2017 Annual Groundwater Monitoring and Corrective Action Report Addendum No. 1

Ottumwa Generating Station – Ash Pond
Ottumwa, Iowa

Prepared for:

Alliant Energy

SCS ENGINEERS

25222072.00 | May 4, 2022

2830 Dairy Drive
Madison, WI 53718-6751
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1.0 INTRODUCTION

This 2017 Annual Groundwater Monitoring and Corrective Action Report Addendum (Addendum) was prepared to support compliance with the groundwater monitoring requirements of the Coal Combustion Residuals (CCR) Rule [40 CFR 257.50-107]. The original 2017 Annual Groundwater Monitoring and Corrective Report (Annual Report) was completed on January 31, 2018, to fulfill the requirements of 40 CFR 257.90(e).

The 2017 Annual Report and this Addendum cover the period of groundwater monitoring from January 1, 2017, through December 31, 2017.

This Addendum includes the following tables, figures, and appendix materials to support the information in the original 2017 Annual Report:

- Table 1 – Groundwater Monitoring Well Network
- Table 2 – Groundwater Elevation Summary
- Table 3 – Horizontal Gradients and Flow Velocities
- Table 4 – 2017 Groundwater Field Data Summary
- Figure 1 – Site Location Map
- Figure 2 – Site Plan and Monitoring Well Location
- Figure 3 – Shallow Potentiometric Surface, January 18-19, 2017
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- Appendix A – Regional Hydrogeologic Information
- Appendix B – Boring Logs and Well Construction Documentation
- Appendix C – Historical Monitoring Results

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Tables

Table 1. Groundwater Monitoring Well Network
Ottumwa Generating Station - Ash Pond / SCS Engineers Project #25222072.00

Monitoring Well	Location in Monitoring Network	Role in Monitoring Network
MW-301	Upgradient	Background
MW-302	Downgradient	Compliance
MW-303	Downgradient	Compliance
MW-304	Downgradient	Compliance
MW-305	Downgradient	Compliance
MW-306	Downgradient	Compliance

Created by:	MDB	Date:	12/17/2021
Last revision by:	JAO	Date:	3/22/2022
Checked by:	KLG	Date:	3/28/2022

\\Mad-fs01\data\Projects\25222072.00\Deliverables\2017 Fed Annual Report Addendum - OGS AP\Tables\[Table 1_GW Monitoring Well Network.xlsx]GW Summary

Table 2. Groundwater Elevations - CCR Rule Monitoring Well Networks
IPL - Ottumwa Generating Station / SCS Engineers Project #25222072.00

Ground Water or Surface Water Elevation in feet above mean sea level (amsl)									
Well Number	**MW-301**	**MW-302**	**MW-303**	**MW-304**	**MW-305**	**MW-306**	**MW-307**	**MW-308**	**MW-309**
Top of Well Casing Elevation / Surface Water Reference Elevation (feet amsl)	686.63	673.90	661.07	682.84	683.91	683.47	657.56	655.39	654.94
Screen Length (ft)	10.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Total Depth (ft from top of casing)	17.0	25.8	17.5	52.3	51.5	36.6	28.0	25.0	27.5
Top of Well Screen Elevation (ft)	679.63	653.10	648.57	635.54	637.41	651.87	634.56	635.39	632.44
Measurement Date									
April 26, 2016	682.80	655.63	652.42	655.37	661.67	670.86	NI	NI	NI
June 23, 2016	682.58	655.65	652.89	656.53	662.36	670.64	NI	NI	NI
August 9, 2016	682.27	655.52	651.76	653.79	660.78	670.35	NI	NI	NI
October 26-27, 2016	682.04	655.67	652.17	655.03	661.37	670.21	NI	NI	NI
January 18-19, 2017	681.67	655.46	651.74	654.50	660.87	669.89	648.81	647.42	646.66
April 19-20, 2017	682.15	656.35	654.57	657.48	663.27	670.69	653.62	651.09	650.16
June 20-21, 2017	681.91	655.65	652.42	654.75	661.26	669.94	649.85	648.26	647.60
August 21-23, 2017	681.28	655.13	650.58	652.39	659.00	668.77	645.78	643.12	641.82
November 8, 2017	681.54	655.40	651.34	653.03	659.76	669.04	647.37	644.99	644.20
Bottom of Well Elevation (ft)	669.63	648.10	643.57	630.54	632.41	646.87	629.56	630.39	627.44

Notes:
NI = not installed

Created by: NDK Date: 1/15/2018
Last rev. by: JAO Date: 3/22/2022
Checked by: KLG Date: 3/28/2022

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Table 3. Horizontal Gradients and Flow Velocity
Ottumwa Generating Station - Ash Pond /
SCS Engineers Project #25222072.00
January - December 2017

	Shallow				
Sampling Dates	**h1 (ft)**	**h2 (ft)**	**Δl (ft)**	**Δh/Δl (ft/ft)**	**V (ft/d)**
January 18-19, 2017	669.89	650.00	296	0.07	0.48
January 18-19, 2017	665.00	651.74	568	0.02	0.17
April 19-20, 2017	670.69	650.00	498	0.04	0.29
April 19-20, 2017	670.00	654.57	682	0.02	0.16
June 20-21, 2017	665.00	652.42	544	0.02	0.16
June 20-21, 2017	665.00	649.85	246	0.06	0.44
August 21-25, 2017	665.00	650.58	597	0.02	0.17
August 21-25, 2017	668.77	645.00	308	0.08	0.55
November 8, 2017	665.00	651.34	921	0.01	0.10
November 8, 2017	660.00	647.37	247	0.05	0.36

	Well	K Values (cm/sec)	K Values (ft/d)
Upgradient Well	MW-301	4.6E-03	13
Shallow Wells	MW-302	3.2E-03	9.1
	MW-303	1.2E-04	0.35
	MW-304	3.5E-04	0.98
	MW-305	2.5E-03	7.1
	MW-306	2.8E-03	8.1
	Geometric Mean	1.0E-03	2.8

Assumed Unconsolidated Porosity, n
0.40

Note: Geometric mean calculations do not include upgradient well MW-301
Note: Horizontal gradients were measured at two points to account for variation across the site
Groundwater flow velocity equation: V = [K*(Δh/Δl)] / n

ft = feet
ft/d = feet per day
K = hydraulic conductivity
n = effective porosity
V = groundwater flow velocity
h1, h2 = point interpreted groundwater elevation
Δl = distance between location 1 and 2
Δh/Δl = hydraulic gradient

Created by: NDK Date: 3/30/2022
Last revision by: JAO Date: 4/11/2022
Checked by: NDK Date: 4/14/2022

Table 4. 2017 Groundwater Field Data Summary
Ottumwa Generating Station - Ash Pond
SCS Engineers Project #25220072.00

Well	Sample Date	Groundwater Elevation (feet)	Field Temperature (deg C)	Field pH (Std. Units)	Oxygen, Dissolved (mg/L)	Field Specific Conductance (umhos/cm)	Field Oxidation Potential (mV)	Turbidity (NTU)
MW-301	1/18/2017	681.67	6.8	6.47	4.87	834	30.2	0.6
	4/19/2017	682.15	10.8	6.64	5.74	742	148	0.47
	6/20/2017	681.91	17.3	6.31	4.34	758	67.2	0.38
	8/23/2017	681.28	19.7	6.16	2.88	1107	41.4	0.79
	11/8/2017	681.54	13.9	6.41	4.16	743	200.7	1.03
MW-302	1/18/2017	655.46	12.9	6.62	0.18	2247	38.7	3.11
	4/19/2017	656.35	12.8	6.78	0.18	2220	121.1	2.32
	6/20/2017	655.65	13.4	6.67	0.12	2085	21	2.63
	8/22/2017	655.13	14	6.75	0.08	2991	20.8	1.32
	11/8/2017	655.4	13.8	6.55	0.4	2274	191.7	1.63
MW-303	1/18/2017	651.74	10.6	6.77	0.17	1611	21.3	3.3
	4/19/2017	654.57	10.6	7.02	0.56	1687	99.5	2.2
	6/20/2017	652.42	14.1	6.81	0.08	1670	8.6	2.77
	8/22/2017	650.58	16.8	6.53	0.08	2474	20.9	14.62
	11/8/2017	651.34	15.2	6.6	0.48	1896	176.8	3.67
MW-304	1/18/2017	654.5	12.9	7.05	0.16	2052	-79.3	1.17
	4/19/2017	657.48	13.4	7.27	0.12	2139	-40.5	1.95
	6/21/2017	654.75	13.3	7.29	0.1	2029	-66.6	1.64
	8/22/2017	652.39	13.4	6.72	0.08	2881	-10.1	0.92
	11/8/2017	653.03	13.3	7	0.25	2205	162.7	3.88

Table 4. 2017 Groundwater Field Data Summary
Ottumwa Generating Station - Ash Pond
SCS Engineers Project #25220072.00

MW-305	1/18/2017	660.87	12.8	6.96	0.09	1794	24.2	0.5
	4/19/2017	663.27	13.2	7.3	0.15	1822	17.6	0.51
	6/21/2017	661.26	13.3	7.06	0.06	1730	-4.5	1.9
	8/23/2017	659	13.3	6.88	0.12	2422	-51.3	0.58
	11/8/2017	659.76	13.2	7.01	0.2	1738	146.1	2.68
MW-306	1/18/2017	669.89	13.6	6.51	0.13	1215	44.2	0.49
	4/19/2017	670.69	13.2	6.79	0.21	1210	70.9	0.13
	6/21/2017	669.94	13.4	6.71	0.07	1151	15.1	0.14
	8/23/2017	668.77	13.2	6.46	0.08	1576	-10.5	0.74
	11/8/2017	669.04	13.6	6.49	0.18	1186	174.1	0.82

Created by: JAO Date: 3/23/2022
Last revision by: JAO Date: 3/23/2022
Checked by: KLG Date: 3/28/2022

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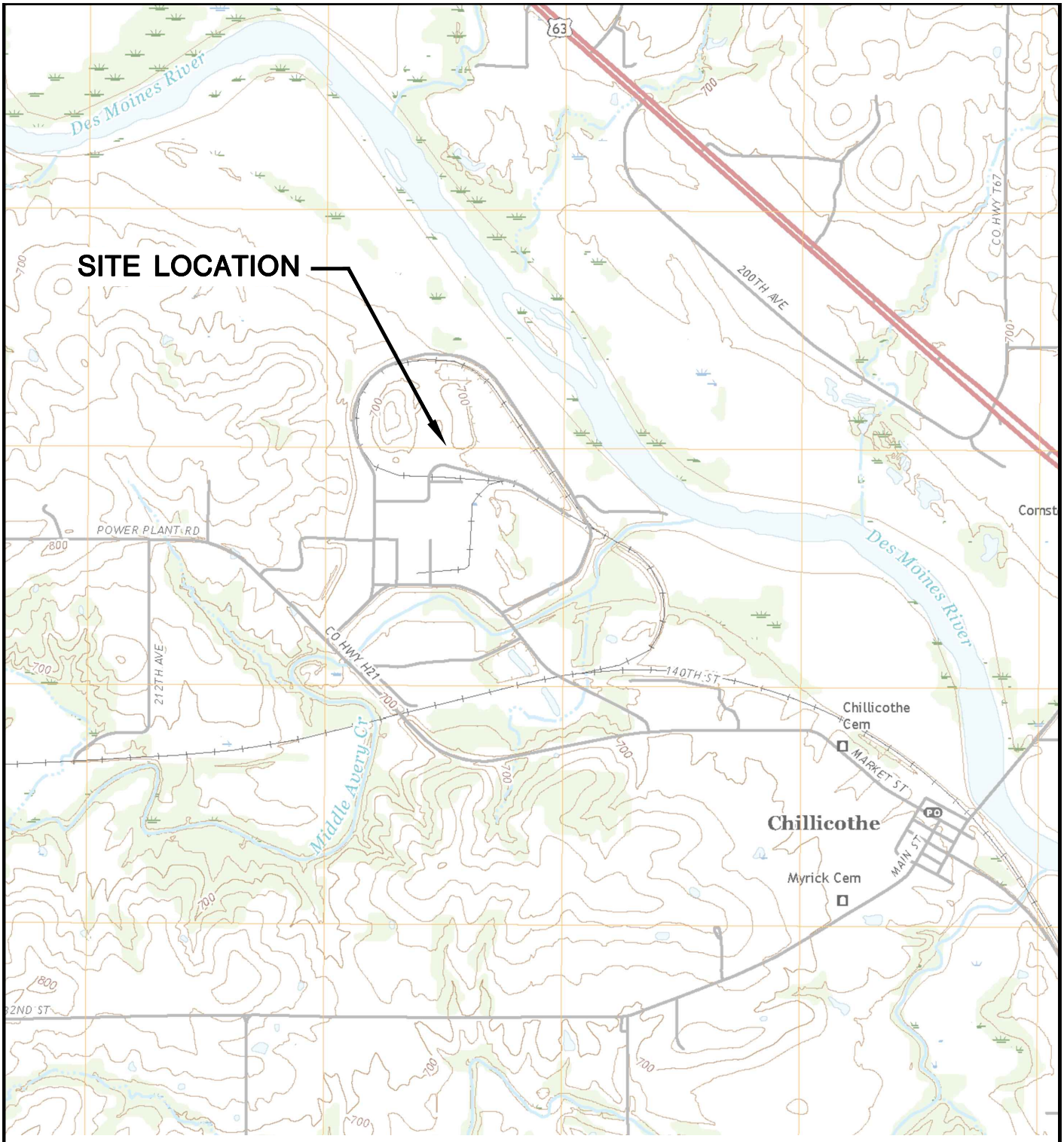
Figures



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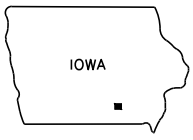
CHILLICOTHE QUADRANGLE
IOWA–WAPELLO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
2018
SCALE: 1" = 2,000'



CLIENT	INTERSTATE POWER AND LIGHT CO. 20775 POWER PLANT ROAD OTTUMWA, IA 52501	SITE	ALLIANT ENERGY OTTUMWA GENERATING STATION OTTUMWA, IOWA

SITE LOCATION MAP

PROJECT NO.	25219072.00	DRAWN BY:	BSS
DRAWN:	11/15/2019	CHECKED BY:	MDB
REVISED:	01/10/2020	APPROVED BY:	TK 01/30/2020

ENGINEER

SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830

FIGURE 1

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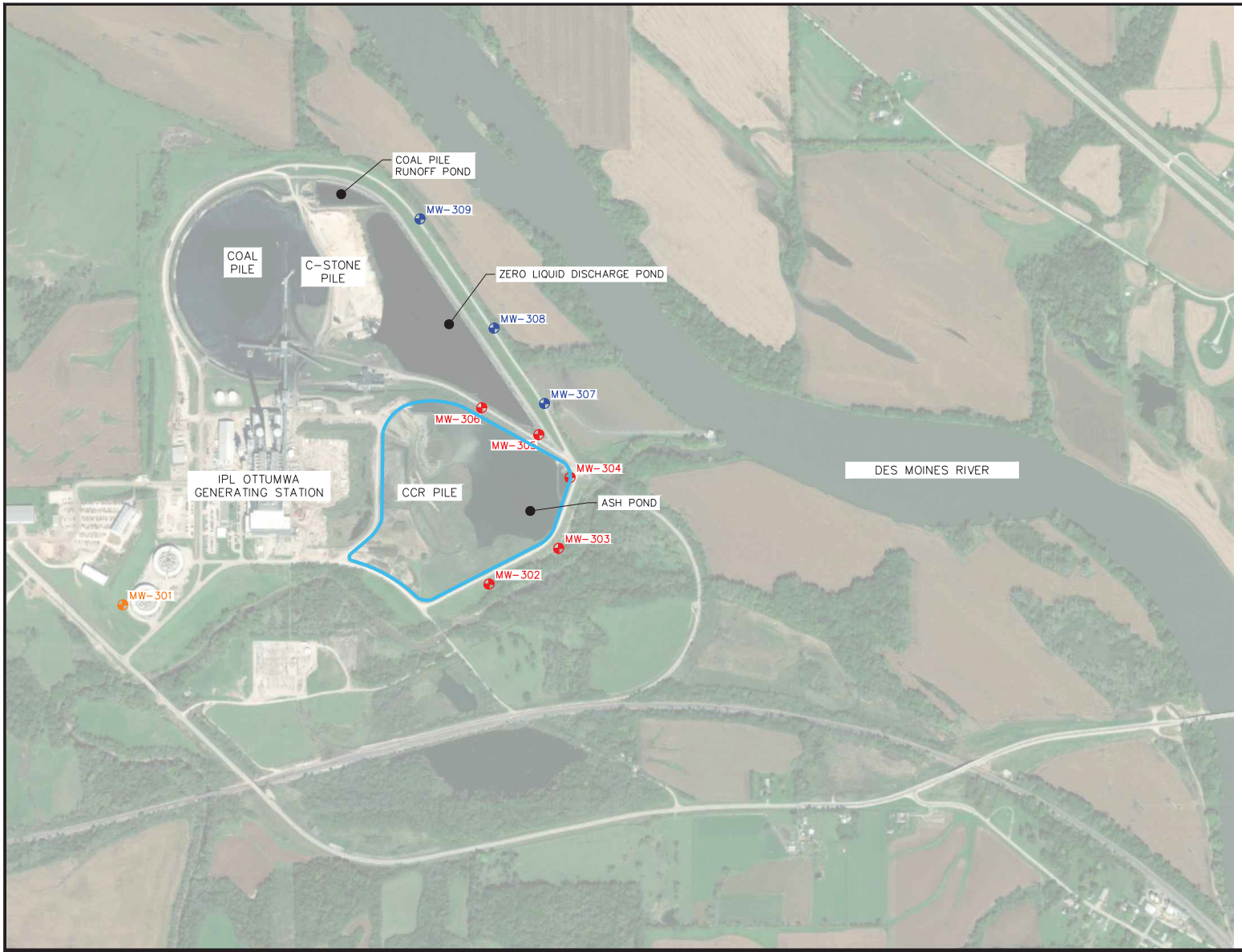

LEGEND

- CCR UNIT
- CCR ZLDP MONITORING WELL
- CCR ASH POND MONITORING WELL
- CCR BACKGROUND MONITORING WELL

NOTES:

1. 2014 AERIAL PHOTOGRAPH SOURCES: ESRI, DIGITALGLOBE, GEOEYE, I-CUBED, USDA FSA, USGS, AEX, GETMAPPING, AEROGRID, IGN, IGP, SWISSTOPO, AND THE GIS USER COMMUNITY.
2. CCR UNIT LIMITS ARE APPROXIMATE.
3. MONITORING WELLS MW-301, MW-302, AND MW-304, WERE INSTALLED BY CASCADE DRILLING, LLP. UNDER THE SUPERVISION OF SCS ENGINEERS FROM NOVEMBER 11-12, 2015.
4. MONITORING WELLS MW-303 AND MW-305 WERE INSTALLED BY CASCADE DRILLING LLP. UNDER THE SUPERVISION OF SCS ENGINEERS ON DECEMBER 7-8, 2015.
5. MONITORING WELLS MW-307, MW-308, AND MW-309 WERE INSTALLED BY CASCADE DRILLING, LLP. UNDER THE SUPERVISION OF SCS ENGINEERS FROM OCTOBER 25-27, 2016.
6. THE BACKGROUND MONITORING WELL FOR THE OGS ASH POND IS MW-301.

N

800 0 800

SCALE: 1" = 800'

PROJECT NO.	25222072.00	DRAWN BY:	KP
DRAWN:	04/06/2022	CHECKED BY:	NDK
REVISED:	04/06/2022	APPROVED BY:	TK 05/03/2022

ENGINEER: SCS ENGINEERS
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CLIENT: INTERSTATE POWER AND LIGHT CO.
20775 POWER PLANT ROAD
OTTUMWA, IA 52501

SITE: ALLIANT ENERGY
OTTUMWA GENERATING STATION
OTTUMWA, IOWA

SITE PLAN AND MONITORING WELL LOCATIONS-ASH POND

FIGURE 2

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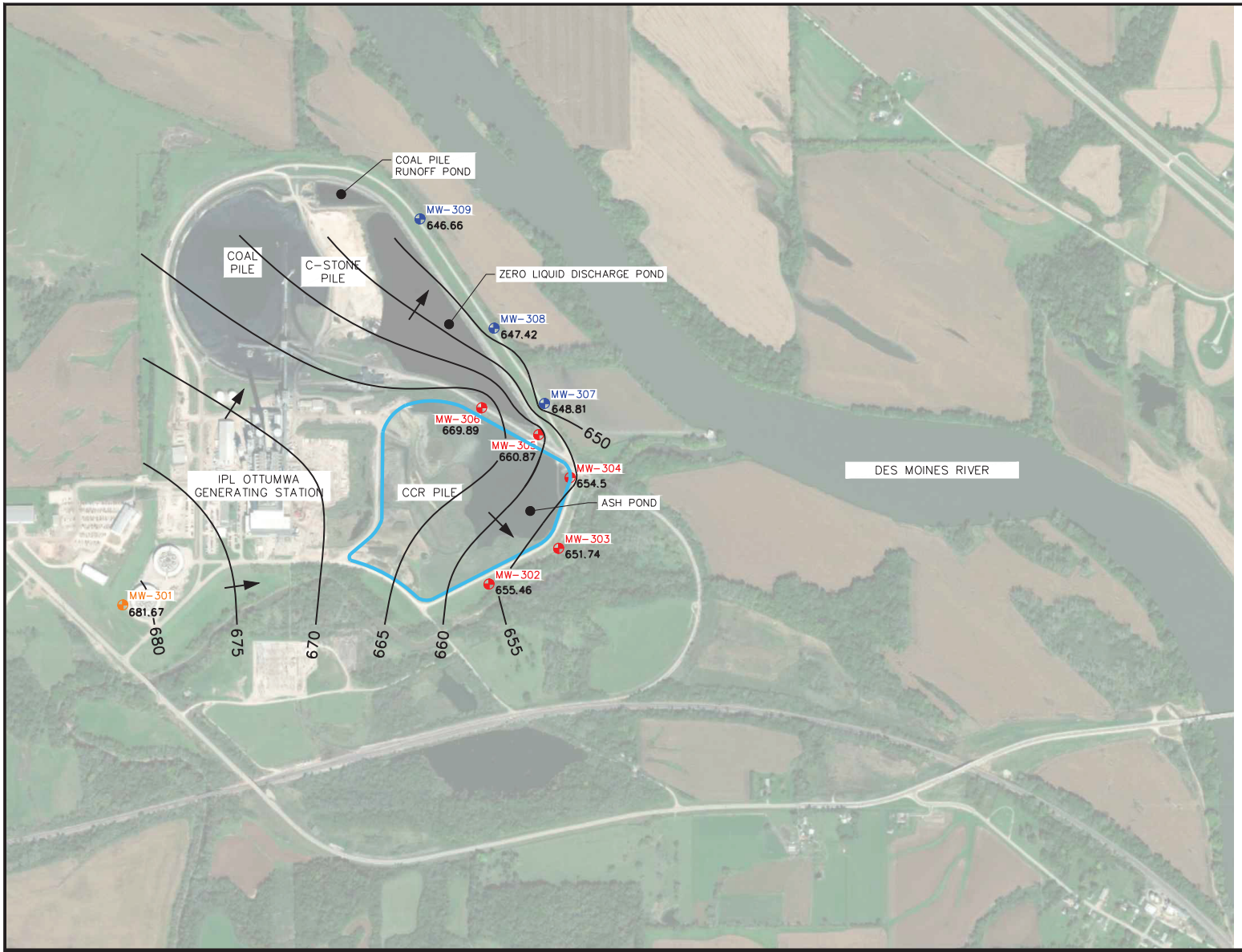

LEGEND

- CCR UNIT
- CCR ZLDP MONITORING WELL
- CCR ASH POND MONITORING WELL
- CCR BACKGROUND MONITORING WELL
- 682.15 — POTENTIOMETRIC ELEVATION AT WELL (JANUARY 18–19, 2017)
- POTENTIOMETRIC SURFACE CONTOUR
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTE:

1. THE BACKGROUND MONITORING WELL FOR THE OGS ASH POND IS MW-301.

N

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SCALE: 1" = 800'

PROJECT NO.	25222072.00	DRAWN BY:	KP
DRAWN:	04/06/2022	CHECKED BY:	NDK
REVISED:	04/08/2022	APPROVED BY:	TK 05/03/2022

ENGINEER: SCS ENGINEERS
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OTTUMWA GENERATING STATION
OTTUMWA, IOWA

SHALLOW POTENTIOMETRIC SURFACE
JANUARY 18–19, 2017

FIGURE 3

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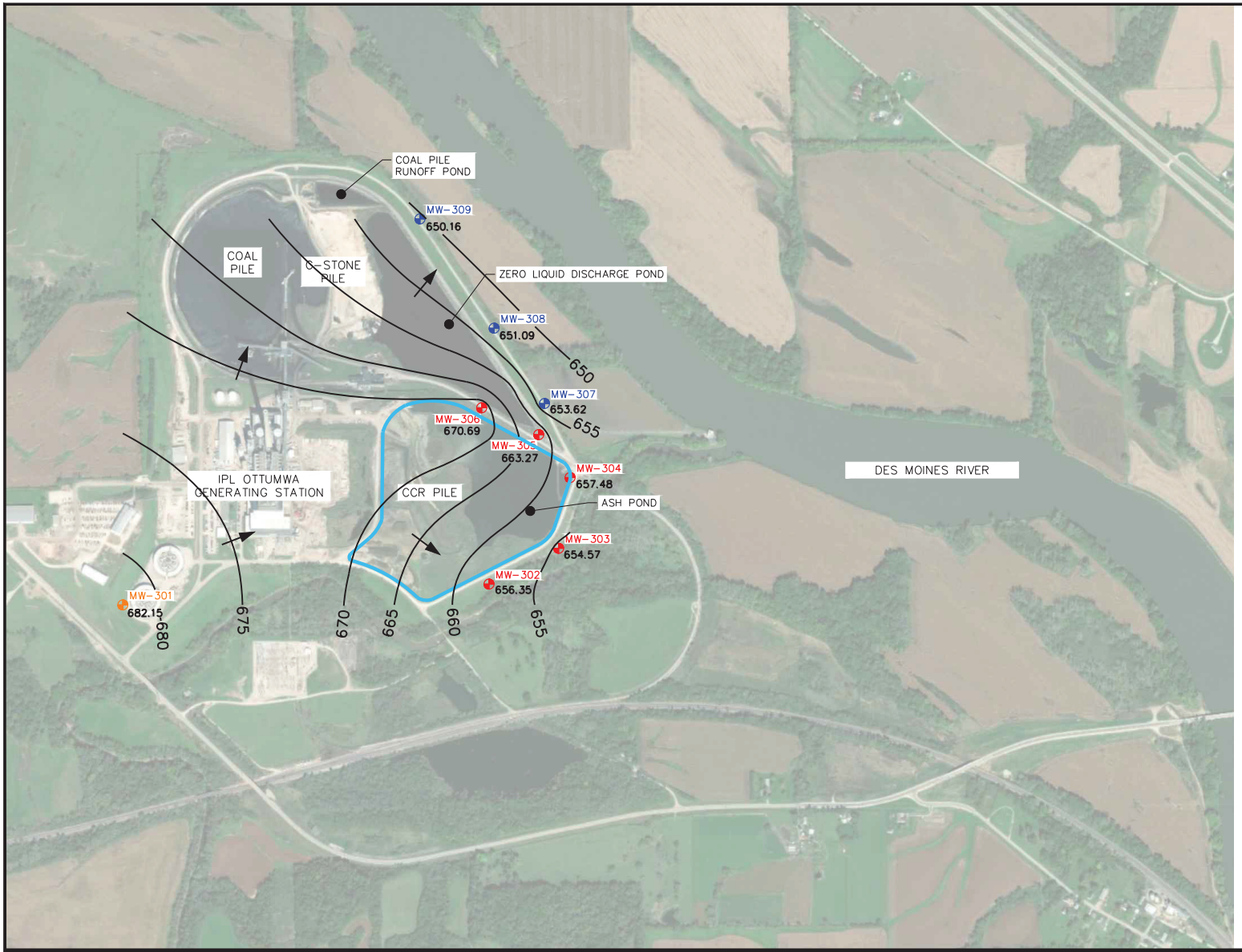

LEGEND

- CCR UNIT
- CCR ZLDP MONITORING WELL
- CCR ASH POND MONITORING WELL
- CCR BACKGROUND MONITORING WELL
- 682.15 — POTENTIOMETRIC ELEVATION AT WELL (APRIL 19–20, 2017)
- POTENTIOMETRIC SURFACE CONTOUR
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTE:

1. THE BACKGROUND MONITORING WELL FOR THE OGS ASH POND IS MW-301.

N

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SCALE: 1" = 800'

PROJECT NO.	25222072.00	DRAWN BY:	KP
DRAWN:	03/26/2022	CHECKED BY:	NDK
REVISED:	04/08/2022	APPROVED BY:	TK 05/03/2022

ENGINEER: SCS ENGINEERS
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CLIENT: INTERSTATE POWER AND LIGHT CO.
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OTTUMWA, IA 52501

SITE: ALLIANT ENERGY
OTTUMWA GENERATING STATION
OTTUMWA, IOWA

SHALLOW POTENTIOMETRIC SURFACE
APRIL 19–20, 2017

FIGURE 4

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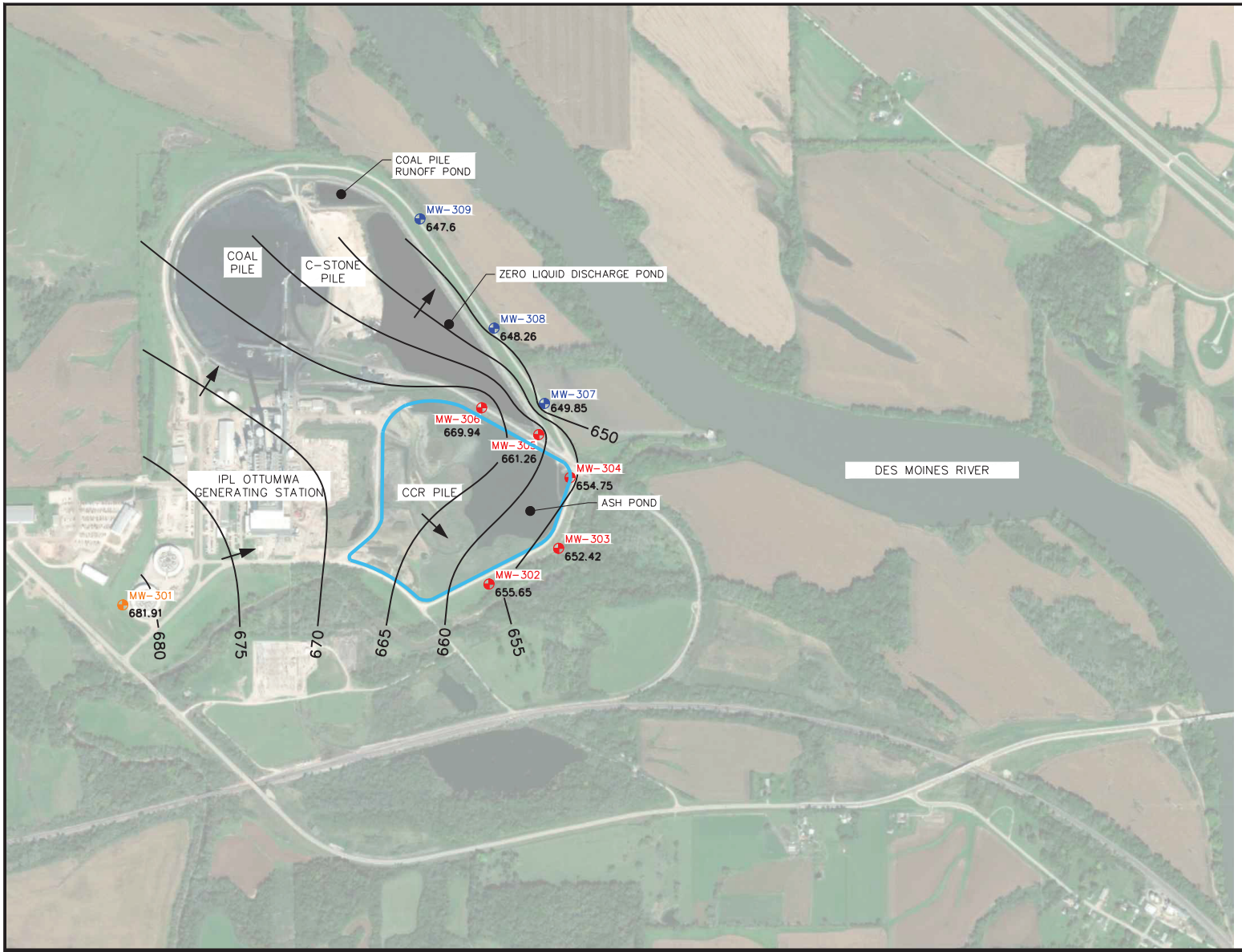

LEGEND

- CCR UNIT
- CCR ZLDP MONITORING WELL
- CCR ASH POND MONITORING WELL
- CCR BACKGROUND MONITORING WELL
- 682.15 — POTENTIOMETRIC ELEVATION AT WELL (JUNE 20–21, 2017)
- POTENTIOMETRIC SURFACE CONTOUR
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTE:

1. THE BACKGROUND MONITORING WELL FOR THE OGS ASH POND IS MW-301.

N

800 0 800

SCALE: 1" = 800'

PROJECT NO.	25222072.00	DRAWN BY:	KP
DRAWN:	04/06/2022	CHECKED BY:	NDK
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ENGINEER: SCS ENGINEERS
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OTTUMWA GENERATING STATION
OTTUMWA, IOWA

SHALLOW POTENTIOMETRIC SURFACE
JUNE 20–21, 2017

FIGURE 5

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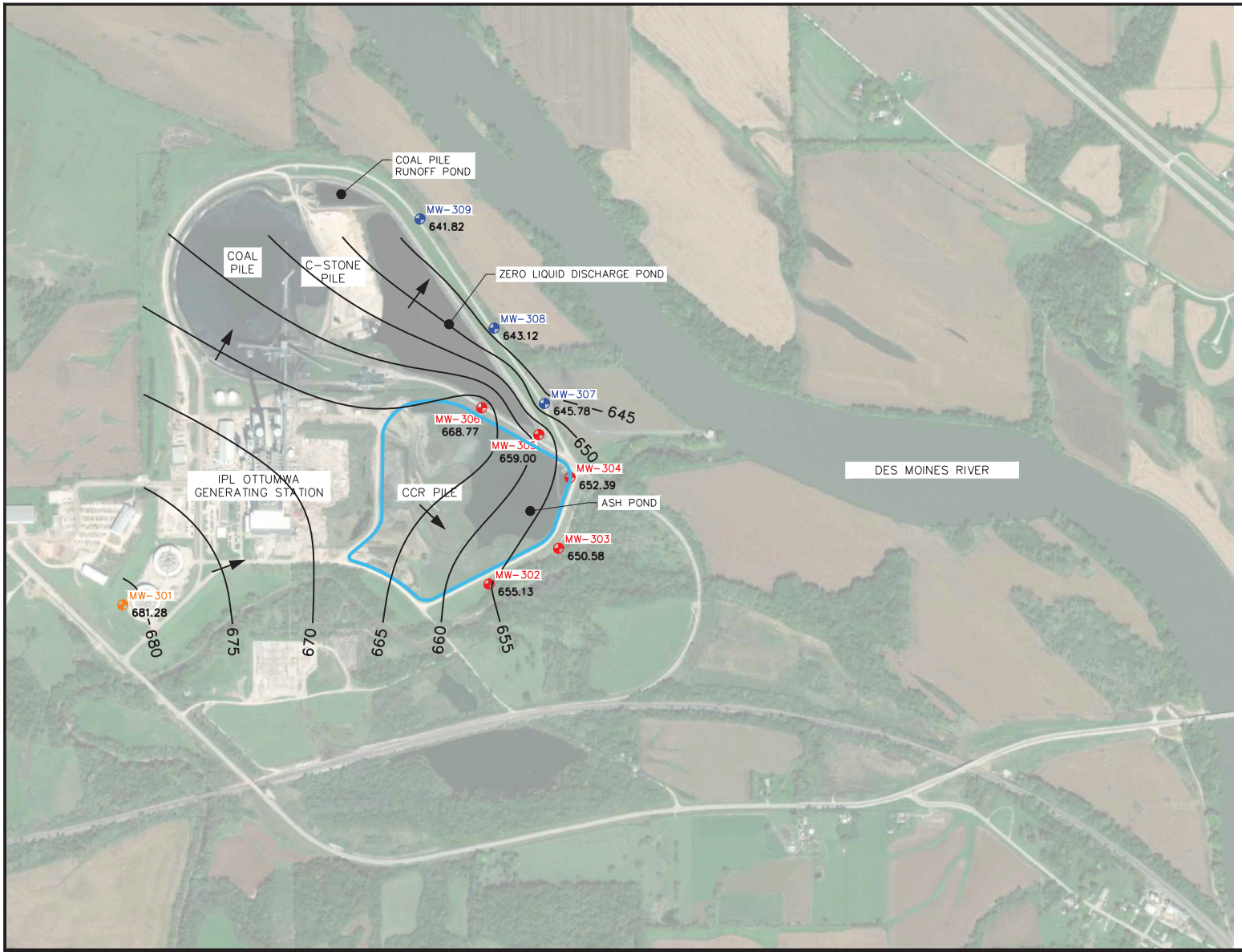

LEGEND

- CCR UNIT
- CCR ZLDP MONITORING WELL
- CCR ASH POND MONITORING WELL
- CCR BACKGROUND MONITORING WELL
- 682.15 — POTENTIOMETRIC ELEVATION AT WELL (AUGUST 21–23, 2017)
- POTENTIOMETRIC SURFACE CONTOUR
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTE:

1. THE BACKGROUND MONITORING WELL FOR THE OGS ASH POND IS MW-301.

N

800 0 800

SCALE: 1" = 800'

PROJECT NO.	25222072.00	DRAWN BY:	KP
DRAWN:	04/06/2022	CHECKED BY:	NDK
REVISED:	04/08/2022	APPROVED BY:	TK 05/03/2022

ENGINEER: SCS ENGINEERS
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OTTUMWA GENERATING STATION
OTTUMWA, IOWA

SHALLOW POTENTIOMETRIC SURFACE
AUGUST 21–23, 2017

FIGURE 6

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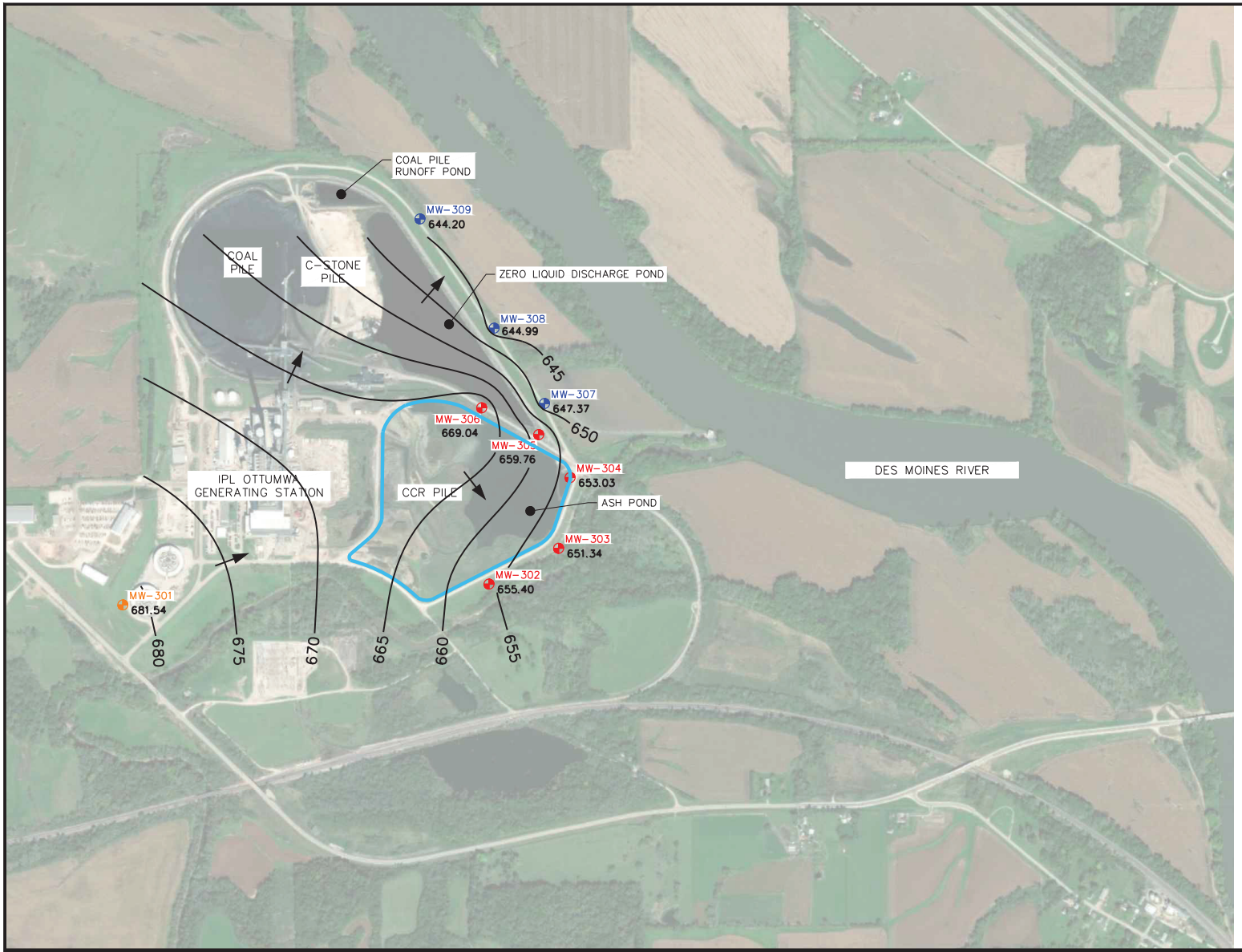

LEGEND

- CCR UNIT
- CCR ZLDP MONITORING WELL
- CCR ASH POND MONITORING WELL
- CCR BACKGROUND MONITORING WELL
- 682.15 — POTENTIOMETRIC ELEVATION AT WELL (NOVEMBER 8, 2017)
- POTENTIOMETRIC SURFACE CONTOUR
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTE:

1. THE BACKGROUND MONITORING WELL FOR THE OGS ASH POND IS MW-301.

N

800 0 800

SCALE: 1" = 800'

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DRAWN:	04/06/2022	CHECKED BY:	NDK
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OTTUMWA, IOWA

SHALLOW POTENTIOMETRIC SURFACE
NOVEMBER 8, 2017

FIGURE 7

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Appendix A

Regional Hydrogeologic Information

Table OGS-2. Regional Hydrogeologic Stratigraphy
Ottumwa Midland Landfill / SCS Engineers Project #25215053.01

Age of Rocks	Hydrogeologic Unit	General Thickness (feet)	Name of Rock Unit*	Type of Rock
Quaternary (0-1 million years old)	Surficial Aquifers • Alluvial • Buried-Channel • Drift	0 to 320	Undifferentiated	• Sand, gravel, silt, and clay • Sand, gravel, silt, and clay • Till (sandy, pebbly clay), sand, and silt
Pennsylvanian (180 to 310 million years old)	Aquiclude	0 to 370	Undifferentiated	• Shale, sandstone, limestone, and coal
Mississippian (310 to 345 million years old	Mississippian Aquifer • Upper	0 to 600	St. Louis Spergen	• Limestone and sandstone • Limestone
	• Lower		Warsaw Keokuk Burlington Hampton Starrs Cave	• Shale and dolomite • Dolomite, limestone, and shale • Dolomite and limestone • Limestone and dolomite • Limestone
	Aquiclude	0 to 425	Prospect Hill McCraney	• Siltstone • Limestone
Devonian (345 to 400 million years old)			Yellow Spring Lime Creek	• Shale, dolomite, and siltstone • Dolomite and shale
	Devonian Aquifer	110 to 420	Cedar Valley Wapsipinicon	• Limestone and dolomite • Dolomite, limestone, shale, and gypsum
Silurian (400 to 425 million years old)		0 to 105	Undifferentiated	• Dolomite
Ordovician (425 to 500 million years old)	Aquiclude	150 to 600	Maquoketa Galena Decorah Platteville	• Dolomite and shale • Dolomite and chert • Limestone and shale • Limestone, shale, and sandstone
	Cambrian-Ordovician aquifer	750 to 1,110	St. Peter Prairie du Chien	• Sandstone • Dolomite and sandstone
Cambrian (500 to 600 million years old)			Jordan St. Lawrence	• Sandstone • Dolomite
	Not considered an aquifer in southeast Iowa	450 to 750+	Franconia Galesville Eau Claire Mt. Simon	• Shale, siltstone, and sandstone • Sandstone • Sandstone, shale, and dolomite • Sandstone
Precambrian (600 million to 2 billion + years old)				• Sandstone, igneous rocks, and metamorphic rocks

*This nomenclature and classification of rock units in this report are those of the Iowa Geological Survey and do not necessarily coincide with those accepted by the U.S. Geological Survey.

Source: "Water Resources of Southeast Iowa," Iowa Geologic Survey Water Atlas No. 4.

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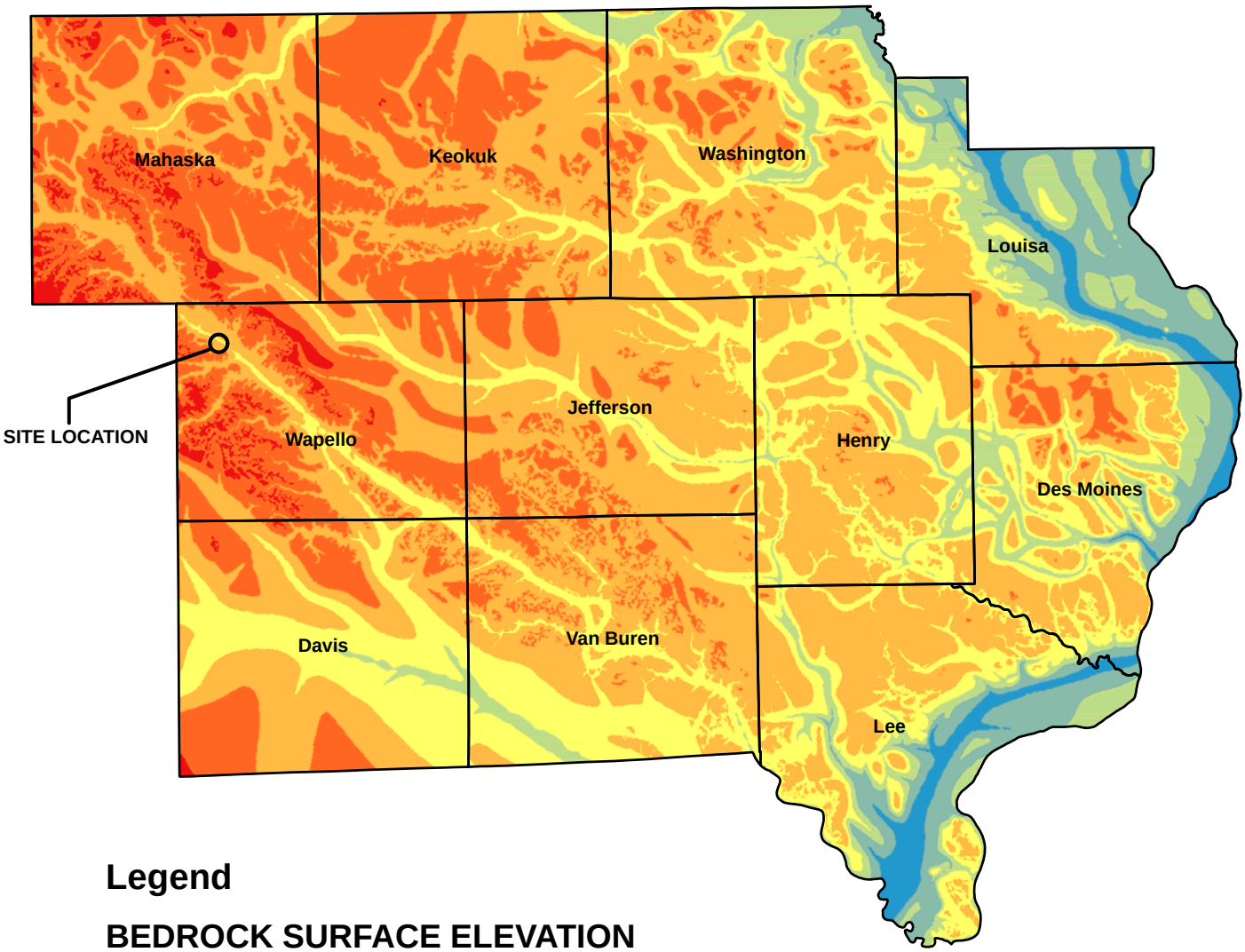

Legend

BEDROCK SURFACE ELEVATION

ELEVATION ABOVE MEAN SEA LEVEL IN FEET

- BELOW 300
- 300 TO 400
- 400 TO 500
- 500 TO 600
- 600 TO 700
- 700 TO 800
- 800 TO 900

N

0 5 10 20 Miles

MAP DATA DERIVED FROM IOWA GEOLOGICAL AND WATER SURVEY
IOWA BEDROCK SURFACE ELEVATION AS OBTAINED
FROM IOWA NATURAL RESOURCES
GEOGRAPHIC INFORMATION SYSTEMS LIBRARY

CLIENT	INTERSTATE POWER AND LIGHT CO. 20775 POWER PLANT ROAD OTTUMWA, IA 52501	SITE	OTTUMWA GENERATING STATION OTTUMWA, IOWA	SE IOWA REGIONAL BEDROCK SURFACE ELEVATION

PROJECT NO.	25215053.03	DRAWN BY:	JB	ENGINEER	FIGURE
DRAWN:	07/29/13	CHECKED BY:	MDB		
REVISED:	05/29/15	APPROVED BY:			

SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830 FAX: (608) 224-2839

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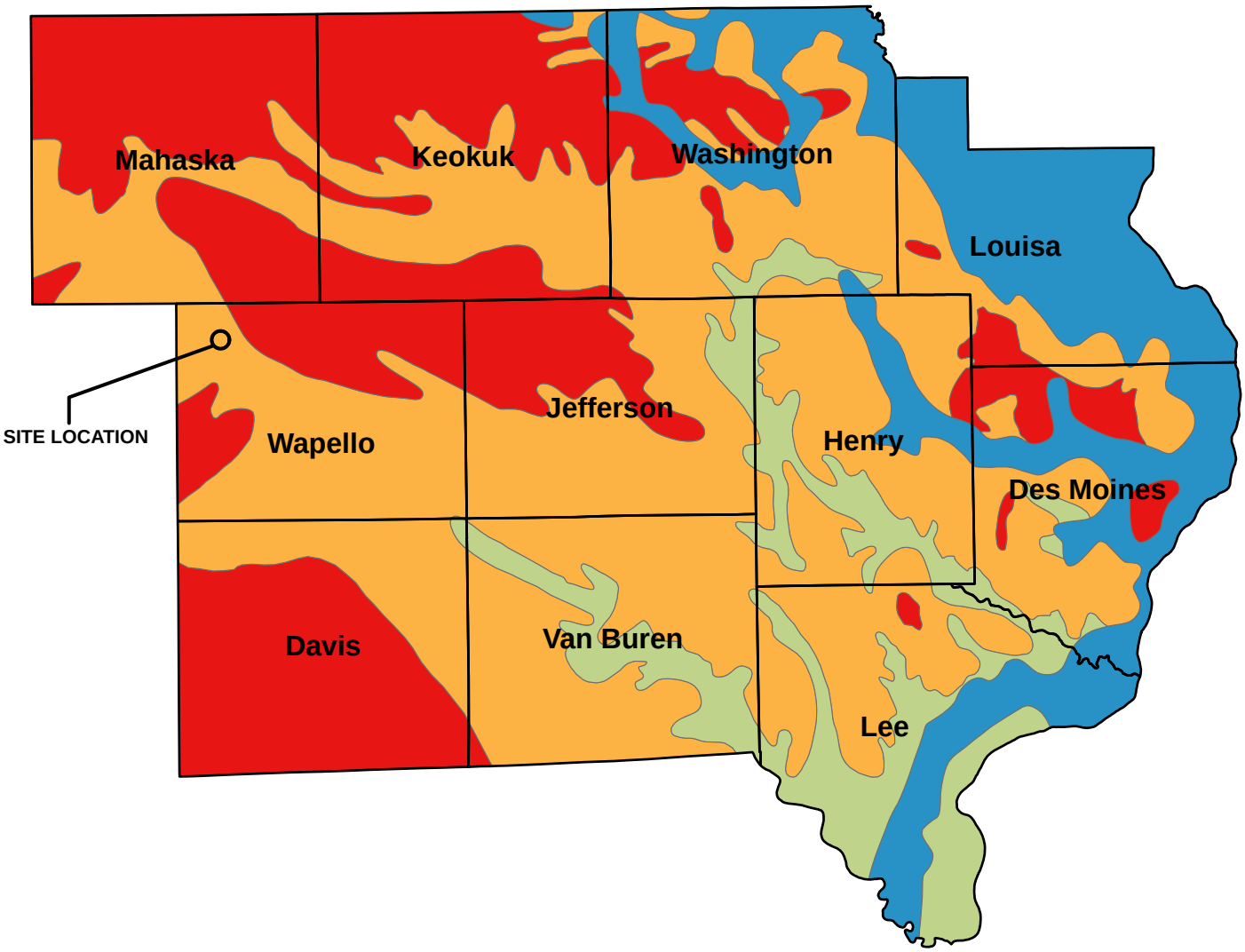

Legend

MISSISSIPIAN AQUIFER POTENTIOMETRIC SURFACE

ELEVATION ABOVE MEAN SEA LEVEL IN FEET

- MISSISSIPPIAN NOT PRESENT
- 550
- 650
- 750

N

0 5 10 20 Miles

MAP DATA DERIVED FROM IOWA GEOLOGICAL AND WATER SURVEY
MISSISSIPIAN AQUIFER POTENTIOMETRIC SURFACE ELEVATION AS OBTAINED
FROM IOWA NATURAL RESOURCES
GEOGRAPHIC INFORMATION SYSTEMS LIBRARY

CLIENT	INTERSTATE POWER AND LIGHT CO. 20775 POWER PLANT ROAD OTTUMWA, IA 52501	SITE	OTTUMWA GENERATING STATION OTTUMWA, IOWA

SE IOWA
REGIONAL MISSISSIPIAN AQUIFER
POTENTIOMETRIC SURFACE ELEVATION

PROJECT NO.	25215053.03	DRAWN BY:	JB
DRAWN:	07/29/13	CHECKED BY:	MDB
REVISED:	05/29/15	APPROVED BY:	

ENGINEER

SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830 FAX: (608) 224-2839

FIGURE

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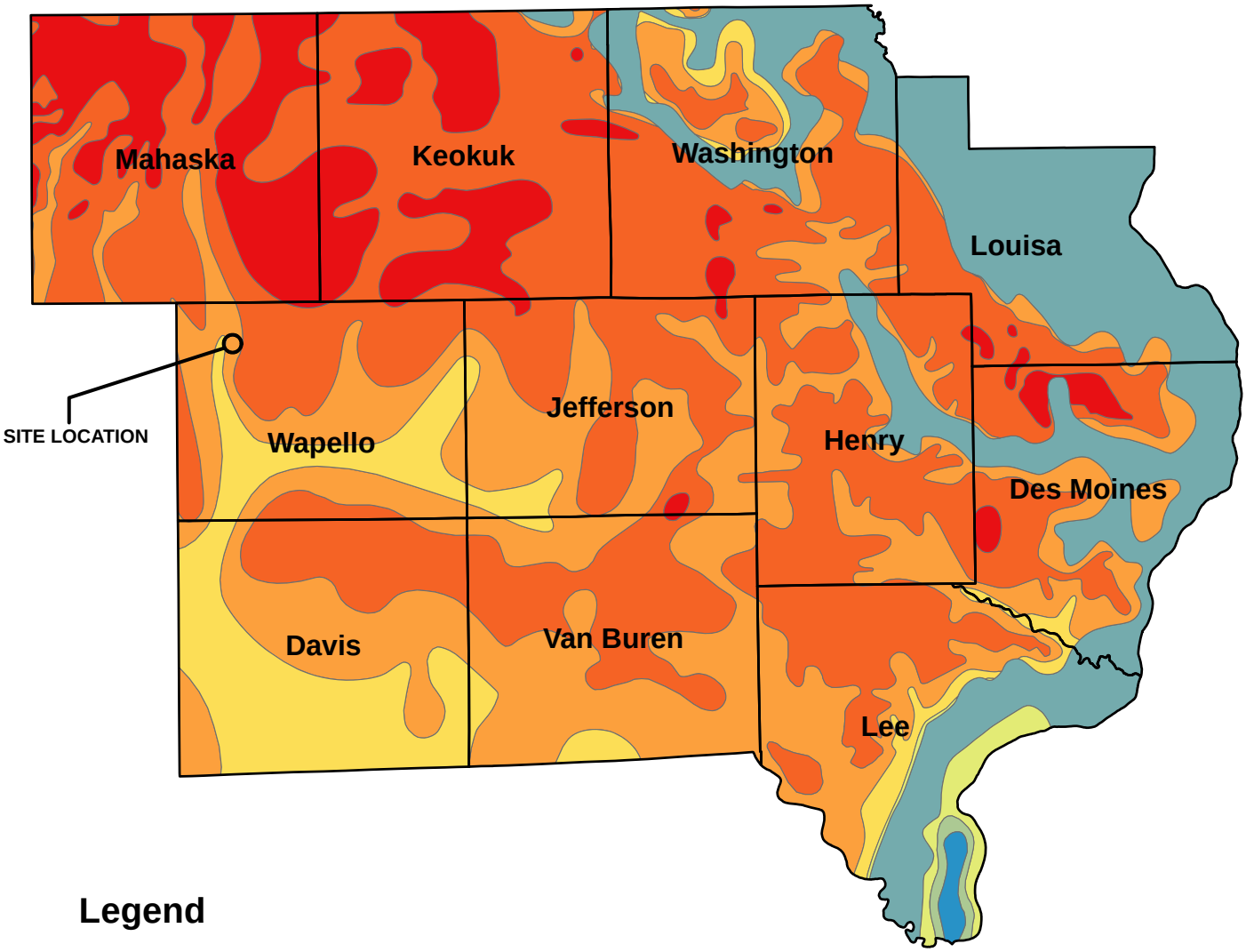

Legend

MISSISSIPIAN AQUIFER ELEVATION

ELEVATION ABOVE MEAN SEA LEVEL IN FEET

- MISSISSIPPIAN NOT PRESENT
- 150
- 250
- 350
- 450
- 550
- 650
- 750

N

0 5 10 20 Miles

MAP DATA DERIVED FROM IOWA GEOLOGICAL AND WATER SURVEY MISSISSIPPIAN AQUIFER SURFACE ELEVATION AS OBTAINED FROM IOWA NATURAL RESOURCES GEOGRAPHIC INFORMATION SYSTEMS LIBRARY

CLIENT	INTERSTATE POWER AND LIGHT CO. 20775 POWER PLANT ROAD OTTUMWA, IA 52501	SITE	OTTUMWA GENERATING STATION OTTUMWA, IOWA	SE IOWA REGIONAL MISSISSIPIAN AQUIFER SURFACE ELEVATION

PROJECT NO.	25215053.03	DRAWN BY:	JB	ENGINEER	FIGURE
DRAWN:	07/29/13	CHECKED BY:	MDB		
REVISED:	05/29/15	APPROVED BY:			

SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830 FAX: (608) 224-2839

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Appendix B

Boring Logs and Well Construction Documentation

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL- Ottumwa Generating Station SCS#: 25215135.40		MW-301

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Todd Schmalfeld Cascade Drilling	11/10/2015	11/10/2015	4-1/4 hollow stem auger

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-301	Feet	684.3 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 400,077 N, 1,899,709 E S/C/N
NW 1/4 of SW 1/4 of Section 26, T 73 N, R 15 W
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0	TOPSOIL.	TOPSOIL									
			1	SANDY SILT WITH GRAVEL, gray (7.5YR 6/1), gravel is fine.										
			2											
			3											
			4		ML									
S1	10	woh 1 3 9	5							W				
			6											
			7	WEATHERED SANDSTONE, very weak, light gray matrix (10YR 7/1), scondary color very dark gray 910YR 3/1), massive.										
S2	13	24 50	8							W				
			9											
			10											
S3	5	50	11		SANDSTONE					W				
			12											
S4	6	50	13							W				
			14											
S5	4	50	15							W				
				Endo of Boring at 15 feet bgs.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature for Kyle Kramer

Firm SCS Engineers
2830 Dairy Drive Madison, WI 53718

Tel: (608) 224-2830
Fax:

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL- Ottumwa Generating Station SCS#: 25215135.40		MW-302

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Todd Schmalfeld Cascade Drilling	11/10/2015	11/10/2015	4-1/4 hollow stem auger

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-302	Feet	671.6 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 400,267 N, 1,902,625 E S/C/N
NE 1/4 of SE 1/4 of Section 26, T 73 N, R 15 W
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1	TOPSOIL.	TOPSOIL									
			2	LEAN CLAY WITH SAND, dark gray (10YR 4/1).										
			3											
			4											
			5											
			6											
			7		CL									
			8											
			9											
			10											
S1	19	1 4 5 7	11							M				
			12											
S2	19	2 4 7 11	13							M				
			14	LEAN CLAY WITH SAND, very dark gray (5Y 3/1).										
			15		CL									
			16											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature for Kyle Kramer
Firm SCS Engineers
2830 Dairy Drive Madison, WI 53718
Tel: (608) 224-2830
Fax:

Boring Number MW-302 Page 2 of 2

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
S3	24	2 3 9 9	17	POORLY GRADED SAND, olive yellow (2.5Y 6/6).	SP					M				
			18	LEAN CLAY, dark grayish brown (10YR 4/2).	CL									
S4	24	4 4 4 4	19	POORLY GRADED GRAVEL, fine.	GP					W				saturation @ 18 ft bgs.
			20	LEAN CLAY, brownish yellow (10YR 6/8).	CL									
S5	15	2 3 3 6	21	POORLY GRADED GRAVEL WITH CLAY, gray (10YR 5/1), fine.	GP-GC					W				
			22											
S6	24	3 4 8 9	23							W				
			24	POORLY GRADED SAND, gray (10YR 5/1), medium grained.	SP									
			25											
S7	24	4 3 6 8	26							W				
			27											
			28	Same as above, but brown (10YR 5/3).										
S8	24	7 8 11 9	29	POORLY GRADED SAND, gray (10YR 5/1), fine grained, (weathered bedrock?).	SP					W				
			30	Medium grained.										
S9	23	5 14 33 50/.4	31							W				
			32											
			33											
S10	12	12 50/.3	34							W				
			35	POORLY GRADED SAND, olive yellow (2.5Y 7/1), fine grained, (weathered bedrock?).	SP									
S11	3	50/.3	36							W				
			37	End of Boring at 37 feet bgs.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL- Ottumwa Generating Station SCS#: 25215135.40		MW-303

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Todd Schmalfeld Cascade Drilling	12/8/2015	12/8/2015	4-1/4 hollow stem auger

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-303	Feet	659.0 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 400,583 N, 1,903,215 E S/C/N
NE 1/4 of SE 1/4 of Section 26, T 73 N, R 15 W
Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1–8	FILL, boring location was cleared to 9' bgs by hydrovac, then back filled.	FILL									
S1	1	50	9–11	WEATHERED SANDSTONE, medium grained, brown (10YR 5/4).	SANDSTONE					W				
S2	NR		12–14											
				End of Boring at 14.5 ft bgs.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature for Kyle Kramer

Firm SCS Engineers
2830 Dairy Drive Madison, WI 53718
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Fax:

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL- Ottumwa Generating Station SCS#: 25215135.40		MW-304

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Todd Schmalfeld Cascade Drilling	11/11/2015	11/11/2015	4-1/4 hollow stem auger

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-304	Feet	680.1 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 401,152 N, 1,903,287 E S/C/N
SE 1/4 of NE 1/4 of Section 26, T 73 N, R 15 W
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N Feet ☐ S ☐ E Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1	TOPSOIL.	TOPSOIL									
			1	FAT CLAY, black (10YR 2/1).										
			2											
			3											
			4											
			5											
			6											
			7		CH									
			8											
			9											
			10											
S1	23	4 5 4 5	11							M				
			12											
			13	FAT CLAY, yellowish brown (10YR 5/4).										
S2	19.5	4 4 5 5	14		CH					M				
			15	FAT CLAY, yellowish brown (10YR 3/4).										
			16		CH									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature for Kyle Kramer

Firm SCS Engineers
2830 Dairy Drive Madison, WI 53718

Tel: (608) 224-2830
Fax:

Boring Number MW-304 Page 2 of 3

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
S3	12	3 3 4 5	17	FAT CLAY, yellowish brown (10YR 3/4). *(continued)*						M				
S4	22	4 3 7 12	18 19							M				
S5	23	2 7 8 9	20 21							M				
S6	23	3 4 8 6	22 23 24							M				
S7	23	5 11 15 11	25 26		CH					M				
S8	15	4 4 5 6	27 28 29							M				
S9	18	4 6 9 9	30 31							M				
S10	24	4 6 7 6	32 33 34							M				
S11	16	2 2 4 6	35 36	FAT CLAY, DARK OLIVE BROWN (2.5Y 3/3).						M				
S12	24	4 3 5 5	37 38 39		CH					M				
S13	18	2 3 3 3	40 41							M				
			42											

Boring Number MW-304 Page 3 of 3

Sample 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/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			43	FAT CLAY, DARK OLIVE BROWN (2.5Y 3/3). *(continued)*	CH									
S14	24	3 4 9 14	44	SANDY SILT, very dark gray.	ML					W				
			45	POORLY GRADED SAND, medium grained, gray (5Y 6/1), (weathered bedrock).										
S16	15	30 50/.4	46							W				
			47											
S17	5	33 50/.2	48		SP					W				
			49											
			50											
S18		50/.4	51							W				
			52	End of Boring at 52 feet bgs.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL- Ottumwa Generating Station SCS#: 25215135.40		MW-305

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Todd Schmalfeld Cascade Drilling	12/7/2015	12/8/2015	4-1/4 hollow stem auger

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-305	Feet	681.5 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 401,473 N, 1,903,023 E S/C/N
SE 1/4 of NE 1/4 of Section 26, T 73 N, R 15 W
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1	TOPSOIL	TOPSOIL									
				GRAVEL	GP									
			2	FAT CLAY										
			3											
			4											
			5											
			6											
			7											
			8											
			9		CH									
			10	FAT CLAY, very dark grayish brown (10YR 3/2).										
S1	18	3 6 9 11	11							W				
			12											
S2	22	3 7 14 22	13	same as above except, brown (10YR 4/3).						W				
			14											
			15											
			16											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature for Kyle Kramer
Firm SCS Engineers
2830 Dairy Drive Madison, WI 53718
Tel: (608) 224-2830
Fax:

Boring Number MW-305 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	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
S3	22	5 15 14 15	17	FAT CLAY *(continued)*										
S4	20	3 5 13 15	18 19 20		CH									
S5	24	4 5 7 11	21 22	FAT CLAY WITH SILT, dark gray (10YR 4/1).						M				
S6	20	7 11 15 20	23 24	same as above except, very dark brown (10YR 2/2).						M				
S7	24	4 8 11 12	25 26 27	same as above except, very dark gray (10YR 3/1).	CH					M				
S8	24	8 12 16 21	28 29							M				
S9	13	4 4 7 12	30 31 32							M				
S10	24	5 6 9	33 34	LEAN CLAY, very dark brown (10YR 2/2).						W				
S11	24	4 4 5 7	35 36 37		CL					W				
S12	22	2 2 3 5	38 39 40	same as above except, very dark grayish brown (10YR 3/2).						W				
S13	6	3 9 11	41 42	POORLY GRADED SANDY GRAVEL, fine, brown (10YR 4/3).	GPS					W				water @ 41.0 ft bgs.

Boring Number MW-305 Page 3 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	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
S14	22	23 50	43	POORLY GRADED SAND, medium grained, yellowish brown (10YR 5/4), (weathered bedrock). *(continued)*	SP					S				
			44											
			45											
S15	6	5 10 50	46		SP					S				
			47											
			48											
S16	6	50	49							S				
			50	End of Boring at 50 ft bgs.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL- Ottumwa Generating Station SCS#: 25215135.40		MW-306

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Todd Schmalfeld Cascade Drilling	11/12/2015	11/12/2015	4-1/4 hollow stem auger

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-306	Feet	681.1 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 401,666 N, 1,902,629 E S/C/N
SE 1/4 of NE 1/4 of Section 26, T 73 N, R 15 W
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N Feet ☐ S ☐ E Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1	TOPSOIL.	TOPSOIL									
			1	FAT CLAY, dark olive brown (2.5Y 3/3).										
			2											
			3											
			4											
			5											
			6											
			7		CH									
			8											
			9											
			10											
S1	18	3 6 9 11	11							M				
			12											
			13	FAT CLAY, gray (10YR 5/1).										
S2	22	5 6 7 9	14							M				
			15		CH									
			16											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature for Kyle Kramer

Firm SCS Engineers
2830 Dairy Drive Madison, WI 53718

Tel: (608) 224-2830
Fax:

Boring Number MW-306 Page 2 of 2

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
S3	22	5 10 10 14	17	FAT CLAY, gray (10YR 5/1). *(continued)* FAT CLAY, gray (10YR 5/1).	CH					M				
			18	FAT CLAY, dark olive brown (2.5Y 3/3).										
S4	13	5 8 14 17	19							M				
			20											
S5	15	5 6 13 16	21							W				
			22		CH									
			23											
S6	15	3 5 7 9	24							W				
			25											
S7	22	2 5 7 11	26	POORLY GRADED SAND, very dark grayish brown (10YR 3/2), medium to coarse grained, (weathered bedrock?).						W				
			27											
			28											
S8	NR	7 3 4 3	29							W				
			30		SP									
S9	18	1 1 2 2	31							W				
			32											
			33											
S10	13	WOR	34							W				
				End of Boring at 34.5 feet bgs.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL-Ottumwa Generating Station SCS#: 25216148.00		MW-307

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mike Mueller Cascade Drilling	10/25/2016	10/25/2016	HSA

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-307	Feet	655.1 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 401,707 N, 1,903,070 E S/C/N
NE 1/4 of SE 1/4 of Section 26, T 73 N, R 15 W
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1–15	POORLY GRADED SAND WITH GRAVEL, tan, fine to coarse sand and gravel, (construction fill sand to fill in hydrovac hole cleared to 8.5 ft bgs).	SP									water level 6.5 ft bgs.
S1	24	2 2 3 2	10	LEAN CLAY, dark yellowish brown (10YR 4/4), slightly dense.	CL					W				
S2	14	4 1 4 4	13–14							W				

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm SCS Engineers
2830 Dairy Drive Madison, WI 53711
Tel: (608) 224-2830
Fax:

Boring Number MW-307 Page 2 of 2

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			16	LEAN CLAY, dark yellowish brown (10YR 4/4), slightly dense. *(continued)*	CL									
S3	24	1 2 2 4	17	SILT, dark yellowish brown (10YR 3/4), fine to medium sand.	ML					W				
S4	17	3 3 3	18 19							W				Bedrock @19.5 ft bgs.
S5	5	50/0.5	20 21 22	SANDSTONE, dark brown (10YR 3/3),						W				More competent @20.5' -24.5' bgs.
			23 24 25 26 27	more weathered.										
S6	1	100	28	Same as above except, gray (10YR 6/1). End of boring at 28 ft bgs.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL-Ottumwa Generating Station SCS#: 25216148.00		MW-308

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mike Mueller Cascade Drilling	10/25/2016	10/25/2016	HSA

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-308	Feet	652.9 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 402,312 N, 1,902,665 E S/C/N
NE 1/4 of SE 1/4 of Section 26, T 73 N, R 15 W
Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1–9	POORLY GRADED SAND WITH GRAVEL, tan, fine to coarse sand and gravel, (construction fill sand to fill in hydrovac hole cleared to 9.5 ft bgs).	SP									water @ 6.5 ft bgs.
S1	24	19 4 2 2	10–12	LEAN CLAY, brown (10YR 4/3), dense.	CL					W				
S2	13	1 2 2 2	13–15	SILT, brown (10YR 4/3), some clay.	ML					W				

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm SCS Engineers
2830 Dairy Drive Madison, WI 53711
Tel: (608) 224-2830
Fax:

Boring Number MW-308 Page 2 of 2

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			16	SILT, brown (10YR 4/3), some clay. *(continued)*	ML									
S3	18	1 2 1 3		SILTY SAND, brown (10YR 4/3).	SM					W				
			17	POORLY GRADED SAND, brown (10YR 4/3), fine grained.	SP									
			18											
S4	13	4 12 13 3		WELL GRADED SAND AND GRAVEL, dark grayish brown (10YR 3/2), fine to coarse grained, (weathered bedrock).	SW					W				
			19	SANDSTONE, dark grayish brown (10YR 4/2), weathered bedrock.										
S5	6	12 26 50/0.4	20	Same as above except, brown (10YR 4/3).						W				
			21											
			22											
			23											
			24	Same as above except, dark grayish brown (10YR 4/2).										
S6	4	50/0.4	25							W				
				End of boring at 25 ft bgs.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL-Ottumwa Generating Station SCS#: 25216148.00		MW-309

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mike Mueller Cascade Drilling	10/27/2016	10/27/2016	HSA

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-309	Feet	652.5 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 403,189 N, 1,902,070 E S/C/N
NE 1/4 of SE 1/4 of Section 26, T 73 N, R 15 W
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1	Hydrovac borehole to 10 ft bgs.										
			2											
			3											
			4											
			5											
			6											
			7											
			8											
			9											
			10	LEAN CLAY, very dark grayish brown (10YR 3/2), trace sand.										
S1		3 3 6 7	11							W				
			12		CL									
S2		2 2 2 2	13							W				
			14											
			15											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm SCS Engineers
2830 Dairy Drive Madison, WI 53711

Tel: (608) 224-2830
Fax:

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A

Boring Number MW-309

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
S3		1 1 1 1	16 17	SILTY SAND, very dark grayish brown (10YR 3/2), fine to medium grained.	SM					W				
S4		3 5 4 6	18 19							W				
			20	POORLY GRADED SAND, yellowish brown (10YR 5/4), coarse grained.	SP									
S5		2 3 7 50	21 22	WEATHERED SANDSTONE.						W				
			23 24											
S6			25 26 27							W				
				End of boring at 27.5 ft bgs.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL-Ottumwa Generating Station SCS#: 25216148.00		B-309X

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mike Mueller Cascade Drilling	10/26/2016	10/26/2016	HSA

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			Feet	Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane N, E S/C/N
NE 1/4 of SE 1/4 of Section 26, T 73 N, R 15 W
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1–15	POORLY GRADED SAND WITH GRAVEL, tan, fine to coarse sand and gravel, (construction fill sand to fill in hydrovac hole cleared to 9 ft bgs).	SP									Water at 6.5 ft bgs
S1	12	1 3 3 4	9–12	LEAN CLAY, dark brown (10YR 3/3), medium dense.	CL					W				
S2	18	3 3 3 3	13–15	SILT, dark brown (10YR 3/3), some clay.	ML					W				

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm SCS Engineers
2830 Dairy Drive Madison, WI 53711
Tel: (608) 224-2830
Fax:

Boring Number B-309X

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			16	SILT, dark brown (10YR 3/3), some clay. *(continued)*	ML									
S3	20	3 3 3 2	17	POORLY GRADED SAND, very dark grayish brown (10YR 3/2), fine grained.	SP					W				
			18	SILT, dark brown (10YR 3/3).	ML									
				POORLY GRADED SAND, brown (10YR 4/3).	SP									
S4	15	1 17 50/0.2	19	WEATHERED SANDSTONE, grayish brown (10YR 5/2).						W				Bedrock at18.5 ft bgs
S5	6	50/0.3	20							W				
			21											
			22											
			23											
			24											
			25											
			26											
				End of boring at 26.5 ft bgs.										

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: IPL - Ottumwa Generating Station Permit No.:

Well or Piezometer No: MW-301

Dates Started: 11/10/15 Date Completed: 11/10/15

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft):

Specify corner of site: SE of Parcel 003052640340000

Distance & direction along boundary: 106' W

Distance & direction from boundary to wall: 306' N

Elevations (± 0.01 ft MSL):

Ground Surface: 684.28

Top of protective casing: 687.12

Top of well casing: 686.63

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Cascade Drilling, LP
301 Alderson St
Schofield, WI 54476

Name of Driller: Todd Schmalfeld

Drilling Method: HSA

Drilling Fluid: NA

Bore Hole Diameter: 8 inch

Soil Sampling Method: Spoon

Depth of Boring: 15 ft

C. MONITORING WELL INSTALLATION

Casing material: PVC sch 40

Length of casing: 4 ft

Outside casing diameter: 2.38"

Inside casing diameter: 2"

Casing joint type: threaded

Casing/screen joint type: threaded

Screen material: PVC

Screen opening size: 0.010"

Screen length: 10 ft

Depth of well: 14 ft

Filter Pack:

Material: Red Flint

Grain size: #40

Volume: 4 cu. ft.

Seal (minimum 3 ft length above filter pack):

Material: 3/8 inch bentonite chips

Placement method: Gravity

Volume: 8 cu. ft.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel 6 inch

Material of grout between protective casing and well casing: sand

Protective cap:

Material: Steel, vented

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 3.09 ft Stabilization Time: <5 minutes

Well development method: Surged with block and pumped to reduce turbidity. 435 gallons pumped.

Average depth of frostline: 3.5'

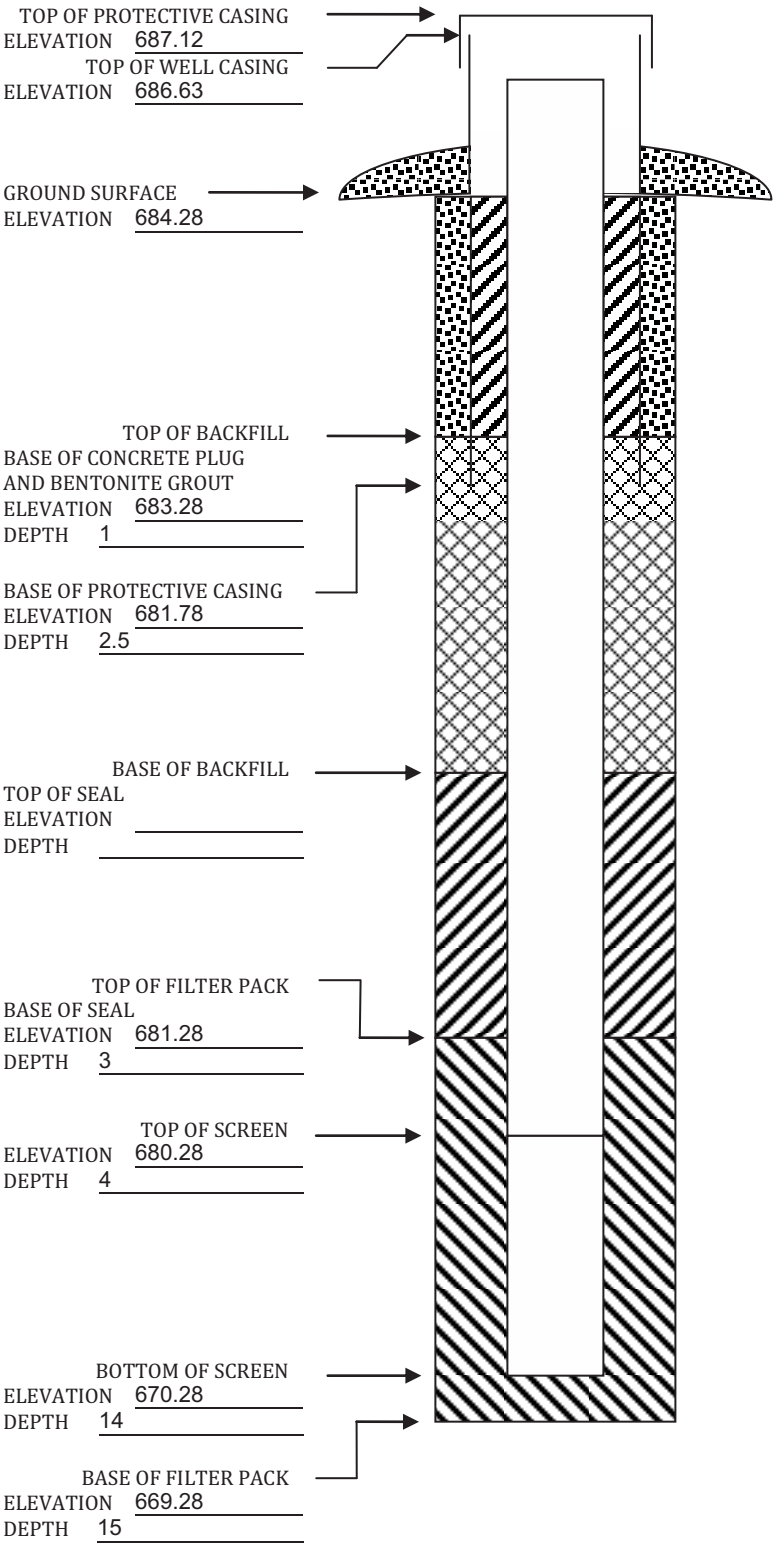
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: IPL - Ottumwa Generating Station Permit No.:

Well or Piezometer No: MW-302

Dates Started: 11/10/15 Date Completed: 11/11/15

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft):

Specify corner of site: NW of Parcel 003052630215000

Distance & direction along boundary: 844' NE

Distance & direction from boundary to wall: 4.5' S

Elevations (± 0.01 ft MSL):

Ground Surface: 671.55

Top of protective casing: 674.39

Top of well casing: 673.90

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Cascade Drilling, LP
301 Alderson St
Schofield, WI 54476

Name of Driller: Todd Schmalfeld

Drilling Method: HSA

Drilling Fluid: NA

Bore Hole Diameter: 8 inch

Soil Sampling Method: Spoon

Depth of Boring: 24 ft

C. MONITORING WELL INSTALLATION

Casing material: PVC sch 40

Length of casing: 13 ft

Outside casing diameter: 2.38"

Inside casing diameter: 2"

Casing joint type: threaded

Casing/screen joint type: threaded

Screen material: PVC

Screen opening size: 0.010

Screen length: 10 ft

Depth of well: 23 ft

Filter Pack:

Material: Red Flint

Grain size: #40

Volume: 3.5 cu. ft

Seal (minimum 3 ft length above filter pack):

Material: 3/8" bentonite chips

Placement method: Gravity

Volume: 2.6 cu. ft

Backfill (if different from seal):

Material: 3/8" bentonite chips

Placement method: Gravity

Volume: 1 cu. ft.

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: sand

Protective cap:

Material: Steel, vented

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 18.19 Stabilization Time: < 5 min

Well development method: Surged with block and pumped to remove turbidity. 183 gallons purged

Average depth of frostline: 3.5'

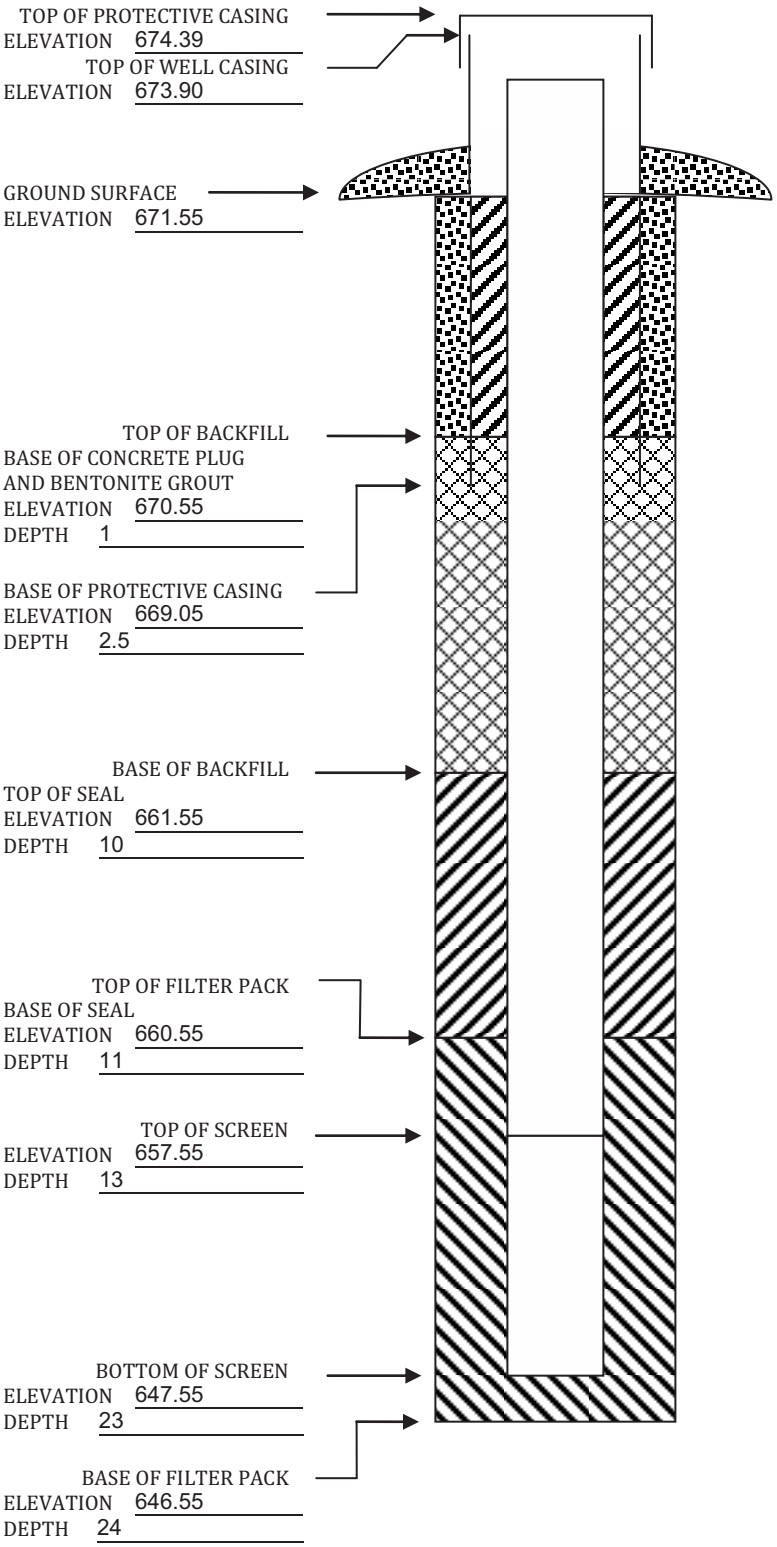
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: IPL - Ottumwa Generating Station Permit No.:

Well or Piezometer No: MW-303

Dates Started: 12/8/15 Date Completed: 12/8/15

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft):

Specify corner of site: SE of parcel 003052630207000

Distance & direction along boundary: 181' NW

Distance & direction from boundary to wall: 0

Elevations (± 0.01 ft MSL):

Ground Surface: 658.95

Top of protective casing: 661.67

Top of well casing: 661.07

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Cascade Drilling, LP
301 Alderson St
Schofield, WI 54476

Name of Driller: Todd Schmalfeld

Drilling Method: HSA

Drilling Fluid: NA

Bore Hole Diameter: 8 inch

Soil Sampling Method: Spoon

Depth of Boring: 14.5 ft

C. MONITORING WELL INSTALLATION

Casing material: PVC sch 80

Length of casing: 3 ft

Outside casing diameter: 2.38"

Inside casing diameter: 2"

Casing joint type: threaded

Casing/screen joint type: threaded

Screen material: PVC

Screen opening size: 0.010

Screen length: 10 ft

Depth of well: 14 ft

Filter Pack:

Material: Red Flint

Grain size: #40

Volume: 7.5 cu. ft.

Seal (minimum 3 ft length above filter pack):

Material: 3/8" bentonite chips

Placement method: Gravity

Volume: 10 cu. ft.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel 6 inch

Material of grout between protective casing and well casing: sand

Protective cap:

Material: Steel, vented

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 7.71' Stabilization Time: ~ 1 day (bails dry)

Well development method: Bailed dry 3 times to reduce turbidity

Average depth of frostline: 3.5'

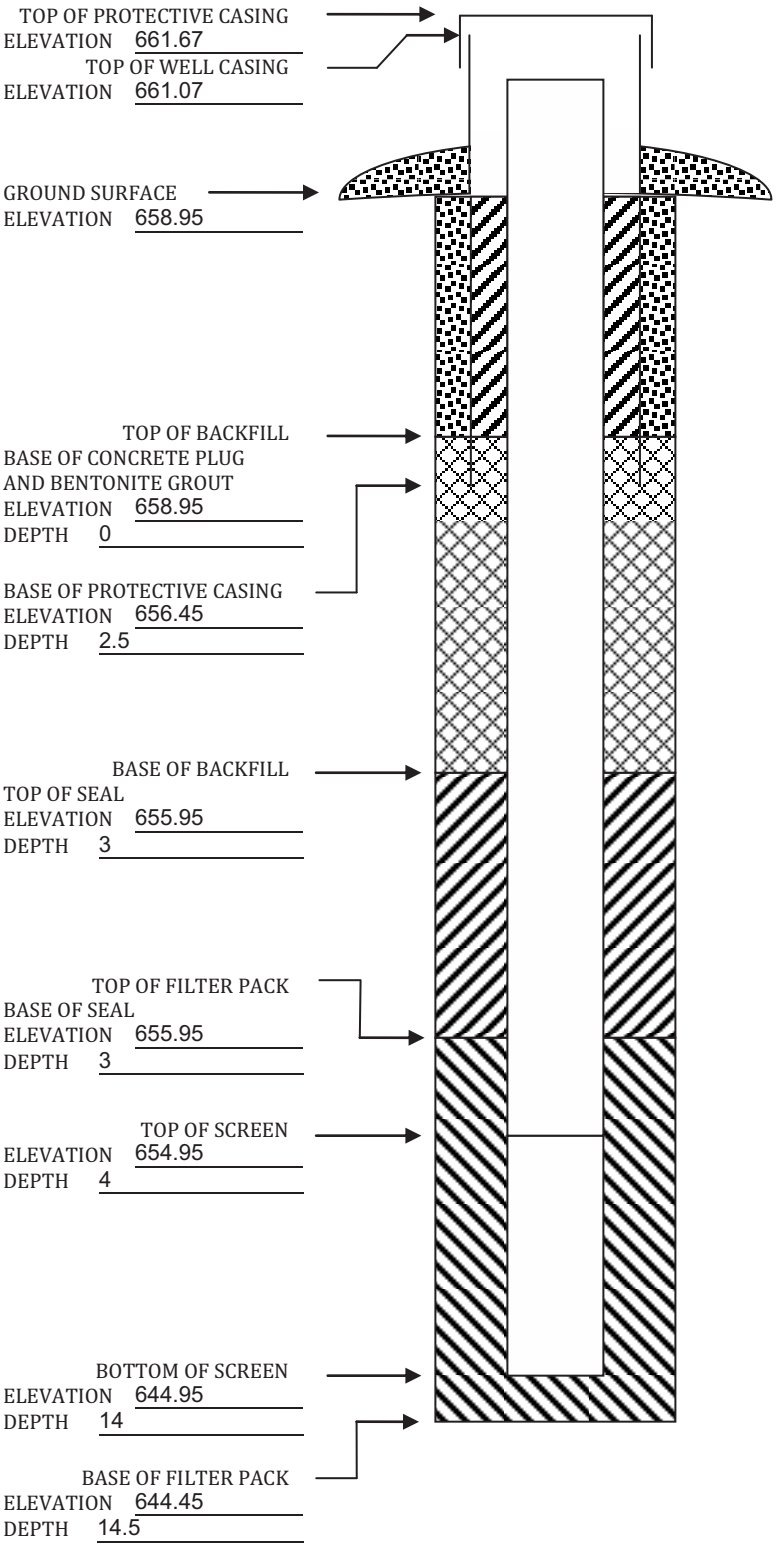
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: IPL - Ottumwa Generating Station Permit No.:

Well or Piezometer No: MW-304

Dates Started: 11/11/15 Date Completed: 11/12/15

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft):

Specify corner of site: SE of Parcel 003052620200000

Distance & direction along boundary: 502' W

Distance & direction from boundary to wall: 44' N

Elevations (± 0.01 ft MSL):

Ground Surface: 680.09

Top of protective casing: 683.36

Top of well casing: 682.84

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Cascade Drilling, LP
301 Alderson St
Schofield, WI 54476

Name of Driller: Todd Schmalfeld

Drilling Method: HSA

Drilling Fluid: NA

Bore Hole Diameter: 8 inch

Soil Sampling Method: Spoon

Depth of Boring: 52 ft

C. MONITORING WELL INSTALLATION

Casing material: PVC sch 40

Length of casing: 40 ft

Outside casing diameter: 2.38"

Inside casing diameter: 2"

Casing joint type: threaded

Casing/screen joint type: threaded

Screen material: PVC

Screen opening size: 0.010"

Screen length: 5 ft

Depth of well: 50 ft

Filter Pack:

Material: Red Flint

Grain size: #40

Volume: 2 cu. ft.

Seal (minimum 3 ft length above filter pack):

Material: 3/8" bentonite chips

Placement method: gravity

Volume: .3 cu. ft.

Backfill (if different from seal):

Material: AquaGuard Grout

Placement method: tremie

Volume: 75 gallons

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: sand

Protective cap:

Material: Steel, vented

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 24.5 ft Stabilization Time: ~1 day (bails dry)

Well development method: bailed dry 3 times to reduce turbidity

Average depth of frostline: 3.5'

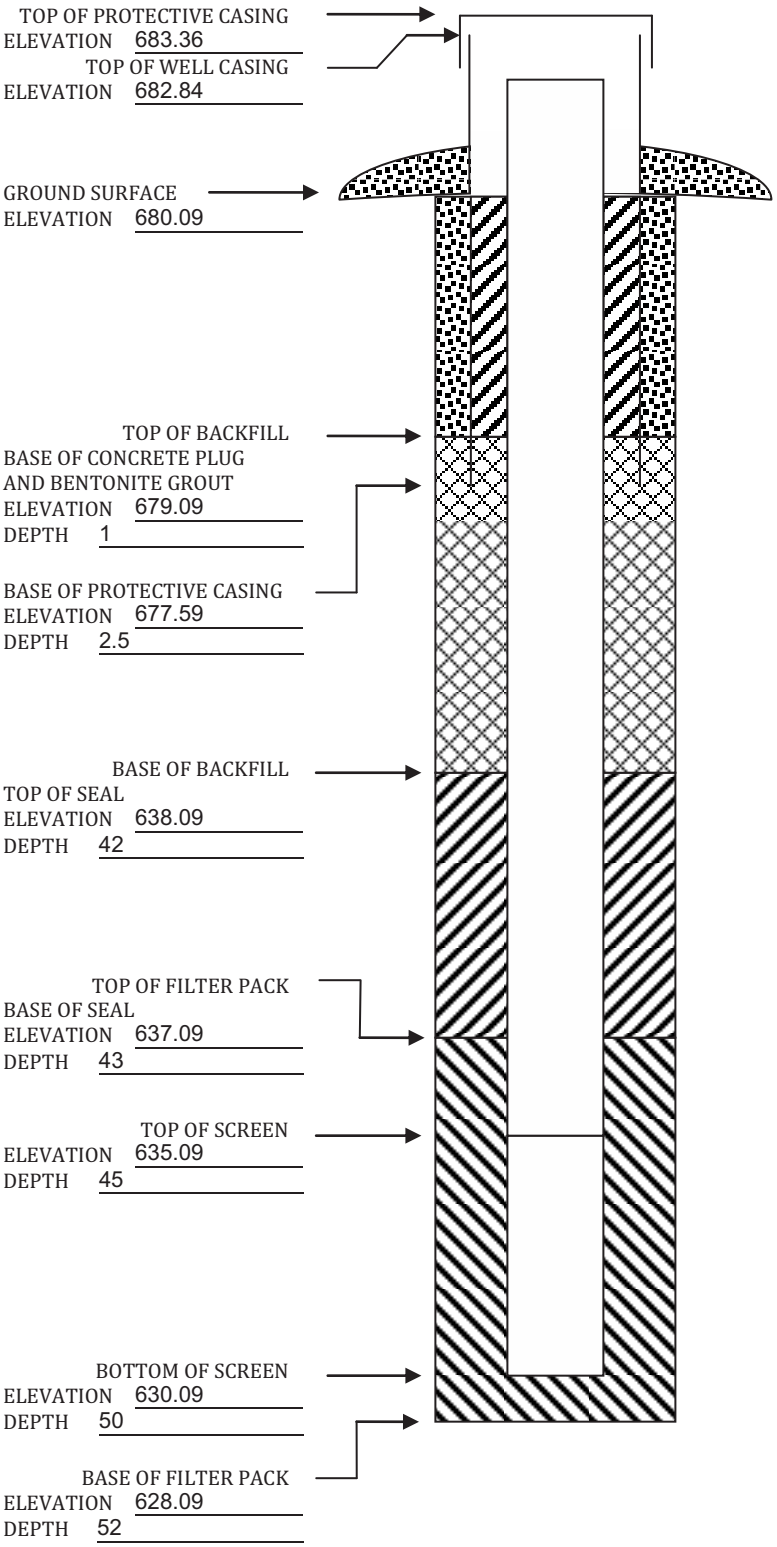
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: IPL - Ottumwa Generating Station Permit No.:

Well or Piezometer No: MW-305

Dates Started: 12/7/15 Date Completed: 12/8/15

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft):

Specify corner of site: SW of Parcel 003052620200000

Distance & direction along boundary: 539' E

Distance & direction from boundary to wall: 404' N

Elevations (± 0.01 ft MSL):

Ground Surface: 681.54

Top of protective casing: 684.53

Top of well casing: 683.91

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Cascade Drilling, LP
301 Alderson St
Schofield, WI 54476

Name of Driller: Todd Schmalfeld

Drilling Method: HSA

Drilling Fluid: NA

Bore Hole Diameter: 8 inch

Soil Sampling Method: Spoon

Depth of Boring: 50 ft

C. MONITORING WELL INSTALLATION

Casing material: PVC sch 80

Length of casing: 44 ft

Outside casing diameter: 2.38"

Inside casing diameter: 2"

Casing joint type: threaded

Casing/screen joint type: threaded

Screen material: PVC

Screen opening size: 0.010

Screen length: 5 ft

Depth of well: 49 ft

Filter Pack:

Material: Red Flint

Grain size: #40

Volume: 2 cu. ft.

Seal (minimum 3 ft length above filter pack):

Material: 3/8" bentonite chips

Placement method: gravity

Volume: .3 cu. ft.

Backfill (if different from seal):

Material: AquaGuard grou

Placement method: tremie

Volume: 80 gallons

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: sand

Protective cap:

Material: Steel, vented

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 22.02 Stabilization Time: < 5 min

Well development method: Surged with block and pumped to reduce turbidity

Average depth of frostline: 3.5'

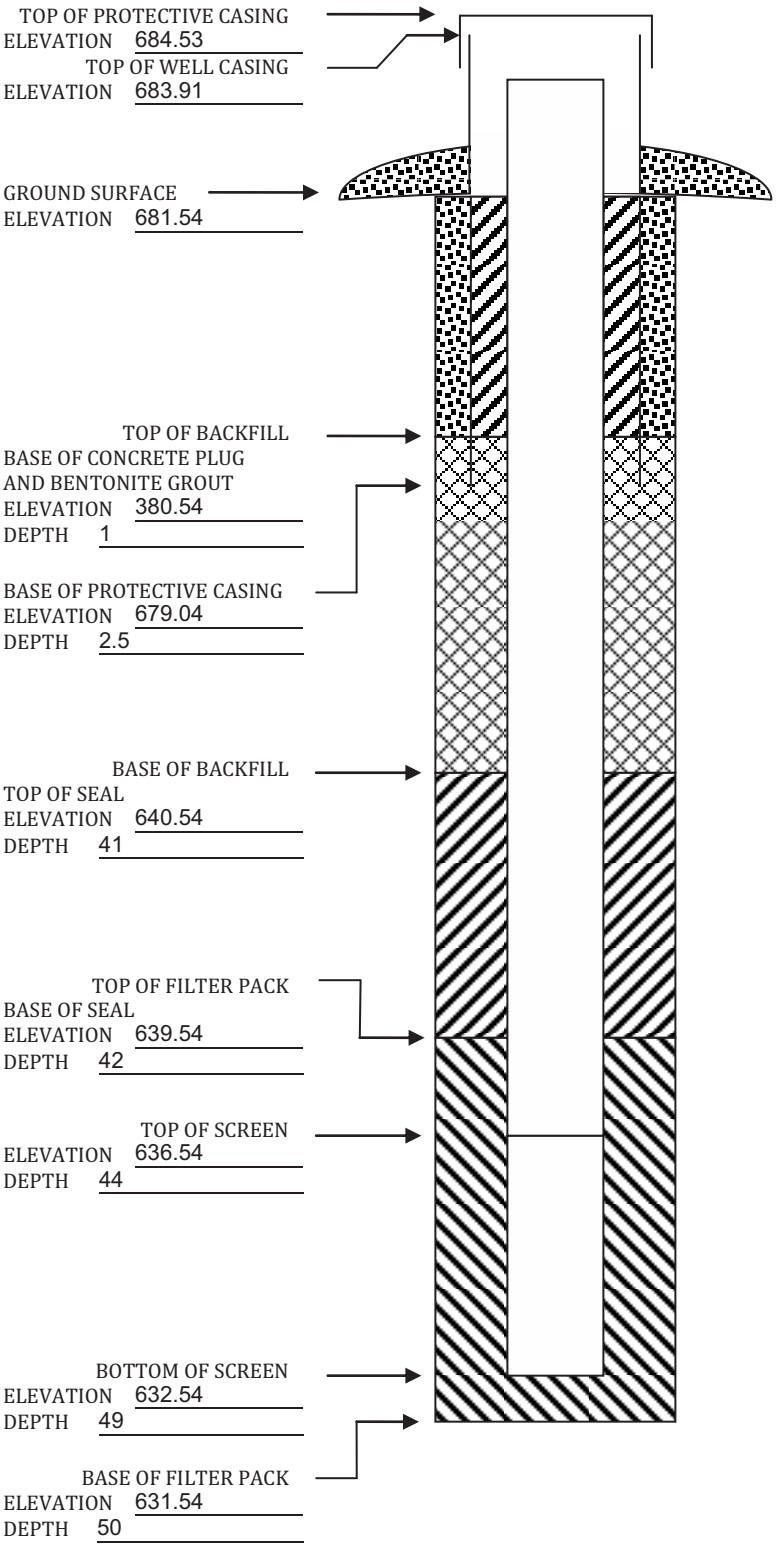
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: IPL - Ottumwa Generating Station Permit No.:

Well or Piezometer No: MW-306

Dates Started: 11/12/15 Date Completed: 11/12/15

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft):

Specify corner of site: NW of Parcel 003052620200000

Distance & direction along boundary: 137.5' E

Distance & direction from boundary to wall: 321' S

Elevations (± 0.01 ft MSL):

Ground Surface: 681.05

Top of protective casing: 683.98

Top of well casing: 683.47

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Cascade Drilling, LP
301 Alderson St
Schofield, WI 54476

Name of Driller: Todd Schmalfeld

Drilling Method: HSA

Drilling Fluid: NA

Bore Hole Diameter: 8 inch

Soil Sampling Method: Spoon

Depth of Boring: 34.5 ft

C. MONITORING WELL INSTALLATION

Casing material: PVC sch 80

Length of casing: 29 ft

Outside casing diameter: 2.38"

Inside casing diameter: 2"

Casing joint type: threaded

Casing/screen joint type: threaded

Screen material: PVC

Screen opening size: 0.010"

Screen length: 5 ft

Depth of well: 34 ft

Filter Pack:

Material: Red Flint

Grain size: #40

Volume: 2 cu. ft.

Seal (minimum 3 ft length above filter pack):

Material: 3/8" bentonite chips

Placement method: Gravity

Volume: 10.5 cu. ft.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: sand

Protective cap:

Material: Steel, vented

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 12.96' Stabilization Time: < 5 min

Well development method: Surged with block and pumped. 193 gallons purged.

Average depth of frostline: 3.5'

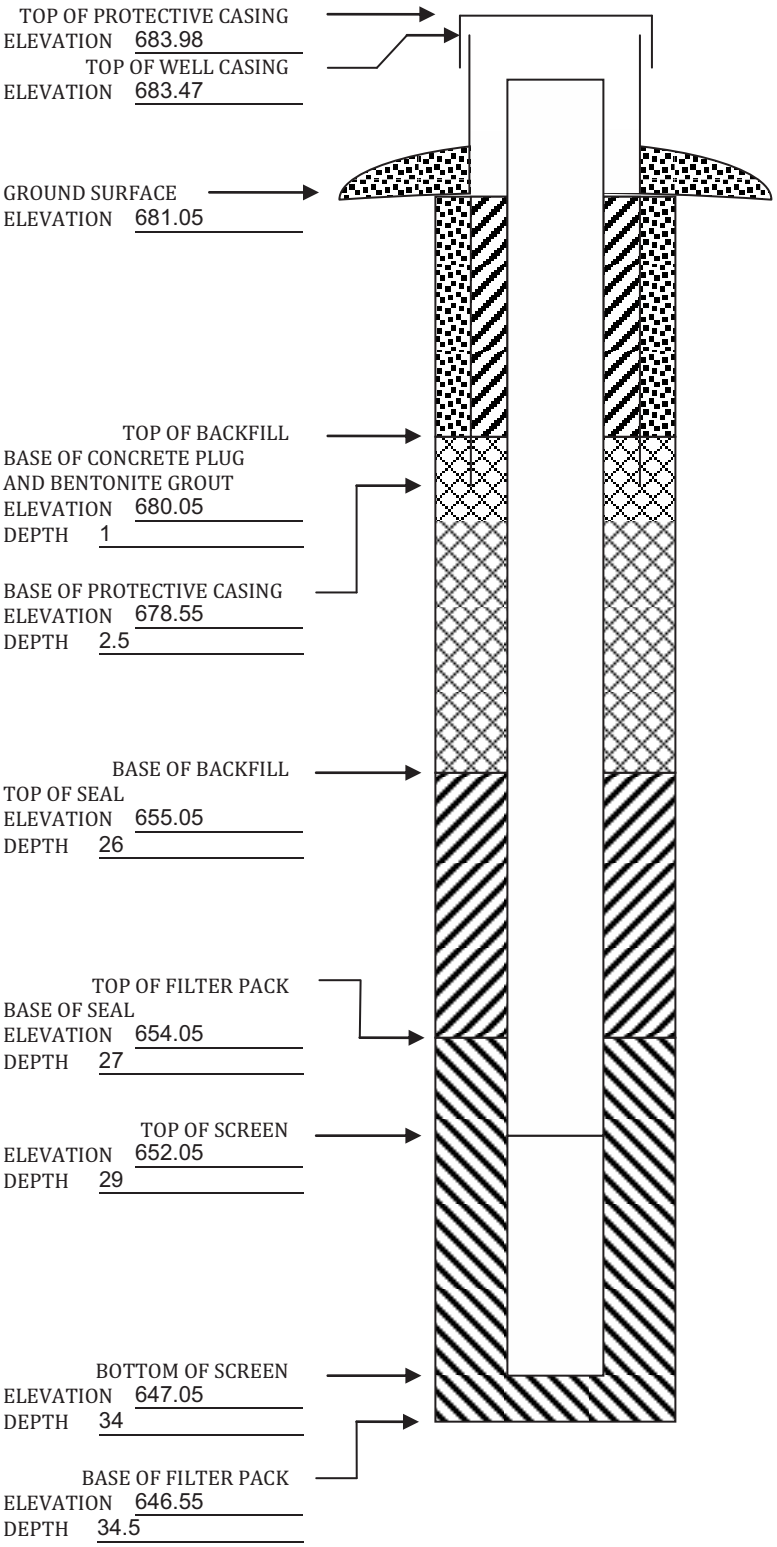
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: IPL - Ottumwa Generating Station Permit No.:

Well or Piezometer No: MW-307

Dates Started: 10/25/16 Date Completed: 10/25/16

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft):

Specify corner of site: NE of Parcel 003052620200000

Distance & direction along boundary: 683' W

Distance & direction from boundary to wall: 296' S

Elevations (± 0.01 ft MSL):

Ground Surface: 655.08

Top of protective casing: 657.58

Top of well casing: 657.56

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Cascade Drilling, LP
301 Alderson St
Schofield, WI 54476

Name of Driller: Mike Mueller

Drilling Method: HSA

Drilling Fluid: NA

Bore Hole Diameter: 8 inch

Soil Sampling Method: Spoon

Depth of Boring: 28 ft

C. MONITORING WELL INSTALLATION

Casing material: PVC sch 40

Length of casing: 22 ft

Outside casing diameter: 2.38"

Inside casing diameter: 2"

Casing joint type: threaded

Casing/screen joint type: threaded

Screen material: PVC

Screen opening size: 0.010"

Screen length: 5 ft

Depth of well: 27 ft

Filter Pack:

Material: Red Flint

Grain size: #40

Volume: 200 lbs

Seal (minimum 3 ft length above filter pack):

Material: 3/8 inch bentonite chips

Placement method: Gravity

Volume: 250 lbs

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel 6 inch

Material of grout between protective casing and well casing: sand

Protective cap:

Material: Steel, vented

Vented: ☑ Yes ☐ No Locking: ☐ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 8.12 Stabilization Time: 5 minutes

Well development method: surged with bailer and pumped

Average depth of frostline: 3.5'

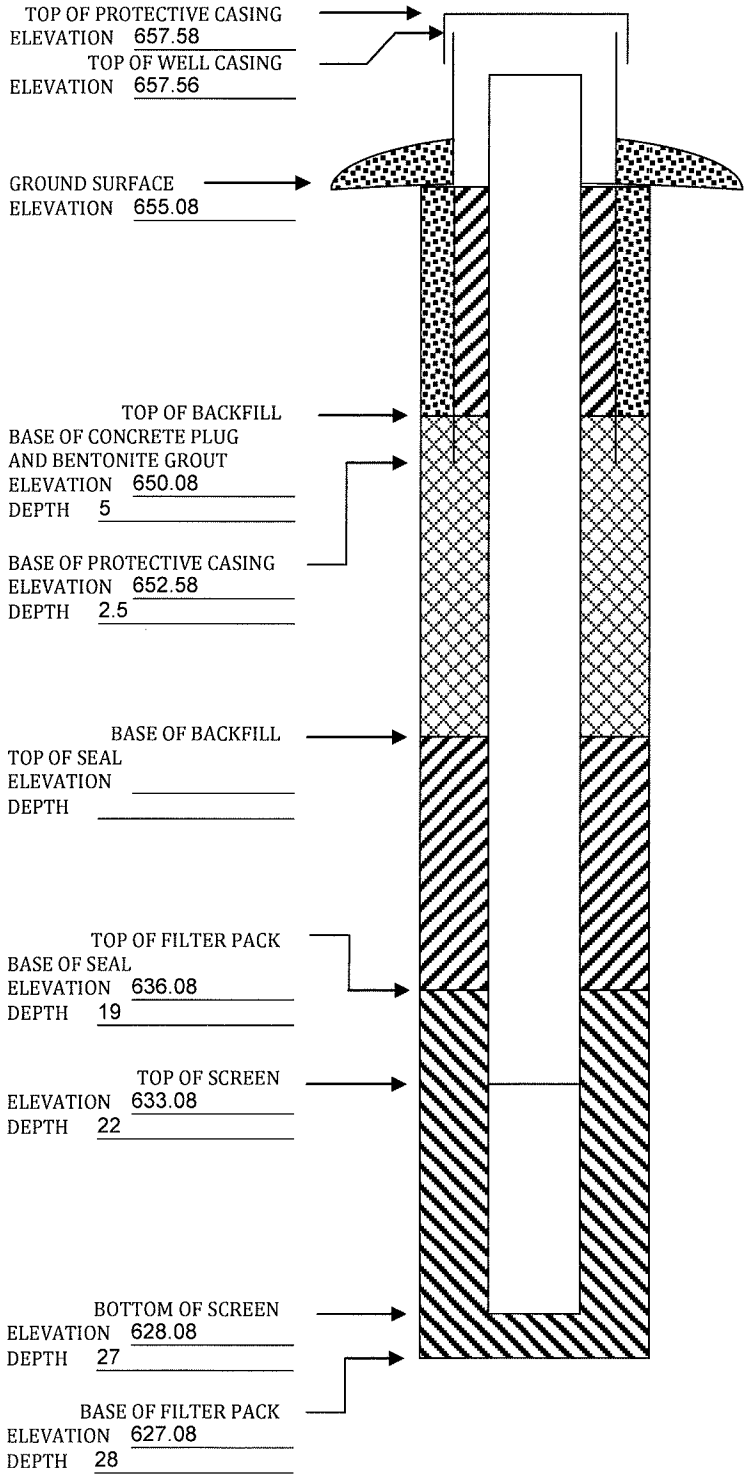
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: IPL - Ottumwa Generating Station Permit No.:

Well or Piezometer No: MW-308

Dates Started: 10/26/16 Date Completed: 10/26/16

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft):

Specify corner of site: SW of Parcel 0030502620203000

Distance & direction along boundary: 158' E

Distance & direction from boundary to wall: 417' N

Elevations (± 0.01 ft MSL):

Ground Surface: 652.87

Top of protective casing: 655.23

Top of well casing: 655.39

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Cascade Drilling, LP
301 Alderson St
Schofield, WI 54476

Name of Driller: Mike Mueller

Drilling Method: HSA

Drilling Fluid: NA

Bore Hole Diameter: 8 inch

Soil Sampling Method: Spoon

Depth of Boring: 25 ft

C. MONITORING WELL INSTALLATION

Casing material: PVC sch 40

Length of casing: 19 ft

Outside casing diameter: 2.38"

Inside casing diameter: 2"

Casing joint type: threaded

Casing/screen joint type: threaded

Screen material: PVC

Screen opening size: 0.010"

Screen length: 5 ft

Depth of well: 24 ft

Filter Pack:

Material: Red Flint

Grain size: #40

Volume: 200 lbs

Seal (minimum 3 ft length above filter pack):

Material: 3/8 inch bentonite chips

Placement method: Gravity

Volume: 200 lbs

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel 6 inch

Material of grout between protective casing and well casing: sand

Protective cap:

Material: Steel, vented

Vented: ☑ Yes ☐ No Locking: ☐ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 9.85 Stabilization Time: 5 minutes

Well development method: surged with bailer and pumped

Average depth of frostline: 3.5'

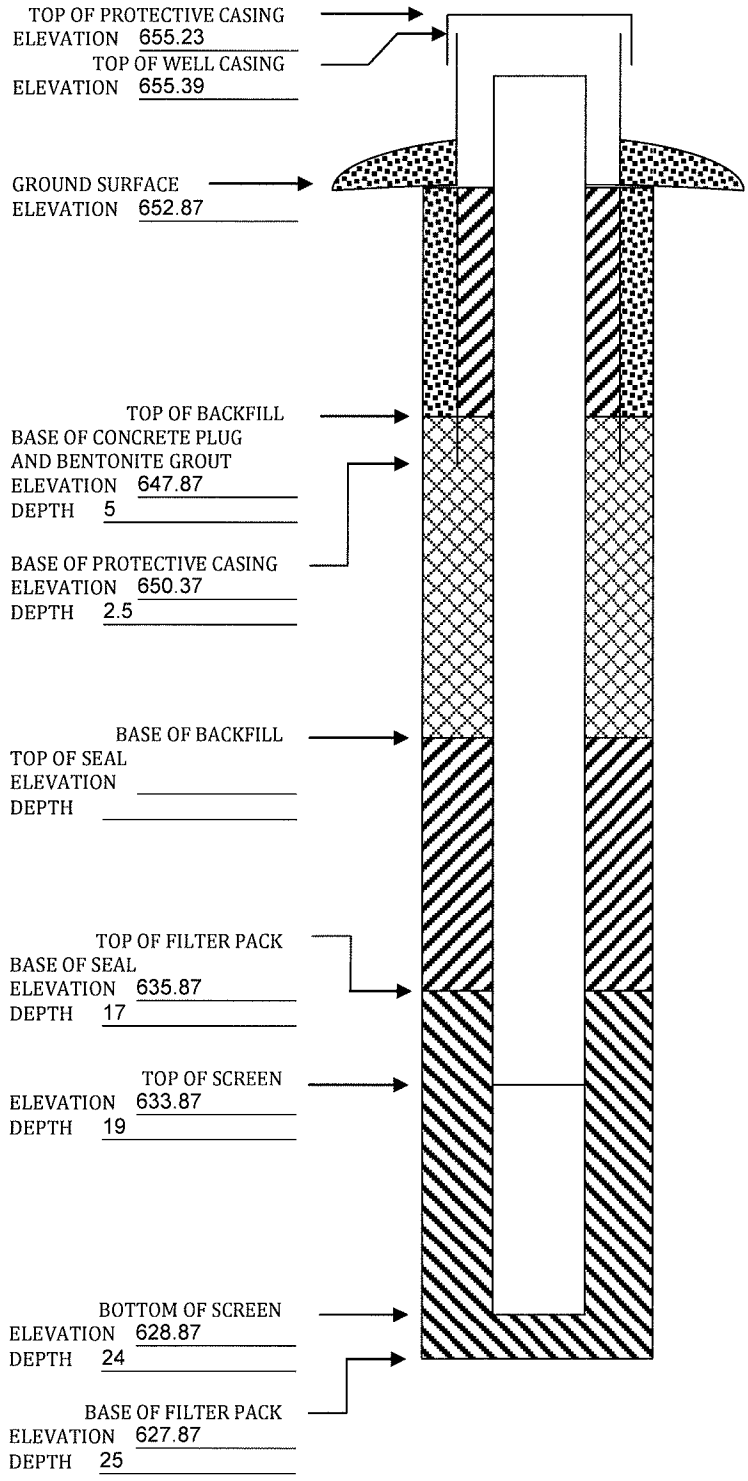
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: IPL - Ottumwa Generating Station Permit No.:

Well or Piezometer No: MW-309

Dates Started: 10/27/16 Date Completed: 10/27/16

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft):

Specify corner of site: NE of Parcel 003052620204000

Distance & direction along boundary: 480' W

Distance & direction from boundary to wall: 438' S

Elevations (± 0.01 ft MSL):

Ground Surface: 652.45

Top of protective casing: 654.97

Top of well casing: 654.94

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Cascade Drilling, LP
301 Alderson St
Schofield, WI 54476

Name of Driller: Mike Mueller

Drilling Method: HSA

Drilling Fluid: NA

Bore Hole Diameter: 8 inch

Soil Sampling Method: Spoon

Depth of Boring: 27.5 ft

C. MONITORING WELL INSTALLATION

Casing material: PVC sch 40

Length of casing: 21.5 ft

Outside casing diameter: 2.38"

Inside casing diameter: 2"

Casing joint type: threaded

Casing/screen joint type: threaded

Screen material: PVC

Screen opening size: 0.010"

Screen length: 5 ft

Depth of well: 26.5 ft

Filter Pack:

Material: Red Flint

Grain size: #40

Volume: 200 lbs

Seal (minimum 3 ft length above filter pack):

Material: 3/8 inch bentonite chips

Placement method: Gravity

Volume: 600 lbs

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel 6 inch

Material of grout between protective casing and well casing: sand

Protective cap:

Material: Steel, vented

Vented: ☑ Yes ☐ No Locking: ☐ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 9.87 Stabilization Time: 5 minutes

Well development method: surged with bailer and pumped

Average depth of frostline: 3.5'

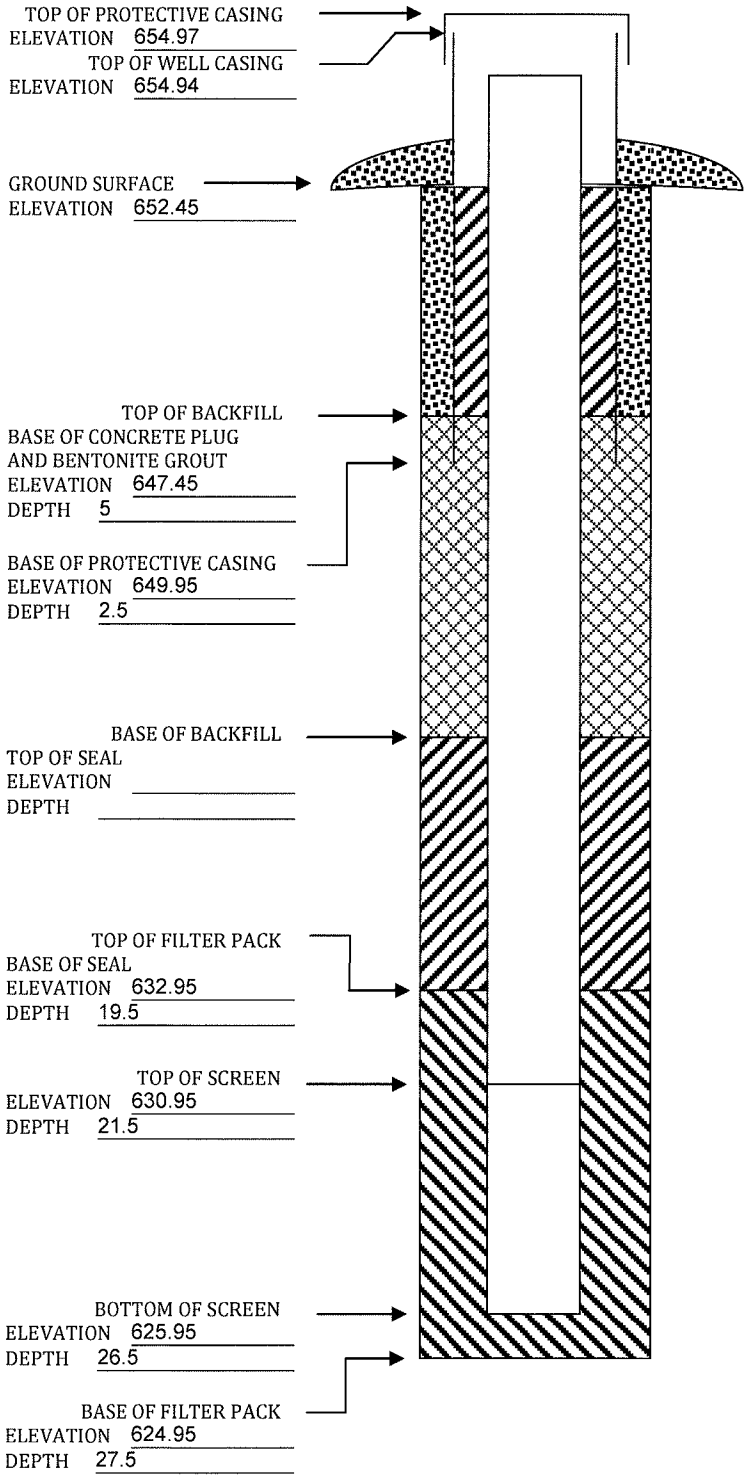
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Appendix C

Historical Monitoring Results

Single Location

Name: IPL - Ottumwa Generating Station

Location ID:	MW-301					
Number of Sampling Dates:	5					
Parameter Name	**Units**	**1/18/2017**	**4/19/2017**	**6/20/2017**	**8/23/2017**	**11/8/2017**
Boron	ug/L	599	565	657	779	488
Calcium	mg/L	74.1	61.5	59.3	66.8	65.2
Chloride	mg/L	71.6	54.8	69.8	73.5	59.8
Fluoride	mg/L	0.17	0.24	0.26	0.34	0.27
Field pH	Std. Units	6.47	6.64	6.31	6.16	6.41
Sulfate	mg/L	171	190	166	162	178
Total Dissolved Solids	mg/L	545	499	490	557	448
Antimony	ug/L	0.11	<0.026	0.054	0.063	--
Arsenic	ug/L	0.23	0.22	0.15	0.14	--
Barium	ug/L	42.4	35.5	39.9	44	--
Beryllium	ug/L	<0.08	<0.012	<0.012	<0.012	--
Cadmium	ug/L	<0.029	0.035	0.044	0.037	--
Chromium	ug/L	0.59	0.49	0.25	0.39	--
Cobalt	ug/L	1.3	0.97	1	0.96	--
Lead	ug/L	<0.19	0.06	0.1	0.049	--
Lithium	ug/L	20.1	21.8	24.9	27.9	--
Mercury	ug/L	<0.039	<0.046	<0.046	<0.046	--
Molybdenum	ug/L	0.76	0.54	0.79	1.3	--
Selenium	ug/L	5.9	4.2	5.5	7.2	--
Thallium	ug/L	<0.5	0.14	<0.036	0.067	--
Total Radium	pCi/L	0.143	0.631	1.06	0.725	--
Radium-226	pCi/L	0.143	0.139	0.501	0.123	--
Radium-228	pCi/L	-0.403	0.492	0.562	0.602	--
Field Specific Conductance	umhos/cm	834	742	758	1107	743
Field Temperature	deg C	6.8	10.8	17.3	19.7	13.9
Groundwater Elevation	feet	681.67	682.15	681.91	681.28	681.54
Oxygen, Dissolved	mg/L	4.87	5.74	4.34	2.88	4.16
Turbidity	NTU	0.6	0.47	0.38	0.79	1.03
pH at 25 Degrees C	Std. Units	6.8	6.7	6.5	6.4	6.4
Field Oxidation Potential	millivolts	30.2	148	67.2	41.4	200.7

Single Location

Name: IPL - Ottumwa Generating Station

Location ID:	MW-302					
Number of Sampling Dates:	5					
Parameter Name	**Units**	**1/18/2017**	**4/19/2017**	**6/20/2017**	**8/22/2017**	**11/8/2017**
Boron	ug/L	1250	1200	1180	1250	1320
Calcium	mg/L	188	184	175	179	183
Chloride	mg/L	259	281	253	264	254
Fluoride	mg/L	0.21	0.2	0.26	0.27	0.2
Field pH	Std. Units	6.62	6.78	6.67	6.75	6.55
Sulfate	mg/L	777	907	858	858	786
Total Dissolved Solids	mg/L	1660	1670	1670	1620	1620
Antimony	ug/L	0.11	<0.026	0.052	0.036	--
Arsenic	ug/L	0.23	0.25	0.083	0.19	--
Barium	ug/L	20.4	19.4	18.2	18.5	--
Beryllium	ug/L	<0.08	<0.012	<0.012	<0.012	--
Cadmium	ug/L	0.15	0.2	0.19	0.21	--
Chromium	ug/L	0.58	1	0.58	0.7	--
Cobalt	ug/L	0.94	0.95	0.86	0.88	--
Lead	ug/L	<0.19	0.2	0.081	<0.033	--
Lithium	ug/L	9.7	10.1	9.7	13.8	--
Mercury	ug/L	<0.039	<0.046	<0.046	<0.046	--
Molybdenum	ug/L	0.5	0.44	0.38	0.51	--
Selenium	ug/L	<0.18	<0.086	<0.086	<0.086	--
Thallium	ug/L	<0.5	0.049	<0.036	<0.036	--
Total Radium	pCi/L	0.136	0.776	1.29	1.61	--
Radium-226	pCi/L	0.136	0.342	0.13	0.406	--
Radium-228	pCi/L	-0.0781	0.434	1.16	1.2	--
Field Specific Conductance	umhos/cm	2247	2220	2085	2991	2274
Field Temperature	deg C	12.9	12.8	13.4	14	13.8
Groundwater Elevation	feet	655.46	656.35	655.65	655.13	655.4
Oxygen, Dissolved	mg/L	0.18	0.18	0.12	0.08	0.4
Turbidity	NTU	3.11	2.32	2.63	1.32	1.63
pH at 25 Degrees C	Std. Units	6.8	6.8	6.6	6.6	6.5
Field Oxidation Potential	millivolts	38.7	121.1	21	20.8	191.7

Single Location

Name: IPL - Ottumwa Generating Station

Location ID:	MW-303					
Number of Sampling Dates:	5					
Parameter Name	**Units**	**1/18/2017**	**4/19/2017**	**6/20/2017**	**8/22/2017**	**11/8/2017**
Boron	ug/L	738	577	834	1180	1070
Calcium	mg/L	173	226	210	200	234
Chloride	mg/L	190	141	186	268	185
Fluoride	mg/L	0.21	0.19	0.23	0.3	0.19
Field pH	Std. Units	6.77	7.02	6.81	6.53	6.6
Sulfate	mg/L	168	333	284	215	348
Total Dissolved Solids	mg/L	1030	1170	1210	1220	1290
Antimony	ug/L	0.19	0.16	0.19	0.3	--
Arsenic	ug/L	0.54	0.47	0.33	0.61	--
Barium	ug/L	75.3	79.1	76.4	83.8	--
Beryllium	ug/L	<0.08	<0.012	<0.012	0.015	--
Cadmium	ug/L	0.31	0.81	0.52	0.57	--
Chromium	ug/L	0.52	0.27	0.37	0.61	--
Cobalt	ug/L	2.6	1.8	1.9	2.8	--
Lead	ug/L	<0.19	0.068	0.07	0.19	--
Lithium	ug/L	<4.9	<2.9	3.4	8.1	--
Mercury	ug/L	<0.039	<0.046	<0.046	<0.046	--
Molybdenum	ug/L	0.64	3.9	0.81	0.64	--
Selenium	ug/L	0.8	1.1	0.47	0.52	--
Thallium	ug/L	<0.5	0.16	<0.036	<0.036	--
Total Radium	pCi/L	0.805	1.62	1.62	2.36	--
Radium-226	pCi/L	0.145	1.06	0.556	1.4	--
Radium-228	pCi/L	0.66	0.556	1.06	0.958	--
Field Specific Conductance	umhos/cm	1611	1687	1670	2474	1896
Field Temperature	deg C	10.6	10.6	14.1	16.8	15.2
Groundwater Elevation	feet	651.74	654.57	652.42	650.58	651.34
Oxygen, Dissolved	mg/L	0.17	0.56	0.08	0.08	0.48
Turbidity	NTU	3.3	2.2	2.77	14.62	3.67
pH at 25 Degrees C	Std. Units	7.1	7.2	6.8	6.8	6.7
Field Oxidation Potential	millivolts	21.3	99.5	8.6	20.9	176.8

Single Location

Name: IPL - Ottumwa Generating Station

Location ID:	MW-304					
Number of Sampling Dates:	5					
Parameter Name	**Units**	**1/18/2017**	**4/19/2017**	**6/21/2017**	**8/22/2017**	**11/8/2017**
Boron	ug/L	995	1030	982	1040	1040
Calcium	mg/L	122	129	126	130	136
Chloride	mg/L	383	430	382	409	417
Fluoride	mg/L	0.82	0.88	1	0.89	0.96
Field pH	Std. Units	7.05	7.27	7.29	6.72	7
Sulfate	mg/L	204	208	254	194	194
Total Dissolved Solids	mg/L	1230	1310	1240	1250	1270
Antimony	ug/L	0.1	<0.026	0.06	0.035	--
Arsenic	ug/L	0.82	0.73	0.57	0.67	--
Barium	ug/L	92.4	94.9	87.1	91.5	--
Beryllium	ug/L	<0.08	<0.012	<0.012	<0.012	--
Cadmium	ug/L	<0.029	<0.018	<0.018	<0.018	--
Chromium	ug/L	0.69	0.56	0.6	0.43	--
Cobalt	ug/L	<0.5	0.37	0.36	0.3	--
Lead	ug/L	<0.19	0.13	0.081	0.041	--
Lithium	ug/L	<4.9	<2.9	<2.9	5.3	--
Mercury	ug/L	<0.039	<0.046	<0.046	<0.046	--
Molybdenum	ug/L	1.5	1.5	1.5	1.6	--
Selenium	ug/L	<0.18	0.17	0.14	0.21	--
Thallium	ug/L	<0.5	0.042	<0.036	<0.036	--
Total Radium	pCi/L	2.94	2.44	3.55	3.2	--
Radium-226	pCi/L	1.33	0.894	1.62	1.2	--
Radium-228	pCi/L	1.61	1.55	1.93	2	--
Field Specific Conductance	umhos/cm	2052	2139	2029	2881	2205
Field Temperature	deg C	12.9	13.4	13.3	13.4	13.3
Groundwater Elevation	feet	654.5	657.48	654.75	652.39	653.03
Oxygen, Dissolved	mg/L	0.16	0.12	0.1	0.08	0.25
Turbidity	NTU	1.17	1.95	1.64	0.92	3.88
pH at 25 Degrees C	Std. Units	7.2	7.2	7.2	7	6.9
Field Oxidation Potential	millivolts	-79.3	-40.5	-66.6	-10.1	162.7

Single Location

Name: IPL - Ottumwa Generating Station

Location ID:	MW-305					
Number of Sampling Dates:	5					
Parameter Name	**Units**	**1/18/2017**	**4/19/2017**	**6/21/2017**	**8/23/2017**	**11/8/2017**
Boron	ug/L	956	907	889	903	925
Calcium	mg/L	98.5	96.2	93.8	95.8	99.5
Chloride	mg/L	289	312	290	295	282
Fluoride	mg/L	0.35	0.38	0.4	0.48	0.4
Field pH	Std. Units	6.96	7.3	7.06	6.88	7.01
Sulfate	mg/L	90	109	121	124	138
Total Dissolved Solids	mg/L	1020	1040	1010	1040	1040
Antimony	ug/L	0.18	0.063	0.12	0.12	--
Arsenic	ug/L	0.57	0.61	0.37	0.51	--
Barium	ug/L	117	115	110	114	--
Beryllium	ug/L	<0.08	<0.012	<0.012	<0.012	--
Cadmium	ug/L	<0.029	0.052	0.039	0.034	--
Chromium	ug/L	<0.34	0.36	0.22	0.45	--
Cobalt	ug/L	15.2	14.6	14.4	14.7	--
Lead	ug/L	<0.19	0.093	<0.033	0.039	--
Lithium	ug/L	<4.9	<2.9	<2.9	<2.9	--
Mercury	ug/L	<0.039	<0.046	<0.046	<0.046	--
Molybdenum	ug/L	5.9	5.8	5.8	6	--
Selenium	ug/L	0.34	0.39	0.16	0.26	--
Thallium	ug/L	<0.5	0.34	0.29	0.36	--
Total Radium	pCi/L	1.46	0.673	0.996	1.08	--
Radium-226	pCi/L	0.162	0.494	0.301	0.291	--
Radium-228	pCi/L	1.3	0.179	0.695	0.793	--
Field Specific Conductance	umhos/cm	1794	1822	1730	2422	1738
Field Temperature	deg C	12.8	13.2	13.3	13.3	13.2
Groundwater Elevation	feet	660.87	663.27	661.26	659	659.76
Oxygen, Dissolved	mg/L	0.09	0.15	0.06	0.12	0.2
Turbidity	NTU	0.5	0.51	1.9	0.58	2.68
pH at 25 Degrees C	Std. Units	7.3	7.4	7.1	7.1	7
Field Oxidation Potential	millivolts	24.2 mV	17.6	-4.5	-51.3	146.1

Single Location

Name: IPL - Ottumwa Generating Station

Location ID:	MW-306					
Number of Sampling Dates:	5					
Parameter Name	**Units**	**1/18/2017**	**4/19/2017**	**6/21/2017**	**8/23/2017**	**11/8/2017**
Boron	ug/L	809	814	784	822	881
Calcium	mg/L	85.9	81.3	75.6	73.9	73.1
Chloride	mg/L	57.2	58.5	56	54.4	50.4
Fluoride	mg/L	0.087	0.11	<0.1	0.15	0.11
Field pH	Std. Units	6.51	6.79	6.71	6.46	6.49
Sulfate	mg/L	285	300	282	264	274
Total Dissolved Solids	mg/L	828	819	775	769	773
Antimony	ug/L	0.18	0.051	0.13	0.1	--
Arsenic	ug/L	0.47	0.42	0.41	0.38	--
Barium	ug/L	56.4	54.3	48.7	47.4	--
Beryllium	ug/L	<0.08	<0.012	<0.012	<0.012	--
Cadmium	ug/L	0.74	0.72	0.65	0.72	--
Chromium	ug/L	0.68	0.52	0.57	0.58	--
Cobalt	ug/L	6	5.7	5.2	5	--
Lead	ug/L	<0.19	0.038	0.1	<0.033	--
Lithium	ug/L	<4.9	<2.9	<2.9	<2.9	--
Mercury	ug/L	<0.039	<0.046	<0.046	<0.046	--
Molybdenum	ug/L	4.7	4.7	4.6	4.4	--
Selenium	ug/L	0.2	<0.086	0.088	0.13	--
Thallium	ug/L	<0.5	0.14	0.082	<0.036	--
Total Radium	pCi/L	0.435	0.213	1.03	1.3	--
Radium-226	pCi/L	-0.15	0.0761	0	0.517	--
Radium-228	pCi/L	0.435	0.137	1.03	0.784	--
Field Specific Conductance	umhos/cm	1215	1210	1151	1576	1186
Field Temperature	deg C	13.6	13.2	13.4	13.2	13.6
Groundwater Elevation	feet	669.89	670.69	669.94	668.77	669.04
Oxygen, Dissolved	mg/L	0.13	0.21	0.07	0.08	0.18
Turbidity	NTU	0.49	0.13	0.14	0.74	0.82
pH at 25 Degrees C	Std. Units	6.9	7	6.8	6.7	6.5
Field Oxidation Potential	millivolts	44.2	70.9	15.1	-10.5	174.1

Single Location

Name: IPL - Ottumwa Generating Station

Location ID:	MW-307					
Number of Sampling Dates:	5					
Parameter Name	**Units**	**1/19/2017**	**4/20/2017**	**6/21/2017**	**8/21/2017**	**11/8/2017**
Boron	ug/L	207	205	197	197	214
Calcium	mg/L	230	241	229	221	227
Chloride	mg/L	210	201	213	219	217
Fluoride	mg/L	0.12	0.13	0.16	0.2	0.12
Field pH	Std. Units	6.7	6.51	6.82	6.4	6.61
Sulfate	mg/L	105	105	110	102	102
Total Dissolved Solids	mg/L	1050	1100	1070	1050	1030
Antimony	ug/L	0.1	<0.026	<0.026	<0.026	<0.026
Arsenic	ug/L	1.1	0.96	0.62	0.52	0.54
Barium	ug/L	127	139	132	128	131
Beryllium	ug/L	<0.08	0.029	0.016	<0.012	<0.012
Cadmium	ug/L	<0.029	0.025	<0.018	<0.018	0.018
Chromium	ug/L	0.59	1.6	1	0.38	0.38
Cobalt	ug/L	0.62	1.6	1.1	1.1	1.3
Lead	ug/L	<0.19	0.49	0.26	0.085	0.075
Lithium	ug/L	10	9.4	11.2	15.2	12.9
Mercury	ug/L	<0.039	<0.046	<0.046	<0.046	<0.046
Molybdenum	ug/L	0.5	0.56	0.31	0.31	0.37
Selenium	ug/L	<0.18	0.12	0.11	0.11	0.13
Thallium	ug/L	<0.5	<0.036	<0.036	<0.036	0.065
Total Radium	pCi/L	2.66	2.77	2.83	3.07	2.88
Radium-226	pCi/L	1.55	1.72	1.87	1.69	1.76
Radium-228	pCi/L	1.11	1.05	0.96	1.38	1.12
Field Specific Conductance	umhos/cm	1640	1648	1557	2193	1656
Field Temperature	deg C	12.9	12	12.7	13	13.2
Groundwater Elevation	feet	648.81	653.62	649.85	645.78	647.37
Oxygen, Dissolved	mg/L	0.16	0.2	0.08	0.08	0.17
Turbidity	NTU	9.01	66.67	34.94	4.89	11.16
pH at 25 Degrees C	Std. Units	7	6.9	6.8	6.9	7
Field Oxidation Potential	millivolts	-42	-16	-23.1	23.7	176.7

Single Location

Name: IPL - Ottumwa Generating Station

Location ID:	MW-308					
Number of Sampling Dates:	5					
Parameter Name	**Units**	**1/19/2017**	**4/20/2017**	**6/21/2017**	**8/21/2017**	**11/8/2017**
Boron	ug/L	218	146	182	214	240
Calcium	mg/L	212	222	209	218	212
Chloride	mg/L	151	149	146	151	156
Fluoride	mg/L	0.11	0.12	0.12	0.23	0.12
Field pH	Std. Units	6.85	6.7	6.93	6.52	6.76
Sulfate	mg/L	296	283	303	294	297
Total Dissolved Solids	mg/L	1060	1100	1050	1020	1120
Antimony	ug/L	0.11	<0.026	0.039	<0.026	<0.026
Arsenic	ug/L	0.44	0.34	0.14	0.32	0.32
Barium	ug/L	118	118	125	132	133
Beryllium	ug/L	<0.08	<0.012	<0.012	<0.012	<0.012
Cadmium	ug/L	<0.029	<0.018	<0.018	<0.018	<0.018
Chromium	ug/L	0.57	0.44	0.34	0.49	0.45
Cobalt	ug/L	0.52	0.43	0.25	0.26	0.23
Lead	ug/L	<0.19	0.066	<0.033	<0.033	<0.033
Lithium	ug/L	10.3	13.3	12.7	19.1	12.6
Mercury	ug/L	<0.039	<0.046	<0.046	<0.046	<0.046
Molybdenum	ug/L	0.95	0.53	0.5	0.61	0.75
Selenium	ug/L	<0.18	<0.086	<0.086	<0.086	<0.086
Thallium	ug/L	<0.5	<0.036	<0.036	<0.036	<0.036
Total Radium	pCi/L	1.45	0.496	3.3	2.17	1.47
Radium-226	pCi/L	0.282	-0.173	2	1.42	1.18
Radium-228	pCi/L	1.17	0.496	1.3	0.745	0.286
Field Specific Conductance	umhos/cm	1559	1509	1467	2042	1577
Field Temperature	deg C	12.6	11.9	12.2	12.6	13
Groundwater Elevation	feet	647.42	651.09	648.26	643.12	644.99
Oxygen, Dissolved	mg/L	0.15	0.21	0.03	0.12	0.12
Turbidity	NTU	1.65	4.6	0.84	1.15	0.73
pH at 25 Degrees C	Std. Units	7.2	7.2	7	6.9	7
Field Oxidation Potential	millivolts	-44.4	1.7	-29.1	24.4	169.7

Single Location

Name: IPL - Ottumwa Generating Station

Location ID:	MW-309					
Number of Sampling Dates:	5					
Parameter Name	**Units**	**1/19/2017**	**4/20/2017**	**6/21/2017**	**8/21/2017**	**11/8/2017**
Boron	ug/L	1300	1280	1250	1320	1360
Calcium	mg/L	134	152	136	135	135
Chloride	mg/L	73.1	73.7	75.5	78.4	78.1
Fluoride	mg/L	0.12	0.13	0.16	0.19	0.14
Field pH	Std. Units	7.18	7.01	7.17	6.9	7.11
Sulfate	mg/L	406	393	415	395	402
Total Dissolved Solids	mg/L	1030	1030	1020	1010	1010
Antimony	ug/L	0.095	<0.026	0.041	0.029	<0.026
Arsenic	ug/L	0.66	1.1	0.52	0.44	0.45
Barium	ug/L	48.7	62.4	48.7	46.1	46
Beryllium	ug/L	<0.08	0.073	0.025	<0.012	0.016
Cadmium	ug/L	<0.029	0.042	0.033	0.018	<0.018
Chromium	ug/L	1.4	3.2	1.8	1.2	1.2
Cobalt	ug/L	2	3.1	2.4	2.1	2
Lead	ug/L	<0.19	1	0.5	0.096	0.057
Lithium	ug/L	5.8	9.3	7.3	9.4	6.9
Mercury	ug/L	<0.039	<0.046	<0.046	<0.046	<0.046
Molybdenum	ug/L	0.57	0.32	0.28	0.28	0.37
Selenium	ug/L	<0.18	0.22	<0.086	<0.086	<0.086
Thallium	ug/L	<0.5	<0.036	<0.036	<0.036	<0.036
Total Radium	pCi/L	0.606	2.23	1.63	1.65	1.11
Radium-226	pCi/L	0.143	0.968	1.37	0.783	0.284
Radium-228	pCi/L	0.463	1.26	0.259	0.866	0.825
Field Specific Conductance	umhos/cm	1426	1430	1363	1821	1431
Field Temperature	deg C	12.7	12.1	12.4	12.6	13.1
Groundwater Elevation	feet	646.66	650.16	647.6	641.82	644.2
Oxygen, Dissolved	mg/L	0.09	0.16	0.06	0.08	0.13
Turbidity	NTU	8.56	77.74	20.33	2.34	3.71
pH at 25 Degrees C	Std. Units	7.4	7.4	7.2	7.2	7.4
Field Oxidation Potential	millivolts	-42.1	0.2	-34.8	-5	149.7