2019 Annual Groundwater Monitoring and Corrective Action Report Addendum No. 1

Ottumwa Generating Station – Zero Liquid Discharge Pond
Ottumwa, Iowa

Prepared for:

Alliant Energy

SCS ENGINEERS

25222072.00 | May 4, 2022

2830 Dairy Drive
Madison, WI 53718-6751
608-224-2830

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1.0 INTRODUCTION

This 2019 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 2019 Annual Groundwater Monitoring and Corrective Report (Annual Report) was completed on January 31, 2020, to fulfill the requirements of 40 CFR 257.90(e).

The 2019 Annual Report and this Addendum cover the period of groundwater monitoring from January 1, 2019, through December 31, 2019.

This Addendum includes the following tables, figures, and appendix materials to support the information in the original 2019 Annual Report:

- Table 1 – Groundwater Monitoring Well Network
- Table 2 – Groundwater Elevation Summary
- Table 3 – Horizontal Gradients and Flow Velocities
- Table 4 – Groundwater Analytical Results Summary - 2019
- Table 5 – 2019 Groundwater Field Data Summary
- Figure 1 – Site Location Map
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- Figure 4 – Shallow Potentiometric Surface, October 23-24, 2019
- Appendix A – Regional Hydrogeologic Information
- Appendix B – Boring Logs and Well Construction Documentation
- Appendix C – Historical Monitoring Results
- Appendix D – Statistical Evaluation

Tables

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

Monitoring Well	Location in Monitoring Network	Role in Monitoring Network
MW-301	Upgradient	Background
MW-307	Downgradient	Compliance
MW-308	Downgradient	Compliance
MW-309	Downgradient	Compliance

Created by: RM Date: 12/14/2020
Last revision by: JAO Date: 3/22/2022
Checked by: KLG Date: 3/28/2022

\\Mad-fs01\data\Projects\25222072.00\Deliverables\2019 Fed Annual Report Addendum - OGS ZLDP\Tables\[Table 1_GW Monitoring Well Network.xlsx]GW Summary

Table 2. Groundwater Elevation Summary
WPL - Ottumwa Generating Station / SCS Engineers Project #25222072.00

Ground 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**	**MW-310**	**MW-311**
Top of Casing Elevation (feet amsl)	686.63	673.90	661.07	682.84	683.91	683.47	657.56	655.39	654.94	658.63	654.18
Screen Length (ft)	10.00	5.00	5.00	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	25.9	17.9
Top of Well Screen Elevation (ft)	679.63	653.10	648.57	635.54	637.41	651.87	634.56	635.39	632.44	637.76	641.24
Measurement Date											
April 26, 2016	682.80	655.63	652.42	655.37	661.67	670.86	NI	NI	NI	NI	NI
June 23, 2016	682.58	655.65	652.89	656.53	662.36	670.64	NI	NI	NI	NI	NI
August 9, 2016	682.27	655.52	651.76	653.79	660.78	670.35	NI	NI	NI	NI	NI
October 26-27, 2016	682.04	655.67	652.17	655.03	661.37	670.21	NI	NI	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	NI	NI
April 19-20, 2017	682.15	656.35	654.57	657.48	663.27	670.69	653.62	651.09	650.16	NI	NI
June 20-21, 2017	681.91	655.65	652.42	654.75	661.26	669.94	649.85	648.26	647.60	NI	NI
August 21-23, 2017	681.28	655.13	650.58	652.39	659.00	668.77	645.78	643.12	641.82	NI	NI
November 8, 2017	681.54	655.40	651.34	653.03	659.76	669.04	647.37	644.99	644.20	NI	NI
April 18, 2018	681.53	655.71	652.47	655.55	660.99	668.92	649.66	647.91	647.65	NI	NI
May 30, 2018	NM	NM	NM	NM	NM	NM	652.45	651.05	650.98	NI	NI
June 28, 2018	NM	NM	NM	NM	NM	NM	652.87	651.43	651.47	NI	NI
July 18, 2018	NM	NM	NM	NM	NM	NM	652.27	650.67	650.69	NI	NI
August 14-15, 2018	680.91	656.05	652.57	656.35	661.56	668.66	NM	NM	NM	NI	NI
August 29, 2018	681.09	655.89	655.07	657.82	NM	NM	NM	NM	NM	NI	NI
October 16, 2018	682.50	656.91	656.17	658.20	663.37	670.24	654.13	NM	651.61	NI	NI
January 8, 2019	682.22	656.03	654.65	656.28	662.13	669.84	NM	NM	NM	NI	NI
April 8, 2019	682.69	657.23	655.55	659.33	664.01	670.96	654.90	653.70	653.55	NI	NI
August 28, 2019	NM	NM	NM	NM	NM	NM	NM	NM	NM	640.98	642.10
October 23-24, 2019	683.07	660.14	653.86	657.71	663.21	671.28	651.89	651.31	651.28	649.31	647.80
December 11, 2019	NM	NM	NM	NM	NM	NM	649.59	647.39	647.24	NM	NM
Bottom of Well Elevation (ft)	669.63	648.10	643.57	630.54	632.41	646.87	629.56	630.39	627.44	632.76	636.24

Notes:
NM = not measured
NI= not installed

Created by: MDB Date: 5/1/2017
Last rev. by: NDK Date: 3/25/2022
Checked by: KLG Date: 3/28/2022
Proj Mgr QA/QC: Date:

I:\25222072.00\Deliverables\2019 Fed Annual Report Addendum - OGS ZLDP\Tables\[Table 2_ZLDP - GW elevation Summary.xls]levels

Table 3. Horizontal Gradients and Flow Velocity
Ottumwa Generating Station - Zero Liquid Discharge Pond /
SCS Engineers Project #25222072.00
January - December 2019

	Shallow				
Sampling Dates	**h1 (ft)**	**h2 (ft)**	**Δl (ft)**	**Δh/Δl (ft/ft)**	**V (ft/d)**
April 9, 2019	670.00	654.90	455	0.03	0.23
April 9, 2019	665.00	653.70	387	0.03	0.21
October 23-24, 2019	671.28	650.00	621	0.03	0.24
October 23-24, 2019	660.00	651.28	517	0.02	0.12

	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: Multiple gradients were measured for each date 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: 4/18/2022

Table 4. Groundwater Analytical Results Summary - CCR Program

Ottumwa Generating Station - Zero Liquid Discharge Pond (ZLDP) / SCS Engineers Project #25222072.00

			Background Well		Compliance Wells								
Parameter Name	**UPL**		**MW-301**		**MW-307**			**MW-308**			**MW-309**		
			4/8/2019	10/24/2019	4/8/2019	10/23/2019	12/11/2019	4/8/2019	10/23/2019	12/11/2019	4/8/2019	10/23/2019	12/11/2019
Appendix III													
Boron, ug/L	820		380	680	240	200	190 J	190 J	220	160 J	1,500	1,300	1,100
Calcium, mg/L	78.7		43	78	240	230	230	240	240	220	160	150	150
Chloride, mg/L	86.8		50	110	220	220	200	160	160	150	72	74	66
Fluoride, mg/L	0.484	**UPL only**	0.44 J	<0.23	0.28 J	<0.23	<0.23	<0.23	<0.23	<0.23	0.27 J	<0.23	<0.23
Field pH, Std. Units	6.87		6.61	6.33	6.76	6.68	6.37	6.90	6.78	6.55	7.18	6.98	6.67
Sulfate, mg/L	199		81	130	100	95	92	300	300	280	410	400	370
Total Dissolved Solids, mg/L	628		340	510	1,000	1,000	1,000	1,200	1,100	1,100	1,100	1,100	980
Appendix IV	**UPL**	**GPS**											
Antimony, ug/L	0.22	6	<1.00	<0.53	NA	NA	<0.53	NA	NA	<0.53	NA	NA	<0.53
Arsenic, ug/L	0.53	10	<2.00	<0.75	NA	NA	<0.75	NA	NA	<0.75	NA	NA	1.1 J
Barium, ug/L	68.8	2,000	25.5	56	NA	NA	140	NA	NA	130	NA	NA	54
Beryllium, ug/L	LOQ (varies by well)	4	<1.00	<0.27	NA	NA	<0.27	NA	NA	<0.27	NA	NA	<0.27
Cadmium, ug/L	0.12	5	<0.500	0.040 J1	NA	NA	<0.039	NA	NA	<0.039	NA	NA	0.090 J
Chromium, ug/L	1.07	100	<5.00	<0.98	NA	NA	<0.98	NA	NA	5.9	NA	NA	1.7 J
Cobalt, ug/L	4.1	6	<0.500	0.60	NA	NA	11	NA	NA	0.26 J	NA	NA	3.7
Fluoride, mg/L	0.484	4	<0.500	<0.23	NA	<0.23	<0.23	NA	<0.23	<0.23	NA	<0.23	<0.23
Lead, ug/L	0.1	15	<0.500	<0.27	NA	NA	0.71	NA	NA	0.52	NA	NA	2.8
Lithium, ug/L	34.2	40	15.5	24	NA	NA	12	NA	NA	16	NA	NA	8.2 J
Mercury, ug/L	LOQ (varies by well)	2	<0.200	<0.10	NA	NA	<0.10	NA	NA	<0.10	NA	NA	<0.10
Molybdenum, ug/L	1.74	100	<2.00	1.1 J1	NA	NA	<1.1	NA	NA	<1.1	NA	NA	<1.1
Selenium, ug/L	8.55	50	<5.00	6.2	NA	NA	<1.0	NA	NA	<1.0	NA	NA	<1.0
Thallium, ug/L	0.14	2	<1.00	<0.27	NA	NA	<0.27	NA	NA	<0.27	NA	NA	<0.27
Radium 226/228 Combined, pCI/L	2.15	5	NA	0.956	NA	NA	2.46	NA	NA	2.73	NA	NA	1.77

Blue highlighted cell indicates the compliance well result exceeds the UPL and the LOQ.

Yellow highlighted cell indicates the compliance well result exceeds the GPS.

Abbreviations:
UPL = Upper Prediction Limit
LOD = Limit of Detection
GPS = Groundwater Protection Standard
LOQ = Limit of Quantitation
ug/L = micrograms per liter
mg/L = milligrams per liter

Notes:
J = Estimated concentration at or above the LOD and below the LOQ.
J1 = Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

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Checked by: MDB Date: 3/30/2022
Proj Mgr QA/QC: Date:

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Table 5. 2019 Groundwater Field Data Summary
Ottumwa Generating Station - Zero Liquid Discharge Pond
SCS Engineers Project #25222072.00

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	1/8/2019	682.22	7.88	5.68	5.68	310	118.3	0.77
	4/8/2019	682.69	7.27	6.61	8.32	501	37.6	1.87
	10/24/2019	683.07	13.71	6.33	4.94	902	9.9	1.60
MW-307	4/8/2019	654.9	12.47	6.76	0.51	1599	-3.7	26
	10/23/2019	651.89	13.38	6.68	0.25	1684	-24.8	12.5
	12/11/2019	649.59	11.5	6.37	0.18	1576	-45.8	43.13
MW-308	4/8/2019	653.7	12.54	6.9	0.66	1539	-23	6.87
	10/23/2019	651.31	13.16	6.78	4.42	1637	-38.7	7.42
	12/11/2019	647.39	10.5	6.55	0.43	1532	-56.6	15.72
MW-309	4/8/2019	653.55	12.4	7.18	0.66	1396	-3.3	72.1
	10/23/2019	651.28	12.83	6.98	0.36	1461	-27.5	42.6
	12/11/2019	647.24	11.5	6.67	0.26	1350	-37.8	413.6

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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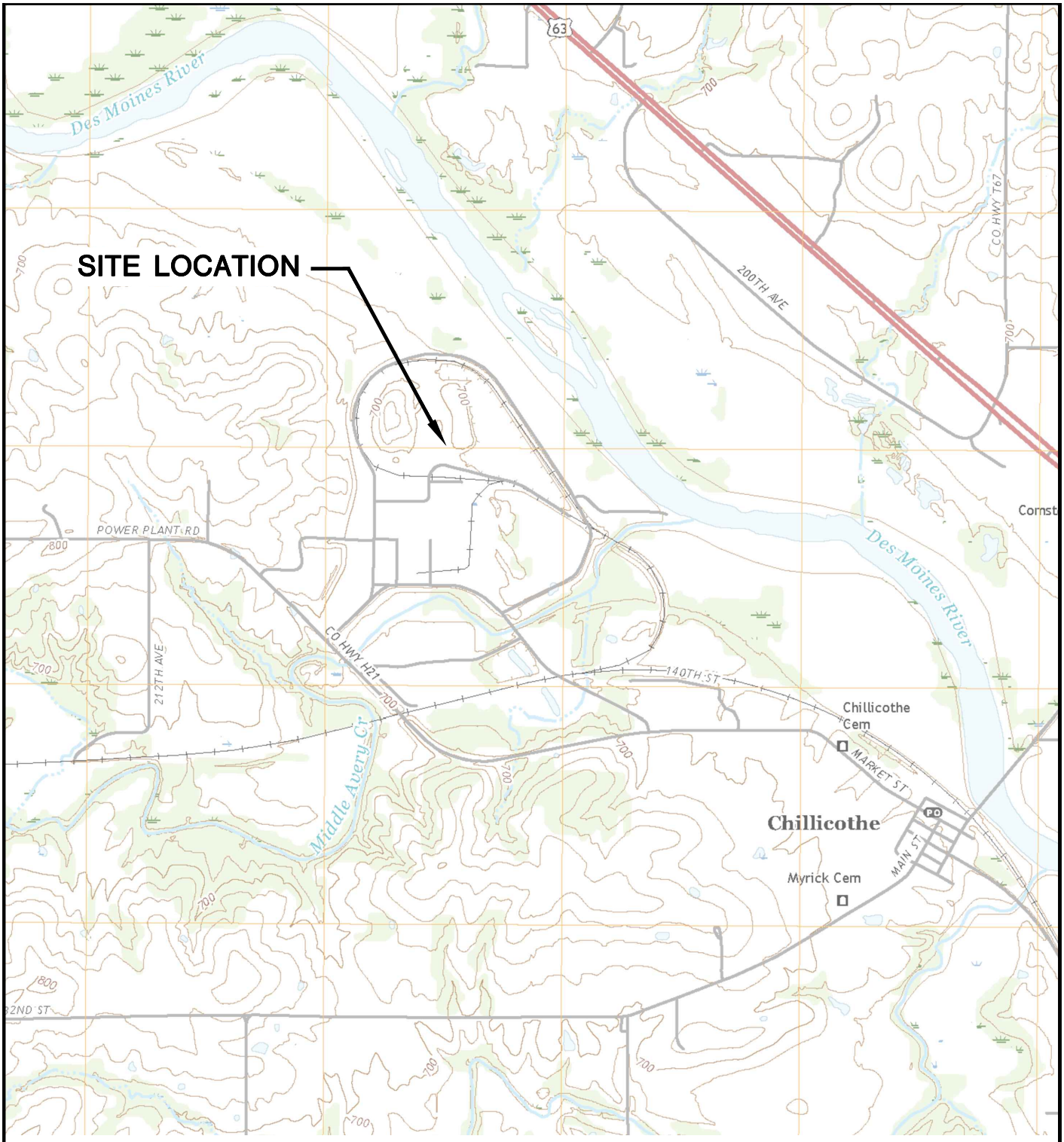
Figures



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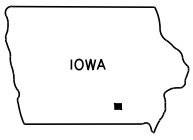
CHILLICOTHE QUADRANGLE
IOWA–WAPELLO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
2018
SCALE: 1" = 2,000'



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
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FIGURE
1

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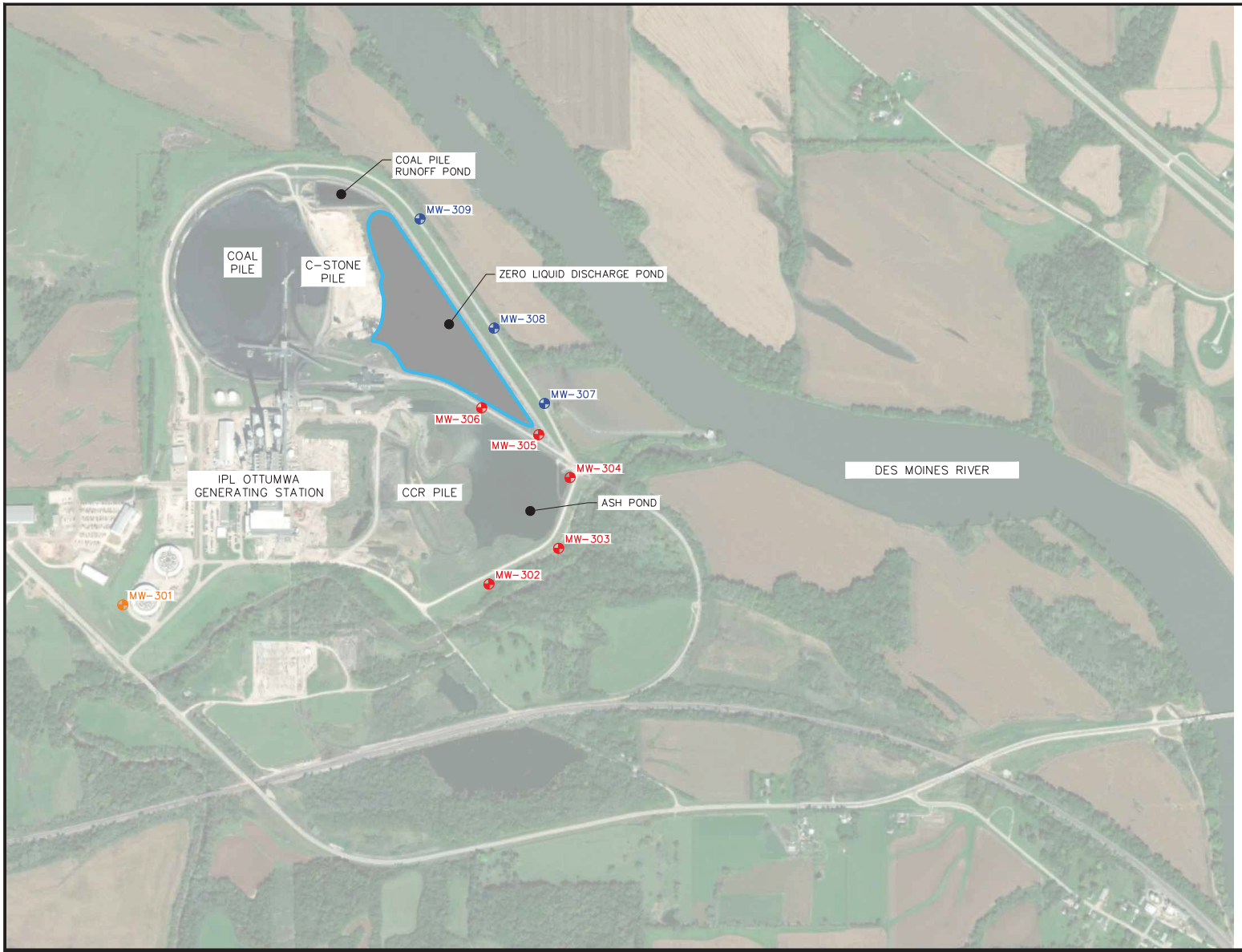

LEGEND

- 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 ZLDP 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 5/3/2022

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

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-ZERO LIQUID DISCHARGE POND

FIGURE 2

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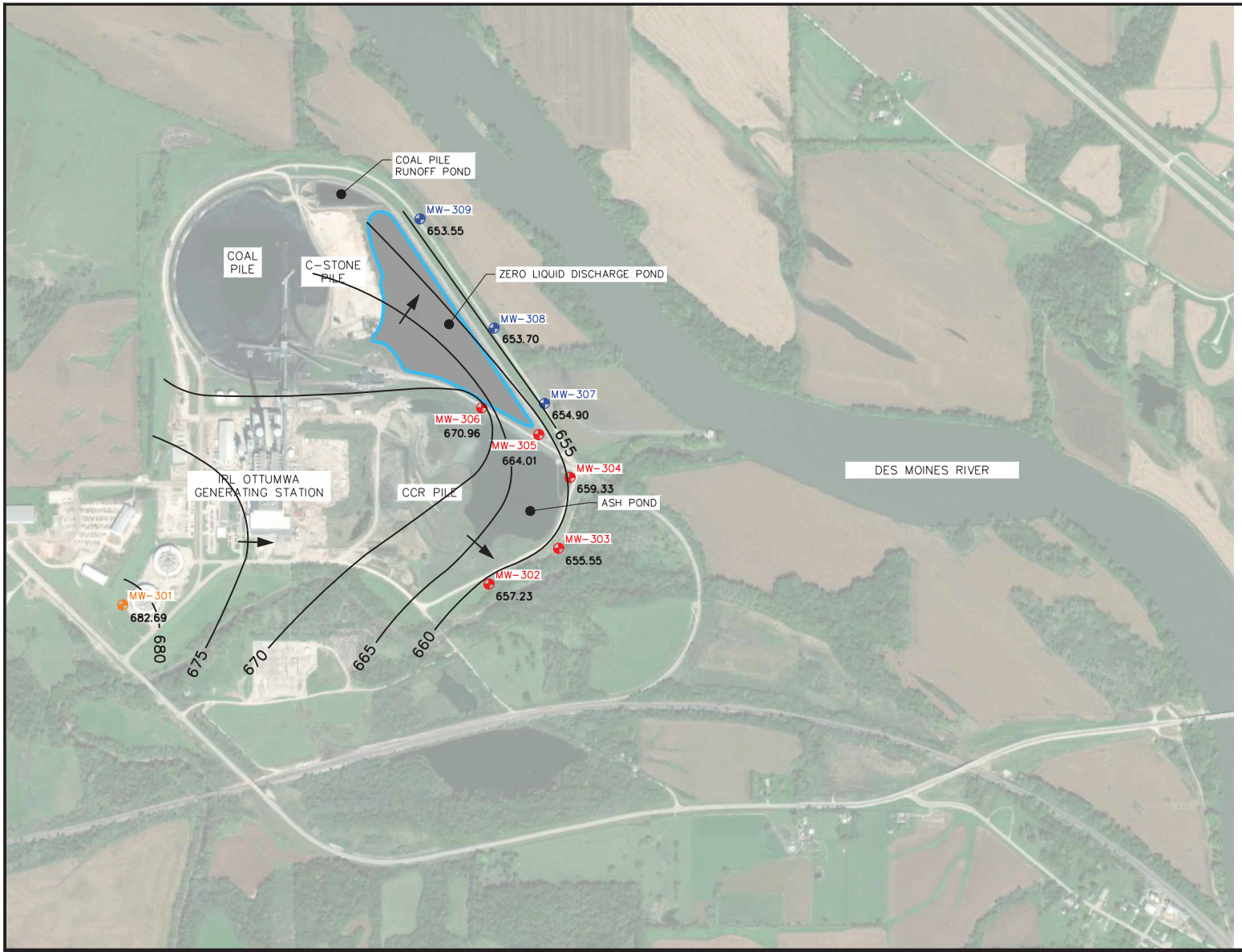

LEGEND

- CCR UNIT
- CCR ZLDP MONITORING WELL
- CCR ASH POND MONITORING WELL
- CCR BACKGROUND MONITORING WELL
- 682.15 — POTENTIOMETRIC ELEVATION AT WELL (APRIL 8, 2019)
- POTENTIOMETRIC SURFACE CONTOUR
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTE:

1. THE BACKGROUND MONITORING WELL FOR THE OGS ZLDP 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 5/3/2022

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20775 POWER PLANT ROAD
OTTUMWA, IA 52501

SITE: ALLIANT ENERGY
OTTUMWA GENERATING STATION
OTTUMWA, IOWA

SHALLOW POTENTIOMETRIC SURFACE
APRIL 8, 2019

FIGURE 3

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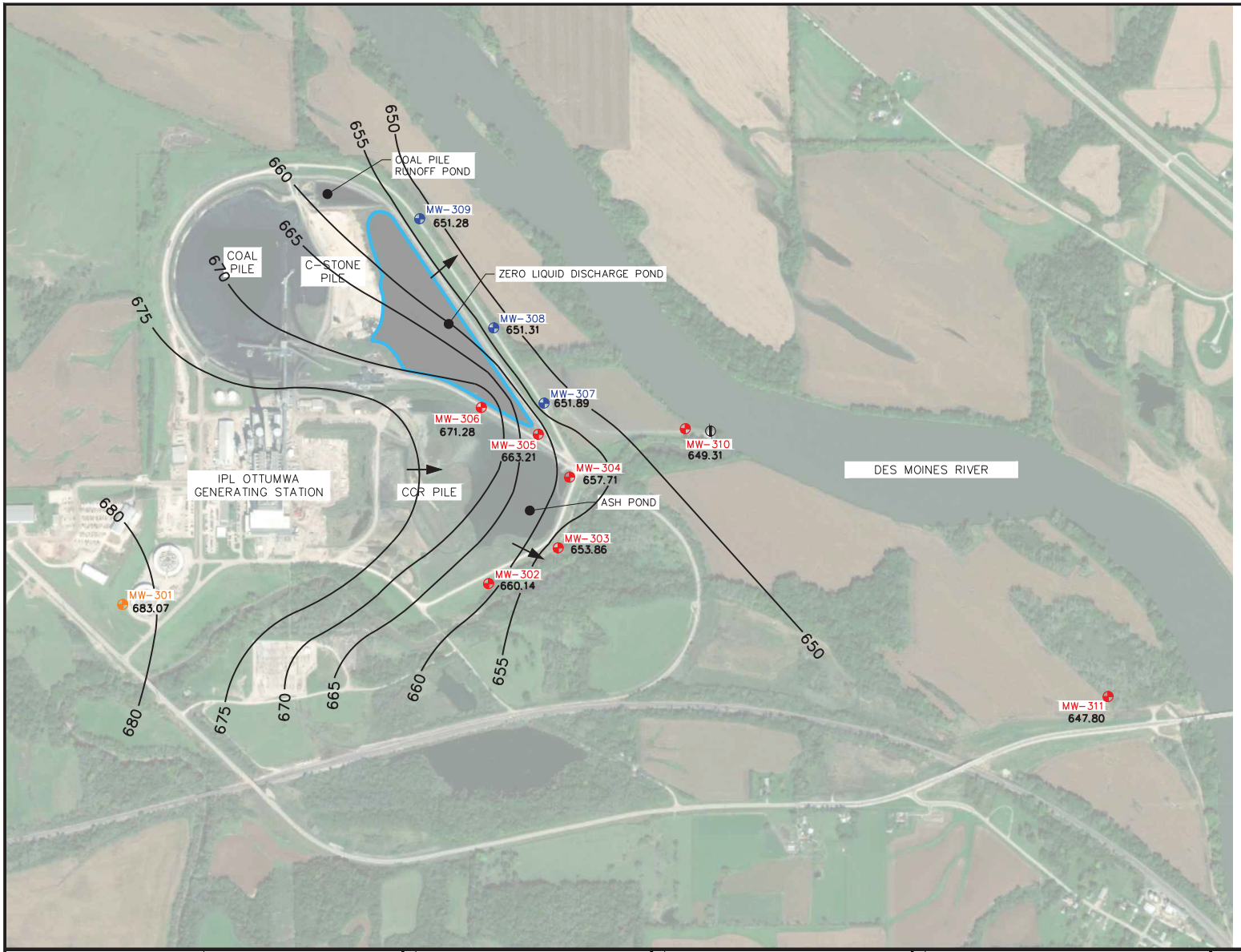

LEGEND

- CCR UNIT
- CCR ZLDP MONITORING WELL
- CCR ASH POND MONITORING WELL
- CCR BACKGROUND MONITORING WELL
- RIVER ELEVATION MEASUREMENT LOCATION
- 683.07 — POTENTIOMETRIC ELEVATION AT WELL (OCTOBER 23–24, 2019)
- POTENTIOMETRIC SURFACE CONTOUR
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTE:

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

N

800 0 800

SCALE: 1" = 800'

PROJECT NO.	25222072.00	DRAWN BY:	KP
DRAWN:	03/26/2022	CHECKED BY:	NDK
REVISED:	03/26/2022	APPROVED BY:	TK 5/3/2022

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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

SHALLOW POTENTIOMETRIC SURFACE
OCTOBER 23–24, 2019

FIGURE 4

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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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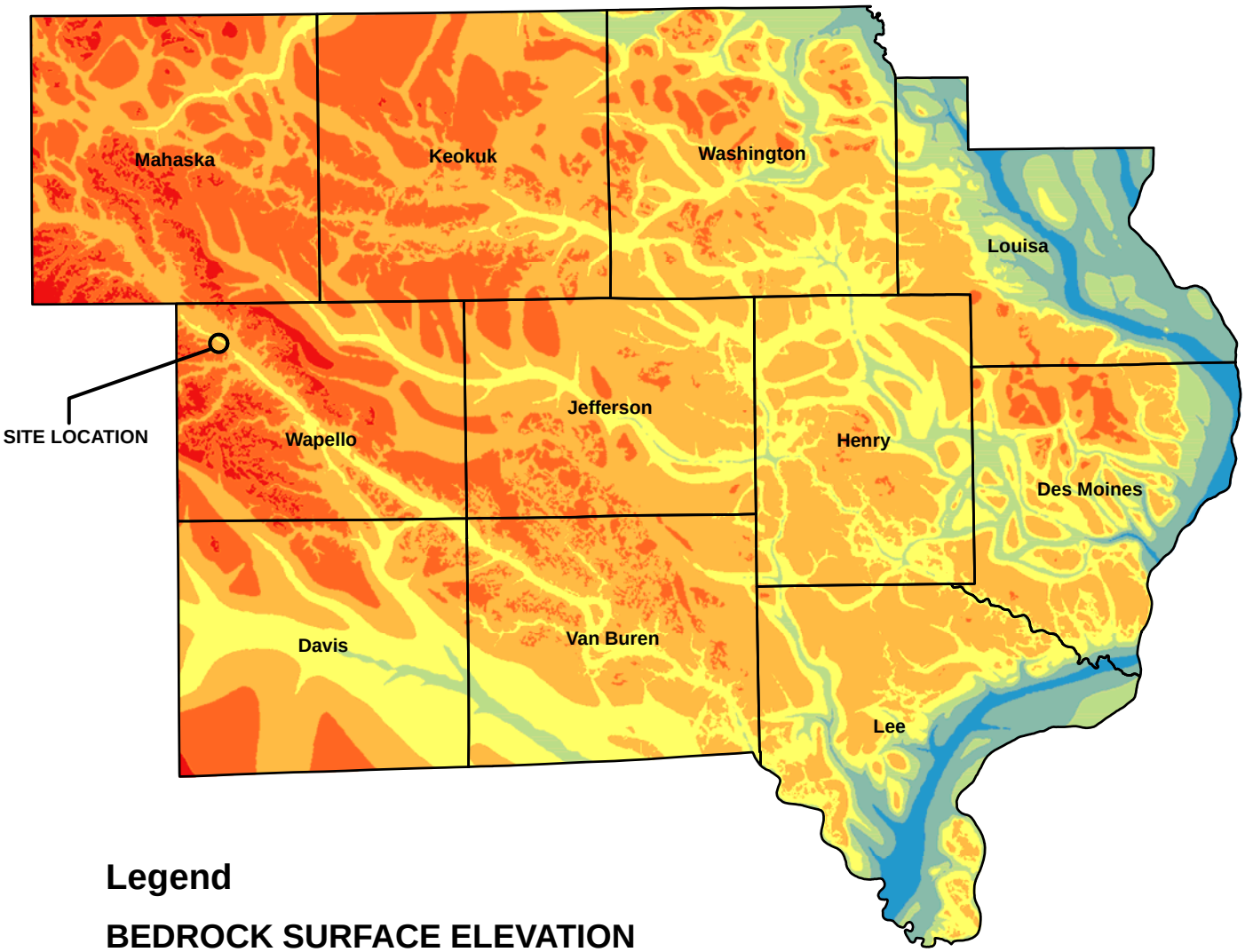


Legend

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

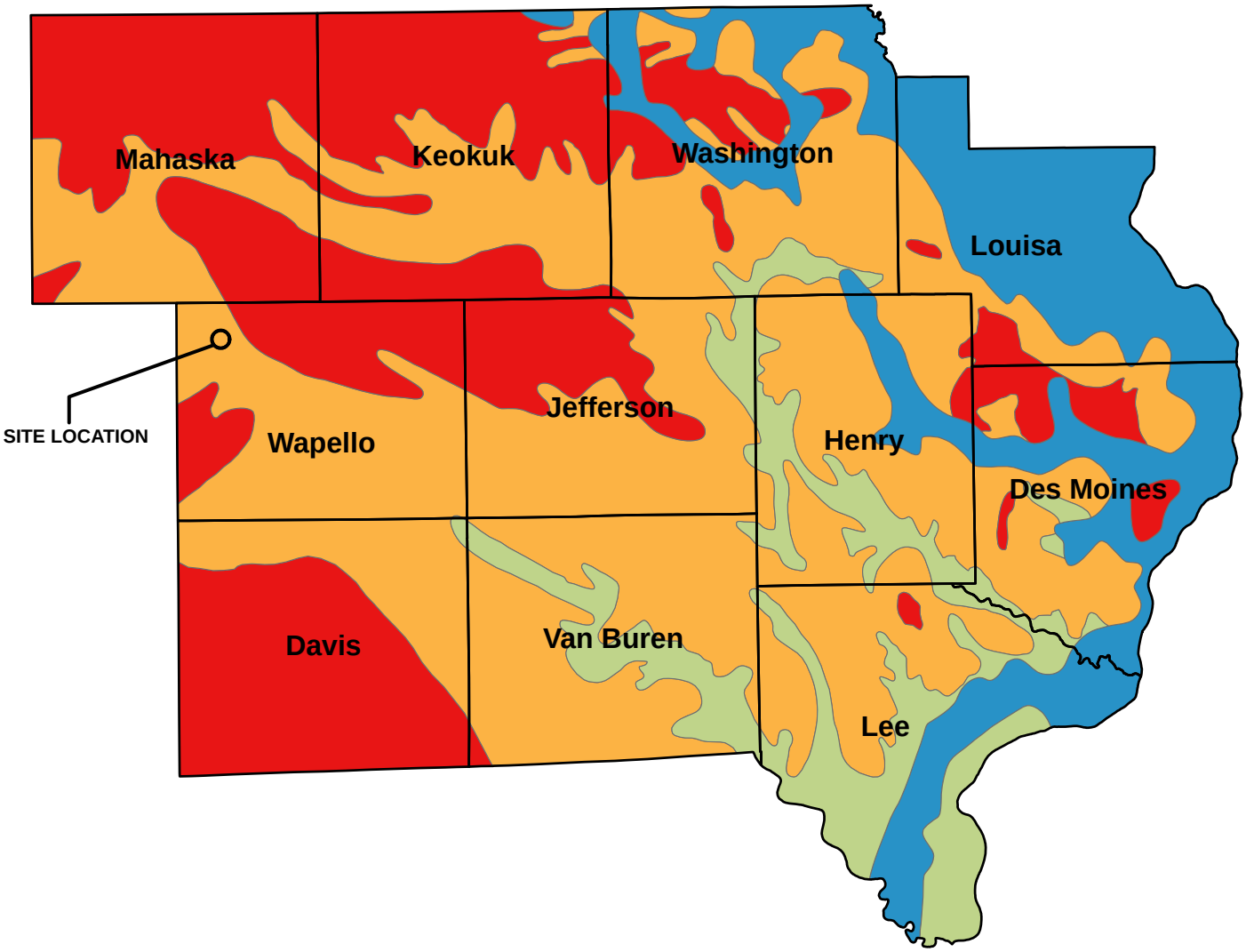
MAP DATA DERIVED FROM IOWA GEOLOGICAL AND WATER SURVEY
IOWA BEDROCK SURFACE ELEVATION AS OBTAINED
FROM IOWA NATURAL RESOURCES
GEOGRAPHIC INFORMATION SYSTEMS LIBRARY

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

I:\25215053\Drawings\OGS\ArcMAP\OML-BEDROCK TOPO 8.5X11 portrait.mxd



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

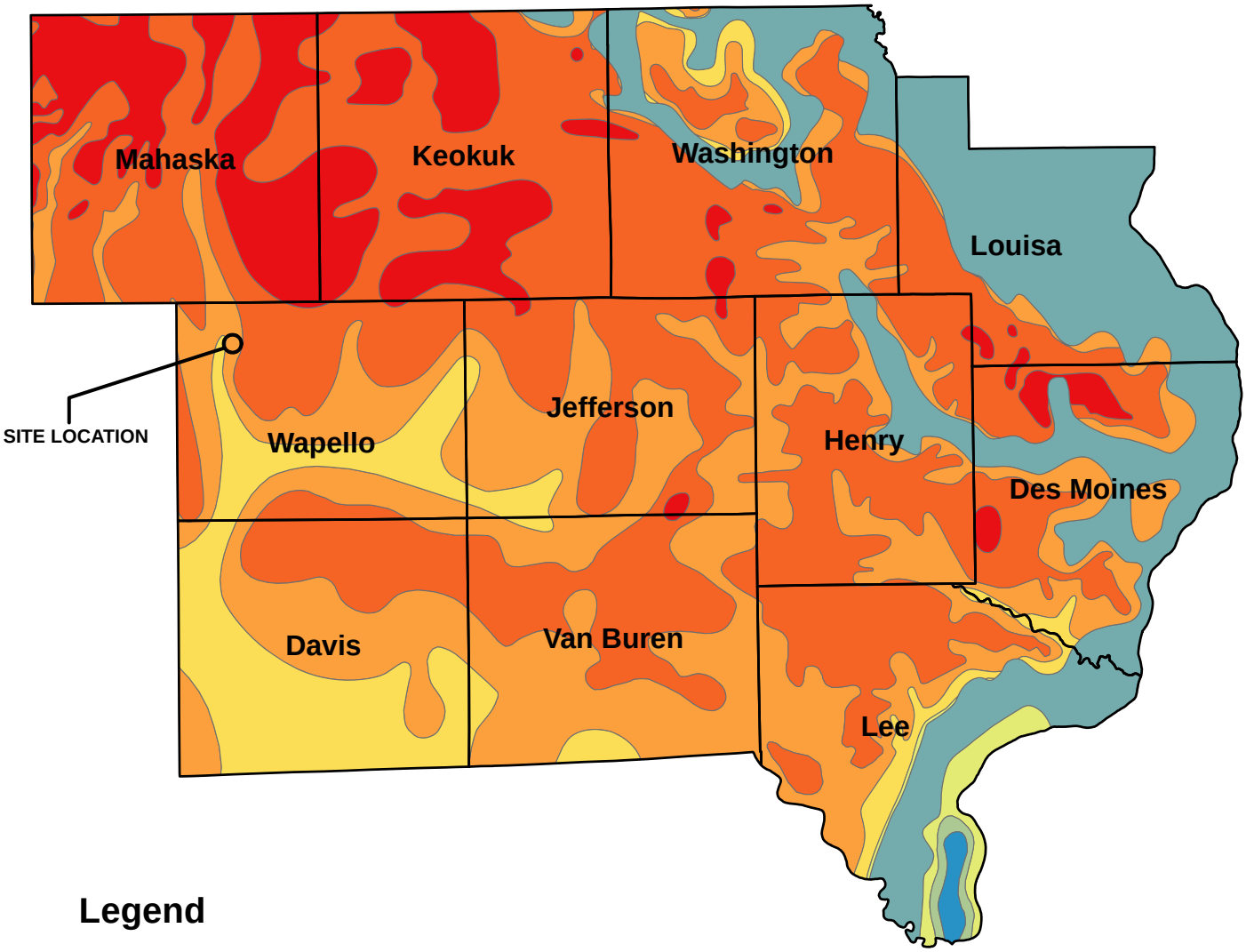
PROJECT NO.	25215053.03	DRAWN BY:	JB
DRAWN:	07/29/13	CHECKED BY:	MDB
REVISED:	05/29/15	APPROVED BY:	

ENGINEER

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

FIGURE

I:\25215053\Drawings\OGS\ArcMAP\OML-MISSISS POTENT 8.5X11 portrait.mxd



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	SCS ENGINEERS 2830 DAIRY DRIVE MADISON, WI 53718-6751 PHONE: (608) 224-2830 FAX: (608) 224-2839	FIGURE
DRAWN: 07/29/13	CHECKED BY: MDB			
REVISED: 05/29/15	APPROVED BY:			

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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
			1	TOPSOIL.	TOPSOIL									
			2	SANDY SILT WITH GRAVEL, gray (7.5YR 6/1), gravel is fine.										
			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	Firm	
for Kyle Kramer	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	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									
			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
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-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 ☐ 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									
			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 20							M				
S5	23	2 7 8 9	21 22 23							M				
S6	23	3 4 8 6	24 25							M				
S7	23	5 11 15 11	26 27		CH					M				
S8	15	4 4 5 6	28 29 30							M				
S9	18	4 6 9 9	31 32 33							M				
S10	24	4 6 7 6	34 35							M				
S11	16	2 2 4 6	36 37 38	FAT CLAY, DARK OLIVE BROWN (2.5Y 3/3).						M				
S12	24	4 3 5 5	39 40		CH					M				
S13	18	2 3 3 3	41 42							M				

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	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 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									
			2	FAT CLAY, dark olive brown (2.5Y 3/3).										
			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#: 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 ☐ (cstimatcd: ☐) 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	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	SANDY SILT WITH GRAVEL, gray (7.5YR 6/1), gravel is fine.										
			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#: 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	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			16	LEAN CLAY, dark yellowish brown (10YR 4/4), slightly dense. *(continued)*	CL									
S3	24	1 2 2 4	16	SILT, dark yellowish brown (10YR 3/4), fine to medium sand.						W				
			17											
			18		ML									
S4	17	3 3 3	19							W				Bedrock @19.5 ft bgs.
			20	SANDSTONE, dark brown (10YR 3/3),										
S5	5	50/0.5	21							W				More competent @20.5' -24.5' bgs.
			22											
			23											
			24											
			25	more weathered.										
			26											
			27											
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	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	13–14	SILT, brown (10YR 4/3), some clay.	ML					W				
			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:

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									
			13											
S2		2 2 2 2	14							W				
			15											

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

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

Boring Number MW-309 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	SILTY SAND, very dark grayish brown (10YR 3/2), fine to medium grained.										
S3		1 1 1 1	17		SM					W				
			18											
S4		3 5 4 6	19							W				
			20	POORLY GRADED SAND, yellowish brown (10YR 5/4), coarse grained.	SP									
S5		2 3 7 50	21							W				
			22	WEATHERED SANDSTONE.										
			23											
			24											
S6			25							W				
			26											
			27											
				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	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	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									
			2											
			3											
			4											
			5											
			6											
			7											Water at 6.5 ft bgs
			8											
			9	LEAN CLAY, dark brown (10YR 3/3), medium dense.	CL									
			10											
S1	12	1 3 3 4	11							W				
			12											
			13	SILT, dark brown (10YR 3/3), some clay.	ML									
S2	18	3 3 3 3	14							W				
			15											

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

Signature	Firm	Tel: (608) 224-2830
	SCS Engineers 2830 Dairy Drive Madison, WI 53711	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									
S4	15	1 17 50/0.2	19	POORLY GRADED SAND, brown (10YR 4/3).	SP					W				Bedrock at18.5 ft bgs
S5	6	50/0.3	20	WEATHERED SANDSTONE, grayish brown (10YR 5/2).						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'

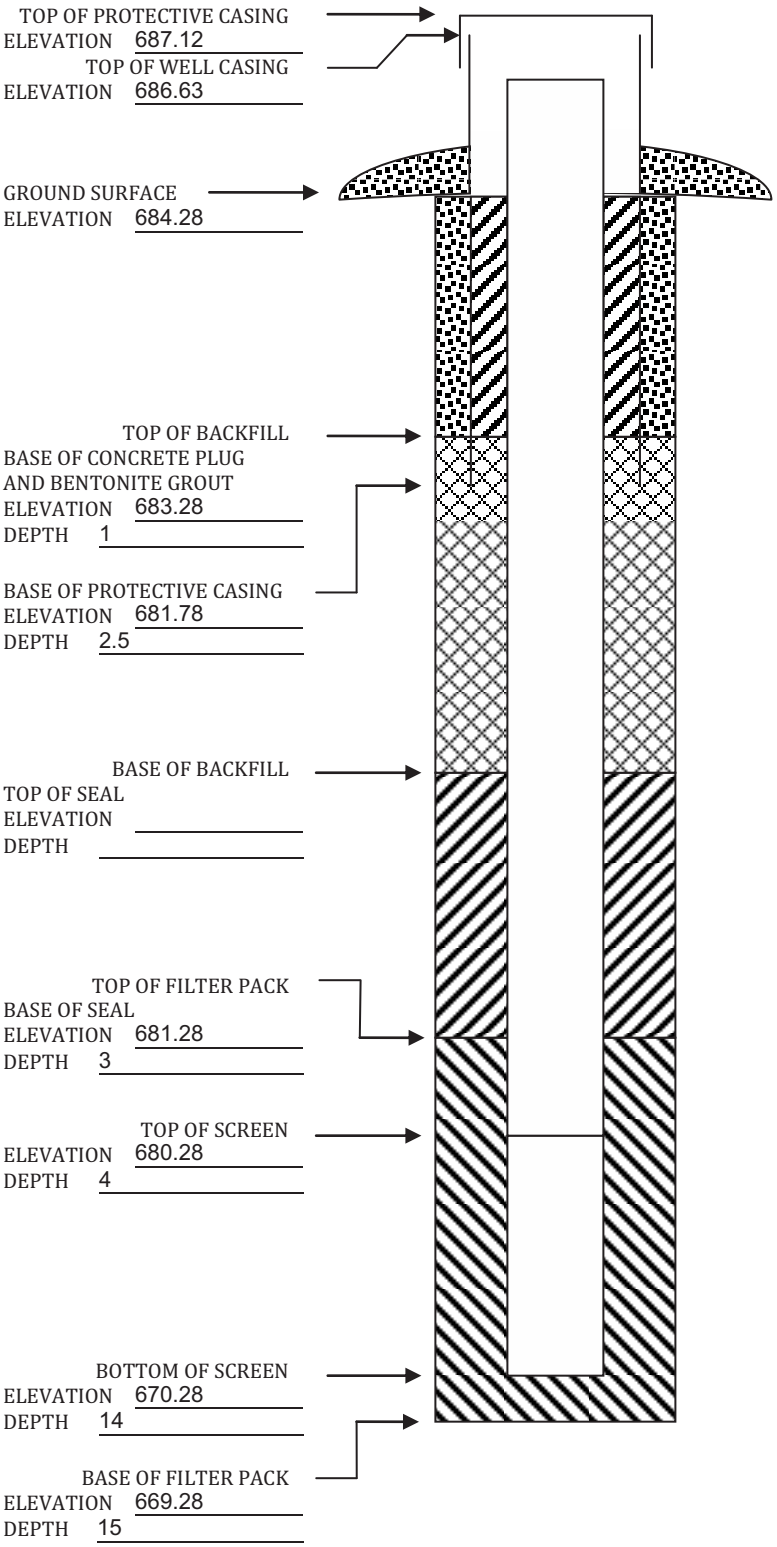
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

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-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'

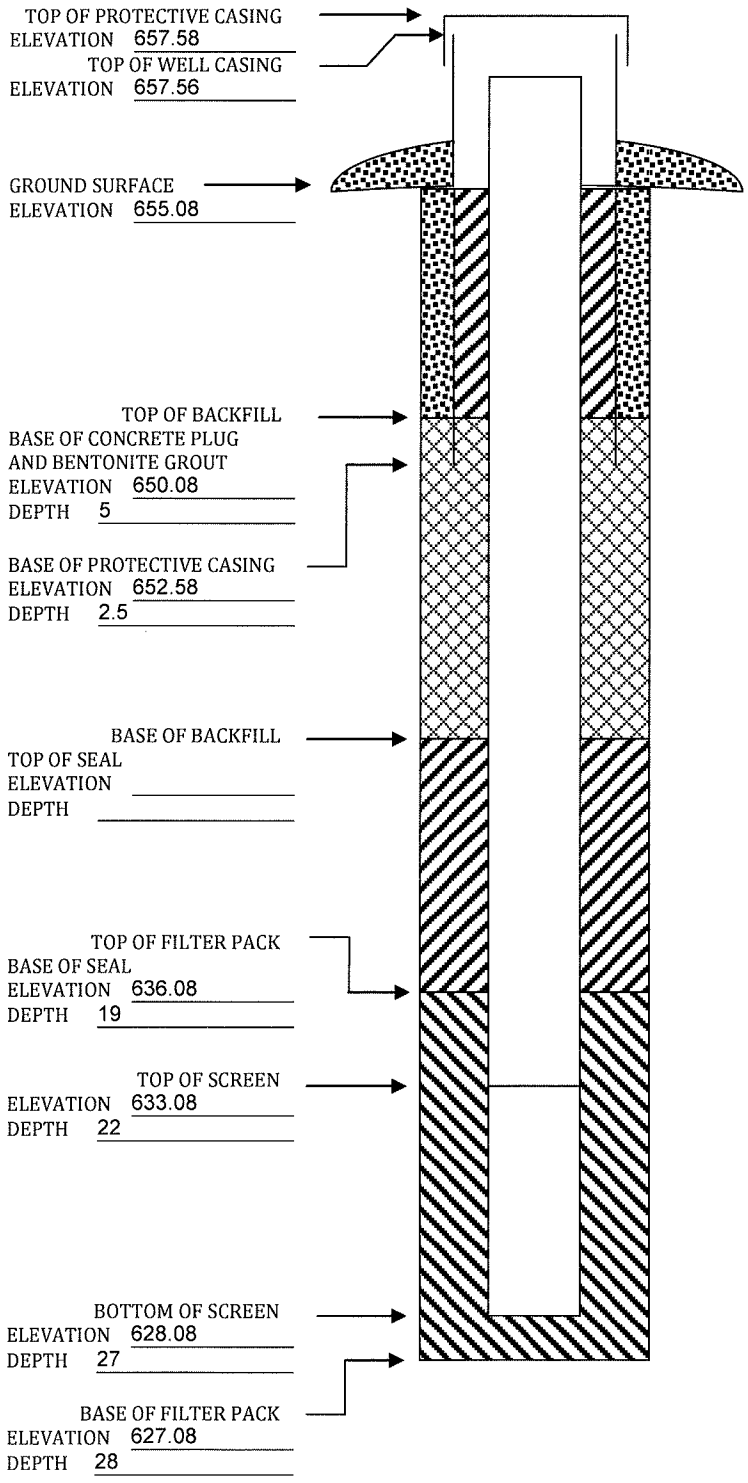
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

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'

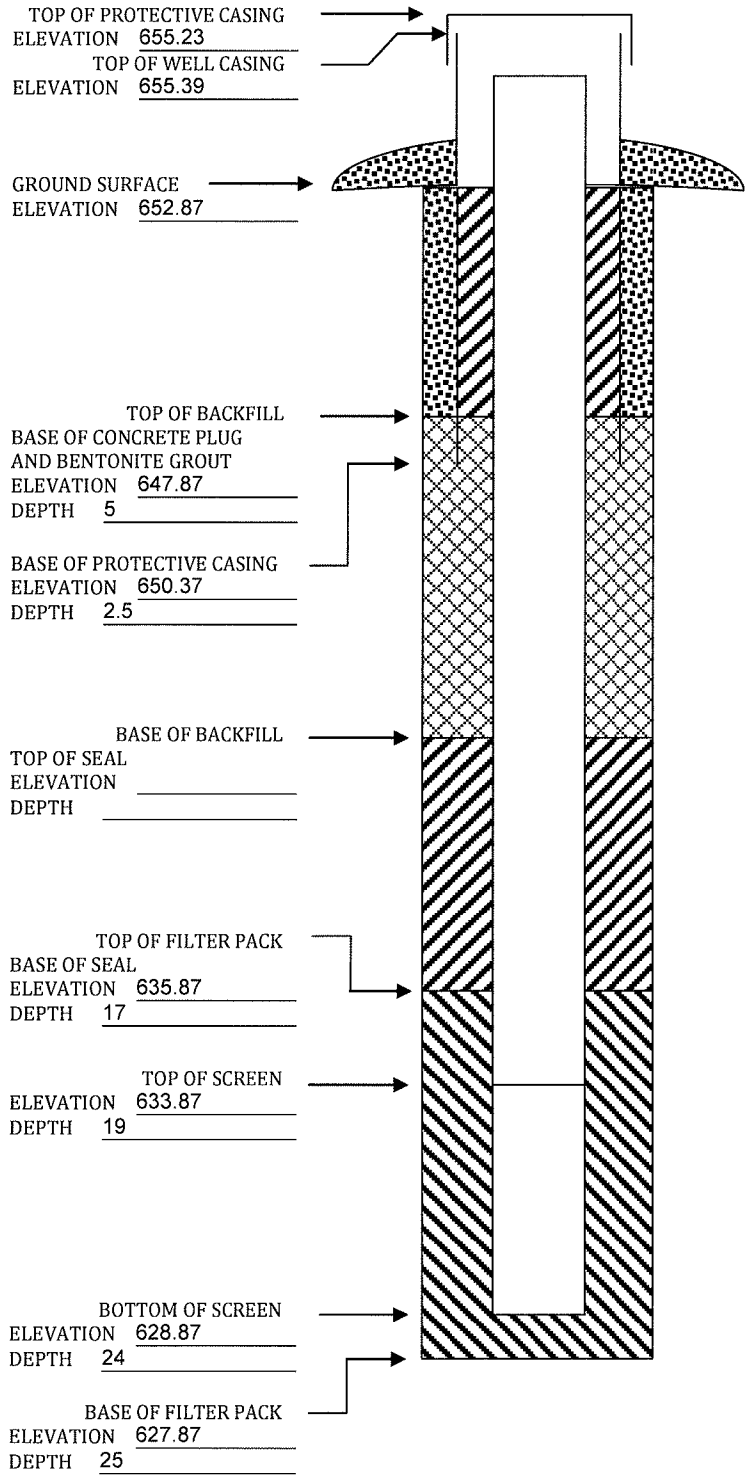
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

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'

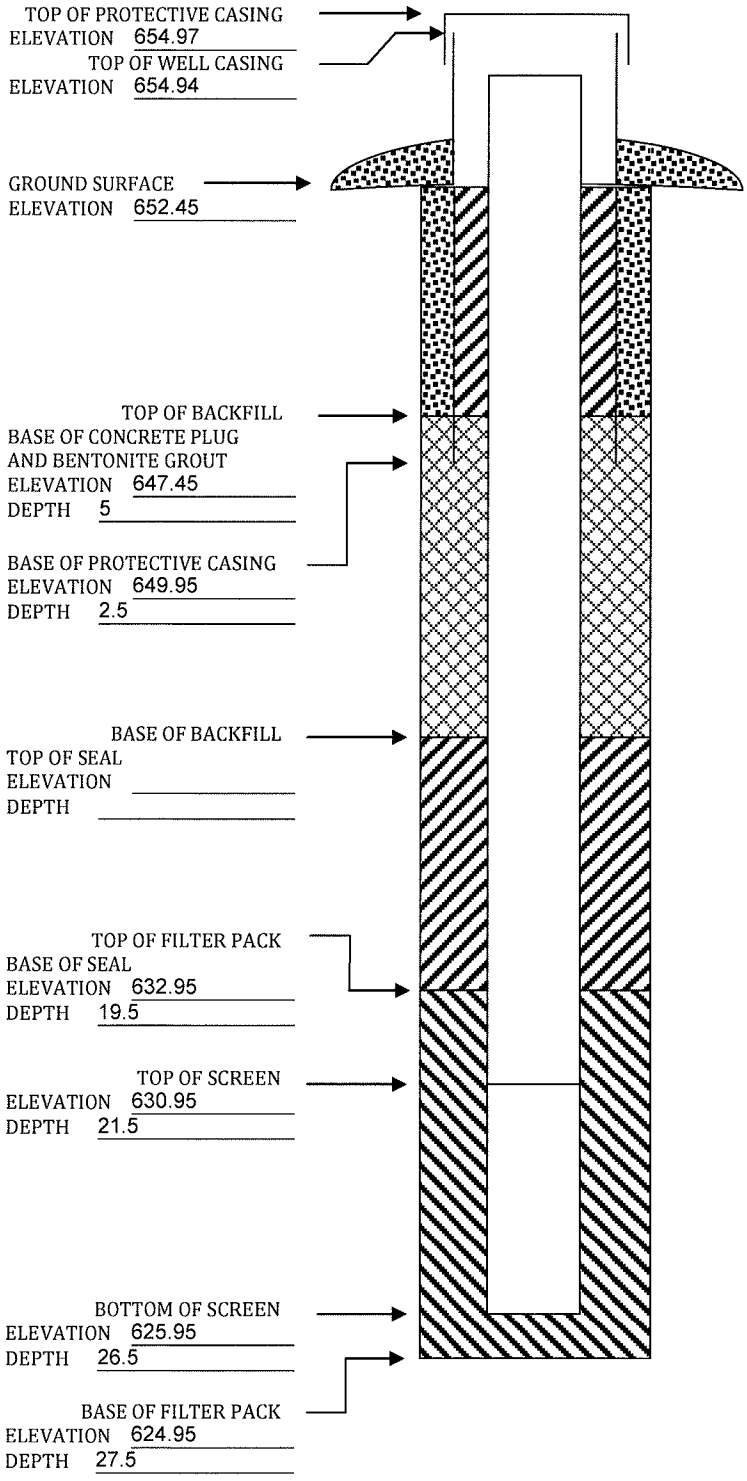
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

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-307			
Number of Sampling Dates:	3			
Parameter Name	**Units**	**4/8/2019**	**10/23/2019**	**12/11/2019**
Boron	ug/L	240	200	190
Calcium	mg/L	240	230	230
Chloride	mg/L	220	220	200
Fluoride	mg/L	0.28	<0.23	<0.23
Field pH	Std. Units	6.76	6.68	6.37
Sulfate	mg/L	100	95	92
Total Dissolved Solids	mg/L	1000	1000	1000
Antimony	ug/L	--	--	<0.53
Arsenic	ug/L	--	--	<0.75
Barium	ug/L	--	--	140
Beryllium	ug/L	--	--	<0.27
Cadmium	ug/L	--	--	<0.039
Chromium	ug/L	--	--	<0.98
Cobalt	ug/L	--	--	11
Lead	ug/L	--	--	0.71
Lithium	ug/L	--	--	12
Mercury	ug/L	--	--	<0.1
Molybdenum	ug/L	--	--	<1.1
Selenium	ug/L	--	--	<1
Thallium	ug/L	--	--	<0.27
Total Radium	pCi/L	--	--	2.46
Radium-226	pCi/L	--	--	1.65
Radium-228	pCi/L	--	--	0.81
Field Specific Conductance	umhos/cm	1599	1684	1576
Field Temperature	deg C	12.47	13.38	11.5
Groundwater Elevation	feet	654.9	651.89 ft	649.59
Oxygen, Dissolved	mg/L	0.51	0.25	0.18
Turbidity	NTU	26	12.5	43.13
pH at 25 Degrees C	Std. Units	6.7	7.5	6.7
Field Oxidation Potential	millivolts	-3.7	-24.8	-45.8

Single Location

Name: IPL - Ottumwa Generating Station

Location ID:	MW-308			
Number of Sampling Dates:	3			
Parameter Name	**Units**	**4/8/2019**	**10/23/2019**	**12/11/2019**
Boron	ug/L	190	220	160
Calcium	mg/L	240	240	220
Chloride	mg/L	160	160	150
Fluoride	mg/L	<0.23	<0.23	<0.23
Field pH	Std. Units	6.9	6.78	6.55
Sulfate	mg/L	300	300	280
Total Dissolved Solids	mg/L	1200	1100	1100
Antimony	ug/L	--	--	<0.53
Arsenic	ug/L	--	--	<0.75
Barium	ug/L	--	--	130
Beryllium	ug/L	--	--	<0.27
Cadmium	ug/L	--	--	<0.039
Chromium	ug/L	--	--	5.9
Cobalt	ug/L	--	--	0.26
Lead	ug/L	--	--	0.52
Lithium	ug/L	--	--	16
Mercury	ug/L	--	--	<0.1
Molybdenum	ug/L	--	--	<1.1
Selenium	ug/L	--	--	<1
Thallium	ug/L	--	--	<0.27
Total Radium	pCi/L	--	--	2.73
Radium-226	pCi/L	--	--	1.54
Radium-228	pCi/L	--	--	1.19
Field Specific Conductance	umhos/cm	1539	1637	1532
Field Temperature	deg C	12.54	13.16	10.5
Groundwater Elevation	feet	653.7	651.31	647.39
Oxygen, Dissolved	mg/L	0.66	4.42	0.43
Turbidity	NTU	6.87	7.42	15.72
pH at 25 Degrees C	Std. Units	6.8	7.9	6.8
Field Oxidation Potential	millivolts	-23	-38.7	-56.6

Single Location

Name: IPL - Ottumwa Generating Station

Location ID:	MW-309			
Number of Sampling Dates:	3			
Parameter Name	**Units**	**4/8/2019**	**10/23/2019**	**12/11/2019**
Boron	ug/L	1500	1300	1100
Calcium	mg/L	160	150	150
Chloride	mg/L	72	74	66
Fluoride	mg/L	0.27	<0.23	<0.23
Field pH	Std. Units	7.18	6.98	6.67
Sulfate	mg/L	410	400	370
Total Dissolved Solids	mg/L	1100	1100	980
Antimony	ug/L	--	--	<0.53
Arsenic	ug/L	--	--	1.1
Barium	ug/L	--	--	54
Beryllium	ug/L	--	--	<0.27
Cadmium	ug/L	--	--	0.09
Chromium	ug/L	--	--	1.7
Cobalt	ug/L	--	--	3.7
Lead	ug/L	--	--	2.8
Lithium	ug/L	--	--	8.2
Mercury	ug/L	--	--	<0.1
Molybdenum	ug/L	--	--	<1.1
Selenium	ug/L	--	--	<1
Thallium	ug/L	--	--	<0.27
Total Radium	pCi/L	--	--	1.77
Radium-226	pCi/L	--	--	1.08
Radium-228	pCi/L	--	--	0.683
Field Specific Conductance	umhos/cm	1396	1461	1350
Field Temperature	deg C	12.4	12.83	11.5
Groundwater Elevation	feet	653.55	651.28	647.24
Oxygen, Dissolved	mg/L	0.66	0.36	0.26
Turbidity	NTU	72.1	42.6	413.6
pH at 25 Degrees C	Std. Units	7.2	7.2	7.1
Field Oxidation Potential	millivolts	-3.3	-27.5	-37.8

Appendix D

Statistical Evaluation

APPENDIX D – STATISTICAL EVALUATION

2019 Annual Report Addendum
Ottumwa Generating Station Zero Liquid Discharge Pond

Statistical evaluation completed in 2019 included the following:

- Evaluation of April 2019 detection monitoring results
- Evaluation of October 2019 detection monitoring results (finalized in January 2020)

The April 2019 results evaluation was based on interwell UPLs previously calculated for the OGS Ash Pond using the background monitoring data from upgradient well MW-301. This is a shared background well included in the monitoring systems for both the Main Ash Pond and the Zero Liquid Discharge Pond. The UPL calculations were provided in the 2018 Annual Report Addendum for the OGS Ash Pond.

The assessment monitoring results for December 2019 were evaluated in 2020.

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