Luminant

Dynegy Midwest Generation, LLC
1500 Eastport Plaza Dr.
Collinsville, IL 62234

October 25, 2021

Illinois Environmental Protection Agency
DWPC – Permits MC #15
Attn: Part 845 Coal Combustion Residual Rule Submittal
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

Re: Vermilion Power Plant New East Ash Pond; IEPA ID # W1838000002-04

Dear Mr. LeCrone:

In accordance with 35 I.A.C. § 845.200, Dynegy Midwest Generation, LLC (DMG) is submitting an operating permit application for the Vermilion Power Plant New East Ash Pond (IEPA ID # W1838000002-04). One hardcopy and one digital copy are provided with this submittal.

The permit application was prepared in accordance with 35 I.A.C. § 845.230(d)(2) (Existing, Inactive and Inactive Closed CCR Surface Impoundment that have not completed an Agency approved closure before July 30, 2021). This submittal includes the completed permit forms as required by § 845.210.

Sincerely,

Cynthia Vodopivec
SVP-Environmental Health and Safety

Enclosures

Form CCR 1

Illinois Environmental Protection Agency

CCR Surface Impoundment Permit Application

Form CCR 1 – General Provisions

Bureau of Water ID Number:
W1838000002

CCR Permit Number:
Initial Permit

Facility Name:
Vermilion Power Plant

For IEPA Use Only

SECTION 1: FACILITY, OPERATOR, AND OWNER INFORMATION (35 Ill. Adm. Code 845.210(b))

Facility, Operator, and Owner Information

1.1 Facility Name

Vermilion Power Plant

1.2 Illinois EPA CCR Permit Number (if applicable)

Initial Permit

1.3 Facility Contact Information

Name (first and last)	Title	Phone Number
Phil Morris	Senior Director - Environmental	618-343-7794

Email address
phil.morris@vistracorp.com

1.4 Facility Mailing Address

Street or P.O. box
1500 Eastport Plaza Dr

City or town	State	Zip Code
Collinsville	IL	62234

1.5 Facility Location

Street, route number, or other specific identifier
10188 East 2150 North Road

County name	County code (if known)	
Vermilion		

City or town	State	Zip Code
Oakwood	IL	61858

1.6 Name of Owner/Operator

Dynegy Midwest Generation, LLC

Facility, Operator, and Owner Info

1.7	Owner/Operator Contact Information		
	Name (first and last) Phil Morris	Title Senior Director - Environmental	Phone Number 618-343-7794
	Email address phil.morris@vistracorp.com		
1.8	Owner/Operator Mailing Address		
	Street or P.O. box 1500 Eastport Plaza Dr		
	City or town Collinsville	State IL	Zip Code 62234

SECTION 2: LEGAL DESCRIPTION (35 Ill. Adm. Code 845.210(c))

Legal Description

2.1 Legal Description of the facility boundary

See Attachment A.

SECTION 3: PUBLICLY ACCESSIBLE INTERNET SITE REQUIREMENTS (35 Ill. Adm. Code 845.810)

Internet Site

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

www.luminant.com/illinois-ccr/

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

☑ Yes ☐ 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.

W1838000002-04 (see Attachment A)	☑	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
	☐	Attached written description

SECTION 5: CHECKLIST AND CERTIFICATION STATEMENT

Checklist and Certification Statement

5.1 In Column 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 Cynthia Vodopivec	Official Title SVP - Environmental
Signature	Date Signed 10/25/2021

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:
W1838000002

CCR Permit Number:
Initial Permit

Facility Name:
Vermilion Power Plant

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.	New East Ash Pond
1.2	Identification number of the CCR surface impoundment (if one has been assigned by the Agency).	W1838000002-04
1.3	Description of the boundaries of the CCR surface impoundment (35 Ill. Adm. Code 845.210(c)).	See Attachment A.
1.4	State the purpose for which the CCR surface impoundment is being used.	See Attachment B.
1.5	How long has the CCR surface impoundment been in operation?	See Attachment B.
1.6	List the types of CCR that have been placed in the CCR surface impoundment.	See Attachment B.

Construction History (Continued)	1.7	List name of the watershed within which the CCR surface impoundment is located.	
		See Attachment B.	
	1.8	Size in acres of the watershed within which the CCR surface impoundment is located.	
		See Attachment B.	
	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:	
		☑	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).

Prepared for

Dynegy Midwest Generation, LLC
1500 Eastport Plaza Drive
Collinsville, Illinois 62234

INITIAL OPERATING PERMIT APPLICATION

VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Prepared by

Geosyntec consultants

engineers | scientists | innovators

134 N. Lasalle Street, Suite 300
Chicago, Illinois 60602

Project Number CHE8404A

October 2021

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ATTACHMENTS

1. INTRODUCTION

Dynegy Midwest Generation, LLC (Dynegy) is the owner of the inactive coal-fired Vermilion Power Plant (VPP), also referred to as Vermilion Power Station, located approximately 13 miles Northwest of Danville, Illinois. According to the Illinois Environmental Protection Agency (IEPA), this power plant has three surface impoundments: North Ash Pond Area (NAP), Old East Ash Pond Area (OEAP), and New East Ash Pond (NEAP). The IEPA assigned identification numbers assigned to these impoundments are: W1838000002-01 for the NAP, W1838000002-03 for the OEAP, and W1838000002-04 for the NEAP. There are no National Inventory of Dams (NID) numbers assigned for the NAP or OEAP by the Illinois Department of Natural Resources (IDNR). The NID number for the NEAP is IL50291.

This initial operating permit application was developed in accordance with 35 Ill. Admin. Code 845 Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845).

This initial operating permit application is for the New East Ash Pond.

1.1. Facility Information

> Section 845.210(b)(1): *All permit applications must contain the name, address, email address and telephone number of the operator, or duly authorized agent, and the property owner to whom all inquiries and correspondence shall be addressed.*

Facility:	New East Ash Pond (NEAP) Vermilion Power Plant 10188 East 2150 North Road Oakwood, IL 61858
Owner/Operator:	Dynegy Midwest Generation, LLC 1500 Eastport Plaza Drive Collinsville, IL 62234 Phil Morris, Sr. Director Corporate Environmental 618-606-7788 phil.morris@vistracorp.com

1.2. Legal Description

> Section 845.210(c): *All permit applications must contain a legal description of the facility boundary and a description of the boundaries of all units included in the facility.*

Legal description of the facility is provided in **Attachment A**.

1.3. Previous Assessments

> Section 845.210(d): *Previous Assessments, Investigations Plans, and Programs*

Because the Vermilion Power Plant was not operating as of October 19, 2015 the surface impoundment was not regulated by 40 C.F.R. Part 257 and therefore no previous assessments, investigation plans or programs were previously completed.

> Section 845.210(d)(1): *The Agency may approve the use of any hydrogeologic site investigation or characterization, groundwater monitoring well or system, or groundwater monitoring plan, bearing the seal and signature of an Illinois Licensed Professional Geologist or Licensed Professional Engineer, completed before April 21, 2021 to satisfy the requirements of this Part.*

No hydrogeologic site investigation or characterization, groundwater monitoring well or system, or groundwater monitoring plan have been completed with a seal from an Illinois Licensed Professional Geologist or Licensed Professional Engineer; however, field investigations have been completed that will be utilized in the following sections of this report.

> Section 845.210(d)(2): *For existing CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a previously completed location restriction demonstration required by Section 845.300 (Placement Above the Uppermost Aquifer), Section 845.310 (Wetlands), Section 845.320 (Fault Areas), Section 845.330 (Seismic Impact Zones), and Section 845.340 (Unstable Areas) provided that the previously completed assessments meet the applicable requirements of those Sections.*

No previous assessments are available.

> Section 845.210(d)(3): *For existing CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a previously completed assessment to serve as the initial assessment required by Section 845.440 (Hazard Potential Classification Assessment), Section 845.450 (Structural Stability Assessment) and Section 845.460 (Safety Factor Assessment) provided that the previously completed assessment: A) Was*

> *not completed more than five years ago; and B) Meets the applicable requirements of those Sections.*

No previous assessments are available.

> <u>Section 845.210(d)(4):</u> *For inactive closed CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a post-closure care plan previously approved by the Agency.*

No post-closure care plan was previously approved by the Agency.

2. OPERATING PERMIT

2.1. Initial Operating Permit

<u>Section 845.230(d):</u> *Initial Operating Permit for Existing, Inactive and Inactive Closed CCR Surface Impoundments*

The NEAP, as defined by IEPA, is an existing, inactive CCR surface impoundment that has not completed post-closure care. Per Part 845, Dynegy is submitting an initial operating permit application to IEPA by October 31, 2021. The following sections contain information or references to documents required for the Operating Permit application (Section 845.230).

2.2. History of Construction

<u>Section 845.230(d)(2)(A):</u> *The history of construction specified in Section 845.220(a)(1);*

The history of construction and certification have been completed as specified by Section 845.220(a)(1) and is provided in **Attachment B**.

2.3. Chemical Constituents

<u>Section 845.230(d)(2)(B):</u> *An analysis of the chemical constituents found within the CCR to be placed in the CCR surface impoundment;*

An analysis of the chemical constituents found within the CCR placed in NEAP is provided in **Attachment C**.

<u>Section 845.230(d)(2)(C):</u> *An analysis of the chemical constituents of all waste streams, chemical additives and sorbent materials entering or contained 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 NEAP surface impoundment is provided in **Attachment D**.

2.4. Location Standards Demonstration

<u>Section 845.230(d)(2)(D):</u> *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:*

The NEAP location standards as specified in Section 845.230(d)(2)(D) are described in the following sections.

Section 845.230(d)(2)(D)(i): *Placement Above the Uppermost Aquifer;*

The placement above uppermost aquifer location standard certification as specified by Section 845.300 is provided in **Attachment E**.

Section 845.230(d)(2)(D)(ii): *Wetlands;*

The NEAP wetlands location standard certification as specified by Section 845.310 is provided in **Attachment F**.

Section 845.230(d)(2)(D)(iii): *Fault Areas;*

The NEAP fault areas location standard certification as specified by Section 845.320 is provided in **Attachment G**.

Section 845.230(d)(2)(D)(iv): *Seismic Impact Zone;*

The NEAP seismic impact zones location standard certification as specified by Section 845.330 is provided in **Attachment H**.

Section 845.230(d)(2)(D)(v): *Unstable Areas and Floodplains;*

The NEAP unstable area and floodplains location standard certification as specified by Section 845.340 is provided in **Attachment I**.

2.5. Permanent Markers

Section 845.230(d)(2)(E): *Evidence of permanent markers required by Section 845.130 have been installed;*

Evidence of permanent markers at the NEAP as required by Section 845.130 is provided in **Attachment J**.

2.6. Slope Maintenance

Section 845.230(d)(2)(F): *Documentation that the CCR surface impoundment, if not incised, will be operated and maintained with one of the forms of slope protection specified in Section 845.430;*

The NEAP is not incised; it was constructed by excavation of soils from withing the footprint to build a perimeter dike to contain CCR. Documentation of slope protection as required by Section 845.430 is provided in **Attachment K**.

2.7. Initial Emergency Action Plan

> Section 845.230(d)(2)(G): *Initial Emergency Action Plan and accompanying certification (see Section 845.520(e));*

The initial emergency action plan and certification has been completed as specified by Section 845.520(e) and is provided in the Safety Emergency Response Plan in **Attachment L**.

2.8. Fugitive Dust Control Plan

> Section 845.230(d)(2)(H): *Fugitive dust control plan and accompanying certification (see Section 845.500(b)(7));*

The fugitive dust control plan and certification has been completed as specified by Section 845.500(b)(7) and is provided in **Attachment M**.

2.9. Groundwater Monitoring

> Section 845.230(d)(2)(I): *Groundwater monitoring information:*

The groundwater monitoring information for the NEAP are described in the following sections.

> Section 845.230(d)(2)(I)(i): *Hydrogeologic site characterization (see Section 845.620);*

A Hydrogeologic Site Characterization Report for the NEAP is provided in **Attachment N**.

> Section 845.230(d)(2)(I)(ii): *Design and construction plans of a groundwater monitoring system (see Section 845.630);*

Design and construction plans of a groundwater monitoring system are provided in the Groundwater Monitoring Plan in **Attachment O**.

> Section 845.230(d)(2)(I)(iii): *A groundwater sampling and analysis program that includes selection of the statistical procedures to be used for evaluating groundwater monitoring data (see Section 845.640); and*

A groundwater sampling and analysis program that meets the requirements of Section 845.640 is provided in the Groundwater Monitoring Plan in **Attachment O**.

> Section 845.230(d)(2)(I)(iv): *Proposed groundwater monitoring program that includes a minimum of eight independent samples for each background and downgradient well (see Section 845.650(b));*

A proposed groundwater monitoring program that meets the requirements of Section 845.650(b) is provided in the Groundwater Monitoring Plan in **Attachment O**.

2.10. Preliminary Closure Plan

> Section 845.230(d)(2)(J): *Preliminary written closure plan (see Section 845.720(a));*

The preliminary written closure plan and certification has been completed as specified by Section 845.720(a) and is provided in **Attachment P**.

2.11. Initial Post-Closure Care Plan

> Section 845.230(d)(2)(K): *Initial written post-closure care plan, if applicable (see Section 845.780(d));*

The NEAP closure will be completed by removing CCR as specified in Section 845.740 and an initial written post-closure care plan is not required per Section 845.780(a)(2), which states: *"An owner or operator of a CCR surface impoundment that elects to close a CCR surface impoundment by removing CCR as provided by Section 845.740 is not subject to the post-closure care criteria of this Section."*

2.12. Liner Certification

> Section 845.230(d)(2)(L): *The certification required by Section 845.400(h), or a statement that the CCR surface impoundment does not have a liner that meets the requirements of Section 845.400(b) or (c);*

The liner certification has been completed as specified by Section 845.400(h) that states the surface impoundment does not have a liner that meets the requirements of Section 845.400(b) or (c) is provided in **Attachment Q**.

2.13. History of Groundwater Exceedances

> Section 845.230(d)(2)(M): *History of known exceedances of the groundwater protection standards in Section 845.600, and any corrective action taken to remediate the groundwater;*

A history of known exceedances and any corrective action taken is provided in **Attachment R**.

2.14. Financial Assurance Requirements

> <u>Section 845.230(d)(2)(N):</u> *A certification that the owner or operator meets the financial assurance requirements of Subpart I;*

A certification that the owner meets the financial assurance is provided in **Attachment S**.

2.15. Hazard Potential Classification

> <u>Section 845.230(d)(2)(O):</u> *Hazard potential classification assessment and accompanying certification (see Section 845.440(a)(2));*

The Hazard Potential Classification Assessment and certification is provided in **Attachment T**.

2.16. Structural Stability Assessment

> <u>Section 845.230(d)(2)(P):</u> *Structural stability assessment and accompanying certification (see Section 845.450(c));*

The Structural Stability Assessment and certification as required by Section 845.450(c) is provided in **Attachment U**.

2.17. Safety Factor Assessment

> <u>Section 845.230(d)(2)(Q):</u> *Safety factor assessment and accompanying certification (see Section 845.460(b));*

The Safety Factor Assessment and certification as required by Section 845.460(b) is provided in **Attachment V**.

2.18. Inflow Design Flood Control System Plan

> <u>Section 845.230(d)(2)(R):</u> *Inflow design flood control system plan and accompanying certification (see Section 845.510(c)(3));*

The Inflow Design Flood Control System Plan and certification as required by Section 845.510(c)(3) is provided in **Attachment W**.

2.19. Safety and Health Plan

> <u>Section 845.230(d)(2)(S):</u> *Safety and health plan (see Section 845.530); and*

The safety and health plan in accordance with Section 845.530 is included in **Attachment X**.

2.20. Proposed Closure Priority Categorization

> <u>Section 845.230(d)(2)(T):</u> *For CCR surface impoundments required to close under 845.700, the proposed closure priority categorization required by Section 845.700(g).*

A CCR Surface Impoundment Category Designation and Justification letter was submitted to IEPA on May 19, 2021. The NEAP was designated as Category 4 Inactive CCR surface impoundment with a prospective exceedance of groundwater protection standards in Section 845.600. This letter is provided in **Attachment Y**.

ATTACHMENT A

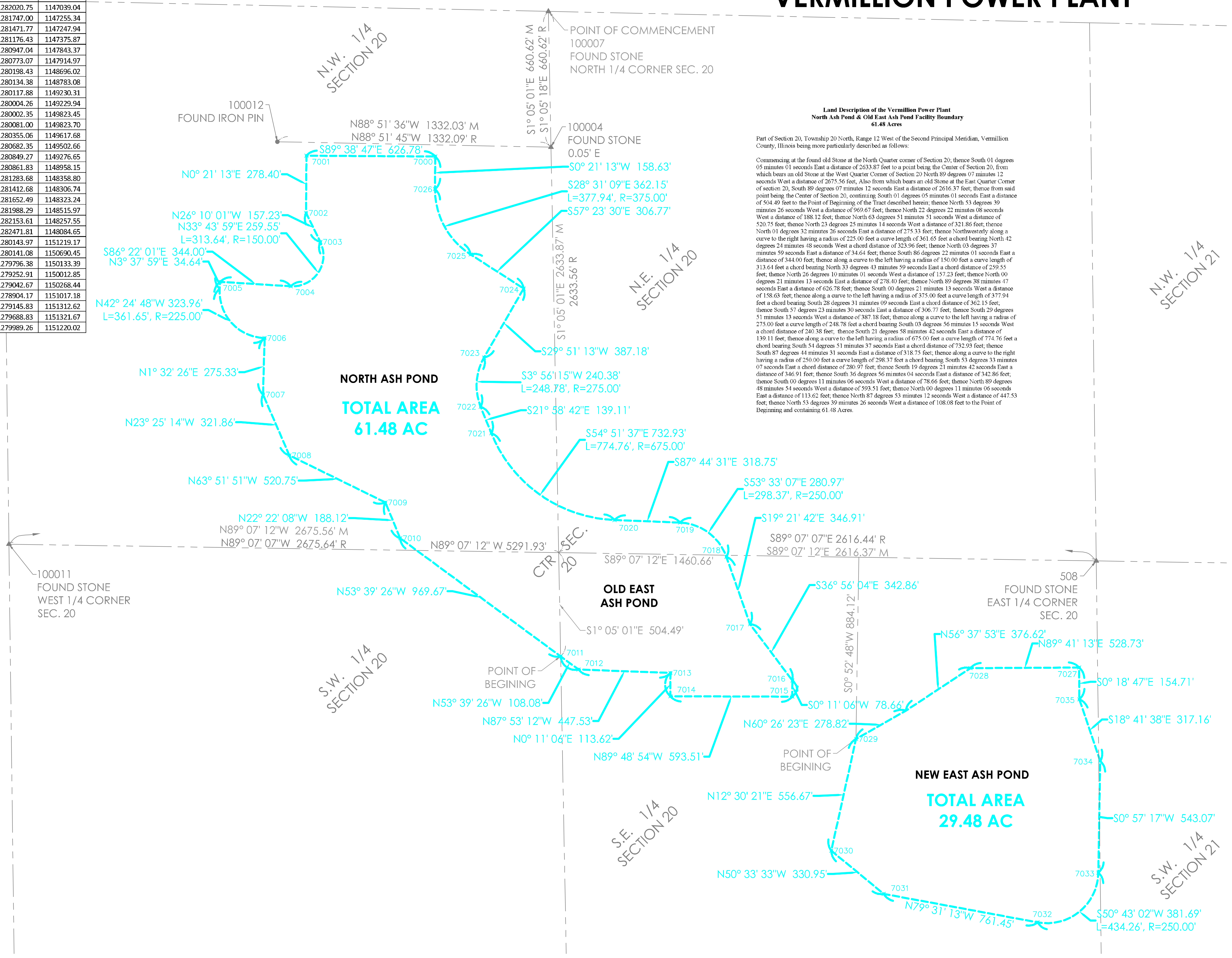
Legal Description (845.210)

CONTROL MONUMENTATION TABLE				
POINT NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION
508	1280662.64	1151302.54	0.00	FOUND STONE
100004	128675.72	1148649.22	588.39	502 FOUND STONE
100007	128336.22	1148636.67	588.21	501 FOUND STONE
100011	1280743.93	1146011.24	700.94	503 FOUND STONE
100012	1282702.02	1147317.5	644.87	FOUND I PIN W/CAP

CCR FACILITY BOUNDARY CORNERS		
POINT NO.	NORTHING	EASTING
7000	1282630.44	1148085.63
7001	1282634.31	1147458.86
7002	1282355.92	1147457.14
7003	1282214.80	1147526.48
7004	1281998.95	1147382.34
7005	1282020.75	1147039.04
7006	1281747.00	1147255.34
7007	1281471.77	1147247.94
7008	1281176.43	1147375.87
7009	1280947.04	1147843.37
7010	1280773.07	1147914.97
7011	1280198.43	1148696.02
7012	1280134.38	1148783.08
7013	1280117.88	1149230.31
7014	1280004.26	1149229.94
7015	1280002.35	1149823.45
7016	1280081.00	1149823.70
7017	1280355.06	1149617.68
7018	1280682.35	1149502.66
7019	1280849.27	1149276.65
7020	1280861.83	1148958.15
7021	1281283.68	1148358.80
7022	1281412.68	1148306.74
7023	1281652.49	1148323.24
7024	1281988.29	1148515.97
7025	1282153.61	1148257.55
7026	1282471.81	1148084.65
7027	1280143.97	1151219.17
7028	1280141.08	1150690.45
7029	1279796.38	1150133.39
7030	1279252.91	1150012.85
7031	1279042.67	1150268.44
7032	1278904.17	1151017.18
7033	1279145.83	1151312.62
7034	1279688.83	1151321.67
7035	1279989.26	1151220.02

Luminant

DYNEGY MIDWEST GENERATION, LLC
VERMILLION POWER PLANT



Land Description of the Vermillion Power Plant
North Ash Pond & Old East Ash Pond Facility Boundary
61.48 Acres

Part of Section 20, Township 20 North, Range 12 West of the Second Principal Meridian, Vermillion County, Illinois being more particularly described as follows:

Commencing at the found old Stone at the North Quarter corner of Section 20; thence South 01 degrees 05 minutes 01 seconds East a distance of 2633.87 feet to a point being the Center of Section 20, from which bears an old Stone at the West Quarter Corner of Section 20 North 89 degrees 07 minutes 12 seconds West a distance of 2675.56 feet, Also from which bears an old Stone at the East Quarter Corner of section 20, South 89 degrees 07 minutes 12 seconds East a distance of 2616.37 feet; thence from said point being the Center of Section 20, continuing South 01 degrees 05 minutes 01 seconds East a distance of 504.49 feet to the Point of Beginning of the Tract described herein; thence North 53 degrees 39 minutes 26 seconds West a distance of 969.67 feet; thence North 22 degrees 22 minutes 08 seconds West a distance of 188.12 feet; thence North 63 degrees 51 minutes 51 seconds West a distance of 520.75 feet; thence North 23 degrees 25 minutes 14 seconds West a distance of 321.86 feet; thence North 01 degrees 32 minutes 26 seconds East a distance of 275.33 feet; thence Northwesterly along a curve to the right having a radius of 225.00 feet a curve length of 361.65 feet a chord bearing North 42 degrees 24 minutes 48 seconds West a chord distance of 323.96 feet; thence North 03 degrees 37 minutes 59 seconds East a distance of 34.64 feet; thence South 86 degrees 22 minutes 01 seconds East a distance of 344.00 feet; thence along a curve to the left having a radius of 150.00 feet a curve length of 313.64 feet a chord bearing North 33 degrees 43 minutes 59 seconds East a chord distance of 259.55 feet; thence North 26 degrees 10 minutes 01 seconds West a distance of 157.23 feet; thence North 00 degrees 21 minutes 13 seconds East a distance of 278.40 feet; thence North 89 degrees 38 minutes 47 seconds East a distance of 626.78 feet; thence South 00 degrees 21 minutes 13 seconds West a distance of 158.63 feet; thence along a curve to the left having a radius of 375.00 feet a curve length of 377.94 feet a chord bearing South 28 degrees 31 minutes 09 seconds East a chord distance of 362.15 feet; thence South 57 degrees 23 minutes 30 seconds East a distance of 306.77 feet; thence South 29 degrees 51 minutes 13 seconds West a distance of 387.18 feet; thence along a curve to the left having a radius of 275.00 feet a curve length of 248.78 feet a chord bearing South 03 degrees 56 minutes 15 seconds West a chord distance of 240.38 feet; thence South 21 degrees 58 minutes 42 seconds East a distance of 139.11 feet; thence along a curve to the left having a radius of 675.00 feet a curve length of 774.76 feet a chord bearing South 54 degrees 51 minutes 37 seconds East a chord distance of 732.93 feet; thence South 87 degrees 44 minutes 31 seconds East a distance of 318.75 feet; thence along a curve to the right having a radius of 250.00 feet a curve length of 298.37 feet a chord bearing South 53 degrees 33 minutes 07 seconds East a chord distance of 280.97 feet; thence South 19 degrees 21 minutes 42 seconds East a distance of 346.91 feet; thence South 36 degrees 56 minutes 04 seconds East a distance of 342.86 feet; thence South 00 degrees 11 minutes 06 seconds West a distance of 78.66 feet; thence North 89 degrees 48 minutes 54 seconds West a distance of 593.51 feet; thence North 00 degrees 11 minutes 06 seconds East a distance of 113.62 feet; thence North 87 degrees 53 minutes 12 seconds West a distance of 447.53 feet; thence North 53 degrees 39 minutes 26 seconds West a distance of 108.08 feet to the Point of Beginning and containing 61.48 Acres.

N

0' 150' 300'

LEGEND

—-·-—	SECTION LINE
━━	FACILITY BOUNDARY
●	FOUND SURVEY MARKER AS NOTED
▲	FOUND SURVEY STONE
M	DENOTES MEASURED DIMENSION
R	DENOTES RECORD (DEED) DIMENSION

SURVEY NOTE:
THIS DRAWING AND THE INFORMATION SHOWN HERE ON WAS OBTAINED FROM DATA COLLECTED FROM A FIELD SURVEY MADE BY INGENAE, LLC BETWEEN FEBRUARY 12 THROUGH JULY 15, 2021. SURVEY COORDINATES, BEARINGS & DISTANCES ARE REFERENCED TO ILLINOIS EAST 1201 STATE PLANE COORDINATE SYSTEM NAD 1983.

SURVEYOR CERTIFICATE:
THIS IS TO CERTIFY THAT WE, INGENAE, LLC, HAVE AT THE REQUEST OF AND FOR THE EXCLUSIVE USE OF THE OWNERS, PERFORMED A SURVEY OF THE TRACT AS SHOWN HEREON AND THAT THIS IS A TRUE REPRESENTATION OF THAT SURVEY. THIS PLAT AND THE SURVEY FROM WHICH IT IS BASED WERE DONE IN ACCORDANCE WITH THE "MINIMUM STANDARDS OF PRACTICE" FOR LAND SURVEYING IN THE STATE OF ILLINOIS.

INGENAE, LLC
PROFESSIONAL DESIGN FIRM
LICENSE NO. 184.007588-0010

MICHAEL J. GRAMINSKI
Sept. 20. 2021

MICHAEL J. GRAMINSKI DATE
I.P.L.S. NO. 035.002901
EXPIRES: 11/30/2022

Land Description of the Vermillion Power Plant
New East Ash Pond Facility Boundary
29.48 Acres

Part of the Southeast Quarter of Section 20 and Part of the Southwest Quarter of Section 21, Township 20 North, Range 12 West of the Second Principal Meridian, Vermillion County, Illinois being more particularly described as follows:

Commencing at the found old Stone at the North Quarter corner of Section 20; thence South 01 degrees 05 minutes 01 seconds East a distance of 2633.87 feet to a point being the Center of Section 20, from which bears an old Stone at the West Quarter Corner of Section 20 North 89 degrees 07 minutes 12 seconds West a distance of 2675.56 feet, Also from which bears an old Stone at the East Quarter Corner of section 20, South 89 degrees 07 minutes 12 seconds East a distance of 2616.37 feet; thence from said point being the Center of Section 20, South 89 degrees 07 minutes 12 seconds East a distance of 1460.66; thence South 00 degrees 52 minutes 48 seconds West a distance of 884.12 feet to the Point of Beginning of the Tract described herein; thence North 60 degrees 26 minutes 23 seconds East a distance of 278.82 feet; thence North 56 degrees 37 minutes 53 seconds East a distance of 376.62 feet; thence North 89 degrees 41 minutes 13 seconds East a distance of 528.73 feet; thence South 00 degrees 18 minutes 47 seconds East a distance of 154.71 feet; thence South 18 degrees 41 minutes 38 seconds East a distance of 317.16 feet; thence South 00 degrees 57 minutes 17 seconds West a distance of 543.07 feet; thence along a curve to the right having a radius of 250.00 feet a curve length of 434.26 feet a chord bearing South 50 degrees 43 minutes 02 seconds West a chord distance of 381.69 feet; thence North 79 degrees 31 minutes 13 seconds West a distance of 761.45 feet; thence North 50 degrees 33 minutes 33 seconds West a distance of 330.95 feet; thence North 12 degrees 30 minutes 21 seconds East a distance of 556.67 feet to the Point of Beginning and containing 29.48 Acres.

IngenAE
502 Earth City Plaza, Suite 120
Earth City, MO 63045
www.ingenae.com

Submissions / Revisions:	Date:
1	
2	
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9	
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11	
12	
13	

Luminant

Project Name & Location:

VERMILLION
POWER PLANT
10188 EAST 2150 NORTH RD
OAKWOOD, IL
61858

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Drawing Name:

CCR FACILITY BOUNDARY EXHIBIT

Date: 08/06/2021	Project No.
Type: SITE	Drawing No. 1
Drawn By: CB	
Approved By: MG	
Scale: AS NOTED	

Luminant

DYNEGY MIDWEST GENERATION, LLC
VERMILLION POWER PLANT

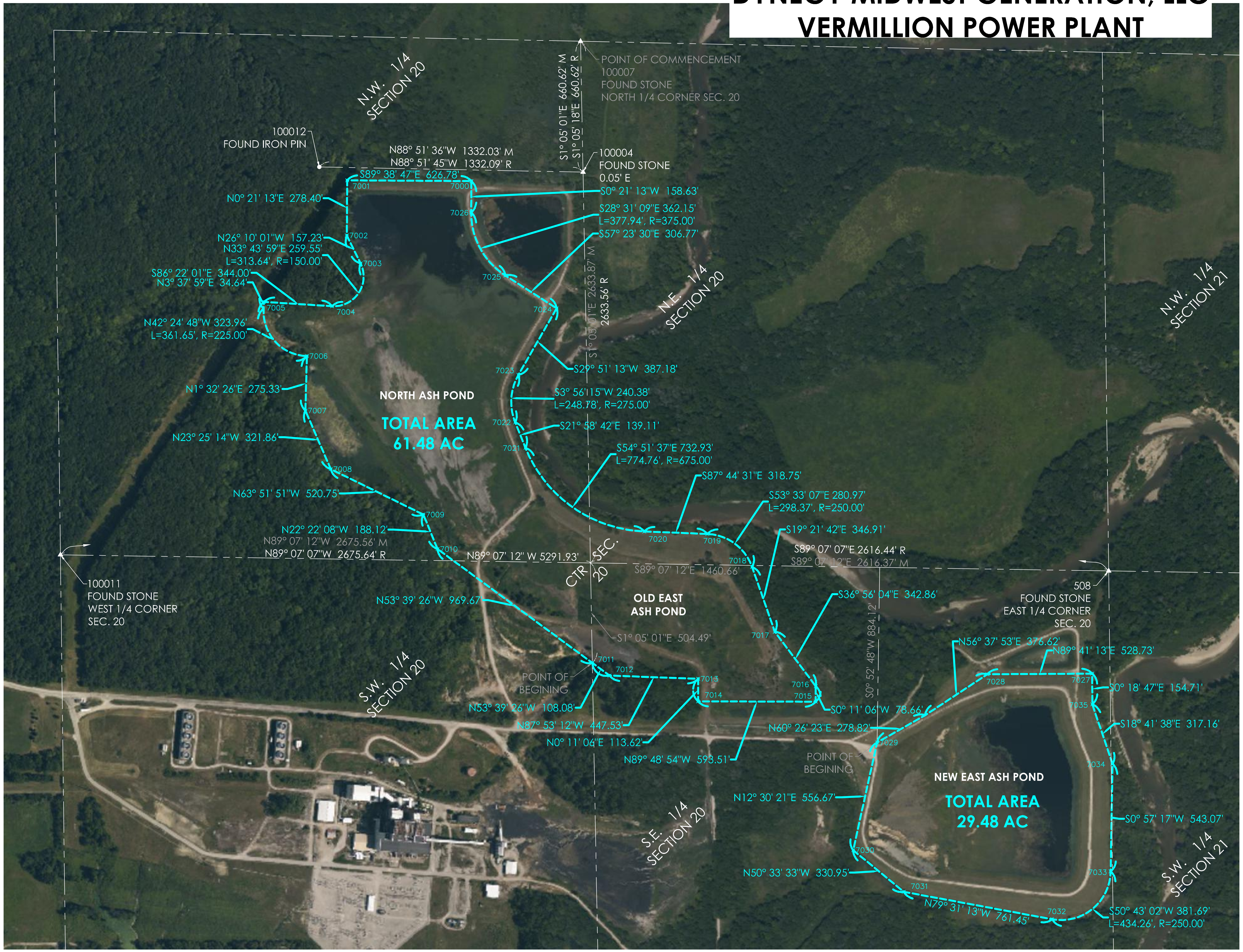
N

0' 150' 300'

LEGEND

- —·—·— SECTION LINE
- —— FACILITY BOUNDARY
- ● FOUND SURVEY MARKER AS NOTED
- ▲ FOUND SURVEY STONE
- M DENOTES MEASURED DIMENSION
- R DENOTES RECORD (DEED) DIMENSION

SURVEY NOTE:
THIS DRAWING AND THE INFORMATION SHOWN HERE ON WAS OBTAINED FROM DATA COLLECTED FROM A FIELD SURVEY MADE BY INGENAE, LLC BETWEEN FEBRUARY 12 THROUGH JULY 15, 2021. SURVEY COORDINATES, BEARINGS & DISTANCES ARE REFERENCED TO ILLINOIS EAST 1201 STATE PLANE COORDINATE SYSTEM NAD 1983.



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Luminant

Project Name & Location:

VERMILLION
POWER PLANT
10188 EAST 2150 NORTH RD
OAKWOOD, IL
61858

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Drawing Name:
CCR FACILITY BOUNDARY EXHIBIT

Date: 08/06/2021	Project No.
Type: SITE	Drawing No. 2
Drawn By: CB	
Approved By: MG	
Scale: AS NOTED	

ATTACHMENT B

History of Construction (845.220)

Prepared for

Dynegy Midwest Generation
1500 Eastport Plaza Drive
Collinsville, Illinois 62234

HISTORY OF CONSTRUCTION REPORT

VERMILION POWER PLANT
OAKWOOD, ILLINOIS

Prepared by

Geosyntec consultants
engineers | scientists | innovators
134 N. Lasalle Street Suite 300
Chicago, IL 60602

Project Number CHE8404A

October 2021

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1. INTRODUCTION

Dynegy Midwest Generation (Dynegy) Company's Vermilion Power Plant (the Site) is a retired electric power generating facility with a coal fired unit in Oakwood, Illinois. The facility began operations in the mid-1950s and was retired in November 2011. The Site produced and stored coal combustion residuals (CCRs), a.k.a. "coal ash", as a part of its historical operations in three coal ash surface impoundments (impoundments) located north and east of the power plant (North Ash Pond, Old East Ash Pond, New East Ash Pond) as shown in Appendix A.

Impoundments containing coal in Illinois ash are regulated by the Illinois Environmental Protection Agency (IEPA) Coal Combustion Residual (CCR) Title 35 Environmental Protection, Subtitle G Waste Disposal, Chapter I Pollution Control Board, Subchapter j Coal Combustion Waste Surface Impoundments, Part 845 Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845) [1]. A construction history detailed in Section 845.220(a)(1) is required.

1.1. Information Availability

This report is based on the information available at the time this report was developed. In preparing this report, Geosyntec looked to Section 845.220(a)(1) as guidance to identify what historical information to provide in this report. Consistent with Section 845.220(a)(1), this report provides a summary of the information that was reasonably and readily available and notes any data gaps. Unfortunately, given the age of the plant and the time since it was closed, data gaps exist, which are noted.

2. HISTORY OF CONSTRUCTION

2.1. Identifying Information Section

> *Section 845.220(a)(1)(A):* *Identifying Information*
> i) *The name and address of the person or persons owning or operating the CCR surface impoundment;*
> ii) *The name associated with the CCR surface impoundment; and*
> iii) *The identification number of the CCR surface impoundment if one has been assigned by the Agency.*

Owner: Dynegy Midwest Generation, LLC

Address: 1500 Eastport Plaza Drive
Collinsville, IL 62234

Facility: Vermilion Power Plant
10188 East 2150 North Rd
Oakwood, IL 61858

CCR Units: New East Ash Pond (NEAP)
Old East Ash Pond (OEAP)
North Ash Pond (NAP)

A secondary or polishing pond is present at both the NAP and EAP as shown in Appendix A. The secondary ponds would not qualify as CCR surface impoundments.

2.2 Location

Locations of the CCR units have been noted on the topographic and vicinity map in Appendix A.

2.3. Purpose

> *Section 845.220(a)(1)(B):* *A statement of the purpose for which the CCR surface impoundment is being used, how long the CCR surface impoundment has been in operation, and the types of CCR that have been placed in the CCR surface impoundment.*

All CCR units at the Vermilion Power Plant have been inactive since 2011. The purpose of the units was to manage wastewaters using sedimentation to remove settleable matter and turbidity prior to discharging through an NPDES permitted outfall pursuant to an NPDES permit. Fly ash and bottom ash have been placed in the CCR surface impoundments.

2.4. Watershed

> _Section 845.220(a)(1)(C):_ *The name and size in acres of the watershed within which the CCR unit is located.*

All CCR units at the Site are located within the Middle Fork Vermilion River Watershed, which has a drainage area of 17,215 acres. The Environmental Protection Agency (EPA) 12-digit hydrological unit code (HUC) for this watershed is 051201090509 [2].

2.5. Foundation and Abutment Materials

> _Section 845.220(a)(1)(D):_ *A description of the physical and engineering properties of the foundation and abutment materials on which the CCR surface impoundment is constructed.*

Four native soil units comprise the foundation soils for the impoundments at the Site. These are, from shallow to deep, Clay Alluvium, Sand Alluvium, Reworked (weathered) Till and Glacial Till. The engineering properties that have been developed for these are provided in Table 1 [3] [4].

Clay Alluvium

Clay Alluvium consists of clay soils below the coal ash and riverbank berm materials. This soil unit is stream-deposited alluvium placed by the Middle Fork Vermilion River. The soils are generally lean clays and silty clays with varying amounts of sand and gravel. The average moisture content is 19 percent, with a range of 9 to 57 percent. The average total unit weight is 112 pounds per cubic foot (pcf) and the average plasticity index is 11 percent. The SPT N-values range from weight of hammer (WOH) to 37, with an average of 10. The range corresponds to a consistency of very soft to hard with the average value corresponding to stiff. This layer is discontinuous but was found to be up to approximately 50 feet thick.

Sand Alluvium

Sand Alluvium consists of fine to coarse-grained sands and gravels located below the clay alluvium. This soil unit is also stream-deposited alluvium placed by the Middle Fork Vermilion River. Lenses of silt, clay, and cobbles were observed. The average moisture content is 16 percent, with a range of 6 to 30 percent. The average total unit weight is 122 pcf. The SPT N-values range from WOH to 77, with an average of 16. The range corresponds to a consistency of very loose to very dense with the average value corresponding to medium dense. This layer is discontinuous but was found to be up to approximately 20 feet thick.

Reworked Till

Reworked Till consists of weathered glacial till, the uppermost portion of the glacial till. This soil group is generally located below the alluvium and consists of clay and sandy soils. The average moisture content is 14 percent, with a range of 11 to 25 percent. The average total unit weight is

141 pcf and the average plasticity index is 9 percent. The SPT N-values range from 3 to 53, with an average of 13. The range corresponds to a consistency of soft to hard with the average value corresponding to stiff. This layer is discontinuous but was found to be up to approximately 40 feet thick.

Glacial Till

Glacial Till consists of clay and sandy soils. This soil group is generally located below the alluvial soils and reworked glacial till. The average moisture content is 16 percent, with a range of 5 to 37 percent. The average total unit weight is 129 pcf and the average plasticity index is 11 percent. The SPT N-values range from WOH to 100, with an average of 38. The range corresponds to a consistency of very soft to hard with the average value corresponding to hard. This layer is discontinuous but was found to be up to approximately 60 feet thick.

Bedrock

Bedrock encountered onsite consists of moderately to highly weathered limestone, shale, and coal from the Shelburn-Patoka Formations. Rock coring was conducted in 12 borings with an average recovery of 94 percent and an average rock quality designation (RQD) of 62 percent.

2.6. Constructed Materials

> *Section 845.220(a)(1)(E): A statement 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; the method of site preparation and construction of each zone of the CCR surface impoundment; and the approximate dates of construction of each successive stage of construction of the CCR surface impoundment.*

2.6.1. Constructed Material Properties

The material unit used to construct the CCR units was identified as Fill. Engineering parameters of Fill are summarized in Table 2 [3] [4].

Fill

All fill material used to construct the riverbank berms of the OEAP, NAP, and NEAP, as well as fill used to cover the OEAP, were classified as a single unit referred to as Fill. Fill consists of lean clay, silty clay, and silty sand with varying amounts of sand and gravel. The average moisture content is 15 percent, with a range of 7 to 43 percent. The average total unit weight is 131 pounds per square foot (pcf) and the average plasticity index is 12 percent. The standard penetration test (SPT) N-values range from 2 to 93, with an average of 16. The range corresponds to a consistency of soft to hard, with the average value corresponding to very stiff.

2.6.2 Construction Activities

Construction methods and times of the CCR units at the Site are summarized below.

Old East Ash Pond and North Ash Pond

What is commonly referred to as the OEAP was the first impoundment to accept coal ash beginning around 1955. The eastern berm of the OEAP was constructed and then raised using initial clay berms to approximately elevation 602 feet and raised again to the current elevation ranging from 624 to 636 feet using coal ash with a Fill cover. Overtime, the northern end of the OEAP extended into what is currently referred to as the NAP and the outer berm of the OEAP was extended northward to include what is commonly referred to as the NAP[1]. These units were designed and managed as a single impoundment for purposes of treating and storing coal ash until the area referred to as the OEAP received a Fill cover of varying thickness sometime after 1985 and before 1998 [5].

Over time a surficial berm constructed from coal ash, with an access road on top, was constructed on the surface of the coal ash to the south of the northern perimeter of the OEAP to manage surface water flows and provide vehicle access. The NAP was subsequently designed to incorporate the surficial berm and coal ash located within the OEAP. The NAP was constructed in 1977.

Soil boring records through the surficial berm show coal ash present below the berm and road, demonstrating that the NAP and OEAP had a common operational area on the northern end of the OEAP and southern area of the NAP. A geotechnical boring was drilled off the edge of this road near the center of the OEAP and indicates 13.5 ft of clay fill overlying 9.0 ft of coal ash before native soils were encountered at a depth of 22.5 ft. This boring was completed as part of the 2017 geotechnical investigation to support closure design of the OEAP and NAP. The NAP remained active until the NEAP construction was finished in 1989.

The eastern edge of the OEAP are delineated by berms, while the northwestern edge shares a border with the NAP and the southern edge is bounded by the existing topography. The northern and eastern edges of the NAP are delineated by berms, the southern edge shares a border with the OEAP, and the western edge is bounded by the existing topography. The Secondary NAP is not a CCR surface impoundment and is located at the northeast corner of the NAP. This pond was constructed with the NAP. The NAP has not been covered, but has vegetation growing from the CCR over a majority of the impoundment.

---

[1] Based on historical aerial photos.

New East Ash Pond

The NEAP was constructed in the late 1980s separate from the OEAP and NAP as a single impoundment for purposes of treating and storing coal ash. The riverbank berm consists of Fill material with a slurry wall to roughly elevation 600 feet. In the 2003, the NEAP was expanded on the western edge with a slurry trench and the existing berms were raised to their current elevation of roughly 620 feet. The slurry wall and slurry trench tied into the bedrock below the berm.

The northern, eastern, and southern edges of the NEAP are delineated by berms, while the western interior slope of the impoundment is bounded by the existing topography. The Secondary NEAP is not a CCR surface impoundment and is located along the northern berm of the NEAP. This pond was constructed with the NEAP.

2.7. Drawings and Details

> *Section 840.220(a)(1)(F): At a scale that details engineering structures and appurtenances relevant to the design, construction, operation, and maintenance of the CCR surface impoundment, detailed dimensional drawings of the CCR surface impoundment, including a plan view and cross- sections of the length and width of the CCR surface impoundment, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the normal operating pool surface elevation and the maximum pool surface elevation following peak discharge from the inflow design flood, the expected maximum depth of CCR within the CCR surface impoundment, and any identifiable natural or manmade features that could adversely affect operation of the CCR surface impoundment due to malfunction or mis-operation.*

This section documents information related to the existing conditions, design, construction, operation, instrumentation monitoring, cross sections, and maintenance of the impoundments on dimensional drawings, to the extent this information is available. Drawings and figures referenced in Table 3 are located in Appendix B and Appendix C.

2.8. Existing Instrumentation

> *Section 845.220(a)(1)(G): A description of the type, purpose, and location of existing instrumentation.*

A total of 11 vibrating-wire piezometers were installed by multiple consultants in 2013 and 2017 as summarized in Table 4 below. A total of 34 monitoring wells are present at the Site which are actively monitored for groundwater quality and/or groundwater elevation. Piezometer and monitoring well locations are included in Appendix C.

2.9. Area-Capacity Curves

Section 845.220(a)(1)(H): Area-capacity curves for the CCR surface impoundment.

An area-capacity curve for the OEAP was not identified in the documentation available. Area-capacity curves for the NEAP and NAP are presented in **Figures 1 and 2**.

2.10. Description of Spillway and Diversion Design Features

Section 845.220(a)(1)(I): A description of each spillway and diversion design features and capacities and calculations used in their determination.

Old East Ash Pond

The current condition of the OEAP does not include a standing pool of water; therefore, there is no pool elevation. The OEAP is graded to drain from South to North via a pipe and let down structure, leading to the NAP. During the 2014 annual inspection, the following structure was noted: "*A grated stormwater structure was observed along the exterior toe of the southern berm. It is our understanding that this concrete pipe was installed for stormwater control along the southern toe of the pond due to erosion issues. Erosion features from stormwater runoff were not observed along the southern downstream toe.*" [7].

A linear feature was identified using ground penetrating radar (GPR) during a geotechnical exploration in 2017 and is shown on **Figure 2**. It was designated a "potential pipe" in the GPR survey. No additional documentation for this potential pipe is available.

North Ash Pond

The pool level in the NAP is approximately 597.0 feet and maintained with a discharge structure [8]. The discharge structure is a drop inlet that connects the NAP and the Secondary NAP; however, the size and material type of this pipe is unknown [7].

The Secondary NAP has a normal pool elevation of approximately 587.5 feet [8]. This pond discharges to National Pollutant Discharge Elimination System (NPDES) Permitted Outfall 001 through a 30-inch diameter corrugated metal pipe riser connected to an outlet pipe of unknown size and material type at the southeast end of the pond that discharges into a drainage channel to Middle Fork Vermilion River [7]. A 12-inch high-density polyethylene (HDPE) pipe near the riser serves as an emergency spillway for the Secondary NAP that drains to the Middle Fork Vermilion River.

Currently stormwater runoff from the valley, located west of NAP, is managed by a 36-inch diameter pipe network that collects surface water from two inlets located upstream of a berm or "saddle dam" and conveys to a location just north of the north berm. The water is transmitted into a ditch that flows eastward to the Middle Fork of the Vermilion River [8]. Multiple manhole access points are present within the NAP for maintenance.

Capacity calculations for the NAP discharge structure and pipes were not identified in the documentation available.

A linear feature was identified using ground penetrating radar (GPR) during a geotechnical exploration in 2017 and is shown on **Figure 3**. It was designated a “potential pipe” in the GPR survey. No additional documentation for this potential pipe is available.

New East Ash Pond

The pool level in the NEAP and Secondary NEAP is approximately 594.0 feet and maintained with two drop inlet discharge structures to the Secondary NEAP [8]. The first drop inlet near the north embankment is an 18-inch diameter ductile iron pipe (DIP) that outlets at the Secondary NEAP. The second drop inlet within the north embankment is a 36-inch diameter reinforced concrete pipe (RCP) that connects to a manhole on the downstream slope, which then connects to a corrugated metal pipe (CMP) of unknown diameter that outlets to the Secondary NEAP. This pond discharges to NPDES Permitted Outfall 003 through a drop inlet with a 36-inch diameter pipe of unknown material type into a drainage channel to the Middle Fork Vermilion River. The embankment was constructed with a downstream internal blanket drain with a length of 50 feet [7].

Hydraulic and hydrologic calculations for spillway sizing were not identified in the documentation available for the original construction; however, calculations were completed for the expansion using HEC-RAS [6].

2.11. Construction Specifications

> *Section 845.220(a)(1)(J): The construction specifications and provisions for surveillance, maintenance, and repair of the CCR surface impoundment.*

Dynegy conducts annual surveillance and routine maintenance for the impoundments. The associated Operations and Maintenance Plans for each facility are included in Appendix D.

Specifications for construction of the NEAP and the NEAP expansion are included in Appendix E. Specifications for the OEAP and NAP were not identified in the documentation available.

2.12. Record or Knowledge of Structural Instability

> *Section 845.220(a)(1)(K): Any record or knowledge of structural instability of the CCR surface impoundment.*

There is no record or knowledge of structural instabilities of the OEAP, NAP, or NEAP.

3. LIMITATIONS

The observations presented herein are based on information provided by Dynegy using that degree of care and skill ordinarily exercised under similar circumstances by competent members of the engineering profession. Geosyntec has assumed that such information is correct and has not verified and is not responsible for the accuracy of such provided information. No warranties can be made regarding information and documents not presently available.

4. REFERENCES

[1] Illinois Environmental Protection Agency, "Title 35 Environmental Protection, Subtitle G Waste Disposal, Chapter I Pollution Control Board, Subchapter j Coal Combustion Waste Surface Impoundments, Part 845 Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments," 2021.

[2] Environmental Protection Agency (EPA), "Watershed Index Online Tool," 2019. [Online]. Available: https://www.epa.gov/wsio/download-and-use-wsio-tool. [Accessed February 2020].

[3] Geosyntec Consultants, Inc., "North Ash Pond Trench Revetment System Slope Stability Assessment (Draft)," 2020.

[4] Geosyntec Consultants, Inc., "Reliability Assessment of the Old East Ash Pond (Draft)," 2019.

[5] Google, "Google Earth Pro," Google, 1985, 1998. [Online]. Available: earth.google.com/web. [Accessed 24 June 2021].

[6] URS Corporation, "Vermilion Power Station Expansion fo Existing Ash Pond Calculation Book," 2002.

[7] URS Corporation, "Dam Inspections Vermilion Power Station," 2014.

[8] Stantec Consulting Services, Inc., "Privileged and Confidential Attorney Work Product Information - Vermilion Site Unwatering and Dewatering Volumes," 2019.

TABLES

Table 1. Engineering Parameters of Foundation Materials

Soil Unit	Total Unit Weight, γ_T (pcf)	Drained Conditions		Undrained Conditions		Natural Water Content, w (%)	Plasticity Index, PI (%)
		Friction Angle, φ' (deg)	Cohesion, c' (psf)	Friction Angle, φ (deg)	Cohesion, c (psf)		
Clay Alluvium	112	32	50	0	1,500	19	11
Sand Alluvium	122	33	0	-	-	16	N/A
Reworked Till	141	35	0	0	1,700	14	9
Glacial Till	129	37	0	-	-	16	11

Table 2. Engineering Parameters of Constructed Materials

Soil Unit	Total Unit Weight, γ_T (pcf)	Drained Conditions		Undrained Conditions		Natural Water Content, w (%)	Plasticity Index, PI (%)
		Friction Angle, φ' (deg)	Cohesion, c' (psf)	Friction Angle, φ (deg)	Cohesion, c (psf)		
Fill	131	36	50	0	1,000	15	12
Coal Ash[1]	107	34	0	-	-	38	N/A

[1] This includes parameters for all coal ash onsite.

Table 3. Engineering Detail Drawings

Drawings	OEAP	NAP	NEAP
Dimensional Plan View	Sheet 2 of 18	Sheet 2 of 18	C-SK.26869-4, P-04, Sheet 2 of 18
Dimensional Cross Sections	Sheet 11 of 18, Sheet 12 of 18	Sheet 13 of 18, Sheet 14 of 18	TS-05 through TS-12
Foundation Improvements	Not Available	Not Available	Not Available
Drainage Provisions	Not Available	Not Available	SK.26869-4, D-02, D-04
Instrument Locations	Figure No. 1-2, Drawing-01	Figure No. 1-2, Drawing-01	Figure No. 1-2, Drawing-01
Slope Protection	Not Available	Not Available	Not Available
Normal Operation Pool Elevation	Not Available	Sheet 3 of 18[1]	P-04
Maximum Pool Surface Elevation	Not Available	Not Available	Not Available
Expected Maximum Depth of CCR	61 feet	33 feet	21 feet

[1] Normal operating pool not available. Pool elevation from March 26, 2018 survey provided on this drawing sheet.

Table 4. Piezometer Summary

Instrument	Unit	Installation Date
B-13-3	OEAP	2013
B-13-6	OEAP	2013
B-13-9	OEAP	2013
STN-S-18	OEAP	2017
STN-S-22	NAP	2017
STN-S-23	OEAP	2017
STN-S-25	NEAP	2017
STN-S-29	NAP	2017
STN-S-31	NAP	2017
STN-S-35	NAP	2017
B1-2	NAP	2018
B3-2	OEAP	2018

FIGURES

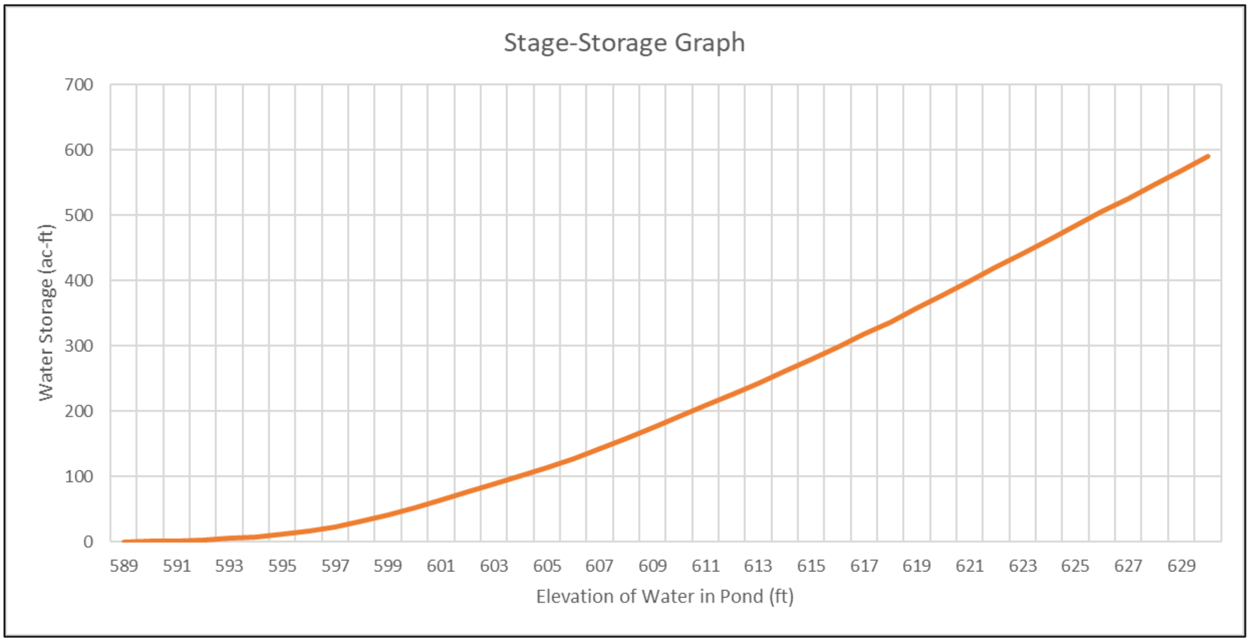


Figure 1. New East Ash Pond Stage-Storage Graph

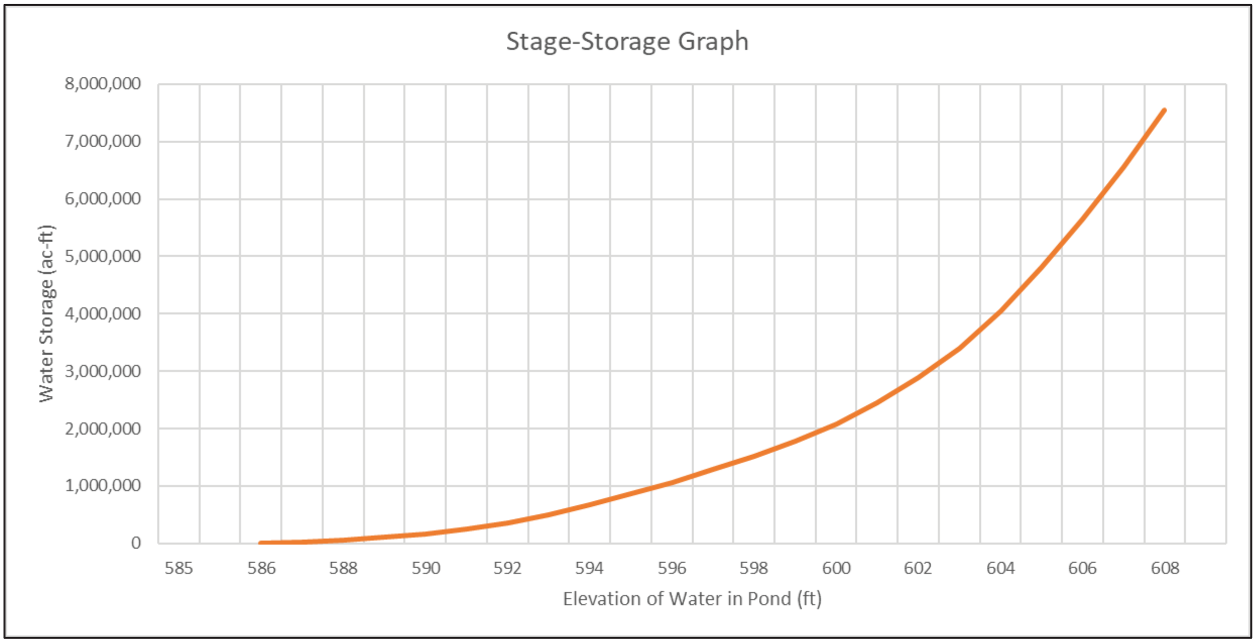


Figure 2. North Ash Pond Stage-Storage Graph

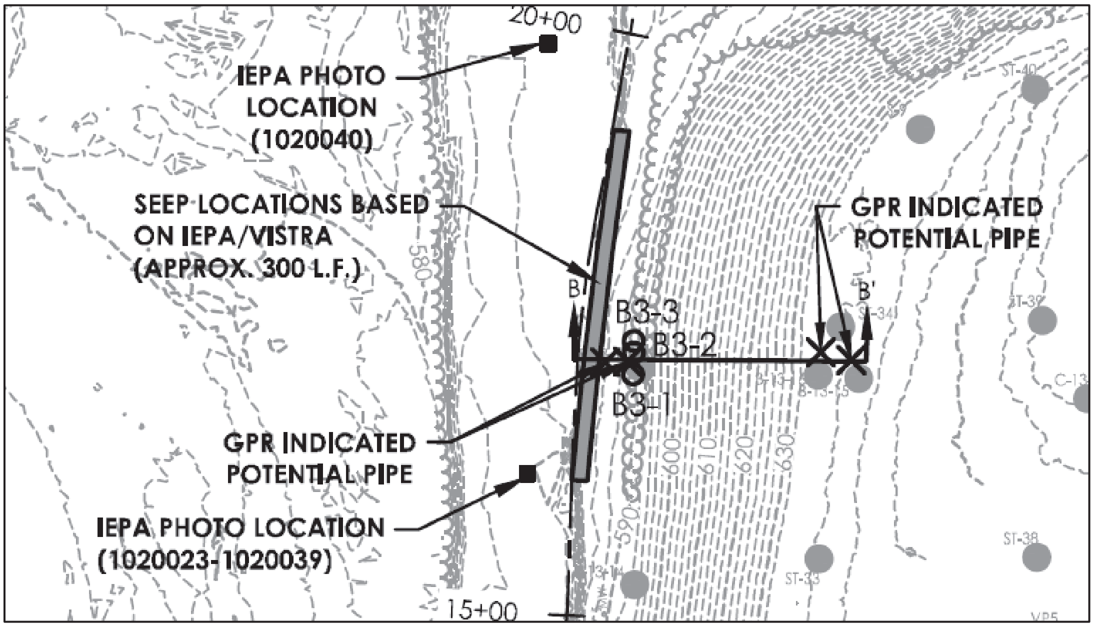


Figure 3. Old East Ash Pond GPR Indicated Pipe

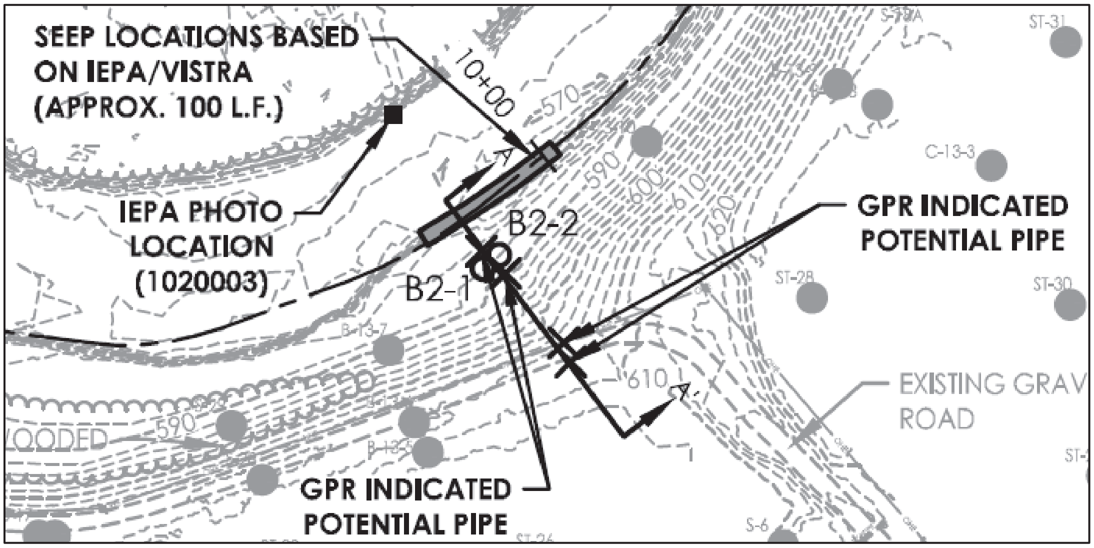
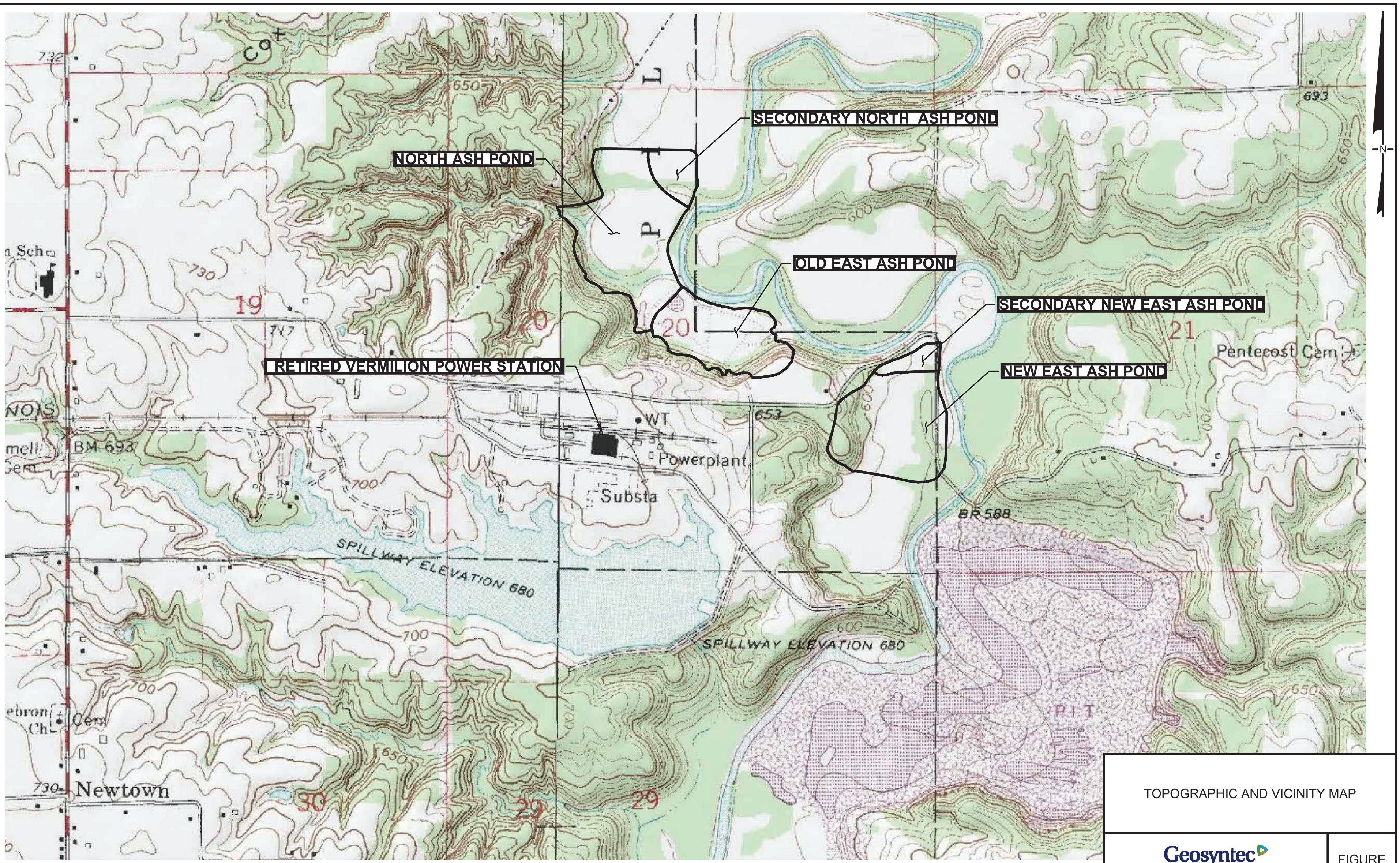


Figure 4. North Ash Pond GPR Indicated Pipe

APPENDIX A. TOPOGRAPHIC AND VICINITY MAP



REFERENCE: THIS MAP WAS PRODUCED IN THE YEAR 1978 AND IT WAS PROVIDED BY WWW.MYTOPO.COM. THIS MAP IS BASED ON THE GRAPHIC 7.5 MINUTE TOPOGRAPHIC MAP OF DANVILLE NW, ILLINOIS QUADRANGLE.

0 1000 2000

SCALE IN FEET

TOPOGRAPHIC AND VICINITY MAP

Geosyntec consultants

FIGURE 1

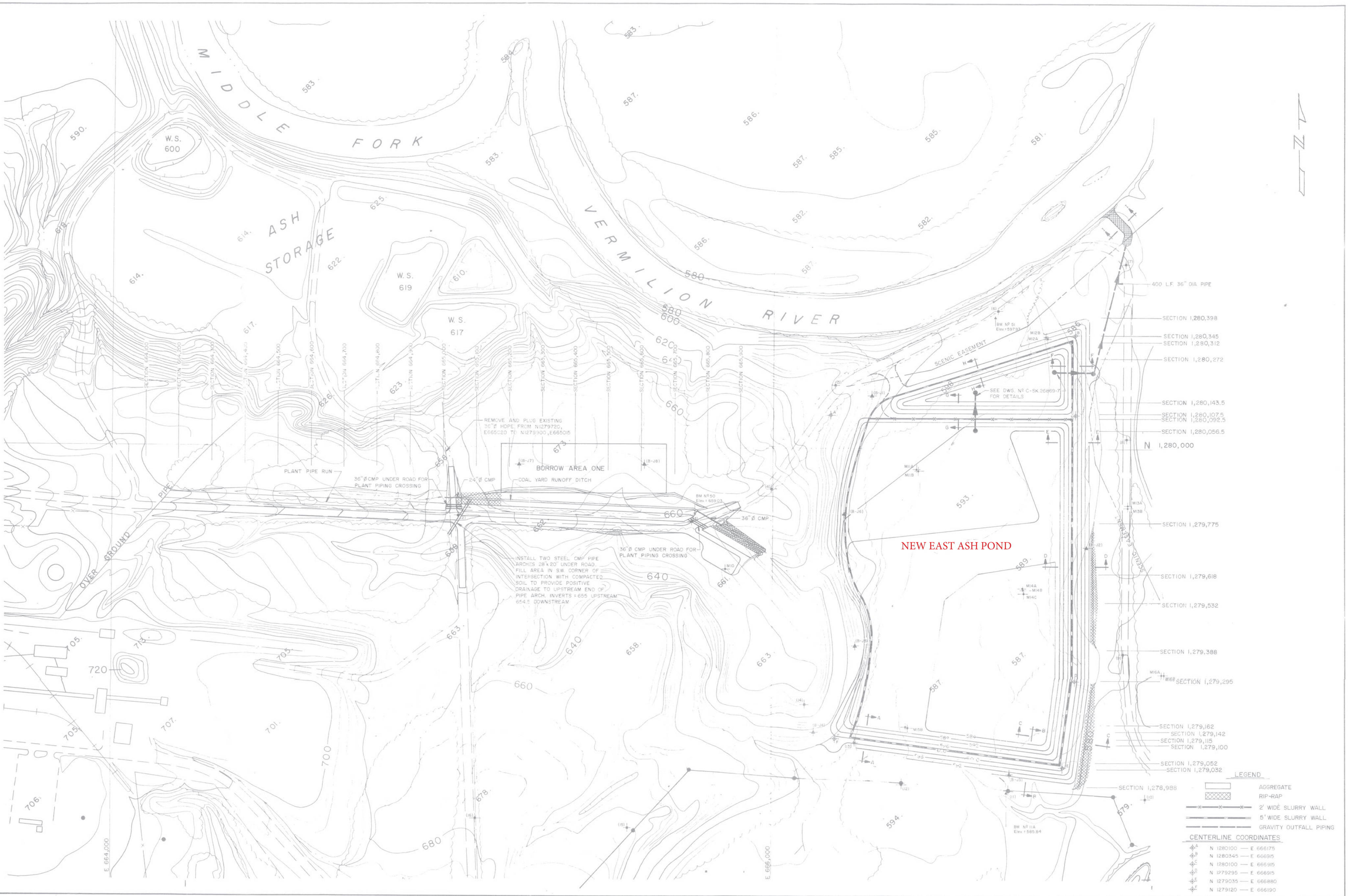
PROJECT NO: CHE8404

JUNE 2020

H:\V\VERMILION - CHE8404\DRAWINGS\FIGURES\8404-001-SITE LOCATION MAP (APRIL 2020) - L□□S□□d □□ DW□□□□ □□ 6:22:20

APPENDIX B. VERMILION POWER PLANT DRAWINGS

- **C-SK.26869-4, ASH DISPOSAL FACILITY VERMILION POWER PLANT**
- **P-04, E-VER1-C128-3, EASH ASH POND EXPANSION**
- **TS-01, E-VER1-C129-1, EASH ASH POND EXPANSION**
- **TS-02, E-VER1-C129-2, EASH ASH POND EXPANSION**
- **TS-03, E-VER1-C129-3, EASH ASH POND EXPANSION**
- **TS-04, E-VER1-C129-4, EASH ASH POND EXPANSION**
- **TS-05, E-VER1-C129-5, EASH ASH POND EXPANSION**
- **TS-06, E-VER1-C129-6, EASH ASH POND EXPANSION**
- **TS-07, E-VER1-C129-7, EASH ASH POND EXPANSION**
- **TS-08, E-VER1-C129-8, EASH ASH POND EXPANSION**
- **D-02, E-VER1-C130-2, EASH ASH POND EXPANSION**
- **D-04, E-VER1-C130-4, EASH ASH POND EXPANSION**
- **SHEET 2 OF 18, VERMILION ASH POND CLOSURE PLAN (DRAFT, NOT CONSTRUCTED)**
- **SHEET 3 OF 18, VERMILION ASH POND CLOSURE PLAN (DRAFT, NOT CONSTRUCTED)**
- **SHEET 11 OF 18, VERMILION ASH POND CLOSURE PLAN (DRAFT, NOT CONSTRUCTED)**
- **SHEET 12 OF 18, VERMILION ASH POND CLOSURE PLAN (DRAFT, NOT CONSTRUCTED)**
- **SHEET 13 OF 18, VERMILION ASH POND CLOSURE PLAN (DRAFT, NOT CONSTRUCTED)**
- **SHEET 14 OF 18, VERMILION ASH POND CLOSURE PLAN (DRAFT, NOT CONSTRUCTED)**
- **FIGURE NO. 1-2, NORTH ASH POND SYSTEM CORRECTIVE ACTION PLAN**



FOR CLARITY ONLY THE SECTIONS LISTED BELOW SHOW
THE CLAY CORE AND SLURRY WALL IN THE EXTERIOR DIKE

A – A	N 1279115	E 666275	SHEET Nº 12
B – B	N 1279052	E 666790	SHEET Nº 12
C – C	N 1279120	E 666885	SHEET Nº 12
D – D	N 1279618	E 666915	SHEET Nº 13
L – L	N 1280056.5	E 666916	SHEET Nº 15
TYPICAL CROSS SECTION			SHEET Nº 17
F – F	N 1280272	E 666915	SHEET Nº 19
G – G	N 1280100	E 666510	SHEET Nº 18
H – H	[illegible]	[illegible]	SHEET Nº 18

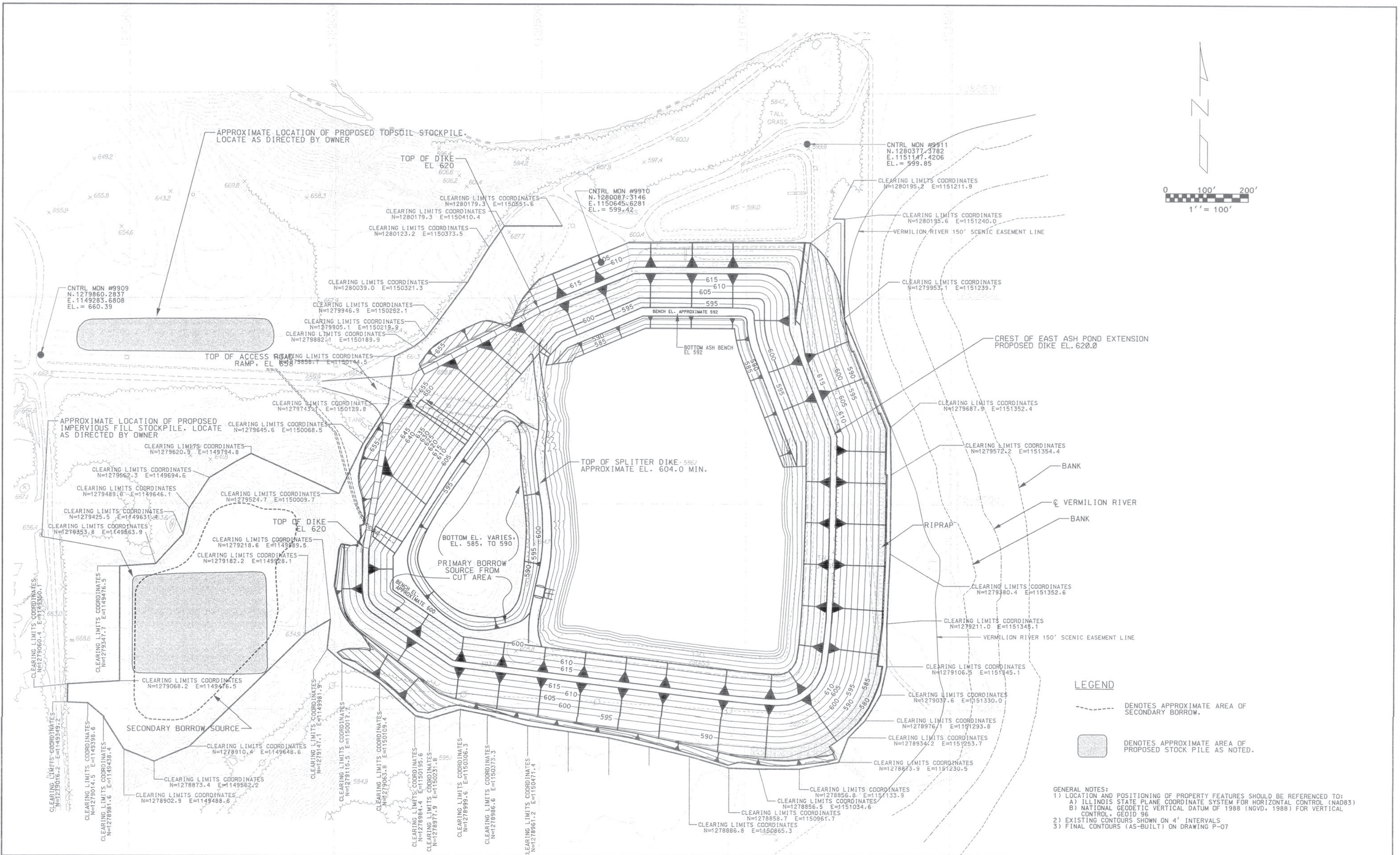
* ORIGINAL CONTOURS FROM AERIAL PHOTO SHOT AND PLOTTED 3/22/78

ILLINOIS POWER COMPANY
DECATUR

ASH DISPOSAL FACILITY
VERMILION POWER STATION

DR G.R.H.	TR	CKD.
OK.	DATE 1-29-88*	SCALE 1" = 100'
APP	PRINTED	C-SK.26869-4
APP		

REVISIONS



LEGEND

- - - - - DENOTES APPROXIMATE AREA OF SECONDARY BORROW.

▨ DENOTES APPROXIMATE AREA OF PROPOSED STOCK PILE AS NOTED.

GENERAL NOTES:
1) LOCATION AND POSITIONING OF PROPERTY FEATURES SHOULD BE REFERENCED TO:
   A) ILLINOIS STATE PLANE COORDINATE SYSTEM FOR HORIZONTAL CONTROL (NAD83)
   B) NATIONAL GEODETIC VERTICAL DATUM OF 1988 (NGVD, 1988) FOR VERTICAL CONTROL, GEOID 96
2) EXISTING CONTOURS SHOWN ON 4' INTERVALS
3) FINAL CONTOURS (AS-BUILT) ON DRAWING P-07

NO.	DATE	REVISION DESCRIPTION	APPROVED
3	2/28/03	AS-BUILT DMG PROJECT #20965	DAG
2	7/25/02	MODIFIED GENERAL NOTES: 1 & 2	DAG
1	6/14/02	MODIFICATIONS/CLARIFICATIONS AND ADDITIONAL DETAILS FOR BID PACKAGE SUBMITTAL	DAG

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SUBMITTED:	3/7/03

DYNEGY

DYNEGY MIDWEST GENERATION
VERMILION POWER STATION
DANVILLE, ILLINOIS

EAST ASH POND EXPANSION

SITE CLEARING, STOCKPILE, BORROW
AND EASEMENT PLAN
EAST ASH POND
EXPANSION TO ELEVATION 620
VERMILION POWER STATION

URS PROJECT NO.
23-20020051.00

SHEET NO.
P-04

E-VER1-C128-3

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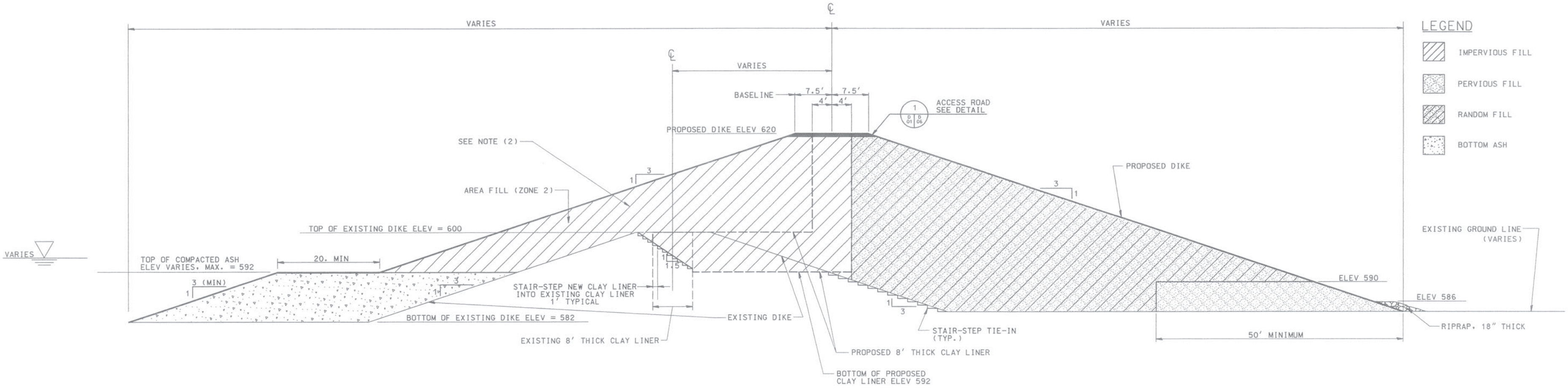
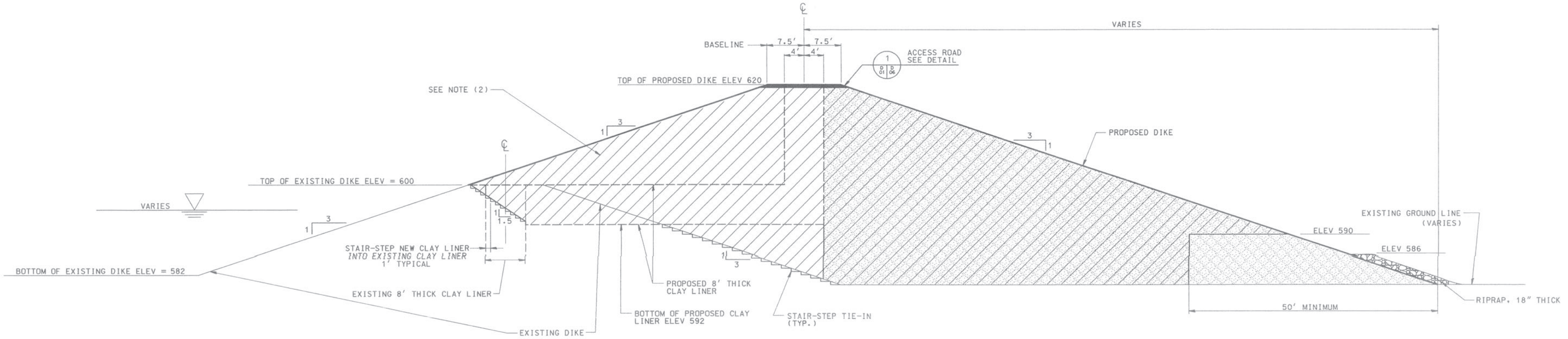
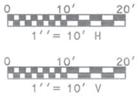


TYPICAL SECTION NO 2 (CUT AT APPROXIMATELY STA 29+95)
TRANSITION FROM DOWNSTREAM CONSTRUCTION EAST
TO LINER CROSSOVER CONSTRUCTION NORTHEAST
STA 28+86 TO STA 30+62

GENERAL NOTES:
(1) SEE DRAWING P-06 FOR EXTENT OF TYPICAL SECTIONS.
(2) DUE TO MATERIAL VOLUME LIMITATIONS, IMPERVIOUS FILL MATERIAL WAS NOT EXCLUSIVELY USED FOR THE INSIDE HALF OF THE EMBANKMENT, HOWEVER, IT WAS USED, AT A MINIMUM, FOR THE PROPOSED 8' THICK CLAY LINER LIMITS SHOWN.



TYPICAL SECTION NO 1 (CUT AT APPROXIMATELY STA 25+70)
DOWNSTREAM CONSTRUCTION EAST
STA 22+58 TO STA 28+86



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DYNEGY
DYNEGY MIDWEST GENERATION
VERMILION POWER STATION
DANVILLE, ILLINOIS

EAST ASH POND EXPANSION

TYPICAL SECTIONS NO.1 AND 2
EAST ASH POND
EXPANSION TO ELEVATION 620
VERMILION POWER STATION

URS PROJECT NO.
23-20020051.00

SHEET NO.
TS-01

E-VER1-C129-1

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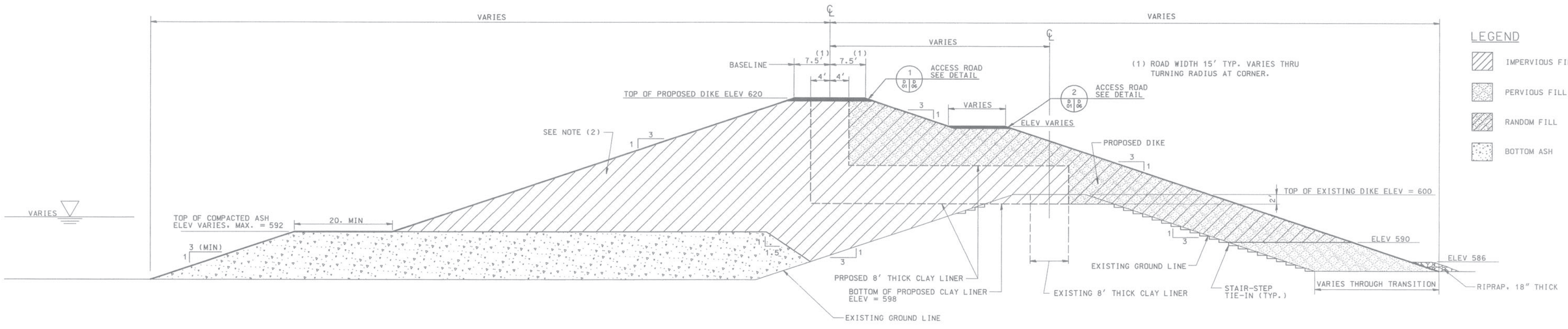
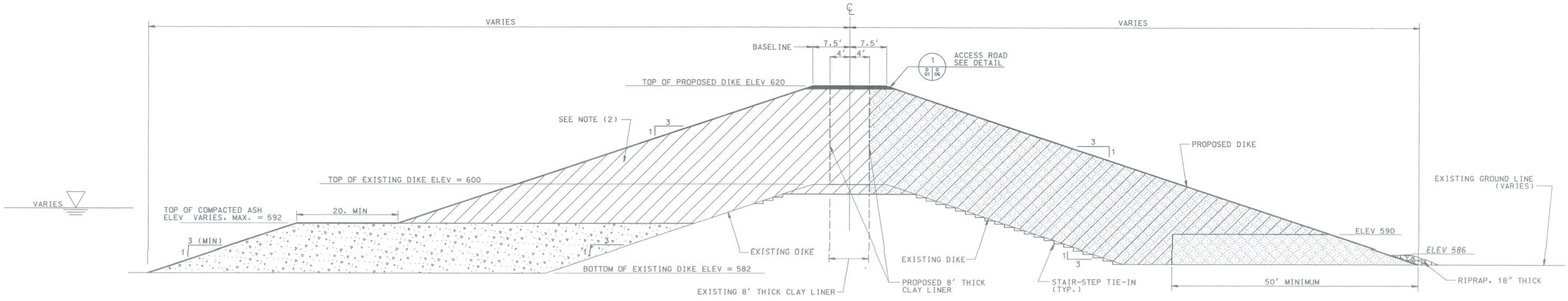


TYPICAL SECTION NO 4 (CUT AT APPROXIMATELY STA 32+60)
TRANSITION FROM CROSSOVER CONSTRUCTION NORTHEAST
TO UPSTREAM CONSTRUCTION NORTH
STA 30+65 TO STA 33+12

GENERAL NOTES:
(1) SEE DRAWING P-06 FOR EXTENT OF TYPICAL SECTIONS.
(2) DUE TO MATERIAL VOLUME LIMITATIONS, IMPERVIOUS FILL MATERIAL WAS NOT EXCLUSIVELY USED FOR THE INSIDE HALF OF THE EMBANKMENT. HOWEVER, IT WAS USED, AT A MINIMUM, FOR THE PROPOSED 8' THICK CLAY LINER LIMITS SHOWN.



TYPICAL SECTION NO 3
LINER CROSSOVER CONSTRUCTION NORTHEAST
STA 30+62 TO STA 30+65

0 10' 20'
1'' = 10' H

0 10' 20'
1'' = 10' V

NO.	DATE	REVISION DESCRIPTION	APPROVED
2	2/28/03	AS-BUILT DMG PROJECT #20965	DAG
1	6/14/02	MODIFICATIONS/CLARIFICATIONS AND ADDITIONAL DETAILS FOR BID PACKAGE SUBMITTAL	DAG

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DATE/TIME: 03/05/2003 3:53:41 PM
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SUBMITTED:	3/7/03

DYNEGY
DYNEGY MIDWEST GENERATION
VERMILION POWER STATION
DANVILLE, ILLINOIS

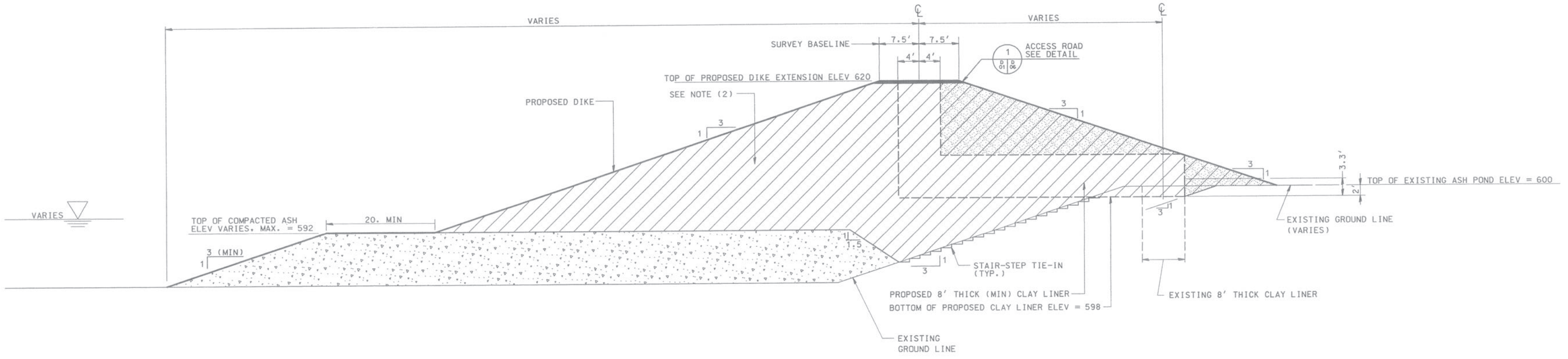
EAST ASH POND EXPANSION

TYPICAL SECTIONS NO.3 AND 4
EAST ASH POND
EXPANSION TO ELEVATION 620
VERMILION POWER STATION

URS PROJECT NO.
23-20020051.00

SHEET NO.
TS-02

E-VER1-C129-2



LEGEND

▨ IMPERVIOUS FILL

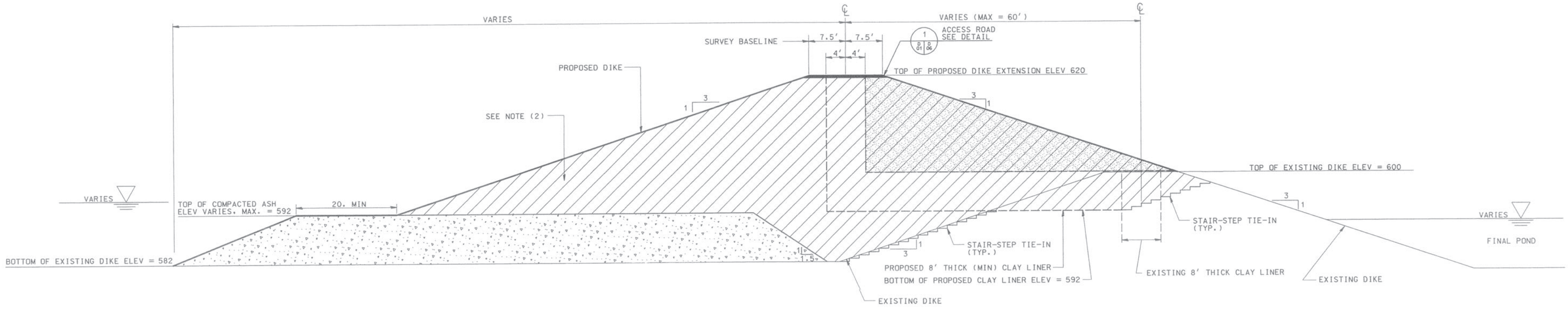
░ PERVIOUS FILL

▩ RANDOM FILL

▒ BOTTOM ASH

TYPICAL SECTION NO 6 (CUT AT APPROXIMATELY STA 0+14)
TRANSITION FROM UPSTREAM CONSTRUCTION NORTH
TO LINER CROSSOVER CONSTRUCTION NORTHWEST
STA 0+00 TO STA 0+14
STA 33+12 TO STA 36+39 (POE)

GENERAL NOTES:
(1) SEE DRAWING P-06 FOR EXTENT OF TYPICAL SECTIONS.
(2) DUE TO MATERIAL VOLUME LIMITATIONS, IMPERVIOUS FILL MATERIAL WAS NOT EXCLUSIVELY USED FOR THE INSIDE HALF OF THE EMBANKMENT, HOWEVER, IT WAS USED, AT A MINIMUM, FOR THE PROPOSED 8' THICK CLAY LINER LIMITS SHOWN.



TYPICAL SECTION NO 5 (CUT AT APPROXIMATELY STA 34+75)
UPSTREAM CONSTRUCTION NORTH
STA 33+12 TO STA 36+39

0 10' 20'
1''= 10' H

0 10' 20'
1''= 10' V

NO.	DATE	REVISION DESCRIPTION	APPROVED
2	2/28/03	AS-BUILT DWG PROJECT #20965	DAG
1	6/14/02	MODIFICATIONS/CLARIFICATIONS AND ADDITIONAL DETAILS FOR BID PACKAGE SUBMITTAL	DAG

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APPROVED: DAG
SUBMITTED: 3/7/03

DYNEGY
DYNEGY MIDWEST GENERATION
VERMILION POWER STATION
DANVILLE, ILLINOIS

EAST ASH POND EXPANSION

TYPICAL SECTIONS NO.5 AND 6
EAST ASH POND
EXPANSION TO ELEVATION 620
VERMILION POWER STATION

URS PROJECT NO.
23-20020051.00

SHEET NO.
TS-03

E-VER1-C129-3

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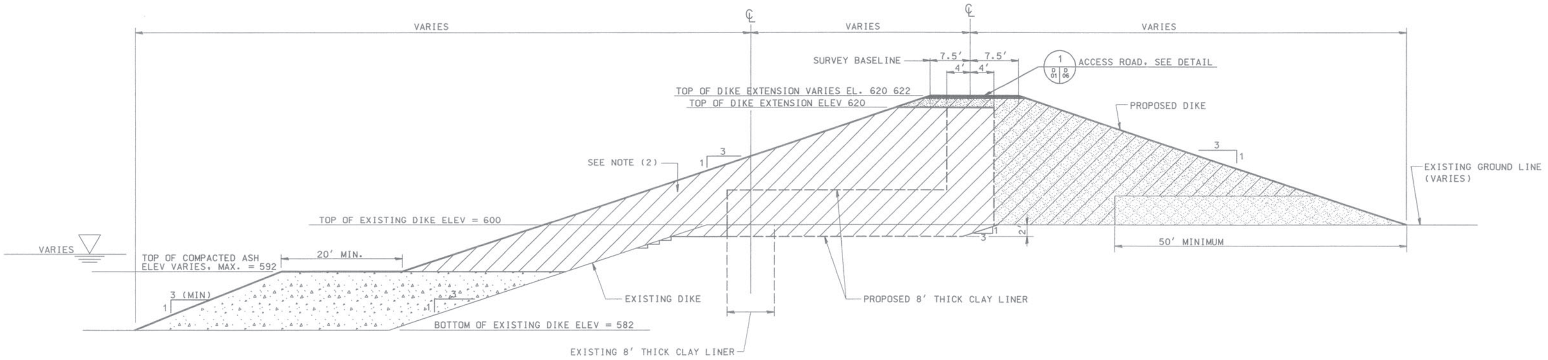
LEGEND

▨ IMPERVIOUS FILL

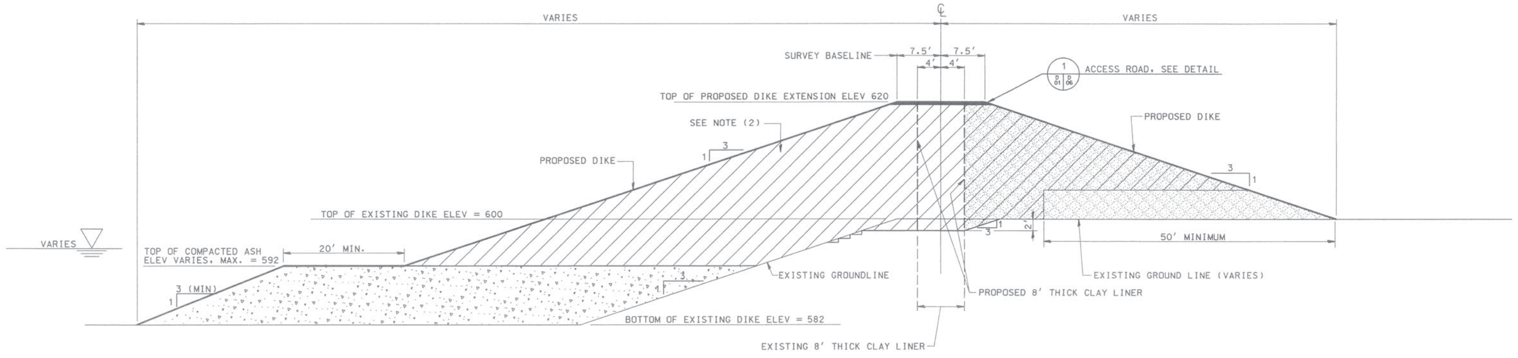
░ PERVIOUS FILL

▩ RANDOM FILL

░ BOTTOM ASH



TYPICAL SECTION NO 8 (CUT APPROXIMATELY STA 1+40)
TRANSITION FROM LINER CROSSOVER CONSTRUCTION NORTHWEST
TO BLOCK LINER CONSTRUCTION NORTHWEST
STA 0+18 TO STA 2+60



TYPICAL SECTION NO 7
LINER CROSSOVER CONSTRUCTION NORTHWEST
STA 0+14 TO STA 0+18

GENERAL NOTES:
(1) SEE DRAWING P-06 FOR EXTENT OF TYPICAL SECTIONS.
(2) DUE TO MATERIAL VOLUME LIMITATIONS, IMPERVIOUS FILL MATERIAL WAS NOT EXCLUSIVELY USED FOR THE INSIDE HALF OF THE EMBANKMENT, HOWEVER, IT WAS USED, AT A MINIMUM, FOR THE PROPOSED 8' THICK CLAY LINER LIMITS SHOWN.

0 10' 20'
1''= 10' H

0 10' 20'
1''= 10' V

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1	6/14/02	MODIFICATIONS/CLARIFICATIONS AND ADDITIONAL DETAILS FOR BID PACKAGE SUBMITTAL	DAG

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DRAWN: DJD
CHECKED: WDL
APPROVED: DAG
SUBMITTED: 3/7/03

DYNEGY
DYNEGY MIDWEST GENERATION
VERMILION POWER STATION
DANVILLE, ILLINOIS

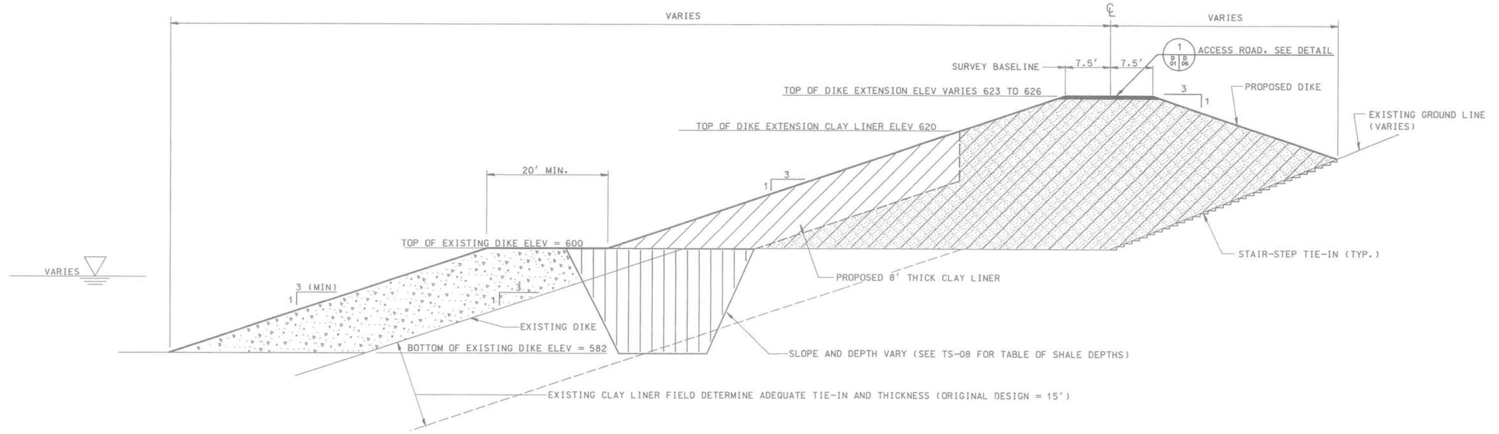
EAST ASH POND EXPANSION

TYPICAL SECTIONS NO. 7 AND 8
EAST ASH POND
EXPANSION TO ELEVATION 620
VERMILION POWER STATION

URS PROJECT NO.
23-20020051.00

SHEET NO.
TS-04

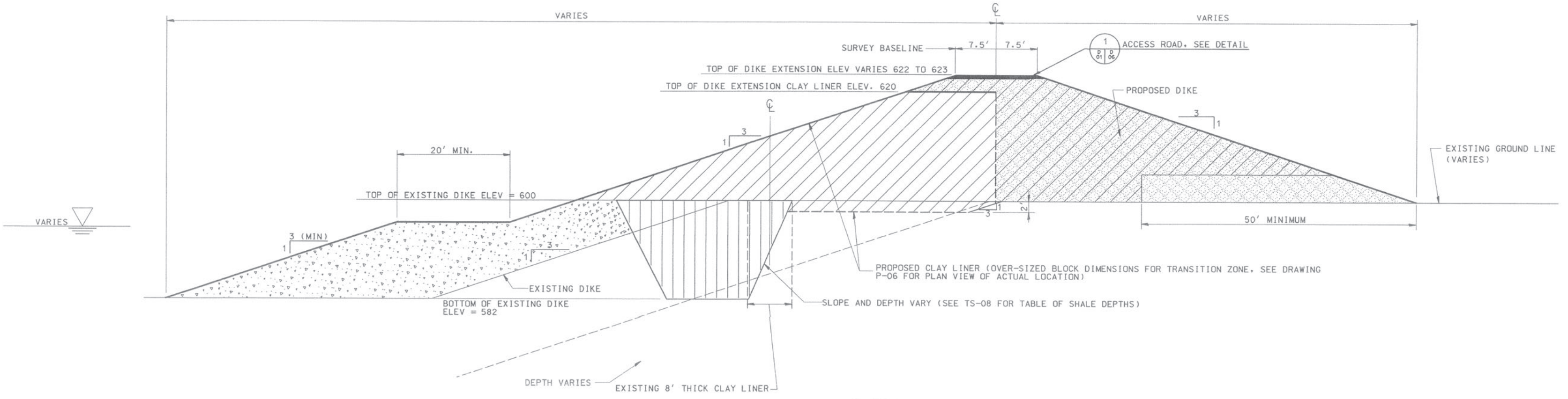
E-VER1-C129-4



LEGEND

- ▨ IMPERVIOUS FILL
- ▒ PERVIOUS FILL
- ▩ RANDOM FILL
- ░ BOTTOM ASH
- ▥ IMPERVIOUS FILL (CLAY LINER TIE-IN TRENCH TO SHALE)

TYPICAL SECTION NO 10 (CUT AT APPROXIMATELY STA 2+75)
START OF ELEVATED CREST
CONSTRUCTION NORTHWEST
STA 2+69 TO STA 2+92



0 10' 20'
1'' = 10' H

0 10' 20'
1'' = 10' V

TYPICAL SECTION NO 9
BLOCK LINER CONSTRUCTION NORTHWEST
STA 2+60 TO STA 2+69

GENERAL NOTES:
(1) SEE DRAWING P-06 FOR EXTENT OF TYPICAL SECTIONS

NO.	DATE	REVISION DESCRIPTION	APPROVED
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1	6/14/02	MODIFICATIONS/CLARIFICATIONS AND ADDITIONAL DETAILS FOR BID PACKAGE SUBMITTAL	DAG

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APPROVED:	DAG
SUBMITTED:	3/7/03

DYNEGY
DYNEGY MIDWEST GENERATION
VERMILION POWER STATION
DANVILLE, ILLINOIS

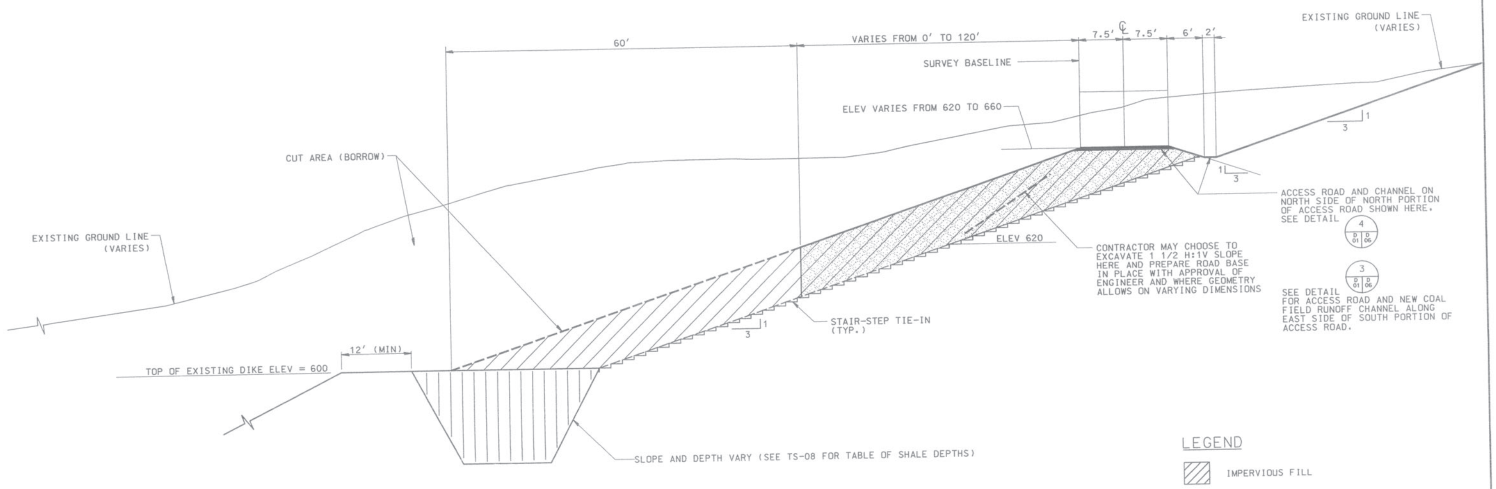
EAST ASH POND EXPANSION

TYPICAL SECTIONS NO.9 AND 10
EAST ASH POND
EXPANSION TO ELEVATION 620
VERMILION POWER STATION

URS PROJECT NO.
23-20020051.00

SHEET NO.
TS-05

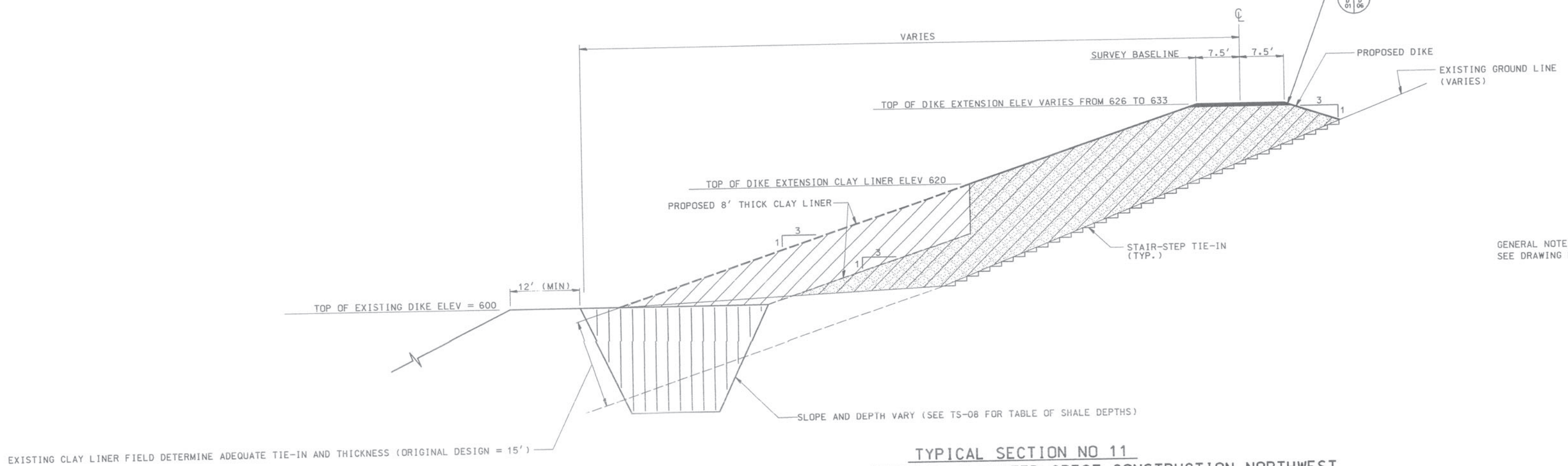
E-VER1-C129-5



TYPICAL SECTION NO 12
BOTTOM LINER WITH ELEVATED CREST CONSTRUCTION NORTHWEST
STA 3+39 TO STA 10+38

LEGEND

▨	IMPERVIOUS FILL
░	PERVIOUS FILL
▨	RANDOM FILL
░	BOTTOM ASH
▥	IMPERVIOUS FILL (CLAY LINER TIE-IN TRENCH TO SHALE)



GENERAL NOTE:
SEE DRAWING P-06 FOR EXTENT OF TYPICAL SECTIONS.

0 10′ 20′
1′′= 10′ H

0 10′ 20′
1′′= 10′ V

TYPICAL SECTION NO 11
TRANSITION FROM START OF ELEVATED CREST CONSTRUCTION NORTHWEST TO BOTTOM LINER WITH ELEVATED CREST CONSTRUCTION NORTHWEST
STA 2+92 TO STA 3+39

2	2/28/03	AS-BUILT DMG PROJECT #20965	DAG
1	6/14/02	MODIFICATIONS/CLARIFICATIONS AND ADDITIONAL DETAILS FOR BID PACKAGE SUBMITTAL	DAG
		REVISION DESCRIPTION	APPROVED

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DRAWN: DJD
CHECKED: WDL
APPROVED: DAG
SUBMITTED: 3/7/03

DYNEGY
DYNEGY MIDWEST GENERATION
VERMILION POWER STATION
DANVILLE, ILLINOIS

EAST ASH POND EXPANSION

TYPICAL SECTIONS NO.11 AND 12
EAST ASH POND
EXPANSION TO ELEVATION 620
VERMILION POWER STATION

URS PROJECT NO. 23-20020051.00
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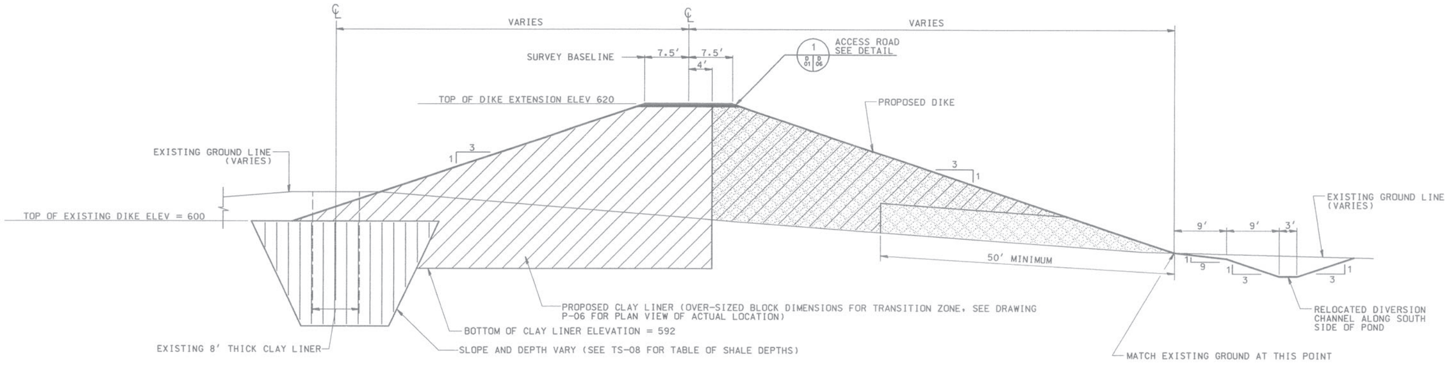
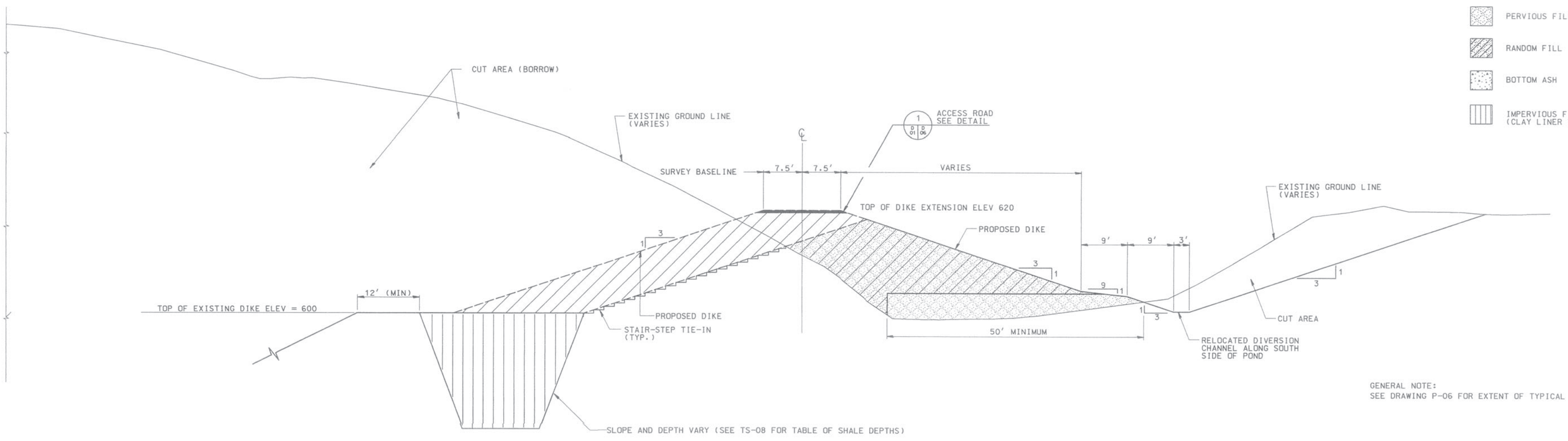


TYPICAL SECTION NO 14
BLOCK LINER CONSTRUCTION SOUTHWEST
STA 15+89 TO STA 15+97

LEGEND

- ▨ IMPERVIOUS FILL
- ░ PERVIOUS FILL
- ▩ RANDOM FILL
- ⁘ BOTTOM ASH
- ▥ IMPERVIOUS FILL (CLAY LINER TIE-IN TRENCH TO SHALE)



GENERAL NOTE:
SEE DRAWING P-06 FOR EXTENT OF TYPICAL SECTIONS.

TYPICAL SECTION NO 13
BOTTOM LINER CONSTRUCTION SOUTHWEST
STA 10+38 TO STA 15+89

0 10' 20'
1'' = 10' H

0 10' 20'
1'' = 10' V

NO.	DATE	REVISION DESCRIPTION	APPROVED
2	2/28/03	AS-BUILT DMG PROJECT #20965	DAG
1	6/14/02	MODIFICATIONS/CLARIFICATIONS AND ADDITIONAL DETAILS FOR BID PACKAGE SUBMITTAL	DAG

PREPARED BY:

URS
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St. Louis, MO 63043
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WM. L. DURBIN
NO. 62-040635
William L Durbin
3/6/03
SEAL

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DESIGNED:	DAG
DRAWN:	DJD
CHECKED:	WDL
APPROVED:	DAG
SUBMITTED:	3/7/03

DYNEGY
DYNEGY MIDWEST GENERATION
VERMILION POWER STATION
DANVILLE, ILLINOIS

EAST ASH POND EXPANSION

TYPICAL SECTIONS NO.13 AND 14
EAST ASH POND
EXPANSION TO ELEVATION 620
VERMILION POWER STATION

URS PROJECT NO.
23-20020051.00

SHEET NO.
TS-07

E-VER1-C129-7

USER NAME: DJDEGUI0
DATE/TIME: 03/05/2003 3:57:22 PM
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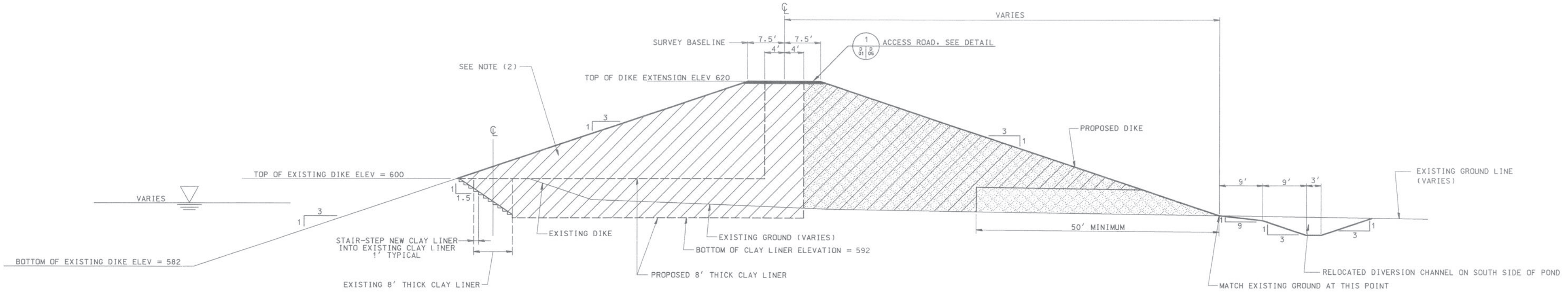
ELEVATION OF SHALE AS MEASURED IN BOTTOM OF CLAY LINER TIE-IN TRENCH
(SEE TS-05, TS-06, AND TS-07 FOR SECTIONS)

ROAD STATION	BOTTOM ELEVATION	OFFSET FT. LEFT *
2+60	592.0	5
3+05	592.0	39
3+55	592.0	83
4+00	582.8	105
4+95	580.3	141
5+25	582.5	152
5+80	583.7	173
6+40	585.5	194
6+95	586.7	182
7+53	584.7	173
8+06	585.0	148
8+63	583.7	124
9+18	585.4	100
9+85	585.6	73
10+25	585.0	56
11+00	584.9	47
11+90	579.0	47
12+40	579.0	47
12+90	577.0	47
13+40	577.5	46
13+90	579.0	46
14+65	580.0	47
15+20	584.3	47
15+98	582.2	48

* PERPENDICULAR FROM ℄ OF TRENCH TO INSIDE EDGE OF ROAD

LEGEND

- ▨ IMPERVIOUS FILL
- ░ PERVIOUS FILL
- ▨ RANDOM FILL
- ░ BOTTOM ASH



TYPICAL SECTION NO 15
DOWNSTREAM CONSTRUCTION SOUTH
STA 15+97 TO STA 22+58

0 10' 20'
1''= 10' H

0 10' 20'
1''= 10' V

GENERAL NOTES:
(1) SEE DRAWING P-06 FOR EXTENT OF TYPICAL SECTIONS.
(2) DUE TO MATERIAL VOLUME LIMITATIONS, IMPERVIOUS FILL MATERIAL WAS NOT EXCLUSIVELY USED FOR THE INSIDE HALF OF THE EMBANKMENT. HOWEVER, IT WAS USED, AT A MINIMUM, FOR THE PROPOSED 8' THICK CLAY LINER LIMITS SHOWN.

NO.	DATE	REVISION DESCRIPTION	APPROVED
2	2/28/03	AS-BUILT DMG PROJECT #20965	DAG
1	6/14/02	MODIFICATIONS/CLARIFICATIONS AND ADDITIONAL DETAILS FOR BID PACKAGE SUBMITTAL	DAG

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DESIGNED:	DAG
DRAWN:	DJD
CHECKED:	WDL
APPROVED:	DAG
SUBMITTED:	3/7/03

DYNEGY
DYNEGY MIDWEST GENERATION
VERMILION POWER STATION
DANVILLE, ILLINOIS

EAST ASH POND EXPANSION

TYPICAL SECTIONS NO.15
EAST ASH POND
EXPANSION TO ELEVATION 620
VERMILION POWER STATION

URS PROJECT NO.
23-20020051.00

SHEET NO.
TS-08

E-VER1-C129-8

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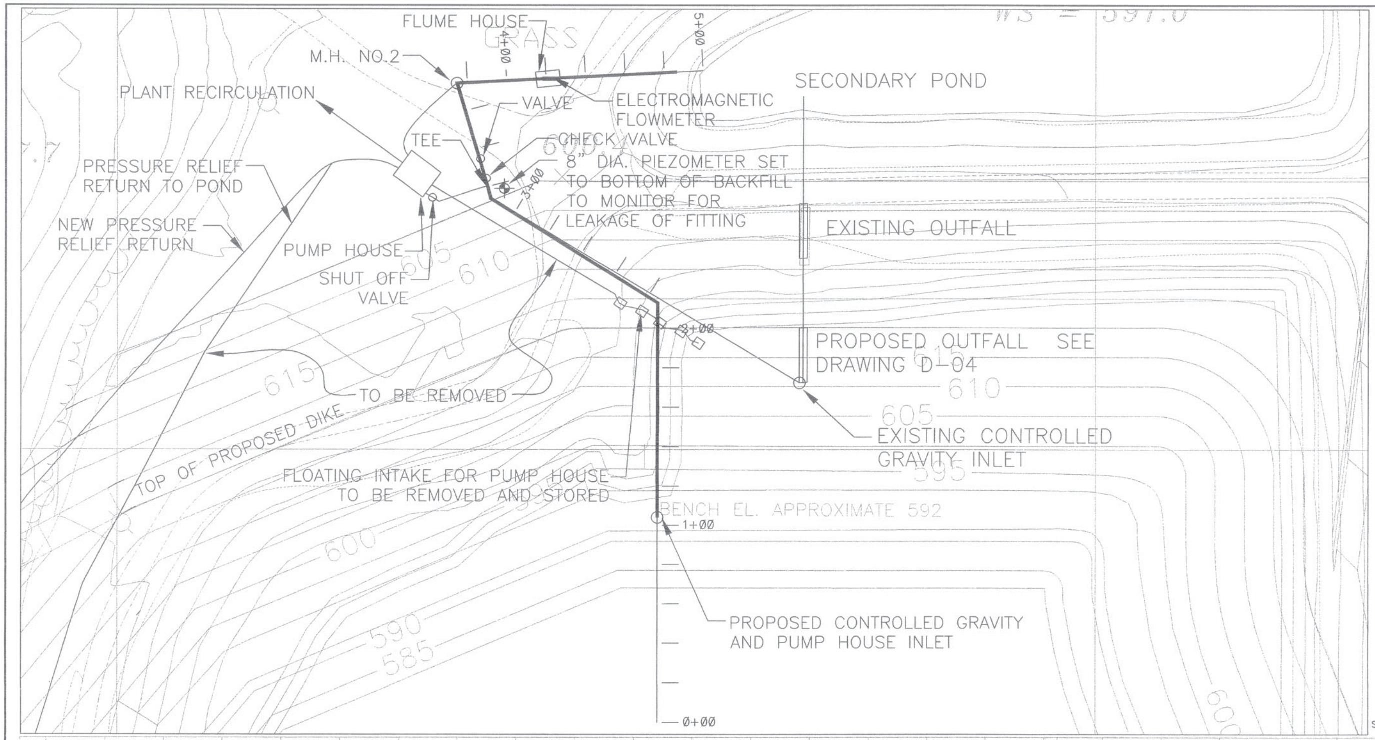


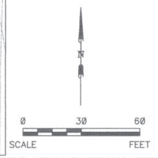
NOTES:

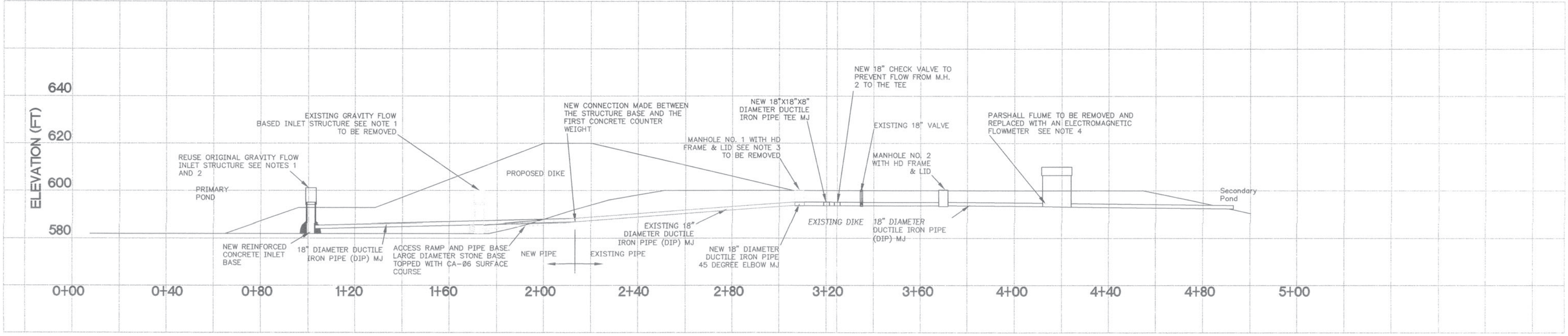
1. REMOVE EXISTING CONTROLLED GRAVITY FLOW INLET STRUCTURE AND SKIMMER. THE INLET SHALL BE DISASSEMBLED TO THE CONCRETE BASE AND SALVAGED. ALL PIPE SECTIONS SHALL BE STORED FOR REUSE AS THE NEW GRAVITY FLOW INLET. THE CORRUGATED METAL SKIMMER SHALL BE REPLACED.

2. THE NEW GRAVITY FLOW INLET SHALL BE CONSTRUCTED REUSING THE OLD INLET PIPE SECTIONS. THE BASE IS TO BE CONSTRUCTED IN THE SAME MANNER AS THE EXISTING BASE AND SET ON SHALE AT ELEVATION 582. SEE DRAWING D-06. A NEW SKIMMER SHALL BE CONSTRUCTED AND IS SHOWN ON DRAWING NUMBER D-06.

3. EXISTING MANHOLE 1 SHALL BE REMOVED AND REPLACED WITH AN 18 INCH 45 DEGREE ELBOW, 18 INCH TEE WITH A 8 INCH BRANCH AND A 18 INCH CHECK VALVE SHALL BE INSTALLED AT THE SAME TIME. THE CHECK VALVE SHALL BE INSTALLED TO ALLOW FLOW FROM THE TEE TO M.H. NO. 2.

4. THE PARSHALL FLUME SHALL BE REMOVED COMPLETELY AND REPLACED WITH AN ELECTROMAGNETIC FLOWMETER.





GENERAL NOTES:
1) LOCATION AND POSITIONING OF PROPERTY FEATURES SHOULD BE REFERENCED TO:
A) ILLINOIS STATE PLANE COORDINATE SYSTEM FOR HORZONTAL CONTROL.
B) NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD, 1929) FOR VERTICAL CONTROL
2) EXISTING CONTOURS SHOWN ON 4' INTERVALS.

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NO.	DATE	REVISION DESCRIPTION	APPROVED
1	2/28/03	AS-BUILT DMG PROJECT #20965	DAG

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WM. L. DURBIN
3/6/03
SEAL

DATE: 6/14/02
DESIGNED: DAG
DRAWN: DJD
CHECKED: WDL
APPROVED: DAG
SUBMITTED: 3/7/03

DYNEGY
DYNEGY MIDWEST GENERATION
VERMILION POWER STATION
DANVILLE, ILLINOIS

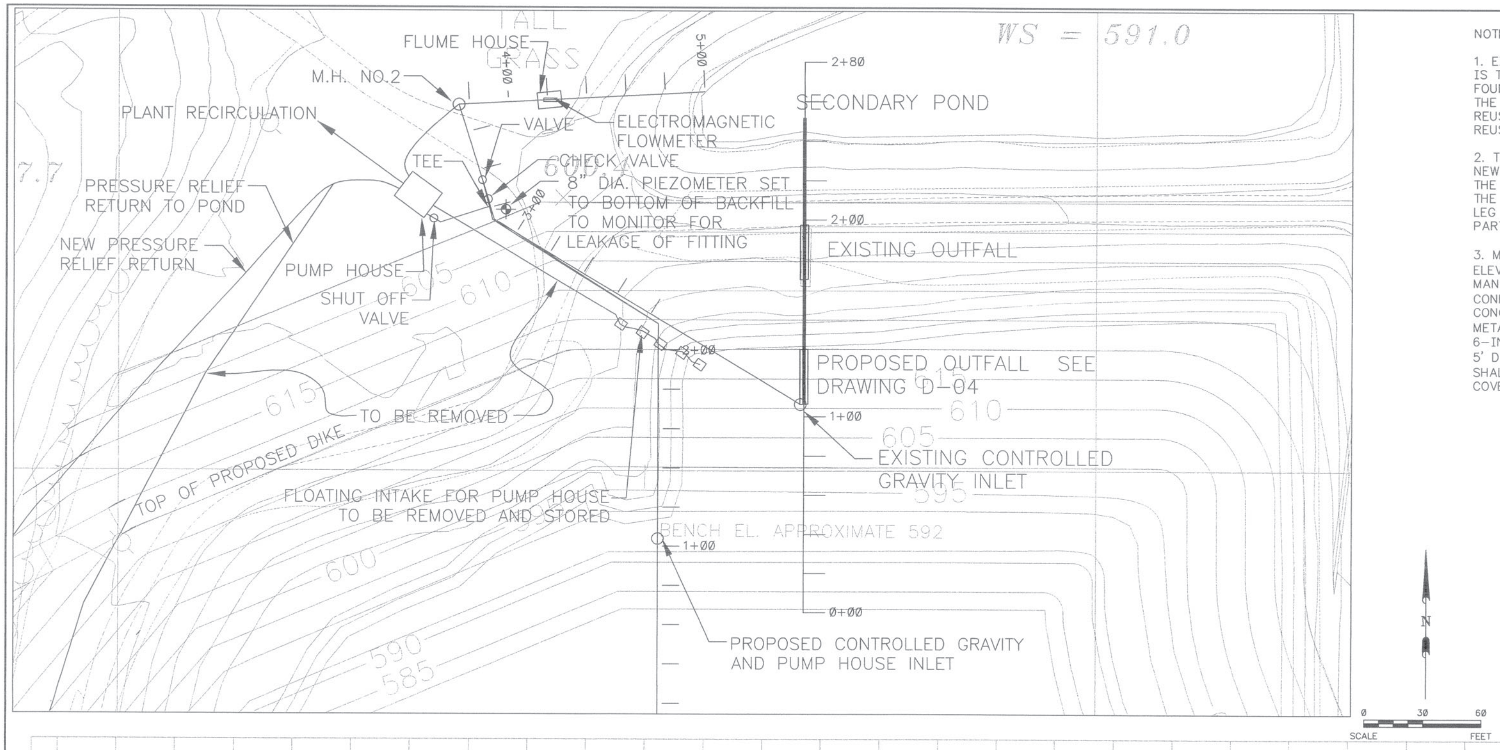
EAST ASH POND EXPANSION

GRAVITY CONTROL SYSTEM
PLAN AND PROFILE
EAST ASH POND EXPANSION TO EL. 620
VERMILION POWER STATION

URS PROJECT NO.
23-20020051.00

SHEET NO.
D-02

E-VERI-C130-2

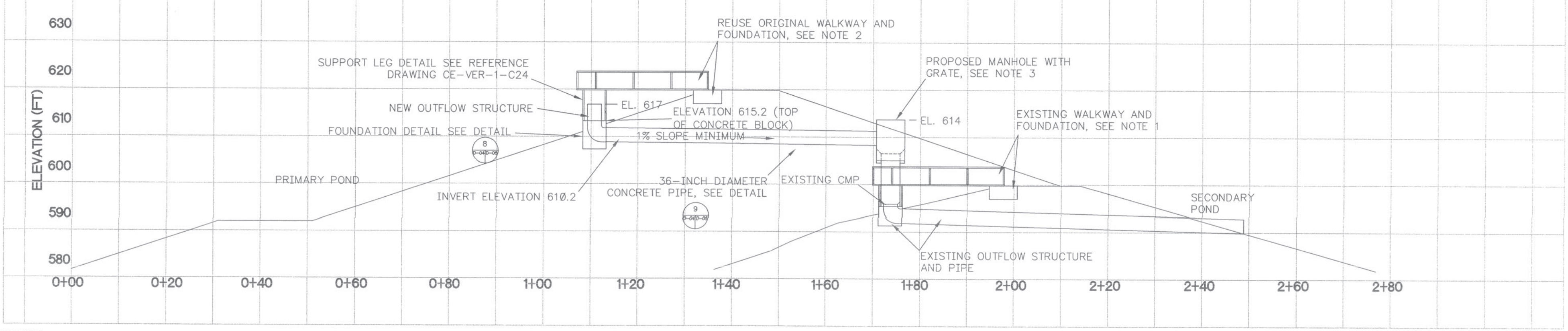


NOTES:

1. EXISTING WALKWAY IS TO BE REMOVED AND REUSED. THE WALKWAY IS TO BE UNBOLTED FROM ITS SUPPORT LEGS AND FROM THE FOUNDATION. THE LEGS SHALL BE CUT OFF AT THE CONCRETE BASE. THE FOUNDATION AT THE TOP OF THE DIKE SHALL BE REMOVED AND REUSED. THE WALKWAY AND THE FOUNDATION SHOULD BE STORED UNTIL REUSED.

2. THE EXISTING WALKWAY AND FOUNDATION SHALL BE REUSED WITH THE NEW OUTFALL. THE FOUNDATION SHALL BE PLACED AT THE CREST OF THE DIKE. NEW SUPPORT LEGS SHALL BE FABRICATED AND SET INTO THE CONCRETE BASE. THE WALKWAY SHALL BE BOLTED TO THE SUPPORT LEG AND FOUNDATION. SEE REFERENCE DRAWINGS FOR SUPPORT LEG PARTS.

3. MANHOLE SHALL BE MADE OF 4' DIAMETER CONCRETE PIPE, TO ELEVATION 603.8. THE REMAINING SECTIONS SHALL BE 5' DIAMETER MANHOLES. THE NEW 36-INCH DIAMETER CONCRETE PIPE SHALL BE CONNECTED TO THE 5' DIAMETER MANHOLE. THE FIRST VERTICAL 4' CONCRETE PIPE IS TO BE PLACED OVER THE EXISTING CORRUGATED METAL PIPE AND THE ANNULUS GROUTED. A FOUNDATION 1' WIDE BY 6-INCHES DEEP SHALL BE POURED AT ELEVATION 602.3 TO SUPPORT THE 5' DIAMETER MANHOLE. THE ANNULUS BETWEEN THE 5' AND 4' PIPES SHALL BE GROUTED (1' MINIMUM). THE TOP OF THE MANHOLE IS TO BE COVERED WITH A GRATE.



GENERAL NOTES:
1) LOCATION AND POSITIONING OF PROPERTY FEATURES SHOULD BE REFERENCED TO:
A) ILLINOIS STATE PLANE COORDINATE SYSTEM FOR HORZONTAL CONTROL.
B) NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD, 1929) FOR VERTICAL CONTROL
2) EXISTING CONTOURS SHOWN ON 4' INTERVALS.

NO.	DATE	REVISION DESCRIPTION	APPROVED
1	2/28/03	AS-BUILT DMG PROJECT #20965	DAG

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CHECKED:	WDL
APPROVED:	DAG
SUBMITTED:	6/14/02

DYNEGY
DYNEGY MIDWEST GENERATION
VERMILION POWER STATION
DANVILLE, ILLINOIS

EAST ASH POND EXPANSION

OUTFALL SYSTEM PLAN AND PROFILE
EAST ASH POND EXPANSION TO EL. 620
VERMILION POWER STATION

URS PROJECT NO.
23-20020051.00
SHEET NO.
D-04

E-VERI-C130-4

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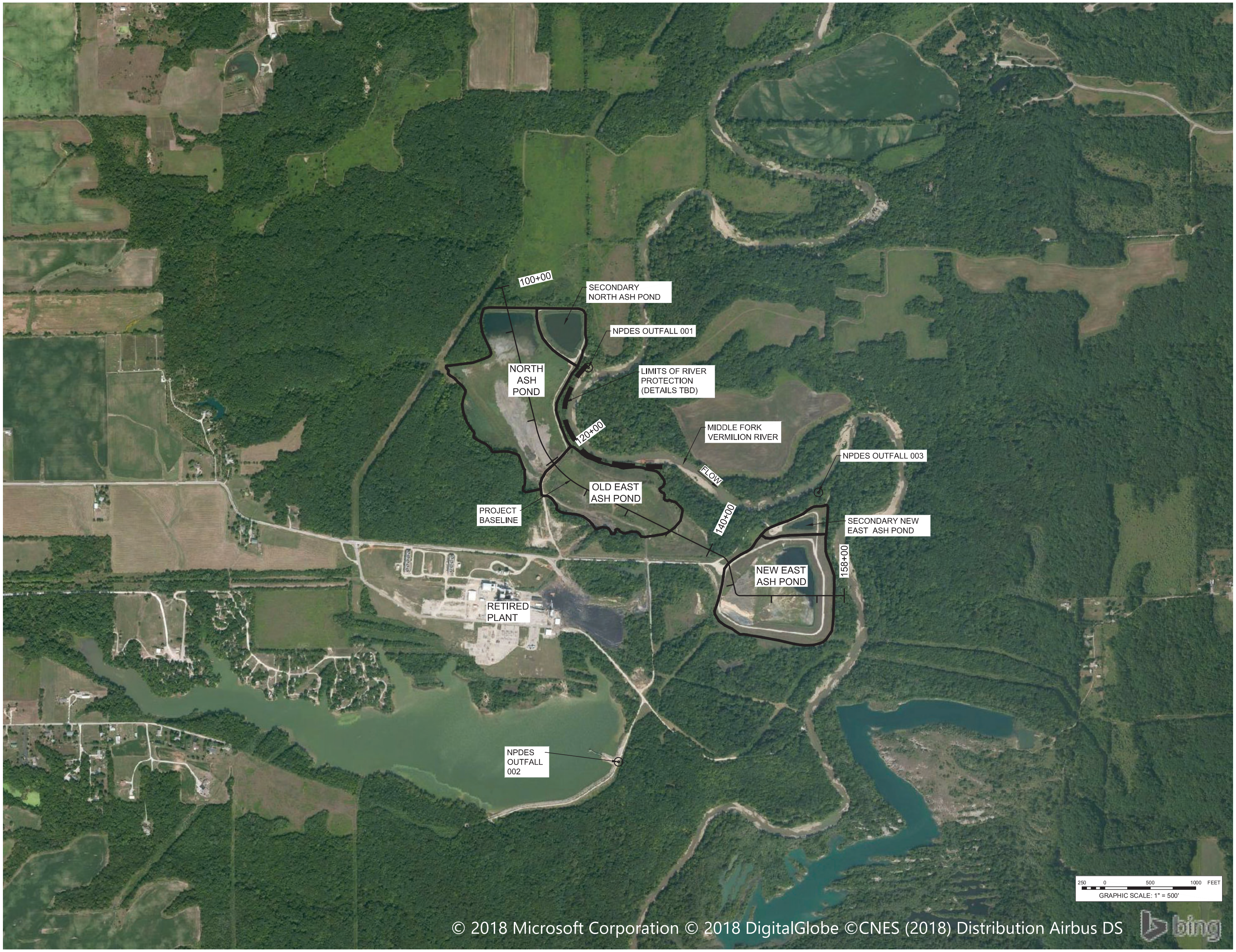

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Notes
-

LEGEND

- PROJECT BASELINE
- APPROXIMATE ASH POND BOUNDARY
- LIMITS OF RIVER PROTECTION

0			
Revision	By	Appd	YYYY.MM.DD
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Issued	By	Appd	YYYY.MM.DD

File Name: 02-57154_100_SOV	TJ	CJJ	MCV	2019.06.19
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

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Client/Project
DYNEGY MIDWEST GENERATION, LLC

VERMILION ASH PONDS CLOSURE PLAN

OAKWOOD, ILLINOIS

Title
SITE OVERVIEW

Project No. 175657154
Scale 1"=500'
Revision A
Sheet 2 of 18
Drawing No.

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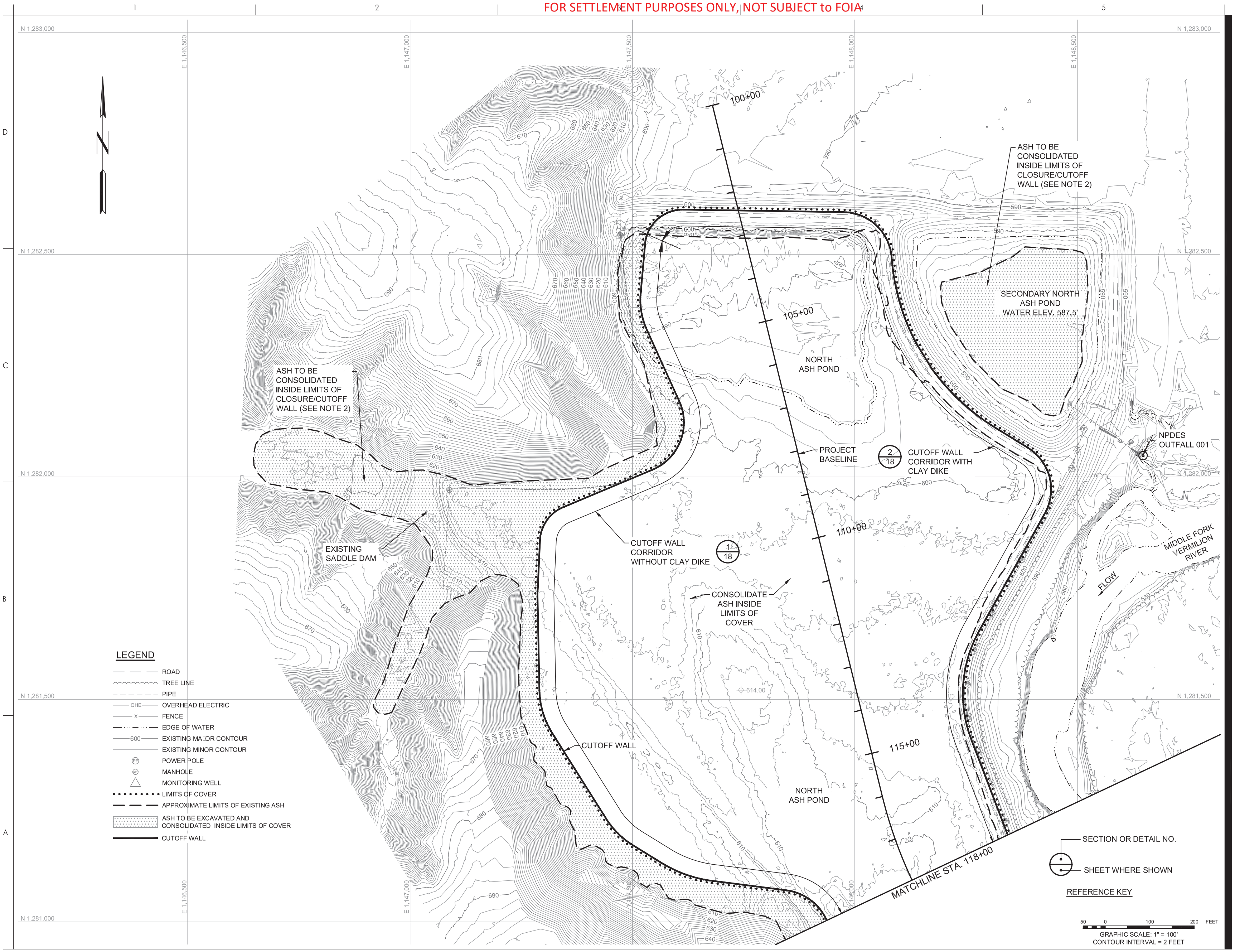

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Notes

1. DETAILED TOPOGRAPHIC SURVEY WAS COMPLETED ON MARCH 26, 2018 BY INGENAE. PUBLICLY AVAILABLE LIDAR WAS USED TO SUPPLEMENT EXISTING TOPOGRAPHY BEYOND THE LIMITS OF THE DETAILED SURVEY.
2. ASH OUTSIDE OF THE LIMITS OF THE CUTOFF WALL WILL BE EXCAVATED AND PLACED WITHIN THE LIMITS OF THE CUTOFF WALL. EXISTING ASH WILL BE EXCAVATED TO VISIBLE NATIVE GROUND. ONCE VISUALLY EXCAVATED, AN ADDITIONAL ONE FOOT OF MATERIAL WILL BE EXCAVATED. THESE AREAS WILL THEN BE GRADED TO DRAIN.
3. APPROXIMATE LIMITS OF ASH SHOWN ON THIS DRAWING WILL BE VERIFIED DURING CONSTRUCTION.

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ACC	CJJ	MCV	2019.06.19
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VERMILION ASH PONDS CLOSURE PLAN

OAKWOOD, ILLINOIS

Title
NORTH ASH POND
PROJECT OVERVIEW

Project No.	Scale
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Revision	Sheet	Drawing No.
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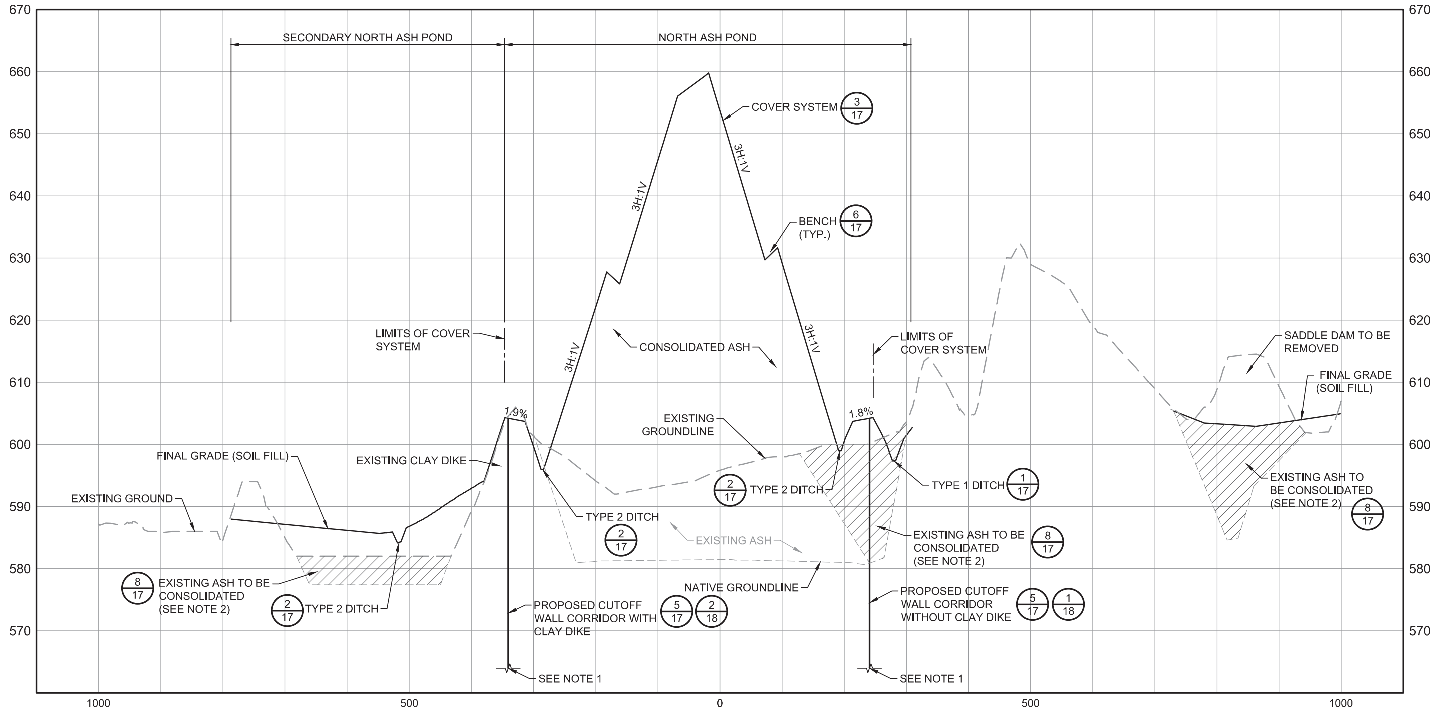

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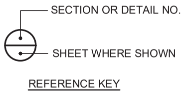

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Notes

1. THE CUTOFF WALL WILL EXTEND TO BEDROCK. THE BOTTOM OF THE WALL IS NOT SHOWN AND WILL BE IDENTIFIED DURING FINAL DESIGN.
2. ASH OUTSIDE OF THE LIMITS OF THE CUTOFF WALL WILL BE EXCAVATED AND PLACED WITHIN THE LIMITS OF THE CUTOFF WALL. EXISTING ASH WILL BE EXCAVATED TO VISIBLE NATIVE GROUND. ONCE VISUALLY EXCAVATED, AN ADDITIONAL ONE FOOT OF MATERIAL WILL BE EXCAVATED.
3. PROPOSED FINAL GRADE CONTOURS SHOWN OUTSIDE OF THE LIMITS OF COVER WILL BE ACHIEVED BY PLACING SOIL FILL.

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Revision	By	Appd	YYYY.MM.DD
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File Name: 11_16-57154_302_XS1	ACC	CJJ	MCV	2019.06.19
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VERMILION ASH PONDS CLOSURE PLAN

OAKWOOD, ILLINOIS

Title
NORTH ASH POND
CROSS SECTION

Project No.	Scale
175657154	AS NOTED

Revision	Sheet	Drawing No.
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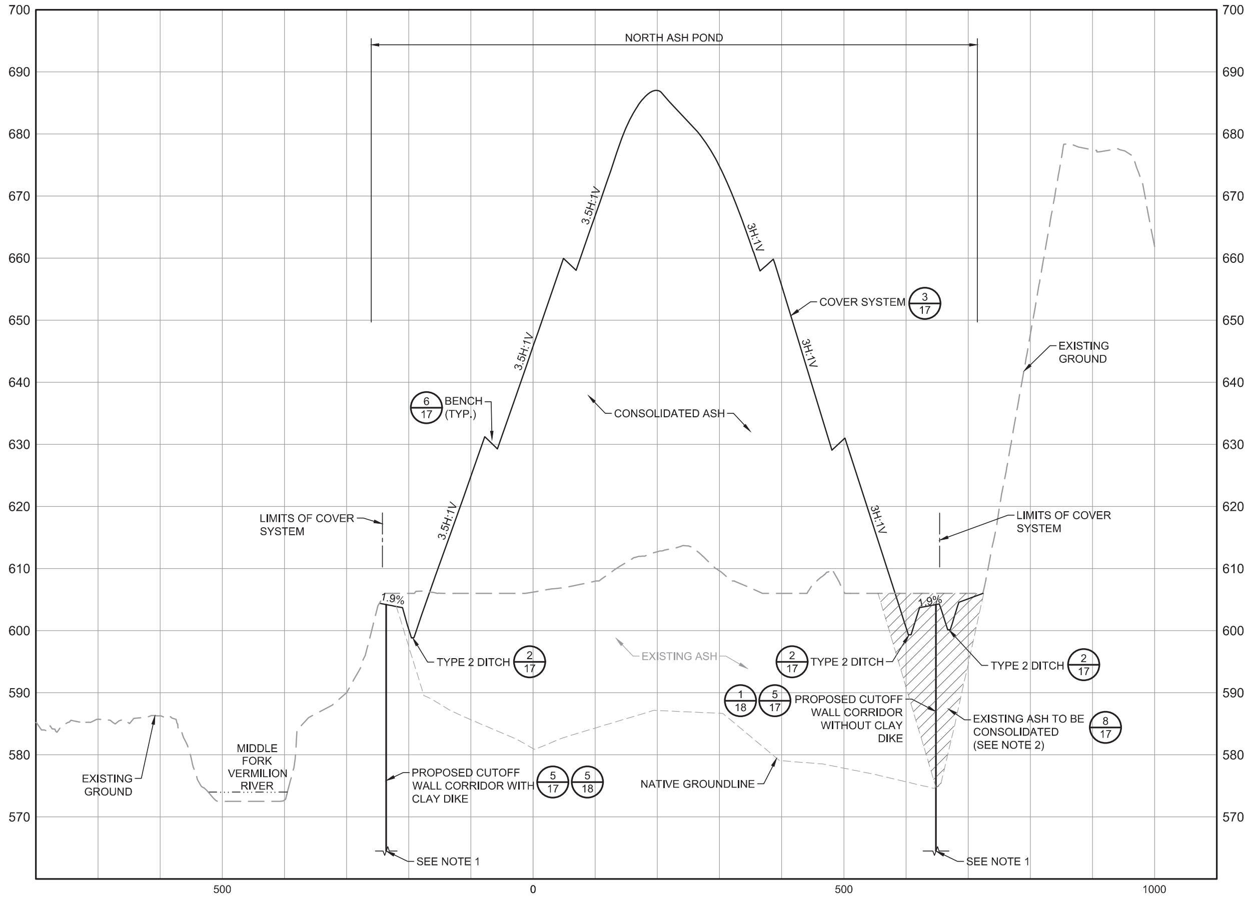

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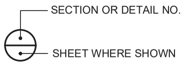

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Notes

1. THE CUTOFF WALL WILL EXTEND TO BEDROCK. THE BOTTOM OF THE WALL IS NOT SHOWN AND WILL BE IDENTIFIED DURING FINAL DESIGN.
2. ASH OUTSIDE OF THE LIMITS OF THE CUTOFF WALL WILL BE EXCAVATED AND PLACED WITHIN THE LIMITS OF THE CUTOFF WALL, EXISTING ASH WILL BE EXCAVATED TO VISIBLE NATIVE GROUND. ONCE VISUALLY EXCAVATED, AN ADDITIONAL ONE FOOT OF MATERIAL WILL BE EXCAVATED.

Revision	By	Appd	YYYY.MM.DD
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VERMILION ASH PONDS CLOSURE PLAN

OAKWOOD, ILLINOIS

Title
NORTH ASH POND
CROSS SECTION

Project No.	Scale
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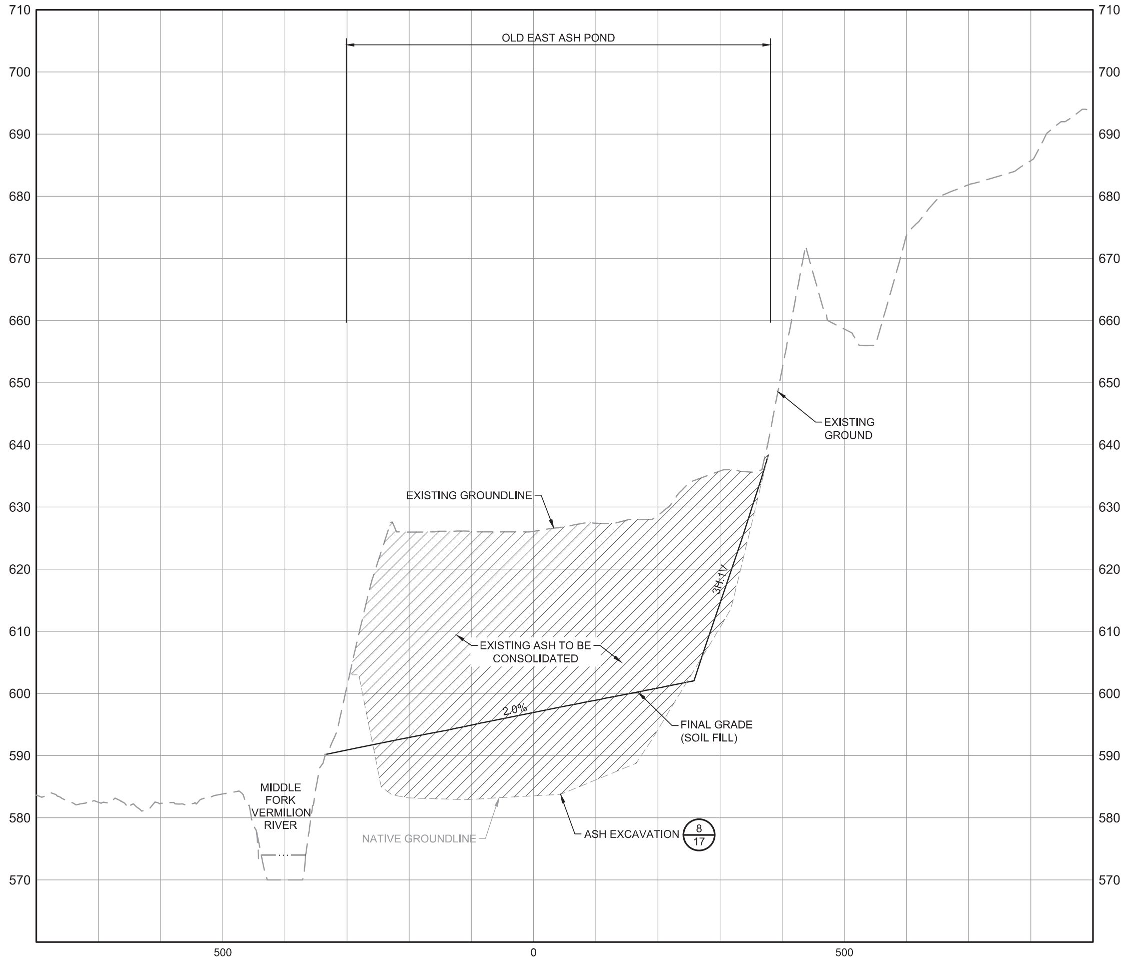

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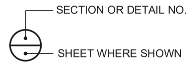

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Notes

1. ASH OUTSIDE OF THE LIMITS OF THE CUTOFF WALL WILL BE EXCAVATED AND PLACED WITHIN THE LIMITS OF THE CUTOFF WALL. EXISTING ASH WILL BE EXCAVATED TO VISIBLE NATIVE GROUND, ONCE VISUALLY EXCAVATED, AN ADDITIONAL ONE FOOT OF MATERIAL WILL BE EXCAVATED.
2. PROPOSED FINAL GRADE CONTOURS SHOWN OUTSIDE OF THE LIMITS OF COVER WILL BE ACHIEVED BY PLACING SOIL FILL.

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VERMILION ASH PONDS CLOSURE PLAN

OAKWOOD, ILLINOIS

Title
OLD EAST ASH POND
CROSS SECTION

Project No.		Scale
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Revision	Sheet	Drawing No.
A	13 of 18	

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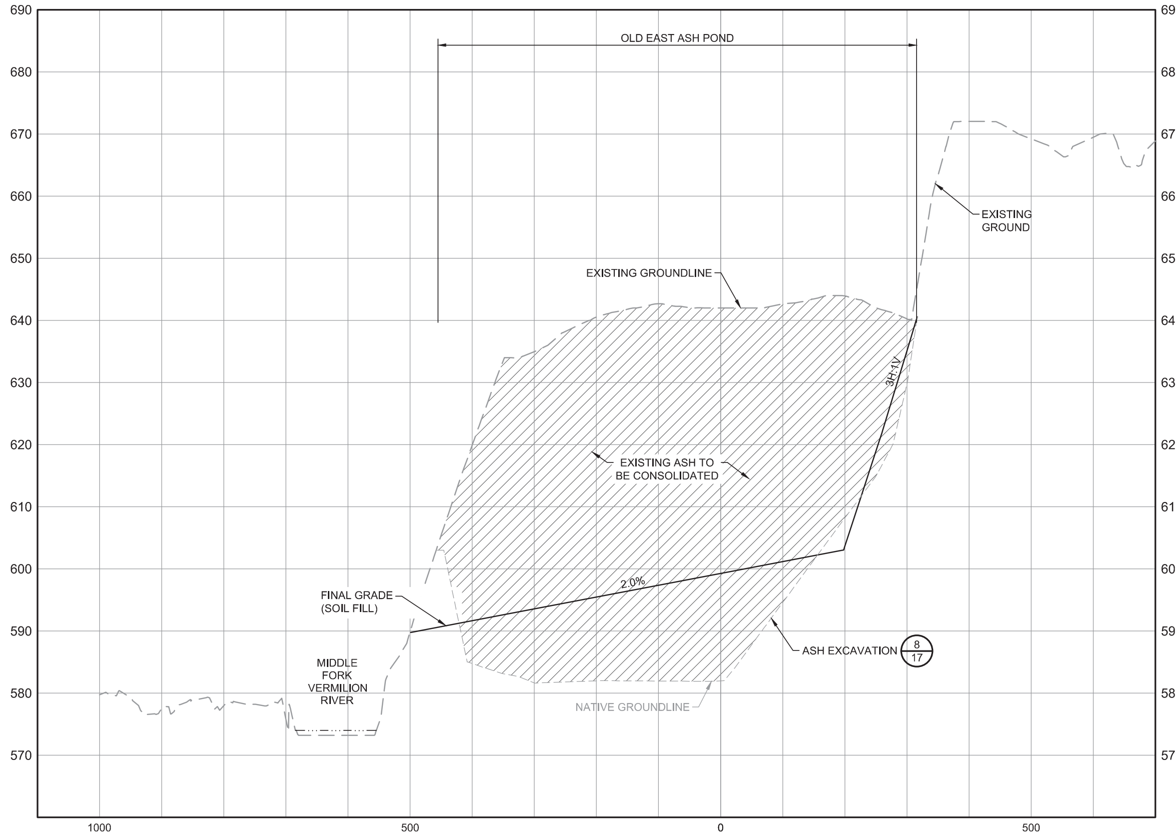

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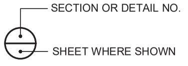

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Notes

1. ASH OUTSIDE OF THE LIMITS OF THE CUTOFF WALL WILL BE EXCAVATED AND PLACED WITHIN THE LIMITS OF THE CUTOFF WALL. EXISTING ASH WILL BE EXCAVATED TO VISIBLE NATIVE GROUND, ONCE VISUALLY EXCAVATED, AN ADDITIONAL ONE FOOT OF MATERIAL WILL BE EXCAVATED.
2. PROPOSED FINAL GRADE CONTOURS SHOWN OUTSIDE OF THE LIMITS OF COVER WILL BE ACHIEVED BY PLACING SOIL FILL.

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File Name: 11_16-57154_302_XS1	ACC	CJJ	MCV	2019.06.19
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VERMILION ASH PONDS CLOSURE PLAN

OAKWOOD, ILLINOIS

Title
OLD EAST ASH POND
CROSS SECTION

Project No. 175657154	Scale AS NOTED
Revision A	Sheet 14 of 18
Drawing No.	

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APPENDIX C. BORING AND PIEZOMETER LOCATIONS

VERMILION POWER STATION

NORTH, OLD EAST AND EAST ASH POND CLOSURE
BORING LOCATION MAP
DRAWING-01

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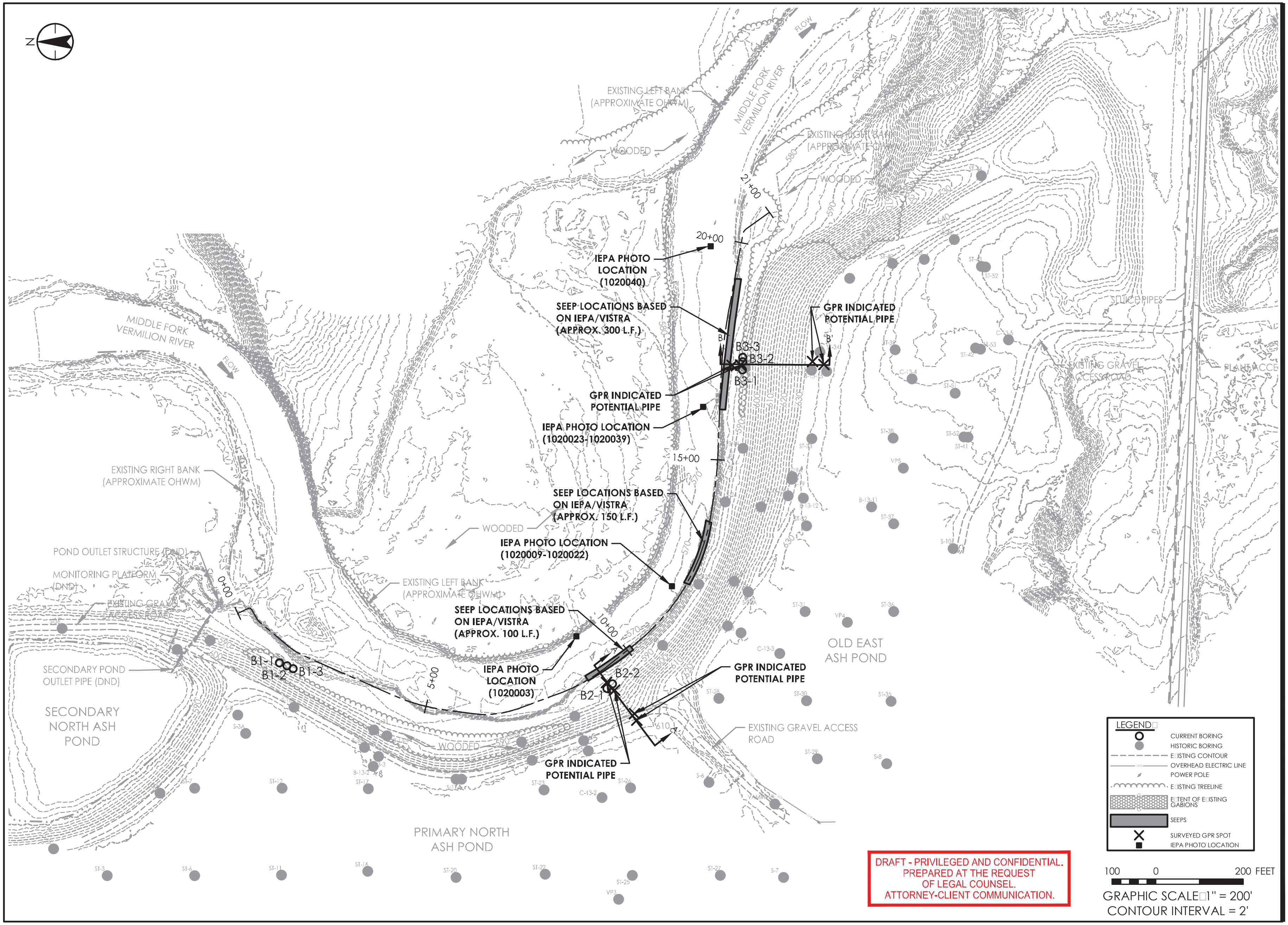
DYNEGY, INC.

MAY 15, 2017



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ATTORNEY-CLIENT COMMUNICATION.

SaveDate: 2018/10/12 3:26 PM Login: Sams, Brian
J:\175657154\technical_production\drawing\sheet_files\permit\pipe_plan.dwg

Stantec

3052 Beaumont Centre Circle
Lexington, Kentucky 40513
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
VISTRA ENERGY

MIDDLE FORK VERMILION RIVER
SEEP MITIGATION
OAKWOOD, ILLINOIS

Title
PIPE, SEEPAGE, AND BORING LOCATION PLAN

Permit-Seal

Project Number: 175657154
File Name: Pipe_Plan.dwg

BFS	JSH	TCD	18.10.05
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. *

Revision 0
Sheet * of *

Privileged and confidential. Prepared at the request of legal counsel. Attorney-client communication.

LEGEND

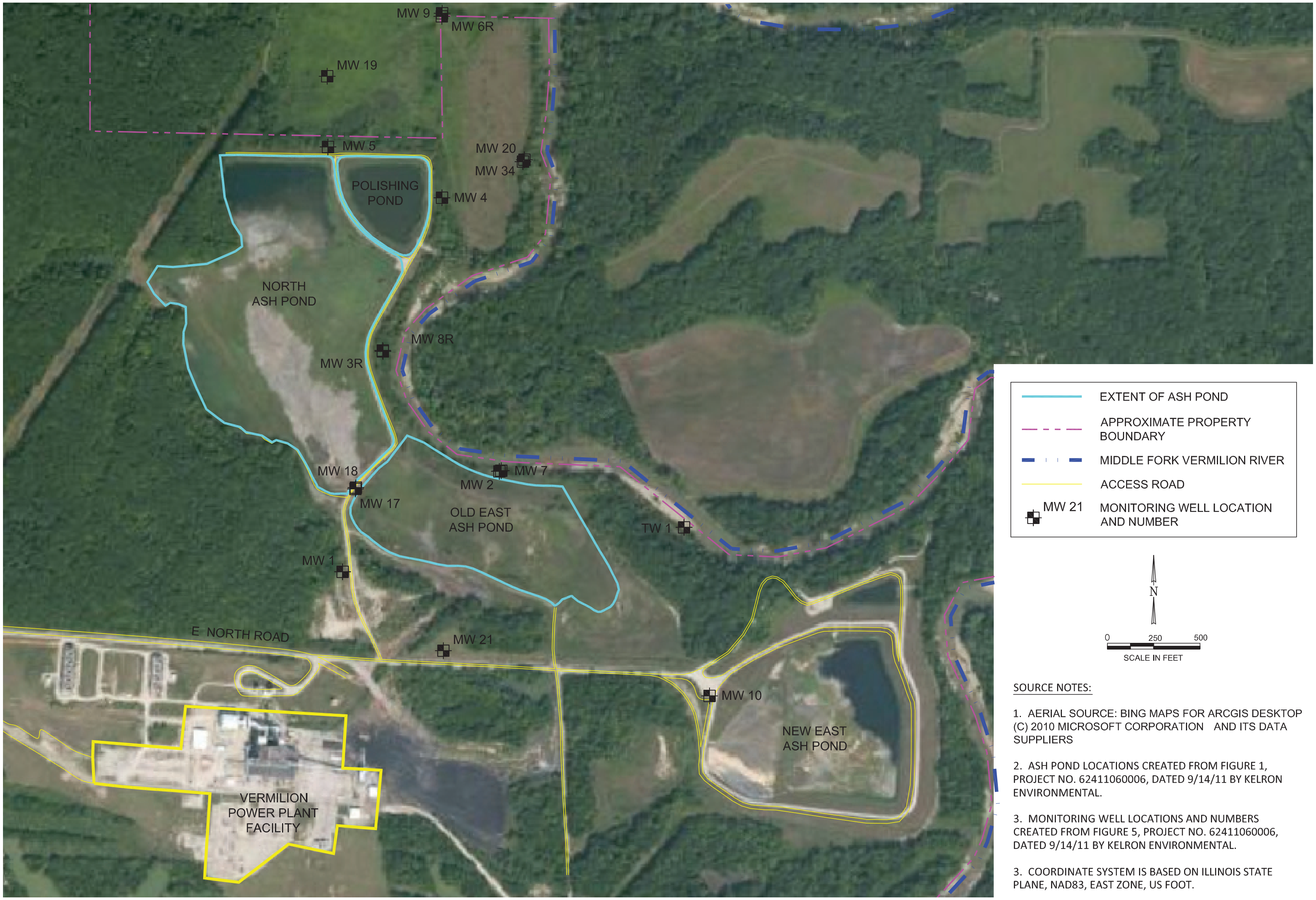
S-101 ●	STANTEC BORINGS PERFORMED 11/13-11/17/2018
☐	STANTEC TEST PITS PERFORMED 11/8-11/9/2018
HA-1 ☐	STANTEC HAND AUGER PERFORMED 11/8-11/9/2018

VERMILION POWER STATION

NORTH, OLD EAST AND EAST ASH POND CLOSURE SUMMARY OF STAGE 1 BORINGS AND TEST PITS
DRAWING-01

Stantec
1859 Bowles Avenue, Suite 250
Saint Louis, Missouri 63026-1944
www.stantec.com

DECEMBER 0□, 201□



SOURCE NOTES:

1. AERIAL SOURCE: BING MAPS FOR ARCGIS DESKTOP (C) 2010 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS

2. ASH POND LOCATIONS CREATED FROM FIGURE 1, PROJECT NO. 62411060006, DATED 9/14/11 BY KELRON ENVIRONMENTAL.

3. MONITORING WELL LOCATIONS AND NUMBERS CREATED FROM FIGURE 5, PROJECT NO. 62411060006, DATED 9/14/11 BY KELRON ENVIRONMENTAL.

3. COORDINATE SYSTEM IS BASED ON ILLINOIS STATE PLANE, NAD83, EAST ZONE, US FOOT.

DRAWN BY:	NWD	DATE:	03/02/12
CHECKED BY:	CAR/BRH	DATE:	03/02/12
APPROVED BY:	BRH	DATE:	03/26/12
DRAWING NO:	20461-12-B01-2C		
REFERENCE:	.		

SITE MAP
NORTH ASH POND SYSTEM

CORRECTIVE ACTION PLAN
DYNEGY MIDWEST GENERATION, LLC
VERMILION POWER STATION
OAKWOOD, ILLINOIS

NATURAL
RESOURCE
TECHNOLOGY

PROJECT NO.
2046.1/1.2

FIGURE NO.
1-2

Mar 26, 2012 12:52pm PLOTTED BY: ndraskovich SAVED BY: ndraskovich
Y:\ACADData\Projects\20\2046\1-2 & 2-2\20461-12-B01-2C.dwg Layout1
IMAGES: Y:\ACADData\Projects\20\2046\4 vermillion\aerials\Bing_Imagery_from_GIS.tif;
XREFS:

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

PROJECT: 169000XXXX | DATED: 3/24/2021 | DESIGNER: galarnmc

Y:\Mapping\Projects\6\68192\MXD\Figure 1_Boring Locations_2103.mxd

🟦 2021 MONITORING WELL LOCATION
◓ PROPOSED STAFF GAUGE
⊕ PROPOSED BORING (LOCATION COLLECTED WITH GPS)
🟡 2019 ANTIDEGRADATION LOCATION
▚ EXISTING MONITORING WELL LOCATION
– – APPROXIMATE PROPERTY BOUNDARY (ORIN, 2012)

0 300 600
Feet

PROPOSED MONITORED NATURAL ATTENUATION BORING LOCATIONS

Privileged & Confidential

DYNEGY MIDWEST GENERATION
VERMILION SITE
OAKWOOD, ILLINOIS

FIGURE 2

DRAFT

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

APPENDIX D. OPERATION AND MAINTENANCE PLANS

- **VERMILION POWER PLANT NORTH ASH POND (OCT. 2013) OPERATION AND MAINTENANCE PLAN, DRAFT**
- **VERMILION POWER PLANT OLD EAST ASH POND (OCT. 2013) OPERATION AND MAINTENANCE PLAN, DRAFT**
- **VERMILION POWER PLANT EAST ASH POND SYSTEM (NOV. 2014) OPERATION AND MAINTENANCE PLAN**

DYNEGY OPERATING COMPANY

Vermilion Power Station

Oakwood, Illinois

North Ash Pond

IDNR Permit No. (Not permitted)

Dam ID No. (Not permitted)

Operation and Maintenance Plan

October 2013

TABLE OF CONTENTS

DYNEGY OPERATING COMPANY
VERMILION POWER STATION
IDAM OPERATION AND MAINTENANCE PLAN

1.0 GENERAL

The following maintenance procedures are provided to insure the structural integrity of the Vermilion reservoir system, which is unclassified by the Illinois Department of Natural Resources, Office of Water Resources (OWR). It should be noted that the station was mothballed in March 2011 and retired in November 2011.

2.0 EMERGENCY OPERATIONS

2.1 Unusual Conditions

Any unusual condition discovered during routine inspection which may constitute an emergency shall be handled as follows. Notice of any type of emergency involving the berms or outfall shall be made to the following:

Project Manager, Engineering and Projects Department: Frank Bielser

office:	(217) 762-8291
home:	(217) 762-8291
cellular phone:	(217) 412-6612
e-mail:	frank.bielser@dynegy.com

or

Senior Director, Eng. and Projects Department: Mark Vogt

office:	(618) 206-5890
home:	(618) 282-6193
cellular phone:	(618) 410-6618
blackberry:	mark.vogt@dynegy.com

One of the above designated personnel shall notify the following county, state, and federal regulatory authorities, and the consulting engineer of the emergency condition.

Office of Water Resources, Dam Safety Section, Dam Safety Engineers
(217) 782-3863 (Monday - Friday, 8:00 a.m. - 4:30 p.m.)

Illinois Emergency Management Agency, 24-hour service
1-(800) 782-7860

Vermilion County Sheriff
Emergency 911 or (217) 442-4080
Illinois Department of Natural Resources, Kickapoo State Park
(217) 442-4915

Senior Director - Environmental Compliance – Rick Diericx
(618) 206-5912 or Rick.Diericx@dynegy.com

2.2 Dewatering

The Senior Director and Project Manager shall have the responsibility of determining whether dewatering of the disposal facility is necessary. A concrete spillway structure is located at the facility. Dewatering will be accomplished, using portable pumps.

3.0 MAINTENANCE

3.1 Vegetation

Berms shall be maintained to protect the structural integrity of the disposal facility. Damaged and barren areas shall be repaired as soon as appropriate after being discovered. Damaged areas shall be filled with topsoil, limed, fertilized, and seeded with appropriate vegetation. Trees and shrubs observed during the inspections shall be cut and removed from the berms and outfall channel. This shall be done frequently enough that no trees will reach the size where the root structure would require removal and filling. Woody vegetation, shrubs, and trees shall be removed during the early stages of growth before reaching a three-inch diameter.

Low growing vegetation that will facilitate inspections shall be planted and maintained.

3.2 Spillway

The spillway shall be inspected periodically and identified deficiencies resolved.

3.3 Animal Damage and Repairs

Animal burrows discovered during inspections shall be promptly repaired by backfilling/compacting clay.

3.4 Restriction of Unauthorized Vehicles

Access is controlled by the main plant access gate and security fencing. No unauthorized vehicles are allowed into the site area.

3.5 Riverbank Erosion

The ongoing erosion along the riverbank shall be monitored. Any evidence of significant changes to the erosion rate, as compared to the previous inspection, shall be reported immediately to both the Project Manager and Senior Director.

3.6 Inspections

Routine inspections shall be conducted, looking for seepage and slumping; settlement of the crest; sloughing of embankments; formation of depressions near the toe; embankment erosion; and tree growth. Also, any evidence of significant changes to the ongoing riverbank erosion, as compared to the previous inspection, should be monitored.

If such conditions are observed and those conditions are judged to pose an imminent threat to the integrity of the embankment, the notifications described in Section 2.1 of this plan shall be made. These individuals will then meet to develop a plan to evaluate the cause of the distress and any further action required. As a professional courtesy, IDNR will be informed of the condition and any proposed remediation.

Both weekly and quarterly inspections should be conducted, by qualified station employees, supported by DOC personnel, using the inspection checklists forms listed in Section 4.0.

Annual inspections will also be conducted by a licensed professional engineer (PE). All inspections by the PE shall include observations of the embankment surfaces for signs of settlement or slope failure, animal burrows, tree growth, erosion features on or adjacent to the embankments, and the conditions of the discharge facilities.

The inspections by the PE shall be done in general accordance with “Guidelines and Forms for Inspection of Illinois Dams", 1987 using the standard forms approved by the IDNR.

Any deficiencies noted by the PE, warranting remedial actions, shall be reported to both the Project Manager and Senior Director, as listed in Section 2.1. Corrective action shall be implemented, as required, to assure dam safety. Copies of the PE’s reports will not be provided to the Illinois Department of Natural Resources, Office of Water Resources.

4.0 Reporting

The following inspection checklists should be used during the weekly and quarterly inspections.

WEEKLY DAM INSPECTION FORM

Dam Location: **Vermilion Station – North Ash Pond**
Owner: **Dynegy Operating Company**
Permit No.:N/A **Class of Dam: N/A**
Type of Dam: **Earthen embankment**
Type of Spillway: **Drop inlet, for both primary and secondary cells**

Date Inspected: ____________________
Weather Conditions: ____
Pool Elevation: ____________________

Inspection Personnel:

____ ____________________________
Name / Title **Signature**

Inspection Item	Conditions	Location of Problem and Recommended Remedial Measures and Implementation Schedule
Vertical and Horizontal Alignment of Crest		
Unusual Movement or Cracking at or Beyond Toe		
Seepage		
Vegetative Cover		
Embankment Erosion		
Structural Cracking		
Outfall Structures		
Other		

QUARTERLY DAM INSPECTION FORM

Dam Location: **Vermilion Station – North Ash Pond**
Owner: **Dynegy Operating Company**
Permit No.:N/A **Class of Dam: N/A**

Type of Dam: __Earthen embankment__________

Type of Spillway: ______Drop inlet, for both primary and secondary cells_________

Date Inspected: ______________
Weather Conditions: ____
Pool Elevation: _____________________

Inspection Personnel:
____
Name / Title **Signature**

Inspection Item	Conditions	Location of Problem and Recommended Remedial Measures and Implementation Schedule
Vertical and Horizontal Alignment of Crest	Good condition, with no significant issues	
Downstream Fill Slopes	Good condition, with no significant issues	
Upstream Fill Slopes	Good condition, with no significant issues	
Unusual Movement or Cracking at or Beyond Toe	Good condition, with no significant issues	
Seepage (Condition/Color)	Good condition, with no significant issues	
Vegetative Cover (Tree growth)	Good condition, with no significant issues	
Animal Damage	Good condition, with no significant issues	
Embankment Erosion	Good condition, with no significant issues	
Water Passages	Good condition, with no significant issues	
Structural Cracking	Good condition, with no significant issues	
Outfall Structures	Good condition	
Other		

DYNEGY OPERATING COMPANY

Vermilion Power Station

Oakwood, Illinois

Old East Ash Pond

IDNR Permit No. (Not permitted)

Dam ID No. (Not permitted)

Operation and Maintenance Plan

October 2013

TABLE OF CONTENTS

DYNEGY OPERATING COMPANY
VERMILION POWER STATION
IDAM OPERATION AND MAINTENANCE PLAN

1.0 GENERAL

The following maintenance procedures are provided to insure the structural integrity of the Vermilion reservoir system, which is unclassified by the Illinois Department of Natural Resources, Office of Water Resources (OWR). It should be noted that the station was mothballed in March 2011 and retired in November 2011.

2.0 EMERGENCY OPERATIONS

2.1 Unusual Conditions

Any unusual condition discovered during routine inspection which may constitute an emergency shall be handled as follows. Notice of any type of emergency involving the berms or outfall shall be made to the following:

Project Manager, Engineering and Projects Department: Frank Bielser

office:	(217) 762-8291
home:	(217) 762-8291
cellular phone:	(217) 412-6612
e-mail:	frank.bielser@dynegy.com

or

Senior Director, Eng. and Projects Department: Mark Vogt

office:	(618) 206-5890
home:	(618) 282-6193
cellular phone:	(618) 410-6618
blackberry:	mark.vogt@dynegy.com

One of the above designated personnel shall notify the following county, state, and federal regulatory authorities, and the consulting engineer of the emergency condition.

Office of Water Resources, Dam Safety Section, Dam Safety Engineers
(217) 782-3863 (Monday - Friday, 8:00 a.m. - 4:30 p.m.)

Illinois Emergency Management Agency, 24-hour service
1-(800) 782-7860

Vermilion County Sheriff
Emergency 911 or (217) 442-4080
Illinois Department of Natural Resources, Kickapoo State Park
(217) 442-4915

Senior Director - Environmental Compliance – Rick Diericx
(618) 206-5912 or Rick.Diericx@dynegy.com

2.2 Dewatering

Not applicable.

3.0 MAINTENANCE

3.1 Vegetation

Berms shall be maintained to protect the structural integrity of the disposal facility. Damaged and barren areas shall be repaired as soon as appropriate after being discovered. Damaged areas shall be filled with topsoil, limed, fertilized, and seeded with appropriate vegetation. Trees and shrubs observed during the inspections shall be cut and removed from the berms. This shall be done frequently enough that no trees will reach the size where the root structure would require removal and filling. Woody vegetation, shrubs, and trees shall be removed during the early stages of growth before reaching a three-inch diameter.

Low growing vegetation that will facilitate inspections shall be planted and maintained.

3.2 Riverbank Erosion

The ongoing erosion along the riverbank shall be monitored. Any evidence of significant changes to the erosion rate, as compared to the previous inspection, shall be reported immediately to both the Project Manager and Senior Director.

3.3 Animal Damage and Repairs

Animal burrows discovered during inspections shall be promptly repaired by backfilling/compacting clay.

3.4 Restriction of Unauthorized Vehicles

Access is controlled by the main plant access gate and security fencing. No unauthorized vehicles are allowed into the site area.

3.5 Inspections

Routine inspections shall be conducted, looking for seepage and slumping; settlement of the crest; sloughing of embankments; formation of depressions near the toe; tree growth; and embankment erosion.

Also, any evidence of significant changes to the ongoing riverbank erosion, as compared to the previous inspection, should be monitored. If such conditions are observed and those conditions are judged to pose an imminent threat to the integrity of the embankment, the notifications described in Section 2.1 of this plan shall be made. These individuals will then meet to develop a plan to evaluate the cause of the distress and any further action required. As a professional courtesy, IDNR will be informed of the condition and any proposed remediation.

Both weekly and quarterly inspections should be conducted, by qualified station employees, supported by DOC personnel, using the inspection checklists forms listed in Section 4.0.

Annual inspections will also be conducted by a licensed professional engineer (PE). All inspections by the PE shall include observations of the embankment surfaces for signs of settlement or slope failure, animal burrows, tree growth, erosion features on or adjacent to the embankments, and the conditions of the discharge facilities.

The inspections by the PE shall be done in general accordance with “Guidelines and Forms for Inspection of Illinois Dams", 1987 using the standard forms approved by the IDNR.

Any deficiencies noted by the PE, warranting remedial actions, shall be reported to both the Project Manager and Senior Director, as listed in Section 2.1. Corrective action shall be implemented, as required, to assure dam safety. Copies of the PE’s reports will not be provided to the Illinois Department of Natural Resources, Office of Water Resources.

4.0 Reporting

The following inspection checklists should be used during the weekly and quarterly inspections.

WEEKLY DAM INSPECTION FORM

Dam Location: **Vermilion Station – Old East Ash Pond**
Owner: **Dynegy Operating Company**
Permit No.: **N/A** **Class of Dam: N/A**
Type of Dam: **Earthen/ash embankment**
Type of Spillway: **N/A**

Date Inspected: ____________________
Weather Conditions: ____
Pool Elevation: ____________________

Inspection Personnel:

____ ____________________________
Name / Title **Signature**

Inspection Item	Conditions	Location of Problem and Recommended Remedial Measures and Implementation Schedule
Vertical and Horizontal Alignment of Crest		
Unusual Movement or Cracking at or Beyond Toe		
Seepage		
Vegetative Cover		
Embankment Erosion		
Structural Cracking		
Outfall Structures		
Other		

QUARTERLY DAM INSPECTION FORM

Dam Location: **Vermilion Station – Old East Ash Pond**
Owner: **Dynegy Operating Company**
Permit No.: **N/A** **Class of Dam: N/A**

Type of Dam: Earthen/ash embankment

Type of Spillway: ____________________

Date Inspected: ______________

Weather Conditions: ____

Pool Elevation: ______________________

Inspection Personnel:

____

Name / Title **Signature**

Inspection Item	Conditions	Location of Problem and Recommended Remedial Measures and Implementation Schedule
Vertical and Horizontal Alignment of Crest	Good condition, with no significant issues	
Downstream Fill Slopes	Good condition, with no significant issues	
Upstream Fill Slopes	Good condition, with no significant issues	
Unusual Movement or Cracking at or Beyond Toe	Good condition, with no significant issues	
Seepage (Condition/Color)	Good condition, with no significant issues	
Vegetative Cover (Tree growth)	Good condition, with no significant issues	
Animal Damage	Good condition, with no significant issues	
Embankment Erosion	Good condition, with no significant issues	
Water Passages	Good condition, with no significant issues	
Structural Cracking	Good condition, with no significant issues	
Outfall Structures	Good condition	
Other		

DYNEGY OPERATING COMPANY

Vermilion Site

Oakwood, Illinois

East Ash Pond System

Intermediate Class III Dam

IDNR Permit No. DS2011079

Dam ID No. IL50291

Operation and Maintenance Plan

Revised November 2014

TABLE OF CONTENTS

DYNEGY OPERATING COMPANY
VERMILION SITE
IDNR CLASS III DAM OPERATION AND MAINTENANCE PLAN

1.0 GENERAL

The following maintenance procedures are provided to insure the structural integrity of the Vermilion wet ash disposal facility, which is classified as an Intermediate Class III dam by the Illinois Department of Natural Resources, Office of Water Resources (OWR). It should be noted that the station was mothballed in March 2011 and retired in November 2011.

2.0 EMERGENCY OPERATIONS

2.1 Unusual Conditions

Any unusual condition discovered during routine inspection which may constitute an emergency shall be handled as follows. Notice of any type of emergency involving the berms or outfall shall be made to the following:

Project Manager, Engineering and Projects Department: Frank Bielser

office:	(217) 762-8291 (Vermilion trailer)
home:	(217) 762-8291
cellular phone:	(217) 412-6612
e-mail:	frank.bielser@dynegy.com

or

Construction Manager: Steve Bluemner, P.E.

office:	(618) 343-7711
personal cell:	(618) 980-0397
cellular (work):	(618) 343-5822
blackberry:	Steve.Bluemner@dynegy.com

One of the above designated personnel shall notify the following, of the emergency condition:

Office of Water Resources, Dam Safety Section, Dam Safety Engineers
(217) 782-3863 (Monday - Friday, 8:00 a.m. - 4:30 p.m.)

Illinois Emergency Management Agency, 24-hour service
1-(800) 782-7860

Vermilion County Sheriff
Emergency 911 or (217) 442-4080
Illinois Department of Natural Resources, Kickapoo State Park
(217) 442-4915

Senior Director - Environmental Compliance – Rick Diericx
(618) 343-7761 or Rick.Diericx@dynegy.com

2.2 Dewatering

The Senior Director and Project Manager shall have the responsibility of determining whether dewatering of the disposal facility is necessary. A gravity outlet structure is located at the facility. The valve to this structure can be opened to lower the water level. This dewatering shall continue until the desired water level is reached.

3.0 MAINTENANCE

3.1 Vegetation

Berms shall be maintained to protect the structural integrity of the disposal facility. Damaged and barren areas shall be repaired as soon as appropriate after being discovered. Damaged areas shall be filled with topsoil, limed, fertilized, and seeded with appropriate vegetation. Trees and shrubs observed during the inspections shall be cut and removed from the berms and outfall channel. This shall be done frequently enough that no trees will reach the size where the root structure would require removal and filling. Woody vegetation, shrubs, and trees shall be removed during the early stages of growth before reaching a three-inch diameter.

Low growing vegetation that will facilitate inspections shall be planted and maintained.

3.2 Effluent Discharge Canal

The effluent discharge canal shall be inspected semiannually and repaired as needed. Any replacement of riprap shall be done in a timely manner.

3.3 Animal Damage and Repairs

Animal burrows discovered during inspections shall be promptly repaired by filling with grout.

3.4 Restriction of Unauthorized Vehicles

Access to the ash pond site area is controlled by the main plant access gate. No unauthorized vehicles are allowed into the site area.

3.5 Riverbank Erosion

The ongoing erosion along the riverbank shall be visually monitored and measured, on a periodic basis. Any erosion rate change and measurements shall be documented in the internal inspection checklists. Any evidence of significant changes to the erosion rate, as compared to the previous inspection, shall be reported immediately to both the Project Manager and Senior Director.

3.6 Inspections

Because a portion of the site is probably undermined by coal workings, there is potential for mine-induced subsidence and damage to the embankment. Therefore, the routine inspections are needed to document the condition of the embankment and potential subsidence related damage.

Indications of subsidence would include settlement of the crest, sloughing of embankments or formation of depressions near the toe. If such conditions are observed and those conditions are judged to pose an imminent threat to the integrity of the embankment, the notifications, described in Section 2.1 of this plan, shall be made. These individuals will then meet to develop a plan to evaluate the cause of the distress and any further action required. IDNR will be informed of the condition and any proposed remediation.

Both weekly and quarterly inspections should be conducted, by qualified station employees, supported by DOC personnel, using the inspection checklists forms listed in Section 4.0. Weekly inspections should be focused on evidence of seepage and slumping, and unusual seepage at and/or blockage of outfall structures. Quarterly inspections will be focused on embankment erosion, tree growth and embankment seepage. Also, any evidence of significant changes to the ongoing riverbank erosion, as compared to the previous inspection, should be monitored.

Annual inspections will also be conducted by a licensed professional engineer (PE). All inspections by the PE shall include observations of the embankment surfaces for signs of settlement or slope failure, animal burrows, tree growth, erosion features on or adjacent to the embankments, and the conditions of the discharge facilities.

The inspections by the PE shall be done in general accordance with “Guidelines and Forms for Inspection of Illinois Dams", 1987 using the standard forms approved by the IDNR.

Any deficiencies noted by the PE, warranting remedial actions, shall be reported to both the Project Manager and Senior Director, as listed in Section 2.1. Corrective action, as required to assure dam safety, will be implemented. Every five years, a copy of the most recent PE report shall be provided to the Illinois Department of Natural Resources, Office of Water Resources.

4.0 Reporting

The following inspection checklists should be used during the weekly and quarterly inspections.

WEEKLY DAM INSPECTION FORM

Dam Location: Vermilion Site – East Ash Pond
Owner: Dynegy Operating Company
Permit No.: DS2011079 **Class of Dam:** III
Type of Dam: Earthen embankment
Type of Spillway: Drop inlet, for both primary and seconday

Date Inspected: ____________________
Weather Conditions: ____
Pool Elevation: ____________________

Inspection Personnel:

____ ____________________________
Name / Title **Signature**

Inspection Item	Conditions	Location of Problem and Recommended Remedial Measures and Implementation Schedule
Vertical and Horizontal Alignment of Crest		
Unusual Movement or Cracking at or Beyond Toe		
Seepage		
Vegetative Cover		
Embankment Erosion		
Structural Cracking		
Outfall Structures		
Other		

QUARTERLY DAM INSPECTION FORM

Dam Location: Vermilion Site – East Ash Pond

Owner: Dynegy Operating Company

Permit No.: DS2011079 **Class of Dam:** III

Type of Dam: Earthen embankment

Type of Spillway: Drop inlet, for both primary and secondary cells

Date Inspected: ______________

Weather Conditions: ____

Pool Elevation: ____________________

Inspection Personnel:

____

Name / Title **Signature**

Inspection Item	Conditions	Location of Problem and Recommended Remedial Measures and Implementation Schedule
Vertical and Horizontal Alignment of Crest	Good condition, with no significant issues	
Downstream Fill Slopes	Good condition, with no significant issues	
Upstream Fill Slopes	Good condition, with no significant issues	
Unusual Movement or Cracking at or Beyond Toe	Good condition, with no significant issues	
Seepage (Condition/Color)	Good condition, with no significant issues	
Vegetative Cover (Tree growth)	Good condition, with no significant issues	
Animal Damage	Good condition, with no significant issues	
Embankment Erosion	Good condition, with no significant issues	
Water Passages	Good condition, with no significant issues	
Structural Cracking	Good condition, with no significant issues	
Outfall Structures	Good condition	
Other		

APPENDIX E. SPECIFICATIONS

- **SPECIFICATIONS FOR AN ASH DISPOSAL FACILITY AT THE VERMILION POWER PLANT W.O. 26869, APRIL 1988 BY ILLINOIS POWER COMPANY**
- **VERMILION POWER PLANT EAST ASH POND EXPANSION SPECIFICATIONS, JUNE 2002 BY URS CORPORATION**

JEL
CS860387

ILLINOIS POWER

SPECIFICATIONS FOR AN ASH DISPOSAL FACILITY AT THE VERMILION POWER PLANT

W.O. 26869

APRIL, 1988

APPROVED
FOR
CONSTRUCTION
RELEASED BY JEL
DATE 9-13-88

CIVIL/STRUCTURAL ENGINEERING SECTION
HEADQUARTERS ENGINEERING DEPARTMENT
ILLINOIS POWER COMPANY
DECATUR, ILLINOIS

ADDENDUM NO. 1

Specifications for an Ash Disposal Facility At the Vermilion Power Plant
W.O. 26869

A. Specifications

1. Construction Schedule

   Completion date for the slurry wall shall be deleted. The project completion date shall remain August 1, 1989.

2. Section I - General Requirements

   Project Description

   The soil-bentonite backfill shall have a maximum permeability of 1×10^{-7} cm/sec.

3. Section VI - Slurry Wall Construction

   a. General

      The perimeter slurry wall shall provide a combined minimum width of eight feet of soil-bentonite slurry backfill. The soil-bentonite slurry backfill shall have a hydraulic conductivity of less than 1×10^{-7} cm/sec.

   b. Specifications and Goals

      1. The gradation and materials used for the backfill shall be such that the soil-bentonite slurry backfill barrier(s) achieves an effective, long term hydraulic conductivity of less than 1×10^{-7} cm/sec with Vermilion Ash Pond leachate as the permeant.

      2. The minimum long term soil-bentonite slurry backfill barrier(s) width required is eight feet or multiple widths to attain an equivalent thickness.

      3. All efforts shall be made to provide a continuous, homogeneous mixture of soil and bentonite within the trench and the occurrence of "windows" of material having a hydraulic conductivity of greater than 1×10^{-7} cm/sec shall not be allowed.

      11. Backfill slurry mixture shall include sufficient percentage of bentonite to meet the requirements herein specified.

c. Quality Control

Table 1 - Quality Control Testing Program

Backfill Mix	% Bentonite not less than % specified in the design mix Triaxial hydraulic conductivity test $\leq 1 \times 10^{-7}$ cm/sec.

4. Section VIII - Piping

Corrugated metal pipe/pipe arch culverts shall be formed from precoated galvanized steel sheets. Thickness of the sheets shall correspond to the IDOT specifications for Type 2A CMP for road culverts.

Reinforced concrete pipe shall be used for all ash pond piping. Class V pipe with spigot groove type joints and O-ring gaskets shall be used. A reinforced concrete pipe cradle shall be required under all ash pond dikes as shown on the following detail. (See Section VIII for detail.)

RCC Pipe Class V shall be used for the outfall piping.

5. Section IX - Hydrogeologic Study

Only the boring data from the study will be included in the construction specifications.

6. Section XII - Bid Units

		Est. No. of Units
8a.	Reinforced concrete pipe with reinforced concrete cradle. Ash pond piping 36" diameter. (per lineal foot)	172
8b.	Reinforced concrete pipe. Outfall piping 36" diameter. (per lineal foot)	400
10b.	Four foot thick barrier. (per square yard)	8,400
13.	Reinforced concrete including all labor, materials, equipment, and supervision. (per cubic yard)	12

B. <u>Plans</u>

Sheets C-SK26869-5.3 through C-SK26869-5.16 reflect the change from a five foot wide slurry trench to a minimum width of eight feet for the soil-bentonite slurry backfill system. On the plans this is shown as two four foot wide slurry trenches.

JEL
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ILLINOIS
IP
POWER

SPECIFICATIONS FOR AN ASH DISPOSAL FACILITY AT THE VERMILION POWER PLANT
W.O. 26869

APRIL, 1988

CIVIL/STRUCTURAL ENGINEERING SECTION
HEADQUARTERS ENGINEERING DEPARTMENT
ILLINOIS POWER COMPANY
DECATUR, ILLINOIS

STATE OF ILLINOIS

Permit
No. 19333

Department of Transportation

Division of Water Resources

2300 South Dirksen Parkway
Springfield, Illinois 62764

Permission Is Hereby Granted, this 23rd day of August 19 88

To

Illinois Power Company
500 South 27th Street
Decatur, Illinois 62525-1805

To construct, operate and maintain a wet ash disposal facility, classified as a small size Class III structure, within the flood plain of the Middle Fork Vermilion River at the Vermilion Power Plant in the SE 1/4 of Section 20, Township 20 North, Range 12 West of the 2nd Principal Meridian in Vermilion County,

in accordance with an application dated March 29, 1988 , and the specifications and plans entitled

SHEETS C-SK. 26869-4 TO 10(32 SHEETS, RECEIVED 8-23-88)
SPECIFICATIONS FOR AN ASH DISPOSAL FACILITY AT VERMILION POWER PLANT (RECEIVED 8-23-88)
MAINTENANCE PLAN, ILLINOIS POWER CO., VERMILION CLASS III DAM, (RECEIVED 8-11-88)

filed with the Department of Transportation and made a part hereof, and subject to the terms and special conditions contained herein:

Examined and Recommended:

Neil R. Fulton
Chief, Bureau of Resource Management.
Neil R. Fulton

APPROVED:

Gregory W. Baise
Secretary
Gregory W. Baise

Approval Recommended:

Donald R. Vonnahme
Donald R. Vonnahme Director

cc: Louisville District Corps of Engineers Il. Dept. of Conservation

(over)

(39193—5M 5-81s—12-83)

Table of Contents

The following data and drawings, attached hereto, are a part of these specifications:

The following drawings are not attached hereto, but are considered a part of these specifications:

Ash Pond Plan	C-SK.26869-6
Cross Sections 1278988, 1279032, and 1279052	C-SK.26869-5.1
Cross Sections 1279100, 1279115, and 1279142	C-SK.26869-5.2
Cross Section 1279162	C-SK.26869-5.3

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Table of Contents (cont.)

SPECIFICATIONS
ASH DISPOSAL FACILITY
VERMILION POWER PLANT
W.O. 26869

Description of Project

This project consists of excavating, hauling, placing, and compacting borrow material, installing a soil-bentonite slurry backfill, and other facilities at the Vermilion Power Plant to construct a new ash disposal facility.

All of the information contained and referenced to herein is the proprietary and confidential property of Illinois Power Company.

Construction Schedule

A preconstruction conference will be held prior to starting work to coordinate construction activities with plant operations.

The Contractor shall submit a construction schedule to the Company's Supervisor of Construction two weeks prior to the date of the preconstruction conference. Two weeks notice will also be required prior to starting construction. One days notice will be required for restarting work after a delay.

Access to the Company's equipment, material, and property shall be maintained at all times. Interference with daily operations shall be minimized.

The Contractor shall obtain all permits, licenses, and required documents to perform the work. All costs resulting from compliance with these documents shall be considered incidental to the contract and be included in the Contractor's bid.

Slurry wall construction shall be completed before November 1, 1988. The project shall be completed before August 1, 1989. Continued operation of the plant hinges on project completion prior to this date. Failure to meet this date would severely limit the Company's ability to meet load expectations, and the Contractor will be expected to utilize the necessary personnel and equipment to complete the project by August 1, 1989.

Project Location

Illinois Power Company
Vermilion Power Plant
Box 257
Oakwood, Illinois 61858
Six miles north of Rt. I-74 at Oakwood Turnoff
Phone (217) 354-2141
Albert F. Lueck, Plant Manager
Bruce Brown, Supervisor - Results

SECTION I

General Requirements

Introduction

The Contractor shall furnish, at his expense, all supervision, labor, tools, equipment, transportation, materials (unless noted otherwise), and other services as necessary for the construction of this project. The Contractor shall perform the work in a good, workmanlike manner in accordance with these specifications and drawings. All work shall be performed under the personal and constant supervision of a competent Construction Superintendent or Foreman.

A Company Representative will be on the job to assure that the facilities constructed meet the requirements of the Company's specifications.

The Company will cooperate in any way possible with technical or practical construction advice requested by the Contractor. However, the methods used to meet these specifications are the sole responsibility of the Contractor. The Contractor is in charge of the work and is responsible for safety.

The Contractor shall submit a list of subcontractors with his proposal.

Drawings, Data, and Special Agreements

Drawings and data are listed in the Table of Contents of these specifications. Any questions concerning these drawings and data shall be referred to the Company's Representative. The Contractor shall not take advantage of errors and omissions in the plans and/or discrepancies between the plans and specifications. The Company will make corrections and supply information omitted to the plans and specifications, with the Company's interpretation being final. Any addenda issued during the time of bidding are considered a part of these specifications.

Revised or additional drawings and data may be issued after the contract agreement is signed. Within ten days after the receipt of any supplemental information, the Contractor shall advise the Company of any changes in unit costs in writing. No work shall be done on properties on which a cost change is required until a price is agreed to between the Company and the Contractor.

Examination of the Work Site

The Contractor shall examine the job location and job requirements. The Contractor shall be held responsible for any loss or error resulting from ignorance concerning requirements of the work or any difficulties encountered. Contractor shall be familiar with the conditions and difficulties to be encountered in the work.

Project Description

A new wet ash disposal facility is to be constructed at the Vermilion Power Plant. The main construction components will be compacted borrow and a soil-bentonite slurry backfill.

Silty sand borrow material for the outer portions of the dikes will be taken from inside the proposed containment dikes. Silty clay borrow material for the impermeable core of the dike will be taken from Borrow Area One and other borrow areas designated on the plans. A continuous soil-bentonite slurry backfill system will be installed around the ash facility perimeter. The clay core and bluff clay barrier shall have a maximum permeability of 1 x 10^{-7} cm/sec. The soil-bentonite backfill shall have a maximum permeability of 1 x 10^{-7} cm/sec. Preconstruction testing of the silty clay and soil-bentonite slurry backfill components to determine the proper construction techniques and mix components to achieve the maximum stated permeability shall be performed by the Contractor. The results of this testing shall be issued in a report(s) to be used during construction of the various components to ensure the desired results are obtained.

Construction areas shall be cleared. All vegetation and deleterious material shall be legally disposed of in an environmentally safe manner. The Contractor shall control and eliminate all fugitive dust caused by the work. The Contractor shall control and eliminate all erosion resulting from the work. No sediments or other material shall be allowed to escape the project site to the Middle Fork of the Vermilion River or adjacent wetlands.

A portion of the ash pond dike shall be built prior to installation of the soil-bentonite slurry backfill to allow keying of the slurry wall into the clay core and bluff clay barrier. The slurry wall shall also be keyed into the shale as shown on the plans, a minimum of four feet into unweathered shale.

The Contractor shall be required to design the soil-bentonite slurry backfill to meet certain performance criteria. A report will be submitted prior to constructing the slurry wall addressing the design and anticipated performance of the soil-bentonite slurry backfill. A quality control program shall be part of the report. Necessary tests, sampling schedule, test reports, and other requirements shall be addressed in the report. The Company shall retain a testing agency to review, comment, and approve the report prior to construction beginning on the soil-bentonite slurry backfill. The same testing firm shall be retained to provide additional construction quality assurance (testing and reporting) for the soil-bentonite slurry backfill. In addition to verifying all components of the soil-bentonite slurry backfill construction, the testing agency will also perform testing of borrow materials, compaction, concrete, and other inspection duties.

Gravity piping and reinforced concrete structures will connect the settling and polishing ponds. Discharge piping will be outletted towards the north.

The Middle Fork of the Vermilion River is bounded by a scenic easement. A line on either side of the stream, 200 ft. from the stream center line (total of 400 ft.), defines the easement. Applicable portions of the easement are shown on the plans. The conditions stated in the easement are to help preserve the stream's natural characteristics. Therefore, the Contractor will not encroach upon the easement and will not be allowed to operate construction equipment within the easement except for construction of the discharge piping, channel, and entrance road.

Any structures, fills, roads, or other facilities built to provide access or protect items on the site shall be removed at the end of the project at the direction of the Company.

The Contractor shall inform the construction work force of the high voltage transmission line located at the south end of the project site. Work operations shall not cause damage to or tripping out of the line.

SECTION II

Earthwork Specifications

Portions of this work require the placement and compaction of soil or aggregate. This work will be covered by the following specification for earthwork operations.

Clearing and stripping of construction areas will be required. The cross sections show the removal of approximately 15 inches over the construction areas to determine approximate quantities of fill that will be required. For clearing and stripping the actual depth will be determined by the Company's contracted soil testing firm and may be more or less than 15 inches depending upon the actual conditions encountered.

Prior to starting construction, designated borrow area zones, four acres in size, shall be laid out on a plan sheet, by coordinates, by the Contractor. The Contractor shall then strip or clear the borrow area to allow cross sectioning of the borrow area by the Company. The Contractor shall not remove any material from the borrow area until the cross sectioning is completed. The Contractor shall notify the Company's Representative one week in advance of the intention to strip or clear an area. The Contractor shall inform the Company's representative when the operations are complete. The Company will cross section the area within five working days after receiving the Contractor's written notification that an area is ready. The bluff areas along the west edge of the pond are to be included in the borrow area designations. After all the suitable material is removed from a borrow zone, the Company will again cross section the area to determine how many cubic yards were removed. The Company's on-site testing agency representative will be responsible for determining suitable materials to incorporate into the work. Small deposits of silt may be encountered in the borrow area. Silt deposits less than five cubic yards in size may be used provided the material is spread in a very thin layer with other suitable material. Deposits larger than five cubic yards or multiple deposits in an area shall remain undisturbed until all other areas in the bottom have been exhausted. Once an area has been exhausted it will be cross sectioned. The Company may then direct the Contractor to remove the remaining material and stockpile it near Borrow Area One. The area will be cross sectioned again to determine the quantity of overburden removed from the ash pond interior.

Contours shown in the bottom (non-dike portion) of the new ash pond, except for the north polishing pond, (592 and lower) are general in nature and the actual "as-built" contours will depend on how much material is removed from a particular area. The north polishing pond bottom shall be excavated to the contours shown on the plans. The Contractor should arrange the borrow area zones to provide positive drainage from the work areas. Positive drainage will be maintained around the dike construction areas. The Contractor will be responsible for pumping excess water from the interior of the dike. The Contractor shall grade the construction area to prevent ponding of water that interferes with the work. The Contractor shall construct sumps to pump from, as necessary, to allow removal of borrow material as part of the work.

The moisture content limits for silty clay used in constructing the clay core and bluff clay barrier shall be -1% to +3% of the optimum moisture content determined by ASTM D698. All compaction tests shall be compared to the combined Proctor curve/permeability chart prepared by the testing agency to ensure the compacted clay core and bluff clay barrier have a maximum permeability of 1×10^{-7} cm/sec. The silty clay in these two areas shall be compacted to at least 97% of the maximum dry density (ASTM D698). If a greater degree of compaction is required to meet the permeability requirements, this work shall be done with no increase in the corresponding unit price for this work.

Suitable silty clay (glacial till) from the lower portions of the road cut shall be used to construct the clay core and bluff clay barrier. The upper portion cut material shall be used to form the road embankment. The remainder of the clay core and bluff clay barrier material shall be obtained in Borrow Area One. Unsuitable overburden shall be removed after stripping of the site and stockpiled adjacent to the borrow area. Testing of the upper portion of Borrow Area One is ongoing at the time of this writing and its properties relative to permeability are unknown. Therefore, a bid item will be included for removal and stockpiling. If the soil will meet the permeability criteria set forth, it will be considered silty clay borrow for use in the clay core or bluff clay barrier and deleted from the stockpile bid quantity. Borrow Area One will be initially cross sectioned after stripping and removal of unsuitable overburden.

Excavated material from the bluff area shall be used in areas outside of the clay core and bluff clay barrier shown on the plans. Silty clay suitable for fill areas shall be used adjacent to the clay core material as shown on the typical section. Sand combinations may be used in the outer portions of the dike. Small silt deposits may be distributed through the exterior portions of the dike. Extensive deposits of silt or numerous small deposits that would result in a deposit of silt more than five cubic yards to be placed in the dike will be transported adjacent to Borrow Area One and stockpiled.

Borrow Area One shall not be stripped until material is needed or storage area is required.

Stockpiled material in and adjacent to Borrow Area One shall be tracked in place to stabilize it and remove large voids.

Aggregate shown on the plans is to be placed at the end of construction. Material required to maintain the road in an accessible condition during construction will be incidental to the contract. Rough cutting of some portions of the runoff ditch and pipe run may be necessary to provide material for the dike, but it should be noted that the runoff ditch cannot become operational until the ash pond is operational. Therefore runoff cannot be routed to the ash pond until the dikes are constructed and all outfall piping is in place.

Quantities of fill are approximate and will depend on "as-built" conditions. The contours of the existing ground are from an aerial photo shot and plotted in 1978 and, while generally correct, some modification has taken place due to farming and other activities. Some variation in the final units is to be expected.

The exposed subgrade of all construction areas, particularly the bluff side of the pond, shall be disced and/or scarified prior to compaction of the subgrade and placement of fill. The subgrade of all construction areas shall be compacted to 95% of the maximum dry density of the material (ASTM D698) before placement of fill begins.

Unless otherwise noted, compaction requirements for all phases of the work shall be 95% of the maximum dry density and -1% to +3% of the optimum moisture content as determined by ASTM D698.

Should construction of the ash pond dike and road be delayed by winter weather until the next construction season, the Contractor shall remove, replace, and recompact the following depth of material for each of the noted areas prior to placing new fill. The ash pond dike will require the removal, replacement, and recompaction of 12 inches of material. Roadwork will require the removal, replacement, and recompaction of 6 inches of material. Daily occurrences of frost removal will be determined by the Company's Site Representative. Both daily and seasonal removal and replacement will be considered incidental to the contract.

1. SCOPE

1.1 This specification covers the minimum performance requirements, materials, and references necessary to govern earthwork and related operations. Earthwork is the movement of soil, sand, or rock from one location to another, shaping the materials in accordance with the plans or specifications, and achieving the desired physical condition of the materials by various methods.

2. DEFINITIONS

2.1 Borrow Excavation: Work done in obtaining material for embankments or fills from a source other than required excavation. Included is the excavating, transporting, placing, and compacting of materials from locations furnished by the Contractor necessary for the construction of embankments, subgrade, shoulders, sub-base, intersections, approaches, entrances, and other items indicated on the plans or noted in the specifications.

2.2 Channel Excavation: The removal and satisfactory disposal of all materials encountered in the construction of ditches, stream channels, or swales.

2.3 Clay: An aggregate of microscopic and submicroscopic flake-shaped crystalline minerals characterized by the typical colloidal properties of cohesion, plasticity, and the ability to absorb ions conforming to the gradations set forth in the Unified Classification System.

2.4 Clearing: The removal and disposal of all obstructions such as fences, walls, foundations, buildings, trees, stumps, brush, accumulations of rubbish of whatever nature, and existing structures.

2.5 Construction Inspector: The Owner's on-site representative.

2.6 Contractor: The party or parties proposing to provide all labor, equipment and materials required to perform the work specified herein or on the plans.

2.7 Crushed Gravel: Fractured particles resulting from the crushing of gravel which, prior to crushing, would have been retained on a screen with an opening 1.5 times as large as the maximum size of the resulting crushed material.

2.8 Crushed Stone: Angular fragments resulting from the mechanical crushing of granite, limestone, or dolomite from undisturbed, consolidated deposits: (Dolomite shall be a carbonate rock containing 11.0% or more magnesium oxide (MgO). Limestone shall be a carbonate rock containing less than 11.0% magnesium oxide).

2.9 Engineer: The Owner's project engineer.

2.10 Embankment: Consists of the construction of fill areas (berms, road subgrade) by hauling depositing, placing and compacting the specified material above the natural surface or a specified grade line.

2.11 Footing Excavation: See Structure Excavation.

2.12 Gravel: Coarse, granular, unconsolidated material resulting from the reduction of rock by the action of the elements and having subangular to rounded surfaces conforming to the gradations set forth in the Unified Classification System.

2.13 Impervious Backfill: Fine aggregate (Silty Clay, CL to CL-CH) placed and compacted in excavations, around structures or other items as indicated in the plans and specifications.

2.14 Inorganic Silt: Fine grained soil possessing little or no plasticity or cohesion conforming to the gradations set forth in the Unified Classification System.

2.15 Owner: Illinois Power Company or its designated agent.

2.16 Pipe Excavation: The excavation, removal and satisfactory disposal of all materials encountered constructing a trench for installation of the specified pipe.

2.17 Porous Backfill: Fine aggregate (clean sand) placed and compacted in excavations, around structures or other items as indicated in the plans and specifications.

2.18 Rock: Natural aggregate of mineral grains connected by strong and permanent cohesive forces.

2.19 Sand: Fine granular material resulting from the natural disintegration of rock conforming to the gradations set forth in the Unified Classification System.

2.20 Soil: Natural aggregate of mineral grains, with or without organic constituents, that can be separated by gentle mechanical means such as agitation in water. Gravel and sand are coarse grained soils, while silts and clays are fine grained soils.

2.21 Stripping: The excavation, removal and satisfactory disposal (if required) of all materials taken between the original surface and the top of suitable material for the construction of embankments, subgrade, sub-base, shoulders, intersections, ditches, waterways, entrances, approaches and incidental work.

2.22 Structure Excavation: Removal of any and all materials encountered during installation of any designated structure and the satisfactory disposal of all materials.

2.23 Unclassified Excavation: The removal of any combination of topsoil, earth, rock, muck or obstacle carried out to the lines and grades specified or shown on the plans without regard to percentage of moisture and type of material found.

3. REFERENCES

3.1 The reference to specifications or organizations (such as ASTM) together wit any diagrams, drawings or plans shall be considered as part of this specification. In the event of conflict between this specification and the referenced documents, the requirements of this specification shall take precedence. The following specifications, standards, and codes apply:

3.1.1 American Society for Testing and Materials (ASTM)

3.1.1.1 ASTM D75-82: Practice for Sampling Aggregates

3.1.1.2 ASTM D420-69: Recommended Practice for Investigating and Sampling Soil and Rock for Engineering Purposes

3.1.1.3 ASTM D421-58: Method for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants

3.1.1.4 ASTM D422-63: Method for Particle-Size Analysis of Soils

3.1.1.5 ASTM D653-85: Terms and Symbols Relating to Soil and Rock Mechanics

3.1.1.6 ASTM D698-78: Test Methods for Moisture - Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb (2.49 kg) Rammer and 12- inch (305-mm) Drop

3.1.1.7 ASTM D854-83: Test Method for Specific Gravity of Soils

3.1.1.8 ASTM D1140-54: Test Method for Amount of Material in Soils Finer than the No. 200 (75- m) Sieve

3.1.1.9 ASTM D1452-80: Practice for Soil Investigation and Sampling by Auger Borings

3.1.1.10 ASTM D1556-82: Test Method for Density of Soil in Place by the Sand-Cone Method

3.1.1.11 ASTM D1557-78: Test Methods for Moisture-Density Relations o Soils and Soil-Aggregate Mixture Using 10-lb (4.5 kg) Rammer and 18-inch (457-mm) Drop

3.1.1.12 ASTM D1558-84: Test Method for Moisture Content Penetration Resistance Relationships of Fine Grained Soils

3.1.1.13 ASTM D1586-84: Method for Penetration Test and Split-Barrel Sampling of Soils

3.1.1.14 ASTM D1587-83: Practice for Thin-Walled Tube Sampling of Soils

3.1.1.15 ASTM D2167-84: Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method

3.1.1.16 ASTM D2168-80: Methods for Calibration of Laboratory Mechanical-Rammer Soil Compactors

3.1.1.17 ASTM D2216-80: Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock and Soil Aggregate Mixtures

3.1.1.18 ASTM D2217-66: Method for Wet Preparation of Soil Samples for Particle Size Analysis and Determination of Soil Constants

3.1.1.19 ASTM D2487-83: Test Method for Classification of Soils for Engineering Purposes

3.1.1.20 ASTM D2922-81: Test Methods for Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)

3.1.1.21 ASTM D3017-78: Test Method for Moisture Content of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)

3.1.1.22 ASTM D3740-80: Practice for the Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

3.1.1.23 ASTM D4220-83: Practices for Preserving and Transporting Soil Samples

3.1.1.24 ASTM D4318-84: Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

3.1.1.25 ASTM C29-78: Test Method for Unit Weight and Voids in Aggregate

3.1.1.26 ASTM C127-84: Test Method for Specific Gravity and Absorption of Coarse Aggregate

3.1.1.27 ASTM C128-84: Test Method for Specific Gravity and Absorption of Fine Aggregate

3.1.1.28 ASTM C136-84: Method for Sieve Analysis of Fine and Coarse Aggregates

3.1.1.29 ASTM C566-84: Test Method for Total Moisture Content of Aggregate by Drying

3.1.1.30 ASTM C702-80: Methods for Reducing Field Samples of Aggregate to Testing Size

3.1.1.31 ASTM D75-82: Practice for Sampling Aggregates

3.1.1.32 ASTM E11-81: Specification for Wire-Cloth Sieves for Testin Purposes

3.1.1.33 ASTM D3665-82: Practice For Random Sampling of Construction Materials

3.1.2 Standard Specifications for Road and Bridge Construction - Illinois Department of Transportation (IDOT) - October 1, 1983

4. MATERIALS

4.1 Acceptability -

4.1.1 Previous testing data will be considered in determining acceptability. No material will be brought to the construction site unti it has been tested by the Owner, or the designated testing agency, and found suitable for the intended application. Material hauled to the site prior to the owner's approval may be rejected, and in such cases must be removed by the Contractor at his own expense.

4.1.2 All material shall come from the same location and exhibit similar characteristics.

4.2 The type of material and gradation to be used at a particular location will be designated in the General portion of the specifications or noted on the plans for a specific project.

4.2.1 In most instances coarse grained material (gravels, crushed stone, sand) will be designated by an IDOT gradation. Materials with these gradations are readily available state wide during the construction season.

4.2.2 Fine grained materials (clay, silty clay) will be designated by a Unified System Classification (ASTM D2487). See Figures 1 and 2.

4.3 Top soil shall be relatively free from large roots, sticks, weeds, brush or stones larger than 1 inch in diameter, or other litter and waste products. Top soil shall be a loamy mixture having the following characteristics:

1. At least 90% passing the No. 10 sieve.
2. Not less than 1% or more than 10 % organic matter.
3. Not less than 12% or more than 50% clay.
4. No more than 55% sand
5. A $_p$H value between five and eight.

5. CONSTRUCTION REQUIREMENTS

5.1 Unless otherwise noted, compaction requirements for all phases of the work shall be 95% of the Maximum Dry Density and ± 2% of the Optimum Moisture Content as determined by ASTM D698.

5.2 Compaction shall be obtained by mechanical means in a timely manner so as to delay construction. Lift thicknesses may vary depending upon the condition of the material and equipment used, but should never exceed six inches. Each lift will be tested by the owner or an outside agency.

5.3 Material placed which does not meet the minimum compaction requirements sha be reworked as necessary to obtain the specified compaction at no extra cos to the Owner. No further placement of material will be allowed until the compaction requirements are met. If the material becomes unsuitable for us after placement, even if previously compacted to the specified percentage, will be removed and replaced by suitable material which will be compacted i accordance with the specifications at no extra cost to the Owner.

5.4 No placement of material will be allowed on wet or frozen subgrade.

5.5 The Contractor will maintain his work in such a manner to prevent ponding o water in the project area. In excavations where water may collect the Contractor shall establish and maintain pumping capabilities to keep the excavation free of water. This includes a layer of oversize rock (±4") covered by a layer (±2") of crushed stone (CA-6 or CA-10) or a mud mat to allow work to proceed in the excavation without contamination by mud or water.

5.6 Erosion control is the responsibility of the Contractor.

5.7 Disposal of all unsuitable material in a legal, safe, and satisfactory manne is the responsibility of the Contractor. This includes, but is not limited to, materials resulting from clearing and stripping of a site.

5.8 The Contractor shall be responsible for, and shall take all necessary precautions to preserve and protect, all existing tile drains, sewers, other subsurface drains, underground utilities, above ground utilities, private transmission lines, and appurtenances which may be affected by his operation and shall repair, at his own expense, any and all damages resulting from his actions or negligence.

5.9 The Contractor shall notify the Construction Inspector two days in advance o beginning or resuming work.

5.10 Trenches for pipe installation shall be excavated to an elevation 4 inches below the bottom of the pipe such that the invert of the pipe will be at t depth and grade specified. The trench will be excavated 18 inches wider t the external diameter of the pipe, or more if necessary, to permit through tamping under the haunches and around the pipe. Where a firm foundation i not encountered at the grade established all such unsuitable soil shall be removed for the width of the trench and replaced with well compacted beddi material or suitable compacted aggregate. In areas requiring impervious backfill, the trench bottom will be shaped to conform to the pipe's shape lieu of bedding. In general, areas subject to traffic, right of ways, pub property, load bearing areas and other heavily used areas shall be backfil with porous backfill compacted to the requirements of 5.1.

5.11 Access to the project site will be maintained at all times. If the work is being performed at an existing facility the Contractor shall make the necessary arrangements to maintain access to vital areas of the yard.

5.12 Various portions of the work will require testing by I.P. personnel or an outside testing agency. The Contractor will cooperate with the testing program and make his work accessible at all times.

~~5.13 Stripping and clearing of the borrow site is incidental to the contract. T Contractor shall be responsible for acquiring the legal rights to a borrow site and any ramifications resulting from the removal of the material.~~

5.14 If the work generates sufficient dust to cause complaints to be received by the Owner, the Contractor shall alleviate the situation at no cost to the Owner.

5.15 Unless otherwise specified, the entire subgrade (fill or existing), includi substation sites, shall meet the compaction requirements stated in Section 5.1. All holes, ruts, soft places, and other defects shall be corrected. no case shall the surface course, base course, or other items be placed on soft or unstable material or over areas that are not properly drained.

5.15.1 In cut sections the Contractor will be required to make the following efforts to obtain compaction of the material in accordance with the requirements of 5.1:

1. Cut plan ditches, which drain the area, to grade at least tw weeks prior to starting work on the subgrade.
2. Air dry the top 8 inches of subgrade, including at least two eight-inch depth processings utilizing discs or tillers each day for three consecutive good drying days.
3. Recompact the layer processed in the above paragraphs to achieve compaction results stated in 5.1. When the above wo has failed to produce satisfactory work, contact the Enginee to review the circumstances.

5.15.2 The subgrade shall be constructed so that after being compacted will conform to the alignment, grade, and cross section shown on the plans. Equipment of such weight or used in such a way as to cause a rut in the finished subgrade of one inch or more in dept shall be removed from the work or the rutting shall otherwise be prevented. Rutted areas shall be graded and rerolled with a smooth-wheeled roller.

5.16 A smooth surface is desired at the termination point of each type of mater used whether it is virgin subgrade, embankment material, crushed stone, or other construction materials. When a sheepsfoot roller is used, the area must be leveled at the finished grade. The interface between continuing layers of embankment are not to be leveled and are expected to exhibit a normal amount of "fluff" associated with an ongoing fill operation.

5.17 Unless specifically called out in the plans or specifications no sheet pili will be required. If, as construction proceeds, it becomes apparent sheet piling or a larger area will be needed for excavation contact the Engineer review the situation and determine how to proceed.

5.18 Traffic control, including provisions for the necessary barricades, flagmen and other items, is the responsibility of the Contractor.

5.19 Embankment operations shall comply with the following requirements:

1. Before any embankment is placed, all clearing and stripping over the entire area shall be performed. The top six inches of the exposed surface shall be disced, and then compacted to meet the requirements 5.1. When construction is resumed after any freezing weather the top eight inches of all partially completed embankments will be reworked and compacted to meet the requirements of 5.1 prior to placing more fill.

2. Embankment material will be specified in the General Section of the specifications. If required, the material shall be disced sufficient to break down oversize clods, mix the material, secure a uniform moisture content, and insure uniform density and compaction. Each layer of material shall extend the entire length and width of embankment, if possible, and shall be leveled when placed. Embankmen around structures is not to be placed until the concrete has attained its specified strength. Any rock larger than six inches in diameter will be removed from the fill.

3. If an embankment is to be constructed on an existing slope the existi slope shall have steps cut into it prior to starting construction of the embankment.

5.20 Topsoil shall not be placed until the area to be covered has been shaped, trimmed, and finished. All irregularities in the surface shall be filled o smoothed out before the top soil is placed. If the existing surface has become hardened or crusted it shall be disced or raked until broken up to provide a bond with the top soil. One rolling by a smooth drum of the surface will be required. All unsuitable debris and stones larger than thr inches in diameter shall be removed from the area.

5.21 Base course shall consist of crushed stone aggregate as specified in the General Section, bid units, or on the plans. The aggregate shall be deposited full-lane width directly on the subgrade, geotextile fabric (if specified), or previous layer of compacted base course in such a way to prevent segregation and require a minimum amount of blade work. Immediatel after placement of the material it shall be compacted by a rubber tired roller or vibratory smooth steel drum machine to the requirements of 5.1. I any subgrade material is worked into the base material during the operations all granular material affected will be removed and replaced with new aggregate at no cost to the owner.

6. INSPECTION BY OWNER

6.1 The Owner is responsible for testing the project materials and results of th work performed at regular intervals.

6.2 The Contractor will cooperate with the Owner at all times to provide access to the materials and site for testing purposes.

6.3 The Contractor shall submit the following information for each material within two weeks of the contract award:

1. Supplier's Name, Address and Telephone Number.
2. Pit/Facility Name, Address and Telephone Number.
3. Person in Charge at Pit/Facility.
4. Map, with Directions, Indicating Pit/Facility Location.

7. MEASUREMENT

~~7.1 The right is reserved to increase or decrease quantities, as required, with no increase in the unit price.~~

~~7.2 Items measured in units of weight may be paid for on a dry-weight basis at the discretion of the Engineer if the moisture content is found to be excessive. The bid units will not be affected unless the moisture content o coarse grained soils exceeds 12%, or 20% for fine grained soils.~~

~~7.3 Clearing will not be measured for payment and is incidental to the contract.~~

~~7.4 Pipe excavation and furnishing, placing, and compacting bedding will not be measured for payment and are to be included in the price bid per lineal foot of the pipe specified.~~

~~7.5 Cross section measurements and the average end area method shall be used to determine volumes of excavations or required material for embankments.~~

~~7.6 Embankment quantities shall be cubic yards of compacted material at the project site. The plan quantities will be used for bidding purposes. If there is a discrepancy between the successful bidder's take off quantities of more than plus 5% the Contractor shall notify the Engineer in writing prior to starting work. Arrangements will be made to cross section the project area after the embankment work is completed and the volume determined in accordance with these specifications. If the Contractor's quantities are less than 105% of the estimated contract quantities he shall be paid the contract quantities when the project is constructed to the lines and grades shown in the plans and specifications.~~

~~7.7 The following items will be measured in cubic yards:~~

1. ~~Embankment.~~
2. ~~Channel Excavation.~~
3. ~~Structure Excavation.~~
4. ~~Unclassified Excavation.~~

~~7.8 The following items will be measured in tons:~~

1. ~~Sand~~
2. ~~Gravel~~
3. ~~Crushed Gravel~~
4. ~~Crushed Stone Aggregate~~

~~7.9 Impervious backfill will not be measured for payment and will be considered incidental to the contract.~~

~~7.10 Porous backfill will be measured in tons of the specified material.~~

~~7.11 Stripping will be measured in cubic yards. The average depth of material to be removed and use of this material will be noted in the General Section at the beginning of the specification.~~

~~7.12 Top soil will be measured in square yards and include furnishing, excavating, transporting, placing, and grading the material as indicated in the plans and specifications. Depth of top soil will be 4 inches.~~

~~7.13 Geotextile fabric will be measured in square yards, not including laps or portions anchored in trenches.~~

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Soil Classification Chart

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests^A				Soil Classification	
				Group Symbol	Group Name^B
Coarse-Grained Soils More than 50 % retained on No. 200 sieve	Gravels More than 50 % of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5 % fines^C	$Cu \geq 4$ and $1 \leq Cc \leq 3^E$	GW	Well-graded gravel^F
			$Cu < 4$ and/or $1 > Cc > 3^E$	GP	Poorly graded gravel^F
		Gravels with Fines More than 12 % fines^C	Fines classify as ML or MH	GM	Silty gravel^{F,G,H}
			Fines classify as CL or CH	GC	Clayey gravel^{F,G,H}
	Sands 50 % or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5 % fines^D	$Cu \geq 6$ and $1 \leq Cc \leq 3^E$	SW	Well-graded sand^I
			$Cu < 6$ and/or $1 > Cc > 3^E$	SP	Poorly graded sand^I
		Sands with Fines More than 12 % fines^D	Fines classify as ML or MH	SM	Silty sand^{G,H,I}
			Fines classify as CL or CH	SC	Clayey sand^{G,H,I}
Fine-Grained Soils 50 % or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above "A" line^J	CL	Lean clay^{K,L,M}
			PI < 4 or plots below "A" line^J	ML	Silt^{K,L,M}
		organic	$\frac{\text{Liquid limit – oven dried}}{\text{Liquid limit – not dried}} < 0.75$	OL	Organic clay^{K,L,M,N} Organic silt^{K,L,M,O}
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay^{K,L,M}
			PI plots below "A" line	MH	Elastic silt^{K,L,M}
		organic	$\frac{\text{Liquid limit – oven dried}}{\text{Liquid limit – not dried}} < 0.75$	OH	Organic clay^{K,L,M,P} Organic silt^{K,L,M,Q}
Highly organic soils		Primarily organic matter, dark in color, and organic odor		PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12 % fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay

[D] Sands with 5 to 12 % fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10} \qquad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15 % sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15 % gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29 % plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30 % plus No. 200, predominantly sand, add "sandy" to group name.

[M] If soil contains ≥ 30 % plus No. 200, predominantly gravel, add "gravelly" to group name.

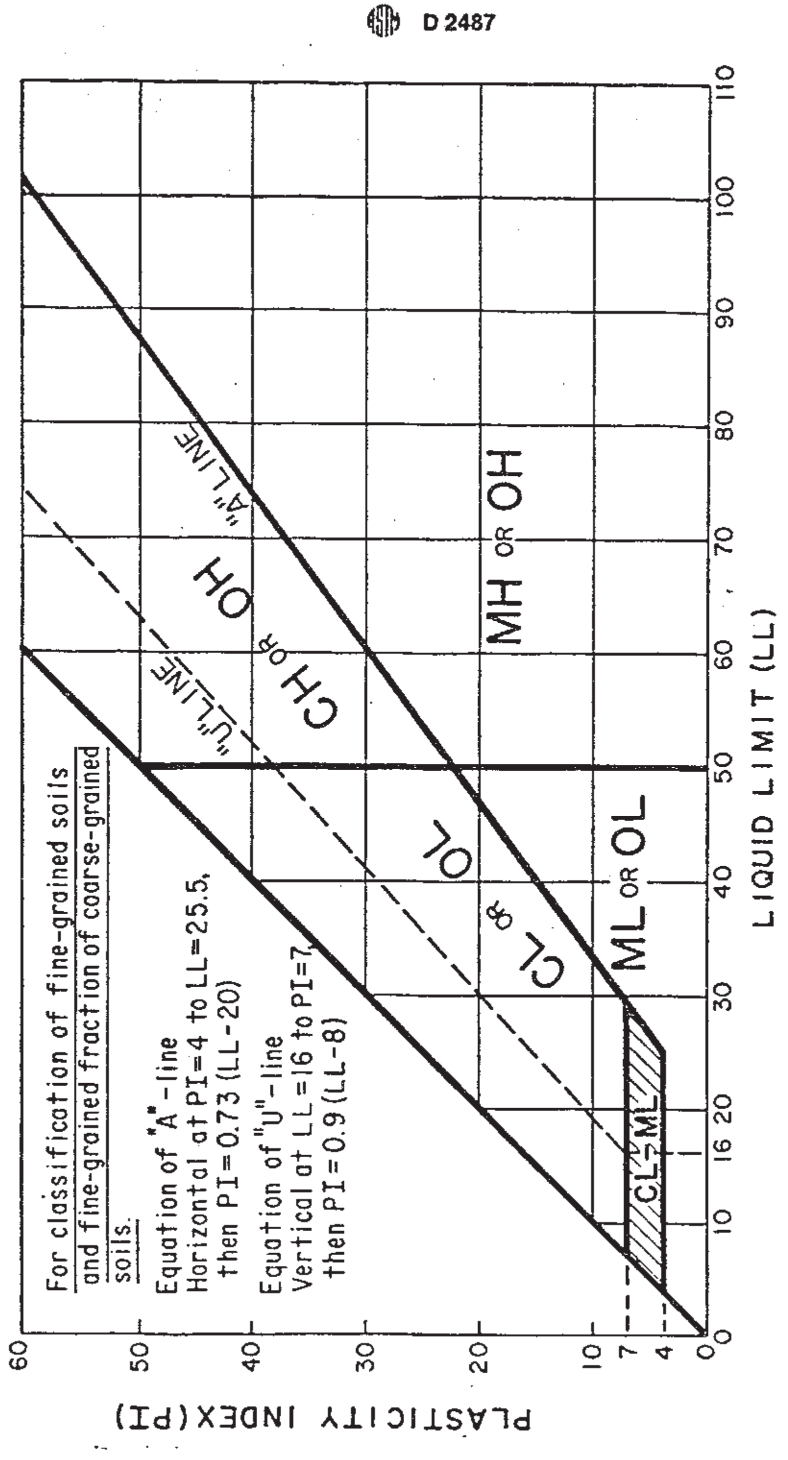
[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.

FIGURE 1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For classification of fine-grained soils and fine-grained fraction of coarse-grained soils.
Equation of "A"-line
Horizontal at PI=4 to LL=25.5,
then PI=0.73 (LL-20)
Equation of "U"-line
Vertical at LL=16 to PI=7,
then PI=0.9 (LL-8)
"U" LINE
"A" LINE
CH OR OH
MH OR OH
CL OR OL
ML OR OL
CL-ML
PLASTICITY INDEX (PI)
LIQUID LIMIT (LL)
0
4
7
10
20
30
40
50
60
0
10
16
20
30
40
50
60
70
80
90
100
110

FIGURE 2

SECTION III

Foundation Specifications

Portions of this work require the installation of reinforced concrete for foundations. This work shall be covered by the following specification.

Exposed edges shall be chamferred or rounded.

SPECIFICATION FOR THE INSTALLATION OF CONCRETE FOUNDATIONS

1. SCOPE

1.1 This specification covers the minimum requirements for concrete foundation installation.

1.2 Except as noted otherwise, the Contractor shall furnish all labor, material, tools, and equipment necessary for concrete work shown on the drawings and specified herein.

2. DEFINITIONS

2.1 The term "Contractor", as used in this specification, shall refer to the party of parties proposing to perform the work and provide the material herein specified.

2.2 The term "Owner", as used in this specification, shall refer to Illinois Power Company or its designated agent.

2.3 The term "Engineer", as used in this specification, shall refer to the Owner's Project Engineer.

2.4 All design terms and symbols shall be as defined in ACI 318.

3. REFERENCES

3.1 Any specification or document referred to in this specification is to be considered as part of this specification. In the event of conflict between this specification and referenced documents, the requirements of this specification shall take precedence. The following specifications, standards, and codes apply:

3.1.1 American Concrete Institute (ACI)

3.1.1.1 ACI 305R-77 - Recommended Practice for Hot-Weather Concreting.

3.1.1.2 ACI 306-66 - Recommended Practice for Cold-Weather Concreting.

3.1.1.3 ACI 308-71 - Recommend Practice of Curing Concrete.

3.1.1.4 ACI 315R-80 - Manual of Standard Practice for Detailing Reinforced Concrete Structures.

3.1.1.5 ACI 318-83 - Building Code Requirements for Reinforced Concrete.

3.1.1.6 ACI 347-78 - Recommended Practice for Concrete Formwork.

3.1.2 American Society for Testing and Materials (ASTM)

3.1.2.1 ASTM A82-76 - Cold-Drawn Steel Wire for Concrete Reinforcement.

3.1.2.2 ASTM A615-78 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

3.1.2.3 ASTM C31-69 - Making and Curing Concrete Test Specimens in the Field.

3.1.2.4 ASTM C33-78 - Concrete Aggregates.

3.1.2.5 ASTM C94-78 - Ready-Mixed Concrete.

3.1.2.6 ASTM C150-78 - Portland Cement.

3.1.2.7 ASTM C171-69 - Sheet Materials for Curing Concrete.

3.1.2.8 ASTM C309-74 - Liquid Membrane - Forming Compounds for Curing Concrete.

3.1.2.9 ASTM C494-77 - Chemical Admixtures for Concrete.

3.1.3 Illinois Department of Transportation (IDOT) - 1983 Specifications for Roads and Bridges.

4. WORK NOT INCLUDED IN THIS SECTION

4.1 Illinois Power Company will furnish all anchor bolts (when required), elevation reference stakes, and location stakes.

5. GENERAL REQUIREMENTS

5.1 All concrete work shall conform to ACI 347 unless otherwise specified. This work shall also be performed under the personal and constant supervision of a competent Construction Superintendent or Foreman experienced in concrete work.

5.2 The Contractor shall provide forms for all concrete work above and below ground.

5.3 The Company reserves the right to inspect all materials and make concrete tests.

5.4 If requested, the Contractor shall provide concrete test cylinders in accordance with ASTM C31 (two from each truckload) from the concrete placed for the structure foundations. Cylinders shall be dated and labeled as to the foundation and truckload number.

5.5 If the concrete test cylinders, whether made by the Contractor or a testing agency, fail to meet specified compressive strength, the Contractor shall replace any and all affected areas at his own cost.

6. MATERIALS

6.1 Cement shall be Portland Cement conforming to ASTM C150, Type I.

6.2 Fine aggregate shall be sand - clean, hard, durable, uncoated grains, free from deleterious substances, conforming to ASTM C33.

6.3 Coarse aggregate shall be washed gravel or crushed limestone - clean, hard, durable uncoated particles without flat or elongated pieces. Aggregate shall be free from deleterious materials and shall conform to ASTM C33. Gradation shall be No. 467 (1-1/2 inch) to No. 4 for all foundations except drilled piers. Gradation shall be No. 67 (3/4 inch) to No. 4 for drilled piers.

6.4 Water shall be clean and free from injurious amounts of oils, acids, salts, organic, or other deleterious matter.

6.5 Reinforcing bars shall conform to ASTM A615, Grade 60 unless otherwise noted on the foundation drawings. Reinforcing wire shall conform to ASTM A82. All reinforcing shall be free from hard rust, dirt, and oil.

6.6 Removable forms shall be wood, metal, approved fiber tubes, or other approved materials. Forms for exposed concrete surfaces shall be moisture-resistant concrete form plywood, uniformly thick boards lined with moisture-resistant concrete form plywood, or lined with hard, pressed, treated fiberboard.

6.7 Curing materials shall conform to ASTM C171. Curing compounds shall conform to ASTM C309.

6.8 Water-reducing admixtures shall conform to ASTM C494.

6.9 CA-6 road mix shall conform to IDOT specifications.

7 EXCAVATION

7.1 All excavated material shall be removed from the site and disposed of by the Contractor. Any affected ground area shall be returned to its former condition. Seeding and/or sodding may be required.

When soil conditions demand, casing will be allowed to help excavation. This casing shall be removed during placement of the concrete.

7.2 The actual depth of the foundation dig shall be within ± 6 inches from the required foundation depth given on the drawings. This depth shall be measured from an elevation reference stake provided at each structure.

7.3 If over-excavation occurs, the hole shall be filled with compacted CA-6 road mix up to the required depth.

8. FORMS

8.1 Forms shall conform to the shape, line, and dimensions of the members indicated on the drawings, and shall be substantial and tight to prevent leakage of mortar. They shall be properly braced or tied together so as to maintain position and shape. Lumber, once used in forms, shall have nails withdrawn, and the surfaces to be exposed to concrete shall be carefully cleaned before reuse.

8.2 Forms for exposed surfaces shall be coated with nonstaining mineral oil, applied before the reinforcing steel is placed. Before concrete is placed, surplus oil shall be removed from the contact face of forms and from reinforcing steel and other surfaces requiring bond with the concrete.

8.3 Forms shall not be disturbed until the concrete has adequately hardened and has gone through the first stage of curing, a minimum of 16 hours. Care shall be taken to avoid spalling the concrete surfaces. Wood forms and all particles of wood shall be completely removed.

9. REINFORCING

9.1 All bars shall be bent accurately, placed in position as shown on the drawings, securely tied with #16 gauge black, annealed wire at all intersections, and securely held in place by spacers, chairs, or other approved supports in accordance with ACI 315R. At time of placing concrete, all reinforcing shall be free of loose rust, scale, oil, paint, mud, or other coatings which will destroy or reduce the concrete bond. Unless otherwise shown on the drawings or specified, the spacing, amount of concrete coverage, splicing, and bending of reinforcing steel shall conform to the requirements of ACI 318.

9.2 Reinforcing shall not be welded unless approved by the Engineer.

9.3 Anchor bolts (when used) shall be a minimum of 6" from the bottom of the foundation. All steel shall have a minimum of 3" concrete cover.

9.4 Lap splices for reinforcement shall conform to requirements of ACI 318 Class B splices.

9.5 All anchor bolt threads shall be taped to protect them from dirt or concrete during construction.

10. TOLERANCES

10.1 Formwork shall be set and maintained so as to insure completed concrete work within tolerance limits.

10.2 Forms used for the round tops of drilled piers shall be placed concentric to the structure and to the rest of the foundation, and shall extend at least 6 inches but not more than 18 inches below ground (final grade).

10.3 Anchor bolts shall be secured plumb and true by use of a template at the top. Secure wiring or open steel template shall be used at the bottom of the anchor bolts.

10.4 If templates are not supplied with the anchor bolts, the Contractor shall furnish them. Template anchor bolt spacing shall not vary more than ± 1/16 inch.

10.5 Anchor bolts which are not plumb shall not be corrected by bending the tops of the bolts. Incorrectly located or out-of-plumb anchor bolts shall be corrected by removing and repouring the concrete containing the bolts.

10.6 Centerlines of anchor bolt groups shall not vary more than ± 1/8 inch.

10.7 Anchor bolt elevations shall not vary by more than ± 1/8 inch. The anchor bolts shall extend out of the foundation a distance equal to the thread length unless otherwise specified.

10.8 Top elevation of the finished foundation shall not vary more than ± 1/4 inch from the elevation indicated on the drawings. Foundation elevations for the same structure shall not vary more than ± 1/8 inch.

11. CONCRETE MIX

11.1 All concrete shall have a minimum compressive strength of 3500 psi at 28 days. The mix shall have a minimum of 5 1/2 sacks of cement per cubic yard and a maximum water cement ratio of .50 (by weight).

11.2 All concrete shall have 5 to 7 per cent entrained air.

11.3 All concrete except for drilled piers shall have a slump of 4 to 5 inches. Concrete for drilled piers shall have a slump of 5 to 7 inches.

11.4 Water-reducing admixtures may be used to help meet the above concrete mixture specifications, following admixture manufacture recommendations.

12. MIXING CONCRETE

12.1 Unless otherwise approved by Engineer, "Ready-Mixed" concrete shall be used for all concrete. It shall be mixed and delivered in accordance with the requirements set forth in ASTM C94.

13. PREPARATION FOR PLACING CONCRETE

13.1 Water shall be removed from excavations before depositing concrete unless a tremie chute is properly used to avoid mixing of fresh concrete with ground water. Any water flow shall be diverted through a proper side drain to prevent washing over freshly deposited concrete. Hardened concrete, ice, debris, and foreign materials shall be removed from form interiors and from mixing and conveying equipment.

13.2 The Owner shall be notified sufficiently in advance of the scheduled time for concrete placement to permit examination of forms and reinforcement. No concrete shall be poured until the Owner has approved reinforcing and forms. This inspection is a precautionary measure and in no way relieves the Contractor of responsibility for the accuracy of form and reinforcement.

14. PLACING OF CONCRETE

14.1 Equipment for conveying concrete shall be of such size and design as to insure a continuous flow of concrete without material separation at the delivery end.

14.2 Concrete shall be conveyed from the mixer as rapidly as practicable without segregation or loss of ingredients. Concrete shall be placed in forms as nearly as practicable in final position to avoid rehandling. Vibrators shall not be used to transport concrete within forms. The concreting shall be carried on at such a rate that the concrete is at all times plastic and flows readily into the spaces between the reinforcing bars. No concrete that has partially hardened, been contaminated by foreign materials, or retempered shall be used. Immediately after depositing, concrete shall be compacted in an approved manner by spading, rodding, forking, or vibrating to eliminate air pockets. Concrete placed in drilled piers below ten feet is not required to be compacted as previously described. All concrete shall be worked into corners around reinforcement and inserts to prevent voids, trapped water, or stone pockets.

14.3 Care shall be exercised in use of a vibrator to prevent segregation, sand pockets, or bleeding. The vibrator shall be moved continuously in and out of concrete, remaining stationary only a few seconds in any position.

14.4 Concrete shall be placed through a hopper to control the direction of fall and shall not strike the sides of the dig, reinforcement, or anchor bolts during placement. Chutes, if used, must slope sufficiently to insure flow of properly proportioned concrete.

14.5 Once concreting has begun, it shall be carried on as a continuous operation until the placing of the foundation is completed.

14.6 Adjacent surfaces shall be protected from concrete drippings, spillage, or splashes. Damaged surfaces shall be cleaned immediately.

14.7 Care shall be taken during placement of concrete in the forms at the top of each drilled pier such that no concrete ledges, caused by leakage of the mixture from below the forms, will remain below ground when forms are removed. If any such concrete ledges form, they shall be chopped flush with the surrounding pier surface.

14.8 If casing is used, the concrete level shall be maintained above the bottom of the casing until the groundline has been reached.

15. HOT-WEATHER REQUIREMENTS

15.1 All hot-weather concreting shall conform to ACI 305R unless otherwise specified.

15.2 The maximum temperature of mixed concrete shall be 90°F. Temperature of aggregates and mixing water shall be reduced by the use of chilled water or ice.

16. COLD-WEATHER REQUIREMENTS

16.1 All cold-weather concreting shall conform to ACI 306 unless otherwise specified.

16.2 Concrete damaged by freezing shall be removed and replaced.

17. CURING AND PROTECTION

17.1 All curing shall conform to ACI 308 unless otherwise specified.

17.2 After the concrete is placed, the structure shall not be erected for a minimum of 7 days and no load shall be applied to the structure for a minimum of 30 days, unless approved by the Engineer.

18. CONCRETE FINISHES

18.1 Tops of all foundations shall be floated and brought to a true level or sloped slightly, with a 1-inch beveled or rounded edge. Foundation tops shall be steel-troweled to obtain a smooth, dense surface.

18.2 Exposed formed surfaces shall be rubbed to the extent of removing small irregularities. Minor voids may be filled with cement mortar. The surface shall not be brush-coated with a cement paste after rubbing.

19. JOINTS

19.1 Construction joints shall not be allowed unless otherwise shown on the drawings or as directed and approved by the Engineer. Where a joint is to be made, a cross-type impression shall be formed in the concrete before it hardens. The impression length shall be a minimum of 2/3 of the foundation dimension in each direction and shall be 4 inches deep.

19.2 Immediately before the placing of new concrete, the hardened concrete surface shall be thoroughly cleaned, all laitance removed, and the surface slushed with a cost of cement grout.

SECTION IV

Erosion Control Specifications

General

Portions of this work require installation of erosion control measures. This work is governed by the following specification.

A firm base should be provided for the erosion control measures. Cut areas of the subgrade should be rolled to provide a smooth, straight surface. Fill areas should be adequately compacted to provide a firm, smooth surface also.

Temporary erosion controls (type, implementation, and maintenance), necessary to limit erosion from the site, are the responsibility of the Contractor.

Materials

Riprap and bedding material shall meet the following requirements:

1. Description. Riprap shall be stone quarried from undisturbed, consolidated deposits of rock reasonably free of shale and shaly stone. The ledges shall be sufficiently thick to produce the desired dimensions. The stone shall be reasonably free of laminations, seams, cracks, and other structural defects or imperfections tending to destroy its resistance to weather. Field stone or boulders will not be accepted. Bedding material shall be crushed stone, gravel or slag.

2. Quality. The riprap stone shall be quarried from ledges approved for Portland cement concrete quality stone provided the ledges are sufficiently thick to produce the desired dimensions. Ledges not previously approved shall be checked with ledge rock samples crushed to 1 1/2 inch top size. The riprap stone shall conform to Article 704.01, IDOT Specifications, Coarse Aggregate, Class A quality Na_2SO_4 soundness requirement. The bedding material for riprap shall conform to Article 704.01, IDOT Specification, Coarse Aggregate, class A quality Na_2SO_4 soundness requirement.

3. Gradation. The stone for riprap shall have a maximum weight per piece of 150 pounds and not more than 5 percent shall weigh less than 3 pounds per piece. The material shall be evenly graded and 30 to 70 percent of the material shall weigh 60 pounds or more per piece.

   Bedding material shall be well graded between the 3 inch and No. 4 sieves. 100% shall pass the 3 inch sieve with no more than 5 percent passing the No. 4 sieve. It shall be reasonably free from thin, flat and elongated pieces, and shall contain no organic matter nor soft friable particles in quantities considered objectionable by the Engineer.

Installation

This item shall consists of furnishing, transporting, and placing a protective course of stone, laid as riprap on slopes or in channels.

The bed for the riprap shall be trimmed and shaped so that the finished surface shall conform to the lines specified.

A bedding layer will be required for stone riprap. No bedding is required for concrete block riprap, broken concrete riprap or for stone or broken concrete dumped riprap, unless specified.

Bedding material shall be spread uniformly on the prepared base, in a satisfactory manner, to the neat lines specified. Placing of material by methods which will tend to segregate particle sizes within the bedding will not be permitted. Any damage to the surface of the bedding base during placing of the bedding shall be repaired before proceeding with the work. Compaction of the bedding layers will not be required but it shall be finished to present a reasonably even surface free from all mounds, windrows, or depressions. Bedding shall be a minimum of 4 inches in thickness.

Stone shall be placed on the bedding layer in such manner as to produce a reasonably well-graded mass of rock with the minimum practicable percentage of voids and shall be constructed to the lines and grades shown.

The stone riprap shall be placed to its full course thickness at one operation and in such a manner as to avoid displacing the bedding material. Placing of material shall begin at the lower elevations and progress up the slope. The larger stones shall be well distributed and the entire mass of stones in their final position shall be roughly graded to conform to the gradation specified. The finished riprap shall be free from objectionable pockets of small stones and clusters of larger stones. Placing riprap in layers will not be permitted. Placing riprap by dumping into chutes or by similar methods likely to cause segregation of the various sizes will not be permitted. The desired distribution of the various sizes of stones throughout the mass shall be obtained by selective loading of the material at the quarry or other source; by controlled dumping of successive loads during final placing or by other methods of placement which will produce the specified results. Rearranging of individual stones by mechanical equipment or by hand will be required to the extent necessary to obtain a reasonably well graded distribution of stone sizes as specified above. Stone riprap shall be a minimum of 18 inches thick.

SECTION V

Seeding

Scope

This specification covers the minimum requirements for seeding areas disturbed by construction activities, slope protection, and related operations.

General Requirements

All work shall be performed under the personal and constant supervision of a competent Construction Superintendent or Foreman.

The Company reserves the right to inspect all materials and perform all tests necessary to determine compliance with the specifications. If the materials or finished product fail to meet the controlling criteria for these tests, the Contractor shall replace all affected areas at this expense.

Each lot of seed furnished shall be tested by a State Agriculture Department (including states other then Illinois). All seeds shall comply with the requirements of the U.S. Department of Agriculture Consumer and Marketing Service, Rules and Regulations under the Federal Seed Act of August 9, 1939, issued March 1940, reprinted with amendments April, 1968, or any current revisions.

Acceptance of seeds furnished under this specification will be based on receipt and approval of a certification covering tests from each lot of seed. Certification shall consist of test reports showing the required test results of lots corresponding to the shipment and signed by the responsible personnel of the State Seed Laboratory.

Seeds shall be packed for delivery in suitable bags in accordance with standard commercial practice. Each bag shall be tagged or labeled as required by the Illinois Seed Law.

All sloped areas disturbed by construction activities shall be seeded with the Prairie mixture. The dikes, slopes and toe areas, shall be seeded with the Prairie mixture.

Flat areas disturbed by construction shall be seeded with the Grass mixture (borrow area, pipe run from plant to ash pond, and coal yard runoff ditch).

Operations

Seeding

Immediately prior to the seed bed preparation, fertilizer nutrients and agricultural limestone shall be uniformly spread at the designated rate over the areas indicated on the plans.

Agricultural ground limestone, conforming to the requirements of Article 717.06 of IDOT specifications, shall be thoroughly mixed, at the rate of two tons per acre, with surface soil before completion of ground preparations.

Fertilizer shall consist of nitrogen, phosphate, and potassium nutrients.

Fertilizer shall be applied at such rate that each acre will receive the following of available units:

Nitrogen 60 pounds
Phosphate (P_2O_2) 100 pounds
Potassium (K_2O) 100 pounds

Fertilizer can be placed during ground preparation or mixed with, and placed with, seed and mulch during final seeding.

All trimming, shaping, and finishing work on the disturbed area shall be completed prior to starting seed bed preparation. Stones, boulders, debris and similar material larger than two inches in diameter shall be removed from the seed bed area. The seed bed will be worked to a minimum depth of three inches, reducing all soil particles to a size smaller than two inches as the largest dimension. The prepared surface shall be relatively free from weeds, clods, stones, roots, sticks, rivulets, gullies, crusting, and caking.

No seed will be sown during unfavorable climatic conditions or when the ground is not in a proper condition for seeding.

All seeded areas, including slopes up to 3 to 1 or flatter, shall be rolled at right angles within 12 hours of seeding to compact the seed bed and place the seed in contact with the soil. Slopes steeper than 3 to 1 do not need to be rolled.

The optimum depth for seeding shall be 1/4 inch.

All legumes shall be innoculated per the manufacturers recommendations immediately before sowing.

Seeding operations shall be between June 1 and December 1.

Within 24 hours from the time the seeding has been performed, the seed bed shall be given a covering of mulch. On slopes steeper than 3 to 1, mulch shall be applied on the same working day.

Prairie seeding shall be done by hydraulic seeders or with a range land type grass drill. The water application rate for hydraulic seeding shall be greater than 500 gallons per acre. Non-toxic, non-permanent dye shall be added to each hydraulic seed batch to color the seeded area green or blue-green.

Slope Protection

Method A

Hay or straw mulch shall be hand or machine applied loose enough to permit air to circulate, but compact enough to prevent erosion. If baled material is used, care shall be taken that the material is in a loosened condition.

The mulch shall be stabilized by working the area with dull blades or disks. The blades or disks shall be without camber, notched, approximately 20 inches in diameter, spaced at 3(±) inch intervals, and equipped with scrapers. The stabilizer shall weigh approximately 1,000 pounds and be approximately six feet wide.

Method B

Paper mat shall be placed within 24 hours after seeding operations have been completed. Prior to placing the mat, the areas to be covered shall be relatively free of all rocks or clods over 1 1/2 inches in diameter, sticks, or other foreign material which will prevent the close contact of the mat with the seed bed. If the seed bed becomes crusted or eroded, the Contractor will be required to rework the soil until it is smooth and reseed such areas which are reworked. After the area has been properly shaped, fertilized, and seeded, the mat or blanket shall be laid out flat, evenly, and smoothly, without stretching the material.

Paper mat used as a ditch lining shall be applied with the lengths running parallel to the flow of water. Where more than one width is required, a lap joint not less then 4 inches shall be used with the upslope width on top.

An anchor slot shall occur at the upslope edge of the paper mat placement. This is accomplished by burying at least 6 inches of the end of the mat vertically in a slot dug in the soil. The soil shall be firmly tamped against the jute in the slot.

Junction slots shall be used to join the ends of successive lengths. For junction slots, the upslope end of each strip of paper mat shall be buried at least 6 inches in a slot dug in the earth. Soil shall be firmly tamped against the mat in the slot. The ends of the mat shall overlap at least 12 inches with the upslope section on top.

Check slots shall be constructed by placing a tight fold at least 6 inches vertically into the soil. On ditch grades of 4 percent or less, such check slots shall be spaced so that a check or junction slot occurs within each 50 feet. On grades greater then 4 percent, such slots shall occur within each 25 feet.

A terminal fold shall occur at the bottom end of the mat. This end shall be folded under approximately 4 inches and stapled to the ground.

Paper mat shall be held in place by means of wire staples. Staples shall be driven perpendicular to the plane of the soil. Staples shall be spaced not more than three feet apart in three rows for each strip, with a row along each edge and one row spaced alternately in the middle. All ends of mat and check slot locations shall be fastened by staples spaced six inches apart across the width.

When paper mat is used on cuts or fills, the mat may be placed with the length running from top to toe of slop or placed with the length running parallel to the contour. Check slots will not be required when the mat is placed on cuts or fill.

Materials

Seeding Mixtures

Crown Vetch	Seeds	lbs./Acre
Spring	Crown Vetch	20
	Perennial Ryegrass	10
	Lespedeza, Ladino, Alfalfa, White Dutch Clover*	5
Fall	Crown Vetch	20
	Winter Vetch	40

* Lespedeza shall not be sown north of US 136.

Grass	Seeds	lbs./Acre
Spring	Ky. Bluegrass	50
	Perennial Ryegrass	20
	Redtop or Creeping Red Fescue	10
	Ladino or White Dutch Clover	5
Fall	Ky. Bluegrass	50
	Perennial Ryegrass	20
	Redtop or Creeping Red Fescue	10
	Spring Oats	48

Prairie

Seeds	lbs./Acre
Big Bluestem - Andropogon Gerardi	6
Little Bluestem - Andropogon Scoparius	3
Prairie Wild Rye - Elymus Canadensis	1
Side - Oats Grama - Bouteloua Curtipendula	3
Indian Grass - Sorghastrum Nutans	6
Switch Grass - Panicum Virgatum	1
Perennial Ryegrass	20
Prairie Forbs Mixture	2
Amorpha Canescens - Lead Plant and Inoculant	
Aster Laevis - Smooth Aster	
Aster Novae-Angliae - New England Aster*	
Ceanothus Americanus - New Jersey Tea	
Coreopsis Palmata - Prairie Coreopsis*	
Echinacea Pallida - Pale Purple Coneflower*	
Eryngium Yuccifolium - Rattlesnake Master**	
Liatris Pycnostachya - Prairie Blazing Star	
Monarda Fistulosa - Prairie Bergamot	
Parthenium Integrifolium - Prairie Quinine	
Petalostemum Candidum - White Prairie Clover	
Petalostemum Purpureum - Purple Prairie Clover	
Potentilla Arguta - Prairie Cinquefoil	
Ratibida Pinnata - Yellow Coneflower*	
Rudbeckia Hirta - Black-eyed Susan*	
Rudbeckia Subtomentosa - Sweet Coneflower*	
Silphium Laciniatum - Compass Plant**	
Silphium Terebinthinaceum - Prairie Dock**	
Solidago Rigida - Rigid Goldenrod*	

The prairie forbs seed mixture shall be subject to the following requirements:

1. The mix shall contain not more than 15% of any one kind of seed.
2. The mix shall consist of not less than 10% of each species indicated with a single asterisk (*).
3. The mix shall contain not less than 1% of each species indicated with two asterisks (**).
4. The mix may contain not more than 5% of annuals, grasses or other plants not indicated in the above list.

Seed mixture shall be proportioned by weight.

No seeds shall be sown until they have been tested for purity and until such tests indicate that the seeds do not contain any seeds of the noxious weeds classed as "Primary Noxious Weed Seed" in the existing Illinois Seed Law, and not more than the maximum number per ounce sample, specified in Table II, Noxious Weeds classed as "Secondary Noxious Weed Seed" in the existing Illinois Seed Law.

In determining the viable germination percent of legumes, the percent hard seed is to be added to the percent test germination; however, the percent hard seed added shall not exceed the maximum specified in Table II when planted in the fall season.

Seeds having a purity that is below the purity specified in Table II will be rejected. Seeds having a total inert matter and weed seed content greater than 20% of the sample in cases of bluegrass, redtop, orchard grass, brome grass, and creeping red fescue, and greater than 3% in all other agricultural seeds listed in Table II, will be rejected. Any sample containing more than 5% by weight of seed of other cultivated plants will be rejected. Seeds that fail to meet the requirements of Table II, "Maximum Weed Seed Percent" and "Remarks" will be rejected.

Pure, live seed shall be defined as the sproutable seed of a specified variety and calculated as the product of the viable germination times the purity. The seed weights per acre listed are designed to yield specific amounts of pure, live seed per acre based on the pure, live seed percent values listed in Table II. Seed which has actual pure, live seed yield according to tests less than the intended yield will have the specified quantity adjusted to meet the intended pure, live seed yield. The adjusted weight to be sown will be calculated as follows:

Variety of Seeds	Hard Seed Percent Maximum	Purity Percent Minimum	Pure, Live Seed Percent Minimum	Weed Percent Maximum	Secondary Noxious Weeds Number per Ounce Maximum Permitted*	Remarks
Alfalfa	20	92	89	0.50	6	Note 1
Brome Grass	-	75	68	2.00	5	-
Clover, Alsike	15	92	87	0.30	6	Note 2
Clover, Crimson	15	92	83	0.50	6	-
Clover, Ladino	15	92	89	0.30	6	-
Clover, Red	20	92	89	0.30	6	-
Clover, White Dutch	30	92	88	0.30	6	Note 3
Dawson Red Fescue	0	97	85	0.10	3	-
Fescue, Alta or KY. 31	-	92	88	1.00	6	-
Fescue, Creeping Red	-	75	82	1.00	6	-
Fults Salt Grass	0	98	85	0.10	2	-
Kentucky Bluegrass	-	75	72	0.50	7	Note 5
Lespedeza, Korean	20	92	84	0.50	6	Note 3
Oats	-	92	88	0.50	2	Note 4
Orchard Grass	-	75	70	1.50	5	Note 4
Redtop	-	75	78	1.80	5	Note 4
Reed Canary Grass	-	92	63	1.00	5	-
Ryegrass, Perennial, Annual	-	92	88	0.50	5	Note 4
Rye, Grain, Winter	-	92	83	0.50	2	Note 4
Scaldis Hard Fescue	0	97	85	0.10	3	-
Timothy	-	92	84	0.50	5	Note 4
Vetch, Crown	30	92	67	1.00	6	Notes 3 & 6
Vetch, Spring	30	92	88	1.00	2	Note 4
Vetch, Winter	15	92	83	1.00	2	Note 4
Wheat, Hard Red Winter	-	92	89	0.50	2	Note 4

Note 1. Shall be grown in Kansas or farther north; shall be free from any mixture with southern or foreign seeds, blends or adulterations with screenings, frosted or damaged seeds; and shall not contain more than 0.2 percent bur or sweet clover mixture.

Note 2. Shall be free from blends or adulterations with screenings, blasted, shriveled or immature seeds.

Note 3. Shall be hulled and free from blends or adulterations with blasted, shriveled or immature seeds.

Note 4. Shall be recleaned.

Note 5. Shall not contain more than 5 percent adulteration with Canada Blue Grass, Merion Blue Grass or other hybrids or varieties of blue grass.

Note 6. Shall be scarified.

* No primary Noxious Weeds are permitted.

$$\text{Adjusted pounds per acre} = \frac{\text{Intended pure live seed per acre} \times 100}{\text{Actual pure live seed percent}}$$

Intended pure, live seed per acre equals the product of the specified pounds per acre and pure, live seed percent.

$$\text{Actual pure live seed percent} = \frac{\text{Actual germination percent} \times \text{Actual purity percent}}{100}$$

Seeds which meet the noxious weed seed and purity requirements may be sown prior to the completion of the germination test provided 115 percent of the specified amount is sown.

Straw shall be stalks of air-dried wheat, rye, oats, or other approved straw.

Hay shall be air-dried. Hay shall be obtained from fields of timothy, redtop, or mature brome grass.

Staples shall be made from No. 11 gage or heavier wire, width 1 or 2 inches at the throat and 6 inches from top to bottom after bending. The staples shall be packaged in cartons.

Paper mat shall consist of a knitted construction of polypropylene yarn with uniform openings interwoven with strips of biodegradable paper designed to degrade over selected periods of time recommended by the manufacturer and approved by the Engineer for each installation.

The paper mat shall be furnished in rolls which can be easily handled. The rolls shall be packaged with suitable protection for outdoor storage at a construction site in a manner which protects them from biodegradation prior to use.

The weight of the paper mat shall be approximately 0.2 pounds per square yard.

SECTION VI

Slurry Wall Construction

General

A portion of this project requires construction of an impermeable barrier(s) (soil-bentonite slurry backfill) to impede the flow of water from the wet ash disposal facility into the surrounding soil. The perimeter slurry wall system shall provide a combined minimum width of 8 ft. of soil-bentonite slurry backfill. The soil-bentonite slurry backfill shall have a hydraulic conductivity of less than 1×10^{-7} cm/sec. The barrier(s) shall be keyed into the clay core and shale aquaclude.

Soil boring information is located in Sections VI and X of these specifications. Additional borings may be performed by the Contractor if more information is desired at no cost to the Company. The Company anticipates performing 12 more borings (B-J1 to J12) prior to construction. This information will be made available to the Contractor.

Construction of the slurry wall(s) shall be performed after stripping or clearing of the area has been performed. The clay core and other dike material will be placed or cut to the level necessary to start excavating for the slurry wall(s). Material excavated from the trench may be used as a slurry component if it is found to be suitable for this application.

The soil-bentonite slurry backfill is the key component in isolating the groundwater outside the pond from mixing with any of the ash sluice water. Therefore, installation of the soil-bentonite slurry backfill is planned to be continuous around the pond.

Definitions

API - American Petroleum Institute
ASTM - American Society for Testing and Materials
EM - Engineering Manual of the Department of the Army, Corps of Engineers
Owner - Illinois Power Company
Slurry Trench (Slurry Wall) - A narrow vertical-walled trench of specified width excavated by the slurry trench method and backfilled with the specified materials to form a cutoff wall of low permeability.
Slurry Trench Technique - A method of excavating a narrow vertical-walled trench using a specified slurry mixture to support the trench walls, form a filter cake on and in the trench walls, and prevent movement of water through the excavated trench.
Water-Bentonite Slurry - A stable colloidal suspension of powdered bentonite in water.
Soil-Bentonite Slurry Backfill - A homogeneous mixture of specified soil material, bentonite, and water.

Slurry Trench Specialist - An individual or company who has had proven and successful experience in slurry trench construction and is knowledgeable with regards to the following: 1) the use, testing, and control of bentonite as a slurry: 2) the proper mixing methods employed to mix the slurry and backfill methods; 3) excavation and backfill operations; and 4) construction equipment and testing requirements needed for slurry trench construction.

Working Platform - The surface of compacted fill and/or excavated surface on which the slurry wall should be constructed.

Qualification of Contractor

The Contractor shall submit evidence indicating competence and experience in slurry wall construction. This information shall include a list of projects and clients (addresses and phone numbers) served in the last three years. The Contractor shall name the Slurry Trench Specialist who will be charge of this construction. All information will be submitted with the bid package.

Preconstruction Design

The Contractor shall include as part of this project a slurry wall design incorporating all the items mentioned in this specification. The preconstruction investigation will determine the proper blend of material and work to achieve the stated specifications and goals.

Materials shall be tested for compatibility with all waste streams to be routed to the ash pond. Materials to be incorporated into the work shall be compatible with all wastes routed to the ash pond.

Permeability of the soil-bentonite slurry backfill shall be determined by testing of various mixtures of materials and bentonite to determine a range of weights/components needed to achieve the desired results.

The results of the preconstruction testing shall be submitted to the Owner for review prior to beginning any construction on the soil-bentonite slurry backfill. The report will include the following:

1. Soil bentonite slurry backfill mix design
   Trial mix reports including compatibility testing
   Chemical analysis of water supply
   Mix proportions
   Density
   Moisture Content
   Gradations
   Hydraulic conductivity on at least four samples of the proposed mix design
   Porosity of soil-bentonite slurry backfill
   Other parameters necessary to provide a satisfactory design

2. Specifications of the batch plant and layouts showing locations of equipment, ponds, tanks, pumps, valves, hoses, and supply lines.

3. Source of all imported material
(Shipment of materials to the site shall include the shipper's written verification of the quality or specification of the material.)

4. Certification of bentonite quality (API 13A)

5. Capping detail for soil-bentonite slurry backfill barrier(s).

Specifications and Goals

1. The gradation and materials used for the backfill shall be such that the soil-bentonite slurry backfill barrier(s) achieves an effective, long-term hydraulic conductivity of less than 1×10^{-7} cm/sec with Vermilion Ash Pond leachate as the permeant.

2. The eventual height of the embankment will be elevation 660. This will place a significant hydraulic head and earth load on the slurry backfill. Trench stability and elimination of long term deformations are long range goals. The minimum long term soil-bentonite slurry backfill barrier(s) width desired is 8 ft. or multiple widths to attain an equivalent thickness. The Contractor's report shall address this issue and provide a design that will yield a soil-bentonite slurry backfill with the required minimum thickness even after the application of the long term loading.

3. All efforts shall be made to provide a continuous, homogeneous mixture of soil and bentonite within the trench and the occurrence of "windows" of material having a hydraulic conductivity of greater than 1×10^{-7} cm/sec shall not be allowed.

4. The completed soil-bentonite slurry backfill cutoff wall shall not crack, shrink, or undergo other physical changes which may adversely affect the hydraulic conductivity of the barrier over the design life of the facility.

5. The required depth of the trench shall be to the top of competent, solid bedrock but no less than 4 ft. of penetration. Bedrock shall be defined as material of such strength that it satisfies all of the following:

   a. It cannot be excavated or removed by grabbing, scraping, or rotary scraping action under full down pressure of clamshell backhoe rock bucket.

   b. The above tools, when used after chiseling operations, shall consistently recover either rock fragments only or no material at all.

   c. Rock fragments removed shall be geologically consistent with the rock type underlying the site as based on rock cores.

d. After excavating to the required depths, the Contractor shall take all necessary measures to remove all loose material or cuttings from the bottom of the trench with the excavation tools or by other suitable means such as air lift or suction pumps.

6. Slurry shall consists of a stable colloidal suspension of bentonite in water and shall be controlled by the current API Standard 13B - "Standard Procedure for Testing Drilling Fluids". The slurry shall be a mixture of not less than 18 pounds per barrel (42 gallons) of bentonite and water. Additional bentonite may be required depending on the hardness and temperature of the water and the quality of the bentonite.

   The slurry shall have a minimum apparent viscosity of 15 centipose or 40 seconds reading through a Marsh Funnel Viscosimeter, and a maximum filtrate loss of 30 cubic centimeters in 30 minutes at 100 psi.

   The slurry mixture in the trench shall have a unit weight of not less than 64 pcf and not greater than 94 pcf.

7. Bentonite used in preparing slurry shall be pulverized (powder or granular) premium grade sodium cation montmorillonite (unless preconstruction testing finds this material incompatible for the intended use) and shall meet the current API Standard 13A "API Specifications for Oil-Well Drilling-Fluid Materials".

8. Water shall be fresh, free of excessive amounts of deleterious substances that adversely affect the properties of the slurry. It is the responsibility of the Contractor that the slurry resulting from the water shall always meet the standards of this specification.

9. Admixtures or additives shall not be used unless the use of these items was presented and discussed in the preconstruction report.

10. The material for trench backfilling shall be composed of slurry and selected soils obtained from the project site and trench excavation. The soil shall be friable and free from roots, organic matter, or other deleterious materials. The backfill shall be thoroughly mixed and reasonably well graded between the following gradation limits:

Screen Size (US Standard)	Percent Passing By Dry Weight
3"	<95%
#200	>15%

The above limitations are considered minimums and the fines may be increased to provide the necessary impermeability.

11. Backfill slurry mixture shall include sufficient percentage of bentonite to meet the requirements herein specified.

Installation

Excavation of the slurry trench shall be accomplished by the use of any suitable earth moving equipment or combination thereof such as a backhoe and/or clamshell so that the required trench width can be carried to its final depth of cut continuously along the trench line. Special chopping, chiseling, or other suitable equipment may be used as necessary to satisfactorily accomplish the work.

The slurry batching plant shall include the necessary equipment including a mixer capable of producing a colloidal suspension of bentonite in water, pumps, valves, hoses, supply lines, and other appurtenances to adequately supply slurry to the trench. Storage will be the Contractor's responsibility. Slurry shall be agitated or recirculated in the ponds to maintain a homogenous mix. No slurry is to be made in the trench. Mixing shall continue until all bentonite particles are fully hydrated.

Mixing equipment for the backfill may consist of suitable earth moving equipment capable of thoroughly mixing the soil and slurry into a homogenous paste having the required gradation and properties free from large lumps or pockets of fines, sand or gravel. Occasional lumps of up to 6 inches in their largest dimension will be permitted. The backfill shall have a slump of 2 to 6 inches just prior to placing. Backfill materials shall be sluiced with slurry during blending operations, but sluicing with water will not be permitted.

Excavation shall be carried to the final depth of the point where excavation is started and continued along the line of the trench. Excavation shall proceed from the starting point to the finish point. Slurry shall be introduced into the trench at the same time trenching is begun and shall be maintained in the trench during excavation until backfilled. The Contractor shall maintain the stability of the excavated trench at all times for its full depth. The level of the bentonite slurry shall always be maintained within 2 ft. of the top of the excavation and higher if necessary to prevent sloughing of the walls. The Contractor shall be prepared to raise the slurry level at any time. To this end, the Contractor's personnel shall be on call on weekends and/or holidays.

The backfill shall be placed continuously from the beginning of the trench, in the direction of the excavation, to the end of the trench. The toe of the slope of the trench excavation shall precede the toe of the backfill slope so that the toe of the backfill shall not be less than 50 ft. following the toe of the excavation, or as required to permit proper cleaning of the trench bottom and permit inspection and measurement. Placing operations shall proceed in such fashion that the surface of the backfill below the slurry shall follow a reasonably smooth grade and not have hollows which may trap pockets of slurry during subsequent backfilling. Free dropping of backfill material through the slurry will not be permitted. Initial backfill shall be placed by lowering it to the bottom of the backfill rises above the surface of the slurry trench at the end of the trench. Additional backfill may then be placed in such a manner that the backfill enters the trench by sliding down the forward face of the previously placed backfill. To accomplish this, sufficient backfill shall be piled on the edge of the existing backfill to cause a slump and sliding action on the face of the in-place backfill. Methods of placement that cause segregating of the backfill will not be permitted.

The cut-off trench shall be capped upon completion of backfill placement before drying of the backfill can occur.

After the soil-bentonite slurry backfill work has been completed, all remaining excavated material and slurry shall be removed and the working platform cleaned and leveled. All storage ponds shall be pumped dry and destroyed. Excess slurry shall be spread in thin layers in adjacent areas designated by the Company's Representative.

Quality Control

The following schedule (Table 1) shall be considered as a minimum amount of testing to be performed during construction of the slurry wall by the Contractor.

Table 1

Quality Control Testing Program

	Item	Standard	Type of Test	Minimum Frequency	Specified Values
Materials	Water	--	-- pH -- Total hardness	Per water source or as changes occur	As required by bentonite supplier to properly hydrate bentonite with approved additives.
	Additives	--	Manufacturer certificate of compliance with stated characteristics		As approved by Engineer.
	Bentonite	API Std. 13A	Manufacturer certificate of compliance		Premium grade sodium cation** montmorillonite.
Slurry	Prepared for placement into the trench	API Std. 13B	- Unit weight - Viscosity - Filtrate loss	1 set per shift and per batch (pond)	Unit weight - 1.03-1.30 gm/cc V $\geq$ 15 centipose or 40 sec-Marsh @ 20°C Loss $\leq$ 30 cc in 30 min

Item		Standard	Type of Test	Minimum Frequency	Specified Values
				@ 690 kilopascal	
	In trench	API Std. 13B 1	- Unit weight	1 set per shift at point of backfilling	Unit weight - 1.03-1.30 gm/cc
			- Sand content	1 set per shift	
Backfill Mix *	At trench	ASTM C143	- Slump	1 set per 375 M^3	Slump 10 to 15 cm
		ASTM D422	- Gradation	1 test per 375 M^3	Consistent with design mix mix $\geq$ 15% passing #200 sieve, % bentonite not less than % specified in design mix
		ASTM C138	- Density	1 test per 375 M^3	$\geq$ 1.6 gm/cc
		EM1110-2-1906	- Triaxial hydraulic conductivity test	1 test per 2000 M^3	$\leq 1 \times 10^{-7}$ cm/sec

Notes:

* Hydrometer testing of off-site borrow shall be required if said borrow contains greater 0.5% -2 material, for use in computing % bentonite in backfill mix.

** Dependent on compatibility testing.

The above testing shall be performed by the Contractor. Results of all tests will be recorded on forms acceptable to the Owner and signed by the Contractor's Slurry Trench Specialist. Signed copies will be submitted daily to the Company's Representative.

The Company shall retain an independent testing firm to perform additional tests. Any discrepancy between the results of the two tests shall halt work immediately until the discrepancy is resolved. Any loss of productivity or time caused by such a delay shall be considered incidental to the Contract and cannot be claimed by the Contractor against the Company. The independent agency shall also evaluate the overall cutoff wall continuity and hydraulic conductivity of random samples. Failure of the installed soil-bentonite slurry backfill on either of these items will be cause for remedial work by the Contractor at no additional cost to the Company.

SECTION VII

Raw Water Chemistry

The following table contains the results of various tests performed on raw water samples taken from the reservoir adjacent to the plant. This water is pumped from the Vermilion River to the reservoir. While there may be some differences in the water between the river and reservoir the results are provided as a guide to the type of water contained in the river and reservoir. While the information is believed to be representative and accurate, no claim is made that the makeup of the water at the time of construction will be exactly as shown in the table.

It should be noted that water testing is part of the preconstruction report.

APPENDIX A

VERMILION-RAW WATER (RESERVOIR)

DATE	pH	P.ALK.	T.ALK.	HARD.	TURB.	TSS	TDS	TOC	SO4	Cl	T.SiO2	S.SiO2	Ca	Mg	Na	Fe	Al
		mg/l	mg/l	mg/l	NTU	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
03/86	8.5	5	133	300	7.6	12.0	340	3.2	120	20.2	4.4	3.7	74	28	9.9	0.310	<0.5
04/86	8.3	0	145	317	1.8	6.1	340	2.9	120	20.4	4.8	0.6	76	31	10.0	0.072	<0.5
05/86	7.1	0	142	317	3.0	3.0	360	3.4	120	19.7	14.3	2.2	75	31	8.6	0.098	<0.5
06/86	7.7	0	121	246	0.7	1.1	300	3.2	110	20.4	5.9	1.6	54	27	7.7	0.066	<0.5
07/86	7.9	0	140	276	2.3	4.4	350	3.3	98	18.7	5.2	3.4	63	29	8.0	0.043	<0.5
08/86	8.0	0	110	224	2.8	9.3	320	4.0	85	19.8	6.5	2.9	42	29	8.9	0.035	<0.5
09/86	7.8	0	140	266	2.2	4.2	328	3.6	96	20.5	4.6	4.0	57	30	8.7	0.110	<0.5
10/86	7.8	0	133	254	2.6	3.9	316	3.6	109	19.2	4.4	3.5	54	29	10.0	0.130	<0.5
11/86	8.2	0	144	271	1.7	5.9	350	4.0	109	19.6	5.2	3.9	56	32	10.1	0.089	<0.5
12/86	8.4	8	158	279	4.6	4.7	353	3.8	92	22.0	4.4	4.8	59	32	10.0	0.053	<0.5
01/87	8.0	0	152	321	2.2	2.5	365	3.7	116	20.5	5.0	4.9	66	38	10.1	0.086	<0.5
02/87	8.4	6	166	297	1.7	2.3	376	3.6	120	21.5	5.2	5.2	58	37	10.6	0.040	<0.5
03/87	8.1	0	158	314	3.2	35.2	393	3.2	109	21.1	8.4	4.0	68	35	10.3	0.106	<0.5

SECTION VIII

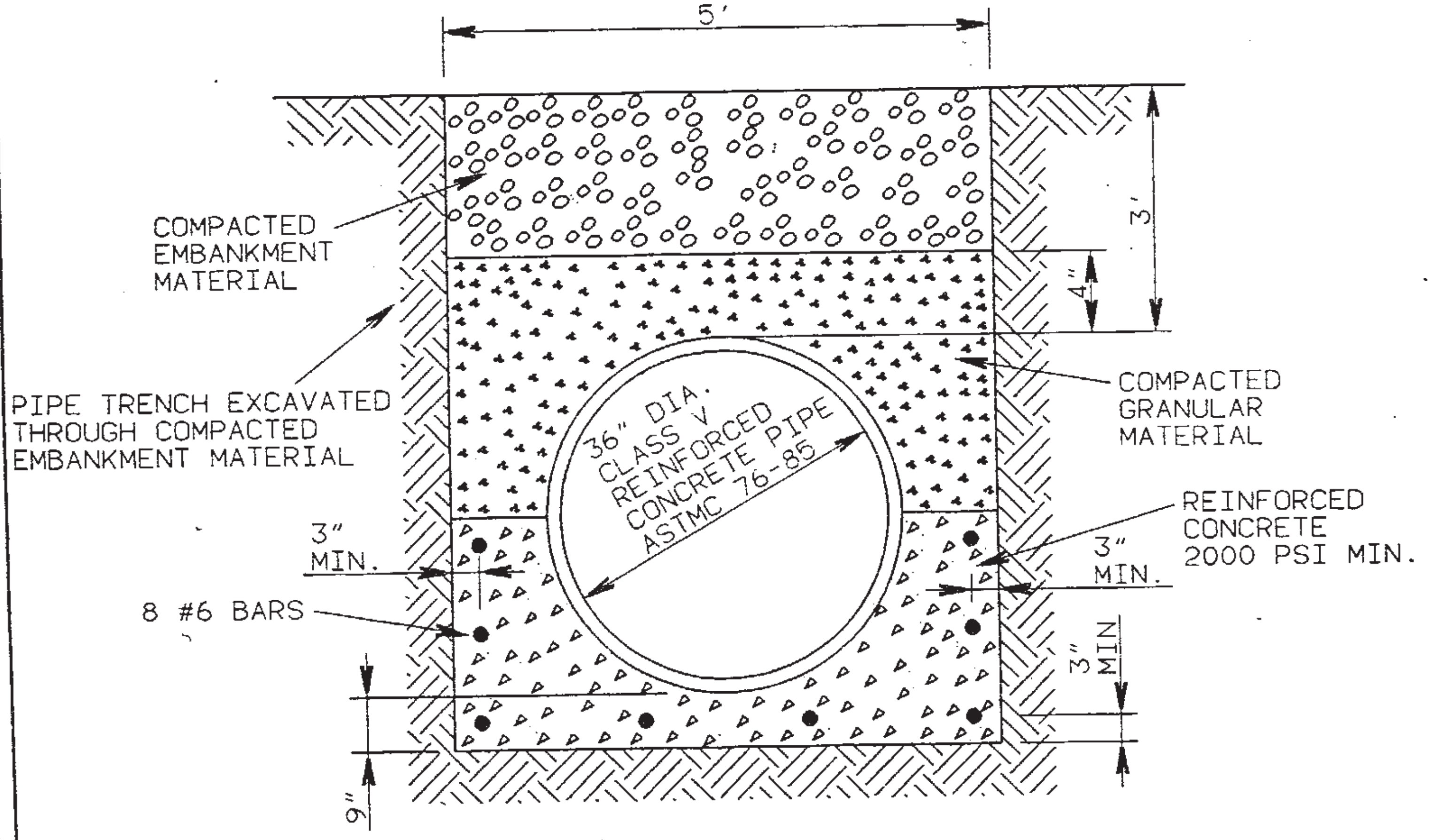
Piping

General

Ash sluice piping material and installation will be performed by others at a later date.

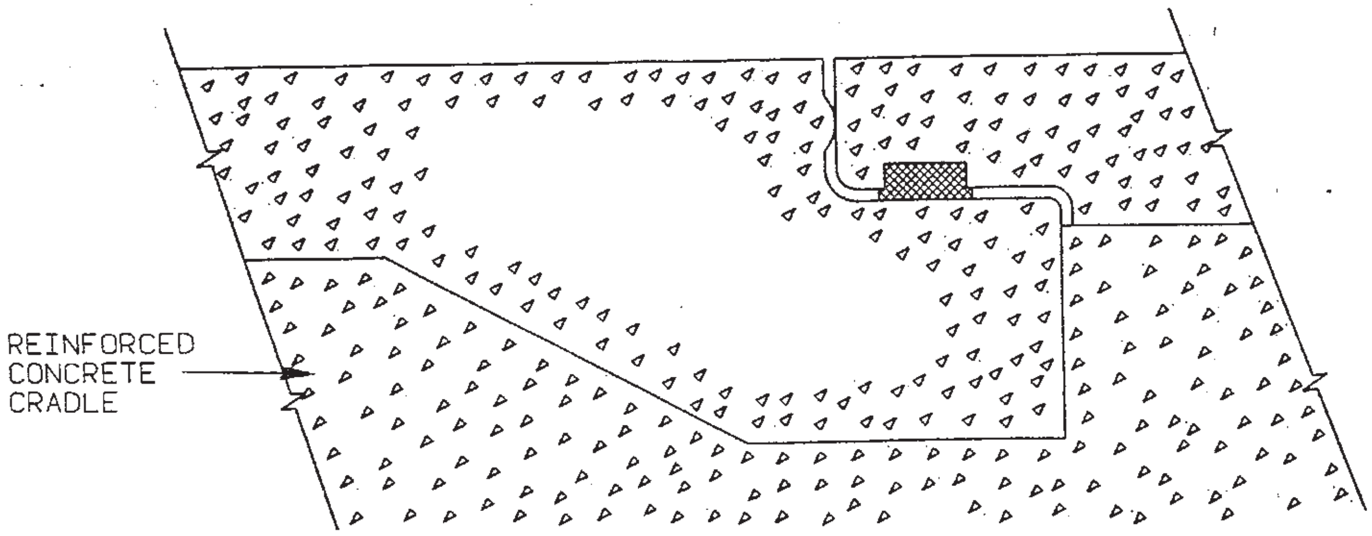
Corrugated metal pipe/pipe arch culverts shall be formed from precoated galvanized steel sheets. Thickness of the sheets shall correspond to the IDOT specifications for Type 2A CMP for road culverts.

Reinforced concrete pipe shall be used for all ash pond piping. Class V pipe with spigot groove type joints and O-ring gaskets shall be used. A reinforced concrete pipe cradle shall be required under all ash pond dikes as shown on the following detail.



TRENCH BEDDING DETAIL

CLASS A TYPE BEDDING - REINFORCED CONCRETE ARCH



TYPICAL CROSS SECTION

SPIGOT GROOVE TYPE JOINT WITH O-RING GASKET ASTMC 443-85

NO	DATE	DRF	DESCRIPTION	E	C	A
0						

ILLINOIS POWER COMPANY
DECATUR

DETAIL - TRENCH BEDDING
OF OUTFALL PIPING
VERMILION POWER STATION

DR WJM	CAD WJM	DATE 7-27-88
CK	CKD	SCALE NONE
APP	PRINTED 8-3-88	A-SK.26869-11
APP		

M-02081

SECTION IX

Hydrogeologic Study

The following study is provided as general information concerning the project. Any interpretation and use of the information by the Contractor is at the Contractor's risk.

APPENDIX D. BORING DATA

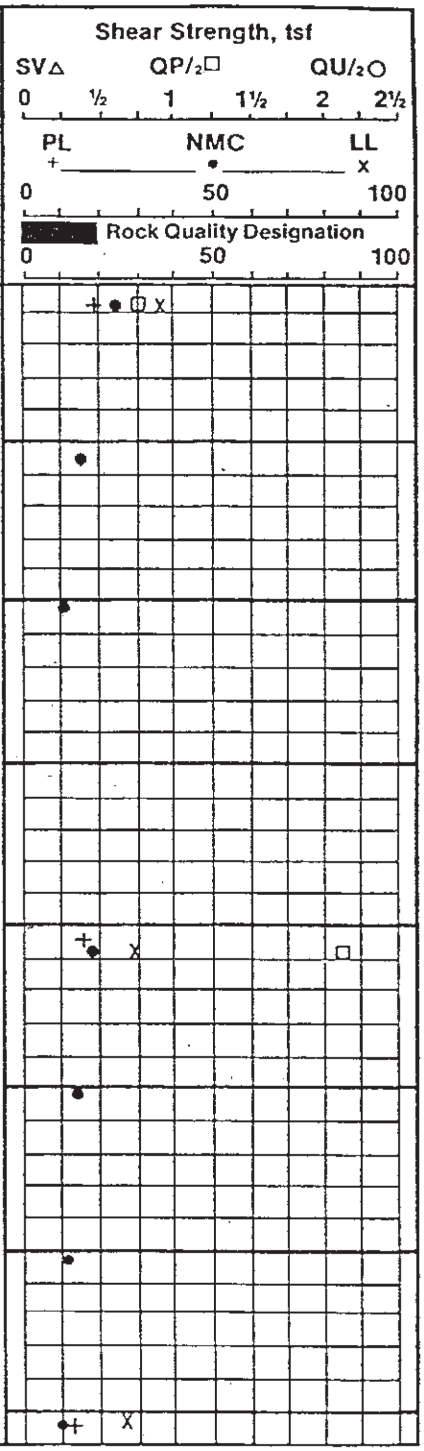
Records of Subsurface Exploration
General Notes
Notations Used
Unified Soil Classification System

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-10
SHEET 1 **OF** 3

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 656.2'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
					Yellow-Brown Silty CLAY Trace Roots, CL		
							103
	1	HST	60/36		Brown CLAY w/Silt, Roots, CH		
					Olive-Brown Silty CLAY, TILL, CL		
5							
					-w/Gravel 6.0-8.0'		
	2	HST	60/12				
10					-w/Gravel 10.0-12.5', & 18.0-21.0'		
	3	HST	60/6				
15							
	4	HST	60/10		-w/Cobbles @ 17.0'		
20					-Brown 20.0-30.0'		
							111
	5	HST	60/24				
25					-w/Sand, Gravel Seam @ 25.0'		
	6	HST	60/6				
30					-Gray Below 30.0'		
	7	HST	30/6				
					-Gravel Seam @ 32.5'		
35	8	SS	24/24	1		17-25-23-24	127



DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/28-29/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
____ Hours after completion ____ Feet
____ after completion ____ Feet
____ after completion ____ Feet

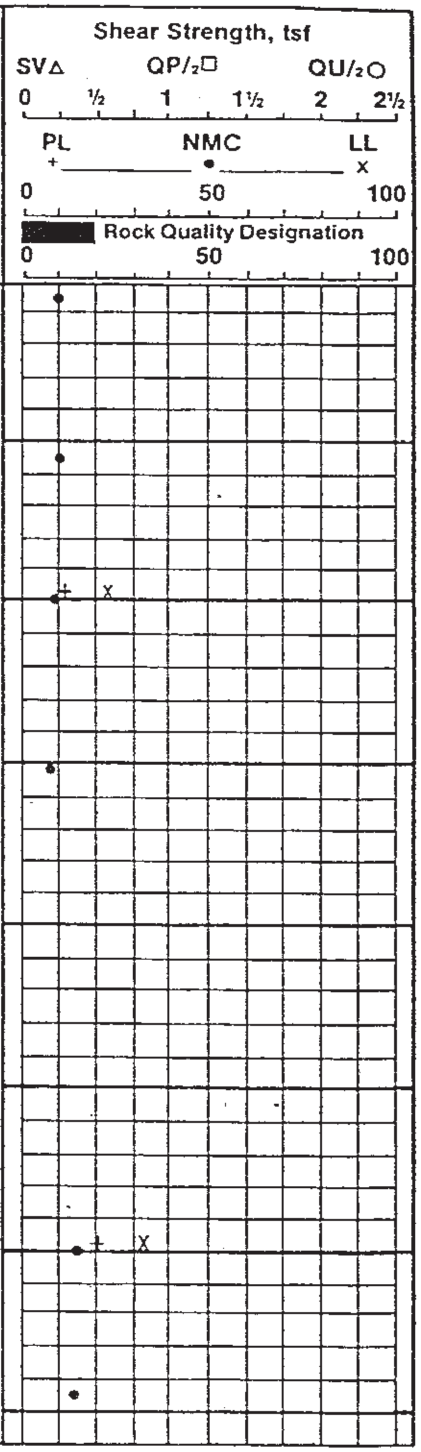
NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-10
SHEET 2 OF 3

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 656.2'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
	8	HST	24/24		Gray Silty CLAY Trace Sand, Gravel, TILL, CL	17-25-23-24	127
40	9	SS	24/24			11-15-30-39	
					-Gray-Brown Below 43.0'		
45	10	SS	22/18			18-24-40-50/4"	127
					-w/Gravel Seams 49.0-59.0'		
50	11	SS	18/18			23-34-50	
55	12	SS	9/9			48-50/3"	
	13	AS					
60	14	SS	5/0			50/5"	
65	15	SS	17/15			26-30-50/5"	120
70	16	SS	12/12			24-50/6"	



DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/28-29/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-10
SHEET 3 OF 3

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 656.2'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2☐ QU/2○ 0 ½ 1 1½ 2 2½; PL + NMC ● LL × 0 50 100; Rock Quality Designation 0 50 100
					Gray Silty CLAY Trace Sand, Gravel, TILL, CL			
75	17	SS	3/3		Gray Clayey SHALE TOB	50/3"		●
80								

DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/28-29/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS
Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-11A
SHEET 2 OF 2

DESCRIPTION OF MATERIALS
(Color Modifier MATERIAL. Classification)
Soil Classification System Unified
Surface Elevation 594.7'

Shear Strength, tsf: SV△ QP/2☐ QU/2○ — 0 ½ 1 1½ 2 2½
PL + NMC • LL x — 0 50 100
Rock Quality Designation — 0 50 100

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (In)	SEE REMARK #	DESCRIPTION OF MATERIALS	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength / PL NMC LL / Rock Quality Designation
					Gray SHALE			
40	9	SS	2/1.5		TOB	50/2"		
45								

DRILLING METHOD Hollow Auger
DATE DRILLED 4/22/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-118
SHEET 1 OF 1

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 594.9'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½ PL + NMC ● LL x 0 50 100 ■ Rock Quality Designation 0 50 100
					Brown Fine SAND, SP			
					Brown Gravelly SAND Trace Silt, SP			
5								
	1	HST	48/6					
					TOB			
10								
15								
20								
25								
30								
35								

DRILLING METHOD Hollow Auger
DATE DRILLED 4/22/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

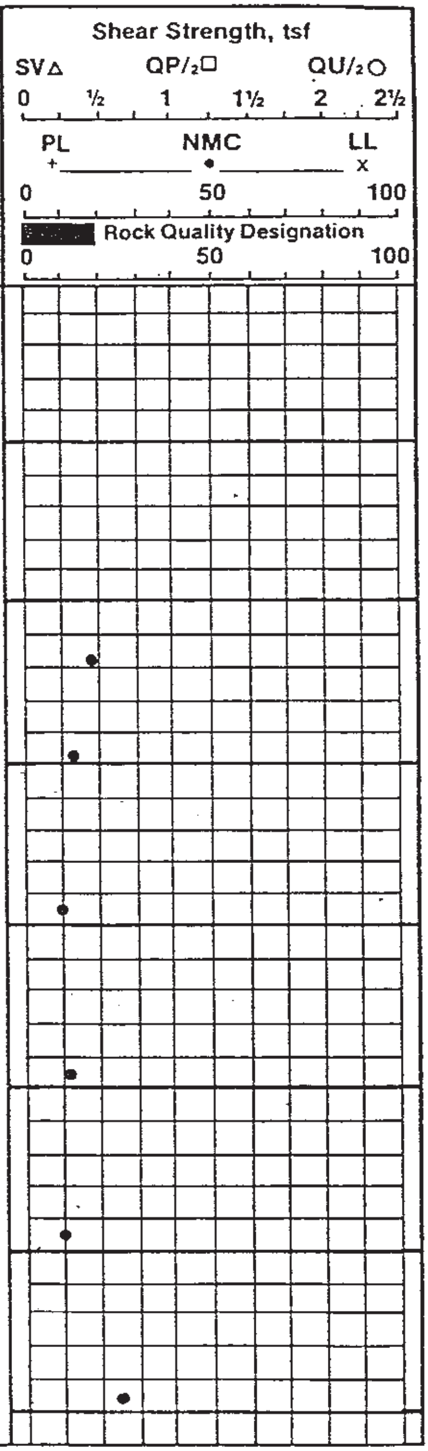
NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-12A
SHEET 1 OF 2

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 590.0'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
					Brown Fine SAND w/Silt, SM		
	1	HST	60/20				
					Olive-Brown Silty CLAY Trace Sand, TILL, CL		
5							
		HST	60/0				
10							
	2	HST	24/0	1	Olive-Gray SHALE		
15	3	SS	9/8			25-50/3"	
20	4	SS	2/2			50/2"	
					-Dark Gray 22.0-32.5'		
25	5	SS	1.5/1.5			50/1.5"	
30	6	SS	1/1			50/1"	
					-Gray Below 32.5'		
35	7	SS	2/1			50/2"	



DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/23/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
____ Hours after completion ____ Feet
____ after completion ____ Feet
____ after completion ____ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-12A
SHEET 2 OF 2

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 590.0'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½ PL + NMC ● LL x 0 50 100 ▇ Rock Quality Designation 0 50 100
					Gray SHALE			
40	8	SS	2/0			50/2"		
45	9	SS	1/0		TOB	50/1"		●
					Remark: 1. Mud Rotary Techniques Used Below 12.0'			

DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/23/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

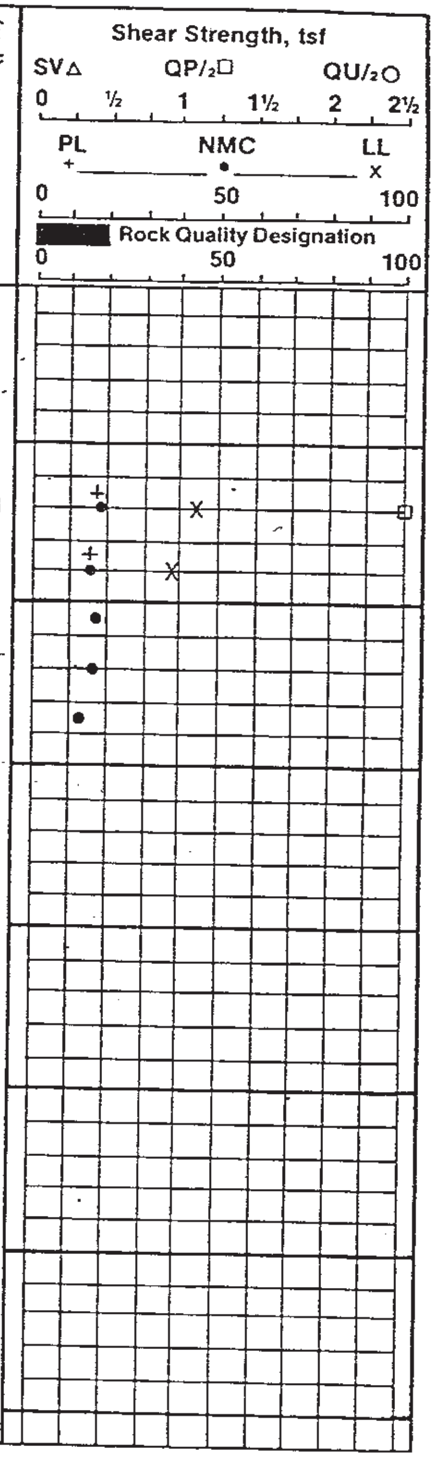
PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-12B
SHEET 1 OF 1

Soil Classification System Unified

Surface Elevation 590.2'

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification)	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
					Brown Fine SAND, SP		
					Brown Gravelly SAND, SP		
5							
	1	SS	24/18		Yellow Brown Silty CLAY, CL	5-16-25-40	111
	2	SS	24/24			7-17-25-31	
10					Olive-Gray Silty CLAY, TILL, CL		
	3	SS	24/18			4-13-20-35	
	4	SS	24/12			10-17-28-35	
	5	SS	23/24		Olive-Gray SHALE	10-20-36-50/5"	
15					TOB		
20							
25							
30							
35							



DRILLING METHOD Hollow Auger
DATE DRILLED 4/23/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
Hours after completion Feet
after completion Feet
after completion Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

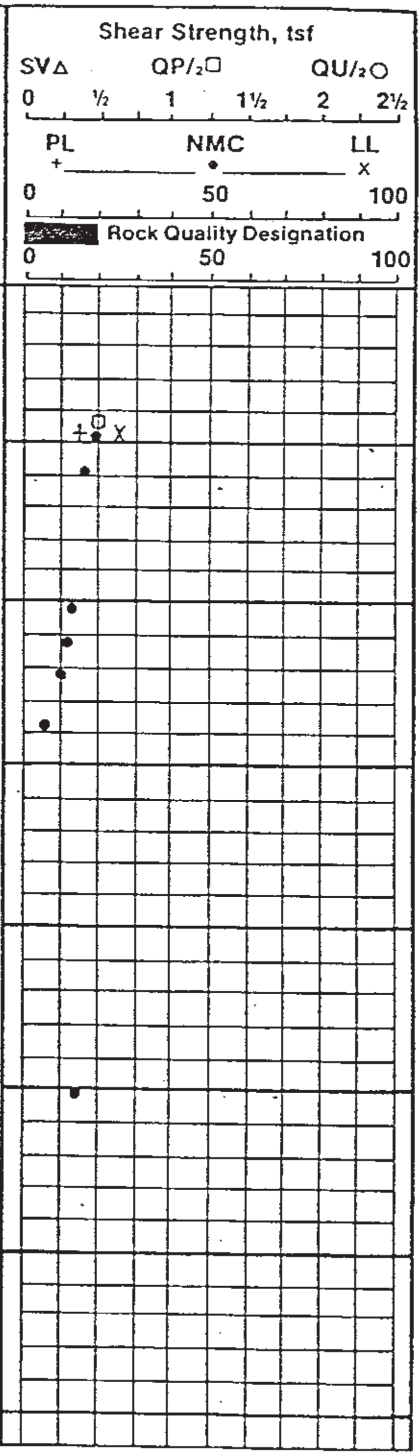
RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-13A
SHEET 1 OF 2

DESCRIPTION OF MATERIALS
(Color Modifier MATERIAL. Classification)
Soil Classification System Unified
Surface Elevation 581.9'

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
					Brown Silty CLAY w/Sand, CL		
	1	HST	60/60				
5							116
	2	HST	60/18		Brown Fine SAND Trace Silt, SP		
					-w/Gravel Below 9.5'		
10							
					Gray SHALE		
	3	HST	60/36				
					-Dark Gray Below 13.5'		
15							
	4	HST	60/0				
20	5	SS	2/2	1		50/2"	
25	6	SS	2/0			50/2"	
30	7	SS	2/0			50/2"	
35	8	SS	1/1			50/1"	



DRILLING METHOD Hollow Auger
DATE DRILLED 4/27/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-13A
SHEET 2 OF 2

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 581.9'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2☐ QU/2○ 0 ½ 1 1½ 2 2½ PL + NMC ● LL x 0 50 100 ▆ Rock Quality Designation 0 50 100
					Dark Gray SHALE			
						50/2"		
					TOB			
40	9	SS	2/1					
					Remark: 1. Mud Rotary Techniques Used Below 20.0'			
45								

DRILLING METHOD Hollow Auger
DATE DRILLED 4/27/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS
Encountered at - F
Hours after completion F
after completion F
after completion F

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORAT
for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-13B
SHEET 1 OF 1

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 581.9'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2 PL + NMC ● LL x 0 50 10 ▬ Rock Quality Designation 0 50 10
					Brown Silty CLAY w/Sand, CL			
5								
	1	SS	24/17		Brown Fine-Medium SAND w/Gravel Trace Silt, SP-SM	3-2-4-3		
10	2	SS	22/8		Brown Silty CLAY w/Sand, CL	6-6-12-50/4"		
					Gray SHALE			
					TOB			
15								
20								
25								
30								
35								

DRILLING METHOD Hollow Auger
DATE DRILLED 3/27/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Fe
____ Hours after completion ____ Fe
____ after completion ____ Fe
____ after completion ____ Fe

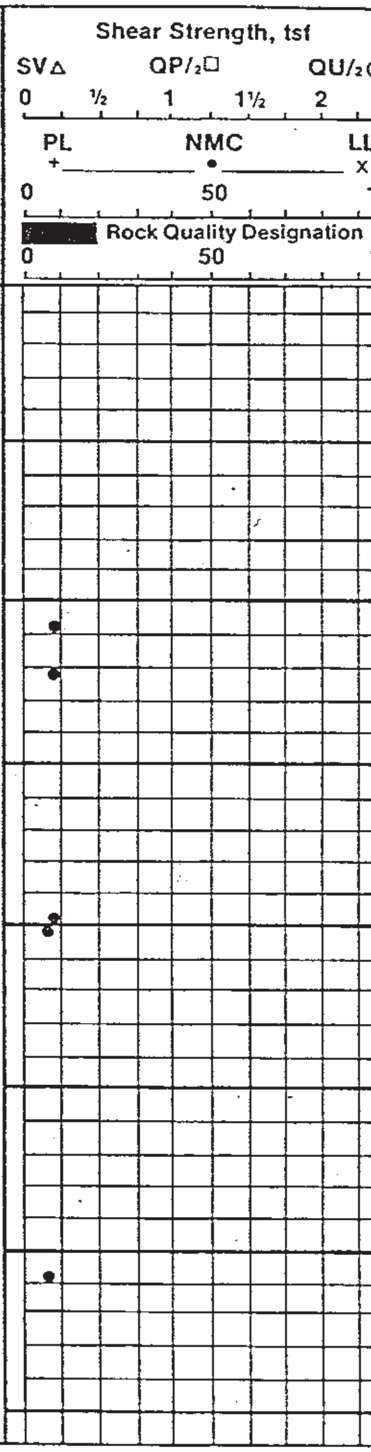
NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATIC
for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-14A
SHEET 1 OF 3

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (In)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 586.1'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
	1	HST	60/30		Brown Fine-Medium SAND Trace Silt, Clay Pockets, SP -w/Roots to 4"		
					Brown Gravelly SAND Trace Cobbles, Silt, SP		
5							
	2	HST	60/18				
10					Dark Gray SHALE		137
	3	HST	60/54				
15			-				
20							141
	4	HST	60/36				
25							
	5	HST	60/6				
30							
	6	HST	60/15				
35	7	HST	30/20				



DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/14-15/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - F
___ Hours after completion ___ F
___ after completion ___ F
___ after completion ___ F

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORAT
for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

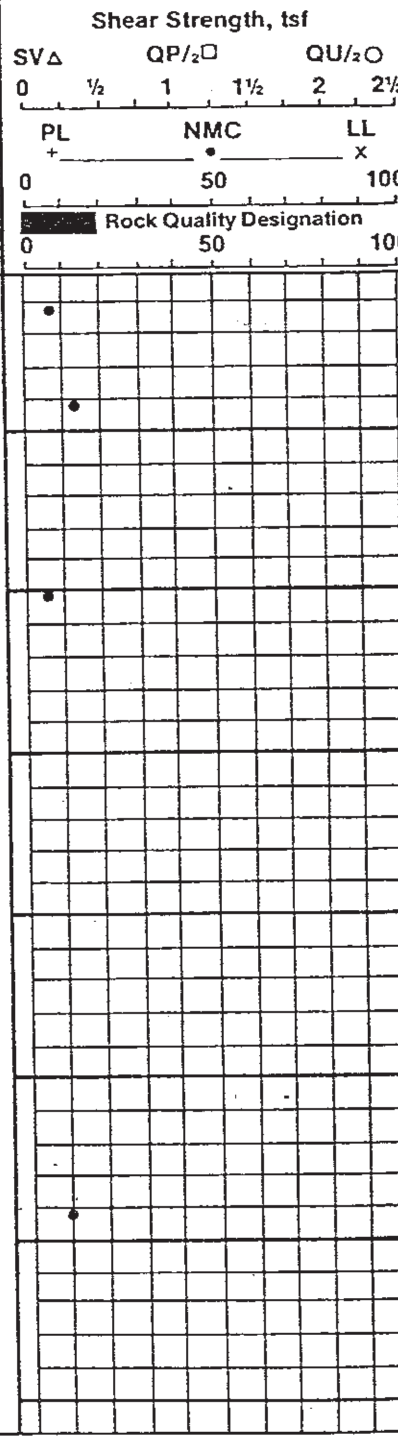
PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-14A
SHEET 2 OF 3

Soil Classification System Unified

Surface Elevation 586.1'

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (In)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification)	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
	7	HST	30/20		Dark Gray SHALE		
	8	SS	3/3			100/3"	
40							
	9	SS	4/4			100/4"	
45	10	AS					
50							
	11	SS	3/2			100/3"	
55							
60							
	12	SS	4.25/6			50/4"-50/.25"	
65							
70							



DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/14-15/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUPWATER LEVELS

Encountered at - Fe
Hours after completion Fe
after completion Fe
after completion Fe

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATI for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-14A
SHEET 3 **OF** 3

DESCRIPTION OF MATERIALS
(Color Modifier MATERIAL. Classification)
Soil Classification System Unified
Surface Elevation 586.1'

Shear Strength, tsf
SV△ QP/2□ QU/2○
0 ½ 1 1½ 2 2½
PL + NMC • LL x
0 50 10
Rock Quality Designation
0 50 10

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
					Dark Gray SHALE		
75	13	SS	5.5/5.5	1		50/5"-50/0.5"	
80					TOB		

Remark:

1. Wet Rotary 75.0-80.0'

DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/14-15/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS
Encountered at -
___ Hours after completion ___
___ after completion ___
___ after completion ___

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORA
for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

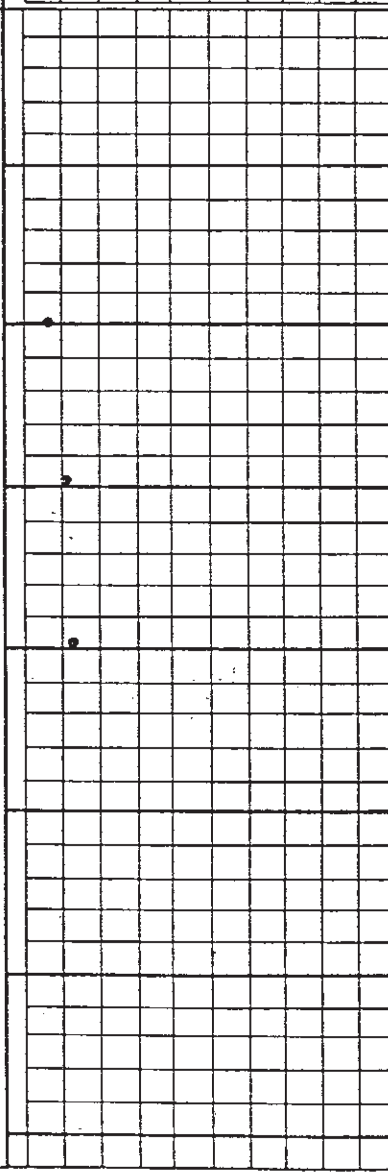
PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-14B
SHEET 1 OF 1

Soil Classification System Unified
Surface Elevation 586.0'

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (In)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification)	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
					Brown Fine-Medium SAND, SP		
					-w/Gravel Below 4.0'		
5							
					-w/Coarse Gravel @ 7.0'		
					Dark Gray SHALE		
10	1	SS	8/8			24-50/2"	
15	2	SS	5/5		-w/Clay Seams @ 14.5'	50/5"	
20	3	SS	4.5/4.5		TOB	50/4.5"	
25							
30							
35							

Shear Strength, tsf
SV△ QP/2□ QU/2○
0 ½ 1 1½ 2 2
PL + NMC • LL x
0 50 10
Rock Quality Designation
0 50 10



DRILLING METHOD Hollow Auger
DATE DRILLED 4/21/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Fe
____ Hours after completion ____ Fe
____ after completion ____ Fe
____ after completion ____ Fe

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATI
for abbreviations, explanations, and qualifications relative to this log.

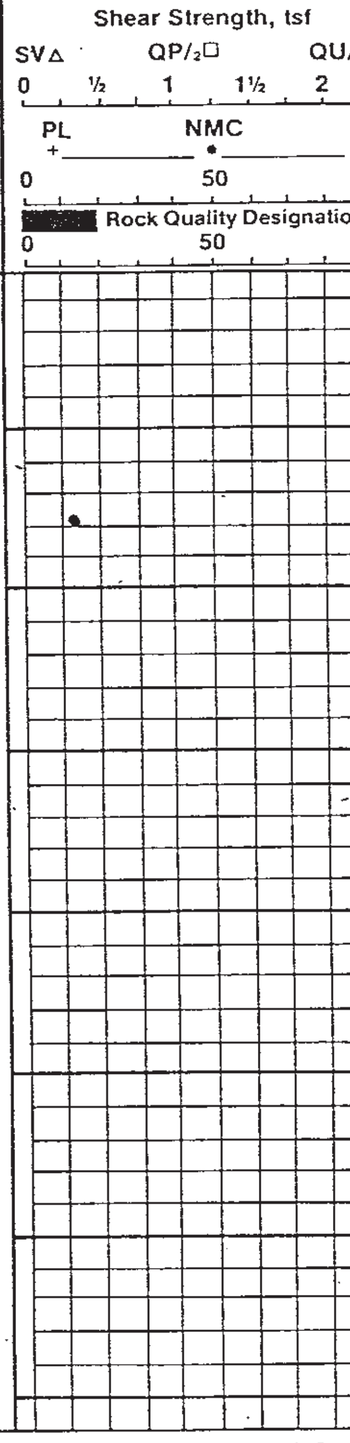
RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-14C
SHEET 1 OF 1

Soil Classification System Unified
Surface Elevation 586.2'

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (In)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification)	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
					Brown Fine-Medium SAND, SP		
					Brown Gravelly SAND Trace Silt, SP		
5	1	SS	18/8			2-3-6	
	2	SS	18/10		Gray SHALE	7-13-26	
					TOB		
10							
15							
20							
25							
30							
35							



DRILLING METHOD Hollow Auger
DATE DRILLED 4/21/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at -
____ Hours after completion ____
____ after completion ____
____ after completion ____

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLOR
for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

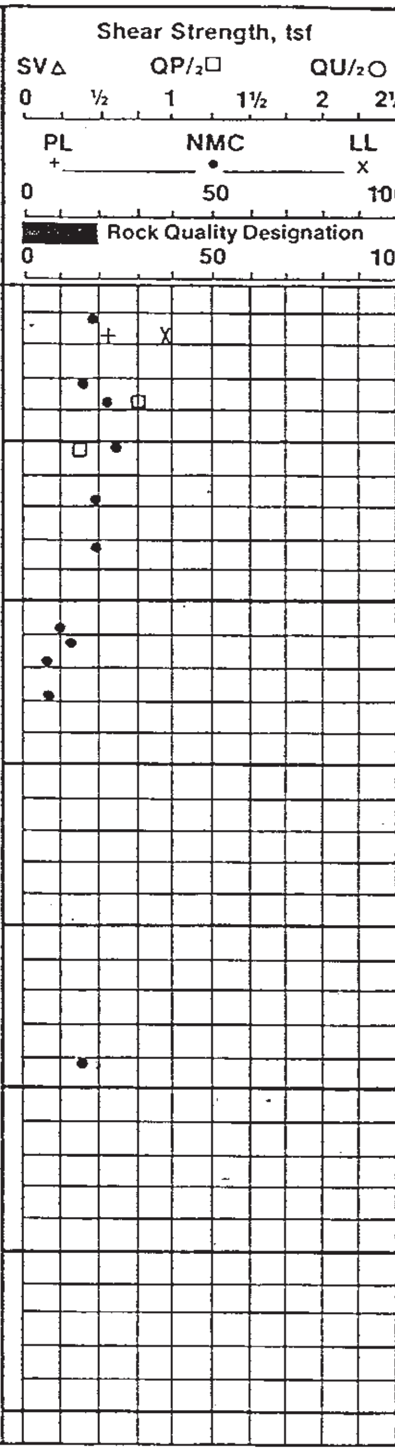
PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-15A
SHEET 1 OF 2

Soil Classification System Unified

Surface Elevation 589.0'

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification)	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
					Brown Silty CLAY Trace Sand, CL		
	1	HST	54/48		-Dark Brown Below 3.0'		101
5							99
	2	HST	60/46		-w/3" Clayey Sand Seam @ 7.0'		
					Brown Clayey Fine SAND, SC		
10					-Gravelly Below 10.5'		
	3	HST	60/42		Dark Gray SHALE		
15				1			
	4	SS	1/1			50/1"	
20							
	5	SS	3/3			50/3"	
25							
30							
	6	SS	1/1			50/1"	
35							



DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/21/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Fee
____ Hours after completion ____ Fee
____ after completion ____ Fee
____ after completion ____ Fee

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATIO for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-15A
SHEET 2 OF 2

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (In)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 589.0'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2☐ QU/2○ 0 ½ 1 1½ 2 2½ PL + NMC ● LL x 0 50 100 Rock Quality Designation 0 50 100
					Dark Gray SHALE			
40								
	7	SS	2/0		TOB	50/2"		
					Remark: 1. Mud Rotary Techniques Used Below 14.5'			
45								

DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/21/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-15B
SHEET 1 OF 1

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 589.0'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/ 0 ½ 1 1½ 2 PL NMC 0 50 Rock Quality Designation 0 50
					Brown Silty CLAY w/Sand, CL			
5								
	1	SS	24/12		Brown Silty Fine SAND, ML	PUSHED		
10	2	SS	12/6		TOB	PUSHED		
15								
20								
25								
30								
35								

DRILLING METHOD Hollow Auger
DATE DRILLED 4/22/87
DRILLED BY Schatter
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at -
Hours after completion
after completion
after completion

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORA
for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

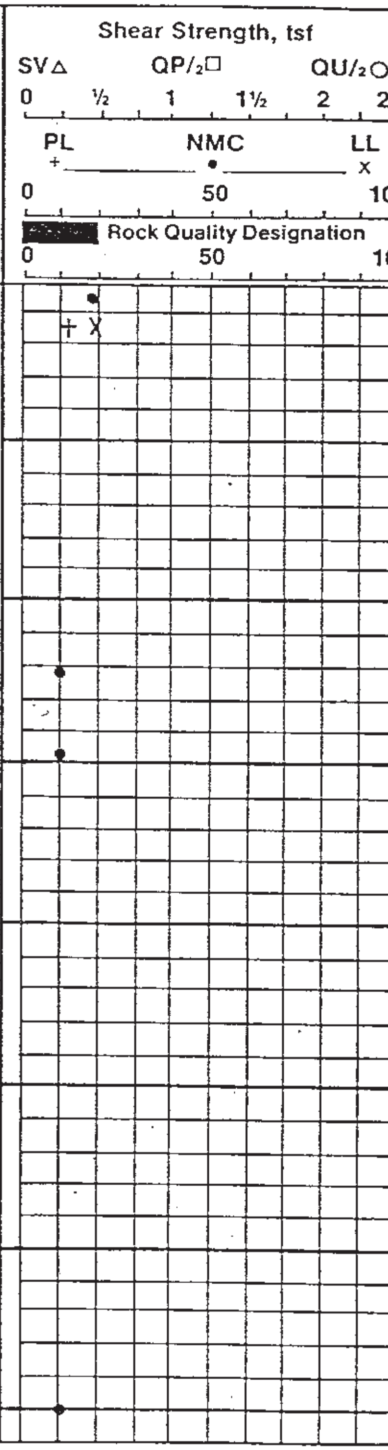
PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-16A
SHEET 1 OF 2

Soil Classification System Unified

Surface Elevation 578.5'

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification)	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
	1	HST	60/20		Dark Brown Sandy SILT w/Clay, ML		
5	2	HST	60/10		Brown Medium SAND w/Fine Trace Clay, SW-SC		
10	3	HST	30/3		Brown Gravelly SAND Trace Clay, SP		
15	4	SS	4/4		Dark Gray SHALE	50/4"	
20	5	SS	3.5/3.5	1		50/3.5"	
25	6	SS	3/3			50/3"	
30	7	SS	3/1			50/3"	
35	8	SS	2/2			50/2"	



DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/28/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at 8.5 Fe
___ Hours after completion ___ Fe
___ after completion ___ Fe
___ after completion ___ Fe

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATIC for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-16A
SHEET 2 **OF** 2

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 578.5'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½; PL + NMC ● LL x 0 50 100; Rock Quality Designation 0 50 100
					Dark Gray SHALE			
					-Rock Seam 37.0-37.5'			
40								
	9	SS	2/0		TOB	40/2"		
45								
					Remarks: 1. Mud Rotary Techniques Used Below 19.5'			

DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/28/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at 8.5 Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

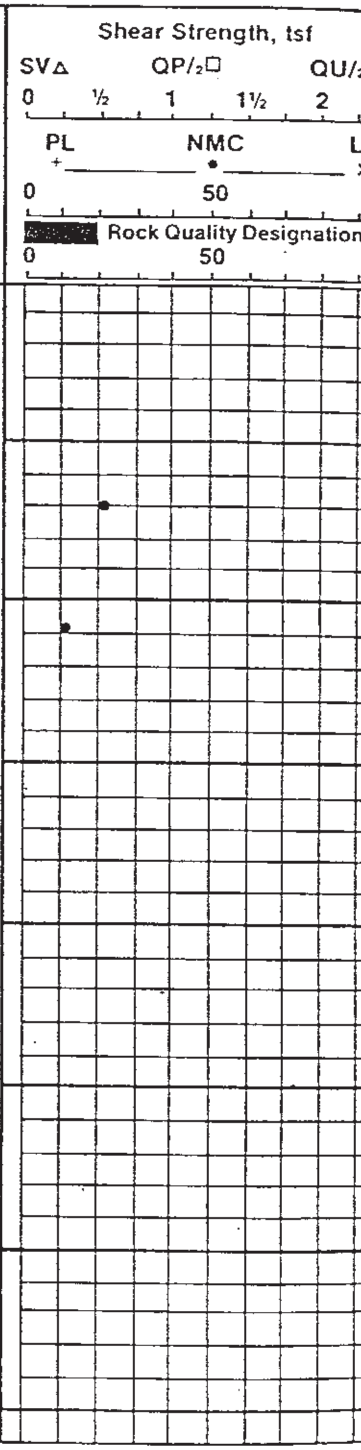
NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-16B
SHEET 1 OF 1

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL Classification) Soil Classification System Unified Surface Elevation 578.5'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
					Gray-Brown Silty CLAY, CL		
5							
	1	SS	24/20		Gray Fine-Medium SAND Trace Silt, SM	2-5-4-6	
	2	SS	24/14		Brown Fine Sand w/Clay, Gravel, SC	2-2-3-9	
10					-Becoming Coarser w/Depth		
	3	SS	17/14			10-29-50/5"	
				1	TOB		
					Remark: 1. Hit Shale @ 11.5'±		
15							
20							
25							
30							
35							



DRILLING METHOD Hollow Auger
DATE DRILLED 4/28/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at -
___ Hours after completion ___
___ after completion ___
___ after completion ___

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORAT for abbreviations, explanations, and qualifications relative to this log.

SECTION X

Soil Borings

The following soil boring logs were performed during May and June, 1988.

The information provided is general in nature and should not be extended to other areas. Interpretation and use of the information by the Contractor is at the Contractor's risk.

Professional Service Industries, Inc.

RECORD OF SUBSURFACE EXPLORATION

Boring J-1 Sheet 1 of 2

Project Name: Ash Pond Facility
Date of Boring: May 26 & 27, 1988
Site: Vermillion Power Plant, Oakwood, Illinois
Project No.: 001-85018

DESCRIPTION	DEPTH	SAMPLE	N	Q_u	Q_p	M_c	REMARKS
El. 612.37* SURFACE							
Brown Silty CLAY, Trace Sand		1-AU	-	-	-	-	
Reddish Brown Silty CLAY, With Sand, Trace Gravel		2-SS	6	-	-	-	
Brown Sandy Silty CLAY, Trace Gravel, (TILL)	5	3-SS	6	-	-	-	
		4-SS	16	-	-	-	
Brown Silty CLAY, With Sand, Trace Gravel, (TILL) Sand Seam at 13'	10	5-SS	20	-	-	-	
		6-SS	62	-	-	-	
Sand Seam at 18'	15	7-SS	38-50/5"	-	-	-	
		8-SS	50/4"	-	-	-	
Brown Fine SAND	20	9-SS	52/6"	-	-	-	▽
Gray Fine Silty SAND		10-SS	50/5"	-	-	-	Water on split-spoon at 20
	25	11-SS	50/5"	-	-	-	Bore Hole washed out at 25'
		12-SS	50/5"	-	-	-	
Gray Sandy SILT	30	13-SS	50/3"	-	-	-	
		14-SS	50/4"	-	-	-	
Brown & Gray Weathered SHALE	35	15-SS	50/6"	-	-	-	
Gray Clayey SILT, With Sand, Trace Gravel, (TILL)		16-SS	50/6"	-	-	-	
	40						
		C-1	-	-	-	-	
	45						

Professional Service Industries, Inc.

RECORD OF SUBSURFACE EXPLORATION

Boring J-1 Sheet 2 of 2

Project Name: Ash Pond Facility
Date of Boring: May 26 & 27, 1988
Site: Vermillion Power Plant, Oakwood, Illinois
Project No.: 001-85018

DESCRIPTION	DEPTH	SAMPLE	N	Q_u	Q_p	M_c	REMARKS
Gray Clayey SILT, With Sand, Trace Gravel, (TILL)		C-1	-	-	-	-	
Gray Weathered SHALE, COAL FRAGMENTS	50	17-SS	67/6"	-	-	-	
		18-SS	50/5"	-	-	-	
Gray SHALE Core Run - 57'3" - 67'3" Recovery - 95% RQD - 90% Relatively solid core throughtout entire length	55	19-SS	66/6"	-	-	-	
				364			Mohs Hardness = 3
	60	C-2	-	-	-	-	Mohs Hardness = 3
	65						Mohs Hardness = 3
				123			
End of Boring at 67' NOTE: Attempted SS sample at 57½', N = 50/1" *Elevation from survey marker							

Professional Service Industries, Inc.

RECORD OF SUBSURFACE EXPLORATION

Boring J-2

Project Name: Ash Pond Facility
Date of Boring: June 2, 1988
Site: Vermillion Power Plant, Oakwood, Illinois
Project No.: 001-85018

DESCRIPTION	DEPTH	SAMPLE	N	Q_u	Q_p	M_c	REMARKS
El. 581.79* SURFACE							
Dark Brown Silty CLAY		1-AU	-	-	-	-	
Dark Brown Silty CLAY, Mottled Brown, With Sand		2-SS	5	-	-	-	
Dark Brown Clayey SAND	5						
Brown & Gray Weathered SHALE		3-SS	52	-	-	-	
Gray SHALE		4-SS	62/6"	-	-	-	Mohs Hardness = 3
Core Run - 9' - 19' REcovery - 93% RQD - 92% Relatively solid core throughout entire length	10	C-1	-	285	-	-	Mohs Hardness = 3
	15						Mohs Hardness = 3
				231			
*Elevation from survey marker End of Boring at 19'							

PSI A-100-9

Professional Service Industries, Inc.

RECORD OF SUBSURFACE EXPLORATION

Boring J-3

Project Name: Ash Pond Facility Date of Boring: May 25, 1988

Site: Vermillion Power Plant, Oakwood, Illinois Project No.: 001-85018

DESCRIPTION	DEPTH	SAMPLE	N	Q_u	Q_p	M_c	REMARKS
EL. 584.66* SURFACE							
Light Brown Silty CLAY, Trace Sand & Gravel		1-AU	-	-	-	-	
		2-SS	7	-	-	-	
Dark Brown & Brown Fine to Medium SAND, Trace Silty Clay	5	3-SS	4	-	-	-	
		4-SS	19	-	-	-	
Brown & Gray Weathered SHALE	10	5-SS	50/6"	-	-	-	▽ Water on split-spoon at 10'
		6-SS	50/6"	-	-	-	Washed out cobbles at 12½'
Gray SHALE Core Run 15' - 24'9" Recovery - 76% RQD - 71% Slight fractures in upper 1' of core Remainder relatively solid	15						
				309			Mohs Hardness = 3
	20	C-1	-		-	-	Mohs Hardness = 3
				321			Mohs Hardness = 3

NOTE: Sample 2-SS, No Recovery
Sample 4-SS, No Recovery
Sample 5-SS, No Recovery

*Elevation from survey marker

Professional Service Industries, Inc.

RECORD OF SUBSURFACE EXPLORATION

Boring J-4

Project Name: Ash Pond Facility
Date of Boring: June 7 & 8, 1988
Site: Vermillion Power Plant
Project No.: 001-85018

DESCRIPTION	DEPTH	SAMPLE	N	Q_u	Q_p	M_c	REMARKS
El. 609.5* SURFACE							
Reddish Brown Silty CLAY, Trace Sand		1-SS	13	-	-	-	
Brown Silty CLAY, With Sand, Trace Gravel, (TILL)	5	2-SS	30	-	-	-	
		3-SS	50/6"	-	-	-	
Gray Silty CLAY, Trace Sand and Gravel, (TILL)	10	4-SS	38-50/6"	-	-	-	
		5-SS	22-50/6"	-	-	-	
	15	6-SS	23-50/6"	-	-	-	
		7-SS	78	-	-	-	
	20	8-SS	90	-	-	-	
		9-SS	90	-	-	-	
Gray Weathered SHALE, Trace Coal Fragments	25	10-SS	73	-	-	-	
Gray SHALE		11-SS	40-50/3"	-	-	-	
Core Run 30' - 39'6" Recovery - 89% RQD - 68%	30						
NOTE: Core barrel broke at 34½' - This section of core severly damaged during removal				195			Mohs Hardness = 2
Core from 34½' to 39½' relatively solid	35	C-1	-		-	-	Mohs Hardness = 3
							Mohs Hardness = 3
	40			210			

*Elevation approximated to be 4½' below survey marker, 614.01

Professional Service Industries, Inc.

RECORD OF SUBSURFACE EXPLORATION

Boring J-5

Project Name: Ash Pond Facility
Date of Boring: June 7, 1988
Site: Vermillion Power Plant, Oakwood, Illinois
Project No.: 001-85018

DESCRIPTION	DEPTH	SAMPLE	N	Q_u	Q_p	M_c	REMARKS
El. 611.71* SURFACE							
Brown Silty CLAY, Trace Sand		1-AU	-	-	-	-	
Brown Clayey SAND		2-SS	10	-	-	-	
Brown Fine SAND	5	3-SS	33	-	-	-	
Brown Silty CLAY, With Sand, Trace Gravel, (TILL)		4-SS	60	-	-	-	
	10	5-SS	52	-	-	-	
Sand Seam at 13'		6-SS	45-50/5"	-	-	-	
Sand Seam at 15'	15	7-SS	50/5"	-	-	-	
Brown-Gray Weathered SHALE		8-SS	75	-	-	-	
Gray SHALE	20	9-SS	34-50/6"	-	-	-	
Core Run - 26'8" - 35'6" Recovery - 80%		10-SS	50/5"	-	-	-	
RQD - 38% Top 6½' of core highly fractured	25	11-SS	50/4"	-	-	-	
Remainder fairly solid							Mohs Hardness = 3
				162			
	30	C-1	-		-	-	Mohs Hardness = 3
							Mohs Hardness = 3
	35			191			

*Elevation from survey marker

Professional Service Industries, Inc.

RECORD OF SUBSURFACE EXPLORATION

Boring J-6

Project Name: Ash Pond Facility
Date of Boring: June 3, 1988
Site: Vermillion Power Plant, Oakwood, Illinois
Project No.: 001-85018

DESCRIPTION	DEPTH	SAMPLE	N	Q_u	Q_p	M_c	REMARKS
El. 595.0* SURFACE							
Brown Silty CLAY, Trace Sand		1-AU	-	-	-	-	
		2-SS	17	-	-	-	
	5	3-SS	23	-	-	-	
Brown-Gray Silty CLAY, With Sand, Trace Gravel, (TILL)		4-SS	17	-	-	-	
	10						
Gray Weathered SHALE		5-ST	-	-	-	-	
		6-SS	72/6"	-	-	-	
Gray SHALE Core Run 15' - 25' Recovery - 59% RQD - 19% Upper 2'10" of core highly fractured Remainder fairly solid	15						Mohs Hardness = 3
							Mohs Hardness = 3
	20	C-1	-	285	-	-	
	25			294			Mohs Hardness = 3

NOTE: Attempted ss sample at 15' - N = 55 to seat

*Elevation approximated to be 8' below survey marker - 603.02

Professional Service Industries, Inc.

RECORD OF SUBSURFACE EXPLORATION

Boring J-7

Project Name: Ash Pond Facility
Date of Boring: May 25, 1988
Site: Vermillion Power Plant, Oakwood, Illinois
Project No.: 001-85018

DESCRIPTION	DEPTH	SAMPLE	N	Q_u	Q_p	M_c	REMARKS
El. 665.27* SURFACE							
CINDERS & ASH		1-AU	-	-	-	8.1	
Brown Silty CLAY, With Sand		2-SS	8	-	-	16.7	
Brown Clayey Fine to Coarse SAND	5	3-SS	13	-	-	16.0	
Gray Silty CLAY, Trace Sand & Gravel, (TILL)		4-SS	16	-	-	14.1	
	10	5-SS	17	-	-	15.4	
		6-SS	22	-	-	14.3	
	15	7-SS	23	-	-	16.0	
		8-SS	30	-	-	14.6	
	20	9-SS	26	-	-	14.3	
*Elevation from survey marker							

PSI A-100-9

Professional Service Industries, Inc.

RECORD OF SUBSURFACE EXPLORATION

Boring J-8

Project Name: Ash Pond Facility Date of Boring: May 25, 1988

Site: Vermillion Power Plant, Oakwood, Illinois Project No.: 001-85018

DESCRIPTION	DEPTH	SAMPLE	N	Q_u	Q_p	M_c	REMARKS
El. 663.49* SURFACE							
Brown Silty CLAY, Trace Sand		1-AU	-	-	-	19.6	
		2-SS	3	-	-	29.5	
Brown Silty CLAY, Trace Sand & Gravel, (TILL)	5	3-SS	8	-	-	17.9	
		4-SS	17	-	-	17.0	
	10	5-SS	18	-	-	17.4	
Gray Silty CLAY, Trace Sand & Gravel, (TILL)		6-SS	23	-	-	15.5	
Brown & Gray Mottled Silty CLAY, Trace Sand & Gravel, (TILL)	15	7-SS	38	-	-	14.7	
		8-SS	50/3"	-	-	-	
Gray Silty CLAY, Trace Sand & Gravel, (TILL)	20	9-SS	50/5"	-	-	11.3	

NOTE: Sample 8-SS, No Recovery

*Elevation from survey marker

Professional Service Industries, Inc.

RECORD OF SUBSURFACE EXPLORATION

Boring J-9

Project Name: Ash Pond Facility
Date of Boring: May 24, 1988
Site: Vermillion Power Plant, Oakwood, Illinois
Project No.: 001-85018

DESCRIPTION	DEPTH	SAMPLE	N	Q_u	Q_p	M_c	REMARKS
El. 666.55* SURFACE							
CINDERS & ASH		1-AU	-	-	-	-	
Brown Silty CLAY, With Sand & Gravel		2-SS	12	-	-	17.8	
Brown Silty CLAY, Trace Sand & Gravel, (TILL)	5	3-SS	22	-	-	18.2	
Gray Silty CLAY, Trace Sand & Gravel, (TILL)		4-SS	18	-	-	15.5	
	10	5-SS	15	-	-	15.6	
		6-SS	21	-	-	12.8	
	15	7-SS	16	-	-	15.0	
		8-SS	16	-	-	15.7	
	20	9-SS	16	-	-	15.5	
*Elevation from survey marker							

PSI A-100-9

Professional Service Industries, Inc.

RECORD OF SUBSURFACE EXPLORATION

Boring J-10

Project Name: Ash Pond Facility

Date of Boring: May 25, 1988

Site: Vermillion Power Plant, Oakwood, Illinois

Project No.: 001-85018

DESCRIPTION	DEPTH	SAMPLE	N	Q_u	Q_p	M_c	REMARKS
El. 657.49* SURFACE							
Brown SAND & GRAVEL - Cinders Ash		1-AU	-	-	-	13.3	
Brown Silty CLAY, Trace Sand & Gravel, (TILL)		2-SS	20	-	-	22.6	
	5	3-SS	27	-	-	14.3	
		4-SS	23	-	-	17.1	
	10	5-SS	25	-	-	17.1	
		6-SS	30	-	-	18.5	
Brown Fine to Coarse SAND & Small GRAVEL	15	7-SS	21	-	-	9.3	
		8-SS	32	-	-	9.3	
	20	9-SS	25-50/3"	-	-	9.1	
*Elevation from survey marker							

Professional Service Industries, Inc.

RECORD OF SUBSURFACE EXPLORATION

Boring J-11

Project Name: Ash Pond Facility

Date of Boring: June 8, 1988

Site: Vermillion Power Plant, Oakwood, Illinois

Project No.: 001-85018

DESCRIPTION	DEPTH	SAMPLE*	N	Q_u	Q_p	M_c	REMARKS
SURFACE							
Dark Brown Silty CLAY							▽
Brown Sandy Silty CLAY	5						
Gray SHALE	10 15 20						
*No Samples taken							

PSI A-100-9

Professional Service Industries, Inc.

RECORD OF SUBSURFACE EXPLORATION

Boring J-12

Project Name: Ash Pond Facility
Date of Boring: June 8, 1988
Site: Vermillion Power Plant, Oakwood, Illinois
Project No.: 001-85018

DESCRIPTION	DEPTH	SAMPLE	N	Q_u	Q_p	M_c	REMARKS
SURFACE							
Dark Brown Silty CLAY, Trace Sand		1-AU	-	-	-	-	
Brown Fine to Medium SAND, Trace Small GRAVEl		2-SS	8	-	-	-	
	5	3-SS	27	-	-	-	
Brown Silty CLAY, Trace Sand, & Gravel, (TILL)		4-SS	50/6"	-	-	-	
	10	5-SS	50/6"	-	-	-	
Gray Silty CLAY, Trace Sand & Gravel, (TILL)		6-SS	40	-	-	-	
Gray SHALE	15	7-SS	40	-	-	-	
		8-SS	50/5"	-	-	-	
	20	9-SS	50/6"	-	-	-	

SECTION XI

Steel Structure Specifications

Portions of this work require the fabrication and erection of steel structures. This work will be covered by the following specification.

Steel shall be A-36.

All members and hardware shall be hot-dip galvanized after fabrication.

Steel members shall be marked as indicated on the plans for ease of erection.

SECTION XII

Bid Units

	Unit Price	Est. No. of Units	Est. Total Price
1. Clearing construction and borrow areas including legal disposal of all vegetation and deleterious material, labor, equipment, and supervision (per acre).		11	
2. Stripping construction and borrow areas including legal disposal of all vegetation and deleterious material, labor, equipment, and supervision (per acre).		16	
3. Embankment including all labor (excavating, hauling, depositing, grading, and compacting), equipment, and supervision (per cubic yard).			
A. Ash Pond			
1. Dike Borrow From Interior of Ash Pond (exclusive of clay core).		30,000	
2. Dike Embankment From Bluff Area		21,000	
3. Clay Core/Bluff Clay Barrier Borrow - Borrow Area One		61,000	
4. Clay Core/Bluff Clay Barrier Embankment - Road Construction		10,000	
5. Overburden Removal - Borrow Area One		15,000	
6. Overburden Removal - Ash Pond Interior		25,000	
B. Road Work/Pipe Run/Ditch			
1. Road Embankment.		6,000	

		Unit Price	Est. No. of Units	Est. Total Price
4.	Top Soil on dike slopes including all material, labor, equipment, and supervision (per acre, four inches thick).		2.1	
5.	Aggregate base course including material, labor, equipment, and supervision.			
	a. CA-1 (per ton)		400	
	b. CA-6 (per ton)		2,900	
6.	Riprap including all material, labor, equipment, and supervision (per square yard, 18 inches thick).		3,500	
7.	Seeding and straw mulch including all material, labor, equipment,and supervision			
	a. Prairie Seed Mixture (per acre)		3	
	b. Grass Seed Mixture (per acre).		4	
8.	Piping including all material (connections, fittings, bolts, blocking, etc.), labor, equipment, and supervision.			
	a. Reinforced concrete pipe with reinforced concrete cradle. Ash pond piping 36" diameter (per lineal foot).		172	
	b. Reinforced concrete pipe. Outfall piping 36" diameter (per lineal foot).		400	
	c. Road CMP 24" diameter Type 2A (per lineal foot).		60	
	d. Road CMP 36" diameter Type 2A (per lineal foot).		450	
	e. Road CMP Arches 28" x 20" Type 2A (per lineal foot).		260	
9.	Slurry Wall Preconstruction Report including all material, labor, equipment, and supervision (each).		1	

	Unit Price	Est. No. of Units	Est. Total Price
10. Slurry Wall Construction including all material, labor, equipment, supervision, testing, and reporting.			
a. 2 foot thick barrier (per square yard).		950	
b. 4 foot thick barrier (per square yard).		8,400	
11. Fabrication and Erection of Effluent Structures including all material, labor, equipment, and supervision.			
a. Main Pond Structure (each).		1	
b. Polishing Pond Structure (each)		1	
c. Outfall Manhole (each).		1	
12. Channel Excavation including all material, equipment, labor, and supervision (per cubic yard).		725	
13. Reinforced Concrete including all labor, materials, equipment, and supervision (per cubic yard).		12	
14. Other (Bidder to specify).			
a.			
b.			
c.			
TOTAL COST OF PROJECT			

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BID FORM

Bid Submitted by:

Contractor: ______________________ Date: ______________________

Address: ______________________

______________________ Phone: ______________________

____

Fax: ______________________

This bid is for all work indicated in the plans and Specifications for the Vermilion Power Station, East Ash Pond Expansion. The unit prices given below are for installed work and include all materials, labor, equipment, and taxes.

Item No.	Description	Est. Qty	Unit	Unit Price	Total Price
1	Mobilization/demobilization	1	L.S.		
2	Clearing and grubbing	20	Acre		
3	Stripping	20	Acre		
4	Dike construction with on-site soil	360,600	Cu yd		
5	Excavate and waste excess cut	54,500	Cu yd		
6	Topsoil	20	Acre		
7	Seeding	20	Acre		
8	Aggregate base course (CA-1) for roads	1250	Ton		
9	Aggregate base course (CA-6) for roads	625	Ton		
10	Riprap on dike	2,700	Sq. yd		
11	Riprap at inflow	440	Sq. yd		
12	Outfall conduit	1	L.S.		

Bid Submitted By: ______________________________ (Page 2)

13	Remove and re-erect existing walkway	1	L.S		
14	New 10” HDPE pipe to pond	200	Ft		
15	New 14” HDPE pipe to pond	100	Ft		
16	Culvert, 36” CSP	1	LS		
17	Flow meter	1	Ea		
18	Pump suction modifications	1	L.S.		
19	Movement monuments	6	Ea		
20	8” PVC recirculation line	1000	Ft		
21	18” pond level control pipe extension/intake structure	1	L.S.		
22	Pumping incidental site water	1	L.S.		
				SUBTOTAL	
				Add for Performance/Payment Bond	
				TOTAL PRICE	

Bid Submitted By: ____ (Page 3)

Proposed Schedule

Bidders shall propose a schedule assuming that a notice of award will be given not later than 30 calendar days after receipt of bids, submittals will be reviewed and returned within 2 weeks after date of receipt of submittal, and normal weather. Bids submitted without a proposed schedule will be considered non-responsive.

Activity	Description	Calendar days after notice of award		Duration (cal. days)
		Start	End	
1	Mobilization			
2	Clearing, grubbing, and stripping			
3	Extend Pond Level Control Pipe			
4	Construct Dike			
5	Reroute piping from plant, place riprap at inflow point			
6	Topsoil and Seeding			
7	Place riprap on river side of dike			
8	Cleanup and demobilization			
TOTAL ESTIMATED TIME TO COMPLETE PROJECT[1]				

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[1] The total time to complete the project is not necessarily the sum of the durations in the last column.

SECTION 1: PROJECT DESCRIPTION

1.0 SCOPE OF WORK

1.1 General

1.1.1 The overall goal for Dynegy Midwest Generation (DMG) is to increase the water storage capacity of their Vermilion Power Station East Ash Pond. The East Ash Pond is an existing coal ash and water storage facility permitted by the IDNR and IEPA. The existing facility consists of an approximately 15-acre Primary Pond and 2-acre Secondary Pond located at the base of a "bluff" adjacent to the Vermilion River. Three sides of the Primary Pond were formed with approximately 15-foot high earth dikes to El. 600 (MSL). The west side of the Primary Pond was formed by a cut slope into the adjoining "bluff".

1.1.2 Fly ash and bottom ash are sluiced to the Primary Pond through piping from the plant. In addition, coal pile runoff and other miscellaneous plant water streams are channeled and piped, respectively, from the plant for discharge into the Primary Pond. The Primary and Secondary Ponds are hydraulically connected through three conduits/structures: a controlled discharge, a primary outfall structure and a 500-gpm fixed or permanent pump. The Secondary Pond discharges through a secondary outfall structure draining ultimately to the Vermilion River. Modification and enhancements will be made to the hydraulic structures (channels, pipes, intake risers, etc.) to accommodate the expanded Primary Pond. Hydraulic details are discussed below.

1.1.3 Increasing the capacity of the East Ash Pond will be made by extending the dikes 20 feet vertically and expanding the pond limits laterally to the west. The dike for the pond expansion shall be constructed of on-site soil obtained from the cut required to expand the pond approximately 5 acres on its west side into the "bluff". Earthwork details are discussed below.

1.2 Earthwork

1.2.1 Bottom Ash

Bottom ash (sand-like coal ash) will be moved from near the existing pipe discharge into the pond to the north area of the pond and used to create a work pad for construction of the raised dike in this area. In this area, the dike expansion will be founded on the inside of the current dike. The bottom ash should be placed to the bottom of the existing pond and will be monitored to assure that most, if not all, existing fly ash (silt-like coal ash) at the bottom has been displaced during placement.

1.2.2 Impervious, Pervious and Random Fill

An essential element of the pond dike is an 8-foot thick liner constructed of low-permeability clay soils (impervious fill). On the west side of the pond the liner will consist of 8 feet of clay placed on a 3H:1V slope on the inside face and horizontally over the bottom of the pond. In other areas the liner will consist of an 8-foot thick clay core liner within the new raised dikes. It is essential that the new liner be adequately tied into the existing liner to provide a continuous barrier between the ash pond water and the ground water adjacent to and under the pond. The existing 8-foot thick clay liner zone is labeled on the Drawings and delineated by dashed lines. In many areas the liner lies within a larger zone of impervious fill making up more than half of the dike. The impervious fill specifications are such that any of this material will also meet the requirements of the 8-foot thick core liner. Identification of the 8-foot core in these areas is made for clarification that the liner has been tied-in and continuous through this zone. Material and placement specifications for clay liner core and impervious fill are the same. The tie-in between existing and new clay liner will be observed and confirmed during construction by the Company's representative.

1.2.2.1 Due to the variable nature of the on-site soils available for fills, it will be necessary to constantly monitor the materials being excavated for dike fill. The Drawings show the types of materials acceptable for each zone within the dike. Summary boring logs have been provided on the Drawings showing the materials available in the primary borrow area and in the existing dike cut. The classification of the borrow materials encountered in these borings (impervious, pervious or random fill) is also shown. It should be noted the borings indicate that the soil types are variable throughout the borrow area. The Owner will provide full-time technical assistance during borrow excavation and dike construction to identify the type of fill being excavated from the cut areas and/or borrow area and evaluate where its use is acceptable. Due to the variability noted in the borings and potential for variation between borings, the Owner's Representative's evaluation of fill type at the time of excavation will be considered final.

1.2.2.2 Small amounts of unsuitable materials may need to be spoiled as part of the work. The Owner will designate a location within 1,000 feet of the pond for such spoil. The work associated with excavating, moving and placing the spoil material will be considered incidental to the project.

1.2.2.3 It is anticipated that some temporary stockpiling of fill materials may be required during the course of the project. The Contractor is responsible for properly sorting all materials that are temporarily stockpiled as well as all costs associated with this activity. It is estimate that there will be about 50,000 cy of excess fill materials available after all excavation and fill is complete.

1.2.2.4 As mentioned above, the western expansion area liner will consist of 8 feet of impervious fill placed on a 3H:1V slope on the inside face and horizontally over the bottom of the pond to form the liner. In this area, excavation to the liner subgrade will be necessary prior to placement of the 8-foot thick liner. The Contractor is free to use his own means/methods. One suggested sequence is given below:

1. This sequence is based on the assumption that the Contractor will install the western expansion liner near the time of completion of the project since nearly all other fill materials lie within the excavation above this area.

2. The Contractor will create a stockpile of approximately 50,000 cy of impervious fill during cut of this area and construction of the raised dikes. The material in this stockpile will be used to supplement the excavation in the west area expected to have pervious fill zones not acceptable for impervious clay liner fill. The stockpile will increase efficiency by keeping equipment used in the cut area operating if caught up with the fill operation on the dikes.

3. Starting on the east side of the horizontal portion of the liner, excavate to liner subgrade in a 100-foot wide “strip” running north and south. Haul all the cut from this area to the stockpile area, separating impervious from pervious and random fill. Throughout this sequence in this area, the control of stormwater run-on and management of stormwater will be imperative since this work will be done below surrounding grade.

4. Excavate a second 100-foot wide “strip” adjacent to the “strip” excavated in 3., above. Use excavation material meeting the requirements for impervious fill to construct the liner in the first “strip” and supplement any shortfall with impervious fill from the stockpile.

5. Continue with strips until pond liner expansion is complete to the west limits.

1.2.2.5 Based on borings completed in the borrow area, the materials appear to generally have water contents near or below optimum. The Contractor should anticipate that the fills will require addition of water to obtain compaction requirements. A hydrant has been identified for the Contractor’s water source on the Drawings.

1.3 Hydraulics

1.3.1 The Primary and Secondary Ponds are hydraulically connected through three conduits/structures at the north end of the Primary Pond: a controlled discharge, a primary outfall structure and a 500-gpm pump and piping.

1.3.2 The existing 48-inch reinforced concrete pipe riser at the existing primary outfall will be removed, as well as the existing walkway bridge to it. A new 48-inch RCP riser extending up to the outboard slope of the dike raise will be installed at that location with a 48-inch by 48-inch by 36-inch tee at the top. A slab with a manhole frame and grate will be installed at the top of the outboard riser for inspection purposes. A 36-inch diameter RCP bedded on a concrete cradle will be installed from the new 48 inch by 48 inch by 36 inch tee to the inboard slope of the dike and a new 48-inch RCP riser will be installed extending up to Elev. 595 feet (MSL). When the dike has been completed, the existing walkway bridge will be reinstalled from the crest of the dike to the new intake pipe.

1.3.3 The controlled discharge structure is a gravity drainage structure which drains water from the primary to secondary ponds through a valved ductile iron pipe. This structure will be relocated further south into the Primary Pond to allow construction of the raised dike. The old structure will be partially salvaged and re-used. New piping will be installed and connected to the existing piping near the current location of the structure. The ductile iron pipe within the existing dike runs to a manhole (Manhole No. 1). The manhole will be excavated, removed, and a wye fitting and check valve will be installed at this location. The manhole must be removed since the piping at this location will be under the additional head of the raised pond (20 feet). An open manhole would allow the pond to drain at this location. The purpose for the wye fitting and check valve is discussed below with the pump system. Note that the flow of water via gravity through this pipe is controlled by a valve downstream of existing Manhole No. 1.

1.3.4 The pump system currently has a floating suction line in the Primary Pond connected at the dike to a buried PVC pipe running to the pump house. This floating structure will be removed and stored on site but will not be re-used. The pump will be connected via new PVC buried piping to the wye that will be installed at the location of Manhole No. 1. Therefore, the ductile iron pipe and gravity discharge structure will feed both the pump system and the gravity discharge system through Manhole No. 2 and into the secondary pond. A check valve will be installed just downstream of the wye fitting to avoid reverse flow and possible loss of suction through the pipe section connecting the wye fitting to Manhole No. 2.

1.4 Access Roads

1.4.1 Gravel access roads will be constructed on the top of the raised dikes and up the slope of the west cut area for access.

1.5 Vermilion River Easement

1.5.1 The Contractor should note that there is a 150-foot easement line from the center of the Middle Fork of the Vermilion River (shown on Drawings) beyond which no disturbance of any kind can be made. The easement is also clearly marked by survey in the field (white PVC pipe on T-posts).

1.6 Time and Materials Work

1.6.1 Time is of the essence on this project. Work on the site has already been started by a contractor under a Time and Materials contract. This work is being done in accordance with the Drawings and Specifications making up these bid documents and under the supervision of the Project Manager. Work was started prior to bidding the remainder of the project to help meet the construction schedule. The work that has been started includes:

- Clearing and grubbing.

- Stripping and stockpiling of topsoil.
- Removal and stockpiling of riprap from the outside of the east dike slope.
- Placement of Bottom Ash to El. 596 in the “upstream raise” portion of the dike on the north end of the pond.
- Placement of Impervious Fill to El. 600 in the “upstream raise” portion of the dike at the north end of the pond.
- Removal of the Controlled Outlet Structure at the north end of the pond.
- Removal of the Primary Outfall Structure at the north end of the pond.

1.6.2 Those items included in these Drawings/Specifications that will have been completed upon accrual of Contract will be deleted from the Contract.

2.0 BIDDING

2.1 A pre-bid meeting will be held at the Vermilion Power Station at a time and date to be announced. All bidders are required to attend this meeting. Check in at the Security Gate and main plant office upon arriving for the meeting.

2.2 Bid will be due at a time and date to be announced. Dynegy Midwest Generation Purchasing Department will receive bids. Bids should be directed to:

Alona Campbell-Walker
Buyer/Contract Administrator
Dynegy Midwest Generation
2828 N. Monroe Street
Decatur, IL 62526
Ph.: (217) 876-3911
Fax: (217) 876-3905

2.3 Bids may be faxed and received in total by 2:00 p.m. on the due date, but a hardcopy must be delivered no later than two working days afterward.

2.4 For technical questions regarding the design or bidding of this project, contact:

Joe Kimlinger, P.E.
Project Manager, Ash Manager
Dynegy Midwest Generation
2828 N. Monroe Street
Decatur, IL 62526
Ph: (217) 876-3943
Fax: (217) 876-7475

2.5 For arrangement of site access during the bidding period, contact:

Mike Dodge
Dynegy Midwest Generation
Vermilion Power Station
Box 250
Oakwood, IL 61858
Ph: (217) 354-2141 (Ext. 221)
Fax: (217) 354-2169

2.6 Tax Exempt Status

As a pollution control facility, items incorporated into the construction of the pond are exempt from Illinois sales tax. Such items include pipe, concrete, stone, etc. Items purchased for construction, but not incorporated into the finished work are not exempt. The Company will provide the necessary documentation to the successful bidder.

2.7 Subsurface Information

It is strongly emphasized that the subsurface information is made available to the Contractor without guarantee or obligation of any kind whatsoever on the part of the Company. The Company does not guarantee the correctness of the designations of any materials shown on the Drawings, nor any interpretations, deductions, or conclusions shown on any drawings, logs, reports, or other documents relative to subsurface conditions. Conditions affecting the Contractor's performance and schedule may differ from those indicated or described. Bidders will be deemed to have inspected the site and satisfied themselves on all matters affecting the Contract and Specifications. Bidders may, at their own expense and with the approval of the Company, make additional investigations if they so desire. The Bidders and Contractor must assume all responsibility for deductions and conclusions as to the nature or condition of soil, and other materials to be excavated, the difficulties of making and maintaining the required excavation, and of doing other work affected by the geology of the job site.

SECTION 2: GENERAL CONDITIONS FOR ERECTED MATERIALS AND EQUIPMENT, AND LABOR CONTRACTS

1.0 DEFINITIONS

1.1 “Company” means Dynegy Midwest Generation, Inc.

1.2 “Contract” consists of the Purchase Order, these General Conditions, the Specifications, and Drawings and Data (if any), and all other Exhibits specified in the Purchase Order, and such documents shall take precedence in the order stated, unless the Company at any time gives written notice to the contrary.

1.3 “Contractor” means the entity, identified as such in the Contract documents, entering into this Contract with the Company for performance of the WORK, and any other specific requirements described in this Contract intended to be an obligation and duty of said party.

1.4 “Engineer” means URS Corporation.

1.5 “On-Site Representative” means the Company’s On-Site Construction Representative.

1.6 “Tester” means the Company’s designated testing agency (including concrete and soil testing).

1.7 “Governmental Authorities” means federal, state or local bodies which may exercise regulatory authority or control over the WORK or the Company’s Project Site or plant of which the WORK is to be a part, or the design, construction, operation, use or environmental conditions thereof.

1.8 “Indemnified Parties” mean the Company, Engineer, their respective officers, directors, partners, shareholders, agents and employees (and each of their heirs, successors and assigns).

1.9 “Project,” “Project Site,” “Site,” and “Premises,” mean the Company’s site or a site controlled by the Company (including one in which the Company has only a partial interest, such as an easement) where the WORK is to be performed or installed and includes all places contiguous thereto and in the vicinity thereof, where materials, equipment, tools, appliances or other facilities required for the performance of the WORK are or are to be located or stored.

1.10 "Reviewed," "approved," "acceptable," "satisfactory," "or equal," or other similar terms used in any Specification to this Contract shall, unless otherwise expressly stated, mean as reviewed and as commented thereon by the Company.

1.11 "Subcontractor" means any individual, partnership, firm, corporation or business entity, other than an employee of the Contractor, who contracts or agrees with the Contractor (or another subcontractor or any tier thereof) to furnish any services, labor, materials or equipment for, or in connection with, the performance of the WORK.

1.12 "WORK" includes, and the Contractor shall furnish, unless the context clearly indicates otherwise, all or any part of such labor, services, methods, material, equipment and transportation or other facilities as may be necessary to complete this Contract, and normally considered part of the type of project covered by this Contract, whether or not fully detailed on the Drawings (if any) or listed in detail in the Specifications.

2.0 INTERPRETATION OF CONTRACT

2.1 Except as noted otherwise, the Contractor shall furnish all tools, equipment, transportation, materials, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, other incidentals and supervision necessary for the construction of the project described in this Specification and on the Drawings listed in the Table of Contents

2.2 The Company will furnish necessary benchmarks and control points for the layout of the work. Alignment, grade and other construction staking are the responsibility of the Contractor.

2.3 The Contractor shall coordinate his work with any and all other contractors and/or Company personnel working on the project.

2.4 Contractor employees are not allowed in Company Buildings, i.e., office, lunchroom, rest rooms, and locker areas unless special arrangements are made. Contractor employees are expected to remain in their assigned work areas. The Contractor shall provide portable toilets for his employees.

2.5 Contractor shall furnish performance and payment bonds, each in an amount at least equal to the contract price as securities for the faithful performance and payment of all the contractor's obligations under the contract documents. These bonds shall remain in effect at least until one year after the date when final payment becomes due, except as otherwise provided by law or regulation. All bonds shall be in the forms prescribed by law or regulation or by the contract documents and be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff Bureau of Accounts, U.S. Treasury Department. All bonds signed by an agent must be accompanied by a certified copy of the authority to act. If the surety on any bond furnished by the contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the project is located or it ceases to meet any of the requirements set forth above, contractor shall within five days thereafter substitute another bond and surety, both of which must be acceptable to the owner

2.6 No Company review or comments shall relieve the Contractor of any of the Contractor's obligations under this Contract.

2.7 The Company is not the designer of the WORK purchased hereunder or any part thereof, and its review and/or comments as to any Drawings, specifications or other documents furnished by the Contractor or any other party shall not be evidence that the Company is the designer of the WORK or any part thereof.

2.8 The Contractor is an independent contractor and not an agent or employee of the Company. Nothing contained in this Contract shall be construed as inconsistent with the Contractor's status as an independent Contractor.

2.9 The Company shall interpret this Contract and any Specifications and Drawings pertaining to this Contract. In case of conflict between the specifications and the Drawings and data, the Company shall resolve such conflict, and its decision shall be binding on the Contractor.

2.10 Any item not included in the Drawings, data or specifications, but which is necessary to complete the WORK as intended, shall be supplied in place. WORK described in words which so applied have a well-known technical or trade meaning shall be held to refer to such recognized standards. In case of any ambiguity or doubt as to the meaning of the drawings, data or specifications or of any discrepancy or conflict between the two, or between different parts of either, the matter shall be brought to the attention of the Company by the Contractor before the WORK is installed or fabricated. The Company will issue written instructions or interpretations as required, and the Contractor shall be bound by the decision of the Company. The Contractor shall assume full responsibility for its failure to request such instructions or interpretations. Where dimensions are given on Drawings, they are to be followed without regard to scale.

2.11 Particular care shall be taken not to disturb or damage the property or facilities of the Company or others. In the event the Contractor causes trouble or damage to any facility, he shall immediately notify the On-Site Representative of the cause, nature and extent of the problem. The Contractor at his expense shall repair any damage done to Company or private property.

2.12 This Contract represents and incorporates the entire understanding of the parties hereto, and each party acknowledges that there are no warranties, representations, covenants or undertakings of any kind, nature or description, except as expressly set forth in this Contract. This Contract supersedes all prior agreements, whether written or oral, with respect to the WORK and the subject matter of this Contract. This Contract shall not be changed or modified except by another instrument in writing executed by a duly authorized representative of each of the parties hereto and entitled “Change Order,” “Amendment to Contract,” or document titles of like meaning.

3.0 CONTRACTOR’S PERFORMANCE AND RIGHT TO ACHIEVE COST SAVINGS

3.1 The Company acknowledges the Contractor’s right to achieve cost savings for its own benefit through the proposal of alternate construction methods and/or materials unless specific requirements are stated in this Contract, provided that the Company agrees in writing and provided that the general quality, integrity or operational parameters of the WORK are not compromised.

3.2 The Contractor shall have exclusive control of the manner and means of performing the WORK, subject only to the right of the Company to generally observe the WORK at all times during construction, to assure compliance with the terms of this Contract, but such observation shall not relieve the Contractor of any obligation or responsibility under this Contract.

3.3 Nothing in this Article shall limit or affect any warranty of the Contractor or any other provisions of this Contract.

3.4 The Contractor shall submit a list of subcontractors (if any) with his bid. The Company reserves the right to reject specific subcontractors but will cover the cost differential required for the use of an alternate subcontractor.

4.0 VERIFICATION OF DIMENSIONS ON DRAWINGS, AND MEASUREMENTS AT SITE

4.1 The Contractor shall make a thorough field check for the purpose of verifying existing conditions that may affect the WORK, such as possible errors in work previously done by others, difficulties that might be encountered in the execution of the WORK for any other reason, and dimensions and other questions relating to interconnection of the WORK with the work of others.

4.2 The Contractor shall satisfy itself as to the accuracy of the above dimensions as such dimensions relate to the dimensions given on any Drawings issued by the Company or others, it being understood that the Company does not guarantee the exactness of such dimensions.

4.3 Should the Contractor discover any variation in the dimensions of existing conditions and those dimensions given on any Drawings issued by the Company, the Contractor shall give immediate notice thereof to the Company, and the Contractor shall not proceed with the WORK until such variation is resolved. In the event that the Contractor fails to so notify the Company of such variation or in the event that the Contractor notifies the Company after the Contractor should have discovered such variation, the Contractor shall be fully responsible for all extra material, labor, and other expenses arising out of the Contractor’s failure to notify the Company in a timely manner.

4.4 No allowance will be made to the Contractor for any extra material, labor or other expenses due to difficulties caused by its failure to comply fully with the preceding paragraphs.

5.0 CONTRACTOR’S INSPECTION AND KNOWLEDGE OF PLANS AND THE PREMISES; COST OF PERFORMANCE

By becoming a party to this Contract, the Contractor represents that it has:

5.1 Carefully and completely examined the Drawings, data and specifications in this Contract affecting the WORK and is fully informed as to all existing conditions and limitations, including laws and regulations of any Governmental Authority affecting the Contractor, the WORK or the Premises, and has included in its proposal all items implied or required to attain the conditions and performance contemplated by this Contract.

5.2 Satisfied itself as to existing construction, labor conditions, working space, storage space, access facilities and all other Site conditions in any way relating to the conduct of the Contractor's WORK by inspection of the Project Site or otherwise.

5.3 Made due allowance in its proposal for any possible increase in cost of performance of the WORK, including increases in the cost of materials and labor.

5.4 Any questions concerning the Drawings and specifications shall be directed to the On-Site Representative. The Contractor shall not take advantage of errors and/or omissions in these documents and/or discrepancies between the plans and specifications. The Company will make corrections and supply information omitted to the plans and specifications with the Company's interpretation being final. Any addenda issued during the time of bidding are considered a part of these Specifications.

6.0 CONTRACTOR'S DRAWINGS AND DATA

All drawings and data required to be submitted to the Company for review shall be submitted in accordance with the schedule provided in this Contract and, if such drawings and data are not covered by such schedule, such drawings and data shall be submitted by the Contractor without unreasonable delay, and no WORK affected thereby shall be started until the Contractor is notified that the Company has no objection to proceeding with the WORK. No such notification shall relieve the Contractor from fulfilling all obligations of the Contractor under this Contract, including obligations relating to design and detailing. As far as practicable, each drawing shall bear a cross-reference note referring to the sheet number(s) of the Company's drawing(s) showing the same WORK.

7.0 SAMPLES

The Contractor shall furnish to the Company approval samples of the WORK reasonably required by the Company.

8.0 INSPECTION, TESTING AND EXPEDITING

8.1 The Company may appoint such inspectors/expeditors as it deems proper, who, in addition to the Company, shall have the right at all reasonable times to inspect the WORK and observe production tests and any other tests specified in this Contract for compliance herewith. The Company will have a Tester check any concrete properties, soil compaction, or other material/performance requirements at the Company's expense. The Contractor shall make all necessary arrangements, and provide all reasonable facilities and proper and safe access for such inspection and testing on the Company's Premises, at the Contractor's shop, or at the mills or shops of any manufacturer where any part of the WORK is being fabricated or manufactured. The Contractor shall ascertain the scope of any inspection which may be contemplated, and shall give ample notice as to the time and place when each part of the WORK will be ready for such inspection. The Company's designated inspector may reject any WORK found to be defective or not in accordance with this Contract, regardless of the stage of its completion or the time or place of discovery of such errors, and regardless of whether such WORK has been previously accepted through oversight or otherwise. Should the Contractor object to any rejection of the WORK by an inspector, the Contractor shall make a written appeal to the Company within ten days of notice of the rejection, and the Company's decision upon the appeal shall be binding upon the Contractor. Such inspection shall in no way relieve the Contractor from its obligations under this Contract.

8.2 When any portion of the WORK must be uncovered for the purpose of inspection or testing, the Contractor shall bear all expense incident to such uncovering, inspection and/or testing when (a) any part of the said WORK is found to be not in accordance with this Contract, or (b) the WORK is found to be in accordance with this Contract, but the Contractor did not provide opportunity to inspect or test the WORK. Except as provided in the preceding sentence and in the event that all the WORK is found to be in accordance with this Contract, the Contractor will be entitled to payment of the cost incident thereto on a cost-plus basis as provided in this Contract, if any, or as may be subsequently agreed in writing.

9.0 MATERIALS, CORRECTION OF WORK AND WARRANTY

9.1 The Contractor warrants that the WORK performed under this Contract shall: (a) be free from defects in design, materials and workmanship, (b) be suitable for its intended purpose as specified in this Contract, (c) include all materials furnished or purchased by the Contractor under this Contract to be new and unused in all cases, unless otherwise specified, (d) be of the best quality and be in full compliance with the Contract documents, and (e) not be subject to any encumbrance, lien, security interest or other defect in title.

9.2 In addition to any other remedy provided by law, if any of the WORK does not comply with the warranties contained in this Article 9 and the Company gives the Contractor notice of noncompliance within one year (or such longer period specified in this Contract for any identified equipment or portion of the WORK) after the WORK is placed in commercial service, or, if there is no commercial service date, regular operating service (excluding any period the WORK or facility of which the WORK is a part is not available for operation because of breach or nonconformity with any of the Contractor's warranties), the Contractor shall at its sole expense promptly correct by repair or replacement any noncomplying WORK. Any equipment furnished as a permanent part of the WORK shall be considered defective or otherwise unsuitable if it shall not comply with this Contract, or if, among other things, it shall develop an undue amount of noise, vibration, heat, deterioration, strain or wear during the first year of actual use in service, provided that said equipment shall be kept in good condition and be properly operated and maintained during said year. The decision to repair or replace shall be made with the concurrence of the Company, and the repair or replacement shall be scheduled consistent with the Company's operating requirements so as to minimize loss of production or use of the WORK or of any plant or equipment of which the WORK is a part. All costs and expenses associated with access to or repair or replacement of the WORK, including transportation costs and all expenses of restoring work of other contractors damaged by any such removal, remedying or replacement, shall be paid by the Contractor. The warranties for any repaired or replaced WORK shall be extended for one year (or such longer period specified in this Contract for any identified equipment or portion of the WORK) from the date of completion of the repair or replacement under the same provisions as contained herein.

9.3 If the Company shall deem it necessary, or if the Contractor fails to perform its obligations under Section 9.2 above in a timely manner, the Company may correct WORK not done in accordance with this Contract, or damaged work of other contractors as provided in this Article 9, or WORK lost or damaged which should be repaired or restored under the provisions of Article 27 hereof, and all charges and costs associated therewith shall be either deductible from the Contract price or payable to the Company on demand.

9.4 If the Contractor does not remove, remedy and/or replace any such WORK within a reasonable time after written notice by the Company, then the Company may remove, remedy and/or replace it at the Contractor's expense.

9.5 The Contractor shall be responsible for completely fulfilling all performance specifications contained in this Contract, and its compliance with any material or design specifications, even though furnished by the Company, shall not alter or diminish such responsibility.

9.6 The Contractor shall be solely responsible for advising the Company in writing of any conflicts between the specifications and the Contractor's design, including performance and levels of quality. The Contractor agrees that its obligations, liabilities and warranties shall not be diminished or extinguished even if it meets the requirements of the Specifications.

10.0 PROGRESS REPORTS

If requested by the Company, the Contractor shall submit to the Company, on or about the twenty-fifth day of each month, a report stating the progress being made in fulfillment of this Contract up to the fifteenth day of said month, including cost/schedule reports, or such other reports which may be required by the Company to monitor costs and construction progress of the WORK. Any such reports shall conform to the format of, and contain the information requested by, the Company. The Contractor also shall attend and participate in any meetings requested by the Company to monitor progress of the WORK.

11.0 DOCUMENTATION; PROPRIETARY INFORMATION

11.1 The Contractor shall provide the Company with the necessary number of copies (as determined by the Company) of all information and documentation (including drawings and data, original manufacturer part number, reports and design) within the Contractor's scope of WORK and which is required for the design, construction, licensing, quality assurance, operation or maintenance of the WORK, the Premises or of a facility for which the WORK is intended.

11.2 No information, drawings or other documents transmitted or furnished by the Contractor to the Company under this Contract shall be deemed proprietary or confidential unless specifically designated as such. The Company shall not be prohibited from disclosure or use of proprietary or confidential information or documents relating to the WORK which is (are) required for the design, construction, operation and maintenance of the WORK or the Premises or other facility for which the WORK is intended, or which is (are) required by the Company for securing or maintaining in effect any license or permit from any Governmental Authority for the Premises or other facility for which the WORK is intended.

11.3 Except as may be required by the Contractor for the performance of its obligations under this Contract, the Company is not obligated under the terms of this Contract to provide the Contractor with any information which the Company considers proprietary. If the Company transmits any information to the Contractor which the Company considers proprietary, the information will be designated as proprietary. The Contractor shall use any such proprietary information exclusively in connection with the WORK, and shall not publish or otherwise disclose it to any third party.

12.0 DELAYS IN COMPLETION AND EXTENSION OF TIME

12.1 It is understood that the Contractor, in determining its price for and completion date of the WORK, contemplated that delays might occur in the prosecution of the WORK.

12.2 The Company shall not be liable to the Contractor for delays of any kind whatsoever, and the Contractor shall be fully responsible for making up time lost by all delays except only to the extent that extensions of time are granted under this Section. If completion of the WORK is delayed by any act or neglect of the Company, or other contractor in the employ of the Company, by strikes, or by other exceptional conditions over which the Contractor has no reasonable control, the time for completion shall, upon receipt of the Contractor’s written request, be extended by such period as the Company may consider reasonable. No such extension shall be allowed unless a claim therefore is presented in writing to the Company within seven days of the commencement of such delay. In the case of a continuing cause of delay, only one claim is necessary. Nothing in this Section shall be construed to release the Contractor from the obligation to perform, at its own expense, all overtime WORK necessary to maintain Contract completion dates where delays have occurred which are not excused by the foregoing provisions of this Section.

12.3 No delays of any kind whatsoever in the prosecution or completion of the WORK, whether or not extended by the Company, shall result in any price adjustment.

12.4 Without limiting any rights or remedies which the Company may have under this Contract or under any law, the Contractor shall be liable for all failures, delays and interruptions in performing any of its obligations under this Contract which are within its reasonable control.

12.5 If this Contract contains no schedule of dates on which drawings and data will be delivered to the Contractor by the Company, such drawings will be delivered in accordance with the Company’s customary practice, subject to delays resulting from conditions over which the Company has no control.

13.0 SUSPENSION

13.1 The Company shall have the right to extend schedules, suspend the Contractor’s performance hereunder, or delay any shipment required hereby, in whole or in part, at any time upon written notice to the Contractor. The Contractor shall, upon receipt of such written notice, have a maximum of three calendar days to suspend or delay its performance hereunder. Any WORK done after such three-day period will be at the Contractor’s sole expense and risk. The Contractor and/or its suppliers shall resume any WORK so suspended or delayed when directed in writing by the Company to do so. The effect of such suspensions or delays upon the Contract price, payment schedules, and delivery schedules may be mutually discussed for the purpose of determining the nature and extent of any adjustments thereto, though the Company shall have the final determination as to whether adjustments will be made.

13.2 In addition to the foregoing, (a) if the WORK to be done under this Contract shall be abandoned by the Contractor, (b) if this Contract or any portion thereof shall be assigned by operation of law or otherwise, (c) if the WORK or any portion thereof is sublet by the Contractor without the permission of the Company, (d) if the Contractor is placed in bankruptcy or if a receiver is appointed for its properties, (e) if the Contractor shall make an assignment for the benefit of creditors, (f) if at any time the necessary progress of WORK is not being maintained, (g) if the Contractor is violating any of the conditions or agreements of this Contract, or (h) if the Contractor is executing this Contract in bad faith or not in accordance with the terms hereof, the Company may, without prejudice to any other rights or remedies it may have as a result thereof, notify the Contractor in writing to discontinue all WORK under this Contract. Within three calendar days from the date of such notice, the Contractor shall discontinue the WORK, whereupon the Company shall then have the power to complete the WORK herein described by this Contract or otherwise, as it may determine, and the Contractor agrees that the Company shall have the right to take possession of and use any and all of the materials, tools, equipment, supplies and property, wherever located, including without limitation the Contractor's plants, subcontractors' plants, or in transit, of any and every kind provided by the Contractor for the purpose of the WORK. The Contractor shall cooperate with the Company and cause the Contractor's subcontractors to so cooperate so that possession can be effected. The expense of so completing the WORK in excess of the unpaid portion of the Contract price due under this Contract shall be charged to the Contractor, and the Contractor shall pay such amount upon demand. The Contractor shall not, in any event, be entitled to any unpaid portion of the Contract price due under the terms of this Contract. The Company will attempt to obtain the lowest figures for completing the WORK but may make such expenditures which in its sole judgment shall best accomplish such completion.

14.0 OVERTIME

14.1 If the Company gives the Contractor written instructions to complete any portion or all of the WORK in advance of Contract completion dates, or to make up time lost by delays caused by exceptional conditions over which the Contractor had no reasonable control as defined in Article 12 above, the Contractor shall comply with such instructions and shall be paid only the actual excess wage, insurance and taxes for overtime occasioned thereby. This provision for reimbursement of overtime does not apply to that overtime arising under Article 12 hereof for which the Contractor is responsible, or to occasional overtime normally required by the nature of the WORK, which charges are deemed included in the Contract price.

14.2 Except in an emergency endangering life or property, no claim for compensation for overtime, in addition to the Contract price, will be honored by the Company, unless advance written permission has first been obtained.

14.3 All claims for payment for overtime must be shown separately on the Contractor's invoices, and not included with amounts applicable to the original Contract price. Further, any invoices covering additions to this Contract must refer to the specific changeorder or similar written authorization issued by the Company approving such additions, and will not be honored unless such reference is included.

15.0 ROUTING OF SHIPMENTS

In the event that this Contract includes the furnishing of equipment and/or material, the Company shall have the option of specifying the routing of shipments. If such specified routing increases the Contractor's shipping cost, it shall immediately notify the Company and, should the Company still specify the more expensive routing, then the Contractor shall be reimbursed by the Company for the increase actually incurred thereby.

16.0 CLEANING UP

16.1 The Contractor shall at all times prevent the accumulation of debris in the construction area, buildings and Premises of the Company, or at the Project Site if not on the Company's Premises affected by the WORK.

16.2 On a daily basis, the Contractor shall remove from the buildings, Premises and Site, all debris caused by the WORK, and shall maintain the buildings in broom-clean condition. To eliminate fire hazards, the Contractor shall remove all combustible or explosive materials from the buildings, immediately upon becoming scrap or otherwise unusable. The Contractor shall remove all such debris and materials to an area designated by the Company.

16.3 The Contractor shall, unless otherwise mutually agreed, remove from the Site all of its offices, racks, surplus materials, erection and construction equipment, tools and supplies, immediately upon termination of their usefulness to the WORK.

16.4 The Contractor shall promptly remove from the Company's Premises or the Project Site all items declared to be nonconforming by the Company on account of failure to conform to this Contract, whether or not actually incorporated in the WORK. Such items may be stored at the Contractor's risk at such place or places either on or off the Site as the Company may determine.

16.5 In the event that the Company determines that the Contractor is failing to fulfill satisfactorily any of the above requirements, the Company shall give the Contractor detailed written notice. If the Contractor fails to comply with said notice within twenty-four hours after receipt of same, the Company may arrange to have such work performed by others, and the cost thereof shall be chargeable to the Contractor and may be deducted from any monies due the Contractor.

17.0 PERMITS AND PUBLIC REGULATIONS

17.1 All necessary permits for the construction of any buildings and completion of the WORK shall be obtained by the Contractor (except for the three permits identified below) and shall be paid by the Company. The Contractor shall not be reimbursed for licenses or other charges prerequisite to performing the WORK or otherwise imposed upon it. The Contractor shall give all required notices with respect to the foregoing. If the Contractor discovers that any Specifications or Drawings forming a part of this Contract are at variance with any legal requirements, it shall promptly notify the Company in writing. If the Contractor performs any WORK which is contrary to any laws, ordinances or regulations, without giving such notice to the Company, it shall bear all penalties and costs arising therefrom. The WORK shall also comply with the regulations of the National Fire Protection Association, or other such board as shall perform similar functions, except as may be otherwise specified in this Contract.

1.7.2 Dynegy Midwest Generation shall obtain the permits required from the Illinois Historical Preservation Agency, Illinois EPA and Illinois DNR-Office of Water Resources.

18.0 COMPLIANCE WITH LAWS, ORDINANCES, REGULATIONS AND CODES

18.1 The Contractor shall at all times be solely responsible for complying with all applicable laws, ordinances, regulations and codes, including those relating to safety of all persons and property, in connection with the WORK. No obligation of the Company shall impose upon it any duty to review the Contractor’s compliance with safety measures.

18.2 Wherever a standard or code is referenced within these Specifications or on the plans, it shall be understood to be the latest edition unless specifically noted otherwise.

18.3 The Contract price is predicated upon the Contractor’s compliance with applicable laws, ordinances, regulations and codes in effect as of the date of this Contract and as in effect thereafter. If any changes shall be made to such applicable laws, ordinances, regulations and/or codes subsequent to date of this Contract, such changes shall be considered to be changes ordered by the Company under Section 23.2 hereof, but only to the extent that the Company becomes legally required to order such changes for the WORK.

18.4 The Contractor agrees that the WORK covered by this Contract shall be or have been manufactured or performed, priced and sold in accordance with all federal, state and local laws, including without limitation, the Fair Labor Standards Act, the Equal Opportunity Clause set forth in 41 CFR Section 60-1.4(A), and the Affirmative Action Clauses set forth in 41 CFR Sections 60-250.44 - 741.4.

19.0 ERECTION

19.1 The Contractor shall keep all its tools, equipment and material, etc., in such condition that the WORK can be carried on with safety to employees of the Company and the Contractor, and also to other persons and property at or near the Project Site.

19.2 The Contractor shall maintain a competent superintendent at the Site at all times to supervise the WORK and conduct it in cooperation with the Company and in coordination with all other WORK being done on the Premises. The superintendent shall be acceptable to the Company and may not be changed except by the request of the Company unless said superintendent proves to be unsatisfactory to the Contractor or ceases to be in the Contractor's employ. Without limiting the Contractor's responsibility to perform the WORK in accordance with this Contract, it is understood that the Contractor shall employ a competent engineer to determine lines and elevations.

19.3 The Contractor shall prepare detailed construction schedules when requested by the Company containing, at a minimum, designated activities necessary to perform the WORK and the date(s) on which each activity will be started and completed. The Contractor is solely responsible for determining the sequence and time estimates of each activity. The Company may require the Contractor to modify any schedule, including any part thereof (a) in the event that the Company determines the schedule or any part thereof to be impracticable or unreasonable, (b) as required by the schedules of other contractors or vendors, (c) to avoid undue interference with Site operations, and (d) to complete the WORK when required by this Contract. The Contractor shall be solely responsible for complying with the detailed construction schedules, including modifications thereof by the Company. In the event that the Contractor cannot maintain any schedule for a reason other than one excused by the Contractor, the Company may require the Contractor to furnish new detailed construction schedules.

19.4 The Contractor shall arrange, schedule and carry on the WORK so as not to interfere with the delivery and erection of the WORK of others or with the operation of any of the Company's existing facilities. To facilitate the erection of such other WORK, the Contractor shall, without cost to the Company, cease WORK at any point, when so directed by the Company, and complete the unfinished WORK at such time as the Company may designate. Materials and equipment shall be delivered to the Site in the order required for erection, and shall be stored as directed by the Company. The Contractor shall ascertain in advance what facilities are available for its use in the delivery, unloading, storing and erection of materials and equipment at the Site.

19.5 The Contractor shall do such cutting, fitting and patching of existing structures as may be required to install the WORK and shall, at all points of contact, properly fit it to existing WORK. The Contractor shall not endanger any WORK by cutting, digging or otherwise, and shall not cut or alter existing structures or the work of any other contractor except with the authorization of the Company.

19.6 The Contractor shall be responsible for determining what temporary shoring and bracing must be provided to support loads to which the WORK may be subjected, including construction equipment and the operation of such equipment. The Contractor shall be solely responsible for the adequacy and safety of such shoring and bracing.

19.7 The Contractor shall be completely responsible for the adequacy of any temporary attachments to the Company's structure or other facilities, whether or not such attachments may be required for the Contractor's cranes, hoists, scaffolds or other construction equipment or devices. Where the Specifications require the Company to review any such temporary attachment, such review shall be solely for the purpose of determining its potential impact on the Company's structure or other facilities, and in no way shall such review be interpreted as constituting approval of the adequacy of such attachments for their intended use.

19.8 The Contractor shall be solely responsible for, and shall have control and charge of, construction means, methods, techniques, sequences and procedure, and for safety precautions and programs in connection with the WORK, and shall carry out the WORK in accordance with the Contract documents. The Company will not be responsible for, or have control or charge over, the acts or omissions of the Contractor, subcontractors or any of their agents or employees, or any other persons performing any of the WORK.

19.9 The Contractor shall perform the WORK in a proper, safe and secure manner to prevent loss, injury or damage to the Company's property, the property on the Premises and to lives of persons, and shall comply with all applicable safety laws, rules and regulations of any Governmental Authority, including those contained in, or issued pursuant to, the Occupational Safety and Health Act of 1970, as amended, and with all safety procedures which the Company may prescribe in connection with the performance of the WORK. The Contractor shall designate a responsible representative at the Project Site who shall be responsible for, and oversee, loss prevention and loss control activities on behalf of the Contractor. This person shall be the Contractor's superintendent unless otherwise designated in writing by the Contractor to the Company.

19.10 The Company may suspend WORK which interferes or threatens to interfere with the operation of the Company's equipment or general safety of personnel or operations until the interference is eliminated. All equipment used by the Contractor on the Premises shall be in first class condition. Any equipment which the Company determines is inadequate or unsafe shall be removed immediately from the Premises at the Contractor's expense after notice from the Company.

19.11 The Contractor shall provide and maintain all passageways, guard fences, lights, barricades and other facilities for protection required by Governmental Authorities or rendered reasonably necessary by local conditions, and shall erect shelters sufficient to protect the WORK from damage. All barricades shall be arranged to ensure the safety of the workers and passersby, and shall be removed by the Contractor upon completion of the WORK.

19.12 The Contractor shall comply strictly with the Company's regulations in effect at any time governing the admittance of the Contractor's employees to the Premises and their identification while there. The Contractor shall bind each subcontractor, and all persons directly or indirectly subject to its direction or that of any subcontractor, to strict compliance with these regulations and with such supplemental, precautionary requirements which the Company may issue during the performance of the WORK.

20.0 FIRE PROTECTION

20.1 The Contractor shall provide its own temporary fire protection facilities for the equipment and materials furnished by it or the Company for its temporary construction buildings and structures. The equipment shall be maintained and inspected in accordance with applicable NFPA codes.

20.2 The Contractor's employees shall not remove the Company's installed fire extinguishers from their mountings unless they are needed to fight an actual fire or unless required to complete the WORK. In the event that the fire equipment is used to fight a fire, the fire extinguishers shall be returned to a location designated by the Company for recharging. In the event that the equipment is removed to complete the WORK, the removed equipment shall be relocated by the Contractor to an area as close to the equipment's original mountings as possible.

21.0 STORAGE AND TEMPORARY BUILDINGS

21.1 Outdoor space for the location of the Contractor's offices, shops or warehouses and for the storage of materials will be provided by the Company without charge. The Company will designate the area that will be available for such use at the time the Contractor visits the Site or when the plant layout is finalized. All temporary facilities required by the Contractor must be provided by the Contractor.

21.2 All temporary buildings required by the Contractor, including associated electrical work and heating facilities, shall be erected and maintained by it and shall be removed by the Contractor at the termination of their usefulness or termination of the WORK. Any temporary construction office to be erected within the main power station building shall be of sheet metal construction with a steel frame.

21.3 Prior to erection of any temporary building, the Contractor shall submit plans to the Company for general approval of construction and appearance before the building(s) may be erected.

21.4 All the Contractor's office furniture, equipment, material and consumables shall be provided by the Contractor at no additional cost to the Company.

21.5 Temporary shelves, bins, boxes, stands, racks, etc., required for the performance of the WORK shall be furnished by the Contractor, and the type(s) and location(s) will be subject to approval by the Company. These shall be removed by the Contractor when they are no longer required for the WORK.

21.6 The Contractor shall be responsible for all actions required by the manufacturers or vendors for the proper storage of equipment or material supplied by them and as instructed by the Company. These include such actions as maintaining warm or dry conditions, rotating shafts, coverings, dunnage, and the like.

21.7 All pressurized gas cylinders shall be stored or used in the upright position, chained or clamped to an adequate support and have the protective caps in place when not in use. The storage and maintenance of such cylinders shall be the sole responsibility of the Contractor.

22.0 MATERIAL SAFETY DATA SHEETS

The Contractor shall submit to the Company, along with any materials provided for the

WORK, applicable and current Material Safety Data Sheets (MSDS) for substances used during WORK to comply with the Toxic Substance Disclosure to Employee Act 83-240. The Contractor shall provide Material Safety Data Sheets at or prior to delivery of the items.

23.0 CHANGES IN THE WORK

23.1 Subject to the Company's prior written approval, the Contractor may make changes in the WORK without any change in the Contract price or the time(s) by which the Contractor must perform its obligations under this Contract, if such changes are made to meet the Contractor's warranties or other obligations under this Contract. In connection with the foregoing, the Contractor agrees promptly to advise the Company in writing of all improvements, whether owned or developed by the Contractor or others, which may come to the attention of the Contractor and which may be made in or to the WORK.

23.2 Revised or additional drawings and data may be issued after the contract is signed. Within 10 (ten) days after the receipt of any supplemental information, the Contractor shall advise the Company of any changes in unit costs in writing. No work shall be done on properties on which a cost change is required until a price is negotiated that is acceptable to the Company and Contractor.

23.3 The Engineer or On-Site Representative shall approve any material, procedures or specifications that the Contractor proposes to substitute for those specified herein, in advance. Any adjustment in price must be agreed to prior to the use of the item in the project.

23.4 The Contractor shall make changes in the WORK ordered by the Company in writing and, if any such change shall affect the Contract price or schedule dates, the Contract price shall be increased or decreased accordingly. The charge or credit for any such changes affecting the Contract price shall be determined, at the Company's option, by any of the following methods: (a) agreed lump sum price, (b) unit prices specified in this Contract or subsequently agreed in writing, (c) actual cost and agreed fixed fee, or (d) cost-plus provision if specified in this Contract. In those instances where the Company elects to order changes on a lump sum price basis, the Contractor shall submit for approval a quotation covering any change which affects the Contract price, and, if any change does not affect the Contract price, the Contractor shall so acknowledge in writing. Such quotation shall be submitted in writing within five days of receipt of the notification of the change, provided that under no circumstances shall the Contractor be entitled to an increase in the Contract price for such changes if the Contractor does not submit its quotation within five days or such period as agreed by the Company in advance. Failure by the Contractor to submit a quotation for changes decreasing the Contract price within the five-day period shall not affect the Company's right to a decrease in the Contract price. A price adjustment, where appropriate, will be mutually agreed in writing. Where such changes may adversely affect the Contractor's ability to meet performance schedules under this Contract or meet other obligations under the provisions of this Contract, an adjustment of such schedules and any other pertinent provisions, including payment schedules, shall be granted by the Company only if the Contractor notified the Company in writing of such effects and where the Company instructs the Contractor to proceed. In any event, the Contractor will receive price adjustments to this Contract only if such adjustments are agreed by the Company prior to commencing the WORK on such changes. The Contractor shall make necessary changes before any agreed price adjustment, if requested to do so by the Company.

23.5 When work is required that falls outside the scope and requirements of these Specifications, the Contractor shall obtain an "Extra Work Authorization" from the On-Site Representative or Engineer. The authorization may be initially oral, but must be in writing before compensation can be made.

23.6 Except in an emergency endangering life or property, no claim for compensation for extra WORK, in addition to the Contract price, will be honored by the Company, unless advance written permission has first been obtained.

23.7 All claims for payment for extra WORK must be shown separately on the Contractor's invoices, and not included with amounts applicable to the original Contract price. Further, any invoices covering additions to this Contract must refer to the specific change order or similar written authorization issued by the Company approving such additions, and will not be honored unless such reference is included.

24.0 COMPANY'S RULES AND REGULATIONS

The Contractor shall abide by any and all rules which the Company may have in effect or hereafter put into effect at the Site of the WORK pertaining to workmen, safety, use of cameras, security procedures or requirements, lighting of fires, and to the handling of equipment, materials, or any other part of the WORK. If, in the Company's judgment, it is desirable, the Contractor shall at the Company's request remove any employee from the WORK.

25.0 COMPANY'S RIGHT TO ORDER ADDITIONAL EFFORT

If the Contractor fails to carry on the WORK with the diligence necessary to complete any portion of the WORK in accordance with the schedule provided in this Contract (or if no such schedule is provided, then within a reasonable time), the Company may in writing order the Contractor to, and the Contractor shall, at its sole cost and expense, use such overtime, including extended shifts, employ such additional personnel, machinery, construction equipment, tools, etc., as shall be specified in such order necessary to maintain schedules and ensure timely completion. In the absence of bad faith, all orders given by the Company hereunder shall be conclusively binding upon the Contractor.

26.0 TERMINATION

26.1 The Company may terminate this Contract, in whole or in part, for its own convenience by written notice at any time. In such event, the Company shall pay the Contractor all labor and material costs incurred in the WORK prior to such notice and reasonable and normal overhead and profit with respect to such costs, less salvage value.

26.2 If either of the following events shall occur: (a) if the Contractor fails to make delivery of the material and/or equipment or to perform the WORK within the time specified herein or any extension hereof, or (b) if the Contractor fails to perform any other provision of this Contract and does not cure such failure within a period of ten days after notice thereof, then the Company may by written notice terminate in whole or in part any uncompleted WORK under this Contract, whereupon the Company may procure the material, equipment and services which, but for such termination, the Contractor would have been required to furnish hereunder; the Contractor shall be liable to the Company for all costs of such material, equipment and services in excess of that portion of the Contract price attributable thereto; and the Contractor shall continue the performance of this Contract to the extent not terminated under the provisions of this Section.

26.3 To the extent permitted by applicable law and in recognition of the nature of the WORK provided hereunder, (a) the insolvency of the Contractor, (b) the filing of a voluntary petition in bankruptcy by the Contractor, (c) the filing of an involuntary petition to have the Contractor declared bankrupt, (d) the appointment of a receiver or trustee for the Contractor, or (e) the execution by the Contractor of an assignment for the benefit of creditors shall entitle the Company to terminate this Contract.

27.0 LOSS OR DAMAGE AND INSURANCE

27.1 Until accepted in its entirety by the Company, the WORK shall be at the Contractor's risk and, if any loss of or damage to the WORK occurs from whatever cause(s) occurs prior to acceptance, the Contractor shall, without cost to the Company, promptly repair or replace the WORK so lost or damaged. In case this Contract provides for the unloading and/or erection of materials and/or equipment, the Contractor shall be fully responsible for all loss of, or damage to, said materials and equipment from whatever cause(s) occurring prior to acceptance of the WORK in its entirety, such responsibility to commence when the equipment or materials is (are) available for such unloading or erection. The Contractor waives and relinquishes all claims against the Company for loss or damage to the Contractor's property, and shall secure a waiver of subrogation by its insurer against the Company. The Contractor shall protect the Company's property from, and shall be responsible for, any loss or damage arising out of the execution of the WORK. In case the Contractor shall use any of the Company's facilities, it shall be the Contractor's duty before such use to ascertain that said facilities are in safe operating condition, and the Contractor shall be responsible for and indemnify the Company against any loss or damage resulting from such use.

27.2 In the event that this Contract calls for equipment or material to be shipped to the Contractor by the Company or others, and which the Contractor is required by this Contract to incorporate in, or attach to, the WORK, then the Contractor shall, upon receipt of said equipment or material, assume full responsibility for loss or damage thereto but shall have no interest in title of same.

27.3 Before commencement of the WORK, the Contractor shall procure insurance covering the above liabilities under policies in forms, in amounts, and with insurance carriers acceptable to the Company. All such policies shall name the Company as an additional named insured and Engineer as an additional insured as their interests may appear and said policies or certificates thereof shall be delivered to the Indemnified Parties.

28.0 INDEMNIFICATION

Contractor agrees to indemnify and hold harmless Dynegy Midwest Generation, Inc., the Engineer, and their respective officers, agents and employees from and against any and all claims, demands, losses, attorneys' fees and expenses arising out of, relating to, or resulting from the services provided by Contractor, its agents, its employees, it subcontractors, and any person or entity having a contract with any of its subcontractors.

This indemnity agreement specifically excludes any obligation to indemnify or hold Dynegy Midwest Generation, Inc. harmless for damages or claims to the extent attributable to any act or omission of Dynegy Midwest Generation, Inc. In addition, this Agreement specifically includes a waiver of any defenses (including, but not limited to, the *Kotecki* limitation defense, 146 Ill.2d at 160) which the Contractor may have as to damages or claims attributable to the fault of the Contractor or its agents, employees, or subcontractors as described herein. Contractor also agrees to reimburse Dynegy Midwest Generation, Inc. and Engineer for all costs and expenses, including but not limited to attorneys' fees, incurred by Dynegy Midwest Generation, Inc. and Engineer in enforcing, or attempting to enforce, any aspect of this indemnification agreement.

29.0 INSURANCE

29.1 The Contractor must provide insurance in accordance with items a-g set forth below in Section 29.2, as applicable. Evidence of compliance therewith is to be in the form of a certificate of insurance indicating that the required coverages are in full force and effect at the required limits. The Company may prohibit the Contractor from commencing or completing the WORK under this Contract until such time as the Contractor has provided the Company with the said certificate of insurance. The Company is under no obligation to pay any invoices submitted for any WORK under this Contract until its Purchasing and Material Control Department is in receipt of said certificate. The failure of the Company to enforce any provision of this Section, however, in no way relieves the Contractor of its obligation to provide the required insurance at the required policy limits.

29.2 Insurance policies written on a "claims made" basis shall be maintained by the Contractor for a minimum period of five years after the completion of this Contract and shall maintain retroactive dates, which are effective on, or before, the beginning of this Contract. The Contractor shall designate the Company as an additional named insured and Engineer as an additional insured on all policies specified below.

a. Workers' Compensation and Occupational Disease Coverage for statutory limits in accordance with applicable law. The policy shall also include Employers' Liability Coverage (Coverage B) at a minimum limit of $500,000.

The Contractor shall determine if the WORK to be performed under this Contract is covered by any Federal Compensation statutes, including, but not limited to, the Longshoremens' and Harbor Workers' Compensation Act. The Contractor shall arrange, pay for, and maintain proper insurance coverage as required by such statute.

b. Commercial General Liability ("CGL") Insurance to cover claims which may arise from the performance of any obligations arising under this Contract. This policy will include protection for the following hazards:

   i. Premises - Operations.

   ii. Independent Contractors' Coverage.

   iii. Products and Completed Operations Liability - Coverage to apply for one year beyond completion and acceptance of the WORK specified by this Contract.

   iv. Deletion of explosion, collapse and underground exclusions (where this Contract provides for any excavation or related services).

   v. Personal Injury Liability.

   vi. Broad Form Property Damage.

   vii. Contractual Liability - Covering the indemnity Agreement in Article 28 of this Contract.

The above policy will be written at limits of at least One Million Dollars ($1,000,000) for each occurrence, One Million Dollars ($1,000,000) aggregate. The general aggregate limit under the CGL policy is to apply as a separate aggregate to the WORK under this Contract.

c. Business Automobile Policy (Commercial Automobile Liability Insurance) providing coverage for all owned, non-owned and hired vehicles. Minimum Limits of Liability shall be at least One Million Dollars ($1,000,000) each occurrence, Bodily Injury and Property Damage Liability combined single limit.

d. (Applicable for an architect, engineer, surveyor, Contractor or other contractor providing professional services.)

Professional Errors and Omissions Liability Insurance, with limits of at least One Million Dollars ($1,000,000) each occurrence, One Million Dollars ($1,000,000) aggregate. The Contractor shall also require all professional subcontracators to obtain and maintain similar insurance with similar minimum limits in connection with subcontracted WORK. All Professional Errors and Omissions Insurance shall be endorsed to provide contractual liability coverage.

e. (Applicable if the Contractor or its subcontractors will use a helicopter or airplane for any reason at the Site or to perform any Contract obligations.)

Aircraft liability (including passenger liability) insurance with a combined limit for bodily injury and property damage of not less than Five Million Dollars ($5,000,000) each occurrence. Such policy shall be in effect prior to the first use of such aircraft and shall continue in effect, at all times, until after such aircraft completes its work and lands at its final destination.

f. (Applicable if the Contractor or its subcontractors will use any marine vessel or floating euqipment for any reason at the Site or to perform any Contract obligations.)

Protection and Indemnity, including Jones Act liability insurance, with limits of liability of not less than Five Million Dollars ($5,000,000) each occurrence.

29.3 The failure of the Company to enforce any provision of this Section, however, in no way relieves the Contractor of its obligation to provide the required insurance at limits not less than the minimums required policy limits as specified above.

29.4 All the above policies shall be written by companies satisfactory to the Company. These policies shall not be changed or cancelled except within 30 days' written notice to the Company from the insurance carrier(s). Notification of cancellation or other changes must be mailed to:

Dynegy Midwest Generation, Inc.
Attn: Director, Business Center
2828 North Monroe Street
Decatur, IL 62526

29.5 The Company should receive confirmation that the Contractor has requested its insurance carrier to submit a certificate of insurance and provide Umbrella Coverage limits, if purchased, prior to the execution of any WORK.

30.0 ADVANCE SHIPMENTS

The Contractor shall make no shipments in advance of the required shipping date, unless there is adequate storage area at the site of the WORK, or such area is provided by the Contractor, and provided such shipment does not interfere with the progress of the WORK in any way. Any such advance shipment shall not entitle the Contractor to any payment prior to the time when such payment would otherwise be due if the shipment were made on the scheduled shipping date.

31.0 PUBLICITY

31.1 The Contractor shall not disclose any details of the WORK to any person(s) except those engaged in its performance, and only then to the extent required for the particular portion, of WORK being done. The Contractor shall not give any information concerning details of the WORK to the press or news disseminating agency without the Company's prior written consent.

31.2 The Contractor shall not display any sign, poster or other advertising matter in or on any part of the Site without the prior written consent of the Company.

31.3 No photographs of the WORK or at the Project Site are to be taken without prior written approval of the Company.

32.0 COST BREAKDOWN

The Contractor shall furnish the Company an itemization of the Contract price, including any changes thereto, according to the system of accounts required by the Company. All invoices submitted for payment, including payments for extra WORK, shall be itemized according to these accounts. This provision shall not be construed as an obligation on the part of the Company to make progress payments in compliance with this breakdown, but such payments shall be based on the value of WORK performed as provided in this Contract.

33.0 TAXES

The Contract price shall be net of any taxes however designated. The Company shall pay to the Contractor only those taxes which the Contractor is required under federal, state, local law, or foreign law to collect from the Company; the Company will not pay or reimburse the Contractor for any occupation, gross receipts, income, franchise, property or other taxes imposed upon the Contractor. If the Company claims exemption from any tax that the Contractor would otherwise be required to collect from the Company, the Company will furnish the Contractor with the documentation, if any, necessary to establish such exemption. Any tax which the Company is required to pay under this Section shall be identified in the Contract documents and shown separately by the Contractor on an appropriate invoice.

34.0 PAYMENTS

34.1 Unless noted otherwise, compensation will be made in accordance with bid units listed in this Specification. While the Company reserves the right to adjust quantities, any change in quantity of an item (or resultant total cost of that item) of ± 25% will require an adjustment of unit cost that is acceptable to the Company and Contractor.

34.2 Progress payments will be made, if requested, on a monthly basis based on the cost of completed bid units. More frequent progress payments can be arranged on large projects if desired. The Contractor shall submit all requests for payment directly to the On-Site Representative.

34.3 Pursuant to the Illinois sales tax exemption for this project, separate documentation shall be provided with each invoice that shows the cost of all materials that are included on the invoice and normally would have been subject to Illinois sales tax. Also, if any Illinois sales tax is paid by the Contractor, the amount, along with a description of the materials on which the tax was paid and an explanation of why the tax was paid will be provided with the invoice.

34.4 Unless noted otherwise, the Company will retain 10% of the total cost of payment requests pending satisfactory completion of the project. After all equipment, surplus material and debris have been removed form the site and the Company accepts the completed project, the Contractor must submit a request for payment for the retained funds. On large projects, the Contractor may bill for a portion of the retainage as major divisions of the project are completed; however, the Company shall retain the final decision as to the appropriateness of such requests.

34.5 The Contractor is specifically cautioned to immediately notify the On-Site Representative when requests for project changes come from outside parties (such as landowners, state agencies, etc.) AND OTHER DYNEGY MIDWEST GENERATION EMPLOYEES. Any project changes made at the request of these individuals, without the approval of the On-Site Representative or Engineer, will not be compensated as part of this contract. The Contractor may make individual payment arrangements with these unauthorized individuals at his own risk.

34.6 No certificates given or payments made shall be considered as evidence of satisfactory or acceptable performance of this Contract, either wholly or in part, nor shall any certificate or payment be construed as acceptance of any defective part of the WORK. The Contractor shall, if requested by the Company, at the time of any application for a partial or final payment, furnish the Company with a verified certificate showing names of subcontractors hereunder, the WORK done by, and the amount payable to, each. The Contractor shall furnish waivers in full or in sufficient amount to justify the requested payment, and shall in all other respects comply and cause all subcontractors to comply with the requirements of applicable local laws to the end that the Company shall be fully protected against claims for all WORK covered by such payments. Acceptance by the Contractor of final payment on the Contract price shall constitute a waiver of all claims against the Company.

35.0 RELEASE OF MECHANICS' LIENS

Pursuant to Section 5 of the Illinois Mechanics' Lien Act, the Contractor must submit a sworn statement of Subcontractors and suppliers furnishing materials and/or labor before any payments are required to be made to the Contractor. The Contractor agrees and acknowledges, therefore, that it shall not be entitled to any payments from the Company until such time that the Contractor has furnished the Company with a sworn statement setting forth the names of all Subcontractors and suppliers furnishing materials and/or labor pursuant to this Contract, and the amounts to become due to each. If Subcontractors are not being utilized, the Contractor shall so certify. Additionally, where Subcontractors are being utilized, the Contractor shall furnish to the Company partial and final lien releases which include all Subcontractors and material suppliers, when applying for Contract payments. No such payments shall be made until the Contractor has furnished the Company with all partial and final lien releases covered by the payment being sought. The Company reserves the right to apply any amount specified as retainage toward payment of unpaid Subcontractors/suppliers.

36.0 ASSIGNMENT OF CONTRACT

This Contract shall inure to the benefit of, and be binding upon, the successors and assigns of the respective parties. No rights, interests or obligations under this Contract shall be transferable or assignable by the Contractor or the Company without the prior written consent of the other party, which consent shall not be unreasonably withheld; however, each party shall have the right, without the prior consent of the other, to transfer or assign this Contract to any successor to all or a significant portion of the transferors' properties, whether by merger, consolidation, liquidation, corporate reorganization, sale, mortgage or otherwise, provided that such transferee or assignee, by written agreement or by operation of law, assumes the obligations of the transferor under this Contract.

If the successor or assignee of the Contractor or the Company shall so covenant and agree, in a writing delivered to the other party, to assume the obligations of such party so assigning and transferring its duties, rights or interests under this Contract, the party so assigning and transferring shall thereupon be released from all liability thereafter arising under this Contract.

37.0 PATENTS

The Contractor shall pay all liability, including all royalties, damages, or license fees, which may be payable on account of the WORK or any part thereof. The Contractor shall, at its own expense, defend any claim brought by others against the Company, its successors, assigns or those using the WORK, because the sale or use of the WORK infringes or is alleged to infringe, directly or contributory, or induce others to infringe rights in, to or under patents, trade secrets, trademarks, or copyrights, and will hold the Company harmless from any liability of any nature or kind (including all costs and expenses) arising out of any such infringement or alleged infringement. In the alternative, and at the Company's option, the Contractor shall reimburse the Company for all costs and expenses, including reasonable attorneys' fees incurred by the Company in defending any such suits or proceedings. In addition to the foregoing, the Contractor shall save the Company harmless against, and shall pay, all awards of damages assessed and all costs of suit adjudged against the Company in such suits or proceedings, provided the Company gives the Contractor reasonable advance notice in writing of the institution of any such suit or proceeding, permits the Contractor to defend it, and gives the Contractor all such information, assistance and authority as shall be necessary to enable the Contractor to do so. In case any part of the WORK is held in any such suit to constitute infringement and its use is enjoined, the Contractor shall, within a reasonable time, and at the election of the Company, either (a) secure for the Company the perpetual right to continue the use of such part of the WORK by procuring for the Company a royalty-free license or such other permission as will enable the Contractor to secure the suspension of any injunction, or (b) replace, at the Contractor's own expense, such part of the WORK with an adequate non-infringing part, or modify it so that it becomes non-infringing.

38.0 NOTICES

38.1 All notices hereunder shall be in writing and delivered in person, or sent by certified or registered mail.

38.2 Such notices to the Company shall be delivered or mailed to:

Dynegy Midwest Generation, Inc.
Attn: Director, Business Center
2828 North Monroe Street
Decatur, Illinois 62526
Purchase Order No. ________________________

39.0 STATE LAW GOVERNING CONTRACT

This Contract shall be governed and construed in all respects in accordance with the internal laws of the State of Illinois without reference to its conflict of law provisions, and the parties agree that the Sixth Judicial Circuit of Macon County, Illinois, shall be the sole and exclusive venue for any dispute or litigation arising under this Contract.

40.0 ARBITRATION

Any dispute arising out of, or relating to, this Contract or the breach, termination or validity hereof, which has not been resolved by mutual negotiation of the parties within 90 days, shall be settled by arbitration in accordance with the then-current rules of the American Arbitration Association by a single independent and impartial arbitrator with knowledge of, or experience in, the subject matter of this Contract. The arbitration shall be governed by the Federal Arbitration Act, 9 U.S.C. §§1-16 to the exclusion of state laws inconsistent therewith, and judgment upon the award rendered by the arbitrator may be entered by any court having jurisdiction thereof. The place of arbitration shall be Chicago, Illinois. The arbitrator is not empowered to award damages in excess of compensatory damages, and each party hereby irrevocably waives any right to recover such damages with respect to any dispute resolved by arbitration. The parties also agree that the fact and outcome of any arbitration shall be strictly confidential, and that a disclosing party shall be liable for $10,000 in liquidated damages. The statute of limitations of the State of Illinois applicable to the commencement of a lawsuit shall apply to the commencement of arbitration hereunder, except that no defenses shall be available based upon the passage of time during any settlement negotiations specified herein.

41.0 LITIGATION

If any dispute is not submitted to, and resolved by, arbitration as provided in Article 40, then either party may initiate litigation upon 60 days' written notice to the other party; provided, however, if one party has requested the other to participate in arbitration and the other has refused or failed to participate, the requesting party may initiate litigation before expiration of the above period. In any such litigation, the prevailing party shall be entitled to an award of attorneys' fees plus costs.

42.0 TIME OF THE ESSENCE

Time is of the essence of this Contract.

43.0 DATE OF CONTRACT

This Contract shall commence on the date and year of execution by the last party to sign the Purchase Order Acknowledgment.

44.0 NON-WAIVER OF RIGHTS

44.1 The failure of the Company to insist upon strict performance by the Contractor or the Company's failure or delay in exercising any rights or remedies provided in this Contract or by law shall not be deemed or construed as a waiver of any claims. No waiver by the Company of a breach of any provision of this Contract shall constitute or be construed as a waiver of any other breach or of that provision. No purported oral modification, waiver or recision of this Contract by an employee or agent of the Company shall operate as a modification, waiver or rescission of any of the provisions of this Contract.

44.2 No certificate given, nor payment made under this Contract, nor partial or entire occupancy of the Premises by the Company shall be construed as an acceptance of defective WORK or of improper materials, or as waiving or condoning any omission or default. No payment or certificate, final or otherwise, shall be construed as relieving the Contractor of its obligations to make good any defects or consequences for which the Contractor may be responsible, nor as a waiver of any obligations of the Contractor under this Contract. Payment by the Company shall not constitute or be construed as a release of any rights or remedies the Company may have against the Contractor under this Contract, at common law or otherwise. Acceptance by the Contractor of final payment on This Contract shall operate as a waiver of all claims against the Company.

45.0 HEADINGS

The heading of Articles and Sections of this Contract are for convenience only and do not define, limit or construe the contents hereof.

46.0 SEVERABILITY

In the event that any provision of this Contract, including the General Conditions, is determined to be invalid or contrary to existing applicable law, the enforceability of the remaining provisions of this Contract shall not be affected and will be given full force and effect unless the Company determines that such invalidity materially affects the basic consideration of this Contract. In that event, the Company may terminate this Contract in accordance with Article 26.

47.0 SMOKING

Effective as of October 1, 1993, the Company has banned smoking in all of its buildings and vehicles. The Contractor will be required to comply with this policy.

48.0 DRUGS, ALCOHOL AND FIREARMS

48.1 The Contractor shall at all times enforce strict discipline and good order among its employees and the employees of any subcontractor of any tier. The Contractor shall not permit or suffer the introduction or use of any weapons, firearms, ammunition, explosives, illegal drugs or intoxicating liquor during performance of the WORK under this Contract, or upon any of the grounds occupied or controlled by the Contractor or the Company.

48.2 The Contractor shall immediately remove from the WORK, whenever requested by the Company, any person considered by the Company to be incompetent, insubordinate, careless, disorderly, in violation of the above restriction on weapons, firearms, ammunition, explosives, drugs or liquor, or under the influence of illegal drugs or intoxicating liquor, and such person shall not again be employed in the performance of the WORK hereunder without the prior written consent of the Company.

IN WITNESS WHEREOF, this Contract has been executed by the parties' duly authorized representatives effective as of the date(s) of the Purchase Order Acknowledgment(s) to which this Contract is appended and of which it is a part.

Dynegy Midwest Generation, Inc.

______________________________ By:____________________________

Contractor

Alona J. Campbell-Walker
Buyer/Contract Administrator

SECTION 3: SAFETY

Contractual Safety Requirements for Performing Work at Dynegy Midwest Generation, Inc Fossil Stations:

This document describes minimum safety requirements, in addition to all OSHA regulations, required by Dynegy for work performed at any Dynegy fossil station. This document is to be carefully reviewed and agreed to via signed attached *Statement of Compliance* prior to commencing work at any Dynegy fossil station. As used herein, the term "Contractor" shall include all subcontractors of the Contractors.

1.0 PRE-MOBILIZATION REQUIREMENTS

1.1 Safety Orientation

Prior to the start of any work or mobilization, contract employees shall attend a mandatory Safety Orientation conducted by Dynegy, unless based on scope of work, orientation is waived by the Plant Safety Coordinator/Plant Management.

1.2 Substance Abuse Testing

All contract employees shall comply with the Dynegy Substance Abuse Prevention Policy which includes pre-employment, reasonable suspicion, and random testing. All substance abuse testing shall conform to the requirements of the Fossil Power Plant Contractor Substance Abuse Testing Program. Any Contractor representative, vendor, or craft worker refusing to test under this testing procedure shall be prohibited access to the work site.

2.0 CONTRACTOR SAFETY PERFORMANCE

All contract work, including materials and equipment utilized, shall be in compliance with the applicable Federal, State, County, and local rules and regulations including, but not limited to the rules and standards established by OSHA. If a local plant work rule or work practice is more stringent than the OSHA requirements or the contractor's general requirements, the contractor shall adhere to the local safety practice.

Contractors are expected to demonstrate safe work behaviors that fully comply with the contractor's and Dynegy's plant safety requirements and stated expectations. Contractor management is responsible for ensuring that said requirements and expectations are understood and exercised by contract employees.

3.0 SAFETY ACCOUNTABILITY

The contractor, as an independent business, retains the obligation to control the manner and means by which it performs its work, pursuant to the provisions of the contract, so long as it does not violate Federal, State, County, local, or site regulations. The contractor therefore is responsible for contract employees' compliance with all applicable safety rules and accepts any liability associated with such non-compliance, including but not limited to costs born by Dynegy as a result of a contractor's failure to comply with the contractor's, the plant's, or regulatory safety requirements. Dynegy reserves the right to observe work performance of contractors and instruct contractor management to correct any identified deficiencies. Also, Dynegy also reserves the right to stop any work where there is perceived imminent danger to any personnel on site.

4.0 BUSINESS PERMIT / LICENSES

Contractor shall obtain, at its own expense, all business licenses and business permits that may be needed in connection with this work. It is the contractor's responsibility to determine the license/permit needs at the site.

5.0 ACCIDENT/DAMAGE TO PROPERTY REPORTS AND PROCEDURES

The contractor shall immediately report to the Dynegy Plant Safety Representative/Plant Management, all accidents, occupational injuries and illnesses involving its employees relating to the work to be performed hereunder, or causing damage to the property of Dynegy.

- Contractor shall promptly furnish the Dynegy Plant Safety Representative/Plant Management with copies of the State of Illinois First Report of Injury form and the Accident Investigation Report relative to any injury incurred on site.

- Contractor agrees to assist Dynegy personnel in any investigation it may conduct of any such accident, injury or illness.

6.0 SAFETY EQUIPMENT, MATERIAL & TOOLS

Unless otherwise agreed to, in writing by Dynegy, contractor shall provide all safety equipment, material, tools, and personal protective equipment necessary to perform the work in a safe, healthful manner.

7.0 SYSTEM WIDE SAFETY REQUIREMENTS

7.1 No Smoking Policy

Smoking is prohibited in all Dynegy facilities and in all Dynegy Company vehicles.

7.2 Parking/Access Policy

All locations have specific entry gates and specific parking areas for contractors and contractors' employees. Contractors shall not use the Main Dynegy access gates.

7.3 Firearms

No personal firearms or ammunition are permitted on Dynegy property.

7.4 Personnel Qualifications

The contractor is responsible for ensuring that only qualified personnel perform work at Dynegy fossil stations. This includes ensuring that all OSHA required training is current for each individual and that employees are physically capable to safely execute any task assigned to him/her. The contractor is responsible for maintaining documentation of required training, physicals, medical surveillance examinations, etc.

7.5 Substance Abuse

No alcohol use or unauthorized use of a controlled substance or use of an illegal substance shall be tolerated. Workers shall report to work fit for duty. (See Attached Fossil Plant Contractor Substance Abuse Testing Program.)

7.6 Hazardous Chemical Reporting

The contractor shall report all chemicals brought on to Dynegy plant property to the Dynegy Plant Environmental Coordinator/Plant Management. Material Safety Data sheets will be required to be maintained for all chemicals used at the plant and made readily available to contract employees.

7.7 Radioactive Materials

Use of radioactive materials by contractor shall be in strict accordance with Federal and State law. Dynegy Plant Management shall be notified prior to bringing radioactive material on site, and before commencement of any radiographic work.

7.8 Personal Protective Equipment

Use of personal protective equipment shall comply with applicable OSHA requirements and the work rules at the site. Standard personal protective equipment required at all fossil plants include:

- Hard hat meeting ANSI Z89.1 - 1986 “American National Standard for Personnel Protection - Protective Headwear for Industrial Workers - Requirements” design criteria (Class B).

- Industrial safety glasses with side shields, meeting ANSI Z87.1 - 1989 “American National Standard Practice for Occupational and Educational Eye and Face Protection” design criteria.

- Work shirts (providing shoulder protection), and full length pants.

- Work shoes, hard soled with leather uppers, appropriate for the task being performed. All plants prohibit the wearing of tennis shoes in the work areas.

- Safety goggles, face shields, safety harness and other fall protection/arrest equipment, metarsal guards, respiratory protection, various types of gloves, etc. may also be required dependent upon the type of work contractors are engaged in. Personal protective equipment is to be provided by the contractor.

7.9 Tagout Policy

All system isolation in conjunction with lockout/tagout is administered by the Dynegy local plant Operations Department. Contractors will adhere to the requirements of the local Plant’s Tagout procedure. Contractor responsibilities relative to this procedure will be communicated prior to commencement of work.

7.10 Equipment Lifts

Contractor shall supply a detailed lifting procedure, including a plot plan to scale indicating adjacent hazards/concerns and describing the methods for each major lift to the Dynegy Plant Safety Representative/Plant Management. Major lifts are defined as the use of multi-cranes, or more than 200 feet of boom or greater than 85% of crane capacity.

- The procedure shall include specific equipment to be used, position of equipment and existing obstructions, route of the load into/out of the plant, high wind restrictions, rigging methods, earth conditions under the lifting equipment, and required road closing to make the lift.
- Contractor is solely responsible for the design, calculations, selection of equipment, location of equipment, and procedures for every crane lift, as required.

7.11 Scaffold Policy

The contractor shall provide a “Competent Person” for all scaffold-building activities, in accordance with OSHA regulations.

7.12 Excavation/Trenching Policy

The contractor shall provide a “Competent Person” to oversee all excavation work, in accordance with OSHA regulations.

7.13 Fall Protection Policy

The contractor shall ensure that all workers, under their direction, comply with all the OSHA regulations for fall protection.

7.14 Confined Space Entry Policy

It is the duty of the contractor to ensure that all workers entering confined spaces are properly trained and the contractor’s entry supervisor is fully trained in all of the requirements as set forth in OSHA Standard 1910.146, Confined Space Entry.

The contractor, when required by OSHA standards and/or Dynegy safety procedures shall provide calibrated, intrinsically safe combustible gas and oxygen monitors for monitoring of all confined space work or hazardous atmospheres. Other equipment necessary for the safe performance of confined space work will also be provided by the contractor, e.g. ventilation equipment, communication devices, etc. Rescue team provisions are the responsibility of the contractor unless negotiated otherwise by Dynegy local plant management.

7.15 Hot Work

All hot work will be administratively controlled via Flame Permits, which are required to be completed for all welding, cutting, brazing and other spark producing work. The contractor is responsible for providing fire watches, as required per OSHA and as noted on the Flame Permit. Personnel assigned fire watch duty shall be trained and thoroughly familiar with the use of hoses, nozzles, and fire extinguishers. Contractor shall provide training for fire watches. Contractor shall provide fire-fighting equipment, as required.

7.16 Industrial Hygiene Testing

Contractors are responsible for ensuring that contract employees are protected against airborne hazards, e.g. asbestos, arsenic, welding fumes, paint vapors, etc. and necessary atmospheric monitoring is conducted by qualified personnel to quantify exposures.

A certified laboratory shall perform analysis of industrial hygiene monitoring. Contractor shall supply documentation of such certification to the plant’s Safety Representative.

8.0 ENVIRONMENTAL CONCERNS

8.1 Leaks or Spills

The contractor shall immediately report all chemical spills, including but not limited to oils, solvents, and fuels spills to the Dynegy’s Site Environmental Coordinator/Plant Management. Contractor shall be constantly alert for unexpected hazards from leaks or spills, and shall be prepared to stop work and evacuate the area. Any unexpected chemical hazard shall be immediately brought to Plant Management’s attention.

8.2 Chemical Disposals

The use of any hazardous chemical on plant property shall be coordinated with the local plant’s Environmental Coordinator. Notify the plant prior to bringing the chemical on the property.

NO WASTE FLUIDS OR MATERIALS ARE TO BE PUT INTO ANY OF THE FLOOR DRAINS AT ANY LOCATION. COORDINATE ALL CHEMICAL DISPOSALS WITH THE LOCAL DYNEGY ENVIRONMENTAL COORDINATOR.

9.0 RIGHT TO TERMINATE

Dynegy reserves the right to stop any contractor activity which Dynegy considers unsafe. In addition, Dynegy reserves the right to immediately terminate the contract, without liability, except to pay for work already performed, should contractor or its subcontractor(s) fail to comply with the safety provisions, as stated herein.

10.0 STATEMENT OF CONTRACTUAL COMPLIANCE

As a pre-requisite for consideration as a potential contractor to perform work at any of Dynegy's fossil fueled generation stations, the contractor hereby agrees to comply with all requirements as identified in the document entitled "Safety Requirements For Performing Work at Dynegy Fossil Facilities." Contractor further acknowledges that it has received this document, and fully understands its content. This statement of compliance will remain in effect and contractor agrees to comply with all safety requirements until such time as contractor provides written notification to Dynegy that it will no longer comply with all safety requirements as referenced above, in which case Dynegy may exercise its right to terminate the agreement.

Company Name____

Signed by____

Title____

Date____

SECTION 4: SUBSTANCE ABUSE TESTING PROGRAM

1.0 SCOPE

This procedure establishes substance abuse testing requirements for all contract employees engaged by Dynegy Midwest Generation, Inc (DMG), Coal Engineering & Maintenance (CE&M) or by one DMG, Inc.'s Fossil Power Plants (Plant).

The prohibited substances for which contract employees must be tested are marijuana, cocaine, opiates, amphetamines, and phencyclidine (PCP). Tests may include additional substances, at DMG, Inc discretion.

2.0 PURPOSE

The purpose of this procedure is to establish substance abuse test requirements for contract employees performing work on DMG, Inc fossil plant premises or facilities.

Nothing in this procedure shall affect the Independent Contractor status of the Contractor, as deemed by DMG, Inc; the purpose of this procedure being to ensure that the work performed by contract employees while on DMG, Inc fossil plant premises is in accordance with Dynegy's Substance Abuse Policy, as documented in Corporate Safety and Health Standards SH2.00, Dynegy Substance Abuse Policy; and SH2.01, Dynegy Substance Abuse Plan and Testing, respectively.

Substance abuse tests shall be performed utilizing the Department of Transportation Guidelines; with the exception that the initial screening shall be performed utilizing on-site chemo-assay test kits. All non-negative tests shall be confirmed utilizing a Substance Abuse and Mental Health Service Administration (SAMHSA) approved laboratory and Gas Chromatography Mass Spectroscopy (GCMS) testing technology.

3.0 RESPONSIBILITY

The CE&M Manager, Plant Manager, or his/her designee is responsible for the overall implementation of the Fossil Plant Contractor Substance Abuse Testing Program. Each Plant Manager, or his/her designee, will assign responsibility for substance abuse testing and data management to a Site Coordinator and an Alternate Site Coordinator.

The Site Coordinator and/or Alternate Site Coordinator are responsible for supervising the actual test, selecting substance abuse testing collectors, coordinating the on-site testing of all contract employees at their respective location, and maintaining the pre-access screening database at their respective location.

The CE&M Regional Projects Director and the CE&M Director of (Plant) Engineering shall coordinate with the local Site Coordinators the pre-access portion of the Fossil Plant Contractor Substance Abuse Testing Program. The CE&M Directors and Plant personnel shall ensure that all Contractors are advised and understand the requirements of this procedure.

CE&M safety representatives, in conjunction with the Plant safety staff, are responsible for coordinating post-accident and for-cause substance abuse testing.

The Contractor is responsible for strict adherence to these conditions. Any costs associated with rehabilitation programs for employees shall be the exclusive responsibility of the individual in question, and/or the Contractor. Under no circumstances shall DMG, Inc bare said costs of such rehabilitation.

Dynegy shall not be responsible in any way for arranging or providing rehabilitation services, or be responsible to any third party for the Contractor's negligence in performing or failing to perform any act pursuant to said program.

The Corporate Substance Abuse Prevention Program Administrator (SAPPA) is responsible for maintaining the pre-access screening database; record-keeping; coordinating the purchase and distribution of supplies; and selecting vendors, as needed, for the substance abuse testing program.

4.0 DEFINITIONS

A non-negative test is an initial, on-site substance abuse test that requires confirmatory analysis by both a SAMHSA-certified laboratory, and a Medical Review Officer (MRO).

A confirmed positive test is a test result which was non-negative in the initial screening, and confirmed by a certified laboratory and a Medical Review Officer.

The pre-access screening database is an electronic database containing records of the pre-screening test results. The database is maintained by the SAPPA, and used by Site Coordinators to ensure contract employees are in compliance with this procedure.

5.0 PROCEDURE

This section identifies the specific requirements necessary for fossil plant Contractor (Contractor) compliance with the Dynegy Substance Abuse Policy.

5.1 General Requirements

All contract employees scheduled to perform work on fossil plant premises for (2) two or more continuous working days should receive a pre-access substance abuse screening prior to beginning work. Depending on the risks associated with a job activity, CE&M or the local Plant leadership DMG, Inc may require a substance abuse screening for tasks involving less than two working days.

5.1a As of January 1, 2000 The MOST Program will be accepted as an acceptable Substance Abuse Program for DMG contractors. Participants must provide proof of current status in the MOST program. (See attached MOST Protocols)

5.1.1 Dynegy, or agents hired by DMG, Inc, shall perform all substance abuse screens.

5.1.2 An on-site substance abuse test kit, approved by the SAPPA, may be used for screening.

5.1.3 If the test kit indicates a non-negative test, the specimen will be sent to an approved laboratory for confirmation. The tested contract employee will not be allowed to begin work until the laboratory and the MRO assess the data.

NOTE: Dynegy is not responsible for any possible loss of wages associated with any waiting period created by the use of the on-site screening method.

5.1.4 The pre-access substance abuse screening is valid for 30 days. If a contract employee is screened for a job, released, then rehired for work at any DMG, Inc fossil plant facility within 30 days of the release, a second screening will not be required.

5.1.5 If a contract employee is absent from a fossil plant facility for less than 30 days and is selected for a random substance abuse screening, the employee will be tested upon return to work.

5.1.6 All contract employees performing work on fossil plant property will be placed in the random pool database after they are pre-access screening. All contract employees in the pool are subject to unannounced, random substance abuse screening. All contract employees will be removed from the random pool database upon release from a fossil plant job site.

5.1.7 Refusal to provide a specimen shall be considered the same as a confirmed positive. Adulteration of a sample will be considered the same as a confirmed positive.

5.1.8 The Site Coordinator and/or Alternate site Coordinator can schedule an On-Site Testing representative for non-routine situations, by calling 800.759.7243, and entering PIN# 8405305. After the beep, enter your area code and phone number, press the (*) button, then if necessary, enter your extension. Concorde will return your call, and advise that a testing representative will be on site within two (2) hours.

5.2 Pre-Access Screening

The Contractor shall arrange with DMG, Inc for substance abuse screening to be administered on the first day the contract employee reports to work at a fossil plant facility. In the event that the testing representative is not on-site the first day a contract employee arrives at the plant, screening will be conducted on the next available day when the testing representative is at the plant.

5.2.1 The Contractor will arrange through the Site Coordinator to use the on-site screening as part of the mobilization process.

5.2.2 The Contract Superintendent, or his designee, must inform either CE&M or the Plant Site Coordinator, in advance, of the number of contract employees to be screened, and the times the employees will arrive for screening.

5.2.3 The local Site Coordinator shall call and schedule the On-Site Testing Representatives for the agreed-upon times for the screening.

5.3 Paperwork

5.3.1 The Contractor will complete the AUTHORIZATION FOR SUBSTANCE ABUSE SCREENING FORM (Attached Appendix A) for each contract employee requiring a substance abuse screen.

5.3.2 The form shall contain the name and the Social Security number of the contract employee to be screened.

5.3.3 The form shall be signed by the Contract Superintendent, or his designee. In addition, the form shall list a designated person to receive the results of a non-negative screening.

5.3.4 The Contract Superintendent, or his designee, shall escort the person(s) requiring the screening to the collection site.

5.3.5 Each contract employee shall provide a completed AUTHORIZATION FOR SUBSTANCE ABUSE SCREENING FORM, and present a photo ID to the On-Site Testing Representative.

NOTE: Once notified, individuals have two hours to provide a urine specimen. If the person cannot provide the necessary amount of urine, or if he/she leaves the premises, it will be considered a confirmed positive test.

5.4 Test Results

5.4.1 If the test kit indicates a negative result, the contract employee may begin work. The test results will be entered into the pre-access screening database as negative, and the contract employee will be entered into the Contractor random selection database.

5.4.2 If a contract employee tests non-negative, the following conditions apply:

5.4.3 If a non-negative test result is obtained, the On-Site Testing Representative will notify the Site Coordinator. The Site Coordinator will inform the Contractor’s designated representative; the representative and the Contractor’s designee, upon receipt of the notification, shall escort the individual off-site. The Contract Superintendent should provide transportation to the employee’s home, if deemed appropriate. The contract employee shall not perform any work when a non-negative test result is obtained.

5.4.4 If the substance abuse screening results are confirmed positive by the MRO, the contract employee will not be eligible for access to any DMG, Inc fossil plant facility for one year from the date of the confirmed positive test.

5.4.5 If the non-negative substance abuse test screening is confirmed negative, the contract employee will have immediate access to DMG, Inc fossil plant facilities.

NOTE: The Corporate SAPPA shall maintain all written records and reports involving substance abuse screening activities. The Corporate SAPPA shall administer the pre-access screening, and maintain a current list of contract employees with restricted

5.5 Random-Sample Screening

The SAPPA shall select contract employees from the Fossil Plant Contractor Random Pool for screening. The SAPPA will notify the Site Coordinator, and schedule the appropriate On-Site Testing Representative. The Site Coordinator will notify the Contract Superintendent. The Contract Superintendent will notify his/her employees of the time and place for the random substance abuse screening.

5.5.1. If a contract employee tests non-negative on a random-sample screening, the employee will be removed from DMG, Inc fossil plant property.

NOTE: If the Contract Superintendent believes the contract employee exhibits job behaviors that indicate he/she may pose a danger to themselves or others, the Superintendent shall provide transportation for the employee to be taken home.

5.5.2 If the non-negative test is confirmed positive by the MRO, the contract employee will be granted access to DMG, Inc fossil plant property, upon completion of the following three conditions:

5.5.2.1 The passage of 15 working days;

5.5.2.2 Proof of a professional assessment obtained by the contract employee or by the Contractor, and proof of compliance with the assessment recommendations. It is the employee's responsibility to provide verification of continuous compliance with the assessment recommendations; and

5.5.2.3 An on-site negative substance abuse screen.

NOTE: The professional assessment shall include recommendations for follow-up testing, and shall be submitted to the Corporate SAPPA. A contract employee who provides a second confirmed positive will be denied access to DMG, INC, fossil plant properties for life.

5.6 Reasonable Cause Substance Abuse Testing

A contract employee shall be tested for substance abuse when there is reasonable cause to believe, from his or her job behavior, that he/she may pose a danger to themselves or others in their job performance.

NOTE: The decision to perform reasonable cause substance abuse screening shall follow the requirements listed in Dynegy's SH2.01 Substance Abuse Plan and Testing, Section 3.5.5.

5.6.1 If the suspected employee tests non-negative, the employee shall follow the steps listed in Section 5.5.2, above, for re-access to DMG, Inc fossil plants property, and the Contractor shall provide transportation for the contract employee to be taken home.

5.6.2 If the suspected employee's test is negative, the employee will be returned to work, or taken for medical evaluation, pursuant to site safety standards.

5.7 Post-Accident Substance Abuse Screening

All contract employees whose actions may reasonably be believed to have been related to any significant accident on DMG, Inc fossil plant premises, or involving fossil plant facilities, as a general standard, must be tested for prohibited substances within eight (8) hours after such accident.

An accident should be considered significant if it results in serious injury or death of any person, substantial damage to property, release of any environmentally-damaging substance, or other accidents which the CE&M Manager or the local Plant Managers consider worthy of a post-accident substance abuse test.

5.7.1 If the suspected employee tests non-negative, the employee shall follow the steps listed in Section 5.5.2, above, for re-access to DMG, Inc fossil plant properties.

5.7.2 If the employee’s test indicates non-negative, and the employee exhibits job behaviors that indicates he/she may pose a danger to themselves or others, the Contractor shall provide transportation for the employee to be taken home.

6.0 REFERENCES

6.1 SH 2.00 Dynegy Substance Abuse Policy

6.2 SH 2.01 Dynegy Substance Abuse Plan and Testing

6.3 MOST Policy and Procedures on Drug Screening

7.0 APPENDICES

7.1 Appendix A – “Authorization for substance Abuse Screening

7.2 MOST protocols at DMG’s Facilities

Dynegy Midwest Generation, Inc

Authorization for Substance Abuse Screening

Date: ________________

You are requested to perform collection and substance abuse screening for the following employee:

Name:____
(Please Print - Last, First, Middle Initial)

Social Security Number: ____

Company: ____

________________________________ ______________________
Project Superintendent **Date**

- -

THESE SCREENINGS ARE CONFIDENTIAL

Results are to be released to: _____________________________________

Title: ___________________________________

- -

COLLECTION DATA

Date of Test: ____

Time of Test: ____

_____________________________________ _________________________
On-Site Testing Representative **Date**

Attach the Chain of Custody Form

cc: Site Coordinator/SAPPA, E-05

MOST Protocols at DMG's Facilities

On January 1, 2000 the MOST Program implemented a Random program whereas 4% per month, per local will be tested at random.

This program will be administered by PMC for all boilermakers employed at DMG Facilities.

Upon Arrival for work at DMG facilities the Boilermaker contractor is required to provide his/her MOST Card to the PMC Superintendent or designee. The card will be verified to ensure it is current.

If the card is not current, the Boilermaker will be asked to return to his/her local to update their card. If it is decided by Plant Management to not send the boilermaker to their local to update the card they may choose to utilize DMG's Fossil Power Plant Contractor Substance Abuse Testing Program PG 1.6 and an On-site test will be conducted.

With the exception of Baldwin Energy Complex " Random"," For Cause" and "Post Accident" testing will be implemented at the designated Certified Laboratory.

The Plant Nurse can conduct Random testing at Baldwin Energy Complex.

PMC will be required to send a list of all Boilermakers employed at each of the DMG facilities by facility monthly to the MOST Programs. This list will be utilized to generate the 5% by facility random selection. PMC Safety will send this list to MOST and will administer the random testing coordination.

DMG's Senior Safety Consultant will periodically Audit PMC's records for adherence to these requirements.

SECTION 5: SUBMITTALS

1.0 Contractor shall provide submittals for the items listed below prior to their use on this project. Installation of these items will not start until after the Owner has approved their submittals.

2.0 Submittals shall be made in a timely manner to insure the job is not delayed. The Contractor must allow the Engineer at least two weeks to approve submittals. Submittals are to be sent directly to the Engineer.

3.0 The Engineer will keep two copies of all submittals and return the rest to the Contractor. The Contractor shall submit three or more copies based on his needs for marked copies to be returned by the Engineer.

4.0 Items requiring submittals include but are not limited to the following. Submittals are also required for items called out in the technical specifications but not listed below:

4.1. Riprap

4.2. Seed and Fertilizer

4.3. Pipe and Fittings

4.4. Flow Meter and Fittings

4.5. Manholes & Accessories

4.6. Stormwater Management Plan

Sediment and erosion control plans meeting the requirements of the Federal and State EPA

4.7 Concrete

SECTION 6: EARTHWORK

1.0 SCOPE

1.1. This Specification covers the minimum performance requirements, materials, and references necessary to govern earthwork and related operations. Earthwork is the movement of soil, sand, or rock from one location to another, shaping the materials in accordance with the plans and specifications, and achieving the desired physical condition of the materials by various methods.

1.2. Earthwork associated with this project includes, but is not necessarily limited to, the following:

1.2.1. Stripping topsoil for later dressing out of dikes and other disturbed areas.

1.2.2. Temporary stockpiling of dike materials.

1.2.3. Dike construction.

1.2.4. Clay liner and core construction. The terms “clay liner” and “clay core” will be used interchangeably within this Specification unless specifically indicated otherwise.

1.2.5. Grading and ditch construction.

1.2.6. Excavation and backfill for manhole(s).

1.2.7. Stone surfacing.

1.3. The borrow site is adjacent to the pond. All work required for access to the borrow area, staging, stockpiling, and the like shall be considered incidental to the project.

1.4. Topsoil shall be stripped from the existing dikes and borrow areas and stockpiled in an area designated by the Owner’s Representative. At the completion of dike construction, the topsoil shall be spread on the outside slope of the dike and prepared for seeding as required elsewhere in the project specification.

1.5. The Contractor shall separate materials encountered in the borrow area as required to place material with the proper gradations and permeability in the dike zones as described below:

1.5.1. Impervious Fill

Impervious fill shall be used to construct the clay liner, clay core, and other portions of the dike as shown on the Drawings. Materials available for construction of impervious fill shall be obtained from on-site excavations and borrow areas and shall include only materials meeting the following classifications of ASTM D 2487, "Classification of Soils for Engineering Purposes," placed as described in the Specifications or as approved by the Engineer.

Clays: CL, CH, CL-ML

Combinations of the above

Materials estimated to meet the requirements of impervious fill are shown on the Summary Boring Logs provided in the Drawings.

The maximum particle size in fill compacted with large, self-propelled rollers, shall be 6 inches and the maximum particle size in other fill shall be 3 inches. Oversize material shall be removed from the fill. The material shall be placed in maximum 8-inch thick loose lifts for fill compacted with large, self-propelled rollers and 4-inch thick loose lifts for fill compacted by other methods, at a moisture content between optimum and 3% above the optimum moisture content as determined by ASTM D 698 and shall be compacted to at least 95% of maximum density as specified in ASTM D 698.

1.5.2. Pervious Fill

Pervious fill shall be used to construct the portion of the downstream dike as shown on the Drawings. Materials available for construction of pervious fill shall be obtained from on-site excavations and borrow areas and shall include materials meeting the following classifications of ASTM D 2487 placed as described in the Specifications or as approved by the Engineer.

Sands:	SM, SP-SM
Gravels:	GM, GP-GM

Combinations of the above

The maximum particle size in fill compacted with large self-propelled rollwers shall be 6 inches and the maximum particle size for other fill shall be 3 inches. Oversize material shall be removed from the fill. Fill compacted with large, self-propelled rollers shall be placed in maximum 8-inch thick loose lifts at a moisture content between 2% below and 3% above the optimum moisture content specified in ASTM D 698 and shall be compacted to at least 95% of maximum density as specified in ASTM D 698. The maximum lift thickness for fill compacted by other methods shall be 4 inches.

1.5.3. Random Fill

Random fill shall be used to construct the portion of the dike as shown on the Drawings. Materials available for construction of random fill shall be obtained from on-site excavations and borrow areas. Impervious and pervious fill materials may be used as random fill.

Inorganic soils not meeting the requirements of impervious or pervious fill may be used as random fill. Random fill shall be placed as described in the Specifications or as approved by the Engineer.

The maximum particle size fill compacted with large self-propelled rollers shall be 6 inches and the maximum particle size in other fill shall be 3 inches. Oversize material shall be removed from the fill. The material shall be placed in maximum 8-inch thick loose lifts for fill compacted with large, self-propelled rollers and 4-inch thick loose lifts for fill compacted by other methods, at a moisture content between 2% below and 3% above the optimum moisture content specified in ASTM D 698 and shall be compacted to at least 95% of maximum density as specified in ASTM D 698.

1.6. Contractor shall be responsible for dust control around the pond and borrow areas.

1.7. Payment for earthwork shall be as indicated on the Bid Form and as specified in this section.

2.0 DEFINITIONS

2.1 Excavation: Work done in obtaining material for dikes, liners, or fills.

2.2 Channel Excavation: The removal and satisfactory disposal or reuse of all materials encountered in the construction of ditches, stream channels, or swales.

2.3 Clay: Soils meeting the classifications of ASTM D 2487 for CL, CH and combination thereof.

2.4 Clearing: The removal and disposal of all obstructions such as fences, walls, foundations, buildings, trees, stumps, brush, accumulations of rubbish of whatever nature, and existing structures.

2.5 Construction Inspector: The Owner's on-site representative.

2.6 Contractor: The party or parties proposing to provide all labor, equipment and materials required to perform the work specified herein or on the plans.

2.7 Crushed Gravel: Fractured particles resulting from the crushing of gravel which, prior to crushing, would have been retained on a screen with an opening 1.5 times as large as the maximum size of the resulting crushed material.

2.8 Crushed Stone: Angular fragments resulting from the mechanical crushing of granite, limestone, or dolomite from undisturbed, consolidated deposits: (Dolomite shall be a carbonate rock containing 11.0% or more magnesium oxide (MgO). Limestone shall be a carbonate rock containing less than 11.0% magnesium oxide).

2.9 Dike: Consists of the construction of fill areas by hauling, depositing, placing and compacting the specified material above the natural surface to a specified grade line..

2.10 Engineer: URS Corporation

2.11 Footing Excavation: See Structure Excavation.

2.12 Gravel: Coarse, granular, unconsolidated material resulting from the reduction of rock by the action of the elements and having subangular to rounded surfaces conforming to the definitions set forth in the Unified Soil Classification System.

2.13 Inorganic Silt: Fine-grained soil possessing little or no plasticity or cohesion conforming to the definitions set forth in the Unified Classification System for ML.

2.14 Owner: Dynegy Midwest Generation, Vermilion Power Station, or its designated agent.

2.15 Pipe Excavation: The excavation, removal and satisfactory disposal or reuse of all materials encountered constructing a trench for installation of the specified pipe.

2.16 Porous Backfill: Fine aggregate (clean sand) placed and compacted in excavations, around structures or other items as indicated in the plans and specifications.

2.17 Rock: Natural aggregate of mineral grains connected by strong and permanent cohesive forces.

2.18 Sand: Fine granular material resulting from the natural disintegration of rock conforming to the gradations set forth in the Unified Soil Classification System.

2.19 Soil: Natural aggregate of mineral grains, with or without organic constituents that can be separated by gentle mechanical means such as agitation in water. Gravel and sand are coarse-grained soils, while silts and clays are fine-grained soils.

2.20 Stripping: The excavation, removal and satisfactory disposal (if required) of all materials taken between the original surface and the top of suitable material for the construction of dikes, subgrade, sub-base, shoulders, intersections, ditches, waterways, entrances, approaches and incidental work.

2.22 Structure Excavation: Removal of any and all materials encountered during installation of any designated structure and the satisfactory disposal or reuse of all materials.

2.23 Unclassified Excavation: The removal of any combination of topsoil, earth, rock, muck or obstacles carried out to the lines and grades specified or shown on the plans without regard to percentage of moisture and type of material found.

2.24 Bottom Ash: The portion of the ash generated during coal combustion formed of angular particles ranging from sand to gravel-size. Bottom ash is free draining and has essentially no cohesion.

3.0 REFERENCES

3.1 The reference to specifications or organizations (such as ASTM) together with any diagrams, drawings or plans shall be considered as part of this specification. In the event of conflict between this specification and the referenced documents, the requirements of this specification shall take precedence. The latest editions of the following specifications, standards, and codes apply:

3.2 American Society for Testing and Materials (ASTM)

ASTM D 75:	Practice for Sampling Aggregates
ASTM D 420:	Recommended Practice for Investigating and Sampling Soil and Rock for Engineering Purposes
ASTM D 421:	Method for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants
ASTM D 422:	Method for Particle-Size Analysis of Soils
ASTM D 653:	Terms and Symbols Relating to Soil and Rock Mechanics
ASTM D 698:	Test Methods for Moisture - Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb (2.49 kg) Rammer and 12- inch Drop
ASTM D 854:	Test Method for Specific Gravity of Soils
ASTM D 1140:	Test Method for Amount of Material in Soils Finer than the No. 200 (0.074-mm) Sieve
ASTM D 1452:	Practice for Soil Investigation and Sampling by Auger Borings
ASTM D 1556:	Test Method for Density of Soil in Place by the Sand-Cone Method
ASTM D 2168:	Methods for Calibration of Laboratory Mechanical-Rammer Soil Compactors
ASTM D 2216:	Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock and Soil Aggregate Mixtures

ASTM D 2217: Method for Wet Preparation of Soil Samples for Particle Size Analysis and Determination of Soil Constants

ASTM D 2487: Test Method for Classification of Soils for Engineering Purposes

ASTM D 2922: Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)

ASTM D 3017: Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

ASTM D 3740: Practice for the Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

ASTM D 4220: Practices for Preserving and Transporting Soil Samples

ASTM D 4318: Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

ASTM C 29: Test Method for Unit Weight and Voids in Aggregate

ASTM C 127: Test Method for Specific Gravity and Absorption of Coarse Aggregate

ASTM C 128: Test Method for Specific Gravity and Absorption of Fine Aggregate

ASTM C 136: Method for Sieve Analysis of Fine and Coarse Aggregates

ASTM C 566: Test Method for Total Moisture Content of Aggregate by Drying

ASTM C 702: Methods for Reducing Field Samples of Aggregate to Testing Size

ASTM D 75: Practice for Sampling Aggregates

ASTM E 11: Specification for Wire-Cloth Sieves for Testing Purposes

ASTM D 3665: Practice for Random Sampling of Construction Materials

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

4.0 MATERIALS

4.1 Acceptability -

4.1.1 The clay liner and clay core shall be constructed of impervious fill with a permeability of not more 10^{-7} cm/sec as placed and compacted. The clay soils in the borrow area have been tested and shown to meet this requirement.

4.1.1.1 Additional soil tests may be made by the Engineer to confirm that actual materials used meet the permeability requirements. If the soil proves unsatisfactory, one or more of the following measures shall be taken:

4.1.1.1.1. The unsatisfactory material will not be used in the liner, but may be used in other portions of the dike as shown on the Drawings.

4.1.1.1.2. The compaction and/or moisture content requirements for the clay liner may be adjusted in some cases to reduce the permeability and allow its use in the liner. If there are extra costs associated with this measure, it shall be agreed upon by the Owner and Contractor prior to its implementation.

4.2 The type of material and gradation to be used at a particular location will be as designated in this section, other portions of the specifications, and on the plans for the project.

4.2.1 Unsatisfactory material used in any portion of the dike (or other parts of this work) shall be removed and replaced at the Contractor's expense.

4.2.2 The Company's On-Site Representative will determine with the Contractor's assistance acceptable locations for the various types of soil that will be encountered during excavation for dike fill. The Contractor remains solely responsible for proper placement and compaction.

4.2.3 In most instances, coarse-grained material (gravels, crushed stone, sand) will be designated by an IDOT gradation. Materials with these gradations are readily available statewide.

4.2.4 Fine-grained materials (clay, silty clay) will be designated by a Unified Soil System Classification Symbol (ASTM D 2487).

4.3 Topsoil shall be relatively free from large roots, sticks, weeds, brush or stones larger than 2 inches in size, or other litter and waste products. Topsoil shall be a loamy mixture having the following characteristics:

- At least 90% passing the No. 10 sieve.
- Not less than 1% or more than 10% organic matter.
- Not less than 12% or more than 50% clay.
- Not more than 55% sand
- A pH value between 5 and 8

5.0 CONSTRUCTION REQUIREMENTS

5.1 Unless noted otherwise below, compaction requirements for all phases of the work shall be at least 95% of the maximum dry density and within -2% to +4% of the optimum moisture content as determined by ASTM D 698 (commonly referred to as the Standard Proctor test).

5.1.1 The clay liner shall be compacted to at least 95% of the maximum dry density at a moisture content between 0% and +4% of optimum moisture content as determined by ASTM D 698.

5.2 Compaction shall be obtained by mechanical means in a timely manner so as not to delay construction. Loose lift thickness may vary depending upon the condition of the material and equipment used, but shall never exceed 8 inches. Each lift will be tested by the Engineer or an outside agency.

5.3 Material placed that does not meet the minimum compaction requirements shall be reworked as necessary to obtain the specified compaction at no extra cost to the Owner. Reworking may include removal, rehandling, reconditioning (including drying or adding water), rerolling, or combination of these procedures. A source of water (hydrant) for the Contractor’s use has been identified on the Drawings. No further placement of material will be allowed until the compaction requirements are met. If the material becomes unsuitable for use after placement, even if previously compacted to the specified percentage, it shall be modified (or removed and replaced by suitable material) and compacted in accordance with the specifications at no extra cost to the Company.

5.4 No material shall be placed on wet or frozen subgrade.

5.5 The Contractor shall maintain his work in such a manner to prevent ponding of water in the project area. In foundation excavations where water collects the Contractor shall pump as required to keep the excavation free of water. A layer of oversize rock (±4 inches) covered by a layer of crushed stone (IDOT CA-6 or CA-10) or a mud mat shall be placed to allow work to proceed in the excavation without contamination by mud or water.

5.6 Erosion control is the responsibility of the Contractor.

5.6.1 Contractor shall submit sediment control plans meeting the requirements of the Federal and State EPA to the Owner for approval prior to the start of work. The plans shall clearly show routing of stormwater discharge and sediment control measures such as settling basins, silt fences, etc. The plans shall be fully implemented and maintained throughout the project at both the pond and borrow site locations.

5.6.2 The Contractor shall provide the Owner plans for control of sediment in stormwater runoff meeting the requirements for a construction-related stormwater discharge permit for both the pond and borrow sites. The Owner will submit these plans to the State for the permit. The Contractor shall provide and maintain sediment control systems that meet the State requirements. If the Owner requires additional sediment control measures beyond those required by the State, the Contractor will be reimbursed at cost for the additional measures. The contractor may submit with his bid an estimate of the cost of the materials to be used for sediment control.

5.6.3 Installation of sediment and erosion control measures shall be paid for as lump sum items. Maintenance of sediment and erosion control measures shall be considered incidental to the earthwork and not paid for separately

5.6.4 Contractor shall repair all erosion damage that occurs during the project at no additional cost to the Owner.

5.6.5 The borrow area shall be left in a condition that will minimize erosion and promote the natural revegetation of the area. Cut slopes shall not be left any steeper than 1 vertical to 4 horizontal. Disturbed areas shall be seeded.

5.7 Disposal of all unsuitable material in a legal, safe, and satisfactory manner is the responsibility of the Contractor. This includes, but is not limited to, materials resulting from clearing and stripping.

5.8 The Contractor shall be responsible for, and shall take all necessary precautions to preserve and protect all existing tile drains, sewers, other subsurface drains, underground utilities, above ground utilities, private transmission lines, and appurtenances which may be affected by his operations and shall repair, at his own expense, any and all damages resulting from his actions or inactions.

5.9 The Contractor shall notify the Engineer two days in advance of beginning or resuming work.

5.10 Unless shown differently on the Drawings or called for in these Specifications, trenches for pipe installation shall be excavated at least 18 inches wider than the outside diameter of the pipe in order to permit thorough tamping of the soil against the pipe. Where a firm foundation is not encountered at the grade established all such unsuitable soil shall be removed for the width of the trench and replaced with well-compacted bedding material or suitable compacted aggregate. In areas requiring impervious backfill, the trench bottom shall be shaped to conform to the pipe's shape in lieu of bedding. Alternatively, the pipe trench can be backfilled with "flowable fill." Flowable fill shall be a flowable, hand-excavable mixture of cement, pozzolan, coarse and fine aggregate, and water mixed in accordance with ASTM C 94. Contractor shall submit details for approval if he intends to use flowable fill, including mix proportions, entrained air, density range, slump, and compressive strength at 28 days.

5.11 Maintain access to the project site at all times. If the work is being performed at an existing facility the Contractor shall make the necessary arrangements to maintain access to vital areas.

5.12 Various portions of the work will require testing by Engineer or an outside designated testing agency. The Contractor will cooperate with the testing program and make his work accessible at all times.

5.13 If the work generates sufficient dust to cause complaints to be received by the Company, the Contractor shall remedy the situation to the satisfaction of the Company at no cost to the Owner.

5.14 All holes, ruts, soft places, and other defects shall be corrected. In no case shall the surface course, base course, or other items be placed on soft or unstable material or over areas that are not properly drained.

5.15 In cut sections where excessively wet soil is encountered, the Contractor will be required to dry the soil and to obtain compaction of the material in accordance with the requirements of paragraph 5.1.

5.16 The subgrade shall be constructed so that after being compacted it will conform to the alignment, grade, and cross section shown on the Drawings. Ruts in the finished subgrade of one inch or more in depth shall be removed from the work or the rutting shall otherwise be prevented. Rutted areas shall be graded and re-rolled with a smooth-wheeled roller.

5.17 A smooth surface is desired at the termination point of each type of material used whether it is virgin subgrade, dike material, crushed stone, or other construction materials. When a sheepsfoot roller is used, the area must be leveled at the finished grade. The interfaces between continuing layers of dike are not to be leveled and are expected to exhibit a normal amount of “fluff” associated with an ongoing fill operation.

5.18 Traffic control, including provisions for the necessary barricades, flagmen and other items, is the responsibility of the Contractor.

5.19 Earthwork operations shall comply with the following requirements:

5.19.1 Before any dike material is placed, all clearing and stripping over the entire area shall be performed. The top six inches of the exposed surface shall be disced, and then compacted to meet the requirements of 5.1 and 5.1.1. When construction is resumed after any freezing weather the top eight inches of all partially completed dikes will be reworked and compacted to meet the requirements of 5.1 and 5.1.1 prior to placing more fill.

5.19.2 Dike material will be as specified in Section 1 of this specification, other portions of the specifications, or on the Drawings for the project. If required, the material shall be disced sufficiently to break down oversize clods, mix the material, secure a uniform moisture content, and insure uniform density and compaction. Each layer of material shall extend the entire length of dike, if possible, and shall be leveled when placed. Earth around structures is not to be placed until the concrete has attained its specified strength.

5.20 Topsoil shall not be placed until the area to be covered has been shaped, trimmed, and finished. All irregularities in the surface shall be filled or smoothed out before the topsoil is placed. If the existing surface has become hardened or crusted it shall be disced or raked until broken up to provide a bond with the topsoil. All unsuitable debris and stones larger than 2 inches in size shall be removed from the area.

5.21 Road surfaces shall consist of crushed stone aggregate shown on the plans. The aggregate shall be deposited full-lane width directly on the subgrade, geotextile fabric (if specified), or previous layer of compacted base course in such a way to prevent segregation and require a minimum amount of blade work. Immediately after placement of the material it shall be compacted by a rubber-tired roller or vibratory smooth steel drum roller to the requirements of 5.1. If any subgrade material is worked into the base material during the operations all granular material affected will be removed and replaced with new aggregate at no cost to the Company.

6.0 INSPECTION BY COMPANY

6.1 The Company is responsible for testing the project materials and results of the work performed at regular intervals. Materials that fail to meet the specified requirements shall be reworked or replaced at the Contractor’s expense.

6.2 The Contractor will cooperate with the Company at all times to provide access to the materials and site for testing purposes.

7.0 MEASUREMENT

7.1 The Company reserves the right to increase or decrease quantities, as required, with no increase in the unit price except as noted in the General Conditions.

7.2 Items measured in units of weight may be paid for on a dry-weight basis at the discretion of the Engineer if the moisture content is found to be excessive. The bid units will not be affected unless the moisture content of coarse-grained soils exceeds 12%.

7.3 Stripping, clearing and grubbing will be measured in acres.

7.4 Pipe excavation and furnishing, placing, and compacting bedding will not be measured for payment and are to be included in the bid price for the pipe.

7.5 Cross section measurements and the average end area method shall be used to determine volumes of excavations of required material for dikes unless otherwise approved by the Engineer.

7.6 Borrow material and dike quantities shall be in net cubic yards of material moved. The plan quantities will be used for bidding purposes. If there is a discrepancy between the successful bidder's take off quantities of more than plus or minus 5% of the plan quantities, the Contractor shall notify the Engineer in writing prior to starting work. The Company will make arrangements to cross-section the project areas before and after earthwork is done to determine the amount of material moved in accordance with these specifications.

7.6.1 In determining the volumes, no allowance will be made for settlement, consolidation, or similar factors. Volumes will be based on before and after topographies at the pond and borrow site.

7.7 The following items will be measured in cubic yards:

7.7.1 Dike Construction

7.7.2 Excavation and disposal of excess cut

7.8 The following items will be measured in tons only if imported from off site. On-site sand and gravel shall be measured in cubic yards.

7.8.1 Sand

7.8.2 Gravel

7.8.3 Crushed Gravel

7.8.4 Crushed Stone Aggregate

7.10 Porous backfill will be measured in tons of the specified material only if it is brought in from off site. On-site sand and gravel shall be measured in cubic yards.

7.11 Topsoil 4 inches thick will be measured in acres and will include excavating, transporting, placing, and grading the material as indicated in the Drawings and Specifications. Minimum thickness of topsoil on the outside and inside of dikes shall be 4 inches.

SECTION 7: CONCRETE

1.0 SCOPE

1.1 This specification covers the minimum requirements for concrete foundations and slabs on grade.

1.2 Except as noted otherwise, the Contractor shall furnish all labor, material, tools, and equipment necessary for concrete work shown on the Drawings and specified herein.

1.3 Exceptions to the requirements of this specification will be considered only if submitted in writing with the bid and an increase (or decrease) in cost for complying with the requirements of this specification is provided.

2.0 DEFINITIONS

2.1 All design terms and symbols shall be as defined in ACI 318.

3.0 REFERENCES

3.1 Any specification or document referred to in this specification is to be considered as part of this specification. In the event of conflict between this specification and referenced documents, the requirements of this specification shall take precedence. The following specifications, standards, and codes apply:

3.1.1 American Concrete Institute (ACI)

ACI 305R: Recommended Practice for Hot-Weather Concreting.

ACI 306: Recommended Practice for Cold-Weather Concreting.

ACI 308: Recommend Practice of Curing Concrete.

ACI 315R: Manual of Standard Practice for Detailing Reinforced Concrete Structures.

ACI-318: Building Code Requirements for Reinforced Concrete.

ACI 347: Recommend Practice for Concrete Formwork.

3.1.2 American Society for Testing and Materials (ASTM)

ASTM A 82:	Cold Drawn Steel Wire for Concrete Reinforcement.
ASTM A 615:	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
ASTM C 31:	Making and Curing Concrete Test Specimens in the Field.
ASTM C 33:	Concrete Aggregates.
ASTM C 94:	Ready-Mixed Concrete.
ASTM C 150:	Portland Cement.
ASTM C 171:	Sheet Materials for Curing Concrete.
ASTM C 309:	Liquid Membrane - Forming Compounds for Curing Concrete.
ASTM C 494:	Chemical Admixtures for Concrete.

3.1.3 Illinois Department of Transportation (IDOT) - 2002 Specifications for Roads and Bridges.

4.0 GENERAL REQUIREMENTS

4.1 All concrete work shall conform to ACI 347 unless otherwise specified. This work shall also be performed under the personal and constant supervision of a competent Construction Superintendent or Foreman experienced in concrete work.

4.2 The Contractor shall provide all forms required for concrete work above and below ground.

4.3 The Company reserves the right to inspect all materials and make concrete tests. A Tester will be on-site the day of the pour to test the concrete.

4.4 If requested, the Contractor shall provide concrete test cylinders in accordance with ASTM C 31 (two from each truckload) from the concrete placed for the structure foundations. Cylinders shall be dated and labeled as to the foundation and truckload number.

4.5 If the concrete test cylinders, whether made by the Contractor or a testing agency, fail to meet specified compressive strength, the Contractor shall replace any and all affected areas at his own cost.

4.6 The On-Site Representative will schedule the Tester.

5.0 MATERIALS

5.1 Cement shall be Portland Cement conforming to ASTM C 150, Type I.

5.2 Fly ash shall be Class C or Class F conforming to AASHTO M-295

5.3 Fine aggregate shall be sand - clean, hard, durable, uncoated grains, free from deleterious substances, conforming to ASTM C 33. Gradation shall conform to IDOT specifications.

5.4 Coarse aggregate shall be natural rock or crushed limestone - clean, hard, durable uncoated particles without flat or elongated pieces. Aggregate shall be free from deleterious materials and shall conform to ASTM C 33. Gradation shall conform to IDOT specifications.

5.5 Water shall be clean and free from injurious amounts of oils, acids, salts, organic, or other deleterious matter.

5.6 Reinforcing bars shall conform to ASTM A 615, Grade 60 unless otherwise noted on the foundation Drawings. Reinforcing wire shall conform to ASTM A 82. All reinforcing shall be free from loose rust, dirt and oil.

5.7 Removable forms shall be wood, metal, approved fiber tubes, or other approved materials.

5.8 Curing materials shall conform to ASTM C 171. Curing compounds shall conform to ASTM C 309.

5.9 Water-reducing admixtures shall conform to ASTM C 494.

5.10 IDOT CA-6 road mix for backfill material shall conform to IDOT specifications.

6.0 EXCAVATION

6.1 All excavated materials shall be reused or properly disposed of on site by the Contractor, unless otherwise noted on the plans or in the specifications. Any affected ground area shall be returned to its former condition.

6.2 The actual depth of the foundation excavation shall be within ±1 inches from the required foundation depth given on the Drawings.

6.3 If over-excavation occurs, the hole shall be filled at Contractor's expense with compacted CA-6 road mix or additional concrete up to the required level.

7.0 FORMS

7.1 Forms shall conform to the shape, line, and dimensions of the members indicated on the Drawings, and shall be substantial and tight to prevent leakage of mortar. They shall be properly braced or tied together so as to maintain position and shape. Lumber, once used in forms, shall have nails withdrawn, and the surfaces to be exposed to concrete shall be carefully cleaned before reuse.

7.2 Forms for exposed surfaces shall be coated with nonstaining mineral oil, applied before the reinforcing steel is placed. Before concrete is placed, surplus oil shall be removed from the contact face of forms. All oil shall be removed from reinforcing steel and other surfaces requiring bond with concrete.

7.3 Forms shall not be disturbed until the concrete has adequately hardened and has gone through the first stage of curing, a minimum of 16 hours. Care shall be taken to avoid spalling the concrete surfaces. Wood forms and all particles of wood shall be completely removed.

8.0 REINFORCING

8.1 All bars shall be bent accurately, placed in position as shown on the Drawings, securely tied with #16 gauge black, annealed wire at all intersections, and securely held in place by spacers, chairs, or other approved supports in accordance with ACI 315R. At time of placing concrete, all reinforcing shall be free of loose rust, scale, oil, paint, mud, or other coatings which will destroy or reduce the concrete bond. Unless otherwise shown on the

Drawings or specified, the spacing, amount of concrete coverage, splicing, and bending of reinforcing steel shall conform to the requirements of ACI 318.

8.2 Reinforcing shall not be welded unless approved by the Engineer.

8.3 Anchor bolts (when used) shall be a minimum of 6 inches from the bottom of the foundation. All steel shall have a minimum of 3 inches concrete cover.

8.4 Lap splices for reinforcement shall conform to requirements of ACI 318 Class B splices.

8.5 All anchor bolt threads shall be taped to protect them from dirt and concrete during construction.

8.6 Foundation anchor bolts shall be connected to the reinforcing cage as detailed on the plans. If no details are shown, the Contractor shall provide a minimum of four No. 4 bar cross ties, two at the top and two at the bottom of the anchor bolt cage, wired to diagonal anchor bolts, each other, and the reinforcing cage per 9.0 tolerances. For foundations with only two anchor bolts, only two No. 4 bars will need to be wired to the reinforcement and anchor bolts (one at the top and one at the bottom).

9.0 TOLERANCES

9.1 Formwork shall be designed, constructed and maintained so as to insure completed concrete work within tolerance limits.

9.2 Top elevation of the finished slab or foundation shall not vary more than + 1/4 inch from the elevation indicated on the Drawings.

10.0 CONCRETE MIX

10.1 The concrete mix design(s) to be used on the project shall be submitted to the Company by the Contractor two weeks prior to any concrete placement at the job site or at the preconstruction meeting. All materials incorporated into the concrete mix shall be identified by brand name, gradation, and the supplier.

10.2 All concrete shall have a minimum compressive strength of 3500 psi at 28 days. The mix shall have a minimum of 5 1/2 sacks of cement per cubic yard and a maximum water cement ratio of 0.50 (by weight). Concrete mixes incorporating fly ash are strongly recommended. Fly ash from DMG facilities are preferred but not required.

10.3 All concrete shall have 5 to 7 percent entrained air.

10.4 All concrete shall have a slump of 4 to 5 inches unless otherwise approved by the Engineer.

10.5 Water-reducing admixtures may be used to help meet the above concrete mixture specifications, following admixture manufacturer recommendations.

11.0 MIXING CONCRETE

11.1 Unless otherwise approved by Engineer, "Ready-Mixed" concrete shall be used for all concrete. It shall be mixed and delivered in accordance with the requirements set forth in ASTM C 94.

12.0 PREPARATION FOR PLACING CONCRETE

12.1 Water shall be removed from excavations before depositing concrete. Hardened concrete, ice, debris, and foreign materials shall be removed from form interiors and from mixing and conveying equipment.

12.2 The On-Site Representative shall be notified sufficiently in advance of the scheduled time for concrete placement to permit examination of forms and reinforcement. No concrete shall be poured until the On-Site Representative has approved reinforcing and forms. This inspection is a precautionary measure and in no way relieves the Contractor of responsibility for the accuracy of form and reinforcement.

13.0 PLACING OF CONCRETE

13.1 Equipment for conveying concrete shall be of such size and design as to insure a continuous flow of concrete without material separation at the delivery end.

13.2 Concrete shall be conveyed from the mixer as rapidly as practical without segregation or loss of ingredients. Concrete shall be placed in forms as nearly as practical in final position to avoid rehandling. Vibrators shall not be used to transport concrete within forms. The concreting shall be carried on at such a rate that the concrete is at all times plastic and flows readily into the spaces between the reinforcing bars. No concrete that has partially hardened, been contaminated by foreign materials, or retempered shall be used. Immediately after depositing, concrete shall be compacted in an approved manner by spading, rodding, forking, or vibrating to eliminate air pockets. All concrete shall be worked into corners around reinforcement and inserts to prevent voids, trapped water, or stone pockets.

13.3 Care shall be exercised in use of a vibrator to prevent segregation, sand pockets, or bleeding. The vibrator shall be moved continuously in and out of concrete, remaining stationary only a few seconds in any position.

13.4 Once concreting has begun, it shall be carried on as a continuous operation until the placement is completed.

13.5 Adjacent surfaces shall be protected from concrete drippings, spillage, or splashes. Damaged surfaces shall be cleaned immediately.

14.0 HOT-WEATHER REQUIREMENTS

14.1 All hot-weather concreting shall conform to ACI 305R unless otherwise specified.

14.2 The maximum temperature of mixed concrete shall be 90°F. Temperature of aggregates and mixing water shall be reduced by the use of chilled water or ice.

15.0 COLD-WEATHER REQUIREMENTS

15.1 All cold-weather concreting shall conform to ACI 306 unless otherwise specified.

15.2 Concrete damaged by freezing shall be removed and replaced.

16.0 CURING AND PROTECTION

16.1 All curing shall conform to ACI 308 unless otherwise specified.

17.0 CONCRETE FINISHES ON EXPOSED SURFACES

17.1 Tops of all slabs shall be floated and brought to a true level with a 3/4-inch beveled or rounded edges. Top surface shall be given a rough broom finish.

17.2 Exposed, formed surfaces shall be left unfinished except that larger voids shall be filled in with an approved concrete patching material. The On-site Representative will determine the voids that require filling. Small “bug holes” need not be filled.

18.0 JOINTS

18.1 Construction joints shall not be allowed unless otherwise shown on the Drawings or as directed and approved by the Engineer. Where a joint is to be made, it shall be formed with a keyway.

18.2 Immediately before the placing of new concrete, the hardened concrete surface shall be thoroughly cleaned, all laitance removed, and the surface dampened with clean water.

SECTION 8: SEEDING

1.0 SCOPE

1.1 This specification covers the minimum requirements for seeding construction areas.

1.2 Use the seed mixture herein specified. Compositions of seed mixtures are given in Part 3 of this Section. Fertilizer requirements are given in Part 4.0, Fertilization of this Section.

1.3 Seed all disturbed areas at the pond site not covered with stone or concrete. This includes, but is not limited to, the following areas:

1.3.1 The outside and inside faces of the dike.

1.3.2 Disturbed areas adjacent to the outside toe of the dike.

1.3.3 Disturbed areas around pipe and roadwork.

1.3.4 The borrow area(s).

2.0 GENERAL REQUIREMENTS

2.1 All work shall be performed under the supervision of a competent Construction Superintendent or Foreman.

2.2 The Owner reserves the right to inspect all materials and perform all tests necessary to determine compliance with the specifications. If the materials or finished product fail to meet the controlling criteria for these tests, the Contractor shall replace all affected areas at the Contractor's expense.

2.3 Each lot of seed furnished shall be tested by a State Agriculture Department (including states other than Illinois).

2.4 Each bag shall be tagged or labeled as required by the Illinois Seed Law.

3.0 SEEDS

3.1 Rate of Application

Seed	lbs./Acre
Brome	30
Alfalfa	0
Oats	40

3.2 Seed mixtures shall be proportioned by weight.

3.3 No seeds shall be sown until they have been tested for purity and until such tests indicate that the seeds do not contain any seeds of the noxious weeds classed as “Primary Noxious Weed Seed” in the existing Illinois Seed Law, and not more than the maximum number per ounce sample, specified in Table 1 of this specification, “Secondary Noxious Weed Seed.”

3.4 In determining the viable germination percent of legumes, the percent hard seed is to be added to the percent test germination; however, the percent hard seed added shall not exceed the maximum specified in Table 1 of this specification when planted in the fall season.

3.5 Seed having a purity that is below the purity specified in Table 1 of this specification will be rejected. Seeds that fail to meet the requirements of Table 1, “Maximum Weed Seed Percent” and “Remarks” will be rejected.

3.6 Pure, live seed shall be defined as the sproutable seed of a specified variety and calculated as the product of the viable germination times the purity. The seed weights per acre listed are designed to yield specific amounts of pure, live seed per acre based on the pure, live seed percent values listed in Table 1 of this specification. Seed which has actual pure, live seed yield according to tests less than the intended yield, will be rejected.

4.0 FERTILIZER

4.1 Fertilizer shall be applied at the rates given below. Fertilizer will be measured by weight (in pounds) of actual nutrients supplied. Weight of each nutrient shall be determined by the following formula: *(total wt. of fertilizer)x(percent of nutrient in fertilizer)=(wt. of nutrient provided).*

4.2 Fertilizer shall be supplied in either liquid or granular form. It shall be properly incorporated into the soil during application or immediately afterwards.

4.3 Fertilizer shall contain the following nutrients: Nitrogen (N), Phosphorus (P_2O_5), and Potassium (K_2O).

4.3.1 From 30 to 40% of the total nitrogen provided shall be in a slow-release form.

4.4 Provide 90 pounds of nitrogen (N) per acre, 30 pounds of phosphorus (P_2O_5) per acre, and 60 pounds of potassium (K_2O) per acre for all areas to be seeded.

4.5 No lime is required.

5.0 MULCH

5.1 Straw shall be stalks of air-dried wheat, rye, oats, or other approved straw.

5.2 Hay shall be air-dried. Hay shall be obtained from field of timothy, redtop, or mature brome grass.

6.0 OPERATIONS

6.1 Seed Bed Preparation

6.1.1 Immediately prior to the seed bed preparation, fertilizer nutrients shall be uniformly spread at the designated rate over the areas indicated on the plans.

6.1.2 Stones, boulders, debris and similar material larger than two inches in diameter shall be removed from the seed bed area. The seed bed will be worked to a minimum depth of three inches, reducing all soil particles to a size smaller than two inches in the largest dimension. The prepared surface shall be relatively free from weeds, clods, stones, roots, sticks, rivulets, gullies, crusting, and caking.

6.2 Seeding

6.2.1 No seed shall be sown during unfavorable climatic conditions or when the ground is not in a proper condition for seeding.

6.2.2 All seeded areas, including slopes up to 3H:1V or flatter, shall be rolled at right angles within 12 hours of seeding to compact the seed bed and place the seed in contact with the soil. Slopes steeper than 3H:1V do not need to be rolled.

6.2.3 Seeding shall be done in a way that incorporates the seed at the optimum depth of 1/4 inch.

6.2.4 All legumes shall be inoculated per the manufacturer's recommendations immediately before sowing.

6.2.5 Seeding shall be done between April 1 and December 1.

6.2.6 Within 24 hours from the time the seeding has been performed, the seedbed shall be given a covering of mulch. On slopes steeper than 3H:1V, mulch shall be applied on the same working day.

6.3 Mulch shall be used on all seeded area not specified otherwise.

6.3.2 Hay or straw mulch shall be hand or machine applied loose enough to permit air to circulate, but compact enough to prevent erosion. If baled material is used, care shall be taken that the material is in a loosened condition.

6.3.3 The mulch shall be stabilized by working the area with dull blades or disks.

TABLE 1

SEED SPECIFICATIONS

Hard Seed	Purity	Pure, Live Seed	Weed	Secondary Noxious Weeds Number/Oz Maximum		
Variety of Seeds	% Max.	% Min.	% Min.	% Max.	Permitted	Remarks
Alfalfa 20	92	89	0.50	6	Note 1	
Brome Grass	--	75	68	2.00	5	--
Dawson Red Fescue	0	97	85	0.10	3	--
Fescue, Alta or KY. 31	--	92	88	1.00	6	--
Fescue, Creeping Red	--	75	82	1.00	6	--
Fults Salt Grass	0	98	85	0.10	2	--
Kentucky Bluegrass	--	75	72	0.50	7	Note 5
Lespedeza, Korean	20	92	84	0.50	6	Note 3
Oats --	92	88	0.50	2	Note 4	
Orchard Grass	--	75	70	1.50	5	Note 4
Redtop --	75	78	1.80	5	Note 4	
Reed Canary Grass	--	92	63	1.00	5	--
Ryegrass, Perennial, Annual	--	92	88	0.50	5	Note 4
Rye, Grain, Winter	--	92	83	0.50	2	Note 4
Scaldis Hard Fescue	0	97	85	0.10	3	--
Timothy	--	92	84	0.50	5	Note 4
Wheat, Hard Red Winter	--	92	89	0.50	2	Note 4

Note 1. Shall be grown in Kansas or farther north; shall be free from any mixture with southern or foreign seeds, blends or adulterations with screenings, frosted or damaged seeds; and shall not contain more than 0.2 percent bur or sweet clover mixture.

Note 2. Shall be free from blends or adulterations with screenings, blasted, shriveled or immature seeds.

Note 3. Shall be hulled and free from blends or adulterations with blasted, shriveled or immature seeds.

Note 4. Shall be recleaned.

Note 5. Shall not contain more than 5 percent adulteration with Canada Blue Grass, Merion Blue Grass or other hybrids or varieties of blue grass.

*No primary Noxious Weeds are permitted

SECTION 9: MISCELLANEOUS STEEL

1.0 SCOPE

1.1 This specification covers the minimum requirements for the design, material, fabrication, inspection, protective coating, drawings, and delivery of miscellaneous steel. Corrugated steel and ductile iron pipe are not included in the scope of this section.

1.2 In the event of discrepancies between the Vendor’s proposal and this Specification, the terms of this Specification shall govern unless written exception is provided by the Vendor and approved by the Engineer.

2.0 DEFINITIONS

2.1 The term “Vendor”, as used in this Specification, shall refer to the party or parties proposing to perform the work and provide the material herein specified to the Contractor.

2.2 All design terms and symbols shall be as defined in the AISC - Steel Construction Manual (latest edition).

3.0 REFERENCES

3.1 The reference to specifications of organizations (such as ASTM), together with any diagrams, drawings, and loading schedules, shall be considered part of this Specification. In the event of conflict between this Specification and referenced documents, the requirements of this Specification shall take precedence. The following specifications, standards, and codes apply:

3.1.1 American Society for Testing and Materials (ASTM)

ASTM A 6 -	General Requirements
ASTM A 143 -	Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

ASTM A 194 -	Carbon and Alloy Steel Nuts for Bolts for High Pressure and High-Temperature Service.
ASTM A 325 -	High Strength Bolts for Structural Steel Joints.
ASTM A 384 -	Safeguarding Against Warpage and Distortion during Hot-Dip Galvanizing of Steel Assemblies.

3.1.2 American Institute of Steel Construction (AISC)

AISC - Steel Construction Manual (latest edition)

3.1.3 Steel Structures Painting Council Surface Preparation Specification (SSPC-SP)

SSPC-SP6 - No. 6 Commercial Blast Cleaning (latest edition)

3.1.4 American National Standards Institute (ANSI)

3.1.5 National Electrical Safety Code (NESC) Part 2

ANSI C135.1 -	American National Standard for Galvanized Steel Bolts and Nuts for Overhead Line Construction

4.0 GENERAL CONSIDERATIONS

4.1 All steel is to be hot dipped galvanized after fabrication.

4.2 All steel shall be either ASTM A 36 or A 992 material.

4.3 Welds shall be with E70 electrodes. Bolts shall be hot dipped galvanized A325 bolts.

4.4 Concrete anchors and other accessories and manufactured components shall be as shown on the plans.

5.0 DRAWINGS

5.1 After acceptance of a proposal, the Contractor shall submit to the Engineer three prints of each detail drawing. One set of these Drawings will be returned to the Contractor marked as “approved” or “approved as noted” or “not approved”. Fabrication shall not begin until the appropriate detail drawings have been approved.

5.2 Engineer's approval of the Vendor's drawings is approval of intent of design and detail only, and in no way relieves the Vendor of responsibility for adequacy or the correctness of dimensions and details.

5.3 Each detail drawing shall include, as a minimum, the following information:

- Dimensions.
- Description and strength of material.
- Weld locations and sizes.
- Size, description, quantity, and location of all holes and hardware.
- Any other special information.

6.0 MATERIAL

6.1 All structural plate material shall be selected with sufficient ductility to avoid brittle fracture.

6.2 The Vendor shall use suitable quality control procedures to insure that the correct steel strength is used in the fabrication of the hardware.

6.3 Materials the Vendor proposes to substitute for those stated herein shall be identified with the applicable ASTM or ANSI designation and shall be subject to the approval of the Engineer.

6.4 Fasteners

6.4.1 All bolts shall conform to ASTM A325 or ANSI C135.1. Nuts shall conform to ASTM A 194 Grade 2, and shall be tapped 0.020 inches oversize for pitch and major diameter. All nuts, bolts, and washers shall be hot dipped galvanized.

6.4.1.1 For galvanized hardware, nuts and bolts shall be galvanized in accordance with ASTM standards, but hot-dip galvanizing will not be allowed for any material with a yield strength greater than 100 ksi.

6.4.2 All bolts of any one diameter and similar length shall be of the same type and strength.

6.4.3 All bolt locations shall permit easy wrench access to both the bolt head and the nut.

7.0 FABRICATION AND QUALITY CONTROL

7.1 Fabrication tolerances will be in accordance with ASTM A 6.

7.2 Fabrication shall be in strict accordance with shop detail drawings prepared by the Vendor and approved by the Engineer.

7.3 Straightening Material - Before being laid out or worked in any manner, structural material shall conform to ASTM A 6 for permissible variations in straightness. If straightening is necessary, it shall be done by methods that will not injure the metal. Members that are bent or warped or otherwise improperly fabricated will be rejected by the Owner.

7.4 Bending - All forming or bending during fabrication shall be done by methods that will prevent embrittlement or loss of strength in the material being worked.

7.5 Holes for connection bolts shall be 1/16 inch larger than the nominal diameter of the bolts. The details of all connections and splices shall be subject to the approval of the Engineer. Connections shall be detailed in accordance with AISC 1.1.5.2 to avoid rust expansion (pack-out).

7.6 All holes shall be cylindrical, perpendicular to the member, clean-cut, and chamfered (when specified). Where necessary to avoid hole distortion, holes close to the points of bends shall be made after bending. The use of a burning torch for cutting holes will not be permitted without approval from the Engineer.

8.0 PROTECTIVE COATINGS

8.1 Surface preparation

8.1.1 For galvanized structures, all fabricated steel components shall be blast cleaned in accordance with SSPC-SP6, or cleaned with an acid-pickling procedure with approval from the Owner.

8.2 Galvanizing

8.2.1 Hardware shall be galvanized in accordance with the applicable ASTM standard and shall remain corrosion-free for 10 years.

8.2.2 Precautions shall be taken against embrittlement, warping, and distortion in accordance with ASTM A143 and in accordance with ASTM A384.

9.0 SHIPPING

9.1 Steel shall be suitably protected to prevent damage to the surface finish during shipment.

9.2 Each shipment shall be accompanied by a checklist of all parts on that particular shipment. Bolts, nuts, and other hardware shall be either boxed or bundled.

10.0 INSPECTION BY OWNER

10.1 Materials and workmanship shall, at all times, be open to inspection and acceptance or rejection by the Owner either at the Vendor’s plant or at the point of delivery. Any omission or failure on the part of the Owner to disapprove or reject any work or materials at the time of inspection shall not be construed as an acceptance of any defective work or materials.

10.2 The Owner shall have free entry to all parts of the Vendor’s plant at all times while work is being carried on. The Vendor shall afford the Owner reasonable facilities, without charge, to satisfy Owner that the materials are being furnished strictly in accordance with this Specification. The Owner will comply with the Vendor’s safety rules.

10.3 The Owner reserves the right to make additional tests and/or inspections deemed necessary to verify compliance with this Specification. Generally, the cost of these tests and inspections shall be borne by the Owner. However, the direct cost of all tests directly related to, and indicating noncompliance with this Specification shall be borne by the Vendor.

SECTION 10: MANHOLES

1. All manholes shall be constructed of precast reinforced concrete. The design, fabrication, modifications, and installation of manholes shall comply with Section 602 of the Illinois Dept. of Transportation "Standard Specifications for Road and Bridge Construction," adopted January 1, 2002. Alternately, the manholes may be constructed using reinforced concrete pipe meeting the requirements of Section 12 of this Specification, with cast iron steps added as described in Paragraph 3 below and a flat slab top as described in Paragraph 4 below.

2. Overall dimensions of manhole rings and flat slab tops shall be as shown in the plans. Minimum thickness and reinforcement shall be as shown in the Illinois Dept. of Transportation "Highway Standards." In addition to these minimums, the fabricator of precast concrete manholes and tops shall design and construct the products to support the anticipated loads and meet industry standards.

3. Precast manholes and extension rings shall have 12-inch wide cast iron manhole steps spaced at 12 inches. Steps shall be as manufactured by Neenah Foundry or an approved equal.

4. The flat slab top for the 48-inch diameter manhole above the existing 36-inch diameter outfall pipe shall have a round Neenah medium or light-duty frame (or approved equal) cast into it. The frame shall be equipped with a Neenah Type G Grate (or an approved equal). Minimum clear opening of frame shall be 20 inches.

5. Submittals for manholes shall include all precast concrete products, frames, and grates.

SECTION 11: RIPRAP

1.0 SCOPE

1.1 This Specification covers the minimum requirements for furnishing, transporting, and placing a protective course of stone as riprap on slopes or in channels.

1.2 Except as noted otherwise, the Contractor shall furnish all labor, material, tools, and equipment necessary for riprap work shown on the Drawings and specified hereinch

2.0 REFERENCES

2.1 The reference to specifications or organizations together with any diagrams, drawings, or plans shall be considered as a part of this Specification. In the event of conflict between this Specification and the referenced documents, this Specification shall take precedence. The following specifications, standards, and codes apply:

2.1.1 American Society for Testing and Materials (ASTM)

2.1.2 ASTM D-751-79: Standard Methods of Testing Coated Fabrics

2.1.2.1 ASTM D-1682-64: Standard Test Methods for Breaking Load and Elongation of Textile Fabrics

2.1.2.2 ASTM D-1777-64: Standard Method for Measuring Thickness of Textile Materials.

2.1.2.3 ASTM D-3776-85: Standard Test Methods for Mass Per Unit Area (Weight) of Woven Fabric

2.1.2.4 ASTM D-3786-87: Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Non-woven Fabrics – Diaphragm Bursting Strength Tester Method

2.1.2.5 ASTM D-3884-80: Standard Test Method for Abrasion Resistance of Textile Fabrics (Rotary Platform, Double-Head Method)

3.0 GENERAL REQUIREMENTS

3.1 This work shall be performed under the personal and constant supervision of a competent Construction Superintendent or Foreman experienced in this type of work.

3.2 The Owner reserves the right to inspect all materials and reject all substandard materials and workmanship.

4.0 MATERIALS

4.1 Riprap shall be rock that is sound, dense, durable, angular, hard, free from cracks, seams, clay, and other defects that would lead to deterioration under water and/or frost action. Rounded boulders or cobbles will not be accepted as riprap. Neither the breadth nor the thickness of any piece of riprap shall be less than one-third of its length.

4.1.1 The riprap stone shall be quarried from ledges for Portland cement concrete quality stone provided the ledges are sufficiently thick to produce the desired dimensions. The riprap stone and bedding shall conform to Coarse Aggregate, Class A quality. The riprap shall be obtained from sources and locations that are approved by the Company. The following tests shall be performed by the Contractor and submitted in advance of placing the proposed riprap, using the services of an independent testing laboratory acceptable to the Company:

Na_2S0_4 Soundness – 5 cycle	
Max % Loss	10
Los Angeles Abrasion	
Max % Loss after 100 revolutions	10
Max % Loss after 500 revolutions	40
Minus No. 200 Sieve Material 1 %	2.5
Max % Deleterious	
Shale Max %	1.0
Clay Lumps Max %	0.25
Coal & Lignite Max %	0.25
Soft & Unsound Fragments Max %	4.0
Other Deleterious Max %	4.0
Total Deleterious Max %	5.0
Max % freeze-thaw loss (AASHTO T103)	5

4.3 Gradation: The stone for 150-pound riprap shall be reasonably well graded, from a minimum weight of 25 lbs. to a maximum piece weight of 150 lbs. with at least 50% weighing more than 100 lbs.

4.4 A non-woven geotextile meeting the following specifications shall be placed on the subgrade for the riprap:

Weight, oz./sq.yd.	ASTM D-3776	8
Thickness, mils	ASTM D-1777	80
Tensile Strength, lbs.	ASTM D-1682	350
Puncture Strength, lbs.	ASTM D-751	150
Mullen Burst Strength	ASTM D-3786	450
Minimum Coefficient of Permeability, cm/sec	Constant Head (50 mm)	0.22
Minimum Permittivity, sec^{-1}	(Coeff. of Permeability/Thickness)	0.96
Abrasion Resistance, lbs.	ASTM D-3884	150

5.0 CONSTRUCTION REQUIREMENTS

5.1 The area to be riprapped shall be cleared of vegetation and other debris. The subgrade for the riprap shall be trimmed and shaped so that the finished surface shall conform to the lines specified.

5.2 Riprap Placement

Geotextile shall be placed on the subgrade and anchored in accordance with the manufacturer's recommendations.

5.2.1 Stone shall be placed on the geotextile to produce a reasonably well-graded mass of rock with a minimum percentage of voids and constructed to the lines and grades shown.

5.2.2 Stone riprap shall be placed to its full course thickness at one operation and in such a manner as to avoid damage to the geotextile. Placing of the material shall start at the lower elevations and progress up the slope. The larger stones shall be well distributed and the entire mass of stones in their final positions shall be roughly graded to conform to the gradation specified. The finished riprap shall be free from objectionable pockets of small stones and clusters of larger stones. Placing of material by methods that segregate particle sizes will not be permitted.

Rearranging individual stones by mechanical equipment or by hand will be required to the extent necessary to obtain a reasonably well graded distribution of stone sizes as specified.

5.2.3 Thickness: All riprap shall be a minimum of 18 inches thick.

5.3 Surplus or excess material resulting from clearing the work area and shaping of the subgrade shall be hauled off and legally disposed of by the Contractor. This work shall be incidental to the contract.

5.4 Any ruts, depressions, mounds, or other damage caused by the Contractor shall be repaired by the Contractor at no cost to the Owner. Repairs to improved areas shall be with like materials and workmanship as the adjacent areas.

6.0 MEASUREMENT

6.1 Riprap shall be measured in units of square yards along the slope.

6.2 Geotextile fabric shall not be measured and shall be included in the unit price per square yard for the riprap.

SECTION 12: REINFORCED CONCRETE PIPE

1.0 Scope

The work consists of furnishing and installing reinforced concrete pipe, fittings, and appurtenances as shown on the Drawings.

2.0 Material

Reinforced concrete pipe and fittings shall conform to the following requirements.

2.1 Pipe Reinforced concrete pipe and fittings shall conform to the requirements of ASTM Standard Specification C 76 (latest revision), Class V, Wall B. The maximum laying length of individual pipe sections shall be 8-feet.

2.2 Gaskets The pipe joint gaskets shall be endless rubber gaskets having circular cross section. The cross-sectional diameter of the gaskets shall conform to the pipe manufacturer's recommendation for the type and size of pipe furnished.

2.3 Joints Joints shall conform to ASTM Standard Specification C 443 (latest revision).

2.4 Joint Sealing Compound The compound shall be a cold-application material unless otherwise specified and shall be a single component or multiple component type. The sealing compound shall conform to the requirements of one of the following specifications:

2.4.1 ASTM Specification C 990 - Joints for concrete pipe, manholes, and precast box sections using preformed flexible joint sealants.

2.4.2 ASTM Specification C 877 - External sealing bands for noncircular concrete sewer, storm drain, and culvert pipe.

2.4.3 ASTM Specification D 1190 - Concrete joint sealer, hot poured elastic type.

2.4.4 ASTM Specification C 920 - Elastomeric joint sealants for cold applied sealing and caulking of joints on mortar and concrete structures not subject to fuel spills. Use type S or M, grade NS for vertical joints; type S or M, grade P or NS for horizontal joints. For class 25, use M, quality materials shall be used for both vertical and horizontal joints unless otherwise specified.

The sealing compound if used with other joint material, such as fillers or gaskets, shall be compatible.

2.5 Fittings

Contractor shall submit shop drawings for approval from his pipe fabricator detailing dimensions of all fittings and certifications that the working pressures and strengths of the fittings equal or exceed the requirements of ASTM Standards C 76 (Class V, Wall B) and C 443.

3.0 LAYING AND BEDDING THE PIPE

3.1 Laying the Pipe

The pipe shall be set to the specified line and grade and temporarily supported on precast concrete blocks or wedges. Concrete blocks and wedges used to temporarily support the pipe during placement of concrete bedding or cradle, or both, shall be a class of concrete equal to or stronger than the concrete used to construct the bedding or cradle. Bell and spigot pipe shall be laid with the bells or grooves facing upstream unless shown otherwise on the Drawings. When precast pipe risers and other similar precast pipe structures are installed before pipe installation, pipe may be installed in the downstream direction with the belled end upstream. Just before each joint is connected, the connecting surface of the bell and spigot or spigots and sleeve shall be thoroughly cleaned and dried. Also, the rubber gasket and the inside surface of the bell or sleeve shall be lubricated with a light film of soft vegetable soap compound (flax soap). The rubber gasket shall be stretched uniformly as it is placed in the spigot groove to ensure a uniform volume of rubber around the circumference of the pipe. The joint shall be connected by means of a pulling or jacking force so applied to the pipe that the spigot enters squarely into the bell, or the joint shall be connected in accordance with the manufacturer's instructions. When the spigot has been seated to within 0.5 inches of its final position, the position of the gasket in the joint shall be checked around the entire circumference of the pipe by means of a metal feeler gauge. In any case where the gasket is found to be displaced, the joint shall be disengaged and properly reconnected. After the position of the gasket has been checked, the spigot shall be completely pulled into the bell and the section of pipe shall be adjusted to line and grade.

3.2 Concrete Cradle

The horizontal pipe for the 36-inch conduit shall be bedded on a concrete cradle as shown on the Drawings throughout the entire horizontal length of the pipe section. The cradle shall terminate at the end of a pipe length. A compressible material with a minimum thickness of 0.5 inches shall be installed in the joint to accommodate slight foundation deflections. Cradle shall be continuously reinforced longitudinally.

4.0 FILLING JOINTS

4.1 Before the placement of the bedding or cradle, the exterior annular space between the ends of the pipe sections shall be cleaned and completely filled with joint sealing compound. Before the compound is applied, the surface against which it is to be placed shall be cleaned of all dust, lubricant, and other substances that would interfere with a bond between the compound and the pipe. If recommended by the manufacturer of the compound, the concrete surface shall be coated with a primer in accordance with the manufacturer's recommendations. Primers shall be applied to the concrete surface only and shall not come in contact with the gasket or gasket sealing surface. Unless the compound or primer is specifically recommended for use on moist concrete, the surface shall be dry when the compound or primer is applied.

4.2 The joint sealing compound shall be allowed to cure until it is sufficiently firm to prevent the entry of concrete or earth into the joint. Before placing bedding or earth backfill (excluding concrete) containing particles larger than 0.25 inch in maximum dimension within 6 inches of the joint sealing compound, the compound shall be covered with a strip of 16-gauge to 24-gauge metal at least 2 inches wider than the space between the ends of the pipe sections.

5.0 HANDLING THE PIPE

The contractor shall furnish all equipment and facilities needed to handle, store, and place the pipe without damaging the pipe.

6.0 PRESSURE TESTING

Before placing any concrete or earthfill around the conduit or filling the pipe joints, the conduit shall be air tested in accordance with ASTM C 924 at a maximum pressure equal to the pressure rating of the pipe joints. The conduit shall be braced on each end to prevent slippage. All end plugs used for the air test shall be capable of resisting the internal pressure and must be securely braced.

7.0 BACKFILL

Backfill shall be accomplished as follows and as described in Paragraph 10, Items of Work and Construction Details, of this Specification:

7.1 Compacted backfill shall be placed to its final depth as shown on the Drawings at vertical and horizontal deflection points, road crossings, and thrust blocks. Backfill shall be placed so that conduit and joint displacement does not occur.

7.2 All joints and connections shall be completely exposed for visual observation during testing.

8.0 CORRECTIONS OF LEAKS

The contractor shall be fully responsible for any and all work required to correct any leakage disclosed by the pressure testing.

9.0 MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the quantity of each size, and thickness class of pipe is determined to the nearest foot by measurement of the installed length of pipe along the crown centerline of the conduit. Payment for each size and thickness class of pipe is made at the contract unit price for that size and thickness class of pipe. Such payment constitutes full compensation for furnishing, transporting, handling, and installing the pipe, concrete cradle, and necessary fittings and appurtenances complete in place. Compensation for any item of work described in the contract, but not listed, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Paragraph 10 of this Specification.

10.0 ITEMS OF WORK AND CONSTRUCTION DETAILS

10.1 Backfill or fill immediately adjacent to the pipe and/or its cradle shall be placed in 4 inch lifts and carefully compacted with appropriately sized equipment to at least 95% of the maximum dry density as determined by ASTM D 698 at a moisture content between 0% to +4% of optimum moisture. Care shall be taken in the compaction process to completely break down clods and remold the backfill material so that it is in intimate contact with the pipe and cradle throughout the length of the pipe. Compacted backfill or fill shall extend from the pipe or concrete cradle out to either natural soil (if the pipe is laid in a trench) or to compacted dike (if the pipe is laid in the dike).

10.2 Contractor shall survey horizontal position and elevation of the top of the existing 36-inch diameter pipe and its foundation and prepare shop drawings showing the proposed lengths of pipe and dimensions of fittings to be furnished for the proposed new outlet pipe.

10.3 No separate payment will be made for reinforced concrete pipe. Compensation for reinforced concrete pipe is included in the bid items for the 36-inch outfall and the pond level control pipe.

SECTION 13: DUCTILE IRON PIPE AND FITTINGS

1.0 SCOPE

The work consists of furnishing and installing ductile-iron pipe, fittings, and appurtenances as specified in 9.0 Items of Work and Construction Details and as shown on the Drawings.

2.0 MATERIAL

Ductile-iron pipe and fittings shall conform to the following requirements. Thickness class of pipe and rated working pressure shall be as specified in 9.0 Items of Work and Construction Details or as shown on the Drawings.

2.1 Pipe Ductile-iron pipe shall conform to the requirements of ANSI/AWWA C151/A21.51, Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids, and ANSI/AWWA C115/A21.15, Flanged Ductile-Iron Pipe with Threaded Flanges.

2.2 Fittings Ductile-iron pipe fittings shall conform to the requirements of ANSI/AWWA C110/A21.10, Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids, and ANSI/AWWA C153/A21.53, Ductile-Iron Compact Fittings, 3-inch through 12-inch, for Water and Other Liquids.

2.3 Joints Rubber-gasket joints for ductile-iron pipe and fittings where either mechanical or push-on joints are used shall conform to the requirements of ANSI/AWWA C111/A21.11, Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings. Unless otherwise specified or indicated on the Drawings, all joints shall be mechanical joints.

2.4 Lining Interior lining for ductile-iron pipe and fittings shall conform to the requirements of ANSI/AWWA C104/A21.4, Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water. Unless otherwise specified, special fittings and appurtenances shall be the same material as the pipe.

2.5 Check Valve The check valve for the pond level control pipe extension shall be an 18-inch diameter Valmatic Model 518 Swing-Flex or equal full body flanged type with a domed access cover and only one moving part, the valve disc. The valve body shall have full flow equal to the nominal pipe diameter at any point through the valve. The seating surface shall be on a 45-degree angle to minimize disc travel. The top access port shall be full size, allowing removal of the disc without removing the valve from the pipeline. The access cover shall be domed in shape. The disc shall be of one piece construction, precision molded with an integral Oh-ring type sealing surface and contain steel and nylon reinforcements in both the Memory-Flex and central disc areas. The flex portion of the disc shall be warranted for twenty-five years. Non-slam closing characteristics shall be provided through a short 35-degree disc stroke and a Memory-Flex return action. The valve body and cover shall be ASTM A126, Class B cast iron. The disc shall be Buna-N (NBR), ASTM D2000-BG. The interior and exterior of the valve shall be coated with a fusion bonded epoxy. The valve shall be cycle tested 1,000,000 times with no sign of wear or distortion of the valve disc or seat and shall remain drop tight at both high and low pressures. The test results shall be independently certified. Bolts and nuts for the flanges shall be Type 316 stainless steel.

3.0 LAYING AND BEDDING THE PIPE

3.1 Pipe shall be installed to the lines and grades shown on the Drawings with bell socket ends aligned upstream unless otherwise specified. The pipe shall be installed in accordance with the manufacturer's recommendations, unless otherwise specified. Two copies of the pipe manufacturer's installation instructions shall be provided to the Engineer before any pipe placement.

3.2 The pipe shall be firmly and uniformly bedded within the trench throughout the entire length of the pipe section to the depth and in the manner specified. Bell holes for flanged, push-on, or mechanical joint pipe shall be provided as necessary to allow space for joint assembly and to permit the pipe barrel to be uniformly supported on the bedding.

3.3 Joints and Connections: Pipe joints shall be mechanical joints and shall be sound and watertight at a pressure of 20 psi. Non-shrink grout shall be used to seal the annulus where the pipe penetrates concrete manholes. The openings in the manholes shall be between 3 and 4 inches larger than the outside diameter of the ductile iron pipe. Install underground piping with restrained joints at horizontal and vertical changes in direction.

3.4 Thrust Restraint - Plugs, caps, tees, wyes and bends deflecting 11.25 degrees or more, either vertically or horizontally shall be provided with thrust restraints. Valves shall be securely anchored or shall be provided with thrust restraints to prevent movement. Thrust restraints shall be restrained joints.

3.4.1 Restrained Joints - For ductile-iron pipe, restrained joints shall be designed by the Contractor or the pipe manufacturer in accordance with DIPRA-Restraint Design.

4.0 HANDLING THE PIPE

The contractor shall furnish all equipment and facilities needed to handle, store, and place the pipe without damaging the pipe, lining, or coating. Pipe coating or lining that is damaged shall be repaired using methods recommended by the manufacturer unless otherwise specified in 9.0 Items of Work and Construction Details.

5.0 PRESSURE TESTING

Pressure testing of the conduit shall be conducted as follows:

5.1 Placement of backfill before pressure testing shall be as specified in 6.0 Backfill.

5.2 Before pressure testing, the pipeline shall be flushed and free of all foreign material.

5.3 The pipeline shall not be pressure tested until concrete for anchor and thrust blocks has attained the minimum specified compressive strength unless other specified methods of thrust restraint are provided.

5.4 The total conduit or continuous section of conduit to be tested shall be filled with clean water at a rate not to exceed the maximum specified and tested at 20 psi.

5.5 The section of conduit being tested shall be allowed to stand full of water for a minimum of 24 hours before the start of pressure and leakage tests. Test pressures shall be held constant for 2 hours. When the amount of water loss exceeds the maximum allowable loss specified in 9.0 Items of Work and Construction Details, the leak(s) shall be repaired or otherwise corrected and the conduit shall be re-tested. The testing procedure shall be repeated until the requirements of the Specifications are met.

5.6 Except for joint material setting or where concrete thrust blocks necessitate a 5-day delay, pipelines jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill. Cement-mortar lined pipe may be filled with water as recommended by the manufacturer before being subjected to the pressure test and subsequent leakage test.

6.0 BACKFILL

6.1 Initial backfill in accordance with 9.0 Items of Work and Construction Details shall be accomplished only in sufficient amount to hold the conduit in place during testing, with the following exceptions:

6.1.1 Compacted backfill shall be placed to its final depth as shown on the Drawings at vertical and horizontal deflection points, road crossings, and thrust blocks. Backfill shall be placed so that conduit and joint displacement does not occur.

6.1.2 All joints and connections shall be completely exposed for visual observation during testing, except at locations described in the exception above.

7.0 CORRECTION OF LEAKS

The contractor shall be fully responsible for any and all work required to correct any leakage when the leakage test results in water loss that exceeds the amount specified in 9.0 Items of Work and Construction Details.

8.0 MEASUREMENT AND PAYMENT

8.1 For items of work for which specific unit prices are established in the contract, the quantity of each size, and thickness class of pipe is determined to the nearest foot by measurement of the installed length of pipe along the crown centerline of the conduit. Payment for each size and thickness class of pipe is made at the contract unit price for that size and thickness class of pipe. Such payment constitutes full compensation for furnishing, transporting, handling, and installing the pipe, concrete cradle, and necessary fittings and appurtenances complete in place.

8.2 Compensation for any item of work described in the contract, but not listed, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in 9.0 Items of Work and Construction Details.

9.0 ITEMS OF WORK AND CONSTRUCTION DETAILS

9.1 Initial backfill material shall be placed and compacted with approved tampers to a height of at least one-foot above the pipe. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe.

9.2 All ductile iron pipe shall be Special Thickness Class 55 or heavier. All ductile iron pipe fittings shall be mechanical joint or flanged fittings, pressure class 350 or heavier.

9.3 Connection to the existing 18-inch diameter pipe shall be made with appropriate mechanical joint ductile iron coupling or fitting meeting the requirements of this Specification.

9.4 Leakage test shall be conducted after the pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and during the test the water line shall be subjected to not less than 20 psi pressure. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section, necessary to maintain pressure within 1 psi of the specified leakage test pressure after the pipe has been filled with water and the air expelled. Piping installation will not be accepted if leakage exceeds the allowable leakage which is determined by the following formula:

$$L = 0.0001351(N)(D)P^{0.5}$$

L = Allowable leakage in gallons per hour

N = Number of joints in the length of pipeline tested

D = Nominal diameter of the pipe in inches

P = Average test pressure during the leakage test, in psi gauge

Should any test of pipe disclose leakage greater than that calculated by the above formula, the defective joints shall be located and repaired until the leakage is within the specified allowance, without additional cost to the Company.

9.5 No separate payment shall be made for ductile iron pipe and fittings. This work shall be considered incidental to Bid Item 17, 16 inch Flow Meter, and to Bid Item 21, 18 inch Pond Level Control Pipe Extension/Intake Structure. Compensation for the 18-inch by 18-inch by 8-inch ductile iron wye, the ductile iron pipe fittings required to connect to the new 8-inch diameter PVC suction line from the pump, and the new 18-inch diameter swing check valve shall be included in the lump sum amount for Bid Item 21, 18 inch Pond Level Control Pipe Extension/Intake Structure.

SECTION 14: PVC PLASTIC PIPE

1.0 SCOPE

The work consists of furnishing and installing plastic and the necessary fittings and appurtenances as shown on the Drawings or as specified herein.

2.0 MATERIAL

2.1 Pipe, fittings, and gaskets shall conform to the requirements of below and as specified in section 14 of this Specification or as shown on the Drawings.

2.2. Scope: This Specification covers the quality of Poly Vinyl Chloride (PVC) plastic pipe, fittings, 8-inch cast iron gate valve, valve box, and joint materials.

2.3. Material:

2.3.1 Pipe - The pipe shall be as uniform as commercially practicable in color, opaqueness, density, and other specified physical properties. It shall be free from visible cracks, holes, foreign inclusions, or other defects. The dimensions of the pipe shall be measured as prescribed in ASTM D 2122. The pipe shall be rated for 200 psi in accordance with ASTM D 2241.

2.3.2 Unless otherwise specified, the pipe shall conform to the requirements listed in this Specification and the requirements shown on the Drawings.

2.3.3 Fittings and joints - Fittings and joints shall be of a schedule, SDR or DR, pressure class, external load carrying capacity, or pipe stiffness that equals or exceeds that of the plastic pipe. The dimensions of fittings and joints shall be compatible with the pipe and measured in accordance with ASTM D 2122. Joint and fitting material shall be compatible with the pipe material. The joints and fittings shall be as uniform as commercially practicable in color, opaqueness, density, and other specified physical properties. It shall be free from visible cracks, holes, foreign inclusions, or other defects. Fittings and joints shall conform to the requirements listed in this Specification, the requirements of the applicable specification referenced in the ASTM or AWWA specification for the pipe, the requirements specified herein, and the requirements shown on the Drawings.

2.3.4 Gaskets - Rubber gaskets for pipe joints shall conform to the requirements of ASTM F 477, Elastomeric Seals (Gaskets) for Jointing Plastic Pipe.

2.3.5 Thrust Restraints - Thrust restraints shall be furnished and installed at all valves, elbows and at the connection with the existing pump. PVC bell restraining harnesses equal to EBAA Series 6500 shall be used. Restraining harnesses shall also be furnished and installed on all pipe joints within 25 feet of all elbows exceeding 11.25 degrees. EBAA 2000 PV Series restraints or equal may be used in lieu of Series 6500 restraining harnesses.

2.3.6 Valve - Gate valves shall be designed for a working pressure of not less than 150 psi. Valve connections shall be as required for the piping in which they are installed. Valves shall have a clear waterway equal to the full nominal diameter of the valve, and shall be opened by turning counterclockwise. The operating nut or wheel shall have an arrow, cast in the metal, indicating the direction of opening. Valves 3 inches and larger shall be iron body, bronze mounted, and shall conform to AWWA C500 and shall be fitted with mechanical joints. Resilient-Seated Gate Valves: For valves 3 to 12 inches in size, resilient-seated gate valves shall conform to AWWA C509.

2.3.7 Valve boxes shall be cast iron or concrete, except that concrete boxes may be installed only in locations not subjected to vehicular traffic. Cast-iron boxes shall be extension type with slide-type adjustment and with flared base. The minimum thickness of metal shall be 3/16 inch. Concrete boxes shall be the standard product of a manufacturer of precast concrete equipment. The word "WATER" shall be cast in the cover. The box length shall adapt, without full extension, to the depth of cover required over the pipe at the valve location.

3.0 HANDLING AND STORAGE

3.1 Pipe shall be delivered to the job site and handled by means that provide adequate support to the pipe and do not subject it to undue stresses or damage. When handling and placing plastic pipe, care shall be taken to prevent impact blows, abrasion damage, and gouging or cutting (by metal edges and/or surface or rocks). The manufacturer's special handling requirements shall be strictly observed. Special care shall be taken to avoid impact when the pipe must be handled at a temperature of 40 degrees Fahrenheit or less.

3.2 Pipe shall be stored on a relatively flat surface so that the barrels are evenly supported.

Unless the pipe is specifically manufactured to withstand exposure to ultraviolet radiation, it shall be covered with an opaque material when stored outdoors for 15 days or longer.

4.0 EXCAVATION

4.1 Excavation shall be in accordance with Section 6, Excavation or as shown on the Drawings.

4.2 The pipe foundation shall be excavated a minimum of 4 inches lower than the pipe grade shown on the Drawings or staked in the field whenever bedrock, boulders, cobbles, or other material that may cause pipe damage is encountered at planned pipe grade.

5.0 LAYING THE PIPE

5.1 Plastic pipe conduits complete with fittings and other related appurtenances shall be installed to the lines and grades shown on the Drawings or specified in Article 14 of this Specification. The pipe shall be installed so that there is no reversal of grade between joints unless otherwise shown on the Drawings. The pipe shall not be dropped or dumped on the bedding or into the pipe trench. The ground surface near the pipe trench shall be free of loose rocks and stones greater than 1 inch in size. This ensures that rock will not be displaced and impact the pipe.

5.2 Just before placement, each pipe section shall be inspected to ensure that all foreign material is removed from inside the pipe. The pipe ends and the couplings shall be free of foreign material when assembled. At the completion of a work shift, all open ends of the pipeline shall be temporarily closed off using a suitable cover or plug.

5.3 Care shall be taken to prevent distortion and damage during hot or cold weather. During unusually hot weather (daytime high temperature of more than 90 °F), the pipe assembled in the trench shall be lightly backfilled or shaded to keep it as near to ground temperature as possible until final backfill is placed. Backfill operations should be performed during daily construction periods when the ground temperature and the temperature of the pipe do not vary more than 40 degrees Fahrenheit.

5.4 During installation, the pipe shall be firmly and uniformly bedded throughout its entire length. Bell holes shall be placed in bedding material under bells, couplings, and other fittings to assure the pipe is uniformly supported throughout its entire length. Blocking or mounding beneath the pipe to bring the pipe to final grade is not permitted.

6.0 PIPE BEDDING

6.1 Earth Bedding - The pipe shall be firmly and uniformly placed on compacted earthfill bedding or an in-place earth material bedding of ample bearing strength to support the pipe without noticeable settlement. The earth material on which the pipe is placed shall be of uniform density to prevent differential settlement.

6.2 Unless otherwise specified, a groove that closely conforms to the outside surface of the pipe shall be formed in the bedding. The depth of the groove shall be equal to or greater than 0.3 of the pipe diameter.

6.3 Earth bedding shall be compacted to a density not less than adjacent undisturbed in-place earth material or be compacted earth backfill. Earthfill material used for compacted earth bedding shall be free of rocks or stones greater than 1 inch in size and earth clods greater than 2 inches in size. The pipe shall be loaded sufficiently during the compaction of bedding under the haunches and around the sides of the pipe to prevent displacement from its final approved placement.

7.0 BACKFILL

7.1 Initial Backfill - Unless otherwise specified, initial backfill to 6 inches above the top of the conduit is required. Earth haunching and initial backfill material shall consist of soil material that is free of rocks, stones, or hard clods more than 1 inch in diameter.

7.2 Initial backfill shall be placed in two stages. In the first stage (haunching), backfill is placed to the pipe spring line (center of pipe). In the second stage, it is placed to 6 inches above the top of the pipe.

7.3 The first stage material shall be worked carefully under the haunches of the pipe to provide continuous support throughout the entire pipe length. The haunching backfill material shall be placed in layers that have a maximum thickness of about 6 inches and compacted as specified in Section 6.0. During compaction operations, care shall be taken to ensure that the tamping or vibratory equipment does not contact the pipe and the pipe is not deformed or displaced.

7.4 When pressure testing is not specified, the pipe shall be covered with a minimum of 6 inches of backfill material as soon as possible following assembling of the pipe in the trench, but not later than within the same day that placement has occurred. When pressure testing is specified, sufficient backfill material shall be placed over the pipe to anchor the conduit against movement during pressure testing activities.

7.5 Final Backfill - Final backfill shall consist of placing the remaining material required to complete the backfill from the top of the initial backfill to the ground surface, including mounding at the top of the trench. Final backfill material within 2 feet of the top of the pipe shall be free of debris or rocks larger than 3 inches nominal diameter. Final backfill compaction requirements shall be as specified in Section 6.0 or as shown on the Drawings.

7.6 Vehicles or construction equipment shall not be allowed to cross the pipe until there is a minimum earth cover of 2 feet over the pipe.

9.0 JOINTS

9.1 Joints shall be either bell-and-spigot type with elastomeric gaskets or coupling type with elastomeric gaskets. When a lubricant is required to facilitate joint assembly, it shall be a type having no deleterious affect on the gasket or pipe material.

9.2 Pipe joints shall be watertight at the pressures specified except where unsealed joints are indicated.

9.3 Pipe shall be installed and joined in accordance with the manufacturer's recommendations. Laying deflections and joint fitting or stab depths shall be within the manufacturer's recommended tolerances.

9.4 Pipe ends shall be cut square and be deburred to provide a uniform, smooth surface for the jointing process. Reference marks shall be placed on the spigot ends to assist in determining when proper seating depth has been achieved within the joint.

10.0 FITTINGS

10.1 Unless otherwise specified, steel fittings, valves, and bolted connections shall be painted or coated as recommended by the manufacturer.

10.2 Fittings for non-pressure pipe shall be of the same or similar material as the pipe and shall provide the same durability, watertightness, and strength as the pipe unless otherwise specified.

11.0 THRUST BLOCKS AND ANCHORS

11.1 When specified, concrete thrust blocks and anchors shall be installed as shown on the Drawings.

11.2 The concrete for the thrust blocks and anchors shall conform to the requirements of Section 7 (Concrete).

11.3 The thrust block cavity shall be excavated undisturbed soil or previously placed compacted backfill. The cavity shall be formed with soil or wood to hold the freshly placed concrete without displacement until an initial set has occurred.

11.4 When excavation beyond the designated trench widths and depths as shown on the Drawings occurs at locations where installation of concrete thrust blocks is required, the contractor shall install an alternative thrust block provision. The concrete thrust block shall have a thickness of one pipe diameter and a contact face area that shall be formed against the pipe as shown on the Drawings. Backfill shall be placed on all sides of the thrust block and to the sides of the excavation. It shall be compacted as specified for initial backfill.

12.0 PRESSURE TESTING

12.1 The conduit shall be tested for leaks in the following manner:

12.1.1 Before pressure testing:

12.1.1.1 Joints of the assembled pipeline shall be allowed to cure as recommended by the manufacturer.

12.1.1.2 Pipeline shall be flushed and cleaned.

12.1.1.3 All concrete anchors and thrust blocks shall be in place and allowed to cure for a minimum of 3 days.

12.1.1.4 Earth backfill shall be sufficient to anchor the conduit against movement during the pressure testing and shall be compacted.

12.1.1.5 The conduit shall be braced, anchored, or both, at each end to restrict all potential pipe movement.

12.1.1.6 The ends of the conduit shall be plugged. The upstream plug shall have a standpipe installed vertically having a minimum diameter of 2 inches and shall be equipped with a shutoff valve. All high points in the line shall be vented to evacuate air pockets. The conduit and the standpipe shall be slowly filled with water such that no air is entrapped during the filling operation. After filling is complete, all vents shall be closed.

12.1.2. During pressure testing, the water level in the standpipe shall be continuously maintained at a minimum of 10 feet above the highest invert elevation of the conduit for no less than 2 hours.

12.1.3 The volume of water leakage in the 2-hour test period shall be recorded. The maximum allowable leakage (L) in gallons per hour shall not exceed 0.02 times the nominal pipe diameter (D) in inches for each 1,000 feet of pipe line, which is about 50 pipe joints (L = 0.02 x D).

12.1.4 When observed leakage exceeds the allowable, leaks shall be sealed by replacement of pipe and fittings as necessary. The conduit shall be retested as described above. This procedure shall be repeated until the conduit leakage does not exceed the allowable specified above.

12.1.5 The contractor shall be fully responsible for all work required to correct leakage exceeding the amount specified.

12.1.6 When observed leakage exceeds the allowable, leaks shall be sealed by replacement of pipe and fittings as necessary. The conduit shall be retested as described in this section. The procedure shall be repeated until the conduit leakage does not exceed the allowable specified above.

12.2 The contractor shall be fully responsible for all work required to correct leakage exceeding the amount specified.

13.0 MEASUREMENT AND PAYMENT

13.1 For items of work for which specific unit prices are established in the contract, the quantity of each kind, size, and class of pipe is determined to the nearest foot by measurement of the laid length along the crown centerline of the conduit. Payment for each kind, size, and class of pipe is made at the contract unit price for that kind, size, and class. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe including excavation, shoring, backfill, bedding, thrust blocks, and all fittings, appurtenances, and other items necessary and incidental to the completion of the work. Payment for appurtenances listed separately in the bid schedule is made at the contract prices for those items. Compensation for any items of work described in the contract, but not listed in the Bid Form, is included in the payment for the item of work to which it is made subsidiary. Such items and items to which they are made subsidiary are identified in Article 14 of this Specification.

14.0 ITEMS OF WORK AND CONSTRUCTION DETAILS

14.1 Compensation for the 8-inch diameter recirculation line shall be paid for at the unit price for Bid Item 20, 8-inch PVC Recirculation Line.

14.2 Compensation for the 8-inch diameter PVC suction line from the pump to the 18-inch pond level control pipe shall be incidental to the lump sum price for Bid Item 18, Pump Suction Modifications, and shall include the 8-inch valve and valve box as well as the 8-inch PVC pipe and fittings between the 18 x 18 x 8 wye and the pump.

SECTION 15: HIGH DENSITY POLYETHYLENE PIPE

1.0 GENERAL

1.1 Section includes:

Furnishing and installing HDPE pipe and fittings.

1.2 Related Sections

Section 5: Submittals.

1.3 References

ASTM D 638: Test Method for Tensile Properties of Plastics.

ASTM D 790: Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

ASTM D 1238: Test Method for Flow Rates of Thermal Plastics Molding and Extrusion Materials.

ASTM D 1505: Test Method for Density of Plastics by the Density Gradient Technique.

ASTM D 1599: Test Method for Short Time Hydraulic Failure Pressure of Plastic Pipe Materials.

ASTM D 1693: Test Method for Environmental Stress Cracking of Ethylene Plastics.

ASTM D 2122: Method for Determining Dimensions of Thermal Plastic Pipe and Fittings.

ASTM D 2837: Method for Obtaining Hydrostatic Design Basis for Thermal Plastic Pipe Materials.

ASTM D 3350-84: Polyethylene Plastics Pipe and Fitting Material.

ASTM F 714-93: Polyethylene (PE) Plastic Pipe Based on Outside Diameter.

ASTM F 1248: Determination of Environmental Stress Crack Resistance (ESCR) of Polyethylene Pipe.

ASTM D 4218: Test Method for Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.

ASTM D1 248: Specification for Polyethylene Plastics Molding and Extrusion Material.

ASTM D 2240: Test Method of Rubber Property - Durometer Hardness.

ASTM D 695: Test Method for Compressive Strength of Rigid Plastics.

ASTM D 256: Test Method for Impact Resistance of Plastics and Electrical Insulating Material.

ASTM D 696: Test Method of Coefficient of Linear Thermal Expansion of Plastics.

ASTM C 177: Test Method for Steady-State Heat Flux Measurement and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

ASTM D 746: Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.

ASTM D 152S: Test Method for Vicat Softening Temperature of Plastics.

1.4 Submittals

1.4.1 Submit in accordance with Section 5, Submittals.

1.4.2 Submit certifications, manufacturer's data, shop drawings, test results, and records as necessary to show that materials, methods, and workmanship meet or exceed the requirements of these specifications.

1.4.3 Submit the following to the Engineer for review and acceptance prior to shipment of the pipe:

1.4.3.1. A statement in writing from the pipe manufacturer that it is listed with the Plastic Pipe Institute as an extruder for polyethylene resin being used to manufacture the pipe for this project.

1.4.3.2. Catalog information confirming the pipe conforms to the requirements of these specifications.

2.0 PRODUCTS

2.1 HDPE Pipe Materials

2.1.1. Physical Properties for pipes and fittings:

Typical Physical Properties*

Property	Specification	Units	Nominal Values
Material Designation	PPI/ASTM	---	PE3408
Material Classification	ASTM D1248	---	III C 5 P34
Cell Classification	ASTM D3350	---	345434C
Density (3)	ASTM D1505	gm/cm^3	0.955
Melt Flow (4)	ASTM D1238	gm/10 min	0.11 @ 2.16 kg***
Flex Modulus (5)	ASTM D790	psi	135,000
Tensile Str. (4)	ASTM D638	psi	3,200
ESCR (3)	ASTM D1693	F_0, Hrs	F_0>5,000
HDB @ 73^{0}F (4)	ASTM D2837	psi	1,600
U-V Stabilizer (C)	ASTM D1603	% C	2.5
Hardness	ASTM D2240	Shore "D"	65
Compressive Strength (Yield)	ASTM D695	psi	1,600
Tensile Strength @ Yield(Type IV Spec)	ASTM D638(2"/min)	psi	3,200
Elongation @ Yield	ASTM D638	% minimum	8
Tensile Strength @ Break(Type IV Spec)	ASTM D638(2"/min)	psi	5000
Elongation @ Break	ASTM D638	% minimum	750
Modulus of Elasticity	ASTM D638	psi	130,000
ESCR			
(Cond A, B, C: Mold. Slab)	ASTM D1693	F_0, Hrs	F_0>5,000**
Compressed Ring (Pipe)	ASTM F1248	F_{50}, Hrs	F_{50}>3,500**
Slow Crack Growth	Battelle Method	Days to Failure	F_0>64
Impact Strength (IZOD) (.125" THK)	ASTM D256(Method A)	in-lb/in Notch	42
Linear Thermal Expansion Coef.	ASTM D696	in/in/^{0}F	1.2 x 10^{-4}
Thermal Conductivity	ASTM C177	BTU-in/Ft^2/hrs/^{0}F	2.7
Brittleness Temp.	ASTM D746	^{0}F	<-180
Vicat Soft Temp.	ASTM D1525	^{0}F	+257
Heat Fusion Cond.	---	psi @ ^{0}F	75 @ 400

This list of Typical Physical Properties is intended for basic characterization of the pipe, and does not represent specific determinations or specifications.

**Tests were discontinued because no failures and no indication of stress crack initiation.

***Average Melt Index Value with a standard deviation of 0.01.

2.1.2 Materials used for the manufacture of polyethylene pipe and fittings shall be extra high molecular weight, high density ethylene/hexane copolymer PE 3408 polyethylene resin meeting the above physical properties and pipe performance requirements. The material shall be listed by the Plastics Pipe Institute in PPI TR-4 with a 73^0F hydrostatic design basis rating of 1600 psi and a 140^0F hydrostatic design basis rating of 800 psi. The PPI Listing shall be based on ASTM D2837 and PPI TR-3 testing and validation of samples of the pipe manufacturer's production pipe.

2.2 Pipe

2.2.1. Solid Pipes

2.2.1.1. Pipe shall be produced with nominal physical properties outlined in Paragraph 2.1.1 and to the dimensions and tolerances specified in ASTM F714. Pipe shall be inspected per industry accepted manufacturer standards for:

Diameter
Wall Thickness
Concentricity
Joint Length
Ovality
Toe-In
Overall Workmanship
Inspection on ID & 0D
Print Line

Pipe shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions or other deleterious defects, and shall be identical in color, density, melt index and other physical properties throughout.

2.2.1.2 Pipe shall be in compliance with the physical and performance requirements of Paragraph 2.1.1.

2.2.1.3. Pipe sizes and types:

a. 14-inch outside diameter, SDR 32, Driscopipe, or approved equal.

b. 10-inch nominal diameter (10.75-inch outside diameter), SDR 21, Driscopipe, or approved equal.

2.3 Fittings

2.3.1 Furnish shop fabricated fittings as shown on the Drawings or required by the work. Fittings shall be molded or custom fabricated and shall have the same pressure ratings and wall thicknesses, or greater, than the pipe connected.

3.0 EXECUTION

3.1 Preparation

3.1.1 Inspect pipe and fittings prior to assembly. Mark and remove from the jobsite all materials that are damaged or do not meet the specifications.

3.1.2 Sections of pipe with cuts or gouges in excess of ten percent of the wall thickness of the pipe shall be cut out and removed.

3.1.3 Confirm location of pipe, fittings and connections.

3.2 Pipe Installation - General

3.2.1 Install pipe to the lines indicated on the Drawings.

3.2.2 Handle and install pipe in accordance with the manufacturer's recommendations.

3.2.3 Joining

3.2.3.1 Butt heat fusion weld the joints in strict accordance with the manufacturer's instructions. The butt fusion equipment shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400^0F, alignment and 75 psi interfacial fusion pressure.

3.2.3.2 Joint weld strength shall be equal to or greater than the tensile strength of the pipe.

3.2.3.3 Socket fusion shall not be used.

SECTION 16: CORRUGATED STEEL PIPE

1.0 GENERAL

1.1 References

The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASTM A 123/A 123M:	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 742/A 742M:	Steel Sheet, Metallic Coated and Polymer Precoated for Corrugated Steel Pipe
ASTM A 760/A 760M:	Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
ASTM A 762/A 762M:	Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
ASTM A 798/A 798M:	Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications

2.0 MATERIALS

2.1 Pipe for Culvert

Pipe for culvert shall be 36-inch diameter 10 gauge pipe and shall conform to the requirements specified.

2.1.1 Fully Bituminous Coated AASHTO M 190 Type A and ASTM A 760/A 760M zinc or aluminum (Type 2) coated pipe of either:

a. Type I pipe with helical 2-2/3 by 1/2 inch corrugations.

b. Type IR pipe with helical 3/4 by 3/4 by 7-1/2 inch corrugations.

2.2 Flared End Sections

Sections shall be at least 10 gauge of a standard design fabricated from zinc coated steel sheets meeting requirements of ASTM A 929/A 929M.

2.3 External Sealing Bands

Requirements for external sealing bands shall conform to ASTM C 877M or ASTM C 877

2.4 Pipe for Skimmer (Pond Level Control Structure)

Pipe for the skimmer shall be 6-foot diameter 8-gauge pipe and shall conform to the requirements specified below:

2.4.1 Fully Bituminous Coated AASHTO M 190 Type A and ASTM A 760/A 760M zinc or aluminum (Type 2) coated pipe of either:

a. Type I pipe with helical 2-2/3 by 1/2 inch corrugations.

b. Type IR pipe with helical 3/4 by 3/4 by 7-1/2 inch corrugations.

3.0 EXECUTION

3.1 Excavation for Pipe Culverts, Storm Drains, and Drainage Structures

Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 6 "Earthwork" and the requirements specified below.

3.1.1 Trenching - The width of trenches at any point below the top of the pipe shall be not greater than the outside diameter of the pipe plus 18 inches to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheeting and bracing, where required, shall be placed within the trench width as specified. Contractor shall not overexcavate. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures will be necessary. Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Company.

3.1.2 Removal of Unstable Material - Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Engineer, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor in his performance of shoring and sheeting, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the Company.

3.2 Bedding

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.2.1 Corrugated Metal Pipe Bedding for corrugated metal pipe shall be in accordance with ASTM A 798/A 798M. It is not required to shape the bedding to the pipe geometry.

3.3 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

3.4 Placing Pipe

Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. Deflection of installed flexible pipe shall not exceed 5 inches:

3.4.1 Corrugated Steel Pipe Laying shall be with the separate sections joined firmly together, with the outside laps of circumferential joints pointing upstream, and with longitudinal laps on the sides. Any unprotected metal in the joints shall be coated with bituminous material as specified in AASHTO M 190 or AASHTO M 243. Interior coating shall be protected against damage from insertion or removal of struts or tie wires. Lifting lugs shall be used to facilitate moving pipe without damage to exterior or interior coatings. During transportation and installation, pipe or pipe arch and coupling bands shall be handled with care to preclude damage to the coating. Damaged coatings shall be repaired in accordance with the manufacturer's recommendations prior to placing backfill. Pipe on which coating has been damaged to such an extent that satisfactory field repairs cannot be made shall be removed and replaced.

3.4.2 Multiple Culverts - Where multiple lines of pipe are installed, adjacent sides of pipe shall be at least half the nominal pipe diameter or 3 feet apart, whichever is less.

3.4.3 Field Joints - Transverse field joints shall be designed so that the successive connection of pipe sections will form a continuous line free of appreciable irregularities in the flow line. In addition, the joints shall meet the general performance requirements described in ASTM A 798/A 798M. Suitable transverse field joints which satisfy the requirements for one or more of the joint performance categories can be obtained with the following types of connecting bands furnished with suitable band-end fastening devices: corrugated bands, bands with projections, flat bands, and bands of special design that engage factory reformed ends of corrugated pipe. The space between the pipe and connecting bands shall be kept free from dirt and grit so that corrugations fit snugly. The connecting band, while being tightened, shall be tapped with a soft-head mallet of wood, rubber or plastic, to take up slack and ensure a tight joint. Field joints for each type of corrugated metal pipe shall maintain pipe alignment during construction and prevent infiltration of fill material during the life of the installations. The type, size, and sheet thickness of the band and the size of angles or lugs and bolts shall be as indicated or where not indicated, shall be as specified in the applicable standards or specifications for the pipe.

3.5 Backfilling

3.5.1 Backfilling Pipe in Trenches - After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 6 inches in compacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. The fill shall be thoroughly compacted under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation of at least 12 inches above the top of the pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 8 inches. Tests for density shall be made as necessary to ensure conformance to the compaction requirements specified in Section 6 (Earthwork). Where it is necessary, in the opinion of the Engineer, that sheeting or portions of bracing used be left in place, the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

3.5.2 Movement of Construction Machinery - When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

4.0 MEASUREMENT AND PAYMENT

4.1 Pipe Culvert - Compensation for the 36-inch corrugated steel pipe culvert extension, including excavating, backfilling, and furnishing and installing pipe, fittings, and the flared end section, will be paid as a lump sum under Bid Item 16, Culvert, 36-inch CSP.

4.2 Skimmer Pipe - Compensation for the 6-foot diameter skimmer pipe, including furnishing and installing the pipe, will be not be paid for separately and will be incidental to the work required under Bid Item 21, 18-inch Pond Level Control Pipe Extension/Intake Structure.

SECTION 17: INSTRUMENTATION

1.0 GENERAL

1.1 Work to be Performed by Contractor

1.1.1. Furnish and install dike movement monuments.

1.1.2 Furnish and install magnetic flow meter.

1.2 Work to be Performed by Others

1.2.1 Surveying the new monuments.

1.3 Related Work Specified Elsewhere

1.3.1 Section 7: Concrete

1.3.2 Section 13: Ductile Iron Pipe and Fittings

1.4 Alternate Location for Flow Meter

1.4.1 Contractor may propose alternate design for location of the flow meter upstream of the existing flume house. Such proposal shall include a description of all details of installing the meter at the changed location and the cost savings, if any. If the proposal is accepted, Contractor shall submit detailed drawings and specifications for the proposed change.

2.0 PRODUCTS AND EXECUTION

2.1 Embankment Movement Monuments

2.1.1 Monuments for movement monitoring shall be reinforced concrete piers 9 inches in diameter, 5 feet deep with 8-5/8-inch diameter Sch 40 PVC pipe sleeve extending from a depth of 4 feet up to the ground surface as shown on the Drawings. Settlement marker on each monument shall be a Berntsen C-style or equal 3-inch domed bronze survey marker for concrete with the monument number stamped on the surface of the marker. Marker shall be detectable by magnetic instruments.

2.1.2 Reinforcing bars shall be standard ASTM A615 billet-steel bars, uncoated finish, Grade 60.

2.1.3 Concrete backfill shall be as specified in Section 7, Concrete.

2.2 Magnetic Flow Meter

2.2.1 Flow meter shall be an electromagnetic flow meter with a capacitance flow level measuring system built into the wall of the measuring tube to provide accurate flow measurements in partially filled pipelines with levels between 10 and 100% of the pipe cross-section. Flow meter shall be a Krohne Tidalflux 16-inch meter or equal 18-inch or 16-inch meter. Other brands and models will be considered. One source for the Krohne flow meter is Gateway Controls at 636.343.9000.

2.2.2 The measuring error shall be less than 1% of the measured value.

2.2.3 Connecting flanges shall be ANSI B16.5 150 lb.

2.2.4 Power for level measuring system: 230/115 V AC, 60HZ

2.2.5 Grounding rings shall be provided.

2.2.6 Protection Category: NEMA 6

2.2.7 Materials

Measuring tube: stainless steel
Liner: Irathane, 0.47” thick
Electrodes: Hastelloy C4
Connecting flanges: steel
Converter housing: sheet steel
Electronics housing: cast aluminum
PG cable entries: nickel-plated brass
Grounding rings: stainless steel AISI 316 Ti/1.4571

2.2.8 Signal converter shall be a Krohne Model IFC 110 PF or equal, 115/230 V AC, 48-63 Hz, with die cast aluminum housing with polyurethane finish, NEMA 4/4X.

2.2.9 The meter shall accurately measure flows at levels down to 10% of the inside tube diameter.

2.2.10 The meter shall operate in ambient temperatures between –13 to +140 degrees Fahrenheit.

2.2.11 Grounding rings shall be provided.

3.0 EXECUTION

3.1 Installing Embankment Movement Monuments

Install movement monuments at the locations shown on the Drawings or as directed by the Engineer. Backfill with concrete fill, and finish the top of the concrete as shown on the Drawings. The movement monuments will be surveyed by others after installation.

3.2 Installing Flow Meter

3.2.1 Sufficient lengths of straight pipe of the appropriate diameter shall be provided upstream and downstream of the meter in accordance with the meter manufacturer's recommendations. This may require removal of portions of the existing pipe and replacement using pipe the same diameter as the meter. Removal of the existing flume insert and partial demolition of the walls of the flume house and the floor of the flume channel will be necessary. The walls and floor shall be replaced with concrete or non-shrink grout of the same or higher strength and finished to match the existing finishes as closely as practicable. Design and submit details of support for the meter and piping inside the flume house and details of connections to existing 18-inch ductile iron pipe.

3.2.2 Test meter and display following installation to assure that they are working properly.

3.2.3 Provide as-built drawings showing details of the meter installation. Provide three copies of operating and maintenance instructions for the meter and signal converter.

4.0 MEASUREMENT AND PAYMENT

4.1 Compensation for all work required for furnishing and installing the settlement monuments will be paid under the unit price for Bid Item 19 (Movement Monuments).

4.2 Compensation for furnishing and installing the flow meter, including demolition, installing the meter, electrical connections, upstream and downstream piping and fittings, and patching the walls and floor of the flume house will be paid as a lump sum under Bid Item 17 (Flow Meter).

ATTACHMENT C

Chemical Constituent Analysis – CCR (845.230)

Safety Data Sheet

Section 1
Identification of the Substance and of the Supplier

1.1 Product Identifier

Product Name/Identification:	ASTM Class C Fly Ash
Synonyms:	Coal Fly Ash, Pozzolan
Formula:	UVCB Substance

1.2 Relevant Identified Uses of the Substance or Mixture and Uses Advices Against

Relevant Identified Uses:	Component of wallboard, concrete, roofing material, bricks, cement kiln feed.
Uses Advised Against:	None known.

1.3 Details of the Supplier of the SDS

Manufacturer/Supplier:	Dynegy, Inc.
Street Address:	601 Travis Street, Suite 1400
City, State and Zip Code:	Houston, TX 77002
Customer Service Telephone:	800-633-4704

Section 2
Hazards Identification

2.1 Classification of the Substance

GHS Classification(s) according to OSHA Hazard Communication Standard (29 CFR 1910.1200):

- Eye Irritant, Category 2A
- STOT-SE, Category 3 (Respiratory Irritation)
- Carcinogen, Category 1A
- STOT-RE, Category 1 (Lungs)
- Toxic to Reproduction, Category 2

2.2 Label Elements

Labelling according to 29 CFR 1910.1200 Appendices A, B and C*	
Hazard Pictogram(s):	
Signal word:	**DANGER**
Hazard Statement(s):	*Causes serious eye irritation.* *May cause damage to lungs after repeated/prolonged exposure via inhalation.* *May cause respiratory irritation.* *May cause cancer of the lung.* *Suspected of damaging fertility or the unborn child.*
Precautionary Statement(s):	*Obtain special instructions before use.* *Do not handle until all safety precautions have been read and understood.* *Avoid breathing dust.* *Wear protective gloves/protective clothing/eye protection/face protection.* *Wash thoroughly after handling.* *Do not eat drink or smoke when using this product.* *Use outdoors or in a well-ventilated area.* *If exposed or concerned: Get medical advice/attention.* *Store in a secure area.* *Dispose of product in accordance with local/national regulations.*

* *Fly ash and other coal combustion products (CCPs) are UVCB substances (unknown or variable composition or biological). Various CCPs, noted as ashes/ash residuals; Ashes, residues, bottom; Bottom ash; Bottom ash residues; Waste solids, ashes under TSCA are defined as: "The residuum from the burning of a combination of carbonaceous materials. The following elements may be present as oxides: aluminum, calcium, iron, magnesium, nickel, phosphorus, potassium, silicon, sulfur, titanium, and vanadium." Ashes including fly ash and fluidized bed combustion ash are identified by CAS number 68131-74-8. The exact composition of the ash is dependent on the fuel source and flue additives composed of many constituents. The*

classification of the final substance is dependent on the presence of specific identified oxides as well as other trace elements.

2.3 Other Hazards

Listed Carcinogens:

-Respirable Crystalline Silica

IARC: [Yes] **NTP:** [Yes] **OSHA:** [Yes] **Other:** **(ACGIH)** [Yes]

Section 3
Composition/Information on Ingredients

Substance	***CAS No.***	***Percentage (%)***	***GHS Classification***
Crystalline Silica	*14808-60-7*	*30 - 60%*	*Repeat Dose STOT, Category 1* *Carcinogen, Category 1A*
Silica, crystalline respirable (RCS)	*14808-60-7*	***See Footnote 1***	*Repeat Dose STOT, Category 1* *Carcinogen, Category 1A*
Aluminosilicates	*71243-67-9* *1327-36-2*	*30 - 60%*	*Single Exposure STOT, Category 3*
Iron oxide	*1309-37-1*	*1 - 10%*	*Not Classified*
Calcium oxide (CaO)	*1305-78-8*	*20 - 30%*	*Skin Irritant, Category 2* *Eye Irritant, Category 1* *Single Exposure STOT, Category 3*
Magnesium oxide	*1309-48-4*	*2 - 10%*	*Not Classified*
Phosphorus pentoxide (P_2O_5)	*1314-56-3*	*≤2%*	*Skin Irritant, Category 2* *Eye Irritant, Category 2B*
Sodium oxide	*1313-59-3*	*1-8%*	*Not Classified*
Potassium oxide (K_2O)	*12136-45-7*	*≤1%*	*Skin Irritant, Category 2* *Eye Irritant, Category 2B*
Titanium dioxide (TiO_2)	*13463-67-7*	*<3%*	*Not Classified*
Bromide salt (calcium)	*7789-41-5*	*See Footnote 2*	*Toxic to Reproduction, Category 2*

Footnote 1: *The percentage of respirable crystalline silica has not been determined. Therefore, a GHS classification of Carcinogen, Category 1A has been assigned.*

Footnote 2: *Analytical data are not available to demonstrate that the concentration of bromide salt is <0.1%; therefore, a GHS classification of Toxic to Reproduction, Category 2 has been assigned.*

Section 4
First Aid Measures

4.1 Description of First Aid Measures

Inhalation:	If product is inhaled and irritation of the nose or coughing occurs, remove person to fresh air. Get medical advice/attention if respiratory symptoms persist.
Skin Contact:	If skin exposure occurs, wash with soap and water.
Eye Contact:	If product gets into the eye, rinse copiously with water for several minutes. Remove contact lenses, if present and easy to do. Seek medical attention/advice if irritation occurs or persists.
Ingestion:	No specific first aid measures are required.

4.2 Most Important Health Effects, Both Acute and Delayed

Acute Effects: Direct exposure may cause respiratory irritation, eye irritation and skin irritation. The product dust can dry and irritate the skin and cause dermatitis and can irritate eyes and skin through mechanical abrasion.

Chronic Effects: Chronic exposure may cause lung damage from repeated exposure. Prolonged inhalation of respirable crystalline silica above certain concentrations may cause lung diseases, including silicosis and lung cancer. Repeated exposure to dusts containing inorganic bromide salts may affect fertility and/or result in effects to the unborn child.

4.3 Indication of Any Immediate Medical Attention and Special Treatment Needed

Seek first aid or call a doctor or Poison Control Center if contact with eyes occurs and irritation remains after rinsing. Get medical advice if inhalation occurs and respiratory symptoms persist.

Section 5
Firefighting Measures

5.1 Extinguishing Media

Suitable Extinguishing Media:	Product is not flammable. Use extinguishing media appropriate for surrounding fire.
Unsuitable Extinguishing Media:	Not applicable, the product is not flammable.

5.2 Special Hazards Arising from the Substance or Mixture

Hazardous Combustion Products:	None known.

5.3 Advice for Firefighters

Special Protective Equipment and Precautions for Firefighters:	As with any fire, wear self-contained breathing apparatus (NIOSH approved or equivalent) and full protective gear.

Section 6
Accidental Release Measures

6.1 Personal Precautions, Protective Equipment and Emergency Procedures

Personal precautions/Protective Equipment:	See Section 8.2.2 Individual Protective Measures. For concentrations exceeding Occupational Exposure Levels (OELs), use a self-contained breathing apparatus (SCBA).
Emergency procedures:	Use scooping, water spraying/flushing/misting or ventilated vacuum cleaning systems to clean up spills. Do not use pressurized air.

6.2 Environmental Precautions

Environmental precautions:	Prevent contamination of drains or waterways and dispose according to local and national regulations.

6.3 Methods and Material for Containment and Cleaning Up

Methods and materials for containment and cleaning up:	Do not use brooms or compressed air to clean surfaces. Use dust collection vacuum and extraction systems. Large spills of dry product should be removed by a vacuum system. Dampened material should be removed by mechanical means and recycled or disposed of according to local and national regulations.

See Sections 8 and 13 for additional information on exposure controls and disposal.

Section 7
Handling and Storage

7.1 Precautions for Safe Handling

Practice good housekeeping. Use adequate exhaust ventilation, dust collection and/or water mist to maintain airborne dust concentrations below permissible exposure limits (note: respirable crystalline silica dust may be in the air without a visible dust cloud).

Do not permit dust to collect on walls, floors, sills, ledges, machinery, or equipment. Maintain and test ventilation and dust collection equipment. In cases of insufficient ventilation, wear a NIOSH approved respirator for silica dust when handling or disposing dust from this product. Avoid contact with skin and eyes. Wash or vacuum clothing that has become dusty. Avoid eating, smoking, or drinking while handling the material.

7.2 Conditions for Safe Storage, Including any Incompatibilities

Minimize dust produced during loading and unloading.

Section 8
Exposure Controls/Personal Protection

8.1 Control Parameters

OCCUPATIONAL EXPOSURE LIMITS					
SUBSTANCE		**OSHA PEL TWA (mg/m^3)**	**NIOSH REL TWA (mg/m^3)**	**ACGIH TLV TWA (mg/m^3)**	**CA - OSHA PEL (mg/m^3)**
Calcium oxide		5	2	2	2
Particulates Not Otherwise Regulated	Total	15	15	10	10
	Respirable	5	5	3	5
Respirable Crystalline Silica	Respirable Crystalline Silica	0.05	0.05	0.025	0.05
Titanium dioxide	Total	15	2.4 (fine) 0.3 (ultrafine)	10	10
Manganese dioxide (as manganese compounds)	Total	5 (Ceiling)	1 3 (STEL)	0.1	0.2
	Respirable	-	-	0.02	-

8.2 Exposure Controls

8.2.1 Engineering Controls

Provide ventilation to maintain the ambient workplace atmosphere below the occupational exposure limit(s). Use general and local exhaust ventilation and dust collection systems as necessary to minimize exposure.

8.2.2 Personal Protective Equipment (PPE)

Respiratory protection:	Wear a NIOSH approved particulate respirator if exposure to airborne particulates is unavoidable and where occupational exposure limits may be exceeded. If airborne exposures are anticipated to exceed applicable PELs or TLVs, a self-contained breathing apparatus or airline respirator is recommended.
Eye and face protection:	If eye contact is possible, wear protective glasses with side shields. Avoid contact lenses.
Hand and skin protection:	Wear gloves and protective clothing. Wash hands with soap and water after contact with material.

Section 9
Physical and Chemical Properties

9.1 Information on Basic Physical and Chemical Properties

Property: Value	Property: Value
Appearance (physical state, color, etc.): Fine tan/ gray particulate	**Upper/lower flammability or explosive limits:** Not applicable
Odor: Odorless[1]	**Vapor Pressure (Pa):** Not applicable
Odor threshold: Not applicable	**Vapor Density:** Not applicable
pH (25 °C) (in water): Not Determined	**Specific gravity or relative density:** 2.2 – 2.9
Melting point/freezing point (°C): Not applicable	**Water Solubility:** Slight
Initial boiling point/boiling range (°C): NA	**Partition coefficient: n-octane/water:** NA
Flash point (°C): Not determined	**Auto ignition temperature (°C):** Not applicable
Evaporation rate: Not applicable	**Decomposition temperature (°C):** Not determined
Flammability (solid, gas): Not combustible	**Viscosity:** Not applicable

[1] The use of urea or aqueous ammonia injected into the flue gas to reduce nitrogen oxides (NOx) emissions may result in the presence of ammonium sulfate or ammonium bisulfate in the ash at less than 0.1%. When ash containing these substances becomes wet under high pH (>9), free ammonia gas may be released resulting in objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces.

Section 10
Stability and Reactivity

10.1 Reactivity:	The material is an inert, inorganic material primarily composed of elemental oxides.
10.2 Chemical stability:	The material is stable under normal use conditions.
10.3 Possibility of hazardous reactions:	The material is a relatively stable, inert material; however, when ash containing ammonia becomes wet under high pH (>9), free ammonia gas may be released resulting in an objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces. Polymerization will not occur.
10.4 Conditions to avoid:	Product can become airborne in moderate winds. Dry material should be stored in silos. Materials stored out of doors should be covered or maintained in a damp condition.
10.5 Incompatible materials:	None known.
10. 6 Hazardous decomposition products:	None known.

Section 11
Toxicological Information

11.1 Information on Toxicological Effects

Endpoint	Data
Acute oral toxicity	LD50 > 2000 mg/kg
Acute dermal toxicity	LD50 > 2000 mg/kg
Acute inhalation toxicity	LD50 > 5.0 mg/L
Skin corrosion/irritation	Does not meet the classification criteria but may cause slight skin irritation. Product dust can dry the skin which can result in irritation.
Eye damage/irritation	Causes serious eye irritation. Positive scores for conjunctiva irritation and chemosis in 2/3 animals based on average of 24, 48 and 72-hour scores with irritation clearing within 21 days; No corneal or iritis effects observed.
Respiratory/skin sensitization	Not a respiratory or dermal sensitizer.
Germ cell mutagenicity	Not mutagenic in in-vitro and in-vivo assays with or without metabolic activation.
Carcinogenicity	Not available. Respirable crystalline silica has been identified as a carcinogen by OSHA, NTP, ACGIH and IARC.
Reproductive toxicity	No developmental toxicity was observed in available animal studies. Reproductive studies on CCPs showed either no reproductive effects, or some effects on male and female reproductive organs and parameters but without a clear dose response. Inorganic bromide salts have been shown to have adverse effects on reproductive parameters in some animal studies.
STOT-SE	CCPs when present as a nuisance dust may result in respiratory irritation.
STOT-RE	In a 180-day inhalation study with fly ash dust, no effects were observed at the highest dose tested. NOEC = 4.2 mg/m^3; it is not possible to assess the level at which toxicologically significant effects may occur. Repeated inhalation exposures to high levels of respirable crystalline silica may result in lung damage (i.e., silicosis).
Aspiration Hazard	Not applicable based product form.

Section 12
Ecological Information

12.1 Toxicity

Fly Ash C (CAS# 68131-74-8)	
Toxicity to Fish	LC50 > 100 mg/L
Toxicity to Aquatic Invertebrates	Data indicates that the test substance is not toxic to *Daphnia magna* (EC50 undetermined).
Toxicity to Aquatic Algae and Plants	EC50 = 10 mg/L

Calcium oxide CAS# 1305-78-8	
Toxicity to Fish	LC50 = 50.6 mg/L The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects.
Toxicity to Aquatic Invertebrates	EC50 = 49.1 mg/L The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects.
Toxicity to Aquatic Algae and Plants	NOEC =48 mg/L @ 72 hours based on $Ca(OH)_2$ The initial pH of the test medium was not directly related to the biologically relevant effects. The formation of precipitates is likely the result of the reaction between CO_2 dissolved in the medium.

12.2 Persistence and Degradability

Not relevant for inorganic materials.

12.3 Bioaccumulative Potential

This material does not contain any compounds that would bioaccumulate up the food chain.

12.4 Mobility in Soil

No data available.

12.5 Results of PBT and vPvB Assessment

This material does not contain any compounds classified as “persistent, bioaccumulative or toxic” nor as “very persistent/very bioaccumulative”.

12.6 Other Adverse Effects

None known.

Section 13

Disposal Considerations

See Sections 7 and 8 above for safe handling and use, including appropriate industrial hygiene practices.

Dispose of all waste product and containers in accordance with federal, state and local regulations.

Section 14
Transport Information

Regulatory entity: U.S. DOT	Shipping Name:	Not Regulated
	Hazard Class:	Not Regulated
	ID Number:	Not Regulated
	Packing Group:	Not Regulated

Section 15
Regulatory Information

15.1 Safety, Health and Environmental Regulations/Legislation Specific for the Mixture

- TSCA Inventory Status

  All components are listed on the TSCA Inventory.

- California Proposition 65.

  The following substances are known to the State of California to be carcinogens and/or reproductive toxicants:

  - Respirable crystalline silica

- State Right-to-Know (RTK)

Component	CAS	MA[1,2]	NJ[3,4]	PA[5]	RI[6]
Ammonium bisulfate	7803-63-6	No	Yes	No	No
Ammonium sulfate	7783-20-2	Yes	No	Yes	No
Calcium oxide	1305-78-8	Yes	Yes	Yes	No
Iron oxide	1309-37-1	Yes	Yes	Yes	No
Magnesium oxide	1309-48-4	No	Yes	No	No
Manganese oxide-as manganese compounds	1313-13-9; Various	No	No	Yes	Yes
Phosphorus pentoxide (or phosphorus oxide)	1314-56-3	Yes	Yes	Yes	No
Potassium oxide	12136-45-7	No	Yes	No	No
Silica-crystalline (SiO2), quartz	14808-60-7	Yes	Yes	Yes	No
Sodium oxide	1313-59-3	No	Yes	No	No
Titanium dioxide	13463-67-7	Yes	Yes	Yes	Yes

[1] Massachusetts Department of Public Health, no date
[2] 189th General Court of The Commonwealth of Massachusetts, no date
[3] New Jersey Department of Health and Senior Services, 2010a
[4] New Jersey Department of Health, 2010b
[5] Pennsylvania Code, 1986
[6] Rhode Island Department of Labor and Training, no date

Section 16
Other Information, Including Date of Preparation or Last Revision

16.1 Indication of Changes

Date of preparation or last revision: February 23, 2018

16.2 Abbreviations and Acronyms

ACGIH:	American Conference of Industrial Hygienists
CA:	California
CAS:	Chemical Abstract Services
CCP:	Coal Combustion Product
CFR:	Code of Federal Regulations
EPA:	Environmental Protection Agency

GHS:	Globally Harmonized System of Classification and Labelling
IARC:	International Agency for Research on Cancer
LC50:	Concentration resulting in the mortality of 50 % of an animal population
LD50:	Dose resulting in the mortality of 50 % of an animal population
MA:	Massachusetts
NA:	Not Applicable
NJ:	New Jersey
NOEC:	No observed effect concentration
NIOSH:	National Institute of Occupational Safety and Health
NOx:	Nitrogen oxides
NTP:	US National Toxicology Program
OEL:	Occupational Exposure Limit
OSHA:	Occupational Safety and Health Administration
PA:	Pennsylvania
PBT:	Persistent, Toxic and Bioaccumulative
PEL:	Permissible exposure limit
PPE:	Personal Protective Equipment
REL:	Recommended exposure limit
RI:	Rhode Island
RCS:	Respirable Crystalline Silica
RTK:	Right-to-Know
SCBA:	Self-contained breathing apparatus
SDS:	Safety Data Sheet
STEL:	Short-term exposure limit
STOT-RE:	Specific target organ toxicity-repeated exposure
STOT-SE:	Specific target organ toxicity-single exposure
TLV:	Threshold limit value
TSCA:	Toxic Substances Control Act
TWA:	Time-weighted average
UEL:	Upper explosive limit
UVCB:	Unknown or Variable Composition/Biological
U.S.:	United States
U.S. DOT:	United States of Department of Transportation

16.3 Other Hazards

Hazardous Materials Identification System (HMIS) Degree of hazard (0= low, 4 = extreme)							
Health:	2*	**Flammability:**	0	**Physical Hazards:**	0	**Personal protection:****	

** Chronic Health Effects*
*** Appropriate personal protection is defined by the activity to be performed.*
See Section 8 for additional information.

DISCLAIMER:

This SDS has been prepared in accordance with the Hazard Communication Rule 29 CFR 1910.1200. Information herein is based on data considered to be accurate as of date prepared. No warranty or representation, express or implied, is made as to the accuracy or completeness of this data and safety information. No responsibility can be assumed for any damage or injury resulting from abnormal use, failure to adhere to recommended practices, or from any hazards inherent in the nature of the product.

Safety Data Sheet

Section 1
Identification of the Substance and of the Supplier

1.1 Product Identifier

Product Name/Identification:	ASTM Bottom Ash
Synonyms:	Ash; Ashes; Ash residues; Ashes, residues, bottom; Bottom ash; Bottom ash residues; Coal Fly Ash; Pozzolan; Waste solids.
Formula:	UVCB Substance

1.2 Relevant Identified Uses of the Substance or Mixture and Uses Advices Against

Relevant Identified Uses:	Component of wallboard, concrete, roofing material, bricks, cement kiln feed.
Uses Advised Against:	None known.

1.3 Details of the Supplier of the SDS

Manufacturer/Supplier:	Dynegy, Inc.
Street Address:	601 Travis Street, Suite 1400
City, State and Zip Code:	Houston, TX 77002
Customer Service Telephone:	800-633-4704

Section 2
Hazards Identification

2.1 Classification of the Substance

GHS Classification(s) according to OSHA Hazard Communication Standard (29 CFR 1910.1200):

- Eye Irritant, Category 2A
- STOT-SE, Category 3 (Respiratory Irritation)
- Carcinogen, Category 1A
- STOT-RE, Category 1 (Lungs)
- Toxic to Reproduction, Category 2

2.2 Label Elements

Labelling according to 29 CFR 1910.1200 Appendices A, B and C*	
Hazard Pictogram(s):	
Signal word:	**DANGER**
Hazard Statement(s):	*Causes serious eye irritation.* *May cause respiratory irritation.* *May cause damage to lungs after repeated/prolonged exposure via inhalation.* *May cause cancer of the lung.* *Suspected of damaging fertility or the unborn child.*
Precautionary Statement(s):	*Obtain special instructions before use.* *Do not handle until all safety precautions have been read and understood.* *Avoid breathing dust.* *Wash thoroughly after handling.* *Do not eat drink or smoke when using this product.* *Wear protective gloves/protective clothing/eye protection/face protection.* *Use outdoors or in a well-ventilated area.* *If exposed or concerned: Get medical advice/attention.* *Store in a secure area.* *Dispose of product in accordance with local/national regulations.*

** Fly ash and other coal combustion products (CCPs) are UVCB substances (unknown or variable composition or biological). Various CCPs, noted as ashes/ash residuals; Ashes, residues, bottom; Bottom ash; Bottom ash residues; Waste solids, ashes under TSCA are defined as: "The residuum from the burning of a combination of carbonaceous materials. The following elements may be present as oxides: aluminum, calcium, iron, magnesium, nickel, phosphorus, potassium, silicon, sulfur, titanium, and vanadium." Ashes including fly ash and fluidized bed combustion ash are identified by CAS number 68131-74-8. The exact composition of the ash is dependent on the fuel source and flue additives composed of many constituents. The classification of the final substance is dependent on the presence of specific identified oxides as well as other trace elements.*

2.3 Other Hazards

Listed Carcinogens:

-Respirable Crystalline Silica

IARC: [Yes] **NTP:** [Yes] **OSHA:** [Yes] **Other:** **(ACGIH)** [Yes]

Section 3
Composition/Information on Ingredients

Substance	*CAS No.*	*Percentage (%)*	*GHS Classification*
Crystalline Silica	*14808-60-7*	*20 - 40%*	*Repeat Dose STOT, Category 1* *Carcinogen, Category 1A*
Silica, crystalline respirable (RCS)	*14808-60-7*	*See Footnote 1*	*Repeat Dose STOT, Category 1* *Carcinogen. Category 1A*
Aluminosilicates[2]	*Various, see Footnote 2*	*10 - 60%*	*Single Exposure STOT, Category 3*
Calcium oxide (CaO)	*1305-78-8*	*10 - 30%*	*Skin Irritant, Category 2* *Eye Irritant, Category 1* *Single Exposure STOT, Category 3*
Iron oxide	*1309-37-1*	*1 - 10%*	*Not Classified*
Manganese dioxide (MnO_2)	*1313-13-9*	*<2%*	*Skin Irritant, Category 2* *Eye Irritant, Category 2B*
Magnesium oxide	*1309-48-4*	*2 - 10%*	*Not Classified*
Phosphorus pentoxide (P_2O_5)	*1314-56-3*	*≤2%*	*Skin Irritant, Category 2* *Eye Irritant, Category 2B*
Sodium oxide	*1313-59-3*	*1 - 10%*	*Not Classified*
Potassium oxide (K_2O)	*12136-45-7*	*≤1%*	*Skin Irritant Category 2* *Eye Irritant Category 2B*
Titanium dioxide (TiO_2)	*13463-67-7*	*<3%*	*Not Classified*

[1] *The percentage of respirable crystalline silica has not been determined. Therefore, a GHS classification of Carcinogen 1A has been assigned.*

[2] *Aluminosilicates (CAS# 1327-36-2) may be in the form of mullite (CAS# 1302-93-8); aluminosilicate glass; pozzolans (CAS# 71243-67-9); or calcium aluminosilicates such as tricalcium aluminate (C3A), or calcium sulfoaluminate (C4A3S). The form is dependent on the source of the coal and or the process used to create the CCP. Pulverized coal combustion would be more likely to create high levels of pozzolans. Aluminosilicates may have inclusions of calcium, titanium, iron, potassium, phosphorus, magnesium and other metal oxides.*

Section 4
First Aid Measures

4.1 Description of First Aid Measures

Inhalation:	If product is inhaled and irritation of the nose or coughing occurs, remove person to fresh air. Get medical advice/attention if respiratory symptoms persist.
Skin Contact:	If skin exposure occurs, wash with soap and water.
Eye Contact:	If product gets into the eye, rinse copiously with water for several minutes. Remove contact lenses, if present and easy to do. Seek medical attention/advice if irritation occurs or persists.
Ingestion:	No specific first aid measures are required.

4.2 Most Important Health Effects, Both Acute and Delayed

Acute Effects: Direct exposure may cause respiratory irritation, eye irritation and skin irritation. The product dust can dry and irritate the skin and cause dermatitis and can irritate eyes and skin through mechanical abrasion.

Chronic Effects: Chronic exposure may cause lung damage from repeated exposure. Prolonged inhalation of respirable crystalline silica above certain concentrations may cause lung diseases, including silicosis and lung cancer.

4.3 Indication of Any Immediate Medical Attention and Special Treatment Needed

Seek first aid or call a doctor or Poison Control Center if contact with eyes occurs and irritation remains after rinsing. Get medical advice if inhalation occurs and respiratory symptoms persist.

Section 5
Firefighting Measures

5.1 Extinguishing Media

Suitable Extinguishing Media:	Product is not flammable. Use extinguishing media appropriate for surrounding fire.
Unsuitable Extinguishing Media:	Not applicable, the product is not flammable.

5.2 Special Hazards Arising from the Substance or Mixture

Hazardous Combustion Products:	None known.

5.3 Advice for Firefighters

Special Protective Equipment and Precautions for Firefighters:	As with any fire, wear self-contained breathing apparatus (NIOSH approved or equivalent) and full protective gear.

Section 6
Accidental Release Measures

6.1 Personal Precautions, Protective Equipment and Emergency Procedures

Personal precautions/Protective Equipment:	See Section 8.2.2 Individual Protective Measures. For concentrations exceeding Occupational Exposure Levels (OELs), use a self-contained breathing apparatus (SCBA).
Emergency procedures:	Use scooping, water spraying/flushing/misting or ventilated vacuum cleaning systems to clean up spills. Do not use pressurized air.

6.2 Environmental Precautions

Environmental precautions:	Prevent contamination of drains or waterways and dispose according to local and national regulations.

6.3 Methods and Material for Containment and Cleaning Up

Methods and materials for containment and cleaning up:	Do not use brooms or compressed air to clean surfaces. Use dust collection vacuum and extraction systems. Large spills of dry product should be removed by a vacuum system. Dampened material should be removed by mechanical means and recycled or disposed of according to local and national regulations.

See Sections 8 and 13 for additional information on exposure controls and disposal.

Section 7
Handling and Storage

7.1 Precautions for Safe Handling

Practice good housekeeping. Use adequate exhaust ventilation, dust collection and/or water mist to maintain airborne dust concentrations below permissible exposure limits (note: respirable crystalline silica dust may be in the air without a visible dust cloud).

Do not permit dust to collect on walls, floors, sills, ledges, machinery, or equipment. Maintain and test ventilation and dust collection equipment. In cases of insufficient ventilation, wear a NIOSH approved respirator for silica dust when handling or disposing dust from this product. Avoid contact with skin and eyes. Wash or vacuum clothing that has become dusty. Avoid eating, smoking, or drinking while handling the material.

7.2 Conditions for Safe Storage, Including any Incompatibilities

Minimize dust produced during loading and unloading.

Section 8
Exposure Controls/Personal Protection

8.1 Control Parameters

OCCUPATIONAL EXPOSURE LIMITS					
SUBSTANCE		**OSHA PEL TWA (mg/m^3)**	**NIOSH REL TWA (mg/m^3)**	**ACGIH TLV TWA (mg/m^3)**	**CA - OSHA PEL (mg/m^3)**
Calcium oxide		5	2	2	2
Particulates Not Otherwise Regulated	Total	15	15	10	10
	Respirable	5	5	3	5
Respirable Crystalline Silica	Respirable	0.05	0.05	0.025	0.05
Manganese dioxide (as manganese compounds)	Total	5 (Ceiling)	1 3 (STEL)	0.1	0.2
	Respirable	-	-	0.02	-

8.2 Exposure Controls

8.2.1 Engineering Controls

Provide ventilation to maintain the ambient workplace atmosphere below the occupational exposure limit(s). Use general and local exhaust ventilation and dust collection systems as necessary to minimize exposure.

8.2.2 Personal Protective Equipment (PPE)

Respiratory protection:	Wear a NIOSH approved particulate respirator if exposure to airborne particulates is unavoidable and where occupational exposure limits may be exceeded. If airborne exposures are anticipated to exceed applicable PELs or TLVs, a self-contained breathing apparatus or airline respirator is recommended.
Eye and face protection:	If eye contact is possible, wear protective glasses with side shields. Avoid contact lenses.
Hand and skin protection:	Wear gloves and protective clothing. Wash hands with soap and water after contact with material.

Section 9
Physical and Chemical Properties

9.1 Information on Basic Physical and Chemical Properties

Property: Value	Property: Value
Appearance (physical state, color, etc.): Fine tan/ gray particulate	**Upper/lower flammability or explosive limits:** Not applicable
Odor: Odorless[1]	**Vapor Pressure (Pa):** Not applicable
Odor threshold: Not applicable	**Vapor Density:** Not applicable
pH (25 °C) (in water): 8 - 11	**Specific gravity or relative density:** 2.2 – 2.9
Melting point/freezing point (°C): Not applicable	**Water Solubility:** Slight
Initial boiling point and boiling range (°C): Not applicable	**Partition coefficient: n-octane/water:** Not determined
Flash point (°C): Not determined	**Auto ignition temperature (°C):** Not applicable
Evaporation rate: Not applicable	**Decomposition temperature (°C):** Not determined
Flammability (solid, gas): Not combustible	**Viscosity:** Not applicable

[1] The use of urea or aqueous ammonia injected into the flue gas to reduce nitrogen oxides (NOx) emissions may result in the presence of ammonium sulfate or ammonium bisulfate in the ash at less than 0.1%. When ash containing these substances becomes wet under high pH (>9), free ammonia gas may be released resulting in objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces.

Section 10
Stability and Reactivity

10.1 Reactivity:	The material is an inert, inorganic material primarily composed of elemental oxides.
10.2 Chemical stability:	The material is stable under normal use conditions.
10.3 Possibility of hazardous reactions:	The material is a relatively stable, inert material; however, when ash containing ammonia becomes wet under high pH (>9), free ammonia gas may be released resulting in an objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces. Polymerization will not occur.
10.4 Conditions to avoid:	Product can become airborne in moderate winds. Dry material should be stored in silos. Materials stored out of doors should be covered or maintained in a damp condition.
10.5 Incompatible materials:	None known.
10. 6 Hazardous decomposition products:	None known.

Section 11
Toxicological Information

11.1 Information on Toxicological Effects

Endpoint	**Data**
Acute oral toxicity	LD50 > 2000 mg/kg
Acute dermal toxicity	LD50 > 2000 mg/kg
Acute inhalation toxicity	LD50 > 5.0 mg/L
Skin corrosion/irritation	Does not meet the classification criteria but may cause slight skin irritation. Product dust can dry the skin which can result in irritation.
Eye damage/irritation	Causes serious eye irritation. Positive scores for conjunctiva irritation and chemosis in 2/3 animals based on average of 24, 48 and 72-hour scores with irritation clearing within 21 days; no corneal or iritis effects observed.
Respiratory/skin sensitization	Not a respiratory or dermal sensitizer.
Germ cell mutagenicity	Not mutagenic in in-vitro and in-vivo assays with or without metabolic activation.
Carcinogenicity	Not available. Respirable crystalline silica has been identified as a carcinogen by OSHA, NTP, ACGIH and IARC.
Reproductive toxicity	No developmental toxicity was observed in available animal studies. Reproductive studies on CCPs showed either no reproductive effects, or some effects on male and female reproductive organs and parameters but without a clear dose response.
STOT-SE	CCPs when present as a nuisance dust may result in respiratory irritation.
STOT-RE	In a 180-day inhalation study with fly ash dust, no effects were observed at the highest dose tested. NOEC = 4.2 mg/m^3; it is not possible to assess the level at which toxicologically significant effects may occur. Repeated inhalation exposures to high levels of respirable crystalline silica may result in lung damage (i.e., silicosis).
Aspiration Hazard	Not applicable based product form.

Section 12
Ecological Information

12.1 Toxicity

Fly Ash (CAS# 68131-74-8)	
Toxicity to Fish	LC50 > 100 mg/L
Toxicity to Aquatic Invertebrates	Data indicates that the test substance is not toxic to *Daphnia magna* (EC50 undetermined)
Toxicity to Aquatic Algae and Plants	EC50 = 10 mg/L
Calcium oxide CAS# 1305-78-8	
Toxicity to Fish	LC50 = 50.6 mg/L The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects.
Toxicity to Aquatic Invertebrates	EC50 = 49.1 mg/L The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects.
Toxicity to Aquatic Algae and Plants	NOEC =48 mg/L @ 72 hours based on $Ca(OH)_2$ The initial pH of the test medium was not directly related to the biologically relevant effects. The formation of precipitates is likely the result of the reaction between CO_2 dissolved in the medium.

12.2 Persistence and Degradability

Not relevant for inorganic materials.

12.3 Bioaccumulative Potential

This material does not contain any compounds that would bioaccumulate up the food chain.

12.4 Mobility in Soil

No data available.

12.5 Results of PBT and vPvB Assessment

This material does not contain any compounds classified as “persistent, bioaccumulative or toxic” nor as “very persistent/very bioaccumulative”.

12.6 Other Adverse Effects

None known.

Section 13
Disposal Considerations

See Sections 7 and 8 above for safe handling and use, including appropriate industrial hygiene practices.

Dispose of all waste product and containers in accordance with federal, state and local regulations.

Section 14
Transport Information

Regulatory entity: U.S. DOT	Shipping Name:	Not Regulated
	Hazard Class:	Not Regulated
	ID Number:	Not Regulated
	Packing Group:	Not Regulated

Section 15
Regulatory Information

15.1 Safety, Health and Environmental Regulations/Legislation Specific for the Mixture

- TSCA Inventory Status

  All components are listed on the TSCA Inventory.

- California Proposition 65

  The following substances are known to the State of California to be carcinogens and/or reproductive toxicants:

  - Respirable crystalline silica
  - Titanium dioxide

- State Right-to-Know (RTK)

Component	**CAS**	**MA**[1,2]	**NJ**[3,4]	**PA**[5]	**RI**[6]
Ammonium bisulfate	7803-63-6	No	Yes	No	No
Ammonium sulfate	7783-20-2	Yes	No	Yes	No
Calcium oxide	1305-78-8	Yes	Yes	Yes	No
Iron oxide	1309-37-1	Yes	Yes	Yes	No
Magnesium oxide	1309-48-4	No	Yes	No	No
Phosphorus pentoxide (or phosphorus oxide)	1314-56-3	Yes	Yes	Yes	No
Potassium oxide	12136-45-7	No	Yes	No	No
Silica-crystalline (SiO_2), quartz	14808-60-7	Yes	Yes	Yes	No
Sodium oxide	1313-59-3	No	Yes	No	No
Titanium dioxide	13463-67-7	Yes	Yes	Yes	Yes

[1] Massachusetts Department of Public Health, no date
[2] 189th General Court of The Commonwealth of Massachusetts, no date
[3] New Jersey Department of Health and Senior Services, 2010a
[4] New Jersey Department of Health, 2010b
[5] Pennsylvania Code, 1986
[6] Rhode Island Department of Labor and Training, no date

Section 16
Other Information, Including Date of Preparation or Last Revision

16.1 Indication of Changes

Date of preparation or last revision: February 23, 2018

16.2 Abbreviations and Acronyms

- ACGIH: American Conference of Industrial Hygienists
- CA: California
- CAS: Chemical Abstract Services
- CCP: Coal Combustion Product
- CFR: Code of Federal Regulations
- EPA: Environmental Protection Agency
- GHS: Globally Harmonized System of Classification and Labelling
- IARC: International Agency for Research on Cancer
- LC50: Concentration resulting in the mortality of 50 % of an animal population
- LD50: Dose resulting in the mortality of 50 % of an animal population
- MA: Massachusetts
- NA: Not Applicable
- NJ: New Jersey
- NOEC: No observed effect concentration
- NIOSH: National Institute of Occupational Safety and Health
- NOx: Nitrogen oxides
- NTP: US National Toxicology Program
- OEL: Occupational Exposure Limit
- OSHA: Occupational Safety and Health Administration
- PA: Pennsylvania
- PBT: Persistent, Toxic and Bioaccumulative
- PEL: Permissible exposure limit
- PPE: Personal Protective Equipment
- REL: Recommended exposure limit
- RI: Rhode Island
- RCS: Respirable Crystalline Silica
- RTK: Right-to-Know
- SCBA: Self-contained breathing apparatus
- SDS: Safety Data Sheet
- STEL: Short-term exposure limit
- STOT-RE: Specific target organ toxicity-repeated exposure
- STOT-SE: Specific target organ toxicity-single exposure
- TLV: Threshold limit value
- TSCA: Toxic Substances Control Act
- TWA: Time-weighted average
- UEL: Upper explosive limit
- UVCB: Unknown or Variable Composition/Biological
- U.S.: United States
- U.S. DOT: United States of Department of Transportation

16.3 Other Hazards

Hazardous Materials Identification System (HMIS) Degree of hazard (0= low, 4 = extreme)							
Health:	2*	**Flammability:**	0	**Physical Hazards:**	0	**Personal protection:****	

** Chronic Health Effects*
****** *Appropriate personal protection is defined by the activity to be performed.*
See Section 8 for additional information.

DISCLAIMER:

This SDS has been prepared in accordance with the Hazard Communication Rule 29 CFR 1910.1200. Information herein is based on data considered to be accurate as of date prepared. No warranty or representation, express or implied, is made as to the accuracy or completeness of this data and safety information. No responsibility can be assumed for any damage or injury resulting from abnormal use, failure to adhere to recommended practices, or from any hazards inherent in the nature of the product.

ATTACHMENT D

Chemical Constituent Analysis – Waste Streams (845.230)

Vermilion Power Plant: New East Ash Pond Chemical Constituents

In accordance with 35 I.A.C. 845.230(d)(2)(C), DMG is submitting available/existing analyses of "the chemical constituents of all waste streams, chemical additives and sorbent materials entering or contained in" the CCR impoundment, New East Ash Pond.

A list of the chemical constituents' analyses contained in the CCR surface impoundment can be found in Appendix A. As determined through antidegradation studies, this list contains chemical constituents found in the surface free liquid and the subsurface free liquids. DMG is also including a list of chemical additives, sorbent materials and waste streams that were submitted in the facility's NPDES permit applications to IEPA within the past ten years at a minimum and/or listed in the current NPDES permit (IL0004057) in Appendix B.

Appendix A: Chemical Constituents Contained in the New East Ash Pond

Pollutant	Units	Surface Free Liquids Average Concentration		Subsurface Free Liquids Average Concentration	
Ammonia	mg/L	<	0.100		0.493
Arsenic	mg/L	<	0.025		0.256
Arsenic, Dissolved	mg/L		0.045		0.070
Barium	mg/L		3.24		69.86
Boron	mg/L	<	0.001	<	0.001
Cadmium	mg/L	<	5.00	<	5.25
Cadmium, Dissolved	mg/L	<	0.005	<	0.007
Chloride	mg/L	<	0.005	<	0.005
Chromium	mg/L	<	0.005	<	0.005
Chromium (hexavalent)	mg/L	<	0.005	<	0.005
Chromium, Dissolved	mg/L	<	0.135	<	0.180
Chromium, Hexavalent, Dissolved	mg/L	<	0.129		3.321
Chromium, Trivalent, Dissolved	mg/L	<	0.015	<	0.026
Copper	mg/L		0.038		0.200
Copper, Dissolved	mg/L		0.000002		0.000009
Cyanide	mg/L	<	0.005	<	0.014
Fluoride	mg/L	<	0.249	<	0.062
Fluoride, Dissolved	mg/L	<	0.050	<	0.050
Iron	mg/L	<	1.05	<	1.01
Iron, Dissolved	mg/L	<	3.00	<	3.00
Lead	mg/L		7.99		7.99
Lead, Dissolved	mg/L	<	0.005	<	0.008
Magnesium	mg/L	<	0.112	<	0.347
Manganese	mg/L	<	0.001		0.006
Mercury	mg/L	<	0.003	<	0.003
Mercury, Dissolved Total	mg/L		98.88		1599
Nickel	mg/L		231		2870
Nickel, Dissolved	mg/L	<	12.63		178
Nitrate - Nitrite	mg/L	<	0.012	<	0.054
Nitrogen, Kjeldahl	mg/L	<	0.100		0.493
Nitrogen, Total	mg/L	<	0.025		0.256
Oil and Grease	mg/L		0.045		0.070
pH	SU		3.24		69.86
Phenols	mg/L	<	0.001	<	0.001
Selenium	mg/L	<	5.00	<	5.25
Silver	mg/L	<	0.005	<	0.007
Sulfate	mg/L	<	0.005	<	0.005
TDS	mg/L	<	0.005	<	0.005
TSS	mg/L	<	0.005	<	0.005
Zinc	mg/L	<	0.135	<	0.180
Zinc, Dissolved	mg/L	<	0.129		3.321

Appendix B: List of Chemical Additives, Waste Streams and Sorbent Materials

Chemical Additives
Sodium Hypochlorite
Hydrazine (30-60%)
Tri-Sodium Phosphate
Hydrochloric Acid
Sodium Bisulfite
Sodium Hydroxide
Sulfuric acid
Nalco 3DT187
Nalco 73199
Nalco 8306
Nalco 7768
Nalco 8133
Nalco PC306
Nalco 8131
Nalco D15
Optisperse PO5244
Inhibitor AZ8100
Depositrol P4520
Mono-Sodium Phosphate
Vitec 3000
PolyFloc

Waste Streams and Sorbent Materials*
Bottom Ash and Fly Ash sluice water
Air Hopper Overflow
Demineralizer Regeneration Wastewater
Coal Pile Runoff
Water Treatment Clarifier Sludge
Water Filter Backwash Wastewater
Area Runoff
Non-Chemical Metal Cleaning Wastewater
Boiler Room & Dust Collector Area Floor Drains
Pyrites from coal crushing
Cooling Tower Overflow
Reverse Osmosis Reject Wastewater
Chemical Tank Cleanout
Cooling Tower Blowdown
Chemical Metal Cleaning Waste Treatment System Effluent
Activated Carbon System Effluent

*No sorbent materials

ATTACHMENT E

Placement Above the Uppermost Aquifer (845.300)

RAMBOLL

ENVIRONMENT
& HEALTH

Dynegy Midwest Generation, LLC
1500 Eastport Plaza Drive
Collinsville, IL 62234

Location Restriction Demonstration – Placement Above Uppermost Aquifer

New East Ash Pond
Vermilion Power Plant
Oakwood, Illinois

October 25, 2021

Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA

T 414-837-3607
F 414-837-3608
www.ramboll.com

Ref. 1940100722

Dynegy Midwest Generation, LLC (Dynegy) is the owner of the inactive Vermilion Power Plant located in Oakwood, Illinois. The New East Ash Pond (NEAP) is an inactive surface impoundment storing coal combustion residuals (CCR) subject to regulation by Section 845 of Title 35 Illinois Administrative Code (I.A.C.), Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments. Ramboll Americas Engineering Solutions, Inc. (Ramboll) has prepared this demonstration to address the requirements of 35 I.A.C. § 845.300 (Placement above the Uppermost Aquifer).

Section 845.300(a): Existing and new CCR surface impoundments, and all lateral expansions of CCR surface impoundments, must be constructed with a base that is located at least 1.52 meters (5 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 surface impoundment and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table).

Geosyntec Consultants reviewed the NEAP bottom elevations during development of the conceptual closure-by-removal design documents for the Construction Permit application being prepared in accordance with 35 I.A.C. § 845.220. Contours developed from these elevations are depicted in Figure 2-8 in Hydrogeologic Site Characterization Report (HCR), New East Ash Pond, Vermilion Power Plant, Oakwood, Illinois, also submitted with the initial operating permit application.

The HCR indicates that the base of the NEAP overlies Pennsylvanian Age shale bedrock that does not meet the definition of an aquifer contained in 35 I.A.C. § 620.110: *"Aquifer" means saturated (with groundwater) soils and geologic materials which hare sufficiently permeable to readily yield economically useful quantities of water to wells, springs, or streams under ordinary hydraulic gradients.* This bedrock is characterized in the HCR as a confining unit. Consequently, an uppermost aquifer does not exist beneath the NEAP.

The HCR also indicates that unlithified geologic materials are present surrounding the NEAP at the same elevation as the CCR. These materials are characterized as potential migration pathways (PMPs); however, the perimeter berms of the NEAP were constructed with a low-permeability clay core keyed until the underlying shale to provide a hydraulic barrier between the CCR and these PMPs. Monitoring wells on the northeast side of the NEAP are frequently dry, indicating that a hydraulic connection does not exist between the NEAP and the PMPs.

Based upon the absence of geologic materials that meet the definition of an uppermost aquifer, the NEAP meets the location restriction requirement for being constructed with a base that is at least 1.52 meters (5 feet) above the upper limit of the uppermost aquifer.

Section 845.300(b): The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of subsection (a).

I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify that the information in this demonstration is accurate as of the date of my signature below. The content of this demonstration is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
Ramboll Americas Engineering Solutions, Inc.
Date: October 25, 2021

ERIC J. TLACHAC
062-063091

ATTACHMENT F

Wetlands (845.310)

Geosyntec consultants

134 N. LaSalle Street, Suite 300
Chicago, IL, 60602
PH 312.658.0500
FAX 312.658.0576
www.geosyntec.com

Memorandum

Date: 15 October 2021

To: Victor Modeer (Dynegy)

From: John Seymour, P.E. (Geosyntec Consultants); Tina Liu, P.E. (Geosyntec Consultants)

Subject: IEPA Part 845 - Wetland Certification for New East Ash Pond at Vermilion Power Plant
Geosyntec Project: CHE8404A

Dynegy Midwest Generation, LLC (Dynegy) is the owner of the inactive coal-fired Vermilion Power Plant (VPP), also referred to as Vermilion Power Station, located approximately 13 miles Northwest of Danville, Illinois. The New East Ash Pond (NEAP) is an inactive surface impoundment storing coal combustion residuals (CCR). The requirements for the NEAP are found in 35 Ill. Admin. Code 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845).

This certification addresses the requirements of Part 845, Section 845.310 Wetlands, which states:

> *Section 845.310(a):* *Existing and new CCR surface impoundments, and all lateral expansions of CCR surface impoundments must not be located in wetlands unless the owner or operator demonstrates [that the requirements listed in 845.310(a)(1) through (5) are met.]*

A review of available data from the United States Fish and Wildlife Service National Wetlands Inventory (https://www.fws.gov/wetlands/data/Mapper.html) was completed for this certification. Based on the available published data and information reviewed, the NEAP CCR surface impoundment is not located within wetlands.

> *Section 845.310(b):* *The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of subsection (a).*

I, John Seymour, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that it is not located within wetlands, and that the CCR Unit meets the requirements of Section 845.310(a).

John Seymour
Printed Name

John Seymour 10/22/2021
Signature Date

062.040562 Illinois 30 November 2021
Registration Number State Expiration Date

JOHN P. SEYMOUR
062-040562

Affix Seal

* * * * *

ATTACHMENT G

Fault Areas (845.320)

Geosyntec consultants

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Chicago, IL, 60602
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www.geosyntec.com

Memorandum

Date: 15 October 2021

To: Victor Modeer (Dynegy)

From: John Seymour, P.E. (Geosyntec Consultants); Omer Bozok, P.E. (Geosyntec Consultants)

Subject: IEPA Part 845 - Fault Area Certification for New East Ash Pond at Vermilion Power Plant
Geosyntec Project: CHE8404A

Dynegy Midwest Generation, LLC (Dynegy) is the owner of the inactive coal-fired Vermilion Power Plant (VPP), also referred to as Vermilion Power Station, located approximately 13 miles Northwest of Danville, Illinois. The New East Ash Pond (NEAP) is an inactive surface impoundment storing coal combustion residuals (CCR). The requirements for the NEAP are found in 35 Ill. Admin. Code 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845).

This certification addresses the requirements of Part 845, Section 845.320 Fault Areas, which states:

> Section 845.320(a): *Existing and new CCR surface impoundments, and all lateral expansions of CCR surface impoundments must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time unless the owner or operator demonstrates that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR surface impoundment.*

A review of available data from the Illinois State Geological Survey, and other information was completed for this certification. The nearest known mapped faults are the Marshall-Sidell Syncline Fault, which is located approximately five miles West of the NEAP. The timeframe of the most recent activity on these faults is not known. Based on the available published geologic data and information reviewed, there are no active faults or fault damage zones that have had displacement in Holocene time reported or indicated within 200 feet of the NEAP.

> <u>Section 845.320(b):</u> *The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of subsection (a).*

I, John Seymour, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that it is not located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time, and that the CCR Unit meets the requirements of Section 845.320(a).

John Seymour
Printed Name

John Seymour 10/22/2021
Signature Date

062.040562 Illinois 30 November 2021
Registration Number State Expiration Date

JOHN P. SEYMOUR
062-040562

Affix Seal

* * * * *

ATTACHMENT H

Seismic Impact Zones (845.330)

Geosyntec consultants

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Memorandum

Date: 15 October 2021

To: Victor Modeer (Dynegy)

From: John Seymour, P.E. (Geosyntec Consultants); Omer Bozok, P.E. (Geosyntec Consultants)

Subject: IEPA Part 845 – Seismic Impact Zone Certification for New East Ash Pond at Vermilion Power Plant
Geosyntec Project: CHE8404A

Dynegy Midwest Generation, LLC (Dynegy) is the owner of the inactive coal-fired Vermilion Power Plant (VPP), also referred to as Vermilion Power Station, located approximately 13 miles Northwest of Danville, Illinois. The New East Ash Pond (NEAP) is an inactive surface impoundment storing coal combustion residuals (CCR). The requirements for the NEAP are found in 35 Ill. Admin. Code 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845).

This certification addresses the requirements of Part 845, Section 845.330 Seismic Impact Zone, which states.

> Section 845.330(a): *Existing and new CCR surface impoundments, and all lateral expansions of CCR surface impoundments must not be located in seismic impact zones unless the owner or operator demonstrates that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.*

Seismic impact zone is defined by Part 845 as an area having a 2% or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10 g in 50 years". The 2014 US Geologic Survey Hazard Map for the NEAP indicates that the maximum expected horizontal acceleration for 2% probability of exceedance in 50 years is between 0.06g and 0.1g. In addition, the 2018 USGS National Seismic Hazard Map also describes the project's region as an area with the "low risk level" of seismic hazard.

> <u>Section 845.330(b):</u> *The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of subsection (a).*

I, John Seymour, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced NEAP, that it is not located within seismic impact zone and it meets the requirements of Section 845.330(a).

John Seymour
Printed Name

John Seymour 10/22/2021
Signature Date

062.040562 Illinois 30 November 2021
Registration Number State Expiration Date

JOHN P. SEYMOUR
062-040562

Affix Seal

* * * * *

ATTACHMENT I

Unstable Areas and Floodplains (845.340)

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consultants

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Memorandum

Date:	15 October 2021
To:	Victor Modeer (Dynegy)
From:	John Seymour, P.E. (Geosyntec Consultants); Omer Bozok, P.E. (Geosyntec Consultants)
Subject:	IEPA Part 845 – Unstable Areas and Floodplains Certification for New East Ash Pond at Vermilion Power Plant Geosyntec Project: CHE8404A

Dynegy Midwest Generation, LLC (Dynegy) is the owner of the inactive coal-fired Vermilion Power Plant (VPP), also referred to as Vermilion Power Station, located approximately 13 miles Northwest of Danville, Illinois. The New East Ash Pond (NEAP) is an inactive surface impoundment storing coal combustion residuals (CCR). The requirements for the NEAP are found in 35 Ill. Admin. Code 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845).

This certification addresses the requirements of Part 845, Section 845.340 Unstable Areas and Floodplains, which states.

> Section 845.340 (a): *An existing or new CCR surface impoundment, or any lateral expansion of a CCR surface impoundment must not be located in an unstable area unless the owner or operator demonstrates that recognized and generally accepted engineering practices have been incorporated into the design of the CCR surface impoundment to ensure that the integrity of the structural components of the CCR surface impoundment will not be disrupted.*
>
> Section 845.340 (b): *The owner or operator must consider all the following factors, at a minimum, when determining whether an area is unstable: 1) On-site or local soil conditions, including but not limited to liquefaction, that may result in significant differential settling; 2) On-site or local geologic or geomorphologic features; and 3) On-site or local human-made features or events (both surface and subsurface)*

Pursuant to Section 845.340 (b)(1), no conditions associated with the potential for significant differential settlement due to liquefaction were identified. A separate report prepared by Geosyntec titled "2021 CCR Initial Safety Factor Assessment, Part 845 – Sections 460, NEAP, Vermilion Power Plant" and dated October 2021 concluded that soils beneath the NEAP perimeter dike are not susceptible to liquefaction and significant differential settlement is unlikely.

Pursuant to Section 845.340 (b)(2), available United States Geological Survey (USGS) and Illinois State Geological Survey (ISGS) information indicates that no karst topography or physiographic features such as sinkholes, vertical shafts, caves, large springs exist at the site. To evaluate the susceptibility of landslides, we reviewed readily available USGS data. The USGS data indicates that the CCR Unit is in an area of low landslide incidence and the closest documented landslide is more than 11 miles from the CCR Unit. Accordingly, it is our opinion that the CCR Unit is not located in an area that has high susceptibility to landslides.

Pursuant to Section 845.340 (b)(3), evidence of on-site or local human-made features or events (both surface and subsurface) was examined. It was concluded that there had been coal mining activities potentially around the perimeter of NEAP prior to construction of NEAP. A geophysical investigation was conducted at the site to identify underground void spaces. A few localized voids and potential voids were identified around the perimeter of the CCR unit. Inspection of the ground surface in these areas is included in the inspection procedures. No evidence of ground subsidence has been identified around the NEAP or on the eastern berm since operations started at the NEAP.

> <u>Section 845.340 (c):</u> *An existing or new CCR surface impoundment, or any lateral expansion of a CCR surface impoundment, must not be located in a floodplain unless the owner or operator demonstrates that recognized and generally accepted engineering practices have been incorporated into the design of the CCR surface impoundment to ensure that the CCR surface impoundment will not restrict the flow of the base flood, reduce the temporary water storage capacity of a floodplain, or result in washout of CCR, so as to pose a hazard to human life, wildlife, or land or water resources.*

The NEAP was constructed before the relevant Effective FEMA Flood Insurance Rate Maps (FIRMs) were issued. The Effective FIRMs do not appear to account for the grading associated with NEAP. It appears the Zone A Floodplain delineated on the FIRM relies upon historical topography along the Middle Fork of the Vermilion River.

Further, the Owner plans to perform closure by removal and there will be no surface impoundment in the floodplain.

> *<u>Section 845.330 (d):</u> The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of subsections (a) and (c).*

I, John Seymour, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced NEAP, that it is not located in an unstable area and that the NEAP meets the requirements of Section 845.340(a) and (c) as described in this certification document.

John Seymour
Printed Name

John Seymour 10/22/2021
Signature Date

062.040562	Illinois	30 November 2021
Registration Number	State	Expiration Date

JOHN P. SEYMOUR
062-040562
LICENSED PROFESSIONAL ENGINEER

Affix Seal

* * * * *

ATTACHMENT J

Permanent Markers (845.130)


VERMILION
NEW EAST POND CELL 1 & 2
ID #: W1838000002-04
DYNEGY MIDWEST
GENERATION, LLC

ATTACHMENT K

Slope Maintenance (845.430)

Geosyntec
consultants

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Memorandum

Date: 15 October 2021

To: Victor Modeer (Dynegy)

From: John Seymour, P.E. (Geosyntec Consultants); Omer Bozok, P.E. (Geosyntec Consultants)

Subject: IEPA Part 845 – Slope Maintenance Documentation for New East Ash Pond at Vermilion Power Plant
Geosyntec Project: CHE8404A

Dynegy Midwest Generation, LLC (Dynegy) is the owner of inactive coal-fired Vermilion Power Plant (VPP), also referred to as Vermilion Power Station, located approximately 13 miles Northwest of Danville, Illinois. The New East Ash Pond (NEAP) is an inactive surface impoundment storing coal combustion residuals (CCR). The requirements for the NEAP are found in 35 Ill. Admin. Code 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845).

This certification addresses the requirements of Part 845, Section 845.430 Slope Maintenance, which states:

> *Section 845.430:* *The slopes and pertinent surrounding areas of the CCR surface impoundment must be designed, constructed, operated, and maintained with one of the forms of slope protection specified in subsection (a) that meets all the performance standards of subsection (b).*
>
> *Section 845.430(a):* *Slope protection must consist of one of the following: 1) A vegetative cover consisting of grassy vegetation; 2) An engineered cover consisting of a single form or combination of forms of engineered slope protection measures; or 3) A combination of the forms of cover specified in subsections (a)(1) or (a)(2).*
>
> *Section 845.430(b):* *Any form of cover for slope protection must meet the following performance standards:*

> *1) The cover must be installed and maintained on the slopes and pertinent surrounding areas of the CCR surface impoundment;*
> *2) The cover must provide protection against surface erosion, wave action, and adverse effects of rapid drawdown;*
> *3) The cover must be maintained to allow for the observation of, and access to, the slopes and pertinent surrounding areas during routine and emergency events;*
> *4) Woody vegetation must be removed from the slopes or pertinent surrounding areas. Any removal of woody vegetation with a diameter greater than 1/2 inch must be directed by a person familiar with the design and operation of the CCR surface impoundment and in consideration of the complexities of removal of a tree or a shrubbery, who must ensure the removal does not create a risk of destabilizing the CCR surface impoundment or otherwise adversely affect the stability and safety of the CCR surface impoundment or personnel undertaking the removal; and*
> *5) The height of vegetation must not exceed 12 inches.*

Slope protection at the CCR Unit consists of vegetative cover. Based on the observations from the weekly inspections conducted in accordance with Section 845.540(a), 2019 annual inspection conducted by Dynegy, and site visits conducted by Geosyntec in 2020 and 2021, the vegetative cover appears to be in good working condition with a maximum vegetation height of 12 inches. Woody vegetation is observed within limited areas on the lower slopes. The owner's Operations and Maintenance Plan provides details for maintaining grass and woody vegetation and addressing erosion features on the slopes. The owner is in the process of addressing the woody vegetation.

* * * * *

ATTACHMENT L

Safety Emergency Response Plan

Initial Emergency Action Plan (845.520)

Prepared for

Dynegy Midwest Generation, LLC
1500 Eastport Plaza Drive
Collinsville, Illinois 62234

SAFETY EMERGENCY RESPONSE PLAN

VERMILION POWER PLANT
OAKWOOD, ILLINOIS

Prepared by

Geosyntec
consultants

engineers | scientists | innovators

134 N. Lasalle Street, Suite 300
Chicago, Illinois 60602

August 2021

EXECUTIVE SUMMARY

Safety Emergency Response Plan for Vermilion Power Plant North Ash Pond, Old East Ash Pond, and New East Ash Pond

This Safety Emergency Response Plan (SERP) was created in accordance with the *Illinois Attorney General (IAG) Agreed Interim Order (AIO) (Draft 5.26.21), Section II(1). Section II(1)* which states that a written SERP for the Vermilion Power Plant (Site) shall be submitted to Illinois EPA, for its review and approval, which, at a minimum, must:

a. *Define the events or circumstances involving the Ponds at the Site 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 2.1)**;

b. *Define responsible persons, their respective responsibilities, and notification procedures in the event of a safety emergency involving a Pond at the Site* **(Section 2.2)***;*

c. Provide contact information of emergency responders **(Section 2.3)***;*

d. Include a map which delineates the downstream area which would be affected in the event of a Pond failure and a physical description of the Ponds at the Site **(Section 2.4)***;*

e. Include provisions for an annual face-to-face meeting or exercise between representatives of the owner or operator of the Ponds at the Site and the local emergency responders **(Section 2.5)***; and*

f. Describe emergency riverbank stabilization measures at or near the Site **(Section 2.6).**

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1. INTRODUCTION

1.1. Statement of Purpose

The Vermilion Power Plant[1] (Plant) is located along the Middle Fork of the Vermilion River near the City of Oakwood in Vermilion County, Illinois. The location is shown in Figure 1-1. The Plant is a retired coal-fired electricity producing power plant owned and operated by Dynegy Midwest Generation, LLC (DMG), a subsidiary of Dynegy. This Safety Emergency Response Plan (SERP) was prepared in accordance with the Illinois Attorney General (IAG) Agreed Interim Order entered on June 30, 2021 and covers the following Coal Combustion Residual (CCR) surface impoundments located at the site:

- North Ash Pond (NAP) – NID # N/A / Old East Ash Pond (OEAP) – NID # IL50291 (Note, no water can be impounded at the OEAP; it is filled and covered to drain surface water)
- New East Ash Pond (NEAP) – NID # IL0004057

The locations of these impoundments are shown in Figure 1-2. Section 1.2 of this SERP includes a description of each impoundment.

---

[1] The Vermilion Power Plant is also known as the "Vermilion Power Station".

The purpose of this SERP is to:

1. Safeguard the lives, as well as to reduce property damage, of citizens living within potential downstream flood inundation areas of CCR impoundments and related facilities at the Vermilion Power Plant.

2. Define the events or circumstances involving the CCR impoundments and related facilities at the Vermilion Power Plant that represent atypical operating conditions that pose a safety hazard or emergency and how to identify those conditions.

3. Define responsible persons, their responsibilities, and notification procedures in the event of a safety emergency.

4. Provide contact information of emergency responders.

5. Identify emergency actions in the event of a potential or imminent failure of the impoundments.

6. Identify the downstream area that would be affected by failure of the impoundments.

7. Provide for effective facility surveillance, prompt notification to local Emergency Management Agencies, citizen warning and notification responses, and preparation should an emergency occur.

8. Describe emergency riverbank stabilization measures to be implemented at the Site, if necessary.

Information provided by DMG was utilized and relied upon in preparation of this report.

1.2. Facility Information

The CCR surface impoundments are located entirely on a tract of land northeast of the Vermilion Power Plant. It is bounded on the west by an access road; the north and east by the Middle Fork of the Vermilion River; and to the south by E. 2150 North Road. The Plant is retired and the three CCR impoundments are inactive. The impoundments are described as follows and illustrated in Figure 1-2. Note all dimensions are approximate. Table 1-1 contains additional geometric details for each impoundment.

The surface impoundments are formed by an elevated embankment that circles the three impoundments. The embankment ranges in elevation of about 594.0 feet to 618.0 feet, though the Old East Ash Pond (OEAP) has been built up to about 636.0-feet as discussed below.

- North Ash Pond (NAP) / Old East Ash Pond (OEAP): The NAP area is approximately 41-acres and was built as a northern extension of the OEAP and has been inactive since 2011. The northern and eastern edges are delineated by perimeter dikes, while the southern edge shares a border with the OEAP. The NAP overlaps/coincides with the OEAP on its southern end. The western edge consists of two earthen embankment saddle dams approximately 16 to 18-feet tall with a combined maximum storage of approximately 40 acre-feet and fitted with surface water intake structures that collect runoff from the western hills into 24-inch diameter HDPE outlet piping that ultimately discharge north of the NAP. The saddle dam basins remain dry outside of rainfall events (i.e., no standing/normal pool). The NAP discharges decant water to a secondary pond (Secondary NAP) separated by a divider dike located at the northeast corner of the NAP. The Primary NAP has an auxiliary spillway that consists of an 18-inch corrugated metal pipe (CMP) through the divider dike. The NAP normal pool elevation is 597.0 feet which is 6.13-feet below its auxiliary spillway invert elevation of 603.13 feet. The NAP does not have a primary spillway, instead the pool is regulated intermittently by manually pumping from Primary NAP to the Secondary NAP. The Secondary NAP has a spillway configuration consisting of primary and auxiliary spillways located at its southeast corner. Its primary spillway consists of a concrete weir intake structure, with stoplogs to adjust weir intake height, connected to an 18-inch diameter CMP outlet pipe through the perimeter dike and to National Pollutant Discharge Elimination System (NPDES) Permitted Outfall 001 (Outfall 001). Its auxiliary spillway consists of a 24-inch HDPE pipe through the perimeter dike that connects to the primary spillway outlet pipe prior to Outfall 001.

  The OEAP area is immediately adjacent to the NAP and covers approximately 21.3 acres. It is typically dry, currently inactive, and does not possess a reservoir nor a spillway. It received a fill cover of varying thicknesses sometime after 1981 and before 2005 based on historical aerial photos. The northern and eastern edges of the OEAP are delineated by a perimeter dike, while the northwestern edge shares a border with the NAP and the southern edge is bounded by existing topography. The perimeter dike was raised twice to increase its capacity reaching a final elevation ranging from 624 to 636 feet.

- New East Ash Pond (NEAP): This impoundment was constructed in the late 1980s separate from the NAP as a single impoundment. In 2003, the NEAP was expanded on the western edge with a low permeability slurry cutoff trench and the existing berms were raised to their current elevation of approximately 620 feet. The northern, eastern, and southern edges of the NEAP are delineated by berms, while the western interior slope of the impoundment is bounded by the existing topography. The NEAP spillway discharges decant water to a Secondary NEAP separated by a divider dike located at the north corner of the NEAP. The NEAP has a primary spillway that consists of an 18-inch diameter galvanized riser connected to a steel outlet pipe through the divider dike and an auxiliary spillway that consists of a 36-inch diameter reinforced concrete pipe (RCP). The normal pool elevation of primary NEAP is 594.0 feet which is 3.30 feet below its primary spillway invert elevation of 597.3 feet; the normal pool elevation of Secondary NEAP is 594.0 feet. The Secondary NEAP has a spillway configuration consisting of primary spillway located at the east. Its primary spillway consists of a concrete weir intake structure, with stoplogs to adjust weir intake height, connected to a 36-inch diameter RCP outlet pipe through the perimeter dike and to NPDES Permitted Outfall 003 (Outfall 003).

Table 1-1. Pond Characteristics

Feature/Parameter	North Ash Pond Area	Old East Ash Pond Area	New East Ash Pond
Maximum Embankment Height(1)	19.0 ft.	40.0 ft.	34.0 ft.
Length of Dam(1)	2,430 ft.	1,480 ft.	3,720 ft.
Crest Width(1)	12.0 ft.	8.0 ft.	15.0 ft.
Crest Elevation(1)(2)	604.0 ft.	636.0 ft.	618.0 ft.
Reservoir Area at Top of Dam(1)	17.8 acres	N/A	22.5 acres
Storage Capacity at Top of Dam(1)	91.3 acre-ft.	N/A	339 acre-ft.
Primary Spillway Type(3)	Manually Pumped Intermittently/As-Needed	N/A	18-in. dia. Galvanized Riser (5-ft. tall) connected to a Steel Outlet Pipe of unknown diameter(4)
Primary Spillway Crest Elevation(1)(3)	N/A	N/A	597.3 ft.
Storage Capacity at Primary Spillway Elevation(1)	N/A	N/A	25.7 acre-ft.
Reservoir Area at Normal Water Surface Elevation(1)	28.8 acres	N/A	7.7 acres
Auxiliary Spillway Type(3)	18-in. dia. CMP	N/A	Open Lid Manhole Riser to 36-in. dia. RCP Outlet
Auxiliary Spillway Crest Elevation(1)(3)	603.1 ft.	N/A	616.9 ft.

Notes:
1) Vermilion Power Plan, November 2018 Topography Drawings (IngenAE, 2018)
2) Elevations are provided in vertical datum NAVD 88 unless specified otherwise
3) History of Construction Report, Vermilion Power Station (Geosyntec, June 2021)
4) New East Ash Pond Primary Spillway Steel Outlet Pipe likely has a diameter of 18-inches

2. SAFETY EMERGENCY RESPONSE PLAN

> <u>IAG Interim Order Section II(1):</u> *Safety Emergency Response Plan. Within forty-five (45) days of the entry of this Order, Defendant shall submit to Illinois EPA, for its review and approval, a written Safety Emergency Response Plan for the Site….:*

This Safety Emergency Response Plan (SERP) has been prepared in accordance with the requirements of the IAG Interim Order (as detailed in the subsequent sections) and will be submitted within forty-five (45) days of the Order, which was entered on June 30, 2021.

2.1. Response Procedures

> <u>IAG AIO Section II(1)(a):</u> *Define the events or circumstances involving the Ponds at the Site 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 4-Step Incident Response Process is shown in Figure 2-1 (figures provided as attachments). The Notification Flowchart is shown in Figure 2-2. The Decision Tree shown in Figure 2-3 provides a flowchart for the various elements of the response process. Upon reaching Step 4 of the response process (termination and follow-up), the SERP Coordinator is responsible for notifying the ESDA/EMAs that the condition of the dam/impoundment has been stabilized. The purpose of this section is to provide specific information that can be used during a response. This information is provided in the following tables:

- Table 2-1 provides guidance for determining the response level.
- Table 2-2 provides impoundment pool level trigger elevations.
- Table 2-3 lists emergency actions to be taken depending on the situation.

To facilitate understanding among everyone involved in implementing this SERP, four response levels are used to identify the condition of an impoundment. These are:

Response Levels:

- **Level 0:** Normal conditions and routine operations, including surveillance and initial investigation of unusual conditions and effects of storm events.
- **Level 1:** Potentially hazardous condition exists, requiring investigation and possible corrective action.
- **Level 2:** Potential failure situation is developing; possible mode of failure is being assessed; corrective measures are underway.
- **Level 3:** Failure is occurring or is imminent, public protective actions are required.

Table 2-1. Guidance for Determining the Response Level

Event	Situation	Response Level
Spillway flow (see Table 2-2 for relevant elevations)	Primary spillway flow is not causing active erosion and impoundment water surface elevation is below auxiliary spillway crest elevation (if equipped).	Level 0
	Impoundment water surface elevation is at or above auxiliary spillway crest elevation (if equipped). No active erosion caused by spillway flow.	Level 1
	Spillway flow actively causing minor erosion that is not threatening the control section or dam/impoundment stability.	Level 2
	Spillway flow that could result in flooding downstream if the reservoir level continues to rise.	Level 2
	Abnormal operation of the spillway system due to blockage or damage that could lead to flooding.	Level 2
	Spillway flow actively eroding the soil around the spillway that is threatening the control section (e.g., undermining) or dam/impoundment stability.	Level 3
	Spillway flow that is flooding people downstream.	Level 3
Embankment overtopping (see Table 2-2 for relevant elevations)	Impoundment water surface elevation at or below typical normal pool fluctuation elevation.	Level 0
	Impoundment water surface elevation above typical normal pool fluctuation elevation.	Level 1
	Impoundment water surface elevation above high normal pool fluctuation elevation.	Level 2
	Impoundment water surface elevation at or above embankment crest elevation.	Level 3
Seepage	New seepage areas in or near the dam/impoundment with clear flow.	Level 1
	New seepage areas with cloudy discharge or increasing flow rate.	Level 2
	Heavy seepage with active erosion, muddy flow, and/or sand boils.	Level 3

Table 2-1. Guidance for Determining the Response Level

Event	Situation	Response Level
Sinkholes	Observation of new sinkhole in impoundment area or on embankment.	Level 2
	Rapidly enlarging sinkhole and/or whirlpool in the impoundment.	Level 3
Cracks without seepage	New cracks in the embankment greater than ¼ inch wide without seepage.	Level 1

Table 2-2. Trigger Elevations(1)(2)(3)

	Embankment Crest Elevation (ft)	Auxiliary Spillway Crest Elevation (ft)	Normal Pool Fluctuation	
			Typical (ft)	High (ft)
North Ash Pond Area	604.0	602.1	597.0	602.1
Old East Ash Pond Area	636.0	NA	Dry	Dry
New East Ash Pond	618.0	609.1	594.0	601.3

Notes:

1) Vermilion Power Plan, November 2018 Topography Drawings (IngenAE, 2018)
2) Elevations are provided in vertical datum NAVD 88 unless specified otherwise
3) History of Construction Report, Vermilion Power Station (Geosyntec, June 2021)

Table 2-3. Emergency Actions

Condition	Description of Condition	Action to be Taken
High Water Level/ Large Spillway Release	See Table 2-1 and Table 2-2 for elevations and triggering water levels associated with the impoundments and spillways covered by this SERP	1. Assess cause of increased reservoir stage, especially during fair weather conditions. 2. Determine Response Level. 3. Make proper notifications as outlined in the Figure 2-2 Notification Flowchart. 4. Perform additional tasks as determined through consultation with the ERT. 5. Make notifications if condition worsens such that downstream flooding is imminent. **Response Level 0**: require enhanced surveillance 3 times per day **Response Level 1**: contact internal chain of command and external response partners as necessary; inspect impoundment minimum 1 time per hour **Response Level 2**: contact internal chain of command; notify ESDA/EMAs and notify external response partners. ESDA/EMAs notify affected parties. **Response Level 3**: contact internal chain of command; notify ESDA/EMAs and notify external response partners. ESDA/EMA's notify affected parties of emergency incident.
Seepage	Localized new seepage or boil(s) observed along downstream face / toe of earthen embankment with muddy discharge and increasing but controllable	1. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos. Document location on a site plan and in inspection notes. 2. Determine Response Level. 3. Make proper notifications as outlined in the Figure 2-2 Notification Flowchart.

Table 2-3. Emergency Actions

Condition	Description of Condition	Action to be Taken
	discharge of water.	4. ERT (with Dam Safety Manager as lead) to determine mitigation actions. The following actions may apply: a. Place a ring of sand bags with a weir at the top towards the natural drainage path to monitor flow rate. If boil becomes too large to sand bag, place a blanket filter over the area using non-woven filter fabric and pea gravel. Attempt to contain flow in such a manner (without performing any excavations) that flow rates can be measured. Stockpile gravel and sand fill for later use, if necessary. b. Inspect the embankment and collect piezometer, water level and seepage flow data daily unless otherwise instructed by the Dam Safety Manager. Record any changes of conditions. Carefully observe embankment for signs of depressions, seepage, sinkholes, cracking or movement. c. Maintain continuous monitoring of feature. Record measured flow rate and any changes of condition, including presence or absence of muddy discharge. 5. Make notifications as outlined in the lower portion of the Notification Flowchart (Figure 2-2) if condition worsens such that failure is imminent.
Sabotage and Miscellaneous Other Issues	Criminal action with significant damage to embankment or structures where	1. Contact law enforcement authorities and restrict all access (except emergency responders) to impoundment. Restrict traffic on embankment crest to essential emergency operations only.

Table 2-3. Emergency Actions

Condition	Description of Condition	Action to be Taken
	significant repairs are required and the integrity of the facility is compromised—condition appears stable with time.	2. Determine Response Level. 3. Make internal notifications as outlined in the upper portion of the Notification Flowchart (Figure 2-2). 4. In conjunction with the Dam Safety Manager, assess extent of damage and visually inspect entire embankment and ancillary structures for additional less obvious damage. Based on inspection results, confirm if extent of damage to various components of the impoundment warrants a revised Response Level and additional notifications. 5. Perform additional tasks as directed by the ERT. 6. Make notifications if conditions worsen.
Embankment Deformation	Cracks: New longitudinal (along the embankment) or transverse (across the embankment) cracks more than 6 inches deep or more than 3 inches wide or increasing with time. New concave cracks on or near the embankment crest associated with slope movement.	1. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos. Document location on a site plan and in inspection notes. 2. Restrict traffic on embankment crest to essential emergency operations only. 3. Determine Response Level. 4. Make notifications as outlined in the Figure 2-2 Notification Flowchart. 5. ERT (with Dam Safety Manager as lead) to determine mitigation actions. The following actions may apply: a. Place buttress fill against base of slope immediately below surface feature. Stock pile additional fill.

Table 2-3. Emergency Actions

Condition	**Description of Condition**	**Action to be Taken**
		b. Place sand bags as necessary around crack area to divert any storm water runoff from flowing into crack(s). 6. As directed by the Dam Safety Manager, additional inspection and monitoring of the dam may be required. Items may include; inspect the dam on a schedule determined by the Dam Safety Managers; collect piezometer and water level data; and record any changes of condition. Carefully observe dam for signs of depressions, seepage, sinkholes, cracking or movement. 7. Make notifications as outlined in the Figure 2-2 Notification Flowchart if conditions worsen such that failure is imminent.
Embankment Deformation	Slides / Erosion: Deep slide / erosion (greater than 2 feet deep) on the embankment that may also extend beyond the embankment toe but does not encroach onto the embankment crest and appears stable with time.	1. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos. Document location on a site plan and in inspection report. 2. Restrict traffic on embankment crest to essential emergency operations only. 3. Determine the Response Level. 4. Make notifications as outlined in the Figure 2-2 Notification Flowchart. 5. ERT (with Dam Safety Manager as lead) to determine mitigation actions. Additional actions may include the following items. a. Place sand bags as necessary around slide area to divert any storm water runoff from flowing into slide(s).

Table 2-3. Emergency Actions

Condition	Description of Condition	Action to be Taken
		b. Increase inspections of the dam; collect piezometer and water level data; and record any changes of condition. During inspections, carefully observe dam for signs of depressions, seepage, sinkholes, cracking or movement. 6. Make notifications as outlined in the Figure 2-2 Notification Flowchart if conditions worsen such that failure is imminent
Embankment Deformation	Sinkholes: Small depression observed on the embankment or within 50 feet of the embankment toe that is less than 5 feet deep and 30 feet wide or which is increasing with time.	1. Slowly open drain gates to lower pool elevation. 2. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos. Document location on a site plan and in inspection notes. 3. Restrict traffic on embankment crest to essential emergency operations only. 4. Determine Response Level. 5. Make notifications as outlined in the Figure 2-2 Notification Flowchart. 6. ERT (with Dam Safety Manager as lead) to determine mitigation actions. Additional actions may include the following items: a. Backfill the depression with relatively clean earth fill (free of organic materials) generally even with surrounding grade and slightly mounded (6 to 12 inches higher) in the center in order to shed storm water away from the depression. Stock pile additional fill.

Table 2-3. Emergency Actions

Condition	Description of Condition	Action to be Taken
		b. Increase inspections of the dam; collect piezometer and water level data daily unless otherwise instructed by Dam Safety Manager; and record any changes of condition. Carefully observe dam for signs of depressions, seepage, sinkholes, cracking or movement. 7. Make notifications as outlined in the Figure 2-2 Notification Flowchart if conditions worsen such that failure is imminent.
Gate Malfunction or Failure	Sluice gate damaged structurally (sabotage, debris, etc.) with uncontrolled release of water at a constant volume. Condition appears stable.	1. Close any other gates, if open. 2. Determine Response Level. 3. Make notifications as outlined in the Figure 2-2 Notification Flowchart. 4. Obtain instructions from the Dam Safety Manager to determine if there are other methods to stop or slow down the flow of water. 5. If conditions worsen such that failure is imminent, make notifications as outlined in the lower portion of the Figure 2-2 Notification Flowchart.

2.2. Roles and Responsibilities

<u>*IAG Interim Order Section II(1)(b):*</u> *Define responsible persons, their respective responsibilities, and notification procedures in the event of a safety emergency involving a Pond at the Site;*

Table 2-4 provides a summary of the SERP roles during an emergency event.

Table 2-4. Summary of SERP Roles

Entity	Role Description
DMG Emergency Response Team (ERT)	**ERT:** DMG personnel responsible for SERP implementation, distribution, updates/maintenance, and training activities. The *ERT* is comprised of the following roles; 1. **DMG Corporate**: DMG corporate entity, committee, team, position, or personnel with relevant responsibility for a given generating station. 2. **Plant Management**: Personnel responsible for day-to-day operation and management of the Plant. 3. **Dam Safety Manager**: Personnel that is most knowledgeable about the design and technical operation of facilities at a given Plant. 4. **SERP Coordinator**: Personnel responsible for implementing the SERP and associated activities **Emergency Event – SERP Responsibilities** 1. Respond to emergencies at the Plant. 2. Verify and assess emergency conditions. 3. Notify and coordinate as appropriate with participating emergency services disaster agencies or emergency management agencies (ESDA/EMA's), emergency responders, regulatory agencies, and all other entities involved or affected by this SERP. 4. Take corrective action at the Plant. 5. Declare termination of emergencies at the Plant.
Vermilion County EMA	1. Receive Response Level reports from *DMG Corporate* through *SERP Coordinator*. 2. Coordinate emergency response activities with local authorities: police, fire and rescue, etc. 3. Coordinate notification of public as necessary through established channels.

Table 2-4. Summary of SERP Roles

Entity	Role Description
	4. Coordinate notification activities to affected parties within inundation areas. 5. Evaluate risk to areas beyond the inundation areas, communicate needs to *DMG Corporate* and/or *SERP Coordinator*, and coordinate aid as appropriate. 6. Responsible for declaring termination of an emergency condition off-site upon receiving notification of an emergency status termination from *DMG Corporate*. 7. If necessary, coordinate with *State ESDA/EMA*.
Vermilion County Police, Fire and Rescue, and Emergency Services	1. Receive alert status reports from the *ERT* or the *Vermilion County ESDA/EMA*. 2. If necessary, notify affected parties and general public within inundation areas (see Section 7). 3. Render assistance to Vermilion County ESDA/EMA, as necessary. 4. Render assistance *to DMG Corporate* and *Plant Management*, as necessary.

2.3. Contact information

IAG Interim Order Section II(1)(c): Provide contact information of emergency responders;

Table 2-5 lists contact information for the emergency responders.

Table 2-5. SERP Emergency Responders

Position	Name	Phone #
Internal Contacts		
Vermilion Power Plant		
Managing Director	Dianna Tickner	(618) 381-3124
Environmental Manager (SERP Coordinator)	Brian Voelker	(217) 412-6605
Engineering Manager	Vic Modeer	(618) 541-0878
DMG Corporate Operations		
Dam Safety Manager	Jason Campbell	(217) 622-3491
Construction Manager	Vic Modeer	(618) 541-0878
External Contacts		
Local / County ESDA/EMA, Police, & Fire		
Vermilion County EMA	Russell Rudd	(217) 443-6011
Vermilion County Sheriff Department	Patrick Hartshorn	911, (217) 442-4080
Cayuga Fire Station		911, (765) 492-3515
State Emergency Management Agencies & Organizations		
IDNR-OWR Dam Safety Section Manager	Paul Mauer	(217) 782-4427
Middle Fork State Fish and Wildlife Area		(217) 442-4915
Illinois Conservation Police		(877) 236-7529
Vermilion County Conservation Police Officer	Chase Sanford	(217) 361-9982
Illinois State Police		911

2.4. Breach Inundation Maps and Potential Impacts

> *<u>IAG Interim Order Section II(1)(d):</u> Include a map which delineates the downstream area which would be affected in the event of a Pond failure and a physical description of the Ponds at the Site;*

An inundation map for potential breach scenarios for the NAP and NEAP are provided in Figure 2-4 and Figure 2-5, respectively. It is the Vermilion County EMA's responsibility to keep a current list of affected parties/properties to contact in the case of emergencies that result in Response Level

2 or 3. This list should encompass all properties within and adjacent to the probable inundation extents shown in the provided map. Currently, there are no residences or otherwise occupied structures in the area of inundation.

Using a semi-quantitative approach for evaluating the extent of inundation due to a breach of the NAP and NEAP at full capacity reservoir volume, Geosyntec developed inundation mapping for full riverbank and 100-year flows in the Middle Fork Vermilion River in July 2021. The full river bank flow condition is when the flows have reached the top of bank but have not spilled over into the overbank (the lower floodplain). This is typically between the 1-year and 5-year flow. The 100-year flow condition is based on the published flows for the 1% (or 100-year flow). The methodology used to identify potential inundation extents due to a potential breach of the ponds consisted of several possible breach scenarios. Inundation limits were plotted using the best available topographic mapping for the site, which consisted of Illinois DOT LiDAR topographic data and supplemented with field survey data. Details for each breach scenario are as follows:

- NAP full riverbank – Using full riverbank flow conditions and assuming a breach on the northern embankment, Figure 2.4a depicts the estimated extend of the potential breach inundation. The inundation area immediately adjacent to the breach extends outside of the river channel banks and returns to the primary flow channel approximately one mile downstream of the breach. Minimal impacts extend downstream of the figure limits.

- NAP 100-year – Using river conditions during a 100-year storm flow and assuming a breach on the northern embankment, Figure 2.4b depicts the estimated extend of a potential breach. The inundation area immediately north of the breach extends slightly outside of the river 100-year flood extents; however, returns to coincide with the 100-year flood extent downstream of the breach location. Minimal impacts extend downstream of the figure limits.

- NEAP full riverbank – Using full riverbank flow conditions and assuming a breach on the eastern embankment, Figure 2.5a depicts the estimated extend of the potential breach inundation. The inundation area immediately adjacent to the breach extends outside of the river channel banks and returns to the primary flow channel approximately 0.5 miles downstream of the breach. Minimal impacts extend downstream of the figure limits.

- NEAP 100year – Using river conditions during a 100-year storm and assuming a breach on the eastern embankment, Figure 2.5b depicts the estimated extend of a potential breach. Overall breach waters stay within the river 100-year flood extents, minimal impacts extend downstream of the figure limits.

Approximate inundation areas are illustrated in Figure 2-4 and Figure 2-5.

2.5. Annual Preparedness Meetings

> <u>*IAG Interim Order Section II(1)(e):*</u> *Include provisions for an annual face-to-face meeting or exercise between representatives of the owner or operator of the Ponds at the Site and the local emergency responders; and*

A coordination meeting shall be conducted annually between representatives of Dynegy Midwest Generation, LLC, and local emergency responders. This meeting may be in the form of face-to-face meeting, tabletop exercise, or additional training regarding the SERP. Internal and external emergency responders listed within Table 2-5 should take part in an annual preparedness meeting.

Emergency supplies and equipment will be provided by DMG emergency response contractor as needed and may include:

- Flashlights
- Generator
- Extension Cords
- Fire extinguishers
- Floodlights
- Backhoe
- Dozer
- Large Equipment (Rental – including excavating equipment, pumps, lighting)
- Grader
- Scraper
- End Loader
- Dump Truck
- Pump and Hoses
- Sandbags and Sand
- Fill (Stone, aggregate, sand)
- Concrete/grout
- Geotextile Filter Fabric
- Plastic Sheeting
- Rope
- Personal Flotation Devices

Table 2-6 is a partial list of area suppliers for many of the items typically needed during an emergency response. Applicable tables should be reviewed and updated as deemed necessary during annual preparedness meetings.

Table 2-6. Supplier Addresses

Supply/Rental Item(s)	Supplier Contact Information	Distance from Site (miles)	Address
Sandbags	Tractor Supply	17	3623 N. Vermilion St., Danville, IL 61832 (217) 431-5756
	Powell Ace Home Center	31	3391 IN-28, West Lebanon, IN 47991 (765) 893-8888
Gravel, Sand, & Riprap	Hanson Aggregates	14	3706 Catlin Homer Rd., Fairmount, IL 61841 (217) 733-2151
	Rogers Group – Interstate Sand & Gravel	31	3255 W. 650 S., Williamsport, IN 47993 (765) 893-4463
Concrete, Cement, Sand, Grout	Sport Redi Mix LLC	18	590 N. J St., Tilton, IL 61833 (217) 446-6992
Portable Pumps, Rental Equipment	United Rentals	29	3501 N. Country View Rd., Urbana, IL 61802 (217) 351-5820
	Sunbelt Rentals	33	1401 N. Mattis Ave, Champaign, IL 61821 (217) 355-1296
	Rain for Rent	105	1110 W. Thompson Rd., Indianapolis, IN 46217 (317) 780-6248
General Hardware & Supply	R.P. Lumber Company	20	1214 S. State St., Westville, IL 61883 (217) 267-3319
	Powell Ace Home Center	31	3391 IN-28, West Lebanon, IN 47991 (765) 893-8888

2.6. Maintenance of Riverbank Conditions

> *<u>AIG Interim Order Section (1)(f):</u> Describe emergency riverbank stabilization measures at or near the Site, including but not limited to:*
>
> *(i): The monitoring activities that Defendant shall conduct in the Middle Fork of the Vermilion River and the riverbank adjacent to the North Ash Pond and the Old East Ash Pond to assist in determining when a safety emergency exists and when the installation of temporary erosion protection is necessary;*
>
> *(ii): The temporary erosion protection that Defendant shall install upon its determination that a safety emergency exists and shall maintain until its closure of the North Ash Pond and the Old East Ash Pond is completed; and*
>
> *(iii): The method and timing of when Defendant will remove the temporary erosion protection, if installed, in consultation with the relevant regulatory authorities.*

2.6.1. Monitoring Activities

Monitoring for riverbank erosion along the OEAP and NAP has been ongoing and will continue. The monitoring program consists of surveying a series of 5-ft long steel reinforcing rods (ground-rod) inserted laterally into the riverbank along the OEAP and NAP. Ground-rods are placed in vertical profiles every 25 ft along the riverbank. Two to three ground-rods are placed at each profile: at the bottom of the riverbank, the middle of the riverbank, and, at approximately half of the profiles, at the top of the riverbank. A survey is performed monthly and consists of measuring the lateral distance from the tip of ground-rod to the riverbank. Once approximately 3 ft of rod is exposed, they are to be re-driven and baseline readings are re-established so that a continuous cumulative erosion value can be calculated.

In addition to ground-rod monitoring, weekly inspections of the Eastern Berms and riverbank along the OEAP and NAP will be performed. Weekly inspections are conducted by a qualified person trained in identifying non-optimal conditions for CCR units. Areas inspected include the top of the riverbank, Eastern Berm crests, upstream and downstream of the Eastern Berms, and spillways. Inspectors provide observations for potential issues including, but not limited to, cracking, settlement, animal burrows, surface erosion, vegetation, seeps, etc.

2.6.2. Maintenance of Riverbank

In the event that cumulative lateral erosion reaches three feet over an entire vertical profile of the riverbank along the OEAP or NAP, an engineering evaluation will be performed by a qualified geotechnical engineer. This evaluation will assess whether maintenance measures are required and if so, provide maintenance recommendations.

Design

A maintenance measure, hereafter referred to as buttress, will be designed based on the engineering evaluation recommendations. First, a preliminary design will be prepared and used to obtain the required environmental permits.

The buttress will consist of varying sizes of aggregate designed to withstand the river flow erosive forces, and placed against the riverbank, extending vertically from the bottom of the riverbank to the top of the riverbank. The buttress will include the placement of a separator fabric between the riverbank and the buttress. The buttress will extend up to five feet within the original riverbank baseline. Potential erosion of the buttress will then be monitored along with the remaining ground-rods. Additional buttress material will be placed as necessary to maintain the temporary riverbank maintenance measure. Buttress erosion and remaining thickness will then be monitored via paint marks on the top of the buttress.

Environmental Permitting and Approvals

DMG will consult with both the US Fish and Wildlife Service (USFW) and the Illinois Department of Natural Resources (IDNR) and revise both the USFW-approved biological assessment and IDNR-approved conservation plan, to reflect the design approach. Through these consultations, DMG will seek revisions to both the current USFW-issued incidental take authorization (ITA) and the current IDNR-drafted ITA if needed.

Based on the preliminary design, the following permits and approvals may be required before construction can commence:

- General NPDES permit for construction activity application (if over one acre is disturbed)
- Re-evaluate the need to revise the current biological assessment and conservation plan and the USFW and INDR ITAs, to reflect any significant design changes
- CWA Section 404 permit and CW Section 401 certification
- IDNR floodplain permit

- IDNR dam safety permit
- Consultation with IDNR Corridor Manager
- Consultation with the Middle Fork River Corridor Advisory Committee

Implementation

Once an engineering evaluation has been conducted and riverbank maintenance is identified as being required, permits are approved, and the design is finalized, DMG will install the buttress.

2.6.3. Removal of Temporary Measures

The buttress, if constructed as the temporary riverbank maintenance measure, will be removed upon completion of OEAP and NAP closures by removal. Environmental permits will be obtained prior to buttress removal. Details regarding the removal of the buttress will be included in a permit application for work in the river. Issued for Construction (IFC) drawings will be prepared and a contractor will be retained.

Once permits are approved, the buttress will be removed using either a long-reach type excavator situated at a safe distance from the edge of the riverbank and/or an amphibious type excavator working in the river. Measures will be taken to protect the river in accordance with permits. Material removed from the temporary measures will be placed at an approved onsite stockpile location.

3. CERTIFICATION

CCR Unit: DMG Midwest Generation, LLC; Vermilion Power Plant, Old East Ash Pond, New East Ash Pond, and North Ash Pond

I, John Seymour, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this SERP has been prepared in accordance with the accepted practice of engineering for the above referenced CCR Units.

John Seymour
Printed Name

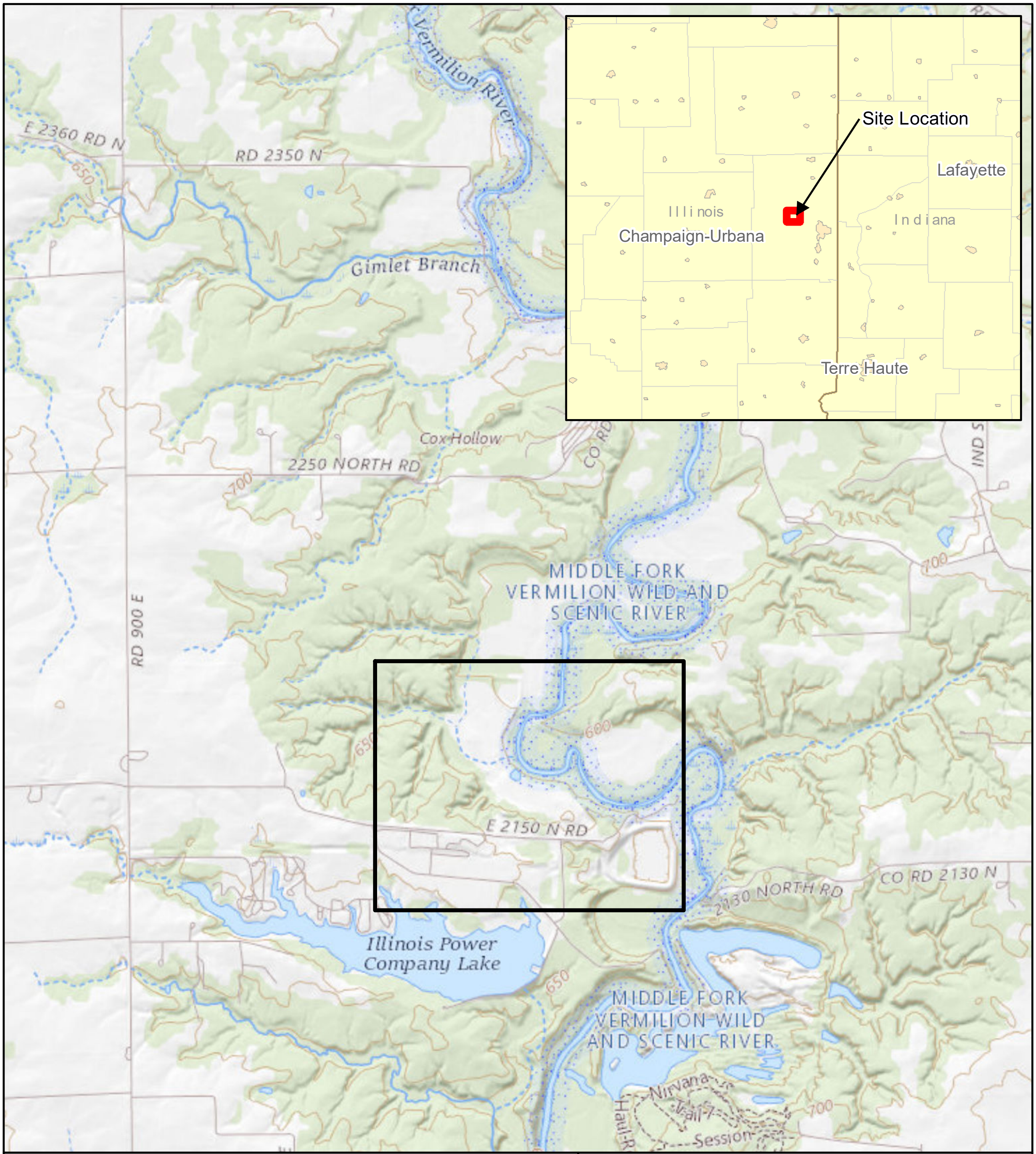
John Seymour 8/16/2021
Signature Date

062.040562 Illinois 30 November 2021
Registration Number State Expiration Date

JOHN P. SEYMOUR
062-040562

Affix Seal

FIGURES



Legend

▭ Site Location

USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS

N

0 750 1,500 3,000
Feet

Site Location Map

Safety Emergency Response Plan
Former Vermilion Power Plant

Geosyntec
consultants

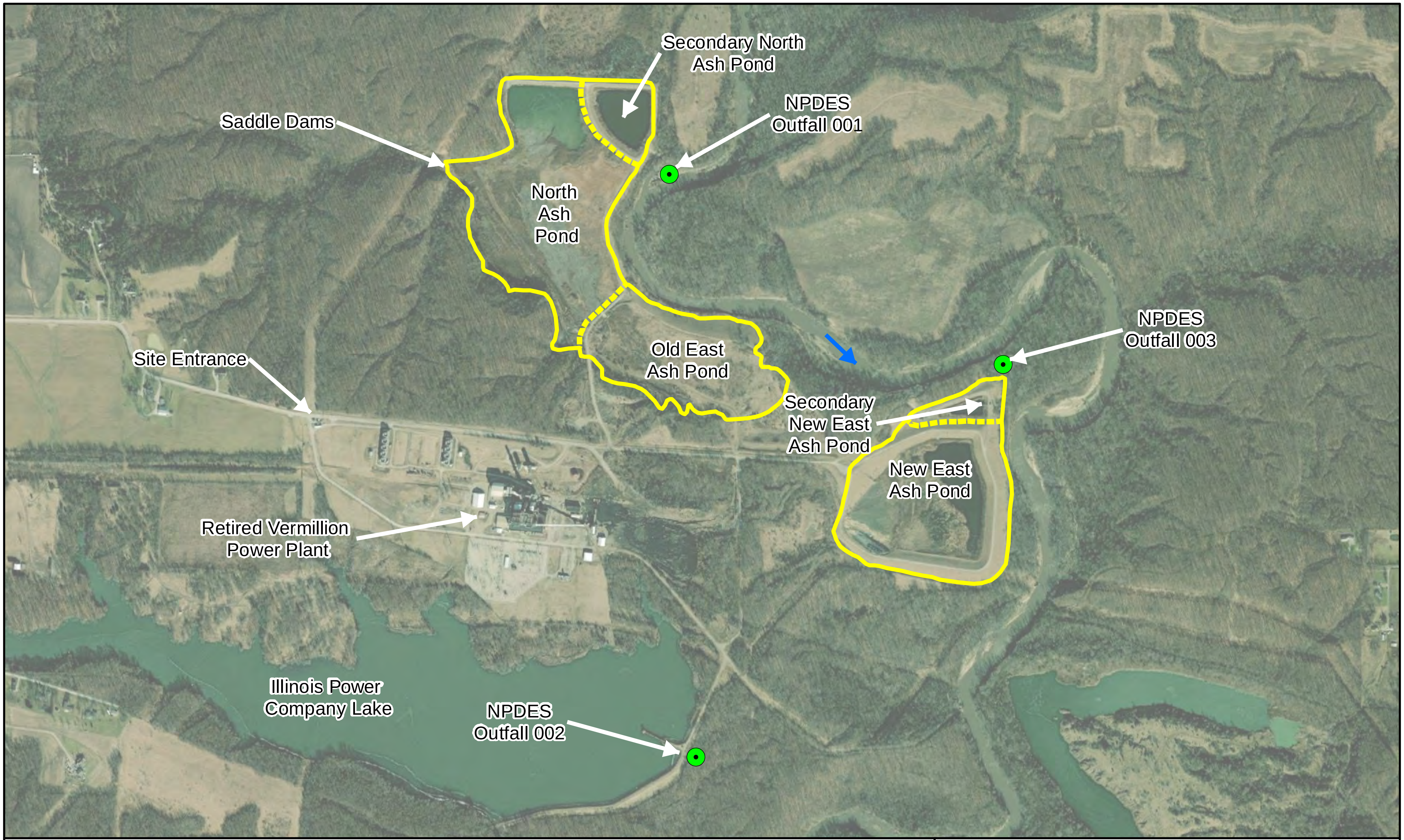
Figure

1-1

CHE8404A-02/04

August 2021

P:\CAD_GIS\Projects\CHE8404A-02_04 Vermillion\MXDs\Figure 1-1 Site Location Map.mxd 7/20/2021 1:07:02 PM



Legend

- ● NPDES Outfall
- → Middle Fork Vermilion River Flow Direction
- ☐ Ash Pond

N

0 250 500 1,000 Feet

CCR Impoundments

Safety Emergency Response Plan
Former Vermilion Power Plant

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consultants

CHE8404A-02/04

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Figure

1-2

Figure 2-1. Summary/Sequence of Tasks in the 4-Step Incident Response Process

Step 1: Detection, Evaluation, and Response Level Determination

Sequence of Tasks:

- Notify SERP Coordinator, Station Management (Director and Engineering), and Dynegy Dam Safety Manager of unusual condition detected and confer on next steps.
- Conduct technical evaluation of conditions as needed.
- Determine Response Level based on evaluation. **(Table 2-1)**
- Reset Response Level as revised evaluations warrant.

Step 2: Notification

Sequence of Tasks:

- Notify authorities, designated personnel, and external response partners of change in Response Level, using the Notification Flowchart. (**Figure 2-2)**
- Re-notify authorities, designated personnel, and external response partners as Response Level is changed

Step 3: Emergency Actions

Sequence of Tasks:

- Perform emergency actions with goal of saving the impoundments/ponds and minimizing impacts to life, property, and environment.**(Table 2-3)**
- Take continuous actions to include situation assessment, information sharing, remediation, and public safety advisories or warnings, as warranted.
- Revise emergency actions as changes in conditions warrant.

Step 4: Follow-up

Sequence of Tasks:

- Document conditions and decisions in the Emergency Incident Log.
- Notify authorities, designated personnel, and external response partners that condition is stabilized; limit incident termination declarations to conditions at the site.
- Conduct and document after-action review of incident and response.

Figure 2-2. Notification Flowchart

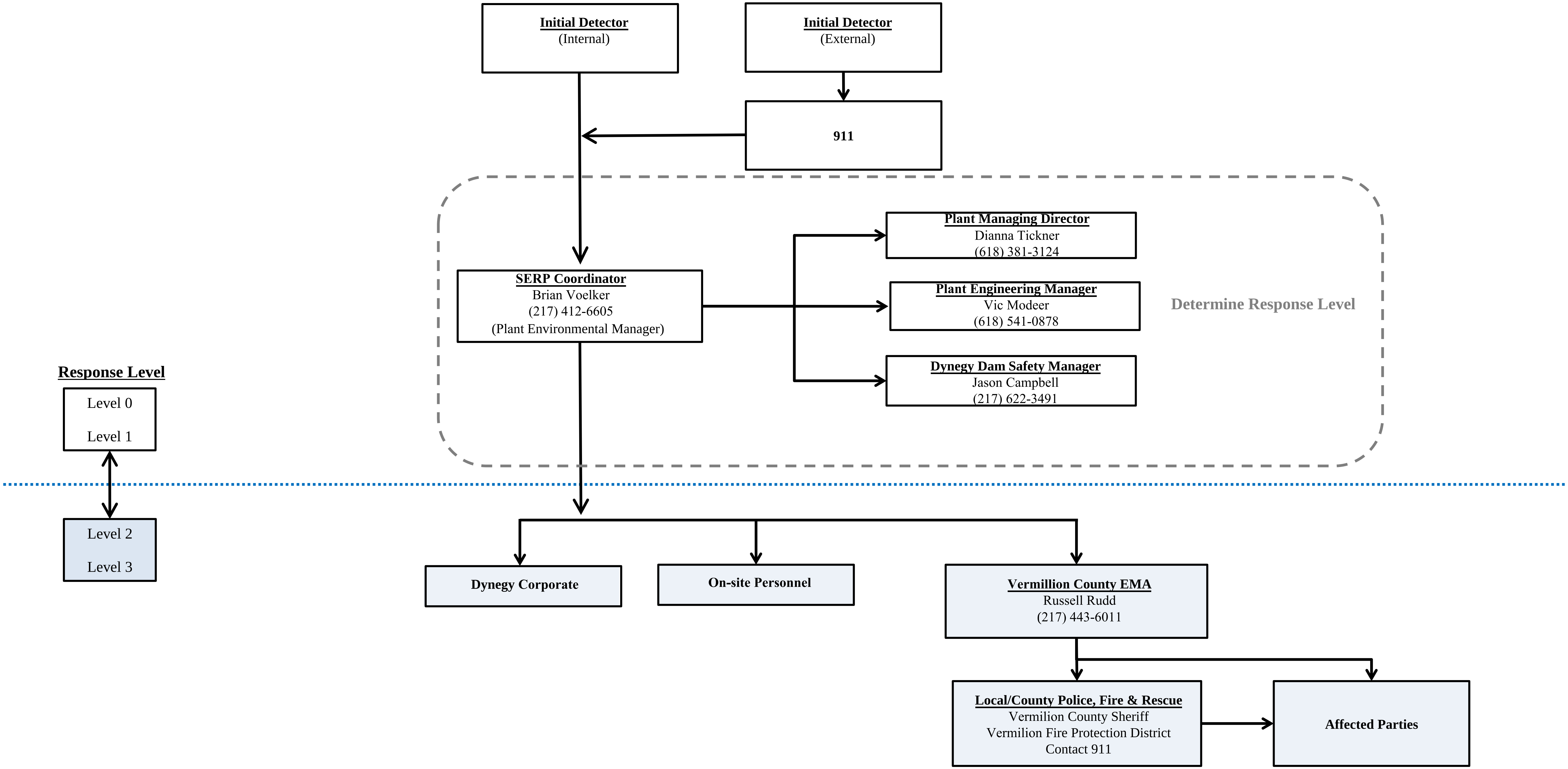
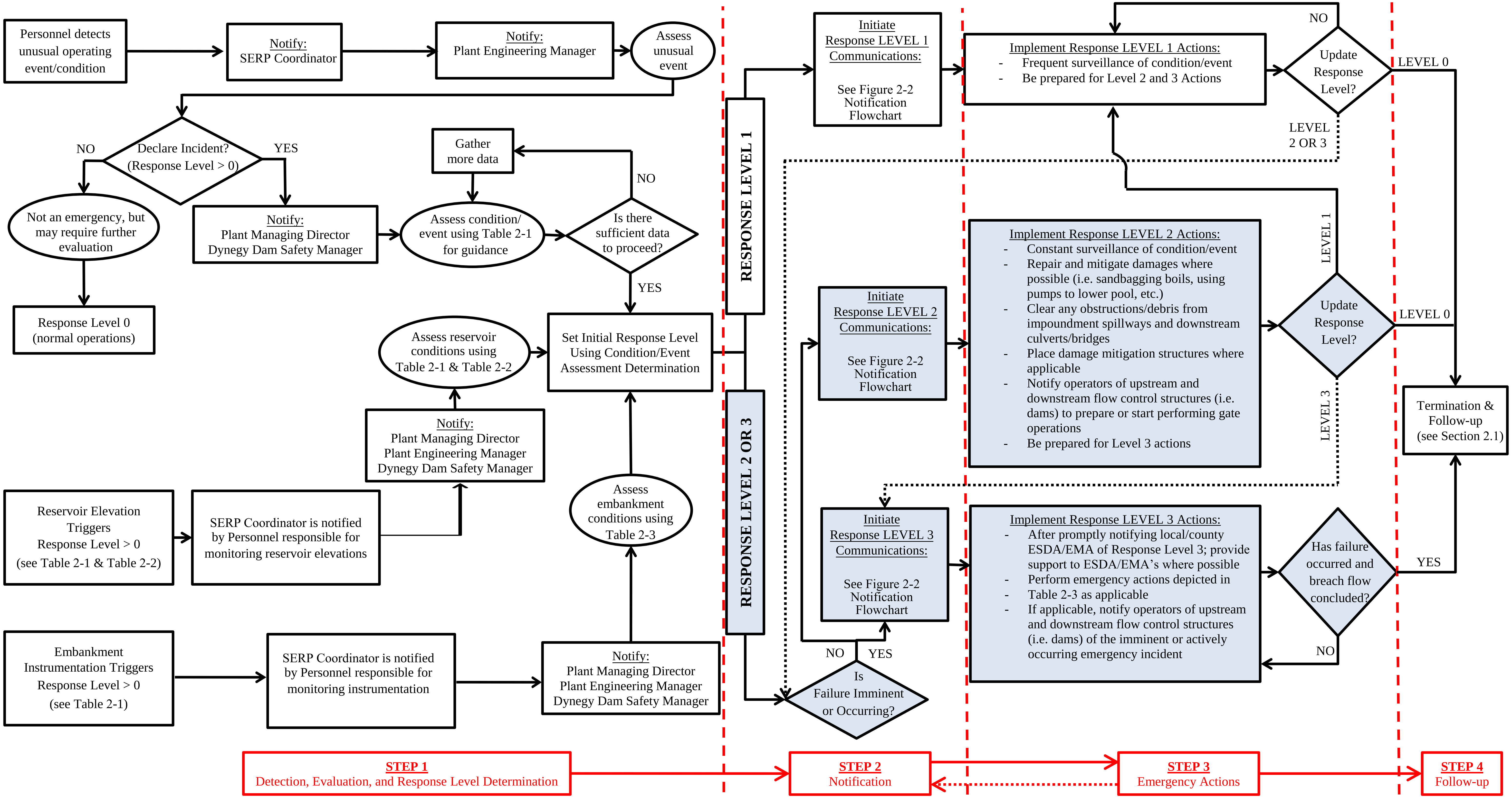


Figure 2-3. SERP Response Process Decision Tree

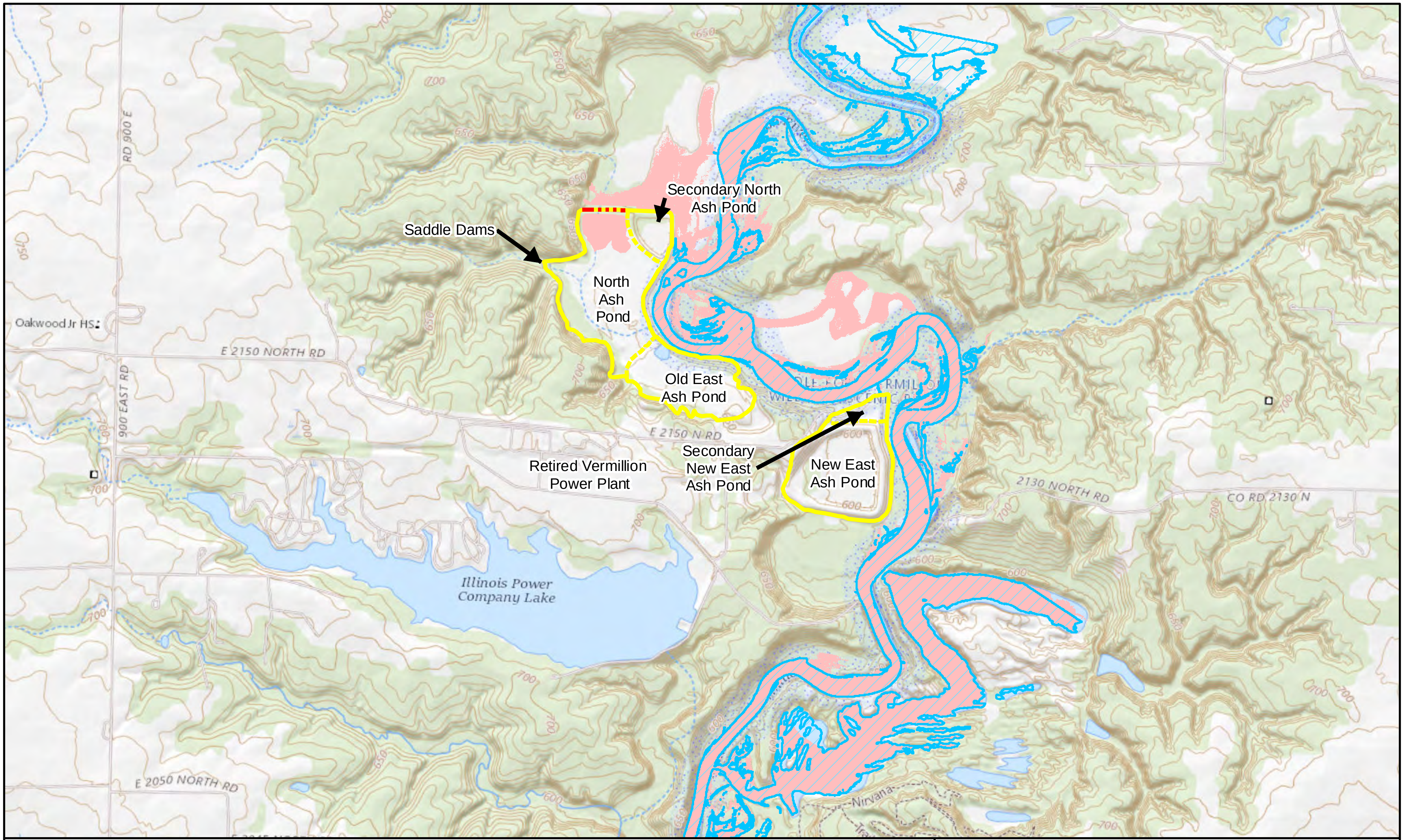
Note: At any given below, if failure is imminent or actively occurring **CALL 911 IMMEDIATELY** to notify emergency responders and then continue with process afterwards.



Implement Response LEVEL 1 Actions:
- Frequent surveillance of condition/event
- Be prepared for Level 2 and 3 Actions

Implement Response LEVEL 2 Actions:
- Constant surveillance of condition/event
- Repair and mitigate damages where possible (i.e. sandbagging boils, using pumps to lower pool, etc.)
- Clear any obstructions/debris from impoundment spillways and downstream culverts/bridges
- Place damage mitigation structures where applicable
- Notify operators of upstream and downstream flow control structures (i.e. dams) to prepare or start performing gate operations
- Be prepared for Level 3 actions

Implement Response LEVEL 3 Actions:
- After promptly notifying local/county ESDA/EMA of Response Level 3; provide support to ESDA/EMA's where possible
- Perform emergency actions depicted in Table 2-3 as applicable
- If applicable, notify operators of upstream and downstream flow control structures (i.e. dams) of the imminent or actively occurring emergency incident



Legend

🟨 Ash Pond

🟥 NAP Breach Extent

▨ Middle Fork Vermilion River Full-Bank Flow

- - - Breach Location

N

0 400 800 1,600 Feet

NAP Inundation Map
Vermilion River Full-Bank Flow

Safety Emergency Response Plan
Former Vermilion Power Plant

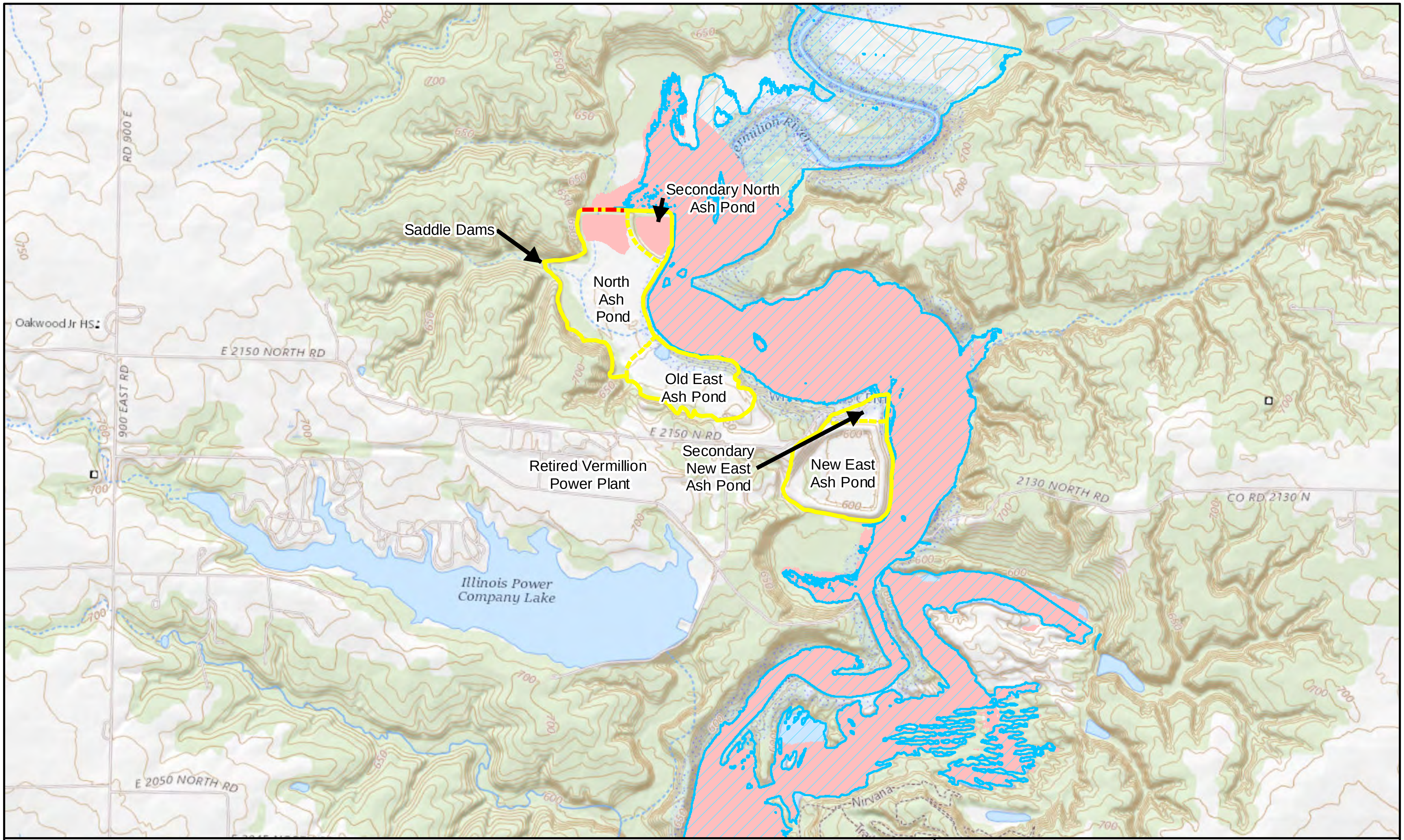
Geosyntec
consultants

CHE8404A-02/04

August 2021

Figure

2-4a



Legend

☐ Ash Pond

🟥 NAP Breach Extent

▨ Middle Fork Vermilion River 100-year Flood Flow

-·- Breach Location

N

0 400 800 1,600 Feet

NAP Inundation Map

Vermilion River 100-year Flood Flow

Safety Emergency Response Plan
Former Vermilion Power Plant

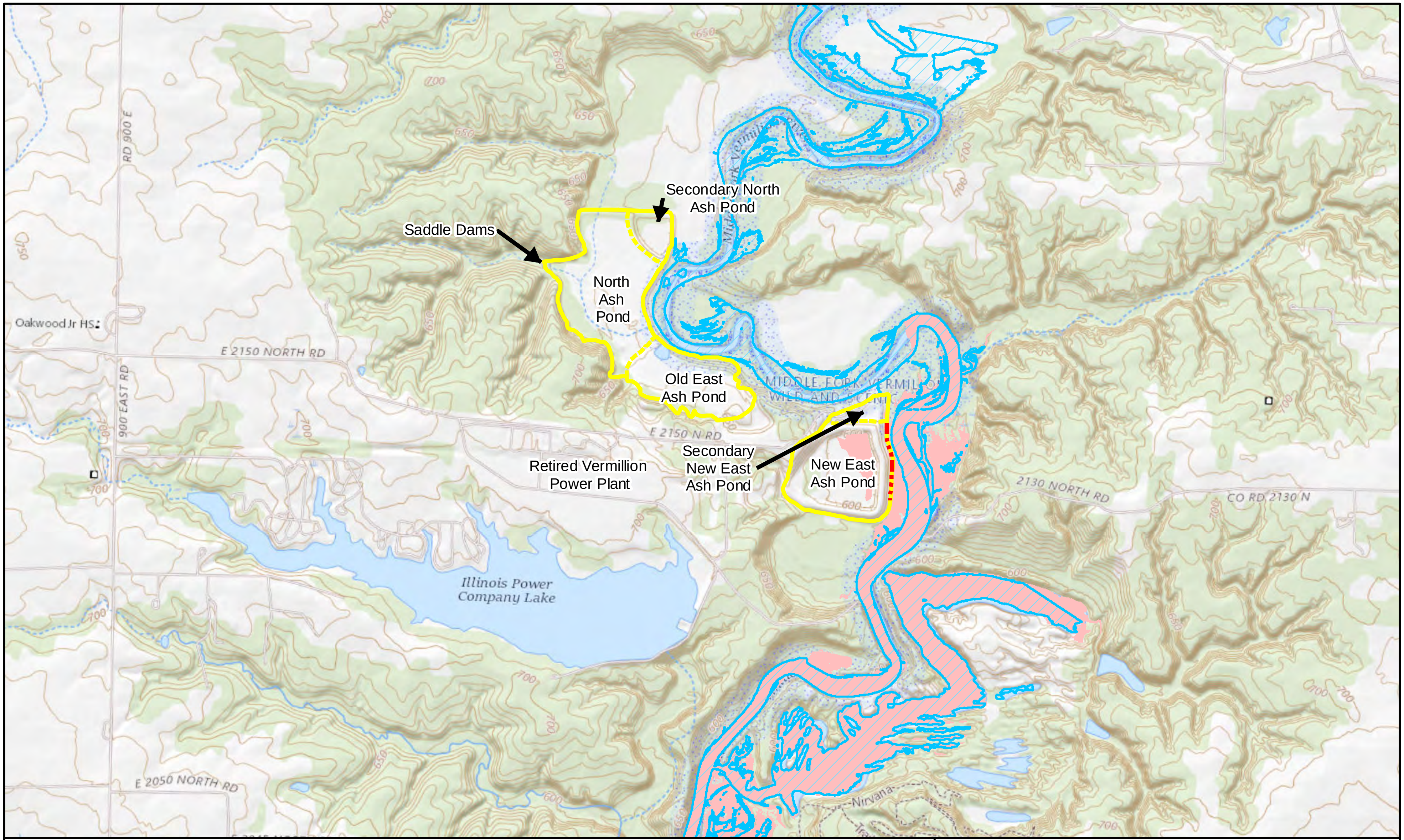
Geosyntec
consultants

CHE8404A-02/04

August 2021

Figure

2-4b



Legend

- ☐ Ash Pond
- 🟥 NEAP Breach Extent
- ▨ Middle Fork Vermilion River Full-Bank Flow
- ---- Breach Location

N

0 400 800 1,600 Feet

NEAP Inundation Map
Vermilion River Full-Bank Flow

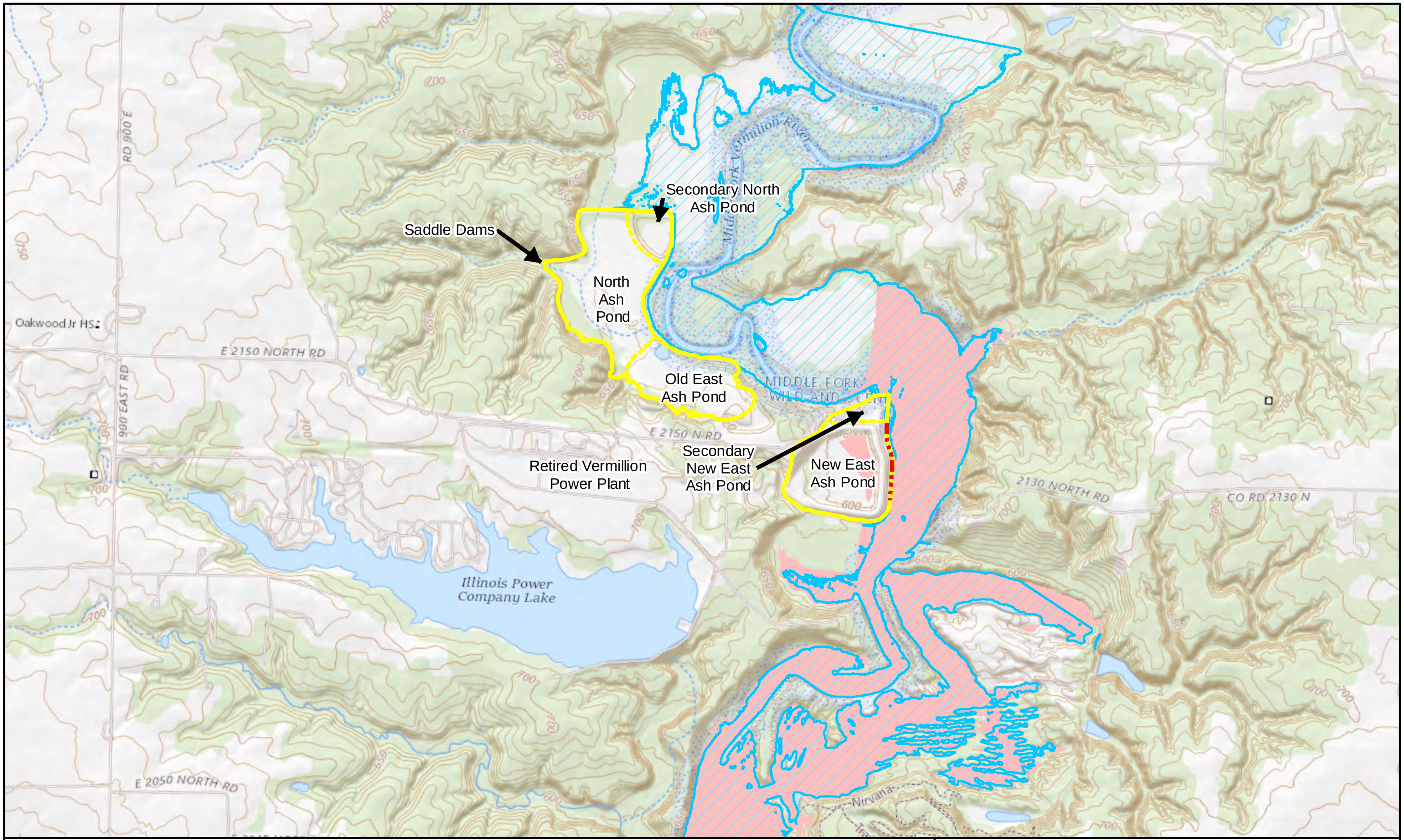
Safety Emergency Response Plan
Former Vermilion Power Plant

Geosyntec consultants

CHE8404A-02/04 | August 2021

Figure

2-5a



Legend

☐ Ash Pond

🟥 NEAP Breach Extent

▨ Middle Fork Vermilion River 100-year Flood Flow

┅ Breach Location

N

0 400 800 1,600 Feet

NEAP Inundation Map

Vermilion River 100-year Flood Flow

Safety Emergency Response Plan
Former Vermilion Power Plant

Geosyntec consultants

CHE8404A-02/04

August 2021

Figure

2-5b

ATTACHMENT M

Fugitive Dust Control Plan (845.500)

Prepared for

Dynegy Midwest Generation, LLC
1500 Eastport Plaza Drive
Collinsville, Illinois 62234

CCR FUGITIVE DUST CONTROL PLAN

VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Prepared by

Geosyntec
consultants

engineers | scientists | innovators

134 N. Lasalle Street, Suite 300
Chicago, Illinois 60602

Project Number CHE8404A

October 2021

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1. INTRODUCTION

Dynegy Midwest Generation, LLC (Dynegy) is the owner of the inactive coal-fired Vermilion Power Plant (VPP), also referred to as Vermilion Power Station, located approximately 13 miles Northwest of Danville, Illinois. The New East Ash Pond (NEAP) is an inactive surface impoundment storing coal combustion residuals (CCR). The requirements for the NEAP are found in 35 Ill. Admin. Code 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845).

This Fugitive Dust Control (FDC) Plan addresses the requirements of Part 845.500(b) for the North Ash Pond (NEAP).

1.1. Facility Information

Facility:	Vermilion Power Plant 10188 East 2150 North Rd Oakwood, IL 61858
Owner/Operator:	Dynegy Midwest Generation, LLC 1500 Eastport Plaza Drive Collinsville, IL 62234

2. CCR FUGITIVE DUST CONTROL MEASURES AND APPROPRIATENESS

> Section 845.500(b)(1): *The CCR fugitive dust control plan must identify and describe the CCR fugitive dust control measures the owner or operator will use to minimize CCR from becoming airborne at the facility. The owner or operator must select, and include in the CCR fugitive dust control plan, the CCR fugitive dust control measures that are most appropriate for site conditions, along with an explanation of how the measures selected are applicable and appropriate for site conditions. Examples of control measures that may be appropriate include: locating CCR inside an enclosure or partial enclosure; operating a water spray or fogging system; reducing fall distances at material drop points; using wind barriers, compaction, or vegetative covers; establishing and enforcing reduced vehicle speed limits; paving and sweeping roads; covering trucks transporting CCR; reducing or halting operations during high wind events; or applying a daily cover.*

CCR fugitive dust has the potential to become airborne at the facility during periods of CCR management that can cause CCR to be exposed in the CCR surface impoundment. Areas at the facility that have the potential for airborne CCR fugitive dust are limited to the surface impoundment.

This Section 2 identifies and describes the control measures selected and adopted by the facility to minimize CCR from becoming airborne at the facility and explains how the selected measures are applicable and appropriate for site conditions. The control measures may be adjusted or modified based on observed effectiveness of minimizing CCR from becoming airborne and weather conditions.

2.1. Management of CCR in the CCR Surface Impoundments

The facility manages CCR in a surface impoundment located at the facility. Table 2-1 identifies CCR fugitive dust control measures that have been selected for use by the facility during CCR management in the CCR surface impoundments and explains how the selected measures are applicable and appropriate for site conditions. The facility will use the identified measures during CCR management in the CCR surface impoundments to minimize CCR from becoming airborne at the facility. CCR management within the surface impoundments is minimal and only occurs during required maintenance.

Table 2-1. Control Measures for CCR Management in CCR Surface Impoundments

CCR Activity	CCR Fugitive Dust Control Measures	Applicability and Appropriateness of Control Measures
Management of CCR in the facility's CCR unit	Water dry CCR material disturbed during routine maintenance, as necessary.	Wetting CCR reduces the potential for CCR fugitive dust generation during handling of CCR during routine maintenance if handling is required.
	Water areas of exposed CCR in CCR surface impoundments, as necessary.	Water will be applied to areas of exposed CCR to maintain moisture content to minimize the potential for CCR fugitive dust generation in excessively dry or windy conditions.
	Allow naturally occurring grass vegetation to develop in areas of exposed CCR in CCR surface impoundments, as necessary.	Vegetation provides a wind screen and/or cover to reduce wind entrainment of CCR.
	Apply chemical dust suppressant on areas of exposed CCR in CCR surface impoundments, as necessary.	Mixing an appropriate chemical dust suppressant with water and applying to areas of exposed CCR will minimize the potential for CCR fugitive dust generation in excessively dry or windy conditions.

3. PROCEDURES TO LOG CITIZEN COMPLAINTS

> Section 845.500(b)(2): *The CCR fugitive dust control plan must include procedures to log every complaint from members of the public received by the owner or operator involving CCR fugitive dust events at the facility. The owner or operator must:*
>
> > *A) Include for each logged complaint the date of the complaint, the date of the incident, the name and contact information of the complainant, if given, and all actions taken to assess and resolve the complaint; and*
> >
> > *B) Submit quarterly reports to the Agency no later than 14 days from the end of the quarter of all complaints received in that quarter, including the information required by subsection (b)(2)(A).*

In the event the owner or operator of the facility receives a citizen complaint involving a CCR fugitive dust event at the facility, relevant information about the compliant will be logged. Information that will be recorded includes, as applicable:

- Date/Time the complaint is received
- Date/Time and duration of the CCR fugitive dust event
- Description of the nature of the CCR fugitive dust event
- Name of the citizen entering the complaint (if provided)
- Address & phone number of citizen entering the complaint (if provided)
- Name of the personnel who took the complaint
- All actions taken to assess and resolve the complant.

All citizen complaints involving CCR fugitive dust events at the facility will be investigated promptly. As deemed appropriate or necessary, corrective measures will be taken and a follow-up response will be provided to the complainant. Quarterly reports will be submitted to IEPA in accordance with Section 845.500(b)(2)(B).

4. PROCEDURES FOR PERIODIC ASSESSMENT OF THE PLAN

> Section 845.500(b)(3): *The CCR fugitive dust control plan must include a description of the procedures the owner or operator will follow to periodically assess the effectiveness of the control plan.*

The facility conducts inspections associated with CCR fugitive dust control. The facility also uses the procedures identified in Section 3 of this plan to log citizen complaints involving CCR fugitive dust events at the facility. These inspections and the investigations of citizen complaints will be used to periodically assess the effectiveness of the CCR fugitive dust control plan.

When a CCR fugitive dust event is observed or a citizen complaint involving a CCR fugitive dust event at the facility is received, current CCR management practices will be reviewed to see that the selected control measures are being properly implemented. If the control measures are not being properly implemented, relevant operating personnel will be notified and, as warranted, re-trained in the proper implementation of CCR fugitive dust control measures. If appropriate, use of revised and/or additional control measures will be evaluated. As warranted, revised and/or additional control measures found to be applicable and appropriate to control CCR fugitive dust emissions will be incorporated into an amended CCR FDC Plan.

The plan also will be reassessed in the event of material changes in site conditions potentially resulting in CCR fugitive dust becoming airborne at the facility.

5. INITIAL PLAN & AMENDMENTS

> Section 845.500(b)(4): *The owner or operator of a CCR surface impoundment must prepare an initial CCR fugitive dust control plan for the facility by October 31, 2021, or by initial receipt of CCR in any CCR surface impoundment at the facility if the owner or operator becomes subject to this Part after October 31, 2021.*

The initial CCR fugitive dust control plan will be submitted by October 31, 2021.

> Section 845.500(b)(5): *Amendment of the Plan. The owner or operator of a CCR surface impoundment subject to the requirements may amend the written CCR fugitive dust control plan at any time provided the revised plan is submitted to the Agency. The owner or operator must amend the written plan whenever there is a change in conditions that would substantially affect the written plan in effect, such as the construction and operation of a new CCR surface impoundment.*

The written CCR FDC Plan may be amended at any time provided the revised plan is placed in the facility's operating record as required by Section 845.800(d)(7). The written CCR fugitive dust control plan must be amended whenever there is a change in conditions that would substantially affect the written plan in effect as required by Section 845.500(b)(5).

Table 5-1. CCR Fugitive Dust Control Plan Amendments

Amendment Number and Date	Pages or Section	Description of Amendment	Professional Engineer Certifying Plan
Version 0 October 2021	NA	Initial Plan	John Seymour, PE

6. RECORDKEEPING

> <u>Section 845.500(b)(6):</u> *The owner or operator must place the initial and any amendments to the fugitive dust control plan in the facility's operating record as required by Section 845.800(d)(7). The most recent fugitive dust control plan must be placed in the facility's operating record and available on the owner's or operator's CCR website before submitting a permit application under this Part.*

The written CCR FDC Plan, any amendment of the written plan, and the annual CCR fugitive dust control report required by Section 845.500(c) will be placed in the facility's written operating record as required by Section 845.800(d)(7).

7. CERTIFICATION

CCR Unit: Dynegy Midwest Generation, LLC; Vermilion Power Plant, New East Ash Pond

I, John Seymour, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify in accordance with Section 845.500(b)(7), to the best of my knowledge, information, and belief, that the information contained in this plan has been prepared in accordance with the accepted practice of engineering and meets the requirements of Section 845.500(b).

John Seymour
Printed Name

John Seymour 10/22/2021
Signature Date

062.040562 Illinois 30 November 2021
Registration Number State Expiration Date

JOHN P. SEYMOUR
062-040562

Affix Seal

ATTACHMENT N

Hydrogeologic Site Characterization (845.620)

Intended for
Dynegy Midwest Generation, LLC

Date
October 25, 2021

Project No.
1940100722

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT

NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT VERMILION POWER PLANT NEW EAST ASH POND

Project Name	**Vermilion Power Plant New East Ash Pond**
Project No.	**1940100722**
Recipient	**Dynegy Midwest Generation, LLC**
Document Type	**Hydrogeologic Site Characterization Report**
Revision	**FINAL**
Date	**October 25, 2021**

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Senior Managing Engineer

Brian G. Hennings, PG
Managing Hydrogeologist

Jake J. Walczak, PG
Senior Hydrogeologist

Eric D. Plante
Geologist

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TABLES (IN TEXT)

TABLES (ATTACHED)

FIGURES (IN TEXT)

FIGURES (ATTACHED)

APPENDICES

ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
§	Section
2003 Report	Kelron Environmental, Inc., November 30, 2003. Regional and Local Hydrogeology and Geochemistry, Vermilion Power Plant, Illinois. Volumes 1 and 2.
35 I.A.C.	Title 35 of the Illinois Administrative Code
40 C.F.R.	Title 40 of the Code of Federal Regulations
BCU	Bedrock Confining Unit
bgs	below ground surface
CAP	Corrective Action Plan
CCR	coal combustion residuals
cm/s	centimeters per second
Company Lake	Illinois Power Company Lake
CSM	conceptual site model
DMG	Dynegy Midwest Generation, LLC
ESRI	Environmental Systems Research Institute
FEMA	Federal Emergency Management Agency
ft/day	feet/day
ft/ft	feet per feet
g	horizontal acceleration
GIS	Geographic Information System
GMP	Groundwater Monitoring Plan
GWPS	Groundwater Protection Standard
HCR	Hydrogeologic Site Characterization Report
HUC	Hydrologic Unit Code
ID	identification
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
ILMINES	Illinois Mines
ILOIL	Illinois Oil and Gas Resources
ISAS	Illinois State Archaeological Survey
ISGS	Illinois State Geological Survey
ISWS	Illinois State Water Survey
Kelron	Kelron Environmental, Inc.
Mathes	John Mathes & Associates, Inc.
mg/L	milligrams per liter
Middle Fork	Middle Fork of the Vermilion River
msl	above mean sea level
NAP	North Ash Pond
NAVD88	North American Vertical Datum of 1988
NEAP	New East Ash Pond
NGVD29	National Geodetic Vertical Datum of 1929
NID	National Inventory of Dams

No.	number
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRT	Natural Resource Technology, Inc.
OEAP	Old East Ash Pond
Part 845	Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845
pCi/L	picocuries per liter
PMP	Potential Migration Pathway
Ramboll	Ramboll Americas Engineering Solutions, Inc.
SI	surface impoundment
SSURGO	Soil Survey Geographic
SU	standard units
TDS	total dissolved solids
TU	tritium units
UCU	Upper Confining Unit
USDI	United States Department of the Interior
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VPP	Former Vermilion Power Plant

EXECUTIVE SUMMARY

This Hydrogeologic Site Characterization Report (HCR) for the New East Ash Pond (NEAP) expands upon the hydrogeology, groundwater quality data, and conceptual site model (CSM) in the 2003 Regional and Local Hydrogeology and Geochemistry Report prepared for the NEAP (Kelron Environmental, Inc, [Kelron], 2003). This report has been assembled to satisfy the information and analysis requirements of Title 35 of the Illinois Administrative Code (35 I.A.C.) Section (§) 845.620 as summarized in **Table ES-1**. The CSM includes hydrogeologic and groundwater quality data specific to the NEAP, which has been collected between 1987 and 2021. The NEAP is part of the Former Vermilion Power Plant (VPP) which is located four miles northeast of the Village of Oakwood in Vermilion County (**Figure 1-1**).

The VPP property is situated in a predominantly agricultural area. The VPP is bound by fallow fields owned by the Illinois Department of Natural Resources (IDNR) to the north, the Middle Fork of the Vermilion River (Middle Fork) to the east, the Kickapoo State Recreation Area to the south, and steep bluffs that include the Orchid Hill National Heritage Landmark to the west. The Orchid Hill National Heritage Landmark is partially within the VPP's property boundary but is administered by IDNR. Three coal combustion residuals (CCR) Units are present on the VPP property including the North Ash Pond (NAP; Vistra identification [ID] number [No.] 910, Illinois Environmental Protection Agency [IEPA] ID No. W1838000002-01), Old East Ash Pond (OEAP; Vistra ID No. 911, IEPA ID No. W1838000002-03), and the NEAP (Vistra ID No. 912, IEPA ID No. W1838000002-04, and National Inventory of Dams (NID) No. IL50291). The three units are inactive with plans for closure by removal at the NEAP.

The NEAP was constructed with berms containing a low-permeable clay core keyed into shale, which is greater than 80 feet thick in the vicinity of the ash ponds, providing separation between CCR materials contained within the NEAP and any potential aquifers. In addition to the CCR present in the NEAP, there are three different types of unlithified material present above the bedrock, which were categorized into hydrostratigraphic units in this report as follows:

- **Upper Unit**: includes mixed alluvial deposits of the Cahokia Alluvium described as sand with occasional layers of silty clay. The alluvial sand is generally a fine to medium sand that contains silts, clays, and gravels in varying amounts. This unit is present outside of the NEAP and in the bottomlands of the Middle Fork.
- **Upper Confining Unit (UCU)**: consists predominantly of low permeability silty and clayey diamictons (glacial till) of the Wedron Formation with intermittent sand layers and lenses. This unit is present outside of the NEAP and along the western bluff of the Middle Fork.
- **Bedrock Confining Unit (BCU)**: lowermost unit identified at the site and underlies all unlithified deposits. This unit occurs within Pennsylvanian shale which is the uppermost lithified unit at the Site.

None of the hydrostratigraphic units described above have been identified as an aquifer; however, the Upper Unit and BCU have been identified as potential migration pathways (PMPs). As determined by the geologic information provided, groundwater quality standards for the monitoring well network screened in the PMP Upper Unit (alluvial deposits) and BCU (shale bedrock) within the bottomlands along the Middle Fork and in the vicinity of the coal mined area are Class IV - Other Groundwater (35 I.A.C. § 620.440 (a) and (c)) standards.

Groundwater flow direction and gradients toward the Middle Fork have not changed significantly since the hydrogeologic study of the NEAP was completed in 2003, and recent data supports the existing CSM.

Part 845 parameters were monitored in the Upper Unit and BCU PMP monitoring wells at the NEAP as part of previous groundwater quality investigations. These data were supplemented with installation and sampling of additional locations installed in 2021. The results indicate that the following parameters were greater than the applicable 35 I.A.C. § 845.600(a)(1) groundwater protection standards (GWPSs):

- Arsenic, boron, chloride, chromium, cobalt, lead, lithium, sulfate, TDS, thallium, and radium 226 and 228 combined are considered potential exceedances of the Part 845 GWPS. Cobalt, pH, and sulfate were also detected at a concentration greater than the GWPS in the upgradient background UCU well 10. The downgradient wells of the Upper Unit and BCU are influenced by former coal mine areas. Results for these parameters were compared directly to GWPS, without an evaluation of background concentrations or application of statistical methods.

Concentration results for the above parameters were compared directly to 35 I.A.C. § 845.600(a)(1) GWPS to determine potential exceedances. Potential exceedances include results reported during the background groundwater monitoring or prior period that are greater than the GWPS. The results are considered potential exceedances because the results were compared directly to the standard and did not include an evaluation of background groundwater quality the statistical methodologies proposed in the groundwater monitoring plan (GMP) provided in the Operating Permit application. Exceedances will be determined following IEPA approval of the GMP.

TABLE ES-1. PART 845 REQUIREMENTS CHECKLIST
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Part 845 Reference	Part 845 Components	Location of Information in HCR
845.620(b)	**The hydrogeologic site characterization shall include but not be limited to the following:**	--
845.620(b)(1)	Geologic well logs/boring logs;	Table 3-1 Figure 3-1 Appendix B
845.620(b)(2)	Climatic aspects of the site, including seasonal and temporal fluctuations in groundwater flow;	Sections 3.2.2 & 3.3.1 Figures 3-2 to 3-5
845.620(b)(3)	Identification of nearby surface water bodies and drinking water intakes;	Sections 3.3.2 & 5.2 Appendix A
845.620(b)(4)	Identification of nearby pumping wells and associated uses of the groundwater;	Section 5.1 Appendix A
845.620(b)(5)	Identification of nearby dedicated nature preserves;	Section 5.3 Appendix A
845.620(b)(6)	Geologic setting;	Section 2 Figures 2-1 to 2-5
845.620(b)(7)	Structural characteristics;	Section 2.4.3 Figure 2-6
845.620(b)(8)	Geologic cross-sections;	Figures 2-9 through 2-11
845.620(b)(9)	Soil characteristics;	Section 2.3 Figure 2-3

TABLE ES-1. PART 845 REQUIREMENTS CHECKLIST
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Part 845 Reference	Part 845 Components	Location of Information in HCR
845.620(b)(10)	Identification of confining layers;	Section 3.2.1
845.620(b)(11)	Identification of potential migration pathways;	Section 3.2.3
845.620(b)(12)	Groundwater quality data;	Section 4.2 Table 4-1
845.620(b)(13)	Vertical and horizontal extent of the geologic layers to a minimum depth of 100 feet below land surface, including lithology and stratigraphy;	Section 2.5 Figures 2-9 to 2-11
845.620(b)(14)	A map displaying any known underground mines beneath a CCR surface impoundment;	Section 2.4.5 Appendix A
845.620(b)(15)	Chemical and physical properties of the geologic layers to a minimum depth of 100 feet below land surface;	Section 2.5 Tables 2-1, 2-2, & 2-4 Appendices B & C
845.620(b)(16)	Hydraulic characteristics of the geologic layers identified as migration pathways and geologic layers that limit migration, including:	Sections 3.2.1, 3.2.3 & 3.2.3 Tables 3-2 to 3-4 Appendices C & D
845.620(b)(16)(A)	water table depth;	Section 3.2.2 Figures 3-3 to 3-5
845.620(b)(16)(B)	hydraulic conductivities;	Section 3.2.5 Table 3-3 Appendix F
845.620(b)(16)(C)	effective and total porosities;	Sections 2.5 & 3.1 Table 2-1

TABLE ES-1. PART 845 REQUIREMENTS CHECKLIST

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Part 845 Reference	Part 845 Components	Location of Information in HCR
845.620(b)(16)(D)	direction and velocity of groundwater flow; and	Sections 3.2.2, 3.2.3 & 3.2.4 Tables 3-2 & 3-4 Figures 3-3 to 3-5
845.620(b)(16)(E)	map of the potentiometric surface;	Figures 3-2 to 3-5
845.620(b)(17)	Groundwater classification pursuant to 35 I.A.C. § 620; and	Section 3.2.7

[O: EDP 08/06/21, U: LDC 08/19/21, C: EDP 08/20/21]

Notes:

35 I.A.C. § 620 = Title 35 of the Illinois Administrative Code, Part 620
HCR = Hydrogeologic Characterization Report
-- = reference to main regulation

1 INTRODUCTION

1.1 Overview

In accordance with requirements of the Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: 35 I.A.C. § 845 (Part 845) (IEPA, April 15, 2021), Ramboll Americas Engineering Solutions, Inc. (Ramboll) has prepared this HCR on behalf of the VPP (**Figure 1-1**), operated by Dynegy Midwest Generation, LLC (DMG). This report will apply specifically to the CCR Unit referred to as the NEAP. However, information gathered to evaluate other CCR units at the VPP regarding geology, hydrogeology, and groundwater quality is included, where appropriate. The 29-acre NEAP is an inactive, unlined CCR surface impoundment (SI) constructed overtop a thick shale formation using berms constructed with a low permeability clay core keyed into the underlying shale formation. The SI was used to manage CCR and non-CCR waste streams and to clarify process water prior to discharge in accordance with the plant's National Pollutant Discharge Elimination System (NPDES) permit (IL0004057) at the VPP. This HCR includes Part 845 content requirements specific to 35 I.A.C. § 845.620(b) (Hydrogeologic Site Characterization) for the NEAP at the VPP.

1.2 Part 845 Description

Part 845 contains comprehensive rules for the design, construction, operation, corrective action, closure, and post closure care of SIs containing CCR. CCR is commonly referred to as coal ash, and CCR SIs are commonly referred to as coal ash ponds. This rule includes GWPSs applicable to each CCR SI at the waste boundary and requires each owner or operator to monitor groundwater. IEPA's rule includes a permitting program as well as all federal standards for CCR SIs promulgated by the United States Environmental Protection Agency (USEPA). In addition, the rules include procedures for public participation, closure alternatives analyses, and closure prioritization, and provides access to records via public website. The rules also include financial assurance requirements for CCR SIs.

A checklist summarizing the specific requirements of 35 I.A.C. § 845.620 is included in **Table ES-1**. The table provides references to sections, tables, and figures included in this document to locate the information that meets specific requirements of 35 I.A.C. § 845.620.

1.3 Previous Investigations and Reports

Several hydrogeologic investigations have been performed concerning the CCR Units located at the VPP. The information presented in this HCR includes data collected in support of the monitoring well network established for development of the GMP and supplements comprehensive data collection and evaluations from prior hydrogeologic investigation reports (recent to oldest), including, but not limited to, the following:

- ***Kelron, March 15, 2012. Hydrogeology and Groundwater Quality of the North Ash Pond System, Dynegy Midwest Generation, Inc., Vermilion Power Station, Oakwood, Illinois.***
  A hydrogeologic investigation report prepared to provide background information needed to develop a Corrective Action Plan (CAP) for the NAP and OEAP at the VPP. The primary objective of the report was to present the result of the investigation of the hydrogeology and groundwater quality in the vicinity of the NAP and OEAP.

- ***Kelron, March 15, 2012. Hydrogeology and Groundwater Quality of the Old East Ash Pond, Dynegy Midwest Generation, Inc., Vermilion Power Station, Oakwood, Illinois***
  A hydrogeologic investigation report prepared to provide background information needed to develop a CAP for the NAP and OEAP at the VPP. The primary objective of the report was to present the result of the investigation of the hydrogeology and groundwater quality in the vicinity of the NAP and OEAP.
- ***Natural Resource Technology, Inc. (NRT) and Kelron, June 15, 2009. Water Well Survey, Dynegy Midwest Generation, Inc., Vermilion Power Station, Oakwood, Illinois.***
  A water well survey was performed in accordance with the "Right to Know" Potable Water Well Survey procedures of 35 I.A.C. § 1600.210(b)(1) and 35 I.A.C. § 1600.210(b)(2). The purpose of the survey was to identify water wells located within 2,500 feet of DMG's VPP property boundary.
- ***Kelron, November 30, 2003. Regional and Local Hydrogeology and Geochemistry, Vermilion Power Plant, Illinois. Volumes 1 and 2.***
  A comprehensive regional and local hydrogeologic and geochemical report, hereinafter referred to as the 2003 Report, to characterize the site, specifically in the vicinity of the NEAP, and support a planned expansion of the primary cell of the NEAP.
- ***John Mathes & Associates, Inc. (Mathes), July 13, 1987. Hydrogeologic Investigation of Existing Ash Disposal Ponds, Vermilion Power Plant, Illinois Power Company, Oakwood, Illinois.***
  A hydrogeological report to obtain information concerning subsurface conditions at the site to make recommendations concerning location and construction of the new ash pond system for the VPP.

A GMP is being prepared for the NEAP in conjunction with this report.

1.4 Site Location and Background

The NEAP is located in east central Illinois in Vermilion County, approximately five miles northeast of the Village of Oakwood, located within the east half of the northeast quarter of the southeast quarter of Section 20, Township 20 North, Range 12 West (**Figure 1-1**). The VPP is an approximately 982-acre property consisting of 19 parcels, including a retired coal-fired power plant and SIs. The VPP ceased operations in 2011 when the power plant was retired.

The NEAP lies in the bottomlands of the Middle Fork and is bordered to the west by bluffs; to the south by unimproved DMG land; and to the north and east by the Middle Fork. **Figure 1-2** depicts the location of the inactive NEAP.

1.5 Site History and CCR Units

All ash ponds at the VPP are out of service. The present-day NEAP system consists of the NEAP (29-acres) and a secondary pond (**Figure 1-2**). When the NEAP was active, the ash in the NEAP settled out of the sluice water, was decanted to the secondary pond, and then discharged to the Middle Fork in accordance with the effluent limits and monitoring requirements of the VPP's NPDES permit. The NPDES-permitted outfalls to the Middle Fork are still in effect.

The OEAP, located northwest of the NEAP, was built as part of the original plant construction and put into service in the mid-1950's. The OEAP continued in operation until the NAP, located north of the OEAP, was constructed and put on-line in the mid-1970’s. The 41-acre NAP is an expansion of the 21.3-acre OEAP. The southern end of the NAP overlies the northern end of the OEAP. The NAP was utilized for sluiced coal ash disposal from the mid-1970’s to 1989-1990, at which time all ash disposal was diverted to the NEAP.

The original East Ash Pond (1989 pond footprint) was constructed in 1989 and expanded in 2002 to form the present-day NEAP (**Figure 1-2**). The 1989 pond footprint was built overtop a thick shale formation which is greater than 80 feet thick in the vicinity of the ash ponds. The alluvial deposits overlying the shale formation were excavated within the berms of the 1989 pond footprint so that the shale surface was exposed. The earthen berms on the north, east, and south sides of the 1989 pond footprint were constructed with a low-permeable clay core and were keyed into the underlying shale formation with cutoff walls. The cutoff walls extended in depth to the underlying shale and above the shale surface into the low-permeable clay core of the earthen berms. A natural earthen bluff composed of low-permeability native clays formed the west side of the 1989 pond footprint.

New berms were constructed to expand the capacity of the 1989 pond footprint in 2002, forming the footprint of the present-day NEAP (**Figure 1-2**). The new berms raised the height of the original berms and were constructed with clay liners keyed into the underlying clay core. A cutoff trench backfilled with low permeability fill was placed along the western side slope of the enlarged NEAP. The low-permeable materials surrounding the footprint of the present-day NEAP form the existing containment system. The secondary pond was not expanded or modified as part of the 2002 NEAP expansion.

The approximate dates of construction of VPP CCR Units, are summarized in **Table A** below.

Table A. History of Construction and Operation

Date	Event
mid-1950’s	Construction of OEAP
mid-1970’s	Construction of NAP; CCR disposal to OEAP ceased
1989-1990	Construction of original East Ash Pond (1989 pond footprint), CCR disposal at NAP ceased
2002	Embankment raised to expand the capacity of the East Ash Pond (1989 pond footprint) in 2002, forming the footprint of the present-day NEAP, and expansion of NEAP.
2011	CCR disposal to NEAP ceased

2 REGIONAL AND SITE GEOLOGY

Historic NEAP hydrogeologic and groundwater quality data was presented in the 2003 Report (Kelron, 2003) to establish a CSM. Significant portions of the results of the 2003 Report are included in this HCR, along with supplemental information (including information sourced from previous investigations and reports identified in **Section 1.3** of this HCR) and updated as needed to satisfy the content requirements specific to 35 I.A.C. § 845.620(b).

2.1 Topography

Topography in the vicinity of the NEAP (**Figure 2-1**) ranges from approximately 580 feet North American Vertical Datum 1988 (NAVD88) along the Middle Fork east of the Site to approximately 660 feet NAVD88 in the upland area to the northwest. The uplands are fairly uniform in elevation. They generally occur between the elevations of 650 and 720 feet NAVD88 in the vicinity of the VPP (Kelron, 2003). For purposes of this report, the slopes at elevations of approximately 600 to 650 feet NAVD88 between the uplands and bottomlands are also considered upland areas. The lowland areas along the Middle Fork lie between elevations of 580 and 600 feet above mean sea level (msl).

Prior to the construction of the ponds, the existing surface topography within the bottomlands was relatively flat with elevations ranging from 580 to 600 feet msl at the NEAP and 600 to 650 feet msl along the natural earthen bluff forming the west side of the NEAP embankment (**Figure 2-2**) with drainage toward the Middle Fork (Kelron, 2003).

2.2 Regional Geomorphology

The VPP is located within Vermilion County, which has an area of about 577,030 acres or 901 square miles (Natural Resources Conservation Service [NRCS], 2009). The physiographic division in the region of the VPP is the Bloomington Ridged Plain Section of the Central Lowland Province. The Bloomington Ridged Plain includes most of the Wisconsinan Stage moraines and is characterized by low, broad morainic ridges with intervening stretches of relatively flat or gently rolling ground moraine. Drainage is generally in the initial stages of development, and most streams follow, and are eroding, in constructional depressions, many of which cross morainic ridges. The valleys of principal streams are large and have floodplains bordered by valley-train terraces (NRT, 2017).

2.3 Soils

Surficial soils at the NEAP are shown on **Figure 2-3** and based on Vermilion County soil survey data available in the Soil Survey Geographic (SSURGO) database by the United States Department of Agriculture's NRCS provided by Environmental Systems Research Institute (ESRI) web hosted layer. Soils adjacent to the NEAP include Shaffton loam (0 to 2 percent slopes) along the east berm and in the bottomlands areas along the Middle Fork; Landes loam (0 to 2 percent slopes) along the south central area of the NEAP; and Ozaukee silt loam (30 to 70 percent slopes) and Blount silt loam (2 to 4 percent slopes) along the west berm of the NEAP and the boundary between the bottomlands and upland bluffs.

2.4 Regional Geology

2.4.1 Regional Unlithified Geology

The unlithified deposits covering the bedrock in the region surrounding the VPP are derived from recent river deposition (alluvial sediments) in the river valleys and glacial drift deposits occurring below the alluvial sediments and in the upland areas. The glacial and interglacial geologic events that shaped the topography seen today occurred during the Pleistocene Epoch, about 2 million to 12,000 years ago. Thickness of these deposits in the region range from zero thickness along portions of the Middle Fork where bedrock is exposed to over 200 feet in the upland areas (Piskin and Bergstrom, 1975).

At least three major glaciations (pre-Illinoisan, Illinoisan, and Wisconsin) are known to have entered the east-central Illinois region (Selkregg and Kempton, 1958). Each glaciation was followed by an interglacial period in which the climate warmed and the ice front moved back. The surficial features seen in the upland areas are part of the Gifford Moraine, which was formed during the Woodfordian Substage of the Wisconsinan Stage of glaciation (Willman and Frye, 1970).

Based on stack-unit maps of geologic materials to a depth of 15 meters (49.3 feet) prepared by Berg and Kempton (1988), the bottomlands adjacent to the Middle Fork are characterized by the following downward sequence of unlithified deposits:

- Less than 6 meters (19.7 feet) of Cahokia Alluvium (*i.e.,* alluvial sediments deposited by streams and rivers).
- Less than 6 meters of Henry Formation deposits of Wisconsinan age, which consist of glacial outwash dominated by sand and gravel.
- Less than 6 meters of Glasford Formation deposits of Illinoisan age, which consist of silty and clayey diamictons.

Diamicton is unsorted, non-stratified sediment with a wide range of particle sizes (*i.e.,* clay, silt, sand, gravel, cobbles, and boulders). When diamicton is due to glacial deposition it is known as till. The diamictons in the vicinity of the Site are till deposits characterized by a clay matrix containing variable percentages of silt, sand, gravel, cobbles, and boulders.

The unlithified deposits of the upland areas bordering the Middle Fork are characterized by the following downward sequence:

- Greater than 6 meters (19.7 feet) of Wedron Formation deposits of Wisconsinan age, which consist of silty and clayey diamictons.
- Less than 6 meters of Glasford Formation silty and clayey diamictons (Berg and Kempton, 1988).

Unlithified deposits greater than 15 meters (49.3 feet) below ground surface (bgs) are not identified in the stack-unit maps; however, based on published literature the Glasford Formation deposits, the unlithified deposits either extend to the top of bedrock or are underlain by the Banner Formation of pre-Illinoisan age (*i.e.,* greater than 500,000 years of age). The Banner Formation, which consists of till and intercalated outwash where present, is draped over the bedrock surface and is generally deepest where the bedrock is deepest.

The surficial geologic deposits in the vicinity of the NEAP are shown on **Figure 2-4** and a generalized stratigraphic column is shown on **Figure 2-5**.

2.4.2 Regional Bedrock Geology

The VPP and vicinity are located on the northeast flank of the Illinois Basin. The bedrock strata are of Pennsylvanian age and dip gently southwestward toward the center of the Basin. The Site lies approximately 3 miles west of the central axis of the Danville Bedrock Valley, which is oriented northwest to southeast and midway between the Middle Fork and North Fork of the Vermilion River (Selkregg and Kempton, 1958). Regionally, the Pennsylvanian bedrock consists of mainly shale with thin limestone, sandstone, and coal beds (Selkregg and Kempton, 1958). The bedrock surface elevation in the vicinity of the Site is between 500 and 600 feet National Geodetic Vertical Datum of 1929 (NGVD29) (Willman et al., 1967). The rocks were originally deposited as unlithified sediments in coastal marshes or in shallow seas that repeatedly formed in the area. The shale was originally deposited as clay, while coal was formed from plants buried in the coastal swamps. Sandstone was deposited as sand and the limestone was formed by precipitation of carbonates and by accumulation of seashells on the sea floor (Selkregg and Kempton, 1958).

After the Pennsylvanian sediments were deposited, the seas retreated, and the upper part of the bedrock was deeply eroded. During the Pleistocene epoch, continental glaciers advanced from the north and overrode the eroded bedrock surface (Selkregg and Kempton, 1958), leaving the glacial deposits that mantle the area today.

The principal formations within the Pennsylvanian bedrock in the region are, from upper to lower, the Bond, Shelburn, and Carbondale Formations. In the vicinity of the VPP, the principal formation is the Shelburn, which contains a major coal seam mined in the region, the Danville (No. 7) Coal. Based on the 2003 investigation of the hydrogeology in the vicinity of the NEAP at the VPP, the upper zone of the shale is moderately weathered at the surface at most locations (Kelron, 2003). Otherwise, the shale is massive with very few horizontal joints or partings. Some near vertical joints were observed near the surface but were typically irregular and closed.

2.4.3 Structure

The major geologic structural features around Illinois are shown on **Figure 2-6.** The VPP is located within a relatively stable region of the continent on the east flank of the Illinois Basin. Rock units to the west of the VPP form the La Salle Anticlinorium where folds are expressed in synclines, anticlines, arches, and monoclines present in the area (Nelson, 1993; Nelson, 1995) and can change local dip and strike of bedrock units (Nelson, 1995). Rock units to the south of the VPP form the Marshal-Sidell Syncline, a north-trending depression between the La Salle Anticlinorium and the east flank of the Illinois Basin (Nelson, 1995). The syncline is expressed by relatively steep irregular dips west of the syncline and gentle dips to the east of the syncline (Nelson, 1995).

2.4.4 Seismic Setting

Seismic impact zone is defined by Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257.53 as an area having a 2 percent or greater probability that the maximum expected horizontal acceleration (g), expressed as a percentage of the earth's gravitational pull, will exceed 0.10 g in 50 years. The 2014 United States Geological Survey (USGS) Hazard Map for the CCR Unit indicates that the maximum expected horizontal acceleration for 2 percent probability of exceedance in 50 years is between 0.06 g and 0.1 g. In addition, the 2018 USGS National

Seismic Hazard Map also describes the project's region as an area with the "low risk level" of seismic hazard (Geosyntec, 2021).

2.4.5 Mining Activities

Mining in the vicinity of the NEAP was discussed in detail as presented in Kelron 2003. A comprehensive search was performed utilizing the Illinois State Geological Survey's (ISGS) Illinois Mines (ILMINES) Map[1] for mining activities within a 1,000-meter radius of the NEAP (**Appendix A**). With the exception of the Harmattan Mine (ISGS Index No. 0673) which is an abandoned surface mine located approximately 740 feet southeast of the NEAP, all mines within a 1,000-meter radius of the NEAP were identified as underground (subsurface) mines (**Figure A-1**). The Harmattan Mine operated between 1949 and 1970 at depths between 70 to 102 feet bgs to mine a coal seam thickness ranging from approximately 5 to 7 feet. The following abandoned subsurface mines were also identified in this survey:

- Crawford Mine (ISGS Index No. 3889): underlies most of the NEAP. The former entrance to the Crawford Mine, owned by W.F. Crawford & Sons, was located in the field (Kelron, 2003) (**Figure A-2**). The Crawford Mine is a slope mine with the main coal seam (Danville [No. 7] Coal) located between the depths of 80 and 92 feet bgs. The average thickness of the main coal seam is approximately 5.5 feet (Kelron, 2003). The mine entrance and extent were field verified as discussed in Kelron 2003 and presented on **Figure A-2**, which provides more detailed site specific data that is not reflected in ILMINES Map provided in **Figure A-1**.
- Middle Fork No. 2 Mine (ISGS Index No. 3888): A Middle Fork Coal Company mine, located approximately 75 feet south of the NEAP. The Middle Fork No. 2 Mine operated from 1939 to 1948 using a room-pillar method whereby the coal is removed in 'rooms' with 'pillars' of coal left in place to support the roof (Kelron, 2003), removing approximately 7,633 tons of coal during operation.
- Pilot Mine (ISGS Index No. 3890): located approximately 520 feet south of the NEAP. The Pilot Mine was owned by Swisher Mine and was a main drift mine with the main coal seam (Danville [No. 7] Coal) mined between 1884 and 1888 at depths between 89 and 95 feet bgs, with an average thickness of 5.5 to 6.0 feet (ISGS, 2007).
- Bonnett Mine (ISGS Index No. 3891): located approximately 1,610 feet south of the NEAP. The Bonnett Mine is a main shaft mine with the main coal seam (Danville [No. 7] Coal) mined between 1888 and 1907 at depths between 86 and 100 feet bgs, with thicknesses averaging between 5.33 and 6.0 feet (ISGS, 2007).
- Homer Fletcher Mine (ISGS Index No. 6534): located approximately 1,590 feet southwest of the NEAP. The Homer Fletcher Mine is a main slope mine with the main coal seam (Danville [No. 7] Coal) mined between 1933 and 1937 (ISGS, 2007).
- Calvert Mine (ISGS Index No. 3893): located approximately 1,380 feet south of the NEAP. The Calvert mine is a slope mine with the main coal seam (Danville [No. 7] Coal) mined at a depth of approximately 70 feet bgs, with a thickness averaging 6 feet (ISGS, 2007).

The presence of coal mining activities beneath portions of the NEAP has been documented based on exploratory borings, geophysics, and historic data acquired from the ISGS. To varying degrees, these mining activities have altered the natural topography, hydrology, surface water

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[1] ISGS ILMINES Map: https://prairie-research.maps.arcgis.com/apps/webappviewer/index.html?id=e38e9769e1c04ec29e41dd5ba1c59bd7

chemistry, and groundwater chemistry that existed in the area before mining began (Kelron, 2003).

A comprehensive search was also performed utilizing ISGS's Illinois Oil and Gas Resources (ILOIL) Map[2] to identify oil and gas wells within a 1,000-meter radius around the NEAP. Based on records obtained from ILOIL, there are no oil or gas wells located within a 1,000-meter radius of the NEAP property.

2.5 Site Geology

A field investigation was performed in 2021 to collect additional data for the discussion of vertical and horizontal lithology, stratigraphy, chemical properties, and physical properties of geologic layers to a minimum of 100 feet bgs as specified in 35 I.A.C. § 845.620(b). Field investigation locations are shown on **Figure 2-7**.

2.5.1 Site Specific Unlithified Geology

Including the fill and CCR within the NEAP, there are three principal types of unlithified deposits present above the bedrock in the vicinity of the NEAP: fill and CCR (CCR consisting primarily of fly ash with lesser amounts of bottom ash and slag); mixed alluvial deposits of the Cahokia Alluvium (composed primarily of sand with occasional layers of silty clay); and the Upper Till Unit (Wedron Formation till, including diamicton, consisting of clay and silty clay with occasional sand lenses). Available geotechnical data collected during the 2021 field investigation is summarized in **Table 2-1**. Descriptions of the fill and CCR, mixed deposits of Cahokia Alluvium, and Upper Till Unit are summarized below.

2.5.1.1 Fill and CCR

The CCR contained within the NEAP consist predominantly of fly ash with lesser amounts of bottom ash and slag. Average and median thickness of CCR measured within the NEAP are 27 and 24 feet, respectively, based on comparisons between the topographic surface (**Figure 2-1**) within the NEAP and an approximate base of ash surface provided by Geosyntec (**Figure 2-8**). Two borings (NED1 and NED2) were drilled in the CCR and completed with leachate wells. Borings NED1 and NED2 did not encounter the base of ash within the NEAP; however, ash was at a minimum 15.5 and 15 feet thick, respectively (**Appendix B**). The maximum thickness of CCR is approximately 39 feet in the NEAP along the west portion of the NEAP along the upland bluff area based on comparisons between the topographic (**Figure 2-1**) and approximate base of ash surface (**Figure 2-8**).

The elevation at the top of the fill layer estimated from the topographic surface (**Figure 2-1**) within the limits of the NEAP (**Figure 2-8**) is highest towards the west portion of the NEAP along the upland bluff area at 651 feet NGVD29. The fill layer elevation declines towards the northeast area of the NEAP to its lowest measured elevation of 594 feet NGVD29, where ponded NEAP water lies above the fill layer. The average slope of the fill layer within the NEAP is from west to east at approximately 0.02 feet per foot (ft/ft).

The elevation at the base of the fill layer, which corresponds to the elevation at the top of the Upper Till Unit deposits (upland bluff areas) and/or the top of bedrock (bottomlands of the Middle Fork), ranges from 615 to 642 feet NGVD29 based on the approximate base of ash surface

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[2] ISGS ILOIL Map: https://prairie-research.maps.arcgis.com/apps/webappviewer/index.html?id=af7f150b9ec348d3860b1d225bffb035

(**Figure 2-8**). These elevations correlate with land surface elevations presented on USGS topographic maps prepared in 1948 prior to ash management (**Figure 2-2**).

The lateral extent of CCR within the NEAP provided in the base of ash surface (**Figure 2-8**) indicate the CCR material approximates the CCR unit boundaries as shown in **Figure 1-2**, where CCR are bound by the NEAP berms to the north, east, and south, and the bluffs to the west.

Leachate well NED1 was sampled in 2021. The results of leachate (porewater) samples collected from within the NEAP are summarized in **Table 2-2**.

2.5.1.2 Mixed Deposits of the Cahokia Alluvium

The mixed deposits of the Cahokia Alluvium in the vicinity of the NEAP are composed primarily of sand with occasional layers of silty clay. The alluvial sand is generally a fine to medium sand that contains silts, clays, and gravels in varying amounts. The alluvial sand in some areas may be overlain by silty to sandy clay (Kelron, 2003). The alluvial deposits are present within the bottomlands of the Middle Fork between the elevations of 587 and 595 feet NGVD29, where the highest observations were generally located near the uplands and the lowest elevations were located near the Middle Fork. The alluvial deposits in the vicinity of the NEAP and within the bottomlands of the Middle Fork generally range in thickness from 10 to 25 feet. Thickness of the alluvial deposits immediately adjacent to the Middle Fork is generally 10 to 15 feet. In places where the unlithified deposits within the bottomlands of the Middle Fork become thicker, the alluvial deposits may be underlain by glacial deposits consisting of outwash sand and gravel or diamictons (Kelron, 2003). Along the western bluffs of the Middle Fork valley, the layer’s alluvial deposits rest unconformably against the Upper Till Unit.

Cross-sections developed as part of this HCR are provided in **Figure 2-9** through **Figure 2-11** and include data from previous investigations as well as data collected in 2021 to further define the vertical and horizontal lithology, and stratigraphy in the vicinity of the NEAP. The lateral and vertical extent of the mixed deposits of the Cahokia Alluvium as presented in **Figure 2-9** through **Figure 2-11** are consistent with observations from the 2003 Report (Kelron, 2003).

Geotechnical samples were collected as part of the 2021 investigation to characterize the mixed deposits of the Cahokia Alluvium. The Cahokia Alluvium in the NEAP was classified as silty sand to sand, with fines content ranging from approximately 5 to 40 percent. The Cahokia Alluvium is consistently dark brown to yellowish brown in color and has a moisture content of approximately 21 percent. Total porosity calculated from the measured geotechnical data ranges from 40 to 44 percent, with an average total porosity 42 percent. The geotechnical sample results are summarized in **Table 2-1** and the geotechnical laboratory reports are included in **Appendix C**.

Table 2-3 presents a summary of soil geochemical analytical data. Samples 70D (16-18) and 71D (9-11) were collected from the mixed deposits of the Cahokia Alluvium.

2.5.1.3 Upper Till Unit

This till layer, the Upper Till Unit, consists predominantly of silty and clayey diamictons of the Wedron Formation with intermittent sand layers and lenses (Kelron, 2012a; Kelron, 2012b). The Upper Till Unit has been identified as a brown to gray clay to silty clay with variable amounts of sand with sporadic lenses of silt and sand (Kelron, 2012a; Kelron, 2012b). The top of this layer represents the top of the glacial till across the Site, and is the most prevalent and laterally continuous fine-grained unlithified deposit within the uplands in the vicinity of the NEAP. In the upland areas the top of till is near ground surface (covered by topsoil).

The uppermost elevation of the Upper Till Unit in the vicinity of the NEAP is 664 feet NGVD29 and the lowermost elevation is below 552 feet NGVD29. In general, the alluvial deposits pinch out towards the uplands and are supplanted by glacial deposits (till) at higher topographic elevations (Kelron, 2003). West of the NEAP, the thickest Upper Till Unit materials range from 71 feet at Well MW22 to the north to 103 feet at boring B208 to the south (Kelron, 2003). Upper Till Unit materials are thickest (greater than 100 feet) where the shale bedrock decreases in elevation (Kelron, 2003).

Cross-sections developed as part of this HCR are provided in **Figure 2-9** through **Figure 2-11** and include data from previous investigations as well as data collected in 2021 to further define the vertical and horizontal lithology, and stratigraphy in the vicinity of the NEAP. The lateral and vertical extent of the Upper Till Unit as presented in **Figure 2-9** through **Figure 2-11** are consistent with observations from the 2003 Report (Kelron, 2003).

Geotechnical samples were collected as part of the 2021 investigation to characterize the Upper Till Unit in the vicinity of the VPP. Data collected from upland borings (101 through 105) located to the west of the NEAP within the Upper Till Unit is classified as mostly clay with variable sand-sized particles, but also as clayey sand, silty sand to sand classifications in four locations. The Upper Till Unit is consistently dark gray in color, and has a moisture content ranging from 9 to 25 percent. Total porosity calculated from the measured geotechnical data ranges from 21 to 43 percent, with an average total porosity of 31 percent. The geotechnical sample results are summarized in **Table 2-1** and the geotechnical laboratory reports are included in **Appendix C**.

Soil samples were collected from the Upper Till Unit and submitted for laboratory geochemical analysis. **Table 2-3** presents a summary of soil geochemical analytical data.

2.5.2 Site Specific Bedrock Geology

The lowermost layer, and only lithified geologic layer identified in borings at the Site, is the Pennsylvanian shale bedrock. The bedrock layer was intercepted by borings in both the uplands and bottomlands of the Middle Fork valley. The highest elevation at which the bedrock was intercepted in the vicinity of the NEAP was 593.4 feet NGVD29 in the upland boring B102, and the lowest elevation was 554.1 feet NGVD29 at boring B208. Generally, the top of the shale occurs within 10 to 25 feet of ground surface in the bottomlands of the Middle Fork in the vicinity of the NEAP, and rapidly increases in depth toward the western upland bordering the NEAP where the bedrock is overlain by the Upper Till Unit.

The upper 75 feet of bedrock at the site typically consists of Pennsylvanian Age Shelburn Formation, which is composed of non-marine and marine, silty and micaceous shales (Kelron, 2003). The Shelburn Formation contains a major coal seam mined in the region, the Danville (No. 7) Coal (Kelron, 2003). Descriptions of the bedrock and Danville (No. 7) Coal deposits are summarized below.

Based on geologic logs prepared by the ISGS, the shale has been described as medium to dark gray, massive and with blocky fracture. Some intervals have thin interbeds of light gray shale (Kelron, 2003). Abundant carbonized plant materials have been observed in non-marine shales, while fossils including brachiopods, gastropods, and bivalves have been observed in marine shales. The upper zone of the shale is often weathered and appears greenish-gray to bluish-gray (Kelron, 2003).

Based on the 2003 Report, the Danville (No. 7) Coal or mine features (including void remaining where the coal was removed through mining) were intercepted at eight locations in the vicinity of the NEAP (B201 through B208), although most borings advanced prior to 2003 did not penetrate deep enough into the bedrock to intercept the coal seam. The top of the Danville (No. 7) Coal was intercepted at depths of 80 to 102.5 feet bgs in the bottomlands of the Middle Fork adjacent to the NEAP. Greater boring depths were required to intercept the coal seam in the upland areas, where borings B203 and B208 intercepted the coal seam at depths of 127 and 152 feet bgs, respectively (Kelron, 2003). Based on data provided in the 2003 Report, the thickness of the coal seam ranged from 4 to 7 feet with an average thickness of 5.5 feet at borings B201 to B208. Elevations of the top of the Danville (No. 7) Coal at boring B201 to B208 ranged from 496.6 to 508.6 feet NGVD29, and elevations of the bottom of Danville (No. 7) Coal ranged from 491.3 to 504.6 feet NGVD29.

Cross-sections developed as part of this HCR are provided in **Figure 2-9** through **Figure 2-11** and include data between 2012 and 2021 to further define the vertical and horizontal lithology, and stratigraphy in the vicinity of the NEAP. The lateral and vertical extent of the bedrock layer as presented in **Figure 2-9** through **Figure 2-11** are consistent with observations from the previous hydrogeologic investigations described above.

Samples 70D (22-24) and 71D (12-14) were collected from the bedrock and submitted for laboratory geochemical analysis. **Table 2-3** presents a summary of soil geochemical analytical data.

3 REGIONAL AND LOCAL HYDROGEOLOGY

3.1 Regional Hydrogeology

3.1.1 Unlithified Deposits Hydrogeology

Alluvial deposits along the Middle Fork valley contain a wide variety of sediments ranging from clay to sand, gravel, and cobbles. The effective porosities for the types of sediments found in the vicinity of the VPP range from 20 to 35 percent for poorly sorted sand and gravel alluvial deposits to 10 to 20 percent for the diamictons found in the upland areas and in the deeper deposits within the Middle Fork valley (Fetter, 1980). Effective porosity, which is a measure of the pore space through which saturated flow can occur, typically ranges from 10 to 30 percent for poorly sorted sand and gravel deposits to 5 to 20 percent for diamictons (Walton, 1988).

Horizontal hydraulic conductivity for the alluvial deposits as measured by field tests can vary greatly depending on the percentage of fine-grained materials within those deposits. Deposits with materials ranging from sand to gravel typically have horizontal hydraulic conductivities ranging from 10^{-1} to 10^{-4} centimeters per second (cm/s). Silt, clay, and mixtures of sand, silt, and clay typically have values ranging from 10^{-4} to 10^{-7} cm/s (United States Department of the Interior [USDI], 1981; Fetter, 1980).

3.1.2 Bedrock Hydrogeology

The Pennsylvanian rocks, mainly shale with thin limestone, sandstone, and coal beds, found in the vicinity of the VPP generally have low porosity and hydraulic conductivity. The porosity of shale typically ranges from 1 to 20 percent (Walton, 1988). Representative horizontal field hydraulic conductivity for shale typically ranges from 5×10^{-6} to 5×10^{-10} cm/s. Representative aquitard field permeability ranges for shale, which is defined as the rate of vertical flow of water through a unit horizontal cross-sectional area of the aquitard, are 5×10^{-8} to 5×10^{-12} cm/s. In contrast to the low permeability of shale, coal deposits have horizontal permeability ranging from 5×10^{-2} to 5×10^{-5} cm/s (Walton, 1988).

The Pennsylvanian rocks in the region yield small amounts of water to wells from interconnected pores, cracks, fractures, crevices, joints, and bedding planes. Water-bearing openings are variable from location to location and are best developed near the surface in thin limestones and sandstones, when present, within the predominantly shale formation. Shallow sandstone and creviced limestone may yield small supplies in some areas, but water quality becomes poorer with increasing depth. The Pennsylvanian bedrock is not a reliable source of groundwater and the quality varies considerably. Small domestic supplies have been obtained from creviced limestone, permeable sandstone, or cracked shale and coal in the upper part of the bedrock (Selkregg and Kempton, 1958).

Water in the Pennsylvanian rocks becomes highly mineralized with increasing depth. Recharge to the Pennsylvanian rocks is derived locally from vertical leakage through the glacial drift and other unlithified materials that are in turn recharged from precipitation. Water occurs in these rocks mainly under artesian and leaky-artesian conditions (Csallany, 1966).

3.2 Site Hydrogeology

Prior to 2021, there were nine monitoring wells (10, 16A, 16B, 22, 23, 24, 25, 35S, 35D) around the NEAP for monitoring groundwater. Two piezometers (NED1 and NED2) were also completed within the pond. Six wells (26, 27, 28, 29, 30, and 31) were located on the north and east side of the Middle Fork that were abandoned or destroyed. Four monitoring wells (13A, 13B, 13BR, and 32) were abandoned or destroyed. In 2021, four monitoring wells (70S, 70D, 71S, and 71D) were installed around the perimeter of the NEAP to meet the requirements of Part 845. Wells 101S, 102S, 103S, 104S, and 105S were also completed in 2021 in the upland area west of the NEAP in the vicinity of the VPP. Construction details for monitoring wells and piezometers adjacent to the NEAP are provided in **Table 3-1**, and depicted on **Figure 2-7** and **Figure 3-1**. Boring logs, monitoring well, and piezometer construction forms are provided in **Appendix B**.

3.2.1 Hydrostratigraphic Units

Four distinct water-bearing units have been identified in the vicinity of the NEAP based on stratigraphic relationships and common hydrogeologic characteristics. The units are described as follows:

- **CCR Unit:** comprised predominantly of CCR (primarily fly ash, bottom ash, and boiler slag) within the fill and CCR material described in **Section 2.5.1.1**. This hydrostratigraphic unit is present within the NEAP and occurs within saturated materials. Fill materials are present at elevations ranging from 651 to 571 feet NAVD88. The base of this unit is the base of ash within the NEAP (**Figure 2-8**). Water levels (the phreatic surface) measured in piezometer NED1 within the CCR Unit indicate the phreatic surface is greater than the elevation of the water levels in the underlying bedrock layer (**Figures 3-2** through **3-4**; **Table 3-1**).
- **Upper Unit**: includes mixed alluvial deposits of the Cahokia Alluvium described in **Section 2.5.1.2** as sand with occasional layers of silty clay. The alluvial sand is generally a fine to medium sand that contains silts, clays, and gravels in varying amounts. The alluvial sand in some areas may be overlain by silty to sandy clay (Kelron, 2003). The alluvial deposits are present within the bottomlands of the Middle Fork between the elevations of 587 and 595 feet NGVD29, where the highest observations were generally located near the uplands and the lowest elevations were located near the Middle Fork. The Upper Unit is the uppermost native material present in the bottomlands of the Middle Fork. This unit may be absent beneath portions of the NEAP where it was excavated within the area of the 1989 pond footprint. Prior to construction of the East Ash Pond in 1989, groundwater in the alluvial deposits downgradient of the ash pond was typically encountered 5 to 6 feet bgs and discharged to the Middle Fork. According to the 2003 Report, groundwater levels were frequently measured at or near the base of the well screens of 13B and 16B following construction of the East Ash Pond in 1989, indicating the East Ash Pond (1989 pond footprint) was hydraulically isolated from both the shale and alluvial deposits, as designed. Alluvial deposit monitoring wells 16B and 35S have been dry during recent monitoring events, indicating the alluvial deposits continue to be hydraulically isolated from the ash pond. Groundwater elevation in the alluvial deposits typically conforms to the ground surface topography, and fluctuates in response to changes in river stage and variations in precipitation (Kelron, 2003).
- **UCU**: comprised of clay, silt, and minor amounts of sand lenses within the Upper Till Unit described in **Section 2.5.1.3**. Wells 101S, 102S, 103S, 104S, and 105S are screened within discontinuous sand lenses observed in the upland area west of the NEAP in the vicinity of the

VPP. These sand lenses are present at elevations above the pre-construction ground surface in the NEAP. These wells went dry during development and 103S did not contain enough water to sample, indicating that the lateral continuity and extent of these sand lenses is limited. Groundwater elevations in the vicinity of the NEAP are highest in Well 10, which is screened in the upland till located immediately west of the NEAP. The relatively high groundwater elevations observed at monitoring well 10 are consistent with the well's high topographic position when compared to wells located in the bottomlands of the Middle Fork (**Figures 3-2** through **3-4**; **Table 3-1**). Groundwater levels in these glacial deposits are consistently higher than those in the underlying shale, where groundwater elevations in till well 10 are consistently greater than shale well 22, indicating downward vertical gradients.

- **BCU**: the lowermost hydrostratigraphic unit identified at the Site and underlies all unlithified deposits. This unit occurs within Pennsylvanian shale bedrock described in **Section 2.5.2**, which is the uppermost lithified unit at the Site. As presented by Kelron (2003), groundwater in the shale flows into the overlying alluvium and enters directly into the Middle Fork in some locations. The potentiometric surface maps (**Figures 3-2** through **3-4**) indicated groundwater elevations in the shale are highest in the topographically highest areas to the west of the Middle Fork, while the lowest groundwater elevations occur at shale wells located adjacent to the Middle Fork. Potentiometric surface maps also indicate groundwater flow direction toward the Middle Fork, demonstrating that the Middle Fork is the receiving body for the shale. Deep shale well 32 was also reported to be flowing under artesian conditions during the investigation completed for the 2003 Report. According to the 2003 Report, high hydraulic heads and artesian groundwater flow conditions were also observed when the coal seam and overlying fractured shale in close proximity to the mined areas were intercepted at exploratory borings B201 and B202 (**Appendix Figure B-1**). In addition, hydrogen sulfide gas vented from the coal seam penetrated by borings B201 and B202 until they were sealed. Groundwater within the bedrock is at the end of its flow path as indicated by upward hydraulic gradients, high dissolved mineral content, and isotopic analysis indicating water is significantly older by 13,000 to 35,000 radiocarbon years before present than recent groundwater in the overlying unlithified deposits. In support of the Carbon-14 results, tritium concentrations for the same set of bedrock groundwater samples were all below detection limits ranging from 0.43 to 0.52 tritium units (TU). Water with non-detectable tritium concentrations at the time that study was completed in 2003 was considered to be greater than 50 years old. The isotopic and other geochemical data from background monitoring wells supports the CSM that the Middle Fork is a regional receiving body for groundwater discharge from bedrock (Kelron, 2003).

3.2.2 Uppermost Aquifer

None of the hydrostratigraphic units described in **Section 3.2.1** have been identified as an aquifer as defined by 35 I.A.C. § 610.110; however, the Upper Unit and BCU have been identified as PMPs as described below in **Section 3.2.3**. The NEAP was constructed with berms containing a low-permeable clay core keyed into shale, which is greater than 80 feet thick in the vicinity of the ash ponds providing separation between CCR materials contained within the NEAP and any potential aquifers. Groundwater monitoring wells screened in the alluvial deposits are frequently dry and continue to be hydraulically isolated from the ash pond. Further, as presented by Kelron (2003), groundwater in the shale is at the end of its flow path as it migrates upward into the overlying alluvium and directly into the Middle Fork in some locations, preventing downward migration of water in contact with CCR materials contained within the NEAP.

3.2.3 Potential Migration Pathways

The Upper Unit is a laterally continuous fine- to coarse-grained deposit within the bottomlands of the Middle Fork in the vicinity of the NEAP, with the exception of the areas excavated during construction of the East Ash Pond in the1989 pond footprint. These alluvial deposits lie unconformably on top of the underlying glacial till/or bedrock and terminate laterally along the western bluffs of the river valley where the deposits rest unconformably against the till that comprises the uplands. As described in **Section 3.2.1**, groundwater monitoring wells screened in the alluvial deposits are frequently dry and continue to be hydraulically isolated from the ash pond. Four monitoring wells (16B, 35S, 71S, and 70S) are screened in the Upper Unit adjacent to the NEAP to monitor this PMP.

The BCU is the lowermost unit identified at the site and the only laterally continuous hydrostratigraphic unit identified in both the bottomlands of the Middle Fork and uplands in the vicinity of the NEAP. As presented by Kelron (2003), groundwater in the shale is at the end of its flow path as it migrates upward into the overlying alluvium and directly into the Middle Fork in some locations. Five monitoring wells (22, 16A, 35D, 70D, and 71D) are screened in the BCU adjacent to the NEAP to monitor this PMP.

3.2.4 Water Table Elevation and Groundwater Flow

Groundwater elevations have been collected at variable frequencies and wells at the NEAP wells since the initial hydrogeologic study conducted by Mathes (1987) prior to 1989 construction of the East Ash Pond. Prior to groundwater elevation measurements collected during the 2021 field investigations, groundwater elevation data was collected quarterly (**Appendix D**) at the NEAP at BCU monitoring well locations 10, 16A, and 35D as part of another NEAP monitoring program (discussed in **Section 4.1** of this HCR). Groundwater flow in bedrock is represented using groundwater elevation contour maps for three 2021 sampling events (**Figures 3-2** through **3-4**) additional contour maps from 2018 are also provided in **Appendix D**.

The Upper Unit terminates on the west side of the NEAP along the upland bluff area (upgradient of the NEAP) and wells screened in the Upper Unit east of the NEAP (downgradient of the NEAP) are frequently dry; therefore, contour maps are not provided to illustrate flow within the Upper Unit PMP. Based on 2021 field investigation data, the groundwater elevation in wells surrounding the NEAP averaged 567.4 feet NAVD88 in the BCU from March to August 2021, where 71D was dry in five monitoring events from May to August 2021. Groundwater elevations averaged 576.97 feet NAVD88 in the Upper Unit from March to August 2021, where well 16B was dry in eight monitoring events from March to August 2021, and 35S was dry in five monitoring events from May to August 2021. Groundwater elevation in UCU well 10 averaged 609.36 feet NAVD88 from March to August 2021.

Uncharacteristically low water levels were also observed at BCU well 35D during initial 2021 field investigation monitoring. Review of the available data indicated that another NEAP monitoring program (discussed in **Section 4.1** of this HCR) had collected groundwater from well 35D prior to the water level being collected for the 2021 field investigations. The water level recorded by the other monitoring program recorded an elevation of 577.51 feet NAVD88, which is higher than the elevation of 549.33 feet NAVD88 recorded later that day. Since groundwater was sampled for multiple monitoring events within a short timeframe in March 2021, causing drawdown of water levels within well 35D, well 35D water levels likely did not fully recover to static before the next sampling event in April 2021[3]. The initial March 2021 groundwater elevation measured prior to sampling for the other NEAP monitoring program at 35D (577.51 feet NAVD88) is representative of static water levels and used for water level elevation and groundwater flow evaluations associated with 35D in March 2021.

Similarly, wells 70D and 71D were installed in 2021 in the BCU, where the hydraulic conductivity of the BCU is relatively low with a geometric mean of 7.09 x 10^{-6} centimeters per second (cm/s). Water levels at wells 70D and 71D did not likely equilibrate to static water levels following installation as a result of the low permeability of the shale and frequent sampling in order to acquire eight rounds of groundwater samples within a six-month period.

3.2.4.1 Vertical Hydraulic Gradient

Vertical hydraulic gradients were calculated using available groundwater elevation data in March 2021 through August 2021 at nested well locations within the UCU, Upper Unit, and BCU. Vertical hydraulic gradients for the NEAP are presented in **Table 3-2**. The results of the vertical hydraulic gradient calculations for these hydrostratigraphic units are summarized below:

- UCU to BCU:
  - Vertical gradients in well nest 10/22, located west of the NEAP in the upland bluff area, were consistently downward in 2021, with an average vertical gradient of 0.156 ft/ft.
- Upper Unit to BCU:
  - A Vertical gradient calculated in downgradient well nest 35S/35D in the northeast area of the NEAP and adjacent to the Middle Fork was upward in March 2021 (-0.140 ft/ft). Vertical hydraulic gradient could only be calculated in March 2021 using a groundwater elevation for 35D (577.51 feet NAVD88) collected as part of another NEAP monitoring program as described in **Section 3.2.4**. Groundwater elevation at 35D was either not static or well 35S was dry for the remaining 2021 field investigation monitoring events and vertical hydraulic gradient calculations could not be completed.

Unlike the bottomlands of the Middle Fork where groundwater within the shale is typically discharging upward into the alluvial deposits and the river, vertical groundwater movement in the uplands (comprised of glacial till) is downward. Groundwater levels in the glacial deposits are consistently higher than those in the underlying shale, as demonstrated with the calculated vertical hydraulic gradients at well nest 10/22 that have an average downward gradient of 0.156 ft/ft (**Table 3-2**). In 2021 groundwater elevations at UCU well 10 were greater than groundwater elevations at BCU well 22, which was consistent with observations at this well nest as reported by Kelron (2003).

In 2002, upward vertical gradients were also observed between the shale and alluvial deposits at all of the nested wells within the bottomlands of the Middle Fork during at least part of the monitoring period, with the exception of nested wells 23/24 (these evaluations included alluvial deposit and shale wells nests 13B/13A, 16B/16A, 23/24, 26/27, and 28/29). Nested wells

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[3] Note the initial groundwater elevation measurement at shale monitoring well 35D (installed in 2017 to replace well 13A) collected in March of 2017 was as low as 539.00 feet NAVD88 and near the well's bottom screen elevation of 536.77 feet NAVD88, and was attributed to slow recovery of water levels following well installation. All groundwater elevations collected at 35D since March 2017 have been greater than 565.18 feet NAVD88 (averaging 574.70 feet NAVD88), with the exception of the two 2021 field investigation groundwater elevations collected in March 2021 (549.33 feet NAVD88) and April 2021 (561.82 feet NAVD88). Groundwater elevations were greater than 570 feet NAVD88 in the subsequent 2021 field investigation monitoring events (May through July 2021).

16B/16A experienced upward vertical gradients in only one of the eight groundwater level monitoring events in 2002 and the overall eight-month average vertical gradient was downward. Groundwater elevations measured at BCU well 16A in 2021 ranged from 568.28 to 571.32 feet NAVD88, which were consistently greater than the elevation of the top of bedrock at location 16A (approximately 566 feet NGVD) indicating the presence of upward gradients in the bedrock. The greatest upward gradients were observed between shallow shale well 13A and nested deep shale well 32. Deep shale well 32 was also reported to be flowing under artesian conditions during the investigation completed for the 2003 Report. Note that well 35D (installed in March 2017) replaced well 13A, where the greatest upward gradients within the bedrock were observed and reported in the 2003 Report; it is expected that vertical gradients are upward at well nest 35S/35D under normal conditions (static conditions).

3.2.4.2 Impact of Existing Ponds

Water level elevations collected from NED1 indicate the phreatic surface is above the water levels observed in BCU and Upper Unit PMPs within the bottomlands of the Middle Fork; however, the groundwater elevation contours of the BCU (**Figures 3-2** through **3-4**) illustrate flow toward the Middle Fork with no observable radial component of flow outward along the perimeter of the NEAP. The absence of a radial component of flow indicates the NEAP does not significantly impact groundwater flow direction.

3.2.4.3 Ash Saturation

As reported in the 2003 Report, the groundwater surface is not affected by water levels in the East Ash Pond (1989 pond footprint), which has been hydraulically isolated from both the shale and alluvial deposits by soil/bentonite slurry walls and a compacted clay core. Changes in pond elevation also do not result in any corresponding changes in the shallow groundwater levels (Kelron, 2003). Saturated ash was present within the NEAP during the 2021 field investigation monitoring based on the presence of water within well NED1, which is screened within the CCR. As discussed above, the water within the NEAP is hydraulically isolated from surrounding groundwater; therefore, the thickness of saturated ash within the pond will vary with the level of water maintained in the pond. Water level measurements collected from NED1 in 2021 were compared to the estimated base of ash elevation in the vicinity of the boring and indicate approximately 10 feet of saturated ash in the NEAP.

3.2.4.4 Impact of River Stage on Groundwater Flow

Although a gaining stream through most of the year, there are periods of high precipitation during which surface water runoff (*i.e.,* overland flow) directly into the Middle Fork results in higher river elevations and the Middle Fork may temporarily become a losing stream, with surface water moving outward from the river into the adjacent groundwater units (Kelron, 2012a; Kelron, 2012b). Additional discussion of river elevations is provided in **Section 3.3.2** of this HCR. Groundwater elevations and contour maps from spring months, when reversals would be expected to occur, do not indicate flow inland from the river (**Figures 3-2** through **3-4**).

3.2.5 Hydraulic Conductivities

3.2.5.1 Field Hydraulic Conductivity

Field hydraulic conductivity tests performed on the CCR Unit, Upper Unit, UCU, and BCU materials at the Site were completed as part of the 2021 field investigation. Hydraulic conductivity test analyses and results are summarized in **Table 3-3** and provided in **Appendix E**.

Field hydraulic conductivity tests in well NED1 estimated the horizontal hydraulic conductivity of the CCR Unit at 2.4 x 10^{-3} cm/s.

Field hydraulic conductivity tests indicated that the horizontal hydraulic conductivity for the Upper Unit ranged from 7.4 x 10^{-4} to 1.1 x 10^{0} cm/s, with a geometric mean of 1.1 x 10^{-2} cm/s. Hydraulic conductivities of the alluvial deposits as determined by Mathes (1987) ranged from 1 x 10^{-3} to 7 x 10^{-3} cm/s. The calculated geometric mean of alluvial deposit hydraulic conductivities was 1.5 x 10^{-2} cm/s based on field hydraulic conductivity tests completed as part of the 2003 Report for monitoring wells 26 and 28, both located to the north on the east side of the Middle Fork. The calculated geometric mean hydraulic conductivity calculated based on field hydraulic conductivity tests conducted in 2021 are consistent with the previously reported values in the 2003 Report for alluvial deposits in the vicinity of the NEAP.

Field hydraulic conductivity tests in UCU well 10 estimated the horizontal hydraulic conductivity of the UCU at 8.8 x 10^{-6} cm/s.

Based on field hydraulic conductivity testing, the horizontal hydraulic conductivity for the BCU ranged from 1.1 x 10^{-6} to 2.3 x 10^{-5} cm/s, with a geometric mean of 7.1 x 10^{-6} cm/s. The horizontal hydraulic conductivity of the shale determined by Mathes (1987) from field permeability tests ranged from 4 x 10^{-10} to 1 x 10^{-8} cm/s, with a geometric mean of 4.3 x 10^{-9} cm/s. Results of field hydraulic conductivity tests conducted on shale wells as part of the investigation for the 2003 Report range from 1.5 x 10^{-7} to 1 x 10^{-4} cm/s, with a geometric mean of 3 x 10^{-6} cm/s. The range of horizontal hydraulic conductivities based on field hydraulic conductivity tests conducted in 2021 are consistent with the previously reported values in the 2003 Report for the shale bedrock in the vicinity of the NEAP.

3.2.5.2 Laboratory Hydraulic Conductivity

Nine samples were collected for laboratory vertical hydraulic conductivity analysis (ASTM D 5084) during the 2021 field investigations from the hydrostratigraphic units described in **Section 3.2.1** of this HCR. The results of the 2021 analyses are tabulated in **Table 2-1** and laboratory reports are provided in **Appendix C**. The results of the 2021 vertical hydraulic conductivity analysis for these hydrostratigraphic units are summarized below:

- Upper Unit
  - Two samples were collected from the Upper Unit (mixed deposits of the Cahokia Alluvium) at two locations (70S and 71S) in the vicinity of the NEAP as part of the 2021 field investigation and the resulting vertical hydraulic conductivities for the samples ranged from 5.2 x 10^{-4} to 1.3 x 10^{-3} cm/s.
- UCU
  - Eight samples were collected as part of the 2021 investigation to characterize the UCU (Upper Confining Unit) in the vicinity of the VPP. The resulting vertical hydraulic conductivities from upland borings (101 through 105) located to the west of the NEAP ranged from 1.6 x 10^{-8} to 8.2 x 10^{-5} cm/s with a geometric mean of approximately 6.2 x 10^{-7} cm/s.

- BCU
  - The vertical hydraulic conductivity calculated from tests performed in the laboratory on one shale core ranged from 1 x 10^{-8} to 5 x 10^{-8} cm/s (Kelron, 2003).

3.2.6 Horizontal Groundwater Gradients and Flow Velocity

The Middle Fork is the regional receiving body for both the BCU and overlying Upper Unit PMPs. Under normal conditions in the vicinity of the NEAP, groundwater generally flows from the west to east toward the Middle Fork (**Figures 3-2** through **3-4**) in both the BCU and Upper Unit PMPs. The potentiometric surface maps (**Figures 3-2** through **3-4**) indicate groundwater elevations in the shale are highest in the topographically highest areas to the west of the Middle Fork, while the lowest groundwater elevations occur at shale wells located adjacent to the Middle Fork. There is little seasonal variation in groundwater flow direction in the BCU as illustrated in **Figures 3-2** through **3-4**.

Horizontal hydraulic gradients calculated for the BCU between wells 22 and 16A from March through August 2021 range from 0.0213 to 0.0256 ft/ft (**Table 3-4**), and groundwater generally flows from west to east across the Site toward the Middle Fork. These gradients are consistent with previously reported gradients in the 2003 Report, where horizontal hydraulic gradients in the shallow shale ranged from 0.026 to 0.038 ft/ft towards the Middle Fork (Kelron, 2003). Based on data provided in **Table 3-4**, there is little seasonal variation of horizontal hydraulic gradients in the BCU.

Horizontal hydraulic gradients in the Upper Unit between 70S and 71S from March through August 2021 range from 0.0171 to 0.0214 ft/ft (**Table 3-4**) as groundwater generally flows from west to east across the Site toward the Middle Fork within the bottomlands of the Middle Fork and south of the NEAP (between Wells 70S and 71S). Based on data provided in **Table 3-4** there is little seasonal variation of horizontal hydraulic gradients in the Upper Unit.

3.2.6.1 Groundwater Velocity

Groundwater flow in the BCU and Upper Unit under normal flow conditions is generally from west to east across the Site (**Figure 3-2** through **3-4**) towards the Middle Fork. The average hydraulic conductivities between wells were used with other field and literature values for each hydrostratigraphic unit to calculate groundwater velocities (**Table 3-4**).

Groundwater flow velocities for the BCU between March and August 2021 range from 0.004 feet per day (ft/day) to 0.005 ft/day (**Table 3-4**), and groundwater generally flows from west to east across the Site toward the Middle Fork. Groundwater velocity reported in the 2003 Report in the shallow shale was slightly lower than what was observed in 2021 and approximated as 0.002 ft/day towards the Middle Fork (Kelron, 2003). The lower groundwater velocity as calculated in the 2003 Report is consistent with the lower average hydraulic conductivity for the shale bedrock used in the 2003 Report calculation (3 x 10^{-6} cm/s) when compared to the geometric mean hydraulic conductivity of 7.09 x 10^{-6} cm/s presented in **Table 3-4**. Based on data provided in **Table 3-4** there is little seasonal variation of groundwater flow velocities in the BCU.

Groundwater velocities in the Upper Unit between March and August 2021 range from 2.52 to 2.85 ft/day (**Table 3-4**), and groundwater generally flows from west to east across the Site toward the Middle Fork within the bottomlands of the Middle Fork and south of the NEAP (between Wells 70S and 71S). Based on data provided in **Table 3-4** there is little seasonal variation of groundwater flow velocities in the Upper Unit.

3.2.7 Groundwater Classification

The classification of groundwater at the NEAP has been evaluated and, based on the detailed geologic information provided in the 2003 Report, groundwater quality standards for the monitoring well network screened in the PMP Upper Unit (alluvial deposits) and BCU (shale bedrock) within the bottomlands along the Middle Fork and in the vicinity of the coal mined area are Class IV - Other Groundwater (35 IAC 620.440 (a) and (c)) standards.

Given the influence of former coal mines documented on the geochemistry of groundwater in the bedrock at the site, and based upon the influence of upward vertical gradients between the shale and alluvial deposits of the bottomlands along the Middle Fork, as well as influences from surficial mine spoils, the groundwater designation for the Upper Unit and BCU (alluvial deposit and shale wells [(*i.e.,* 16A, 16B, 22, 35D, 35S, 70S, 70D, 71S, and 71D]) is Class IV – Other Groundwater. Class IV groundwater is defined as groundwater within a previously mined area that cannot meet the standards of Class I or II groundwater.

3.3 Surface Water Hydrology

3.3.1 Climate

The climate at the VPP is characterized by four distinct seasons (summer, fall, winter, and spring) without prolonged periods of extreme cold, extreme heat, or high humidity. Precipitation is usually adequate through summer, although drought periods are not uncommon. Because of its latitude, the area can experience very abrupt temperature changes during all but the mid-summer season. Average monthly climatic data was obtained from the Illinois State Water Survey (ISWS). The data was recorded between 1981 and 2010 from Danville, Illinois, which is located approximately eight miles southeast of the VPP. The data includes monthly maximum and minimum temperatures (degrees Fahrenheit [°F]) and average rainfall for each month calculated from daily values collected over the 29-year period and is summarized in **Table B** below.

Table B: Average Monthly Temperature Extremes and Precipitation for Danville, IL

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Maximum Temperature (°F)	35.1	40.0	51.9	64.8	74.7	83.3	85.4	83.8	78.3	66.1	52.2	38.3	62.9
Minimum Temperature (°F)	19.2	22.9	32.0	42.1	51.5	60.9	64.7	63.1	55.1	43.8	34.5	23.3	42.8
Precipitation (inches)	2.21	2.21	3.02	3.98	4.74	4.55	4.67	3.48	2.93	3.57	3.83	2.83	42.02

https://www.isws.illinois.edu/statecli/newnormals/normals.USC00112140.txt

3.3.2 Surface Waters

The predominant surface water body in the region is the Middle Fork. The Middle Fork is located directly adjacent to and downgradient from the NEAP. A USGS stream gage (03336645) for the Middle Fork Vermilion River above Oakwood, Illinois is located 3 miles south (downstream) of the

VPP. The gage datum elevation is 544.42 feet NGVD29. Daily gage heights for the periods of January 1, 2017 to July 1, 2021 are shown in **Figure A** below (USGS, 2021).

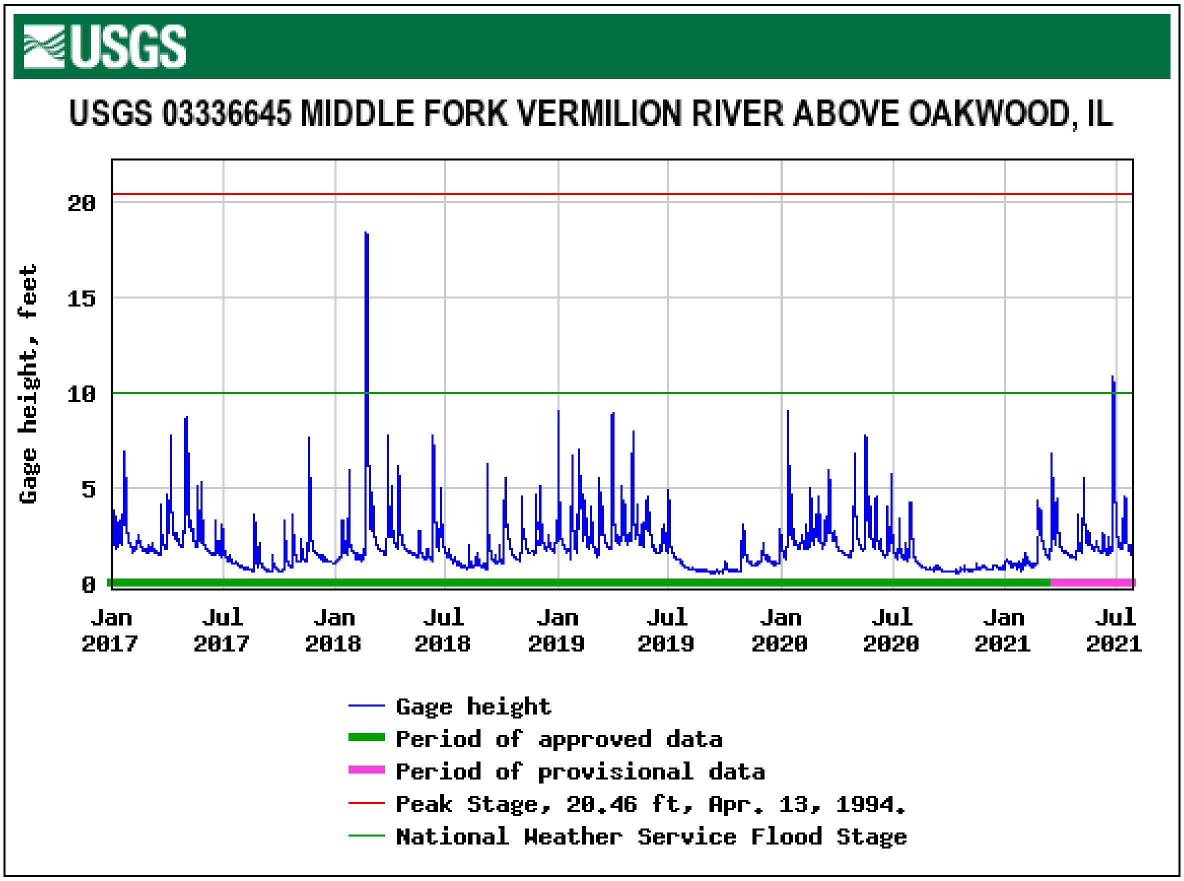

Figure A. Daily Gage Height (feet) January 1, 2017 to July 1, 2021 for USGS Gaging Station 03336645 at the Middle Fork Vermilion River above Oakwood, Illinois.

Bordering the north perimeter of the NEAP, the river elevation has been measured at 572.01 feet NGVD29 and 573.26 feet NGVD29 in January 2002 and May 2002, respectively (Kelron, 2003). Downstream of the NEAP in the vicinity of well 25, the river elevation has been measured at 560.29 feet NGVD29 and 561.40 feet NGVD29 in January 2002 and May 2002, respectively (Kelron, 2003). Elevations of the river are lower than groundwater elevations and little seasonal variation in groundwater flow has been observed; therefore, for most of the year the Middle Fork is a gaining stream. Although the majority of groundwater baseflow into the river is from unlithified deposits within the river valley, the Middle Fork is also a regional receiving water body for the shallow bedrock (Kelron, 2012a; Kelron, 2012b).

The Illinois Power Company Lake (Company Lake) is another large surface water body located to the south of the VPP. Company Lake is located within the VPP property and was created to provide process water for the VPP prior to its retirement. A former stream valley was dammed, and the reservoir was filled with water pumped from the Middle Fork (the river-intake pump house for VPP is located east of the lake on the Middle Fork to the east of the VPP) and supplemented by natural precipitation. Company Lake is located southwest of the NEAP and south of the VPP, which sits on top of the bluff between the lake and the NAP and OEAP. The base of the lake is interpreted to be the UCU. Groundwater elevation in the UCU well 10 averaged 609.37 feet NAVD88 from March to August 2021. Groundwater levels in these glacial deposits are consistently higher than those in the underlying shale, where groundwater elevations in till well 10 are consistently greater than shale well 22, indicating downward vertical gradients. **Figures 3-2** through **3-4** also illustrate flow from west to east within the bedrock towards the Middle Fork. Therefore, Company Lake is not downgradient of the NEAP.

A map of wetlands and surface waters in the vicinity of the NEAP is presented in **Figure A-4** in **Appendix A.** A Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (Map number 17183C0275D date effective 5/16/2012) is attached in **Appendix F** and can also be viewed online at: https://www.illinoisfloodmaps.org/dfirm.aspx. The eastern edge (eastern berm) of the NEAP occurs within the floodplain of the Vermilion River as identified on the 2012 FEMA map. The flood hazard areas shown on the map are defined as those areas subject to inundation by the 1 percent annual chance flood (*i.e.,* 100-year flood), also known as the base flood, that has a 1 percent chance of being equaled or exceeded in any given year. No base flood elevation has been established for this area.

4 GROUNDWATER QUALITY

4.1 Summary of Groundwater Monitoring Activities

4.1.1 Groundwater Quality Investigations (1987-2002)

A hydrogeological investigation was performed by Mathes in 1987 in the vicinity of the East Ash Pond (1989 pond footprint). The purpose of the 1987 study was to obtain sufficient information concerning subsurface conditions at the site to make recommendations concerning location and construction of a new ash pond system (East Ash Pond) for the VPP. Information from the 1987 Mathes investigation was incorporated into the study for the 2003 Report. In addition, several monitoring wells from the Mathes study (10, 13A, 13B, 16A and 16B), which were not destroyed during construction of the East Ash Pond in 1989, were incorporated into the investigation for the 2003 Report.

Eleven groundwater monitoring wells were installed in 2001 and monitored along with the five previously existing monitoring wells on a monthly basis for a six-month period in 2002 as part of the investigation completed for the 2003 Report. As part of the investigation for the 2003 Report, the sixteen wells were monitored for select water quality and field parameters listed in **Table C** below.

Table C. Groundwater Monitoring Program Parameters for the 2003 Report

Field Parameters		
pH	Groundwater Elevation	Specific Conductance
Temperature		
Metals (Dissolved)		
Aluminum	Barium	Boron
Calcium	Iron	Lithium
Magnesium	Manganese	Molybdenum
Phosphorus (total)	Potassium	Selenium
Sodium	Strontium	Vanadium
Inorganics		
Alkalinity (total)	Sulfate (total)	Chloride (total)
TDS		

Additionally, surface water grab samples were collected from the East Ash Pond (1989 pond footprint) from January 2002 through May 2002, and upstream on the Middle Fork at Higginsville Bridge from March through August 2002 and analyzed as totals for parameters listed in **Table C**. Furthermore, as part of their separate study, ISGS collected groundwater samples from both the NEAP monitoring wells and private wells for inorganic and isotopic (tritium and Carbon-14) chemical analysis. Monitoring of the 11 wells installed in 2001 was discontinued after August 2002, while quarterly groundwater monitoring continued at the five wells (10, 13A, 13B, 16A, and 16B) as part of the NPDES Permit No. IL0004057, with subsequent replacement of wells 13A and 13B with 35D and 35S, respectively.

4.1.2 Groundwater Quality Investigations and NPDES Monitoring

As discussed in **Section 4.1.1**, quarterly groundwater monitoring of five wells (10, 13A, 13B, 16A and 16B) for selected inorganic parameters was instituted in 1994. Eleven groundwater monitoring wells (22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32) were installed in 2001 and monitored along with the five previously existing monitoring wells on a monthly basis for a six-month period in 2002 as part of the investigation completed for the 2003 Report.

Monitoring of the eleven wells installed in 2001 (22, 23, 24, 25, 26, 27, 28, 29, 30, 31, and 32) was discontinued after 2002, while quarterly groundwater monitoring of five wells installed prior to East Ash Pond construction in 1989 (10, 13A, 13B, 16A and 16B) was continued, with subsequent replacement of wells 13B and 13A with wells 35S and 35D, respectively, in 2017 due to a 2015 flood which destroyed 13B and 13A.

Water quality and field parameters monitored after 2002 were established by Special Condition 19 of NPDES Permit No. IL0004057 and are listed below in **Table D**. The permit was allowed to expire following the retirement of the facility; however, groundwater monitoring continues to be performed quarterly in accordance with the NPDES Permit requirements. Monitoring of water quality parameters at well 10, installed in the upland till, was performed intermittently from 2002 to 2011, and quarterly monitoring was initiated in 2011 as part of the former NPDES Permit requirements. Alluvial deposit wells 13B and 16B were monitored for groundwater elevation only as a result of being consistently dry.

Table D. NPDES Permit Groundwater Monitoring Parameters

Field Parameters[1]	
Groundwater Elevation	pH
Metals (Dissolved)	
Boron	Manganese
Inorganics (Total, except TDS)	
Sulfate	TDS

[1] Temperature and specific conductance were recorded during sample collection.

4.1.3 Part 845 Well Installation and Groundwater Monitoring

In 2021, four additional monitoring wells (70S, 70D, 71S, and 71D) were installed along the south and southeastern perimeter of the NEAP to assess the vertical and horizontal lithology, stratigraphy, chemical properties, and physical properties of geologic layers to a minimum of 100 feet bgs as specified in 35 I.A.C. § 845.620(b).

Prospective Part 845 monitoring wells were sampled for eight rounds between March and August 2021 and the results were assessed for selection of the NEAP Part 845 monitoring well network presented in the GMP.

Groundwater samples were analyzed for 35 I.A.C. § 845.600 parameters summarized in **Table E** below. Part 845 groundwater monitoring results are included below in **Section 4.2**. A summary of groundwater analytical data is presented in **Table 4-1**.

Table E. Part 845 Groundwater Monitoring Program Parameters

Field Parameters[1]			
Groundwater elevation	pH	Turbidity	
Metals (Total)			
Antimony	Boron	Cobalt	Molybdenum
Arsenic	Cadmium	Lead	Selenium
Barium	Calcium	Lithium	Thallium
Beryllium	Chromium	Mercury	
Inorganics (Total)			
Fluoride	Sulfate	Chloride	TDS
Other (Total)			
Radium 226 and 228 combined			

[1] Dissolved oxygen, temperature, specific conductance, and oxidation/reduction potential were recorded during sample collection.

4.2 Groundwater Monitoring Results and Analysis

The groundwater analytical results collected from 2015 through 2021 as part of the NEAP monitoring for NPDES Permit No. IL0004057 and NEAP Part 845 groundwater monitoring were compared directly to the GWPS included in 35 I.A.C. § 845.600(a)(1). This data set was selected because it includes parameters (total metals) consistent with the parameter list in 35 I.A.C. § 845.600(a)(1). Results indicate that the parameters discussed in the following sections were detected at concentrations greater than the applicable 35 I.A.C. § 845.600(a)(1) standards and are considered potential exceedances[1]. A summary of groundwater analytical data is provided in **Table 4-1**, groundwater field parameters are included in **Table 4-2**.

4.2.1 Arsenic

Arsenic was detected at concentrations greater than the GWPS (0.01 milligrams per liter [mg/L]) at two downgradient BCU wells (70D and 71D) in 2021. Arsenic concentrations in BCU wells 70D and 71D ranged from less than 0.001 to 0.0172 mg/L, with a median arsenic concentration lower than the GWPS of 0.0017 mg/L. Recent samples from both wells have been below the GWPS.

Arsenic was not detected at concentrations greater than the GWPS in Upper Unit and UCU wells during groundwater monitoring events.

4.2.2 Boron

Boron is a primary indicator parameter for CCR leachate impacts on groundwater quality. Boron was detected at concentrations greater than the GWPS (2 mg/L) in downgradient BCU well 35D during two events. Boron concentrations in the BCU ranged from 1.41 to 2.47 mg/L, with median boron concentration of 1.83 mg/L.

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[1] Potential exceedances include results reported during the eight rounds of baseline groundwater monitoring that are greater than the applicable 35 I.A.C. § 845.600(a)(1) standards. The results are considered potential exceedances because they were compared directly to the standard and did not include an evaluation of background groundwater quality or apply the statistical methodologies proposed in the Groundwater Monitoring Plan (GMP). For simplicity, "GWPS" will be used hereafter in discussing potential exceedances. Exceedances will be determined following IEPA approval of the GMP.

Boron was not detected at concentrations greater than the GWPS in Upper Unit and UCU wells during groundwater monitoring events.

4.2.3 Chloride

Chloride was detected at concentrations greater than the GWPS (200 mg/L) in downgradient BCU wells (35D, 70D, and 71D). Chloride concentrations in these BCU wells ranged from 172 to 745 mg/L, with a median chloride concentration greater of 489 mg/L.

Chloride was not detected at concentrations greater than the GWPS in Upper Unit and UCU wells during groundwater monitoring events.

4.2.4 Chromium

Chromium was detected at concentrations greater than the GWPS (0.1 mg/L) in BCU downgradient well 71D during one sample event in April 2021. Chromium concentrations in the BCU well 71D ranged from 0.005 to 0.138 mg/L, with a median chromium concentration of 0.007 mg/L.

Chromium was not detected at concentrations greater than the GWPS in Upper Unit and UCU wells during groundwater monitoring events.

4.2.5 Cobalt

Cobalt was consistently detected at concentrations greater than the GWPS (0.006 mg/L) in upgradient UCU well 10. Cobalt concentrations ranged from 0.0058 to 0.0858 mg/L, with a median cobalt concentration of 0.0246 mg/L.

Cobalt was detected at concentrations greater than the GWPS in downgradient BCU wells 70D and 71D. Cobalt concentrations in these wells ranged from 0.0018 to 0.0668 mg/L, with a median cobalt concentration of 0.009 mg/L.

Cobalt was detected at concentration greater than the GWPS in downgradient wells screened in the BCU and in upgradient wells screened in the UCU.

4.2.6 Lead

Lead was detected at concentrations greater than the GWPS (0.0075 mg/L) in downgradient BCU wells 70D and 71D. Lead concentrations in these wells ranged from 0.0011 to 0.0597 mg/L, with a median lead concentration of 0.006 mg/L.

Lead was not detected greater than the GWPS in Upper Unit and UCU wells during groundwater monitoring events.

4.2.7 Lithium

Lithium was detected at concentrations greater than the GWPS (0.04 mg/L) in BCU downgradient wells (35D, 70D, and 71D). Lithium concentrations in these BCU wells ranged from 0.0311 to 0.169 mg/L, with a median lithium concentration of 0.101 mg/L. These observations appear to be coincident with chloride.

Lithium was not detected at concentrations greater than the GWPS in Upper Unit and UCU wells during groundwater monitoring events.

4.2.8 pH

Measurements of pH were detected outside the GWPS lower limit for pH (6.5 standard units [SU]) standard in background UCU well 10 during May 2018. The upper limit standard for pH is 9.0 SU. Measurements of pH in UCU wells ranged from 6.4 to 7.0 SU, with a median pH measurement of 6.8 SU.

Measurements of pH were not detected at concentrations less than, or greater than the GWPS in Upper Unit or BCU wells during groundwater monitoring events.

4.2.9 Sulfate

Sulfate is also a primary indicator of CCR leachate impacts on groundwater quality. Sulfate was detected at concentrations greater than the GWPS (400 mg/L) at Upper Unit downgradient well 70S. Sulfate concentrations in 70S ranged from 541 to 840 mg/L, with a median concentration of 702 mg/L.

Sulfate was detected at concentrations greater than the GWPS in upgradient UCU well 10 once in June of 2015. Sulfate concentrations in 10 ranged from 35 to 409 mg/L, with a median concentration of 296 mg/L.

Sulfate was detected at concentrations greater than the GWPS at BCU downgradient well 35D. Sulfate concentrations in 35D ranged from 895 to 2,020 mg/L, with a median concentration of 1,780 mg/L.

4.2.10 Thallium

Thallium was detected at concentrations greater than the GWPS (0.002 mg/L) in Upper Unit well 71S during the initial groundwater monitoring event in 2021. Thallium concentrations in 71S ranged from less than 0.001 to 0.0047 mg/L, with a median thallium concentration of 0.002 mg/L.

Thallium was not detected at concentrations greater than the GWPS in UCU and BCU wells during groundwater monitoring events.

4.2.11 Total Dissolved Solids

TDS was detected at concentrations greater than the GWPS (1,200 mg/L) in Upper Unit well 70S. TDS concentrations in 70S ranged from 1,140 to 1,580 mg/L, with a median TDS concentration of 1345 mg/L.

TDS was detected at concentrations greater than the GWPS in three downgradient BCU wells (35D, 70D, and 71D). TDS concentrations in these wells ranged from 792 to 4,420 mg/L, with a median TDS concentration of 3,070 mg/L. These observations appear to be coincident with chloride and lithium in the BCU.

TDS was detected at concentrations greater than the GWPS in downgradient wells screened in the BCU and Upper Unit.

4.2.12 Radium 226 and 228 Combined

Radium 226 and 228 combined was detected at concentrations greater than the GWPS at downgradient BCU wells 70D and 71D. Radium 226 and 228 combined concentrations in the in these wells ranged from 1.17 to 11.8 pCi/L, with a median radium 226 and 228 combined concentration of 3.28 pCi/L.

Radium 226 and 228 combined was not detected at concentrations greater than the GWPS in Upper Unit or UCU wells during groundwater monitoring events.

5 EVALUATION OF POTENTIAL RECEPTORS

5.1 Water Well Survey

A water well inventory was completed in 2021 utilizing federal and state databases to assess nearby pumping wells, drinking water receptors, and other uses of water in the vicinity of the NEAP. Based on records obtained from IEPA, ISGS, and ISWS, there are 30 wells located within 1000-meters of the NEAP (**Figure A-3**). These included four coal test wells, five farm/domestic private water wells, one mineral test well, and 20 monitoring wells for Illinois Power and DMG. The identified wells within a 1,000-meter radius around the Site are shown and tabulated in **Appendix A** along with available well construction information from well forms, also provided in **Appendix A**. Groundwater flow in the unlithified materials and bedrock in the vicinity of the NEAP is generally to the east. Based on west to east groundwater flow immediately toward the receiving surface water body (Middle Fork), only two farm/domestic private wells (API Nos. 121832310500 and 121832310600 installed in 1987 prior to construction of the East Ash Pond in 1989) were between the NEAP and surface water body. None of the remaining three farm/domestic private water wells identified are downgradient of the NEAP or in the prevailing direction of groundwater flow, and are not likely to be impacted by groundwater from the NEAP. Remaining monitoring wells within the prevailing direction of groundwater flow in the vicinity of the NEAP were owned by Illinois Power and DMG.

5.2 Surface Water

A survey to identify surface water features was conducted for a 1,000-meter radius around the NEAP. Based on an ESRI Geographic Information System (GIS) database layer which presents the detailed water bodies (*e.g.,* lakes, reservoirs, large rivers, and swamps) in the United States provided by the United States Fish and Wildlife Service (USFWS), the USGS National Hydrography Database, and National Wetland Inventory. There are 41 surface water features within a 1,000-meter radius around the NEAP, where five of the features are located hydraulically downgradient of the NEAP and are associated with the Middle Fork. The remaining surface water features identified within a 1,000-meter radius of the NEAP are either upgradient and associated with the Company Lake in the upland areas, located northwest of the upland bluff area separating the NAP and OEAP from the NEAP, or are situated to the north or east of the Middle Fork and are not considered hydraulically connected to the NEAP. The identified surface water features within a 1,000-meter radius around the NEAP are tabulated along with their distance from the unit, physical orientation to the unit, and approximate hydraulic orientation to the unit in **Appendix A** and shown in **Figure A-4**.

As discussed in **Section 3.2.2** of this HCR, lateral groundwater flow in the unlithified materials and bedrock is generally west to east across the NEAP toward the Middle Fork and there is little seasonal variation in groundwater flow direction. The predominant receiving surface water body in the region is the Middle Fork (borders the VPP to the east) (**Figure 1-2**). Bordering the north perimeter of the NEAP, the river elevation has been measured at 572.01 feet NGVD29 and 573.26 feet NGVD29 in January 2002 and May 2002, respectively (Kelron, 2003). Downstream of the NEAP in the vicinity of well 25, the river elevation has been measured at 560.29 feet NGVD29 and 561.40 feet NGVD29 in January 2002 and May 2002, respectively (Kelron, 2003). Seasonal changes in river elevations over time, and the influence on groundwater flow, are described in **Section 3.3.2** of this HCR. The USGS National Map places the NEAP within the Middle Fork

Vermilion River Watershed (Hydrologic Unit Code [HUC] 051201090509). The HUC watershed is present throughout the area presented on **Figure A-4**.

Company Lake is another large surface water body located to the south of the VPP. As discussed in **Section 3.3.2**, Company Lake is not downgradient of the NEAP and is not considered a potential receptor of impacts from the NEAP.

Based on the survey to identify surface water features for a 1,000-meter radius around the NEAP, an 11.1 acre freshwater forested/shrub wetland is located to the northeast within an oxbow of the Middle Fork, and riverine surface water feature paralleling the Middle Fork are located to the north and east of the NEAP. A map of wetlands and surface waters in the vicinity of the Site is presented in **Figure A-4**.

5.3 Nature Preserves, Historic Sites, Endangered/Threatened Species

A survey to identify nature preserves and historic sites was conducted for a 1,000-meter radius of the NEAP as shown and tabulated in **Appendix A**. Based on an ESRI GIS database layers which present the national register of historic places, national forests, state parks, national parks, and national heritage areas (as designated by the National Park Service) in the United States, no national forests or national parks were identified within a 1,000-meter radius of the NEAP. However, based on data available from IDNR Illinois Nature Preserves Commission (IDNR, April 2021), there are 10 nature preserves within Vermilion County. Based on data available from the IDNR's Illinois Natural Heritage Database, there are 27 natural areas in Vermilion County (IDNR, December 2020a) and the IDNR Illinois Nature Preserves Commission identified 20 protected areas in Vermilion County (IDNR, October 2019), as tabulated in **Appendix A**. Note a single area may have multiple designations (*e.g.,* Middlefork Woods Nature Preserve is a nature preserve, natural area, and protected area) identified by IDNR Illinois Nature Preserves Commission (IDNR, October 2019; IDNR, April 2021) and IDNR's Illinois Natural Heritage Database (IDNR, December 2020a). As shown in **Figure A-5**, Middle Fork State Conservation Area, Orchid Hill Natural Heritage Landmark, and Kickapoo State Resource Management Area were identified in the survey within 1,000 meters of the NEAP. The Middle Fork State Conservation Area was designated a State and National Scenic River in 1990. The Middle Fork area to the north extends through Kennekuk Cove County Park, along the eastern portion of the VPP, and ends at the south boundary of Kickapoo State Resource Management Area adjacent to the Middle Fork (IDNR, April 2021). The Illinois Department of Conservation designated Orchid Hill Natural Heritage Landmark is partially within the VPP property boundary but is administered by IDNR.

A survey to identify endangered/threatened species was conducted for Vermilion County and tabulated in **Appendix A**. Based on data available from the IDNR Illinois Natural Heritage Database (IDNR, December 2020b), as of December 2020 there are 46 endangered or threatened species reported in Vermilion County. Twenty-eight species are listed as endangered and 18 are listed as threatened.

Additionally, a search of the IDNR Historic Preservation Division database for historic sites in the vicinity of the Site yielded no results within 1,000 meters of the NEAP. The Illinois State Archaeological Survey (ISAS) databases that do not require credentials to access were also searched and yielded no results within 1,000 meters of the NEAP.

6 CONCLUSIONS

Hydrogeologic characterization of the VPP was originally developed as part of the *Hydrogeologic Investigation of Existing Ash Disposal Ponds, Vermilion Power Plant, Illinois Power Company, Oakwood, Illinois* (Mathes, 1987) and most recently updated for the *Hydrogeology and Groundwater Quality of the North Ash Pond System Report* (Kelron, 2012a) and *Hydrogeology and Groundwater Quality of the Old East Ash Pond Report* (Kelron, 2012b). Results of these hydrogeologic studies, along with the comprehensive 2003 Report focusing on the vicinity of the NEAP - *Regional and Local Hydrogeology and Geochemistry, Vermilion Power Plant, Illinois. Volumes 1 and 2,* were reintroduced in this HCR and updated to include geologic, hydrogeologic, and groundwater quality data collected with a focus on the NEAP (Part 845 regulated) CCR Unit and subject of this HCR.

The data were summarized and evaluated for changes in groundwater conditions since the previous investigations. Available groundwater quality data for the NEAP was compared to the GWPS.

The results of the hydrogeologic and groundwater quality evaluation are:

- There are three principal types of unlithified materials above bedrock in the vicinity of the NEAP, including the following: fill and CCR (CCR consisting primarily of fly ash with lesser amounts of bottom ash and slag), mixed alluvial deposits of the Cahokia Alluvium (composed primarily of sand with occasional layers of silty clay), and the Upper Till Unit (Wedron Formation till, including diamicton, consisting of clay and silty clay with occasional sand lenses).
- In the vicinity of the VPP, the principal bedrock formation is the Shelburn, which contains a major coal seam mined in the region, the Danville (No. 7) Coal. Groundwater in the shale flows into the overlying alluvium and enters into the Middle Fork in some locations. Groundwater within the bedrock is at the end of its flow path as indicated by upward hydraulic gradients, high dissolved mineral content, and isotopic analysis indicating water is significantly older by 13,000 to 35,000 radiocarbon years before present than recent groundwater in the overlying unlithified deposits.
- Four distinct water-bearing units have been identified in the vicinity of the NEAP based on stratigraphic relationships and common hydrogeologic characteristics. The units are described as follows: CCR Unit, Upper Unit (mixed deposits of Cahokia Alluvium), UCU (clay till), and the BCU (shale bedrock).
- None of the hydrostratigraphic units described above have been identified as an aquifer; however, the Upper Unit and BCU have been identified as PMPs. The NEAP was constructed with berms containing a low-permeable clay core keyed into BCU shale, which is greater than 80 feet thick in the vicinity of the ash ponds, providing separation between CCR materials contained within the NEAP and any potential aquifers.
- The predominant surface water body in the region is the Middle Fork. The Middle Fork is located directly adjacent to the NEAP.
- The Middle Fork is the regional receiving body for both the BCU and overlying Upper Unit PMPs. Under normal conditions in the vicinity of the NEAP, groundwater generally flows from the west to east toward the Middle Fork in both the BCU and Upper Unit PMPs. The potentiometric surface maps indicate groundwater elevations in the shale are highest in the

topographically highest areas to the west of the Middle Fork, while the lowest groundwater elevations occur at shale wells located adjacent to the Middle Fork. There is little seasonal variation in groundwater flow direction in the BCU.

- Vertical groundwater migration between the UCU and BCU is downward in the bluffs west of the Middle Fork. Vertical groundwater migration between the BCU and the Upper Unit in the bottomlands of the Middle Fork is upward.
- As determined by the geologic information provided, groundwater quality standards for the monitoring well network screened in the PMP Upper Unit (alluvial deposits) and BCU (shale bedrock) within the bottomlands along the Middle Fork and in the vicinity of the coal mined area are Class IV - Other Groundwater (35 IAC 620.440 (a) and (c)) standards.
- Arsenic, boron, chloride, chromium, cobalt, lead, lithium, sulfate, TDS, thallium, and radium 226 and 228 combined are considered potential exceedances of the Part 845 GWPS. Cobalt, pH, and sulfate were also detected at a concentration greater than the GWPS in the upgradient background UCU well 10. The downgradient wells of the Upper Unit and BCU are influenced by former coal mine areas. Results for these parameters were compared directly to GWPS, without an evaluation of background concentrations or application of statistical methods. Evaluation of background groundwater quality will be completed as part of the GMP, and compliance with Part 845 will be determined following the first round of groundwater sampling. The first round of groundwater sampling for compliance will be completed following issuance of the Operating Permit and in accordance with the GMP.

This HCR satisfies Part 845 content requirements specific to 35 I.A.C.§ 845.620(b) (Hydrogeologic Site Characterization) for the NEAP at the VPP.

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TABLES

TABLE 2-1. GEOTECHNICAL RESULTS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Sample ID	Field Location ID	Top of Sample (ft bgs)	Bottom of Sample (ft bgs)	Moisture Content (%)	Dry Density (pcf)	Specific Gravity	Total Porosity[1] (%)	Vertical Hydraulic Conductivity (cm/s)	LL	PL	PI	Laboratory USCS	Gravel (%)	Sand (%)	Fines (%)
Cahokia Alluvium															
MW-70SA (16.5-17)	70SA	16.5	17	20.8	99.6	2.655	39.9	5.15E-04	12	12	NP	SM	0.1	60.0	39.9
MW-71S (10-10.5)	71S	10	10.5	20.8	93.2	2.653	43.7	1.26E-03	17	10	7	SP	0.0	95.3	4.7
Upper Till Unit															
MW-101 (10-12)	101	10	12	15.6	--	--	--	--	22	15	7	CL-ML	1.4	16.4	82.2
MW-101 (30-32)	101	30	32	13.3	124.2	--	--	--	--	--	--	--	--	--	--
MW-101 (32-33)	101	32	33	15.3	--	--	--	--	28	15	13	CL	0.0	14.5	85.5
MW-101 (60-62)	101	60	62	12.0	127.4	--	--	1.00E-07	--	--	--	--	--	--	--
MW-101 (62-63)	101	62	63	11.9	--	--	--	--	24	13	11	CL	2.9	21.4	75.7
MW-101 (92-93)	101	92	93	11.4	--	--	--	--	25	13	12	CL	2.4	26.3	71.3
MW-101 (132-133)	101	132	133	11.3	--	--	--	--	20	12	8	CL	3.5	42.5	54.0
MW-102 (10-12)	102	10	12	16.2	--	--	--	--	28	16	12	CL	0.2	15.9	83.9
MW-102 (28-30)	102	28	30	14.9	--	--	--	--	24	14	10	CL	1.3	17.0	81.7
MW-102 (30-32)	102	30	32	15.0	120.6	--	--	1.60E-08	--	--	--	--	--	--	--
MW-102 (60-62)	102	60	62	12.5	127.0	--	--	--	--	--	--	--	--	--	--
MW-102 (62-64)	102	62	64	12.4	--	--	--	--	24	14	10	CL	1.7	24.9	73.4
MW-102 (94-96)	102	94	96	9.2	--	--	--	--	27	14	13	CL	3.1	26.2	70.7
MW-102 (130-132)	102	130	132	10.2	--	--	--	--	20	12	8	CL	2.3	43.7	54.0
MW-103 (10-12)	103	10	12	15.0	--	--	--	--	28	16	12	CL	1.0	14.4	84.6
MW-103 (15-17)	103	15	17	16.6	116.8	2.702	30.7	3.61E-08	30	15	15	CL	0.0	14.7	85.3
MW-103 (28-30)	103	28	30	13.5	--	--	--	--	21	13	8	CL	3.8	26.4	69.8
MW-103 (30-32)	103	30	32	13.2	125.2	--	--	6.10E-08	--	--	--	--	--	--	--
MW-103 (60-62)	103	60	62	15.8	118.0	--	--	--	--	--	--	--	--	--	--
MW-103 (88-90)	103	88	90	15.9	--	--	--	--	28	15	13	CL	0.9	14.2	84.9
MW-103 (90-92)	103	90	92	18.1	111.8	2.680	33.1	--	--	--	--	--	--	--	--
MW-103 (95.5-96)	103	95.5	96	13.9	128.4	2.706	24.0	9.35E-06	17	10	7	CL-ML	0.0	48.2	51.8
MW-103 (102-104)	103	102	104	10.2	--	--	--	--	23	12	11	CL	2.5	35.4	62.1
MW-103 (130.5-131)	103	130.5	131	8.9	98.8	2.688	41.1	2.19E-05	16	11	5	SC-SM	37.1	50.3	12.6
MW-103 (132.5-133)	103	132.5	133	15.3	95.2	2.677	43.0	8.17E-05	14	7	7	SP-SC	0.0	94.3	5.7
MW-103 (138-140)	103	138	140	10.5	--	--	--	--	21	11	10	CL	1.7	41.8	56.5
MW-103 (140.5-141)	103	140.5	141	10.8	127.5	2.704	24.4	3.82E-07	23	11	12	CL	0.0	42.6	57.4
MW-104 (10-12)	104	10	12	14.5	--	--	--	--	26	15	11	CL	1.3	16.8	81.9
MW-104 (30-32)	104	30	32	15.2	119.7	2.730	29.7	--	--	--	--	--	--	--	--
MW-104 (60.5-61)	104	60.5	61	12.4	--	--	--	--	20	13	7	CL-ML	4.5	24.7	70.8
MW-104 (92-94)	104	92	94	9.5	--	--	--	--	25	13	12	CL	1.5	33.8	64.7
MW-104 (130-132)	104	130	132	12.1	--	--	--	--	20	12	8	CL	4.3	40.7	55.0
MW-105 (10-12)	105	10	12	25.2	97.0	2.740	43.3	--	--	--	--	--	--	--	--
MW-105 (17-19)	105	17	19	24.8	--	--	--	--	44	19	25	CL	0.6	1.9	97.5

TABLE 2-1. GEOTECHNICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Sample ID	Field Location ID	Top of Sample (ft bgs)	Bottom of Sample (ft bgs)	Moisture Content (%)	Dry Density (pcf)	Specific Gravity	Total Porosity[1] (%)	Vertical Hydraulic Conductivity (cm/s)	LL	PL	PI	Laboratory USCS	Gravel (%)	Sand (%)	Fines (%)
MW-105 (28-30)	105	28	30	17.8	--	--	--	--	39	17	22	CL	0.0	3.1	96.9
MW-105 (58-60)	105	58	60	12.9	--	--	--	--	22	13	9	CL	0.9	26.1	73.0
MW-105 (88-90)	105	88	90	10.5	--	--	--	--	25	12	13	CL	0.3	33.8	65.9
MW-105 (130-132)	105	130	132	10.2	--	--	--	--	20	12	8	CL	7.1	42.5	50.4

[O:EDP 7/13/21 C: EGP 7/27/21; U: EDP 8/16/21, C:KLT 8/16/21]

Notes:
[1] Porosity calculated as relationship of bulk density (p_b) to particle density (p_d) ($n = 100[1- (p_b/p_d)]$)
-- = Not Analyzed
% = Percent
bgs = below ground surface
cm/s = centimeters per second
ft = foot/feet
LL = Liquid limit
NP = Non Plastic
pcf = pounds per cubic foot
PI = Plasticity Index
PL = Plastic Limit

USCS = Unified Soil Classification System
CL = Lean Clay
CL-ML = Silty Clay
SC-SM = Silty Clayey Sand
SM = Silty Sand
SP = Poorly Graded Sand
SP-SC= Poorly Graded Sand with Clay

TABLE 2-2. POREWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Sample Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, Total (mg/L)	Chloride, total in water (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)
NED1	04/01/2021	0.0016	0.049	0.0324	<0.001	18.6	<0.001	497	44	<0.0015	<0.001	0.32	<0.001	0.247	<0.0002	0.426	9.2	0.441	<0.001	1340	<0.002
NED1	04/21/2021	<0.001	0.0498	0.029	<0.001	19.3	<0.001	472	32	<0.0015	<0.001	0.38	<0.001	0.305	<0.0002	0.345	8.9	1.08	<0.001	1230	<0.002
NED1	05/11/2021	<0.002	0.078	0.0289	<0.001	14	<0.001	674	18	<0.001	<0.001	0.2	<0.001	0.275	<0.0002	0.154	7.9	1.23	<0.001	1300	<0.001
NED1	06/04/2021	<0.001	0.0939	0.0319	<0.001	13.5	<0.001	532	18	<0.0015	<0.001	0.24	<0.001	0.359	<0.0002	0.16	7.5	0.0973	<0.001	1400	<0.002
NED1	08/17/2021	0.0011	0.0673	0.0314	<0.001	18.3	<0.001	531	25	<0.0015	<0.001	0.29	<0.001	0.363	<0.0002	0.2	8.7	0.0754	<0.001	1510	<0.002

Notes:
Field readings are reported with as many significant figures as provided by analytical laboratory.
< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method.
mg/L = milligrams per liter
pCi/L = picocuries per liter
SU = standard units

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TABLE 2-3. SOIL ANALYTICAL RESULTS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Sample Location	Geologic Unit	Sample Depth (ft BGS)	Sample Date	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Boron (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Lead (mg/kg)	Lithium (mg/kg)	Mercury (mg/kg)	Molybdenum (mg/kg)	Selenium (mg/kg)	Thallium (mg/kg)
70D	Mixed deposits of the Cahokia alluvium	16-18	03/04/2021	<0.36	5.07	34.2	0.16	3.87	<0.2	7.55	4.09	8.38	4.97	<0.011	0.99	<1	<5
70D	Pennsylvanian shale bedrock	22-24	03/04/2021	<0.4	6.11	30.2	1.05	7.1	<0.19	27.1	16.9	15.4	33.3	<0.01	0.29	<0.93	<4.63
71D	Mixed deposits of the Cahokia alluvium	9-11	03/03/2021	<0.38	8.93	22.3	0.25	5.14	<0.19	9.33	9.06	8.03	8.12	<0.012	2.05	<0.96	<4.81
71D	Pennsylvanian shale bedrock	12-14	03/03/2021	<0.38	4.09	39.3	0.92	6.09	<0.19	25.1	14.1	14.5	31.1	0.012	<0.19	<0.94	<4.72
103	Upper Till Unit	13-15	03/07/2021	<0.38	5.61	40.1	0.63	16.5	<0.2	23.4	8.14	14.2	26.3	0.012	1.84	<0.98	<4.9
103	Upper Till Unit	92-94	03/08/2021	1.71	26.3	7.99	0.06	3.38	<0.19	7.18	9.77	38	3.9	<0.011	1.41	<0.93	<4.63
103	Lower Till Unit	173-175	03/09/2021	<0.38	3.87	46.7	0.33	8.24	<0.2	14.9	5.82	9.02	12	<0.011	0.86	<0.98	<4.9

Notes:
< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method.
BGS = below ground surface
ft = foot or feet
mg/kg = milligrams per kilogram

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TABLE 3-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Well Number	HSU	Date Constructed	Top of PVC Elevation (ft)	Measuring Point Elevation (ft)	Measuring Point Description	Ground Elevation (ft)	Screen Top Depth (ft BGS)	Screen Bottom Depth (ft BGS)	Screen Top Elevation (ft)	Screen Bottom Elevation (ft)	Well Depth (ft BGS)	Bottom of Boring Elevation (ft)	Screen Length (ft)	Screen Diameter (inches)	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)
10	UCU	04/29/1987	659.09	659.09	Top of PVC	656.33	46.60	56.60	609.70	599.70	56.60	581.40	10	2	40.178985	-87.739824
16B	UU	04/28/1987	580.62	580.62	Top of PVC	578.59	7.00	12.00	571.50	566.50	12.00	566.50	5	2	40.17809	-87.735084
16A	BCU	04/28/1987	580.32	580.32	Top of PVC	578.60	21.80	41.80	556.50	536.50	41.80	536.50	20	2	40.178093	-87.735056
22	BCU	12/05/2001	658.62	658.62	Top of PVC	655.93	80.00	100.00	576.00	556.00	100.00	556.00	20	2	40.178997	-87.73985
23	UU	12/03/2001	601.96	601.96	Top of PVC	599.27	11.80	21.80	587.30	577.30	22.00	577.10	10	2	40.180987	-87.737312
24	BCU	12/03/2001	601.82	601.82	Top of PVC	599.07	34.80	54.70	564.15	544.25	55.00	544.00	19.9	2	40.181001	-87.737328
25	BCU	12/04/2001	582.36	582.36	Top of PVC	579.40	19.10	38.70	559.70	540.10	39.00	539.80	19.6	2	40.174473	-87.736911
35S	UU	03/01/2017	584.92	584.92	Top of PVC	581.64	3.50	8.50	577.65	572.65	8.50	572.70	5	2	40.17977	-87.735586
35D	BCU	03/03/2017	584.14	584.14	Top of PVC	581.77	35.00	45.00	546.25	536.25	45.00	535.50	10	2	40.179762	-87.735575
70S	UU	03/04/2021	593.74	593.74	Top of PVC	591.64	10.00	20.00	581.64	571.64	20.00	571.60	10	2	40.176952	-87.737931
70D	BCU	03/04/2021	594.52	594.52	Top of PVC	591.90	41.00	51.00	550.90	540.90	51.00	539.90	10	2	40.176957	-87.737958
71S	UU	03/03/2021	579.56	579.56	Top of PVC	577.19	5.50	10.50	571.69	566.69	10.50	566.70	5	2	40.177106	-87.735397
71D	BCU	03/03/2021	579.89	579.89	Top of PVC	577.18	30.00	40.00	547.18	537.18	40.00	537.20	10	2	40.177118	-87.735391
NED1	CCR	02/12/2019	600.07	600.07	Top of PVC	597.76	5.32	14.95	592.44	582.81	15.44	582.32	9.63	2	40.17947	-87.738094

Notes:
All elevation data are presented relative to the North American Vertical Datum 1988 (NAVD88), GEOID 12A
BCU = bedrock confining unit
BGS = below ground surface
CCR = Coal Combustion Residual
ft = foot or feet
HSU = Hydrostratigraphic Unit
PVC = polyvinyl chloride
UCU = upper confining unit
UU = upper unit

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TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Date	10 Groundwater Elevation (ft NAVD88)	22 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UCU	BCU				
3/29/2021	609.54	603.60	5.94	43.61	0.136	down
4/12/2021	610.25	603.87	6.38	38.79	0.164	down
5/10/2021	604.57	598.84	5.73	38.64	0.148	down
6/3/2021	609.21	603.40	5.81	43.28	0.134	down
6/17/2021	609.48	603.32	6.16	43.55	0.141	down
7/8/2021	611.18	603.72	7.46	38.79	0.192	down
7/27/2021	610.71	604.01	6.70	38.79	0.173	down
7/8/2021	610.01	603.92	6.09	38.79	0.157	down
			Middle of screen elevation 10			604.7
			Middle of screen elevation 22			565.9

Date	35S Groundwater Elevation (ft NAVD88)	35D[4] Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	Upper Unit	BCU				
3/29/2021	573.12	577.51[3]	-4.39	31.35	-0.140	up
			Middle of screen elevation 35S			575.6
			Middle of screen elevation 35D			541.8

[O:EDP 8/9/21 C: KLT 8/13/21]

Notes:

1. Distance change was calculated using the midpoint of the piezometer screen and water table surface. If the water
2. Vertical gradients between ±0.0015 are considered flat, and typically have less than 0.02 foot difference in groundwater elevation between wells.
3. Another NEAP monitoring program which included sampling at well 35D occurred on March 29, 2021. The water level measured in that program (577.51 ft NAVD88) was used to calculate vertical gradient on March 29, 2021.

[4] groundwater elevations were not likely to have recovered between monitoring events

ft = feet
NAVD88 = North American Vertical Datum of 1988
dh = head change
dl = distance change
-- = Not calculated
UCU = upper confining unit
BCU = bedrock confining unit

TABLE 3-3. FIELD HYDRAULIC CONDUCTIVITIES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Well ID	Gradient Position	Bottom of Screen Elevation (ft NAVD88)	Screen Length [1] (ft)	Field Identified Screened Material	Slug Type	Analysis Method	Number of Field Tests	Test Analyzed[2]	Hydraulic Conductivity (cm/s)	Minimum Hydraulic Conductivity (cm/s)	Maximum Hydraulic Conductivity (cm/s)	Hydraulic Conductivity Geometric Mean (cm/s)
Upper Unit												
23	S	577.30	10.0	ML/ S(CL)	Solid	Springer-Gelhar	2	RH-1	1.12E+00	7.40E-04	1.12E+00	1.06E-02
70S	S	571.64	10.0	SC/SM	Solid	Bouwer-Rice	4	RH-1	1.43E-03			
71S	D	566.69	5.0	SP	Solid	Bouwer-Rice	4	FH-1	7.40E-04			
Bedrock Confining Unit												
16A	D	536.50	20.0	Shale	Solid	Bouwer-Rice	1	FH-1	1.13E-06	1.13E-06	2.34E-05	7.09E-06
22	U	556.00	20.0	Shale	Solid	Bouwer-Rice	2	FH-1	2.34E-05			
24	S	544.25	19.9	Shale	Solid	Bouwer-Rice	2	FH-1	9.56E-06			
25	S	540.10	19.6	Shale	Solid	Bouwer-Rice	1	FH-1	9.97E-06			
CCR Unit												
NED1	NA	582.98	10.0	Ash	Solid	Bouwer-Rice	4	RH-1	2.43E-03	2.43E-03	2.43E-03	2.43E-03
Upper Confining Unit												
10	U	599.70	10.0	CL	Solid	Bouwer-Rice	1	RH-1	8.76E-06	8.76E-06	8.76E-06	8.76E-06

[U:EDP:8/9/21 C: KLT 8/13/21]

Notes:
1. All wells are constructed from 2 inch PVC with 0.01 inch slotted screens.
2. Test response data (elapsed time and corresponding changes in water levels) were plotted as normalized displacement to evaluate similarity among repeat test data within each well. A single test was selected for analysis at each well based on the quality of the test data (i.e., smooth recovery curve) and coincidence of repeat test data.

cm/s = centimeters per second
D = downgradient
FH-1 = Falling Head 1 Test
ft = foot/feet
NA = Not Applicable
NAVD88 = North American Vertical Datum of 1988
RH-1 = Rising Head 1 Test
S = sidegradient
U = upgradient

USCS = Unified Soil Classification System
CCR = Coal Combustion Residual
ML = Silt
S(CL) = Sandy clay
SC = Clayey sand
SM = Silty sand
SP= Sand
CL = Lean clay

TABLE 3-4. HORIZONTAL HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

$V = K\,i\ /\ n_e$

V = Groundwater Velocity
K = Hydraulic Conductivity [1]
n_e = Effective Porosity [2]

Northern NEAP Bedrock Confining Unit (22 to 35D)

Distance between Wells (ft):	1191	
Hydraulic Conductivity (ft/day):	0.02	
Effective Porosity (%):	10	Assumes: shale

Date	22 Groundwater Elevation (ft NAVD88)	35D[4] Groundwater Elevation (ft NAVD88)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/day)
3/29/2021	603.60	577.51[3]	26.09	0.0219	0.004
			Average	0.0219	0.004

Southern NEAP Bedrock Confining Unit (22 to 16A)

Distance between Wells (ft):	1388	
Hydraulic Conductivity (ft/day):	0.02	
Effective Porosity (%):	10	Assumes: shale

Date	22 Groundwater Elevation (ft NAVD88)	16A Groundwater Elevation (ft NAVD88)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/day)
3/29/2021	603.60	569.01	34.59	0.0249	0.005
4/12/2021	603.87	568.28	35.59	0.0256	0.005
5/10/2021	598.84	569.34	29.50	0.0213	0.004
6/3/2021	603.40	568.39	35.01	0.0252	0.005
6/17/2021	603.32	569.51	33.81	0.0244	0.005
7/8/2021	603.72	571.32	32.40	0.0233	0.005
7/27/2021	604.01	571.56	32.45	0.0234	0.005
8/16/2021	603.92	571.81	32.11	0.0231	0.005
			Average	0.0239	0.005

TABLE 3-4. HORIZONTAL HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Southern NEAP Upper Unit (70S to 71S)

Distance between Wells (ft):	711	
Hydraulic Conductivity (ft/day):	30.0	
Effective Porosity (%):	22.5	Assumes: sand

Date	70S Groundwater Elevation (ft NAVD88)	71S Groundwater Elevation (ft NAVD88)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/day)
3/29/2021	585.60	571.23	14.37	0.0202	2.69
4/12/2021	584.17	569.85	14.32	0.0201	2.69
5/10/2021	584.75	569.54	15.21	0.0214	2.85
6/3/2021	582.66	569.17	13.49	0.0190	2.53
6/17/2021	580.00	--	--	--	--
7/8/2021	585.81	570.83	14.98	0.0211	2.81
7/27/2021	582.69	569.23	13.46	0.0189	2.52
8/16/2021	580.59	568.46	12.13	0.0171	2.27
			Average	0.0197	2.62

[O: EDP, C: KLT 8/13/21]

Notes:

[1] Hydraulic conductivity values used above are the geometric mean of hydrostratigraphic unit hydraulic conductivity values calculated from slug tests completed in April 2021 by Ramboll.

[2] Effective porosity used in calculations in the Upper Unit was derived from literature values for poorly sorted sand, which range from 0.10 to 0.35 (Fetter, C.W., 1980, 1988. Applied Hydrogeology, Merrill Publishing Company, Columbus, Ohio.; Walton, W.C., 1988. Practical Aspects of Groundwater Modeling. National Water Well Association, Worthington, Ohio.); Effective porosity used in calculations in the Bedrock Confining Unit was calculated in Kelron Environmental (Kelron), 2003. Regional and Local Hydrogeology and Geochemistry, Vermilion Power Plant, Illinois, Dynegy Midwest Generation, LLC, November 30, 2003). Effective porosity for the Upper Unit may be as high as maximum total porosity (43.7%) calculated in Table 2-1.

[3] Another NEAP monitoring program which included sampling at well 35D occurred on March 29, 2021. The water level measured in that program (577.51 ft NAVD88) was used to calculate horizontal gradient on March 29, 2021.

[4] groundwater elevations were not likely to have recovered between monitoring events

-- = no data available
% = percent
ft/day = feet per day
ft/ft = feet per feet
ft= feet
NAVD88 = North American Vertical Datum of 1988
NEAP = New East Ash Pond

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, Total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
10	03/26/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.8	--	--	35	--	224
10	06/02/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.8	--	--	409	--	1180
10	09/23/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.5	--	--	256	--	982
10	11/23/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.7	--	--	239	--	990
10	02/25/2016	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.7	--	--	355	--	994
10	05/19/2016	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.8	--	--	393	--	1090
10	09/07/2016	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.7	--	--	300	--	1010
10	12/19/2016	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.8	--	--	396	--	1050
10	03/21/2017	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.8	--	--	269	--	932
10	06/16/2017	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.8	--	--	379	--	1100
10	07/12/2017	--	--	--	--	--	--	--	7	--	--	--	--	--	--	--	6.7	--	--	332	--	1030
10	09/14/2017	--	--	--	--	--	--	--	8	--	--	--	--	--	--	--	6.7	--	--	286	--	964
10	11/08/2017	--	--	--	--	--	--	--	7	--	--	--	--	--	--	--	6.9	--	--	270	--	842
10	01/24/2018	--	--	--	--	--	--	--	12	--	--	--	--	--	--	--	7.0	--	--	233	--	826
10	03/22/2018	--	--	--	--	--	--	--	9	--	--	--	--	--	--	--	6.8	--	--	296	--	890
10	05/09/2018	--	--	--	--	--	--	--	8	--	--	--	--	--	--	--	6.4	--	--	337	--	1010
10	08/17/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.8	--	--	280	--	994
10	12/03/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.7	--	--	269	--	886
10	03/25/2019	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.8	--	--	356	--	1100
10	05/22/2019	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.7	--	--	361	--	1080
10	09/27/2019	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.8	--	--	281	--	970
10	12/23/2019	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.7	--	--	262	--	970

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
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VERMILION POWER PLANT
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Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, Total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
10	03/17/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.7	--	--	357	--	1090
10	06/22/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.8	--	--	334	--	1070
10	09/29/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.6	--	--	289	--	920
10	12/07/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.6	--	--	260	--	934
10	03/29/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.8	--	--	279	--	994
10	04/01/2021	<0.001	<0.001	0.079	<0.001	0.0587	<0.001	182	6	<0.0015	0.009	0.13	<0.001	0.0143	<0.0002	<0.0015	6.8	1.1	<0.001	292	<0.002	942
10	04/21/2021	<0.001	<0.001	0.047	<0.001	0.0587	<0.001	193	6	<0.0015	0.017	0.14	<0.001	0.018	<0.0002	0.0017	6.8	3.35	<0.001	309	<0.002	1080
10	05/10/2021	<0.002	<0.001	0.0678	<0.001	0.053	<0.001	160	4	<0.001	0.029	0.14	<0.001	0.0112	<0.0002	0.00139	6.8	1.37	<0.001	224	<0.001	850
10	06/03/2021	<0.001	<0.001	0.0795	<0.001	0.0835	<0.001	186	5	0.003	0.0858	0.14	<0.001	0.0164	<0.0002	0.0035	6.7	0.944	<0.001	317	<0.002	980
10	06/17/2021	<0.001	<0.001	0.0625	<0.001	0.111	<0.001	186	6	<0.0015	0.0058	0.14	<0.001	0.0155	<0.0002	0.002	6.8	0.146	<0.001	272	<0.002	946
10	07/08/2021	0.0047	<0.001	0.068	<0.001	0.0499	<0.001	166	5	<0.0015	0.0201	0.13	<0.001	0.0163	<0.0002	0.0018	6.7	0.554	<0.001	328	<0.002	988
10	07/27/2021	<0.001	<0.001	0.0712	<0.001	0.237	<0.001	182	4	0.0017	0.0339	0.14	<0.001	0.0167	<0.0002	0.0017	6.8	0.775	<0.001	338	<0.002	1010
10	08/17/2021	<0.001	<0.001	0.0772	<0.001	0.0695	<0.001	192	5	0.0039	0.0518	0.13	<0.001	0.0161	<0.0002	0.0016	6.7	0.263	<0.001	296	<0.002	970
16A	03/26/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.3	--	--	135	--	760
16A	06/02/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.3	--	--	135	--	810
16A	09/23/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.4	--	--	32	--	698
16A	11/23/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.3	--	--	51	--	800
16A	02/25/2016	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.4	--	--	39	--	636
16A	05/19/2016	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.4	--	--	62	--	692
16A	09/07/2016	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.4	--	--	38	--	728
16A	12/19/2016	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.4	--	--	33	--	722
16A	03/21/2017	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.4	--	--	22	--	664

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OAKWOOD, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, Total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
16A	06/16/2017	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.4	--	--	39	--	680
16A	09/14/2017	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.4	--	--	35	--	700
16A	11/08/2017	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.5	--	--	24	--	706
16A	03/22/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.4	--	--	29	--	558
16A	05/09/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.0	--	--	50	--	622
16A	08/17/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.6	--	--	18	--	676
16A	12/03/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.5	--	--	<10	--	748
16A	03/25/2019	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.1	--	--	92	--	684
16A	05/22/2019	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.1	--	--	76	--	604
16A	09/27/2019	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.5	--	--	49	--	674
16A	12/23/2019	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.3	--	--	28	--	668
16A	03/17/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.4	--	--	38	--	672
16A	06/22/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.4	--	--	71	--	684
16A	09/29/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.4	--	--	34	--	615
16A	12/07/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.4	--	--	24	--	678
16A	03/29/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.6	--	--	27	--	660
16A	04/01/2021	<0.001	0.0016	0.261	<0.001	0.675	<0.001	40.8	131	<0.0015	<0.001	0.77	<0.001	0.0291	<0.0002	<0.0015	7.5	0.361	<0.001	31	<0.002	662
16A	04/21/2021	<0.001	0.0028	0.335	<0.001	0.613	<0.001	71.1	106	<0.0015	<0.001	0.64	<0.001	0.0288	<0.0002	<0.0015	7.2	0.576	<0.001	78	<0.002	692
16A	05/11/2021	<0.002	0.00353	0.245	<0.001	0.807	<0.001	36.6	139	<0.001	<0.001	0.78	<0.001	0.0297	<0.0002	<0.001	7.4	0.379	<0.001	16	<0.001	582
16A	06/03/2021	<0.001	0.0013	0.272	<0.001	0.716	<0.001	51.6	128	<0.0015	<0.001	0.68	<0.001	0.0303	<0.0002	<0.0015	7.3	0.512	<0.001	47	<0.002	680
16A	06/17/2021	<0.001	0.0011	0.251	<0.001	0.746	<0.001	42.2	144	<0.0015	<0.001	0.78	<0.001	0.0312	<0.0002	<0.0015	7.4	1.67	<0.001	30	<0.002	630
16A	07/08/2021	0.001	0.0012	0.249	<0.001	0.768	<0.001	38	151	<0.0015	<0.001	0.77	<0.001	0.0313	<0.0002	<0.0015	7.3	1.16	<0.001	24	<0.002	688

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, Total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
16A	07/27/2021	<0.001	0.0014	0.248	<0.001	0.794	<0.001	35.3	163	<0.0015	<0.001	0.84	<0.001	0.0319	<0.0002	<0.0015	7.4	1.58	<0.001	16	<0.002	662
16A	08/17/2021	<0.001	0.0018	0.261	<0.001	0.755	<0.001	33.3	176	<0.0015	<0.001	0.84	<0.001	0.0319	<0.0002	<0.0015	7.5	0.53	<0.001	11	<0.002	654
22	04/01/2021	<0.001	<0.001	0.0723	<0.001	0.41	<0.001	41.5	23	<0.0015	<0.001	0.43	<0.001	0.0347	<0.0002	<0.0015	7.4	1.41	<0.001	34	<0.002	484
22	04/20/2021	<0.001	<0.001	0.0798	<0.001	0.418	<0.001	37.5	11	<0.0015	<0.001	0.4	<0.001	0.0326	<0.0002	<0.0015	7.6	1.52	<0.001	27	<0.002	476
22	05/10/2021	<0.002	<0.001	0.0795	<0.001	0.433	<0.001	45.7	11	<0.001	<0.001	0.42	<0.001	0.0318	<0.0002	<0.001	7.3	0.31	<0.001	30	<0.001	494
22	06/03/2021	<0.001	<0.001	0.0787	<0.001	0.361	<0.001	48.3	7	<0.0015	<0.001	0.38	<0.001	0.0311	<0.0002	<0.0015	7.3	2.85	<0.001	29	<0.002	450
22	06/17/2021	<0.001	<0.001	0.0791	<0.001	0.377	<0.001	50.3	7	<0.0015	<0.001	0.39	<0.001	0.0313	<0.0002	<0.0015	7.2	0.526	<0.001	30	<0.002	468
22	07/08/2021	<0.001	<0.001	0.082	<0.001	0.348	<0.001	47.7	7	<0.0015	<0.001	0.37	<0.001	0.0306	<0.0002	<0.0015	7.2	0.386	<0.001	30	<0.002	476
22	07/27/2021	<0.001	<0.001	0.0795	<0.001	0.311	<0.001	48.2	7	<0.0015	<0.001	0.39	<0.001	0.0304	<0.0002	<0.0015	7.3	0.409	<0.001	30	<0.002	486
22	08/17/2021	<0.001	<0.001	0.0785	<0.001	0.34	<0.001	47.1	7	<0.0015	<0.001	0.38	<0.001	0.0309	<0.0002	<0.0015	7.3	0.953	<0.001	29	<0.002	474
35D	03/21/2017	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	8.0	--	--	1060	--	2880
35D	06/16/2017	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.2	--	--	1850	--	4320
35D	09/14/2017	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.1	--	--	1940	--	4300
35D	11/08/2017	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.2	--	--	1860	--	4240
35D	03/22/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.2	--	--	1840	--	4100
35D	05/09/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.8	--	--	1870	--	4140
35D	08/17/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.2	--	--	1780	--	4280
35D	12/03/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.1	--	--	1900	--	4420
35D	03/25/2019	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.3	--	--	1680	--	4030
35D	05/22/2019	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.4	--	--	1780	--	4180
35D	09/27/2019	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.3	--	--	1780	--	4210
35D	12/23/2019	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.1	--	--	1990	--	4340

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, Total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
35D	03/17/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.2	--	--	1800	--	4110
35D	06/22/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.4	--	--	1910	--	2310
35D	09/29/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.2	--	--	1770	--	4240
35D	12/07/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.2	--	--	2020	--	4280
35D	03/29/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.5	--	--	1430	--	3620
35D	04/01/2021	0.0013	0.0035	0.111	<0.001	2.01	<0.001	112	529	0.0034	0.0039	0.76	0.0057	0.14	<0.0002	0.018	8.2	1.17	<0.001	1640	<0.002	3830
35D	04/21/2021	0.0039	0.0013	0.0294	<0.001	1.75	<0.001	93.6	281	<0.0015	<0.001	0.65	<0.001	0.131	<0.0002	0.027	7.8	0.119	<0.001	1220	<0.002	2920
35D	05/11/2021	0.00211	0.00155	0.0261	<0.001	1.85	<0.001	106	306	<0.001	0.00127	0.66	<0.001	0.112	<0.0002	0.0235	--	0.882	<0.001	1390	<0.001	3070
35D	06/03/2021	<0.002	0.0027	0.0546	<0.001	2.47	<0.001	98.1	461	0.0028	0.0022	0.75	0.0021	0.169	<0.0002	0.0178	7.2	2.06	<0.001	1300	<0.002	3240
35D	06/17/2021	<0.002	0.0035	0.14	<0.002	1.81	<0.001	99.4	393	0.0044	0.0041	0.75	0.0046	0.116	<0.0002	0.0187	7.2	0.276	<0.001	1320	<0.002	3170
35D	07/08/2021	<0.001	0.0025	0.0297	<0.001	1.93	<0.001	86	372	<0.0015	0.0018	0.74	<0.001	0.13	<0.0002	0.0165	7.2	0.866	<0.001	1230	<0.002	2910
35D	07/27/2021	<0.001	0.0021	0.0263	<0.001	1.46	<0.001	70.4	234	<0.0015	0.0014	0.79	0.0011	0.102	<0.0002	0.0211	7.4	0.416	<0.001	981	<0.002	2320
35D	08/17/2021	<0.001	0.0013	0.0269	<0.001	1.41	<0.001	65.7	199	<0.0015	0.001	0.76	0.0013	0.0954	<0.0002	0.0173	7.3	1.37	<0.001	895	<0.002	2090
70S	04/01/2021	<0.001	<0.001	0.0175	<0.001	0.457	<0.001	253	19	<0.0015	<0.001	0.14	<0.001	0.0137	<0.0002	0.005	7.0	0.0826	<0.001	760	<0.002	1450
70S	04/21/2021	<0.001	<0.001	0.0205	<0.001	0.403	<0.001	281	17	<0.0015	<0.001	0.14	<0.001	0.0127	<0.0002	0.0053	6.9	0.235	<0.001	840	<0.002	1580
70S	05/10/2021	<0.002	<0.001	0.0185	<0.001	0.382	<0.001	270	16	<0.001	<0.001	0.14	<0.001	0.0107	<0.0002	0.00542	7.0	0.792	<0.001	779	<0.001	1480
70S	06/03/2021	<0.001	<0.001	0.0165	<0.001	0.424	<0.001	245	15	<0.0015	<0.001	0.14	<0.001	0.0122	<0.0002	0.0058	6.9	0.371	<0.001	673	<0.002	1350
70S	06/17/2021	<0.001	<0.001	0.0187	<0.001	0.363	<0.001	250	15	<0.0015	<0.001	0.15	<0.001	0.0129	<0.0002	0.005	6.8	0.0959	<0.001	730	<0.002	1340
70S	07/08/2021	<0.0011	<0.0011	0.0172	<0.0011	0.253	<0.0011	220	14	<0.0017	<0.0011	0.16	<0.0011	0.0121	<0.0002	0.0061	6.8	1.85	<0.0011	589	<0.0022	1220
70S	07/27/2021	<0.001	<0.001	0.0148	<0.001	0.556	<0.001	229	11	<0.0015	<0.001	0.17	<0.001	0.0127	<0.0002	0.0063	7.0	0.0438	<0.001	541	<0.002	1140
70S	08/17/2021	<0.001	<0.001	0.0195	<0.001	0.538	<0.001	232	15	<0.0015	<0.001	0.16	<0.001	0.0157	<0.0002	0.0069	6.9	0.56	<0.001	638	<0.002	1250
70D	04/01/2021	0.0014	0.0054	0.336	0.0018	0.712	<0.001	39.6	317	0.0329	0.0213	0.76	0.0231	0.0633	<0.0002	0.0367	7.6	4.3	<0.001	53	<0.002	792

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, Total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
70D	04/21/2021	0.0013	0.0018	0.521	<0.001	1.01	<0.001	48.1	517	0.0143	0.011	0.57	0.0071	0.0574	<0.0002	0.0342	7.3	11.8	0.0012	48	<0.002	1150
70D	05/10/2021	<0.002	0.0112	0.89	0.00287	1.25	<0.001	69.1	680	0.0898	0.0668	0.54	0.0539	0.143	<0.0002	0.0159	--	4.89	<0.001	53	<0.001	1470
70D	06/03/2021	<0.001	<0.001	0.687	<0.001	1.56	<0.001	68.6	665	0.0078	0.0065	0.47	0.0034	0.0838	<0.0002	0.0518	7.0	--	0.0011	48	<0.002	1570
70D	06/17/2021	<0.001	0.0022	0.726	<0.001	1.33	<0.001	73.1	680	0.0168	0.0136	0.5	0.0082	0.0931	<0.0002	0.0144	7.1	1.17	<0.001	49	<0.002	1600
70D	07/08/2021	<0.0011	0.0081	0.954	0.0025	1.58	<0.0011	82.5	735	0.0679	0.0528	0.41	0.0315	0.138	<0.0002	0.0129	6.8	5.86	<0.0011	49	<0.0022	1770
70D	07/27/2021	<0.001	<0.001	0.734	<0.001	1.54	<0.001	78.1	745	0.002	0.0019	0.44	0.0011	0.0869	<0.0002	0.0096	7.0	2.17	<0.001	48	<0.002	1830
70D	07/28/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.1	3.57	--	--	--	--
70D	08/17/2021	<0.001	<0.001	0.761	<0.001	1.54	<0.001	91.5	716	0.0161	0.0036	0.36	0.0023	0.0994	<0.0002	0.0087	6.8	2.98	<0.001	50	<0.002	1940
71S	04/01/2021	<0.001	0.0064	0.0476	<0.001	0.179	0.0014	115	2	<0.0015	0.0034	0.18	<0.001	0.0054	<0.0002	0.0035	6.9	0.192	0.0026	68	0.0047	486
71S	04/21/2021	<0.001	0.0076	0.0534	<0.001	0.215	<0.001	116	3	<0.0015	<0.001	0.17	<0.001	0.0061	<0.0002	0.0021	6.7	0.444	<0.001	68	<0.002	500
71S	05/12/2021	<0.002	0.00556	0.0487	<0.001	0.227	<0.001	124	3	<0.001	<0.001	0.18	<0.001	0.00582	<0.0002	0.00288	6.8	0.523	<0.001	69	<0.001	474
71S	06/03/2021	<0.001	0.0053	0.0446	<0.001	0.229	<0.001	116	2	<0.0015	<0.001	0.18	<0.001	0.0059	<0.0002	0.0026	6.7	0.00652	<0.001	60	<0.002	484
71S	06/17/2021	<0.001	0.0071	0.0421	<0.001	0.219	<0.001	117	2	<0.0015	<0.001	0.19	<0.001	0.0043	<0.0002	0.0026	6.8	0.463	<0.001	65	<0.002	502
71S	07/08/2021	<0.0011	0.0021	0.0493	<0.0011	0.173	<0.0011	128	2	<0.0017	0.0013	0.19	<0.0011	0.0043	<0.0002	0.0022	6.6	0.559	<0.0011	46	<0.0022	490
71S	07/27/2021	<0.001	0.0023	0.0462	<0.001	0.251	<0.001	132	2	<0.0015	<0.001	0.2	<0.001	0.0052	<0.0002	0.0028	6.8	0.572	<0.001	60	<0.002	538
71S	08/17/2021	<0.001	0.0041	0.0672	<0.001	0.272	<0.001	122	3	0.0022	0.002	0.19	0.0014	0.0071	<0.0002	0.0031	6.7	0.408	<0.001	69	<0.002	534
71D	04/01/2021	0.0013	0.0172	0.299	0.0038	0.58	<0.001	37.7	172	0.138	0.0601	0.92	0.0597	0.112	<0.0002	0.0242	7.6	7.65	<0.001	44	<0.002	896
71D	04/21/2021	0.0013	0.0016	0.141	<0.001	1.01	<0.001	17.6	389	0.0095	0.005	0.8	0.0045	0.0311	<0.0002	0.0287	--	1.36	0.0012	43	<0.002	1010
71D	06/17/2021	<0.001	0.0016	0.4	<0.001	1.1	<0.001	28.7	563	0.005	0.0022	0.73	0.002	0.0502	<0.0002	0.016	7.2	2.66	<0.001	72	<0.002	1640
71D	08/17/2021	<0.001	<0.001	0.677	<0.001	1.3	<0.001	34.9	674	0.0028	0.0018	0.56	0.0013	0.0627	<0.0002	0.0126	7.0	2.59	<0.001	63	<0.002	1900

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, Total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200

Notes:
Detected at concentration greater than the GWPS
-- = data not available
GWPS = Groundwater Protection Standard
mg/L = milligrams per liter
pCi/L = picocuries per liter
SU = standard units
< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method. Estimated concentrations below the reporting limit and associated qualifiers are not provided since they are not utilized in statistics to determine exceedances above Part 845 standards.
35 I.A.C. 845.600 = Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845

TABLE 4-2. GROUNDWATER FIELD PARAMETERS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)
10	03/26/2015	--	--	6.8	377	12.3	--
10	06/02/2015	--	--	6.8	1430	13.3	--
10	09/23/2015	--	--	6.5	1200	14.2	--
10	11/23/2015	--	--	6.7	1240	12.1	--
10	02/25/2016	--	--	6.7	1450	11.6	--
10	05/19/2016	--	--	6.8	1570	13.7	--
10	09/07/2016	--	--	6.7	1360	15.9	--
10	12/19/2016	--	--	6.8	1500	10.8	--
10	03/21/2017	--	--	6.8	1327	12.8	--
10	06/16/2017	--	--	6.8	1617	15.6	--
10	07/12/2017	4.46	121	6.7	991	17.2	<1
10	09/14/2017	6.63	137	6.7	1110	14.8	<1
10	11/08/2017	4.26	84	6.9	1150	13.1	<1
10	01/24/2018	<1	50	7.0	1490	10.7	9.5
10	03/22/2018	<1	74	6.8	1450	14.3	2.9
10	05/09/2018	1.34	73	6.4	1510	15.3	1.2
10	08/17/2018	--	--	6.8	1445	--	--
10	12/03/2018	--	--	6.7	1322	--	--
10	03/25/2019	--	--	6.8	1620	--	--
10	05/22/2019	--	--	6.6	1570	--	--
10	09/27/2019	--	--	6.8	1450	--	--
10	12/23/2019	--	--	6.7	1250	--	--
10	03/17/2020	--	--	6.7	1530	--	--
10	06/22/2020	--	--	6.8	1380	--	--
10	09/29/2020	--	--	6.6	1210	--	--
10	12/07/2020	--	--	6.6	1250	--	--
10	03/29/2021	--	--	6.8	1470	--	--
10	04/01/2021	5.28	162	6.8	1481	12.0	0
10	04/21/2021	5.17	255	6.8	1607	9.8	34.1
10	05/10/2021	4.34	188	6.8	1270	14.3	38.6
10	06/03/2021	3.45	12	6.7	1580	14.3	46
10	06/17/2021	3.45	3	6.8	1390	14.1	25
10	07/08/2021	4.08	40	6.7	1580	15.3	14
10	07/27/2021	4.21	-76	6.8	1530	15.3	9.7
10	08/17/2021	3.85	-48	6.7	1420	16.2	28
16A	03/26/2015	--	--	7.3	1040	11.1	--
16A	06/02/2015	--	--	7.3	1220	10.8	--
16A	09/23/2015	--	--	7.4	1110	11.8	--
16A	11/23/2015	--	--	7.3	1230	11.7	--
16A	02/25/2016	--	--	7.4	1210	10.9	--
16A	05/19/2016	--	--	7.4	1275	11.5	--
16A	09/07/2016	--	--	7.4	1220	13.2	--
16A	12/19/2016	--	--	7.4	1350	11.6	--
16A	03/21/2017	--	--	7.4	1274	11.5	--

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)
16A	06/16/2017	--	--	7.4	1315	12.1	--
16A	09/14/2017	--	--	7.4	1040	12.4	--
16A	11/08/2017	--	--	7.5	1230	12.1	--
16A	03/22/2018	--	--	7.4	1040	12.3	--
16A	05/09/2018	--	--	7.0	1080	12.5	--
16A	08/17/2018	--	--	7.6	1567	--	--
16A	12/03/2018	--	--	7.5	1411	--	--
16A	03/25/2019	--	--	7.1	1259	--	--
16A	05/22/2019	--	--	7.1	1130	--	--
16A	09/27/2019	--	--	7.5	1410	--	--
16A	12/23/2019	--	--	7.3	1150	--	--
16A	03/17/2020	--	--	7.4	1200	--	--
16A	06/22/2020	--	--	7.4	1150	--	--
16A	09/29/2020	--	--	7.4	1120	--	--
16A	12/07/2020	--	--	7.4	1170	--	--
16A	03/29/2021	--	--	7.6	1200	--	--
16A	04/01/2021	0.17	-30.6	7.5	1282	11.5	8.05
16A	04/21/2021	0.03	-42.6	7.2	1317	11.3	28.5
16A	05/11/2021	4.44	-38	7.4	1408	11.6	42.6
16A	06/03/2021	0.36	-113	7.3	1290	11.7	13
16A	06/17/2021	0.41	-135	7.4	1180	11.6	1.8
16A	07/08/2021	0.39	-38	7.3	1290	12.2	1.2
16A	07/27/2021	0.58	-45	7.4	1310	12.9	7.5
16A	08/17/2021	0.57	-55	7.5	1220	14.3	2.3
22	04/01/2021	0.21	-73.6	7.4	913.7	12.7	7.12
22	04/20/2021	11.00	-14.4	7.6	0.8	10.0	0
22	05/10/2021	0.14	-57.2	7.3	833.2	13.1	1.92
22	06/03/2021	0.50	-104	7.3	856	13.6	<1
22	06/17/2021	1.99	-80	7.2	782	14.0	2.5
22	07/08/2021	1.67	8	7.2	859	15.0	2.8
22	07/27/2021	2.23	-32	7.3	834	15.5	<1
22	08/17/2021	1.30	-28	7.3	765	14.8	<1
35D	03/21/2017	--	--	8.0	3360	13.2	--
35D	06/16/2017	--	--	7.2	6020	13.4	--
35D	09/14/2017	--	--	7.1	5590	13.2	--
35D	11/08/2017	--	--	7.2	5730	12.7	--
35D	03/22/2018	--	--	7.2	7680	13.9	--
35D	05/09/2018	--	--	6.8	7300	14.2	--
35D	08/17/2018	--	--	7.2	6300	--	--
35D	12/03/2018	--	--	7.1	6410	--	--
35D	03/25/2019	--	--	7.3	6490	--	--
35D	05/22/2019	--	--	7.4	6360	--	--
35D	09/27/2019	--	--	7.3	6580	--	--
35D	12/23/2019	--	--	7.1	5590	--	--

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)
35D	03/17/2020	--	--	7.2	6150	--	--
35D	06/22/2020	--	--	7.4	5780	--	--
35D	09/29/2020	--	--	7.2	5390	--	--
35D	12/07/2020	--	--	7.2	5690	--	--
35D	03/29/2021	--	--	7.5	5380	--	--
35D	04/01/2021	17.00	78	8.2	5772	9.4	153
35D	04/21/2021	6.79	108	7.8	4363	12.1	77.1
35D	06/03/2021	0.79	-132	7.2	5180	14.2	98
35D	06/17/2021	0.48	-96	7.2	4490	14.9	35
35D	07/08/2021	7.25	22	7.2	4630	13.7	22
35D	07/27/2021	0.49	-70	7.4	3510	12.9	7.5
35D	08/17/2021	0.54	-62	7.3	3000	13.5	6
70D	04/01/2021	8.23	157	7.6	1400	18.1	2010
70D	04/21/2021	5.67	129	7.3	2058	13.0	0
70D	06/03/2021	2.91	91	7.0	3080	13.6	75
70D	06/17/2021	1.25	46	7.1	2950	13.6	1900
70D	07/08/2021	2.99	46	6.8	3460	13.0	150
70D	07/27/2021	2.68	6	7.0	3510	13.4	420
70D	07/28/2021	3.31	102	7.1	3480	14.6	1600
70D	08/17/2021	3.04	16	6.8	3300	14.0	240
70S	04/01/2021	0.07	118	7.0	1862	10.7	2.65
70S	04/21/2021	0.04	135	6.9	1955	9.1	1.06
70S	05/10/2021	0.19	116	7.0	1796	8.6	0
70S	06/03/2021	0.55	45	6.9	1740	9.9	<1
70S	06/17/2021	0.38	15	6.8	1620	9.9	8.5
70S	07/08/2021	0.40	25	6.8	1600	12.1	1
70S	07/27/2021	0.47	-46	7.0	1530	14.0	<1
70S	08/17/2021	0.47	-25	6.9	1490	15.0	3.1
71D	04/01/2021	8.77	116	7.6	1312	16.5	5130
71D	06/17/2021	0.76	27	7.2	2830	13.7	160
71D	08/17/2021	0.84	-14	7.0	3270	14.1	100
71S	04/01/2021	2.62	34.1	6.9	896.2	9.3	1.42
71S	04/21/2021	0.19	-8.1	6.7	913.1	9.5	5.36
71S	05/12/2021	0.24	-34.7	6.8	908.9	10.1	0
71S	06/03/2021	0.54	-82	6.7	900	12.3	6.5
71S	06/17/2021	0.43	-88	6.8	845	13.5	3.3
71S	07/08/2021	0.44	61	6.6	929	13.6	1
71S	07/27/2021	0.43	-2	6.8	919	15.5	49
71S	08/17/2021	0.58	-14	6.7	851	17.2	8.5
NED1	04/01/2021	0.08	-267	9.2	2594	11.2	0.51
NED1	04/21/2021	0.01	-194	8.9	2472	11.2	9.32
NED1	05/11/2021	0.15	-91	7.9	2871	11.9	4.18
NED1	06/04/2021	0.30	-173	7.5	2680	12.6	4.4
NED1	08/17/2021	0.34	-184	8.7	2390	17.0	<1

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)

Notes:
Field readings are reported with as many significant figures as provided by analytical laboratory.
-- = data not available
cm = centimeter
deg. C = degrees Celsius
mg/L = milligrams per liter
mV = millivolts
NTU = nephelometric turbidity units
SU = standard units

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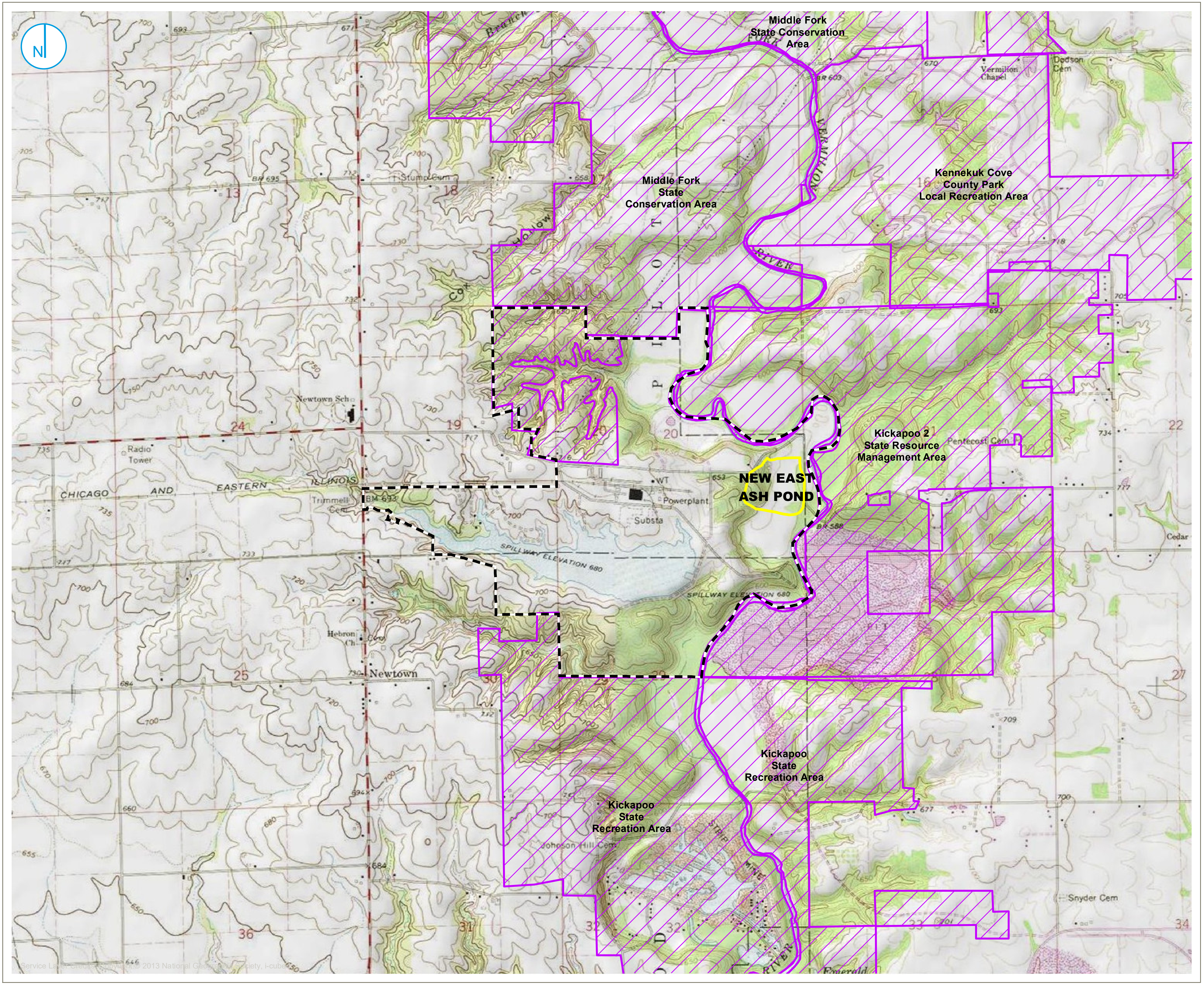
FIGURES



🟨 PART 845 REGULATED UNIT (SUBJECT UNIT)

▭ PROPERTY BOUNDARY

▨ PROTECTED AREA

SITE LOCATION MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

FIGURE 1-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\Figure 1-1_Site Location Map.mxd

PROJECT: 169000XXXX | DATED: 10/7/2021 | DESIGNER: STOLZSD

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

▣ COAL MINE SHAFT
☐ UNDERGROUND OR SURFACE COAL MINE
☐ PART 845 REGULATED UNIT (SUBJECT UNIT)
☐ SITE FEATURE
⬚ PROPERTY BOUNDARY

SITE MAP

HYDROGEOLOGIC SITE
CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

FIGURE 1-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\Figure 1-2_Site Map.mxd

PROJECT: 169000XXXX | DATED: 10/12/2021 | DESIGNER: STOLZSD

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Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\Figure 2-1_Site Topographic Map.mxd

PROJECT: 169000XXXX | DATED: 10/7/2021 | DESIGNER: STOLZSD

10 FOOT ELEVATION CONTOUR
2 FOOT ELEVATION CONTOUR
🟨 PART 845 REGULATED UNIT (SUBJECT UNIT)
☐ SITE FEATURE
⬚ PROPERTY BOUNDARY

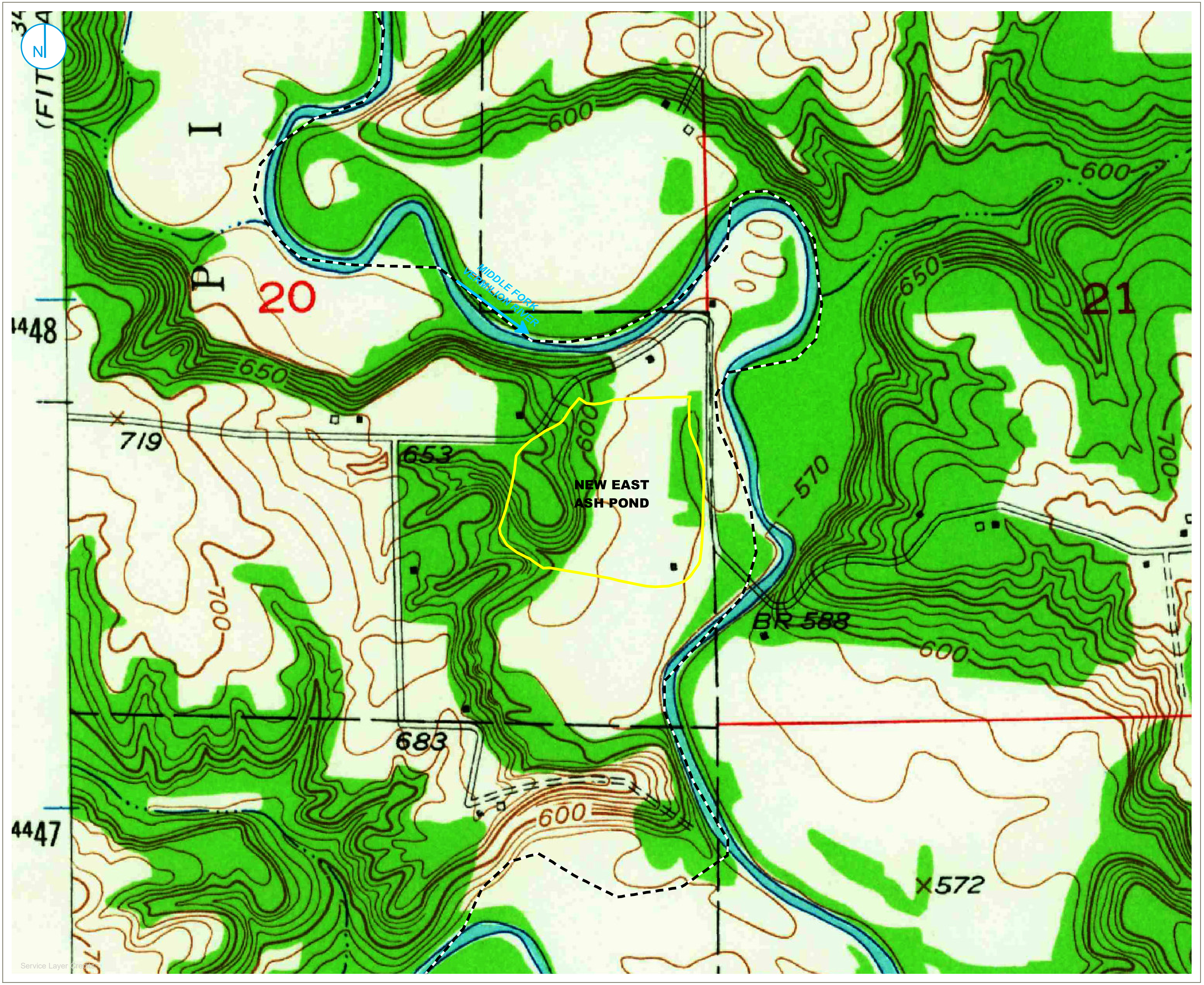
0 150 300
Feet

SITE TOPOGRAPHIC MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

FIGURE 2-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.



SITE TOPOGRAPHIC MAP 1948
PRE-CONSTRUCTION

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

FIGURE 2-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\Figure 2-2_Site Topographic Map 1948.mxd

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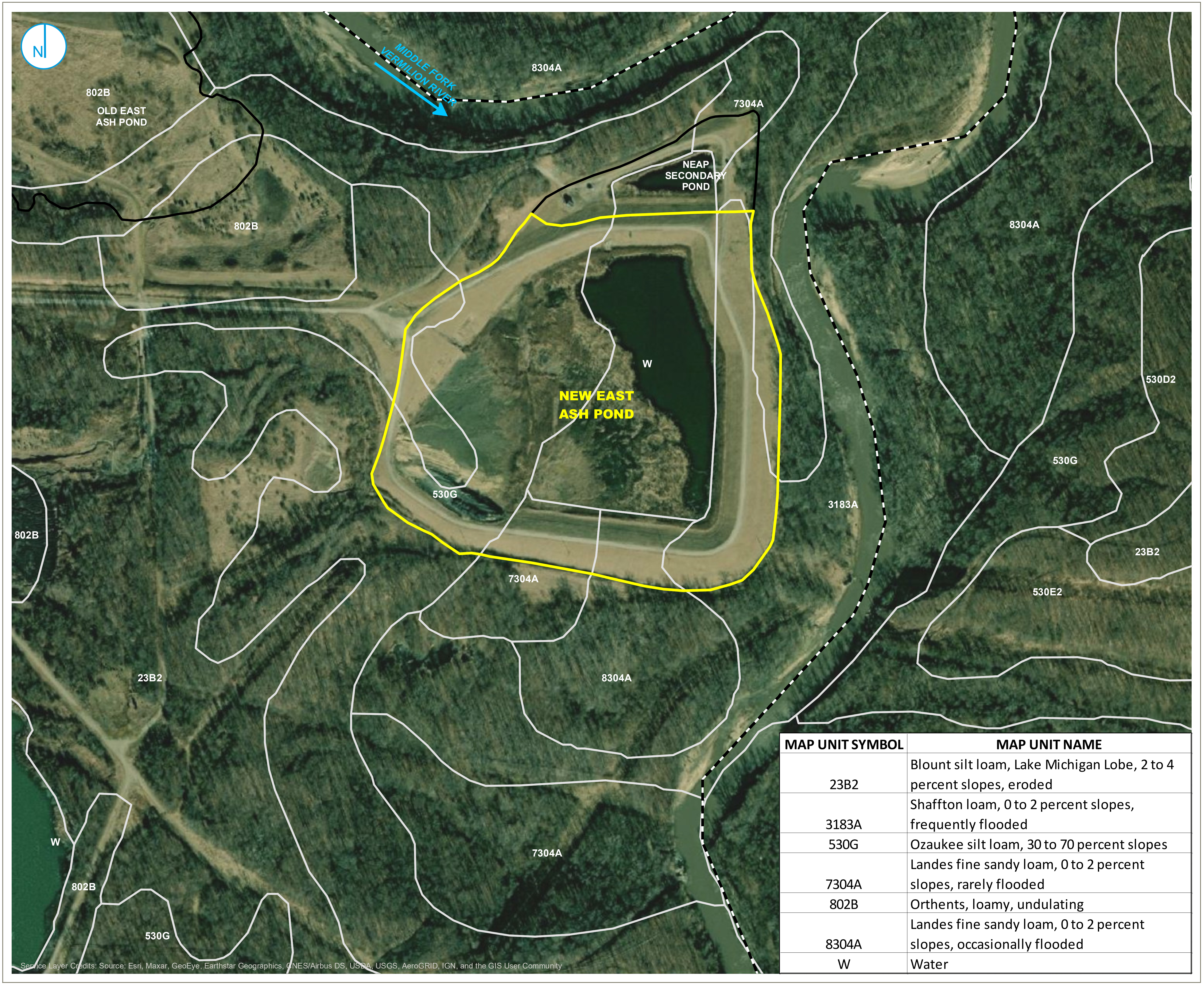
Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\Figure 2-3_Soil Survey Map.mxd



Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

MAP UNIT SYMBOL	MAP UNIT NAME
23B2	Blount silt loam, Lake Michigan Lobe, 2 to 4 percent slopes, eroded
3183A	Shaffton loam, 0 to 2 percent slopes, frequently flooded
530G	Ozaukee silt loam, 30 to 70 percent slopes
7304A	Landes fine sandy loam, 0 to 2 percent slopes, rarely flooded
802B	Orthents, loamy, undulating
8304A	Landes fine sandy loam, 0 to 2 percent slopes, occasionally flooded
W	Water

PROJECT: 169000XXXX | DATED: 10/7/2021 | DESIGNER: STOLZSD

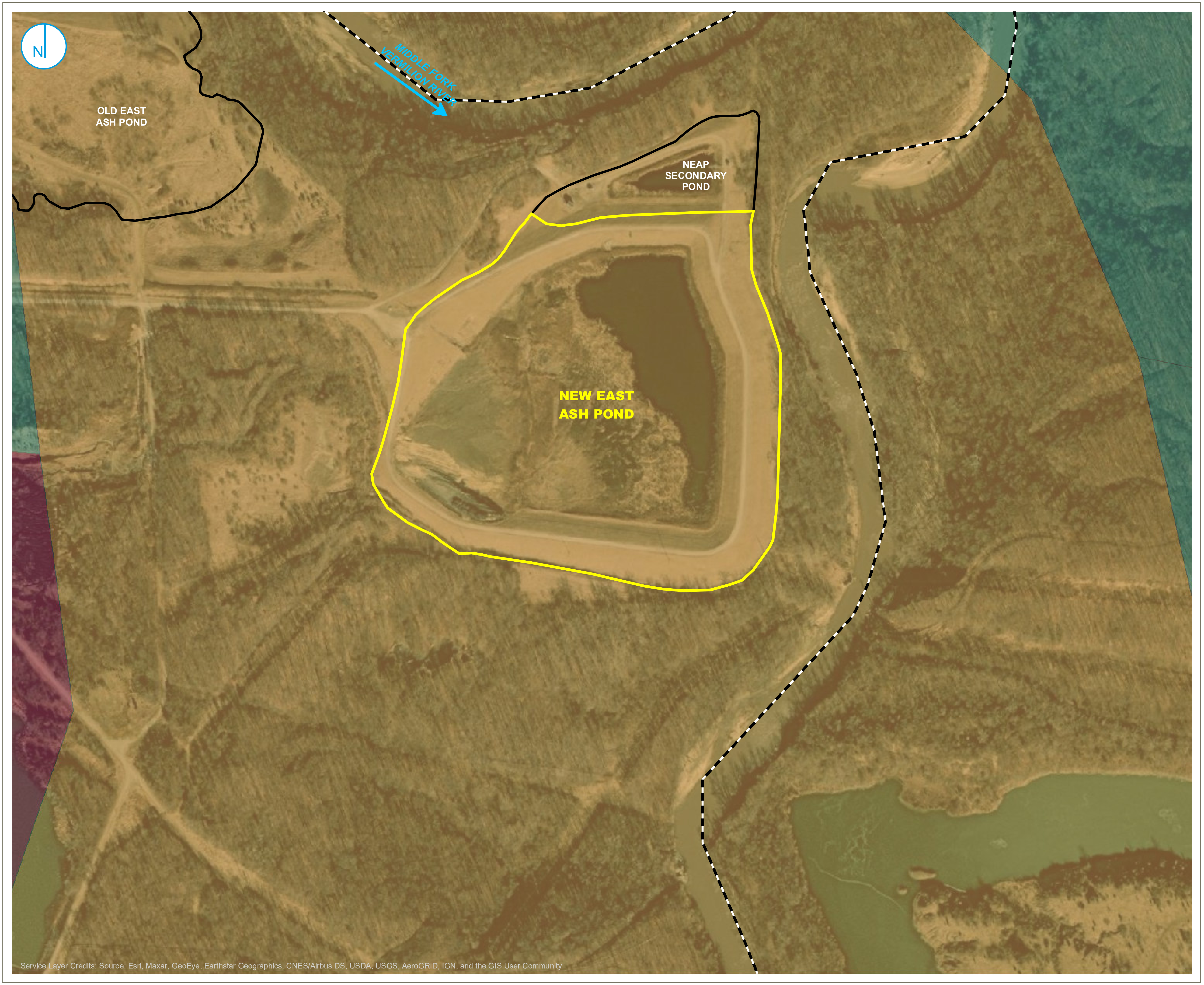
SOIL SURVEY MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

FIGURE 2-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



🟨 PART 845 REGULATED UNIT (SUBJECT UNIT)
⬛ SITE FEATURE
▭ PROPERTY BOUNDARY
🟧 CAHOKIA ALLUVIUM (INCLUDES ALLUVIAL FAN FACIES)
🟦 SNIDER TILL MEMBER
🟪 SURFACE-MINED AREA

0 150 300 Feet

SURFICIAL GEOLOGIC DEPOSITS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

FIGURE 2-4

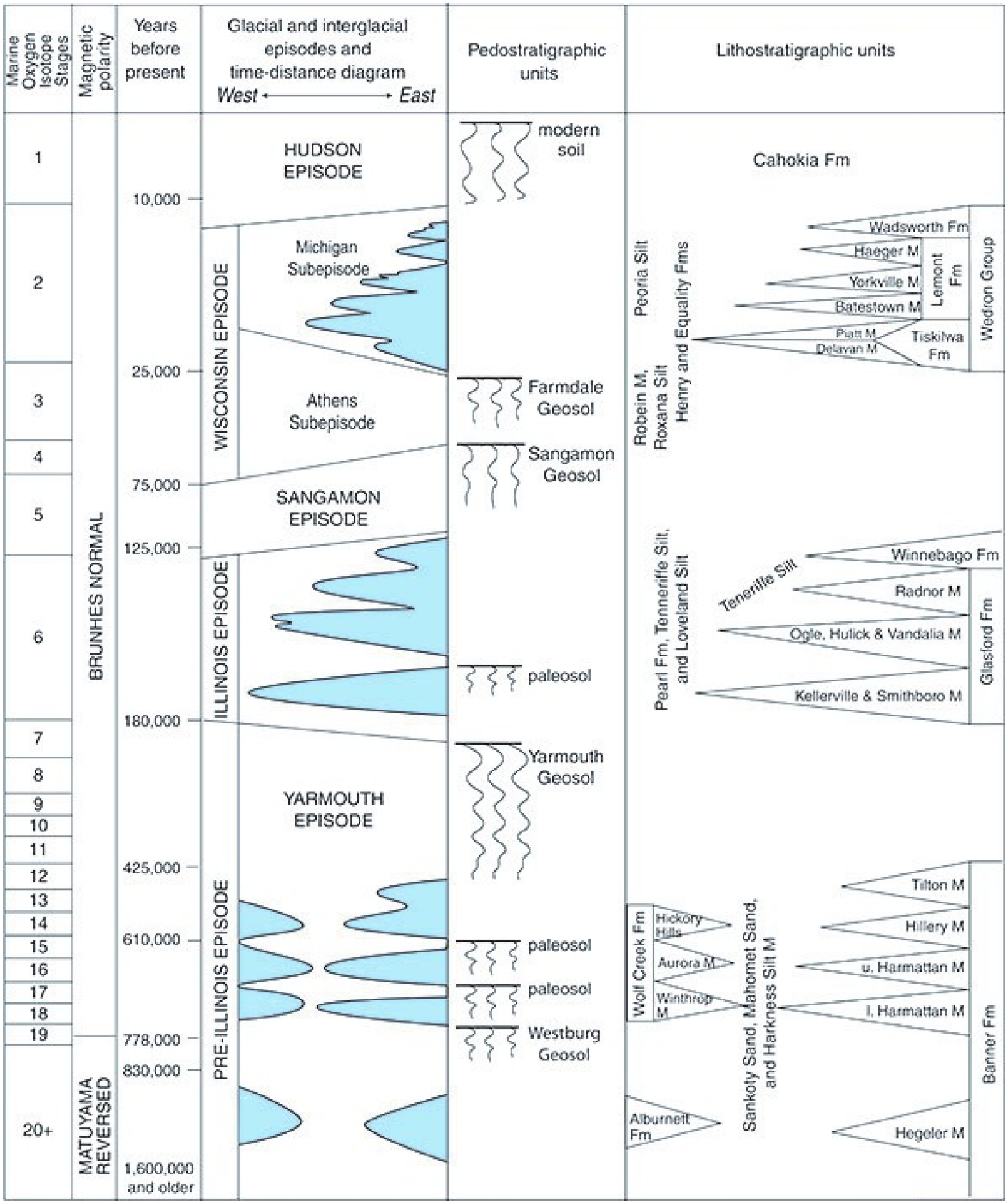
RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\Figure 2-4_Surficial Geologic Deposits.mxd

PROJECT: 169000XXXX | DATED: 10/7/2021 | DESIGNER: STOLZSD

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\Figure 2-5_Generalized Stratigraphic Column.mxd

PROJECT: 169000XXXX | DATED: 10/7/2021 | DESIGNER: STOLZSD



SOURCE NOTE: STRATIGRAPHIC COLUMN IS FROM GEOLOGY OF ILLINOIS, KOLATA AND NIMZ, EDS.(2010).

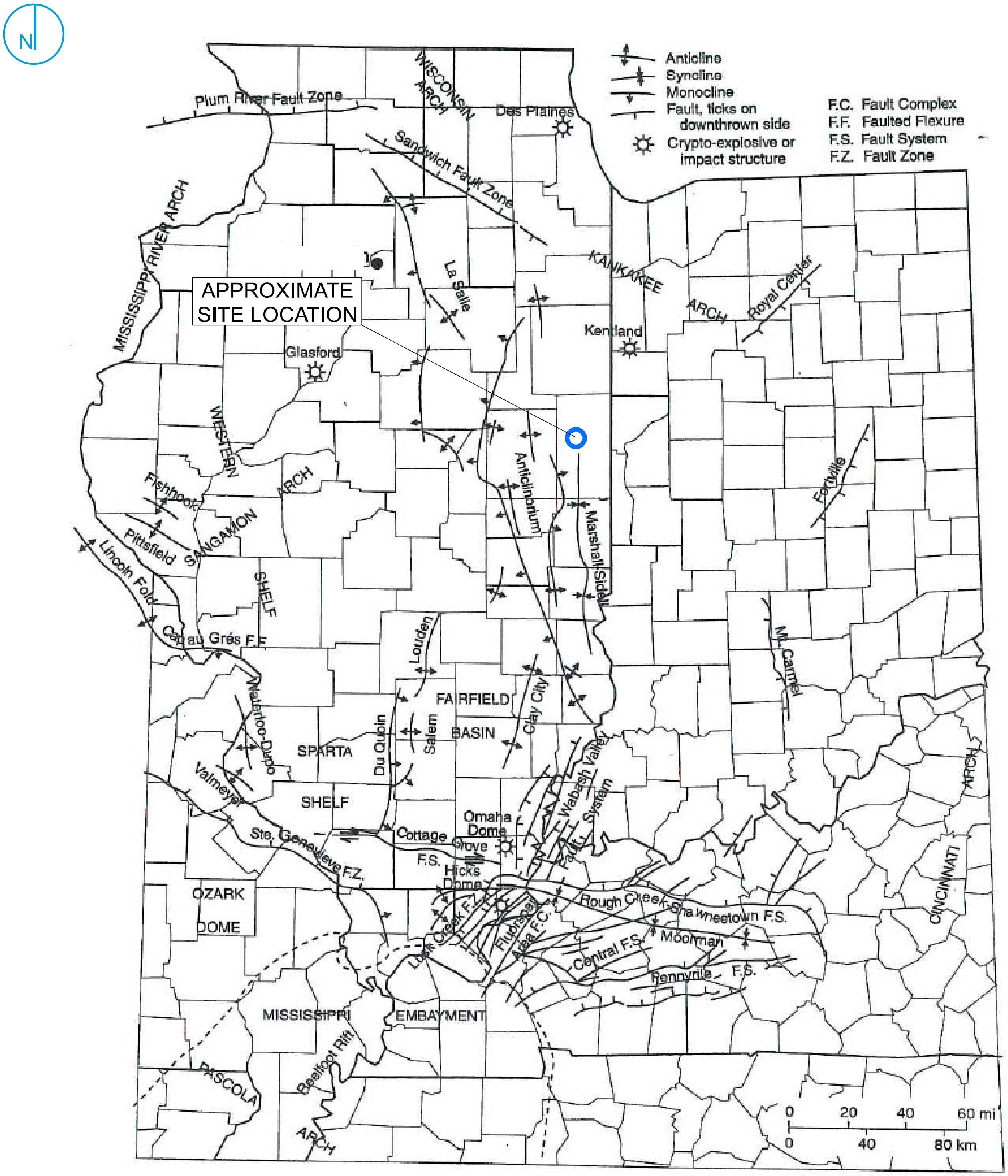
GENERALIZED STRATIGRAPHIC COLUMN FOR THE VERMILION AREA

FIGURE 2-5

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\Figure 2-6_Major Structural Features of Illinois.mxd



SOURCE NOTE: MODIFIED FROM "NELSON, W.J. 1995, STRUCTURAL FEATURES IN ILLINOIS, ILLINOIS STATE GEOLOGICAL SURVEY, BULLETIN 100, CHAMPAIGN, ILLINOIS."

Service Layer Credits:

PROJECT: 169000XXXX | DATED: 10/7/2021 | DESIGNER: STOLZSD

MAJOR STRUCTURAL FEATURES OF ILLINOIS

FIGURE 2-6

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

FIELD INVESTIGATION LOCATIONS

HYDROGEOLOGIC SITE
CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION SITE
OAKWOOD, ILLINOIS

FIGURE 2-7

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\Figure 2-7_Field Investigation Locations.mxd

PROJECT: 169000XXXX | DATED: 10/12/2021 | DESIGNER: STOLZSD

- BOTTOM OF ASH ELEVATION
- PART 845 REGULATED UNIT (SUBJECT UNIT)
- SITE FEATURE
- PROPERTY BOUNDARY

NOTE
BOTTOM OF ASH CONTOURS PROVIDED BY GEOSYNTEC.

0 150 300 Feet

BOTTOM OF ASH MAP

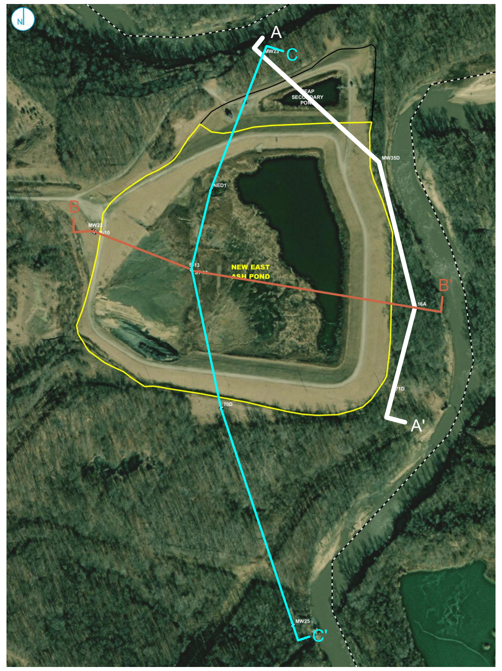
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

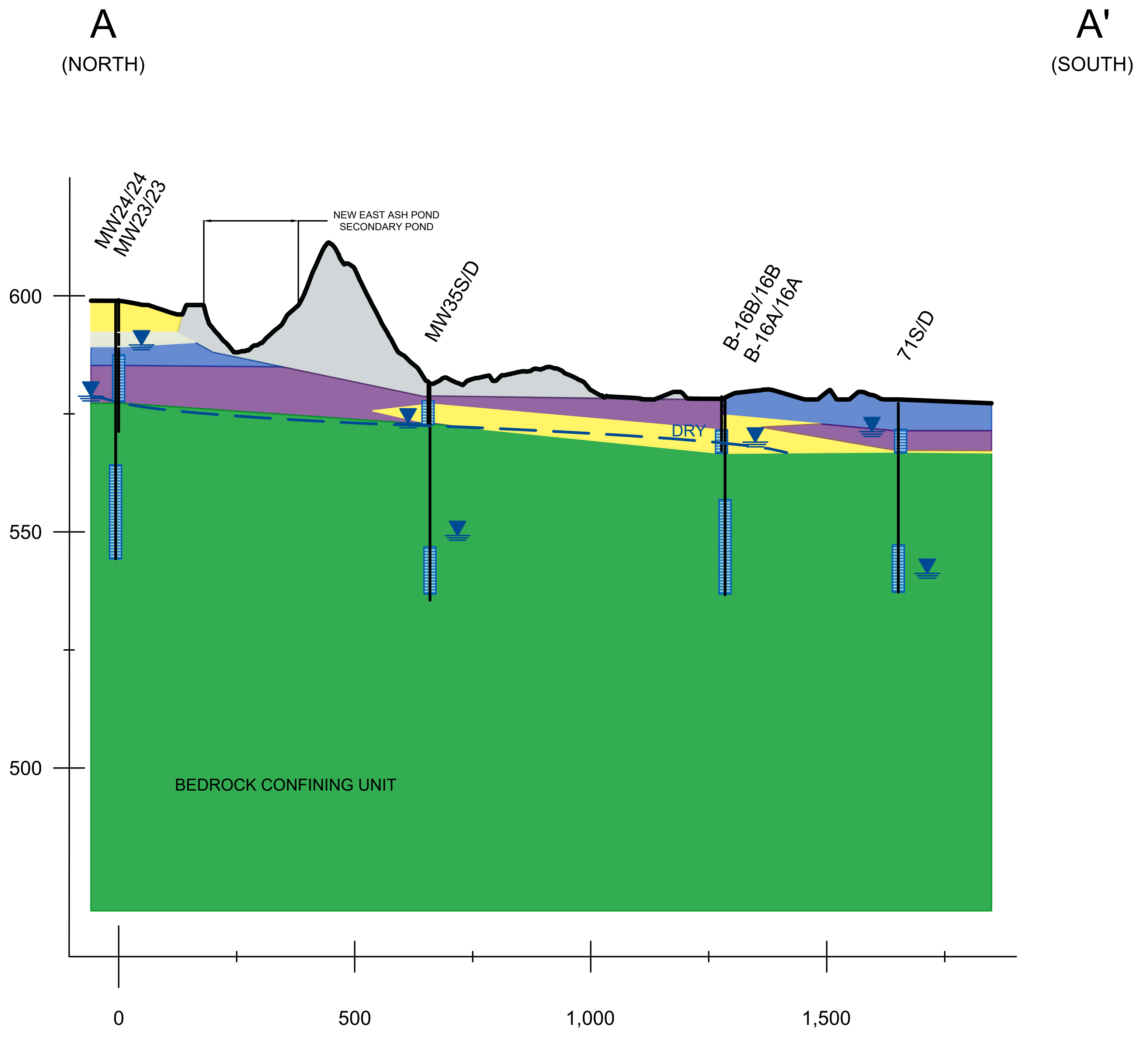
FIGURE 2-8

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\Figure 2-8_Bottom of Ash.mxd

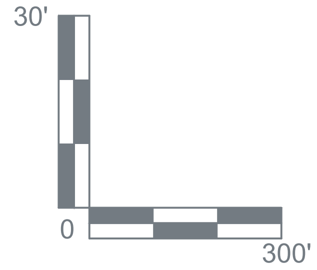
PROJECT: 169000XXXX | DATED: 10/12/2021 | DESIGNER: STOLZSD





NOTES

1. This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.
2. Scale is approximate.
3. Vertical scale is exaggerated 10X.
4. Groundwater elevations measured on March 29, 2021.
5. PMP = Potential Migration Pathway



LEGEND

- ⬜ FILL
- 🟪 CLAY (CL/CH)
- ⬜ TILL (CL/CH)
- 🟦 SILT (ML)
- 🟨 SAND (SP/SM/SW)
- ⬜ GRAVEL (GP/GW)
- 🟩 BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE, SANDSTONE, V. LITTLE SS)
- ▤ WELL SCREEN INTERVAL
- - - BEDROCK CONFINING UNT POTENTIOMETRIC SURFACE
- ▼ BEDROCK CONFINING UNIT / PMP GROUNDWATER / OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)

GEOLOGIC CROSS SECTION
A-A'

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

FIGURE 2-9

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

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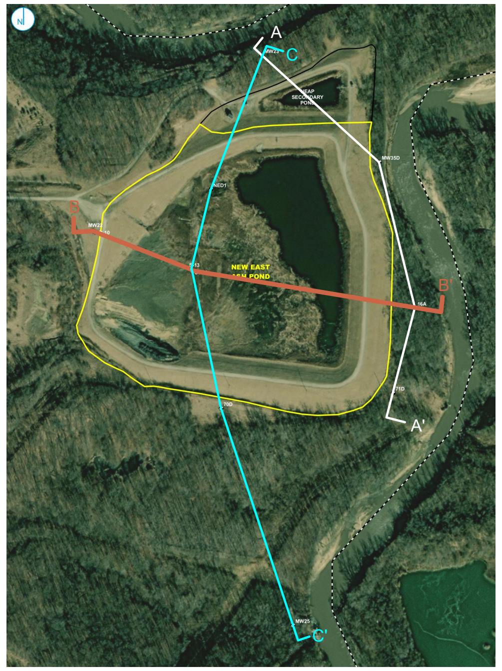
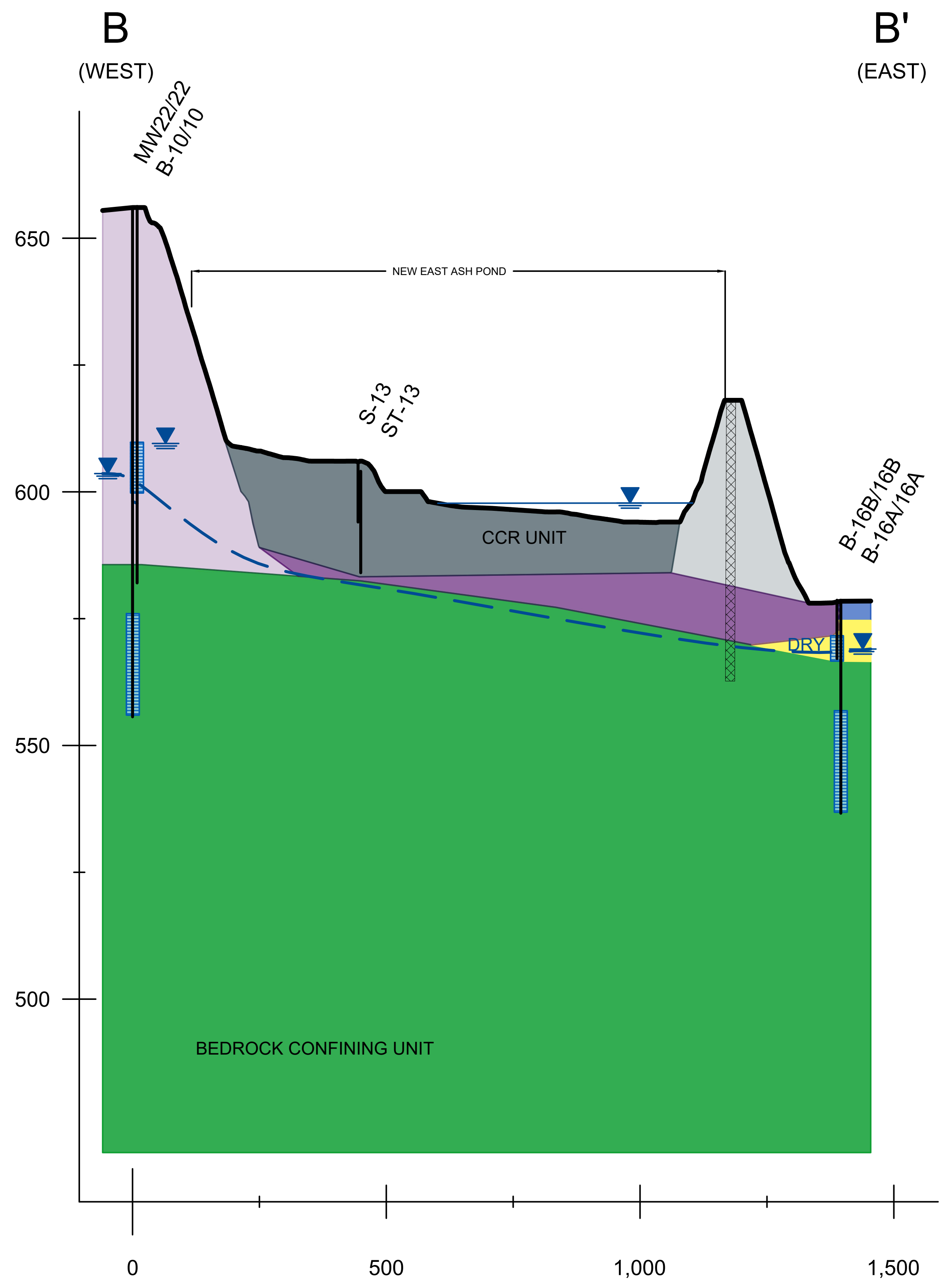
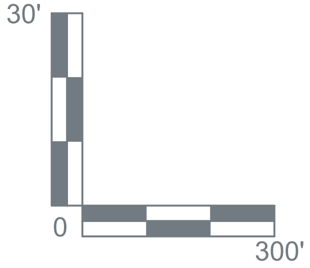
PROJECT: 1940100806 DATED: 10/12/2021 DESIGNER: ENGELHSA





NOTES

1. This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.
2. Scale is approximate.
3. Vertical scale is exaggerated 10X.
4. Groundwater elevations measured on March 29, 2021.
5. PMP = Potential Migration Pathway



LEGEND

🟫	COAL COMBUSTION RESIDUALS (CCR)
⬜	FILL
🟪	CLAY (CL/CH)
⬜	TILL (CL/CH)
🟦	SILT (ML)
🟨	SAND (SP/SM/SW)
🟩	BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE, SANDSTONE, V. LITTLE SS)
▤	WELL SCREEN INTERVAL
- -	BEDROCK CONFINING UNT POTENTIOMETRIC SURFACE
▼	BEDROCK CONFINING UNIT / PMP GROUNDWATER / OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)
▨	CLAY CORE KEYED 8-FT INTO BEDROCK

GEOLOGIC CROSS SECTION
B-B'

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

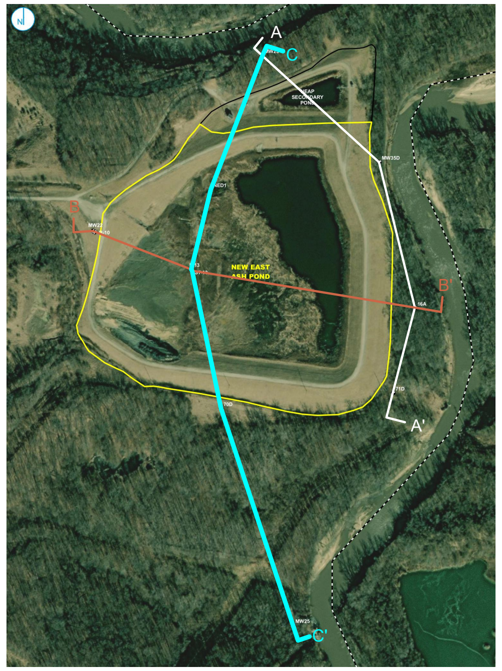
FIGURE 2-10

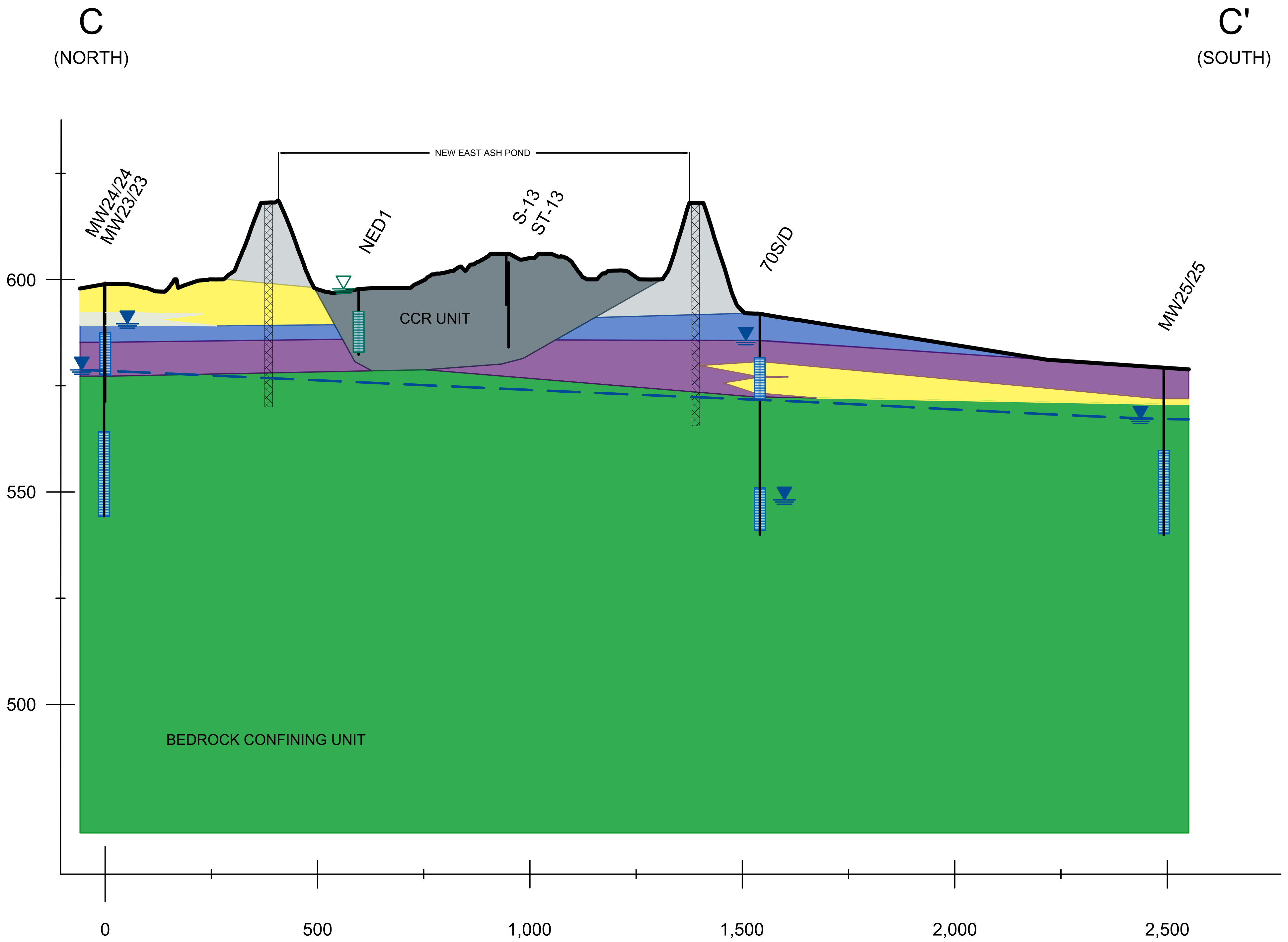
RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

\\ramboll.sharepoint.com@SSL\DavWWWRoot\sites\vistra\Shared Documents\CCR GW\Deliverables\Part 845 Operating Permits\Sites\Vermilion\Hydrogeo Report\NEAP HCR\Figures\working files\CAD\Cross Sections\Vermilion-NEAP-Cross Sections.dwg
PROJECT: 1940100806 DATED: 10/12/2021 DESIGNER: ENGELHSA

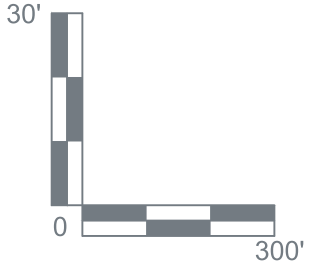
\\ramboll.sharepoint.com@SSL\DavWWWRoot\sites\vista\Shared Documents\CCR GW\Deliverables\Part 845 Operating Permits\Sites\Vermilion\Hydrogeo Report\NEAP HCR\Figures\working files\CAD\Cross Sections\Vermilion-NEAP-Cross Sections.dwg
PROJECT: 1940100806 DATED: 10/12/2021 DESIGNER: ENGELHSA





NOTES

1. This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.
2. Scale is approximate.
3. Vertical scale is exaggerated 10X.
4. Groundwater elevations measured on March 29, 2021.
5. PMP = Potential Migration Pathway



LEGEND

■	COAL COMBUSTION RESIDUALS (CCR)
■	FILL
■	CLAY (CL/CH)
■	TILL (CL/CH)
■	SILT (ML)
■	SAND (SP/SM/SW)
■	GRAVEL (GP/GW)
🟩	BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE, SANDSTONE, V. LITTLE SS)
▤	WELL SCREEN INTERVAL
- - -	BEDROCK CONFINING UNT POTENTIOMETRIC SURFACE
▽	POREWATER ELEVATION
▼	BEDROCK CONFINING UNIT / PMP GROUNDWATER / OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)
⊠	CLAY CORE KEYED 8-FT INTO BEDROCK

GEOLOGIC CROSS SECTION
C-C'

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

FIGURE 2-11

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\Figure 3-1_Monitoring Well Location Map.mxd

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

- 🟧 BACKGROUND WELL
- ■ MONITORING WELL
- 🟩 SOURCE SAMPLE LOCATION
- ▭ PART 845 REGULATED UNIT (SUBJECT UNIT)
- ▭ SITE FEATURE
- ⬚ PROPERTY BOUNDARY

0 150 300 Feet

MONITORING WELL LOCATION MAP

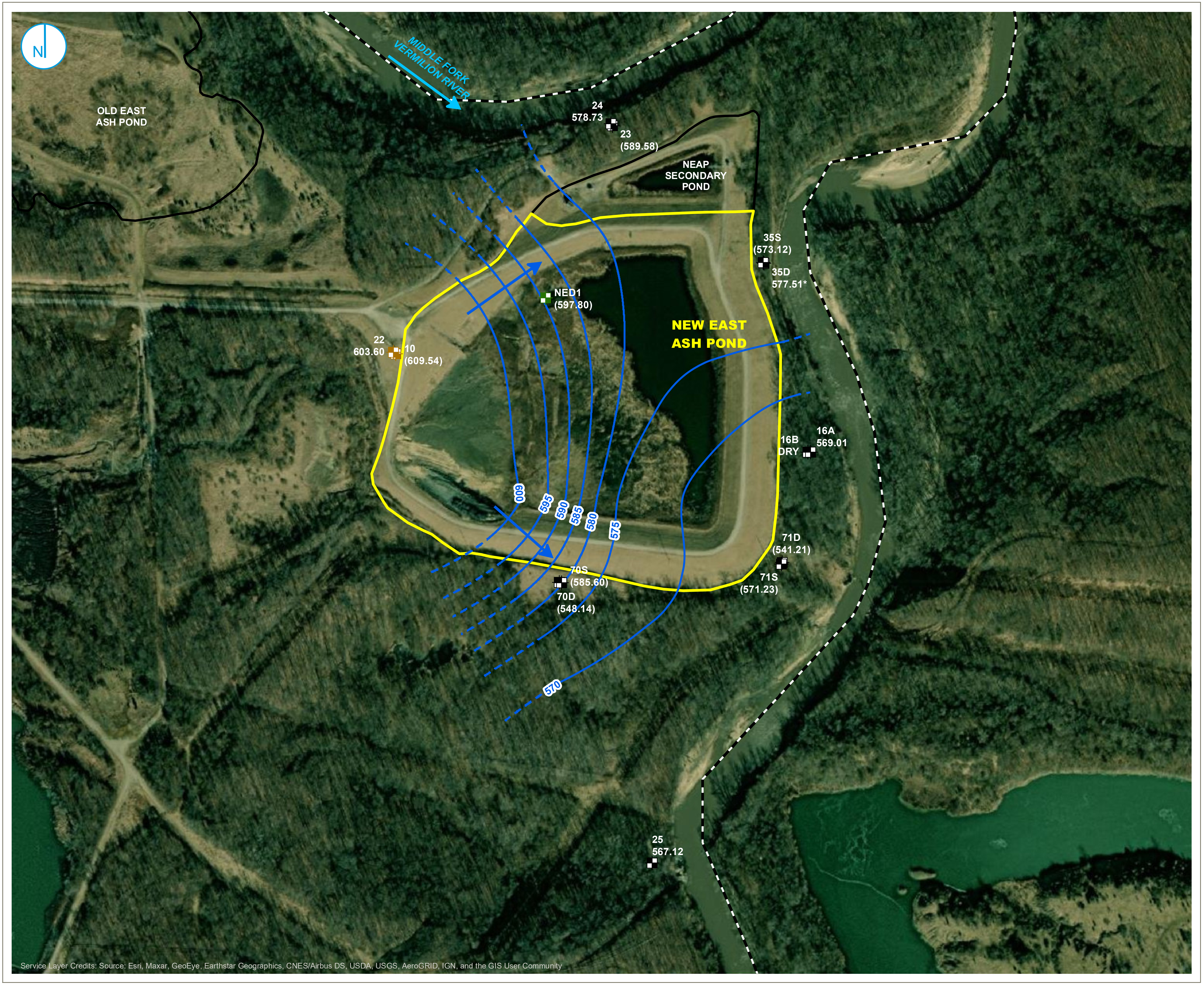
HYDROGEOLOGIC SITE
CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

FIGURE 3-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

PROJECT: 169000XXXX | DATED: 10/7/2021 | DESIGNER: STOLZSD

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\Figure 3-2_GWE Contours Event 1_20210329.mxd



Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

⊞ BACKGROUND WELL
⊞ MONITORING WELL
⊞ SOURCE SAMPLE LOCATION
— GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD88)
- - INFERRED GROUNDWATER ELEVATION CONTOUR
→ GROUNDWATER FLOW DIRECTION
☐ PART 845 REGULATED UNIT (SUBJECT UNIT)
☐ SITE FEATURE
☐ PROPERTY BOUNDARY

NOTES:
1. ELEVATIONS IN PARENTHESIS WERE NOT USED FOR CONTOURING.
2. NM = NOT MEASURED
3. ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988
4. * ELEVATION COLLECTED AS PART OF NPDES PERMIT NO. IL0004057 MONITORING ON MARCH 29, 2021..

0 150 300
Feet

BEDROCK GROUNDWATER ELEVATION CONTOURS MARCH 29, 2021

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

FIGURE 3-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 10/7/2021 | DESIGNER: STOLZSD

🟧 BACKGROUND WELL
■ MONITORING WELL
🟩 SOURCE SAMPLE LOCATION
— GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD88)
- - INFERRED GROUNDWATER ELEVATION CONTOUR
→ GROUNDWATER FLOW DIRECTION
🟨 PART 845 REGULATED UNIT (SUBJECT UNIT)
☐ SITE FEATURE
⬚ PROPERTY BOUNDARY

NOTES:

1. ELEVATIONS IN PARENTHESIS WERE NOT USED FOR CONTOURING.
2. NM = NOT MEASURED
3. ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988..

0 150 300
Feet

BEDROCK GROUNDWATER ELEVATION CONTOURS APRIL 12, 2021

HYDROGEOLOGIC SITE
CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

FIGURE 3-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\Figure 3-3_GWE Contours Event 2_20210412.mxd

PROJECT: 169000XXXX | DATED: 10/7/2021 | DESIGNER: STOLZSD

- 🟧 BACKGROUND WELL
- ■ MONITORING WELL
- 🟩 SOURCE SAMPLE LOCATION
- — GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD88)
- - - INFERRED GROUNDWATER ELEVATION CONTOUR
- → GROUNDWATER FLOW DIRECTION
- ▭ PART 845 REGULATED UNIT (SUBJECT UNIT)
- ▭ SITE FEATURE
- ⬚ PROPERTY BOUNDARY

NOTES:

1. ELEVATIONS IN PARENTHESIS WERE NOT USED FOR CONTOURING.
2. NM = NOT MEASURED
3. ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988..

0 200 400 Feet

BEDROCK GROUNDWATER ELEVATION CONTOURS MAY 10, 2021

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

FIGURE 3-4

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\Figure 3-4_GWE Contours Event 3_20210510.mxd

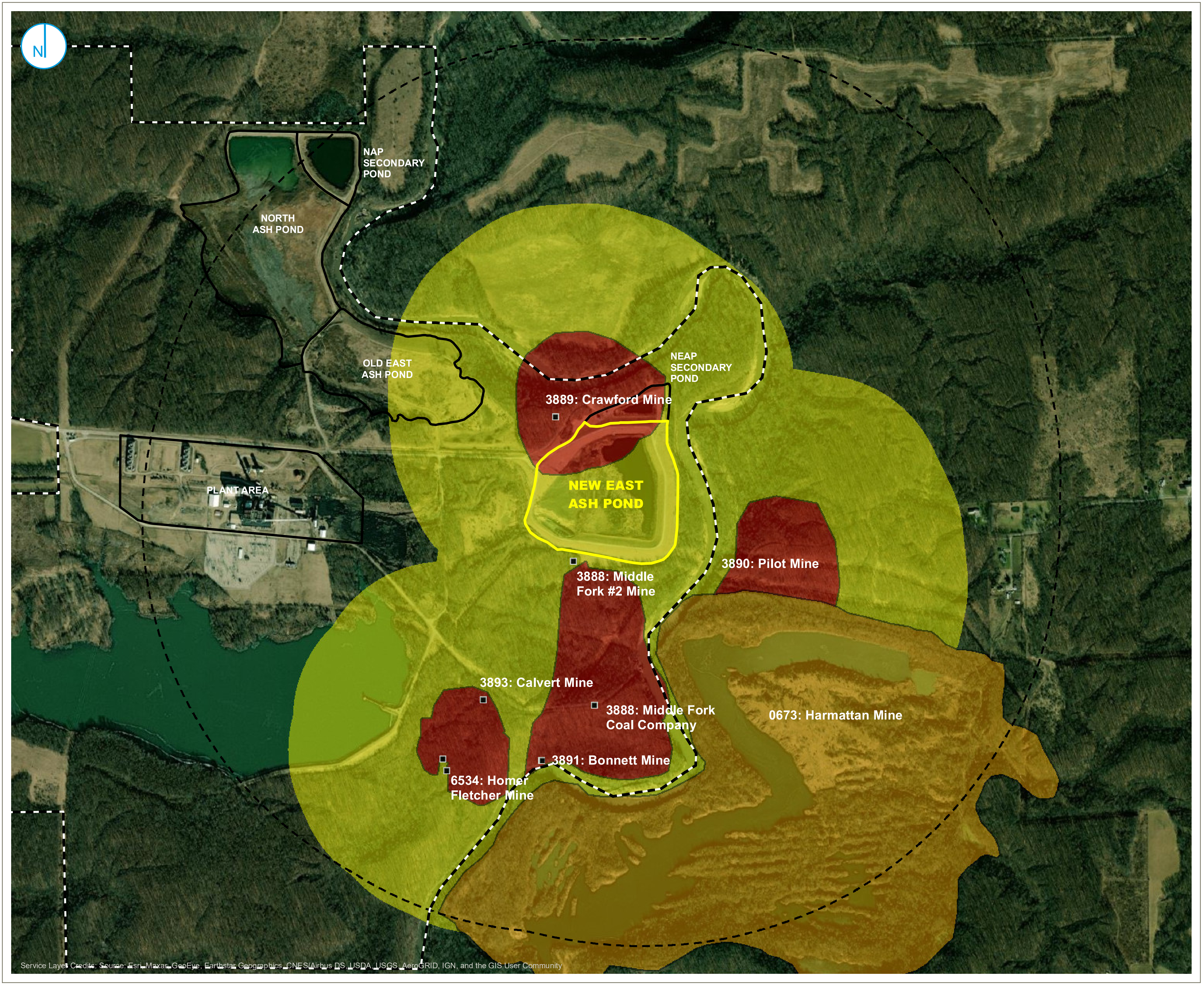
PROJECT: 169000XXXX | DATED: 10/7/2021 | DESIGNER: STOLZSD

APPENDICES

APPENDIX A
INFORMATION PERTINENT TO 35 I.A.C. § 845.220(a)(3)

MINING ACTIVITIES

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\Figure A-1_Active and Abandoned Coal Mines.mxd



Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

■ COAL MINE SHAFT
🟧 SURFACE COAL MINE
🟥 UNDERGROUND COAL MINE
🟨 UNDERGROUND MINE BUFFER REGION
☐ PART 845 REGULATED UNIT (SUBJECT UNIT)
⬚ 1000 METER UNIT BUFFER
☐ SITE FEATURE
⬚ PROPERTY BOUNDARY

SOURCES: ISGS - ILMINES

0 400 800 Feet

ACTIVE AND ABANDONED COAL MINES

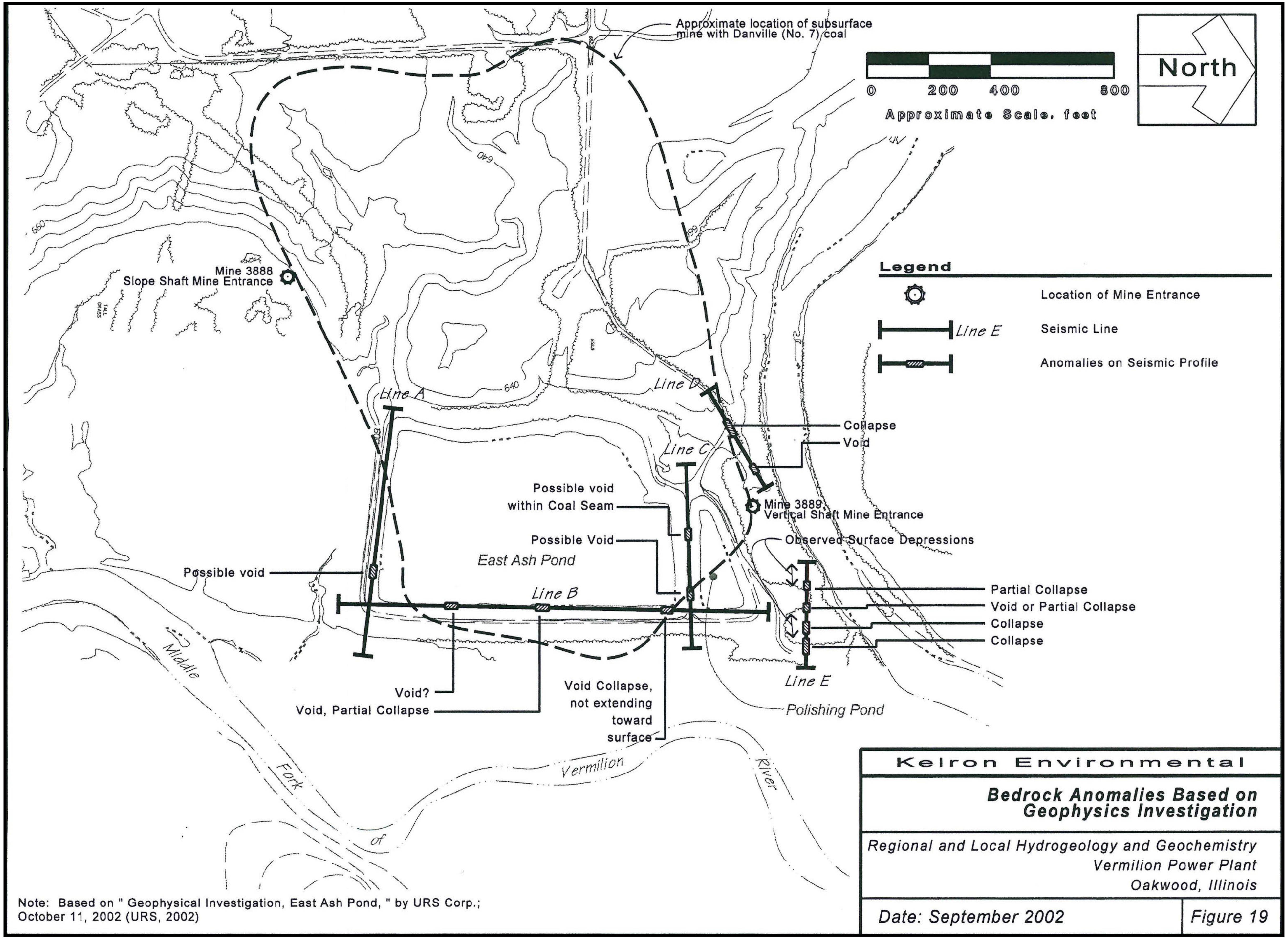
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

FIGURE A-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 10/7/2021 | DESIGNER: STOLZSD



Kelron Environmental

Bedrock Anomalies Based on Geophysics Investigation

Regional and Local Hydrogeology and Geochemistry
Vermilion Power Plant
Oakwood, Illinois

Date: September 2002

Figure 19

Note: Based on " Geophysical Investigation, East Ash Pond, " by URS Corp.; October 11, 2002 (URS, 2002)

APPROXIMATE LOCATION OF SUBSURFACE MINE

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

FIGURE A-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\Figure A-2_ Approx Loc of SS Mine.mxd

PROJECT: 169000XXXX | DATED: 10/7/2021 | DESIGNER: STOLZSD

MINES WITHIN 1,000 METERS

DESKTOP STUDY

VERMILION POWER PLANT

NEW EAST ASH POND

OAKWOOD, ILLINOIS

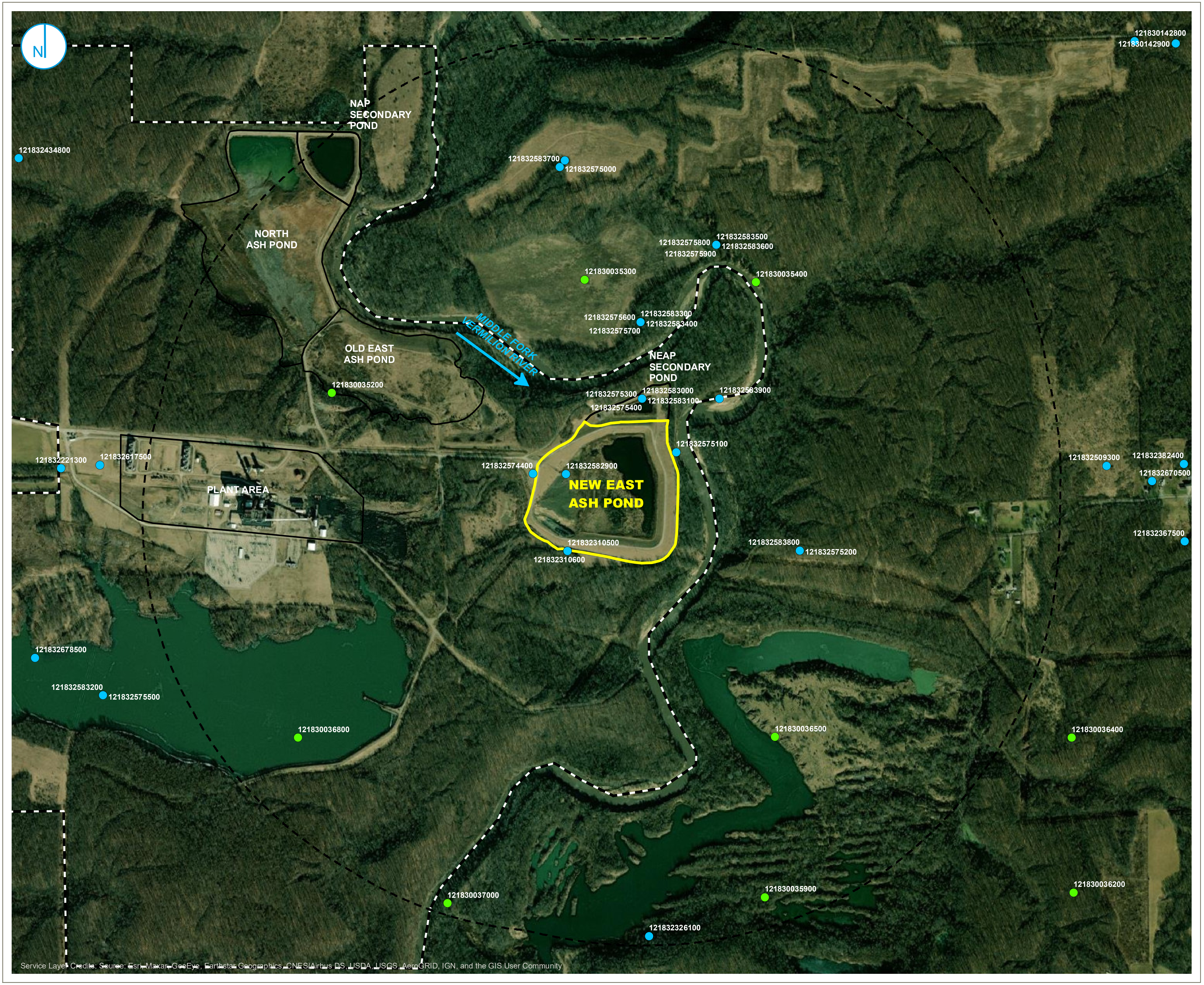
Mine ID	Mine Name	Distance from Unit (ft)	Physical Orientation to Unit	Hydraulic Orientation to Unit	Range of Active Dates	Mine Type	Size (Acres)	Coal Unit Mined	Mine Depth Top (ft BGS)	Mine Depth Bottom (ft BGS)	Production (tons)	Notes
New East Ash Pond												
3891	Bonnett Mine	1613.2	S	Downgradient	1888-1907	Underground	26.98	Danville	86	100	56,350	Abandoned
3893	Calvert Mine	1381.2	S	Downgradient	-	Underground	2.74	Danville	-	-	-	Abandoned, Depth noted as 70'
3888	Middle Fork Coal Company No. 2 Mine	74.4	S	Downgradient	1939-1948	Underground	26.98	Danville	-	-	7,633	Abandoned, Depth noted as 82'
3889	Crawford Mine	0	N	Upgradient	-	Underground	27.14	Danville	-	-	-	Abandoned, Depth noted as 106'
3890	Pilot Mine	520.9	E	Downgradient	1884-1888	Underground	15.76	Danville	89	95	8,010	Abandoned
0673	Harmattan Mine, Division of AMAX	737.3	SE	Downgradient	1949-1970	Surface	269.2	Danville	70	102	15,216,438	Abandoned
6534	Homer Fletcher Mine	1589.2	S	Downgradient	1933-1937	Underground	9.96	Danville	-	-	14,147	Abandoned

Notes:

[O: EGP 8/5/21; C:EDP 8/16/21]

- = no data
ft = feet
N = north
NW = northwest
NE = northeast
E = east
S = south
SW = southwest
SE = southeast
W = west

WATER WELL SURVEY



Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\Figure A-2_Drinking Water Intakes.mxd

PROJECT: 169000XXXX | DATED: 8/11/2021 | DESIGNER: STOLZSD

● WATER
● N/A
▭ PART 845 REGULATED UNIT (SUBJECT UNIT)
▭ 1000 METER UNIT BUFFER
▭ SITE FEATURE
▭ PROPERTY BOUNDARY

SOURCES: IL WELLS

0 400 800 Feet

DRINKING WATER INTAKES, PUMPING WELLS, AND USES OF WATER

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

FIGURE A-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

WATER WELLS WITHIN 1,000 METERS

DESKTOP STUDY
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Well Number	Date Constructed	Ground Elevation (ft MSL)	Screen Top Depth (ft bgs)	Screen Bottom Depth (ft bgs)	Screen Top Elevation (ft MSL)	Screen Bottom Elevation (ft MSL)	Bottom of Boring Elevation (ft MSL)	Screen Length (ft)	Screen Diameter (inches)	Well Depth from Ground Surface (ft bgs)	Total Boring Depth (ft bgs)	Latitude (DD)	Longitude (DD)	Notes
121830035300	-	600	-	-	-	-	543	-	-	57	57	40.183549	-87.738226	Coal Test
121830036800	6/1/1911	629	-	-	-	-	476	-	-	153	153	40.172811	-87.747119	Coal Test
121830036500	-	-	-	-	-	-	-	-	-	-	-	40.172754	-87.732472	Coal Test, Well information not available
121830037000	6/1/1911	-	-	-	-	-	-	-	-	-	-	40.16889	-87.742558	Coal Test, Well information not available
121830035900	9/1/1910	575	-	116	-	-	459	-	-	116	116	40.168983	-87.732816	Mineral Test
121830035200	7/1/1911	605	-	-	-	-	439	-	-	166	166	40.180921	-87.746015	Private Water Well
121830035400	9/1/1910	588	-	-	-	-	457	-	-	131	131	40.183465	-87.732967	Private Water Well
121832310500	12/16/1987	-	-	-	-	-	-	48	4	131	131	40.177165	-87.738801	Private Water Well
121832326100	5/31/1998	-	-	66	-	-	-	-	-	66	66	40.168087	-87.736379	Private Water Well
121832310600	12/13/1987	-	-	-	-	-	-	-	4	139	139	40.177165	-87.738801	Private Water Well
121832582900	11/30/2001	656	80	100	576	556	556	10	2	100	100	40.178973	-87.738835	Water Well Monitoring Well, DMG; 22
121832583000	12/3/2001	599	12	22	587	577	571	10	2	28	28	40.180735	-87.736484	Water Well Monitoring Well, DMG; 23
121832583100	12/3/2001	599	35	55	564	544	544	20	2	55	55	40.180735	-87.736484	Water Well Monitoring Well, DMG; 24
121832575400	12/3/2001	599	35	55	564	544	544	20	2	55	55	40.180735	-87.736484	Water Well Monitoring Well, DMG; 24
121832583300	11/21/2001	581	8	13	573	568	565	5	2	16	16	40.182543	-87.736517	Water Well Monitoring Well, DMG; 26
121832583400	11/26/2001	581	23	43	558	538	537	20	2	44	44	40.182543	-87.736517	Water Well Monitoring Well, DMG; 27
121832583500	11/26/2001	581	8	13	573	568	566	5	2	15	15	40.18435	-87.734175	Water Well Monitoring Well, DMG; 28
121832583600	11/27/2001	581	23	43	558	538	536	20	2	45	45	40.18435	-87.734175	Water Well Monitoring Well, DMG; 29
121832583700	11/21/2001	646	127	147	519	499	498	5	2	148	148	40.186207	-87.738961	Water Well Monitoring Well, DMG; 30
121832574400	1/7/2002	654	-	-	-	-	554	-	-	100	100	40.178988	-87.739846	Water Well Monitoring Well, IL Power Plant
121832575000	1/7/2002	645	-	-	-	-	497	-	-	148	148	40.186362	-87.738803	Water Well Monitoring Well, IL Power Plant
121832575100	1/7/2002	591	162	182	541	521	519	20	2	184	56	40.179472	-87.735447	Water Well Monitoring Well, IL Power Plant, 32
121832575300	12/3/2001	599.271	11.8	21.8	587.471	577.471	577.3	10	2	28	28	40.180735	-87.736484	Water Well Monitoring Well, IL Power Plant; 23
121832575600	11/21/2001	525	-	-	-	-	509	-	-	16	16	40.182543	-87.736517	Water Well Monitoring Well, IL Power Plant; 26
121832575700	11/26/2001	703	-	-	-	-	659	-	-	44	44	40.182543	-87.736517	Water Well Monitoring Well, IL Power Plant; 27
121832575800	11/26/2001	703	-	-	-	-	688	-	-	15	15	40.18435	-87.734175	Water Well Monitoring Well, IL Power Plant; 28
121832575900	11/27/2001	703	-	-	-	-	658	-	-	45	45	40.18435	-87.734175	Water Well Monitoring Well, IL Power Plant; 29
121832583800	11/29/2001	591	162	182	541	521	519	20	2	184	184	40.177139	-87.73167	Water Well Monitoring Well, IL Power Plant; 31
121832575200	11/29/2001	591	162	182	541	521	519	20	2	184	184	40.177139	-87.73167	Water Well Monitoring Well, IL Power Plant; 31
121832583900	12/4/2001	582	45.8	55.8	536.2	526.2	526	10	2	56	56	40.18073	-87.734105	Water Well Monitoring Well, IL Power Plant; 32

Notes:

[O:EGP 8/9/21; C:EDP 8/17/21]

- = no data
bgs = below ground surface
DD = decimal degrees
DMG = Dynegy Midwest Generation
ft = feet
MSL = above Mean Sea Level

ILLINOIS STATE GEOLOGICAL SURVEY

Private Water Well	**Top**	**Bottom**
soil	0	2
clay	2	118
sand	118	131
Total Depth		**131**

Casing: 4" SCH #40 from -1' to 127'
Screen: 48' of 4" diameter 12 slot
Grout: CLAY from 0 to 0.

Size hole below casing: 4"

Water from sand at 127' to 131'.
Static level 30' below casing top which is 1' above GL
Pumping level 50' when pumping at 0 gpm for 2 hours

Permanent pump installed at 60'
on December 16, 1987, with a capacity of 15 gpm

Owner Address: R. R. 2 Box 134 Danville, IL
Location source: Location from permit

Permit Date: December 9, 1987 **Permit #:** 138144

COMPANY Beck, Harold F. Jr.
FARM Carter, Charles
DATE DRILLED December 16, 1987 **NO.** 1
ELEVATION 0 **COUNTY NO.** 23105
LOCATION NW SE SE
LATITUDE 40.177165 **LONGITUDE** -87.738801
COUNTY **Vermilion** **API** **121832310500** **20 - 20N - 12W**

ILLINOIS STATE GEOLOGICAL SURVEY

Private Water Well	Top	Bottom
soil	0	2
clay	2	127
sand	127	139
Total Depth		**139**

Casing: 4" SCH #40 from -1' to 135'

Screen: 48' of 4" diameter 12 slot

Grout: CLAY from 0 to 127.

Size hole below casing: 4"

Water from sand at 135' to 139'.
Static level 40' below casing top which is 1' above GL
Pumping level 60' when pumping at 0 gpm for 2 hours

Permanent pump installed at 80'
on December 13, 1987, with a capacity of 15 gpm

Owner Address: R.R. 2 Box 135 Danville, IL
Location source: Location from permit

Permit Date: December 9, 1987 **Permit #:** 138143

COMPANY Beck, Harold F. Jr.
FARM Gress, Dale
DATE DRILLED December 13, 1987 **NO.** 2
ELEVATION 0 **COUNTY NO.** 23106
LOCATION NW SE SE
LATITUDE 40.177165 **LONGITUDE** -87.738801
COUNTY **Vermilion** **API** **121832310600** **20 - 20N - 12W**

ILLINOIS STATE GEOLOGICAL SURVEY

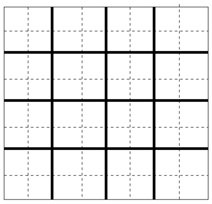
Private Water Well	Top	Bottom
top soil	0	2
yellow clay	2	19
blue clay	19	42
gravel	42	43
blue clay	43	66
Total Depth		**66**

Casing: 6" PLASTIC from -1' to 24'
36" CONCRETE from 24' to 66'

Water from gravel at 0' to 43'.

Owner Address: R.R. #2 Danville, IL
Address of well: N. R.R. #150
Location source: Location from permit

Permit Date: May 20, 1988 **Permit #:** 002096



COMPANY Reynolds, Joseph R.
FARM Zook, Doug
DATE DRILLED May 31, 1988 **NO.**
ELEVATION 0 **COUNTY NO.** 23261
LOCATION SE SE NE
LATITUDE 40.168087 **LONGITUDE** -87.736379
COUNTY Vermilion **API 121832326100** **29 - 20N - 12W**

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Monitoring	**Top**	**Bottom**
Total Depth		**100**

Remarks: natural gamma log on file

Owner Address: ,

Address of well:

Danville, IL

Location source: Global Positioning System verified Verified by: CJS on August 13, 2002.

Image viewing help: New users please read this.

GET FILE Natural Gamma Log

Permit Date: **Permit #:**

COMPANY	Mid America Drlg Services, Inc		
FARM	IL Power Plant		
DATE DRILLED	January 7, 2002	**NO.**	MW-22
ELEVATION	654	**COUNTY NO.**	25744
LOCATION	SW NE SE		
LATITUDE	40.178988	**LONGITUDE**	-87.739846
COUNTY	**Vermilion**	**API**	**121832574400**

20 - 20N - 12W

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
Total Depth		**148**

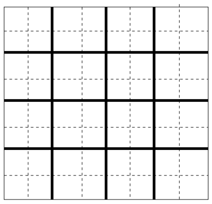
Remarks: natural gamma log on file

Owner Address: ,
Address of well:
Danville, IL
Location source: Global Positioning System verified Verified by: CJS on August 13, 2002.

Image viewing help: New users please read this.
GET FILE Natural Gamma Log

Permit Date: **Permit #:**

COMPANY Mid America Drlg Services, Inc
FARM IL Power Plant
DATE DRILLED January 7, 2002 **NO.** MW-30
ELEVATION 645 **COUNTY NO.** 25750
LOCATION SW NE NE
LATITUDE 40.186362 **LONGITUDE** -87.738803
COUNTY Vermilion **API** 121832575000 **20 - 20N - 12W**



ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	Top	Bottom
Total Depth		**56**

Remarks: natural gamma log on file

Owner Address: ,

Address of well:

Danville, IL

Location source: Global Positioning System verified Verified by: CJS on August 13, 2002.

Image viewing help: New users please read this.

GET FILE Natural Gamma Log

Permit Date: **Permit #:**

COMPANY Mid America Drlg Services, Inc

FARM IL Power Plant

DATE DRILLED January 7, 2002 **NO.** MW-32

ELEVATION 591 **COUNTY NO.** 25751

LOCATION NW NW SW

LATITUDE 40.179472 **LONGITUDE** -87.735447

COUNTY Vermilion **API 121832575100** **21 - 20N - 12W**

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
Total Depth		**184**

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Mid America Drlg Services, Inc
FARM IL Power Plant
DATE DRILLED November 29, 2001 **NO.** MW-31
ELEVATION 703 **COUNTY NO.** 25752
LOCATION NE SW SW
LATITUDE 40.177139 **LONGITUDE** -87.73167
COUNTY **Vermilion** **API** **121832575200** **21 - 20N - 12W**

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
Total Depth		**28**

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Mid America Drlg Services, Inc
FARM IL Power Plant
DATE DRILLED December 3, 2001 **NO.** MW-23
ELEVATION 703 **COUNTY NO.** 25753
LOCATION NE NE SE
LATITUDE 40.180735 **LONGITUDE** -87.736484
COUNTY **Vermilion** **API** **121832575300** **20 - 20N - 12W**

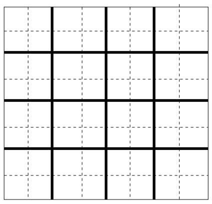
ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	Top	Bottom
Total Depth		**55**

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Mid America Drlg Services, Inc
FARM IL Power Plant
DATE DRILLED December 3, 2001 **NO.** MW-24
ELEVATION 703 **COUNTY NO.** 25754
LOCATION NE NE SE
LATITUDE 40.180735 **LONGITUDE** -87.736484
COUNTY **Vermilion** **API** **121832575400** **20 - 20N - 12W**



ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
Total Depth		**16**

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

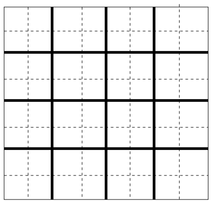
COMPANY Mid America Drlg Services, Inc
FARM IL Power Plant
DATE DRILLED November 21, 2001 **NO.** MW-26
ELEVATION 525GL **COUNTY NO.** 25756
LOCATION SE SE NE
LATITUDE 40.182543 **LONGITUDE** -87.736517
COUNTY Vermilion API 121832575600 20 - 20N - 12W

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
Total Depth		**44**

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**



COMPANY Mid America Drlg Services, Inc
FARM IL Power Plant
DATE DRILLED November 26, 2001 **NO.** MW-27
ELEVATION 703GL **COUNTY NO.** 25757
LOCATION SE SE NE
LATITUDE 40.182543 **LONGITUDE** -87.736517
COUNTY Vermilion API 121832575700 20 - 20N - 12W

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
Total Depth		**15**

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY	Mid America Drlg Services, Inc
FARM	IL Power Plant
DATE DRILLED	November 26, 2001
NO.	MW-28
ELEVATION	703
COUNTY NO.	25758
LOCATION	NW SW NW
LATITUDE	40.18435
LONGITUDE	-87.734175
COUNTY	**Vermilion**
API	**121832575800**

21 - 20N - 12W

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
Total Depth		**45**

Owner Address: ,
Location source: Location from the driller

Permit Date:
Permit #:

COMPANY Mid America Drlg Services, Inc
FARM IL Power Plant
DATE DRILLED November 27, 2001
NO. MW-29
ELEVATION 703
COUNTY NO. 25759
LOCATION NW SW NW
LATITUDE 40.18435
LONGITUDE -87.734175
COUNTY **Vermilion**
API **121832575900**
21 - 20N - 12W

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
till	0	71
shale	71	100
Total Depth		**100**

Casing: 4" STEEL from 0' to 70'
2" PVC from -3' to 80'
2" PVC SCREEN from 80' to 100'

Screen: 20' of 2" diameter .01 slot

Grout: BENTONITE SLRY from 0 to 73.

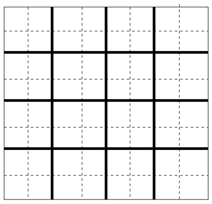
Grout: BENTONITE CHIPS from 73 to 78.

Water from shale at 80' to 100'.
Static level 56' below casing top which is 3' above GL

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Mid America Drlg Services, Inc
FARM Dynegy Midwest Generation
DATE DRILLED November 30, 2001 **NO.** 22
ELEVATION 656 **COUNTY NO.** 25829
LOCATION SW NE SE
LATITUDE 40.178973 **LONGITUDE** -87.738835



COUNTY Vermilion **API 121832582900** **20 - 20N - 12W**

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
sand with silt, trace gravel	0	5
silty sand with gravel	5	7
gravel	7	8
silty gravel with sand, trace clay	8	10
silt with sand	10	14
sandy clay with gravel	14	22
shale weathered dark blue-gray	22	28
Total Depth		**28**

Casing: 2" PVC from -3' to 12'
2" PVC SCREEN from 12' to 22'

Screen: 10' of 2" diameter .01 slot

Grout: BENT CHIPS/SLRY from 1 to 9.

Grout: SILICA from 9 to 22.

Water from silt/sandy clay at 12' to 22'.
Static level 13' below casing top which is 3' above GL

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Mid America Drlg Services, Inc
FARM Dynegy Midwest Generation
DATE DRILLED December 3, 2001 **NO.** 23
ELEVATION 599 **COUNTY NO.** 25830
LOCATION NE NE SE
LATITUDE 40.180735 **LONGITUDE** -87.736484
COUNTY Vermilion API 121832583000 20 - 20N - 12W

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
sand with silt, trace gravel	0	5
silty sand with gravel	5	7
gravel	7	8
silty gravel with sand, trace clay	8	10
silt with sand	10	14
sandy clay with gravel	14	22
shale weathered dark blue-gray	22	28
shale, competent, hard	28	55
Total Depth		**55**

Casing: 4.5" STEEL from 0' to 12'
2" PVC SCREEN from 35' to 55'
2" PVC from -3' to 35'

Screen: 20' of 2" diameter .01 slot

Grout: BENTONITE CHIPS from 27 to 32.

Grout: SILICA from 32 to 55.

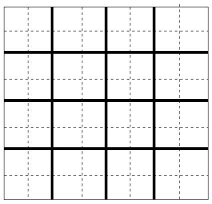
Grout: BENTONITE SLRY from 1 to 27.

Water from shale at 35' to 55'.
Static level 22' below casing top which is 3' above GL

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Mid America Drlg Services, Inc
FARM Dynegy Midwest Generation
DATE DRILLED December 3, 2001 **NO.** 24
ELEVATION 599 **COUNTY NO.** 25831
LOCATION NE NE SE
LATITUDE 40.180735 **LONGITUDE** -87.736484
COUNTY Vermilion **API 121832583100** **20 - 20N - 12W**



ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
silty & sandy clay, dark brown	0	2
sand fine, well sorted, yellow-brown	2	5
sand f w/shell frag clayey & silty sand	5	8
sand f-crs with trace gravel	8	9
sand & gravel	9	12
sty cl ov gry allvl,s med-crs w/silty cl	12	13
shale weathered, greenish-gray	13	15
shale competent, hard, fissil	15	16
Total Depth		**16**

Casing: 2" PVC from -3' to 8'
2" PVC SCREEN from 8' to 13'

Screen: 5' of 2" diameter .01 slot

Grout: SILICA from 6 to 16.

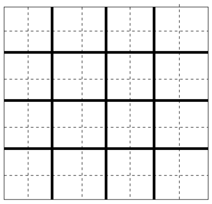
Grout: BENTONITE CHIPS from 1 to 6.

Water from sand at 0' to 0'.
Static level 9' below casing top which is 3' above GL

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Mid America Drlg Services, Inc
FARM Dynegy Midwest Generation
DATE DRILLED November 21, 2001 **NO.** 26
ELEVATION 581 **COUNTY NO.** 25833
LOCATION SE SE NE
LATITUDE 40.182543 **LONGITUDE** -87.736517



COUNTY Vermilion **API 121832583300** **20 - 20N - 12W**

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
blind drill to 16.5',allvl clay sand gvl	0	13
shale weathered greenish-gray	13	15
shale competent, hard fissile	15	44
Total Depth		**44**

Casing: 2" PVC from -3' to 23'
2" PVC SCREEN from 23' to 43'
4" STEEL from 0' to 15'

Screen: 20' of 2" diameter .01 slot

Grout: BENTONITE CHIPS from 2 to 21.

Grout: SILICA from 21 to 44.

Water from shale at 23' to 43'.
Static level 8' below casing top which is 3' above GL

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Mid America Drlg Services, Inc
FARM Dynegy Midwest Generation
DATE DRILLED November 26, 2001 **NO.** 27
ELEVATION 581 **COUNTY NO.** 25834
LOCATION SE SE NE
LATITUDE 40.182543 **LONGITUDE** -87.736517
COUNTY **Vermilion** **API** **121832583400** **20 - 20N - 12W**

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
sandy silt, trace clay dark brown	0	4
silty sand fine, med-yellow brown	4	5
sandy silt, trace clay, dark brown	5	6
sand fine	6	7
sandy with gravel & trace silt	7	9
silt with trace gravel, olive gray	9	15
shale weathered dark olive gray at	15	15
Total Depth		**15**

Casing: 2" PVC from -3' to 8'
2" PVC SCREEN from 8' to 13'

Screen: 5' of 2" diameter .01 slot

Grout: SILICA from 6 to 15.

Grout: BENTONITE CHIPS from 2 to 6.

Water from silt at 9' to 13'.
Static level 9' below casing top which is 3' above GL

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Mid America Drlg Services, Inc
FARM Dynegy Midwesr Generation
DATE DRILLED November 26, 2001 **NO.** 28
ELEVATION 581 **COUNTY NO.** 25835
LOCATION NW SW NW
LATITUDE 40.18435 **LONGITUDE** -87.734175
COUNTY Vermilion **API 121832583500** **21 - 20N - 12W**

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
blind drill to 16' allvl silt sand gvl	0	15
shale weathered dark olive gray	15	18
shale competent very hard	18	45
Total Depth		**45**

Casing: 2" PVC from -3' to 23'
4" STEEL from 0' to 15'
2" PVC SCREEN from 23' to 43'

Screen: 20' of 2" diameter .01 slot

Grout: BENTNOITE CHIPS from 2 to 21.

Grout: SILICA from 21 to 45.

Water from shale at 23' to 43'.
Static level 4' below casing top which is 3' above GL

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Mid America Drlg Services, Inc
FARM Dynegy Midwest Generation
DATE DRILLED November 27, 2001 **NO.** 29
ELEVATION 581 **COUNTY NO.** 25836
LOCATION NW SW NW
LATITUDE 40.18435 **LONGITUDE** -87.734175
COUNTY Vermilion **API 121832583600** **21 - 20N - 12W**

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	Top	Bottom
silty clay with trace sand olive	0	6
silt with fine sand to silty sand	6	11
silty clay with trace fine sand & gravel	11	20
sand & gravel, dry	20	23
silty clay with sand & gravel	23	24
s med-crs w/gvl wet-silty clay s/gvl dry	24	29
sand fine light brown moist	29	36
silty clay with sand & gravel dry	36	84
silty sand medium gray wet	84	85
silty clay with trace sand & gravel	85	116
shale competent very hard light gray	116	144
coal, black vertical calcite filled frac	144	148
Total Depth		**148**

Casing: 2" PVC from -3' to 127'
2" PVC SCREEN from 127' to 147'

Screen: 20' of 2" diameter .01 slot

Grout: BENTONITE from 1 to 122.

Grout: BENTONTIE from 122 to 125.

Water from shale at 127' to 147'.
Static level 63' below casing top which is 3' above GL

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Mid America Drlg Services, Inc
FARM Dynegy Midwest Generation
DATE DRILLED November 21, 2001 **NO.** 30
ELEVATION 646 **COUNTY NO.** 25837
LOCATION SW NE NE
LATITUDE 40.186207 **LONGITUDE** -87.738961
COUNTY Vermilion **API 121832583700** **20 - 20N - 12W**

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	**Top**	**Bottom**
sandy clay & sandy silt	0	21
till w/s tr gvl med brn silt/sandy silt	21	68
silty sand to sandy silt wet	68	89
sandy silt with gravel lenses	89	99
silt with sand	99	100
sandy silt with gravel lenses	100	153
shale weathered gray	153	155
shale competent, very hard dark gray	155	184
Total Depth		**184**

Casing: 2" PVC from -3' to 162'
2" PVC SCREEN from 162' to 182'

Screen: 20' of 2" diameter .01 slot

Grout: BENTONITE from 0 to 153.

Grout: BENTONITE CHIPS from 153 to 160.

Grout: SILICA from 160 to 184.

Water from shale at 162' to 182'.
Static level 85' below casing top which is 3' above GL

Owner Address: ,
Location source: Location from permit

Permit Date: **Permit #:**

COMPANY Mid America Drlg Services, Inc
FARM Dynegy Midwest Generation
DATE DRILLED November 29, 2001 **NO.** 31
ELEVATION 0 **COUNTY NO.** 25838
LOCATION NE SW SW
LATITUDE 40.177139 **LONGITUDE** -87.73167
COUNTY **Vermilion** **API** **121832583800** **21 - 20N - 12W**

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	Top	Bottom
clayey sand, reddish-brown	0	6
clay with sand, yellow-brown	6	7
sand with trace silt, brown	7	10
shale weathered gray	10	11
shale competent hard	11	56
Total Depth		**56**

Casing: 4.5" STEEL from 0' to 12'
2" PVC from 0' to 46'
2" PVC SCREEN from 46' to 56'

Screen: 10' of 2" diameter .01 slot

Grout: BENTONITE SLRY from 1 to 41.

Grout: BENTONITE CHIPS from 41 to 44.

Water from shale at 46' to 56'.

Remarks: static water level 2.7' above casing

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY Mid America Drlg Services, Inc
FARM Dynegy Midwest Generation
DATE DRILLED December 4, 2001 **NO.** 32
ELEVATION 582 **COUNTY NO.** 25839
LOCATION NW NW SW
LATITUDE 40.18073 **LONGITUDE** -87.734105
COUNTY **Vermilion** **API** **121832583900** **21 - 20N - 12W**

ILLINOIS STATE GEOLOGICAL SURVEY

Mineral Test	**Top**	**Bottom**
soil	0	2
sand	2	8
blue shale	8	60
coal #7 (65'11")	60	66
rock (66'1")	66	66
coal (66'5")	66	67
shale (66'11")	67	67
coal	67	68
shale	68	81
limestone	81	82
coal	82	83
blue shale	83	88
black shale	88	90
rock,very hard	90	91
black shale	91	92
coal #6	92	97
gray shale	97	116
Total Depth		**116**

Driller's Log filed

Owner Address: ,

Permit Date: **Permit #:**

COMPANY owner
FARM Layton, J.
DATE DRILLED September 1, 1910 **NO.** 14
ELEVATION 575GL **COUNTY NO.** 00359
LOCATION SW NW
LATITUDE 40.168983 **LONGITUDE** -87.732816
COUNTY Vermilion API 121830035900 28 - 20N - 12W

ILLINOIS STATE GEOLOGICAL SURVEY

Private Water Well	**Top**	**Bottom**
sand & blue clay	0	16
blue clay	16	26
blue shale	26	79
coal #7	79	83
dark blue shale	83	86
coal	86	86
blue shale	86	97
limestone	97	102
blue shale	102	110
coal #6	110	114
blue shale	114	131
Danville Coal #7	78	83
Herrin Coal #6	110	114
Total Depth		**131**

Driller's Log filed

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY	owner		
FARM	Albright,Chas		
DATE DRILLED	September 1, 1910	**NO.**	15
ELEVATION	588GL	**COUNTY NO.**	00354
LOCATION	SW NW		
LATITUDE	40.183465	**LONGITUDE**	-87.732967
COUNTY	**Vermilion**	**API**	**121830035400**

21 - 20N - 12W

ILLINOIS STATE GEOLOGICAL SURVEY

Coal Test	**Top**	**Bottom**
surface	0	1
sand & gravel	1	10
shale	10	48
coal -good	48	55
fire clay	55	57
Danville Coal #7	49	56
Total Depth		**57**

Driller's Log filed

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner
FARM
DATE DRILLED **NO.** 4
ELEVATION 600GL **COUNTY NO.** 00353
LOCATION 3300'S line, 800'E line of section
LATITUDE 40.183549 **LONGITUDE** -87.738226
COUNTY Vermilion **API 121830035300** **20 - 20N - 12W**

ILLINOIS STATE GEOLOGICAL SURVEY

Coal Test	Top	Bottom
clay	0	7
sand	7	19
clay	19	35
sand	35	115
coal #7	115	118
gray shale	118	136
coal #6	136	139
gray shale	139	153
Danville Coal #7	115	118
Herrin Coal #6	136	139
Total Depth		**153**

Driller's Log filed

Owner Address: ,

Permit Date: **Permit #:**

COMPANY owner

FARM Snyder, G.B.

DATE DRILLED June 1, 1911 **NO.** 35

ELEVATION 629GL **COUNTY NO.** 00368

LOCATION NE NW

LATITUDE 40.172811 **LONGITUDE** -87.747119

COUNTY Vermilion **API 121830036800** **29 - 20N - 12W**

Page 1

ILLINOIS STATE GEOLOGICAL SURVEY

Private Water Well	**Top**	**Bottom**
clay	0	14
sand	14	105
blue shale	105	113
coal #7	113	120
gray shale	120	141
gray shale(hard)	141	143
black shale	143	144
coal #6	144	148
gray shale	148	166
Danville Coal #7	113	120
Herrin Coal #6	144	148
Total Depth		**166**

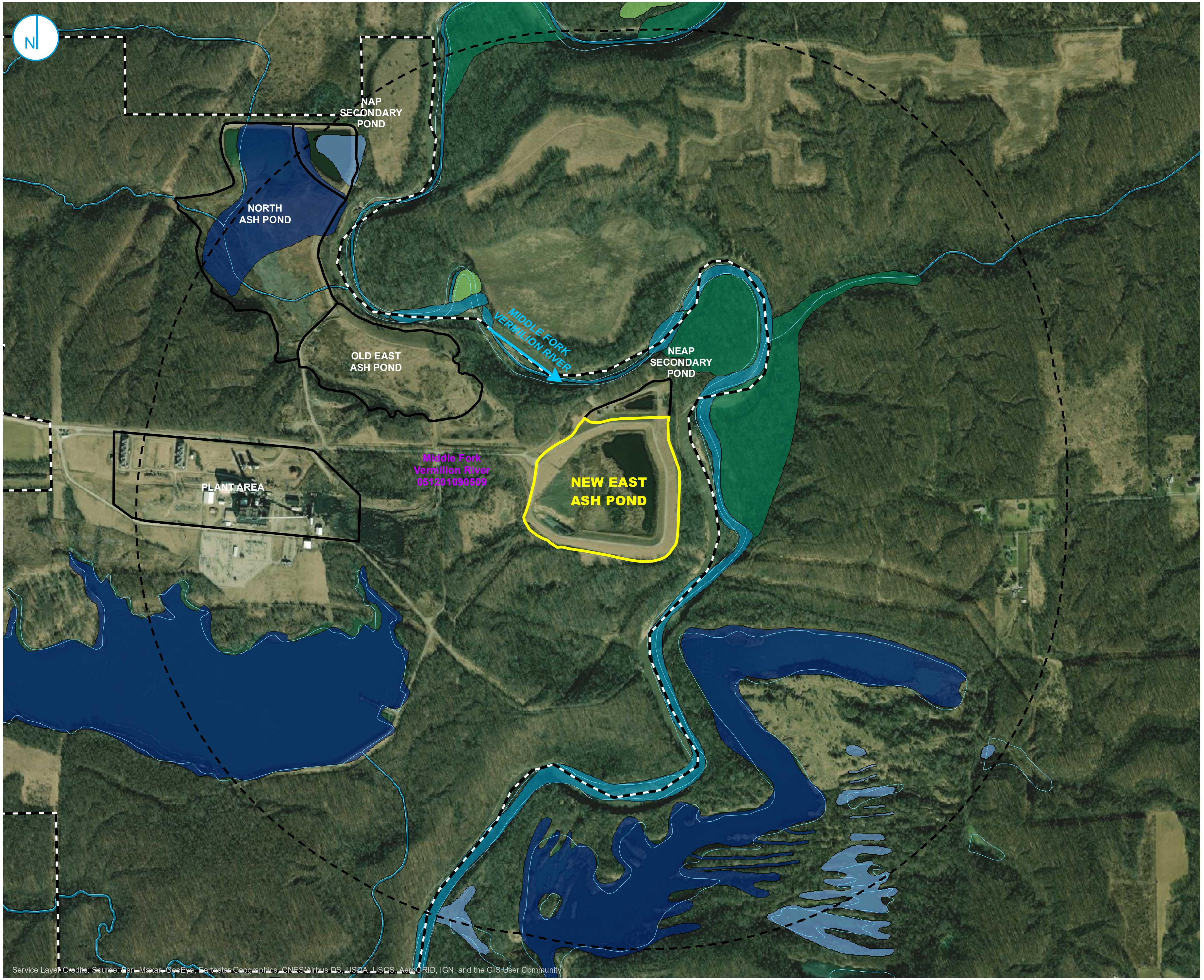
Driller's Log filed

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner
FARM Synder,G.B.
DATE DRILLED July 1, 1911 **NO.** 37
ELEVATION 605GL **COUNTY NO.** 00352
LOCATION NE NE SW
LATITUDE 40.180921 **LONGITUDE** -87.746015
COUNTY Vermilion **API 121830035200** **20 - 20N - 12W**

SURFACE WATERS



Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\Figure A-4_Surface Waterbodies.mxd

PROJECT: 169000XXXX | DATED: 10/7/2021 | DESIGNER: STOLZSD

▭ PART 845 REGULATED UNIT (SUBJECT UNIT)
⬚ 1000 METER UNIT BUFFER
▭ SITE FEATURE
⬚ PROPERTY BOUNDARY
— SURFACE WATERBODY
▭ WATERSHED BOUNDARY (HUC 12)

NATIONAL WETLANDS INVENTORY

● FRESHWATER EMERGENT WETLAND
● FRESHWATER FORESTED/SHRUB WETLAND
● FRESHWATER POND
● LAKE
● OTHER
● RIVERINE

SOURCES: USGS, USFWS

0 400 800 Feet

SURFACE WATERBODIES

HYDROGEOLOGIC SITE
CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

FIGURE A-5

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

SURFACE WATER FEATURES WITHIN 1,000 METERS

DESKTOP STUDY
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

HUC/NHD ID	Surface Water ID	Distance from NEAP Unit (meters)	Physical Orientation to NEAP Unit	Hydraulic Orientation to NEAP Unit	Classification Code	Size (acres)
155277012	NHD Flowline, Stream/River (Hydrographic Category/intermittent)	317.78	NE	--	46003	--
155276987	NHD Flowline, Stream/River (Hydrographic Category/intermittent)	657.58	NW	--	46003	--
155274815	NHD Flowline, Stream/River (Hydrographic Category/intermittent)	717.28	SW	--	46003	--
155281224	Hydrographic Category/perennial	991.42	SE	--	39004	1.24
155281209	Hydrographic Category/perennial	772.08	SE	--	39004	0.99
155281219	Hydrographic Category/perennial	923.42	SE	--	39004	1.24
155281236	Hydrographic Category/perennial	955.57	SE	--	39004	2.72
155281208	Hydrographic Category/perennial	953.56	SE	--	39004	2.22
155281202	Hydrographic Category/perennial (Illinois Power Company Lake)	410.40	SW	Upgradient	39004	105.76
155281165	Hydrographic Category/perennial	201.65	SE	--	39004	61.28
155281238	Hydrographic Category/perennial	987.18	S	--	39004	1.73
155282412	Hydrographic Category/perennial (Middle F	67.75	E	Downgradient	46006	1098.38
--	Lake	396.61	SW	Upgradient	L1UBHh	108.86
--	Lake	787.10	NW	--	L1UBHh	21.52
--	Freshwater Emergent Wetland	422.49	NW	--	PEM1/USA	1.10
--	Freshwater Forested/Shrub Wetland	132.83	NE	Downgradient	PFO1C	11.07
--	Freshwater Forested/Shrub Wetland	104.41	E	--	PFO1C	21.84
--	Freshwater Forested/Shrub Wetland	887.05	N	--	PFO1C	10.59
--	Freshwater Forested/Shrub Wetland	977.92	N	--	PFO1C	5.17
--	Freshwater Pond	844.90	NW	--	PUBHh	2.71
--	Freshwater Pond	897.42	S	--	PUBHx	2.15
--	Freshwater Pond	880.48	SE	--	PUBHx	10.76
--	Freshwater Pond	858.00	SE	--	PUBHx	0.37
--	Freshwater Pond	818.62	SE	--	PUBHx	0.17

SURFACE WATER FEATURES WITHIN 1,000 METERS

DESKTOP STUDY
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

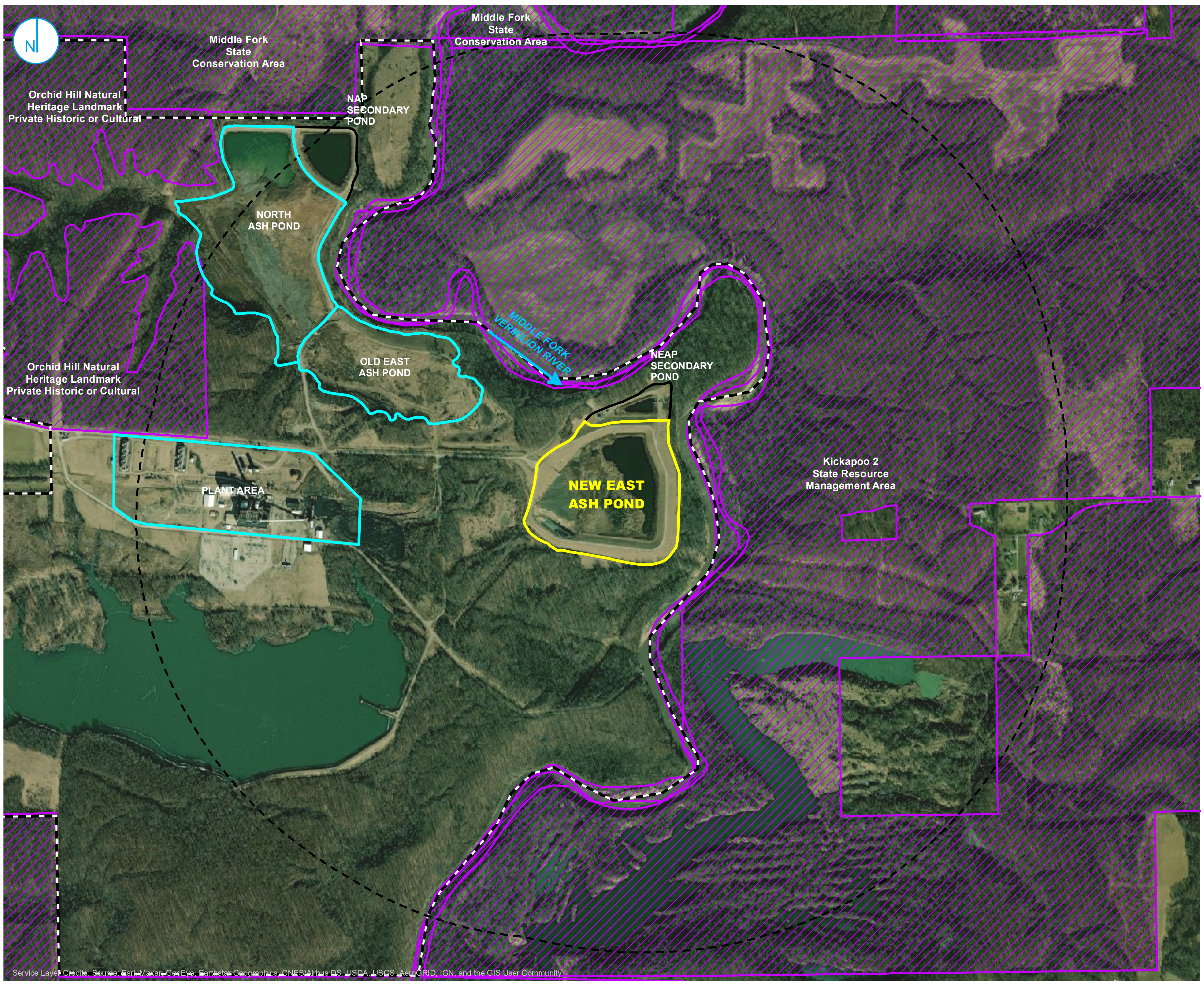
HUC/NHD ID	Surface Water ID	Distance from NEAP Unit (meters)	Physical Orientation to NEAP Unit	Hydraulic Orientation to NEAP Unit	Classification Code	Size (acres)
--	Freshwater Pond	820.02	SE	--	PUBHx	0.08
--	Freshwater Pond	756.25	SE	--	PUBHx	0.93
--	Freshwater Pond	745.42	SE	--	PUBHx	0.11
--	Freshwater Pond	725.23	SE	--	PUBHx	0.11
--	Freshwater Pond	674.19	SE	--	PUBHx	0.28
--	Freshwater Pond	949.81	SE	--	PUBHx	0.25
--	Riverine	91.89	NW	--	R2UBH	0.96
--	Riverine	388.35	N	--	R2UBH	20.43
	Riverine	335.64	NW	--	R2USA	0.31
--	Riverine	163.15	N	Downgradient	R2USA	1.25
--	Riverine	715.36	SW	--	R4SBC	1.22
--	Riverine	654.57	NW	--	R4SBC	0.44
--	Riverine	736.79	NE	--	R4SBC	1.69
--	Riverine	275.60	N	Downgradient	R5UBH	0.02
--	Riverine	455.82	NE	--	R5UBH	0.17
--	Lake	190.98	S	--	L1UBHx	70.70
--	Riverine	69.99	E	Downgradient	R2UBH	394.85

Notes:

[O: EGP 8/5/21, U: JJW 8/17/21]

NE = northeast
E = east
S = south
SW = southwest
SE = southeast
W = west

NATURE PRESERVES, HISTORIC SITES, ENDANGERED/THREATENED SPECIES



Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\Figure A-5_Nature Preserves.mxd

PROJECT: 169000XXXX | DATED: 10/7/2021 | DESIGNER: STOLZSD

▨ PROTECTED AREA
▭ PART 845 REGULATED UNIT (SUBJECT UNIT)
⬚ 1000 METER UNIT BUFFER
▭ SITE FEATURE
⬚ PROPERTY BOUNDARY

SOURCES: USGS - PAD-US

0 400 800 Feet

NATURE PRESERVES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

FIGURE A-6

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

NATURE PRESERVES AND HISTORIC SITES WITHIN VERMILION COUNTY

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER STATION
NEW EAST ASH POND
OAKWOOD, ILLINOIS

INAI/INPC Number	INAI/INPC Name	Category/ Categories	Size (acres)	Notes
0104	Camp Drake	I	4.76	--
NP191	Carl Flierman's River Nature Preserve	--	--	Privately Owned Nature Preserve
NHL179	Collie - Flower Acres Natural Heritage Landmark	--	--	Natural Heritage Landmark
1627	Craver's Seep	I	5.40	--
1587/NP278	Doris Westfall Prairie Restoration Nature Preserve	I-R, III	43.87	Nature Preserve
NHL204	East Conkeytown Natural Heritage Landmark	--	--	Natural Heritage Landmark
1742/LWR050	Edgewood Farm Land and Water Reserve	III	147.5	Land and Water Reserve
1073/NP142	Fairchild Cemetery Prairie/Savanna Nature Preserve	I, III	3.3	Nature Preserve
0879/NP113	Forest Glen Seep Nature Preserve	I,II,III	24.63	Nature Preserve
1534	Harry "Babe" Woodyard State Natural Area	II,III	II,III	--
1540/NP070	Horseshoe Bottom Nature Preserve	III	91.97	Nature Preserve
NP199	Howards Hollow Seep Nature Preserve	--	--	Nature Preserve
1638/NP289	Jordan Creek of the North Fork Nature Preserve	III	46.8	Nature Preserve
NHL137	Jordan Creek of the Salt Fork Natural Heritage Landmark	--	--	Natural Heritage Landmark
1142	Kennekuk Cove County Park	II	851.07	Local Recreation Area
1930	Kennekuk Seep	I	1.89	--
1817	Kickapoo Hill Prairie	I, III	37.09	--
-	Kickapoo 2 State Resource Management Area	--	--	State Resource Management Area
1511/LWR086	Kinney's Ford Seep Land and Water Reserve	I,II,III	793.96	Land and Water Reserve
NHL205	Larimore 40 Natural Heritage Landmark	-	40	Natural Heritage Landmark
LWR146	Larimore's Salt Fk of Vermilion River Land and Water Reserve	--	--	Land and Water Reserve
1140/LWR021	Little Vermilion River Land and Water Reserve	II, III, VI	1227	Land and Water Reserve
0494	Middle Fork of the Vermilion River State Conservation Area	II, III, IV, VI	2700	State Conservation Area
1512	Middle Fork Seeps	I	19.79	--
1955	Middlefork Ephemeral Ponds	II	318.65	--
0810/NP071	Middlefork Woods Nature Preserve	I, II, III	90.06	Nature Preserve
1141	North Fork Vermilion River	II, III	325	--
0805/NHL107	Orchid Hill Natural Heritage Landmark	III	147.45	Natural Heritage Landmark, Private Historic or Cultural
1420	Pellville Cemetery	I	1.09	--
NHL206	R.W. Larimore's Salt Fork River Natural Heritage Landmark	--	--	Natural Heritage Landmark
1718	Rock Cut Road Botanical Area	II, III	50.55	--
0041/NP033	Russell M. Duffin Natural Area	II, III	217.33	Nature Preserve
1427	Salt Fork Vermilion River Segment	II, III, VI	609.34	--
0495	Vermilion River - Wabash Drainage Danville Segment	II,VI	265.61	--
0023	Willow Creek Seep	I,III	30	--
0804/NP072	Windfall Prairie Nature Preserve	I,II,III	58.64	Nature Preserve

[OB:EGP 8/6/21; CB: JJW 8/17/21]

I = High quality natural community and natural community restorations
II = Specific suitable habitat for state-listed species or state-listed species relocations
III = State dedicated Nature Preserves, Land and Water Reserves, & Natural Heritage Landmarks
IV = Outstanding geological features
V = Not used at this time
VI = Unusual concentrations of flora or fauna and high quality streams
-- = not applicable, no data
INAI = Illinois Natural Areas Inventory
INPC = Illinois Nature Preserves Commission

ENDANGERED/THREATENED SPECIES WITHIN VERMILION COUNTY

DESKTOP STUDY
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Scientific Name	Common Name	Status	Number of Occurrences	Last Observed
Ambystoma platineum	Silvery Salamander	LE	6	8/7/2019
Ammocrypta pellucida	Eastern Sand Darter	LT	11	10/16/2020
Apalone mutica	Smooth Softshell	LT	1	9/13/2012
Asclepias meadii	Mead's Milkweed	LE	1	6/21/2012
Asio flammeus	Short-eared Owl	LE	3	12/14/2014
Bartramia longicauda	Upland Sandpiper	LE	1	7/4/1986
Calephelis muticum	Swamp Metalmark	LE	1	6/18/1989
Carex bromoides	Sedge	LT	1	5/15/2012
Carex prasina	Drooping Sedge	LT	1	7/2/2014
Carex willdenowii	Willdenow's Sedge	LT	1	6/20/1905
Circus hudsonius	Northern Harrier	LE	3	6/11/1993
Cyclonaias tuberculata	Purple Wartyback	LT	20	9/16/2020
Cypripedium parviflorum	Small Yellow Lady's Slipper	LE	3	5/18/2018
Diploperla robusta	Robust Springfly	LE	1	4/2009
Emydoidea blandingii	Blanding's Turtle	LE	2	12/9/2017
Epioblasma rangiana	Northern Riffleshell	LE	5	9/23/2019
Erimystax x-punctatus	Gravel Chub	LT	2	10/16/2020
Etheostoma camurum	Bluebreast Darter	LE	18	10/16/2020
Filipendula rubra	Queen-of-the-prairie	LT	2	7/11/2016
Hemidactylium scutatum	Four-toed Salamander	LT	1	2/21/2017
Hybopsis amblops	Bigeye Chub	LT	16	10/16/2020
Ixobrychus exilis	Least Bittern	LT	2	6/14/2012
Lampsilis fasciola	Wavy-rayed Lampmussel	LE	29	10/2020
Lethenteron appendix	American Brook Lamprey	LT	1	1/23/2001
Monarda clinopodia	White Bergamot	LT	1	7/27/1992
Moxostoma carinatum	River Redhorse	LT	9	10/7/2016
Myotis austroriparius	Southeastern Myotis	LE	2	6/18/1905
Myotis septentrionalis	Northern Long-eared Myotis	LT	4	9/2/2014
Myotis sodalis	Indiana Bat	LE	5	7/12/2018
Necturus maculosus	Mudpuppy	LT	2	10/7/2015
Nocomis micropogon	River Chub	LE	2	5/19/2001
Notropis boops	Bigeye Shiner	LE	7	8/20/2020
Noturus stigmosus	Northern Madtom	LE	1	8/1962
Pleurobema clava	Clubshell	LE	7	10/2/2019
Poa languida	Weak Bluegrass	LE	1	5/14/2012
Poa wolfii	Wolf's Bluegrass	LE	2	5/14/2012
Poliocitellus franklinii	Franklin's Ground Squirrel	LT	1	5/23/2009
Ptychobranchus fasciolaris	Kidneyshell	LE	4	9/20/2011
Quadrula metanevra	Monkeyface	LT	10	8/26/2020
Reginaia ebenus	Ebonyshell	LE	1	8/30/2016
Scirpus hattorianus	Bulrush	LE	1	9/10/2012
Silene regia	Royal Catchfly	LE	1	7/16/2015
Simpsonaias ambigua	Salamander Mussel	LE	5	11/2/2016

ENDANGERED/THREATENED SPECIES WITHIN VERMILION COUNTY

DESKTOP STUDY
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Scientific Name	Common Name	Status	Number of Occurrences	Last Observed
Theliderma cylindrica	Rabbitsfoot	LE	5	9/16/2020
Toxolasma lividum	Purple Lilliput	LE	11	9/16/2020
Villosa iris	Rainbow	LE	12	10/2020

Notes:

[O:EGP 8/9/21; C:EDP 8/17/21]

LE = listed endangered
LT = listed threatened

APPENDIX B
BORING LOGS AND WELL CONSTRUCTION LOGS

BORING AND WELL LOCATIONS MAP

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Coffeen\GMF_RP\Figure B-1_Boring and MW Locations.mxd

PROJECT: 169000XXXX | DATED: 10/12/2021 | DESIGNER: STOLZSD

⊕ BORING LOCATION
▭ PART 845 REGULATED UNIT (SUBJECT UNIT)
▭ SITE FEATURE
⬚ PROPERTY BOUNDARY

0 275 550
Feet

BORING AND MONITORING WELL LOCATIONS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION SITE
OAKWOOD, ILLINOIS

FIGURE B-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

BORING LOGS

RAMBOLL

SOIL BORING LOG INFORMATION

Page 1 of 3

Facility/Project Name Vermilion Power Station	License/Permit/Monitoring Number	Boring Number 70D

Boring Drilled By: Name of crew chief (first, last) and Firm Jason Greer Cascade Drilling	Date Drilling Started 3/4/2021	Date Drilling Completed 3/4/2021	Drilling Method Mini Sonic

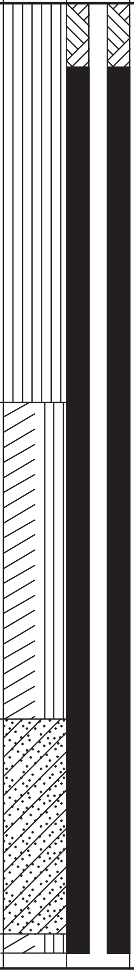
Common Well Name 70D	Final Static Water Level Feet (NAVD88)	Surface Elevation 591.90 Feet (NAVD88)	Borehole Diameter 6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☐
State Plane 1,278,929.46 N, 1,150,617.15 E [✓ E]/ W
1/4 of 1/4 of Section , T N, R

Lat ___° ___' ___"
Long ___° ___' ___"

Local Grid Location
Feet ☐ N ☐ S
Feet ☐ E ☐ W

Facility ID	County Vermilion	State Illinois	Civil Town/City/ or Village Oakwood

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
1 CS	60 47		1 2 3 4	0 - 6.3' **SILT:** ML, dark brown (10YR 3/3) to brown (10YR 4/3), clay (15-25%), sand, (0-5%), roots (0-5%), stiff, slow dilatancy, low toughness, low plasticity, moist.	ML				1.5 1.5					CS= Core Sample
2 CS	60 60		5 6						1.5					
			7 8 9	6.3 - 11.3' **SILTY CLAY:** CL/ML, brown (10YR 4/3), sand (0-10%), gravel (0-5%), firm, slow dilatancy, low toughness, medium plasticity, moist.	CL/ML				0.75 0.75					
3 CS	120 120		10 11	9.4' color change to yellowish brown (10YR 5/4).										
			12 13 14 15	11.3 - 14.7' **CLAYEY SAND:** SC, yellowish brown (10YR 5/6), rounded fine sand, silt (5-10%), gravel (0-5%), loose, wet.	SC									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

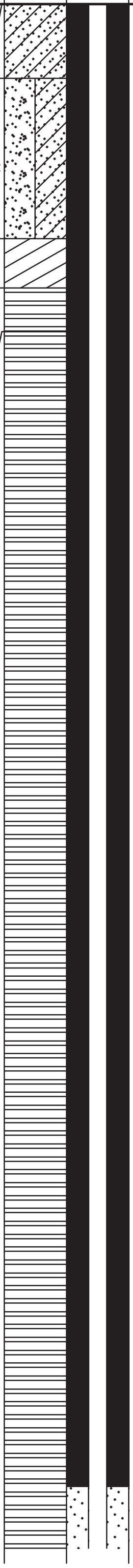
Signature	Firm Ramboll 234 W. Florida Street, Milwaukee, WI 53204	Tel: (414) 837-3607 Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number 70D

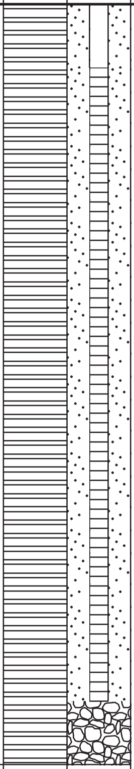
Page 2 of 3

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
				14.7 - 15' **SILTY CLAY:** CL/ML, yellowish brown (10YR 5/6), soft, slow dilatancy, low toughness, medium plasticity.	CL/ML							
			16	15 - 16.2' **CLAYEY SAND:** SC, yellowish brown (10YR 5/6), rounded fine sand, silt (5-10%), gravel (0-5%), loose, wet.	SC							
			17									
			18	16.2 - 18.8' **POORLY-GRADED SAND WITH CLAY:** SP-SC, ???, subrounded to rounded, fine to medium sand, loose, wet.	SP-SC							
			19	18.8 - 19.6' **LEAN CLAY:** CL, dark gray (10YR 4/1), gravel, (0-5%), sand (0-5%), stiff, no dilatancy, low toughness, medium plasticity, moist.	CL		2.5					
4 CS	120 97		20	19.6 - 20.3' **Weathered SHALE Bedrock** BDX (SH), gray (10YR 5/1), dry.	BDX (SH)							
			21	20.3 - 52' **SHALE:** BDX (SH), gray (10YR 5/1).								
			22									
			23									
			24									
			25									
			26									
			27									
			28									
			29									
5 CS	132 132		30		BDX (SH)							
			31									
			32									
			33									
			34									
			35									
			36									
			37									
			38									
			39									
			40									



SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number 70D

Sample		Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties					RQD/ Comments
Number and Type	Length Att. & Recovered (in)								Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	
6 CS	132 132		41 42 43 44 45 46 47 48 49 50 51	20.3 - 52' **SHALE:** BDX (SH), gray (10YR 5/1). *(continued)*	BDX (SH)									
			52	52' End of Boring.										

RAMBOLL

SOIL BORING LOG INFORMATION

Page 1 of 2

Facility/Project Name Vermilion Power Station	License/Permit/Monitoring Number	Boring Number 70S

Boring Drilled By: Name of crew chief (first, last) and Firm Jason Greer Cascade Drilling	Date Drilling Started 3/4/2021	Date Drilling Completed 3/4/2021	Drilling Method Mini Sonic

Common Well Name	Final Static Water Level Feet (NAVD88)	Surface Elevation 591.64 Feet (NAVD88)	Borehole Diameter 6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☐
State Plane 1,278,927.79 N, 1,150,624.72 E [✓ E]/ W
1/4 of 1/4 of Section , T N, R
Lat ____° ____' ______"
Long ____° ____' ______"
Local Grid Location
Feet ☐ N ☐ S
Feet ☐ E ☐ W

Facility ID	County Vermilion	State Illinois	Civil Town/City/ or Village Oakwood

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			1 2 3 4 5 6	0 - 6.3' **SILT:** ML, Blind drilled to 17 feet below ground surface. See 70 boring log for detailed lithology.	ML									
			7 8 9 10 11	6.3 - 11.3' **SILTY CLAY:** CL/ML.	CL/ML									
			12	11.3 - 14.7' **CLAYEY SAND:** SC.	SC									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm Ramboll 234 W. Florida Street, Milwaukee,WI 53204	Tel: (414) 837-3607 Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number 70S

Page 2 of 2

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13 14	11.3 - 14.7' **CLAYEY SAND:** SC. *(continued)*	SC									Attempted to wash out sand, but saw well 70D was influenced by watetr so stepped out to location 70SA.
			15	14.7 - 15' **SILTY CLAY:** CL/ML.	CL/ML									
			16	15 - 16.2' **CLAYEY SAND:** SC.	SC									
				16.2 - 17' **POORLY-GRADED SAND WITH CLAY:** SP-SC.	SP-SC									
1 MC	24 6		17 18	17 - 19' No Recovery.										MC= Modified California
			19	19 - 19.6' **LEAN CLAY:** CL, Blind drilled 19-20 feet bgs. See 70 boring log for detailed lithology.	CL									
			20	19.6 - 20' **Weathered SHALE Bedrock** BDX (SH).	BDX (SH)									
				20' End of Boring. Attempted to install well at 20' bgs, but due to heaving sands the well came up to 18' bgs..										

SOIL BORING LOG INFORMATION

Page 1 of 2

Facility/Project Name Vermilion Power Station	License/Permit/Monitoring Number	Boring Number 70SA	
Boring Drilled By: Name of crew chief (first, last) and Firm Jason Greer Cascade Drilling	Date Drilling Started 3/4/2021	Date Drilling Completed 3/4/2021	Drilling Method Mini Sonic
Common Well Name 70SA	Final Static Water Level Feet (NAVD88)	Surface Elevation Feet (NAVD88)	Borehole Diameter 6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☐

State Plane N, E [✓ E]/ W

1/4 of 1/4 of Section , T N, R

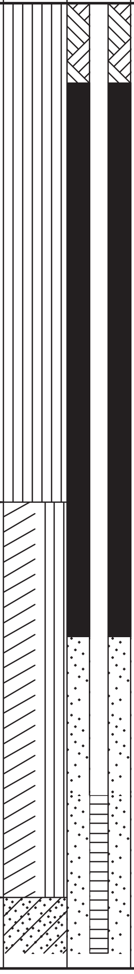
Lat ° ' "

Long ° ' "

Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Vermilion	Illinois	Oakwood

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			0	0 - 6.3' **SILT:** ML, Blind drilled 15 ft bgs. See 70 boring log for detailed lithology..	ML									MC= Modified California
			6.3	6.3 - 11.3' **SILTY CLAY:** CL/ML.	CL/ML									
			11.3	11.3 - 14.7' **CLAYEY SAND:** SC.	SC									



I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

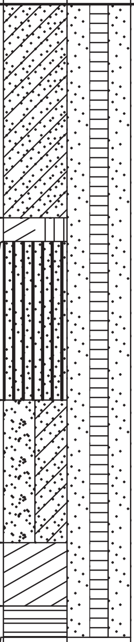
Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

Template: RAMBOLL_IL_BORING LOG - Project: 845_VERMILION_2021 (2).GPJ

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number 70SA

Page 2 of 2



Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	PID 10.6 eV Lamp	Soil Properties Compressive Strength (tsf)	Soil Properties Moisture Content	Soil Properties Liquid Limit	Soil Properties Plasticity Index	Soil Properties P 200	RQD/ Comments
			13 14	11.3 - 14.7' **CLAYEY SAND:** SC. *(continued)*	SC							
				14.7 - 15' **SILTY CLAY:** CL/ML.	CL/ML							
1 MC	24 18		15 16	15 - 17' **SILTY SAND:** SM.	SM							
	17							20.8	12		39.9	
			17 18	17 - 18.8' **POORLY-GRADED SAND WITH CLAY:** SP-SC, Blind drilled 17-20 ft bgs. See 70 boring log for detailed lithology..	SP-SC							
			19	18.8 - 19.6' **LEAN CLAY:** CL.	CL							
				19.6 - 20' **Weathered SHALE Bedrock** BDX (SH).	BDX (SH)							
			20	20' End of Boring.								

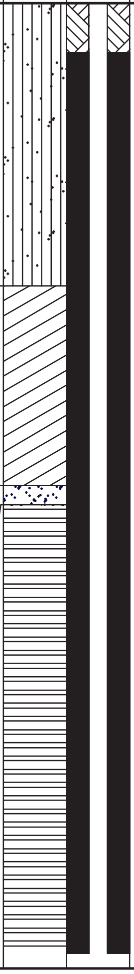
SOIL BORING LOG INFORMATION

Page 1 of 2

Facility/Project Name Vermilion Power Station	License/Permit/Monitoring Number	Boring Number 71D	
Boring Drilled By: Name of crew chief (first, last) and Firm Jason Greer Cascade Drilling	Date Drilling Started 3/3/2021	Date Drilling Completed 3/3/2021	Drilling Method Mini Sonic
Common Well Name 71D	Final Static Water Level Feet (NAVD88)	Surface Elevation 577.18 Feet (NAVD88)	Borehole Diameter 6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☐
State Plane 1,278,992.96 N, 1,151,334.05 E [✓ E]/ W
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location
Feet ☐ N ☐ S
Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Vermilion	Illinois	Oakwood



Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
1 CS	120 110		1.5 3.0 4.5	0 - 5.8' **SILT WITH SAND:** (ML)s, dark brown (10YR 3/3) to brown (10YR 4/3), sand (15-25%), clay (5-10%), organic material (0-10%), firm, slow dilatancy, low toughness, low plasticity, moist.	(ML)s				0.75 0.75 0.75					CS= Core Sample SH= Shelby Tube
			6.0 7.5 9.0	5.8 - 9.9' **LEAN CLAY:** CL, brown (10YR 4/3), silt (15-25%), sand (0-5%), gravel (0-5%), firm, slow dilatancy, low toughness, medium plasticity, moist.	CL				0.75 0.75					
2 CS	96 96		10.5	9.9 - 10.3' **POORLY-GRADED SAND:** SP, dark grayish brown (10YR 4/2), subrounded to rounded, medium to coarse sand, clay (0-10%), loose, wet.	SP									
3 SH	24 24		12.0 13.5 15.0 16.5 18.0 19.5	10.3 - 20' **Weathered SHALE Bedrock** BDX (SH), gray (10YR 5/1), dry.	BDX (SH)				2.5					

I hereby certify that the information on this form is true and correct to the best of my knowledge.

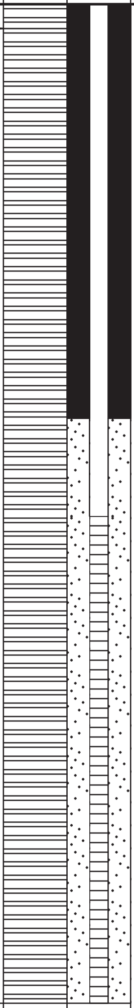
Signature	Firm Ramboll 234 W. Florida Street, Milwaukee,WI 53204	Tel: (414) 837-3607 Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number 71D

Page 2 of 2

Sample		Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties					RQD/ Comments
Number and Type	Length Att. & Recovered (in)								Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	
4 CS	120 81			20 - 40' **SHALE:** BDX (SH), dark gray (10YR 4/1).										
			21.0											
			22.5											
			24.0											
			25.5											
			27.0											
			28.5											
5 CS	120 120		30.0		BDX (SH)									
			31.5											
			33.0											
			34.5											
			36.0											
			37.5											
			39.0											
				40' End of Boring.										



SOIL BORING LOG INFORMATION

Page 1 of 1

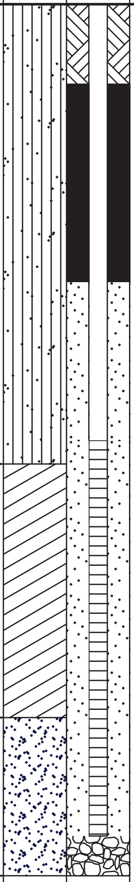
Facility/Project Name Vermilion Power Station	License/Permit/Monitoring Number	Boring Number 71S

Boring Drilled By: Name of crew chief (first, last) and Firm Jason Greer Cascade Drilling	Date Drilling Started 3/3/2021	Date Drilling Completed 3/3/2021	Drilling Method Mini Sonic

Common Well Name 71S	Final Static Water Level Feet (NAVD88)	Surface Elevation 577.19 Feet (NAVD88)	Borehole Diameter 6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☐
State Plane 1,278,988.40 N, 1,151,332.51 E [✓ E]/ W
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location
☐ N ☐ E
Feet ☐ S Feet ☐ W

Facility ID	County Vermilion	State Illinois	Civil Town/City/ or Village Oakwood



Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
				0 - 5.8' **SILT WITH SAND:** (ML)s, Blind Drilled to 9' below ground surface (bgs). See boring log 71D for detailed lithology.	(ML)s									
				5.8 - 9' **LEAN CLAY:** CL.	CL									
1 MC	24 24			9 - 11' **POORLY-GRADED SAND:** SP.	SP					20.8	17	7	4.7	MC= Modified California
				11' End of Boring.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm Ramboll 234 W. Florida Street, Milwaukee,WI 53204	Tel: (414) 837-3607 Fax: (414) 837-3608

FIELD BORING LOG

CLIENT: Vistra Energy Corp.
Site: Vermilion Power Station
Location: Oakwood, IL
Project: 18E0141
DATES: Start: 2/12/2019
Finish: 2/12/2019
WEATHER: Overcast, cool (hi-30's)

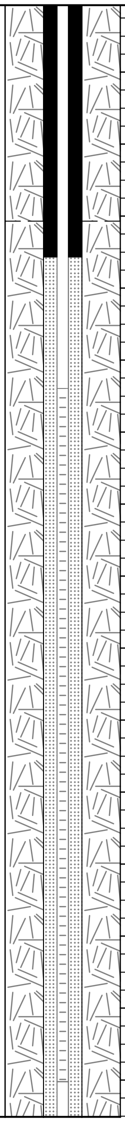
CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 4¼" Hollow Stem Auger

FIELD STAFF: Driller: B Williamson
Helper: D Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: NED1
Well ID: NED1
Surface Elev: 597.93 ft. MSL
Completion: 15.44 ft. BGS
Station: 1,279,841.66N
1,150,574.39E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Danville NW
Township: Blount
Section 20, **Tier** 20N.; **Range** 12W.

WATER LEVEL INFORMATION:
▼ = 3.00 - durring drilling
▼ = 2.09 - 2/20/2019
▽ =



SAMPLE			TESTING								
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
								Dark gray, moist, ASH.			
							▼ 2			596	
	0/60 *0%*	BD									
							▼				
							4			594	
							6			592	
	0/60 *0%*	BD									
							8			590	
								Dark gray, wet, ASH.			
							10			588	
							12			586	
	0/60 *0%*	BD									
							14			584	
	0/5 *0%*	○ NR									

End of Boring = 15.5 ft.

NOTE(S):

Page 1 of 1

FIELD BORING LOG

HANSON

CLIENT: Vistra Energy Corp.
Site: Vermilion Power Station
Location: Oakwood, IL
Project: 18E0141
DATES: Start: 2/12/2019
Finish: 2/12/2019
WEATHER: Overcast, cool (hi-30's)

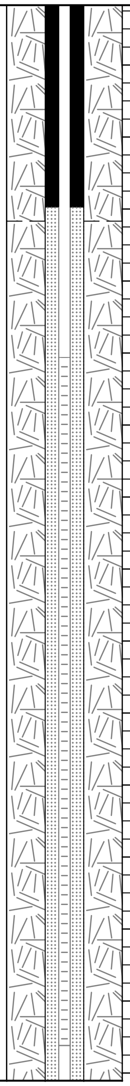
CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 4¼" Hollow Stem Auger
FIELD STAFF: Driller: B Williamson
Helper: D Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: NED2
Well ID: NED2
Surface Elev: 598.83 ft. MSL
Completion: 14.94 ft. BGS
Station: 1,279,587.42N
1,150,619.28E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Danville NW
Township: Blount
Section 20, **Tier** 20N.; **Range** 12W.

WATER LEVEL INFORMATION:
▼ = 3.00 - durring drilling
▼ = 1.71 - 2/20/2019
▽ =

SAMPLE			TESTING								
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Water Content (%)	Dry Density (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	0/60 *0%*	BD					▼ 1.71 2 ▼ 3.00 4	Dark gray, moist, ASH.		598 596 594	
	0/60 *0%*	BD					6 8	Dark gray, wet, ASH.		592 590	
	0/60 *0%*	BD					10 12 14			588 586 584	



End of Boring = 15.0 ft.

NOTE(S):

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LOG OF BORING MW22

(Page 1 of 2)

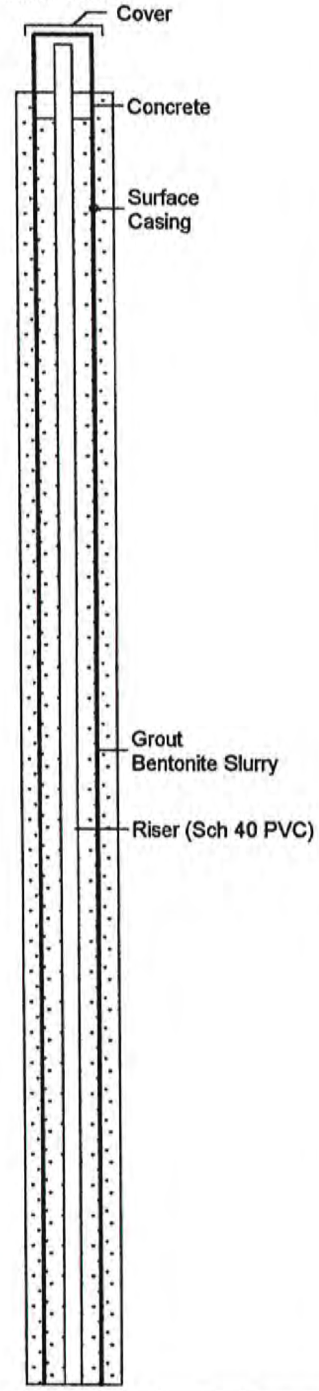
East Ash Pond Hydrogeologic Investigation
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Location: Twp 20N, Rng 12W, 20 SW/NE/SE

Date Completed	: 11/30/2001	Driller	: Dusty Jackson
Hole Diameter	: 4 1/2; 2 1/2 inches	Geologist	: Eric Kovatch (NRT)
Drilling Method	: Rotary	Land Surface Elevation	: 655.6
Sampling Method	: HQ Core (2.5 inch)	Top of Casing Elevation	: 658.60
Drilling Company	: Mid-America Drilling, Inc.	X,Y Coordinates	: 1150083,1279669

Depth in Feet	DESCRIPTION	Surf. Elev. 655.6	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
0		655						
5	Blind Drill to 70.5 feet - see log of Well MW10	650						
10	Surface Casing = 4.3 I.D. / 4.5 inch O.D. Installed to 70 feet below ground	645						
15		640						
20		635						
25		630						
30		625						
35		620						
40		615						
45		610						
50								

Well: MW22
Elev.: 658.60



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LOG OF BORING MW22

(Page 2 of 2)

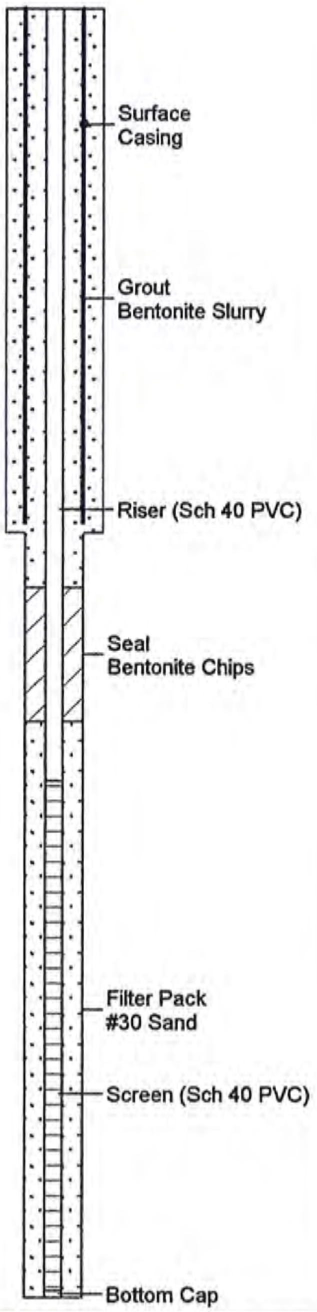
East Ash Pond Hydrogeologic Investigation
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Location: Twp 20N, Rng 12W, 20 SW/NE/SE

Date Completed	: 11/30/2001	Driller	: Dusty Jackson
Hole Diameter	: 4 1/2; 2 1/2 inches	Geologist	: Eric Kovatch (NRT)
Drilling Method	: Rotary	Land Surface Elevation	: 655.6
Sampling Method	: HQ Core (2.5 inch)	Top of Casing Elevation	: 658.60
Drilling Company	: Mid-America Drilling, Inc.	X,Y Coordinates	: 1150083,1279669

Depth in Feet	DESCRIPTION	Surf. Elev. 655.6	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
50		605						
55		600						
60		595						
65		590						
70	SHALE, bedrock	585					SH	
	HQ Core 1 (70.5-80: 9.5 ft recovery) - weathered, blocky, fissile, soft, dark gray							
75		580	1	114				
	- competent, hard, dark gray; laminated with clay/ silt seams/lenses, <1 to 4 mm, light gray							
80	- seams/lenses of light gray clay/silt from <1 to 11mm	575						
	HQ Core 2 (80-90: 10 ft recovery) - same as above with occasional blue tint, blocky when sheared							
85		570	2	120				
90	- seams/lenses of light gray clay/silt from <1 to 2 cm	565						
	HQ Core 3 (90-100: 10 ft recovery)							
95		560	3	120				
	END BOREHOLE AT 100 FEET BLS							
100								

Well: MW22
Elev.: 658.60



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LOG OF BORING MW23

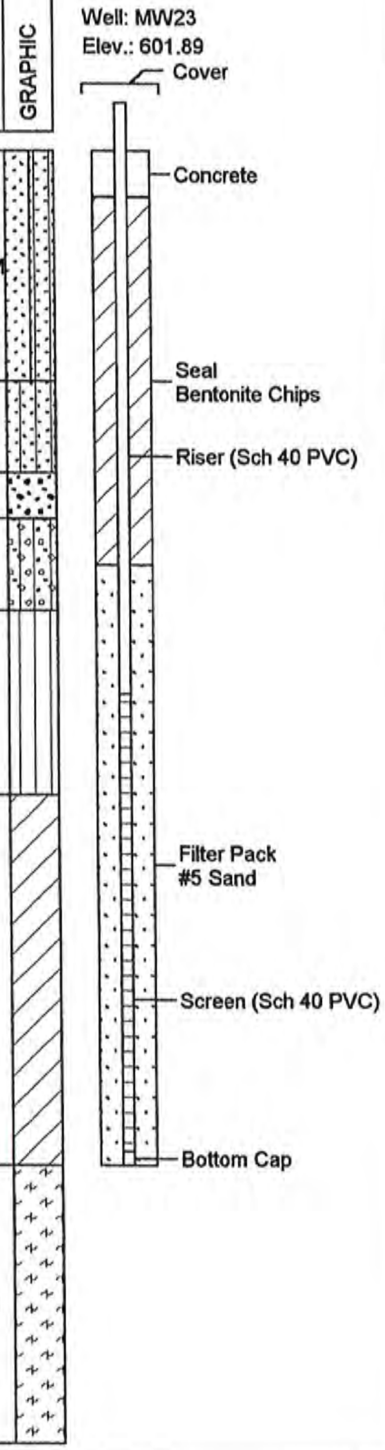
(Page 1 of 1)

East Ash Pond Hydrogeologic Investigation
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Location: Twp 20N, Rng 12W, 20 NE/NE/SE

Date Completed	: 12/03/2001	Driller	: Dusty Jackson
Hole Diameter	: 5 7/8 inch	Geologist	: Rebecca Caudill (NRT)
Drilling Method	: Hollow-stem	Land Surface Elevation	: 599.2
Sampling Method	: Split-Spoon	Top of Casing Elevation	: 601.89
Drilling Company	: Mid-America Drilling, Inc.	X,Y Coordinates	: 1150788, 1280399

Depth in Feet	DESCRIPTION	Surf. Elev. 599.19	Samples	Recovery inches	Blow Count	Qp TSF	USCS
0	SAND (fine-med) with silt, poorly graded, trace fine gravel, reddish-yellow, very moist	599					
2		597	1	15	9 5 4 3		SP-SM
4		595	2	13	9 5 6 8		
	Silty SAND (fine-crse) with gravel (fine-crse), dark brown (15% clay), slightly moist						SM
6		593	3	16	5 12 17 27		
	GRAVEL (fine-crse), angular limestone and dolomite						GP
8	Silty GRAVEL (fine) with sand (med-crse) and trace clay, poorly graded, slightly moist	591	4	7	23 24 28 28		GM
10	SILT with sand (fine), yellow with dark brown and black mottling, laminated	589	5	16	18 22 22 23	1.5	
12	- alternating layers (< 2 inches) of silt with sand and coarse sand with trace silt and fine gravel - grades to silt with gravel, yellow brown, hard, slightly moist	587	6	18	23 33 27 50	1.0	ML
14	Sandy CLAY with gravel; lean clay, fine-med sand, fine gravel; very hard, olive, slightly moist	585	7	15	23 29 39 41	>4.5	
16	- grades to sandy lean clay with trace gravel	583	8	15	28 49 50	>4.5	
18		581	9	18	22 35 36 50	>4.5	CL
20	- with fine sand, trace gravel, slightly moist	579	10	11	12 20 29	>4.5	
22	Weathered SHALE Bedrock, lean clay with silt, dark bluish gray grading to greenish gray and deeper green, hard, low-med plasticity, moist to very moist	577	11	18	17 27 41 68	3.5	
24		575	12	13	33 49 50	>4.5	SH
26		573	13	6	37 50	>4.5	
	END BOREHOLE AT 28 FEET BLS						
28							



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LOG OF BORING MW24

(Page 1 of 1)

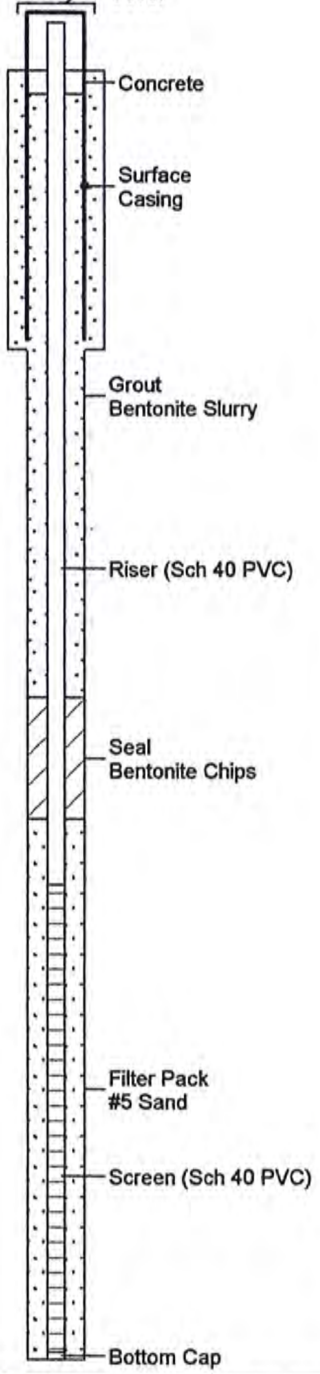
East Ash Pond Hydrogeologic Investigation
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Location: Twp 20N, Rng 12W, 20 NE/NE/SE

Date Completed	: 12/03/2001	Driller	: Dusty Jackson
Hole Diameter	: 5 7/8, 4 1/2; 2 1/2 inches	Geologist	: Rebecca Caudill (NRT)
Drilling Method	: Hollow-Stem / Rotary	Land Surface Elevation	: 598.8
Sampling Method	: HQ Core (2.5 inch)	Top of Casing Elevation	: 601.81
Drilling Company	: Mid-America Drilling, Inc.	X,Y Coordinates	: 1150783, 1280404

Depth in Feet	DESCRIPTION	Surf. Elev. 598.8	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
0		598						
5	Blind Drill to 27 feet - see log of Well MW23	593						
10	Surface Casing = 4.3 I.D. / 4.5 inch O.D. Installed to 11.5 feet below ground	588						
15		583						
20		578						
25		573						
	Weathered SHALE bedrock, lean clay with silt, greenish gray to dark gray; with occasional light gray seams/lenses of laminated clay/silt from <1 to 4 mm						SH	
30	SHALE bedrock, competent, hard HQ Core 1 (27-35: 7.7 ft recovery)	568	1	92.5				
35	- light gray seams/lenses of clay/silt from <1 to 10 mm	563						
40	HQ Core 2 (35-45: 9.9 ft recovery)	558	2	119			SH	
45	- light gray seams/lenses of clay/silt are <1 to 2 mm	553						
50	HQ Core 3 (45-55: 9.8 ft recovery)	548	3	118				
55	END BOREHOLE AT 55 FEET BLS							

Well: MW24
Elev.: 601.81



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LOG OF BORING MW25

(Page 1 of 1)

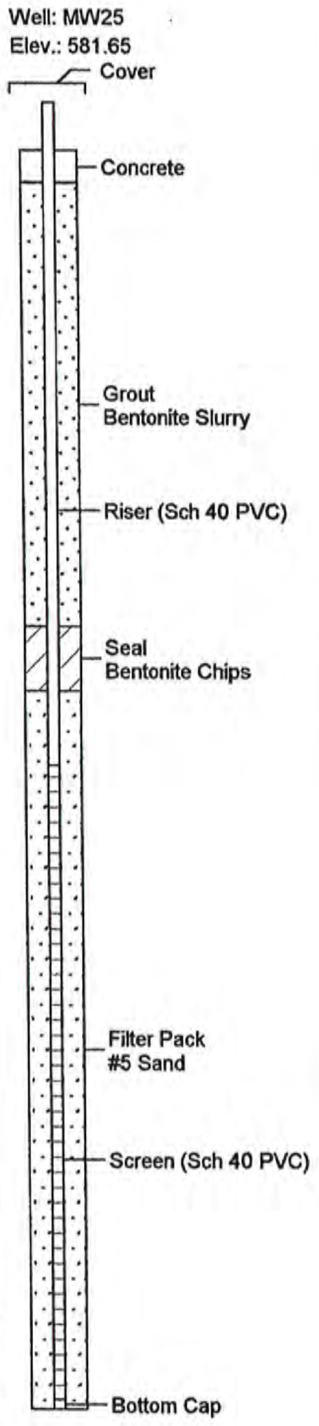
East Ash Pond Hydrogeologic Investigation
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Location: Twp 20N, Rng 12W, 29 NW/NW/NW

Date Completed	: 12/04/2001	Driller	: Dusty Jackson
Hole Diameter	: 5 7/8; 4 1/2; 2 1/2 inches	Geologist	: Rebecca Caudill
Drilling Method	: Hollow-stem / Rotary	Land Surface Elevation	: 578.8
Sampling Method	: Split-Spoon / HQ Core (2.5 inch)	Top of Casing Elevation	: 581.65
Drilling Company	: Mid-America Drilling, Inc.	X,Y Coordinates	: 1150916, 1278027

Depth in Feet	DESCRIPTION	Surf. Elev. 578.8	Samples	Recovery inches	Blow Count	Qp TSF	USCS
0	CLAY lean, medium plasticity, firm, light brown-gray with 20% strong brown mottling, moist	578					
			1	6	6 7 7 3		CL
5	- greenish gray w 30% mottling		2	18	5 7 11 15		
		573	3	22	5 6 8 11		
	SAND grading to Clayey SAND (medium, rounded), wet						SC
	SAND with clay and gravel (fine subangular gravel)		4	9	10 75		SP
10	Weathered SHALE bedrock,lean clay with silt, greenish gray						SH
	SHALE, bedrock, competent, very hard, dark gray; with thin light gray laminations (seams and lenses) of clay/silt <1 to 6 mm	568					
15	HQ Core 1 (9-19: 9.8 ft recovery) (2.25 inch diameter)	563	5	118			
20	- seams of light gray clay/silt (laminations) range from 1mm to 3 cm	558					
25	HQ Core 2 (19-29: 9.9 ft recovery)	553	6	119			SH
30	- seams of light gray laminations less than 1 mm	548					
35	HQ Core 3 (29-39: 9.9 ft recovery)	543	7	119			
	END BOREHOLE AT 39 FEET BLS						
40							

GRAPHIC



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LOG OF BORING MW26

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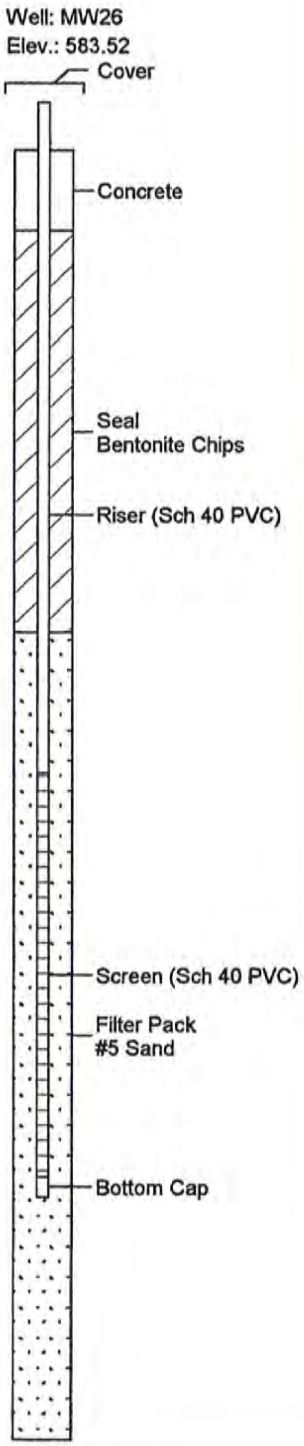
East Ash Pond Hydrogeologic Investigation
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Location: Twp 20N, Rng 12W, 20 SE/SE/NE

Date Completed	: 11/21/2001	Driller	: Dusty Jackson
Hole Diameter	: 7 1/2 inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-stem	Land Surface Elevation	: 580.5
Sampling Method	: Split-Spoon	Top of Casing Elevation	: 583.52
Drilling Company	: Mid-America Drilling, Inc.	X,Y Coordinates	: 1150782, 1280741

Depth in Feet	DESCRIPTION	Surf. Elev. 580.5	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
0	Silty and sandy CLAY, with roots, dark brown, moist	580			3		CL	
2 4	SAND (fine), well sorted, light yellow-brown, moist	578 576	1 2	20 20	3 3 4 3 4 4 4	1.75	SP	
6	SAND (fine-medium) w/ shell fragments, poorly sorted, light brown, moist - wet	574	3	14	4 5 4 4 3		SW	
	Clayey and silty SAND (fine), dark brown				5		SM	
8	SAND (fine-crse) w/ trace fine gravel (angular-subrounded), poorly sorted	572	4	18	7 10		SW	
10	SAND (fine-crse) and GRAVEL (fine, subangular-subrounded), poorly sorted	570	5	6	7 8 12 17 7 15		GW	
12	Silty CLAY, olive-gray; alluvial	568	6	8	18 29		CL	
	SAND (med-crse) with silty clay, olive-gray; alluvial, wet		7	7	25		SC	
14	Weathered SHALE Bedrock, lean clay with silt, uniform, medium greenish gray, moist	566			50		SH	
16	SHALE Bedrock, hard, fissile with horizontal parting, greenish gray END BOREHOLE AT 16 FEET BLS		8	8	35 50		SH	



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LOG OF BORING MW27

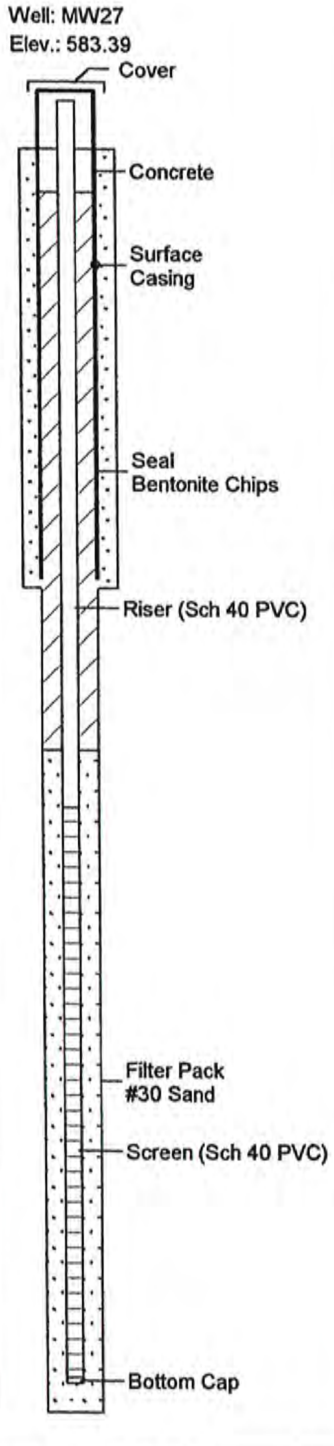
(Page 1 of 1)

East Ash Pond Hydrogeologic Investigation
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Location: Twp 20N, Rng 12W, 20 SE/SE/NE

Date Completed	: 11/26/2001	Driller	: Dusty Jackson
Hole Diameter	: 5 7/8, 2 1/2 inches	Geologist	: Eric Kovatch (NRT)
Drilling Method	: Hollow-Stem	Land Surface Elevation	: 580.4
Sampling Method	: HQ Core (2.5 inch)	Top of Casing Elevation	: 583.39
Drilling Company	: Mid-America Drilling, Inc.	X,Y Coordinates	: 1150787, 1280744

Depth in Feet	DESCRIPTION	Surf. Elev. 580.4	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
0		580						
	Blind Drill to 16.5 feet - see log of Well MW26							
5		575						
	Surface Casing = 4.3 I.D. / 4.5 inch O.D. Installed to 15 feet below groundr							
10		570						
	Weathered Shale at 13.3 feet (log MW26)							
15	Competent Shale at 15.0 feet (log MW26)	565						
	SHALE bedrock, competent w/ yellow-brown very fine sand/silt seams and lenses (<1 mm to 2 cm), light gray to olive gray							
20		560	1	102				
	HQ Core 1 (16.5-25: 8.5 ft recovery)							
25	- gray to dark gray; with thin laminations (seams/ lenses) of clay/silt/very fine sand (<1 to 4 mm), light gray	555						
30	HQ Core 2 (25-35: 10 ft recovery)	550	2	120			SH	
35		545						
40	HQ Core 3 (35-44: 9 ft recovery)	540	3	108				
	END BOREHOLE AT 44 FEET BLS							
45								



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KELRON
Environmental

LOG OF BORING MW28

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East Ash Pond Hydrogeologic Investigation
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Location: Twp 20N, Rng 12W, 21 NW/SW/NW

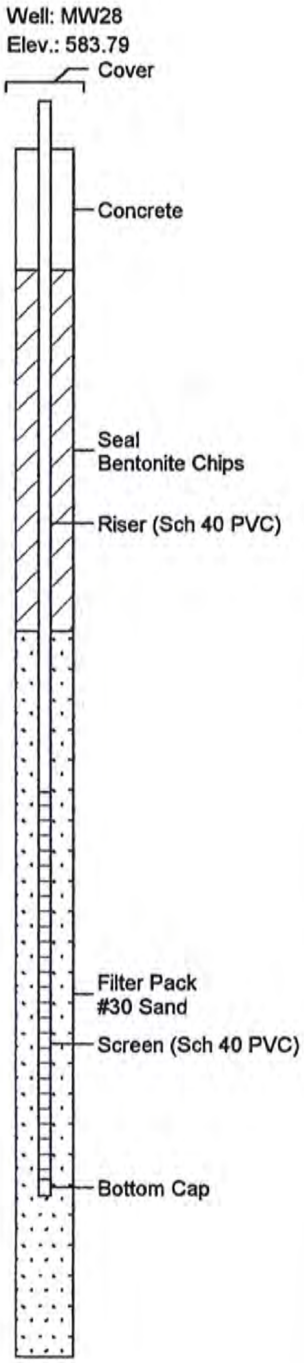
Date Completed : 11/26/2001
Hole Diameter : 7 1/2 inch
Drilling Method : Hollow-stem
Sampling Method : Split-Spoon
Drilling Company : Mid-America Drilling, Inc.

Driller : Dusty Jackson
Geologist : Eric Kovatch (NRT)
Land Surface Elevation : 580.8
Top of Casing Elevation: 583.79
X,Y Coordinates : 1151565, 1281552

DESCRIPTION	USCS
Sandy SILT with grass, roots, organic fibers, dark brown - trace clay, soft to firm, low plasticity, homogeneous	ML
Silty SAND (fine), poorly sorted, med to yellow brown; grades into sandy silt	SM
Sandy SILT, trace clay, soft to firm, low plasticity, dark brown, moist	ML
SAND (fine), well sorted, moist	SP
SAND with Gravel and trace silt (fine-crse sand, fine-med subrounded gravel), moist	SW
SILT with trace gravel lenses, hard, non-plastic, dark olive gray, moist - grades into weathered shale	ML
Weathered SHALE bedrock, blocky, crumbles when wet, dark olive gray	SH

END BOREHOLE AT 15 FEET BLS

Samples	Recovery inches	Blow Count	Qp TSF
1	22	2 4 6 14	2.25
2	20	8 11 8 11	1.75
3	14	11 11 8 12	1.5
4	6	7 11 27 50	0.25
5	20	10 25 40 50	
6	22	12 28 48 50	
7	24	14 34 35 45	4.5



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KELRON
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LOG OF BORING MW29

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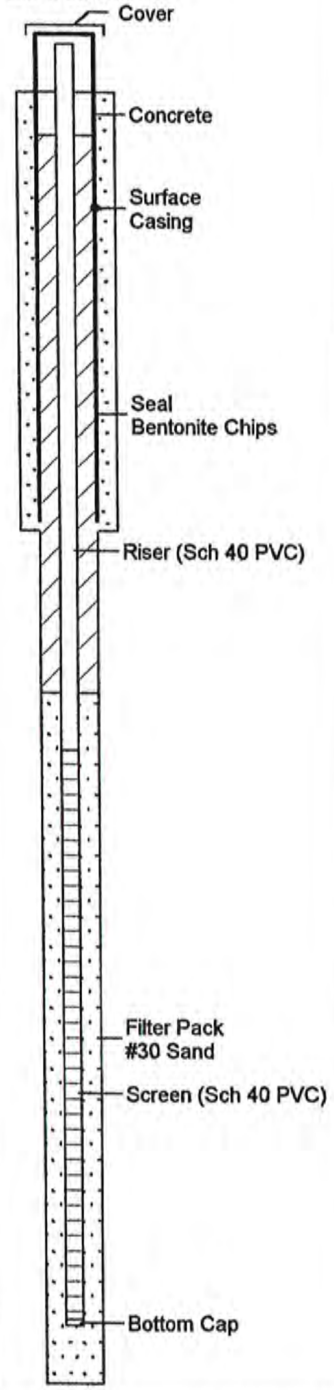
East Ash Pond Hydrogeologic Investigation
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Location: Twp 20N, Rng 12W, 21 NW/SW/NW

Date Completed	: 11/27/2001	Driller	: Dusty Jackson
Hole Diameter	: 5 7/8, 2 1/2 Inches	Geologist	: Eric Kovatch (NRT)
Drilling Method	: Hollow-Stem	Land Surface Elevation	: 580.9
Sampling Method	: HQ Core (2.5 inch)	Top of Casing Elevation	: 583.90
Drilling Company	: Mid-America Drilling, Inc.	X,Y Coordinates	: 1151564, 1281557

Depth in Feet	DESCRIPTION	Surf. Elev. 580.9	Samples	Recovery inches	Blow Count	Qp TSF	USCS
0							
		580					
5	Blind Drill to 16 feet - see log of Well MW28						
		575					
	Surface Casing = 4.3 I.D. / 4.5 inch O.D. Installed to 15 feet below ground						
10		570					
15	Weathered Shale at 14.75 feet (log MW28)	565					
	Weathered SHALE bedrock, blocky and striated with very fine yellow-brown sand/silt seams, dark olive gray						SH
20	SHALE bedrock, competent, dark olive gray; laminated with very fine seams and lenses (<1 to 3 mm) of clay with silt and fine sand (light gray), fractures along laminations HQ Core 1 (16-25: 9 ft recovery)	560	1	108			
25	- gray to dark gray; laminated with light gray seams/ lenses of clay, silt, fine sand (<1 to 8 mm)	555					
30	HQ Core 2 (25-35: 10 ft recovery)	550	2	120			SH
35		545					
40	HQ Core 3 (35-45: 10 ft recovery)	540	3	120			
45	END BOREHOLE AT 45 FEET BLS						

Well: MW29
Elev.: 583.90



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KELRON
Environmental

LOG OF BORING MW30

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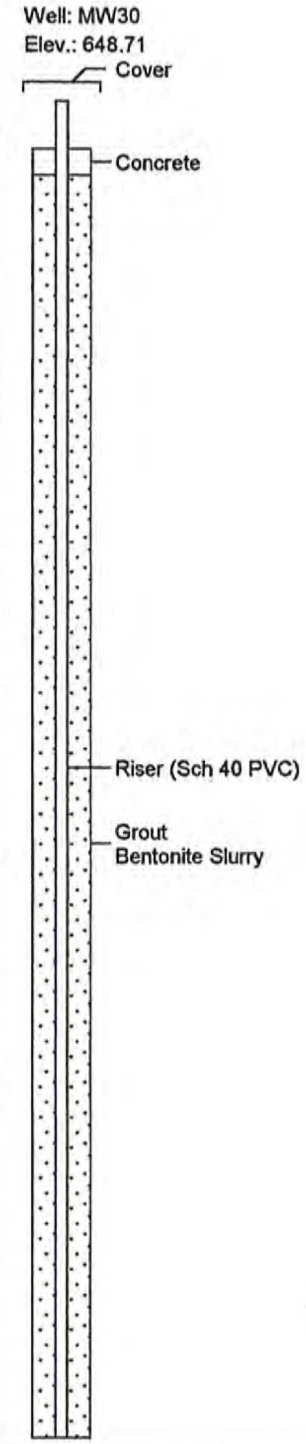
East Ash Pond Hydrogeologic Investigation
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Location: Twp 20N, Rng 12W, 20 SW/NE/NE

Date Completed	: 11/21/2001	Driller	: Dusty Jackson
Hole Diameter	: 9 1/2; 5 7/8; 4 1/2; 2 1/2 inches	Geologist	: Stuart Cravens
Drilling Method	: Hollow-stem / Rotary	Land Surface Elevation	: 645.7
Sampling Method	: Split-Spoon / HQ Core (2.5 inch)	Top of Casing Elevation	: 648.71
Drilling Company	: Mid-America Drilling, Inc.	X,Y Coordinates	: 1150347, 1282360

Depth in Feet	DESCRIPTION	Surf. Elev. 645.7	Samples	Recovery inches	Blow Count	Qp TSF	USCS
0	Silty CLAY till w/ trace f-med sand, olive, moist	645					CL
5	- w/ light gray mottling grading to brown, trace f.gravel	640	1	20	9 7 12 17	4.5	
	SILT w/ f.sand grading to Silty SAND, olive, dry						ML
10	- very moist	635	2	20	7 9 14 20	>4.5	
	Silty CLAY till w/ trace sand and gravel, dry						CL
15	- med gray	630	3	24	16 25 32 48	>4.5	
	- moist - w/ sand and gravel, med brown		4	17	27 47 50	>4.5	
20	SAND and GRAVEL, f-crse sand, f.gravel, lt brown, dry	625					SW
	Silty CLAY till w/ sand and gravel (fine)						CL
25	SAND (med-crse) w/ f.gravel, poorly sorted, wet		5	17	11 25 37 50	>4.5	SW
	Silty CLAY till w/ f. sand and gravel, dry	620					CL
30	SAND (fine), well sorted, light brown, moist	615	6	13	33 50 50		SP
35			7	14	48 50		
	Silty CLAY till w/ sand and gravel, med gray, dry	610					CL
40		605	8	12	36 107	>4.5	
45		600	9	15	29 45 50	>4.5	
50							



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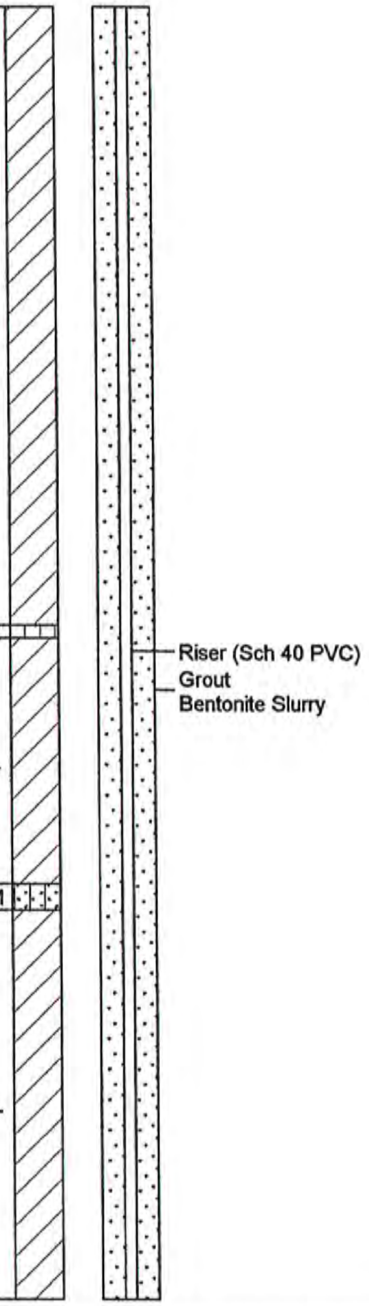
KELRON Environmental	LOG OF BORING MW30 (Page 2 of 3)

East Ash Pond Hydrogeologic Investigation Vermilion Power Station Dynegy Midwest Generation, Inc.	Date Completed	: 11/21/2001	Driller	: Dusty Jackson
	Hole Diameter	: 9 1/2; 5 7/8; 4 1/2; 2 1/2 inches	Geologist	: Stuart Cravens
	Drilling Method	: Hollow-stem / Rotary	Land Surface Elevation	: 645.7
	Sampling Method	: Split-Spoon / HQ Core (2.5 inch)	Top of Casing Elevation	: 648.71
Location: Twp 20N, Rng 12W, 20 SW/NE/NE	Drilling Company	: Mid-America Drilling, Inc.	X,Y Coordinates	: 1150347, 1282360

Depth in Feet	DESCRIPTION	Surf. Elev. 645.7	Samples	Recovery inches	Blow Count	Qp TSF	USCS
50		595					
55		590	10	11	62 112	>4.5	
60		585					CL
65		580	11	15	27 37 50	>4.5	
70		575					
75	SILT, med gray, slightly moist	570	12	12			ML
	Silty CLAY till w/ trace sand and gravel, med gray						CL
80		565					
85	Silty SAND (fine), well sorted, med gray, wet	560	13	10	66 78		SM
	Silty CLAY till w/ trace sand and gravel, med gray, moist						CL
90		555					
95		550	14	22	33 28 52 54	>4.5	
100							

GRAPHIC

Well: MW30
Elev.: 648.71



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KELRON
Environmental

LOG OF BORING MW30

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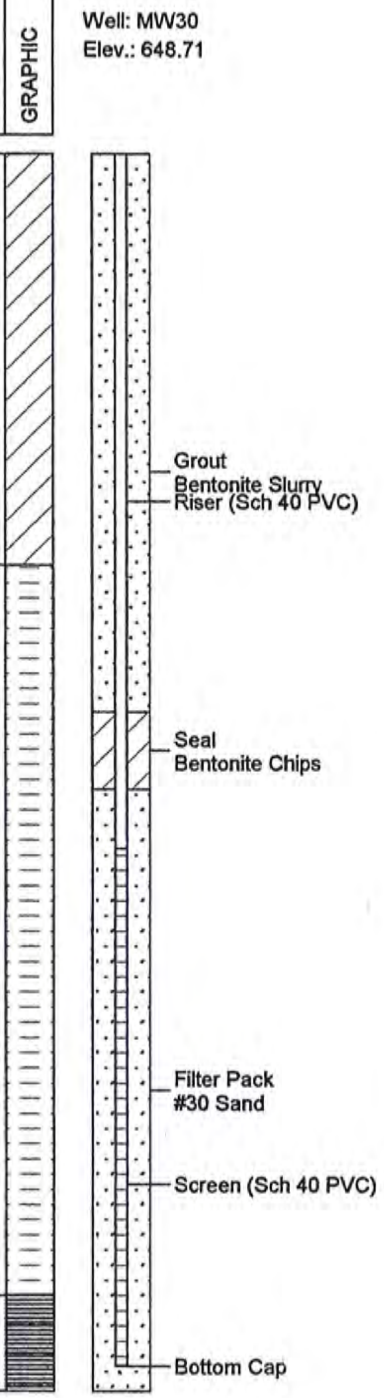
East Ash Pond Hydrogeologic Investigation
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Location: Twp 20N, Rng 12W, 20 SW/NE/NE

Date Completed	: 11/21/2001	Driller	: Dusty Jackson
Hole Diameter	: 9 1/2; 5 7/8; 4 1/2; 2 1/2 inches	Geologist	: Stuart Cravens
Drilling Method	: Hollow-stem / Rotary	Land Surface Elevation	: 645.7
Sampling Method	: Split-Spoon / HQ Core (2.5 inch)	Top of Casing Elevation	: 648.71
Drilling Company	: Mid-America Drilling, Inc.	X,Y Coordinates	: 1150347, 1282360

Depth in Feet	DESCRIPTION	Surf. Elev. 645.7	Samples	Recovery inches	Blow Count	Qp TSF	USCS
100		545					CL
105	- dark brown w/ 2x6 mm piece of wood, trace sand, plastic, olive gray - layer of clay w/ silt, plastic (thickness unknown)	540	15	20	26 34 40 46	>4.5	
110		535					
115		530	16	17	32 47 50	>4.5	
	SHALE, bedrock, very hard, light gray, dry, fissile		17	6	135		SH
120	HQ Core 1 (119-129: 9.8 ft recovery) (2.25 inch diameter)	525	18	117			
125		520					
130	HQ Core 2 (129-139: 10 ft recovery)	515	19	120			
135		510					
140	HQ Core 3 (139-148: 9 ft recovery)	505	20	108			
145	COAL w/ vertical, calcite filled fractures, black, sl.moist	500					CO
	END BOREHOLE AT 148 FEET BLS						
150							



KELRON Environmental

LOG OF BORING MW31

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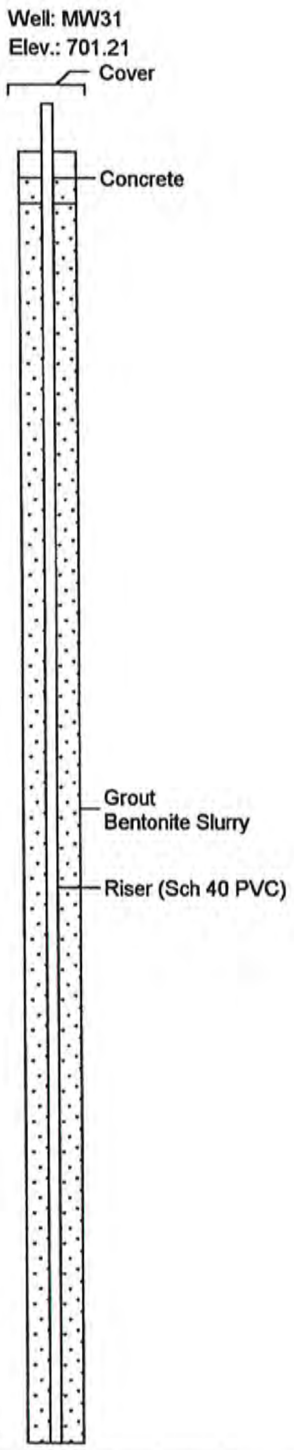
East Ash Pond Hydrogeologic Investigation
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Location: Twp 20N, Rng 12W, 21 NE/SW/SW

Date Completed	: 11/29/2001	Driller	: Dusty Jackson
Hole Diameter	: 9 1/2; 5 7/8; 4 1/2; 2 1/2 inches	Geologist	: Eric Kovatch
Drilling Method	: Hollow-stem / Rotary	Land Surface Elevation	: 698.2
Sampling Method	: Split-Spoon / HQ Core (2.5 inch)	Top of Casing Elevation	: 701.21
Drilling Company	: Mid-America Drilling, Inc.	X,Y Coordinates	: 1152932, 1279256

Depth in Feet	DESCRIPTION	Surf. Elev. 698.2	Samples	Recovery inches	Blow Count	Qp TSF	USCS
0	Silty CLAY w/ very fine sand, trace gravel in lenses, blocky, hard to very hard, nonplastic, elastic silt/lean clay (Till); yellow to medium brown, dry	698					
5		693	1	21	15 20 25 27	>4.5	
10		688	2	22	15 15 25 29	>4.5	
15		683					
20	Silty CLAY w/ trace to some very fine sand, medium plasticity, dark gray, moist	678	3	22	17 22 22 27	>4.5	
25		673					CL
30	- trace gravel in lenses	668	4	24	12 18 34 41	>4.5	
35		663					
40	- increasing sand	658	5	24	19 36 43 41	>4.5	
45		653					
50	- increasing percentage of fine sand, moist to wet		6	24	17 27	2.75	



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KELRON
Environmental

LOG OF BORING MW31

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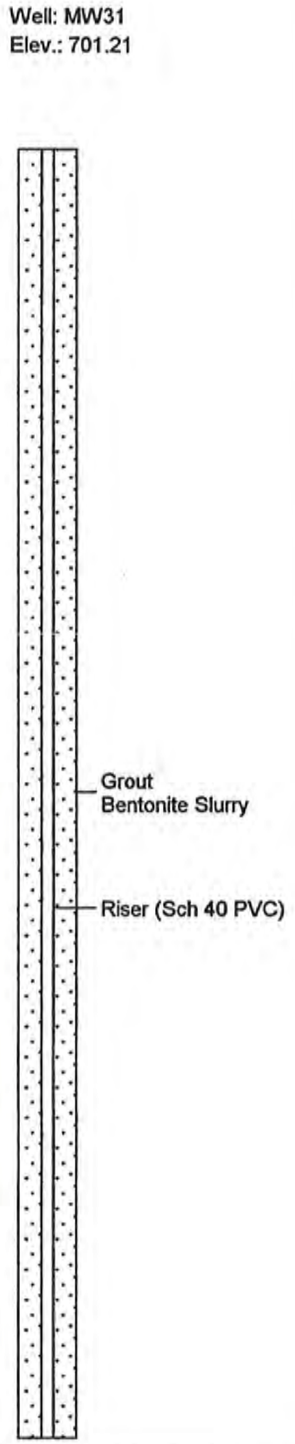
East Ash Pond Hydrogeologic Investigation
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Location: Twp 20N, Rng 12W, 21 NE/SW/SW

Date Completed	: 11/29/2001	Driller	: Dusty Jackson
Hole Diameter	: 9 1/2; 5 7/8; 4 1/2; 2 1/2 inches	Geologist	: Eric Kovatch
Drilling Method	: Hollow-stem / Rotary	Land Surface Elevation	: 698.2
Sampling Method	: Split-Spoon / HQ Core (2.5 inch)	Top of Casing Elevation	: 701.21
Drilling Company	: Mid-America Drilling, Inc.	X,Y Coordinates	: 1152932, 1279256

Depth in Feet	DESCRIPTION	Surf. Elev. 698.2	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
100		598					CL	
	- sand layer (3-inches), fine to med sand, gray, wet							
105	Sandy SILT (fine sand) w/ lenses of gravel (Till), hard	593	13	18	50 64 73	0.3/2.5		
110	- increasing sand content, trace gravel and organic matter (wood)	588	14	12	35 64	2.25		
115		583						
120	- sand layers, very fine to medium sand with silt	578	15	16	35 50 67			
125		573					ML	
130	- SILT w/ very fine sand, low plasticity, elastic, moist to wet	568	16	22	35 38 48 47	2.5		
135		563						
140	- trace very fine sand, less sand than above	558	17	24	47 35 60 80	2.5		
145		553						
150	Sandy SILT (very fine to fine sand), blue gray		18	12	36 77	2.75		



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KELRON Environmental	LOG OF BORING MW31 (Page 2 of 4)

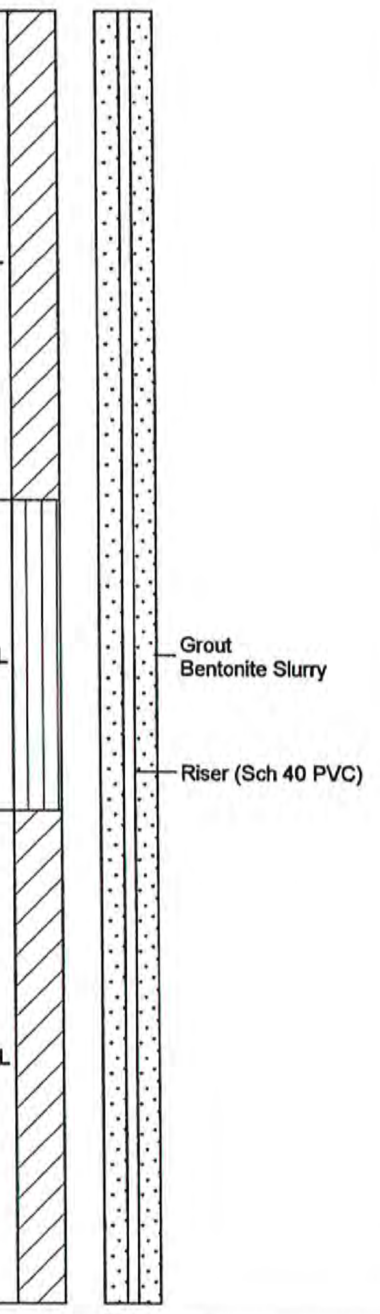
East Ash Pond Hydrogeologic Investigation
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Location: Twp 20N, Rng 12W, 21 NE/SW/SW

Date Completed	: 11/29/2001	Driller	: Dusty Jackson
Hole Diameter	: 9 1/2; 5 7/8; 4 1/2; 2 1/2 inches	Geologist	: Eric Kovatch
Drilling Method	: Hollow-stem / Rotary	Land Surface Elevation	: 698.2
Sampling Method	: Split-Spoon / HQ Core (2.5 inch)	Top of Casing Elevation	: 701.21
Drilling Company	: Mid-America Drilling, Inc.	X,Y Coordinates	: 1152932, 1279256

Depth in Feet	DESCRIPTION	Surf. Elev. 698.2	Samples	Recovery inches	Blow Count	Qp TSF	USCS
50		648	6	24	34 43	2.75	
55		643					
60	- thin layer (<3 inches) of fine to medium silty sand, weak, gray to dark gray, wet	638	7	17	26 48 50	3.5/1.5	CL
65		633					
70	Sandy SILT to SILT w/ sand (fine-crse sand), wet	628	8	4	50	0.5/1.8	
75		623					ML
80		618	9	5	91	0.5/1.8	
	Silty CLAY with fine sand, trace gravel						
85		613					
90		608	10	12	73 100	3.5	CL
95		603	11	5	140	4.5	
100			12	6	174	4.0	

Well: MW31
Elev.: 701.21



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LOG OF BORING MW31

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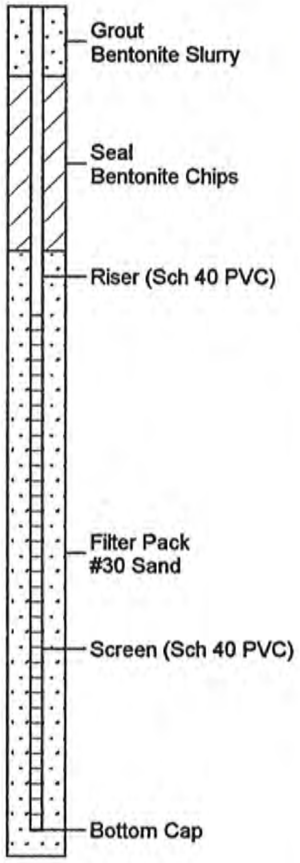
East Ash Pond Hydrogeologic Investigation
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Location: Twp 20N, Rng 12W, 21 NE/SW/SW

Date Completed	: 11/29/2001	Driller	: Dusty Jackson
Hole Diameter	: 9 1/2; 5 7/8; 4 1/2; 2 1/2 inches	Geologist	: Eric Kovatch
Drilling Method	: Hollow-stem / Rotary	Land Surface Elevation	: 698.2
Sampling Method	: Split-Spoon / HQ Core (2.5 inch)	Top of Casing Elevation	: 701.21
Drilling Company	: Mid-America Drilling, Inc.	X,Y Coordinates	: 1152932, 1279256

Depth in Feet	DESCRIPTION	Surf. Elev. 698.2	Samples	Recovery Inches	Blow Count	Qp TSF	USCS	GRAPHIC
150		548					ML	
	Weathered SHALE bedrock, blocky, laminated, light blue gray to gray		19	1	100		SH	
155	SHALE bedrock, competent, very hard, gray to dark gray; with laminations of light gray seams/lenses of clay/silt <1 mm	543	20	120				
160	HQ Core 1 (153-163: 10 ft recovery) (2.25 inch diameter)	538						
165		533						
	HQ Core 2 (163-173: 10 ft recovery)		21	120				
170		528					SH	
175		523						
	HQ Core 3 (173-183: 10 ft recovery)		22	120				
180		518						
	END BOREHOLE AT 184 FEET BLS							
185		513						
190		508						
195		503						
200								

Well: MW31
Elev.: 701.21



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KELRON
Environmental

LOG OF BORING MW32

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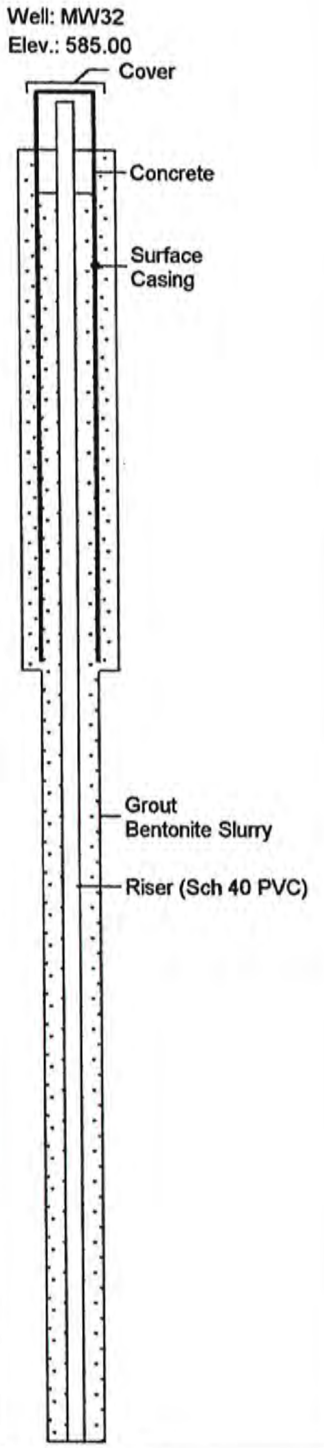
East Ash Pond Hydrogeologic Investigation
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Location: Twp 20N, Rng 12W, 21 NW/NW/SW

Date Completed	: 12/04/2001	Driller	: Dusty Jackson
Hole Diameter	: 5 7/8, 4 1/2; 2 1/2 inches	Geologist	: Rebecca Caudill (NRT)
Drilling Method	: Hollow-Stem / Rotary	Land Surface Elevation	: 581.9
Sampling Method	: HQ Core (2.5 inch)	Top of Casing Elevation	: 585.00
Drilling Company	: Mid-America Drilling, Inc.	X,Y Coordinates	: 1151312, 1279850

Depth in Feet	DESCRIPTION	Surf. Elev. 581.9	Samples	Recovery inches	Blow Count	Qp TSF	USCS
0	Clayey SAND, fine, rounded, well sorted, dark reddish brown, slightly moist	581					
	Surface Casing = 4.3 I.D. / 4.5 inch O.D. Installed to 11.96 feet (143.5 inches below ground)		1	21	4 5 5 7		SC
5			2	2	5 5 6 6		
	CLAY with Sand (fine), lean, firm, plastic, light yellowish brown with strong brown mottling, very moist; grades to sand at 7 feet	576	3	22	5 6 7 8		CL
	SAND, medium, rounded, well sorted, with trace silt, brown, slightly moist - same as above with 10% crse sand, trace gravel		4	23	5 5 5 6		SP
10	Weathered SHALE bedrock, gray; upper 2 inches very moist	571	5	6	14 67		SH
	SHALE bedrock, competent, hard; medium to dark gray; with fine laminations from seams/lenses of light gray clay/silt, some with cross-bedding, <1 mm to 4 cm						
15	HQ Core 1 (11.5-21.5: 9.75 ft recovery)	566	6	117			
20	- light gray seams/lenses range from <1 to 4 mm	561					SH
25	HQ Core 2 (21.5-31.5: 9.9 ft recovery)	556	7	119			
30							



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KELRON
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LOG OF BORING MW32

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East Ash Pond Hydrogeologic Investigation
Vermilion Power Station
Dynegy Midwest Generation, Inc.

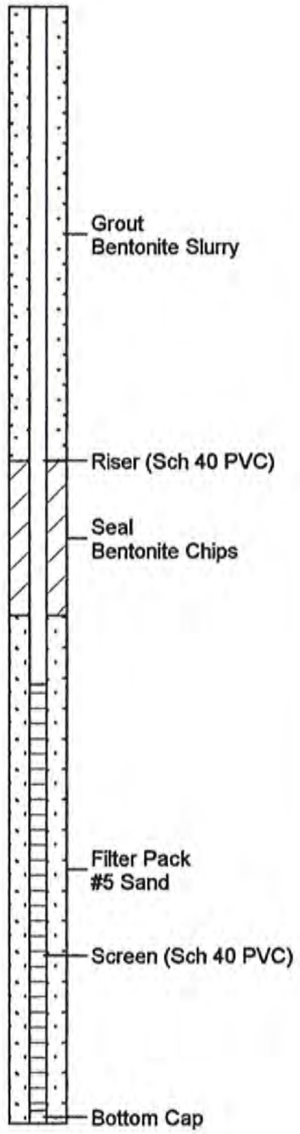
Location: Twp 20N, Rng 12W, 21 NW/NW/SW

Date Completed : 12/04/2001
Hole Diameter : 5 7/8, 4 1/2; 2 1/2 inches
Drilling Method : Hollow-Stem / Rotary
Sampling Method : HQ Core (2.5 inch)
Drilling Company : Mid-America Drilling, Inc.

Driller : Dusty Jackson
Geologist : Rebecca Caudill (NRT)
Land Surface Elevation : 581.9
Top of Casing Elevation: 585.00
X,Y Coordinates : 1151312, 1279850

Depth in Feet	DESCRIPTION	Surf. Elev. 581.9	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
30								
		551	7	119				
	- light gray seams/lenses range from <1 to 7 mm							
35								
		546						
	HQ Core 3 (31.5-41.5: 10 ft recovery)		8	120				
40								
		541						
	- light gray seams/lenses range from <1 to 2 cm							
							SH	
45								
		536						
	HQ Core 4 (41.5-51.5: 9.9 ft recovery)		9	118.5				
50								
		531						
	HQ Core 5 (51.5-56: 4.4 ft recovery)							
			10	52.5				
55	END BOREHOLE AT 56 FEET BLS							
		526						
60								

Well: MW32
Elev.: 585.00



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KELRON
Environmental

LOG OF BORING B201

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/11-12/2002	Driller	: Dusty Jackson
Hole Diameter	: 8-inch; 3-inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-Stem; Rotary	Land Surface Elevation	: 599.1
Sampling Method	: NQ Core (1 7/8 inch)	X,Y Coordinates	: 1150614, 1280277
Drilling Company	: Mid-America Drilling, Inc.		

Depth in Feet	DESCRIPTION	Surf. Elev. 599.1	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
0	Silty CLAY with sand (fine-med) and gravel (fine), pieces of coal, organics-roots, dark brown, moist		1	11	3 2 2 3	1.5	CL	
	- trace sand and gravel, dark brown							
	- trace sand, no roots, plastic/soft, medium brown		2	14	2 5 6 7	1.5		
5	- trace sand and gravel, roots, pieces of coal and shale, dark brown w/ gray mottling	595	3	17	5 6 7 9	0.75 / 2.5		
	Silty to Clayey SAND (fine), light brown, wet		4	15	5 7 7 8		SC-SM	
	SAND (fine-crse) with gravel (fine), light brown to gray		5	15	7 10 15 22		SW	
10	SILT with sand (fine) and layers of Silty SAND w/ trace gravel, very hard, reddish-brown with light gray mottling	590	6	13	26 36 50	>4.5	SM	
	SAND (fine-crse) with gravel (fine) and clay layers, light brown, wet		7	7	49 50		SW	
	- trace gravel, reddish-brown	585	8	5	50	>4.5		
15	Silty CLAY w/ trace sand (fine), medium-gray with green mottling, moist						CL	
	- layer of sand and gravel with shale pieces, subrounded to subangular, light gray, dry		9	4	50	>4.5		
	- trace fine sand, green-gray, slightly moist		10	9	29 50	>4.5		
		580						
20	- trace fine-med sand, horizontal parting, light gray		11	10	31 58	>4.5		
	- piece of wood (1.5" x 0.25"), shell fragment < 2 mm, angular sand, slightly moist - olive gray		12	19	33 36 42 45	>4.5		
	Silty CLAY w/ trace sand (fine-crse) and gravel (fine), subroundedr to angular, olive gray	575	13	9	31 50	>4.5		
25								

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Environmental

LOG OF BORING B201

East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed : 03/11-12/2002
Hole Diameter : 8-inch; 3-inch
Drilling Method : Hollow-Stem; Rotary
Sampling Method : NQ Core (1 7/8 inch)
Drilling Company : Mid-America Drilling, Inc.

Driller : Dusty Jackson
Geologist : Stuart Cravens
Land Surface Elevation : 599.1
X,Y Coordinates : 1150614, 1280277

Depth in Feet	DESCRIPTION	Surf. Elev. 599.1	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
25								
	- dry		14	5	70			
	- pieces of coal < 1/4", olive gray with green-gray mottling	570	15	13	31 51 50	>4.5		
30	- blocky fracture, olive gray w/ occasional reddish-brown and green gray mottling		16	17	28 45 50	>4.5		
	Silty CLAY, olive gray, uniform, horizontal parting, slightly moist		17	18	19 47 55	>4.5	CL	
		565						
35	- no horizontal parting, subplastic, soft, green gray		18	24	21 26 28 41	2.5 / 2.25		
			19	18	15 31 73	2.25 / >4.5		
	SAND (fine-crse) and GRAVEL (fine) with clay and silt, broken shale, olive gray, wet	560	20	11	48 50	>4.5	GC	
	Silty CLAY, uniform, olive gray, moist						CL	
40			21	9	44 50	>4.5		
	SHALE bedrock, competent, hard, horizontal parting, occasional silt and fine sandstone layers less than 1/8" to 1-inch thick - light to medium gray							
	NQ Core 1 (41-51: 10 ft recovery)	555						
45			22	120			SH	
		550						
50								

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LOG OF BORING B201

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/11-12/2002
Hole Diameter	: 8-inch; 3-inch
Drilling Method	: Hollow-Stem; Rotary
Sampling Method	: NQ Core (1 7/8 inch)
Drilling Company	: Mid-America Drilling, Inc.
Driller	: Dusty Jackson
Geologist	: Stuart Cravens
Land Surface Elevation	: 599.1
X,Y Coordinates	: 1150614, 1280277

Depth in Feet	DESCRIPTION	Surf. Elev. 599.1	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
50	SHALE bedrock, competent, hard, horizontal parting, occasional silt and fine sandstone layers less than 1/8" to 1-inch thick		22	120				
	NQ Core 2 (51-61: 10 ft recovery)	545						
55								
			23	120				
		540						
60								
							SH	
	NQ Core 3 (61-71: 10 ft recovery)	535						
65								
			24	120				
		530						
70								
			25	120				
	NQ Core 4 (71-81: 10 ft recovery)	525						
75								

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LOG OF BORING B201

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed : 03/11-12/2002
Hole Diameter : 8-inch; 3-inch
Drilling Method : Hollow-Stem; Rotary
Sampling Method : NQ Core (1 7/8 inch)
Drilling Company : Mid-America Drilling, Inc.

Driller : Dusty Jackson
Geologist : Stuart Cravens
Land Surface Elevation : 599.1
X,Y Coordinates : 1150614, 1280277

Depth in Feet	DESCRIPTION	Surf. Elev. 599.1	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
75	SHALE bedrock, competent, hard, horizontal parting, occasional silt and fine sandstone layers less than 1/8" to 1-inch thick							
			25	120				
		520						
80								
	NQ Core 5 (81-91: 10 ft recovery)	515						
85	- soft, easier coring							
			26	120				
							SH	
		510						
90								
	- stopped coring due to high hydraulic head approx. 30 ft above LS at >100 gpm; water level 14 hrs later was 21.75 ft BLS							
	NQ Core 6 (91-101: 10 ft recovery)	505						
95			27	120				
		500						
100								

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LOG OF BORING B201

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/11-12/2002	Driller	: Dusty Jackson
Hole Diameter	: 8-inch; 3-inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-Stem; Rotary	Land Surface Elevation	: 599.1
Sampling Method	: NQ Core (1 7/8 inch)	X,Y Coordinates	: 1150614, 1280277
Drilling Company	: Mid-America Drilling, Inc.		

Depth in Feet	DESCRIPTION	Surf. Elev. 599.1	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
100	NQ Core 7 (101-104.5: 1.65 ft recovery)		27	120			SH	
	- TOP OF VOID (Depth = 102.5 ft; Elevation = 496.6); broken shale, clay, coal, trace sulfur		28	20			CO-SH	
		495						
105	NQ Core 8 (104.5-109: 0.8 ft recovery)		29	10				
	- BOTTOM OF VOID (Depth = 107.5 ft; Elevation = 491.6)							
	CLAY, soft, med gray						CL	
	SHALE w/ thin coal lenses, green gray						SH	
		490						
	END BOREHOLE AT 109 FEET BLS							
110								
		485						
115								
		480						
120								
		475						
125								

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Environmental

LOG OF BORING B202

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/12-13/2002	Driller	: Dusty Jackson
Hole Diameter	: 8-inch; 3-inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-Stem; Rotary	Land Surface Elevation	: 606.0
Sampling Method	: NQ Core (1 7/8 inch)	X,Y Coordinates	: 1150547, 1280287
Drilling Company	: Mid-America Drilling, Inc.		

Depth in Feet	DESCRIPTION	Surf. Elev. 606.0	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
0	Silty CLAY with sand (fine) and trace gravel (fine), organics-roots, dark brown w/ light gray mottling, moist	605						▨
	- with fine-crse sand, trace gravel (subrounded), very soft, plastic, yellow-orange		1	16	10 11 14 18	3.5 / 1.5		
5		600						
			2	18	12 16 18 22	>4.5 / 1.75		
10		595						
							CL	
	- dry		3	19	18 24 31 51	>4.5		
15		590						
	CLAY w/ silt, trace fine sand, very stiff, olive gray, moist Silty CLAY with sand (fine-crse), trace gravel (subrounded to subangular), coal pieces < 1/4-inch, dry - with occasional sand fine lenses, light gray w/ yellow-orange mottling		4	20	18 28 48 52	>4.5		
20		585						
	CLAY with silt, trace fine-crse sand, very stiff, olive gray		5	10	---	>4.5		
25								

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LOG OF BORING B202

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed : 03/12-13/2002
Hole Diameter : 8-inch; 3-inch
Drilling Method : Hollow-Stem; Rotary
Sampling Method : NQ Core (1 7/8 inch)
Drilling Company : Mid-America Drilling, Inc.

Driller : Dusty Jackson
Geologist : Stuart Cravens
Land Surface Elevation : 606.0
X,Y Coordinates : 1150547, 1280287

Depth in Feet	DESCRIPTION	Surf. Elev. 606.0	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
25								
		580						
	- trace coal <1mm, piece shell		6	19	28 38 49 50	>4.5		
30								
		575						
			7	3	28 36 50	>4.5		
35								
		570					CL	
			8	8	33 37 58	>4.5		
40								
		565						
	Silty CLAY, uniform, soft, medium plastic, olive gray, moist - very hard		9	24	13 17 35 >100	2.0-3.0		
45								
		560						
	SHALE bedrock, competent, hard, horizontal parting, occasional fine sandstone layers from <1/8-inch to 1 inch thick, light to medium gray		10	6	90	>4.5	SH	
			11	120				
50								

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LOG OF BORING B202

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/12-13/2002	Driller	: Dusty Jackson
Hole Diameter	: 8-inch; 3-inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-Stem; Rotary	Land Surface Elevation	: 606.0
Sampling Method	: NQ Core (1 7/8 inch)	X,Y Coordinates	: 1150547, 1280287
Drilling Company	: Mid-America Drilling, Inc.		

Depth in Feet	DESCRIPTION	Surf. Elev. 606.0	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
50	SHALE bedrock, competent, hard, horizontal parting, occasional fine sandstone layers from <1/8-inch to 1 inch thick, light to medium gray							
		555						
	NQ Core 1 (49-59: 10 ft recovery)		11	120				
55								
		550						
60								
		545						
	NQ Core 2 (59-69: 10 ft recovery)		12	120			SH	
65								
		540						
	- 3 fine sandstone layers (1/8-1/4 inch) at 69-70 ft							
70								
		535						
	NQ Core 3 (69-80: 6.5 ft recovery)		13	78				
75								

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Environmental

LOG OF BORING B202

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/12-13/2002	Driller	: Dusty Jackson
Hole Diameter	: 8-inch; 3-inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-Stem; Rotary	Land Surface Elevation	: 606.0
Sampling Method	: NQ Core (1 7/8 inch)	X,Y Coordinates	: 1150547, 1280287
Drilling Company	: Mid-America Drilling, Inc.		

Depth in Feet	DESCRIPTION	Surf. Elev. 606.0	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
75	SHALE bedrock, competent, hard, horizontal parting, occasional fine sandstone layers from <1/8-inch to 1 inch thick, light to medium gray							
		530						
			13	78				
80								
		525						
85	NQ Core 4 (80-94: 10.4 ft recovery)							
		520						
			14	125			SH	
90	- hydrogen sulfide gas pocket at 90 feet BLS vented for several minutes prior to removal of core barrel and release of hydraulic head							
		515						
	- Top of fractured shale with voids (Depth = 92.5 ft; Elevation = 513.3 ft)							
	- stopped coring at 94 ft due to high hydraulic head ranging from 15-24 ft above LS at >100 gpm; water level 16 hrs later was 13.8 ft BLS							
95								
	- soft coring at 94-103 ft	510						
	NQ Core 5 (94-104: 2 ft recovery)		15	24				
	- light gray							
	- Bottom of fractured shale with voids (Depth = 99 ft; Elevation = 506.8)							
100								

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LOG OF BORING B202

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed : 03/12-13/2002
Hole Diameter : 8-inch; 3-inch
Drilling Method : Hollow-Stem; Rotary
Sampling Method : NQ Core (1 7/8 inch)
Drilling Company : Mid-America Drilling, Inc.

Driller : Dusty Jackson
Geologist : Stuart Cravens
Land Surface Elevation : 606.0
X,Y Coordinates : 1150547, 1280287

Depth in Feet	DESCRIPTION	Surf. Elev. 606.0	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
100								
		505						
			15	24				
	SHALE, solid and fractured layers, light gray; 2 limestone layers 1/2-inch thick							
105								
		500						
							SH	
	NQ Core 6 (104-114: 8.1 ft recovery)							
			16	97				
110	- soft coring							
		495						
	- very soft coring							
	- clay, soft, light gray							
	COAL, loose, broken, black (depth = 114.3 to 114.5 ft)						CO	
115	SHALE with thin coal lenses, green gray (Base of Mine); grading to dark gray with no coal						SH	
		490						
	COAL, solid core, black						CO	
	SHALE, high organics, dark gray grading to light gray; occasional limestone layers < 1/2-inch thick							
			17	116				
120	NQ Core 7 (114-124: 9.7 ft recovery)						SH	
		485						
	END BOREHOLE AT 124 FEET BLS							
	Notes: Base of mine = 114.5 ft; elevation = 491.3 ft							
125								

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Environmental

LOG OF BORING B203

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/13/2002	Driller	: Dusty Jackson
Hole Diameter	: 8-inch; 3-inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-Stem; Rotary	Land Surface Elevation	: 627.1
Sampling Method	: NQ Core (1 7/8 inch)	X,Y Coordinates	: 1150427, 1280159
Drilling Company	: Mid-America Drilling, Inc.		

Depth in Feet	DESCRIPTION	Surf. Elev. 627.1	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
0	Silty CLAY with sand (fine-crse) and trace gravel (fine), subrounded, very stiff, yellow orange w/ red-brown iron oxidation mottling, dry							▨
		625						▨
5								▨
		620						▨
	- light gray mottling; small 1/2 inch long x 1/8 inch calcium carbonate cylinder (fossil)		1	19	15 24 49 42	>4.5		▨
10								▨
		615					CL	▨
15								▨
		610						▨
	- dark gray		2	6	60	>4.5		▨
20								▨
		605						▨
25								

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Environmental

LOG OF BORING B203

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed : 03/13/2002
Hole Diameter : 8-inch; 3-inch
Drilling Method : Hollow-Stem; Rotary
Sampling Method : NQ Core (1 7/8 inch)
Drilling Company : Mid-America Drilling, Inc.

Driller : Dusty Jackson
Geologist : Stuart Cravens
Land Surface Elevation : 627.1
X,Y Coordinates : 1150427, 1280159

Depth in Feet	DESCRIPTION	Surf. Elev. 627.1	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
25	Silty CLAY with sand (fine-crse) and trace gravel (fine), subrounded, very stiff, yellow orange w/ red-brown iron oxidation mottling, dry							
		600						
	- olive gray, slightly moist		3	6	60	>4.5		
30								
		595						
35								
		590					CL	
			4	12	37 50	>4.5		
40								
		585						
45								
		580						
	CLAY with silt and sand (fine-med), olive gray, moist		5	14	27 36 50	>4.5		
50								

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LOG OF BORING B203

East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/13/2002	Driller	: Dusty Jackson
Hole Diameter	: 8-inch; 3-inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-Stem; Rotary	Land Surface Elevation	: 627.1
Sampling Method	: NQ Core (1 7/8 inch)	X,Y Coordinates	: 1150427, 1280159
Drilling Company	: Mid-America Drilling, Inc.		

Depth in Feet	DESCRIPTION	Surf. Elev. 627.1	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
50								
		575						
			6	0	35 45 50			
55								
		570						
			7	10	54 50	>4.5	CL	
60								
		565						
	Silty CLAY, uniform, medium stiff, olive gray, moist		8	15	15 18 24 25	3.0		
65								
	SHALE bedrock, competent, hard, horizontal parting, occasional fine sandstone layers							
		560						
	- olive gray		9	9	63 50			
	- light to medium gray							
70							SH	
		555	10	120				
	NQ Core 1 (69-79: 10 ft recovery)							
75								

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Environmental

LOG OF BORING B203

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed : 03/13/2002
Hole Diameter : 8-inch; 3-inch
Drilling Method : Hollow-Stem; Rotary
Sampling Method : NQ Core (1 7/8 inch)
Drilling Company : Mid-America Drilling, Inc.

Driller : Dusty Jackson
Geologist : Stuart Cravens
Land Surface Elevation : 627.1
X,Y Coordinates : 1150427, 1280159

Depth in Feet	DESCRIPTION	Surf. Elev. 627.1	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
75	SHALE bedrock, competent, hard, horizontal parting, occasional fine sandstone layers							
		550	10	120				
80								
		545						
	NQ Core 2 (79-89: 10 ft recovery)		11	120				
85								
		540					SH	
	- medium gray							
90								
		535						
			12	109				
	NQ Core 3 (89-97.7: 9.1 ft recovery)							
95								
		530						
	- medium to dark gray							
			13	120				
100								

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Environmental

LOG OF BORING B203

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/13/2002	Driller	: Dusty Jackson
Hole Diameter	: 8-inch; 3-inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-Stem; Rotary	Land Surface Elevation	: 627.1
Sampling Method	: NQ Core (1 7/8 inch)	X,Y Coordinates	: 1150427, 1280159
Drilling Company	: Mid-America Drilling, Inc.		

Depth in Feet	DESCRIPTION	Surf. Elev. 627.1	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
100	SHALE bedrock, competent, hard, horizontal parting, occasional fine sandstone layers							
		525						
	NQ Core 4 (97.7-107.7: 10 ft recovery)		13	120				
105								
		520						
110								
		515	14	120			SH	
	NQ Core 5 (107.7-117.7: 10 ft recovery)							
115								
		510						
120								
			15	120				
		505						
	NQ Core 6 (117.7-127.7: 10 ft recovery)							
125								

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Environmental

LOG OF BORING B203

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/13/2002	Driller	: Dusty Jackson
Hole Diameter	: 8-inch; 3-inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-Stem; Rotary	Land Surface Elevation	: 627.1
Sampling Method	: NQ Core (1 7/8 inch)	X,Y Coordinates	: 1150427, 1280159
Drilling Company	: Mid-America Drilling, Inc.		

Depth in Feet	DESCRIPTION	Surf. Elev. 627.1	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
125			15	120			SH	
	COAL, black, occasional vertical calcite-filled fractures; 5.3 foot thick seam NQ Core 7 (127.7-137.7: 8.8 ft recovery)	500					CO	
130								
	SHALE, olive gray grading to light gray	495	16	106			SH	
	SHALE, light gray with CLAY layer						SH-CL	
	SHALE, olive gray						SH	
135	COAL interlayered with SHALE (green black to black)						CO-SH	
	SHALE, light gray with clayey intervals grading to dark gray						SH	
	END BOREHOLE AT 137.7 FEET BLS	490						
140								
		485						
145								
		480						
150								

Notes: Primary Coal Seam = 127 - 132.3 feet BLS;
Elevation = 494.8 - 500.1 feet NGVD

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/14/2002	Driller	: Dusty Jackson
Hole Diameter	: 8-inch; 3-inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-Stem; Rotary	Land Surface Elevation	: 588.0
Sampling Method	: NQ Core (1 7/8 inch)	X,Y Coordinates	: 1150065, 1278812
Drilling Company	: Mid-America Drilling, Inc.		

Depth in Feet	DESCRIPTION	Surf. Elev. 588.0	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
0	FILL: Silty CLAY loam with trace sand (fine-med), coal pieces, and high organics (roots), moist - trace fine gravel		1	17	2 2 3 5	1.0	FL	
	FILL: Sand, Shale, Coal, very loose, wet	585	2	14	2 3 3 4	1.75		
5	Silty CLAY with trace sand (fine-crse), high organics (roots), dark brown with dark gray mottling, moist		3	19	1 2 3 3	1.0	CL	
	- w/ sand (fine-crse) and gravel (fine-crse), medium brown, wet		4	19	2 2 3 3	0.5 - 0.75		
	- light gray with reddish-brown iron oxidation mottling, moist	580	5	24	2 2 3 3	0.75		
10			6	24	2 3 4 4	0.5 - 0.75		
	Clayey SAND (fine-med), reddish-brown, wet						SC	
	Silty CLAY w/ trace sand (fine), light gray with reddish-brown iron oxidation mottling, moist	575	7	24	2 7 11 12	0.5 - 2.25	CL	
	SAND (fine-crse), light gray, wet						SW	
	SAND and GRAVEL, fine-crse, well graded, light gray, wet		8	11	37 50		GW	
15	SHALE bedrock, competent, hard, horizontal parting, occasional silt or fine sandstone layers (<1/4-inch) - light to medium gray						SH	
		570	9	5	50			
20			10	108				
	NQ Core 1 (19-29: 9 ft recovery)	565						
25								

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KELRON
Environmental

LOG OF BORING B204

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/14/2002	Driller	: Dusty Jackson
Hole Diameter	: 8-inch; 3-inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-Stem; Rotary	Land Surface Elevation	: 588.0
Sampling Method	: NQ Core (1 7/8 inch)	X,Y Coordinates	: 1150065, 1278812
Drilling Company	: Mid-America Drilling, Inc.		

Depth in Feet	DESCRIPTION	Surf. Elev. 588.0	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
25								
			10	108			SH	
	VOID - sloped mineshaft from 28 to 36.75 feet below ground surface	560						
30								
		555						
35								
	SHALE, dark gray							
		550						
40	NQ Core 2 (36.75-44: 6.7 ft recovery)		11	80				
		545					SH	
	- medium to dark gray							
45								
			12	109				
	NQ Core 3 (44-53: 9 ft recovery)	540						
50								

KELRON
Environmental

LOG OF BORING B204

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/14/2002	Driller	: Dusty Jackson
Hole Diameter	: 8-inch; 3-inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-Stem; Rotary	Land Surface Elevation	: 588.0
Sampling Method	: NQ Core (1 7/8 inch)	X,Y Coordinates	: 1150065, 1278812
Drilling Company	: Mid-America Drilling, Inc.		

Depth in Feet	DESCRIPTION	Surf. Elev. 588.0	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
50	SHALE, dark gray							
			12	109				
		535						
55								
	NQ Core 4 (53-63: 10 ft recovery)	530	13	120				
60								
							SH	
		525						
65								
	NQ Core 5 (63-73: 10 ft recovery)	520	14	120				
70								
		515						
			15	120				
75								

KELRON
Environmental

LOG OF BORING B204

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/14/2002	Driller	: Dusty Jackson
Hole Diameter	: 8-inch; 3-inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-Stem; Rotary	Land Surface Elevation	: 588.0
Sampling Method	: NQ Core (1 7/8 inch)	X,Y Coordinates	: 1150065, 1278812
Drilling Company	: Mid-America Drilling, Inc.		

Depth in Feet	DESCRIPTION	Surf. Elev. 588.0	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
75	NQ Core 6 (73-83: 10 ft recovery)	510	15	120			SH	
80								
	COAL, with horizontal bedding planes and vertical fractures filled with pyrite and calcite, black; 8-inch layer	505					CO	
	SHALE (green gray) with interlayered COAL (black)						SH-CO	
85	COAL; 4.1 foot layer NQ Core 7 (83-93: 10 ft recovery)	500	16	120			CO	
	SHALE, dark gray with 1/4-inch coal layer						SH	
	COAL; 3-inch layer						CO	
90	SHALE, medium gray - clayey, softer - greenish gray to black						SH	
	COAL; 3-inch layer						CO	
	SHALE, dark grading to medium gray END BOREHOLE AT 93 FEET BLS	495					SH	
95								
		490						
100								

Notes: Primary Coal Seam = 83 - 88.9 feet BLS;
Elevation = 499.1 - 505 feet NGVD

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LOG OF BORING B205

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed : 03/14-15/2002
Hole Diameter : 8-inch; 3-inch
Drilling Method : Hollow-Stem; Rotary
Sampling Method : NQ Core (1 7/8 inch)
Drilling Company : Mid-America Drilling, Inc.

Driller : Dusty Jackson
Geologist : Stuart Cravens
Land Surface Elevation : 589.6
X,Y Coordinates : 1150223, 1278791

Depth in Feet	DESCRIPTION	Surf. Elev. 589.6	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
0	No Split-Spoon Sampling							
	Unconsolidated Deposits to Top of Bedrock at 21.5 feet							
		585						
5								
		580						
10								
		575						
15								
		570						
20								
	SHALE bedrock, competent, hard, horizontal parting, occasional clay, silt or fine sandstone layers (<1/4-inch)						SH	
			1	120				
	- medium to dark gray	565						
25								

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LOG OF BORING B205

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed : 03/14-15/2002
Hole Diameter : 8-inch; 3-inch
Drilling Method : Hollow-Stem; Rotary
Sampling Method : NQ Core (1 7/8 inch)
Drilling Company : Mid-America Drilling, Inc.

Driller : Dusty Jackson
Geologist : Stuart Cravens
Land Surface Elevation : 589.6
X,Y Coordinates : 1150223, 1278791

Depth in Feet	DESCRIPTION	Surf. Elev. 589.6	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
25	SHALE bedrock, competent, hard, horizontal parting, occasional clay, silt or fine sandstone layers (<1/4-inch)							
	NQ Core 1 (23-33: 10 ft recovery)		1	120				
30		560						
35		555						
							SH	
	NQ Core 2 (33-43: 10 ft recovery)		2	120				
40		550						
45	NQ Core 3 (43-53: 10 ft recovery)	545						
			3	120				
	- clayey layer, 1.5-inch thick, light gray							
50		540						

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/14-15/2002	Driller	: Dusty Jackson
Hole Diameter	: 8-inch; 3-inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-Stem; Rotary	Land Surface Elevation	: 589.6
Sampling Method	: NQ Core (1 7/8 inch)	X,Y Coordinates	: 1150223, 1278791
Drilling Company	: Mid-America Drilling, Inc.		

Depth in Feet	DESCRIPTION	Surf. Elev. 589.6	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
50	SHALE bedrock, competent, hard, horizontal parting, occasional clay, silt or fine sandstone layers (<1/4-inch)		3	120				
55		535						
	NQ Core 4 (53-63: 10 ft recovery)		4	120				
60		530						
							SH	
65		525						
	NQ Core 5 (63-72.25: 9.25 ft recovery)		5	111				
70		520						
			6	111				
75		515						

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed : 03/14-15/2002
Hole Diameter : 8-inch; 3-inch
Drilling Method : Hollow-Stem; Rotary
Sampling Method : NQ Core (1 7/8 inch)
Drilling Company : Mid-America Drilling, Inc.

Driller : Dusty Jackson
Geologist : Stuart Cravens
Land Surface Elevation : 589.6
X,Y Coordinates : 1150223, 1278791

Depth in Feet	DESCRIPTION	Surf. Elev. 589.6	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
75								
	NQ Core 6 (72.25-82: 9.25 ft recovery)		6	111				
80		510					SH	
	- dark gray							
85		505						
	COAL, with horizontal bedding planes and vertical fractures filled with pyrite and calcite, black		7	120			CO	
	NQ Core 7 (82-92: 10 ft recovery)							
90		500						
	SHALE (green gray) with interlayered COAL (black)						SH-CO	
	COAL; 3.5-inch layer						CO	
	SHALE, dark gray to olive gray with high organics - clayey, softer, light gray						SH	
	COAL; 7-inch layer						CO	
	SHALE, green gray grading to dark gray	495						
95	- clayey, light gray and olive gray		8	90				
	NQ Core 8 (92-100: 7.5 ft recovery)						SH	
	Notes: Primary Coal Seam = 86.3 - 91.85 feet BLS; Elevation = 497.75 - 503.3 feet NGVD							
	END BOREHOLE AT 100 FEET BLS	490						
100								

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/15+18/2002	Driller	: Dusty Jackson
Hole Diameter	: 8-inch; 3-inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-Stem; Rotary	Land Surface Elevation	: 589.0
Sampling Method	: NQ Core (1 7/8 inch)	X,Y Coordinates	: 1150345, 1278682
Drilling Company	: Mid-America Drilling, Inc.		

Depth in Feet	DESCRIPTION	Surf. Elev. 589.0	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
0	FILL: Coal, shale, sand, clay; loose, dark brown to black, moist		1	21	2 2 3 1	0.5-0.75	FL	
	Silty CLAY with trace sand (fine-crse), high organics (roots), very soft, plastic, dark brown, moist - yellowish brown		2	24	3 3 5 4	1.5	CL	
		585						
5			3	18	4 4 6 6	1.25-1.75		
	Sandy and silty CLAY, very soft, yellowish brown, very moist		4	24	5 5 6 8	0.25-1.0	SC	
		580	5	16	—	1.75		
	Silty CLAY w/ trace sand (fine-crse), yellowish brown, moist						CL	
10	Sandy and silty CLAY, fine sand, very soft, yellowish brown - fine to coarse sand, wet		6	12	2 2 3 3	0.75-1.25	SC	
	Clayey SAND and GRAVEL, yellowish brown - with cobbles		7	8	6 8 11 14	0.5	GC	
		575	8	0	50			
15								
	SHALE bedrock, competent, hard, horizontal parting, occasional silt, fine sandstone, and clayey layers < 3-inches - light to medium gray		9	5	100			
		570						
20							SH	
			10	120				
	NQ Core 1 (19-29: 10 ft recovery)	565						
25								

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/15+18/2002	Driller	: Dusty Jackson
Hole Diameter	: 8-inch; 3-inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-Stem; Rotary	Land Surface Elevation	: 589.0
Sampling Method	: NQ Core (1 7/8 inch)	X,Y Coordinates	: 1150345, 1278682
Drilling Company	: Mid-America Drilling, Inc.		

Depth in Feet	DESCRIPTION	Surf. Elev. 589.0	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
25	SHALE bedrock, competent, hard, horizontal parting, occasional silt, fine sandstone, and clayey layers < 3-inches							
			10	120				
		560						
30								
	NQ Core 2 (29-39: 10 ft recovery)	555	11	120				
35								
							SH	
	- medium to dark gray	550						
40								
	NQ Core 3 (39-49: 10 ft recovery)	545	12	120				
45								
		540						
			13	120				
50								

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed : 03/15+18/2002
Hole Diameter : 8-inch; 3-inch
Drilling Method : Hollow-Stem; Rotary
Sampling Method : NQ Core (1 7/8 inch)
Drilling Company : Mid-America Drilling, Inc.

Driller : Dusty Jackson
Geologist : Stuart Cravens
Land Surface Elevation : 589.0
X,Y Coordinates : 1150345, 1278682

Depth in Feet	DESCRIPTION	Surf. Elev. 589.0	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
50	SHALE bedrock, competent, hard, horizontal parting, occasional silt, fine sandstone, and clayey layers < 3-inches							
	NQ Core 4 (49-59: 10 ft recovery)	535	13	120				
55								
		530						
60								
							SH	
	NQ Core 5 (59-69: 10 ft recovery)	525	14	120				
65								
		520						
70	- lost water at 70 feet BLS							
			15	102				
	NQ Core 6 (69-79: 8.5 ft recovery)	515						
75								

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/15+18/2002	Driller	: Dusty Jackson
Hole Diameter	: 8-inch; 3-inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-Stem; Rotary	Land Surface Elevation	: 589.0
Sampling Method	: NQ Core (1 7/8 inch)	X,Y Coordinates	: 1150345, 1278682
Drilling Company	: Mid-America Drilling, Inc.		

Depth in Feet	DESCRIPTION	Surf. Elev. 589.0	Samples	Recovery inches	Blow Count	Qp TSF	USCS
75			15	102			SH
	VOID, one foot wide, no core recovery						
	SHALE, dark gray, very soft coring after 78 feet - black, organic rich	510					SH
80	- TOP OF VOID (Depth = 80.4 ft; Elevation = 508.6 feet) NQ Core 7 (79-89: 6 ft recovery) - BOTTOM OF VOID (Depth = 84.4 ft; Elevation = 504.6)	505	16	72			
85	SHALE (olive gray grading medium gray); at 84.7 feet becomes clayey, softer, light gray, blocky fracture - greenish gray to black with thin black organic layers						SH
	COAL, low grade with horizontal parting; 6-inch layer						CO
	SHALE, greenish gray grading to dark gray - grading to light gray, clayey						SH
	END BOREHOLE AT 89 FEET BLS	500					
90	Notes: Primary Coal Seam = 80.4 to 84.4 feet BLS; Elevation = 504.6 - 508.6 feet NGVD						
		495					
95							
		490					
100							

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LOG OF BORING B207

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed : 03/18/2002
Hole Diameter : 8-inch; 3-inch
Drilling Method : Hollow-Stem; Rotary
Sampling Method : NQ Core (1 7/8 inch)
Drilling Company : Mid-America Drilling, Inc.

Driller : Dusty Jackson
Geologist : Stuart Cravens
Land Surface Elevation : 595.6
X,Y Coordinates : 1150358, 1278992

Depth in Feet	DESCRIPTION	Surf. Elev. 595.6	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
0	Silty CLAY with trace sand (fine-crse), high organics (roots), very soft, high plasticity, dark brown, moist	595	1	19	2 5 5 5	1.0-1.5	CL	
			2	14	3 3 5 5	1.0		
5	- light brown	590	3	18	3 4 5 6	1.0		
	- wet		4	15	2 5 12 25	1.0		
	- trace coarse gravel (> 1-inch)		5	7	6 10 2 2	1.0		
10	Sandy CLAY (fine sand), yellowish brown, wet - light gray	585	6	22	2 3 1 2	0.5		
	Clayey SAND (fine-medium), light gray SAND with clay		7	18	4 3 2 1	1.0	SC	
15	Silty CLAY with trace fine to coarse sand, very soft, light gray with reddish-brown iron oxidation mottling, moist	580	8	24	1 1 2 3	1.0	CL	
	Clayey to silty SAND, uniform, poorly graded, light gray, wet		9	19	4 3 4 7		SC	
	SAND, fine, porrly graded		10	24	4 4 4 5		SP	
20		575	11	5	10 25 35 40			
	SAND and GRAVEL, fine to coarse, well graded						GW	
	SHALE bedrock, competent, hard, horizontal parting, occasional silt, fine sandstone, and clayey layers - medium gray grading to dark gray light gray clayey intervals < 1-inch thick		12	120			SH	
25								

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LOG OF BORING B207

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed : 03/18/2002
Hole Diameter : 8-inch; 3-inch
Drilling Method : Hollow-Stem; Rotary
Sampling Method : NQ Core (1 7/8 inch)
Drilling Company : Mid-America Drilling, Inc.

Driller : Dusty Jackson
Geologist : Stuart Cravens
Land Surface Elevation : 595.6
X,Y Coordinates : 1150358, 1278992

Depth in Feet	DESCRIPTION	Surf. Elev. 595.6	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
25	SHALE bedrock, competent, hard, horizontal parting, occasional silt, fine sandstone, and clayey layers	570						
	NQ Core 1 (23-33: 10 ft recovery)		12	120				
30		565						
35		560						
	NQ Core 2 (33-43: 10 ft recovery)		13	120			SH	
40		555						
45		550						
	NQ Core 3 (43-53: 10 ft recovery)		14	120				
50								

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LOG OF BORING B207

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/18/2002	Driller	: Dusty Jackson
Hole Diameter	: 8-inch; 3-inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-Stem; Rotary	Land Surface Elevation	: 595.6
Sampling Method	: NQ Core (1 7/8 inch)	X,Y Coordinates	: 1150358, 1278992
Drilling Company	: Mid-America Drilling, Inc.		

Depth in Feet	DESCRIPTION	Surf. Elev. 595.6	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
50	SHALE bedrock, competent, hard, horizontal parting, occasional silt, fine sandstone, and clayey layers	545						
			14	120				
55		540						
	NQ Core 4 (53-63: 10 ft recovery)							
			15	120				
60		535						
							SH	
65		530						
	NQ Core 5 (63-73: 10 ft recovery)							
			16	120				
70		525						
			17	110				
75								

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/18/2002	Driller	: Dusty Jackson
Hole Diameter	: 8-inch; 3-inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-Stem; Rotary	Land Surface Elevation	: 595.6
Sampling Method	: NQ Core (1 7/8 inch)	X,Y Coordinates	: 1150358, 1278992
Drilling Company	: Mid-America Drilling, Inc.		

Depth in Feet	DESCRIPTION	Surf. Elev. 595.6	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
75		520						
	NQ Core 6 (73-83: 9.2 ft recovery)		17	110				
80		515					SH	
85	NQ Core 7 (83-92.5: 9.5 ft recovery)	510	18	114				
	- dark gray - black with pyritized shells, high organics							
90	COAL (5.5 foot seam)	505					CO	
95								
	SHALE, greenish gray and black interlayered	500	19	108			SH	
	COAL interlayered with SHALE; 3 coal layers of 3, 3.5, and 2 inches alternating with greenish gray and black, organic rich shale; light gray clayey layer at 97.55 to 97.85 foot interval						SH-CO	
	SHALE, dark gray						SH	
100								

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/18/2002	Driller	: Dusty Jackson
Hole Diameter	: 8-inch; 3-inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-Stem; Rotary	Land Surface Elevation	: 595.6
Sampling Method	: NQ Core (1 7/8 inch)	X,Y Coordinates	: 1150358, 1278992
Drilling Company	: Mid-America Drilling, Inc.		

Depth in Feet	DESCRIPTION	Surf. Elev. 595.6	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
100								
	- grading to medium gray	495	19	108			SH	
	END BOREHOLE AT 102.5 FEET BLS							
	Notes: Primary Coal Seam = 90 to 95.5 feet BLS; Elevation = 500.1 - 505.6 feet NGVD							
105		490						
110		485						
115		480						
120		475						
125								

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/19/2002	Driller	: Dusty Jackson
Hole Diameter	: 8-inch; 3-inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-Stem; Rotary	Land Surface Elevation	: 657.6
Sampling Method	: NQ Core (1 7/8 inch)	X,Y Coordinates	: 1149885, 1278897
Drilling Company	: Mid-America Drilling, Inc.		

Depth in Feet	DESCRIPTION	Surf. Elev. 657.6	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
0	No sampling until 8 feet below ground surface							
		655						
5								
		650						
	Silty CLAY with trace sand and gravel, stiff, tan to olive gray with reddish-brown Fe-oxidation mottling, moist		1	24	13 15 19 27	3.0 / >4.5	CL	▨
10								▨
		645						▨
15								▨
		640						▨
	- with sand and gravel (fine-crse), subrounded with shale pieces, yellowish orange, dry							▨
20	SAND (fine-crse) with clay and trace gravel (fine, angular to subangular), well graded, loose, yellowish orange, dry		2	20	24 18 12 10	2.5	SC	▨
		635						▨
25								

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LOG OF BORING B208

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed : 03/19/2002
Hole Diameter : 8-inch; 3-inch
Drilling Method : Hollow-Stem; Rotary
Sampling Method : NQ Core (1 7/8 inch)
Drilling Company : Mid-America Drilling, Inc.

Driller : Dusty Jackson
Geologist : Stuart Cravens
Land Surface Elevation : 657.6
X,Y Coordinates : 1149885, 1278897

Depth in Feet	DESCRIPTION	Surf. Elev. 657.6	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
25							SC	
		630						
	Silty to Sandy CLAY, fine-crse sand, trace fine gravel, slightly moist		3	22	13 13 15 15	1.5 - 3.25	CL	
30	SAND (fine-crse) with trace gravel (fine), yellowish brown, wet						SW	
	Sandy CLAY grading to CLAY with sand, fine-crse sand, fine gravel (subangular to subrounded), very stiff, dark gray, dry							
		625						
35								
		620						
			4	15	23 26 35 40	>4.5		
40							CL	
		615						
45								
		610						
	- CLAY with trace sand (fine-crse), hard, olive gray, dry		5	13	35 40 48 50	>4.5		
50								

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LOG OF BORING B208

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed : 03/19/2002
Hole Diameter : 8-inch; 3-inch
Drilling Method : Hollow-Stem; Rotary
Sampling Method : NQ Core (1 7/8 inch)
Drilling Company : Mid-America Drilling, Inc.
Driller : Dusty Jackson
Geologist : Stuart Cravens
Land Surface Elevation : 657.6
X,Y Coordinates : 1149885, 1278897

Depth in Feet	DESCRIPTION	Surf. Elev. 657.6	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
50							CL	
		605						
55								
		600						
	SAND (fine-crse) with gravel and clay, yellowish orange, wet		6	17	32 48 50	>4.5	SC	
60	Silty CLAY with trace sand (fine) grading to Sandy SILT with clay (fine-crse sand) and trace gravel (fine-crse), moist						CL-ML	
		595						
	Silty SAND (fine), poorly graded, light brown grading to yellowish orange, moist		7	21	21 31 15 17	1.0	SM	
65	Silty CLAY with fine sand and trace fine gravel grading						CL	
	Sandy SILT (fine sand)						ML	
		590						
	Silty CLAY with sand (fine-crse) and trace fine gravel, stiff, light brown to light gray with reddish-brown Fe-oxidation mottling, dry		8	19	12 13 15 17	2.5 - 3.0	CL	
70								
		585						
	- very stiff, rounded to subrounded gravel, yellowish orange, moist		9	24	26 28 33 44	4.0 - 4.5		
75								

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East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed : 03/19/2002
Hole Diameter : 8-inch; 3-inch
Drilling Method : Hollow-Stem; Rotary
Sampling Method : NQ Core (1 7/8 inch)
Drilling Company : Mid-America Drilling, Inc.

Driller : Dusty Jackson
Geologist : Stuart Cravens
Land Surface Elevation : 657.6
X,Y Coordinates : 1149885, 1278897

Depth in Feet	DESCRIPTION	Surf. Elev. 657.6	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
75							CL	
		580						
	SAND and GRAVEL (fine-crse), well graded, light gray, wet						GW	
	Silty CLAY with sand (fine-crse) and trace fine gravel (subrounded), stiff, olive gray, moist		10	24	23 25 33 38	2.5 - >4.5		
80								
		575						
	- very stiff		11	24	19 24 34 34	>4.5		
85								
		570						
	- subrounded to angular gravel		12	23	35 42 39 50	>4.5	CL	
90								
		565						
			13	23	25 27 40 50	>4.5		
95	- 1-inch piece of light gray shale with horizontal parting							
		560						
			14	6	62	>4.5		
100								

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Environmental

LOG OF BORING B208

(Page 5 of 7)

East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed	: 03/19/2002	Driller	: Dusty Jackson
Hole Diameter	: 8-inch; 3-inch	Geologist	: Stuart Cravens
Drilling Method	: Hollow-Stem; Rotary	Land Surface Elevation	: 657.6
Sampling Method	: NQ Core (1 7/8 inch)	X,Y Coordinates	: 1149885, 1278897
Drilling Company	: Mid-America Drilling, Inc.		

Depth in Feet	DESCRIPTION	Surf. Elev. 657.6	Samples	Recovery inches	Blow Count	Qp TSF	USCS
100							CL
		555					
	SAND and GRAVEL (fine-crse), well graded, light gray, wet		15	6	94		GW
	SHALE bedrock, competent, hard, horizontal parting, occasional clay, silt, or fine sandstone layers - medium to dark gray with lighter gray clayey layers						
105							
		550					
110	NQ Core 1 (106-115: 8.6 ft recovery)		16	103			
		545					SH
115							
		540					
	NQ Core 2 (115-125: 10 ft recovery)						
120			17	120			
		535					
125							

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KELRON
Environmental

LOG OF BORING B208

(Page 6 of 7)

East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed : 03/19/2002
Hole Diameter : 8-inch; 3-inch
Drilling Method : Hollow-Stem; Rotary
Sampling Method : NQ Core (1 7/8 inch)
Drilling Company : Mid-America Drilling, Inc.

Driller : Dusty Jackson
Geologist : Stuart Cravens
Land Surface Elevation : 657.6
X,Y Coordinates : 1149885, 1278897

Depth in Feet	DESCRIPTION	Surf. Elev. 657.6	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
125	SHALE bedrock, competent, hard, horizontal parting, occasional clay, silt, or fine sandstone layers							
		530						
	NQ Core 3 (125-135: 10 ft recovery)							
130			18	120				
		525						
135								
		520					SH	
	NQ Core 4 (135-145: 10 ft recovery)							
140			19	120				
		515						
145								
		510	20	120				
	NQ Core 5 (145-155: 10 ft recovery)							
150								

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KELRON
Environmental

LOG OF BORING B208

(Page 7 of 7)

East Ash Pond Geologic Borings
Vermilion Power Station
Dynegy Midwest Generation, Inc.

Date Completed : 03/19/2002
Hole Diameter : 8-inch; 3-inch
Drilling Method : Hollow-Stem; Rotary
Sampling Method : NQ Core (1 7/8 inch)
Drilling Company : Mid-America Drilling, Inc.

Driller : Dusty Jackson
Geologist : Stuart Cravens
Land Surface Elevation : 657.6
X,Y Coordinates : 1149885, 1278897

Depth in Feet	DESCRIPTION	Surf. Elev. 657.6	Samples	Recovery inches	Blow Count	Qp TSF	USCS	GRAPHIC
150	- dark gray						SH	
	- greenish gray with black layers	505	20	120				
	COAL (5.8 foot seam)						CO	
155								
		500						
	COAL (black to greenish gray) interlayered with SHALE; 2 coal layers of 2.5 inch thickness alternating with medium to dark gray shale with black layers						SH-CO	
160			21	110				
	SHALE, greenish gray to black grading to medium gray						SH	
	NQ Core 6 (155-165: 10 ft recovery)							
	- clayey, light gray	495						
	END BOREHOLE AT 165 FEET BLS							
165	Notes: Primary Coal Seam = 153.2 to 159 feet BLS; Elevation = 498.6 - 504.4 feet NGVD							
		490						
170								
		485						
175								

BORING NO. B-101
DATE 11-06-01
W. & A. FILE NO. 2069
SHEET 1 OF 34

WHITNEY & ASSOCIATES
INCORPORATED
2406 West Nebraska Avenue
PEORIA, ILLINOIS 61604

BORING LOG

PROJECT IP VERMILION EAST ASH POND EXTENSION
LOCATION Danville, Illinois
BORING LOCATION See Site Plan Sheet
DRILLED BY Fehl
BORING TYPE Hollow-Stem Auger
WEATHER CONDITIONS Partly Cloudy & Mild
SOIL CLASSIFICATION SYSTEM U. S. B. S. C.
SEEPAGE WATER ENCOUNTERED AT ELEVATION (-)21.3 Ft.
GROUND SURFACE ELEVATION 0.0
GROUND WATER ELEVATION AT - HRS. -
BORING DISCONTINUED AT ELEVATION (-)33.8 Ft.
GROUND WATER ELEVATION AT COMPLETION (-)11.5 Ft.

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
Brown SILTY CLAY LOAM Organic Topsoil	7"						
Very Stiff, Brown SANDY SILTY CLAY CL-ML							
	04						
		SS	5 6 6(12)	2.5	2.4	108	12
Very Stiff, Gray SILTY CLAYEY SAND SC-SM (Glacial Till)	08						
		SS	20 41 62(103)	3.0	-	-	11
	12						
Hard, Gray SANDY SILTY CLAY CL-ML (Glacial Till)							
	16	SS	17 20 18(38)	4.5+	4.1	129	7
	20	SS	18 26 34(60)	4.5+	5.3	132	7
	24						
Very Dense, Gray SILTY CLAYEY SAND SC-SM		SS	97/3"	-	-	-	8

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

BORING LOG

(CONTINUATION)

BORING NO. B-101

DATE 11-06-01

PROJECT IP Vermilion East Ash Pond Extension

LOCATION Danville, Illinois

SHEET 2 OF 34

W. & A. FILE NO. 2069

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
See Sheet 1 of 34							
Hard, Gray SHALE							
	30	SS	120/6*	4.5+	-	-	9
AUGER REFUSAL AT (-)33.8 FEET	34						
EXPLORATORY BORING DISCONTINUED							
	38						
	42						
	46						
	50						
	54						

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES

SS - SPLIT SPOON SAMPLE

ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.

Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.

Dd - NATURAL DRY DENSITY - P.C.F.

Mc - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES

PEORIA, ILLINOIS

BORING NO. B-102
DATE 11-12-01
W. & A. FILE NO. 2069
SHEET 3 OF 34

WHITNEY & ASSOCIATES
INCORPORATED
2406 West Nebraska Avenue
PEORIA, ILLINOIS 61604

BORING LOG

PROJECT IP VERMILION EAST ASH POND EXTENSION
LOCATION Danville, Illinois
BORING LOCATION See Site Plan Sheet
DRILLED BY Fehl
BORING TYPE Hollow-Stem Auger
WEATHER CONDITIONS Partly Cloudy & Mild
SOIL CLASSIFICATION SYSTEM U.S.B.S.C.
SEEPAGE WATER ENCOUNTERED AT ELEVATION None
GROUND SURFACE ELEVATION 0.0
GROUND WATER ELEVATION AT - HRS. -
BORING DISCONTINUED AT ELEVATION (-)56.0 Ft.
GROUND WATER ELEVATION AT COMPLETION None

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
Brown SILTY CLAY LOAM Organic Topsoil	7"						
Very Stiff, Brown SANDY SILTY CLAY With Fine-Grained Gravel CL-ML							
	04						
		SS	4 5 6(11)	2.5	-	-	13
Hard, Gray-Brown LEAN CLAY - CL (Glacial Till)	08						
		SS	10 14 16(30)	4.5+	5.1	125	14
	12						
Medium-Density, Brown, Fine- To Coarse-Grained SAND And Fine-Grained GRAVEL With Considerable Silty Clay							
	16	SS	8 10 12(22)	-	-	-	10
Hard, Gray-Brown LEAN CLAY - CL (Glacial Till)	20	SS	12 16 17(33)	4.5+	6.3	125	8
	24						
Hard, Gray SANDY SILTY CLAY - CL-ML (Glacial Till)		SS	8 14 18(32)	-	-	-	9

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

BORING LOG

(CONTINUATION)

BORING NO. B-102

DATE 11-12-01

PROJECT IP Vermilion East Ash Pond Extension

SHEET 4 OF 34

LOCATION Danville, Illinois

W. & A. FILE NO. 2069

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
See Sheet 3 of 34					–		
Hard, Gray SANDY LEAN CLAY - CL (Glacial Till)	30	SS	8 22 26(48)	4.5+	7.1	128	10
Very Stiff, Light Brown SILT - ML	34	SS	15 26 35(61)	3.0	–	–	13
Hard, Light Brown SANDY SILT - ML	38	SS	98/7"	4.5+	–	–	9
	42						
Hard, Light Brown And Gray-Brown LEAN CLAY With Sand - CL (Glacial Till)	46	SS	101/6"	4.5+	6.6	126	12
Hard, Gray-Brown And Gray SHALE	50	SS	101/9"	4.5+	–	–	13
EXPLORATORY BORING DISCONTINUED	54	SS	115/6"	4.5+	–	–	10

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

BORING NO. B-103
DATE 11-08-01
W. & A. FILE NO. 2069
SHEET 5 OF 34

WHITNEY & ASSOCIATES
INCORPORATED
2406 West Nebraska Avenue
PEORIA, ILLINOIS 61604

BORING LOG

PROJECT IP VERMILION EAST ASH POND EXTENSION
LOCATION Danville, Illinois
BORING LOCATION See Site Plan Sheet
DRILLED BY Fehl
BORING TYPE Hollow-Stem Auger
WEATHER CONDITIONS Partly Cloudy & Mild
SOIL CLASSIFICATION SYSTEM U.S.B.S.C.
SEEPAGE WATER ENCOUNTERED AT ELEVATION (-)32.5 Ft.
GROUND SURFACE ELEVATION 0.0
GROUND WATER ELEVATION AT - HRS. -
BORING DISCONTINUED AT ELEVATION (-)76.0 Ft.
GROUND WATER ELEVATION AT COMPLETION (-)43.5 Ft.

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
Brown SILTY CLAY LOAM Organic Topsoil	6"						
Hard, Light Brown SILTY CLAY With Sand CL-ML							
	04						
		SS	8 10 13(23)	4.5+	4.1	114	12
Hard, Light Brown And Brown SANDY SILTY CLAY CL-ML (Glacial Till)	08						
		SS	11 19 20(39)	4.5+	7.4	128	11
	12						
	16	SS	8 13 15(28)	4.5+	6.9	125	13
	20	ST					
Dense, Light Brown, Fine- To Coarse-Grained SAND With Some Fine-Grained Gravel	24	SS	9 16 18(34)	-	-	-	7

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

BORING NO. B-103

BORING LOG
(CONTINUATION)

DATE 11-08-01

PROJECT IP Vermilion East Ash Pond Extension

SHEET 6 OF 34

LOCATION Danville, Illinois

W. & A. FILE NO. 2069

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
See Sheet 5 of 34							
Medium-Density, Gray, Fine- To Medium-Grained SAND	30	SS	10 12 12(24)	-	-	-	17
	34	ST					
Hard, Gray-Brown SANDY SILTY CLAY CL-ML (Glacial Till)	38						
		SS	14 18 20(38)	4.5+	9.1	131	9
	42						
Hard, Light Brown And Orange-Brown SILTY SAND - SM (Glacial Till)	46	SS	38 50 60(110)	4.5+	-	-	8
Very Dense, Light Brown, Fine- To Coarse-Grained SAND	50	SS	101/10"	-	-	-	4
Hard, Gray-Brown SANDY LEAN CLAY CL (Glacial Till)	54	SS	17 19 25(44)	4.5+	4.9	125	13

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

BORING NO. B-103

BORING LOG
(CONTINUATION)

DATE 11-08-01

PROJECT IP Vermilion East Ash Pond Extension
SHEET 7 OF 34
LOCATION Danville, Illinois
W. & A. FILE NO. 2069

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
See Sheet 6 of 34					—		
Very Dense, Gray-Brown, Fine-Grained SAND And Fine-Grained GRAVEL	60	SS	21 37 41(78)	-	-	-	5
Hard, Gray-Brown LEAN CLAY With SAND - CL (Glacial Till)	64	SS	31 40 52(92)	4.5+	6.5	125	13
Hard, Gray-Brown And Gray SHALE	68	SS	101/7"	4.5+	-	-	12
	72	SS	95/6"	4.5+	-	-	8
EXPLORATORY BORING DISCONTINUED	76						
	80						
	84						

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

BORING NO. B-104
DATE 11-07-01
W. & A. FILE NO. 2069
SHEET 8 OF 34

WHITNEY & ASSOCIATES
INCORPORATED
2406 West Nebraska Avenue
PEORIA, ILLINOIS 61604

BORING LOG

PROJECT IP VERMILION EAST ASH POND EXTENSION
LOCATION Danville, Illinois
BORING LOCATION See Site Plan Sheet
DRILLED BY Fehl
BORING TYPE Hollow-Stem Auger
WEATHER CONDITIONS Partly Cloudy & Mild
SOIL CLASSIFICATION SYSTEM U.S.B.S.C.
SEEPAGE WATER ENCOUNTERED AT ELEVATION None
GROUND SURFACE ELEVATION 0.0
GROUND WATER ELEVATION AT - HRS. -
BORING DISCONTINUED AT ELEVATION (-)66.0 Ft.
GROUND WATER ELEVATION AT COMPLETION None

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
Brown SILTY CLAY LOAM Organic Topsoil	6"						
	04						
		ST					
Hard, Light Brown SANDY LEAN CLAY CL (Glacial Till)	08						
		SS	8 10 11(21)	4.5+	5.6	120	13
	12						
	16	ST					
Hard, Brown SANDY SILTY CLAY CL-ML (Glacial Till)	20						
		SS	11 13 21(34)	4.5+	4.3	122	14
	24						
		ST					

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

BORING LOG

(CONTINUATION)

BORING NO. B-104

DATE 11-07-01

PROJECT IP Vermilion East Ash Pond Extension

LOCATION Danville, Illinois

SHEET 9 OF 34

W. & A. FILE NO. 2069

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
See Sheet 8 of 34							
Hard, Gray SANDY SILTY CLAY CL-ML (Glacial Till)	30	SS	10 13 16(29)	4.5+	4.5	130	7
	34	ST					
	38						
Hard, Brown SANDY SILTY CLAY CL-ML (Glacial Till)	42	SS	97/9"	4.5+	7.2	130	8
Hard, Gray-Brown SANDY SILT - ML (Glacial Till)	46	SS	103	4.5+	-	-	9
Hard, Gray-Brown SANDY SILTY CLAY CL-ML (Glacial Till)							
Very Dense, Gray-Brown SILTY FINE-GRAINED SAND - SM	50	SS	102/10"	4.5+	8.8	128	9
	54	SS	101/5"	-	-	-	13

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES

SS - SPLIT SPOON SAMPLE

ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.

Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.

Dd - NATURAL DRY DENSITY - P.C.F.

Mc - NATURAL MOISTURE CONTENT - %

BORING LOG

(CONTINUATION)

BORING NO. B-104

DATE 11-07-01

PROJECT IP Vermilion East Ash Pond Extension

SHEET 10 **OF** 34

LOCATION Danville, Illinois

W. & A. FILE NO. 2069

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
See Sheet 9 of 34							
Hard, Gray-Brown LEAN CLAY With Sand - CL (Glacial Till)	60	SS	20 30 54(84)	4.5+	7.3	123	12
Hard, Gray-Brown SHALE	64	SS	102/6"	4.5+	-	-	9
EXPLORATORY BORING DISCONTINUED	68						
	72						
	76						
	80						
	84						

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

BORING NO. B-105
DATE 11-06-01
W. & A. FILE NO. 2069
SHEET 11 OF 34

WHITNEY & ASSOCIATES
INCORPORATED
2406 West Nebraska Avenue
PEORIA, ILLINOIS 61604

BORING LOG

PROJECT IP VERMILION EAST ASH POND EXTENSION
LOCATION Danville, Illinois
BORING LOCATION See Site Plan Sheet
DRILLED BY Fehl
BORING TYPE Hollow-Stem Auger
WEATHER CONDITIONS Partly Cloudy & Mild
SOIL CLASSIFICATION SYSTEM U.S.B.S.C.
SEEPAGE WATER ENCOUNTERED AT ELEVATION None
GROUND SURFACE ELEVATION 0.0
GROUND WATER ELEVATION AT - HRS. -
BORING DISCONTINUED AT ELEVATION (-)166.0 Ft.
GROUND WATER ELEVATION AT COMPLETION None

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
Brown SILTY CLAY LOAM Organic Topsoil	6"						
Hard, Brown SANDY SILTY CLAY CL-ML (Glacial Till)							
	04						
		SS	10 13 20(33)	4.5+	4.1	118	14
	08						
		SS	10 13 14(27)	4.5+	5.2	124	11
	12						
Hard, Gray-Brown LEAN CLAY With Sand - CL (Glacial Till)	16	SS	10 11 15(26)	4.5+	7.6	122	15
Very Stiff, Gray LEAN CLAY With Sand - CL (Glacial Till)	20	SS	9 9 11(20)	3.9	3.8	120	15
Hard, Gray-Brown SANDY SILTY CLAY CL (Glacial Till)	24	SS	13 13 10(23)	4.2	-	-	9

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

BORING NO. B-105

BORING LOG

(CONTINUATION)

DATE 11-06-01

PROJECT IP Vermilion East Ash Pond Extension

LOCATION Danville, Illinois

SHEET 12 OF 34

W. & A. FILE NO. 2069

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
See Sheet 11 of 34					–		
Hard, Gray SANDY LEAN CLAY - CL (Glacial Till)	30	SS	13 13 14(27)	4.5+	7.9	128	11
Hard, Gray-Brown SANDY SILTY CLAY CL-ML (Glacial Till)	34	SS	13 15 20(35)	4.5+	7.3	132	10
	38						
Hard, Brown And Gray-Brown SANDY SILT - ML (Glacial Till)		SS	107/12"	4.5+	5.1	133	9
	42						
		SS	103/7"	4.5+	-	-	10
	46						
Hard, Brown SILTY CLAY - CL-ML	50	SS	101/11"	4.5+	4.5	119	15
Very Stiff, Gray-Brown SANDY LEAN CLAY - CL (Glacial Till)	54	SS	101/8"	3.7	3.2	126	12

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

BORING LOG
(CONTINUATION)

BORING NO. B-105

DATE 11-06-01

PROJECT IP Vermilion East Ash Pond Extension

SHEET 13 OF 34

LOCATION Danville, Illinois

W. & A. FILE NO. 2069

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q_p	Q_u	D_d	M_c
See Sheet 12 of 34							
Hard, Gray-Brown SILTY CLAY With Sand - CL (Glacial Till)							
	60	SS	20 21 15(36)	4.5+	5.3	124	13
	64						
Hard, Gray-Brown SHALE		SS	111/4"	4.5+	-	-	8
EXPLORATORY BORING DISCONTINUED							
	68						
	72						
	76						
	80						
	84						

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Q_p - CALIBRATED PENETROMETER READING - T.S.F.
Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
D_d - NATURAL DRY DENSITY - P.C.F.
M_c - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

WHITNEY & ASSOCIATES
INCORPORATED
2406 West Nebraska Avenue
PEORIA, ILLINOIS 61604

BORING LOG

BORING NO. B-106
DATE 11-06-01
W. & A. FILE NO. 2069
SHEET 14 OF 34
PROJECT IP VERMILION EAST ASH POND EXTENSION
LOCATION Danville, Illinois
BORING LOCATION See Site Plan Sheet
DRILLED BY Fehl
BORING TYPE Hollow-Stem Auger
WEATHER CONDITIONS Partly Cloudy & Mild
SOIL CLASSIFICATION SYSTEM U.S.B.S.C.
SEEPAGE WATER ENCOUNTERED AT ELEVATION None
GROUND SURFACE ELEVATION 0.0
GROUND WATER ELEVATION AT - HRS. -
BORING DISCONTINUED AT ELEVATION (-)76.0 Ft.
GROUND WATER ELEVATION AT COMPLETION None

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
Brown SILTY CLAY LOAM Organic Topsoil	6"						
Hard, Light Brown SANDY SILTY CLAY CL-ML (Glacial Till)							
	04						
		SS	9 15 24(39)	4.5+	-	-	9
	08						
		SS	18 32 60(92)	4.5+	8.3	126	12
	12						
Dense, Orange-Brown, Fine- To Coarse-Grained SAND And Fine-Grained GRAVEL							
	16	SS	10 15 30(45)	-	-	-	8
Hard, Light Brown SANDY LEAN CLAY CL (Glacial Till)							
	20	SS	5 6 13(19)	4.5+	6.3	128	11
Medium-Density, Light Brown, Fine- To Medium-Grained SILTY SAND And Fine-Grained GRAVEL - SM	24	SS	12 11 13(24)	-	-	-	5

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

BORING LOG
(CONTINUATION)

BORING NO. B-106

DATE 11-06-01

PROJECT IP Vermilion East Ash Pond Extension

SHEET 15 OF 34

LOCATION Danville, Illinois

W. & A. FILE NO. 2069

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
See Sheet 14 of 34							
Medium-Density, Light Brown, Fine- To Medium-Grained SAND With Some Fine-Grained Gravel							
	30	SS	10 10 12(22)	-	-	-	4
	34	SS	8 13 11(24)	-	-	-	5
	38						
Hard, Gray-Brown SANDY LEAN CLAY CL (Glacial Till)		SS	8 14 20(34)	4.5+	9.6	132	9
	42						
Hard, Brown SANDY SILTY CLAY - CL (Glacial Till)		SS	10 16 21(37)	4.5+	6.2	126	11
	46						
	50	SS	24 25 35(60)	4.5+	5.4	125	11
	54	SS	25 37 54(91)	-	-	-	10

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

BORING NO. B-106

BORING LOG
(CONTINUATION)

DATE 11-06-01

PROJECT IP Vermilion East Ash Pond Extension

SHEET 16 OF 34

LOCATION Danville, Illinois

W. & A. FILE NO. 2069

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
See Sheet 15 of 34					–		
Very Dense, Light Brown, Fine- To Medium-Grained SAND							
Very Dense, Gray, Medium- To Coarse-Grained SAND With Some Fine-Grained Gravel	60	SS	35 42 77(119)	–	–	–	7
Hard, Gray SANDY SILTY CLAY CL-ML (Glacial Till)	64	SS	102/12"	4.5+	8.8	129	9
	68						
Hard, Gray SHALE		SS	98	4.5+	–	–	11
	72						
		SS	103	4.5+	–	–	10
	76						
EXPLORATORY BORING DISCONTINUED							
	80						
	84						

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
INCORPORATED
2406 West Nebraska Avenue
PEORIA, ILLINOIS 61604

BORING LOG

BORING NO. B-107
DATE 11-07-01
W. & A. FILE NO. 2069
SHEET 17 OF 34
PROJECT IP VERMILION EAST ASH POND EXTENSION
LOCATION Danville, Illinois
BORING LOCATION See Site Plan Sheet
DRILLED BY Fehl
BORING TYPE Hollow-Stem Auger
WEATHER CONDITIONS Partly Cloudy & Mild
SOIL CLASSIFICATION SYSTEM U.S.B.S.C.
SEEPAGE WATER ENCOUNTERED AT ELEVATION (-)27.2 Ft.
GROUND SURFACE ELEVATION 0.0
GROUND WATER ELEVATION AT - HRS. -
BORING DISCONTINUED AT ELEVATION (-)71.0 Ft.
GROUND WATER ELEVATION AT COMPLETION (-)24.5 Ft. CAVE-IN

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
Brown SILTY CLAY LOAM Organic Topsoil	6"						
Hard, Light Brown SILTY CLAY With Sand - CL-ML (Glacial Till)							
	04						
		SS	13 24 28(52)	4.5+	5.3	124	12
	08						
		SS	12 15 16(31)	4.5+	-	-	10
	12						
Dense, Light Brown, Fine- To Coarse-Grained SAND With Some Fine-Grained Gravel	16	SS	10 15 30(45)	-	-	-	5
Dense, Light Brown, Fine- To Coarse-Grained SAND And Fine- To Medium-Grained GRAVEL	20	SS	8 10 15(25)	-	-	-	5
	24						
Medium-Density, Brown, Medium- To Coarse-Grained SAND And Fine GRAVEL		SS	6 11 13(24)	-	-	-	10

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

BORING LOG
(CONTINUATION)

BORING NO. B-107

DATE 11-07-01

PROJECT IP Vermilion East Ash Pond Extension

SHEET 18 OF 34

LOCATION Danville, Illinois

W. & A. FILE NO. 2069

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
See Sheet 17 of 34							
	30	SS	7 12 15(27)	-	-	-	8
Medium-Density, Gray-Brown, Fine- To Medium-Grained SAND With Some Coarse-Grained Sand	34	SS	10 11 15(26)	-	-	-	7
Dense, Brown, Medium- To Coarse-Grained SAND With Considerable Fine-Grained Gravel	38	SS	11 18 22(40)	-	-	-	6
	42						
Very Dense, Brown, Medium- To Coarse-Grained SAND With Considerable Fine-Grained Gravel	46	SS	27 30 52(82)	-	-	-	12
Very Dense, Light Brown, Fine- To Medium-Grained SAND	50	SS	18 20 65(85)	-	-	-	7
Hard, Gray SILTY SAND - SM (Glacial Till)	54	SS	16 24 20(44)	4.5+	-	-	8

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

BORING LOG
(CONTINUATION)

BORING NO. B-107

DATE 11-07-01

PROJECT IP Vermilion East Ash Pond Extension

SHEET 19 OF 34

LOCATION Danville, Illinois

W. & A. FILE NO. 2069

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q_p	Q_u	D_d	M_c
See Sheet 18 of 34							
Hard, Gray SANDY SILT - SM (Glacial Till)	60	SS	98/6"	4.5+	-	-	9
Hard, Gray SANDY SILTY CLAY - CL-ML (Glacial Till)	64	SS	22 32 53(85)	4.5+	5.5	127	9
	68						
Hard, Gray SHALE		SS	101/5"	4.5+	-	-	8
EXPLORATORY BORING DISCONTINUED	72						
	76						
	80						
	84						

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Q_p - CALIBRATED PENETROMETER READING - T.S.F.
Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
D_d - NATURAL DRY DENSITY - P.C.F.
M_c - NATURAL MOISTURE CONTENT - %

BORING NO. B-108
DATE 11-06-01
W. & A. FILE NO. 2069
SHEET 20 OF 34

WHITNEY & ASSOCIATES
INCORPORATED
2406 West Nebraska Avenue
PEORIA, ILLINOIS 61604

BORING LOG

PROJECT IP VERMILION EAST ASH POND EXTENSION
LOCATION Danville, Illinois
BORING LOCATION See Site Plan Sheet
DRILLED BY Fehl
BORING TYPE Hollow-Stem Auger
WEATHER CONDITIONS Partly Cloudy & Mild
SOIL CLASSIFICATION SYSTEM U.S.B.S.C.
SEEPAGE WATER ENCOUNTERED AT ELEVATION None
GROUND SURFACE ELEVATION 0.0
GROUND WATER ELEVATION AT - HRS. -
BORING DISCONTINUED AT ELEVATION (-)71.0 Ft.
GROUND WATER ELEVATION AT COMPLETION None

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
Brown SILTY CLAY LOAM Organic Topsoil	6"						
Hard, Light Brown SANDY SILTY CLAY CL-ML (Glacial Till)							
	04						
		SS	15 29 35(64)	4.5+	5.4	124	9
	08						
Medium-Density, Light Brown, Fine- To Medium-Grained SAND With Considerable Coarse-Grained Sand And Fine-Grained Gravel		SS	9 12 15(27)	-	-	-	10
	12						
Hard, Brown And Orange-Brown SANDY SILTY CLAY With Fine-Grained Gravel CL-ML (Glacial Till)	16	SS	15 18 12(30)	4.5+	-	-	10
Medium-Density, Light Brown, Fine- To Medium-Grained SAND And GRAVEL	20	SS	10 12 18(30)	-	-	-	6
Medium-Density, Brown, Fine- To Coarse-Grained SAND	24	SS	5 8 10(18)	-	-	-	6

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

BORING NO. B-108

BORING LOG
(CONTINUATION)

DATE 11-06-01

PROJECT IP Vermilion East Ash Pond Extension
LOCATION Danville, Illinois

SHEET 21 OF 34
W. & A. FILE NO. 2069

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
See Sheet 20 of 34							
Dense, Brown, Fine- To Coarse-Grained SAND And Fine-Grained GRAVEL With Some Silty Clay	30	SS	12 18 13(31)	-	-	-	7
Hard, Gray-Brown SANDY SILTY CLAY CL-ML (Glacial Till)	34	SS	15 17 20(37)	4.5+	6.4	128	10
Hard, Gray SANDY LEAN CLAY - CL (Glacial Till)	38						
		SS	7 13 20(33)	4.5+	9.6	126	9
	42						
Hard, Gray And Gray-Brown SANDY SILTY CLAY - CL-ML (Glacial Till)		SS	13 26 88(114)	4.5+	-	-	7
	46						
	50	SS	107/10"	4.5+	6.7	130	8
	54	SS	18 22 33(55)	4.5+	4.2	127	12

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

BORING NO. B-108

BORING LOG
(CONTINUATION)

DATE 11-06-01

PROJECT IP Vermilion East Ash Pond Extension

LOCATION Danville, Illinois

SHEET 22 OF 34

W. & A. FILE NO. 2069

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
See Sheet 21 of 34							
	60						
		SS	102/6"	4.5+	-	-	9
	64						
		SS	102/6"	4.5+	4.1	126	13
Hard, Gray SHALE	68						
		SS	108/6"	4.5+	-	-	8
EXPLORATORY BORING DISCONTINUED	72						
	76						
	80						
	84						

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

BORING NO. B-109
DATE 11-07-01
W. & A. FILE NO. 2069
SHEET 23 OF 34

WHITNEY & ASSOCIATES
INCORPORATED
2406 West Nebraska Avenue
PEORIA, ILLINOIS 61604

BORING LOG

PROJECT IP VERMILION EAST ASH POND EXTENSION
LOCATION Danville, Illinois
BORING LOCATION See Site Plan Sheet
DRILLED BY Fehl
BORING TYPE Hollow-Stem Auger
WEATHER CONDITIONS Partly Cloudy & Mild
SOIL CLASSIFICATION SYSTEM U. S. B. S. C.
SEEPAGE WATER ENCOUNTERED AT ELEVATION None
GROUND SURFACE ELEVATION 0.0
GROUND WATER ELEVATION AT - HRS. -
BORING DISCONTINUED AT ELEVATION (-)71.0 Ft.
GROUND WATER ELEVATION AT COMPLETION None

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
Brown SILTY CLAY LOAM Organic Topsoil	6"						
Hard, Light Brown SILTY CLAY CL-ML							
	04						
		SS	12 19 27(46)	4.5+	-	-	10
Hard, Light Brown LEAN CLAY With SAND - CL (Glacial Till)	08						
		SS	10 17 29(46)	4.5+	9.7	130	12
	12						
	16	SS	15 21 26(47)	4.5+	4.4	125	12
Medium-Density, Light Brown, Medium-To Coarse-Grained GRAVEL							
Medium-Density, Light Brown, Fine-To Coarse-Grained SAND And Fine-To Medium-Grained GRAVEL	20	SS	8 11 15(26)	-	-	-	5
Medium-Density, Light Brown, Fine-To Coarse-Grained SAND	24	SS	9 12 16(28)	-	-	-	5

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

BORING LOG
(CONTINUATION)

BORING NO. B-109

DATE 11-07-01

PROJECT IP Vermilion East Ash Pond Extension

SHEET 24 OF 34

LOCATION Danville, Illinois

W. & A. FILE NO. 2069

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
See Sheet 23 of 34							
Dense, Light Brown, Fine- To Coarse-Grained SAND And Fine-Grained GRAVEL	30	SS	14 31 23(54)	-	-	-	6
Dense, Light Brown Coarse-Grained GRAVEL	34						
Hard, Gray-Brown SANDY LEAN CLAY CL (Glacial Till)		SS	15 20 24(44)	4.5+	6.7	130	9
	38						
		SS	18 22 26(48)	4.5+	7.0	128	10
	42						
Hard, Gray-Brown SANDY SILTY CLAY CL-ML (Glacial Till)		SS	20 24 30(54)	4.5+	7.5	130	8
	46						
Very Stiff, Light Brown SANDY SILTY CLAY - CL-ML (Glacial Till)	50	SS	26 35 36(71)	4.0	3.7	126	13
Hard, Light Brown SANDY SILTY CLAY CL-ML (Glacial Till)	54	SS	102/12"	4.5+	-	-	8

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

BORING LOG
(CONTINUATION)

BORING NO. B-109

DATE 11-07-01

PROJECT IP Vermilion East Ash Pond Extension

SHEET 25 OF 34

LOCATION Danville, Illinois

W. & A. FILE NO. 2069

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
See Sheet 24 of 34							
	60						
		SS	103/11"	4.5+	7.3	131	8
	64						
Hard, Gray And Gray-Brown SHALE							
		SS	90/12"	-	-	-	11
	68						
		SS	101/6"	-	-	-	9
EXPLORATORY BORING DISCONTINUED	72						
	76						
	80						
	84						

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
INCORPORATED
2406 West Nebraska Avenue
PEORIA, ILLINOIS 61604

BORING LOG

BORING NO. B-110
DATE 11-08-01
W. & A. FILE NO. 2069
SHEET 26 OF 34
PROJECT IP VERMILION EAST ASH POND EXTENSION
LOCATION Danville, Illinois
BORING LOCATION See Site Plan Sheet
DRILLED BY Fehl
BORING TYPE Hollow-Stem Auger
WEATHER CONDITIONS Partly Cloudy & Mild
SOIL CLASSIFICATION SYSTEM U.S.B.S.C.
SEEPAGE WATER ENCOUNTERED AT ELEVATION None
GROUND SURFACE ELEVATION 0.0
GROUND WATER ELEVATION AT - HRS. -
BORING DISCONTINUED AT ELEVATION (-)86.0 Ft.
GROUND WATER ELEVATION AT COMPLETION None

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Q_p	Q_u	D_d	M_c
Brown SILTY CLAY LOAM Organic Topsoil	6"						
Hard, Brown And Dark Brown LEAN CLAY With Sand - CL (Glacial Till)							
	04						
		SS	10 13 15(28)	4.5+	4.6	122	13
	08						
		SS	10 15 20(35)	4.5+	4.2	120	14
	12						
Very Dense, Light Brown, Fine- To Coarse-Grained SAND And Fine-Grained GRAVEL	16	SS	22 40 51(91)	-	-	-	6
Medium-Density, Light Brown, Fine- To Coarse-Grained SAND	20	SS	7 8 8(16)	-	-	-	7
Dense, Brown, Fine- To Coarse-Grained SAND With Occasional Fine-Grained Gravel	24	SS	12 14 18(32)	-	-	-	5

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Q_p - CALIBRATED PENETROMETER READING - T.S.F.
Q_u - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
D_d - NATURAL DRY DENSITY - P.C.F.
M_c - NATURAL MOISTURE CONTENT - %

BORING NO. B-110

BORING LOG

(CONTINUATION)

DATE 11-08-01

PROJECT IP Vermilion East Ash Pond Extension

SHEET 27 OF 34

LOCATION Danville, Illinois

W. & A. FILE NO. 2069

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
See Sheet 26 of 34							
Medium-Density, Brown, Fine- To Coarse-Grained SAND With Occasional Fine-Grained Gravel	30	SS	7 8 9(17)	-	-	-	9
Hard, Gray SANDY LEAN CLAY - CL (Glacial Till)	34	SS	12 14 22(36)	4.5+	4.2	125	12
Very Stiff, Gray-Brown SANDY LEAN CLAY - CL (Glacial Till)	38						
		SS	11 14 22(36)	2.5	2.2	120	14
	42						
	46	SS	15 27 35(62)	4.0	3.7	123	12
	50	SS	15 26 22(48)	4.5+	4.0	125	18
Hard, Gray-Brown SANDY SILTY CLAY CL-ML (Glacial Till)	54	SS	20 30 41(71)	4.5+	6.6	128	10

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

BORING LOG

(CONTINUATION)

BORING NO. B-110

DATE 11-08-01

PROJECT IP Vermilion East Ash Pond Extension

LOCATION Danville, Illinois

SHEET 28 OF 34

W. & A. FILE NO. 2069

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
See Sheet 27 of 34					–		
	60	SS	17 22 31(39)	4.5+	7.8	128	12
Very Dense, Gray SILTY FINE-GRAINED SAND - SM	64	SS	103	-	-	-	14
Hard, Gray SILTY CLAY SAND - SC-SM (Glacial Till)	68						
		SS	20 27 25(52)	4.5+	5.2	130	9
	72						
		SS	94	4.5+	7.1	132	8
	76						
Hard, Gray SANDY SILTY CLAY - CL-ML (Glacial Till)							
	80	SS	98	4.5+	4.2	127	10
	84	SS	101	4.5+	6.7	131	9
EXPLORATORY BORING DISCONTINUED							

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

BORING NO. B-111
DATE 11-12-01
W. & A. FILE NO. 2069
SHEET 29 OF 34

WHITNEY & ASSOCIATES
INCORPORATED
2406 West Nebraska Avenue
PEORIA, ILLINOIS 61604

BORING LOG

PROJECT IP VERMILION EAST ASH POND EXTENSION
LOCATION Danville, Illinois
BORING LOCATION See Site Plan Sheet
DRILLED BY Fehl
BORING TYPE Hollow-Stem Auger
WEATHER CONDITIONS Partly Cloudy & Mild
SOIL CLASSIFICATION SYSTEM U. S. B. S. C.
SEEPAGE WATER ENCOUNTERED AT ELEVATION (-)33.2 Ft.
GROUND SURFACE ELEVATION 0.0
GROUND WATER ELEVATION AT - HRS. -
BORING DISCONTINUED AT ELEVATION (-)76.0 Ft.
GROUND WATER ELEVATION AT COMPLETION None

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
Brown SILTY CLAY LOAM Organic Topsoil	6"						
Hard, Light Brown, Gray And Gray-Brown LEAN CLAY With Sand - CL (Glacial Till)							
	04						
		SS	12 14 20(34)	4.5+	4.7	121	12
	08						
		SS	15 22 29(51)	4.5+	5.2	125	12
	12						
	16	SS	10 13 25(38)	4.5+	-	-	10
Dense, Brown, Fine- To Coarse-Grained SAND With Some Fine-Grained Gravel And Silty Clay	20	SS	8 15 19(34)	-	-	-	6
	24						
Dense, Brown, Fine- To Coarse-Grained SAND With Some Fine Gravel		SS	10 13 18(31)	-	-	-	6

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

BORING LOG
(CONTINUATION)

BORING NO. B-111

DATE 11-12-01

PROJECT IP Vermilion East Ash Pond Extension

SHEET 30 OF 34

LOCATION Danville, Illinois

W. & A. FILE NO. 2069

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
See Sheet 29 of 34							
Medium-Density, Brown, Fine- To Coarse-Grained SAND With Considerable Silty Clay	30	SS	5 6 8(13)	-	-	-	10
Very Dense, Brown, Medium- To Coarse-Grained SAND And Fine- To Medium-Grained GRAVEL	34	SS	18 34 24(58)	-	-	-	16
Hard, Gray SANDY LEAN CLAY - CL (Glacial Till)	38	SS	18 9 14(23)	4.5+	4.3	125	10
	42						
Hard, Gray SANDY SILTY CLAY - CL-ML (Glacial Till)	46	SS	12 24 31(55)	4.5+	-	-	9
	50	SS	13 17 27(44)	4.5+	7.2	129	11
	54	SS	14 18 25(43)	4.5+	-	-	10

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

BORING NO. B-111

BORING LOG
(CONTINUATION)

DATE 11-12-01

PROJECT IP Vermilion East Ash Pond Extension

LOCATION Danville, Illinois

SHEET 31 OF 34

W. & A. FILE NO. 2069

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
See Sheet 31 of 34							
Hard, Gray SANDY SILT With Fine- To Medium-Grained GRAVEL - ML	60						
		SS	101/4"	4.5+	-	-	8
Hard, Gray SANDY SILTY CLAY - CL-ML (Glacial Till)	64						
		SS	20 38 42(80)	4.5+	8.6	131	9
	68						
		SS	19 36 43(79)	4.5+	7.1	128	10
	72						
		SS	25 57	4.5+	-	-	9
	76						
EXPLORATORY BORING DISCONTINUED							
	80						
	84						

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
INCORPORATED
2406 West Nebraska Avenue
PEORIA, ILLINOIS 61604

BORING LOG

BORING NO. B-112
DATE 11-09-01
W. & A. FILE NO. 2069
SHEET 32 OF 34
PROJECT IP VERMILION EAST ASH POND EXTENSION
LOCATION Danville, Illinois
BORING LOCATION See Site Plan Sheet
DRILLED BY Fehl
BORING TYPE Hollow-Stem Auger
WEATHER CONDITIONS Partly Cloudy & Mild
SOIL CLASSIFICATION SYSTEM U.S.B.S.C.
SEEPAGE WATER ENCOUNTERED AT ELEVATION (-)33.1 Ft.
GROUND SURFACE ELEVATION 0.0
GROUND WATER ELEVATION AT - HRS. -
BORING DISCONTINUED AT ELEVATION (-)76.0 Ft.
GROUND WATER ELEVATION AT COMPLETION (-)27.6 Ft. CAVE-IN

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
Brown SILTY CLAY LOAM Organic Topsoil	7"						
Stiff, Light Brown SILT - ML							
	04						
		SS	6 7 13(20)	2.0	-	-	9
Dense, Gray-Brown SILTY CLAYEY SAND - SC-SM	08						
		SS	15 18 19(37)	-	-	-	11
	12						
Medium-Density, Gray-Brown, Fine- To Medium-Grained SAND And Fine- To Medium-Grained GRAVEL	16	SS	12 12 15(27)	-	-	-	5
Dense, Light Brown, Fine- To Medium-Grained SAND	20	SS	9 15 18(33)	-	-	-	5
Dense, Brown, Medium- To Coarse-Grained SAND With Considerable Fine-Grained Gravel	24	SS	9 14 19(33)	-	-	-	7

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

BORING NO. B-112

BORING LOG
(CONTINUATION)

DATE 11-09-01

PROJECT IP Vermilion East Ash Pond Extension
SHEET 33 OF 34
LOCATION Danville, Illinois
W. & A. FILE NO. 2069

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
See Sheet 32 of 34							
Loose, Brown, Medium- To Coarse-Grained SAND And Fine- To Medium-Grained GRAVEL	30	SS	3 4 5(9)	-	-	-	15
Medium-Density, Brown, Fine- To Medium-Grained SAND With Some Fine-Grained Gravel	34	SS	6 7 8(15)	-	-	-	17
	38						
Hard, Gray-Brown LEAN CLAY With Sand CL (Glacial Till)		SS	9 15 20(35)	4.5+	6.1	123	12
	42						
Hard, Gray SANDY SILTY CLAY - CL (Glacial Till)	46	SS	13 24 33(57)	4.5+	6.8	124	10
	50	SS	15 18 24(42)	4.5+	7.2	130	10
	54	SS	101/11"	4.5+	7.1	130	10

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

BORING LOG
(CONTINUATION)

BORING NO. B-112

DATE 11-09-01

PROJECT IP Vermilion East Ash Pond Extension

LOCATION Danville, Illinois

SHEET 34 OF 34

W. & A. FILE NO. 2069

DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dd	Mc
See Sheet 33 of 34					—		
Hard, Gray SILTY CLAYEY SAND SC-SM (Glacial Till)	60	SS	108/11"	4.0	-	-	11
Hard, Gray SANDY SILTY CLAY - CL-ML (Glacial Till)	64	SS	35 48	4.5+	8.4	128	10
	68						
		SS	97/12"	4.5+	5.9	127	10
	72						
		SS	79/6"	4.5+	-	-	9
	76						
EXPLORATORY BORING DISCONTINUED							
	80						
	84						

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

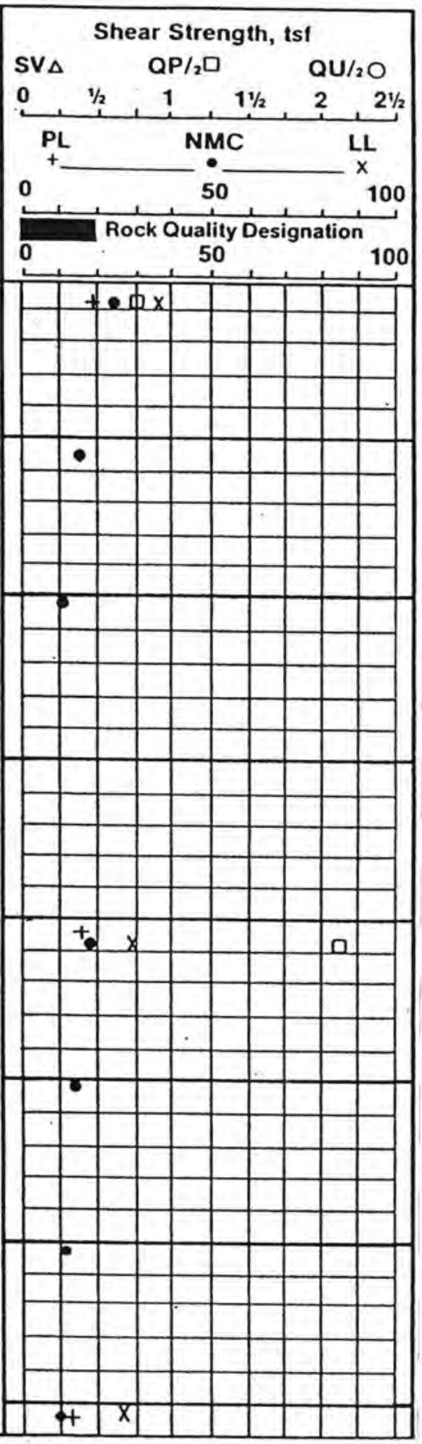
Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-10
SHEET 1 **OF** 3

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 656.2'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
					Yellow-Brown Silty CLAY Trace Roots, CL		
	1	HST	60/36		Brown CLAY w/Silt, Roots, CH		103
					Olive-Brown Silty CLAY, TILL, CL		
5					-w/Gravel 6.0-8.0'		
	2	HST	60/12				
10					-w/Gravel 10.0-12.5', & 18.0-21.0'		
	3	HST	60/6				
15							
	4	HST	60/10		-w/Cobbles @ 17.0'		
20					-Brown 20.0-30.0'		
							111
	5	HST	60/24				
25					-w/Sand, Gravel Seam @ 25.0'		
	6	HST	60/6				
30					-Gray Below 30.0'		
	7	HST	30/6				
					-Gravel Seam @ 32.5'		
35	8	SS	24/24	1		17-25-23-24	127



DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/28-29/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS
Encountered at - Feet
Hours after completion Feet
after completion Feet
after completion Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

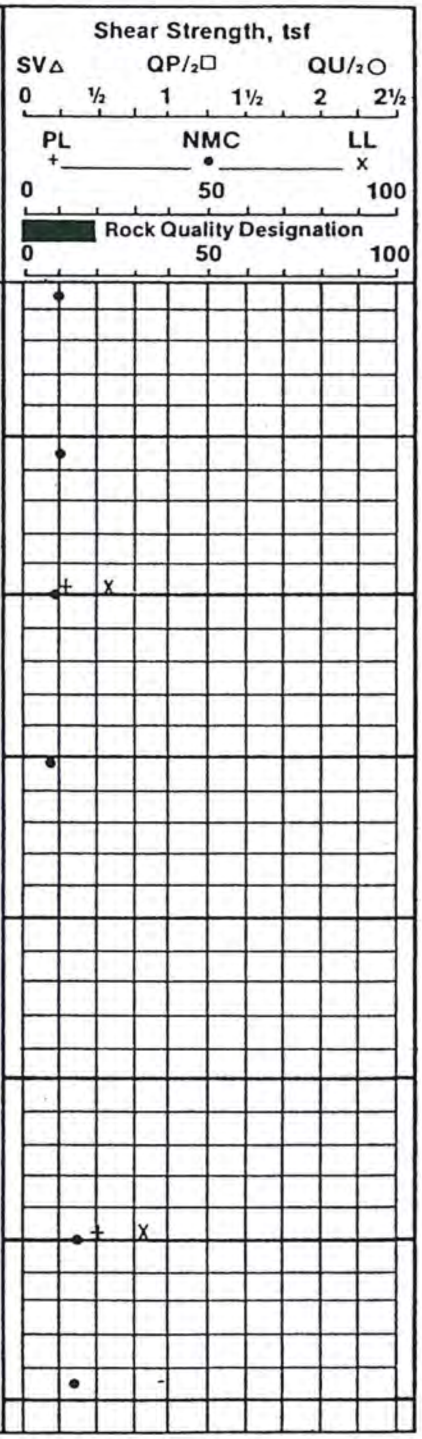
RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-10
SHEET 2 **OF** 3

Soil Classification System Unified
Surface Elevation 656.2'

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification)	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
	8	HST	24/24		Gray Silty CLAY Trace Sand, Gravel, TILL, CL	17-25-23-24	127
40	9	SS	24/24			11-15-30-39	
					-Gray-Brown Below 43.0'		
45	10	SS	22/18			18-24-40-50/4"	127
					-w/Gravel Seams 49.0-59.0'		
50	11	SS	18/18			23-34-50	
55	12	SS	9/9			48-50/3"	
	13	AS					
60	14	SS	5/0			50/5"	
65	15	SS	17/15			26-30-50/5"	120
70	16	SS	12/12			24-50/6"	



DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/28-29/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS
Encountered at - Feet
____ Hours after completion ____ Feet
____ after completion ____ Feet
____ after completion ____ Feet

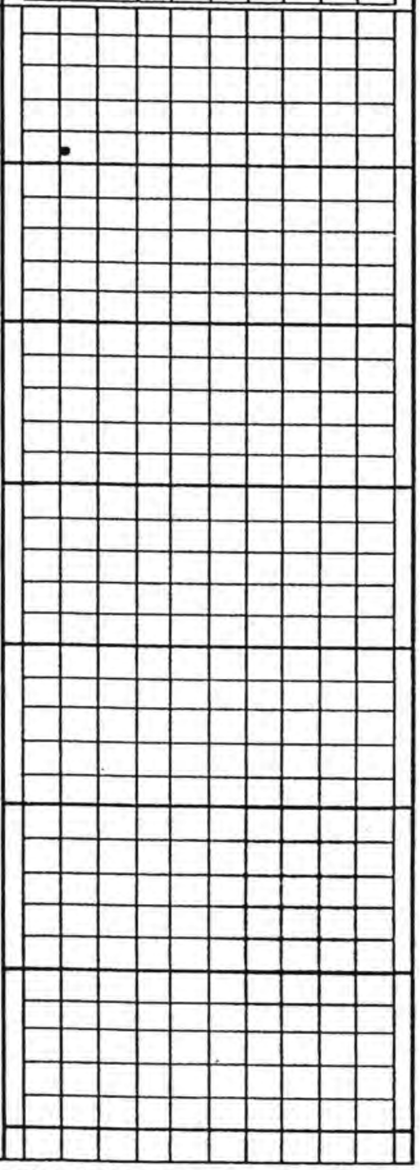
NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-10
SHEET 3 **OF** 3

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 656.2'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/₂□ QU/₂○ 0 ½ 1 1½ 2 2½; PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100
					Gray Silty CLAY Trace Sand, Gravel, TILL, CL			
75	17	SS	3/3		Gray Clayey SHALE TOB	50/3"		
80								



DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/28-29/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

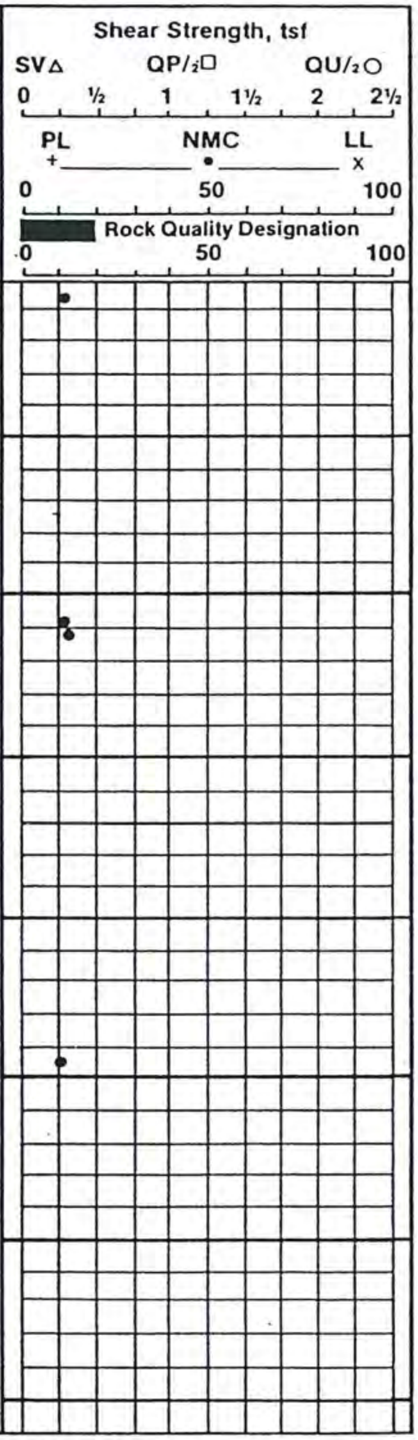
RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-11A
SHEET 1 **OF** 2

DESCRIPTION OF MATERIALS
(Color Modifier MATERIAL, Classification)
Soil Classification System Unified
Surface Elevation 594.7'

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
	1				Dark Brown Fine SAND w/Silt, SM -Brown Below 1.0'		
	2	HST	60/24				
5					-w/Gravel Below 5.0'		
	3	HST	60/12		Brown Coarse GRAVEL w/Sand, GP		
10					Dark Gray-Brown SHALE		124
	4	HST	60/46				
15							
20	5	SS	3/3			50/3"	
					-Gray Below 22.5'		
25	6	SS	2/2			50/2"	
30	7	SS	2/2			50/2"	
35	8	SS	1.5/1.5			50/1.5"	



DRILLING METHOD Hollow Auger
DATE DRILLED 4/22/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-11A
SHEET 2 **OF** 2

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 594.7'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/₂□ QU/₂○ 0 ½ 1 1½ 2 2½; PL + NMC • LL x 0 50 100; ■ Rock Quality Designation 0 50 100
					Gray SHALE			
40	9	SS	2/1.5		TOB	50/2"		
45								

DRILLING METHOD Hollow Auger
DATE DRILLED 4/22/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS
Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-11B
SHEET 1 **OF** 1

DESCRIPTION OF MATERIALS
(Color Modifier MATERIAL. Classification)
Soil Classification System Unified
Surface Elevation 594.9'

Shear Strength, tsf: SV△ QP/2□ QU/2○ — 0, ½, 1, 1½, 2, 2½
PL + NMC ● LL x — 0, 50, 100
Rock Quality Designation — 0, 50, 100

DEPTH (ft)	SAMPLE NUMBER	INTERVAL AND TYPE	ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
0					Brown Fine SAND, SP		
					Brown Gravelly SAND Trace Silt, SP		
5	1	HST	48/6				
					TOB		
10							
15							
20							
25							
30							
35							

DRILLING METHOD Hollow Auger
DATE DRILLED 4/22/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

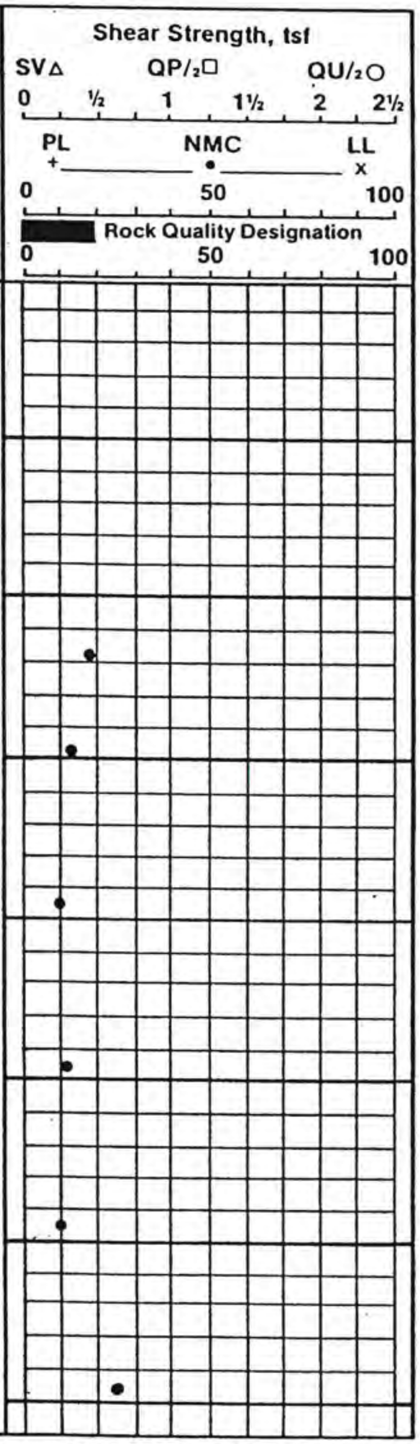
NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-12A
SHEET 1 **OF** 2

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 590.0'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
					Brown Fine SAND w/Silt, SM		
	1	HST	60/20				
5					Olive-Brown Silty CLAY Trace Sand, TILL, CL		
		HST	60/0				
10	2	HST	24/0				
				1	Olive-Gray SHALE		
15	3	SS	9/8			25-50/3"	
20	4	SS	2/2			50/2"	
					-Dark Gray 22.0-32.5'		
25	5	SS	1.5/1.5			50/1.5"	
30	6	SS	1/1			50/1"	
					-Gray Below 32.5'		
35	7	SS	2/1			50/2"	



DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/23/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-12A
SHEET 2 **OF** 2

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 590.0'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2☐ QU/2○ 0 ½ 1 1½ 2 2½ / PL + NMC ● LL x 0 50 100 / ▆ Rock Quality Designation 0 50 100
					Gray SHALE			
40	8	SS	2/0			50/2"		
45	9	SS	1/0		TOB	50/1"		●

Remark:

1. Mud Rotary Techniques Used Below 12.0'

DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/23/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

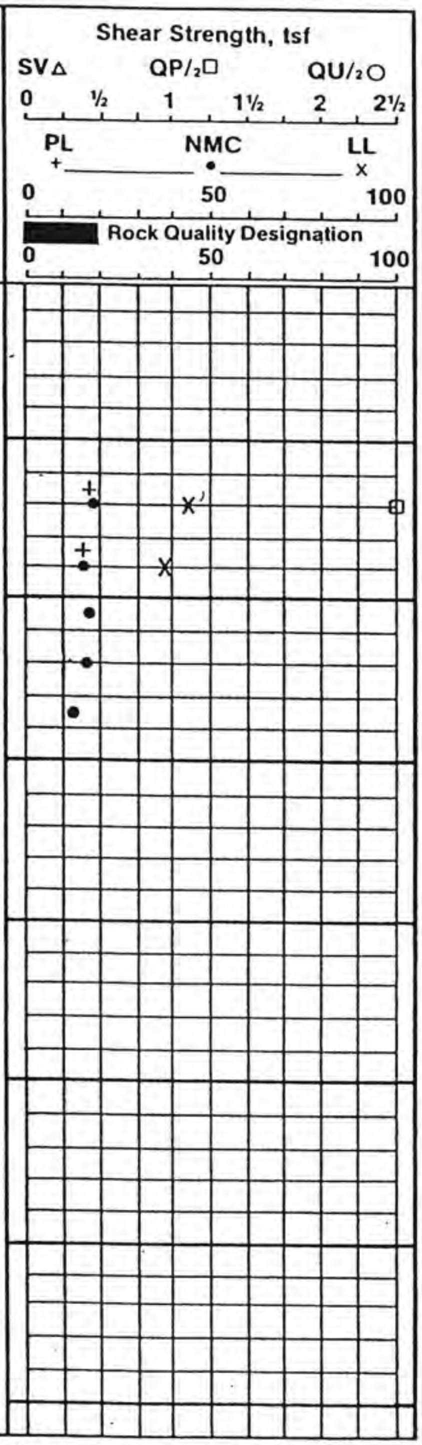
NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-12B
SHEET 1 **OF** 1

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 590.2'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
					Brown Fine SAND, SP		
					Brown Gravelly SAND, SP		
5							
	1	SS	24/18		Yellow Brown Silty CLAY, CL	5-16-25-40	111
	2	SS	24/24		Olive-Gray Silty CLAY, TILL, CL	7-17-25-31	
10	3	SS	24/18			4-13-20-35	
	4	SS	24/12			10-17-28-35	
	5	SS	23/24		Olive-Gray SHALE	10-20-36-50/5"	
					TOB		
15							
20							
25							
30							
35							



DRILLING METHOD Hollow Auger
DATE DRILLED 4/23/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
__ Hours after completion __ Feet
__ after completion __ Feet
__ after completion __ Feet

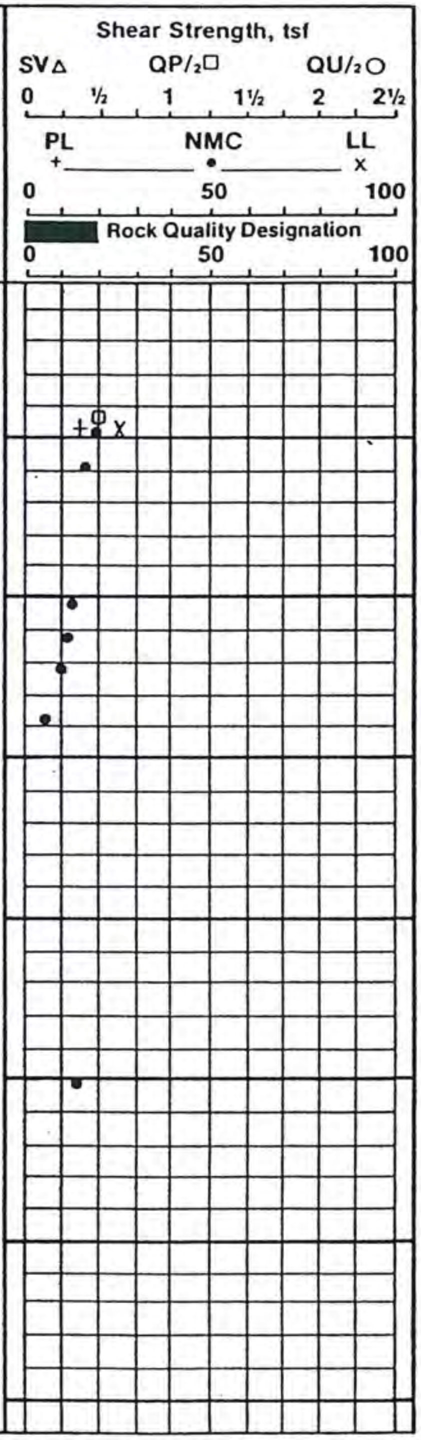
NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-13A
SHEET 1 **OF** 2

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 581.9'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
					Brown Silty CLAY w/Sand, CL		
	1	HST	60/60				
5							116
	2	HST	60/18		Brown Fine SAND Trace Silt, SP		
10					-w/Gravel Below 9.5'		
					Gray SHALE		
	3	HST	60/36		-Dark Gray Below 13.5'		
15							
	4	HST	60/0				
20	5	SS	2/2	1		50/2"	
25	6	SS	2/0			50/2"	
30	7	SS	2/0			50/2"	
35	8	SS	1/1			50/1"	



DRILLING METHOD Hollow Auger
DATE DRILLED 4/27/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
____ Hours after completion ____ Feet
____ after completion ____ Feet
____ after completion ____ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-13A
SHEET 2 **OF** 2

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 581.9'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½; PL + NMC ● LL x 0 50 100; ▬ Rock Quality Designation 0 50 100
					Dark Gray SHALE			
40	9	SS	2/1		TOB	50/2"		●
					Remark: 1. Mud Rotary Techniques Used Below 20.0'			
45								

DRILLING METHOD Hollow Auger
DATE DRILLED 4/27/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
Hours after completion Feet
after completion Feet
after completion Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-13B
SHEET 1 OF 1

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 581.9'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½ PL + NMC • LL x 0 50 100 ▮ Rock Quality Designation 0 50 100
					Brown Silty CLAY w/Sand, CL			
5								
	1	SS	24/17		Brown Fine-Medium SAND w/Gravel Trace Silt, SP-SM	3-2-4-3		
10	2	SS	22/8		Brown Silty CLAY w/Sand, CL	6-6-12-50/4"		
					Gray SHALE			
					TOB			
15								
20								
25								
30								
35								

DRILLING METHOD Hollow Auger
DATE DRILLED 3/27/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

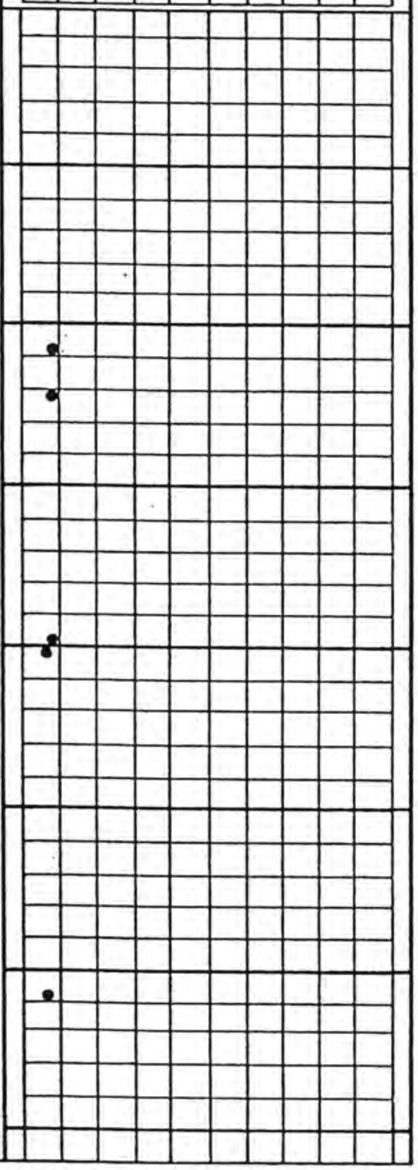
PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-14A
SHEET 1 **OF** 3

Soil Classification System Unified
Surface Elevation 586.1'

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification)	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
	1	HST	60/30		Brown Fine-Medium SAND Trace Silt, Clay Pockets, SP -w/Roots to 4"		
					Brown Gravelly SAND Trace Cobbles, Silt, SP		
5							
	2	HST	60/18				
10					Dark Gray SHALE		
							137
	3	HST	60/54				
15							
20							
							141
	4	HST	60/36				
25							
	5	HST	60/6				
30							
	6	HST	60/15				
35	7	HST	30/20				

Shear Strength, tsf
SV△ QP/2□ QU/2○
0 ½ 1 1½ 2 2½
PL + NMC • LL x
0 50 100
■ Rock Quality Designation
0 50 100



DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/14-15/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

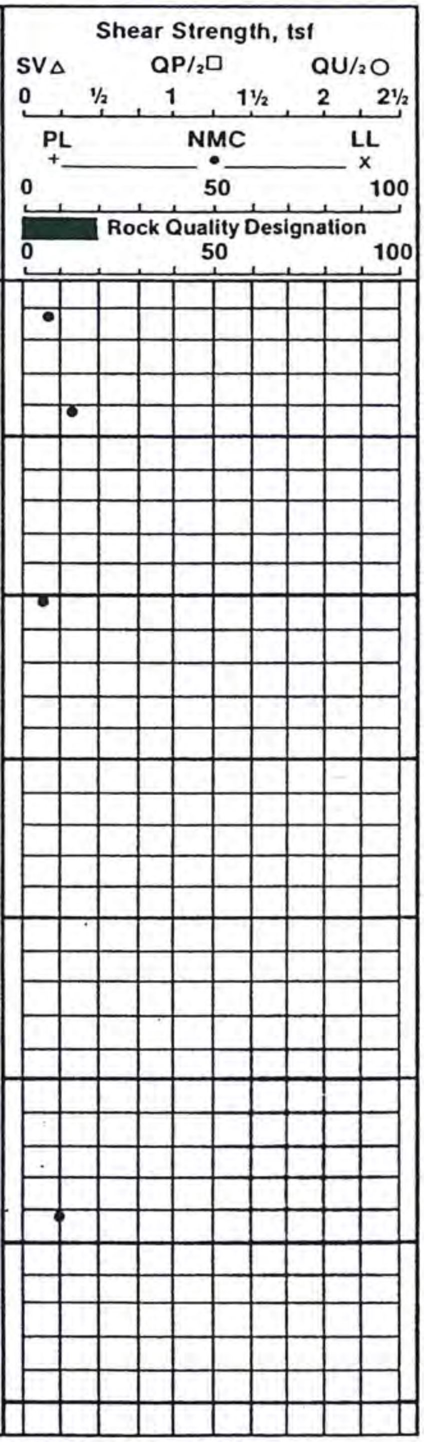
NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-14A
SHEET 2 **OF** 3

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 586.1'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
	7	HST	30/20		Dark Gray SHALE		
	8	SS	3/3			100/3"	
40							
	9	SS	4/4			100/4"	
45	10	AS					
50							
	11	SS	3/2			100/3"	
55							
60							
	12	SS	4.25/6			50/4"=50/.25'	
65							
70							



DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/14-15/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
Hours after completion Feet
after completion Feet
after completion Feet

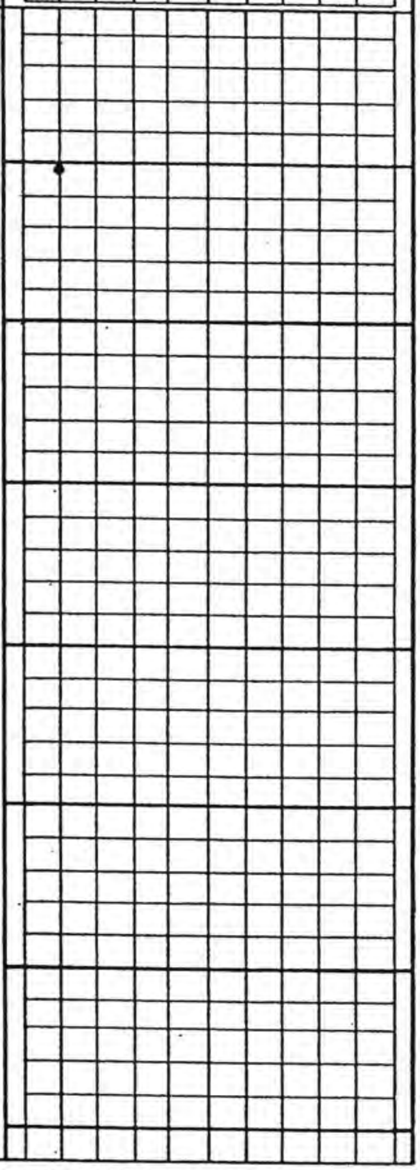
NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-14A
SHEET 3 **OF** 3

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 586.1'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½ PL + NMC • LL x 0 50 100 Rock Quality Designation 0 50 100
					Dark Gray SHALE			
75	13	SS	5.5/5.5	1		50/5"-50/0.5"		
80					TOB			



Remark:

1. Wet Rotary 75.0-80.0'

DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/14-15/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

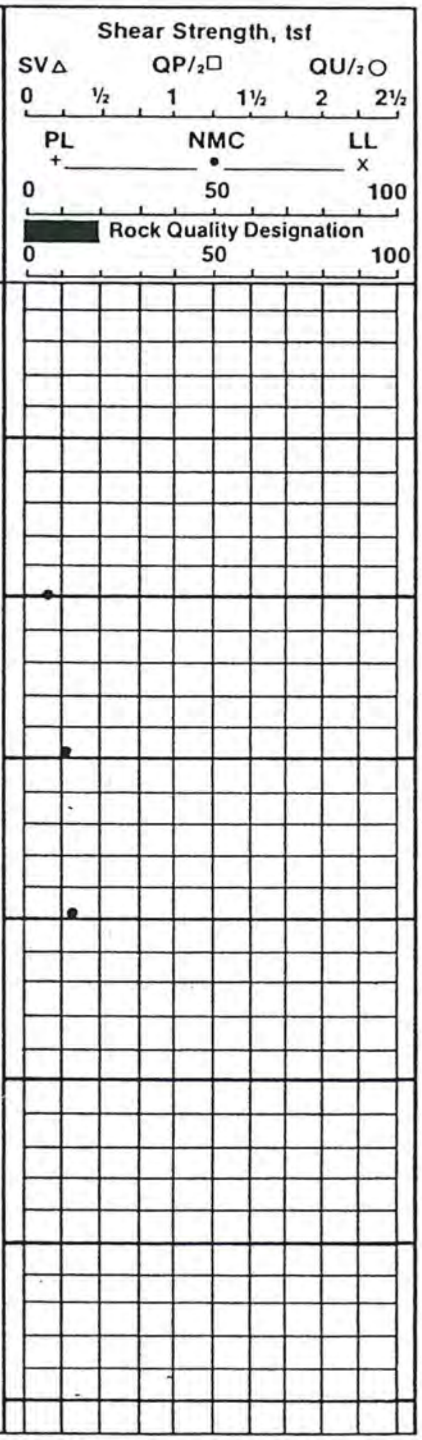
NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-14B
SHEET 1 **OF** 1

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 586.0'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
					Brown Fine-Medium SAND, SP		
					-w/Gravel Below 4.0'		
5							
					-w/Coarse Gravel @ 7.0'		
					Dark Gray SHALE		
10	1	SS	8/8			24-50/2"	
15	2	SS	5/5		-w/Clay Seams @ 14.5'	50/5"	
20	3	SS	4.5/4.5		TOB	50/4.5"	
25							
30							
35							



DRILLING METHOD Hollow Auger
DATE DRILLED 4/21/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

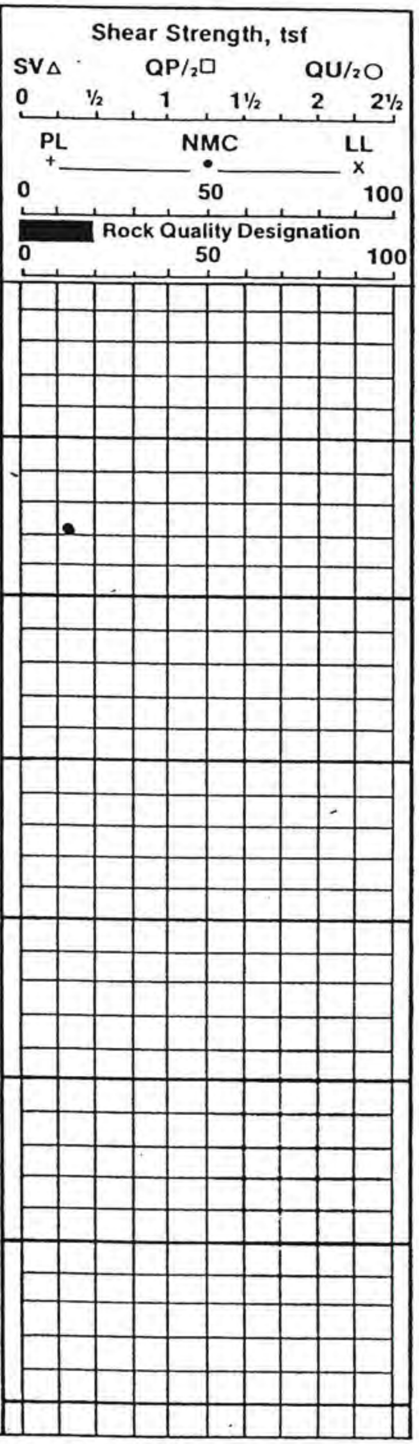
RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-14C
SHEET 1 **OF** 1

DESCRIPTION OF MATERIALS
(Color Modifier MATERIAL. Classification)
Soil Classification System Unified
Surface Elevation 586.2'

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
					Brown Fine-Medium SAND, SP		
					Brown Gravelly SAND Trace Silt, SP		
5							
	1	SS	18/8			2-3-6	
	2	SS	18/10		Gray SHALE	7-13-26	
					TOB		
10							
15							
20							
25							
30							
35							



DRILLING METHOD Hollow Auger
DATE DRILLED 4/21/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

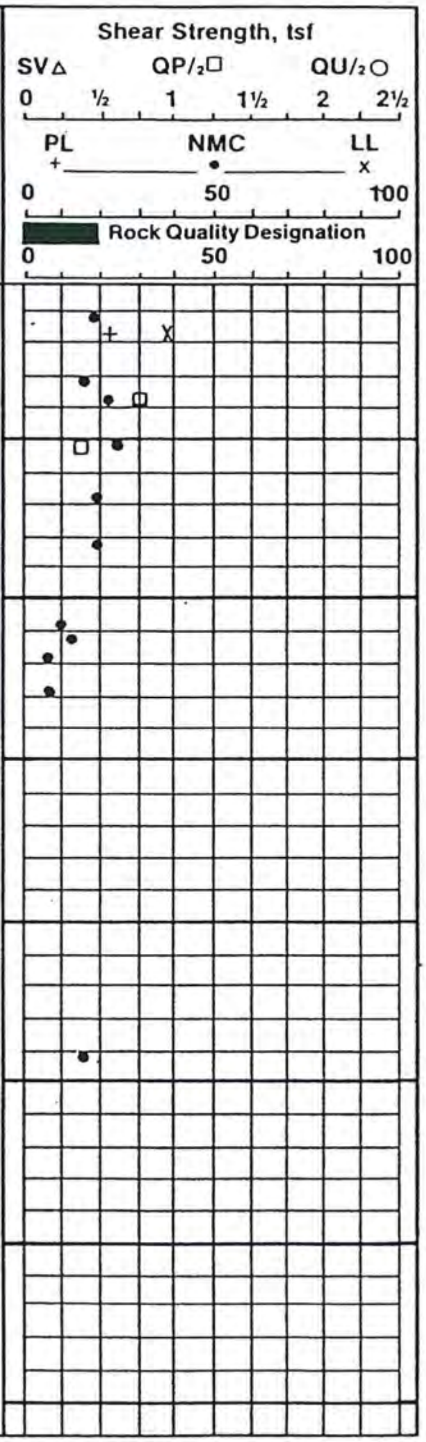
NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-15A
SHEET 1 **OF** 2

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified; Surface Elevation 589.0'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
					Brown Silty CLAY Trace Sand, CL		
	1	HST	54/48				
					-Dark Brown Below 3.0'		101
5							99
	2	HST	60/46		-w/3" Clayey Sand Seam @ 7.0'		
					Brown Clayey Fine SAND, SC		
10					-Gravelly Below 10.5'		
					Dark Gray SHALE		
	3	HST	60/42				
15				1			
	4	SS	1/1			50/1"	
20							
	5	SS	3/3			50/3"	
25							
30							
	6	SS	1/1			50/1"	
35							



DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/21/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS
Encountered at - Feet
___Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-15A
SHEET 2 **OF** 2

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 589.0'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½; PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100
					Dark Gray SHALE			
40								
	7	SS	2/0		TOB	50/2"		
45								

Remark:

1. Mud Rotary Techniques Used Below 14.5'

DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/21/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS
Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-15B
SHEET 1 **OF** 1

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 589.0'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2☐ QU/2○ 0 ½ 1 1½ 2 2½; PL + NMC ● LL x 0 50 100; ▬ Rock Quality Designation 0 50 100
0					Brown Silty CLAY w/Sand, CL			
9	1	SS	24/12			PUSHED		
9.5					Brown Silty Fine SAND, ML			
10	2	SS	12/6			PUSHED		
11					TOB			

DRILLING METHOD Hollow Auger
DATE DRILLED 4/22/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

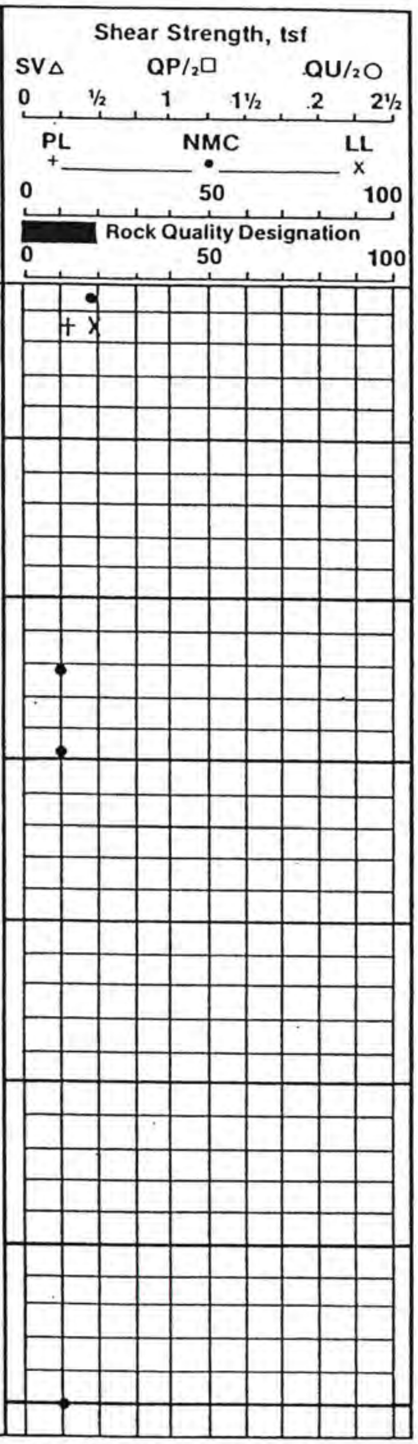
NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-16A
SHEET 1 **OF** 2

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 578.5'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
					Dark Brown Sandy SILT w/Clay, ML		
	1	HST	60/20				
					Brown Medium SAND w/Fine Trace Clay, SW-SC		
5							
	2	HST	60/10				
10					Brown Gravelly SAND Trace Clay, SP		
	3	HST	30/3				
					Dark Gray SHALE		
15	4	SS	4/4			50/4"	
20	5	SS	3.5/3.5	1		50/3.5"	
25	6	SS	3/3			50/3"	
30	7	SS	3/1			50/3"	
35	8	SS	2/2			50/2"	



DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/28/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at 8.5 Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-16A
SHEET 2 **OF** 2

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (In)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 578.5'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/₂□ QU/₂○ 0 ½ 1 1½ 2 2½; PL + NMC • LL x 0 50 100; Rock Quality Designation 0 50 100
					Dark Gray SHALE			
					-Rock Seam 37.0-37.5'			
40								
	9	66	2/0		TOB	40/2"		
45								
					Remarks:			
					1. Mud Rotary Techniques Used Below 19.5'			

DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/28/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at 8.5 Feet
____ Hours after completion ____ Feet
____ after completion ____ Feet
____ after completion ____ Feet

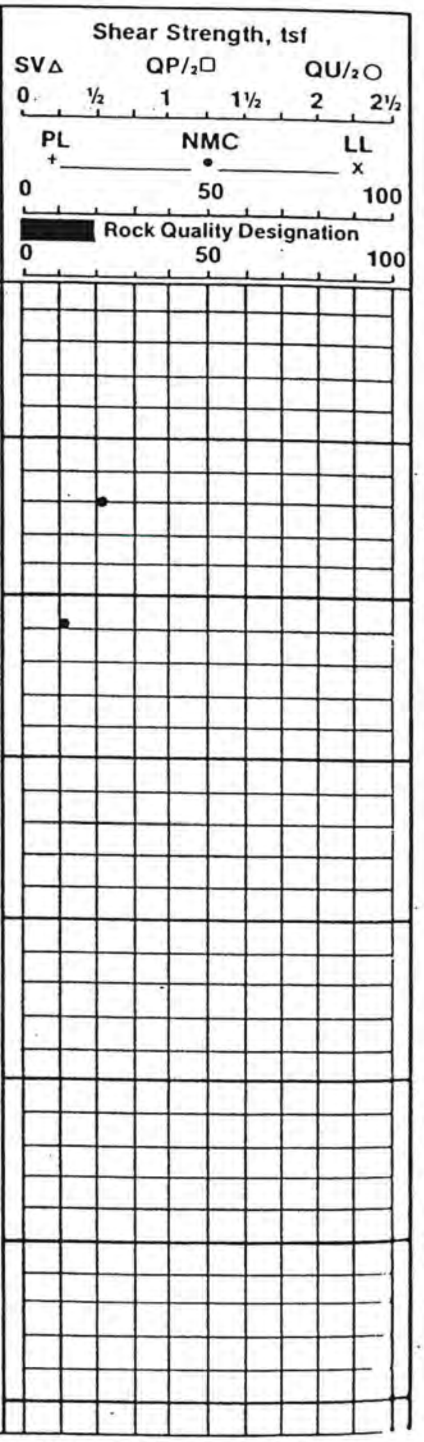
NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-16B
SHEET 1 **OF** 1

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 578.5'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
					Gray-Brown Silty CLAY, CL		
5							
	1	SS	24/20		Gray Fine-Medium SAND Trace Silt, SM	2-5-4-6	
	2	SS	24/14		Brown Fine Sand w/Clay, Gravel, SC	2-2-3-9	
10					-Becoming Coarser w/Depth		
	3	SS	17/14	1		10-29-50/5"	
					TOB		
					Remark: 1. Hit Shale @ 11.5'±		
15							
20							
25							
30							
35							



DRILLING METHOD Hollow Auger
DATE DRILLED 4/28/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

Illinois Environmental Protection Agency Well Completion Report

SITE #: IL0004057 (NPDES #) COUNTY: Vermilion WELL #: MW22

SITE NAME: Vermilion Station, Dynegy Midwest Generation, Inc. BOREHOLE #:

STATE PLANE COORDINATE: X 1150083 Y 1279669 (or) LATITUDE: ° ' " LONGITUDE: ° ' "

SURVEYED BY: Chastain & Assoc., Inc. ILL. REGISTRATION #: 2217

DRILLING CONTRACTOR: Mid-America Drilling, Inc. DRILLER: Dusty Jackson

CONSULTING FIRM: Kelron Environmental GEOLOGIST: Eric Kovatch (NRT)

DRILLING METHOD: Hollow-Stem Auger/Coring DRILLING FLUIDS (TYPE): Water

LOGGED BY: Eric Kovatch (NRT) DATE STARTED: 12-5-01 DATE FINISHED: 12-5-01

REPORT FORM COMPLETED BY: Stuart Cravens DATE: 2-6-02

ANNULAR SPACE DETAILS

TYPE OF SURFACE SEAL: Cement

TYPE OF ANNULAR SEALANT: Bentonite grout

INSTALLATION METHOD: tremie

SETTING TIME: 24-hours

TYPE OF BENTONITE SEAL - [✓ GRANULAR] PELLET, SLURRY (CIRCLE ONE)

INSTALLATION METHOD: through augers

SETTING TIME: 1-hour

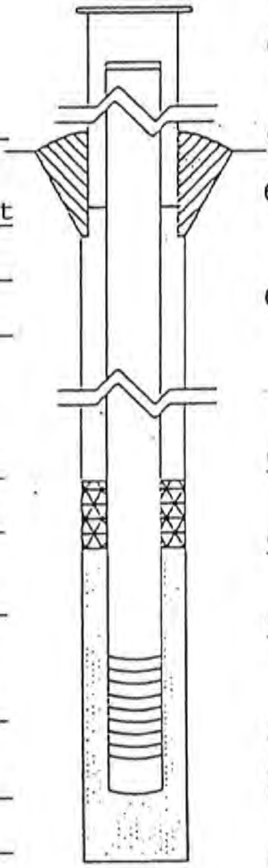
TYPE OF SAND PACK: Silica

GRAIN SIZE: 30 (SIEVE SIZE)

INSTALLATION METHOD: through augers

TYPE OF BACKFILL MATERIAL: (IF APPLICABLE)

INSTALLATION METHOD:



ELEVATIONS (MSL)*	DEPTHS (BGS) (.01 ft)	
		TOP OF PROTECTIVE CASING
658.60	-3.00	TOP OF RISER PIPE
655.60	0.00	GROUND SURFACE
654.60	1.00	TOP OF ANNULAR SEALANT
601.99	53.61	STATIC WATER LEVEL (AFTER COMPLETION)
583.10	72.50	TOP OF SEAL
577.90	77.70	TOP OF SANDPACK
575.60	80.00	TOP OF SCREEN
555.60	100.00	BOTTOM OF SCREEN
555.60	100.00	BOTTOM OF WELL
555.60	100.00	BOTTOM OF BOREHOLE

* REFERENCED TO A NATIONAL GEODETIC VERTICAL DATUM

WELL CONSTRUCTION MATERIALS

(CIRCLE ONE)

PROTECTIVE CASING	SS304, SS316, PTFE, PVC OR OTHER: Steel
RISER PIPE ABOVE W.T.	SS304, SS316, PTFE, [✓ PVC] OR OTHER:
RISER PIPE BELOW W.T.	SS304, SS316, PTFE, [✓ PVC] OR OTHER:
SCREEN	SS304, SS316, PTFE, [✓ PVC] OR OTHER:

CASING MEASUREMENTS

DIAMETER OF BOREHOLE (in)	6 /2.5
ID OF RISER PIPE (in)	2
PROTECTIVE CASING LENGTH (ft)	5
RISER PIPE LENGTH (ft)	83
BOTTOM OF SCREEN TO END CAP (ft)	0
SCREEN LENGTH (1st SLOT TO LAST SLOT) (ft)	20
TOTAL LENGTH OF CASING (ft)	103
SCREEN SLOT SIZE **	0.010

** HAND-SLOTTED WELL SCREENS ARE UNACCEPTABLE

(941014)

Illinois Environmental Protection Agency Well Completion Report

SITE #: IL0004057 (NPDES #) COUNTY: Vermilion WELL #: MW23

SITE NAME: Vermilion Station, Dynegy Midwest Generation, Inc. BOREHOLE #:

STATE PLANE COORDINATE: X 1150788 Y 1280399 (or) LATITUDE: ° ' " LONGITUDE: ° ' "

SURVEYED BY: Chastain & Assoc., Inc. ILL. REGISTRATION #: 2217

DRILLING CONTRACTOR: Mid-America Drilling, Inc. DRILLER: Dusty Jackson

CONSULTING FIRM: Kelron Environmental GEOLOGIST: Rebecca Caudill (NRT)

DRILLING METHOD: Hollow-Stem Auger/Coring DRILLING FLUIDS (TYPE): Water

LOGGED BY: Rebecca Caudill (NRT) DATE STARTED: 12-3-01 DATE FINISHED: 12-3-01

REPORT FORM COMPLETED BY: Stuart Cravens DATE: 2-26-02

ANNULAR SPACE DETAILS

TYPE OF SURFACE SEAL: Cement

TYPE OF ANNULAR SEALANT:

INSTALLATION METHOD:

SETTING TIME: 24-hours

TYPE OF BENTONITE SEAL – [✓ GRANULAR], PELLET, SLURRY (CIRCLE ONE)

INSTALLATION METHOD: through augers

SETTING TIME: 1-hour

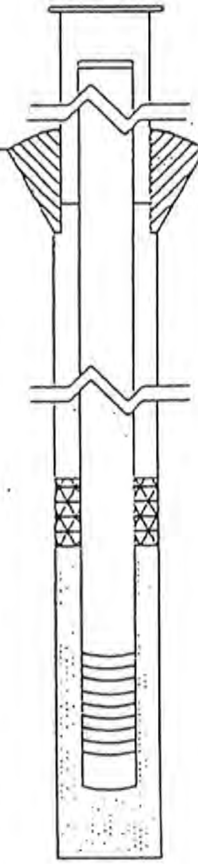
TYPE OF SAND PACK: Silica

GRAIN SIZE: 5 (SIEVE SIZE)

INSTALLATION METHOD: through augers

TYPE OF BACKFILL MATERIAL: (IF APPLICABLE)

INSTALLATION METHOD:



ELEVATIONS (MSL)*	DEPTHS (BGS) (.01 ft)	
		TOP OF PROTECTIVE CASING
601.89	-2.70	TOP OF RISER PIPE
599.20	0.00	GROUND SURFACE
598.20	1.00	TOP OF ANNULAR SEALANT
588.10	11.09	STATIC WATER LEVEL (AFTER COMPLETION)
592.20	7.00	TOP OF SEAL
590.20	9.00	TOP OF SANDPACK
587.40	11.80	TOP OF SCREEN
577.40	21.80	BOTTOM OF SCREEN
577.20	22.00	BOTTOM OF WELL
577.20	22.00	BOTTOM OF BOREHOLE

* REFERENCED TO A NATIONAL GEODETIC VERTICAL DATUM

WELL CONSTRUCTION MATERIALS

(CIRCLE ONE)

PROTECTIVE CASING	SS304, SS316, PTFE, PVC OR OTHER: Steel
RISER PIPE ABOVE W.T.	SS304, SS316, PTFE, [✓ PVC] OR OTHER:
RISER PIPE BELOW W.T.	SS304, SS316, PTFE, [✓ PVC] OR OTHER:
SCREEN	SS304, SS316, PTFE, [✓ PVC] OR OTHER:

CASING MEASUREMENTS

DIAMETER OF BOREHOLE (in)	6
ID OF RISER PIPE (in)	2
PROTECTIVE CASING LENGTH (ft)	5
RISER PIPE LENGTH (ft)	14.50
BOTTOM OF SCREEN TO END CAP (ft)	0.30
SCREEN LENGTH (1st SLOT TO LAST SLOT) (ft)	9.90
TOTAL LENGTH OF CASING (ft)	24.70
SCREEN SLOT SIZE **	0.010

** HAND-SLOTTED WELL SCREENS ARE UNACCEPTABLE

(941014)

Illinois Environmental Protection Agency Well Completion Report

SITE #: IL0004057 (NPDES #) COUNTY: Vermilion WELL #: MW24

SITE NAME: Vermilion Station, Dynegy Midwest Generation, Inc. BOREHOLE #:

STATE PLANE COORDINATE: X 1150783 Y 1280404 (or) LATITUDE: ° ' " LONGITUDE: ° ' "

SURVEYED BY: Chastain & Assoc., Inc. ILL. REGISTRATION #: 2217

DRILLING CONTRACTOR: Mid-America Drilling, Inc. DRILLER: Dusty Jackson

CONSULTING FIRM: Kelron Environmental GEOLOGIST: Rebecca Caudill (NRT)

DRILLING METHOD: Hollow-Stem Auger/Coring DRILLING FLUIDS (TYPE): Water

LOGGED BY: Rebecca Caudill (NRT) DATE STARTED: 12-3-01 DATE FINISHED: 12-3-01

REPORT FORM COMPLETED BY: Stuart Cravens DATE: 2-26-02

ANNULAR SPACE DETAILS

TYPE OF SURFACE SEAL: Cement

TYPE OF ANNULAR SEALANT: Bentonite grout

INSTALLATION METHOD: tremie

SETTING TIME: 24-hours

TYPE OF BENTONITE SEAL – [✓ GRANULAR] PELLET, SLURRY (CIRCLE ONE)

INSTALLATION METHOD: through augers

SETTING TIME: 1-hour

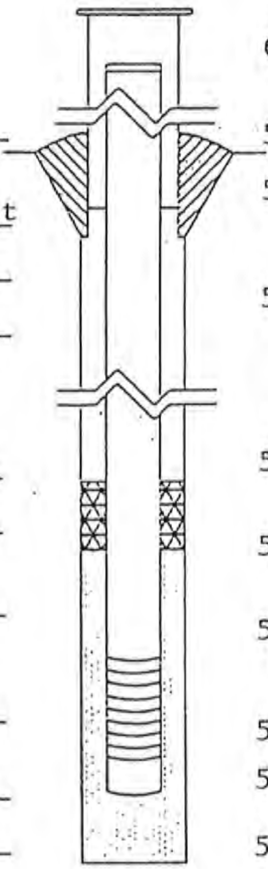
TYPE OF SAND PACK: Silica

GRAIN SIZE: 5 (SIEVE SIZE)

INSTALLATION METHOD: through augers

TYPE OF BACKFILL MATERIAL: (IF APPLICABLE)

INSTALLATION METHOD:



ELEVATIONS (MSL)*	DEPTHS (BGS) (.01 ft)	
		TOP OF PROTECTIVE CASING
601.81	-3.01	TOP OF RISER PIPE
598.80	0.00	GROUND SURFACE
597.80	1.00	TOP OF ANNULAR SEALANT
576.09	22.71	STATIC WATER LEVEL (AFTER COMPLETION)
572.00	26.80	TOP OF SEAL
566.80	32.00	TOP OF SANDPACK
564.00	34.80	TOP OF SCREEN
544.00	54.70	BOTTOM OF SCREEN
543.80	55.00	BOTTOM OF WELL
543.80	55.00	BOTTOM OF BOREHOLE

* REFERENCED TO A NATIONAL GEODETIC VERTICAL DATUM

WELL CONSTRUCTION MATERIALS

(CIRCLE ONE)

PROTECTIVE CASING	SS304, SS316, PTFE, PVC OR OTHER: Steel
RISER PIPE ABOVE W.T.	SS304, SS316, PTFE, [✓ PVC] OR OTHER:
RISER PIPE BELOW W.T.	SS304, SS316, PTFE, [✓ PVC] OR OTHER:
SCREEN	SS304, SS316, PTFE, [✓ PVC] OR OTHER:

CASING MEASUREMENTS

DIAMETER OF BOREHOLE (in)	6 /2.5
ID OF RISER PIPE (in)	2
PROTECTIVE CASING LENGTH (ft)	5
RISER PIPE LENGTH (ft)	34.80
BOTTOM OF SCREEN TO END CAP (ft)	0.30
SCREEN LENGTH (1st SLOT TO LAST SLOT) (ft)	19.90
TOTAL LENGTH OF CASING (ft)	55.00
SCREEN SLOT SIZE **	0.010

** HAND-SLOTTED WELL SCREENS ARE UNACCEPTABLE

(941014)

Illinois Environmental Protection Agency Well Completion Report

SITE #: IL0004057 (NPDES #) COUNTY: Vermilion WELL #: MW25

SITE NAME: Vermilion Station, Dynegy Midwest Generation, Inc. BOREHOLE #:

STATE PLANE COORDINATE: X 1150916 Y 1278027 (or) LATITUDE: ° ' " LONGITUDE: ° ' "

SURVEYED BY: Chastain & Assoc., Inc. ILL. REGISTRATION #: 2217

DRILLING CONTRACTOR: Mid-America Drilling, Inc. DRILLER: Dusty Jackson

CONSULTING FIRM: Kelron Environmental GEOLOGIST: Rebecca Caudill (NRT)

DRILLING METHOD: Hollow-Stem Auger/Coring DRILLING FLUIDS (TYPE): Water

LOGGED BY: Rebecca Caudill (NRT) DATE STARTED: 12-4-01 DATE FINISHED: 12-4-01

REPORT FORM COMPLETED BY: Stuart Cravens DATE: 2-26-02

ANNULAR SPACE DETAILS

TYPE OF SURFACE SEAL: Cement

TYPE OF ANNULAR SEALANT: Bentonite grout

INSTALLATION METHOD: tremie

SETTING TIME: 24-hours

TYPE OF BENTONITE SEAL – [✓ GRANULAR] PELLET, SLURRY (CIRCLE ONE)

INSTALLATION METHOD: through augers

SETTING TIME: 1-hour

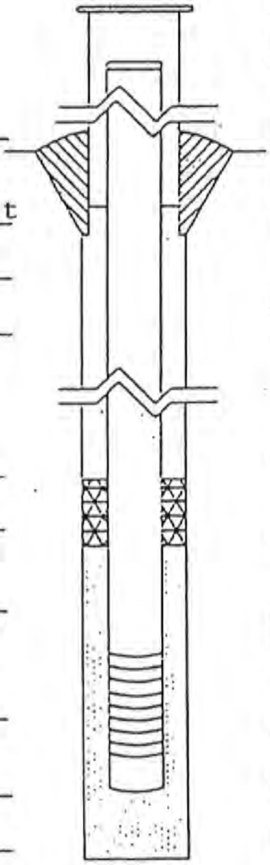
TYPE OF SAND PACK: Silica

GRAIN SIZE: 5 (SIEVE SIZE)

INSTALLATION METHOD: through augers

TYPE OF BACKFILL MATERIAL: (IF APPLICABLE)

INSTALLATION METHOD:



ELEVATIONS (MSL)*	DEPTHS (BGS) (.01 ft)	
		TOP OF PROTECTIVE CASING
581.65	-2.80	TOP OF RISER PIPE
578.80	0.00	GROUND SURFACE
577.80	1.00	TOP OF ANNULAR SEALANT
562.78	16.02	STATIC WATER LEVEL (AFTER COMPLETION)
564.00	14.80	TOP OF SEAL
562.00	16.80	TOP OF SANDPACK
559.70	19.10	TOP OF SCREEN
540.10	38.70	BOTTOM OF SCREEN
539.80	39.00	BOTTOM OF WELL
539.80	39.00	BOTTOM OF BOREHOLE

* REFERENCED TO A NATIONAL GEODETIC VERTICAL DATUM

WELL CONSTRUCTION MATERIALS

(CIRCLE ONE)

PROTECTIVE CASING	SS304, SS316, PTFE, PVC OR OTHER: Steel
RISER PIPE ABOVE W.T.	SS304, SS316, PTFE, [✓ PVC] OR OTHER:
RISER PIPE BELOW W.T.	SS304, SS316, PTFE, [✓ PVC] OR OTHER:
SCREEN	SS304, SS316, PTFE, [✓ PVC] OR OTHER:

CASING MEASUREMENTS

DIAMETER OF BOREHOLE (in)	6
ID OF RISER PIPE (in)	2
PROTECTIVE CASING LENGTH (ft)	5
RISER PIPE LENGTH (ft)	21.90
BOTTOM OF SCREEN TO END CAP (ft)	0.30
SCREEN LENGTH (1st SLOT TO LAST SLOT) (ft)	19.60
TOTAL LENGTH OF CASING (ft)	41.80
SCREEN SLOT SIZE **	0.010

** HAND-SLOTTED WELL SCREENS ARE UNACCEPTABLE

(941014)

Illinois Environmental Protection Agency Well Completion Report

SITE #: IL0004057 (NPDES #) COUNTY: Vermilion WELL #: MW26

SITE NAME: Vermilion Station, Dynegy Midwest Generation, Inc. BOREHOLE #:

STATE PLANE COORDINATE: X 1150782 Y 1280741 (or) LATITUDE: ° ' " LONGITUDE: ° ' "

SURVEYED BY: Chastain & Assoc., Inc. ILL. REGISTRATION #: 2217

DRILLING CONTRACTOR: Mid-America Drilling, Inc. DRILLER: Dusty Jackson

CONSULTING FIRM: Kelron Environmental GEOLOGIST: Stuart Cravens

DRILLING METHOD: Hollow-Stem Auger/Coring DRILLING FLUIDS (TYPE): Water

LOGGED BY: Stuart Cravens DATE STARTED: 11-21-01 DATE FINISHED: 11-21-01

REPORT FORM COMPLETED BY: Stuart Cravens DATE: 2-26-02

ANNULAR SPACE DETAILS

TYPE OF SURFACE SEAL: Cement

TYPE OF ANNULAR SEALANT:

INSTALLATION METHOD:

SETTING TIME: 24-hours

TYPE OF BENTONITE SEAL – [✓ GRANULAR], PELLET, SLURRY (CIRCLE ONE)

INSTALLATION METHOD: through augers

SETTING TIME: 1-hour

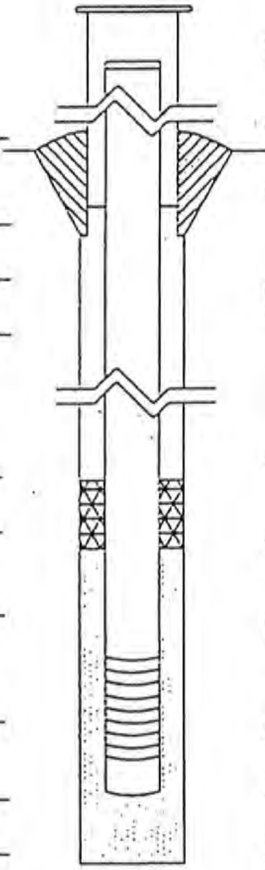
TYPE OF SAND PACK: Silica

GRAIN SIZE: 30 (SIEVE SIZE)

INSTALLATION METHOD: through augers

TYPE OF BACKFILL MATERIAL: (IF APPLICABLE)

INSTALLATION METHOD:



ELEVATIONS (MSL)*	DEPTHS (BGS)	(.01 ft)
		TOP OF PROTECTIVE CASING
583.52	-3.05	TOP OF RISER PIPE
580.47	0.00	GROUND SURFACE
579.47	1.00	TOP OF ANNULAR SEALANT
573.49	6.98	STATIC WATER LEVEL (AFTER COMPLETION)
579.47	1.00	TOP OF SEAL
574.47	6.00	TOP OF SANDPACK
572.72	7.75	TOP OF SCREEN
567.72	12.75	BOTTOM OF SCREEN
567.47	13.00	BOTTOM OF WELL
567.47	13.00	BOTTOM OF BOREHOLE

* REFERENCED TO A NATIONAL GEODETIC VERTICAL DATUM

WELL CONSTRUCTION MATERIALS

(CIRCLE ONE)

PROTECTIVE CASING	SS304, SS316, PTFE, PVC OR OTHER: Steel
RISER PIPE ABOVE W.T.	SS304, SS316, PTFE, [✓ PVC] OR OTHER:
RISER PIPE BELOW W.T.	SS304, SS316, PTFE, [✓ PVC] OR OTHER:
SCREEN	SS304, SS316, PTFE, [✓ PVC] OR OTHER:

CASING MEASUREMENTS

DIAMETER OF BOREHOLE (in)	6 /2.5
ID OF RISER PIPE (in)	2
PROTECTIVE CASING LENGTH (ft)	5
RISER PIPE LENGTH (ft)	10.80
BOTTOM OF SCREEN TO END CAP (ft)	0.25
SCREEN LENGTH (1st SLOT TO LAST SLOT) (ft)	5.00
TOTAL LENGTH OF CASING (ft)	16.05
SCREEN SLOT SIZE **	0.010

** HAND-SLOTTED WELL SCREENS ARE UNACCEPTABLE

(941014)

Illinois Environmental Protection Agency Well Completion Report

SITE #: IL0004057 (NPDES #) COUNTY: Vermilion WELL #: MW27

SITE NAME: Vermilion Station, Dynegy Midwest Generation, Inc. BOREHOLE #:

STATE PLANE COORDINATE: X 1150787 Y 1280744 (or) LATITUDE: ° ' " LONGITUDE: ° ' "

SURVEYED BY: Chastain & Assoc., Inc. ILL. REGISTRATION #: 2217

DRILLING CONTRACTOR: Mid-America Drilling, Inc. DRILLER: Dusty Jackson

CONSULTING FIRM: Kelron Environmental GEOLOGIST: Eric Kovatch (NRT)

DRILLING METHOD: Hollow-Stem Auger/Coring DRILLING FLUIDS (TYPE): Water

LOGGED BY: Eric Kovatch (NRT) DATE STARTED: 11-25-01 DATE FINISHED: 11-26-01

REPORT FORM COMPLETED BY: Stuart Cravens DATE: 2-06-02

ANNULAR SPACE DETAILS

TYPE OF SURFACE SEAL: Cement

TYPE OF ANNULAR SEALANT: Bentonite grout

INSTALLATION METHOD: tremie

SETTING TIME: 24-hours

TYPE OF BENTONITE SEAL - [✓ GRANULAR] PELLET, SLURRY (CIRCLE ONE)

INSTALLATION METHOD: through augers

SETTING TIME: 1-hour

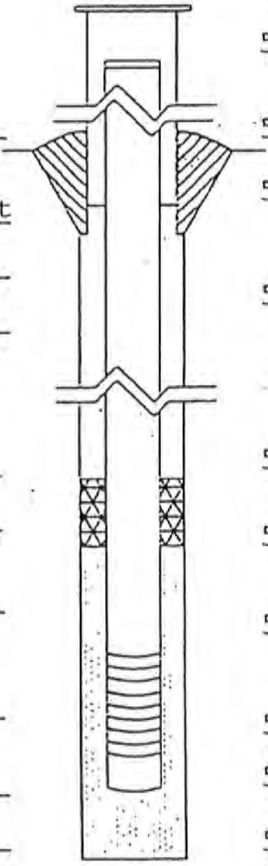
TYPE OF SAND PACK: Silica

GRAIN SIZE: 30 (SIEVE SIZE)

INSTALLATION METHOD: through augers

TYPE OF BACKFILL MATERIAL: (IF APPLICABLE)

INSTALLATION METHOD:



ELEVATIONS (MSL)*	DEPTHS (BGS)	(.01 ft)
		TOP OF PROTECTIVE CASING
583.39	-3.00	TOP OF RISER PIPE
580.39	0.00	GROUND SURFACE
578.89	1.50	TOP OF ANNULAR SEALANT
574.69	5.70	STATIC WATER LEVEL (AFTER COMPLETION)
578.89	1.50	TOP OF SEAL
559.39	21.00	TOP OF SANDPACK
557.39	23.00	TOP OF SCREEN
537.39	43.00	BOTTOM OF SCREEN
537.39	43.00	BOTTOM OF WELL
536.39	44.00	BOTTOM OF BOREHOLE

* REFERENCED TO A NATIONAL GEODETIC VERTICAL DATUM

WELL CONSTRUCTION MATERIALS (CIRCLE ONE)

PROTECTIVE CASING	SS304, SS316, PTFE, PVC OR OTHER: Steel
RISER PIPE ABOVE W.T.	SS304, SS316, PTFE, [✓ PVC] OR OTHER:
RISER PIPE BELOW W.T.	SS304, SS316, PTFE, [✓ PVC] OR OTHER:
SCREEN	SS304, SS316, PTFE, [✓ PVC] OR OTHER:

CASING MEASUREMENTS

DIAMETER OF BOREHOLE (in)	6 /2.5
ID OF RISER PIPE (in)	2
PROTECTIVE CASING LENGTH (ft)	5
RISER PIPE LENGTH (ft)	26
BOTTOM OF SCREEN TO END CAP (ft)	0
SCREEN LENGTH (1st SLOT TO LAST SLOT) (ft)	20
TOTAL LENGTH OF CASING (ft)	46
SCREEN SLOT SIZE **	0.010

** HAND-SLOTTED WELL SCREENS ARE UNACCEPTABLE

(941014)

Illinois Environmental Protection Agency Well Completion Report

SITE #: IL0004057 (NPDES #) COUNTY: Vermilion WELL #: MW31

SITE NAME: Vermilion Station, Dynegy Midwest Generation, Inc. BOREHOLE #:

STATE PLANE COORDINATE: X 1152932 Y 1279256 (or) LATITUDE: ___° ___' ___" LONGITUDE: ___° ___' ___"

SURVEYED BY: Chastain & Assoc., Inc. ILL. REGISTRATION #: 2217

DRILLING CONTRACTOR: Mid-America Drilling, Inc. DRILLER: Dusty Jackson

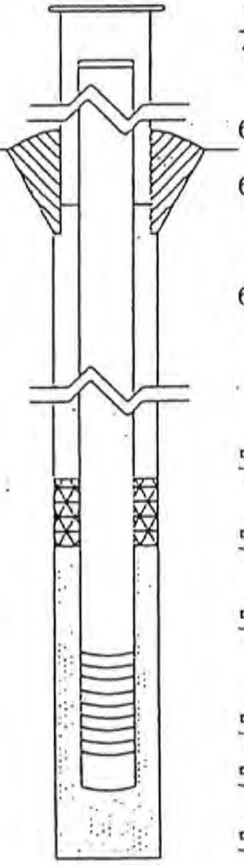
CONSULTING FIRM: Kelron Environmental GEOLOGIST: Eric Kovatch (NRT)

DRILLING METHOD: Hollow-Stem Auger/Coring DRILLING FLUIDS (TYPE): Water

LOGGED BY: Eric Kovatch (NRT) DATE STARTED: 11-29-01 DATE FINISHED: 11-29-01

REPORT FORM COMPLETED BY: Stuart Cravens DATE: 2-6-02

ANNULAR SPACE DETAILS



TYPE OF SURFACE SEAL: Cement

TYPE OF ANNULAR SEALANT: Bentonite grout

INSTALLATION METHOD: tremie

SETTING TIME: 24-hours

TYPE OF BENTONITE SEAL – [✓ GRANULAR], PELLET, SLURRY (CIRCLE ONE)

INSTALLATION METHOD: through augers

SETTING TIME: 1-hour

TYPE OF SAND PACK: Silica

GRAIN SIZE: 30 (SIEVE SIZE)

INSTALLATION METHOD: through augers

TYPE OF BACKFILL MATERIAL: (IF APPLICABLE)

INSTALLATION METHOD:

ELEVATIONS (MSL)*	DEPTHS (BGS) (.01 ft)	
		TOP OF PROTECTIVE CASING
701.21	-3.00	TOP OF RISER PIPE
698.21	0.00	GROUND SURFACE
696.21	2.00	TOP OF ANNULAR SEALANT
613.09	85.12	STATIC WATER LEVEL (AFTER COMPLETION)
545.51	152.7	TOP OF SEAL
538.71	159.5	TOP OF SANDPACK
536.21	162.0	TOP OF SCREEN
516.21	182.0	BOTTOM OF SCREEN
516.21	182.0	BOTTOM OF WELL
514.21	184.0	BOTTOM OF BOREHOLE

* REFERENCED TO A NATIONAL GEODETIC VERTICAL DATUM

WELL CONSTRUCTION MATERIALS

(CIRCLE ONE)

PROTECTIVE CASING	SS304, SS316, PTFE, PVC OR OTHER: Steel
RISER PIPE ABOVE W.T.	SS304, SS316, PTFE, [✓ PVC] OR OTHER:
RISER PIPE BELOW W.T.	SS304, SS316, PTFE, [✓ PVC] OR OTHER:
SCREEN	SS304, SS316, PTFE, [✓ PVC] OR OTHER:

CASING MEASUREMENTS

DIAMETER OF BOREHOLE (in)	6 /2.5
ID OF RISER PIPE (in)	2
PROTECTIVE CASING LENGTH (ft)	5
RISER PIPE LENGTH (ft)	165
BOTTOM OF SCREEN TO END CAP (ft)	0
SCREEN LENGTH (1st SLOT TO LAST SLOT) (ft)	20
TOTAL LENGTH OF CASING (ft)	185
SCREEN SLOT SIZE **	0.010

** HAND-SLOTTED WELL SCREENS ARE UNACCEPTABLE

(941014)

Illinois Environmental Protection Agency **Well Completion Report**

SITE #: IL0004057 (NPDES #) COUNTY: Vermilion WELL #: MW32

SITE NAME: Vermilion Station, Dynegy Midwest Generation, Inc. BOREHOLE #:

STATE PLANE COORDINATE: X 1151312 Y 1279850 (or) LATITUDE: ° ' " LONGITUDE: ° ' "

SURVEYED BY: Chastain & Assoc., Inc. ILL. REGISTRATION #: 2217

DRILLING CONTRACTOR: Mid-America Drilling, Inc. DRILLER: Dusty Jackson

CONSULTING FIRM: Kelron Environmental GEOLOGIST: Rebecca Caudill (NRT)

DRILLING METHOD: Hollow-Stem Auger/Coring DRILLING FLUIDS (TYPE): Water

LOGGED BY: Rebecca Caudill (NRT) DATE STARTED: 12-4-01 DATE FINISHED: 12-4-01

REPORT FORM COMPLETED BY: Stuart Cravens DATE: 2-26-02

ANNULAR SPACE DETAILS

TYPE OF SURFACE SEAL: Cement

TYPE OF ANNULAR SEALANT: Bentonite grout

INSTALLATION METHOD: tremie

SETTING TIME: 24-hours

TYPE OF BENTONITE SEAL – [✓ GRANULAR], PELLET, SLURRY (CIRCLE ONE)

INSTALLATION METHOD: through augers

SETTING TIME: 1-hour

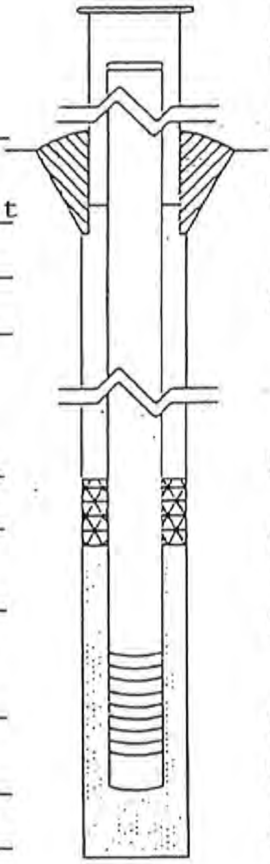
TYPE OF SAND PACK: Silica

GRAIN SIZE: 30 (SIEVE SIZE)

INSTALLATION METHOD: through augers

TYPE OF BACKFILL MATERIAL: (IF APPLICABLE)

INSTALLATION METHOD:



ELEVATIONS (MSL)*	DEPTHS (BGS) (.01 ft)	
		TOP OF PROTECTIVE CASING
585.00	-3.1	TOP OF RISER PIPE
581.90	0.00	GROUND SURFACE
580.90	1.00	TOP OF ANNULAR SEALANT
584.91	-3.01	STATIC WATER LEVEL (AFTER COMPLETION)
541.30	40.60	TOP OF SEAL
537.70	44.20	TOP OF SANDPACK
536.10	45.80	TOP OF SCREEN
526.10	55.80	BOTTOM OF SCREEN
526.10	55.80	BOTTOM OF WELL
525.90	56.00	BOTTOM OF BOREHOLE

* REFERENCED TO A NATIONAL GEODETIC VERTICAL DATUM

WELL CONSTRUCTION MATERIALS

(CIRCLE ONE)

PROTECTIVE CASING	SS304, SS316, PTFE, PVC OR OTHER: Steel
RISER PIPE ABOVE W.T.	SS304, SS316, PTFE, [✓ PVC] OR OTHER:
RISER PIPE BELOW W.T.	SS304, SS316, PTFE, [✓ PVC] OR OTHER:
SCREEN	SS304, SS316, PTFE, [✓ PVC] OR OTHER:

(941014)

CASING MEASUREMENTS

DIAMETER OF BOREHOLE (in)	6 /2.5
ID OF RISER PIPE (in)	2
PROTECTIVE CASING LENGTH (ft)	5
RISER PIPE LENGTH (ft)	48.90
BOTTOM OF SCREEN TO END CAP (ft)	0.30
SCREEN LENGTH (1st SLOT TO LAST SLOT) (ft)	9.90
TOTAL LENGTH OF CASING (ft)	59.10
SCREEN SLOT SIZE **	0.010

** HAND-SLOTTED WELL SCREENS ARE UNACCEPTABLE

KELRON environmental
1213 Dorchester Drive Champaign, IL 61821

217 390.1503
fax: 355.1385

February 5, 2002

Vermilion County Health Department
200 S. College, Suite A
Danville, Illinois 61832

Attn: Mr. Mike Hannon
Environmental Health

Mr. Hannon:

Re: Submittal of Well Construction Reports

On behalf of Dynegy Midwest Generation, Inc., and in accordance with the requirements of the Illinois Department of Public Health, Kelron Environmental is submitting the monitoring well construction reports for 11 new monitoring wells installed at the Vermilion Power Plant near Danville, Illinois. Although the wells were installed during November and December 2001, the survey results were not available until February 2002, thereby delaying final completion of the well construction reports.

Please feel free to contact me (217-390-1503) if you have any questions regarding the submitted well construction reports.

Sincerely,

Stuart J. Cravens, ILPG/CGWP
Senior Hydrogeologist

Enclosure: Well Construction Reports (11)

cc: Tom Davis (DMG)

RECORD OF SUBSURFACE EXPLORATION

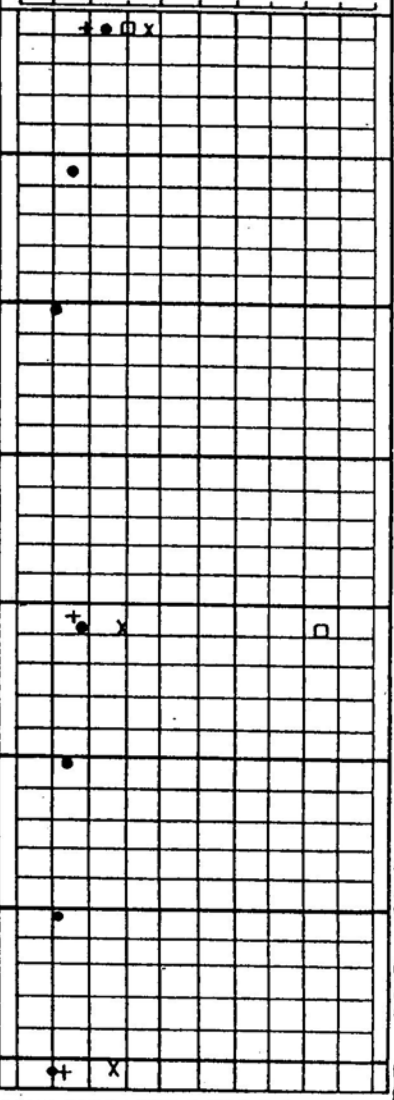
PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-10
SHEET 1 **OF** 3

DESCRIPTION OF MATERIALS
(Color Modifier MATERIAL. Classification)
Soil Classification System Unified
Surface Elevation 656.2'

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
	1	HST	60/36		Yellow-Brown Silty CLAY Trace Roots, CL Brown CLAY w/Silt, Roots, CH Olive-Brown Silty CLAY, TILL, CL		103
5	2	HST	60/12		-w/Gravel 6.0-8.0'		
10	3	HST	60/6		-w/Gravel 10.0-12.5', & 18.0-21.0'		
15	4	HST	60/10		-w/Cobbles @ 17.0'		
20	5	HST	60/24		-Brown 20.0-30.0'		111
25	6	HST	60/6		-w/Sand, Gravel Seam @ 25.0'		
30	7	HST	30/6		-Gray Below 30.0' -Gravel Seam @ 32.5'		
35	8	SS	24/24	1		17-25-23-24	127

Shear Strength, tsf
SV△ QP/2☐ QU/2○
0 ½ 1 1½ 2 2½
PL + NMC ● LL x
0 50 100
Rock Quality Designation
0 50 100



DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/28-29/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS
Encountered at - Feet
____ Hours after completion ____ Feet
____ after completion ____ Feet
____ after completion ____ Feet

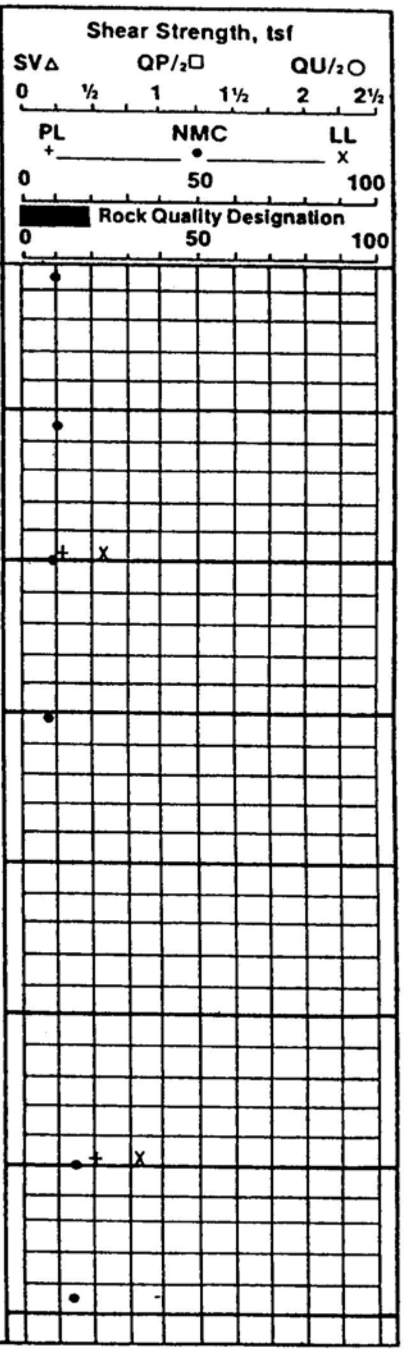
NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-10
SHEET 2 **OF** 3

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 656.2'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
	8	HST	24/24		Gray Silty CLAY Trace Sand, Gravel, TILL, CL	17-25-23-24	127
40	9	SS	24/24			11-15-30-39	
					-Gray-Brown Below 43.0'		
45	10	SS	22/18			18-24-40-50/4"	127
					-w/Gravel Seams 49.0-59.0'		
50	11	SS	18/18			23-34-50	
55	12	SS	9/9			48-50/3"	
	13	AS					
60	14	SS	5/0			50/5"	
65	15	SS	17/15			26-30-50/5"	120
70	16	SS	12/12			24-50/6"	



DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/28-29/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
Hours after completion Feet
after completion Feet
after completion Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-10
SHEET 3 **OF** 3

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 656.2'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½ PL + NMC ● LL × 0 50 100 Rock Quality Designation 0 50 100
					Gray Silty CLAY Trace Sand, Gravel, TILL, CL			
75	17	~~SS~~	3/3		Gray Clayey SHALE TOB	50/3"		
80								

DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/28-29/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

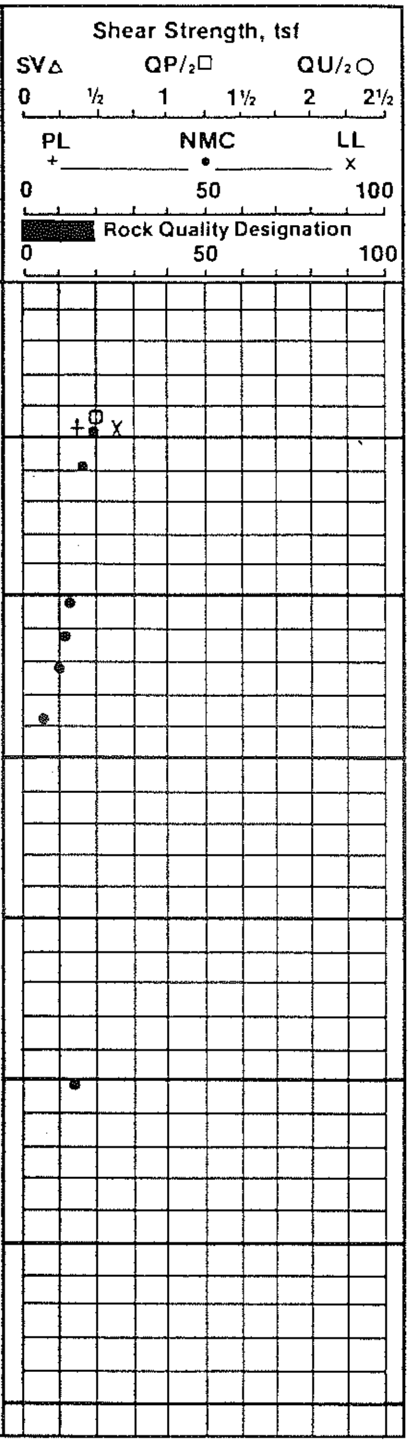
RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-13A
SHEET 1 **OF** 2

Soil Classification System Unified
Surface Elevation 581.9'

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification)	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
0					Brown Silty CLAY w/Sand, CL		
	1	HST	60/60				
5							116
	2	HST	60/18		Brown Fine SAND Trace Silt, SP		
10					-w/Gravel Below 9.5'		
	3	HST	60/36		Gray SHALE -Dark Gray Below 13.5'		
15							
	4	HST	60/0				
20	5	SS	2/2	1		50/2"	
25	6	SS	2/0			50/2"	
30	7	SS	2/0			50/2"	
35	8	SS	1/1			50/1"	



DRILLING METHOD Hollow Auger
DATE DRILLED 4/27/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
____Hours after completion ____ Feet
____ after completion ____ Feet
____ after completion ____ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-13A
SHEET 2 OF 2

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 581.9'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV∆ QP/2☐ QU/2○ 0 ½ 1 1½ 2 2½ PL + NMC ● LL x 0 50 100 ▬ Rock Quality Designation 0 50 100
					Dark Gray SHALE			
40	9	SS	2/1		TOB	50/2"		
					Remark: 1. Mud Rotary Techniques Used Below 20.0'			
45								

DRILLING METHOD Hollow Auger
DATE DRILLED 4/27/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-13B
SHEET 1 OF 1

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 581.9'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½ PL + NMC • LL x 0 50 100 ▇ Rock Quality Designation 0 50 100
					Brown Silty CLAY w/Sand, CL			
5								
	1	SS	24/17		Brown Fine-Medium SAND w/Gravel Trace Silt, SP-SM	3-2-4-3		
10	2	SS	22/8		Brown Silty CLAY w/Sand, CL	6-6-12-50/4"		
					Gray SHALE			
					TOB			
15								
20								
25								
30								
35								

DRILLING METHOD Hollow Auger
DATE DRILLED 3/27/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
____Hours after completion ____ Feet
____ after completion ____ Feet
____ after completion ____ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

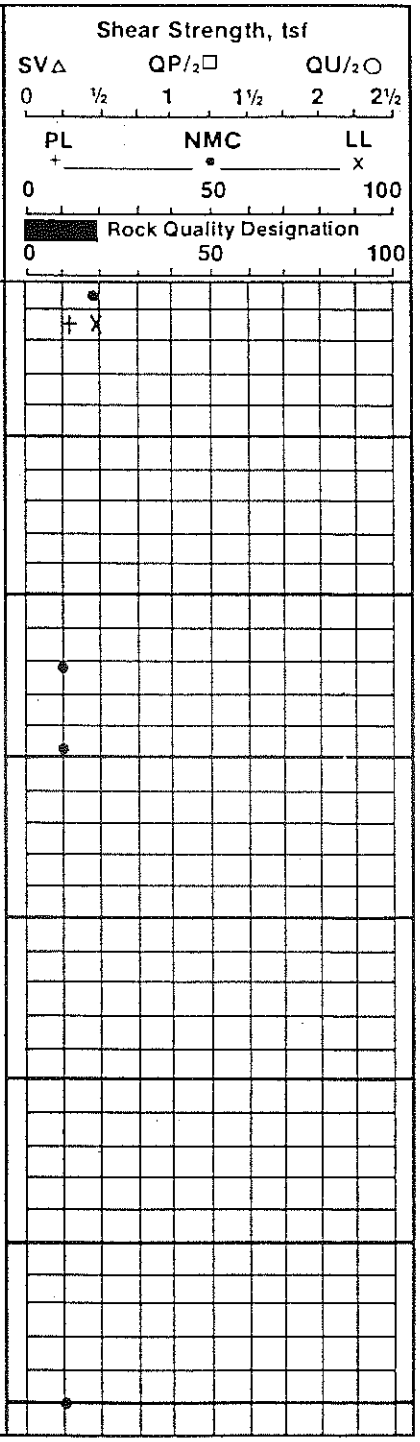
RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-16A
SHEET 1 OF 2

DESCRIPTION OF MATERIALS
(Color Modifier MATERIAL. Classification)
Soil Classification System Unified
Surface Elevation 578.5'

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
					Dark Brown Sandy SILT w/Clay, ML		
	1	HST	60/20				
5					Brown Medium SAND w/Fine Trace Clay, SW-SC		
	2	HST	60/10				
10					Brown Gravelly SAND Trace Clay, SP		
	3	HST	30/3				
					Dark Gray SHALE		
15	4	SS	4/4			50/4"	
20	5	SS	3.5/3.5	1		50/3.5"	
25	6	SS	3/3			50/3"	
30	7	SS	3/1			50/3"	
35	8	SS	2/2			50/2"	



DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/28/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at 8.5 Feet
____Hours after completion ____ Feet
____ after completion ____ Feet
____ after completion ____ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-16A
SHEET 2 OF 2

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL. Classification) Soil Classification System Unified Surface Elevation 578.5'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)	Shear Strength, tsf SV△ QP/2□ QU/2○ 0 ½ 1 1½ 2 2½ PL + NMC • LL x 0 50 100 ▓ Rock Quality Designation 0 50 100
					Dark Gray SHALE -Rock Seam 37.0-37.5'			
40								
	9	SS	2/0		TOB	40/2"		
45					Remarks: 1. Mud Rotary Techniques Used Below 19.5'			

DRILLING METHOD Hollow Auger & Mud Rotary
DATE DRILLED 4/28/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at 8.5 Feet
___ Hours after completion ___ Feet
___ after completion ___ Feet
___ after completion ___ Feet

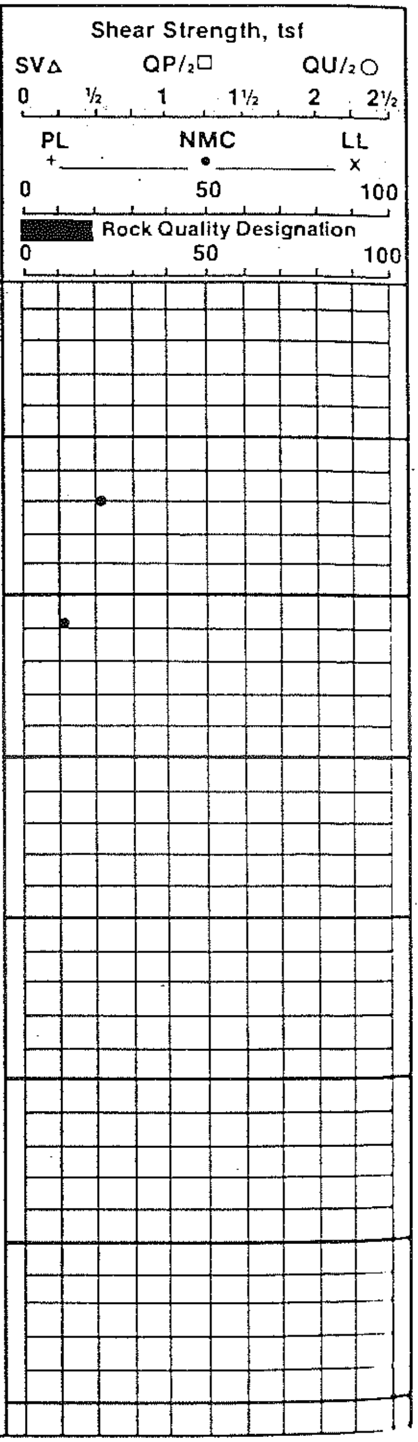
NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

RECORD OF SUBSURFACE EXPLORATION

PROJECT Hydrogeologic Study Number One
Vermilion Power Plant
JOB NO. 11872803

BORING B-16B
SHEET 1 OF 1

DEPTH (ft)	SAMPLE NUMBER	SAMPLE INTERVAL AND TYPE	SAMPLE ADVANCED / RECOVERED (in)	SEE REMARK #	DESCRIPTION OF MATERIALS (Color Modifier MATERIAL, Classification) Soil Classification System Unified Surface Elevation 578.5'	BLOWS (per 6 in)	DRY UNIT WEIGHT (pcf)
					Gray-Brown Silty CLAY, CL		
5							
	1	SS	24/20		Gray Fine-Medium SAND Trace Silt, SM	2-5-4-6	
	2	SS	24/14		Brown Fine Sand w/Clay, Gravel, SC	2-2-3-9	
10					-Becoming Coarser w/Depth		
	3	SS	17/14	1		10-29-50/5"	
					TOB		
					Remark:		
15					1. Hit Shale @ 11.5'±		
20							
25							
30							
35							



DRILLING METHOD Hollow Auger
DATE DRILLED 4/28/87
DRILLED BY Schaffer
LOGGED BY Shively/Jacobi
PIEZOMETER Yes

GROUNDWATER LEVELS

Encountered at - Feet
____Hours after completion ____ Feet
____ after completion ____ Feet
____ after completion ____ Feet

NOTE: Refer to the attached GENERAL NOTES and NOTATION USED ON RECORDS OF SUBSURFACE EXPLORATION for abbreviations, explanations, and qualifications relative to this log.

SOIL BORING LOG INFORMATION

Facility/Project Name Vermilion Power Station	License/Permit/Monitoring Number	Boring Number MW35D	
Boring Drilled By: Name of crew chief (first, last) and Firm Bruno Williamson Ramsey Geotechnical Engineering	Date Drilling Started 3/1/2017	Date Drilling Completed 3/3/2017	Drilling Method rotary/auger
Common Well Name MW35D	Final Static Water Level Feet (NAVD88)	Surface Elevation 581.25 Feet (NAVD88)	Borehole Diameter 7.3 inches

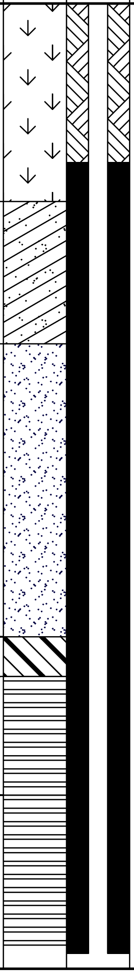
Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,279,955.58 N, 1,151,276.17 E [✓ E]/W
1/4 of 1/4 of Section , T N, R

Lat 40° 10'47.14212"
Long 87° 44' 8.06652"

Local Grid Location
Feet ☐ N ☐ S
Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Vermilion	IL	Danville

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
1 SS	24 16.5	2 2 3 3	1	0 - 2.5' **FILL, SILT:** ML, very dark grayish brown (10YR 3/2), 15-30% silt, trace wood and roots, cohesive, low plasticity, moist.	(FILL) ML						
2 SS	24 19	1 3 3 3	2 3	2.5 - 4.3' **SANDY LEAN CLAY:** s(CL), weak red (2.5YR 4/2), 5-15% fine sand, sand content increasing with depth, low plasticity, moist.	s(CL)						
3 SS	24 21	2 3 4 3	4 5	4.3 - 8' **POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/6), fine sand, 15-30% clay, moist. 5.1' trace clay.							
4 SS	24 18	3 3 3 3	6 7	7.5' trace gravel and cobbles.	SP						Auger bringing up cobbles on flights.
5 SS	24 10	3 4 4 22	8 9	8 - 8.5' **FAT CLAY:** CH, very dark grayish brown (10YR 3/2), trace silt, high plasticity, moist. 8.5 - 10' **Weathered SHALE Bedrock** BDX (SH), very dark grayish brown (10YR 3/2) to very dark greenish gray (GLEY 1 3/10Y), highly weathered, red (7.5YR 4/6) discoloration, fissile, moist.	CH BDX (SH)	0.5					
6 SS	15 15	20 34 50 for 3"	10 11 12	10 - 15.6' **Weathered SHALE Bedrock** to **SHALE:** BDX (SH), gray (GLEY 1 6/N), weak, fissile, intensely fractured, red (7.5YR 4/6) discoloration, dry.	BDX (SH)						



I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL
RESOURCE
TECHNOLOGY

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number MW35D

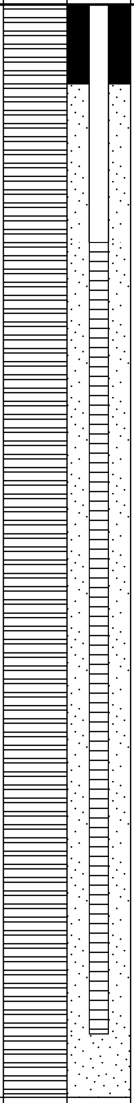
Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	8 9	45 50 for 2"	13	10 - 15.6' **Weathered SHALE Bedrock** to **SHALE:** BDX (SH), gray (GLEY 1 6/N), weak, fissile, intensely fractured, red (7.5YR 4/6) discoloration, dry. *(continued)*										
8 SS	9 7	31 50 for 3"	14 15		BDX (SH)									
9 CORE	120 120		16 17 18 19 20 21 22 23 24 25	15.6 - 45.8' **SHALE:** BDX (SH), dark reddish gray (10YR 4/1) to gray (2.5Y 5/1), microcrystalline, thinly bedded to laminated, weak, slightly decomposed (very dark gray (10YR 3/1) to black (10YR 2/1) discoloration in partly healed fractures), competent, dry to moist in fractures.	BDX (SH)									Core 9, RQD = 89%. Light brown gray return water. 4" diameter outer casing set from 0-16 ft bgs.
10 CORE	131.3 120		26 27 28 29 30 31 32	25.6' partly to totally healed fractures.										Core 10, RQD = 89%. Light gray return water.

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW35D

Page 3 of 3

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
11 CORE	111.1 120		33 34 35 36 37 38 39 40 41 42 43 44 45	15.6 - 45.8' **SHALE:** BDX (SH), dark reddish gray (10YR 4/1) to gray (2.5Y 5/1), microcrystalline, thinly bedded to laminated, weak, slightly decomposed (very dark gray (10YR 3/1) to black (10YR 2/1) discoloration in partly healed fractures), competent, dry to moist in fractures. *(continued)* 41.9' - 43' crossbedding.	BDX (SH)									Core 11, RQD = 93%. Gray return water.
				45.8' End of Boring.										

NATURAL
RESOURCE
TECHNOLOGY

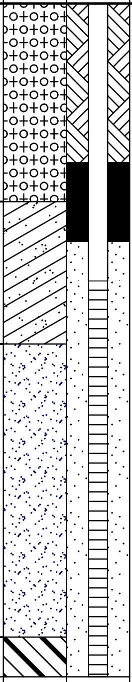
SOIL BORING LOG INFORMATION

Page 1 of 1

Facility/Project Name Vermilion Power Station	License/Permit/Monitoring Number		Boring Number MW35S
Boring Drilled By: Name of crew chief (first, last) and Firm Bruno Williamson Ramsey Geotechnical Engineering	Date Drilling Started 3/1/2017	Date Drilling Completed 3/1/2017	Drilling Method hollow stem auger
Common Well Name MW35S	Final Static Water Level Feet (NAVD88)	Surface Elevation 581.15 Feet (NAVD88)	Borehole Diameter 7.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,279,958.41 N, 1,151,272.97 E [✓ E]/W
1/4 of 1/4 of Section , T N, R
Lat 40° 10'47.17026"
Long 87° 44' 8.10749"
Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County Vermilion	State IL	Civil Town/City/ or Village Danville

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1 2	0 - 2.5' **FILL, SILT:** ML, Blind Drill. See MW35D Boring Log for Detailed Lithology.	(FILL) ML									Blind Drill.
			3 4	2.5 - 4.3' **SANDY LEAN CLAY:** s(CL).	s(CL)									
			5 6 7	4.3 - 8' **POORLY-GRADED SAND:** SP.	SP									
			8	8 - 8.5' **FAT CLAY:** CH.	CH									
				8.5' End of Boring.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

Template: ILLINOIS BORING LOG - Project: 2411 GINT 2017.GPJ

WELL CONSTRUCTION LOGS

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Vermilion Power Station

Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.

Well Name: 70D

Facility License, Permit or Monitoring No.:

Local Grid Origin ☐ (estimated: ☐) or Well Location ☐

Lat. ____ ° ____ ' ____ " Long. ____ ° ____ ' ____ " or

St. Plane 1,278,929 ft. N, 1,150,617 ft. [✓ E]/W

Facility ID:

Date Well Installed: 03/04/2021

Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W

Type of Well: Well Code 12/pz

Well Installed By: (Person's Name and Firm)
Jason Greer
Cascade Drilling

Distance from Waste/Source ____ ft.

State: Illinois

Location of Well Relative to Waste/Source:
u ☐ Upgradient
s ☐ Sidegradient
d ☒ Downgradient
n ☐ Not Known

Gov. Lot Number:

A. Protective pipe, top elevation 595.10 ft. MSL

B. Well casing, top elevation 594.52 ft. MSL

C. Land surface elevation 591.9 ft. MSL

D. Surface seal, bottom 590.9 ft. MSL or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used:
Rotary ☐
Hollow Stem Auger ☐
Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐
Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Potable City Water

E. Bentonite seal, top 557.9 ft. MSL or 34.0 ft.

F. Fine sand, top ____ ft. MSL or ____ ft.

G. Filter pack, top 552.9 ft. MSL or 39.0 ft.

H. Screen joint, top 550.9 ft. MSL or 41.0 ft.

I. Well bottom 540.9 ft. MSL or 51.0 ft.

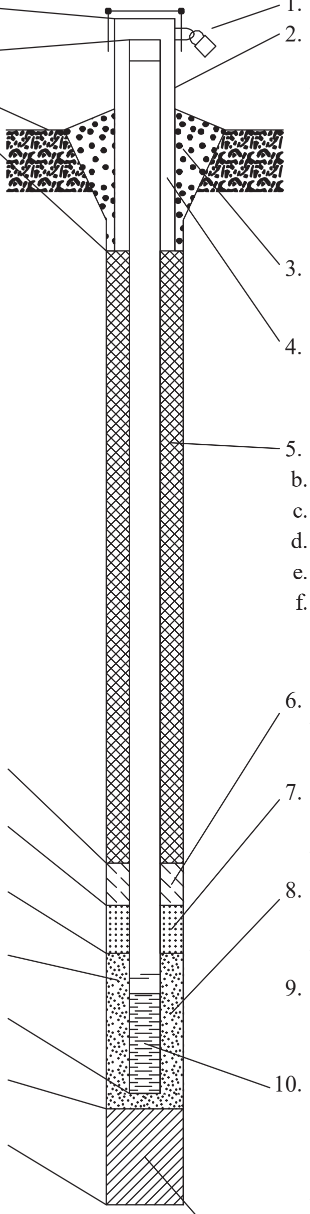
J. Filter pack, bottom 540.9 ft. MSL or 51.0 ft.

K. Borehole, bottom 539.9 ft. MSL or 52.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒
Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: 4 Steel Bollards

3. Surface seal:
Bentonite ☐
Concrete ☒
Other ☐

4. Material between well casing and protective pipe:
Bentonite ☐
Sand Other ☒

5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. 9.2 Lbs/gal mud weight . . . Bentonite slurry ☒
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. ____ Ft^3 volume added for any of the above
f. How installed: Tremie ☐
Tremie pumped ☒
Gravity ☐

6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
a. NA
b. Volume added 0 ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. FILTERSIL 0.85
b. Volume added ____ ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒
Flush threaded PVC schedule 80 ☐
Other ☐

10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒
Continuous slot ☐
Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☐
Formation Materials Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 3/31/2021

Signature

Firm: Ramboll
234 W. Florida Street, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name Vermilion Power Station	Local Grid Location of Well ________ft. ☐ N. ☐ S. ________ft. ☐ E. ☐ W.	Well Name 70SA
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☐ Lat. ___° ___' ___" Long. ___° ___' ___" or St. Plane 1,278,928 ft. N, 1,150,625 ft. E. [✓ E]/W	Date Well Installed 03/04/2021
Facility ID	Section Location of Waste/Source ____1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm) Jason Greer Cascade Drilling
Type of Well Well Code 11/mw	Location of Well Relative to Waste/Source u ☐ Upgradient s ☐ Sidegradient d ☒ Downgradient n ☐ Not Known	Gov. Lot Number
Distance from Waste/ Source ft. | State Illinois		

A. Protective pipe, top elevation 594.08 ft. MSL

B. Well casing, top elevation 593.74 ft. MSL

C. Land surface elevation 591.6 ft. MSL

D. Surface seal, bottom 590.6 ft. MSL or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☒
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used:
Rotary ☐
Hollow Stem Auger ☐
Sonic Other ☒

15. Drilling fluid used: Water ☐ 0 2 Air ☐
Drilling Mud ☐ 0 3 None ☒

16. Drilling additives used? ☐ Yes ☒ No

Describe ____________

17. Source of water (attach analysis, if required):

E. Bentonite seal, top 590.6 ft. MSL or 1.0 ft.

F. Fine sand, top ______ ft. MSL or ______ ft.

G. Filter pack, top 583.6 ft. MSL or 8.0 ft.

H. Screen joint, top 581.6 ft. MSL or 10.0 ft.

I. Well bottom 571.6 ft. MSL or 20.0 ft.

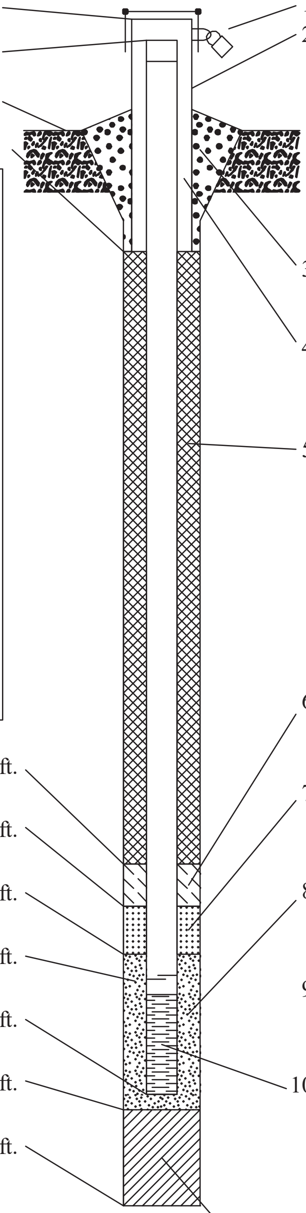
J. Filter pack, bottom 571.6 ft. MSL or 20.0 ft.

K. Borehole, bottom 571.6 ft. MSL or 20.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   - a. Inside diameter: 4.0 in.
   - b. Length: 5.0 ft.
   - c. Material: Steel ☒ Other ☐
   - d. Additional protection? ☒ Yes ☐ No
   - If yes, describe: 4 Steel Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   - b. ______Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   - c. ______Lbs/gal mud weight . . . Bentonite slurry ☐
   - d. ______% Bentonite . . . Bentonite-cement grout ☐
   - e. ______Ft^3 volume added for any of the above
   - f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   - b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   - c. ______ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   - a. NA
   - b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   - a. FILTERSIL 0.85
   - b. Volume added ______ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    - a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    - b. Manufacturer Johnson Screens
    - c. Slot size: 0.010 in.
    - d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 3/31/2021

Signature	Firm Ramboll 234 W. Florida Street, Milwaukee,WI 53204	Tel: (414) 837-3607 Fax: (414) 837-3608

MONITORING WELL CONSTRUCTION

Facility/Project Name: Vermilion Power Station

Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.

Well Name: 71D

Facility License, Permit or Monitoring No.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☐

Lat. ___° ___' ___" Long. ___° ___' ___" or

St. Plane 1,278,993 ft. N, 1,151,334 ft. E. [✓ E]/W

Facility ID

Date Well Installed: 03/03/2021

Section Location of Waste/Source: ___1/4 of ___1/4 of Sec. ___, T. ___ N, R. ___ ☐ E ☐ W

Type of Well: Well Code 12/pz

Well Installed By: (Person's Name and Firm)
Jason Greer
Cascade Drilling

Distance from Waste/Source ___ ft.

State: Illinois

Location of Well Relative to Waste/Source:
u ☐ Upgradient s ☐ Sidegradient
d ☒ Downgradient n ☐ Not Known

Gov. Lot Number

A. Protective pipe, top elevation 580.25 ft. MSL

B. Well casing, top elevation 579.89 ft. MSL

C. Land surface elevation 577.2 ft. MSL

D. Surface seal, bottom 576.2 ft. MSL or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐
Hollow Stem Auger ☐
Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐
Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Potable City Water

E. Bentonite seal, top 551.2 ft. MSL or 26.0 ft.

F. Fine sand, top ____ ft. MSL or ____ ft.

G. Filter pack, top 549.2 ft. MSL or 28.0 ft.

H. Screen joint, top 547.2 ft. MSL or 30.0 ft.

I. Well bottom 537.2 ft. MSL or 40.0 ft.

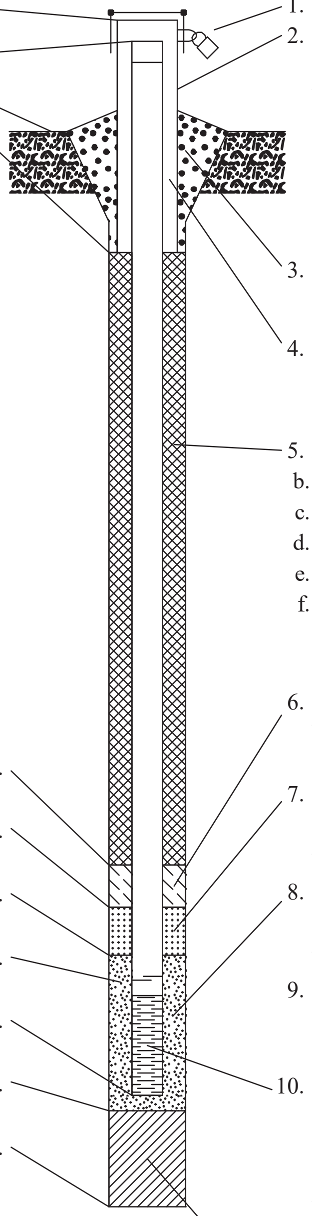
J. Filter pack, bottom 537.2 ft. MSL or 40.0 ft.

K. Borehole, bottom 537.2 ft. MSL or 40.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒
   Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: 4 Steel Bollards

3. Surface seal: Bentonite ☐
Concrete ☒
Other ☐

4. Material between well casing and protective pipe:
Bentonite ☐
Sand Other ☒

5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. 9.5 Lbs/gal mud weight . . . Bentonite slurry ☒
   d. ____% Bentonite . . . Bentonite-cement grout ☐
   e. ____Ft^3 volume added for any of the above
   f. How installed: Tremie ☐
   Tremie pumped ☒
   Gravity ☐

6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
   a. NA
   b. Volume added 0 ft^3

8. Filter pack material: Manufacturer, product name & mesh size
   a. FILTERSIL 0.85
   b. Volume added ____ ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒
Flush threaded PVC schedule 80 ☐
Other ☐

10. Screen material: Schedule 40 PVC
   a. Screen Type: Factory cut ☒
   Continuous slot ☐
   Other ☐
   b. Manufacturer Johnson Screens
   c. Slot size: 0.010 in.
   d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☒
Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 3/31/2021

Signature

Firm
Ramboll
234 W. Florida Street, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name Vermilion Power Station	Local Grid Location of Well _____ft. ☐ N. ☐ S. _____ft. ☐ E. ☐ W.	Well Name
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☐ Lat. ___ ° ___ ' ___ " Long. ___ ° ___ ' ___ " or	71S
Facility ID	St. Plane 1,278,988 ft. N, 1,151,333 ft. E. [✓ E]/W	Date Well Installed 03/03/2021
Type of Well Well Code 11/mw	Section Location of Waste/Source ____1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm) Jason Greer
Distance from Waste/ Source ft. | State Illinois	Location of Well Relative to Waste/Source u ☐ Upgradient s ☐ Sidegradient d ☒ Downgradient n ☐ Not Known | Gov. Lot Number	Cascade Drilling

A. Protective pipe, top elevation 579.80 ft. MSL

B. Well casing, top elevation 579.56 ft. MSL

C. Land surface elevation 577.2 ft. MSL

D. Surface seal, bottom 576.2 ft. MSL or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☒
SM ☐ SC ☐ ML ☐ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐
Hollow Stem Auger ☐
Sonic Other ☒

15. Drilling fluid used: Water ☐ 0 2 Air ☐
Drilling Mud ☐ 0 3 None ☒

16. Drilling additives used? ☐ Yes ☒ No

Describe __________

17. Source of water (attach analysis, if required):

E. Bentonite seal, top 576.2 ft. MSL or 1.0 ft.

F. Fine sand, top ____ ft. MSL or ____ ft.

G. Filter pack, top 573.7 ft. MSL or 3.5 ft.

H. Screen joint, top 571.7 ft. MSL or 5.5 ft.

I. Well bottom 566.7 ft. MSL or 10.5 ft.

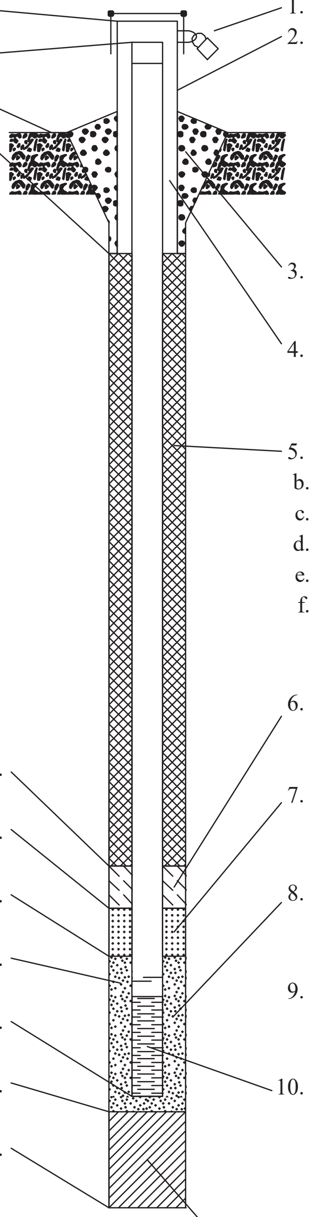
J. Filter pack, bottom 566.7 ft. MSL or 10.5 ft.

K. Borehole, bottom 566.2 ft. MSL or 11.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒
   Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: 4 Steel Bollards

3. Surface seal: Bentonite ☐
Concrete ☒
Other ☐

4. Material between well casing and protective pipe:
Bentonite ☐
Sand Other ☒

5. Annular space seal: a. Granular/Chipped Bentonite ☒
b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ____Lbs/gal mud weight . . . Bentonite slurry ☐
d. ____% Bentonite . . . Bentonite-cement grout ☐
e. ____Ft^3 volume added for any of the above
f. How installed: Tremie ☐
Tremie pumped ☐
Gravity ☒

6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
a. NA
b. Volume added 0 ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. FILTERSIL 0.85
b. Volume added ____ ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒
Flush threaded PVC schedule 80 ☐
Other ☐

10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒
Continuous slot ☐
Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 5.0 ft.

11. Backfill material (below filter pack): None ☐
Formation Materials Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 3/31/2021

Signature	Firm Ramboll 234 W. Florida Street, Milwaukee,WI 53204	Tel: (414) 837-3607 Fax: (414) 837-3608

Illinois Environmental Protection Agency

Well Completion Report

Site #: ______ County: Vermilion Well #: NED1

Site Name: Vermilion Power Station Borehole #: NED1

State Plane Coordinate: X 1,150,574.4 Y 1,279,841.7 (or) Latitude: 40° 10' 46.060" Longitude: 87° 44' 17.120"

Surveyed By: Kyle J. Nolan IL Registration #: 035-003919

Drilling Contractor: Ramsey Geotechnical Engineering, LLC Driller: B Williamson

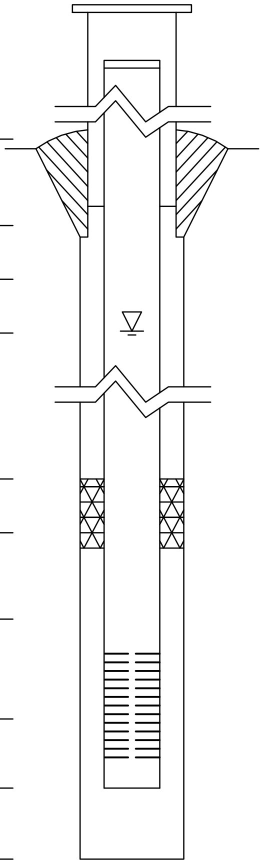
Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow stem auger Drilling Fluid (Type): none

Logged By: Joe Kimlinger Date Started: 2/12/2019 Date Finished: 2/12/2019

Report Form Completed By: Rhonald W. Hasenyager Date: 3/6/2019

ANNULAR SPACE DETAILS



Type of Surface Seal: Bentonite chips

Type of Annular Sealant: ______

Installation Method: ______

Setting Time: ______

Type of Bentonite Seal -- [✓ Granular] Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: +24 hrs.

Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: ______ (if applicable)

Installation Method: ______

Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
		Top of Protective Casing
599.87	-1.94	Top of Riser Pipe
597.93	0.00	Ground Surface
		Top of Annular Sealant
595.84	2.09	Static Water Level (After Completion) 2/20/2019
597.93	0.00	Top of Seal
594.43	3.50	Top of Sand Pack
592.61	5.32	Top of Screen
582.98	14.95	Bottom of Screen
582.49	15.44	Bottom of Well
582.49	15.44	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	n/a
Riser Pipe Length	(feet)	7.26
Bottom of Screen to End Cap	(feet)	0.49
Screen Length (1st slot to last slot)	(feet)	9.63
Total Length of Casing	(feet)	17.38
Screen Slot Size **	(inches)	0.010

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: [✓ None]
Riser Pipe Above W.T.	SS304	SS316	PTFE	[✓ PVC]	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	[✓ PVC]	OTHER:
Screen	SS304	SS316	PTFE	[✓ PVC]	OTHER:

Well Completion Form (revised 02/06/02)

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency

Well Completion Report

Site #:
County: Vermilion
Well #: NED2

Site Name: Vermilion Power Station
Borehole #: NED2

State Plane Coordinate: X 1,150,619.3 Y 1,279,587.4 (or) Latitude: 40° 10' 43.550" Longitude: 87° 44' 16.560"

Surveyed By: Kyle J. Nolan
IL Registration #: 035-003919

Drilling Contractor: Ramsey Geotechnical Engineering, LLC
Driller: B Williamson

Consulting Firm: Hanson Professional Services Inc.
Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow stem auger
Drilling Fluid (Type): none

Logged By: Joe Kimlinger
Date Started: 2/12/2019 Date Finished: 2/12/2019

Report Form Completed By: Rhonald W. Hasenyager
Date: 3/6/2019

ANNULAR SPACE DETAILS

Type of Surface Seal: Bentonite chips

Type of Annular Sealant:

Installation Method:

Setting Time:

Type of Bentonite Seal -- [✓ Granular] Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: +24 hrs.

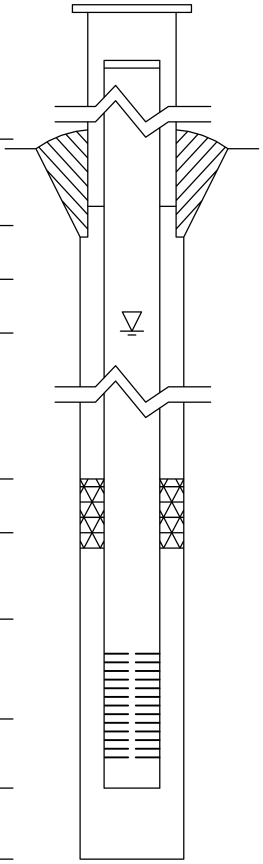
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: (if applicable)

Installation Method:



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
		Top of Protective Casing
600.81	-1.98	Top of Riser Pipe
598.83	0.00	Ground Surface
		Top of Annular Sealant
597.12	1.71	Static Water Level (After Completion) 2/20/2019
598.83	0.00	Top of Seal
596.03	2.80	Top of Sand Pack
593.94	4.89	Top of Screen
584.38	14.45	Bottom of Screen
583.89	14.94	Bottom of Well
583.89	14.94	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	n/a
Riser Pipe Length	(feet)	6.87
Bottom of Screen to End Cap	(feet)	0.49
Screen Length (1st slot to last slot)	(feet)	9.56
Total Length of Casing	(feet)	16.92
Screen Slot Size **	(inches)	0.010

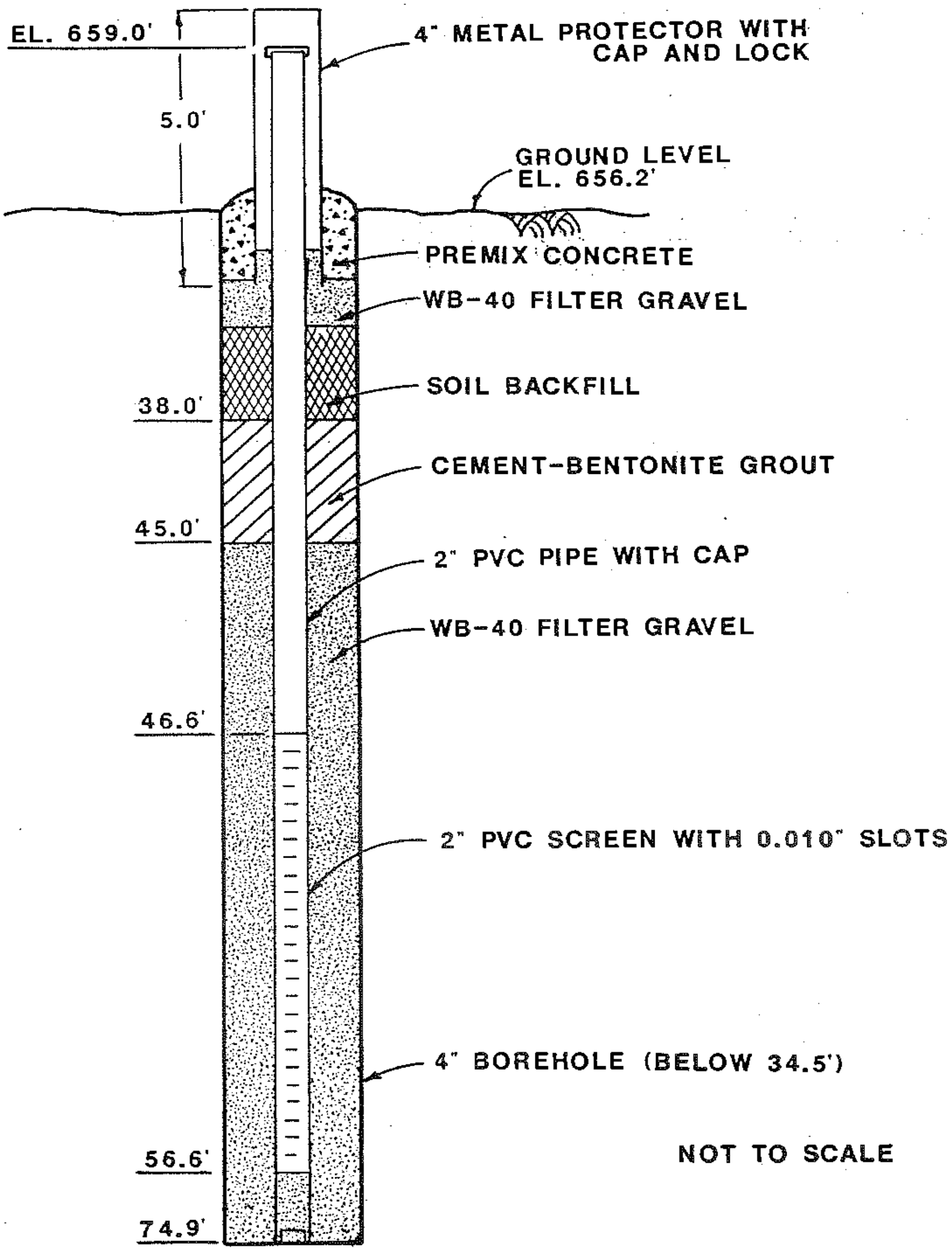
WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: [✓ None]
Riser Pipe Above W.T.	SS304	SS316	PTFE	[✓ PVC]	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	[✓ PVC]	OTHER:
Screen	SS304	SS316	PTFE	[✓ PVC]	OTHER:

Well Completion Form (revised 02/06/02)

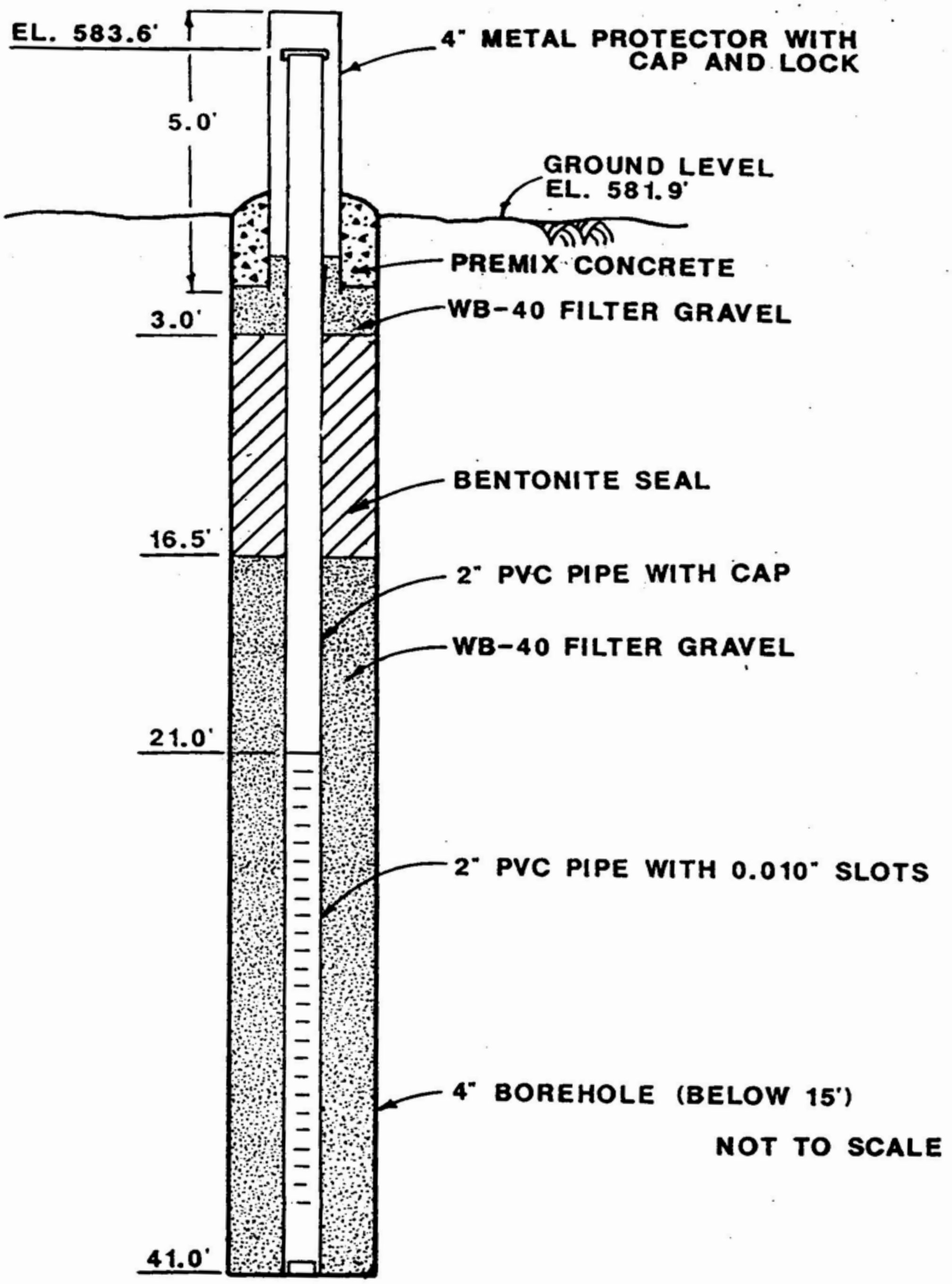
**Hand-Slotted Well Screens Are Unacceptable



NOT TO SCALE

Mathes Geotechnical Services, Inc.	
ILLINOIS POWER COMPANY VERMILION POWER STATION PIEZOMETER 10	
11872803	FIGURE 7a

MW-13A

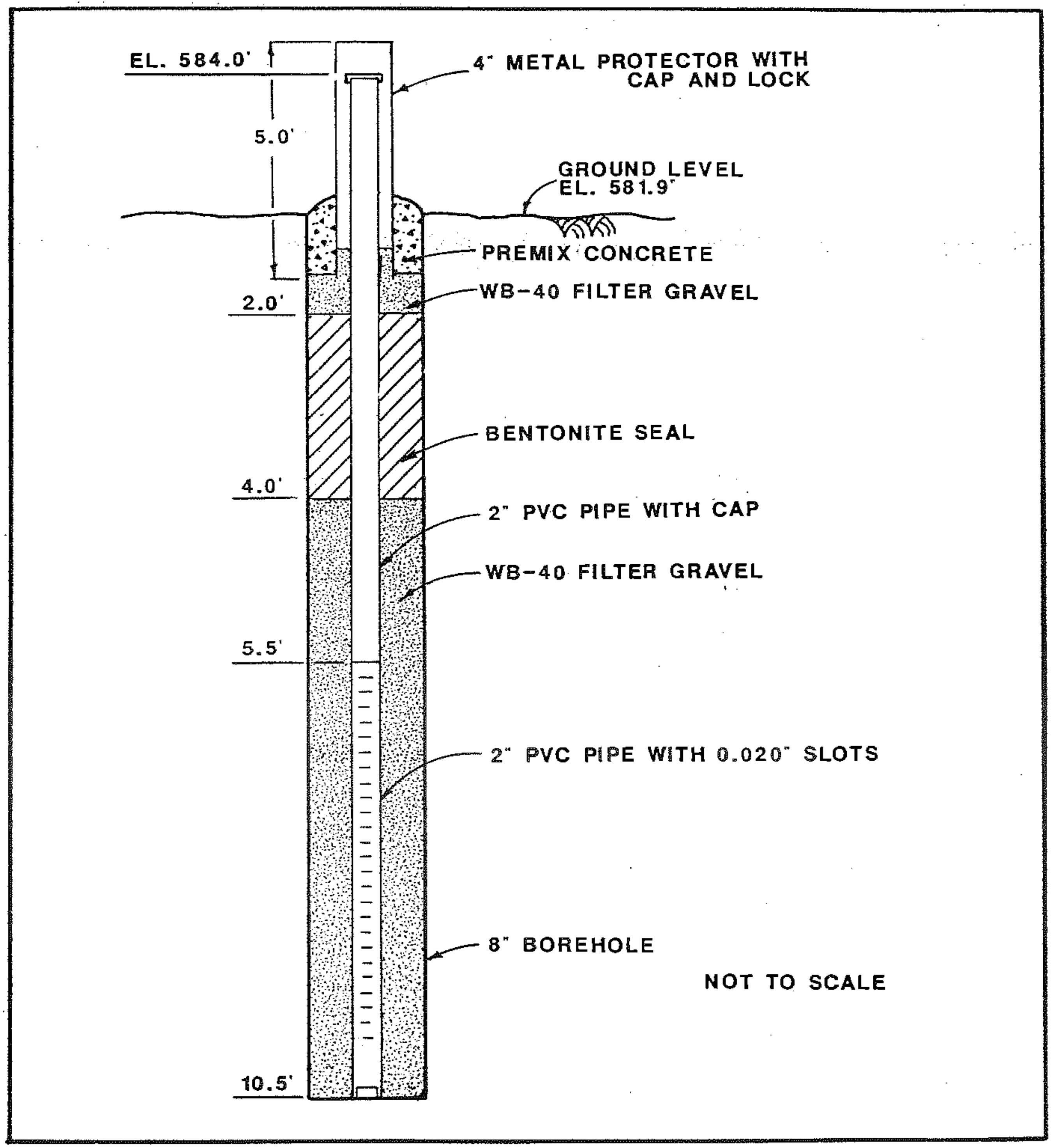


Mathes Geotechnical Services, Inc.

ILLINOIS POWER COMPANY
VERMILION POWER STATION
PIEZOMETER 13A

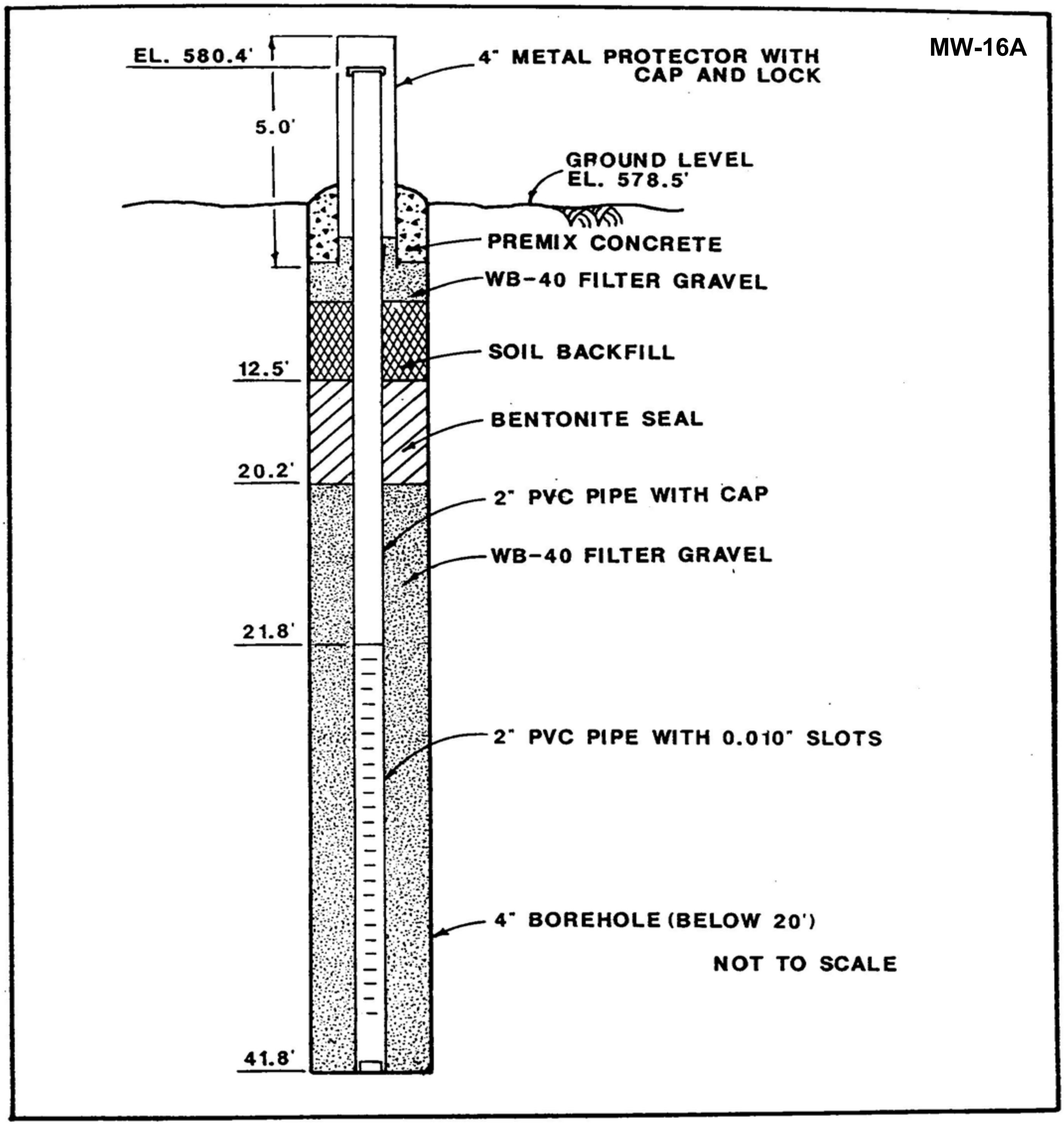
11872803

FIGURE 7f



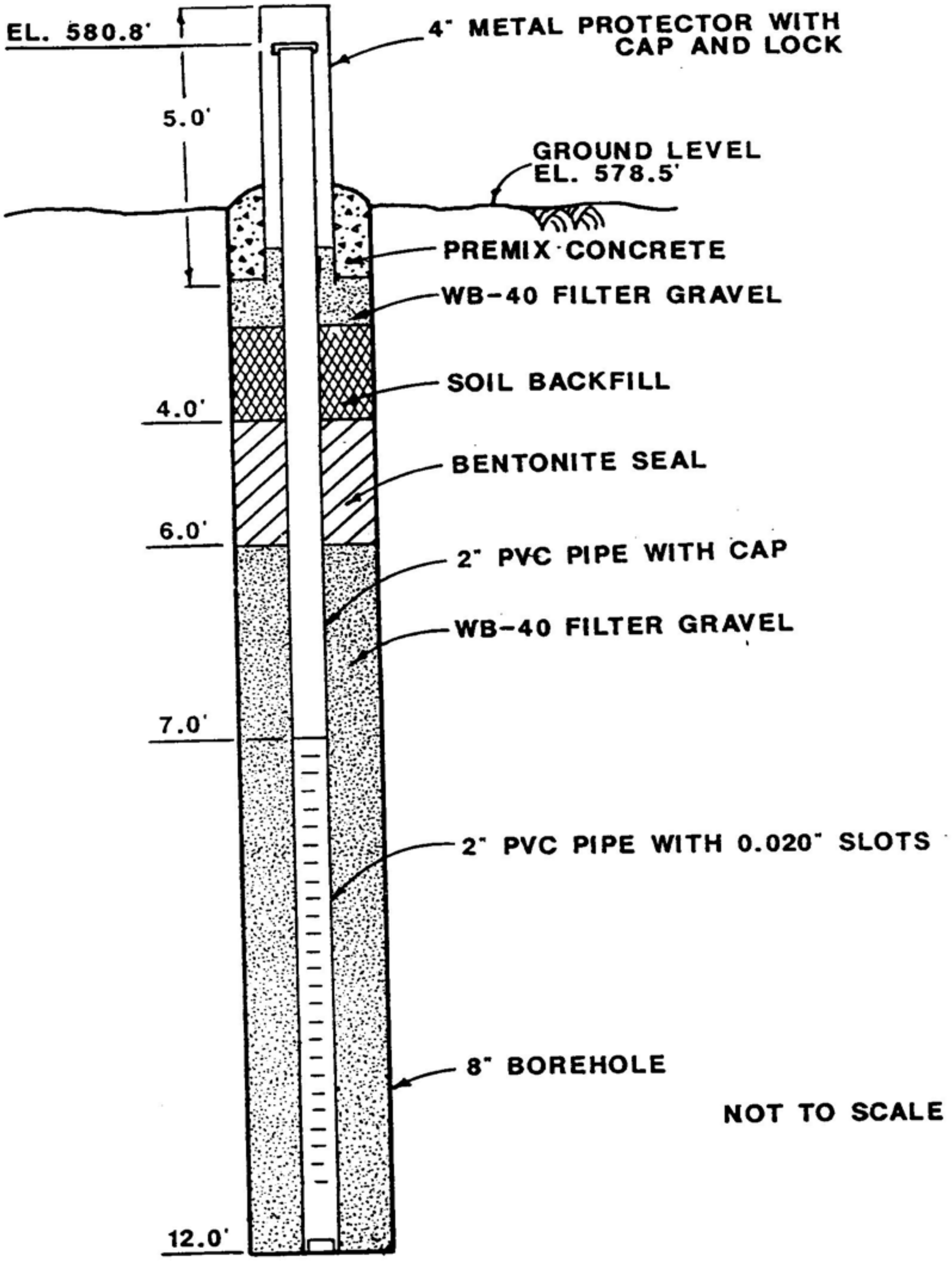
Mathes Geotechnical Services, Inc.
ILLINOIS POWER COMPANY VERMILION POWER STATION PIEZOMETER 13B

11872803	FIGURE 7g



Mathes Geotechnical Services, Inc.	
ILLINOIS POWER COMPANY VERMILION POWER STATION PIEZOMETER 16 A	
11872803	FIGURE 7m

MW-16B



NOT TO SCALE

Mathes Geotechnical Services, Inc.
ILLINOIS POWER COMPANY VERMILION POWER STATION PIEZOMETER 16B

11872803	FIGURE 7n

NATURAL
RESOURCE
TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Vermilion Power Station

Local Grid Location of Well: ______ft. ☐ N. ☐ S. ______ft. ☐ E. ☐ W.

Well Name: MW35D

Facility License, Permit or Monitoring No.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☒

Lat. 40° 10' 47.142" Long. 87° 44' 8.067" or

Facility ID

St. Plane 1,279,955.58 ft. N, 1,151,276.17 ft. E. [✓ E]/W

Date Well Installed: 03/03/2017

Section Location of Waste/Source: ____1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W

Type of Well: mw

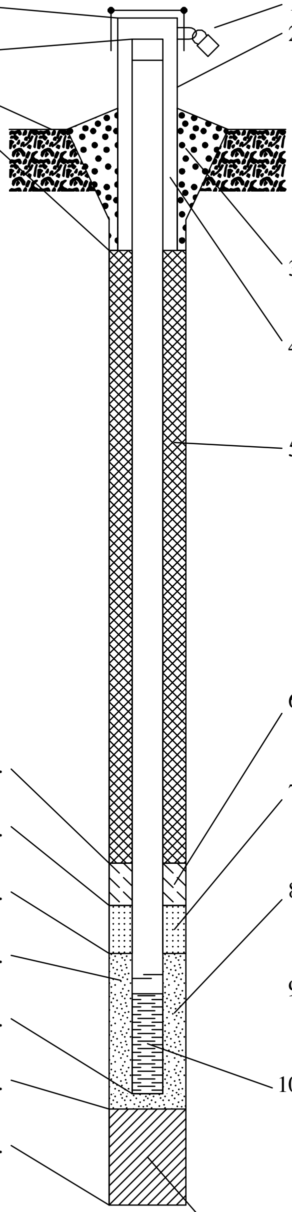
Well Installed By: (Person's Name and Firm)
Bruno Williamson
Ramsey Geotechnical Engineering

Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known

Gov. Lot Number

Distance from Waste/Source ft.

State: IL



A. Protective pipe, top elevation ______ ft. MSL

B. Well casing, top elevation 584.15 ft. MSL

C. Land surface elevation 581.25 ft. MSL

D. Surface seal, bottom 579.3 ft. MSL or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐
Hollow Stem Auger ☐
HSA / Rotary Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐
Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis, if required):
City of Champaign

E. Bentonite seal, top 551.3 ft. MSL or 30.0 ft.

F. Fine sand, top ______ ft. MSL or ______ ft.

G. Filter pack, top 548.3 ft. MSL or 33.0 ft.

H. Screen joint, top 546.3 ft. MSL or 35.0 ft.

I. Well bottom 536.3 ft. MSL or 45.0 ft.

J. Filter pack, bottom 535.5 ft. MSL or 45.8 ft.

K. Borehole, bottom 535.5 ft. MSL or 45.8 ft.

L. Borehole, diameter 7.3 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 1.99 in.

1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
   a. Inside diameter: 6.0 in.
   b. Length: 6.0 ft.
   c. Material: Steel ☒
   ______ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: 4" diameter protective PVC casing

3. Surface seal: Bentonite ☐
   Concrete ☒
   ______ Other ☐

4. Material between well casing and protective pipe:
   Bentonite ☒
   Sand Other ☒

5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ______Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ______Lbs/gal mud weight . . . Bentonite slurry ☐
   d. 30 % Bentonite . . . Bentonite-cement grout ☒
   e. ______Ft^3 volume added for any of the above
   f. How installed: Tremie ☒
   Tremie pumped ☐
   Gravity ☐

6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ______ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
   a. ______
   b. Volume added ______ ft^3

8. Filter pack material: Manufacturer, product name & mesh size
   a. NSF Quartz Sand #10-20
   b. Volume added ______ ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒
   Flush threaded PVC schedule 80 ☐
   ______ Other ☐

10. Screen material: Schedule 40 PVC
   a. Screen Type: Factory cut ☒
   Continuous slot ☐
   ______ Other ☐
   b. Manufacturer ______
   c. Slot size: 0.100 in.
   d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☒
   ______ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 4/6/2017

Signature

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL
RESOURCE
TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Vermilion Power Station

Local Grid Location of Well: ______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.

Well Name: MW35S

Facility License, Permit or Monitoring No.:

Local Grid Origin ☐ (estimated: ☐) or Well Location ☒

Lat. 40° 10' 47.170" Long. 87° 44' 8.107" or

Facility ID:

St. Plane 1,279,958.41 ft. N, 1,151,272.97 ft. E. [✓ E]/W

Date Well Installed: 03/01/2017

Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W

Type of Well: mw

Well Installed By: (Person's Name and Firm)
Bruno Williamson
Ramsey Geotechnical Engineering

Distance from Waste/Source: ft.

State: IL

Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known

Gov. Lot Number:

A. Protective pipe, top elevation ______ ft. MSL

B. Well casing, top elevation 584.79 ft. MSL

C. Land surface elevation 581.15 ft. MSL

D. Surface seal, bottom 579.2 ft. MSL or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☒
SM ☐ SC ☐ ML ☐ MH ☐ CL ☒ CH ☒
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐
Hollow Stem Auger ☒
______ Other ☐

15. Drilling fluid used: Water ☐ 0 2 Air ☐
Drilling Mud ☐ 0 3 None ☒

16. Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis, if required):

E. Bentonite seal, top 579.2 ft. MSL or 2.0 ft.

F. Fine sand, top ______ ft. MSL or ______ ft.

G. Filter pack, top 578.2 ft. MSL or 3.0 ft.

H. Screen joint, top 577.7 ft. MSL or 3.5 ft.

I. Well bottom 572.7 ft. MSL or 8.5 ft.

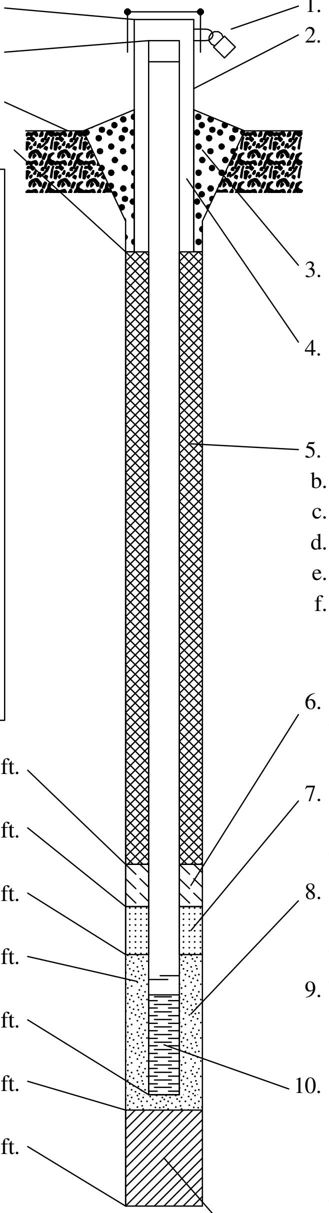
J. Filter pack, bottom 572.7 ft. MSL or 8.5 ft.

K. Borehole, bottom 572.7 ft. MSL or 8.5 ft.

L. Borehole, diameter 7.3 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 1.99 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 6.0 ft.
   c. Material: Steel ☒
   ______ Other ☐
   d. Additional protection? ☐ Yes ☒ No
   If yes, describe: ______
3. Surface seal: Bentonite ☐
   Concrete ☒
   ______ Other ☐
4. Material between well casing and protective pipe:
   Bentonite ☒
   Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. ______ Ft^3 volume added for any of the above
   f. How installed: Tremie ☒
   Tremie pumped ☐
   Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ______ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ______
   b. Volume added ______ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. NSF Quartz Sand #10-20
   b. Volume added ______ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒
   Flush threaded PVC schedule 80 ☐
   ______ Other ☐
10. Screen material: Schedule 40 PVC
   a. Screen Type: Factory cut ☒
   Continuous slot ☐
   ______ Other ☐
   b. Manufacturer ______
   c. Slot size: 0.100 in.
   d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☒
   ______ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 4/6/2017

Signature

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

APPENDIX C
GEOTECHNICAL LABORATORY REPORTS

TERRACON GEOTECHNICAL REPORT

Terracon

May 21, 2021

Mr. Scott Woods
Ramboll Environ U.S. Corporation
333 West Wacker Drive, Ste 2700
Chicago, IL 60606-2872

RE: Laboratory Testing Program for the Vermilion Power Station Project – Terracon Project No. 11215020

Dear Mr. Woods,

We are pleased to submit our report pertaining to geotechnical laboratory testing of twenty-five (25) soil samples in reference to the Vermilion Power Station Project. As instructed, Terracon performed the following tests on each of the samples:

- Specific Gravity of Soils – ASTM D854
- Water Content of Soil and Rock – ASTM D2216
- Liquid Limit, Plastic Limit and Plasticity Index of Soils – ASTM D4318
- Permeability of Granular Soils (Constant Head) – ASTM D 2434 *
- Hydraulic Conductivity of Saturated Porous Materials Using a Flexible-Wall Permeameter – ASTM D5084
- Laboratory Determination of Density (Unit Weight) of Soil Specimens – ASTM D7263
- Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis – ASTM D6913
- Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis – ASTM D7928

Seven samples, originally scheduled for hydraulic conductivity tests following ASTM D5084, did not meet the flow criteria for the standard because of the granular matrix of the samples. Instead the tests were run following ASTM D 2434 which allows for greater permeant flow through the specimen.

The test data included in this report, only represent the samples tested and may not reflect actual site materials and/or conditions. The scope of services provided by Terracon did not include interpretation of the laboratory test data, and therefore, we are not liable for any interpretation performed by others. If you wish us to provide you with this service, we would be happy to discuss this matter with you at your convenience. Any reproduction of this report must be done in its entirety.

We are pleased to have the opportunity to provide you with our testing services. Should you have any questions, or require additional assistance, please feel free to contact us at any time.

Sincerely,
Terracon Consultants, Inc.

William P. Quinn

William P. Quinn
Department Manager – Laboratory Services

Attachments:

Terracon

LABORATORY TESTING SUMMARY

PROJECT NAME: Vermillion Power Station

PROJECT NUMBER: 11215020

CLIENT: Ramboll

Boring Number	Sample Number	Depth	Description	USCS	WC %	Dry Density (pcf)	% Gravel	% Sand	% Silt	% Clay	LL	PL	PI	Permeability k (cm/sec)	Specific Gravity
MW-37	0945	5.0'-7.0'	DARK BROWN SANDY LEAN CLAY	CL	19.3	105.8	0.0	39.5	39.8	20.7	27	17	10	4.79E-06	2.697
MW-37	N/A	18.5'-19.0'	GRAY CLAYEY SAND	SC	3.1	122.7	8.2	50.6	23.6	17.6	19	11	8	5.07E-06	2.664
MW-37	1100	25.0'-27.0'	GRAY AND GRAYISH BROWN POORLY GRADED SAND WITH SILT	SP-SM	17.7	98.5	1.4	87.3	8.6	2.7	9	11	NP	2.13E-04	2.684
MW-37	1300	35.5'-36.0'	GRAY AND BROWN SILTY CLAYEY SAND	SC-SM	9.9	130.5	4.2	47.6	29.7	18.5	17	11	6	3.35E-05	2.655
MW-37	1415	50.5'-51.0'	GRAYISH BROWN POORLY GRADED SAND WITH SILTY CLAY	SP-SC	17.7	96.2	0.0	93.1	4.1	2.8	13	7	6	8.16E-04	2.645
MW-37	1500	55.0'-57.0'	GRAY LEAN CLAY - SAND SEAMS NOTED	CL	23.8	101.4	0.0	1.9	62.5	35.6	31	18	13	5.44E-08	2.694
MW-38	0835	5.0'-7.0'	BROWN SILTY SAND	SM	17.1	108.3	0.0	55.6	30.6	13.8	17	14	3	2.20E-06	2.645
MW-38	0910	21.5'-22.0'	BROWNISH GRAY POORLY GRADED SAND WITH SILTY CLAY	SP-SC	12.6	97.2	4.7	86.1	5.2	4.0	11	7	4	1.67E-04	2.706
MW-38	1655	35.0'-37.0'	GRAY SANDY LEAN CLAY - SILT SEAMS NOTED	CL	12.6	125.6	3.9	35.1	39.5	21.5	21	12	9	3.11E-08	2.697
MW-41	0945	8.0'-10.0'	GRAY TRACE BROWN SANDY LEAN CLAY - SAND SEAMS NOTED	CL	12.8	127.7	0.7	43.9	29.5	25.9	23	11	12	3.46E-08	2.718
MW-41	1045	25.0'-25.5'	BROWN POORLY GRADED SAND	SP	16.0	90.5	0.0	95.6	1.6	2.8	13	4	9	2.37E-03	2.651
MW-41	1130	35.0'-37.0'	GRAYISH BROWN SANDY SILTY CLAY	CL-ML	12.3	122.9	0.7	42.9	39.7	16.7	20	14	6	5.74E-07	2.712
MW-43	1330	35.0'-37.0'	GRAY AND GRAYISH BROWN SANDY LEAN CLAY	CL	11.8	128.7	0.0	43.5	30.9	25.6	21	11	10	2.17E-08	2.701
MW-43	1400	50.0'-52.0'	GRAY LEAN CLAY WITH SAND - SAND SEAMS NOTED	CL	16.3	117.1	0.0	23.2	50.5	26.3	28	16	12	1.39E-07	2.687
MW-43	1500	61.0'-61.5'	BROWNISH GRAY LEAN CLAY	CL	22.4	105.2	0.0	0.8	64.9	34.3	33	21	12	4.17E-07	2.684
MW-70SA	1615	16.5'-17.0'	BROWN AND DARK BROWN SILTY SAND	SM	20.8	99.6	0.1	60.0	23.9	16.0	12	12	NP	5.15E-04	2.655
MW-71S	1615	10.0'-10.5'	GRAY POORLY GRADED SAND	SP	20.8	93.2	0.0	95.3	1.7	3.0	17	10	7	1.26E-03	2.653
MW-103	1110	15.0'-17.0'	BROWN AND GRAYISH BROWN LEAN CLAY WITH SAND	CL	16.6	116.8	0.0	14.7	38.6	46.7	30	15	15	3.61E-08	2.702
MW-103	0915	95.5'-96.0'	BROWN AND GRAY SANDY SILTY CLAY	CL-ML	13.9	128.4	0.0	48.2	24.8	27.0	17	10	7	9.35E-06	2.706
MW-103	1150	130.5'-131.0'	GRAY SILTY CLAYEY SAND WITH GRAVEL	SC-SM	8.9	98.8	37.1	50.3	6.9	5.7	16	11	5	2.19E-05	2.688
MW-103	1350	132.5'-133.0'	GRAY AND BROWN POORLY GRADED SAND WITH SILTY CLAY	SP-SC	15.3	95.2	0.0	94.3	2.5	3.2	14	7	7	8.17E-05	2.677
MW-103	1420	140.5'-141.0'	BROWNISH GRAY SANDY LEAN CLAY	CL	10.8	127.5	0.0	42.6	29.2	28.2	23	11	12	3.82E-07	2.704
MW-103	0810	163.0'-163.5'	GRAY SILTY CLAYEY SAND	SC-SM	13.8	109.5	0.0	64.8	19.4	15.8	17	11	6	4.31E-06	2.676
XCM-02	1500	15.5'-16.0'	DARK GRAY SILT	ML	30.7	88.1	0.0	5.1	69.3	25.6	26	28	NP	8.86E-06	2.667
XCM-02	1600	36.0'-36.5'	DARK GRAY ELASTIC SILT WITH SAND	MH	64.2	61.2	0.3	17.8	71.6	10.3	53	57	NP	3.30E-05	2.656

Specific Gravity of Soils
ASTM D854

Terracon
Consulting Engineers & Scientists

SPECIFIC GRAVITY OF SOIL SOLIDS

ASTM D-854

AASHTO T 100

Laboratory Services Group 192 Exchange Blvd. Glendale Heights, Illinois 60139 Ph. (630) 717-4263

Project Number: 11215019
Project Name: Vermillion Power Station
Test Date: 4/1/2021

Results Summary

Boring / Sample	Sample Number	Depth (ft)		Specific Gravity (Gs)
MW-37	0945	5.0'-7.0'		2.697
MW-37	0	18.5'-19.0'		2.664
MW-37	1100	25.0'-27.0'		2.684
MW-37	1300	35.5'-36.0'		2.655
MW-37	1415	50.5'-51.0'		2.645
MW-37	1500	55.0'-57.0'		2.694
MW-38	0835	5.0'-7.0'		2.645
MW-38	0910	21.5'-22.0'		2.706
MW-38	1655	35.0'-37.0'		2.697
MW-41	0945	8.0'-10.0'		2.718
MW-41	1045	25.0'-25.5'		2.651
MW-41	1130	35.0'-37.0'		2.712
MW-43	1330	35.0'-37.0'		2.701
MW-43	1400	50.0'-52.0'		2.687
MW-43	1500	61.0'-61.5'		2.684
MW-70SA	1615	15.5'-17.0'		2.655
MW-71S	1615	10.0'-10.5'		2.653

Tested By: SJH

Checked By: WPQ

Terracon
Consulting Engineers & Scientists

SPECIFIC GRAVITY OF SOIL SOLIDS

ASTM D-854

AASHTO T 100

Laboratory Services Group **192 Exchange Blvd.** **Glendale Heights, Illinois 60139** **Ph. (630) 717-4263**

Project Number: 11215019
Project Name: Vermillion Power Station
Test Date: 4/1/2021

Results Summary

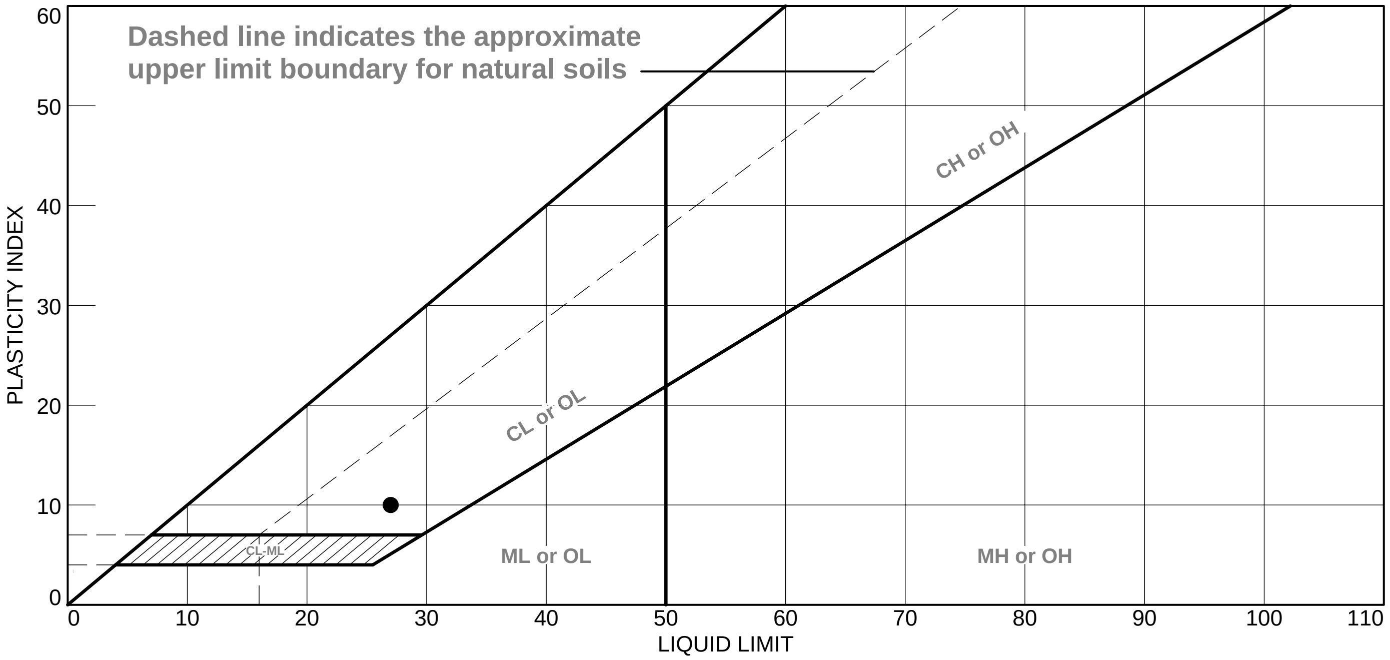
Boring / Sample	Sample Number	Depth (ft)		Specific Gravity (Gs)
MW-103	1110	15.0'-17.0'		2.702
MW-103	0915	95.5'-96.0'		2.706
MW-103	1150	130.5'-131.0'		2.688
MW-103	1350	132.5'-133.0'		2.667
MW-103	1420	140.5'-141.0'		2.704
MW-103	0810	163.0'-163.5'		2.676
XCM-02	1500	15.5'-16.0'		2.667
XCM-02	1600	36.0'-36.5'		2.656

Tested By: SJH

Checked By: WPQ

Liquid Limit, Plastic Limit and Plasticity Index of Soils
ASTM D4318

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK BROWN SANDY LEAN CLAY	27	17	10	99.0	60.5	CL

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

Source of Sample: MW-37 **Depth:** 5.0'-7.0'
Sample Number: 0945

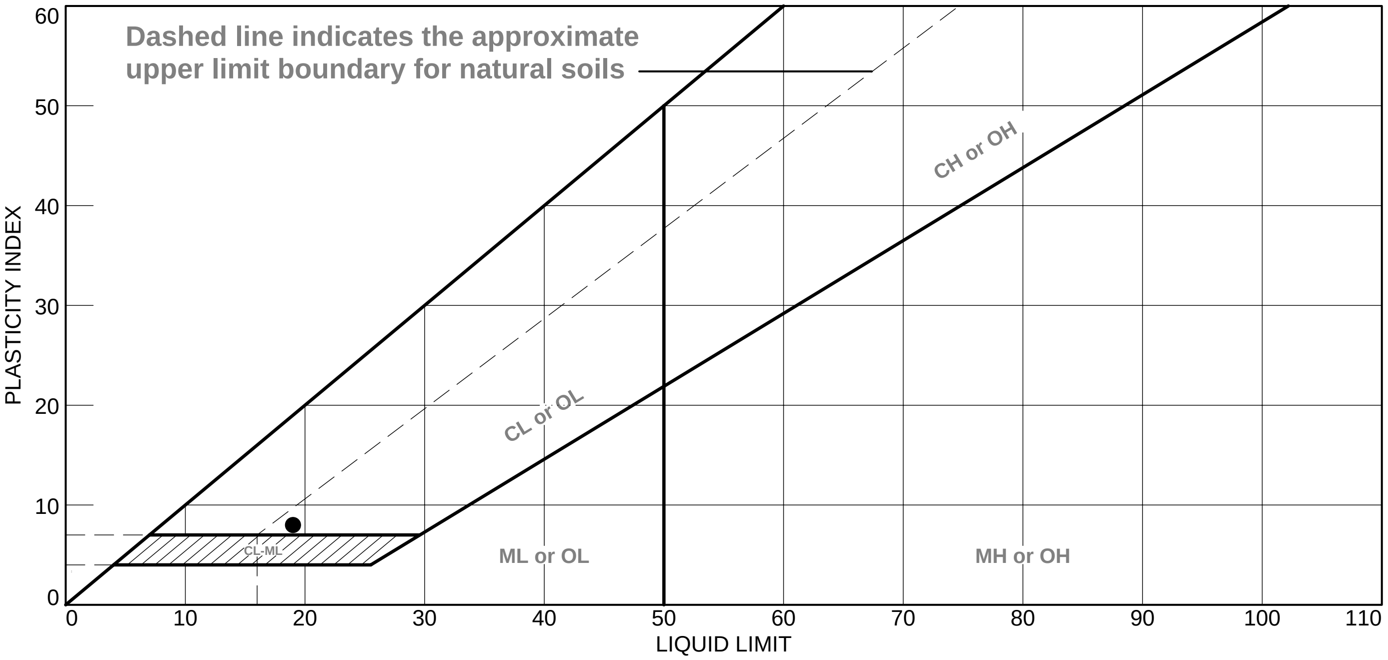
Terracon

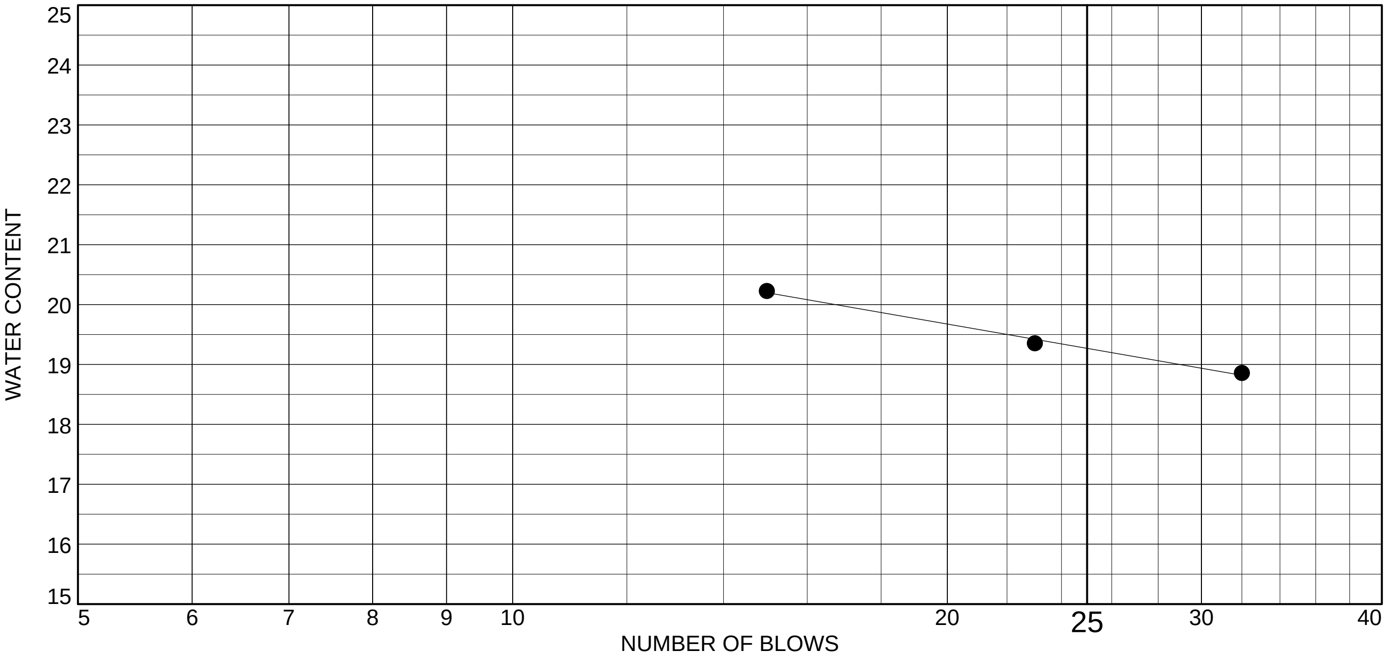
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY CLAYEY SAND	19	11	8	72.0	41.2	SC

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

Source of Sample: MW-37 **Depth:** 18.5'-19.0'
Sample Number: N/A

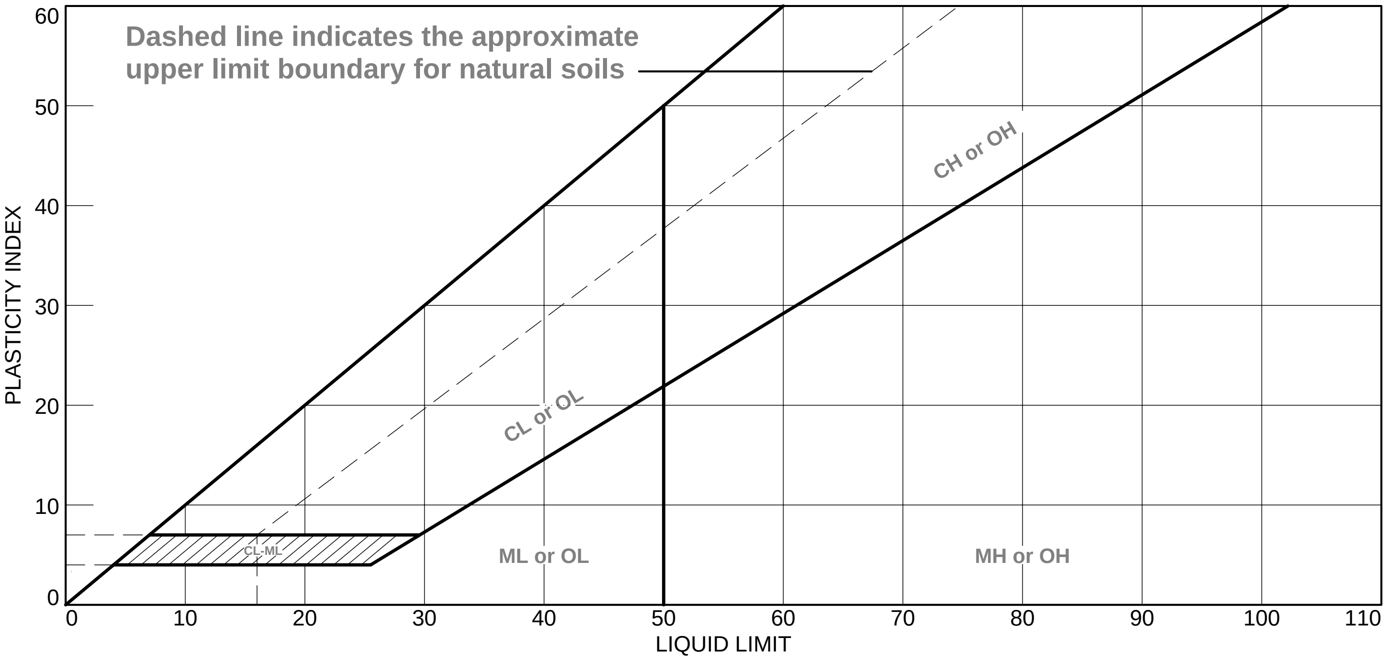
Terracon

Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY AND GRAYISH BROWN POORLY GRADED SAND WITH SILT	9	11	NP	68.0	11.3	SP-SM

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

Source of Sample: MW-37 **Depth:** 25.0'-27.0'
Sample Number: 1100

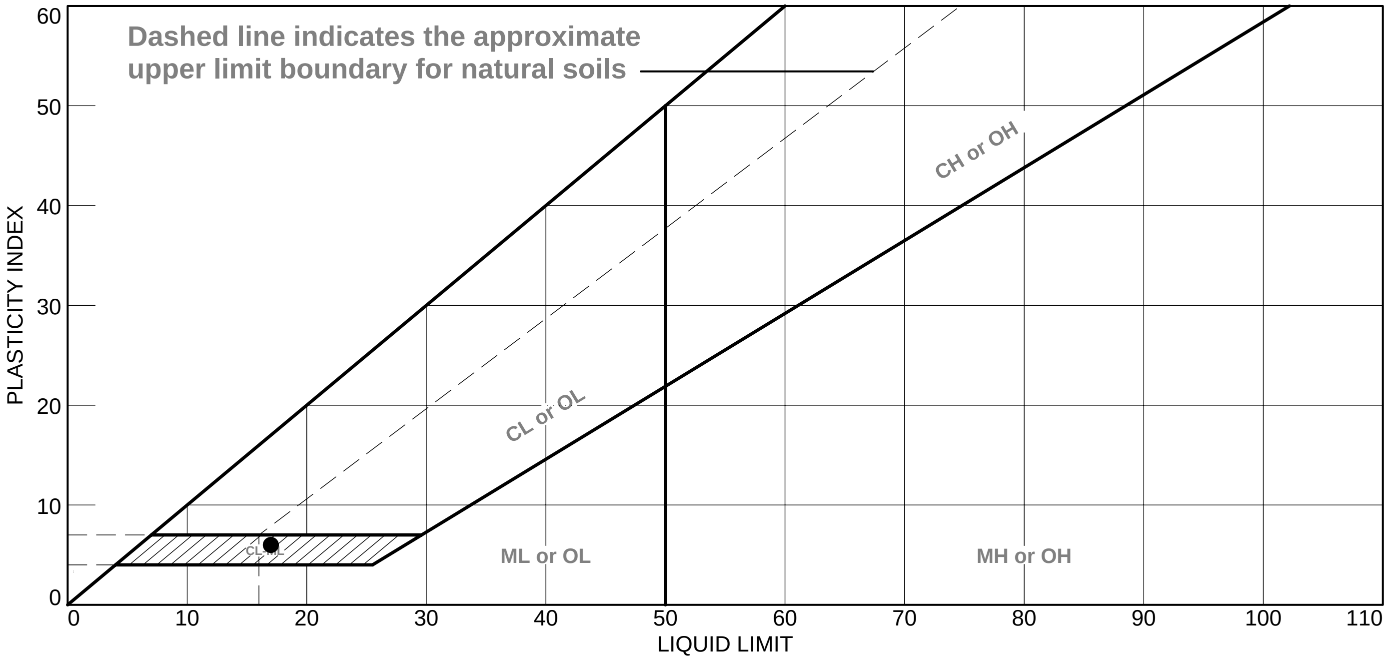
Terracon

Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY AND BROWN SILTY CLAYEY SAND	17	11	6	82.9	48.2	SC-SM

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

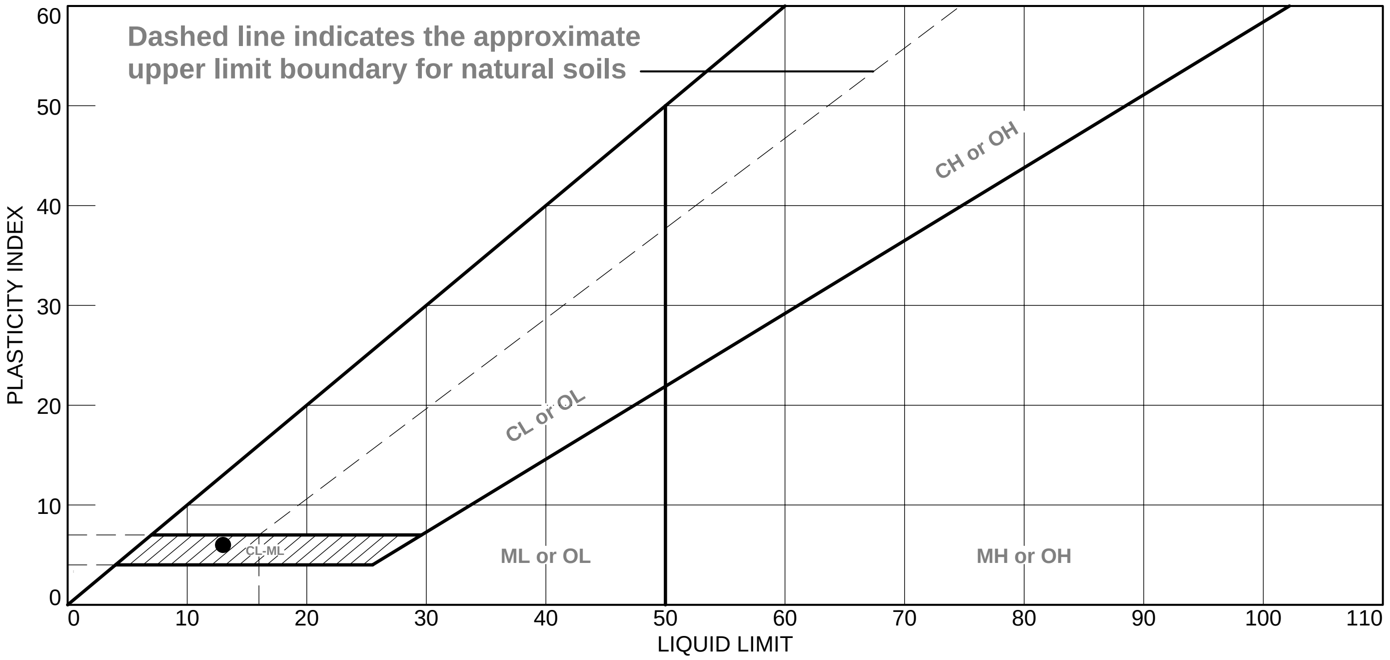
Source of Sample: MW-37 **Depth:** 35.5'-36.0'
Sample Number: 1300

Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAYISH BROWN POORLY GRADED SAND WITH SILTY CLAY	13	7	6	97.3	6.9	SP-SC

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

Source of Sample: MW-37 **Depth:** 50.5'-51.0'
Sample Number: 1415

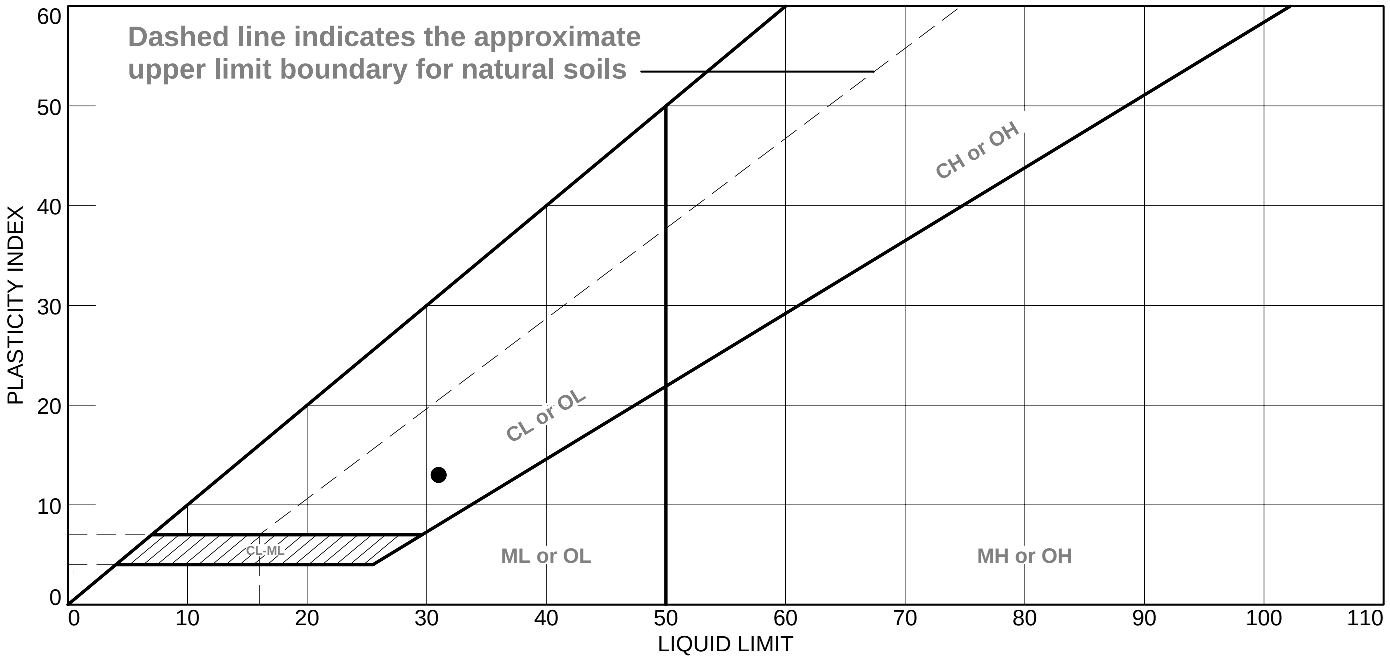
Terracon

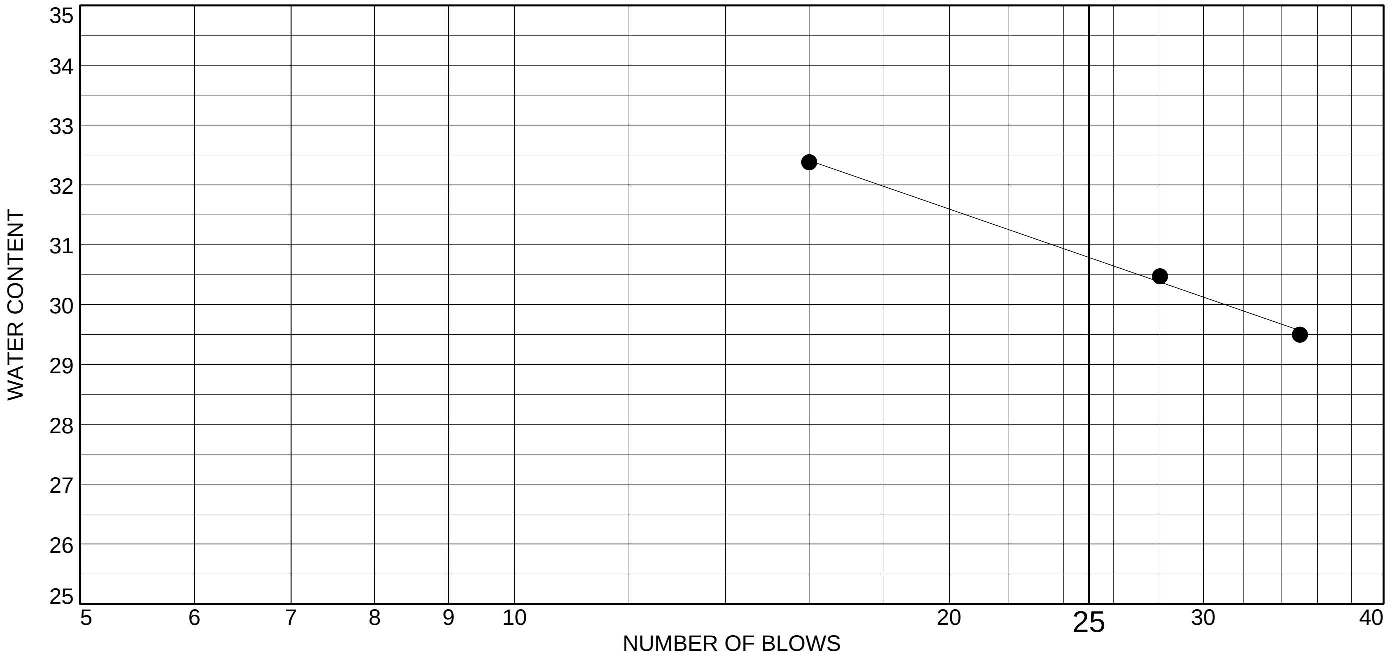
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY LEAN CLAY - SAND SEAMS NOTED	31	18	13	99.7	98.1	CL

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

Source of Sample: MW-37 **Depth:** 55.0'-57.0'
Sample Number: 1500

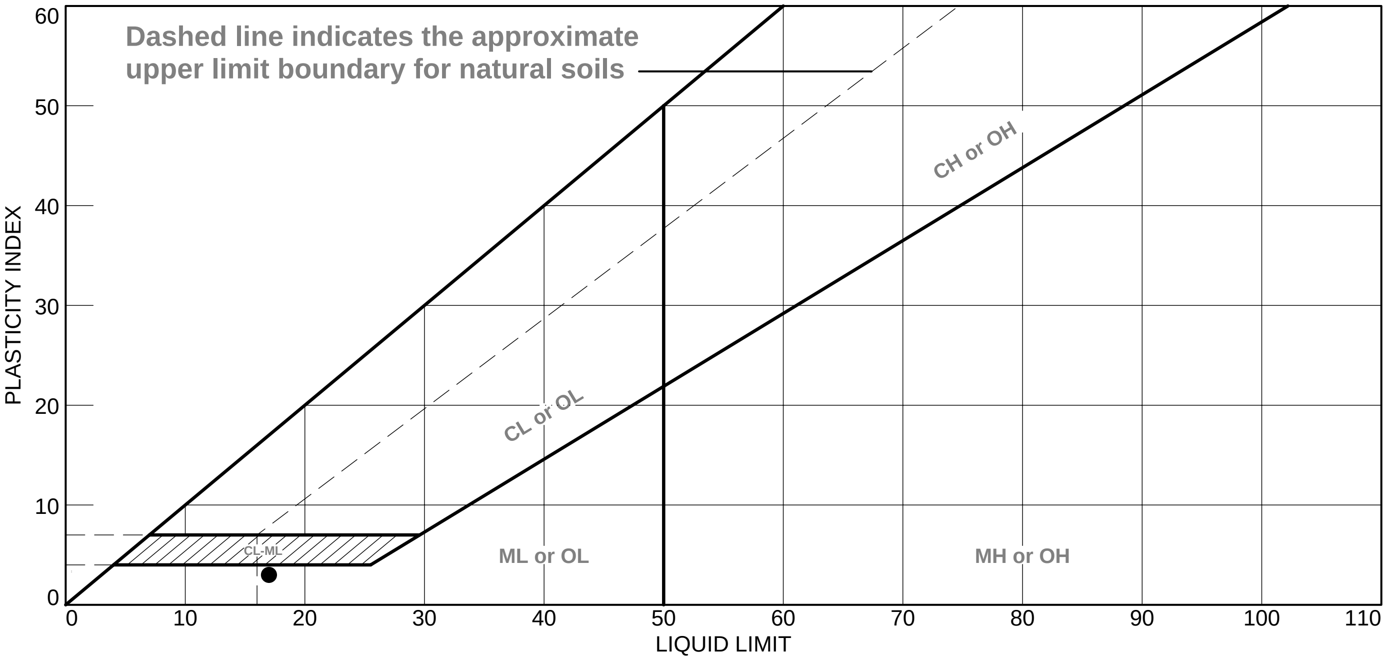
Terracon

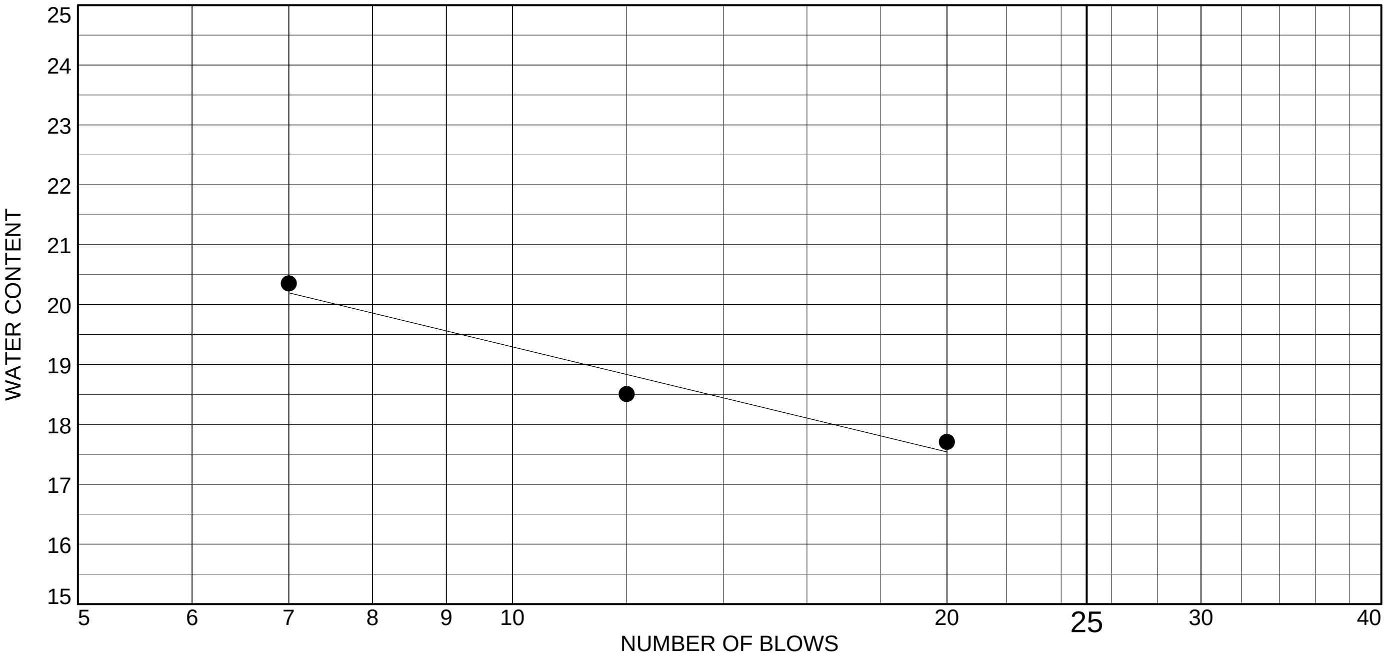
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN SILTY SAND	17	14	3	98.9	44.4	SM

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

Source of Sample: MW-38 **Depth:** 5.0'-7.0'
Sample Number: 0835

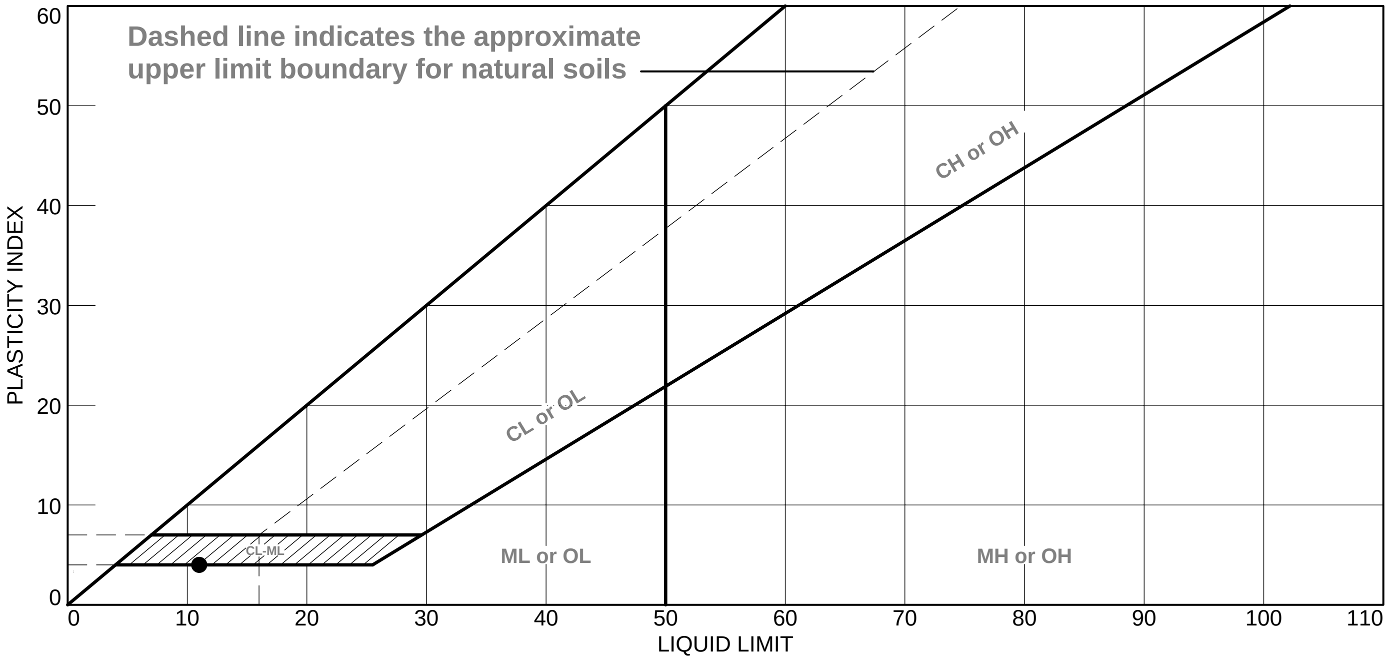
Terracon

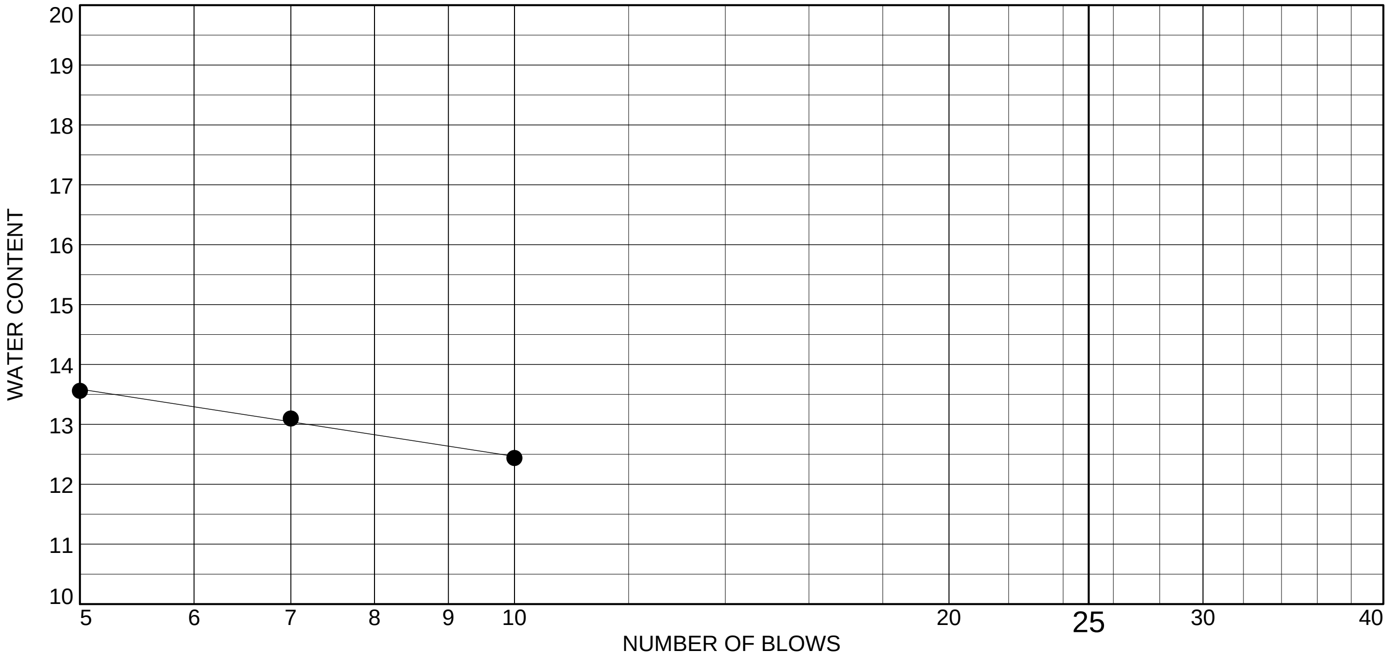
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWNISH GRAY POORLY GRADED SAND WITH SILTY CLAY	11	7	4	57.1	9.2	SP-SC

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

Source of Sample: MW-38 **Depth:** 21.5'-22.0'
Sample Number: 0910

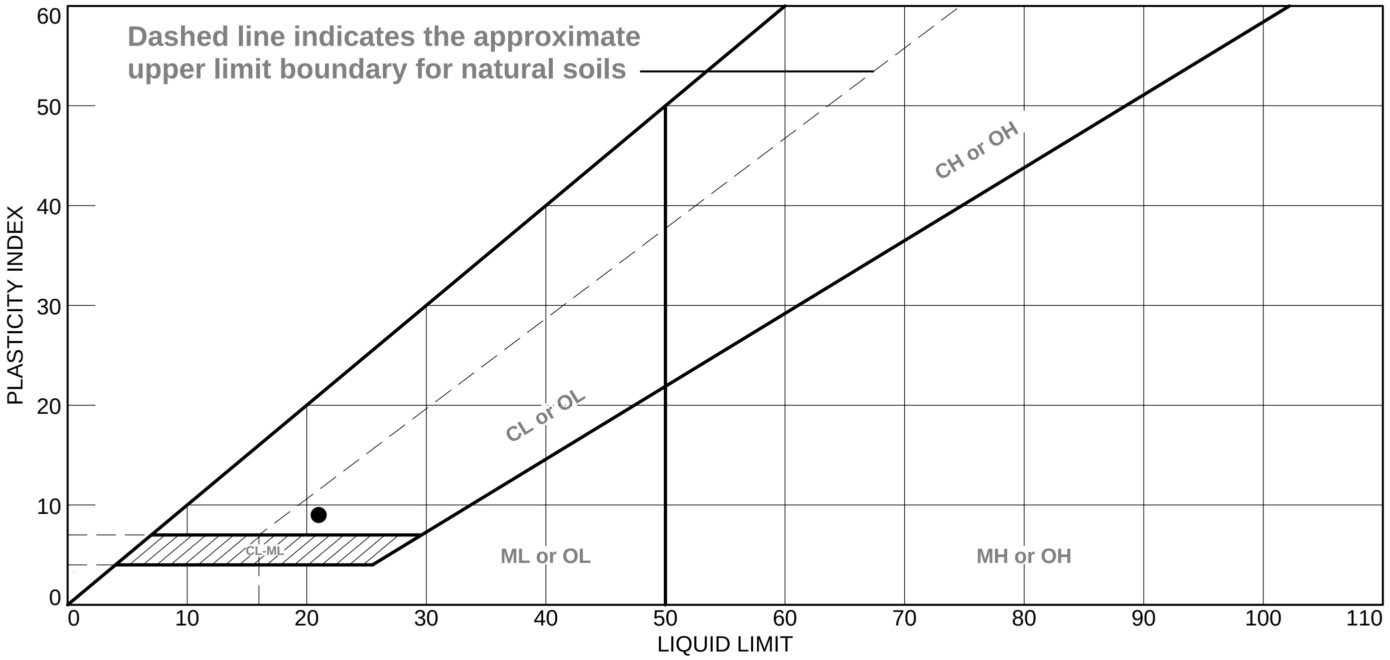
Terracon

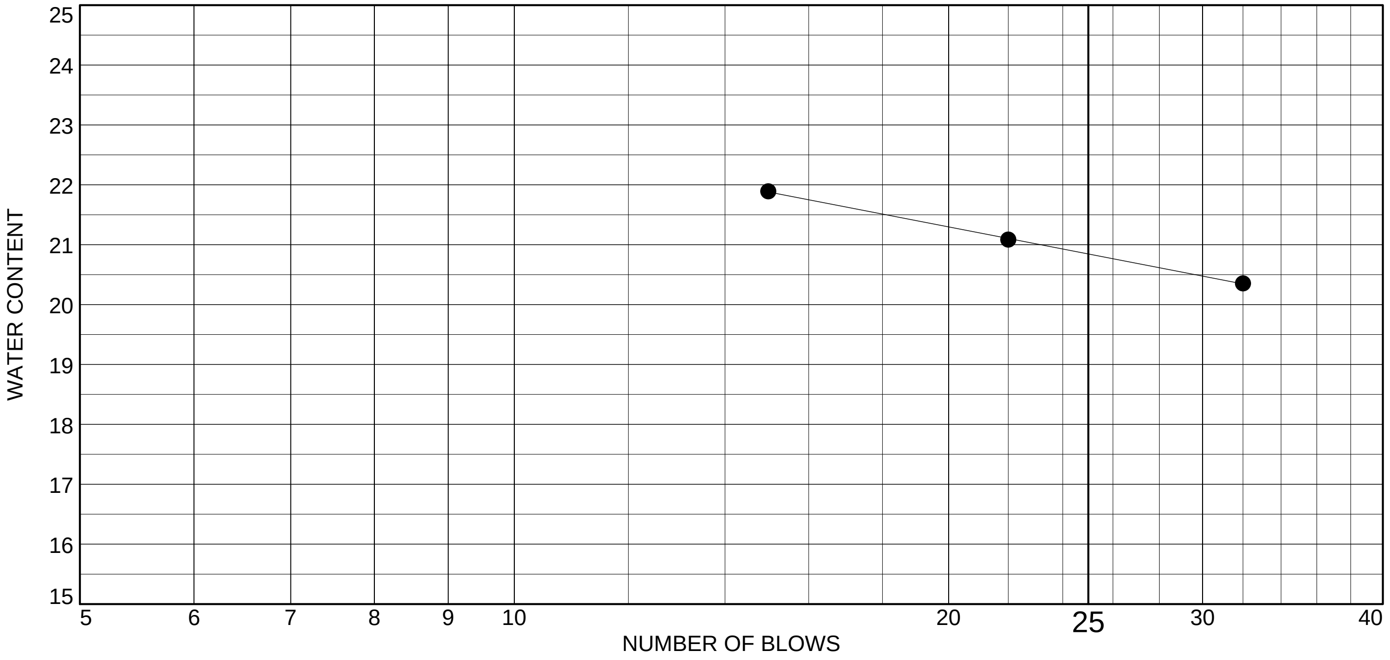
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY SANDY LEAN CLAY - SILT SEAMS NOTED	21	12	9	84.9	61.0	CL

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

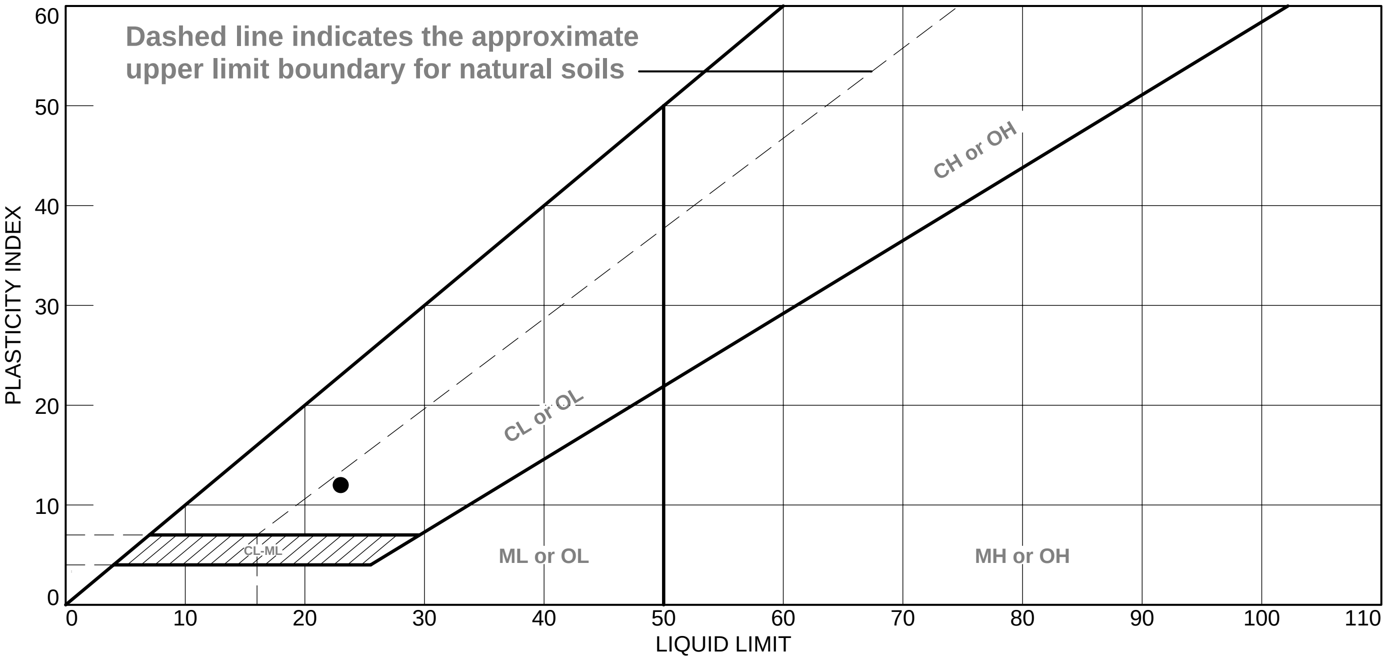
Source of Sample: MW-38 **Depth:** 35.0'-37.0'
Sample Number: 1655

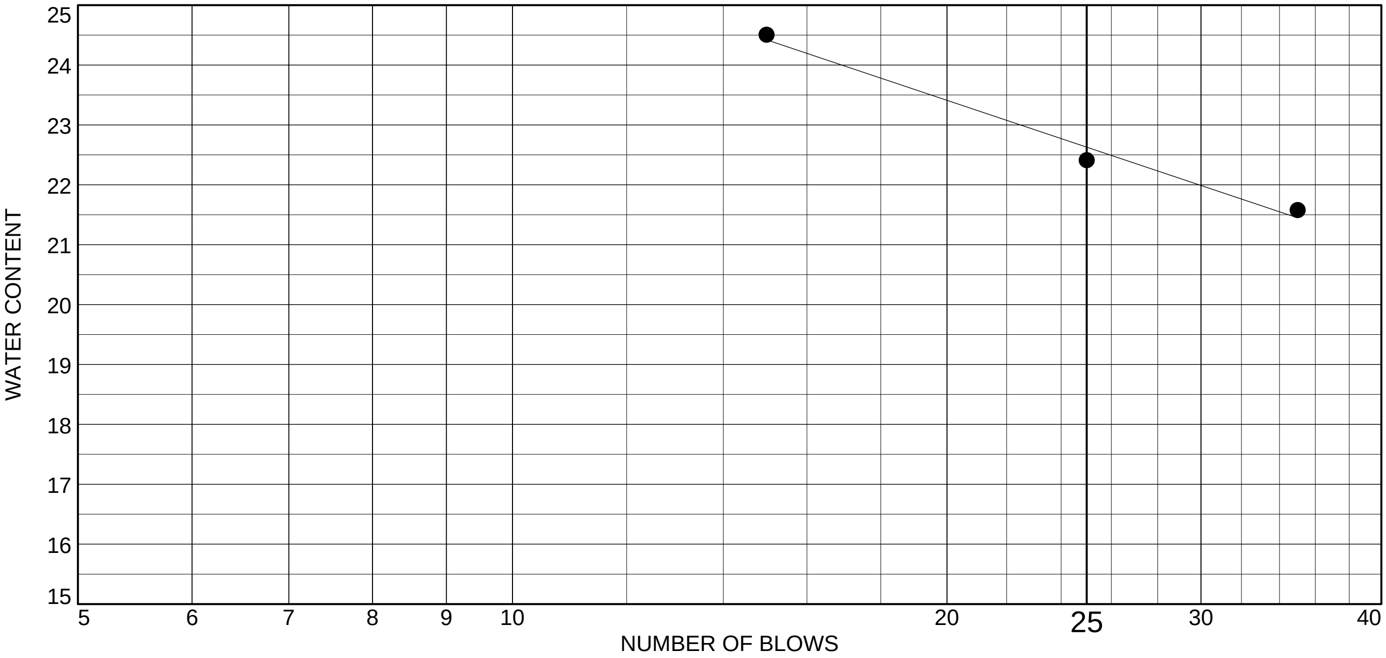
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY TRACE BROWN SANDY LEAN CLAY - SAND SEAMS NOTED	23	11	12	84.7	55.4	CL

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

Source of Sample: MW-41 **Depth:** 8.0'-10.0'
Sample Number: 0945

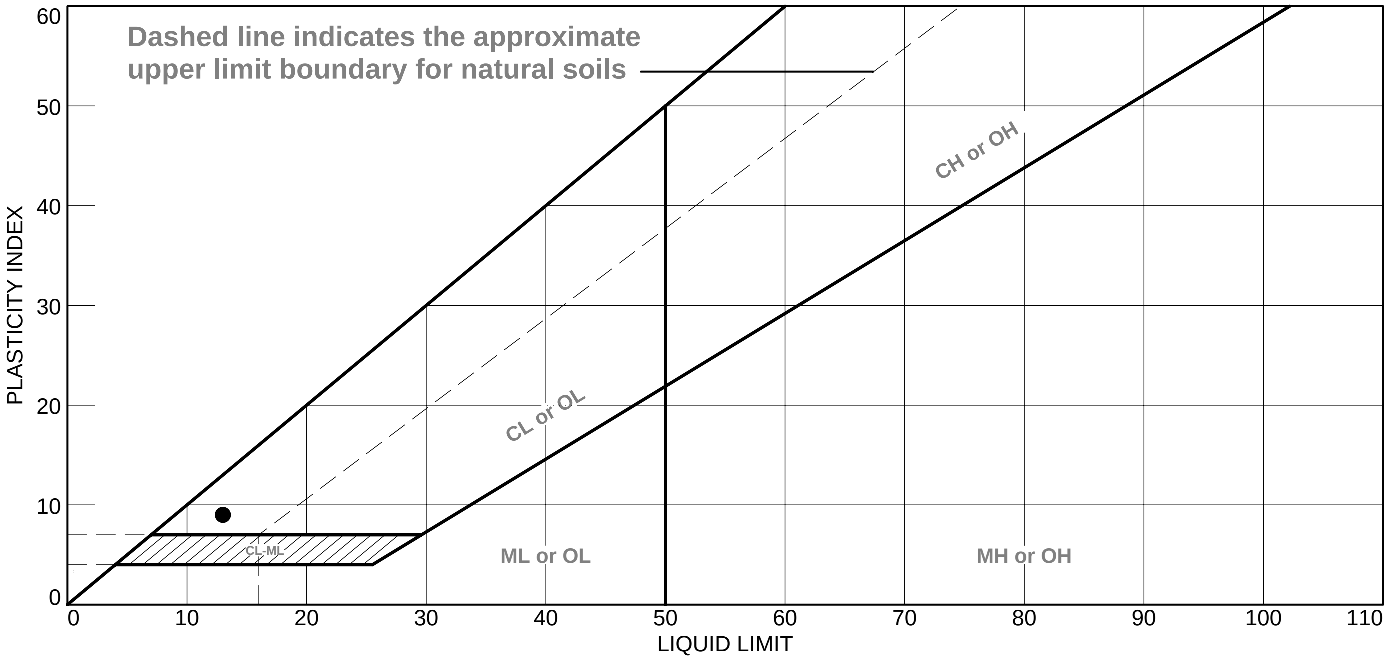
Terracon

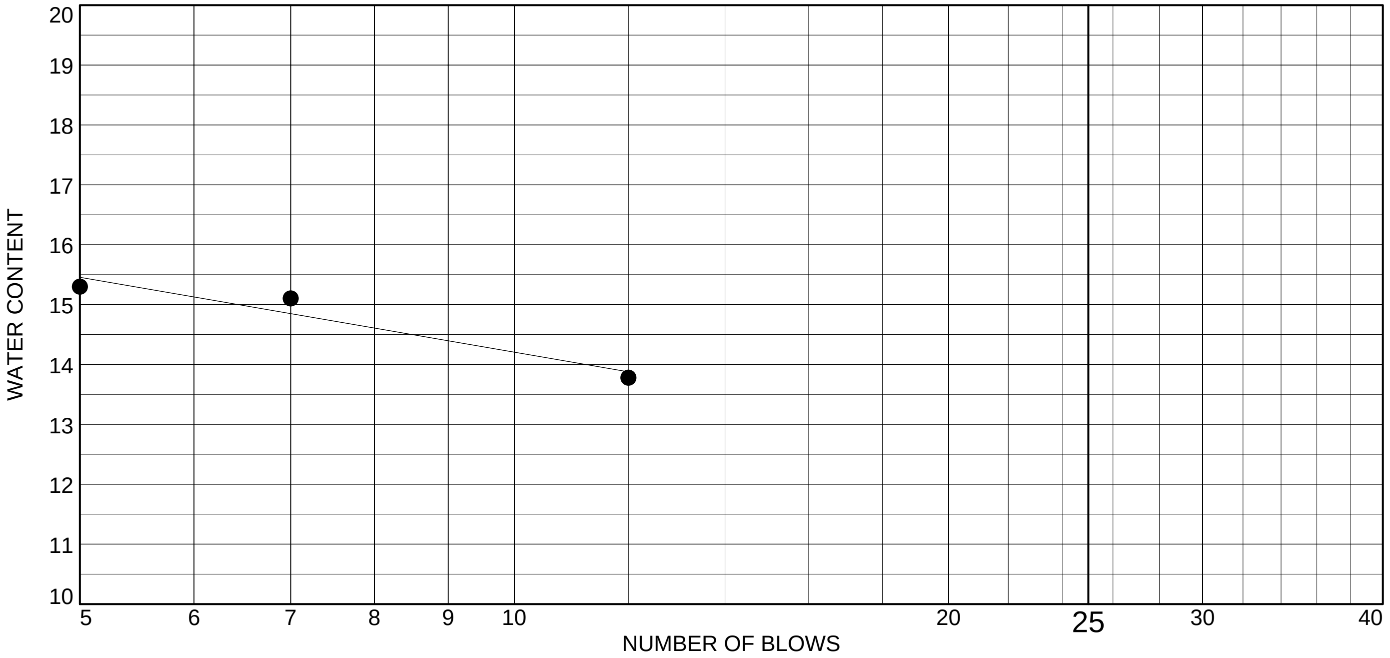
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN POORLY GRADED SAND	13	4	9	89.3	4.4	SP

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

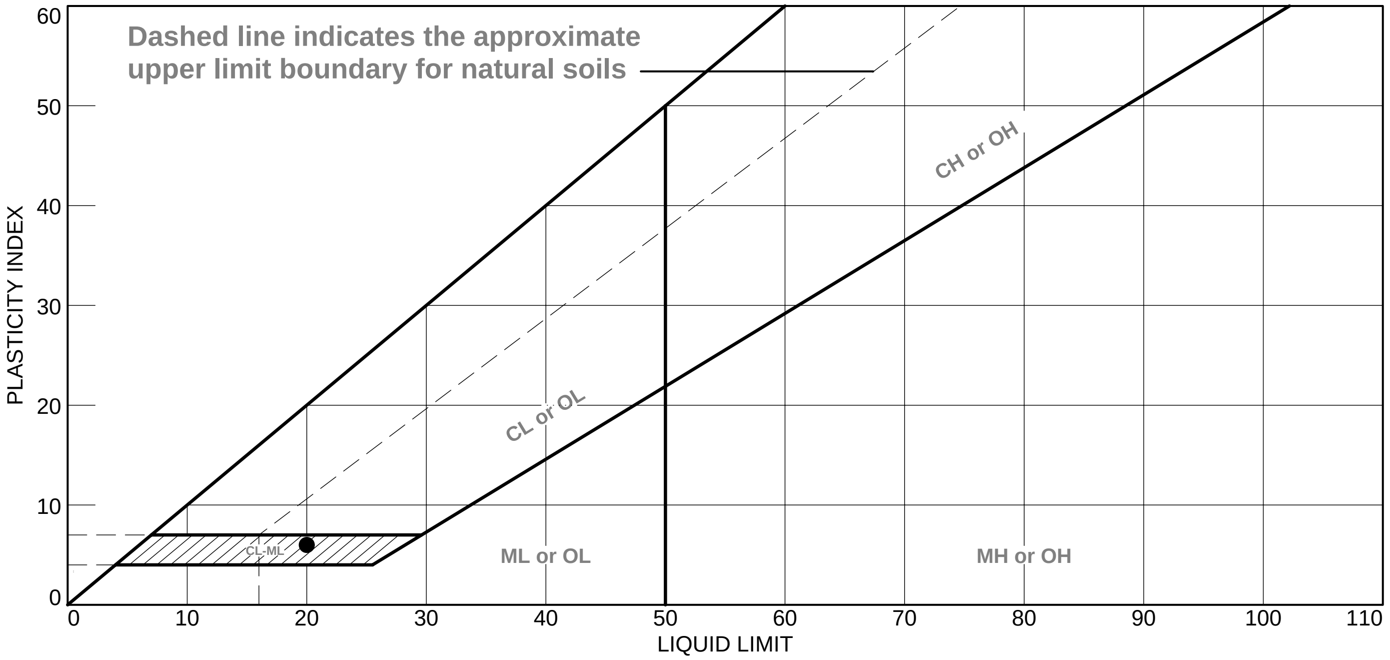
Source of Sample: MW-41 **Depth:** 25.0'-25.5'
Sample Number: 1045

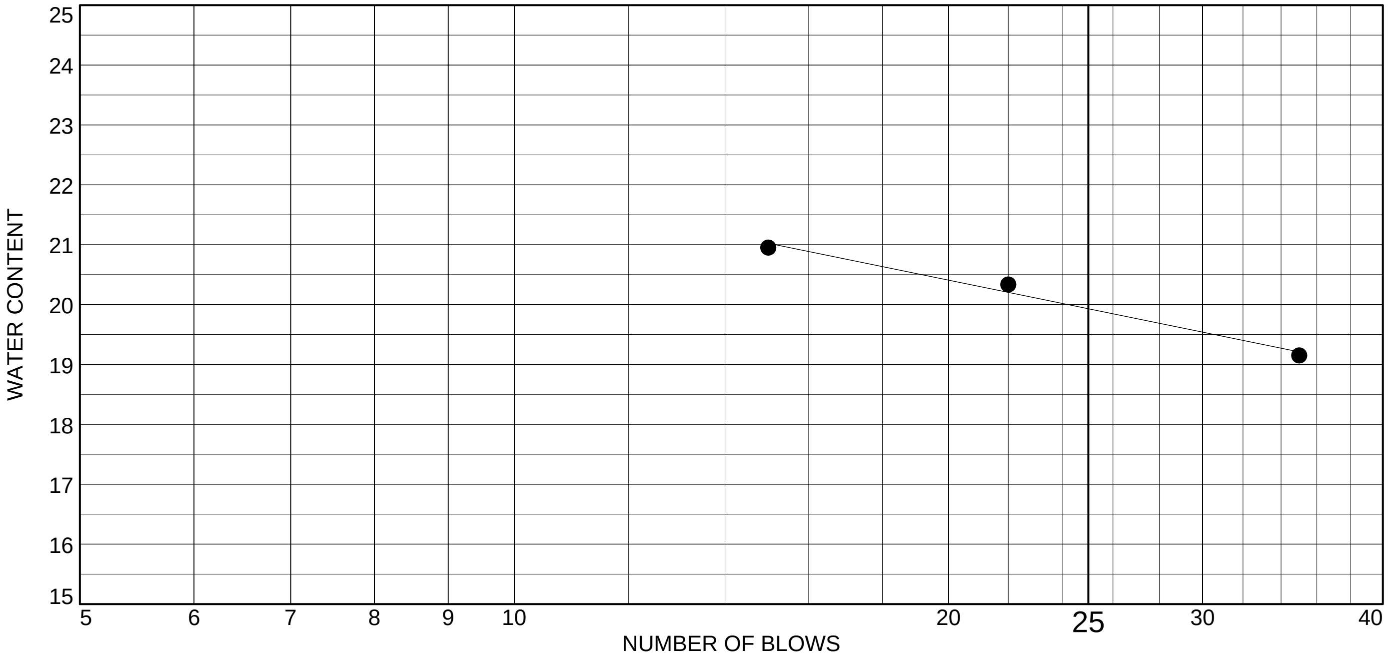
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAYISH BROWN SANDY SILTY CLAY	20	14	6	83.0	56.4	CL-ML

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

Source of Sample: MW-41 **Depth:** 35.0'-37.0'
Sample Number: 1130

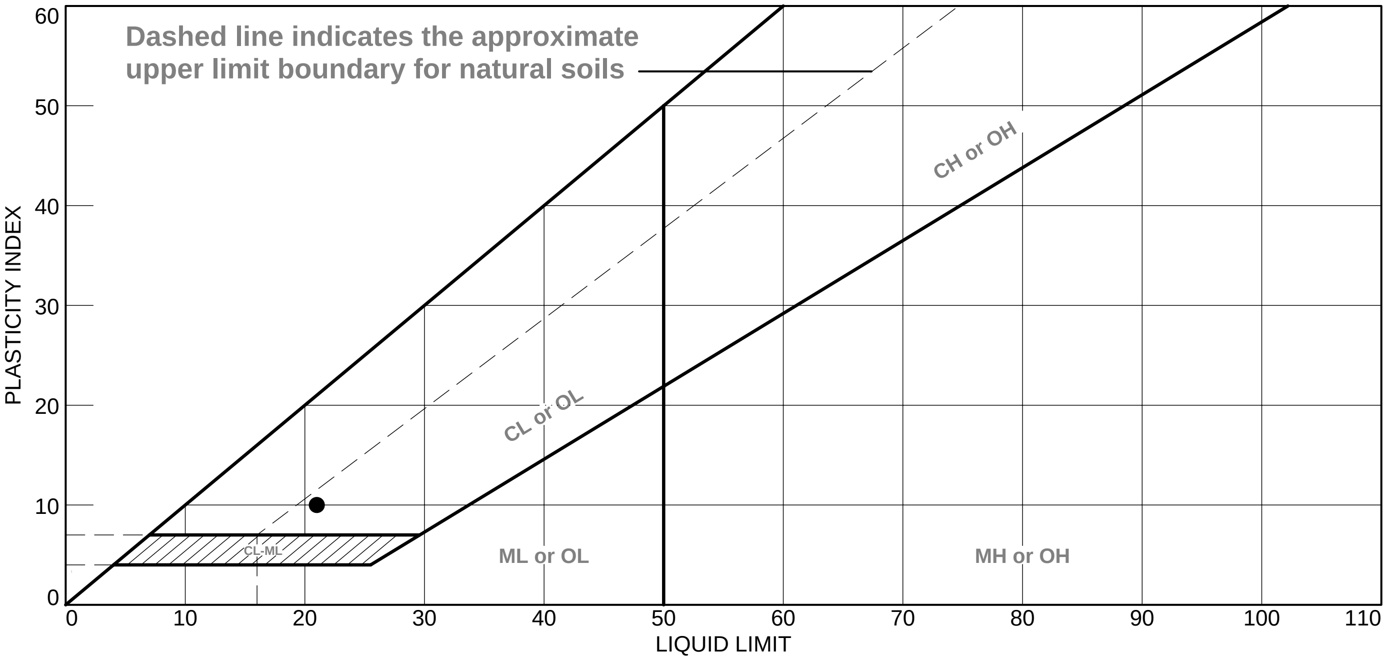
Terracon

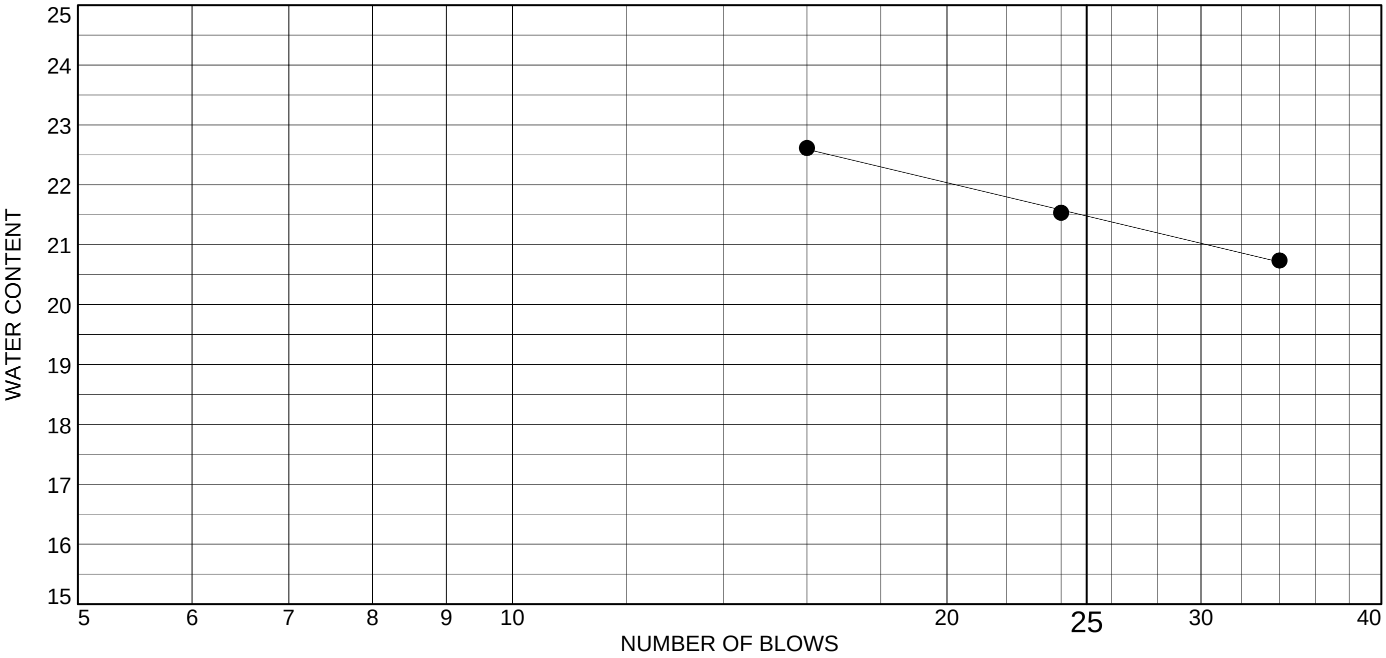
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY AND GRAYISH BROWN SANDY LEAN CLAY	21	11	10	85.6	56.5	CL

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

Source of Sample: MW-43 **Depth:** 35.0'-37.0'
Sample Number: 1330

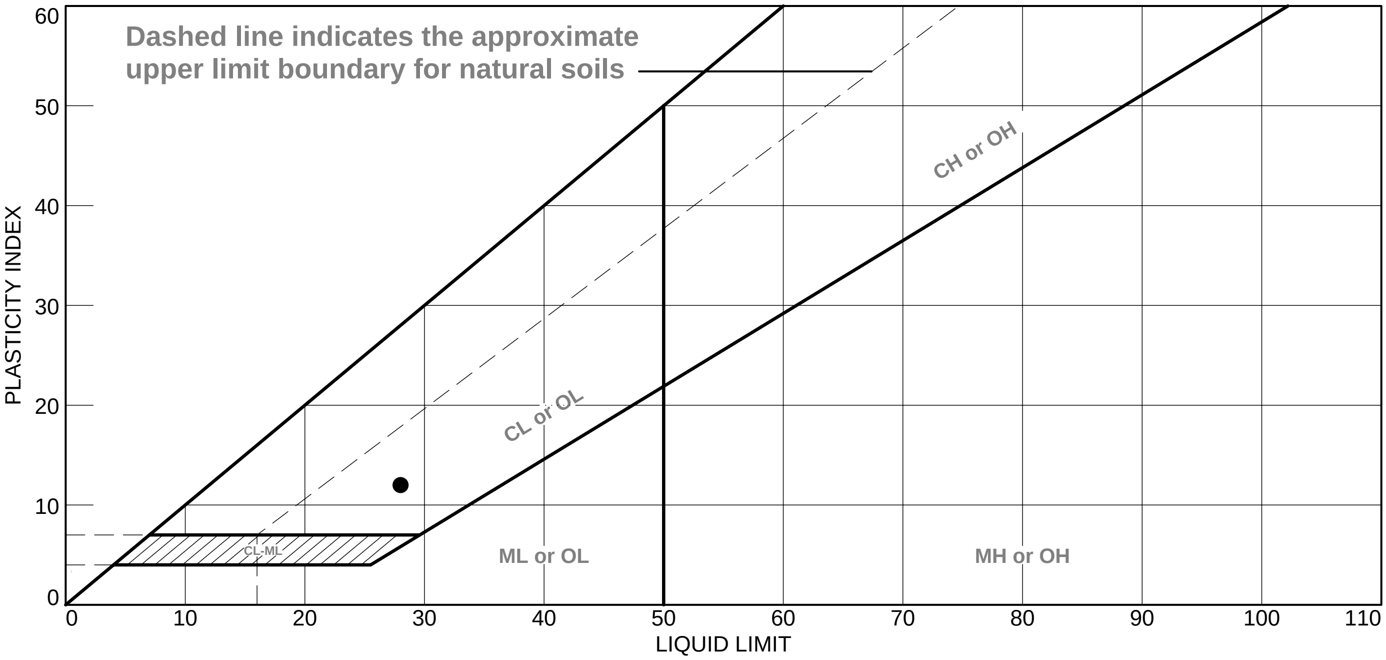
Terracon

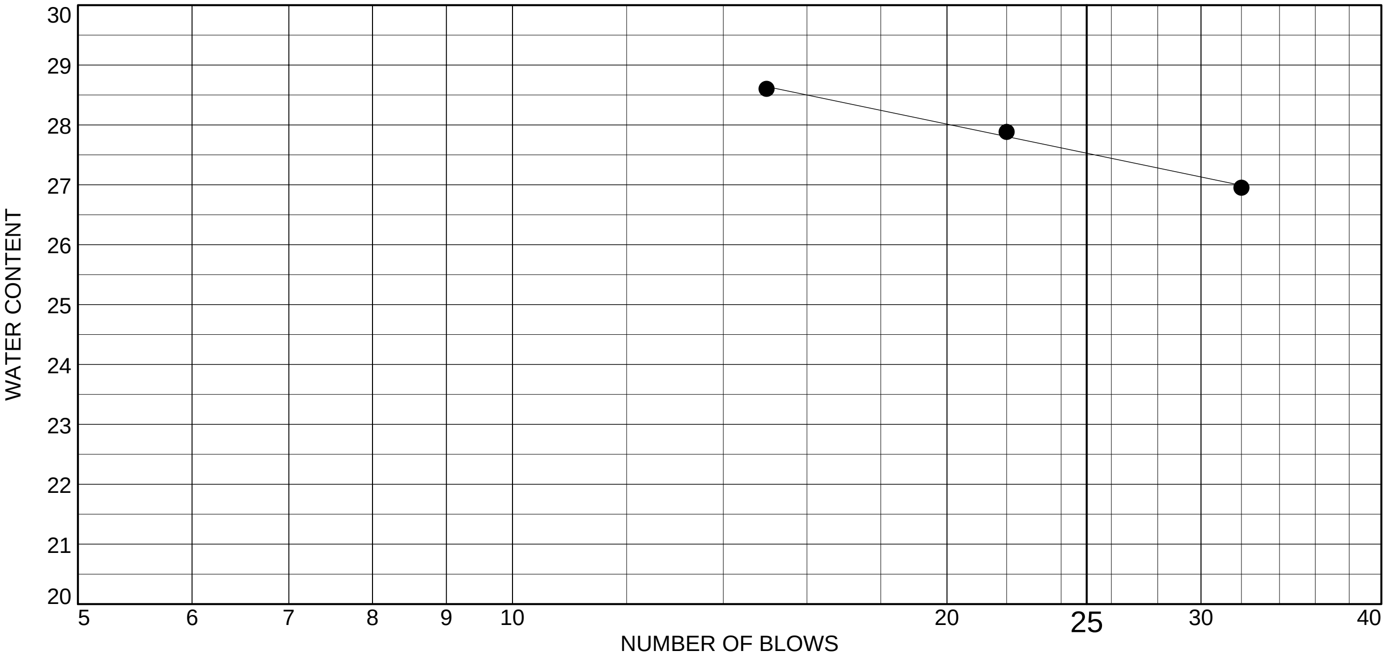
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY LEAN CLAY WITH SAND - SAND SEAMS NOTED	28	16	12	94.1	76.8	CL

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

Source of Sample: MW-43 **Depth:** 50.0'-52.0'
Sample Number: 1400

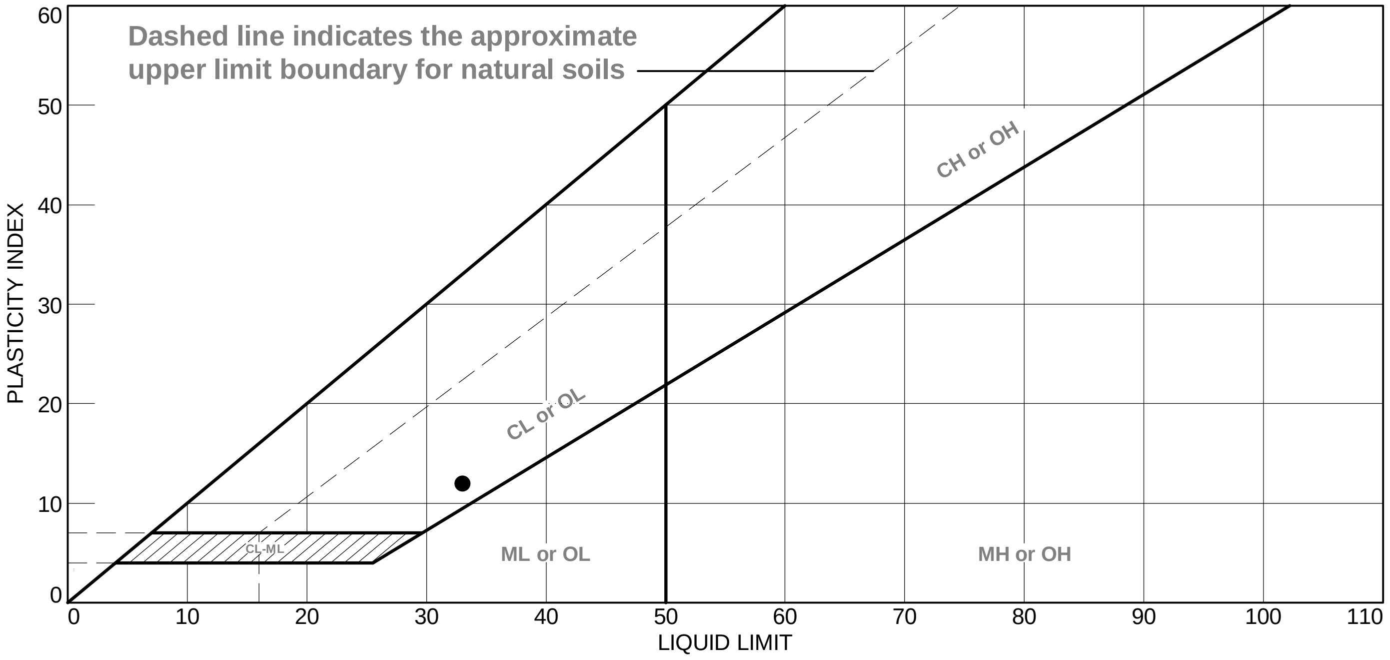
Terracon

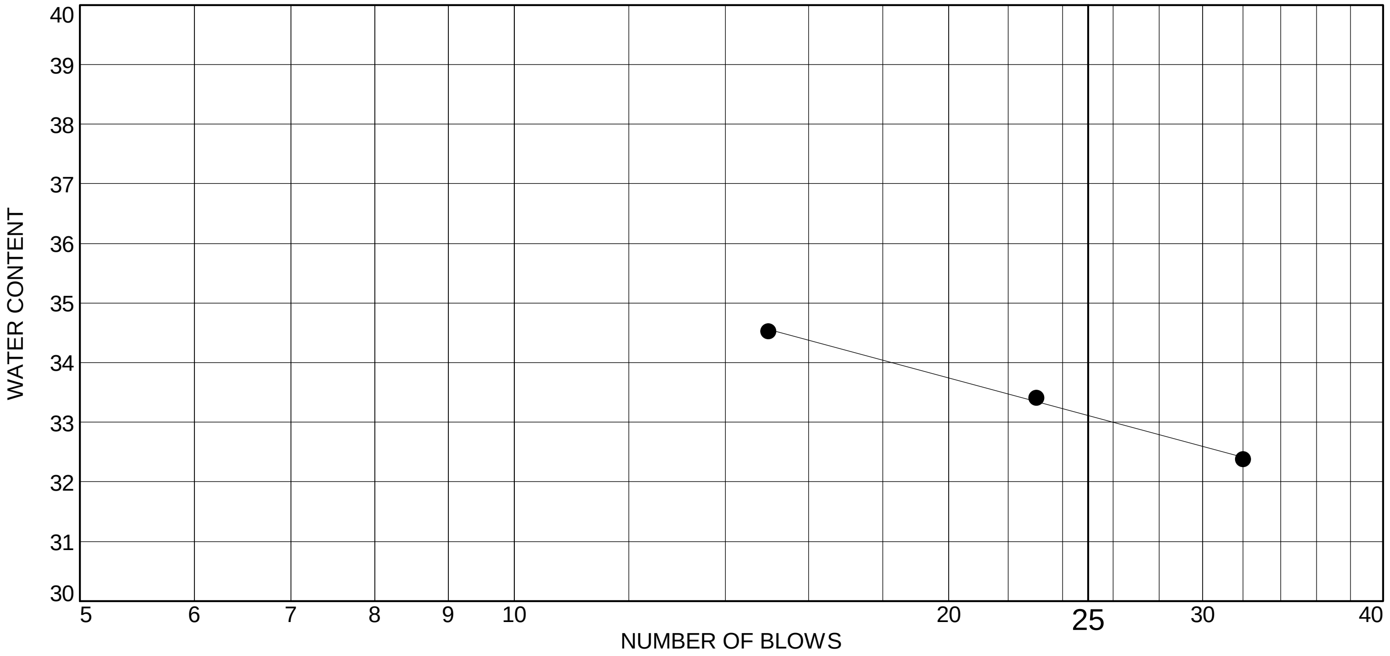
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWNISH GRAY LEAN CLAY	33	21	12	99.9	99.2	CL

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

Source of Sample: MW-43 **Depth:** 61.0'-61.5'
Sample Number: 1500

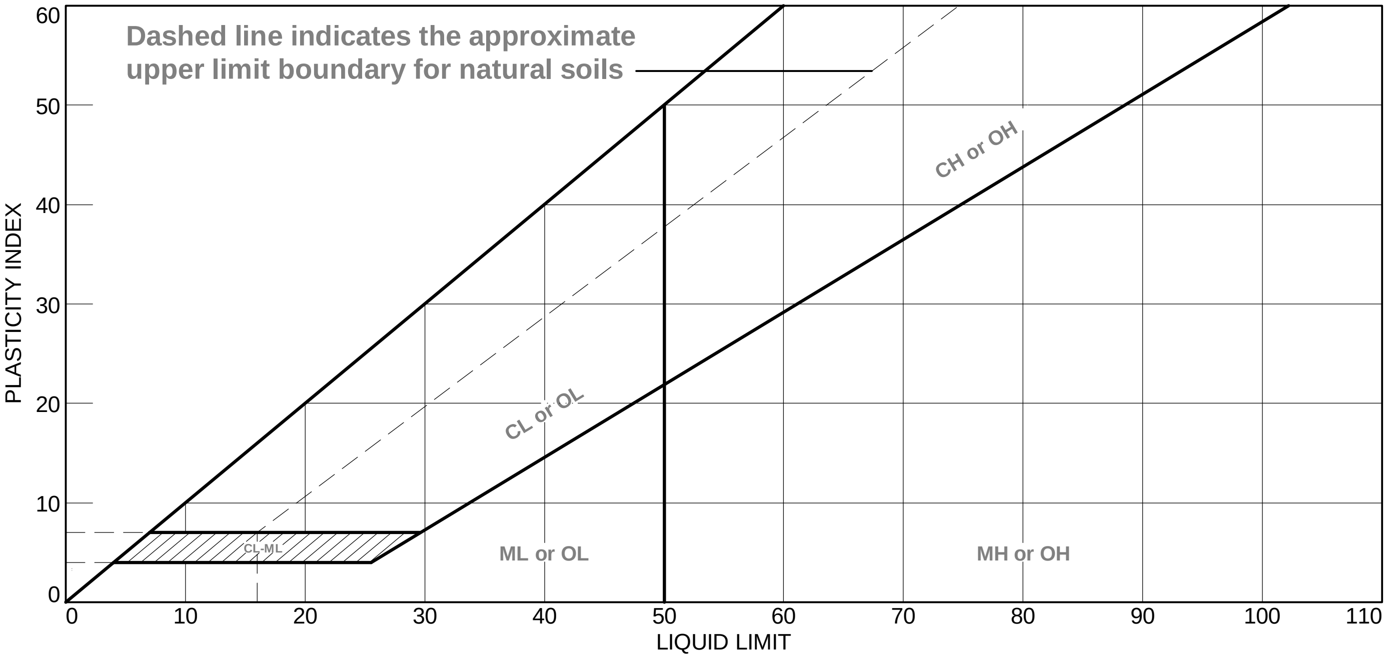
Terracon

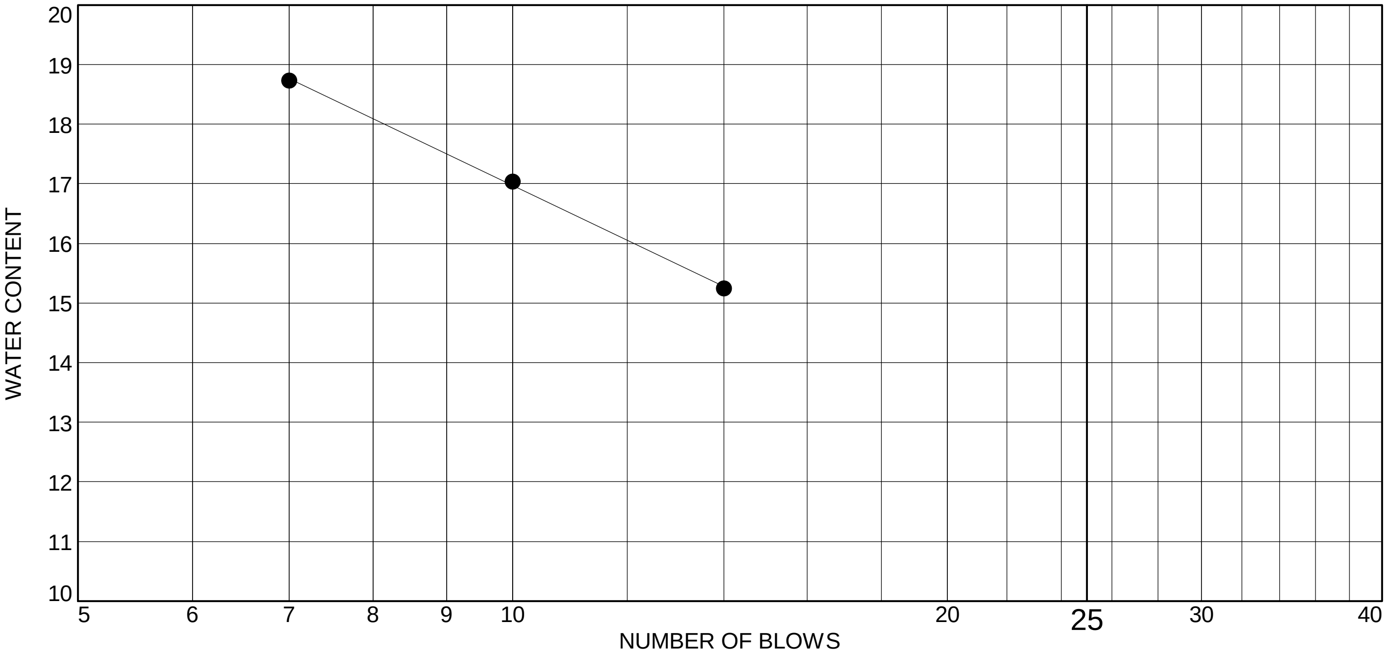
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND DARK BROWN SILTY SAND	12	12	NP	94.0	39.9	SM

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

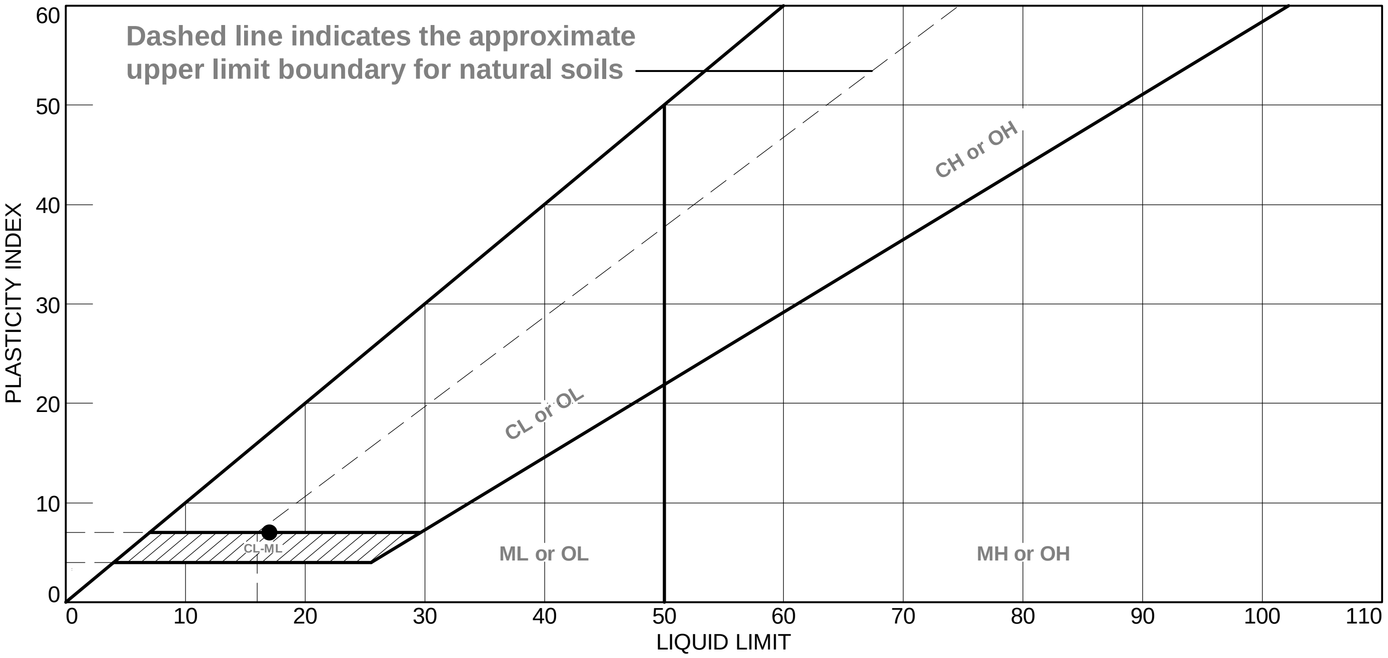
Source of Sample: MW-70SA **Depth:** 16.5'-17.0'
Sample Number: 1615

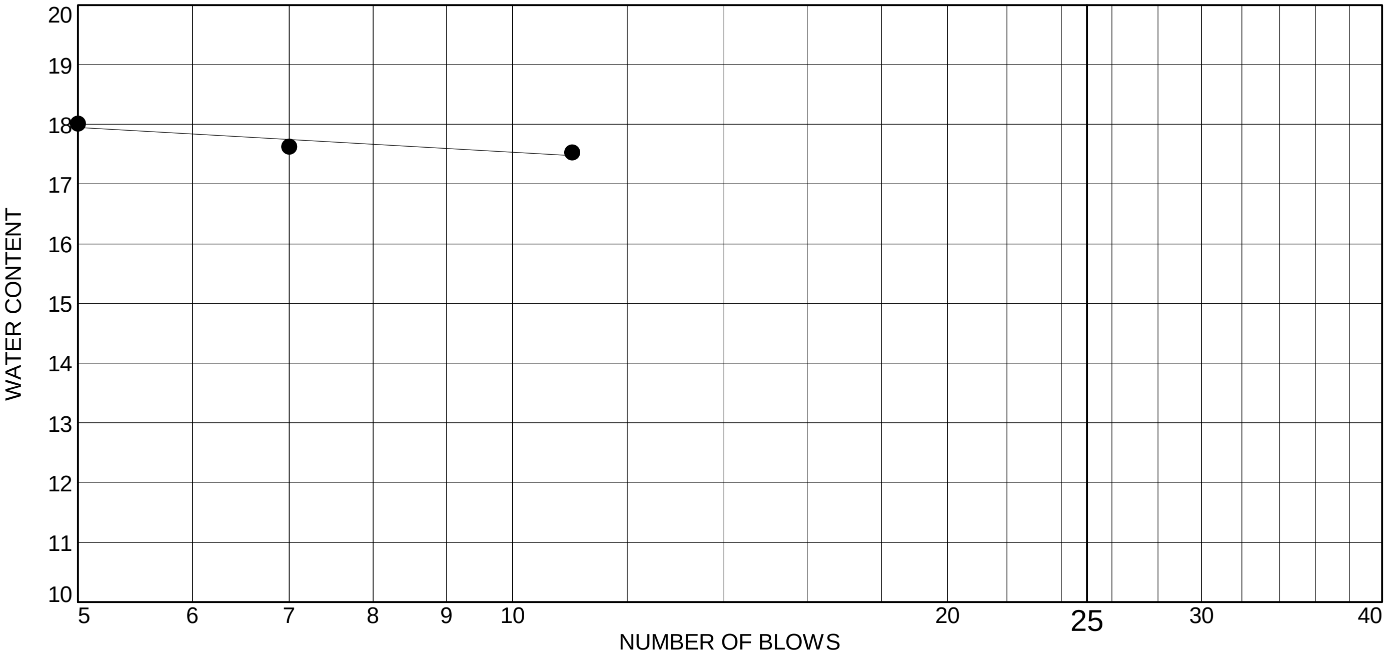
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY POORLY GRADED SAND	17	10	7	96.3	4.7	SP

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

Source of Sample: MW-71S **Depth:** 10.0'-10.5'
Sample Number: 1615

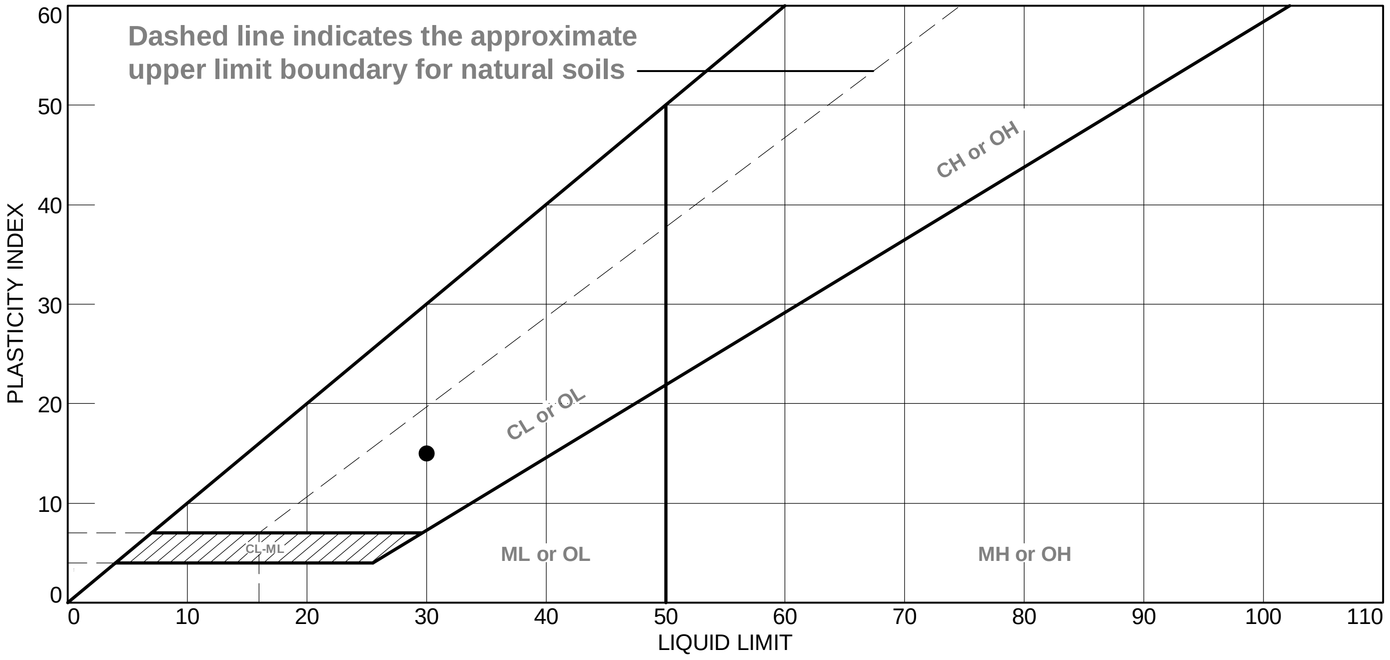
Terracon

Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND GRAYISH BROWN LEAN CLAY WITH SAND	30	15	15	93.1	85.3	CL

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

Source of Sample: MW-103 **Depth:** 15.0'-17.0'
Sample Number: 1110

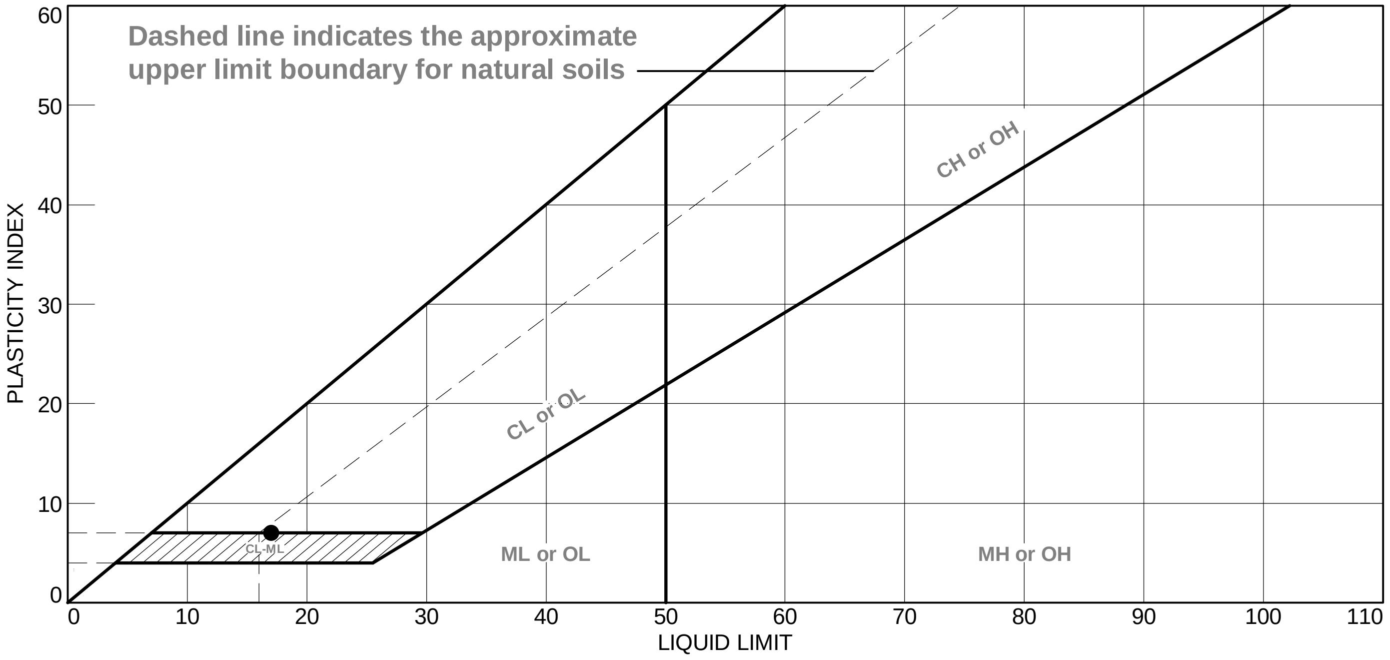
Terracon

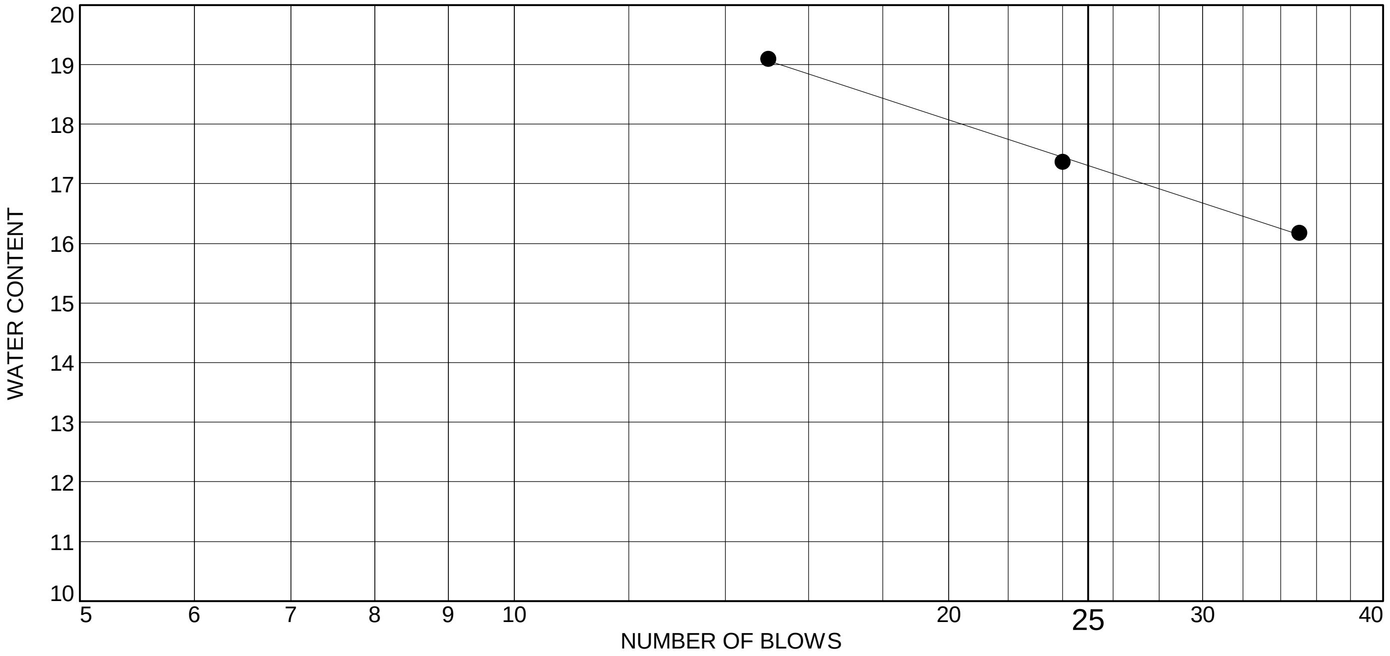
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318


Dashed line indicates the approximate upper limit boundary for natural soils



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND GRAY SANDY SILTY CLAY	17	10	7	90.0	51.8	CL-ML

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

Source of Sample: MW-103 **Depth:** 95.5'-96.0'

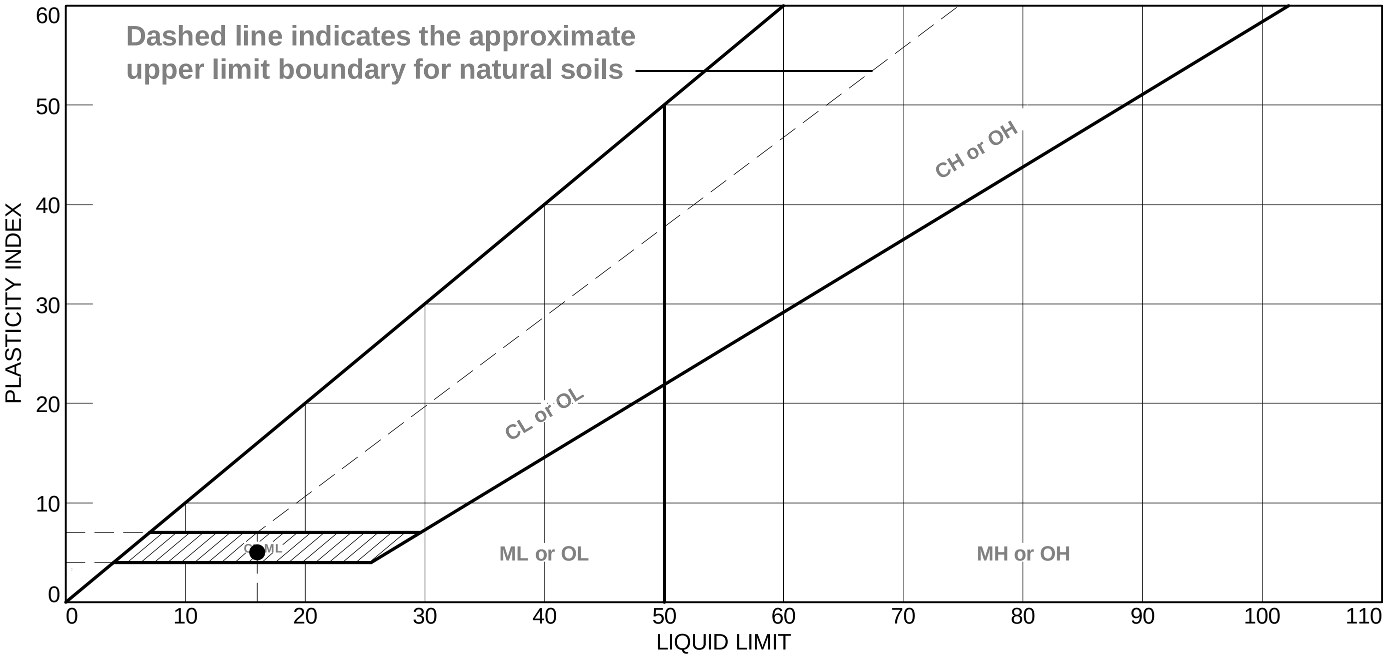
Sample Number: 0915

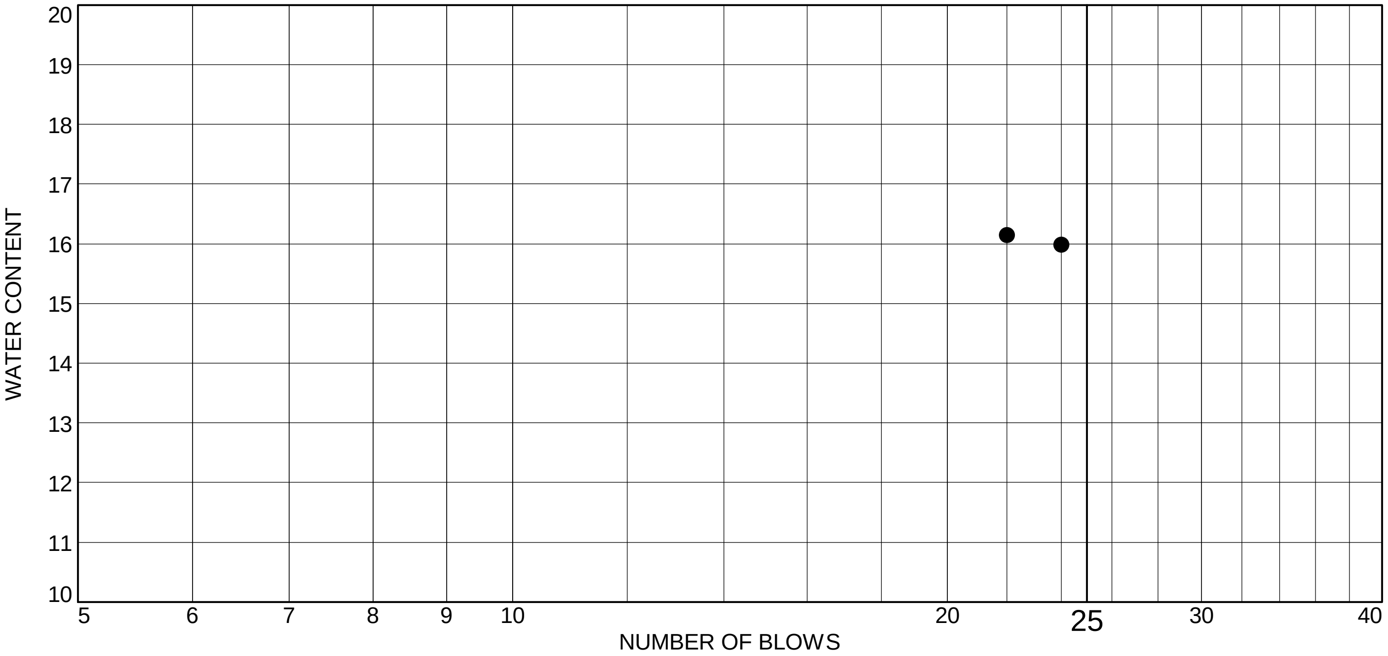
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY SILTY CLAYEY SAND WITH GRAVEL	16	11	5	24.9	12.6	SC-SM

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

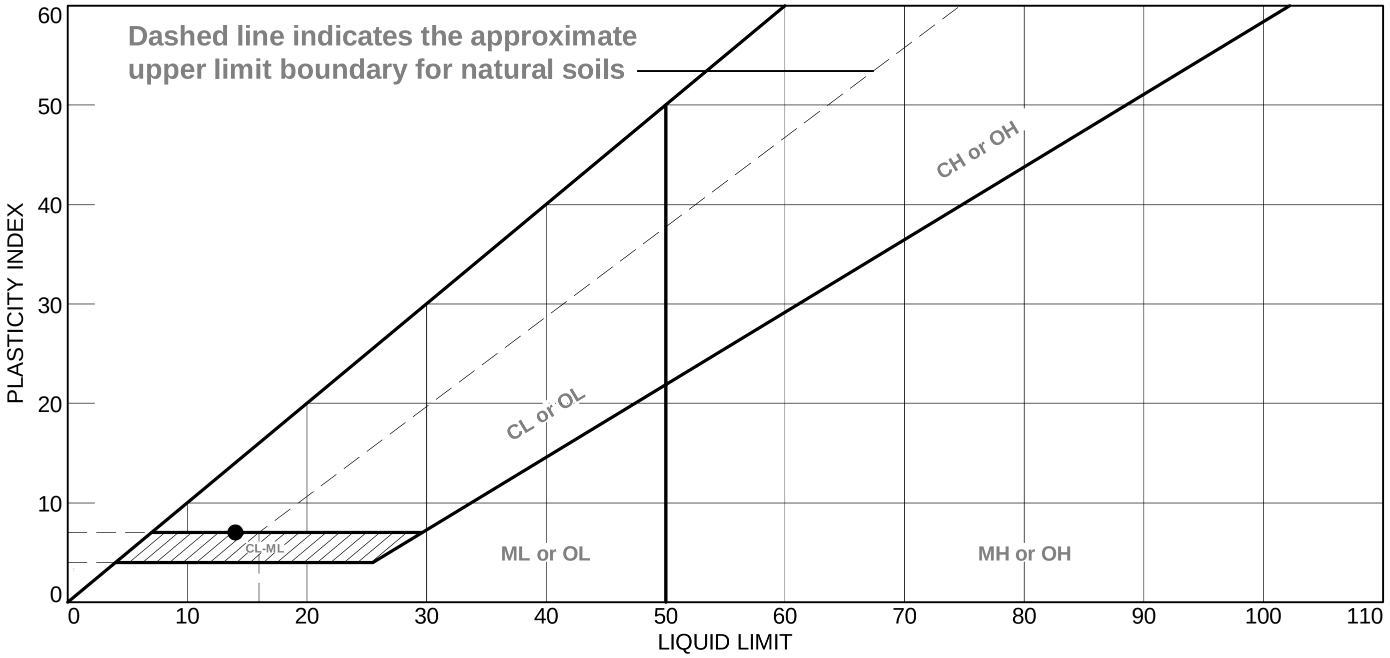
Source of Sample: MW-103 **Depth:** 130.5'-131.0'
Sample Number: 1150

Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY AND BROWN POORLY GRADED SAND WITH SILTY CLAY	14	7	7	54.9	5.7	SP-SC

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

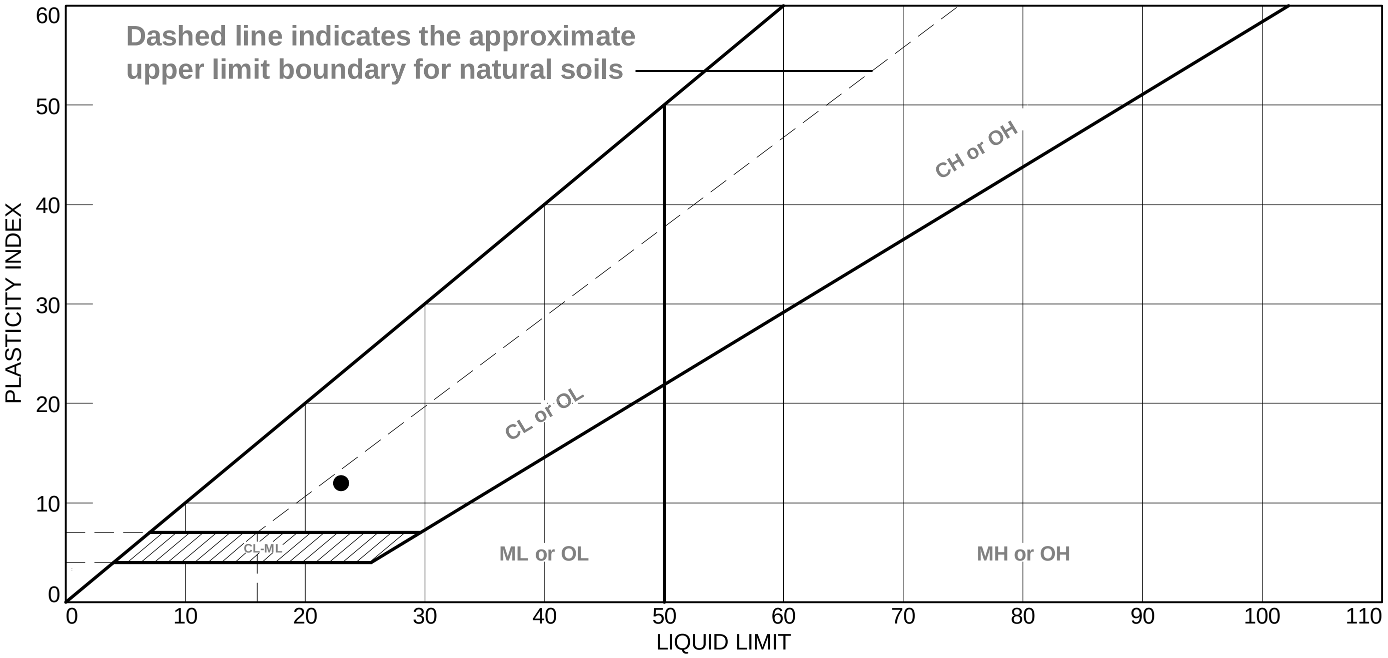
Source of Sample: MW-103 **Depth:** 132.5'-133.0'
Sample Number: 1350

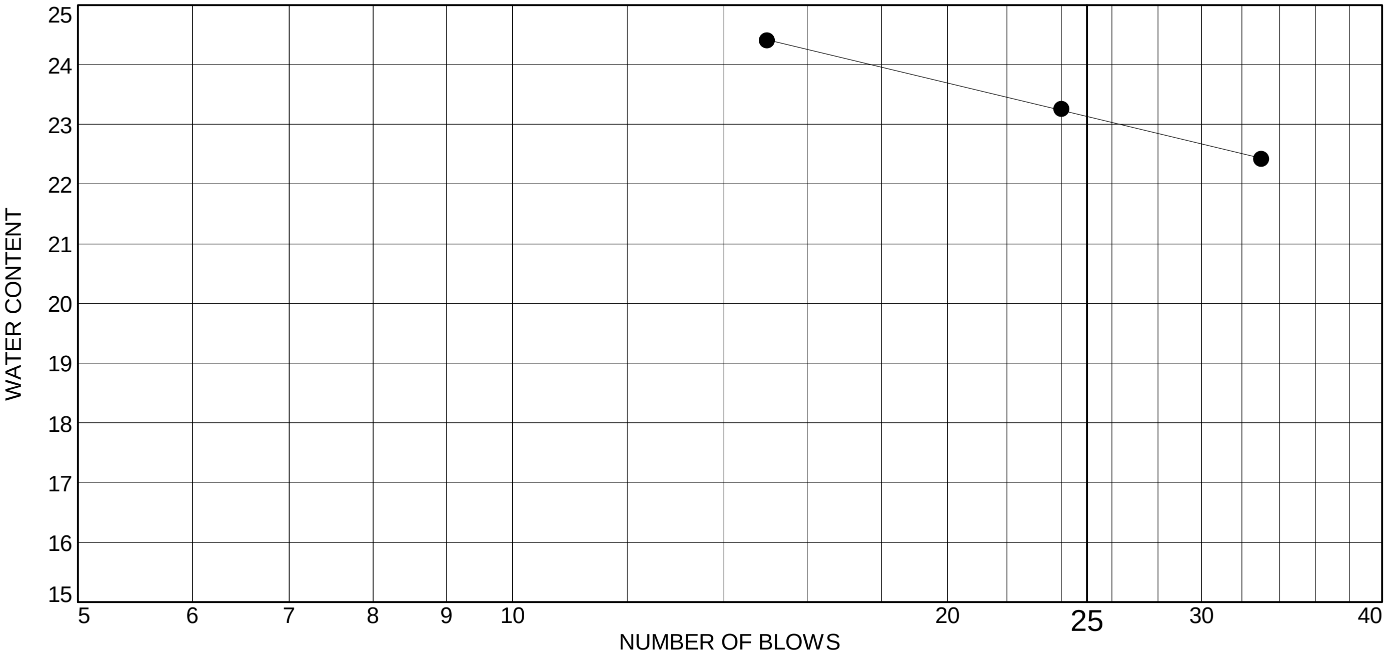
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWNISH GRAY SANDY LEAN CLAY	23	11	12	87.0	57.4	CL

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

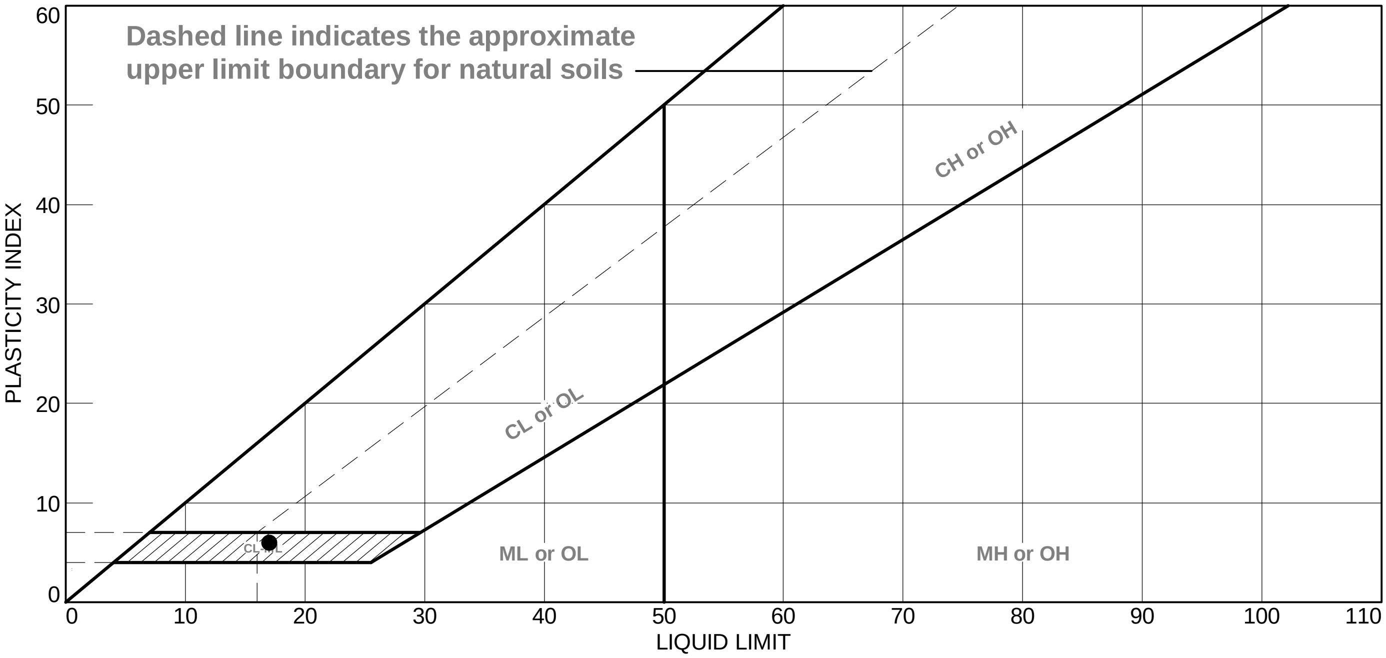
Source of Sample: MW-103 **Depth:** 140.5'-141.0'
Sample Number: 1420

Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY SILTY CLAYEY SAND	17	11	6	85.2	35.2	SC-SM

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

Source of Sample: MW-103 **Depth:** 163.0'-163.5'
Sample Number: 0810

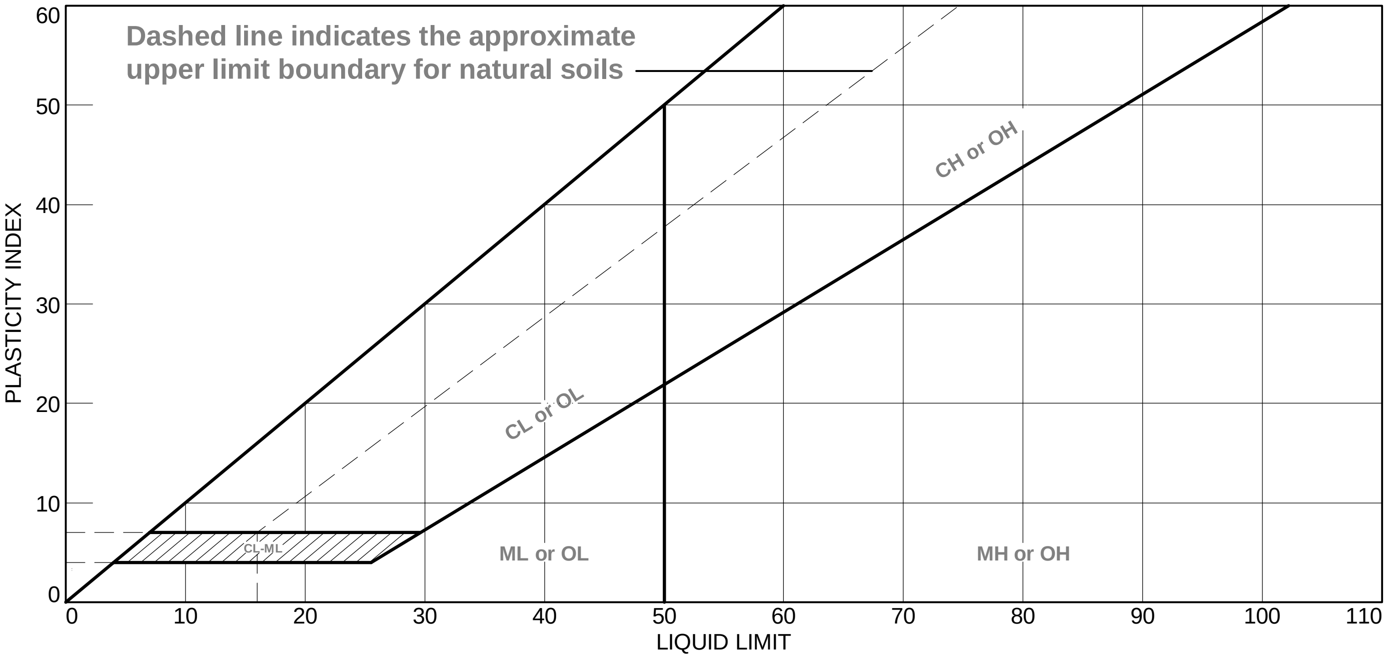
Terracon

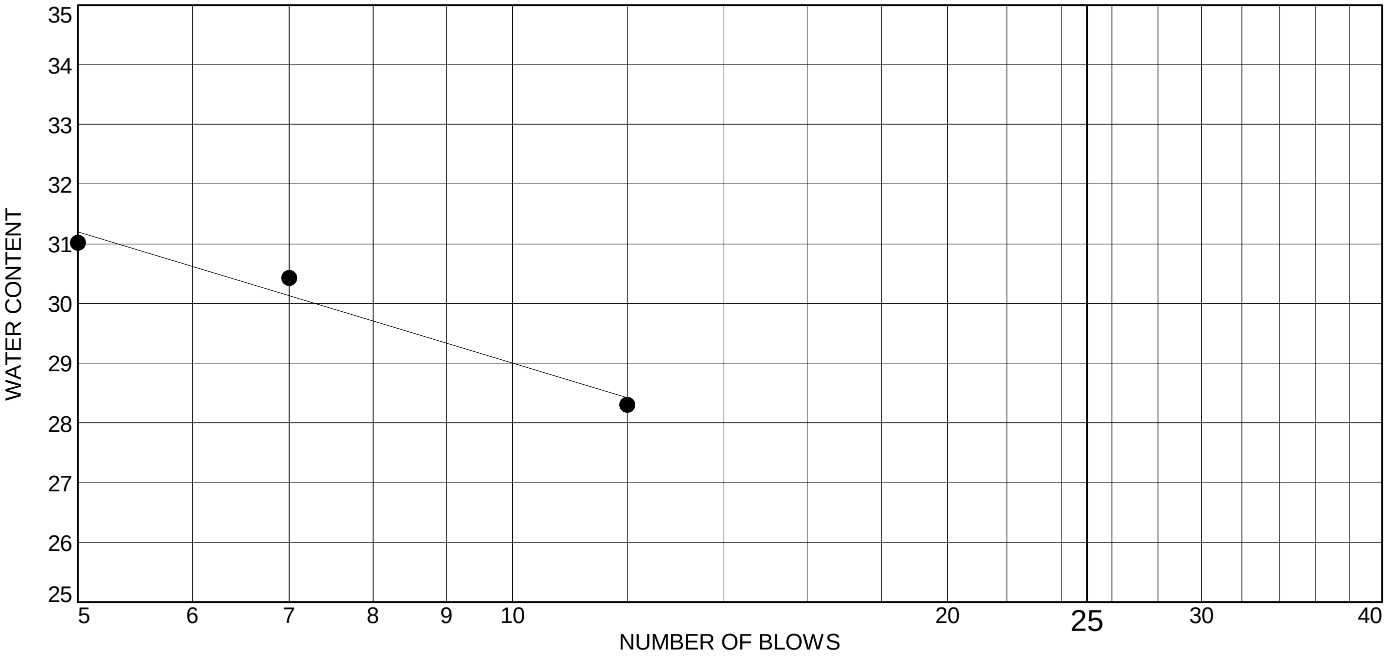
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY SILT	26	28	NP	99.6	94.9	ML

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

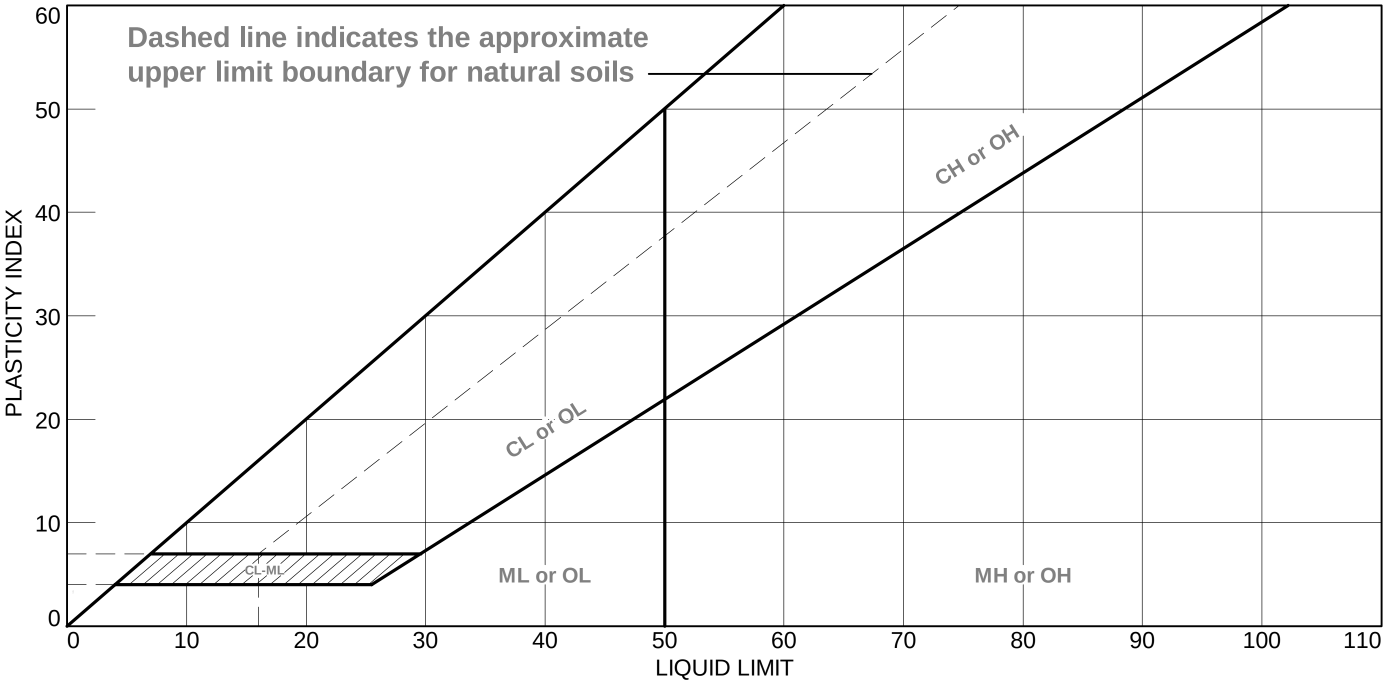
Source of Sample: XCM-02 **Depth:** 15.5'-16.0'
Sample Number: 1500

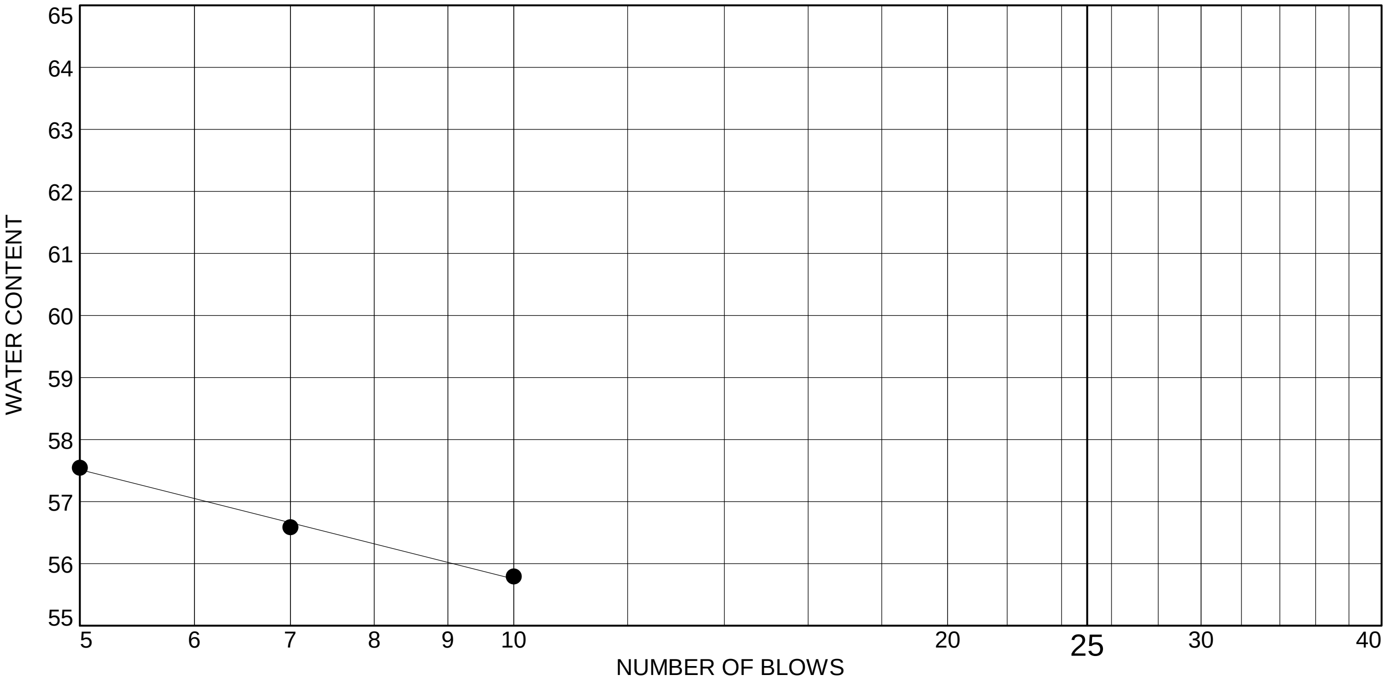
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY ELASTIC SILT WITH SAND	53	57	NP	95.7	81.9	MH

Project No. 11215020 **Client:** RAMBOLL ENVIRON US CORP.

Project: VERMILLION POWER STATION

Source of Sample: XCM-02 **Depth:** 36.0'-36.5'
Sample Number: 1600

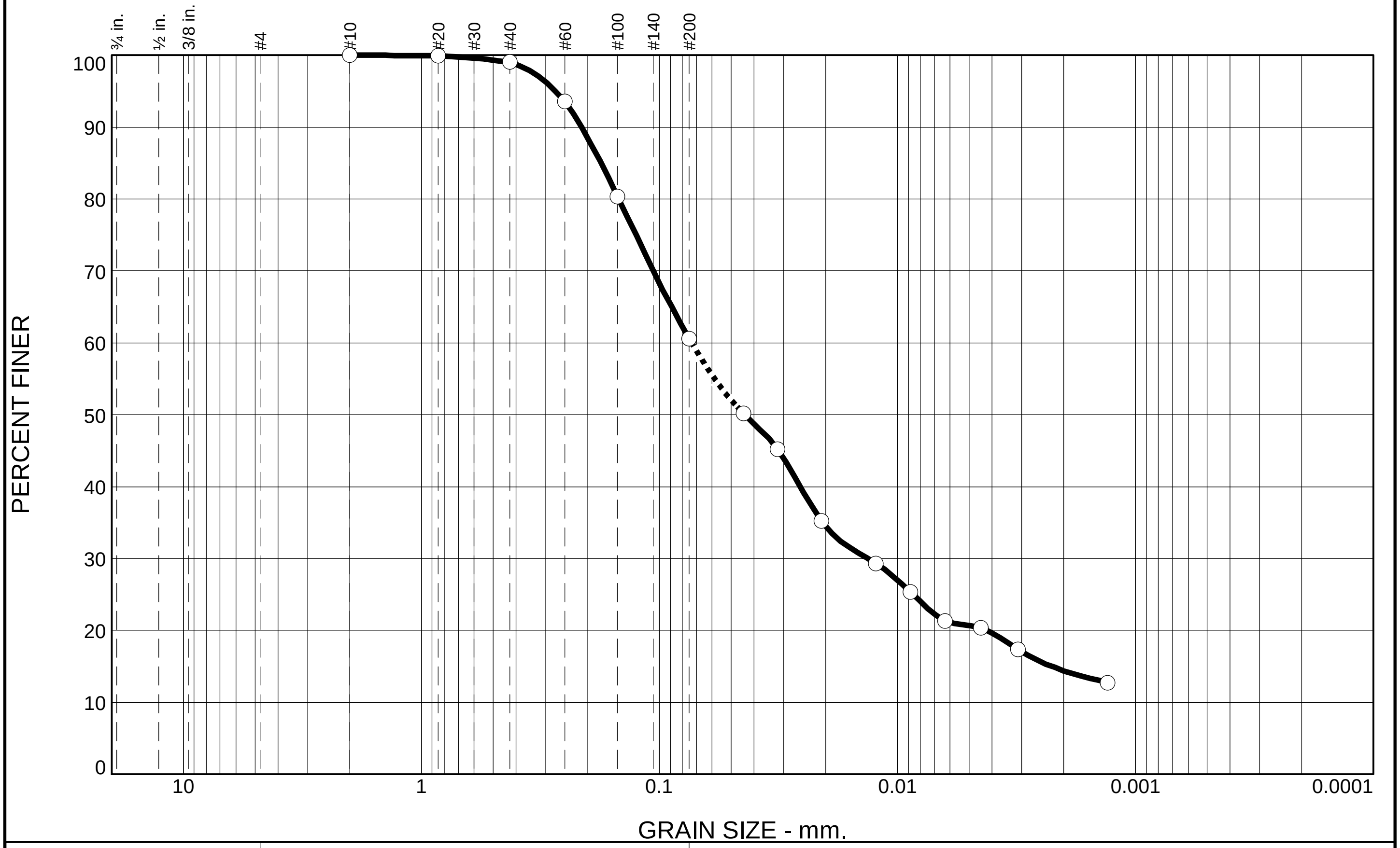
Remarks:

Figure

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
ASTM D6913

Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis
ASTM D7928

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	**Fine**	**Coarse**	**Medium**	**Fine**	**Silt**	**Clay**
0.0	0.0	0.0	1.0	38.5	39.8	20.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.9		
#40	99.0		
#60	93.5		
#100	80.4		
#200	60.5		
0.0443 mm.	50.2		
0.0319 mm.	45.2		
0.0209 mm.	35.3		
0.0123 mm.	29.3		
0.0088 mm.	25.3		
0.0063 mm.	21.3		
0.0045 mm.	20.4		
0.0031 mm.	17.4		
0.0013 mm.	12.7		

* (no specification provided)

Soil Description

DARK BROWN SANDY LEAN CLAY

Atterberg Limits

PL= 17 LL= 27 PI= 10

Coefficients

D_{90}= 0.2122	D_{85}= 0.1757	D_{60}= 0.0734
D_{50}= 0.0438	D_{30}= 0.0133	D_{15}= 0.0023
D_{10}=	C_u=	C_c=

Classification

USCS= CL AASHTO= A-4(3)

Remarks

F.M.=0.24

Source of Sample: MW-37 **Depth:** 5.0'-7.0'
Sample Number: 0945

Date: 3-25-21

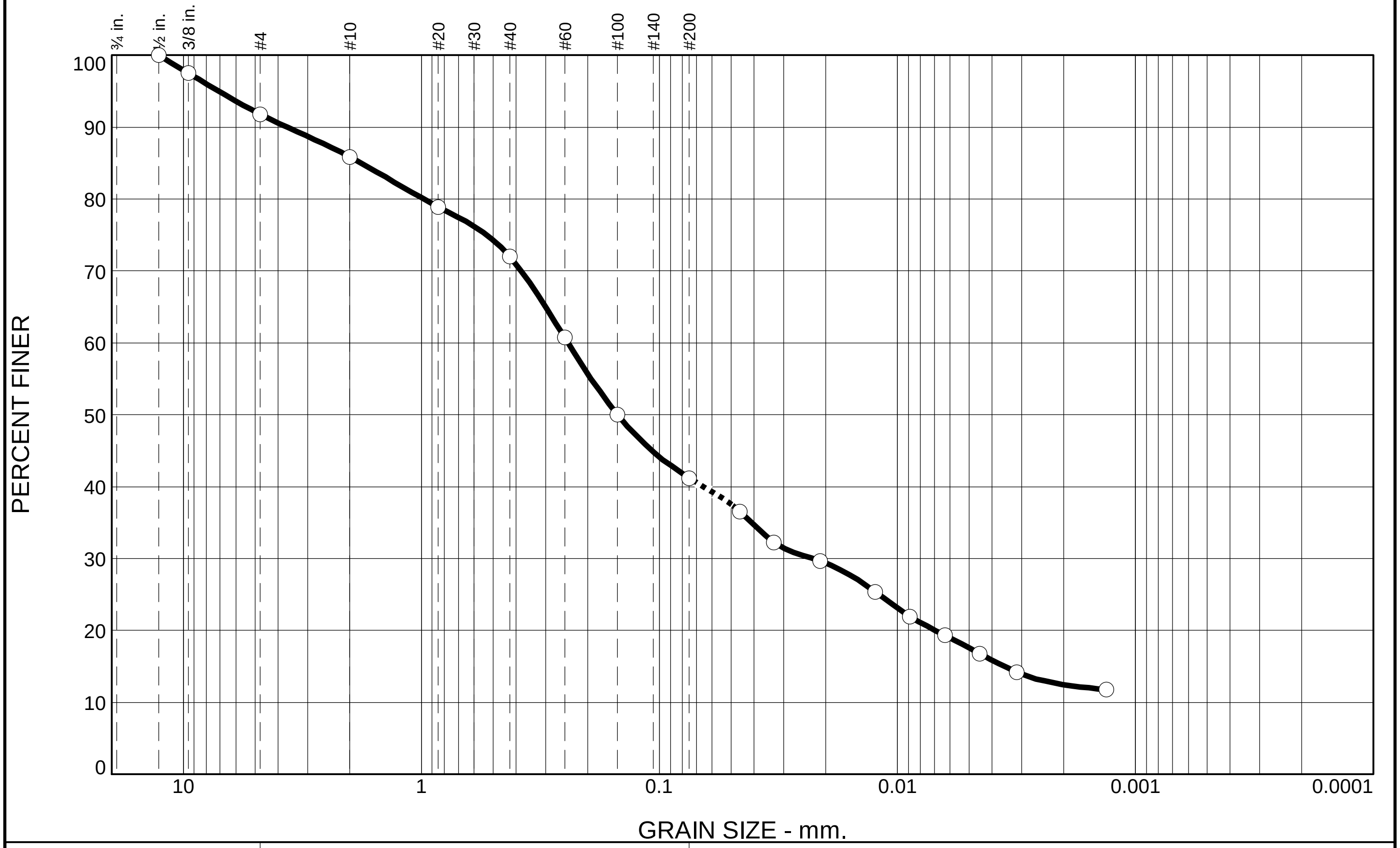
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION

Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	8.2	5.9	13.9	30.8	23.6	17.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5	100.0		
.375	97.5		
#4	91.8		
#10	85.9		
#20	78.9		
#40	72.0		
#60	60.7		
#100	50.0		
#200	41.2		
0.0459 mm.	36.5		
0.0330 mm.	32.2		
0.0211 mm.	29.7		
0.0124 mm.	25.4		
0.0089 mm.	21.9		
0.0063 mm.	19.4		
0.0045 mm.	16.8		
0.0032 mm.	14.2		
0.0013 mm.	11.8		

* (no specification provided)

Soil Description

GRAY CLAYEY SAND

Atterberg Limits

PL= 11 LL= 19 PI= 8

Coefficients

D_{90}= 3.6621 D_{85}= 1.7885 D_{60}= 0.2422
D_{50}= 0.1499 D_{30}= 0.0227 D_{15}= 0.0036
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-4(0)

Remarks

F.M.=1.51

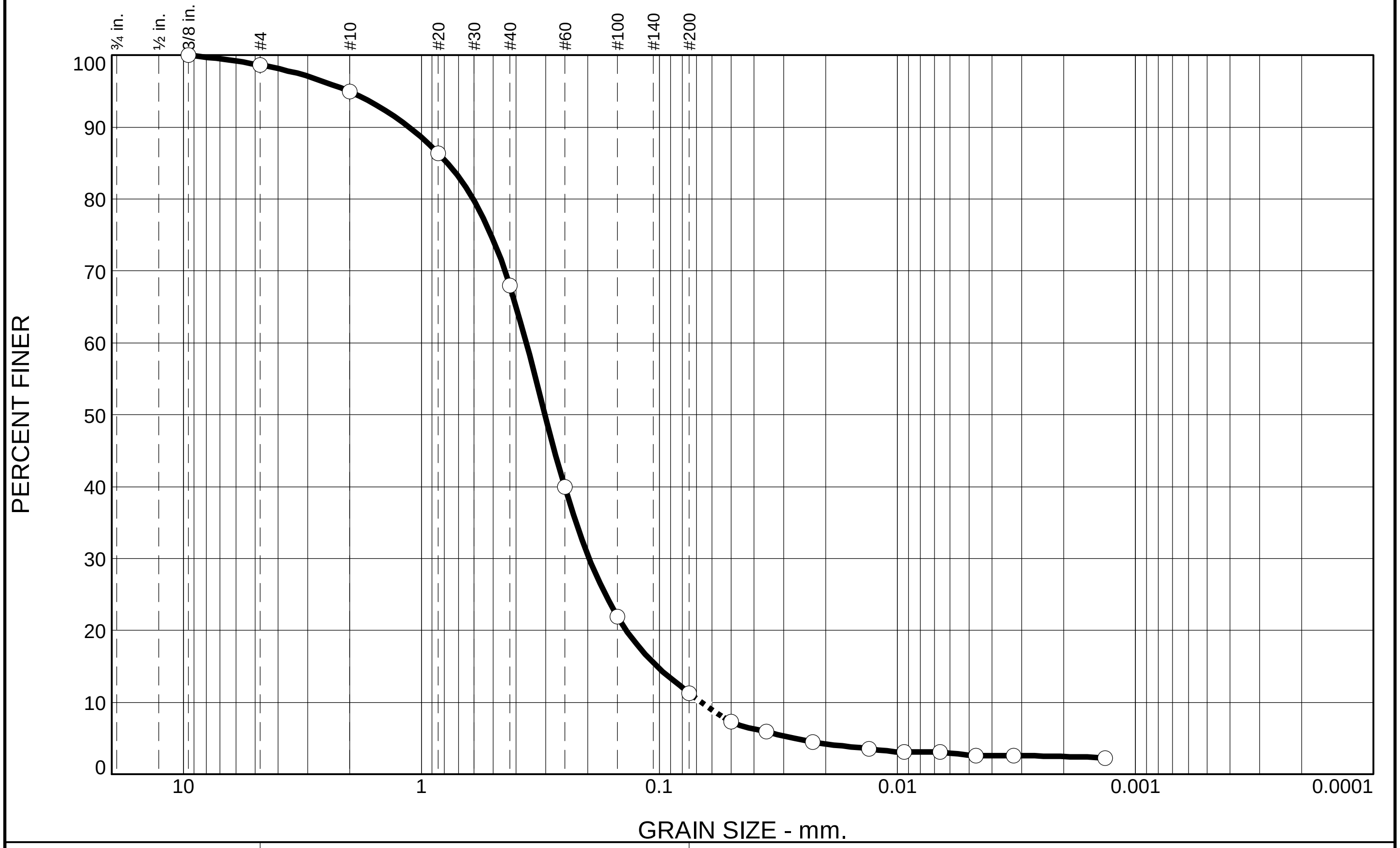
Source of Sample: MW-37 **Depth:** 18.5'-19.0'
Sample Number: N/A
Date: 4-28-21

Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION
Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	1.4	3.7	26.9	56.7	8.6	2.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	98.6		
#10	94.9		
#20	86.4		
#40	68.0		
#60	40.0		
#100	21.9		
#200	11.3		
0.0499 mm.	7.3		
0.0356 mm.	5.9		
0.0227 mm.	4.5		
0.0132 mm.	3.5		
0.0093 mm.	3.1		
0.0066 mm.	3.1		
0.0047 mm.	2.6		
0.0032 mm.	2.6		
0.0013 mm.	2.3		

* (no specification provided)

Soil Description

GRAY AND GRAYISH BROWN POORLY GRADED SAND WITH SILT

Atterberg Limits

PL= 11 LL= 9 PI= NP

Coefficients

D_{90}= 1.1232 D_{85}= 0.7780 D_{60}= 0.3623
D_{50}= 0.3023 D_{30}= 0.1971 D_{15}= 0.1021
D_{10}= 0.0668 C_u= 5.43 C_c= 1.61

Classification

USCS= SP-SM AASHTO= A-2-4(0)

Remarks

F.M.=1.64

Source of Sample: MW-37 **Depth:** 25.0'-27.0'
Sample Number: 1100

Date: 3-25-21

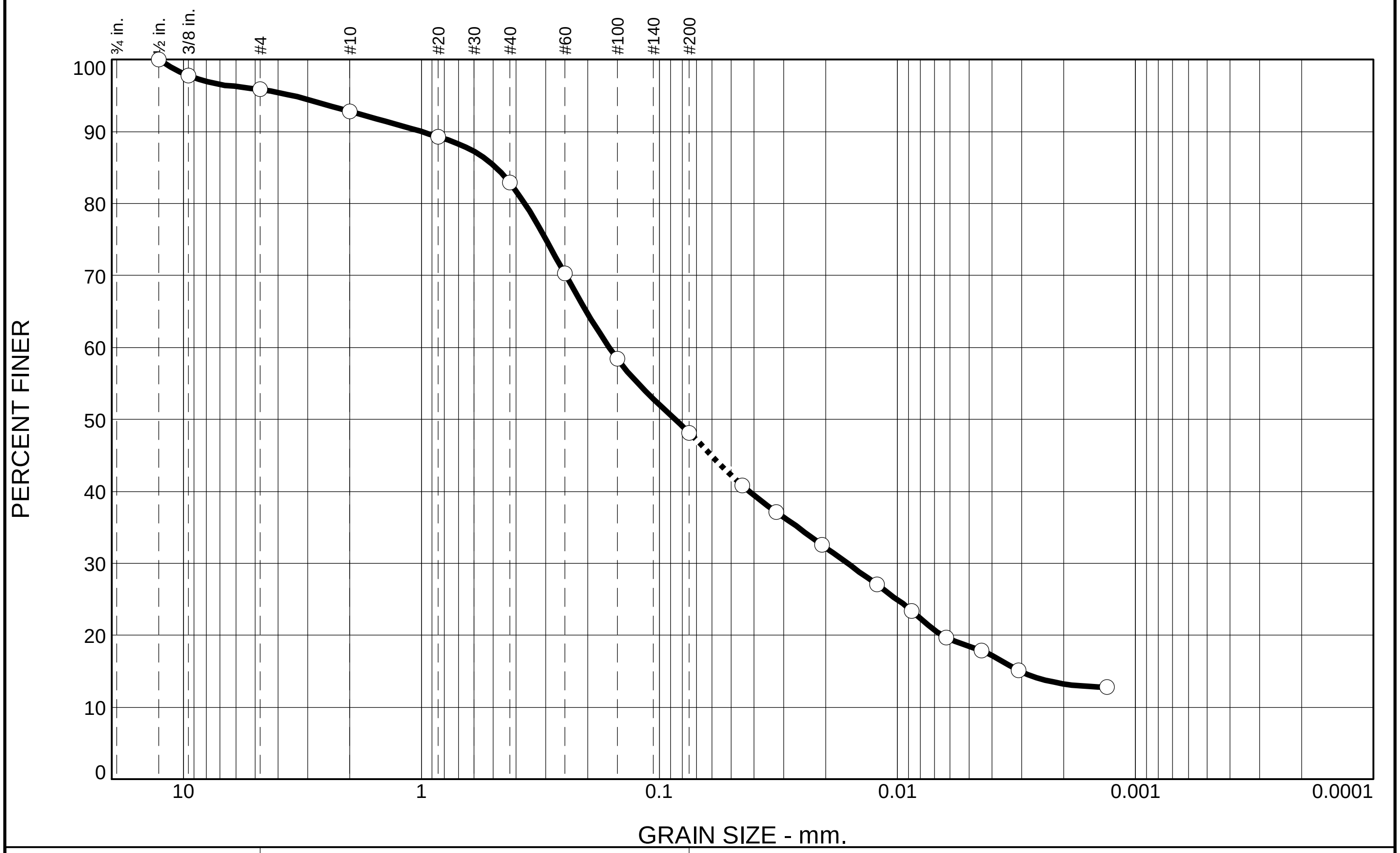
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION

Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.2	3.0	9.9	34.7	29.7	18.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5	100.0		
.375	97.8		
#4	95.8		
#10	92.8		
#20	89.3		
#40	82.9		
#60	70.3		
#100	58.4		
#200	48.2		
0.0449 mm.	40.8		
0.0322 mm.	37.1		
0.0207 mm.	32.5		
0.0122 mm.	27.0		
0.0087 mm.	23.4		
0.0062 mm.	19.7		
0.0044 mm.	17.9		
0.0031 mm.	15.1		
0.0013 mm.	12.8		

* (no specification provided)

Soil Description

GRAY AND BROWN SILTY CLAYEY SAND

Atterberg Limits

PL= 11 LL= 17 PI= 6

Coefficients

D_{90}= 1.0012 D_{85}= 0.4864 D_{60}= 0.1626

D_{50}= 0.0858 D_{30}= 0.0162 D_{15}= 0.0031

D_{10}= C_u= C_c=

Classification

USCS= SC-SM AASHTO= A-4(0)

Remarks

F.M.=1.02

Source of Sample: MW-37 **Depth:** 35.5'-36.0'
Sample Number: 1300

Date: 4-2-21

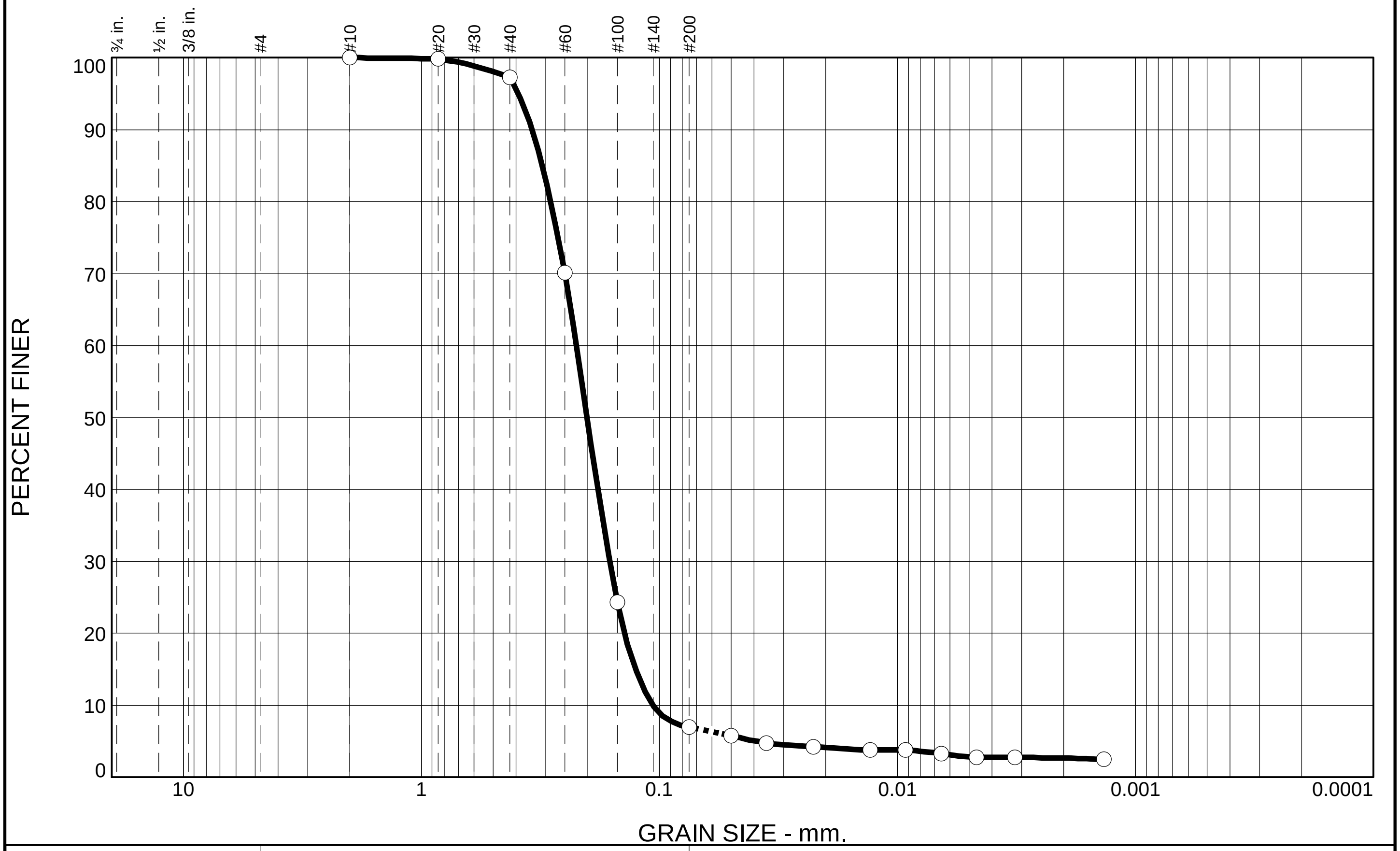
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION

Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	**Fine**	**Coarse**	**Medium**	**Fine**	**Silt**	**Clay**
0.0	0.0	0.0	2.7	90.4	4.1	2.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.9		
#40	97.3		
#60	70.1		
#100	24.3		
#200	6.9		
0.0500 mm.	5.7		
0.0355 mm.	4.7		
0.0225 mm.	4.2		
0.0130 mm.	3.7		
0.0092 mm.	3.7		
0.0065 mm.	3.2		
0.0046 mm.	2.7		
0.0032 mm.	2.7		
0.0014 mm.	2.5		

* (no specification provided)

Soil Description

GRAYISH BROWN POORLY GRADED SAND WITH SILTY CLAY

Atterberg Limits

PL= 7 LL= 13 PI= 6

Coefficients

D_{90}= 0.3426 D_{85}= 0.3102 D_{60}= 0.2233
D_{50}= 0.2012 D_{30}= 0.1617 D_{15}= 0.1261
D_{10}= 0.1064 C_u= 2.10 C_c= 1.10

Classification

USCS= SP-SC AASHTO= A-2-4(0)

Remarks

F.M.=0.94

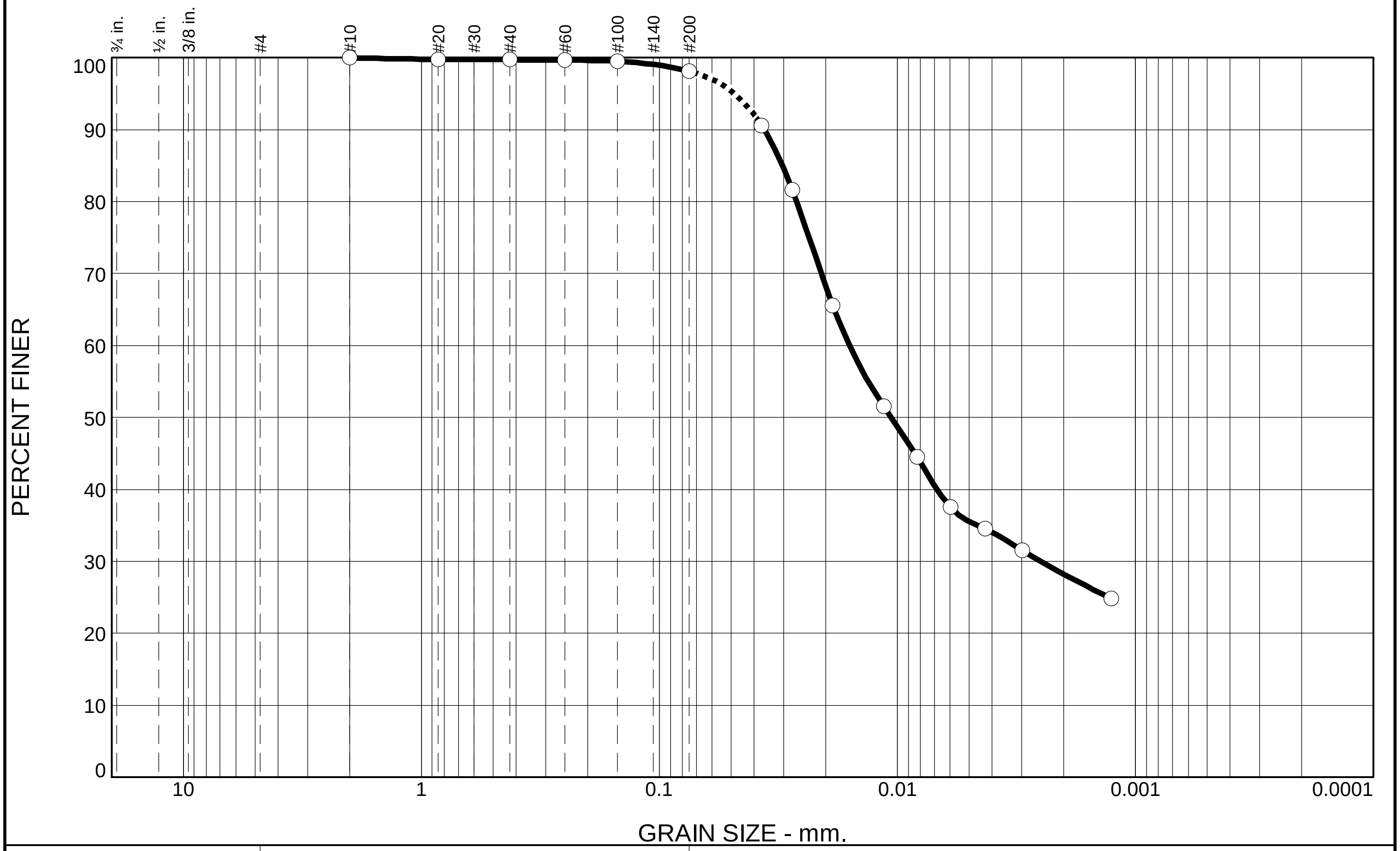
Source of Sample: MW-37 **Depth:** 50.5'-51.0'
Sample Number: 1415
Date: 4-2-21

Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION
Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.3	1.6	62.5	35.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.8		
#40	99.7		
#60	99.7		
#100	99.5		
#200	98.1		
0.0373 mm.	90.6		
0.0276 mm.	81.6		
0.0187 mm.	65.6		
0.0114 mm.	51.5		
0.0083 mm.	44.5		
0.0060 mm.	37.5		
0.0043 mm.	34.5		
0.0030 mm.	31.5		
0.0013 mm.	24.8		

* (no specification provided)

Soil Description

GRAY LEAN CLAY - SAND SEAMS NOTED

Atterberg Limits

PL= 18 LL= 31 PI= 13

Coefficients

D_{90}= 0.0364 D_{85}= 0.0304 D_{60}= 0.0159
D_{50}= 0.0106 D_{30}= 0.0025 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(12)

Remarks

F.M.=0.01

Source of Sample: MW-37 **Depth:** 55.0'-57.0'
Sample Number: 1500

Date: 3-25-21

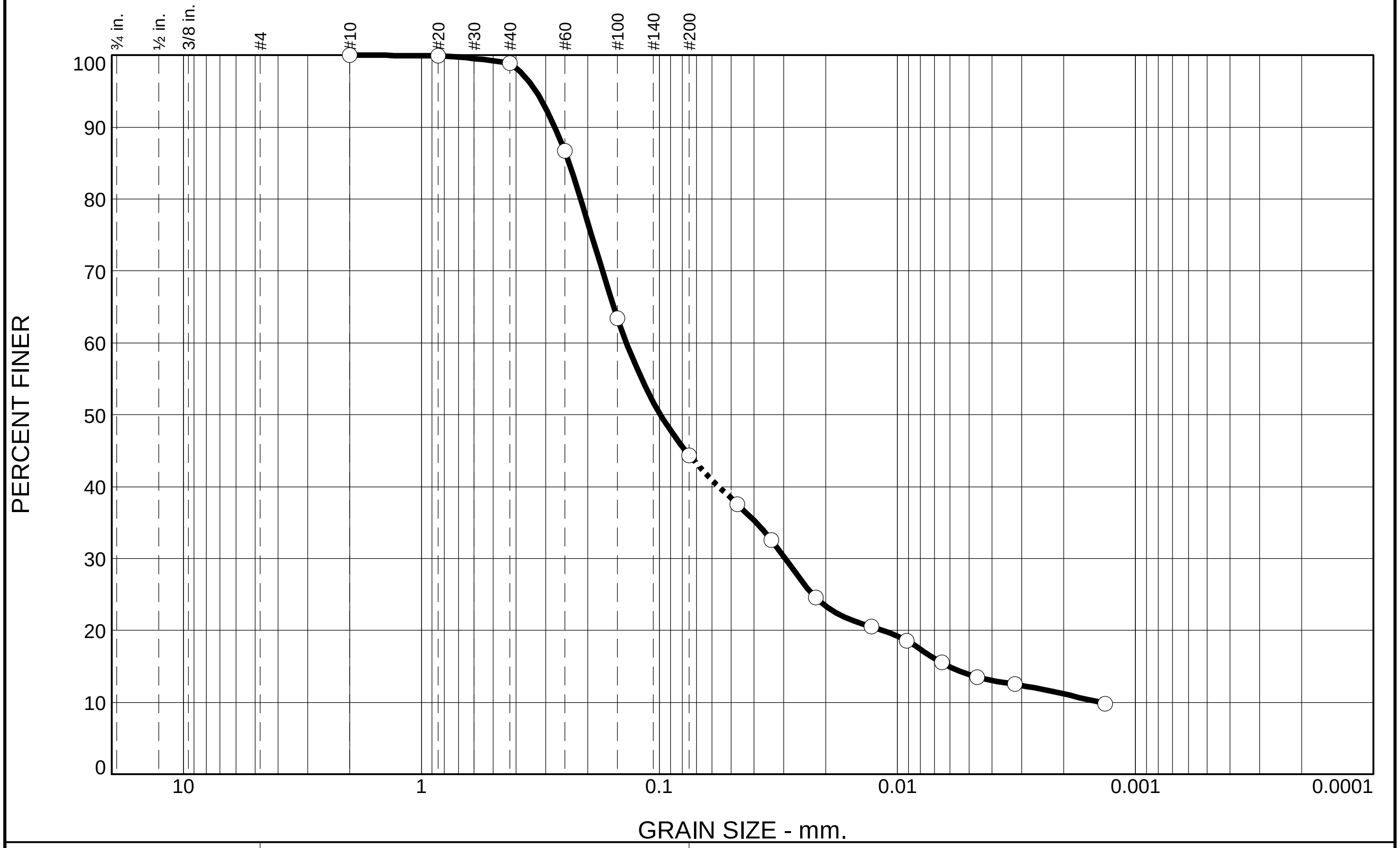
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION

Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	1.1	54.5	30.6	13.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.9		
#40	98.9		
#60	86.7		
#100	63.4		
#200	44.4		
0.0471 mm.	37.6		
0.0339 mm.	32.6		
0.0220 mm.	24.5		
0.0128 mm.	20.5		
0.0091 mm.	18.5		
0.0065 mm.	15.5		
0.0046 mm.	13.5		
0.0032 mm.	12.5		
0.0013 mm.	9.8		

* (no specification provided)

Soil Description

BROWN SILTY SAND

Atterberg Limits

PL= 14 LL= 17 PI= 3

Coefficients

D_{90}= 0.2745	D_{85}= 0.2397	D_{60}= 0.1376
D_{50}= 0.0990	D_{30}= 0.0296	D_{15}= 0.0061
D_{10}= 0.0014	C_u= 97.91	C_c= 4.54

Classification

USCS= SM AASHTO= A-4(0)

Remarks

F.M.=0.44

Source of Sample: MW-38 **Depth:** 5.0'-7.0'
Sample Number: 0835

Date: 3-25-21

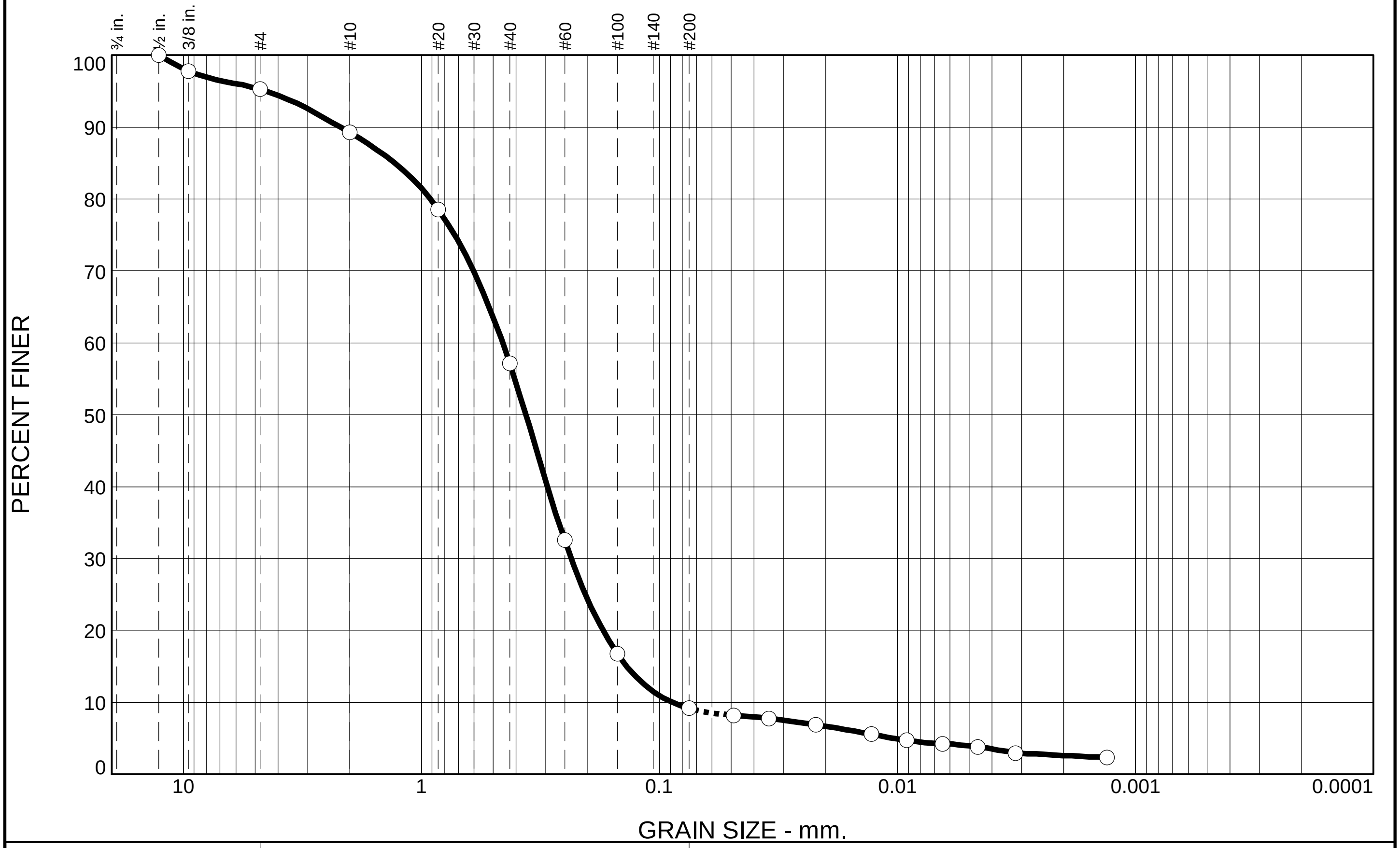
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION

Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.7	6.1	32.1	47.9	5.2	4.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5	100.0		
.375	97.8		
#4	95.3		
#10	89.2		
#20	78.5		
#40	57.1		
#60	32.5		
#100	16.7		
#200	9.2		
0.0488 mm.	8.2		
0.0346 mm.	7.8		
0.0220 mm.	6.9		
0.0128 mm.	5.6		
0.0091 mm.	4.7		
0.0065 mm.	4.3		
0.0046 mm.	3.8		
0.0032 mm.	2.9		
0.0013 mm.	2.3		

* (no specification provided)

Soil Description

BROWNISH GRAY POORLY GRADED SAND WITH SILTY CLAY

Atterberg Limits

PL= 7 LL= 11 PI= 4

Coefficients

D_{90}= 2.1869 D_{85}= 1.2912 D_{60}= 0.4551
D_{50}= 0.3636 D_{30}= 0.2348 D_{15}= 0.1371
D_{10}= 0.0883 C_u= 5.15 C_c= 1.37

Classification

USCS= SP-SC AASHTO= A-2-4(0)

Remarks

F.M.=2.05

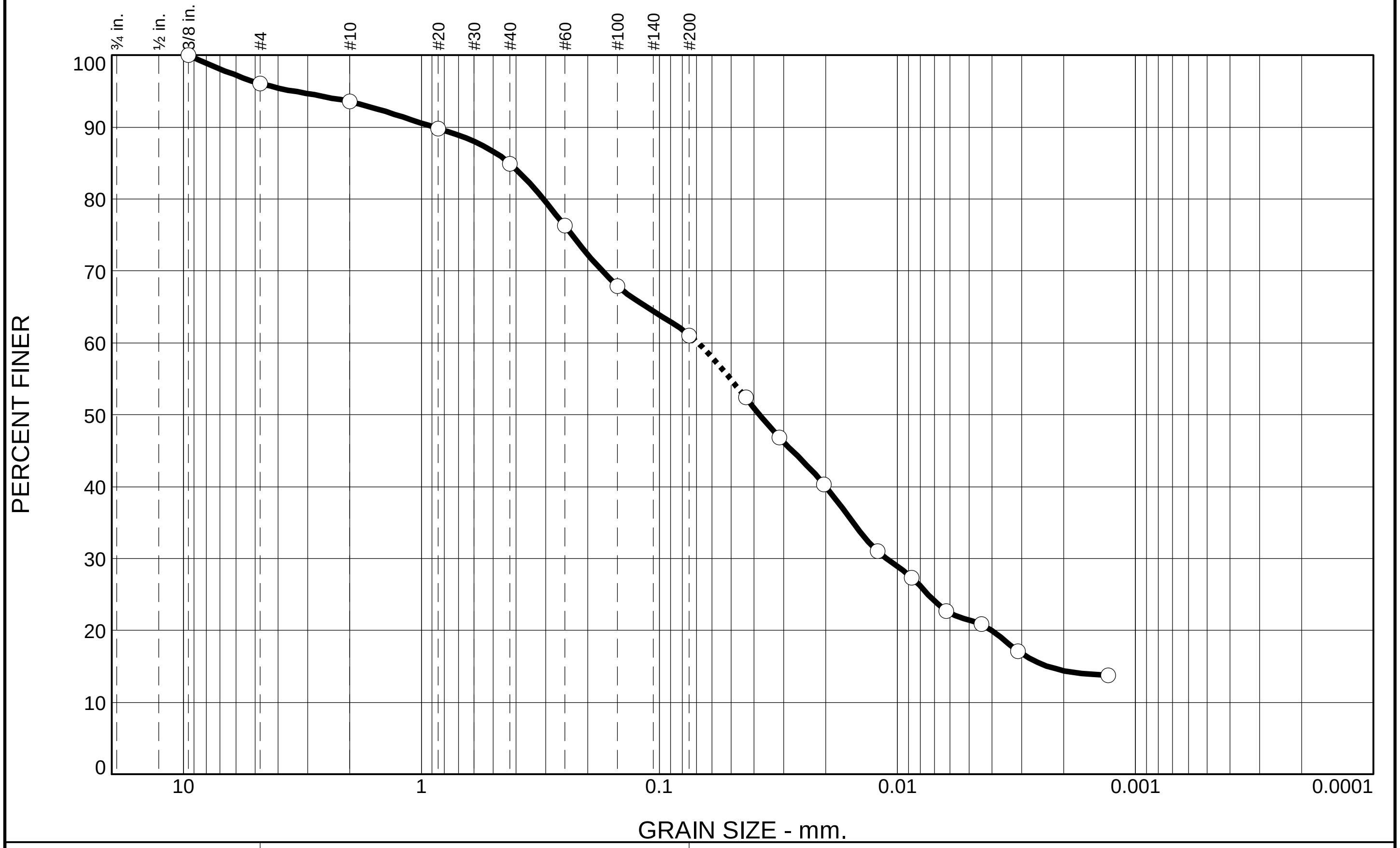
Source of Sample: MW-38 **Depth:** 21.5'-22.0'
Sample Number: 0910 **Date:** 4-16-21

Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION
Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.9	2.6	8.6	23.9	39.5	21.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	96.1		
#10	93.5		
#20	89.8		
#40	84.9		
#60	76.3		
#100	67.9		
#200	61.0		
0.0433 mm.	52.4		
0.0313 mm.	46.8		
0.0203 mm.	40.3		
0.0121 mm.	31.1		
0.0087 mm.	27.3		
0.0062 mm.	22.7		
0.0044 mm.	20.9		
0.0031 mm.	17.1		
0.0013 mm.	13.7		

* (no specification provided)

Soil Description

GRAY SANDY LEAN CLAY - SILT SEAMS NOTED

Atterberg Limits

PL= 12 LL= 21 PI= 9

Coefficients

D_{90}= 0.8898 D_{85}= 0.4275 D_{60}= 0.0691
D_{50}= 0.0379 D_{30}= 0.0111 D_{15}= 0.0023
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-4(2)

Remarks

F.M.=0.83

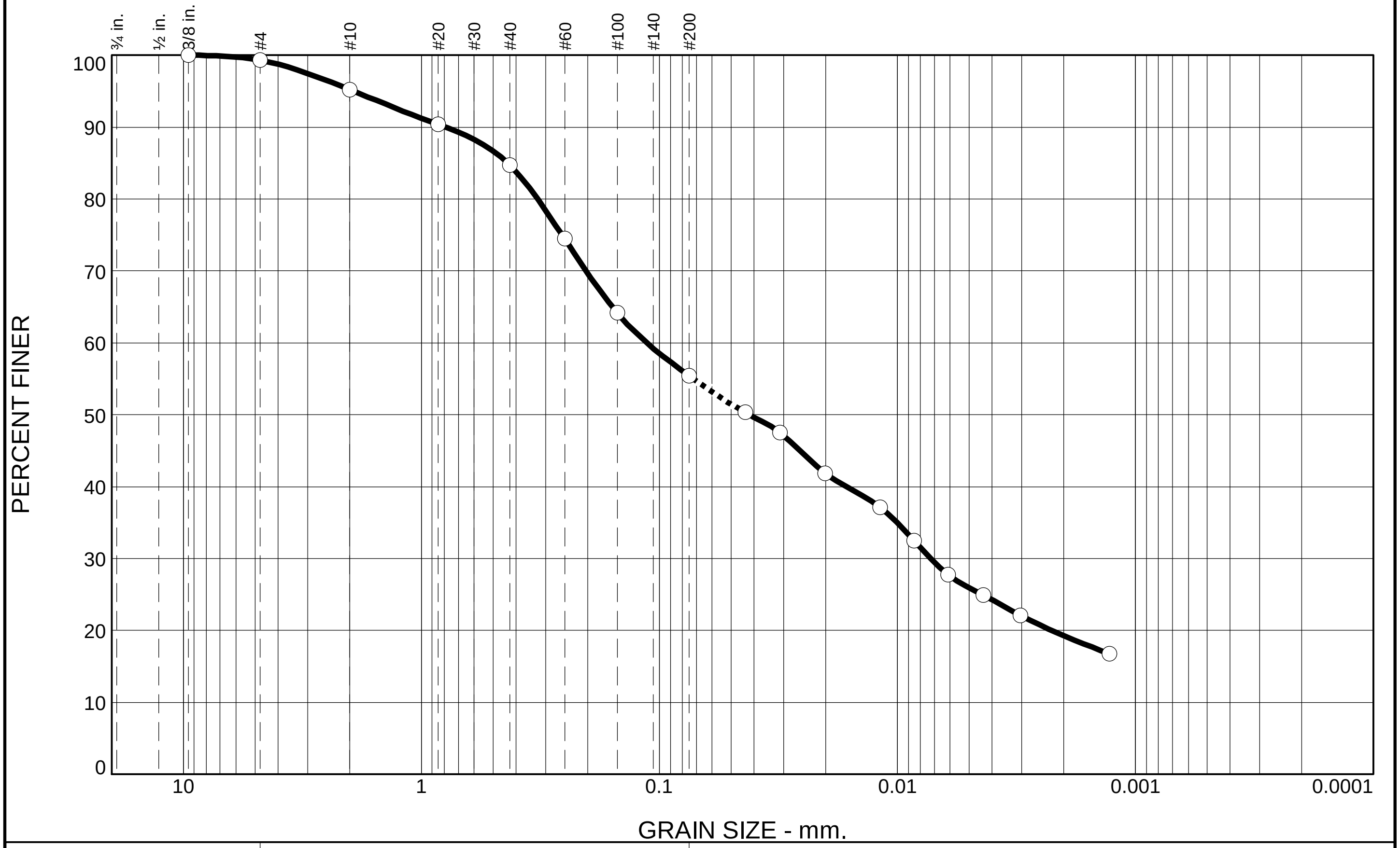
Source of Sample: MW-38 **Depth:** 35.0'-37.0'
Sample Number: 1655 **Date:** 3-25-21

Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION
Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.7	4.1	10.5	29.3	29.5	25.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.3		
#10	95.2		
#20	90.4		
#40	84.7		
#60	74.5		
#100	64.2		
#200	55.4		
0.0436 mm.	50.3		
0.0312 mm.	47.5		
0.0201 mm.	41.9		
0.0118 mm.	37.1		
0.0085 mm.	32.4		
0.0061 mm.	27.7		
0.0044 mm.	24.9		
0.0030 mm.	22.1		
0.0013 mm.	16.8		

* (no specification provided)

Soil Description

GRAY TRACE BROWN SANDY LEAN CLAY - SAND SEAMS NOTED

Atterberg Limits

PL= 11 LL= 23 PI= 12

Coefficients

D_{90}= 0.7945 D_{85}= 0.4337 D_{60}= 0.1130
D_{50}= 0.0418 D_{30}= 0.0073 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(3)

Remarks

F.M.=0.82

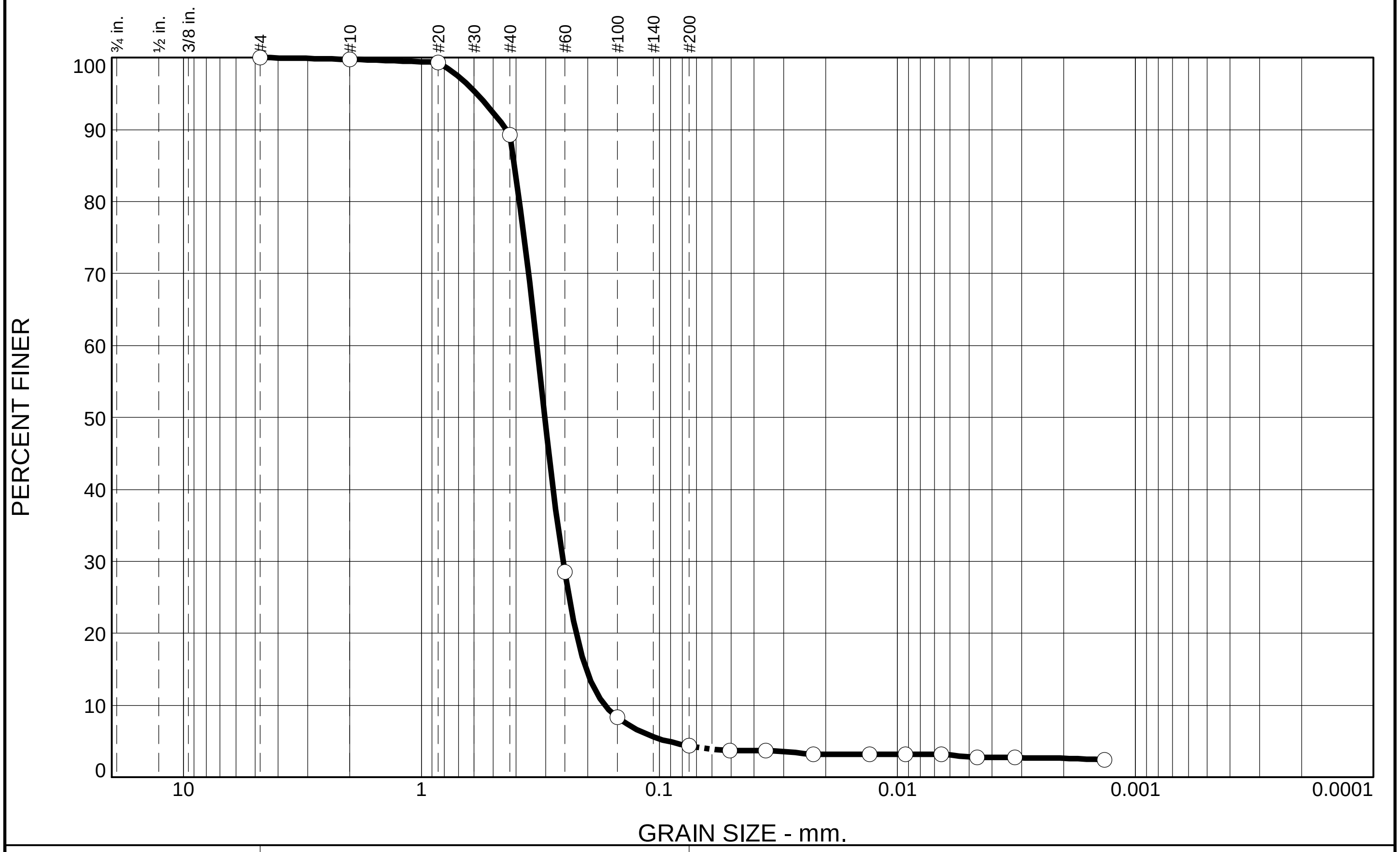
Source of Sample: MW-41 **Depth:** 8.0'-10.0'
Sample Number: 0945
Date: 3-25-21

Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION
Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	10.5	84.9	1.6	2.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.8		
#20	99.3		
#40	89.3		
#60	28.5		
#100	8.3		
#200	4.4		
0.0504 mm.	3.7		
0.0357 mm.	3.7		
0.0226 mm.	3.2		
0.0131 mm.	3.2		
0.0092 mm.	3.2		
0.0065 mm.	3.2		
0.0046 mm.	2.7		
0.0032 mm.	2.7		
0.0014 mm.	2.5		

* (no specification provided)

Soil Description

BROWN POORLY GRADED SAND

Atterberg Limits

PL= 4 LL= 13 PI= 9

Coefficients

D_{90}= 0.4405 D_{85}= 0.4054 D_{60}= 0.3275
D_{50}= 0.3028 D_{30}= 0.2541 D_{15}= 0.2027
D_{10}= 0.1697 C_u= 1.93 C_c= 1.16

Classification

USCS= SP AASHTO= A-2-4(0)

Remarks

F.M.=1.48

Source of Sample: MW-41 **Depth:** 25.0'-25.5'
Sample Number: 1045

Date: 4-2-21

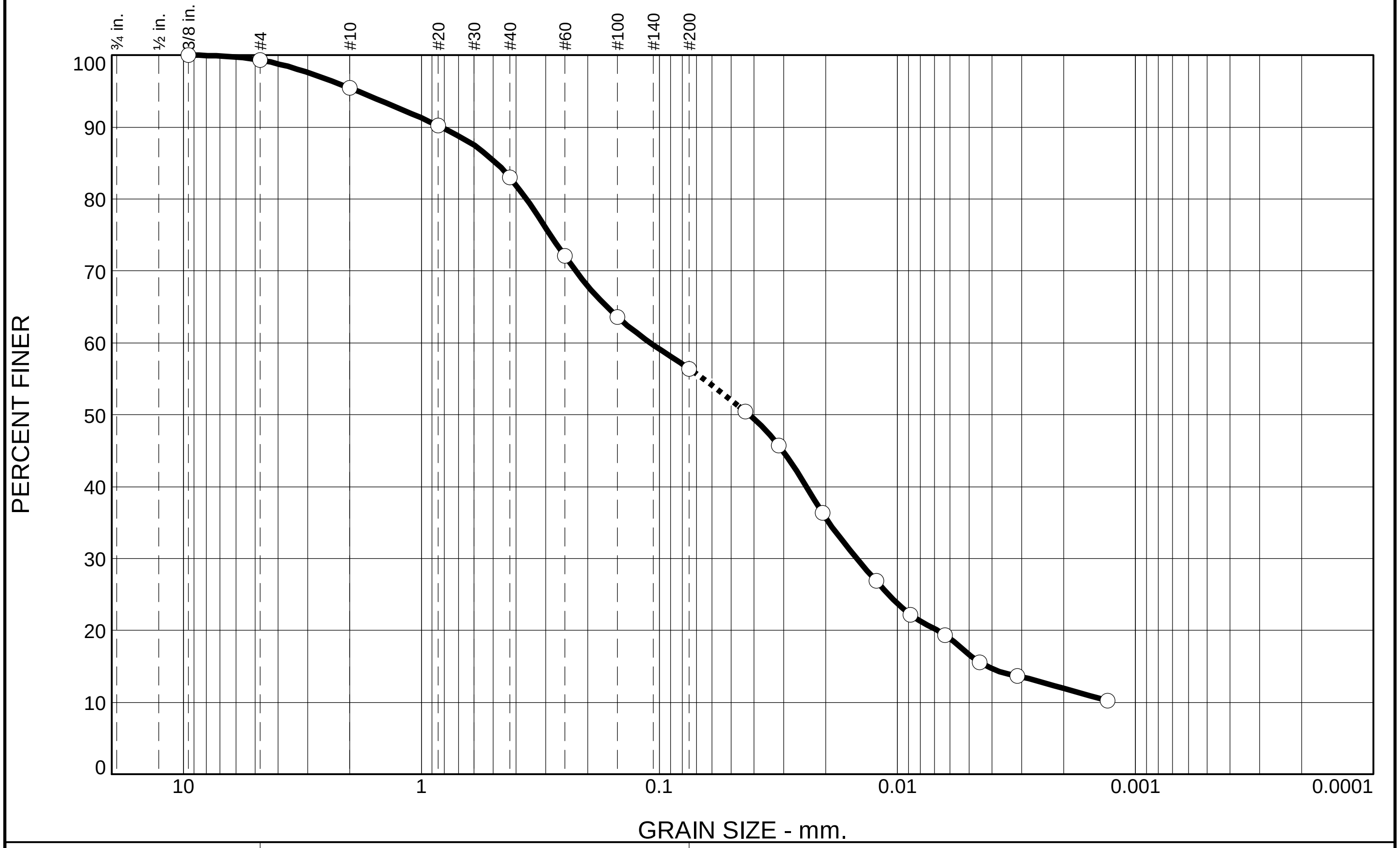
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION

Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.7	3.9	12.4	26.6	39.7	16.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.3		
#10	95.4		
#20	90.2		
#40	83.0		
#60	72.1		
#100	63.6		
#200	56.4		
0.0437 mm.	50.5		
0.0314 mm.	45.7		
0.0206 mm.	36.3		
0.0123 mm.	26.9		
0.0088 mm.	22.2		
0.0063 mm.	19.3		
0.0045 mm.	15.6		
0.0031 mm.	13.7		
0.0013 mm.	10.2		

* (no specification provided)

Soil Description

GRAYISH BROWN SANDY SILTY CLAY

Atterberg Limits

PL= 14 LL= 20 PI= 6

Coefficients

D_{90}= 0.8278	D_{85}= 0.4839	D_{60}= 0.1090
D_{50}= 0.0420	D_{30}= 0.0148	D_{15}= 0.0042
D_{10}=	C_u=	C_c=

Classification

USCS= CL-ML AASHTO= A-4(0)

Remarks

F.M.=0.85

Source of Sample: MW-41 **Depth:** 35.0'-37.0'
Sample Number: 1130

Date: 3-25-21

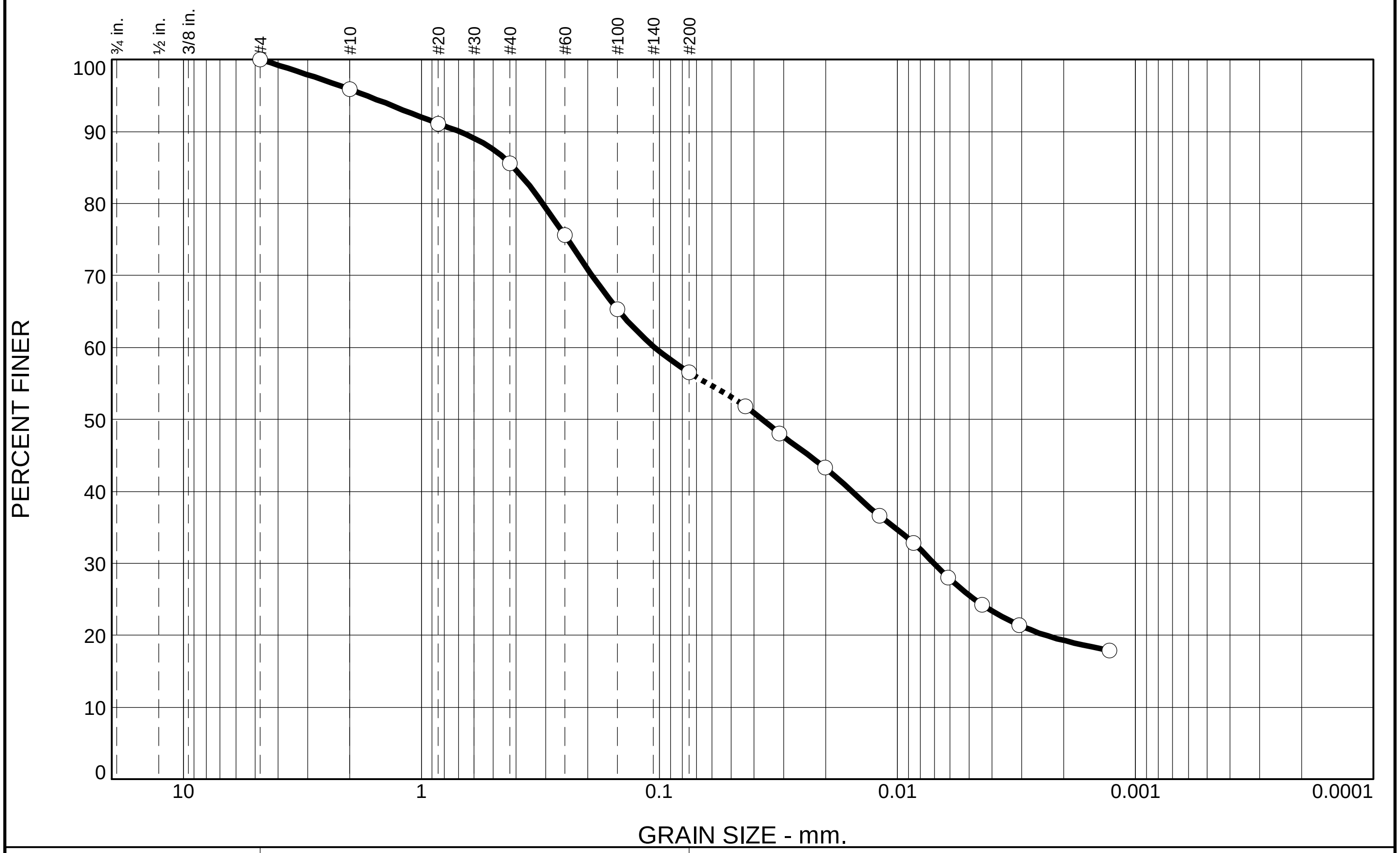
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION

Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.1	10.3	29.1	30.9	25.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	95.9		
#20	91.1		
#40	85.6		
#60	75.6		
#100	65.3		
#200	56.5		
0.0436 mm.	51.8		
0.0313 mm.	48.0		
0.0202 mm.	43.3		
0.0119 mm.	36.6		
0.0085 mm.	32.8		
0.0061 mm.	28.1		
0.0044 mm.	24.3		
0.0031 mm.	21.4		
0.0013 mm.	17.9		

* (no specification provided)

Soil Description

GRAY AND GRAYISH BROWN SANDY LEAN CLAY

Atterberg Limits

PL= 11 LL= 21 PI= 10

Coefficients

D_{90}= 0.6930 D_{85}= 0.4083 D_{60}= 0.1046
D_{50}= 0.0370 D_{30}= 0.0070 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-4(2)

Remarks

F.M.=0.77

Source of Sample: MW-43 **Depth:** 35.0'-37.0'
Sample Number: 1330

Date: 3-25-21

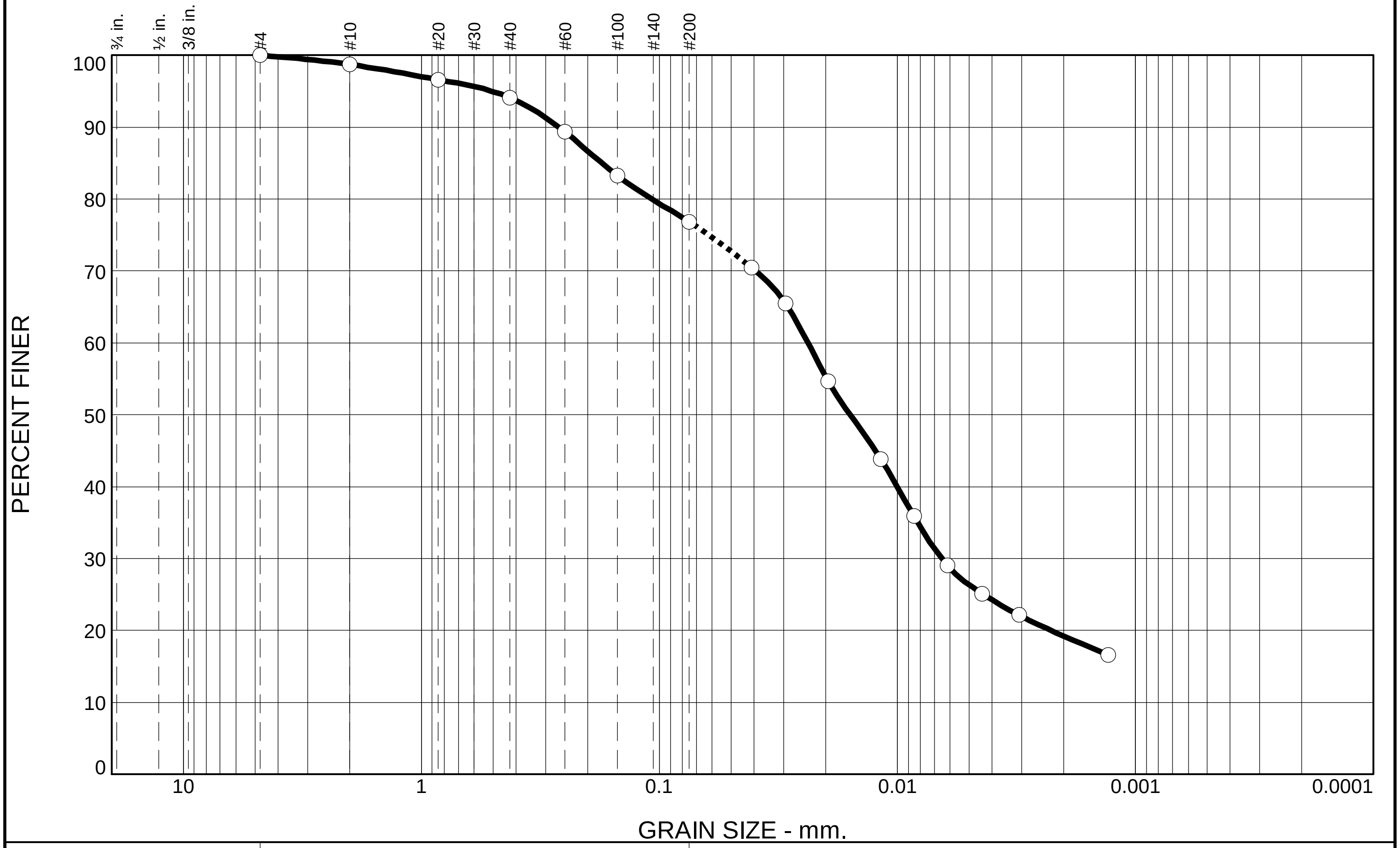
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION

Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.3	4.6	17.3	50.5	26.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	98.7		
#20	96.6		
#40	94.1		
#60	89.4		
#100	83.2		
#200	76.8		
0.0409 mm.	70.4		
0.0295 mm.	65.5		
0.0195 mm.	54.7		
0.0117 mm.	43.8		
0.0085 mm.	36.0		
0.0062 mm.	29.1		
0.0044 mm.	25.1		
0.0031 mm.	22.2		
0.0013 mm.	16.6		

* (no specification provided)

Soil Description

GRAY LEAN CLAY WITH SAND - SAND SEAMS NOTED

Atterberg Limits

PL= 16 LL= 28 PI= 12

Coefficients

D_{90}= 0.2641	D_{85}= 0.1746	D_{60}= 0.0238
D_{50}= 0.0158	D_{30}= 0.0065	D_{15}=
D_{10}=	C_u=	C_c=

Classification

USCS= CL AASHTO= A-6(7)

Remarks

F.M.=0.33

Source of Sample: MW-43 **Depth:** 50.0'-52.0'
Sample Number: 1400
Date: 3-25-21

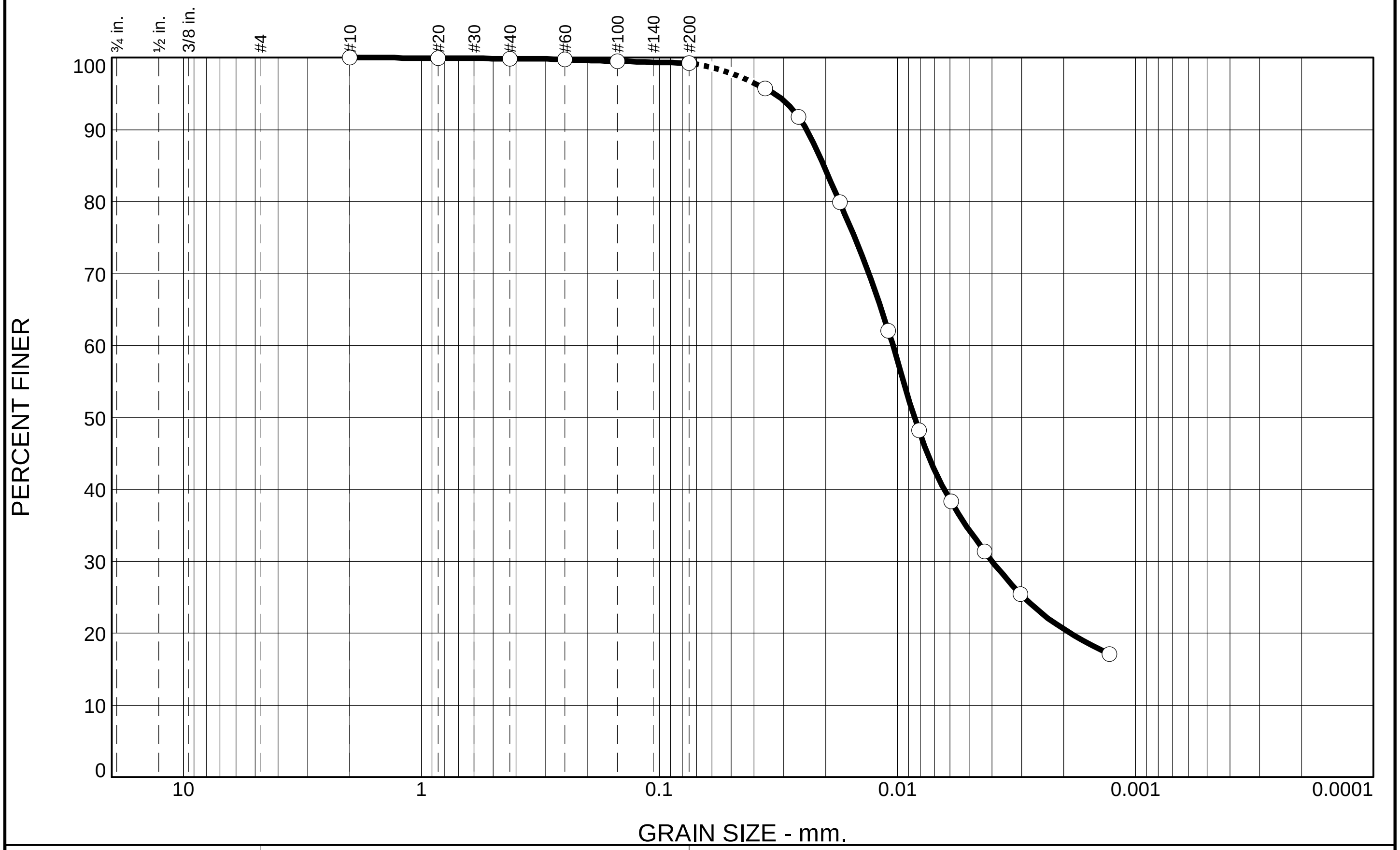
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION

Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.7	64.9	34.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.9		
#40	99.9		
#60	99.7		
#100	99.5		
#200	99.2		
0.0360 mm.	95.7		
0.0260 mm.	91.8		
0.0175 mm.	79.9		
0.0109 mm.	62.1		
0.0081 mm.	48.2		
0.0060 mm.	38.3		
0.0043 mm.	31.4		
0.0030 mm.	25.5		
0.0013 mm.	17.1		

* (no specification provided)

Soil Description

BROWNISH GRAY LEAN CLAY

Atterberg Limits

PL= 21 LL= 33 PI= 12

Coefficients

D_{90}= 0.0241 D_{85}= 0.0203 D_{60}= 0.0104
D_{50}= 0.0085 D_{30}= 0.0040 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(12)

Remarks

F.M.=0.01

Source of Sample: MW-43 **Depth:** 61.0'-61.5'
Sample Number: 1500 **Date:** 4-16-21

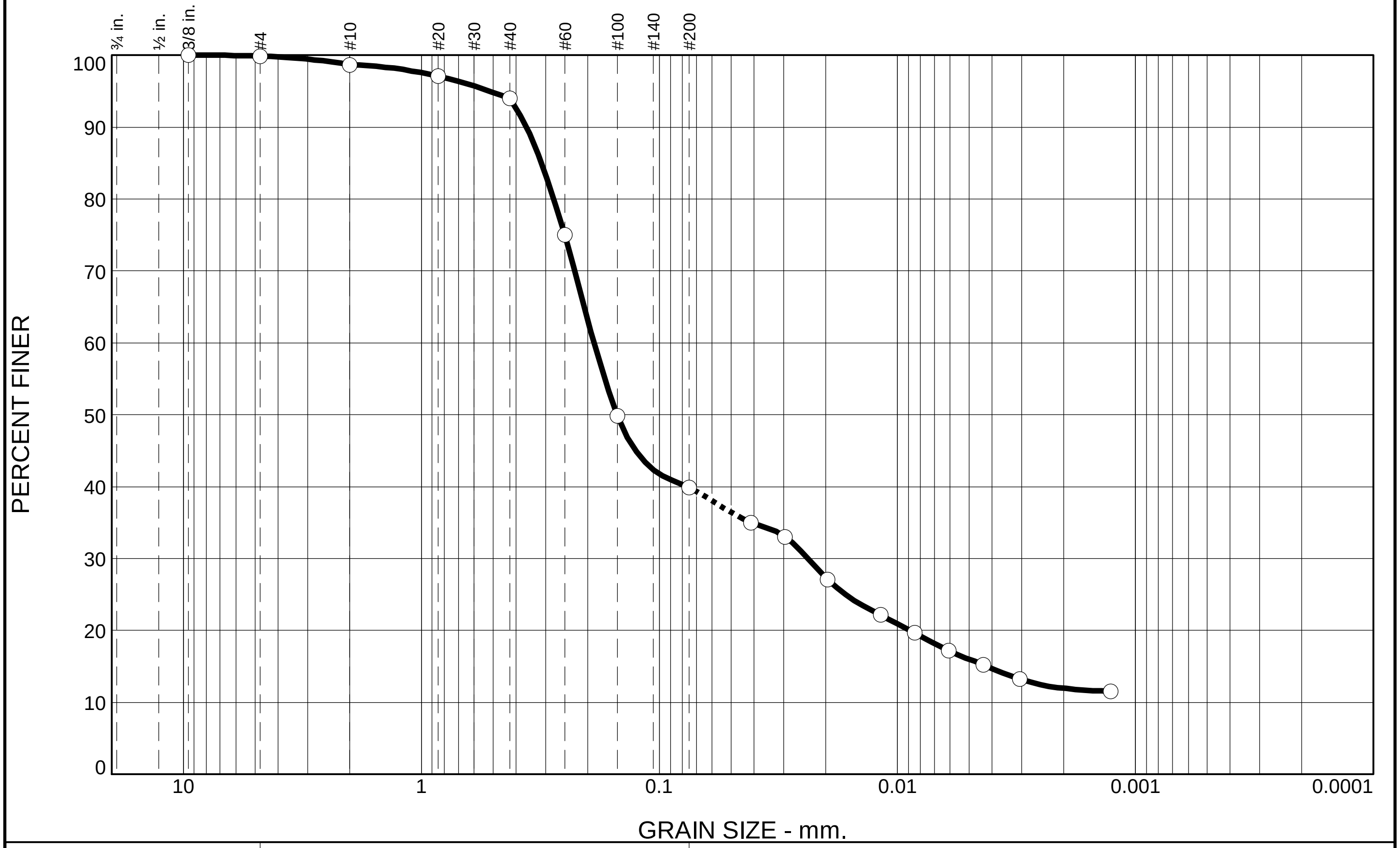
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION

Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.1	1.2	4.7	54.1	23.9	16.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.9		
#10	98.7		
#20	97.1		
#40	94.0		
#60	75.0		
#100	49.9		
#200	39.9		
0.0412 mm.	35.0		
0.0296 mm.	33.0		
0.0197 mm.	27.1		
0.0118 mm.	22.1		
0.0085 mm.	19.7		
0.0061 mm.	17.2		
0.0044 mm.	15.2		
0.0031 mm.	13.2		
0.0013 mm.	11.5		

* (no specification provided)

Soil Description

BROWN AND DARK BROWN SILTY SAND

Atterberg Limits

PL= 12 LL= 12 PI= NP

Coefficients

D_{90}= 0.3618 D_{85}= 0.3127 D_{60}= 0.1879

D_{50}= 0.1505 D_{30}= 0.0237 D_{15}= 0.0042

D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

F.M.=0.74

Source of Sample: MW-70SA **Depth:** 16.5'-17.0'
Sample Number: 1615 **Date:** 4-16-21

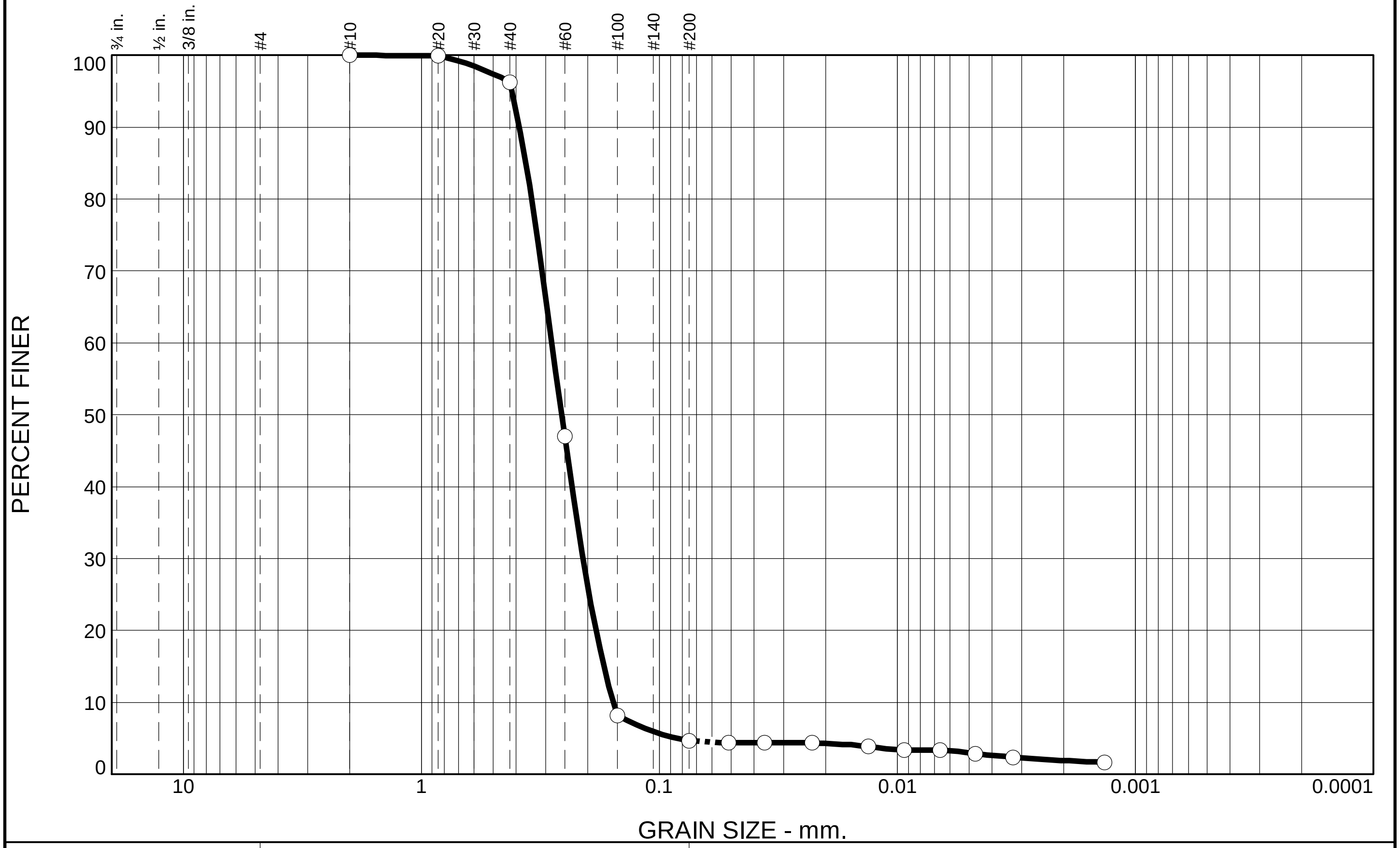
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION

Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	3.7	91.6	1.7	3.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.9		
#40	96.3		
#60	47.0		
#100	8.2		
#200	4.7		
0.0510 mm.	4.4		
0.0361 mm.	4.4		
0.0228 mm.	4.4		
0.0132 mm.	3.9		
0.0094 mm.	3.4		
0.0066 mm.	3.4		
0.0047 mm.	2.9		
0.0033 mm.	2.4		
0.0013 mm.	1.6		

* (no specification provided)

Soil Description

GRAY POORLY GRADED SAND

Atterberg Limits

PL= 10 LL= 17 PI= 7

Coefficients

D_{90}= 0.3868 D_{85}= 0.3638 D_{60}= 0.2829
D_{50}= 0.2574 D_{30}= 0.2092 D_{15}= 0.1714
D_{10}= 0.1564 C_u= 1.81 C_c= 0.99

Classification

USCS= SP AASHTO= A-2-4(0)

Remarks

F.M.=1.27

Source of Sample: MW-71S **Depth:** 10.0'-10.5'
Sample Number: 1615 **Date:** 4-16-21

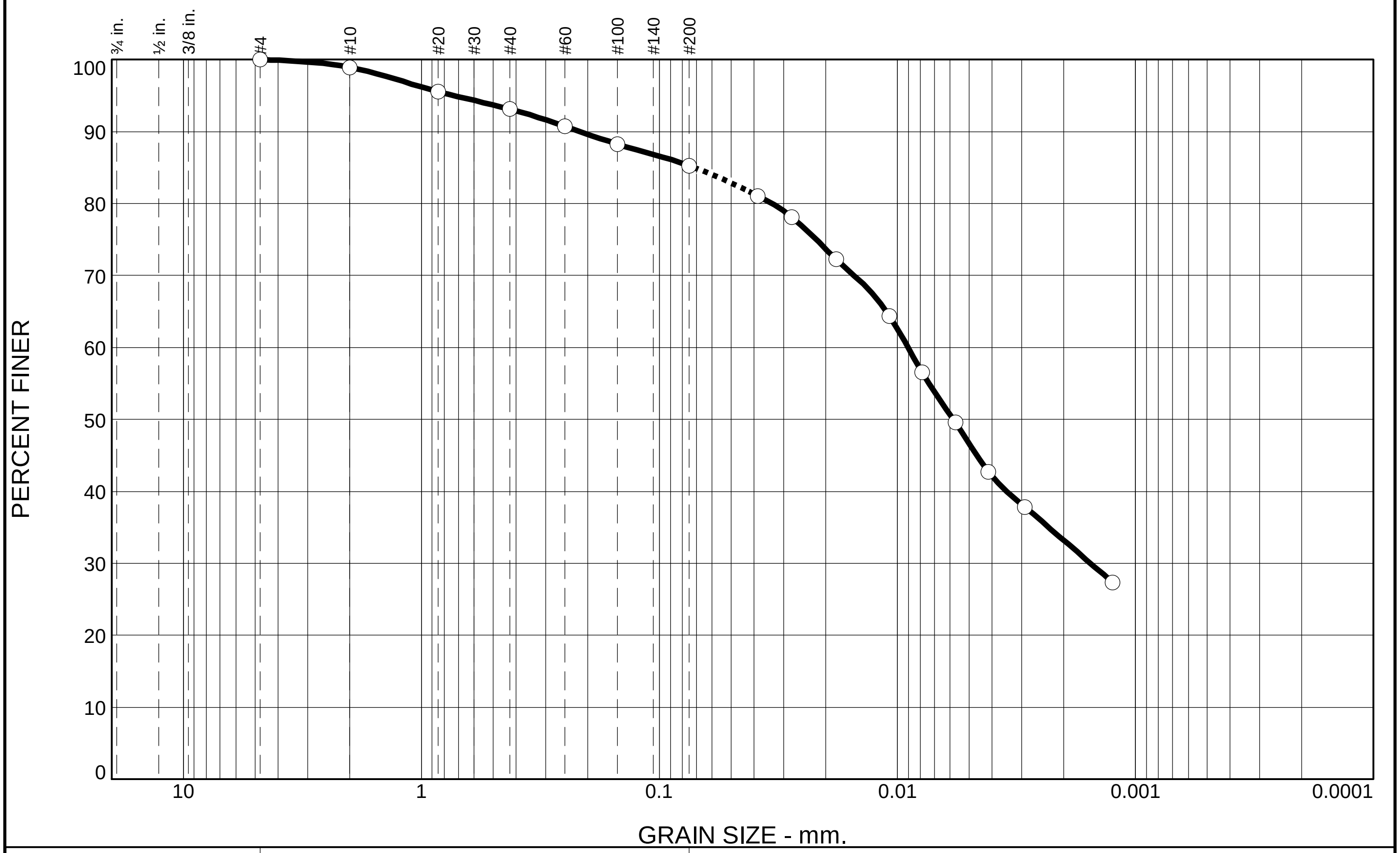
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION

Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.1	5.8	7.8	38.6	46.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	98.9		
#20	95.6		
#40	93.1		
#60	90.8		
#100	88.2		
#200	85.3		
0.0387 mm.	81.1		
0.0278 mm.	78.1		
0.0181 mm.	72.2		
0.0108 mm.	64.4		
0.0079 mm.	56.5		
0.0057 mm.	49.6		
0.0041 mm.	42.7		
0.0029 mm.	37.8		
0.0013 mm.	27.3		

* (no specification provided)

Soil Description

BROWN AND GRAYISH BROWN LEAN CLAY WITH SAND

Atterberg Limits

PL= 15 LL= 30 PI= 15

Coefficients

D_{90}= 0.2148 D_{85}= 0.0713 D_{60}= 0.0090
D_{50}= 0.0058 D_{30}= 0.0015 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(11)

Remarks

F.M.=0.30

Source of Sample: MW-103 **Depth:** 15.0'-17.0'
Sample Number: 1110

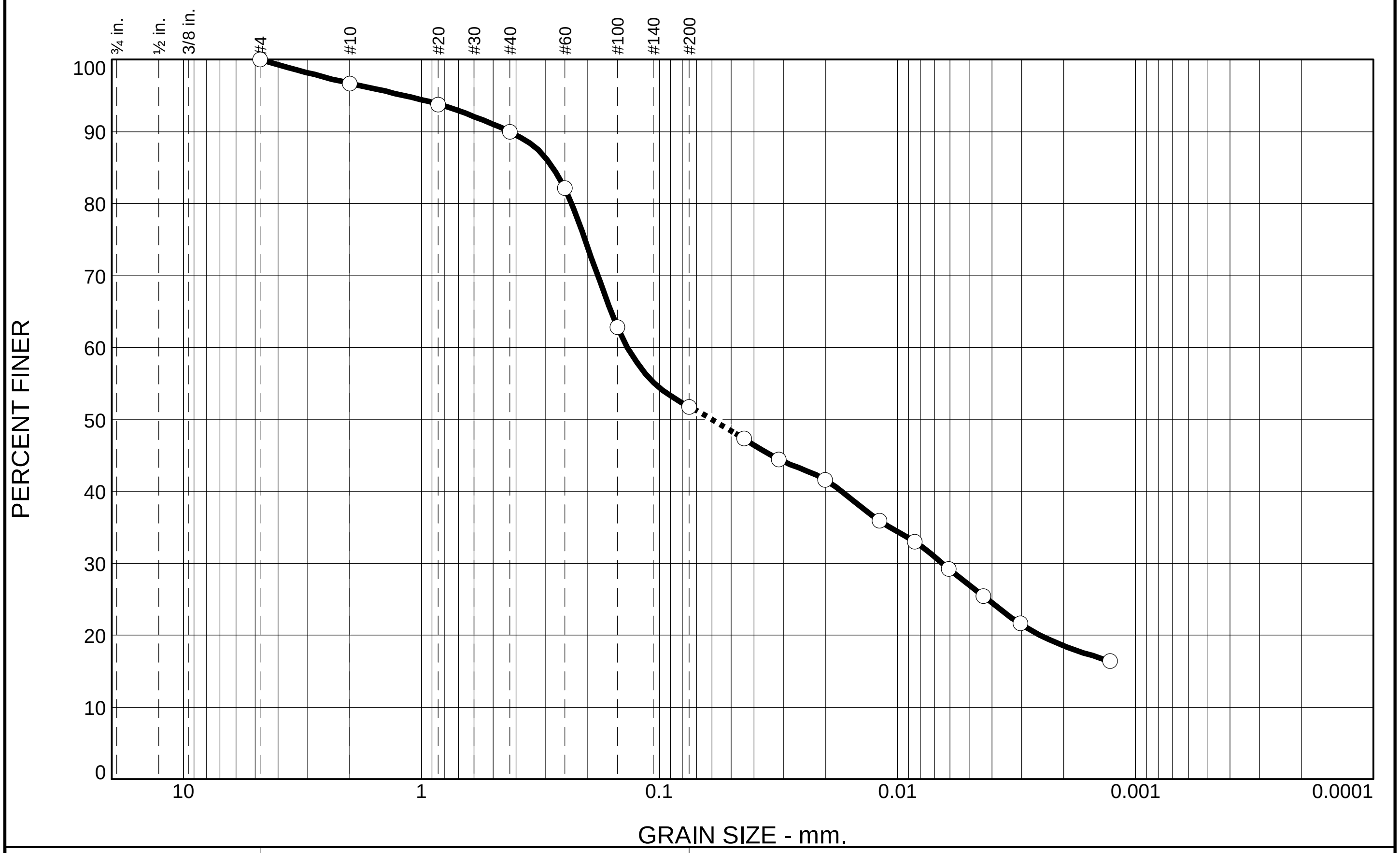
Date: 3-25-21

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION

Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.3	6.7	38.2	24.8	27.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	96.7		
#20	93.8		
#40	90.0		
#60	82.1		
#100	62.8		
#200	51.8		
0.0441 mm.	47.3		
0.0315 mm.	44.5		
0.0202 mm.	41.6		
0.0119 mm.	35.9		
0.0085 mm.	33.0		
0.0061 mm.	29.2		
0.0043 mm.	25.4		
0.0031 mm.	21.6		
0.0013 mm.	16.4		

* (no specification provided)

Soil Description

BROWN AND GRAY SANDY SILTY CLAY

Atterberg Limits

PL= 10 LL= 17 PI= 7

Coefficients

D_{90}= 0.4271 D_{85}= 0.2800 D_{60}= 0.1361
D_{50}= 0.0603 D_{30}= 0.0065 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL-ML AASHTO= A-4(0)

Remarks

F.M.=0.66

Source of Sample: MW-103 **Depth:** 95.5'-96.0'
Sample Number: 0915

Date: 4-16-21

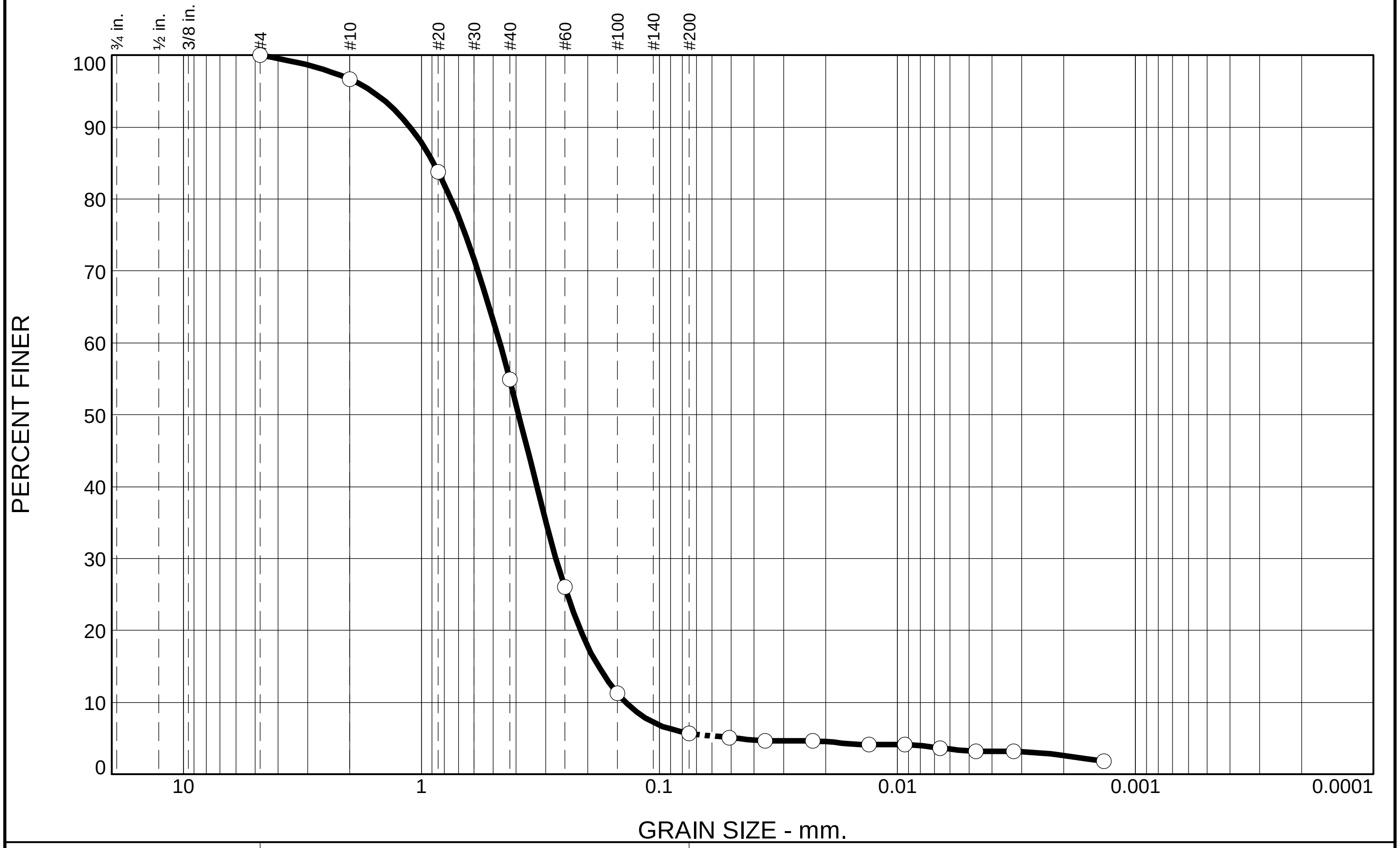
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION

Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.3	41.8	49.2	2.5	3.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	96.7		
#20	83.8		
#40	54.9		
#60	26.0		
#100	11.2		
#200	5.7		
0.0507 mm.	5.1		
0.0360 mm.	4.6		
0.0228 mm.	4.6		
0.0132 mm.	4.1		
0.0093 mm.	4.1		
0.0066 mm.	3.6		
0.0047 mm.	3.2		
0.0032 mm.	3.2		
0.0014 mm.	1.8		

* (no specification provided)

Soil Description

GRAY AND BROWN POORLY GRADED SAND WITH SILTY CLAY

Atterberg Limits

PL= 7 LL= 14 PI= 7

Coefficients

D_{90}= 1.1145 D_{85}= 0.8892 D_{60}= 0.4681
D_{50}= 0.3894 D_{30}= 0.2718 D_{15}= 0.1803
D_{10}= 0.1385 C_u= 3.38 C_c= 1.14

Classification

USCS= SP-SC AASHTO= A-2-4(0)

Remarks

F.M.=1.93

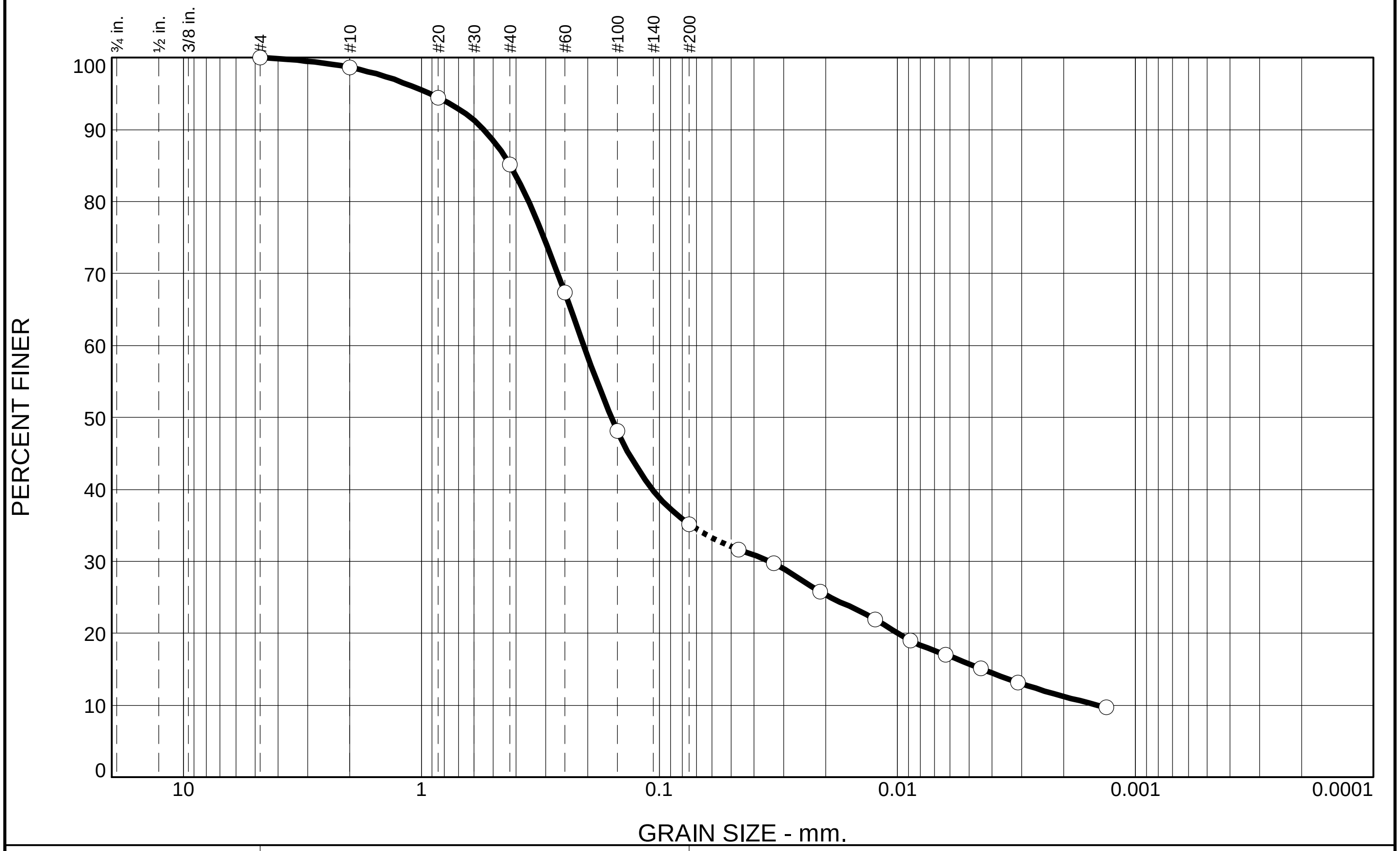
Source of Sample: MW-103 **Depth:** 132.5'-133.0'
Sample Number: 1350
Date: 4-28-21

Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION
Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.3	13.5	50.0	19.4	15.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	98.7		
#20	94.4		
#40	85.2		
#60	67.4		
#100	48.1		
#200	35.2		
0.0465 mm.	31.7		
0.0331 mm.	29.7		
0.0212 mm.	25.8		
0.0124 mm.	21.9		
0.0088 mm.	19.0		
0.0063 mm.	17.0		
0.0045 mm.	15.1		
0.0031 mm.	13.1		
0.0013 mm.	9.7		

* (no specification provided)

Soil Description

GRAY SILTY CLAYEY SAND

Atterberg Limits

PL= 11 LL= 17 PI= 6

Coefficients

D_{90}= 0.5460 D_{85}= 0.4223 D_{60}= 0.2079
D_{50}= 0.1591 D_{30}= 0.0345 D_{15}= 0.0044
D_{10}= 0.0014 C_u= 144.71 C_c= 3.99

Classification

USCS= SC-SM AASHTO= A-2-4(0)

Remarks

F.M.=0.91

Source of Sample: MW-103 **Depth:** 163.0'-163.5'
Sample Number: 0810

Date: 4-2-21

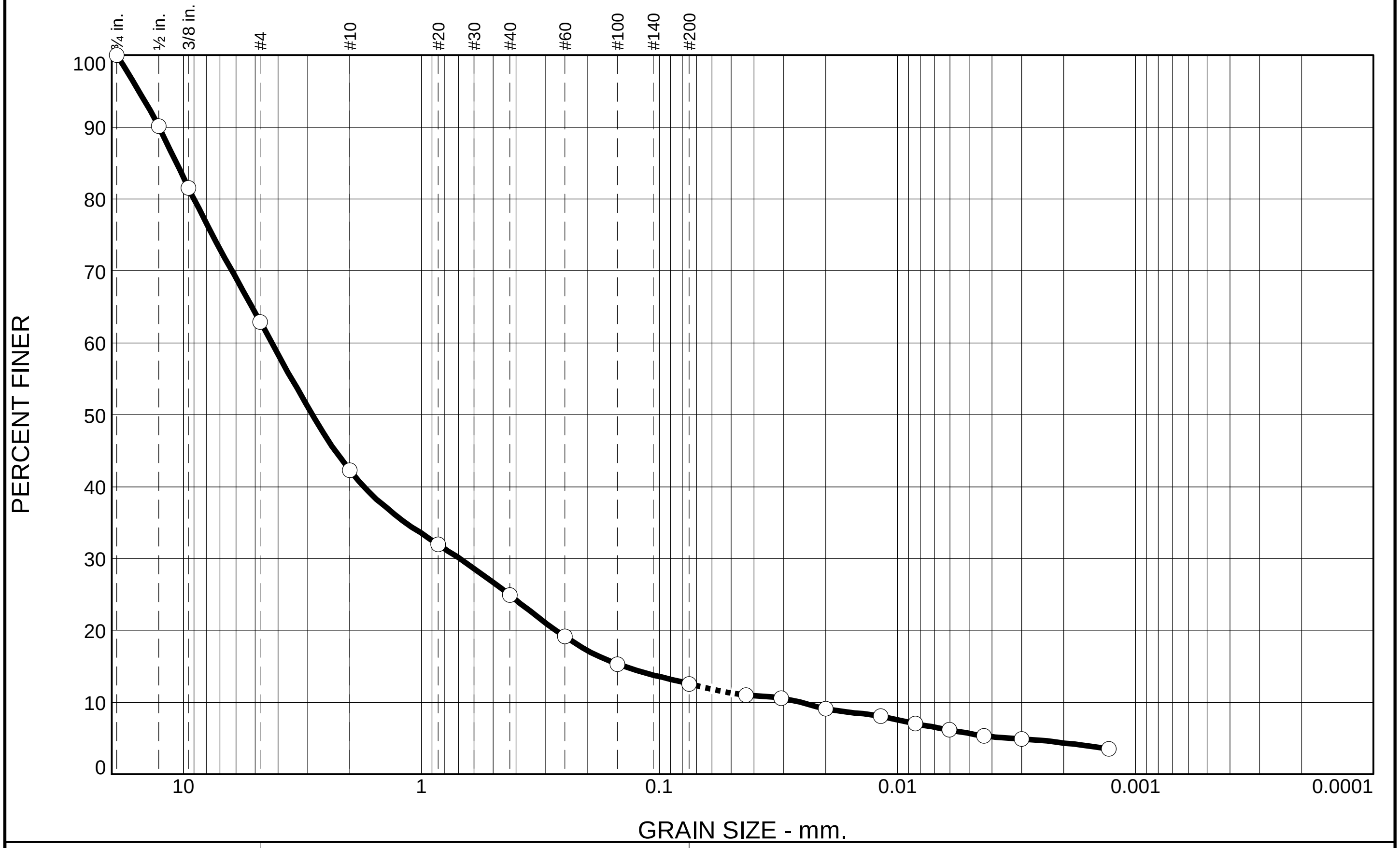
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION

Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	**Fine**	**Coarse**	**Medium**	**Fine**	**Silt**	**Clay**
0.0	37.1	20.6	17.4	12.3	6.9	5.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	90.1		
.375	81.6		
#4	62.9		
#10	42.3		
#20	32.0		
#40	24.9		
#60	19.1		
#100	15.3		
#200	12.6		
0.0432 mm.	11.0		
0.0308 mm.	10.6		
0.0200 mm.	9.1		
0.0117 mm.	8.1		
0.0084 mm.	7.0		
0.0060 mm.	6.2		
0.0043 mm.	5.3		
0.0030 mm.	4.9		
0.0013 mm.	3.6		

* (no specification provided)

Soil Description

GRAY SILTY CLAYEY SAND WITH GRAVEL

Atterberg Limits

PL= 11 LL= 16 PI= 5

Coefficients

D_{90}= 12.6544 D_{85}= 10.6763 D_{60}= 4.2501
D_{50}= 2.8713 D_{30}= 0.6915 D_{15}= 0.1406
D_{10}= 0.0256 C_u= 166.04 C_c= 4.40

Classification

USCS= SC-SM AASHTO= A-1-a

Remarks

F.M.=4.10

Source of Sample: MW-103 **Depth:** 130.5'-131.0'
Sample Number: 1150

Date: 4-2-21

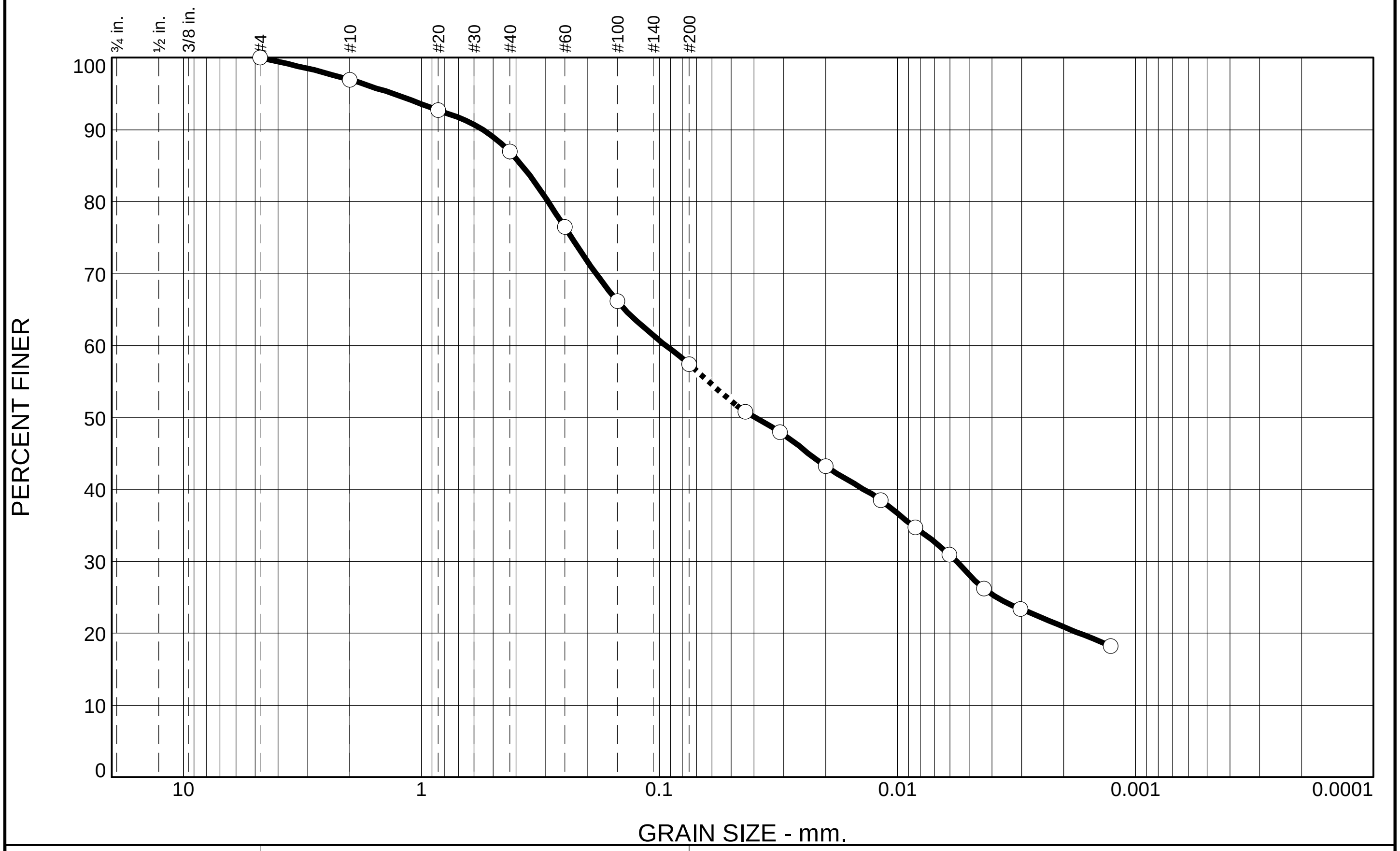
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION

Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.1	9.9	29.6	29.2	28.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	96.9		
#20	92.7		
#40	87.0		
#60	76.5		
#100	66.2		
#200	57.4		
0.0435 mm.	50.8		
0.0311 mm.	48.0		
0.0200 mm.	43.2		
0.0118 mm.	38.5		
0.0084 mm.	34.7		
0.0060 mm.	30.9		
0.0043 mm.	26.2		
0.0030 mm.	23.4		
0.0013 mm.	18.2		

* (no specification provided)

Soil Description

BROWNISH GRAY SANDY LEAN CLAY

Atterberg Limits

PL= 11 LL= 23 PI= 12

Coefficients

D_{90}= 0.5533 D_{85}= 0.3770 D_{60}= 0.0940
D_{50}= 0.0398 D_{30}= 0.0057 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(3)

Remarks

F.M.=0.71

Source of Sample: MW-103 **Depth:** 140.5'-141.0'
Sample Number: 1420 **Date:** 4-16-21

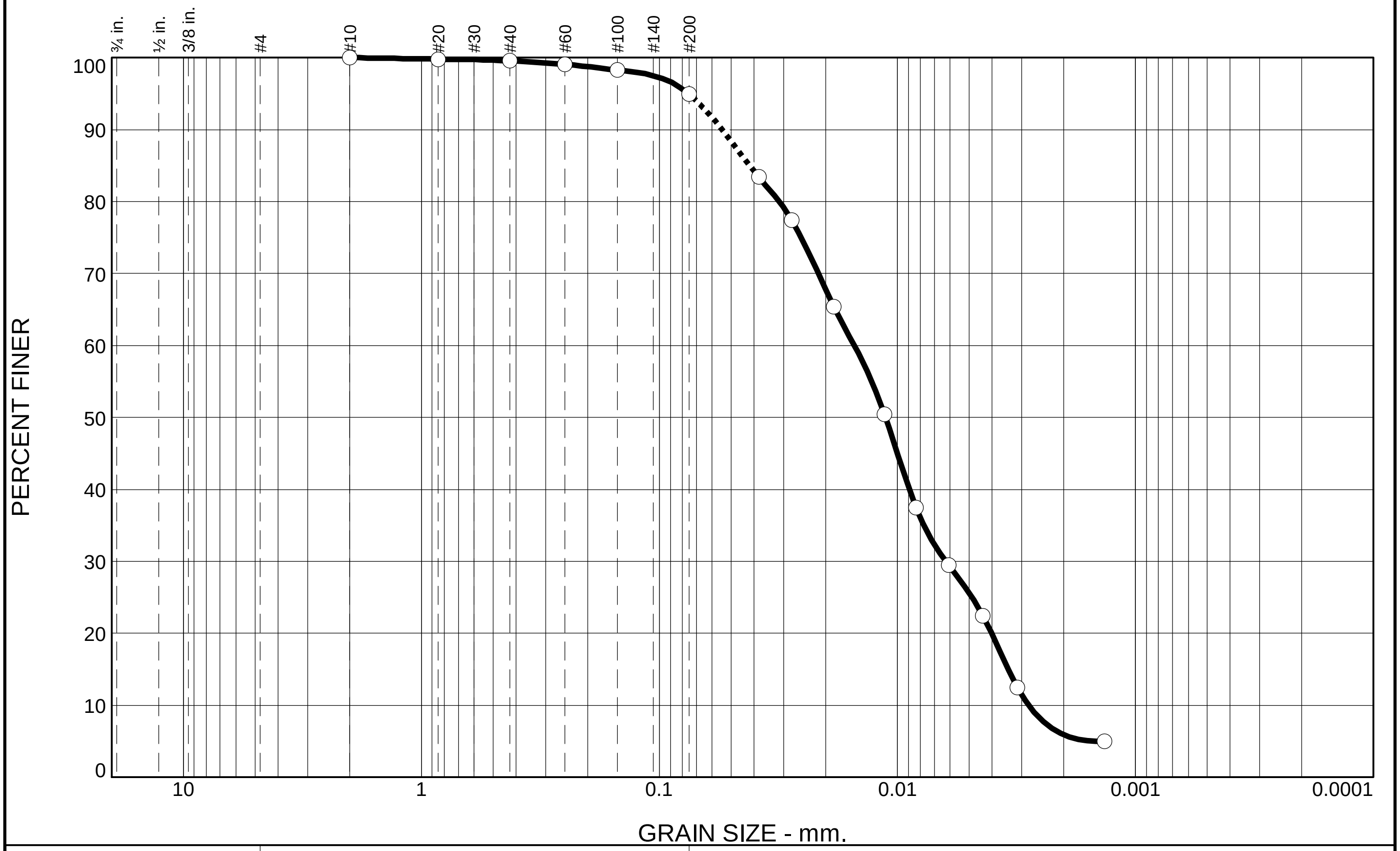
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION

Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.4	4.7	69.3	25.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.8		
#40	99.6		
#60	99.1		
#100	98.3		
#200	94.9		
0.0382 mm.	83.4		
0.0278 mm.	77.4		
0.0185 mm.	65.4		
0.0113 mm.	50.4		
0.0084 mm.	37.5		
0.0061 mm.	29.5		
0.0044 mm.	22.5		
0.0031 mm.	12.5		
0.0013 mm.	5.0		

* (no specification provided)

Soil Description

DARK GRAY SILT

Atterberg Limits

PL= 28 LL= 26 PI= NP

Coefficients

D_{90}= 0.0546 D_{85}= 0.0418 D_{60}= 0.0152
D_{50}= 0.0112 D_{30}= 0.0062 D_{15}= 0.0034
D_{10}= 0.0028 C_u= 5.42 C_c= 0.92

Classification

USCS= ML AASHTO= A-4(0)

Remarks

F.M.=0.03

Source of Sample: XCM-02 **Depth:** 15.5'-16.0'
Sample Number: 1500
Date: 4-2-21

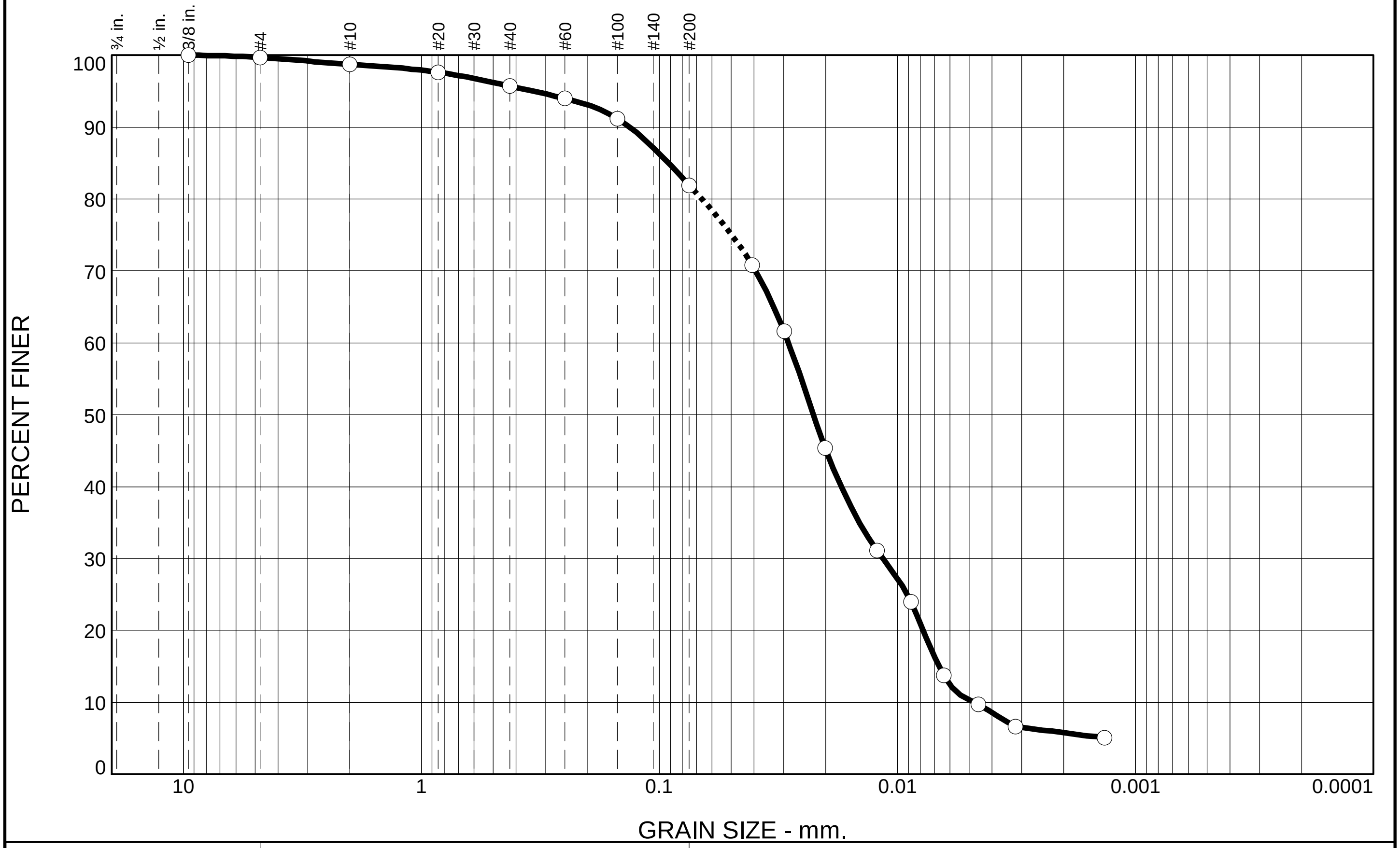
Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION

Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.3	1.0	3.0	13.8	71.6	10.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.7		
#10	98.7		
#20	97.6		
#40	95.7		
#60	94.0		
#100	91.2		
#200	81.9		
0.0408 mm.	70.8		
0.0299 mm.	61.6		
0.0201 mm.	45.3		
0.0121 mm.	31.1		
0.0088 mm.	23.9		
0.0064 mm.	13.7		
0.0046 mm.	9.7		
0.0032 mm.	6.6		
0.0014 mm.	5.1		

* (no specification provided)

Soil Description

DARK GRAY ELASTIC SILT WITH SAND

Atterberg Limits

PL= 57 LL= 53 PI= NP

Coefficients

D_{90}= 0.1334 D_{85}= 0.0918 D_{60}= 0.0287
D_{50}= 0.0225 D_{30}= 0.0115 D_{15}= 0.0067
D_{10}= 0.0048 C_u= 6.00 C_c= 0.97

Classification

USCS= MH AASHTO= A-5(3)

Remarks

F.M.=0.21

Source of Sample: XCM-02 **Depth:** 36.0'-36.5'
Sample Number: 1600

Date: 4-2-21

Terracon

Client: RAMBOLL ENVIRON US CORP.
Project: VERMILLION POWER STATION

Project No: 11215020 **Figure**

Tested By: SJH **Checked By:** WPQ

GEOTECHNOLOGY GEOTECHNICAL REPORT

GEOTECHNOLOGY INC
FROM THE GROUND UP

Via email: IVaught@geosyntec.com

May 7, 2021

Mr. Isaiah Vaught, EIT
Geosyntec Consultants, Inc.
1 McBride and Son Center Drive, Suite 202
Chesterfield, Missouri 63005

Re: Laboratory Testing Services
Vermillion Landfill Feasibility Investigation
Danville, Illinois
Geotechnology Project No. J038678.01

Dear Mr. Vaught:

Included in this report are the test results for soil samples received in our laboratory on March 18, 2021. The samples were tested in general accordance with the test methods listed below.

Test to Determine	Method of Test
Particle-Size Analysis of Soil	ASTM D422
Water (Moisture) Content of Soil	ASTM D2216
One-Dimensional Consolidation of Soils	ASTM D2435
Classification of Soils for Engineering Purposes	ASTM D2487
Liquid Limit, Plastic Limit and Plasticity Index of Soils	ASTM D4318
Consolidated-Undrained Triaxial Compression Test	ASTM D4767
Hydraulic Conductivity Using a Flexible Wall Permeameter	ASTM D5084
Density (Unit Weight) of Soil Specimens	ASTM D7263

This report has been prepared for the exclusive use of Geosyntec Consultants, Inc. Our scope of services was limited to performing specific tests on provided samples and did not include engineering or interpretation of the test results.

We trust this is the information you require. Please contact the undersigned if you have any questions regarding this report.

* * * * *

Respectfully submitted,

GEOTECHNOLOGY, INC.

Janet M May

Janet M. May
Illinois Laboratory Manager

JMM/LPH:jmm

Attachments: Appendix A – Summary of Laboratory Results
Appendix B – Atterberg Limits' Results
Appendix C – Grain Size Distribution
Appendix D – Consolidation Results
Appendix E – Triax Results
Appendix F – Hydraulic Conductivity Data

APPENDIX A

Summary of Laboratory Results

APPENDIX A
SUMMARY OF LABORATORY TEST RESULTS

Vermillion Landfill Feasibility Investigation

		ASTM D2216	ASTM D7263	ASTM D4318			ASTM D1140	ASTM D2487
Boring Number	Depth, feet	Moisture Content, %	Dry Unit Weight, pcf	Liquid Limit	Plastic Limit	Plasticity Index	Percent Passing No. 200	USCS Symbol
MW-101	10-12	15.6	--	22	15	7	82.2	CL-ML
MW-101	30-32	13.3	124.2	--	--	--	--	--
MW-101	32-33	15.3	--	28	15	13	85.5	CL
MW-101	60-62	12.0	127.4	--	--	--	--	--
MW-101	62-63	11.9	--	24	13	11	75.7	CL
MW-101	92-3	11.4	--	25	13	12	71.3	CL
MW-101	132-133	11.3	--	20	12	8	54.0	CL
MW-102	10-12	16.2	--	28	16	12	83.9	CL
MW-102	28-30	14.9	--	24	14	10	81.7	CL
MW-102	30-32	15.0	120.6	--	--	--	--	--
MW-102	60-62	12.5	127.0	--	--	--	--	--
MW-102	62-64	12.4	--	24	14	10	73.4	CL
MW-102	94-64	9.2	--	27	14	13	70.8	CL
MW-102	130-132	10.2	--	20	12	8	54.0	CL
MW-103	10-12	15.0	--	28	16	12	84.7	CL
MW-103	28-30	13.5	--	21	13	8	69.8	CL
MW-103	30-32	13.2	125.2	--	--	--	--	--
MW-103	60-62	15.8	118.0	--	--	--	--	--
MW-103	88-90	15.9	--	28	15	13	84.8	CL
MW-103	90-62	18.1	111.8	--	--	--	--	--
MW-103	102-104	10.2	--	23	12	11	62.1	CL
MW-103	138-140	10.5	--	21	11	10	56.5	CL

APPENDIX A
SUMMARY OF LABORATORY TEST RESULTS

Vermillion Landfill Feasibility Investigation

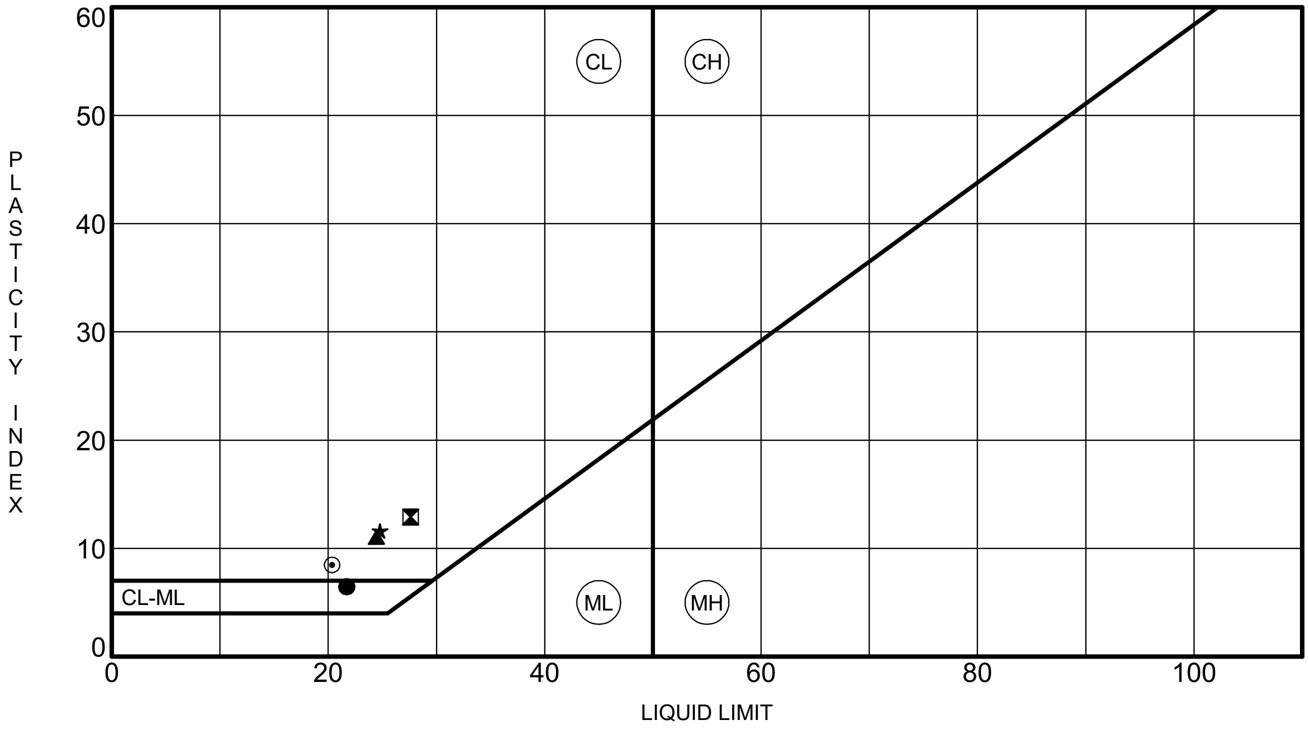
		ASTM D2216	ASTM D7263	ASTM D4318			ASTM D1140	ASTM D2487
Boring Number	Depth, feet	Moisture Content, %	Dry Unit Weight, pcf	Liquid Limit	Plastic Limit	Plasticity Index	Percent Passing No. 200	USCS Symbol
MW-104	10-12	14.5	--	26	15	11	81.8	CL
MW-104	30-32	15.2	119.7	--	--	--	--	--
MW-104	60.5-61	12.4	--	20	13	7	70.9	CL-ML
MW-104	92-94	9.5	--	25	13	12	64.7	CL
MW-104	130-132	12.1	--	20	12	8	55.0	CL
MW-105	10-12	25.2	97.0	--	--	--	--	--
MW-105	17-19	24.8	--	44	19	25	97.4	CL
MW-105	28-30	17.8	--	39	17	22	96.9	CL
MW-105	58-60	12.9	--	22	13	9	73.0	CL
MW-105	88-90	10.5	--	25	12	13	65.9	CL
MW-105	130-132	10.2	--	20	12	8	50.4	CL

		ASTM D2216	ASTM D7263	ASTM D5084	
Boring Number	Depth, feet	Moisture Content, %	Dry Unit Weight, pcf	Hydraulic Conductivity, cm/sec	Range of Hydraulic Gradient
MW-101	60-62	12.0	127.4	1.0×10^{-7}	1.6 - 9.4
MW-102	30-32	15.0	120.6	1.6×10^{-8}	7.8 - 8.3
MW-103	30-32	13.2	125.2	6.1×10^{-8}	9.9 - 10.7

Notes and Abbreviations:
% - Percent
cm/sec - Centimeters per second
pcf - Pounds per cubic foot
USCS – Unified Soil Classification System

APPENDIX B

Atterberg Limits' Results



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**MW-101**	**10.0-12.0 Feet**	**22**	**15**	**7**	**82.2**	**Olive-brown, SILTY CLAY with SAND - (CL-ML)**
⧗	**MW-101**	**32.0-33.0 Feet**	**28**	**15**	**13**	**85.5**	**Dark gray, LEAN CLAY - (CL)**
▲	**MW-101**	**62.0-63.0 Feet**	**24**	**13**	**11**	**75.7**	**Dark gray, LEAN CLAY with SAND - (CL)**
★	**MW-101**	**92.0-93.0 Feet**	**25**	**13**	**12**	**71.3**	**Dark gray, LEAN CLAY with SAND - (CL)**
⊙	**MW-101**	**132.0-133.0 Feet**	**20**	**12**	**8**	**54.0**	**Dark gray-brown, SANDY LEAN CLAY - (CL)**

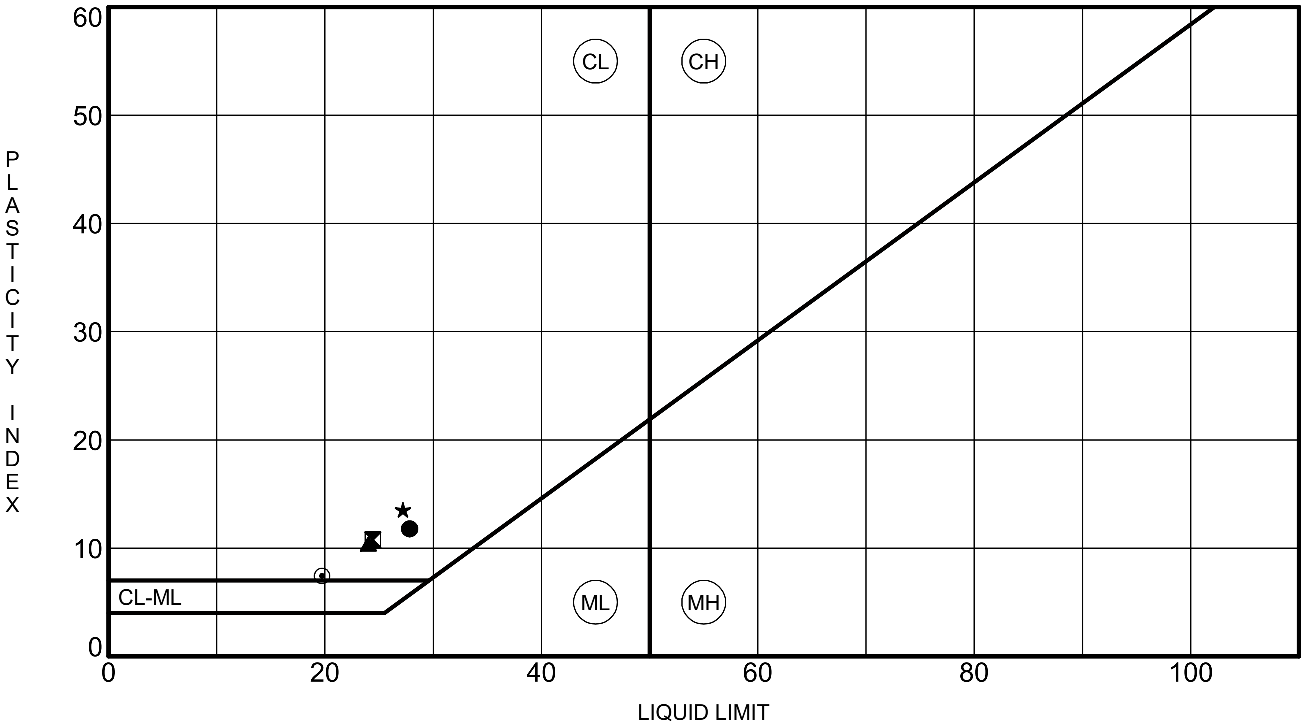
GEOTECHNOLOGY INC
FROM THE GROUND UP

ATTERBERG LIMITS' RESULTS

Project Number: J038678.01

Project: Vermillion On-Site Landfill Site Feasibility

Location: Danville, Illinois



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**MW-102**	**10.0-12.0 Feet**	**28**	**16**	**12**	**83.9**	**Olive-brown, LEAN CLAY with SAND - (CL)**
⧗	**MW-102**	**28.0-30.0 Feet**	**24**	**14**	**10**	**81.7**	**Dark gray, LEAN CLAY with SAND - (CL)**
▲	**MW-102**	**62.0-64.0 Feet**	**24**	**14**	**10**	**73.4**	**Dark gray, LEAN CLAY with SAND - (CL)**
★	**MW-102**	**94.0-96.0 Feet**	**27**	**14**	**13**	**70.8**	**Dark gray, LEAN CLAY with SAND - (CL)**
⊙	**MW-102**	**130.0-132.0 Feet**	**20**	**12**	**8**	**54.0**	**Dark gray-brown, SANDY LEAN CLAY - (CL)**

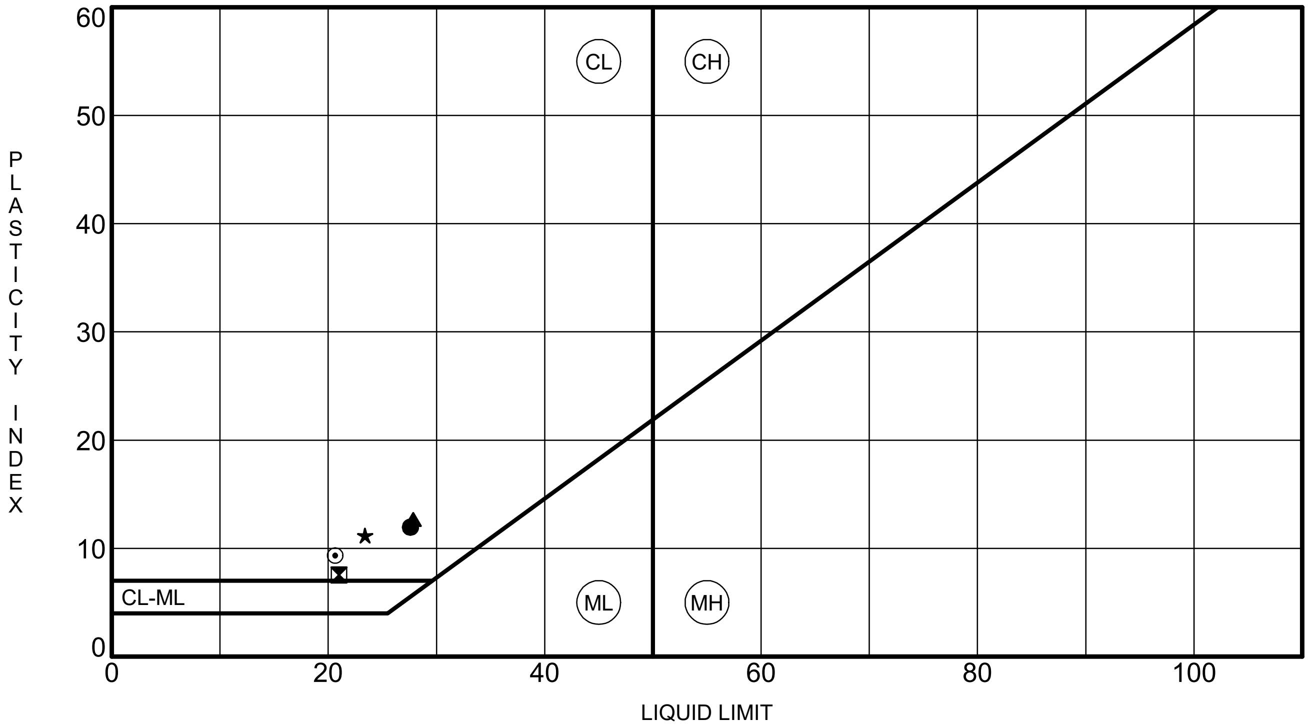
GEOTECHNOLOGY INC
FROM THE GROUND UP

ATTERBERG LIMITS' RESULTS

Project Number: J038678.01

Project: Vermillion On-Site Landfill Site Feasibility

Location: Danville, Illinois



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**MW-103**	**10.0-12.0 Feet**	**28**	**16**	**12**	**84.7**	**Olive-brown, LEAN CLAY with SAND - (CL)**
⧗	**MW-103**	**28.0-30.0 Feet**	**21**	**13**	**8**	**69.8**	**Dark gray, SANDY LEAN CLAY - (CL)**
▲	**MW-103**	**88.0-90.0 Feet**	**28**	**15**	**13**	**84.8**	**Dark gray, LEAN CLAY with SAND - (CL)**
★	**MW-103**	**102.0-104.0 Feet**	**23**	**12**	**11**	**62.1**	**Dark gray-brown, SANDY LEAN CLAY - (CL)**
⊙	**MW-103**	**138.0-140.0 Feet**	**21**	**11**	**10**	**56.5**	**Dark gray-brown, SANDY LEAN CLAY - (CL)**

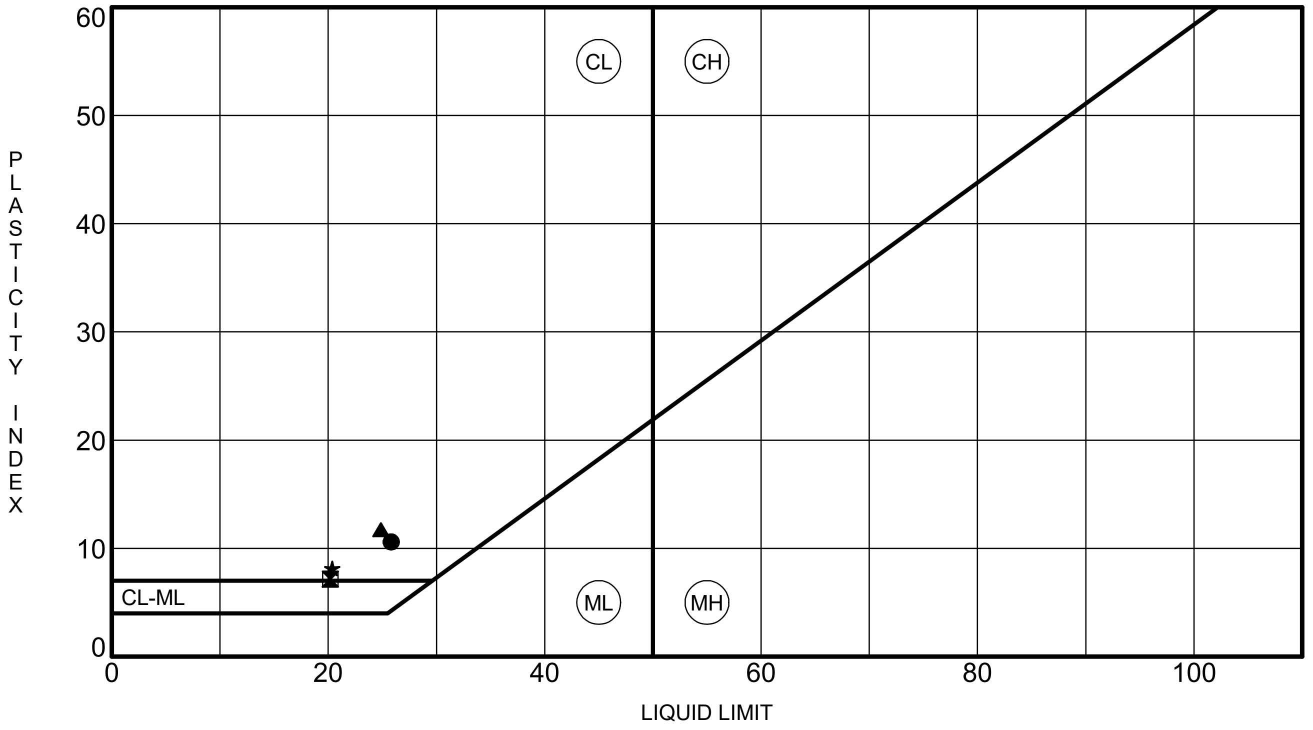
GEOTECHNOLOGY INC
FROM THE GROUND UP

ATTERBERG LIMITS' RESULTS

Project Number: J038678.01

Project: Vermillion On-Site Landfill Site Feasibility

Location: Danville, Illinois



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**MW-104**	**10.0-12.0 Feet**	**26**	**15**	**11**	**81.8**	**Olive-brown, LEAN CLAY with SAND - (CL)**
⧗	**MW-104**	**60.5-61.5 Feet**	**20**	**13**	**7**	**70.9**	**Dark gray, SILTY CLAY with SAND - (CL-ML)**
▲	**MW-104**	**92.0-94.0 Feet**	**25**	**13**	**12**	**64.7**	**Dark gray-brown, SANDY LEAN CLAY - (CL)**
★	**MW-104**	**130.0-132.0 Feet**	**20**	**12**	**8**	**55.0**	**Dark gray-brown, SANDY LEAN CLAY - (CL)**

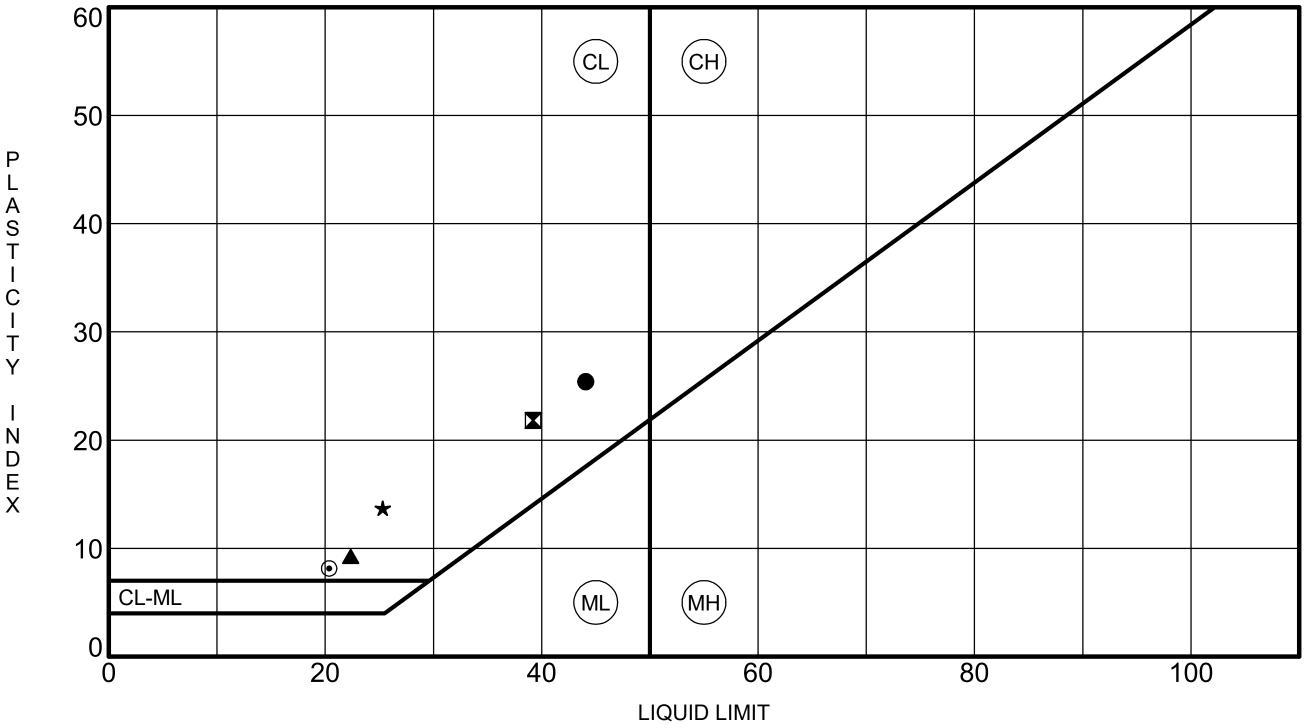
GEOTECHNOLOGY INC
FROM THE GROUND UP

ATTERBERG LIMITS' RESULTS

Project Number: J038678.01

Project: Vermillion On-Site Landfill Site Feasibility

Location: Danville, Illinois



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**MW-105**	**17.0-19.0 Feet**	**44**	**19**	**25**	**97.4**	**Dark yellow-brown, LEAN CLAY - (CL)**
⧗	**MW-105**	**28.0-30.0 Feet**	**39**	**17**	**22**	**96.9**	**Dark gray, LEAN CLAY - (CL)**
▲	**MW-105**	**58.0-60.0 Feet**	**22**	**13**	**9**	**73.0**	**Dark gray, LEAN CLAY with SAND - (CL)**
★	**MW-105**	**88.0-90.0 Feet**	**25**	**12**	**13**	**65.9**	**Dark gray, SANDY LEAN CLAY - (CL)**
⊙	**MW-105**	**130.0-132.0 Feet**	**20**	**12**	**8**	**50.4**	**Dark gray-brown, SANDY LEAN CLAY - (CL)**

GEOTECHNOLOGY INC
FROM THE GROUND UP

ATTERBERG LIMITS' RESULTS

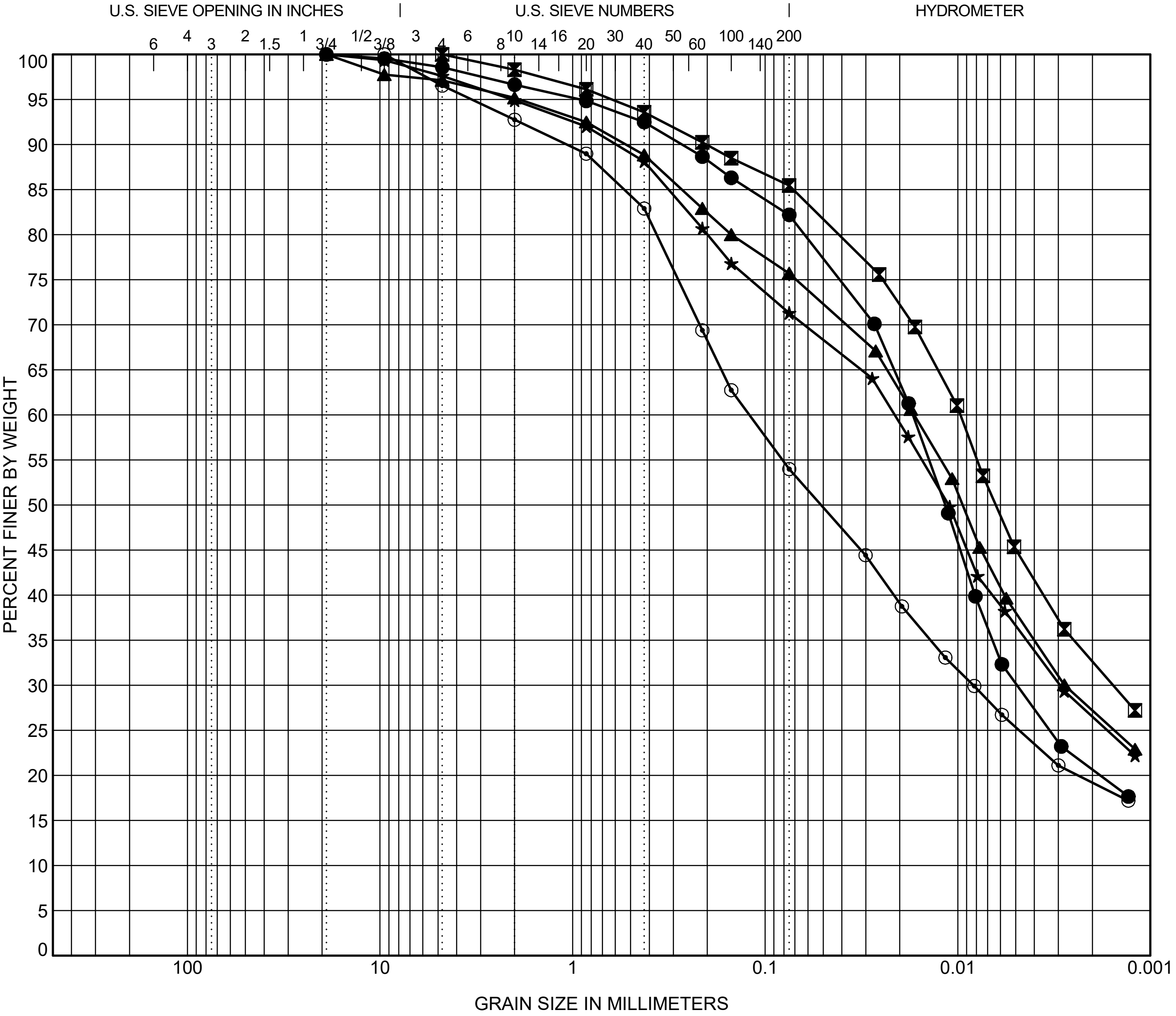
Project Number: J038678.01

Project: Vermillion On-Site Landfill Site Feasibility

Location: Danville, Illinois

APPENDIX C

Grain Size Distribution



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	**MW-101**	**10.0-12.0 Feet**	**Olive-brown, SILTY CLAY with SAND - (CL-ML)**	**22**	**15**	**7**		
⧗	**MW-101**	**32.0-33.0 Feet**	**Dark gray, LEAN CLAY - (CL)**	**28**	**15**	**13**		
▲	**MW-101**	**62.0-63.0 Feet**	**Dark gray, LEAN CLAY with SAND - (CL)**	**24**	**13**	**11**		
★	**MW-101**	**92.0-93.0 Feet**	**Dark gray, LEAN CLAY with SAND - (CL)**	**25**	**13**	**12**		
⊙	**MW-101**	**132.0-133.0 Feet**	**Dark gray-brown, SANDY LEAN CLAY - (CL)**	**20**	**12**	**8**		

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**MW-101**	**10.0-12.0 Feet**	**19**	**0.017**	**0.005**		**1.4**	**16.4**	**52.0**	**30.2**
⧗	**MW-101**	**32.0-33.0 Feet**	**4.75**	**0.01**	**0.002**		**0.0**	**14.5**	**40.4**	**45.0**
▲	**MW-101**	**62.0-63.0 Feet**	**19**	**0.017**	**0.003**		**2.9**	**21.4**	**37.6**	**38.1**
★	**MW-101**	**92.0-93.0 Feet**	**19**	**0.021**	**0.003**		**2.4**	**26.3**	**34.7**	**36.6**
⊙	**MW-101**	**132.0-133.0 Feet**	**9.5**	**0.121**	**0.008**		**3.5**	**42.5**	**28.6**	**25.3**

GEOTECHNOLOGY INC
FROM THE GROUND UP

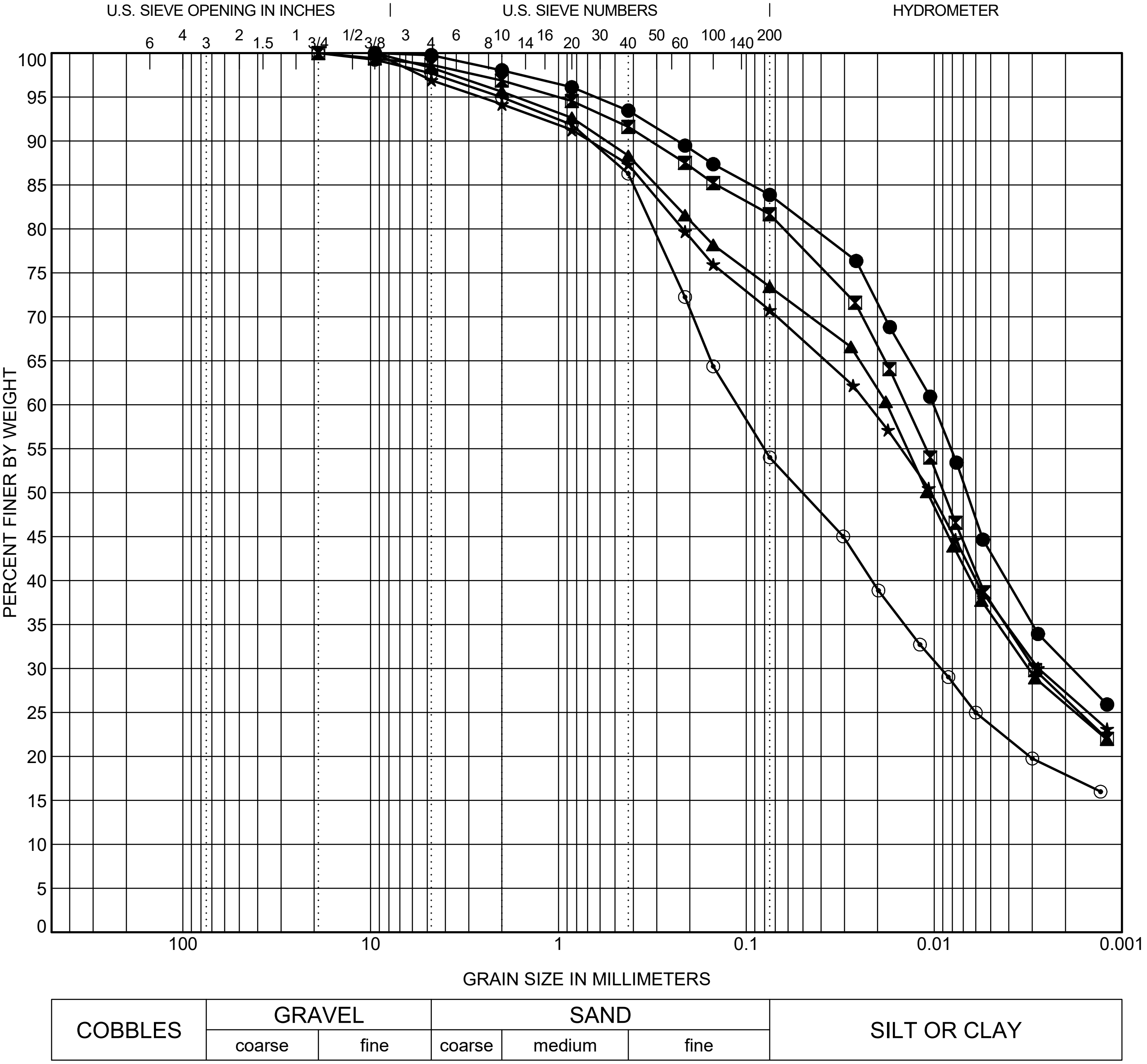
GRAIN SIZE DISTRIBUTION

Project Number: J038678.01

Project: Vermillion On-Site Landfill Site Feasibility

Location: Danville, Illinois

GRAIN SIZE WIDER IDENTIFICATION J038678.01 LAB RESULTS.GPJ GEOTECHNOLOGY.GDT 4/30/21



Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	**MW-102**	**10.0-12.0 Feet**	**Olive-brown, LEAN CLAY with SAND - (CL)**	**28**	**16**	**12**		
⧗	**MW-102**	**28.0-30.0 Feet**	**Dark gray, LEAN CLAY with SAND - (CL)**	**24**	**14**	**10**		
▲	**MW-102**	**62.0-64.0 Feet**	**Dark gray, LEAN CLAY with SAND - (CL)**	**24**	**14**	**10**		
★	**MW-102**	**94.0-96.0 Feet**	**Dark gray, LEAN CLAY with SAND - (CL)**	**27**	**14**	**13**		
⊙	**MW-102**	**130.0-132.0 Feet**	**Dark gray-brown, SANDY LEAN CLAY - (CL)**	**20**	**12**	**8**		

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**MW-102**	**10.0-12.0 Feet**	**9.5**	**0.01**	**0.002**		**0.2**	**15.9**	**40.7**	**43.1**
⧗	**MW-102**	**28.0-30.0 Feet**	**19**	**0.014**	**0.003**		**1.3**	**17.0**	**44.1**	**37.6**
▲	**MW-102**	**62.0-64.0 Feet**	**9.5**	**0.018**	**0.003**		**1.7**	**24.9**	**37.2**	**36.2**
★	**MW-102**	**94.0-96.0 Feet**	**9.5**	**0.022**	**0.003**		**3.1**	**26.2**	**33.4**	**37.4**
⊙	**MW-102**	**130.0-132.0 Feet**	**19**	**0.112**	**0.009**		**2.3**	**43.7**	**30.4**	**23.6**

GEOTECHNOLOGY INC
FROM THE GROUND UP

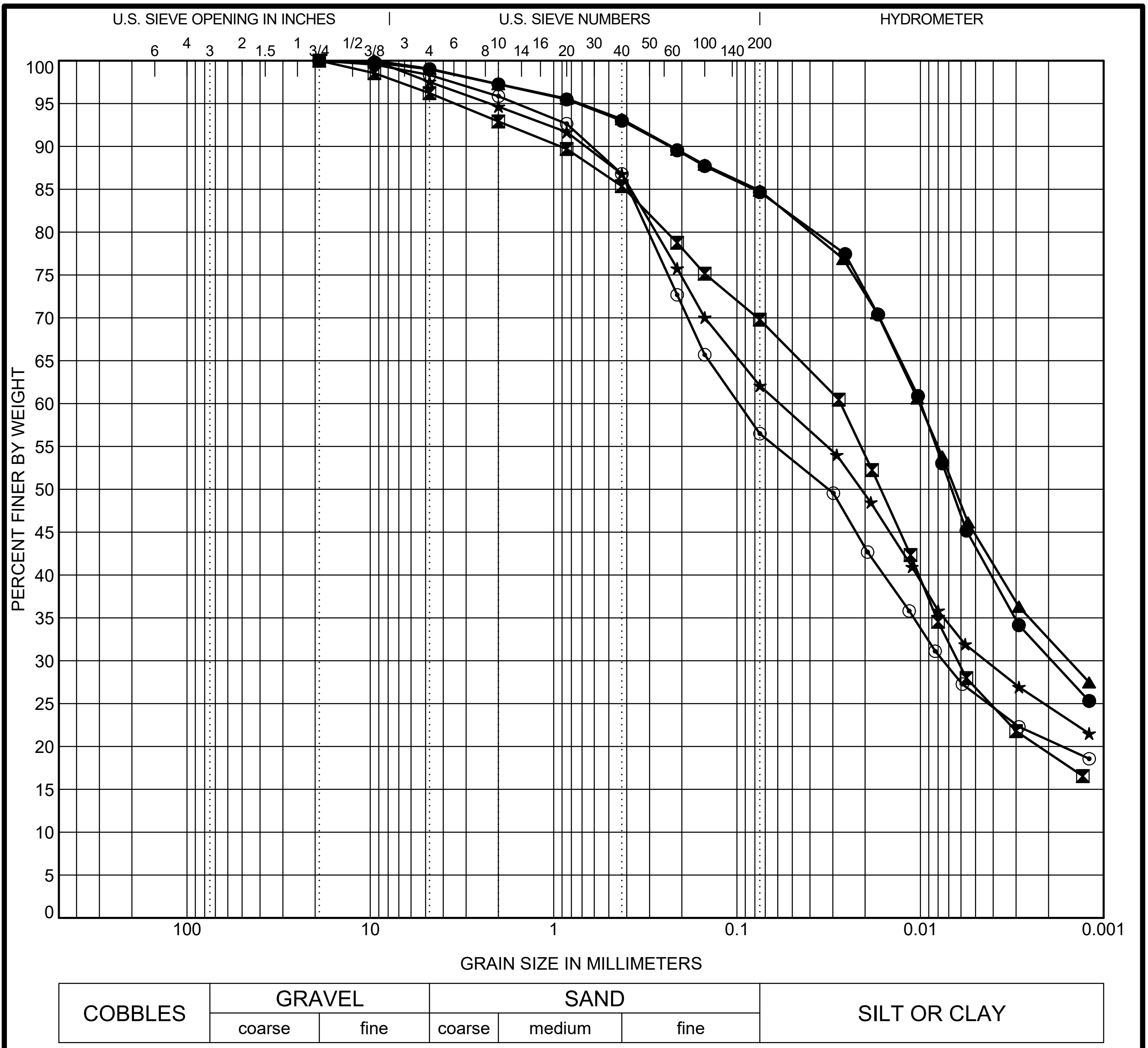
GRAIN SIZE DISTRIBUTION

Project Number: J038678.01

Project: Vermillion On-Site Landfill Site Feasibility

Location: Danville, Illinois

GRAIN SIZE WIDER IDENTIFICATION J038678.01 LAB RESULTS.GPJ GEOTECHNOLOGY.GDT 4/30/21



Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	**MW-103**	**10.0-12.0 Feet**	**Olive-brown, LEAN CLAY with SAND - (CL)**	**28**	**16**	**12**		
⧗	**MW-103**	**28.0-30.0 Feet**	**Dark gray, SANDY LEAN CLAY - (CL)**	**21**	**13**	**8**		
▲	**MW-103**	**88.0-90.0 Feet**	**Dark gray, LEAN CLAY with SAND - (CL)**	**28**	**15**	**13**		
★	**MW-103**	**102.0-104.0 Feet**	**Dark gray-brown, SANDY LEAN CLAY - (CL)**	**23**	**12**	**11**		
⊙	**MW-103**	**138.0-140.0 Feet**	**Dark gray-brown, SANDY LEAN CLAY - (CL)**	**21**	**11**	**10**		

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**MW-103**	**10.0-12.0 Feet**	**19**	**0.01**	**0.002**		**1.0**	**14.4**	**41.4**	**43.3**
⧗	**MW-103**	**28.0-30.0 Feet**	**19**	**0.027**	**0.006**		**3.8**	**26.4**	**43.0**	**26.8**
▲	**MW-103**	**88.0-90.0 Feet**	**9.5**	**0.01**	**0.002**		**0.9**	**14.2**	**40.2**	**44.7**
★	**MW-103**	**102.0-104.0 Feet**	**9.5**	**0.058**	**0.004**		**2.5**	**35.4**	**31.1**	**30.9**
⊙	**MW-103**	**138.0-140.0 Feet**	**19**	**0.098**	**0.008**		**1.7**	**41.8**	**30.4**	**26.1**

GEOTECHNOLOGY INC
FROM THE GROUND UP

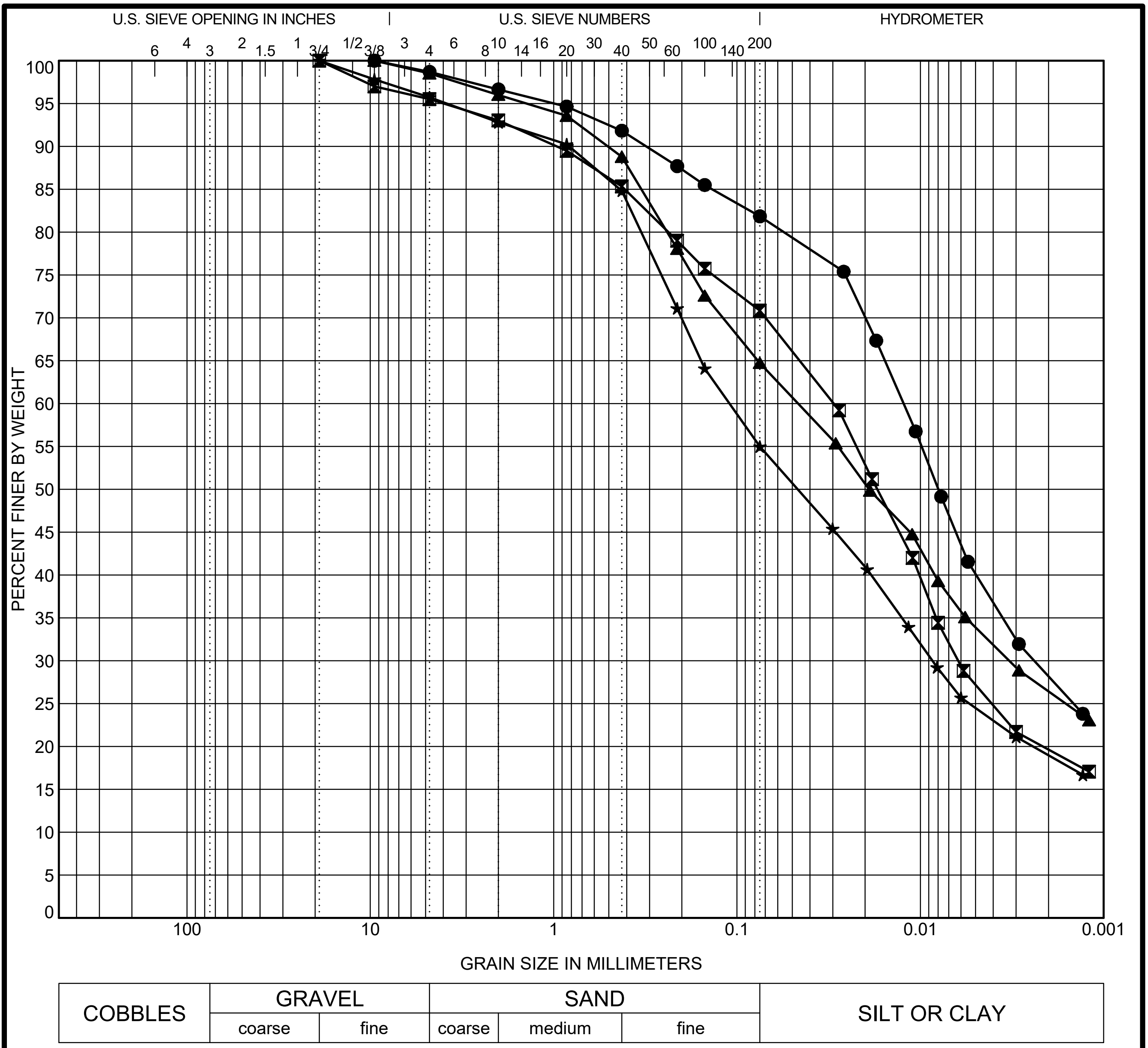
GRAIN SIZE DISTRIBUTION

Project Number: J038678.01

Project: Vermillion On-Site Landfill Site Feasibility

Location: Danville, Illinois

GRAIN SIZE WIDER IDENTIFICATION J038678.01 LAB RESULTS.GPJ GEOTECHNOLOGY.GDT 4/30/21



	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**MW-104**	**10.0-12.0 Feet**	**Olive-brown, LEAN CLAY with SAND - (CL)**	**26**	**15**	**11**		
⧗	**MW-104**	**60.5-61.0 Feet**	**Dark gray, SILTY CLAY with SAND - (CL-ML)**	**20**	**13**	**7**		
▲	**MW-104**	**92.0-94.0 Feet**	**Dark gray-brown, SANDY LEAN CLAY - (CL)**	**25**	**13**	**12**		
★	**MW-104**	**130.0-132.0 Feet**	**Dark gray-brown, SANDY LEAN CLAY - (CL)**	**20**	**12**	**8**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**MW-104**	**10.0-12.0 Feet**	**9.5**	**0.012**	**0.002**		**1.3**	**16.8**	**41.7**	**40.1**
⧗	**MW-104**	**60.5-61.0 Feet**	**19**	**0.03**	**0.006**		**4.5**	**24.7**	**43.6**	**27.2**
▲	**MW-104**	**92.0-94.0 Feet**	**9.5**	**0.046**	**0.003**		**1.5**	**33.8**	**30.8**	**33.9**
★	**MW-104**	**130.0-132.0 Feet**	**19**	**0.11**	**0.009**		**4.3**	**40.7**	**30.5**	**24.5**

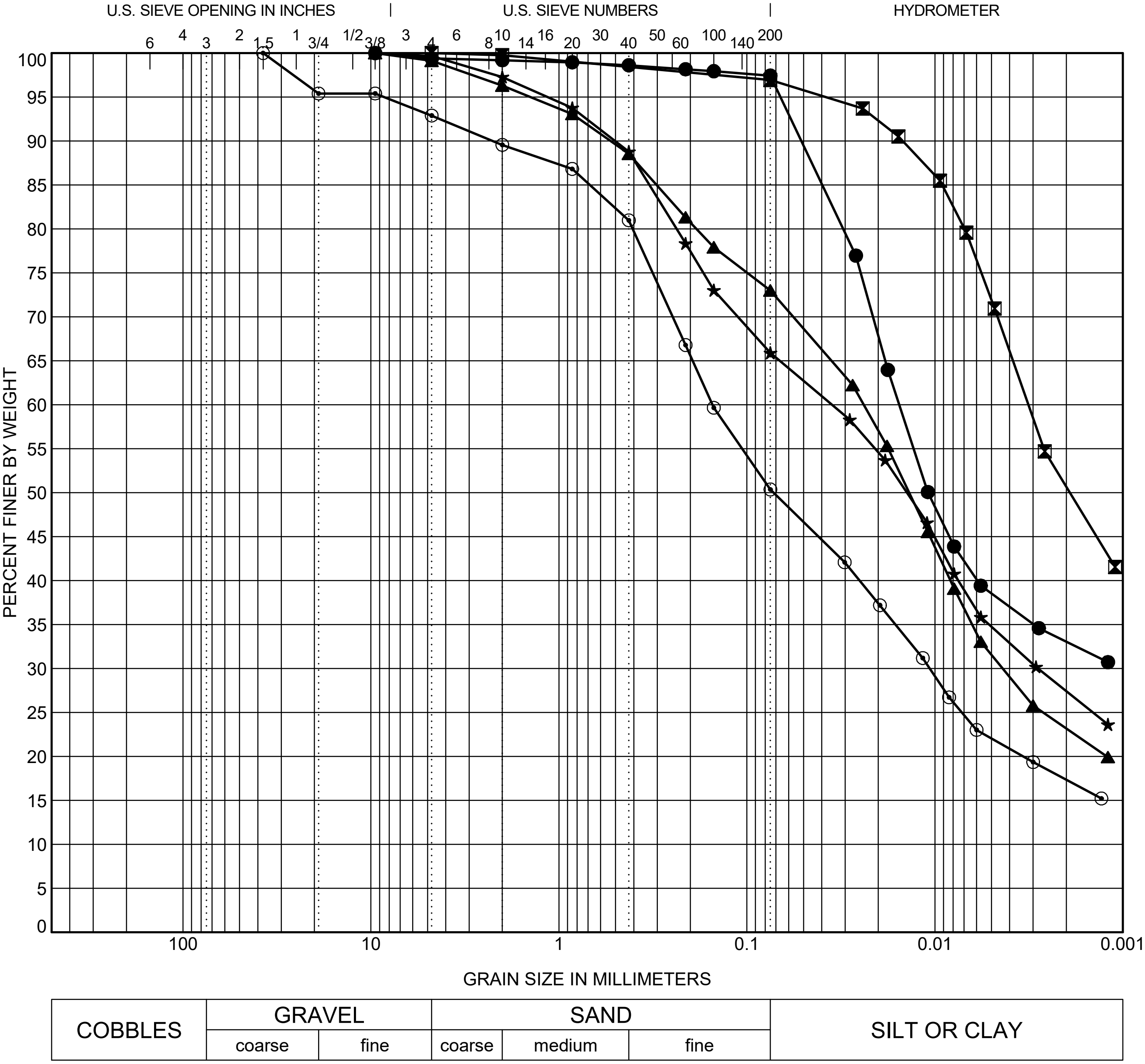
GEOTECHNOLOGY INC
FROM THE GROUND UP

GRAIN SIZE DISTRIBUTION

Project Number: J038678.01

Project: Vermillion On-Site Landfill Site Feasibility

Location: Danville, Illinois



	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**MW-105**	**17.0-19.0 Feet**	**Dark yellow-brown, LEAN CLAY - (CL)**	**44**	**19**	**25**		
☒	**MW-105**	**28.0-30.0 Feet**	**Dark gray, LEAN CLAY - (CL)**	**39**	**17**	**22**		
▲	**MW-105**	**58.0-60.0 Feet**	**Dark gray, LEAN CLAY with SAND - (CL)**	**22**	**13**	**9**		
★	**MW-105**	**88.0-90.0 Feet**	**Dark gray, SANDY LEAN CLAY - (CL)**	**25**	**12**	**13**		
⊙	**MW-105**	**130.0-132.0 Feet**	**Dark gray-brown, SANDY LEAN CLAY - (CL)**	**20**	**12**	**8**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**MW-105**	**17.0-19.0 Feet**	**9.5**	**0.015**			**0.6**	**1.9**	**58.9**	**38.5**
☒	**MW-105**	**28.0-30.0 Feet**	**4.75**	**0.003**			**0.0**	**3.1**	**25.0**	**72.0**
▲	**MW-105**	**58.0-60.0 Feet**	**9.5**	**0.024**	**0.004**		**0.9**	**26.1**	**41.4**	**31.6**
★	**MW-105**	**88.0-90.0 Feet**	**9.5**	**0.035**	**0.003**		**0.3**	**33.8**	**31.2**	**34.8**
⊙	**MW-105**	**130.0-132.0 Feet**	**37.5**	**0.153**	**0.011**		**7.1**	**42.5**	**28.3**	**22.0**

GEOTECHNOLOGY INC
FROM THE GROUND UP

GRAIN SIZE DISTRIBUTION

Project Number: J038678.01

Project: Vermillion On-Site Landfill Site Feasibility

Location: Danville, Illinois

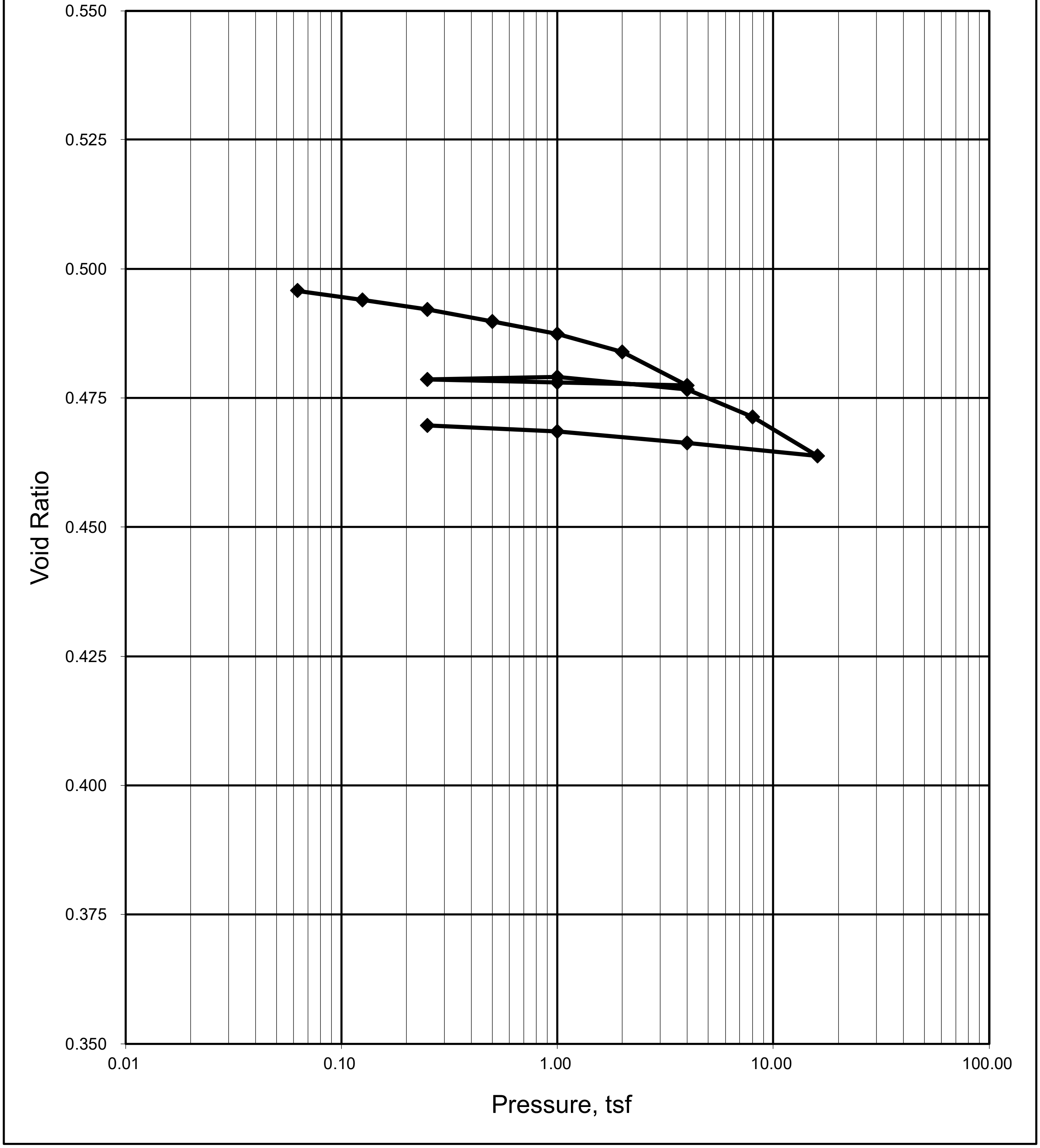
APPENDIX D

Consolidation Results

CONSOLIDATION TEST

Vermillion Landfill
Feasibility Investigation

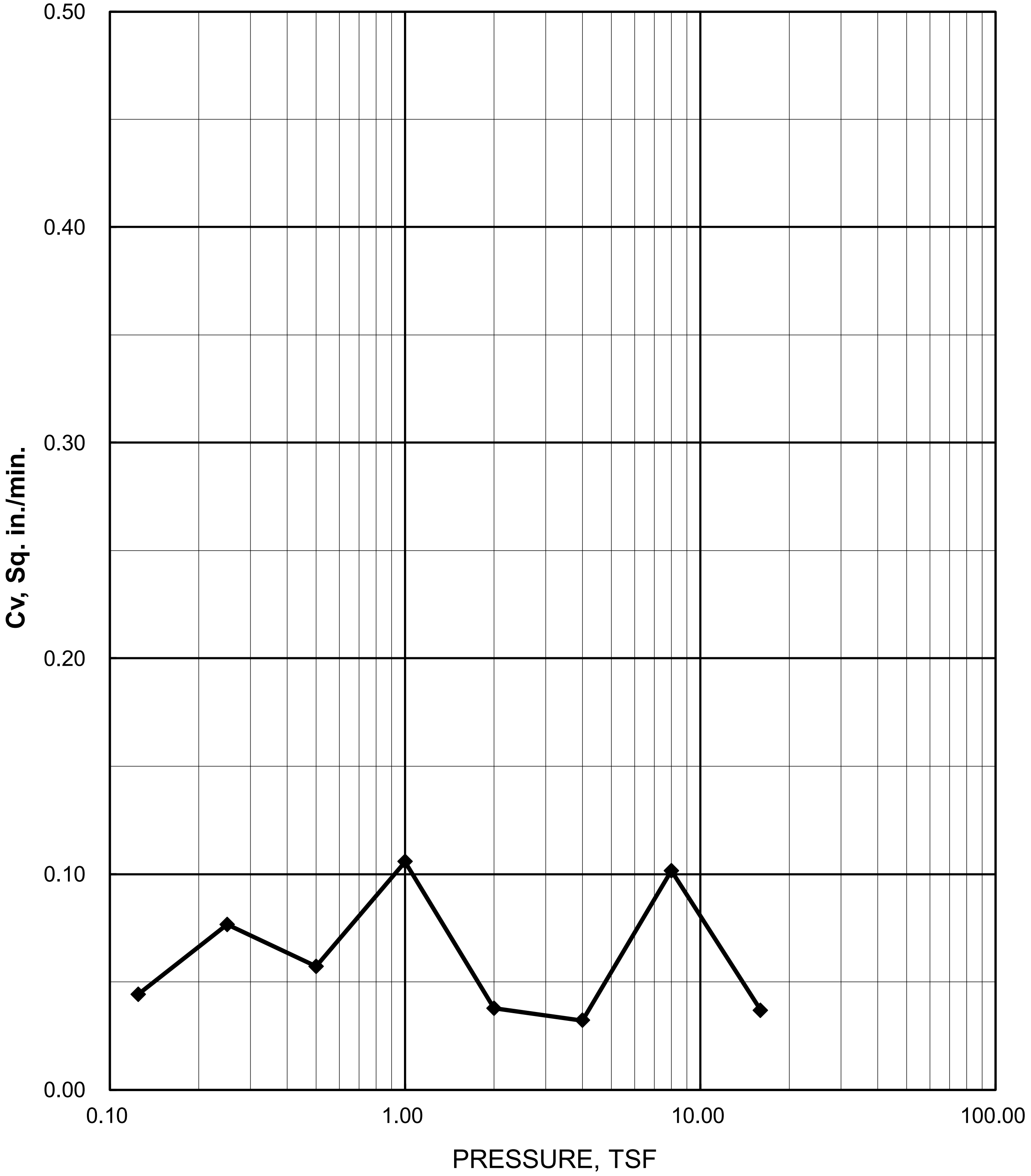
Boring MW-103, Sample at 90.0-91.0 Feet
Dry Unit Wt. = 111.8 pcf; Moisture Content = 18.1%



CONSOLIDATION TEST

Vermillion Landfill
Feasibility Investigation

Boring MW-103, Sample at 90.0-91.0 Feet
Dry Unit Wt. = 111.8 pcf; Moisture Content = 18.1 %



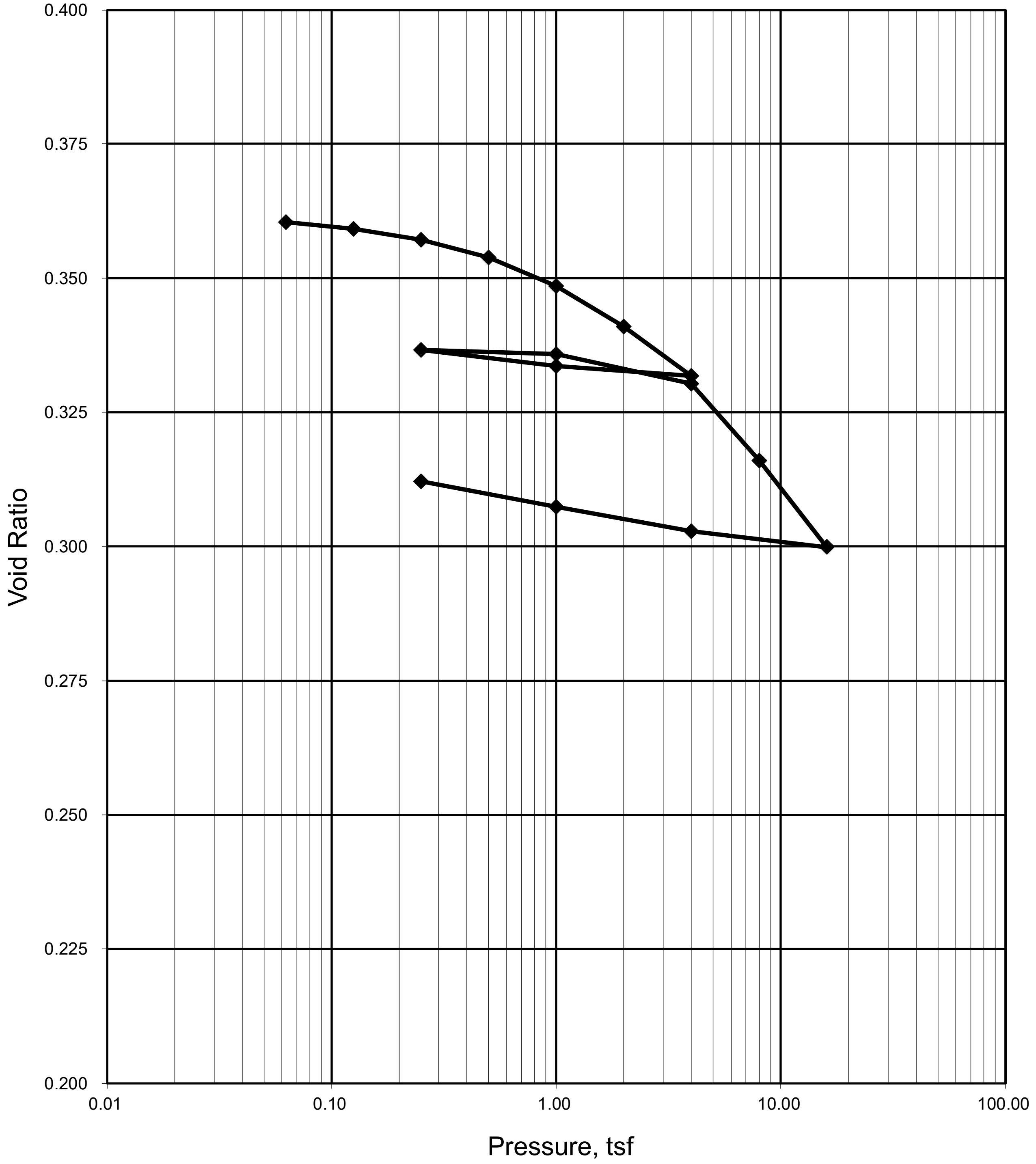
CONSOLIDATION
TEST DATA
Square Root of Time Method

JOB NUMBER:	J038678.01	INITIAL MOISTURE:		FINAL MOISTURE:		INITIAL DATA:	
BORING NUMBER:	MW-103	WET WT SPLE + RING	244.19	WET WT SPLE + RING	243.39	SAMPLE HT.:	0.739
SAMPLE NUMBER:	-	DRY WT SPLE + RING	224.98	DRY WT SPLE + RING	224.98	SAMPLE DIA.:	2.500
DEPTH (Feet):	90.0-91.0	WT OF RING	118.58	WT OF RING	118.58	VOLUME:	59.425
		DRY WT OF SAMPLE	106.40	DRY WT OF SAMPLE	106.40	SPECIFIC GRAV.:	2.680
WET UNIT WT =	132.0	WT OF WATER	19.21	WT OF WATER	18.41	HT. OF SOLIDS:	0.494
DRY UNIT WT =	111.8	MOISTURE CONTENT	18.1	MOISTURE CONTENT	17.3	VOID RATIO:	0.497

PRESSURE (tsf)	D100 *0.0001"	MACHINE DEFLECTION *0.0001"	CORR. FACTOR	CORR. D100 *0.0001"	CONSOLIDATION (Percent)	VOID RATIO CHANGE	VOID RATIO	D 90 UNCORR	H 50 CORR	~~t 50 or~~ t 90	Cv (SQ IN/MIN)
0.000	0.0	0.0	0.0	0.0	0.00	0.0000	0.497				
0.063	10.0	5.0	0.0	5.0	0.07	0.0010	0.496				
0.125	24.1	10.0	0.0	14.1	0.19	0.0029	0.494	23.5	0.7374	2.60	0.0443
0.250	42.2	19.0	0.0	23.2	0.31	0.0047	0.492	41.5	0.7365	1.50	0.0767
0.500	64.6	30.0	0.0	34.6	0.47	0.0070	0.490	64.0	0.7354	2.00	0.0573
1.000	91.2	45.0	0.0	46.2	0.63	0.0094	0.487	90.7	0.7342	1.08	0.1058
2.000	131.4	68.0	0.0	63.4	0.86	0.0128	0.484	130.3	0.7325	3.00	0.0379
4.000	170.7	75.0	0.0	95.7	1.30	0.0194	0.477	169.8	0.7293	3.50	0.0322
1.000	164.0	62.0	9.3	92.7	1.25	0.0188	0.478				
0.250	144.0	45.0	9.3	89.7	1.21	0.0182	0.479				
1.000	150.0	53.0	9.3	87.7	1.19	0.0178	0.479				
4.000	184.9	76.0	9.3	99.6	1.35	0.0202	0.477				
8.000	218.9	93.0	0.0	125.9	1.70	0.0255	0.471	218.0	0.7263	1.10	0.1017
16.000	275.8	113.0	0.0	162.8	2.20	0.0330	0.464	274.7	0.7226	3.00	0.0369
4.000	248.0	89.0	8.2	150.8	2.04	0.0306	0.466				
1.000	220.0	72.0	8.2	139.8	1.89	0.0283	0.468				
0.250	198.0	56.0	8.2	133.8	1.81	0.0271	0.470				

CONSOLIDATION TEST
Vermilliion Landfill
Feasibility Investigation

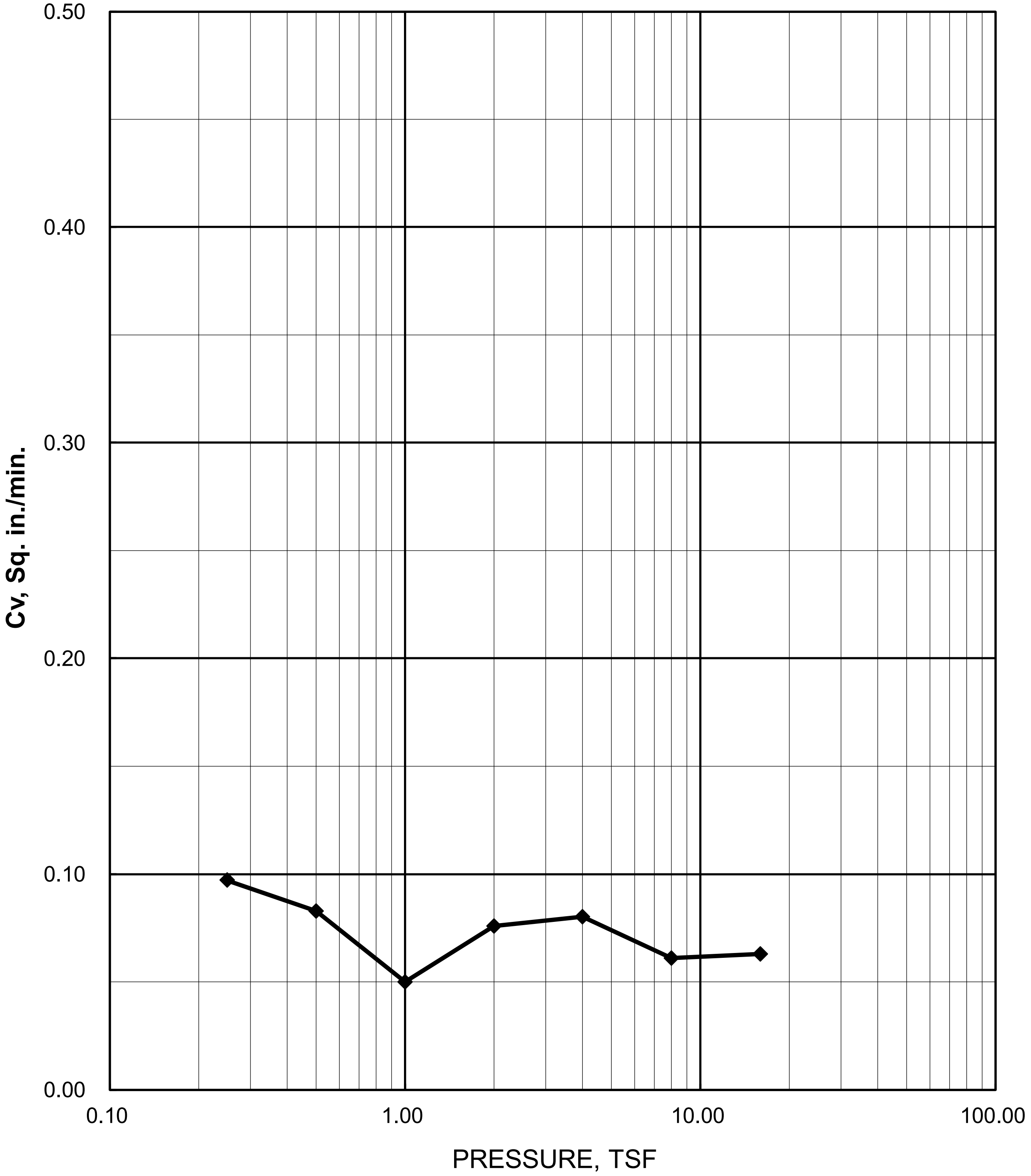
Boring MW-104, Sample at 30.0-32.0 Feet
Dry Unit Wt. = 125.3 pcf; Moisture Content = 12.6%



CONSOLIDATION TEST

Vermillion Landfill
Feasibility Investigation

Boring MW-104, Sample at 30.0-32.0 Feet
Dry Unit Wt. = 125.3 pcf; Moisture Content = 12.6 %



CONSOLIDATION
TEST DATA
Square Root of Time Method

JOB NUMBER:	J038678.01	INITIAL MOISTURE:		FINAL MOISTURE:		INITIAL DATA:	
BORING NUMBER:	MW-104	WET WT SPLE + RING	258.97	WET WT SPLE + RING	257.98	SAMPLE HT.:	0.743
SAMPLE NUMBER:	-	DRY WT SPLE + RING	243.80	DRY WT SPLE + RING	243.80	SAMPLE DIA.:	2.500
DEPTH (Feet):	30.0-32.0	WT OF RING	123.82	WT OF RING	123.82	VOLUME:	59.799
		DRY WT OF SAMPLE	119.98	DRY WT OF SAMPLE	119.98	SPECIFIC GRAV.:	2.730
WET UNIT WT =	141.1	WT OF WATER	15.17	WT OF WATER	14.18	HT. OF SOLIDS:	0.546
DRY UNIT WT =	125.3	MOISTURE CONTENT	12.6	MOISTURE CONTENT	11.8	VOID RATIO:	0.361

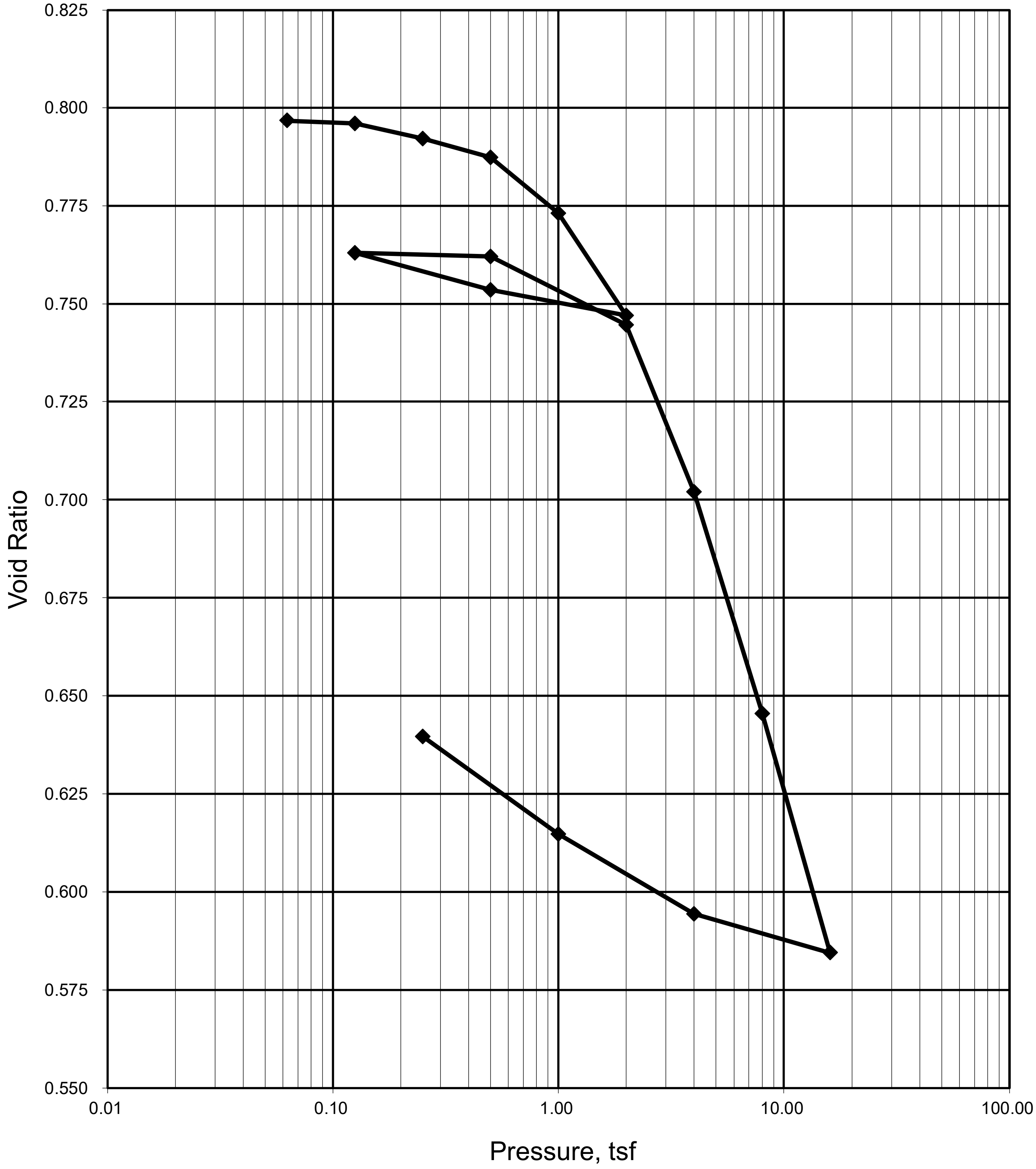
PRESSURE (tsf)	D100 *0.0001"	MACHINE DEFLECTION *0.0001"	CORR. FACTOR	CORR. D100 *0.0001"	CONSOLIDATION (Percent)	VOID RATIO CHANGE	VOID RATIO	D 90 UNCORR	H 50 CORR	~~t 50 or~~ t 90	Cv (SQ IN/MIN)
0.000	0.0	0.0	0.0	0.0	0.00	0.0000	0.361				
0.063	2.0	1.0	0.0	1.0	0.01	0.0002	0.360				
0.125	15.9	8.0	0.0	7.9	0.11	0.0014	0.359				
0.250	39.2	20.0	0.0	19.2	0.26	0.0035	0.357	38.5	0.7416	1.20	0.0971
0.500	70.0	33.0	0.0	37.0	0.50	0.0068	0.354	68.7	0.7398	1.40	0.0829
1.000	112.2	46.0	0.0	66.2	0.89	0.0121	0.349	110.2	0.7370	2.30	0.0501
2.000	169.3	62.0	0.0	107.3	1.44	0.0196	0.341	167.0	0.7329	1.50	0.0759
4.000	235.6	78.0	0.0	157.6	2.12	0.0288	0.332	233.0	0.7279	1.40	0.0802
1.000	229.0	62.0	19.4	147.6	1.99	0.0270	0.334				
0.250	198.0	47.0	19.4	131.6	1.77	0.0241	0.337				
1.000	212.0	57.0	19.4	135.6	1.82	0.0248	0.336				
4.000	264.1	79.0	19.4	165.7	2.23	0.0303	0.330				
8.000	340.8	97.0	0.0	243.8	3.28	0.0446	0.316	337.0	0.7194	1.80	0.0610
16.000	447.0	115.0	0.0	332.0	4.47	0.0608	0.300	442.0	0.7107	1.70	0.0630
4.000	434.0	95.0	23.0	316.0	4.25	0.0578	0.303				
1.000	388.0	74.0	23.0	291.0	3.91	0.0533	0.307				
0.250	346.0	58.0	23.0	265.0	3.56	0.0485	0.312				

Geotechnology, Inc.

CONSOLIDATION TEST

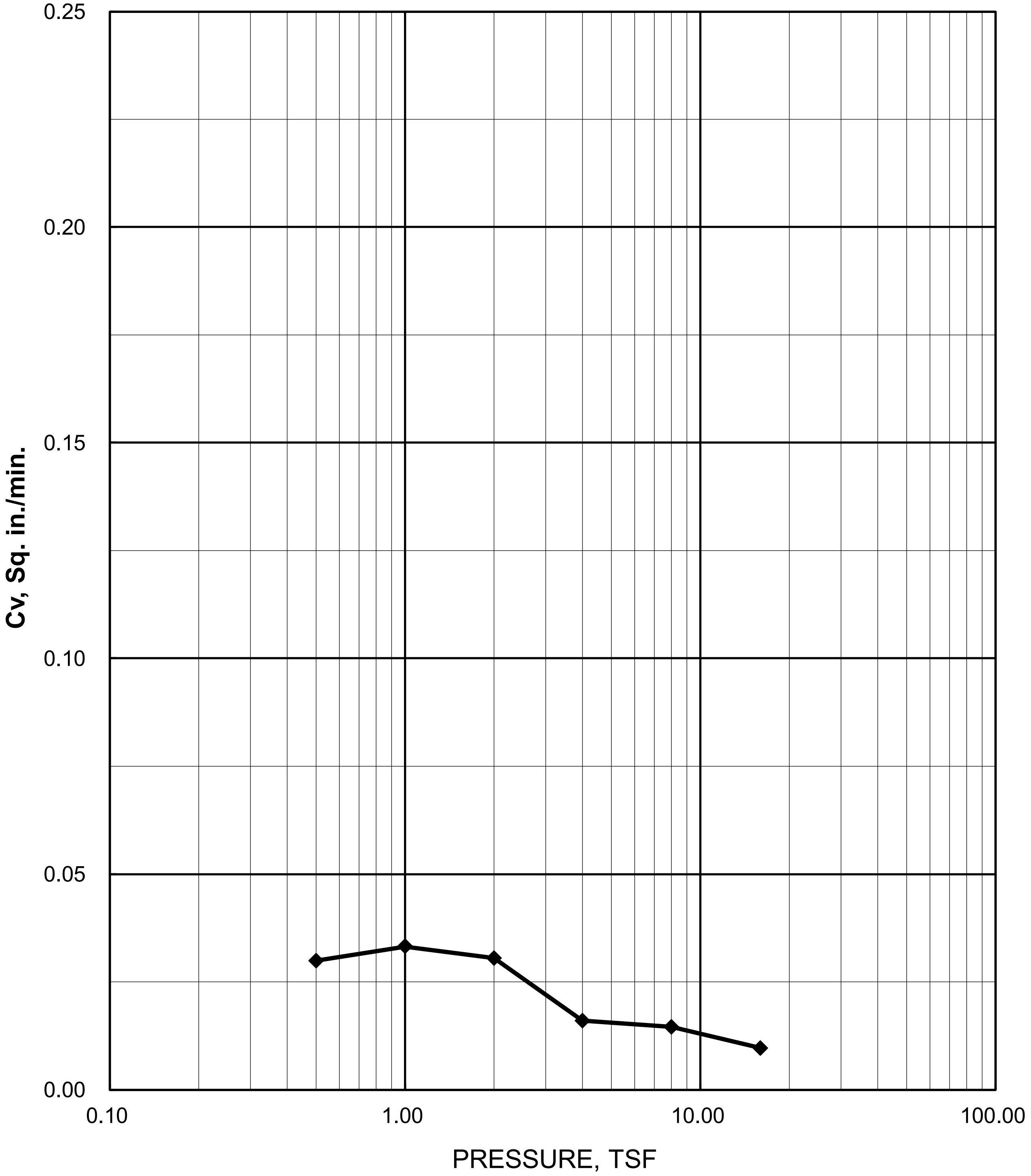
Vermillion Landfill
Feasibility Investigation

Boring MW-105, Sample at 10.0-12.0 Feet
Dry Unit Wt. = 95.2 pcf; Moisture Content = 26.2%



CONSOLIDATION TEST
Vermillion Landfill
Feasibility Investigation

Boring MW-105, Sample at 10.0-12.0 Feet
Dry Unit Wt. = 95.2 pcf; Moisture Content = 26.2 %



CONSOLIDATION
TEST DATA

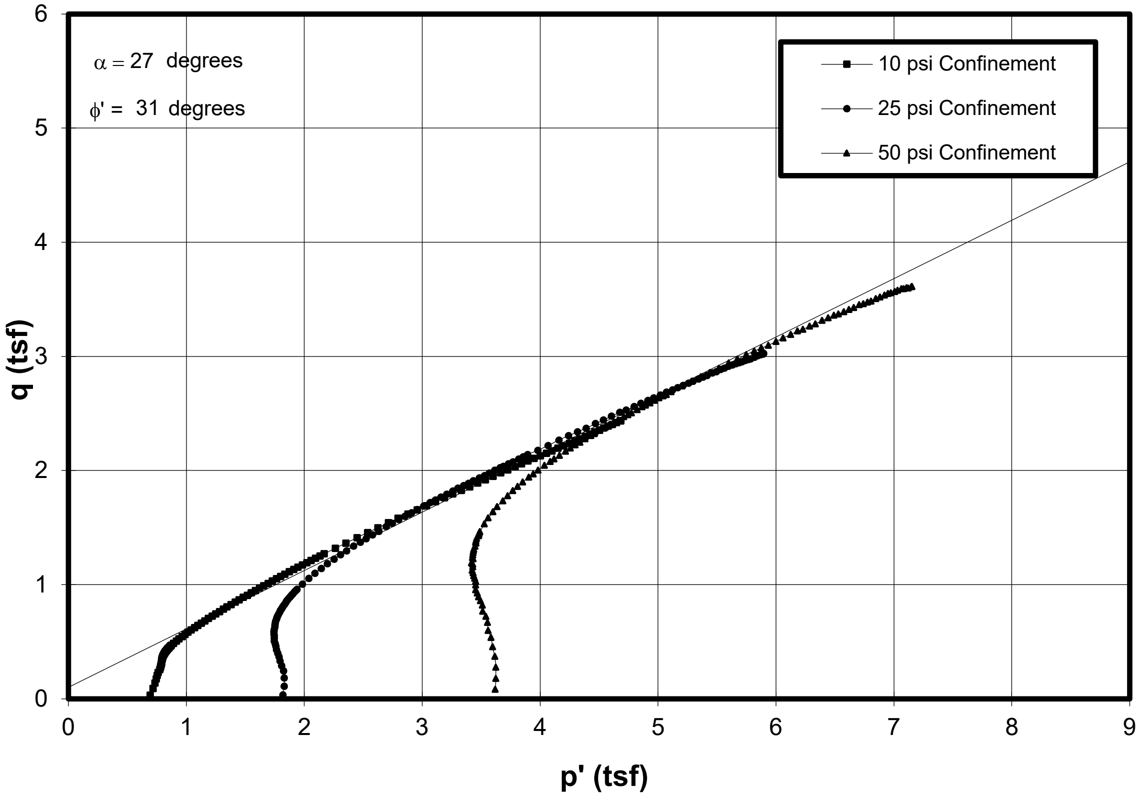
Log of Time Method

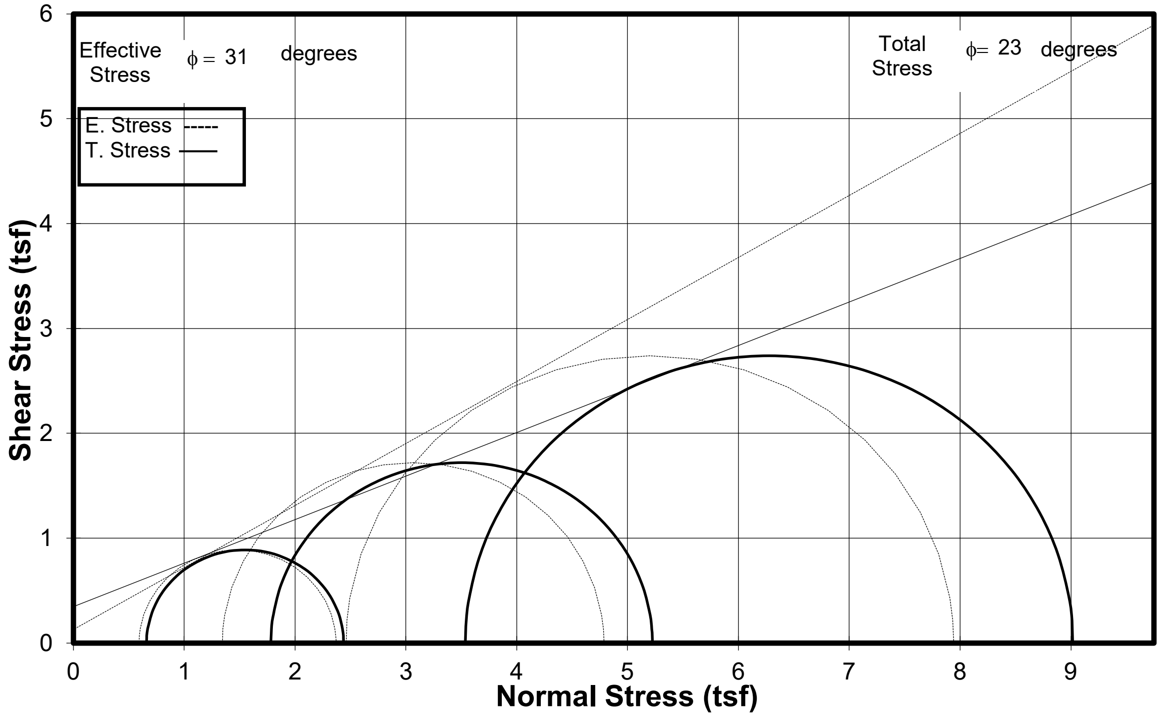
JOB NUMBER:	J038678.01	INITIAL MOISTURE:		FINAL MOISTURE:		INITIAL DATA:	
BORING NUMBER:	MW-105	WET WT SPLE + RING	245.65	WET WT SPLE + RING	242.63	SAMPLE HT.:	0.743
SAMPLE NUMBER:	-	DRY WT SPLE + RING	221.76	DRY WT SPLE + RING	221.76	SAMPLE DIA.:	2.500
DEPTH (Feet):	10.0-12.0	WT OF RING	130.58	WT OF RING	130.58	VOLUME:	59.791
		DRY WT OF SAMPLE	91.18	DRY WT OF SAMPLE	91.18	SPECIFIC GRAV.:	2.740
WET UNIT WT =	120.2	WT OF WATER	23.89	WT OF WATER	20.87	HT. OF SOLIDS:	0.414
DRY UNIT WT =	95.2	MOISTURE CONTENT	26.2	MOISTURE CONTENT	22.9	VOID RATIO:	0.797

PRESSURE (tsf)	D100 *0.0001"	MACHINE DEFLECTION *0.0001"	CORR. FACTOR	CORR. D100 *0.0001"	CONSOLIDATION (Percent)	VOID RATIO CHANGE	VOID RATIO	D 50 UNCORR	H 50 CORR	t 50 or ~~t 90~~	Cv (SQ IN/MIN)
0.000	0.0	0.0	0.0	0.0	0.00	0.0000	0.797				
0.063	2.0	2.0	0.0	0.0	0.00	0.0000	0.797				
0.125	11.0	8.0	0.0	3.0	0.04	0.0007	0.796				
0.250	37.0	18.0	0.0	19.0	0.26	0.0046	0.792				
0.500	70.0	31.0	0.0	39.0	0.52	0.0094	0.787	62.5	0.7402	0.90	0.0300
1.000	146.0	48.0	0.0	98.0	1.32	0.0237	0.773	131.0	0.7350	0.80	0.0333
2.000	270.5	65.0	0.0	205.5	2.76	0.0497	0.747	246.3	0.7252	0.85	0.0305
0.500	251.0	51.0	21.5	178.5	2.40	0.0431	0.754				
0.125	198.0	37.0	21.5	139.5	1.88	0.0337	0.763				
0.500	211.0	46.0	21.5	143.5	1.93	0.0347	0.762				
2.000	303.0	66.0	21.5	215.5	2.90	0.0521	0.745				
4.000	476.0	84.0	0.0	392.0	5.27	0.0948	0.702	424.5	0.7093	1.55	0.0160
8.000	732.0	106.0	0.0	626.0	8.42	0.1513	0.645	646.0	0.6893	1.60	0.0146
16.000	1005.0	127.0	0.0	878.0	11.81	0.2122	0.585	903.5	0.6657	2.25	0.0097
4.000	971.0	106.0	28.0	837.0	11.26	0.2023	0.594				
1.000	864.0	83.0	28.0	753.0	10.13	0.1820	0.615				
0.250	747.0	69.0	28.0	650.0	8.74	0.1571	0.640				

APPENDIX E

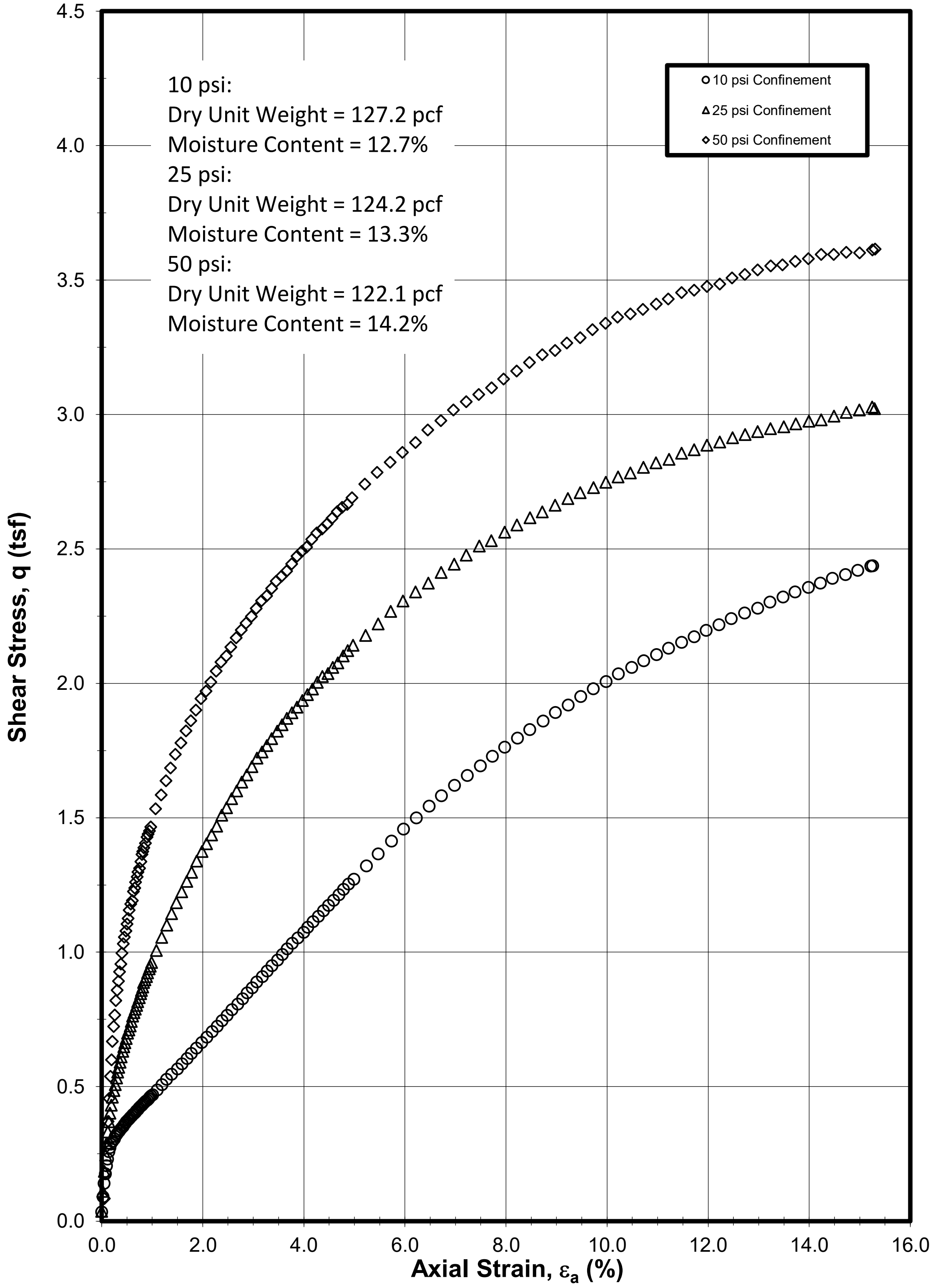
Triaxial Results





CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

ASTM D 4767
Project No.: J038678.01
Boring: MW-101, MW-101, MW-101
Sample Depth: 30.0-30.5, 30.5-31.0, 31.0-31.5



CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D 4767
Project No.: J038678.01
Boring: MW-101, MW-101, MW-101
Sample Depth: 30.0-30.5, 30.5-31.0, 31.0-31.5

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01
Boring No.: MW-101
Sample No.: -
Specimen No.: A
Depth (ft.): 30.0-30.5

Initial Height., H_o (in): 5.601
Initial Diameter, D_o (in): 2.871
Membrane Thickness (in): 0.02
Ht Change at End of Consol.,ΔH_o (in): 0.016 H_c 5.585
Ht Change at End of Saturation, H_s (in): 0.000
Volume change during Consol. V_c (cc^3): 5.03 0.30683 in^3

Confining Pressure (psi): 10.00
Initial Volume, V_o (in^3): 36.26
Initial Area, A_o (in^2): 6.47
Area after Consol., A_c (in^2): 6.437
Piston Correction (lbs): 13.1

Elasped Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
0.00	0.00	19.16	30.70	39.84	0.000	6.437	0.00	0.21	9.14	10.07	1.10	0.00	0.034	0.692
1.52	0.00	29.28	31.16	39.84	0.025	6.439	0.00	0.33	8.68	11.19	1.29	0.03	0.090	0.715
3.02	0.00	38.27	31.61	39.85	0.047	6.440	0.00	0.43	8.23	12.13	1.47	0.07	0.140	0.733
4.52	0.00	44.67	31.96	39.86	0.073	6.442	0.00	0.50	7.87	12.77	1.62	0.09	0.176	0.743
6.02	0.01	49.98	32.24	39.85	0.096	6.443	0.00	0.56	7.60	13.31	1.75	0.11	0.206	0.753
7.52	0.01	54.41	32.49	39.87	0.115	6.445	0.00	0.61	7.35	13.76	1.87	0.13	0.231	0.760
9.02	0.01	59.33	32.67	39.87	0.143	6.446	0.01	0.66	7.17	14.33	2.00	0.14	0.258	0.774
10.52	0.01	62.12	32.82	39.87	0.161	6.448	0.01	0.69	7.02	14.61	2.08	0.15	0.273	0.779
12.02	0.01	64.45	32.95	39.86	0.178	6.449	0.01	0.72	6.89	14.85	2.16	0.16	0.286	0.782
13.52	0.01	66.43	33.07	39.86	0.214	6.451	0.01	0.74	6.77	15.03	2.22	0.17	0.297	0.785
15.02	0.01	68.03	33.17	39.85	0.252	6.453	0.01	0.76	6.67	15.18	2.28	0.18	0.306	0.786
16.52	0.02	69.57	33.27	39.85	0.269	6.454	0.01	0.78	6.57	15.31	2.33	0.19	0.315	0.788
18.02	0.02	70.81	33.36	39.84	0.295	6.456	0.01	0.79	6.48	15.41	2.38	0.19	0.322	0.788
19.52	0.02	71.96	33.44	39.84	0.319	6.458	0.01	0.80	6.40	15.51	2.42	0.20	0.328	0.789
21.02	0.02	73.12	33.51	39.83	0.350	6.460	0.01	0.81	6.33	15.61	2.47	0.20	0.334	0.790
22.52	0.02	74.30	33.59	39.84	0.368	6.461	0.02	0.83	6.25	15.72	2.51	0.21	0.341	0.791
24.02	0.02	75.48	33.66	39.85	0.400	6.463	0.02	0.84	6.17	15.82	2.56	0.21	0.347	0.792
25.52	0.02	76.54	33.75	39.88	0.430	6.465	0.02	0.85	6.09	15.90	2.61	0.22	0.353	0.791
27.02	0.02	77.52	33.80	39.87	0.444	6.466	0.02	0.86	6.04	16.00	2.65	0.22	0.358	0.793
28.52	0.03	78.65	33.84	39.87	0.468	6.467	0.02	0.87	5.99	16.12	2.69	0.23	0.365	0.796
30.02	0.03	79.61	33.89	39.86	0.488	6.469	0.02	0.88	5.95	16.23	2.73	0.23	0.370	0.798
31.53	0.03	80.58	33.93	39.86	0.519	6.471	0.02	0.90	5.91	16.33	2.76	0.23	0.375	0.801
33.03	0.03	81.50	33.97	39.85	0.546	6.472	0.02	0.90	5.87	16.43	2.80	0.24	0.380	0.803
34.53	0.03	82.51	34.01	39.85	0.566	6.474	0.02	0.92	5.83	16.55	2.84	0.24	0.386	0.806
36.03	0.03	83.47	34.04	39.84	0.596	6.476	0.02	0.93	5.80	16.66	2.87	0.24	0.391	0.808
37.53	0.03	84.39	34.07	39.84	0.618	6.477	0.03	0.94	5.77	16.77	2.91	0.24	0.396	0.811
39.03	0.04	85.22	34.10	39.84	0.645	6.479	0.03	0.95	5.74	16.87	2.94	0.24	0.401	0.814
40.53	0.04	86.17	34.12	39.83	0.669	6.481	0.03	0.96	5.72	16.99	2.97	0.25	0.406	0.817
42.03	0.04	87.04	34.17	39.85	0.689	6.482	0.03	0.96	5.67	17.07	3.01	0.25	0.410	0.819
43.53	0.04	87.95	34.19	39.86	0.717	6.484	0.03	0.97	5.65	17.19	3.04	0.25	0.415	0.822
45.03	0.04	88.98	34.21	39.86	0.737	6.485	0.03	0.99	5.63	17.32	3.08	0.25	0.421	0.826
46.53	0.04	90.00	34.23	39.87	0.769	6.487	0.03	1.00	5.61	17.46	3.11	0.25	0.427	0.831
48.03	0.04	90.90	34.24	39.87	0.795	6.489	0.03	1.01	5.60	17.59	3.14	0.25	0.431	0.835
49.53	0.05	91.79	34.24	39.87	0.819	6.490	0.03	1.02	5.60	17.71	3.17	0.26	0.436	0.839
51.03	0.05	92.68	34.25	39.86	0.846	6.492	0.04	1.03	5.59	17.84	3.19	0.26	0.441	0.844
52.53	0.05	93.49	34.25	39.86	0.869	6.494	0.04	1.03	5.59	17.96	3.21	0.26	0.445	0.848
54.03	0.05	94.31	34.25	39.86	0.905	6.496	0.04	1.04	5.59	18.08	3.24	0.26	0.450	0.852
55.53	0.05	95.25	34.26	39.86	0.931	6.498	0.04	1.05	5.58	18.22	3.26	0.26	0.455	0.857
57.03	0.05	96.24	34.26	39.85	0.948	6.499	0.04	1.06	5.58	18.37	3.29	0.26	0.460	0.862
58.53	0.05	97.16	34.27	39.87	0.975	6.500	0.04	1.07	5.57	18.49	3.32	0.26	0.465	0.866
60.03	0.06	97.94	34.28	39.87	1.008	6.503	0.04	1.08	5.56	18.60	3.34	0.26	0.469	0.870
66.03	0.06	101.36	34.25	39.86	1.099	6.509	0.05	1.12	5.59	19.15	3.42	0.26	0.488	0.891
72.03	0.07	104.96	34.19	39.87	1.194	6.515	0.05	1.16	5.65	19.74	3.50	0.25	0.507	0.914
78.03	0.07	108.61	34.15	39.88	1.285	6.521	0.05	1.20	5.69	20.33	3.57	0.25	0.527	0.937
84.03	0.08	112.20	34.06	39.86	1.385	6.528	0.06	1.23	5.77	20.95	3.63	0.24	0.546	0.962
90.05	0.08	115.89	33.98	39.85	1.497	6.535	0.06	1.27	5.85	21.58	3.69	0.24	0.566	0.988
96.05	0.09	119.36	33.91	39.87	1.587	6.541	0.07	1.31	5.93	22.17	3.74	0.23	0.585	1.012
102.05	0.09	123.15	33.79	39.88	1.690	6.548	0.07	1.35	6.04	22.85	3.78	0.22	0.605	1.040
108.05	0.10	126.62	33.66	39.87	1.775	6.553	0.07	1.39	6.18	23.50	3.80	0.21	0.623	1.068
114.07	0.10	130.31	33.55	39.88	1.874	6.560	0.08	1.42	6.29	24.15	3.84	0.21	0.643	1.096
120.07	0.11	134.29	33.42	39.86	1.980	6.567	0.08	1.47	6.42	24.86	3.88	0.20	0.664	1.126
126.07	0.12	138.12	33.28	39.84	2.082	6.574	0.09	1.51	6.55	25.57	3.90	0.19	0.684	1.156
132.07	0.12	142.05	33.17	39.87	2.188	6.581	0.09	1.55	6.67	26.25	3.94	0.18	0.705	1.185
138.08	0.13	145.75	33.00	39.87	2.288	6.588	0.10	1.59	6.83	26.96	3.95	0.17	0.725	1.217
144.08	0.13	149.65	32.86	39.88	2.380	6.594	0.10	1.63	6.97	27.68	3.97	0.16	0.745	1.247
150.08	0.14	153.40	32.70	39.87	2.481	6.601	0.10	1.67	7.14	28.39	3.97	0.14	0.765	1.279

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01
Boring No.: MW-101
Sample No.: -
Specimen No.: A
Depth (ft.): 30.0-30.5

Initial Height., H_o (in): 5.601
Initial Diameter, D_o (in): 2.871
Membrane Thickness (in): 0.02
Ht Change at End of Consol.,ΔH_o (in): 0.016 H_c 5.585
Ht Change at End of Saturation, H_s (in): 0.000
Volume change during Consol. V_c (cc^3): 5.03 0.30683 in^3

Confining Pressure (psi): 10.00
Initial Volume, V_o (in^3): 36.26
Initial Area, A_o (in^2): 6.47
Area after Consol., A_c (in^2): 6.437
Piston Correction (lbs): 13.1

Elasped Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
156.08	0.14	157.51	32.53	39.86	2.576	6.607	0.11	1.71	7.31	29.16	3.99	0.13	0.787	1.313
162.08	0.15	161.37	32.38	39.87	2.695	6.615	0.11	1.75	7.46	29.87	4.00	0.12	0.807	1.344
168.08	0.16	165.28	32.19	39.89	2.789	6.622	0.12	1.79	7.65	30.62	4.00	0.11	0.827	1.378
174.10	0.16	169.31	31.99	39.88	2.879	6.628	0.12	1.83	7.85	31.41	4.00	0.09	0.848	1.413
180.10	0.17	172.94	31.82	39.89	2.978	6.635	0.12	1.87	8.02	32.11	4.00	0.08	0.867	1.445
186.10	0.17	177.22	31.62	39.88	3.069	6.641	0.13	1.91	8.22	32.92	4.01	0.07	0.889	1.481
192.10	0.18	180.98	31.42	39.87	3.178	6.648	0.13	1.95	8.42	33.67	4.00	0.05	0.909	1.515
198.10	0.18	185.08	31.24	39.88	3.276	6.655	0.14	1.99	8.60	34.43	4.01	0.04	0.930	1.549
204.12	0.19	188.90	31.03	39.87	3.371	6.662	0.14	2.03	8.81	35.19	4.00	0.02	0.950	1.584
210.12	0.19	192.97	30.82	39.86	3.479	6.669	0.15	2.07	9.02	35.98	3.99	0.01	0.971	1.620
216.12	0.20	197.07	30.63	39.88	3.575	6.676	0.15	2.11	9.20	36.76	3.99	0.00	0.992	1.655
222.12	0.21	201.11	30.41	39.87	3.672	6.683	0.15	2.16	9.43	37.56	3.98	-0.02	1.013	1.692
228.12	0.21	205.19	30.21	39.88	3.773	6.690	0.16	2.20	9.63	38.34	3.98	-0.04	1.034	1.727
234.12	0.22	209.03	29.98	39.87	3.879	6.697	0.16	2.24	9.85	39.11	3.97	-0.05	1.053	1.763
240.13	0.22	213.09	29.75	39.87	3.995	6.705	0.17	2.28	10.08	39.90	3.96	-0.07	1.074	1.800
246.13	0.23	216.76	29.54	39.89	4.079	6.711	0.17	2.31	10.29	40.64	3.95	-0.08	1.092	1.834
252.13	0.23	221.02	29.31	39.88	4.183	6.718	0.17	2.36	10.53	41.47	3.94	-0.10	1.114	1.872
258.13	0.24	224.86	29.07	39.87	4.286	6.725	0.18	2.39	10.77	42.25	3.92	-0.12	1.133	1.909
264.15	0.25	229.01	28.85	39.89	4.387	6.732	0.18	2.44	10.99	43.05	3.92	-0.13	1.154	1.946
270.15	0.25	232.97	28.61	39.88	4.490	6.740	0.19	2.48	11.23	43.85	3.90	-0.15	1.174	1.983
276.15	0.26	236.80	28.35	39.87	4.590	6.747	0.19	2.51	11.49	44.64	3.89	-0.17	1.193	2.021
282.15	0.26	240.84	28.13	39.89	4.693	6.754	0.20	2.55	11.71	45.42	3.88	-0.18	1.214	2.057
288.15	0.27	244.74	27.88	39.88	4.783	6.761	0.20	2.59	11.96	46.22	3.86	-0.20	1.233	2.094
294.17	0.27	248.75	27.63	39.87	4.883	6.768	0.20	2.63	12.21	47.02	3.85	-0.22	1.253	2.132
300.17	0.28	252.39	27.39	39.89	4.990	6.775	0.21	2.67	12.44	47.76	3.84	-0.24	1.271	2.167
315.17	0.29	262.31	26.78	39.89	5.237	6.793	0.22	2.76	13.06	49.74	3.81	-0.28	1.320	2.261
330.17	0.31	271.48	26.16	39.90	5.470	6.810	0.23	2.85	13.68	51.62	3.77	-0.33	1.366	2.351
345.17	0.32	281.22	25.50	39.88	5.735	6.829	0.24	2.95	14.34	53.60	3.74	-0.37	1.413	2.446
360.18	0.33	290.38	24.86	39.89	5.970	6.846	0.25	3.04	14.98	55.48	3.70	-0.42	1.458	2.537
375.18	0.35	299.14	24.23	39.89	6.227	6.865	0.26	3.12	15.61	57.27	3.67	-0.47	1.500	2.624
390.18	0.36	308.19	23.61	39.90	6.480	6.883	0.27	3.20	16.23	59.09	3.64	-0.51	1.543	2.711
405.18	0.38	316.40	23.01	39.91	6.721	6.901	0.28	3.28	16.83	60.77	3.61	-0.55	1.582	2.794
420.18	0.39	324.71	22.39	39.92	6.982	6.920	0.29	3.36	17.45	62.47	3.58	-0.60	1.621	2.877
435.18	0.40	332.63	21.79	39.92	7.233	6.939	0.30	3.43	18.05	64.09	3.55	-0.64	1.657	2.957
450.18	0.42	340.41	21.21	39.93	7.492	6.958	0.31	3.50	18.63	65.66	3.52	-0.68	1.693	3.035
465.20	0.43	348.11	20.62	39.94	7.728	6.976	0.32	3.57	19.22	67.23	3.50	-0.73	1.729	3.112
480.20	0.45	355.56	20.03	39.92	7.974	6.995	0.33	3.64	19.80	68.76	3.47	-0.77	1.762	3.188
495.20	0.46	363.09	19.53	39.92	8.226	7.014	0.34	3.70	20.31	70.20	3.46	-0.80	1.796	3.258
510.20	0.47	370.33	18.96	39.93	8.472	7.033	0.35	3.77	20.88	71.67	3.43	-0.85	1.828	3.332
525.20	0.49	377.42	18.43	39.94	8.734	7.053	0.37	3.83	21.41	73.06	3.41	-0.88	1.859	3.401
540.20	0.50	384.66	17.92	39.94	8.974	7.072	0.38	3.89	21.92	74.45	3.40	-0.92	1.891	3.469
555.20	0.52	391.29	17.41	39.95	9.232	7.092	0.39	3.94	22.42	75.75	3.38	-0.96	1.920	3.534
570.22	0.53	398.58	16.93	39.96	9.480	7.111	0.40	4.01	22.91	77.11	3.37	-0.99	1.951	3.601
585.22	0.54	405.36	16.45	39.96	9.725	7.131	0.41	4.06	23.39	78.39	3.35	-1.03	1.980	3.664
600.22	0.56	411.76	16.00	39.97	9.978	7.151	0.42	4.12	23.84	79.59	3.34	-1.06	2.007	3.724
615.22	0.57	418.45	15.52	39.95	10.221	7.170	0.43	4.17	24.32	80.85	3.32	-1.09	2.035	3.786
630.22	0.59	424.45	15.08	39.95	10.487	7.191	0.44	4.22	24.75	81.95	3.31	-1.12	2.059	3.841
645.23	0.60	430.59	14.67	39.96	10.724	7.210	0.45	4.27	25.17	83.06	3.30	-1.15	2.084	3.896
660.23	0.61	436.29	14.27	39.96	10.979	7.231	0.46	4.31	25.57	84.09	3.29	-1.18	2.107	3.947
675.23	0.63	442.17	13.87	39.96	11.215	7.250	0.47	4.36	25.97	85.14	3.28	-1.21	2.130	4.000
690.23	0.64	447.94	13.47	39.97	11.475	7.272	0.48	4.40	26.37	86.16	3.27	-1.24	2.153	4.051
705.23	0.65	453.25	13.10	39.97	11.722	7.292	0.49	4.44	26.74	87.10	3.26	-1.27	2.173	4.098
720.23	0.67	459.41	12.71	39.98	11.961	7.312	0.50	4.49	27.13	88.16	3.25	-1.30	2.197	4.151
735.23	0.68	464.98	12.33	39.98	12.213	7.333	0.51	4.53	27.51	89.13	3.24	-1.32	2.218	4.199
750.25	0.70	470.76	11.97	39.96	12.459	7.353	0.52	4.57	27.87	90.11	3.23	-1.35	2.240	4.247
765.25	0.71	476.52	11.63	39.97	12.721	7.375	0.53	4.61	28.21	91.04	3.23	-1.37	2.262	4.293

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01
Boring No.: MW-101
Sample No.: -
Specimen No.: A
Depth (ft.): 30.0-30.5

Initial Height., H_o (in): 5.601
Initial Diameter, D_o (in): 2.871
Membrane Thickness (in): 0.02
Ht Change at End of Consol.,ΔH_o (in): 0.016 H_c 5.585
Ht Change at End of Saturation, H_s (in): 0.000
Volume change during Consol. V_c (cc^3): 5.03 0.30683 in^3

Confining Pressure (psi): 10.00
Initial Volume, V_o (in^3): 36.26
Initial Area, A_o (in^2): 6.47
Area after Consol., A_c (in^2): 6.437
Piston Correction (lbs): 13.1

Elasped Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
780.25	0.72	481.57	11.31	39.97	12.981	7.397	0.54	4.65	28.53	91.85	3.22	-1.40	2.280	4.333
795.25	0.74	487.54	10.98	39.98	13.224	7.418	0.55	4.69	28.86	92.81	3.22	-1.42	2.302	4.380
810.25	0.75	492.75	10.67	39.98	13.482	7.440	0.56	4.73	29.17	93.63	3.21	-1.44	2.321	4.421
825.25	0.77	498.13	10.36	39.99	13.718	7.461	0.57	4.77	29.48	94.48	3.21	-1.46	2.340	4.463
840.25	0.78	503.11	10.05	40.00	13.981	7.483	0.58	4.80	29.79	95.26	3.20	-1.49	2.357	4.502
855.27	0.79	507.74	9.77	40.01	14.221	7.504	0.59	4.83	30.07	95.98	3.19	-1.51	2.373	4.538
870.27	0.81	512.81	9.47	40.01	14.460	7.525	0.60	4.86	30.37	96.76	3.19	-1.53	2.390	4.577
885.27	0.82	517.25	9.18	40.01	14.719	7.548	0.62	4.89	30.66	97.44	3.18	-1.55	2.404	4.611
900.27	0.84	522.12	8.91	39.99	14.962	7.570	0.63	4.92	30.92	98.16	3.17	-1.57	2.421	4.647
915.27	0.85	526.91	8.63	40.00	15.217	7.592	0.64	4.95	31.20	98.87	3.17	-1.59	2.436	4.683
917.88	0.85	527.46	8.65	39.99	15.255	7.596	0.64	4.95	31.19	98.90	3.17	-1.59	2.438	4.683

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01
Boring No.: MW-101
Sample No.: 0
Specimen No.: B
Depth (ft.): 30.5-31.0

Initial Height., H_o (in): 5.919
Initial Diameter, D_o (in): 2.872
Membr. Thickness (in): 0.02
Ht Change at End of Consol.,ΔH_o (in): 0.035 H_c 5.884
Ht Change at End of Saturation, H_s (in): 0.000
Volume change during Consol. V_c (cc^3): 11.32 0.69052 in^3

Confining Pressure (psi): 25.00
Initial Volume, V_o (in^3): 38.34
Initial Area, A_o (in^2): 6.48
Area after Consol., A_c (in^2): 6.40
Piston Correction (lbs): 11.6

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
0.00	0.00	18.04	30.28	55.00	0.000	6.398	0.00	0.20	24.73	25.74	1.04	0.00	0.04	1.82
1.50	0.00	31.27	31.16	55.00	0.023	6.399	0.00	0.35	23.84	26.92	1.13	0.06	0.11	1.83
3.02	0.00	44.52	32.18	55.00	0.055	6.402	0.00	0.50	22.83	27.98	1.23	0.14	0.19	1.83
4.52	0.00	55.19	33.09	55.00	0.078	6.403	0.00	0.62	21.91	28.73	1.31	0.20	0.25	1.82
6.02	0.01	63.10	33.95	55.00	0.100	6.404	0.00	0.71	21.05	29.10	1.38	0.26	0.29	1.81
7.52	0.01	70.63	34.71	55.00	0.122	6.406	0.01	0.79	20.30	29.52	1.45	0.32	0.33	1.79
9.02	0.01	77.37	35.35	54.99	0.145	6.407	0.01	0.87	19.65	29.93	1.52	0.37	0.37	1.78
10.53	0.01	82.92	35.93	54.99	0.163	6.409	0.01	0.93	19.08	30.21	1.58	0.41	0.40	1.77
12.03	0.01	88.25	36.49	55.00	0.189	6.410	0.01	0.99	18.51	30.48	1.65	0.45	0.43	1.76
13.53	0.01	93.58	36.98	55.01	0.213	6.412	0.01	1.05	18.02	30.81	1.71	0.48	0.46	1.76
15.03	0.01	98.02	37.41	55.01	0.243	6.414	0.01	1.10	17.60	31.08	1.77	0.51	0.49	1.75
16.55	0.02	101.96	37.82	55.00	0.271	6.415	0.01	1.14	17.19	31.28	1.82	0.54	0.51	1.74
18.05	0.02	106.50	38.17	55.00	0.296	6.417	0.01	1.19	16.83	31.63	1.88	0.57	0.53	1.74
19.55	0.02	110.27	38.48	55.00	0.318	6.418	0.01	1.24	16.53	31.91	1.93	0.59	0.55	1.74
21.05	0.02	113.57	38.76	55.00	0.340	6.420	0.01	1.27	16.25	32.14	1.98	0.61	0.57	1.74
22.55	0.02	116.92	39.01	55.00	0.362	6.421	0.02	1.31	15.99	32.40	2.03	0.63	0.59	1.74
24.07	0.02	120.43	39.27	55.00	0.386	6.423	0.02	1.35	15.74	32.69	2.08	0.65	0.61	1.74
25.57	0.02	124.26	39.48	55.00	0.415	6.425	0.02	1.39	15.52	33.06	2.13	0.66	0.63	1.75
27.07	0.03	127.20	39.69	55.00	0.439	6.426	0.02	1.42	15.32	33.31	2.17	0.68	0.65	1.75
28.57	0.03	129.98	39.88	55.00	0.460	6.428	0.02	1.45	15.13	33.55	2.22	0.69	0.66	1.75
30.07	0.03	132.91	40.06	55.01	0.487	6.429	0.02	1.49	14.94	33.82	2.26	0.70	0.68	1.76
31.57	0.03	136.35	40.21	55.01	0.514	6.431	0.02	1.53	14.79	34.20	2.31	0.72	0.70	1.76
33.08	0.03	138.55	40.36	55.00	0.537	6.433	0.02	1.55	14.65	34.39	2.35	0.73	0.71	1.77
34.58	0.03	141.33	40.48	55.00	0.567	6.435	0.02	1.58	14.52	34.69	2.39	0.73	0.73	1.77
36.08	0.03	144.24	40.61	55.00	0.584	6.436	0.02	1.61	14.40	35.01	2.43	0.74	0.74	1.78
37.58	0.04	147.80	40.73	55.00	0.614	6.438	0.03	1.65	14.28	35.44	2.48	0.75	0.76	1.79
39.08	0.04	150.24	40.82	55.00	0.638	6.439	0.03	1.68	14.18	35.72	2.52	0.76	0.78	1.80
40.58	0.04	152.53	40.90	55.00	0.668	6.441	0.03	1.70	14.10	35.99	2.55	0.76	0.79	1.80
42.10	0.04	155.02	40.98	55.00	0.689	6.442	0.03	1.73	14.03	36.30	2.59	0.77	0.80	1.81
43.60	0.04	157.55	41.05	55.00	0.711	6.444	0.03	1.76	13.96	36.61	2.62	0.78	0.82	1.82
45.12	0.04	160.23	41.12	55.00	0.743	6.446	0.03	1.79	13.88	36.95	2.66	0.78	0.83	1.83
46.62	0.05	163.03	41.18	55.00	0.773	6.448	0.03	1.82	13.82	37.32	2.70	0.78	0.85	1.84
48.13	0.05	165.16	41.25	55.00	0.789	6.449	0.03	1.84	13.76	37.58	2.73	0.79	0.86	1.85
49.63	0.05	167.60	41.28	55.00	0.815	6.451	0.03	1.87	13.72	37.91	2.76	0.79	0.87	1.86
51.13	0.05	170.57	41.33	55.00	0.829	6.452	0.03	1.90	13.68	38.33	2.80	0.80	0.89	1.87
52.65	0.05	172.41	41.36	55.00	0.856	6.453	0.04	1.92	13.65	38.57	2.83	0.80	0.90	1.88
54.15	0.05	174.64	41.38	55.00	0.885	6.455	0.04	1.95	13.63	38.89	2.85	0.80	0.91	1.89
55.65	0.05	177.05	41.41	55.00	0.909	6.457	0.04	1.97	13.60	39.23	2.89	0.80	0.92	1.90
57.15	0.06	179.87	41.43	55.00	0.939	6.459	0.04	2.00	13.58	39.64	2.92	0.80	0.94	1.92
58.65	0.06	181.70	41.44	55.00	0.960	6.460	0.04	2.02	13.56	39.90	2.94	0.80	0.95	1.92
60.17	0.06	184.21	41.45	54.99	0.989	6.462	0.04	2.05	13.55	40.27	2.97	0.80	0.96	1.94
66.17	0.06	192.39	41.44	55.00	1.083	6.468	0.05	2.14	13.56	41.52	3.06	0.80	1.01	1.98
72.17	0.07	201.33	41.39	55.00	1.186	6.475	0.05	2.24	13.62	42.93	3.15	0.80	1.06	2.04
78.17	0.08	209.68	41.27	54.99	1.290	6.482	0.05	2.33	13.73	44.30	3.23	0.79	1.10	2.09
84.18	0.08	217.67	41.13	54.99	1.381	6.488	0.06	2.41	13.88	45.65	3.29	0.78	1.14	2.14
90.18	0.09	225.13	40.96	55.00	1.477	6.494	0.06	2.49	14.05	46.93	3.34	0.77	1.18	2.20
96.18	0.09	232.67	40.75	54.99	1.587	6.501	0.07	2.57	14.25	48.27	3.39	0.75	1.22	2.25
102.18	0.10	239.93	40.53	54.99	1.682	6.508	0.07	2.65	14.47	49.57	3.42	0.74	1.26	2.31
108.18	0.10	246.31	40.28	55.00	1.778	6.514	0.07	2.72	14.72	50.76	3.45	0.72	1.30	2.36
114.20	0.11	253.96	40.02	55.00	1.880	6.521	0.08	2.80	14.98	52.16	3.48	0.70	1.34	2.42
120.20	0.12	260.70	39.75	54.99	1.985	6.528	0.08	2.87	15.26	53.43	3.50	0.68	1.37	2.47
126.20	0.12	266.32	39.47	55.00	2.077	6.534	0.09	2.93	15.54	54.53	3.51	0.66	1.40	2.52
132.20	0.13	272.52	39.16	55.00	2.177	6.540	0.09	2.99	15.84	55.74	3.52	0.64	1.44	2.58
138.20	0.13	278.61	38.86	55.00	2.274	6.547	0.10	3.06	16.14	56.93	3.53	0.62	1.47	2.63
144.20	0.14	286.29	38.56	55.00	2.376	6.554	0.10	3.14	16.44	58.36	3.55	0.60	1.51	2.69
150.20	0.15	291.72	38.25	54.99	2.469	6.560	0.10	3.19	16.76	59.47	3.55	0.57	1.54	2.74
156.22	0.15	298.21	37.94	54.99	2.573	6.567	0.11	3.26	17.06	60.72	3.56	0.55	1.57	2.80

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01
Boring No.: MW-101
Sample No.: 0
Specimen No.: B
Depth (ft.): 30.5-31.0

Initial Height., H_o (in): 5.919
Initial Diameter, D_o (in): 2.872
Membr. Thickness (in): 0.02
Ht Change at End of Consol.,ΔH_o (in): 0.035 H_c 5.884
Ht Change at End of Saturation, H_s (in): 0.000
Volume change during Consol. V_c (cc^3): 11.32 0.69052 in^3
Confining Pressure (psi): 25.00
Initial Volume, V_o (in^3): 38.34
Initial Area, A_o (in^2): 6.48
Area after Consol., A_c (in^2): 6.40
Piston Correction (lbs): 11.6

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
162.22	0.16	303.68	37.62	54.99	2.674	6.574	0.11	3.32	17.39	61.82	3.56	0.53	1.60	2.85
168.22	0.16	309.89	37.30	54.99	2.772	6.580	0.12	3.38	17.71	63.05	3.56	0.51	1.63	2.91
174.22	0.17	315.13	36.98	54.98	2.871	6.587	0.12	3.44	18.03	64.11	3.56	0.48	1.66	2.96
180.23	0.17	321.17	36.65	54.99	2.971	6.594	0.12	3.50	18.35	65.31	3.56	0.46	1.69	3.01
186.23	0.18	327.21	36.34	54.98	3.073	6.601	0.13	3.56	18.66	66.48	3.56	0.44	1.72	3.07
192.23	0.19	331.74	36.03	54.98	3.174	6.608	0.13	3.61	18.98	67.43	3.55	0.41	1.74	3.11
198.23	0.19	336.49	35.70	54.99	3.267	6.614	0.14	3.65	19.30	68.43	3.55	0.39	1.77	3.16
204.23	0.20	341.48	35.39	54.98	3.364	6.621	0.14	3.70	19.62	69.45	3.54	0.37	1.79	3.21
210.23	0.20	346.94	35.07	54.98	3.475	6.628	0.15	3.76	19.94	70.54	3.54	0.34	1.82	3.26
216.23	0.21	351.71	34.78	54.99	3.568	6.635	0.15	3.81	20.22	71.49	3.54	0.32	1.85	3.30
222.25	0.22	356.40	34.45	54.98	3.667	6.642	0.15	3.85	20.56	72.48	3.53	0.30	1.87	3.35
228.25	0.22	360.59	34.16	54.98	3.768	6.649	0.16	3.89	20.85	73.35	3.52	0.28	1.89	3.39
234.27	0.23	364.82	33.90	54.99	3.868	6.655	0.16	3.94	21.11	74.19	3.51	0.26	1.91	3.43
240.27	0.23	369.83	33.53	54.99	3.972	6.663	0.17	3.98	21.47	75.25	3.50	0.23	1.94	3.48
246.27	0.24	374.21	33.23	54.98	4.072	6.670	0.17	4.03	21.77	76.15	3.50	0.21	1.96	3.53
252.28	0.25	378.58	32.94	55.00	4.171	6.676	0.17	4.07	22.07	77.04	3.49	0.19	1.98	3.57
258.28	0.25	383.50	32.64	54.99	4.268	6.683	0.18	4.12	22.36	78.02	3.49	0.17	2.00	3.61
264.28	0.26	388.04	32.34	54.98	4.369	6.690	0.18	4.16	22.67	78.94	3.48	0.15	2.03	3.66
270.28	0.26	390.50	32.11	54.99	4.477	6.698	0.19	4.18	22.89	79.47	3.47	0.13	2.04	3.69
276.28	0.27	395.00	31.80	54.99	4.571	6.705	0.19	4.23	23.21	80.40	3.46	0.11	2.06	3.73
282.30	0.27	398.51	31.51	54.98	4.672	6.712	0.20	4.26	23.50	81.15	3.45	0.09	2.08	3.77
288.30	0.28	403.87	31.21	54.99	4.778	6.719	0.20	4.31	23.79	82.18	3.45	0.07	2.10	3.82
294.30	0.29	407.82	30.94	54.98	4.867	6.725	0.20	4.35	24.07	82.99	3.45	0.05	2.12	3.85
300.30	0.29	412.09	30.69	54.97	4.972	6.733	0.21	4.39	24.31	83.80	3.45	0.03	2.14	3.89
315.30	0.31	419.99	30.00	54.98	5.224	6.751	0.22	4.46	25.01	85.51	3.42	-0.02	2.18	3.98
330.32	0.32	429.06	29.36	54.98	5.469	6.768	0.23	4.55	25.64	87.33	3.41	-0.07	2.22	4.07
345.32	0.34	438.98	28.76	54.96	5.719	6.786	0.24	4.64	26.25	89.23	3.40	-0.11	2.27	4.16
360.32	0.35	447.31	28.14	54.95	5.961	6.804	0.25	4.72	26.86	90.91	3.38	-0.15	2.31	4.24
375.32	0.37	454.96	27.58	54.96	6.213	6.822	0.26	4.78	27.42	92.42	3.37	-0.19	2.34	4.31
390.32	0.38	462.32	26.99	54.97	6.461	6.840	0.27	4.85	28.01	93.92	3.35	-0.24	2.37	4.39
405.32	0.40	471.17	26.45	54.98	6.717	6.859	0.28	4.93	28.55	95.56	3.35	-0.28	2.41	4.47
420.32	0.41	478.30	25.94	54.98	6.975	6.878	0.29	4.99	29.07	96.93	3.33	-0.31	2.44	4.54
435.32	0.42	486.01	25.48	54.97	7.215	6.896	0.30	5.05	29.53	98.34	3.33	-0.35	2.48	4.60
450.32	0.44	493.70	24.94	54.95	7.474	6.915	0.31	5.12	30.06	99.79	3.32	-0.38	2.51	4.67
465.32	0.45	498.77	24.47	54.95	7.712	6.933	0.32	5.16	30.53	100.81	3.30	-0.42	2.53	4.73
480.32	0.47	506.35	24.00	54.95	7.973	6.952	0.33	5.22	31.01	102.18	3.30	-0.45	2.56	4.79
495.33	0.48	512.76	23.56	54.95	8.216	6.971	0.34	5.27	31.44	103.34	3.29	-0.48	2.59	4.85
510.33	0.50	519.47	23.13	54.95	8.473	6.990	0.35	5.33	31.88	104.54	3.28	-0.51	2.62	4.91
525.33	0.51	524.99	22.71	54.94	8.718	7.009	0.36	5.37	32.29	105.54	3.27	-0.54	2.64	4.96
540.33	0.53	531.26	22.30	54.94	8.972	7.029	0.37	5.42	32.71	106.65	3.26	-0.57	2.66	5.02
555.35	0.54	537.66	21.92	54.95	9.226	7.048	0.39	5.46	33.09	107.73	3.26	-0.60	2.69	5.07
570.35	0.56	543.32	21.51	54.95	9.467	7.067	0.40	5.51	33.49	108.74	3.25	-0.63	2.71	5.12
585.35	0.57	548.63	21.14	54.96	9.733	7.088	0.41	5.54	33.86	109.63	3.24	-0.66	2.73	5.17
600.35	0.59	554.05	20.78	54.96	9.974	7.107	0.42	5.58	34.22	110.56	3.23	-0.68	2.75	5.21
615.37	0.60	559.45	20.44	54.96	10.219	7.126	0.43	5.62	34.56	111.45	3.22	-0.71	2.77	5.26
630.37	0.62	563.82	20.11	54.96	10.463	7.146	0.44	5.65	34.90	112.19	3.21	-0.73	2.78	5.30
645.37	0.63	569.63	19.78	54.97	10.722	7.166	0.45	5.69	35.23	113.10	3.21	-0.76	2.80	5.34
660.37	0.65	574.53	19.47	54.97	10.967	7.186	0.46	5.72	35.54	113.88	3.20	-0.78	2.82	5.38
675.37	0.66	578.78	19.16	54.97	11.224	7.207	0.47	5.75	35.84	114.55	3.20	-0.80	2.83	5.41
690.37	0.68	584.96	18.87	54.96	11.474	7.227	0.48	5.79	36.14	115.48	3.20	-0.82	2.86	5.46
705.37	0.69	589.06	18.56	54.96	11.720	7.247	0.49	5.82	36.44	116.12	3.19	-0.84	2.87	5.49
720.38	0.70	594.26	18.29	54.97	11.979	7.269	0.50	5.85	36.71	116.88	3.18	-0.86	2.89	5.53
735.38	0.72	598.26	18.02	54.97	12.231	7.290	0.51	5.87	36.98	117.47	3.18	-0.88	2.90	5.56
750.38	0.73	603.24	17.74	54.98	12.481	7.310	0.52	5.90	37.27	118.20	3.17	-0.90	2.91	5.60
765.38	0.75	607.32	17.48	54.97	12.732	7.331	0.53	5.93	37.53	118.79	3.17	-0.92	2.93	5.63
780.38	0.76	611.28	17.21	54.97	12.980	7.352	0.54	5.95	37.79	119.36	3.16	-0.94	2.94	5.66
795.38	0.78	615.24	16.98	54.98	13.235	7.374	0.55	5.97	38.03	119.90	3.15	-0.96	2.95	5.69

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01 Boring No.: MW-101
Sample No.: 0 Specimen No.: B
Depth (ft.): 30.5-31.0

Initial Height., H_o (in):	5.919	Confining Pressure (psi):	25.00
Initial Diameter, D_o (in):	2.872	Initial Volume, V_o (in^3):	38.34
Membr. Thickness (in):	0.02	Initial Area, A_o (in^2):	6.48
Ht Change at End of Consol.,ΔH_o (in):	0.035 H_c 5.884	Area after Consol., A_c (in^2):	6.40
Ht Change at End of Saturation, H_s (in):	0.000	Piston Correction (lbs):	11.6
Volume change during Consol. V_c (cc^3):	11.32 0.69052 in^3		

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
810.38	0.79	618.36	16.73	54.97	13.495	7.396	0.56	5.98	38.28	120.32	3.14	-0.98	2.95	5.71
825.38	0.81	622.34	16.51	54.98	13.733	7.417	0.57	6.00	38.49	120.85	3.14	-0.99	2.96	5.74
840.38	0.82	626.28	16.27	54.98	13.992	7.439	0.58	6.02	38.73	121.37	3.13	-1.01	2.97	5.76
855.40	0.84	629.08	16.07	54.97	14.238	7.460	0.59	6.03	38.94	121.71	3.13	-1.02	2.98	5.78
870.40	0.85	633.76	15.83	54.97	14.489	7.482	0.61	6.06	39.18	122.34	3.12	-1.04	2.99	5.81
885.42	0.87	638.36	15.64	54.98	14.735	7.504	0.62	6.08	39.36	122.90	3.12	-1.05	3.01	5.84
900.42	0.88	642.21	15.42	54.98	14.991	7.526	0.63	6.10	39.59	123.38	3.12	-1.07	3.02	5.87
915.42	0.90	646.39	15.20	54.98	15.243	7.549	0.64	6.12	39.81	123.91	3.11	-1.09	3.03	5.89
918.10	0.90	645.56	15.18	54.98	15.292	7.553	0.64	6.11	39.82	123.76	3.11	-1.09	3.02	5.89

Report No.:

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01

Boring No.: MW-101

Sample No.: 0

Specimen No.: C

Depth (ft.): 31.0-31.5

Initial Height., H_o (in): 6.070

Confining Pressure (psi): 50.00

Initial Diameter, D_o (in): 2.861

Initial Volume, V_o (in^3): 39.03

Membr. Thickness (in): 0.02

Initial Area, A_o (in^2): 6.43

t Change at End of Consol.,ΔH_o (in): 0.045 H_c 6.025

Area after Consol., A_c (in^2): 6.31

Change at End of Saturation, H_s (in): 0.000

Piston Correction (lbs): 2.3

ume change during Consol. V_c (cc^3): 16.30 0.9943 in^3

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
0.00	0.00	17.09	35.96	85.06	0.051	6.316	0.00	0.19	49.10	51.43	1.05	0.00	0.08	3.62
1.50	0.005	33.73	37.22	85.03	0.075	6.318	0.00	0.38	47.83	52.80	1.10	0.09	0.18	3.62
3.02	0.006	51.05	38.58	85.03	0.100	6.319	0.00	0.58	46.48	54.19	1.17	0.19	0.28	3.62
4.52	0.008	67.41	40.00	85.04	0.128	6.321	0.01	0.77	45.06	55.35	1.23	0.29	0.37	3.61
6.02	0.009	82.30	41.44	85.02	0.147	6.322	0.01	0.94	43.62	56.26	1.29	0.39	0.46	3.60
7.52	0.010	96.80	42.76	85.01	0.174	6.324	0.01	1.10	42.29	57.23	1.35	0.49	0.54	3.58
9.02	0.012	107.72	43.96	85.03	0.194	6.325	0.01	1.23	41.09	57.75	1.41	0.58	0.60	3.56
10.52	0.013	119.74	45.00	85.03	0.212	6.326	0.01	1.36	40.06	58.61	1.46	0.65	0.67	3.55
12.02	0.014	129.56	45.96	85.00	0.236	6.328	0.01	1.47	39.10	59.20	1.51	0.72	0.72	3.54
13.52	0.016	137.01	46.89	85.04	0.261	6.329	0.01	1.56	38.16	59.44	1.56	0.79	0.77	3.51
15.02	0.017	146.46	47.70	85.06	0.280	6.331	0.01	1.66	37.35	60.12	1.61	0.85	0.82	3.51
16.52	0.018	153.44	48.47	85.04	0.304	6.332	0.01	1.74	36.59	60.45	1.65	0.90	0.86	3.49
18.02	0.020	159.38	49.16	85.04	0.333	6.334	0.01	1.81	35.89	60.69	1.69	0.95	0.89	3.48
19.52	0.021	165.45	49.79	85.03	0.355	6.335	0.01	1.88	35.26	61.01	1.73	1.00	0.93	3.47
21.02	0.023	170.58	50.38	85.04	0.378	6.337	0.02	1.94	34.67	61.22	1.77	1.04	0.96	3.45
22.52	0.024	177.71	50.92	85.02	0.402	6.338	0.02	2.02	34.14	61.81	1.81	1.08	1.00	3.45
24.02	0.026	183.87	51.41	85.02	0.427	6.340	0.02	2.09	33.64	62.27	1.85	1.11	1.03	3.45
25.52	0.027	188.40	51.88	85.02	0.450	6.341	0.02	2.14	33.17	62.51	1.88	1.15	1.06	3.44
27.02	0.029	192.50	52.31	85.01	0.479	6.343	0.02	2.18	32.75	62.73	1.92	1.18	1.08	3.44
28.52	0.030	197.06	52.73	84.99	0.504	6.345	0.02	2.23	32.32	63.01	1.95	1.21	1.10	3.43
30.02	0.032	200.82	53.16	85.05	0.524	6.346	0.02	2.28	31.90	63.17	1.98	1.24	1.13	3.42
31.52	0.033	206.15	53.50	85.04	0.543	6.347	0.02	2.34	31.56	63.67	2.02	1.26	1.16	3.43
33.02	0.035	210.35	53.82	85.04	0.576	6.349	0.02	2.38	31.24	64.00	2.05	1.29	1.18	3.43
34.53	0.036	212.55	54.12	85.03	0.605	6.351	0.03	2.41	30.94	64.03	2.07	1.31	1.19	3.42
36.03	0.038	218.68	54.42	85.03	0.628	6.353	0.03	2.48	30.63	64.69	2.11	1.33	1.23	3.43
37.53	0.039	220.97	54.69	85.02	0.652	6.354	0.03	2.50	30.36	64.77	2.13	1.35	1.24	3.42
39.03	0.041	224.83	54.94	85.02	0.673	6.356	0.03	2.55	30.12	65.13	2.16	1.37	1.26	3.43
40.53	0.042	228.39	55.17	85.02	0.703	6.358	0.03	2.58	29.89	65.44	2.19	1.38	1.28	3.43
42.03	0.043	231.66	55.38	85.01	0.721	6.359	0.03	2.62	29.68	65.74	2.22	1.40	1.30	3.44
43.53	0.045	234.16	55.56	85.00	0.750	6.361	0.03	2.65	29.50	65.94	2.24	1.41	1.31	3.44
45.03	0.047	238.58	55.75	84.99	0.776	6.362	0.03	2.70	29.30	66.44	2.27	1.43	1.34	3.45
46.53	0.048	243.41	55.99	85.05	0.799	6.364	0.03	2.75	29.07	66.95	2.30	1.44	1.36	3.46
48.03	0.049	245.26	56.17	85.04	0.812	6.365	0.03	2.77	28.89	67.05	2.32	1.46	1.37	3.45
49.53	0.050	247.85	56.33	85.03	0.836	6.366	0.04	2.80	28.73	67.29	2.34	1.47	1.39	3.46
51.03	0.052	250.94	56.49	85.03	0.864	6.368	0.04	2.83	28.57	67.61	2.37	1.48	1.41	3.46
52.53	0.054	255.06	56.60	85.03	0.897	6.370	0.04	2.88	28.46	68.13	2.39	1.49	1.43	3.48
54.03	0.055	257.08	56.72	85.02	0.917	6.371	0.04	2.90	28.33	68.32	2.41	1.50	1.44	3.48
55.53	0.057	259.16	56.83	85.01	0.946	6.373	0.04	2.93	28.22	68.52	2.43	1.50	1.45	3.48
57.03	0.058	261.97	56.96	85.00	0.969	6.375	0.04	2.96	28.10	68.83	2.45	1.51	1.47	3.49
63.03	0.064	274.15	57.38	85.03	1.069	6.381	0.04	3.09	27.68	70.28	2.54	1.54	1.53	3.53
69.05	0.071	283.56	57.63	85.02	1.175	6.388	0.05	3.19	27.42	71.44	2.61	1.56	1.58	3.56
75.05	0.077	293.26	57.80	85.00	1.271	6.394	0.05	3.30	27.26	72.76	2.67	1.57	1.64	3.60
81.05	0.082	301.89	57.98	85.02	1.365	6.400	0.06	3.39	27.08	73.88	2.73	1.59	1.68	3.63
87.05	0.088	311.24	58.02	85.01	1.458	6.406	0.06	3.49	27.03	75.25	2.78	1.59	1.74	3.68
93.05	0.094	319.16	58.03	84.98	1.566	6.413	0.07	3.58	27.03	76.43	2.83	1.59	1.78	3.72
99.05	0.100	327.49	58.05	85.01	1.667	6.420	0.07	3.67	27.00	77.65	2.88	1.59	1.82	3.77
105.05	0.106	334.40	57.98	84.99	1.765	6.426	0.07	3.74	27.07	78.74	2.91	1.59	1.86	3.81
111.05	0.112	341.93	57.94	85.02	1.865	6.433	0.08	3.82	27.11	79.90	2.95	1.58	1.90	3.85
117.05	0.118	349.93	57.83	85.01	1.965	6.439	0.08	3.91	27.22	81.20	2.98	1.58	1.94	3.90
123.05	0.125	355.30	57.68	84.98	2.067	6.446	0.09	3.96	27.38	82.13	3.00	1.56	1.97	3.94
129.05	0.130	361.62	57.58	85.01	2.162	6.452	0.09	4.03	27.48	83.16	3.03	1.56	2.00	3.98
135.05	0.137	369.27	57.40	84.99	2.266	6.459	0.10	4.11	27.65	84.46	3.05	1.54	2.05	4.04
141.05	0.142	375.67	57.20	84.97	2.359	6.465	0.10	4.18	27.85	85.59	3.07	1.53	2.08	4.08
147.05	0.149	380.15	57.06	85.00	2.465	6.472	0.10	4.22	28.00	86.37	3.09	1.52	2.10	4.12
153.07	0.154	386.38	56.88	84.98	2.558	6.479	0.11	4.29	28.18	87.46	3.10	1.51	2.13	4.16

Report No.:

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01
Boring No.: MW-101
Sample No.: 0
Specimen No.: C
Depth (ft.): 31.0-31.5

Initial Height., H_o (in): 6.070
Initial Diameter, D_o (in): 2.861
Membr. Thickness (in): 0.02
t Change at End of Consol.,ΔH_o (in): 0.045 H_c 6.025
Change at End of Saturation, H_s (in): 0.000
ume change during Consol. V_c (cc^3): 16.30 0.9943 in^3

Confining Pressure (psi): 50.00
Initial Volume, V_o (in^3): 39.03
Initial Area, A_o (in^2): 6.43
Area after Consol., A_c (in^2): 6.31
Piston Correction (lbs): 2.3

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
159.07	0.160	393.05	56.65	84.95	2.659	6.485	0.11	4.36	28.40	88.65	3.12	1.49	2.17	4.21
165.07	0.167	398.64	56.49	85.00	2.764	6.492	0.12	4.41	28.57	89.61	3.14	1.48	2.20	4.25
171.07	0.172	403.81	56.26	84.98	2.858	6.499	0.12	4.47	28.80	90.58	3.15	1.46	2.22	4.30
177.07	0.179	408.74	56.07	84.99	2.964	6.506	0.12	4.51	28.99	91.46	3.15	1.45	2.25	4.34
183.07	0.184	414.44	55.84	84.99	3.059	6.512	0.13	4.57	29.22	92.50	3.17	1.43	2.28	4.38
189.07	0.191	420.06	55.59	84.96	3.165	6.519	0.13	4.63	29.46	93.54	3.17	1.41	2.31	4.43
195.07	0.197	423.75	55.40	84.99	3.262	6.526	0.14	4.67	29.66	94.23	3.18	1.40	2.32	4.46
201.07	0.203	429.24	55.15	84.97	3.363	6.532	0.14	4.72	29.90	95.25	3.19	1.38	2.35	4.51
207.07	0.208	434.62	54.89	84.95	3.456	6.539	0.14	4.78	30.16	96.27	3.19	1.36	2.38	4.55
213.07	0.214	438.50	54.72	84.99	3.559	6.546	0.15	4.81	30.34	96.97	3.20	1.35	2.40	4.58
219.07	0.220	442.23	54.46	84.95	3.657	6.552	0.15	4.85	30.59	97.73	3.19	1.33	2.42	4.62
225.07	0.226	447.62	54.27	84.98	3.757	6.559	0.16	4.90	30.78	98.67	3.21	1.32	2.44	4.66
231.07	0.233	453.39	54.01	84.98	3.863	6.566	0.16	4.96	31.04	99.73	3.21	1.30	2.47	4.71
237.07	0.239	457.02	53.75	84.96	3.961	6.573	0.17	4.99	31.30	100.47	3.21	1.28	2.49	4.74
243.07	0.244	460.46	53.56	84.98	4.054	6.580	0.17	5.03	31.50	101.13	3.21	1.27	2.51	4.77
249.07	0.250	466.15	53.30	84.96	4.155	6.586	0.17	5.08	31.76	102.18	3.22	1.25	2.54	4.82
255.08	0.257	470.98	53.06	84.94	4.258	6.594	0.18	5.13	31.99	103.07	3.22	1.23	2.56	4.86
261.08	0.263	474.22	52.84	84.98	4.360	6.601	0.18	5.16	32.21	103.71	3.22	1.22	2.57	4.89
267.08	0.269	478.25	52.59	84.95	4.461	6.608	0.19	5.20	32.47	104.49	3.22	1.20	2.59	4.93
273.08	0.275	482.60	52.33	84.93	4.556	6.614	0.19	5.24	32.72	105.33	3.22	1.18	2.61	4.97
279.08	0.281	487.63	52.15	84.97	4.662	6.622	0.20	5.29	32.91	106.20	3.23	1.17	2.64	5.01
285.08	0.287	491.02	51.89	84.95	4.758	6.628	0.20	5.32	33.16	106.89	3.22	1.15	2.65	5.04
291.08	0.293	493.59	51.68	84.97	4.856	6.635	0.20	5.34	33.38	107.42	3.22	1.13	2.67	5.07
297.08	0.298	498.68	51.45	84.95	4.954	6.642	0.21	5.39	33.60	108.33	3.22	1.12	2.69	5.11
312.08	0.314	509.35	50.88	84.96	5.205	6.659	0.22	5.49	34.18	110.31	3.23	1.07	2.74	5.20
327.08	0.328	518.72	50.32	84.95	5.451	6.677	0.23	5.58	34.74	112.07	3.23	1.03	2.78	5.29
342.08	0.344	527.10	49.77	84.95	5.710	6.695	0.24	5.65	35.29	113.67	3.22	0.99	2.82	5.36
357.08	0.359	535.37	49.23	84.95	5.953	6.712	0.25	5.72	35.82	115.23	3.22	0.96	2.86	5.44
372.10	0.374	543.77	48.69	84.95	6.211	6.731	0.26	5.80	36.37	116.81	3.21	0.92	2.90	5.51
387.10	0.389	553.88	48.16	84.93	6.451	6.748	0.27	5.89	36.89	118.62	3.22	0.88	2.94	5.60
402.10	0.404	561.86	47.61	84.90	6.713	6.767	0.28	5.96	37.45	120.13	3.21	0.84	2.98	5.67
417.10	0.419	570.84	47.12	84.90	6.962	6.785	0.29	6.04	37.94	121.72	3.21	0.80	3.02	5.75
432.10	0.435	578.19	46.62	84.90	7.212	6.803	0.30	6.10	38.43	123.07	3.20	0.77	3.05	5.81
447.10	0.449	584.78	46.15	84.89	7.460	6.822	0.31	6.15	38.91	124.29	3.19	0.73	3.07	5.88
462.12	0.465	591.11	45.67	84.89	7.714	6.840	0.32	6.20	39.39	125.46	3.19	0.70	3.10	5.93
477.12	0.479	599.01	45.23	84.89	7.954	6.858	0.33	6.26	39.82	126.82	3.18	0.67	3.13	6.00
492.12	0.495	606.37	44.81	84.89	8.209	6.877	0.34	6.32	40.24	128.07	3.18	0.64	3.16	6.06
507.12	0.510	614.14	44.35	84.89	8.466	6.897	0.36	6.39	40.71	129.41	3.18	0.60	3.19	6.12
522.12	0.525	621.33	43.94	84.89	8.716	6.916	0.37	6.44	41.11	130.62	3.18	0.58	3.22	6.18
537.12	0.541	626.06	43.53	84.89	8.972	6.935	0.38	6.47	41.53	131.47	3.17	0.55	3.24	6.23
552.12	0.555	633.03	43.13	84.89	9.206	6.953	0.39	6.53	41.93	132.63	3.16	0.52	3.27	6.28
567.12	0.571	638.79	42.72	84.90	9.469	6.973	0.40	6.57	42.34	133.61	3.16	0.49	3.29	6.33
582.12	0.585	646.25	42.33	84.90	9.709	6.992	0.41	6.63	42.72	134.82	3.16	0.46	3.32	6.39
597.12	0.601	652.62	41.94	84.91	9.970	7.012	0.42	6.67	43.11	135.85	3.15	0.43	3.34	6.44
612.12	0.615	658.87	41.60	84.91	10.208	7.030	0.43	6.72	43.45	136.83	3.15	0.41	3.36	6.49
627.13	0.630	663.00	41.23	84.91	10.463	7.051	0.44	6.74	43.82	137.53	3.14	0.38	3.37	6.53
642.13	0.645	668.16	40.84	84.85	10.706	7.070	0.45	6.77	44.22	138.40	3.13	0.35	3.39	6.57
657.13	0.661	674.14	40.51	84.86	10.974	7.091	0.46	6.81	44.55	139.29	3.13	0.33	3.41	6.62
672.13	0.675	679.51	40.18	84.87	11.208	7.110	0.47	6.85	44.88	140.13	3.12	0.30	3.43	6.66
687.13	0.691	686.27	39.87	84.88	11.475	7.131	0.48	6.89	45.19	141.10	3.12	0.28	3.45	6.71
702.13	0.706	690.05	39.53	84.88	11.724	7.151	0.49	6.91	45.52	141.69	3.11	0.26	3.46	6.74
717.13	0.722	694.84	39.24	84.89	11.976	7.172	0.50	6.94	45.81	142.37	3.11	0.24	3.48	6.77
732.13	0.737	698.58	38.94	84.89	12.230	7.192	0.51	6.96	46.11	142.91	3.10	0.22	3.48	6.80
747.15	0.752	705.04	38.67	84.89	12.474	7.213	0.52	7.00	46.39	143.82	3.10	0.20	3.51	6.85
762.15	0.767	709.65	38.38	84.89	12.726	7.233	0.53	7.03	46.68	144.46	3.09	0.17	3.52	6.88

Report No.:

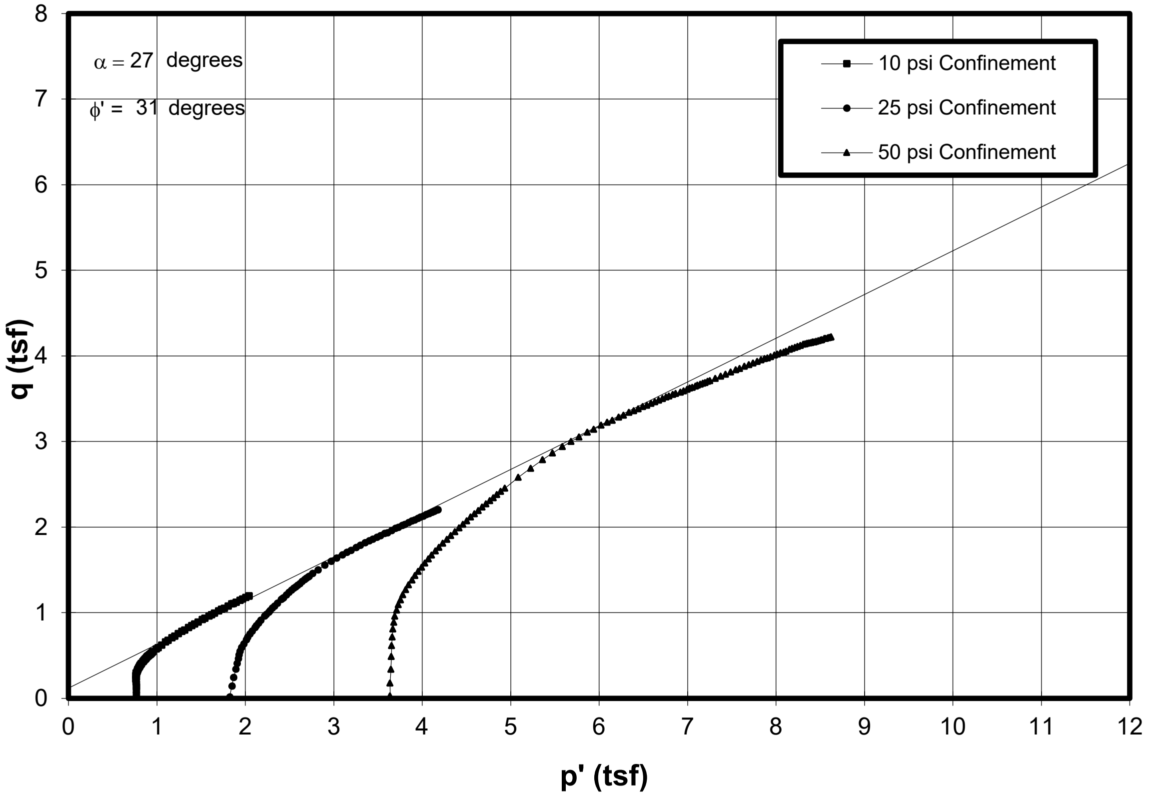
CU TRIAXIAL TEST: Stress-Strain Data

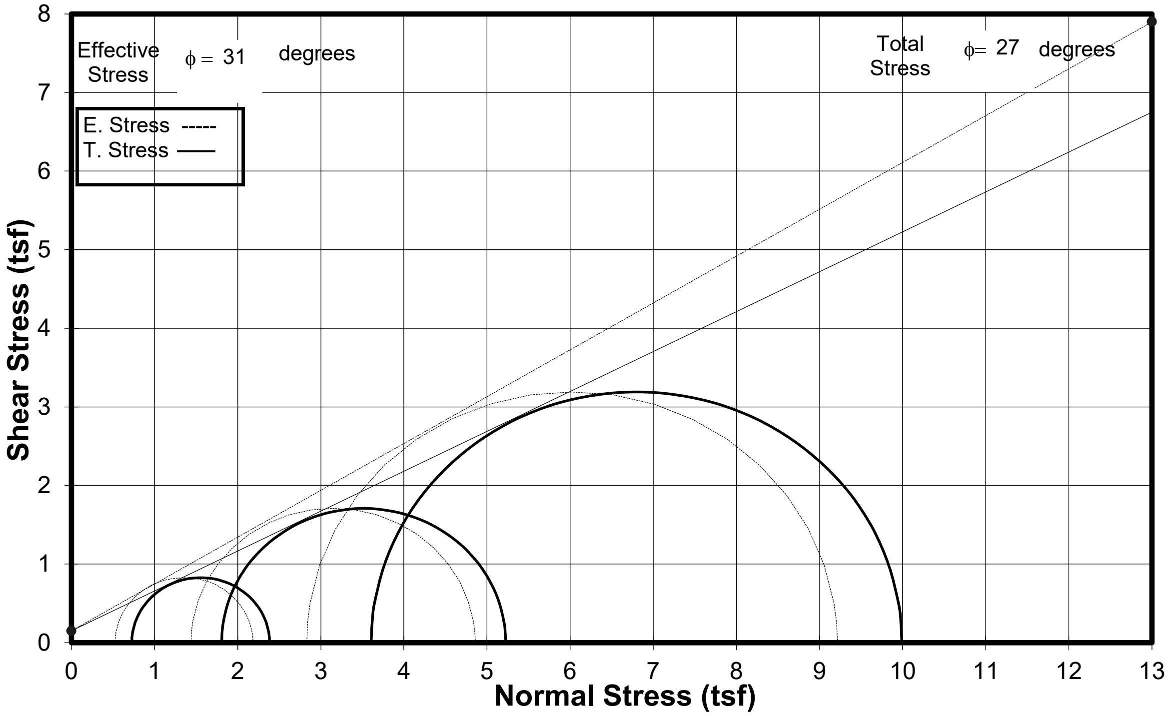
Project No.: J038678.01
Boring No.: MW-101
Sample No.: 0
Specimen No.: C
Depth (ft.): 31.0-31.5

Initial Height., H_o (in): 6.070
Initial Diameter, D_o (in): 2.861
Membr. Thickness (in): 0.02
t Change at End of Consol.,ΔH_o (in): 0.045 H_c 6.025
Change at End of Saturation, H_s (in): 0.000
ume change during Consol. V_c (cc^3): 16.30 0.9943 in^3

Confining Pressure (psi): 50.00
Initial Volume, V_o (in^3): 39.03
Initial Area, A_o (in^2): 6.43
Area after Consol., A_c (in^2): 6.31
Piston Correction (lbs): 2.3

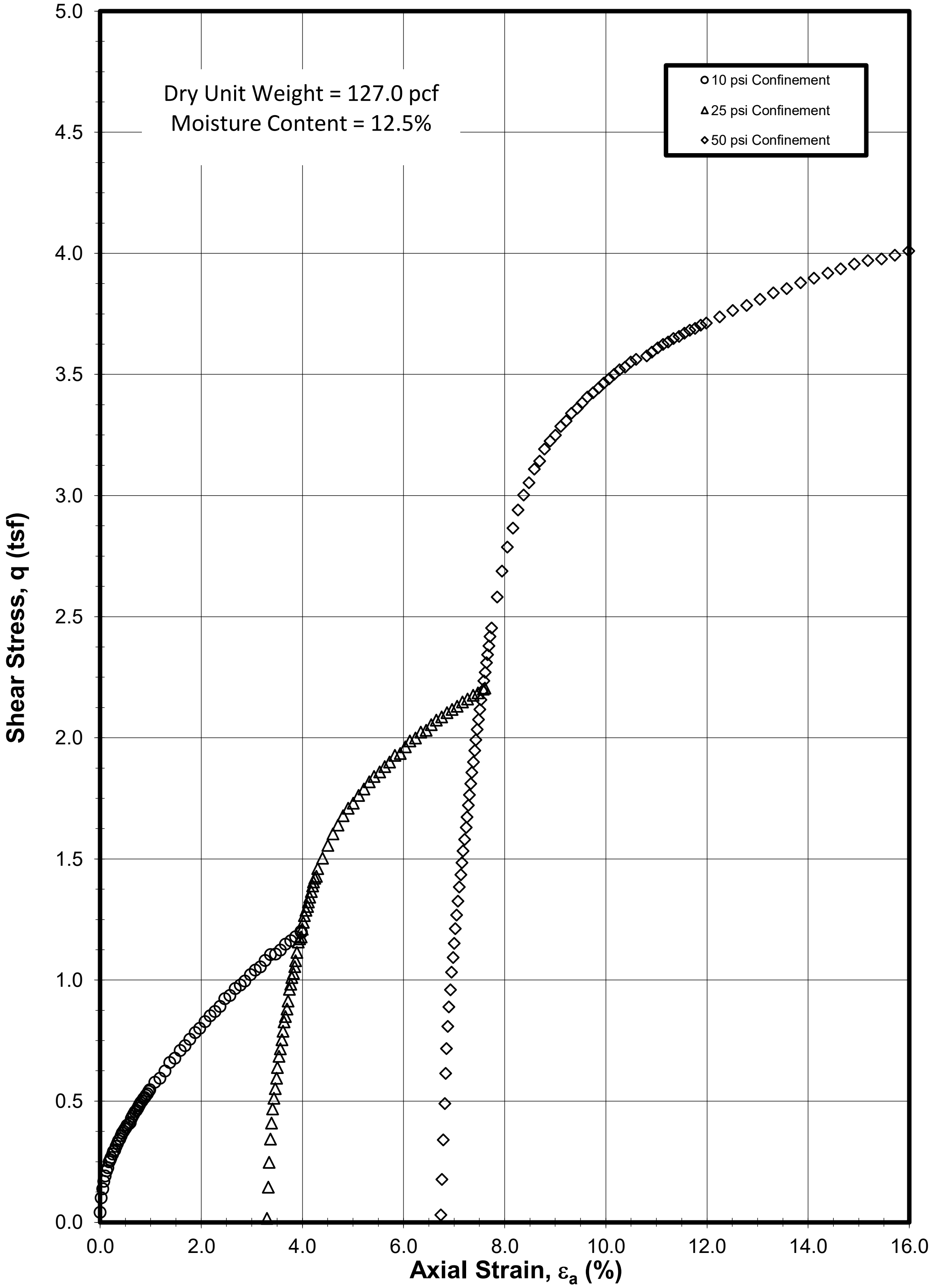
Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
777.15	0.782	715.24	38.11	84.90	12.980	7.254	0.54	7.06	46.95	145.22	3.09	0.15	3.54	6.92
792.15	0.798	720.23	37.86	84.91	13.238	7.276	0.56	7.09	47.20	145.87	3.09	0.14	3.55	6.95
807.15	0.812	723.00	37.60	84.91	13.471	7.296	0.56	7.09	47.45	146.23	3.08	0.12	3.56	6.97
822.15	0.827	727.83	37.33	84.91	13.726	7.317	0.58	7.12	47.72	146.87	3.08	0.10	3.57	7.01
837.15	0.842	732.01	37.11	84.91	13.982	7.339	0.59	7.14	47.95	147.37	3.07	0.08	3.58	7.03
852.15	0.858	737.29	36.86	84.92	14.235	7.361	0.60	7.17	48.19	148.04	3.07	0.07	3.59	7.06
867.15	0.873	739.50	36.63	84.93	14.484	7.382	0.61	7.17	48.43	148.29	3.06	0.05	3.59	7.08
882.15	0.888	743.39	36.41	84.93	14.735	7.404	0.62	7.18	48.64	148.73	3.06	0.03	3.60	7.11
897.15	0.903	745.10	36.17	84.93	14.995	7.426	0.63	7.18	48.88	148.90	3.05	0.02	3.60	7.12
912.15	0.919	749.61	35.94	84.88	15.250	7.449	0.64	7.20	49.12	149.44	3.04	0.00	3.61	7.15
915.35	0.922	750.67	35.91	84.93	15.302	7.453	0.64	7.21	49.14	149.54	3.04	0.00	3.61	7.15





CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

ASTM D 4767
Project No.: J038678.01
Boring: MW-102
Sample Depth: 60.0-62.0



CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

ASTM D 4767

Project No.: J038678.01

Boring: MW-102

Sample Depth: 60.0-62.0

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01
Boring No.: MW-102
Sample No.: -
Specimen No.: A
Depth (ft.): 60.0-62.0

Initial Height., H_o (in): 6.478
Initial Diameter, D_o (in): 2.862
Membrane Thickness (in): 0.02
Ht Change at End of Consol.,ΔH_o (in): 0.011 H_c 6.467
Ht Change at End of Saturation, H_s (in): 0.000
Volume change during Consol. V_c (cc^3): 4.64 0.28304 in^3

Confining Pressure (psi): 10.00
Initial Volume, V_o (in^3): 41.67
Initial Area, A_o (in^2): 6.43
Area after Consol., A_c (in^2): 6.40
Piston Correction (lbs): 8.5

Elasped Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
0.00	0.00	15.82	19.93	29.99	0.000	6.399	0.00	0.18	10.06	11.20	1.11	0.00	0.041	0.765
1.50	0.00	26.44	20.73	30.00	0.021	6.400	0.00	0.30	9.26	12.06	1.30	0.06	0.101	0.768
3.00	0.00	33.05	21.26	30.00	0.053	6.402	0.00	0.37	8.73	12.57	1.44	0.10	0.138	0.767
4.52	0.00	38.60	21.69	30.00	0.074	6.404	0.00	0.43	8.31	13.00	1.57	0.13	0.169	0.767
6.02	0.01	42.62	22.05	30.01	0.098	6.405	0.00	0.48	7.95	13.27	1.67	0.15	0.192	0.764
7.52	0.01	46.25	22.34	30.01	0.125	6.407	0.01	0.52	7.66	13.55	1.77	0.17	0.212	0.763
9.02	0.01	48.68	22.59	30.01	0.153	6.409	0.01	0.55	7.41	13.68	1.85	0.19	0.226	0.759
10.53	0.01	52.94	22.79	30.01	0.177	6.410	0.01	0.59	7.20	14.13	1.96	0.21	0.250	0.768
12.03	0.01	54.57	22.98	30.01	0.199	6.412	0.01	0.61	7.02	14.20	2.02	0.22	0.259	0.764
13.53	0.01	56.13	23.14	30.01	0.216	6.413	0.01	0.63	6.85	14.28	2.08	0.23	0.267	0.761
15.03	0.02	58.64	23.28	30.01	0.246	6.415	0.01	0.66	6.71	14.52	2.16	0.24	0.281	0.764
16.53	0.02	60.57	23.41	30.00	0.265	6.416	0.01	0.68	6.58	14.69	2.23	0.25	0.292	0.766
18.03	0.02	61.66	23.52	30.01	0.290	6.417	0.01	0.69	6.47	14.75	2.28	0.26	0.298	0.764
19.55	0.02	64.44	23.62	30.01	0.315	6.419	0.01	0.72	6.37	15.08	2.37	0.27	0.314	0.772
21.05	0.02	66.58	23.72	30.00	0.342	6.421	0.01	0.75	6.28	15.32	2.44	0.27	0.326	0.778
22.57	0.02	68.61	23.81	30.02	0.366	6.422	0.02	0.77	6.18	15.54	2.51	0.28	0.337	0.782
24.07	0.03	69.96	23.90	30.02	0.391	6.424	0.02	0.78	6.10	15.66	2.57	0.29	0.344	0.783
25.57	0.03	72.40	23.96	30.01	0.415	6.425	0.02	0.81	6.03	15.97	2.65	0.29	0.358	0.792
27.08	0.03	74.41	24.02	30.01	0.438	6.427	0.02	0.83	5.97	16.22	2.72	0.29	0.369	0.799
28.58	0.03	75.77	24.07	30.01	0.467	6.429	0.02	0.85	5.92	16.38	2.77	0.30	0.377	0.803
30.08	0.03	77.32	24.12	30.01	0.492	6.430	0.02	0.86	5.87	16.58	2.82	0.30	0.385	0.808
31.58	0.03	78.53	24.17	30.01	0.512	6.432	0.02	0.88	5.83	16.71	2.87	0.30	0.392	0.811
33.08	0.03	80.01	24.20	30.00	0.533	6.433	0.02	0.89	5.79	16.90	2.92	0.31	0.400	0.817
34.58	0.04	81.15	24.24	30.01	0.568	6.435	0.02	0.91	5.75	17.04	2.96	0.31	0.406	0.821
36.08	0.04	82.06	24.26	30.00	0.596	6.437	0.03	0.92	5.73	17.16	2.99	0.31	0.411	0.824
37.60	0.04	85.12	24.29	30.00	0.618	6.439	0.03	0.95	5.70	17.60	3.09	0.31	0.428	0.839
39.10	0.04	86.70	24.33	30.01	0.641	6.440	0.03	0.97	5.67	17.81	3.14	0.32	0.437	0.845
40.62	0.04	88.54	24.34	30.01	0.668	6.442	0.03	0.99	5.65	18.07	3.20	0.32	0.447	0.854
42.12	0.04	90.28	24.36	30.02	0.690	6.443	0.03	1.01	5.63	18.33	3.25	0.32	0.457	0.863
43.62	0.05	91.27	24.37	30.01	0.716	6.445	0.03	1.02	5.63	18.47	3.28	0.32	0.462	0.867
45.13	0.05	92.86	24.38	30.01	0.743	6.447	0.03	1.03	5.61	18.70	3.33	0.32	0.471	0.875
46.63	0.05	94.49	24.38	30.01	0.765	6.448	0.03	1.05	5.61	18.94	3.38	0.32	0.480	0.884
48.13	0.05	95.72	24.39	30.01	0.780	6.449	0.03	1.07	5.61	19.13	3.41	0.32	0.487	0.890
49.63	0.05	97.04	24.38	30.00	0.802	6.451	0.03	1.08	5.61	19.33	3.45	0.32	0.494	0.898
51.15	0.05	98.21	24.38	30.00	0.829	6.452	0.03	1.09	5.61	19.52	3.48	0.32	0.500	0.905
52.65	0.06	100.05	24.38	30.00	0.863	6.454	0.04	1.11	5.61	19.80	3.53	0.32	0.511	0.915
54.15	0.06	101.01	24.37	30.00	0.884	6.456	0.04	1.12	5.62	19.95	3.55	0.32	0.516	0.920
55.65	0.06	102.48	24.38	30.01	0.910	6.458	0.04	1.14	5.61	20.16	3.59	0.32	0.524	0.928
57.15	0.06	103.64	24.36	30.02	0.937	6.459	0.04	1.15	5.63	20.36	3.62	0.32	0.530	0.936
58.65	0.06	105.49	24.35	30.01	0.963	6.461	0.04	1.17	5.64	20.65	3.66	0.32	0.540	0.946
60.17	0.06	106.79	24.34	30.01	0.983	6.462	0.04	1.19	5.65	20.86	3.69	0.32	0.548	0.955
66.17	0.07	112.49	24.27	30.00	1.083	6.469	0.05	1.25	5.72	21.80	3.81	0.31	0.579	0.991
72.17	0.08	115.50	24.18	30.02	1.182	6.475	0.05	1.28	5.81	22.33	3.84	0.31	0.595	1.013
78.18	0.08	120.99	24.06	30.01	1.281	6.482	0.05	1.34	5.93	23.28	3.93	0.30	0.625	1.052
84.18	0.09	127.42	23.93	30.01	1.376	6.488	0.06	1.41	6.06	24.39	4.02	0.29	0.660	1.096
90.18	0.10	130.73	23.79	30.02	1.477	6.495	0.06	1.44	6.20	25.02	4.03	0.28	0.677	1.124
96.18	0.10	136.67	23.62	30.01	1.582	6.502	0.07	1.51	6.37	26.09	4.09	0.27	0.710	1.169
102.18	0.11	140.25	23.45	30.00	1.679	6.508	0.07	1.55	6.55	26.79	4.09	0.25	0.729	1.200
108.18	0.11	145.32	23.27	30.01	1.776	6.514	0.07	1.60	6.72	27.72	4.13	0.24	0.756	1.240
114.18	0.12	150.40	23.07	30.01	1.878	6.521	0.08	1.65	6.92	28.68	4.15	0.23	0.783	1.281
120.18	0.13	153.67	22.89	30.02	1.972	6.528	0.08	1.69	7.10	29.34	4.13	0.21	0.801	1.312
126.20	0.13	158.89	22.68	30.00	2.073	6.534	0.09	1.74	7.31	30.32	4.15	0.20	0.828	1.355
132.20	0.14	163.37	22.47	30.00	2.173	6.541	0.09	1.79	7.52	31.20	4.15	0.18	0.852	1.394
138.20	0.15	166.76	22.26	30.01	2.270	6.547	0.10	1.83	7.73	31.90	4.13	0.17	0.870	1.427
144.22	0.15	170.82	22.04	29.99	2.371	6.554	0.10	1.87	7.95	32.72	4.11	0.15	0.892	1.464
150.22	0.16	176.68	21.81	29.99	2.465	6.561	0.10	1.93	8.19	33.82	4.13	0.13	0.923	1.512

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01
Boring No.: MW-102
Sample No.: -
Specimen No.: A
Depth (ft.): 60.0-62.0

Initial Height., H_o (in):	6.478	Confining Pressure (psi):	10.00
Initial Diameter, D_o (in):	2.862	Initial Volume, V_o (in^3):	41.67
Membrane Thickness (in):	0.02	Initial Area, A_o (in^2):	6.43
Ht Change at End of Consol.,ΔH_o (in):	0.011 H_c 6.467	Area after Consol., A_c (in^2):	6.40
Ht Change at End of Saturation, H_s (in):	0.000	Piston Correction (lbs):	8.5
Volume change during Consol. V_c (cc^3):	4.64 0.28304 in^3		

Elasped Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
156.22	0.17	179.41	21.59	30.00	2.568	6.567	0.11	1.96	8.40	34.43	4.10	0.12	0.937	1.542
162.22	0.17	184.69	21.36	29.99	2.670	6.574	0.11	2.01	8.63	35.43	4.10	0.10	0.965	1.586
168.22	0.18	187.57	21.13	30.01	2.770	6.581	0.12	2.04	8.86	36.07	4.07	0.09	0.980	1.618
174.22	0.19	190.79	20.90	29.99	2.862	6.587	0.12	2.08	9.09	36.76	4.04	0.07	0.996	1.651
180.23	0.19	195.77	20.66	29.98	2.971	6.595	0.12	2.13	9.34	37.73	4.04	0.05	1.022	1.694
186.23	0.20	199.37	20.43	30.01	3.070	6.602	0.13	2.17	9.56	38.47	4.02	0.04	1.041	1.729
192.23	0.20	202.01	20.20	29.99	3.168	6.608	0.13	2.19	9.80	39.08	3.99	0.02	1.054	1.760
198.23	0.21	207.04	19.95	29.99	3.263	6.615	0.14	2.24	10.04	40.06	3.99	0.00	1.081	1.804
204.25	0.22	211.80	19.72	30.01	3.367	6.622	0.14	2.29	10.27	40.97	3.99	-0.02	1.105	1.845
210.25	0.22	212.42	19.50	29.98	3.469	6.629	0.15	2.30	10.50	41.26	3.93	-0.03	1.107	1.863
216.25	0.23	215.63	19.26	30.00	3.564	6.635	0.15	2.33	10.73	41.95	3.91	-0.05	1.124	1.896
222.25	0.24	220.25	19.03	29.98	3.666	6.642	0.15	2.38	10.96	42.84	3.91	-0.07	1.148	1.937
228.27	0.24	223.22	18.79	29.98	3.768	6.649	0.16	2.41	11.20	43.49	3.88	-0.08	1.162	1.969
234.27	0.25	226.58	18.57	29.98	3.866	6.656	0.16	2.44	11.42	44.18	3.87	-0.10	1.179	2.002
240.27	0.26	230.72	18.33	29.99	3.973	6.664	0.17	2.48	11.66	45.00	3.86	-0.12	1.200	2.040
240.97	0.26	230.00	18.30	29.98	3.982	6.664	0.17	2.47	11.70	44.93	3.84	-0.12	1.196	2.039

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Boring No.: MW-102
Sample No.: -
Specimen No.: A
Depth (ft.): 60.0-62.0

Initial Height., H_o (in): 6.478
Initial Diameter, D_o (in): 2.862
Membr. Thickness (in): 0.02
Ht Change at End of Consol.,ΔH_o (in): 0.218 H_c 6.260
Ht Change at End of Saturation, H_s (in): 0.000
Volume change during Consol. V_c (cc^3): 10.64 0.64904 in^3

Confining Pressure (psi): 25.00
Initial Volume, V_o (in^3): 41.67
Initial Area, A_o (in^2): 6.43
Area after Consol., A_c (in^2): 6.55
Piston Correction (lbs): 17.7

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
0.00	0.21	20.66	19.99	45.07	3.300	6.776	0.14	0.21	25.07	25.51	1.02	0.00	0.02	1.82
1.52	0.21	44.95	21.43	45.06	3.326	6.778	0.14	0.47	23.63	27.66	1.17	0.10	0.14	1.85
3.02	0.21	64.19	22.57	45.06	3.340	6.779	0.14	0.67	22.50	29.36	1.31	0.19	0.25	1.87
4.52	0.21	82.26	23.54	45.06	3.369	6.781	0.14	0.86	21.52	31.05	1.44	0.26	0.34	1.89
6.02	0.21	94.88	24.30	45.05	3.390	6.782	0.14	1.00	20.76	32.15	1.55	0.31	0.41	1.90
7.52	0.21	105.78	24.91	45.07	3.414	6.784	0.14	1.11	20.16	33.14	1.64	0.35	0.47	1.92
9.02	0.22	114.26	25.40	45.08	3.440	6.786	0.14	1.20	19.67	33.90	1.72	0.39	0.51	1.93
10.52	0.22	121.74	25.82	45.07	3.465	6.788	0.15	1.28	19.25	34.58	1.80	0.42	0.55	1.94
12.02	0.22	129.90	26.14	45.08	3.490	6.789	0.15	1.37	18.93	35.46	1.87	0.44	0.60	1.96
13.52	0.22	138.08	26.43	45.08	3.509	6.791	0.15	1.45	18.64	36.37	1.95	0.46	0.64	1.98
15.02	0.22	146.93	26.67	45.08	3.539	6.793	0.15	1.55	18.40	37.43	2.03	0.48	0.69	2.01
16.52	0.22	152.75	26.88	45.08	3.565	6.795	0.15	1.61	18.19	38.07	2.09	0.50	0.72	2.03
18.02	0.23	159.82	27.05	45.07	3.596	6.797	0.15	1.68	18.02	38.93	2.16	0.51	0.75	2.05
19.52	0.23	166.53	27.18	45.06	3.617	6.798	0.15	1.75	17.88	39.78	2.22	0.52	0.79	2.08
21.02	0.23	173.86	27.29	45.06	3.640	6.800	0.15	1.83	17.78	40.75	2.29	0.52	0.83	2.11
22.53	0.23	178.12	27.39	45.03	3.663	6.802	0.15	1.87	17.68	41.27	2.33	0.53	0.85	2.12
24.03	0.23	184.10	27.47	45.05	3.695	6.804	0.15	1.94	17.59	42.05	2.39	0.54	0.88	2.15
25.53	0.23	190.23	27.57	45.08	3.715	6.805	0.16	2.00	17.50	42.86	2.45	0.55	0.91	2.17
27.03	0.23	199.56	27.63	45.08	3.743	6.807	0.16	2.10	17.43	44.15	2.53	0.55	0.96	2.22
28.53	0.24	203.62	27.67	45.07	3.770	6.809	0.16	2.14	17.40	44.71	2.57	0.55	0.98	2.24
30.03	0.24	208.74	27.67	45.07	3.790	6.811	0.16	2.20	17.39	45.45	2.61	0.55	1.01	2.26
31.53	0.24	212.16	27.69	45.08	3.821	6.813	0.16	2.23	17.38	45.93	2.64	0.55	1.03	2.28
33.03	0.24	217.43	27.73	45.07	3.848	6.815	0.16	2.29	17.34	46.65	2.69	0.56	1.06	2.30
34.53	0.24	222.04	27.71	45.05	3.865	6.816	0.16	2.33	17.35	47.34	2.73	0.56	1.08	2.33
36.03	0.24	228.65	27.73	45.06	3.892	6.818	0.16	2.40	17.33	48.28	2.79	0.56	1.11	2.36
37.53	0.25	236.73	27.72	45.04	3.918	6.820	0.16	2.49	17.35	49.47	2.85	0.56	1.16	2.41
39.03	0.25	239.43	27.70	45.06	3.943	6.821	0.17	2.52	17.37	49.88	2.87	0.55	1.17	2.42
40.53	0.25	240.92	27.66	45.06	3.976	6.824	0.17	2.53	17.40	50.12	2.88	0.55	1.18	2.43
42.03	0.25	247.00	27.67	45.06	3.995	6.825	0.17	2.59	17.39	51.00	2.93	0.55	1.21	2.46
43.53	0.25	252.51	27.65	45.05	4.017	6.827	0.17	2.65	17.42	51.82	2.97	0.55	1.24	2.49
45.05	0.25	257.75	27.62	45.08	4.041	6.828	0.17	2.71	17.44	52.60	3.02	0.55	1.27	2.52
46.55	0.25	261.97	27.57	45.04	4.070	6.830	0.17	2.75	17.49	53.26	3.04	0.55	1.29	2.55
48.05	0.26	265.12	27.51	45.06	4.101	6.833	0.17	2.78	17.56	53.77	3.06	0.54	1.30	2.57
49.55	0.26	268.68	27.46	45.06	4.120	6.834	0.17	2.82	17.61	54.34	3.09	0.54	1.32	2.59
51.05	0.26	272.57	27.41	45.07	4.145	6.836	0.17	2.86	17.66	54.95	3.11	0.53	1.34	2.61
52.55	0.26	277.02	27.36	45.05	4.178	6.838	0.18	2.90	17.71	55.63	3.14	0.53	1.37	2.64
54.05	0.26	281.40	27.29	45.05	4.202	6.840	0.18	2.95	17.77	56.33	3.17	0.53	1.39	2.67
55.55	0.26	284.67	27.24	45.05	4.220	6.841	0.18	2.98	17.83	56.86	3.19	0.52	1.41	2.69
57.05	0.27	287.63	27.17	45.02	4.245	6.843	0.18	3.01	17.90	57.35	3.20	0.52	1.42	2.71
58.55	0.27	289.19	27.11	45.08	4.278	6.845	0.18	3.03	17.95	57.62	3.21	0.51	1.43	2.72
60.05	0.27	295.39	27.04	45.07	4.303	6.847	0.18	3.09	18.02	58.58	3.25	0.51	1.46	2.76
66.05	0.28	303.76	26.75	45.05	4.399	6.854	0.18	3.18	18.32	60.06	3.28	0.49	1.50	2.82
72.05	0.28	314.25	26.43	45.04	4.505	6.862	0.19	3.28	18.64	61.86	3.32	0.46	1.56	2.90
78.05	0.29	323.53	26.10	45.06	4.605	6.869	0.19	3.38	18.97	63.50	3.35	0.44	1.60	2.97
84.05	0.29	330.81	25.76	45.05	4.703	6.876	0.20	3.45	19.30	64.85	3.36	0.42	1.64	3.03
90.05	0.30	338.66	25.40	45.05	4.805	6.883	0.20	3.53	19.67	66.30	3.37	0.39	1.68	3.09
96.07	0.31	344.75	25.08	45.06	4.908	6.891	0.21	3.59	19.99	67.46	3.37	0.37	1.71	3.15
102.07	0.31	349.26	24.73	45.05	5.008	6.898	0.21	3.63	20.34	68.41	3.36	0.34	1.73	3.19
108.07	0.32	355.58	24.39	45.03	5.110	6.905	0.21	3.69	20.67	69.61	3.37	0.32	1.76	3.25
114.07	0.33	361.19	24.08	45.05	5.215	6.913	0.22	3.75	20.98	70.68	3.37	0.29	1.79	3.30
120.07	0.33	367.27	23.74	45.04	5.320	6.921	0.22	3.80	21.33	71.84	3.37	0.27	1.82	3.35
126.07	0.34	371.84	23.42	45.05	5.418	6.928	0.23	3.85	21.65	72.77	3.36	0.25	1.84	3.40
132.07	0.35	375.89	23.11	45.05	5.526	6.936	0.23	3.89	21.96	73.60	3.35	0.22	1.86	3.44
138.07	0.35	380.53	22.78	45.03	5.629	6.943	0.24	3.93	22.28	74.55	3.35	0.20	1.88	3.49
144.07	0.36	384.54	22.49	45.05	5.723	6.950	0.24	3.97	22.58	75.37	3.34	0.18	1.90	3.53
150.07	0.36	390.13	22.19	45.04	5.827	6.958	0.24	4.02	22.88	76.41	3.34	0.16	1.93	3.57
156.07	0.37	392.07	21.88	45.02	5.935	6.966	0.25	4.03	23.18	76.93	3.32	0.14	1.93	3.60

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Depth (ft.): 60.0-62.0

Initial Height., H_o (in): 6.478
Initial Diameter, D_o (in): 2.862
Membr. Thickness (in): 0.02
Ht Change at End of Consol.,ΔH_o (in): 0.218 H_c 6.260
Ht Change at End of Saturation, H_s (in): 0.000
Volume change during Consol. V_c (cc^3): 10.64 0.64904 in^3

Confining Pressure (psi): 25.00
Initial Volume, V_o (in^3): 41.67
Initial Area, A_o (in^2): 6.43
Area after Consol., A_c (in^2): 6.55
Piston Correction (lbs): 17.7

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
162.07	0.38	397.84	21.61	45.04	6.034	6.973	0.25	4.09	23.46	77.98	3.32	0.12	1.96	3.65
168.07	0.38	402.91	21.32	45.03	6.126	6.980	0.26	4.14	23.75	78.94	3.32	0.10	1.99	3.70
174.07	0.39	405.81	21.03	45.02	6.235	6.988	0.26	4.16	24.04	79.58	3.31	0.07	2.00	3.73
180.07	0.40	410.83	20.76	45.04	6.343	6.996	0.27	4.21	24.31	80.50	3.31	0.06	2.02	3.77
186.07	0.40	412.88	20.48	45.02	6.446	7.004	0.27	4.22	24.59	81.01	3.30	0.04	2.03	3.80
192.08	0.41	417.79	20.22	45.01	6.547	7.011	0.27	4.27	24.85	81.92	3.30	0.02	2.05	3.84
198.08	0.42	421.73	19.96	45.03	6.648	7.019	0.28	4.31	25.10	82.67	3.29	0.00	2.07	3.88
204.08	0.42	424.91	19.69	45.01	6.755	7.027	0.28	4.33	25.38	83.33	3.28	-0.02	2.09	3.91
210.08	0.43	428.89	19.45	45.03	6.859	7.035	0.29	4.37	25.61	84.07	3.28	-0.04	2.10	3.95
216.08	0.44	431.81	19.20	45.02	6.960	7.043	0.29	4.39	25.87	84.67	3.27	-0.06	2.12	3.98
222.08	0.44	434.96	18.93	45.00	7.062	7.050	0.30	4.42	26.14	85.32	3.26	-0.08	2.13	4.01
228.08	0.45	438.69	18.72	45.03	7.165	7.058	0.30	4.45	26.35	86.00	3.26	-0.09	2.15	4.04
234.08	0.45	441.66	18.46	45.01	7.266	7.066	0.30	4.48	26.60	86.61	3.26	-0.11	2.16	4.08
240.08	0.46	445.22	18.22	45.00	7.375	7.074	0.31	4.51	26.85	87.29	3.25	-0.13	2.18	4.11
246.08	0.47	447.45	18.01	45.02	7.471	7.082	0.31	4.53	27.06	87.75	3.24	-0.14	2.18	4.13
252.08	0.47	451.15	17.76	45.01	7.578	7.090	0.32	4.56	27.30	88.45	3.24	-0.16	2.20	4.17
253.63	0.48	452.20	17.71	45.00	7.612	7.092	0.32	4.57	27.36	88.63	3.24	-0.16	2.21	4.18

Report No.:

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Initial Height., H_o (in): 6.478
Initial Diameter, D_o (in): 2.862
Membr. Thickness (in): 0.02
t Change at End of Consol.,ΔH_o (in): 0.419 H_c 6.059
Change at End of Saturation, H_s (in): 0.000
ume change during Consol. V_c (cc^3): 15.24 0.92964 in^3

Confining Pressure (psi): 50.00
Initial Volume, V_o (in^3): 41.67
Initial Area, A_o (in^2): 6.43
Area after Consol., A_c (in^2): 6.72
Piston Correction (lbs): 21.00

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
0.00	0.41	27.02	19.95	70.02	6.740	7.209	0.28	0.00	50.07	50.91	1.02	0.00	0.03	3.64
1.52	0.410	56.34	21.98	70.02	6.760	7.211	0.28	0.54	48.05	52.95	1.10	0.15	0.18	3.64
3.02	0.411	89.13	24.12	70.02	6.784	7.213	0.28	0.87	45.90	55.34	1.21	0.30	0.34	3.64
4.52	0.413	119.24	26.13	70.02	6.815	7.215	0.29	1.17	43.89	57.51	1.31	0.44	0.49	3.65
6.02	0.414	144.15	27.81	70.01	6.833	7.217	0.29	1.42	42.21	59.27	1.40	0.57	0.61	3.65
7.52	0.415	164.67	29.15	70.00	6.851	7.218	0.29	1.62	40.87	60.78	1.49	0.66	0.72	3.66
9.02	0.416	183.18	30.30	70.00	6.874	7.220	0.29	1.81	39.72	62.18	1.57	0.75	0.81	3.67
10.52	0.418	199.36	31.27	70.00	6.896	7.222	0.29	1.97	38.76	63.45	1.64	0.81	0.89	3.68
12.02	0.420	213.58	32.11	70.02	6.926	7.224	0.29	2.11	37.92	64.57	1.70	0.88	0.96	3.69
13.52	0.421	228.19	32.84	70.03	6.951	7.226	0.29	2.25	37.19	65.86	1.77	0.93	1.03	3.71
15.02	0.423	240.41	33.41	70.02	6.979	7.228	0.29	2.37	36.61	66.97	1.83	0.97	1.09	3.73
16.52	0.424	252.32	33.90	70.03	7.003	7.230	0.29	2.49	36.12	68.12	1.89	1.00	1.15	3.75
18.02	0.426	264.40	34.34	70.02	7.025	7.232	0.29	2.61	35.68	69.34	1.94	1.04	1.21	3.78
19.52	0.427	275.82	34.71	70.02	7.052	7.234	0.30	2.72	35.31	70.54	2.00	1.06	1.27	3.81
21.02	0.429	287.46	35.04	70.01	7.078	7.236	0.30	2.84	34.98	71.80	2.05	1.09	1.33	3.84
22.52	0.430	299.19	35.32	70.00	7.102	7.238	0.30	2.95	34.70	73.14	2.11	1.11	1.38	3.88
24.02	0.432	309.45	35.54	70.00	7.133	7.240	0.30	3.06	34.48	74.33	2.16	1.12	1.43	3.92
25.53	0.434	319.57	35.73	70.00	7.156	7.242	0.30	3.16	34.29	75.52	2.20	1.14	1.48	3.95
27.03	0.435	329.41	35.87	70.00	7.178	7.243	0.30	3.25	34.15	76.73	2.25	1.15	1.53	3.99
28.53	0.437	339.15	36.03	70.03	7.209	7.246	0.30	3.35	34.00	77.90	2.29	1.16	1.58	4.03
30.03	0.438	349.18	36.16	70.03	7.237	7.248	0.30	3.45	33.87	79.14	2.34	1.17	1.63	4.07
31.53	0.440	357.96	36.23	70.02	7.255	7.249	0.30	3.53	33.80	80.28	2.38	1.17	1.67	4.11
33.03	0.441	367.62	36.30	70.02	7.280	7.251	0.31	3.63	33.72	81.53	2.42	1.18	1.72	4.15
34.53	0.442	376.42	36.34	70.02	7.302	7.253	0.31	3.71	33.68	82.69	2.45	1.18	1.76	4.19
36.03	0.444	385.87	36.37	70.02	7.329	7.255	0.31	3.81	33.65	83.94	2.49	1.18	1.81	4.23
37.53	0.445	395.39	36.37	70.01	7.352	7.257	0.31	3.90	33.65	85.24	2.53	1.18	1.86	4.28
39.03	0.447	404.15	36.36	70.01	7.382	7.259	0.31	3.99	33.66	86.44	2.57	1.18	1.90	4.32
40.53	0.449	413.71	36.38	70.01	7.407	7.261	0.31	4.08	33.64	87.73	2.61	1.18	1.95	4.37
42.05	0.450	422.88	36.37	70.00	7.432	7.263	0.31	4.17	33.65	88.98	2.64	1.18	1.99	4.41
43.55	0.452	431.46	36.33	70.00	7.457	7.265	0.31	4.25	33.69	90.19	2.68	1.18	2.03	4.46
45.05	0.453	439.88	36.32	70.02	7.482	7.267	0.31	4.34	33.71	91.35	2.71	1.18	2.08	4.50
46.55	0.455	448.46	36.27	70.02	7.507	7.269	0.31	4.42	33.75	92.56	2.74	1.18	2.12	4.55
48.05	0.456	456.59	36.22	70.02	7.532	7.271	0.32	4.50	33.80	93.71	2.77	1.17	2.16	4.59
49.55	0.458	464.43	36.17	70.02	7.561	7.273	0.32	4.57	33.85	94.81	2.80	1.17	2.19	4.63
51.05	0.460	472.63	36.11	70.02	7.588	7.276	0.32	4.65	33.92	95.99	2.83	1.16	2.23	4.68
52.55	0.461	479.97	36.01	70.02	7.616	7.278	0.32	4.73	34.01	97.08	2.85	1.16	2.27	4.72
54.05	0.463	488.22	35.95	70.02	7.641	7.280	0.32	4.81	34.07	98.25	2.88	1.15	2.31	4.76
55.55	0.464	494.93	35.87	70.01	7.660	7.281	0.32	4.87	34.16	99.24	2.91	1.15	2.34	4.80
57.07	0.466	502.36	35.80	70.01	7.690	7.284	0.32	4.94	34.23	100.31	2.93	1.14	2.38	4.84
58.57	0.467	510.42	35.72	70.00	7.711	7.285	0.32	5.02	34.30	101.48	2.96	1.14	2.42	4.89
60.07	0.469	517.64	35.60	69.99	7.740	7.288	0.32	5.09	34.42	102.57	2.98	1.13	2.45	4.93
66.07	0.476	544.09	35.24	70.02	7.854	7.297	0.33	5.35	34.78	106.47	3.06	1.10	2.58	5.08
72.07	0.481	566.42	34.80	70.01	7.945	7.304	0.33	5.56	35.23	109.90	3.12	1.07	2.69	5.22
78.07	0.488	587.17	34.31	70.00	8.054	7.312	0.34	5.76	35.71	113.13	3.17	1.03	2.79	5.36
84.07	0.495	603.81	33.83	70.02	8.165	7.321	0.34	5.91	36.19	115.80	3.20	1.00	2.87	5.47
90.07	0.501	619.67	33.31	70.01	8.265	7.329	0.35	6.06	36.71	118.39	3.23	0.96	2.94	5.58
96.07	0.508	632.88	32.79	70.02	8.377	7.338	0.35	6.18	37.23	120.61	3.24	0.92	3.00	5.68
102.08	0.514	643.97	32.23	70.00	8.478	7.346	0.36	6.29	37.79	122.59	3.24	0.88	3.05	5.77
108.08	0.520	656.16	31.71	69.99	8.585	7.355	0.36	6.40	38.31	124.67	3.25	0.85	3.11	5.87
114.08	0.527	663.69	31.19	70.01	8.690	7.363	0.36	6.46	38.83	126.12	3.25	0.81	3.14	5.94
120.08	0.532	674.52	30.72	70.00	8.789	7.371	0.37	6.56	39.31	127.96	3.26	0.78	3.19	6.02
126.08	0.539	682.08	30.20	69.99	8.898	7.380	0.37	6.63	39.82	129.39	3.25	0.74	3.22	6.09
132.08	0.546	687.81	29.74	70.01	9.005	7.389	0.38	6.68	40.28	130.53	3.24	0.70	3.25	6.15
138.08	0.552	696.18	29.27	70.00	9.109	7.397	0.38	6.75	40.75	132.03	3.24	0.67	3.29	6.22
144.08	0.558	701.38	28.82	69.99	9.212	7.406	0.39	6.79	41.20	133.07	3.23	0.64	3.31	6.27

Report No.:

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01
Boring No.: MW-102
Sample No.: -
Specimen No.: A
Depth (ft.): 60.0-62.0

Initial Height., H_o (in): 6.478
Initial Diameter, D_o (in): 2.862
Membr. Thickness (in): 0.02
t Change at End of Consol.,ΔH_o (in): 0.419 H_c 6.059
Change at End of Saturation, H_s (in): 0.000
ume change during Consol. V_c (cc^3): 15.24 0.92964 in^3

Confining Pressure (psi): 50.00
Initial Volume, V_o (in^3): 41.67
Initial Area, A_o (in^2): 6.43
Area after Consol., A_c (in^2): 6.72
Piston Correction (lbs): 21.00

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
150.08	0.565	708.84	28.38	70.01	9.319	7.414	0.39	6.86	41.64	134.41	3.23	0.61	3.34	6.34
156.08	0.572	713.92	27.96	70.00	9.434	7.424	0.40	6.90	42.07	135.40	3.22	0.58	3.36	6.39
162.08	0.577	719.20	27.55	69.99	9.530	7.432	0.40	6.94	42.47	136.42	3.21	0.55	3.38	6.44
168.08	0.584	725.12	27.16	70.01	9.639	7.441	0.40	6.99	42.86	137.49	3.21	0.52	3.41	6.49
174.10	0.591	729.59	26.78	70.00	9.747	7.450	0.41	7.02	43.24	138.36	3.20	0.49	3.42	6.54
180.10	0.597	734.73	26.38	69.99	9.857	7.459	0.41	7.06	43.64	139.33	3.19	0.46	3.44	6.59
186.10	0.603	739.45	26.05	70.01	9.959	7.467	0.42	7.10	43.97	140.18	3.19	0.44	3.46	6.63
192.10	0.610	744.06	25.72	69.99	10.067	7.476	0.42	7.14	44.30	141.02	3.18	0.42	3.48	6.67
198.10	0.616	748.75	25.34	69.97	10.165	7.484	0.43	7.17	44.68	141.91	3.18	0.39	3.50	6.72
204.12	0.622	753.45	25.06	69.99	10.270	7.493	0.43	7.21	44.96	142.71	3.17	0.37	3.52	6.76
210.12	0.629	756.76	24.75	69.98	10.384	7.503	0.44	7.23	45.27	143.34	3.17	0.35	3.53	6.79
216.12	0.636	761.93	24.45	69.99	10.493	7.512	0.44	7.27	45.57	144.21	3.16	0.32	3.55	6.83
222.12	0.642	765.24	24.15	69.98	10.596	7.520	0.44	7.29	45.87	144.83	3.16	0.30	3.56	6.87
234.13	0.655	769.87	23.58	69.98	10.811	7.538	0.45	7.32	46.44	145.78	3.14	0.26	3.58	6.92
240.13	0.661	774.11	23.34	69.97	10.911	7.547	0.46	7.35	46.69	146.48	3.14	0.24	3.59	6.95
246.13	0.668	778.71	23.03	69.95	11.023	7.556	0.46	7.39	46.99	147.26	3.13	0.22	3.61	6.99
252.13	0.675	782.60	22.80	69.98	11.133	7.566	0.47	7.41	47.22	147.88	3.13	0.21	3.62	7.02
258.13	0.681	785.54	22.54	69.96	11.232	7.574	0.47	7.43	47.49	148.42	3.13	0.19	3.63	7.05
264.13	0.687	789.58	22.26	69.95	11.338	7.583	0.48	7.46	47.76	149.11	3.12	0.17	3.65	7.09
270.13	0.694	792.41	22.05	69.97	11.448	7.593	0.48	7.48	47.97	149.57	3.12	0.15	3.66	7.11
276.15	0.700	796.13	21.79	69.96	11.556	7.602	0.48	7.51	48.23	150.20	3.11	0.13	3.67	7.14
282.15	0.706	799.53	21.54	69.94	11.660	7.611	0.49	7.53	48.48	150.77	3.11	0.11	3.68	7.17
288.15	0.713	802.13	21.34	69.96	11.765	7.620	0.49	7.54	48.68	151.19	3.11	0.10	3.69	7.20
294.15	0.719	805.93	21.09	69.95	11.875	7.629	0.50	7.57	48.93	151.81	3.10	0.08	3.70	7.23
300.15	0.726	808.71	20.87	69.93	11.985	7.639	0.50	7.59	49.16	152.27	3.10	0.07	3.71	7.25
315.15	0.742	816.42	20.36	69.94	12.249	7.662	0.51	7.63	49.66	153.48	3.09	0.03	3.74	7.31
330.15	0.758	824.47	19.85	69.94	12.512	7.685	0.52	7.69	50.17	154.72	3.08	-0.01	3.76	7.38
345.15	0.775	831.60	19.40	69.94	12.784	7.709	0.54	7.73	50.62	155.77	3.08	-0.04	3.79	7.43
360.15	0.791	839.48	18.94	69.94	13.049	7.732	0.55	7.78	51.08	156.93	3.07	-0.07	3.81	7.49
375.17	0.807	847.52	18.51	69.95	13.313	7.756	0.56	7.83	51.51	158.08	3.07	-0.10	3.84	7.55
388.98	0.822	853.83	18.16	69.95	13.575	7.780	0.57	7.86	51.86	158.92	3.06	-0.13	3.85	7.59
403.98	0.839	861.79	17.74	69.95	13.851	7.805	0.58	7.91	52.28	160.02	3.06	-0.16	3.88	7.64
418.98	0.855	868.51	17.29	69.92	14.117	7.829	0.59	7.95	52.73	160.99	3.05	-0.19	3.90	7.69
434.00	0.872	875.80	16.93	69.93	14.389	7.854	0.60	7.99	53.09	161.93	3.05	-0.22	3.92	7.74
449.00	0.887	882.11	16.56	69.93	14.642	7.877	0.61	8.02	53.47	162.79	3.04	-0.24	3.94	7.79
464.00	0.904	889.29	16.21	69.93	14.914	7.902	0.63	8.06	53.81	163.69	3.04	-0.27	3.96	7.83
479.00	0.920	895.21	15.88	69.94	15.183	7.927	0.64	8.09	54.15	164.43	3.04	-0.29	3.97	7.87
494.00	0.936	899.36	15.51	69.94	15.449	7.952	0.65	8.10	54.51	164.96	3.03	-0.32	3.98	7.90
509.00	0.952	905.73	15.21	69.95	15.715	7.977	0.66	8.13	54.81	165.72	3.02	-0.34	3.99	7.94
524.00	0.969	912.35	14.87	69.95	15.988	8.003	0.67	8.16	55.15	166.52	3.02	-0.37	4.01	7.98
539.02	0.984	918.10	14.59	69.94	16.247	8.028	0.68	8.19	55.43	167.18	3.02	-0.39	4.02	8.01
554.02	1.001	923.90	14.25	69.92	16.524	8.054	0.69	8.21	55.77	167.87	3.01	-0.41	4.04	8.05
569.02	1.017	928.77	13.86	69.93	16.786	8.080	0.70	8.23	56.16	168.51	3.00	-0.44	4.04	8.09
584.02	1.033	933.69	13.68	69.93	17.051	8.106	0.71	8.24	56.34	168.94	3.00	-0.45	4.05	8.11
599.02	1.049	942.25	13.43	69.94	17.314	8.131	0.73	8.29	56.59	169.89	3.00	-0.47	4.08	8.15
614.02	1.065	947.22	13.17	69.94	17.578	8.157	0.74	8.31	56.85	170.40	3.00	-0.49	4.09	8.18
629.02	1.082	953.01	12.88	69.95	17.850	8.184	0.75	8.33	57.14	171.02	2.99	-0.51	4.10	8.21
644.02	1.097	958.48	12.65	69.95	18.113	8.211	0.76	8.35	57.37	171.55	2.99	-0.53	4.11	8.24
659.02	1.114	964.48	12.38	69.95	18.380	8.238	0.77	8.37	57.64	172.17	2.99	-0.54	4.12	8.27
674.02	1.130	970.88	12.13	69.93	18.648	8.265	0.78	8.40	57.90	172.83	2.99	-0.56	4.14	8.31
689.02	1.146	974.94	11.88	69.93	18.918	8.292	0.79	8.41	58.15	173.19	2.98	-0.58	4.14	8.33
704.02	1.163	979.94	11.64	69.93	19.188	8.320	0.80	8.42	58.38	173.64	2.97	-0.60	4.15	8.35
719.02	1.178	983.87	11.42	69.94	19.437	8.346	0.82	8.43	58.60	173.98	2.97	-0.61	4.15	8.37
734.03	1.194	988.06	11.18	69.94	19.709	8.374	0.83	8.44	58.84	174.33	2.96	-0.63	4.16	8.39
749.03	1.211	992.86	11.01	69.95	19.980	8.402	0.84	8.45	59.01	174.68	2.96	-0.64	4.16	8.41

Report No.:

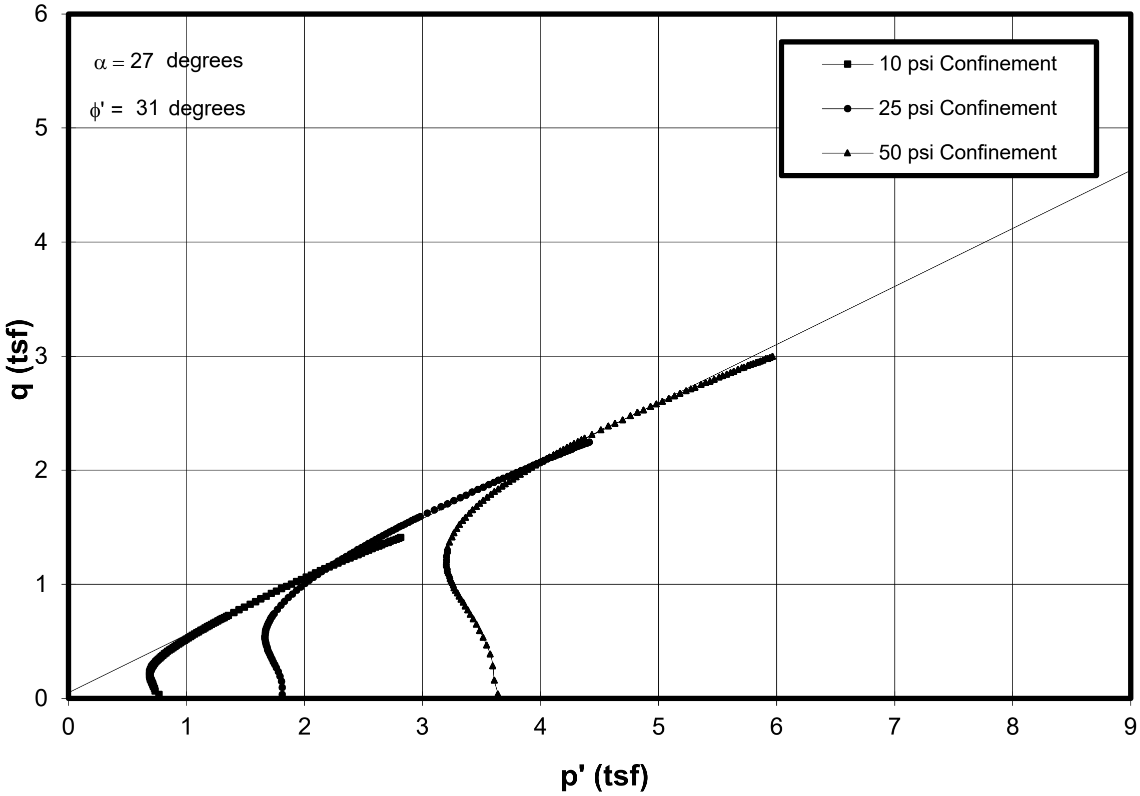
CU TRIAXIAL TEST: Stress-Strain Data

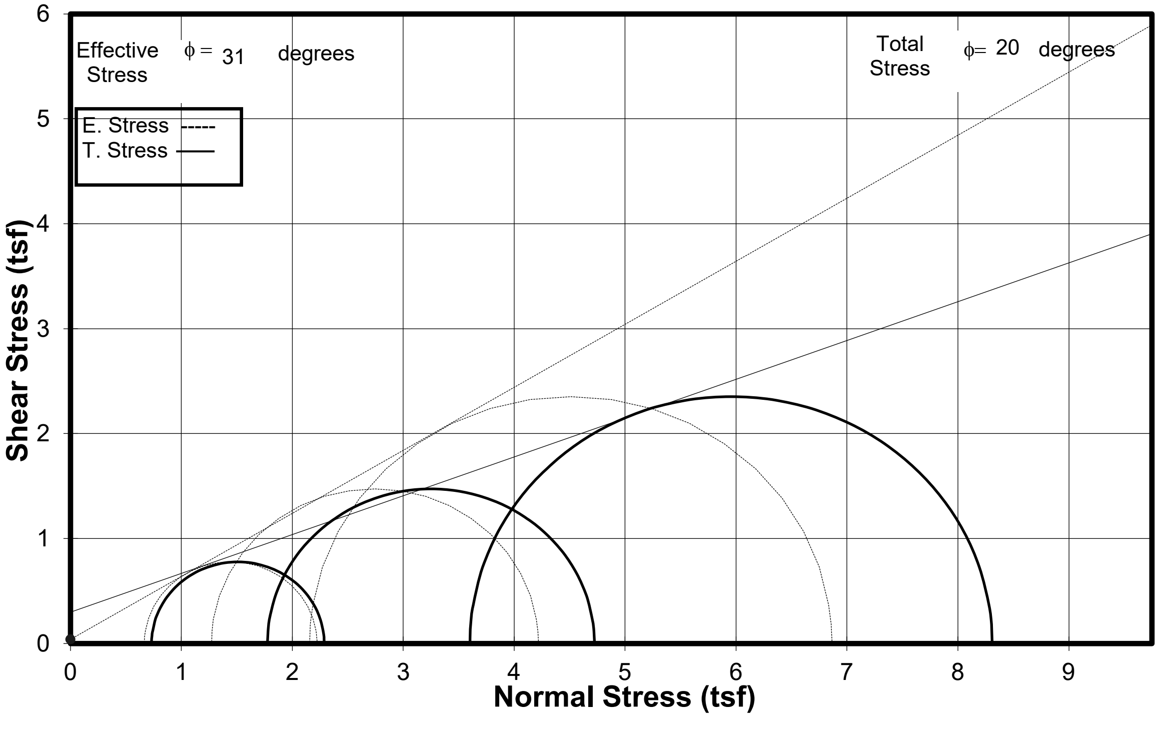
Project No.: J038678.01
Boring No.: MW-102
Sample No.: -
Specimen No.: A
Depth (ft.): 60.0-62.0

Initial Height., H_o (in): 6.478
Initial Diameter, D_o (in): 2.862
Membr. Thickness (in): 0.02
t Change at End of Consol.,ΔH_o (in): 0.419 H_c 6.059
Change at End of Saturation, H_s (in): 0.000
ume change during Consol. V_c (cc^3): 15.24 0.92964 in^3

Confining Pressure (psi): 50.00
Initial Volume, V_o (in^3): 41.67
Initial Area, A_o (in^2): 6.43
Area after Consol., A_c (in^2): 6.72
Piston Correction (lbs): 21.00

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
764.03	1.227	996.30	10.76	69.95	20.260	8.432	0.85	8.45	59.26	174.93	2.95	-0.66	4.16	8.43
779.03	1.243	1001.49	10.56	69.96	20.520	8.459	0.86	8.46	59.46	175.36	2.95	-0.68	4.17	8.45
794.03	1.260	1006.01	10.29	69.93	20.794	8.489	0.87	8.47	59.73	175.77	2.94	-0.70	4.18	8.48
809.03	1.276	1011.62	10.10	69.93	21.060	8.517	0.88	8.49	59.93	176.23	2.94	-0.71	4.19	8.50
824.03	1.292	1015.46	9.92	69.94	21.324	8.546	0.89	8.49	60.11	176.47	2.94	-0.72	4.19	8.52
839.03	1.309	1022.59	9.70	69.94	21.598	8.576	0.91	8.52	60.32	177.12	2.94	-0.74	4.20	8.55
854.03	1.324	1026.25	9.53	69.94	21.859	8.604	0.92	8.52	60.50	177.33	2.93	-0.75	4.21	8.56
869.05	1.341	1031.56	9.30	69.95	22.129	8.634	0.93	8.54	60.72	177.76	2.93	-0.77	4.21	8.59
884.05	1.356	1035.76	9.14	69.95	22.388	8.663	0.94	8.54	60.89	178.02	2.92	-0.78	4.22	8.60
899.05	1.373	1040.98	8.93	69.96	22.662	8.694	0.95	8.55	61.09	178.42	2.92	-0.79	4.22	8.62
899.20	1.373	1040.24	8.92	69.95	22.664	8.694	0.95	8.55	61.10	178.33	2.92	-0.79	4.22	8.62





CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

ASTM D 4767

Project No.: J038678.01

Boring: MW-103, MW-103, MW-103

Sample Depth: 60.1-60.6, 60.6-61.2, 61.2-61.7 Feet

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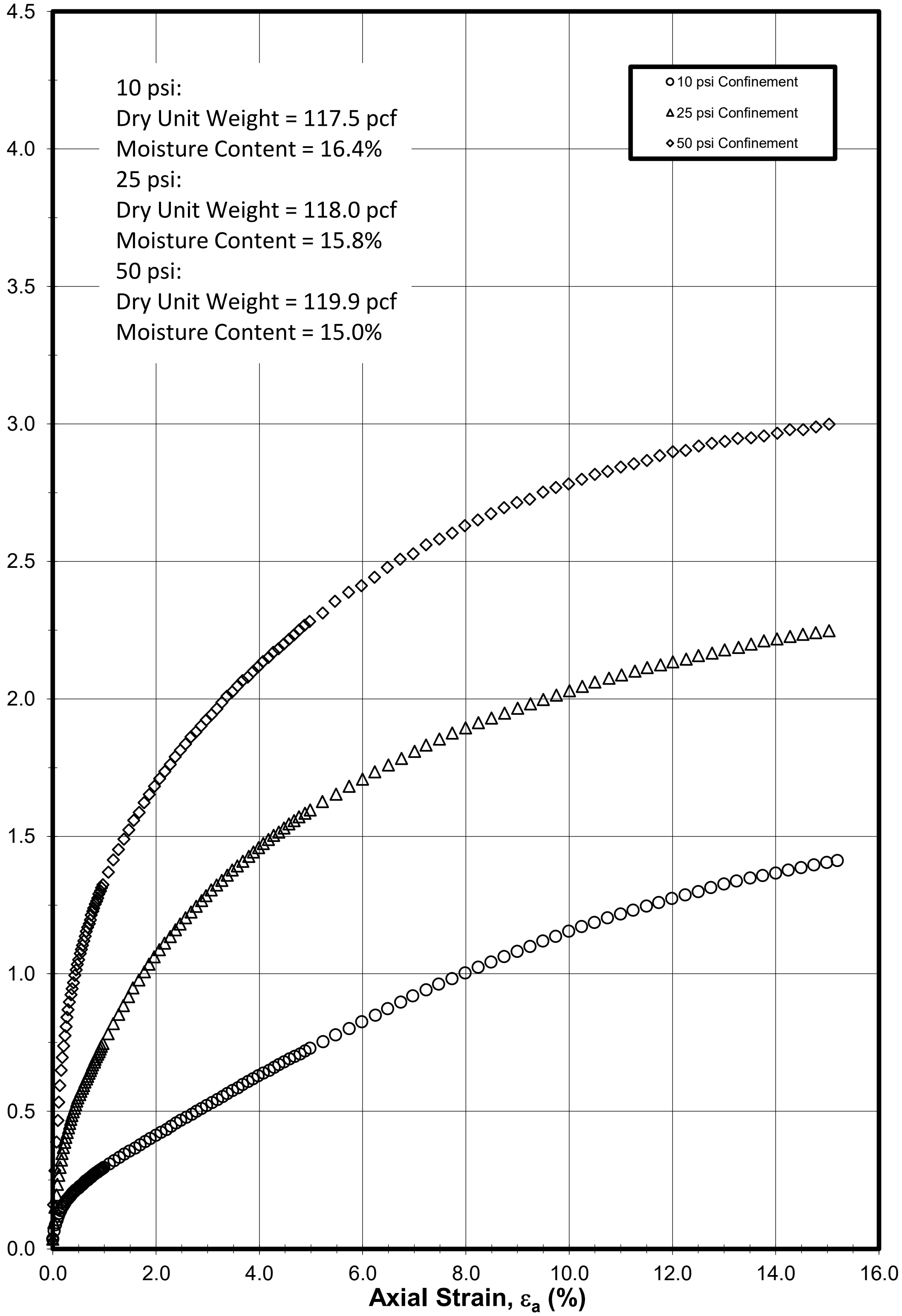

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D 4767
Project No.: J038678.01
Boring: MW-103, MW-103, MW-103
Sample Depth: 60.1-60.6, 60.6-61.2, 61.2-61.7 Feet

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01 Boring No.: MW-103
Sample No.: - Specimen No.: A
Depth (ft.): 60.1-60.6

Initial Height., H_o (in): 6.483
Initial Diameter, D_o (in): 2.868
Membrane Thickness (in): 0.02
Ht Change at End of Consol.,ΔH_o (in): 0.022 H_c 6.461
Ht Change at End of Saturation, H_s (in): 0.000
Volume change during Consol. V_c (cc^3): 7.55 0.46055 in^3

Confining Pressure (psi): 10.00
Initial Volume, V_o (in^3): 41.89
Initial Area, A_o (in^2): 6.46
Area after Consol., A_c (in^2): 6.413
Piston Correction (lbs): 12.1

Elasped Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
0.00	0.00	18.57	19.99	30.12	0.000	6.413	0.00	0.21	10.13	11.13	1.10	0.00	0.036	0.766
1.50	0.00	23.84	20.85	30.12	0.029	6.415	0.00	0.27	9.28	11.10	1.20	0.06	0.066	0.734
3.00	0.00	27.78	21.26	30.12	0.050	6.416	0.00	0.31	8.86	11.30	1.27	0.09	0.088	0.726
4.50	0.01	30.89	21.59	30.12	0.087	6.418	0.00	0.35	8.54	11.46	1.34	0.11	0.105	0.720
6.02	0.01	33.28	21.85	30.11	0.104	6.420	0.00	0.37	8.28	11.57	1.40	0.13	0.119	0.714
7.52	0.01	35.24	22.07	30.11	0.125	6.421	0.01	0.39	8.06	11.66	1.45	0.15	0.130	0.710
9.02	0.01	36.95	22.25	30.10	0.152	6.423	0.01	0.41	7.87	11.73	1.49	0.16	0.139	0.706
10.53	0.01	38.51	22.42	30.10	0.169	6.424	0.01	0.43	7.70	11.81	1.53	0.17	0.148	0.703
12.03	0.01	39.85	22.57	30.09	0.197	6.426	0.01	0.45	7.56	11.87	1.57	0.19	0.155	0.699
13.53	0.01	41.23	22.71	30.09	0.220	6.427	0.01	0.46	7.42	11.94	1.61	0.20	0.163	0.697
15.03	0.02	42.53	22.87	30.13	0.243	6.428	0.01	0.48	7.26	11.99	1.65	0.21	0.170	0.693
16.55	0.02	43.71	22.98	30.13	0.266	6.430	0.01	0.49	7.15	12.06	1.69	0.21	0.177	0.691
18.05	0.02	44.83	23.08	30.12	0.298	6.432	0.01	0.50	7.04	12.12	1.72	0.22	0.183	0.690
19.55	0.02	45.79	23.17	30.12	0.318	6.433	0.01	0.51	6.95	12.18	1.75	0.23	0.188	0.689
21.05	0.02	46.70	23.25	30.12	0.345	6.435	0.01	0.52	6.87	12.24	1.78	0.23	0.193	0.688
22.55	0.02	47.62	23.33	30.11	0.363	6.436	0.02	0.53	6.79	12.30	1.81	0.24	0.198	0.687
24.05	0.02	48.55	23.41	30.11	0.386	6.438	0.02	0.54	6.72	12.37	1.84	0.25	0.204	0.687
25.55	0.03	49.47	23.47	30.10	0.416	6.440	0.02	0.55	6.65	12.45	1.87	0.25	0.209	0.688
27.07	0.03	50.30	23.53	30.10	0.439	6.441	0.02	0.56	6.59	12.51	1.90	0.25	0.213	0.688
28.57	0.03	51.12	23.59	30.10	0.471	6.443	0.02	0.57	6.53	12.58	1.93	0.26	0.218	0.688
30.07	0.03	51.87	23.65	30.10	0.501	6.445	0.02	0.58	6.48	12.64	1.95	0.26	0.222	0.688
31.58	0.03	52.66	23.73	30.13	0.517	6.446	0.02	0.59	6.39	12.68	1.98	0.27	0.226	0.686
33.08	0.04	53.51	23.78	30.13	0.547	6.448	0.02	0.60	6.34	12.75	2.01	0.27	0.231	0.687
34.58	0.04	54.23	23.83	30.13	0.573	6.450	0.02	0.60	6.30	12.82	2.04	0.28	0.235	0.688
36.08	0.04	55.00	23.87	30.12	0.599	6.452	0.03	0.61	6.26	12.90	2.06	0.28	0.239	0.690
37.58	0.04	55.72	23.90	30.12	0.619	6.453	0.03	0.62	6.22	12.97	2.09	0.28	0.243	0.691
39.08	0.04	56.42	23.94	30.12	0.638	6.454	0.03	0.63	6.18	13.05	2.11	0.28	0.247	0.692
40.58	0.04	57.05	23.97	30.11	0.675	6.456	0.03	0.63	6.15	13.11	2.13	0.29	0.250	0.694
42.08	0.04	57.78	24.00	30.11	0.694	6.458	0.03	0.64	6.12	13.19	2.15	0.29	0.254	0.695
43.60	0.05	58.48	24.03	30.10	0.718	6.459	0.03	0.65	6.10	13.27	2.18	0.29	0.258	0.697
45.10	0.05	59.11	24.05	30.10	0.742	6.461	0.03	0.66	6.07	13.34	2.20	0.29	0.262	0.699
46.60	0.05	59.72	24.08	30.10	0.761	6.462	0.03	0.66	6.04	13.41	2.22	0.29	0.265	0.700
48.10	0.05	60.41	24.14	30.13	0.788	6.464	0.03	0.67	5.99	13.46	2.25	0.30	0.269	0.700
49.62	0.05	60.99	24.16	30.13	0.810	6.465	0.03	0.68	5.96	13.52	2.27	0.30	0.272	0.701
51.12	0.05	61.70	24.18	30.13	0.836	6.467	0.03	0.68	5.95	13.61	2.29	0.30	0.276	0.704
52.62	0.06	62.31	24.19	30.12	0.866	6.469	0.04	0.69	5.93	13.68	2.31	0.30	0.279	0.706
54.12	0.06	62.97	24.21	30.12	0.889	6.470	0.04	0.70	5.91	13.77	2.33	0.30	0.283	0.709
55.62	0.06	63.56	24.22	30.12	0.915	6.472	0.04	0.70	5.90	13.84	2.35	0.30	0.286	0.711
57.12	0.06	64.12	24.24	30.11	0.933	6.473	0.04	0.71	5.89	13.92	2.36	0.31	0.289	0.713
58.62	0.06	64.68	24.25	30.11	0.964	6.475	0.04	0.72	5.87	13.99	2.38	0.31	0.292	0.715
60.13	0.06	65.34	24.26	30.11	0.988	6.477	0.04	0.72	5.86	14.08	2.40	0.31	0.296	0.718
66.13	0.07	67.74	24.33	30.13	1.095	6.484	0.05	0.75	5.80	14.37	2.48	0.31	0.309	0.726
72.13	0.08	69.99	24.34	30.12	1.189	6.490	0.05	0.77	5.79	14.70	2.54	0.31	0.321	0.737
78.13	0.08	72.22	24.34	30.10	1.287	6.496	0.05	0.80	5.78	15.03	2.60	0.31	0.333	0.749
84.13	0.09	74.35	24.37	30.13	1.382	6.503	0.06	0.82	5.75	15.32	2.66	0.32	0.344	0.759
90.13	0.10	76.51	24.35	30.12	1.484	6.509	0.06	0.84	5.78	15.66	2.71	0.31	0.356	0.772
96.13	0.10	78.54	24.32	30.10	1.596	6.517	0.07	0.86	5.81	16.00	2.75	0.31	0.367	0.785
102.13	0.11	80.76	24.32	30.13	1.691	6.523	0.07	0.89	5.81	16.33	2.81	0.31	0.379	0.797
108.15	0.12	82.93	24.28	30.11	1.789	6.530	0.07	0.91	5.85	16.69	2.85	0.31	0.390	0.811
114.15	0.12	84.97	24.26	30.14	1.883	6.536	0.08	0.93	5.87	17.01	2.90	0.31	0.401	0.824
120.15	0.13	87.16	24.20	30.13	1.994	6.543	0.08	0.95	5.92	17.39	2.94	0.30	0.413	0.839
126.15	0.14	89.30	24.14	30.11	2.096	6.550	0.09	0.98	5.99	17.77	2.97	0.30	0.424	0.855
132.17	0.14	91.22	24.11	30.14	2.200	6.557	0.09	0.99	6.02	18.08	3.00	0.30	0.434	0.867
138.17	0.15	93.39	24.03	30.12	2.290	6.563	0.10	1.02	6.09	18.47	3.03	0.29	0.446	0.884
144.17	0.15	95.61	23.95	30.11	2.386	6.570	0.10	1.04	6.17	18.88	3.06	0.29	0.457	0.902
150.17	0.16	97.52	23.91	30.13	2.476	6.576	0.10	1.06	6.22	19.20	3.09	0.28	0.467	0.915

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01
Boring No.: MW-103
Sample No.: -
Specimen No.: A
Depth (ft.): 60.1-60.6

Initial Height., H_o (in): 6.483
Initial Diameter, D_o (in): 2.868
Membrane Thickness (in): 0.02
Ht Change at End of Consol.,ΔH_o (in): 0.022 H_c 6.461
Ht Change at End of Saturation, H_s (in): 0.000
Volume change during Consol. V_c (cc^3): 7.55 0.46055 in^3

Confining Pressure (psi): 10.00
Initial Volume, V_o (in^3): 41.89
Initial Area, A_o (in^2): 6.46
Area after Consol., A_c (in^2): 6.413
Piston Correction (lbs): 12.1

Elasped Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
156.17	0.17	99.73	23.83	30.12	2.587	6.583	0.11	1.08	6.30	19.60	3.11	0.28	0.479	0.932
162.18	0.17	101.79	23.74	30.11	2.691	6.590	0.11	1.10	6.39	19.99	3.13	0.27	0.490	0.949
168.18	0.18	103.76	23.68	30.13	2.782	6.596	0.12	1.12	6.44	20.33	3.16	0.27	0.500	0.964
174.20	0.19	105.81	23.59	30.12	2.880	6.603	0.12	1.15	6.54	20.72	3.17	0.26	0.511	0.981
180.20	0.19	107.88	23.53	30.14	2.977	6.610	0.12	1.17	6.60	21.08	3.20	0.25	0.521	0.996
186.20	0.20	110.03	23.43	30.12	3.085	6.617	0.13	1.19	6.70	21.49	3.21	0.25	0.533	1.015
192.20	0.21	112.13	23.33	30.11	3.192	6.624	0.13	1.21	6.80	21.89	3.22	0.24	0.543	1.033
198.20	0.21	114.23	23.26	30.14	3.289	6.631	0.14	1.23	6.86	22.26	3.24	0.24	0.554	1.048
204.22	0.22	116.34	23.15	30.13	3.379	6.637	0.14	1.25	6.97	22.67	3.25	0.23	0.565	1.067
210.22	0.22	118.48	23.04	30.11	3.480	6.644	0.15	1.27	7.08	23.09	3.26	0.22	0.576	1.086
216.22	0.23	120.44	22.97	30.14	3.584	6.651	0.15	1.29	7.15	23.44	3.28	0.21	0.586	1.101
222.23	0.24	122.70	22.86	30.13	3.676	6.658	0.15	1.32	7.27	23.88	3.28	0.21	0.598	1.121
228.23	0.24	124.82	22.75	30.12	3.782	6.665	0.16	1.34	7.37	24.28	3.29	0.20	0.609	1.140
234.23	0.25	126.78	22.66	30.14	3.874	6.671	0.16	1.36	7.46	24.64	3.30	0.19	0.619	1.156
240.23	0.26	128.87	22.55	30.13	3.976	6.678	0.17	1.38	7.58	25.06	3.31	0.18	0.629	1.175
246.25	0.26	130.90	22.47	30.15	4.076	6.685	0.17	1.40	7.65	25.42	3.32	0.18	0.640	1.191
252.25	0.27	132.89	22.35	30.14	4.190	6.693	0.18	1.42	7.78	25.82	3.32	0.17	0.649	1.209
258.25	0.28	134.96	22.23	30.13	4.287	6.700	0.18	1.44	7.90	26.23	3.32	0.16	0.660	1.229
264.25	0.28	137.05	22.14	30.16	4.378	6.706	0.18	1.46	7.98	26.61	3.33	0.15	0.671	1.245
270.27	0.29	138.90	22.01	30.14	4.479	6.714	0.19	1.48	8.11	26.99	3.33	0.15	0.680	1.264
276.27	0.30	141.04	21.89	30.13	4.584	6.721	0.19	1.50	8.23	27.41	3.33	0.14	0.690	1.283
282.27	0.30	142.97	21.80	30.16	4.686	6.728	0.20	1.52	8.32	27.77	3.34	0.13	0.700	1.299
288.27	0.31	144.82	21.67	30.14	4.792	6.736	0.20	1.53	8.45	28.15	3.33	0.12	0.709	1.318
294.28	0.32	146.94	21.56	30.14	4.885	6.742	0.20	1.55	8.57	28.56	3.33	0.11	0.720	1.337
300.28	0.32	148.84	21.46	30.16	4.978	6.749	0.21	1.57	8.67	28.92	3.34	0.11	0.729	1.353
315.28	0.34	153.79	21.16	30.16	5.234	6.767	0.22	1.62	8.96	29.89	3.34	0.08	0.754	1.399
330.28	0.35	158.87	20.88	30.17	5.478	6.785	0.23	1.67	9.25	30.87	3.34	0.06	0.779	1.444
345.28	0.37	163.59	20.58	30.17	5.738	6.803	0.24	1.71	9.55	31.81	3.33	0.04	0.801	1.489
360.28	0.39	168.62	20.25	30.15	5.985	6.821	0.25	1.76	9.87	32.81	3.32	0.02	0.826	1.537
375.30	0.40	173.65	19.94	30.15	6.248	6.840	0.26	1.81	10.18	33.79	3.32	0.00	0.850	1.583
390.30	0.42	178.48	19.63	30.15	6.484	6.857	0.27	1.85	10.49	34.75	3.31	-0.03	0.873	1.629
405.32	0.44	183.60	19.33	30.15	6.737	6.876	0.28	1.90	10.79	35.72	3.31	-0.05	0.898	1.675
420.32	0.45	188.35	19.04	30.16	6.971	6.893	0.29	1.95	11.08	36.65	3.31	-0.07	0.920	1.718
435.32	0.47	192.97	18.74	30.16	7.227	6.912	0.30	1.99	11.39	37.55	3.30	-0.09	0.942	1.762
450.33	0.48	197.58	18.44	30.17	7.474	6.931	0.31	2.03	11.69	38.44	3.29	-0.11	0.963	1.805
465.33	0.50	201.87	18.13	30.17	7.731	6.950	0.32	2.07	11.99	39.29	3.28	-0.13	0.983	1.846
480.33	0.52	206.39	17.83	30.18	7.982	6.969	0.33	2.11	12.29	40.16	3.27	-0.16	1.003	1.888
495.35	0.53	210.91	17.54	30.18	8.238	6.989	0.34	2.15	12.59	41.03	3.26	-0.18	1.024	1.930
510.35	0.55	215.18	17.23	30.19	8.484	7.007	0.35	2.19	12.89	41.86	3.25	-0.20	1.043	1.971
525.35	0.56	219.68	16.92	30.17	8.740	7.027	0.37	2.22	13.20	42.74	3.24	-0.22	1.063	2.014
540.37	0.58	223.83	16.59	30.13	8.991	7.046	0.38	2.26	13.54	43.58	3.22	-0.25	1.081	2.056
555.37	0.60	228.03	16.35	30.06	9.242	7.066	0.39	2.30	13.77	44.33	3.22	-0.26	1.100	2.092
570.37	0.61	232.47	16.08	30.11	9.488	7.085	0.40	2.33	14.05	45.14	3.21	-0.28	1.119	2.131
585.38	0.63	236.39	15.77	30.13	9.739	7.105	0.41	2.37	14.35	45.92	3.20	-0.30	1.136	2.170
600.38	0.65	240.70	15.49	30.15	9.989	7.125	0.42	2.40	14.63	46.71	3.19	-0.32	1.155	2.209
615.40	0.66	244.78	15.22	30.16	10.236	7.144	0.43	2.44	14.91	47.47	3.18	-0.34	1.172	2.245
630.40	0.68	248.44	14.94	30.17	10.489	7.164	0.44	2.47	15.18	48.17	3.17	-0.36	1.187	2.281
645.40	0.69	252.32	14.67	30.18	10.743	7.185	0.45	2.50	15.45	48.88	3.16	-0.38	1.203	2.316
660.40	0.71	255.85	14.40	30.19	10.994	7.205	0.46	2.52	15.72	49.55	3.15	-0.40	1.218	2.350
675.40	0.73	259.39	14.13	30.19	11.239	7.225	0.47	2.55	15.99	50.21	3.14	-0.42	1.232	2.383
690.40	0.74	263.12	13.87	30.20	11.496	7.246	0.48	2.58	16.25	50.89	3.13	-0.44	1.247	2.417
705.40	0.76	266.35	13.57	30.16	11.733	7.265	0.49	2.60	16.55	51.54	3.11	-0.46	1.260	2.451
720.42	0.77	269.99	13.35	30.07	11.987	7.286	0.50	2.63	16.77	52.16	3.11	-0.48	1.274	2.482
735.42	0.79	273.53	13.13	30.12	12.245	7.308	0.51	2.66	16.99	52.76	3.11	-0.49	1.288	2.511
750.42	0.81	276.66	12.88	30.15	12.500	7.329	0.52	2.68	17.24	53.34	3.09	-0.51	1.299	2.541
765.42	0.82	280.47	12.66	30.16	12.744	7.349	0.53	2.71	17.47	53.98	3.09	-0.53	1.314	2.572

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01
Boring No.: MW-103
Sample No.: -
Specimen No.: A
Depth (ft.): 60.1-60.6

Initial Height., H_o (in): 6.483
Initial Diameter, D_o (in): 2.868
Membrane Thickness (in): 0.02
Ht Change at End of Consol.,ΔH_o (in): 0.022 H_c 6.461
Ht Change at End of Saturation, H_s (in): 0.000
Volume change during Consol. V_c (cc^3): 7.55 0.46055 in^3

Confining Pressure (psi): 10.00
Initial Volume, V_o (in^3): 41.89
Initial Area, A_o (in^2): 6.46
Area after Consol., A_c (in^2): 6.413
Piston Correction (lbs): 12.1

Elasped Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
780.43	0.84	283.78	12.43	30.18	12.996	7.371	0.54	2.73	17.69	54.54	3.08	-0.54	1.327	2.600
795.43	0.86	286.79	12.21	30.19	13.241	7.392	0.55	2.75	17.92	55.07	3.07	-0.56	1.338	2.628
810.43	0.87	289.83	12.00	30.20	13.500	7.414	0.56	2.77	18.13	55.59	3.07	-0.58	1.348	2.654
825.43	0.89	292.52	11.78	30.21	13.746	7.435	0.58	2.79	18.34	56.05	3.06	-0.59	1.358	2.678
840.43	0.90	295.30	11.53	30.09	14.001	7.457	0.59	2.81	18.60	56.57	3.04	-0.61	1.367	2.706
855.45	0.92	298.30	11.43	30.15	14.240	7.478	0.60	2.83	18.70	56.97	3.05	-0.62	1.378	2.724
870.45	0.94	300.91	11.18	30.15	14.488	7.499	0.61	2.85	18.94	57.45	3.03	-0.63	1.386	2.750
885.45	0.95	303.85	10.99	30.17	14.739	7.521	0.62	2.86	19.13	57.92	3.03	-0.65	1.396	2.774
900.45	0.97	306.52	10.81	30.19	14.987	7.543	0.63	2.88	19.32	58.34	3.02	-0.66	1.405	2.796
912.15	0.98	308.77	10.67	30.20	15.191	7.562	0.64	2.89	19.46	58.69	3.02	-0.67	1.412	2.813

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01 Boring No.: MW-103
Sample No.: - Specimen No.: A
Depth (ft.): 60.6-61.2

Initial Height., H_o (in): 6.337
Initial Diameter, D_o (in): 2.864
Membr. Thickness (in): 0.02
Ht Change at End of Consol.,ΔH_o (in): 0.039 H_c 6.298
Ht Change at End of Saturation, H_s (in): 0.000
Volume change during Consol. V_c (cc³): 11.89 0.72529 in³

Confining Pressure (psi): 25.00
Initial Volume, V_o (in³): 40.83
Initial Area, A_o (in²): 6.44
Area after Consol., A_c (in²): 6.37
Piston Correction (lbs): 11.0

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in²)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
0.00	0.00	17.14	30.34	54.99	0.000	6.367	0.00	0.19	24.64	25.60	1.04	0.00	0.03	1.81
1.50	0.00	28.00	31.18	54.99	0.020	6.368	0.00	0.32	23.81	26.48	1.11	0.06	0.10	1.81
3.00	0.00	37.82	32.06	55.00	0.042	6.370	0.00	0.43	22.93	27.14	1.18	0.12	0.15	1.80
4.50	0.00	45.67	32.85	55.00	0.075	6.372	0.00	0.52	22.13	27.57	1.25	0.18	0.20	1.79
6.02	0.01	52.58	33.59	55.00	0.089	6.373	0.00	0.59	21.40	27.92	1.30	0.23	0.23	1.78
7.52	0.01	58.38	34.25	55.01	0.117	6.375	0.00	0.66	20.74	28.17	1.36	0.28	0.27	1.76
9.02	0.01	63.39	34.83	55.00	0.143	6.376	0.01	0.72	20.15	28.37	1.41	0.32	0.30	1.75
10.53	0.01	68.11	35.37	55.00	0.166	6.378	0.01	0.77	19.61	28.57	1.46	0.36	0.32	1.73
12.03	0.01	72.39	35.87	54.99	0.179	6.379	0.01	0.82	19.12	28.74	1.50	0.40	0.35	1.72
13.53	0.01	76.24	36.31	54.99	0.206	6.380	0.01	0.86	18.67	28.90	1.55	0.43	0.37	1.71
15.05	0.01	79.68	36.72	54.99	0.233	6.382	0.01	0.90	18.27	29.03	1.59	0.46	0.39	1.70
16.55	0.02	82.91	37.08	55.00	0.253	6.383	0.01	0.93	17.90	29.17	1.63	0.49	0.41	1.69
18.05	0.02	85.98	37.41	55.00	0.281	6.385	0.01	0.97	17.57	29.32	1.67	0.51	0.42	1.69
19.55	0.02	89.06	37.72	55.00	0.304	6.387	0.01	1.00	17.27	29.49	1.71	0.53	0.44	1.68
21.05	0.02	91.90	38.01	55.00	0.327	6.388	0.01	1.03	16.98	29.64	1.75	0.55	0.46	1.68
22.55	0.02	94.61	38.27	54.99	0.348	6.389	0.01	1.07	16.71	29.80	1.78	0.57	0.47	1.67
24.05	0.02	97.07	38.52	54.99	0.370	6.391	0.02	1.09	16.46	29.93	1.82	0.59	0.48	1.67
25.55	0.03	99.47	38.76	54.99	0.398	6.393	0.02	1.12	16.23	30.07	1.85	0.61	0.50	1.67
27.07	0.03	101.79	38.97	55.00	0.421	6.394	0.02	1.14	16.02	30.22	1.89	0.62	0.51	1.66
28.57	0.03	104.00	39.16	55.00	0.445	6.396	0.02	1.17	15.82	30.37	1.92	0.63	0.52	1.66
30.07	0.03	106.40	39.35	55.00	0.467	6.397	0.02	1.20	15.63	30.55	1.95	0.65	0.54	1.66
31.57	0.03	108.64	39.51	55.00	0.486	6.398	0.02	1.22	15.47	30.73	1.99	0.66	0.55	1.66
33.07	0.03	110.74	39.65	55.00	0.523	6.401	0.02	1.24	15.33	30.92	2.02	0.67	0.56	1.66
34.57	0.03	112.80	39.79	54.99	0.544	6.402	0.02	1.27	15.19	31.09	2.05	0.68	0.57	1.67
36.07	0.04	114.81	39.93	54.99	0.574	6.404	0.02	1.29	15.06	31.27	2.08	0.69	0.58	1.67
37.57	0.04	116.72	40.05	54.99	0.599	6.406	0.03	1.31	14.93	31.44	2.11	0.70	0.59	1.67
39.07	0.04	118.89	40.18	54.99	0.624	6.407	0.03	1.33	14.80	31.64	2.14	0.71	0.61	1.67
40.57	0.04	120.86	40.30	55.00	0.654	6.409	0.03	1.36	14.68	31.82	2.17	0.72	0.62	1.67
42.07	0.04	122.81	40.40	55.01	0.678	6.411	0.03	1.38	14.59	32.03	2.20	0.72	0.63	1.68
43.57	0.04	124.69	40.49	55.01	0.702	6.412	0.03	1.40	14.50	32.23	2.22	0.73	0.64	1.68
45.08	0.05	126.48	40.57	55.01	0.729	6.414	0.03	1.42	14.41	32.42	2.25	0.74	0.65	1.69
46.58	0.05	128.26	40.65	55.00	0.748	6.415	0.03	1.44	14.33	32.61	2.28	0.74	0.66	1.69
48.10	0.05	130.28	40.73	54.99	0.773	6.417	0.03	1.46	14.25	32.84	2.30	0.75	0.67	1.70
49.60	0.05	132.05	40.80	54.99	0.806	6.419	0.03	1.48	14.18	33.04	2.33	0.75	0.68	1.70
51.10	0.05	133.82	40.87	54.99	0.819	6.420	0.03	1.50	14.11	33.25	2.36	0.76	0.69	1.70
52.60	0.05	135.59	40.94	55.00	0.846	6.422	0.04	1.52	14.05	33.45	2.38	0.76	0.70	1.71
54.10	0.05	137.29	40.99	55.00	0.870	6.423	0.04	1.54	13.99	33.65	2.41	0.77	0.71	1.72
55.60	0.06	139.00	41.04	55.00	0.897	6.425	0.04	1.56	13.94	33.87	2.43	0.77	0.72	1.72
57.10	0.06	140.78	41.09	55.00	0.919	6.426	0.04	1.57	13.90	34.10	2.45	0.77	0.73	1.73
58.60	0.06	142.51	41.14	55.00	0.940	6.428	0.04	1.59	13.85	34.31	2.48	0.78	0.74	1.73
60.12	0.06	144.27	41.18	55.00	0.969	6.429	0.04	1.61	13.81	34.54	2.50	0.78	0.75	1.74
66.12	0.07	150.87	41.30	55.00	1.072	6.436	0.04	1.68	13.68	35.41	2.59	0.79	0.78	1.77
72.12	0.07	157.55	41.38	55.00	1.172	6.443	0.05	1.76	13.61	36.36	2.67	0.79	0.82	1.80
78.13	0.08	163.68	41.41	55.00	1.276	6.449	0.05	1.82	13.57	37.25	2.74	0.80	0.85	1.83
84.13	0.09	169.60	41.41	55.00	1.368	6.455	0.06	1.89	13.58	38.14	2.81	0.80	0.88	1.86
90.13	0.09	175.58	41.38	54.99	1.469	6.462	0.06	1.95	13.60	39.07	2.87	0.79	0.92	1.90
96.13	0.10	181.46	41.35	55.01	1.553	6.468	0.07	2.02	13.64	39.99	2.93	0.79	0.95	1.93
102.15	0.10	186.90	41.27	55.00	1.667	6.475	0.07	2.07	13.72	40.88	2.98	0.79	0.98	1.97
108.15	0.11	192.33	41.17	55.01	1.773	6.482	0.07	2.13	13.81	41.79	3.03	0.78	1.01	2.00
114.15	0.12	197.57	41.06	54.99	1.863	6.488	0.08	2.19	13.92	42.68	3.07	0.77	1.04	2.04
120.15	0.12	202.59	40.94	55.01	1.963	6.495	0.08	2.24	14.04	43.54	3.10	0.76	1.06	2.07
126.17	0.13	207.50	40.80	55.00	2.064	6.501	0.09	2.29	14.19	44.41	3.13	0.75	1.09	2.11
132.17	0.14	211.92	40.66	55.01	2.163	6.508	0.09	2.34	14.32	45.20	3.16	0.74	1.11	2.14
138.17	0.14	216.58	40.50	55.00	2.277	6.516	0.10	2.39	14.48	46.03	3.18	0.73	1.14	2.18
144.17	0.15	221.11	40.36	55.01	2.376	6.522	0.10	2.43	14.62	46.84	3.20	0.72	1.16	2.21
150.17	0.16	225.13	40.17	55.01	2.468	6.528	0.10	2.48	14.81	47.62	3.21	0.71	1.18	2.25
156.18	0.16	229.54	40.01	55.01	2.571	6.535	0.11	2.52	14.97	48.42	3.23	0.70	1.20	2.28

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01
Boring No.: MW-103
Sample No.: -
Specimen No.: A
Depth (ft.): 60.6-61.2

Initial Height., H_o (in): 6.337
Initial Diameter, D_o (in): 2.864
Membr. Thickness (in): 0.02
Ht Change at End of Consol.,ΔH_o (in): 0.039 H_c 6.298
Ht Change at End of Saturation, H_s (in): 0.000
Volume change during Consol. V_c (cc^3): 11.89 0.72529 in^3

Confining Pressure (psi): 25.00
Initial Volume, V_o (in^3): 40.83
Initial Area, A_o (in^2): 6.44
Area after Consol., A_c (in^2): 6.37
Piston Correction (lbs): 11.0

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
162.18	0.17	233.63	39.83	55.02	2.676	6.542	0.11	2.56	15.15	49.18	3.25	0.68	1.23	2.32
168.18	0.17	237.53	39.64	55.01	2.778	6.549	0.12	2.60	15.35	49.94	3.25	0.67	1.25	2.35
174.18	0.18	241.66	39.47	54.99	2.881	6.556	0.12	2.65	15.52	50.70	3.27	0.66	1.27	2.38
180.20	0.19	245.15	39.30	54.99	2.969	6.562	0.12	2.68	15.69	51.37	3.27	0.64	1.28	2.41
186.20	0.19	249.08	39.12	54.98	3.068	6.569	0.13	2.72	15.87	52.11	3.28	0.63	1.30	2.45
192.20	0.20	252.70	38.94	54.98	3.176	6.576	0.13	2.76	16.05	52.80	3.29	0.62	1.32	2.48
198.22	0.21	256.04	38.77	54.98	3.272	6.583	0.14	2.79	16.22	53.44	3.30	0.61	1.34	2.51
204.22	0.21	259.75	38.59	54.98	3.379	6.590	0.14	2.83	16.39	54.14	3.30	0.59	1.36	2.54
210.22	0.22	263.33	38.41	54.97	3.473	6.596	0.15	2.86	16.58	54.83	3.31	0.58	1.38	2.57
216.22	0.23	266.36	38.22	54.98	3.576	6.603	0.15	2.89	16.77	55.44	3.31	0.57	1.39	2.60
222.23	0.23	269.85	38.04	54.97	3.678	6.610	0.15	2.93	16.94	56.10	3.31	0.55	1.41	2.63
228.23	0.24	273.32	37.87	54.97	3.798	6.619	0.16	2.96	17.12	56.75	3.32	0.54	1.43	2.66
234.23	0.24	276.49	37.70	54.97	3.885	6.625	0.16	2.99	17.29	57.36	3.32	0.53	1.44	2.69
240.23	0.25	279.71	37.51	54.97	3.988	6.632	0.17	3.02	17.48	58.00	3.32	0.52	1.46	2.72
246.23	0.26	282.81	37.34	54.97	4.079	6.638	0.17	3.06	17.65	58.59	3.32	0.50	1.47	2.74
252.25	0.26	285.78	37.15	54.97	4.176	6.645	0.17	3.08	17.83	59.19	3.32	0.49	1.49	2.77
258.25	0.27	288.81	36.98	54.97	4.278	6.652	0.18	3.11	18.01	59.77	3.32	0.48	1.50	2.80
264.25	0.28	291.33	36.80	54.97	4.377	6.659	0.18	3.14	18.18	60.29	3.32	0.46	1.52	2.82
270.25	0.28	294.39	36.63	54.97	4.478	6.666	0.19	3.17	18.36	60.87	3.32	0.45	1.53	2.85
276.25	0.29	297.33	36.46	54.97	4.574	6.672	0.19	3.19	18.53	61.44	3.32	0.44	1.54	2.88
282.27	0.29	299.90	36.29	54.97	4.672	6.679	0.20	3.22	18.70	61.95	3.31	0.43	1.56	2.90
288.27	0.30	302.84	36.12	54.97	4.768	6.686	0.20	3.25	18.87	62.52	3.31	0.42	1.57	2.93
294.27	0.31	305.53	35.94	54.97	4.882	6.694	0.20	3.27	19.04	63.04	3.31	0.40	1.58	2.96
300.27	0.31	308.00	35.78	54.98	4.983	6.701	0.21	3.29	19.21	63.53	3.31	0.39	1.60	2.98
315.27	0.33	314.48	35.37	54.98	5.225	6.718	0.22	3.35	19.61	64.78	3.30	0.36	1.63	3.04
330.28	0.35	320.35	34.93	54.97	5.487	6.737	0.23	3.41	20.05	65.97	3.29	0.33	1.65	3.10
345.28	0.36	326.63	34.53	54.98	5.740	6.755	0.24	3.46	20.45	67.18	3.28	0.30	1.68	3.15
360.28	0.38	332.36	34.15	54.98	5.999	6.774	0.25	3.51	20.84	68.28	3.28	0.27	1.71	3.21
375.28	0.39	338.16	33.74	54.98	6.237	6.791	0.26	3.57	21.25	69.43	3.27	0.24	1.73	3.26
390.30	0.41	343.90	33.36	54.98	6.502	6.810	0.27	3.62	21.63	70.51	3.26	0.22	1.76	3.32
405.30	0.43	349.21	32.99	54.98	6.751	6.828	0.28	3.66	22.00	71.53	3.25	0.19	1.78	3.37
420.30	0.44	355.09	32.63	54.98	7.006	6.847	0.29	3.71	22.36	72.61	3.25	0.16	1.81	3.42
435.32	0.46	360.19	32.29	54.98	7.229	6.863	0.30	3.76	22.70	73.58	3.24	0.14	1.83	3.47
450.32	0.47	365.32	31.93	54.98	7.490	6.883	0.31	3.80	23.05	74.53	3.23	0.11	1.85	3.51
465.32	0.49	370.54	31.61	54.98	7.735	6.901	0.32	3.84	23.38	75.48	3.23	0.09	1.88	3.56
480.33	0.50	375.10	31.28	54.98	7.995	6.920	0.34	3.88	23.71	76.32	3.22	0.07	1.89	3.60
495.33	0.52	379.78	30.99	55.00	8.245	6.939	0.35	3.92	24.00	77.14	3.21	0.05	1.91	3.64
510.33	0.54	384.01	30.67	55.00	8.496	6.958	0.36	3.95	24.32	77.92	3.20	0.02	1.93	3.68
525.33	0.55	388.50	30.36	55.00	8.750	6.978	0.37	3.98	24.62	78.72	3.20	0.00	1.95	3.72
540.33	0.57	393.00	30.07	54.99	9.003	6.997	0.38	4.02	24.91	79.51	3.19	-0.02	1.97	3.76
555.35	0.58	397.17	29.79	55.00	9.254	7.016	0.39	4.05	25.20	80.24	3.18	-0.04	1.98	3.80
570.35	0.60	401.43	29.51	55.00	9.497	7.035	0.40	4.08	25.47	80.97	3.18	-0.06	2.00	3.83
585.35	0.61	405.54	29.24	54.99	9.753	7.055	0.41	4.11	25.75	81.67	3.17	-0.08	2.01	3.87
600.35	0.63	409.91	28.97	54.99	10.008	7.075	0.42	4.14	26.01	82.39	3.17	-0.10	2.03	3.90
615.35	0.65	413.99	28.73	54.99	10.255	7.095	0.43	4.17	26.25	83.06	3.16	-0.12	2.04	3.94
630.35	0.66	418.27	28.48	55.00	10.500	7.114	0.44	4.20	26.51	83.75	3.16	-0.13	2.06	3.97
645.35	0.68	422.36	28.25	55.00	10.771	7.136	0.45	4.23	26.73	84.38	3.16	-0.15	2.08	4.00
660.37	0.69	425.76	28.01	55.00	11.015	7.155	0.46	4.25	26.97	84.94	3.15	-0.17	2.09	4.03
675.37	0.71	429.76	27.79	55.00	11.275	7.176	0.47	4.28	27.20	85.55	3.15	-0.18	2.10	4.06
690.38	0.72	433.43	27.57	55.01	11.509	7.195	0.48	4.30	27.42	86.13	3.14	-0.20	2.11	4.09
705.38	0.74	436.69	27.33	55.00	11.772	7.217	0.49	4.32	27.66	86.64	3.13	-0.22	2.12	4.11
720.38	0.76	440.02	27.12	55.00	12.007	7.236	0.50	4.34	27.86	87.15	3.13	-0.23	2.13	4.14
735.38	0.77	443.21	26.90	55.01	12.265	7.257	0.51	4.36	28.08	87.64	3.12	-0.25	2.14	4.17
750.38	0.79	447.04	26.71	55.01	12.503	7.277	0.52	4.39	28.28	88.20	3.12	-0.26	2.16	4.19
765.40	0.80	450.28	26.52	55.01	12.766	7.299	0.53	4.40	28.47	88.65	3.11	-0.28	2.17	4.22
780.40	0.82	453.87	26.33	55.01	13.013	7.320	0.55	4.43	28.66	89.16	3.11	-0.29	2.18	4.24
795.40	0.84	457.08	26.15	55.02	13.279	7.342	0.56	4.44	28.84	89.59	3.11	-0.30	2.19	4.26

CU TRIAXIAL TEST: Stress-Strain Data

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Area after Consol., A_c (in^2): 6.37
Piston Correction (lbs): 11.0

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
810.42	0.85	460.72	25.95	55.02	13.524	7.363	0.57	4.46	29.03	90.11	3.10	-0.32	2.20	4.29
825.42	0.87	464.47	25.78	55.02	13.774	7.384	0.58	4.49	29.20	90.61	3.10	-0.33	2.21	4.31
840.42	0.88	467.17	25.60	55.01	14.023	7.406	0.59	4.50	29.38	90.98	3.10	-0.34	2.22	4.33
855.43	0.90	470.37	25.45	55.02	14.277	7.428	0.60	4.52	29.54	91.39	3.09	-0.35	2.23	4.35
870.43	0.92	473.41	25.30	55.03	14.529	7.449	0.61	4.53	29.69	91.76	3.09	-0.36	2.23	4.37
885.45	0.93	475.99	25.12	55.03	14.776	7.471	0.62	4.54	29.87	92.10	3.08	-0.38	2.24	4.39
900.45	0.95	478.91	24.97	55.03	15.032	7.494	0.63	4.56	30.02	92.46	3.08	-0.39	2.25	4.41

Report No.:

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01

Boring No.: MW-103

Sample No.: -

Specimen No.: A

Depth (ft.): 61.2-61.7

Initial Height., H_o (in): 6.491

Initial Diameter, D_o (in): 2.860

Membr. Thickness (in): 0.02

t Change at End of Consol.,ΔH_o (in): 0.053 H_c 6.438

Change at End of Saturation, H_s (in): 0.000

ume change during Consol. V_c (cc^3): 18.75 1.14375 in^3

Confining Pressure (psi): 50.00

Initial Volume, V_o (in^3): 41.69

Initial Area, A_o (in^2): 6.42

Area after Consol., A_c (in^2): 6.30

Piston Correction (lbs): 17.2

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
0.00	0.00	23.87	20.01	70.00	0.000	6.298	0.00	0.27	49.99	51.06	1.02	0.00	0.04	3.64
1.52	0.001	45.20	22.14	70.00	0.015	6.299	0.00	0.52	47.86	52.31	1.09	0.15	0.16	3.61
3.02	0.003	66.94	24.03	70.00	0.041	6.301	0.00	0.76	45.97	53.87	1.17	0.29	0.28	3.59
4.53	0.005	85.21	25.77	70.00	0.072	6.303	0.00	0.97	44.23	55.02	1.24	0.42	0.39	3.57
6.03	0.006	98.84	27.28	70.01	0.098	6.304	0.00	1.13	42.72	55.67	1.30	0.52	0.47	3.54
7.53	0.007	110.60	28.63	70.02	0.116	6.305	0.00	1.26	41.37	56.19	1.36	0.62	0.53	3.51
9.03	0.009	121.16	29.87	70.02	0.137	6.307	0.01	1.38	40.13	56.62	1.41	0.71	0.59	3.48
10.53	0.011	131.00	31.02	70.02	0.165	6.309	0.01	1.49	38.98	57.03	1.46	0.79	0.65	3.46
12.03	0.012	139.21	32.05	70.02	0.186	6.310	0.01	1.59	37.95	57.29	1.51	0.87	0.70	3.43
13.55	0.014	146.47	32.98	70.01	0.211	6.311	0.01	1.67	37.02	57.51	1.55	0.93	0.74	3.40
15.05	0.015	153.16	33.81	70.01	0.238	6.313	0.01	1.75	36.19	57.73	1.60	0.99	0.78	3.38
16.55	0.017	158.96	34.56	70.01	0.261	6.315	0.01	1.81	35.44	57.89	1.63	1.05	0.81	3.36
18.05	0.018	164.90	35.26	70.01	0.275	6.316	0.01	1.88	34.74	58.13	1.67	1.10	0.84	3.34
19.57	0.019	169.70	35.90	70.00	0.297	6.317	0.01	1.93	34.10	58.25	1.71	1.14	0.87	3.32
21.07	0.021	174.64	36.51	70.00	0.324	6.319	0.01	1.99	33.49	58.41	1.74	1.19	0.90	3.31
22.57	0.023	179.46	37.06	70.00	0.355	6.321	0.01	2.04	32.94	58.61	1.78	1.23	0.92	3.30
24.07	0.024	183.35	37.61	70.02	0.377	6.322	0.02	2.09	32.39	58.68	1.81	1.27	0.95	3.28
25.58	0.026	187.21	38.08	70.02	0.403	6.324	0.02	2.13	31.92	58.81	1.84	1.30	0.97	3.27
27.08	0.028	191.84	38.52	70.02	0.428	6.325	0.02	2.18	31.48	59.09	1.88	1.33	0.99	3.26
28.58	0.029	195.42	38.93	70.02	0.457	6.327	0.02	2.22	31.07	59.24	1.91	1.36	1.01	3.25
30.08	0.031	198.98	39.33	70.02	0.476	6.328	0.02	2.26	30.67	59.40	1.94	1.39	1.03	3.24
31.58	0.032	201.94	39.70	70.02	0.502	6.330	0.02	2.30	30.30	59.49	1.96	1.42	1.05	3.23
33.10	0.034	206.09	40.05	70.01	0.532	6.332	0.02	2.34	29.95	59.79	2.00	1.44	1.07	3.23
34.60	0.036	208.76	40.35	70.01	0.554	6.333	0.02	2.37	29.65	59.90	2.02	1.46	1.09	3.22
36.12	0.037	211.45	40.65	70.00	0.575	6.335	0.02	2.40	29.35	60.02	2.04	1.49	1.10	3.22
37.62	0.039	214.29	40.94	69.99	0.604	6.336	0.03	2.43	29.06	60.17	2.07	1.51	1.12	3.21
39.12	0.040	217.30	41.21	70.00	0.628	6.338	0.03	2.47	28.79	60.37	2.10	1.53	1.14	3.21
40.62	0.042	220.48	41.47	69.99	0.651	6.339	0.03	2.50	28.53	60.60	2.12	1.55	1.15	3.21
42.12	0.043	223.02	41.75	70.02	0.675	6.341	0.03	2.53	28.26	60.72	2.15	1.57	1.17	3.20
43.62	0.045	225.44	41.95	70.02	0.705	6.343	0.03	2.56	28.05	60.88	2.17	1.58	1.18	3.20
45.13	0.047	227.93	42.16	70.01	0.729	6.344	0.03	2.58	27.84	61.06	2.19	1.60	1.20	3.20
46.63	0.048	231.05	42.36	70.02	0.745	6.345	0.03	2.62	27.64	61.34	2.22	1.61	1.21	3.20
48.15	0.050	233.65	42.56	70.01	0.774	6.347	0.03	2.65	27.44	61.55	2.24	1.62	1.23	3.20
49.65	0.051	235.64	42.73	70.01	0.794	6.349	0.03	2.67	27.27	61.68	2.26	1.64	1.24	3.20
51.15	0.053	238.36	42.91	70.01	0.824	6.350	0.03	2.70	27.09	61.93	2.29	1.65	1.25	3.20
52.67	0.055	240.30	43.06	70.00	0.850	6.352	0.04	2.72	26.94	62.06	2.30	1.66	1.26	3.20
54.17	0.056	242.18	43.21	70.00	0.871	6.354	0.04	2.74	26.79	62.20	2.32	1.67	1.27	3.20
55.67	0.057	244.96	43.35	69.99	0.890	6.355	0.04	2.77	26.65	62.49	2.35	1.68	1.29	3.21
57.17	0.059	246.91	43.48	69.99	0.923	6.357	0.04	2.79	26.52	62.66	2.36	1.69	1.30	3.21
58.68	0.061	249.11	43.63	69.99	0.944	6.358	0.04	2.82	26.37	62.85	2.38	1.70	1.31	3.21
60.18	0.063	251.13	43.77	70.02	0.972	6.360	0.04	2.84	26.23	63.01	2.40	1.71	1.32	3.21
66.18	0.069	259.30	44.19	70.00	1.076	6.367	0.05	2.93	25.81	63.84	2.47	1.74	1.37	3.23
72.18	0.075	267.46	44.52	69.99	1.172	6.373	0.05	3.02	25.48	64.76	2.54	1.76	1.41	3.25
78.20	0.082	274.39	44.81	70.02	1.274	6.379	0.05	3.09	25.19	65.51	2.60	1.79	1.45	3.26
84.20	0.089	281.33	45.00	70.00	1.376	6.386	0.06	3.17	25.00	66.37	2.65	1.80	1.49	3.29
90.20	0.095	287.71	45.16	69.99	1.472	6.392	0.06	3.24	24.85	67.17	2.70	1.81	1.52	3.31
96.20	0.101	294.15	45.28	70.01	1.569	6.399	0.07	3.31	24.72	68.00	2.75	1.82	1.56	3.34
102.22	0.108	299.46	45.34	70.00	1.673	6.405	0.07	3.36	24.66	68.74	2.79	1.82	1.59	3.36
108.22	0.114	306.18	45.38	69.99	1.770	6.412	0.07	3.43	24.62	69.69	2.83	1.83	1.62	3.40
114.22	0.120	311.77	45.41	70.01	1.867	6.418	0.08	3.49	24.59	70.49	2.87	1.83	1.65	3.42
120.22	0.127	317.35	45.38	70.00	1.967	6.425	0.08	3.55	24.62	71.34	2.90	1.83	1.68	3.45
126.22	0.133	322.56	45.36	69.99	2.071	6.431	0.09	3.60	24.64	72.13	2.93	1.83	1.71	3.48
132.23	0.140	327.55	45.31	70.02	2.173	6.438	0.09	3.66	24.69	72.90	2.95	1.82	1.74	3.51
138.23	0.146	332.48	45.23	70.01	2.273	6.445	0.10	3.71	24.77	73.69	2.98	1.82	1.76	3.54
144.23	0.153	337.72	45.15	69.99	2.369	6.451	0.10	3.76	24.85	74.54	3.00	1.81	1.79	3.58

Report No.:

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01
Boring No.: MW-103
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Specimen No.: A
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Initial Diameter, D_o (in): 2.860
Membr. Thickness (in): 0.02
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Change at End of Saturation, H_s (in): 0.000
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Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
150.25	0.159	342.43	45.07	70.01	2.473	6.458	0.10	3.81	24.93	75.30	3.02	1.80	1.81	3.61
156.25	0.166	346.78	44.95	70.01	2.574	6.465	0.11	3.85	25.05	76.03	3.04	1.80	1.84	3.64
162.25	0.172	351.76	44.83	69.99	2.676	6.471	0.11	3.91	25.17	76.88	3.05	1.79	1.86	3.67
168.25	0.179	355.41	44.71	70.02	2.773	6.478	0.12	3.94	25.29	77.50	3.06	1.78	1.88	3.70
174.25	0.185	359.58	44.58	70.00	2.871	6.484	0.12	3.98	25.42	78.23	3.08	1.77	1.90	3.73
180.25	0.191	363.94	44.42	69.99	2.973	6.491	0.12	4.03	25.58	79.00	3.09	1.76	1.92	3.76
186.27	0.198	367.73	44.30	70.01	3.073	6.498	0.13	4.07	25.70	79.65	3.10	1.75	1.94	3.79
192.27	0.205	372.09	44.13	70.00	3.177	6.505	0.13	4.11	25.87	80.43	3.11	1.74	1.96	3.83
198.27	0.211	376.56	43.96	69.98	3.276	6.511	0.14	4.15	26.04	81.24	3.12	1.72	1.99	3.86
204.27	0.217	380.95	43.83	70.02	3.375	6.518	0.14	4.20	26.17	81.98	3.13	1.72	2.01	3.89
210.28	0.224	384.35	43.66	70.00	3.476	6.525	0.15	4.23	26.34	82.62	3.14	1.70	2.03	3.92
216.28	0.230	388.60	43.47	69.99	3.579	6.532	0.15	4.27	26.53	83.39	3.14	1.69	2.05	3.96
222.28	0.237	392.49	43.32	70.01	3.675	6.538	0.15	4.31	26.68	84.08	3.15	1.68	2.07	3.99
228.28	0.243	395.22	43.14	70.00	3.775	6.545	0.16	4.34	26.86	84.62	3.15	1.67	2.08	4.01
234.28	0.250	399.35	42.95	69.99	3.879	6.552	0.16	4.38	27.05	85.37	3.16	1.65	2.10	4.05
240.30	0.256	402.70	42.80	70.01	3.972	6.559	0.17	4.41	27.20	85.98	3.16	1.64	2.12	4.07
246.30	0.262	406.70	42.60	70.00	4.072	6.566	0.17	4.45	27.40	86.73	3.17	1.63	2.14	4.11
252.30	0.269	409.76	42.42	69.98	4.175	6.573	0.18	4.48	27.58	87.31	3.17	1.61	2.15	4.14
258.30	0.275	413.57	42.27	70.00	4.272	6.579	0.18	4.51	27.73	87.98	3.17	1.60	2.17	4.17
264.30	0.282	416.39	42.06	69.99	4.373	6.586	0.18	4.54	27.94	88.56	3.17	1.59	2.18	4.19
270.32	0.288	419.95	41.88	70.00	4.473	6.593	0.19	4.57	28.12	89.21	3.17	1.57	2.20	4.22
276.32	0.295	423.67	41.71	70.00	4.577	6.600	0.19	4.61	28.29	89.88	3.18	1.56	2.22	4.25
282.32	0.301	426.94	41.52	69.99	4.673	6.607	0.20	4.64	28.48	90.50	3.18	1.55	2.23	4.28
288.32	0.307	430.71	41.35	70.01	4.772	6.614	0.20	4.67	28.66	91.18	3.18	1.54	2.25	4.31
294.32	0.314	434.19	41.16	70.00	4.874	6.621	0.20	4.71	28.84	91.83	3.18	1.52	2.27	4.34
300.33	0.320	437.20	40.96	69.99	4.975	6.628	0.21	4.73	29.04	92.41	3.18	1.51	2.28	4.37
315.33	0.336	443.97	40.51	69.99	5.227	6.645	0.22	4.79	29.49	93.71	3.18	1.48	2.31	4.44
330.33	0.352	452.95	40.06	70.00	5.468	6.662	0.23	4.88	29.94	95.35	3.18	1.44	2.35	4.51
345.33	0.369	460.15	39.62	70.01	5.727	6.681	0.24	4.94	30.38	96.68	3.18	1.41	2.39	4.57
360.33	0.385	465.84	39.17	70.00	5.976	6.698	0.25	4.99	30.83	97.81	3.17	1.38	2.41	4.63
375.35	0.401	472.87	38.70	69.97	6.231	6.717	0.26	5.05	31.30	99.15	3.17	1.35	2.44	4.70
390.35	0.417	480.64	38.28	69.98	6.481	6.735	0.27	5.12	31.72	100.54	3.17	1.32	2.48	4.76
405.35	0.433	487.47	37.86	69.98	6.730	6.753	0.28	5.18	32.14	101.78	3.17	1.29	2.51	4.82
420.35	0.449	492.51	37.45	69.99	6.980	6.771	0.29	5.22	32.55	102.75	3.16	1.26	2.53	4.87
435.37	0.465	499.88	37.06	69.99	7.229	6.789	0.30	5.28	32.94	104.05	3.16	1.23	2.56	4.93
450.37	0.482	505.21	36.66	70.00	7.488	6.808	0.31	5.32	33.34	105.03	3.15	1.20	2.58	4.98
465.37	0.498	510.79	36.27	70.01	7.735	6.826	0.32	5.36	33.74	106.05	3.14	1.17	2.60	5.03
480.38	0.514	517.02	35.88	69.97	7.980	6.844	0.33	5.41	34.12	107.15	3.14	1.14	2.63	5.09
495.38	0.530	522.54	35.50	69.98	8.234	6.863	0.35	5.46	34.50	108.13	3.13	1.12	2.65	5.13
510.38	0.546	528.17	35.15	69.97	8.486	6.882	0.36	5.50	34.85	109.10	3.13	1.09	2.67	5.18
525.38	0.562	533.86	34.78	69.98	8.737	6.901	0.37	5.54	35.22	110.09	3.13	1.06	2.70	5.23
540.38	0.579	538.79	34.46	69.98	8.990	6.920	0.38	5.58	35.54	110.92	3.12	1.04	2.71	5.27
555.38	0.595	542.67	34.13	69.99	9.235	6.939	0.39	5.60	35.87	111.60	3.11	1.02	2.73	5.31
570.38	0.611	549.03	33.76	69.97	9.492	6.959	0.40	5.65	36.24	112.67	3.11	0.99	2.75	5.36
585.38	0.627	553.77	33.47	69.97	9.745	6.978	0.41	5.68	36.53	113.42	3.11	0.97	2.77	5.40
600.40	0.643	557.86	33.16	69.98	9.991	6.997	0.42	5.71	36.84	114.11	3.10	0.95	2.78	5.43
615.40	0.659	562.53	32.86	69.98	10.244	7.017	0.43	5.74	37.14	114.86	3.09	0.93	2.80	5.47
630.42	0.676	567.58	32.57	69.99	10.499	7.037	0.44	5.78	37.43	115.65	3.09	0.90	2.82	5.51
645.42	0.692	571.39	32.32	69.99	10.748	7.057	0.45	5.80	37.68	116.22	3.08	0.89	2.83	5.54
660.42	0.708	576.05	32.05	70.00	11.001	7.077	0.46	5.83	37.95	116.93	3.08	0.87	2.84	5.58
675.42	0.724	579.98	31.76	69.96	11.251	7.097	0.47	5.85	38.24	117.55	3.07	0.85	2.86	5.61
690.42	0.741	583.83	31.52	69.95	11.507	7.117	0.48	5.87	38.48	118.10	3.07	0.83	2.87	5.64
705.42	0.757	588.96	31.26	69.95	11.757	7.137	0.49	5.91	38.74	118.85	3.07	0.81	2.88	5.67
720.42	0.773	593.52	31.05	69.95	12.009	7.158	0.50	5.93	38.95	119.47	3.07	0.80	2.90	5.70
735.43	0.789	596.13	30.84	69.94	12.256	7.178	0.51	5.94	39.16	119.82	3.06	0.78	2.90	5.72

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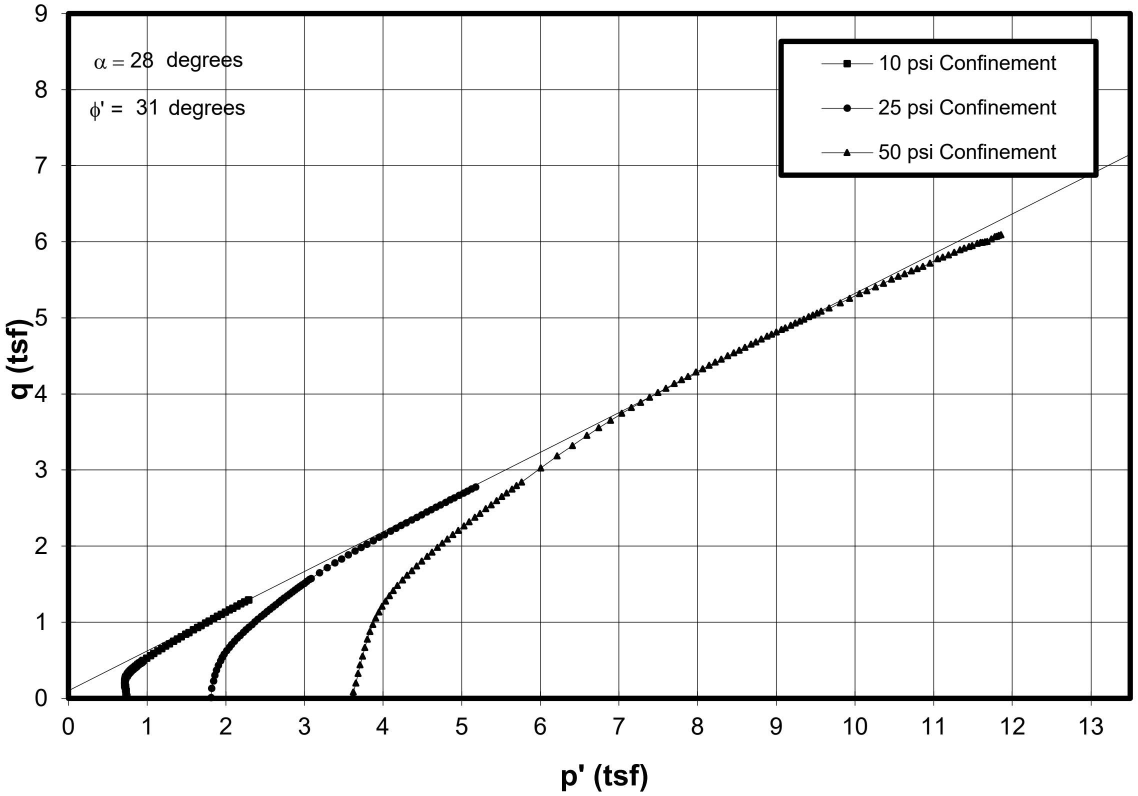
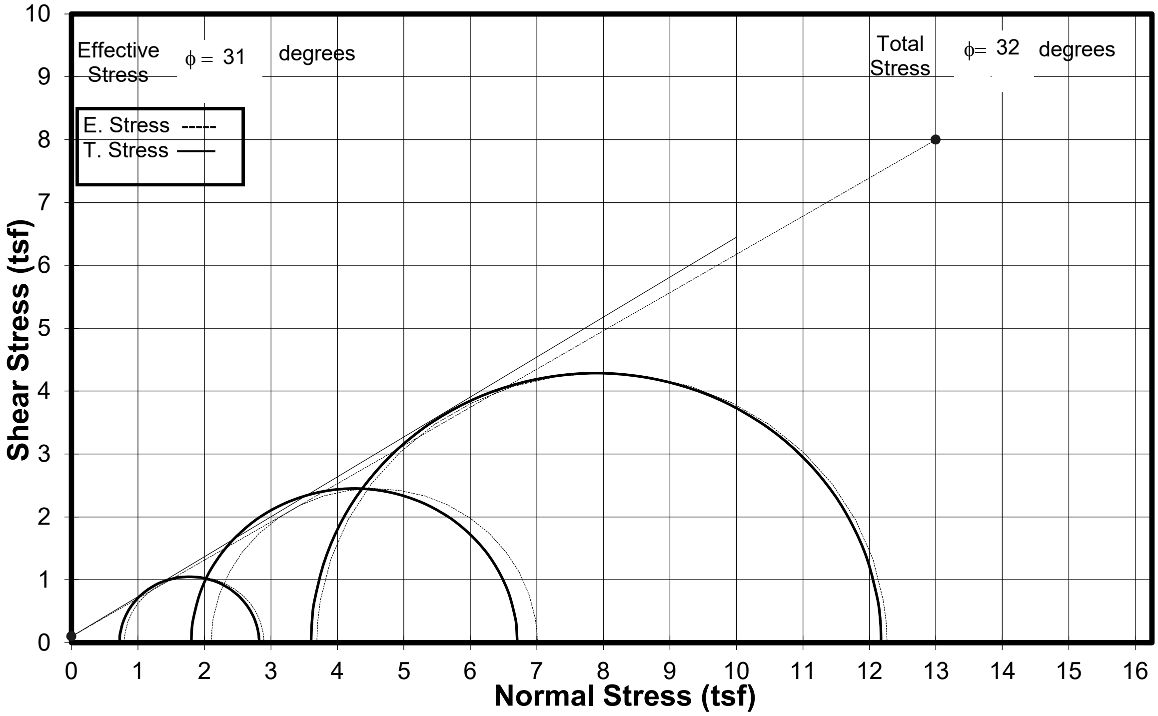
t Change at End of Consol.,ΔH_o (in): 0.053 H_c 6.438
Change at End of Saturation, H_s (in): 0.000
ume change during Consol. V_c (cc^3): 18.75 1.14375 in^3

Confining Pressure (psi): 50.00
Initial Volume, V_o (in^3): 41.69
Initial Area, A_o (in^2): 6.42
Area after Consol., A_c (in^2): 6.30
Piston Correction (lbs): 17.2

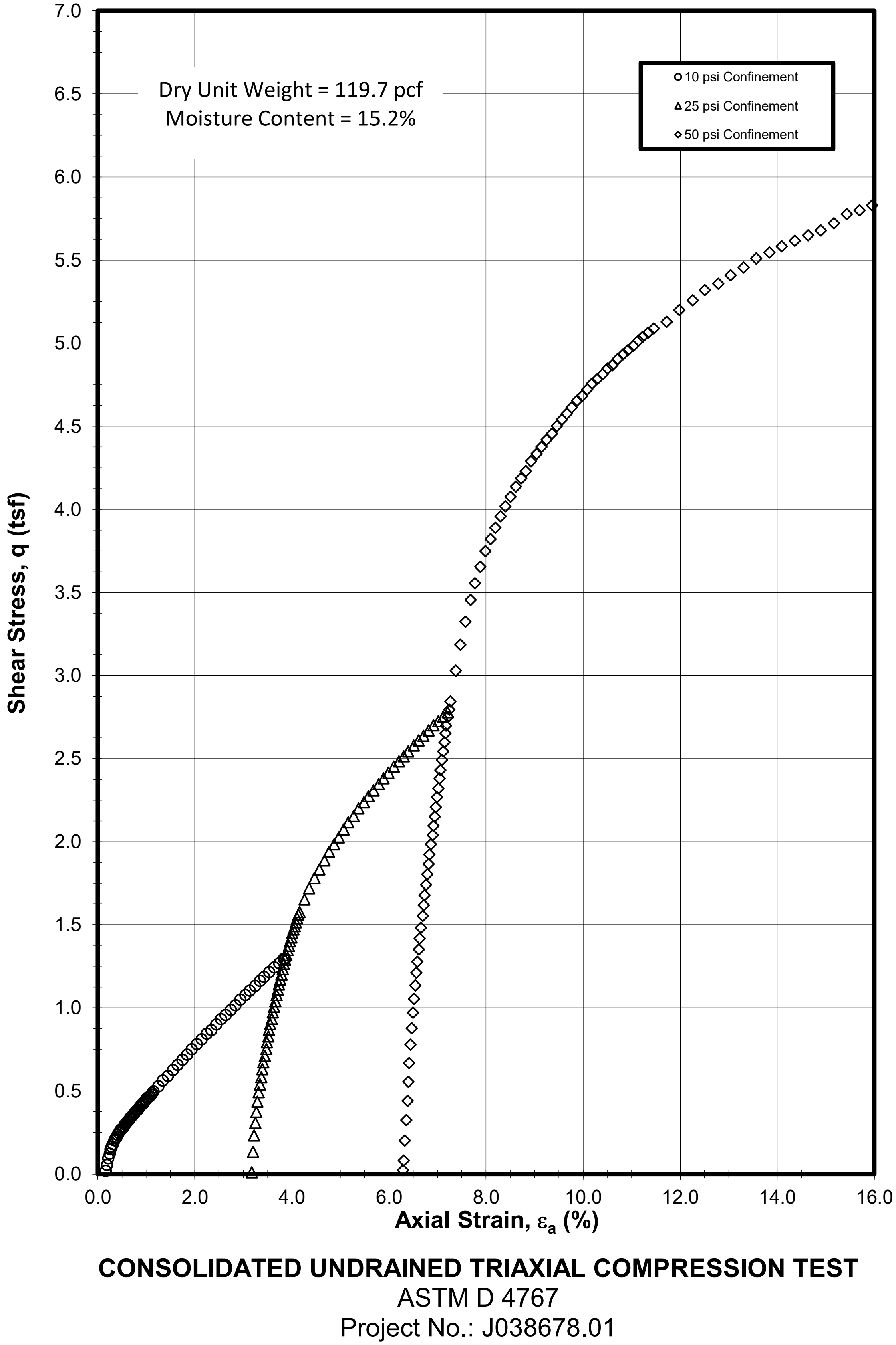
Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
750.43	0.805	601.01	30.63	69.94	12.510	7.199	0.52	5.97	39.37	120.48	3.06	0.76	2.92	5.75
765.43	0.822	604.56	30.41	69.95	12.765	7.220	0.54	5.99	39.59	120.95	3.06	0.75	2.93	5.78
780.43	0.838	607.65	30.20	69.91	13.018	7.241	0.55	6.00	39.80	121.35	3.05	0.73	2.94	5.80
795.43	0.854	611.56	30.01	69.92	13.263	7.261	0.56	6.02	39.99	121.85	3.05	0.72	2.95	5.83
810.43	0.871	613.87	29.83	69.91	13.524	7.283	0.57	6.03	40.17	122.10	3.04	0.71	2.95	5.84
825.45	0.887	616.88	29.64	69.92	13.772	7.304	0.58	6.04	40.36	122.47	3.03	0.69	2.96	5.86
840.45	0.903	620.79	29.48	69.93	14.029	7.326	0.59	6.06	40.52	122.91	3.03	0.68	2.97	5.88
855.45	0.919	625.12	29.31	69.93	14.275	7.347	0.60	6.08	40.70	123.44	3.03	0.67	2.98	5.91
870.47	0.935	626.93	29.08	69.90	14.530	7.369	0.61	6.08	40.92	123.67	3.02	0.65	2.98	5.92
885.47	0.952	630.74	28.96	69.91	14.780	7.390	0.62	6.10	41.04	124.07	3.02	0.64	2.99	5.94
900.47	0.968	634.63	28.80	69.92	15.035	7.413	0.63	6.12	41.20	124.50	3.02	0.63	3.00	5.97





CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

ASTM D 4767
Project No.: J038678.01
Boring: MW-104
Sample Depth: 30.0-32.0



CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D 4767
Project No.: J038678.01
Boring: MW-104
Sample Depth: 30.0-32.0

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01
Boring No.: MW-104
Sample No.: -
Specimen No.: A
Depth (ft.): 30.0-32.0

Initial Height., H_o (in): 6.085
Initial Diameter, D_o (in): 2.874
Membrane Thickness (in): 0.02
Ht Change at End of Consol.,ΔH_o (in): 0.010 H_c 6.075
Ht Change at End of Saturation, H_s (in): 0.001
Volume change during Consol. V_c (cc^3): 4.85 0.29585 in^3

Confining Pressure (psi): 10.00
Initial Volume, V_o (in^3): 39.48
Initial Area, A_o (in^2): 6.49
Area after Consol., A_c (in^2): 6.45
Piston Correction (lbs): 6.9

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
0.00	0.01	10.45	30.02	40.03	0.164	6.458	0.01	0.12	10.01	10.56	1.06	0.00	0.020	0.741
1.50	0.01	16.72	30.65	40.02	0.189	6.460	0.01	0.19	9.38	10.90	1.16	0.05	0.055	0.730
3.02	0.01	23.99	31.19	40.02	0.215	6.461	0.01	0.27	8.84	11.49	1.30	0.08	0.095	0.732
4.52	0.01	28.88	31.66	40.03	0.247	6.463	0.01	0.32	8.37	11.78	1.41	0.12	0.123	0.725
6.02	0.02	33.49	32.04	40.03	0.263	6.464	0.01	0.37	7.99	12.11	1.52	0.15	0.148	0.723
7.52	0.02	36.35	32.36	40.01	0.284	6.466	0.01	0.40	7.67	12.22	1.59	0.17	0.164	0.716
9.02	0.02	39.25	32.64	40.01	0.311	6.468	0.01	0.44	7.39	12.40	1.68	0.19	0.180	0.712
10.52	0.02	43.30	32.88	40.02	0.343	6.470	0.01	0.48	7.15	12.78	1.79	0.21	0.203	0.718
12.02	0.02	45.51	33.08	40.03	0.364	6.471	0.02	0.51	6.95	12.92	1.86	0.22	0.215	0.715
13.52	0.02	46.82	33.25	40.03	0.391	6.473	0.02	0.52	6.78	12.95	1.91	0.23	0.222	0.710
15.02	0.02	49.34	33.39	40.03	0.411	6.474	0.02	0.55	6.64	13.20	1.99	0.24	0.236	0.714
16.53	0.03	51.34	33.51	40.03	0.433	6.476	0.02	0.57	6.52	13.38	2.05	0.25	0.247	0.717
18.03	0.03	53.53	33.61	40.02	0.460	6.477	0.02	0.59	6.42	13.62	2.12	0.26	0.259	0.721
19.53	0.03	54.96	33.70	40.02	0.477	6.478	0.02	0.61	6.33	13.75	2.17	0.27	0.267	0.723
21.05	0.03	56.56	33.78	40.01	0.513	6.481	0.02	0.63	6.25	13.92	2.23	0.27	0.276	0.726
22.55	0.03	57.91	33.84	40.01	0.533	6.482	0.02	0.64	6.19	14.06	2.27	0.28	0.283	0.729
24.07	0.03	60.53	33.90	40.02	0.557	6.484	0.02	0.67	6.13	14.41	2.35	0.28	0.298	0.739
25.57	0.04	61.75	33.95	40.01	0.583	6.485	0.02	0.68	6.08	14.54	2.39	0.28	0.305	0.743
27.07	0.04	63.65	33.99	40.01	0.610	6.487	0.03	0.70	6.04	14.79	2.45	0.29	0.315	0.750
28.57	0.04	65.02	34.03	40.02	0.633	6.489	0.03	0.72	6.00	14.96	2.49	0.29	0.323	0.754
30.08	0.04	66.52	34.06	40.03	0.656	6.490	0.03	0.74	5.97	15.16	2.54	0.29	0.331	0.761
31.58	0.04	68.61	34.08	40.03	0.674	6.491	0.03	0.76	5.95	15.46	2.60	0.29	0.342	0.771
33.10	0.04	69.68	34.09	40.03	0.704	6.493	0.03	0.77	5.94	15.61	2.63	0.29	0.348	0.776
34.60	0.04	71.12	34.10	40.03	0.724	6.494	0.03	0.79	5.93	15.82	2.67	0.29	0.356	0.783
36.10	0.05	72.47	34.11	40.02	0.747	6.496	0.03	0.80	5.92	16.02	2.70	0.29	0.363	0.790
37.60	0.05	74.09	34.10	40.02	0.773	6.498	0.03	0.82	5.93	16.27	2.75	0.29	0.372	0.799
39.10	0.05	76.22	34.10	40.02	0.804	6.500	0.03	0.84	5.93	16.60	2.80	0.29	0.384	0.811
40.60	0.05	76.86	34.09	40.02	0.829	6.501	0.03	0.85	5.94	16.71	2.81	0.29	0.388	0.815
42.12	0.05	78.96	34.08	40.02	0.852	6.503	0.04	0.87	5.95	17.04	2.86	0.29	0.399	0.828
43.62	0.05	80.61	34.08	40.03	0.879	6.505	0.04	0.89	5.95	17.29	2.90	0.29	0.408	0.837
45.12	0.05	81.96	34.06	40.03	0.899	6.506	0.04	0.90	5.97	17.51	2.93	0.29	0.415	0.846
46.63	0.06	83.42	34.04	40.03	0.926	6.508	0.04	0.92	5.99	17.75	2.96	0.29	0.423	0.855
48.13	0.06	84.41	34.02	40.02	0.951	6.509	0.04	0.93	6.01	17.92	2.98	0.29	0.429	0.862
49.63	0.06	86.93	33.99	40.02	0.977	6.511	0.04	0.96	6.04	18.33	3.04	0.29	0.443	0.877
51.15	0.06	87.91	33.96	40.02	0.993	6.512	0.04	0.97	6.07	18.51	3.05	0.28	0.448	0.885
52.65	0.06	90.03	33.93	40.02	1.019	6.514	0.04	0.99	6.10	18.86	3.09	0.28	0.460	0.899
54.15	0.06	90.72	33.90	40.02	1.052	6.516	0.04	1.00	6.13	19.00	3.10	0.28	0.463	0.905
55.67	0.07	91.99	33.87	40.01	1.080	6.518	0.05	1.01	6.16	19.22	3.12	0.28	0.470	0.914
57.17	0.07	93.70	33.83	40.02	1.102	6.519	0.05	1.03	6.20	19.52	3.15	0.27	0.479	0.926
58.67	0.07	95.46	33.79	40.02	1.124	6.521	0.05	1.05	6.24	19.82	3.18	0.27	0.489	0.938
60.17	0.07	97.13	33.77	40.04	1.152	6.523	0.05	1.07	6.26	20.10	3.21	0.27	0.498	0.949
66.17	0.08	102.60	33.59	40.03	1.252	6.529	0.05	1.13	6.44	21.10	3.28	0.26	0.528	0.992
72.18	0.08	108.88	33.39	40.02	1.343	6.535	0.06	1.20	6.64	22.25	3.35	0.24	0.562	1.040
78.18	0.09	114.26	33.20	40.03	1.446	6.542	0.06	1.25	6.83	23.24	3.40	0.23	0.591	1.082
84.18	0.09	120.81	32.95	40.02	1.550	6.549	0.06	1.32	7.08	24.47	3.46	0.21	0.626	1.136
90.18	0.10	126.29	32.71	40.01	1.647	6.555	0.07	1.38	7.32	25.54	3.49	0.19	0.656	1.183
96.20	0.11	132.09	32.47	40.03	1.750	6.562	0.07	1.44	7.56	26.64	3.52	0.18	0.687	1.231
102.20	0.11	138.06	32.20	40.02	1.844	6.569	0.08	1.51	7.83	27.80	3.55	0.16	0.719	1.283
108.20	0.12	144.05	31.95	40.03	1.940	6.575	0.08	1.57	8.08	28.94	3.58	0.14	0.751	1.333
114.22	0.12	149.69	31.66	40.02	2.043	6.582	0.09	1.63	8.37	30.07	3.59	0.12	0.781	1.384
120.22	0.13	155.35	31.38	40.02	2.142	6.589	0.09	1.69	8.65	31.19	3.60	0.10	0.811	1.434
126.22	0.14	161.60	31.10	40.03	2.250	6.596	0.09	1.76	8.93	32.38	3.63	0.08	0.844	1.487
132.22	0.14	165.89	30.81	40.02	2.345	6.602	0.10	1.80	9.22	33.31	3.61	0.06	0.867	1.531
138.23	0.15	172.31	30.50	40.01	2.445	6.609	0.10	1.87	9.53	34.56	3.63	0.03	0.901	1.587
144.23	0.15	178.26	30.23	40.03	2.541	6.616	0.11	1.93	9.80	35.71	3.64	0.02	0.933	1.638
150.23	0.16	183.10	29.92	40.02	2.634	6.622	0.11	1.98	10.11	36.73	3.63	-0.01	0.958	1.686

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01
Boring No.: MW-104
Sample No.: -
Specimen No.: A
Depth (ft.): 30.0-32.0

Initial Height., H_o (in): 6.085
Initial Diameter, D_o (in): 2.874
Membrane Thickness (in): 0.02
Ht Change at End of Consol.,ΔH_o (in): 0.010 H_c 6.075
Ht Change at End of Saturation, H_s (in): 0.001
Volume change during Consol. V_c (cc^3): 4.85 0.29585 in^3

Confining Pressure (psi): 10.00
Initial Volume, V_o (in^3): 39.48
Initial Area, A_o (in^2): 6.49
Area after Consol., A_c (in^2): 6.45
Piston Correction (lbs): 6.9

Elasped Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
156.23	0.17	189.01	29.60	40.02	2.740	6.629	0.11	2.04	10.43	37.90	3.63	-0.03	0.989	1.740
162.25	0.17	194.18	29.31	40.04	2.833	6.635	0.12	2.10	10.71	38.94	3.63	-0.05	1.016	1.788
168.25	0.18	200.62	29.01	40.03	2.937	6.643	0.12	2.17	11.02	40.19	3.65	-0.07	1.050	1.843
174.25	0.18	206.00	28.70	40.03	3.042	6.650	0.13	2.22	11.33	41.27	3.64	-0.09	1.078	1.893
180.25	0.19	211.05	28.41	40.04	3.132	6.656	0.13	2.27	11.62	42.30	3.64	-0.12	1.104	1.941
186.27	0.20	216.51	28.08	40.04	3.240	6.663	0.14	2.33	11.95	43.41	3.63	-0.14	1.133	1.993
192.27	0.20	222.26	27.78	40.03	3.342	6.670	0.14	2.39	12.25	44.54	3.64	-0.16	1.162	2.045
198.27	0.21	226.77	27.48	40.04	3.429	6.676	0.14	2.44	12.55	45.48	3.63	-0.18	1.186	2.089
204.27	0.21	232.50	27.17	40.04	3.535	6.684	0.15	2.49	12.86	46.62	3.62	-0.21	1.215	2.141
210.27	0.22	237.79	26.86	40.04	3.636	6.691	0.15	2.55	13.17	47.68	3.62	-0.23	1.242	2.191
216.27	0.23	242.73	26.56	40.05	3.737	6.698	0.16	2.60	13.47	48.68	3.61	-0.25	1.268	2.237
222.28	0.23	248.01	26.26	40.04	3.836	6.705	0.16	2.65	13.77	49.74	3.61	-0.27	1.295	2.286
223.47	0.23	247.77	26.19	40.04	3.859	6.706	0.16	2.65	13.84	49.76	3.60	-0.28	1.293	2.290

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01
Boring No.: MW-104
Sample No.: -
Specimen No.: A
Depth (ft.): 30.0-32.0

Initial Height., H_o (in): 6.085
Initial Diameter, D_o (in): 2.874
Membr. Thickness (in): 0.02
Ht Change at End of Consol.,ΔH_o (in): 0.188 H_c 5.897
Ht Change at End of Saturation, H_s (in): 0.000
Volume change during Consol. V_c (cc^3): 9.11 0.55571 in^3

Confining Pressure (psi): 25.00
Initial Volume, V_o (in^3): 39.48
Initial Area, A_o (in^2): 6.49
Area after Consol., A_c (in^2): 6.60
Piston Correction (lbs): 12.8

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
0.00	0.19	14.76	30.00	55.01	3.171	6.817	0.13	0.15	25.01	25.30	1.01	0.00	0.01	1.81
1.52	0.19	38.04	31.59	55.00	3.198	6.819	0.13	0.39	23.42	27.12	1.16	0.11	0.13	1.82
3.02	0.19	56.72	32.64	55.01	3.219	6.821	0.13	0.59	22.37	28.81	1.29	0.19	0.23	1.84
4.52	0.19	71.01	33.42	55.00	3.246	6.823	0.14	0.74	21.59	30.12	1.40	0.25	0.31	1.86
6.02	0.19	83.67	34.08	55.00	3.271	6.824	0.14	0.87	20.93	31.31	1.50	0.29	0.37	1.88
7.52	0.19	95.36	34.61	55.00	3.291	6.826	0.14	1.00	20.39	32.49	1.59	0.33	0.44	1.90
9.02	0.20	106.28	35.03	55.01	3.319	6.828	0.14	1.11	19.98	33.67	1.69	0.36	0.49	1.93
10.52	0.20	115.23	35.37	55.00	3.343	6.829	0.14	1.20	19.64	34.63	1.76	0.39	0.54	1.95
12.02	0.20	123.35	35.64	55.01	3.370	6.831	0.14	1.29	19.37	35.55	1.84	0.41	0.58	1.98
13.52	0.20	132.58	35.84	55.02	3.392	6.833	0.14	1.39	19.17	36.70	1.91	0.42	0.63	2.01
15.02	0.20	140.35	35.99	55.01	3.411	6.834	0.14	1.47	19.02	37.68	1.98	0.43	0.67	2.04
16.52	0.20	147.81	36.10	55.01	3.441	6.836	0.14	1.55	18.91	38.66	2.04	0.44	0.71	2.07
18.02	0.20	155.60	36.17	55.00	3.473	6.839	0.14	1.63	18.84	39.72	2.11	0.44	0.75	2.11
19.52	0.21	163.25	36.22	55.01	3.488	6.840	0.15	1.71	18.79	40.78	2.17	0.45	0.79	2.14
21.02	0.21	170.20	36.24	55.01	3.514	6.842	0.15	1.78	18.77	41.78	2.23	0.45	0.83	2.18
22.52	0.21	177.90	36.24	55.00	3.529	6.843	0.15	1.86	18.77	42.89	2.29	0.45	0.87	2.22
24.02	0.21	184.41	36.22	55.00	3.555	6.844	0.15	1.93	18.79	43.86	2.33	0.45	0.90	2.26
25.52	0.21	190.57	36.20	55.00	3.585	6.847	0.15	1.99	18.81	44.77	2.38	0.45	0.93	2.29
27.02	0.21	197.73	36.16	55.00	3.605	6.848	0.15	2.07	18.85	45.86	2.43	0.44	0.97	2.33
28.52	0.21	204.52	36.10	55.00	3.634	6.850	0.15	2.14	18.91	46.90	2.48	0.44	1.01	2.37
30.02	0.22	210.97	36.05	55.01	3.657	6.852	0.15	2.21	18.96	47.88	2.53	0.44	1.04	2.41
31.52	0.22	218.14	35.97	55.01	3.688	6.854	0.15	2.28	19.04	49.00	2.57	0.43	1.08	2.45
33.02	0.22	224.27	35.90	55.01	3.712	6.856	0.15	2.34	19.11	49.96	2.61	0.42	1.11	2.49
34.53	0.22	230.17	35.82	55.01	3.734	6.857	0.16	2.41	19.19	50.89	2.65	0.42	1.14	2.52
36.03	0.22	235.79	35.73	55.00	3.759	6.859	0.16	2.46	19.28	51.79	2.69	0.41	1.17	2.56
37.53	0.22	241.59	35.63	55.00	3.785	6.861	0.16	2.52	19.37	52.72	2.72	0.41	1.20	2.60
39.03	0.22	247.83	35.54	55.01	3.811	6.863	0.16	2.59	19.46	53.71	2.76	0.40	1.23	2.63
40.53	0.23	253.87	35.45	55.01	3.835	6.864	0.16	2.65	19.56	54.68	2.80	0.39	1.26	2.67
42.03	0.23	258.58	35.36	55.00	3.859	6.866	0.16	2.70	19.65	55.44	2.82	0.39	1.29	2.70
43.53	0.23	264.18	35.26	55.00	3.886	6.868	0.16	2.76	19.75	56.35	2.85	0.38	1.32	2.74
45.03	0.23	270.13	35.15	55.00	3.913	6.870	0.16	2.82	19.86	57.32	2.89	0.37	1.35	2.78
46.53	0.23	274.90	35.05	55.00	3.937	6.872	0.16	2.87	19.95	58.10	2.91	0.36	1.37	2.81
48.03	0.23	280.17	34.96	55.01	3.961	6.873	0.17	2.92	20.05	58.95	2.94	0.36	1.40	2.84
49.53	0.24	284.76	34.85	55.01	3.992	6.876	0.17	2.97	20.16	59.71	2.96	0.35	1.42	2.88
51.03	0.24	289.85	34.74	55.01	4.007	6.877	0.17	3.02	20.27	60.56	2.99	0.34	1.45	2.91
52.53	0.24	294.06	34.63	55.01	4.034	6.879	0.17	3.07	20.38	61.27	3.01	0.33	1.47	2.94
54.05	0.24	297.98	34.53	55.00	4.059	6.880	0.17	3.11	20.48	61.93	3.02	0.33	1.49	2.97
55.55	0.24	302.29	34.42	55.00	4.082	6.882	0.17	3.15	20.59	62.65	3.04	0.32	1.51	3.00
57.05	0.24	307.01	34.32	55.00	4.106	6.884	0.17	3.20	20.69	63.43	3.07	0.31	1.54	3.03
58.55	0.24	311.39	34.19	55.00	4.136	6.886	0.17	3.24	20.82	64.18	3.08	0.30	1.56	3.06
60.05	0.25	314.47	34.09	55.00	4.159	6.888	0.17	3.27	20.92	64.72	3.09	0.29	1.58	3.08
66.05	0.25	329.33	33.65	55.01	4.263	6.895	0.18	3.43	21.36	67.27	3.15	0.26	1.65	3.19
72.05	0.26	342.46	33.20	55.00	4.359	6.902	0.18	3.56	21.81	69.57	3.19	0.23	1.72	3.29
78.05	0.26	354.81	32.73	54.99	4.466	6.910	0.19	3.68	22.28	71.78	3.22	0.20	1.78	3.39
84.05	0.27	364.96	32.28	55.00	4.568	6.917	0.19	3.79	22.73	73.64	3.24	0.16	1.83	3.47
90.05	0.28	375.65	31.83	55.00	4.674	6.925	0.20	3.89	23.18	75.58	3.26	0.13	1.89	3.56
96.05	0.28	386.18	31.35	55.00	4.770	6.932	0.20	4.00	23.66	77.53	3.28	0.10	1.94	3.64
102.05	0.29	395.06	30.91	55.00	4.872	6.939	0.20	4.08	24.10	79.19	3.29	0.07	1.98	3.72
108.05	0.29	403.76	30.49	54.99	4.967	6.946	0.21	4.17	24.52	80.81	3.30	0.04	2.03	3.79
114.05	0.30	413.31	30.01	55.00	5.071	6.954	0.21	4.26	25.00	82.59	3.30	0.00	2.07	3.87
120.05	0.30	422.13	29.57	55.01	5.167	6.961	0.22	4.35	25.44	84.24	3.31	-0.03	2.12	3.95
126.07	0.31	429.66	29.14	55.00	5.275	6.969	0.22	4.42	25.87	85.69	3.31	-0.06	2.15	4.02
132.07	0.32	439.01	28.72	55.00	5.376	6.976	0.22	4.51	26.29	87.39	3.32	-0.09	2.20	4.09
138.07	0.32	446.89	28.29	55.00	5.487	6.984	0.23	4.59	26.72	88.87	3.33	-0.12	2.24	4.16
144.07	0.33	454.35	27.85	54.99	5.581	6.991	0.23	4.66	27.16	90.32	3.33	-0.15	2.27	4.23
150.07	0.34	461.61	27.44	54.99	5.681	6.999	0.24	4.73	27.57	91.69	3.33	-0.18	2.31	4.29
156.07	0.34	469.36	27.02	54.99	5.787	7.007	0.24	4.81	27.99	93.15	3.33	-0.21	2.35	4.36

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01
Boring No.: MW-104
Sample No.: -
Specimen No.: A
Depth (ft.): 30.0-32.0

Initial Height., H_o (in): 6.085
Initial Diameter, D_o (in): 2.874
Membr. Thickness (in): 0.02
Ht Change at End of Consol.,ΔH_o (in): 0.188 H_c 5.897
Ht Change at End of Saturation, H_s (in): 0.000
Volume change during Consol. V_c (cc^3): 9.11 0.55571 in^3

Confining Pressure (psi): 25.00
Initial Volume, V_o (in^3): 39.48
Initial Area, A_o (in^2): 6.49
Area after Consol., A_c (in^2): 6.60
Piston Correction (lbs): 12.8

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
162.07	0.35	476.63	26.61	54.98	5.886	7.014	0.25	4.88	28.40	94.53	3.33	-0.24	2.38	4.43
168.07	0.35	483.72	26.21	54.99	5.990	7.022	0.25	4.94	28.80	95.86	3.33	-0.27	2.41	4.49
174.07	0.36	491.48	25.81	54.99	6.098	7.030	0.25	5.02	29.20	97.29	3.33	-0.30	2.45	4.55
180.08	0.37	497.97	25.44	54.99	6.205	7.038	0.26	5.08	29.57	98.51	3.33	-0.33	2.48	4.61
186.08	0.37	504.70	25.03	54.98	6.302	7.045	0.26	5.14	29.98	99.80	3.33	-0.36	2.51	4.67
192.08	0.38	510.94	24.67	54.99	6.396	7.052	0.27	5.20	30.34	100.98	3.33	-0.38	2.54	4.73
198.08	0.38	518.57	24.28	54.99	6.510	7.061	0.27	5.27	30.73	102.36	3.33	-0.41	2.58	4.79
204.08	0.39	525.02	23.90	54.98	6.609	7.068	0.28	5.33	31.11	103.57	3.33	-0.44	2.61	4.85
210.08	0.40	530.93	23.55	54.99	6.710	7.076	0.28	5.38	31.46	104.68	3.33	-0.46	2.64	4.90
216.08	0.40	538.10	23.15	54.99	6.816	7.084	0.28	5.45	31.86	106.02	3.33	-0.49	2.67	4.96
222.08	0.41	544.62	22.80	54.98	6.916	7.092	0.29	5.51	32.21	107.20	3.33	-0.52	2.70	5.02
228.08	0.41	550.07	22.44	54.98	7.015	7.099	0.29	5.56	32.57	108.25	3.32	-0.54	2.72	5.07
234.08	0.42	556.14	22.08	54.97	7.118	7.107	0.30	5.61	32.93	109.38	3.32	-0.57	2.75	5.12
239.92	0.43	561.96	21.74	54.96	7.215	7.114	0.30	5.67	33.27	110.45	3.32	-0.59	2.78	5.17

Report No.:

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01
Boring No.: MW-104
Sample No.: -
Specimen No.: A
Depth (ft.): 30.0-32.0

Initial Height., H_o (in): 6.085
Initial Diameter, D_o (in): 2.874
Membr. Thickness (in): 0.02
t Change at End of Consol.,ΔH_o (in): 0.360 H_c 5.725
Change at End of Saturation, H_s (in): 0.000
ume change during Consol. V_c (cc^3): 12.73 0.77653 in^3

Confining Pressure (psi): 50.00
Initial Volume, V_o (in^3): 39.48
Initial Area, A_o (in^2): 6.49
Area after Consol., A_c (in^2): 6.76
Piston Correction (lbs): 15.43

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
0.00	0.36	19.81	30.00	80.01	6.287	7.215	0.26	0.00	50.01	50.62	1.01	0.00	0.02	3.62
1.50	0.361	31.76	30.83	80.01	6.305	7.216	0.26	0.30	49.19	51.45	1.05	0.06	0.08	3.62
3.02	0.362	55.78	32.07	80.00	6.328	7.218	0.26	0.54	47.94	53.53	1.12	0.15	0.20	3.65
4.52	0.364	80.57	33.40	80.03	6.357	7.220	0.27	0.78	46.61	55.63	1.19	0.24	0.32	3.68
6.02	0.365	103.83	34.63	80.03	6.383	7.222	0.27	1.02	45.39	57.63	1.27	0.33	0.44	3.71
7.52	0.366	126.84	35.81	80.03	6.398	7.223	0.27	1.25	44.20	59.63	1.35	0.42	0.56	3.74
9.02	0.367	149.45	36.98	80.02	6.417	7.225	0.27	1.47	43.04	61.59	1.43	0.50	0.67	3.77
10.53	0.369	171.68	38.05	80.02	6.442	7.227	0.27	1.69	41.97	63.59	1.52	0.58	0.78	3.80
12.03	0.370	191.54	38.98	80.02	6.470	7.229	0.27	1.89	41.04	65.40	1.59	0.65	0.88	3.83
13.53	0.372	210.62	39.77	80.01	6.496	7.231	0.27	2.08	40.24	67.23	1.67	0.70	0.97	3.87
15.03	0.373	227.30	40.43	80.02	6.518	7.233	0.27	2.24	39.59	68.88	1.74	0.75	1.05	3.90
16.55	0.375	243.60	40.97	80.00	6.543	7.234	0.27	2.40	39.04	70.58	1.81	0.79	1.14	3.95
18.05	0.376	258.68	41.42	80.00	6.563	7.236	0.27	2.55	38.59	72.21	1.87	0.82	1.21	3.99
19.55	0.377	272.16	41.77	80.00	6.585	7.238	0.27	2.69	38.24	73.71	1.93	0.85	1.28	4.03
21.05	0.379	287.08	42.10	80.03	6.619	7.240	0.28	2.83	37.91	75.43	1.99	0.87	1.35	4.08
22.55	0.380	300.67	42.34	80.03	6.635	7.242	0.28	2.97	37.68	77.07	2.05	0.89	1.42	4.13
24.05	0.381	313.55	42.50	80.04	6.661	7.244	0.28	3.10	37.51	78.67	2.10	0.90	1.48	4.18
25.55	0.383	328.05	42.61	80.02	6.696	7.246	0.28	3.24	37.40	80.54	2.15	0.91	1.55	4.25
27.07	0.384	341.11	42.68	80.01	6.715	7.248	0.28	3.37	37.34	82.27	2.20	0.91	1.62	4.31
28.57	0.386	353.31	42.71	80.01	6.734	7.249	0.28	3.49	37.30	83.91	2.25	0.91	1.68	4.36
30.07	0.387	366.17	42.70	80.00	6.763	7.251	0.28	3.62	37.31	85.68	2.30	0.91	1.74	4.43
31.57	0.389	378.72	42.66	80.00	6.791	7.254	0.28	3.74	37.36	87.44	2.34	0.91	1.80	4.49
33.08	0.390	391.44	42.58	79.99	6.818	7.256	0.28	3.86	37.43	89.25	2.38	0.91	1.87	4.56
34.58	0.391	402.91	42.49	79.99	6.833	7.257	0.29	3.98	37.52	90.91	2.42	0.90	1.92	4.62
36.08	0.393	415.44	42.40	80.00	6.867	7.260	0.29	4.10	37.61	92.71	2.47	0.89	1.98	4.69
37.60	0.395	426.83	42.31	80.02	6.899	7.262	0.29	4.21	37.70	94.35	2.50	0.89	2.04	4.75
39.10	0.396	438.02	42.17	80.01	6.917	7.263	0.29	4.32	37.84	96.03	2.54	0.88	2.09	4.82
40.60	0.398	449.39	42.01	80.02	6.944	7.266	0.29	4.43	38.01	97.74	2.57	0.86	2.15	4.89
42.12	0.399	461.02	41.85	80.01	6.965	7.267	0.29	4.55	38.16	99.48	2.61	0.85	2.21	4.96
43.62	0.400	473.28	41.67	80.00	6.991	7.269	0.29	4.67	38.34	101.33	2.64	0.84	2.27	5.03
45.12	0.402	484.12	41.49	80.01	7.016	7.271	0.29	4.77	38.53	102.98	2.67	0.83	2.32	5.09
46.62	0.403	496.23	41.30	79.99	7.044	7.273	0.29	4.89	38.72	104.82	2.71	0.81	2.38	5.17
48.13	0.404	506.37	41.11	80.00	7.061	7.275	0.29	4.99	38.90	106.39	2.73	0.80	2.43	5.23
49.63	0.406	518.96	40.91	79.99	7.091	7.277	0.30	5.11	39.10	108.30	2.77	0.79	2.49	5.31
51.13	0.407	529.52	40.70	79.99	7.117	7.279	0.30	5.22	39.31	109.94	2.80	0.77	2.54	5.37
52.65	0.409	540.87	40.51	80.01	7.142	7.281	0.30	5.33	39.50	111.67	2.83	0.76	2.60	5.44
54.15	0.410	551.95	40.31	80.02	7.166	7.283	0.30	5.44	39.71	113.37	2.86	0.74	2.65	5.51
55.65	0.411	561.35	40.10	80.01	7.179	7.284	0.30	5.53	39.91	114.86	2.88	0.73	2.70	5.57
57.15	0.413	572.16	39.90	80.01	7.219	7.287	0.30	5.63	40.12	116.52	2.90	0.71	2.75	5.64
58.65	0.415	581.13	39.70	80.01	7.247	7.289	0.30	5.72	40.31	117.92	2.93	0.70	2.79	5.70
60.15	0.416	591.20	39.50	80.00	7.265	7.291	0.30	5.82	40.51	119.48	2.95	0.68	2.84	5.76
66.15	0.422	629.53	38.70	79.98	7.375	7.299	0.31	6.19	41.32	125.45	3.04	0.63	3.03	6.00
72.15	0.428	661.90	37.96	80.02	7.471	7.307	0.31	6.50	42.05	130.52	3.10	0.57	3.19	6.21
78.15	0.434	690.71	37.19	80.01	7.577	7.315	0.32	6.78	42.83	135.14	3.16	0.52	3.32	6.41
84.17	0.440	718.24	36.43	79.98	7.685	7.324	0.32	7.04	43.58	139.54	3.20	0.46	3.45	6.59
90.17	0.445	739.39	35.78	80.02	7.774	7.331	0.32	7.24	44.24	142.99	3.23	0.42	3.56	6.74
96.17	0.451	760.47	35.03	79.99	7.884	7.340	0.33	7.44	44.99	146.49	3.26	0.36	3.65	6.89
102.17	0.458	780.40	34.35	80.01	7.992	7.348	0.33	7.62	45.66	149.76	3.28	0.31	3.75	7.04
108.18	0.463	796.03	33.65	80.01	8.095	7.357	0.34	7.77	46.37	152.47	3.29	0.26	3.82	7.16
114.18	0.469	810.87	32.99	79.99	8.196	7.365	0.34	7.90	47.02	155.03	3.30	0.21	3.89	7.27
120.18	0.475	825.99	32.37	80.01	8.301	7.373	0.35	8.04	47.65	157.58	3.31	0.17	3.96	7.39
126.18	0.481	839.21	31.72	80.02	8.404	7.381	0.35	8.16	48.30	159.90	3.31	0.12	4.02	7.50
132.20	0.487	852.03	31.10	79.99	8.508	7.390	0.36	8.28	48.91	162.12	3.31	0.08	4.08	7.60
138.20	0.493	865.48	30.49	80.00	8.616	7.399	0.36	8.40	49.53	164.42	3.32	0.03	4.14	7.70
144.20	0.499	876.73	29.90	80.00	8.723	7.407	0.36	8.50	50.11	166.39	3.32	-0.01	4.19	7.79

Report No.:

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01
Boring No.: MW-104
Sample No.: -
Specimen No.: A
Depth (ft.): 30.0-32.0

Initial Height., H_o (in): 6.085
Initial Diameter, D_o (in): 2.874
Membr. Thickness (in): 0.02
t Change at End of Consol.,ΔH_o (in): 0.360 H_c 5.725
Change at End of Saturation, H_s (in): 0.000
ume change during Consol. V_c (cc^3): 12.73 0.77653 in^3

Confining Pressure (psi): 50.00
Initial Volume, V_o (in^3): 39.48
Initial Area, A_o (in^2): 6.49
Area after Consol., A_c (in^2): 6.76
Piston Correction (lbs): 15.43

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
150.20	0.505	886.43	29.35	80.01	8.819	7.415	0.37	8.58	50.66	168.13	3.32	-0.05	4.23	7.88
156.20	0.511	899.54	28.77	80.00	8.925	7.424	0.37	8.70	51.24	170.34	3.32	-0.09	4.29	7.98
162.22	0.517	909.96	28.21	80.01	9.038	7.433	0.38	8.79	51.81	172.16	3.32	-0.13	4.33	8.06
168.22	0.523	919.70	27.67	80.02	9.139	7.441	0.38	8.87	52.35	173.87	3.32	-0.17	4.37	8.14
174.22	0.529	929.48	27.16	79.99	9.247	7.450	0.39	8.96	52.85	175.54	3.32	-0.20	4.42	8.22
180.22	0.536	938.52	26.61	80.00	9.355	7.459	0.39	9.03	53.40	177.16	3.32	-0.24	4.46	8.30
186.23	0.541	949.04	26.10	80.01	9.457	7.467	0.39	9.12	53.92	178.94	3.32	-0.28	4.50	8.38
192.23	0.547	958.07	25.60	79.99	9.563	7.476	0.40	9.20	54.42	180.50	3.32	-0.32	4.54	8.46
198.23	0.553	966.57	25.10	79.99	9.665	7.484	0.40	9.27	54.91	182.00	3.31	-0.35	4.57	8.53
204.23	0.559	975.43	24.64	80.01	9.765	7.493	0.41	9.34	55.37	183.50	3.31	-0.39	4.61	8.60
210.25	0.565	985.16	24.13	79.99	9.876	7.502	0.41	9.43	55.88	185.15	3.31	-0.42	4.65	8.68
216.25	0.571	992.27	23.69	80.03	9.979	7.511	0.42	9.48	56.33	186.39	3.31	-0.45	4.68	8.74
222.25	0.577	1001.51	23.22	80.00	10.084	7.519	0.42	9.56	56.80	187.94	3.31	-0.49	4.72	8.81
228.25	0.583	1010.29	22.75	79.98	10.187	7.528	0.43	9.63	57.27	189.42	3.31	-0.52	4.76	8.88
234.25	0.589	1016.99	22.33	80.01	10.291	7.537	0.43	9.68	57.68	190.57	3.30	-0.55	4.78	8.94
240.25	0.595	1024.30	21.87	80.00	10.400	7.546	0.43	9.74	58.14	191.84	3.30	-0.59	4.81	9.00
246.25	0.601	1032.55	21.43	79.98	10.505	7.555	0.44	9.81	58.58	193.22	3.30	-0.62	4.85	9.06
252.27	0.607	1038.00	21.02	80.01	10.606	7.563	0.44	9.85	58.99	194.20	3.29	-0.65	4.87	9.11
258.27	0.613	1047.04	20.57	80.00	10.715	7.572	0.45	9.92	59.44	195.67	3.29	-0.68	4.90	9.18
264.27	0.620	1054.07	20.18	79.98	10.826	7.582	0.45	9.98	59.83	196.82	3.29	-0.71	4.93	9.24
270.27	0.626	1060.65	19.75	80.02	10.929	7.591	0.46	10.03	60.26	197.96	3.29	-0.74	4.96	9.30
276.28	0.632	1067.15	19.33	80.00	11.036	7.600	0.46	10.08	60.69	199.07	3.28	-0.77	4.98	9.35
282.28	0.638	1075.34	18.95	80.01	11.142	7.609	0.47	10.14	61.06	200.36	3.28	-0.80	5.01	9.41
288.28	0.643	1081.38	18.56	80.01	11.233	7.617	0.47	10.19	61.45	201.40	3.28	-0.82	5.04	9.46
294.30	0.649	1087.82	18.14	79.99	11.341	7.626	0.47	10.24	61.87	202.50	3.27	-0.85	5.06	9.52
300.30	0.656	1094.60	17.78	80.02	11.461	7.636	0.48	10.29	62.24	203.56	3.27	-0.88	5.09	9.57
315.30	0.671	1106.32	16.89	80.03	11.723	7.659	0.49	10.37	63.12	205.56	3.26	-0.94	5.13	9.67
330.32	0.686	1124.79	15.93	79.99	11.983	7.682	0.50	10.51	64.08	208.50	3.25	-1.01	5.20	9.81
345.32	0.702	1140.52	15.06	79.98	12.255	7.705	0.51	10.62	64.95	210.96	3.25	-1.08	5.26	9.93
360.32	0.716	1157.19	14.21	79.98	12.507	7.728	0.52	10.74	65.80	213.55	3.25	-1.14	5.32	10.06
375.32	0.732	1169.17	13.42	80.00	12.784	7.752	0.53	10.82	66.60	215.43	3.23	-1.19	5.36	10.15
390.33	0.746	1183.57	12.62	80.01	13.038	7.775	0.54	10.92	67.39	217.64	3.23	-1.25	5.41	10.26
405.33	0.762	1197.10	11.86	79.99	13.307	7.799	0.56	11.01	68.15	219.67	3.22	-1.31	5.45	10.36
420.33	0.777	1212.36	11.17	79.99	13.567	7.822	0.57	11.12	68.84	221.86	3.22	-1.36	5.51	10.47
435.33	0.792	1223.97	10.49	80.00	13.841	7.847	0.58	11.19	69.52	223.53	3.22	-1.40	5.54	10.55
450.33	0.807	1235.64	9.90	80.01	14.092	7.870	0.59	11.26	70.11	225.15	3.21	-1.45	5.58	10.63
465.33	0.822	1247.07	9.19	80.02	14.364	7.895	0.60	11.33	70.82	226.82	3.20	-1.50	5.62	10.71
480.35	0.838	1257.91	8.61	80.01	14.637	7.920	0.61	11.39	71.40	228.27	3.20	-1.54	5.65	10.79
495.35	0.853	1268.34	7.97	80.01	14.896	7.944	0.62	11.45	72.05	229.75	3.19	-1.59	5.68	10.86
510.35	0.868	1281.72	7.34	79.98	15.166	7.970	0.63	11.53	72.68	231.57	3.19	-1.63	5.72	10.95
525.35	0.883	1298.07	6.72	79.98	15.430	7.995	0.64	11.64	73.29	233.73	3.19	-1.68	5.78	11.05
540.35	0.899	1307.12	6.14	79.99	15.696	8.020	0.66	11.69	73.87	234.93	3.18	-1.72	5.80	11.12
555.37	0.913	1317.67	5.54	80.00	15.952	8.044	0.67	11.75	74.47	236.36	3.17	-1.76	5.83	11.19
570.37	0.929	1329.18	5.00	79.99	16.220	8.070	0.68	11.81	75.01	237.81	3.17	-1.80	5.86	11.26
585.37	0.944	1341.10	4.46	79.99	16.487	8.096	0.69	11.88	75.55	239.30	3.17	-1.84	5.89	11.33
600.37	0.959	1349.74	3.97	80.00	16.756	8.122	0.70	11.91	76.04	240.33	3.16	-1.87	5.91	11.39
615.37	0.974	1359.64	3.47	80.02	17.018	8.148	0.71	11.96	76.55	241.53	3.16	-1.91	5.94	11.45
630.38	0.989	1366.53	3.06	80.02	17.277	8.173	0.72	11.99	76.96	242.27	3.15	-1.94	5.95	11.49
645.38	1.005	1377.79	2.62	80.01	17.549	8.200	0.73	12.04	77.39	243.53	3.15	-1.97	5.98	11.55
660.38	1.020	1385.15	2.23	80.01	17.818	8.227	0.74	12.07	77.78	244.28	3.14	-2.00	5.99	11.59
675.38	1.035	1389.52	1.85	79.98	18.079	8.253	0.75	12.07	78.16	244.66	3.13	-2.03	5.99	11.62
690.38	1.050	1394.94	1.47	80.00	18.339	8.279	0.77	12.08	78.55	245.16	3.12	-2.05	6.00	11.65
705.40	1.066	1401.12	1.19	80.00	18.612	8.307	0.78	12.09	78.82	245.63	3.12	-2.07	6.00	11.68
720.40	1.080	1413.26	0.91	79.99	18.866	8.333	0.79	12.15	79.10	246.84	3.12	-2.09	6.04	11.73
735.42	1.095	1424.45	0.67	80.00	19.134	8.361	0.80	12.21	79.35	247.87	3.12	-2.11	6.07	11.78

Report No.:

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01

Boring No.: MW-104

Sample No.: -

Specimen No.: A

Depth (ft.): 30.0-32.0

Initial Height., H_o (in): 6.085

Initial Diameter, D_o (in): 2.874

Membr. Thickness (in): 0.02

t Change at End of Consol.,ΔH_o (in): 0.360 H_c 5.725

Change at End of Saturation, H_s (in): 0.000

ume change during Consol. V_c (cc^3): 12.73 0.77653 in^3

Confining Pressure (psi): 50.00

Initial Volume, V_o (in^3): 39.48

Initial Area, A_o (in^2): 6.49

Area after Consol., A_c (in^2): 6.76

Piston Correction (lbs): 15.43

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
750.42	1.110	1430.28	0.41	80.01	19.397	8.388	0.81	12.22	79.61	248.28	3.12	-2.13	6.07	11.80
765.42	1.126	1437.35	0.19	80.02	19.664	8.416	0.82	12.24	79.82	248.78	3.12	-2.15	6.08	11.83
780.10	1.141	1444.42	-0.05	80.00	19.922	8.443	0.83	12.26	80.06	249.31	3.11	-2.16	6.09	11.86

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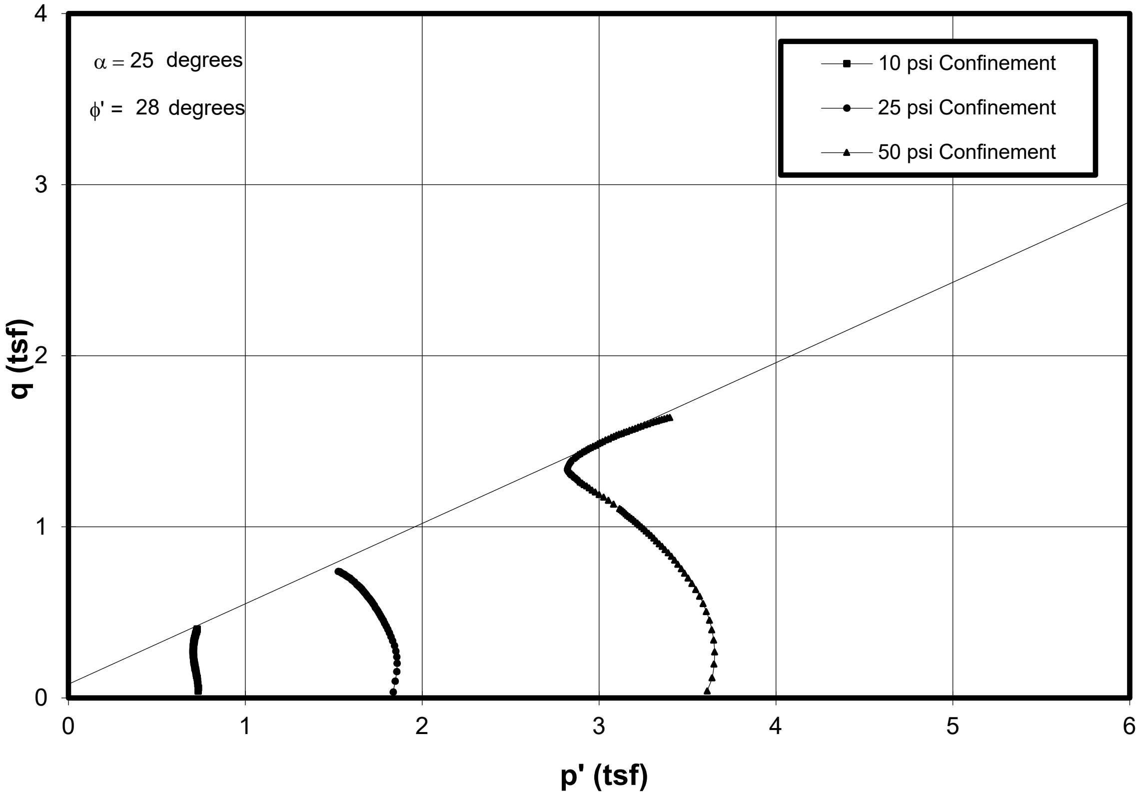
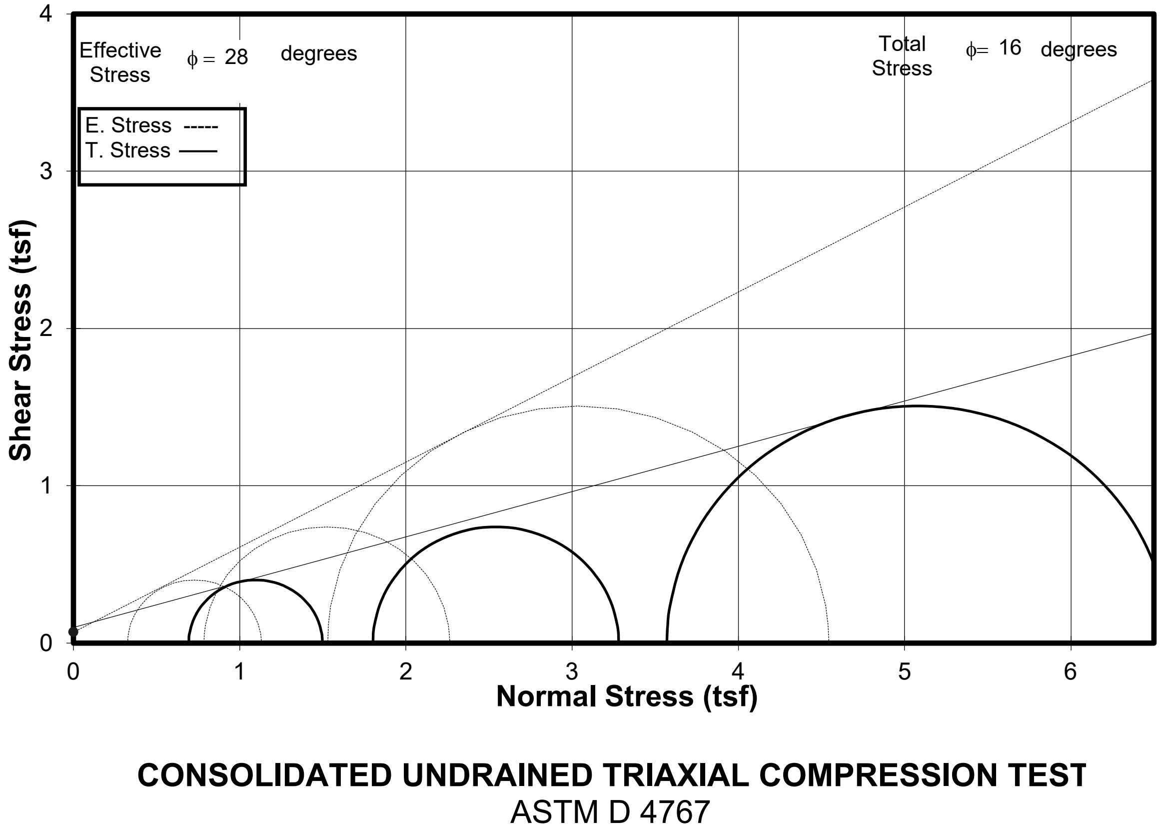
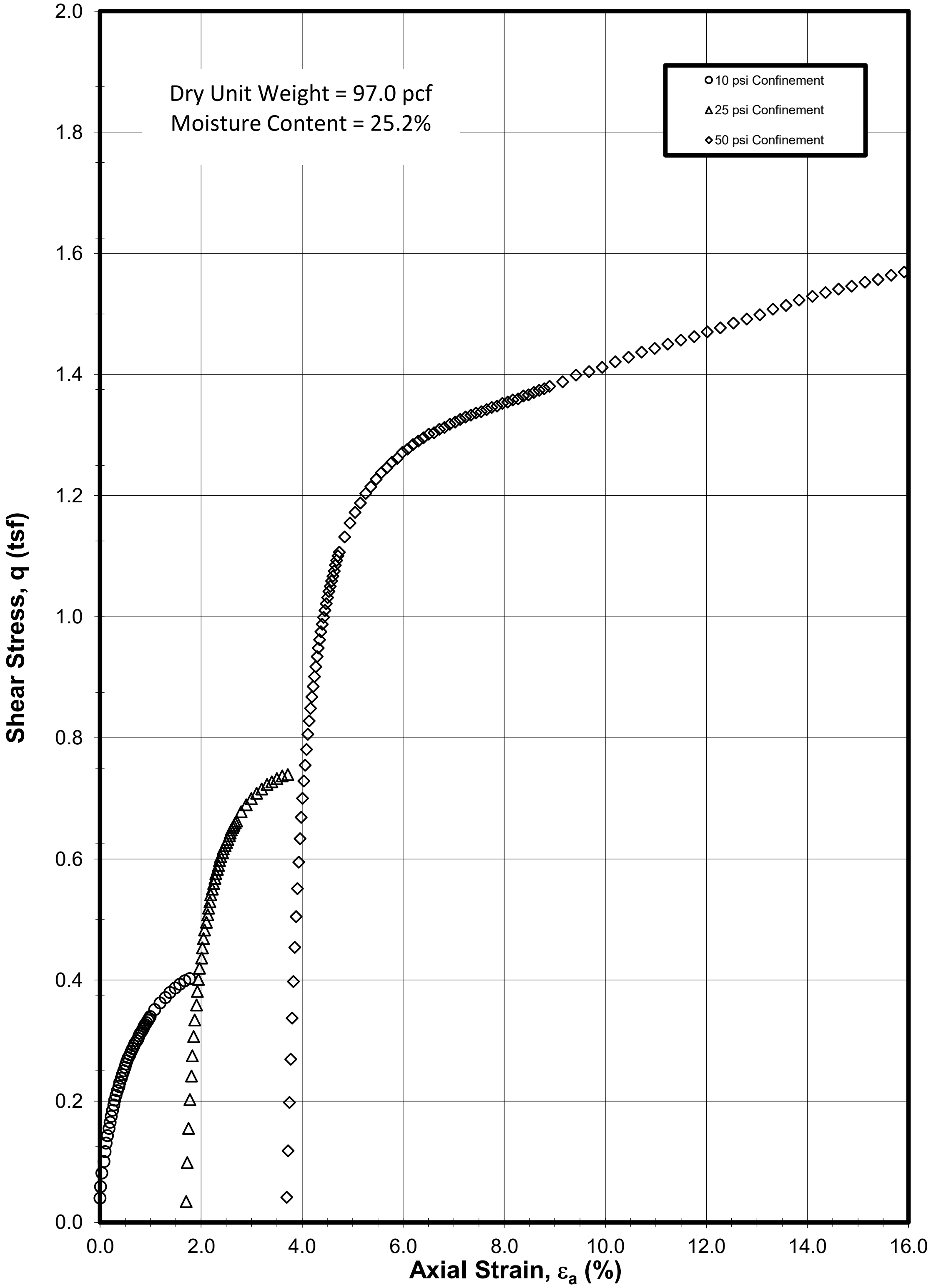




CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

ASTM D 4767
Project No.: J038678.01
Boring: MW-105
Sample Depth: 10.0-12.0



CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

ASTM D 4767
Project No.: J038678.01
Boring: MW-105
Sample Depth: 10.0-12.0

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01
Boring No.: MW-105
Sample No.: -
Specimen No.: A
Depth (ft.): 10.0-12.0

Initial Height., H_o (in): 5.664
Initial Diameter, D_o (in): 2.864
Membrane Thickness (in): 0.02
Ht Change at End of Consol.,ΔH_o (in): 0.018 H_c 5.646
Ht Change at End of Saturation, H_s (in): 0.000
Volume change during Consol. V_c (cc^3): 5.61 0.34221 in^3

Confining Pressure (psi): 10.00
Initial Volume, V_o (in^3): 36.49
Initial Area, A_o (in^2): 6.44
Area after Consol., A_c (in^2): 6.40
Piston Correction (lbs): 7.4

Elasped Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
0.00	0.00	14.50	35.41	45.03	0.000	6.402	0.00	0.16	9.62	10.73	1.12	0.00	0.040	0.732
1.52	0.00	17.88	35.66	45.03	0.012	6.403	0.00	0.20	9.37	11.00	1.17	0.02	0.059	0.733
3.02	0.00	21.87	36.00	45.04	0.038	6.404	0.00	0.25	9.03	11.29	1.25	0.04	0.081	0.731
4.52	0.00	25.24	36.30	45.04	0.077	6.407	0.00	0.28	8.73	11.52	1.32	0.06	0.100	0.729
6.02	0.01	28.14	36.56	45.03	0.099	6.408	0.00	0.32	8.47	11.71	1.38	0.08	0.117	0.726
7.53	0.01	30.67	36.79	45.03	0.123	6.410	0.01	0.34	8.24	11.87	1.44	0.10	0.131	0.724
9.03	0.01	32.91	37.00	45.03	0.146	6.411	0.01	0.37	8.03	12.01	1.50	0.11	0.143	0.721
10.53	0.01	34.98	37.19	45.03	0.177	6.413	0.01	0.39	7.84	12.14	1.55	0.13	0.155	0.719
12.03	0.01	36.83	37.36	45.02	0.200	6.415	0.01	0.41	7.67	12.25	1.60	0.14	0.165	0.717
13.53	0.01	38.57	37.53	45.02	0.222	6.416	0.01	0.43	7.50	12.36	1.65	0.15	0.175	0.715
15.03	0.01	40.33	37.68	45.02	0.249	6.418	0.01	0.45	7.35	12.48	1.70	0.16	0.185	0.714
16.53	0.02	41.92	37.82	45.02	0.275	6.420	0.01	0.47	7.21	12.58	1.75	0.17	0.194	0.712
18.03	0.02	43.41	37.97	45.04	0.291	6.421	0.01	0.49	7.06	12.66	1.79	0.18	0.202	0.710
19.53	0.02	44.79	38.09	45.03	0.315	6.422	0.01	0.50	6.94	12.76	1.84	0.19	0.210	0.709
21.05	0.02	46.11	38.21	45.03	0.344	6.424	0.01	0.52	6.82	12.85	1.88	0.20	0.217	0.708
22.55	0.02	47.38	38.32	45.03	0.372	6.426	0.02	0.53	6.71	12.93	1.93	0.21	0.224	0.707
24.05	0.02	48.62	38.42	45.03	0.390	6.427	0.02	0.54	6.61	13.02	1.97	0.22	0.231	0.707
25.55	0.02	49.86	38.52	45.02	0.423	6.429	0.02	0.56	6.51	13.11	2.01	0.22	0.238	0.706
27.05	0.02	50.99	38.61	45.02	0.442	6.430	0.02	0.57	6.42	13.19	2.06	0.23	0.244	0.706
28.57	0.03	52.09	38.70	45.02	0.469	6.432	0.02	0.58	6.33	13.28	2.10	0.24	0.250	0.706
30.07	0.03	53.12	38.78	45.02	0.497	6.434	0.02	0.59	6.24	13.35	2.14	0.24	0.256	0.705
31.58	0.03	54.11	38.86	45.02	0.513	6.435	0.02	0.60	6.16	13.42	2.18	0.25	0.261	0.705
33.08	0.03	55.03	38.96	45.03	0.535	6.436	0.02	0.61	6.07	13.47	2.22	0.26	0.266	0.704
34.58	0.03	56.00	39.03	45.03	0.558	6.438	0.02	0.62	6.00	13.55	2.26	0.26	0.272	0.704
36.08	0.03	56.92	39.09	45.02	0.594	6.440	0.02	0.63	5.94	13.63	2.30	0.27	0.277	0.704
37.58	0.03	57.85	39.16	45.02	0.615	6.442	0.03	0.64	5.87	13.70	2.33	0.27	0.282	0.705
39.08	0.04	58.70	39.22	45.02	0.646	6.444	0.03	0.65	5.81	13.77	2.37	0.27	0.287	0.705
40.60	0.04	59.57	39.28	45.02	0.669	6.445	0.03	0.66	5.75	13.84	2.41	0.28	0.291	0.705
42.10	0.04	60.34	39.34	45.02	0.690	6.446	0.03	0.67	5.69	13.90	2.44	0.28	0.296	0.705
43.60	0.04	61.06	39.39	45.01	0.728	6.449	0.03	0.68	5.64	13.96	2.48	0.29	0.300	0.705
45.10	0.04	61.80	39.44	45.02	0.753	6.451	0.03	0.69	5.59	14.02	2.51	0.29	0.304	0.706
46.60	0.04	62.63	39.49	45.01	0.773	6.452	0.03	0.70	5.54	14.10	2.55	0.29	0.308	0.707
48.10	0.05	63.36	39.56	45.03	0.799	6.454	0.03	0.70	5.47	14.14	2.58	0.30	0.312	0.706
49.62	0.05	64.07	39.61	45.03	0.827	6.455	0.03	0.71	5.42	14.20	2.62	0.30	0.316	0.707
51.12	0.05	64.78	39.65	45.02	0.853	6.457	0.04	0.72	5.38	14.27	2.65	0.31	0.320	0.707
52.62	0.05	65.40	39.69	45.02	0.873	6.458	0.04	0.73	5.34	14.32	2.68	0.31	0.323	0.708
54.12	0.05	65.95	39.73	45.02	0.894	6.460	0.04	0.73	5.30	14.37	2.71	0.31	0.326	0.708
55.62	0.05	66.55	39.76	45.02	0.921	6.461	0.04	0.74	5.27	14.42	2.74	0.31	0.330	0.709
57.13	0.05	67.24	39.80	45.01	0.951	6.463	0.04	0.75	5.23	14.49	2.77	0.32	0.333	0.710
58.65	0.05	67.82	39.84	45.01	0.969	6.465	0.04	0.75	5.19	14.54	2.80	0.32	0.336	0.710
60.15	0.06	68.41	39.87	45.01	0.991	6.466	0.04	0.76	5.16	14.59	2.83	0.32	0.340	0.711
66.15	0.06	70.56	40.01	45.02	1.084	6.472	0.05	0.78	5.02	14.78	2.94	0.33	0.351	0.713
72.15	0.07	72.55	40.12	45.01	1.189	6.479	0.05	0.80	4.91	14.97	3.05	0.34	0.362	0.716
78.15	0.07	74.28	40.21	45.01	1.293	6.486	0.05	0.82	4.82	15.13	3.14	0.35	0.371	0.718
84.17	0.08	75.82	40.30	45.01	1.386	6.492	0.06	0.84	4.73	15.27	3.23	0.35	0.379	0.720
90.17	0.08	77.22	40.36	45.00	1.491	6.499	0.06	0.85	4.67	15.41	3.30	0.36	0.387	0.723
96.17	0.09	78.38	40.43	45.01	1.579	6.505	0.07	0.86	4.60	15.51	3.37	0.36	0.393	0.724
102.17	0.09	79.55	40.48	45.00	1.679	6.511	0.07	0.87	4.55	15.63	3.43	0.36	0.399	0.727
107.03	0.10	80.23	40.51	45.00	1.773	6.518	0.07	0.88	4.52	15.69	3.47	0.37	0.402	0.728

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01 Boring No.: MW-105
Sample No.: - Specimen No.: A
Depth (ft.): 10.0-12.0

Initial Height., H_o (in): 5.664
Initial Diameter, D_o (in): 2.864
Membr. Thickness (in): 0.02
Ht Change at End of Consol.,ΔH_o (in): 0.112 H_c 5.552
Ht Change at End of Saturation, H_s (in): 0.000
Volume change during Consol. V_c (cc^3): 18.26 1.11386 in^3

Confining Pressure (psi): 25.00
Initial Volume, V_o (in^3): 36.49
Initial Area, A_o (in^2): 6.44
Area after Consol., A_c (in^2): 6.37
Piston Correction (lbs): 8.3

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
0.00	0.09	14.47	34.97	59.98	1.707	6.482	0.07	0.16	25.01	25.96	1.04	0.00	0.03	1.83
1.50	0.10	26.06	35.70	59.96	1.726	6.483	0.07	0.28	24.28	27.02	1.11	0.05	0.10	1.85
3.02	0.10	36.25	36.36	59.95	1.755	6.485	0.07	0.40	23.61	27.92	1.18	0.10	0.16	1.86
4.52	0.10	44.81	36.99	59.93	1.781	6.487	0.07	0.49	22.99	28.61	1.24	0.15	0.20	1.86
6.02	0.10	51.82	37.56	59.92	1.811	6.489	0.08	0.57	22.41	29.12	1.30	0.19	0.24	1.86
7.52	0.10	57.86	38.11	59.92	1.827	6.490	0.08	0.64	21.87	29.50	1.35	0.23	0.27	1.85
9.02	0.10	63.60	38.66	59.93	1.854	6.492	0.08	0.70	21.32	29.84	1.40	0.27	0.31	1.84
10.52	0.10	68.56	39.16	59.93	1.875	6.493	0.08	0.75	20.81	30.09	1.45	0.30	0.33	1.83
12.02	0.11	73.04	39.64	59.94	1.911	6.496	0.08	0.80	20.34	30.31	1.49	0.34	0.36	1.82
13.52	0.11	77.06	40.08	59.95	1.929	6.497	0.08	0.85	19.90	30.49	1.53	0.37	0.38	1.81
15.02	0.11	80.72	40.49	59.97	1.947	6.498	0.08	0.89	19.49	30.64	1.57	0.40	0.40	1.80
16.52	0.11	84.05	40.86	59.97	1.971	6.500	0.08	0.93	19.11	30.77	1.61	0.42	0.42	1.80
18.02	0.11	87.10	41.21	59.98	2.012	6.502	0.08	0.96	18.76	30.88	1.65	0.45	0.44	1.79
19.52	0.11	90.16	41.56	59.99	2.029	6.504	0.09	0.99	18.42	31.01	1.68	0.47	0.45	1.78
21.02	0.11	92.95	41.88	59.99	2.049	6.505	0.09	1.02	18.09	31.11	1.72	0.50	0.47	1.77
22.52	0.11	95.51	42.19	60.00	2.069	6.506	0.09	1.05	17.78	31.19	1.75	0.52	0.48	1.76
24.02	0.12	97.85	42.48	60.01	2.107	6.509	0.09	1.08	17.49	31.25	1.79	0.54	0.50	1.75
25.52	0.12	100.12	42.75	60.01	2.133	6.510	0.09	1.10	17.22	31.33	1.82	0.56	0.51	1.75
27.02	0.12	102.15	43.00	60.01	2.147	6.511	0.09	1.12	16.97	31.39	1.85	0.58	0.52	1.74
28.52	0.12	104.04	43.25	60.01	2.177	6.513	0.09	1.14	16.73	31.43	1.88	0.60	0.53	1.73
30.02	0.12	106.14	43.48	60.01	2.194	6.514	0.09	1.17	16.50	31.51	1.91	0.61	0.54	1.73
31.52	0.12	107.89	43.70	60.01	2.225	6.517	0.09	1.19	16.28	31.56	1.94	0.63	0.55	1.72
33.02	0.12	109.61	43.91	60.01	2.251	6.518	0.09	1.20	16.07	31.61	1.97	0.64	0.56	1.72
34.52	0.13	111.10	44.11	60.01	2.277	6.520	0.10	1.22	15.87	31.64	1.99	0.66	0.57	1.71
36.02	0.13	112.58	44.30	60.01	2.293	6.521	0.10	1.24	15.68	31.67	2.02	0.67	0.58	1.70
37.52	0.13	113.91	44.48	60.01	2.324	6.523	0.10	1.25	15.50	31.69	2.04	0.68	0.58	1.70
39.03	0.13	115.09	44.65	60.02	2.347	6.525	0.10	1.26	15.32	31.69	2.07	0.70	0.59	1.69
40.53	0.13	116.57	44.83	60.02	2.367	6.526	0.10	1.28	15.15	31.74	2.10	0.71	0.60	1.69
42.03	0.13	117.80	44.99	60.02	2.388	6.527	0.10	1.29	14.98	31.76	2.12	0.72	0.60	1.68
43.53	0.13	119.01	45.15	60.02	2.422	6.530	0.10	1.30	14.83	31.78	2.14	0.73	0.61	1.68
45.03	0.14	120.17	45.30	60.02	2.441	6.531	0.10	1.32	14.68	31.81	2.17	0.74	0.62	1.67
46.53	0.14	121.20	45.44	60.02	2.475	6.533	0.10	1.33	14.54	31.82	2.19	0.75	0.62	1.67
48.03	0.14	122.17	45.58	60.02	2.503	6.535	0.10	1.34	14.40	31.82	2.21	0.76	0.63	1.66
49.53	0.14	123.09	45.71	60.02	2.527	6.537	0.11	1.35	14.27	31.83	2.23	0.77	0.63	1.66
51.03	0.14	124.23	45.84	60.02	2.564	6.539	0.11	1.36	14.13	31.86	2.25	0.78	0.64	1.66
52.53	0.14	125.08	45.97	60.02	2.579	6.540	0.11	1.37	14.01	31.86	2.27	0.79	0.64	1.65
54.03	0.14	126.02	46.09	60.02	2.598	6.541	0.11	1.38	13.88	31.88	2.30	0.80	0.65	1.65
55.53	0.15	126.78	46.22	60.03	2.629	6.544	0.11	1.39	13.75	31.86	2.32	0.81	0.65	1.64
57.03	0.15	127.49	46.34	60.03	2.650	6.545	0.11	1.39	13.64	31.85	2.33	0.82	0.66	1.64
58.53	0.15	128.21	46.44	60.03	2.677	6.547	0.11	1.40	13.54	31.85	2.35	0.83	0.66	1.63
60.03	0.15	128.84	46.54	60.03	2.702	6.549	0.11	1.41	13.44	31.84	2.37	0.83	0.66	1.63
66.05	0.15	131.72	46.95	60.03	2.792	6.555	0.12	1.44	13.03	31.86	2.44	0.86	0.68	1.62
72.05	0.16	133.97	47.30	60.03	2.892	6.561	0.12	1.46	12.68	31.83	2.51	0.89	0.69	1.60
78.05	0.17	135.94	47.60	60.03	2.996	6.568	0.13	1.48	12.37	31.81	2.57	0.91	0.70	1.59
84.05	0.17	137.71	47.89	60.03	3.098	6.575	0.13	1.50	12.09	31.77	2.63	0.93	0.71	1.58
90.05	0.18	139.14	48.14	60.04	3.201	6.582	0.13	1.51	11.84	31.72	2.68	0.95	0.72	1.57
96.07	0.18	140.60	48.36	60.03	3.306	6.589	0.14	1.53	11.61	31.69	2.73	0.96	0.72	1.56
102.07	0.19	141.57	48.56	60.03	3.403	6.596	0.14	1.54	11.41	31.62	2.77	0.98	0.73	1.55
108.07	0.19	142.65	48.75	60.03	3.503	6.603	0.15	1.54	11.22	31.57	2.81	0.99	0.73	1.54
114.07	0.20	143.60	48.92	60.03	3.605	6.610	0.15	1.55	11.05	31.52	2.85	1.00	0.74	1.53
119.95	0.21	144.20	49.08	60.03	3.717	6.618	0.16	1.56	10.90	31.44	2.88	1.02	0.74	1.52

Report No.:

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01 Boring No.: MW-105
Sample No.: - Specimen No.: A
Depth (ft.): 10.0-12.0

Initial Height., H_o (in): 5.664
Initial Diameter, D_o (in): 2.864
Membr. Thickness (in): 0.02
t Change at End of Consol.,ΔH_o (in): 0.218 H_c 5.445
Change at End of Saturation, H_s (in): 0.000
ume change during Consol. V_c (cc^3): 31.27 1.90747 in^3

Confining Pressure (psi): 50.00
Initial Volume, V_o (in^3): 36.49
Initial Area, A_o (in^2): 6.44
Area after Consol., A_c (in^2): 6.35
Piston Correction (lbs): 13.85

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
0.00	0.20	21.43	35.44	85.01	3.698	6.594	0.15	0.00	49.57	50.72	1.02	0.00	0.04	3.61
1.50	0.20	35.44	36.12	85.01	3.724	6.596	0.16	0.38	48.89	52.16	1.07	0.05	0.12	3.64
3.00	0.20	50.08	37.07	85.01	3.750	6.597	0.16	0.54	47.94	53.43	1.11	0.12	0.20	3.65
4.50	0.21	63.21	38.03	85.01	3.776	6.599	0.16	0.68	46.98	54.46	1.16	0.19	0.27	3.65
6.00	0.21	75.62	39.03	85.02	3.802	6.601	0.16	0.81	45.98	55.34	1.20	0.26	0.34	3.65
7.50	0.21	86.73	40.01	85.02	3.828	6.603	0.16	0.93	45.00	56.04	1.25	0.33	0.40	3.64
9.00	0.21	97.12	40.99	85.02	3.854	6.605	0.16	1.05	44.02	56.62	1.29	0.40	0.45	3.62
10.50	0.21	106.43	41.93	85.02	3.880	6.606	0.16	1.15	43.07	57.09	1.33	0.47	0.50	3.61
12.02	0.21	114.98	42.83	85.01	3.906	6.608	0.16	1.24	42.17	57.48	1.36	0.53	0.55	3.59
13.52	0.21	123.04	43.72	85.01	3.932	6.610	0.16	1.33	41.29	57.81	1.40	0.60	0.59	3.57
15.02	0.22	130.17	44.55	85.01	3.958	6.612	0.17	1.41	40.46	58.05	1.43	0.66	0.63	3.55
16.52	0.22	136.72	45.35	85.03	3.984	6.614	0.17	1.48	39.66	58.24	1.47	0.71	0.67	3.52
18.02	0.22	142.48	46.07	85.03	4.010	6.615	0.17	1.54	38.94	58.38	1.50	0.77	0.70	3.50
19.52	0.22	147.78	46.74	85.02	4.036	6.617	0.17	1.60	38.26	58.50	1.53	0.81	0.73	3.48
21.02	0.22	152.57	47.38	85.02	4.062	6.619	0.17	1.65	37.63	58.59	1.56	0.86	0.75	3.46
22.52	0.22	157.39	47.99	85.02	4.088	6.621	0.17	1.70	37.02	58.70	1.59	0.90	0.78	3.45
24.02	0.22	162.06	48.60	85.02	4.114	6.623	0.17	1.75	36.40	58.79	1.61	0.95	0.81	3.43
25.52	0.23	166.16	49.17	85.02	4.140	6.624	0.17	1.79	35.84	58.83	1.64	0.99	0.83	3.41
27.02	0.23	170.01	49.71	85.02	4.166	6.626	0.17	1.83	35.30	58.87	1.67	1.03	0.85	3.39
28.52	0.23	173.58	50.21	85.02	4.192	6.628	0.18	1.87	34.80	58.90	1.69	1.06	0.87	3.37
30.02	0.23	176.80	50.68	85.02	4.218	6.630	0.18	1.91	34.32	58.90	1.72	1.10	0.88	3.36
31.52	0.23	179.86	51.13	85.02	4.244	6.632	0.18	1.94	33.88	58.91	1.74	1.13	0.90	3.34
33.02	0.23	182.90	51.59	85.03	4.270	6.633	0.18	1.97	33.42	58.91	1.76	1.16	0.92	3.32
34.52	0.23	185.98	52.02	85.03	4.296	6.635	0.18	2.01	32.99	58.93	1.79	1.19	0.93	3.31
36.02	0.24	188.68	52.43	85.03	4.322	6.637	0.18	2.03	32.58	58.93	1.81	1.22	0.95	3.29
37.52	0.24	191.27	52.82	85.03	4.348	6.639	0.18	2.06	32.19	58.92	1.83	1.25	0.96	3.28
39.02	0.24	193.71	53.18	85.03	4.374	6.641	0.18	2.09	31.83	58.91	1.85	1.28	0.98	3.27
40.52	0.24	196.08	53.54	85.03	4.400	6.642	0.18	2.11	31.47	58.90	1.87	1.30	0.99	3.25
42.02	0.24	198.25	53.88	85.03	4.426	6.644	0.19	2.13	31.13	58.89	1.89	1.33	1.00	3.24
43.52	0.24	200.39	54.20	85.03	4.452	6.646	0.19	2.16	30.81	58.88	1.91	1.35	1.01	3.23
45.02	0.24	202.49	54.52	85.02	4.478	6.648	0.19	2.18	30.49	58.86	1.93	1.37	1.02	3.22
46.53	0.25	204.43	54.83	85.02	4.504	6.650	0.19	2.20	30.18	58.84	1.95	1.40	1.03	3.20
48.03	0.25	206.30	55.12	85.02	4.530	6.651	0.19	2.22	29.89	58.82	1.97	1.42	1.04	3.19
49.53	0.25	207.92	55.40	85.04	4.556	6.653	0.19	2.24	29.61	58.78	1.99	1.44	1.05	3.18
51.03	0.25	209.60	55.67	85.03	4.582	6.655	0.19	2.25	29.34	58.75	2.00	1.46	1.06	3.17
52.53	0.25	211.12	55.92	85.03	4.608	6.657	0.19	2.27	29.09	58.73	2.02	1.47	1.07	3.16
54.03	0.25	212.75	56.17	85.03	4.634	6.659	0.19	2.29	28.84	58.71	2.04	1.49	1.08	3.15
55.53	0.25	214.58	56.42	85.03	4.660	6.660	0.20	2.31	28.59	58.72	2.05	1.51	1.08	3.14
57.03	0.26	216.09	56.67	85.03	4.686	6.662	0.20	2.32	28.34	58.70	2.07	1.53	1.09	3.13
58.53	0.26	217.50	56.89	85.03	4.712	6.664	0.20	2.34	28.11	58.67	2.09	1.55	1.10	3.12
60.03	0.26	218.71	57.11	85.02	4.738	6.666	0.20	2.35	27.90	58.63	2.10	1.56	1.11	3.12
66.03	0.26	223.63	57.93	85.04	4.842	6.673	0.20	2.40	27.08	58.52	2.16	1.62	1.13	3.08
72.03	0.27	228.08	58.65	85.03	4.946	6.680	0.21	2.44	26.36	58.43	2.22	1.67	1.15	3.05
78.03	0.27	231.65	59.28	85.02	5.050	6.688	0.21	2.48	25.73	58.29	2.27	1.72	1.17	3.02
84.03	0.28	234.75	59.84	85.03	5.154	6.695	0.22	2.51	25.17	58.16	2.31	1.76	1.19	3.00
90.05	0.29	237.93	60.35	85.03	5.258	6.702	0.22	2.54	24.66	58.09	2.36	1.79	1.20	2.98
96.05	0.29	240.23	60.77	85.02	5.362	6.710	0.22	2.56	24.24	57.98	2.39	1.82	1.21	2.96
102.05	0.30	242.76	61.17	85.02	5.466	6.717	0.23	2.59	23.84	57.91	2.43	1.85	1.23	2.94
108.05	0.30	245.08	61.53	85.02	5.570	6.725	0.23	2.61	23.48	57.87	2.46	1.88	1.24	2.93
114.05	0.31	246.85	61.84	85.02	5.674	6.732	0.24	2.62	23.17	57.78	2.49	1.90	1.25	2.91
120.07	0.31	248.79	62.11	85.02	5.778	6.739	0.24	2.64	22.90	57.76	2.52	1.92	1.25	2.90
126.07	0.32	250.27	62.33	85.01	5.882	6.747	0.25	2.65	22.67	57.71	2.55	1.94	1.26	2.89
132.07	0.33	252.38	62.57	85.02	5.986	6.754	0.25	2.67	22.44	57.76	2.57	1.95	1.27	2.89
138.07	0.33	253.70	62.75	85.01	6.090	6.762	0.26	2.68	22.26	57.73	2.59	1.97	1.28	2.88
144.07	0.34	255.32	62.93	85.00	6.194	6.769	0.26	2.70	22.08	57.75	2.62	1.98	1.28	2.87

Report No.:

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01 Boring No.: MW-105
Sample No.: - Specimen No.: A
Depth (ft.): 10.0-12.0

Initial Height., H_o (in): 5.664
Initial Diameter, D_o (in): 2.864
Membr. Thickness (in): 0.02
t Change at End of Consol.,ΔH_o (in): 0.218 H_c 5.445
Change at End of Saturation, H_s (in): 0.000
ume change during Consol. V_c (cc^3): 31.27 1.90747 in^3

Confining Pressure (psi): 50.00
Initial Volume, V_o (in^3): 36.49
Initial Area, A_o (in^2): 6.44
Area after Consol., A_c (in^2): 6.35
Piston Correction (lbs): 13.85

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
150.08	0.34	256.67	63.13	85.01	6.298	6.777	0.26	2.71	21.87	57.71	2.64	1.99	1.29	2.86
156.08	0.35	257.92	63.29	85.00	6.402	6.784	0.27	2.72	21.72	57.69	2.66	2.01	1.30	2.86
162.08	0.35	259.37	63.45	85.01	6.506	6.792	0.27	2.73	21.56	57.71	2.68	2.02	1.30	2.85
168.08	0.36	260.11	63.58	85.00	6.610	6.800	0.28	2.73	21.43	57.65	2.69	2.03	1.30	2.85
174.10	0.37	261.45	63.70	84.99	6.714	6.807	0.28	2.75	21.31	57.69	2.71	2.03	1.31	2.84
180.10	0.37	262.29	63.82	85.00	6.818	6.815	0.29	2.75	21.19	57.65	2.72	2.04	1.31	2.84
186.10	0.38	263.54	63.91	84.99	6.922	6.822	0.29	2.76	21.10	57.70	2.73	2.05	1.32	2.84
192.10	0.38	264.53	64.01	84.98	7.026	6.830	0.29	2.77	21.00	57.70	2.75	2.06	1.32	2.83
198.10	0.39	265.61	64.12	84.98	7.130	6.838	0.30	2.78	20.89	57.71	2.76	2.07	1.33	2.83
204.10	0.39	266.65	64.21	84.97	7.234	6.845	0.30	2.78	20.80	57.73	2.78	2.07	1.33	2.83
210.10	0.40	267.53	64.27	84.97	7.338	6.853	0.31	2.79	20.74	57.75	2.79	2.08	1.33	2.83
216.10	0.41	268.55	64.35	84.97	7.442	6.861	0.31	2.80	20.66	57.79	2.80	2.08	1.34	2.82
222.12	0.41	269.19	64.39	84.96	7.546	6.868	0.32	2.80	20.62	57.79	2.80	2.08	1.34	2.82
228.12	0.42	270.19	64.46	84.97	7.650	6.876	0.32	2.81	20.55	57.83	2.81	2.09	1.34	2.82
234.12	0.42	271.13	64.51	84.96	7.754	6.884	0.32	2.81	20.49	57.87	2.82	2.09	1.35	2.82
240.12	0.43	271.88	64.55	84.95	7.858	6.892	0.33	2.82	20.46	57.90	2.83	2.10	1.35	2.82
246.12	0.43	273.01	64.61	84.96	7.962	6.899	0.33	2.83	20.40	57.96	2.84	2.10	1.35	2.82
252.12	0.44	273.72	64.64	84.95	8.066	6.907	0.34	2.83	20.37	57.99	2.85	2.10	1.35	2.82
258.13	0.44	274.71	64.66	84.94	8.170	6.915	0.34	2.84	20.35	58.07	2.85	2.10	1.36	2.82
264.13	0.45	275.34	64.70	84.94	8.274	6.923	0.35	2.84	20.31	58.08	2.86	2.11	1.36	2.82
270.13	0.46	276.55	64.74	84.94	8.378	6.931	0.35	2.85	20.27	58.18	2.87	2.11	1.36	2.82
276.15	0.46	277.15	64.76	84.94	8.482	6.939	0.36	2.85	20.25	58.20	2.87	2.11	1.37	2.82
282.15	0.47	278.26	64.78	84.93	8.586	6.947	0.36	2.86	20.23	58.29	2.88	2.11	1.37	2.83
288.15	0.47	279.20	64.78	84.93	8.690	6.954	0.36	2.86	20.23	58.39	2.89	2.11	1.37	2.83
294.15	0.48	280.03	64.79	84.93	8.795	6.962	0.37	2.87	20.22	58.45	2.89	2.11	1.38	2.83
300.15	0.48	281.14	64.80	84.93	8.899	6.970	0.37	2.88	20.21	58.55	2.90	2.11	1.38	2.84
315.15	0.50	283.32	64.82	84.92	9.158	6.990	0.38	2.89	20.19	58.74	2.91	2.12	1.39	2.84
330.15	0.51	286.28	64.82	84.91	9.418	7.010	0.39	2.91	20.19	59.05	2.92	2.12	1.40	2.85
345.17	0.53	288.12	64.79	84.90	9.678	7.031	0.41	2.92	20.22	59.23	2.93	2.11	1.40	2.86
360.17	0.54	290.35	64.75	84.89	9.938	7.051	0.42	2.93	20.26	59.48	2.94	2.11	1.41	2.87
375.17	0.56	292.98	64.73	84.88	10.198	7.071	0.43	2.95	20.28	59.75	2.95	2.11	1.42	2.88
390.17	0.57	295.21	64.69	84.88	10.458	7.092	0.44	2.97	20.32	60.00	2.95	2.11	1.43	2.89
405.17	0.58	297.72	64.62	84.86	10.718	7.112	0.45	2.98	20.39	60.30	2.96	2.10	1.44	2.90
420.17	0.60	299.79	64.56	84.86	10.978	7.133	0.46	2.99	20.45	60.54	2.96	2.10	1.44	2.92
435.17	0.61	301.97	64.49	84.86	11.238	7.154	0.47	3.01	20.52	60.79	2.96	2.09	1.45	2.93
450.18	0.63	304.18	64.43	84.85	11.498	7.175	0.48	3.02	20.58	61.04	2.97	2.09	1.46	2.94
465.18	0.64	306.18	64.33	84.85	11.758	7.196	0.49	3.03	20.67	61.30	2.96	2.08	1.46	2.95
480.18	0.65	308.64	64.24	84.84	12.018	7.217	0.50	3.04	20.77	61.61	2.97	2.07	1.47	2.97
495.18	0.67	310.82	64.14	84.83	12.278	7.239	0.51	3.05	20.87	61.89	2.97	2.07	1.48	2.98
510.18	0.68	313.33	64.07	84.83	12.538	7.260	0.53	3.07	20.94	62.19	2.97	2.06	1.48	2.99
525.20	0.70	315.54	63.98	84.83	12.798	7.282	0.54	3.08	21.03	62.46	2.97	2.06	1.49	3.01
540.20	0.71	317.89	63.89	84.83	13.058	7.304	0.55	3.09	21.12	62.75	2.97	2.05	1.50	3.02
555.20	0.73	320.68	63.78	84.84	13.318	7.326	0.56	3.11	21.23	63.11	2.97	2.04	1.51	3.04
570.20	0.74	322.87	63.65	84.85	13.577	7.348	0.57	3.12	21.36	63.41	2.97	2.03	1.51	3.05
585.20	0.75	325.60	63.54	84.85	13.837	7.370	0.58	3.14	21.46	63.76	2.97	2.02	1.52	3.07
600.20	0.77	327.77	63.43	84.84	14.097	7.392	0.59	3.15	21.58	64.05	2.97	2.02	1.53	3.08
615.20	0.78	330.02	63.32	84.85	14.357	7.415	0.60	3.16	21.69	64.33	2.97	2.01	1.54	3.10
630.20	0.80	332.14	63.18	84.85	14.617	7.437	0.61	3.17	21.82	64.62	2.96	2.00	1.54	3.11
645.20	0.81	334.17	63.05	84.86	14.877	7.460	0.62	3.18	21.96	64.90	2.96	1.99	1.55	3.13
660.20	0.82	336.47	62.94	84.86	15.137	7.483	0.63	3.19	22.07	65.19	2.95	1.98	1.55	3.14
675.20	0.84	338.46	62.81	84.87	15.397	7.506	0.65	3.20	22.20	65.45	2.95	1.97	1.56	3.16
690.20	0.85	340.90	62.67	84.88	15.657	7.529	0.66	3.21	22.34	65.78	2.94	1.96	1.56	3.17
705.20	0.87	343.04	62.52	84.89	15.917	7.552	0.67	3.22	22.49	66.08	2.94	1.95	1.57	3.19
720.22	0.88	345.17	62.38	84.89	16.177	7.576	0.68	3.23	22.63	66.36	2.93	1.94	1.57	3.20
735.22	0.90	347.78	62.24	84.90	16.437	7.599	0.69	3.25	22.77	66.71	2.93	1.93	1.58	3.22

Report No.:

CU TRIAXIAL TEST: Stress-Strain Data

Project No.: J038678.01
Boring No.: MW-105
Sample No.: -
Specimen No.: A
Depth (ft.): 10.0-12.0

Initial Height., H_o (in): 5.664
Initial Diameter, D_o (in): 2.864
Membr. Thickness (in): 0.02
t Change at End of Consol.,ΔH_o (in): 0.218 H_c 5.445
Change at End of Saturation, H_s (in): 0.000
ume change during Consol. V_c (cc^3): 31.27 1.90747 in^3

Confining Pressure (psi): 50.00
Initial Volume, V_o (in^3): 36.49
Initial Area, A_o (in^2): 6.44
Area after Consol., A_c (in^2): 6.35
Piston Correction (lbs): 13.85

Elapsed Time (min)	Vertical Deform. (in)	Vertical Load (lbf)	Pore Pressure (psi)	Cell Pressure (psi)	Axial Strain (%)	Corrected Area (in^2)	Membr. Correct. (psi)	Deviator Stress (tsf)	σ_3' (psi)	σ_1' (psi)	Obliquity	Excess Pore Pr. (tsf)	q (tsf)	p' (tsf)
750.22	0.91	349.99	62.09	84.91	16.696	7.623	0.70	3.26	22.92	67.02	2.92	1.92	1.59	3.24
765.22	0.92	352.84	61.95	84.91	16.957	7.647	0.71	3.27	23.06	67.39	2.92	1.91	1.60	3.26
780.22	0.94	355.11	61.77	84.89	17.216	7.671	0.72	3.28	23.24	67.73	2.91	1.90	1.60	3.27
795.22	0.95	357.57	61.62	84.88	17.476	7.695	0.73	3.29	23.39	68.06	2.91	1.89	1.61	3.29
810.22	0.97	359.83	61.45	84.88	17.736	7.719	0.74	3.30	23.56	68.38	2.90	1.87	1.61	3.31
825.22	0.98	361.78	61.30	84.89	17.996	7.744	0.75	3.31	23.71	68.64	2.89	1.86	1.62	3.32
840.22	0.99	364.15	61.16	84.90	18.256	7.768	0.76	3.32	23.84	68.94	2.89	1.85	1.62	3.34
855.22	1.01	366.12	61.01	84.90	18.516	7.793	0.78	3.33	24.00	69.20	2.88	1.84	1.63	3.35
870.22	1.02	368.14	60.87	84.91	18.776	7.818	0.79	3.33	24.14	69.46	2.88	1.83	1.63	3.37
885.22	1.04	370.27	60.71	84.91	19.036	7.843	0.80	3.34	24.30	69.74	2.87	1.82	1.64	3.39
900.18	1.05	372.17	60.57	84.92	19.295	7.868	0.81	3.35	24.44	69.98	2.86	1.81	1.64	3.40

APPENDIX F

Hydraulic Conductivity Data

HYDRAULIC CONDUCTIVITY TEST DATA

(ASTM D 5084)

		Initial Unit Weight		Unit Weight as Tested	
JOB NO.:	J038678.01	WET UNIT WEIGHT, pcf:	142.7	WET UNIT WEIGHT, pcf:	143.0
BORING NO.:	MW-101	DRY UNIT WEIGHT, pcf:	127.4	DRY UNIT WEIGHT, pcf:	127.9
SAMPLE NO.:	-				
DEPTH (Feet):	60.0-62.0				

	Initial	As Tested**		Initial	As Tested	INITIAL MOISTURE CONTENT		FINAL MOISTURE CONTENT	
LENGTH, in.:	3.769	3.755	LENGTH, cm:	9.573	9.538	WET WT SPLE+TARE	1200.16	WET WT SPLE+TARE	1199.01
DIAMETER, in.:	2.881	2.881	DIAMETER, cm	7.318	7.318	DRY WT SPLE+TARE	1101.63	DRY WT SPLE+TARE	1101.63
WET WT., gms.:	920.15	919.00				TARE WEIGHT	280.01	TARE WEIGHT	280.01
AREA, sq.in.:	6.519	6.519	AREA, sq cm:	42.058	42.058	**% MOISTURE**	12.0	% MOISTURE	11.9

B VALUE (before Permeation): 98% Cell / Back Pressure, psi: 43 / 40

HEAD (PSI)	DATE (YR,MO,DY)	TIME (HR,MN,SC)	TEMP °C	ELAPSED MINUTES	BOTTOM BURETTE	TOP BURETTE	Q (CC)	K CM/SEC	HYDRAULIC GRADIENT	HYDRAULIC HEAD	HEAD LOSS,%	k (in/sec)
1.0	02-Apr-21	11:41 AM	19.4	0	3.66	22.87			9.35	89.51		
1.0	05-Apr-21	08:21 AM	20.5	4120	15.23	11.31	11.57	1.4E-07	6.93	66.38	25.84	5.7E-08
0.0	05-Apr-21	08:30 AM	20.5	0	5.80	23.62			1.86	17.82		
0.0	05-Apr-21	05:53 PM	23.3	563	6.07	23.40	0.27	9.8E-08	1.81	17.33	2.75	3.9E-08
0.0	06-Apr-21	08:02 AM	22.6	849	6.45	23.04	0.38	1.0E-07	1.73	16.59	4.27	4.0E-08
0.0	06-Apr-21	05:03 PM	23.5	541	6.68	22.81	0.23	1.0E-07	1.68	16.13	2.77	4.1E-08
0.0	07-Apr-21	08:37 AM	23.2	934	7.06	22.46	0.38	9.8E-08	1.61	15.40	4.53	3.9E-08

Average Temp. = 21.9

AVERAGE K = 1.1E-07

Corrected K for 20°C = 1.0E-07

AVERAGE K = 4.3E-08

Corrected K for 20°C = 4.1E-08

** Measurements at end of test

HYDRAULIC CONDUCTIVITY TEST DATA
(ASTM D 5084)

JOB NO.: J038678.01
BORING NO.: MW-102
SAMPLE NO.: -
DEPTH (Feet): 30.0 - 32.0

	Initial Unit Weight		Unit Weight as Tested
WET UNIT WEIGHT, pcf:	138.7	WET UNIT WEIGHT, pcf:	138.9
DRY UNIT WEIGHT, pcf:	120.6	DRY UNIT WEIGHT, pcf:	120.9

	Initial	As Tested**		Initial	As Tested
LENGTH, in.:	4.263	4.243	LENGTH, cm:	10.828	10.777
DIAMETER, in.:	2.850	2.853	DIAMETER, cm	7.239	7.247
WET WT., gms.:	989.90	989.27			
AREA, sq.in.:	6.379	6.393	AREA, sq cm:	41.157	41.244

INITIAL MOISTURE CONTENT		FINAL MOISTURE CONTENT	
WET WT SPLE+TARE	1267.06	WET WT SPLE+TARE	1265.97
DRY WT SPLE+TARE	1137.81	DRY WT SPLE+TARE	1137.81
TARE WEIGHT	277.16	TARE WEIGHT	277.16
% MOISTURE	15.0	% MOISTURE	14.9

B VALUE (before Permeation): 98%

Cell / Back Pressure, psi: 34 / 30

HEAD (PSI)	DATE (YR,MO,DY)	TIME (HR,MN,SC)	TEMP °C	ELAPSED MINUTES	BOTTOM BURETTE	TOP BURETTE	Q (CC)	K CM/SEC	HYDRAULIC GRADIENT	HYDRAULIC HEAD	HEAD LOSS,%	k (in/sec)
1.0	02-Apr-21	05:07 PM	20.3	0	3.04	22.20			8.26	89.46		
1.0	05-Apr-21	08:20 AM	20.6	3793	4.37	20.90	1.33	1.8E-08	8.02	86.83	2.94	7.1E-09
1.0	05-Apr-21	05:51 PM	23.2	571	4.54	20.65	0.17	1.9E-08	7.98	86.41	0.48	7.6E-09
1.0	06-Apr-21	08:03 AM	22.5	852	4.80	20.43	0.26	1.5E-08	7.94	85.93	0.56	5.9E-09
1.0	06-Apr-21	05:01 PM	23.8	538	4.96	20.25	0.16	1.7E-08	7.90	85.59	0.40	6.6E-09
1.0	07-Apr-21	08:38 AM	23.2	937	5.25	19.94	0.29	1.7E-08	7.85	84.99	0.70	6.8E-09

Average Temp. = 22.3

AVERAGE K = 1.7E-08
Corrected K for 20°C = 1.6E-08

AVERAGE K = 6.8E-09
Corrected K for 20°C = 6.4E-09

** Measurements at end of test

HYDRAULIC CONDUCTIVITY TEST DATA
(ASTM D 5084)

JOB NO.: J038678.01
BORING NO.: MW-103
SAMPLE NO.: -
DEPTH (Feet): 30.0 - 32.0

Initial Unit Weight		**Unit Weight as Tested**	
WET UNIT WEIGHT, pcf:	141.8	WET UNIT WEIGHT, pcf:	142.0
DRY UNIT WEIGHT, pcf:	125.2	DRY UNIT WEIGHT, pcf:	126.0

	Initial	As Tested**		Initial	As Tested
LENGTH, in.:	4.551	4.527	LENGTH, cm:	11.560	11.499
DIAMETER, in.:	2.856	2.856	DIAMETER, cm	7.254	7.254
WET WT., gms.:	1084.97	1080.86			
AREA, sq.in.:	6.406	6.406	AREA, sq cm:	41.331	41.331

INITIAL MOISTURE CONTENT		FINAL MOISTURE CONTENT	
WET WT SPLE+TARE	1378.99	WET WT SPLE+TARE	1374.28
DRY WT SPLE+TARE	1252.47	DRY WT SPLE+TARE	1252.47
TARE WEIGHT	294.02	TARE WEIGHT	294.02
% MOISTURE	13.2	% MOISTURE	12.7

B VALUE (before Permeation): 97%   Cell / Back Pressure, psi: 33 / 30

HEAD (PSI)	DATE (YR,MO,DY)	TIME (HR,MN,SC)	TEMP ºC	ELAPSED MINUTES	BOTTOM BURETTE	TOP BURETTE	Q (CC)	K CM/SEC	HYDRAULIC GRADIENT	HYDRAULIC HEAD	HEAD LOSS,%	k (in/sec)
1.5	05-Apr-21	08:28 AM	20.7	0	4.40	22.23			10.66	123.28		
1.5	05-Apr-21	05:52 PM	23.4	564	5.30	21.13	0.90	7.1E-08	10.49	121.28	1.62	2.8E-08
1.5	06-Apr-21	08:04 AM	22.7	852	6.70	19.73	1.40	6.7E-08	10.25	118.48	2.31	2.6E-08
1.5	06-Apr-21	05:02 PM	23.7	538	7.50	18.90	0.80	6.3E-08	10.11	116.85	1.38	2.5E-08
1.5	07-Apr-21	08:39 AM	23.2	937	8.82	17.54	1.32	6.0E-08	9.88	114.17	2.29	2.4E-08

Average Temp. = 22.7

AVERAGE K = 6.5E-08
Corrected K for 20ºC = 6.1E-08

AVERAGE K = 2.6E-08
Corrected K for 20ºC = 2.4E-08

** Measurements at end of test

APPENDIX D
GROUNDWATER CONTOUR MAPS AND ELEVATIONS

GROUNDWATER CONTOUR MAPS

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\Figure D-1_GWE ULDB_May2018.mxd

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

- NEAP UNLITHIFIED DEPOSITS (TILL) MONITORING WELL
- NEAP UNLITHIFIED DEPOSITS (ALLUVIAL) MONITORING WELL
- NEAP BEDROCK (SHALE) MONITORING WELL
- MONITORING WELL LOCATION
- ABANDONED/DESTROYED MONITORING WELL LOCATION
- ▣ COAL MINE SHAFT
- HISTORIC BEDROCK GROUNDWATER ELEVATION CONTOUR - MAY 2002 (5-FT INTERVAL)
- → GROUNDWATER FLOW DIRECTION
- APPROXIMATE LOCATION OF SUBSURFACE MINE WITH DANVILLE (NO. 7) COAL
- PART 845 REGULATED UNIT (SUBJECT UNIT)
- SITE FEATURE
- PROPERTY BOUNDARY

Notes

NM* = NOT MEASURED,
WELL 16B IS TYPICALLY DRY

0 150 300
Feet

GROUNDWATER ELEVATIONS IN UNLITHIFIED DEPOSITS AND BEDROCK - MAY 2018

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

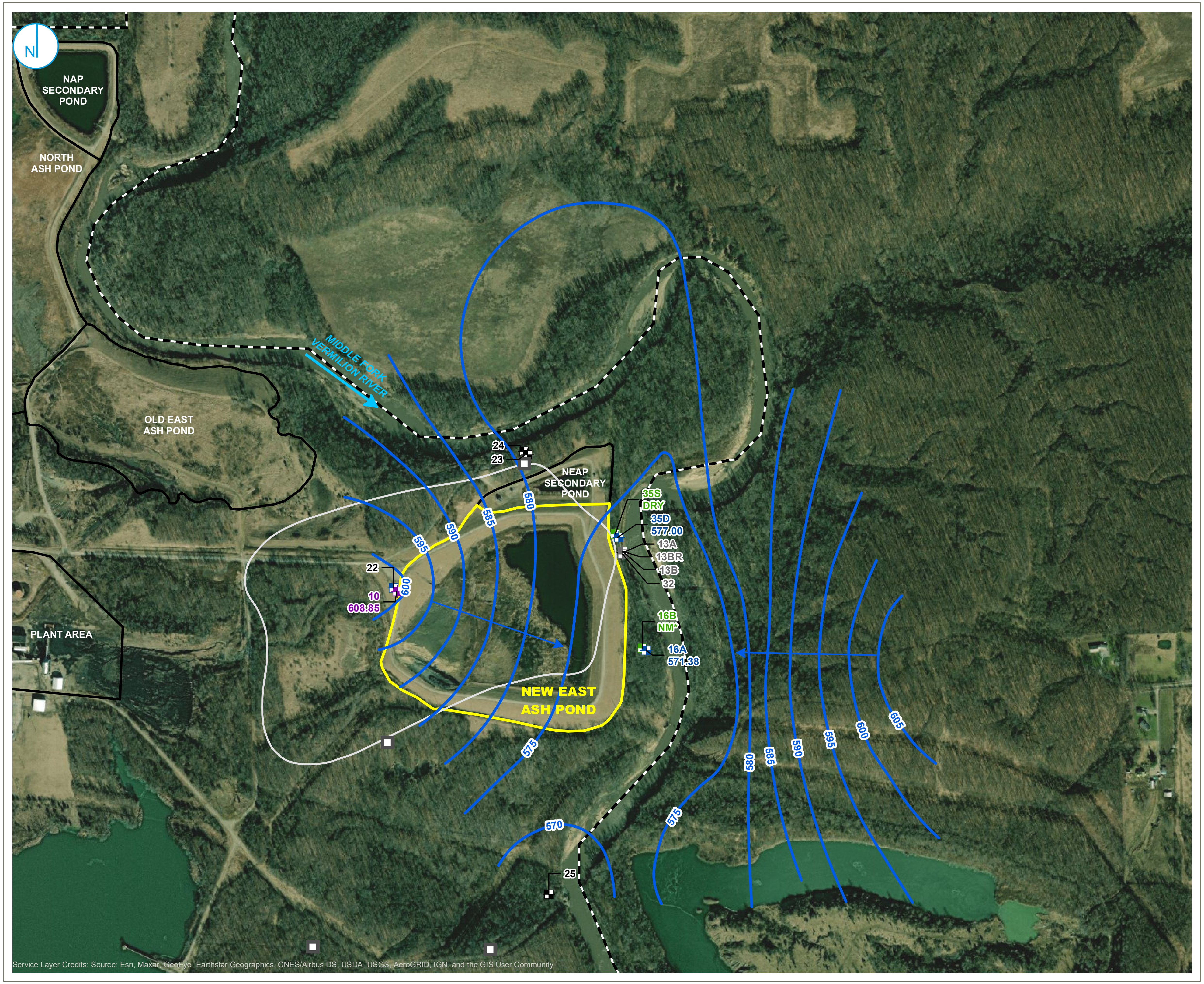
FIGURE D-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 10/13/2021 | DESIGNER: STOLZSD

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\Figure D-2_GWE ULDB_Dec2018.mxd



Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

✚	NEAP UNLITHIFIED DEPOSITS (TILL) MONITORING WELL
✚	NEAP UNLITHIFIED DEPOSITS (ALLUVIAL) MONITORING WELL
✚	NEAP BEDROCK (SHALE) MONITORING WELL
✚	MONITORING WELL LOCATION
✚	ABANDONED/DESTROYED MONITORING WELL LOCATION
▣	COAL MINE SHAFT
—	HISTORIC BEDROCK GROUNDWATER ELEVATION CONTOUR - JANUARY 2002 (5-FT INTERVAL)
→	GROUNDWATER FLOW DIRECTION
▭	APPROXIMATE LOCATION OF SUBSURFACE MINE WITH DANVILLE (NO. 7) COAL
▭	PART 845 REGULATED UNIT (SUBJECT UNIT)
▭	SITE FEATURE
⬚	PROPERTY BOUNDARY

Notes

NM* = NOT MEASURED,
WELL 16B IS TYPICALLY DRY

0 150 300
Feet

GROUNDWATER ELEVATIONS IN UNLITHIFIED DEPOSITS AND BEDROCK - DECEMBER 2018

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

FIGURE D-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 10/13/2021 | DESIGNER: STOLZSD

TABLE D-1. GROUNDWATER ELEVATION RESULTS

TABLE D-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
01	07/13/2017	583.94
01	09/13/2017	582.69
01	11/08/2017	582.21
01	01/24/2018	581.94
01	03/22/2018	582.24
01	05/09/2018	582.86
02	07/13/2017	575.40
02	09/14/2017	574.81
02	11/08/2017	575.16
02	01/24/2018	575.81
02	03/22/2018	575.10
02	05/09/2018	575.53
03R	07/13/2017	582.80
03R	09/14/2017	581.73
03R	11/08/2017	581.19
03R	01/24/2018	584.40
03R	03/22/2018	582.19
03R	05/09/2018	582.87
04	07/13/2017	583.51
04	09/13/2017	582.57
04	11/08/2017	583.38
04	01/24/2018	584.15
04	03/22/2018	584.56
04	05/09/2018	584.55
05	07/13/2017	588.75
05	09/14/2017	585.91
05	11/08/2017	588.33
05	01/24/2018	589.26
05	03/22/2018	589.21
05	05/09/2018	589.39
06R	07/13/2017	584.85
06R	09/13/2017	582.64
06R	11/08/2017	582.98
06R	01/24/2018	587.28
06R	03/22/2018	588.31
06R	05/09/2018	588.48
08R	07/13/2017	577.41
08R	09/14/2017	576.31
08R	11/08/2017	576.46
08R	01/24/2018	577.37
08R	03/22/2018	577.44
08R	05/09/2018	577.67
09	07/12/2017	584.98
09	09/13/2017	582.82
09	11/08/2017	583.14

TABLE D-1. GROUNDWATER ELEVATIONS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
09	01/24/2018	587.25
09	03/22/2018	588.31
09	05/09/2018	588.51
10	03/26/2015	611.40
10	06/02/2015	609.70
10	09/23/2015	608.27
10	11/23/2015	607.31
10	02/25/2016	608.37
10	05/19/2016	609.26
10	09/07/2016	608.27
10	12/19/2016	608.07
10	03/21/2017	609.54
10	06/16/2017	610.33
10	07/12/2017	609.21
10	09/14/2017	608.15
10	11/08/2017	607.34
10	01/24/2018	607.10
10	03/22/2018	608.26
10	05/09/2018	609.97
10	08/17/2018	608.80
10	12/03/2018	608.85
10	03/25/2019	610.70
10	05/22/2019	611.23
10	09/27/2019	608.63
10	12/23/2019	608.27
10	03/17/2020	611.23
10	06/22/2020	611.66
10	09/29/2020	608.78
10	12/07/2020	608.00
10	03/29/2021	609.54
10	04/01/2021	652.49
10	04/12/2021	610.25
10	04/21/2021	610.25
10	05/10/2021	604.57
10	06/03/2021	609.21
10	06/17/2021	609.48
10	07/08/2021	611.18
10	07/27/2021	610.71
10	08/16/2021	610.01
10	08/17/2021	610.01
16A	03/26/2015	568.18
16A	06/02/2015	570.39
16A	09/23/2015	572.72
16A	11/23/2015	571.44
16A	02/25/2016	568.79

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
16A	05/19/2016	569.56
16A	09/07/2016	572.11
16A	12/19/2016	571.05
16A	03/21/2017	568.69
16A	06/16/2017	570.19
16A	09/14/2017	570.92
16A	11/08/2017	571.02
16A	03/22/2018	568.32
16A	05/09/2018	568.30
16A	08/17/2018	571.16
16A	12/03/2018	571.38
16A	03/25/2019	568.18
16A	05/22/2019	569.19
16A	09/27/2019	570.95
16A	12/23/2019	568.92
16A	03/17/2020	568.79
16A	06/22/2020	570.09
16A	09/29/2020	571.17
16A	12/07/2020	569.57
16A	03/29/2021	569.01
16A	04/01/2021	569.01
16A	04/12/2021	568.28
16A	04/21/2021	568.28
16A	05/10/2021	569.34
16A	05/11/2021	569.34
16A	06/03/2021	568.39
16A	06/17/2021	569.51
16A	07/08/2021	571.32
16A	07/27/2021	571.56
16A	08/16/2021	571.81
16A	08/17/2021	571.81
17	07/12/2017	584.67
17	09/13/2017	583.66
17	11/08/2017	583.56
17	01/24/2018	584.23
17	03/22/2018	584.16
17	05/09/2018	584.83
18	07/12/2017	599.35
18	09/13/2017	597.12
18	11/08/2017	596.02
18	01/24/2018	595.02
18	03/22/2018	598.56
18	05/09/2018	599.89
19	07/13/2017	588.73
19	09/13/2017	585.70

TABLE D-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
19	11/08/2017	587.16
19	01/24/2018	589.55
19	03/22/2018	589.60
20	07/13/2017	577.99
20	09/13/2017	576.83
20	11/08/2017	577.24
20	01/24/2018	577.94
20	03/22/2018	579.21
20	05/09/2018	579.09
21	07/13/2017	583.21
21	09/13/2017	582.72
21	11/08/2017	581.67
21	01/24/2018	581.36
21	03/22/2018	581.51
21	05/09/2018	582.45
22	03/29/2021	603.60
22	04/01/2021	603.60
22	04/12/2021	603.87
22	04/20/2021	603.87
22	05/10/2021	598.84
22	06/03/2021	603.40
22	06/17/2021	603.32
22	07/08/2021	603.72
22	07/27/2021	604.01
22	08/16/2021	603.92
22	08/17/2021	603.92
23	03/29/2021	589.58
23	04/12/2021	589.36
23	05/10/2021	588.58
23	07/05/2021	580.15
23	07/07/2021	580.15
23	07/26/2021	588.47
24	03/30/2021	578.73
24	04/12/2021	578.58
24	05/10/2021	579.96
24	07/05/2021	580.00
24	07/07/2021	580.00
24	07/26/2021	580.27
25	03/30/2021	567.12
25	04/12/2021	565.80
25	05/10/2021	566.35
25	07/05/2021	564.19
25	07/07/2021	564.19
25	07/26/2021	566.60
25	08/16/2021	567.43

TABLE D-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
34	07/13/2017	578.40
34	09/13/2017	577.81
34	11/08/2017	577.95
34	01/24/2018	577.37
34	03/22/2018	578.53
34	05/09/2018	578.97
35S	03/29/2021	573.12
35S	04/12/2021	572.89
35D	03/21/2017	539.00
35D	06/16/2017	565.18
35D	09/14/2017	572.99
35D	11/08/2017	565.68
35D	03/22/2018	578.32
35D	05/09/2018	568.57
35D	08/17/2018	574.09
35D	12/03/2018	577.00
35D	03/25/2019	580.71
35D	05/22/2019	574.77
35D	09/27/2019	577.40
35D	12/23/2019	577.21
35D	03/17/2020	577.25
35D	06/22/2020	573.71
35D	09/29/2020	579.56
35D	12/07/2020	577.60
35D	03/29/2021	549.33
35D	04/01/2021	549.33
35D	04/12/2021	561.82
35D	04/21/2021	561.82
35D	05/10/2021	570.83
35D	06/03/2021	572.26
35D	06/17/2021	570.33
35D	07/08/2021	570.54
35D	07/27/2021	571.08
35D	08/16/2021	569.32
35D	08/17/2021	569.32
70S	03/29/2021	585.60
70S	04/01/2021	585.60
70S	04/12/2021	584.17
70S	04/21/2021	584.17
70S	05/10/2021	584.75
70S	06/03/2021	582.66
70S	06/17/2021	580.00
70S	07/08/2021	585.81
70S	07/27/2021	582.69
70S	08/16/2021	580.59

TABLE D-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
70S	08/17/2021	580.59
70D	03/29/2021	548.14
70D	04/01/2021	548.14
70D	04/12/2021	543.92
70D	04/21/2021	543.92
70D	05/10/2021	545.43
70D	06/03/2021	546.75
70D	06/17/2021	544.54
70D	07/08/2021	544.72
70D	07/27/2021	544.31
70D	07/28/2021	594.52
70D	08/16/2021	544.09
70D	08/17/2021	544.09
71S	03/29/2021	571.23
71S	04/01/2021	571.23
71S	04/12/2021	569.85
71S	04/21/2021	569.85
71S	05/10/2021	569.54
71S	05/12/2021	569.54
71S	06/03/2021	569.17
71S	07/08/2021	570.83
71S	07/27/2021	569.23
71S	08/16/2021	568.46
71S	08/17/2021	568.46
71D	03/29/2021	541.21
71D	04/01/2021	541.21
71D	04/12/2021	538.61
71D	06/17/2021	539.90
71D	08/17/2021	579.89
NED1	03/29/2021	597.80
NED1	04/01/2021	597.80
NED1	04/12/2021	596.64
NED1	04/21/2021	596.64
NED1	05/10/2021	596.50
NED1	05/11/2021	596.50
NED1	06/04/2021	596.39
NED1	06/17/2021	596.09
NED1	07/05/2021	598.68
NED1	07/07/2021	598.68
NED1	07/26/2021	598.60
NED1	08/16/2021	598.47
NED1	08/17/2021	598.47
SG01	03/29/2021	680.76
SG01	04/12/2021	680.50
SG01	05/10/2021	680.82

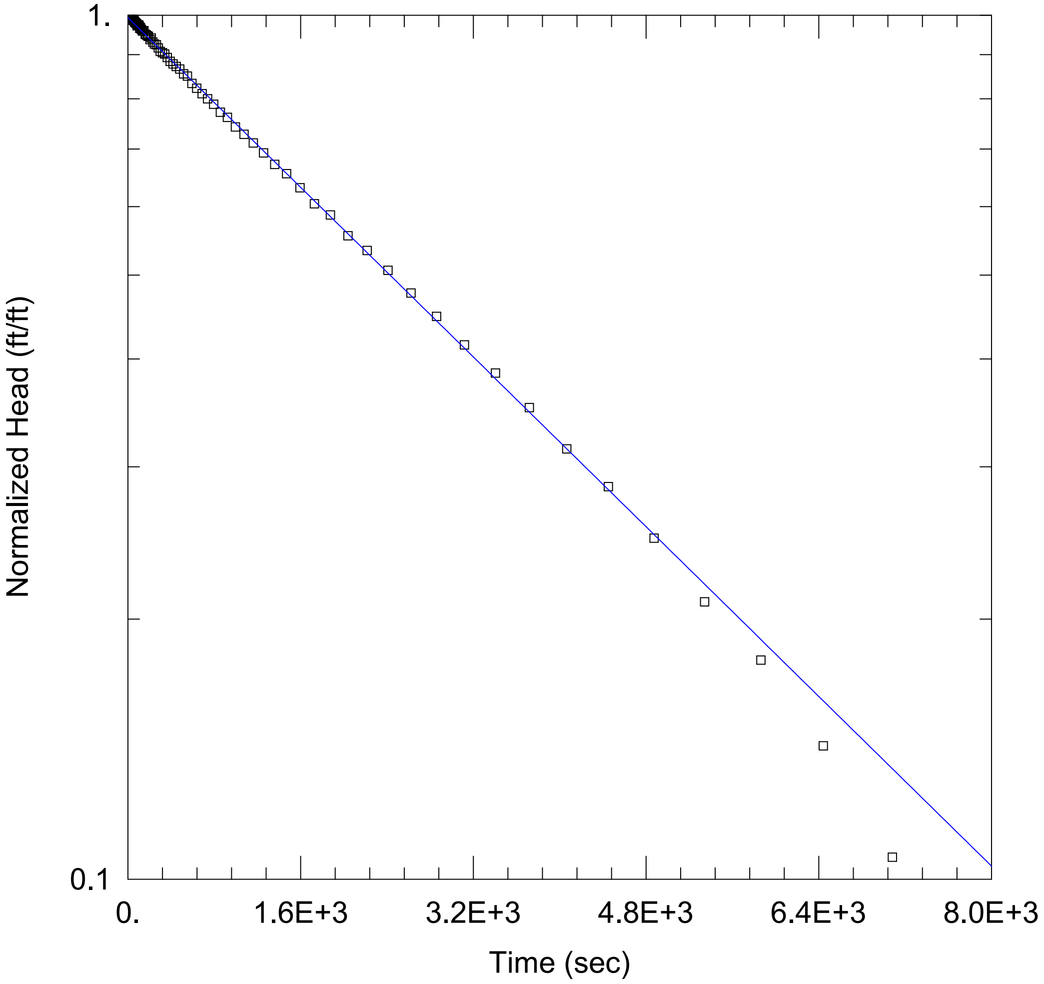
TABLE D-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
SG01	07/05/2021	680.77
SG01	07/08/2021	680.77
SG01	07/26/2021	681.07
SG01	08/16/2021	679.67

Notes:
ft NAVD88 = feet relative to the North American Vertical Datum 1988, GEOID 12A

generated 10/05/2021, 4:09:57 PM CDT

APPENDIX E
FIELD HYDRAULIC CONDUCTIVITY TEST DATA



10 FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Dynegy Midwest Generation, LLC
Location: Vermilion Power Plant
Test Date: 04/16/2021

AQUIFER DATA

Saturated Thickness: 65.9 ft
Anisotropy Ratio (Kz/Kr): 1.

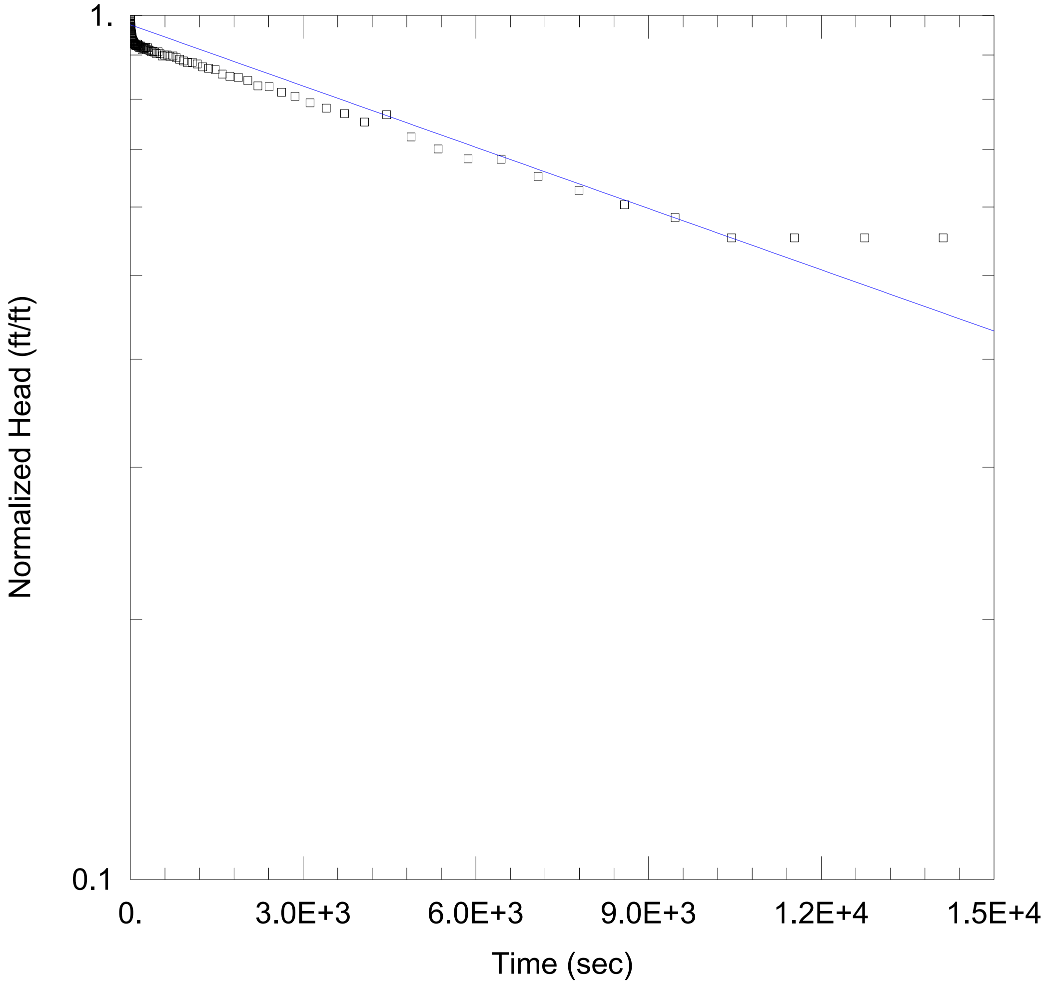
WELL DATA (10)

Initial Displacement: 1.5 ft
Total Well Penetration Depth: 47.6 ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.4 ft
Screen Length: 10. ft
Well Radius: 0.17 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 8.76E-6 cm/sec
y0 = 1.49 ft



16A FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Dynegy Midwest Generation, LLC
Location: Vermilion Power Plant
Test Date: 04/15/2021

AQUIFER DATA

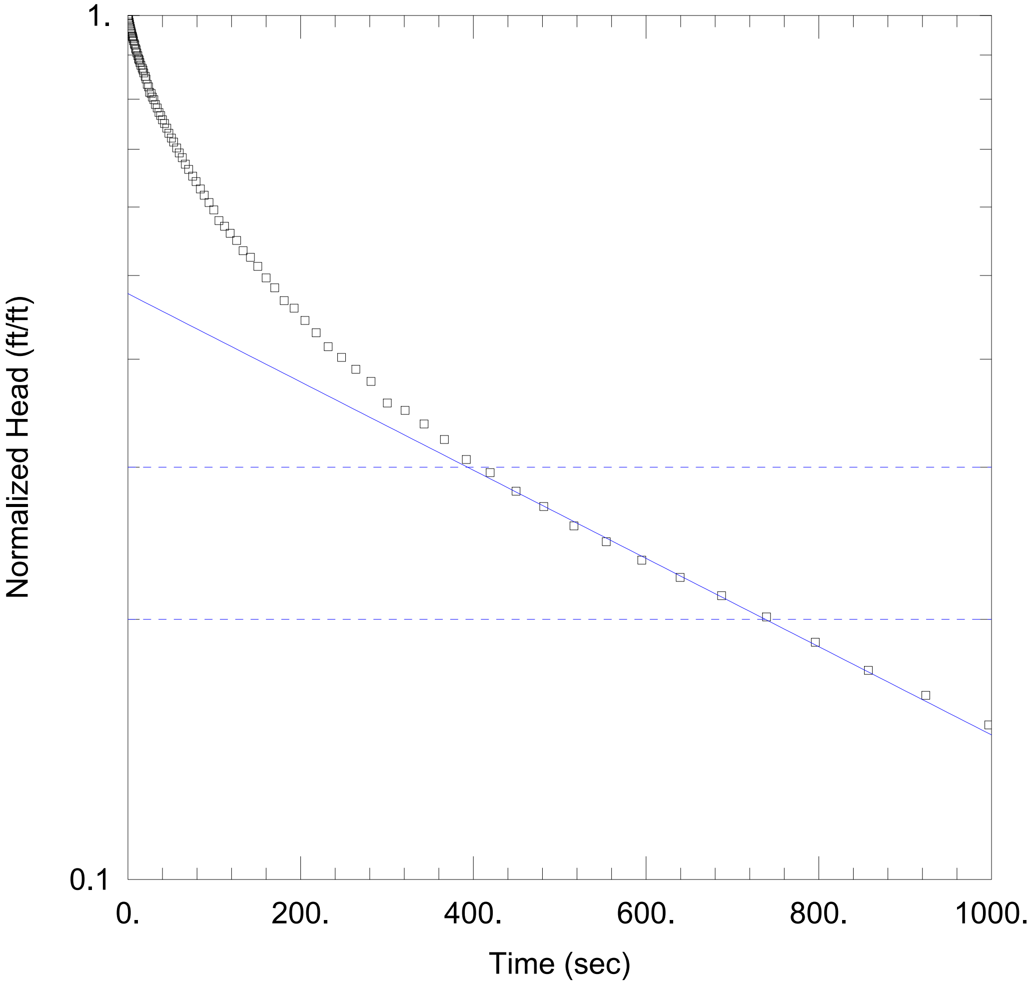
Saturated Thickness: 31.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (16A)

Initial Displacement: 1.63 ft
Total Well Penetration Depth: 31.3 ft
Casing Radius: 0.083 ft
Static Water Column Height: 31.3 ft
Screen Length: 20. ft
Well Radius: 0.17 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.13E-6 cm/sec
y0 = 1.59 ft



22 FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Dynegy Midwest Generation, LLC
Location: Vermilion Power Plant
Test Date: 04/15/2021

AQUIFER DATA

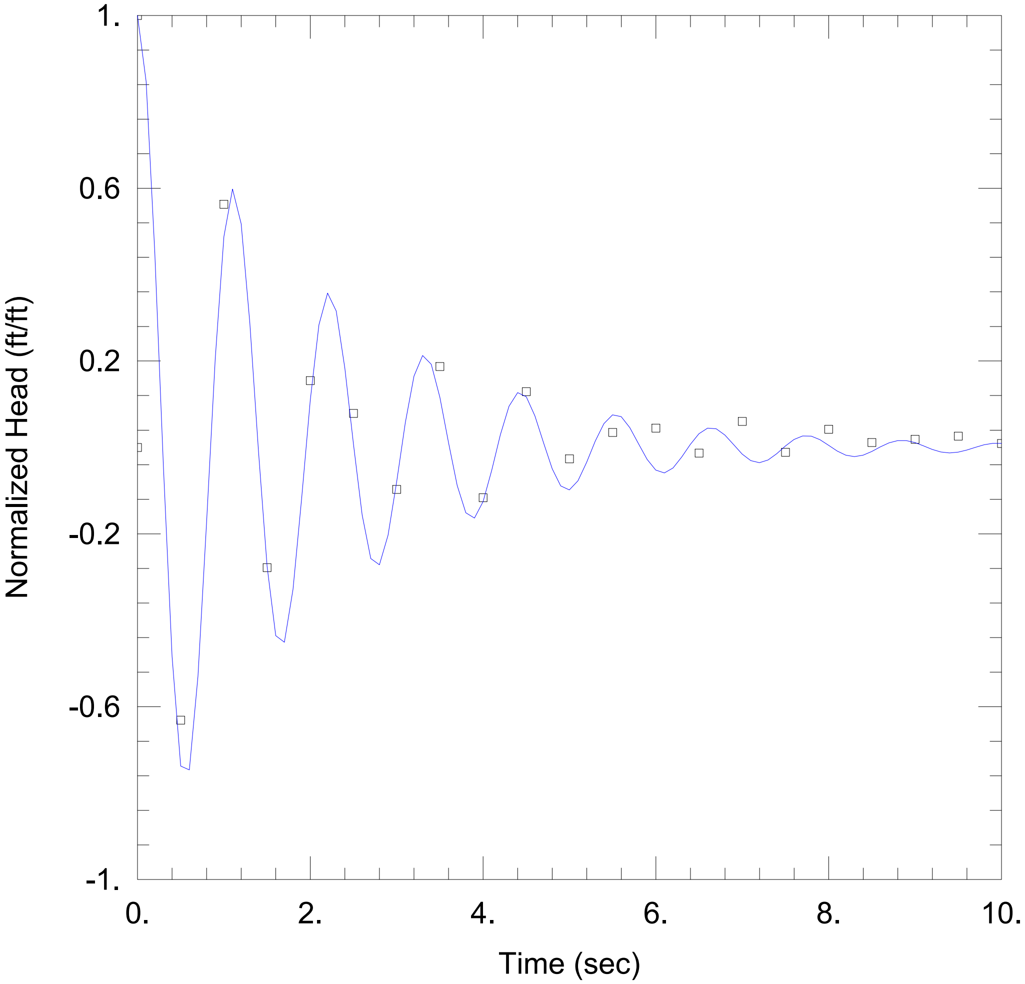
Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (22)

Initial Displacement: 1.61 ft
Static Water Column Height: 47.98 ft
Total Well Penetration Depth: 30. ft
Screen Length: 20. ft
Casing Radius: 0.09 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 2.34E-5 cm/sec
y0 = 0.767 ft



23 RH-1

PROJECT INFORMATION

Company: Ramboll
Client: Dynegy Midwest Generation, LLC
Location: Vermilion Power Plant
Test Date: 04/19/2021

AQUIFER DATA

Saturated Thickness: 11.8 ft
Anisotropy Ratio (Kz/Kr): 1.

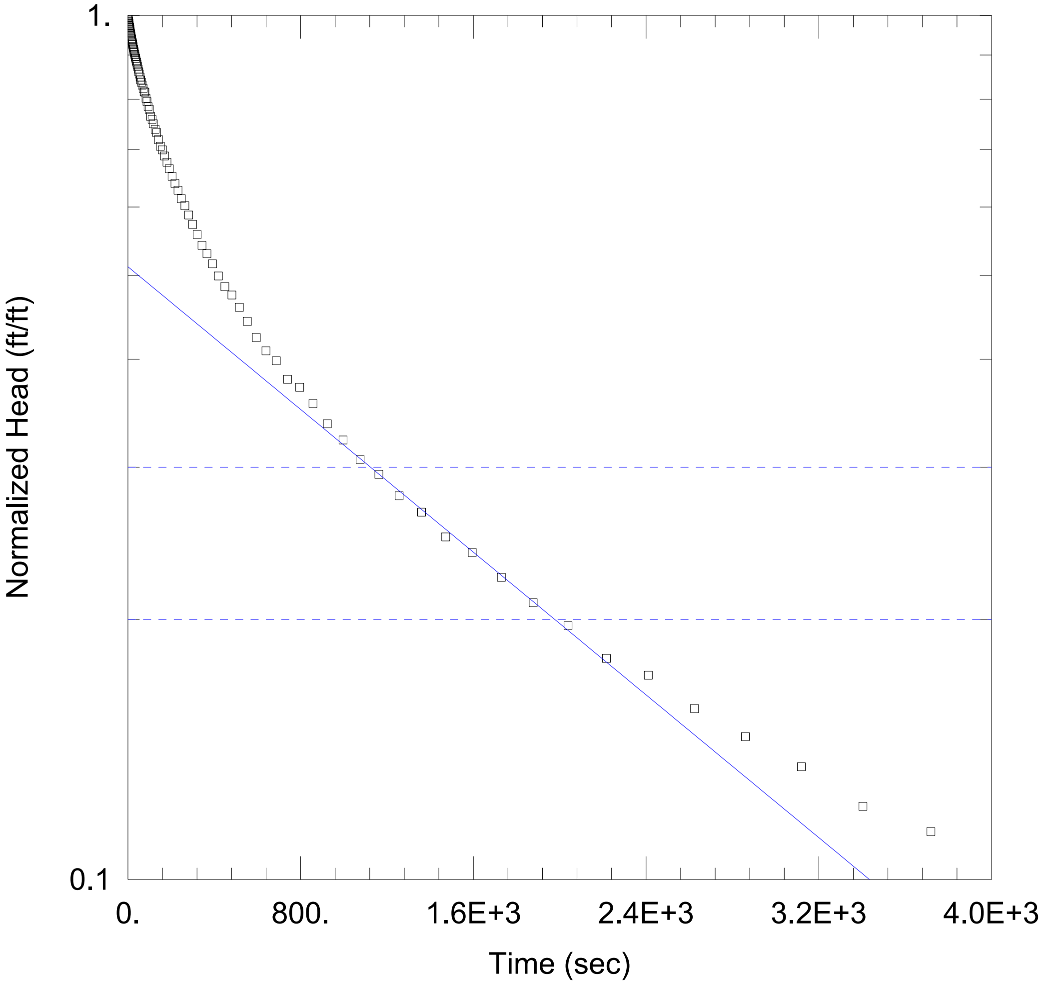
WELL DATA (23)

Initial Displacement: 1.88 ft
Static Water Column Height: 11.62 ft
Total Well Penetration Depth: 11.62 ft
Screen Length: 10. ft
Casing Radius: 0.09 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Springer-Gelhar

K = 1.12 cm/sec
Le = 0.991 ft



24 FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Dynegy Midwest Generation, LLC
Location: Vermilion Power Plant
Test Date: 04/19/2021

AQUIFER DATA

Saturated Thickness: 34.6 ft
Anisotropy Ratio (Kz/Kr): 1.

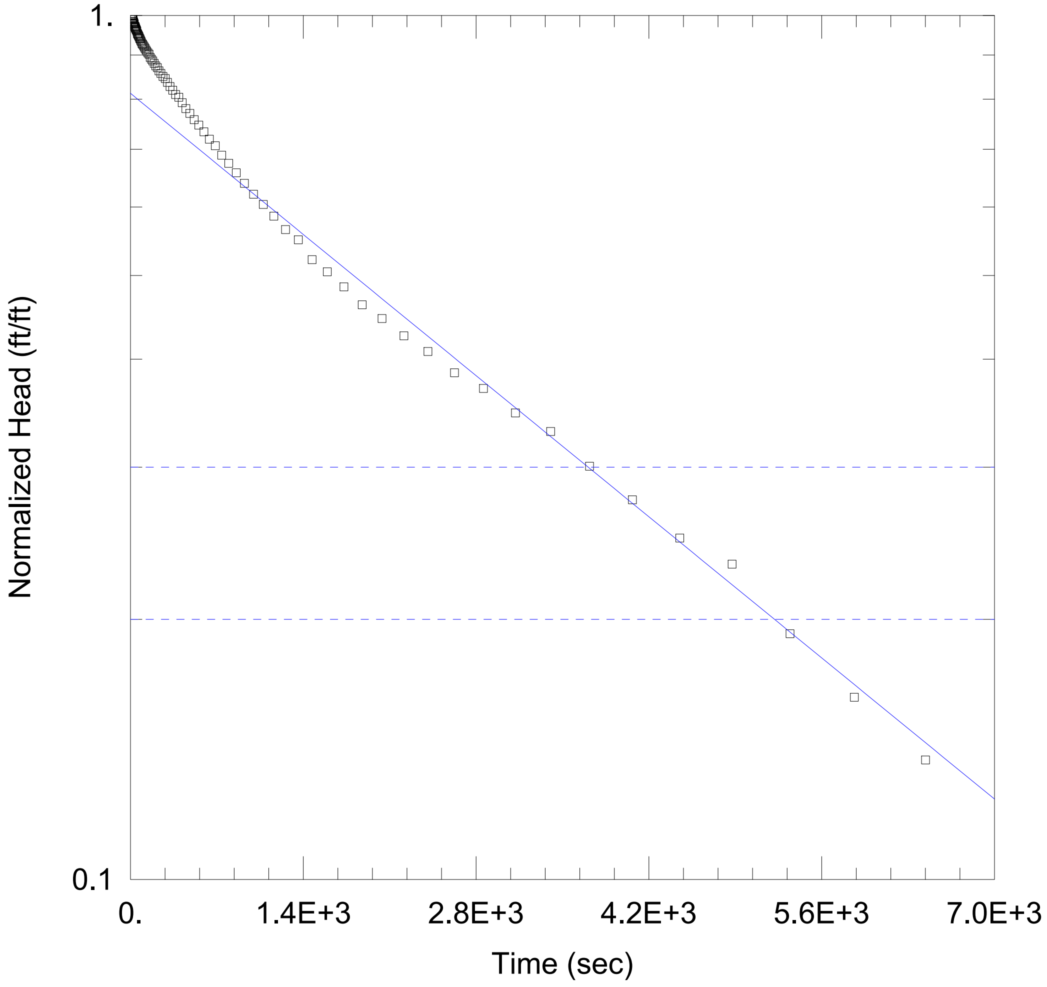
WELL DATA (24)

Initial Displacement: 1.77 ft
Static Water Column Height: 34.26 ft
Total Well Penetration Depth: 34.3 ft
Screen Length: 19.9 ft
Casing Radius: 0.09 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 9.56E-6 cm/sec
y0 = 0.906 ft



25 FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Dynegy Midwest Generation, LLC
Location: Vermilion Power Plant
Test Date: 04/19/2021

AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 1.

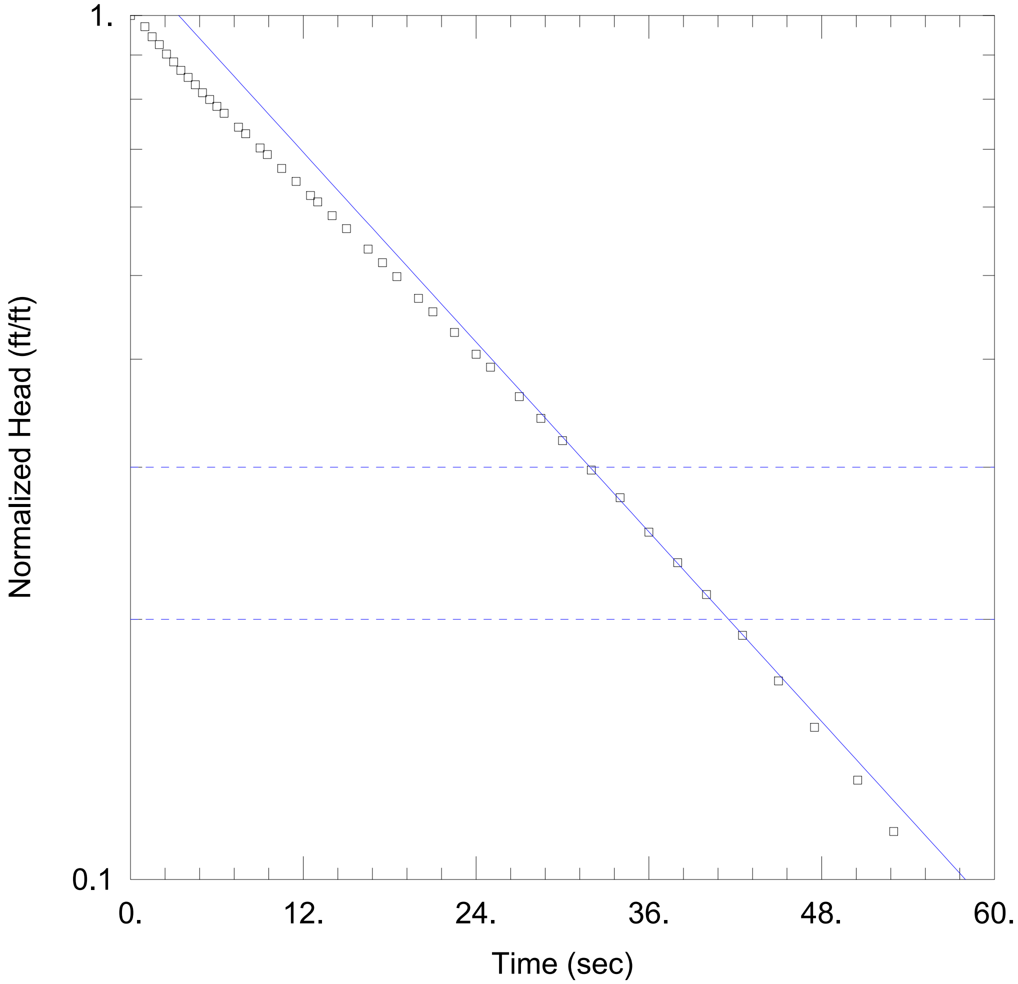
WELL DATA (25)

Initial Displacement: 1.2 ft
Total Well Penetration Depth: 25.28 ft
Casing Radius: 0.09 ft
Static Water Column Height: 7.25 ft
Screen Length: 19.6 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 9.97E-6 cm/sec
y0 = 0.975 ft



70S RH1

PROJECT INFORMATION

Company: Ramboll
Client: Dynegy Midwest Generation, LLC
Location: Vermilion Power Plant
Test Date: 04/14/2021

AQUIFER DATA

Saturated Thickness: 7.5 ft
Anisotropy Ratio (Kz/Kr): 1.

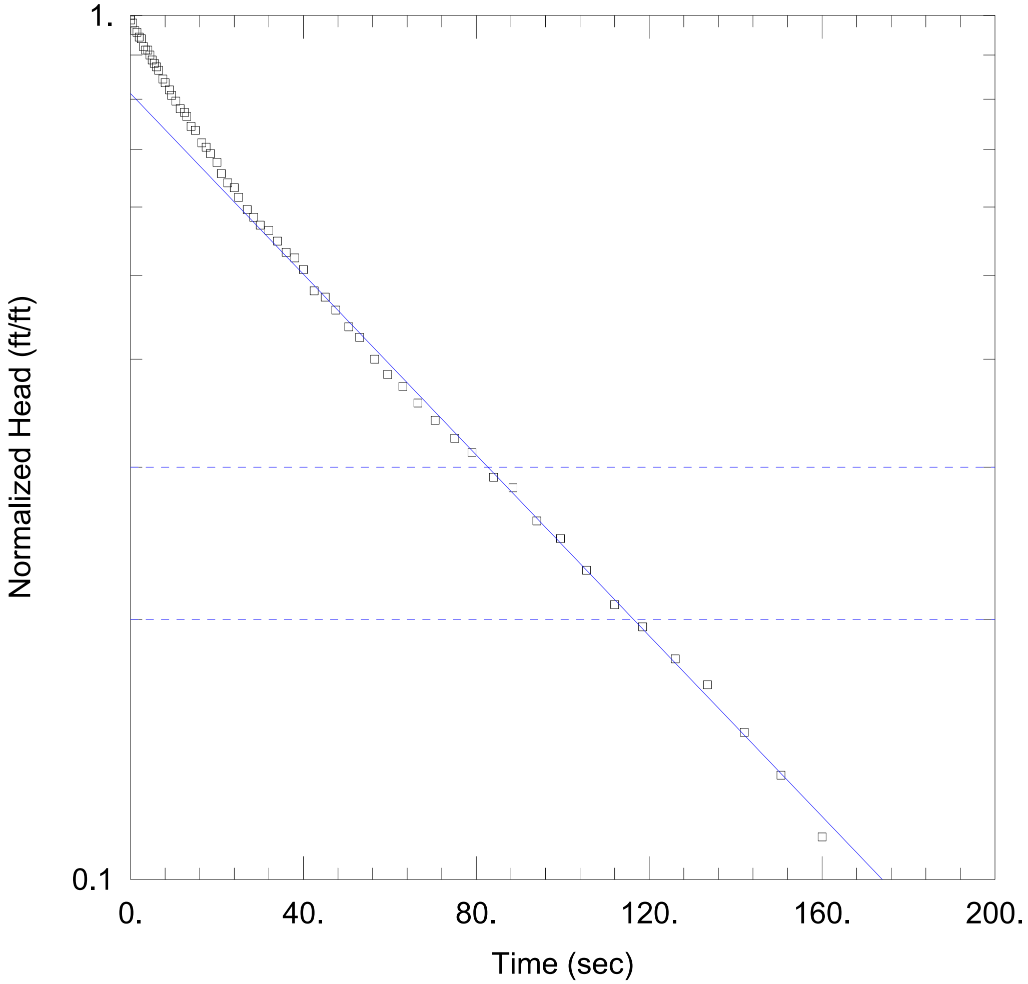
WELL DATA (70S)

Initial Displacement: 1.32 ft
Static Water Column Height: 12.24 ft
Total Well Penetration Depth: 7.5 ft
Screen Length: 7.5 ft
Casing Radius: 0.086 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.00143 cm/sec
y0 = 1.52 ft



71S FH1

PROJECT INFORMATION

Company: Ramboll
Client: Dynegy Midwest Generation, LLC
Location: Vermilion Power Plant
Test Date: 04/14/2021

AQUIFER DATA

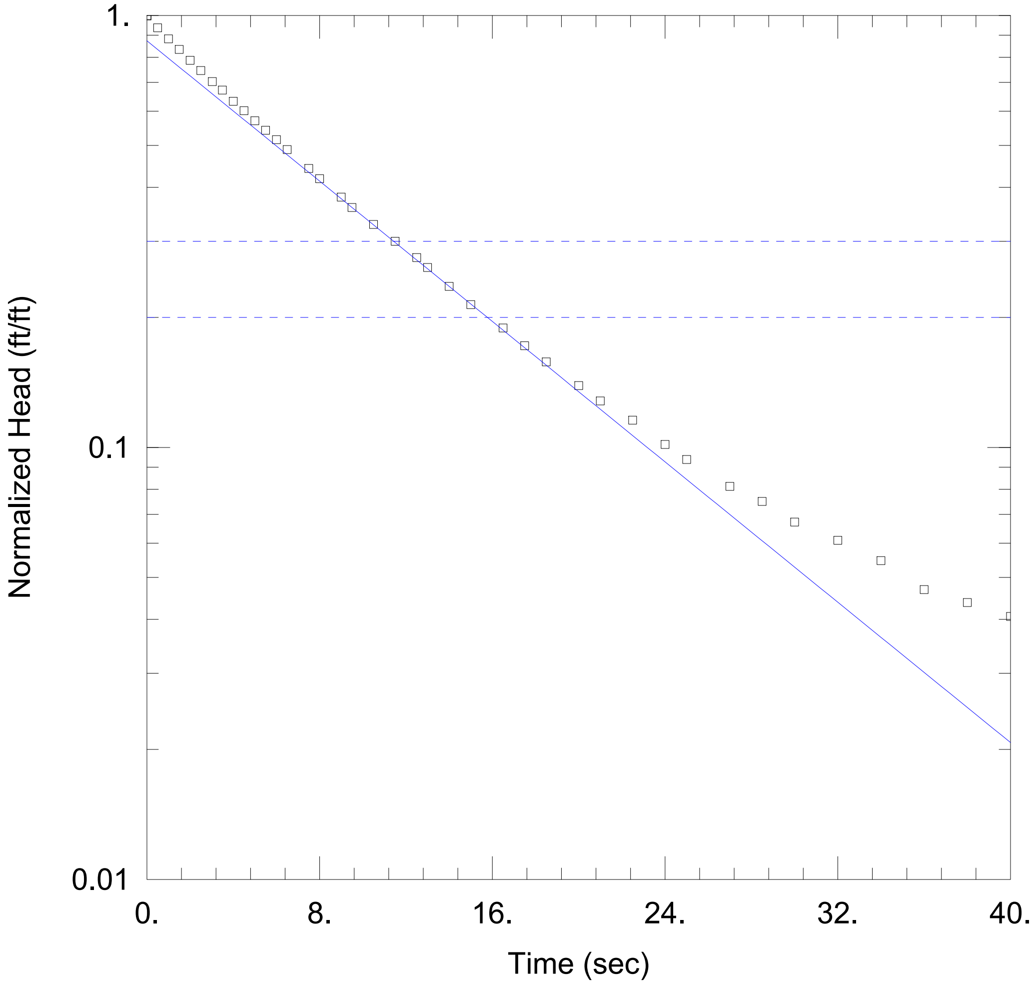
Saturated Thickness: 2.8 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (71S)

Initial Displacement: 0.25 ft
Total Well Penetration Depth: 2.8 ft
Casing Radius: 0.086 ft
Static Water Column Height: 3.02 ft
Screen Length: 2.8 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00074 cm/sec
y0 = 0.203 ft



NED1 RH-1

PROJECT INFORMATION

Company: Ramboll
Client: Dynegy Midwest Generation, LLC
Location: Vermilion Power Plant
Test Date: 04/15/2021

AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 1.

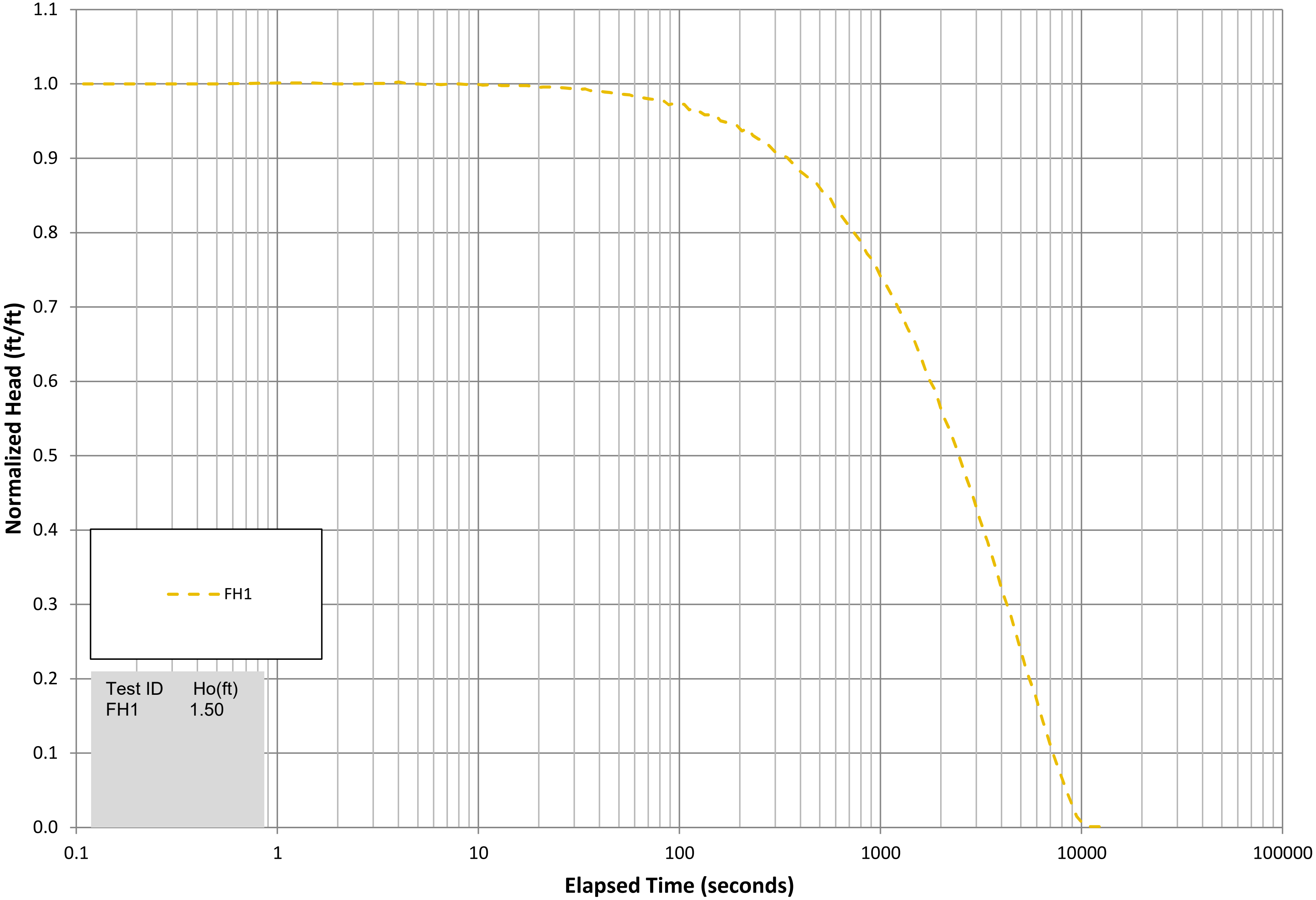
WELL DATA (NED1)

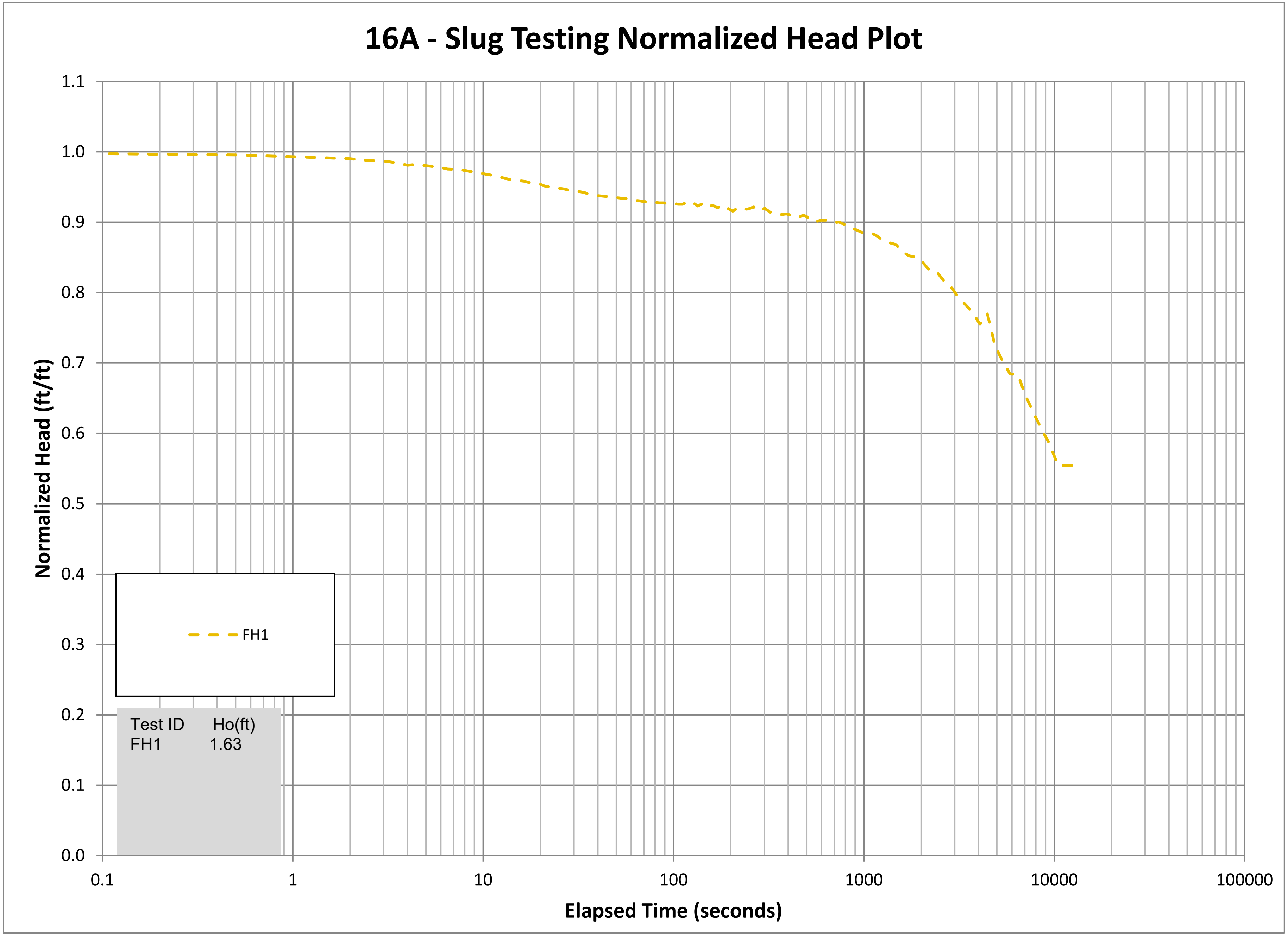
Initial Displacement: 0.64 ft
Static Water Column Height: 13.22 ft
Total Well Penetration Depth: 13.22 ft
Screen Length: 9.63 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

SOLUTION

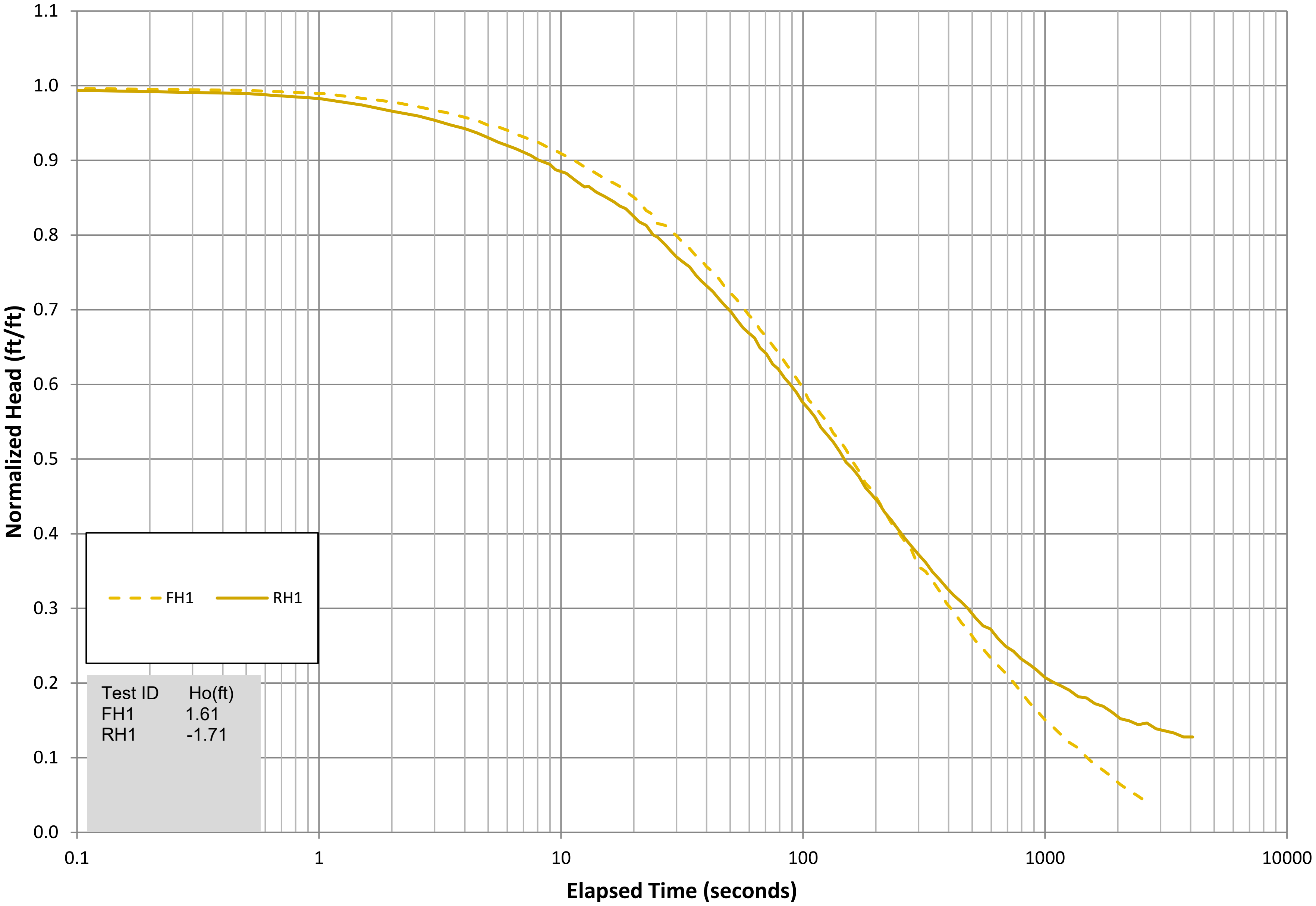
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00243 cm/sec
y0 = 0.559 ft

10 - Slug Testing Normalized Head Plot



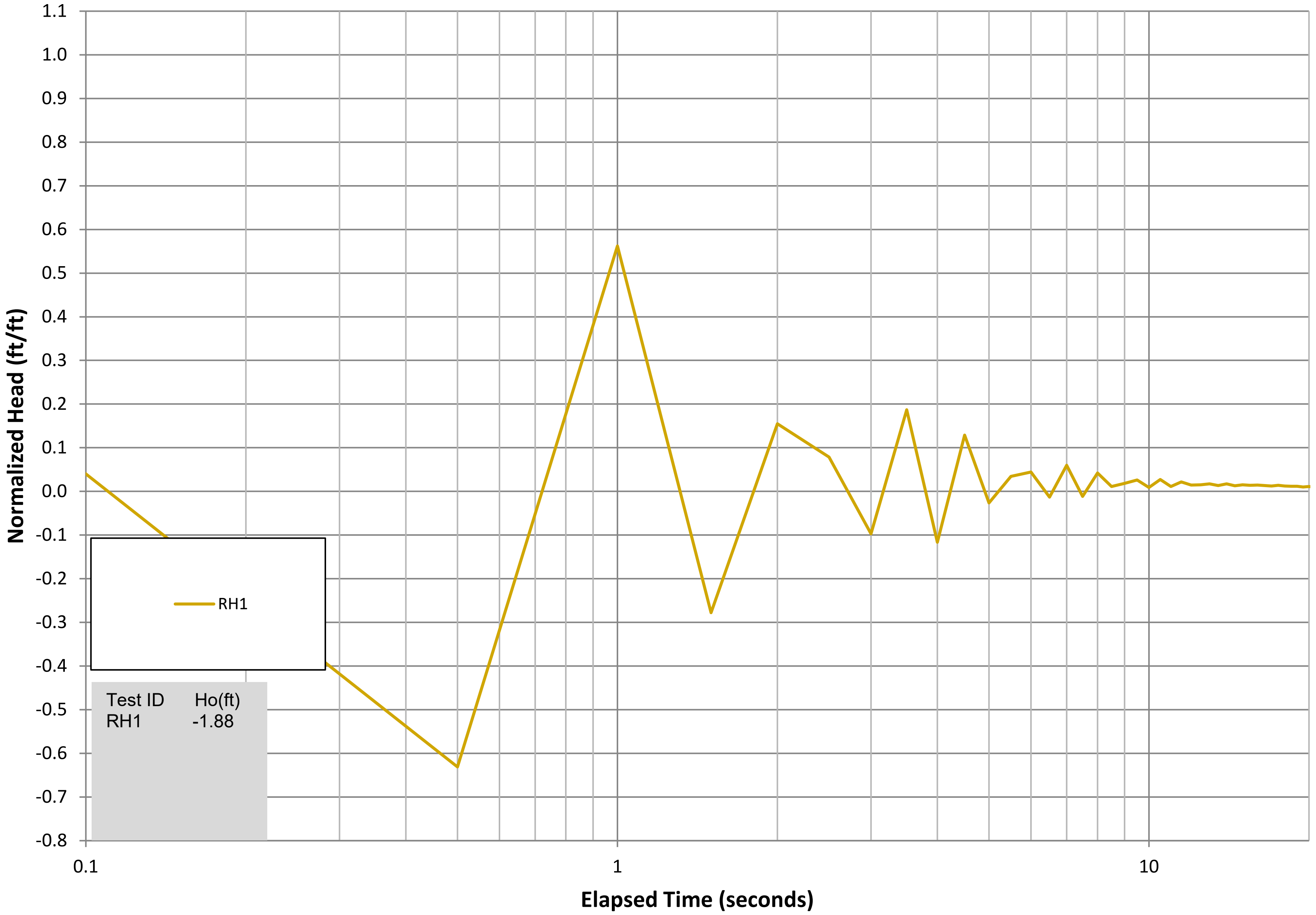

16A - Slug Testing Normalized Head Plot
Normalized Head (ft/ft)
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.1
1
10
100
1000
10000
100000
Elapsed Time (seconds)
FH1
Test ID Ho(ft)
FH1 1.63

22 - Slug Testing Normalized Head Plot

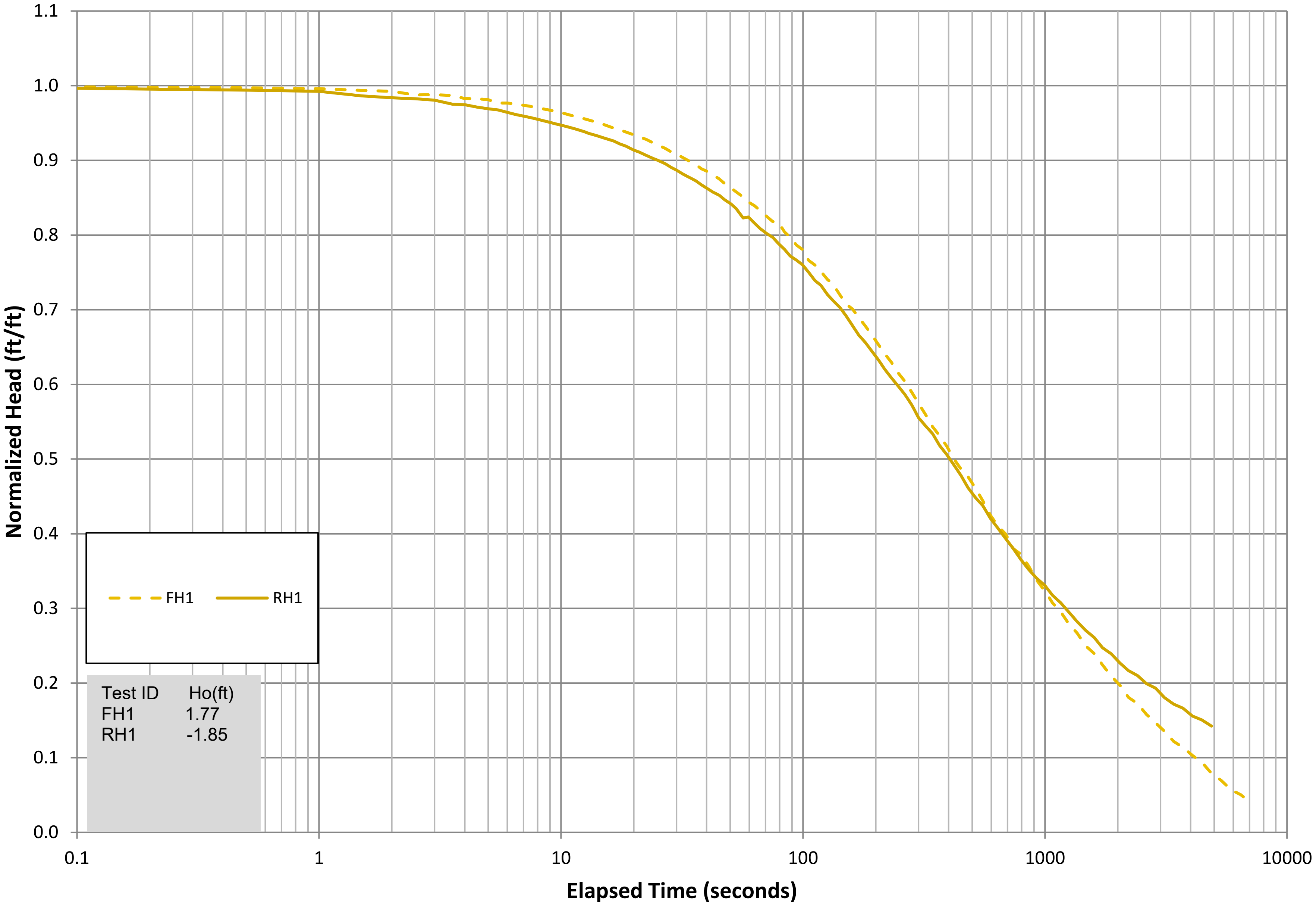


Test ID	Ho(ft)
FH1	1.61
RH1	-1.71

23 - Slug Testing Normalized Head Plot

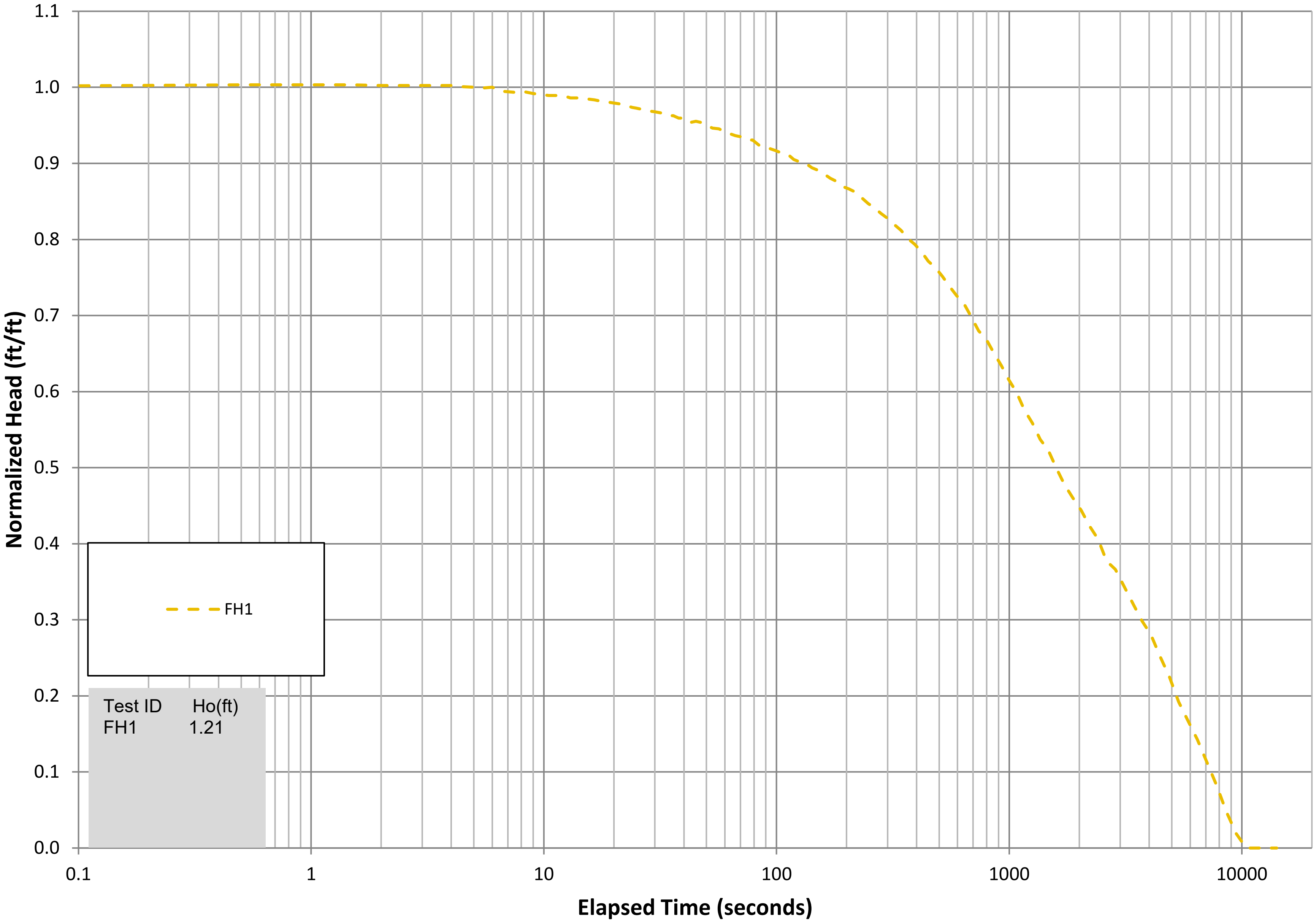


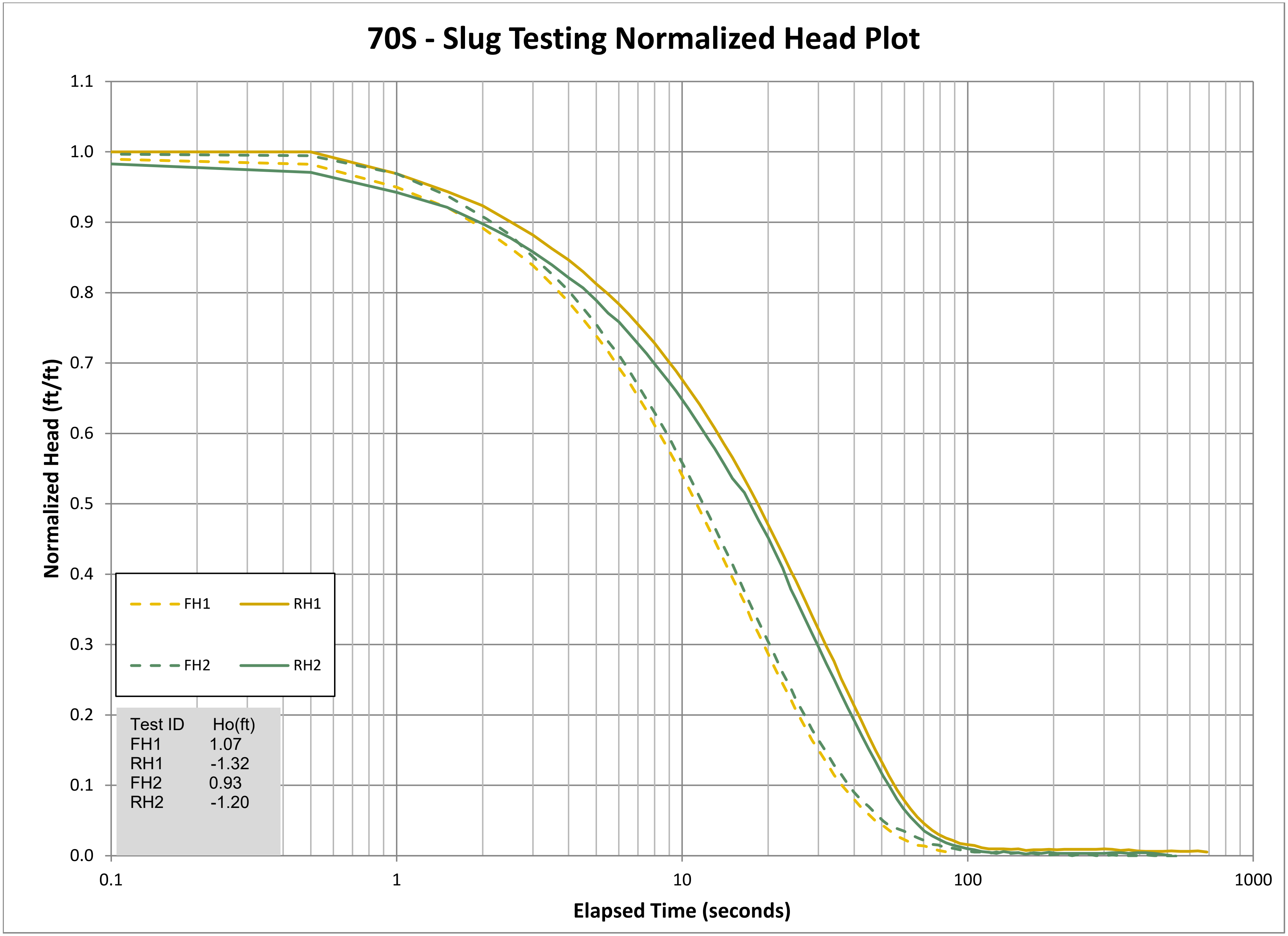
24 - Slug Testing Normalized Head Plot



Test ID	Ho(ft)
FH1	1.77
RH1	-1.85

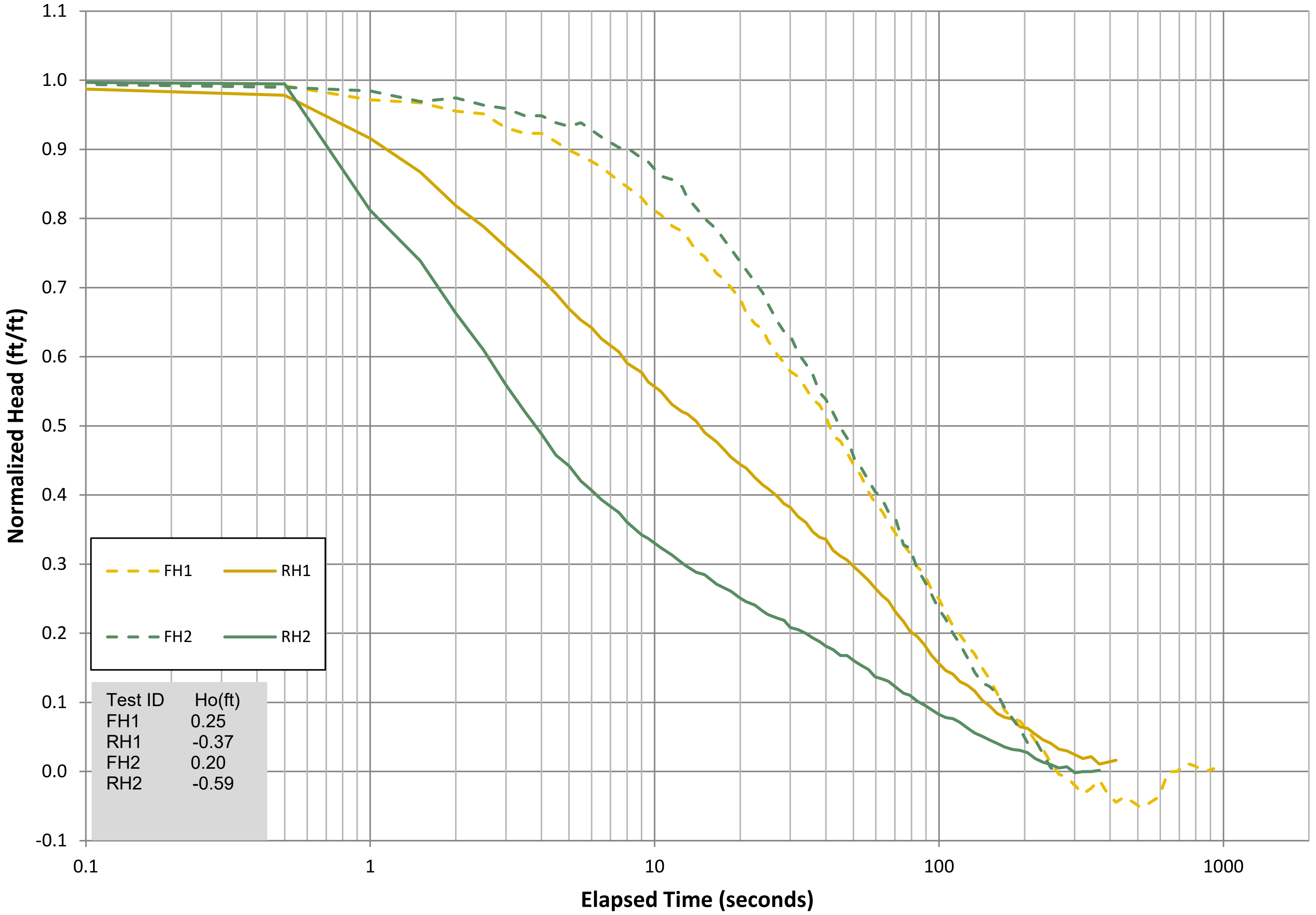
25 - Slug Testing Normalized Head Plot





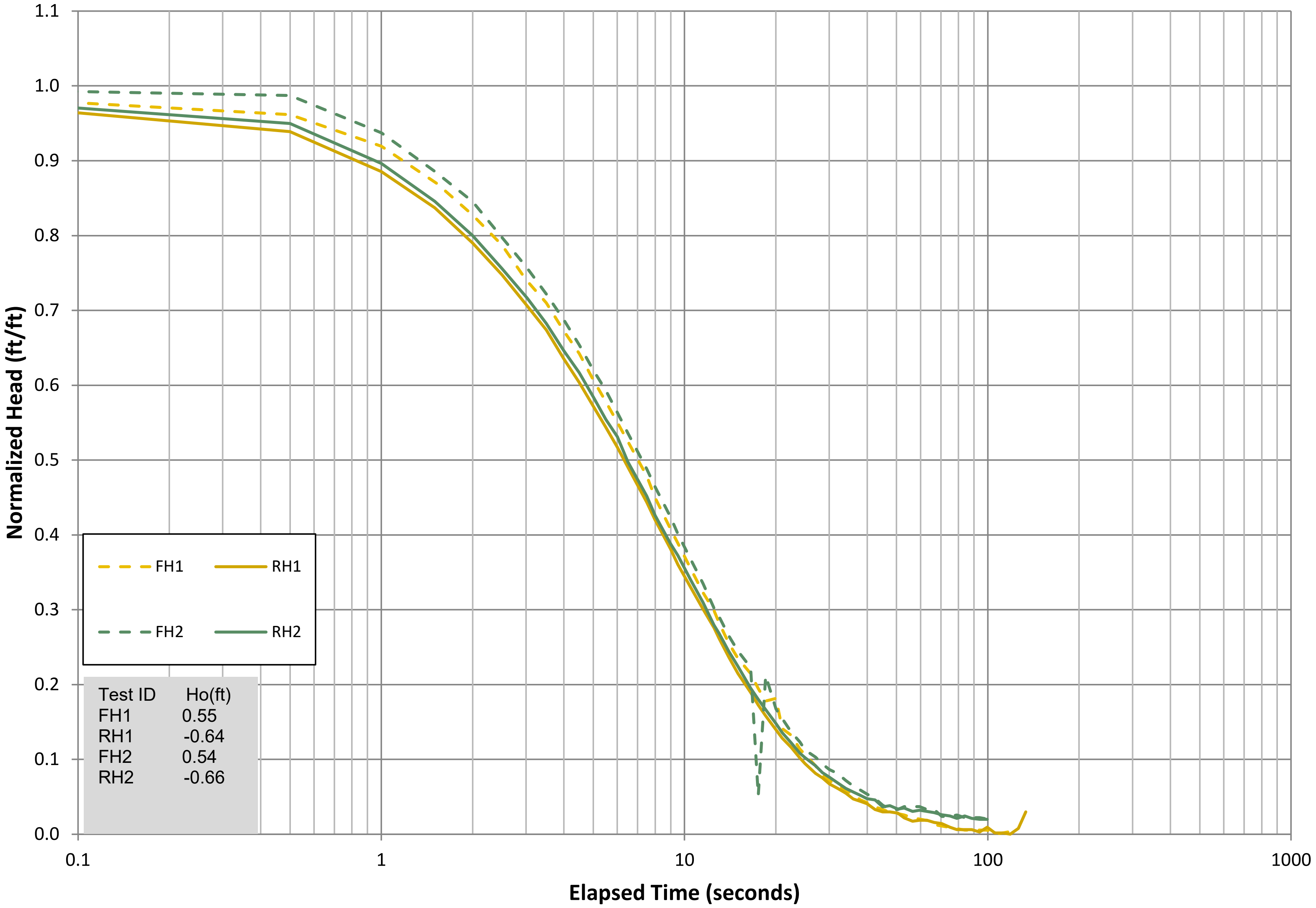
Test ID	Ho(ft)
FH1	1.07
RH1	-1.32
FH2	0.93
RH2	-1.20

71S - Slug Testing Normalized Head Plot



Test ID	Ho(ft)
FH1	0.25
RH1	-0.37
FH2	0.20
RH2	-0.59

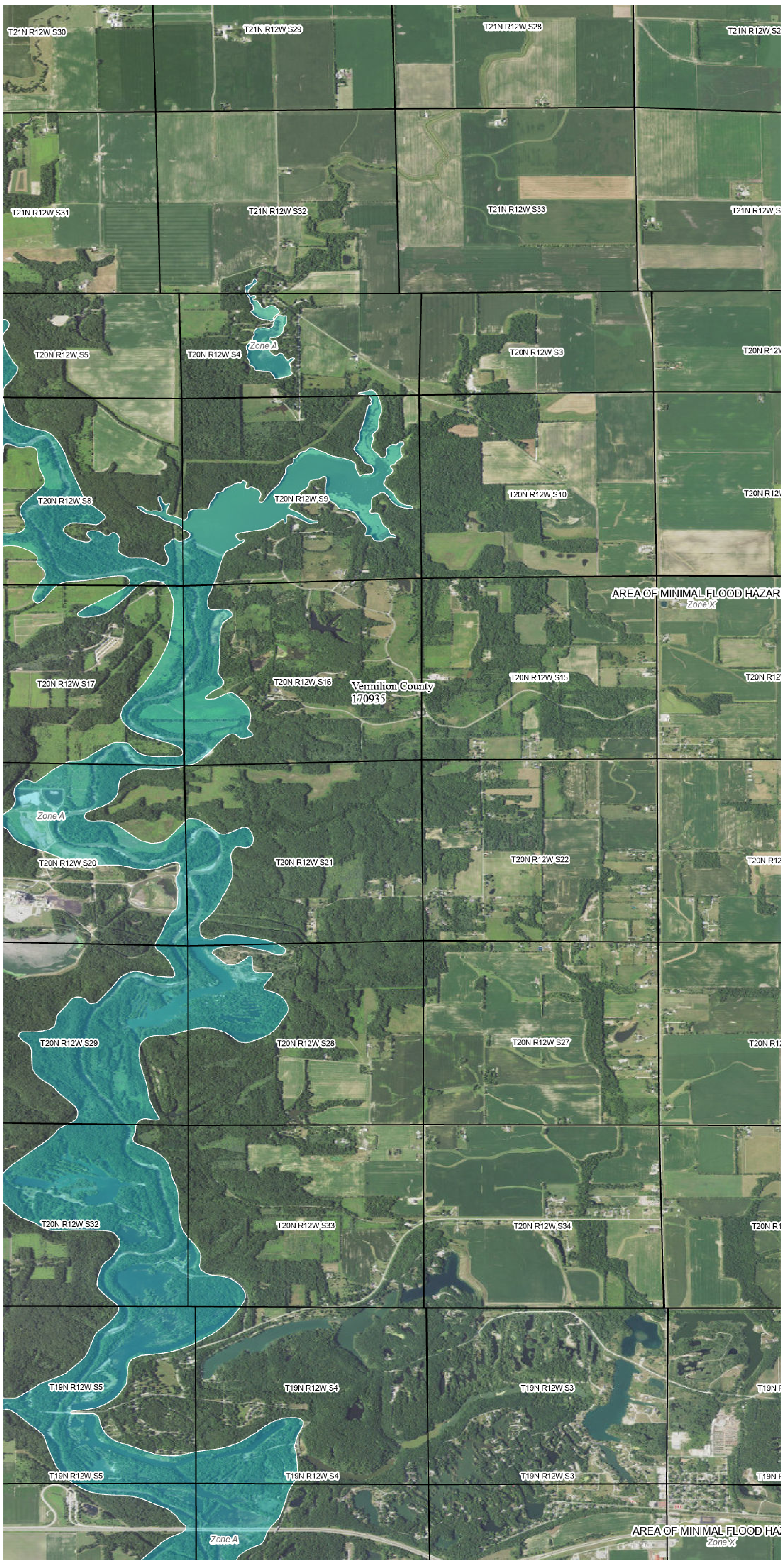
NED1 - Slug Testing Normalized Head Plot



Test ID	Ho(ft)
FH1	0.55
RH1	-0.64
FH2	0.54
RH2	-0.66

APPENDIX F
FEMA FLOOD HAZARD MAP

87°46'54.23"W 40°15'26.41"N



87°39'20.81"W 40°7'3.7"N

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP
FOR DRAFT 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
	ı ı ı ı ı ı ı ı ı ı	Levee, Dike, or Floodwall
OTHER FEATURES	(B) —— 20.2	Cross Sections with 1% Annual Chance
	—— 17.5	Water Surface Elevation
	(8) - - - - -	Coastal Transect
	-·— -·— -·—	Coastal Transect Baseline
	—— - - ——	Profile Baseline
	——	Hydrographic Feature
	~~ 513 ~~~~	Base Flood Elevation Line (BFE)
	═══	Limit of Study
	——	Jurisdiction Boundary

NOTES TO USERS

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SCALE

Map Projection:
GCS, Geodetic Reference System 1980;
Vertical Datum: No elevation features on this FIRM

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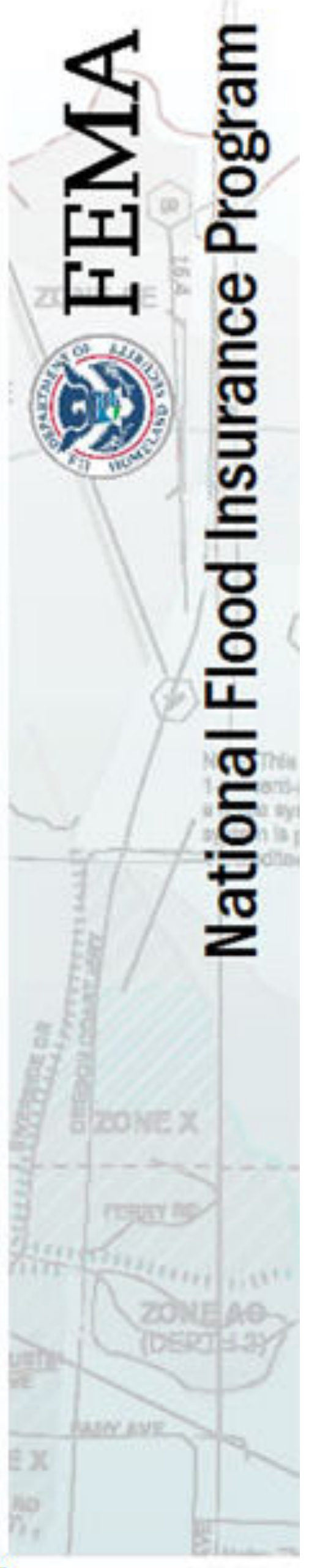
1 inch = 2,000 feet **1:24,000**

0 1,000 2,000 4,000 6,000 8,000
Feet

Meters
0 210 420 840 1,260 1,680



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

VERMILION COUNTY, ILLINOIS
AND INCORPORATED AREAS

PANEL **275** OF **500**

Panel Contains:

COMMUNITY	NUMBER	PANEL
VERMILION COUNTY	170935	0275

MAP NUMBER
17183C0275D
EFFECTIVE DATE
May 16, 2012

ATTACHMENT O

Groundwater Monitoring Plan

Groundwater Monitoring System (845.630)

Groundwater Sampling and Analysis Program (845.640)

Proposed Groundwater Monitoring Program (845.650)

Intended for
Dynegy Midwest Generation, LLC

Date
October 25, 2021

Project No.
1940100722

GROUNDWATER MONITORING PLAN

NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

GROUNDWATER MONITORING PLAN
VERMILION POWER PLANT NEW EAST ASH POND

Project name	**Vermilion Power Plant New East Ash Pond**
Project no.	**1940100722**
Recipient	**Dynegy Midwest Generation, LLC**
Document type	**Groundwater Monitoring Plan**
Revision	**FINAL**
Date	**October 25, 2021**

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LICENSED PROFESSIONAL CERTIFICATIONS

35 I.A.C. § 845.630 Groundwater Monitoring Systems (PE)

I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify that the groundwater monitoring system described in this document (Groundwater Monitoring Plan, Vermilion Power Plant New East Ash Pond), has been designed and constructed to meet the requirements of 35 I.A.C. § 845.630. The monitoring system was developed based on information included in the Hydrogeologic Site Characterization Report (Ramboll 2021; included in the Operating Permit to which this Groundwater Monitoring Plan is attached).

Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
Date: October 25, 2021

ERIC J. TLACHAC
062-063091

35 I.A.C. § 845.630 Groundwater Monitoring Systems (PG)

I, Brian G. Hennings, a qualified professional geologist in good standing in the State of Illinois, certify that the groundwater monitoring system described in this document (Groundwater Monitoring Plan, Vermilion Power Plant New East Ash Pond), has been designed and constructed to meet the requirements of 35 I.A.C. § 845.630. The monitoring system was developed based on information included in the Hydrogeologic Site Characterization Report (Ramboll 2021; included in the Operating Permit to which this Groundwater Monitoring Plan is attached).

Brian G. Hennings
Professional Geologist
196.001482
Illinois
Date: October 25, 2021

BRIAN G. HENNINGS
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CONTENTS

TABLES (IN TEXT)

TABLES (ATTACHED)

FIGURES (ATTACHED)

APPENDICES

ACRONYMS AND ABBREVIATIONS

35 I.A.C.	Title 35 of the Illinois Administrative Code
ASD	Alternate Source Demonstration
BCU	Bedrock Confining Unit
bgs	below ground surface
CCR	coal combustion residuals
DMG	Dynegy Midwest Generation, LLC
GMP	Groundwater Monitoring Plan
GWPS	groundwater protection standard
HCR	Hydrogeologic Site Characterization Report
ID	identification
IEPA	Illinois Environmental Protection Agency
Kelron	Kelron Environmental, Inc.
Middle Fork	Middle Fork of the Vermilion River
NEAP	New East Ash Pond
NID	National Inventory of Dams
No.	number
NPDES	National Pollutant Discharge Elimination System
Part 845	Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845
PMP	potential migration pathway
QA/QC	quality assurance/quality control
Ramboll	Ramboll Americas Engineering Solutions, Inc.
RL	reporting limit
SI	surface impoundment
TDS	total dissolved solids
UCU	Upper Confining Unit
USEPA	United States Environmental Protection Agency
VPP	Former Vermilion Power Plant

1. INTRODUCTION

1.1 Overview

In accordance with requirements of the Standards for the Disposal of Coal Combustion Residuals (CCR) in Surface Impoundments (SIs): Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845 (Part 845) (Illinois Environmental Protection Agency [IEPA], April 15, 2021), Ramboll Americas Engineering Solutions, Inc. (Ramboll) has prepared this Groundwater Monitoring Plan (GMP) on behalf of the former Vermilion Power Plant (VPP) (**Figure 1-1**), operated by Dynegy Midwest Generation, LLC (DMG). This report will apply specifically to the CCR Unit referred to as the New East Ash Pond (NEAP), Vistra identification (ID) number (No.) 912, IEPA ID No. W1838000002-04, and National Inventory of Dams (NID) No. IL50291. However, information gathered to evaluate other CCR units at the VPP regarding geology, hydrogeology, and groundwater quality is included, where appropriate. The 29-acre NEAP is an inactive, unlined CCR SI constructed overtop a thick shale formation using berms constructed with a low permeability clay core keyed into the underlying shale formation. The SI was used to manage CCR and non-CCR waste streams and to clarify process water prior to discharge in accordance with the plants National Pollutant Discharge Elimination System (NPDES) permit (IL0004057) at the VPP. This GMP includes Part 845 content requirements specific to 35 I.A.C. § 845.630 (Groundwater Monitoring System), 35 I.A.C. § 845.640 (Groundwater Sampling and Analysis), and 35 I.A.C. § 845.650 (Groundwater Monitoring Program) for the NEAP at the VPP.

A checklist which identifies the specific requirements of 35 I.A.C. § 845.630, 35 I.A.C. § 845.640, and 35 I.A.C. § 845.650 is included in **Table 1-1**. The table provides references to sections, tables, and figures included in this document to locate the information that meets specific requirements of 35 I.A.C. § 845.630, 35 I.A.C. § 845.640, and 35 I.A.C. § 845.650.

1.2 Site Location and Background

The NEAP is located in east central Illinois in Vermilion County, approximately five miles northeast of the Village of Oakwood, located within the east half of the northeast quarter of the southeast quarter of Section 20, Township 20 North, Range 12 West (**Figure 1-1**). The VPP is an approximately 982-acre property consisting of 19 parcels, including a retired coal-fired power plant and SIs. The VPP ceased operations in 2011 when the power plant was retired.

The NEAP lies in the bottomlands of the Middle Fork of the Vermilion River (Middle Fork) and is bordered to the west by bluffs, to the south by unimproved DMG land, and to the north and east by the Middle Fork. **Figure 1-2** depicts the location of the inactive NEAP.

All ash ponds at the VPP are out of service. The present-day NEAP system consists of the NEAP (29-acres) and a secondary pond (**Figure 1-2**). When the NEAP was active, the ash in the NEAP settled out of the sluice water, was decanted to the polishing pond, and then discharged to the Middle Fork in accordance with the effluent limits and monitoring requirements of the VPP's NPDES permit. The NPDES-permitted outfalls to the Middle Fork are still in effect.

The 1989 footprint of the East Ash Pond was built directly overtop a thick shale formation which is greater than 80 feet thick in the vicinity of the ash ponds. The earthen berms on the north, east, and south sides of the 1989 footprint were "keyed" into the underlying shale formation with two four-foot-thick soil/bentonite slurry walls. These walls extended approximately 8 feet down into the shale and approximately 12 feet above the shale surface into the clay-core center of the earthen berms. A natural earthen bluff composed of low permeability native clays formed the west side of the 1989 footprint.

New berms were constructed to expand the capacity of the East Ash Pond in 2002, forming the footprint of the present-day NEAP (**Figure 1-2**). The new berms raised the height of the original berms by approximately 20 feet and were constructed with 8-foot clay liners keyed into the underlying clay core.

1.3 Conceptual Model

Significant site investigation has been completed at the VPP to characterize the geology, hydrogeology, and groundwater quality. Based on extensive investigation and monitoring, the NEAP has been well characterized and detailed in the Hydrogeologic Site Characterization Report (HCR; included in the Operating Permit to which this Plan is attached). A site conceptual model has been developed and is discussed below.

In addition to the CCRs present in the NEAP, there are three different types of unlithified material present above the bedrock, which were categorized into hydrostratigraphic units in this report as follows:

- **Upper Unit:** includes mixed alluvial deposits of the Cahokia Alluvium described as sand with occasional layers of silty clay. The alluvial sand is generally a fine to medium sand that contains silts, clays, and gravels in varying amounts. This unit is present outside of the NEAP and in the bottomlands of the Middle Fork.
- **Upper Confining Unit (UCU):** consists of predominantly low permeability silty and clayey diamictons (glacial till) of the Wedron Formation with intermittent sand layers and lenses. This unit is present outside of the NEAP and along the western bluff of the Middle Fork.
- **Bedrock Confining Unit (BCU):** lowermost unit identified at the site and underlies all unlithified deposits. This unit occurs within Pennsylvanian shale which is the uppermost lithified unit at the Site.

None of the hydrostratigraphic units described above have been identified as an aquifer. However, the Upper Unit and BCU have been identified as potential migration pathways (PMPs). As determined by the geologic information provided, groundwater quality standards for the monitoring well network screened in the Upper Unit PMP (alluvial deposits) and BCU PMP (shale bedrock) within the bottomlands along the Middle Fork and in the vicinity of the coal mined area are Class IV - Other Groundwater (35 I.A.C. § 620.440 (a) and (c)) standards.

Groundwater flow direction and gradients toward the Middle Fork have not changed significantly since the hydrogeologic study of the NEAP was completed in 2003, and recent data supports the existing CSM. A bedrock groundwater elevation contour map for March 29, 2021 is presented in **Figure 1-3**.

Part 845 parameters were monitored in the Upper Unit PMP and BCU PMP monitoring wells at the NEAP as part of previous groundwater quality investigations. These data were supplemented with sampling of additional locations installed in 2021. The results indicate that the following parameters were greater than the applicable 35 I.A.C. § 845.600(a)(1) groundwater protection standards (GWPSs) and are considered potential exceedances:

- Arsenic, boron, chloride, chromium, cobalt, lead, lithium, sulfate, TDS, thallium, and radium 226 and 228 combined are considered potential exceedances of the Part 845 GWPS. Cobalt, pH, and sulfate were also detected at a concentration greater than the GWPS in the upgradient background UCU well 10. The downgradient wells of the Upper Unit and BCU are influenced by former coal mine areas. Results for these parameters were compared directly to GWPS, without an evaluation of background concentrations or application of statistical methods.

Concentration results for the above parameters were compared directly to 35 I.A.C. § 845.600(a)(1) GWPSs to determine potential exceedances. Evaluation of background groundwater quality has been completed as part of this GMP, and compliance with Part 845 will be determined following the first round of groundwater sampling. The first round of groundwater sampling for compliance will be completed the quarter following issuance of the Operating Permit and in accordance with this GMP.

2. GROUNDWATER MONITORING SYSTEMS

2.1 Existing Monitoring Well Network and Analysis

This GMP is being provided to propose a groundwater monitoring network and monitoring program specific to the NEAP that will comply with Part 845. Monitoring networks and programs that apply to other units are not discussed in this GMP. Groundwater monitoring at the VPP has been performed periodically since 1994 to evaluate and assess the groundwater quality at the NEAP. The remaining discussion in this document will include only monitoring well locations and results that are applicable and specific to the NEAP.

2.1.1 Groundwater Quality Investigations and NPDES Monitoring

Quarterly groundwater monitoring of five wells (10, 13A, 13B, 16A, and 16B), installed prior to East Ash Pond construction in 1989, for selected inorganic parameters was initiated in 1994. Eleven groundwater monitoring wells (22, 23, 24, 25, 26, 27, 28, 29, 30, 31, and 32) were installed in 2001 and monitored along with the five previously existing monitoring wells on a monthly basis for a six-month period in 2002 as part of the investigation completed for the 2003 report, *Regional and Local Hydrogeology and Geochemistry*, *Geochemistry, Vermilion Power Plant* (Kelron Environmental, Inc. [Kelron], 2003).

Monitoring of the eleven wells installed in 2001 (22, 23, 24, 25, 26, 27, 28, 29, 30, 31, and 32) was discontinued after 2002, while quarterly groundwater monitoring of five wells installed prior to East Ash Pond construction (10, 13A, 13B, 16A, and 16B) continued, with subsequent replacement of wells 13B and 13A with wells 35S and 35D, respectively, in 2017 due to a 2015 flood which destroyed 13B and 13A.

Water quality and field parameters monitored at these locations after 2002 was established by Special Condition 19 of the NPDES Permit No. IL0004057 and details are listed below in **Table A**. The permit was allowed to expire following the retirement of the facility; however, groundwater monitoring continues to be performed quarterly in accordance with the NPDES Permit requirements. Monitoring of water quality parameters at well 10, installed in the upland till, was performed intermittently from 2002 to 2011, and quarterly monitoring was initiated in 2011 as part of the former NPDES Permit requirements. Alluvial deposit wells 13B and 16B were monitored for groundwater elevation only as a result of being consistently dry.

Table A. NPDES Permit Groundwater Monitoring Parameters

Field Parameters[1]	
Groundwater Elevation	pH
Metals (Dissolved)	
Boron	Manganese
Inorganics (Total, except TDS)	
Sulfate	TDS

[1] Temperature and specific conductance were recorded during sample collection.

2.1.2 Part 845 Well Installation and Monitoring

In 2021, four additional monitoring wells (70S, 70D, 71S, and 71D) were installed along the south and southeastern perimeter of the NEAP to assess the vertical and horizontal lithology, stratigraphy, chemical properties, and physical properties of geologic layers to a minimum of 100 feet below ground surface (bgs) as specified in 35 I.A.C. § 845.620(b).

Prospective Part 845 monitoring wells were sampled and analyzed for eight rounds between March and August 2021. Groundwater samples were collected and analyzed for 35 I.A.C. § 845.600 parameters as summarized in **Table B** below.

Table B. Part 845 Groundwater Monitoring Program Parameters

Field Parameters[1]			
Groundwater Elevation	pH	Turbidity	
Metals (Total)			
Antimony	Boron	Cobalt	Molybdenum
Arsenic	Cadmium	Lead	Selenium
Barium	Calcium	Lithium	Thallium
Beryllium	Chromium	Mercury	
Inorganics (Total, except TDS)			
Fluoride	Sulfate	Chloride	TDS
Other (Total)			
Radium 226 and 228 combined			

[1] Dissolved oxygen, temperature, specific conductance, and oxidation/reduction potential were recorded during sample collection.

Data and results from the Part 845 background monitoring were included in the water quality discussion included in the HCR (included in the Operating Permit to which this Plan is attached). The data collected from background locations during the Part 845 monitoring were used to evaluate and calculate background concentrations for the NEAP. The evaluation and discussion are included in **Section 3.2** of this report.

Data collected from the groundwater quality investigations and the Part 845 background monitoring were used for selection of the Part 845 monitoring well network proposed in **Section 2.2**.

2.2 Proposed Part 845 Monitoring Well Network

The groundwater monitoring network proposed in this plan will include four monitoring wells screened in the unlithified materials of the Upper Unit PMP (16B, 35S, 70S, and 71S), five wells screened in the BCU PMP (16A, 22, 35D, 70D, and 71D), one well screened in the UCU (10), and one temporary well (water level only) screened in CCR materials (NED1) to be measured on an as-needed basis until remedial activities begin following approval of the construction permit application. The proposed network is summarized in **Table C** below and displayed on **Figure 2-1.** Ten wells (two background and eight compliance) will be used to monitor groundwater concentrations within the hydrostratigraphic units.

The groundwater samples collected from the ten wells will be used to monitor and evaluate groundwater quality and demonstrate compliance with the groundwater quality standards listed in 35 I.A.C. § 845.600(a). The proposed monitoring wells will yield groundwater samples that represent the quality of downgradient groundwater at the CCR boundary (as required in 845.630(a)(2)). Monitoring well depths and construction details are listed in **Table 2-1** and summarized in **Table C** below.

Table C. Proposed Part 845 Monitoring Well Network

Well ID	Monitored Unit	Well Screen Interval (feet bgs)	Well Type[1]
10	UCU	46.6 – 56.6	Background
16B	Upper Unit	7.0 – 12.0	Compliance
16A	BCU	21.8 – 41.8	Compliance
22	BCU	80.0 – 100.0	Background
35S	Upper Unit	3.5 – 8.5	Compliance
35D	BCU	35.0 – 45.0	Compliance
70S	Upper Unit	10.0 – 20.0	Compliance
70D	BCU	41.0 – 51.0	Compliance
71S	Upper Unit	5.5 – 10.5	Compliance
71D	BCU	30.0 – 40.0	Compliance
NED1[2,3]	CCR	5.32 – 14.95	WLO

[1] Well type refers to the role of the well in the monitoring network.

[2] Well is to be for water level data collection only on an as-needed basis. This well is an interim well that is expected to be removed during remedial construction following IEPA approval of the construction permit application.

[3] Location is temporary pending implementation of impoundment closure per an approved Construction Permit Application.

WLO = Water Level Only

2.3 Well Abandonment

Wells 23 and 24, located north of the NEAP Secondary Pond (**Figure 2-1**), are not located downgradient of the NEAP, are not required for monitoring groundwater flow or compliance, and are in close proximity to an area of coal mine subsidence and the Middle Fork. Therefore, wells 23 and 24 will be abandoned.

3. APPLICABLE GROUNDWATER QUALITY STANDARDS

3.1 Groundwater Classification

The classification of groundwater at the NEAP has been evaluated and, based on the detailed geologic information provided in the 2003 Kelron Report, groundwater quality standards for the monitoring well network screened in the PMP upper unit (alluvial deposits) and PMP BCU (shale bedrock) within the bottomlands along the Middle Fork and in the vicinity of the coal mined area are Class IV - Other Groundwater (35 I.A.C. § 620.440 (a) and (c)) standards.

Given the influence of former coal mines documented at the site on the geochemistry of groundwater in the bedrock and based upon the influence of upward vertical gradients between the shale and alluvial deposits of the bottomlands along the Middle Fork, as well as influences from surficial mine spoils, the groundwater designation for the upper unit and BCU (alluvial deposit and shale wells [*i.e.,* 16A, 16B, 22, 35D, 35S, 70S, 70D, 71S, and 71D]) is Class IV – Other Groundwater. Class IV groundwater is defined as groundwater within a previously mined area that cannot meet the standards of Class I or II groundwater.

3.2 Statistical Evaluation of Background Groundwater Data

A Statistical Analysis Plan (**Appendix A**) has been developed to describe procedures that will be used to establish background conditions and implement compliance monitoring as necessary and required by 35 I.A.C. § 845.640 and 35 I.A.C. § 845.650. The Statistical Analysis Plan was prepared in accordance with the requirements of 35 I.A.C. § 845.640(f), with reference to the acceptable statistical procedures provided in United States Environmental Protection Agency (USEPA)'s *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (*Unified Guidance,* March 2009), and is intended to provide a logical process and framework for conducting the statistical analysis of the data obtained during groundwater monitoring.

In accordance with 35 I.A.C. § 845.640(f)(1), the statistical method chosen for analysis of background groundwater quality was either the tolerance interval or the prediction interval procedure for each constituent listed in 35 I.A.C. § 845.600(a)(1) at this CCR unit per 35 I.A.C. § 845.640(f)(1)(C). A comparison of the statistical background concentrations and groundwater quality standards listed in 35 I.A.C. § 845.600(a)(1) and the resulting GWPSs are summarized in **Table 3-1**.

3.3 Applicable Groundwater Protection Standards

The applicable GWPS will be established in accordance with 35 I.A.C. § 845.600(a)(1) (greater of the background concentration or numerical limit specified in 35 I.A.C. § 845.600(a)(1)). The results of the statistical analysis of background groundwater data (**Table 3-1**) indicate that most background concentrations in the upper unit, UCU, and BCU are less than the groundwater quality standards listed in 35 I.A.C. § 845.600(a)(1). Therefore, for these parameters, the groundwater quality standards listed in 35 I.A.C. § 845.600(a)(1) will be applied to the results from the proposed groundwater monitoring network. The exceptions include cobalt, pH (lower limit), and radium 226 and 228 combined, where the background concentration is greater (or less than for pH) the 35 I.A.C. § 845.600(a)(1) standard. In these instances, the GWPS will be the background concentration.

Under most circumstances, the GWPS will be compared to the lower confidence limit for the observed concentrations for each constituent in each compliance well. Exceptions are when there are high percentages (greater than 50 percent) of non-detects in compliance well data, for which a future mean (for 50 to 70 percent non-detects) or median (for greater than 70 percent non-detects) will be compared to the GWPS. Consistent with the *Unified Guidance*, the same general statistical method of confidence interval testing against a fixed GWPS is recommended in compliance and corrective action programs. Confidence intervals provide a flexible and statistically accurate method to test how a parameter estimated from a single sample compares to a fixed numerical limit. Confidence intervals explicitly account for variation and uncertainty in the sample data used to construct them.

Evaluation of the applicable standards will occur in conjunction with the analysis of groundwater quality results. Background calculations and the resulting concentrations may be updated as appropriate, in accordance with the Statistical Analysis Plan included in **Appendix A.**

4. GROUNDWATER MONITORING PLAN

The groundwater monitoring plan will monitor and evaluate groundwater quality to demonstrate compliance with the groundwater quality standards included in 35 I.A.C. § 845.600(a). The groundwater monitoring program will include sampling and analysis procedures that are consistent and that provide an accurate representation of groundwater quality at the background and compliance wells as required by 35 I.A.C. § 845.630. As discussed in **Section 2**, two monitoring programs specific to the NEAP exist: ground water monitoring performed as required by Special Condition 19 of NPDES Permit No. IL0004057 and the proposed Part 845 monitoring program. These programs will continue to be monitored as specified in IEPA approvals. Upon approval of the Operating Permit applications (and by extension the GMPs) for the NEAP, the monitoring program formerly specified by Special Condition 19 of NPDES Permit No. IL0004057 will be discontinued and will be replaced by the proposed Part 845 monitoring program.

4.1 Monitoring Networks and Parameters

4.1.1 NPDES Groundwater Monitoring

The NPDES monitoring program, along with historic groundwater monitoring, was discussed in detail in **Section 2.1.1**. Monitoring wells continue to be sampled on a quarterly basis for the parameters previously required under Special Condition 19 of NPDES Permit No. IL0004057. Upon approval of this GMP through IEPA granting a Part 845 Operating Permit for the NEAP, this monitoring program will be superseded by the Part 845 Monitoring Program summarized below.

4.1.2 Part 845 Groundwater Monitoring

The proposed Part 845 NEAP monitoring program will consist of two background monitoring wells (10 and 22), eight compliance monitoring wells (16A, 16B, 35S, 35D, 70S, 70D, 71S, and 71D), and one temporary water level only well (NED1) to monitor potential impacts from the NEAP (**Figure 2-1**). These monitoring wells are screened within the upper unit PMP (16B, 35S, 70S, and 71S), the BCU PMP (16A, 22, 35D, 70D, and 71D), and the UCU (10) at the NEAP. Groundwater samples will be collected and analyzed for the laboratory and field parameters in **Table D** below:

Table D. Part 845 Groundwater Monitoring Program Parameters

Field Parameters[1]			
Groundwater Elevation	pH	Turbidity	
Metals (Total)			
Antimony	Boron	Cobalt	Molybdenum
Arsenic	Cadmium	Lead	Selenium
Barium	Calcium	Lithium	Thallium
Beryllium	Chromium	Mercury	
Inorganics (Total, except TDS)			
Fluoride	Sulfate	Chloride	TDS
Other (Total)			
Radium 226 and 228 combined			

[1] Dissolved oxygen, temperature, specific conductance, and oxidation/reduction potential will be recorded during sample collection.

All parameters listed above were sampled a minimum of eight times by October 18, 2021 from wells that yielded water to establish background groundwater quality in accordance with 35 I.A.C. § 845.650 (b)(1)(A). Discussion of background groundwater quality is included in **Section 3.2**.

4.2 Sampling Schedule

Groundwater sampling for the Part 845 monitoring well network will initially be performed quarterly according to the schedule in **Table E** below:

Table E. Part 845 Sampling Schedule

Frequency	**Duration**
Monthly (groundwater elevations only)	Begins: the quarter following approval of this plan and issuance of the Operating Permit.
	Ends: Following the 30-year post closure care period and following IEPA approval of documentation that groundwater concentrations are below standards in 35 I.A.C. § 845.600 and concentrations exceeding background are not increasing and meet requirements in 35 I.A.C. § 845.780 (c)(2)(B)(i) and (ii).
Quarterly (groundwater quality)	Begins: the quarter following approval of this plan and issuance of the Operating Permit.
	Ends: Following the 30-year post closure care period and following IEPA approval of documentation that groundwater concentrations are below standards in 35 I.A.C. § 845.600 and concentrations exceeding background are not increasing and meet requirements in 35 I.A.C. § 845.780 (c)(2)(B)(i) and (ii), or upon IEPA approval of an alternate schedule as allowed by 35 I.A.C. § 845.650(b)(4).
Semi-annual (groundwater quality)	Begins: Following 5 years of quarterly groundwater monitoring and IEPA approval of a demonstration that groundwater concentrations are below standards in 35 I.A.C. § 845.600 and not exhibiting statistically-significant increasing trends, monitoring effectiveness is not compromised by a semi-annual schedule, and sufficient data has been collected to characterize groundwater.
	Ends: Following detection of a statistically-significant increasing trend in groundwater concentrations or an exceedance of the standards in 35 I.A.C. § 845.600 (quarterly monitoring shall be resumed in these circumstances), or following the 30-year post closure care period and following IEPA approval of documentation that groundwater concentrations

	are below standards in 35 I.A.C. § 845.600 and concentrations exceeding background are not increasing and meet requirements in 35 I.A.C. § 845.780 (c)(2)(B)(i) and (ii).

4.3 Groundwater Sample Collection

Groundwater sampling procedures have been developed and the collection of groundwater samples is being implemented to meet the requirements of 35 I.A.C. § 845.640. In addition to groundwater well samples, quality assurance samples will be collected as described in **Section 4.5** (**Table 4-1**).

4.4 Laboratory Analysis

Laboratory analysis will be performed consistent with the requirements of 35 I.A.C. § 845.640(j) by a state-certified laboratory using methods approved by IEPA and USEPA. Laboratory methods may be modified based on laboratory equipment availability or procedures, but the Reporting Limit (RL) for all parameters analyzed, regardless of method, will be lower than the applicable groundwater quality standard. RLs for the applicable parameters are summarized in **Table 4-2**. Concentrations lower than the RL will be reported as less than the RL.

4.5 Quality Assurance Program

Consistent with the requirements of 35 I.A.C. § 845.640(a)(5), the sampling and analysis program includes procedures and techniques for quality assurance/quality control (QA/QC). Additional quality assurance samples to be collected will include the following:

- Field duplicates will be collected at a frequency of one per group of ten or fewer investigative water samples.
- One equipment blank sample will be collected and analyzed for each day of sampling. If dedicated sampling equipment is used, then equipment blank samples will not be collected.

The duplicate and equipment blank quality assurance samples will be supplemented by the laboratory QA/QC program, which typically includes:

- Regular generation of instrument calibration curves to assure instrument reliability.
- Laboratory control samples and/or quality control check standards that have been spiked, and analyses to monitor the performance of the analytical method.
- Matrix spike/matrix spike duplicate analyses to determine percent recoveries and relative percent differences for each of the parameters detected.
- Analysis of replicate samples to check the precision of the instrumentation and/or methodology employed for all analytical methods.
- Analysis of method blanks to assure that the system is free of contamination.

Water quality meters used to measure pH and turbidity will be calibrated according to manufacturer's specifications. At a minimum, it is recommended that calibration of pH occur daily prior to sampling and checked for accuracy at the end of each day. Unusual or suspect pH measurements during sampling events will be flagged, evaluated, and additional calibration may be performed throughout the sampling events. Turbidity meters will be checked daily, prior to and following sampling. Unusual measurements or erratic meter performance will be flagged and evaluated for overall effects on the data prior to reporting.

4.6 Groundwater Monitoring System Maintenance Plan

Consistent with the requirements of 35 I.A.C. § 845.630(e)(2), maintenance will be performed as needed to assure that the monitoring wells provide representative groundwater samples. Monitoring wells will be inspected during each groundwater sampling event; inspections will consist of the following:

- Visual inspection, clearing of vegetation, replacement of markers, and painting of protective casings as needed to assure that monitoring wells are clearly marked and accessible.
- Visual inspection and repair or replacement of well aprons as needed to assure that they are intact, drain water away from the well, and have not heaved.
- Visual inspection and repair or replacement of protective casings as needed to assure that they are undamaged, and that locks are present and functional.
- Checks to assure that well caps are intact and vented, unless in flood-prone areas in which case caps will not be vented.
- Annual measurement of monitoring well depths to determine the degree of siltation within the wells. Wells will be redeveloped as needed to remove siltation from the screened interval if it impedes flow of water into the well.
- Checks to assure that wells are clear of internal obstructions, and flow freely.

If maintenance of a monitoring well cannot address an identified deficiency, a replacement well will be installed.

4.7 Statistical Analysis

Statistical analysis will be consistent with procedures listed in 35 I.A.C. § 845.640(f). A Statistical Analysis Plan, provided in **Appendix A**, has been developed to summarize the statistical procedures that will be used to evaluate the groundwater results.

4.8 Data Reporting

Groundwater monitoring and analysis completed as part of the Part 845 monitoring under an approved monitoring program will be reported to IEPA within 60 days after completion of sampling and the data placed in the facility’s operating record as required by 35 I.A.C. § 845.610(b)(3)(D). Within 14 days of posting to the operating record, information will be posted to the publicly accessible internet site “Illinois CCR Rule Compliance Data and Information” as required by 35 I.A.C. § 845.810(d). Information will also be provided to IEPA annually by January 31 as required by 35 I.A.C. § 845.550. The report will include the status of the groundwater monitoring and any required corrective action plan for the NEAP in addition to other requirements detailed in 35 I.A.C. § 845.610(e).

4.9 Compliance with Applicable On-site Groundwater Protection Standards

In accordance with 35 I.A.C. § 845.600(a)(1), the groundwater protection standard at the waste boundary will be the higher of either the 35 I.A.C. § 845.600 standard or the concentration determined by background groundwater monitoring.

As provided in 35 I.A.C. § 845.780(c)(2), at the end of the 30-year post-closure care period, groundwater monitoring will continue to be conducted in post-closure care until the groundwater results show the concentrations are:

- Below the GWPS in 35 I.A.C. § 845.600; and
- Not increasing for those constituents over background, using the statistical procedures and performance standards in 35 I.A.C. § 845.640(f) and (g), provided that:
    - Concentrations have been reduced to the maximum extent feasible; and
    - Concentrations are protective of human health and the environment.

If one or more constituents are detected and confirmed by an immediate resample, to be greater than the GWPS in any sampling event, an Alternate Source Demonstration (ASD) will be evaluated as described in **Section 4.10**.

4.10 Alternate Source Demonstrations

As allowed in 35 I.A.C. § 845.650(e), following detection of an exceedance of the GWPS, an ASD will be evaluated and, if completed, submitted to IEPA within 60 days. The ASD will provide lines of evidence that a source other than the NEAP caused the contamination and the NEAP did not contribute to the contamination, or that the exceedance of the GWPS resulted from error in sampling, analysis, statistical evaluation, natural variation in groundwater quality, or a change in the potentiometric surface and groundwater flow direction.

The ASD will include information and analysis that supports the conclusions and a certification of accuracy by a qualified professional engineer. Once the ASD is approved by IEPA, the Part 845 groundwater monitoring will continue as defined in **Section 4.1.1**.

If an ASD is not completed and submitted, or IEPA does not approve the ASD, a notification of the exceedance will be provided to IEPA and placed in the operating record. Additional actions will also be completed as required by 35 I.A.C § 845.650(d)(1) through (3); including, initiation of an assessment of corrective measures under 35 I.A.C § 845.660. As allowed in 35 I.A.C § 845.650(e)(7) a petition for review of IEPA's non-concurrence under 35 I.A.C. § 105 may also be filed.

4.11 Assessment of Corrective Measures and Corrective Action

As described in 35 I.A.C. § 845.660, if the ASD summarized in **Section 4.10** has not been approved by IEPA, an assessment of corrective measures will be initiated within 90 days of the detection of a result exceeding 35 I.A.C. § 845.600 standards (*i.e.,* receipt of laboratory data). The assessment of corrective measures will include at least the following (35 I.A.C. § 845.660(c)):

- The performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to any residual contamination;
- The time required to begin and complete the corrective action plan; and
- The institutional requirements, such as State or local permit requirements or other environmental or public health requirements that may substantially affect implementation of the corrective action plan.

Within one year of completing the assessment of corrective measures, a corrective action plan will be developed to identify the selected remedy in accordance with 35 I.A.C. § 845.670. If closure of the CCR Unit is required, a closure alternatives analysis will be completed as specified in 35 I.A.C. § 845.710. The analysis and selected alternative will be submitted to IEPA in a Closure Plan as specified by 35 I.A.C. § 845.720. Groundwater monitoring proposed in this Addendum will continue as specified until the post closure care period has expired and IEPA has approved termination of post-closure care.

5. REFERENCES

Illinois Environmental Protection Agency, 2021. *Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845*. April 15, 2021.

Kelron Environmental, Inc. (Kelron), 2003. *Regional and Local Hydrogeology and Geochemistry, Vermilion Power Plant, Illinois, Dynegy Midwest Generation, LLC*. November 30, 2003.

Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2021. *Hydrogeologic Site Characterization Report, Vermilion New East Ash Pond, Vermilion Power Plant, Oakwood, Illinois*.

United States Environmental Protection Agency (USEPA), March 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance. Office of Resource Conservation and Recovery, Program Implementation and Information Division, United States Environmental Protection Agency, Washington D.C. EPA/530/R-09/007.United States Environmental Protection Agency (USEPA), 2015. Title 40 of the Code of Federal Regulations, Part 257.

TABLES

TABLE 1-1. PART 845 REQUIREMENTS CHECKLIST

GROUNDWATER MONITORING PLAN
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Part 845 Reference	Part 845 Components	Location of Information in GMP
845.630	**Groundwater Monitoring Systems**	
845.630(a)(2)	Potential contaminant pathways must be monitored.	Sections 1.3, 2.2, & 4.1.1
845.630(a) 845.630(b) 845.630(c)	At least two upgradient wells and four downgradient wells (min. 1 and 3, but requires additional documentation)	Sections 2.2 & 4.1.1 Table 2-1 Figure 2-1
845.630(a) 845.630(b) 845.630(c)	Downgradient Well Density	Figure 2-1
845.630(a)(2)	Downgradient wells at waste boundary	Figure 2-1
845.640	**Groundwater Sampling and Analysis Requirements**	
845.640(a)	Consistent sampling and analysis procedures	Section 4 Tables 4-1 & 4-2
845.640(b)	Methods are appropriate	Section 4 Tables 4-1 & 4-2
845.640(c)	Groundwater elevations must be measured in each well prior to purging, each time groundwater is sampled.	Section 4.3
845.640 (d)(e)(f)(g)(h)	Establishement of background and application of statistical methods	Sections 3 & 4.7 Appendix A
845.640(i)	Analyze total recoverable metals	Sections 4.1.1 & 4.4

TABLE 1-1. PART 845 REQUIREMENTS CHECKLIST
GROUNDWATER MONITORING PLAN
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Part 845 Reference	Part 845 Components	Location of Information in GMP
845.640(j)	Analyze groundwater samples using a certified laboratory	Section 4.4
845.650	**Groundwater Monitoring Program**	
845.650(a)	Must include monitoring for all constituents with a groundwater protection standard in Section 845.600(a), calcium, and turbidity	Section 4.1.1
845.650(b)(c)	Groundwater Monitoring Frequency	Sections 4.1.1 & 4.2
845.650(d)(e)	Exceedances of the groundwater protection standard	Sections 4.9, 4.10 & 4.11
NA	Staff gauge/ piezometer to monitor head in impoundment?	Sections 2.2 & 4.1.1 Figure 2-1 (NED1)
NA	Staff gauge/ piezometer to monitor head of neighboring surface water body?	NA

[O: CJC 08/10/21, C: LDC 08/20/21]

Notes:
GMP = Groundwater Monitoring Plan
NA = Not Applicable

TABLE 2-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
GROUNDWATER MONITORING PLAN
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Well Number	Type	HSU	Date Constructed	Top of PVC Elevation (ft)	Measuring Point Elevation (ft)	Measuring Point Description	Ground Elevation (ft)	Screen Top Depth (ft BGS)	Screen Bottom Depth (ft BGS)	Screen Top Elevation (ft)	Screen Bottom Elevation (ft)	Well Depth (ft BGS)	Bottom of Boring Elevation (ft)	Screen Length (ft)	Screen Diameter (inches)	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)
10	B	UCU	04/29/1987	659.09	659.09	Top of PVC	656.33	46.60	56.60	609.70	599.70	56.60	581.40	10	2	40.178985	-87.739824
16B	C	UU	04/28/1987	580.62	580.62	Top of PVC	578.59	7.00	12.00	571.50	566.50	12.00	566.50	5	2	40.17809	-87.735084
16A	C	BCU	04/28/1987	580.32	580.32	Top of PVC	578.60	21.80	41.80	556.50	536.50	41.80	536.50	20	2	40.178093	-87.735056
22	B	BCU	12/05/2001	658.62	658.62	Top of PVC	655.93	80.00	100.00	576.00	556.00	100.00	556.00	20	2	40.178997	-87.73985
35S	C	UU	03/01/2017	584.92	584.92	Top of PVC	581.64	3.50	8.50	577.65	572.65	8.50	572.70	5	2	40.17977	-87.735586
35D	C	BCU	03/03/2017	584.14	584.14	Top of PVC	581.77	35.00	45.00	546.25	536.25	45.00	535.50	10	2	40.179762	-87.735575
70S	C	UU	03/04/2021	593.74	593.74	Top of PVC	591.64	10.00	20.00	581.64	571.64	20.00	571.60	10	2	40.176952	-87.737931
70D	C	BCU	03/04/2021	594.52	594.52	Top of PVC	591.90	41.00	51.00	550.90	540.90	51.00	539.90	10	2	40.176957	-87.737958
71S	C	UU	03/03/2021	579.56	579.56	Top of PVC	577.19	5.50	10.50	571.69	566.69	10.50	566.70	5	2	40.177106	-87.735397
71D	C	BCU	03/03/2021	579.89	579.89	Top of PVC	577.18	30.00	40.00	547.18	537.18	40.00	537.20	10	2	40.177118	-87.735391
NED1	WLO	CCR	02/12/2019	600.07	600.07	Top of PVC	597.76	5.32	14.95	592.44	582.81	15.44	582.32	9.63	2	40.17947	-87.738094

Notes:
All elevation data are presented relative to the North American Vertical Datum 1988 (NAVD88), GEOID 12A
Type refers to the role of the well in the monitoring network: background (B), compliance (C), or water level measurements only (WLO)
WLO wells are temporary pending implementation of impoundment closure per an approved Construction Permit application
-- = data not available
BCU = bedrock confining unit
BGS = below ground surface
CCR = Coal Combustion Residual
ft = foot or feet
HSU = Hydrostratigraphic Unit
PVC = polyvinyl chloride
SW = surface water
UCU = upper confining unit
UU = upper unit

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TABLE 3-1. BACKGROUND GROUNDWATER QUALITY AND STANDARDS

GROUNDWATER MONITORING PLAN
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Parameter	Background Concentration	845 Limit	Groundwater Protection Standard	Unit
Antimony, total	0.005	0.006	0.006	mg/L
Arsenic, total	0.001	0.010	0.010	mg/L
Barium, total	0.082	2.0	2.0	mg/L
Beryllium, total	0.001	0.004	0.004	mg/L
Boron, total	0.43	2	2	mg/L
Cadmium, total	0.001	0.005	0.005	mg/L
Chloride, total	20.4	200	200	mg/L
Chromium, total	0.004	0.1	0.1	mg/L
Cobalt, total	0.09	0.006	0.09	mg/L
Fluoride, total	0.43	4.0	4.0	mg/L
Lead, total	0.001	0.0075	0.0075	mg/L
Lithium, total	0.03	0.04	0.04	mg/L
Mercury, total	0.0002	0.002	0.002	mg/L
Molybdenum, total	0.004	0.1	0.1	mg/L
pH (field)	7.8 / 6.3	9.0 / 6.5	9.0 / 6.3	SU
Radium 226 and 228 combined	7	5	7	pCi/L
Selenium, total	0.001	0.05	0.05	mg/L
Sulfate, total	338	400	400	mg/L
Thallium, total	0.002	0.002	0.002	mg/L
Total Dissolved Solids	1080	1200	1200	mg/L

Notes:
For pH, the values presented are the upper / lower limits
Groundwater protection standards for calcium and turbidity do not apply per 35 I.A.C. § 845.600(b)
mg/L = milligrams per liter
SU = standard units
pCi/L = picocuries per liter

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TABLE 4-1. SAMPLING AND ANALYSIS SUMMARY

GROUNDWATER MONITORING PLAN
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Parameter	Analytical Method [1]	Number of Samples	Field Duplicates [2]	Field Blanks [3]	Equipment Blanks [3]	MS/MSD [4]	Total	Container Type	Minimum Volume [5]	Preservation (Cool to 4 °C for all samples)	Sample Hold Time from Collection Date
Metals											
Metals [6]	6020, Li - EPA 200.7	10	1	0	0	1	12	plastic	600 mL	HNO_3 to pH<2	6 months
Mercury	7470A or 6020	10	1	0	0	1	12	plastic	400 mL	HNO_3 to pH<2	28 days
Inorganic Parameters											
Fluoride	9214 or EPA 300	10	1	0	0	1	12	plastic	300 mL	Cool to 4 °C	28 days
Chloride	9251 or EPA 300	10	1	0	0	1	12	plastic	100 mL	Cool to 4 °C	28 days
Sulfate	9036 or EPA 300	10	1	0	0	1	12	plastic	50 mL	Cool to 4 °C	28 days
Total Dissolved Solids	SM 2540 C	10	1	0	0	1	12	plastic	200 mL	Cool to 4 °C	7 days
Radium											
Radium 226	9315 or EPA 903	10	0	0	0	0	10	plastic	1000 mL	HNO_3 to pH<2	6 months
Radium 228	9320 or EPA 904	10	0	0	0	0	10	plastic	1000 mL	HNO_3 to pH<2	6 months
Field Parameters											
pH	SM 4500-H+ B	10	NA	NA	NA	NA	10	flow-through cell	NA	none	immediately
Dissolved Oxygen [8]	SM 4500-O/405.1	10	NA	NA	NA	NA	10	flow-through cell	NA	none	immediately
Temperature [8]	SM 2550	10	NA	NA	NA	NA	10	flow-through cell	NA	none	immediately
Oxidation/Reduction Potential [8]	SM 2580 B	10	NA	NA	NA	NA	10	flow-through cell	NA	none	immediately
Specific Conductance [8]	SM 2510 B	10	NA	NA	NA	NA	10	flow-through cell	NA	none	immediately
Turbidity [7]	SM 2130 B	10	NA	NA	NA	NA	10	flow-through cell or hand-held turbidity meter	NA	none	immediately

[O: CJC 08/13/21; C: EDP 08/17/21]

Notes:

[1] Analytical method numbers are from SW-846 unless otherwise indicated. Analytical methods may be updated with more recent versions as appropriate.

[2] Field duplicates will be collected at a frequency of one per group of 10 or fewer investigative water sample. Field duplicates will not be collected for radium analysis.

[3] Field blanks will be collected at the discretion of the project manager; Equipment blanks will be collected at a rate of 1 per sampling event if non-dedicated equipment is used.

[4] Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples will be collected at a frequency of one per group of 20 or fewer investigative water samples per CCR unit/multi-unit. Additional volume to be determined by laboratory.

[5] Sample volume is estimated and will be determined by the laboratory.

[6] Metals = antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, lead, lithium, molybdenum, selenium, thallium. Metals may be analyzed via ICP/ ICP-MS USEPA methods 6010 or 6020 depending on laboratory instrument availability.

[7] If turbidity exceeds 10 NTUs, a duplicate sample filtered through a .45 micron filter may be collected for metals analysis in addition to the unfiltered sample. Both samples would be submitted for analysis.

[8] Parameter collected for quality assurance and quality control for field sampling purposes only; not required to be collected or reported under Part 845; collection of parameter may be discontinued without notification.

< = less than
°C = degrees Celsius
HNO_3 = nitric acid
mL = milliliter
NA = not applicable
NTU = nephelometric turbidity unit

TABLE 4-2. DETECTION AND REPORTING LIMITS FOR PART 845 PARAMETERS

GROUNDWATER MONITORING PLAN
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Constituent	CAS	Unit	Analytical Methods [1]	USEPA MCL [2]	IL Part 845.600	RL [4, 5]	MDL [5]
Metals							
Antimony	7440-36-0	mg/L	6020	0.006	0.006	0.003	0.00036
Arsenic	7440-38-2	mg/L	6020	0.01	0.01	0.001	0.00013
Barium	7440-39-3	mg/L	6020	2	2	0.001	0.00028
Beryllium	7440-41-7	mg/L	6020	0.004	0.004	0.001	0.000017
Boron	7440-42-8	mg/L	6020	NS	2	0.01	0.0023
Cadmium	7440-43-9	mg/L	6020	0.005	0.005	0.001	0.000042
Calcium	7440-70-2	mg/L	6020	NS	NS	0.15	0.15
Chromium	7440-47-3	mg/L	6020	0.1	0.1	0.004	0.00027
Cobalt	7440-48-4	mg/L	6020	0.006	0.006	0.002	0.000017
Lead	7439-92-1	mg/L	6020	0.015	0.0075	0.001	0.000025
Lithium	7439-93-2	mg/L	6020 or EPA 200.7	0.04	0.04	0.02	0.0001
Mercury	7439-97-6	mg/L	6020 or 7470A	0.002	0.002	0.0002	0.000078
Molybdenum	7439-98-7	mg/L	6020	0.1	0.1	0.001	0.000063
Selenium	7782-49-2	mg/L	6020	0.05	0.05	0.001	0.00032
Thallium	7440-28-0	mg/L	6020	0.002	0.002	0.001	0.000062
Inorganics							
Fluoride	7681	mg/L	9214 or EPA 300	4	4	0.25	0.065
Chloride	16887-00-6	mg/L	9251 or EPA 300	250 [3]	200	1	0.15
Sulfate	18785-72-3	mg/L	9036 or EPA 300	250 [3]	400	1	0.24
Total Dissolved Solids	10052	mg/L	SM 2540C	500 [3]	1200	17	--
Other							
Radium 226 and 228 combined	7440-14-4	pCi/L	9315/9320 or EPA 903/904	5	5	-- [6]	-- [7]

TABLE 4-2. DETECTION AND REPORTING LIMITS FOR PART 845 PARAMETERS

GROUNDWATER MONITORING PLAN
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Constituent	CAS	Unit	Analytical Methods [1]	USEPA MCL [2]	IL Part 845.600	RL [4, 5]	MDL [5]
Field							
pH	NA	SU	SM 4500-H+ B	NS	6.5-9.0	NA	NA
Oxidation/Reduction Potential	NA	mV	SM 2580 B	NS	NS	NA	NA
Dissolved Oxygen	NA	mg/L	SM 4500-O/405.1	NS	NS	NA	NA
Temperature	NA	°C	SM 2550	NS	NS	NA	NA
Specific Conductivity	NA	µS/cm	SM 2510 B	NS	NS	NA	NA
Turbidity	NA	NTU	SM 2130 B	NS	NS	NA	NA

O: CJC 08/13/21; C:EDP 08/18/21]

Notes:

[1] Analytical method numbers are from SW-846 unless otherwise indicated. Metals will be analyzed via Method 6020 or 6010 depending on laboratory equipment availability. Selected method will ensure reporting limits (RLs) are below Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845.600 groundwater protection standards.

[2] USEPA MCL = United States Environmental Protection Agency Maximum Contaminant Level.

[3] USEPA SMCL = United States Environmental Protection Agency Secondary Maximum Contaminant Level.

[4] RLs will be less than the 35 I.A.C. § 845.600 groundwater protection standards.

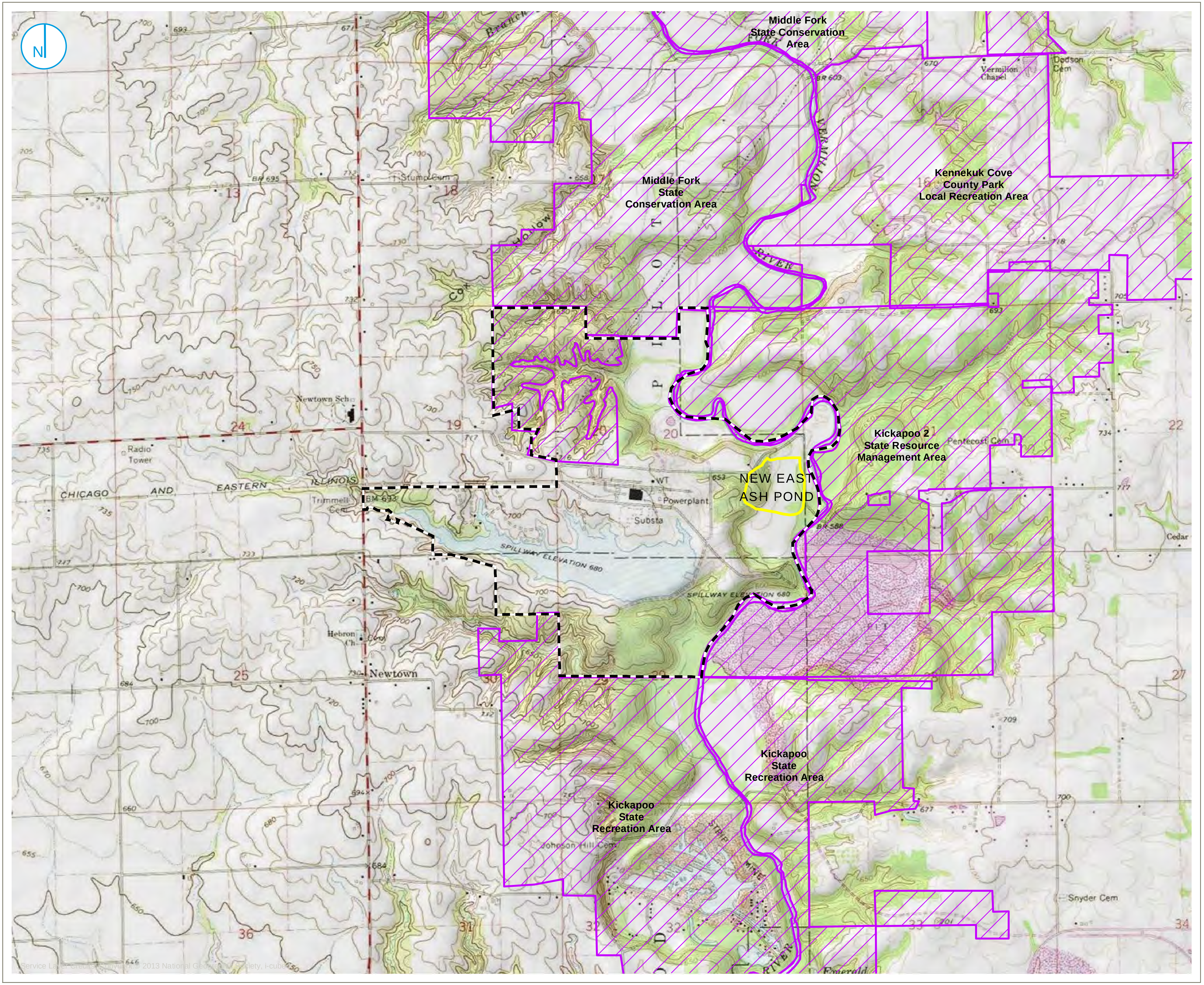
[5] RLs and method detection limits (MDL) will vary depending on the laboratory performing the work.

[6] All radium results will be reported (values may be positive or negative) and will include uncertainty and the calculated MDC.

[7] Laboratories calculate a minimum detectable concentration (MDC) based on the sample.

°C = degrees Celsius
CAS = Chemical Abstract Number
MDL = Method detection limit as established by the laboratory
mg/L = milligrams per liter
mV = millivolts
pCi/L = picoCuries per liter
NS = No standard
NTU = nephelometric turbidity unit
RL = Reporting limit as established by the laboratory
SM = Standard Methods for the Examination of Water and Wastewater
SU = standard units
µS/cm = microSiemens per centimeter

FIGURES



▭ PART 845 REGULATED UNIT (SUBJECT UNIT)

▭ PROPERTY BOUNDARY

▨ PROTECTED AREA

0 1,000 2,000
Feet

SITE LOCATION MAP

GROUNDWATER MONITORING PLAN
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

FIGURE 1-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\GMP\Figure 1-1_Site Location Map.mxd

PROJECT: 169000XXXX | DATED: 10/7/2021 | DESIGNER: STOLZSD

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

▣ COAL MINE SHAFT
▭ UNDERGROUND OR SURFACE COAL MINE
▭ PART 845 REGULATED UNIT (SUBJECT UNIT)
▭ SITE FEATURE
⬚ PROPERTY BOUNDARY

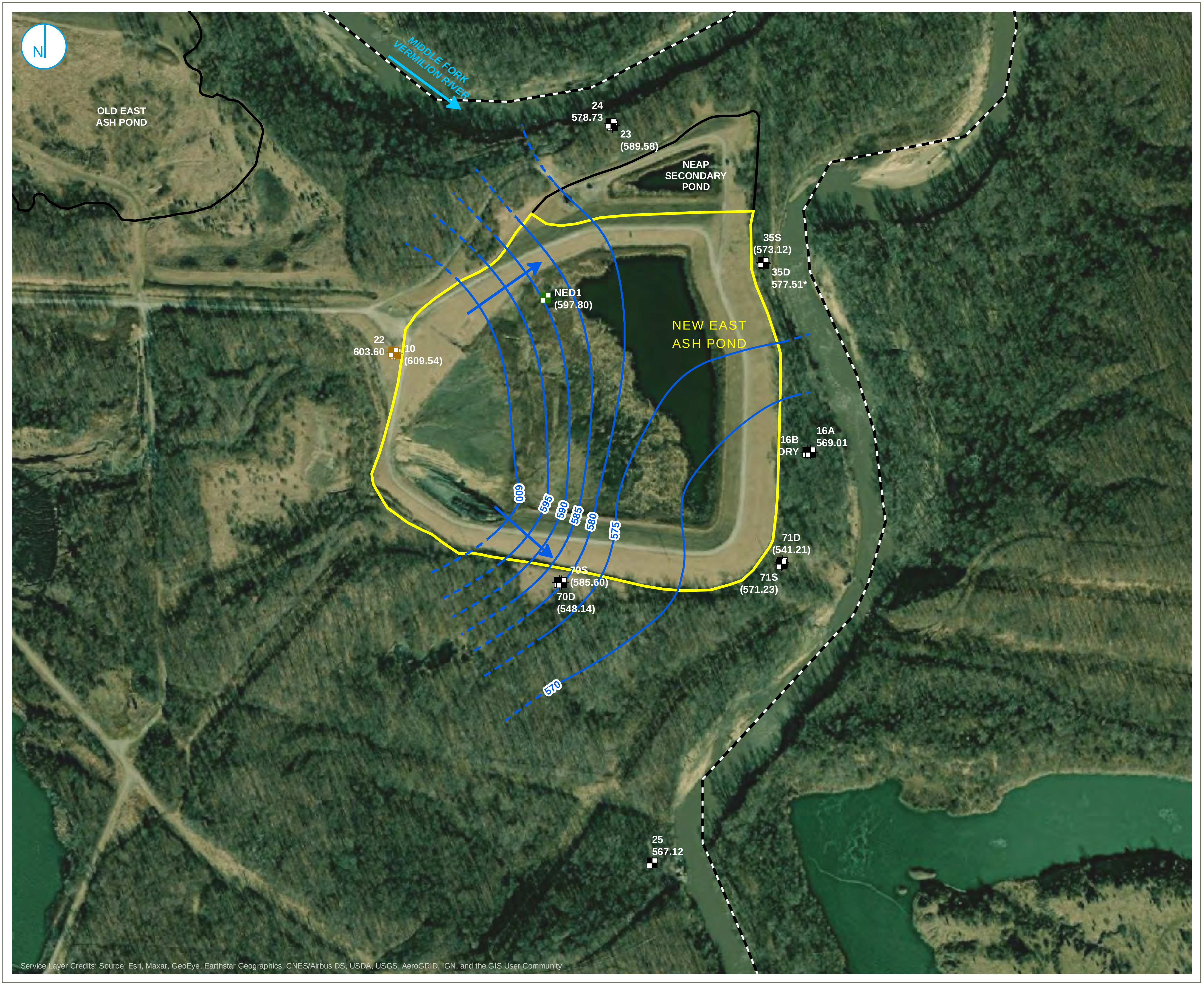
0 150 300 Feet

SITE MAP

GROUNDWATER MONITORING PLAN
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

FIGURE 1-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.



Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\GMP\Figure 1-3_GWE Contours Event 1_20210329.mxd

PROJECT: 169000XXXX | DATED: 10/7/2021 | DESIGNER: STOLZSD

▨	BACKGROUND WELL
▨	MONITORING WELL
▨	SOURCE SAMPLE LOCATION
—	GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD88)
- -	INFERRED GROUNDWATER ELEVATION CONTOUR
→	GROUNDWATER FLOW DIRECTION
☐	PART 845 REGULATED UNIT (SUBJECT UNIT)
☐	SITE FEATURE
☐	PROPERTY BOUNDARY

NOTES:

1. ELEVATIONS IN PARENTHESIS WERE NOT USED FOR CONTOURING.
2. NM = NOT MEASURED
3. ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988
4. * ELEVATION COLLECTED AS PART OF NPDES PERMIT NO. IL0004057 MONITORING ON MARCH 29, 2021..

0 150 300
Feet

BEDROCK GROUNDWATER ELEVATION CONTOURS
MARCH 29, 2021

GROUNDWATER MONITORING PLAN
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

FIGURE 1-3

RAMBOLL AMERICAS
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Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\NEAP\GMP\Figure 2-1_Proposed 845 GW Monitoring Well Network.mxd

PROJECT: 169000XXXX | DATED: 10/8/2021 | DESIGNER: HOTCALD

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🟦 COMPLIANCE WELL
🟫 BACKGROUND WELL
🟩 SOURCE SAMPLE LOCATION
▨ MONITORING WELL TO BE ABANDONED
🟨 PART 845 REGULATED UNIT (SUBJECT UNIT)
☐ SITE FEATURE
⬚ PROPERTY BOUNDARY

PROPOSED PART 845 GROUNDWATER MONITORING NETWORK

GROUNDWATER MONITORING PLAN
NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

FIGURE 2-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

APPENDIX A
STATISTICAL ANALYSIS PLAN

Prepared for
Dynegy Midwest Generation, LLC

Date
October 25, 2021

Project No.
1940100722

STATISTICAL ANALYSIS PLAN

NEW EAST ASH POND
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

RAMBOLL Bright ideas. Sustainable change.

STATISTICAL ANALYSIS PLAN
VERMILION POWER PLANT NEW EAST ASH POND

Project Name	**Vermilion Power Plant New East Ash Pond**
Project No.	**1940100722**
Recipient	**Dynegy Midwest Generation, LLC**
Document Type	**Statistical Analysis Plan**
Version	**FINAL**
Date	**October 25, 2021**

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LICENSED PROFESSIONAL CERTIFICATIONS

This certification is based on the description of the statistical methods selected to evaluate groundwater as presented in the following Statistical Analysis Plan; Vermilion Power Plant New East Ash Pond. The procedures described in the plan will be used to establish background conditions and implement compliance monitoring as necessary and required by 35 I.A.C. § 845.640 and 35 I.A.C. § 845.650. The Statistical Analysis Plan was prepared in accordance with the requirements of 35 I.A.C. § 845.640(f), with reference to the acceptable statistical procedures provided in the United States Environmental Protection Agency (USEPA)'s *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (*Unified Guidance,* March 2009), and is intended to provide a logical process and framework for conducting the statistical analysis of the data obtained during groundwater monitoring. In accordance with 35 I.A.C. § 845.640(f)(1), the statistical method chosen for analysis of background groundwater quality will be either the tolerance interval or the prediction interval procedure for each constituent listed in 35 I.A.C. § 845.600(a)(1) at this CCR unit per 35 I.A.C. § 845.640(f)(1)(C). Groundwater Protection Standards (GWPS) will be established in accordance with 35 I.A.C. § 845.600(a) (greater of the background concentration or numerical limit specified in 35 I.A.C. § 845.600(a)(1)). The GWPS will be compared to the lower confidence limit for the observed concentrations for each constituent in each compliance well. Consistent with the *Unified Guidance*, the same general statistical method of confidence interval testing against a fixed GWPS is recommended in compliance and corrective action programs. Confidence intervals provide a flexible and statistically accurate method to test how a parameter estimated from a single sample compares to a fixed numerical limit. Confidence intervals explicitly account for variation and uncertainty in the sample data used to construct them.

Description of the statistical methods chosen for analysis of groundwater monitoring data and application of these methods for determining exceedances of the GWPS identified in 35 I.A.C. § 845.600(a) is provided in this Statistical Analysis Plan.

35 I.A.C. § 845.640 Statistical Analysis (PE)

I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify that the statistical methods summarized above and described in this document (Statistical Analysis Plan; Vermilion Power Plant New East Ash Pond) are appropriate for evaluating the groundwater monitoring data collected as described in the attached document and are in substantial compliance with 35 I.A.C. § 845.640.

Eric J. Tlachac

Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
Date: October 25, 2021

ERIC J. TLACHAC
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35 I.A.C. § 845.640 Statistical Analysis (PG)

I, Brian G. Hennings, a qualified professional geologist in good standing in the State of Illinois, certify that the statistical methods described in this document (Statistical Analysis Plan; Vermilion Power Plant New East Ash Pond) are appropriate for evaluating the groundwater monitoring data collected as described in the attached document and are in substantial compliance with 35 I.A.C. § 845.640.

Brian G. Hennings
Professional Geologist
196.001482
Illinois
Date: October 25, 2021

BRIAN G. HENNINGS
196.001482

35 I.A.C. § 845.640 Statistical Analysis

I, Rachel A. Banoff, a qualified professional, certify that the statistical methods described in this document (Statistical Analysis Plan; Vermilion Power Plant New East Ash Pond), are appropriate for evaluating the groundwater monitoring data collected as described in the attached document and are in substantial compliance with 35 I.A.C. § 845.640.

Rachel Banoff

Rachel A. Banoff, EIT
Project Statistician
Date: October 25, 2021

CONTENTS

TABLES (IN TEXT)

ACRONYMS AND ABBREVIATIONS

§	Section
35 I.A.C.	Title 35 of the Illinois Administrative Code
ANOVA	analysis of variance
CCR	coal combustion residuals
COC	constituents of concern
GWPS	groundwater protection standard
IEPA	Illinois Environmental Protection Agency
LCL	lower confidence limit
LTL	lower tolerance limit
MSE	mean squared error
P	probability
Part 845	Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845
RCRA	Resource Conservation and Recovery Act
RL	reporting limit
ROS	regression on order statistics
SI	surface impoundment
SSI	statistically significant increase
SWFPR	site-wide false positive rate
Unified Guidance	*Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (USEPA, 2009)
UPL	upper prediction limit
USEPA	United States Environmental Protection Agency
UTL	upper tolerance limit

1. INTRODUCTION

In April 2021, the Illinois Environmental Protection Agency (IEPA) issued a final rule for the regulation and management of Coal Combustion Residuals (CCR) in surface impoundments (SIs) under the Standards for the Disposal of CCR in Surface Impoundments: Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845 (Part 845). Facilities regulated under Part 845 are required to develop and sample a groundwater monitoring well network to evaluate whether impounded CCR materials are impacting downgradient groundwater quality. The groundwater quality evaluation must include selection and certification by a qualified professional engineer of the statistical procedures to be used. The procedures described in the evaluation will be used to establish background conditions and implement compliance and corrective action monitoring as necessary and required by 35 I.A.C. § 845.640 and 35 I.A.C. § 845.650. This Statistical Analysis Plan was prepared in accordance with the requirements of 35 I.A.C. § 845.640(f), with reference to the acceptable statistical procedures provided in United States Environmental Protection Agency's (USEPA's) *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (*Unified Guidance*) (March 2009).

This Statistical Analysis Plan does not include procedures for groundwater sample collection and analysis, as these activities are conducted in accordance with the Sampling and Analysis Plan prepared for each CCR unit in accordance with 35 I.A.C. § 845.640. This Statistical Analysis Plan will be used as the primary reference for evaluating groundwater quality during operation and post-closure care.

1.1 Statistical Analysis Objectives

This Statistical Analysis Plan is intended to provide a logical process and framework for conducting the statistical analyses of data obtained during groundwater monitoring conducted in accordance with the Sampling and Analysis Plan for each CCR unit. The Statistical Analysis Plan will enable a qualified professional engineer to certify that the selected statistical methods are appropriate for evaluating the groundwater monitoring data for the applicable CCR unit(s).

1.2 Statistical Analysis Plan Approach

The main sections of this Statistical Analysis Plan should be viewed as a "generic" outline of statistical methods utilized for each CCR unit and constituent required to be monitored. The statistical analysis of the groundwater monitoring data, however, will be conducted on an individual-constituent or well basis, and may involve the use of appropriate statistical procedures depending on multiple factors such as detection frequency and normality distributions.

The CCR Rule outlines two phases of groundwater monitoring:

- Background Monitoring in accordance with 35 I.A.C. § 845.650(b)(1)
- Compliance Monitoring in accordance with 35 I.A.C. § 845.650

Each phase of the groundwater monitoring program requires specific statistical procedures to accomplish the intended purpose. During the background monitoring phase, background groundwater quality will be established utilizing upgradient and background wells and downgradient groundwater quality data will be collected to facilitate statistics in subsequent phases. Compliance Monitoring is then initiated through the evaluation of the downgradient groundwater monitoring data for exceedances of the groundwater protection standard (GWPS) established by Part 845 (concentration specified in 35 I.A.C. § 845.600 or an IEPA-approved background concentration). The developed statistical analysis plan will be implemented for each monitoring phase and in accordance with the statistical procedures.

2. BACKGROUND MONITORING AND DATA PREPARATION

The background and compliance monitoring wells were sampled and analyzed for constituents, as listed in Part 845 (antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chloride, chromium, cobalt, fluoride, lead, lithium, mercury, molybdenum, pH, radium 226 and 228 combined, selenium, sulfate, thallium, total dissolved solids, and turbidity), during the baseline phase of the groundwater monitoring program.

The background monitoring well(s) were placed upgradient of the CCR unit, or at an alternative background location, where they are not affected by potential leakage from the CCR unit. Compliance monitoring wells were placed at the waste boundary of the CCR unit, along the same groundwater flow path. As 35 I.A.C. § 845.630(a) specifies, the location of these wells ensures that background accurately represents the quality of unaffected groundwater, while compliance wells accurately represent groundwater quality at the waste boundary and monitor all potential contaminant pathways.

As required by 35 I.A.C. § 845.650(a)(1), eight sampling events were completed within 180 days of April 21, 2021. As outlined, groundwater sampling procedures included sampling of the background and compliance wells using low-flow sampling methods, collection of one field quality control sample per event, and groundwater samples were not field filtered before laboratory analysis of total recoverable metals.

Following completion of the eight sampling events, background groundwater quality was established for Part 845 constituents. Groundwater monitoring will be conducted quarterly for at least the first five years. In accordance with 35 I.A.C. § 845.650(b)(4), after the first five years, a request to reduce the monitoring frequency to semiannual may be submitted to IEPA if all of the following can be demonstrated:

- Groundwater monitoring effectiveness will not be compromised by the reduced frequency
- Sufficient data has been collected to characterize groundwater
- Monitoring to date does not show any statistically significant increasing trends
- The concentrations of monitored constituents at the compliance monitoring wells are below the applicable GWPSs established in 35 I.A.C. § 845.600

The following subsections outline the statistical tests and procedures (methods) that will be utilized to evaluate data collected for each constituent in both background and compliance wells for Background and Compliance Monitoring. When necessary and contingent upon equivalent statistical power, an alternative test not included in this Statistical Analysis Plan may be chosen due to site-specific data requirements.

2.1 Sample Independence

Independence of sample results is a major assumption for most statistical analyses. To ensure physical independence of groundwater sampling results, the minimum time between sampling events must be longer than the time required for groundwater to move through the monitoring well. The sampling schedules for both the baseline and compliance monitoring periods are specified in 35 I.A.C. § 845.650(b) and may conflict with the statistical assumption of independence of sample results.

2.2 Non-Detect Data Processing

The reporting limit (RL) will be used as the lower level for the reporting of non-detected groundwater quality data. For all summary statistics (box plots, timeseries, etc.), the RL will be substituted for concentrations reported below the RL, including non-detects. With professional judgement, analytical results between the RL and the method detection limit, *i.e.,* estimated values, typically identified with a "J" flag, may be utilized if provided by the laboratory.

For all statistical test procedures:

- If the frequency of non-detect data are less than or equal to 15 percent, half of the RL will be substituted for these data
- If the non-detect frequency is between 15 percent and 50 percent, either the Kaplan-Meier or robust regression on order statistics (ROS) will be used to estimate the mean and standard deviation adjusted for the presence of left-censored values
- If the non-detect frequency is greater than 50 percent, a non-parametric test will be used
- If only one background result is detected that value will be used as the non-parametric upper prediction limit (UPL)

2.3 Testing for Normality

Many statistical analyses assume that sample data are normally distributed (parametric). However, environmental data are frequently not normally distributed (nonparametric). 35 I.A.C. § 845.640(g) requires the knowledge of the background data distribution for comparison to compliance results. The *Unified Guidance* document recommends the Shapiro-Wilk normality test for sample sizes of 50 or less, and the Shapiro-Francia normality test for sample sizes greater than 50.

When possible, transformation of datasets to achieve normal distributions is preferred.

2.4 Testing for Outliers

Part 845 constituents will be screened for the existence of outliers using a method described by the *Unified Guidance*. Outliers are extreme data points that may represent an anomaly or erroneous data point. To test for outliers, one or more of the following outlier tests will be utilized:

- Dixon's test, for well-constituent pairs with less than 25 samples, assumes normally distributed data.
- Rosner's test, for well-constituent pairs with more than 20 samples, assumes normally distributed data.
- Grubb's test for well-constituent pairs with seven or more samples, assumes normally distributed data.
- Time series, box-whisker plots, and probability plots provide visual tools to identify potential outliers, and evaluation of seasonal, spatial, or temporal variability for both normally and non-normally distributed data.

Data quality control, groundwater geochemistry, and sampling procedures will be evaluated as potential sources of error leading to an outlier result. The outlier tests cannot be used alone to determine whether a value is a true outlier that should be excluded from future statistical analysis. Corroborating evidence needed to exclude values includes a discrete data reporting or analytical error, or potential laboratory bias. Absent corroborating evidence, the flagged values are considered true, but extreme, values in the data set. Professional judgement will be used to exclude extreme outliers from further statistical analyses. Outliers will be retained in the database.

With professional judgement, a confirmatory sample may be collected to allow for the distinction between an outlier and a true representation of groundwater quality at the monitoring point. If re-sampling is conducted, this sample will be collected within 90 days following outlier identification. If the confirmatory sample indicates the original result as an outlier, it will be reported as such.

2.5 Trend Analysis

Statistical analyses supporting the lack of trend are a fundamental step to confirm the assumption that groundwater quality values are stationary or constant over time at a CCR unit. These analyses allow for evaluation of variation in the background and compliance data for each constituent over time. A statistically significant increasing trend in background data could indicate an existing release from the CCR unit or alternate source, requiring further investigation. In addition, statistically significant trending background data can result in increased standard deviation and, therefore, greater prediction or control limits. Consequently, the increased prediction or control limit will have less power or ability to identify a release from the CCR unit.

A linear regression, coupled with a t-test for slope significance at a 95 percent confidence level (0.05 significance level), may be used on datasets for each constituent with few non-detects and a normally distributed variance of the mean to evaluate time trends. The Theil-Sen trend line, coupled with the Mann-Kendall test for slope significance at a 95 percent confidence level (0.05 significance level), will be used for datasets with frequent non-detects or non-normal variance. Similarly, trend analyses could also be used on compliance data to evaluate a possible release from the CCR unit.

2.6 Spatial Variation

Spatial trends and/or variation between background wells could indicate an existing release from a CCR unit. If the spatial variability is not due to an existing release, intrawell comparisons in compliance wells may be used to account for spatial variability and monitor for a future release. However, the CCR unit being monitored was placed into service prior to the start of groundwater monitoring and it is unknown whether a previous release has occurred. Accordingly, intrawell comparisons in compliance wells cannot be used to determine the occurrence of a future release. Interwell comparisons between compliance wells and background wells will be used.

2.7 Temporal Variation

Time series plots can be used to identify temporal dependence. Potentially significant temporal components of variability can be identified by graphing single constituent data from multiple wells together on a time series plot. With temporal dependence, the time series plot as a pattern of parallel traces, in which the individual wells will tend to rise and fall together across the sequence of sampling dates. Time series plots can be helpful by plotting multiple constituents over time for the same well, or averaging values for each constituent across wells on each sampling event and then plotting the averages over time. In either case, the plots can signify whether the general concentration pattern over time is simultaneously observed for different constituents. If so, it may indicate that a group of constituents is highly correlated in groundwater or that the same artifacts of sampling and/or lab analysis impacted the results of several monitoring parameters.

Hydrologic factors such as drought, recharge patterns or regular (*e.g.,* seasonal) water table fluctuations may be responsible for the temporal variation. In these cases, it may be useful to test for the presence of a significant temporal effect by first constructing a parallel time series plot and then running a formal one-way analysis of variance (ANOVA) ($\alpha = 0.05$) for temporal effects. A one-way ANOVA for temporal effects considers multiple well data sets for individual sampling events or seasons as the relevant statistical factor. If event-specific analytical differences or seasonality appear to be an important temporal factor, the one-way ANOVA for temporal effects can be used to formally identify seasonality, parallel trends, or changes in lab performance that affect other temporal effects. The one-way ANOVA for temporal effects assumes that the data groups are normally distributed with constant variance. It is also assumed that for each of a series of background wells, measurements are collected at each well on sampling events or dates common to all the wells. Results of the ANOVA can also be used to create temporally stationary residuals, where the temporal effect has been 'subtracted from' the original measurements. These stationary residuals may be used to replace the original data in subsequent statistical testing.

If the data cannot be normalized, a similar test for a temporal or seasonal effect can be performed using the Kruskal-Wallis test ($\alpha = 0.05$). Each sampling event should be treated as a separate 'well,' while each well is treated as a separate 'sampling event.' In this case, no residuals can be computed since the Kruskal-Wallis test employs ranks of the data rather than the measurements themselves.

Where both spatial and temporal variation occur, two-way ANOVA can be considered where both well location and sampling event/season are treated as statistical factors. This procedure is described in Davis (1994).

2.8 Updating Background

Updating the background dataset periodically by adding recent results to an existing background dataset can improve the statistical power and accuracy of the statistical analysis, especially for non-parametric prediction intervals. The *Unified Guidance* recommends updating statistical limits (background) when at least four to eight new measurements (every 1 to 2 years under a quarterly monitoring program), are available for comparison to historical data. Professional judgement will be used to evaluate whether any background data appear to be affected by a release and need to be excluded from a background update. A t-test for equal means (if normal data distribution) or appropriate non-parametric test (if non-normal data distribution) such as a Mann-Whitney (or Wilcoxon) rank-sum or box-whisker plots, will be conducted to evaluate whether the two groups of background sample populations are statistically different prior to updating any background datasets. A 0.05 significance level will be utilized when evaluating the two populations, with the null hypothesis that they are equivalent. In addition, time series graphs or other trend evaluation statistics will be conducted on the new background dataset to verify the absence of a release or changing groundwater quality. If the tests indicate that there are no statistical differences between the two background populations, the new data will be combined with the existing dataset. If the two populations are found to be different, the data will be reviewed to evaluate the cause of the difference. If the differences appear to be caused by a release (if the new data are significantly higher, or lower for pH), then the previous background dataset may continue to be used. Furthermore, verified outliers will not be added to an existing background dataset. In accordance with the *Unified Guidance*, continual background updates will not be conducted due to the lack of sufficient samples for a statistical comparison.

3. COMPLIANCE MONITORING

Compliance monitoring is designed to monitor groundwater for evidence of a release by comparing Part 845 constituents in compliance wells to both background concentrations and the GWPS. Compliance Monitoring will begin the 1st quarter following approval of this Groundwater Monitoring Plan and issuance of the Operating Permit. The selected Compliance Monitoring statistical method used to compare compliance groundwater quality data for each constituent to the GWPS will provide for adequate statistical power, error levels and individual test false positive rates, and be appropriate for the distribution and detection frequency of the background dataset. Statistical power is the ability of a statistical test to detect a true exceedance.

In accordance with 35 I.A.C. § 845.610(b)(3)(D), compliance monitoring statistical analyses will be completed and submitted to IEPA within 60 days after completion of sampling.

3.1 GWPS Establishment and Exceedance Determination

In accordance with 35 I.A.C. § 845.600(a), the GWPS will be the constituent concentrations specified in 35 I.A.C. § 845.600(a)(1) except for when the background concentration is greater, or no concentration is specified (*i.e.,* for calcium and turbidity), in which case the GWPS will be the background concentration. The GWPS based on background concentration will be calculated using a parametric upper tolerance limit (UTL), a parametric UPL for a future mean, or a non-parametric UPL for a future median.

Statistical calculations that will be utilized in Compliance Monitoring procedures are summarized in **Table A** below and listed in **Sections 3.1.1** through **3.1.7**. Depending on the distribution of the data and the percentage of non-detects, it may be more appropriate to use a parametric model over a non-parametric model. As necessary, other techniques as mentioned in the *Unified Guidance* and/or new methods will be implemented.

Table A. Statistical Calculations Used in Compliance Monitoring Procedures

Compliance Monitoring						
	Background Data			Compliance Data		
Significant Trend?	Percent Non-Detects	Distribution	GWPS Determination	Percent Non-Detects	Distribution	Method to Determine Exceedance
No	0 ≤ 50	Normal	35 I.A.C § 845.600(a)(1) constituent concentration or The Upper Tolerance Limit	≤75	Normal	Parametric Lower Confidence Limit around a Normal Mean
				≤75	Log-Normal	Parametric Lower Confidence Limit around a Lognormal Geometric Mean
				NA	Non-Normal	Non-Parametric Lower Confidence Limit around a Median
				>75	Unknown/ Cannot be determined	
	50 ≤ 70	Normal	The Upper Prediction Limit for a Future Mean	NA	NA	Future mean
	>70	Non-Normal	Upper Prediction Limit for a Future Median	NA	NA	Future median
	100	Non-Normal	Double Quantification Rule	NA	NA	Individual Retesting Values
Yes	0 ≤ 50	Normal	UCL of Confidence Band around Linear Regression	≤75	Residuals after subtracting trend are normal, equal variance	Lower Limit from Confidence Band around Linear Regression
	50 ≤ 100	Non-Normal	UCL of Confidence Band around Thiel-Sen trend line	≤75	Residuals not normal	Lower Limit from Confidence Band around Thiel-Sen

3.1.1 The Upper Tolerance Limit

The UTL will be used to calculate the GWPS when pooled background data are normally distributed, with a non-detect frequency of 50 percent or less. When non-detect frequency is 15 percent or less, half the RL will be substituted for non-detects. The *Unified Guidance* recommends 95 percent confidence level and 95 percent coverage (95/95 tolerance interval).

- When non-detect frequency is 15 percent or less, half the RL will be substituted for non-detects (simple substitution), and the normal mean and standard deviation will be calculated.

- The Kaplan-Meier or the ROS method will be used when the detection frequency is between 15 percent and 50 percent. The Kaplan-Meier method assesses the linearity of a censored probability plot to determine whether the background sample can be approximately normalized. If so, then the Kaplan-Meier method will be used to compute estimates of the mean and standard deviation adjusted for the presence of left-censored values. The Kaplan-Meier or ROS estimate of the mean and standard deviation will be substituted for the sample mean and standard deviation.
- If background normality cannot be achieved, non-parametric UTLs will not be calculated until a minimum of 60 background samples have been collected (to achieve 95 percent coverage).

The parametric UTL on a future mean will be calculated from the background dataset as follows:

$$UTL = \overline{x} + \kappa\,(n, \gamma, \alpha - 1) \cdot s$$

$\overline{x}$ = background sample mean

s = background sample standard deviation

$\kappa\,(n, \gamma, \alpha - 1)$ = one-sided normal tolerance factor based on the chosen coverage (γ) and confidence level (α -1) and the size of the background dataset (n). Values are tabulated in Table 17-3 in Appendix D of the *Unified Guidance*. If exact values are not provided, then κ values can be estimated by linear interpolation.

If the UTL is constructed on the logarithms of original observations to achieve normality, where $\overline{y}$ and s_y are the log-mean and log-standard deviation, the limit will be exponentiated for back-transformation to the concentration scale as follows:

$$UTL = \exp\left[\overline{y} + \kappa\,(n, \gamma, \alpha - 1) \cdot s_y\right]$$

$\overline{y}$ = background sample log-mean

s_y = background sample log-standard deviation

When the GWPS is based on the 35 I.A.C. § 845.600(a)(1) constituent concentrations or a UTL derived from the background dataset, an exceedance in compliance wells relative to the GWPS will be evaluated using confidence intervals. A confidence interval defines the upper and lower bound of the true mean of a constituent concentration in groundwater within a specified confidence range.

- Non-detects in compliance data will be handled similarly to upgradient analyses, with half the RL substituted for non-detects when the frequency is 15 percent or less.
- The Kaplan-Meier, or the ROS method, will be used when the detection frequency is between 15 percent and 50 percent to compute estimates of the mean and standard deviation adjusted for the presence of left-censored values. These estimates will then be substituted for the sample mean and standard deviation.

Once the GWPS is established for background data using the UTL, either parametric or non-parametric confidence intervals will be computed for each constituent in compliance wells to identify GWPS exceedances.

3.1.2 Parametric Confidence Intervals around a Mean

If compliance data are approximately normal, one-sided parametric confidence intervals around a sample mean will be constructed for each constituent and well pair. The lower confidence limit (LCL) will be calculated as:

$$LCL_{1-\alpha} = \overline{x} - t_{1-\alpha,n-1} \cdot \frac{s}{\sqrt{n}}$$

$\overline{x}$ = compliance sample mean

s = compliance sample standard deviation

n = compliance sample size

$t_{1-\alpha,n-1}$ = obtained from a Student’s t-table with (n–1) degrees of freedom (Table 16-1 in Appendix D of the *Unified Guidance*)

The chosen t value will aim to achieve both a low false-positive rate, and high statistical power. Minimum α values are tabulated in Table 22-2 of Appendix D of the *Unified Guidance*. The selected minimum α value, from which the t value will be derived, will have at least 80 percent power ($1-\beta = 0.8$) when the underlying mean concentration is twice the GWPS.

If compliance data are distributed lognormally, the LCL will be computed around the lognormal geometric mean as:

$$LCL_{1-\alpha} = \exp\left(\overline{y} - t_{1-\alpha,n-1} \cdot \frac{s_y}{\sqrt{n}}\right)$$

$\overline{y}$ = compliance sample log-mean

s_y = compliance sample log-standard deviation

3.1.3 Non-Parametric Confidence Intervals around a Median

Non-parametric confidence intervals around the median will be computed if the compliance data contain greater than 50 percent non-detects or are not normally distributed. The mathematical algorithm used to construct non-parametric confidence intervals is based on the probability (*P*) that any randomly selected measurement in a sample of n concentration measurements will be less than an unknown *P* x 100th percentile of interest (where *P* is between 0 and 1). Then the probability that the measurement will exceed the *P* x 100th percentile is (1–*P*). The number of sample values falling below the *P* x 100th percentile out of a set of n should follow a binomial distribution with parameters n and success probability *P*, where ‘success’ is defined as the event that a sample measurement is below the *P* x 100th percentile. The probability that the interval formed by a given pair of order statistics will contain the percentile of interest will then be determined by a cumulative binomial distribution *Bin(x;n,p)*, representing the probability of *x* or fewer successes occurring in *n* trials with success probability p. *P* will be set to 0.50 for an interval around the median.

The sample size n will be ordered from least to greatest. Given *P* = 0.50, candidate interval endpoints will be chosen by ordered data values with ranks close to the product of (n+1) x 0.50. If the result of (n+1) x 0.50 is a fraction (for even-numbered sample sizes), the rank values immediately above and below will be selected as possible candidate endpoints. If the result of (n+1) x 0.50 is an integer (for odd-numbered sample sizes), one will be added to and subtracted from the result to get the upper and lower candidate endpoints. The ranks of the endpoints will be denoted L* and U*. For a one-sided LCL, the confidence level associated with endpoint L* will be computed as:

$$1-\alpha = Bin(L^{*}-1; n, 0.50) = \sum_{x=L^{*}}^{n} \binom{n}{x}\left(\frac{1}{2}\right)^{n}$$

If the candidate endpoint(s) do not achieve the desired confidence level, new candidate endpoints (L*–1) and (U*+1) and achieved confidence levels will be calculated. If one candidate endpoint equals the data minimum or maximum, only the rank of the other endpoint will be changed. Achievable confidence levels are tabulated using these equations in Table 21-11 in Appendix D of the *Unified Guidance*.

Both parametric and non-parametric confidence limits will then be compared to the GWPS. The CCR unit is considered to be in compliance if the LCL is equal to or lower than the GWPS for all detected constituents at all compliance monitoring wells. A GWPS exceedance is determined if the LCL exceeds the GWPS.

3.1.4 The Upper Prediction Limit for a Future Mean

The parametric UPL for a future mean will be used to calculate the GWPS if the pooled background data contain 50 to 70 percent non-detects and normality can be achieved. The Kaplan-Meier or ROS methods will be used to estimate the mean and standard deviation. The non-parametric UPL for a future median will be calculated as the GWPS if background samples cannot be normalized or contain greater than 70 percent non-detects. The parametric UPL for a future mean will be calculated from the background dataset at follows:

$$UPL_{1-\alpha} = \overline{x} + \kappa s$$

$\overline{x}$ = background sample mean

s = background standard deviation

κ = multiplier based on the order (p) of the future mean to be predicted, the number of compliance wells to be tested (w), the background sample size (n) the number (c) of constituents of concern (COCs), the “1-of-m” retesting scheme, and the evaluation schedule (annual, semi-annual, quarterly). Values are tabulated in 19-5 to 19-9 in Appendix D of the *Unified Guidance*.

The mean of order p will be computed for each well and compared against the UPL. For any compliance point mean that exceeds the limit, p additional resamples may be collected at that well for a 1-of-2 retesting scheme. Resample means will then be compared to the UPL. A GWPS exceedance has been deemed to occur at a compliance well when the initial mean and all resample means exceed the UPL.

3.1.5 The Non-Parametric Upper Prediction Limit for a Future Median

The non-parametric UPL for a future median will be used to calculate the GWPS if the pooled background data contain greater than 70 percent non-detects and normality cannot be achieved. Non-parametric methods assume that the data does not have an underlying distribution. To calculate the non-parametric UPL on a future value, the target per-constituent false positive rate (α_{const}) will be determined as follows:

$$\alpha_{const} = 1 - (1 - \alpha)^{1/c}$$

α = the site-wide false positive rate (SWFPR) of 0.10 recommended by the *Unified Guidance*

c = the number of monitoring constituents

The number of yearly statistical evaluation (nE) will be multiplied by the number of compliance wells (w) to determine the look-up table entry, w*. The background sample size (n) and w* will be used to select an achievable per-constituent false positive rate value in Table 19-24 of Appendix D in the *Unified Guidance*. The chosen achievable per-constituent false positive rate value will determine the type of non-parametric prediction limit (maximum or 2nd highest value in background) and a retesting scheme for a future median. The background data will be sorted in ascending order, and the upper prediction limit will be set to the appropriate order statistic previously determined by the achievable per-constituent false positive rate value in Table 19-24. If all constituent measurements in a background sample are non-detect, the Double Quantification rule will be used. The use of the Double Quantification rule in Compliance Monitoring will only be applicable if the RL is above the 35 I.A.C. § 845.600(a)(1) constituent concentration or a constituent concentration is not specified in § 845.600(a)(1). This scenario is highly unlikely. The constituent will also be removed from calculations identifying the target false positive rate.

Two initial measurements per compliance well will be collected. If both do not exceed the upper prediction limit, a third initial measurement will not be collected since the median of order 3 will also not exceed the limit. If both exceed the prediction limit, a third initial measurement will not be collected since the median will also exceed the limit. If one initial measurement is above and one below the limit, a third initial observation may be collected to determine the position of the median relative to the UPL. Up to three resamples will be collected in order to assess the resample median. In all cases, if two or more of the compliance point observations are non-detect, the median will be set equal to the RL. The median value for each compliance well will be compared to the UPL. For the 1-of-2 retesting scheme, if any compliance point median exceeds the limit, up to three additional resamples will may be collected from that well. The resample median will be computed and compared to the UPL. A GWPS exceedance has been deemed to occur at a compliance well when either the initial median, or both the initial median and resample median exceed the UPL.

If the concentrations of detected constituents are below the established GWPS, Compliance Monitoring will continue.

3.1.6 Parametric Linear Regression and Confidence Band

If the t-test detects a significant trend in the parametric linear regression line using either background or compliance data for a particular constituent, confidence bands accounting for trends will be constructed to account for the trend-induced variation. If this is not accounted for, a wider confidence interval will inevitably be calculated for a given confidence level and sample size (n). A wider confidence interval will result in less statistical power, or ability to demonstrate an exceedance or return to compliance. When a linear trend line has been estimated, a series of confidence intervals is estimated at each point along the trend. This creates a simultaneous confidence band that follows the trend line. As the underlying population mean increases or decreases, the confidence band does also to reflect this change at that point in time.

Linear regression will be used when background or compliance data are approximately normally distributed, with a constant sample variance around the mean, and the frequency of non-detects is low. The linear regression of concentration against sampling date (time) will be computed as follows:

$$\hat{b} = \sum_{i=1}^{n} (t_i - \bar{t}) \cdot x_i / (n-1) \cdot s_t^2$$

x_i = i^{th} concentration value and

t_i = i^{th} sampling date

$\bar{t}$ = sampling mean date

s_t^2 = variance of the sampling dates

This estimate leads to the following regression equation:

$$\hat{x} = \bar{x} + \hat{b} \cdot (\mathrm{t} - \bar{t})$$

$\bar{x}$ = mean concentration level

$\hat{x}$ = estimated mean concentration at time t

The regression residuals will also be computed at each sampling event to ensure uniformity and lack of significant skewness. Regression residuals will be computed at each sampling event as follows:

$$r_i = x_i - \hat{x}_i$$

The estimated variance around the regression line, or mean squared error (MSE) will be computed as follows:

$$s_e^2 = \frac{1}{n-2} \sum_{i=1}^{n} r_i^2$$

The confidence intervals around a linear regression trend line given confidence level (1-ɑ) and a point in time (t_0), will be computed as follows:

$$LCL_{1-\alpha} = \hat{x}_0 - \sqrt{2 s_e^2 \cdot F_{1-2\alpha,2,\mathrm{n}-1} \cdot \left[\frac{1}{n} + \frac{(t_0 - \bar{t})^2}{(n-1) \cdot s_t^2}\right]}$$

$$UCL_{1-\alpha} = \hat{x}_0 - \sqrt{2 s_e^2 \cdot F_{1-2\alpha,2,\mathrm{n}-2} \cdot \left[\frac{1}{n} + \frac{(t_0 - \bar{t})^2}{(n-1) \cdot s_t^2}\right]}$$

$\hat{x}_0$ = estimated mean concentration from the regression equation at time t_0

$F_{1-2\alpha,2,\mathrm{n}-2}$ = upper (1-2α)th percentage point from an F-distribution with 2 and (n-2) degrees of freedom

For background data, the UCL around the linear regression line will be used as the GWPS for the trending constituent. For compliance data, confidence bands around the linear regression line will be compared to the GWPS. The CCR unit is considered to be in compliance if the LCL is equal to or lower than the GWPS for all detected constituents at all compliance wells. A GWPS exceedance is determined when the LCL based on the trend line first exceeds the GWPS.

3.1.7 Non-Parametric Thiel-Sen Trend Line and Confidence Band

If the Mann-Kendall test detects a significant trend in the non-parametric Thiel-Sen line using either background or compliance data for a particular constituent, confidence bands accounting for trends will be constructed to account for the trend-induced variation. The Thiel-Sen trend line will be used as a non-parametric alternative to linear regression when trend residuals cannot be normalized or if there are a higher percentage of non-detects in either background or compliance data. The Thiel-Sen trend line estimates the median concentration over time by combining the median pairwise slope with the median concentration value and the median sample date. To compute the Thiel-Sen line, the data will first be ordered by sampling event x1, x2, xn. All possible distinct pairs of measurements (x_i, x_j) for j > i will be considered and the simple pairwise slope estimate will be computed for each pair as follows:

$$m_{ij} = (x_j - x_i)/(j - i)$$

With a sample size of n, there will be a total of N = n(n-1)/2 pairwise estimates (m_{ij}). If a given observation is a non-detect, half the RL will be substituted. The N pairwise slope estimates (m_{ij}) will be ordered from least to greatest (renamed m(1), m(2),..m(N)). The Thiel-Sen estimate of slope (Q) will be calculated as the median value of the list depending on whether N is even or odd as follows:

$$Q = \begin{cases} m_{([N+1]/2)}\ if\ N\ is\ odd \\ (m_{(N/2)} + m_{([N+2]/2)})/2\ if\ N\ is\ even \end{cases}$$

The sample concentration magnitude will be ordered from least to greatest, x(1), x(2), to x(n) and the median concentration will be calculated as follows:

$$\tilde{x} = \begin{cases} x_{([n+1]/2)}\ if\ n\ is\ odd \\ (x_{(n/2)} + x_{([n+2]/2)})/2\ if\ n\ is\ even \end{cases}$$

The median sampling date ($\tilde{t}$) with ordered times (t(1), t(2), to t(n)) will also be determined in this way. The Thiel-Sen trend line will then be computed for an estimate at any time (t) of the expected median concentration (x) as follows:

$$x = \tilde{x} + Q \cdot (\mathrm{t} - \tilde{t}) = (\tilde{x} - Q \cdot \tilde{t}) + Q \cdot \mathrm{t}$$

To construct a confidence band around the Thiel-Sen line, sample pairs (ti, xi) will be formed with a sample date (ti) and the concentration measurement from that date (xi). Bootstrap samples (B) will be formed by repeatedly sampling n pairs at random with replacement from the original sample pairs. This will be repeated 500 times. For each bootstrap sample, a Thiel-Sen trend line will be constructed using the equation above. A series of equally spaced time points (tj) will be identified along the range of sampling dates represented in the original sample, j =1 to m. The Thiel-Sen trend line associated with each bootstrap replicate will be used to compute an estimated concentration ($\hat{x}_j^B$). An LCL will be constructed for the lower α^{th} percentile $\hat{x}_j^{[\alpha]}$ from the distribution of estimated concentrations at each time point (tj). For a UCL, compute the upper $(1-\alpha)^{th}$ percentile, $\hat{x}_j^{[1-\alpha]}$ at each time point (tj).

For background data, the UCL around the Thiel-Sen trend line will be used as the GWPS for the trending constituent. For compliance data, confidence bands around the Thiel-Sen trend line will be compared to the GWPS. The CCR unit is considered to be in compliance if the LCL is equal to or lower than the GWPS for all detected constituents at all compliance wells. A GWPS exceedance is confirmed when the LCL based on the trend line first exceeds the GWPS.

3.2 Determination of Statistically Significant Increases over Background

In accordance with 35 I.A.C. §§ 845.610(b)(3)(B) and 845.640(h), individual monitoring event concentrations for each constituent detected in the compliance monitoring wells during compliance monitoring sampling events will be compared to the background concentration as determined by the methods described above. An exceedance of the background concentration for any constituent measured at any compliance monitoring well, or constituent detection if not detected in the background samples, constitutes a Statistically Significant Increase (SSI). An exception to this method is pH, where two-sided (upper and lower) tolerance limits are established from the distribution of the background groundwater quality data. An exceedance of either the UTL or lower tolerance limit (LTL) would constitute an SSI for pH.

4. REFERENCES

Davis, C.B., 1994. *Environmental Regulatory Statistics.* In GP Patil & CR Rao (Eds.) *Handbook of Statistics, Volume 12: Environmental Statistics*, Chapter 26. New York: Elsevier Science B.V.

United States Environmental Protection Agency (USEPA), 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Unified Guidance*. EPA 530-R-09-007. March 2009.

ATTACHMENT P

Preliminary Written Closure Plan (845.720)

Prepared for

Dynegy Midwest Generation, LLC
1500 Eastport Plaza Drive
Collinsville, Illinois 62234

CCR PRELIMINARY CLOSURE PLAN

VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Prepared by

Geosyntec consultants

engineers | scientists | innovators

134 N. Lasalle Street, Suite 300
Chicago, Illinois 60602

Project Number CHE8404A

October 2021

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1. INTRODUCTION

Dynegy Midwest Generation, LLC (Dynegy) is the owner of the inactive coal-fired Vermilion Power Plant (VPP), also referred to as Vermilion Power Station, located approximately 13 miles Northwest of Danville, Illinois. The New East Ash Pond (NEAP) is an inactive surface impoundment storing coal combustion residuals (CCR). The requirements are specified in 35 Ill. Admin. Code 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845).

This Preliminary Closure Plan addresses the requirements of Part 845.720(a) for the New East Ash Pond (NEAP).

1.1. Facility Information

Facility:	Vermilion Power Plant 10188 East 2150 North Rd Oakwood, IL 61858
CCR Unit:	New East Ash Pond (NEAP)
Owner/Operator:	Dynegy Midwest Generation, LLC 1500 Eastport Plaza Drive Collinsville, IL 62234
Closure Method:	Closure by Removal

2. CLOSURE PLAN DESCRIPTION

2.1. Description of Closure

> *Section 845.720(a)(1)(A): A narrative description of how the CCR surface impoundment will be closed in accordance with this Part.*

The NEAP contains water in its eastern section. The NEAP is not covered; it has exposed coal ash above the impounded water level and coal ash below the impounded water. The visible CCR will be removed, as well as any pipes and discharge structures within the surface impoundment. The coal ash will be hauled to a landfill that meets State requirements of IAC Part 811. This landfill may be onsite or offsite. The area will be graded and/or backfilled as necessary to minimize the potential for ponding and vegetated with native grasses.

General fill will be placed to provide positive drainage following excavation of the coal ash from the NEAP. The eastern berms do not contain coal ash. The select portions of the eastern berms will be excavated and used as low permeability soil or general fill. This fill will promote positive drainage on the final closure area to convey non-contact stormwater offsite.

2.2. Description of Removal Plan

> *Section 845.720(a)(1)(B): If closure of the CCR surface impoundment will be accomplished through removal of CCR from the CCR surface impoundment, a description of the procedures to remove the CCR and decontaminate the CCR surface impoundment in accordance with Section 845.740.*

The closure of the NEAP will be accomplished by removal of CCR from the surface impoundment. The NEAP contains water in its eastern section. Water from the CCR Impoundments are required to be removed and the CCR dewatered in accordance with the Illinios Attorney General (IAG) Interim Order (IO) entered June 30, 2021. The existing coal ash will be consolidated and removed from the NEAP. All areas affected by releases of CCR from the CCR surface impoundment will be decontaminated.Groundwater monitoring will be performed in accordance with Section 845.740(b). All structures and conveyances used to manage CCR will be decontaminated or removed and sent to a licensed landfill.

> *Section 845.720(a)(1)(C): If closure of the CCR surface impoundment will be accomplished by leaving CCR in place, a description of the final cover system, designed in accordance with Section 845.750, and the methods and procedures to be used to*

> *install the final cover. The closure plan must also discuss how the final cover system will achieve the performance standards specified in Section 845.750.*

Closure by removal is the chosen closure method for the NEAP, and therefore, this requirement is not applicable.

3. INVENTORY AND AREA ESTIMATES

3.1. Estimate of the Maximum Inventory

> Section 845.720(a)(1)(D): *An estimate of the maximum inventory of CCR ever on-site over the active life of the CCR surface impoundment.*

Closure by removal at the facility will include removing approximately 343,000 cubic yards of coal ash from the NEAP.

3.2. Estimate of the Largest Area

> Section 845.720(a)(1)(E): *An estimate of the largest area of the CCR surface impoundment ever requiring a final cover (see Section 845.750), at any time during the CCR surface impoundment's active life.*

A final cover is not required because the Closure by Removal method will be implemented.

4. CLOSURE SCHEDULE

> Section 845.720(a)(1)(F): *A schedule for completing all activities necessary to satisfy the closure criteria in this Section, including an estimate of the year in which all closure activities for the CCR surface impoundment will be completed. The schedule should provide sufficient information to describe the sequential steps that will be taken to close the CCR surface impoundment, including identification of major milestones such as coordinating with and obtaining necessary approvals and permits from other agencies, the dewatering and stabilization phases of CCR surface impoundment closure, or installation of the final cover system, and the estimated timeframes to complete each step or phase of CCR surface impoundment closure. When preparing the preliminary written closure plan, if the owner or operator of a CCR surface impoundment estimates that the time required to complete closure will exceed the timeframes specified in Section 845.760(a), the preliminary written closure plan must include the site-specific information, factors and considerations that would support any time extension sought under Section 845.760(b).*

The closure schedule is provided for the scenario where a new on site landfill (Landfill) is provided. To construct the Landfill, the Plant will be demolished.

Table 4-1 CCR Preliminary Closure Schedule

Milestone	**Timeframe (all preliminary estimates)**
Preliminary Written Closure Plan	October 2021
Notification of Intent to Close Placed in Operating Record	By the date the owner or operator initiates closure of a CCR surface impoundment, the owner or operator must prepare a notification of intent to close a CCR surface impoundment. The notification must be placed in the facility's operating record as required by Section 845.800(d)(22) and Section 845.730(d).
Agency Coordination and Permit Acquisition • Coordinating with State Agencies for Compliance for Closure and On site Landfill • Acquiring various State permits	 Year 1 – 8 Year 2 – 8

Dewater and Stabilize CCR • Complete pond water removal and CCR Dewatering, as necessary • Complete Stabilization	Year 1 - Ongoing NA
Mobilization (Plant Demolition)	Year 2
Plant Demolition (for on site Landfill)	Year 2 through 6
Mobilization New Landfill	Year 6
Mobilization CCR Closure	Year 7
Excavate CCR and Haul to Landfill	Year 8 – 12
Estimate of Year in Which All Closure Activities Will be Completed	Year 2033

5. RECORDKEEPING

> <u>Section 845.720(a)(2):</u> *The owner or operator of the CCR surface impoundment must submit the preliminary written closure plan to the Agency with its initial operating permit application. The owner or operator of the CCR surface impoundment must submit the most recently amended preliminary closure plan to the Agency with each operating permit renewal application. The owner or operator must place preliminary and amended preliminary written closure plans in the facility's operating record as required by Section 845.800(d)(20).*

This Preliminary Closure Plan will be submitted with the initial operating permit application and will be placed in the facility’s operating rcord as required by Section 845(d)(20).

6. AMENDMENTS OF PRELIMINARY WRITTEN CLOSURE PLAN

> Section 845.720(a)(3)(A): *The owner or operator may amend the preliminary written closure plan at any time.*
>
> Section 845.720(a)(3)(B): *The owner or operator must amend the preliminary written closure plan whenever: i) There is a change in the operation of the CCR surface impoundment that would substantially affect the written closure plan in effect; or ii) Before closure activities have commenced, unanticipated events necessitate a revision of the written closure plan.*
>
> Section 845.720(a)(3)(C): *The owner or operator must amend the closure plan at least 60 days before a planned change in the operation of the facility or CCR surface impoundment, or within 60 days after an unanticipated event requires the need to revise an existing written closure plan.*

This Preliminary Closure Plan will be amended as required by Section 845.720(a)(3). In accordance with Section 845.720(a)(3)(B), this Preliminary Closure Plan will be amended to provide additional details after the final design is completed, if the final design would substantially affect this written preliminary closure plan. This Preliminary Closure Plan reflects the information available to date.

Table 6-1. CCR Preliminary Closure Plan Amendments

Amendment Number and Date	Pages or Section	Description of Amendment	Professional Engineer Certifying Plan
Version 0 October 2021	NA	Preliminary Closure Plan	John Seymour, PE

7. CERTIFICATION

CCR Unit: Dynegy Midwest Generation, LLC; Vermilion Power Plant, New East Ash Pond

I, John Seymour, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify in accordance with Section 845.720(a)(4), to the best of my knowledge, information, and belief, that the information contained in this plan has been prepared in accordance with the accepted practice of engineering and meets the requirements of Section 845.720(a).

John Seymour
Printed Name

John Seymour 10/22/2021
Signature Date

062.040562 Illinois 30 November 2021
Registration Number State Expiration Date

JOHN P. SEYMOUR
062-040562

Affix Seal

ATTACHMENT Q

Liner Certification (845.400)

Prepared for

Dynegy Midwest Generation, LLC
1500 Eastport Plaza Drive
Collinsville, Illinois 62234

CCR LINER DESIGN CRITERIA EVALUATION

VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Prepared by

Geosyntec consultants

engineers | scientists | innovators

134 N. Lasalle Street, Suite 300
Chicago, Illinois 60602

Project Number CHE8404A

October 2021

TABLE OF CONTENTS

1. INTRODUCTION

Dynegy Midwest Generation, LLC (Dynegy) is the owner of the inactive coal-fired Vermilion Power Plant (VPP), also referred to as Vermilion Power Station, located approximately 13 miles Northwest of Danville, Illinois. The New East Ash Pond (NEAP) is an inactive surface impoundment storing coal combustion residuals (CCR). The NEAP must meet the requirements of 35 Ill. Admin. Code 845 Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845).

This liner design criteria evaluation addresses the requirements of Part 845.400 for the New East Ash Pond (NEAP).

1.1. Facility Information

Facility:	Vermilion Power Plant 10188 East 2150 North Rd Oakwood, IL 61858
Owner/Operator:	Dynegy Midwest Generation, LLC 1500 Eastport Plaza Drive Collinsville, IL 62234

2. LINER EVALUATION

> <u>Section 845.400(a):</u> *An existing CCR surface impoundment is considered to be an existing lined surface impoundment if it has been constructed with either a composite liner that meets the requirements of subsection (b) or an alternative composite liner that meets the requirements of subsection (c).*

The NEAP liner information is included in the History of Construction Report.

Based on the evaluation of design drawings and available records it has been determined that the Vermilion Power Plant, NEAP is not constructed with a liner that meets the criteria specified in Section 845.400(b) for a composite liner, or the criteria specified in Section 845.400(c) for an alternative composite liner. Consequently, it will be considered an existing inactive unlined CCR surface impoundment.

3. CERTIFICATION

CCR Unit: Dynegy Midwest Generation, LLC; Vermilion Power Plant, New East Ash Pond

I, John Seymour, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify in accordance with Section 845.400(h), to the best of my knowledge, information, and belief, that the information contained in this plan has been prepared in accordance with the accepted practice of engineering and the above referenced CCR Unit does not have a liner that meets the requirements of Section 845.400(b) or (c).

John Seymour
Printed Name

John Seymour 10/22/2021
Signature Date

062.040562 Illinois 30 November 2021
Registration Number State Expiration Date

JOHN P. SEYMOUR
062-040562

Affix Seal

ATTACHMENT R

History of Known Groundwater Exceedances (845.600)

HISTORY OF POTENTIAL EXCEEDANCES

This presentation of the History of Potential Exceedances, and any corrective action taken to remediate groundwater, is provided to meet the requirements of Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845.230(d)(2)(M) for the Vermilion Power Plant New East Ash Pond, Illinois Environmental Protection Agency (IEPA) ID No. W1838000002-04.

Note

Groundwater concentrations from 2015 to 2021 presented in the Hydrogeologic Site Characterization Report (HCR) Table 4-1, and evaluated and summarized in the following tables, are considered potential exceedances because the methodology used to determine them is proposed in the Statistical Analysis Plan (Appendix A to Groundwater Monitoring Plan [GMP]), which has not been reviewed or approved by the IEPA at the time of submittal of the 35 I.A.C. § 845 Operating Permit application.

Alternate sources for potential exceedances as allowed by 35 I.A.C. § 845.650(e) have not yet been evaluated. These will be evaluated and presented in future submittals to IEPA as appropriate.

Table 1 summarizes how the potential exceedances were determined. Table 2 is a summary of all potential exceedances.

Background Concentrations

Background monitoring wells identified in the GMP include 10 and 22.

For monitoring wells, either newly constructed in 2021 or existing wells, background concentrations calculated from the eight sampling events required by 35 I.A.C. § 845.650(b)(1)(A), to be collected within 180 days from April 21, 2021, were compared to the standards identified in 35 I.A.C. § 845.600(a)(1). For constituents with calculated background concentrations greater than the standards in 35 I.A.C. § 845.600(a)(1), those calculated background concentrations were used as GWPSs. Compliance well statistical calculations from that same time period were compared to the GWPSs to determine potential exceedances.

Corrective Action

No corrective actions have been taken to remediate the groundwater.

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
16A	BCU	845	Antimony, total	mg/L	04/01/2021 - 08/17/2021	CI around median	0.001	0.006	0.005	0.006	Standard
16A	BCU	845	Arsenic, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.000921	0.010	0.001	0.01	Standard
16A	BCU	845	Barium, total	mg/L	04/01/2021 - 08/17/2021	CI around median	0.24	2.0	0.082	2	Standard
16A	BCU	845	Beryllium, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
16A	BCU	845	Boron, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.67	2.0	0.43	2	Standard
16A	BCU	845	Cadmium, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
16A	BCU	845	Chloride, total	mg/L	04/01/2021 - 08/17/2021	CB around linear reg	142	200	20	200	Standard
16A	BCU	845	Chromium, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.0015	0.10	0.004	0.1	Standard
16A	BCU	845	Cobalt, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.001	0.090	0.090	0.006	Background
16A	BCU	845	Fluoride, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.69	4.0	0.43	4	Standard
16A	BCU	845	Lead, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.001	0.0075	0.001	0.0075	Standard
16A	BCU	845	Lithium, total	mg/L	04/01/2021 - 08/17/2021	CB around linear reg	0.031	0.040	0.030	0.04	Standard
16A	BCU	845	Mercury, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
16A	BCU	845	Molybdenum, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.0015	0.10	0.004	0.1	Standard
16A	BCU	845	pH (field)	SU	03/29/2021 - 08/17/2021	CI around mean	7.3	6.3/9.0	6.3/7.8	6.5/9	Background/Standard
16A	BCU	845	Radium 226 + radium 228, total	pCi/L	04/01/2021 - 08/17/2021	CI around mean	0.27	7.0	7.0	5	Background
16A	BCU	845	Selenium, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.001	0.050	0.001	0.05	Standard
16A	BCU	845	Sulfate, total	mg/L	03/29/2021 - 08/17/2021	CI around mean	11	400	338	400	Standard
16A	BCU	845	Thallium, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
16A	BCU	845	Total Dissolved Solids	mg/L	03/29/2021 - 08/17/2021	CI around mean	624	1200	1080	1200	Standard
35D	BCU	845	Antimony, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.000748	0.006	0.005	0.006	Standard
35D	BCU	845	Arsenic, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.00135	0.010	0.001	0.01	Standard
35D	BCU	845	Barium, total	mg/L	04/01/2021 - 08/17/2021	CI around geomean	0.021	2.0	0.082	2	Standard
35D	BCU	845	Beryllium, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
35D	BCU	845	Boron, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	1.5	2.0	0.43	2	Standard
35D	BCU	845	Cadmium, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
35D	BCU	845	Chloride, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	227	200	20	200	Standard
35D	BCU	845	Chromium, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.000931	0.10	0.004	0.1	Standard
35D	BCU	845	Cobalt, total	mg/L	04/01/2021 - 08/17/2021	Future median	0.0014	0.090	0.090	0.006	Background
35D	BCU	845	Fluoride, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.68	4.0	0.43	4	Standard
35D	BCU	845	Lead, total	mg/L	04/01/2021 - 08/17/2021	CI around geomean	0.000807	0.0075	0.001	0.0075	Standard
35D	BCU	845	Lithium, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.100	0.040	0.030	0.04	Standard
35D	BCU	845	Mercury, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
35D	BCU	845	Molybdenum, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.016	0.10	0.004	0.1	Standard
35D	BCU	845	pH (field)	SU	03/29/2021 - 08/17/2021	CI around mean	7.1	6.3/9.0	6.3/7.8	6.5/9	Background/Standard
35D	BCU	845	Radium 226 + radium 228, total	pCi/L	04/01/2021 - 08/17/2021	CI around mean	0.22	7.0	7.0	5	Background
35D	BCU	845	Selenium, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.001	0.050	0.001	0.05	Standard
35D	BCU	845	Sulfate, total	mg/L	03/29/2021 - 08/17/2021	CB around linear reg	701	400	338	400	Standard
35D	BCU	845	Thallium, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
35D	BCU	845	Total Dissolved Solids	mg/L	03/29/2021 - 08/17/2021	CB around linear reg	1650	1200	1080	1200	Standard
70S	UU	845	Antimony, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.001	0.006	0.005	0.006	Standard
70S	UU	845	Arsenic, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.001	0.010	0.001	0.01	Standard
70S	UU	845	Barium, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.016	2.0	0.082	2	Standard
70S	UU	845	Beryllium, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
70S	UU	845	Boron, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.32	2.0	0.43	2	Standard
70S	UU	845	Cadmium, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
70S	UU	845	Chloride, total	mg/L	04/01/2021 - 08/17/2021	CB around linear reg	9.0	200	20	200	Standard
70S	UU	845	Chromium, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.0015	0.10	0.004	0.1	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES

HISTORY OF POTENTIAL EXCEEDANCES
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
70S	UU	845	Cobalt, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.001	0.090	0.090	0.006	Background
70S	UU	845	Fluoride, total	mg/L	04/01/2021 - 08/17/2021	CB around linear reg	0.15	4.0	0.43	4	Standard
70S	UU	845	Lead, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.001	0.0075	0.001	0.0075	Standard
70S	UU	845	Lithium, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.011	0.040	0.030	0.04	Standard
70S	UU	845	Mercury, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
70S	UU	845	Molybdenum, total	mg/L	04/01/2021 - 08/17/2021	CB around T-S line	0.00497	0.10	0.004	0.1	Standard
70S	UU	845	pH (field)	SU	04/01/2021 - 08/17/2021	CI around mean	6.8	6.3/9.0	6.3/7.8	6.5/9	Background/Standard
70S	UU	845	Radium 226 + radium 228, total	pCi/L	04/01/2021 - 08/17/2021	CI around mean	-0.135	7.0	7.0	5	Background
70S	UU	845	Selenium, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.001	0.050	0.001	0.05	Standard
70S	UU	845	Sulfate, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	586	400	338	400	Standard
70S	UU	845	Thallium, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
70S	UU	845	Total Dissolved Solids	mg/L	04/01/2021 - 08/17/2021	CB around linear reg	980	1200	1080	1200	Standard
70D	BCU	845	Antimony, total	mg/L	04/01/2021 - 08/17/2021	CI around geomean	0.000914	0.006	0.005	0.006	Standard
70D	BCU	845	Arsenic, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	-0.000156	0.010	0.001	0.01	Standard
70D	BCU	845	Barium, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.49	2.0	0.082	2	Standard
70D	BCU	845	Beryllium, total	mg/L	04/01/2021 - 08/17/2021	CI around median	0.001	0.004	0.001	0.004	Standard
70D	BCU	845	Boron, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.98	2.0	0.43	2	Standard
70D	BCU	845	Cadmium, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
70D	BCU	845	Chloride, total	mg/L	04/01/2021 - 08/17/2021	CB around linear reg	591	200	20	200	Standard
70D	BCU	845	Chromium, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	-0.00234	0.10	0.004	0.1	Standard
70D	BCU	845	Cobalt, total	mg/L	04/01/2021 - 08/17/2021	Future median	0.0036	0.090	0.090	0.006	Background
70D	BCU	845	Fluoride, total	mg/L	04/01/2021 - 08/17/2021	CB around linear reg	0.21	4.0	0.43	4	Standard
70D	BCU	845	Lead, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	-0.00344	0.0075	0.001	0.0075	Standard
70D	BCU	845	Lithium, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.063	0.040	0.030	0.04	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
70D	BCU	845	Mercury, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
70D	BCU	845	Molybdenum, total	mg/L	04/01/2021 - 08/17/2021	CB around linear reg	-0.0231	0.10	0.004	0.1	Standard
70D	BCU	845	pH (field)	SU	04/01/2021 - 08/17/2021	CI around mean	6.8	6.3/9.0	6.3/7.8	6.5/9	Background/Standard
70D	BCU	845	Radium 226 + radium 228, total	pCi/L	04/01/2021 - 08/17/2021	CI around mean	1.1	7.0	7.0	5	Background
70D	BCU	845	Selenium, total	mg/L	04/01/2021 - 08/17/2021	CI around median	0.001	0.050	0.001	0.05	Standard
70D	BCU	845	Sulfate, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	48	400	338	400	Standard
70D	BCU	845	Thallium, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
70D	BCU	845	Total Dissolved Solids	mg/L	04/01/2021 - 08/17/2021	CB around linear reg	1730	1200	1080	1200	Standard
71S	UU	845	Antimony, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.001	0.006	0.005	0.006	Standard
71S	UU	845	Arsenic, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.00286	0.010	0.001	0.01	Standard
71S	UU	845	Barium, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.042	2.0	0.082	2	Standard
71S	UU	845	Beryllium, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
71S	UU	845	Boron, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.18	2.0	0.43	2	Standard
71S	UU	845	Cadmium, total	mg/L	04/01/2021 - 08/17/2021	CI around median	0.001	0.005	0.001	0.005	Standard
71S	UU	845	Chloride, total	mg/L	04/01/2021 - 08/17/2021	CI around median	2.0	200	20	200	Standard
71S	UU	845	Chromium, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.0012	0.10	0.004	0.1	Standard
71S	UU	845	Cobalt, total	mg/L	04/01/2021 - 08/17/2021	Future median	0.0013	0.090	0.090	0.006	Background
71S	UU	845	Fluoride, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.17	4.0	0.43	4	Standard
71S	UU	845	Lead, total	mg/L	04/01/2021 - 08/17/2021	CI around median	0.001	0.0075	0.001	0.0075	Standard
71S	UU	845	Lithium, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.00452	0.040	0.030	0.04	Standard
71S	UU	845	Mercury, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
71S	UU	845	Molybdenum, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.00224	0.10	0.004	0.1	Standard
71S	UU	845	pH (field)	SU	04/01/2021 - 08/17/2021	CI around mean	6.7	6.3/9.0	6.3/7.8	6.5/9	Background/Standard
71S	UU	845	Radium 226 + radium 228, total	pCi/L	04/01/2021 - 08/17/2021	CI around mean	0.19	7.0	7.0	5	Background

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
71S	UU	845	Selenium, total	mg/L	04/01/2021 - 08/17/2021	CI around median	0.001	0.050	0.001	0.05	Standard
71S	UU	845	Sulfate, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	55	400	338	400	Standard
71S	UU	845	Thallium, total	mg/L	04/01/2021 - 08/17/2021	CI around geomean	0.00133	0.002	0.002	0.002	Standard
71S	UU	845	Total Dissolved Solids	mg/L	04/01/2021 - 08/17/2021	CI around mean	476	1200	1080	1200	Standard
71D	BCU	845	Antimony, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.000757	0.006	0.005	0.006	Standard
71D	BCU	845	Arsenic, total	mg/L	04/01/2021 - 08/17/2021	CI around geomean	0.000138	0.010	0.001	0.01	Standard
71D	BCU	845	Barium, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	-0.132	2.0	0.082	2	Standard
71D	BCU	845	Beryllium, total	mg/L	04/01/2021 - 08/17/2021	CI around median	0	0.004	0.001	0.004	Standard
71D	BCU	845	Boron, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.31	2.0	0.43	2	Standard
71D	BCU	845	Cadmium, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
71D	BCU	845	Chloride, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	-47.8	200	20	200	Standard
71D	BCU	845	Chromium, total	mg/L	04/01/2021 - 08/17/2021	CI around geomean	0.000232	0.10	0.004	0.1	Standard
71D	BCU	845	Cobalt, total	mg/L	04/01/2021 - 08/17/2021	Future median	0.0022	0.090	0.090	0.006	Background
71D	BCU	845	Fluoride, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.41	4.0	0.43	4	Standard
71D	BCU	845	Lead, total	mg/L	04/01/2021 - 08/17/2021	CI around geomean	0.000104	0.0075	0.001	0.0075	Standard
71D	BCU	845	Lithium, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	-0.0144	0.040	0.030	0.04	Standard
71D	BCU	845	Mercury, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
71D	BCU	845	Molybdenum, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.00361	0.10	0.004	0.1	Standard
71D	BCU	845	pH (field)	SU	04/01/2021 - 08/17/2021	Most recent sample	7.0	6.3/9.0	6.3/7.8	6.5/9	Background/Standard
71D	BCU	845	Radium 226 + radium 228, total	pCi/L	04/01/2021 - 08/17/2021	CI around mean	-2.76	7.0	7.0	5	Background
71D	BCU	845	Selenium, total	mg/L	04/01/2021 - 08/17/2021	CI around median	0	0.050	0.001	0.05	Standard
71D	BCU	845	Sulfate, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	23	400	338	400	Standard
71D	BCU	845	Thallium, total	mg/L	04/01/2021 - 08/17/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
71D	BCU	845	Total Dissolved Solids	mg/L	04/01/2021 - 08/17/2021	CI around mean	259	1200	1080	1200	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Notes:
Potential exceedance of GWPS
HSU = hydrostratigraphic unit:
  BCU = Bedrock Confining Unit
  UU = Upper Unit
Program = regulatory program data were collected under:
  257 = 40 C.F.R. Part 257 Subpart D (Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments)
  845 = 35 I.A.C. Part 845 (Sampling events completed to assess well locations for inclusion in the Part 845 monitoring well network)
mg/L = milligrams per liter
pCi/L = picoCuries per liter
SU = standard units
Sample Count = number of samples from Sampled Date Range used to calculate the Statistical Result
Statistical Calculation = method used to calculate the statistical result:
  All ND - Last = All results were below the reporting limit, and the last determined reporting limit is shown
  CB around linear reg = Confidence band around linear regression
  CB around T-S line = Confidence band around Thiel-Sen line
  CI around geomean = Confidence interval around the geometric mean
  CI around mean = Confidence interval around the mean
  CI around median = Confidence interval around the median
  Future median = Median of the three most recent samples
  Most recent sample = Result for the most recently collected sample used due to insufficient data
Statistical Result = calculated in accordance with Statistical Analysis Plan using constituent concentrations observed at monitoring well during all sampling events within the specified date range
For pH, the values presented are the lower / upper limits
GWPS = Groundwater Protection Standard
GWPS Source:
  Standard = standard specified in 35 I.A.C. § 845.600(a)(1)
  Background = background concentration (see cover page for additional information)

TABLE 2. SUMMARY OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
35D	BCU	845	Chloride, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	227	200	20	200	Standard
35D	BCU	845	Lithium, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.100	0.040	0.030	0.04	Standard
35D	BCU	845	Sulfate, total	mg/L	03/29/2021 - 08/17/2021	CB around linear reg	701	400	338	400	Standard
35D	BCU	845	Total Dissolved Solids	mg/L	03/29/2021 - 08/17/2021	CB around linear reg	1650	1200	1080	1200	Standard
70S	UU	845	Sulfate, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	586	400	338	400	Standard
70D	BCU	845	Chloride, total	mg/L	04/01/2021 - 08/17/2021	CB around linear reg	591	200	20	200	Standard
70D	BCU	845	Lithium, total	mg/L	04/01/2021 - 08/17/2021	CI around mean	0.063	0.040	0.030	0.04	Standard
70D	BCU	845	Total Dissolved Solids	mg/L	04/01/2021 - 08/17/2021	CB around linear reg	1730	1200	1080	1200	Standard

Notes:
HSU = hydrostratigraphic unit:
  BCU = Bedrock Confining Unit
  UU = Upper Unit
Program = regulatory program data were collected under:
  257 = 40 C.F.R. Part 257 Subpart D (Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments)
  845 = 35 I.A.C. Part 845 (Sampling events completed to assess well locations for inclusion in the Part 845 monitoring well network)
mg/L = milligrams per liter
pCi/L = picoCuries per liter
SU = standard units
Sample Count = number of samples from Sampled Date Range used to calculate the Statistical Result
Statistical Calculation = method used to calculate the statistical result:
  CB around linear reg = Confidence band around linear regression
  CI around mean = Confidence interval around the mean
Statistical Result = calculated in accordance with Statistical Analysis Plan using constituent concentrations observed at monitoring well during all sampling events within the specified date range
For pH, the values presented are the lower / upper limits
GWPS = Groundwater Protection Standard
GWPS Source:
  Standard = standard specified in 35 I.A.C. § 845.600(a)(1)
  Background = background concentration (see cover page for additional information)

ATTACHMENT S

Financial Assurance Requirements

Certification of Financial Assurance Requirements

On June 17, 2021, Dynegy Midwest Generation, LLC provided financial assurance in the form of performance bonds to the Illinois Environmental Protection Agency in the amount of $129,602,578 for the Old East/North Ash Pond System and the New East Pond Cell 1 & 2 at the Vermilion Power Plant.[1]

I, Matthew A. Goering, Senior Vice President of Dynegy Midwest Generation, LLC, do hereby certify to the best of my knowledge for the above referenced CCR Units that the financial assurance instruments satisfy the requirements of 35 I.A.C. Part 845, Subpart I.

Matthew A. Goering
Senior Vice President
Dynegy Midwest Generation, LLC

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[1] In the operating permit applications, the Old East/North Ash Pond system is referred to as the Old East Ash Pond and North Ash Pond, and the New East Pond Cell 1 & 2 is referred to as the New East Ash Pond.

ATTACHMENT T

Hazard Potential Classification Assessment (845.440)

Luminant

Office Memorandum

Date: October 12, 2021

To: Cynthia Vodopivec

cc: Charles Koudelka
Phil Morris

From: Vic Modeer

Subject: Dynegy Midwest Generation, LLC
Vermilion Power Plant – New East Ash Pond

Documentation of Initial Hazard Potential Classification Certification
Vermilion Power Plant New East Ash Pond.

Purpose

This letter documents the certification of the initial hazard potential classification assessment for the Vermillion Power Plant New East Ash Pond (NEAP).

The *Illinois Administrative Code (IAC), Title 35, Part 845.440* requires the owner or operator of an existing coal combustion residuals (CCR) surface impoundment to conduct an initial hazard potential classification assessment, and the basis for the classification, of the CCR unit as either a Class 1 (high hazard) or Class 2 (significant hazard) CCR surface impoundment.

Results

A breach analysis was performed by Geosyntec to evaluate potential hazards associated with a failure of the NEAP's perimeter containment dike. Breach locations were selected based on nearby downstream areas that could be potentially impacted. The breach failure mode consisted of the NEAP's reservoir full of water and a resultant overtopping of the perimeter containment dike's crest. The overtopping breach failures were modeled along the NEAP's eastern perimeter containment dike for two downstream conditions along the Middle Fork Vermilion River: 1) "Full Riverbank Flow"; and 2) "100-Year Flow" scenarios.

Model results indicate that a breach of the eastern perimeter containment dike would inundate the undeveloped floodplain area immediately to the east of the NEAP. The model results indicate that breach discharge would flow into the Middle Fork Vermilion River and not result in any structures being impacted. Therefore, failure or mis-operation of the NEAP would result in no probable loss of human life. However, a NEAP breach event would result in off-site release of CCR material onto immediate downstream areas and into the Middle Fork Vermilion River, resulting in environmental damage.

Section 845.120 defines a "Class 2 CCR surface impoundment" as 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.

Based on the results of the analysis summarized above, the initial hazard potential hazard classification was conducted in accordance with Section 845.440, with the NEAP assigned a Class 2 hazard potential classification. Accordingly, the certification below satisfies the requirements of Section 845.440(a)(2).

Sincerely,

Vic Modeer, PE, D.GE
(IL, MO, IN, KY, OH, LA)
Engineering Manager

VICTOR ALBERT MODEER JR.
062-043112

ATTACHMENT U

Structural Stability Assessment (845.450)

Prepared for

Dynegy Midwest Generation, LLC
1500 Eastport Plaza Drive
Collinsville, Illinois 62234

CCR INITIAL STRUCTURAL STABILITY ASSESSMENT

VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Prepared by

Geosyntec consultants
engineers | scientists | innovators

134 N. Lasalle Street, Suite 300
Chicago, Illinois 60602

Project Number CHE8404A

October 2021

TABLE OF CONTENTS

1. INTRODUCTION

Dynegy Midwest Generation, LLC (Dynegy) is the owner of inactive coal-fired Vermilion Power Plant (VPP), also referred to as Vermilion Power Station, located approximately 13 miles Northwest of Danville, Illinois. The New East Ash Pond (NEAP) is an inactive surface impoundment storing coal combustion residuals (CCR). The NEAP must meet the requirements of 35 Ill. Admin. Code 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845).

The NEAP is an existing CCR surface impoundment as defined by Section 845.120. This Initial Structural Stability Assessment addresses the requirements of Part 845.450 for the NEAP.

1.1. Facility Information

Facility:	Vermilion Power Plant 10188 East 2150 North Rd Oakwood, IL 61858
Owner/Operator:	Dynegy Midwest Generation, LLC 1500 Eastport Plaza Drive Collinsville, IL 62234

2. INITIAL STRUCTURAL STABILITY ASSESSMENT

> Section 845.450(a): *The owner or operator of a CCR surface impoundment must conduct initial and annual structural stability assessments and document whether the design, construction, operation, and maintenance of the CCR surface impoundment is consistent with recognized and generally accepted engineering practices for the maximum volume of CCR and CCR wastewater that can be impounded in the CCR surface impoundment. The assessment must, at a minimum, document whether the CCR surface impoundment has been designed, constructed, operated, and maintained with: [the standards in (a)(1)-(7)].*

An initial structural stability assessment has been performed to document that the design, construction, operation, and maintenance of the NEAP is consistent with recognized and generally accepted good engineering practices. The results of the structural stability assessment are discussed in the following sections.

Based on the assessment and its results, the design, construction, operation, and maintenance of NEAP were found to be consistent with recognized and generally accepted good engineering practices and meets the standards in Section 845.450(a)(1)-(7), except as noted herein.

2.1. Foundations and Abutments

> Section 845.450(a)(1): *The assessment must, at a minimum, document whether the CCR surface impoundment has been designed, constructed, operated, and maintained with: 1) Stable foundations and abutments;*

The stability of the NEAP foundation and abutments was evaluated based on the review of the History of Construction Report, review of observations from the 2019 annual inspection forms, review of geophysical investigation results, review of available geotechnical data, and performing slope stability analyses.

It was concluded that there had been coal mining activities around the perimeter of NEAP prior to construction of the NEAP. A geophysical investigation was conducted at the site to identify underground void spaces. A few localized voids and potential voids were identified around the perimeter of the CCR unit. Inspection of the ground surface in these areas is included in the inspection procedures. No evidence of ground subsidence has been identified around the NEAP or on the eastern berm since operations started at the NEAP.

The foundation of NEAP and abutments appear to be stable after the review of geotechnical investigations, inspection records, laboratory data, and safety factors for slip surfaces meeting or exceeding the minimum requirements specified by Section 845.460.

2.2. Slope Protection

> *<u>Section 845.450(a)(2):</u> The assessment must, at a minimum, document whether the CCR surface impoundment has been designed, constructed, operated, and maintained with: ... 2) Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown;*

Procedures for operation and maintenance were reviewed. The adequacy of slope protection present at NEAP was evaluated by reviewing inspection reports and conditions observed in the field during the 2019 annual inspection, and subsequent visits made by Geosyntec in 2020 and 2021.

The perimeter dike slopes are generally 3H:1V and are covered with vegetation for slope protection. Dynegy regularly maintains the slopes, including repairing observed surface erosion and addressing areas of poor vegetation growth, as required.

Based on this evaluation, NEAP meets the requirements of Section 845.450(a)(2).

2.3. Dike Compaction

> *<u>Section 845.450(a)(3):</u> The assessment must, at a minimum, document whether the CCR surface impoundment has been designed, constructed, operated, and maintained with: ... 3) Dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR surface impoundment;*

Compaction of the NEAP perimeter dike was evaluated using field data obtained from the various geotechnical investigations. The standard penetration test (SPT) N-values for the cohesive component of the perimeter dike ranges from 7 to 93, with an average of 19; the range corresponds to a consistency of soft to hard, with the average value corresponding to very stiff.

The consistencies based on average values are indicative of mechanically compacted dikes. Further, slope stability analyses as required by Section 845.460 result in acceptable safety factors. Therefore, the dike compaction and density are sufficient for withstanding required ranges in loading conditions.

2.4. Vegetated Slopes

> *<u>Section 845.450(a)(4):</u> The assessment must, at a minimum, document whether the CCR surface impoundment has been designed, constructed, operated, and maintained with: ... 4) Slope protection consistent with Section 845.430;*

The adequacy of slope vegetation at NEAP was evaluated by reviewing conditions observed from the 2019 annual inspection forms, and visual observations obtained from additional field visits conducted by Geosyntec in 2020 and 2021. At the time of the 2019 annual inspection, and site visits in 2020 and 2021, the exterior slopes were vegetated and well-maintained. Some woody vegetation was observed on lower portions of the perimeter dike.

Based on this evaluation, NEAP meets the requirements of Section 845.450 with the exception of limited areas where woody vegetation exists. Dynegy has an operation and maintenance plan to remove the woody vegetation in accordance with Section 845.430(b)(4).

2.5. Spillways

> *Section 845.450(a)(5): The assessment must, at a minimum, document whether the CCR surface impoundment has been designed, constructed, operated, and maintained with: ... 5) A single spillway or a combination of spillways configured as specified in subsection (a)(5)(A). The combined capacity of all spillways must be designed, constructed, operated, and maintained to adequately manage flow during and following the peak discharge from the event specified in subsection (a)(5)(B);*

The spillways at the NEAP were evaluated using hydrologic and hydraulic analyses, and historic design and construction information provided by Dynegy. The NEAP is a Class 2 CCR surface impoundment; therefore, the 1,000-year storm event is the design flow event for NEAP, per Section 845.510(a)(3)(B).

Per the June 22, 2021 Illinois Attorney General (IAG) Interim Order (Order), *II. Interim Injunction Relief (2)(b); Within forty-five (45) days of the entry of this Order, Defendant shall submit to Illinois EPA, for it review and approval, a written scope of work for the removal of free water and dewatering of the Ponds at the Site, including a proposed schedule for implementation.* Therefore, the starting water surface elevation was set at the bottom elevation of the NEAP (589.0 feet) when evaluating the 1,000-year storm event as the IAG Order requires removal of free water from NEAP as part of its normal operating condition.

The primary spillway system for the NEAP consists of an 18-inch diameter steel pipe through the divider dike embankment, which transitions to a drop inlet structure on the upstream side of the embankment. The NEAP auxiliary spillway system consists of a 36-inch diameter reinforced concrete pipe (RCP) through the divider dike embankment, which transitions to a drop inlet structure on the upstream side of the embankment. Both spillway systems discharge to a secondary settling pond non-CCR impoundment on the downstream side of the divider dike embankment. The primary and auxiliary spillway pipes and inlet structures are constructed of metal and concrete, both of which are non-erodible materials. The capacities of the spillways were evaluated using hydrologic and hydraulic analyses. The analysis found that the spillways adequately manage flow during peak discharge resulting from the 1,000-year storm event to prevent overtopping of the embankments with a starting water surface elevation at the bottom of NEAP. The hydrologic and hydraulic analysis did not consider additional outflow from a portable pump.

Based on these evaluations, the NEAP meets the requirements in Section 845.450(a)(5).

2.6. Stability and Structural Integrity of Hydraulic Structures

> Section 845.450(a)(6): *The assessment must, at a minimum, document whether the CCR surface impoundment has been designed, constructed, operated, and maintained with: ... 6) Hydraulic structures underlying the base of the CCR surface impoundment or passing through the dike of the CCR surface impoundment that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the CCR surface impoundment;*

The discharge pipe for NEAP will be removed as part of the upcoming closure. Dynegy is in the process of submitting the construction permit for the closure activities.

2.7. Downstream Slope Inundation/Stability

> Section 845.450(a)(7): *The assessment must, at a minimum, document whether the CCR surface impoundment has been designed, constructed, operated, and maintained with: ... 7) For CCR surface impoundments with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body.*

The river level is generally around elevation 573 ft with ordinary high water mark being at an approximate elevation of 580 ft. The toe of the perimeter dike is around 582 ft. It is unlikely that the river level would rise over 590 and stay there for a considerable amount of time to saturate the cohesive soils that could reduce the stability of the perimeter dike. Therefore, it is unlikely that a rapid drawdown condition would occur at the NEAP perimeter dike. Based on this evaluation, Section 845.450(a)(7) is not applicable for NEAP.

3. CERTIFICATION

CCR Unit: Dynegy Midwest Generation, LLC; Vermilion Power Plant, New East Ash Pond

I, John Seymour, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify in accordance with Section 845.450(c), to the best of my knowledge, information, and belief, that the information contained in this plan has been prepared in accordance with the accepted practice of engineering and meets the requirements of Section 845.450, with the exception for Section 845.450(a)(4) where woody vegetation was identified.

John Seymour
Printed Name

John Seymour 10/22/2021
Signature Date

062.040562 Illinois 30 November 2021
Registration Number State Expiration Date

JOHN P. SEYMOUR
062-040562

Affix Seal

ATTACHMENT V

Safety Factor Assessment (845.460)

Prepared for

Dynegy Midwest Generation, LLC
1500 Eastport Plaza Drive
Collinsville, Illinois 62234

CCR INITIAL SAFETY FACTOR ASSESSMENT

VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Prepared by

Geosyntec
consultants

engineers | scientists | innovators

134 N. Lasalle Street, Suite 300
Chicago, Illinois 60602

Project Number CHE8404A

October 2021

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1. INTRODUCTION

Dynegy Midwest Generation, LLC (Dynegy) is the owner of inactive coal-fired Vermilion Power Plant (VPP), also referred to as Vermilion Power Station, located approximately 13 miles Northwest of Danville, Illinois. The New East Ash Pond (NEAP) is an inactive surface impoundment storing coal combustion residuals (CCR). The NEAP must meet the requirements of 35 Ill. Admin. Code 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845).

NEAP is an existing CCR surface impoundment as defined by Section 845.120. This Initial Safety Factor Assessment addresses the requirements of Section 845.460 for the NEAP.

1.1. Facility Information

Facility:	Vermilion Power Plant 10188 East 2150 North Rd Oakwood, IL 61858
Owner/Operator:	Dynegy Midwest Generation, LLC 1500 Eastport Plaza Drive Collinsville, IL 62234

2. INITIAL SAFETY FACTOR ASSESSMENT

> <u>Section 845.460(a):</u> *The owner or operator of a CCR surface impoundment must conduct an initial and annual safety factor assessments for each CCR surface impoundment and document whether the calculated factors of safety for each CCR surface impoundment achieve the minimum safety factors specified in this Section for the critical cross section of the embankment. The critical cross section is 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 safety factor assessments must be supported by appropriate engineering calculations.*
>
> 1. *For new CCR surface impoundments, the calculated static factor of safety under the end-of-construction loading condition must equal or exceed 1.30. The assessment of this loading condition is only required for the initial safety factor assessment and is not required for subsequent assessments.*
> 2. *The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.*
> 3. *The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.*
> 4. *The calculated seismic factor of safety must equal or exceed 1.00.*
> 5. *For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.*

A geotechnical investigation program and stability analyses were performed by Geosyntec to evaluate the stability of the NEAP perimeter dike. Available data from field investigations, existing documents and reports, and other information provided to Geosyntec from Dynegy were utilized to perform this assessment.

In general, the perimeter dike of NEAP consists of a fine-grained compacted soil overlying native clay alluvium and sand alluvium ranging from 5 to 20 feet thick extending down to bedrock. The phreatic surface was established considering groundwater level readings from both borings and established wells in and around the NEAP.

One (1) representative cross section was analyzed using limit equilibrium slope stability analysis software to evaluate the stability of the perimeter dike system and foundations. The cross section were located to represent critical surface geometry, subsurface stratigraphy, and phreatic conditions across the site. The cross sections was evaluated for the loading conditions stipulated in Section 845.460(a).

NEAP was constructed in 2003, and it is currently inactive. Therefore, the end-of-construction short-term loading condition was not applicable and not analyzed for this initial safety factor assessment.

Results of the Initial Safety Factor Assessments, for the critical cross section for the applicable loading conditions, are provided in Table 1 (i.e., the table identifies the lowest calculated factor of safety for any one of the two analyzed cross sections for each loading condition).

Table 2-1: Summary of Initial Safety Factor Assessments

Loading Conditions	845.460(a) Subsection	Minimum Factor of Safety	Calculated Factor of Safety
End-of-Construction Loading	1	1.30	Not Applicable
Long-term Maximum Storage Pool Loading	2	1.50	2.42
Maximum Surcharge Pool Loading	3	1.40	2.41
Seismic	4	1.00	2.02
Soils Susceptible to Liquefaction	5	1.20	>1.20

Based on this evaluation, NEAP meets the requirements in 845.460(a).

3. CERTIFICATION

CCR Unit: Dynegy Midwest Generation, LLC; Vermilion Power Plant, New East Ash Pond

I, John Seymour, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify in accordance with Section 845.460(b), to the best of my knowledge, information, and belief, that the information contained in this plan has been prepared in accordance with the accepted practice of engineering and meets the requirements of Section 845.460.

John Seymour
Printed Name

John Seymour 10/22/2021
Signature Date

062.040562 Illinois 30 November 2021
Registration Number State Expiration Date

JOHN P. SEYMOUR
062-040562

Affix Seal

ATTACHMENT W

Inflow Design Flood Control System Plan (845.510)

Prepared for

Dynegy Midwest Generation, LLC
1500 Eastport Plaza Drive
Collinsville, Illinois 62234

INITIAL CCR INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

VERMILION POWER PLANT
NEW EAST ASH POND
OAKWOOD, ILLINOIS

Prepared by

Geosyntec consultants
engineers | scientists | innovators

134 N. Lasalle Street, Suite 300
Chicago, Illinois 60602

Project Number CHE8404A

October 2021

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1. INTRODUCTION

Dynegy Midwest Generation, LLC (Dynegy) is the owner of inactive coal-fired Vermilion Power Plant (VPP), also referred to as Vermilion Power Station, located approximately 13-miles Northwest of Danville, Illinois. The New East Ash Pond (NEAP) is an inactive surface impoundment storing coal combustion residuals (CCR). The owner must prepare an Inflow Design Flood Control System Plant that meets the requirements of *35 Ill. Admin Code 845 Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments* (herein referred to as *Section 845*).

NEAP is an existing CCR surface impoundment as defined by *Section 845.120*, This Inflow Design Flood Control System Plan addresses the requirements of *Section 845.510(c)* for the NEAP.

1.1. Facility Information

Facility:	Vermilion Power Plant 10188 East 2150 North Rd Oakwood, IL 61858
Owner/Operator:	Dynegy Midwest Generation, LLC 1500 Eastport Plaza Drive Collinsville, IL 62234

2. INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

> <u>Section 845.510(c)(1):</u> *Content of the Plan. The owner or operator must prepare initial and annual inflow design flood control system plans for the CCR surface impoundment. These plans must document how the inflow design flood control system has been designed and constructed to meet the requirements of this Section. Each plan must be supported by appropriate engineering calculations.*
>
> <u>Section 845.510(c)(2):</u> *Amendment of the Plan. The owner or operator of the CCR surface impoundment may amend the written inflow design flood control system plan at any time. The owner or operator must amend the written inflow design flood control system plan whenever there is a change in conditions that would substantially affect the written plan in effect.*

Analyses completed for the initial inflow design flood control system plan of the NEAP are described in the following subsections. Data and analysis results in the following subsections are based on spillway design information shown on design drawings, construction information, topographic surveys, information about operational and maintenance pocesures provided by Dynegy. The analysis approach and results of the hydrologic and hydraulic analyses are presented in the following subsections.

2.1. Initial Inflow Design Flood Control Systems (Section 845.510(a))

> <u>Section 845.510(a):</u> *The owner or operator of an existing or new CCR surface impoundment or any lateral expansion of a CCR surface impoundment must design, construct, operate, and maintain an inflow design flood control system as specified in subsections (a)(1) and (2).*
>
> *1. The inflow design flood control system must adequately manage flow into the CCR surface impoundment during and following the peak discharge of the inflow design flood specified in subsection (a)(3).*
>
> *2. The inflow design flood control system must adequately manage flow from the CCR surface impoundment to collect and control the peak discharge resulting from the inflow design flood specified in subsection (a)(3).*
>
> *3. The inflow design flood, at a minimum, is:*
>
> *A. For a Class 1 CCR surface impoundment, as determined under Section 845.440(a), the probable maximum flood;*
>
> *B. For a Class 2 CCR surface impoundment, as determined under Section 845.440(a), the 1000-year flood; or*

C. For an incised CCR surface impoundment, the 25-year flood.

The NEAP is a Class 2 CCR surface impoundement based on the certified documentation of initial hazard potential classification (Luminant, October 2021), in accordance with *Section 845.440*.

An initial inflow design flood control system plan, supported by a hydraulic and hydrologic analysis, was developed for the NEAP by evaluating the effects of a 24-hour duration design storm for the 1,000-year Inflow Design Flood (IDF) using a hydrologic HEC-HMS (Version 4.8) computer model and a starting water surface elevation of 589.0 feet (NAVD 88). Per the June 22, 2021 Illinois Attorney General (IAG) Interim Order (Order), *II. Interim Injunction Relief (2)(b); Within forty-five (45) days of the entry of this Order, Defendant shall submit to Illinois EPA, for it review and approval, a written scope of work for the removal of free water and dewatering of the Ponds at the Site, including a proposed schedule for implementation.* Therefore, the starting water surface elevation was set at the bottom elevation of the NEAP (589.0 feet) when evaluating the 1,000-year IDF as the IAG Order requires removal of free water from NEAP as part of its normal operating condition.

The computer model evaluated the NEAP ability to collect and control the 1,000-year IDF under existing operatrional and maintenance procedures. Rainfall data for the 1,000-year IDF was obtained from the National Oceanic and Atmosheric Administration (NOAA) Precipitation Frequency Distribution Server (PFDS), which is an online interactive map that provides NOAA Atlas 14 rainfall data for a selected location. The NOAA Atlas 14 rainfall depth is 10.5 inches at NEAP per the PFDS for the 1,000-year, 24-hour rainfall event.

The HEC-HMS model results for the NEAP indicate that the CCR unit has sufficient storage capacity and spillway structures to adequately manage: (1) flow into the CCR unit during and following the peak discharge of the 1,000-year IDF, and (2) flow from the CCR unit to collect and control the peak discharge resulting from the 1,000-year IDF. The peak water surcharge elevation is 601.6 feet (NAVD 88), and the minimum crest elevation of the NEAP dike is 620.0 feet (NAVD 88). Therefore, overtopping of the NEAP dike is not expected during the evaluated 1,000-year IDF.

Based on this evaluation, the NEAP meets the requirements in *Section 845.510(a)*.

2.2. Discharge from the CCR Surface Impoundment (Section 845.510(b))

> *Section 845.510(a):* *Discharge from the CCR surace impoundment must be handled in accordance with the surface water requirements in Section 845.110(b)(3) and 35 Ill. Adm. Code Subtitle C.*

> <u>Section 845.110(b):</u> *Any CCR surface impoundment or lateral expansion of a CCR surface impoundment is subject to the following requirements:*
>
> 3. *Rivers, Lakes and Streams Act [615 ILCS 5/23 and 23(a)] and 17 Ill. Adm. Code 3702.*

The handling of discharge was evaluated by reviewing design drawings, operational and maintenance procedures, and the inflow design flood control system plan developed per *Section 845.510(a)*.

Based on this evaluation, outflow from the NEAP is ultimately routed through a NPDES-permitted discharge into the Middle Fork Vermilion River via its secondary settling pond non-CCR surface impoundment. Hydraulic and hydrologic analyses performed as part of the initial inflow design flood control system plan found that the NEAP adequately manages flow during the 1,000-year IDF, as overtopping of the NEAP embankment is not expected during the evaluated IDF.

Therefore, discharge of pollutants in violation of the NPDES permit is not expected during normal and IDF conditions as all discharge is routed through the existing spillway system and NPDES-permitted outfall.

Based on this evaluation, the NEAP meets the requirements in *Section 845.510(b)*.

3. CERTIFICATION

CCR Unit: Dynegy Midwest Generation, LLC; Vermilion Power Plant, New East Ash Pond

I, John Seymour, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify in accordance with Section 845.510(c)(3) to the best of my knowledge, information, and belief, that the information contained in this plan has been prepared in accordance with the accepted practice of engineering and that, for the above referenced CCR Unit, this initial inflow design flood control system plan meets the requirements of *Section 845.510*.

John Seymour
Printed Name

John Seymour 10/22/2021
Signature Date

062.040562 Illinois 30 November 2021
Registration Number State Expiration Date

JOHN P. SEYMOUR
062-040562

Affix Seal

ATTACHMENT X

Safety and Health Plan (845.530)

PART 845 SAFETY AND HEALTH PLAN

VERMILION POWER PLANT
NAP/OEAP AND NEAP CCR UNITS

CONTENTS

APPENDICES

ACRONYMS & ABBREVIATIONS

%	Percent
§	Section
35 I.A.C.	Title 35 of the Illinois Administrative Code
29 C.F.R.	Title 29 of the Code of Federal Regulations
ACGIH	American Conference of Governmental Industrial Hygienists
CCR	Coal Combustion Residual
DMG	Dynegy Midwest Generation, LLC
HAZWOPER	Hazardous Waste Operations and Emergency Response
ID	identification
IDLH	Immediately Dangerous to Life and Health
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
kV	kilovolt
Middle Fork	Middle Fork of the Vermilion River
NAP	North Ash Pond
NEAP	New East Ash Pond
NID	National Inventory of Dams
NIOSH	National Institute for Occupational Safety and Health
No.	number
NPDES	National Pollutant Discharge Elimination System
OEAP	Old East Ash Pond
OSHA	Occupational Safety and Health Administration
Part 845	35 I.A.C. Part 845: Residuals in Surface Impoundments
PEL	Permissible Exposure Level
PFAS	Per- and polyfluoroalkyl substances
PFD	Personal Flotation Device
PNOR	particulates not otherwise recognized
POC	Point of Contact
PPE	personal protective equipment
ppm	parts per million
SDS	Safety Data Sheet
Site	NAP, OEAP, and NEAP
STEL	Short Term Exposure Limit
TLV	Threshold Limit Value
TWA	time-weighted averages
USCG	United States Coast Guard
VPP	Vermilion Power Plant

REVISION SUMMARY

Revision Date	**Description of Changes** (Section title or number – description)	**Responsible Party** (individual name or title, company / agency name, document reference and date)

PREFACE

Dynegy Midwest Generation, LLC (DMG) has prepared this Safety and Health Plan in accordance with requirements set forth in Title 35 of the Illinois Administrative Code (35 I.A.C.) Part 845: Residuals in Surface Impoundments (Part 845), Section (§) 845.530. DMG assessed health and safety hazards of its coal combustion residual (CCR) surface impoundments to develop and update this Safety and Health Plan.

This document describes the minimum anticipated protective measures necessary for worker health and safety at the Vermilion Power Plant (VPP) CCR Units, including the North Ash Pond (NAP; Vistra identification [ID] number [No.] 910, Illinois Environmental Protection Agency [IEPA] ID No. W1838000002-01), Old East Ash Pond (OEAP; Vistra ID No. 911, IEPA ID No. W1838000002-03), and New East Ash Pond (NEAP; Vistra ID No. 912, IEPA ID No. W1838000002-04, National Inventory of Dams [NID] No. IL50291), collectively referred to as the Site. Employees of DMG, contract workers, and third-party contractors must read and comply with the contents of this document. The contents of this document are not intended to cover all situations that may arise nor to waive any provisions specified in Federal, State, and local regulations or site owner / contractor health and safety requirements.

Third-party contractors are accountable for the health and safety of their employees. Third-party contractors are required to prepare a Safety and Health Plan that meets the minimum requirements herein. However, no requirements or provisions within this plan shall be construed as an assumption of DMG of their legal responsibilities as an employer.

This Safety and Health Plan will be reviewed and updated annually, at a minimum. The Safety and Health Plan will also be updated if facility operations change, or a new hazard is identified.

1. INTRODUCTION

This Safety and Health Plan has been developed to outline the requirements to be met by employees of DMG, contract workers, and third-party contractors while performing any activity to construct, operate, or close the CCR Units at the Site. This Safety and Health Plan has been developed to meet the requirements of 35 I.A.C. § 845.530 and describes the responsibilities, training requirements, protective equipment, and safety procedures necessary to minimize the risk of injury, fires, explosion, chemical spills, material damage incidents, and near misses related to CCR activities. This Safety and Health Plan incorporates by reference the Occupational Safety and Health Administration (OSHA) regulations contained in Title 29 of the Code of Federal Regulations (29 C.F.R.) § 1910 and 29 C.F.R. § 1926.

The requirements and guidelines in this Safety and Health Plan are based on a review of available information and data, and an evaluation of identified on-site hazards. This Safety and Health Plan will be reviewed with persons assigned to work at the Site and will be available on-site.

1.1 Site Description/History

The VPP is located in east central Illinois in Vermilion County, approximately five miles northeast of the Village of Oakwood, located within Section 20, Township 20 North, Range 12 West. The VPP is an approximately 982-acre property consisting of 19 parcels, including a retired coal-fired power plant and surface impoundments. The VPP ceased operations in 2011 when the power plant was retired.

The NAP and OEAP CCR Units are located adjacent to each other in the northern portion of the VPP. The NAP is bordered on the north by fallow fields owned by the Illinois Department of Natural Resources (IDNR); to the east by the Middle Fork of the Vermilion River (Middle Fork); to the south by the OEAP; and to the west by steep bluffs that include the Illinois Department of Conservation designated Orchid Hill Natural Heritage Landmark, which is partially within the VPP property boundary but is administered by IDNR. The OEAP is bordered to the north and northeast by the Middle Fork; to the southeast, south, and west by steep bluffs; and to the northwest by the NAP. The NAP and OEAP are both located on terraces adjacent to the Middle Fork, which is bordered to the east and west by steep bluffs. The NEAP lies in the bottomlands of the Middle Fork and is bordered by bluffs to the west; to the south by unimproved DMG land; and to the north and east by the Middle Fork (Appendix A).

1.2 Facility Personnel

The following table outlines key personnel with respect to facility operations and health and safety.

Name	Position	Phone Number
Dianna Tickner	Point-of-Contact (POC)	618-381-3124
Brian Voelker	Environmental Manager	618-343-7824
Security Guard	Onsite Security / Emergency Contact	713-542-7692
Matt Ballance	Engineering Manager	618-343-7739 (office) 618-792-7274 (mobile)
Jason Campbell	Dam Safety Manager	271-753-8904 (Springfield) 217-622-3491 (mobile)
Stu Cravens	Senior Technical Expert	217-390-1503 (mobile)
Vic Modeer	Engineering Manager	618-541-0878
Charles Koudelka	Plant Closure Director	903-235-8633

1.3 Responsibilities

The following persons have responsibilities associated with communicating and implementing the Safety and Health Plan for the Site CCR Units.

1.3.1 DMG Point of Contact

The DMG Point of Contact (POC) is a management-level person who is requiring employees, contract workers, or third-party contractors to enter the Site CCR Units. The DMG POC is responsible to communicate Safety and Health Plan information and requirements to employees, contract workers, and third-party contractors, and oversee work performed in the Site CCR Units to the extent necessary to confirm implementation of Safety and Health Plan requirements.

1.3.2 DMG Employees

DMG employees are directly hired by DMG. They are required to implement and/or follow Safety and Health Plan requirements as applicable to their work and exercise their "stop work authority" if safety requirements are unclear or unanticipated site conditions or hazards are observed.

1.3.3 Contract Workers

Contract workers are those hired by DMG through an agency firm. Similar to DMG employees, contract workers are required to implement and/or follow Safety and Health Plan requirements as applicable to their work and exercise their "stop work authority" if safety requirements are unclear or unanticipated site conditions or hazards are observed.

1.3.4 Third-Party Contractor Employees

Third-party contractor employees work for firms under contract to DMG. Third-party contractors include prime contractors and all of their lower tier subcontractors. Similar to DMG employees, third-party contractors are required to implement Safety and Health Plan requirements as applicable to their work and exercise their "stop work authority" if safety requirements are unclear or unanticipated site conditions or hazards are observed.

1.3.5 Third-Party Contractor Safety Competent Person

Third-party contractors will be required to designate a Safety Competent Person. The Safety Competent Person must be in a management position (*e.g.,* superintendent, foreman, etc.) with OSHA 30-hour construction safety certification who may perform other duties, unless DMG requires a dedicated Safety Competent Person. A Safety Competent Person must be on site at all times when the subcontractor has employees performing work for DMG and must possess a sound working knowledge of pertinent OSHA regulations, this Safety and Health Plan, and other applicable safety requirements related to the scope of work. Third-party contractors must also designate a backup Safety Competent Person that possesses the same authority and training. The competent person will ensure timely correction of safety deficiencies identified by DMG. The Safety Competent Person is responsible to ensure Safety and Health Plan requirements have been communicated to lower-tier subcontractors and enforce Safety and Health Plan requirements.

2. SITE ACCESS & CONTROL

This section outlines requirements for ensuring that only authorized personnel and visitors are permitted at the Site.

2.1 Facility Security

Elements of site control include restricting access to the Site CCR Units to persons until they have met the training requirements outlined in this Safety and Health Plan and have been authorized to do so by the VPP POC or their representative.

Access to the Site CCR Units requires 24 hours' notice unless access is required for emergency response.

Upon arrival to the Site, all DMG employees, contract workers, and third-party contractors must check in/out at Security. A COVID-19 screening must also be completed per Section 3.9.

2.2 Third-Party Contractor Management

Prior to working at the Site, all prime third-party contractors must maintain an active registration with ISNetworld and maintain a grade of A or B. DMG may exempt a third-party contractor from being registered in ISNetworld under special circumstances. Lower tier subcontractors are currently not required to be registered in ISNetworld, but this requirement may change at the discretion of DMG.

2.3 Third-Party Contractor Safety and Health Plan

Prior to being authorized to conduct work at the NAP/OEAP and NEAP CCR Units, third-party contractors must develop and submit a Safety and Health Plan. The third-party contractor's Safety and Health Plan must be specific to the scope of work that they will be performing at the NAP/OEAP and NEAP CCR Units. The third-party contractor's Safety and Health Plan must meet or exceed all the requirements in this Safety and Health Plan, other DMG requirements, and applicable regulations. All lower tier subcontractors of third-party contractors must meet the requirements in this Safety and Health Plan as well as the requirements outlined in the Safety and Health Plan of the third-party with whom they are contracted.

2.4 Authorized Personnel

At a minimum, authorized personnel who will be granted unescorted access to the project include DMG employees, contract workers, and third-party contractors that meet the following:

- Reviewed this Safety and Health Plan and other applicable safety planning documentation
- Have completed all the training, medical surveillance, and drug screen and background investigation requirements as outlined in Section 3 of this Safety and Health Plan.
- Have signed the VPP safety briefing.

2.5 Visitors

Visitors must be escorted by Authorized Personnel through the NAP/OEAP and NEAP CCR Units if they have not reviewed this Safety and Health Plan or completed the training requirements outlined in Section 3 of this Safety and Health Plan. Visitors may not undertake any activity to construct, operate, or close a CCR surface impoundment.

2.6 Communication

Communication between workers and emergency services must be maintained at all times. Cellular service is not consistently available and cannot be relied upon to summon emergency services. In lieu of using mobile phones, handheld radios must be used to communicate with Security. Third-party contractors are responsible for providing their radios and must leave one at Security upon arrival to the site.

3. TRAINING & MEDICAL REQUIREMENTS

Project personnel must be properly trained for the type of work being performed and in accordance with 35 I.A.C. § 845.530, 29 C.F.R. § 1926 and 29 C.F.R. § 1910, and DMG policies. Additionally, personnel working in areas regulated by the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standards (29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65) must have current medical surveillance. All employees, contractors, and third-party contractors must complete the following prior to beginning any activity to construct, operate, or close the CCR Units at the Site.

3.1 HAZWOPER Training

35 I.A.C. § 845.530(c)(2)(E) requires that all employees, contract workers, and third-party contractors be trained in accordance with 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65. The following training will be completed as required by job function:

- **OSHA 40-Hour Training** per 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65, for those personnel who are expected to have extensive contact with contaminated materials and/or may be required to wear a respirator.
- **OSHA 24-Hour Training** per 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65, for those personnel who are expected to have minimal contact with contaminated materials and will NOT be required to wear a respirator.
- **OSHA 8-hour Supervisor Training** per 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65, for Site Supervisors, Foremen, Superintendents, and others who will be directing and managing site activities.
- **OSHA 8-hour Refresher** per 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65, completed within 12 months of initial 40-hour or 24-hour training and annually thereafter.

The following matrix outlines HAZWOPER training requirements based on typical job functions at the NAP/OEAP and NEAP CCR Units. It is not intended to be all inclusive, new job functions must be evaluated per 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65.

Training	Job Function
OSHA 40-hour	Ash handlers
OSHA 24-hour	Personnel not required to handle CCR materials
OSHA 8-hour Supervisor Training	Third-Party Contractor Safety Competent Persons
OSHA 8-hour refresher	All personnel

3.2 OSHA Construction Outreach Training

35 I.A.C. § 845.530(c)(2)(E) requires that all employees, contract workers, and third-party contractors complete an OSHA 10-hour or 30-hour construction safety training. These trainings will be completed as follows:

- All employees, contract workers, and third-party contract employees: OSHA 10-hour or 30-hour construction outreach training.
- Supervisors, superintendents, foreman and safety professionals: OSHA 30-hour construction outreach training.

3.3 NAP/OEAP and NEAP CCR Units Safety and Health Plan Review

Pursuant to 35 I.A.C. § 845.530(d)(e), before beginning any activity at the NAP/OEAP and NEAP CCR Units, and annually thereafter, all DMG employees, contract workers, and third-party contractors must review the content of this HASP. After reviewing this Safety and Health Plan all personnel will understand the following:

- Procedures for using, inspecting, repairing, and replacing facility emergency and monitoring equipment
- Communications or alarm systems outlined in Section 6
- Response to fires and explosions outlined in Section 6
- Response to a spill or release of CCR
- Information about chemical hazards and hazardous materials outlined in Section 5
- The use of engineering controls, administrative controls, and personal protective equipment (PPE) outlined in Section 4

All personnel will acknowledge this HASP by signing the *Safety and Health Plan Acknowledgment Form (Appendix B).*

3.4 Emergency and Monitoring Equipment Training

All DMG employees, contract workers, and third-party contractors must be aware of how to respond to alarms and other emergencies as outlined in Section 6 of this plan. Individuals may only use facility emergency and monitoring equipment if they have been trained in their use and authorized to do so by the designated POC. Additionally, a written release may need to be completed as required by Vistra Corporate Procedure FFA-POL-0006.

Individual DMG employees and contract workers may be responsible for using, inspecting, repairing and replacing facility emergency monitoring equipment. These individuals will be trained in accordance with procedures identified by DMG. These individuals will review and adhere to the manufacturer’s instructions, where applicable.

Third-party contractors are responsible for inspecting, repairing, and replacing any owned emergency (*i.e.*, fire extinguishers) and monitoring equipment (*i.e.*, air monitoring equipment). Third-party contractors will maintain procedures for using, inspecting, repairing, and replacing owned emergency and monitoring equipment that is consistent with the manufacturer’s requirements. Third-party contractor employees who are responsible for this equipment will be trained in procedures for using, inspecting, and repairing owned equipment by their employer.

3.5 Hazard Communication

All employees, contract workers, and third-party contractors must be trained in chemical hazards (if any) associated with their work in accordance with 29 C.F.R. § 1910.1200. Work tasks performed on the NAP/OEAP and NEAP CCR Units may include exposure to compounds identified in the Hazard Communication section of this Safety and Health Plan and is included as part of the Safety and Health Plan Review outlined in Section 3.3.

3.6 Medical Surveillance

All employees, contract workers, and third-party contractors engaged in operations specified in 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65 and meet one of the criteria outlined in 29 C.F.R. § 1910.120(f)(2) and 29 C.F.R. § 1926.65(f)(2) must participate in a medical surveillance program that is administered by their employer. The criteria for participating in a medical surveillance program are:

- All employees who are or may be exposed to hazardous substances at or above the established permissible exposure limit, without regard to the use of respirators, for 30 days or more a year;
- All employees who wear a respirator for 30 days or more a year; or
- All employees who are injured, become ill or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operation.

The medical surveillance program must result in documentation that an individual is cleared to work on sites covered by 29 C.F.R. § 1910.120 and 20 C.F.R. § 1926.65 and is medically fit to wear a respirator when applicable.

3.7 Drug Screen and Background Investigations

DMG requires that contract worker agencies and third-party contractors are responsible for ensuring that all personnel have completed and passed a drug and alcohol test and background investigation prior to on-site work as described in Appendix C.

3.8 COVID-19 Site Entry Guidelines

All personnel entering Vistra work sites shall review and adhere to the site entry guidelines provided in Appendix D.

3.9 Document Management

DMG will maintain employee and contract employee training and medical surveillance records in/at corporate headquarters. Third-party contractors are responsible for maintaining training and medical surveillance documentation for their employees. Third-party contractors will produce documentation upon DMG request.

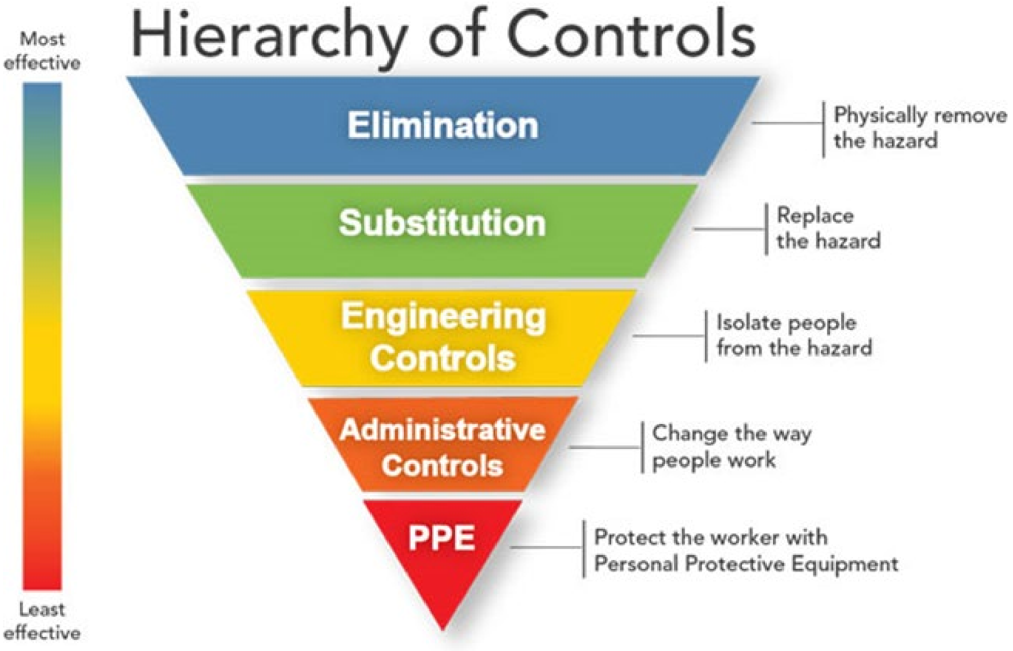
3.10 Industrial Hygiene Sampling Records

Upon receipt of exposure sampling results DMG and third-party contractors must distribute exposure sampling results to employees within 15 business days unless otherwise required by applicable regulation. All personnel exposure sampling results and records must be maintained by the employee’s company for at least 30 years following termination of employment.

4. HAZARD & CONTROLS

The following section outlines general controls for the hazards and controls. Third-party contractors are still responsible for developing a Safety and Health Plan that incorporates requirements of this Safety and Health Plan, other safety requirements for the VPP, as well as the third-party contractor's safety policies and procedures. Safety and Health Plans developed by third-party contractors must be specific to the site and the anticipated work means and methods. Safety and Health Plans that consist of only standard operating procedures or are not otherwise specific to the work performed at the NAP/OEAP and NEAP CCR Units will not be accepted by DMG.

DMG requires that a hierarchy of controls be considered when performing work at the Site. Implement controls that favor elimination, substitution, and engineering over the use of administrative controls and PPE when feasible. See the figure below for additional guidance (courtesy of the National Institute for Occupational Safety and Health [NIOSH]).



4.1 Ash/Unstable Surfaces

Prior to working in or on an ash pond, third-party contractors must notify the facility POC. Work in or on an ash pond may not begin until the facility POC has approved the work. Upon completion of the work, third-party contractors must notify the facility POC that they have left the ash pond.

All individuals must check in with site security upon arrival and departure of the NAP/OEAP and NEAP CCR Units.

When working on ash ponds or unstable surfaces the following requirements must be implemented where applicable and feasible. The following table summarizes safety controls for work performed in ash ponds and on unstable surfaces and are aligned to the hierarchy of controls:

Elimination	Substitution	Engineering	Administrative	PPE
Change the work task or work methods so that work on ash ponds is no longer required	Use the lightest available tracked equipment to reduce ground pressure	Use crane mats or other cribbing to support heavy equipment on ash ponds	Traverse compacted paths that have previously been used by heavy equipment	Use a restraint (tethering) system to prevent falls or slips into unstable ash pond surfaces or surface water that represents a drowning hazard
			If an unstable condition exists, complete a Next Level Up Pre-Job Brief prior to accessing the ash pond.	
			Approach the ash pond from the most stable direction	
			Inspect travel paths for recent terrain shifts, particularly following heavy rains or rapid dewatering	
			Working alone on ash ponds is prohibited without pre-approval from the POC.	
			When a drowning hazard exists, implement requirements for working on/near water as outlined in Section 4.4.	
			Implement an emergency response plan with trained responders for falls into (or engulfment by) ash	

4.2 Ash Inhalation/Airborne Exposure

Ash that becomes airborne due to site activities or environmental conditions may result in an exposure to its components as outlined in Section 5.1. DMG and third-party contractors are responsible for ensuring their respective employees' and contract workers' exposures are below occupational exposure limits. Upon request, third-party contractors must demonstrate to DMG that exposure control methods are adequate. The following table summarizes airborne exposure controls and is aligned to the hierarchy of controls:

Elimination	Substitution	Engineering	Administrative	PPE
Change the work task or work methods so that work on ash ponds is no longer required	Substitute manual work methods for those that can be completed from the cab of a vehicle	Continually wet work areas to reduce the amount of ash that becomes airborne Equip vehicles and heavy equipment cabs with filters. Clean and change filters as required	Conduct air monitoring or exposure sampling to confirm that airborne exposure is below regulatory limits	If exposure levels are above the PEL, equip employees with respirators appropriate to the level of exposure

4.3 Stuck Vehicles/Equipment

If a vehicle or piece of equipment becomes stuck, a third-party towing or wrecking company who is trained in vehicle extraction must be retained and DMG will be notified. Third-party contractors may extract their own vehicle if they have an approved extraction plan, and a competent person is on site to implement the extraction. The extraction plan shall be included as part of the third-party contractor’s reviewed and approved Safety and Health Plan. The above notifications are still required.

The hazards presented by stuck vehicles/equipment must not be underestimated. While the weight of the stuck equipment can be calculated, it’s impossible to precisely calculate the other forces that are pulling against the towing vehicle which requires special training and experience to properly size towing equipment and select towing techniques. This is especially true for “complex” or high-hazard extractions involving equipment stuck at axle depth (or beyond) or sloped surfaces or any area where extraction activities could trigger shifts in the ground surface. No chains shall be used to remove stuck vehicles/equipment.

The following table summarizes safety controls related to stuck vehicles and equipment and are aligned to the hierarchy of controls:

Elimination	Substitution	Engineering	Administrative	PPE
Change the work task or work methods so that work on ash ponds is no longer required	Use the lightest available tracked equipment to reduce ground pressure Substitute tracked equipment for wheeled equipment	Use crane mats or other cribbing to support heavy equipment on ash ponds Lighten the load – Remove materials from stuck vehicles or equipment prior to extraction if possible	Only persons trained in vehicle extraction are permitted to remove stuck vehicles/equipment A professional towing/wrecking service is required Prepare for spills (damage to fuel or hydraulic systems)	All persons involved in removing stuck equipment must wear PPE that includes hard hat, safety boots, safety glasses, high visibility vests, and cut resistant gloves

4.4 Working Near/Over Water

All employees, contract workers, and third-party contractors must wear a United States Coast Guard (USCG) approved personal floatation device (PFD), when within 6 feet of water, over water, and/or wading in water where the danger of drowning exists. The PFD must be properly secured to the wearer, free of all defects including rips, tears, stress, and fading, and be kept clean and free of excessive dirt and oil.

If the possibility of falling into water has been eliminated through the use of guardrails, fall restraint, or other method, the use of a PFD is no longer required.

When performing work on water from a vessel, at least one lifesaving rescue vessel (*e.g.,* a skiff) shall be immediately available at locations where employees are working over, in, on, or adjacent to water where the danger of drowning exists. However, if the water is so shallow that rescuers could simply walk/run into the water body without endangering themselves and/or others or the work was being conducted very close to shore (*e.g.,* the length of the skiff from shore would be greater than the working distance from shore and/or the skiff would foul on the bottom), a skiff would not be required.

The following table summarizes the requirements for working over/near water where a drowning hazard exists and are aligned to the hierarchy of controls:

Elimination	**Substitution**	**Engineering**	**Administrative**	**PPE**
Change the work task or work methods so that work near a drowning hazard is no longer required		Install guardrails that separate work areas from the drowning hazard	All work to be performed by at least two people where each is equipped with proper safety gear and capable of summoning emergency rescue	All personnel are required to wear suitable PFDs
		Utilize equipment (crowd-control barricades, safety fence, etc.) that will keep personnel at least 6 feet from a drowning hazard	When working on water use of a rescue skiff as outlined above	
			Use of a ring buoy with 90 feet of braided polycarbonate (or equivalent) line	
			Ring buoys must be positioned within 100 feet of work (maximum of 200 feet spacing)	

4.5 Heavy Equipment

All heavy equipment operators must be competent and authorized to operate each piece of heavy equipment. Forklift and telehandler (*e.g.,* Lull, JLG) operators must have a license or certificate that indicates they have passed a written test and "road" test for the equipment they will be operating within the last 3 years. Third-party contractors will provide proof of qualification upon request of DMG.

Persons working around heavy equipment must implement the “25 Foot Rule.” The 25 Foot Rule requires that persons get the operator’s attention and permission prior to approaching closer than 25 feet to heavy equipment. Persons must walk quickly through blind spots. Loitering in heavy equipment blind spots (especially to the rear) must be avoided.

Temporary fuel storage tanks will be labelled as to their content and be protected from collision by Site vehicles using solid barricades including balusters, chain link fence, or equivalent. Spill kit (55-gallon sorbent capacity contained in an overpack) and one 20-pound Type ABC fire extinguisher will be located within 45 feet of fueling areas. Tanks will be rated for above ground use and will be double walled or have secondary containment in case of a leak. Tanks and dispensing hose will be bonded and grounded. On-site filling of fuel storage tanks will be completed with trucks that have automatic over-flow shutoffs. These trucks will be properly bonded to the storage tank and meet all of the other storage tank requirements. Temporary secondary containment must be provided in the refueling area that includes the storage tank and dispensing hoses.

Elimination	Substitution	Engineering	Administrative	PPE
		Heavy equipment (and vehicles) must be equipped with backup alarms, horns, roll-over protection (when feasible)	Operators must be competent and authorized	Operators must use seatbelts when equipped
		Vehicles and heavy equipment operated at night must have headlights, tail lamps, and reflectors	Forklift operators must have a current license or certificate (within 3 years)	High visibility vests are required when working around heavy equipment
			All vehicles and equipment must be turned off when not in use	
			Operators must inspect equipment daily prior to use	
			Persons working near heavy equipment must follow the “25 Foot Rule” and avoid lingering in blind spots as outlined above	
			Always obey site speed limits – 15 mph unless otherwise posted	

4.6 Overhead Powerlines

All overhead powerlines must be assumed to be energized until confirmed otherwise. The minimum clearance distance for equipment working near energized power lines must be in accordance with the table found in 29 C.F.R. § 1926.1408(h).

The following table summarizes safety controls for work near energized power lines:

Elimination	Substitution	Engineering	Administrative	PPE
Plan to work away from powerlines	Use heavy equipment with shorter booms/attachments to avoid coming close to power lines	Contact the utility owner to deenergize the line	Install signs to warn personnel of overhead powerlines	

Elimination	Substitution	Engineering	Administrative	PPE
		Contact the utility owner to install insulated sleeves over energized lines	Install a non-conductive distance marker to delineate minimum clearance	
			Use a dedicated spotter to ensure equipment does not enter minimum clearance distances	

4.7 Severe Weather

Severe weather conditions include but are not limited to high winds, electrical storms, heavy rain, and tornados can cause hazardous conditions at CCR surface impoundments. The primary control for severe weather is monitoring weather reports prior to beginning work and as work occurs throughout the day. In remote work areas with inconsistent cellular service, a weather radio should be used.

Monitor lightning using a commercially available mobile application if cellular service is available. When lightning is observed within 10 miles of the CCR surface impoundment, or a storm is imminent, take shelter in the nearest solid structure or fully enclosed vehicle. If possible, secure all tools, materials, and equipment prior to the storm arriving. Work may resume 30 minutes after the last lightning strike is observed within 10 miles. The severe weather shelter location is located at the Security Office.

Do not conduct work on a CCR surface impoundment when there is a risk for tornados in the area. If on a CCR surface impoundment and a tornado forms, seek the nearest substantial shelter. The closest tornado shelter is located at the Security Office (identified as the Muster Point in Appendix A). If no shelter is available, attempt to evacuate to a shelter using a vehicle. If a tornado forms and you are not in a shelter, take one of the following actions:

- Stay in a vehicle with the seat belt on, keep your head below the windows and cover it with your hands
- If there is an area which is noticeably lower than the work area, lie in that area and cover your head with your hands.

Heavy rainfall may result in rapidly rising water and flash flooding near the bank of the Vermilion River. No work should be conducted along the bank of the river after periods of heavy rainfall, especially when a flash flood warning is in effect. Work along the riverbank may require implementing the controls outlined in Section 4.4.

The following table summarizes safety controls related to severe weather:

Elimination	Substitution	Engineering	Administrative	PPE
Plan outdoor tasks on days with low potential for severe weather.			Prior to beginning outdoor work monitor the day’s weather.	

Elimination	Substitution	Engineering	Administrative	PPE
			Periodically monitor weather throughout the day. Use a weather app which issues alerts for severe weather and lightning, assuming cell service is available	
			Utilize a weather radio if cellular service is inconsistent	
			Stop all outdoor work and seek shelter when lightning is observed	
			Do not conduct work along the Vermilion River bank after periods of heavy rainfall	

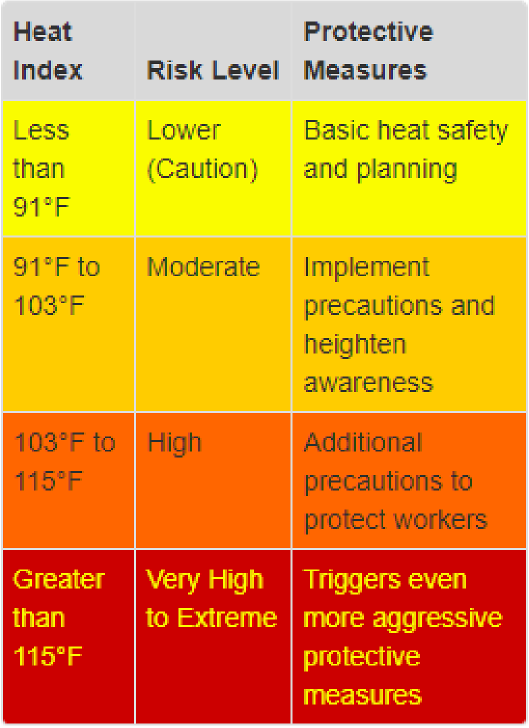
4.8 Heat Stress

Heat stress can be a significant hazard, especially for workers wearing protective clothing. Depending on the ambient conditions and the work being performed, heat stress can occur very rapidly, within as little as 15 minutes. Employees, contract workers, and third-party contractors will be instructed in the identification of a heat stress victim, the first-aid treatment procedures for the victim, and in the prevention of heat stress incidents.

Workers will be encouraged to immediately report any heat-related problems that they experience or observe in fellow workers. Any worker exhibiting signs of heat stress and exhaustion should be made to rest in a cool location and drink plenty of water. Emergency help by a medical professional is required immediately for anyone exhibiting symptoms of heat stroke, such as red, dry skin, confusion, delirium, or unconsciousness. Heat stroke is a life-threatening condition that must be treated immediately by competent medical authority.

4.8.1 Heat Stress Prevention

To prevent heat stress, DMG employees, contract workers, and third-party contractors will implement heat stress prevention measures as outlined in OSHA's Heat Index (below). A summary of these precautions is described below.



Heat Index	Risk Level	Protective Measures
Less than 91°F	Lower (Caution)	Basic heat safety and planning
91°F to 103°F	Moderate	Implement precautions and heighten awareness
103°F to 115°F	High	Additional precautions to protect workers
Greater than 115°F	Very High to Extreme	Triggers even more aggressive protective measures

Know the Symptoms: Some symptoms associated with heat stress are: Employees should be aware of these symptoms with themselves and with their co-workers:

- Elevated heart rate, lack of concentration, difficulty focusing on a task, fatigue
- Irritability and/or sickness
- Cramps, rash, headache
- Loss of desire to drink water
- Fainting
- Skin clammy, moist, and pale (severe heat exhaustion)
- Skin extremely dry and red (heat stroke)

Acclimatize: When high heat stress conditions arise, employees should be exposed to the heat for short work periods followed by longer periods of work. Acclimatization usually takes five (5) days and should be provided for all new employees and employees returning from an absence of two (2) weeks or more. Contact Corporate Health and Safety for proper procedures.

Hydration & Pace of Work: Make sure all employees intake plenty of water throughout the work day (sometimes as much as a quart per worker per hour) and let employees know where the drinking water is located. Adjust your work pace and expectations on how much work can be done during periods of high heat stress. Workers cannot do as much during periods of high heat stress compared with similar periods of low heat stress. After acclimatization, workers may be able to resume a more "normal" work pace as long as fluid intake is adequate.

Work/Rest Periods: If possible, heavy work should be scheduled during the cooler parts of the day (*i.e.,* early morning) and rest periods should be taken in cool areas for longer periods.

Personal Protective Equipment (PPE): Employees using PPE (*i.e.*, Tyvek® suits or other equipment which may retain heat) can be more susceptible to heat stress due to the fact that heat/sweat often cannot escape the suits and/or the equipment. Persons wearing PPE that contributes to heat stress require more hydration, longer rest periods, or a reduced pace of work. Also, more careful monitoring of each person's health status is required by co-workers and management.

The following table summarizes safety controls for heat related illnesses:

Elimination	Substitution	Engineering	Administrative	PPE
Perform outdoor, strenuous, tasks at cooler times of day/year	Use mechanized equipment in place of manual labor	Install fans or air conditioning units in the work area	Train all personnel to know the signs of heat stress/stroke and how to prevent it	Implement the use of cooling vests or other similar PPE
		Install a canopy to provide shade to work areas	Allow workers to acclimatize to the work environment	
		Provide cool, shaded break areas	Adjust work pace to allow for the effects of heat	
			Implement work/rest periods	

4.9 Cold Stress

The four environmental conditions that cause cold-related stress are low temperatures, high/cool winds (wind chill), dampness, and cold water. One, or any combination of these factors, can cause cold-related hazards. Cold stress, including frostbite and hypothermia, can result in severe health effects. Employees, contract employees, and third-party contractors will be instructed in the identification of a cold stress victim, the first-aid treatment procedures for the victim and in the prevention of heat stress incidents.

A dangerous situation of rapid heat loss may arise for any individual exposed to high winds and cold temperatures. Major risk factors for cold-related stresses include:

- Wearing inadequate or wet clothing thus increasing the effects of cold on the body.
- Taking certain drugs or medications such as alcohol, nicotine, caffeine, and medication thus inhibiting the body's response to the cold and/or impairing judgment.
- Having a cold or certain disease, such as diabetes, heart, vascular and thyroid problems, and thereby increasing susceptibility to the winter elements.
- Lower body-fat composition or other physiological differences. Statistics show that men experience far greater death rates due to cold exposure than women, potentially attributable to participation in risk-taking activities, lower body-fat composition and/or other physiological differences.
- Becoming exhausted or immobilized, especially due to injury or entrapment, thus speeding up the effects of cold weather.

The following table provides the resulting equivalent chill temperature to exposed skin because of increasing wind speeds at decreasing actual temperatures. Personnel shall be aware of predicted weather conditions before beginning site work and stay apprised of changes.

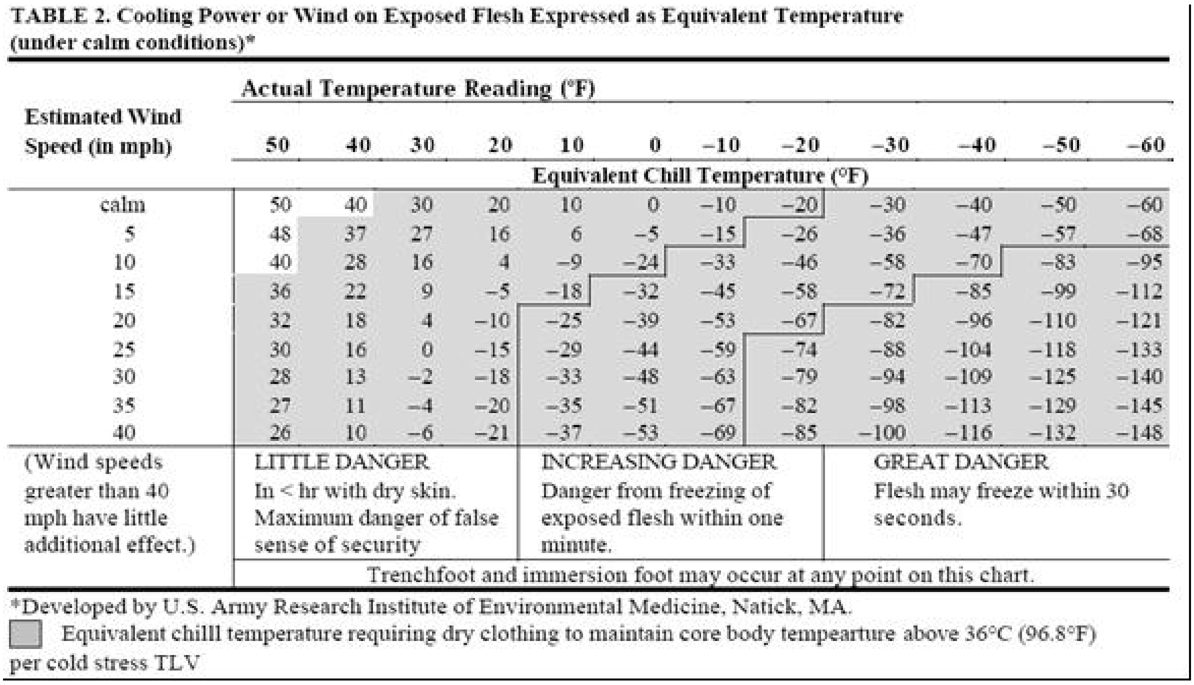


TABLE 2. Cooling Power or Wind on Exposed Flesh Expressed as Equivalent Temperature (under calm conditions)*

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	−10	−20	−30	−40	−50	−60
	Equivalent Chill Temperature (°F)											
calm	50	40	30	20	10	0	−10	−20	−30	−40	−50	−60
5	48	37	27	16	6	−5	−15	−26	−36	−47	−57	−68
10	40	28	16	4	−9	−24	−33	−46	−58	−70	−83	−95
15	36	22	9	−5	−18	−32	−45	−58	−72	−85	−99	−112
20	32	18	4	−10	−25	−39	−53	−67	−82	−96	−110	−121
25	30	16	0	−15	−29	−44	−59	−74	−88	−104	−118	−133
30	28	13	−2	−18	−33	−48	−63	−79	−94	−109	−125	−140
35	27	11	−4	−20	−35	−51	−67	−82	−98	−113	−129	−145
40	26	10	−6	−21	−37	−53	−69	−85	−100	−116	−132	−148
(Wind speeds greater than 40 mph have little additional effect.)	LITTLE DANGER In < hr with dry skin. Maximum danger of false sense of security				INCREASING DANGER Danger from freezing of exposed flesh within one minute.				GREAT DANGER Flesh may freeze within 30 seconds.			
	Trenchfoot and immersion foot may occur at any point on this chart.											

*Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.

▨ Equivalent chilll temperature requiring dry clothing to maintain core body tempearture above 36°C (96.8°F) per cold stress TLV

The following table summarizes safety controls for preventing cold stress:

Elimination	Substitution	Engineering	Administrative	PPE
Perform work during warm parts of the day or warmer parts of the year		Install heaters in enclosed work areas	Train all personnel on the symptoms of cold stress and how to prevent it	All personnel must wear multiple layers of clothing
		Provide a warm break area	Implement work/rest schedule	Utilize hand/foot warmers when required

An additional hazard in cold weather conditions is the increased risk for slips from the accumulation of ice and snow in general work areas, ruts where water is accumulated, and heavy equipment. The following table outlines controls that may be used for preventing slips:

Elimination	Substitution	Engineering	Administrative	PPE
Perform work during warm parts of the day or in areas free of accumulated areas		Clear snow in work areas		Use traction control devices (*i.e.,* YakTrax) on work boots to provide additional traction.
		Apply salt/sand to icy areas		
		Use equipment to access work areas		

4.10 Biological Hazards

The following are biological hazards that may be present at the NAP/OEAP and NEAP CCR Units.

4.10.1 Ticks (Lyme Disease) & Mites

Although Lyme disease has been detected throughout the continental United States, it is prevalent primarily in certain areas in New England, the Mid-Atlantic and the northern Midwest states. Although Lyme disease is the most common tickborne illness, other tickborne illnesses include southern tick-associated rash illness, Rocky Mountain spotted fever, ehrlichiosis, and tularemia. More information on Lyme disease and other tickborne illnesses can be found from the CDC.

Prevention

- Standard field gear (work boots, socks, and light-colored coveralls) provides good protection against tick bites, particularly if the joints are taped. However, even when wearing field gear, the following precautions shall be taken when working in areas that might be infested with ticks:
  - Wear long pants and long-sleeved shirts that fit tightly at the ankles and wrists, tape cuffs if necessary
  - Wear light colored clothing so ticks can be easily spotted
  - Per- and polyfluoroalkyl substances (PFAS)-free tick repellents (DEET <u>and</u> Permethrin) must be used when walking in all overgrown areas. DEET (≥25 percent [%]) must be applied to skin while permethrin must be applied to clothes and allowed to dry. Spray outer clothing, particularly your pant legs and socks, BUT NOT YOUR SKIN, with an insect repellent that contains permethrin. For heavily infested tick areas, wear spun polypropylene coveralls that have been sprayed with permethrin.
  - Inspect clothing frequently
  - Inspect head and body thoroughly when you return from the field, particularly on your lower legs and areas covered with hair
  - When walking in wooded areas, wear a hard hat, and avoid contact with bushes, tall grass, or brush as much as possible

Removal

- Remove any ticks by tugging with tweezers or special tick removal tools
- Do not squeeze or crush the tick
- DO NOT use matches, a lit cigarette, nail polish, or any other type of chemical to "coax" the tick out

Treatment

- Disinfect the area with alcohol or a similar antiseptic after removal
- Notify the Safety Competent Person of the embedded tick
- For several days to several weeks after removal of the tick, look for the signs of the onset of tickborne illness, such as a rash
- No further treatment is necessary for ticks embedded <48 hours.
- If other signs or symptoms of tickborne illness are observed (fever/chills, aches, and pains), then notify the Safety Competent Person and seek medical attention

The following table summarizes safety controls to reduce the hazards associated with ticks and mites.

Elimination	Substitution	Engineering	Administrative	PPE
Use mechanical equipment to remove overgrown vegetation		Remove overgrowth and excessive vegetation from walkways and work areas (provide safe access)	Train personnel on tick and mite prevention. Areas of vegetation overgrowth and/or debris piles should be considered "high risk" areas	Wear light-colored long sleeved shirt tucked into pants. Tuck pant legs into socks
			Perform frequent tick checks in the field and a thorough tick check after completing work activities	Apply Permethrin to clothes and DEET (20% or more) to exposed skin
			Call licensed pesticide contractors to remove infestations of bees, wasps, fire ants, etc.	

4.10.2 Insect Bites/Stings

Stinging/biting insects at the NAP/OEAP and NEAP CCR Units include spiders, wasps, and bees. Contact with these insects may result in project personnel experiencing adverse health effects that range from being mildly uncomfortable to being life-threatening. Therefore, insects present a serious hazard to project personnel, and extreme caution must be exercised whenever Site and weather conditions increase the risk of encountering stinging insects. Some of the factors related to stinging insects that increase the degree of risk associated with accidental contact are as follows:

- The nests for these insects are frequently found in remote wooded or grassy areas or equipment staging areas where equipment has not been moved recently.
- Some people are hypersensitive to the toxins injected by a sting, and when stung, experience a violent and immediate allergic reaction resulting in a life-threatening condition known as anaphylactic shock. Anaphylactic shock manifests itself very rapidly and is characterized by extreme swelling of the body, eyes, face, mouth, and respiratory passages.
- The hypersensitivity needed to cause anaphylactic shock, can in some people accumulate over time and exposure, therefore even if someone has been stung previously and not experienced an allergic reaction, there is no guarantee that they will not have an allergic reaction if they are stung again
- Spider bites generally only cause localized reactions such as swelling, pain, and redness. However, bites from a Black Widow or Brown Recluse, or if you are allergic to spiders, can cause symptoms that are more serious.
- ***If a worker knows that they are hypersensitive to bee, wasp, or hornet stings, or other insects, they must inform the Safety Competent Person prior to site work. Persons who have been prescribed epi-pens by their physician must have an epi-pen on the Site.***
- Inspect any clothing or PPE that has been left for a period of time prior to putting it on. Shake out the clothing and inspect the inside of safety shoes/boots prior to putting them on
- Nests in active work areas must be eradicated. Small nests may be handled by Site personnel using consumer-type insecticide. A pest control contractor should be hired to handle large or difficult to reach nests.

The following table outlines safety controls to reduce the risk of hazards associated with stinging/biting insects.

Elimination	Substitution	Engineering	Administrative	PPE
Use mechanical equipment to remove overgrown vegetation		Remove overgrowth and excessive vegetation from walkways and work areas (provide safe access)	Train personnel on stinging/biting insect prevention. Areas of vegetation overgrowth and/or debris piles should be considered "high risk" areas	Wear light-colored long sleeved shirt tucked into pants. Tuck pant legs into socks
		Eradicate nests in the work area as outlined above.	Instruct personnel to inspect/shake out clothing and work boots that have been left for a period of time.	Apply Permethrin to clothes and DEET (20% or more) to exposed skin – NOTE this will not repel bees/wasps
			Instruct employees who are hypersensitive to insect bites/stings to carry their epi-pen while on site	

4.10.3 Venomous Snakes

There are four species of venomous snakes in Illinois, they are:

- Copperhead
- Cottonmouth Water Moccasin
- Timber rattlesnake
- Eastern Massasauga

Generally, these snakes are found in the southern one-third of the state, with the Cottonmouth Water Moccasin found mostly in the southernmost portions of Illinois. Snakes are generally found in tall grass, wood piles, or other covered areas. Snakes are generally not aggressive towards humans, but if they are encountered avoid the snake and do not provoke it. If bitten by a snake that may be venomous seek medical treatment.

The following table outlines safety controls to reduce the hazard associated with venomous snakes.

Elimination	Substitution	Engineering	Administrative	PPE
Use mechanical equipment to remove overgrown vegetation		Remove debris piles, overgrowth and excessive vegetation from walkways and work areas (provide safe access)	Train personnel on the identification of venomous snakes. Areas of vegetation overgrowth and/or debris piles should be considered "high risk" areas	If working in area with snakes cannot be avoided, wear snake chaps
			Instruct personnel to not disturb snakes if they identify one in their work area	

Elimination	Substitution	Engineering	Administrative	PPE
			Use caution when moving staged tools or materials into which snakes may have moved	

4.10.4 Poisonous Plants and Plant Hazards

Poison ivy and poison oak may be present at the Site. Poison ivy thrives in all types of light and usually grows in the form of a trailing vine; however, it can also grow as a bush and can attain heights of 10 feet or more. Poison ivy has pointed leaves that grow in clusters of three. Poison oak resembles poison ivy except that the poison oak leaves are more rounded rather than jagged like poison ivy, and the underside of poison oak leaves are covered with hair.

The skin reaction associated with contacting these plants is caused by the body's allergic reaction to toxins contained in oils produced by the plant. Becoming contaminated with the oils does not require contact with just the leaves. Contamination can be achieved through contact with other parts of the plant such as the branches, stems or berries, or contact with contaminated items such as tools and clothing. The allergic reaction associated with exposure to these plants will generally cause the following signs and symptoms:

Symptoms

- Blistering at the site of contact, usually occurring within 12 to 48 hours after contact and in many cases, persons experience almost immediate irritation.
- Reddening, swelling, itching, and burning at the site of contact.
- Pain, if the reaction is severe.
- Conjunctivitis, asthma, and other allergic reactions if the person is extremely sensitive to the poisonous plant toxin.

Prevention

- The best treatment appears to be removal of the irritating oil before it has had time to cause inflammation by wiping exposed skin with rubbing alcohol followed by washing with soap and water.
- A visual Site inspection and identification of the plants should be completed prior to starting work so that all individuals are aware of the potential exposure. Avoid contact with any poisonous plants on the Site, and keep a steady watch to identify, report, and mark poisonous plants found on the Site.
- Avoid contact with, and wash daily, contaminated tools, equipment, and clothing.
- Barrier creams (Ivy Block®) and orally administered desensitization may prove effective and should be tried to find the best preventive solution.
- Keeping the skin covered as much as possible (*i.e.*, long pants and long-sleeved shirts) in areas where these plants are known to exist will limit much of the potential exposure. PFAS-free spun polypropylene coveralls or Tyvek® may be worn to prevent contact of skin and clothes with poison ivy.

The following table outlines safety controls to mitigate the hazards associated with poisonous plants.

Elimination	Substitution	Engineering	Administrative	PPE
Use mechanical equipment to remove overgrown vegetation		Remove overgrowth and excessive vegetation from walkways and work areas (provide safe access)	Train personnel on the identification of poisonous plants	Wear pants and long sleeves when working in overgrown areas
			Instruct personnel to avoid areas where poisonous plants have been identified	Consider the use of a coverall when working in areas where these plants are present, especially for hypersensitive employees.
			Provide isopropyl alcohol along with soap and water to remove oils from skin, tools, and equipment.	

4.11 Working Alone

As outlined in Section 4.1, working alone while on an ash pond must be pre-approved by the POC. Working alone is prohibited for tasks deemed to be high risk by DMG including, but not limited to, handling highly hazardous chemicals (sulfuric acid), work over/near water, excavation and trenching, hot work (grinding, welding and torch cutting), and elevated work that requires personal fall arrest. Third-party contractors are responsible for identifying potential high-risk tasks in their Safety and Health Plan and requiring that a buddy system be implemented while high risk work is performed. The buddy must be located in a safe area but may perform other tasks that do not prevent observing the person performing high risk work. Working alone may occur on and around other parts of the NAP/OEAP and NEAP CCR Units when there is no drowning hazard or risk of severe injury due to high-risk work.

Elimination	Substitution	Engineering	Administrative	PPE
	Modify work methods by substituting lower hazard methods for high hazard methods	Varies depending on the hazard, but for example, could include installing guardrails (temporary or permanent) which mitigates a fall hazard reducing the risk to levels where working alone may be permitted	Prohibit working alone on ash ponds and for other high hazard tasks without prior approval from the POC.	
			Implement a buddy system whenever feasible (required for high hazard work)	

Elimination	Substitution	Engineering	Administrative	PPE
			Implement a worker check-in, emergency alerting, and monitoring system	

5. HAZARD COMMUNICATION

As required by 35 I.A.C. § 845.530, the OSHA HAZWOPER standards (29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65) and OSHA Hazard Communication Standard, site personnel, subcontractors, and visitors must be informed of chemical hazards associated with their work area. The information in this section is based on:

- Recommendations in the most recent "NIOSH Pocket Guide to Chemical Hazards" by the Department of Health and Human Services, Centers for Disease Control and Prevention, and the NIOSH Pocket Guide.
- Requirements set forth in the OSHA regulations from as defined in Chapter 17 of 29 C.F.R. § 1910.1200(c) for all hazards not otherwise classified.

5.1 Coal Combustion Residuals

Primary exposure to CCR is through inhalation and skin contact. CCR is typically a fine, black, grey, or tan particulate. CCR is comprised of several components. The following table outlines the components of the CCR. The exact percentage of each component will vary based on the type of ash and location at the surface impoundment.

Chemical	Percentage	PEL	IDLH	ACGIH TLV	Symptoms of Exposure & Health Effects
Crystalline Silica	20-60% (total)	0.05 mg/m^3 (respirable)	25 mg/m^3 (respirable)	0.025 mg/m^3 (respirable)	Cough, dyspnoea (breathing difficulty), wheezing; decreased pulmonary function, progressive respiratory symptoms (silicosis); irritation eyes; [potential occupational carcinogen]
Iron oxide	1-10%	5 mg/m^3	2500 mg/m^3	5 mg/m^3	Benign pneumoconiosis with X-ray shadows indistinguishable from fibrotic pneumoconiosis (siderosis)
Calcium oxide	10-30%	5 mg/m^3	25 mg/m^3	2 mg/m^3	irritation eyes, skin, upper respiratory tract; ulcer, perforation nasal septum; pneumonitis; dermatitis
Titanium dioxide	<3%	15 mg/m^3	ND	10 mg/m^3	Lung fibrosis; [potential occupational carcinogen]
Aluminosilicates	10-60%	15 mg/m^3 (PNOR)	ND	10 mg/m^3 (PNOR)	irritation eyes, skin, throat, upper respiratory system
Magnesium oxide	2-10%				
Magnesium dioxide	<2%				
Phosphorous pentoxide	≤2%				
Sodium oxide	1-10%				
Potassium oxide	≤1%				
Bromide salt	<0.1%				

Footnotes:

All values are 8-hour time-weighted averages (TWAs) unless otherwise indicated.

- PEL: Permissible Exposure Limit, the concentration an employee may be exposed to for an 8-hour work day for a 40-hour work week for which nearly all employees may be repeatedly exposed without adverse health effects.
- IDLH: IMMEDIATELY Dangerous to Life and Health, contaminant concentration which present the possibility for severe health consequences if exposed to the IDLH concentration without the appropriate personal protective equipment (PPE).
- ACGIH TLV: American Conference of Governmental Industrial Hygienists Threshold Limit Value
- mg/m^3 = milligrams per cubic meter of air
- PNOR: Particulates Not Otherwise Regulated
- ND: Not Determined

5.2 Safety Data Sheets

Pursuant to 35 I.A.C. § 845.530(b)(3), DMG will provide Safety Data Sheets (SDSs) to all employees, contract workers, and third-party contractors for the CCR located at the Site. Third-party contractors will incorporate SDSs in their Safety and Health Plan and provide SDSs to DMG prior to bringing a material on site. SDSs are provided in Appendix E.

5.3 Signage

The absence of any of the following signage does not mean that a potential hazard does not exist. Signage will be posted by DMG, but employees, contract workers, and third-party contractors must remain vigilant for changing site conditions.

To aid in hazard communication and pursuant to 35 I.A.C. § 845.530(f), DMG will post the following signs at the NAP/OEAP and NEAP CCR Units:

- Signs identifying the hazards of CCR, including dust inhalation when handling CCR.
- Signs identifying unstable CCR areas that make the operation of heavy equipment hazardous.
- Signs identifying the necessary safety measures and necessary precautions, including the proper use of PPE.

The following signs may also be posted at the CCR units to aid in hazard communication:

- Overhead electrical lines that may be struck by heavy equipment of vehicles will have signs warning drivers of their presence.

6. EMERGENCY RESPONSE PLAN

This emergency response section details actions to be taken in the event of site emergencies. This section is consistent with the NAP/OEAP and NEAP CCR Units Emergency Action Plan. All personnel on site must be familiar with emergency signals and the content of this section.

6.1 Emergency Phone Numbers & Notifications

Emergency Number	
Site Address	**Emergency Phone Number**
10188 East 2150 North Road Oakwood, IL	911
Site Security	713-542-7692

Medical Treatment	
Local Hospital	**Phone Number**
OSF Sacred Heart Medical Center 812 N Logan Ave Danville, IL	217-449-5000

Incident Notifications		
Title	**Name**	**Contact Number**
Point of Contact	Dianna Tickner	318-381-3124

6.2 Evacuation Signal

Upon notification to evacuate, all personnel will leave the work area and proceed to the muster point.

6.3 Muster Point

The muster point for the NAP/OEAP and NEAP CCR Units is located at the Security Office, which is also the severe weather shelter location. The muster point is shown on Appendix A.

6.4 Calls for Emergency Support

In the case of an emergency, site personnel will call Site Security at 713-542-7692. Site security will coordinate the arrival of on-site emergency personnel. The individual calling for emergency support will briefly explain the nature of the emergency and site conditions as follows:

- Indicate his/her name
- Location of emergency
- Description of emergency conditions that may require special rescue equipment, such as confined spaces, excavations, and elevated work platforms
- Potential chemical hazards and recommended PPE

6.5 Fire & Explosion Response Plan

Trained site personnel may respond to incipient stage fires using a 20-pound Type ABC dry chemical fire extinguisher or hose. An incipient stage fire is a fire which is in the initial or beginning stage and which can be controlled or extinguished by portable fire extinguishers, Class II standpipe or small hose systems without the need for protective clothing or breathing apparatus. Personnel shall only attempt to extinguish the fire if it is safe to do so.

A fire that CANNOT be readily extinguished with a fire extinguisher will require evacuation of the work area personnel to Muster Point areas per this Safety and Health Plan. If personal injuries result from any fire or explosion, the procedures outlined in the Personal Injury Response Plan will also be followed.

All fires or explosions must be reported to the contacts outlined in Section 6.1 of this Safety and Health Plan.

6.6 Injury Response Plan

Treatment for minor injuries will be provided on site using available first aid supplies and personnel trained in first aid. All third-party contractors must have at least one individual on site who is trained in first aid, CPR, and AED use. Third-party contractors must provide their own first aid kits and AED. For minor injuries that are not life-threatening but require further medical attention, employees should be treated by occupational physicians at occupational clinics whenever possible. Treatment of minor injuries by emergency room or personal physicians should be avoided. When injured workers are released back to work with restrictions, all subcontractors are expected to accommodate those restrictions.

Emergency medical incidents include puncture wounds to the head, chest, and abdomen, serious head and spinal cord injuries, and loss of consciousness must be treated at the hospital emergency room listed in Section 6.1 of this Safety and Health Plan.

All injuries must be reported to the contacts outlined in Section 6.1 of this Safety and Health Plan.

6.7 Spill Response Plan

In general, DMG employees, contract workers, and third-party contractors are trained and equipped to handle small spills associated with their work. Third-party contractors must include an approved spill response plan in their Safety and Health Plan. If a third-party contractor will store oil at capacities greater than 1,320 gallons the spill response plan must meet the requirements of the Spill Prevention, Control, and Countermeasure regulation. Site personnel will generally respond to spills as follows:

- Stop the leak immediately if it can be done without directly contacting the leaking material.
- Remove or stop all ignition sources (hot work, generators, etc.) that are within 25 feet of any part of the spill.
- On-site personnel should immediately secure the area to prevent unauthorized entry into the spill area.
- Although not likely given the anticipated types of spills, site personnel must immediately initiate evacuation if a spill may cause an explosion, death, or serious injury.
- Site personnel may only respond to incipient stage fires regardless if such fires are associated with a spill.
- PPE for spills to open areas generally requires Modified Level D PPE (poly-coat Tyvek®, nitrile gloves, and boot covers or boot decontamination). Over-boots or boot covers may also be used if persons cleaning the spill would have to walk on spilled materials. Latex gloves are not acceptable and will degrade with exposure to petroleum products.

6.8 CCR Spill or Release Response Plan

Response to minor or incidental spills of CCR will be managed as outlined in the General Spill Response Plan. An incidental release is a release of a hazardous substance which does not pose a significant safety or health hazard to employees in the immediate vicinity or to the employee cleaning it up, nor does it have the potential to become an emergency within a short time frame. Incidental releases are limited in quantity, exposure potential, or toxicity and present minor safety or health hazards to employees in the immediate work area or those assigned to clean them up. An incidental spill may be safely cleaned up by employees who are familiar with CCR. Response to major releases of CCR will be in accordance with the VPP Emergency Action Plan.

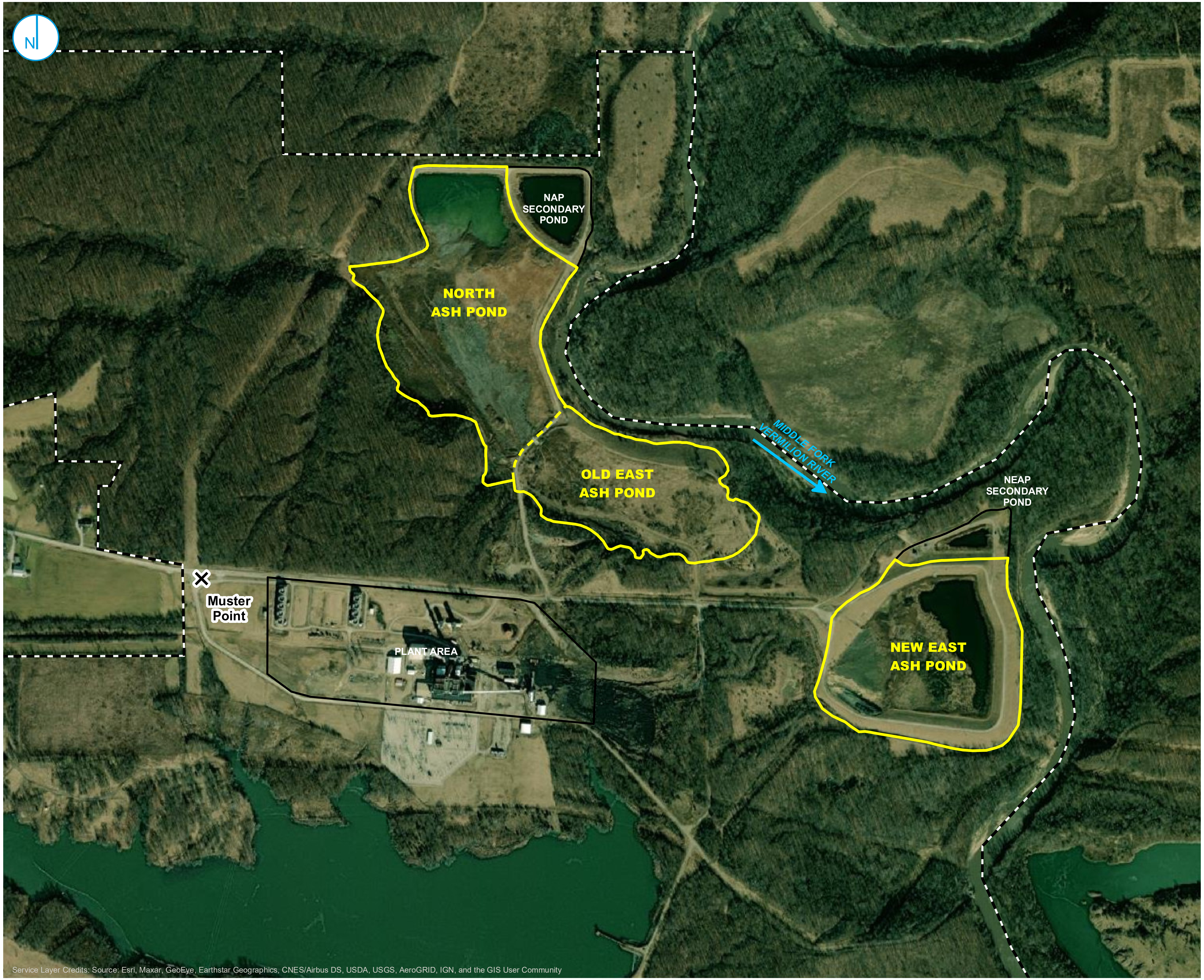
6.9 Ash Pond Rescue

Ash ponds may be unstable and represent an engulfment hazard if persons and equipment traverse the surface, berms, or other unstable areas. Special training is required on behalf of emergency responders to retrieve persons and equipment who become trapped in unstable ash. **Untrained persons must not enter unstable areas** in an attempt to conduct rescue because of the significant potential that they will also become victims. Call the VPP emergency number and state that an "ash pond rescue" is required. The VPP emergency contact will notify the designated service to perform the ash pond rescue. On-site personnel should remain on stand-by to support the ash pond rescue team as necessary.

6.10 Incident Reporting

All incidents must be reported to the contacts outlined in Section 6.1 of this Safety and Health Plan. An Incident Report must be completed for all injuries, illnesses, spills, fire, explosion, or property damage. The absence of an injury does not preclude the need to complete an Incident Report as such incidents will be classified as "near miss" or "other." It will include, but is not limited to, the nature of the problem, time, location, and corrective actions taken to prevent recurrence.

APPENDIX A
SITE MAP



Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

🟨 PART 845 REGULATED UNIT (SUBJECT UNIT)
☐ SITE FEATURE
⬚ PROPERTY BOUNDARY

0 300 600 Feet

SITE MAP

PART 845 SAFETY AND HEALTH PLAN
VERMILION POWER PLANT
OAKWOOD, ILLINOIS

APPENDIX A

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Vermilion\Appendix A_VER Site Map_SnHP.mxd

PROJECT: 169000XXXX | DATED: 9/22/2021 | DESIGNER: STOLZSD

APPENDIX B
SAFETY AND HEALTH PLAN ACKNOWLEDGMENT FORM

SAFETY AND HEALTH PLAN ACKNOWLEDGEMENT FORM

I HEREBY CERTIFY THAT I HAVE READ AND UNDERSTOOD ALL HEALTH AND SAFETY PROCEDURES AS STATED HEREIN:

Name and Affiliation (printed)	**Signature**	**Date**

APPENDIX C
DRUG SCREEN POLICIES AND SUPPLEMENTAL TERMS

Drug and Background Investigations

Contractor is solely responsible for ensuring that all members of Contractor Project Team have completed and passed all drug and alcohol tests and background investigations required under this Attachment and under Contractor's own programs before assigning such personnel to perform Work. Contractor is also solely responsible for ensuring that such testing and investigations are performed in accordance with all applicable laws.

1. Required Investigations. Except as otherwise required by applicable law, Required Investigations shall consist of all of the following:

   1.1 a 7-panel drug screening;

   1.2 a background investigation that includes a criminal records check in all counties where the applicable person has resided for at least the last seven (7) years;

   1.3 a third-party verification of previous employment and the highest education level completed by the applicable person;

   1.4 a check of the National Sex Offender Registry and Terrorist Watch List (Denied Parties); and

   1.5 a check of Motor Vehicles Record (if work to be performed by the applicable person requires driving as part of the defined duties).

2. Notices to Tested Persons Regarding Background Checks. All background checks will be conducted in compliance with applicable provisions of the Fair Credit Reporting Act.
3. Forms and Testing Organization for Drug Tests. Except for those positions subject to Department of Transportation ("DOT") drug and alcohol testing regulations, all drug testing shall be performed using the Universal Toxicology four part "Non-DOT" Chain of Custody and Request Form with white and blue top page, and shall be conducted by an independent third-party organization.

4. Pass/Fail Standards – Background Checks. A person shall be deemed to have failed the applicable background check if:

   4.1 information is reported through the background check process indicating that such person has failed to disclose or misrepresented information requested at any time about such a person's criminal background history; or

   4.2 such person has ever committed any felony constituting a violent crime, crime against a person, sexual offense or fraud; or

   4.3 such person has committed any other felony, or has been incarcerated for a felony, within ten (10) years prior to the date of such background check (i.e., for these felonies there must be a ten (10) year lapse in time from the later of the commission and the end of any period of incarceration); or

   4.4 such person has committed any misdemeanor that:

      4.4.1 involves violence that is sexually related; or

4.4.2 consists of a DUI that is the second (or more) DUI in the last two (2) years prior to the date of the background check; or

4.4.3 consists of a theft-related offense; provided that there can be no more than one theft by check and it must have been for an amount less that $100; or

4.4.4 consists of any drug-related misdemeanor committed at any time within forty-eight (48) months prior to the date of the background check.

4.4 For purposes of both felonies and misdemeanors, a person is deemed to have committed the applicable offense if he/she is convicted or enters a plea of guilty or nolo contendere for such offense (to include, without limitation, sentences of probation and deferred adjudication).

5. **Pass/Fail Standards – Drug Tests.** A person shall be deemed to have failed the applicable drug test if any of the following maximum cut-off levels are exceeded, unless there is a legitimate medical explanation for the presence of a tested substance at or above the applicable cut-off level:

5.1	Amphetamines	500ng/mL
5.2	Barbiturates	150ng/mL
5.3	Benzodiazepines	150ng/mL
5.4	Cocaine	150ng/mL
5.5	Marijuana	150ng/mL
5.6	Opiates	2000ng/mL
5.7	Phencyclidine	25ng/mL

For any positions subject to DOT drug and alcohol testing requirements, testing shall be conducted according to the applicable DOT panel and cutoff levels.

6. **Other Requirements.**

6.1 Background checks and drug tests will be paid for by Contractor without reimbursement by Company.

6.2 Contractor will keep background checks and drug test records while the applicable persons are working pursuant to this Agreement and for three (3) years thereafter.

6.3 Upon request, Contractor will provide a certification to Company that no person required hereunder to pass a background check or drug test has failed such investigation or test. Contractor will not provide the specific results of the background check or drug test of any individual to Company.

6.4 If any person required under this Agreement to pass a background check or drug test fails such check or test, Contractor will not report the specific results of such check or test to Company and will not allow such individual to perform any Work for Company. Although such person may not be assigned to perform any Work for Company, nothing in this Attachment requires Contractor to take any other action with respect to such person's employment with Contractor.

Supplemental Terms for Onsite Services

1. SAFETY

1.1 Contractor agrees that any safety-related assistance or initiatives undertaken by Company will not relieve Contractor while on Company Property from responsibility for the implementation of, and compliance with, safe working practices, as developed from their own experience, or as imposed by law or regulation, and will not in any way, affect the responsibilities resting with Contractor under the provisions of any agreement to which these policies are attached and to meet all safety requirements as specified by the Occupational Safety & Health Administration (OSHA), the Mine Safety Health Administration (MSHA), including the "Mining Contractor Safety Reference Handbook" located at http://www.vistraenergy.com/wp-content/uploads/2016/12/Contractors-Safety-Handbook_Final-MC-08262016.pdf, the Department of Transportation (DOT) and any other applicable state or federal safety and health laws or regulations.

1.2 In the event that a material safety data sheet, warning label, or other documentation concerning the use of hazardous chemicals at any property owned or controlled by Company or any of its affiliates (collectively, "**Company Properties**"), applies to any materials or equipment provided by Contractor as an aspect of the Work, such documentation will be provided by Contractor to Company prior to the commencement of any such Work.

1.3 Contractor will report to Company all accidents involving personal injuries (including death) and damage to property occurring directly or indirectly as a result of the Work performed by Contractor hereunder immediately, but in no event, no later than 24 hours after the occurrence of any such accident. Any accident or incident occurring directly or indirectly as a result of the Work which Contractor must report to a regulatory agency (e.g. OSHA, MSHA, TCEQ) must also be reported to Company immediately following notification to the regulatory agency.

2. SECURITY

2.1 It will be the affirmative duty of Contractor to ensure that Contractor Group assists in carrying out all security measures, to include reporting all information or knowledge of matters adversely affecting security to Company's designated security personnel.

2.2 Company reserves the right to exclude any of Contractor's employees from any Company Property by denial of access, suspension or revocation of access authorization, preemptory expulsion, or by any other means, without notice or cause. Former Company employees, and any of Contractor's employees who previously have been excluded from any Company Property, may be brought onto Company property or facilities only if prior approval from Company is obtained. If Contractor terminates a member of Contractor Group performing Work on Company's premises, Contractor shall inform Company immediately, but in no event, no later than twenty-four (24) hours after such employee is terminated in order for Company to remove access to Company Property for such employee.

2.3 Company measures may also include investigations, whether by Company or law enforcement officials. Contractor agrees to cooperate in such investigations and understands that Company reserves the right to require anyone in Contractor Group to authorize appropriate agencies to release his or her criminal records to Contractor as a condition of either initial or continued permission for access to any Company Property. Investigations may include searches of Contractor Group. Such searches may include searches of facilities assigned to Contractor Group, search of all Company Property areas and property at such Company Property areas, searches of including, but not limited to, offices, lockers, desks, lunch boxes, packages and motor vehicles (regardless of ownership). Without limiting the foregoing, Contractor acknowledges and agrees that all members of Contractor Group, to the extent that Company reasonably determines that such members require security badge access prior to entering onto any Company Property, shall be required to comply with Company's standard security badge requirements, including without limitation a background check to be performed by Company.

3. ISNETWORLD

3.1 Contractor agrees to maintain at Contractor's expense a subscription with ISNetworld (www.ISNetworld.com), Company's safety compliance program or any replacement program therefor, as directed by Company, for the Term of the Agreement. Contractor shall also furnish ISNetworld with any information requested by ISNetworld relating to ISNetworld's evaluation of the Contractor's safety program and practices. As a minimum, requested documents will be related to safety, health, and insurance (i.e., regulatory required training, certifications, safety plans, safe and secure workplace practices, insurance certificates, etc.), OSHA and MSHA injury rates and Experience Modification Rate (EMR).

3.2 Contractor has and during the performance of this Agreement shall continue to report full, complete and accurate information to ISNetworld concerning Contractor's employees.

4. MATERIALS, EQUIPMENT AND LABOR. Contractor will be solely responsible for the proper storage, transportation and disposal of any product or waste, other than sandblasting waste, used or generated in connection with the Work in accordance with all applicable Environmental Laws. Contractor will dispose of all waste materials, other than sandblasting waste, at an off-site disposal facility approved for such waste materials pursuant to applicable Environmental Laws and will complete and sign all waste manifests as the generator of such waste. Company will be responsible for the storage, transportation and disposal of any sandblasting waste generated during the performance of the Work.

5. CONDITIONS AFFECTING WORK

5.1 Contractor will investigate and acquaint itself with the conditions affecting the Work, including but not limited to those related to the transportation, disposal, handling and storage of materials and waste; availability of labor, water, electric power and roads; the uncertainties of weather, river stages or similar physical conditions at the site; the conformation and condition of the ground; and the character of equipment and facilities needed preliminary to and during prosecution of the Work. Contractor has satisfied itself as to the character, quality and quantity of surface and subsurface materials or obstacles to be encountered. Contractor's failure to acquaint itself with any conditions affecting the Work or any available related information will not relieve it from responsibility for properly estimating the difficulty or cost of successfully performing the Work.

5.2 Contractor assumes full responsibility for investigating conditions and determining the existence and magnitude of any hazards to the physical well-being of property of Contractor, the employees, agents, and servants of Contractor, or any other person or entity who is or may become involved in the performance of Work, and any and all other persons in the vicinity of the Work. Contractor will advise all of the above-specified persons or entities of any hazards relating to Work, and will ensure that those persons or entities are advised of and fully understand the nature of the hazards and safety precautions that can be taken to eliminate or minimize dangers relating to the hazards.

5.3 Contractor will provide information to Company regarding hazardous chemicals and/or consumable products that contain constituents listed in 40 CFR 372.65 used at any Company Property. Contractor will report the amount of such material carried on and off the site, the amount actually used and the manner of use. Contractor will provide the maximum quantity of the material stored on site at any one time and if a waste material was collected, where it was disposed of (location name and address). Contractor will provide information on the amount of material used for the previous calendar year by the first of February.

5.4 Contractor will use its best efforts to ensure that the Work is performed so as to minimize any adverse impact upon natural resources and the environment and will use best industry practices in this regard at all times.

5.5 Contractor acknowledges and agrees that all members of Contractor Group performing Work at any Company Generation or Mining Property are required to view Company's "Contractor/Visitor Safety Orientation" video (in the case of Company Generation property), when applicable, and to read and adhere to Company's "Contractor/Visitor Safety Booklet" (in the case of Company Mining property) prior to performing any Work at any Company Generation or Mining Property.

5.6 Contractor will immediately notify Company as soon as Contractor has reason to believe that Contactor, or any employee or other person performing the Work, is not or may not be performing the Work in compliance with applicable Environmental Laws. Contractor will provide Company with written notice to Company of such actual or potential non-compliance within three (3) days following the discovery thereof. Contractor will take immediate steps to ensure compliance with all applicable Environmental Laws and will, if directed by Company, cease all Work until authorized by Company to resume the Work.

5.7 Contractor will report to Company all accidents involving personal injuries (including death) and damage to property occurring directly or indirectly as a result of the Work performed by Contractor hereunder immediately, but in no event, no later than 24 hours after the occurrence of any such accident. Any accident or incident occurring directly or indirectly as a result of the Work which Contractor must report to a regulatory agency (e.g. OSHA, MSHA, TCEQ) must also be reported to Company immediately following notification to the regulatory agency.

6. WORK SITE PERMITS AND LICENSES

6.1 Subject to the following two paragraphs, Contractor will obtain, prior to the commencement of the Work, and provide to Company upon request, all permits, licenses and governmental authorizations, at its sole expense, required for the performance of the Work. Contractor will be solely responsible for maintaining compliance with such permits, licenses and governmental authorizations.

6.2 In the event that a storm water discharge permit is required for the performance of the Work, (i) Contractor will be responsible for filing a Notice of Intent with respect to the Work, in addition to any Notice of Intent that Company may be required to file, and (ii) Contractor will coordinate with

Company in the preparation and execution of a Storm Water Pollution Prevention Plan for the Work Site.

6.3 In the event that the performance of the Work involves the handling or abatement of asbestos-containing materials, Contractor will coordinate with Company in the preparation and filing of all required notification forms.

7. ACCESS. Should Contractor desire access to the Work Site over any land not controlled by Company, it will, at its sole expense, obtain all proper permits or written permission necessary for that access.

8. COMPANY FACILITIES. Contractor will not use Company's sanitary facilities, changehouses, shops, parks, storage buildings, tools, equipment or other facilities unless so directed by Company. Contractor will not discharge, without Company's prior written authorization, any product or waste used or generated in connection with the Work through any (i) Company-permitted outfall, (ii) Company-owned or operated pollution control equipment, or (iii) storm or sanitary sewer located at or in the vicinity of the Work Site. Any request for authorization to discharge will include, at a minimum, either a copy of the Material Safety Data Sheet for the product or a written description of the waste, including a list of the constituents of the waste and the relative concentrations thereof.

9. ENVIRONMENTAL

9.1 In the event that Contractor discovers during the performance of the Work any substance at the Work Site that is not the subject of the Work or has not otherwise been identified by Company for Contractor, which substance Contractor has reason to believe is or may be a Hazardous Substance that (i) has been or may be released or spilled into the soil, surface water, or groundwater or in a building or structure, or (ii) consists of asbestos-containing materials, lead-based paint, batteries, thermostats, lighting equipment, or equipment containing polychlorinated biphenyls, Contractor will immediately stop Work and notify Company of the discovery. Contractor will not resume the Work until receiving authorization from Company to do so.

9.2 The term "Hazardous Substance" means any product, waste, emission or substance defined, listed or designated as a hazardous or toxic substance, hazardous waste, hazardous material or pollutant by or pursuant to any Environmental Law and includes, but is not limited to, any petroleum-based product, substance or waste, including any additives associated therewith, pesticides, fertilizers, solvents, polychlorinated biphenyls, mercury, lead, lead-based paint, asbestos-containing material or explosives.

9.3 Contractor will immediately notify Company in the event of a spill or release of any material which Contractor knows or has reason to believe is a Hazardous Substance, whether onto the ground, into any body of water, a storm or sanitary sewer, or the air, or anywhere on property owned or controlled by Company, including within any building or structure. Contractor will be solely responsible, as may be required by applicable Environmental Laws, for, in consultation with Company, (i) notifying the appropriate governmental agencies of such spill or release caused or permitted by the acts or omissions of Contractor and (ii) for the cleanup and remediation of such spill or release.

10. PROTECTION OF HIGHWAYS AND RAILROADS. Contractor will make suitable arrangements with governmental authorities and railroads for the construction of all structures, whether underneath or over roads, railroads or rights-of-way to protect the public from accident or delay. Contractor will repair, at its

own expense, to the satisfaction of the governmental authorities or other owners, all roads, railroads and bridges that may be damaged by, or given undue wear due to the Work.

11. CLEANING UP

11.1 Contractor will at all times keep the Work Site free of waste materials or rubbish caused by the Work. After completing the Work, Contractor will remove all its waste materials, rubbish, tools, supplies, equipment and surplus materials from and about the Work Site.

11.2 If Contractor fails to keep the Work Site clean or to clean up after completing the Work, Company may do so and charge all costs of cleaning up to Contractor. Those costs may be deducted from the final payment to Contractor.

12. COLLATERAL WORK. Company and other contractors may be working at the Work Site. Company reserves the right to coordinate the performance of Contractor's Work with the work of others. Contractor will cooperate with and will not delay, impede or otherwise impair the work of others. Company does not guarantee Contractor continuous uninterrupted access to the Work Site, but will provide such access as good construction practices will allow, considering the other activities in the area.

13. ALCOHOLIC BEVERAGES, DRUGS AND WEAPONS. Contractor will inform all members of Contractor Group who may be involved in the performance of any Work of the following Company rules relating to alcoholic beverages, drugs and weapons, with which all personnel are expected to comply:

13.1 Bringing, attempting to bring, possessing, using or being under the influence of intoxicants, drugs, or narcotics while on any Company Property, including but not limited to parking areas, is prohibited. Possessing alcoholic beverages in sealed containers is permitted, however, in designated parking areas.

13.2 Prescription or over-the-counter medications that could affect the performance of safety-sensitive work are allowed on Company Property only if they have been previously cleared by Contractor. Contractor must confirm that the medication and dosage do not impair an individual's ability to perform safety-sensitive work before clearing the individual to perform such work while under the influence of the medication.

13.3 Bringing, attempting to bring, possessing or using firearms, whether classified as legal or illegal, while on any Company Property, including but not limited to buildings, parking areas, recreation facilities, equipment and vehicles, is prohibited, unless otherwise required by applicable law. Use or possession of firearms for specific situations is permitted if approved by function or higher level management of Company.

13.4 Off-the-job involvement with intoxicants, illegal drugs, or illegal narcotics that adversely affects Company's business, to include impairing the individual's ability to perform his job or the public trust in the safe operation of Company, is prohibited.

13.5 Any conduct on any Company Property which is in violation of any state or federal law or regulation is considered a violation of these rules and a breach of any agreement to which these policies are attached.

13.6 In order to enforce these rules, all individuals with access to any Company Property as well as the vehicles, offices, lockers and any personal belongings of such individuals on any Company Property are subject to search by Company and its agents, to include security representatives appointed or employed by Company. Individuals may be required to take a blood, urinalysis or Breathalyzer test, or submit to other recognized investigatory tests or procedures as are deemed appropriate or necessary by Company in the investigation of a violation of these rules.

14. TITLE AND RIGHT. Nothing in the Agreement will vest Contractor with any right of property in materials used after they have been attached to or incorporated into the Work, nor materials for which Contractor has received full or partial payment. All those materials, upon being so attached, incorporated or paid for, will become the property of Company. Any gravel, sand, stone, minerals, timber or other materials excavated, uncovered, developed or obtained in the Work, or on any land belonging to Company may be used, in the performance of the Work, provided such materials meet the requirements of this Agreement. Any objects or natural materials or animals excavated or exposed that may have historical significance or constitute a threatened or endangered species must be brought to the attention of Company.

15. PROTECTION AGAINST LIENS AND ENCUMBRANCES

15.1 Contractor will not at any time permit any lien, attachment or other encumbrance ("**Encumbrance**") by any person or persons whosoever or by reason of any claim or demand against Contractor to be placed or remain on the property of Company, including, but not limited to, the Work Site upon which Work is being performed or equipment and materials that are being furnished. To prevent an Encumbrance from being placed on the property of Company, Contractor will furnish during the progress of any Work, as requested from time to time, verified statements showing Contractor's total outstanding indebtedness in connection with the Work.

15.2 If Contractor allows any indebtedness to accrue to subcontractors or others and fails to pay or discharge that indebtedness within five (5) days after demand, then Company may withhold any money due Contractor until that indebtedness is paid or pay the indebtedness and apply that amount against the money due Contractor.

15.3 If Contractor allows any Encumbrances, whether valid or invalid to be placed on the property of Company, any and all claims or demands for payment to Contractor will be denied by Company until the Encumbrance is removed. If the Encumbrance is not removed immediately, Company may pay that claim or demand and deduct the amount paid, together with all related expenses, including attorneys' fees, from any further payment due Contractor, or at Company's election, Contractor will, upon demand, reimburse Company for the amount paid and all related expenses. Any payment made in good faith by Company will be binding on Contractor.

16. TERMINATION FOR DEFAULT

16.1 If a petition in bankruptcy should be filed by Contractor, or if Contractor should make a general assignment for the benefit of creditors, or if a receiver should be appointed due to the insolvency of Contractor, or if Contractor should refuse or fail to supply enough properly skilled workmen or proper equipment, materials or services or should fail to make prompt payment to subcontractors, or to pay promptly for materials or labor, or disregard laws, ordinances or the instruction of Company's Contract Coordinator, or if Contractor should refuse or fail to abide by the SOW Construction Schedule or otherwise violate any provisions of the Agreement or SOW, then Company, upon a determination by Company's Contract Coordinator that sufficient cause exists to justify such action, may, without prejudice to any other right or remedy available to it after giving Contractor seven (7) days' written notice, terminate the Agreement or the SOW and take possession of the Work Site. In the event of such a termination, Company may use all or part of Contractor's equipment and materials and may finish the Work by whatever method Company may deem expedient. In such event, Contractor will not be entitled to receive any further payment hereunder until the Work is finished. If the unpaid balance of the SOW fees will exceed the expense of finishing the Work, including compensation of Company's Contract Coordinator, other Company personnel, third party engineering companies, or other contractors for additional services, such excess will be paid to Contractor. If the expense of finishing the Work will exceed such unpaid balance, Contractor will pay the difference to Company within fifteen (15) days of receiving an invoice for same. The expenses incurred by Company herein, and the damage incurred through Contractor's default, will be determined by Company's Contract Coordinator, in its sole discretion, and such determination will be binding as between the parties.

16.2 In the event of a termination under the provisions of this Section 3, Contractor will transfer and assign to Company, in accordance with Company's instructions, all Work, all construction records, reports, permits, data and information, other materials (including all Company-supplied materials), supplies, Work in progress and other goods for which Contractor is entitled to receive reimbursement hereunder, and any and all plans, drawings, sketches, specifications, and information in connection with the Work, and will take such action as may be necessary to secure Company, at Company's sole election, the rights of Contractor under any or all orders and subcontracts made in connection with the Work.

16.3 In the event that Company so directs or authorizes, Contractor will sell at a price approved by Company, or retain at a mutually agreeable price, any such materials, supplies, Work in progress, or other goods as referred to in the preceding paragraph. In any event, Company will receive any and all records, plans, drawings, data, permits, specifications, sketches, reports, or other information relating to the Work. The proceeds of any such sale or the agreed price will be paid or credited to Company in such manner as Company may direct so as to reduce the amount payable by Company under this Section 3.

APPENDIX D
COVID-19 SITE ENTRY GUIDELINES

COVID-19 Vistra Site Entry Guidelines – *Effective: June 17, 2021*
These guidelines are applicable to ALL PERSONNEL entering Vistra work sites.

To enter a Vistra work site, each person must answer the following three questions with a "no" answer *and* pass the required temperature testing *unless* they display their Vistra vaccination sticker on their employee badge or hardhat:

Site Entry Questions:

1. In the past 10 days, have you tested positive for COVID-19 or are you currently waiting on test results?

2. In the past 10 days, have you been within six feet of someone, where masks were not worn, who:
    a. has tested positive for COVID-19,
    b. is known to be waiting on test results for COVID-19, or
    c. is under a quarantine order?

3. In the past 10 days, have you or someone who has been within six feet of you where masks were not worn had:
    a. flu-like symptoms,
    b. a deep, dry cough,
    c. recent shortness of breath or difficulty breathing,
    d. new loss of taste or smell, and/or
    e. fever of 100 degrees or above?

Temperature Testing:
You must register a temperature between 96- and 100-degrees Fahrenheit as described in the temperature procedures. (see next page for testing procedures)

- If your temperature is below 96 degrees, retest with a different device.
- If your temperature is 100-degrees Fahrenheit or above, retest on another device preferably an ear thermometer, if your temperature still registers 100-degrees Fahrenheit or above you may not enter the site.

Clearance to enter the site:

- If you have answered **"no"** to all three questions ***and*** passed the temperature test, you may enter the site.
- ***If you have an approved Vistra vaccination sticker, you are cleared to enter the site without the temperature test or answering COVID screening questions.***
- If you passed the temperature test ***and*** answered "Yes" to any of the questions, but have been cleared through VistraTravelerSafety (HR clearance) to enter the Vistra work site for that instance of exposure, testing, or symptoms, you may enter the site.

Anyone *not* cleared to enter the work site must immediately leave the work site and notify their supervisor who will notify HR at VistraTravelerSafety@vistracorp.com for next steps.

Any symptomatic employee, unvaccinated employee exposed to COVID-19 or any employee tested for COVID-19 as described above must be cleared through VistraTravelerSafety prior to returning to work.

Required Temperature Testing Procedures:

All persons entering the site without a Vistra vaccination sticker, who have cleared all questions above, will also submit to temperature testing or self-administer a temperature test as required by the facility management. If a self-administered test is required, then a member of the management team or their designee will witness the testing; however, where that is not practicable, each person must attest that they are only entering the site premises because they have passed the screening questions and temperature test required for entry. Also:

  a. Hats may cause false high temperatures and should not be worn for five minutes immediately preceding a forehead temperature test.
  b. Each person is responsible for ensuring all self-testing materials and areas touched during testing are sanitized.
  c. All personnel should maintain a **distance of at least six feet** from other people during this process or wear required masks.

Temperature Testing Requirements:

1. **All persons entering the site without a Vistra vaccination sticker must register a temperature between 96- and 100-degrees Fahrenheit. Any such person who has a temperature not within that range or who triggers an alarm on a thermal camera** must **retest with a different device**, preferably an **ear thermometer**, if available. If the second test registers a temperature of 100 degrees or above:
   a. That person **may not enter** the Vistra work site and must notify their supervisor, who will notify HR at VistraTravelerSafety@vistracorp.com for next steps.
   b. If there is significant inconsistency between the two tests, repeat another temperature test and use the two closest readings.
2. **Anyone who registers a temperature between 96- and 100-degrees Fahrenheit** may proceed to their work site.
   - **If temperature is below 96 degrees, wait a few minutes and retest with a different device.**

Control rooms and communal areas:

All persons entering the site without a Vistra vaccination sticker should maintain at least six-feet distance from other people as much as possible and should wear face coverings when six-feet distance is not feasible. No one should gather in communal areas (including the temperature-testing area) without a Vistra vaccination sticker. Only operators are allowed in control rooms without plant manager approval.

Vistra Vaccination Sticker protocols:

All persons with a valid Vistra vaccination sticker do not have to socially distance or wear masks while at the site. They will also not be required to quarantine as a part of COVID-19 exposures unless exhibiting COVID-19 symptoms. To be eligible for these protocols, each person must have their approved Vistra vaccination sticker easily visible at all times while at work. If someone who has applied for a Vistra vaccination sticker believes they have specific health conditions that may affect the ability to have a full immune response to the vaccination, please consult your health provider prior to working without a mask.

Any symptomatic employee, unvaccinated employee exposed to COVID-19 or any employee tested for COVID-19 as described above must be cleared through VistraTravelerSafety prior to returning to work.

APPENDIX E
SAFETY DATA SHEETS

DYNEGY

Safety Data Sheet

Section 1
Identification of the Substance and of the Supplier

1.1 Product Identifier

Product Name/Identification:	ASTM Bottom Ash
Synonyms:	Ash; Ashes; Ash residues; Ashes, residues, bottom; Bottom ash; Bottom ash residues; Coal Fly Ash; Pozzolan; Waste solids.
Formula:	UVCB Substance

1.2 Relevant Identified Uses of the Substance or Mixture and Uses Advices Against

Relevant Identified Uses:	Component of wallboard, concrete, roofing material, bricks, cement kiln feed.
Uses Advised Against:	None known.

1.3 Details of the Supplier of the SDS

Manufacturer/Supplier:	Dynegy, Inc.
Street Address:	601 Travis Street, Suite 1400
City, State and Zip Code:	Houston, TX 77002
Customer Service Telephone:	800-633-4704

Section 2
Hazards Identification

2.1 Classification of the Substance

GHS Classification(s) according to OSHA Hazard Communication Standard (29 CFR 1910.1200):

- Eye Irritant, Category 2A
- STOT-SE, Category 3 (Respiratory Irritation)
- Carcinogen, Category 1A
- STOT-RE, Category 1 (Lungs)
- Toxic to Reproduction, Category 2

2.2 Label Elements

Labelling according to 29 CFR 1910.1200 Appendices A, B and C*	
Hazard Pictogram(s):	
Signal word:	**DANGER**
Hazard Statement(s):	*Causes serious eye irritation.* *May cause respiratory irritation.* *May cause damage to lungs after repeated/prolonged exposure via inhalation.* *May cause cancer of the lung.* *Suspected of damaging fertility or the unborn child.*
Precautionary Statement(s):	*Obtain special instructions before use.* *Do not handle until all safety precautions have been read and understood.* *Avoid breathing dust.* *Wash thoroughly after handling.* *Do not eat drink or smoke when using this product.* *Wear protective gloves/protective clothing/eye protection/face protection.* *Use outdoors or in a well-ventilated area.* *If exposed or concerned: Get medical advice/attention.* *Store in a secure area.* *Dispose of product in accordance with local/national regulations.*

** Fly ash and other coal combustion products (CCPs) are UVCB substances (unknown or variable composition or biological). Various CCPs, noted as ashes/ash residuals; Ashes, residues, bottom; Bottom ash; Bottom ash residues; Waste solids, ashes under TSCA are defined as: "The residuum from the burning of a combination of carbonaceous materials. The following elements may be present as oxides: aluminum, calcium, iron, magnesium, nickel, phosphorus, potassium, silicon, sulfur, titanium, and vanadium." Ashes including fly ash and fluidized bed combustion ash are identified by CAS number 68131-74-8. The exact composition of the ash is dependent on the fuel source and flue additives composed of many constituents. The classification of the final substance is dependent on the presence of specific identified oxides as well as other trace elements.*

2.3 Other Hazards

Listed Carcinogens:

-Respirable Crystalline Silica

IARC: [Yes] **NTP:** [Yes] **OSHA:** [Yes] **Other:** **(ACGIH)** [Yes]

Section 3
Composition/Information on Ingredients

Substance	*CAS No.*	*Percentage (%)*	*GHS Classification*
Crystalline Silica	*14808-60-7*	*20 - 40%*	*Repeat Dose STOT, Category 1* *Carcinogen, Category 1A*
Silica, crystalline respirable (RCS)	*14808-60-7*	*See Footnote 1*	*Repeat Dose STOT, Category 1* *Carcinogen. Category 1A*
Aluminosilicates[2]	*Various, see Footnote 2*	*10 - 60%*	*Single Exposure STOT, Category 3*
Calcium oxide (CaO)	*1305-78-8*	*10 - 30%*	*Skin Irritant, Category 2* *Eye Irritant, Category 1* *Single Exposure STOT, Category 3*
Iron oxide	*1309-37-1*	*1 - 10%*	*Not Classified*
Manganese dioxide (MnO_2)	*1313-13-9*	*<2%*	*Skin Irritant, Category 2* *Eye Irritant, Category 2B*
Magnesium oxide	*1309-48-4*	*2 - 10%*	*Not Classified*
Phosphorus pentoxide (P_2O_5)	*1314-56-3*	*≤2%*	*Skin Irritant, Category 2* *Eye Irritant, Category 2B*
Sodium oxide	*1313-59-3*	*1 - 10%*	*Not Classified*
Potassium oxide (K_2O)	*12136-45-7*	*≤1%*	*Skin Irritant Category 2* *Eye Irritant Category 2B*
Titanium dioxide (TiO_2)	*13463-67-7*	*<3%*	*Not Classified*
Bromide salt (calcium)	*7789-41-5*	*See Footnote 3*	*Toxic to Reproduction Category 2*

[1] *The percentage of respirable crystalline silica has not been determined. Therefore, a GHS classification of Carcinogen 1A has been assigned.*

[2] *Aluminosilicates (CAS# 1327-36-2) may be in the form of mullite (CAS# 1302-93-8); aluminosilicate glass; pozzolans (CAS# 71243-67-9); or calcium aluminosilicates such as tricalcium aluminate (C3A), or calcium sulfoaluminate (C4A3S). The form is dependent on the source of the coal and or the process used to create the CCP. Pulverized coal combustion would be more likely to create high levels of pozzolans. Aluminosilicates may have inclusions of calcium, titanium, iron, potassium, phosphorus, magnesium and other metal oxides.*

[3] *Analytical data are not available to demonstrate that the concentration of bromide salt is <0.1%; therefore, a GHS classification of Toxic to Reproduction Category 2 has been assigned.*

Section 4
First Aid Measures

4.1 Description of First Aid Measures

Inhalation:	If product is inhaled and irritation of the nose or coughing occurs, remove person to fresh air. Get medical advice/attention if respiratory symptoms persist.
Skin Contact:	If skin exposure occurs, wash with soap and water.
Eye Contact:	If product gets into the eye, rinse copiously with water for several minutes. Remove contact lenses, if present and easy to do. Seek medical attention/advice if irritation occurs or persists.
Ingestion:	No specific first aid measures are required.

4.2 Most Important Health Effects, Both Acute and Delayed

Acute Effects: Direct exposure may cause respiratory irritation, eye irritation and skin irritation. The product dust can dry and irritate the skin and cause dermatitis and can irritate eyes and skin through mechanical abrasion.

Chronic Effects: Chronic exposure may cause lung damage from repeated exposure. Prolonged inhalation of respirable crystalline silica above certain concentrations may cause lung diseases, including silicosis and lung cancer. Repeated exposure to dusts containing inorganic bromide salts may affect fertility and/or result in effects to the unborn child.

4.3 Indication of Any Immediate Medical Attention and Special Treatment Needed

Seek first aid or call a doctor or Poison Control Center if contact with eyes occurs and irritation remains after rinsing. Get medical advice if inhalation occurs and respiratory symptoms persist.

Section 5
Firefighting Measures

5.1 Extinguishing Media

Suitable Extinguishing Media:	Product is not flammable. Use extinguishing media appropriate for surrounding fire.
Unsuitable Extinguishing Media:	Not applicable, the product is not flammable.

5.2 Special Hazards Arising from the Substance or Mixture

Hazardous Combustion Products:	None known.

5.3 Advice for Firefighters

Special Protective Equipment and Precautions for Firefighters:	As with any fire, wear self-contained breathing apparatus (NIOSH approved or equivalent) and full protective gear.

Section 6
Accidental Release Measures

6.1 Personal Precautions, Protective Equipment and Emergency Procedures

Personal precautions/Protective Equipment:	See Section 8.2.2 Individual Protective Measures. For concentrations exceeding Occupational Exposure Levels (OELs), use a self-contained breathing apparatus (SCBA).
Emergency procedures:	Use scooping, water spraying/flushing/misting or ventilated vacuum cleaning systems to clean up spills. Do not use pressurized air.

6.2 Environmental Precautions

Environmental precautions:	Prevent contamination of drains or waterways and dispose according to local and national regulations.

6.3 Methods and Material for Containment and Cleaning Up

Methods and materials for containment and cleaning up:	Do not use brooms or compressed air to clean surfaces. Use dust collection vacuum and extraction systems. Large spills of dry product should be removed by a vacuum system. Dampened material should be removed by mechanical means and recycled or disposed of according to local and national regulations.

See Sections 8 and 13 for additional information on exposure controls and disposal.

Section 7
Handling and Storage

7.1 Precautions for Safe Handling

Practice good housekeeping. Use adequate exhaust ventilation, dust collection and/or water mist to maintain airborne dust concentrations below permissible exposure limits (note: respirable crystalline silica dust may be in the air without a visible dust cloud).

Do not permit dust to collect on walls, floors, sills, ledges, machinery, or equipment. Maintain and test ventilation and dust collection equipment. In cases of insufficient ventilation, wear a NIOSH approved respirator for silica dust when handling or disposing dust from this product. Avoid contact with skin and eyes. Wash or vacuum clothing that has become dusty. Avoid eating, smoking, or drinking while handling the material.

7.2 Conditions for Safe Storage, Including any Incompatibilities

Minimize dust produced during loading and unloading.

Section 8
Exposure Controls/Personal Protection

8.1 Control Parameters

OCCUPATIONAL EXPOSURE LIMITS					
SUBSTANCE		**OSHA PEL TWA (mg/m^3)**	**NIOSH REL TWA (mg/m^3)**	**ACGIH TLV TWA (mg/m^3)**	**CA - OSHA PEL (mg/m^3)**
Calcium oxide		5	2	2	2
Particulates Not Otherwise Regulated	Total	15	15	10	10
	Respirable	5	5	3	5
Respirable Crystalline Silica	Respirable	0.05	0.05	0.025	0.05
Manganese dioxide **(as manganese compounds)**	Total	5 (Ceiling)	1 3 (STEL)	0.1	0.2
	Respirable	-	-	0.02	-

8.2 Exposure Controls

8.2.1 Engineering Controls

Provide ventilation to maintain the ambient workplace atmosphere below the occupational exposure limit(s). Use general and local exhaust ventilation and dust collection systems as necessary to minimize exposure.

8.2.2 Personal Protective Equipment (PPE)

Respiratory protection:	Wear a NIOSH approved particulate respirator if exposure to airborne particulates is unavoidable and where occupational exposure limits may be exceeded. If airborne exposures are anticipated to exceed applicable PELs or TLVs, a self-contained breathing apparatus or airline respirator is recommended.
Eye and face protection:	If eye contact is possible, wear protective glasses with side shields. Avoid contact lenses.
Hand and skin protection:	Wear gloves and protective clothing. Wash hands with soap and water after contact with material.

Section 9
Physical and Chemical Properties

9.1 Information on Basic Physical and Chemical Properties

Property: Value	Property: Value
Appearance (physical state, color, etc.): Fine tan/ gray particulate	**Upper/lower flammability or explosive limits:** Not applicable
Odor: Odorless[1]	**Vapor Pressure (Pa):** Not applicable
Odor threshold: Not applicable	**Vapor Density:** Not applicable
pH (25 °C) (in water): 8 - 11	**Specific gravity or relative density:** 2.2 – 2.9
Melting point/freezing point (°C): Not applicable	**Water Solubility:** Slight
Initial boiling point and boiling range (°C): Not applicable	**Partition coefficient: n-octane/water:** Not determined
Flash point (°C): Not determined	**Auto ignition temperature (°C):** Not applicable
Evaporation rate: Not applicable	**Decomposition temperature (°C):** Not determined
Flammability (solid, gas): Not combustible	**Viscosity:** Not applicable

[1] The use of urea or aqueous ammonia injected into the flue gas to reduce nitrogen oxides (NOx) emissions may result in the presence of ammonium sulfate or ammonium bisulfate in the ash at less than 0.1%. When ash containing these substances becomes wet under high pH (>9), free ammonia gas may be released resulting in objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces.

Section 10
Stability and Reactivity

10.1 Reactivity:	The material is an inert, inorganic material primarily composed of elemental oxides.
10.2 Chemical stability:	The material is stable under normal use conditions.
10.3 Possibility of hazardous reactions:	The material is a relatively stable, inert material; however, when ash containing ammonia becomes wet under high pH (>9), free ammonia gas may be released resulting in an objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces. Polymerization will not occur.
10.4 Conditions to avoid:	Product can become airborne in moderate winds. Dry material should be stored in silos. Materials stored out of doors should be covered or maintained in a damp condition.
10.5 Incompatible materials:	None known.
10. 6 Hazardous decomposition products:	None known.

Section 11
Toxicological Information

11.1 Information on Toxicological Effects

Endpoint	**Data**
Acute oral toxicity	LD50 > 2000 mg/kg
Acute dermal toxicity	LD50 > 2000 mg/kg
Acute inhalation toxicity	LD50 > 5.0 mg/L
Skin corrosion/irritation	Does not meet the classification criteria but may cause slight skin irritation. Product dust can dry the skin which can result in irritation.
Eye damage/irritation	Causes serious eye irritation. Positive scores for conjunctiva irritation and chemosis in 2/3 animals based on average of 24, 48 and 72-hour scores with irritation clearing within 21 days; no corneal or iritis effects observed.
Respiratory/skin sensitization	Not a respiratory or dermal sensitizer.
Germ cell mutagenicity	Not mutagenic in in-vitro and in-vivo assays with or without metabolic activation.
Carcinogenicity	Not available. Respirable crystalline silica has been identified as a carcinogen by OSHA, NTP, ACGIH and IARC.
Reproductive toxicity	No developmental toxicity was observed in available animal studies. Reproductive studies on CCPs showed either no reproductive effects, or some effects on male and female reproductive organs and parameters but without a clear dose response. Inorganic bromide salts have been shown to have adverse effects on reproductive parameters in some animal studies.
STOT-SE	CCPs when present as a nuisance dust may result in respiratory irritation.
STOT-RE	In a 180-day inhalation study with fly ash dust, no effects were observed at the highest dose tested. NOEC = 4.2 mg/m^3; it is not possible to assess the level at which toxicologically significant effects may occur. Repeated inhalation exposures to high levels of respirable crystalline silica may result in lung damage (i.e., silicosis).
Aspiration Hazard	Not applicable based product form.

Section 12
Ecological Information

12.1 Toxicity

Fly Ash (CAS# 68131-74-8)	
Toxicity to Fish	LC50 > 100 mg/L
Toxicity to Aquatic Invertebrates	Data indicates that the test substance is not toxic to *Daphnia magna* (EC50 undetermined)
Toxicity to Aquatic Algae and Plants	EC50 = 10 mg/L
Calcium oxide CAS# 1305-78-8	
Toxicity to Fish	LC50 = 50.6 mg/L The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects.
Toxicity to Aquatic Invertebrates	EC50 = 49.1 mg/L The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects.
Toxicity to Aquatic Algae and Plants	NOEC =48 mg/L @ 72 hours based on $Ca(OH)_2$ The initial pH of the test medium was not directly related to the biologically relevant effects. The formation of precipitates is likely the result of the reaction between CO_2 dissolved in the medium.

12.2 Persistence and Degradability

Not relevant for inorganic materials.

12.3 Bioaccumulative Potential

This material does not contain any compounds that would bioaccumulate up the food chain.

12.4 Mobility in Soil

No data available.

12.5 Results of PBT and vPvB Assessment

This material does not contain any compounds classified as “persistent, bioaccumulative or toxic” nor as “very persistent/very bioaccumulative”.

12.6 Other Adverse Effects

None known.

Section 13
Disposal Considerations

See Sections 7 and 8 above for safe handling and use, including appropriate industrial hygiene practices.

Dispose of all waste product and containers in accordance with federal, state and local regulations.

Section 14
Transport Information

Regulatory entity: U.S. DOT	Shipping Name:	Not Regulated
	Hazard Class:	Not Regulated
	ID Number:	Not Regulated
	Packing Group:	Not Regulated

Section 15
Regulatory Information

15.1 Safety, Health and Environmental Regulations/Legislation Specific for the Mixture

- TSCA Inventory Status

  All components are listed on the TSCA Inventory.

- California Proposition 65

  The following substances are known to the State of California to be carcinogens and/or reproductive toxicants:

  - Respirable crystalline silica
  - Titanium dioxide

- State Right-to-Know (RTK)

Component	**CAS**	**MA**[1,2]	**NJ**[3,4]	**PA**[5]	**RI**[6]
Ammonium bisulfate	7803-63-6	No	Yes	No	No
Ammonium sulfate	7783-20-2	Yes	No	Yes	No
Calcium oxide	1305-78-8	Yes	Yes	Yes	No
Iron oxide	1309-37-1	Yes	Yes	Yes	No
Magnesium oxide	1309-48-4	No	Yes	No	No
Phosphorus pentoxide (or phosphorus oxide)	1314-56-3	Yes	Yes	Yes	No
Potassium oxide	12136-45-7	No	Yes	No	No
Silica-crystalline (SiO_2), quartz	14808-60-7	Yes	Yes	Yes	No
Sodium oxide	1313-59-3	No	Yes	No	No
Titanium dioxide	13463-67-7	Yes	Yes	Yes	Yes

[1] Massachusetts Department of Public Health, no date
[2] 189th General Court of The Commonwealth of Massachusetts, no date
[3] New Jersey Department of Health and Senior Services, 2010a
[4] New Jersey Department of Health, 2010b
[5] Pennsylvania Code, 1986
[6] Rhode Island Department of Labor and Training, no date

Section 16

Other Information, Including Date of Preparation or Last Revision

16.1 Indication of Changes

Date of preparation or last revision: February 23, 2018

16.2 Abbreviations and Acronyms

- ACGIH: American Conference of Industrial Hygienists
- CA: California
- CAS: Chemical Abstract Services
- CCP: Coal Combustion Product
- CFR: Code of Federal Regulations
- EPA: Environmental Protection Agency
- GHS: Globally Harmonized System of Classification and Labelling
- IARC: International Agency for Research on Cancer
- LC50: Concentration resulting in the mortality of 50 % of an animal population
- LD50: Dose resulting in the mortality of 50 % of an animal population
- MA: Massachusetts
- NA: Not Applicable
- NJ: New Jersey
- NOEC: No observed effect concentration
- NIOSH: National Institute of Occupational Safety and Health
- NOx: Nitrogen oxides
- NTP: US National Toxicology Program
- OEL: Occupational Exposure Limit
- OSHA: Occupational Safety and Health Administration
- PA: Pennsylvania
- PBT: Persistent, Toxic and Bioaccumulative
- PEL: Permissible exposure limit
- PPE: Personal Protective Equipment
- REL: Recommended exposure limit
- RI: Rhode Island
- RCS: Respirable Crystalline Silica
- RTK: Right-to-Know
- SCBA: Self-contained breathing apparatus
- SDS: Safety Data Sheet
- STEL: Short-term exposure limit
- STOT-RE: Specific target organ toxicity-repeated exposure
- STOT-SE: Specific target organ toxicity-single exposure
- TLV: Threshold limit value
- TSCA: Toxic Substances Control Act
- TWA: Time-weighted average
- UEL: Upper explosive limit
- UVCB: Unknown or Variable Composition/Biological
- U.S.: United States
- U.S. DOT: United States of Department of Transportation

16.3 Other Hazards

Hazardous Materials Identification System (HMIS) Degree of hazard (0= low, 4 = extreme)							
Health:	2*	**Flammability:**	0	**Physical Hazards:**	0	**Personal protection:****	

** Chronic Health Effects*
****** *Appropriate personal protection is defined by the activity to be performed.*
See Section 8 for additional information.

DISCLAIMER:

This SDS has been prepared in accordance with the Hazard Communication Rule 29 CFR 1910.1200. Information herein is based on data considered to be accurate as of date prepared. No warranty or representation, express or implied, is made as to the accuracy or completeness of this data and safety information. No responsibility can be assumed for any damage or injury resulting from abnormal use, failure to adhere to recommended practices, or from any hazards inherent in the nature of the product.

Safety Data Sheet

Section 1
Identification of the Substance and of the Supplier

1.1 Product Identifier

Product Name/Identification:	ASTM Class C Fly Ash
Synonyms:	Coal Fly Ash, Pozzolan
Formula:	UVCB Substance

1.2 Relevant Identified Uses of the Substance or Mixture and Uses Advices Against

Relevant Identified Uses:	Component of wallboard, concrete, roofing material, bricks, cement kiln feed.
Uses Advised Against:	None known.

1.3 Details of the Supplier of the SDS

Manufacturer/Supplier:	Dynegy, Inc.
Street Address:	601 Travis Street, Suite 1400
City, State and Zip Code:	Houston, TX 77002
Customer Service Telephone:	800-633-4704

Section 2
Hazards Identification

2.1 Classification of the Substance

GHS Classification(s) according to OSHA Hazard Communication Standard (29 CFR 1910.1200):

- Eye Irritant, Category 2A
- STOT-SE, Category 3 (Respiratory Irritation)
- Carcinogen, Category 1A
- STOT-RE, Category 1 (Lungs)
- Toxic to Reproduction, Category 2

2.2 Label Elements

Labelling according to 29 CFR 1910.1200 Appendices A, B and C*	
Hazard Pictogram(s):	
Signal word:	**DANGER**
Hazard Statement(s):	*Causes serious eye irritation.* *May cause damage to lungs after repeated/prolonged exposure via inhalation.* *May cause respiratory irritation.* *May cause cancer of the lung.* *Suspected of damaging fertility or the unborn child.*
Precautionary Statement(s):	*Obtain special instructions before use.* *Do not handle until all safety precautions have been read and understood.* *Avoid breathing dust.* *Wear protective gloves/protective clothing/eye protection/face protection.* *Wash thoroughly after handling.* *Do not eat drink or smoke when using this product.* *Use outdoors or in a well-ventilated area.* *If exposed or concerned: Get medical advice/attention.* *Store in a secure area.* *Dispose of product in accordance with local/national regulations.*

** Fly ash and other coal combustion products (CCPs) are UVCB substances (unknown or variable composition or biological). Various CCPs, noted as ashes/ash residuals; Ashes, residues, bottom; Bottom ash; Bottom ash residues; Waste solids, ashes under TSCA are defined as: "The residuum from the burning of a combination of carbonaceous materials. The following elements may be present as oxides: aluminum, calcium, iron, magnesium, nickel, phosphorus, potassium, silicon, sulfur, titanium, and vanadium." Ashes including fly ash and fluidized bed combustion ash are identified by CAS number 68131-74-8. The exact composition of the ash is dependent on the fuel source and flue additives composed of many constituents. The* *classification of the final substance is dependent on the presence of specific identified oxides as well as other trace elements.*

2.3 Other Hazards

Listed Carcinogens:

-Respirable Crystalline Silica

IARC: [Yes] **NTP:** [Yes] **OSHA:** [Yes] **Other:** **(ACGIH)** [Yes]

Section 3
Composition/Information on Ingredients

Substance	CAS No.	Percentage (%)	GHS Classification
Crystalline Silica	14808-60-7	30 - 60%	Repeat Dose STOT, Category 1 Carcinogen, Category 1A
Silica, crystalline respirable (RCS)	14808-60-7	See Footnote 1	Repeat Dose STOT, Category 1 Carcinogen, Category 1A
Aluminosilicates	71243-67-9 1327-36-2	30 - 60%	Single Exposure STOT, Category 3
Iron oxide	1309-37-1	1 - 10%	Not Classified
Calcium oxide (CaO)	1305-78-8	20 - 30%	Skin Irritant, Category 2 Eye Irritant, Category 1 Single Exposure STOT, Category 3
Magnesium oxide	1309-48-4	2 - 10%	Not Classified
Phosphorus pentoxide (P_2O_5)	1314-56-3	≤2%	Skin Irritant, Category 2 Eye Irritant, Category 2B
Sodium oxide	1313-59-3	1-8%	Not Classified
Potassium oxide (K_2O)	12136-45-7	≤1%	Skin Irritant, Category 2 Eye Irritant, Category 2B
Titanium dioxide (TiO_2)	13463-67-7	<3%	Not Classified
Bromide salt (calcium)	7789-41-5	See Footnote 2	Toxic to Reproduction, Category 2

Footnote 1: The percentage of respirable crystalline silica has not been determined. Therefore, a GHS classification of Carcinogen, Category 1A has been assigned.

Footnote 2: Analytical data are not available to demonstrate that the concentration of bromide salt is <0.1%; therefore, a GHS classification of Toxic to Reproduction, Category 2 has been assigned.

Section 4
First Aid Measures

4.1 Description of First Aid Measures

Inhalation:	If product is inhaled and irritation of the nose or coughing occurs, remove person to fresh air. Get medical advice/attention if respiratory symptoms persist.
Skin Contact:	If skin exposure occurs, wash with soap and water.
Eye Contact:	If product gets into the eye, rinse copiously with water for several minutes. Remove contact lenses, if present and easy to do. Seek medical attention/advice if irritation occurs or persists.
Ingestion:	No specific first aid measures are required.

4.2 Most Important Health Effects, Both Acute and Delayed

Acute Effects: Direct exposure may cause respiratory irritation, eye irritation and skin irritation. The product dust can dry and irritate the skin and cause dermatitis and can irritate eyes and skin through mechanical abrasion.

Chronic Effects: Chronic exposure may cause lung damage from repeated exposure. Prolonged inhalation of respirable crystalline silica above certain concentrations may cause lung diseases, including silicosis and lung cancer. Repeated exposure to dusts containing inorganic bromide salts may affect fertility and/or result in effects to the unborn child.

4.3 Indication of Any Immediate Medical Attention and Special Treatment Needed

Seek first aid or call a doctor or Poison Control Center if contact with eyes occurs and irritation remains after rinsing. Get medical advice if inhalation occurs and respiratory symptoms persist.

Section 5
Firefighting Measures

5.1 Extinguishing Media

Suitable Extinguishing Media:	Product is not flammable. Use extinguishing media appropriate for surrounding fire.
Unsuitable Extinguishing Media:	Not applicable, the product is not flammable.

5.2 Special Hazards Arising from the Substance or Mixture

Hazardous Combustion Products:	None known.

5.3 Advice for Firefighters

Special Protective Equipment and Precautions for Firefighters:	As with any fire, wear self-contained breathing apparatus (NIOSH approved or equivalent) and full protective gear.

Section 6
Accidental Release Measures

6.1 Personal Precautions, Protective Equipment and Emergency Procedures

Personal precautions/Protective Equipment:	See Section 8.2.2 Individual Protective Measures. For concentrations exceeding Occupational Exposure Levels (OELs), use a self-contained breathing apparatus (SCBA).
Emergency procedures:	Use scooping, water spraying/flushing/misting or ventilated vacuum cleaning systems to clean up spills. Do not use pressurized air.

6.2 Environmental Precautions

Environmental precautions:	Prevent contamination of drains or waterways and dispose according to local and national regulations.

6.3 Methods and Material for Containment and Cleaning Up

Methods and materials for containment and cleaning up:	Do not use brooms or compressed air to clean surfaces. Use dust collection vacuum and extraction systems. Large spills of dry product should be removed by a vacuum system. Dampened material should be removed by mechanical means and recycled or disposed of according to local and national regulations.

See Sections 8 and 13 for additional information on exposure controls and disposal.

Section 7
Handling and Storage

7.1 Precautions for Safe Handling

Practice good housekeeping. Use adequate exhaust ventilation, dust collection and/or water mist to maintain airborne dust concentrations below permissible exposure limits (note: respirable crystalline silica dust may be in the air without a visible dust cloud).

Do not permit dust to collect on walls, floors, sills, ledges, machinery, or equipment. Maintain and test ventilation and dust collection equipment. In cases of insufficient ventilation, wear a NIOSH approved respirator for silica dust when handling or disposing dust from this product. Avoid contact with skin and eyes. Wash or vacuum clothing that has become dusty. Avoid eating, smoking, or drinking while handling the material.

7.2 Conditions for Safe Storage, Including any Incompatibilities

Minimize dust produced during loading and unloading.

Section 8
Exposure Controls/Personal Protection

8.1 Control Parameters

OCCUPATIONAL EXPOSURE LIMITS					
SUBSTANCE		**OSHA PEL TWA (mg/m^3)**	**NIOSH REL TWA (mg/m^3)**	**ACGIH TLV TWA (mg/m^3)**	**CA - OSHA PEL (mg/m^3)**
Calcium oxide		5	2	2	2
Particulates Not Otherwise Regulated	Total	15	15	10	10
	Respirable	5	5	3	5
Respirable Crystalline Silica	Respirable Crystalline Silica	0.05	0.05	0.025	0.05
Titanium dioxide	Total	15	2.4 (fine) 0.3 (ultrafine)	10	10
Manganese dioxide (as manganese compounds)	Total	5 (Ceiling)	1 3 (STEL)	0.1	0.2
	Respirable	-	-	0.02	-

8.2 Exposure Controls

8.2.1 Engineering Controls

Provide ventilation to maintain the ambient workplace atmosphere below the occupational exposure limit(s). Use general and local exhaust ventilation and dust collection systems as necessary to minimize exposure.

8.2.2 Personal Protective Equipment (PPE)

Respiratory protection:	Wear a NIOSH approved particulate respirator if exposure to airborne particulates is unavoidable and where occupational exposure limits may be exceeded. If airborne exposures are anticipated to exceed applicable PELs or TLVs, a self-contained breathing apparatus or airline respirator is recommended.
Eye and face protection:	If eye contact is possible, wear protective glasses with side shields. Avoid contact lenses.
Hand and skin protection:	Wear gloves and protective clothing. Wash hands with soap and water after contact with material.

Section 9
Physical and Chemical Properties

9.1 Information on Basic Physical and Chemical Properties

Property: Value	Property: Value
Appearance (physical state, color, etc.): Fine tan/ gray particulate	**Upper/lower flammability or explosive limits:** Not applicable
Odor: Odorless[1]	**Vapor Pressure (Pa):** Not applicable
Odor threshold: Not applicable	**Vapor Density:** Not applicable
pH (25 °C) (in water): Not Determined	**Specific gravity or relative density:** 2.2 – 2.9
Melting point/freezing point (°C): Not applicable	**Water Solubility:** Slight
Initial boiling point/boiling range (°C): NA	**Partition coefficient: n-octane/water:** NA
Flash point (°C): Not determined	**Auto ignition temperature (°C):** Not applicable
Evaporation rate: Not applicable	**Decomposition temperature (°C):** Not determined
Flammability (solid, gas): Not combustible	**Viscosity:** Not applicable

[1] The use of urea or aqueous ammonia injected into the flue gas to reduce nitrogen oxides (NOx) emissions may result in the presence of ammonium sulfate or ammonium bisulfate in the ash at less than 0.1%. When ash containing these substances becomes wet under high pH (>9), free ammonia gas may be released resulting in objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces.

Section 10
Stability and Reactivity

10.1 Reactivity:	The material is an inert, inorganic material primarily composed of elemental oxides.
10.2 Chemical stability:	The material is stable under normal use conditions.
10.3 Possibility of hazardous reactions:	The material is a relatively stable, inert material; however, when ash containing ammonia becomes wet under high pH (>9), free ammonia gas may be released resulting in an objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces. Polymerization will not occur.
10.4 Conditions to avoid:	Product can become airborne in moderate winds. Dry material should be stored in silos. Materials stored out of doors should be covered or maintained in a damp condition.
10.5 Incompatible materials:	None known.
10. 6 Hazardous decomposition products:	None known.

Section 11
Toxicological Information

11.1 Information on Toxicological Effects

Endpoint	Data
Acute oral toxicity	LD50 > 2000 mg/kg
Acute dermal toxicity	LD50 > 2000 mg/kg
Acute inhalation toxicity	LD50 > 5.0 mg/L
Skin corrosion/irritation	Does not meet the classification criteria but may cause slight skin irritation. Product dust can dry the skin which can result in irritation.
Eye damage/irritation	Causes serious eye irritation. Positive scores for conjunctiva irritation and chemosis in 2/3 animals based on average of 24, 48 and 72-hour scores with irritation clearing within 21 days; No corneal or iritis effects observed.
Respiratory/skin sensitization	Not a respiratory or dermal sensitizer.
Germ cell mutagenicity	Not mutagenic in in-vitro and in-vivo assays with or without metabolic activation.
Carcinogenicity	Not available. Respirable crystalline silica has been identified as a carcinogen by OSHA, NTP, ACGIH and IARC.
Reproductive toxicity	No developmental toxicity was observed in available animal studies. Reproductive studies on CCPs showed either no reproductive effects, or some effects on male and female reproductive organs and parameters but without a clear dose response. Inorganic bromide salts have been shown to have adverse effects on reproductive parameters in some animal studies.
STOT-SE	CCPs when present as a nuisance dust may result in respiratory irritation.
STOT-RE	In a 180-day inhalation study with fly ash dust, no effects were observed at the highest dose tested. NOEC = 4.2 mg/m^3; it is not possible to assess the level at which toxicologically significant effects may occur. Repeated inhalation exposures to high levels of respirable crystalline silica may result in lung damage (i.e., silicosis).
Aspiration Hazard	Not applicable based product form.

Section 12
Ecological Information

12.1 Toxicity

Fly Ash C (CAS# 68131-74-8)	
Toxicity to Fish	LC50 > 100 mg/L
Toxicity to Aquatic Invertebrates	Data indicates that the test substance is not toxic to *Daphnia magna* (EC50 undetermined).
Toxicity to Aquatic Algae and Plants	EC50 = 10 mg/L

Calcium oxide CAS# 1305-78-8	
Toxicity to Fish	LC50 = 50.6 mg/L The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects.
Toxicity to Aquatic Invertebrates	EC50 = 49.1 mg/L The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects.
Toxicity to Aquatic Algae and Plants	NOEC =48 mg/L @ 72 hours based on $Ca(OH)_2$ The initial pH of the test medium was not directly related to the biologically relevant effects. The formation of precipitates is likely the result of the reaction between CO_2 dissolved in the medium.

12.2 Persistence and Degradability

Not relevant for inorganic materials.

12.3 Bioaccumulative Potential

This material does not contain any compounds that would bioaccumulate up the food chain.

12.4 Mobility in Soil

No data available.

12.5 Results of PBT and vPvB Assessment

This material does not contain any compounds classified as “persistent, bioaccumulative or toxic” nor as “very persistent/very bioaccumulative”.

12.6 Other Adverse Effects

None known.

Section 13

Disposal Considerations

See Sections 7 and 8 above for safe handling and use, including appropriate industrial hygiene practices.

Dispose of all waste product and containers in accordance with federal, state and local regulations.

Section 14

Transport Information

Regulatory entity: U.S. DOT	Shipping Name:	Not Regulated
	Hazard Class:	Not Regulated
	ID Number:	Not Regulated
	Packing Group:	Not Regulated

Section 15
Regulatory Information

15.1 Safety, Health and Environmental Regulations/Legislation Specific for the Mixture

- TSCA Inventory Status

  All components are listed on the TSCA Inventory.

- California Proposition 65.

  The following substances are known to the State of California to be carcinogens and/or reproductive toxicants:

  - Respirable crystalline silica

- State Right-to-Know (RTK)

Component	**CAS**	**MA[1,2]**	**NJ[3,4]**	**PA[5]**	**RI[6]**
Ammonium bisulfate	7803-63-6	No	Yes	No	No
Ammonium sulfate	7783-20-2	Yes	No	Yes	No
Calcium oxide	1305-78-8	Yes	Yes	Yes	No
Iron oxide	1309-37-1	Yes	Yes	Yes	No
Magnesium oxide	1309-48-4	No	Yes	No	No
Manganese oxide-as manganese compounds	1313-13-9; Various	No	No	Yes	Yes
Phosphorus pentoxide (or phosphorus oxide)	1314-56-3	Yes	Yes	Yes	No
Potassium oxide	12136-45-7	No	Yes	No	No
Silica-crystalline (SiO2), quartz	14808-60-7	Yes	Yes	Yes	No
Sodium oxide	1313-59-3	No	Yes	No	No
Titanium dioxide	13463-67-7	Yes	Yes	Yes	Yes

[1] Massachusetts Department of Public Health, no date
[2] 189th General Court of The Commonwealth of Massachusetts, no date
[3] New Jersey Department of Health and Senior Services, 2010a
[4] New Jersey Department of Health, 2010b
[5] Pennsylvania Code, 1986
[6] Rhode Island Department of Labor and Training, no date

Section 16
Other Information, Including Date of Preparation or Last Revision

16.1 Indication of Changes

Date of preparation or last revision: February 23, 2018

16.2 Abbreviations and Acronyms

ACGIH:	American Conference of Industrial Hygienists
CA:	California
CAS:	Chemical Abstract Services
CCP:	Coal Combustion Product
CFR:	Code of Federal Regulations
EPA:	Environmental Protection Agency

GHS:	Globally Harmonized System of Classification and Labelling
IARC:	International Agency for Research on Cancer
LC50:	Concentration resulting in the mortality of 50 % of an animal population
LD50:	Dose resulting in the mortality of 50 % of an animal population
MA:	Massachusetts
NA:	Not Applicable
NJ:	New Jersey
NOEC:	No observed effect concentration
NIOSH:	National Institute of Occupational Safety and Health
NOx:	Nitrogen oxides
NTP:	US National Toxicology Program
OEL:	Occupational Exposure Limit
OSHA:	Occupational Safety and Health Administration
PA:	Pennsylvania
PBT:	Persistent, Toxic and Bioaccumulative
PEL:	Permissible exposure limit
PPE:	Personal Protective Equipment
REL:	Recommended exposure limit
RI:	Rhode Island
RCS:	Respirable Crystalline Silica
RTK:	Right-to-Know
SCBA:	Self-contained breathing apparatus
SDS:	Safety Data Sheet
STEL:	Short-term exposure limit
STOT-RE:	Specific target organ toxicity-repeated exposure
STOT-SE:	Specific target organ toxicity-single exposure
TLV:	Threshold limit value
TSCA:	Toxic Substances Control Act
TWA:	Time-weighted average
UEL:	Upper explosive limit
UVCB:	Unknown or Variable Composition/Biological
U.S.:	United States
U.S. DOT:	United States of Department of Transportation

16.3 Other Hazards

Hazardous Materials Identification System (HMIS)

Degree of hazard (0= low, 4 = extreme)

Health:	2*	**Flammability:**	0	**Physical Hazards:**	0	**Personal protection:****		

** Chronic Health Effects*
****** *Appropriate personal protection is defined by the activity to be performed.*
See Section 8 for additional information.

DISCLAIMER:

This SDS has been prepared in accordance with the Hazard Communication Rule 29 CFR 1910.1200. Information herein is based on data considered to be accurate as of date prepared. No warranty or representation, express or implied, is made as to the accuracy or completeness of this data and safety information. No responsibility can be assumed for any damage or injury resulting from abnormal use, failure to adhere to recommended practices, or from any hazards inherent in the nature of the product.

ATTACHMENT Y

Proposed Closure Priority Categorization (845.700)

Luminant

Phil Morris
Dynegy Midwest Generation, LLC
Luminant
1500 Eastport Plaza Drive
Collinsville, IL 62234

May 19, 2021

Mr. Darin LeCrone, P.E.
Manager, Industrial Unit
Bureau of Water, Division of Water Pollution Control, Permits Section
Illinois Environmental Protection Agency
1021 North Grand Avenue, East
Springfield, IL 62794-9276

Re: CCR Surface Impoundment Category Designation and Justification for Dynegy Midwest Generation, LLC

Dear Mr. LeCrone:

Pursuant to 35 I.A.C. 845.700(c), Dynegy Midwest Generation, LLC submits the information necessary to categorize the CCR surface impoundments located at the Baldwin Power Plant and the retired Hennepin and Vermilion Power Plants. The following parameters were used in assessing and justifying each assigned category.

- Category 1 – *Impacts to existing potable water supply well or impacts to groundwater quality within the setback of an existing potable water supply well.*
  - This review includes an assessment of potable water wells within 2,500 feet of CCR surface impoundments to determine whether any potential impacts are occurring within the setback zone of any community water supply well established under the Illinois Groundwater Protection Act.
  - This information was developed during the Part 845 rulemaking and is summarized in Attachment 1, Table 2: Impacts to Potable Water Supply.
- Category 2 – *Imminent threat to human health or the environment or have been designated by IEPA under (g)(5)*
  - The surface impoundments at Baldwin, Hennepin and Vermilion Power Plants do not pose an imminent threat to human health or the environment. There are no known conditions at or around the facility where someone or something may be exposed to contaminant concentrations reasonably expected to cause harm
- Category 3 – *Located in areas of environmental justice ("EJ") concern*
  - EJ areas were evaluated using the EJ mapping link from IEPA's webpage located at https://www2.illinois.gov/epa/topics/environmental-justice. Per the IEPA mapping tool, the EJ Status thresholds were determined as twice the state averages for Minority and Low Income consistent with 35 IAC 845.700(g)(6).
  - An EJ map denoting the facilities with impoundments is located in Attachment 3.

- Category 4-7
    - Category 4 - Inactive CCR surface impoundments that have an exceedance of the groundwater protection standards in Section 845.600
    - Category 5 - Existing CCR surface impoundments that have exceedances of the groundwater protection standards in Section 845.600
    - Category 6 - Inactive CCR surface impoundments that are in compliance with the groundwater protection standards in Section 845.600.
    - Category 7 – Existing CCR surface impoundments that are in compliance with the groundwater protection standards in Section 845.600

Based on the information above, category designations have been assigned. The category designations for each CCR impoundment are shown in Attachment 1, Table 1: Category Designations.

If you have any questions regarding this submittal, please contact Phil Morris at 618-343-7794 or phil.morris@vistracorp.com.

Sincerely,

Phil Morris
Senior Environmental Director

Attachments

Attachment 1

Table 1: Category Designation

Facility	**Pond Description**	**Classifications**	**Potable Water Supply Impacts (Category 1)**	**Human Health or Environment Threat (Category 2)**	**Located within Environmental Justice Areas[1] (Category 3)**	**Standards Exceedances[2] (Categories 4,5,6,7)**	**Impoundment Category 845.700(g)**
Baldwin	Bottom Ash Pond	Existing	No	No	No	No	7
Hennepin	East New Primary Pond	Inactive	No	No	Yes	NA[3]	3
Vermilion	North Pond Cell 1 & 2	Inactive	No	No	No	Yes	4
	Old East Pond	Inactive	No	No	No	Yes	4
	New East Pond Cell 1 & 2	Inactive	No	No	No	Yes	4

[1] See Attachment 3 Environmental Justice Area Map

[2] Ground water analyses for purposes of categories 4-7, assumptions have been made based on current groundwater data. However, since sampling and analysis is ongoing and subject to IEPA review and approval, IPGC reserves the right to update its category designations for Categories 4-7.

[3] NA for this determination since the CCR surface impoundment was assign a highest priority category

Attachment 2

Table 2: Impacts to Potable Water Supply

Site Name	Private and Semi-Private Wells	Non-Community Water Supply (CWS) Wells	Non-CWS Surface Water Intakes	Community Water Supply Wells	CWS Surface Water Intakes
Baldwin	**Present, but not at risk** Twenty-two (22) water wells were identified and eight (8) are located potentially downgradient of the site. Based on Ramboll's review of groundwater data, these wells are unlikely to be impacted by releases from the site.	Absent	Absent	**Present, but not at risk** Two (2) active CWS wells were identified; however, they are unlikely to be at risk because of their hydrogeologic location relative to the power plant.	**Present, but not at risk** One (1) CWS surface water intake was identified potentially downgradient of the site. Based on Ramboll's review of available information, this CWS surface water intake is unlikely to be impacted by releases from the site.
Hennepin	**Present, but not at risk** Sixteen (16) water wells were identified and one (1) is located potentially downgradient of the site. However, this well is unlikely to be present/in use based on its remote floodplain location and installation date (1884).	**Present, but not at risk** Three (3) non-CWS wells were identified; however, they are unlikely to be at risk because of their relative hydrogeologic position or inactive status.	Absent	Absent	Absent
Vermilion	**Present, but not at risk** Seventy-nine (79) water wells were identified; however, they are unlikely to be at risk because of their hydrogeologic location relative to the power plant, they are abandoned, they do not appear to be used for potable purposes, and/or they are unlikely to be present based on the mapped location. None of the off-site wells are located in a downgradient direction.	**Present, but not at risk** Two CWS wells were identified; however, they are unlikely to be at risk because of their hydrogeologic location relative to the power plant and/or their inactive status.	**Present, but inactive** One non-CWS surface water intake was identified; however, it is unlikely to be at risk because it is listed with inactive status.	Absent	Absent

Attachment 3: EJ Mapping Denoting Facilities with Impoundments