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February 21, 2024

Submitted via electronic mail

Ms. Ann Bekta
Wisconsin Department of Natural Resources
2514 Morse Street
Janesville, WI 53545

Subject: **Plan of Operations Modification Request – Addendum #5**
Initial Permitting of CCR Landfill
Wisconsin Power and Light Company
Dry Ash Disposal Facility (WDNR License #3025)
Columbia Energy Center
Portage, WI

Dear Ms. Bekta,

On behalf of Wisconsin Power and Light Company (WPL), Alliant Energy is submitting this Addendum #5 to the Plan of Operations Modification intended to meet the requirements of NR 514.045 for Initial Permitting of a CCR Landfill for the Dry Ash Disposal Facility located at the Columbia Energy Center (#3025).

Thank you very much for your consideration of this initial submittal. If you have any questions or comments regarding this information, please call me at (608) 458-3853.

Regards,

Jeff Maxted
Manager – Environmental Services
Alliant Energy

CC: Tyler Sullivan – Wisconsin DNR
Eric Sandvig, Director of Operations – Columbia Energy Center
Brian Clepper, Lead GENCO Environmental Specialist – Columbia Energy Center
Phil Gearing, Eric Nelson – SCS Engineers

February 21, 2024
File No. 25222260.00

Ms. Ann Bekta
Wisconsin Department of Natural Resources
2514 Morse Lane
Janesville, WI 53545

Subject: Addendum No. 5 to Plan of Operation Modification Request WDNR CCR Code Update
Dry Ash Disposal Facility, License #3025
Columbia Energy Center
Town of Pacific, Columbia County, Wisconsin

Dear Ms. Bekta:

On behalf of Wisconsin Power and Light Company (WPL), SCS Engineers (SCS) prepared this Addendum No. 5 to the Plan Modification Request Wisconsin Department of Natural Resources (WDNR) Coal Combustion Residuals (CCR) Code Update for the Dry Ash Disposal Facility, License No. 3025, at the Columbia Energy Center. The original Plan Modification Request WDNR CCR Code Update was submitted on December 12, 2022; Addendum No. 1 was submitted on February 1, 2023; Addendum No. 2 was submitted on September 1, 2023; Addendum No. 3 was submitted on November 3, 2023, and Addendum No. 4 was submitted on November 20, 2023.

This addendum covers additional information for the WDNR CCR Code Update dated December 2022 to demonstrate compliance with NR 514.045 including the following:

- A request for one additional exemption in accordance with NR 507.29 and NR 140.28.
- Additional information supporting exemption requests submitted in prior addenda.

If you have any questions regarding this addendum, please contact Jeff Maxted with Alliant Energy at (608) 458-3853.

Sincerely,

Thomas Karwoski, PG
Senior Hydrogeologist
SCS Engineers

Phillip Gearing, PE
Senior Project Manager
SCS Engineers

MDB/AJR/TK/PG

cc: Tyler Sullivan, WDNR
Jeff Maxted, Alliant Energy
Matt Bizjack, Alliant Energy
Brian Clepper, WPL

Encl. Addendum No. 5

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Plan of Operation Modification Request WDNR CCR Code Update Addendum No. 5

Columbia Dry Ash Disposal Facility
Pardeeville, Wisconsin

Prepared for:

Wisconsin Power and Light Company
Columbia Energy Center
W8375 Murray Road
Pardeeville, Wisconsin 53954

SCS ENGINEERS

25222260.00 | February 21, 2024

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

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CERTIFICATIONS

"I, Phillip E. Gearing, hereby certify that I am a licensed professional engineer in the State of Wisconsin in accordance with the requirements of ch. A-E 4, Wis. Adm. Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch. A-E 8, Wis. Adm. Code; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 500 to 538, Wis. Adm. Code."

Senior Project Manager E-45115
Signature, title and P.E. number

2/21/2024
Date

WISCONSIN PHILLIP E. GEARING E-45115 SUN PRAIRIE, WIS. PROFESSIONAL ENGINEER
2/21/2024

"I, Thomas J. Karwoski, hereby certify that I am a licensed professional geologist in the State of Wisconsin in accordance with the requirements of ch. GHSS 2, Wis. Adm. Code; that the preparation of this document has not involved any unprofessional conduct as detailed in ch. GHSS 5, Wis. Adm. Code; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 500 to 538, Wis. Adm. Code."

Senior Hydrogeologist
Signature, title

2/21/2024
Date

WISCONSIN THOMAS J. KARWOSKI G-276 MADISON WI PROFESSIONAL GEOLOGIST
2/21/2024

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1.0 INTRODUCTION

On behalf of Wisconsin Power and Light Company (WPL), SCS Engineers (SCS) prepared this Plan of Operation Modification (Plan Mod) Request – Addendum No. 5 for the Columbia Dry Ash Disposal (COL) Facility. This Addendum addresses additional information for the Wisconsin Department of Natural Resources (WDNR) Coal Combustion Residuals (CCR) Code Update dated December 2022 to demonstrate compliance with NR 514.045.

This Addendum includes:

- A request for one additional exemption in accordance with NR 507.29 and NR 140.28.
- Additional information supporting exemption requests submitted in prior addenda.

2.0 COMPLIANCE WITH NR 507.15 (3)(I)

NR 507.15 (3)(i)

> *"The owner or operator of the CCR landfill shall establish baseline groundwater quality in accordance with s. NR 507.18 for each CCR well and for each of the constituents required under ch. NR 507 Appendix I, Table 1A and in accordance with the approved sampling plan."*

Baseline groundwater quality will be established for each CCR well in accordance with NR 507.18 and for each constituent required under NR 507 Appendix I, Table 1A. Groundwater sampling results used to establish baseline groundwater quality were submitted to GEMS on November 20, 2023. A copy of the cover letter for that submittal is included as **Appendix A.**

Proposed preventive action limits (PALs) and alternative concentration limits (ACLs) for CCR monitoring wells were previously included in Addendum 2 and Addendum 3. Proposed PALs and ACLs for non-CCR monitoring wells were also included in Addendum 2.

Table 1 summarizes PAL exceedances for nitrate + nitrite as nitrogen at MW-302. **Table 2** summarizes calculated ACLs for wells and parameters with confirmed PAL exceedances, including previously-submitted ACLs and the new nitrite + nitrate ACL for MW-302. Other PAL exceedances and proposed ACLs for wells at COL were previously submitted in Addendum 2 and Addendum 3. The proposed ACL included in this submittal that was not previously proposed in Addendum 2 or Addendum 3 are indicated by bold outlining in **Table 2**, and the ACL calculation is included as **Appendix A.**

In addition to exemptions previously requested in Addendum 2 and Addendum 3, an exemption in accordance with NR 507.29 and NR 140.28 is requested for:

- Nitrite + Nitrate as N at MW-302

Concentrations of nitrite + nitrate appear to reflect sources not related to the ash disposal facility (ADF). The justification below for nitrite + nitrite exemptions in CCR monitoring wells at COL includes information summarized in previous Addenda, with the addition of more detail regarding County-wide nitrogen concentrations and a comparison of on-site upgradient and downgradient concentrations.

- Nitrite + nitrate concentrations appear to be associated with agricultural land use.

- Nitrate concentrations in groundwater in Columbia County are variable, and PAL or enforcement standards (ES) exceedances in supply wells are fairly common.
  - The proposed ACL at MW-302 is 13 milligrams per liter (mg/L). This concentration, and all baseline sampling results for nitrogen at MW-302, are within the range of concentrations reported in UW Extension Geological and Natural History Survey Circular 37, Ground-Water Resources and Geology of Columbia County, Wisconsin (non-detect to 17 mg/L). This Circular was published in 1978.
  - The proposed ACL is also within the range of concentrations included in a more updated Columbia County data set referenced in the USGS Protecting Wisconsin's Groundwater Through Comprehensive Planning report (https://wi.water.usgs.gov/gwcomp/find/columbia/index_full.html, accessed 2/6/2024).
    - This report references data available as of October 1, 2007, through the WDNR Groundwater Retrieval Network.
    - Forty-four percent of private well samples in Columbia County contained 2 to 10 mg/L nitrate-nitrogen.
    - Twenty percent of samples exceeded 10 mg/L.
- Exemptions were requested for monitoring wells MW-301 and MW-92A, which are located to the east or southeast (upgradient) of the ADF.
  - Concentrations at these upgradient wells have ranged from "not detected" to 9.1 mg/L.
  - Concentrations at MW-302 during baseline sampling were similar, ranging from 1.7 mg/L to 10.8 mg/L.

3.0 ADDITIONAL SUPPORT FOR PREVIOUSLY-REQUESTED EXEMPTIONS

WDNR has requested additional justification for the exemption requests submitted with previous Addenda for boron, chloride, nitrite + nitrate as nitrogen, and sulfate. Graphs of concentrations over time for the wells discussed below are in **Appendix B.**

3.1 BORON AND SULFATE

Alternate Source Demonstrations (ASDs) for boron and sulfate concentrations at MW-33AR, MW-34A, and MW-302 have been prepared and posted to Alliant's CCR website, in compliance with the Federal CCR Rule. The most recent ASD for boron and sulfate at these wells is included as **Appendix C.**

Relevant information from the ASD is summarized below, with the addition of recent concentration ranges as compared to historical data and information related to MW-33BR and MW-34B. These wells were not included in the ASD because they are not CCR monitoring wells. Graphs of concentration over time for the wells discussed below are included in **Appendix B.**

3.1.1 Pre-Landfill Water Quality

Elevated levels of boron and sulfate were present in the area west of the landfill, where MW-33AR, MW-33BR, MW-34A, MW-34B, and MW-302 are located, before the landfill was constructed. Groundwater monitoring performed in 1977 and 1978 as part of the Feasibility Study (Warzyn, 1978) and Supplemental Feasibility Study (Warzyn, 1979) for the landfill permitting showed that wells located along the west side of the future landfill footprint, where the wells listed above are located, had elevated results for sulfate and specific conductance. Boron was not included in the feasibility study monitoring. Historical boron concentrations from samples collected prior to CCR placement in the ADF are discussed below in Section 3.1.2.

The 1978 Feasibility Study for the Dry ADF discusses the influence of the ash pond effluent ditch on groundwater west of the proposed site. The former ash pond effluent ditch carried effluent from the ash ponds located north of the plant, and flowed south between the west side of the current landfill and the substation.

Groundwater monitoring in December 1977 indicated that sulfate was present at 1,200 mg/L in MW-33A, which was located near the point where the ash pond effluent discharged from a culvert into the effluent ditch. The sulfate concentration at this well decreased to 830 mg/L in the December 1978 sampling (Warzyn, 1979). Current concentrations of sulfate in this area are much lower. The proposed ACL at MW-33AR is 200 mg/L.

Sulfate concentrations at MW-34A in December 1977 and December 1978 were 140 mg/L and 46 mg/L, respectively. Recent total sulfate concentrations at this well (39.8 mg/L to 169 mg/L between December 2015 and April 2023) are similar to the 1977 to 1978 results.

MW-33BR was not included in previous ASDs because it is not a CCR monitoring well. Historical results for comparison are available in the Feasibility Report and in GEMS. Sulfate concentrations at MW-33B (later replaced by MW-33BR) were 22 mg/L and 31 mg/L in December 1977 and December 1978. The oldest data available in GEMS are from 1996. Sulfate concentrations at MW-33B and MW-33BR have generally declined from approximately 200 mg/L in the 1990s and 2000s. More recent concentrations (less than 50 mg/L between April 2017 and October 2022) are similar to the results from 1977 and 1978, with the exception of a single concentration of 83.4 mg/L in April 2023. The subsequent October 2023 result was 32.4 mg/L.

Vertical gradients at MW-33AR/MW-33BR are typically downward. The increase in sulfate concentrations at MW-33BR between the late 1970s and the 1990s may be attributable to downward flow of groundwater impacted by the elevated sulfate concentrations described above at MW-33A.

Specific conductance values recorded at MW-33A, MW-34A, and MW-34B in 1977 to 1978 were higher than or similar to recent concentrations, indicating influence from a source other than the landfill.

- At MW-33A/MW-33AR:
  - Specific conductance values recorded in 1977 and 1978 were 2,500 and 1,970 μmhos/cm, respectively.
  - Values recorded in December 2015 through June 2023 were 417.6 to 1,312 μmhos/cm.

- At MW-34A:
  - Specific conductance values recorded in 1977 and 1978 were 680 and 560 µmhos/cm, respectively.
  - Values recorded in December 2015 through June 2023 were 386.9 µg/L to 843 µg/L.

- At MW-34B:
  - Specific conductance values recorded in 1977 and 1978 were 1,700 and 1,575 µmhos/cm, respectively.
  - Values recorded in October 2015 through April 2023 were 335.4 µmhos/cm to 519 µmhos/cm.

3.1.2 Long-Term Concentration Trends

Monitoring performed under the state program documents that the concentrations of boron were elevated before CCR disposal in the landfill began, and have decreased since the landfill has been in operation. Routine groundwater monitoring for the COL ADF began after the Plan of Operation was approved and prior to initial CCR disposal. The earliest data available from the WDNR Groundwater Environmental Monitoring System (GEMS) database is from September 1984. Initial placement of CCR in test plots in Module 1 of the ADF was approved in October 1984, and CCR disposal began sometime after that. Therefore, the initial groundwater monitoring results in the GEMS database represent pre-disposal conditions for the landfill.

Graphs of historical concentrations are provided in **Appendix B**. Results for compliance well MW-33AR are plotted with results from well MW-33A. MW-33AR was a replacement well for MW-33A at a slightly different location and depth. The well screen was installed approximately 10 feet higher in MW-33AR than in MW-33A, intersecting the water table, which may explain the increase in concentration that occurred with the well replacement. Results for compliance well MW-302 are plotted with results from monitoring well MW-85, which was located near the current MW-302 location (see **Figure 2**) and was monitored from September 1984 through September 1995.

The earliest historic monitoring data show that before CCR disposal in the landfill began, concentrations of boron and sulfate were significantly higher than current concentrations in the area west of the landfill.

3.1.2.1 Boron

The recent boron concentrations are consistent with generally decreasing or stable historical concentrations at MW-33AR, MW-33BR, MW-34A, and MW-34B (**Appendix B**). Recent boron concentrations at MW-302 have been variable, but remain well below the concentrations observed in samples from MW-85 prior to CCR disposal in the landfill.

Comparisons of historic and recent boron concentrations at these wells are summarized below:

- MW-33A/AR: Results from 1984 through 1986 were 1,560 µg/L to 2,720 µg/L. Recent boron concentrations used to calculate the proposed ACL are less than 1,000 µg/L.

- MW-33B/BR: The oldest available data are from 1990s and were 580 to 1,100 µg/L. Concentrations have generally decreased since that time. Recent boron concentrations used to calculate the proposed ACL are all less than or equal to 660 µg/L.

- MW-34A: Results from 1984 through 1986 were 690 µg/L to 6,400 µg/L Recent boron concentrations used to calculate the proposed ACL are all less than 250 µg/L.

- MW-34B: Results from 1984 through 1986 were 1,560 µg/L to 2,720 µg/L. Recent boron concentrations used to calculate the proposed ACL are less than or equal to 1,000 µg/L.

- MW-302/MW-85: MW-302 was installed in 2015. Monitoring well MW-85 existed in the same general area in the 1980s to 1990s. Results at MW-85 from 1984 through 1986 were 2,310 µg/L to 3,080 µg/L. Recent boron concentrations used to calculate the proposed ACL for MW-302 are less than 2,000 µg/L, and all but one result are less than or equal to 833 µg/L.

3.1.2.2 Sulfate

Comparison of recent and historic sulfate concentrations is summarized above in Section 3.1.1. Graphs included in **Appendix B** show long-term deceasing concentrations at MW-33AR, MW-33BR, and MW-34A, with more stable concentrations in recent years at MW-33AR and MW-34A.

3.1.3 Groundwater Flow Direction Changes

Groundwater flow directions have changed through time due to changes in water management at the plant, so that groundwater impacted by the effluent ditch formerly flowed to the east, under the landfill, and is now flowing north and/or west. The 1978 Feasibility Study report states that the southern 2/3 of the proposed fill area (including the area of the active CCR landfill phases) exhibits a southeast and southerly groundwater flow direction, toward an agricultural drainage ditch southeast and south of the landfill area. The 1981 Plan of Operation indicates that flow in the landfill area is to the east-southeast. A water table map prepared by RMT, based on October 2002 water level measurements, shows flow under the landfill generally to the east and northeast from a groundwater high near the effluent ditch and Wisconsin Pollutant Discharge Elimination System (WPDES) pond between the landfill and the substation. The 1981 and 2002 water table maps are provided in **Appendix D.**

Under current conditions, groundwater flow below the active landfill area is generally to the north and northwest. The flow changes with time reflect the termination of discharge to the ash pond effluent ditch in the mid-2000s. When discharge via this ditch was active, the ditch was a source of recharge to the groundwater and created a high groundwater area with flow moving away from the ditch to the east. After discharge to the ditch was terminated, water levels in this area decreased significantly and the groundwater flow direction changed.

The termination of discharge to the ash pond effluent ditch in the mid-2000s is noted on the boron, sulfate, and specific conductance concentration plots in **Appendix B.** The time period after discharge was terminated coincides with a reduction in concentrations and/or a reduction in variability for boron, sulfate, and/or specific conductance at MW-33AR, MW-33BR, MW-34A, and MW-34B. Concentration plots for boron and sulfate at MW4 are also included in **Appendix B.** This well was formerly located to the north of Module 3, approximately 450 feet to the east-southeast of MW-34A and MW-34B. MW4 was abandoned during construction of Module 4. Boron and sulfate concentrations at this well were not reported for all years, but concentrations were higher in the 1980s and/or 1990s than in 2011 to 2015.

With the changes in groundwater flow, historically impacted groundwater moved in alternating directions. While the effluent ditch was active, impacted groundwater likely moved eastward past the current compliance wells located on the west side of the ADF, as indicated by the long-term concentration data. Although the compliance wells on the west side of Modules 1-3 are downgradient from the landfill under current flow conditions, the observed groundwater impacts may be residual from the past when the wells were downgradient from the effluent ditch.

3.2 CHLORIDE

3.2.1 MW-33AR

ASDs for chloride concentrations at MW-33AR have been prepared and posted to Alliant's CCR website, in compliance with the Federal CCR Rule. The most recent ASD for Modules 1-3 is included as **Appendix C.** Relevant information from the ASD is included below.

The variations in chloride results for well MW-33AR since detection monitoring was initiated have not correlated with boron concentrations, as would be expected for a CCR leachate source; therefore, an alternative source is more likely. The chloride results for well MW-33AR increased beginning in 2016, peaked in April 2018 and April 2019, decreased significantly in May 2020, and have remained relatively low since then. Recent chloride concentrations at MW-33AR (since 2020) are similar to those reported for samples from MW-33A prior to CCR disposal in the landfill (**Appendix B**).

Over the time period since 2016, when chloride concentrations at MW-33AR were highly variable, boron concentrations at MW-33AR have been generally following a long, steady decreasing trend. The lack of correlation with boron indicates the source of the increase and subsequent decrease in chloride is not likely the CCR landfill.

Sampling of the landfill leachate pond and lysimeters LS-1 and LS-3R, located on the western and southern edges of Modules 1-3, indicates that boron and chloride concentrations are generally both higher than background (Table 4 in **Appendix B**); therefore, a leachate source would tend to influence concentrations of both parameters. Furthermore, the peak chloride concentrations in the groundwater samples from MW-33AR in 2018 and 2019 exceeded the chloride concentrations measured in the leachate at that time, indicating the leachate was not the source of chloride at this location (Table 2, Table 4, and Appendix A in **Appendix B**). Recent samples from the leachate pond have shown increased concentrations of chloride, but this increase does not correlate with results at MW-33AR, which have decreased, or with chloride results from the lysimeters, which remain low. Based on the comparison of groundwater and leachate chloride results, an alternative man-made source, such as road salt, is a more likely source of chloride than the CCR Unit.

3.2.2 MW-37A, MW-86, MW-309, and MW-310

ASDs for chloride concentrations at MW-310 have been prepared and posted to Alliant's CCR website, in compliance with the Federal CCR Rule. The most recent ASD that includes chloride at MW-310 is included as **Appendix D.** The same lines of evidence that support an alternative source for elevated chloride concentrations at MW-310 apply to MW-309, MW-37A, and MW-86. Lines of evidence included in the ASD, with the addition of historical data at non-CCR wells MW-37A and MW-86, are summarized below.

Monitoring wells MW-37A, MW-309, and MW-310 are located adjacent to the plant entrance road (Murray Road). These wells are installed between the road and the storm water ditch on the south side of the road. MW-86 is located on the west side of Highway 51. At these locations, there is a high potential for road salt application to result in increased chloride concentrations in groundwater.

Variable chloride concentrations have been observed at MW-37A, MW-86, MW-309, and MW-310. For example, chloride concentrations at MW-37A from 2015 to present range from 2 mg/L to over 200 mg/L. These fluctuations support the attribution of chloride concentrations at these wells to a seasonal or impermanent source such as road salt application.

The earliest data available from the WDNR GEMS database is from September 1984. Initial placement of CCR in test plots in Module 1 of the ADF was approved in October 1984, and CCR disposal began sometime after that. Therefore, the initial groundwater monitoring results in the GEMS database represent pre-disposal conditions for the landfill.

- MW-37A: Chloride concentrations from 2015 to present (2 to 279 mg/L) are similar to those detected in 1984 to 1986 (8 to 319 mg/L).
- MW-86: Chloride concentrations from 2015 to present (176 mg/L to 484 mg/) are similar to those detected in 1984 to 1986 (100 mg/L to 577 mg/L).
- MW-309 and MW-310: Data from the 1980s are not available for MW-309 and MW-310, but these wells are located in the same general area as MW-37A, approximately 300 feet and 600 feet west of MW-37A along the south side of Murray Rd, and chloride concentrations at these locations in the 1980s were likely similar to those at MW-37A.

In addition to the comparisons to historical data presented above, MW-86 is located upgradient (east) of the landfill. Recent chloride concentrations at MW-86 are higher than or similar to other wells for which exemptions are requested.

3.3 NITRITE + NITRATE

Exemptions requests for nitrite + nitrate as nitrogen were submitted in previous addenda for several CCR monitoring wells and non-CCR monitoring wells.

Concentrations of nitrite + nitrate appear to reflect sources not related to the ADF. The justification below for nitrite + nitrite exemptions in CCR monitoring wells at COL includes information summarized in previous Addenda, with the addition of more detail regarding County-wide nitrogen concentrations and a comparison of on-site upgradient and downgradient concentrations.

- Nitrite + nitrate concentrations appear to be associated with agricultural land use.
- Nitrate concentrations in groundwater in Columbia County are variable, and PAL or ES exceedances in supply wells are fairly common.
    - The proposed ACLs at CCR monitoring wells and non-CCR monitoring wells where exemptions have been requested (2.7 mg/L to 15 mg/L) are within the range of concentrations reported in UW Extension Geological and Natural History Survey Circular 37, Ground-Water Resources and Geology of Columbia County, Wisconsin (non-detect to 17 mg/L). This Circular was published in 1978.

- The proposed ACLs are also consistent with concentrations included in a more updated Columbia County data set referenced in the USGS Protecting Wisconsin's Groundwater Through Comprehensive Planning report (https://wi.water.usgs.gov/gwcomp/find/columbia/index_full.html, accessed 2/6/2024).
  - This report references data available as of October 1, 2007, through the WDNR Groundwater Retrieval Network.
  - Forty-four percent of private well samples in Columbia County contained 2 to 10 mg/L nitrate-nitrogen
  - Twenty percent of samples exceeded 10 mg/L.

- Exemptions were requested for monitoring wells MW-301 and MW-92A, which are located to the east or southeast (upgradient) of the ADF. Detected concentrations at downgradient wells are similar to concentrations at these upgradient wells.
  - Concentrations at these upgradient wells have ranged from "not detected" to 9.1 mg/L.
  - Concentrations at wells downgradient of the ADF for which exemptions were requested have ranged from 0.91 mg/L to 18 mg/L. This range includes a single 18 mg/L result at MW-34B. The next highest detected concentration at a downgradient well was 11.2 mg/L at MW-34A.

Tables

Table 1.
Groundwater Results Exceeding NR 140 Standards - MW-302, Nitrite + Nitrate
Columbia Energy Center Ash Disposal Facility

Parameter	PAL	ES	Well	Sample Date	Result	Exceedance Type
Nitrogen (NO2 + NO3), Total (mg/L)*	2	10	MW-302	10/27/2022	4.6	PAL
				12/2/2022	7.1	PAL
				1/13/2023	2.4	PAL
				2/21/2023	1.8	PAL
				3/28/2023	1.7	PAL
				4/27/2023	6.2	PAL
				5/31/2023	9.5	PAL
				6/30/2023	10.8	ES

Notes:
PAL = NR 140 Preventive Action Limit   mg/L = milligrams per liter
ES = NR 140 Enforcement Standard

*: Exceedance summaries for other wells and parameters were submitted in Addendum 2 and Addendum 3.

Prepared by: MDB, 1/19/2024
Checked by: NLB, 1/19/2024

I:\25222260.00\Data and Calculations\Groundwater PALs ACLs\[Tables 1-2_MW302A Nitrogen_Exceedances ACL summaries_Addendum 5.xlsx]Add 5_Table 1_Ex Summary

Table 2. Proposed Alternative Concentration Limits for Public Health and Welfare Parameters, CCR Monitoring Wells
Columbia Energy Center Ash Disposal Facility / SCS Engineers Project #25222260.00

Well	License # 03025 DNR ID #	Beryllium, Total	Boron, Total	Chloride, Total	Manganese, Total	Nitrite + Nitrate as Nitrogen, Total	Sulfate, Total	Thallium, Total
		PAL = 0.4 ES = 4 µg/L	PAL = 0.2 ES = 1 mg/L	PAL = 125 ES = 250 (mg/L)	PAL = 25 ES = 50 (µg/L)	PAL = 2 ES = 10 (mg/L)	PAL = 125 ES = 250 (mg/L)	PAL = 0.4 ES = 2 (µg/L)
MW-33AR	063	--	0.92	180	--	3.4	200	--
MW-34A	020	--	0.25	--	--	12	160	--
MW-84A	038	--	--	--	--	--	--	--
MW-301	100	--	--	--	48	2.7	--	--
MW-302	102	--	1.3	--	--	13	--	--
MW-309	104	--	--	820	--	--	--	0.89
MW-310	106	0.78	--	330	--	--	--	1.3
MW-311	108	--	--	--	--	--	--	--
MW-313	110	--	--	--	160	7.8	--	--
MW-314	112	--	--	--	--	8.6	--	--
MW-315	114	--	--	--	120	--	--	--

Abbreviations:
PAL = NR 140 preventive action limit
ES = NR 140 enforcement standard
ACLs = Alternative concentration limits
mg/L = milligrams per liter
µg/L = micrograms per liter
NC = Not calculated due to increasing trend

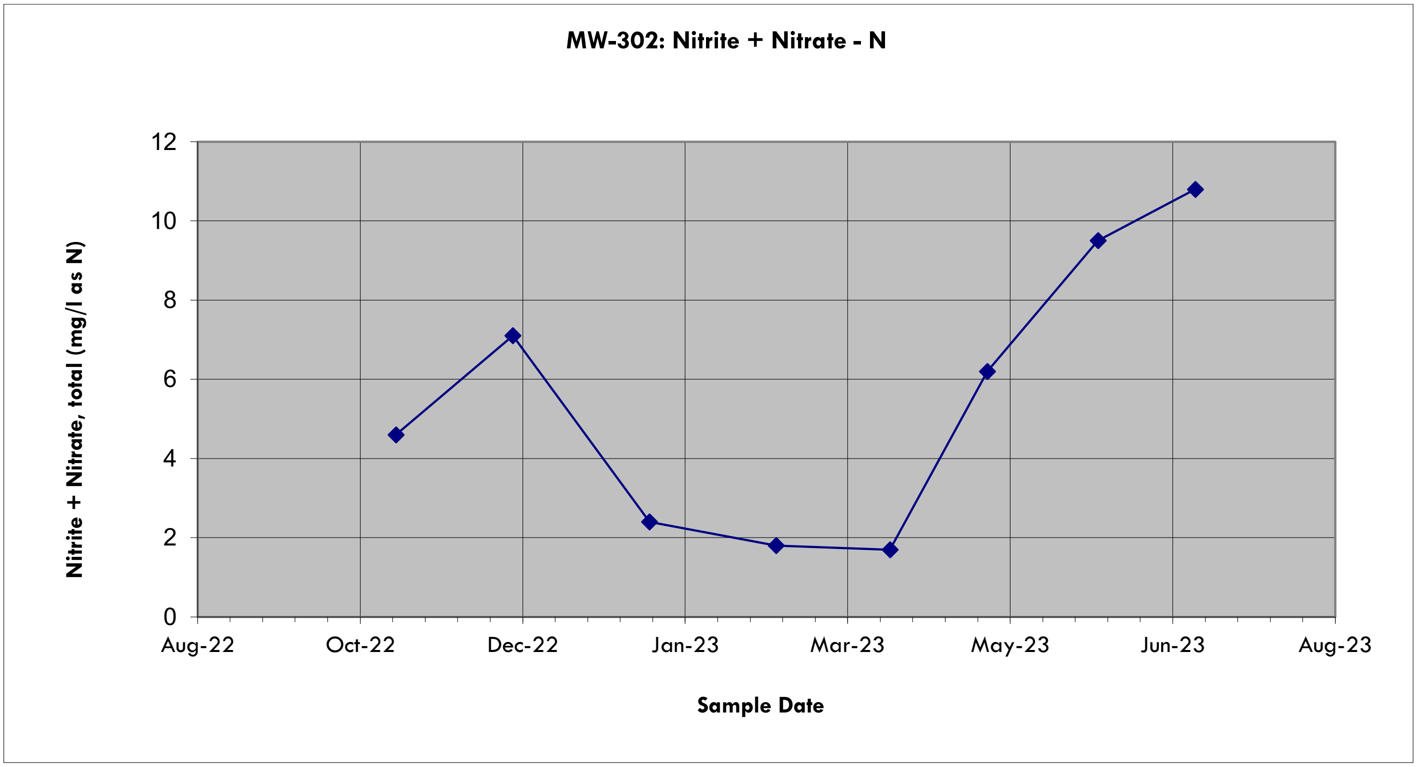
Thin outline denotes a value previously submitted with the 9/1/2023 Plan Modification Addendum 2 and/or the 11/3/2023 Plan Modification Addendum 3.
Thick outline denotes a value not included in the tables submitted with the 9/1/2023 Plan Modification Addendum 2 or the 11/3/2023 Plan Modification Addendum 3.

Created by: MDB Date: 8/9/2023
Revised by: MDB Date: 1/19/2024
Checked by: NLB Date: 1/19/2024

I:\25222260.00\Data and Calculations\Groundwater PALs ACLs\[Tables 1-2_MW302A Nitrogen_Exceedances ACL summaries_Addendum 5.xlsx]Add 5_Table 1_Ex Summary

Appendix A

ACL Calculation



Point Name	Parameter	Mult Sample ID	Report Value	Sample Date	Graph Value	Calculation Value	Notes
MW-302	NITRITE PLUS NITRATE, TOTAL 1 DET. (MG/L AS N)	01	4.6	10/27/2022	4.6	4.6	
MW-302	NITRITE PLUS NITRATE, TOTAL 1 DET. (MG/L AS N)	01	7.1	12/2/2022	7.1	7.1	
MW-302	NITRITE PLUS NITRATE, TOTAL 1 DET. (MG/L AS N)	01	2.4	1/13/2023	2.4	2.4	
MW-302	NITRITE PLUS NITRATE, TOTAL 1 DET. (MG/L AS N)	01	1.8	2/21/2023	1.8	1.8	
MW-302	NITRITE PLUS NITRATE, TOTAL 1 DET. (MG/L AS N)	01	1.7	3/28/2023	1.7	1.7	
MW-302	NITRITE PLUS NITRATE, TOTAL 1 DET. (MG/L AS N)	01	6.2	4/27/2023	6.2	6.2	
MW-302	NITRITE PLUS NITRATE, TOTAL 1 DET. (MG/L AS N)	01	9.5	5/31/2023	9.5	9.5	
MW-302	NITRITE PLUS NITRATE, TOTAL 1 DET. (MG/L AS N)	01	10.8	6/30/2023	10.8	10.8	
Calculations							
Count						8	
Mean						5.51	
Std Dev						3.27	
2 X SD (ACL)						6.55	
ACL, Calculated						12.06	
ACL, Rounded						13	

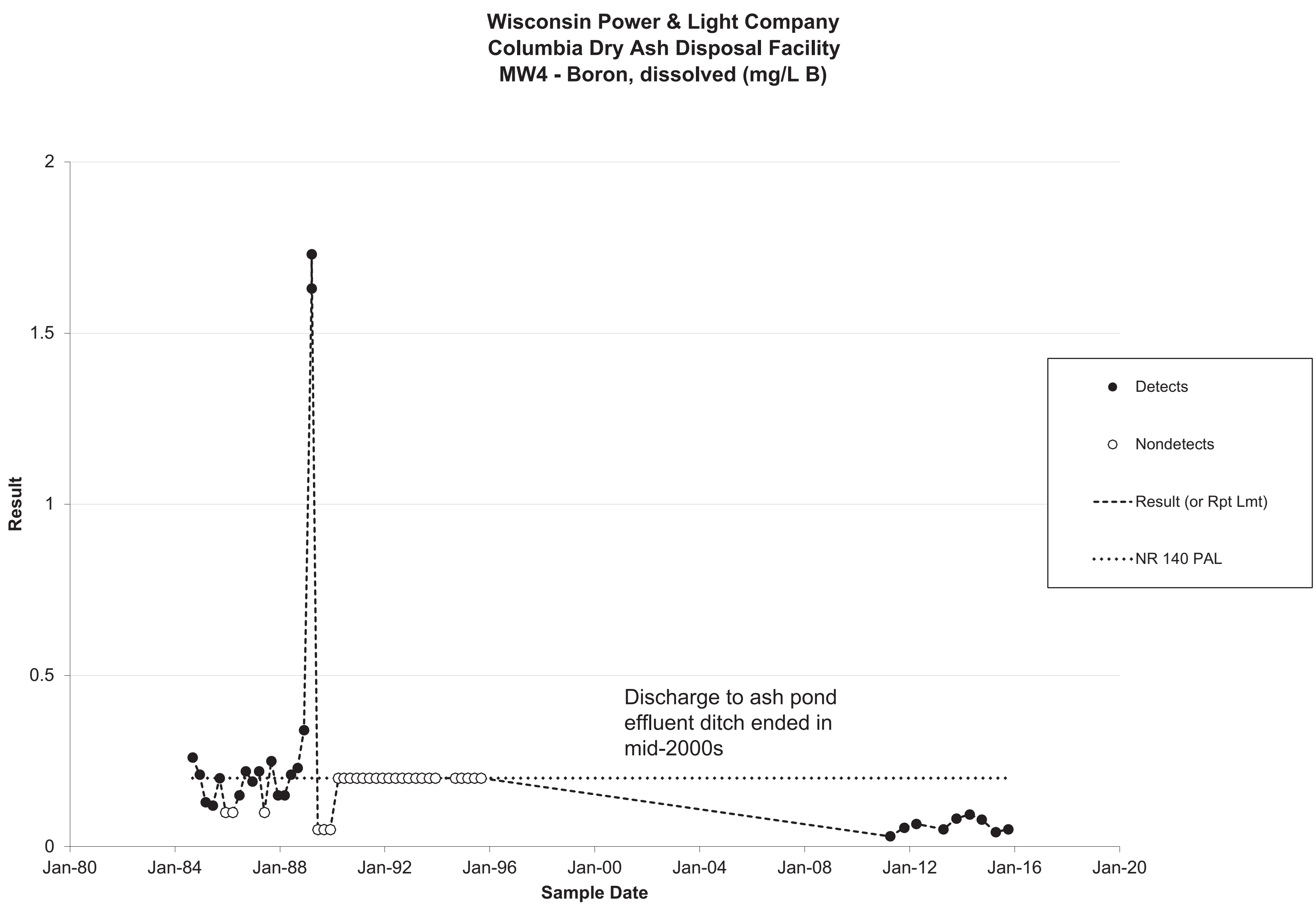
Duplicate Data Not Used for Calculations							

Note: Current PAL = 2 mg/l; ES = 10 mg/l

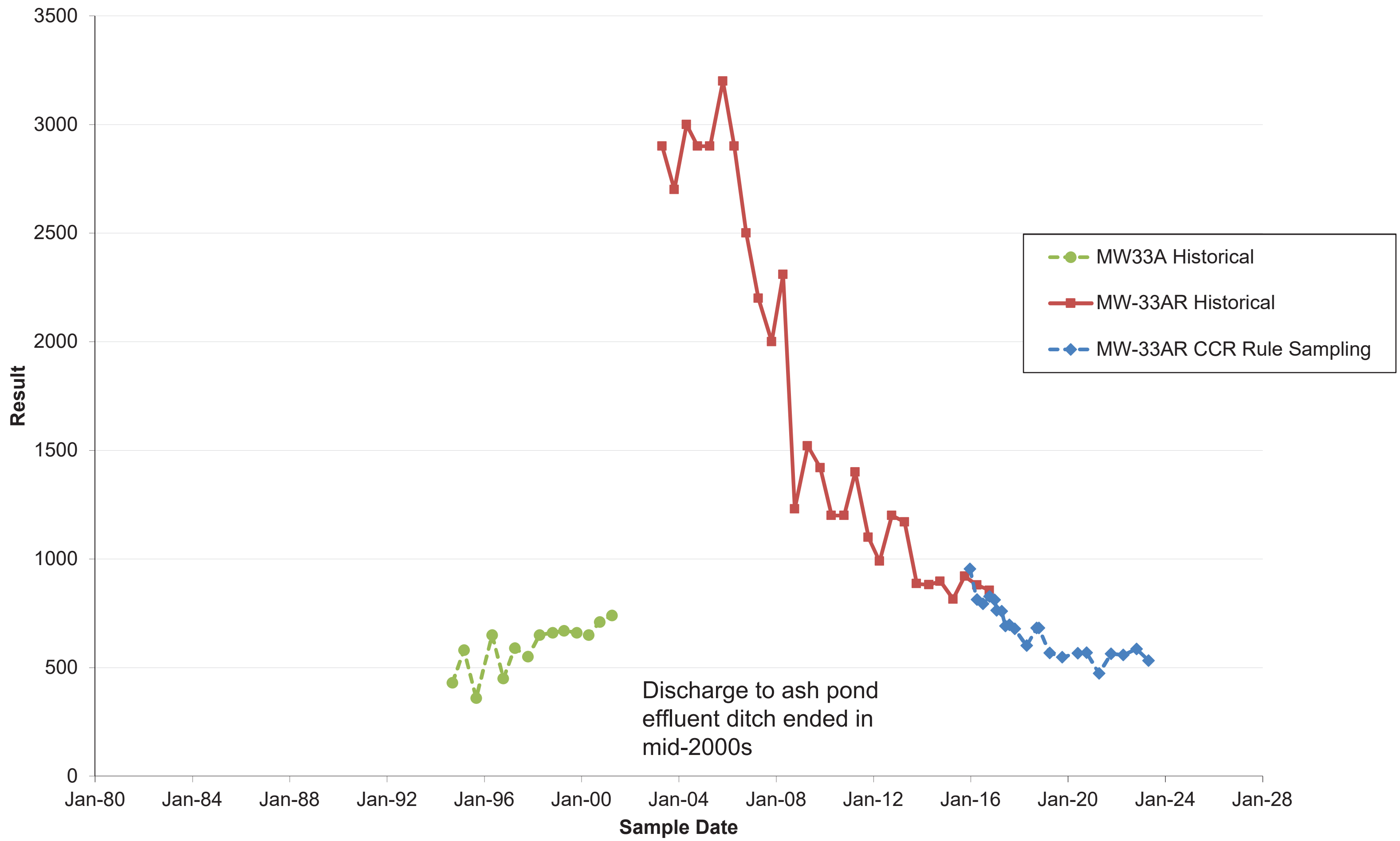
I:\25222260.00\Data and Calculations\Groundwater PALs ACLs\[ACL Calculations_CCR Wells_Combined.xlsx]MW-302_Nitrogen_ACL_Add5

Appendix B

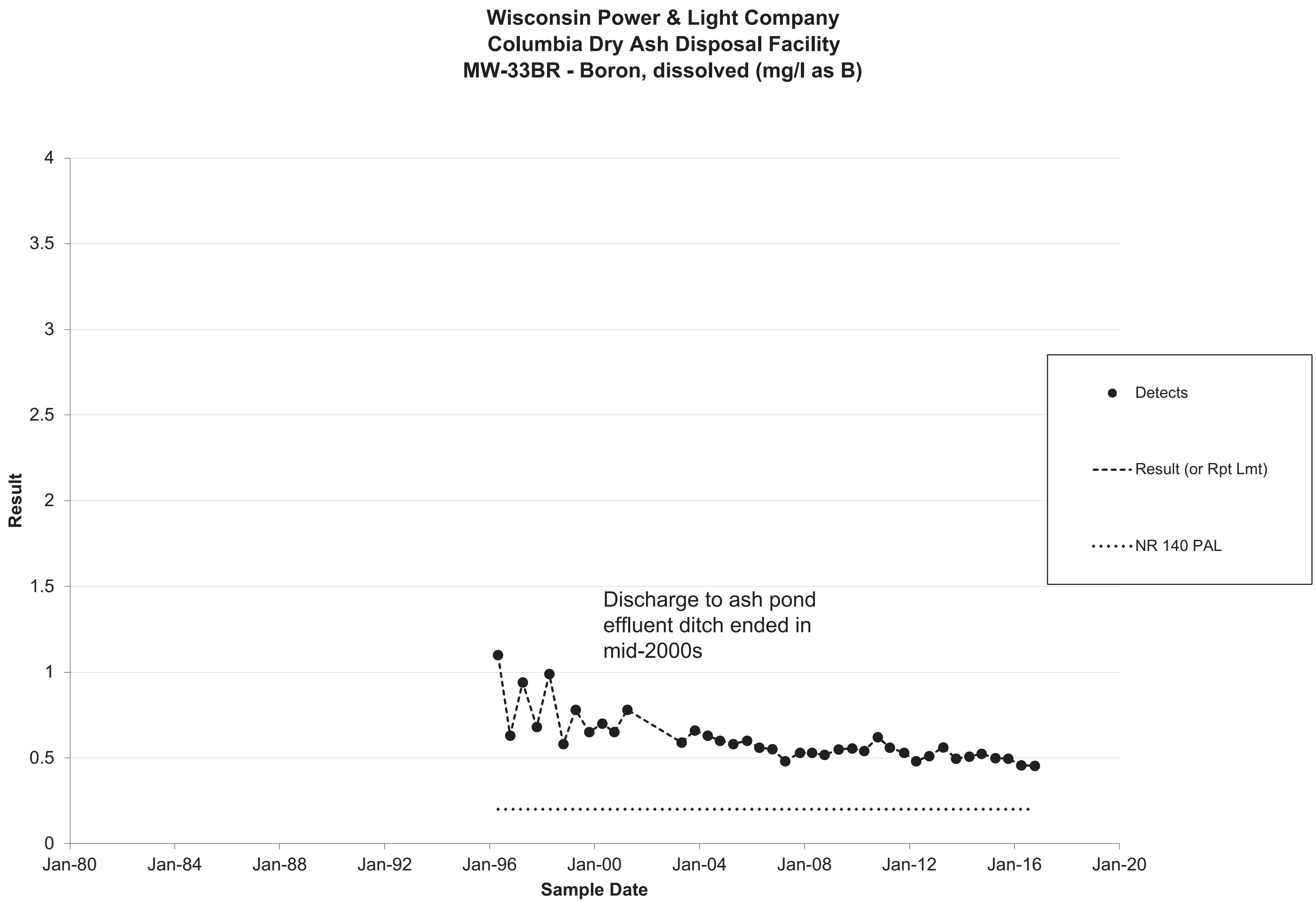
Trend Plots


Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW4 - Boron, dissolved (mg/L B)
Result
2
1.5
1
0.5
0
Jan-80
Jan-84
Jan-88
Jan-92
Jan-96
Jan-00
Jan-04
Jan-08
Jan-12
Jan-16
Jan-20
Sample Date
Detects
Nondetects
Result (or Rpt Lmt)
NR 140 PAL
Discharge to ash pond effluent ditch ended in mid-2000s

Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-33A and MW-33AR - Boron (µg/l as B)

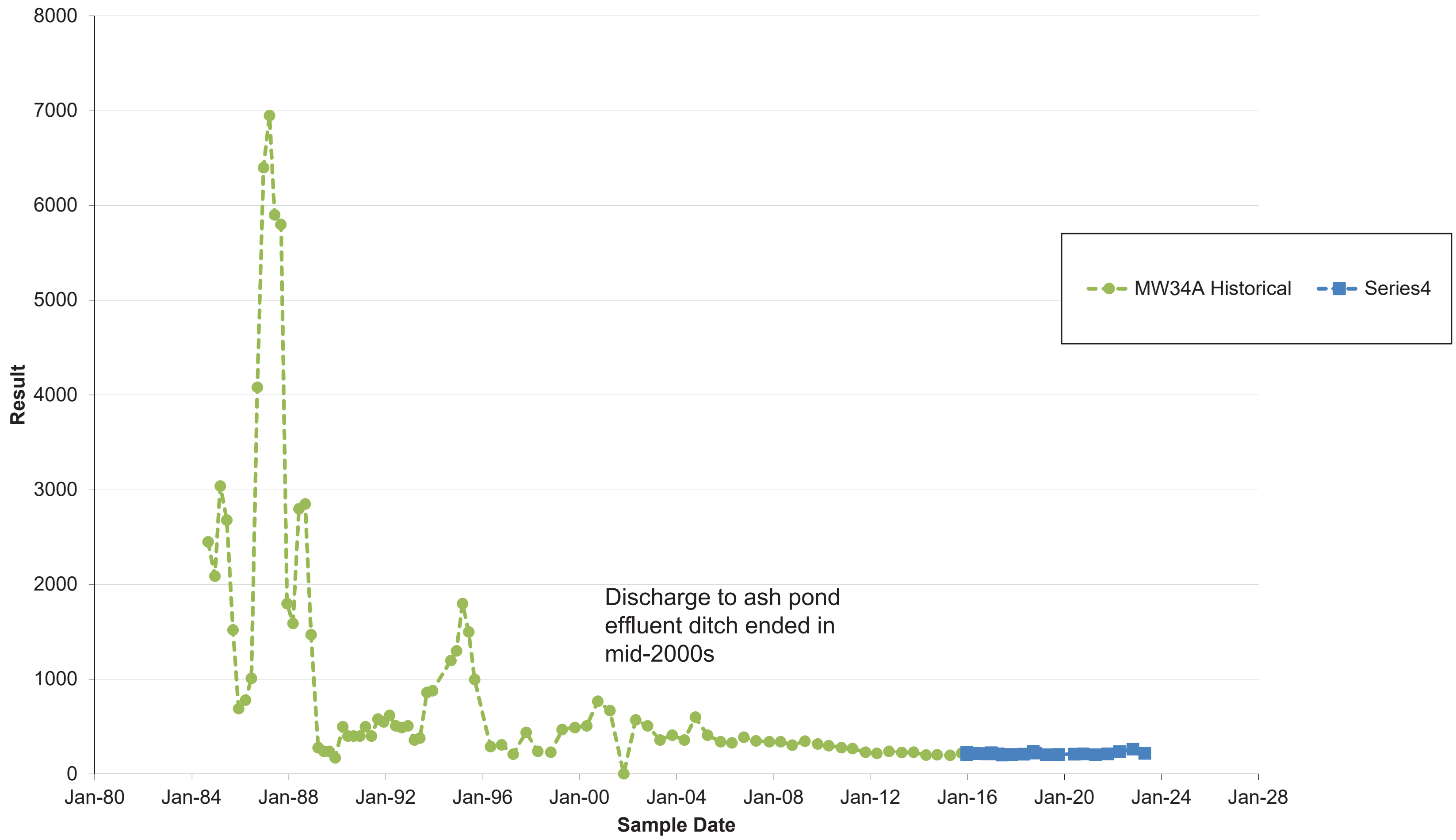


I:\25223067.00\Deliverables\COL 1-3 ASD - April 2023\Graphs\[Bo_COL Dry.xlsx]MW-33AR



Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-33BR - Boron, dissolved (mg/l as B)
Result
Sample Date
0
0.5
1
1.5
2
2.5
3
3.5
4
Jan-80
Jan-84
Jan-88
Jan-92
Jan-96
Jan-00
Jan-04
Jan-08
Jan-12
Jan-16
Jan-20
Discharge to ash pond effluent ditch ended in mid-2000s
Detects
Result (or Rpt Lmt)
NR 140 PAL

Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW34A - Boron (µg/l as B)



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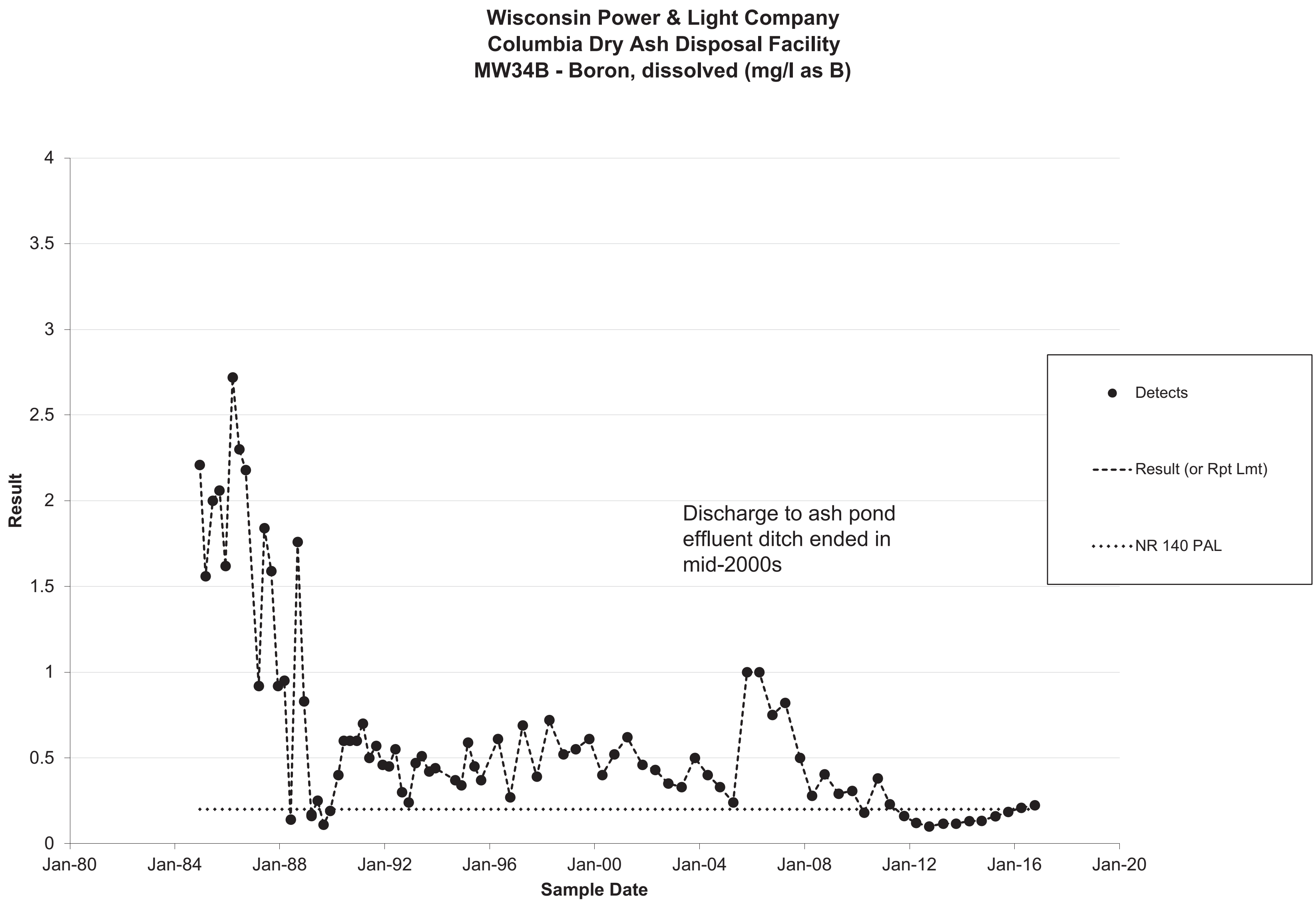
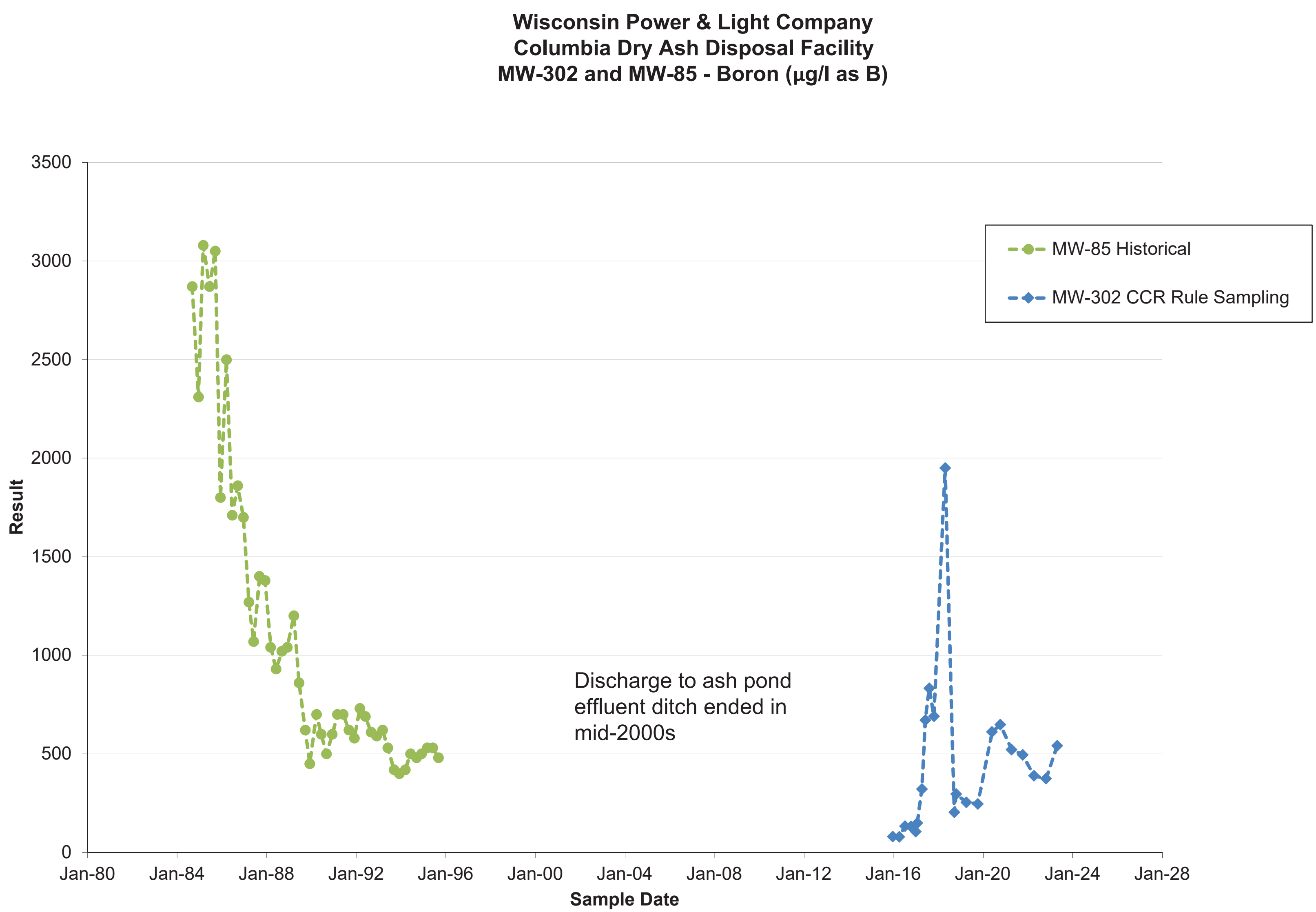

Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW34B - Boron, dissolved (mg/l as B)
Result
4
3.5
3
2.5
2
1.5
1
0.5
0
Jan-80
Jan-84
Jan-88
Jan-92
Jan-96
Jan-00
Jan-04
Jan-08
Jan-12
Jan-16
Jan-20
Sample Date
Discharge to ash pond effluent ditch ended in mid-2000s
Detects
Result (or Rpt Lmt)
NR 140 PAL



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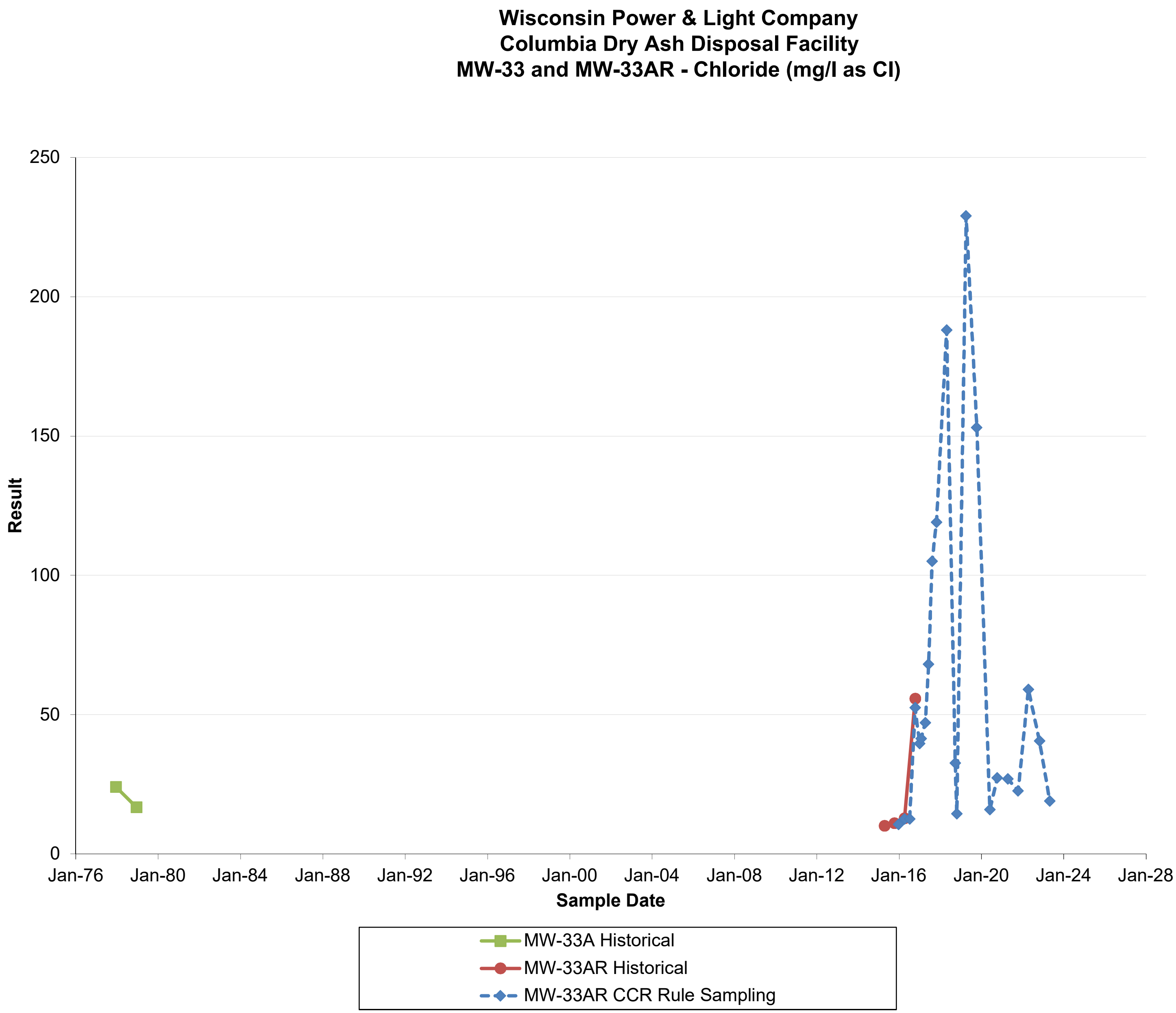
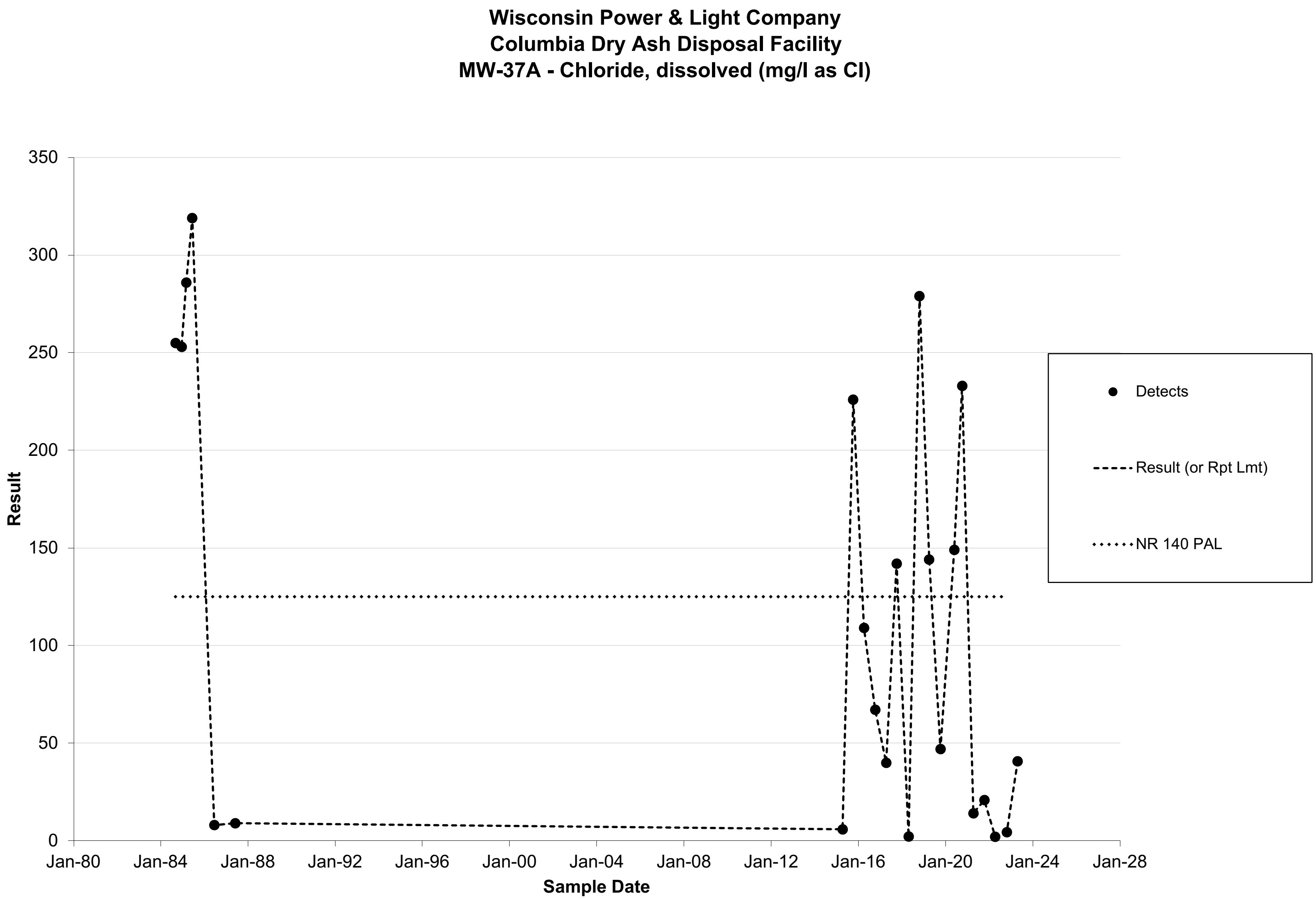
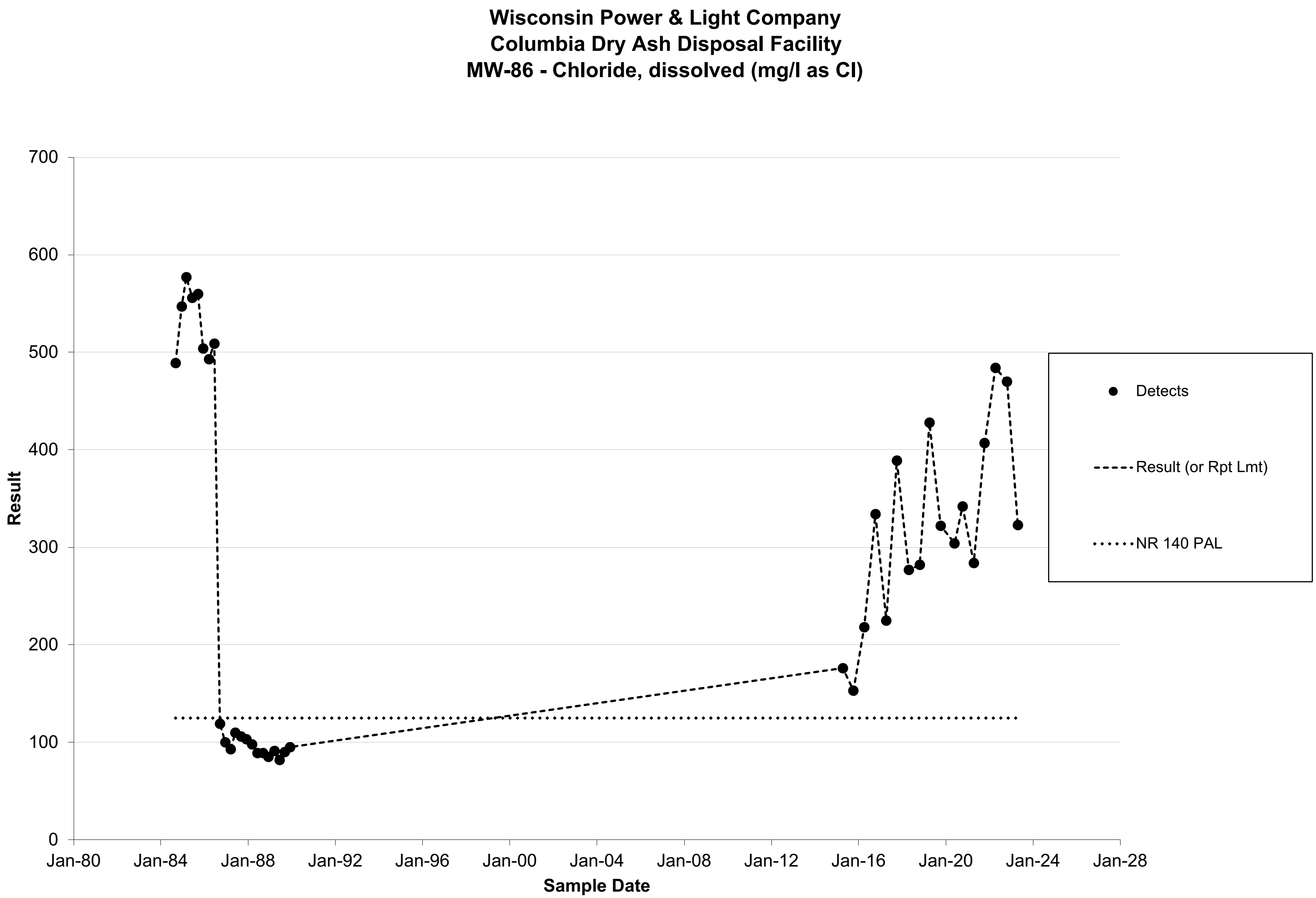


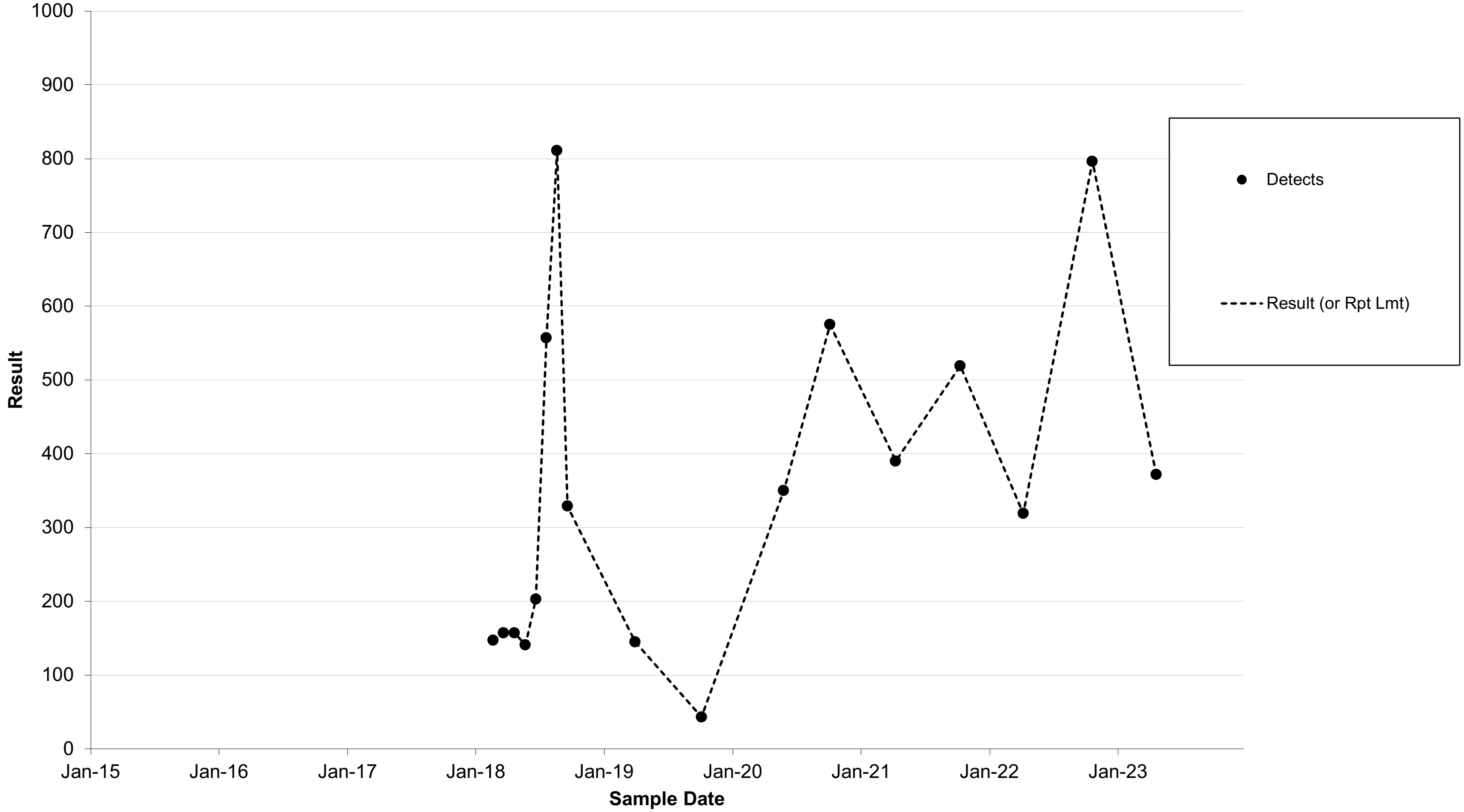
I:\25223067.00\Deliverables\COL 1-3 ASD - April 2023\Graphs\[Cl_COL Dry.xlsx]MW-33AR

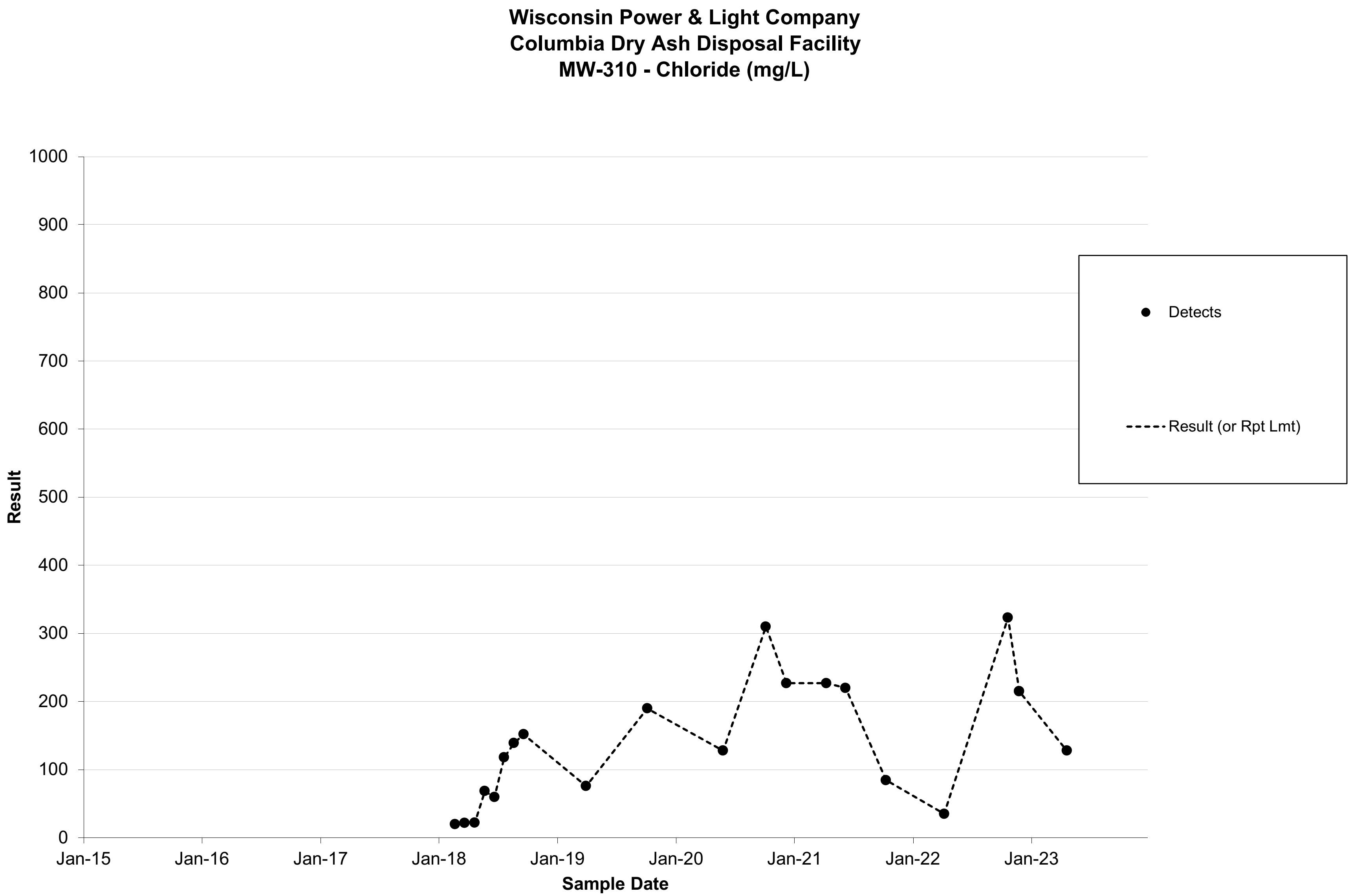

Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-37A - Chloride, dissolved (mg/l as Cl)
Result
Sample Date
0
50
100
150
200
250
300
350
Jan-80
Jan-84
Jan-88
Jan-92
Jan-96
Jan-00
Jan-04
Jan-08
Jan-12
Jan-16
Jan-20
Jan-24
Jan-28
Detects
Result (or Rpt Lmt)
NR 140 PAL



Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-86 - Chloride, dissolved (mg/l as Cl)
Result
0
100
200
300
400
500
600
700
Jan-80
Jan-84
Jan-88
Jan-92
Jan-96
Jan-00
Jan-04
Jan-08
Jan-12
Jan-16
Jan-20
Jan-24
Jan-28
Sample Date
Detects
Result (or Rpt Lmt)
NR 140 PAL

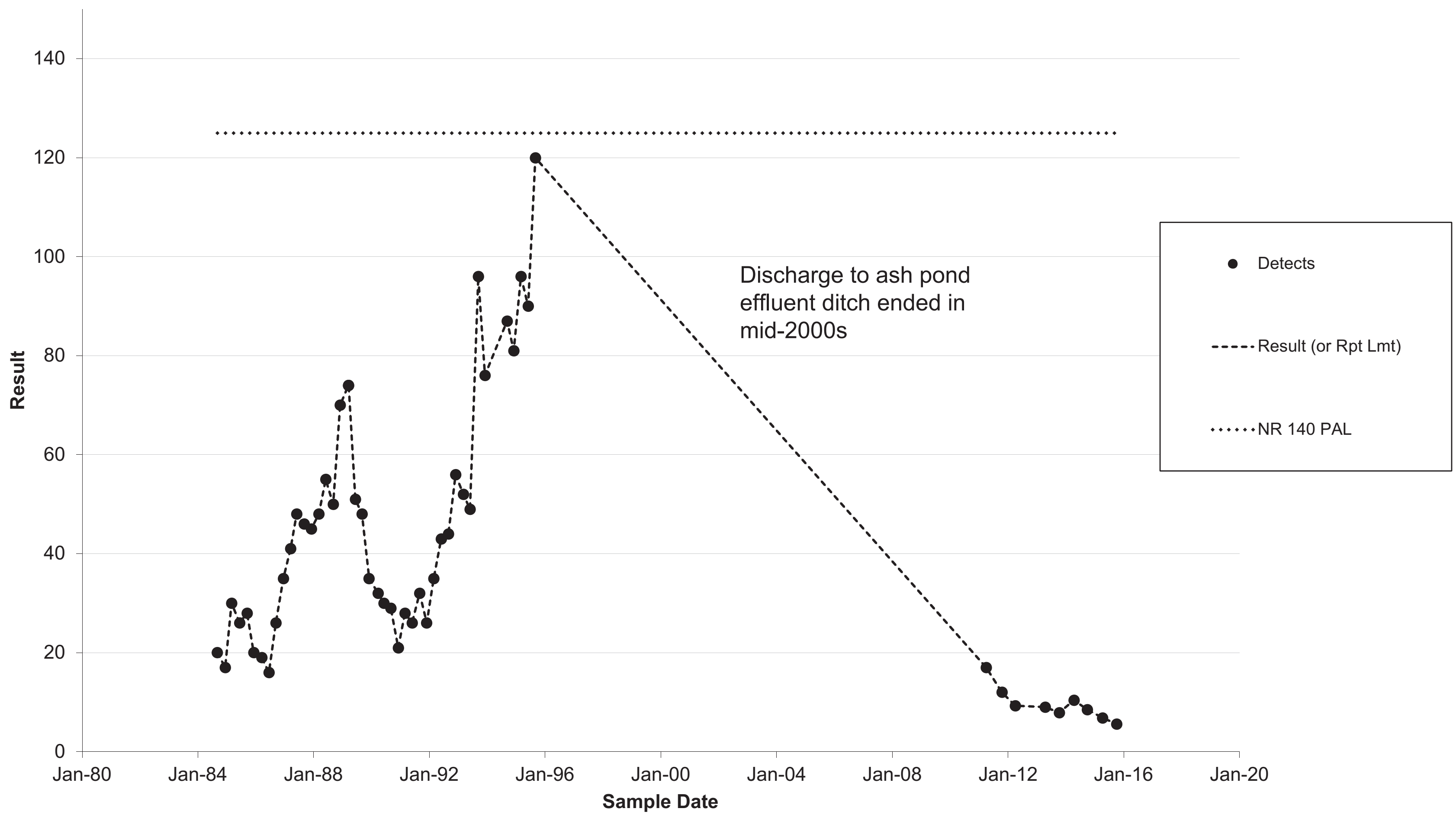
Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-309 - Chloride (mg/L)

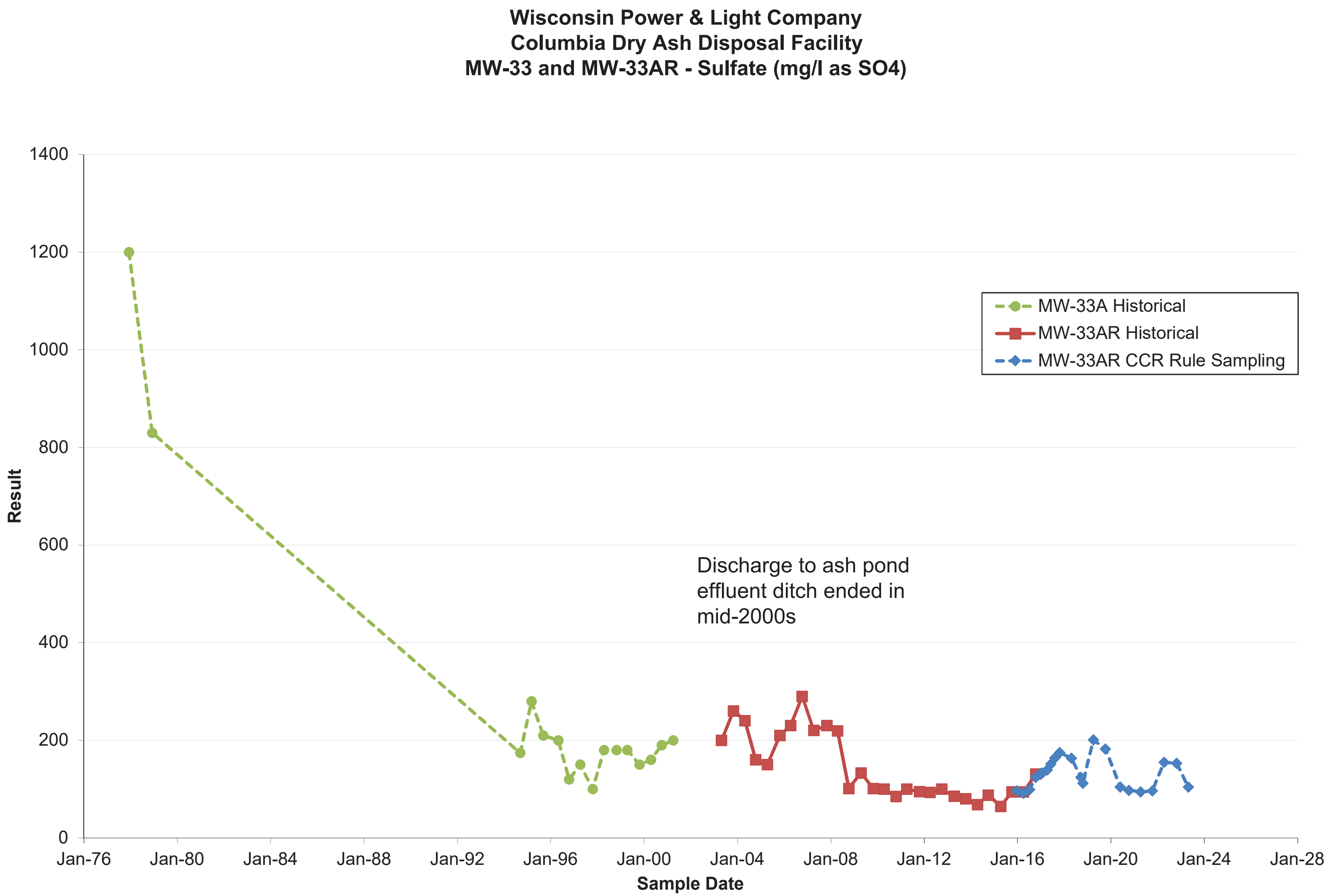




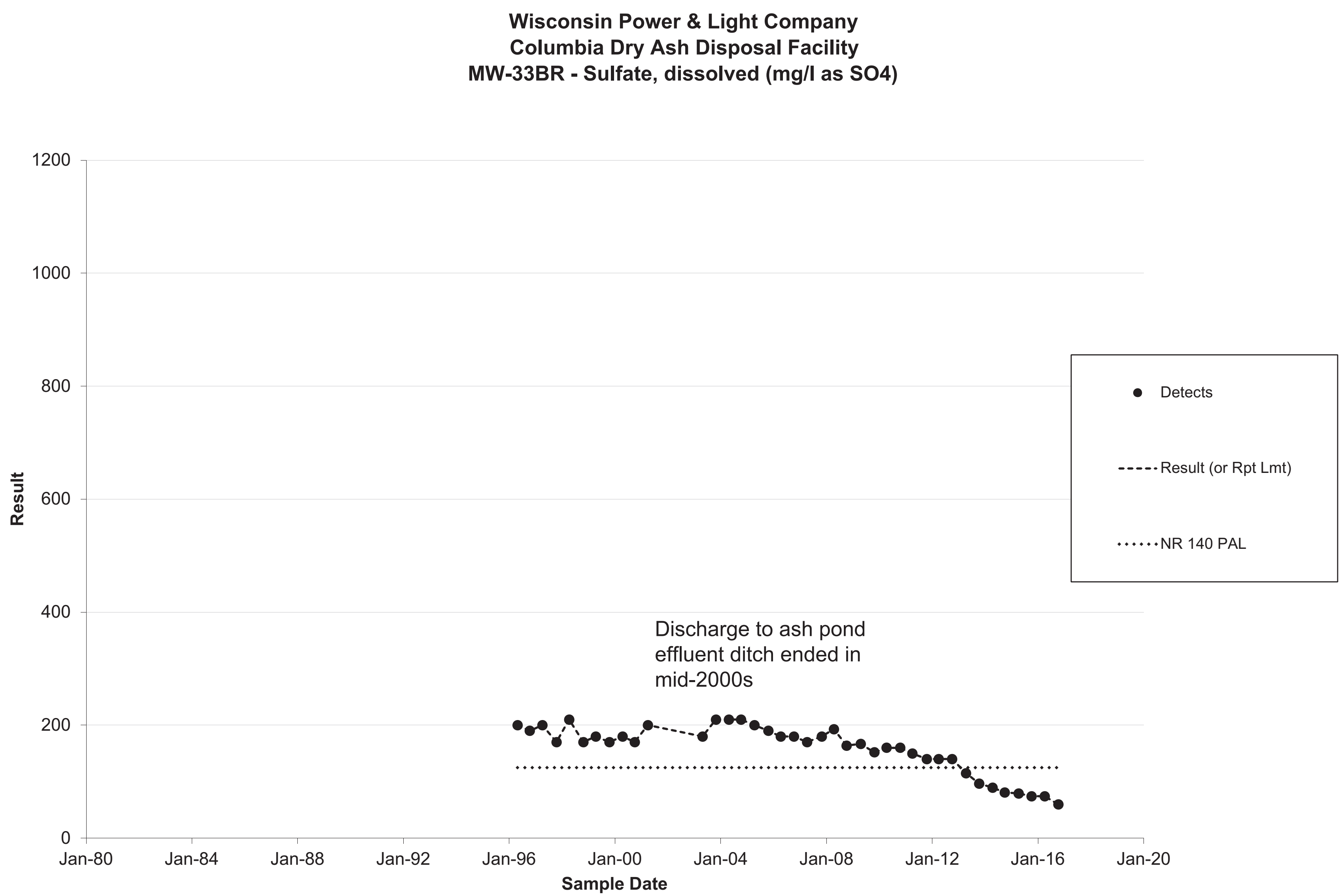
Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-310 - Chloride (mg/L)
Result
1000
900
800
700
600
500
400
300
200
100
0
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Sample Date
Detects
Result (or Rpt Lmt)

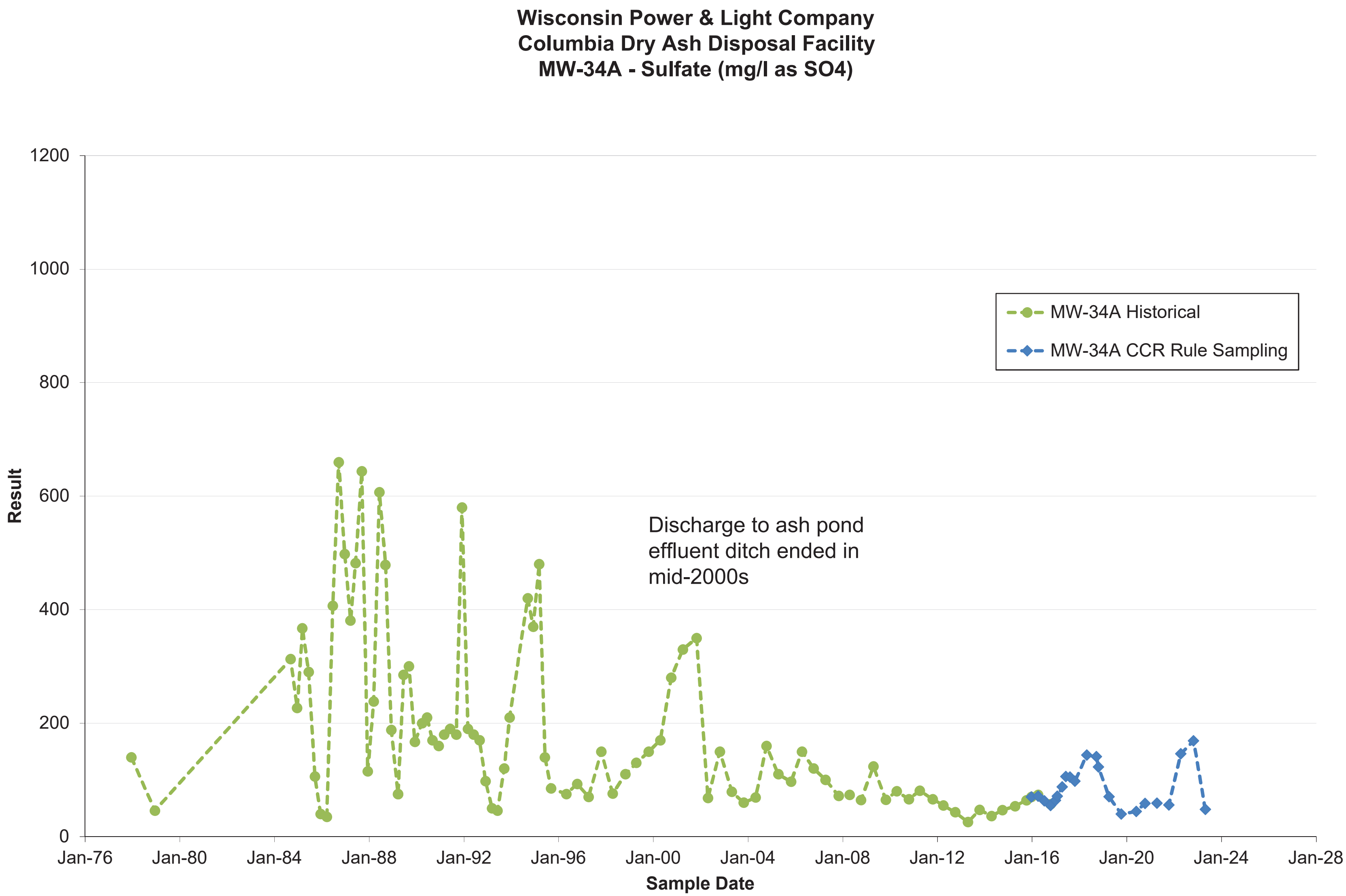
Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW4 - Sulfate, dissolved (mg/L SO4)





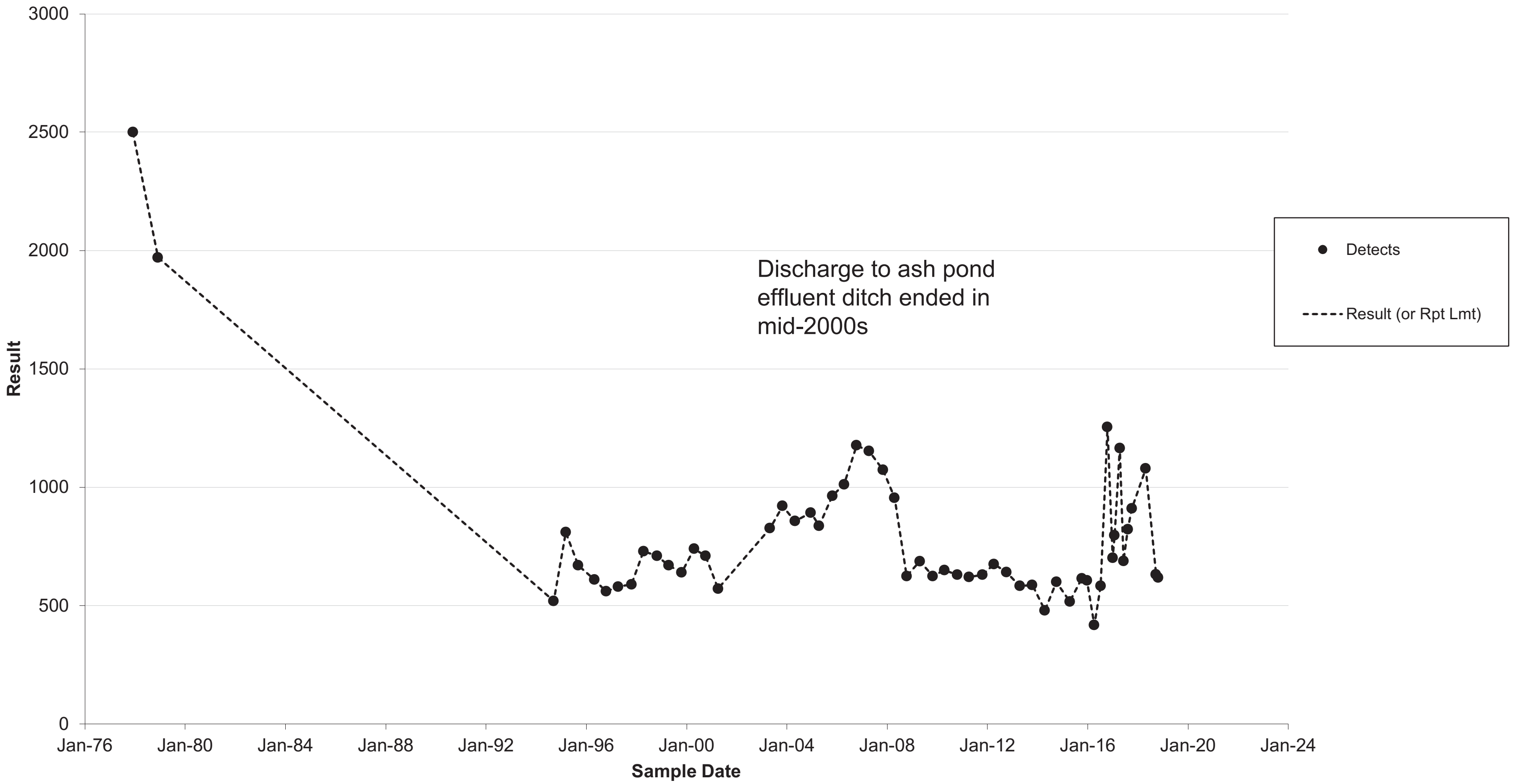
I:\25223067.00\Deliverables\COL 1-3 ASD - April 2023\Graphs\[SO4_COL Dry.xlsx]MW-33AR CCR

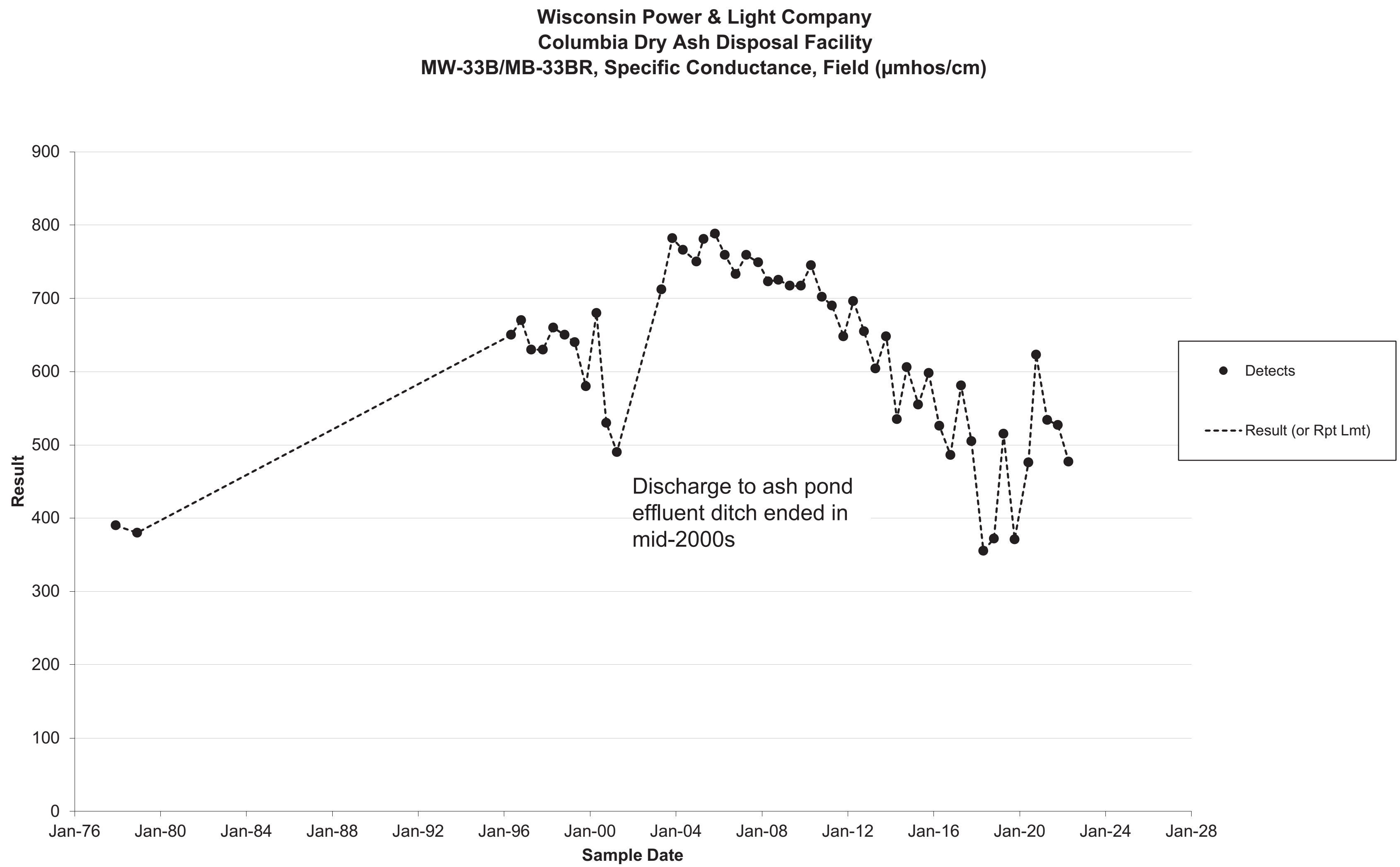

Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-33BR - Sulfate, dissolved (mg/l as SO4)
1200
1000
800
600
400
200
0
Result
Jan-80
Jan-84
Jan-88
Jan-92
Jan-96
Jan-00
Jan-04
Jan-08
Jan-12
Jan-16
Jan-20
Sample Date
Discharge to ash pond effluent ditch ended in mid-2000s
Detects
Result (or Rpt Lmt)
NR 140 PAL



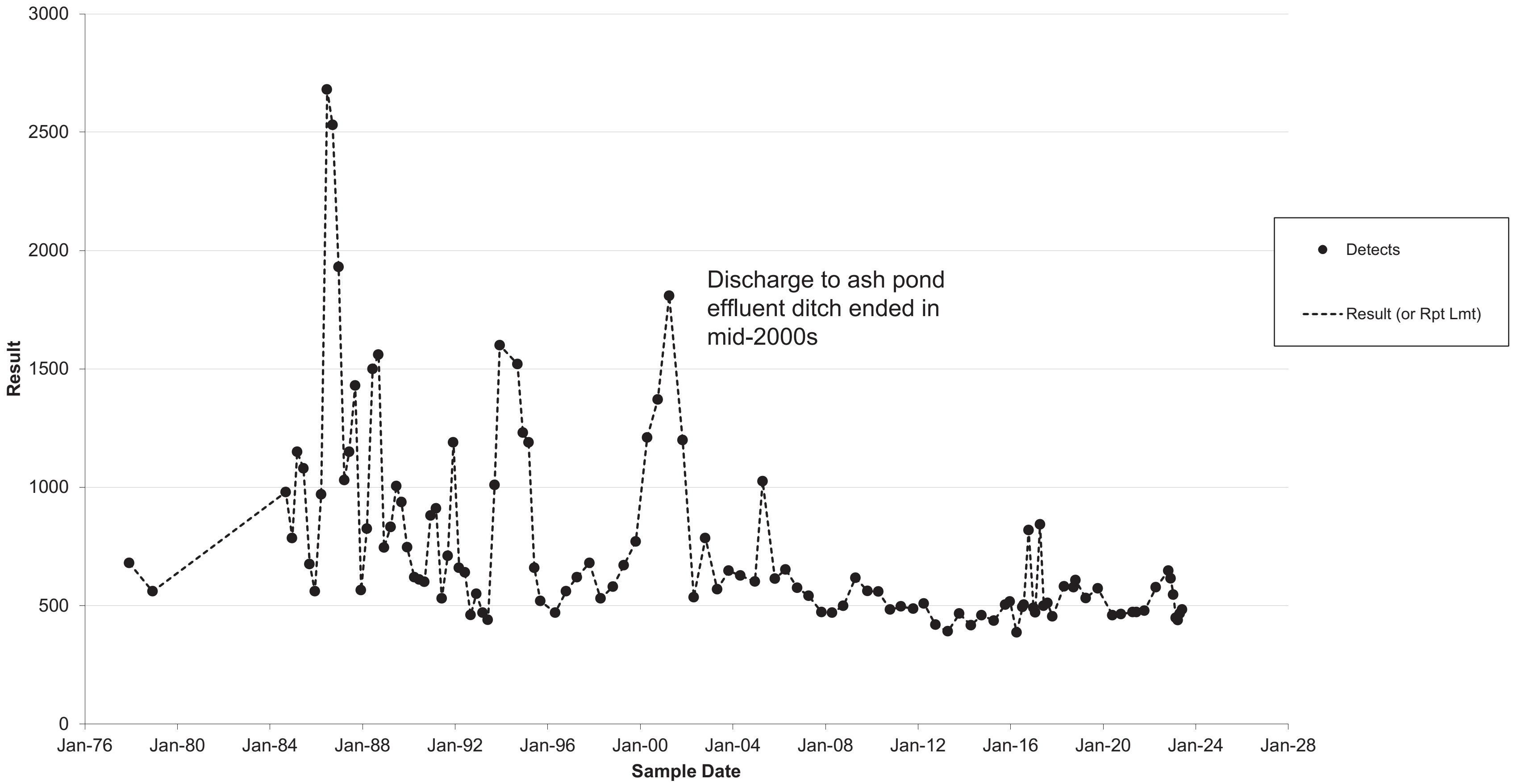
I:\25223067.00\Deliverables\COL 1-3 ASD - April 2023\Graphs\[SO4_COL Dry.xlsx]MW-34A CCR

Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-33A/MW-33AR - Specific Conductance, Field (µmhos/cm)

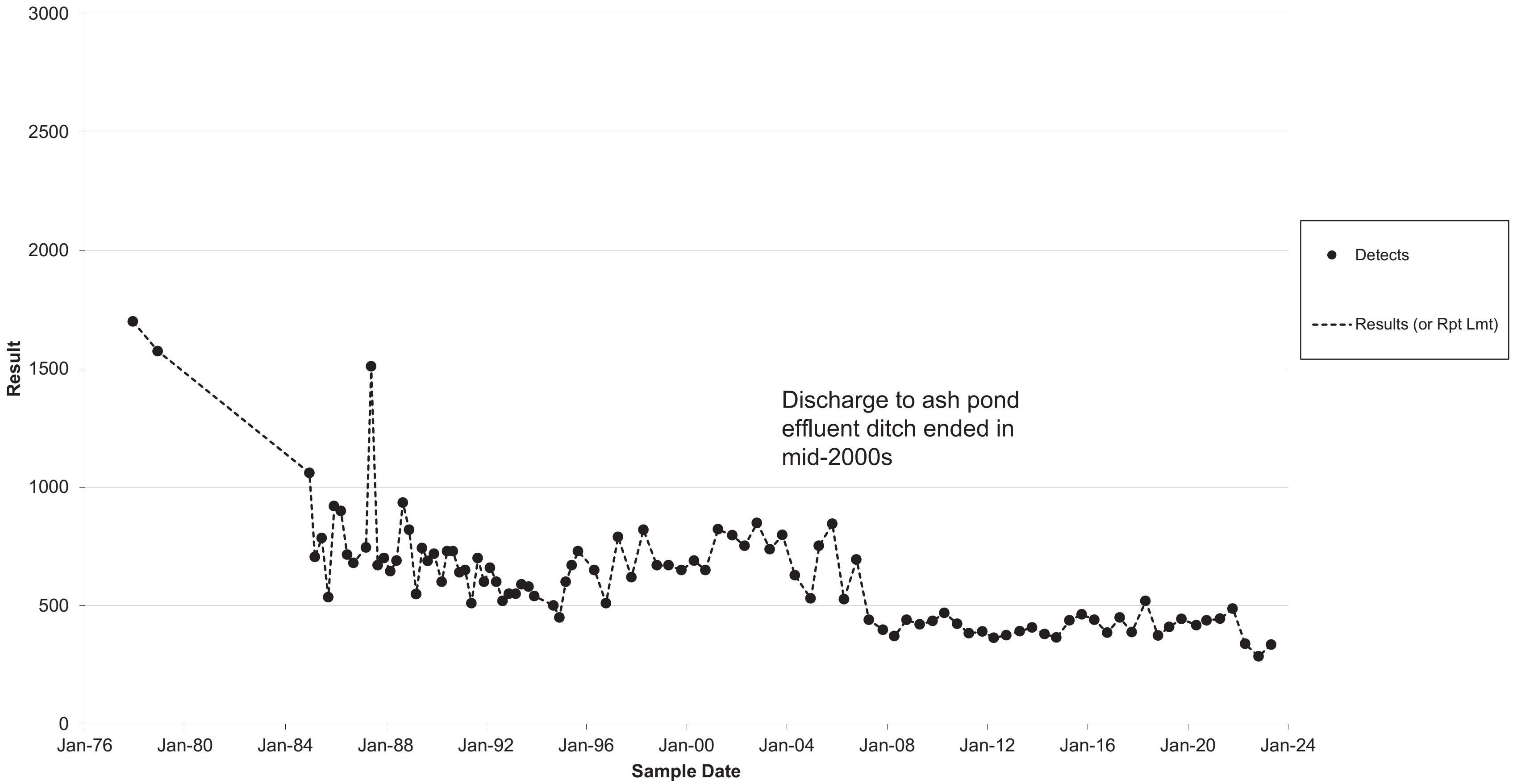



Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-33B/MB-33BR, Specific Conductance, Field (µmhos/cm)
900
800
700
600
500
400
300
200
100
0
Result
Jan-76
Jan-80
Jan-84
Jan-88
Jan-92
Jan-96
Jan-00
Jan-04
Jan-08
Jan-12
Jan-16
Jan-20
Jan-24
Jan-28
Sample Date
Discharge to ash pond effluent ditch ended in mid-2000s
Detects
Result (or Rpt Lmt)

Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-34A - Specific conductance-field (umhos/cm @ 25c)



Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-34B - Specific conductance-field (umhos/cm @ 25c)



Appendix C

Alternative Source Demonstration, April 2023 Detection Monitoring

Alternative Source Demonstration
April 2023 Detection Monitoring

Dry Ash Disposal Facility, Modules 1-3
Columbia Energy Center
Pardeeville, Wisconsin

Prepared for:

Alliant Energy

SCS ENGINEERS

25223067.00 | November 21, 2023

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

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Appendices

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PE CERTIFICATION

11/20/2023

I, Sherren Clark, hereby certify that the information in this alternative source demonstration is accurate and meets the requirements of 40 CFR 257.94(e)(2). This certification is based on my review of the groundwater data and related site information available for the Columbia Energy Center Dry Ash Disposal Facility. I am a duly licensed Professional Engineer under the laws of the State of Wisconsin.

11/20/2023

(signature) (date)

Sherren Clark. PE

(printed or typed name)

License number E-29863

My license renewal date is July 31, 2024.

Pages or sheets covered by this seal:
Alternative Source Demonstration, April 2023 Detection
Monitoring, Dry Ash Disposal Facility, Modules 1-3,
Columbia Energy Center, Pardeeville, Wisconsin

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1.0 INTRODUCTION

This Alternative Source Demonstration (ASD) was prepared to support compliance with the groundwater monitoring requirements of the "Coal Combustion Residuals (CCR) Final Rule" published by the U.S. Environmental Protection Agency (U.S. EPA) in the *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule*, dated April 17, 2015 (U.S. EPA, 2015), and subsequent amendments. Specifically, this report was prepared to fulfill the requirements of 40 CFR 257.94(e)(2). The applicable sections of the Rule are provided below in *italics*.

1.1 §257.94(E)(2) ALTERNATIVE SOURCE DEMONSTRATION REQUIREMENTS

The owner and operator may demonstrate that a source other than the CCR Unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The owner or operator must complete the written demonstration within 90 days of detecting a statistically significant increase over background levels.

An ASD is completed when there are exceedances of one or more benchmarks established within the groundwater monitoring program to determine if any other sources are likely causes of the identified exceedance(s) of established benchmark(s) at the site. This ASD was performed in response to results indicating a statistically significant increase (SSI) over background levels during detection monitoring under the CCR Rule.

This ASD report evaluates the SSIs observed in the statistical evaluation of the October 2022 detection monitoring event at the Columbia Energy Center (COL) Dry Ash Disposal Facility (ADF), Modules 1-3 CCR Unit. The first ASD was prepared for this facility evaluating the SSIs observed in the statistical evaluation of the October 2017 detection monitoring event (SCS Engineers [SCS], 2018). The October 2017 ASD and subsequent semiannual updates have provided several lines of evidence demonstrating that SSIs reported for boron, chloride, field pH, and sulfate concentrations in the downgradient monitoring wells were likely due to man-made sources other than the CCR Units and/or naturally occurring constituents in the alluvial aquifer.

As discussed in more detail in **Section 4.2** of this ASD, the findings for the April 2023 monitoring event were consistent with those for the previous events.

1.2 SITE INFORMATION AND MAP

The COL site is located at W8375 Murray Road, Pardeeville, Columbia County, Wisconsin (**Figure 1**). The COL site is an active coal-burning generating station, which has been burning coal and disposing of CCR on site since the mid-1970s. The layout of the site is shown on **Figure 2**. The COL property includes two areas of CCR storage and disposal. These are the ADF and the Ash Ponds Facility. This ASD will evaluate the conditions at the site for Modules 1-3 of the ADF only. The ADF is operated under the Wisconsin Department of Natural Resources (WDNR) License No. 3025.

The groundwater monitoring system monitors the following CCR Unit:

- COL Dry ADF – Modules 1-3 (existing CCR Landfill)

Modules 1-3 were originally described as separate existing CCR landfills, although they are contiguous and are managed as a single landfill by the facility and by the WDNR. Wisconsin Power and Light Company (WPL) subsequently clarified that Modules 1-3 are one existing CCR landfill under the federal CCR Rule, and this report reflects WPL's clarification.

A map showing the CCR Unit and all background (or upgradient) and downgradient monitoring wells with identification numbers for the CCR groundwater monitoring program and the state monitoring program is provided as **Figure 2.** Separate monitoring systems have been established for the other CCR Units at COL, which include Modules 4-6 of the COL ADF, Modules 10-11 of the COL ADF, the primary ash pond, and the secondary ash pond.

1.3 STATISTICALLY SIGNIFICANT INCREASES IDENTIFIED

SSIs were identified by comparing the monitoring results to Upper Prediction Limits (UPLs) established in accordance with 40 CFR 257.93(f)(3) and the statistical method previously selected for the CCR Unit. The UPLs are based on an interwell approach using two background monitoring wells: MW-84A and MW-301. The interwell UPLs were calculated based on a 1-of-2 resampling approach. The UPLs and results for the April 2023 monitoring event are summarized in **Table 1.**

The April 2023 SSIs include the following parameters and wells:

- Boron: MW-33AR, MW-34A, MW-302
- Chloride: MW-33AR
- Sulfate: MW-33AR, MW-34A, MW-302

Concentration trends for the parameters with SSIs are shown in **Appendix A.**

1.4 OVERVIEW OF ALTERNATIVE SOURCE DEMONSTRATION

This ASD report includes:

- Background information (**Section 2.0**).
- Evaluation of potential that SSIs are due to methodology or analysis (**Section 3.0**).
- Evaluation of potential that SSIs are due to natural sources or man-made sources other than the CCR Units (**Section 4.0**).
- ASD conclusions (**Section 5.0**).
- Monitoring recommendations (**Section 6.0**).

The CCR Rule constituent results from background and compliance sampling for parameters with SSIs are provided in **Table 2.** The laboratory reports for the April 2023 detection monitoring event will be included in the 2023 Annual Groundwater Monitoring and Corrective Action Report to be completed in January 2024. Complete laboratory reports for the background monitoring events and the previous detection monitoring events were included in previous annual groundwater monitoring and corrective action reports.

2.0 BACKGROUND

To provide context for the ASD evaluation, the following background information is provided in this section of the report, prior to the ASD evaluation sections:

- Geologic and hydrogeologic setting
- CCR Rule monitoring system
- Other monitoring wells

A more detailed discussion of the background information for the site is provided in the ASD for the October 2017 event (SCS, 2018).

2.1 REGIONAL GEOLOGY AND HYDROGEOLOGY

2.1.1 Regional Information

For the purposes of groundwater monitoring, the surficial sand and gravel aquifer is considered the uppermost aquifer, as defined under 40 CFR 257.53. Immediately underlying the surficial sand and gravel aquifer is the Cambrian-Ordovician sandstone aquifer.

Additional details on the regional geology and hydrogeology were provided in the October 2017 ASD (SCS, 2018).

2.1.2 Site Information

Soils at the site are primarily sand to a depth of approximately 50 to 100 feet, and overlie sandstone bedrock. Soils encountered during the site feasibility study for the COL ADF were described as generally sandy with interbedded silty clay lenses up to 20 feet thick (Warzyn Engineering, Inc. [Warzyn], 1978). During drilling of CCR wells MW-301 and MW-302, the unconsolidated materials were identified as consisting primarily of silty sand and sand. Boring logs for previously installed monitoring wells MW-33AR, MW-34A, MW-84A, and MW-1AR (abandoned) show silty sand and sand as the primary unconsolidated materials at these locations. All CCR monitoring wells are screened within the unconsolidated sand unit.

Shallow groundwater at the site generally flows to the north and west across the existing landfill Modules 1-3 area, then generally flows west toward the Wisconsin River. The groundwater flow map for April 2023 is shown on Figure 3. Historically, localized groundwater mounding was associated with the ash ponds; however, flow in the ash pond area changed in 2022 and 2023 as the ponds were closed and CCR was removed. In 2022, dewatering wells located around the Secondary Pond lowered the water table near the Secondary Ash Pond and discharged groundwater to the Primary Ash Pond. Beginning in spring 2023, dewatering activities switched to the Primary Ash Pond area, and groundwater pumped from dewatering wells around the Primary Ash Pond was discharged to the large cooling pond south of the generating station. The April 2023 groundwater flow map shows temporary inward gradients in the vicinity of the Primary Ash Pond due to dewatering activities. These temporary changes may have had some impact on flow directions in the MOD 1-3 area, but the general flow directions to the north and/or west did not change. The groundwater elevation data for the CCR monitoring wells and state monitoring program wells are provided in Table 3.

2.2 CCR RULE MONITORING SYSTEM

The groundwater monitoring system established in accordance with the CCR Rule consists of two upgradient (background) monitoring wells and three downgradient monitoring wells (**Table 1** and **Figure 2**). The background wells include MW-301 and MW-84A. The downgradient wells include MW-302, MW-33AR, and MW-34A. MW-1AR was added to the monitoring program in 2021 as a supplemental well because monitoring data have indicated that the groundwater flow direction in this part of the site is sometimes to the northeast. MW-1AR was abandoned in 2022 because it was within the footprint of the Modules 10-11 expansion area. The monitoring network certification was updated with the abandonment of MW-1AR in October 2022. Flow direction in this area of the site will continue to be monitored by additional wells in the State monitoring program, including water level-only monitoring wells MW-312 and MW-93A, and CCR rule monitoring wells for Modules 10-11, including MW-313, MW-314, and MW-315. The CCR Rule wells are installed within the sand and gravel aquifer. Well depths range from approximately 29 to 51 feet, measured from the top of the well casing.

2.3 OTHER MONITORING WELLS

Additional groundwater monitoring wells currently exist at COL as part of the monitoring systems developed for the state monitoring program and for the other CCR Units.

Monitoring wells for the state monitoring program are installed in the unconsolidated sand and gravel unit, which is the uppermost aquifer as defined under 40 CFR 257.53. This shallow monitoring system includes water table wells and mid-depth piezometers. Well depths range from approximately 14 to 76 feet, measured from the top of the well casing.

3.0 METHODOLOGY AND ANALYSIS REVIEW

To evaluate the potential that an SSI is due to a source other than the regulated CCR Unit, SCS used a two-step evaluation process. First, the sample collection, field and laboratory analysis, and statistical evaluation were reviewed to identify any potential error or analysis that led to exceedance of the benchmark. Second, potential alternative sources, including natural variation and man-made sources other than the CCR Unit, were evaluated. This section of the report provides the findings of the methodology and analysis review. **Section 4.0** of the report addresses the potential alternative sources.

3.1 SAMPLING AND FIELD ANALYSIS

Field notes and sampling results were reviewed to determine if any sampling error may have caused or contributed to the observed SSIs. Potential field sampling errors or issues could include mislabeling of samples, improper sample handling, missed holding times, cross-contamination during sampling, or other field error. Field blank sample results were also reviewed for any indication of potential contamination from sampling equipment or containers.

SCS did not identify any sampling errors for field data that may have caused or contributed to observed SSIs.

The April 2023 monitoring event was completed in accordance with the Sampling and Analysis Plan for the monitoring system.

3.2 LABORATORY ANALYSIS REVIEW

The laboratory reports for the April 2023 detection monitoring event were reviewed to determine if any laboratory analysis error or issue may have caused or contributed to an observed SSI for boron, chloride, or sulfate. The laboratory report review included reviewing the laboratory quality control flags and narrative, verifying that correct methods were used and desired detection limits were achieved, and checking the field and laboratory blank sample results.

Based on the review of the laboratory reports, SCS did not identify any laboratory analysis issues that could have caused or contributed to the observed SSIs for boron, chloride, and sulfate.

Time series plots of the SSI constituent analytical data were also reviewed for any anomalous results that might indicate a possible sampling or laboratory error (e.g., dilution error or incorrect sample labeling). The time series plots are provided in **Appendix A**. The concentrations observed are similar to historical concentrations for sulfate, boron, and chloride.

3.3 STATISTICAL EVALUATION REVIEW

The review of the statistical results and methods included a quality control check of the following:

- Input analytical data vs. laboratory analytical reports
- Statistical method and process for each SSI

Based on the review of the statistical evaluation, SCS did not identify any errors or issues in the statistical evaluation that caused or contributed to the determination of interwell SSIs for the April 2023 detection monitoring event.

3.4 SUMMARY OF METHODOLOGY AND ANALYSIS REVIEW FINDINGS

In summary, there were no changes to the SSI determinations for the April 2023 monitoring event based on the methodology and analysis review. No other errors or issues causing or contributing to the reported SSIs were identified.

4.0 ALTERNATIVE SOURCES

This section of the report discusses the potential alternative sources for the boron, chloride, and sulfate SSIs at the downgradient monitoring wells; identifies the most likely alternative source(s); and presents the lines of evidence indicating that an alternative source is the most likely cause of the observed SSIs.

4.1 POTENTIAL CAUSES OF SSI

4.1.1 Natural Variation

The statistical analysis was completed using an interwell approach, comparing the April 2023 detection monitoring results to the UPLs calculated based on the sampling of the background wells (MW-84A and MW-301). If concentrations of a constituent that is naturally present in the aquifer vary spatially, then the potential exists that the downgradient concentrations may be higher than upgradient concentrations due to natural variation. Previous monitoring results for boron, chloride, and sulfate at COL Modules 1-3 landfill are shown in **Table 2**.

Although natural variation is present in the shallow aquifer, it does not appear likely that natural variation is the primary source causing the boron, chloride, and sulfate SSIs.

4.1.2 Man-Made Alternative Sources

Man-made alternative sources that could potentially contribute to the boron, chloride, and sulfate SSIs could include the closed ash pond landfill, the active and inactive ash ponds, the former ash pond effluent ditch, the coal storage area, road salt use, railroad operations, or other plant operations.

Based on the groundwater flow directions and on previous investigations at the site, the former ash pond effluent ditch, a non CCR alternative source, appears to be the most likely cause of the boron and/or sulfate SSIs for wells MW-33AR, MW-34A, and MW-302. The ash pond effluent ditch may also have contributed to the chloride SSI at MW-33AR.

4.2 LINES OF EVIDENCE

The lines of evidence indicating that the SSIs for boron, chloride, and sulfate in compliance wells MW-33AR, MW-34A, and MW-302, relative to the background wells, are due to an alternative source include:

1. Elevated levels of boron, chloride, and sulfate were present in the area west of the landfill, where the three compliance wells are located before the landfill was constructed.

2. Monitoring performed under the state program documents that the concentrations of boron, chloride, and sulfate were elevated before CCR disposal in the landfill began, and have decreased since the landfill has been in operation.

3. Groundwater flow directions have changed through time due to changes in water management at the plant, so that groundwater impacted by the effluent ditch formerly flowed to the east, under the landfill, and is now flowing west and/or north.

4. The variations in chloride results for well MW-33AR since detection monitoring was initiated have not correlated with boron concentrations, as would be expected for a CCR leachate source; therefore, an alternative source is more likely.

4.2.1 Pre-Landfill Water Quality

Elevated levels of boron, chloride, and sulfate were present in the area west of the landfill, where the three compliance wells are located, before the landfill was constructed. Groundwater monitoring performed in 1977 and 1978 as part of the Feasibility Study for the landfill permitting showed that wells located along the west side of the future landfill footprint, where the current compliance wells are located, had elevated results for sulfate, chloride, and specific conductance. The 1978 Feasibility Study (Warzyn, 1978) for the Dry ADF discusses the influence of the ash pond effluent ditch on groundwater west of the proposed site. The former ash pond effluent ditch carried effluent from the ash ponds located north of the plant, and flowed south between the west side of the current landfill and the substation. Groundwater monitoring in December 1977 indicated that sulfate was present at 1,200 milligrams per liter (mg/L) in MW-33A, which was located near the point where the ash pond effluent discharged from a culvert into the effluent ditch. The sulfate concentration at this well decreased to 830 mg/L in the December 1978 sampling (Warzyn, 1979). Current concentrations of sulfate in this area, while above background, are much lower. The April

2023 sulfate result for MW-33AR (installed to replace MW-33A) was 104 mg/L, for MW-34A was 48.4 mg/L, and for MW-302 was 36.6 mg/L (**Table 1**).

Selected text and tables from the 1978 Feasibility Study and the 1979 Supplementary Feasibility Study Report are included in **Appendix B**.

4.2.2 Long-Term Concentration Trends

Monitoring performed under the state program documents that the concentrations of boron and sulfate were elevated before CCR disposal in the landfill began, and have decreased since the landfill has been in operation. Routine groundwater monitoring for the COL ADF began after the Plan of Operation was approved and prior to initial CCR disposal. The earliest data available from the WDNR Groundwater Environmental Monitoring System (GEMS) database is from September 1984. Initial placement of CCR in test plots in Module 1 of the ADF was approved in October 1984, and CCR disposal began sometime after that. Therefore, the initial groundwater monitoring results in the GEMS database represent pre-disposal conditions for the landfill.

The earliest historic monitoring data show that before CCR disposal in the landfill began, concentrations of boron and sulfate were significantly higher than current concentrations in the area west of the landfill where the compliance wells are located. Graphs of historical concentrations are provided in **Appendix C**. Results for compliance well MW-33AR are plotted with results from well MW-33A. MW-33AR was a replacement well for MW-33A at a slightly different location and depth. The well screen was installed approximately 10 feet higher in MW-33AR than in MW-33A, intersecting the water table, which may explain the increase in concentration that occurred with the well replacement. Results for compliance well MW-302 are plotted with results from monitoring well MW-85, which was located near the current MW-302 location (see **Figure 2**) and was monitored from September 1984 through September 1995.

The recent boron concentrations are consistent with generally decreasing or stable historical concentrations at MW-33AR and MW-34A (**Appendix A** and **Appendix C**). Recent boron concentrations at MW-302 have been variable, but remain well below the concentrations observed in samples from MW-85 prior to CCR disposal in the landfill.

4.2.3 Groundwater Flow Direction Changes

Groundwater flow directions have changed through time due to changes in water management at the plant, so that groundwater impacted by the effluent ditch formerly flowed to the east, under the landfill, and is now flowing north and/or west. The 1978 Feasibility Study report states that the southern 2/3 of the proposed fill area (including the area of the active CCR landfill phases) exhibits a southeast and southerly groundwater flow direction, toward an agricultural drainage ditch southeast and south of the landfill area. The 1981 Plan of Operation indicates that flow in the landfill area is to the east-southeast. A water table map prepared by RMT, based on October 2002 water level measurements, shows flow under the landfill generally to the east and northeast from a groundwater high near the effluent ditch and Wisconsin Pollutant Discharge Elimination System (WPDES) pond between the landfill and the substation. The 1981 and 2002 water table maps are provided in **Appendix D**.

Under current conditions, groundwater flow below the active landfill area is generally to the north and northwest. The flow changes with time reflect the termination of discharge to the ash pond effluent ditch in the mid-2000s. When discharge via this ditch was active, the ditch was a source of recharge to the groundwater and created a high groundwater area with flow moving away from the ditch to the east. After discharge to the ditch was terminated, water levels in this area decreased significantly and the groundwater flow direction changed.

With the changes in groundwater flow, historically impacted groundwater moved in alternating directions. While the effluent ditch was active, impacted groundwater likely moved eastward past the current compliance wells, as indicated by the long-term concentration data. Although the compliance wells on the west side of Modules 1-3 are downgradient from the landfill under current flow conditions, the observed groundwater impacts may be residual from the past when the wells were downgradient from the effluent ditch.

4.2.4 Chloride and Boron Concentrations

The variations in chloride results for well MW-33AR since detection monitoring was initiated have not correlated with boron concentrations, as would be expected for a CCR leachate source; therefore, an alternative source is more likely. The chloride results for well MW-33AR increased beginning in 2016, peaked in April 2018 and April 2019, decreased significantly in May 2020, and have remained relatively low since then. The 2022 and April 2023 concentrations exceeded the interwell UPL but were significantly lower than the values observed in 2019 (**Table 2** and **Appendix A**). Current chloride concentrations at MW-33AR are similar to those reported for samples from MW-33A prior to CCR disposal in the landfill (**Appendix B**).

Over the time period since 2016, when chloride concentrations at MW-33AR were highly variable, boron concentrations at MW-33AR have been generally following a long, steady decreasing trend. The lack of correlation with boron indicates the source of the increase and subsequent decrease in chloride is not likely the CCR landfill.

Sampling of the landfill leachate pond and lysimeters LS-1 and LS-3R, located on the western and southern edges of Modules 1-3, indicates that boron and chloride concentrations are generally both higher than background (**Table 4**); therefore, a leachate source would tend to influence concentrations of both parameters. Furthermore, the peak chloride concentrations in the groundwater samples from MW-33AR in 2018 and 2019 exceeded the chloride concentrations measured in the leachate at that time, indicating the leachate was not the source of chloride at this location (**Table 2**, **Table 4**, and **Appendix A**). Recent samples from the leachate pond have shown increased concentrations of chloride, but this increase does not correlate with results at MW-33AR, which have decreased, or with chloride results from the lysimeters, which remain low. Based on the comparison of groundwater and leachate chloride results, an alternative man-made source, such as road salt, is a more likely source of chloride than the CCR Unit.

5.0 ALTERNATIVE SOURCE DEMONSTRATION CONCLUSIONS

The lines of evidence discussed above regarding the SSIs reported for boron, chloride, and sulfate concentrations in downgradient monitoring wells MW-33AR, MW-34A, and/or MW-302 demonstrate that the SSIs are likely primarily due to sources other than the CCR Unit. Boron and sulfate concentrations were elevated prior to disposal of CCR in the landfill and are associated with historical discharges from the ash ponds via the effluent ditch located west of the landfill. Pre-landfill chloride concentrations at MW-33A were also similar to current concentrations at MW-33AR and historic impacts may have contributed to the SSI for chloride. However, based on more recent higher concentrations of chloride, elevated chloride concentrations detected at well MW-33AR appear more likely to be related to an alternative non-CCR source, such as salt.

6.0 SITE GROUNDWATER MONITORING RECOMMENDATIONS

In accordance with section 257.94(e)(2) of the CCR Rule, the COL Modules 1-3 CCR Units may continue with detection monitoring based on this ASD. The ASD report will be included in the 2023 Annual Report due January 31, 2024.

7.0 REFERENCES

SCS Engineers, 2018, Alternative Source Demonstration, October 2017 Detection Monitoring, Columbia Energy Center Dry Ash Disposal Facility, April 2018.

U.S. EPA, 2015, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule, April 2015.

Warzyn Engineering, Inc., 1978, Feasibility Study, Proposed Fly Ash and/or Scrubber Sludge Disposal Facility – Columbia Site, Wisconsin Power and Light Company, Town of Pacific, Columbia County, WI, January 1978.

Warzyn Engineering, Inc., 1979, and Preliminary Engineering Concepts, Columbia Site, Wisconsin Power and Light Company, Town of Pacific, Columbia County, WI, January 1978.

Tables

Table 1. Groundwater Analytical Results Summary -
Columbia Landfill MOD 1-3 / SCS Engineers Project #25223067.00

Parameter Name	UPL Method	UPL		Background Wells: MW-84A 4/27/2023		Background Wells: MW-301 4/27/2023		Compliance Wells: MW-33AR 4/24/2023		Compliance Wells: MW-34A 4/26/2023		Compliance Wells: MW-302 4/27/2023	
Appendix III													
Boron, ug/L	P	35.6		10.3		20.1		532		220		541	
Calcium, ug/L	NP	129,000		68600		120000		55300		49600		66500	
Chloride, mg/L	P	6.2		3.0		1.5	J	19.0		2.0		1.3	J
Fluoride, mg/L	DQ	DQ		<0.095		<0.095		<0.095		<0.095		<0.095	
Field pH, Std. Units	P	7.78		7.01		6.65		7.61		7.53		7.36	
Sulfate, mg/L	P	30.3		1.3	J	12.3		104		48.4		36.6	
Total Dissolved Solids, mg/L	NP	514		326		526		394		302		352	

4.4 Blue shaded cell indicates the compliance well result exceeds the UPL (background) and the Limit of Quantitation (LOQ).

Abbreviations:

UPL = Upper Prediction Limit
DQ = Double Qualification
SSI = Statistically Significant Increase
-- = Not Measured
µg/L = micrograms per liter
NP = Nonparametric UPL with 1-of-2 retesting
P = Parametric UPL with 1-of-2 retesting
LOQ = Limit of Quantitation
LOD = Limit of Detection
mg/L = milligrams per liter

J = Estimated concentration at or above the LOD and below the LOQ.
M0 = Matrix spike recovery and/or matrix spike duplicate recovery was outside laboratory control limits

Notes:

1. An individual result above the UPL does not constitute an SSI above background. See the accompanying report text for identification of statistically significant results.
2. Interwell UPLs calculated based on results from background wells MW-84A and MW-301. Interwell UPLs based on 1-of-2 retesting approach. UPLs updated in January 2020 based on background well results through October 2019.
3. Interwell UPLs calculated based on results from background wells MW-84 and MW-301.

Created by:	NDK	Date:	5/17/2022
Last revision by:	NLB	Date:	9/20/2023
Checked by:	RM	Date:	10/3/2023
Scientist/Proj Mgr QA/QC:	TK	Date:	11/11/2023

Table 2. Historical Analytical Results for Parameters with SSIs
Columbia Dry ADF, Modules 1-3

Well Group	Well	Collection Date	Boron (µg/L)	Chloride (mg/L)	Sulfate (mg/L)
Background	MW-301	12/22/2015	26.5	3.70 J	9.30
		4/5/2016	25.2	4.00	15.3
		7/8/2016	23.6	3.50 J	15.0
		10/13/2016	30.6	2.20	13.9
		12/29/2016	32.8	2.00 J	12.3 J
		1/25/2017	32.6	1.50 J	6.50
		4/11/2017	28.8	2.00	10.3
		6/6/2017	21.3	3.50	17.1
		8/8/2017	30.6	5.50	31.6
		10/23/2017	34.3	4.00	27.5
		4/25/2018	24.3	2.30	8.60
		8/8/2018	22.8	--	--
		10/22/2018	27.8	3.20	19.2
		4/3/2019	26.9	2.90 J, B	5.30 J
		10/9/2019	35.9	1.70	8.40
		5/29/2020	21.3	2.00 J	11.5 J
		10/8/2020	28.8	3.40	25.1
		4/13/2021	22.2	1.50 J	8.5
		10/14/2021	31.4	2.70	17.4
		4/13/2022	28.7	1.90 J	12.7
		10/27/2022	37.5	2.3	11.6
		4/27/2023	20.1	1.5 J	12.3
	MW-84A	12/22/2015	11.9	4.90	4.90
		4/5/2016	14.0	4.70	4.30
		7/8/2016	14.7	5.10	3.70 J
		7/28/2016	--	--	--
		10/13/2016	11.1	4.30	2.60 J
		12/29/2016	14.7	4.70	2.70 J
		1/25/2017	16.1	4.60	3.00
		4/11/2017	12.9	4.90	2.80 J
		6/6/2017	14.8	5.50	2.70 J
		8/8/2017	22.9	5.50	2.00 J
		10/24/2017	13.8	5.10	2.20 J
		4/25/2018	25.0	4.80	2.80 J
		8/8/2018	12.8	--	--
		10/22/2018	10.1 J	4.20	1.60 J
		4/3/2019	13.6	3.60 B	1.40 J
		10/9/2019	12.0	3.90	1.30 J
		5/29/2020	10.0	3.70	1.50 J
		10/8/2020	9.7 J	4.30	1.30 J
		4/13/2021	14.3	4.40	1.40 J
		10/14/2021	11.1	3.50	17.4
		4/13/2022	10.5	5.20	1.40 J, M0
		10/27/2022	12.2	3.4	1.1 J
		4/27/2023	10.3	3.0	1.3 J

Table 2. Historical Analytical Results for Parameters with SSIs
Columbia Dry ADF, Modules 1-3

Well Group	Well	Collection Date	Boron (µg/L)	Chloride (mg/L)	Sulfate (mg/L)
Compliance	MW-302	12/22/2015	80.0	4.20	37.4
		4/5/2016	78.8	4.10	55.6
		7/7/2016	134	3.10 J	35.4
		10/13/2016	132	1.10 J	64.7
		12/29/2016	106	1.20 J	56.4
		1/25/2017	149	1.60 J	61.6
		4/11/2017	322	1.60 J	81.3
		6/6/2017	671	3.50	84.6
		8/8/2017	833	4.50	79.0
		10/24/2017	691	6.90	78.4
		4/24/2018	1,950	15.0	109
		9/21/2018	203	1.70 J	30.0
		10/22/2018	296	1.80 J	26.9
		4/2/2019	254	1.50 J	25.2
		10/9/2019	246	1.10 J	16.7
		5/29/2020	611	1.20 J	34.6
		10/8/2020	648	1.10 J	36.5
		4/13/2021	521	1.40 J	36.9
		10/14/2021	495	1.30 J	37.8
		4/12/2022	389	0.79 J	22.1 M0
		10/27/2022	374	2.1	30.3
		4/27/2023	541	1.3 J	36.6
	MW-33AR	12/21/2015	954	10.6	96.2
		4/5/2016	813	12.5	91.5
		7/7/2016	794	12.5	99.2
		10/13/2016	827	52.5	124
		12/29/2016	812	39.6	132
		1/25/2017	763	41.4	133
		4/11/2017	760	47.1	139
		6/6/2017	692	68.1	151
		8/7/2017	697	105	164
		10/24/2017	678	119	175
		4/24/2018	601	188	163
		9/21/2018	683	32.6	124
		10/22/2018	682	14.4	112
		4/2/2019	568	229	201
		10/8/2019	548	153	182
		5/28/2020	566	15.9	104
		10/8/2020	569	27.3	97.4
		4/13/2021	473	26.9	94.3
		6/11/2021	--	--	--
		10/12/2021	564	22.6	96.4
		4/12/2022	558	59.0	155
		10/27/2022	586	40.5	153
		4/27/2023	532	19.0	104

Table 2. Historical Analytical Results for Parameters with SSIs
Columbia Dry ADF, Modules 1-3

Well Group	Well	Collection Date	Boron (µg/L)	Chloride (mg/L)	Sulfate (mg/L)
Compliance	MW-34A	12/21/2015	230	4.90	69.9
		4/5/2016	220	5.10	71.6
		7/7/2016	216	5.60	63.4
		7/28/2016	--	--	--
		10/13/2016	212	6.80	54.8
		12/29/2016	224	7.10	63.9
		1/25/2017	214	7.20	71.2
		4/11/2017	214	6.20	87.6
		6/6/2017	201	7.80	106
		8/7/2017	205	7.40	105
		10/24/2017	208	7.60	98.0
		4/24/2018	209	8.20	144
		9/21/2018	241	17.1	141
		10/22/2018	233	19.9	123
		4/4/2019	204	18.7	70.4
		10/8/2019	207	57.9	39.8
		5/28/2020	210	3.90	44.4
		10/8/2020	213	2.10	58.7
		4/13/2021	203	2.30	59.3
		6/11/2022	--	--	--
		10/12/2021	212	1.90 J, M0	56.1
		4/12/2022	237	2.20	146
		10/27/2022	264	2.20	169
		4/28/2023	220	2.0	48.4
	MW-1AR(2)	4/14/2021	16.1	1.50 J	4.40 M0
		10/14/2021	12.4	1.20 J	3.10

Abbreviations:
µg/L = micrograms per liter or parts per billion (ppb)
mg/L = milligrams per liter or parts per million (ppm)
J = Estimated value below the laboratory's limit of quantitation
B = Analyte was detected in the associated Method Blank.
M0 = matrix spike recovery and/or matrix spike duplicate recovery outside of laboratory control limits.

Notes:
(1) Analytical laboratory reports provided in the Annual Groundwater Monitoring and Corrective Action Reports.
(2) MW-1AR was added to the sampling network in 2021 to provide additional evaluation of site conditions in the CCR unit. MW-1AR was abandoned in March of 2022.

Created by:	NDK	Date:	3/19/2020
Last revision by:	NLB	Date:	9/20/2023
Checked by:	RM	Date:	10/3/2023
PM/Scientist Check:	TK	Date:	11/11/2023

Table 3. Groundwater Elevation - State Monitoring Program and CCR Well Network
Columbia Dry Ash and Ash Pond Disposal Facilities / SCS Engineers Project #25223067.00

Dry Ash Facility (Facility ID #03025)

Well Number	MW-1AR	MW-4	MW-5R	MW-33AR	MW-33BR	MW-34A	MW-34B	MW-37A	MW-83	MW-84A	MW-84B	MW-86	MW-91AR	MW-91B	MW-92A	MW-92B	MW-93A	MW-93B	MW-312	LS-1	LS-3R	LH-2	LH-3	LH-4
Top of Casing Elevation (feet amsl)	822.55	819.74	805.44	808.29	808.39	805.95	806.05	813.04	807.96	814.28	814.26	824.79	809.03	808.45	808.47	808.41	827.89	827.71	826.79					
Screen Length (ft)																	10	5	10					
Total Depth (ft from top of casing)	44.40	39.58	25.97	31.08	57.50	35.43	56.95	31.80	25.42	40.21	52.02	45.43	32.90	52.38	28.94	51.75	50.7	82.5	52.5	17.42	17.10	19.90		
Top of Well Screen Elevation (ft)	778.15	780.16	779.47	777.21	750.89	770.52	749.10	781.24	782.54	774.07	762.24	779.36	776.13	756.07	779.53	756.66	787.19	750.21	784.29	NM	NM	NM		
Measurement Date																								
October 2, 2012	783.41	783.70	784.96	782.38	782.23	783.03	782.99	782.66	dry	783.84	783.94	783.81	784.09	783.90	784.49	784.06	NI	NI	NI			dry	--	
April 15, 2013	785.44	784.02	786.09	784.16	784.14	784.74	784.79	783.87	784.49	785.83	785.76	785.22	785.14	785.01	785.75	785.34	NI	NI	NI	NM	dry	dry	--	
October 8, 2013													785.66	785.42	785.97	785.52	NI	NI	NI	NM	NM	NM	--	
October 15, 2013	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	785.66	785.42	785.97	785.52	NI	NI	NI				--	
April 14, 2014	784.95	784.09	785.63	783.74	783.91	784.63	784.70	783.45	783.73	785.58	785.52	784.96	785.04	784.96	785.99	785.54	NI	NI	NI	NM	dry	leachate depth = 0.2 in.	--	
October 2-3, 2014	785.03	785.39	786.08	784.37	784.28	784.57	784.54	784.56	dry	785.24	785.18	785.19	785.47	785.28	785.75	785.33	NI	NI	NI	NM	dry	leachate depth = 0.3 in.	--	
April 13-14, 2015	783.96	783.63	785.25	783.01	782.74	783.65	783.95	782.87	dry	784.43	784.51	784.17	784.48	784.37	785.07	784.66	NI	NI	NI	dry	--	dry	--	
October 6-7, 2015	784.28	784.44	785.72	783.68	783.33	784.05	784.02	783.66	dry	784.80	784.76	784.66	784.89	784.70	785.20	784.76	NI	NI	NI	broken	dry	leachate depth = 14.8 in.	--	
April 4-6, 2016	785.82	aband	787.02	785.29	785.07	785.63	785.67	784.76	785.43	786.37	786.26	785.89	786.05	785.95	786.61	786.21	NI	NI	NI	broken	dry	15.9"	--	
October 11-13, 2016	786.64	aband	788.00	787.36	786.46	786.45	786.32	786.40	786.81	787.22	787.11	786.96	787.17	786.81	787.68	787.25	NI	NI	NI	liquid depth = 3.5'	dry	0.8"	1.4"	
April 10-13, 2017	786.96	aband	788.13	786.39	785.99	786.30	786.28	786.34	786.23	787.16	787.06	786.96	787.24	787.03	787.90	787.60	NI	NI	NI	liquid depth = 3.0'	dry	-0.3	1.4"	
October 3-5, 2017	785.48	aband	786.66	784.51	784.22	784.67	784.63	784.86	784.29	NM	786.49	785.58	786.08	785.83	786.47	786.02	NI	NI	NI	liquid depth = 2.7'	dry	NM	NM	
October 9-10, 2017	NM	aband	NM	NM	NM	NM	NM	NM	NM	785.56 [6]	NM	NM	NM	NM	NM	NM	NI	NI	NI	NM	NM	1.4" [5]	1.6" [5]	
February 21, 2018	783.97	aband	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	784.68	784.46	NM	NM	NI	NI	NI	NM	NM	NM	NM	
April 23-25, 2018	783.99	aband	785.36	783.09	786.36	781.77	780.79	783.28	783.32	785.88	784.91	782.54	784.71	784.53	785.23	784.81	NI	NI	NI	liquid depth = 2.7'	NM	NM	NM	
October 23-25, 2018	788.25	aband	789.71	788.77	787.96	787.88	787.73	787.62	788.26	788.32	788.19	788.21	788.59	788.31	789.32	788.87	NI	NI	NI	dry	liquid depth = 2.4'	4.6	4	--
April 1-4, 2019	787.05	aband	788.64	786.63	786.54	786.82	786.92	786.47	786.78	787.35	787.34	787.16	787.45	787.18	788.04	787.63	NI	NI	NI	liquid depth = 3.9'	dry	--	--	
October 7-9, 2019	787.26	aband	789.23	788.26	787.64	787.92	787.74	786.77	788.90	787.79	787.73	787.44	787.78	787.62	788.63	788.17	NI	NI	NI	liquid depth = 3.8'	dry	-0.1"	11.7"	13.1"
May 27-28, 2020	786.92	aband	788.34	786.01	785.75	785.98	785.99	786.22	786.03	787.02	786.99	786.94	787.26	787.05	787.86	787.47	NI	NI	NI	liquid depth = 3.8'	dry	-0.1	2.4	2.4
October 7-8, 2020	785.95	aband	787.76	785.91	785.45	785.70	785.68	785.52	785.72	786.10	786.06	786.10	786.55	786.33	786.85	786.38	NI	NI	NI	liquid depth = 3.8'	dry	-0.1	2.7	2.4
February 25, 2021	NM	aband	NM	NM	NM	784.75	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NI	NI	NI	NM	NM	-0.1	2.7	2.6
April 14, 2021	778.12	aband	787.29	784.27	784.05	784.77	784.77	784.46	c	785.84	785.81	785.60	785.86	785.69	786.47	786.06	NI	NI	NI	liquid depth = 3.7'		--	0.233	0.21666667
June 11, 2021	NM	aband	NM	784.19	NM	784.66	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NI	NI	NI	NM	NM	NM	NM	NM
October 11-12, 14, 2021	784.47	aband	786.78	783.73	783.60	784.42	784.41	783.88	783.87	784.96	784.88	784.79	785.14	784.94	785.55	785.11	NI	NI	NI	liquid depth = 3.7'	--			
October 17, 2021	NM	aband	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NI	NI	NI	NM	NM	-0.01	0.26	0.23
April 1, 2022	aband	aband	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	-"0.1"	3.1"	2.9"
April 11-13, 2022	aband	aband	785.52	783.27	783.45	784.30	784.42	783.26	783.78	785.02	785.00	784.70	784.83	784.72	785.45	785.02	783.99	783.97	783.73	liquid depth = 3.8'	dry	NM	NM	NM
October 24-28, 2022	aband	aband	785.43	781.94	781.61	783.61	783.61	782.28	dry	784.57	784.54	784.38	784.64	784.47	785.05	784.62	783.74	782.76	783.50	liquid depth = 3.6'	dry	NM	NM	NM
February 20-23, 2023	aband	aband	NM	783.57	NM	784.48	NM	NM	NM	785.25	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
March 27-28, 2023	aband	aband	NM	784.52	NM	785.23	NM	NM	NM	786.21	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
April 24-27, 2023	aband	aband	787.76	785.79	785.35	786.22	786.12	784.99	786.05	786.97	786.86	786.67	786.76	786.59	787.53	787.11	785.87	785.85	785.55	liquid depth = 3.5'	dry	NM	NM	NM
May 16, 2023	aband	aband	787.79	785.64	785.25	786.06	786.05	785.39	785.77	786.88	786.79	786.74	786.95	786.75	787.47	787.05	786.23	786.21	785.97	NM	NM	NM	NM	NM
May 30-31, 2023	aband	aband	NM	785.23	NM	785.70	NM	NM	NM	786.57	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Bottom of Well Elevation (ft)	778.15	780.16	779.47	777.21	750.89	770.52	749.10	781.24	782.54	774.07	762.24	779.36	776.13	756.07	779.53	756.66	777.19	745.21	774.29	NM	NM	NM	NM	

Ash Pond Facility (Facility ID #02325)

Well Number	M-3	M-4R	MW-39A	MW-39B	MW-48A	MW-48B	MW-57	MW-59	MW-216R	MW-217	MW-220RR	SG-1	SG-2	SG-3	SG-4
Top of Casing Elevation (feet amsl)	788.23	806.10	809.62	809.50	828.86	828.84	786.29	815.48	814.21	791.55	792.90	792.06	795.25	808.60	805.36
Screen Length (ft)															
Total Depth (ft from top of casing)	16.90	25.55	34.80	76.07	51.88	75.80	14.40	38.50	37.85	37.37	18.96	--	--	--	--
Top of Well Screen Elevation (ft)	771.33	780.55	774.82	733.43	776.98	753.04	771.89	776.98	776.36	754.18	773.94	--	--	--	--
Measurement Date															
October 2, 2012	780.13	786.76	781.49	781.34	782.03	781.93	780.58	779.88	781.91	780.95	780.55	789.14	793.85	dry	dry
April 15, 2013	785.16	788.39	783.97	784.00	783.77	783.78	784.69	783.66	784.09	784.75	785.02	789.5 [1]	NM	dry	dry
October 8, 2013	781.22	786.67	NM	NM	783.69	783.58	NM	NM	783.39	782.27	782.36	789.5 [1]	791.33	dry	dry
October 15, 2013	NM	NM	782.94	782.81	NM	NM	782.47	783.49	NM	NM	NM	NM	NM	NM	NM
April 14, 2014	786.04	788.96	783.57	783.68	783.56	783.57	785.51	783.41	783.73	785.25	785.87	788.90	dry	dry	dry
October 1-3, 2014	781.16	787.55	783.42	783.32	784.05	783.94	782.32	783.55	783.79	782.63	783.03	NM	dry	dry	dry
April 13-14, 2015	783.08	786.83	782.77	782.68	782.80	782.82	782.81	782.83	782.93	783.34	783.42	789.3	791.70	dry	dry
October 6-7, 2015	780.66	786.12	782.97	782.81	783.10	783.01	781.82	783.25	783.18	781.95	782.26	788.48	791.58	dry	dry
April 4-6, 2016	784.21	789.09	785.27	785.27	784.79	784.76	783.21	784.97	785.68	785.02	784.36	NM	793.40	dry	dry
October 11-13, 2016	781.88	787.88	785.75	785.52	785.73	785.61	783.12	786.51	786.16	783.75	784.09	788.32	792.52	dry	dry
April 10-13, 2017	782.94	787.95	785.44	785.20	785.82	785.69	782.77	786.09	785.95	784.29	784.09	788.31	793.85	dry	dry
October 3-5, 2017	780.93	787.04	783.35	783.18	784.30	784.19	782.37	784.23	783.89	782.48	782.61	788.3	793.45	dry	dry
April 23-25, 2018	782.89	790.43	782.86	782.87	783.14	783.09	783.04	783.02	783.23	783.26	783.45	788.38	>795.25	dry	dry
October 23-25, 2018	782.95	788.47	787.12	786.88	787.12	786.99	783.48	787.73	787.49	784.90	784.52	787.76	793.25	dry	dry
April 1-4, 2019	785.68	789.44	786.28	786.31	786.56	786.45	785.27	787.39	786.53	786.33	785.46	788.40	794.60	dry	dry
October 7-9, 2019	785.33	790.65	787.10	787.02	786.68	786.65	785.29	786.68	787.07	786.01	785.42	748.48	795.20	dry	dry
May 27-29, 2020	781.80	787.73	785.12	784.92	785.74	785.59	783.11	785.89	785.60	783.41	783.89	748.48	>795.25	dry	dry
October 7-8 &17, 2020	781.42	787.74	784.74	784.64	785.03	784.96	782.83	785.43	785.10	783.06	783.49	788.34	793.32	dry	NM
April 12, 2021	782.30	786.34	783.66	783.65	784.13	784.08	782.79	784.08	783.97	783.15	783.49	788.03	793.45	below gauge	dry
October 11-12, 14, 2021	781.03	786.33	782.94	782.85	783.09	783.03	781.94	783.11	783.04	782.15	782.66	788.59	795.13	dry	dry
April 11-13, 2022	783.95	788.26	783.37	783.34	783.10	783.10	NM	782.99	783.40	783.93	783.83	788.4	794.65	dry	dry
June 3, 2022	NM	NM	NM	NM	NM	NM	782.13	NM	NM	NM	NM	NM	NM	NM	NM
October 25, 26, 28, 2022	780.41	783.85	780.76	780.66	779.57	779.55	779.23	778.98	778.61	780.33	781.49	NM	795.21	dry	dry
March 27-28, 2023	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
April 24-27, 2023	785.18	dry	785.38	785.19	784.55	784.51	NM	784.83	784.46	783.78	785.30	787.8	NM	NM	NM
May 16, 2023	782.79	781.64	784.70	784.58	784.60	784.49	782.80	784.68	783.94	782.07	784.03	NM	NM	NM	NM
Bottom of Well Elevation (ft)	771.33	780.55	774.82	733.43	776.98	753.04	771.89	776.98	776.36	754.18	773.94	--	--	--	--

Table 3. Groundwater Elevation - State Monitoring Program and CCR Well Network
Columbia Dry Ash and Ash Pond Disposal Facilities / SCS Engineers Project #25223067.00

	Well Number	MW-301	MW-302	MW-303	MW-304	MW-305	M-4R	MW-33AR	MW-34A	MW-84A	MW-306	MW-307	MW-308	MW-309	MW-310	MW-311	MW-312	MW-313	MW-314	MW-315	MW-316
	Top of Casing Elevation (feet amsl)	806.89	813.00	815.72	805.42	806.32	806.10	808.29	805.95	814.28	807.63	806.89	806.9	813.27	813.62	809.74	826.786	820.3	821.57	819.78	808.49
	Screen Length (ft)	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Total Depth (ft from top of casing)	29.40	33.6	35.80	25.7	25.6	39.58	31.08	35.43	40.21	27	26.5	28	37.67	38.41	36.19	52.5				43.7
	Top of Well Screen Elevation (ft)	787.49	789.40	785.72	789.72	790.72	776.52	787.21	780.52	784.07	790.63	790.39	788.90	785.60	785.21	783.55	784.29				774.79
	Measurement Date																				
	December 21-22, 2015	785.56	784.78	784.11	786.13	788.96	787.58	783.77	783.50	785.31	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
	April 4-5, 2016	786.78	785.81	785.48	788.08	789.61	789.09	785.29	785.63	786.37	--	--	--	--	--	--	NI	NI	NI	NI	NI
	July 7-8, 2016	786.31	786.28	784.60	787.36	789.26	787.43	785.19	785.05	785.89	--	--	--	--	--	--	NI	NI	NI	NI	NI
	July 28, 2016	NM	NM	784.35	NM	NM	NM	NM	784.86	785.61	--	--	--	--	--	--	NI	NI	NI	NI	NI
	October 11-13, 2016	787.64	787.76	786.18	788.18	789.78	787.88	787.36	786.45	787.22	--	--	--	--	--	--	NI	NI	NI	NI	NI
	December 29, 2016	787.37	787.05	NM	NM	NM	NM	785.66	785.72	786.63	--	--	--	--	--	--	NI	NI	NI	NI	NI
	January 25-26, 2017	787.27	786.89	785.28	789.34	789.36	789.64	785.88	785.98	786.70	785.50	785.36	785.73	--	--	--	NI	NI	NI	NI	NI
	April 10 & 11, 2017	787.89	787.55	786.00	788.22	789.57	787.95	786.39	786.30	787.16	786.22	785.64	786.51	--	--	--	NI	NI	NI	NI	NI
	June 6, 2017	788.25	788.37	786.49	788.58	789.79	787.83	787.27	786.66	787.63	786.85	786.07	786.46	--	--	--	NI	NI	NI	NI	NI
	August 7-9, 2017	787.34	787.55	785.42	789.52	789.30	788.54	786.11	785.81	786.68	785.69	785.19	785.37	--	--	--	NI	NI	NI	NI	NI
	October 23-24, 2017	785.89	785.94	783.92	788.97	788.14	788.00	784.13	784.50	785.32	783.97	784.79	784.17	--	--	--	NI	NI	NI	NI	NI
	February 21, 2018	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	783.19	783.05	783.02	NI	NI	NI	NI	NI
	March 23, 2018	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	783.10	783.10	783.00	NI	NI	NI	NI	NI
	April 23-25, 2018	785.29	784.37	783.27	789.69	787.67	790.43	783.09	781.77	785.88	783.24	783.65	782.65	783.07	782.97	781.83	NI	NI	NI	NI	NI
	May 24, 2018	NM	NM	NM	NM	NM	NM	NM	NM	NM	785.79	785.09	NM	785.45	785.97	786.11	NI	NI	NI	NI	NI
	June 23, 2018	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	786.03	786.64	786.47	NI	NI	NI	NI	NI
	July 23, 2018	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	786.27	786.35	786.55	NI	NI	NI	NI	NI
	August 7, 2018	787.06	NM	785.20	788.25	788.56	787.63	NM	NM	786.55	NM	NM	NM	NM	NM	NM	NI	NI	NI	NI	NI
	August 22, 2018	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	785.54	785.40	785.46	NI	NI	NI	NI	NI
	September 21, 2018	NM	788.37	786.50	NM	NM	NM	787.90	787.01	NM	NM	NM	NM	787.08	787.24	787.66	NI	NI	NI	NI	NI
	October 22-24, 2018	788.98	789.16	787.51	789.05	790.04	788.47	788.77	787.88	788.32	787.66	786.57	787.81	787.99	788.18	788.64	NI	NI	NI	NI	NI
	April 1-4, 2019	787.04	787.56	786.52	789.72	790.07	789.44	786.63	786.82	787.35	786.72	786.71	787.53	786.30	786.38	786.38	NI	NI	NI	NI	NI
	June 12, 2019	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	787.25	NM	NI	NI	NI	NI	NI
	June 19, 2019	NM	NM	786.81	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NI	NI	NI	NI	NI
	October 7-9, 2019	788.47	788.31	787.02	790.41	790.36	790.65	NM	NM	NM	787.47	786.99	787.18	787.26	787.94	787.64	NI	NI	NI	NI	NI
	December 13, 2019	--	--	--	--	--	--	--	--	--	787.03	785.68	786.43	--	--	--	NI	NI	NI	NI	NI
CCR Rule Wells	December 23, 2019	--	--	--	--	--	--	--	--	--	--	--	--	--	775.22	--	NI	NI	NI	NI	NI
	January 17, 2020	--	--	785.58	--	--	--	--	--	--	--	--	--	--	--	--	NI	NI	NI	NI	NI
	February 3, 2020	787.24	NM	NM	NM	NM	NM	NM	NM	786.50	785.77	785.57	786.48	NM	NM	NM	NI	NI	NI	NI	NI
	May 27-29, 2020	787.77	787.29	785.56	789.30	787.78	787.73	786.01	785.98	787.02	785.77	785.35	786.28	785.98	785.81	785.85	NI	NI	NI	NI	NI
	June 30, 2020	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	786.18	NM	NM	NI	NI	NI	NI	NI
	August 6, 2020	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	785.93	NM	NM	NI	NI	NI	NI	NI
	October 7-8, 2020	786.53	786.74	785.16	788.52	787.96	787.74	785.91	785.70	786.10	785.39	784.71	785.68	785.47	785.56	785.83	NI	NI	NI	NI	NI
	December 11, 2020	NM	NM	NM	NM	788.19	NM	NM	NM	NM	NM	NM	NM	785.26	785.26	NM	NI	NI	NI	NI	NI
	February 25, 2021	NM	NM	784.27	NM	788.36	NM	NM	784.75	NM	NM	NM	NM	NM	NM	NM	NI	NI	NI	NI	NI
	April 12, 2021	786.50	785.77	784.07	787.99	788.11	786.34	784.27	784.77	785.84	784.32	784.21	785.55	784.29	784.24	784.15	NI	NI	NI	NI	NI
	June 11, 2021	NM	NM	NM	NM	NM	NM	784.19	784.66	NM	NM	NM	NM	784.20	784.05	NM	NI	NI	NI	NI	NI
	July 20, 2021	NM	NM	783.64	NM	788.39	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NI	NI	NI	NI	NI
	October 11-12, 14, 2021	785.28	785.09	783.09	787.78	787.75	786.33	783.73	784.42	784.96	782.93	782.44	783.76	783.65	783.48	783.48	NI	NI	NI	NI	NI
	December 21, 2021	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	782.93	NM	NM	NI	NI	NI	NI	NI
	February 24, 2022	NM	NM	782.34	NM	786.49	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NI	NI	NI	NI	NI
	April 11-13, 2022	785.44	784.42	783.40	788.20	787.87	788.26	783.27	784.30	785.02	783.11	783.32	784.19	783.14	783.19	783.04	NI	NI	NI	NI	NI
	July 27, 2022	NM	NM	783.07	NM	787.03	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NI	NI	NI	NI	NI
	October 25-27, 2022	784.91	784.62	778.94	781.79	784.97	783.85	781.94	783.61	784.57	778.32	777.89	784.16	781.50	780.96	781.23	NI	NI	NI	NI	NI
	November 30, 2022	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	781.62	781.14	781.15	NI	NI	NI	NI	NI
	December 2, 2022	785.12	784.48	NM	783.97	NM	NM	781.91	783.71	784.76	778.52	779.54	NM	NM	NM	NM	NI	NI	NI	NI	NI
	January 12-13, 2023	785.20	784.55	NM	NM	NM	NM	782.75	784.10	784.88	NM	NM	NM	782.57	782.45	782.32	NI	NI	NI	NI	NI
	January 20, 2023	NM	NM	NM	788.08	NM	NM	NM	NM	NM	782.15	782.11	784.98	NM	NM	NM	NM	NM	NM	NM	NI
	January 24, 2023	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	783.73	783.36	783.63	783.77	NI
	February 20-23, 2023	785.56	784.98	NM	NM	NM	NM	NM	NM	NM	783.04	782.91	785.32	783.31	783.34	783.40	783.50	783.59	783.82	783.96	NI
	March 27-28, 2023	786.83	785.87	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	783.84	783.98	784.43	NM	784.12	784.41	784.57	NI
	April 24-27, 2023	787.57	786.87	784.38	784.03	NM	NM	785.79	786.22	786.97	784.82	784.25	787.75	785.05	785.18	785.69	NM	785.21	785.43	785.59	NI
	May 5, 2023	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	785.55	NM	NM	NM	780.49
	May 16, 2023	787.43	787.07	783.88	784.12	dry	781.64	785.64	786.06	786.88	784.65	783.89	786.88	785.15	785.11	785.39	785.97	785.46	785.68	785.88	780.48
	May 30-31, 2023	787.04	786.89	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	784.90	784.69	784.97	NM	785.24	785.55	785.77	NM
	June 29-30, 2023	786.32	786.39	NM	NM	NM	NM	784.32	785.04	785.92	NM	NM	NM	784.12	783.84	783.97	NM	784.67	784.95	785.17	NM
	July 31, 2023	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	783.96	784.26	784.49	NM
	August 31, 2023	NM	785.30	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	782.47	NM	NM	783.55	783.83	783.97	NM
	Bottom of Well Elevation (ft)	777.49	779.40	775.72	779.72	780.72	766.52	777.21	770.52	774.07	780.63	780.39	778.90	775.60	775.21	773.55	774.29	820.30	821.57	819.78	764.79

Notes:
NM = not measured

Created by:	MDB	Date:	5/6/2013
Last revision by:	EMS	Date:	8/31/2023
Checked by:	JSN	Date:	9/1/2023
Proj Mgr QA/QC:	TK	Date:	11/11/2023

(1) The elevation for SG-1 is read off of the staff gauge (rather than measured from the top of the gauge).
(2) SG-2 could not be located during the April 2013 event.
(3) SG-3 could not be located during the October 2013 event. SG-1 could not be safely accessed during the October 2013 event.
(4) LH-2 measurements are given as leachate depth, measured by a transducer.
(5) LH-2 and LH-3 measurements were collected by WPL staff on October 9, 2017.
(6) The depth to water at MW-84A was not measured prior to purging for sampling during the October 3-5 sampling event. The level was allowed to return to static and was measured on 10/10/2017.
(7) BC = Brian Clepper; NS= Nate Sievers - Columbia Site employees.
(8) MW-303 was extended in 2022 due to regrading. Prior to October 2022, the TOC elevation was 811.52'. For events in October 2022 and later, the TOC elevation is 815.72'.

I:\25223067.00\Deliverables\COL 1-3 ASD - April 2023\Tables\[Table 3 - wlstat_Columbia.xls]levels

Table 4. Analytical Results - Lysimeters and Leachate Pond
Columbia Dry Ash Disposal Facility
SCS Engineers Project #25223067.00

Monitoring Point	Monitoring Period	Monitoring Point Dry/ Broken	Boron, Total (µg/L)	Chloride, Total (mg/L)	Sulfate, Total (mg/L)
LS-1	2015-Apr	DRY	--	--	--
	2015-Oct	BROKEN	--	--	--
	2016-Apr	DRY	--	--	--
	2016-Oct	--	6,530	12.3	789
	2017-Apr	--	6,510	20.7 J	814
	2017-Oct	--	6,200	14.2 J	764
	2018-Apr	--	5,920	16.0 J	856
	2018-Oct	DRY	--	--	--
	2019-Apr	--	5,640	22.0 J	911
	2019-Oct	--	6,180	19.2 J	861
	2020-May	--	6,180	25.4 J	1,040
	2020-Oct	--	5,640	27.2 J	950
	2021-Apr	--	6,010	21.1 J	976
	2021-Oct	--	6,230	14.3 J	987
	2022-Apr	--	6,140	13.3 J	1,040
	2022-Oct	--	6,000	16.7 J	898
	2023-Apr	--	6,200	27.1 J	969
LS-3R	2015-Apr	--	6,480	20.6 B	807
	2015-Oct	DRY	--	--	--
	2016-Apr	DRY	--	--	--
	2016-Oct	DRY	--	--	--
	2017-Apr	DRY	--	--	--
	2017-Oct	DRY	--	--	--
	2018-Apr	DRY	--	--	--
	2018-Oct	--	6,180	26.2 J	841
	2019-Apr	DRY	--	--	--
	2019-Oct	DRY	--	--	--
	2020-May	DRY	--	--	--
	2020-Oct	DRY	--	--	--
	2021-Apr	DRY	--	--	--
	2021-Oct	DRY	--	--	--
	2022-Apr	DRY	--	--	--
	2022-Oct	DRY	--	--	--
	2023-Apr	DRY	--	--	--

Table 4. Analytical Results - Lysimeters and Leachate Pond
Columbia Dry Ash Disposal Facility
SCS Engineers Project #25223067.00

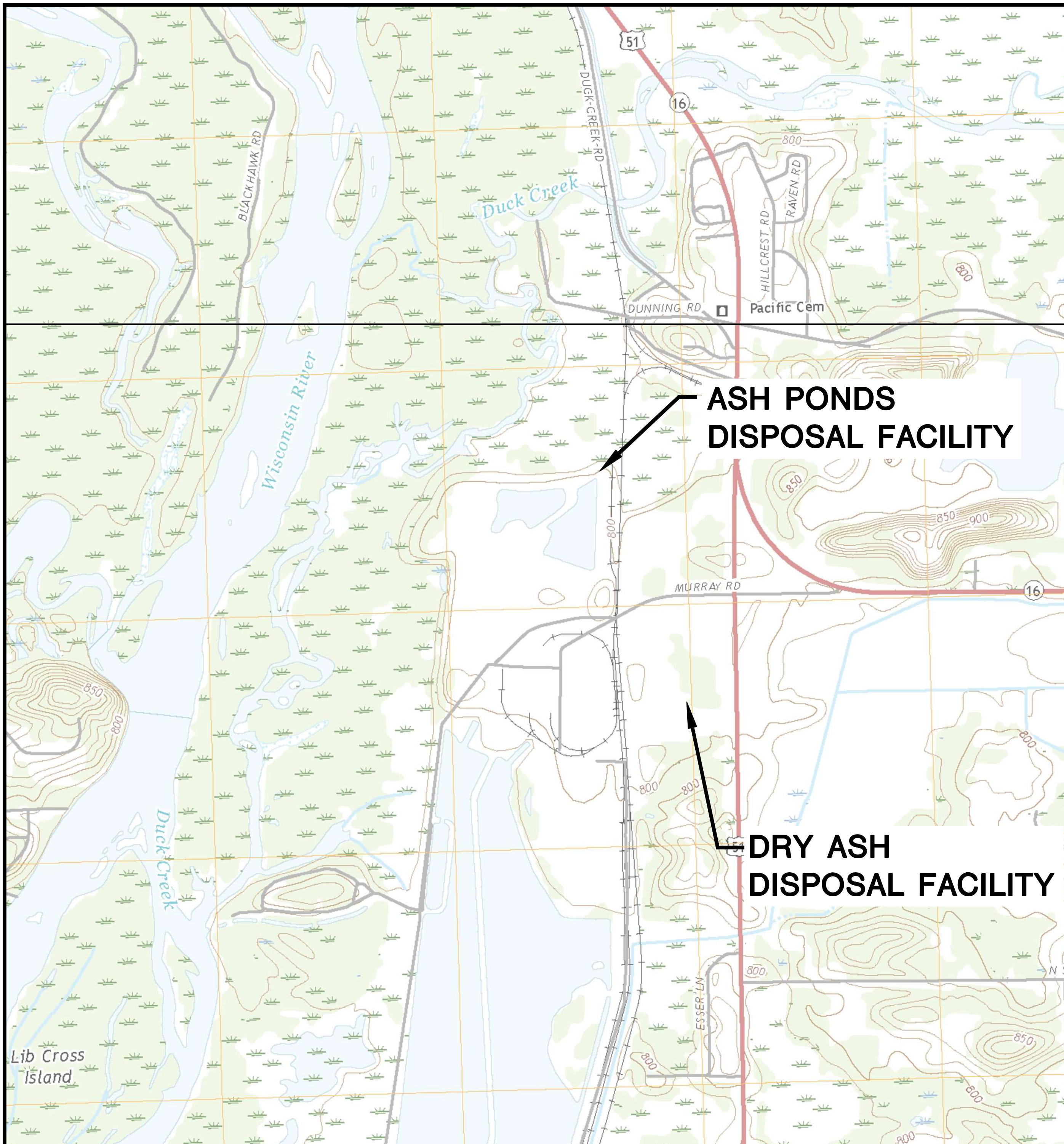
Monitoring Point	Monitoring Period	Monitoring Point Dry/ Broken	Boron, Total (µg/L)	Chloride, Total (mg/L)	Sulfate, Total (mg/L)
LP-1	2015-Apr	--	4,060	27.8	734
	2015-Oct	--	4,300	37.1	820
	2016-Apr	--	1,830	26.8	416
	2016-Oct	--	4,610	71.5	835
	2017-Apr	--	2,690	66.3	587
	2017-Oct	--	4,970	91.7	739
	2018-Apr	--	2,060	63.2	634
	2018-Oct	--	2,630	151	907
	2019-Apr	--	570	35.1	249
	2019-Oct	--	1,270	63.9	602
	2020-May	--	2,460	179	952
	2020-Oct	--	2,710	243	1,160
	2021-Apr	--	3,340	319	1,180
	2021-Oct	--	3,440	299	1,470
	2022-Apr	--	1,030	89.2	506
	2022-Oct	--	2,040	175	752
	2023-Apr	--	2,110	404	856

Abbreviations:
µg/L = micrograms per liter
mg/L = milligrams per liter
-- = not analyzed

Notes:
B = Analyte was detected in the associated method blank.
J = Estimated concentration at or above the Limit of Detection (LOD) and below the Limit of Quantitation (LOQ).

Created by:	MDB	Date:	12/1/2014
Last revision by:	NLB	Date:	10/3/2023
Checked by:	RM	Date:	10/3/2023

Figures

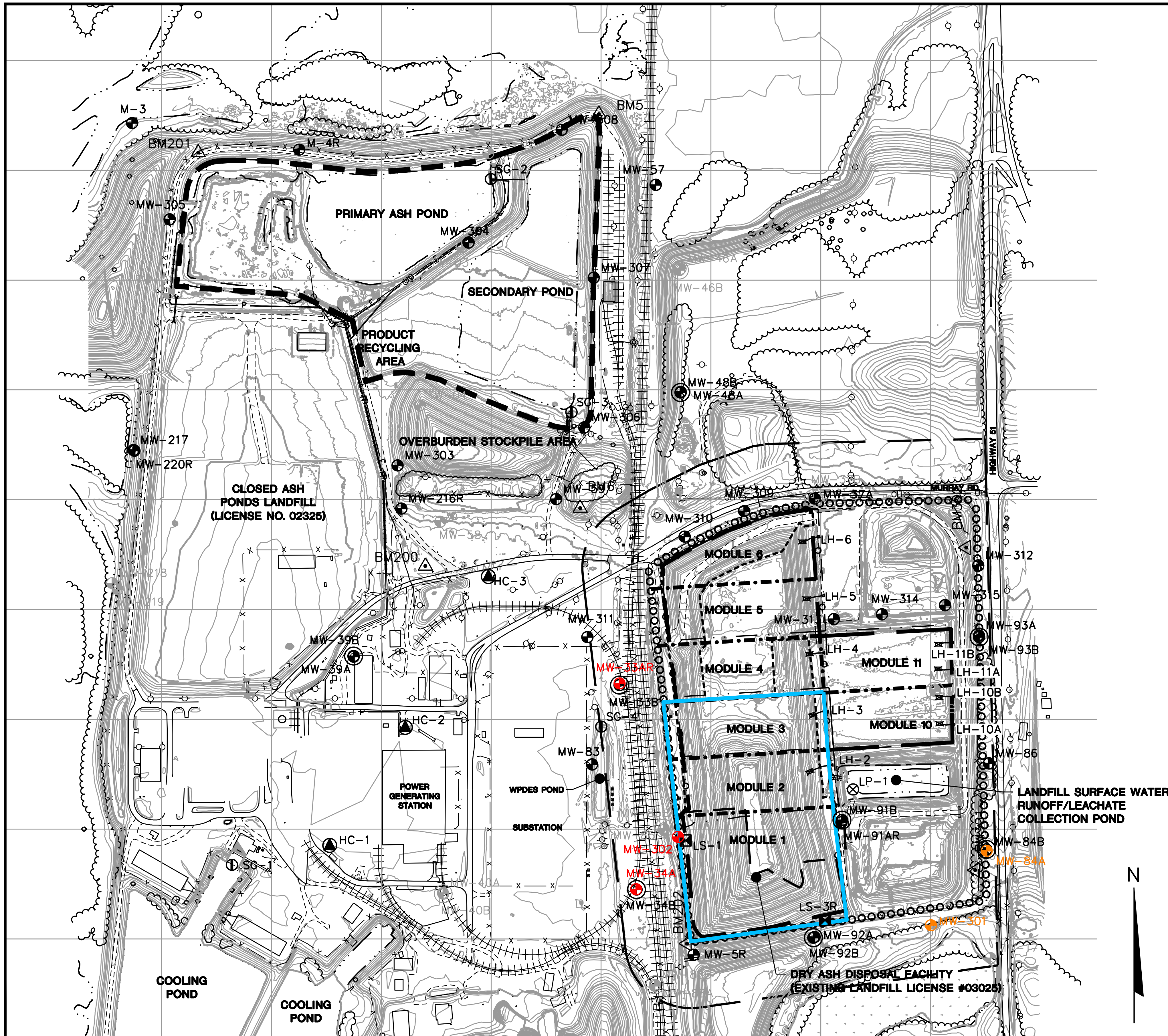


POYNETTE QUADRANGLE
WISCONSIN–COLUMBIA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
2018
SCALE: 1" = 2,000'

CLIENT	SITE	
ALLIANT ENERGY COLUMBIA ENERGY CENTER W8375 MURRAY ROAD PARDEEVILLE, WI 53954	ALLIANT ENERGY COLUMBIA ENERGY CENTER PARDEEVILLE, WI	SITE LOCATION MAP

				ENGINEER	
PROJECT NO.	25223067.00	DRAWN BY:	BSS	SCS ENGINEERS 2830 DAIRY DRIVE MADISON, WI 53718-6751 PHONE: (608) 224-2830	FIGURE
DRAWN:	12/02/2019	CHECKED BY:	TK		1
REVISED:	05/01/2023	APPROVED BY:	TK 11/11/2023		

I:\25223067.00\Drawings\Site Location Map.dwg, 10/12/2023 9:55:52 AM



LEGEND

- EXISTING MAJOR CONTOUR (10' INTERVAL)
- EXISTING MINOR CONTOUR (2' CONTOUR)
- EXISTING FENCELINE
- EXISTING TRACKS
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EDGE OF WATER
- DRY ASH DISPOSAL FACILITY LIMITS
- LIMITS OF WASTE
- LINER PHASE/MODULE LIMITS
- WATER SUPPLY WELL
- STAFF GAUGE
- WATER TABLE WELL
- PIEZOMETER
- SURFACE WATER SAMPLE LOCATION
- LYSIMETER
- ABANDONED WATER TABLE WELL
- ABANDONED PIEZOMETER
- LEACHATE HEADWELL
- CCR UNIT
- CCR MONITORING WELL
- CCR BACKGROUND MONITORING WELL

NOTES:

1. BASE MAP CREATED FROM AERIAL SURVEY BY KBM, FLOWN DECEMBER 1, 2014, AND GROUND SURVEYS BY SCS ENGINEERS IN MAY 2019, DECEMBER 2020, NOVEMBER 2021, AND DECEMBER 2021, AND BY DRONE SURVEY BY AMES IN NOVEMBER 2022.
2. MONITORING WELL LOCATIONS AND ELEVATIONS SURVEYED BY WISCONSIN POWER AND LIGHT, INC. IN DECEMBER 1994, NOVEMBER 1996, APRIL 2003, AND JANUARY 2016, AND BY SCS ENGINEERS IN FEBRUARY 2018.
3. SUPPLY WELL LOCATIONS ARE APPROXIMATE AND ASSUMED BASED ON JANUARY 2013 DRAWINGS BY TRC.
4. MONITORING WELLS MW-301 THROUGH MW-305 INSTALLED BY BADGER STATE DRILLING ON NOVEMBER 11-13, 2015.
5. MONITORING WELLS MW-306 THROUGH MW-308 INSTALLED BY BADGER STATE DRILLING ON NOVEMBER 14-15, 2016.
6. MONITORING WELLS MW-309 THROUGH MW-311 INSTALLED BY BADGER STATE DRILLING ON FEBRUARY 13-14, 2018.
7. MONITORING WELLS MW-93A, MW-93B, AND MW-312 WERE INSTALLED BY CASCADE ENVIRONMENTAL ON MARCH 23-28, 2022.
8. MONITORING WELLS MW-313, MW-314, AND MW-315 WERE INSTALLED BY HORIZON CONSTRUCTION & EXPLORATION ON DECEMBER 12 AND 19, 2022.
9. BACKGROUND MONITORING WELLS FOR THE MODULE 1-3 DRY ASH FACILITY ARE: MW-301 AND MW-84A.

N

500 0 500

SCALE: 1" = 500'

PROJECT NO.	25223067.00	DRAWN BY:	KP		
DRAWN:	12/02/2019	CHECKED BY:	TK		
REVISED:	10/12/2023	APPROVED BY:	TK 11/11/2023		

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

CLIENT: ALLIANT ENERGY
COLUMBIA ENERGY CENTER
W8375 MURRAY ROAD
PARDEEVILLE, WI 53954

SITE: ALLIANT ENERGY
COLUMBIA ENERGY CENTER
MODULES 1-3 DRY ASH DISPOSAL FACILITY
PARDEEVILLE, WI

SITE PLAN AND MONITORING WELL LOCATIONS

FIGURE 2

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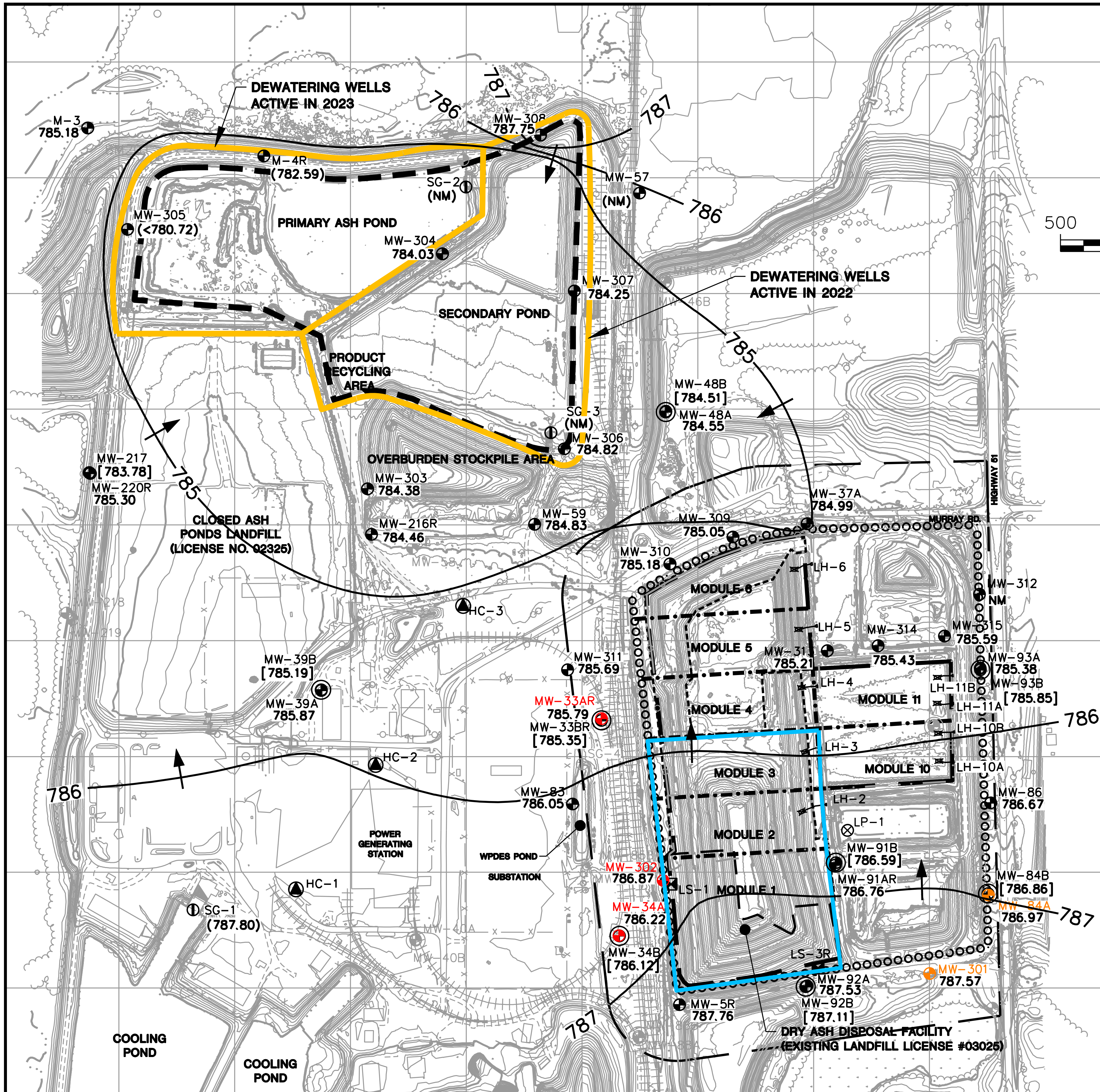

LEGEND

- EXISTING MAJOR CONTOUR (10' INTERVAL)
- EXISTING MINOR CONTOUR (2' CONTOUR)
- EXISTING FENCELINE
- EXISTING TRACKS
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EDGE OF WATER
- DRY ASH DISPOSAL FACILITY LIMITS
- LIMITS OF WASTE
- LINER PHASE/MODULE LIMITS
- WATER SUPPLY WELL
- STAFF GAUGE
- WATER TABLE WELL
- PIEZOMETER
- SURFACE WATER SAMPLE LOCATION
- LYSIMETER
- ABANDONED WATER TABLE WELL
- ABANDONED PIEZOMETER
- LEACHATE HEADWELL
- APPROXIMATE LOCATION OF DEWATERING WELLS
- CCR UNIT
- CCR MONITORING WELL
- CCR BACKGROUND MONITORING WELL
- 787.62 WATER TABLE ELEVATION
- [788.87] POTENTIOMETRIC SURFACE ELEVATION (NOT CONTOURED)
- (795.20) SURFACE WATER ELEVATION (NOT CONTOURED)
- WATER TABLE CONTOUR
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTES:

1. BASE MAP CREATED FROM AERIAL SURVEY BY KBM, FLOWN DECEMBER 1, 2014, AND GROUND SURVEYS BY SCS ENGINEERS IN MAY 2019, DECEMBER 2020, NOVEMBER 2021, AND DECEMBER 2021, AND BY DRONE SURVEY BY AMES IN NOVEMBER 2022.
2. MONITORING WELL LOCATIONS AND ELEVATIONS SURVEYED BY WISCONSIN POWER AND LIGHT, INC. IN DECEMBER 1994, NOVEMBER 1996, APRIL 2003, AND JANUARY 2016 AND BY SCS ENGINEERS IN FEBRUARY 2018.
3. SUPPLY WELL LOCATIONS ARE APPROXIMATE AND ASSUMED BASED ON JANUARY 2013 DRAWINGS BY TRC.
4. MONITORING WELLS MW-301 THROUGH MW-305 INSTALLED BY BADGER STATE DRILLING ON NOVEMBER 11-13, 2015.
5. MONITORING WELLS MW-306 THROUGH MW-308 INSTALLED BY BADGER STATE DRILLING ON NOVEMBER 14-15, 2016.
6. MONITORING WELLS MW-309 THROUGH MW-311 INSTALLED BY BADGER STATE DRILLING ON FEBRUARY 13-14, 2018.
7. GROUNDWATER AND SURFACE WATER ELEVATIONS WERE MEASURED ON APRIL 12-14, 2021.
8. BACKGROUND MONITORING WELLS FOR THE MODULE 1-3 DRY ASH FACILITY ARE: MW-301 AND MW-84A.
9. MONITORING WELLS MW-93A, MW-93B, AND MW-312 INSTALLED BY CASCADE ENVIRONMENTAL ON MARCH 25-28, 2022.
8. MONITORING WELLS MW-313, MW-314, AND MW-315 WERE INSTALLED BY HORIZON CONSTRUCTION & EXPLORATION ON DECEMBER 12 AND 19, 2022.
9. GROUNDWATER AND SURFACE WATER ELEVATIONS WERE MEASURED ON APRIL 24-27, 2023.
10. DEWATERING WELLS WERE ACTIVE AROUND THE PRIMARY POND DURING THE APRIL 2023 SAMPLING EVENT.

PROJECT NO.	25223067.00	DRAWN BY:	KP
DRAWN:	10/12/2023	CHECKED BY:	TK
REVISED:	11/10/2023	APPROVED BY:	TK 11/11/2023

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

CLIENT: ALLIANT ENERGY
COLUMBIA ENERGY CENTER
W8375 MURRAY ROAD
PARDEEVILLE, WI 53954

SITE: ALLIANT ENERGY
COLUMBIA ENERGY CENTER
MODULES 1-3 DRY ASH DISPOSAL FACILITY
PARDEEVILLE, WI

WATER TABLE MAP
APRIL 2023

FIGURE 3

I:\25223067.00\Drawings\Modules 1-3\Water Table Map-April 2023.dwg, 11/10/2023 3:27:53 PM

Appendix A

Trend Plots for CCR Wells

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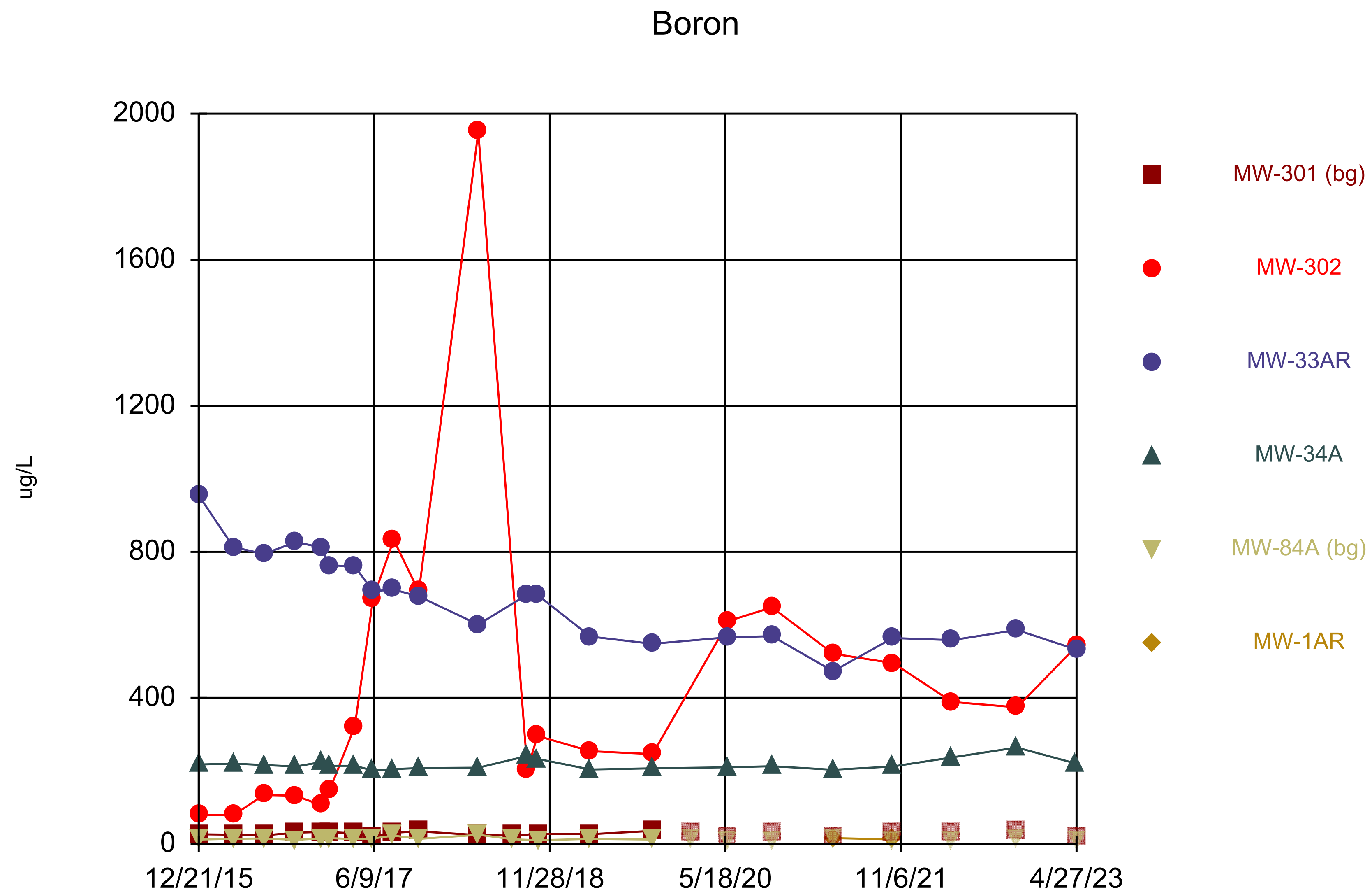

Time Series Analysis Run 10/4/2023 2:00 PM View: COL Secondary Pond

Columbia Energy Center Client: SCS Engineers Data: December - Chem- export-Dec2020

Time Series

Constituent: Boron (ug/L)   Analysis Run 10/4/2023 2:01 PM   View: COL Secondary Pond

Columbia Energy Center   Client: SCS Engineers   Data: December - Chem- export-Dec2020

	MW-301 (bg)	MW-302	MW-33AR	MW-34A	MW-84A (bg)	MW-1AR
12/21/2015			954	217.5 (D)		
12/22/2015	26.5	80			11.9	
4/5/2016	25.2	78.8	813	220	14	
7/7/2016		134	794	216		
7/8/2016	23.6				14.7	
10/13/2016	30.6	132	827	212	11.1	
12/29/2016	32.8	106	812	224	14.7	
1/25/2017	32.6	149	763	214	16.1	
4/11/2017	28.8	322	760	214	12.9	
6/6/2017	21.3	671	692	201	14.8	
8/7/2017			697	205		
8/8/2017	30.6	833			22.9	
10/23/2017	34.3					
10/24/2017		691	678	208	13.8	
4/24/2018		1950	601	209		
4/25/2018	24.3				25	
8/8/2018	22.8				12.8	
9/21/2018		203	683	241		
10/22/2018		296	682	233		
10/24/2018	27.8				10.1 (J)	
4/2/2019	26.9	254	568	204		
4/3/2019					13.6	
10/8/2019			548	207		
10/9/2019	35.9	246			12	
2/3/2020	27.9				15.7	
5/28/2020			566	210		
5/29/2020	21.3	611			10	
10/8/2020	28.8	648	569	213	9.7 (J)	
4/13/2021		521	473	203		
4/14/2021	22.2				14.3	16.1
10/12/2021			564	212		
10/14/2021	31.4	495			11.1	12.4
4/12/2022		389	558	237		
4/13/2022	28.7				10.5	
10/27/2022	37.5	374	586	264	12.2	
4/26/2023				220		
4/27/2023	20.1	541	532		10.3	

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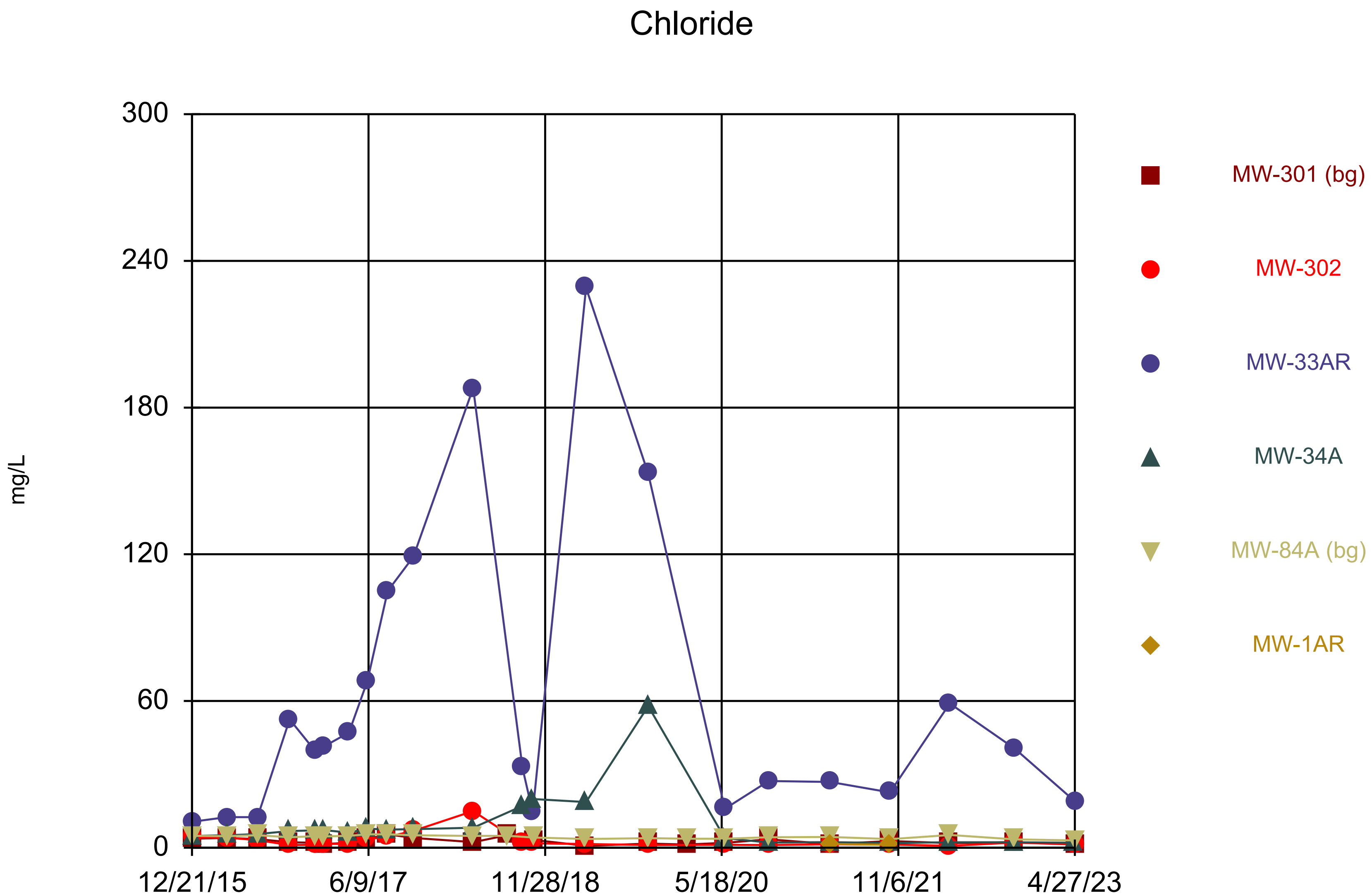

Time Series Analysis Run 10/4/2023 2:00 PM View: COL Secondary Pond

Columbia Energy Center Client: SCS Engineers Data: December - Chem- export-Dec2020

Time Series

Constituent: Chloride (mg/L) Analysis Run 10/4/2023 2:01 PM View: COL Secondary Pond

Columbia Energy Center Client: SCS Engineers Data: December - Chem- export-Dec2020

	MW-301 (bg)	MW-302	MW-33AR	MW-34A	MW-84A (bg)	MW-1AR
12/21/2015			10.6	4.85 (D)		
12/22/2015	3.7 (J)	4.2			4.9	
4/5/2016	4	4.1	12.5	5.1	4.7	
7/7/2016		3.1 (J)	12.5	5.6		
7/8/2016	3.5 (J)				5.1	
10/13/2016	2.2	1.1 (J)	52.5	6.8	4.3	
12/29/2016	2 (J)	1.2 (J)	39.6	7.1	4.7	
1/25/2017	1.5 (J)	1.6 (J)	41.4	7.2	4.6	
4/11/2017	2	1.6 (J)	47.1	6.2	4.9	
6/6/2017	3.5	3.5	68.1	7.8	5.5	
8/7/2017			105	7.4		
8/8/2017	5.5	4.5			5.5	
10/23/2017	4					
10/24/2017		6.9	119	7.6	5.1	
4/24/2018		15	188	8.2		
4/25/2018	2.3				4.8	
8/8/2018	5.2				4.9	
9/21/2018		1.7 (J)	32.6	17.1		
10/22/2018		1.8 (J)	14.4	19.9		
10/24/2018	3.2				4.2	
4/2/2019	0.79 (J)	1.5 (J)	229	18.7		
4/3/2019					3.6	
10/8/2019			153	57.9		
10/9/2019	1.7 (J)	1.1 (J)			3.9	
2/3/2020	1.3 (J)				3.7	
5/28/2020			15.9	3.9		
5/29/2020	2 (J)	1.2 (J)			3.7	
10/8/2020	3.4	1.1 (J)	27.3	2.1	4.3	
4/13/2021		1.4 (J)	26.9	2.3		
4/14/2021	1.5 (J)				4.4	1.5 (J)
10/12/2021			22.6	1.9 (J)		
10/14/2021	2.7	1.3 (J)			3.5	1.2 (J)
4/12/2022		0.79 (J)	59	2.2		
4/13/2022	1.9 (J)				5.2	
10/27/2022	2.3	2.1	40.5	2.2	3.4	
4/26/2023				2		
4/27/2023	1.5 (J)	1.3 (J)	19		3	

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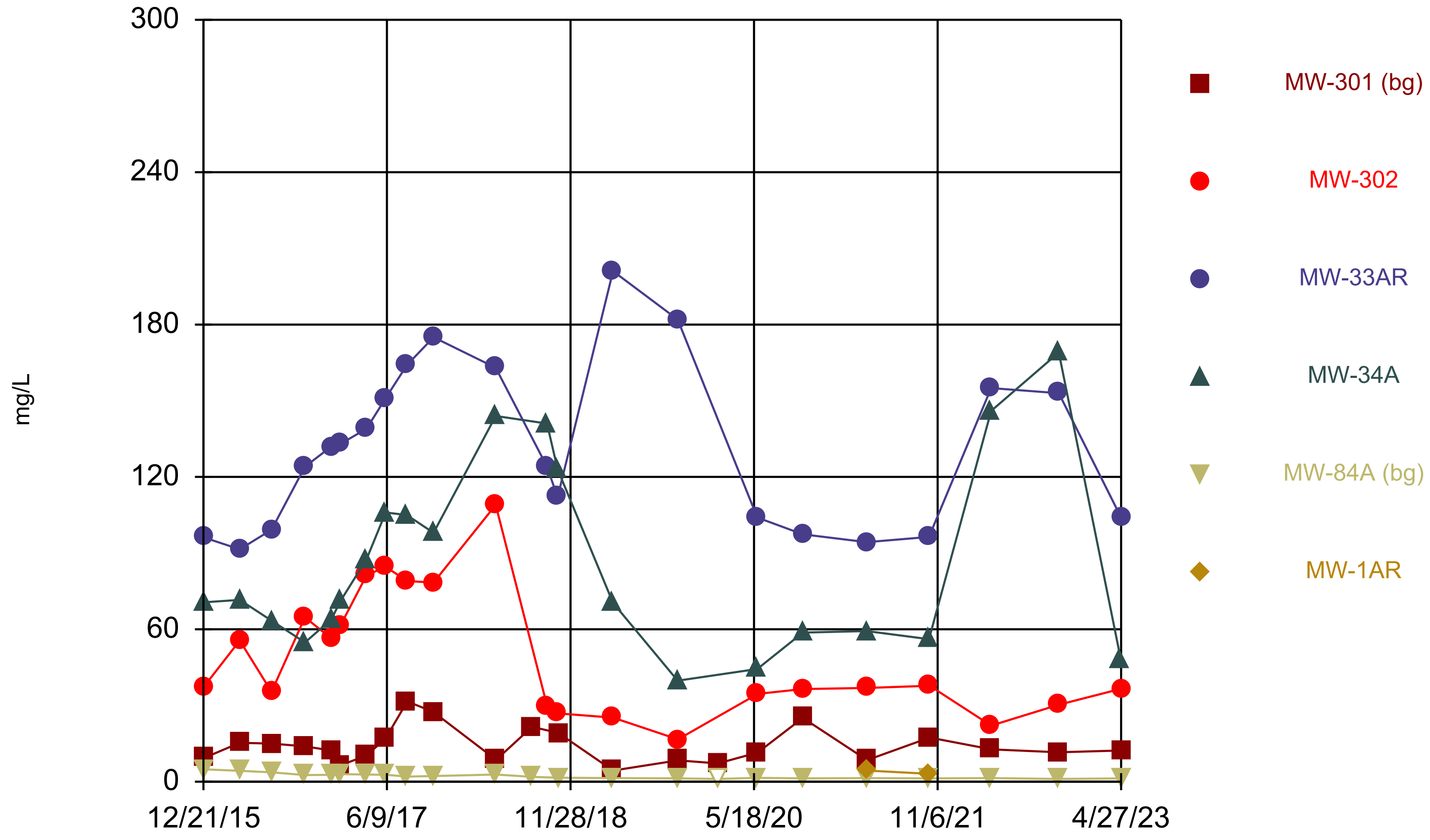
Hollow symbols indicate censored values.

Sulfate



Time Series Analysis Run 10/4/2023 2:00 PM View: COL Secondary Pond

Columbia Energy Center Client: SCS Engineers Data: December - Chem- export-Dec2020

Time Series

Constituent: Sulfate (mg/L) Analysis Run 10/4/2023 2:01 PM View: COL Secondary Pond

Columbia Energy Center Client: SCS Engineers Data: December - Chem- export-Dec2020

	MW-301 (bg)	MW-302	MW-33AR	MW-34A	MW-84A (bg)	MW-1AR
12/21/2015			96.2	70.6 (D)		
12/22/2015	9.3	37.4			4.9	
4/5/2016	15.3	55.6	91.5	71.6	4.3	
7/7/2016		35.4	99.2	63.4		
7/8/2016	15				3.7 (J)	
10/13/2016	13.9	64.7	124	54.8	2.6 (J)	
12/29/2016	12.3 (J)	56.4	132	63.9	2.7 (J)	
1/25/2017	6.5	61.6	133	71.2	3	
4/11/2017	10.3	81.3	139	87.6	2.8 (J)	
6/6/2017	17.1	84.6	151	106	2.7 (J)	
8/7/2017			164	105		
8/8/2017	31.6	79			2 (J)	
10/23/2017	27.5					
10/24/2017		78.4	175	98	2.2 (J)	
4/24/2018		109	163	144		
4/25/2018	8.6				2.8 (J)	
8/8/2018	21.6				1.9 (J)	
9/21/2018		30	124	141		
10/22/2018		26.9	112	123		
10/24/2018	19.2				1.6 (J)	
4/2/2019	4.4	25.2	201	70.4		
4/3/2019					1.4 (J)	
10/8/2019			182	39.8		
10/9/2019	8.4	16.7			1.3 (J)	
2/3/2020	7.2				<2.2 (U)	
5/28/2020			104	44.4		
5/29/2020	11.5	34.6			1.5 (J)	
10/8/2020	25.1	36.5	97.4	58.7	1.3 (J)	
4/13/2021		36.9	94.3	59.3		
4/14/2021	8.5				1.4 (J)	4.4
10/12/2021			96.4	56.1		
10/14/2021	17.4	37.8			1.3 (J)	3.1
4/12/2022		22.1	155	146		
4/13/2022	12.7				1.4 (J)	
10/27/2022	11.6	30.3	153	169	1.1 (J)	
4/26/2023				48.4		
4/27/2023	12.3	36.6	104		1.3 (J)	

ND substitution: RL or RL/2 if <15% NDs.

Appendix B

Feasibility Study Water Quality Information

1370

FEASIBILITY STUDY
PROPOSED FLY ASH AND/OR SCRUBBER SLUDGE
DISPOSAL FACILITY-COLUMBIA SITE
WISCONSIN POWER AND LIGHT COMPANY
TOWN OF PACIFIC, COLUMBIA COUNTY, WISCONSIN

Jan 78 C 7134

conceivable that groundwater flow in the area north of Murray Road may be altered such that contaminants derived from the present ash settling basin might be diverted southerly towards the homes along Murray Road. These questions would have to be addressed in greater detail, consistent with the goals of Wisconsin Power and Light Company.

WATER QUALITY

During the first two weeks of December, 1977, 64 water samples were obtained from surface waters and groundwater monitoring wells at the Columbia Energy Center. The purpose of the sampling was to assess background water quality in the vicinity of the proposed disposal site. The sampling stations included 59 monitoring wells, the cooling lake, ash settling pond, the drainage ditch carrying the ash pond discharge waters and the agricultural drainage ditch along the southern boundary of the site. Due to the large number of sampling stations, the analyses were limited to pH, specific conductance, iron, calcium, magnesium, sulfate and chloride. The analytical data is contained in Appendix F and is discussed below.

pH

Most groundwaters found in the United States have pH values ranging from around 6.0 to 8.5. The pH of a water represents the result of a number of interrelated chemical equilibria. This equilibria can be altered shortly after sampling by gains or losses of carbon dioxide, the oxidation of ferrous iron and numerous other chemical reactions. Thus, pH measurements must be taken shortly after obtaining the sample. For this study, the pH of samples was determined immediately upon return to the laboratory.

Within the proposed site boundaries at the Columbia Energy Center, pH values ranged between 6.3 and 8.1 and averaged 7.5. Typically, the lower pH values were observed in the lowland areas and wetlands, probably as a result of acidic organic soils. The pH of water in the ash disposal settling pond and the cooling lake was 11.4 and 8.3, respectively.

SPECIFIC CONDUCTANCE

Specific conductance, or conductivity, is the ability of a substance to conduct an electric current. The conductance determination is correlative with the dissolved-solids concentration. Conductivity, however, is temperature dependent and thus requires the reference of specific conductance measurements to a standard temperature. The values discussed here are referred to 25°C.

The specific conductance of groundwater in the study area ranged from 220 umhos/cm to a maximum of 2600 umhos/cm. The highest conductivity readings were observed in monitoring wells located along the coal storage area and the drainage ditch carrying the ash pond discharge where values up to 2600 umhos/cm were measured. The conductivity of the ash pond effluent was 1380 umhos/cm. This data appears to confirm earlier speculation of infiltration of effluent from the ash pond discharge channel and from the coal storage area into the groundwater. Conductance within the proposed site boundaries averaged approximately 465 umhos/cm.

Conductivity in the ash disposal settling pond was measured at 1510 umhos/cm. Shallow monitoring wells M-6 and 39A, located adjacent to the pond also exhibited elevated values of 1160 umhos/cm and 1800 umhos/cm, respectively.

High conductivities were also observed along U. S. Highway 51 at monitoring wells 51A and 51B. The chloride data, discussed below, indicates infiltration of road salt has probably occurred at this location.

Specific conductance measurements obtained in the vicinity of the proposed disposal site are shown on Drawing C 7134-15.

IRON

The element iron is an abundant element found in most rocks and soil. It generally occurs as sulfides and oxides in igneous and metamorphic rocks and as iron oxide and hydroxide cementing materials in coarse-grained sedimentary rocks.

Ferrous iron is unstable in the presence of oxygen where it is bound to hydroxide anions as $2Fe(OH)_3$.

$$2Fe^{++} + 4HCO_3^- + H_2O \rightleftharpoons 2Fe(OH)_3 + 4CO_2$$

If subjected to a strong reducing environment, such as a marsh, the reaction is reversed and iron goes back into solution. The amount which dissolves is related to a number of variables including the velocity with which water moves through this environment.

The U. S. Public Health Service recommends an iron concentration of less than 0.3 mg/l in water used for drinking and culinary purposes. Laundry and porcelain tend to be stained when concentrations reach 0.5 to 1.0 mg/l. At this level it can also be tasted.

The presence of iron under the proposed disposal area in the majority of cases was below the detection limit of 0.1 mg/l. In monitoring wells 5 and 18, located in or near the central marsh area, iron increased to 10 mg/l and 5.7 mg/l, respectively. In the southern marsh, monitoring wells exhibited concentrations between 0.5 mg/l and 6.1 mg/l. Although the iron concentration in the cooling lake was below the detection limit, down-gradient wells 44 and 30A located on the cooling lake dike yielded values of 11 mg/l and 26 mg/l iron respectively. Boring logs indicated trace amounts of organic material at the base of the dike which is probably the reason for the high concentrations observed. At the same location, iron in well 30B installed to a depth of 100 feet below the surface was below 0.1 mg/l. Thus, the occurrence of high iron concentrations in this area appears restricted to groundwater in the upper portion of the aquifer where organic material is present and conditions are favorable for the dissolution of iron.

The ash pond discharge in the drainage ditch paralleling the west site boundary showed an iron concentration of 3.7 mg/l. Shallow monitoring wells 33A and 34A adjacent to the ditch indicated less than 0.1 mg/l iron.

North of Murray Road the iron concentration in monitoring wells in the marsh and uplands were typically less than 0.1 mg/l. Although the ash basin had less than 0.1 mg/l iron, several wells along cross-section F-F' showed anomalously high values (#M6-2.3 mg/l; #47-16 mg/l; #51B-21 mg/l).

CALCIUM

Calcium, because of its relative abundance and mobility, is the principle cation in most natural fresh water. Calcium is a constituent of many rock types but is found in greatest quantities in waters leaching deposits of limestone and dolomite. In sandstone and other detrital rock, calcium carbonate is a common cement between grains.

Monitoring wells located within the site boundaries exhibited calcium concentrations between 30 mg/l and 66 mg/l and averaged about 42 mg/l. Similar to iron, the concentrations of calcium in monitoring wells along cross-section F-F' were anomalously high, up to 150 mg/l calcium. Water table wells along the drainage ditch carrying the ash pond discharge averaged 83 mg/l while the ash pond effluent contained 28 mg/l. Generally the amount of calcium in groundwater decreased with depth. Nested monitoring wells typically showed somewhat lower concentrations of calcium in the deeper wells.

MAGNESIUM

As a relatively abundant element on the earth's crust, the principle sources of magnesium in natural waters are considered to be ferromagnesian minerals in igneous rocks and magnesium carbonate in carbonate rocks (limestone and dolomite). Waters in which magnesium is the predominant cation are somewhat unusual. Like calcium, magnesium imparts the property of hardness to water and is, therefore, of concern to industrial users.

Generally, concentrations of magnesium were 1/3 to 1/2 of the calcium levels. Magnesium concentrations within the site boundaries ranged between 10 mg/l and 36 mg/l and averaged 27 mg/l. Similar to calcium and iron, higher magnesium values were observed, in general, north of Murray Road and especially in monitoring wells along cross-section F-F'.

SULFATE

Sulphur is widely distributed in reduced form in both igneous and sedimentary rocks as metallic sulfides and when present in sufficient concentrations, constitutes ore of economic importance. During weathering processes with aerated water, the sulfides are oxidized to sulfate ions and are dissolved into water. Pyrite (FeS_2) crystals often occur in sedimentary rocks and are particularly associated with biogenic deposits such as coal which were deposited under strongly reducing conditions.

The concentrations of sulfate in groundwater in the vicinity of the proposed disposal site ranged from less than 1 mg./l to 1,200 mg./l of sulfate. (Refer to Drawing C 7134-15.) Typically, within the site boundaries concentrations averaged approximately 12 mg./l. Near the coal storage area, however, significant increases were observed. Observation wells 26A, 26B, and 42 exhibited concentrations between 900 and 1100 mg./l. The depth of sulfate enrichment in groundwater, near the coal pile, appears to extend to considerable depths, indicated by relatively high sulfate concentrations in Well 26B sealed 100 feet below ground surface. The oxidation of pyrite minerals in the coal leaching into the groundwater is probably the major source of the high concentrations observed.

Sulfate concentrations in the ash disposal settling pond were 520 mg./l. In the ditch carrying the ash pond discharge, the effluent is treated with sulfuric acid which results in precipitation of barium sulfate and aluminum hydroxide (personal communication, Merlin Horn, 1978). Consequently, the sulfate concentration of the effluent waters is lowered considerably to 13 mg./l. Well 33A, however, located near the point of effluent discharge, exhibited 1200 mg./l sulfates.

CHLORIDE

Chloride is generally present in much lower concentrations in rocks than many of the other major constituents of natural water. Important sources, however, are associated with sedimentary rocks, particularly the evaporites. The chemical behavior of chloride in natural water is relatively inert compared to the other major ions. There are few oxidation-reduction reactions and no significant chemical complexing reactions which chloride enters into. In addition, chloride ions are not significantly adsorbed on mineral surfaces. For these reasons, chloride is commonly used as a tracer in groundwater.

Chloride concentrations in groundwater in the vicinity of the Columbia Energy Center typically range between 0.5 mg./l and 30 mg./l. The highest concentrations in monitoring wells tended to be located adjacent to U. S. Highway 51 where the use of road salt has resulted in the percolation of chloride into the groundwater. Monitoring Wells 51A and 51B located in a low area north of Murray Road along U. S. Highway 51, yielded chloride concentrations in excess of 200 mg./l. Two other wells, 52A and 19, also located along U. S. Highway 51, yielded values of 30 mg./l and 42.5 mg./l chloride, respectively.

Within the proposed site boundaries, the chloride concentration averaged 7.1 mg./l. Excluding the few wells adjacent to U. S. Highway 51 exhibiting elevated concentrations, no other significant trends in the occurrence of chloride were observed.

SUMMARY

In summary, the groundwater in the vicinity of the proposed disposal site exhibited a somewhat alkaline pH. In lowland areas, the pH was typically below 7.0, probably a result of the presence of acidic organic soils.

Specific conductance within the proposed site averaged 465 umhos/cm. Conductivities up to 2600 umhos/cm were observed, however, in the vicinity of the coal storage area, the present ash disposal pond and ash pond effluent channel where infilatration of water from these sources is occurring into the groundwater system.

The groundwater typically exhibted relatively low iron concentrations although, locally, concentrations in excess of drinking water standards were observed in about 20% of the wells. The occurrence of the higher iron concentrations appears to be related to the presence of organic soils.

Groundwater at the proposed site also tended to exhibit high calculated hardness (216 mg./l) based on average observed values for calcium (42 mg./l) and magnesium (27 mg./l). Dissolution of limestone and dolomite rocks in the glacial drift are the probable sources of these elements in the groundwater.

Enrichment of sulfate in groundwater has occurred as a result of leaching of pyrite (FeS_2) minerals from the coal storage area where concentrations up to 1200 mg./l were observed. The depth of this enrichment appears to extend beyond the maximum depth into the aquifer investigated. Sulfate concentrations decreased rapidly away from the coal storage area to an average of 12 mg./l within the proposed site boundaries. Other local sources of sulfate in groundwater appear to be related to the present ash settling pond.

The concentration of chloride within the proposed site averaged 7.1 mg./l. Higher levels were generally observed in wells adjacent to U. S. Highway 51 where the infiltration of road salt has locally raised chloride concentrations.

The above interpretations are based on one round of water quality sampling only and should be considered as preliminary in nature. High sulfate and chloride concentrations observed at greater depths may be a temporary condition resulting from contamination of spoil backfill materials with coal dust or salt, respectively, during installation of the monitoring well. Future sampling of these monitoring wells will help to distinguish short term contamination from actual conditions existing in the aquifer.

APPENDIX F
WATER QUALITY DATA

WELL NO.	pH	SPECIFIC CONDUCTANCE (umhos/cm @ 25°C)	SULFATE (mg/l)	CHLORIDE (mg/l)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	IRON (mg/l)
1A	7.6	550	17.	6.5	52	37	<0.1
1B	8.05	460	16.	10.5	39	31	<0.1
2	7.8	527	14.	2.5	45	32	<0.1
3A	7.5	548	13.	2.5	58	36	<0.1
3B	8.1	506	14.	7.0	50	34	<0.1
4	7.8	580	10.	4.0	59	34	<0.1
5	6.3	560	210.	12.5	13	29	10
16	7.6	408	12.	1.5	42	28	<0.1
17	6.45	350	30.	16.5	16	13	0.6
18	6.45	380	4.	4.5	33	22	5.7
19	7.9	570	10.	42.5	44	24	<0.1
20	8.0	340	10.	5.0	36	24	<0.1
21	6.9	220	20.	4.5	23	10	0.1
24A	7.45	775	18.	6.0	76	52	0.1
24B	7.85	440	15.	6.0	43	31	0.1
25	8.1	300	10.	2.5	29	20	<0.1
26A	7.2	2100	900	17.0	140	48	1.5
26B	7.5	2600	1100	16.5	43	7.0	0.2
27	7.15	400	6.	8.0	23	18	<0.1
28A	7.75	500	3.	0.5	48	31	<0.1
28B	7.6	480	4.	3.5	39	28	<0.1
29A	7.8	330	16.	1.5	33	21	0.5
30A	6.75	920	64.	11.0	38	30	26
30B	7.6	770	210	21.0	37	19	<0.1
33A	8.2	2500	1200	24.0	83	50	<0.1
33B	7.9	390	22.	6.5	31	27	0.2
34A	7.7	680	140.	10.0	58	45	0.1
34B	7.7	1700	660	15.0	48	22	<0.1
35	6.8	740	<1.0	4.0	66	33	2.9
36	6.8	740	<1.0	3.5	53	35	6.1
37A	7.7	460	9.	4.0	48	31	0.8
37B	7.5	630	73.	7.5	71	35	<0.1
39A	7.5	1800	350	22.0	180	100	0.1
39B	7.9	330	560	20.5	31	22	0.1
40A	8.0	630	140	8.5	43	29	<0.1
40B	8.1	330	17.	3.0	31	22	<0.1
41	6.8	590	16.	11.0	58	27	9.3

WELL NO.	pH	SPECIFIC CONDUCTANCE (umhos/cm @ 25°C)	SULFATE (mg/l)	CHLORIDE (mg/l)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	IRON (mg/l)
42	7.4	2400	900	17.5	50	12	0.5
44	6.9	490	<1.	16.5	39	23	11
45	7.6	390	14.	3.0	40	25	<0.1
46A	7.3	1100	21.	15.5	140	82	<0.1
46B	7.8	470	25.	17.5	40	26	<0.1
47	6.6	1200	3.	8.0	140	40	16
48A	7.3	620	15.	8.0	62	37	<0.1
48B	7.1	520	22.	20.0	43	29	0.2
49	7.15	730	6.	3.5	75	41	<0.1
50A	7.6	520	28.	15.5	51	34	<0.1
50B	7.5	410	21.	18.0	31	21	<0.1
51A	6.1	1850	8.	205.	65	40	<0.1
51B	7.2	1250	23.	275.	57	36	21
52A	7.7	450	16.	30.5	36	17	<0.1
52B	7.4	430	40.	17.5	32	20	<0.1
53	7.75	450	27.	10.5	39	28	<0.1
54A	7.8	350	12.	4.0	34	21	0.1
54B	7.55	390	15.	5.5	40	24	0.1
55B	7.9	340	23.	17.5	32	22	0.1
56	7.8	450	22.	9.5	43	28	0.1
57	7.85	380	17.	7.0	38	24	0.1
M-6	7.0	1160	5.	7.0	150	91	2.3
Cooling Lake	8.3	370	31.	18.0	34	21	<0.1
Ash Pond Effluent	7.45	1380	13.	4.0	28	1.2	3.7
Ash Pond	11.4	1510	520.	23.5	29	0.2	<0.1
Drainage Ditch (A)	7.8	500	21.	7.0	43	29	<0.1
Drainage Ditch (B)	9.05	1780	750	14.0	42	5.4	<0.1

APPENDICES TO

SUPPLEMENTARY FEASIBILITY STUDY REPORT
AND PRELIMINARY ENGINEERING CONCEPTS
COLUMBIA SITE
WISCONSIN POWER AND LIGHT COMPANY
TOWN OF PACIFIC, COLUMBIA COUNTY, WISCONSIN

WARZYN
ENGINEERING INC

APPENDIX I

WATER QUALITY DATA - DECEMBER 1978

WARZYN
ENGINEERING INC

12/78

C 7134

WATER QUALITY DATA

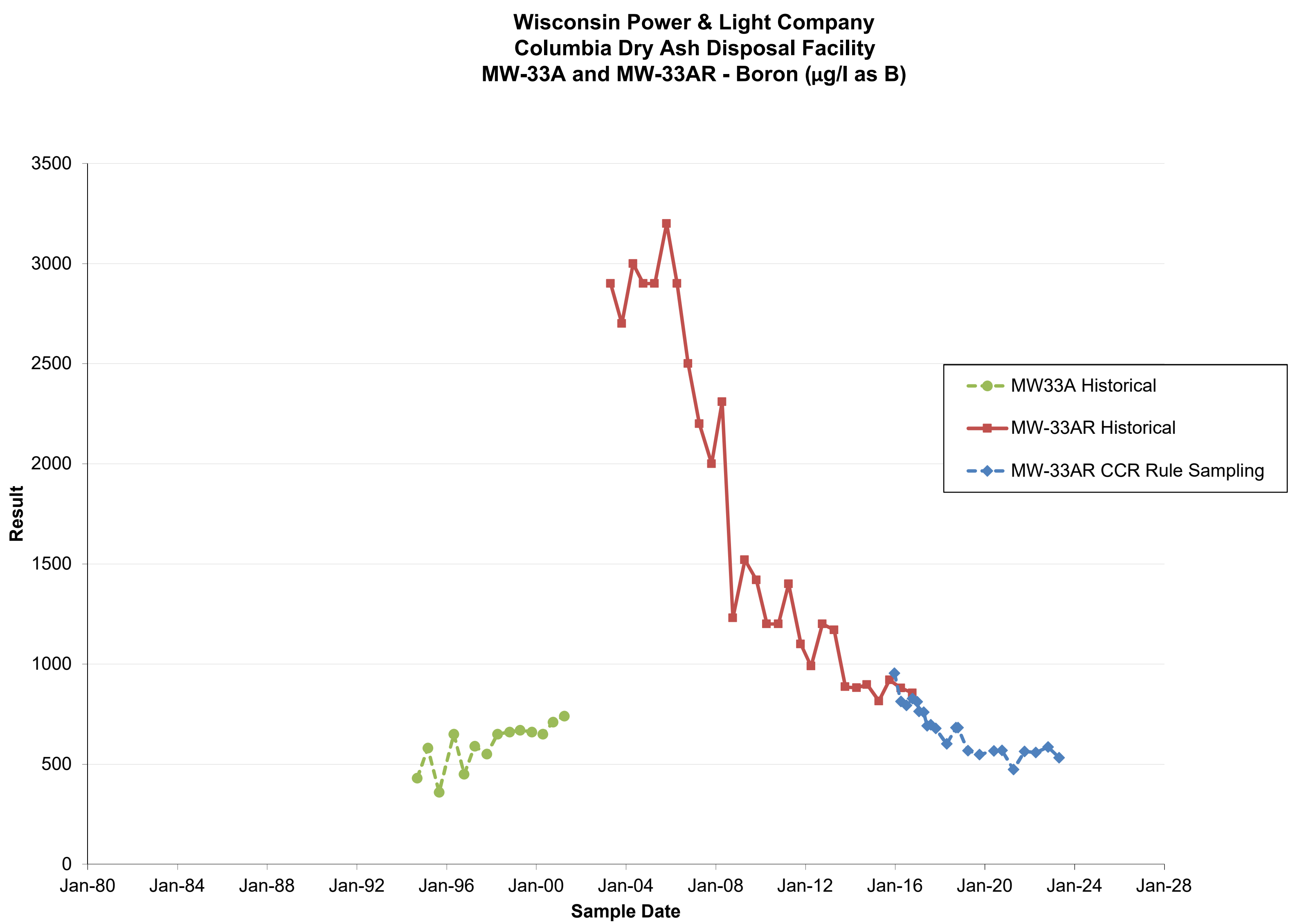
WELL NO.	pH	SPECIFIC CONDUCTANCE (umhos/cm @ 25°C)	SULFATE (mg/l)	CHLORIDE (mg/l)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	IRON (mg/l)	BORON (mg/l)
1A	7.3	530	30	3.1	54	35	<0.1	-
1B	7.0	470	67	6.1	49	30	<0.1	-
2	7.25	458	91	<.5	48	24	<0.1	-
3A	7.0	560	36	<.5	61	31	<0.1	-
3B	7.15	530	52	35.7	37	33	<0.1	-
4	7.2	750	69	5.8	49	30	<0.1	-
5	6.35	1,650	670	14.1	14	13	1.7	-
16	6.9	390	69	1.0	49	23	<0.1	-
17	5.55	295	57	16.3	14	8.6	0.2	-
18	5.9	430	10	4.2	47	21	1.1	-
19	7.4	765	75	4.2	51	28	<0.1	-
20	7.4	380	26	1.6	39	26	<0.1	-
21	5.7	250	54	10.4	15	8.3	0.2	-
24A	7.2	730	36	1.6	65	42	<0.1	-
24B	7.2	470	10	7.3	42	28	<0.1	-
25	7.0	335	29	7.8	39	21	0.2	-
26A	7.4	2,250	650	12.6	32	8.6	<0.1	-
26B	6.8	2,530	840	20.8	49	18	<0.1	-
27	6.9	410	24	4.2	40	24	0.4	-
28A	7.2	500	61	0.5	45	28	<0.1	-
28B	7.0	465	6	2.1	39	26	0.1	-
29A	7.1	410	24	3.6	31	22	0.1	-
30A	5.8	1,140	15	<0.5	97	56	38	-
30B	6.65	835	160	14.6	37	20	<0.1	-
33A	7.8	1,970	830	16.7	21	8.9	<0.1	-
33B	7.5	380	31	7.3	24	27	<0.1	-
34A	7.25	560	46	4.2	53	33	<0.1	-
34B	8.5	1,575	730	21.9	28	29	0.1	-
35	6.7	545	61	3.6	60	26	1.0	-
36	6.4	515	5.0	2.6	43	24	4.8	-
37A	7.05	438	30	3.7	50	28	<0.1	-
37B	6.7	325	18	7.3	1.0	0.5	<0.1	-
39A	6.35	1,260	33	13.6	70	7.6	0.1	-
39B	6.7	385	25	4.2	30	21	<0.1	-
40A	7.35	483	40	<0.5	48	24	<0.1	<.05
40B	7.25	343	4	4.2	21	14	<0.1	-
41	6.1	640	54	19.8	43	32	<0.1	-

WELL NO.	pH	SPECIFIC CONDUCTANCE (umhos/cm @ 25°C)	SULFATE (mg/l)	CHLORIDE (mg/l)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	IRON (mg/l)	BORON (mg/l)
42	7.15	2,050	910	15.6	23	7.5	0.1	-
44	6.15	710	6	0.5	56	27	3.5	-
45	7.2	420	32	1.0	44	26	<0.1	-
46A	7.0	560	93	<0.5	130	75	<0.1	<0.05
46B	6.5	1,290	170	20.8	46	30	<0.1	<0.05
47	7.3	958	120	<0.5	110	48	<0.1	-
48A	6.15	640	59	<0.5	42	51	<0.1	<0.05
48B	6.8	450	23	5.2	40	27	<0.1	<0.05
49	7.0	880	26	2.1	93	58	0.1	-
50A	7.4	660	25	17.7	60	36	<0.1	-
50B	7.1	405	16	17.7	38	23	<0.1	-
51A	7.0	1,170	57	135	66	31	<0.1	-
51B	7.3	1,410	22	330	46	39	<0.1	-
52A	7.0	370	110	18.5	35	10	<0.1	-
52B	7.0	595	43	52.5			0.1	-
53	Frozen							
54A	7.5	345	10	1.0	36	22	<0.1	<0.05
54B	Frozen							
55B	7.3	505	26	15.6	52	29	<0.1	<0.05
56	Frozen							
57	Frozen							
M-6								
58	6.55	1,265	140	<0.5	110	65	0.1	-
59	6.8	925	40	<0.5	86	60	<0.1	-
60	7.2	1,510	54	4.7	130	85	<0.1	-
61A	6.85	590	39	30.2	58	31	<0.1	-
61B	7.2	505	6	13.5	48	29	<0.1	-
62	6.7	1,517	72	178	120	53	<0.1	-
64	6.9	670	100	26.8	63	36	0.8	-
65	7.2	830	57	17.8	78	50	<0.1	-
66	6.5	680	55	40	66	24	3.6	-

WELL NO.	pH	SPECIFIC CONDUCTANCE (umhos/cm @ 25°C)	SULFATE (mg/l)	CHLORIDE (mg/l)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	IRON (mg/l)	BORON (mg/l)
67	7.0	560	100	1.0	57	32	1.0	-
68A	7.6	440	32	2.1	40	27	<0.1	-
68B	7.2	400	36	1.0	42	25	<0.1	-
70A	7.5	440	20	<0.5	27	37	<0.1	-
70B	7.3	520	25	5.2	51	34	<0.1	-
72A	6.45	860	11	<0.5	100	41	1.8	-
72B	8.4	230	45	<0.5	17	19	<0.1	-
M-4	7.6	864	180	26.1	20	11	<0.1	0.39
MM-4			2	2.6	14	21	0.9	-
Cooling Lake at 1	7.7	355	36	13.6	31	21.2	<0.1	-
Ash Pond at 2	11.4	3,210	1,100	22.9	34	<0.1	<0.1	-
Ash Pond at 3	8.7	725	34	21.9	48	16	<0.1	-
Ash Pond Effluent at 4	6.7	3,090	1,400	25.0	39	0.4	<0.1	-
Drainage Ditch at 5	7.2	730	74	33.9	56	38	<0.1	-
Drainage Ditch at 6	7.35	2,750	640	18.8	34	7.5	<0.1	-
Drainage Ditch at 7	8.05	1,780	740	27.1	31	0.2	<0.1	-

Appendix C

Long-Term Concentration Trend Plots



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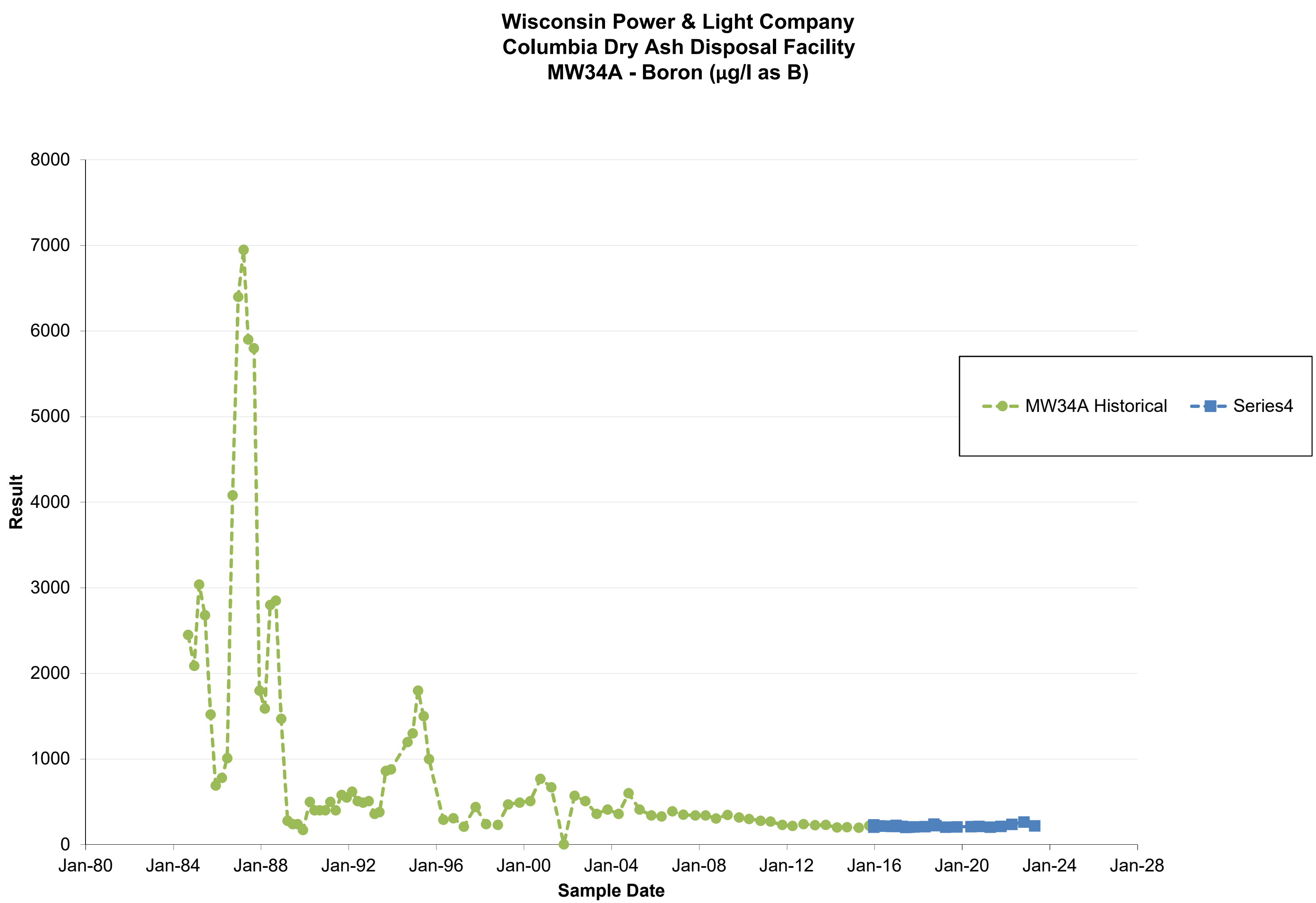

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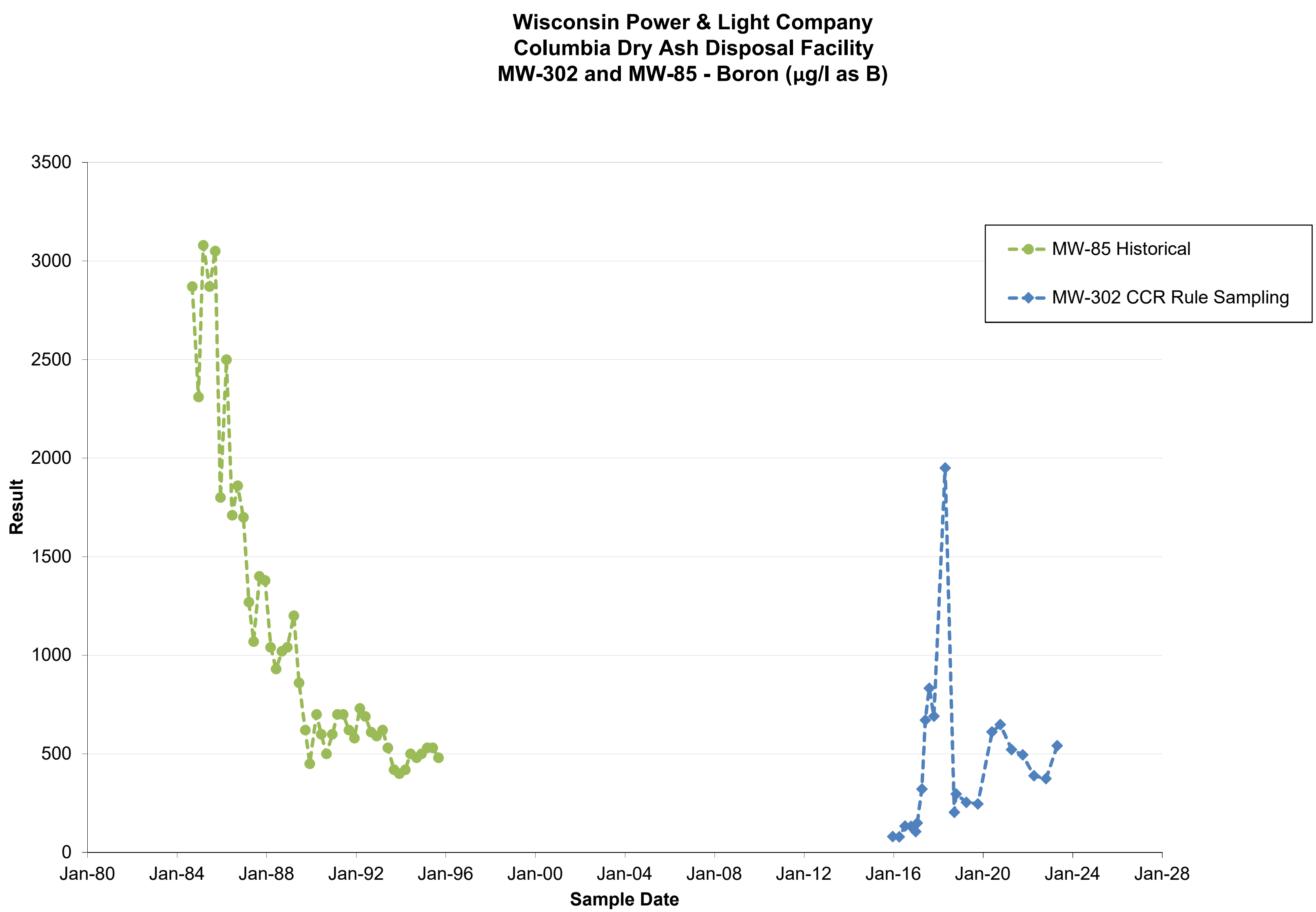

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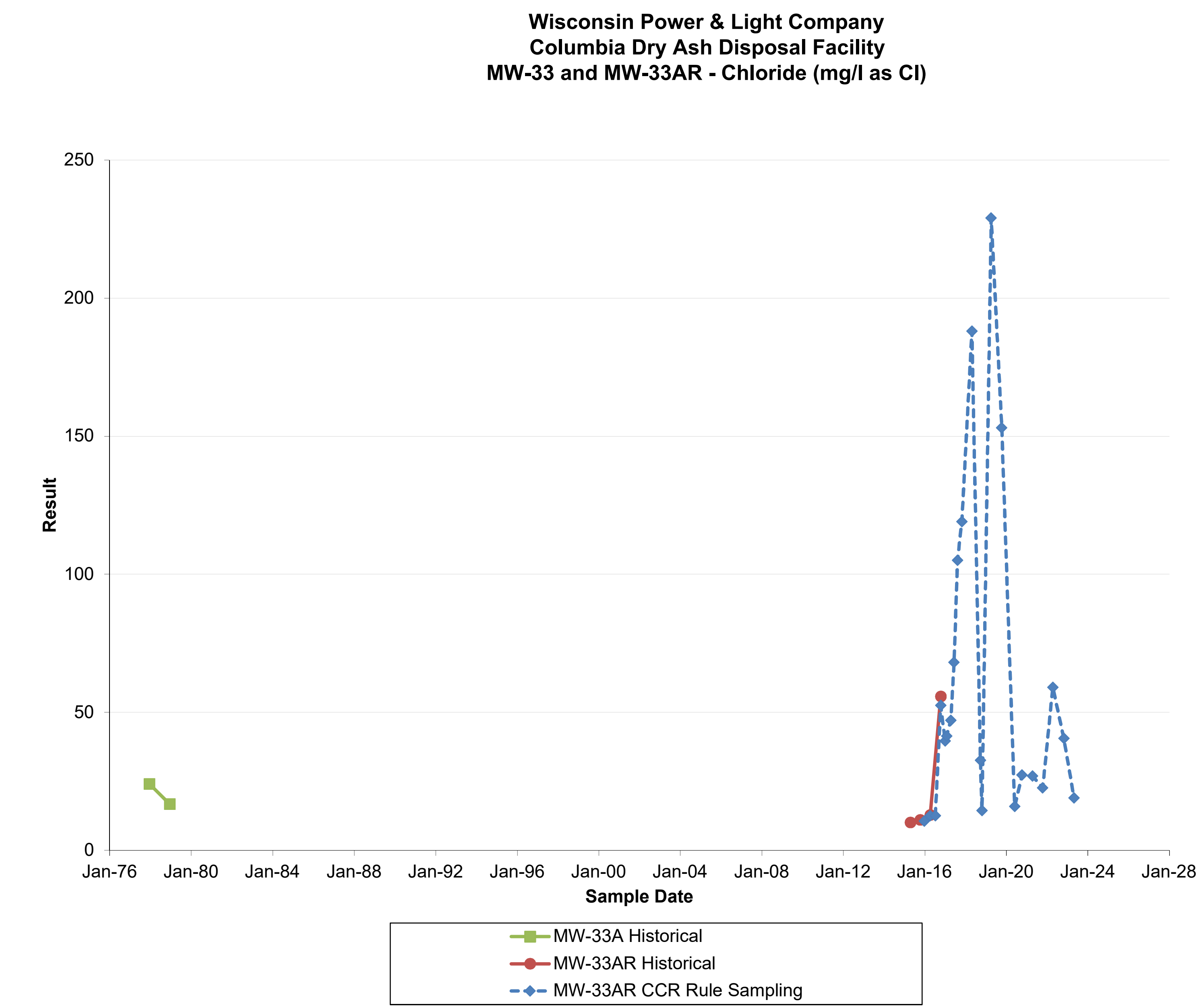

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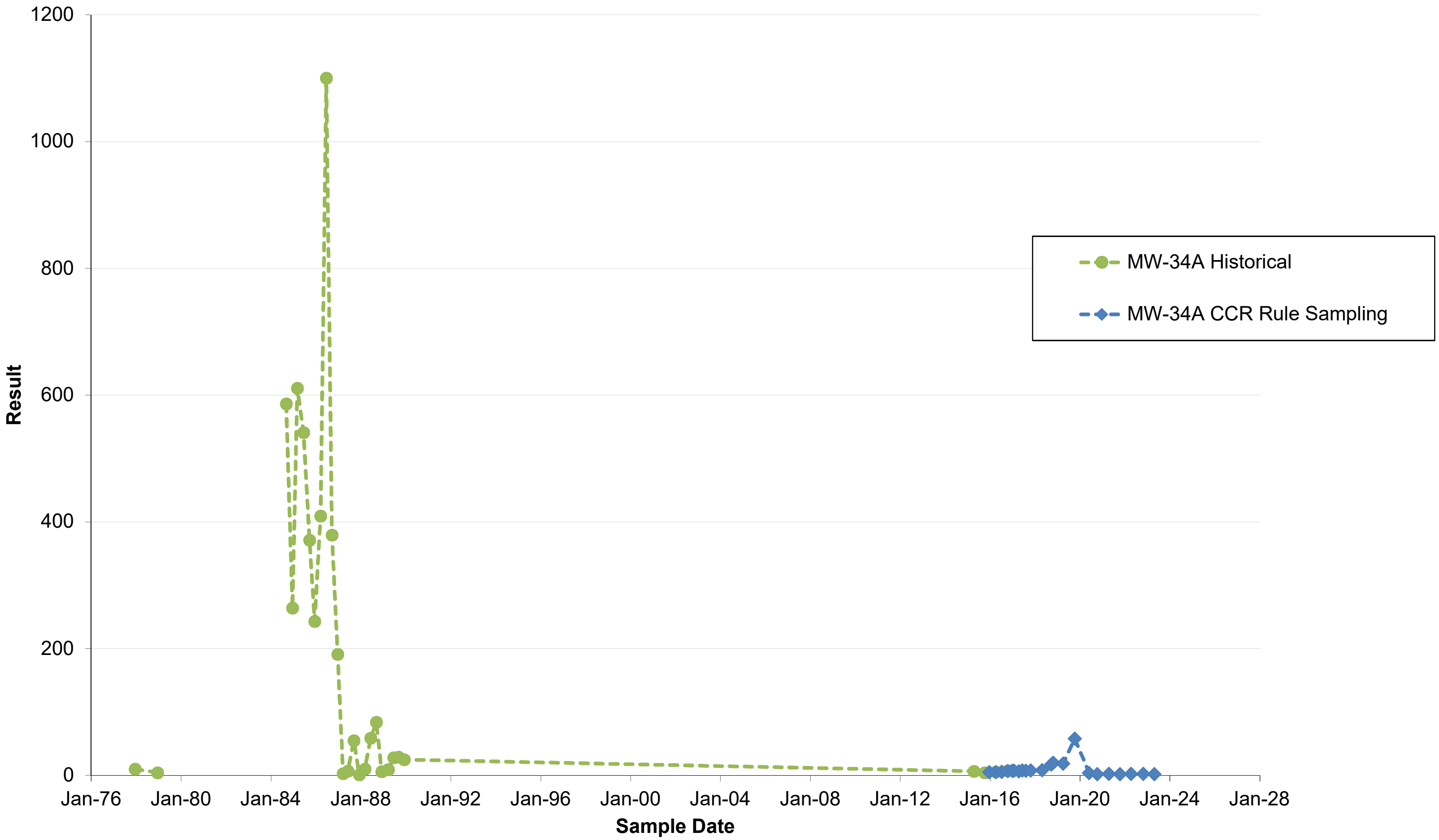
Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW34A - Chloride (mg/l as Cl)



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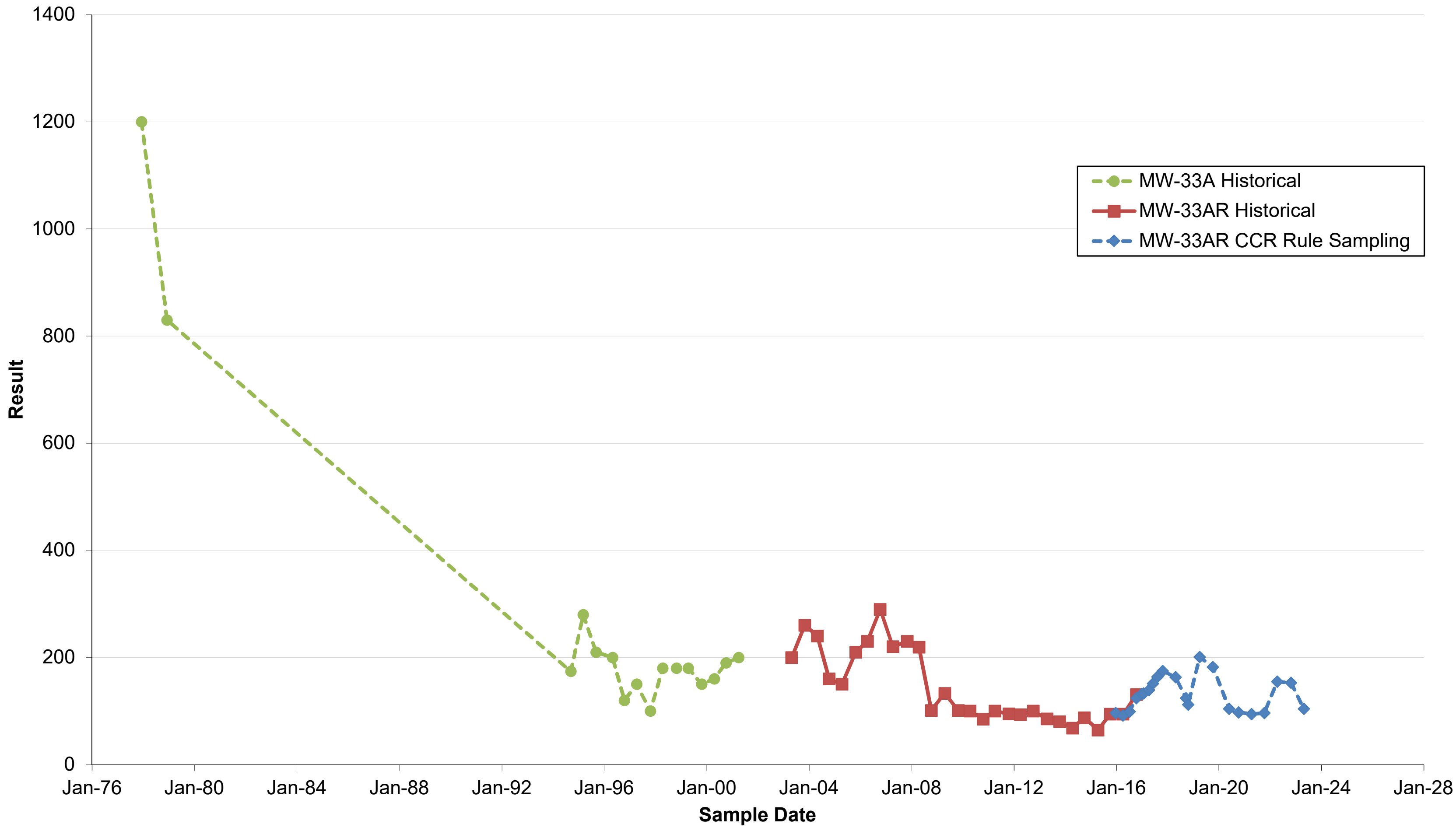
Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-33 and MW-33AR - Sulfate (mg/l as SO4)



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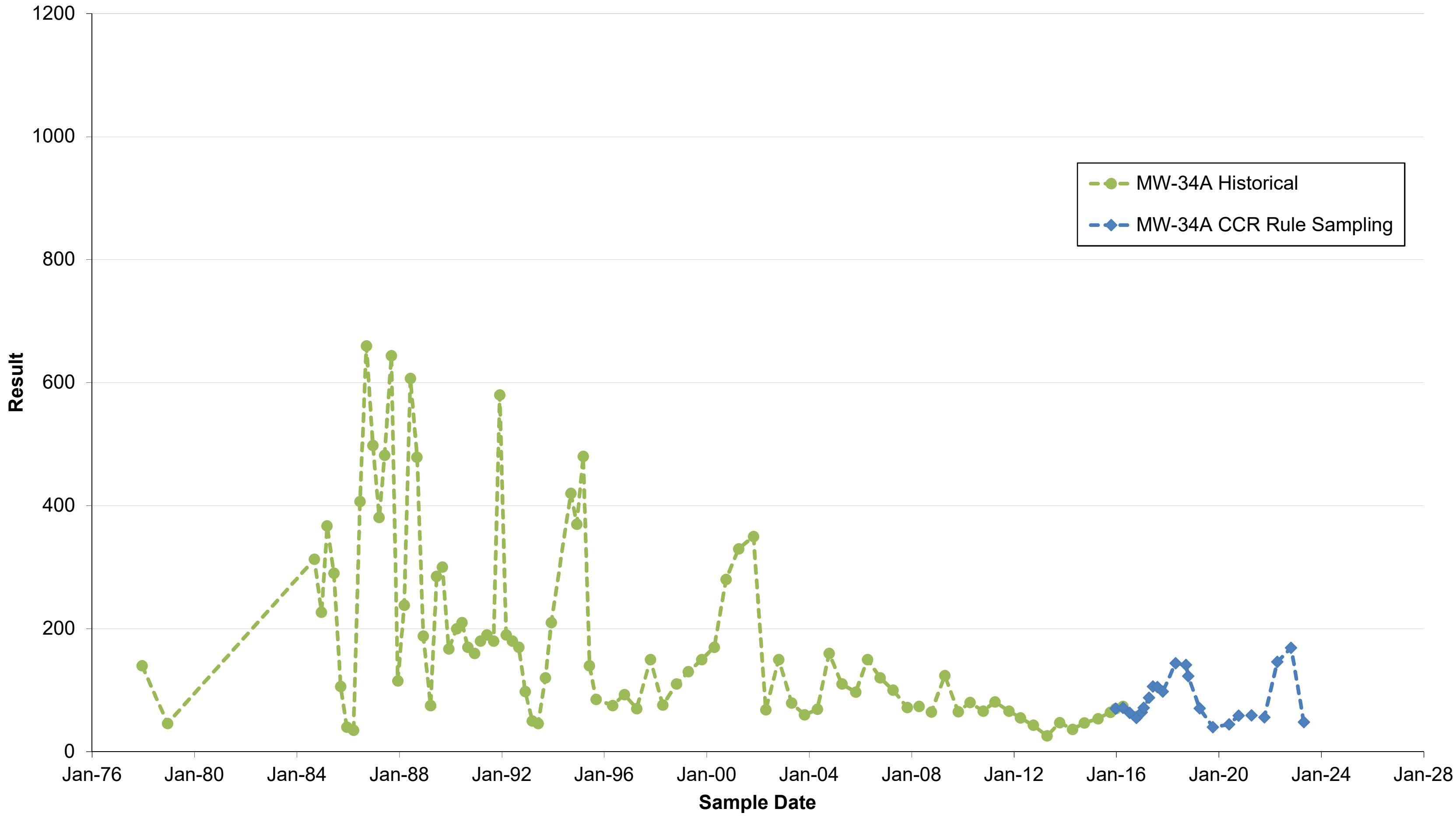
Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-34A - Sulfate (mg/l as SO4)



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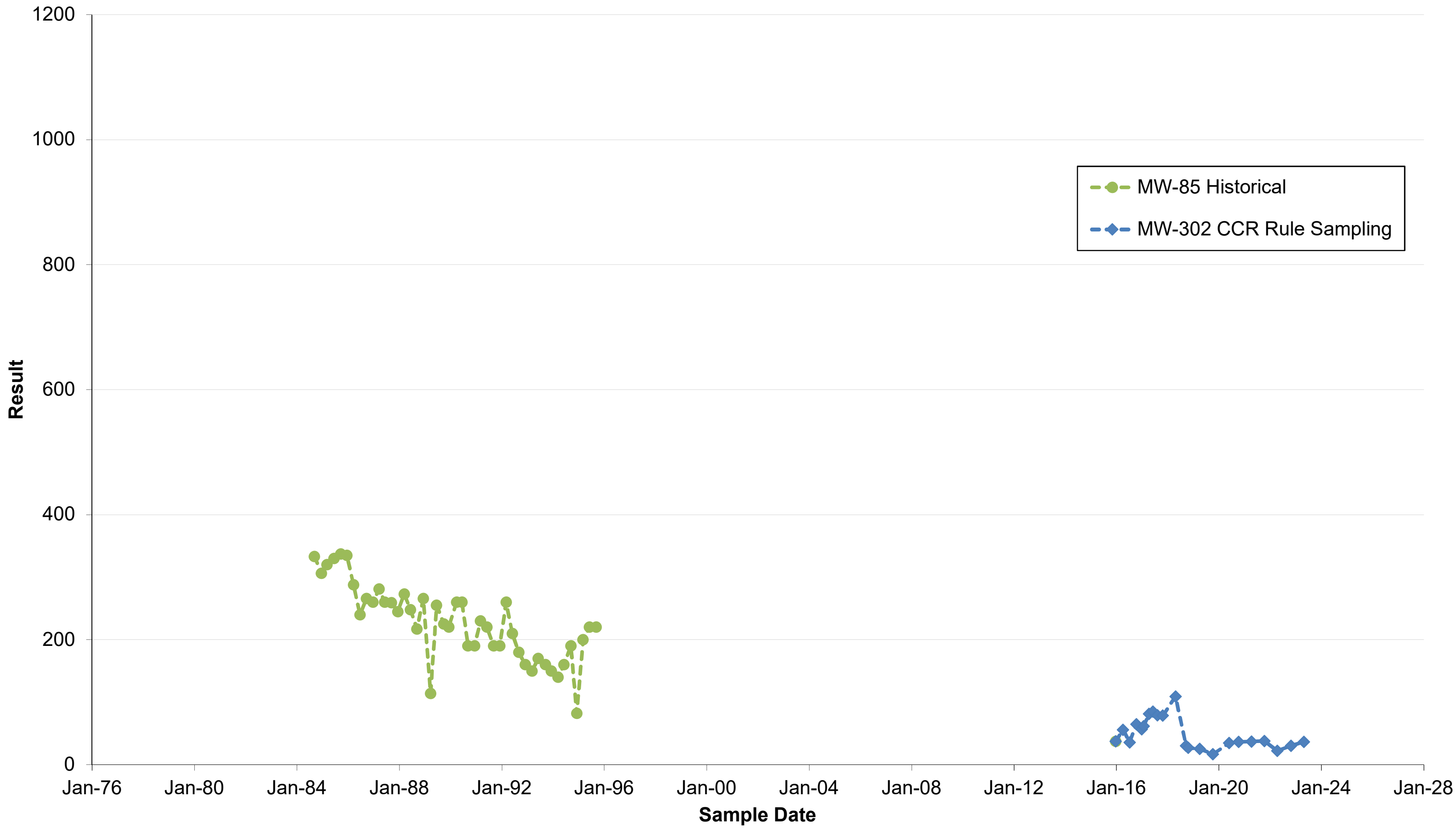
Wisconsin Power & Light Company
Columbia Dry Ash Disposal Facility
MW-85 and MW-302 - Sulfate (mg/l as SO4)



Appendix D

Historical Groundwater Flow Maps

LEGEND

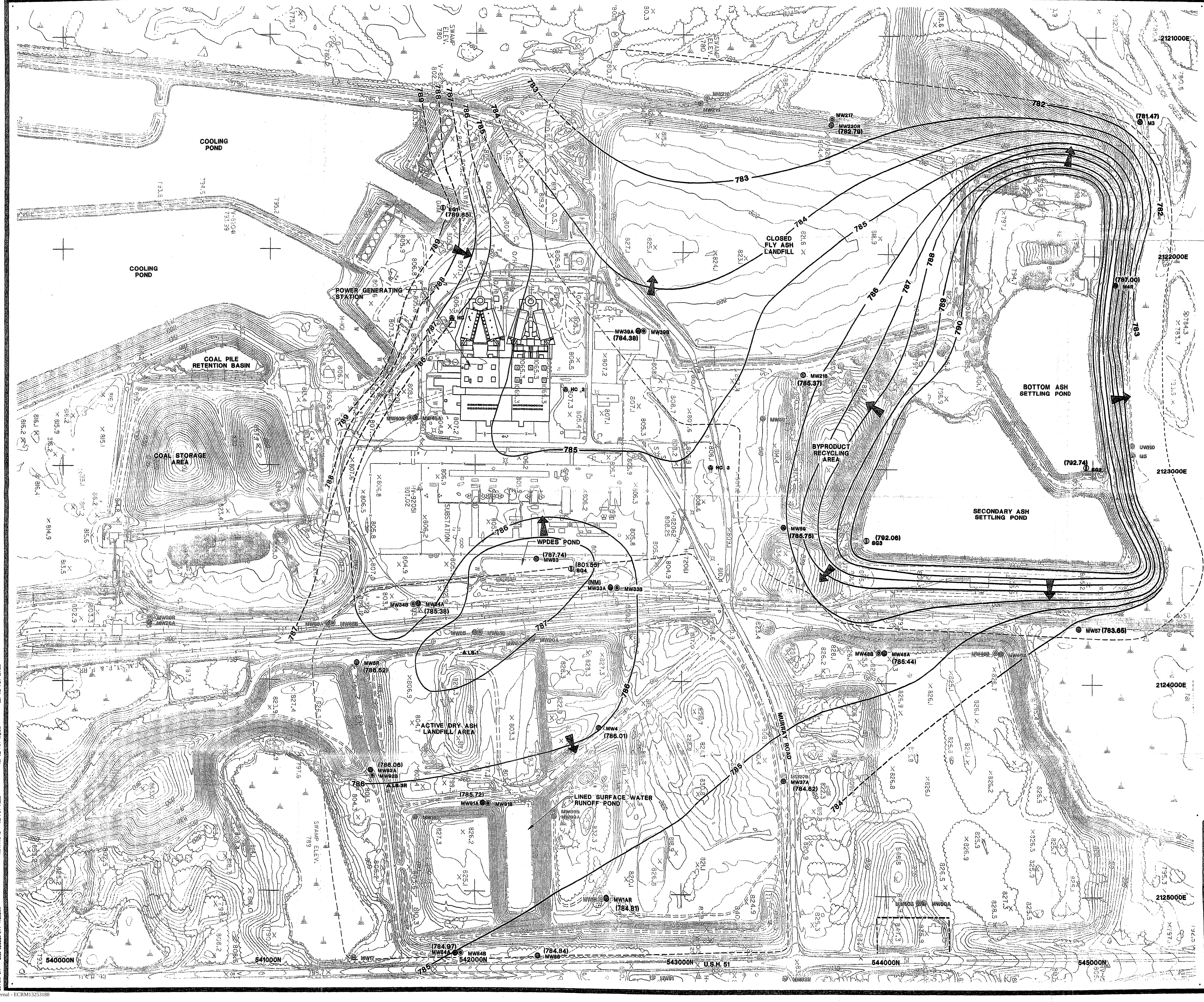
- PROPOSED PROJECT AREA
- OBSERVATION WELL LOCATION, NUMBER, AND WATER TABLE ELEVATION
- BORING LOCATION AND NUMBER
- WETLANDS
- TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL: 20 FT.)
- PRIVATE RESIDENCES (ASSUMED LOCATIONS OF PRIVATE WATER SUPPLY WELLS)
- COMMERCIAL BUILDINGS (ASSUMED LOCATIONS OF POSSIBLE PUBLIC WATER SUPPLY WELLS)
- SURFACE WATERS (STREAMS OR DRAINAGE DITCHES) ARROWS INDICATE DIRECTION OF FLOW
- OTHER BUILDINGS (GARAGES, BARNS, ETC.)
- HIGH CAPICITY WELLS
- —790— WATER TABLE CONTOURS (CONTOUR INTERVAL: 1 FT.)
- DIRECTION OF GROUNDWATER FLOW

NO.	BY	DATE	REVISION	APP'D

WATER TABLE CONTOUR MAP 2/4/81

PLAN OF OPERATION – ASH DISPOSAL FACILITY
COLUMBIA SITE
WISCONSIN POWER & LIGHT COMPANY
PART OF SECTIONS 27 & 34, T12N, R9E
TOWN OF PACIFIC COLUMBIA CO. WISCONSIN

WARZYN ENGINEERING INC	DRAWN TDH	SCALE 1" = 300'	SHEET 39 OF 39
	CHECKED RJK	DATE 2/10/81	DRAWING NO. C7134-94
	APPROVED		
	REFERENCE		PRINTED 8/3/88



LEGEND

- PROPERTY LINE
- EXISTING RAILROAD TRACKS
- EXISTING GROUND CONTOUR
- CONTOUR DEPRESSION
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING FENCE
- EXISTING BUILDING
- EXISTING SPOT ELEVATION
- TREES AND/OR BRUSH
- WETLAND AREA
- EDGE OF WATER
- HC 1 — WATER SUPPLY WELL
- MW91A — WATER TABLE WELL
- MW91B — PIEZOMETER
- ABANDONED WATER TABLE WELL
- ABANDONED PIEZOMETER
- SG1 — STAFF GAUGE
- LS-1 — LYSIMETER
- DESIGN MANAGEMENT ZONE
- PROPERTY LINE
- O.S. — OPEN STORAGE
- O.H. — OVERHEAD STRUCTURE
- E.P.S. — ELECTRICAL POWER STATION
- T — TANK
- W — WALL
- (785.31) — WATER TABLE ELEVATION (FT-MSL) (N.M. = NOT MEASURED)
- 786 — GROUNDWATER CONTOUR LINE (1FT INTERVAL- FT. M.S.L.) (DASHED WHERE INFERRED)
- GROUNDWATER FLOW DIRECTION

NOTES

1. BASE MAP IS PROVIDED BY WISCONSIN POWER & LIGHT CO. AND IS BASED ON PHOTOS TAKEN ON APRIL 6, 1995 BY AERO-METRIC ENGINEERING, SHEBOYGAN, WI.
2. HORIZONTAL DATUM IS BASED ON THE WISCONSIN STATE PLANE COORDINATE SYSTEM, SOUTH ZONE - DATUM: NAD 83(91).
3. VERTICAL DATUM IS REFERENCED TO U.S.G.S. MEAN SEA LEVEL (MSL). TOPOGRAPHIC CONTOUR INTERVAL IS TWO FEET.
4. MONITORING WELL LOCATIONS AND ELEVATIONS SURVEYED BY WISCONSIN POWER & LIGHT CO. IN DECEMBER 1994 & NOVEMBER 1996.
5. THE LOCATION OF THE DESIGN MANAGEMENT ZONE DEMARCATION LINE IS APPROXIMATE.
6. WATER ELEVATION USED TO PREPARE THIS MAP WERE MEASURED ON OCTOBER 24, 2002.
7. THE WATER LEVEL AT MW 33A AND MW 33B COULD NOT BE MEASURED DURING OCTOBER 2002 DUE TO AN OBSTRUCTION IN THE WELL CASING.

NO.	BY	DATE	REVISION	APP'D.
3.				
2.				
1.				

PROJECT: ALLIANT ENERGY - WP&L COLUMBIA ASH PONDS & DRY ASH DISPOSAL FACILITY

SHEET TITLE: WATER TABLE MAP (OCTOBER 2002)

DRAWN BY: defoej	SCALE: 1"=200'	PROJ. NO. 3024.28
CHECKED BY: JMR		FILE NO. WATERTBL.PLT
APPROVED BY: JCO	DATE PRINTED:	FIGURE 3
DATE: JANUARY 2003		

RMT
744 Heartland Trail
Madison, WI 53717-1934
P.O. Box 8923
Madison, WI 53708-8923
Phone: 608-831-4444

Appendix D

Alternative Source Demonstration, October 2022 Detection Monitoring

Alternative Source Demonstration October 2022 Detection Monitoring

Dry Ash Disposal Facility, Modules 4 - 6
Columbia Energy Center
Pardeeville, Wisconsin

Prepared for:

Alliant Energy

SCS ENGINEERS

25223067.00 | May 31, 2023

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

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PE CERTIFICATION

5/31/2023

I, Sherren Clark, hereby certify that that the information in this alternate source demonstration is accurate and meets the requirements of 40 CFR 257.94(e)(2). This certification is based on my review of the groundwater data and related site information available for the Columbia Energy Center Dry Ash Disposal Facility. I am a duly licensed Professional Engineer under the laws of the State of Wisconsin.

(signature)	5/31/2023 (date)

(printed or typed name)

License number E-29863

My license renewal date is July 31, 2024.

Pages or sheets covered by this seal:
Alternative Source Demonstration, October 2022 Detection Monitoring, Dry Ash Disposal Facility, Modules 4-6
Columbia Energy Center, Pardeeville, Wisconsin (Entire Document)

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1.0 INTRODUCTION

This Alternative Source Demonstration (ASD) was prepared to support compliance with the groundwater monitoring requirements of the "Coal Combustion Residuals (CCR) Final Rule" published by the U.S. Environmental Protection Agency (U.S. EPA) in the *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule*, dated April 17, 2015 (U.S. EPA, 2015), and subsequent amendments. Specifically, this report was prepared to fulfill the requirements of 40 CFR 257.94(e)(2). The applicable sections of the Rule are provided below in *italics*.

This ASD also provides the results for the October 2022 sampling event and a supplemental resampling event completed in November 2022.

1.1 §257.94(E)(2) ALTERNATIVE SOURCE DEMONSTRATION REQUIREMENTS

The owner and operator may demonstrate that a source other than the CCR Unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The owner or operator must complete the written demonstration within 90 days of detecting a statistically significant increase over background levels.

An ASD is completed when there are exceedances of one or more benchmarks established within the groundwater monitoring program. The ASD is completed to determine if any other sources are likely causes of the identified exceedance(s) of established benchmark(s) at the site. This ASD was performed in response to results indicating a statistically significant increase (SSI) over background levels during detection monitoring under the CCR Rule.

This ASD report is evaluating the SSIs observed in the statistical evaluation of the October 2022 detection monitoring event and the November 2022 resampling event at the Columbia Energy Center (COL) Dry Ash Disposal Facility, Modules 4-6 CCR Unit (Mod 4-6).

This ASD report is evaluating the SSIs for boron, chloride and calcium that were observed in the statistical evaluation of the October 2022 sampling and November 2022 resampling events.

1.2 SITE INFORMATION AND MAP

The COL site is located at W8375 Murray Road, Pardeeville, Columbia County, Wisconsin (**Figure 1**). The COL site is an active coal-burning generating station, which has been burning coal and disposing of CCR on site since the mid-1970s. The layout of the site is shown on **Figure 2**. The COL property includes two areas of CCR storage and disposal. These are the Dry Ash Disposal Facility (ADF) and the Ash Ponds Facility. This ASD evaluates the conditions at the site for Mod 4-6 of the ADF only. The Mod 4 CCR Unit became operational in 2018, following the construction of module 4 Modules 5 and 6 were constructed in 2021 and began receiving waste in 2022. The monitoring network certification was updated to include modules 5 and 6 on December 9, 2021, and the CCR Unit was subsequently referred to as Mod 4-6. The ADF is operated under the Wisconsin Department of Natural Resources (WDNR) License No. 3025.

The groundwater monitoring system at the COL Mod 4-6 facility monitors a single CCR Unit:

- COL Dry Ash Disposal Facility – Modules 4-6 (new landfill)

A map showing the CCR Unit and all background (or upgradient) and downgradient monitoring wells with identification numbers for the CCR groundwater monitoring program and the state monitoring program is provided on **Figure 2.** Separate monitoring systems have been established for the other CCR Units at COL, which include Modules 1-3 of the COL ADF, the primary ash pond, and the secondary ash pond.

1.3 STATISTICALLY SIGNIFICANT INCREASES IDENTIFIED

The statistical evaluation was completed in accordance with 40 CFR 257.93(f)(3) using a prediction interval procedure, in which an interval for each constituent is established from the distribution of the background data, and the level of each constituent in each compliance well is compared to the Upper Prediction Limit (UPL) to evaluate whether an SSI has occurred. The evaluation was based on an intrawell UPL with 1-of-2 retesting, calculated using Sanitas software. The retesting approach results in a slightly lower UPL, but only 1 of 2 samples collected for the event (original and retest) must meet the UPL to demonstrate compliance. The intrawell UPLs, and the October 2022 sampling results and the November 2022 resampling results, are summarized in the attached **Table 1.**

The October 2022 SSIs include the following parameters and wells:

- Boron: MW-309
- Calcium: MW-309
- Chloride: MW-310

Concentration trends for the parameters with SSIs are shown in **Appendix A.**

1.4 OVERVIEW OF ALTERNATIVE SOURCE DEMONSTRATION

This ASD report includes:

- Background information (**Section 2.0**)
- Evaluation of potential that SSIs are due to methodology or analysis (**Section 3.0**)
- Evaluation of potential that SSIs are due to natural sources or man-made sources other than the CCR Units (**Section 4.0**)
- ASD conclusions (**Section 5.0**)
- Monitoring recommendations (**Section 6.0**)

Historical monitoring results from background and compliance sampling for the CCR Rule constituent results with SSIs are provided in **Table 2.** The laboratory reports for the October 2022 detection monitoring event will be included in the 2023 Annual Groundwater Monitoring and Corrective Action Report to be submitted in January 2024. Complete laboratory reports for the background monitoring events and the previous detection monitoring events were included in previous annual groundwater monitoring and corrective action reports.

2.0 BACKGROUND

To provide context for the ASD evaluation, the following background information is provided in this section of the report, prior to the ASD evaluation sections:

- Geologic and hydrogeologic setting
- CCR Rule monitoring system
- Other monitoring wells

2.1 REGIONAL GEOLOGY AND HYDROGEOLOGY

2.1.1 Regional Information

For the purposes of groundwater monitoring, the surficial sand and gravel aquifer is considered to be the uppermost aquifer unit, as defined under 40 CFR 257.53, at the COL ADF. Immediately underlying the surficial sand and gravel aquifer is the Cambrian-Ordovician sandstone aquifer.

Additional details on the regional geology and hydrogeology were provided in the May 2020 ASD (SCS Engineers [SCS], 2020).

2.1.2 Site Information

Soils at the site are primarily sand to a depth of approximately 50 to 100 feet and overlie sandstone bedrock. Soils encountered during the site feasibility study for the COL ADF were described as generally sandy with interbedded silty clay lenses up to 20 feet thick (Warzyn Engineering, Inc. [Warzyn], 1978). During drilling of CCR well MW-301, the unconsolidated materials were identified as consisting primarily of silty sand. The boring log for previously installed monitoring well MW-84A shows silty sand and sand as the primary unconsolidated materials at these locations. CCR monitoring wells MW-84A and MW-301 are screened within the unconsolidated sand unit. The geology in the vicinity of wells MW-309, MW-310, and MW-311 is a poorly graded sand and gravel.

Shallow groundwater at the site generally flows to the northwest across the existing landfill area, then generally flows west toward the Wisconsin River. A groundwater flow map for October 2022 is shown on **Figure 3.** Historically, localized groundwater mounding was associated with the ash ponds. The October 2022 flow map shows temporary inward gradients in the vicinity of the Secondary Ash Pond due to groundwater dewatering activities. These temporary changes in flow do not affect groundwater flow directions in the vicinity of Mod 4-6. The groundwater elevation data for the state and CCR monitoring program wells are provided in **Table 3.**

2.2 CCR RULE MONITORING SYSTEM

The groundwater monitoring system established in accordance with the CCR Rule consists of two upgradient (background) monitoring wells and three downgradient monitoring wells. The background wells include MW-301 and MW-84A. The downgradient wells include MW-309, MW-310, and MW-311. The background wells are shared with the other COL CCR Units. The CCR Rule wells are installed within the sand and gravel aquifer. Well depths range from approximately 36 to 38 feet, measured from the top of the well casing.

2.3 OTHER MONITORING WELLS

Additional groundwater monitoring wells currently exist at COL as part of the monitoring systems developed for the state monitoring program and for the other CCR Units.

Monitoring wells for the state monitoring program are installed in the unconsolidated sand and gravel unit, which is the uppermost aquifer as defined under 40 CFR 257.53. This shallow monitoring system includes water table wells and mid-depth piezometers. Well depths range from approximately 14 to 76 feet, measured from the top of the well casing.

3.0 METHODOLOGY AND ANALYSIS REVIEW

To evaluate the potential that an SSI is due to a source other than the regulated CCR Unit, SCS used a two-step evaluation process. First, the sample collection, field and laboratory analysis, and statistical evaluation were reviewed to identify any potential error or analysis that led to exceedance of the benchmark. Second, potential alternative sources, including natural variation and man-made sources other than the CCR Unit, were evaluated. This section of the report provides the findings of the methodology and analysis review. Section 4.0 of the report addresses the potential alternative sources.

3.1 SAMPLING AND FIELD ANALYSIS

Field notes and sampling results were reviewed to determine if any sampling error may have caused or contributed to the observed SSIs. Potential field sampling errors or issues could include mislabeling of samples, improper sample handling, missed holding times, cross contamination during sampling, or other field error. Field blank sample results were also reviewed for any indication of potential contamination from sampling equipment or containers.

SCS collected samples on October 26 and 27, 2022. Retest samples were collected on November 30, 2022. Field parameter results were compiled by SCS and provided to the laboratory for inclusion in the laboratory report. SCS did not identify issues with the field analysis based on review of the data and field notes. Because boron, calcium, and chloride are laboratory parameters, there is little potential for a field analysis error to contribute to an SSI.

3.2 LABORATORY ANALYSIS REVIEW

The laboratory reports for the October 2022 detection monitoring event and the November 2022 resampling event were reviewed to determine if any laboratory analysis error or issue may have caused or contributed to an observed SSI for boron, chloride, or calcium. The laboratory report review included reviewing the laboratory quality control flags and narrative, verifying that correct methods were used and desired detection limits were achieved, and checking the field and laboratory blank sample results.

Following evaluation of the October 2022 sampling results, SCS resampled MW-309 and MW-310 for specific parameters on November 30, 2022. The resampling was performed on select parameters that exceeded UPLs in the October 2022 event, including boron and calcium for MW-309 and calcium and chloride for MW-310. Based on the review of the laboratory reports, SCS did not identify any additional issues due to a laboratory analysis error in the other laboratory reports. There were no laboratory quality control flags or issues identified in the laboratory reports that affect the usability of the data for detection monitoring.

Time series plots of the SSI constituent analytical data were also reviewed for any anomalous results that might indicate a possible sampling or laboratory error (e.g., dilution error or incorrect sample labeling). The time series plots are provided in Appendix A. The boron and chloride concentrations observed are within the range of historical concentrations. The calcium concentrations detected at MW-309 in October and November 2022 are higher than previous results but are similar to each other, indicating that these results are not due to a sampling or laboratory error.

3.3 STATISTICAL EVALUATION REVIEW

The review of the statistical results and methods included a quality control check of the following:

- Input analytical data vs. laboratory analytical reports
- Statistical method and process for each SSI

Based on the October 2022 sampling results and the November 2022 retest results, SSIs for boron and calcium occurred for MW-309, and an SSI occurred for chloride at MW-310 for the October 2022 semiannual event. The intrawell UPL at MW-310 was exceeded for calcium in October 2022, but the resample result in November 2022 was below the UPL. Therefore, according to the 1-of-2 retesting approach, there was no SSI for calcium at MW-310 in October 2022.

Based on the review of the statistical evaluation, SCS did not identify any errors in the statistical evaluation that caused or contributed to the determination of intrawell SSIs for boron, calcium, and/or chloride at wells MW-309 and MW-310. However, the small size of the intrawell background data set (eight samples per well) and the short timeframe over which they were collected (8 months) may have contributed to the identification of the October 2022 result as SSIs. The small background data set collected from February through September 2018 likely does not represent the full range of variability in background concentrations at the compliance monitoring wells. The Unified Guidance for Statistical Analysis of Groundwater Monitoring Data at Resource Conservation and Recovery Act (RCRA) Facilities (U.S. EPA, 2009; Section 5.3.1) recommends periodic updating of background for both intrawell and interwell analyses. For semiannual monitoring, an update interval of 2 to 3 years is recommended; therefore, a UPL update is planned for 2023.

3.4 SUMMARY OF METHODOLOGY AND ANALYSIS REVIEW FINDINGS

In summary, there were no changes to the SSI determinations for the October 2022 monitoring event based on the methodology and analysis review, and no errors or issues caused or contributed to the reported SSIs.

4.0 ALTERNATIVE SOURCES

This section discusses the potential alternative sources for the boron, calcium, and chloride SSIs at the downgradient monitoring wells; identifies the most likely alternative source(s); and presents the lines of evidence indicating that an alternative source is the most likely cause of the observed SSIs.

4.1 POTENTIAL CAUSES OF SSI

4.1.1 Natural Variation

The statistical analysis was completed using an intrawell approach, comparing the October 2022 detection monitoring results to the UPLs calculated based on background sampling of the compliance wells (MW-309, MW-310, and MW-311). If concentrations of a constituent that is naturally present in the aquifer vary with time, then the potential exists that the compliance sampling concentrations may be higher than background concentrations due to natural temporal variation.

Temporal variation can occur seasonally or due to longer-term events such as changes in infiltration patterns and groundwater flow directions caused by wet or dry years.

Background sampling at the three MOD 4-6 compliance wells was performed prior to disposal of CCR in MOD 4-6. Because the background sampling at the three compliance wells was performed after other potential man-made sources of boron, calcium, and chloride had been in operation for many years, it is difficult to determine how much of the variation in boron, calcium, and chloride concentrations is due to natural sources versus man-made alternative sources associated with the long-term use of the property, as discussed in **Section 4.1.2**. Based on comparison to the two upgradient wells, it appears likely that boron, calcium, and chloride may reflect man-made sources. Based on historical data showing calcium concentrations at many site monitoring wells that are comparable to the October and November 2022 concentrations at MW-309, it appears that the elevated calcium concentration may also be at least partially due to natural fluctuations. Regardless of the source, natural temporal variations in infiltration and groundwater flow direction may have contributed to the SSIs for boron and calcium at MW-309 and for chloride at MW-310.

4.1.2 Man-Made Alternative Sources

Man-made alternative sources that could potentially contribute to the boron, calcium, and chloride SSIs could include the closed ash pond landfill, the active and inactive ash ponds (currently in the closure process), the surface water/leachate collection pond for the ADF, the former ash pond effluent ditch, the coal storage area, railroad operations, road salt use, and/or other plant operations.

Based on the historic groundwater flow directions and on previous investigations at the site, the ash ponds and the former ash pond effluent ditch appear to be the most likely cause of the boron SSI for well MW-309.

Road salt use appears to be the most likely cause of the chloride SSI for MW-310. Road salt use also appears to be a likely cause for the calcium SSI for MW-309, as a result of sodium-calcium cation exchange.

4.2 LINES OF EVIDENCE

The lines of evidence indicating that the SSIs for boron, calcium, and chloride in compliance wells MW-309 and MW-310, relative to the intrawell background sampling, are due to one or more alternative sources include:

1. The detected concentrations of boron and chloride exceeding intrawell UPLs are below the background concentrations at other wells in the monitoring network. These results indicate that concentrations in these ranges were present in the groundwater in this area prior to initiation of CCR disposal in the Mod 4-6 CCR Unit. The background data for the intrawell statistical analysis represent pre-disposal conditions. Information about the historical boron and chloride concentrations is presented in **Section 4.2.1**.

2. The detected concentrations of calcium exceeding the intrawell UPL at MW-309 are within the range of concentrations detected at other on-site wells in the 1980s. These results indicate that concentrations in this range were present in the groundwater on site prior to the construction of the ADF. The background data for the intrawell statistical analysis represent pre-disposal conditions. Information about the historical calcium concentrations is presented in **Section 4.2.2**.

3. MW-309 and MW-310 are located adjacent to the plant entrance road, where elevated chloride concentrations due to road salt impacts are likely. Elevated calcium concentrations can also be caused by cation exchange following road salt application. More information about the effects of road salt on the chloride and calcium concentrations is presented in **Section 4.2.3**.

4. The Mod 4-6 CCR Unit was constructed with a composite liner system and leachate collection system. Module 4 has only been receiving CCR since late 2018 and Modules 5 and 6 started receiving CCR in 2022; therefore, it is very unlikely that a release from Mod 4-6 could have reached MW-309 and MW-310 by October 2022. More information about the composite liner is presented in **Section 4.2.4**.

Each of these lines of evidence and the supporting data are discussed in more detail in the following sections.

4.2.1 Background Concentrations – Boron and Chloride

Historical boron and chloride concentrations for all five Mod 4-6 wells are shown in **Table 2** and on the time series plots in **Appendix A.** As shown on the time series plots, the concentrations of boron in the May 2020 through June 2021 samples from MW-309 were higher than the background results at MW-309, but do not exceed the range of background sampling results for MW-310, located approximately 300 feet to the west along Murray Road.

As discussed in more detail in the ASD for the May 2020 monitoring event (SCS, 2020), the background concentrations of boron in the area of the Mod 4-6 compliance wells likely reflect historical ash management activities at the site under different groundwater flow conditions. The background data for the intrawell statistical analysis represent pre-disposal conditions at MOD 4-6.

For chloride, the October 2022 results at MW-310 exceeded the intrawell UPL based on the 2018 background sampling at this well, but the chloride concentrations were lower than those detected in current monitoring at MW-309 (**Appendix A**).

These results indicate that boron and chloride concentrations in the ranges detected at the Mod 4-6 compliance wells in October and November 2022 were present in the groundwater in this area prior to initiation of CCR disposal in the Mod 4-6 CCR Unit. Based on these results, it is likely that the boron and chloride concentrations from natural and/or man-made alternative sources have varied in concentration at MW-309 and MW-310 in response to changes in groundwater flow and infiltration.

4.2.2 Background Concentrations – Calcium

Historical calcium concentrations for non-CCR Rule wells at the ADF and select wells associated with the Ash Ponds site are included in **Appendix B.** Both tabulated data and a plot of calcium concentrations over time are included in **Appendix B.** This table and plot include historical data available in the WDNR Groundwater Environmental Monitoring System (GEMS) database for monitoring wells at the COL ADF.

The earliest calcium data available from the GEMS database for wells associated with the ADF are from September 1984. Initial placement of CCR in test plots in Module 1 of the ADF was approved in October 1984, and CCR disposal began sometime after that. Therefore, the initial groundwater monitoring results in the GEMS database represent pre-disposal conditions for the landfill. The historical results for the ADF wells are from 1984 through 1987, and the results for the Ash Ponds site wells are from 1981 through 1992. Data for two wells associated with the COL Ash Ponds site, and located approximately 850 feet and 1,400 feet from MW-309, are also included in **Appendix B.**

The historical data show fluctuating historical calcium concentrations. Of the landfill wells and two closest pond wells to MW-309, 15 wells have historic calcium concentrations above 100 mg/L and four wells have at least one concentration above 150 mg/L.

These results indicate that the calcium concentrations detected in October and November 2022 at MW-309 were present in the groundwater in this area prior to construction of the ADF and initiation of CCR disposal in Mod 4-6, and the calcium SSI at MW-309 may be at least partially attributed to background concentrations.

4.2.3 Location Adjacent to Entrance Road

Monitoring well MW-310 is located adjacent to the plant entrance road, where elevated chloride concentrations due to road salt impacts are likely. In order to be located as close as possible to the waste boundary of the CCR Unit (including the Mod 5/6 additions constructed in 2021), these wells are installed between the entrance road and the storm water ditch on the south side of the road. At this location, there is a high potential for road salt application to result in increased chloride concentrations in groundwater.

It appears that elevated calcium concentrations at MW-309 are also at least partially attributable to road salt application. Calcium concentrations at both MW-309 and MW-310 are strongly correlated with chloride concentrations, with R^2 values greater than 0.6 (**Appendix C**); this correlation would be expected if calcium is being mobilized through cation exchange with sodium following road salt application. If complete cation exchange were occurring between sodium (from road salt) and calcium, an increase of two moles of chloride per mole of calcium would be expected. The actual ratio is higher, as indicated by the trendline slopes in **Appendix C**, indicating that incomplete cation exchange is occurring. Calcium concentrations at MW-309 and MW-310 are not strongly correlated with sulfate concentrations (**Appendix C**), indicating that co-dissolution of calcium and sulfate from anhydrite or gypsum in CCR (specifically flue gas desulfurization waste) is not a likely source of the increase in calcium concentrations. The molar concentrations for sulfate are lower than for calcium, which is not consistent with a CCR/flue gas desulfurization (FGD) source. Sulfate is expected to be more mobile than calcium in groundwater and would be expected to be at a similar or higher concentration than calcium if the source was a release from Mod 4-6.

A temporary increase in both calcium and chloride concentrations was previously observed at MW-309 in August 2018, prior to CCR disposal in Mod 4-6 (**Appendix A**). These fluctuations indicate that the increased concentrations are at least partly attributable to a seasonal or impermanent source such as road salt application.

4.2.4 Mod 4-6 Composite Liner

The Mod 4-6 CCR Unit was constructed with a composite liner system and leachate collection system, and has only been receiving CCR since late 2018; therefore, it is very unlikely that a release from Mod 4-6 could have reached MW-309 and MW-310 by October 2022. The liner system includes the following:

- 2 feet of compacted clay
- Geosynthetic clay liner (GCL)
- 60-mil high density polyethylene (HDPE) geomembrane
- Leachate collection drainage layer
- Leachate collection piping

The liner was constructed in 2018, and CCR placement in Mod 4 began in November 2018. CCR placement in Mod 5-6 began in 2022.

Given the liner system in place, a release from Mod 4-6 would have to penetrate the HDPE liner at a flaw, flow vertically through the GCL and compacted clay liner, and travel with the groundwater approximately 600 feet north to MW-309 and MW-310 from Module 4 in less than four years, or travel to the wells from Modules 5 and 6 in less than one year. Based on the hydraulic conductivity of the liner clay (10^{-8} centimeters/second) and the very low estimated average groundwater velocity (0.2 to 4 feet per year [SCS, 2021b]), it is very unlikely that changes in boron, calcium, and chloride concentrations at MW-309 and MW-310 reflect a release from Mod 4-6. Extensive testing was performed as part of the WDNR-approved construction documentation (SCS, 2021b) to document the proper construction of the liner.

5.0 ALTERNATIVE SOURCE DEMONSTRATION CONCLUSIONS

The lines of evidence discussed above regarding the SSIs reported for boron and calcium at MW-309 and for chloride at MW-310 demonstrate that the SSIs are likely due to sources other than the Mod 4-6 CCR Unit. Similar boron and chloride concentrations were present in the area prior to disposal of CCR in Mod 4-6. Similar calcium concentrations were historically detected at other monitoring wells located around the landfill and to the southeast of the ponds. The SSIs likely reflect road salt impacts (chloride and calcium) and impacts associated with historical discharges from the ash ponds via the effluent ditch located west of the landfill (boron). Natural variation associated with changes in infiltration and groundwater flow may also have contributed to the SSI for calcium.

6.0 SITE GROUNDWATER MONITORING RECOMMENDATIONS

In accordance with section 257.94(e)(2) of the CCR Rule, the COL Mod 4-6 CCR Unit may continue with detection monitoring based on this ASD. The ASD report will be included in the 2023 Annual Report due January 31, 2024.

7.0 REFERENCES

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Warzyn Engineering, Inc., 1978, Feasibility Study, Proposed Fly Ash and/or Scrubber Sludge Disposal Facility – Columbia Site, Wisconsin Power and Light Company, Town of Pacific, Columbia County, WI, January 1978.

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Tables

Table 1. Groundwater Analytical Results Summary
Columbia Dry Ash Disposal Facility - Modules 4-6 / SCS Engineers Project #25223067.00

Parameter Name	Background Wells		Compliance Wells							
	MW-84A	MW-301	MW-309			MW-310			MW-311	
	10/27/2022	10/27/2022	Intrawell UPL	10/26/2022	11/30/2022	Intrawell UPL	10/26/2022	11/30/2022	Intrawell UPL	10/27/2022
Boron, µg/L	12.2	37.5	42.2	46.6	49.3	81.9	71.3	--	49.8	34.2
Calcium, µg/L	78,400	62,800 P6	99,900	162,000	153,000	56,000	68,900	55,500	84,200	66,300
Chloride, mg/L	3.4	2.3	901	796	--	205	323	215	4.41	1.2 J
Fluoride, mg/L	<0.095	<0.095 M0	DQ	<0.095	--	DQ	<0.095	--	DQ	<0.095
Field pH, Std. Units	7.31	6.80	8.18	7.23	--	8.12	7.61	--	8.07	7.50
Sulfate, mg/L	1.1 J	11.6	53.1	28.9	--	118	32.8	--	131	15.5
Total Dissolved Solids, mg/L	302	282	1,730	1670	--	759	750	--	462	268

4.4 Blue shaded cell indicates the compliance well result exceeds the UPL (background) and the Limit of Quantitation (LOQ).

Abbreviations:
mg/L = milligrams per liter
µg/L = micrograms per liter
-- = Not Analyzed
SSI = Statistically Significar
LOD = Limit of Detection
DQ= Double Quantification
LOQ = Limit of Quantitation

Lab Notes:
J = Estimated concentration at or above the LOD and below the LOQ.
P6 = Matrix spike recovery was outside laboratory control limits due to a parent sample concentration notably higher than the spike level.
M0 = Matrix spike recovery and/or matrix spike duplicate recovery was outside laboratory control limits.

Note:
1. Intrawell UPLs based on 1-of-2 retesting approach; therefore, there is no SSI unless the original sample result and a retest result are above the UPL.
2. Intrawell UPL for fluoride is based on the double quantification rule, because fluoride was not detected above the LOQ in the background samples.

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Last revision by:	NLB	Date:	4/26/2023
Checked by:	RM	Date:	5/3/2023
Scientist/PM QA/QC:	TK	Date:	5/15/2023

I:\25223067.00\Deliverables\COL MOD 4 ASD - October 2022\Tables\[Table 1 - COL LF MOD 4_Screening Summary - Oct 2022.xlsx]Table 1 - 2022 Analytical

Table 2. Historical Analytical Results for Parameters with SSIs
Columbia Dry ADF, Modules 4-6

Well Group	Well	Collection Date	Boron (µg/L)	Calcium (µg/L)	Chloride (mg/L)
Background	MW-301	12/22/2015	26.5	126,000	3.70 J
		4/5/2016	25.2	115,000	4.00
		7/8/2016	23.6	108,000	3.50 J
		10/13/2016	30.6	118,000	2.20
		12/29/2016	32.8	129,000	2.00 J
		1/25/2017	32.6	124,000	1.50 J
		4/11/2017	28.8	120,000	2.00
		6/6/2017	21.3	111,000	3.50
		8/8/2017	30.6	108,000	5.50
		10/23/2017	34.3	87,200	4.00
		4/25/2018	24.3	112,000	2.30
		8/8/2018	22.8	105,000	5.20
		10/24/2018	27.8	101,000	3.20
		4/2/2019	26.9	126,000	0.79 J
		10/9/2019	35.9	114,000	1.70
		2/3/2020	27.9	113,000	1.30 J
		5/29/2020	21.3	112,000	2.00 J
		10/8/2020	28.8	93,000	3.40
		4/14/2021	22.2	117,000	1.50 J
		10/14/2021	31.4	67,800 P6	2.7
		4/13/2022	28.7	97,300	1.9 J
		10/27/2022	37.5	62,800 P6	2.30
	MW-84A	12/22/2015	11.9	74,000	4.90
		4/5/2016	14.0	72,200	4.70
		7/8/2016	14.7	67,600	5.10
		10/13/2016	11.1	74,000	4.30
		12/29/2016	14.7	76,000	4.70
		1/25/2017	16.1	70,800	4.60
		4/11/2017	12.9	73,200	4.90
		6/6/2017	14.8	76,100	5.50
		8/8/2017	22.9	74,900	5.50
		10/24/2017	13.8	77,500	5.10
		4/25/2018	25.0	76,600	4.80
		8/8/2018	12.8	76,000	4.90
		10/24/2018	10.1 J	74,000	4.20
		4/3/2019	13.6	80,100	3.60
		10/9/2019	12.0	73,500	3.90
		2/3/2020	15.7	72,700	3.70
		5/29/2020	10.0	77,600	3.70
		10/8/2020	9.7 J	69,200	4.30
		4/14/2021	14.3	69,100	4.40
		10/14/2021	11.1	75,300	3.5 M0
		4/13/2022	10.5	75,100	5.20
		10/27/2022	12.2	78,400	3.4

Table 2. Historical Analytical Results for Parameters with SSIs
Columbia Dry ADF, Modules 4-6

Well Group	Well	Collection Date	Boron (µg/L)	Calcium (µg/L)	Chloride (mg/L)
Compliance	MW-309	2/21/2018	31.4	42,700	147
		3/23/2018	31.0	41,800	157
		4/23/2018	30.4	39,600	157
		5/24/2018	28.0	52,700	141
		6/23/2018	26.6	67,600	203
		7/23/2018	35.5	63,800	557
		8/22/2018	40.5	93,600	811
		9/21/2018	30.0	55,200	329
		4/2/2019	37.4	45,300	145
		10/8/2019	33.4	46,900	43.2
		5/29/2020	54.6	51,600	350
		6/30/2020	50.7	--	--
		8/6/2020	55.3	--	--
		10/8/2020	57.7	65,300	575
		12/11/2020	65.9	--	--
		4/13/2021	48.0	62,300	390
		6/11/2021	49.9	--	--
		10/14/2021**	36.4	83,100	519
		4/12/2022	32.5	80,200	319
		10/26/2022*	46.6	162,000	796
		11/30/2022	49.3	153,000	--
	MW-310	2/21/2018	67.1	32,400	19.8
		3/23/2018	62.1	33,400	21.7
		4/23/2018	60.7	32,100	22.1
		5/24/2018	59.2	32,100	68.6
		6/23/2018	61.4	34,300	59.8
		7/23/2018	69.5	39,700	118
		8/22/2018	64.2	38,800	139
		9/21/2018	80.3	54,100	152
		4/2/2019	73.0	38,800	76.0
		10/8/2019	81.8	57,600	190
		12/23/2019	--	55,400	--
		5/29/2020	74.4	41,100	128
		10/8/2020	77.6	62,000	310
		12/11/2020	--	56,800	227
		4/13/2021	69.6	49,300	227
		6/11/2021	--	--	220
		10/14/2021	72.0	38,900	84.5
		4/12/2022	72.0	31,900	35.2
		10/26/2022*	71.3	68,900	323
		11/30/2023	--	55,500	215
	MW-311	2/21/2018	43.7	58,000	2.90
		3/23/2018	42.7	61,000	2.70
		4/23/2018	40.1	56,600	2.60
		5/24/2018	31.7	62,500	3.50
		6/23/2018	33.6	70,700	3.00
		7/23/2018	30.1	76,800	2.00 J
		8/22/2018	32.4	65,700	2.00 J
		9/21/2018	27.5	75,400	3.90
		4/2/2019	35.7	65,600	1.90 J
		10/8/2019	33.5	63,900	1.50 J
		5/29/2020	25.7	62,200	1.50 J
		10/8/2020	26.2	73,400	1.40 J
		4/14/2021	33.6	59,000	1.30 J
		10/14/2021	31.7	61,000	1.3 J
		4/12/2022	32.7	61,800	1.0 J
		10/27/2022	34.2	66,300	1.2 J

Table 2. Historical Analytical Results for Parameters with SSIs
Columbia Dry ADF, Modules 4-6

Abbreviations:
μg/L = micrograms per liter or parts per billion (ppb)
mg/L = milligrams per liter or parts per million (ppm)
-- = Not sampled
J = Estimated value below the laboratory's limit of quantitation
* - re-sampled and analyzed for boron & calcium on 11/30/2022
** - re-sampled for boron on pH on 12/21/2021

Note:
(1) Complete laboratory reports included in the Annual Groundwater Monitoring and Corrective Action Reports.

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Last revision by:	NLB	Date:	4/26/2023
Checked by:	RM	Date:	5/3/2023
PM QC Check:	TK	Date:	5/15/2023

I:\25223067.00\Deliverables\COL MOD 4 ASD - October 2022\Tables\[Table 2 - Historical Analytical Results

Table 3. Groundwater Elevation - State Monitoring Program and CCR Well Network
Columbia Dry Ash and Ash Pond Disposal Facilities / SCS Engineers Project #25223067.00

	Well Number	MW-1AR	MW-4	MW-5R	MW-33AR	MW-33BR	MW-34A	MW-34B	MW-37A	MW-83	MW-84A	MW-84B	MW-86	MW-91AR	MW-91B	MW-92A	MW-92B	MW-93A	MW-93B	MW-312
Dry Ash Facility (Facility ID #03025)	**Top of Casing Elevation (feet amsl)**	822.55	819.74	805.44	808.29	808.39	805.95	806.05	813.04	807.96	814.28	814.26	824.79	809.03	808.45	808.47	808.41	827.89	827.71	826.79
	Screen Length (ft)																	10	5	10
	Total Depth (ft from top of casing)	44.40	39.58	25.97	31.08	57.50	35.43	56.95	31.80	25.42	40.21	52.02	45.43	32.90	52.38	28.94	51.75	50.7	82.5	52.5
	Top of Well Screen Elevation (ft)	778.15	780.16	779.47	777.21	750.89	770.52	749.10	781.24	782.54	774.07	762.24	779.36	776.13	756.07	779.53	756.66	787.19	750.21	784.29
	Measurement Date																			
	October 2, 2012	783.41	783.70	784.96	782.38	782.23	783.03	782.99	782.66	dry	783.84	783.94	783.81	784.09	783.90	784.49	784.06	NI	NI	NI
	April 15, 2013	785.44	784.02	786.09	784.16	784.14	784.74	784.79	783.87	784.49	785.83	785.76	785.22	785.14	785.01	785.75	785.34	NI	NI	NI
	October 8, 2013													785.66	785.42	785.97	785.52	NI	NI	NI
	October 15, 2013	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	785.66	785.42	785.97	785.52	NI	NI	NI
	April 14, 2014	784.95	784.09	785.63	783.74	783.91	784.63	784.70	783.45	783.73	785.58	785.52	784.96	785.04	784.96	785.99	785.54	NI	NI	NI
	October 2-3, 2014	785.03	785.39	786.08	784.37	784.28	784.57	784.54	784.56	dry	785.24	785.18	785.19	785.47	785.28	785.75	785.33	NI	NI	NI
	April 13-14, 2015	783.96	783.63	785.25	783.01	782.74	783.65	783.95	782.87	dry	784.43	784.51	784.17	784.48	784.37	785.07	784.66	NI	NI	NI
	October 6-7, 2015	784.28	784.44	785.72	783.68	783.33	784.05	784.02	783.66	dry	784.80	784.76	784.66	784.89	784.70	785.20	784.76	NI	NI	NI
	April 4-6, 2016	785.82	aband	787.02	785.29	785.07	785.63	785.67	784.76	785.43	786.37	786.26	785.89	786.05	785.95	786.61	786.21	NI	NI	NI
	October 11-13, 2016	786.64	aband	788.00	787.36	786.46	786.45	786.32	786.40	786.81	787.22	787.11	786.96	787.17	786.81	787.68	787.25	NI	NI	NI
	April 10-13, 2017	786.96	aband	788.13	786.39	785.99	786.30	786.28	786.34	786.23	787.16	787.06	786.96	787.24	787.03	787.90	787.60	NI	NI	NI
	October 3-5, 2017	785.48	aband	786.66	784.51	784.22	784.67	784.63	784.86	784.29	NM	786.49	785.58	786.08	785.83	786.47	786.02	NI	NI	NI
	October 9-10, 2017	NM	aband	NM	NM	NM	NM	NM	NM	NM	785.56 [6]	NM	NM	NM	NM	NM	NM	NI	NI	NI
	February 21, 2018	783.97	aband	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	784.68	784.46	NM	NM	NI	NI	NI
	April 23-25, 2018	783.99	aband	785.36	783.09	786.36	781.77	780.79	783.28	783.32	785.88	784.91	782.54	784.71	784.53	785.23	784.81	NI	NI	NI
	October 23-25, 2018	788.25	aband	789.71	788.77	787.96	787.88	787.73	787.62	788.26	788.32	788.19	788.21	788.59	788.31	789.32	788.87	NI	NI	NI
	April 1-4, 2019	787.05	aband	788.64	786.63	786.54	786.82	786.92	786.47	786.78	787.35	787.34	787.16	787.45	787.18	788.04	787.63	NI	NI	NI
	October 7-9, 2019	787.26	aband	789.23	788.26	787.64	787.92	787.74	786.77	788.90	787.79	787.73	787.44	787.78	787.62	788.63	788.17	NI	NI	NI
	May 27-28, 2020	786.92	aband	788.34	786.01	785.75	785.98	785.99	786.22	786.03	787.02	786.99	786.94	787.26	787.05	787.86	787.47	NI	NI	NI
	October 7-8, 2020	785.95	aband	787.76	785.91	785.45	785.70	785.68	785.52	785.72	786.10	786.06	786.10	786.55	786.33	786.85	786.38	NI	NI	NI
	February 25, 2021	NM	aband	NM	NM	NM	784.75	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NI	NI	NI
	April 14, 2021	778.12	aband	787.29	784.27	784.05	784.77	784.77	784.46	c	785.84	785.81	785.60	785.86	785.69	786.47	786.06	NI	NI	NI
	June 11, 2021	NM	aband	NM	784.19	NM	784.66	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NI	NI	NI
	October 11-12, 14, 2021	784.47	adand	786.78	783.73	783.60	784.42	784.41	783.88	783.87	784.96	784.88	784.79	785.14	784.94	785.55	785.11	NI	NI	NI
	October 17, 2021	NM	adand	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NI	NI	NI
	April 1, 2022	aband	aband	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
	April 11-13, 2022	aband	adand	785.52	783.27	783.45	784.30	784.42	783.26	783.78	785.02	785.00	784.70	784.83	784.72	785.45	785.02	783.99	783.97	783.73
	October 24-28, 2022	aband	aband	785.43	781.94	781.61	783.61	783.61	782.28	dry	784.57	784.54	784.38	784.64	784.47	785.05	784.62	783.74	782.76	783.50
	Bottom of Well Elevation (ft)	778.15	780.16	779.47	777.21	750.89	770.52	749.10	781.24	782.54	774.07	762.24	779.36	776.13	756.07	779.53	756.66	777.19	745.21	774.29

	Well Number	M-3	M-4R	MW-39A	MW-39B	MW-48A	MW-48B	MW-57	MW-59	MW-216R	MW-217	MW-220RR	SG-1	SG-2	SG-3	SG-4
Ash Pond Facility (Facility ID #02325)	**Top of Casing Elevation (feet amsl)**	788.23	806.10	809.62	809.50	828.86	828.84	786.29	815.48	814.21	791.55	792.90	792.06	795.25	808.60	805.36
	Screen Length (ft)															
	Total Depth (ft from top of casing)	16.90	25.55	34.80	76.07	51.88	75.80	14.40	38.50	37.85	37.37	18.96	--	--	--	--
	Top of Well Screen Elevation (ft)	771.33	780.55	774.82	733.43	776.98	753.04	771.89	776.98	776.36	754.18	773.94	--	--	--	--
	Measurement Date															
	October 2, 2012	780.13	786.76	781.49	781.34	782.03	781.93	780.58	779.88	781.91	780.95	780.55	789.14	793.85	dry	dry
	April 15, 2013	785.16	788.39	783.97	784.00	783.77	783.78	784.69	783.66	784.09	784.75	785.02	789.5 [1]	NM	dry	dry
	October 8, 2013	781.22	786.67	NM	NM	783.69	783.58	NM	NM	783.39	782.27	782.36	789.5 [1]	791.33	dry	dry
	October 15, 2013	NM	NM	782.94	782.81	NM	NM	782.47	783.49	NM	NM	NM	NM	NM	NM	NM
	April 14, 2014	786.04	788.96	783.57	783.68	783.56	783.57	785.51	783.41	783.73	785.25	785.87	788.90	dry	dry	dry
	October 1-3, 2014	781.16	787.55	783.42	783.32	784.05	783.94	782.32	783.55	783.79	782.63	783.03	NM	dry	dry	dry
	April 13-14, 2015	783.08	786.83	782.77	782.68	782.80	782.82	782.81	782.83	782.93	783.34	783.42	789.3	791.70	dry	dry
	October 6-7, 2015	780.66	786.12	782.97	782.81	783.10	783.01	781.82	783.25	783.18	781.95	782.26	788.48	791.58	dry	dry
	April 4-6, 2016	784.21	789.09	785.27	785.27	784.79	784.76	783.21	784.97	785.68	785.02	784.36	NM	793.40	dry	dry
	October 11-13, 2016	781.88	787.88	785.75	785.52	785.73	785.61	783.12	786.51	786.16	783.75	784.09	788.32	792.52	dry	dry
	April 10-13, 2017	782.94	787.95	785.44	785.20	785.82	785.69	782.77	786.09	785.95	784.29	784.09	788.31	793.85	dry	dry
	October 3-5, 2017	780.93	787.04	783.35	783.18	784.30	784.19	782.37	784.23	783.89	782.48	782.61	788.3	793.45	dry	dry
	April 23-25, 2018	782.89	790.43	782.86	782.87	783.14	783.09	783.04	783.02	783.23	783.26	783.45	788.38	>795.25	dry	dry
	October 23-25, 2018	782.95	788.47	787.12	786.88	787.12	786.99	783.48	787.73	787.49	784.90	784.52	787.76	793.25	dry	dry
	April 1-4, 2019	785.68	789.44	786.28	786.31	786.56	786.45	785.27	787.39	786.53	786.33	785.46	788.40	794.60	dry	dry
	October 7-9, 2019	785.33	790.65	787.10	787.02	786.68	786.65	785.29	786.68	787.07	786.01	785.42	748.48	795.20	dry	dry
	May 27-29, 2020	781.80	787.73	785.12	784.92	785.74	785.59	783.11	785.89	785.60	783.41	783.89	748.48	>795.25	dry	dry
	Bottom of Well Elevation (ft)	771.33	780.55	774.82	733.43	776.98	753.04	771.89	776.98	776.36	754.18	773.94	--	--	--	--

Table 3. Groundwater Elevation - State Monitoring Program and CCR Well Network
Columbia Dry Ash and Ash Pond Disposal Facilities / SCS Engineers Project #25223067.00

	Well Number	MW-301	MW-302	MW-303	MW-304	MW-305	M-4R	MW-33AR	MW-34A	MW-84A	MW-306	MW-307	MW-308	MW-309	MW-310	MW-311	MW-312	MW-313	MW-314	MW-315
CCR Rule Wells	**Top of Casing Elevation (feet amsl)**	806.89	813.00	815.72	805.42	806.32	806.10	808.29	805.95	814.28	807.63	806.89	806.9	813.27	813.62	809.74	826.786	820.30	821.57	819.78
	Screen Length (ft)	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Total Depth (ft from top of casing)	29.40	33.6	35.80	25.7	25.6	39.58	31.08	35.43	40.21	27	26.5	28	37.67	38.41	36.19	52.5			
	Top of Well Screen Elevation (ft)	787.49	789.40	785.72	789.72	790.72	776.52	787.21	780.52	784.07	790.63	790.39	788.90	785.60	785.21	783.55	784.29			
	Measurement Date																			
	December 21-22, 2015	785.56	784.78	784.11	786.13	788.96	787.58	783.77	783.50	785.31	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
	April 4-5, 2016	786.78	785.81	785.48	788.08	789.61	789.09	785.29	785.63	786.37	--	--	--	--	--	--	NI	NI	NI	NI
	July 7-8, 2016	786.31	786.28	784.60	787.36	789.26	787.43	785.19	785.05	785.89	--	--	--	--	--	--	NI	NI	NI	NI
	July 28, 2016	NM	NM	784.35	NM	NM	NM	NM	784.86	785.61	--	--	--	--	--	--	NI	NI	NI	NI
	October 11-13, 2016	787.64	787.76	786.18	788.18	789.78	787.88	787.36	786.45	787.22	--	--	--	--	--	--	NI	NI	NI	NI
	December 29, 2016	787.37	787.05	NM	NM	NM	NM	785.66	785.72	786.63	--	--	--	--	--	--	NI	NI	NI	NI
	January 25-26, 2017	787.27	786.89	785.28	789.34	789.36	789.64	785.88	785.98	786.70	785.50	785.36	785.73	--	--	--	NI	NI	NI	NI
	April 10 & 11, 2017	787.89	787.55	786.00	788.22	789.57	787.95	786.39	786.30	787.16	786.22	785.64	786.51	--	--	--	NI	NI	NI	NI
	June 6, 2017	788.25	788.37	786.49	788.58	789.79	787.83	787.27	786.66	787.63	786.85	786.07	786.46	--	--	--	NI	NI	NI	NI
	August 7-9, 2017	787.34	787.55	785.42	789.52	789.30	788.54	786.11	785.81	786.68	785.69	785.19	785.37	--	--	--	NI	NI	NI	NI
	October 23-24, 2017	785.89	785.94	783.92	788.97	788.14	788.00	784.13	784.50	785.32	783.97	784.79	784.17	--	--	--	NI	NI	NI	NI
	February 21, 2018	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	783.19	783.05	783.02	NI	NI	NI	NI
	March 23, 2018	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	783.10	783.10	783.00	NI	NI	NI	NI
	April 23-25, 2018	785.29	784.37	783.27	789.69	787.67	790.43	783.09	781.77	785.88	783.24	783.65	782.65	783.07	782.97	781.83	NI	NI	NI	NI
	May 24, 2018	NM	NM	NM	NM	NM	NM	NM	NM	NM	785.79	785.09	NM	785.45	785.97	786.11	NI	NI	NI	NI
	June 23, 2018	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	786.03	786.64	786.47	NI	NI	NI	NI
	July 23, 2018	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	786.27	786.35	786.55	NI	NI	NI	NI
	August 7, 2018	787.06	NM	785.20	788.25	788.56	787.63	NM	NM	786.55	NM	NM	NM	NM	NM	NM	NI	NI	NI	NI
	August 22, 2018	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	785.54	785.40	785.46	NI	NI	NI	NI
	September 21, 2018	NM	788.37	786.50	NM	NM	NM	787.90	787.01	NM	NM	NM	NM	787.08	787.24	787.66	NI	NI	NI	NI
	October 22-24, 2018	788.98	789.16	787.51	789.05	790.04	788.47	788.77	787.88	788.32	787.66	786.57	787.81	787.99	788.18	788.64	NI	NI	NI	NI
	April 1-4, 2019	787.04	787.56	786.52	789.72	790.07	789.44	786.63	786.82	787.35	786.72	786.71	787.53	786.30	786.38	786.38	NI	NI	NI	NI
	June 12, 2019	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	787.25	NM	NI	NI	NI	NI
	June 19, 2019	NM	NM	786.81	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NI	NI	NI	NI
	October 7-9, 2019	788.47	788.31	787.02	790.41	790.36	790.65	NM	NM	NM	787.47	786.99	787.18	787.26	787.94	787.64	NI	NI	NI	NI
	December 13, 2019	--	--	--	--	--	--	--	--	--	787.03	785.68	786.43	--	--	--	NI	NI	NI	NI
	December 23, 2019	--	--	--	--	--	--	--	--	--	--	--	--	--	775.22	--	NI	NI	NI	NI
	January 17, 2020	--	--	785.58	--	--	--	--	--	--	--	--	--	--	--	--	NI	NI	NI	NI
	February 3, 2020	787.24	NM	NM	NM	NM	NM	NM	NM	786.50	785.77	785.57	786.48	NM	NM	NM	NI	NI	NI	NI
	May 27-29, 2020	787.77	787.29	785.56	789.30	787.78	787.73	786.01	785.98	787.02	785.77	785.35	786.28	785.98	785.81	785.85	NI	NI	NI	NI
	June 30, 2020	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	786.18	NM	NM	NI	NI	NI	NI
	August 6, 2020	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	785.93	NM	NM	NI	NI	NI	NI
	October 7-8, 2020	786.53	786.74	785.16	788.52	787.96	787.74	785.91	785.70	786.10	785.39	784.71	785.68	785.47	785.56	785.83	NI	NI	NI	NI
	December 11, 2020	NM	NM	NM	NM	788.19	NM	NM	NM	NM	NM	NM	NM	785.26	785.26	NM	NI	NI	NI	NI
	February 25, 2021	NM	NM	784.27	NM	788.36	NM	NM	784.75	NM	NM	NM	NM	NM	NM	NM	NI	NI	NI	NI
	April 12, 2021	786.50	785.77	784.07	787.99	788.11	786.34	784.27	784.77	785.84	784.32	784.21	785.55	784.29	784.24	784.15	NI	NI	NI	NI
	June 11, 2021	NM	NM	NM	NM	NM	NM	784.19	784.66	NM	NM	NM	NM	784.20	784.05	NM	NI	NI	NI	NI
	July 20, 2021	NM	NM	783.64	NM	788.39	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NI	NI	NI	NI
	October 11-12, 14, 2021	785.28	785.09	783.09	787.78	787.75	786.33	783.73	784.42	784.96	782.93	782.44	783.76	783.65	783.48	783.48	NI	NI	NI	NI
	December 21, 2021	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	782.93	NM	NM	NI	NI	NI	NI
	February 24, 2022	NM	NM	782.34	NM	786.49	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NI	NI	NI	NI
	April 11-13, 2022	785.44	784.42	783.40	788.20	787.87	788.26	783.27	784.30	785.02	783.11	783.32	784.19	783.14	783.19	783.04	NI	NI	NI	NI
	July 27, 2022	NM	NM	783.07	NM	787.03	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NI	NI	NI	NI
	October 25-27, 2022	784.91	784.62	778.94	781.79	784.97	783.85	781.94	783.61	784.57	778.32	777.89	784.16	781.50	780.96	781.23	NI	NI	NI	NI
	November 30, 2022	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	781.62	781.14	781.15	NI	NI	NI	NI
	December 2, 2022	785.12	784.48	NM	783.97	NM	NM	781.91	783.71	784.76	778.52	779.54	NM	NM	NM	NM	NI	NI	NI	NI
	January 12-13, 2023	785.20	784.55	NM	NM	NM	NM	782.75	784.10	784.88	NM	NM	NM	782.57	782.45	782.32	NI	NI	NI	NI
	January 20, 2023	NM	NM	NM	788.08	NM	NM	NM	NM	NM	782.15	782.11	784.98	NM	NM	NM	NM	NM	NM	NM
	January 24, 2023	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	783.36	783.63	783.77
	February 20-23, 2023	785.56	784.98	NM	NM	NM	NM	NM	NM	NM	783.04	782.91	785.32	783.31	783.34	783.40	NM	783.59	783.82	783.96
	Bottom of Well Elevation (ft)	777.49	779.40	775.72	779.72	780.72	766.52	777.21	770.52	774.07	780.63	780.39	778.90	775.60	775.21	773.55	774.29	820.30	821.57	819.78

Table 3. Groundwater Elevation - State Monitoring Program and CCR Well Network
Columbia Dry Ash and Ash Pond Disposal Facilities / SCS Engineers Project #25223067.00

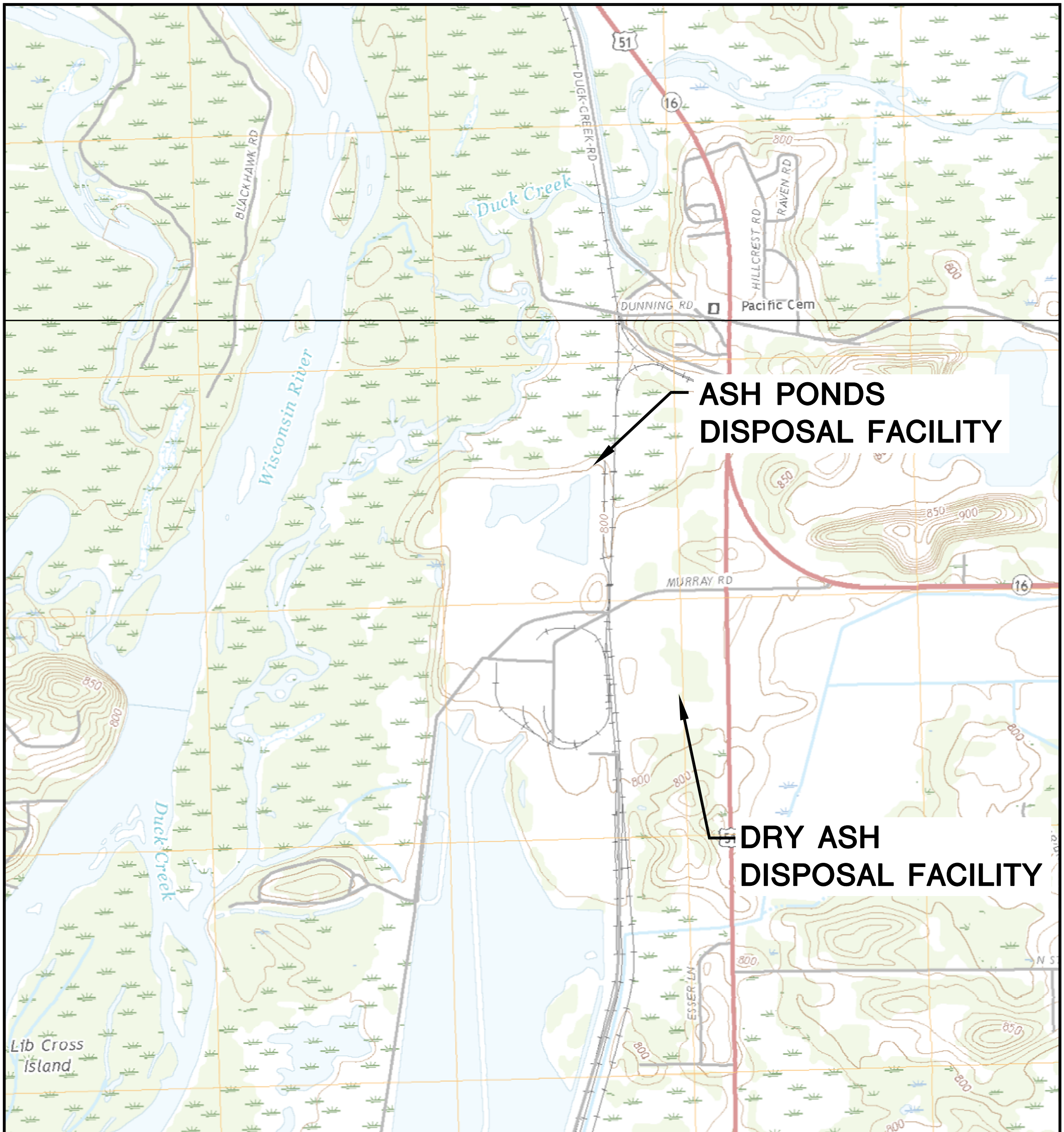
Notes:
NM = not measured

Created by:	MDB	Date:	5/6/2013
Last revision by:	NLB	Date:	4/25/2023
Checked by:	RM	Date:	5/1/2023

(1) The elevation for SG-1 is read off of the staff gauge (rather than measured from the top of the gauge).
(2) SG-2 could not be located during the April 2013 event.
(3) SG-3 could not be located during the October 2013 event. SG-1 could not be safely accessed during the October 2013 event.
(4) LH-2 measurements are given as leachate depth, measured by a transducer.
(5) LH-2 and LH-3 measurements were collected by WPL staff on October 9, 2017.
(6) The depth to water at MW-84A was not measured prior to purging for sampling during the October 3-5 sampling event. The level was allowed to return to static and was measured on 10/10/2017.
(7) BC = Brian Clepper; NS= Nate Sievers - Columbia Site employees.
(8) MW-303 was extended in 2022 due to regrading. Prior to October 2022, the TOC elevation was 811.52'. For events in October 2022 and later, the TOC elevation is 815.72'.

I:\25223067.00\Deliverables\COL MOD 4 ASD - October 2022\Tables\[Table 3 - GW Elevations.xls]levels

Figures



N

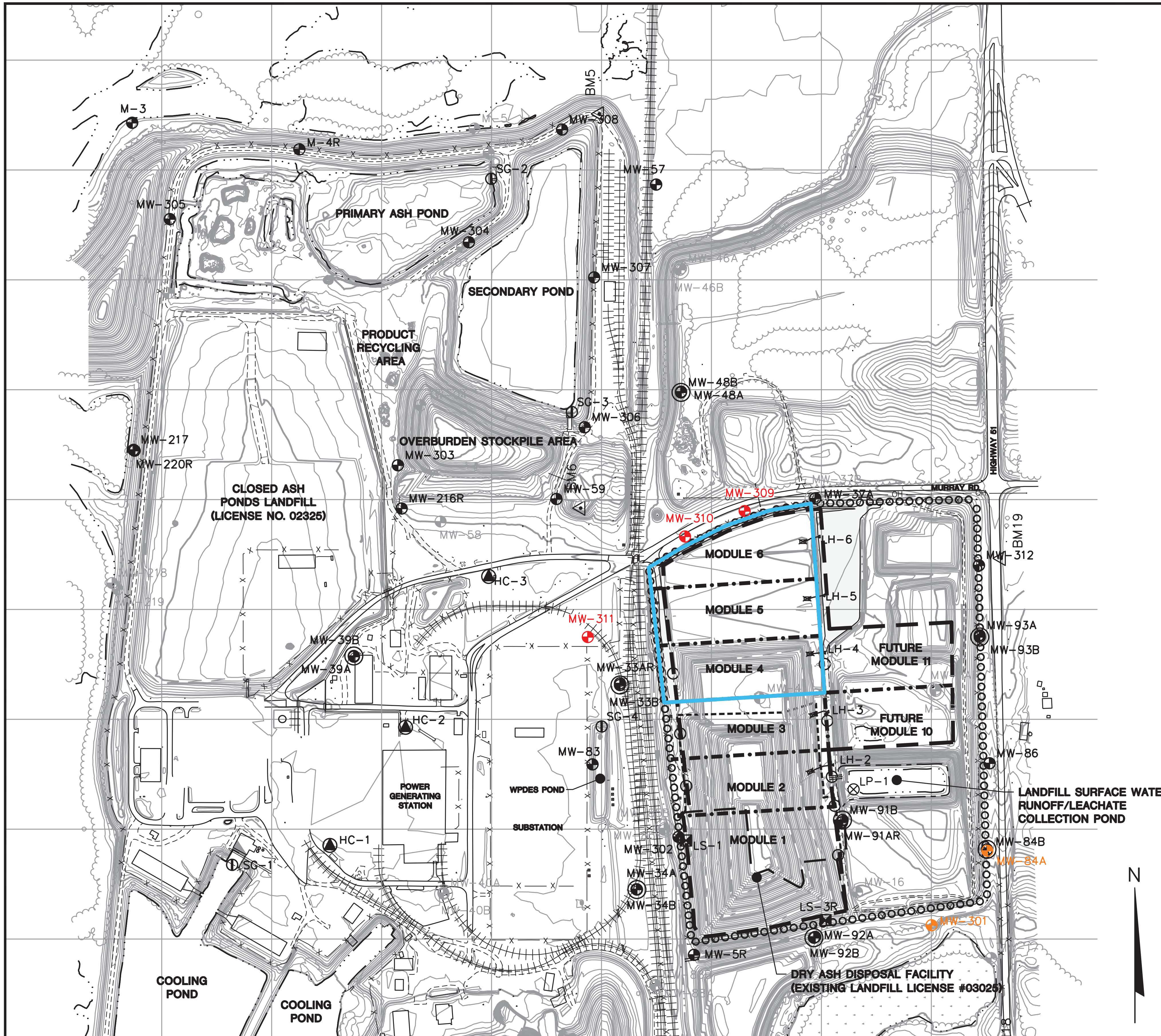
POYNETTE QUADRANGLE
WISCONSIN–COLUMBIA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
2018
SCALE: 1" = 2,000'

WISCONSIN

CLIENT	ALLIANT ENERGY COLUMBIA ENERGY CENTER W8375 MURRAY ROAD PARDEEVILLE, WI 53954	SITE	ALLIANT ENERGY COLUMBIA ENERGY CENTER PARDEEVILLE, WI	SITE LOCATION MAP

PROJECT NO.	25220067.00	DRAWN BY:	BSS	ENGINEER	SCS ENGINEERS 2830 DAIRY DRIVE MADISON, WI 53718-6751 PHONE: (608) 224-2830	FIGURE 1
DRAWN:	12/02/2019	CHECKED BY:	MDB			
REVISED:	01/10/2020	APPROVED BY:	TK 04/10/2020			

I:\25220067.00\Drawings\ASD Mod 1-3 LF\Site Location Map.dwg, 4/12/2020 7:05:09 PM



LEGEND

	EXISTING MAJOR CONTOUR (10' INTERVAL)
	EXISTING MINOR CONTOUR (2' CONTOUR)
—x—x—	EXISTING FENCELINE
	EXISTING TRACKS
	EXISTING PAVED ROAD
	EXISTING UNPAVED ROAD
	EDGE OF WATER
oooooooo	DRY ASH DISPOSAL FACILITY LIMITS
	LIMITS OF WASTE
	LINER PHASE/MODULE LIMITS
	WATER SUPPLY WELL
	STAFF GAUGE
	WATER TABLE WELL
	PIEZOMETER
	SURFACE WATER SAMPLE LOCATION
	LYSIMETER
	ABANDONED WATER TABLE WELL
	ABANDONED PIEZOMETER
	LEACHATE HEADWELL
	CCR UNIT
	CCR MONITORING WELL
	CCR BACKGROUND MONITORING WELL

NOTES:

1. BASE MAP CREATED FROM AERIAL SURVEY BY KBM, FLOWN DECEMBER 1, 2014, AND GROUND SURVEY BY SCS ENGINEERS IN MAY 2016, JUNE 2016, OCTOBER 2016, NOVEMBER 2016, APRIL 2017, NOVEMBER 2017, JULY 2018, FEBRUARY 2019, MAY 2019, SEPTEMBER 2020, AUGUST 2021, AND NOVEMBER 2021.
2. MONITORING WELL LOCATIONS AND ELEVATIONS SURVEYED BY WISCONSIN POWER AND LIGHT, INC. IN DECEMBER 1994, NOVEMBER 1996, APRIL 2003, AND JANUARY 2016, AND BY SCS ENGINEERS IN FEBRUARY 2018.
3. SUPPLY WELL LOCATIONS ARE APPROXIMATE AND ASSUMED BASED ON JANUARY 2013 DRAWINGS BY TRC.
4. MONITORING WELLS MW-301 THROUGH MW-305 INSTALLED BY BADGER STATE DRILLING ON NOVEMBER 11-13, 2015.
5. MONITORING WELLS MW-306 THROUGH MW-308 INSTALLED BY BADGER STATE DRILLING ON NOVEMBER 14-15, 2016.
6. MONITORING WELLS MW-309 THROUGH MW-311 INSTALLED BY BADGER STATE DRILLING ON FEBRUARY 13-14, 2018.
7. MONITORING WELLS MW-93A, MW-93B, AND MW-312 WERE INSTALLED BY CASCADE ENVIRONMENTAL ON MARCH 23-28, 2022.
8. BACKGROUND MONITORING WELLS FOR THE MODULE 4-6 DRY ASH DISPOSAL FACILITY ARE: MW-301 AND MW-84A.

N

500 0 500

SCALE: 1" = 500'

PROJECT NO.	25222067.00	DRAWN BY:	KP
DRAWN:	12/02/2019	CHECKED BY:	MDB
REVISED:	01/16/2023	APPROVED BY:	TK 5/30/2023

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

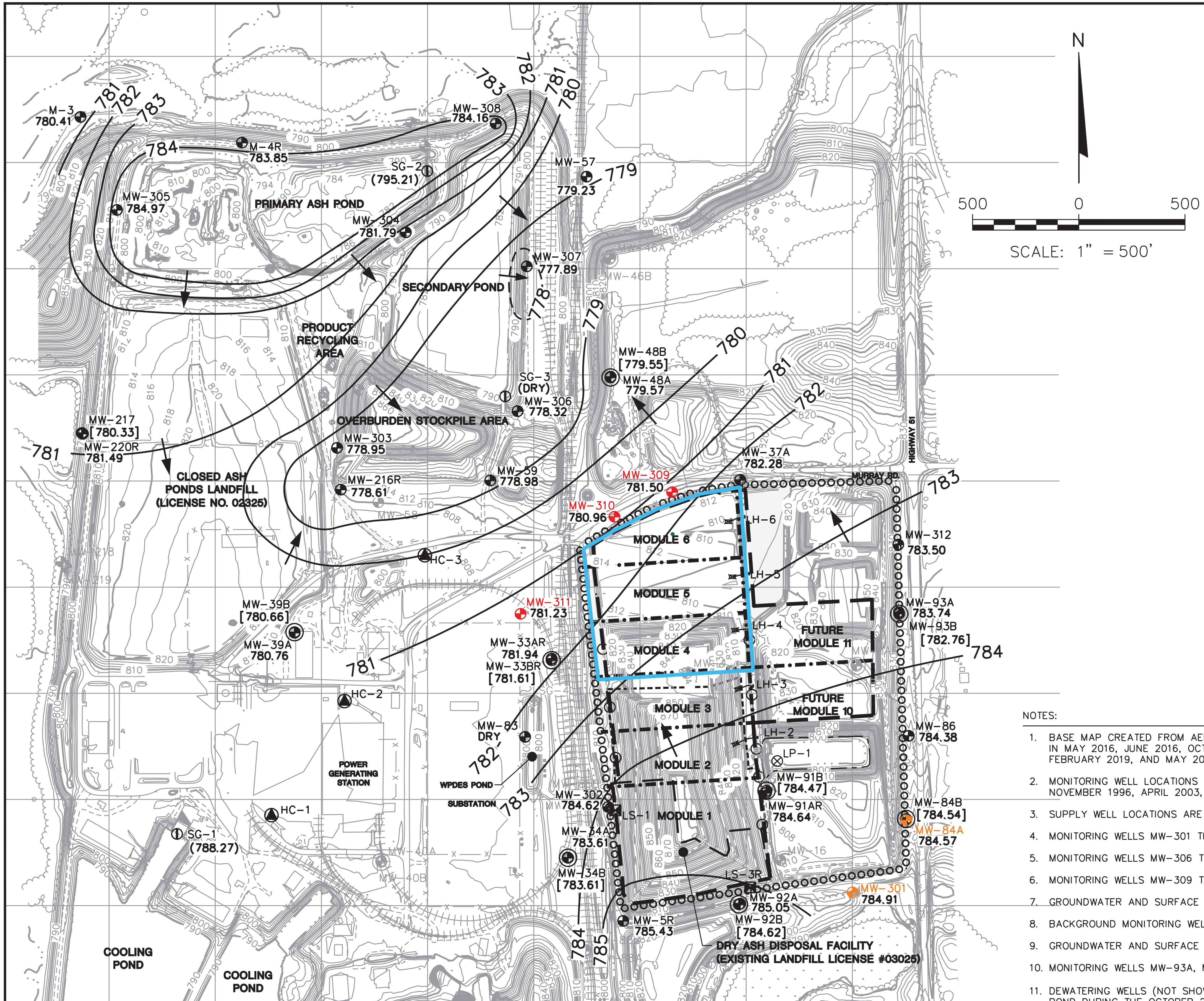
CLIENT: ALLIANT ENERGY, COLUMBIA ENERGY CENTER, W8375 MURRAY ROAD, PARDEEVILLE, WI 53954

SITE: ALLIANT ENERGY, COLUMBIA ENERGY CENTER, MODULES 4-6 DRY ASH DISPOSAL FACILITY, PARDEEVILLE, WI

SITE PLAN AND MONITORING WELL LOCATIONS

FIGURE 2

I:\25222067.00\Drawings\Modules 4-6\Site Plan and Monitoring Well Locations Mod 4-6.dwg, 1/16/2023 3:06:53 PM



LEGEND

- EXISTING MAJOR CONTOUR (10' INTERVAL)
- EXISTING MINOR CONTOUR (2' CONTOUR)
- EXISTING FENCELINE
- EXISTING TRACKS
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EDGE OF WATER
- DRY ASH DISPOSAL FACILITY LIMITS
- LIMITS OF WASTE
- LINER PHASE/MODULE LIMITS
- WATER SUPPLY WELL
- STAFF GAUGE
- WATER TABLE WELL
- PIEZOMETER
- SURFACE WATER SAMPLE LOCATION
- LYSIMETER
- ABANDONED WATER TABLE WELL
- ABANDONED PIEZOMETER
- LEACHATE HEADWELL
- CCR UNIT
- CCR MONITORING WELL
- CCR BACKGROUND MONITORING WELL
- 787.62 WATER TABLE ELEVATION
- [788.87] POTENTIOMETRIC SURFACE ELEVATION (NOT CONTOURED)
- (795.20) SURFACE WATER ELEVATION (NOT CONTOURED)
- WATER TABLE CONTOUR
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTES:

1. BASE MAP CREATED FROM AERIAL SURVEY BY KBM, FLOWN DECEMBER 1, 2014, AND GROUND SURVEY BY SCS ENGINEERS IN MAY 2016, JUNE 2016, OCTOBER 2016, NOVEMBER 2016, APRIL 2017, NOVEMBER 2017, JULY 2018, AUGUST 2018, FEBRUARY 2019, AND MAY 2019.
2. MONITORING WELL LOCATIONS AND ELEVATIONS SURVEYED BY WISCONSIN POWER AND LIGHT, INC. IN DECEMBER 1994, NOVEMBER 1996, APRIL 2003, AND JANUARY 2016 AND BY SCS ENGINEERS IN FEBRUARY 2018.
3. SUPPLY WELL LOCATIONS ARE APPROXIMATE AND ASSUMED BASED ON JANUARY 2013 DRAWINGS BY TRC.
4. MONITORING WELLS MW-301 THROUGH MW-305 INSTALLED BY BADGER STATE DRILLING ON NOVEMBER 11-13, 2015.
5. MONITORING WELLS MW-306 THROUGH MW-308 INSTALLED BY BADGER STATE DRILLING ON NOVEMBER 14-15, 2016.
6. MONITORING WELLS MW-309 THROUGH MW-311 INSTALLED BY BADGER STATE DRILLING ON FEBRUARY 13-14, 2018.
7. GROUNDWATER AND SURFACE WATER ELEVATIONS WERE MEASURED ON APRIL 12-14, 2021.
8. BACKGROUND MONITORING WELLS FOR THE MODULE 4-6 DRY ASH FACILITY ARE: MW-301 AND MW-84A.
9. GROUNDWATER AND SURFACE WATER ELEVATIONS WERE MEASURED ON OCTOBER 25-27, 2022.
10. MONITORING WELLS MW-93A, MW-93B, AND MW-312 INSTALLED BY CASCADE ENVIRONMENTAL ON MARCH 25-28, 2022.
11. DEWATERING WELLS (NOT SHOWN) AROUND THE SECONDARY POND WERE PUMPING AND DISCHARGING TO THE PRIMARY POND DURING THE OCTOBER 2022 SAMPLING EVENT.

PROJECT NO.	25222067.00	DRAWN BY:	KP
DRAWN:	12/15/2022	CHECKED BY:	MDB
REVISED:	12/30/2022	APPROVED BY:	TK, 1/16/2023

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

CLIENT: ALLIANT ENERGY
COLUMBIA ENERGY CENTER
W8375 MURRAY ROAD
PARDEEVILLE, WI 53954

SITE: ALLIANT ENERGY
COLUMBIA ENERGY CENTER
MODULES 4-6 DRY ASH DISPOSAL FACILITY
PARDEEVILLE, WI

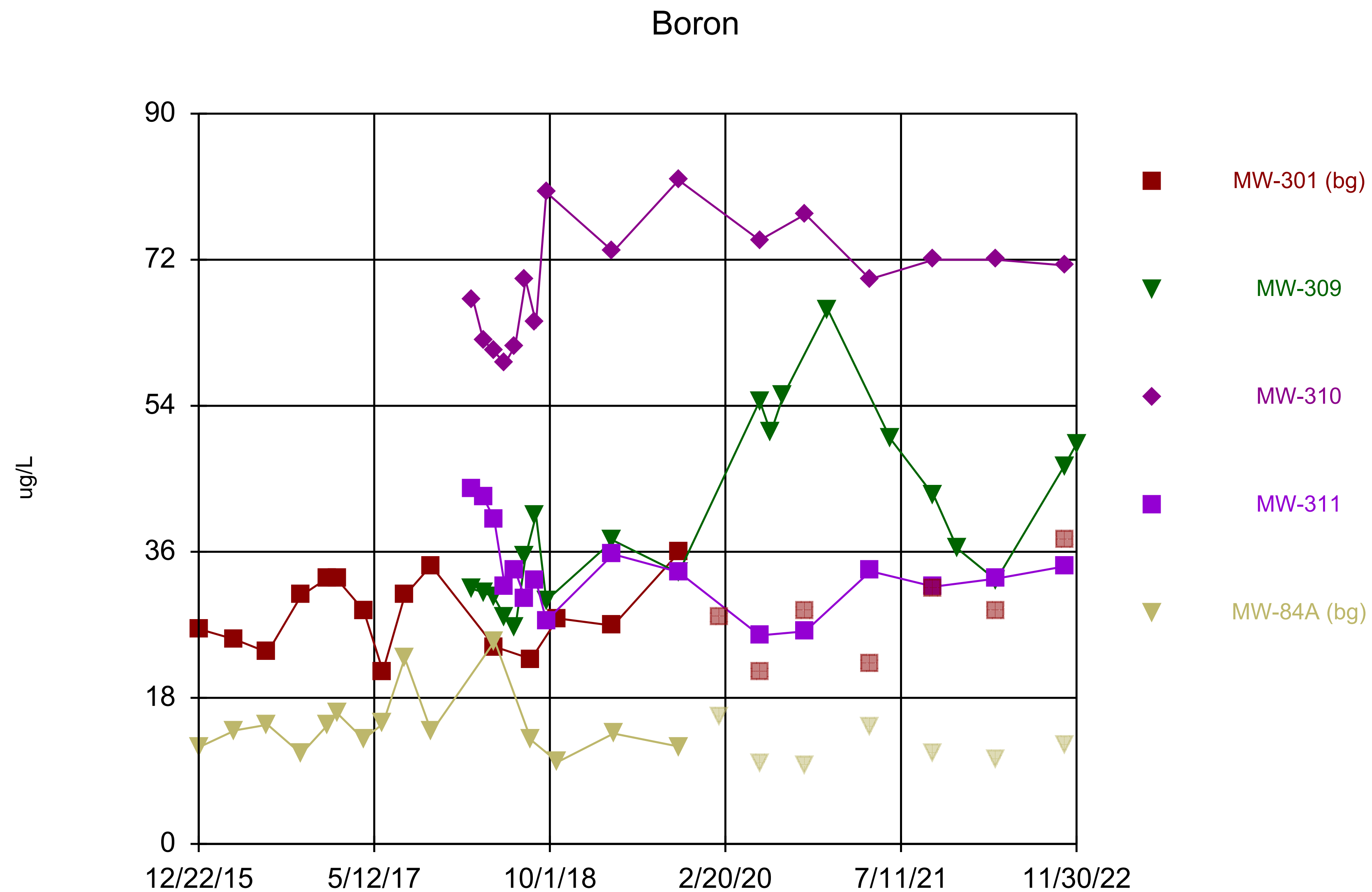
WATER TABLE MAP
OCTOBER 2022

FIGURE 3

I:\25222067.00\Drawings\Modules 4-6\Water Table Map-October 2022.dwg, 1/16/2023 2:40:42 PM

Appendix A

Trend Plots for CCR Wells



Time Series Analysis Run 5/19/2023 3:18 PM View: COL MOD 4-6

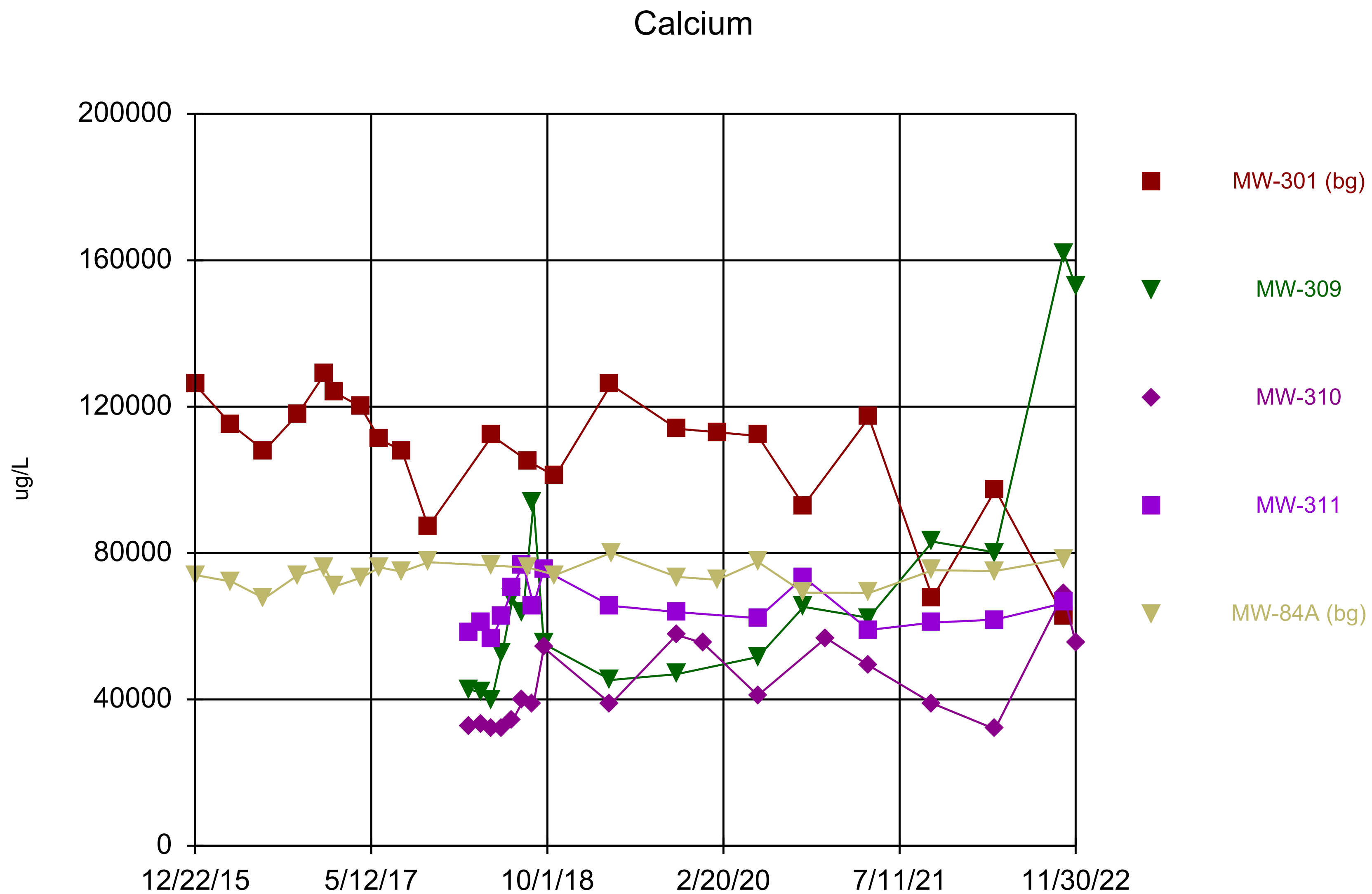
Columbia Energy Center Client: SCS Engineers Data: December - Chem- export-Dec2020

Time Series

Constituent: Boron (ug/L) Analysis Run 5/19/2023 3:27 PM View: COL MOD 4-6

Columbia Energy Center Client: SCS Engineers Data: December - Chem- export-Dec2020

	MW-301 (bg)	MW-309	MW-310	MW-311	MW-84A (bg)
12/22/2015	26.5				11.9
4/5/2016	25.2				14
7/8/2016	23.6				14.7
10/13/2016	30.6				11.1
12/29/2016	32.8				14.7
1/25/2017	32.6				16.1
4/11/2017	28.8				12.9
6/6/2017	21.3				14.8
8/8/2017	30.6				22.9
10/23/2017	34.3				
10/24/2017					13.8
2/21/2018		31.4	67.1	43.7	
3/23/2018		31	62.1	42.7	
4/23/2018		30.4	60.7	40.1	
4/25/2018	24.3				25
5/24/2018		28	59.2	31.7	
6/23/2018		26.6	61.4	33.6	
7/23/2018		35.5	69.5	30.1	
8/8/2018	22.8				12.8
8/22/2018		40.5	64.2	32.4	
9/21/2018		30	80.3	27.5	
10/24/2018	27.8				10.1 (J)
4/2/2019	26.9	37.4	73	35.7	
4/3/2019					13.6
10/8/2019		33.4	81.8	33.5	
10/9/2019	35.9				12
2/3/2020	27.9				15.7
5/29/2020	21.3	54.6	74.4	25.7	10
6/30/2020		50.7			
8/6/2020		55.3			
10/8/2020	28.8		77.6	26.2	9.7 (J)
12/11/2020		65.9 (R)			
4/13/2021			69.6		
4/14/2021	22.2			33.6	14.3
6/11/2021		49.9 (R)			
10/14/2021	31.4	42.9	72	31.7	11.1
12/21/2021		36.4			
4/12/2022		32.5	72	32.7	
4/13/2022	28.7				10.5
10/26/2022		46.6	71.3		
10/27/2022	37.5			34.2	12.2
11/30/2022		49.3			



Time Series Analysis Run 5/19/2023 3:18 PM View: COL MOD 4-6

Columbia Energy Center Client: SCS Engineers Data: December - Chem- export-Dec2020

Time Series

Constituent: Calcium (ug/L)   Analysis Run 5/19/2023 3:27 PM   View: COL MOD 4-6

Columbia Energy Center   Client: SCS Engineers   Data: December - Chem- export-Dec2020

	MW-301 (bg)	MW-309	MW-310	MW-311	MW-84A (bg)
12/22/2015	126000				74000
4/5/2016	115000				72200
7/8/2016	108000				67600
10/13/2016	118000				74000
12/29/2016	129000				76000
1/25/2017	124000				70800
4/11/2017	120000				73200
6/6/2017	111000				76100
8/8/2017	108000				74900
10/23/2017	87200				
10/24/2017					77500
2/21/2018		42700	32400	58000	
3/23/2018		41800	33400	61000	
4/23/2018		39600	32100	56600	
4/25/2018	112000				76600
5/24/2018		52700	32100	62500	
6/23/2018		67600	34300	70700	
7/23/2018		63800	39700	76800	
8/8/2018	105000				76000
8/22/2018		93600	38800	65700	
9/21/2018		55200	54100	75400	
10/24/2018	101000				74000
4/2/2019	126000	45300	38800	65600	
4/3/2019					80100
10/8/2019		46900	57600	63900	
10/9/2019	114000				73500
12/23/2019			55400		
2/3/2020	113000				72700
5/29/2020	112000	51600	41100	62200	77600
10/8/2020	93000	65300		73400	69200
12/11/2020			56800 (R)		
4/13/2021		62300	49300		
4/14/2021	117000			59000	69100
10/14/2021	67800	83100	38900	61000	75300
4/12/2022		80200	31900	61800	
4/13/2022	97300				75100
10/26/2022		162000	68900		
10/27/2022	62800			66300	78400
11/30/2022		153000	55500		

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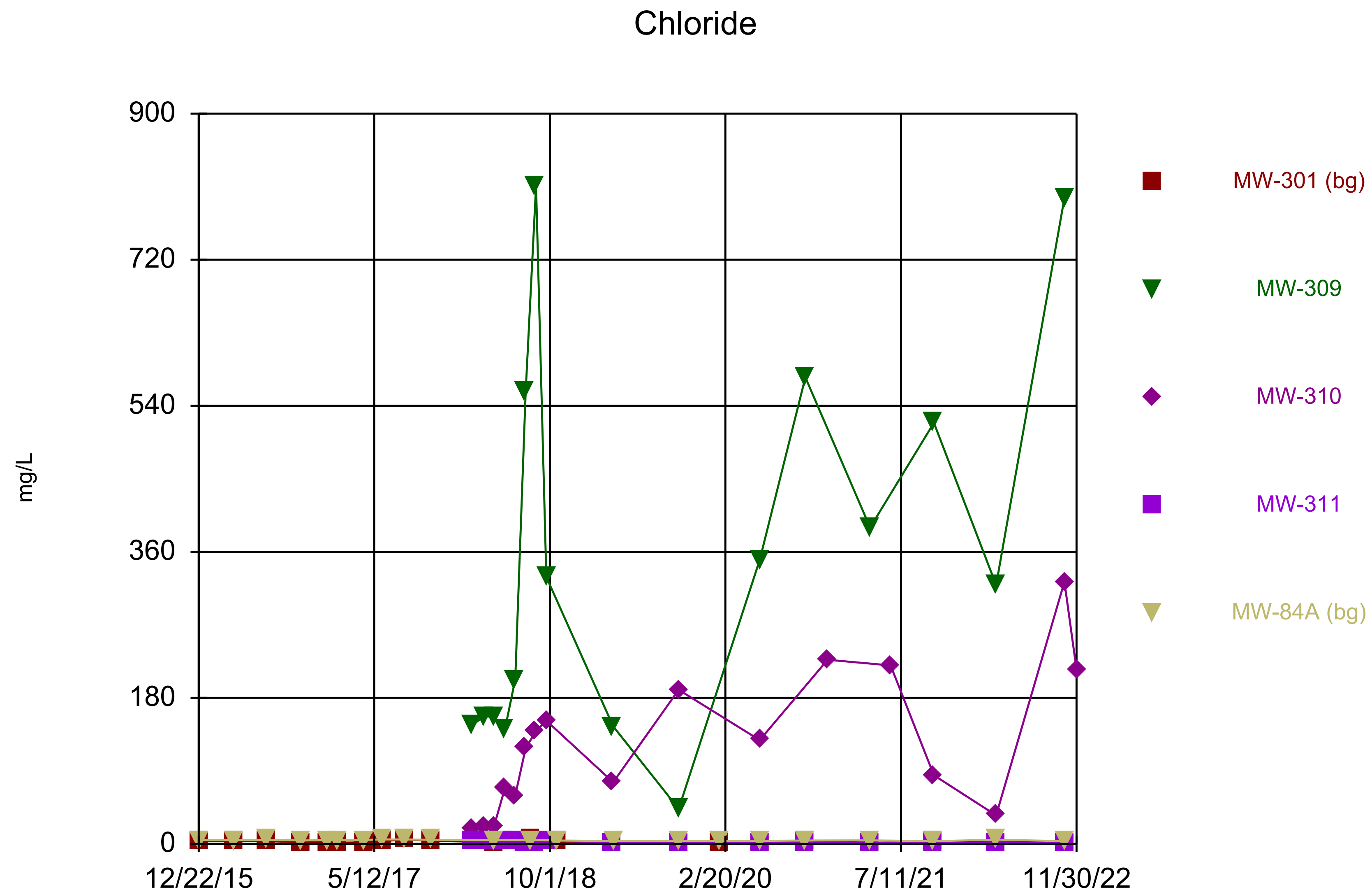


Time Series Analysis Run 5/19/2023 3:18 PM View: COL MOD 4-6

Columbia Energy Center Client: SCS Engineers Data: December - Chem- export-Dec2020

Time Series

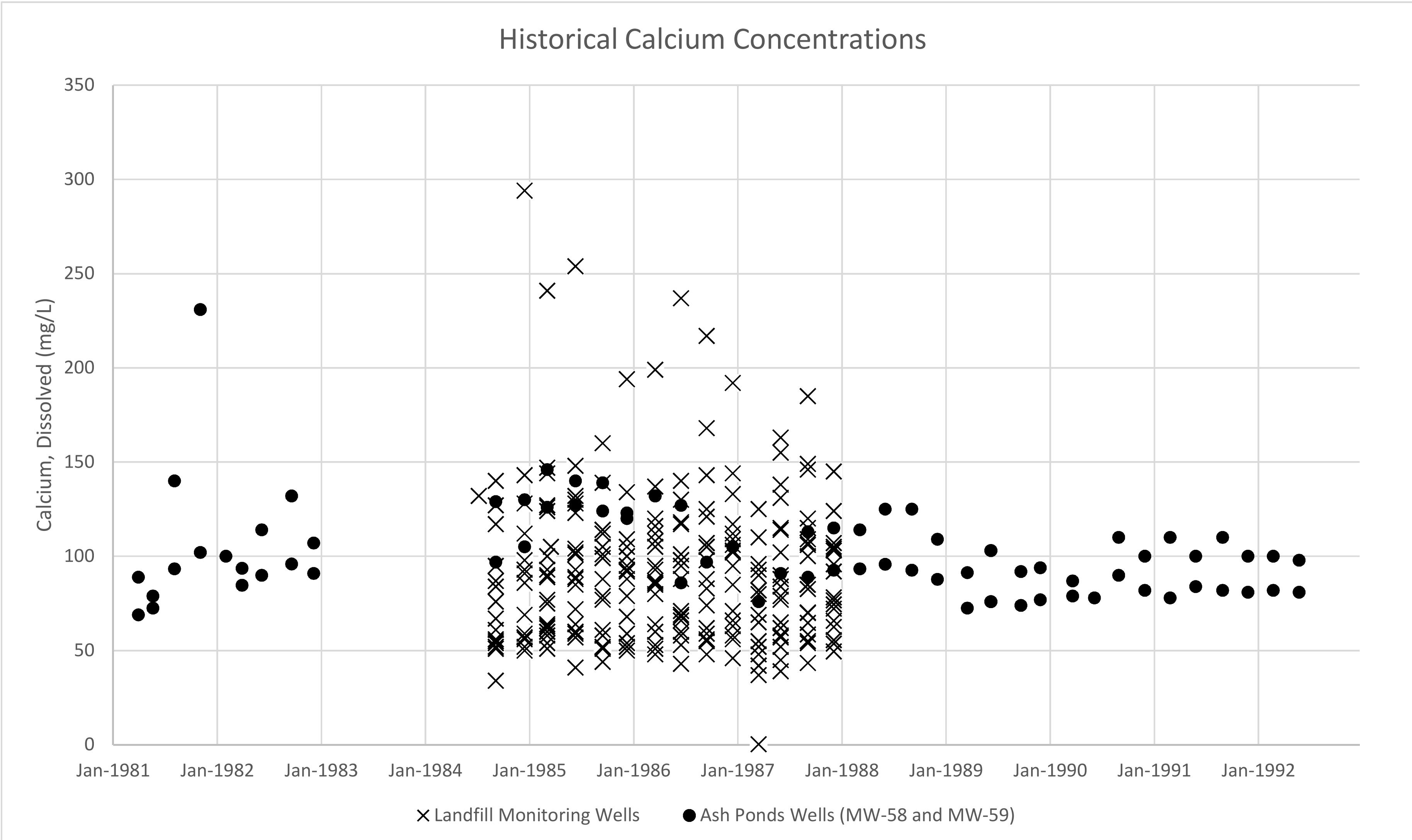
Constituent: Chloride (mg/L)   Analysis Run 5/19/2023 3:27 PM   View: COL MOD 4-6

Columbia Energy Center   Client: SCS Engineers   Data: December - Chem- export-Dec2020

	MW-301 (bg)	MW-309	MW-310	MW-311	MW-84A (bg)
12/22/2015	3.7 (J)				4.9
4/5/2016	4				4.7
7/8/2016	3.5 (J)				5.1
10/13/2016	2.2				4.3
12/29/2016	2 (J)				4.7
1/25/2017	1.5 (J)				4.6
4/11/2017	2				4.9
6/6/2017	3.5				5.5
8/8/2017	5.5				5.5
10/23/2017	4				
10/24/2017					5.1
2/21/2018		147	19.8	2.9	
3/23/2018		157	21.7	2.7	
4/23/2018		157	22.1	2.6	
4/25/2018	2.3				4.8
5/24/2018		141	68.6	3.5	
6/23/2018		203	59.8	3	
7/23/2018		557	118	2 (J)	
8/8/2018	5.2				4.9
8/22/2018		811	139	2 (J)	
9/21/2018		329	152	3.9	
10/24/2018	3.2				4.2
4/2/2019	0.79 (J)	145	76	1.9 (J)	
4/3/2019					3.6
10/8/2019		43.2	190	1.5 (J)	
10/9/2019	1.7 (J)				3.9
2/3/2020	1.3 (J)				3.7
5/29/2020	2 (J)	350	128	1.5 (J)	3.7
10/8/2020	3.4	575		1.4 (J)	4.3
12/11/2020			227 (R)		
4/13/2021		390			
4/14/2021	1.5 (J)			1.3 (J)	4.4
6/11/2021			220 (R)		
10/14/2021	2.7	519	84.6	1.3 (J)	3.5
4/12/2022		319	35.2	1 (J)	
4/13/2022	1.9 (J)				5.2
10/26/2022		796	323		
10/27/2022	2.3			1.2 (J)	3.4
11/30/2022			215		

Appendix B

Historical Calcium Data


Historical Calcium Concentrations
Calcium, Dissolved (mg/L)
350
300
250
200
150
100
50
0
Jan-1981
Jan-1982
Jan-1983
Jan-1984
Jan-1985
Jan-1986
Jan-1987
Jan-1988
Jan-1989
Jan-1990
Jan-1991
Jan-1992
Landfill Monitoring Wells
Ash Ponds Wells (MW-58 and MW-59)

Historical Calcium Results
License #3025 Wells and Select License #2325 Wells

Lic#	Point ID	Point Name	Parameter Description	Sample Date	Result Value	Result Unit
3025	43	MW88B	CALCIUM, DISSOLVED (MG/L CA)	12/17/1984	86	mg/L
3025	43	MW88B	CALCIUM, DISSOLVED (MG/L CA)	3/7/1985	75	mg/L
3025	43	MW88B	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	85	mg/L
3025	43	MW88B	CALCIUM, DISSOLVED (MG/L CA)	9/18/1985	79	mg/L
3025	43	MW88B	CALCIUM, DISSOLVED (MG/L CA)	12/12/1985	88	mg/L
3025	43	MW88B	CALCIUM, DISSOLVED (MG/L CA)	3/21/1986	95	mg/L
3025	43	MW88B	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	95	mg/L
3025	43	MW88B	CALCIUM, DISSOLVED (MG/L CA)	9/18/1986	98	mg/L
3025	43	MW88B	CALCIUM, DISSOLVED (MG/L CA)	12/19/1986	103	mg/L
3025	43	MW88B	CALCIUM, DISSOLVED (MG/L CA)	3/20/1987	82	mg/L
3025	43	MW88B	CALCIUM, DISSOLVED (MG/L CA)	6/5/1987	102	mg/L
3025	43	MW88B	CALCIUM, DISSOLVED (MG/L CA)	9/9/1987	106	mg/L
3025	43	MW88B	CALCIUM, DISSOLVED (MG/L CA)	12/9/1987	124	mg/L
3025	42	MW88A	CALCIUM, DISSOLVED (MG/L CA)	12/17/1984	294	mg/L
3025	42	MW88A	CALCIUM, DISSOLVED (MG/L CA)	3/7/1985	241	mg/L
3025	42	MW88A	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	254	mg/L
3025	42	MW88A	CALCIUM, DISSOLVED (MG/L CA)	9/18/1985	160	mg/L
3025	42	MW88A	CALCIUM, DISSOLVED (MG/L CA)	12/12/1985	194	mg/L
3025	42	MW88A	CALCIUM, DISSOLVED (MG/L CA)	3/21/1986	199	mg/L
3025	42	MW88A	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	140	mg/L
3025	42	MW88A	CALCIUM, DISSOLVED (MG/L CA)	9/18/1986	168	mg/L
3025	42	MW88A	CALCIUM, DISSOLVED (MG/L CA)	12/19/1986	133	mg/L
3025	42	MW88A	CALCIUM, DISSOLVED (MG/L CA)	3/20/1987	110	mg/L
3025	42	MW88A	CALCIUM, DISSOLVED (MG/L CA)	6/5/1987	131	mg/L
3025	42	MW88A	CALCIUM, DISSOLVED (MG/L CA)	9/9/1987	149	mg/L
3025	42	MW88A	CALCIUM, DISSOLVED (MG/L CA)	12/9/1987	105	mg/L
3025	41	MW86	CALCIUM, DISSOLVED (MG/L CA)	9/7/1984	76	mg/L
3025	41	MW86	CALCIUM, DISSOLVED (MG/L CA)	12/17/1984	98	mg/L
3025	41	MW86	CALCIUM, DISSOLVED (MG/L CA)	3/7/1985	127	mg/L
3025	41	MW86	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	89	mg/L
3025	41	MW86	CALCIUM, DISSOLVED (MG/L CA)	9/18/1985	114	mg/L
3025	41	MW86	CALCIUM, DISSOLVED (MG/L CA)	12/12/1985	100	mg/L
3025	41	MW86	CALCIUM, DISSOLVED (MG/L CA)	3/21/1986	105	mg/L
3025	41	MW86	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	98	mg/L
3025	41	MW86	CALCIUM, DISSOLVED (MG/L CA)	9/18/1986	107	mg/L
3025	41	MW86	CALCIUM, DISSOLVED (MG/L CA)	12/19/1986	102	mg/L
3025	41	MW86	CALCIUM, DISSOLVED (MG/L CA)	3/20/1987	80	mg/L
3025	41	MW86	CALCIUM, DISSOLVED (MG/L CA)	6/5/1987	114	mg/L
3025	41	MW86	CALCIUM, DISSOLVED (MG/L CA)	9/9/1987	100	mg/L
3025	41	MW86	CALCIUM, DISSOLVED (MG/L CA)	12/9/1987	95.8	mg/L
3025	40	MW85	CALCIUM, DISSOLVED (MG/L CA)	9/7/1984	87	mg/L
3025	40	MW85	CALCIUM, DISSOLVED (MG/L CA)	12/17/1984	93	mg/L
3025	40	MW85	CALCIUM, DISSOLVED (MG/L CA)	3/7/1985	89	mg/L
3025	40	MW85	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	130	mg/L
3025	40	MW85	CALCIUM, DISSOLVED (MG/L CA)	9/18/1985	114	mg/L
3025	40	MW85	CALCIUM, DISSOLVED (MG/L CA)	12/12/1985	93	mg/L
3025	40	MW85	CALCIUM, DISSOLVED (MG/L CA)	3/21/1986	87	mg/L
3025	40	MW85	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	69	mg/L
3025	40	MW85	CALCIUM, DISSOLVED (MG/L CA)	9/18/1986	88	mg/L
3025	40	MW85	CALCIUM, DISSOLVED (MG/L CA)	12/19/1986	85	mg/L
3025	40	MW85	CALCIUM, DISSOLVED (MG/L CA)	3/20/1987	69	mg/L
3025	40	MW85	CALCIUM, DISSOLVED (MG/L CA)	6/5/1987	84	mg/L

Lic#	Point ID	Point Name	Parameter Description	Sample Date	Result Value	Result Unit
3025	40	MW85	CALCIUM, DISSOLVED (MG/L CA)	9/9/1987	82.6	mg/L
3025	40	MW85	CALCIUM, DISSOLVED (MG/L CA)	12/9/1987	76.6	mg/L
3025	39	MW84B	CALCIUM, DISSOLVED (MG/L CA)	9/7/1984	55	mg/L
3025	39	MW84B	CALCIUM, DISSOLVED (MG/L CA)	12/17/1984	57	mg/L
3025	39	MW84B	CALCIUM, DISSOLVED (MG/L CA)	3/7/1985	58	mg/L
3025	39	MW84B	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	60	mg/L
3025	39	MW84B	CALCIUM, DISSOLVED (MG/L CA)	9/18/1985	52	mg/L
3025	39	MW84B	CALCIUM, DISSOLVED (MG/L CA)	12/12/1985	54	mg/L
3025	39	MW84B	CALCIUM, DISSOLVED (MG/L CA)	3/21/1986	51	mg/L
3025	39	MW84B	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	53	mg/L
3025	39	MW84B	CALCIUM, DISSOLVED (MG/L CA)	9/18/1986	55	mg/L
3025	39	MW84B	CALCIUM, DISSOLVED (MG/L CA)	12/19/1986	56	mg/L
3025	39	MW84B	CALCIUM, DISSOLVED (MG/L CA)	3/20/1987	42	mg/L
3025	39	MW84B	CALCIUM, DISSOLVED (MG/L CA)	6/5/1987	58	mg/L
3025	39	MW84B	CALCIUM, DISSOLVED (MG/L CA)	9/9/1987	54	mg/L
3025	39	MW84B	CALCIUM, DISSOLVED (MG/L CA)	12/9/1987	55.6	mg/L
3025	38	MW84A	CALCIUM, DISSOLVED (MG/L CA)	9/7/1984	54	mg/L
3025	38	MW84A	CALCIUM, DISSOLVED (MG/L CA)	12/17/1984	56	mg/L
3025	38	MW84A	CALCIUM, DISSOLVED (MG/L CA)	3/7/1985	60	mg/L
3025	38	MW84A	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	59	mg/L
3025	38	MW84A	CALCIUM, DISSOLVED (MG/L CA)	9/18/1985	58	mg/L
3025	38	MW84A	CALCIUM, DISSOLVED (MG/L CA)	12/12/1985	68	mg/L
3025	38	MW84A	CALCIUM, DISSOLVED (MG/L CA)	3/21/1986	60	mg/L
3025	38	MW84A	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	53	mg/L
3025	38	MW84A	CALCIUM, DISSOLVED (MG/L CA)	9/18/1986	56	mg/L
3025	38	MW84A	CALCIUM, DISSOLVED (MG/L CA)	12/19/1986	58	mg/L
3025	38	MW84A	CALCIUM, DISSOLVED (MG/L CA)	3/20/1987	42	mg/L
3025	38	MW84A	CALCIUM, DISSOLVED (MG/L CA)	6/5/1987	57	mg/L
3025	38	MW84A	CALCIUM, DISSOLVED (MG/L CA)	9/9/1987	58.6	mg/L
3025	38	MW84A	CALCIUM, DISSOLVED (MG/L CA)	12/9/1987	62.6	mg/L
3025	37	MW82B	CALCIUM, DISSOLVED (MG/L CA)	9/7/1984	67	mg/L
3025	37	MW82B	CALCIUM, DISSOLVED (MG/L CA)	12/17/1984	69	mg/L
3025	37	MW82B	CALCIUM, DISSOLVED (MG/L CA)	3/7/1985	77	mg/L
3025	37	MW82B	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	88	mg/L
3025	37	MW82B	CALCIUM, DISSOLVED (MG/L CA)	9/18/1985	101	mg/L
3025	37	MW82B	CALCIUM, DISSOLVED (MG/L CA)	12/12/1985	105	mg/L
3025	37	MW82B	CALCIUM, DISSOLVED (MG/L CA)	3/21/1986	120	mg/L
3025	37	MW82B	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	118	mg/L
3025	37	MW82B	CALCIUM, DISSOLVED (MG/L CA)	9/18/1986	121	mg/L
3025	37	MW82B	CALCIUM, DISSOLVED (MG/L CA)	12/19/1986	117	mg/L
3025	37	MW82B	CALCIUM, DISSOLVED (MG/L CA)	3/20/1987	90	mg/L
3025	37	MW82B	CALCIUM, DISSOLVED (MG/L CA)	6/5/1987	115	mg/L
3025	37	MW82B	CALCIUM, DISSOLVED (MG/L CA)	9/9/1987	85	mg/L
3025	37	MW82B	CALCIUM, DISSOLVED (MG/L CA)	12/9/1987	92	mg/L
3025	36	MW82A	CALCIUM, DISSOLVED (MG/L CA)	7/9/1984	132	mg/L
3025	36	MW82A	CALCIUM, DISSOLVED (MG/L CA)	12/17/1984	128	mg/L
3025	36	MW82A	CALCIUM, DISSOLVED (MG/L CA)	3/7/1985	124	mg/L
3025	36	MW82A	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	132	mg/L
3025	36	MW82A	CALCIUM, DISSOLVED (MG/L CA)	9/18/1985	112	mg/L
3025	36	MW82A	CALCIUM, DISSOLVED (MG/L CA)	12/12/1985	93	mg/L
3025	36	MW82A	CALCIUM, DISSOLVED (MG/L CA)	3/21/1986	80	mg/L
3025	36	MW82A	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	69	mg/L

Lic#	Point ID	Point Name	Parameter Description	Sample Date	Result Value	Result Unit
3025	36	MW82A	CALCIUM, DISSOLVED (MG/L CA)	9/18/1986	74	mg/L
3025	36	MW82A	CALCIUM, DISSOLVED (MG/L CA)	12/19/1986	71	mg/L
3025	36	MW82A	CALCIUM, DISSOLVED (MG/L CA)	3/20/1987	0.32	mg/L
3025	36	MW82A	CALCIUM, DISSOLVED (MG/L CA)	6/5/1987	77	mg/L
3025	36	MW82A	CALCIUM, DISSOLVED (MG/L CA)	9/9/1987	70.2	mg/L
3025	36	MW82A	CALCIUM, DISSOLVED (MG/L CA)	12/9/1987	74.5	mg/L
3025	35	MW81	CALCIUM, DISSOLVED (MG/L CA)	12/17/1984	91	mg/L
3025	35	MW81	CALCIUM, DISSOLVED (MG/L CA)	3/7/1985	90	mg/L
3025	35	MW81	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	93	mg/L
3025	35	MW81	CALCIUM, DISSOLVED (MG/L CA)	9/18/1985	88	mg/L
3025	35	MW81	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	88	mg/L
3025	35	MW81	CALCIUM, DISSOLVED (MG/L CA)	6/5/1987	88	mg/L
3025	35	MW81	CALCIUM, DISSOLVED (MG/L CA)	9/7/1987	85	mg/L
3025	34	MW80B	CALCIUM, DISSOLVED (MG/L CA)	9/7/1984	56	mg/L
3025	34	MW80B	CALCIUM, DISSOLVED (MG/L CA)	12/17/1984	57	mg/L
3025	34	MW80B	CALCIUM, DISSOLVED (MG/L CA)	3/7/1985	60	mg/L
3025	34	MW80B	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	60	mg/L
3025	34	MW80B	CALCIUM, DISSOLVED (MG/L CA)	9/18/1985	58	mg/L
3025	34	MW80B	CALCIUM, DISSOLVED (MG/L CA)	12/12/1985	59	mg/L
3025	34	MW80B	CALCIUM, DISSOLVED (MG/L CA)	3/21/1986	53	mg/L
3025	34	MW80B	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	58	mg/L
3025	34	MW80B	CALCIUM, DISSOLVED (MG/L CA)	9/18/1986	59	mg/L
3025	34	MW80B	CALCIUM, DISSOLVED (MG/L CA)	12/19/1986	63	mg/L
3025	34	MW80B	CALCIUM, DISSOLVED (MG/L CA)	3/20/1987	48	mg/L
3025	34	MW80B	CALCIUM, DISSOLVED (MG/L CA)	6/5/1987	62	mg/L
3025	34	MW80B	CALCIUM, DISSOLVED (MG/L CA)	9/9/1987	70	mg/L
3025	34	MW80B	CALCIUM, DISSOLVED (MG/L CA)	12/9/1987	65.8	mg/L
3025	33	MW80A	CALCIUM, DISSOLVED (MG/L CA)	9/7/1984	61	mg/L
3025	33	MW80A	CALCIUM, DISSOLVED (MG/L CA)	12/17/1984	59	mg/L
3025	33	MW80A	CALCIUM, DISSOLVED (MG/L CA)	3/7/1985	63	mg/L
3025	33	MW80A	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	64	mg/L
3025	33	MW80A	CALCIUM, DISSOLVED (MG/L CA)	9/18/1985	61	mg/L
3025	33	MW80A	CALCIUM, DISSOLVED (MG/L CA)	12/12/1985	59	mg/L
3025	33	MW80A	CALCIUM, DISSOLVED (MG/L CA)	3/21/1986	64	mg/L
3025	33	MW80A	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	68	mg/L
3025	33	MW80A	CALCIUM, DISSOLVED (MG/L CA)	9/18/1986	62	mg/L
3025	33	MW80A	CALCIUM, DISSOLVED (MG/L CA)	12/19/1986	66	mg/L
3025	33	MW80A	CALCIUM, DISSOLVED (MG/L CA)	3/20/1987	55	mg/L
3025	33	MW80A	CALCIUM, DISSOLVED (MG/L CA)	6/5/1987	52	mg/L
3025	33	MW80A	CALCIUM, DISSOLVED (MG/L CA)	9/9/1987	55	mg/L
3025	33	MW80A	CALCIUM, DISSOLVED (MG/L CA)	12/9/1987	53.7	mg/L
3025	10	MW5	CALCIUM, DISSOLVED (MG/L CA)	9/7/1984	84	mg/L
3025	10	MW5	CALCIUM, DISSOLVED (MG/L CA)	12/17/1984	93	mg/L
3025	10	MW5	CALCIUM, DISSOLVED (MG/L CA)	3/7/1985	93	mg/L
3025	10	MW5	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	104	mg/L
3025	10	MW5	CALCIUM, DISSOLVED (MG/L CA)	9/18/1985	105	mg/L
3025	10	MW5	CALCIUM, DISSOLVED (MG/L CA)	12/12/1985	95	mg/L
3025	10	MW5	CALCIUM, DISSOLVED (MG/L CA)	3/21/1986	116	mg/L
3025	10	MW5	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	117	mg/L
3025	10	MW5	CALCIUM, DISSOLVED (MG/L CA)	9/18/1986	125	mg/L
3025	10	MW5	CALCIUM, DISSOLVED (MG/L CA)	12/19/1986	112	mg/L
3025	10	MW5	CALCIUM, DISSOLVED (MG/L CA)	3/20/1987	82	mg/L

Historical Calcium Results
License #3025 Wells and Select License #2325 Wells

Lic#	Point ID	Point Name	Parameter Description	Sample Date	Result Value	Result Unit
3025	10	MW5	CALCIUM, DISSOLVED (MG/L CA)	6/5/1987	88	mg/L
3025	10	MW5	CALCIUM, DISSOLVED (MG/L CA)	9/9/1987	115	mg/L
3025	10	MW5	CALCIUM, DISSOLVED (MG/L CA)	12/9/1987	104	mg/L
3025	9	MW4	CALCIUM, DISSOLVED (MG/L CA)	9/7/1984	140	mg/L
3025	9	MW4	CALCIUM, DISSOLVED (MG/L CA)	12/17/1984	143	mg/L
3025	9	MW4	CALCIUM, DISSOLVED (MG/L CA)	3/7/1985	144	mg/L
3025	9	MW4	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	148	mg/L
3025	9	MW4	CALCIUM, DISSOLVED (MG/L CA)	9/18/1985	139	mg/L
3025	9	MW4	CALCIUM, DISSOLVED (MG/L CA)	12/12/1985	134	mg/L
3025	9	MW4	CALCIUM, DISSOLVED (MG/L CA)	3/21/1986	137	mg/L
3025	9	MW4	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	130	mg/L
3025	9	MW4	CALCIUM, DISSOLVED (MG/L CA)	9/18/1986	143	mg/L
3025	9	MW4	CALCIUM, DISSOLVED (MG/L CA)	12/19/1986	144	mg/L
3025	9	MW4	CALCIUM, DISSOLVED (MG/L CA)	3/20/1987	125	mg/L
3025	9	MW4	CALCIUM, DISSOLVED (MG/L CA)	6/5/1987	138	mg/L
3025	9	MW4	CALCIUM, DISSOLVED (MG/L CA)	9/9/1987	146	mg/L
3025	9	MW4	CALCIUM, DISSOLVED (MG/L CA)	12/9/1987	145	mg/L
3025	23	MW37B	CALCIUM, DISSOLVED (MG/L CA)	9/7/1984	34	mg/L
3025	23	MW37B	CALCIUM, DISSOLVED (MG/L CA)	12/17/1984	50	mg/L
3025	23	MW37B	CALCIUM, DISSOLVED (MG/L CA)	3/7/1985	62	mg/L
3025	23	MW37B	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	72	mg/L
3025	23	MW37B	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	60	mg/L
3025	23	MW37B	CALCIUM, DISSOLVED (MG/L CA)	6/5/1987	39	mg/L
3025	22	MW37A	CALCIUM, DISSOLVED (MG/L CA)	9/7/1984	51	mg/L
3025	22	MW37A	CALCIUM, DISSOLVED (MG/L CA)	12/17/1984	57	mg/L
3025	22	MW37A	CALCIUM, DISSOLVED (MG/L CA)	3/7/1985	64	mg/L
3025	22	MW37A	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	64	mg/L
3025	22	MW37A	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	66	mg/L
3025	22	MW37A	CALCIUM, DISSOLVED (MG/L CA)	6/5/1987	65	mg/L
3025	21	MW34B	CALCIUM, DISSOLVED (MG/L CA)	12/17/1984	112	mg/L
3025	21	MW34B	CALCIUM, DISSOLVED (MG/L CA)	3/7/1985	51	mg/L
3025	21	MW34B	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	41	mg/L
3025	21	MW34B	CALCIUM, DISSOLVED (MG/L CA)	9/18/1985	44	mg/L
3025	21	MW34B	CALCIUM, DISSOLVED (MG/L CA)	12/12/1985	79	mg/L
3025	21	MW34B	CALCIUM, DISSOLVED (MG/L CA)	3/21/1986	85	mg/L
3025	21	MW34B	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	71	mg/L
3025	21	MW34B	CALCIUM, DISSOLVED (MG/L CA)	9/18/1986	83	mg/L
3025	21	MW34B	CALCIUM, DISSOLVED (MG/L CA)	3/20/1987	65	mg/L
3025	21	MW34B	CALCIUM, DISSOLVED (MG/L CA)	6/5/1987	155	mg/L
3025	21	MW34B	CALCIUM, DISSOLVED (MG/L CA)	9/9/1987	64.7	mg/L
3025	21	MW34B	CALCIUM, DISSOLVED (MG/L CA)	12/9/1987	78.3	mg/L
3025	20	MW34A	CALCIUM, DISSOLVED (MG/L CA)	9/7/1984	127	mg/L
3025	20	MW34A	CALCIUM, DISSOLVED (MG/L CA)	12/17/1984	57	mg/L
3025	20	MW34A	CALCIUM, DISSOLVED (MG/L CA)	3/7/1985	147	mg/L
3025	20	MW34A	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	128	mg/L
3025	20	MW34A	CALCIUM, DISSOLVED (MG/L CA)	9/18/1985	77	mg/L
3025	20	MW34A	CALCIUM, DISSOLVED (MG/L CA)	12/12/1985	50	mg/L
3025	20	MW34A	CALCIUM, DISSOLVED (MG/L CA)	3/21/1986	86	mg/L
3025	20	MW34A	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	237	mg/L
3025	20	MW34A	CALCIUM, DISSOLVED (MG/L CA)	9/18/1986	217	mg/L
3025	20	MW34A	CALCIUM, DISSOLVED (MG/L CA)	12/19/1986	192	mg/L
3025	20	MW34A	CALCIUM, DISSOLVED (MG/L CA)	3/20/1987	96	mg/L

Lic#	Point ID	Point Name	Parameter Description	Sample Date	Result Value	Result Unit
3025	20	MW34A	CALCIUM, DISSOLVED (MG/L CA)	6/5/1987	163	mg/L
3025	20	MW34A	CALCIUM, DISSOLVED (MG/L CA)	9/9/1987	185	mg/L
3025	20	MW34A	CALCIUM, DISSOLVED (MG/L CA)	12/9/1987	72.3	mg/L
3025	15	MW25	CALCIUM, DISSOLVED (MG/L CA)	3/20/1985	105	mg/L
3025	15	MW25	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	102	mg/L
3025	15	MW25	CALCIUM, DISSOLVED (MG/L CA)	9/18/1985	99	mg/L
3025	15	MW25	CALCIUM, DISSOLVED (MG/L CA)	12/12/1985	100	mg/L
3025	15	MW25	CALCIUM, DISSOLVED (MG/L CA)	3/21/1986	112	mg/L
3025	15	MW25	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	101	mg/L
3025	15	MW25	CALCIUM, DISSOLVED (MG/L CA)	9/18/1986	105	mg/L
3025	15	MW25	CALCIUM, DISSOLVED (MG/L CA)	12/19/1986	106	mg/L
3025	15	MW25	CALCIUM, DISSOLVED (MG/L CA)	3/20/1987	52	mg/L
3025	15	MW25	CALCIUM, DISSOLVED (MG/L CA)	6/5/1987	79	mg/L
3025	15	MW25	CALCIUM, DISSOLVED (MG/L CA)	9/9/1987	107	mg/L
3025	15	MW25	CALCIUM, DISSOLVED (MG/L CA)	12/9/1987	107	mg/L
3025	8	MW1B	CALCIUM, DISSOLVED (MG/L CA)	9/7/1984	117	mg/L
3025	8	MW1B	CALCIUM, DISSOLVED (MG/L CA)	12/17/1984	143	mg/L
3025	8	MW1B	CALCIUM, DISSOLVED (MG/L CA)	3/7/1985	126	mg/L
3025	8	MW1B	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	123	mg/L
3025	8	MW1B	CALCIUM, DISSOLVED (MG/L CA)	9/18/1985	112	mg/L
3025	8	MW1B	CALCIUM, DISSOLVED (MG/L CA)	12/12/1985	109	mg/L
3025	8	MW1B	CALCIUM, DISSOLVED (MG/L CA)	3/21/1986	108	mg/L
3025	8	MW1B	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	98	mg/L
3025	8	MW1B	CALCIUM, DISSOLVED (MG/L CA)	9/18/1986	105	mg/L
3025	8	MW1B	CALCIUM, DISSOLVED (MG/L CA)	12/19/1986	95	mg/L
3025	8	MW1B	CALCIUM, DISSOLVED (MG/L CA)	3/20/1987	82	mg/L
3025	8	MW1B	CALCIUM, DISSOLVED (MG/L CA)	6/5/1987	90	mg/L
3025	8	MW1B	CALCIUM, DISSOLVED (MG/L CA)	9/9/1987	109	mg/L
3025	8	MW1B	CALCIUM, DISSOLVED (MG/L CA)	12/9/1987	103	mg/L
3025	7	MW1A	CALCIUM, DISSOLVED (MG/L CA)	9/7/1984	95	mg/L
3025	7	MW1A	CALCIUM, DISSOLVED (MG/L CA)	12/17/1984	93	mg/L
3025	7	MW1A	CALCIUM, DISSOLVED (MG/L CA)	3/7/1985	100	mg/L
3025	7	MW1A	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	101	mg/L
3025	7	MW1A	CALCIUM, DISSOLVED (MG/L CA)	9/18/1985	99	mg/L
3025	7	MW1A	CALCIUM, DISSOLVED (MG/L CA)	12/12/1985	92	mg/L
3025	7	MW1A	CALCIUM, DISSOLVED (MG/L CA)	3/21/1986	93	mg/L
3025	7	MW1A	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	98	mg/L
3025	7	MW1A	CALCIUM, DISSOLVED (MG/L CA)	9/18/1986	107	mg/L
3025	7	MW1A	CALCIUM, DISSOLVED (MG/L CA)	12/19/1986	109	mg/L
3025	7	MW1A	CALCIUM, DISSOLVED (MG/L CA)	3/20/1987	93	mg/L
3025	7	MW1A	CALCIUM, DISSOLVED (MG/L CA)	9/9/1987	120	mg/L
3025	11	MW16	CALCIUM, DISSOLVED (MG/L CA)	9/7/1984	52	mg/L
3025	11	MW16	CALCIUM, DISSOLVED (MG/L CA)	12/17/1984	52	mg/L
3025	11	MW16	CALCIUM, DISSOLVED (MG/L CA)	3/7/1985	54	mg/L
3025	11	MW16	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	57	mg/L
3025	11	MW16	CALCIUM, DISSOLVED (MG/L CA)	9/18/1985	51	mg/L
3025	11	MW16	CALCIUM, DISSOLVED (MG/L CA)	12/12/1985	52	mg/L
3025	11	MW16	CALCIUM, DISSOLVED (MG/L CA)	3/21/1986	48	mg/L
3025	11	MW16	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	43	mg/L
3025	11	MW16	CALCIUM, DISSOLVED (MG/L CA)	9/18/1986	48	mg/L
3025	11	MW16	CALCIUM, DISSOLVED (MG/L CA)	12/19/1986	46	mg/L
3025	11	MW16	CALCIUM, DISSOLVED (MG/L CA)	3/20/1987	37	mg/L

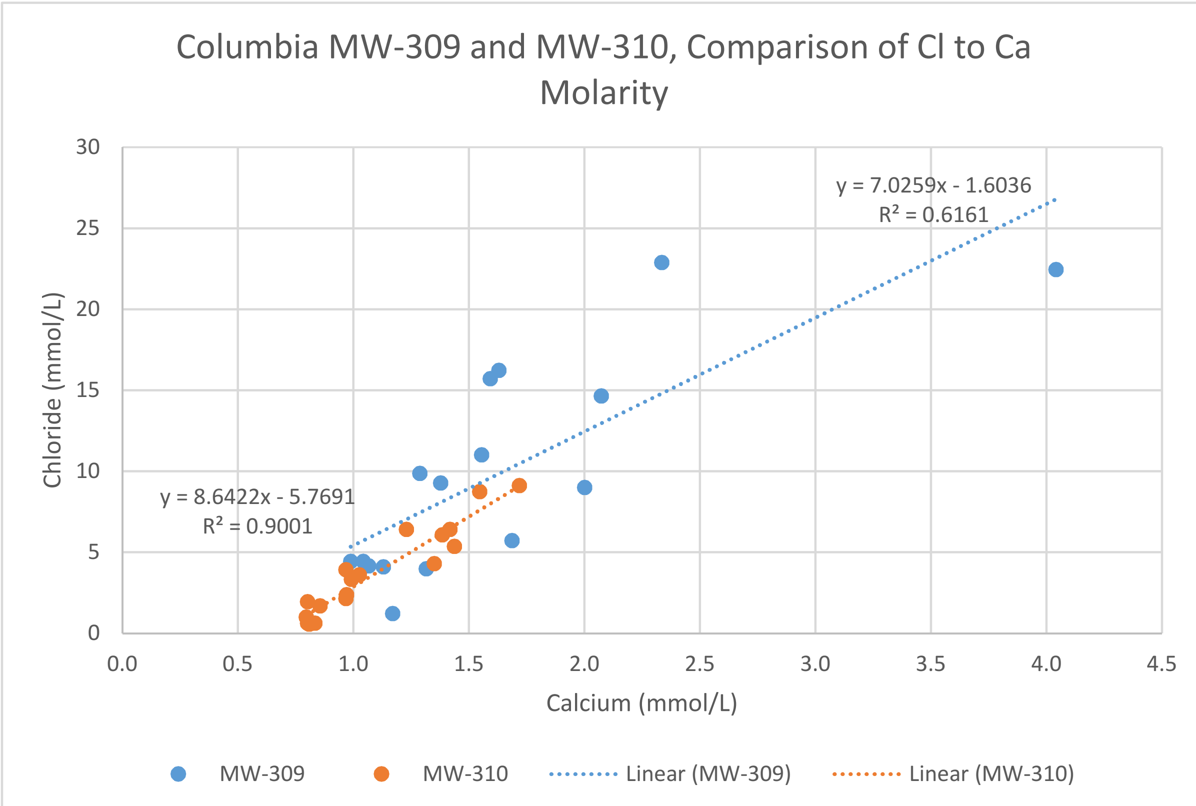
Lic#	Point ID	Point Name	Parameter Description	Sample Date	Result Value	Result Unit
3025	11	MW16	CALCIUM, DISSOLVED (MG/L CA)	6/5/1987	45	mg/L
3025	11	MW16	CALCIUM, DISSOLVED (MG/L CA)	9/9/1987	43.4	mg/L
3025	11	MW16	CALCIUM, DISSOLVED (MG/L CA)	12/9/1987	49.5	mg/L
2325	108	W59 (W-2)	CALCIUM, TOTAL (MG/L CA)	3/30/1981	89	mg/L
2325	108	W59 (W-2)	CALCIUM, TOTAL (MG/L CA)	5/21/1981	72.5	mg/L
2325	108	W59 (W-2)	CALCIUM, TOTAL (MG/L CA)	8/4/1981	93.3	mg/L
2325	108	W59 (W-2)	CALCIUM, TOTAL (MG/L CA)	11/3/1981	102	mg/L
2325	108	W59 (W-2)	CALCIUM, TOTAL (MG/L CA)	2/1/1982	100	mg/L
2325	108	W59 (W-2)	CALCIUM, TOTAL (MG/L CA)	3/30/1982	84.6	mg/L
2325	108	W59 (W-2)	CALCIUM, TOTAL (MG/L CA)	6/7/1982	90	mg/L
2325	108	W59 (W-2)	CALCIUM, TOTAL (MG/L CA)	9/20/1982	96	mg/L
2325	108	W59 (W-2)	CALCIUM, TOTAL (MG/L CA)	12/7/1982	91	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	9/7/1984	97	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	12/17/1984	105	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	3/7/1985	126	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	127	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	9/18/1985	124	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	12/12/1985	123	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	3/21/1986	132	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	86	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	9/18/1986	97	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	12/19/1986	105	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	3/20/1987	76	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	6/5/1987	91	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	9/9/1987	89	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	12/9/1987	92.6	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	3/10/1988	93.4	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	6/7/1988	95.8	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	9/8/1988	92.7	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	12/7/1988	87.8	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	3/22/1989	91.4	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	6/13/1989	76	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	6/14/1989	76	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	9/27/1989	74	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	12/4/1989	77	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	3/28/1990	79	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	6/12/1990	78	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	9/5/1990	90	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	12/6/1990	82	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	3/5/1991	78	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	6/3/1991	84	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	9/6/1991	82	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	12/4/1991	81	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	3/2/1992	82	mg/L
2325	108	W59 (W-2)	CALCIUM, DISSOLVED (MG/L CA)	6/1/1992	81	mg/L
2325	107	W58 (W-1)	CALCIUM, TOTAL (MG/L CA)	3/30/1981	69	mg/L
2325	107	W58 (W-1)	CALCIUM, TOTAL (MG/L CA)	5/21/1981	79	mg/L
2325	107	W58 (W-1)	CALCIUM, TOTAL (MG/L CA)	8/4/1981	140	mg/L
2325	107	W58 (W-1)	CALCIUM, TOTAL (MG/L CA)	11/3/1981	231	mg/L
2325	107	W58 (W-1)	CALCIUM, TOTAL (MG/L CA)	3/30/1982	93.6	mg/L
2325	107	W58 (W-1)	CALCIUM, TOTAL (MG/L CA)	6/7/1982	114	mg/L
2325	107	W58 (W-1)	CALCIUM, TOTAL (MG/L CA)	9/20/1982	132	mg/L

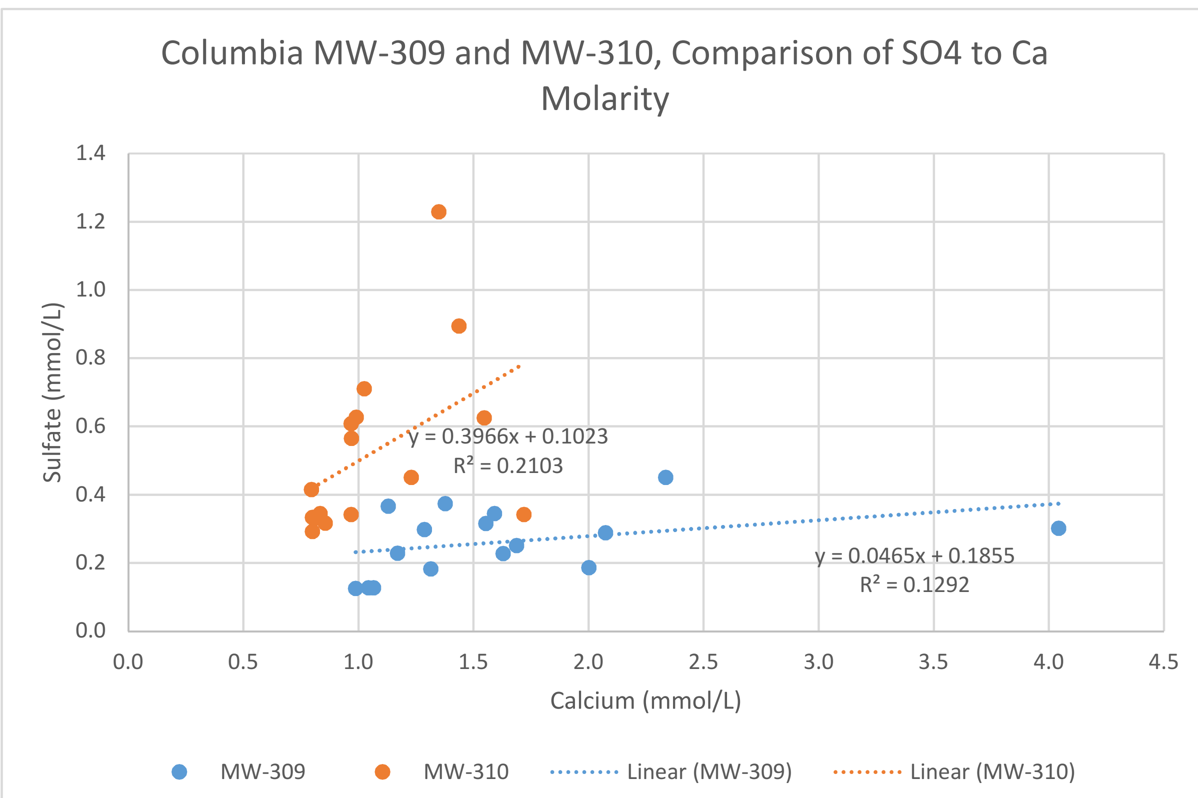
Historical Calcium Results
License #3025 Wells and Select License #2325 Wells

Lic#	Point ID	Point Name	Parameter Description	Sample Date	Result Value	Result Unit
2325	107	W58 (W-1)	CALCIUM, TOTAL (MG/L CA)	12/7/1982	107	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	9/7/1984	129	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	12/17/1984	130	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	3/7/1985	146	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	6/14/1985	140	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	9/18/1985	139	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	12/12/1985	120	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	3/21/1986	132	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	6/20/1986	127	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	9/9/1987	113	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	12/9/1987	115	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	3/10/1988	114	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	6/7/1988	125	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	9/8/1988	125	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	12/7/1988	109	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	3/22/1989	72.5	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	6/13/1989	103	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	6/14/1989	103	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	9/27/1989	92	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	12/4/1989	94	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	3/28/1990	87	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	9/5/1990	110	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	12/6/1990	100	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	3/5/1991	110	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	6/3/1991	100	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	9/6/1991	110	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	12/4/1991	100	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	3/2/1992	100	mg/L
2325	107	W58 (W-1)	CALCIUM, DISSOLVED (MG/L CA)	6/1/1992	98	mg/L

Appendix C

Calcium Correlation Plots


Columbia MW-309 and MW-310, Comparison of Cl to Ca Molarity
y = 7.0259x - 1.6036
R² = 0.6161
y = 8.6422x - 5.7691
R² = 0.9001
Chloride (mmol/L)
Calcium (mmol/L)
MW-309
MW-310
Linear (MW-309)
Linear (MW-310)


Columbia MW-309 and MW-310, Comparison of SO4 to Ca Molarity
y = 0.3966x + 0.1023
R² = 0.2103
y = 0.0465x + 0.1855
R² = 0.1292
Sulfate (mmol/L)
Calcium (mmol/L)
MW-309
MW-310
Linear (MW-309)
Linear (MW-310)