the groundwater at the site. Table 1 summarizes the post-closure monitoring activities planned to meet these objectives and the corresponding frequencies at which these activities will be performed (at a minimum).

Table 1 – Post-Closure Monitoring Frequency

Monitoring Activity	Description	Monitoring Frequency	Action Items
Final Cover Monitoring	Visually inspect final cover for surface erosion.	Weekly, and following each 25-year, 24-hour storm event if the storm event occurs more than 48 hours before the next scheduled weekly inspection.	Replace synthetic turf infill as needed.
	Visually inspect final cover for settlement, subsidence, and vertical cracking.		Repair holes, depressions, *etc*. as needed to prevent standing water and infiltration into covered ash.
Groundwater Monitoring	Monitor groundwater quality at the East Ash Pond.	Quarterly for constituents and monthly for groundwater elevations, switching to semi-annually after five years of post-closure monitoring if approved by the Illinois EPA.	If necessary, implement corrective action remedies to achieve compliance with groundwater protection standards.

2.1 FINAL COVER SYSTEM MONITORING & MAINTENANCE

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.780(b)(1)
Federal CCR Rule Reference: 40 CFR 257.104(b)(1)

Throughout the post-closure care period, MWG will maintain the integrity and effectiveness of the East Ash Pond's final cover system by regularly inspecting the cap for evidence of surface erosion, settlement, subsidence, or other events. If inspections reveal problems, appropriate corrective measures will be taken to remedy effects of surface erosion, settlement, subsidence, or other events.

2.2 GROUNDWATER MONITORING

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.780(b)(3)
Federal CCR Rule Reference: 40 CFR 257.104(b)(3)

MWG will maintain the East Ash Pond's groundwater monitoring system and will continue to monitor groundwater at the site throughout the post-closure care period in accordance with the requirements of 35 Ill. Adm. Code Part 845 Subpart F ("Groundwater Monitoring and Corrective Action") and 40 CFR 257.90 through 40 CFR 257.98. During the first five years of the pond's post-closure care period, groundwater monitoring will be performed quarterly for constituents and monthly for groundwater elevations. After five years of post-closure care, groundwater monitoring may be switched to a semi-annual basis if approved by the Illinois EPA.

3.0 FACILITY CONTACT DURING POST-CLOSURE CARE PERIOD

Illinois CCR Rule Reference: 35 Ill. Adm. 845.780(d)(1)(B)

Federal CCR Rule Reference: 40 CFR 257.104(d)(1)(ii)

The name, address, telephone number, and e-mail address of the person to contact about the East Ash Pond during the post-closure care period are presented below:

Name:	Paulo Rocha, Plant Manager
Address:	Waukegan Generating Station 401 E. Greenwood Ave. Waukegan, IL 60087
Telephone Number:	(847) 599-2212
E-mail Address:	paulo.rocha@nrg.com

4.0 PROPERTY USE DURING POST-CLOSURE CARE PERIOD

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.780(d)(1)(C)

Federal CCR Rule Reference: 40 CFR 257.104(d)(1)(iii)

MWG intends for the East Ash Pond site to remain undisturbed during the post-closure care period. MWG plans to limit access to the site only for inspecting the condition of the final cover system, making repairs to the final cover system (as needed), and for accessing the groundwater monitoring wells (if necessary).

5.0 AMENDMENTS TO POST-CLOSURE CARE PLAN

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.780(d)(3)

Federal CCR Rule Reference: 40 CFR 257.104(d)(3)

This post-closure care plan will be amended in accordance with 35 Ill. Adm. Code 845.780(d)(3) and 40 CFR 257.104(d)(3) if a change in the operation of the East Ash Pond would substantially affect this plan or if an unanticipated event necessitates a revision to this plan.

6.0 CERTIFICATION

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.780(d)(4)

Federal CCR Rule Reference: 40 CFR 257.102(d)(4)

I certify that:

- This written post-closure care plan for the East Ash Pond was prepared by me or under my direct supervision.
- The work was conducted in accordance with the requirements of 35 Ill. Adm. Code 845.780 and with the requirements of 40 CFR 257.104.
- I am a registered professional engineer under the laws of the State of Illinois.

Certified By: Thomas J. Dehlin   Date: October 29, 2021

Seal:

LICENSED PROFESSIONAL ENGINEER
THOMAS J DEHLIN
062-069314
OF ILLINOIS

Th. Dehlin
10/29/2021
Exp. 11/30/2021

7.0 REFERENCES

1. Illinois Pollution Control Board. "Standards for Disposal of Coal Combustion Residuals in CCR Surface Impoundments." 35 Ill. Adm. Code 845. Accessed October 19, 2021.
2. U.S. Environmental Protection Agency. "Standards for Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments." 40 CFR Part 257 Subpart D. https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-257/subpart-D. Accessed October 19, 2021.

ATTACHMENT 12
LINER CERTIFICATION

Attachment 12: Liquid Flow Rate through Alternative Composite Liner
Waukegan East Ash Pond

Darcy's Law for Gravity Flow through Porous Media

Q/A = q = k((h/t)+1)

- Q= flow rate (cubic centimeters/second)
- A = Surface area of the liner (squared centimeters)
- q = flow rate per unit area (cubic centimeters/second/squared centimeter)
- k = hydraulic conductivity of the liner (centimeters/second)
- h = hydraulic head above the liner (centimeters)
- t = thickness of the liner (centimeters)

Section 845.400(c) Comparison Flow Rate

Q/A = q = k((h/t)+1)

- Q= calculated
- A = 326,797.00 ft^2 = 303,604,347.63 cm^2 Based on surface area at toe of embankment
- q = calculated
- k = 1.00E-07 cm/s
- h = 15 ft = 457.2 cm
- t = 2 ft = 60.96 cm

Q = 1.00E-07 $\frac{457.2}{60.96}$ +1 * 303,604,347.63

Q = 258.06 cm^3/s	Compare to Surface Impoundment Flow Rate

Pond Profile

Layers	Depth (ft)	Elevation (ft msl)* From	To	Layer Description	Permeability (cm/s)	Layer Thickness (inch)	Layer Thickness (cm)	Product of Permeability & Layer Thickness
Pond	0	23	3.5	Pond embankment crest	--	--	--	--
	19.5	3.5	3.5	Pond bottom	--	--	--	--
Upper Liner Component	19.5-18.9	3.5	2.9	60-mil HDPE geomembrane	1.10E-11	0.06	0.1524	1.68E-12
Lower Liner Component	18.9-23.9	2.9	-2.1	sand with trace gravel	1.13E-02	5	12.7	1.44E-01

* Elevations are based on Waukegan city Datum

Totals	12.7	1.44E-01

Permeability (weighted) = 1.13E-02

East Ash Pond Flow Rate Calculation

Q/A = q = k((h/t)+1)

- Q= calculated
- A = 326,797.00 ft^2 = 303,604,347.63 cm^2 Based on surface area at toe of embankment
- q = calculated
- k = 1.13E-02 cm/s
- h = 15 ft = 457.2 cm
- t = 5 ft = 152.4 cm

Q = 1.13E-02 $\frac{457.2}{152.4}$ +1 * 303,604,347.63

Q = 13,722,916.51 cm^3/s	Compare to Section 845.400(c) Comparison Flow Rate

Comparison of Surface Impoundment Flow Rate vs Section 845.400(c) Flow Rate

Is the Surface Impoundment Flow Rate of 13,722,916.51 less than the Section 845.400(c) Comparison Flow Rate of 258.06 **NO**

Waukegan West Ash Pond

Darcy's Law for Gravity Flow through Porous Media

Q/A = q = k((h/t)+1)

Q= flow rate (cubic centimeters/second)

A = Surface area of the liner (squared centimeters)

q = flow rate per unit area (cubic centimeters/second/squared centimeter)

k = hydraulic conductivity of the liner (centimeters/second)

h = hydraulic head above the liner (centimeters)

t = thickness of the liner (centimeters)

Section 845.400(c) Comparison Flow Rate

Q/A = q = k((h/t)+1)

Q= calculated

A = 289,663.00 ft^2 = 269,105,732.76 cm^2 Based on surface area at toe of embankment

q = calculated

k = 1.00E-07 cm/s

h = 15 ft = 457.2 cm

t = 2 ft = 60.96 cm

Q = 1.00E-07 $\frac{457.2}{60.96}$ +1 * 269,105,732.76

Q = 228.74 cm^3/s

Compare to Surface Impoundment Flow Rate

Pond Profile

Layers	Depth (ft)	Elevation (ft msl)* From	Elevation (ft msl)* To	Layer Description	Permeability (cm/s)	Layer Thickness (inch)	Layer Thickness (cm)	Product of Permeability & Layer Thickness
Pond	0	23	3.5	Pond embankment crest	--	--	--	--
	19.5	3.5	3.5	Pond bottom	--	--	--	--
Upper Liner Component	19.5-18.9	3.5	2.9	60-mil HDPE geomembrane	1.10E-11	0.06	0.1524	1.68E-12
Lower Liner Component	18.9-23.9	2.9	-2.1	sand with trace gravel	1.13E-02	5	12.7	1.44E-01
						Totals	12.7	1.44E-01

* Elevations are based on Waukegan city Datum

Permeability (weighted) =	1.13E-02

West Ash Pond Flow Rate Calculation

Q/A = q = k((h/t)+1)

Q= calculated

A = 289,663.00 ft^2 = 269,105,732.76 cm^2 Based on surface area at toe of embankment

q = calculated

k = 1.13E-02 cm/s

h = 15 ft = 457.2 cm

t = 5 ft = 152.4 cm

Q = 1.13E-02 $\frac{457.2}{152.4}$ +1 * 269,105,732.76

Q = 12,163,579.12 cm^3/s

Compare to Section 845.400(c) Comparison Flow Rate

Comparison of Surface Impoundment Flow Rate vs Section 845.400(c) Flow Rate

Is the Surface Impoundment Flow Rate of 12,163,579.12 less than the Section 845.400(c) Comparison Flow Rate of 228.74 **NO**

ATTACHMENT 13
HISTORY OF KNOWN EXCEEDANCES

Attachment 13 – No Attachment

ATTACHMENT 14
FINANCIAL ASSURANCE

<u>CERTIFICATION</u>
<u>35 Ill. Adm. Code 845 Subpart I</u>

In accordance with Section 35 Ill. Adm. Code 845.230(a)(17), Midwest Generation, LLC meets the financial assurance requirements of 35 Ill. Adm. Code 845 Subpart I: Financial Assurance for the Waukegan Generating Station. The performance bond is attached.

PERFORMANCE BOND

Date bond executed:	06/21/2021

Effective date:	06/21/2021

Principal:	NRG Energy, Inc. on behalf of Midwest Generation, LLC

Type of organization:	Corporation

State of incorporation:	Delaware

Surety:	Arch Insurance Company

Site Waukegan

Name	Waukegan Generating Station

Address	401 East Greenwood Avenue

City	Waukegan, IL 60087

Amount guaranteed by this bond:	$4,863,593.45		

Name	

Address	

City	

Amount guaranteed by this bond:	$		

Please attach a separate page if more space is needed for all sites.

Total penal sum of bond:	$ 4,863,593.45	

Surety's bond number:	SU1174123	

The Principal and the Surety promise to pay the Illinois Environmental Protection Agency ("IEPA") the above penal sum unless the Principal or Surety provides closure and post-closure care for each site in accordance with the closure and post-closure care plans for that site. To the payment of this obligation the Principal and Surety jointly and severally bind themselves, their heirs, executors, administrators, successors and assigns.

Whereas the Principal is required, under Section 21(d) of the Environmental Protection Act [415 ILCS 5/21(d)], to have a permit to conduct a waste disposal operation;

Whereas the Principal is required, under Section 21.1 of the Environmental Protection Act [415 ILCS 5/21.1], to provide financial assurance for closure and post-closure care;

Whereas the Surety is licensed by the Illinois Department of Insurance or is licensed to transact the business of insurance, or approved to provide insurance as an excess or surplus lines insurer, by the insurance department in one or more states; and

Whereas the Principal and Surety agree that this bond shall be governed by the laws of the State of Illinois;

The Surety shall pay the penal sum to the IEPA or provide closure and post-closure care in accordance with the closure and post-closure care plans for the site if, during the term of the bond, the Principal fails to provide closure or post-closure care for any site in accordance with the closure and post-closure care plans for that site as guaranteed by this bond. The Principal fails to so provide when the Principal:

a) Abandons the site;

b) Is adjudicated bankrupt;

c) Fails to initiate closure of the site or post-closure care when ordered to do so by the Illinois Pollution Control Board or a court of competent jurisdiction;

d) Notifies the IEPA that it has initiated closure, or initiates closure, but fails to close the site or provide post-closure care in accordance with the closure and post-closure care plans; or

e) Fails to provide alternate financial assurance and obtain the IEPA written approval of the assurance provided within 90 days after receipt by both the Principal and the IEPA of a notice from the Surety that the bond will not be renewed for another term.

The Surety shall pay the penal sum of the bond to the IEPA or notify the IEPA that it intends to provide closure and post-closure care in accordance with the closure and post-closure care plans for the site within 30 days after the IEPA mails notice to the Surety that the Principal has met one or more of the conditions described above. Payment shall be made by check or draft payable to the State of Illinois, Landfill Closure and Post-Closure Fund.

If the Surety notifies the IEPA that it intends to provide closure and post-closure care, then the Surety must initiate closure and post-closure care within 60 days after the IEPA mailed notice to the Surety that the Principal met one or more of the conditions described above. The Surety must complete closure and post-closure care in accordance with the closure and post-closure care plans, or pay the penal sum.

The liability of the Surety shall not be discharged by any payment or succession of payments unless and until such payment or payments shall amount in the aggregate to the penal sum of the bond. In no event shall the obligation of the Surety exceed the amount of the penal sum.

This bond shall expire on the __21st day of June__________, 2022 [date]; but such expiration date shall be automatically extended for a period of One [at least one year] on __21st day of June, 2022____ [date] and on each successive expiration date, unless, at least 120 days before the current expiration date, the Surety notifies both the IEPA and the Principal by certified mail that the Surety has decided not to extend the term of this surety bond beyond the current expiration date. The 120 days will begin on the date when both the Principal and the IEPA have received the notice, as evidenced by the return receipts.

The Principal may terminate this bond by sending written notice to the Surety; provided, however, that no such notice shall become effective until the Surety receives written authorization for termination of the bond from the IEPA in accordance with 35 Ill. Adm. Code 807.604.

In Witness Whereof, the Principal and Surety have executed this Performance Bond and have affixed their seals on the date set forth above.

The persons whose signatures appear below certify that they are authorized to execute this surety bond on behalf of the Principal and Surety and that the wording of this surety bond is identical to the wording specified in 35 Ill. Adm. Code 807.Appendix A, Illustration D as such regulation was constituted on the date this bond was executed.

Principal: NRG Energy, Inc. on behalf of Midwest Generation, LLC		Corporate Surety
Signature		Name: Arch Insurance Company
Typed Name Edward Christopher Krupa		Address: Harborside 3, 210 Hudson Street, Suite 300, Jersey City, NJ 07311-1107
Title Vice President		State of Incorporation: Missourt
Date 6/21/2021		Signature
		Typed Name: Mark W. Edwards, II
		Title-Attorney-in-Fact
Corporate seal		Corporate seal

		Bond premium:	$	34,045.00

(Source: Amended at 35 Ill. Reg. 18867, effective October 24, 2011)

Section 807.APPENDIX A Financial Assurance Forms

This Power of Attorney limits the acts of those named herein, and they have no authority to bind the Company except in the manner and to the extent herein stated. Not valid for Note, Loan, Letter of Credit, Currency Rate, Interest Rate or Residential Value Guarantees.

POWER OF ATTORNEY

Know All Persons By These Presents:
That the Arch Insurance Company, a corporation organized and existing under the laws of the State of Missouri, having its principal administrative office in Jersey City, New Jersey (hereinafter referred to as the "Company") does hereby appoint:

Alisa B. Ferris, Anna Childress, Jeffrey M. Wilson, Mark W. Edwards II, Richard H. Mitchell, Robert R. Freel and William M. Smith of Birmingham, AL (EACH)

R. E. Daniels and Shelby E. Daniels of Pensacola, FL (EACH)

its true and lawful Attorney(s)in-Fact, to make, execute, seal, and deliver from the date of issuance of this power for and on its behalf as surety, and as its act and deed: Any and all bonds, undertakings, recognizances and other surety obligations, in the penal sum not exceeding Ninety Million Dollars ($90,000,000.00).
This authority does not permit the same obligation to be split into two or more bonds In order to bring each such bond within the dollar limit of authority as set forth herein.

The execution of such bonds, undertakings, recognizances and other surety obligations in pursuance of these presents shall be as binding upon the said Company as fully and amply to all intents and purposes, as if the same had been duly executed and acknowledged by its regularly elected officers at its principal administrative office in Jersey City, New Jersey.

This Power of Attorney is executed by authority of resolutions adopted by unanimous consent of the Board of Directors of the Company on December 10, 2020, true and accurate copies of which are hereinafter set forth and are hereby certified to by the undersigned Secretary as being in full force and effect:
"**VOTED**, That the Chairman of the Board, the President, or the Executive Vice President, or any Senior Vice President, of the Surety Business Division, or their appointees designated in writing and filed with the Secretary, or the Secretary shall have the power and authority to appoint agents and attorneys-in-fact, and to authorize them subject to the limitations set forth in their respective powers of attorney, to execute on behalf of the Company, and attach the seal of the Company thereto, bonds, undertakings, recognizances and other surety obligations obligatory in the nature thereof, and any such officers of the Company may appoint agents for acceptance of process."

This Power of Attorney is signed, sealed and certified by facsimile under and by authority of the following resolution adopted by the unanimous consent of the Board of Directors of the Company on December 10, 2020:

VOTED, That the signature of the Chairman of the Board, the President, or the Executive Vice President, or any Senior Vice President, of the Surety Business Division, or their appointees designated in writing and filed with the Secretary, and the signature of the Secretary, the seal of the Company, and certifications by the Secretary, may be affixed by facsimile on any power of attorney or bond executed pursuant to the resolution adopted by the Board of Directors on December 10, 2020, and any such power so executed, sealed and certified with respect to any bond or undertaking to which it is attached, shall continue to be valid and binding upon the Company. **In Testimony Whereof**, the Company has caused this instrument to be signed and its corporate seal to be affixed by their authorized officers, this **23rd day of April, 2021**.

Attested and Certified

Regan A. Shulman, Secretary

Arch Insurance Company CORPORATE SEAL 1971 Missouri

Arch Insurance Company

Stephen C. Ruschak, Executive Vice President

STATE OF PENNSYLVANIA SS
COUNTY OF PHILADELPHIA SS

I, **Michele Tripodi**, a Notary Public, do hereby certify that Regan A. Shulman and Stephen C. Ruschak personally known to me to be the same persons whose names are respectively as Secretary and Executive Vice President of the Arch Insurance Company, a Corporation organized and existing under the laws of the State of Missouri, subscribed to the foregoing instrument, appeared before me this day in person and severally acknowledged that they being thereunto duly authorized signed, sealed with the corporate seal and delivered the said instrument as the free and voluntary act of said corporation and as their own free and voluntary acts for the uses and purposes therein set forth.

COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
MICHELE TRIPODI, Notary Public
City of Philadelphia, Phila. County
My Commission Expires July 31, 2021

Michele Tripodi, Notary Public
My commission expires 07/31/2021

CERTIFICATION
I, **Regan A. Shulman**, Secretary of the Arch Insurance Company, do hereby certify that the attached **Power of Attorney dated April 23, 2021** on behalf of the person(s) as listed above is a true and correct copy and that the same has been in full force and effect since the date thereof and is in full force and effect on the date of this certificate; and I do further certify that the said Stephen C. Ruschak, who executed the Power of Attorney as Executive Vice President, was on the date of execution of the attached Power of Attorney the duly elected Executive Vice President of the Arch Insurance Company.
IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed the corporate seal of the Arch Insurance Company on this 21st day of June, 2021.

Regan A. Shulman, Secretary

This Power of Attorney limits the acts of those named therein to the bonds and undertakings specifically named therein and they have no authority to bind the Company except in the manner and to the extent herein stated.

PLEASE SEND ALL CLAIM INQUIRIES RELATING TO THIS BOND TO THE FOLLOWING ADDRESS:
Arch Insurance – Surety Division
3 Parkway, Suite 1500
Philadelphia, PA 19102

Arch Insurance Company CORPORATE SEAL 1971 Missouri

To verify the authenticity of this Power of Attorney, please contact Arch Insurance Company at SuretyAuthentic@archinsurance.com
Please refer to the above named Attorney-in-Fact and the details of the bond to which the power is attached.

ATTACHMENT 15
HAZARD POTENTIAL CLASSIFICATION ASSESSMENT

MWG

Midwest Generation, LLC
Waukegan Generating Station

2021 Hazard Potential Classification Assessment for East Ash Pond & West Ash Pond

Revision 0

October 14, 2021

Issue Purpose: Use

Project No.: 12661-123

55 East Monroe Street
Chicago, IL 60603-5780 USA
312-269-2000
www.sargentlundy.com

Sargent & Lundy

TABLE OF CONTENTS

1.0 PURPOSE & SCOPE

1.1 PURPOSE

The East Ash Pond and West Ash Pond at Midwest Generation, LLC's (MWG) Waukegan Generating Station ("Waukegan" or the "Station") are existing coal combustion residual (CCR) surface impoundments that are regulated by the Illinois Pollution Control Board's "Standards for the Disposal of Coal Combustion Residuals in CCR Surface Impoundments." These regulations are codified in Part 845 to Title 35 of the Illinois Administrative Code (35 Ill. Adm. Code 845, Ref. 1) and are also referred to herein as the "Illinois CCR Rule." Pursuant to 35 Ill. Adm. Code 845.440(a)(1), MWG must conduct and complete a hazard potential classification assessment that assigns hazard potential classifications to the East and West Ash Ponds in accordance with the hazard potential classifications defined in 35 Ill. Adm. Code 845.120.

The East and West Ash Ponds are also regulated by the U.S. Environmental Protection Agency's "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments," 40 CFR Part 257 Subpart D (Ref. 2), also referred to herein as the "Federal CCR Rule." Pursuant to 40 CFR 257.73(f)(3), the Federal CCR Rule requires MWG to conduct and complete a hazard potential classification assessment in accordance with 40 CFR 257.73(a)(2) for the East and West Ash Ponds every five years.

This report documents the 2021 hazard potential classification assessment conducted and completed in accordance with the Illinois and Federal CCR Rules by Sargent & Lundy (S&L) on behalf of MWG for the East and West Ash Ponds at Waukegan. This report:

- Lists the inputs and assumptions used in the 2021 hazard potential classification assessment,
- Discusses the methodology used to conduct the 2021 hazard potential classification assessment,
- Lists and compares the definitions for the hazard potential classifications for CCR surface impoundments promulgated by the Illinois and Federal CCR Rules,
- Summarizes the results from the initial hazard potential classification assessment completed for the East and West Ash Ponds that was conducted in accordance with the Federal CCR Rule,
- Evaluates potential changes to the factors used as the bases for the initial federal hazard potential classifications assigned to the East and West Ash Ponds to determine whether revised federal hazard potential classifications are warranted, and
- Provides the 2021 hazard potential classifications for the East and West Ash Ponds in accordance with 35 Ill. Adm. Code 845.440(a)(1) and 40 CFR 257.73(a)(2).

1.2 SCOPE

Per the 2016 Water Infrastructure Improvements for the Nation (WIIN) Act, the East and West Ash Ponds will continue to be subject to both the Illinois and Federal CCR Rules until the U.S. EPA approves the Illinois

EPA's CCR permit program. The Illinois EPA has yet to publish a timeline for submitting its proposed CCR permit program to the U.S. EPA for approval, and so MWG must provide hazard potential classifications pursuant to both sets of regulations at this time.

2.0 INPUTS

Hazard Potential Classifications

The Illinois CCR Rule (Ref. 1, § 845.120) defines "hazard potential classification" as "the possible adverse incremental consequences that result from the release of water or stored contents due to failure of the diked CCR surface impoundment or mis-operation of the diked CCR surface impoundment or its appurtenances." The Illinois CCR Rule (Ref. 1, § 845.440(a)(1)) requires a CCR surface impoundment be designated as either a Class 1 CCR surface impoundment or a Class 2 CCR surface impoundment. Per 35 Ill. Adm. Code 845.120, the two Illinois hazard potential classifications are defined as follows:

- *Class 1 CCR surface impoundment* means a diked surface impoundment where failure or mis-operation will probably cause loss of human life.
- *Class 2 CCR surface impoundment* means a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.

The Federal CCR Rule (Ref. 2, § 257.53) has the same definition for "hazard potential classification" as the Illinois CCR Rule. However, the Federal CCR Rule has three hazard potential classifications instead of the two designations promulgated by the Illinois CCR Rule. Per 40 CFR 257.53, the three federal hazard potential classifications are defined as follows:

- *High hazard potential CCR surface impoundment* means a diked surface impoundment where failure or mis-operation will probably cause loss of human life.
- *Low hazard potential CCR surface impoundment* means a diked surface impoundment where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.
- *Significant hazard potential CCR surface impoundment* means a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.

Per the preceding sets of definitions for the federal and Illinois hazard potential classifications, a high hazard potential CCR surface impoundment per the Federal CCR Rule is the same as a Class 1 CCR surface impoundment per the Illinois CCR Rule. Similarly, a CCR surface impoundment that is classified as a low or significant hazard potential per the Federal CCR Rule is considered to be a Class 2 CCR surface impoundment per the Illinois CCR Rule.

Site Topography

Two topographic datasets for the East Ash Pond, the West Ash Pond, and the surrounding areas were obtained: one from the U.S. Geological Survey's (USGS) National Elevation Dataset (NED) (Ref. 4) and one from the U.S. Department of Agriculture's (USDA) National Digital Elevation Program (NDEP) (Ref. 5). The USGS dataset was published in 2011 and was utilized in the initial hazard potential classification assessment and the 2016 dike breach analysis. The USGS topography reflects elevation data collected in 2007 at a resolution of approximately 3 meters. Based on a review of the USGS NED, the 2007 USGS elevation dataset is the most recent topographic dataset in the NED at a 3-meter or better resolution for the Station and surrounding areas. Meanwhile, the USDA topography reflects elevation data collected in 2010 at a 1-meter resolution and was utilized in this 2021 assessment to determine whether the site topography referenced in the initial hazard potential classification assessment and the 2016 dike breach analysis should be updated.

Impacted Areas

Areas impacted by a hypothetical failure at either the East Ash Pond or the West Ash Pond were obtained from the ponds' initial hazard potential classification assessment (Ref. 3), the dike breach analyses conducted in 2016 for the ponds' northern and southern dikes (Refs. 6 and 7), and the dike breach inundation maps prepared for the ponds' Emergency Action Plan (Ref. 8). The inputs, assumptions, and methodology utilized to identify areas impacted by failures at each of the ponds' dikes were evaluated to determine whether any updates to these analyses were warranted.

Appendix A provides the initial hazard potential classification assessment conducted by Geosyntec Consultants in 2016 for the East and West Ash Ponds.

Aerial Images

Historical and recent aerial images of the Station and surrounding areas were obtained from Google Earth Pro (Ref. 9).

Property Boundaries

Boundaries for the Station's property and adjacent properties were obtained from the geographic information system (GIS) for Lake County, Illinois (Ref. 10).

Ash Pond Conditions

The operating and physical conditions for the East and West Ash Ponds were based on discussions with MWG personnel and on the annual inspection reports prepared for the CCR surface impoundments in accordance with 40 CFR 257.83(b) (Refs. 11 through 14).

3.0 ASSUMPTIONS

There are no assumptions in this document that require verification.

4.0 METHODOLOGY

The bases for the East and West Ash Ponds' initial hazard potential classifications as documented within the ponds' initial hazard potential classification assessment were reviewed to determine if any changes have occurred since the initial assessment was completed. Identified changes were then evaluated to determine if the ponds' previous hazard potential classifications warranted adjustments. Where no changes were noted for a given input, or where identified changes were determined to have no impact to the results and conclusions of the initial hazard potential classification assessment, the previous evaluation of that input was considered to still be valid for this 2021 assessment.

In instances where changes to one or more factors used as the bases for the initial hazard potential classifications were identified (*e.g.*, downstream development that was not present in 2016), hypothetical dike breaches were considered at each of the two CCR surface impoundments to evaluate the impacts that a release of CCR and CCR wastewater would have on the identified factor(s). These hypothetical dike breaches were evaluated regardless of potential causes and/or apparent dike stability. When evaluating a hypothetical dike breach at a subject CCR surface impoundment, the solid waste materials in the CCR surface impoundment were conservatively considered as an equivalent volume of liquid, and the CCR surface impoundment was assumed to be entirely filled with liquid.

When evaluating the downstream impacts from a hypothetical dike breach at a CCR surface impoundment, the first consideration examined was whether a loss of human life is probable under the given hypothetical failure scenario. Loss of human life is the critical aspect of a federal high hazard potential classification. If a loss of human life is unlikely to occur, then the CCR surface impoundment was not considered to be a federal high hazard potential. In that case, the next consideration examined was the extent of environmental and economic losses resulting from the hypothetical dike breach. If the losses are low and principally contained to MWG's property, then the CCR surface impoundment was considered to be a federal low hazard potential. If the environmental and/or economic losses extend beyond MWG's property, then the CCR surface impoundment was considered to be a federal significant hazard potential.

After assigning federal hazard potential classifications to the East and West Ash Ponds, Illinois CCR Rule hazard potential classifications (either Class 1 or Class 2) were assigned based on the assigned federal hazard potential classifications. An Illinois Class 1 hazard potential classification was assigned to a CCR surface impoundment if the pond was classified as a federal high hazard potential. Alternatively, the CCR surface impoundment was classified as an Illinois Class 2 hazard potential if the pond was classified as either a federal significant or low hazard potential.

5.0 ASSESSMENT

5.1 SUMMARY OF INITIAL HAZARD POTENTIAL CLASSIFICATION ASSESSMENT

The initial hazard potential classification assessment for the East and West Ash Ponds was completed in October 2016 and is included in its entirety in Appendix A. This assessment evaluated the potential consequences of hypothetical dike failures for both ponds. A quantitative dike breach analysis was also conducted for the northern and southern dikes of each pond, which were determined to pose the most risk to human life due to their proximities to occupied buildings and the adjacent topography sloping towards the occupied buildings. Specifically, several Station buildings are downstream of the ponds' northern dikes, and the Waukegan Water Reclamation Facility (WWRF) is downstream of the ponds' southern dikes. The 2016 dike breach analysis also assumed that the East and West Ash Ponds were full at the time of the hypothetical failure. Moreover, the analysis assumed that a hypothetical failure at either pond's southern dike occurred concurrently with the peak flow of stormwater within the unnamed channel during the probable maximum flood event for the area.

5.1.1 SOUTHERN DIKE BREACH ANALYSES

Per Figures 2 through 5 in Appendix A, the 2016 dike breach analysis concluded that the flood released through a hypothetical breach in the East Ash Pond's southern dike could impact eight occupied buildings at the WWRF. Meanwhile, it was determined that a flood released through a similar breach at the West Ash Pond's southern dike could impact an additional six occupied buildings at the WWRF (14 buildings in total). The 2016 dike breach analysis also concluded that the combination of the estimated flood velocity and depth at each of these occupied buildings is within the U.S. Department of the Interior, Bureau of Reclamation's (USBR) "Low Danger Zone" (see Figure 10 in Appendix A). In its "Downstream Hazard Classification Guidelines" (Ref. 15), the USBR states that if the depth-velocity combination of a hazard (*e.g.*, flood) for a given area plots within the "Low Danger Zone," "the number of lives-in-jeopardy associated with possible downstream hazards is assumed to be zero." In other words, floods plotting within the USBR's "Low Danger Zone" are unlikely to cause a probable loss of human life. Therefore, the initial hazard potential classification assessment concluded that a failure at the southern dike of either the East Ash Pond or the West Ash Pond would not result in a probable loss of human life.

5.1.2 NORTHERN DIKE BREACH ANALYSES

Per Figures 6 through 9 in Appendix A, the 2016 dike breach analysis concluded that the flood released through a hypothetical breach in the northern dike of either the East Ash Pond or the West Ash Pond could impact several unoccupied buildings and three occupied buildings at the Station. The 2016 dike breach analysis also concluded that the combination of the estimated flood velocity and depth at each of these occupied buildings is within the USBR's "Low Danger Zone" (see Figure 10 in Appendix A). As previously stated, depth-velocity combinations plotting within the "Low Danger Zone" are unlikely to cause a probable loss of human life. Therefore, the initial hazard potential classification assessment concluded that a failure at the northern dike of either the East Ash Pond or the West Ash Pond would not result in a probable loss of human life.

5.1.3 HAZARD POTENTIAL CLASSIFICATIONS

Although a hypothetical failure at either the East Ash Pond or the West Ash Pond was determined to not cause a probable loss of human life, it was also determined that wastewater released from a dike breach at either pond had the potential to flow directly into Lake Michigan and cause offsite environmental impacts. Therefore, the East and West Ash Ponds were both classified as significant hazard potential CCR surface impoundments.

5.2 CHANGES IN BASES FOR INITIAL HAZARD POTENTIAL CLASSIFICATIONS

5.2.1 CHANGES IN ASH POND OPERATIONS & EMBANKMENT GEOMETRY

In June 2020, Waukegan took the West Ash Pond out of service for routine cleaning. During a site visit in September 2021, it was noted that most of the CCR previously stored in the West Ash Pond had been removed and minimal surface water remained. In April 2021, MWG filed a notice of intent to close the West Ash Pond in accordance with the Federal CCR Rule's closure criteria (Ref. 2, § 257.102). Closure construction activities will commence at the pond upon receipt of a closure construction permit from the Illinois EPA in accordance with Subpart B of the Illinois CCR Rule. Meanwhile, Waukegan continues to operate the East Ash Pond to manage CCR wastestreams and various non-CCR wastestreams from the Station in accordance with 40 CFR 257.103(f)(1). Operating conditions at this pond have not changed since the pond's initial hazard potential classification assessment was conducted in 2016.

As previously mentioned in Section 5.1, the West Ash Pond's 2016 hazard potential classification assessment examined hypothetical breach scenarios assuming the pond was at capacity; therefore, the assumed operating condition used for the initial assessment is conservative for the pond's current operating condition. Therefore, there is no basis to reevaluate the surface water elevations used to conduct the initial hazard potential classification assessment for the East and West Ash Ponds.

Based on reviews of the annual inspection reports (Refs. 11 through 14) and Google Earth aerial images (Ref. 9), there have been no significant modifications to the East and West Ash Ponds (mass excavations, major embankment modifications, *etc*.) since the initial hazard potential classification assessment was completed. It should be noted that the lowering of the East Ash Pond's eastern dike in the fall of 2016, as noted in the 2017 annual inspection report (Ref. 11), was incorporated into the initial hazard potential classification assessment and 2016 dike breach analysis. Therefore, there is no basis to reevaluate the embankment geometry for this 2021 assessment.

5.2.2 CHANGES IN SITE TOPOGRAPHY

When comparing the 2007 USGS topography (Ref. 4) used in the initial hazard potential classification assessment and the 2010 USDA elevation dataset for the area (Ref. 5), no significant differences in the topography adjacent to the ash ponds and within the dike breach impact areas were identified. Moreover, Google Earth aerial images (Ref. 9) indicated that there have been no significant modifications to the ground surfaces (mass excavations, mass fill placement, *etc*.) adjacent to the East and West Ash Ponds or within the dike breach impact areas since 2010, the source date for the USDA elevation dataset. Based on these observations, the topographic data used by the initial hazard potential classification assessment remains valid for this 2021 assessment.

5.2.3 CHANGES IN DOWNSTREAM PROPERTY DEVELOPMENTS

Based on reviews of Google Earth aerial images (Ref. 9) and the Lake County, Illinois GIS (Ref. 10), no new buildings or transport corridors (roads, rail lines, *etc*.) have been constructed in the past five years within the dike breach impact areas identified in the initial hazard potential classification assessment. Thus, there is no basis to reevaluate the potential impacts to the areas downstream of the East and West Ash Ponds for this 2021 assessment.

5.2.4 CHANGES IN USBR DEPTH-VELOCITY FLOOD DANGER LEVELS

The USBR has not updated the depth-velocity flood danger level relationships presented in its "Downstream Hazard Classification Guidelines" (Ref. 15) since the initial hazard potential classification assessment for the East and West Ash Ponds was completed in 2016. Therefore, there is no basis to reevaluate the danger levels assigned to the occupied buildings identified within the inundation areas downstream of the northern and southern dikes for the East and West Ash Ponds.

5.3 2021 HAZARD POTENTIAL CLASSIFICATION ASSESSMENT

Other than the change in the operational status of West Ash Pond, there have been no significant modifications to the East and West Ash Ponds; no significant modifications to the topography adjacent to and downstream of these CCR surface impoundments; and no significant buildings or transport corridors that have been constructed in the areas downstream of the CCR surface impoundments that would be impacted by a hypothetical dike breach. There have also been no changes to the USBR's depth-velocity flood danger level relationships, which were used in the 2016 hazard potential classification assessment. Therefore, the initial hazard potential classification assessment completed in 2016 for these CCR surface impoundments remains valid. In addition, the 2016 dike breach analyses for the ponds' northern and southern dikes still represent the worst-case failure scenarios for each pond since these dikes are the closest to the occupied Station and WWRF buildings.

Based on the preceding observations, the initial federal significant hazard potential classifications assigned to the East and West Ash Ponds in accordance with 40 CFR 257.73(a)(2) and the bases for these assignments remain valid for this 2021 assessment. A loss of human life is unlikely to result from a hypothetical failure at these CCR surface impoundments, but potential offsite environmental damage could occur to Lake Michigan. As discussed in Section 2.0, a CCR surface impoundment classified as a significant hazard potential per the Federal CCR Rule is considered to be an Illinois Class 2 CCR surface impoundment. Therefore, the East and West Ash Ponds were classified as Class 2 CCR surface impoundments pursuant to 35 Ill. Adm. Code 845.440(a)(1).

6.0 CONCLUSIONS

This evaluation reviewed the factors and design inputs used as the bases for the initial hazard potential classification assessment completed in accordance with the Federal CCR Rule for Waukegan's East and West Ash Ponds. It was determined that no significant operational or physical changes to these CCR surface impoundments and no new downstream developments within the dike breach inundation areas have occurred within the last five years that would necessitate changing either pond's initial federal hazard potential classification. Therefore, the initial federal hazard potential classifications assigned to the East and West Ash Ponds and the bases for these assignments remain valid for 2021. These federal hazard potential classifications were then used to determine the hazard potential classifications pursuant to the Illinois CCR Rule based on the similarities between the Federal and Illinois CCR Rule's hazard potential classifications for CCR surface impoundments.

Table 6-1 presents the 2021 hazard potential classifications assigned to the East and West Ash Ponds at Waukegan in accordance with 35 Ill. Adm. Code 845.440(a)(1) and 40 CFR 257.73(a)(2).

Table 6-1 – 2021 Illinois & Federal Hazard Potential Classifications for East Ash Pond & West Ash Pond at the Waukegan Generating Station

CCR Surface Impoundment	Illinois Hazard Potential Classification	Federal Hazard Potential Classification
East Ash Pond	Class 2	Significant
West Ash Pond	Class 2	Significant

7.0 CERTIFICATION

I certify that:

- This hazard potential classification assessment was prepared by me or under my direct supervision.
- The work was conducted in accordance with the requirements of 35 Ill. Adm. Code 845.440 and with the requirements of 40 CFR 257.73(a)(2).
- I am a registered professional engineer under the laws of the State of Illinois.

Certified By: Thomas J. Dehlin   Date: October 14, 2021

Seal:

LICENSED PROFESSIONAL ENGINEER
THOMAS J DEHLIN
062-069314
OF ILLINOIS

Th. Dehlin
10/14/2021
Exp. 11/30/2021

8.0 REFERENCES

1. Illinois Pollution Control Board. “Standards for Disposal of Coal Combustion Residuals in CCR Surface Impoundments.” 35 Ill. Adm. Code 845. Accessed October 13, 2021.
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APPENDIX A: 2016 HAZARD POTENTIAL CLASSIFICATION ASSESSMENT FOR EAST & WEST ASH PONDS

ATTACHMENT 16
STRUCTURAL STABILITY ASSESSMENT

MWG

Midwest Generation, LLC
Waukegan Generating Station

2021 Structural Stability Assessment for East Ash Pond & West Ash Pond

Revision 0

October 14, 2021

Issue Purpose: Use

Project No.: 12661-123

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Sargent & Lundy

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1.0 PURPOSE & SCOPE

1.1 PURPOSE

The East Ash Pond and West Ash Pond at Midwest Generation, LLC's (MWG) Waukegan Generating Station ("Waukegan" or the "Station") are existing coal combustion residual (CCR) surface impoundments that are regulated by the Illinois Pollution Control Board's "Standards for the Disposal of Coal Combustion Residuals in CCR Surface Impoundments." These regulations are codified in Part 845 to Title 35 of the Illinois Administrative Code (35 Ill. Adm. Code 845, Ref. 1) and are also referred to herein as the "Illinois CCR Rule." Pursuant to 35 Ill. Adm. Code 845.450(a), MWG must conduct and complete a structural stability assessment that documents whether the design, construction, operation, and maintenance of the East and West Ash Ponds are consistent with recognized and generally accepted engineering practices for the CCR surface impoundments' storage capacities.

The East and West Ash Ponds are also regulated by the U.S. Environmental Protection Agency's (EPA) "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments," 40 CFR Part 257 Subpart D (Ref. 2), also referred to herein as the "Federal CCR Rule." Pursuant to 40 CFR 257.73(f)(3), the Federal CCR Rule requires MWG to conduct and complete a structural stability assessment in accordance with 40 CFR 257.73(d) for the East and West Ash Ponds every five years.

This report documents the 2021 structural stability assessment conducted and completed in accordance with the Illinois and Federal CCR Rules by Sargent & Lundy (S&L) on behalf of MWG for the East and West Ash Ponds at Waukegan.

1.2 SCOPE

Per the 2016 Water Infrastructure Improvements for the Nation (WIIN) Act, the East and West Ash Ponds will continue to be subject to both the Illinois and Federal CCR Rules until the U.S. EPA approves the Illinois EPA's CCR permit program. The Illinois EPA has yet to publish a timeline for submitting its proposed CCR permit program to the U.S. EPA for approval, and so MWG must conduct structural stability assessments pursuant to both sets of regulations at this time.

2.0 ASSESSMENT

2.1 INPUTS & 2021 ASH POND CONDITIONS

The findings documented in this 2021 structural stability assessment for the East and West Ash Ponds are based on visual observations made during a site visit by S&L on September 22, 2021; discussions with MWG personnel; historical and recent aerial images obtained from Google Earth Pro (Ref. 3); and the East and West Ash Ponds' initial structural stability assessment (Ref. 4), annual inspection reports (Refs. 5

through 8), and history of construction (Ref. 9). The initial structural stability assessment for the East and West Ash Ponds, which was completed in October 2016, is included in its entirety in Appendix A.

In June 2020, Waukegan took the West Ash Pond out of service for routine cleaning. During the September 2021 site visit, it was noted that most of the CCR previously stored in the West Ash Pond had been removed and minimal surface water remained in the pond. In April 2021, MWG filed a notice of intent to close the West Ash Pond in accordance with the Federal CCR Rule's closure criteria (Ref. 2, § 257.102). Closure construction activities will commence at the pond upon receipt of a closure construction permit from the Illinois EPA in accordance with Subpart B of the Illinois CCR Rule. After closing the West Ash Pond, MWG currently plans on subsequently repurposing the area as a new low volume waste pond for the Station. Meanwhile, Waukegan continues to operate the East Ash Pond to manage CCR wastestreams and various non-CCR wastestreams from the Station in accordance with 40 CFR 257.103(f)(1). Operating conditions at this pond have not changed since the pond's initial structural stability assessment was completed in 2016. MWG plans to close the East Ash Pond after repurposing the West Ash Pond as a new low volume waste pond for the non-CCR wastestreams currently being managed in the East Ash Pond.

2.2 STABLE FOUNDATIONS & ABUTMENTS

(35 Ill. Adm. Code 845.450(a)(1); 40 CFR 257.73(d)(1)(i))

The East and West Ash Ponds are comprised of earthen dikes on all sides and do not have any abutments. Detailed information on the soils supporting the East and West Ash Ponds' dikes is provided in the ponds' initial structural stability assessment in Appendix A. Based on reviews of the ponds' annual inspection reports (Refs. 5 through 8) and Google Earth aerial images (Ref. 3), there have been no significant modifications to East and West Ash Ponds' geometries since their initial structural stability assessment was completed. Therefore, the details of the soils supporting the East and West Ash Ponds' dikes and corresponding conclusions documented in the ponds' initial structural stability assessment remain valid for this 2021 assessment (see Appendix A). Thus, the soils supporting the East and West Ash Ponds' dikes are considered to be stable for the maximum volume of CCR and CCR wastewater which can be impounded therein.

2.3 SLOPE PROTECTION

(35 Ill. Adm. Code 845.450(a)(2) & (4); 40 CFR 257.73(d)(1)(ii) & (iv))

The upstream slopes of the East and West Ash Ponds are lined with high-density polyethylene (HDPE) geomembrane. This form of cover protects the upstream slopes of the ponds' dikes against surface erosion, wave action, and adverse effects of sudden (rapid) drawdown.

Slope protection for the downstream slopes of the East and West Ash Ponds consists of vegetative cover which provides protection against surface erosion, wave action, and adverse effects of sudden (rapid) drawdown. It should be noted that the ponds' downstream slopes are unlikely to be inundated by surface water of an adjacent water body. Thus, these slopes are not expected to be subject to wave action or sudden (rapid) drawdown.

During the September 2021 site visit, vegetation greater than 12 inches and woody vegetation were observed along portions of the ponds' downstream slopes. Pursuant to the Illinois CCR Rule (Ref. 1, §§ 845.430(b)(4) and 845.430(b)(5)), the Station should remove the woody vegetation and mow the areas where the height of vegetative cover exceeds 12 inches.

It should be noted that the Federal CCR Rule requirement that vegetation on slopes of dikes and surrounding areas not exceed a height of six inches (Ref. 2, § 257.73(d)(1)(iv)) was vacated by the U.S. Court of Appeals, District of Columbia Circuit after the provision was challenged following publication of the Federal CCR Rule in April 2015. See *USWAG et al.* v. *EPA*, No. 15-1219 (D.C. Circ. 2015). The U.S. EPA has yet to finalize a rule that re-establishes federal limitations for the height of vegetation above the surfaces of CCR surface impoundment dikes.

2.4 DIKE COMPACTION

(35 Ill. Adm. Code 845.450(a)(3); 40 CFR 257.73(d)(1)(iii))

As documented in the East and West Ash Ponds' initial and 2021 safety factor assessments (Refs. 4 and 10), the ponds' dikes are sufficiently compacted to withstand the range of loading conditions in the CCR surface impoundments.

2.5 SPILLWAYS

(35 Ill. Adm. Code 845.450(a)(5); 40 CFR 257.73(d)(1)(v))

The East and West Ash Ponds do not have spillways. As documented in the ponds' 2021 inflow design flood control system plan, each pond is capable of managing the design flood event (1000-year, 24-hour storm) without a spillway.

2.6 EMBEDDED HYDRAULIC STRUCTURES

(35 Ill. Adm. Code 845.450(a)(6); 40 CFR 257.73(d)(1)(vi))

The West Ash Pond has a reinforced concrete distribution trough along the upstream slope of its northern dike that, when the pond was operating, received wastewater from a reinforced concrete inlet trench that passes through the pond's northern dike. The East Ash Pond has a similar reinforced concrete distribution trough that receives wastewater from two reinforced concrete inlet trenches that pass through the pond's northern dike. Meanwhile, portions of three discharge pipes from the Recycle Water Sump located between the East and West Ash Ponds also pass through the ponds' northern dikes. The locations of these hydraulic structures are shown on Figure 2 of the ponds' initial structural stability assessment in Appendix A.

As documented in the initial assessment, visual surveillance of the hydraulic structures passing through the East and West Ash Ponds' northern dikes was performed in June 2016. No significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, or debris that may negatively affect the ponds were identified during the surveillance program except for two isolated locations in two of the discharge pipes from the Recycle Water Sump (labeled Pipes 4E and 4W in Figure 2 of Appendix A). The Station subsequently repaired the deficient portions of these pipes that were identified by the surveillance program.

No similar visual surveillance programs have been performed since the initial video camera inspection in June 2016. However, no visual signs of distress at the dike surfaces that could be indicative of deterioration, failure, deformation, *etc*. (*e.g.*, soft spots caused by leaking water, distortions in dike alignment) were observed during the September 2021 site visit. Moreover, since the West Ash Pond has been taken out of service and had minimal surface water remaining in it as of the September 2021 site visit, the hydraulic structures passing through the West Ash Pond's northern dikes are not expected to convey water again until the pond has been closed and subsequently repurposed as a new low volume waste pond for the Station. Therefore, it is recommended that the Station conduct a visual surveillance program to confirm the hydraulic structures passing through the West Ash Pond's northern dikes are in good, working condition and are free of significant material defects that could impact the structures' integrities prior to repurposing the pond as a new low volume waste pond. Finally, it is recommended that the Station remove the hydraulic structures passing through the East Ash Pond's northern dike as part of the pond's closure construction activities.

2.7 LOW POOL & RAPID DRAWDOWN STABILITY

(35 Ill. Adm. Code 845.450(a)(7); 40 CFR 257.73(d)(1)(vii))

As documented in the East and West Ash Ponds' initial safety factor assessment (Ref. 4), the results of which were revalidated in their 2021 safety factor assessment (Ref. 10), the structural stabilities of the ponds' downstream slopes are maintained during low pool conditions in the unnamed channel south of the ponds. As previously mentioned, the ponds' downstream slopes are unlikely to be inundated by surface water of an adjacent water body, including the unnamed channel south of the ponds. Thus, the East and West Ash Ponds are not considered to be susceptible to a sudden (rapid) drawdown loading condition.

Based on reviews of the East and West Ash Ponds' annual inspection reports (Refs. 5 through 8) and Google Earth aerial images (Ref. 3), there have been no significant modifications to either pond since their initial structural stability assessment was completed. Therefore, the conclusions documented therein regarding the stability of the ponds' southern dikes during low pool conditions at the unnamed channel south of the ponds remain valid for this 2021 assessment (see Appendix A).

3.0 RECOMMENDED CORRECTIVE MEASURES

(35 Ill. Adm. Code 845.450(b)(1); 40 CFR 257.73(d)(1)(2))

Based on the findings documented in this 2021 structural stability assessment, the following corrective measures are recommended:

- Mow vegetation that is greater than 12-inches tall along the East and West Ash Ponds' downstream slopes,
- Remove woody vegetation in accordance with 35 Ill. Adm. Code 845.430(b)(4),
- Conduct a visual surveillance program to verify that the hydraulic structures passing through the West Ash Pond's northern dikes are in good, working condition and are free of significant material defects that could compromise the structures' integrities prior to repurposing the pond as a new low volume waste pond, and
- Remove the hydraulic structures passing through the East Ash Pond's northern dikes as part of the pond's closure construction activities.

4.0 CERTIFICATION

I certify that:

- This structural stability assessment was prepared by me or under my direct supervision.
- The work was conducted in accordance with the requirements of 35 Ill. Adm. Code 845.450 and with the requirements of 40 CFR 257.73(d).
- I am a registered professional engineer under the laws of the State of Illinois.

Certified By: Thomas J. Dehlin Date: October 14, 2021

Seal:

LICENSED PROFESSIONAL ENGINEER
THOMAS J DEHLIN
062-069314
OF ILLINOIS

Th. Dehlin
10/14/2021
Exp. 11/30/2021

5.0 REFERENCES

1. Illinois Pollution Control Board. “Standards for Disposal of Coal Combustion Residuals in CCR Surface Impoundments.” 35 Ill. Adm. Code 845. Accessed October 12, 2021.
2. U.S. Environmental Protection Agency. “Standards for Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments.” 40 CFR Part 257 Subpart D. https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-257/subpart-D. Accessed October 12, 2021.
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10. Sargent & Lundy. “2021 Safety Factor Assessment for East Ash Pond & West Ash Pond.” S&L Project No. 12661-123. October 2021.

APPENDIX A: 2016 EAST & WEST ASH PONDS STRUCTURAL STABILITY ASSESSMENT

ATTACHMENT 17
SAFETY FACTOR ASSESSMENT

MWG

Midwest Generation, LLC
Waukegan Generating Station

2021 Safety Factor Assessment for East Ash Pond & West Ash Pond

Revision 0

October 15, 2021

Issue Purpose: Use

Project No.: 12661-123

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1.0 PURPOSE & SCOPE

1.1 PURPOSE

The East and West Ash Ponds (the Ponds) at Midwest Generation, LLC's (MWG) Waukegan Generating Station ("Waukegan" or the "Station") are existing coal combustion residual (CCR) surface impoundments that are regulated by the Illinois Pollution Control Board's "Standards for the Disposal of Coal Combustion Residuals in CCR Surface Impoundments." These regulations are codified in Part 845 to Title 35 of the Illinois Administrative Code (35 Ill. Adm. Code 845, Ref. 1) and are also referred to herein as the "Illinois CCR Rule." Pursuant to 35 Ill. Adm. Code 845.460(a), MWG must conduct and complete a safety factor assessment that documents whether the critical cross section at each of the Ponds achieves the minimum safety factors specified in 35 Ill. Adm. Code 845.460(a).

The Ponds at Waukegan are also regulated by the U.S. Environmental Protection Agency's "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments," 40 CFR Part 257 Subpart D (Ref. 2), also referred to herein as the "Federal CCR Rule." Pursuant to 40 CFR 257.73(f)(3), the Federal CCR Rule requires MWG to conduct and complete a safety factor assessment in accordance with 40 CFR 257.73(e) for the Ponds every five years.

This report documents the 2021 safety factor assessment conducted and completed in accordance with the Illinois and Federal CCR Rules by Sargent & Lundy (S&L) on behalf of MWG for the East and West Ash Ponds at the Waukegan Generating Station. This report:

- Lists the inputs and assumptions used in the 2021 safety factor assessment,
- Discusses the methodology used to conduct the 2021 safety factor assessment,
- Lists and compares the safety factor acceptance criteria for CCR surface impoundments promulgated by the Illinois and Federal CCR Rules,
- Summarizes the results from the initial safety factor assessment completed for the Ponds that was conducted in accordance with the Federal CCR Rule,
- Evaluates potential changes to the inputs used in the initial safety factor assessment to determine whether new or updated liquefaction and/or structural stability analyses are warranted, and
- Provides the 2021 factors of safety for the East and West Ash Ponds in accordance with 35 Ill. Adm. Code 845.460(a) and 40 CFR 257.73(e).

1.2 SCOPE

Per the 2016 Water Infrastructure Improvements for the Nation (WIIN) Act, the East and West Ash Ponds will continue to be subject to both the Illinois and Federal CCR Rules until the U.S. EPA approves the Illinois EPA's CCR permit program. The Illinois EPA has yet to publish a timeline for submitting its proposed CCR permit program to the U.S. EPA for approval, and so MWG must conduct safety factor assessments pursuant to both sets of regulations at this time.

2.0 INPUTS

Safety Factor Acceptance Criteria for CCR Surface Impoundments

The Illinois CCR Rule (Ref. 1, § 845.460) requires each existing CCR surface impoundment to achieve four minimum safety factors at the impoundment's critical cross section, which is defined by the Illinois CCR Rule as "the cross section anticipated to be the most susceptible of all cross-sections to structural failure based on appropriate engineering considerations, including loading conditions." The Federal CCR Rule (Ref. 2, § 257.73(e)) has the same safety factor acceptance criteria as the Illinois CCR Rule. Table 2-1 presents the safety factor acceptance criteria promulgated by both sets of regulations for existing CCR surface impoundments.

Table 2-1 – Safety Factor Acceptance Criteria for Existing CCR Surface Impoundments

Loading Condition	Minimum Allowable Factor of Safety	Illinois CCR Rule Reference	Federal CCR Rule Reference
Long-Term, Maximum Storage Pool	1.50	§ 845.460(a)(2)	§ 257.73(e)(1)(i)
Maximum Surcharge Pool	1.40	§ 845.460(a)(3)	§ 257.73(e)(1)(ii)
Seismic	1.00	§ 845.460(a)(4)	§ 257.73(e)(1)(iii)
Liquefaction	1.20	§ 845.460(a)(5)	§ 257.73(e)(1)(iv)

Initial Safety Factor Assessment

Appendix A provides the initial safety factor assessment conducted by Geosyntec Consultants in 2016 for the Ponds (Ref. 3). The inputs, assumptions, and methodology utilized in these initial safety factor assessments were evaluated to determine whether any updates to this analysis were warranted.

Site Topography & Aerial Images

Topographic data for the Ponds and the adjacent areas was obtained from an aerial survey flown at the site in December 2015 (Ref. 4). Historical and recent aerial images of the Ponds and adjacent areas were obtained from Google Earth Pro (Ref. 5).

Groundwater

Groundwater data for the Ponds and surrounding areas was obtained from annual groundwater monitoring reports prepared by KPRG and Associates, Inc. for the CCR surface impoundments in accordance with 40 CFR 257.90(e) (Refs. 12 through 15).

Ash Pond Conditions

The operating and physical conditions for the Ponds were based on discussions with MWG personnel and on the annual inspection reports prepared for the CCR surface impoundments in accordance with 40 CFR 257.83(b) (Refs. 6 through 10).

Horizontal Seismic Coefficient

Pursuant to 35 Ill. Adm. Code 845.460(a)(4) and 40 CFR 257.73(e)(1)(iii), the Ponds must have a minimum factor of safety of 1.00 when analyzed under a seismic loading condition. This loading condition is represented by a horizontal seismic coefficient that is based on a peak ground acceleration (PGA) with a 2 percent probability of exceedance in 50 years in accordance with the definition of "[m]aximum horizontal acceleration in lithified earth material" promulgated by 35 Ill. Adm. Code 845.120 and 40 CFR 257.53. The design horizontal seismic coefficient is also based on the mapped spectral response acceleration at a period of 1 second (S_1) and on a site correction factor (F_v) that accounts for the impacts of site-specific soil conditions on the mapped PGA and spectral response acceleration. Table 2-2 presents the seismic response parameters obtained from ASCE 7-16 (Ref. 15) on which the Ponds' seismic loading condition was based.

Table 2-2 – Horizontal Seismic Coefficient Inputs

Parameter	Symbol	Value
Peak Ground Acceleration	PGA	0.077
Mapped Spectral Response, 1-Second Period	S_1	0.056
Site Correction Factor for 1-Second Period	F_v	2.4

3.0 ASSUMPTIONS

There are no assumptions in this document that require verification.

4.0 METHODOLOGY

The inputs for the Ponds' initial safety factor assessment were reviewed to determine if any changes have occurred since the initial assessment was completed. Identified changes were then evaluated to determine if updates to the ponds' previous structural stability and/or liquefaction analyses were warranted. Where no changes were noted for a given input, or where identified changes were determined to have no impact to the results and conclusions of the initial safety factor assessment, the previous evaluation of that input was considered to still be valid.

5.0 ASSESSMENT

5.1 SUMMARY OF INITIAL SAFETY FACTOR ASSESSMENT

The initial safety factor assessment for the East and West Ash Ponds was completed in October 2016 and is included in its entirety in Appendix A. The results of this assessment indicated that the Ponds' critical cross-sections are stable and meet the factor of safety requirements presented in 40 CFR 257.73(e)(1)(i) through 257.73(e)(1)(iv). Because the Illinois and Federal CCR Rules have the same safety factor acceptance criteria, it is noted that the factors of safety calculated in the initial safety factor assessment also comply with the factor of safety requirements promulgated under 35 Ill. Adm. Code 845.460(a)(2) through 845.460(a)(5).

In addition to evaluating the pond's earthen dikes, the initial safety factor assessment also evaluated a metal bin retaining wall located along a portion of the East and West Ash Ponds' northern dikes. This wall section was analyzed to confirm it meets or exceeds the minimum factors of safety for bearing capacity, overturning, and sliding that are generally accepted industry standards.

5.2 CHANGES IN BASES FOR INITIAL FACTORS OF SAFETY

The following subsections summarize the evaluation conducted to determine if changes to the design inputs used in East and West Ash Ponds' initial safety factor assessment have occurred since the assessment was completed, and to determine whether the initial structural stability and liquefaction analyses can be accepted as-is for this 2021 assessment or if further analysis is required.

5.2.1 CHANGES IN GEOTECHNICAL DATA

Based on reviews of the annual inspection reports (Refs. 6 through 10) and Google Earth aerial images (Ref. 5), there have been no significant changes to the embankments or underlying soils that would require updating the geotechnical parameters used in the 2016 analysis (Ref. 3).

5.2.2 CHANGES IN TOPOGRAPHY ADJACENT TO ASH PONDS

Based on reviews of the annual inspection reports (Refs. 6 through 10) and Google Earth aerial images (Ref. 5), there have been no significant modifications to the ground surfaces adjacent to the Ponds (mass excavations, mass fill placement, *etc*.) since the initial safety factor assessment was completed. Therefore, the topographic data collected for the site in 2015 (Ref. 4) remains valid for use in this 2021 assessment.

5.2.3 CHANGES IN GROUNDWATER TABLE

Based on reviews of the annual groundwater monitoring and corrective action reports for the Ponds (Refs. 12 through 15), no significant variations in the groundwater were noted. Because the East and West Ash Ponds are lined with a geomembrane, the embankments are not hydraulically connected to the water levels within the Ponds, and a typical phreatic surface normally associated with seepage through an earthen embankment is not applicable. The reported static groundwater elevation is valid for this analysis and there have been no significant changes in the surface water conditions near the site that would impact the site's groundwater levels.

5.2.4 CHANGES IN EMBANKMENT GEOMETRY

Based on reviews of the annual inspection reports (Refs. 6 through 10), Google Earth aerial images (Ref. 5), and visual observations made in September 2021, there have been no significant modifications to the embankments for the Ponds since the initial safety factor assessment was completed. Therefore, there is no basis to reevaluate the embankment geometry of the Ponds for this 2021 assessment.

5.2.5 CHANGES IN EARTHQUAKE DESIGN BASIS

The design horizontal seismic coefficient utilized in the existing technical analysis (Ref. 3) is based on published data in ASCE 7-10 (Ref. 17). Since developing the technical analysis, an updated publication of the reference material has been produced (ASCE 7-16 (Ref. 16)), which provides updated values for the parameters used to determine the design horizontal seismic coefficient (see Tables 2-2 and 5-1). Based on the changes in the site seismic loading parameters from ASCE 7-10 to ASCE 7-16, the horizontal seismic coefficient for the Ponds' seismic loading condition will be less than the value used in the initial safety factor assessment. Therefore, the horizontal seismic coefficient used for the 2016 analysis is conservative. Thus, it is not necessary to change the earthquake design basis used to conduct the initial safety factor assessment for the Ponds.

Table 5-1 – Seismic Loading Parameters Comparison

Parameter	Symbol	2016 Values per ASCE 7-10	2021 Values per ASCE 7-16
Peak Ground Acceleration	PGA	0.086	0.077
Mapped Spectral Response, 1-Second Period	S_1	0.054	0.056
Site Correction Factor for 1-Second Period	F_v	2.4	2.4

5.2.6 CHANGES IN ASH POND OPERATIONS

In June 2020, Waukegan took the West Ash Pond out of service for routine cleaning. During a site visit in September 2021, it was noted that most of the CCR previously stored in the West Ash Pond had been removed and minimal surface water remained. In April 2021, MWG filed a notice of intent to close the West Ash Pond in accordance with the Federal CCR Rule's closure criteria (Ref. 2, § 257.102). Closure construction activities will commence at the pond upon receipt of a closure construction permit from the Illinois EPA in accordance with Subpart B of the Illinois CCR Rule. Meanwhile, Waukegan continues to operate the East Ash Pond to manage CCR wastestreams and various non-CCR wastestreams from the Station in accordance with 40 CFR 257.103(f)(1). Operating conditions at this pond have not changed since the pond's initial safety factor assessment was conducted in 2016.

The decrease in surface water elevation in the West Ash Pond decreases the driving forces in the embankment; therefore, the surface water elevation used for the 2016 analysis is conservative for the pond's current operation condition. Because the operating conditions at the East Ash Pond have not changed since the initial safety factor assessment was completed, the 2016 structural stability analysis for the pond remains valid. Therefore, there is no basis to reevaluate the surface water elevations used to conduct the initial safety factor assessment for the Ponds.

6.0 2021 SAFETY FACTOR ASSESSMENT CONCLUSIONS

The initial safety factor analyses for the East and West Ash Ponds (Ref. 3) were reviewed and validated for compliance with the Illinois and Federal CCR Rules' safety factor acceptance criteria for existing CCR surface impoundments. No changes that would invalidate the conclusions of the initial safety factor assessment were identified in reviews of available information and reports completed for the CCR surface impoundments since the initial assessment was completed in 2016. Therefore, the results reported in the initial safety factor assessment for the East and West Ash Ponds' earthen dikes and retaining wall remain valid for this 2021 assessment.

Table 6-1 presents the 2021 factors of safety for the East and West Ash Ponds' earthen dikes at Waukegan as determined in accordance with 35 Ill. Adm. Code 845.460(a) and 40 CFR 257.73(e).

Table 6-1 – 2021 Illinois & Federal CCR Rule Factors of Safety for the East and West Ash Ponds at the Waukegan Generating Station

Loading Condition	East Ash Pond	West Ash Pond	Min. Allowable Factor of Safety
Long-Term, Maximum Storage Pool	≥ 1.50	≥ 1.50	**1.50**
Maximum Surcharge Pool	≥ 1.40	≥ 1.40	**1.40**
Seismic	≥ 1.00	≥ 1.00	**1.00**
Liquefaction	Note 1	Note 1	**1.20**

Notes: 1) The embankment soils for the Ponds are not considered susceptible to liquefaction because saturation of the embankment soils is unlikely based on the installed geomembrane liner system. A limited portion of the bottom of the embankments may become saturated with groundwater based on the design phreatic surface. Liquefaction triggering analyses of these saturated soils show that liquefaction and associated post-liquefaction shear strength loss is unlikely for the design seismic event (Ref. 3). Thus, liquefaction safety factors are not reported.

7.0 CERTIFICATION

I certify that:

- This safety factor assessment was prepared by me or under my direct supervision.
- The work was conducted in accordance with the requirements of 35 Ill. Adm. Code 845.460 and with the requirements of 40 CFR 257.73(e).
- I am a registered professional engineer under the laws of the State of Illinois.

Certified By: Thomas J. Dehlin

Date: October 15, 2021

Seal:

Th. Dehlin
10/15/2021
Exp. 11/30/2021

8.0 REFERENCES

1. Illinois Pollution Control Board. "Standards for Disposal of Coal Combustion Residuals in CCR Surface Impoundments." 35 Ill. Adm. Code 845. Accessed October 15, 2021.
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8. Civil & Environmental Consultants, Inc. "Annual Inspection Report, East Ash Pond and West Ash Pond, Waukegan Station." October 2018.
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14. KPRG and Associates, Inc. CCR Compliance Annual Groundwater Monitoring and Corrective Action Report – 2020 Dated January 31, 2021.
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APPENDIX A: 2016 EAST & WEST ASH PONDS SAFETY FACTOR ASSESSMENT

ATTACHMENT 18
INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

MWG

Midwest Generation, LLC
Waukegan Generating Station

2021 Inflow Design Flood Control System Plan for East Ash Pond & West Ash Pond

Revision 0

October 14, 2021

Issue Purpose: Use

Project No.: 12661-123

55 East Monroe Street
Chicago, IL 60603-5780 USA
312-269-2000
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Sargent & Lundy

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1.0 PURPOSE & SCOPE

1.1 PURPOSE

The East Ash Pond and the West Ash Pond at Midwest Generation, LLC's (MWG) Waukegan Generating Station ("Waukegan" or the "Station") are existing coal combustion residual (CCR) surface impoundments that are regulated by the Illinois Pollution Control Board's "Standards for the Disposal of Coal Combustion Residuals in CCR Surface Impoundments." These regulations are codified in Part 845 to Title 35 of the Illinois Administrative Code (35 Ill. Adm. Code 845, Ref. 1) and are also referred to herein as the "Illinois CCR Rule." Pursuant to 35 Ill. Adm. Code 845.510(c)(1), MWG must prepare an inflow design flood control system plan that documents how the inflow design flood control systems for the East and West Ash Ponds have been designed and constructed to meet the hydrologic and hydraulic capacity requirements for CCR surface impoundments promulgated by 35 Ill. Adm. Code 845.510.

The East and West Ash Ponds are also regulated by the U.S. Environmental Protection Agency's "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments," 40 CFR Part 257 Subpart D (Ref. 2), also referred to herein as the "Federal CCR Rule." Pursuant to 40 CFR 257.82(c)(4), the Federal CCR Rule requires MWG to prepare a periodic inflow design flood control system plans in accordance with 40 CFR 257.82(c)(1) for the East and West Ash Ponds every five years.

This report documents the 2021 inflow design flood control system plan prepared in accordance with the Illinois and Federal CCR Rules by Sargent & Lundy (S&L) on behalf of MWG for the East and West Ash Ponds at Waukegan. This report:

- Lists the inputs and assumptions used to determine whether the East and West Ash Ponds can manage the inflow design flood,
- Discusses the methodology used to determine whether the East and West Ash Ponds can manage the inflow design flood,
- Evaluates potential changes to the design inputs used in the initial hydrologic and hydraulic assessment completed for the East and West Ash Ponds that was conducted in accordance with the Federal CCR Rule, and
- Summarizes the results of the hydrologic and hydraulic calculations performed to support the conclusion of whether the East and West Ash Ponds meet the hydrologic and hydraulic requirements for CCR surface impoundments promulgated by both the Federal and Illinois CCR Rules.

1.2 SCOPE

Per the 2016 Water Infrastructure Improvements for the Nation (WIIN) Act, the East and West Ash Ponds will continue to be subject to both the Illinois and Federal CCR Rules until the U.S. EPA approves the Illinois

EPA's CCR permit program. The Illinois EPA has yet to publish a timeline for submitting its proposed CCR permit program to the U.S. EPA for approval, and so MWG must prepare an inflow design flood control system plan pursuant to both sets of regulations at this time.

2.0 INPUTS

Inflow Design Flood Control System

The inflow design flood control systems for the East and West Ash Ponds are documented in the ponds' initial inflow design flood control system plan, which was prepared by Geosyntec Consultants in October 2016 (Ref. 3). This plan is provided in its entirety in Appendix A.

Inflow Design Flood Event

Per the ponds' 2021 hazard potential classification assessment (Ref. 4), the East and West Ash Ponds are both classified as Class 2 CCR surface impoundments pursuant to 35 Ill. Adm. Code 845.440(a)(1) and as significant hazard potential CCR surface impoundments pursuant to 40 CFR 257.73(a)(2). Therefore, the inflow design flood event used in this hydrologic and hydraulic assessment of both ponds is based on the 1,000-year storm (Ref. 1, § 845.510(a)(3); Ref. 2, § 257.82(a)(3)). Per the National Oceanic and Atmospheric Administration's Atlas 14 (Ref. 5), the precipitation depth for the 1,000-year, 24-hour storm event at the Waukegan site is 8.30 inches.

Site Topography

Topographic data for the East Ash Pond, the West Ash Pond, and the surrounding areas was obtained from the photogrammetric survey performed by Geo Terra in 2015 (Ref. 6) that is documented in the ponds' history of construction (Ref. 7).

Aerial Images

Historical and recent aerial images of the Station and surrounding areas were obtained from Google Earth Pro (Ref. 8).

Ash Pond Conditions

The operating and physical conditions for the East and West Ash Ponds were based on discussions with MWG personnel, the history of construction prepared for the CCR surface impoundments in accordance with 40 CFR 257.73(c) (Ref. 7), and the annual inspection reports prepared for the CCR surface impoundments in accordance with 40 CFR 257.83(b) (Refs. 9 through 12). The area-capacity curves for the ponds were obtained from the aforementioned history of construction (Ref. 7).

3.0 ASSUMPTIONS

There are no assumptions in this document that require verification.

4.0 HYDROLOGIC & HYDRAULIC ASSESSMENT

4.1 CHANGES SINCE INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

4.1.1 CHANGES IN ASH POND OPERATIONS

In June 2020, Waukegan took the West Ash Pond out of service for routine cleaning. During a site visit in September 2021, it was noted that most of the CCR previously stored in the West Ash Pond had been removed and minimal surface water remained. In April 2021, MWG filed a notice of intent to close the West Ash Pond in accordance with the Federal CCR Rule's closure criteria (Ref. 2, § 257.102). Closure construction activities will commence at the pond upon receipt of a closure construction permit from the Illinois EPA in accordance with Subpart B of the Illinois CCR Rule. Meanwhile, Waukegan continues to operate the East Ash Pond to manage CCR wastestreams and various non-CCR wastestreams from the Station in accordance with 40 CFR 257.103(f)(1). Operating conditions at this pond have not changed since the initial inflow design flood control system plan was prepared in 2016 for the East and West Ash Ponds.

Based on reviews of the annual inspection reports (Refs. 9 through 12) and Google Earth aerial images (Ref. 8), there have been no significant modifications to the East and West Ash Ponds (mass excavations, major embankment modifications, *etc*.) since the initial inflow design flood control system plan was completed. Therefore, there is no basis to reevaluate the embankment geometry for this 2021 assessment.

4.1.2 CHANGES IN ASH POND TOPOGRAPHY

Based on reviews of the annual inspection reports (Refs. 9 through 12) and Google Earth aerial images (Ref. 8), there have been no significant modifications to embankments for the East and West Ash Ponds (mass excavations, mass fill placement, *etc*.) since the initial inflow design flood control system plan was completed. It should be noted that the lowering of the East Ash Pond's eastern dike in the fall of 2016, as noted in the 2017 annual inspection report (Ref. 9), was incorporated into the initial inflow design flood control system plan. Therefore, the topographic data collected for the ponds in 2015 (Ref. 4) and the area-capacity curves documented in ponds' history of construction (Ref. 7) remain valid for use in this 2021 assessment.

4.2 METHODOLOGY

Because the East and West Ash Ponds are perched, stormwater entering the ponds during the design storm event is limited to direct precipitation and stormwater run-off from the access roads on the ponds' dikes. No rainfall abstraction was considered (*i.e.*, the full design precipitation depth over a pond's catchment area was assumed to enter the pond), which is a conservative assumption. The surface water elevations in the East and West Ash Ponds at the time of the design storm event were assumed to be the ponds' maximum design operating levels: 597.50 feet and 600.00 feet, respectively. The assumed initial surface water elevation in the West Ash Pond is conservative since, as previously mentioned, most of the CCR and surface water previously stored in that pond has been removed.

4.3 RESULTS

Table 4-1 summarizes the results from the hydrologic and hydraulic calculations performed for the East and West Ash Ponds (Ref. 13). Based on these results, water entering the ponds during the inflow design flood event will not overtop the ponds' dikes. The freeboards in the East and West Ash Ponds during the design event were estimated to be 1.1 feet and 1.7 feet, respectively.

Table 4-1 – Summary of Hydrologic & Hydraulic Assessment Results for East & West Ash Ponds

CCR Surface Impoundment	Illinois Hazard Potential Classification	Federal Hazard Potential Classification	Inflow Design Flood	Maximum Surface Water Elevation	Pond Crest Elevation
East Ash Pond	Class 2	Significant	1,000 Year	598.40 feet	599.50 feet
West Ash Pond	Class 2	Significant	1,000 Year	600.80 feet	602.50 feet

5.0 CONCLUSIONS

Based on the hydrologic and hydraulic calculations performed for the East and West Ash Ponds (Ref. 13), the ponds have adequate hydraulic capacities to retain the 1000-year flood event without water overtopping the ponds' dikes. Therefore, the East and West Ash Ponds are able to collect and control the inflow design flood event specified in 35 Ill. Adm. Code 845.510(a)(3) and 40 CFR 257.82(a)(3).

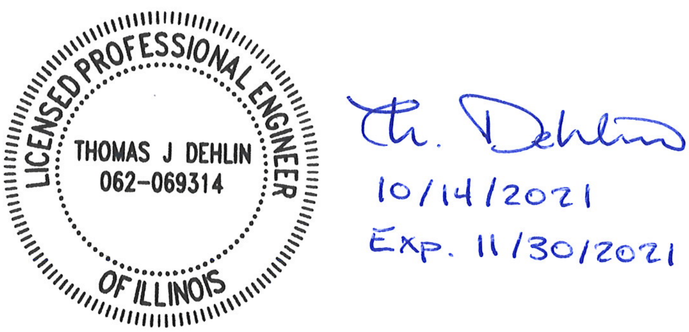
6.0 CERTIFICATION

I certify that:

- This inflow design flood control system plan was prepared by me or under my direct supervision.
- The work was conducted in accordance with the requirements of 35 Ill. Adm. Code 845.510 and with the requirements of 40 CFR 257.82.
- I am a registered professional engineer under the laws of the State of Illinois.

Certified By: Thomas J. Dehlin Date: October 14, 2021

Seal:



7.0 REFERENCES

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2. U.S. Environmental Protection Agency. "Standards for Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments." 40 CFR Part 257 Subpart D. https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-257/subpart-D. Accessed October 13, 2021.
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APPENDIX A: 2016 EAST & WEST ASH POND INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

ATTACHMENT 19
SAFETY AND HEALTH PLAN

1.0 **SAFETY REQUIREMENTS**

1.1 The entire performance of the Work shall comply with the standards authorized by the latest issue of the U.S. Department of Labor Occupational Safety and Health Act (OSHA), as well as state and local jurisdictional requirements.

1.2 CONTRACTORS SAFETY MANUAL

A. The Contractor shall have on file with the Midwest Generation corporate safety office a copy of the most current Safety and Industrial Hygiene Manual. As a minimum, this Manual must address the following items when applicable to their trade: OSHA Compliance, Accident Investigation, Corrective Action, First Aid Treatment, Inspections and Reporting of Deficiencies, Material Handling and Rigging, Performance and Accountability, Personal Safety Equipment, Safety Guidelines, Safety Meetings, Training, Housekeeping, Hearing Protection, Respiratory Protection, Fire Prevention, Grounding Program, Confined Space Entry, Hazard Communication, Fall Protection, Working on or near water and Trenching and Shoring.

B. The Contractor's superintendent or other responsible person must have a copy of the Contractor's most current Safety and Industrial Hygiene Manual available at the job site.

1.3 PRE-MOBILIZATION MEETING

A. The Contractor shall meet with the Purchasers Representative(s) for a pre-mobilization meeting. The pre-mobilization meeting will include a review of safety requirements, job hazard identification, a job specific safety plan (to be developed by the Contractor and provided to Midwest Generation), and submittal requirements for health & safety records, scope and schedule. Hazard identification and assessment will include all chemical constituents found present in the analyses of the CCR and/or other waste streams within the impoundment(s). Recommendations within the NIOSH Pocket Guide to Chemical Hazards will be reviewed and considered. Applicable safety data sheets will be provided, as necessary.

B. Prior to the start of the work at the job site. Contractor shall contact Purchaser's Representative to arrange to receive Purchasers site safety orientation. This session will last approximately 2 hours. The Contractor will be provided with information on the potential hazardous constituents of the CCR

C. Contractor shall provide his employees with orientation in all Contractor, and job specific safety requirements related to their work area. Contractor shall provide Purchaser with completed training documents showing date of training and each employees craft related training as it relates to OSHA requirements. (i.e. competent person, scaffold builder, fork truck and crane operators)

D. The Contractor Shall provide proof of training for all on site personnel in the following:
   - HAZWOPER 29CFR1910.120/29CFR1926.65
   - OSHA 10 Hour or 30 Hour Voluntary Compliance Training for Construction
   - Hazard Communication 29 CFR 1910.1200
   - Contractor's Safety Plan

E. A Competent Person shall be identified by name for Excavations, Fall Protection, etc. if applicable.

1.4 FITNESS FOR DUTY

A. The Contractor/Sub-Contractor/Supplier is required to have a drug and alcohol screening program for all employees assigned to work on Purchaser's property. The program must provide screening for pre-access testing, "for cause" testing and random testing. The Contractor/Sub-Contractor/Supplier shall certify that their employees have passed the appropriate screening test in accordance with their programs.

B. Personnel covered by this program shall be denied access to, or may be required to leave the Purchaser's location if there are reasonable grounds to believe that the individual is:
   1. Under the influence of using, possessing, buying, selling, or otherwise exchanging (whether or not for profit) controlled substances or drug paraphernalia.
   2. Under the influence of consuming, possessing, buying, selling, or otherwise exchanging (whether or not for profit) alcoholic beverages.

1.5 PERSONNEL PROTECTIVE EQUIPMENT (PPE)

A. Prior to starting work, the contractor shall perform a Hazard assessment for PPE
   1. The Contractor will conduct a walk-through survey of each work area to identify sources of work hazards. Each survey will be documented in which it will identify the work area surveyed, the relevant task, the person conducting the survey, findings of potential hazards, control measures, and date of the survey.

   2. The Contractor will conduct, review, and update the hazard assessment for PPE whenever:

      - A job changes
      - New equipment or process is installed
      - There has been an accident
      - Whenever a supervisor or employee requests it

- o Or at least every year
- o Any new PPE requirements that are developed will be added into the Contractors written safety program.

B. Head Protection/ Hard Hats: Hard hats shall be worn in all work areas.

1. Hard hats must not be more than 5 years old, and the harness shall not be more than 1 year old.
2. Hard hats must be worn with brim forward
3. Hard hats must be assigned and used in accordance with ANSI/ISEA Z89.1-2014(R2019)
4. Hard Hats must be cleaned and maintained in accordance with the manufacturer's instruction.

C. Eye Protection: Eye protection shall be worn in all work areas.

1. At a minimum, ANSI Z87-1-2020 compliant Safety Glasses shall be worn.
2. Goggles and face shields shall be used for splash hazards.
3. Fogging potential shall be considered for humid conditions and appropriate anti-fog materials may be used.
4. Detachable side protectors (e.g. clip-on or slide on side shields) that meet OSHA Rule 29 CFR Part 1910.133 and ANSI Z87.1 specifications are also acceptable to wear with prescription glasses. Prescription glasses used with detachable side shields must conform to ANSI Z87.1.
5. Employees must keep eyewear in clean condition and fit for use at all times.

D. Protection Foot Wear

1. All footwear must be compliant with ASTM F2413-18: Performance Requirements For Protective (Safety) Toe Cap Footwear.
2. For work on or near the CCR impoundments, consideration shall be given to traction and slip issues.
3. Safety shoes must be maintained and cleaned in accordance with the manufacturer's guidelines.
4. Boot covers or Rubber boots shall be used in all areas that do or may contain CCR. These covers or boots must be cleaned or disposed of prior to leaving the work area.

E. Hand Protection

1. Employers shall base the selection of the appropriate hand protection on an evaluation of the performance characteristics of the hand protection relative to the task(s) to be performed, conditions present, duration of use, and the hazards and potential hazards identified.
2. Impervious disposable gloves shall be used when working with CCR. Leather, Cotton or other readily absorbable gloves shall not be used.

F. Personal Flotation Devices

1. When working with 10 feet of the water in the impoundments the following shall apply:
   a. All personnel shall wear a Coast Guard Approved PFD
      - Type I: Off-Shore Life Jacket; effective for all waters or where rescue may be delayed.
      - Type II: Near-Shore Buoyant Vest; intended for calm, inland water or where there is a good chance of quick rescue.
      - Type III: Flotation aid; good for calm, inland water, or where there is a good chance of rescue.
      - Type IV: PFD's are throwable devices. They are used to aid persons who have fallen into the water.
      - Type V: Flotation aids such as boardsailing vests, deck suits, work vests, and inflatable PFD's marked for commercial use.
2. Serviceable condition: A PFD is considered to be in serviceable condition only if the following conditions are met.
   a. No PFD may exhibit deterioration that could diminish the performance of the PFD, including:

      1. Metal or plastic hardware used to secure the PFD on the wearer that is broken, deformed, or weakened by corrosion;

      2. Webbings or straps used to secure the PFD on the wearer that are ripped, torn, or which have become separated from an attachment point on the PFD; or

      3. Any other rotted or deteriorated structural component that fails when tugged;

      4. Rips, tears, or open seams in fabric or coatings, that are large enough to allow the loss of buoyant material;

      5. Buoyant material that has become hardened, non-resilient, permanently compressed, waterlogged, oil-soaked, or which shows evidence of fungus or mildew; or

      6. Loss of buoyant material or buoyant material that is not securely held in position.

1.6 EXISTING PLANT FACILITIES

A. Contractor shall be aware that Work may be performed in and around operating equipment.

B. The Contractor shall give proper notices, make all necessary arrangements, and perform all other services required to avoid damage to all utilities, including gas mains, water pipes, sewer pipes, electric cables, fire hydrants, lamp posts, etc., for which Purchaser could be held liable.

C. The Contractor shall barricade or cover any opening created during the course of work for excavations, or grating removal. Barricades shall be a "hard" barrier such as cable or pipe and clamp, safety barrier tape is unacceptable. In addition, any openings creating a fall hazard of 4 feet or more must have a permit authorized before the barrier can be removed. See section 11.4 below for permit requirements.

D. Housekeeping, walkways and tripping hazards

All equipment and material must be kept in an orderly manner. Aisles exits stairways and emergency equipment must never be obstructed. Hoses and welding cables must be tied above walkways so as to not pose as a trip hazard. Barricades, signs and notifications provided by the contractor when required. The owner and contractor will conduct periodic housekeeping audits to assure compliance.

E. Contractor's personnel shall observe all safety, warning, equipment identification instructional signs and tags. Do not remove any tag without prior consent of Purchaser's Representative.

F. When work has been completed, and Contractor decides equipment is ready to be returned to service, Contractor employees shall have all of their employees (working party members) sign off the permit. Contractor shall notify Purchaser's Representative in whose name the outage is being held.

1.7 WELDING, CUTTING and BURNING PERMITS

A. Contractor shall not start welding or cutting operations without a "Welding and Cutting Permit". Permits shall be obtained from Purchaser and posted in accordance with Station site-specific Safety Training requirements.

B. Contractor shall use non-asbestos, fire retardant blankets as required to protect Purchaser's equipment, cable trays, coal transport and storage areas, etc. and to cover gratings (for personnel safety) when welding, grinding and flame cutting processes are used overhead or in such close proximity as to pose a hazard.

C. Contractor shall supply appropriate portable fire extinguishers in welding and cutting areas.

D. Contractor shall furnish a designated "Fire-watch" employee to monitor the area above to the sides and below the cutting and burning area. The fire-watch is to extinguish fires started by sparks from the acts of cutting or welding. The fire-watch employee is to continue monitoring on the job 30 minutes after cutting or burning has been completed.

1.8 SAFETY DATA SHEETS

A. The Purchaser shall make Safety Data Sheets (SDS's) readily available to the Contractor for those substances to which the Contractor's employees may be exposed during normal working conditions and which are under the Purchaser's control.

B. The Contractor shall make Safety Data Sheets (SDS's) readily available to the Purchaser for those substances which are furnished by and under the control of the Contractor. These are to be available at the time of delivery of the substance to the Purchaser's Premises.

C. It is the responsibility of the Contractor to train their employees on SDS's.

1.9 CHEMICALS, SOLVENTS AND GASES

A. Contractor shall comply with all federal, state and local regulations and codes pertaining to handling and storage of flammable liquids and gases.

B. Cleaning agents, solvents, or other substances brought by Contractor onto any of Purchaser's properties by Contractor shall be stored, handled and used in accordance with applicable standards.

C. Contractor shall ensure that liquids or solids will not be poured (disposed of) into Purchaser's drain, sewer systems, lake (where applicable), or onto ground. Contractor shall be liable for any damage and cleanup of improperly disposed liquids or solids.

D. The Contractor is to provide the Purchaser with the name and quantity of usage of any listed Section 313 Toxic Chemical of the Emergency Planning and Community Right-to-Know Act of 1986 (40CFR372).

E. Signage must be posted detailing the presence of and hazards of CCR.

1.10 DISTURBANCE OF DUST

Contractor's work practices shall minimize dust generated while working with CCR. A fugitive dust mitigation plan shall be submitted to the facility prior to activities beginning.

1.11 FALL PROTECTION

Mandatory fall protection is required when working near and area where a fall hazard of **four (4)** feet or more exits.

1.12 BARRIERS AND WARNING SYSTEMS

A. Warning and barricade systems shall be used to divert personnel from a work area. All warning barriers shall be tagged with yellow "Caution Cards". The caution card shall state the hazard, the date erected and a contact name, company and phone number. There are two (2) levels of barricade systems. The barricade systems shall be taken down immediately when the hazard has been removed or at the end of the work shift.

B. A conditional warning is designated with 'Yellow" safety warning tape. This is used to warn workers of a hazard such as wet floors, welding and cutting in an area, or other hazards that with an awareness and proper PPE can be approached.

C. An Unconditional warning is designated with "Red" safety warning tape. This is used to worn workers of a hazard such as a crane lift or overhead work. Red safety tape barriers cannot be access or removed until permission is granted from the person responsible for installing it.

D. Fire and Evacuation warning sirens. Each plant has a siren for fire notification and evacuation notification. The response location and procedure will be addressed in the pre-mobilization meeting and plant site-specific orientation.

1.13 For Contractor's and subcontractor's employees, visitors and any other individuals: Smoking is prohibited on the work site.

1.14 The Contractor is expected to pre-arrange medical emergency services for on-site and off-site treatment. This includes, but is not limited to, first aid and confined space rescue.

1.15 WORKING ON OR NEAR WATER:

A. Life jackets and work vests shall be inspected before and after each use.

B. Ring buoys or Class IV rescue device with at least 90 feet of line shall be provided and readily available for employee rescue operations.

C. The distance from ring buoys to each worker shall not exceed 200 feet.

D. At least one lifesaving skiff shall be immediately available at locations where employees are working over water and/or the local coast guard shall be notified when working in navigable waterways.

E. Under no circumstances will team members enter water bodies without protective clothing (e.g.; waders, wet suit)

F. At least one person should remain on shore as a lookout if other methods of rescue are not available.

1.16 EXCAVATIONS

A. A Competent person shall determine the proper slope or identify engineering controls for all excavations in the CCR area.

B. An inspection of the banks shall be made and documented at least daily to determine any impact of the excavation.

2.0 **<u>CONTRACTOR'S FACILITIES</u>**

2.1 Temporary chemical toilet accommodations shall be furnished and maintained by Contractor for the use of his employees. Location shall be as directed by Purchaser's Representative. Use of Purchaser's toilet facilities by Contractor's employees is not permitted.

2.2 Contractor shall provide his own storage vessels, coolers, ice, water containers, etc., as required for his own drinking water use. Contractor shall supply a trash can with each drinking water container to receive used paper cups. Contractor shall maintain drinking water container, supply suitable water cups and dispose of trash as required. Open drinking cups and containers in the plant areas are not permitted.

2.3 Each Contractor is expected to pre-arrange medical emergency services for on-site and off-site treatment. This includes, but is not limited to, first aid and confined space rescue.

2.4 FIRE PROTECTION FACILITIES

A. Contractor shall provide his own temporary fire protection facilities for the equipment and materials furnished by him or by Purchaser and for his temporary construction buildings and structures. This equipment shall be maintained and inspected in accordance with applicable NFPA codes.

B. Furnish a suitable quantity and type of portable fire extinguishers and equipment, to meet OSHA and applicable codes.

2.5 Purchaser will not furnish any additional illumination of aisles, passages in the buildings, floodlighting of outdoor areas or lighting inside equipment other than that which is existing. Any additional lighting required by the Contractor shall be provided by the Contractor.

2.6 Contractor shall provide and maintain suitably located distribution centers with fused switching equipment and Ground Fault Interruption protection. The equipment supplied shall comply with OSHA regulations and standards.

2.7 Contractor shall supply all adapters and equipment required to connect to station air, water, and electrical systems. All air hoses shall be safety clipped together.

2.8 Any heating facilities required for the performance of the Work shall be furnished, maintained, and removed by Contractor. Open fires WILL NOT BE PERMITTED at any time. Heating equipment shall be as approved by Purchaser's Representative.

3.0 **CONTRACTOR'S TOOLS AND EQUIPMENT**

3.1 TOOLS AND EQUIPMENT

A. Contractor shall maintain, inspect and store tools and equipment for safe and proper use. This includes guards, shields, safety switches and electrical cords.

B. Contractor shall provide hoisting equipment as required to perform the Work. Provide all the necessary guards, signals, and safety devices required for its safe operation. Construction and operation of hoisting equipment shall comply with all applicable requirements of ANSI A10.5, the AGC Manual of Accident Prevention in Construction, and to all applicable federal, state, and local codes. Hoisting equipment shall not be used to transport personnel.

3.2 RIGGING

A. Contractor shall design, furnish, and maintain rigging required for the Work. All rigging plans must be designed by an Illinois licensed structural engineer.

B. Purchaser reserves the right to examine Contractor's design calculations, engineering data, plans, and procedures. Contractor shall submit any documentation requested by the Purchaser for the purpose of this review, including, but not limited to, calculations, diagrams and documents associated with computer-aided analyses and programs. If requested information is considered proprietary by Contractor, Contractor shall allow the Purchaser to review the information at Contractor's offices with the understanding that no copies of proprietary information will be given to the Purchaser. Purchaser's review and approval of submitted information is for general detail only and will not relieve the Contractor of responsibility for meeting all requirements and for accuracy.

C. Lifting and rigging areas shall have the target area and corresponding personnel access landings barricaded with "red" safety tape or hard barriers. No one is allowed under the load or in the target area during lifts.

D. All cranes, hoists, or derricks shall be operated in compliance with existing State and Federal regulations or orders. Cranes and hoists shall be inspected in accordance with OSHA and ANSI requirements. Cranes and hoists shall not be operated near high voltage lines or equipment until a safe operating clearance plan has been established.

ATTACHMENT 20
CLOSURE PRIORITY CATEGORIZATION

Attachment 20 – No Attachment