



2022 Annual Groundwater Monitoring and Corrective Action Report

Ash Disposal Area

Big Stone Plant

Big Stone City, South Dakota

Prepared for
Otter Tail Power Company

January 2023

2022 Annual Groundwater Monitoring and Corrective Action Report

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Contents

- Executive Summary..... iv
- 1.0 Introduction 1
 - 1.1 Purpose..... 1
 - 1.2 Status of the Groundwater Monitoring and Corrective Action Program 1
 - 1.3 CCR Rule Requirements 1
- 2.0 Groundwater Monitoring and Corrective Action Program 3
 - 2.1 Groundwater Monitoring System..... 3
 - 2.1.1 Documentation 3
 - 2.1.2 Changes to Monitoring System..... 3
 - 2.2 Monitoring and Analytical Results..... 3
 - 2.3 Key Actions Completed/Problems Encountered 3
 - 2.4 Key Activities for Upcoming Year 4
- 3.0 References 6

List of Tables

Table 1	CCR Rule Requirements
Table 2	Groundwater Analytical Data Summary

List of Figures

Figure 1	Ash Disposal Area Location
Figure 2	Spring 2022 Groundwater Contours
Figure 3	Fall 2022 Groundwater Contours

List of Appendices

Appendix A	2022 Well Boring Logs
Appendix B	Laboratory Reports and Field Sheets
Appendix C	Groundwater Flow Calculations

Acronyms

Acronym	Description
ADA	Ash Disposal Area
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
EPA	Environmental Protection Agency
OTP	Otter Tail Power Company
SSI	Statistically Significant Increase

Executive Summary

This summary provides an overview of the Groundwater Monitoring & Corrective Action Program status as required by §257.90(e)(6). The CCR unit operated under the detection monitoring program described in §257.94 at the start and at the end of the 2022 annual reporting period. The monitoring program did not identify any statistically significant increases (SSIs) over background for any of the constituents listed in appendix III to the CCR Rule; therefore, constituents listed in appendix IV to the CCR Rule were not monitored. Corrective action provisions of the CCR Rule were not required.

1.0 Introduction

Otter Tail Power Company (OTP) operates the Big Stone Plant (Big Stone), located near Big Stone City, South Dakota. Big Stone is a coal-fired electrical generating plant, the operation of which results in coal combustion residuals (CCR) as a by-product. Management of CCR from plant operations includes placing CCR in an on-site landfill, referred to as the Ash Disposal Area (ADA). The ADA is required to comply with the provisions of the US Environmental Protection Agency (EPA) CCR Rule (40 CFR Parts 257 and 261, Disposal of Coal Combustion Residuals from Electric Utilities) for existing CCR landfills. The location of the ADA is shown on Figure 1.

This 2022 Annual Groundwater Monitoring and Corrective Action Report (Annual Report) describes the monitoring program and results for the ADA at Big Stone. The ADA is currently in detection monitoring, as described by §257.94 of the CCR Rule.

1.1 Purpose

As stated in Section §257.90(e), the purpose of the Annual Report is to:

- Document the status of monitoring and corrective action program for the CCR unit
- Summarize key actions completed
- Describe any problems encountered
- Discuss actions to resolve the problems
- Highlight key activities for the upcoming year

1.2 Status of the Groundwater Monitoring and Corrective Action Program

Baseline monitoring was completed in 2017, as documented in the 2017 Annual Groundwater Monitoring and Corrective Action Report, Ash Disposal Area (Barr, 2018). Statistical evaluation of detection monitoring results, which is the evaluation of groundwater monitoring data for SSIs over background levels for the constituents listed in appendix III to the CCR Rule, began on October 17, 2017, and continued through 2022. In 2022, the monitoring program did not identify any statistically significant increases (SSIs) over background for any of the constituents listed in appendix III to the CCR Rule; therefore, constituents listed in appendix IV to the CCR Rule were not monitored. Corrective action provisions of the CCR Rule were not required.

1.3 CCR Rule Requirements

This Annual Report has been prepared in accordance with the requirements of §257.90(e) of the CCR Rule, as outlined in the following Table 1.

Table 1 CCR Rule Requirements

CCR Rule Reference	Content Required in Report	Location
§257.90(e)(1)	Map showing the CCR unit and all monitoring wells that are part of the groundwater monitoring system	Section 2.1.1 Documentation; see Figure 1
§257.90(e)(2)	Discuss any new or decommissioned monitoring wells	Section 2.1.2 Changes to Monitoring System; Appendix A
§257.90(e)(3)	All monitoring data obtained under §257.90 through §257.98; provide the number and date groundwater samples were collected, and the monitoring (i.e., detection or assessment)	Section 2.2 Monitoring and Analytical Results; Table 2, Figure 2, Figure 3, Appendix B, Appendix C
§257.90(e)(4)	Discuss any transition between monitoring programs	Not applicable – no transition between monitoring programs was necessary
§257.90(e)(5)	Other information specified in §257.90 through §257.98	Throughout report
§257.90(e)(6)	Overview at beginning of annual report	Executive Summary

2.0 Groundwater Monitoring and Corrective Action Program

This section documents the status of the groundwater monitoring and corrective action program for the ADA for 2022. The groundwater monitoring system is described in Section 2.1, the monitoring and analytical results are described in Section 2.2, key actions completed and problems encountered are described in Section 2.3, and key activities planned for 2023 are described in Section 2.4.

2.1 Groundwater Monitoring System

2.1.1 Documentation

Figure 1 shows an aerial image of the ADA and all upgradient (background) and downgradient monitoring wells, including the well identification numbers, that are part of the groundwater monitoring system, as required by §257.90(e)(1). Further details on the monitoring system and the ADA monitoring wells can be found in the Groundwater Monitoring System Report, Big Stone Plant Ash Disposal Area (Barr, 2016).

2.1.2 Changes to Monitoring System

Two downgradient monitoring wells were installed north-northwest of downgradient monitoring well H9 on October 12, 2022 (Appendix A). Well H10 was installed between the ADA and the Holding Pond, and well H11 was installed between the ADA and the Evaporation Pond (Figure 1). In 2022, these wells were used for water level monitoring only. These wells will be added to the CCR groundwater monitoring system starting with the spring 2023 monitoring event.

2.2 Monitoring and Analytical Results

Groundwater samples were collected from monitoring wells H2OX, H3OX, H4OX, H6, H8, and H9 during two semiannual sampling events. A total of 12 groundwater samples were collected and analyzed for the constituents listed in appendix III (Part 257) in 2022 under the detection monitoring program, consistent with the requirements of §257.94(c). Dates of sampling are reported on the field data sheets, and analytical laboratory reports are presented in Appendix B. Results are summarized in Table 2. Groundwater flow data, as required by §257.93(c), are presented in Figure 2, Figure 3, and Appendix C.

2.3 Key Actions Completed/Problems Encountered

The following key actions were completed for the groundwater monitoring program during 2022:

- Completed semiannual groundwater sampling under the detection monitoring program.
- Determined, pursuant to §257.93(h), that a statistically significant increase over background levels did not occur for any of the constituents listed in appendix III at any downgradient monitoring well during the spring 2022 detection monitoring sampling event. Statistical analysis was conducted according to the Statistical Analysis Plan, Appendix B of the CCR Groundwater Sampling and Analysis Plan (Carlson McCain, 2017).

The following problems were encountered, and the following actions were taken to resolve them:

- The water level in monitoring well H6 was below the installed pump and tubing during the fall 2022 detection monitoring event. As a result, a change was made to the sampling protocol and is recorded on the field sheet (Appendix B) and documented in this report, as indicated by the Sampling and Analysis Plan (Carlson McCain, 2017).
 - Change in protocol: Water sample collected with disposable bailer rather than dedicated pump, and stabilization parameters were not measured.
 - Reason for the change: Low water level.
 - Identification of all samples and parameters that may have been impacted: Any parameters in the H6 sample from October 18, 2022, may have been impacted due to disturbing sediment while bailing or due to a depressed water table in the surrounding aquifer.
 - Significance of the potential impact on data integrity: A field pH reading was not collected from the sample. Since data analysis was not complete by the end of 2022, there may be additional, as-yet unknown potential impacts on data integrity.

Water level and volume at H6 will be reassessed during the next sampling event in 2023, and changes to the monitoring system will be undertaken if needed to resolve the problem if spring 2023 monitoring results do not indicate a return to historical conditions.

2.4 Key Activities for Upcoming Year

The following key groundwater monitoring program activities are planned for 2023:

- Evaluate analytical results from the 2022 fall semiannual detection monitoring event for SSIs according to the Statistical Analysis Plan (Carlson McCain, 2017).
- Evaluate hydrogeologic conditions at monitoring well H6 to determine whether monitoring system changes are needed for continued compliance with §257.91.
- Continue the detection monitoring program in accordance with the CCR Rule.
- Evaluate analytical results from the 2023 semiannual detection monitoring events for SSIs according to the Statistical Analysis Plan (Carlson McCain, 2017).
- Commence collection of background water samples from monitoring wells H10 and H11. Appendix III and appendix IV parameters will be analyzed.

**Table 2
Groundwater Analytical Data Summary
Big Stone Plant
Otter Tail Power Company**

Parameter	Analysis Location	Units	Location	H2OX	H2OX	H3OX	H3OX	H4OX	H4OX	H6	H6	H8	H8	H9	H9
			Date	4/19/2022	10/18/2022	4/19/2022	10/18/2022	4/19/2022	10/18/2022	4/19/2022	10/18/2022	4/19/2022	10/18/2022	4/19/2022	10/18/2022
Sample Type			N	N	N	N	N	N	N	N	N	N	N	N	N
Appendix III Parameters															
Boron, total	Lab	mg/l	0.249	0.253	6.730	7.140	0.506	0.503	3.300	2.800	3.280	3.430	1.090	1.350	
Calcium, total	Lab	mg/l	528.0	519.0	386.0	372.0	332.0	284.0	58.20	748.0	116.0	118.0	552.0 J-	605.0	
Chloride	Lab	mg/l	3.4	6.7	68.1	68.7	43.7	42.4	3.0	< 3 U	3.5	3.5	30.3	70.7	
Fluoride	Lab	mg/l	0.330	0.340	0.430	0.410	0.520	0.510	0.430	0.450	0.540	0.540	0.360	0.330	
pH	Field	pH units	7.29	6.35	6.97	7.00	6.84	6.80	7.31	--	7.22	7.15	6.70	6.59	
pH	Lab	pH units	7.4	7.1	7.3	7.1	7.1	7.2	7.4	7.5	7.4	7.4	6.9	6.9	
Solids, total dissolved	Lab	mg/l	4000	3920	2960	4460	2250	2140	669	614	879	907	2540	2880	
Sulfate, as SO4	Lab	mg/l	2390	2200	1490	1360	1210	951	120	83.1	210	256	1430	1370	
Groundwater elevation	Field	ft amsl	1097.77	1096.53	1088.63	1087.35	1092.19	1091.14	1089.20	1080.86	1077.17	1069.28	1079.91	1071.82	

-- Not analyzed/Not available.

N Sample Type: Normal Detection Monitoring

U The analyte was analyzed for, but was not detected.

J- The result is an estimated quantity and may be biased low.

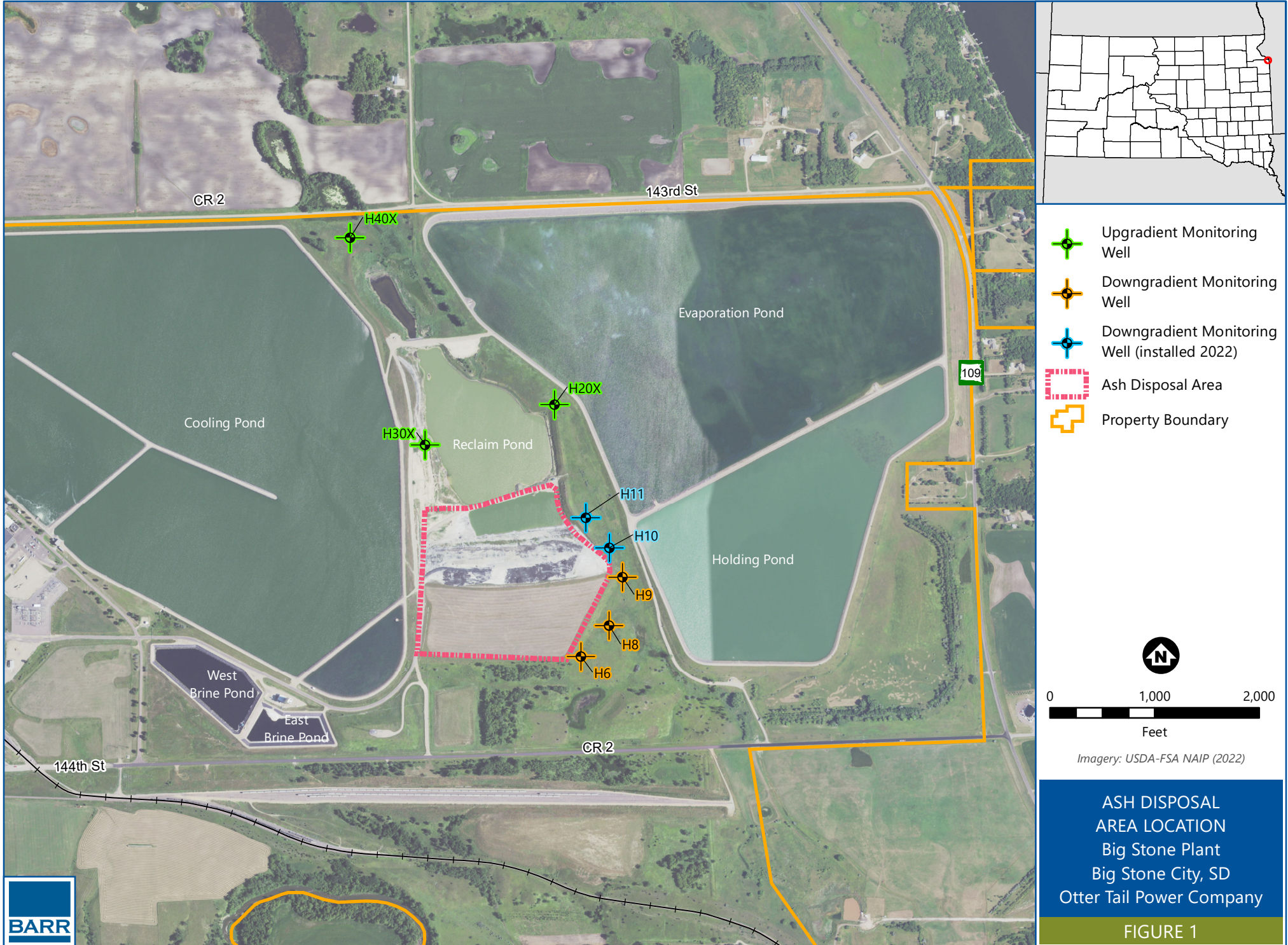
3.0 References

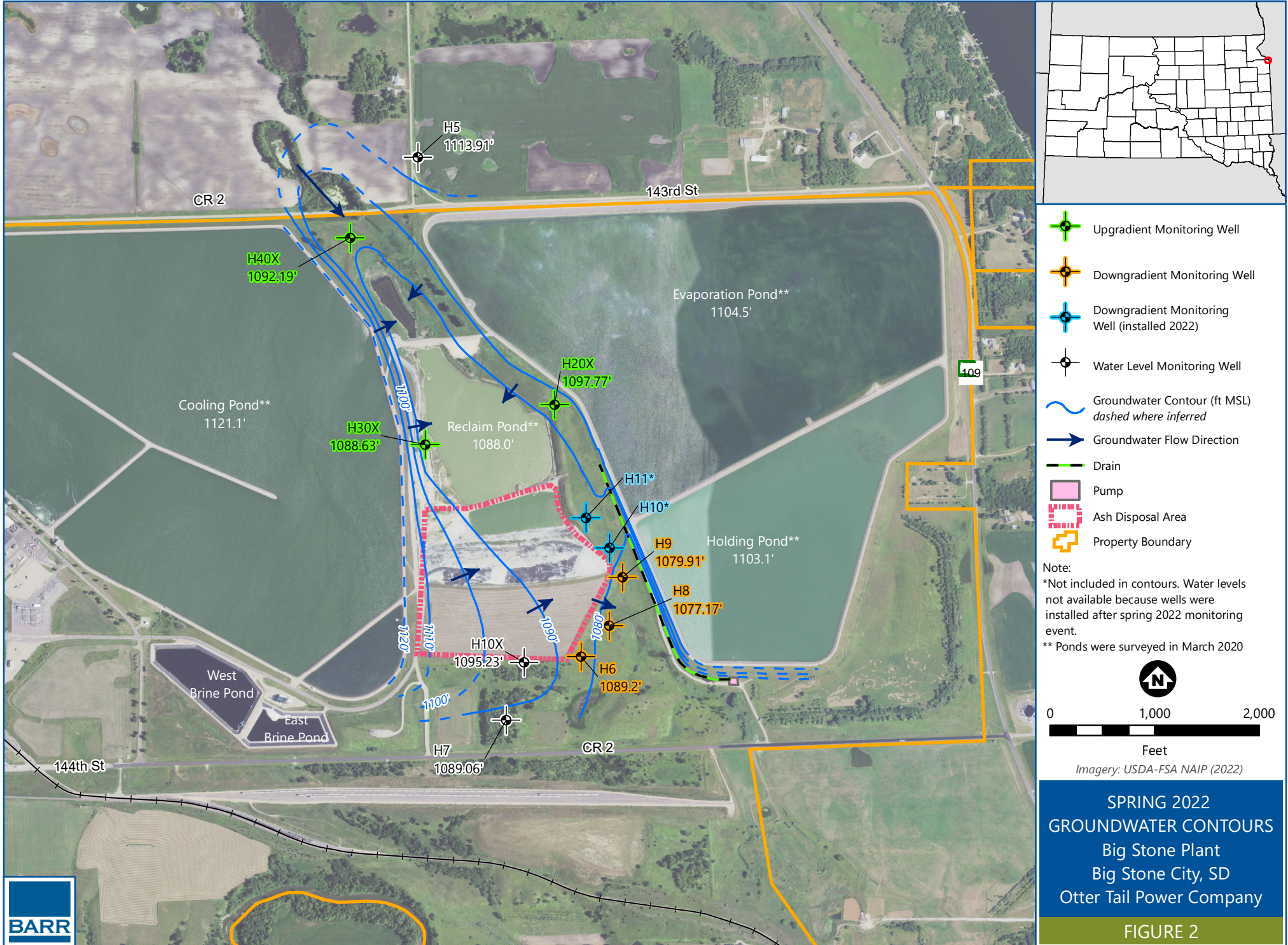
Barr, 2018. 2017 Annual Groundwater Monitoring and Corrective Action Report, Big Stone Plant Ash Disposal Area. Prepared for Otter Tail Power Company. January 2018.

Barr, 2016. Groundwater Monitoring System Report, Big Stone Plant Ash Disposal Area. Prepared for Otter Tail Power Company. December 2016.

Carlson McCain, 2017. CCR Groundwater Sampling and Analysis Plan (Including Statistical Method Selection and Certification), Big Stone Plant Ash Disposal Area. Prepared for Otter Tail Power Company. October 2017.

Figures

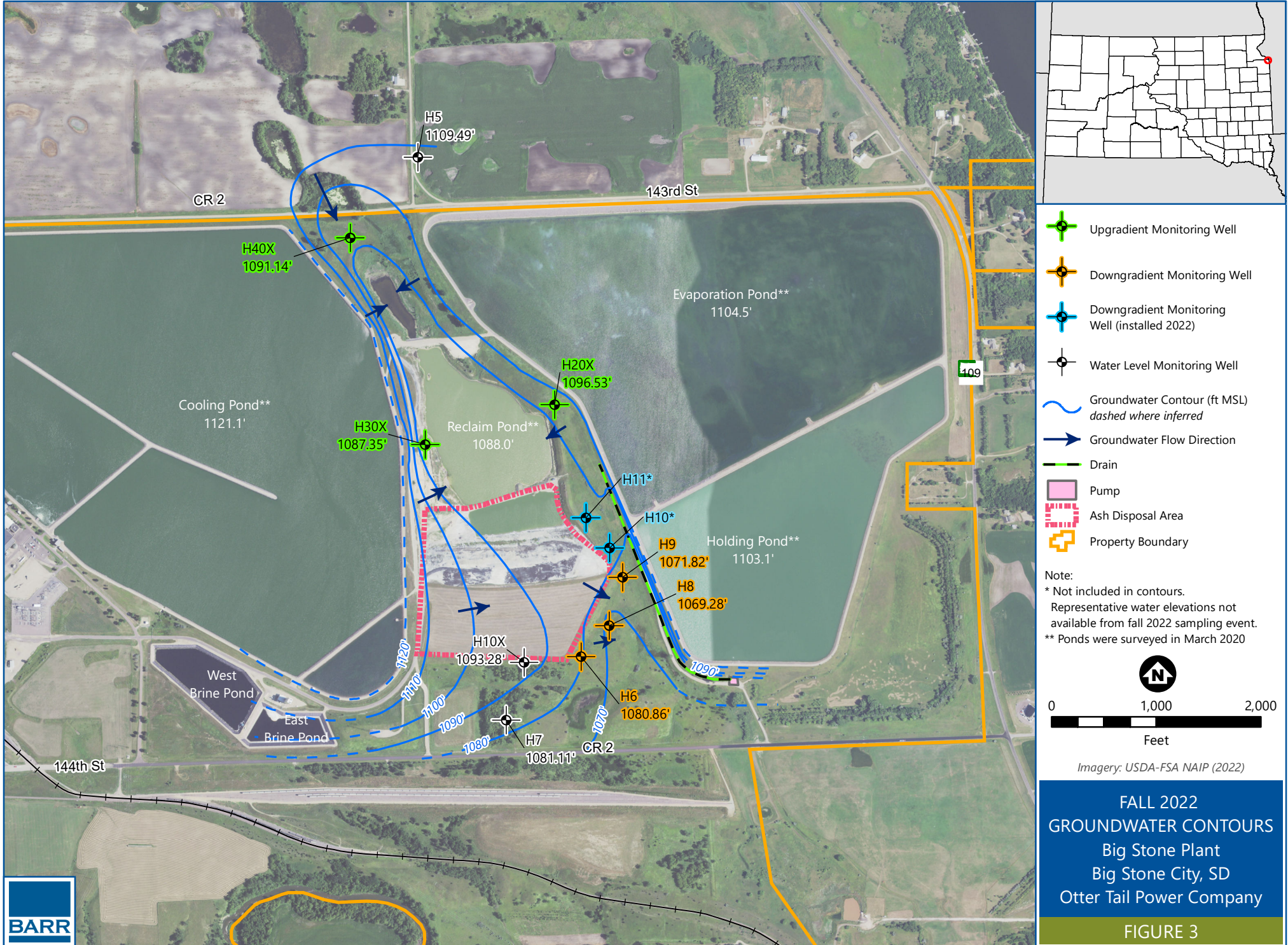




SPRING 2022
 GROUNDWATER CONTOURS
 Big Stone Plant
 Big Stone City, SD
 Otter Tail Power Company

FIGURE 2





Appendices

Appendix A

2022 Well Boring Logs



14 Green River Road
P.O. Box 594
Morris, MN 56267

MONITORING WELL LOG

South Dakota Unique Well Number:	
Well # : H10	
Date Completed: 10/12/2022	10/31/22 12:40
Total Depth Installed (ft bsg): 35.49	Development Date/Method: Surge block
Measured Depth Post-Installation (ft bsg): 35.49	Total Gallons Pumped: ~3
Surface Elevation (ft): 1088.53 ft amsl	
Top of Casing Elevation (ft): 1090.83 ft amsl	
Start: 12:30 10/12/2022 Stop: 14:15 10/12/2022	10/31/22 13:05

WELL DEVELOPMENT

Post Installation Fluid Levels (below surface grade)		
Date/Time	Water Level (ft)	Product Level (ft)
10/31/22 12:40	25.75	-
Post Development Fluid Levels (below surface grade)		
Date/Time	Water Level (ft)	Product Level (ft)
10/31/22 13:05	36.15	-
Measured Bottom of Well Depths (ft. below surface)		

PROJECT INFORMATION

Project Name: Otter Tail Power Company	Project Number: 14643
Project Location: Big Stone City, SD	

DRILLING INFORMATION

Drilling Co.: Dakota Technologies Co.	Method of Drilling: HSA
Overseer: Jesse Frank	Operator: Cody Eystad
Geologist: Jesse Frank	

Sample Core Interval	Depth (feet)	Material Description	Geologic Origin	ASTM	Sample Analysis/	PID (ppm)	amsl (ft.)	Well Diagram	Well Details
	0	Grass					1088.5		TOC 2.30 ft stickup
DT	0-1 ft	Top soil, silty, dry.	Till	SM					Borehole Diameter: 10-inch 2-inch PVC casing Total length of casing and screen 38.55 ft
DT	1-5 ft	Silt loam, unsorted, matrix dominated, non-plastic moderate yellowish brown, dry to moist.	Till	SM					
DT	5-15 ft	Silt loam, unsorted, matrix dominated, pebble clasts, non plastic, stiff at 9-10 ft, moderate yellowish brown, moist.	Till	SM			1078.5		benseal 0-16 ft
DT	15-35 ft	Clay loam, unsorted, matrix dominated, pebble clasts, slightly plastic, stiff, dark yellowish brown, moist.	Till	CL					Bentonite chips 16-18ft Flint sand 18-35 ft
DT	32-35 ft	Color change to olive gray					1068.5		6 Slot Screen 20-35 ft
	40						1048.5		

Notes: Surface elevation provided by OTP. Well went dry during development. High sediments content were observed prior to going dry.	Well Construction Materials: Couplings: 2" ID, 2.75" OD, Steel Casing: 2" ID, 2.38" OD, Steel Screen: 2" ID, 2.47" OD, Steel, 10 slot	Granular Benseal Grout Bentonite Chips Sand Pack/Natural Sand Pack	Sampling Methods: SS= Split Spoon HA = Hand Auger LB = Large Bore R = Rotosonic MS = Macro DT = Dual Tube
---	---	---	--

Hollow Stem Auger Measurements: Cutting Bit = 10" OD, Augers w/ Flights = 7 3/4" OD, Hollow Stem = 4 1/4" ID
Sample Analysis Key: LS = Lab Soil Sample, LW = Lab Water Sample, WL = Water Level



WCEC
ENVIRONMENTAL CONSULTANTS
14 Green River Road
P.O. Box 594
Morris, MN 56267

MONITORING WELL LOG

WELL DEVELOPMENT

South Dakota Unique Well Number:		Post Installation Fluid Levels (below surface grade)	
Well # : H11	Date/Time	Water Level (ft)(TOC)	Product Level (ft)
Date Completed: 10/12/2022	10/31/2022 11:10PM	22.16	-
Total Depth Installed (ft bsg): 42.15	Development Date/Method: Surge block		
Measured Depth Post-Installation (ft bsg): 42.15	Total Gallons Pumped: ~15.5		
Surface Elevation (ft): 1091.84 ft amsl		Post Development Fluid Levels (below surface grade)	
Top of Casing Elevation (ft): 1093.24 ft amsl	Date/Time	Water Level (ft)(TOC)	Product Level (ft)
Start: 10:00 10/12/2022 Stop: 12:00 10/12/2022	10/31/22 13:00	42.38	-
Measured Bottom of Well Depths (ft. below surface)			

PROJECT INFORMATION

DRILLING INFORMATION

Drilling Co.: **Dakota Technologies Co.**

Project Name: Otter Tail Power Company	Overseer: Jesse Frank	Method of Drilling: HSA
Project Location: Big Stone City, SD	Project Number: 14643	Geologist: Jesse Frank
		Operator: Cody Eystad

Sample Core Interval	Depth (feet)	Material Description	Geologic Origin	ASTM	Sample Analysis/	PID (ppm)	amsl (ft.)	Well Diagram	Well Details
	0	Grass					1091.8		TOC 2.4 ft stickup
DT	0-2 ft	Top soil, silty, dry.	Fill	ML					Borehole Diameter: 10-inch 2-inch PVC casing Total length of casing and screen 44.55 ft
DT	2-5 ft	Silt with fine sand, unsorted, matrix dominated, non plastic, moderate yellowish brown, pale gray mottles, moist.	Till	SM					
DT	5-10 ft	Silt with fine sand, unsorted, small pebble clast, matrix dominated, non plastic, moderate yellowish brown, pale gray mottles, moist.	Till	SM					
DT	10					1081.8			benseal 0-23 ft
DT	12-15 ft	Silt loam, unsorted, small pebble clast, matrix dominated, non plastic, dark yellowish brown,	Till	SM					
DT	15-30 ft	Clay sandy loam, unsorted, matrix dominated, pebble clast, non plastic to slightly plastic, stiff, dark yellowish brown, moist. Wet at 20-25 ft	Till	CL					
DT	20					1071.8			
DT	23-25 ft								Bentonite chips 23-25ft
DT	25-42 ft								Flint sand 25-42 feet 6 Slot Screen 27-42 ft
DT	30					1061.8			
DT	30-42 ft	Clay loam, unsorted, matrix dominated, pebble clast, plastic, very stiff, dark yellowish brown, moist. 32-42 ft: Color change to olive gray	Till	CL					
DT	40					1051.8			

Notes: Surface elevation provided by OTP. Well went dry during development. Low sediments were observed during the last ~2 gallons of purging prior to going dry.	Well Construction Materials: Couplings: 2" ID, 2.75" OD, Steel Casing: 2" ID, 2.38" OD, Steel Screen: 2" ID, 2.47" OD, Steel, 10 slot		Granular Benseal Grout Bentonite Chips Sand Pack/Natural Sand Pack	Sampling Methods: SS= Split Spoon HA = Hand Auger LB = Large Bore R = Rotosonic MS = Macro DT = Dual Tube
--	---	--	---	--

Hollow Stem Auger Measurements: Cutting Bit = 10" OD, Augers w/ Flights = 7 3/4" OD, Hollow Stem = 4 1/4" ID
Sample Analysis Key: LS = Lab Soil Sample, LW = Lab Water Sample, WL = Water Level

Appendix B

Laboratory Reports and Field Sheets



MINNESOTA VALLEY TESTING LABORATORIES, INC.

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1201 Lincoln Hwy. ~ Nevada, IA 50201 ~ 800-362-0855 ~ Fax 515-382-3885
www.mvtl.com



FINAL REPORT COMPLETION DATE: 20 May 22 AR

Date Reported: 19 May 2022

PAUL VUKONICH
OTTER TAIL POWER CO
PO BOX 496
FERGUS FALLS MN 56538-0496

Work Order #: 31-0155
Account #: 006106
PO #: 59601

Project Name: BIG STONE CCR

Jeff Hoffman 20 May 22
Field Service Manager/Date Reviewed

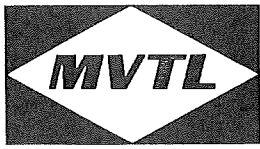
[Signature] 19 May 22
Chemistry Lab Manager/Date Reviewed

[Signature] 19 May 22
Quality Assurance Director/Date Reviewed

- RL = Reporting Limits
NQ = Not Present, Qualitative Only
PQ = Present, Qualitative Only
ND = Not Determined

All data for this report has been approved by MVT Laboratory Management.

MVTL guarantees the accuracy of the analysis done on the sample submitted for testing. It is not possible for MVTL to guarantee that a test result obtained on a particular sample will be the same on any other sample unless all conditions affecting the sample are the same, including sampling by MVTL. As a mutual protection to clients, the public and ourselves, all reports are submitted as the confidential property of clients, and authorization for publication of statements, conclusions or extracts from or regarding our reports is reserved pending our written approval.



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PAUL VUKONICH
OTTER TAIL POWER CO
PO BOX 496
FERGUS FALLS MN 56538-0496

Report Date: 19 May 2022
Lab Number: 22-Al7162
Work Order #: 31-0155
Account #: 006106
Sample Matrix: GROUNDWATER
Date Sampled: 19 Apr 2022 12:32
Sampled By: MVTL FIELD PERSONNEL
Date Received: 19 Apr 2022 16:41
PO #: 59601

Project Name: BIG STONE CCR

Sample Description: H2OX

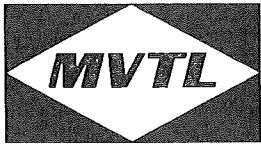
Temp at Receipt: 1.0C

Table with 6 columns: As Received Result, Method RL, Method Reference, Date Analyzed, Analyst. Rows include Water Digestions, pH, Field, pH, Sulfate, Chloride, Solids, Total Dissolved, Calcium, Boron, Fluoride.

* Holding Time Exceeded

~ Sample diluted due to result above calibration of linear range.

RL = Reporting Limit
Analyses performed under our Minnesota Department of Health Accreditation conform to the current TNI standards.
The reporting limit was elevated for any analyte requiring a dilution as coded below:
@ = Due to sample matrix # = Due to concentration of other analytes
! = Due to sample quantity + = Due to internal standard response
CERTIFICATION: MN LAB # 027-015-125 ND WW/DW # R-040



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Page: 3 of 8

PAUL VUKONICH
OTTER TAIL POWER CO
PO BOX 496
FERGUS FALLS MN 56538-0496

Report Date: 19 May 2022
Lab Number: 22-A17163
Work Order #: 31-0155
Account #: 006106
Sample Matrix: GROUNDWATER
Date Sampled: 19 Apr 2022 10:37
Sampled By: MVTl FIELD PERSONNEL
Date Received: 19 Apr 2022 16:41
PO #: 59601

Project Name: BIG STONE CCR

Sample Description: H30X

Temp at Receipt: 1.0C

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
Water Digestions					21 Apr 22	JMS
pH, Field	6.97	units	1.00	SM4500-H+-2011	19 Apr 22 10:37	BMW
pH	* 7.3	units	1.0	SM 4500 H+ B-2000	20 Apr 22 13:08	CC
Sulfate	1490 ~	mg/L	5.0	ASTM D516-11	21 Apr 22 11:10	SS
Chloride	68.1	mg/L	3.0	SM 4500 Cl E	21 Apr 22 10:42	KRM
Solids, Total Dissolved	2960	mg/L	10	SM 2540 C-97	21 Apr 22 13:39	PJH
Calcium	386.0 ~	mg/L	0.500	SW6010D	28 Apr 22 14:28	RMV
Boron	6.730	mg/L	0.100	SW6010D	27 Apr 22 17:35	RMV
Fluoride	0.430 @	mg/L	0.020	EPA 300.0	25 Apr 22 19:23	RMV

* Holding Time Exceeded

~ Sample diluted due to result above calibration of linear range.

RL = Reporting Limit

Analyses performed under our Minnesota Department of Health Accreditation conform to the current TNI standards.

The reporting limit was elevated for any analyte requiring a dilution as coded below:

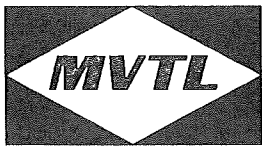
@ = Due to sample matrix

= Due to concentration of other analytes

! = Due to sample quantity

+ = Due to internal standard response

CERTIFICATION: MN LAB # 027-015-125 ND WW/DW # R-040



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Page: 4 of 8

PAUL VUKONICH
OTTER TAIL POWER CO
PO BOX 496
FERGUS FALLS MN 56538-0496

Report Date: 19 May 2022
Lab Number: 22-A17164
Work Order #: 31-0155
Account #: 006106
Sample Matrix: GROUNDWATER
Date Sampled: 19 Apr 2022 11:23
Sampled By: MVTL FIELD PERSONNEL
Date Received: 19 Apr 2022 16:41
PO #: 59601

Project Name: BIG STONE CCR

Sample Description: H40X

Temp at Receipt: 1.0C

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
Water Digestions					21 Apr 22	JMS
pH, Field	6.84	units	1.00	SM4500-H+-2011	19 Apr 22 11:23	BMW
pH	* 7.1	units	1.0	SM 4500 H+ B-2000	20 Apr 22 13:08	CC
Sulfate	1210 ~	mg/L	5.0	ASTM D516-11	21 Apr 22 11:10	SS
Chloride	43.7	mg/L	3.0	SM 4500 Cl E	21 Apr 22 10:42	KRM
Solids, Total Dissolved	2250	mg/L	10	SM 2540 C-97	21 Apr 22 13:39	PJH
Calcium	332.0	mg/L	0.500	SW6010D	27 Apr 22 17:35	RMV
Boron	0.506	mg/L	0.100	SW6010D	27 Apr 22 17:35	RMV
Fluoride	0.520 @	mg/L	0.020	EPA 300.0	25 Apr 22 19:23	RMV

* Holding Time Exceeded

~ Sample diluted due to result above calibration of linear range.

RL = Reporting Limit

Analyses performed under our Minnesota Department of Health Accreditation conform to the current TNI standards.

The reporting limit was elevated for any analyte requiring a dilution as coded below:

@ = Due to sample matrix

= Due to concentration of other analytes

! = Due to sample quantity

+ = Due to internal standard response

CERTIFICATION: MN LAB # 027-015-125 ND WW/DW # R-040



MINNESOTA VALLEY TESTING LABORATORIES, INC.

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2616 East Broadway Ave. ~ Bismarck, ND 58501 ~ 800-279-6885 ~ Fax 701-258-9724
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Page: 5 of 8

PAUL VUKONICH
OTTER TAIL POWER CO
PO BOX 496
FERGUS FALLS MN 56538-0496

Report Date: 19 May 2022
Lab Number: 22-A17165
Work Order #: 31-0155
Account #: 006106
Sample Matrix: GROUNDWATER
Date Sampled: 19 Apr 2022 13:01
Sampled By: MVTL FIELD PERSONNEL
Date Received: 19 Apr 2022 16:41
PO #: 59601

Project Name: BIG STONE CCR

Sample Description: H-6

Temp at Receipt: 1.0C

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
Water Digestions					21 Apr 22	JMS
pH, Field	7.31	units	1.00	SM4500-H+-2011	19 Apr 22 13:01	DGF
pH	* 7.4	units	1.0	SM 4500 H+ B-2000	20 Apr 22 13:08	CC
Sulfate	120	mg/L	5.0	ASTM D516-11	21 Apr 22 11:10	SS
Chloride	3.0	mg/L	3.0	SM 4500 Cl E	21 Apr 22 10:42	KRM
Solids, Total Dissolved	669	mg/L	10	SM 2540 C-97	21 Apr 22 13:39	PJH
Calcium	58.20	mg/L	0.500	SW6010D	27 Apr 22 17:35	RMV
Boron	3.300	mg/L	0.100	SW6010D	27 Apr 22 17:35	RMV
Fluoride	0.430 @	mg/L	0.020	EPA 300.0	25 Apr 22 19:23	RMV

* Holding Time Exceeded

RL = Reporting Limit

Analyses performed under our Minnesota Department of Health Accreditation conform to the current TNI standards.

The reporting limit was elevated for any analyte requiring a dilution as coded below:

@ = Due to sample matrix	# = Due to concentration of other analytes
! = Due to sample quantity	+ = Due to internal standard response

CERTIFICATION: MN LAB # 027-015-125 ND WW/DW # R-040



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Page: 6 of 8

PAUL VUKONICH
OTTER TAIL POWER CO
PO BOX 496
FERGUS FALLS MN 56538-0496

Report Date: 19 May 2022
Lab Number: 22-A17166
Work Order #: 31-0155
Account #: 006106
Sample Matrix: GROUNDWATER
Date Sampled: 19 Apr 2022 13:42
Sampled By: MVTL FIELD PERSONNEL
Date Received: 19 Apr 2022 16:41
PO #: 59601

Project Name: BIG STONE CCR

Sample Description: H-8

Temp at Receipt: 1.0C

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
Water Digestions					21 Apr 22	JMS
pH, Field	7.22	units	1.00	SM4500-H+-2011	19 Apr 22 13:42	DGF
pH	* 7.4	units	1.0	SM 4500 H+ B-2000	20 Apr 22 13:08	CC
Sulfate	210 @	mg/L	5.0	ASTM D516-11	21 Apr 22 11:10	SS
Chloride	3.5	mg/L	3.0	SM 4500 Cl E	21 Apr 22 10:42	KRM
Solids, Total Dissolved	879	mg/L	10	SM 2540 C-97	21 Apr 22 13:39	PJH
Calcium	116.0	mg/L	0.500	SW6010D	27 Apr 22 17:35	RMV
Boron	3.280	mg/L	0.100	SW6010D	27 Apr 22 17:35	RMV
Fluoride	0.540 @	mg/L	0.020	EPA 300.0	25 Apr 22 19:23	RMV

* Holding Time Exceeded

RL = Reporting Limit

Analyses performed under our Minnesota Department of Health Accreditation conform to the current TNI standards.
The reporting limit was elevated for any analyte requiring a dilution as coded below:

@ = Due to sample matrix # = Due to concentration of other analytes
! = Due to sample quantity + = Due to internal standard response

CERTIFICATION: MN LAB # 027-015-125 ND WW/DW # R-040



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Page: 7 of 8

PAUL VUKONICH
OTTER TAIL POWER CO
PO BOX 496
FERGUS FALLS MN 56538-0496

Report Date: 19 May 2022
Lab Number: 22-A17167
Work Order #: 31-0155
Account #: 006106
Sample Matrix: GROUNDWATER
Date Sampled: 19 Apr 2022 14:35
Sampled By: MVTL FIELD PERSONNEL
Date Received: 19 Apr 2022 16:41
PO #: 59601

Project Name: BIG STONE CCR

Sample Description: H-9

Temp at Receipt: 1.0C

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
Water Digestions					21 Apr 22	JMS
pH, Field	6.70	units	1.00	SM4500-H+-2011	19 Apr 22 14:35	DGF
pH	* 6.9	units	1.0	SM 4500 H+ B-2000	20 Apr 22 13:08	CC
Sulfate	1430 ~	mg/L	5.0	ASTM D516-11	21 Apr 22 11:10	SS
Chloride	30.3	mg/L	3.0	SM 4500 Cl E	21 Apr 22 10:42	KRM
Solids, Total Dissolved	2540	mg/L	10	SM 2540 C-97	21 Apr 22 13:39	PJH
Calcium	552.0	mg/L	0.500	SW6010D	27 Apr 22 15:16	RMV
	~See Narrative					
Boron	1.090	mg/L	0.100	SW6010D	27 Apr 22 15:16	RMV
Fluoride	0.360 @	mg/L	0.020	EPA 300.0	25 Apr 22 19:23	RMV

* Holding Time Exceeded

~ Sample diluted due to result above calibration of linear range.

RL = Reporting Limit

Analyses performed under our Minnesota Department of Health Accreditation conform to the current TNI standards.
The reporting limit was elevated for any analyte requiring a dilution as coded below:

@ = Due to sample matrix # = Due to concentration of other analytes
! = Due to sample quantity + = Due to internal standard response

CERTIFICATION: MN LAB # 027-015-125 ND WW/DW # R-040



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Page: 8 of 8

Date Reported: 19 May 2022

PAUL VUKONICH
OTTER TAIL POWER CO
PO BOX 496
FERGUS FALLS MN 56538-0496

Work Order #: 202231-0155
Account Number: 006106
PO #: 59601

Project Name: BIG STONE CCR

LABORATORY NARRATIVE

INORGANIC & METALS ANALYSES:

Due to the high concentration of calcium in the spiked sample, both matrix spike recoveries were outside of acceptance range for sample 22-A17167. Data was reported based on the acceptable recoveries of calcium in the laboratory control spike and the relative percent difference between the matrix spikes.

No other problems were encountered.

MVTL**MINNESOTA VALLEY TESTING LABORATORIES, INC.**

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Page: 1 of 1

Quality Control Report

Lab IDs: 22-A17162 to 22-A17167

Project: BIG STONE CCR

Work Order: 202231-0155

Analyte	LCS Spike Amt	LCS Rec %	LCS % Rec Limits	Matrix Spike Amt	Matrix Spike ID	Matrix Spike Orig Result	Matrix Spike Result	Matrix Spike Rec %	Matrix Spike % Rec Limits	MSD/ Dup Orig Result	MSD/ Dup Result	MSD Rec %	MSD/ Dup RPD	MSD/ Dup RPD Limit (<)	Known Rec (%)	Known % Rec Limits	Method Blank
Boron mg/L	1.000	99	85-115	1.00	22A17166q	3.280	4.360	108	75-125	4.360	4.380	110	0.5	10	96	90-110	< 0.1
	1.000	96	85-115	1.00	22A17167q	1.090	2.140	105	75-125	2.140	2.150	106	0.5	10	96	90-110	< 0.1
Calcium mg/L	50.00	103	85-115	50.0	22A17166q	116.0	169.0	106	75-125	169.0	165.0	98	2.4	10	98	90-110	< 0.5
	50.00	101	85-115	50.0	22A17167q	552.0	580.0	56	75-125	580.0	577.0	50	0.5	10	99	90-110	< 0.5
	50.00	99	85-115	50.0	A17166qc	119.0	169.0	100	75-125	169.0	175.0	112	3.5	10	103	90-110	< 0.5
Chloride mg/L	-	-	-	60.0	22-A17167	30.3	93.4	105	86-117	93.4	91.8	102	1.7	5	94	90-110	< 3
	-	-	-	60.0	22-A17245	< 3	60.0	100	85-115	60.0	61.7	103	2.8	5	-	-	-
	-	-	-	60.0	22-A17129	51.5	113	102	86-117	113	114	104	0.9	5	-	-	-
Fluoride mg/L	-	-	-	1.00	22-A17167	0.360	1.35	99	75-125	1.35	1.35	99	0.0	10	101	90-110	< 0.02
pH units	-	-	-	-	-	-	-	-	-	7.4	7.4	-	0.0	2.5	101	90-110	-
	-	-	-	-	-	-	-	-	-	7.3	7.3	-	0.0	2.5	101	90-110	-
Solids, Total Dissolved mg/L	-	-	-	-	-	-	-	-	-	1190	1180	-	0.8	7	100	85-115	< 10
	-	-	-	-	-	-	-	-	-	536	536	-	0.0	7	-	-	-
Sulfate mg/L	-	-	-	500	22-A17163	1490	1870	76	68-132	1870	1840	70	1.6	5	105	80-120	< 5

One of the matrix spike / matrix spike duplicates failed to recover within acceptance limits, see narrative.

Approved by: 

Minnesota Valley Testing Laboratories

1126 North Front Street New Ulm, MN 56003
 Phone: 800 782 3557 Fax: 507 359 2890

Field Service Chain of Custody Record

Project: Otter Tail Power Company	Project Type: Big Stone Plant CCR	Name of Samplers: DF, BW, MS, DS
Report: Otter Tail Power Company	Carbon Copy: Barr Engineering	Quote Number:
Attn: Paul Vukonich	Attn:	Work Order Number: 31-0155
Address: P.O. Box 496	Address:	Lab Numbers:
Fergus Falls, MN 56538-0496		
Phone: 218-739-8349		

Sample Information					Bottle Type										Analysis				
Lab Number	Sample ID	Unique Station ID	Date	Time	Sample Type	Sample Location	1000 HNO3 Inner Mountain	500 None	1000 none	500 HNO3	Filter? Y or N	500 H2SO4	Filter? Y or N	1000 Amber none	1000 Amber H2SO4	500 NaOH	Other: 150 H2SO4	Other 150 None	Analysis Required
A17162	H2OX		19Apr22	1232	GW				1	1	N								CCR 3
63	H3OX		I	1037	GW				1	1	N								CCR 3
64	H4OX			1123	GW				1	1	N								CCR 3
65	H-6			1301	GW				1	1	N								CCR 3
66	H-8			1342	GW				1	1	N								CCR 3
67	H-9			1435	GW				1	1	N								CCR 3

Comments:

Samples Relinquished By: <i>DF</i>			Samples Received By: <i>A. Rueder</i>		
Date: 19Apr22	Time: 1641	Temp: 1.0°C	Date: 19Apr22	Time: 1641	Temp: 1.0°C
Samples Relinquished into: Fridge		Log in Cart	Other:		
Samples Relinquished By:			Samples Received By:		
Date:	Time:	Temp:	Date:	Time:	Temp:
Delivery: Samplers	Other:		Seal Number(s) - If Used		
Transport: Ambient	<input checked="" type="checkbox"/>	Other:	Seals Intact?	Yes	No

2022

2022 Big Stone Sampling - CCR

Landfill or ADA wells

Site	Parameter List	Well Depth	Diameter (Inches)	Well Elevation	Sample Equipment	Dedicated?	Pump Rate (ml/minute)	Goes Dry?	Sampling Seasons**
H2OX	CCR 3	32.20	2	1103.86	Bladder	Yes	100	Yes	April & Oct
H3OX	CCR 3	22.55	2	1095.26	Bladder	Yes	100	Yes	April & Oct
H4OX	CCR 3	27.20	2	1108.25	Bladder	Yes	100	No	April & Oct
H6	CCR 3	15.00	2	1097.76	Bladder	Yes	100	Yes	April & Oct
H8	CCR 3	22.05	2	1081.23	Bladder	Yes	100	No	April & Oct
H9	CCR 3	30.20	2	1086.21	Bladder	Yes	100	No	April & Oct

Note: CCR sampling is for total recoverable metals. They are not filtered in the field.

CCR 3 & 4 see the first two tabs labeled CCR 3 and CCR 4

CCR - Appendix IV - Assessment Monitoring

Total Concentration Parameters

	Method
Antimony	SW6020A
Arsenic	SW602A
Barium	SW6010C
Beryllium	SW6020A
Cadmium	SW6020A
Chromium, Total	SW6020A
Cobalt	SW6010C
Fluoride	EPA 300
Lead	SW6020A
Lithium	SW6010C
Mercury	EPA 245.7
Molybdenum	SW6020A
Selenium	SW6020A
Thallium	SW6020A
Radium 226 + 228	

Note: These are non-filtered samples.

CCR - Appendix III Detection Monitoring

Field Parameters

pH*

* Field and Laboratory Measurements

Total Concentration Parameters

	Method
Boron	6010
Calcium	6010
Chloride	SM4500 CL E
Fluoride	EPA 300
pH	SM 4500 H+B-96
Sulfate	ASTM D516
Dissolved Solids, Total	SM 2540 C-97

Note: These are non-filtered samples.

Minnesota Valley Testing Laboratories, Inc.

New Ulm, MN 56073

507 354 8517

Groundwater Assessment

Site: Otter Tail Power Co./ Big Stone

Sampling Personnel:

BW

Facility ID:

Date: 19 Apr 22

Unique Station ID:

Sample ID: Well H2OX

Well Condition

Well Locked? Yes No
 Well Labeled? Yes No
 Casing Straight? Yes No

Protective Posts? Yes No
 State ID Tag? Yes No
 Grout Seal Intact? Yes No

Repairs Necessary:

Well Information

Well Depth: 32.83

Well Casing Elevation: 1103.91

Constructed Depth: 32.20

Static Water Elevation: 1097.82

Casing Diameter: 2"

Previous Static: 1097.85

Water Level Before Purge: 6.09

Water Level After Sample: Below pump

Well Volume: 4.36 Gallons

Measurement Method: Rec. Well Steel Tape

Sampling Information

Weather Conditions: Temp: 36 Wind: NE10 Sky: Fair

Sampling Method: Grundfos Bladder SST Disp. Bailor Whale Grab Other:

Dedicated Equipment: Yes No

Pumping Rate: .25 gpm

Well Purged Dry? Yes No

Time Pump Began: 1209 am / pm

Time Purged Dry? 1227

Time of Sampling: 1232 am / pm

Duplicate Sample? Yes No ID: -

Sample EH: 37.5

Sample Appearance: General: Silty Cloudy Color: Tan Phase: Light Sed Odor: None

Time	pH	Specific Cond.	Temp °C	D. O. mg/L	Turbidity NTU	Gallons Removed	SEQ #	Comments:
1227	7.28	3243	6.66	NA	NA	4.5	1	
							2	
1232	7.29	3232	6.63	↓	↓	-	3	Recharge
							4	
							5	

Stabilized? Yes No

Amount Water Removed: 4.5 Gallons

Comments:

* Had to pull pump due to check ball being stuck in the bladder pump.

Exceptions to Protocol:

Minnesota Valley Testing Laboratories, Inc.

New Ulm, MN 56073

507 354 8517

Groundwater Assessment

Site: Otter Tail Power Co./ Big Stone

Sampling Personnel:

BW

Facility ID:

Date: 19 Apr 22

Unique Station ID:

Sample ID: Well H30X

Well Condition

Well Locked? Yes No
 Well Labeled? Yes No
 Casing Straight? Yes No

Protective Posts? Yes No
 State ID Tag? Yes No
 Grout Seal Intact? Yes No

Repairs Necessary:

Well Information

Well Depth: 22.68

Well Casing Elevation: 1095.19

Constructed Depth: 22.55

Static Water Elevation: 1088.56

Casing Diameter: 2"

Previous Static: 1088.64

Water Level Before Purge: 6.63

Water Level After Sample: Below Pump

Well Volume: 2.62 Gallons

Measurement Method: Elec. W/L Steel Tape

Sampling Information

Weather Conditions: Temp: 34 Wind: N610 Sky: Fair

Sampling Method: Grundfos Bladder SS/T Disp. Bailer Whale Grab Other:

Dedicated Equipment: Yes No

Pumping Rate: .25 gpm

Well Purged Dry? Yes No

Time Pump Began: 1021 am/pm

Time Purged Dry: 1032

Time of Sampling: 1037 am/pm

Duplicate Sample? Yes No ID:

Sample EH: 202-5

Sample Appearance: General: Clear Color: None Phase: None Odor: None

Time	pH	Specific Cond.	Temp °C	D. O. mg/L	Turbidity NTU	Gallons Removed	SEQ #	Comments:
1032	6.97	2889	8.94	NA	NA	2.75	1	
							2	
1037	6.97	2900	8.86	I	I	-	3	Recharge
							4	
							5	

Stabilized? Yes No

Amount Water Removed: 2.75 Gallons

Comments:

Exceptions to Protocol:

Minnesota Valley Testing Laboratories, Inc.

New Ulm, MN 56073

507 354 8517

Groundwater Assessment

Site: Otter Tail Power Co./ Big Stone

Sampling Personnel:

BW

Facility ID: _____

Date: 19 Apr 22

Unique Station ID: _____

Sample ID: Well H40X

Well Condition

Well Locked? Yes No
 Well Labeled? Yes No
 Casing Straight? Yes No

Protective Posts? Yes No
 State ID Tag? Yes No
 Grout Seal Intact? Yes No

Repairs Necessary: _____

Well Information

Well Depth: 27.48

Well Casing Elevation: 1108.22

Constructed Depth: 27.20

Static Water Elevation: 1092.16

Casing Diameter: 2"

Previous Static: 1092.22

Water Level Before Purge: 16.06

Water Level After Sample: Below Pump

Well Volume: 1.86 Gallons

Measurement Method: Elec. Well Steel Tape

Sampling Information

Weather Conditions: Temp: 36 Wind: NE 10 Sky: Fair

Sampling Method: Grundfos Bladder SS/T Disp. Bailor Whale Grab Other: _____

Dedicated Equipment: Yes No Pumping Rate: .25 gpm

Well Purged Dry? Yes No Time Pump Began: 1110 am/pm

Time Purged Dry? 1118 Time of Sampling: 1123 am/pm

Duplicate Sample? Yes No ID: _____ Sample EH: 135-9

Sample Appearance: General: Clear Color: None Phase: None Odor: None

Time	pH	Specific Cond.	Temp °C	D. O. mg/L	Turbidity NTU	Gallons Removed	SEQ #	Comments:
1118	6.82	1271	8.35	NA	NA	2	1	
							2	
1123	6.84	1272	8.28	↓	↓	-	3	Recharge
							4	
							5	

Stabilized? Yes No Amount Water Removed: 2 Gallons

Comments:

Exceptions to Protocol:

Minnesota Valley Testing Laboratories, Inc.

New Ulm, MN 56073

507 354 8517

Groundwater Assessment

Sampling Personnel:

DF

Site: Otter Tail Power Co./ Big Stone

Facility ID: —

Date: 19 Apr 22

Unique Station ID: —

Sample ID: Well H6

Well Condition

Well Locked? Yes No
 Well Labeled? Yes No
 Casing Straight? Yes No

Protective Posts? Yes No
 State ID Tag? Yes No
 Grout Seal Intact? Yes No

Repairs Necessary:

Well Information

Well Depth: 17.92

Well Casing Elevation: NA

Constructed Depth: 17.70

Static Water Elevation: ↓

Casing Diameter: 2"

Previous Static: ↓

Water Level Before Purge: 8.56

Water Level After Sample: 8.85

Well Volume: 1.53 Gallons

Measurement Method: Elec. WLI Steel Tape

Sampling Information

Weather Conditions: Temp: 35 Wind: SE 15 Sky: Partly Cloudy

Sampling Method: Grundfos Bladder Disp. Bailor Whale Grab Other:

Dedicated Equipment: Yes No

Pumping Rate: 0.25 gpm

Well Purged Dry? Yes No

Time Pump Began: 1230 1240 am / pm

Time Purged Dry? —

Time of Sampling: 1301 am / pm

Duplicate Sample? Yes ID: —

Sample EH: 186.5

Sample Appearance: General: Clear Color: None Phase: None Odor: None

Time	pH	Specific Cond.	Temp °C	D. O. mg/L	Turbidity NTU	Gallons Removed	SEQ #	Comments:
<u>7</u> <u>1247</u>	<u>7.31</u>	<u>1165</u>	<u>6.11</u>	<u>NA</u>	<u>NA</u>	<u>1.75</u>	<u>1</u>	
<u>1254</u>	<u>7.31</u>	<u>1146</u>	<u>6.23</u>	<u> </u>	<u> </u>	<u>3.5</u>	<u>2</u>	
<u>1301</u>	<u>7.31</u>	<u>1140</u>	<u>6.25</u>	<u> </u>	<u> </u>	<u>5.25</u>	<u>3</u>	
							<u>4</u>	
							<u>5</u>	

Stabilized? Yes No

Amount Water Removed: 5.25 Gallons

Comments:

Exceptions to Protocol:

19 Apr 22
DF

Minnesota Valley Testing Laboratories, Inc.

New Ulm, MN 56073

507 354 8517

Groundwater Assessment

Sampling Personnel:

DF

Site: Otter Tail Power Co./ Big Stone

Facility ID: _____

Date: 19 Aug 22

Unique Station ID: _____

Sample ID: Well H8

Well Condition

Well Locked? Yes No
 Well Labeled? Yes No
 Casing Straight? Yes No

Protective Posts? Yes No
 State ID Tag? Yes NO
 Grout Seal Intact? Yes NO

19 Aug 22

Repairs Necessary: _____

Well Information

Well Depth: 22.33

Well Casing Elevation: 1081.23

Constructed Depth: 22.05

Static Water Elevation: 1077.17

Casing Diameter: 2"

Previous Static: _____

Water Level Before Purge: 4.06

Water Level After Sample: 4.36

Well Volume: 2.98 Gallons

Measurement Method: ~~Elec. WL~~ Steel Tape

Sampling Information

Weather Conditions: Temp: 35 Wind: SE 15 Sky: Pthy, Clady

Sampling Method: Grundfos ~~Bladder SST~~ Disp. Bailer Whale Grab Other:

Dedicated Equipment: Yes No

Pumping Rate: 0.25 gpm

Well Purged Dry? Yes No

Time Pump Began: 1306 am / ~~pm~~

Time Purged Dry? _____

Time of Sampling: 1342 am / ~~pm~~

Duplicate Sample? Yes No ID: _____

Sample EH: 191.4

Sample Appearance: General: Clear Color: None Phase: None Odor: None

Time	pH	Specific Cond.	Temp °C	D. O. mg/L	Turbidity NTU	Gallons Removed	SEQ #	Comments:
1318	7.22	1354	7.12	NA	NA	3	1	
1330	7.22	1355	7.17			6	2	
1342	7.22	1355	7.22			9	3	
							4	
							5	

Stabilized? Yes No

Amount Water Removed: 9 Gallons

Comments:

Exceptions to Protocol:

Minnesota Valley Testing Laboratories, Inc.

New Ulm, MN 56073

507 354 8517

Groundwater Assessment

Sampling Personnel:

DF

Site: Otter Tail Power Co./ Big Stone

Facility ID: —

Date: 19 Apr 22

Unique Station ID: —

Sample ID: Well H9

Well Condition

Well Locked? Yes No
 Well Labeled? Yes No
 Casing Straight? Yes No

Protective Posts? Yes No
 State ID Tag? Yes
 Grout Seal Intact? Yes

Repairs Necessary:

Well Information

Well Depth: 30.71

Well Casing Elevation: 1086.21

Constructed Depth: 30.20

Static Water Elevation: 1079.91

Casing Diameter: 2"

Previous Static: —

Water Level Before Purge: 6.30

Water Level After Sample: 6.55

Well Volume: 3.98 Gallons

Measurement Method: Elec. W/L Steel Tape

Sampling Information

Weather Conditions: Temp: 35 Wind: SE 15 Sky: Partly Cloudy

Sampling Method: Grundfos Bladder SS/T Disp. Bailor Whale Grab Other:

Dedicated Equipment: Yes No

Pumping Rate: 0.25 gpm

Well Purged Dry? Yes No

Time Pump Began: 1347 am / PM

Time Purged Dry? —

Time of Sampling: 1435 am / PM

Duplicate Sample? Yes No ID: —

Sample EH: 207.8

Sample Appearance: General: Clear Color: None Phase: None Odor: None

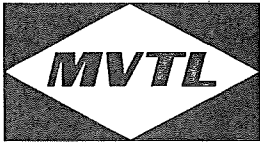
Time	pH	Specific Cond.	Temp °C	D. O. mg/L	Turbidity NTU	Gallons Removed	SEQ #	Comments:
1403	6.71	2812	8.51	NA	NA	4	1	
1419	6.70	2857	8.63			8	2	
1435	6.70	2872	8.66			12	3	
							4	
							5	

Stabilized? Yes No

Amount Water Removed: 12 Gallons

Comments:

Exceptions to Protocol:



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Page: 1 of 8

FINAL REPORT COMPLETION DATE: 9 Nov 22 AH

Date Reported: 8 Nov 2022

JOSH HOLLEN
OTTER TAIL POWER CO
PO BOX 496
FERGUS FALLS MN 56538-0496

Work Order #: 31-0482
Account #: 006106
PO #: 59601

Project Name: BIG STONE PLANT CCR

Handwritten signatures and dates for Field Service Manager, Chemistry Lab Manager, and Quality Assurance Director, all dated 08 Nov 22.

RL = Reporting Limits
NQ = Not Present, Qualitative Only
PQ = Present, Qualitative Only
ND = Not Determined

All data for this report has been approved by MVTL Laboratory Management.

MVTL guarantees the accuracy of the analysis done on the sample submitted for testing. It is not possible for MVTL to guarantee that a test result obtained on a particular sample will be the same on any other sample unless all conditions affecting the sample are the same, including sampling by MVTL. As a mutual protection to clients, the public and ourselves, all reports are submitted as the confidential property of clients, and authorization for publication of statements, conclusions or extracts from or regarding our reports is reserved pending our written approval.



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Page: 2 of 8

JOSH HOLLEN
OTTER TAIL POWER CO
PO BOX 496
FERGUS FALLS MN 56538-0496

Report Date: 8 Nov 2022
Lab Number: 22-A53079
Work Order #: 31-0482
Account #: 006106
Sample Matrix: GROUNDWATER
Date Sampled: 18 Oct 2022 12:26
Sampled By: MVTL FIELD PERSONNEL
Date Received: 18 Oct 2022 16:25
PO #: 59601

Project Name: BIG STONE PLANT CCR

Sample Description: H2OX

Temp at Receipt: 1.9C

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
Water Digestions						
pH, Field	6.35	units	1.00	SM4500-H+-2011	19 Oct 22	RRA
pH	* 7.1	units	1.0	SM 4500 H+ B-2000	18 Oct 22 12:26	BMW
Sulfate	2200 ~	mg/L	5.0	ASTM D516-11	19 Oct 22 12:20	NP
Chloride	6.7	mg/L	3.0	SM 4500 Cl E	20 Oct 22 7:54	SS
Solids, Total Dissolved	3920	mg/L	10	SM 2540 C-97	20 Oct 22 8:04	SS
Calcium	519.0	mg/L	0.500	SW6010D	19 Oct 22 12:49	HO
	~See Narrative				20 Oct 22 16:11	RMV
Boron	0.253	mg/L	0.100	SW6010D	20 Oct 22 16:11	RMV
Fluoride	0.340	mg/L	0.020	EPA 300.0	26 Oct 22 4:46	MDH

* Holding Time Exceeded

~ Sample diluted due to result above calibration of linear range.

RL = Reporting Limit

Analyses performed under our Minnesota Department of Health Accreditation conform to the current TNI standards. The reporting limit was elevated for any analyte requiring a dilution as coded below:

@ = Due to sample matrix # = Due to concentration of other analytes
! = Due to sample quantity + = Due to internal standard response

CERTIFICATION: MN LAB # 027-015-125 ND WW/DW # R-040



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Page: 3 of 8

JOSH HOLLEN
OTTER TAIL POWER CO
PO BOX 496
FERGUS FALLS MN 56538-0496

Report Date: 8 Nov 2022
Lab Number: 22-A53080
Work Order #: 31-0482
Account #: 006106
Sample Matrix: GROUNDWATER
Date Sampled: 18 Oct 2022 10:35
Sampled By: MVTL FIELD PERSONNEL
Date Received: 18 Oct 2022 16:25
PO #: 59601

Project Name: BIG STONE PLANT CCR

Sample Description: H30X

Temp at Receipt: 1.9C

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
Water Digestions						
pH, Field	7.00	units	1.00	SM4500-H+-2011	19 Oct 22	RRA
pH	* 7.1	units	1.0	SM 4500 H+ B-2000	18 Oct 22 10:35	BMW
Sulfate	1360 ~	mg/L	5.0	ASTM D516-11	19 Oct 22 12:20	NP
Chloride	68.7	mg/L	3.0	SM 4500 Cl E	20 Oct 22 9:31	SS
Solids, Total Dissolved	4460	mg/L	10	SM 2540 C-97	20 Oct 22 8:04	SS
Calcium	372.0	mg/L	0.500	SW6010D	19 Oct 22 12:49	HO
	See Narrative				20 Oct 22 16:11	RMV
Boron	7.140	mg/L	0.100	SW6010D	20 Oct 22 16:11	RMV
Fluoride	0.410	mg/L	0.020	EPA 300.0	26 Oct 22 4:46	MDH

* Holding Time Exceeded

~ Sample diluted due to result above calibration of linear range.

RL = Reporting Limit

Analyses performed under our Minnesota Department of Health Accreditation conform to the current TNI standards.
The reporting limit was elevated for any analyte requiring a dilution as coded below:

@ = Due to sample matrix # = Due to concentration of other analytes
! = Due to sample quantity + = Due to internal standard response

CERTIFICATION: MN LAB # O27-015-125 ND WW/DW # R-040



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Page: 4 of 8

JOSH HOLLEN
OTTER TAIL POWER CO
PO BOX 496
FERGUS FALLS MN 56538-0496

Report Date: 8 Nov 2022
Lab Number: 22-A53081
Work Order #: 31-0482
Account #: 006106
Sample Matrix: GROUNDWATER
Date Sampled: 18 Oct 2022 11:19
Sampled By: MVTL FIELD PERSONNEL
Date Received: 18 Oct 2022 16:25
PO #: 59601

Project Name: BIG STONE PLANT CCR

Sample Description: H40X

Temp at Receipt: 1.9C

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
Water Digestions					19 Oct 22	RRA
pH, Field	6.80	units	1.00	SM4500-H+-2011	18 Oct 22 11:19	BMW
pH	* 7.2	units	1.0	SM 4500 H+ B-2000	19 Oct 22 12:20	NP
Sulfate	951 ~	mg/L	5.0	ASTM D516-11	20 Oct 22 9:31	SS
Chloride	42.4	mg/L	3.0	SM 4500 Cl E	20 Oct 22 8:04	SS
Solids, Total Dissolved	2140	mg/L	10	SM 2540 C-97	19 Oct 22 12:49	HO
Calcium	284.0	mg/L	0.500	SW6010D	20 Oct 22 16:11	RMV
	See Narrative					
Boron	0.503	mg/L	0.100	SW6010D	20 Oct 22 16:11	RMV
Fluoride	0.510	mg/L	0.020	EPA 300.0	26 Oct 22 4:46	MDH

* Holding Time Exceeded

~ Sample diluted due to result above calibration of linear range.

RL = Reporting Limit

Analyses performed under our Minnesota Department of Health Accreditation conform to the current TNI standards. The reporting limit was elevated for any analyte requiring a dilution as coded below:

@ = Due to sample matrix # = Due to concentration of other analytes
! = Due to sample quantity + = Due to internal standard response

CERTIFICATION: MN LAB # O27-015-125 ND WW/DW # R-040



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Page: 5 of 8

JOSH HOLLEN
OTTER TAIL POWER CO
PO BOX 496
FERGUS FALLS MN 56538-0496

Report Date: 8 Nov 2022
Lab Number: 22-A53082
Work Order #: 31-0482
Account #: 006106
Sample Matrix: GROUNDWATER
Date Sampled: 18 Oct 2022 11:32
Sampled By: MVTL FIELD PERSONNEL
Date Received: 18 Oct 2022 16:25
PO #: 59601

Project Name: BIG STONE PLANT CCR

Sample Description: H-6

Temp at Receipt: 1.9C

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
Water Digestions					23 Oct 22	RRA
pH	* 7.5	units	1.0	SM 4500 H+ B-2000	19 Oct 22 12:20	NP
Sulfate	83.1	mg/L	5.0	ASTM D516-11	20 Oct 22 9:31	SS
Chloride	< 3	mg/L	3	SM 4500 Cl E	20 Oct 22 8:04	SS
Solids, Total Dissolved	614	mg/L	10	SM 2540 C-97	19 Oct 22 12:49	HO
Calcium	748.0 ~	mg/L	0.500	SW6010D	24 Oct 22 16:21	RMV
Boron	2.800	mg/L	0.100	SW6010D	24 Oct 22 16:21	RMV
Fluoride	0.450 @	mg/L	0.020	EPA 300.0	26 Oct 22 4:46	MDH

* Holding Time Exceeded

~ Sample diluted due to result above calibration of linear range.

RL = Reporting Limit

Analyses performed under our Minnesota Department of Health Accreditation conform to the current TNI standards.
The reporting limit was elevated for any analyte requiring a dilution as coded below:

@ = Due to sample matrix # = Due to concentration of other analytes
! = Due to sample quantity + = Due to internal standard response

CERTIFICATION: MN LAB # 027-015-125 ND WW/DW # R-040



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Page: 6 of 8

JOSH HOLLEN
OTTER TAIL POWER CO
PO BOX 496
FERGUS FALLS MN 56538-0496

Report Date: 8 Nov 2022
Lab Number: 22-A53083
Work Order #: 31-0482
Account #: 006106
Sample Matrix: GROUNDWATER
Date Sampled: 18 Oct 2022 12:03
Sampled By: MVTL FIELD PERSONNEL
Date Received: 18 Oct 2022 16:25
PO #: 59601

Project Name: BIG STONE PLANT CCR

Sample Description: H-8

Temp at Receipt: 1.9C

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
Water Digestions					19 Oct 22	RRA
pH, Field	7.15	units	1.00	SM4500-H+-2011	18 Oct 22 12:03	DGF
pH	* 7.4	units	1.0	SM 4500 H+ B-2000	19 Oct 22 12:20	NP
Sulfate	256 @	mg/L	5.0	ASTM D516-11	20 Oct 22 9:31	SS
Chloride	3.5	mg/L	3.0	SM 4500 Cl E	20 Oct 22 8:04	SS
Solids, Total Dissolved	907	mg/L	10	SM 2540 C-97	19 Oct 22 12:49	HO
Calcium	118.0	mg/L	0.500	SW6010D	20 Oct 22 16:11	RMV
	See Narrative					
Boron	3.430	mg/L	0.100	SW6010D	20 Oct 22 16:11	RMV
Fluoride	0.540	mg/L	0.020	EPA 300.0	26 Oct 22 4:46	MDH

* Holding Time Exceeded

RL = Reporting Limit

Analyses performed under our Minnesota Department of Health Accreditation conform to the current TNI standards.
The reporting limit was elevated for any analyte requiring a dilution as coded below:

@ = Due to sample matrix # = Due to concentration of other analytes
! = Due to sample quantity + = Due to internal standard response

CERTIFICATION: MN LAB # 027-015-125 ND WW/DW # R-040



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Page: 7 of 8

JOSH HOLLEN
OTTER TAIL POWER CO
PO BOX 496
FERGUS FALLS MN 56538-0496

Report Date: 8 Nov 2022
Lab Number: 22-A53084
Work Order #: 31-0482
Account #: 006106
Sample Matrix: GROUNDWATER
Date Sampled: 18 Oct 2022 12:46
Sampled By: MVTL FIELD PERSONNEL
Date Received: 18 Oct 2022 16:25
PO #: 59601

Project Name: BIG STONE PLANT CCR

Sample Description: H-9

Temp at Receipt: 1.9C

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
Water Digestions					19 Oct 22	RRA
pH, Field	6.59	units	1.00	SM4500-H+-2011	18 Oct 22 12:46	DGF
pH	* 6.9	units	1.0	SM 4500 H+ B-2000	19 Oct 22 12:20	NP
Sulfate	1370 ~	mg/L	5.0	ASTM D516-11	20 Oct 22 9:31	SS
Chloride	70.7	mg/L	3.0	SM 4500 Cl E	20 Oct 22 8:04	SS
Solids, Total Dissolved	2880	mg/L	10	SM 2540 C-97	19 Oct 22 12:49	HO
Calcium	605.0	mg/L	0.500	SW6010D	20 Oct 22 16:11	RMV
	~See Narrative					
Boron	1.350	mg/L	0.100	SW6010D	20 Oct 22 16:11	RMV
Fluoride	0.330	mg/L	0.020	EPA 300.0	26 Oct 22 4:46	MDH

* Holding Time Exceeded

~ Sample diluted due to result above calibration of linear range.

RL = Reporting Limit

Analyses performed under our Minnesota Department of Health Accreditation conform to the current TNI standards.

The reporting limit was elevated for any analyte requiring a dilution as coded below:

@ = Due to sample matrix

! = Due to sample quantity

= Due to concentration of other analytes

+ = Due to internal standard response

CERTIFICATION: MN LAB # 027-015-125 ND WW/DW # R-040



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Page: 8 of 8

Date Reported: 8 Nov 2022

JOSH HOLLEN
OTTER TAIL POWER CO
PO BOX 496
FERGUS FALLS MN 56538-0496

Work Order #: 202231-0482
Account Number: 006106
PO #: 59601

Project Name: BIG STONE PLANT CCR

LABORATORY NARRATIVE

INORGANIC & METALS ANALYSES:

Due to the high concentration of calcium in the spiked sample the recovery of the matrix spike duplicate was outside of acceptance range for calcium in samples 22-A53079 through 22-A53081, 22-A53083, 22-A53084. Data was reported based on the acceptable recovery of calcium in the laboratory control spike and the relative percent difference between matrix spikes.

No other problems were encountered.

Quality Control Report

Lab IDs: 22-A53079 to 22-A53084

Project: BIG STONE PLANT CCR

Work Order: 202231-0482

Analyte	LCS Spike Amt	LCS Rec %	LCS % Rec Limits	Matrix Spike Amt	Matrix Spike ID	Matrix Spike Orig Result	Matrix Spike Result	Matrix Spike Rec %	Matrix Spike % Rec Limits	MSD/ Dup Orig Result	MSD/ Dup Result	MSD Rec %	MSD/ Dup RPD	MSD/ Dup RPD Limit (<)	Known Rec (%)	Known % Rec Limits	Method Blank
Boron mg/L	1.000	103	85-115	1.00	22A53091q	0.170	1.240	107	75-125	1.240	1.250	108	0.8	10	99	90-110	< 0.1
	1.000	101	85-115	1.00	22A53410q	< 0.1	1.090	109	75-125	1.090	1.080	108	0.9	10	98	90-110	< 0.1
Calcium mg/L	50.00	101	85-115	50.0	22A53091q	566.0	626.0	120	75-125	626.0	632.0	132	1.0	10	101	90-110	< 0.5
	50.00	101	85-115	50.0	22A53410q	55.60	106.0	101	75-125	106.0	105.0	99	0.9	10	103	90-110	< 0.5
Chloride mg/L	-	-	-	60.0	22-A53084	70.7	133	104	86-117	133	133	104	0.0	5	94	90-110	< 3
Fluoride mg/L	-	-	-	0.20	22-A53084	0.330	0.540	105	75-125	0.540	0.550	110	1.8	10	104	90-110	< 0.02
pH units	-	-	-	-	-	-	-	-	-	8.5	8.5	-	0.0	2.5	101	90-110	-
Solids, Total Dissolved mg/L	-	-	-	-	-	-	-	-	-	2140	2060	-	3.8	7	99	85-115	< 10
	-	-	-	-	-	-	-	-	-	2880	2920	-	1.4	7	-	-	-
Sulfate mg/L	-	-	-	500	22-A53071	430	881	90	56-134	881	916	97	3.9	5	92	80-120	< 5
	-	-	-	500	22-A53083	256	752	99	56-134	752	741	97	1.5	5	91	80-120	< 5

One of the Calcium matrix spike duplicate recoveries was outside of acceptance limits, see narrative.

Approved by: 

Minnesota Valley Testing Laboratories

1126 North Front Street New Ulm, MN 56003
 Phone: 800 782 3557 Fax: 507 359 2890

Field Service Chain of Custody Record

This is an exact copy of the original document

By AB Date 18 Oct 22
 pages 1-10

Project Otter Tail Power Company	Project Type: Big Stone Plant CCR	Name of Samplers: MS, BW, DS, DA
Report Otter Tail Power Company	Carbon Copy: Barr Engineering	Quote Number:
Attn: Paul Vukonich	Attn:	Work Order Number: 31-482
Address P.O. Box 496	Address:	Lab Numbers:
Fergus Falls, MN 56538-0496		
Phone: 218-739-8349		

Sample Information					Bottle Type										Analysis				
Lab Number	Sample ID	Unique Station ID	Date	Time	Sample Type	Sample Location	1000 HNO3 Inner Mountain	500 None	1000 none	500 HNO3	Filter? Y or N	500 H2SO4	Filter? Y or N	1000 Amber none	1000 Amber H2SO4	500 NaOH	Other: 150 H2SO4	Other: 150 None	Analysis Required
A5307	H2OX		18 Oct 22	1226	GW				1	1	N								CCR 3
80	H3OX		I	1035	GW				1	1	N								CCR 3
81	H4OX			1119	GW				1	1	N								CCR 3
82	H-6			1137	GW				1	1	N								CCR 3
83	H-8			1203	GW				1	1	N								CCR 3
84	H-9			1246	GW				1	1	N								CCR 3

Comments:

Samples Relinquished By: <u>[Signature]</u>			Samples Received By: <u>A. Aledu</u>		
Date: <u>18 Oct 22</u>	Time: <u>1625</u>	Temp: <u>1.97m</u>	Date: <u>18 Oct 22</u>	Time: <u>1625</u>	Temp: <u>1.9C</u>
Samples Relinquished into: <u>Fridge</u>		Log in Cart	Other:		
Samples Relinquished By:			Samples Received By:		
Date:	Time:	Temp:	Date:	Time:	Temp:
Delivery: <u>Samplers</u>		Other:	Seal Number(s) - If Used		
Transport: <u>Ambient</u>	<u>Ice</u>	Other:	Seals Intact?	Yes	No

2022

2022 Big Stone Sampling - CCR

Landfill or ADA wells

Site	Parameter List	Well Depth	Diameter (Inches)	Well Elevation	Sample Equipment	Dedicated?	Pump Rate (ml/minute)	Goes Dry?	Sampling Seasons**
H2OX	CCR 3	32.20	2	1103.86	Bladder	Yes	100	Yes	April & Oct
H3OX	CCR 3	22.55	2	1095.26	Bladder	Yes	100	Yes	April & Oct
H4OX	CCR 3	27.20	2	1108.25	Bladder	Yes	100	No	April & Oct
H6	CCR 3	15.00	2	1097.76	Bladder	Yes	100	Yes	April & Oct
H8	CCR 3	22.05	2	1081.23	Bladder	Yes	100	No	April & Oct
H9	CCR 3	30.20	2	1086.21	Bladder	Yes	100	No	April & Oct

Note: CCR sampling is for total recoverable metals. They are not filtered in the field.

CCR 3 & 4 see the first two tabs labeled CCR 3 and CCR 4

CCR - Appendix III Detection Monitoring

Field Parameters

pH*

* Field and Laboratory Measurements

Total Concentration Parameters

	Method
Boron	6010
Calcium	6010
Chloride	SM4500 CL E
Fluoride	EPA 300
pH	SM 4500 H+B-96
Sulfate	ASTM D516
Dissolved Solids, Total	SM 2540 C-97

Note: These are non-filtered samples.

CCR - Appendix IV - Assessment Monitoring

Total Concentration Parameters

	Method
Antimony	SW6020A
Arsenic	SW602A
Barium	SW6010C
Beryllium	SW6020A
Cadmium	SW6020A
Chromium, Total	SW6020A
Cobalt	SW6010C
Fluoride	EPA 300
Lead	SW6020A
Lithium	SW6010C
Mercury	EPA 245.7
Molybdenum	SW6020A
Selenium	SW6020A
Thallium	SW6020A
Radium 226 + 228	

Note: These are non-filtered samples.

Minnesota Valley Testing Laboratories, Inc.

New Ulm, MN 56073

507 354 8517

Groundwater Assessment

Sampling Personnel:

BW

Site: Otter Tail Power Co./ Big Stone

Facility ID:

Date: 18 OCT 27

Unique Station ID:

Sample ID: Well H2OX

Well Condition

Well Locked? Yes No
 Well Labeled? Yes No
 Casing Straight? Yes No

Protective Posts? Yes No
 State ID Tag? Yes No
 Grout Seal Intact? Yes No

Repairs Necessary:

Well Information

Well Depth: 32.83 Well Casing Elevation: 1103.91
 Constructed Depth: 32.20 Static Water Elevation: 1096.58
 Casing Diameter: 2" Previous Static: 1097.82
 Water Level Before Purge: 7.33 Water Level After Sample: Below pump
 Well Volume: 4.16 Gallons Measurement Method: Elec. WLT Steel Tape

Sampling Information

Weather Conditions: Temp: 30 Wind: LUV Sky: Fair
 Sampling Method: Grundfos Bladder SS/T Disp. Bailer Whale Grab Other:
 Dedicated Equipment: Yes No Pumping Rate: .25 gpm
 Well Purged Dry? Yes No Time Pump Began: 1204 am
 Time Purged Dry: 1221 Time of Sampling: 1226 am
 Duplicate Sample? Yes No ID: Sample EH: 758.9
 Sample Appearance: General: Sl. Cloudy Color: grey Phase: None Odor: Chem. Cas

Time	pH	Specific Cond.	Temp °C	D. O. mg/L	Turbidity NTU	Gallons Removed	SEQ #	Comments:
1221	6.26	3507	8.61	NA	NA	4.25	1	
							2	
1226	6.35	3497	8.82				3	Recharge
							4	
							5	

Stabilized? Yes No

Amount Water Removed: 4.25 Gallons

Comments:

* Lots of dead bugs stuck in tubing of pump. Had to blow them out.

Exceptions to Protocol:

Minnesota Valley Testing Laboratories, Inc.

New Ulm, MN 56073

507 354 8517

Groundwater Assessment

Sampling Personnel:

BW

Site: Otter Tail Power Co./ Big Stone

Facility ID:

Date: 18 Oct 22

Unique Station ID:

Sample ID: Well H3OX

Well Condition

Well Locked? Yes No
 Well Labeled? Yes No
 Casing Straight? Yes No

Protective Posts? Yes No
 State ID Tag? Yes No
 Grout Seal Intact? Yes No

Repairs Necessary:

Well Information

Well Depth: 22.68

Well Casing Elevation: 1095.19

Constructed Depth: 22.55

Static Water Elevation: 1087.28

Casing Diameter: 2"

Previous Static: 1088.56

Water Level Before Purge: 7.91

Water Level After Sample: Below Pump

Well Volume: 2.41 Gallons

Measurement Method: Elec. W/L Steel Tape

Sampling Information

Weather Conditions: Temp: 30 Wind: N@10 Sky: Fair

Sampling Method: Grundfos Bladder SST Disp. Bailer Whale Grab Other:

Dedicated Equipment: Yes No

Pumping Rate: .25 gpm

Well Purged Dry? Yes No

Time Pump Began: 1020 am 7 pm

Time Purged Dry? 1030

Time of Sampling: 1035 am 1 pm

Duplicate Sample? Yes No ID: —

Sample EH: 178.8

Sample Appearance: General: Clear Color: N@7C Phase: N@7C Odor: N@7C

Time	pH	Specific Cond.	Temp °C	D. O. mg/L	Turbidity NTU	Gallons Removed	SEQ #	Comments:
1030	6.99	3200	12.32	NA	NA	2.5	1	
							2	
1035	7.00	3174	12.52	↓	↓	—	3	Recharge
							4	
							5	

Stabilized? Yes No

Amount Water Removed: Gallons

Comments:

Exceptions to Protocol:

Minnesota Valley Testing Laboratories, Inc.

New Ulm, MN 56073

507 354 8517

Groundwater Assessment

Sampling Personnel:

BW

Site: Otter Tail Power Co./ Big Stone

Facility ID:

Date: 18 Oct 22

Unique Station ID:

Sample ID: Well H40X

Well Condition

Well Locked? Yes No
 Well Labeled? Yes No
 Casing Straight? Yes No

Protective Posts? Yes No
 State ID Tag? Yes No
 Grout Seal Intact? Yes No

Repairs Necessary:

Well Information

Well Depth: 27.48

Well Casing Elevation: 1108.22

Constructed Depth: 27.20

Static Water Elevation: 1091.11

Casing Diameter: 2"

Previous Static: 1092.16

Water Level Before Purge: 17.11

Water Level After Sample: Below pump

Well Volume: 1.69 Gallons

Measurement Method: Elec. WLI Steel Tape

Sampling Information

Weather Conditions: Temp: 30 Wind: LUV Sky: Fair

Sampling Method: Grundfos Bladder SST Disp. Bailer Whale Grab Other:

Dedicated Equipment: Yes No

Pumping Rate: .25 gpm

Well Purged Dry? Yes No

Time Pump Began: 1107 am

Time Purged Dry: 1114

Time of Sampling: 1119 am

Duplicate Sample? Yes No ID: -

Sample EH: 54.3

Sample Appearance: General: Clear Color: None Phase: None Odor: None

Time	pH	Specific Cond.	Temp °C	D. O. mg/L	Turbidity NTU	Gallons Removed	SEQ #	Comments:
1114	6.82	2269	8.51	NA	NA	1.75	1	
							2	
1119	6.80	2247	8.44			-	3	Recharge
							4	
							5	

Stabilized? Yes No

Amount Water Removed: 1.75 Gallons

Comments:

Exceptions to Protocol:

Minnesota Valley Testing Laboratories, Inc.

New Ulm, MN 56073

507 354 8517

Groundwater Assessment

Sampling Personnel:

DF

Site: Otter Tail Power Co./ Big Stone

Facility ID: —

Date: 18 Oct 22

Unique Station ID: —

Sample ID: Well H6

Well Condition

Well Locked? Yes No
 Well Labeled? Yes No
 Casing Straight? Yes No

Protective Posts? Yes No
 State ID Tag? Yes No
 Grout Seal Intact? Yes No

Repairs Necessary:

Well Information

Well Depth: 17.92

Well Casing Elevation: NA

Constructed Depth: 17.70

Static Water Elevation: L

Casing Diameter: 2"

Previous Static:

Water Level Before Purge: 16.90

Water Level After Sample: Dry

Well Volume: 0.17 Gallons

Measurement Method: ~~elec. W/L~~ Steel Tape

Sampling Information

Weather Conditions: Temp: 31 Wind: NNW 10 Sky: Sunny

Sampling Method: Grundfos ~~Bladder S&T~~ ~~Disp. Bailor~~ Whale Grab Other:

Dedicated Equipment: Yes No

Pumping Rate: 0.25 gpm

Well Purged Dry? Yes No

Time Pump Began: 1131 am/pm

Time Purged Dry: 1132

Time of Sampling: 1137 am/pm

Duplicate Sample? Yes No ID: —

Sample EH: —

Sample Appearance: General: Cloudy Color: Brown Phase: Hy. Sed. Odor: None

Time	pH	Specific Cond.	Temp °C	D. O. mg/L	Turbidity NTU	Gallons Removed	SEQ #	Comments:
1132				NA	NA	0.17	1	
							2	
							3	
							4	
1137							5	Petrage

Stabilized? Yes No

Amount Water Removed: 0.17 Gallons

Comments:

- Water level below dedicated pump so used disp. bailer
- Limited sample - No field readings - 1000 Nbre only!

Exceptions to Protocol:

3 Oct 22
DF

Minnesota Valley Testing Laboratories, Inc.

New Ulm, MN 56073

507 354 8517

Groundwater Assessment

Sampling Personnel:

DF

Site: Otter Tail Power Co./ Big Stone

Facility ID: —

Date: 18 Oct 22

Unique Station ID: —

Sample ID: Well H8

Well Condition

Well Locked? Yes No
 Well Labeled? Yes No
 Casing Straight? Yes No

Protective Posts? Yes No
 State ID Tag? Yes No
 Grout Seal Intact? Yes No

Repairs Necessary: —

Well Information

Well Depth: 22.33

Well Casing Elevation: 1081.23

Constructed Depth: 22.05

Static Water Elevation: 1069.28

Casing Diameter: 2"

Previous Static: —

Water Level Before Purge: 11.95

Water Level After Sample: 14.99

Well Volume: 1.69 Gallons

Measurement Method: Elec. W/L Steel Tape

Sampling Information

Weather Conditions: Temp: 31 Wind: NNW 10 Sky: Sunny

Sampling Method: Grundfos Bladder SST Disp. Bailer Whale Grab Other: —

Dedicated Equipment: Yes No

Pumping Rate: 0.25 gpm

Well Purged Dry? Yes No

Time Pump Began: 1142 am / pm

Time Purged Dry? —

Time of Sampling: 1203 am / pm

Duplicate Sample? Yes No ID: —

Sample EH: 127.1

Sample Appearance: General: Clear Color: None Phase: None Odor: None

Time	pH	Specific Cond.	Temp °C	D. O. mg/L	Turbidity NTU	Gallons Removed	SEQ #	Comments:
<u>7</u> 1149	<u>7.15</u>	<u>1477</u>	<u>11.00</u>	<u>NA</u>	<u>NA</u>	<u>1.75</u>	1	
1156	7.15	1477	11.00			3.5	2	
1203	7.15	1479	10.99			5.25	3	
							4	
							5	

Stabilized? Yes No

Amount Water Removed: 5.25 Gallons

Comments:

Exceptions to Protocol:

Minnesota Valley Testing Laboratories, Inc.

New Ulm, MN 56073

507 354 8517

Groundwater Assessment

Sampling Personnel:

DF

Site: Otter Tail Power Co./ Big Stone

Facility ID: —

Date: 18 Oct 22

Unique Station ID: —

Sample ID: Well H9

Well Condition

Well Locked? Yes No

Well Labeled? Yes No

Casing Straight? Yes No

Protective Posts? Yes No

State ID Tag? Yes No

Grout Seal Intact? Yes No

Repairs Necessary: —

Well Information

Well Depth: 30.71

Well Casing Elevation: 1086.21

Constructed Depth: 30.20

Static Water Elevation: 1071.82

Casing Diameter: 2"

Previous Static: —

Water Level Before Purge: 14.39

Water Level After Sample: 16.75

Well Volume: 2.66 Gallons

Measurement Method: Elec. W/L Steel Tape

Sampling Information

Weather Conditions: Temp: 31 Wind: NNW 10 Sky: Sunny

Sampling Method: Grundfos Bladder S&T Disp. Bailer Whale Grab Other: —

Dedicated Equipment: Yes No Pumping Rate: 0.25 gpm

Well Purged Dry? Yes No Time Pump Began: 1213 am / pm

Time Purged Dry: — Time of Sampling: 1246 am / pm

Duplicate Sample? Yes No ID: — Sample EH: 155.0

Sample Appearance: General: Clear Color: None Phase: None Odor: None

Time	pH	Specific Cond.	Temp °C	D. O. mg/L	Turbidity NTU	Gallons Removed	SEQ #	Comments:
1224	6.59	3430	9.86	NA	NA	2.75	1	
1235	6.59	3433	9.86			5.5	2	
1246	6.59	3436	9.87			8.25	3	
							4	
							5	

Stabilized? Yes No

Amount Water Removed: 8.25 Gallons

Comments:

Exceptions to Protocol:

Appendix C

Groundwater Flow Calculations

Big Stone Ash Disposal Area Groundwater Velocity Calculation

Date 4/19/2021

Kh	2.10E-04	cm/s	Groundwater Monitoring System Report (Barr, 2016)
	5.95E-01	ft/day	
n	0.25		Groundwater Monitoring System Report (Barr, 2016)

	Top of Casing Elevation (1)	Depth to Water	Water Level Elevation
	ft amsl	ft below TOC	ft amsl
H3OX	1095.26	6.63	1088.63
H9	1086.21	6.30	1079.91

(1) Groundwater Monitoring System Report (Barr, 2016)

horizontal distance, ft

	H3OX
H9	2272.3

difference in WL elevation, ft

	H3OX
H9	8.72

horizontal gradient, ft/ft

	H3OX
H9	0.00384

V, ft/d

	H3OX
H9	0.00914

V, ft/yr

	H3OX
H9	3.3

V avg, ft/y

3.3

Big Stone Ash Disposal Area Groundwater Velocity Calculation

Date 10/18/2022

Kh	2.10E-04	cm/s	Groundwater Monitoring System Report (Barr, 2016)
	5.95E-01	ft/day	
n	0.25		Groundwater Monitoring System Report (Barr, 2016)

	Top of Casing Elevation (1)	Depth to Water	Water Level Elevation
	ft amsl	ft below TOC	ft amsl
H3OX	1095.26	7.91	1087.35
H9	1086.21	14.39	1071.82

(1) Groundwater Monitoring System Report (Barr, 2016)

horizontal distance, ft

	H3OX
H9	2272.3

difference in WL elevation, ft

	H3OX
H9	15.53

horizontal gradient, ft/ft

	H3OX
H9	0.00683

V, ft/d

	H3OX
H9	0.01627

V, ft/yr

	H3OX
H9	5.9

V avg, ft/y

5.9
