# 2025 Annual Groundwater Monitoring and Corrective Action Report

*CCR Landfill*
*R.M. Haskett Station, Mandan, North Dakota*

Prepared for
Montana-Dakota Utilities Co.

Prepared by
Barr Engineering Co.

January 2026

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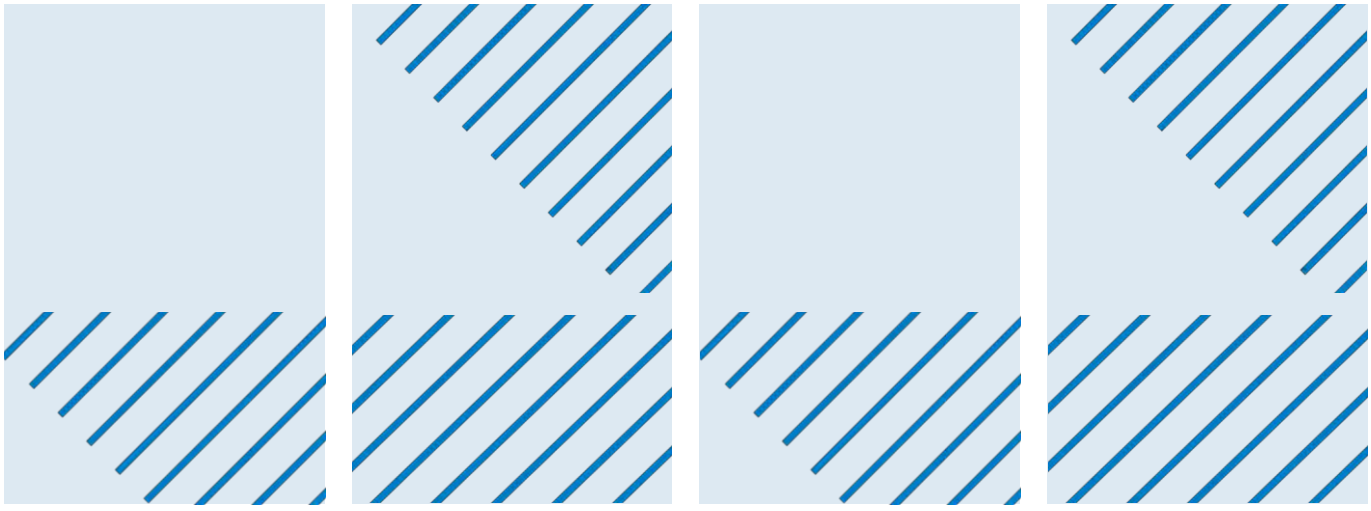


# 2025 Annual Monitoring and Corrective Action Report

January 2026

## Contents


1 Executive Summary ..... 1
2 Introduction ..... 2
2.1 Purpose ..... 2
2.2 CCR Rule Requirements ..... 2
3 Groundwater Monitoring Program ..... 4
3.1 Groundwater Monitoring System ..... 4
3.1.1 Changes to Groundwater Monitoring System ..... 4
3.2 Actions Completed/Problems Encountered ..... 4
3.3 Data and Collection Summary ..... 5
3.3.1 August 2024 Detection Monitoring Event ..... 5
3.3.2 April 2025 Detection Monitoring Event ..... 5
3.3.3 August 2025 Detection Monitoring Event ..... 5
3.4 Activities for the Upcoming Year ..... 5
4 Operational Activity ..... 7
4.1 Asbestos Disposal and Other Materials ..... 7
4.2 Inspections and Maintenance ..... 7
4.3 Leachate Sampling ..... 7
5 References ..... 8

## Tables

Table 1 CCR Rule Requirements and Compliance ..... 2

## Attached Tables

Attached Table 1 Water Quality Analytical Data Summary
Attached Table 2 Sample Summary

## Figures

Figure 1 Site Layout and CCR Monitoring Network
Figure 2 April 2025 Groundwater Elevations
Figure 3 August 2025 Groundwater Elevations

## Appendices

Appendix A Laboratory Reports and Field Sheets: 2025
Appendix B Alternative Source Demonstration Reports
Appendix C Groundwater Elevation and Flow Rate

# Abbreviations

| | |
|---|---|
| ASD | Alternative Source Demonstration |
| CCR | Coal Combustion Residuals |
| CFR | Code of Federal Regulations |
| EPA | Environmental Protection Agency |
| MDU | Montana-Dakota Utilities Co. |
| NDAC | North Dakota Administrative Code |
| NDDEQ | North Dakota Department of Environmental Quality |
| SSI | Statistically Significant Increase |
| TDF | Tire-Derived Fuel |
| TDS | Total Dissolved Solids |

# 1 Executive Summary

This 2025 Annual Groundwater Monitoring and Corrective Action Report (Annual Report) describes the monitoring program and results for the Coal Combustion Residuals (CCR) landfill at Montana-Dakota Utilities Co. (MDU's) R.M. Heskett Station (Site). The permitted landfill is the only CCR Unit at this Site. Content of this report is to satisfy requirements of the federal CCR rule and the State of North Dakota Permit Number 0087.

At the beginning, end, and throughout 2025, the CCR Unit was operating under a detection monitoring program as described in 40 CFR 257.94 and NDAC 33.1-20-08-06-04. Pursuant to § 257.94 and NDAC 33.1-20-08-06-04, statistically significant increases (SSIs) were determined for:

- April 2025: fluoride and sulfate at MW1-90, fluoride at MW2-90, and calcium at MW3-90
- August 2025: fluoride and sulfate at MW1-90, fluoride at MW2-90, and calcium at MW3-90

Subsequent determinations and actions (if any) will be addressed in the 2025 Annual Report. Successful alternative source demonstrations (ASDs) were completed for the August 2024 and April 2025 SSIs. The ASD documentation is included in this report under Appendix B. An ASD for the August 2025 detection monitoring results is in progress, and results of the ASD are anticipated in 2026. Therefore, no assessment monitoring program (§ 257.95 and NDAC 33.1-20-08-06-04) or related corrective or remedial measures (§§ 257.96, 257.97, and 257.98; NDAC 33.1-20-08-06-06, -07, and -08) were necessary.

# 2 Introduction

Montana-Dakota Utilities Co. (MDU) owns and operates R.M. Heskett Station (Site) located in Mandan, Morton County, North Dakota (Figure 1). The Site was comprised of two coal-fired electric generating units which are now decommissioned, demolished, and the areas reclaimed. One coal combustion residual (CCR) unit, as defined by 40 CFR 257.53 and North Dakota Administrative Code (NDAC) 33.1-20-08-01, is located on the property. The CCR unit is a lined landfill containing coal combustion by-products, asbestos wastes generated from construction activity associated with MDU-owned facilities, decommissioning wastes, and ash derived from burning tire-derived fuel (TDF). Final closure of the landfill was completed in 2024. The CCR unit is required to comply with the provisions of the US Environmental Protection Agency (EPA) CCR Rule (40 CFR Parts 257 and 261, Disposal of Coal Combustion Residuals from Electric Utilities) and the North Dakota Department of Environmental Quality (NDDEQ) CCR Rule (NDAC Title 33.1, Article 20, Chapter 8).

This 2025 Annual Groundwater Monitoring and Corrective Action Report (Annual Report) describes the monitoring program and results for the CCR landfill at the Site.

## 2.1 Purpose

As stated in § 257.90(e) and NDAC 33.1-20-08-06-01(e), the Annual Report must:

- Document the status of groundwater monitoring and any corrective action programs for the CCR unit,
- Summarize key actions completed,
- Describe any problems encountered,
- Discuss actions to resolve the problems, and
- Project key activities for the upcoming year.

## 2.2 CCR Rule Requirements

Additional requirements for the Annual Report, as outlined in § 257.90(e) and NDAC 33.1-20-08-06-01(e), and this Site's compliance with the CCR Rules, are summarized in Table 1.

**Table 1 CCR Rule Requirements and Compliance**

| EPA CCR Rule Reference (40 CFR) | NDDEQ CCR Rule Reference (NDAC) | Content Required in Report | Location |
|---|---|---|---|
| § 257.90(e)(1) | § 33.1-20-08-06-01(e)(1) | **Monitoring System Figure:** A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit. | Section 3.1 Groundwater Monitoring System; see Figure 1 |

| EPA CCR Rule Reference (40 CFR) | NDDEQ CCR Rule Reference (NDAC) | Content Required in Report | Location |
|---|---|---|---|
| § 257.90(e)(2) | § 33.1-20-08-06-01(e)(2) | **Monitoring System Adjustments**: Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken. | Section 3.1.1 Changes to Groundwater Monitoring System |
| § 257.90(e)(3) | § 33.1-20-08-06-01(e)(3) | **Data and Collection Summary**: In addition to all the monitoring data obtained under § 257.90 through § 257.98 and § 33.1-20-08-06, a summary including the number of groundwater samples that were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs. | Section 3.3 Data and Collection Summary; monitoring data included in Attached Table 1, Appendix A, and Appendix C |
| § 257.90(e)(4) | § 33.1-20-08-06-01(e)(4) | **Monitoring Program**: A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels). | Not applicable – No transition between monitoring programs was necessary |
| § 257.90(e)(5) | § 33.1-20-08-06-01(e)(5) | **Other Information**: Other information required, if applicable, to be included in the annual report as specified in § 257.90 through § 257.98 and § 33.1-20-08-06. | Section 3.2 Actions Completed/ Problems Encountered; Appendix B |
| § 257.90(e)(6) | n/a | **Executive Summary:** A section at the beginning of the annual report that provides an overview of the current status of groundwater monitoring and corrective action programs for the CCR unit. | Executive Summary |

# 3 Groundwater Monitoring Program

This section documents the status of the groundwater monitoring and corrective action program for the CCR unit in 2025. A description of the groundwater monitoring system is included in Section 3.1, key actions completed and problems encountered are described in Section 3.2, the monitoring and analytical results are described in Section 3.2, and key activities planned for 2026 are described in Section 3.4.

## 3.1 Groundwater Monitoring System

The groundwater monitoring well network consists of three upgradient/cross-gradient wells (MW-13, MW-103, and MW-44R) and four downgradient wells (MW-80R, MW1-90, MW2-90, and MW3-90). Well locations are shown on Figure 1.

### 3.1.1 Changes to Groundwater Monitoring System

In 2021, MDU applied for a modification to Permit 0087 from NDDEQ. The permit application included an updated groundwater monitoring network for the CCR unit. The modified permit was issued on February 14, 2022, and the monitoring network was used through 2023. In 2024, the groundwater monitoring network was updated to include two additional upgradient/cross gradient wells and shown on Figure 1 supplanted the groundwater monitoring system described in the Groundwater Monitoring System Certification (Barr, 2017a). No changes were made to the groundwater monitoring system in 2025.

## 3.2 Actions Completed/Problems Encountered

The following actions were completed in 2025:

- Background Update: Background was statistically evaluated and updated to include data through 2023 from upgradient wells MW-13, MW-103, and MW-44R in accordance with the Groundwater Statistical Method Selection Certification (Statistical Certification; Barr, 2017b). The updated prediction limits were used for the spring and fall 2025 detection monitoring events.

- Detection Monitoring Sampling: Groundwater samples were collected from each well in the groundwater monitoring system on April 23, 2025, and August 14, 2025. Groundwater samples were analyzed for Appendix III constituents, per the detection monitoring program of the CCR Rules (§ 257.94 and NDAC 33.1-20-08-06-04) (Attached Table 2).

- SSI Evaluation: SSI evaluations were conducted in accordance with the Groundwater Statistical Method Selection Certification (Statistical Certification; Barr, 2017b) for April 2025 and August 2025 detection monitoring events. Both detection monitoring events resulted in verified SSIs.

- Verification Retesting: Verification resampling was not conducted for April 2024 or August 2025 detection monitoring events.

- Alternative Source Demonstration (ASD): ASDs were conducted on the verified SSIs for the August 2024 and April 2025 detection monitoring events. The ASDs demonstrated an alternative source for both sampling events, as allowed by the CCR Rules (§ 257.94(e)(2) and NDAC 33.1-20-08-06-04(e)(2)). An ASD for the August 2025 detection monitoring event is in progress and will be completed within 90 days of the SSI determination. More details are provided in Section 2.3. Subsequent determinations and actions (if any) will be addressed in the 2026 Annual Report.

## 3.3 Data and Collection Summary

### 3.3.1 August 2024 Detection Monitoring Event

As mentioned in the 2024 Annual Report (Barr Engineering Co. (Barr), January 2025), an SSI evaluation was conducted on the results of the August 28, 2024, detection monitoring event. Nine potential SSIs (fluoride pH, sulfate, and TDS at MW1-90; pH and fluoride at MW2-90; calcium and pH at MW3-90; and pH at MW-80R) were identified. Verification resampling was conducted on November 26, 2024, and verified four SSIs (fluoride, sulfate, and TDS at MW1-90 and fluoride at MW2-90). Field and Lab information from the August 2024 sampling event was included in the 2024 Annual Report (Barr Engineering Co. (Barr), January 2025).

An ASD was conducted on the verified SSIs and was able to successfully demonstrate that a natural variation in groundwater quality and/or "a source other than the CCR unit" and/or statistical methods resulted in the SSIs, as allowed by § 257.94(e)(2) and NDAC 33.1-20-08-06-04(e)(2). The Alternative Source Demonstration: August 2024 Event Report is included in Appendix B.

### 3.3.2 April 2025 Detection Monitoring Event

Groundwater samples were collected from the seven groundwater monitoring network wells at the Site on April 23, 2025. Four potential SSIs (fluoride and sulfate at MW1-90, fluoride at MW2-90, and calcium at MW3-90) were identified. No verification resampling was performed. A summary of results is included in Attached Table 1. Field data sheets and analytical laboratory reports for detection monitoring sampling are included in Appendix A. Water level contours are shown on Figure 2, and flow calculations are included in Appendix C.

An ASD was conducted on the verified SSIs and was able to successfully demonstrate that a natural variation in groundwater quality and/or "a source other than the CCR unit" resulted in the SSIs, as allowed by § 257.94(e)(2) and NDAC 33.1-20-08-06-04(e)(2). The Alternative Source Demonstration: April 2025 Event Report is included in Appendix B.

### 3.3.3 August 2025 Detection Monitoring Event

Groundwater samples were collected from the seven groundwater monitoring network wells at the Site on August 14, 2025. Four potential SSIs (fluoride and sulfate at MW1-90, fluoride at MW2-90, and calcium at MW3-90) were identified. No verification resampling was performed. A summary of results is included in Attached Table 1. Field data sheets and analytical laboratory reports for detection, monitoring, and sampling are included in Appendix A. Water level contours are shown in Figure 3, and flow calculations are included in Appendix C.

An ASD was ongoing at the end of 2025. If the ASD is not successful, appropriate actions will be initiated per the CCR Rule as applicable.

## 3.4 Activities for the Upcoming Year

The following key activities for analytical results and statistical evaluations are planned for 2026:

- Complete the ASD or assessment monitoring determination for the August 2025 detection monitoring event in accordance with the Statistical Certification (Barr Engineering Co. (Barr), October 2017B).

- Evaluate analytical results from 2026 semi-annual detection monitoring events for SSIs according to the Statistical Certification (Barr Engineering Co. (Barr), October 2017B).

# 4 Operational Activity

Coal-fired unit operation at Heskett Station ceased by March 2022. Remaining landfill capacity was consumed in 2023 by waste generated during decommissioning activities. Final closure of the remaining open area of the landfill began in October 2023 with the geomembrane cover and sand drainage layer installed before halting construction due to winter conditions; final closure was completed in 2024.

## 4.1 Asbestos Disposal and Other Materials

No asbestos or any other material was disposed of in the Landfill in 2025.

## 4.2 Inspections and Maintenance

As previously stated, closure was initiated for the CCR unit in 2023. During closure, MDU staff conducted weekly inspections of the CCR landfill. When closure was certified by a qualified professional engineer, inspections moved to at least semi-annually in accordance with the post-closure care plan (Barr Engineering Co. (Barr), March 2024). The inspections found the Site to be in good order, with no appearances of an actual or potential structural weakness of the landfill. During 2025, the landfill was in post-closure care, and no CCR was hauled, created, or otherwise handled to create CCR fugitive dust emissions.

Phase I and II leachate systems were each flushed with approximately 1,500 gallons of water in August 2025. The system was flushed from the standpipes to the Evaporation Pond. There were no obstructions of flow.

The Landfill cover was inspected for erosion during 2025. No erosion was observed on the seeded areas, and vegetation is well established around Phases I and II. The covers of the ash disposal site are in good condition on all closed slots. The ash slot expansion area has good coverage. Portions of the established vegetation were hayed on the closed slots in July 2025.

## 4.3 Leachate Sampling

A leachate sample was not collected from the Evaporation Pond in 2025 as it was dry for most of the year.

# 5 References


Barr Engineering Co. (Barr). (January 2025). *2024 Annual Groundwater Monitoring and Corrective Action Report: CCR Landfill, R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. .*

Barr Engineering Co. (Barr). (March 2024). *Post-Closure Care Plan for Existing Landfill. Prepared for Montana-Dakota Utilities Co. .*

Barr Engineering Co. (Barr). (October 2017A). *Groundwater Monitoring System Certification, R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. .*

Barr Engineering Co. (Barr). (October 2017B). *Statistical Method Selection Certification, R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. October 2017.*

# Attached Tables

**Attached Table 1**
Water Quality Analytical Data Summary
2025 Annual Monitoring Report
Heskett CCR Groundwater Compliance

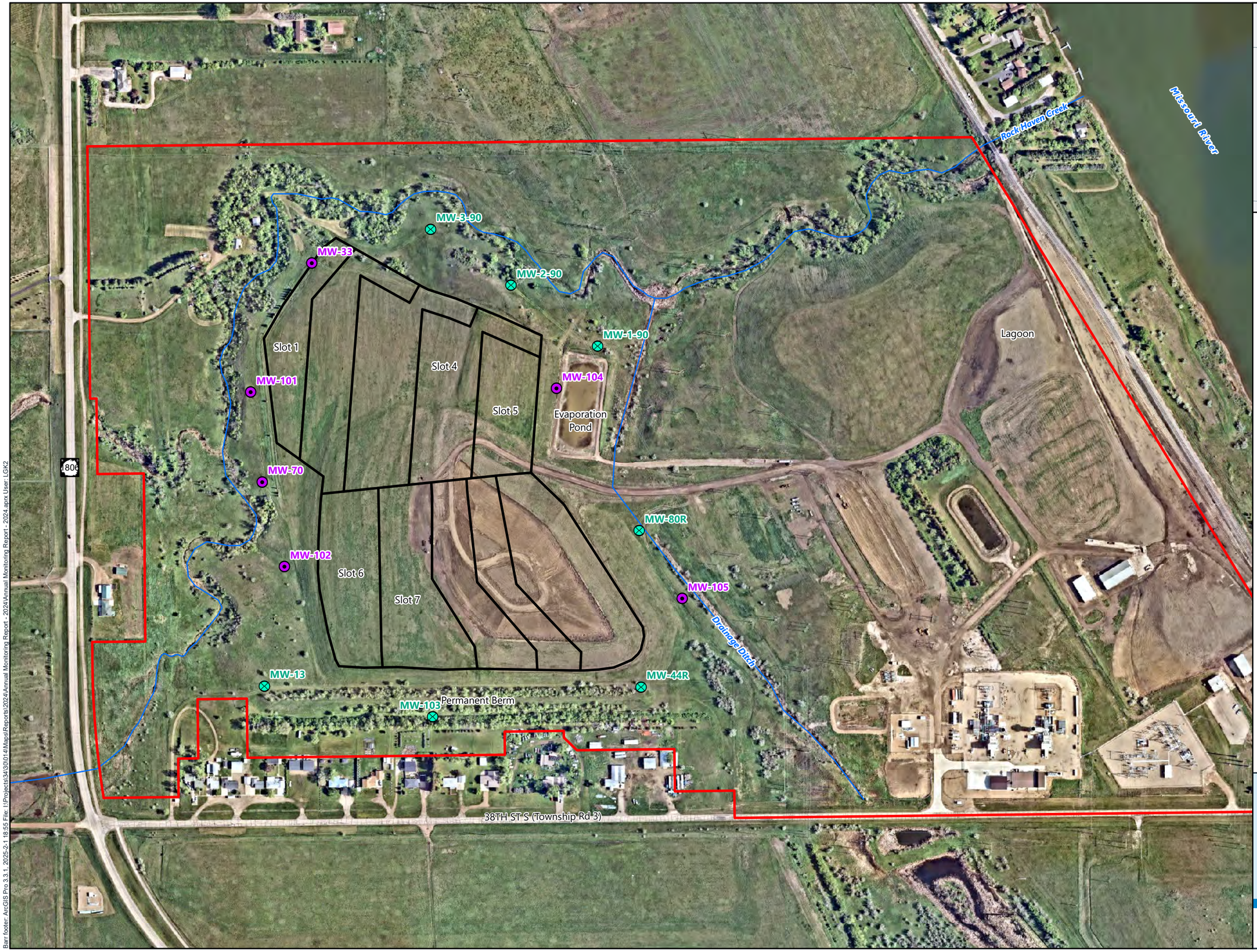
| | | Location | MW1-90 | MW1-90 | MW2-90 | MW2-90 | MW3-90 | MW3-90 | MW13 | MW13 | MW44R | MW44R | MW80R | MW80R | | MW103 | | MW103 | QC | QC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Date | 4/23/25 | 8/14/25 | 4/23/25 | 8/14/25 | 4/23/25 | 8/14/25 | 4/23/25 | 8/14/25 | 4/23/25 | 8/14/25 | 4/23/25 | 8/14/25 | | 4/23/25 | | 8/14/25 | 4/23/25 | 8/14/25 |
| | | Sample Type | N | N | N | N | N | N | N | N | N | N | N | N | FD | N | FD | N | FB | FB |
| Parameter | Analysis Location | Units | | | | | | | | | | | | | | | | | | |
| Appendix III | | | | | | | | | | | | | | | | | | | | |
| Boron, total | Lab | mg/l | < 0.5 U | < 0.5 U | < 0.5 U | < 0.5 U | < 0.5 U | < 0.5 U | **0.68** | **0.65** | < 0.5 U | < 0.5 U | < 0.5 U | < 0.5 U | < 0.5 U | < 0.5 U | < 0.5 U | < 0.5 U | < 0.1 U | < 0.1 U |
| Calcium, total | Lab | mg/l | **444** | **428** | **559** | **535** | **649** | **649** | **443** | **419** | **469** | **446** | **487** | **507** | **482** | **578** | **593** | **570** | < 1 U | < 1 U |
| Chloride | Lab | mg/l | **77.6** | **82.8** | **72.1** | **74.5** | **43.6** | **40.0** | **70.4** | **72.8** | **168** | **164** | **130** | **131** | **132** | **109** | **111** | **112** | < 2.0 U | < 2.0 U |
| Fluoride | Lab | mg/l | **1.21** | **1.17** | **1.13** | **1.07** | **0.12** | **0.10** | **0.98** | **1.01** | **0.69** | **0.67** | **0.21** | **0.21** | **0.20** | **0.13** | **0.15** | **0.13** | < 0.1 U | < 0.1 U |
| pH | Field | pH units | **6.86** | **6.84** | **6.93** | **6.95** | **6.85** | **6.83** | **6.99** | **6.93** | **6.61** | **6.58** | **6.98** | **6.98** | **--** | **6.77** | **--** | **6.75** | -- | -- |
| Solids, total dissolved | Lab | mg/l | **13100** | **13900** | **10600** | **10600** | **6010** | **6100** | **10300** | **10400** | **10800** | **11000** | **5950** | **5880** | **5940** | **5520** | **5530** | **5610** | < 10 U | < 10 U |
| Sulfate, as SO4 | Lab | mg/l | **8020** | **7710** | **6660** | **6340** | **3450** | **3370** | **6570** | **6070** | **6550** | **6260** | **3350** | **3130** | **3110** | **3030** | **3010** | **3120** | < 5 U | < 5 U |

-- Not analyzed/Not available.
N Sample Type: Normal
R Sample Type: Resample
FB Sample Type: Field Blank
FD: Sample Type: Field Duplicate
U: The analyte was analyzed for, but was not detected.

**Attached Table 2**
Sampling Event Summary
2025 Annual Monitoring Report
Heskett CCR Groundwater Compliance

| Event Classification and Number | Monitoring Well | Up or Down Gradient | Event date | No. Samples |
|---|---|---|---|---|
| Detection Monitoring Event #1 | MW-13 | Up | 4/23/2025 | 1 |
| Detection Monitoring Event #1 | MW-103 | Up | 4/23/2025 | 2 |
| Detection Monitoring Event #1 | MW-44R | Up | 4/23/2025 | 1 |
| Detection Monitoring Event #1 | MW1-90 | Down | 4/23/2025 | 1 |
| Detection Monitoring Event #1 | MW2-90 | Down | 4/23/2025 | 1 |
| Detection Monitoring Event #1 | MW3-90 | Down | 4/23/2025 | 1 |
| Detection Monitoring Event #1 | MW-80R | Down | 4/23/2025 | 1 |
| Detection Monitoring Event #2 | MW-13 | Up | 8/14/2025 | 1 |
| Detection Monitoring Event #2 | MW-103 | Up | 8/14/2025 | 1 |
| Detection Monitoring Event #2 | MW-44R | Up | 8/14/2025 | 1 |
| Detection Monitoring Event #2 | MW1-90 | Down | 8/14/2025 | 1 |
| Detection Monitoring Event #2 | MW2-90 | Down | 8/14/2025 | 1 |
| Detection Monitoring Event #2 | MW3-90 | Down | 8/14/2025 | 1 |
| Detection Monitoring Event #2 | MW-80R | Down | 8/14/2025 | 2 |

# Figures





Monitoring Well Location

Monitoring Well Location - Water Level Only

Property Boundary

*Note: MW-103 and MW-44R were water level only monitoring locations for the August 2023 monitoring event.*

0 200 400

Feet

Imagery: NearMap 4/25/2024

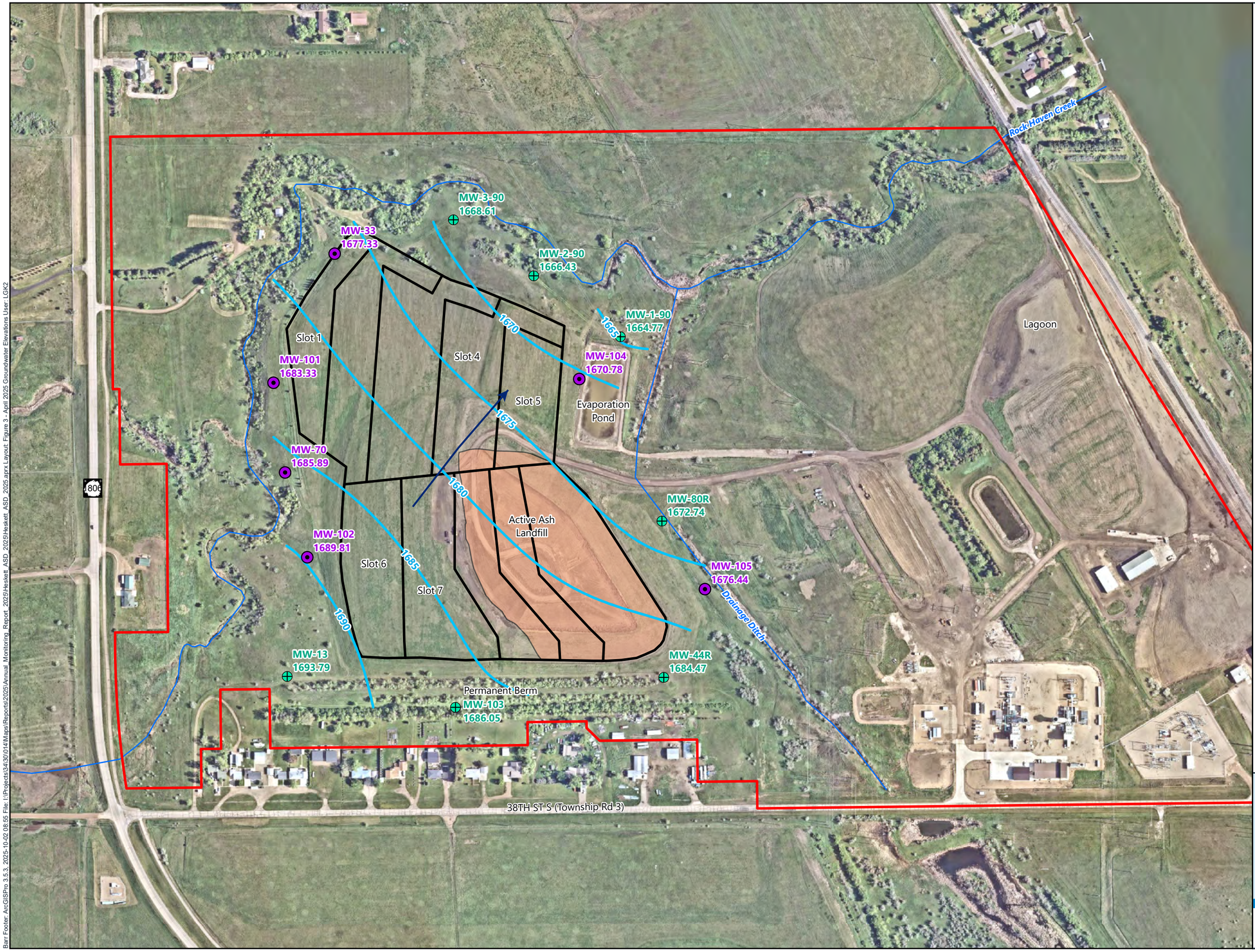
**SITE LAYOUT AND CCR MONITORING NETWORK**

Heskett Station
2024 Annual Monitoring Report
Montana Dakota Utilities
Mandan, North Dakota

FIGURE 1

BARR

Barr footer: ArcGIS Pro 3.3.1, 2025-2-1 18:55 File: I:\Projects\34\30\014\Maps\Reports\2024\Annual Monitoring Report - 2024\Annual Monitoring Report - 2024.aprx User: LGK2




- Monitoring Well Location
- Monitoring Well Location - Water Level Only
- Groundwater Flow Direction
- Property Boundary
- Existing Slot Boundaries
- Groundwater Elevation Contour (ft MSL)
- Active Portion of Landfill

N

0 200 400
Feet

Imagery: NearMap 4/25/2024

**APRIL 2025 GROUNDWATER ELEVATIONS**
Heskett Station
Montana Dakota Utilities
Mandan, North Dakota

FIGURE 2

BARR

MW-3-90
1667.31

MW-33
1676.87

MW-2-90
1665.90

MW-1-90
1664.14

Rock Haven Creek

Lagoon

Slot 1

Slot 4

Slot 5

MW-101
1683.29

MW-104
1670.67

Evaporation
Pond

1670

1665

1675

MW-70
1685.60

1680

Active Ash
Landfill

MW-80R
1672.71

MW-102
1689.76

Slot 6

Slot 7

MW-105
1676.14

Drainage Ditch

1690

1685

MW-13
1694.49

MW-44R
1684.31

Permanent Berm

MW-103
1686.57

806

38TH ST S (Township Rd 3)

Monitoring Well Location

Monitoring Well Location - Water Level Only

Groundwater Flow Direction

Property Boundary

Existing Slot Boundaries

Groundwater Elevation Contour (ft MSL)

Active Portion of Landfill

N

0 200 400

Feet

Imagery: NearMap 4/25/2024

**AUGUST 2025 GROUNDWATER ELEVATIONS**

Heskett Station
Montana Dakota Utilities
Mandan, North Dakota

FIGURE 3

BARR

# Appendices

# Appendix A

## Laboratory Reports and Field Sheets: 2025

**MINNESOTA VALLEY TESTING LABORATORIES, INC.**
1126 North Front St. ~ New Ulm, MN 56073 ~ 800-782-3557 ~ Fax 507-359-2890
2616 East Broadway Ave. ~ Bismarck, ND 58501 ~ 800-279-6885 ~ Fax 701-258-9724
1201 Lincoln Hwy. ~ Nevada, IA 50201 ~ 515-382-5486 ~ Fax 515-382-3885
www.MVTL.com

**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck
**Workorder:** MDU Heskett Spirng 2025 (84509) **PO:** 203855 OP

Brandon Schafer
Montana-Dakota Utilities Co.
400 North Fourth Street
Bismarck, ND 58501

**Certificate of Analysis**

## Approval

**All data reported has been reviewed and approved by:**

Claudette Carroll, Lab Manager Bismarck, ND

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

NEW ULM LAB CERTIFICATIONS:
MN LAB # 027-015-125 ND WW/DW # R-040

BISMARCK LAB CERTIFICATIONS:
MN LAB # 038-999-267 ND W/DW # ND-016

## Workorder Comments

All analytes with dilution factors greater than 1 (displayed in DF column) required dilution due to matrix or high concentration of target analyte unless otherwise noted and reporting limits (RDL column) have been adjusted accordingly.

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1201 Lincoln Hwy. ~ Nevada, IA 50201 ~ 515-382-5486 ~ Fax 515-382-3885
www.MVTL.com

**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## Analytical Results

**Lab ID:** 84509001 **Date Collected:** 04/23/2025 08:25 **Matrix:** Groundwater
**Sample ID:** MW13 **Date Received:** 04/24/2025 08:03 **Collector:** MVTL Field Service

**Temp @ Receipt (C):** 3.6 **Received on Ice:** Yes

| Parameter | Results | Units | RDL | DF | Prepared | Analyzed | Qual |
|---|---|---|---|---|---|---|---|
| **Method: 120.1** | | | | | | | |
| Specific Conductance - Field | **10136** | umhos/cm | 1 | 1 | | 04/23/2025 08:25 | |
| **Method: 150.2** | | | | | | | |
| pH - Field | **6.99** | units | 0.01 | 1 | | 04/23/2025 08:25 | |
| **Method: 170.1** | | | | | | | |
| Temperature - Field C | **7.42** | degrees C | | 1 | | 04/23/2025 08:25 | |
| **Method: ASTM D516-16** | | | | | | | |
| Sulfate | **6570** | mg/L | 250 | 50 | | 04/30/2025 09:46 | |
| **Method: EPA 6010D** | | | | | | | |
| Boron | **0.68** | mg/L | 0.5 | 5 | 04/24/2025 16:40 | 04/29/2025 10:50 | |
| Calcium | **443** | mg/L | 5 | 5 | 04/24/2025 16:40 | 04/25/2025 11:35 | |
| **Method: SM4500 H+ B-2021** | | | | | | | |
| pH | **7.3** | units | 0.1 | 1 | | 04/24/2025 17:03 | * |
| **Method: SM4500-Cl-E 2021** | | | | | | | |
| Chloride | **70.4** | mg/L | 2.0 | 1 | | 04/29/2025 10:44 | |
| **Method: SM4500-F-C-2021** | | | | | | | |
| Fluoride | **0.98** | mg/L | 0.1 | 1 | | 04/24/2025 17:03 | |
| **Method: USGS I-1750-85** | | | | | | | |
| Total Dissolved Solids | **10300** | mg/L | 10 | 1 | | 04/29/2025 15:27 | |

### Analysis Results Comments

***pH***

Sample analyzed beyond holding time.

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## Analytical Results

**Lab ID:** 84509002 **Date Collected:** 04/23/2025 11:45 **Matrix:** Groundwater
**Sample ID:** MW1-90 **Date Received:** 04/24/2025 08:03 **Collector:** MVTL Field Service

**Temp @ Receipt (C):** 3.6 **Received on Ice:** Yes

| Parameter | Results | Units | RDL | DF | Prepared | Analyzed | Qual |
|---|---|---|---|---|---|---|---|
| **Method: 120.1** | | | | | | | |
| Specific Conductance - Field | **11685** | umhos/cm | 1 | 1 | | 04/23/2025 11:45 | |
| **Method: 150.2** | | | | | | | |
| pH - Field | **6.86** | units | 0.01 | 1 | | 04/23/2025 11:45 | |
| **Method: 170.1** | | | | | | | |
| Temperature - Field C | **6.87** | degrees C | | 1 | | 04/23/2025 11:45 | |
| **Method: ASTM D516-16** | | | | | | | |
| Sulfate | **8020** | mg/L | 250 | 50 | | 04/30/2025 09:47 | |
| **Method: EPA 6010D** | | | | | | | |
| Boron | <0.5 | mg/L | 0.5 | 5 | 04/24/2025 16:40 | 04/29/2025 10:53 | |
| Calcium | **444** | mg/L | 5 | 5 | 04/24/2025 16:40 | 04/25/2025 11:36 | |
| **Method: SM4500 H+ B-2021** | | | | | | | |
| pH | **7.2** | units | 0.1 | 1 | | 04/24/2025 17:09 | * |
| **Method: SM4500-Cl-E 2021** | | | | | | | |
| Chloride | **77.6** | mg/L | 2.0 | 1 | | 04/29/2025 10:45 | |
| **Method: SM4500-F-C-2021** | | | | | | | |
| Fluoride | **1.21** | mg/L | 0.1 | 1 | | 04/24/2025 17:09 | |
| **Method: USGS I-1750-85** | | | | | | | |
| Total Dissolved Solids | **13100** | mg/L | 10 | 1 | | 04/29/2025 15:27 | |

### Analysis Results Comments

***pH***

Sample analyzed beyond holding time.

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## Analytical Results

**Lab ID:** 84509003 **Date Collected:** 04/23/2025 12:28 **Matrix:** Groundwater
**Sample ID:** MW2-90 **Date Received:** 04/24/2025 08:03 **Collector:** MVTL Field Service

**Temp @ Receipt (C):** 3.6 **Received on Ice:** Yes

| Parameter | Results | Units | RDL | DF | Prepared | Analyzed | Qual |
|---|---|---|---|---|---|---|---|
| **Method: 120.1** | | | | | | | |
| Specific Conductance - Field | **9436** | umhos/cm | 1 | 1 | | 04/23/2025 12:28 | |
| **Method: 150.2** | | | | | | | |
| pH - Field | **6.93** | units | 0.01 | 1 | | 04/23/2025 12:28 | |
| **Method: 170.1** | | | | | | | |
| Temperature - Field C | **9.7** | degrees C | | 1 | | 04/23/2025 12:28 | |
| **Method: ASTM D516-16** | | | | | | | |
| Sulfate | **6660** | mg/L | 250 | 50 | | 04/30/2025 09:48 | |
| **Method: EPA 6010D** | | | | | | | |
| Boron | <0.5 | mg/L | 0.5 | 5 | 04/24/2025 16:40 | 04/29/2025 10:53 | |
| Calcium | **559** | mg/L | 5 | 5 | 04/24/2025 16:40 | 04/25/2025 11:39 | |
| **Method: SM4500 H+ B-2021** | | | | | | | |
| pH | **7.3** | units | 0.1 | 1 | | 04/24/2025 17:14 | * |
| **Method: SM4500-Cl-E 2021** | | | | | | | |
| Chloride | **72.1** | mg/L | 2.0 | 1 | | 04/29/2025 10:46 | |
| **Method: SM4500-F-C-2021** | | | | | | | |
| Fluoride | **1.13** | mg/L | 0.1 | 1 | | 04/24/2025 17:14 | |
| **Method: USGS I-1750-85** | | | | | | | |
| Total Dissolved Solids | **10600** | mg/L | 10 | 1 | | 04/29/2025 15:27 | |

### Analysis Results Comments

***pH***

Sample analyzed beyond holding time.

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## Analytical Results

**Lab ID:** 84509004 **Date Collected:** 04/23/2025 13:11 **Matrix:** Groundwater
**Sample ID:** MW3-90 **Date Received:** 04/24/2025 08:03 **Collector:** MVTL Field Service

**Temp @ Receipt (C):** 3.6 **Received on Ice:** Yes

| Parameter | Results | Units | RDL | DF | Prepared | Analyzed | Qual |
|---|---|---|---|---|---|---|---|
| **Method: 120.1** | | | | | | | |
| Specific Conductance - Field | **6050** | umhos/cm | 1 | 1 | | 04/23/2025 13:11 | |
| **Method: 150.2** | | | | | | | |
| pH - Field | **6.85** | units | 0.01 | 1 | | 04/23/2025 13:11 | |
| **Method: 170.1** | | | | | | | |
| Temperature - Field C | **8.69** | degrees C | | 1 | | 04/23/2025 13:11 | |
| **Method: ASTM D516-16** | | | | | | | |
| Sulfate | **3450** | mg/L | 250 | 50 | | 04/30/2025 09:49 | |
| **Method: EPA 6010D** | | | | | | | |
| Boron | <0.5 | mg/L | 0.5 | 5 | 04/24/2025 16:40 | 04/29/2025 10:54 | |
| Calcium | **649** | mg/L | 5 | 5 | 04/24/2025 16:40 | 04/25/2025 11:40 | |
| **Method: SM4500 H+ B-2021** | | | | | | | |
| pH | **7.2** | units | 0.1 | 1 | | 04/24/2025 17:20 | * |
| **Method: SM4500-Cl-E 2021** | | | | | | | |
| Chloride | **43.6** | mg/L | 2.0 | 1 | | 04/29/2025 10:48 | |
| **Method: SM4500-F-C-2021** | | | | | | | |
| Fluoride | **0.12** | mg/L | 0.1 | 1 | | 04/24/2025 17:20 | |
| **Method: USGS I-1750-85** | | | | | | | |
| Total Dissolved Solids | **6010** | mg/L | 10 | 1 | | 04/29/2025 15:27 | |

### Analysis Results Comments

***pH***

Sample analyzed beyond holding time.

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## Analytical Results

**Lab ID:** 84509005 **Date Collected:** 04/23/2025 09:20 **Matrix:** Groundwater
**Sample ID:** MW-44R **Date Received:** 04/24/2025 08:03 **Collector:** MVTL Field Service

**Temp @ Receipt (C):** 3.6 **Received on Ice:** Yes

| Parameter | Results | Units | RDL | DF | Prepared | Analyzed | Qual |
|---|---|---|---|---|---|---|---|
| **Method: 120.1** | | | | | | | |
| Specific Conductance - Field | **9647** | umhos/cm | 1 | 1 | | 04/23/2025 09:20 | |
| **Method: 150.2** | | | | | | | |
| pH - Field | **6.61** | units | 0.01 | 1 | | 04/23/2025 09:20 | |
| **Method: 170.1** | | | | | | | |
| Temperature - Field C | **7.52** | degrees C | | 1 | | 04/23/2025 09:20 | |
| **Method: ASTM D516-16** | | | | | | | |
| Sulfate | **6550** | mg/L | 250 | 50 | | 04/30/2025 10:00 | |
| **Method: EPA 6010D** | | | | | | | |
| Boron | <0.5 | mg/L | 0.5 | 5 | 04/24/2025 16:40 | 04/29/2025 10:56 | |
| Calcium | **469** | mg/L | 5 | 5 | 04/24/2025 16:40 | 04/25/2025 11:41 | |
| **Method: SM4500 H+ B-2021** | | | | | | | |
| pH | **6.9** | units | 0.1 | 1 | | 04/24/2025 17:26 | * |
| **Method: SM4500-Cl-E 2021** | | | | | | | |
| Chloride | **168** | mg/L | 2.0 | 1 | | 04/29/2025 10:54 | |
| **Method: SM4500-F-C-2021** | | | | | | | |
| Fluoride | **0.69** | mg/L | 0.1 | 1 | | 04/24/2025 17:26 | |
| **Method: USGS I-1750-85** | | | | | | | |
| Total Dissolved Solids | **10800** | mg/L | 10 | 1 | | 04/29/2025 15:27 | |

### Analysis Results Comments

***pH***

Sample analyzed beyond holding time.

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## Analytical Results

**Lab ID:** 84509006 **Date Collected:** 04/23/2025 11:00 **Matrix:** Groundwater
**Sample ID:** MW-80R **Date Received:** 04/24/2025 08:03 **Collector:** MVTL Field Service

**Temp @ Receipt (C):** 3.6 **Received on Ice:** Yes

| Parameter | Results | Units | RDL | DF | Prepared | Analyzed | Qual |
|---|---|---|---|---|---|---|---|
| **Method: 120.1** | | | | | | | |
| Specific Conductance - Field | **5913** | umhos/cm | 1 | 1 | | 04/23/2025 11:00 | |
| **Method: 150.2** | | | | | | | |
| pH - Field | **6.98** | units | 0.01 | 1 | | 04/23/2025 11:00 | |
| **Method: 170.1** | | | | | | | |
| Temperature - Field C | **7.14** | degrees C | | 1 | | 04/23/2025 11:00 | |
| **Method: ASTM D516-16** | | | | | | | |
| Sulfate | **3350** | mg/L | 250 | 50 | | 04/30/2025 10:01 | |
| **Method: EPA 6010D** | | | | | | | |
| Boron | <0.5 | mg/L | 0.5 | 5 | 04/24/2025 16:40 | 04/29/2025 10:57 | |
| Calcium | **487** | mg/L | 5 | 5 | 04/24/2025 16:40 | 04/25/2025 11:42 | |
| **Method: SM4500 H+ B-2021** | | | | | | | |
| pH | **7.3** | units | 0.1 | 1 | | 04/24/2025 17:32 | * |
| **Method: SM4500-Cl-E 2021** | | | | | | | |
| Chloride | **130** | mg/L | 2.0 | 1 | | 04/29/2025 10:55 | |
| **Method: SM4500-F-C-2021** | | | | | | | |
| Fluoride | **0.21** | mg/L | 0.1 | 1 | | 04/24/2025 17:32 | |
| **Method: USGS I-1750-85** | | | | | | | |
| Total Dissolved Solids | **5950** | mg/L | 10 | 1 | | 04/29/2025 15:27 | |

### Analysis Results Comments

***pH***

Sample analyzed beyond holding time.

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## Analytical Results

**Lab ID:** 84509007 **Date Collected:** 04/23/2025 10:06 **Matrix:** Groundwater
**Sample ID:** MW103 **Date Received:** 04/24/2025 08:03 **Collector:** MVTL Field Service

**Temp @ Receipt (C):** 3.6 **Received on Ice:** Yes

| Parameter | Results | Units | RDL | DF | Prepared | Analyzed | Qual |
|---|---|---|---|---|---|---|---|
| **Method: 120.1** | | | | | | | |
| Specific Conductance - Field | **5748** | umhos/cm | 1 | 1 | | 04/23/2025 10:06 | |
| **Method: 150.2** | | | | | | | |
| pH - Field | **6.77** | units | 0.01 | 1 | | 04/23/2025 10:06 | |
| **Method: 170.1** | | | | | | | |
| Temperature - Field C | **8.08** | degrees C | | 1 | | 04/23/2025 10:06 | |
| **Method: ASTM D516-16** | | | | | | | |
| Sulfate | **3030** | mg/L | 100 | 20 | | 04/30/2025 10:22 | |
| **Method: EPA 6010D** | | | | | | | |
| Boron | <0.5 | mg/L | 0.5 | 5 | 04/24/2025 16:40 | 04/29/2025 10:57 | |
| Calcium | **578** | mg/L | 5 | 5 | 04/24/2025 16:40 | 04/25/2025 11:44 | |
| **Method: SM4500 H+ B-2021** | | | | | | | |
| pH | **7.1** | units | 0.1 | 1 | | 04/24/2025 17:38 | * |
| **Method: SM4500-Cl-E 2021** | | | | | | | |
| Chloride | **109** | mg/L | 2.0 | 1 | | 04/29/2025 10:56 | |
| **Method: SM4500-F-C-2021** | | | | | | | |
| Fluoride | **0.13** | mg/L | 0.1 | 1 | | 04/24/2025 17:38 | |
| **Method: USGS I-1750-85** | | | | | | | |
| Total Dissolved Solids | **5520** | mg/L | 10 | 1 | | 04/29/2025 15:27 | |

### Analysis Results Comments

***pH***

Sample analyzed beyond holding time.

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## Analytical Results

**Lab ID:** 84509008 **Date Collected:** 04/23/2025 10:06 **Matrix:** Groundwater
**Sample ID:** DUP 1 **Date Received:** 04/24/2025 08:03 **Collector:** MVTL Field Service

**Temp @ Receipt (C):** 3.6 **Received on Ice:** Yes

| Parameter | Results | Units | RDL | DF | Prepared | Analyzed | Qual |
|---|---|---|---|---|---|---|---|
| **Method: 120.1** | | | | | | | |
| Specific Conductance - Field | **5748** | umhos/cm | 1 | 1 | | 04/23/2025 10:06 | |
| **Method: 150.2** | | | | | | | |
| pH - Field | **6.77** | units | 0.01 | 1 | | 04/23/2025 10:06 | |
| **Method: 170.1** | | | | | | | |
| Temperature - Field C | **8.08** | degrees C | | 1 | | 04/23/2025 10:06 | |
| **Method: ASTM D516-16** | | | | | | | |
| Sulfate | **3010** | mg/L | 100 | 20 | | 04/30/2025 10:23 | |
| **Method: EPA 6010D** | | | | | | | |
| Boron | <0.5 | mg/L | 0.5 | 5 | 04/24/2025 16:40 | 04/29/2025 10:58 | |
| Calcium | **593** | mg/L | 5 | 5 | 04/24/2025 16:40 | 04/25/2025 11:49 | |
| **Method: SM4500 H+ B-2021** | | | | | | | |
| pH | **7.2** | units | 0.1 | 1 | | 04/24/2025 19:34 | * |
| **Method: SM4500-Cl-E 2021** | | | | | | | |
| Chloride | **111** | mg/L | 2.0 | 1 | | 04/29/2025 10:57 | |
| **Method: SM4500-F-C-2021** | | | | | | | |
| Fluoride | **0.15** | mg/L | 0.1 | 1 | | 04/24/2025 19:34 | |
| **Method: USGS I-1750-85** | | | | | | | |
| Total Dissolved Solids | **5530** | mg/L | 10 | 1 | | 04/29/2025 15:27 | |

### Analysis Results Comments

***pH***

Sample analyzed beyond holding time.

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## Analytical Results

**Lab ID:** 84509009 **Date Collected:** 04/23/2025 10:37 **Matrix:** Groundwater
**Sample ID:** Field Blank (FB) **Date Received:** 04/24/2025 08:03 **Collector:** MVTL Field Service

**Temp @ Receipt (C):** 3.6 **Received on Ice:** Yes

| Parameter | Results | Units | RDL | DF | Prepared | Analyzed | Qual |
|---|---|---|---|---|---|---|---|
| **Method: ASTM D516-16** | | | | | | | |
| Sulfate | <5 | mg/L | 5 | 1 | | 04/30/2025 10:15 | |
| **Method: EPA 6010D** | | | | | | | |
| Boron | <0.1 | mg/L | 0.1 | 1 | 04/24/2025 16:40 | 04/29/2025 11:00 | |
| Calcium | <1 | mg/L | 1 | 1 | 04/24/2025 16:40 | 04/25/2025 11:52 | |
| **Method: SM4500 H+ B-2021** | | | | | | | |
| pH | **6.8** | units | 0.1 | 1 | | 04/24/2025 19:40 | * |
| **Method: SM4500-Cl-E 2021** | | | | | | | |
| Chloride | <2.0 | mg/L | 2.0 | 1 | | 04/29/2025 10:58 | |
| **Method: SM4500-F-C-2021** | | | | | | | |
| Fluoride | <0.1 | mg/L | 0.1 | 1 | | 04/24/2025 19:40 | |
| **Method: USGS I-1750-85** | | | | | | | |
| Total Dissolved Solids | <10 | mg/L | 10 | 1 | | 04/29/2025 15:27 | |

### Analysis Results Comments

***pH***

Sample analyzed beyond holding time.

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## QC Results Summary — WO #: 84509

Sulfate — Units: mg/L

| QC Type | Original Sample ID | Blank Result | Spike Amount | Spike % Recovery | Spike Duplicate % Recovery | Lower Control Limit (%) | Upper Control Limit (%) | RPD (%) | RPD Limit (%) |
|---|---|---|---|---|---|---|---|---|---|
| LFB | | | 100 | 101.0 | | 85 | 115 | | |
| LFB | | | 100 | 99.2 | | 85 | 115 | | |
| LFB | | | 100 | 99.1 | | 85 | 115 | | |
| LFB | | | 100 | 97.5 | | 85 | 115 | | |
| LFB | | | 100 | 95.5 | | 85 | 115 | | |
| LFB | | | 100 | 89.8 | | 85 | 115 | | |
| MB | | <5 | | | | | | | |
| MB | | <5 | | | | | | | |
| MB | | <5 | | | | | | | |
| MB | | <5 | | | | | | | |
| MB | | <5 | | | | | | | |
| MB | | <5 | | | | | | | |
| MS/MSD | 84509004 | | 5000 | 93.5 | 92.3 | 85 | 115 | 0.7 | 20 |
| MS/MSD | 84509009 | | 100 | 93.4 | 94.8 | 85 | 115 | 1.5 | 20 |
| MS/MSD | 84651009 | | 500 | 82.0 | 80.6 | 85 | 115 | 1.3 | 20 |
| MS/MSD | 84964003 | | 1000 | 80.4 | 79.2 | 85 | 115 | 0.6 | 20 |
| MS/MSD | 84966007 | | 500 | 88.0 | 87.5 | 85 | 115 | 0.3 | 20 |

Chloride — Units: mg/L

| QC Type | Original Sample ID | Blank Result | Spike Amount | Spike % Recovery | Spike Duplicate % Recovery | Lower Control Limit (%) | Upper Control Limit (%) | RPD (%) | RPD Limit (%) |
|---|---|---|---|---|---|---|---|---|---|
| LFB | | | 30 | 92.3 | | 90 | 110 | | |
| LFB | | | 30 | 92.2 | | 90 | 110 | | |
| LFB | | | 30 | 91.8 | | 90 | 110 | | |
| LFB | | | 30 | 91.6 | | 90 | 110 | | |
| LFB | | | 30 | 91.9 | | 90 | 110 | | |
| LFB | | | 30 | 91.8 | | 90 | 110 | | |
| LFB | | | 30 | 91.7 | | 90 | 110 | | |
| MB | | <2.0 | | | | | | | |
| MB | | <2.0 | | | | | | | |
| MB | | <2.0 | | | | | | | |

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Chloride — Units: mg/L

| QC Type | Original Sample ID | Blank Result | Spike Amount | Spike % Recovery | Spike Duplicate % Recovery | Lower Control Limit (%) | Upper Control Limit (%) | RPD (%) | RPD Limit (%) |
|---|---|---|---|---|---|---|---|---|---|
| MB | | <2.0 | | | | | | | |
| MB | | <2.0 | | | | | | | |
| MB | | <2.0 | | | | | | | |
| MB | | <2.0 | | | | | | | |
| MS/MSD | 84292001 | | 40 | 100.2 | 97.1 | 80 | 120 | 1.1 | 20 |
| MS/MSD | 84509009 | | 80 | 90.1 | 90.2 | 80 | 120 | 0.4 | 20 |
| MS/MSD | 84651010 | | 80 | 92.9 | 92.8 | 80 | 120 | 0.2 | 20 |

Boron — Units: mg/L

| QC Type | Original Sample ID | Blank Result | Spike Amount | Spike % Recovery | Spike Duplicate % Recovery | Lower Control Limit (%) | Upper Control Limit (%) | RPD (%) | RPD Limit (%) |
|---|---|---|---|---|---|---|---|---|---|
| LFB-DF | | | 0.4 | 110.0 | | 85 | 115 | | |
| MB | | <0.1 | | | | | | | |
| PDS/PDSD | 84509001 | | 1 | 87.2 | 89.1 | 75 | 125 | 1.6 | 20 |
| PDS/PDSD | 84509004 | | 1 | 100.0 | 99.0 | 75 | 125 | 1.2 | 20 |

Calcium — Units: mg/L

| QC Type | Original Sample ID | Blank Result | Spike Amount | Spike % Recovery | Spike Duplicate % Recovery | Lower Control Limit (%) | Upper Control Limit (%) | RPD (%) | RPD Limit (%) |
|---|---|---|---|---|---|---|---|---|---|
| LFB-MI | | | 100 | 107.0 | | 85 | 115 | | |
| MB | | <1 | | | | | | | |
| PDS/PDSD | 84292001 | | 500 | 96.2 | 97.2 | 75 | 125 | 0.5 | 20 |
| PDS/PDSD | 84480001 | | 100 | 100.0 | 101.0 | 75 | 125 | 0.7 | 20 |
| DUP | 84507001 | | | | | | | 0.8 | 20 |
| DUP | 84509006 | | | | | | | 1.4 | 20 |
| PDS/PDSD | 84509007 | | 500 | 97.4 | 98.0 | 75 | 125 | 0.3 | 20 |
| PDS/PDSD | 84509008 | | 500 | 96.3 | 95.3 | 75 | 125 | 0.5 | 20 |

pH — Units: units

| QC Type | Original Sample ID | Blank Result | Spike Amount | Spike % Recovery | Spike Duplicate % Recovery | Lower Control Limit (%) | Upper Control Limit (%) | RPD (%) | RPD Limit (%) |
|---|---|---|---|---|---|---|---|---|---|
| CRM-PH | | | 6 | 100.3 | | | | | |
| CRM-PH | | | 8 | 100.0 | | | | | |
| CRM-PH | | | 6 | 99.8 | | | | | |
| CRM-PH | | | 8 | 99.8 | | | | | |
| DUP | 84480001 | | | | | | | 0.1 | 20 |
| DUP | 84509007 | | | | | | | 1.1 | 20 |

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

pH Units: units

| QC Type | Original Sample ID | Blank Result | Spike Amount | Spike % Recovery | Spike Duplicate % Recovery | Lower Control Limit (%) | Upper Control Limit (%) | RPD (%) | RPD Limit (%) |
|---|---|---|---|---|---|---|---|---|---|
| DUP | 84509008 | | | | | | | 2.7 | 20 |

Fluoride Units: mg/L

| QC Type | Original Sample ID | Blank Result | Spike Amount | Spike % Recovery | Spike Duplicate % Recovery | Lower Control Limit (%) | Upper Control Limit (%) | RPD (%) | RPD Limit (%) |
|---|---|---|---|---|---|---|---|---|---|
| CRM-F | | | 0.6 | 106.0 | | 89.99 | 111.11 | | |
| LFB-F | | | 0.5 | 100.0 | | 90 | 110 | | |
| LFB-F | | | 0.5 | 104.0 | | 90 | 110 | | |
| LFB-F | | | 0.5 | 100.0 | | 90 | 110 | | |
| LFB-F | | | 0.5 | 103.0 | | 90 | 110 | | |
| MB-F | | <0.1 | | | | | | | |
| MB-F | | <0.1 | | | | | | | |
| MB-F | | <0.1 | | | | | | | |
| MB-F | | <0.1 | | | | | | | |
| MS/MSD | 84499001 | | 0.5 | 104.0 | 94.0 | 80 | 120 | 6.8 | 20 |
| MS/MSD | 84509001 | | 0.5 | 112.0 | 104.0 | 80 | 120 | 2.6 | 20 |
| MS/MSD | 84509008 | | 0.5 | 88.0 | 90.0 | 80 | 120 | 1.7 | 20 |

Total Dissolved Solids Units: mg/L

| QC Type | Original Sample ID | Blank Result | Spike Amount | Spike % Recovery | Spike Duplicate % Recovery | Lower Control Limit (%) | Upper Control Limit (%) | RPD (%) | RPD Limit (%) |
|---|---|---|---|---|---|---|---|---|---|
| CRM | | | 736 | 98.0 | | 90.35 | 110.33 | | |
| MB | | <10 | | | | | | | |
| DUP | 84509001 | | | | | | | 1.0 | 20 |

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Member ACIL

**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

Minnesota Valley Testing Laboratories
2616 E. Broadway Ave
Bismarck, ND 58501
(701) 258-9720

Montana – Dakota Utilities
WO: 84509

# Chain of Custody Record

| | | | |
|---|---|---|---|
| Report To: | MDU | CC: | Project Name: MDU Heskett |
| Attn: | Brandon Schafer | | Event: Spring 2025 |
| Address: | 400 N. 4th St<br>Bismarck, ND 58501 | | Sampled By: Jeremy Herges |
| Phone: | 701-391-3812 | | |
| Email: | Brandon.Schafer@mdu.com | | |

| Sample Information | | | | | Sample Containers | | | | | | | | | Field Readings | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lab Number | Sample ID | Date | Time | Sample Type | 1 Liter Raw | 500 mL HNO3 | 500 mL HNO3 (filtered) | 250 mL H2SO4 | | | | | | Temp (°C) | Spec. Cond. | pH | Turbidity (NTU) | Analysis Required |
| 001 | MW13 | 23 Apr 25 | 0825 | GW | X | X | | | | | | | | 7.42 | 10,136 | 6.99 | 13.21 | Boron, Calcium, Chloride, Fluoride, Sulfate, TDS, pH (Routine Parameters Fed .App. III, see attachement) |
| 002 | MW1-90 | 23 Apr 25 | 1145 | GW | X | X | | | | | | | | 6.87 | 11,685 | 6.86 | 0.82 | |
| 003 | MW2-90 | 23 Apr 25 | 1228 | GW | X | X | | | | | | | | 9.70 | 9436 | 6.93 | 0.37 | |
| 004 | MW3-90 | 23 Apr 25 | 1311 | GW | X | X | | | | | | | | 8.69 | 6050 | 6.85 | 0.91 | |
| 005 | MW-44R | 23 Apr 25 | 0920 | GW | X | X | | | | | | | | 7.52 | 9647 | 6.61 | 0.33 | |
| 006 | MW-80R | 23 Apr 25 | 1100 | GW | X | X | | | | | | | | 7.14 | 5913 | 6.98 | 0.95 | |
| 007 | MW-103 | 23 Apr 25 | 1006 | GW | X | X | | | | | | | | 8.08 | 5748 | 6.77 | 0.84 | |
| 008 | Dup 1 | 23 Apr 25 | 1006 | GW | X | X | | | | | | | | 8.08 | 5748 | 6.77 | 0.84 | |
| 009 | Field Blank (FB) | 23 Apr 25 | 1037 | GW | X | X | | | | | | | | NA | NA | NA | NA | |
| | | | | | | | | | | | | | | | | | | |

Comments:

| Relinquished By | | Sample Condition | | Received By | |
|---|---|---|---|---|---|
| Name | Date/Time | Location | Temp (°C) | Name | Date/Time |
| 1 | 24 Apr 25 0853 | Log In<br>Walk In #2 | 3.6 °C/TM BOS<br>ROI (Y) N | | 24 Apr 25 0903 |
| 2 | | | | | |

Page 1 of 1

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

Monitoring Parameters, Frequency, and Network

Heskett Station
Montana-Dakota Utilities
Mandan, North Dakota

| Spring Monitoring Points | Fall Monitoring Points |
|---|---|
| **Upgradient Wells (sample)** | **Upgradient Wells (sample)** |
| MWs: 13, 103, 44R | MWs: 13, 103, 44R |
| **Downgradient Wells (sample)** | **Downgradient Wells (sample)** |
| MWs: 80R, 1-90, 2-90, 3-90 | MWs: 80R, 1-90, 2-90, 3-90 |
| **Water-Level Only** | **Water-Level Only** |
| MWs: 102, 70, 101, 33, 104, 105 | MWs: 102, 70, 101, 33, 104, 105 |

**Water Level Monitoring:** All Wells, semi-annually. Please note where the distance was taken.
Ex) From top of riser to water surface 28.2 feet, riser is 2.5' above ground surface.

**Field Parameters (Always)**

| | | |
|---|---|---|
| Appearance | Water Elevation | Well Depth |
| Dissolved Oxygen | Turbidity | Temperature |
| pH | Specific Conductance | Eh |

**Routine Parameters (total, not dissolved)**

**Fed. App. III aka State App. I (Always, unless noted)**

| | | | |
|---|---|---|---|
| Boron | Chloride | pH | Total Dissolved Solids (TDS) |
| Calcium | Fluoride | Sulfate | |

**Fed. App. IV aka State App. II (Never, unless noted)**

| | | | | |
|---|---|---|---|---|
| Antimony | Beryllium | Cobalt | Lithium | Selenium |
| Arsenic | Cadmium | Fluoride** | Mercury | Thallium |
| Barium | Chromium | Lead | Molybdenum | |

Radium 226 and 228 Combined

*App. III/I and IV/II should always be on separate CoC's and reports when sampling both
**Fluoride is listed in both Appendices and should be reported on both, if necessary

**Parameters for Statistics and Comparison (Never, unless noted)**

| | | |
|---|---|---|
| Alkalinity | Magnesium | Potassium |
| Bicarbonate | Manganese | SAR |
| Calcium | Nitrate-Nitrite, as N | Silver |
| Hardness (as CACO3) | Phosphate | Sodium |
| Iron | | |

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

2616 E. Broadway Ave, Bismarck, ND
Phone: (701) 258-9720

# Field Datasheet

**Groundwater Assessment**

Company: MDU Heskett
Event: Spring 2025
Sample ID: 13
Sampling Personal: JH

**Weather Conditions:** Temp: 35 °F Wind: N @ 5-10 Precip: Sunny / Partly Cloudy / ~~Cloudy~~

## WELL INFORMATION

| | | |
|---|---|---|
| Well Locked? | YES | ~~NO~~ |
| Well Labeled? | YES | NO |
| Repairs Necessary? | | |
| Casing Diameter: | 2" | |
| Measurements are from top of well riser | | |
| Water Level Before Purge: | 30.48 | ft |
| Depth to Top of Pump: | — | ft |
| | | |
| Water Level After Sample: | 31.38 | ft |
| Measurement Method: | Electric Water Level Indicator | |

## SAMPLING INFORMATION

| | | |
|---|---|---|
| Purging Method: | Bladder | |
| Sampling Method: | Bladder | |
| Dedicated Equipment? | YES | NO |

| Control Settings: | | |
|---|---|---|
| Purge: | 3 | Sec. |
| Recover: | 57 | Sec. |
| PSI: | — | |

| Bottle List: |
|---|
| 1 Liter Raw |
| 500mL Nitric |

| Duplicate Sample? |
|---|
| YES / ~~NO~~ |
| Duplicate Sample ID: |
| — |

## FIELD READINGS

| Stabilization Parameters (3 Consecutive) | | Temp. (°C) | Spec. Cond. | pH | DO (mg/L) | ORP (mV) | Turbidity (NTU) | Water Level | Pumping Rate | mL Removed | Appearance or Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Purge Date | Time | ±0.5° | ±5% | ±0.1 | ±10% | ±10 | | (ft) | mL/Min | | Clarity, Color, Odor, Ect. |
| | | | | | | | | | | | clear, slightly turbid, turbid |
| 23 Apr 25 | 0750 | Start of Well Purge | | | | | | | | | |
| | 0810 | 7.08 | 10,214 | 6.94 | 1.08 | 218.5 | 3.88 | 31.34 | 100.0 | 2000.0 | Clear |
| | 0815 | 7.22 | 10,160 | 6.96 | 1.64 | 202.0 | 9.76 | 31.35 | 100.0 | 500.0 | Clear |
| | 0820 | 7.39 | 10,126 | 6.98 | 1.68 | 202.3 | 12.03 | 31.36 | 100.0 | 500.0 | Clear |
| | 0825 | 7.42 | 10,136 | 6.99 | 1.71 | 208.6 | 13.21 | 31.37 | 100.0 | 500.0 | Clear |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Well Stabilized? YES NO Total Volume Purged: 3500.0 mL

| Sample Date | Time | Temp. (°C) | Spec. Cond. | pH | | | Turbidity (NTU) | | | | Appearance or Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Clarity, Color, Odor, Ect. |
| 23 Apr 25 | 0825 | 7.42 | 10,136 | 6.99 | | | 13.21 | | | | Clear |

Comments:

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

# Field Datasheet

**Groundwater Assessment**

2616 E. Broadway Ave, Bismarck, ND
Phone: (701) 258-9720

| | |
|---|---|
| Company: | MDU Heskett |
| Event: | Spring 2025 |
| Sample ID: | 1-9 |
| Sampling Personal: | |

**Weather Conditions:** Temp: 40 °F Wind: N @ 5-10 Precip: Sunny / Partly Cloudy / ~~Cloudy~~

**WELL INFORMATION**

| | |
|---|---|
| Well Locked? | YES ~~NO~~ |
| Well Labeled? | YES NO |
| Repairs Necessary? | |
| Casing Diameter: | 2" |
| Measurements are from top of well riser | |
| Water Level Before Purge: | 11.09 ft |
| Depth to Top of Pump: | — ft |
| | |
| Water Level After Sample: | 11.93 ft |
| Measurement Method: | Electric Water Level Indicator |

**SAMPLING INFORMATION**

| | |
|---|---|
| Purging Method: | Bladder |
| Sampling Method: | Bladder |
| Dedicated Equipment? | (YES) NO |

| Control Settings: | |
|---|---|
| Purge: | 2 Sec. |
| Recover: | 58 Sec. |
| PSI: | — |

| Bottle List: |
|---|
| 1 Liter Raw |
| 500mL Nitric |

| Duplicate Sample? |
|---|
| YES / (NO) |
| Duplicate Sample ID: |
| — |

**FIELD READINGS**

| Stabilization Parameters (3 Consecutive) | | Temp. (°C) | Spec. Cond. | pH | DO (mg/L) | ORP (mV) | Turbidity (NTU) | Water Level | Pumping Rate | mL Removed | Appearance or Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Purge Date | Time | ±0.5° | ±5% | ±0.1 | ±10% | ±10 | | (ft) | mL/Min | | Clarity, Color, Odor, Ect. |
| | | | | | | | | | | | clear, slightly turbid, turbid |
| 23 Apr 25 | 1115 | Start of Well Purge | | | | | | | | | |
| | 1125 | 6.74 | 11,570 | 6.88 | 1.14 | 184.5 | 1.92 | 11.20 | ~~1000~~ 100.0 | 1000.0 | Clear |
| | 1130 | 6.83 | 11,601 | 6.87 | 1.11 | 185.6 | 1.19 | 11.25 | 100.0 | 500.0 | Clear |
| | 1135 | 6.79 | 11,517 | 6.87 | 1.11 | 190.1 | 1.55 | 11.35 | 100.0 | 500.0 | Clear |
| | 1140 | 6.82 | 11,576 | 6.87 | 1.02 | 191.8 | 0.71 | 11.40 | 100.0 | 500.0 | Clear |
| | 1145 | 6.87 | 11,685 | 6.86 | 0.97 | 194.7 | 0.82 | 11.40 | 100.0 | 500.0 | Clear |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Well Stabilized? (YES) NO Total Volume Purged: 3000.0 mL

| Sample Date | Time | Temp. (°C) | Spec. Cond. | pH | | | Turbidity (NTU) | | | | Appearance or Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Clarity, Color, Odor, Ect. |
| 23 Apr 25 | 1145 | 6.87 | 11,685 | 6.86 | | | 0.82 | | | | Clear |

| Comments: | |
|---|---|

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

# Field Datasheet

**Groundwater Assessment**

2616 E. Broadway Ave, Bismarck, ND
Phone: (701) 258-9720

| | |
|---|---|
| Company: | MDU Heskett |
| Event: | Spring 2025 |
| Sample ID: | 2-90 |
| Sampling Personal: | |

**Weather Conditions:** Temp: 45 °F Wind: N @ 5-10 Precip: Sunny / Partly Cloudy / Cloudy

**WELL INFORMATION**

| | |
|---|---|
| Well Locked? | YES (NO) |
| Well Labeled? | (YES) NO |
| Repairs Necessary? | |
| Casing Diameter: | 2" |
| Measurements are from top of well riser | |
| Water Level Before Purge: | 20.65 ft |
| Depth to Top of Pump: | ft |
| | |
| Water Level After Sample: | 20.98 ft |
| Measurement Method: | Electric Water Level Indicator |

**SAMPLING INFORMATION**

| | |
|---|---|
| Purging Method: | Bladder |
| Sampling Method: | Bladder |
| Dedicated Equipment? | (YES) NO |

| Control Settings: | |
|---|---|
| Purge: 2 | Sec. |
| Recover: 58 | Sec. |
| PSI: — | |

| Bottle List: |
|---|
| 1 Liter Raw |
| 500mL Nitric |

| Duplicate Sample? |
|---|
| YES (NO) |
| Duplicate Sample ID: |
| — |

**FIELD READINGS**

| Stabilization Parameters (3 Consecutive) | | Temp. (°C) | Spec. Cond. | pH | DO (mg/L) | ORP (mV) | Turbidity (NTU) | Water Level | Pumping Rate | mL Removed | Appearance or Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Purge Date | Time | ±0.5° | ±5% | ±0.1 | ±10% | ±10 | | (ft) | mL/Min | | clear, slightly turbid, turbid |
| 23 Apr 25 | 1158 | Start of Well Purge | | | | | | | | | |
| | 1208 | 9.86 | 9428 | 6.94 | 4.03 | 225.0 | 0.78 | 20.85 | 100.0 | 1000.0 | Clear |
| | 1213 | 9.77 | 9386 | 6.93 | 3.86 | 237.9 | 5.74 | 20.90 | 100.0 | 500.0 | Clear |
| | 1218 | 9.99 | 9430 | 6.93 | 3.76 | 226.2 | 0.74 | 20.92 | 100.0 | 500.0 | Clear |
| | 1223 | 9.95 | 9405 | 6.93 | 3.70 | 232.4 | 0.45 | 20.95 | 100.0 | 500.0 | Clear |
| | 1228 | 9.70 | 9436 | 6.93 | 3.71 | 233.2 | 0.37 | 20.96 | 100.0 | 500.0 | Clear |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Well Stabilized? (YES) NO Total Volume Purged: 3000.0 mL

| Sample Date | Time | Temp. (°C) | Spec. Cond. | pH | | | Turbidity (NTU) | | | | Appearance or Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Clarity, Color, Odor, Ect. |
| 23 Apr 25 | 1228 | 9.70 | 9436 | 6.93 | | | 0.37 | | | | Clear |

| Comments: | |
|---|---|

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

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Phone: (701) 258-9720

# Field Datasheet

**Groundwater Assessment**

| | |
|---|---|
| Company: | MDU Heskett |
| Event: | Spring 2025 |
| Sample ID: | 3-90 |
| Sampling Personal: | JJ MB |

**Weather Conditions:** Temp: 50 °F Wind: N @ 5-10 Precip: Sunny / Partly Cloudy / Cloudy

## WELL INFORMATION

| | |
|---|---|
| Well Locked? | YES (NO) |
| Well Labeled? | (YES) NO |
| Repairs Necessary? | |
| Casing Diameter: | 2" |
| Measurements are from top of well riser | |
| Water Level Before Purge: | 17.85 ft |
| Depth to Top of Pump: | — ft |
| | |
| Water Level After Sample: | 17.95 ft |
| Measurement Method: | Electric Water Level Indicator |

## SAMPLING INFORMATION

| | |
|---|---|
| Purging Method: | Bladder |
| Sampling Method: | Bladder |
| Dedicated Equipment? | (YES) NO |

| Control Settings: | |
|---|---|
| Purge: | 2 Sec. |
| Recover: | 58 Sec. |
| PSI: | — |

| Bottle List: |
|---|
| 1 Liter Raw |
| 500mL Nitric |

| Duplicate Sample? |
|---|
| YES / (NO) |
| Duplicate Sample ID: |
| — |

## FIELD READINGS

| Stabilization Parameters (3 Consecutive) | | Temp. (°C) | Spec. Cond. | pH | DO (mg/L) | ORP (mV) | Turbidity (NTU) | Water Level | Pumping Rate | mL Removed | Appearance or Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Purge Date | Time | ±0.5° | ±5% | ±0.1 | ±10% | ±10 | | (ft) | mL/Min | | clear, slightly turbid, turbid |
| 23 Apr 25 | 1246 | Start of Well Purge | | | | | | | | | |
| | 1256 | 9.08 | 6054 | 6.85 | 2.02 | 146.1 | 10.77 | 17.92 | 100.0 | 1000.0 | Clear |
| | 1301 | 8.94 | 6045 | 6.85 | 1.97 | 136.0 | 1.67 | 17.94 | 100.0 | 500.0 | Clear |
| | 1306 | 8.74 | 6065 | 6.85 | 1.93 | 130.0 | 0.76 | 17.93 | 100.0 | 500.0 | Clear |
| | 1311 | 8.69 | 6050 | 6.85 | 1.89 | 128.8 | 0.91 | 17.95 | 100.0 | 500.0 | Clear |

Well Stabilized? (YES) NO Total Volume Purged: 2500.0 mL

| Sample Date | Time | Temp. (°C) | Spec. Cond. | pH | | | Turbidity (NTU) | | | | Appearance or Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Clarity, Color, Odor, Ect. |
| 23 Apr 25 | 1311 | 8.69 | 6050 | 6.85 | | | 0.91 | | | | Clear |

Comments:

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

# Field Datasheet

**Groundwater Assessment**

2616 E. Broadway Ave, Bismarck, ND
Phone: (701) 258-9720

| | |
|---|---|
| Company: | MDU Heskett |
| Event: | Spring 2025 |
| Sample ID: | 44R |
| Sampling Personal: | JJ MC |

**Weather Conditions:** Temp: 35 °F Wind: N @ 5-10 Precip: Sunny / Partly Cloudy / Cloudy

**WELL INFORMATION**

| | | |
|---|---|---|
| Well Locked? | YES | NO |
| Well Labeled? | YES | NO |
| Repairs Necessary? | | |
| Casing Diameter: | 2" | |
| Measurements are from top of well riser | | |
| Water Level Before Purge: | 27.10 | ft |
| Depth to Top of Pump: | — | ft |
| | | |
| Water Level After Sample: | 27.67 | ft |
| Measurement Method: | Electric Water Level Indicator | |

**SAMPLING INFORMATION**

| | | |
|---|---|---|
| Purging Method: | Bladder | |
| Sampling Method: | Bladder | |
| Dedicated Equipment? | YES | NO |

| Control Settings: | |
|---|---|
| Purge: 3 | Sec. |
| Recover: 57 | Sec. |
| PSI: — | |

| Bottle List: |
|---|
| 1 Liter Raw |
| 500mL Nitric |

| Duplicate Sample? |
|---|
| YES / NO |
| Duplicate Sample ID: |
| — |

**FIELD READINGS**

| Stabilization Parameters (3 Consecutive) | | Temp. (°C) | Spec. Cond. | pH | DO (mg/L) | ORP (mV) | Turbidity (NTU) | Water Level | Pumping Rate | mL Removed | Appearance or Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Purge Date | Time | ±0.5° | ±5% | ±0.1 | ±10% | ±10 | | (ft) | mL/Min | | Clarity, Color, Odor, Ect. clear, slightly turbid, turbid |
| 23Apr25 | 0850 | Start of Well Purge | | | | | | | | | |
| | 0905 | 7.27 | 9578 | 6.61 | 0.59 | 151.2 | 0.45 | 27.60 | 100.0 | 500.0 | Clear |
| | 0910 | 7.41 | 9580 | 6.61 | 0.52 | 144.8 | 0.27 | 27.62 | 100.0 | 500.0 | Clear |
| | 0915 | 7.46 | 9621 | 6.61 | 0.44 | 140.1 | 0.33 | 27.64 | 100.0 | 500.0 | Clear |
| | 0920 | 7.52 | 9647 | 6.61 | 0.38 | 137.5 | 0.33 | 27.66 | 100.0 | 500.0 | clear |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Well Stabilized? YES NO Total Volume Purged: 3000.0 mL

| Sample Date | Time | Temp. (°C) | Spec. Cond. | pH | | | Turbidity (NTU) | | | | Appearance or Comment Clarity, Color, Odor, Ect. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 23 Apr 25 | 0920 | 7.52 | 9647 | 6.61 | | | 0.33 | | | | Clear |

Comments:

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

2616 E. Broadway Ave, Bismarck, ND
Phone: (701) 258-9720

# Field Datasheet

**Groundwater Assessment**

| | |
|---|---|
| Company: | MDU Heskett |
| Event: | Spring 2025 |
| Sample ID: | BOR |
| Sampling Personal: | |

**Weather Conditions:** Temp: 40 °F Wind: N @ 5-10 Precip: Sunny / Partly Cloudy / (Cloudy)

## WELL INFORMATION

| | | |
|---|---|---|
| Well Locked? | YES | (NO) |
| Well Labeled? | (YES) | NO |
| Repairs Necessary? | | |
| Casing Diameter: | 2" | |
| Measurements are from top of well riser | | |
| Water Level Before Purge: | 14.04 | ft |
| Depth to Top of Pump: | — | ft |
| | | |
| Water Level After Sample: | 14.32 | ft |
| Measurement Method: | Electric Water Level Indicator | |

## SAMPLING INFORMATION

| | | |
|---|---|---|
| Purging Method: | Bladder | |
| Sampling Method: | Bladder | |
| Dedicated Equipment? | (YES | NO) |

| Control Settings: | | |
|---|---|---|
| Purge: | 3 | Sec. |
| Recover: | 3.7 | Sec. |
| PSI: | — | |

| Bottle List: |
|---|
| 1 Liter Raw |
| 500mL Nitric |

| Duplicate Sample? |
|---|
| YES / (NO) |
| Duplicate Sample ID: |
| — |

## FIELD READINGS

| Stabilization Parameters (3 Consecutive) | | Temp. (°C) | Spec. Cond. | pH | DO (mg/L) | ORP (mV) | Turbidity (NTU) | Water Level | Pumping Rate | mL Removed | Appearance or Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Purge Date | Time | ±0.5° | ±5% | ±0.1 | ±10% | ±10 | | (ft) | mL/Min | | Clarity, Color, Odor, Ect. clear, slightly turbid, turbid |
| | 1035 | Start of Well Purge | | | | | | | | | |
| 23 Apr 25 | 1040 | 6.98 | 5927 | 6.99 | 0.82 | 159.9 | 1.01 | 14.25 | 100.0 | 500.0 | Clear |
| | 1045 | 6.97 | 5912 | 6.99 | 0.76 | 157.9 | 0.63 | 14.29 | 100.0 | 500.0 | Clear |
| | 1050 | 7.02 | 5924 | 6.99 | 0.81 | 154.0 | 1.46 | 14.30 | 100.0 | 500.0 | Clear |
| | 1055 | 7.05 | 5937 | 6.99 | 0.75 | 151.5 | 0.88 | 14.30 | 100.0 | 500.0 | Clear |
| | 1100 | 7.14 | 5913 | 6.98 | 0.72 | 147.8 | 0.95 | 14.31 | 100.0 | 500.0 | Clear |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | 2500.0 | |

Well Stabilized? (YES) NO Total Volume Purged: ~~3000.0~~ mL

| Sample Date | Time | Temp. (°C) | Spec. Cond. | pH | | | Turbidity (NTU) | | | | Appearance or Comment Clarity, Color, Odor, Ect. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 23 Apr 25 | 11.00 | 7.14 | 5913 | 6.98 | | | 0.95 | | | | Clear |

Comments: Collected Field Blank @ 1037

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Phone: (701) 258-9720

# Field Datasheet

**Groundwater Assessment**

| | |
|---|---|
| Company: | MDU Heskett |
| Event: | Spring 2025 |
| Sample ID: | 103 |
| Sampling Personal: | JM |

**Weather Conditions:** Temp: 40 °F Wind: N @ 5-10 Precip: Sunny / Partly Cloudy / Cloudy

## WELL INFORMATION

| | |
|---|---|
| Well Locked? | YES (NO) |
| Well Labeled? | (YES) NO |
| Repairs Necessary? | |
| Casing Diameter: | 2" |
| Measurements are from top of well riser | |
| Water Level Before Purge: | 31.48 ft |
| Depth to Top of Pump: | — ft |
| | |
| Water Level After Sample: | 33.85 ft |
| Measurement Method: | Electric Water Level Indicator |

## SAMPLING INFORMATION

| | |
|---|---|
| Purging Method: | Bladder |
| Sampling Method: | Bladder |
| Dedicated Equipment? | (YES) NO |

| Control Settings: | |
|---|---|
| Purge: | 3 Sec. |
| Recover: | 57 Sec. |
| PSI: | — |

| Bottle List: |
|---|
| 1 Liter Raw |
| 500mL Nitric |

| Duplicate Sample? |
|---|
| (YES) / NO |
| Duplicate Sample ID: |
| Dup 1 |

## FIELD READINGS

| Stabilization Parameters (3 Consecutive) | | Temp. (°C) | Spec. Cond. | pH | DO (mg/L) | ORP (mV) | Turbidity (NTU) | Water Level | Pumping Rate | mL Removed | Appearance or Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Purge Date | Time | ±0.5° | ±5% | ±0.1 | ±10% | ±10 | | (ft) | mL/Min | | clear, slightly turbid, turbid |
| 23 Apr 25 | 0936 | Start of Well Purge | | | | | | | | | |
| | 0946 | 7.95 | 5572 | 6.76 | 1.62 | 198.3 | 0.23 | 32.65 | 100.0 | 1000.0 | Clear |
| | 0951 | 8.02 | 5605 | 6.76 | 1.29 | 191.1 | 0.30 | 32.81 | 100.0 | 500.0 | Clear |
| | 0956 | 8.04 | 5620 | 6.77 | 1.34 | 190.7 | 0.30 | 33.05 | 100.0 | 500.0 | Clear |
| | 1001 | 8.02 | 5672 | 6.77 | 1.37 | 185.2 | 1.01 | 33.32 | 100.0 | 500.0 | Clear |
| | 1006 | 8.08 | 5748 | 6.77 | 1.28 | 183.4 | 0.84 | 33.75 | 100.0 | 500.0 | Clear |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Well Stabilized? (YES) NO Total Volume Purged: 3000.0 mL

| Sample Date | Time | Temp. (°C) | Spec. Cond. | pH | | | Turbidity (NTU) | | | | Appearance or Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Clarity, Color, Odor, Ect. |
| 23 Apr 25 | 1006 | 8.08 | 5748 | 6.77 | | | 0.84 | | | | Clear |

| Comments: | |
|---|---|

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Phone: (701) 258-9720

# Field Datasheet

Surface water Assessment

Company: MDU Heskett
Event: Spring 2025
Sampling Personal: [illegible]

**Weather Conditions:** Temp: 35 °F Wind: N @ 5-10 Precip: Sunny / Partly Cloudy / Cloudy

| Well ID | Date | Time | Casing Diameter | Water Level (ft) | | Comments |
|---|---|---|---|---|---|---|
| MW70 | 23 Apr 25 | 0842 | 2" | 20.45 | | |
| MW33 | | 1325 | 2" | 40.62 | | |
| MW101 | | 0844 | 2" | 36.20 | | |
| MW102 | | 0840 | 2" | 16.83 | | |
| MW104 | | 1109 | 2" | 13.73 | | |
| MW105 | | 1030 | 2" | 12.70 | | |
| | | | | | | |
| | | | | | | |

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Member ACIL

**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## Sample Condition Checklist

Date: 24 Apr 25 Time: 0916 Analyst: PN

Work Order #: 84609

Containers Supplied by MVTL: ☒ Yes ☐ No (Designate customer supplied containers as "Other" in container size column)

Comments:

| Number of Bottles | Container Size (mL) F-(500) = Filtered | Container Type CG = Clear Glass, P = Plastic, AG = Amber Glass | Preservation | pH | Sample IDs Preservation reagent added Date/Time Analyst | Unique ID of preservation reagent added | Sample pH after preservation | Required for $HNO_3$ samples only (24 hours later) Sample ID pH Recheck Result Date/Time/Analyst |
|---|---|---|---|---|---|---|---|---|
| 9 | (125) (250) (500) F-(500) (1000) Other | (CG) (P) (AG) Other | NONE $HNO_3$ $H_2SO_4$ NaOH NaOH/ZnAcet HCl | <2 >12 | | | | |
| 9 | (125) (250) (500) F-(500) (1000) Other | (CG) (P) (AG) Other | NONE $HNO_3$ $H_2SO_4$ NaOH NaOH/ZnAcet HCl | <2 >12 | | | | |
| | (125) (250) (500) F-(500) (1000) Other | (CG) (P) (AG) Other | NONE $HNO_3$ $H_2SO_4$ NaOH NaOH/ZnAcet HCl | <2 >12 | | | | |
| | (125) (250) (500) F-(500) (1000) Other | (CG) (P) (AG) Other | NONE $HNO_3$ $H_2SO_4$ NaOH NaOH/ZnAcet HCl | <2 >12 | | | | |
| | (125) (250) (500) F-(500) (1000) Other | (CG) (P) (AG) Other | NONE $HNO_3$ $H_2SO_4$ NaOH NaOH/ZnAcet HCl | <2 >12 | | | | |
| | (125) (250) (500) F-(500) (1000) Other | (CG) (P) (AG) Other | NONE $HNO_3$ $H_2SO_4$ NaOH NaOH/ZnAcet HCl | <2 >12 | | | | |
| | (125) (250) (500) F-(500) (1000) Other | (CG) (P) (AG) Other | NONE $HNO_3$ $H_2SO_4$ NaOH NaOH/ZnAcet HCl | <2 >12 | | | | |
| | (125) (250) (500) F-(500) (1000) Other | (CG) (P) (AG) Other | NONE $HNO_3$ $H_2SO_4$ NaOH NaOH/ZnAcet HCl | <2 >12 | | | | |
| | Oil and grease | (CG) (P) (AG) Other | HCl | n/a | | | | |
| | TOC Vials | (G) (AG) | $H_3PO_4$ | n/a | | | | |
| | DOC Vials | (G) (AG) | None $H_3PO_4$ | n/a | | | | |

*All samples requiring analyses performed outside of the Bismarck laboratory (New Ulm and Sub-Contract) are not documented on this form.
*All samples requiring microbiological tests are not documented on this form.

Form #80-910025-2 M:\Documents\FORMS\Approved Templates\Bismarck\Waters\80-910025-2 Sample Condition Checklist Page 1 of 1 Effective Date : 1 July 2024

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck
**Workorder:** MDU Heskett Fall 2025 (96101) **PO:** 203855 OP

Brandon Schafer
Montana-Dakota Utilities Co.
400 North Fourth Street
Bismarck, ND 58501

**Certificate of Analysis**

## Approval

**All data reported has been reviewed and approved by:**

Claudette Carroll, Lab Manager Bismarck, ND

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

NEW ULM LAB CERTIFICATIONS:
MN LAB # 027-015-125 ND WW/DW # R-040

BISMARCK LAB CERTIFICATIONS:
MN LAB # 038-999-267 ND W/DW # ND-016

## Workorder Comments

All analytes with dilution factors greater than 1 (displayed in DF column) required dilution due to matrix or high concentration of target analyte unless otherwise noted and reporting limits (RDL column) have been adjusted accordingly.

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## Analytical Results

**Lab ID:** 96101001 **Date Collected:** 08/14/2025 08:26 **Matrix:** Groundwater
**Sample ID:** MW13 **Date Received:** 08/15/2025 06:54 **Collector:** MVTL Field Service

**Temp @ Receipt (C):** 1.6 **Received on Ice:** Yes

| Parameter | Results | Units | RDL | DF | Prepared | Analyzed | Qual |
|---|---|---|---|---|---|---|---|
| **Method: 120.1** | | | | | | | |
| Specific Conductance - Field | **10285** | umhos/cm | 1 | 1 | | 08/14/2025 08:26 | |
| **Method: 150.2** | | | | | | | |
| pH - Field | **6.93** | units | 0.01 | 1 | | 08/14/2025 08:26 | |
| **Method: 170.1** | | | | | | | |
| Temperature - Field C | **12.85** | degrees C | | 1 | | 08/14/2025 08:26 | |
| **Method: ASTM D516-16** | | | | | | | |
| Sulfate | **6070** | mg/L | 200 | 40 | | 08/20/2025 09:55 | |
| **Method: EPA 6010D** | | | | | | | |
| Boron | **0.65** | mg/L | 0.5 | 5 | 08/15/2025 16:02 | 08/21/2025 15:25 | |
| Calcium | **419** | mg/L | 5 | 5 | 08/15/2025 16:02 | 08/19/2025 14:22 | |
| **Method: SM4500 H+ B-2021** | | | | | | | |
| pH | **7.3** | units | 0.1 | 1 | | 08/15/2025 16:20 | * |
| **Method: SM4500-Cl-E 2021** | | | | | | | |
| Chloride | **72.8** | mg/L | 2.0 | 1 | | 08/19/2025 10:47 | |
| **Method: SM4500-F-C-2021** | | | | | | | |
| Fluoride | **1.01** | mg/L | 0.1 | 1 | | 08/15/2025 16:20 | |
| **Method: USGS I-1750-85** | | | | | | | |
| Total Dissolved Solids | **10400** | mg/L | 10 | 1 | | 08/15/2025 14:02 | |

### Analysis Results Comments

***pH***

Sample analyzed beyond holding time.

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## Analytical Results

**Lab ID:** 96101002 **Date Collected:** 08/14/2025 11:45 **Matrix:** Groundwater
**Sample ID:** MW1-90 **Date Received:** 08/15/2025 06:54 **Collector:** MVTL Field Service

**Temp @ Receipt (C):** 1.6 **Received on Ice:** Yes

| Parameter | Results | Units | RDL | DF | Prepared | Analyzed | Qual |
|---|---|---|---|---|---|---|---|
| **Method: 120.1** | | | | | | | |
| Specific Conductance - Field | **12051** | umhos/cm | 1 | 1 | | 08/14/2025 11:45 | |
| **Method: 150.2** | | | | | | | |
| pH - Field | **6.84** | units | 0.01 | 1 | | 08/14/2025 11:45 | |
| **Method: 170.1** | | | | | | | |
| Temperature - Field C | **13.49** | degrees C | | 1 | | 08/14/2025 11:45 | |
| **Method: ASTM D516-16** | | | | | | | |
| Sulfate | **7710** | mg/L | 250 | 50 | | 08/20/2025 09:56 | |
| **Method: EPA 6010D** | | | | | | | |
| Boron | <0.5 | mg/L | 0.5 | 5 | 08/15/2025 16:02 | 08/21/2025 15:26 | |
| Calcium | **428** | mg/L | 5 | 5 | 08/15/2025 16:02 | 08/19/2025 14:23 | |
| **Method: SM4500 H+ B-2021** | | | | | | | |
| pH | **7.2** | units | 0.1 | 1 | | 08/15/2025 16:26 | * |
| **Method: SM4500-Cl-E 2021** | | | | | | | |
| Chloride | **82.8** | mg/L | 2.0 | 1 | | 08/19/2025 10:49 | |
| **Method: SM4500-F-C-2021** | | | | | | | |
| Fluoride | **1.17** | mg/L | 0.1 | 1 | | 08/15/2025 16:26 | |
| **Method: USGS I-1750-85** | | | | | | | |
| Total Dissolved Solids | **13900** | mg/L | 10 | 1 | | 08/15/2025 14:02 | |

### Analysis Results Comments

***pH***

Sample analyzed beyond holding time.

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## Analytical Results

**Lab ID:** 96101003 **Date Collected:** 08/14/2025 12:23 **Matrix:** Groundwater
**Sample ID:** MW2-90 **Date Received:** 08/15/2025 06:54 **Collector:** MVTL Field Service

**Temp @ Receipt (C):** 1.6 **Received on Ice:** Yes

| Parameter | Results | Units | RDL | DF | Prepared | Analyzed | Qual |
|---|---|---|---|---|---|---|---|
| **Method: 120.1** | | | | | | | |
| Specific Conductance - Field | **9418** | umhos/cm | 1 | 1 | | 08/14/2025 12:23 | |
| **Method: 150.2** | | | | | | | |
| pH - Field | **6.95** | units | 0.01 | 1 | | 08/14/2025 12:23 | |
| **Method: 170.1** | | | | | | | |
| Temperature - Field C | **12.55** | degrees C | | 1 | | 08/14/2025 12:23 | |
| **Method: ASTM D516-16** | | | | | | | |
| Sulfate | **6340** | mg/L | 200 | 40 | | 08/20/2025 11:23 | |
| **Method: EPA 6010D** | | | | | | | |
| Boron | <0.5 | mg/L | 0.5 | 5 | 08/15/2025 16:02 | 08/21/2025 15:28 | |
| Calcium | **535** | mg/L | 5 | 5 | 08/15/2025 16:02 | 08/19/2025 14:24 | |
| **Method: SM4500 H+ B-2021** | | | | | | | |
| pH | **7.3** | units | 0.1 | 1 | | 08/15/2025 16:32 | * |
| **Method: SM4500-Cl-E 2021** | | | | | | | |
| Chloride | **74.5** | mg/L | 2.0 | 1 | | 08/19/2025 10:50 | |
| **Method: SM4500-F-C-2021** | | | | | | | |
| Fluoride | **1.07** | mg/L | 0.1 | 1 | | 08/15/2025 16:32 | * |
| **Method: USGS I-1750-85** | | | | | | | |
| Total Dissolved Solids | **10600** | mg/L | 10 | 1 | | 08/15/2025 14:02 | |

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## Analytical Results

### Analysis Results Comments

***Fluoride***

Matrix spike and/or matrix spike duplicate recovery was low; the associated laboratory control sample recovery was acceptable.

***pH***

Sample analyzed beyond holding time.

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## Analytical Results

**Lab ID:** 96101004 **Date Collected:** 08/14/2025 13:00 **Matrix:** Groundwater
**Sample ID:** MW3-90 **Date Received:** 08/15/2025 06:54 **Collector:** MVTL Field Service

**Temp @ Receipt (C):** 1.6 **Received on Ice:** Yes

| Parameter | Results | Units | RDL | DF | Prepared | Analyzed | Qual |
|---|---|---|---|---|---|---|---|
| **Method: 120.1** | | | | | | | |
| Specific Conductance - Field | **6069** | umhos/cm | 1 | 1 | | 08/14/2025 13:00 | |
| **Method: 150.2** | | | | | | | |
| pH - Field | **6.83** | units | 0.01 | 1 | | 08/14/2025 13:00 | |
| **Method: 170.1** | | | | | | | |
| Temperature - Field C | **14.47** | degrees C | | 1 | | 08/14/2025 13:00 | |
| **Method: ASTM D516-16** | | | | | | | |
| Sulfate | **3370** | mg/L | 100 | 20 | | 08/20/2025 11:24 | |
| **Method: EPA 6010D** | | | | | | | |
| Boron | <0.5 | mg/L | 0.5 | 5 | 08/15/2025 16:02 | 08/21/2025 15:28 | |
| Calcium | **649** | mg/L | 5 | 5 | 08/15/2025 16:02 | 08/19/2025 14:25 | |
| **Method: SM4500 H+ B-2021** | | | | | | | |
| pH | **7.2** | units | 0.1 | 1 | | 08/15/2025 16:37 | * |
| **Method: SM4500-Cl-E 2021** | | | | | | | |
| Chloride | **40.0** | mg/L | 2.0 | 1 | | 08/19/2025 10:51 | |
| **Method: SM4500-F-C-2021** | | | | | | | |
| Fluoride | **0.10** | mg/L | 0.1 | 1 | | 08/15/2025 16:37 | |
| **Method: USGS I-1750-85** | | | | | | | |
| Total Dissolved Solids | **6100** | mg/L | 10 | 1 | | 08/15/2025 14:02 | |

### Analysis Results Comments

***pH***

Sample analyzed beyond holding time.

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## Analytical Results

**Lab ID:** 96101005 **Date Collected:** 08/14/2025 09:09 **Matrix:** Groundwater
**Sample ID:** MW-44R **Date Received:** 08/15/2025 06:54 **Collector:** MVTL Field Service

**Temp @ Receipt (C):** 1.6 **Received on Ice:** Yes

| Parameter | Results | Units | RDL | DF | Prepared | Analyzed | Qual |
|---|---|---|---|---|---|---|---|
| **Method: 120.1** | | | | | | | |
| Specific Conductance - Field | **9639** | umhos/cm | 1 | 1 | | 08/14/2025 09:09 | |
| **Method: 150.2** | | | | | | | |
| pH - Field | **6.58** | units | 0.01 | 1 | | 08/14/2025 09:09 | |
| **Method: 170.1** | | | | | | | |
| Temperature - Field C | **13.99** | degrees C | | 1 | | 08/14/2025 09:09 | |
| **Method: ASTM D516-16** | | | | | | | |
| Sulfate | **6260** | mg/L | 200 | 40 | | 08/20/2025 11:25 | |
| **Method: EPA 6010D** | | | | | | | |
| Boron | <0.5 | mg/L | 0.5 | 5 | 08/15/2025 16:02 | 08/21/2025 15:29 | |
| Calcium | **446** | mg/L | 5 | 5 | 08/15/2025 16:02 | 08/19/2025 14:26 | |
| **Method: SM4500 H+ B-2021** | | | | | | | |
| pH | **6.9** | units | 0.1 | 1 | | 08/15/2025 16:43 | * |
| **Method: SM4500-Cl-E 2021** | | | | | | | |
| Chloride | **164** | mg/L | 2.0 | 1 | | 08/19/2025 10:52 | |
| **Method: SM4500-F-C-2021** | | | | | | | |
| Fluoride | **0.67** | mg/L | 0.1 | 1 | | 08/15/2025 16:43 | |
| **Method: USGS I-1750-85** | | | | | | | |
| Total Dissolved Solids | **11000** | mg/L | 10 | 1 | | 08/15/2025 14:02 | |

### Analysis Results Comments

***pH***

Sample analyzed beyond holding time.

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## Analytical Results

**Lab ID:** 96101006 **Date Collected:** 08/14/2025 10:52 **Matrix:** Groundwater
**Sample ID:** MW-80R **Date Received:** 08/15/2025 06:54 **Collector:** MVTL Field Service

**Temp @ Receipt (C):** 1.6 **Received on Ice:** Yes

| Parameter | Results | Units | RDL | DF | Prepared | Analyzed | Qual |
|---|---|---|---|---|---|---|---|
| **Method: 120.1** | | | | | | | |
| Specific Conductance - Field | **5963** | umhos/cm | 1 | 1 | | 08/14/2025 10:52 | |
| **Method: 150.2** | | | | | | | |
| pH - Field | **6.98** | units | 0.01 | 1 | | 08/14/2025 10:52 | |
| **Method: 170.1** | | | | | | | |
| Temperature - Field C | **13.35** | degrees C | | 1 | | 08/14/2025 10:52 | |
| **Method: ASTM D516-16** | | | | | | | |
| Sulfate | **3130** | mg/L | 100 | 20 | | 08/20/2025 11:26 | |
| **Method: EPA 6010D** | | | | | | | |
| Boron | <0.5 | mg/L | 0.5 | 5 | 08/15/2025 16:02 | 08/21/2025 15:30 | |
| Calcium | **507** | mg/L | 5 | 5 | 08/15/2025 16:02 | 08/19/2025 14:27 | |
| **Method: SM4500 H+ B-2021** | | | | | | | |
| pH | **7.2** | units | 0.1 | 1 | | 08/15/2025 16:49 | * |
| **Method: SM4500-Cl-E 2021** | | | | | | | |
| Chloride | **131** | mg/L | 2.0 | 1 | | 08/19/2025 10:53 | |
| **Method: SM4500-F-C-2021** | | | | | | | |
| Fluoride | **0.21** | mg/L | 0.1 | 1 | | 08/15/2025 16:49 | |
| **Method: USGS I-1750-85** | | | | | | | |
| Total Dissolved Solids | **5880** | mg/L | 10 | 1 | | 08/15/2025 14:02 | |

### Analysis Results Comments

***pH***

Sample analyzed beyond holding time.

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## Analytical Results

**Lab ID:** 96101007 **Date Collected:** 08/14/2025 10:04 **Matrix:** Groundwater
**Sample ID:** MW-103 **Date Received:** 08/15/2025 06:54 **Collector:** MVTL Field Service

**Temp @ Receipt (C):** 1.6 **Received on Ice:** Yes

| Parameter | Results | Units | RDL | DF | Prepared | Analyzed | Qual |
|---|---|---|---|---|---|---|---|
| **Method: 120.1** | | | | | | | |
| Specific Conductance - Field | **5936** | umhos/cm | 1 | 1 | | 08/14/2025 10:04 | |
| **Method: 150.2** | | | | | | | |
| pH - Field | **6.75** | units | 0.01 | 1 | | 08/14/2025 10:04 | |
| **Method: 170.1** | | | | | | | |
| Temperature - Field C | **12.9** | degrees C | | 1 | | 08/14/2025 10:04 | |
| **Method: ASTM D516-16** | | | | | | | |
| Sulfate | **3120** | mg/L | 100 | 20 | | 08/20/2025 11:27 | |
| **Method: EPA 6010D** | | | | | | | |
| Boron | <0.5 | mg/L | 0.5 | 5 | 08/15/2025 16:02 | 08/21/2025 15:30 | |
| Calcium | **570** | mg/L | 5 | 5 | 08/15/2025 16:02 | 08/19/2025 14:28 | |
| **Method: SM4500 H+ B-2021** | | | | | | | |
| pH | **7.1** | units | 0.1 | 1 | | 08/15/2025 16:54 | * |
| **Method: SM4500-Cl-E 2021** | | | | | | | |
| Chloride | **112** | mg/L | 2.0 | 1 | | 08/19/2025 10:55 | |
| **Method: SM4500-F-C-2021** | | | | | | | |
| Fluoride | **0.13** | mg/L | 0.1 | 1 | | 08/15/2025 16:54 | |
| **Method: USGS I-1750-85** | | | | | | | |
| Total Dissolved Solids | **5610** | mg/L | 10 | 1 | | 08/15/2025 14:02 | |

### Analysis Results Comments

***pH***

Sample analyzed beyond holding time.

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## Analytical Results

**Lab ID:** 96101008 **Date Collected:** 08/14/2025 10:52 **Matrix:** Groundwater
**Sample ID:** Dup 1 **Date Received:** 08/15/2025 06:54 **Collector:** MVTL Field Service

**Temp @ Receipt (C):** 1.6 **Received on Ice:** Yes

| Parameter | Results | Units | RDL | DF | Prepared | Analyzed | Qual |
|---|---|---|---|---|---|---|---|
| **Method: 120.1** | | | | | | | |
| Specific Conductance - Field | **5963** | umhos/cm | 1 | 1 | | 08/14/2025 10:52 | |
| **Method: 150.2** | | | | | | | |
| pH - Field | **6.98** | units | 0.01 | 1 | | 08/14/2025 10:52 | |
| **Method: 170.1** | | | | | | | |
| Temperature - Field C | **13.35** | degrees C | | 1 | | 08/14/2025 10:52 | |
| **Method: ASTM D516-16** | | | | | | | |
| Sulfate | **3110** | mg/L | 200 | 40 | | 08/20/2025 11:28 | |
| **Method: EPA 6010D** | | | | | | | |
| Boron | <0.5 | mg/L | 0.5 | 5 | 08/15/2025 16:02 | 08/21/2025 15:31 | |
| Calcium | **482** | mg/L | 5 | 5 | 08/15/2025 16:02 | 08/19/2025 14:30 | |
| **Method: SM4500 H+ B-2021** | | | | | | | |
| pH | **7.3** | units | 0.1 | 1 | | 08/15/2025 17:00 | * |
| **Method: SM4500-Cl-E 2021** | | | | | | | |
| Chloride | **132** | mg/L | 2.0 | 1 | | 08/19/2025 10:56 | |
| **Method: SM4500-F-C-2021** | | | | | | | |
| Fluoride | **0.20** | mg/L | 0.1 | 1 | | 08/15/2025 17:00 | |
| **Method: USGS I-1750-85** | | | | | | | |
| Total Dissolved Solids | **5940** | mg/L | 10 | 1 | | 08/15/2025 14:02 | |

### Analysis Results Comments

***pH***

Sample analyzed beyond holding time.

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## Analytical Results

**Lab ID:** 96101009 **Date Collected:** 08/14/2025 12:38 **Matrix:** Groundwater
**Sample ID:** Field Blank (FB) **Date Received:** 08/15/2025 06:54 **Collector:** MVTL Field Service

**Temp @ Receipt (C):** 1.6 **Received on Ice:** Yes

| Parameter | Results | Units | RDL | DF | Prepared | Analyzed | Qual |
|---|---|---|---|---|---|---|---|
| **Method: ASTM D516-16** | | | | | | | |
| Sulfate | <5 | mg/L | 5 | 1 | | 08/20/2025 11:36 | |
| **Method: EPA 6010D** | | | | | | | |
| Boron | <0.1 | mg/L | 0.1 | 1 | 08/15/2025 16:02 | 08/21/2025 15:32 | |
| Calcium | <1 | mg/L | 1 | 1 | 08/15/2025 16:02 | 08/19/2025 14:34 | |
| **Method: SM4500 H+ B-2021** | | | | | | | |
| pH | **6.2** | units | 0.1 | 1 | | 08/15/2025 17:06 | * |
| **Method: SM4500-Cl-E 2021** | | | | | | | |
| Chloride | <2.0 | mg/L | 2.0 | 1 | | 08/19/2025 11:02 | |
| **Method: SM4500-F-C-2021** | | | | | | | |
| Fluoride | <0.1 | mg/L | 0.1 | 1 | | 08/15/2025 17:06 | |
| **Method: USGS I-1750-85** | | | | | | | |
| Total Dissolved Solids | <10 | mg/L | 10 | 1 | | 08/15/2025 14:02 | |

### Analysis Results Comments

***pH***

Sample analyzed beyond holding time.

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## QC Results Summary — WO #: 96101

Sulfate — Units: mg/L

| QC Type | Original Sample ID | Blank Result | Spike Amount | Spike % Recovery | Spike Duplicate % Recovery | Lower Control Limit (%) | Upper Control Limit (%) | RPD (%) | RPD Limit (%) |
|---|---|---|---|---|---|---|---|---|---|
| LFB | | | 100 | 103.0 | | 85 | 115 | | |
| LFB | | | 100 | 99.4 | | 85 | 115 | | |
| LFB | | | 100 | 100.0 | | 85 | 115 | | |
| LFB | | | 100 | 95.6 | | 85 | 115 | | |
| LFB | | | 100 | 98.6 | | 85 | 115 | | |
| LFB | | | 100 | 100.0 | | 85 | 115 | | |
| LFB | | | 100 | 104.0 | | 85 | 115 | | |
| MB | | <5 | | | | | | | |
| MB | | <5 | | | | | | | |
| MB | | <5 | | | | | | | |
| MB | | <5 | | | | | | | |
| MB | | <5 | | | | | | | |
| MB | | <5 | | | | | | | |
| MB | | <5 | | | | | | | |
| MS/MSD | 95939004 | | 100 | 105.5 | 101.5 | 85 | 115 | 2.8 | 20 |
| MS/MSD | 96082002 | | 100 | 96.7 | 98.7 | 85 | 115 | 1.7 | 20 |
| MS/MSD | 96101002 | | 5000 | 88.3 | 89.2 | 85 | 115 | 0.8 | 20 |
| MS/MSD | 96105003 | | 500 | 86.5 | 83.3 | 85 | 115 | 1.7 | 20 |
| MS/MSD | 96105013 | | 1000 | 95.5 | 96.8 | 85 | 115 | 0.5 | 20 |
| MS/MSD | 96105023 | | 2000 | 86.8 | 85.3 | 85 | 115 | 0.7 | 20 |

Chloride — Units: mg/L

| QC Type | Original Sample ID | Blank Result | Spike Amount | Spike % Recovery | Spike Duplicate % Recovery | Lower Control Limit (%) | Upper Control Limit (%) | RPD (%) | RPD Limit (%) |
|---|---|---|---|---|---|---|---|---|---|
| LFB | | | 30 | 94.9 | | 90 | 110 | | |
| LFB | | | 30 | 95.1 | | 90 | 110 | | |
| LFB | | | 30 | 94.0 | | 90 | 110 | | |
| LFB | | | 30 | 93.3 | | 90 | 110 | | |
| LFB | | | 30 | 91.2 | | 90 | 110 | | |
| LFB | | | 30 | 92.4 | | 90 | 110 | | |
| LFB | | | 30 | 92.0 | | 90 | 110 | | |

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

Chloride — Units: mg/L

| QC Type | Original Sample ID | Blank Result | Spike Amount | Spike % Recovery | Spike Duplicate % Recovery | Lower Control Limit (%) | Upper Control Limit (%) | RPD (%) | RPD Limit (%) |
|---|---|---|---|---|---|---|---|---|---|
| LFB | | | 30 | 90.8 | | 90 | 110 | | |
| LFB | | | 30 | 90.9 | | 90 | 110 | | |
| MB | | <2.0 | | | | | | | |
| MB | | <2.0 | | | | | | | |
| MB | | <2.0 | | | | | | | |
| MB | | <2.0 | | | | | | | |
| MB | | <2.0 | | | | | | | |
| MB | | <2.0 | | | | | | | |
| MB | | <2.0 | | | | | | | |
| MB | | <2.0 | | | | | | | |
| MS/MSD | 95939002 | | 30 | 93.6 | 93.1 | 80 | 120 | 0.2 | 20 |
| MS/MSD | 96082008 | | 30 | 89.5 | 89.1 | 80 | 120 | 0.3 | 20 |
| MS/MSD | 96105009 | | 30 | 90.0 | 90.6 | 80 | 120 | 0.2 | 20 |
| MS/MSD | 96105023 | | 30 | 87.6 | 88.3 | 80 | 120 | 0.4 | 20 |

Boron — Units: mg/L

| QC Type | Original Sample ID | Blank Result | Spike Amount | Spike % Recovery | Spike Duplicate % Recovery | Lower Control Limit (%) | Upper Control Limit (%) | RPD (%) | RPD Limit (%) |
|---|---|---|---|---|---|---|---|---|---|
| LFB-OE | | | 0.4 | 98.8 | | 85 | 115 | | |
| MB | | <0.1 | | | | | | | |
| PDS/PDSD | 96101003 | | 2 | 106.0 | 109.0 | 75 | 125 | 2.7 | 20 |
| PDS/PDSD | 96562001 | | 4 | 96.2 | 94.9 | 75 | 125 | 0.6 | 20 |

Calcium — Units: mg/L

| QC Type | Original Sample ID | Blank Result | Spike Amount | Spike % Recovery | Spike Duplicate % Recovery | Lower Control Limit (%) | Upper Control Limit (%) | RPD (%) | RPD Limit (%) |
|---|---|---|---|---|---|---|---|---|---|
| LFB-MI | | | 100 | 111.0 | | 85 | 115 | | |
| MB | | <1 | | | | | | | |
| PDS/PDSD | 95761004 | | 100 | 104.0 | 104.0 | 75 | 125 | 0.4 | 20 |
| PDS/PDSD | 95939004 | | 100 | 107.0 | 107.0 | 75 | 125 | 0.2 | 20 |
| PDS/PDSD | 96055001 | | 100 | 105.0 | 104.0 | 75 | 125 | 0.6 | 20 |
| DUP | 96101007 | | | | | | | 1.0 | 20 |
| PDS/PDSD | 96101008 | | 500 | 103.0 | 105.0 | 75 | 125 | 0.8 | 20 |
| PDS/PDSD | 96105007 | | 100 | 102.0 | 101.0 | 75 | 125 | 0.7 | 20 |

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Calcium — Units: mg/L

| QC Type | Original Sample ID | Blank Result | Spike Amount | Spike % Recovery | Spike Duplicate % Recovery | Lower Control Limit (%) | Upper Control Limit (%) | RPD (%) | RPD Limit (%) |
|---|---|---|---|---|---|---|---|---|---|
| PDS/PDSD | 96105016 | | 100 | 95.2 | 95.7 | 75 | 125 | 0.2 | 20 |
| PDS/PDSD | 96105023 | | 500 | 102.0 | 101.0 | 75 | 125 | 0.8 | 20 |

pH — Units: units

| QC Type | Original Sample ID | Blank Result | Spike Amount | Spike % Recovery | Spike Duplicate % Recovery | Lower Control Limit (%) | Upper Control Limit (%) | RPD (%) | RPD Limit (%) |
|---|---|---|---|---|---|---|---|---|---|
| CRM-PH | | | 6 | 100.0 | | | | | |
| CRM-PH | | | 6 | 99.8 | | | | | |
| CRM-PH | | | 6 | 99.7 | | | | | |
| CRM-PH | | | 6 | 99.5 | | | | | |
| CRM-PH | | | 6 | 99.5 | | | | | |
| DUP | 96101006 | | | | | | | 2.8 | 20 |
| DUP | 96105007 | | | | | | | 2.3 | 20 |
| DUP | 96105017 | | | | | | | 0.4 | 20 |
| DUP | 96105021 | | | | | | | 0.6 | 20 |

Fluoride — Units: mg/L

| QC Type | Original Sample ID | Blank Result | Spike Amount | Spike % Recovery | Spike Duplicate % Recovery | Lower Control Limit (%) | Upper Control Limit (%) | RPD (%) | RPD Limit (%) |
|---|---|---|---|---|---|---|---|---|---|
| CRM-F | | | 3.34 | 98.8 | | 88.83 | 111.07 | | |
| LFB-F | | | 0.5 | 94.0 | | 90 | 110 | | |
| LFB-F | | | 0.5 | 100.0 | | 90 | 110 | | |
| MB-F | | <0.1 | | | | | | | |
| MB-F | | <0.1 | | | | | | | |
| MS/MSD | 96101003 | | 0.5 | 74.0 | 78.0 | 80 | 120 | 1.4 | 20 |

Total Dissolved Solids — Units: mg/L

| QC Type | Original Sample ID | Blank Result | Spike Amount | Spike % Recovery | Spike Duplicate % Recovery | Lower Control Limit (%) | Upper Control Limit (%) | RPD (%) | RPD Limit (%) |
|---|---|---|---|---|---|---|---|---|---|
| CRM | | | 736 | 99.0 | | 90.35 | 110.13 | | |
| MB | | <10 | | | | | | | |
| DUP | 96082010 | | | | | | | 0.6 | 20 |
| DUP | 96101003 | | | | | | | 0.2 | 20 |

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Member ACIL

**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

Minnesota Valley Testing Laboratories
2616 E. Broadway Ave
Bismarck, ND 58501
(701) 258-9720

Montana – Dakota Utilities
WO: 96101

# Chain of Custody Record

| | | | |
|---|---|---|---|
| Report To: | MDU | CC: | Project Name: MDU Heskett |
| Attn: | Brandon Schafer | | Event: Fall 2025 |
| Address: | 400 N. 4th St<br>Bismarck, ND 58501 | | Sampled By: |
| Phone: | 701-391-3812 | | |
| Email: | Brandon.Schafer@mdu.com | | |

| Sample Information | | | | | Sample Containers | | | | | | | | | Field Readings | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lab Number | Sample ID | Date | Time | Sample Type | 1 Liter Raw | 500 mL HNO3 | 500 mL HNO3 (filtered) | 250 mL H2SO4 | | | | | | Temp (°C) | Spec. Cond. | pH | Turbidity (NTU) | Analysis Required |
| 001 | MW13 | 14 Aug 25 | 0826 | GW | X | X | | | | | | | | 12.85 | 10285 | 6.93 | 1.57 | Boron, Calcium, Chloride, Fluoride, Sulfate, TDS, pH (Routine Parameters Fed .App. III, see attachement) |
| 002 | MW1-90 | 14 Aug 25 | 1145 | GW | X | X | | | | | | | | 13.49 | 12051 | 6.84 | 4.02 | |
| 003 | MW2-90 | 14 Aug 25 | 1223 | GW | X | X | | | | | | | | 12.55 | 9418 | 6.95 | 4.27 | |
| 004 | MW3-90 | 14 Aug 25 | 1300 | GW | X | X | | | | | | | | 14.47 | 6069 | 6.83 | 0.82 | |
| 005 | MW-44R | 14 Aug 25 | 0909 | GW | X | X | | | | | | | | 13.99 | 9639 | 6.58 | 0.00 | |
| 006 | MW-80R | 14 Aug 25 | 1052 | GW | X | X | | | | | | | | 13.35 | 5963 | 6.98 | 12.16 | |
| 007 | MW-103 | 14 Aug 25 | 1004 | GW | X | X | | | | | | | | 12.90 | 5936 | 6.75 | 0.03 | |
| 008 | Dup 1 | 14 Aug 25 | 1052 | GW | X | X | | | | | | | | 13.35 | 5963 | 6.98 | 12.16 | |
| 009 | Field Blank (FB) | 14 Aug 25 | 1238 | GW | X | X | | | | | | | | NA | NA | NA | NA | |

Comments:

| Relinquished By | | Sample Condition | | Received By | |
|---|---|---|---|---|---|
| Name | Date/Time | Location | Temp (°C) | Name | Date/Time |
| 1 | 15 Aug 25 0654 | Log In Walk In #2 | 1.6 °C/TM 65 ROI Y/N | | 15 Aug 25 0808 |
| 2 | | | | | |

Page 1 of 1

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## Monitoring Parameters, Frequency, and Network

Heskett Station
Montana-Dakota Utilities
Mandan, North Dakota

| Spring Monitoring Points | Fall Monitoring Points |
|---|---|
| **Upgradient Wells (sample)** | **Upgradient Wells (sample)** |
| MWs: 13, 103, 44R | MWs: 13, 103, 44R |
| **Downgradient Wells (sample)** | **Downgradient Wells (sample)** |
| MWs: 80R, 1-90, 2-90, 3-90 | MWs: 80R, 1-90, 2-90, 3-90 |
| **Water-Level Only** | **Water-Level Only** |
| MWs: 102, 70, 101, 33, 104, 105 | MWs: 102, 70, 101, 33, 104, 105 |

**Water Level Monitoring:** All Wells, semi-annually. Please note where the distance was taken.
Ex) From top of riser to water surface 28.2 feet, riser is 2.5' above ground surface.

**Field Parameters (Always)**

| | | |
|---|---|---|
| Appearance | Water Elevation | Well Depth |
| Dissolved Oxygen | Turbidity | Temperature |
| pH | Specific Conductance | Eh |

**Routine Parameters (total, not dissolved)**

**Fed. App. III aka State App. I (Always, unless noted)**

| | | | |
|---|---|---|---|
| Boron | Chloride | pH | Total Dissolved Solids (TDS) |
| Calcium | Fluoride | Sulfate | |

**Fed. App. IV aka State App. II (Never, unless noted)**

| | | | | |
|---|---|---|---|---|
| Antimony | Beryllium | Cobalt | Lithium | Selenium |
| Arsenic | Cadmium | Fluoride** | Mercury | Thallium |
| Barium | Chromium | Lead | Molybdenum | |

Radium 226 and 228 Combined

*App. III/I and IV/II should always be on separate CoC's and reports when sampling both
**Fluoride is listed in both Appendices and should be reported on both, if necessary

**Parameters for Statistics and Comparison (Never, unless noted)**

| | | |
|---|---|---|
| Alkalinity | Magnesium | Potassium |
| Bicarbonate | Manganese | SAR |
| Calcium | Nitrate-Nitrite, as N | Silver |
| Hardness (as CACO3) | Phosphate | Sodium |
| Iron | | |

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

# Field Datasheet

**Groundwater Assessment**

2616 E. Broadway Ave, Bismarck, ND
Phone: (701) 258-9720

| | |
|---|---|
| Company: | MDU Heskett |
| Event: | Fall 2025 |
| Sample ID: | 13 |
| Sampling Personal: | Jamy Mc |

**Weather Conditions:** Temp: 70 °F Wind: N @ 5-10 Precip: Sunny / Partly Cloudy / ~~Cloudy~~

**WELL INFORMATION**

| | |
|---|---|
| Well Locked? | YES (NO) |
| Well Labeled? | (YES) NO |
| Repairs Necessary? | |
| Casing Diameter: | 2" |
| Measurements are from top of well riser | |
| Water Level Before Purge: | 29.78 ft |
| Depth to Top of Pump: | — ft |
| | |
| Water Level After Sample: | 30.45 ft |
| Measurement Method: | Electric Water Level Indicator |

**SAMPLING INFORMATION**

| | |
|---|---|
| Purging Method: | Bladder |
| Sampling Method: | Bladder |
| Dedicated Equipment? | (YES) NO |

| Control Settings: | |
|---|---|
| Purge: | 3 Sec. |
| Recover: | 57 Sec. |
| PSI: | — |

| Bottle List: |
|---|
| 1 Liter Raw |
| 500mL Nitric |

| Duplicate Sample? |
|---|
| YES / (NO) |
| Duplicate Sample ID: |
| — |

**FIELD READINGS**

| Stabilization Parameters (3 Consecutive) | | Temp. (°C) | Spec. Cond. | pH | DO (mg/L) | ORP (mV) | Turbidity (NTU) | Water Level | Pumping Rate | mL Removed | Appearance or Comment Clarity, Color, Odor, Ect. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Purge Date | Time | ±0.5° | ±5% | ±0.1 | ±10% | ±10 | | (ft) | mL/Min | | clear, slightly turbid, turbid |
| 14 Aug 25 | 0801 | Start of Well Purge | | | | | | | | | |
| | 0806 | 13.79 | 10104 | 6.94 | 1.70 | 221.3 | 12.15 | 30.25 | 100.0 | 500 | Clear |
| | 0811 | 13.42 | 10363 | 6.94 | 1.09 | 172.4 | 0.35 | 30.33 | 100.0 | 500 | Clear |
| | 0816 | 12.93 | 10314 | 6.94 | 1.06 | 161.5 | 0.53 | 30.38 | 100.0 | 500 | Clear |
| | 0821 | 13.11 | 10337 | 6.93 | 1.10 | 155.8 | 1.20 | 30.40 | 100.0 | 500 | Clear |
| | 0826 | 12.85 | 10285 | 6.93 | 1.12 | 155.6 | 1.57 | 30.42 | 100.0 | 500 | Clear |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Well Stabilized? (YES) NO Total Volume Purged: 2500 mL

| Sample Date | Time | Temp. (°C) | Spec. Cond. | pH | | | Turbidity (NTU) | | | | Appearance or Comment Clarity, Color, Odor, Ect. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 Aug 25 | 0826 | 12.85 | 10285 | 6.93 | | | 1.57 | | | | Clear |

Comments:

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

# Field Datasheet

**Groundwater Assessment**

2616 E. Broadway Ave, Bismarck, ND
Phone: (701) 258-9720

| | |
|---|---|
| Company: | MDU Heskett |
| Event: | Fall 2025 |
| Sample ID: | 1-90 |
| Sampling Personal: | JH |

**Weather Conditions:** Temp: 75°F Wind: N @ 5-10 Precip: Sunny / Partly Cloudy / Cloudy

## WELL INFORMATION

| | | |
|---|---|---|
| Well Locked? | YES | NO |
| Well Labeled? | YES | NO |
| Repairs Necessary? | | |
| Casing Diameter: | 2" | |
| Measurements are from top of well riser | | |
| Water Level Before Purge: | 11.72 | ft |
| Depth to Top of Pump: | — | ft |
| | | |
| Water Level After Sample: | 11.97 | ft |
| Measurement Method: | Electric Water Level Indicator | |

## SAMPLING INFORMATION

| | | |
|---|---|---|
| Purging Method: | Bladder | |
| Sampling Method: | Bladder | |
| Dedicated Equipment? | YES | NO |

| Control Settings: | | |
|---|---|---|
| Purge: | 3 | Sec. |
| Recover: | 57 | Sec. |
| PSI: | — | |

| Bottle List: |
|---|
| 1 Liter Raw |
| 500mL Nitric |

| Duplicate Sample? |
|---|
| YES / NO |
| Duplicate Sample ID: |
| — |

## FIELD READINGS

| Stabilization Parameters (3 Consecutive) | | Temp. (°C) | Spec. Cond. | pH | DO (mg/L) | ORP (mV) | Turbidity (NTU) | Water Level | Pumping Rate | mL Removed | Appearance or Comment Clarity, Color, Odor, Ect. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Purge Date | Time | ±0.5° | ±5% | ±0.1 | ±10% | ±10 | | (ft) | mL/Min | | clear, slightly turbid, turbid |
| 14 Aug 25 | 1120 | Start of Well Purge | | | | | | | | | |
| | 1125 | 14.65 | 10985 | 6.87 | 2.61 | 204.9 | 2.70 | 11.75 | 100.0 | 500.0 | Clear |
| | 1130 | 13.81 | 11748 | 6.85 | 2.66 | 214.6 | 0.86 | 11.80 | 100.0 | 500.0 | Clear |
| | 1135 | 13.65 | 11956 | 6.84 | 1.23 | 209.8 | 0.44 | 11.85 | 100.0 | 500.0 | Clear |
| | 1140 | 13.52 | 11989 | 6.83 | 1.22 | 207.4 | 0.53 | 11.90 | 100.0 | 500.0 | Clear |
| | 1145 | 13.49 | 12051 | 6.84 | 1.19 | 200.3 | 4.02 | 11.95 | 100.0 | 500.0 | Clear |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Well Stabilized? YES NO Total Volume Purged: 2500 mL

| Sample Date | Time | Temp. (°C) | Spec. Cond. | pH | | | Turbidity (NTU) | | | | Appearance or Comment Clarity, Color, Odor, Ect. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 Aug 25 | 1145 | 13.49 | 12051 | 6.84 | | | 4.02 | | | | Clear |

Comments:

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

# Field Datasheet

**Groundwater Assessment**

2616 E. Broadway Ave, Bismarck, ND
Phone: (701) 258-9720

| | |
|---|---|
| Company: | MDU Heskett |
| Event: | Fall 2025 |
| Sample ID: | 2-90 |
| Sampling Personal: | |

**Weather Conditions:** Temp: 75 °F Wind: N @ 5-10 Precip: Sunny / ~~Partly Cloudy~~ / Cloudy

**WELL INFORMATION**

| | |
|---|---|
| Well Locked? | YES (NO) |
| Well Labeled? | (YES) NO |
| Repairs Necessary? | |
| Casing Diameter: | 2" |
| Measurements are from top of well riser | |
| Water Level Before Purge: | 21.18 ft |
| Depth to Top of Pump: | 22.30 ft |
| | |
| Water Level After Sample: | Below Pump ft |
| Measurement Method: | Electric Water Level Indicator |

**SAMPLING INFORMATION**

| | |
|---|---|
| Purging Method: | Bladder |
| Sampling Method: | Bladder |
| Dedicated Equipment? | (YES) NO |

| Control Settings: | |
|---|---|
| Purge: 3 | Sec. |
| Recover: 57 | Sec. |
| PSI: — | |

| Bottle List: |
|---|
| 1 Liter Raw |
| 500mL Nitric |

| Duplicate Sample? |
|---|
| YES / (NO) |
| Duplicate Sample ID: |
| — |

**FIELD READINGS**

| Stabilization Parameters (3 Consecutive) | | Temp. (°C) | Spec. Cond. | pH | DO (mg/L) | ORP (mV) | Turbidity (NTU) | Water Level | Pumping Rate | mL Removed | Appearance or Comment Clarity, Color, Odor, Ect. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Purge Date | Time | ±0.5° | ±5% | ±0.1 | ±10% | ±10 | | (ft) | mL/Min | | clear, slightly turbid, turbid |
| 14 Aug 25 | 1158 | Start of Well Purge | | | | | | | | | |
| | 1203 | 12.75 | 9479 | 6.95 | 3.90 | 246.8 | 9.89 | 21.45 | 100.0 | 500.0 | Clear |
| | 1208 | 12.71 | 9467 | 6.95 | 3.93 | 249.5 | 3.14 | 21.73 | 100.0 | 500.0 | Clear |
| | 1213 | 12.58 | 9473 | 6.95 | 3.77 | 244.8 | 0.25 | 21.90 | 100.0 | 500.0 | Clear |
| | 1218 | 12.75 | 9450 | 6.95 | 3.81 | 250.8 | 2.97 | 22.05 | 100.0 | 500.0 | Clear |
| | 1223 | 12.55 | 9418 | 6.95 | 3.66 | 254.5 | 4.27 | Below Pump | 100.0 | 500.0 | Clear |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Well Stabilized? (YES) NO Total Volume Purged: 2500.0 mL

| Sample Date | Time | Temp. (°C) | Spec. Cond. | pH | | | Turbidity (NTU) | | | | Appearance or Comment Clarity, Color, Odor, Ect. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 Aug 25 | 1223 | 12.55 | 9418 | 6.95 | | | 4.27 | | | | Clear |

Comments:

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Phone: (701) 258-9720

# Field Datasheet

**Groundwater Assessment**

| | |
|---|---|
| Company: | MDU Heskett |
| Event: | Fall 2025 |
| Sample ID: | 3-90 |
| Sampling Personal: | JMB |

**Weather Conditions:** Temp: 75 °F Wind: N @ 5-10 Precip: Sunny / Partly Cloudy / Cloudy

**WELL INFORMATION**

| | |
|---|---|
| Well Locked? | YES NO |
| Well Labeled? | YES NO |
| Repairs Necessary? | |
| Casing Diameter: | 2" |
| Measurements are from top of well riser | |
| Water Level Before Purge: | 19.15 ft |
| Depth to Top of Pump: | 20.12 ft |
| | |
| Water Level After Sample: | Below Pump ft |
| Measurement Method: | Electric Water Level Indicator |

**SAMPLING INFORMATION**

| | |
|---|---|
| Purging Method: | Bladder |
| Sampling Method: | Bladder |
| Dedicated Equipment? | YES NO |

| Control Settings: | |
|---|---|
| Purge: | 2 Sec. |
| Recover: | 58 Sec. |
| PSI: | — |

| Bottle List: |
|---|
| 1 Liter Raw |
| 500mL Nitric |

| Duplicate Sample? |
|---|
| YES / NO |
| Duplicate Sample ID: |
| — |

**FIELD READINGS**

| Stabilization Parameters (3 Consecutive) | | Temp. (°C) | Spec. Cond. | pH | DO (mg/L) | ORP (mV) | Turbidity (NTU) | Water Level | Pumping Rate | mL Removed | Appearance or Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Purge Date | Time | ±0.5° | ±5% | ±0.1 | ±10% | ±10 | | (ft) | mL/Min | | Clarity, Color, Odor, Ect. clear, slightly turbid, turbid |
| 14 Aug 25 | 1235 | Start of Well Purge | | | | | | | | | |
| | 1240 | 15.50 | 6077 | 6.81 | 0.39 | -229.4 | 2.61 | 19.29 | 100.0 | 500.0 | Clear |
| | 1245 | 15.33 | 6074 | 6.82 | 0.38 | -227.8 | 1.79 | 19.86 | 100.0 | 500.0 | Clear |
| | 1250 | 14.56 | 6049 | 6.82 | 0.40 | -226.2 | 0.95 | 20.05 | 100.0 | 500.0 | Clear |
| | 1255 | 14.65 | 6090 | 6.83 | 0.40 | -219.5 | 0.32 | Below Pump | 100.0 | 500.0 | Clear |
| | 1300 | 14.47 | 6069 | 6.83 | 0.41 | -218.9 | 0.82 | Below Pump | 100.0 | 500.0 | Clear |

Well Stabilized? YES NO Total Volume Purged: 2500.0 mL

| Sample Date | Time | Temp. (°C) | Spec. Cond. | pH | | | Turbidity (NTU) | | | | Appearance or Comment Clarity, Color, Odor, Ect. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 Aug 25 | 1300 | 14.47 | 6069 | 6.83 | | | 0.82 | | | | Clear |

Comments: Collected field Blank at 1238

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

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Phone: (701) 258-9720

# Field Datasheet

**Groundwater Assessment**

| | |
|---|---|
| Company: | MDU Heskett |
| Event: | Fall 2025 |
| Sample ID: | 44R |
| Sampling Personal: | |

**Weather Conditions:** Temp: 70 °F Wind: N @ 5-10 Precip: Sunny / Partly Cloudy / Cloudy

## WELL INFORMATION

| | | |
|---|---|---|
| Well Locked? | YES | (NO) |
| Well Labeled? | (YES) | NO |
| Repairs Necessary? | | |
| Casing Diameter: | 2" | |
| Measurements are from top of well riser | | |
| Water Level Before Purge: | 27.26 | ft |
| Depth to Top of Pump: | — | ft |
| | | |
| Water Level After Sample: | 27.95 | ft |
| Measurement Method: | Electric Water Level Indicator | |

## SAMPLING INFORMATION

| | | |
|---|---|---|
| Purging Method: | Bladder | |
| Sampling Method: | Bladder | |
| Dedicated Equipment? | (YES) | NO |

| Control Settings: | | |
|---|---|---|
| Purge: | 3 | Sec. |
| Recover: | 57 | Sec. |
| PSI: | — | |

| Bottle List: |
|---|
| 1 Liter Raw |
| 500mL Nitric |

| Duplicate Sample? |
|---|
| YES / (NO) |
| Duplicate Sample ID: |
| — |

## FIELD READINGS

| Stabilization Parameters (3 Consecutive) | | Temp. (°C) | Spec. Cond. | pH | DO (mg/L) | ORP (mV) | Turbidity (NTU) | Water Level | Pumping Rate | mL Removed | Appearance or Comment Clarity, Color, Odor, Ect. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Purge Date | Time | ±0.5° | ±5% | ±0.1 | ±10% | ±10 | | (ft) | mL/Min | | clear, slightly turbid, turbid |
| 14 Aug 25 | 0844 | Start of Well Purge | | | | | | | | | |
| | 0849 | 14.44 | 9662 | 6.59 | 1.05 | 141.9 | 1.26 | 27.35 | 100.0 | 500.0 | Clear |
| | 0854 | 14.54 | 9603 | 6.59 | 0.96 | 136.1 | 0.31 | 27.51 | 100.0 | 500.0 | Clear |
| | 0859 | 13.98 | 9668 | 6.58 | 0.63 | 126.5 | 0.00 | 27.68 | 100.0 | 500.0 | Clear |
| | 0904 | 13.89 | 9555 | 6.58 | 0.60 | 132.0 | 1.25 | 27.80 | 100.0 | 500.0 | Clear |
| | 0909 | 13.99 | 9639 | 6.58 | 0.58 | 131.1 | 0.00 | 27.92 | 100.0 | 500.0 | Clear |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Well Stabilized? (YES) NO Total Volume Purged: 2500.0 mL

| Sample Date | Time | Temp. (°C) | Spec. Cond. | pH | | | Turbidity (NTU) | | | | Appearance or Comment Clarity, Color, Odor, Ect. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 Aug 25 | 0909 | 13.99 | 9639 | 6.58 | | | 0.00 | | | | Clear |

Comments:

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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

# Field Datasheet

**Groundwater Assessment**

2616 E. Broadway Ave, Bismarck, ND
Phone: (701) 258-9720

| | |
|---|---|
| Company: | MDU Heskett |
| Event: | Fall 2025 |
| Sample ID: | BOR |
| Sampling Personal: | JMH |

**Weather Conditions:** Temp: 70 °F Wind: N @ 5-10 Precip: Sunny / Partly Cloudy / Cloudy

## WELL INFORMATION

| | |
|---|---|
| Well Locked? | YES (NO) |
| Well Labeled? | (YES) NO |
| Repairs Necessary? | |
| Casing Diameter: | 2" |
| Measurements are from top of well riser | |
| Water Level Before Purge: | 14.07 ft |
| Depth to Top of Pump: | — ft |
| | |
| Water Level After Sample: | 14.50 ft |
| Measurement Method: | Electric Water Level Indicator |

## SAMPLING INFORMATION

| | | |
|---|---|---|
| Purging Method: | Bladder | |
| Sampling Method: | Bladder | |
| Dedicated Equipment? | (YES) | NO |

| Control Settings: | |
|---|---|
| Purge: 3 | Sec. |
| Recover: 57 | Sec. |
| PSI: — | |

| Bottle List: |
|---|
| 1 Liter Raw |
| 500mL Nitric |

| Duplicate Sample? |
|---|
| (YES) / NO |
| Duplicate Sample ID: |
| Dup 1 |

## FIELD READINGS

| Stabilization Parameters (3 Consecutive) | | Temp. (°C) | Spec. Cond. | pH | DO (mg/L) | ORP (mV) | Turbidity (NTU) | Water Level | Pumping Rate | mL Removed | Appearance or Comment Clarity, Color, Odor, Ect. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Purge Date | Time | ±0.5° | ±5% | ±0.1 | ±10% | ±10 | | (ft) | mL/Min | | clear, slightly turbid, turbid |
| 14 Aug 25 | 1027 | Start of Well Purge | | | | | | | | | |
| | 1032 | 13.23 | 5864 | 6.99 | 0.48 | 134.7 | 23.66 | 14.12 | 100.0 | 500.0 | Clear |
| | 1037 | 13.11 | 5950 | 6.98 | 0.32 | 124.2 | 14.06 | 14.20 | 100.0 | 500.0 | Clear |
| | 1042 | 13.00 | 5955 | 6.98 | 0.31 | 125.2 | 14.01 | 14.30 | 100.0 | 500.0 | Clear |
| | 1047 | 13.25 | 5961 | 6.98 | 0.28 | 125.4 | 10.96 | 14.38 | 100.0 | 500.0 | Clear |
| | 1052 | 13.35 | 5963 | 6.98 | 0.24 | 121.1 | 12.16 | 14.48 | 100.0 | 500.0 | Clear |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Well Stabilized? (YES) NO Total Volume Purged: 2500.0 mL

| Sample Date | Time | Temp. (°C) | Spec. Cond. | pH | | | Turbidity (NTU) | | | | Appearance or Comment Clarity, Color, Odor, Ect. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 Aug 25 | 1052 | 13.35 | 5963 | 6.98 | | | 12.16 | | | | Clear |

Comments:

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Phone: (701) 258-9720

# Field Datasheet

**Groundwater Assessment**

| | |
|---|---|
| Company: | MDU Heskett |
| Event: | Fall 2025 |
| Sample ID: | 103 |
| Sampling Personal: | JMK |

**Weather Conditions:** Temp: 70 °F Wind: N @ 5-10 Precip: Sunny / ~~Partly Cloudy~~ / Cloudy

## WELL INFORMATION

| | | |
|---|---|---|
| Well Locked? | YES | NO |
| Well Labeled? | YES | NO |
| Repairs Necessary? | | |
| Casing Diameter: | 2" | |
| Measurements are from top of well riser | | |
| Water Level Before Purge: | 30.96 | ft |
| Depth to Top of Pump: | — | ft |
| | | |
| Water Level After Sample: | 32.20 | ft |
| Measurement Method: | Electric Water Level Indicator | |

## SAMPLING INFORMATION

| | | |
|---|---|---|
| Purging Method: | Bladder | |
| Sampling Method: | Bladder | |
| Dedicated Equipment? | YES | NO |

| Control Settings: | | |
|---|---|---|
| Purge: | 3 | Sec. |
| Recover: | 57 | Sec. |
| PSI: | — | |

| Bottle List: |
|---|
| 1 Liter Raw |
| 500mL Nitric |

| Duplicate Sample? |
|---|
| YES / NO |
| Duplicate Sample ID: |
| — |

## FIELD READINGS

| Stabilization Parameters (3 Consecutive) | | Temp. (°C) | Spec. Cond. | pH | DO (mg/L) | ORP (mV) | Turbidity (NTU) | Water Level | Pumping Rate | mL Removed | Appearance or Comment Clarity, Color, Odor, Ect. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Purge Date | Time | ±0.5° | ±5% | ±0.1 | ±10% | ±10 | | (ft) | mL/Min | | clear, slightly turbid, turbid |
| 14 Aug 25 | 0939 | Start of Well Purge | | | | | | | | | |
| | 0944 | 13.70 | 5950 | 6.78 | 2.09 | 175.4 | 0.66 | 31.18 | 100.0 | 500.0 | Clear |
| | 0949 | 13.17 | 5950 | 6.77 | 1.70 | 179.0 | 0.24 | 31.32 | 100.0 | 500.0 | Clear |
| | 0954 | 13.12 | 5956 | 6.76 | 1.67 | 186.9 | 0.03 | 31.60 | 100.0 | 500.0 | Clear |
| | 0959 | 13.08 | 5958 | 6.76 | 1.63 | 187.5 | 0.00 | 31.85 | 100.0 | 500.0 | Clear |
| | 1004 | 12.90 | 5936 | 6.75 | 1.59 | 183.2 | 0.03 | 32.14 | 100.0 | 500.0 | Clear |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Well Stabilized? YES NO Total Volume Purged: 2500 mL

| Sample Date | Time | Temp. (°C) | Spec. Cond. | pH | | | Turbidity (NTU) | | | | Appearance or Comment Clarity, Color, Odor, Ect. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 Aug 25 | 1004 | 12.90 | 5936 | 6.75 | | | 0.03 | | | | Clear |

Comments:

**MINNESOTA VALLEY TESTING LABORATORIES, INC.**
1126 North Front St. ~ New Ulm, MN 56073 ~ 800-782-3557 ~ Fax 507-359-2890
2616 East Broadway Ave. ~ Bismarck, ND 58501 ~ 800-279-6885 ~ Fax 701-258-9724
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**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

MVTL
2616 E. Broadway Ave, Bismarck, ND
Phone: (701) 258-9720

# Field Datasheet

Surface water Assessment

Company: MDU Heskett
Event: Fall 2025
Sampling Personal: JJH

Weather Conditions: Temp: 70 °F Wind: N @ 5-10 Precip: Sunny / Partly Cloudy / Cloudy

| Well ID | Date | Time | Casing Diameter | Water Level (ft) | | Comments |
|---|---|---|---|---|---|---|
| MW70 | 14 Aug 25 | 0929 | 2" | 20.74 | | |
| MW33 | | 1313 | 2" | 41.08 | | |
| MW101 | | 0931 | 2" | 36.24 | | |
| MW102 | | 0926 | 2" | 16.88 | | |
| MW104 | | 1115 | 2" | 13.84 | | |
| MW105 | | 1111 | 2" | 13.00 | | |
| | | | | | | |
| | | | | | | |

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Member ACIL

**Account #:** 2800 **Client:** Montana-Dakota Utilities - Bismarck

## Sample Condition Checklist

Date: 15 Aug 25 Time: 0857 Analyst: PN

Work Order #: 96101

Containers Supplied by MVTL: ☒ Yes ☐ No (Designate customer supplied containers as "Other" in container size column)

Comments:

| Number of Bottles | Container Size (mL) F-(500) = Filtered | Container Type CG = Clear Glass, P = Plastic, AG = Amber Glass | Preservation | pH | Sample IDs Preservation reagent added Date/Time Analyst | Unique ID of preservation reagent added | Sample pH after preservation | Required for $HNO_3$ samples only (24 hours later) Sample ID pH Recheck Result Date/Time/Analyst |
|---|---|---|---|---|---|---|---|---|
| 9 | (125) (250) (500) F-(500) (1000) Other | (CG) (P) (AG) Other | NONE $HNO_3$ $H_2SO_4$ NaOH NaOH/ZnAcet HCl | <2 >12 | | | | |
| 9 | (125) (250) (500) F-(500) (1000) Other | (CG) (P) (AG) Other | NONE $HNO_3$ $H_2SO_4$ NaOH NaOH/ZnAcet HCl | <2 >12 | | | | |
| | (125) (250) (500) F-(500) (1000) Other | (CG) (P) (AG) Other | NONE $HNO_3$ $H_2SO_4$ NaOH NaOH/ZnAcet HCl | <2 >12 | | | | |
| | (125) (250) (500) F-(500) (1000) Other | (CG) (P) (AG) Other | NONE $HNO_3$ $H_2SO_4$ NaOH NaOH/ZnAcet HCl | <2 >12 | | | | |
| | (125) (250) (500) F-(500) (1000) Other | (CG) (P) (AG) Other | NONE $HNO_3$ $H_2SO_4$ NaOH NaOH/ZnAcet HCl | <2 >12 | | | | |
| | (125) (250) (500) F-(500) (1000) Other | (CG) (P) (AG) Other | NONE $HNO_3$ $H_2SO_4$ NaOH NaOH/ZnAcet HCl | <2 >12 | | | | |
| | (125) (250) (500) F-(500) (1000) Other | (CG) (P) (AG) Other | NONE $HNO_3$ $H_2SO_4$ NaOH NaOH/ZnAcet HCl | <2 >12 | | | | |
| | (125) (250) (500) F-(500) (1000) Other | (CG) (P) (AG) Other | NONE $HNO_3$ $H_2SO_4$ NaOH NaOH/ZnAcet HCl | <2 >12 | | | | |
| | Oil and grease | (CG) (P) (AG) Other | HCl | n/a | | | | |
| | TOC Vials | (G) (AG) | $H_3PO_4$ | n/a | | | | |
| | DOC Vials | (G) (AG) | None $H_3PO_4$ | n/a | | | | |

*All samples requiring analyses performed outside of the Bismarck laboratory (New Ulm and Sub-Contract) are not documented on this form.
*All samples requiring microbiological tests are not documented on this form.

Form #80-910025-2 M:\Documents\FORMS\Approved Templates\Bismarck\Waters\80-910025-2 Sample Condition Checklist Page 1 of 1 Effective Date : 1 July 2024

# Appendix B

## Alternative Source Demonstration Reports

# Alternative Source Demonstration: April 2025 Event

*R.M. Heskett Station*

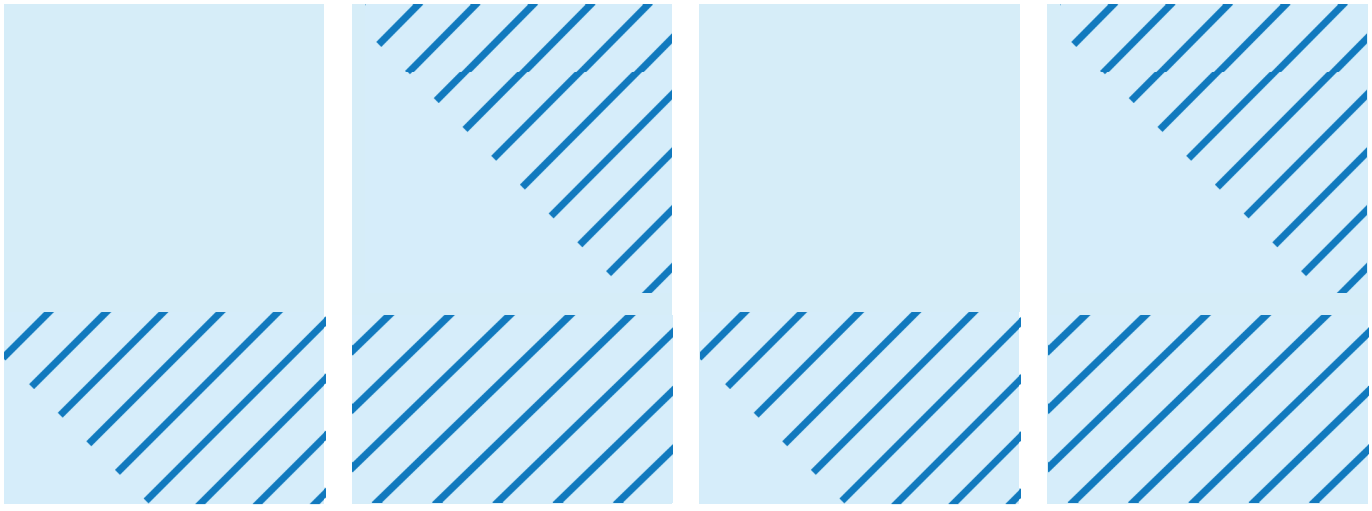
Prepared for
Montana-Dakota Utilities Co.

Prepared by
Barr Engineering Co.

October 2025

4300 MarketPointe Drive, Suite 200
Minneapolis, MN 55435
952.832.2600

barr.com



# Certification

I hereby certify that I, or my agent, have examined this written demonstration and attest that this Coal Combustion Residuals Facility Alternative Source Demonstration (ASD) is accurate and has been prepared in accordance with good engineering practice, including consideration of applicable industry standards and the requirements of 40 CFR § 257.94. I further certify that this report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the state of North Dakota

Kevin L. Solie
North Dakota PE-9488

October 13, 2025
Date

# Alternative Source Demonstration: April 2025 Event

October 2025

## Contents


1 Introduction ..... 1
2 August 2024 SSIs ..... 2
2.1 April 2025 Sampling Event ..... 2
3 Alternative Source Demonstration ..... 3
3.1 Source Hypothesis #1 CCR Unit Release ..... 3
3.2 Source Hypothesis #2: Natural Variations in Pre-Landfill and Site-Specific Background Water Quality ..... 4
3.2.1 Fluoride at MW1-90 and MW2-90 ..... 5
3.2.2 Sulfate at MW1-90 ..... 5
3.2.3 Calcium at MW3-90 ..... 6
3.3 Source Hypothesis #3: Evaporation Pond Release ..... 6
3.3.1 Fluoride and Sulfate at MW1-90 ..... 6
4 Conclusions ..... 10
5 References ..... 11

## Tables

Table 1 Fluoride Concentrations in Morton County, North Dakota ..... 5
Table 2 Summary of SSIs and Alternative Sources ..... 10

## Figures

Figure 1 Site Layout and CCR Monitoring Well Network ..... 2
Figure 2 Piper Plot: Alternative Source Demonstration ..... 3
Figure 3 Groundwater Elevation Contours ..... 4

## Appendices

Appendix A Time Series Plots
Appendix B Prediction Limit Plots
Appendix C Ash SPLP Laboratory Report
Appendix D Aerial Photo (March 30, 1988)
Appendix E Boring Logs
Appendix F MW1-90 Time Series Plots
Appendix G Geochemist's Workbench Results

# Abbreviations

| | |
|---|---|
| ASD | Alternative Source Demonstration |
| CCR | Coal Combustion Residuals |
| NDAC | North Dakota Administrative Code |
| NDDEQ | North Dakota Department of Environmental Quality |
| MDU | Montana-Dakota Utilities Co. |
| SPLP | Synthetic Precipitation Leaching Procedure |
| SSI | Statistically Significant Increase |
| TDS | Total Dissolved Solids |
| US EPA | United States Environmental Protection Agency |

# 1 Introduction

Montana-Dakota Utilities Co. (MDU) owns and operated R.M. Heskett Station (Site) located in Mandan, Morton County, North Dakota (Figure 1). The Site was comprised of two coal-fired electric generating units which are now decommissioned, demolished, and the areas reclaimed. One coal combustion residual (CCR) unit, as defined by 40 CFR § 257.53 and North Dakota Administrative Code (NDAC) 33.1-20-08-01, is located on the property. The CCR unit is a lined landfill containing coal combustion by-products, asbestos wastes generated from construction activity associated with MDU-owned facilities, decommissioning wastes, and ash derived from burning tire-derived fuel at the facility. Final closure of the landfill was completed in 2024.

The CCR Rule (US EPA, 2015) § 257.94(e)(2) allows for an alternative source demonstration (ASD) in the event of an identified statistically significant increase (SSI) in a water quality parameter in a downgradient monitoring well over background levels:

> *The owner or 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 to include obtaining a certification from a qualified professional engineer verifying the accuracy of the information in the report.*

The purpose of this work is to evaluate the data collected as part of the April 2025 monitoring event, along with historical data, to demonstrate if the SSIs are the results of a “source other than the CCR unit” or due to natural variation in groundwater quality or an error in sampling, analysis, or statistical evaluation. Nothing in the foregoing citation of the rule requires that the owner/operator disprove any and all potential counter-arguments that EPA or others may offer to refute this demonstration. Such arguments, if valid, would need to follow requirements of the rule to show a basis that includes rule requirements based on site-specific information.

# 2 April 2025 SSIs

Sampling for the second detection monitoring event in 2025 was conducted April 23, 2025. Final laboratory results were received May 2, 2025. Four potential SSIs over background were identified (see time series plots in Appendix A and prediction limit plots in Appendix B):

- fluoride and sulfate at MW1-90
- fluoride at MW2-90
- calcium at MW3-90

Evaluations were undertaken to review potential alternative sources for the SSIs. These evaluations included comparing leaching tests of on-site CCR materials, leachate collected in the Evaporation Pond (non-CCR unit), regional (background) groundwater quality data, groundwater quality data from additional site wells, and groundwater quality data collected at the Site prior to construction of the CCR unit.

Several characteristics of the CCR unit, site geology, groundwater monitoring well locations, and historical groundwater quality data prompted consideration of potential alternative sources for the SSIs, including elevated water quality parameters in pre-landfill and upgradient groundwater monitoring data, site-specific geologic conditions, and/or leakage from the Evaporation Pond (non-CCR unit).

A successful demonstration of alternative sources for the SSIs are discussed in Section 3.

## 2.1 April 2025 Sampling Event

Concentrations for potential SSIs observed in April 2025 are shown on time series graphs in Appendix A and are consistent with those observed during the prior detection monitoring events.

Trend analysis results through 2025 indicate:

- that fluoride at MW1-90 has a statistically significant increasing trend
- that fluoride at MW2-90, has a statistically significant increasing trend
- that sulfate at MW1-90 has a statistically significant increasing trend
- that calcium at MW3-90, though above the prediction limit, does not have a statistically significant trend

# 3 Alternative Source Demonstration

The purpose of this ASD Report is to evaluate whether the April 2025 SSIs were due to a CCR unit release or due to another source or to error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. For each SSI, three hypotheses regarding the potential source of the SSI are assessed: (1) a release of leachate from the CCR unit, (2) natural variations in non-landfill or regional groundwater quality are the source of one or more of the SSIs, and (3) a release of leachate from the Evaporation Pond (a source other than a CCR unit) is the source of one or more of the SSIs

Successful demonstrations of alternative sources have previously been documented for all three parameters with SSIs at locations within the previous monitoring network. The associated ASD Reports (included as appendices to Barr, 2019; Barr, 2020; Barr, 2021; Barr, 2022; Barr, 2023; Barr, 2024; and Barr, 2025) documented that each of the SSIs could be explained by natural groundwater quality variability based on concentrations that were either present at the Site before the landfill was constructed, consistent with regional groundwater quality data (from specific geology present at site), and/or associated with a release from the Evaporation Pond (non-CCR unit). Note that in this and previous ASDs the lines of evidence are intended to provide sufficient weight of evidence in demonstration of the ASD. This means that if one or more lines of evidence are refuted, sufficient evidence remains to support validity of the ASD.

## 3.1 Source Hypothesis #1 CCR Unit Release

To accept the hypothesis that a release of leachate from the CCR unit is the source of the SSI, it would be assumed that groundwater chemistry at one or more potentially impacted wells (MW1-90, MW2-90, and/or MW3-90) would be geochemically similar to impacted water from the CCR unit represented by leach testing results. However, if these liquids are geochemically dissimilar, this indicates that a source “other than the CCR unit” may be responsible for the SSI. Therefore, major ion chemistry from the CCR groundwater monitoring locations (upgradient and downgradient) was compared to CCR Synthetic Precipitation Leaching Procedure (SPLP; EPA Method 1312) data collected July 2011 (Appendix C).

To further test the hypothesis of a source other than the CCR unit, a Piper diagram (Figure 2) was used to visually compare the CCR SPLP results (Appendix C) and the measured groundwater quality at the Site. Piper diagrams are plots of major ion chemistry of water samples (calcium, magnesium, potassium, sodium, chloride, sulfate, and [bi]carbonate) that are used to differentiate between water types and to identify potential mixing of water types. The Piper diagram provides a means to identify or “fingerprint” water samples by their common characteristics (major ions) to assess which types of water are similar or dissimilar to potential source water types (Helsel et al., 2020). On the Piper diagram depicted in Figure 2, downgradient well compositions are shown as circular points, CCR SPLP compositions as orange triangles, and the range of upgradient compositions as a yellow polygon. All of the downgradient wells plot within the range of upgradient groundwater chemistry. The CCR SPLP results do not.

Downgradient water quality (including the SSI parameter-well pairs) is characterized as an intermediate-sulfate type water, whereas the ash SPLP results are sodium-sulfate type water. The major difference observed between the downgradient water quality and the SPLP results is the dominant cation composition (no cation strongly dominant vs. heavily dominant sodium). All of the SSI well-parameter pairs are clustered with data from that of the upgradient wells, which are intermediate-sulfate water, rather than near the ash SPLP results, which are high sulfate. These results indicate that the water chemistry at the downgradient locations is more like upgradient groundwater than would be expected

from a potential release from the CCR unit. **Therefore, we reject the hypothesis that the CCR unit is the source of the sulfate observed at MW1-90 and calcium observed at MW3-90.**

The EPA has offered criticism of ASDs using Piper Plots, as part of its determinations under Part A and Part B demonstrations under the CCR rule. In these determinations, the EPA has made the argument (without accompanying supporting evidence) that Piper Plots are not suitable for ASDs because of one or more of the following reasons:

a. *Leachate is not groundwater, and therefore different water types cannot be directly compared.* This position is inconsistent with the fundamental premise within the CCR Rule that SSIs are due to changes that occur in groundwater due to a release of leachate from a CCR unit. Statistical methods are a means of making this comparison, Piper Plots are another. The utility of Piper Plots is that they are a useful means of visualizing data and are part of the professional standard of care for comparing the dissolved constituents for any type of solution chemistry for any type of water. If the groundwater were influenced by a release of leachate, it is likely that the change in equilibrium chemistry within the flow system would show some influence on major ion composition. Therefore, Piper Plots are a valuable tool for comparing leachate and groundwater chemistry.

b. *There may be reactions in the subsurface that might influence the results and thereby reduce or add constituents to the downgradient groundwater.* While this may be true at some scale for some parameters, it is generally not true of Appendix III parameters which are major ions that are generally not reactive in the subsurface. As stated in the preamble to the CCR Rule, EPA states that it selected the Appendix III parameters as indicators of coal ash leachate because they are mobile (and hence not reactive) in the subsurface.

c. *Using a single leach test cannot represent the water quality found at a downgradient monitoring well.* The issue is whether a single leach sample is representative of leachate as a distinct water type. As long as the leachate sample is sufficiently different from groundwater, it is useful in assessing the potential effects of a release on downgradient groundwater. In this ASD, several leach tests are used, and they are all more similar to each other than they are to groundwater samples in terms of both the overall concentration of parameters and the proportionate ratios of various parameters along the flow path (which generally do not change along the flow path due to dilution). Therefore, Piper Plots not only show the differences between the two water types; they can also demonstrate the effects of dilution that allows for assessment of a release.

## 3.2 Source Hypothesis #2: Natural Variations in Pre-Landfill and Site-Specific Background Water Quality

As Source Hypothesis #1 (CCR Unit Release) was rejected as a potential source of the SSIs, a second hypothesis was evaluated to identify the potential source of concentrations of SSI parameters and further reinforce the demonstration that the SSIs were not related to the CCR unit. To do this, we evaluated the SSIs by comparison to historical groundwater quality data collected at the Site before the landfill was constructed (pre-landfill data), additional upgradient well data, and/or regional groundwater quality data from the Cannonball Formation and associated units to determine if natural variation is a potential alternative source for the SSIs.

Results from groundwater samples collected in 1986 were included in the 1989 Special Use Disposal Site Permit Application (Permit Application; MDU, 1989). The 1986 samples were collected prior to

construction of the CCR unit; an aerial photograph from March 30, 1988, shows the area of the current CCR unit is undisturbed (Appendix D) on the date that this image was taken.

Discussion of pre-landfill groundwater samples in the Permit Application notes that high calcium, chloride, fluoride, sulfate, TDS, and other parameters were observed at the Site.

### 3.2.1 Fluoride at MW1-90 and MW2-90

Source Hypothesis #2 was tested by comparing fluoride concentrations collected as part of several regional groundwater quality studies on the Cannonball Formation and associated units. A summary of the range of fluoride concentrations in the Cannonball Formation and associated units is included in Table 1 below. As above, the Cannonball is the specific geologic formation present at the Site, and the results are specific to the local area of the Site. Consideration of this information is required to establish a professional standard of care.

**Table 1 Fluoride Concentrations in Morton County, North Dakota**

| Reference | Fluoride Conc. Range | Formation/Units | Data Source Location |
|---|---|---|---|
| Ackerman, D.J., 1980. Ground-Water Resources of Morton County, North Dakota. North Dakota Geological Survey Bulletin 72, Part III. 51 p. | 0.0 to 4.0 mg/L | Cannonball and Ludlow formations, undifferentiated | Morton County |
| Crosby, O.A. and Klausing, R.L., 1984. Hydrology of Area 47, Northern Great Plains and Rocky Mountain Coal Provinces, North Dakota, South Dakota, and Montana. USGS Water-Resources Investigations Open-File Report 83-221, 93 p. | 0.1 to 6.3 mg/L | Entire Fort Union Formation (includes Cannonball Formation) | Morton County |

The Ackerman study provides summary statistics for the fluoride concentrations observed in Morton County. Forty-six samples were analyzed for fluoride; of those, 20 (or 43%) had concentrations greater than 1.3 mg/L (Ackerman, 1980). The fluoride concentrations observed at MW1-90 and MW2-90 in April 2025 (1.21 mg/L and 1.13 mg/L, respectively) are within the range of values consistent with naturally occurring concentrations of fluoride associated with the Cannonball Formation in Morton County. **Therefore, we accept the hypothesis that fluoride concentrations observed at MW1-90 and MW2-90 are consistent with regional (background) groundwater data; however, additional source considerations were evaluated, as described in Section 3.3.**

### 3.2.2 Sulfate at MW1-90

Like the other parameters discussed, there are variable sulfate concentrations both at the Site and in the region. The maximum sulfate concentration reported in the 1989 Permit Application from 1986 (pre-landfill) was 11,632 mg/L (Well 60), indicating that high sulfate concentrations pre-date construction of the CCR unit.

The boring logs for CCR wells and pre-landfill wells note gypsum occurrences across the Site (Appendix E). As groundwater fluctuates and surface water infiltration occurs, periodic dissolution of

gypsum into the water column may occur, resulting in elevated sulfate. Because the elevated sulfate was documented prior to the placement of ash, there is evidence that the concentrations observed more recently are due to natural or pre-existing conditions unrelated to the CCR Unit. Based on presence of gypsum in native subsurface deposits and documentation of elevated sulfate in pre-landfill groundwater, the hypothesis that the SSI for sulfate at MW1-90 may be due to natural conditions is probable.

These results support the hypothesis that the SSI for sulfate at MW1-90 is due to natural variation in groundwater quality. **Therefore, we accept the hypothesis that sulfate concentrations observed at MW1-90 are due to variability in natural conditions and are consistent with regional and Site background groundwater data.**

### 3.2.3 Calcium at MW3-90

Pre-landfill calcium concentrations collected from groundwater at the Site were measured as high as 648 mg/L (Well 44, 1986), indicating that high calcium concentrations were present at the Site that pre-date construction of the CCR unit.

The mineralogy of the underlying Fort Union Group may yield an explanation for the elevated calcium concentrations. The dominant lithology observed at the Site is unconsolidated silt in a clay matrix with interspersed fine to medium-grained sand (10% to 30%). Calcareous (calcium-carbonate-bearing) materials and small gypsum (hydrated calcium sulfate) crystals are documented discontinuously throughout the upper 30 feet of the surface materials, which have been presumed to be the result of diagenetic processes which occur above the water table during alternating wetting and drying cycles (Groenewold et al., 1983). The presence of these minerals can be a source of high calcium concentrations in groundwater.

The boring logs for CCR wells and pre-landfill wells note calcareous material and gypsum occurrences across the Site (Appendix E). As groundwater fluctuates and surface water infiltration occurs, periodic dissolution of these calcium-bearing minerals into the water column may occur, resulting in elevated calcium concentrations.

The presence of soluble calcium-bearing minerals in native subsurface deposits and documentation of elevated calcium in pre-landfill groundwater provide multiple lines of evidence substantiating the hypothesis that the SSI for calcium at MW3-90 is due to natural variation. **Therefore, we accept the hypothesis that calcium concentrations observed at MW3-90 are due to variability in natural conditions and are consistent with regional and Site background groundwater data.**

## 3.3 Source Hypothesis #3: Evaporation Pond Release

Two conditions are necessary to accept the hypothesis that a release of Evaporation Pond water is the source of one or more of the SSIs: (1) mechanism of release (such as an issue with the Evaporation Pond liner integrity) and (2) geochemically similar groundwater chemistry at one or more of the potentially impacted wells with water from the Evaporation Pond. Based on proximity, only the SSIs observed at MW1-90 (fluoride and sulfate) are being evaluated for this potential source.

### 3.3.1 Fluoride and Sulfate at MW1-90

Statistically significant increasing trends in fluoride and sulfate were observed at MW1-90 following the April 2025 detection monitoring event. Past ASD Reports (Barr, 2020; Barr, 2021; Barr, 2022) attributed elevated TDS concentrations at MW-104 to either natural conditions or a release from the Evaporation

Pond. MW-104 is located between the CCR unit and the Evaporation Pond (a non-CCR unit), approximately 225 feet southwest of MW1-90, which is located north of the Evaporation Pond. The Evaporation Pond was designed and constructed to collect surface water run-off from the Site as well as leachate from the CCR Unit. It is not a CCR unit as defined in § 257.53. Due to the relative proximity of MW1-90 to the Evaporation Pond, an evaluation was conducted to assess the Evaporation Pond liner integrity and potential impacts to downgradient wells and determine the geochemical feasibility of Evaporation Pond water contributing to the conditions observed at MW1-90.

## *Liner Integrity Evaluation*

In the 2010 Annual Report for the Special Waste Disposal Permit (SP-087), it was noted that erosion was encountered at the Evaporation Pond. More specifically, “cuts in the banks of the pond ranged from 8 to 24-inches. Erosion was caused from storm water running into the evaporation pond from closed Slots and the haul road” (MDU, 2011). No repairs were made at that time due to standing water in the pond. Similar erosional features were noted in the 2011 and 2012 Annual Reports, citing erosion cuts of 8 to 48 inches (MDU, 2012; MDU, 2013). These erosion cuts were repaired in 2013 during the construction of Slot 10. Additionally, the 2013 Annual Report stated that “the west wall of the evaporation pond was raised and graded to reroute storm water that accumulates outside of the ash disposal area from the cover of Phase I ash disposal site away from the pond during rain events” (MDU, 2014).

These reports did not specify if the erosional cuts were 8 to 48 inches wide or 8 to 48 inches deep. Based on the Phase I Development “as-constructed” Plan Sheets (January and November 1990), the Evaporation Pond was built with a 3-foot-thick compacted clay liner (MDU, 1989, Exhibit 6-B). If the erosional cuts were up to 48 inches deep, then the cuts would extend through the entirety of the liner thickness, creating a conduit for Evaporation Pond water to enter the groundwater. Additionally, no details were provided on the materials used for repairing the Evaporation Pond (i.e., if the liner was impacted, whether the erosion cuts were filled in with a comparable clay liner material).

Additionally, the integrity of the Evaporation Pond liner may have been compromised due to cation exchange. Time series plots of groundwater quality at well MW1-90 (Appendix F) show an increase in sodium; this increase is most apparent at MW1-90 between 2012 and 2023. Sodium concentrations were not measured in 2024 and 2025. The Evaporation Pond liner may be composed of a clay with sodium as its main interlayer cation (e.g., sodium-montmorillonite and/or sodium-bentonite, which are common in the area (Groenewold et al., 1983)), and cation exchange processes can occur between the sodium in the clay and positively charged cations concentrated in the Evaporation Pond water (calcium, magnesium, potassium, and aluminum), increasing the concentration of dissolved sodium as it is released from the clay structure. Over time, this exchange may decrease swelling potential and increase hydraulic conductivity of the clay constituting the pond liner, resulting in increased leakage of Evaporation Pond water.

## *Potential Downgradient Effects*

The base of the Evaporation Pond sits at approximately 1675 feet above MSL, whereas historical groundwater elevations in MW1-90 remain below 1675 feet MSL. Therefore, any water leaking from the Evaporation Pond would move radially outward from the pond through the unsaturated zone downward into the groundwater, toward MW1-90.

Groundwater monitoring data have consistently been collected from MW1-90 since 1990. As seen in the time series plots (Appendix F; 1990-2025), in approximately 2010 the concentrations of chloride, sulfate, TDS, magnesium, sodium, and specific conductance at MW1-90 began increasing more rapidly. To a

lesser extent, changes in concentrations were observed around this same time for potassium, nitrogen, and total alkalinity. This timing corresponds to when the erosional cuts at the Evaporation Pond were first observed in the Annual Monitoring Reports. The increasing trends have continued, despite reports of the erosional cuts being repaired in 2013, except for chloride, which has since leveled off.

## *Geochemical Feasibility*

A simple mixing model was developed in April 2019 (Barr, 2020) to determine the potential of producing a similar water quality to that observed at MW-104 and MW1-90 when mixing Evaporation Pond water with unimpacted upgradient water. This mixing model was conducted in Geochemist's Workbench® v.12.0, using data from water samples collected from the Evaporation Pond and upgradient monitoring well MW-103. The mixing model assumes a starting concentration equal to the upgradient groundwater concentrations and then iteratively mixes it with incremental amounts of Evaporation Pond water. The upgradient groundwater concentrations used in the model were from a sample from upgradient monitoring well MW-103 collected in April 2019, which is assumed to represent the long-term composition of groundwater in that vicinity due to the fairly stable concentrations of major ions exhibited in samples from MW-103 (Barr, 2020). The Evaporation Pond concentrations used in the model were from a sample collected from the pond in September 2014, which is assumed for the purposes of the model to represent a typical Evaporation Pond water composition during the period when the pond liner was compromised.

The results of the model are provided in Appendix G. Figure G.1 shows the results of the mixing model on a Piper diagram. Downgradient wells MW-104 and MW1-90 are shown as gray and green diamonds, respectively. The blue line represents the various possible outcomes when mixing the upgradient water (represented by a blue triangle) with the Evaporation Pond (represented by a red circle). The black circles represent specific proportions (1-part upgradient water to 0.01-, 0.05-, 0.1-, 0.5-, and 1-part Evaporation Pond water). Figure G.2 shows the results as Stiff plots. Table G.1 provides the numerical inputs and results of the various mixing proportions.

As shown on Figure G.1, the downgradient well compositions are similar to the chemistry anticipated if the Evaporation Pond is mixing with upgradient groundwater emanating from the proximity of monitoring well MW-103. The path of the mixing reaction from MW-103 to the Evaporation Pond transects MW1-90 when 1-part upgradient (MW-103) water is mixed with as little as 0.05-part Evaporation Pond water. Therefore, it appears plausible that a relatively small portion of Evaporation Pond water would be needed to "impact" groundwater from upgradient to get a similar chemistry as observed downgradient in MW1-90. The geometry of the Stiff plots in Figure G.2 shows the similarity in ionic composition in the mixing models.

Recorded measurements of fluoride concentrations in the Evaporation Pond have generally been low (<0.3 mg/L), and therefore a release from the Evaporation Pond is unlikely to be a direct source of fluoride to groundwater. However, the Evaporation Pond water has several characteristics that can lead to the release of fluoride from clays and other minerals in aquifer sediments. The pH of the Evaporation Pond is high (≥10), meaning that the water has a high concentration of hydroxide ions. Hydroxide and fluoride have similar ionic radii and charge. Mineralogically, this means that fluoride can easily substitute for hydroxide within mineral structures. In addition, fluoride can sorb to clay, particularly in slightly acidic conditions. A release of high-pH water provides ample hydroxide that can replace fluoride in mineral structures and cause the desorption of fluoride from clay minerals, leading to an increase in fluoride concentrations in groundwater (Edmunds and Smedley, 2013; McMahon et al., 2020).

Based on the description of erosional features extending upwards of 48 inches into the liner of the Evaporation Pond in 2010-2013, corresponding with the increased concentrations of several parameters observed in downgradient monitoring well MW1-90, it is possible that a release from the Evaporation Pond occurred starting in approximately 2011. Furthermore, the results of the geochemical model along with the general proximity and hydraulic position of MW1-90 relative to the Evaporation Pond support the hypothesis that the SSI for fluoride and sulfate at MW1-90 are due to a "source other than the CCR unit." **Therefore, we accept the hypothesis that the fluoride and sulfate concentrations observed at MW1-90 are consistent with a potential release from the Evaporation Pond, a non-CCR unit.**

# 4 Conclusions

Four SSIs were identified from the April 2025 detection monitoring event. This report demonstrates that a "source other than the CCR unit" more likely than not caused the SSIs (natural variation in background and/or pre-landfill groundwater quality and the Evaporation Pond), as allowed by § 257.94(e)(2). The results of this alternative source demonstration are summarized in Table 2 below.

**Table 2 Summary of SSIs and Alternative Sources**

| Well | Parameter | Report Section | Evidence for Alternative Source |
|---|---|---|---|
| MW2-90 | Fluoride | 3.2.1 | Natural variation (geologic background) |
| MW1-90 | Fluoride | 3.2.1, 3.3.1 | Natural variation (geologic background) and/or Other (Evaporation Pond, a non-CCR unit) |
| MW1-90 | Sulfate | 3.2.3, 3.3.1 | Natural variation (pre-landfill values, upgradient groundwater, and geologic background) and/or Other (Evaporation Pond, a non-CCR unit) |
| MW3-90 | Calcium | 3.2.3 | Natural variation (geological background) |

# 5 References


Barr Engineering Co., 2017, Groundwater Monitoring System Documentation. R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. October 2017.

Barr Engineering Co., 2018, 2017 Annual Groundwater Monitoring and Corrective Action Report. R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. January 2018.

Barr Engineering Co., 2019, 2018 Annual Groundwater Monitoring and Corrective Action Report. R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. January 2019.

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Barr Engineering Co., 2021, 2020 Annual Groundwater Monitoring and Corrective Action Report. R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. January 2021.

Barr Engineering Co., 2022, 2021 Annual Groundwater Monitoring and Corrective Action Report. R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. January 2022.

Barr Engineering Co., 2023, 2022 Annual Groundwater Monitoring and Corrective Action Report. R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. January 2023.

Barr Engineering Co., 2024, 2023 Annual Groundwater Monitoring and Corrective Action Report. R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. January 2024.

Barr Engineering Co., 2025, 2024 Annual Groundwater Monitoring and Corrective Action Report. R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. January 2025.

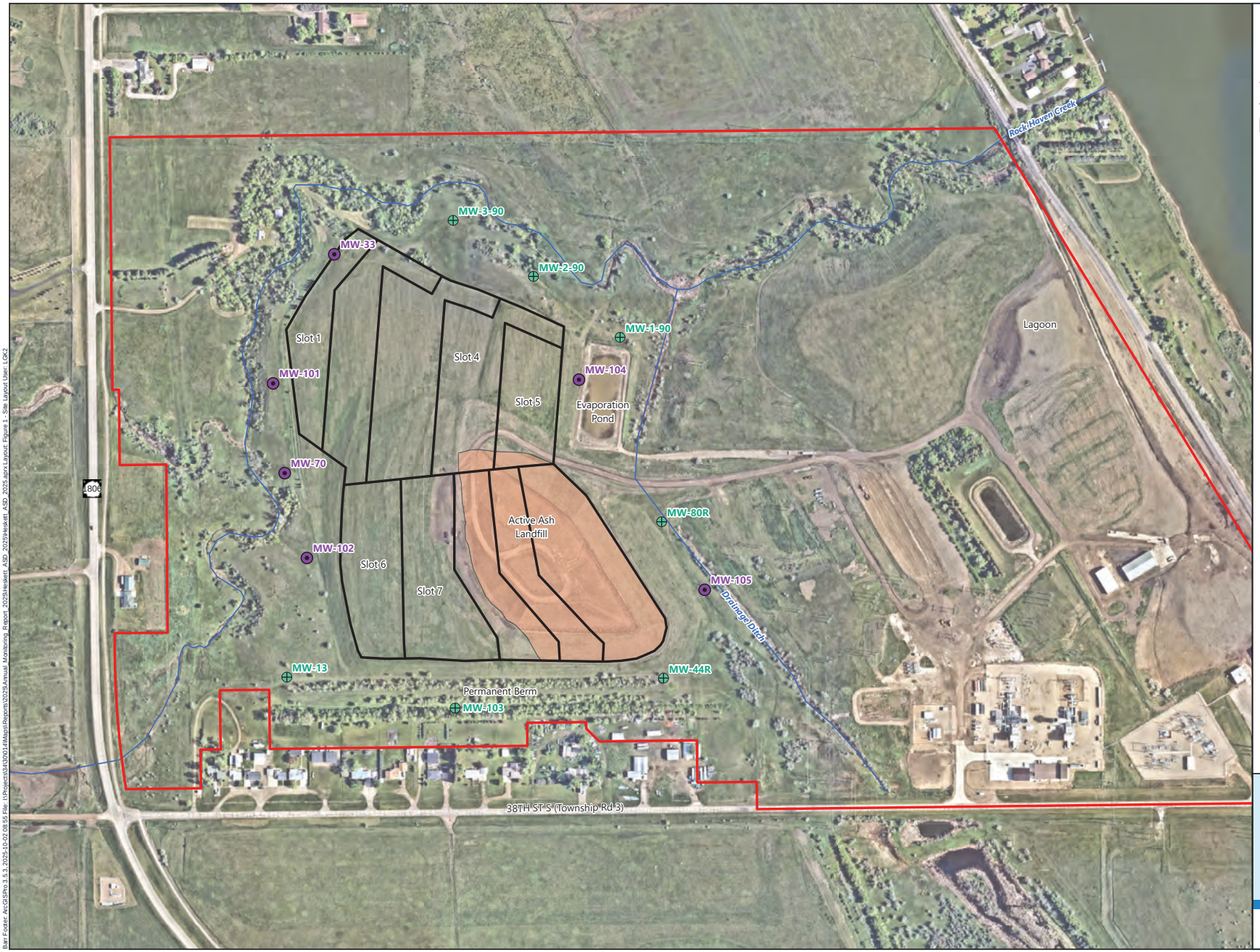
Helsel, D.R., Hirsch, R.M., Ryberg, K.R., Archfield, S.A., and Gilroy, E.J., 2020, Statistical methods in water resources: U.S. Geological Survey Techniques and Methods, book 4, chapter A3, 458 p.

Montana-Dakota Utilities Co. (MDU), 1989, R.M. Heskett Station Special Use Disposal Site Permit Application. Submitted to North Dakota State Department of Health, March 1, 1989.

US EPA, 2015, Hazardous and Solid Waste Management Systems; Management of Coal Combustion Residuals from Electric Utility, CFR Parts 257 and 261, Federal Register, Vol. 80, No. 74, April 17, 2015.

# Figures

**Figure 1** **Site Layout and CCR Monitoring Well Network**




Monitoring Well Location

Monitoring Well Location - Water Level Only

Property Boundary

Existing Slot Boundaries

Active Portion of Landfill

N

0 200 400

Feet

Imagery: NearMap 4/25/2024

**SITE LAYOUT AND CCR MONITORING NETWORK**

Heskett Station

Montana Dakota Utilities

Mandan, North Dakota

FIGURE 1

BARR

**Figure 2** **Piper Plot: Alternative Source Demonstration**

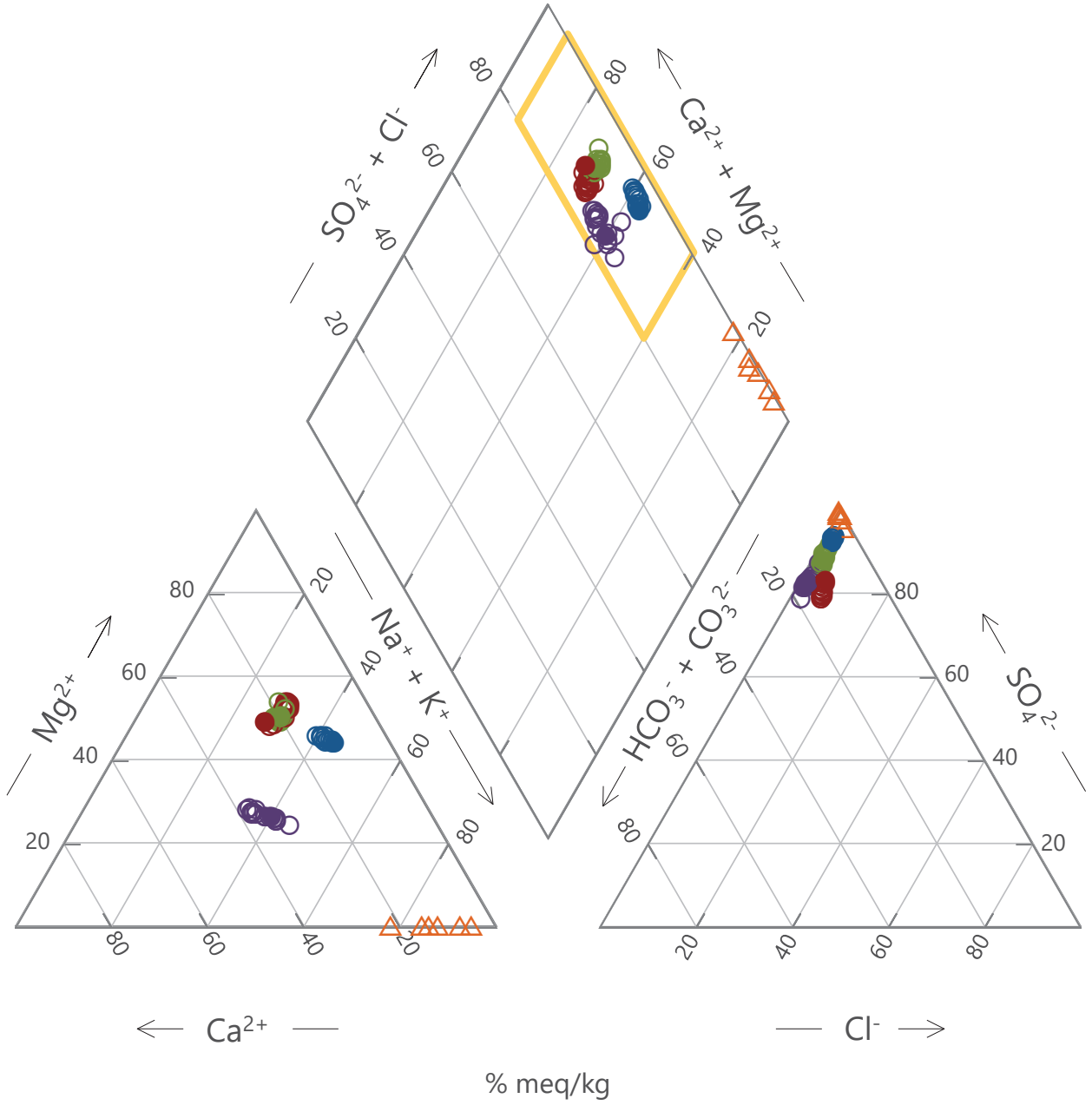
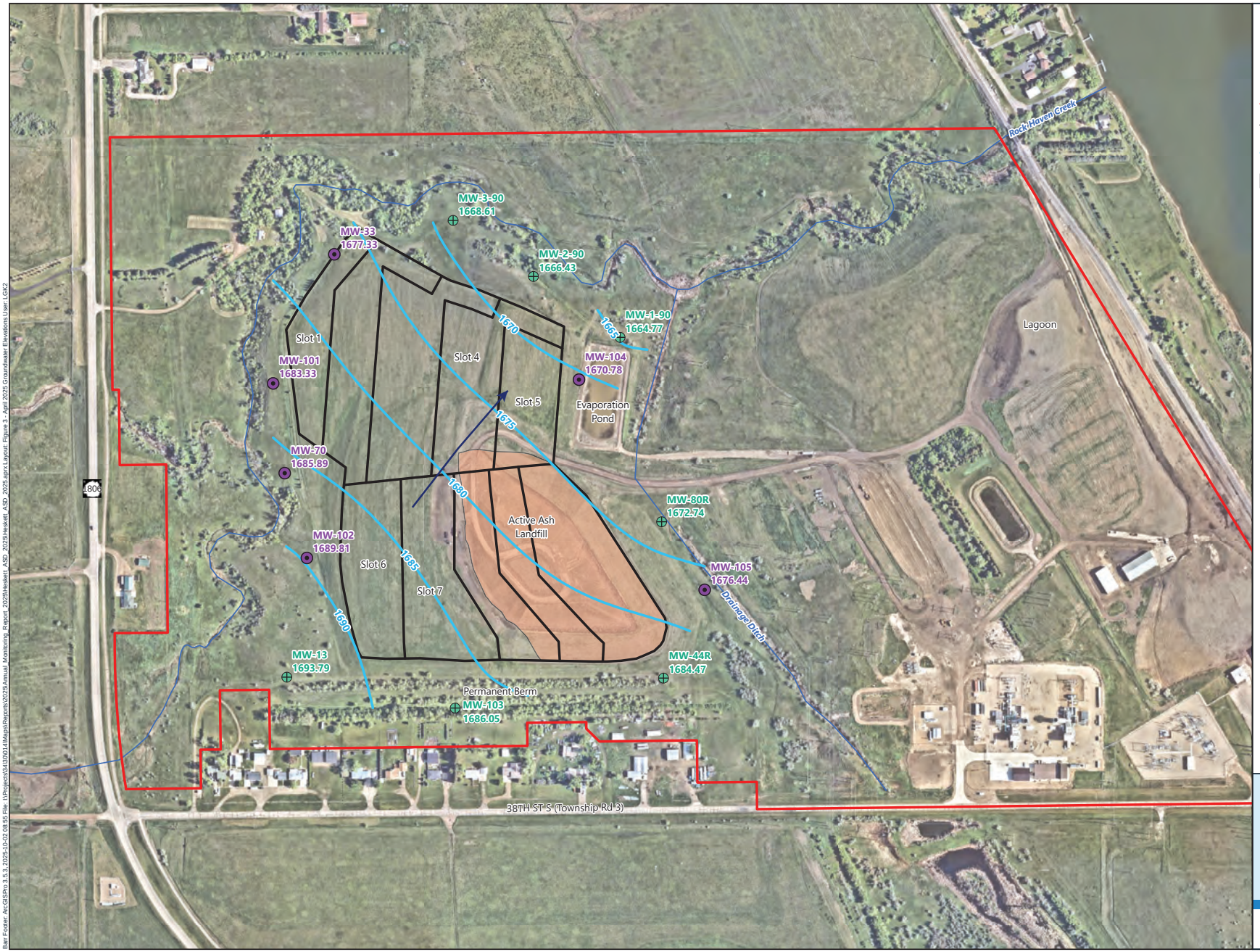



**Figure 2**
Piper Plot: Alternative Source Demonstration
R.M. Heskett Station
Mandan, North Dakota

BARR

**Figure 3** **Groundwater Elevation Contours**




- Monitoring Well Location
- Monitoring Well Location - Water Level Only
- Groundwater Flow Direction
- Property Boundary
- Existing Slot Boundaries
- Groundwater Elevation Contour (ft MSL)
- Active Portion of Landfill

N

0 200 400
Feet

Imagery: NearMap 4/25/2024

**APRIL 2025 GROUNDWATER ELEVATIONS**
Heskett Station
Montana Dakota Utilities
Mandan, North Dakota

FIGURE 3

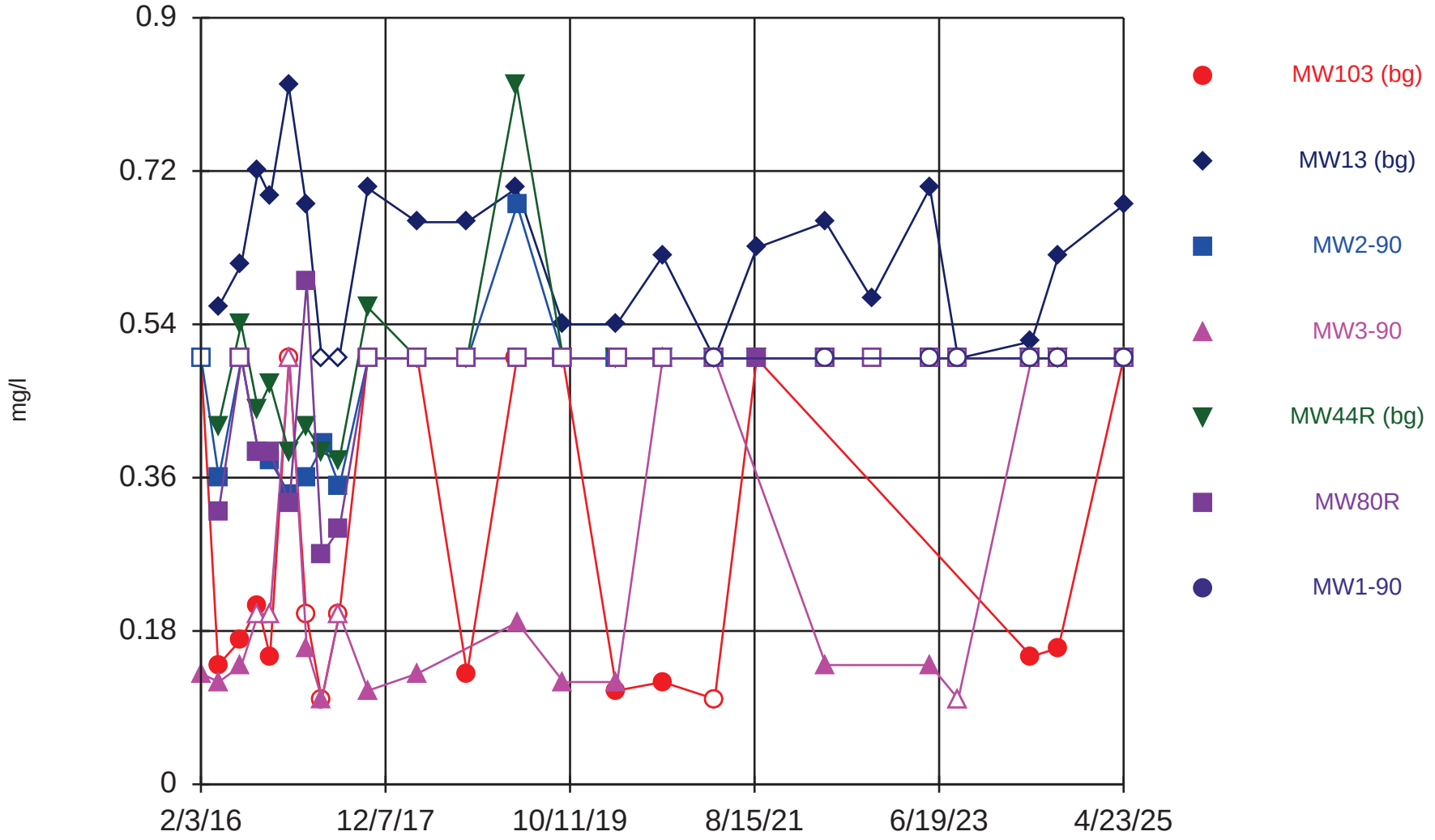
BARR

# Appendices

# Appendix A Time Series Plots

Hollow symbols indicate censored values.

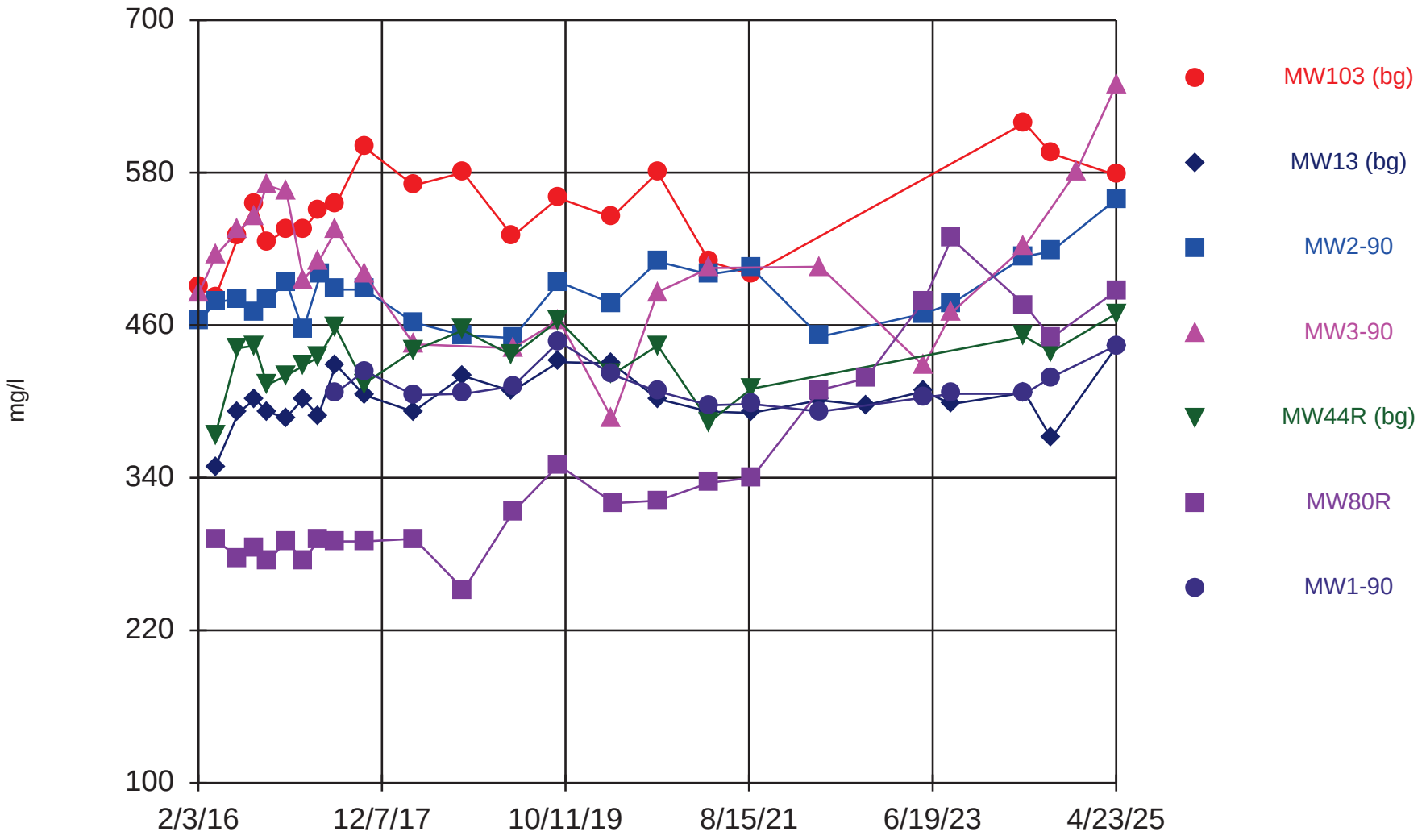
# Boron, total




Time Series Analysis Run 7/8/2025 10:52 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

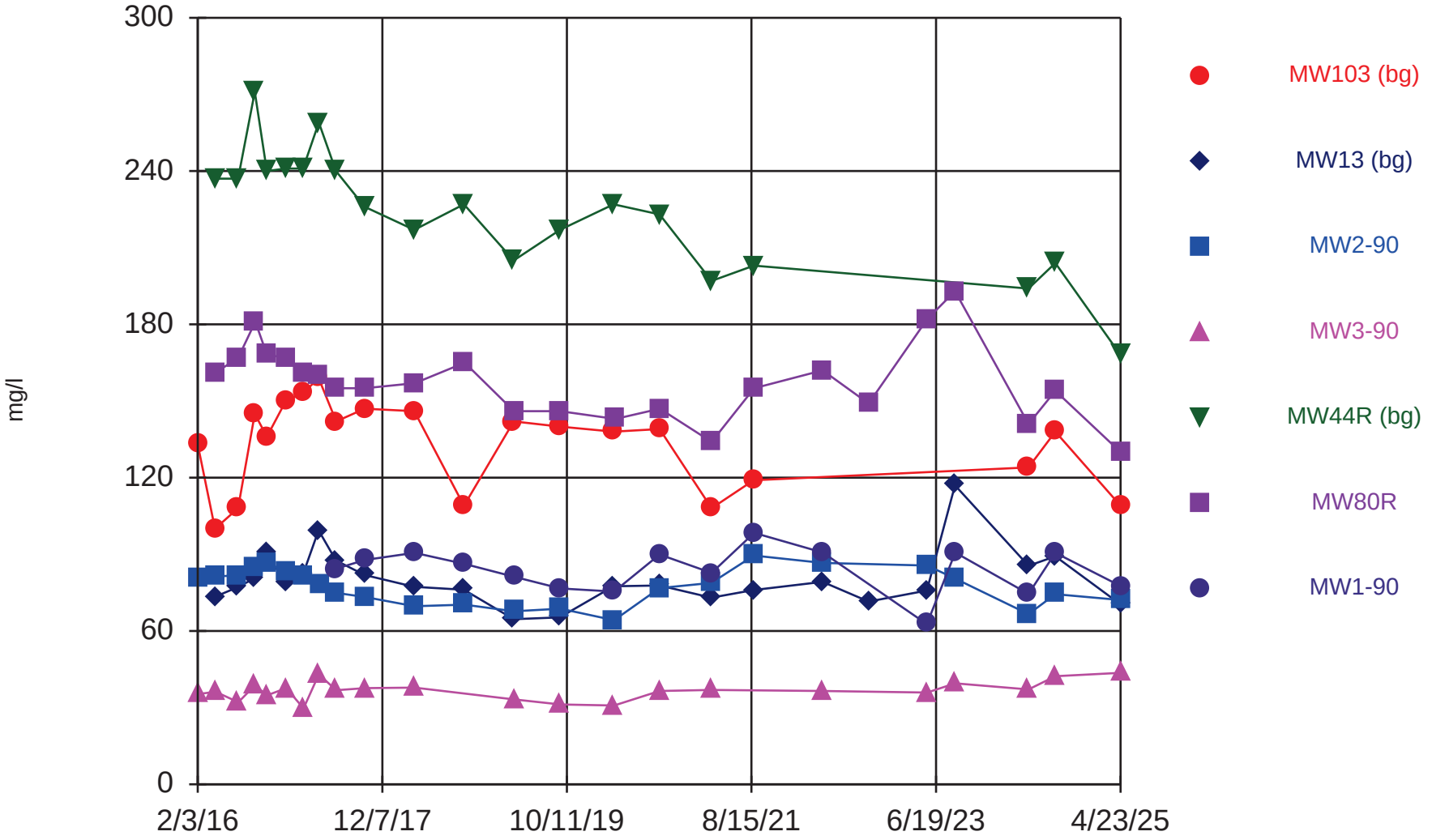
# Calcium, Total




Time Series Analysis Run 7/8/2025 10:52 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

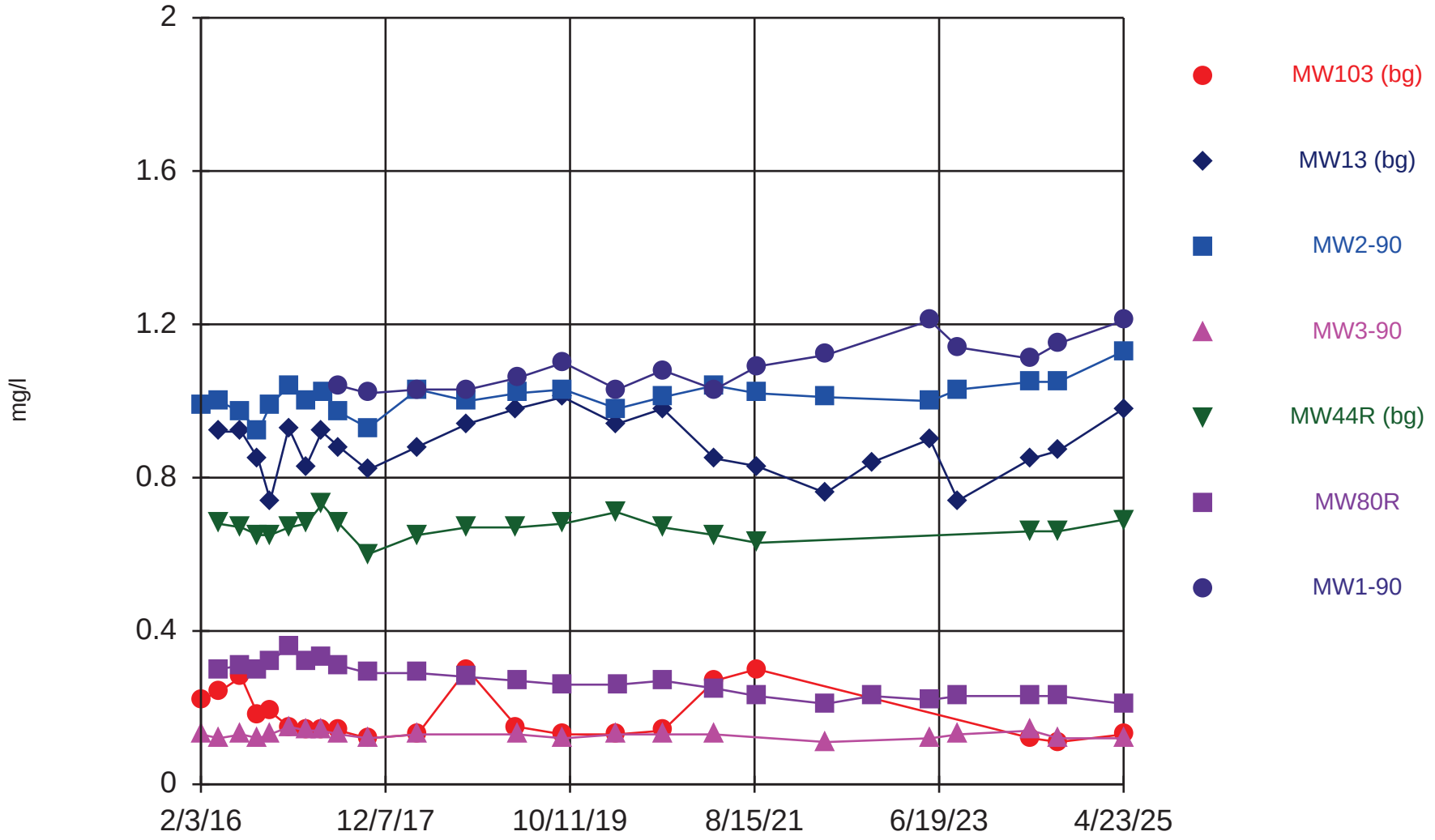
# Chloride




Time Series Analysis Run 7/8/2025 10:52 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

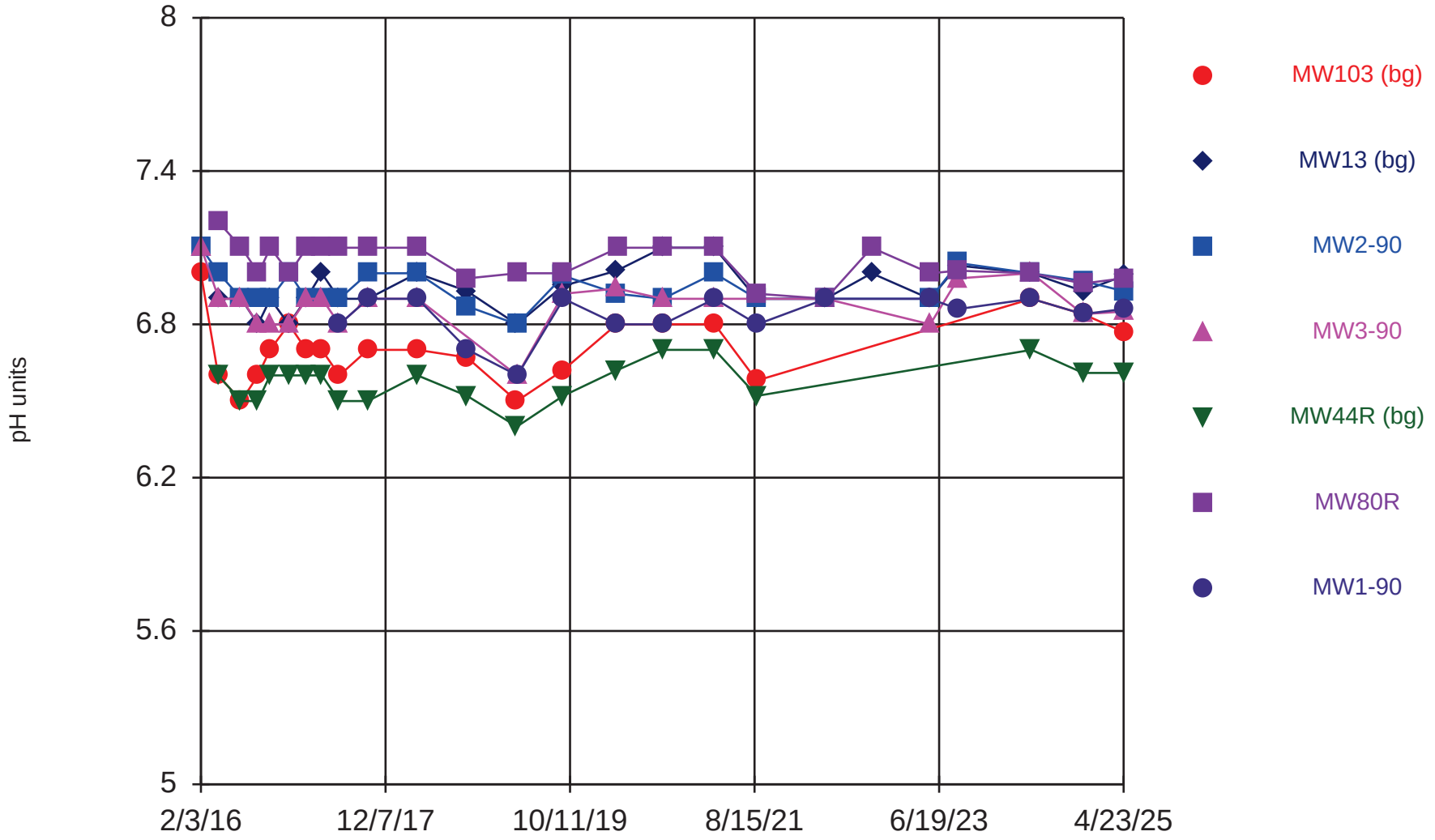
# Fluoride




Time Series Analysis Run 7/8/2025 10:52 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

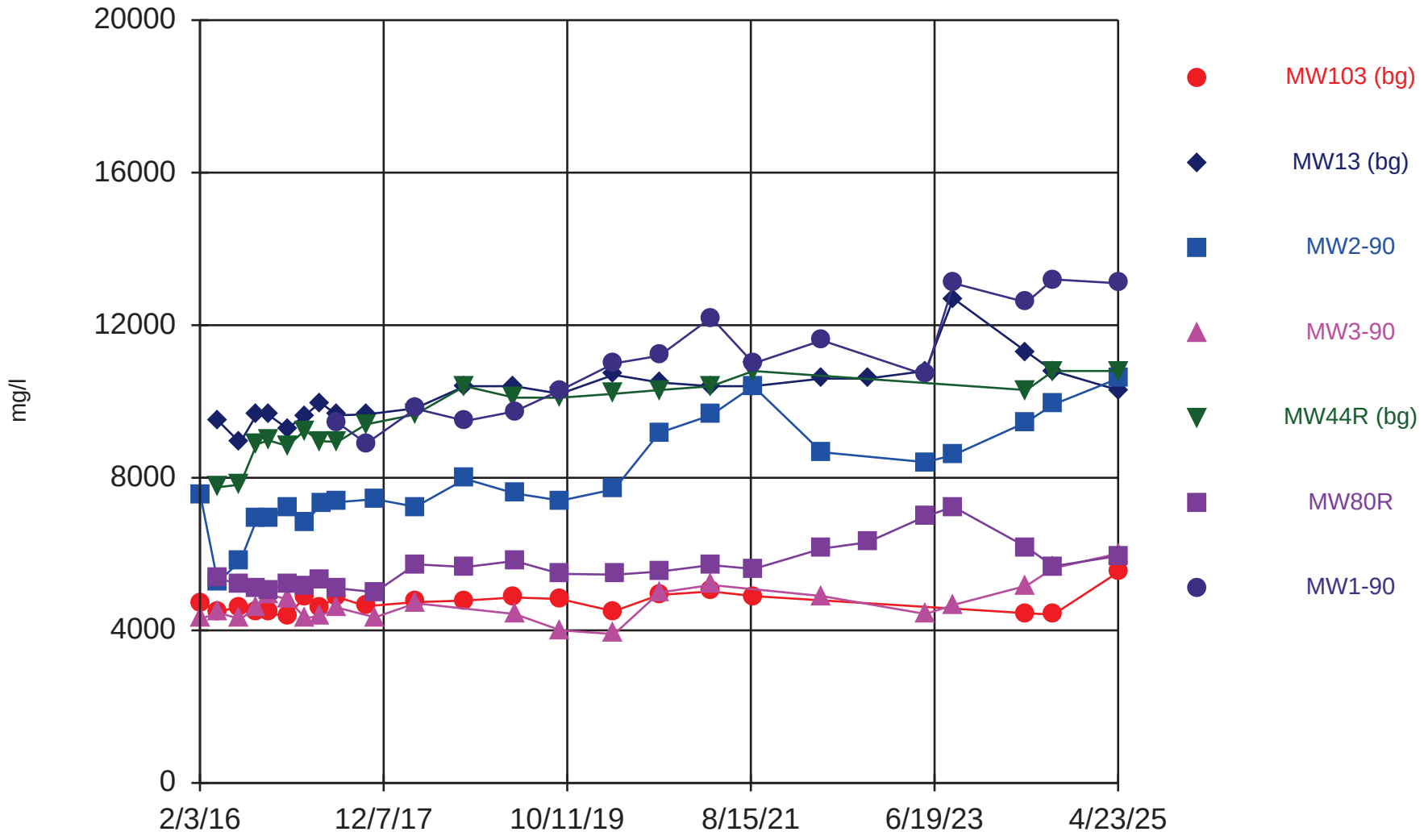
# pH, Field




Time Series Analysis Run 7/8/2025 10:52 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

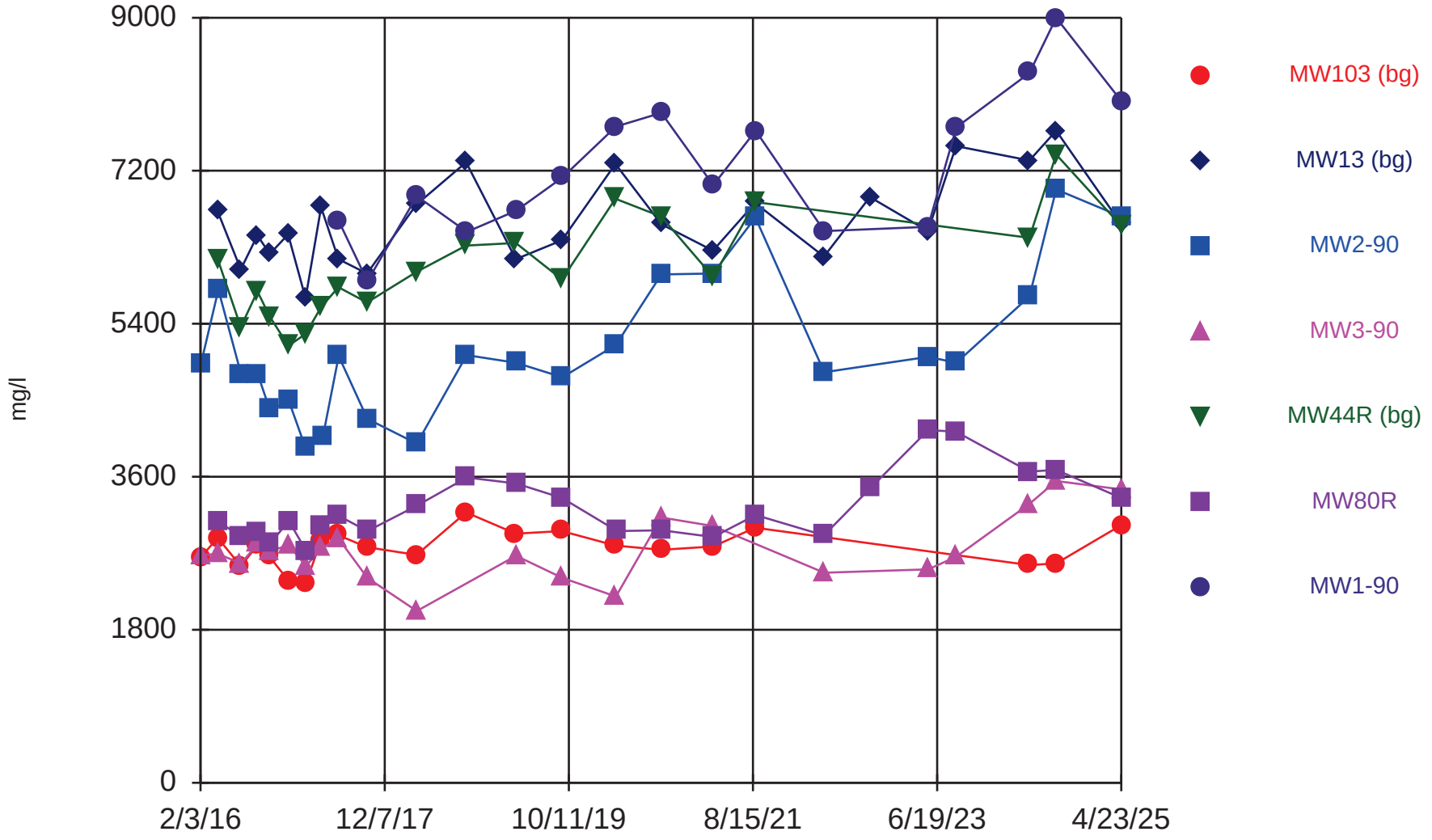
# Solids, total dissolved




Time Series Analysis Run 7/8/2025 10:52 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

# Sulfate, as SO4




Time Series Analysis Run 7/8/2025 10:52 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

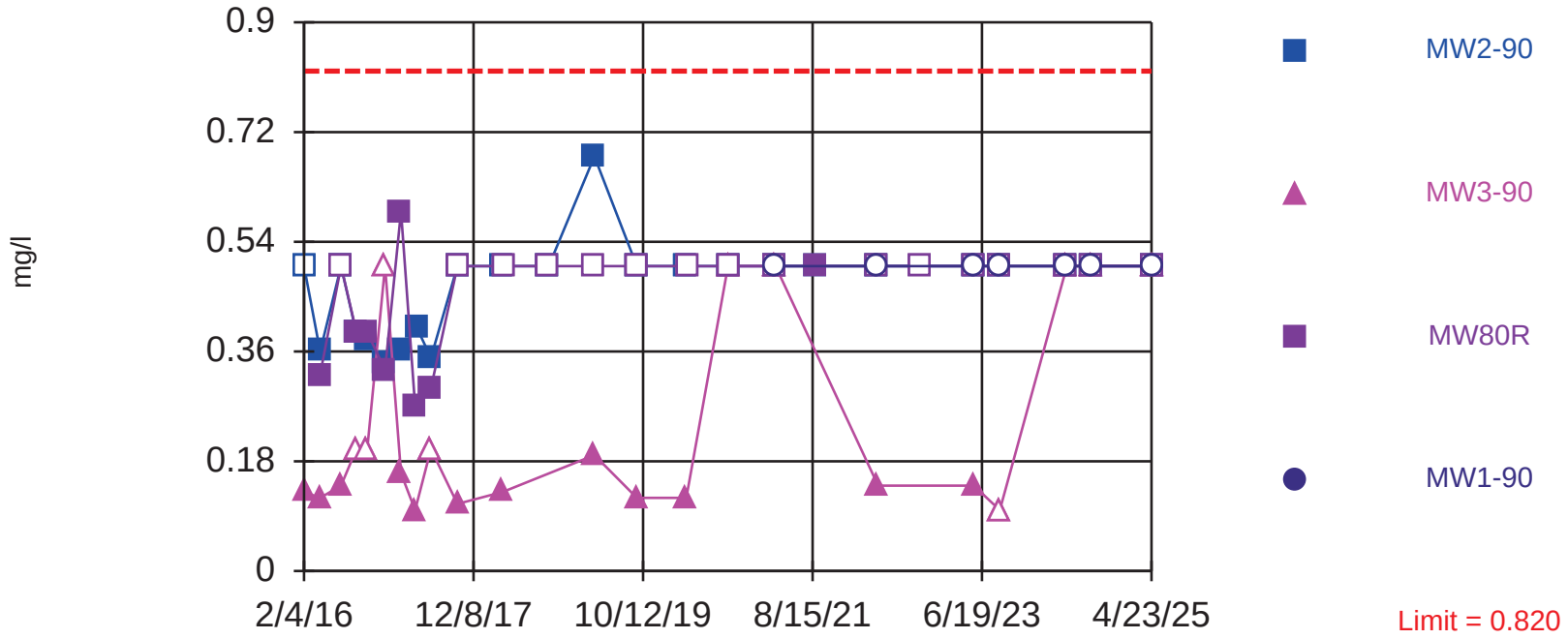
# Appendix B Prediction Limit Plots

Hollow symbols indicate censored values.

Within Limit

# Boron, total

Interwell Non-parametric




Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 56 background values. 35.71% NDs. Annual per-constituent alpha = 0.004891. Individual comparison alpha = 0.0006126 (1 of 2). Comparing 4 points to limit. Seasonality was not detected with 95% confidence.

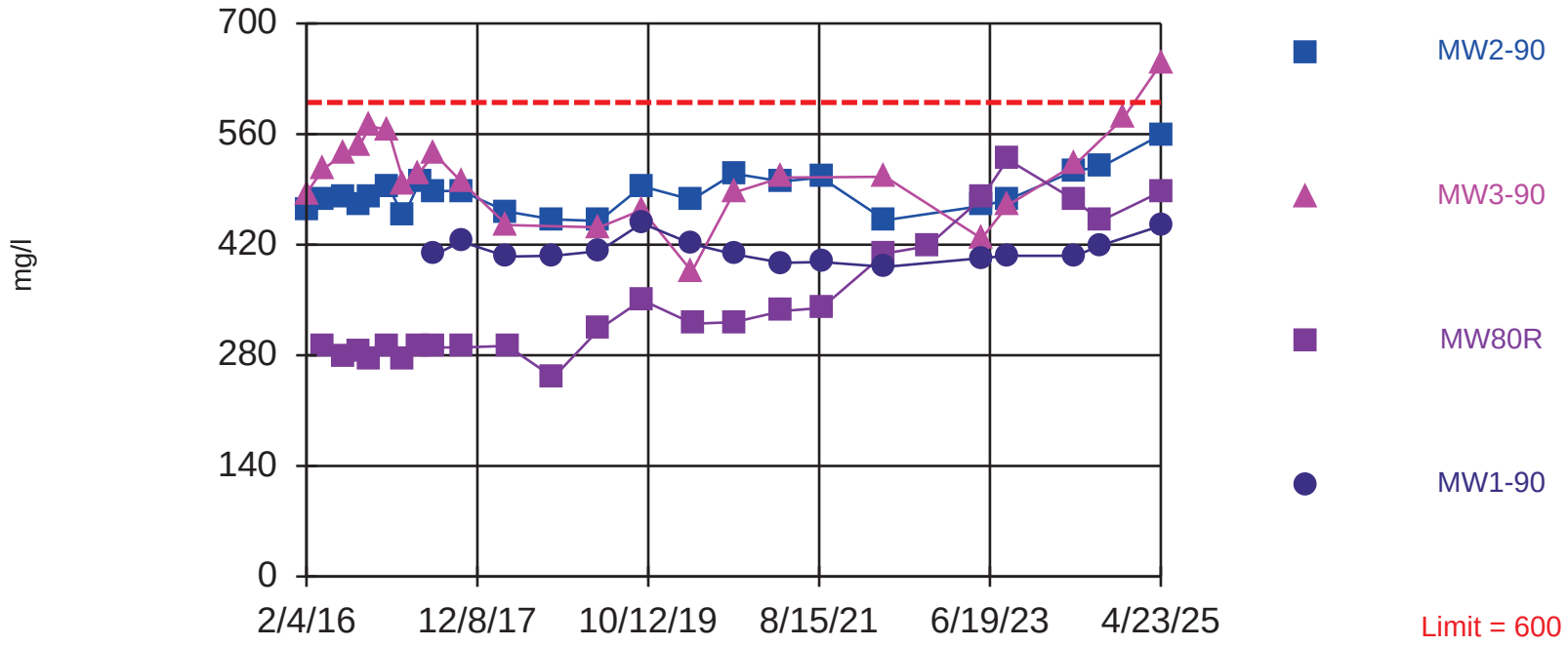
Prediction Limit Analysis Run 7/8/2025 11:07 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Exceeds Limit: MW3-90

# Calcium, Total

Interwell Non-parametric

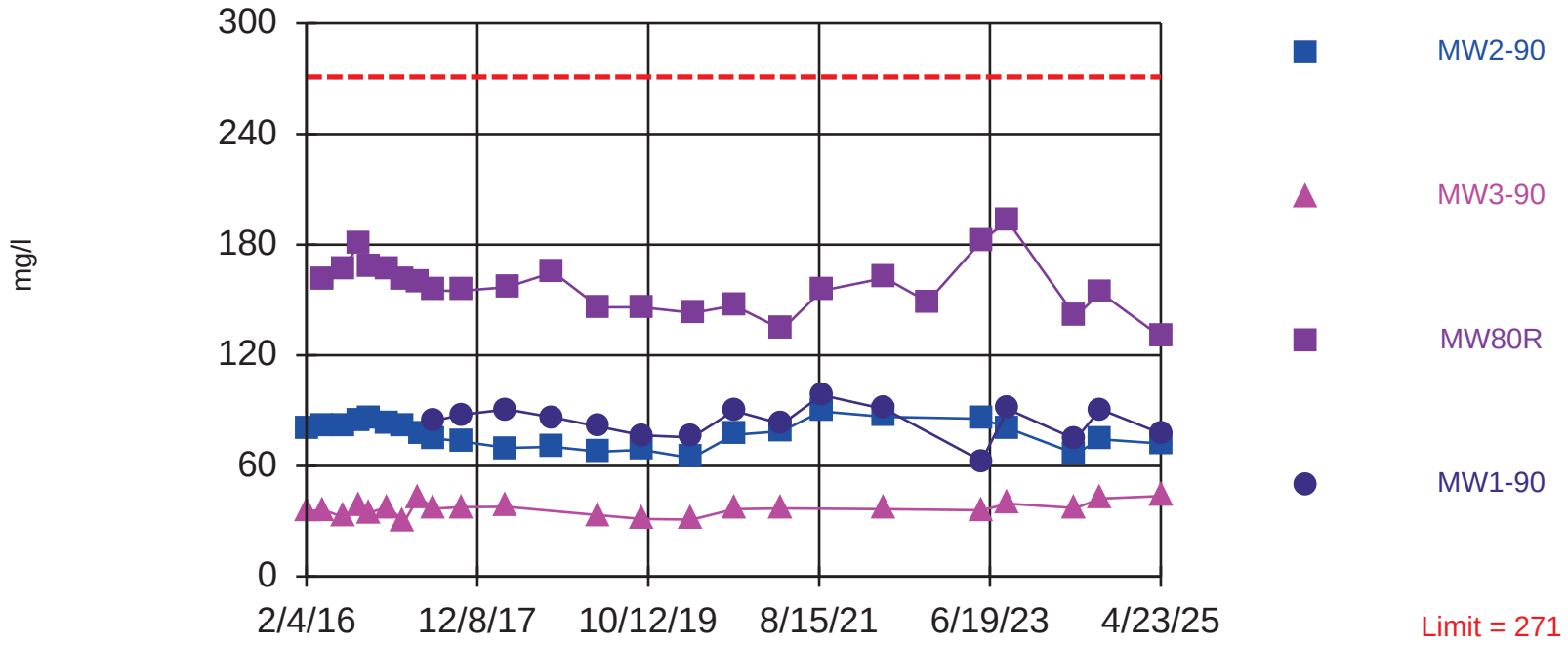



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 56 background values. Annual per-constituent alpha = 0.004891. Individual comparison alpha = 0.0006126 (1 of 2). Comparing 4 points to limit. Seasonality was not detected with 95% confidence.

Within Limit

# Chloride

## Interwell Non-parametric

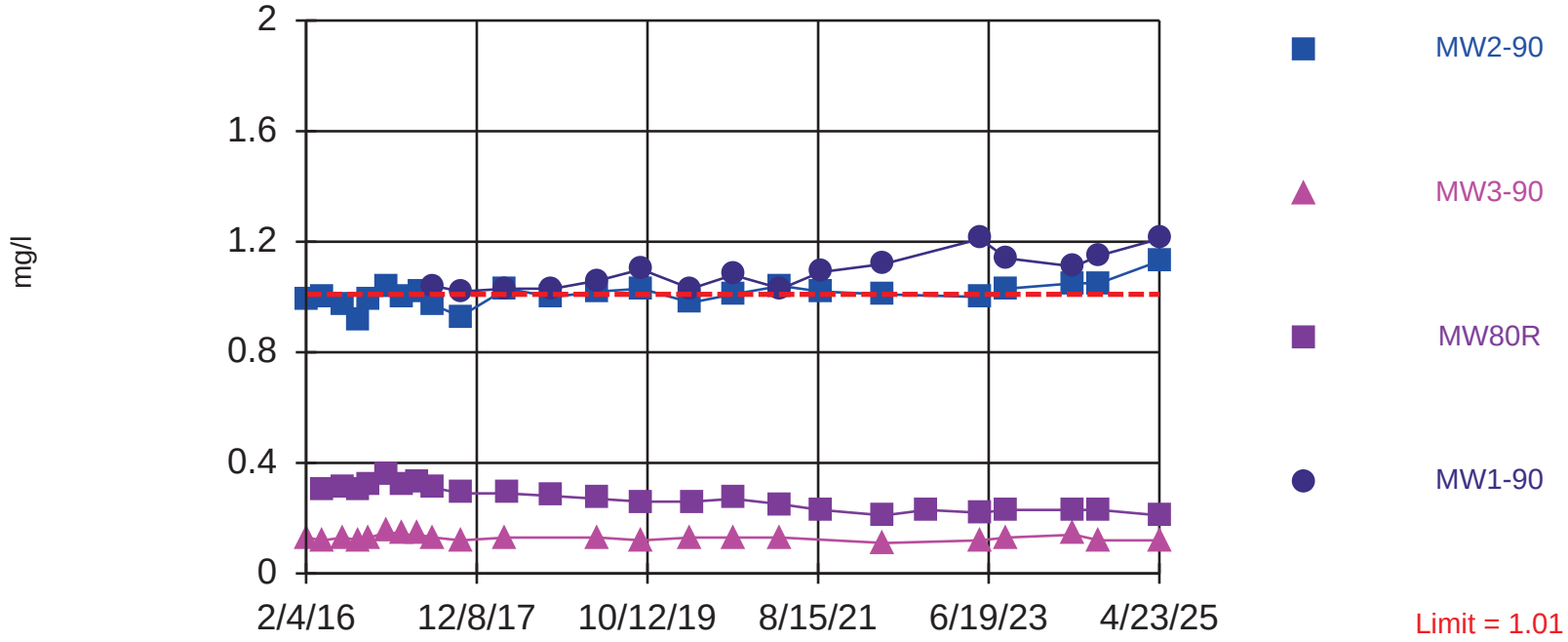



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 56 background values. Annual per-constituent alpha = 0.004891. Individual comparison alpha = 0.0006126 (1 of 2). Comparing 4 points to limit. Seasonality was not detected with 95% confidence.

Exceeds Limit: MW2-90, MW1-90

# Fluoride

Interwell Non-parametric




Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 56 background values. Annual per-constituent alpha = 0.004891. Individual comparison alpha = 0.0006126 (1 of 2). Comparing 4 points to limit. Seasonality was not detected with 95% confidence.

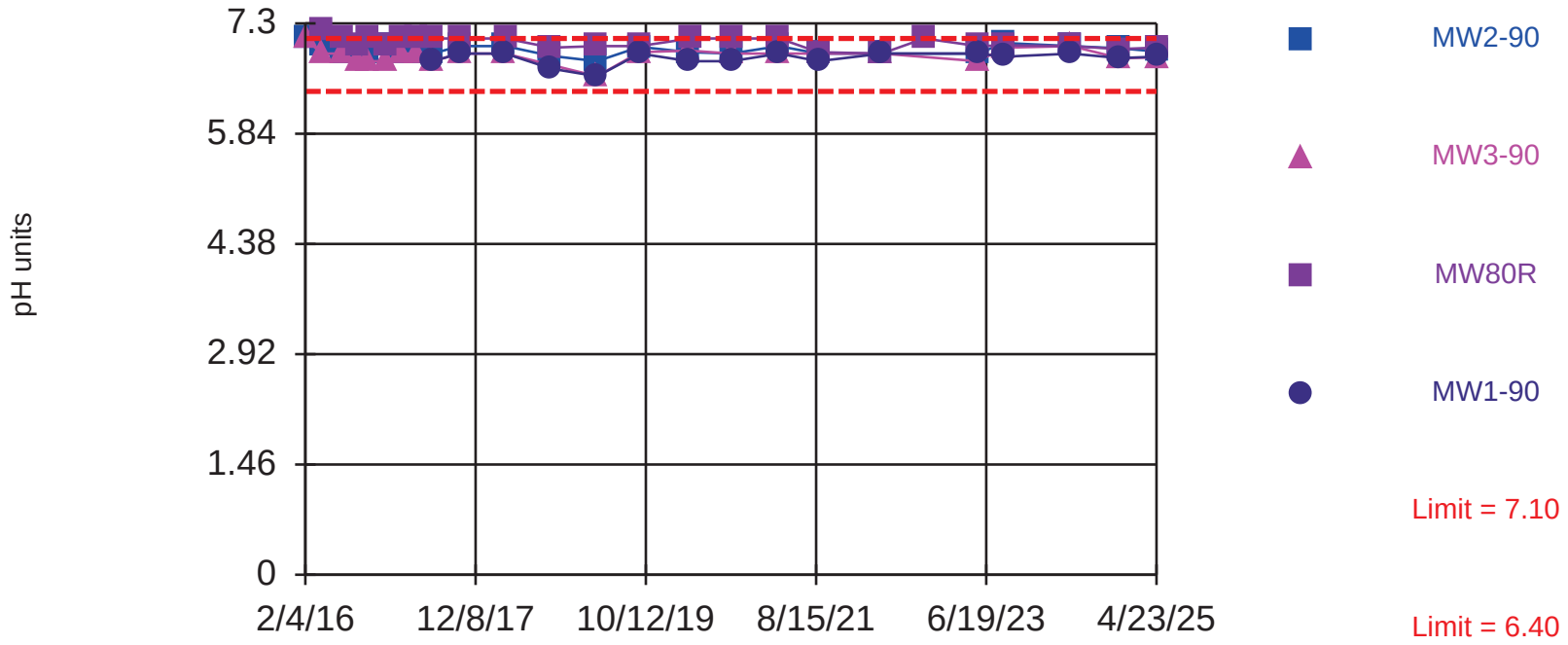
Prediction Limit Analysis Run 7/8/2025 11:07 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Within Limits

# pH, Field

Interwell Non-parametric

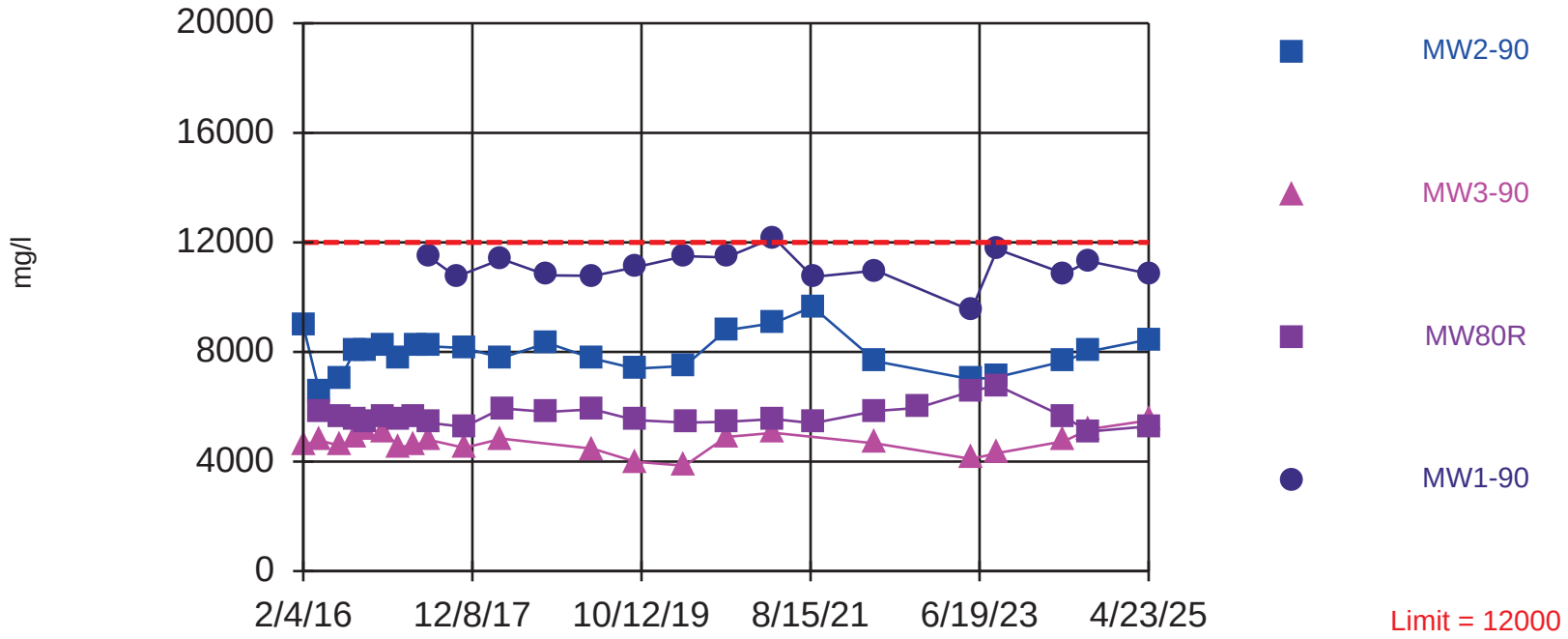



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limits are highest and lowest of 56 background values. Annual per-constituent alpha = 0.009781. Individual comparison alpha = 0.001225 (1 of 2). Comparing 4 points to limit. Seasonality was not detected with 95% confidence.

Within Limit

# Solids, total dissolved, Alt. Values

Interwell Non-parametric




Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 56 background values. Annual per-constituent alpha = 0.004891. Individual comparison alpha = 0.0006126 (1 of 2). Comparing 4 points to limit. Seasonality was not detected with 95% confidence.

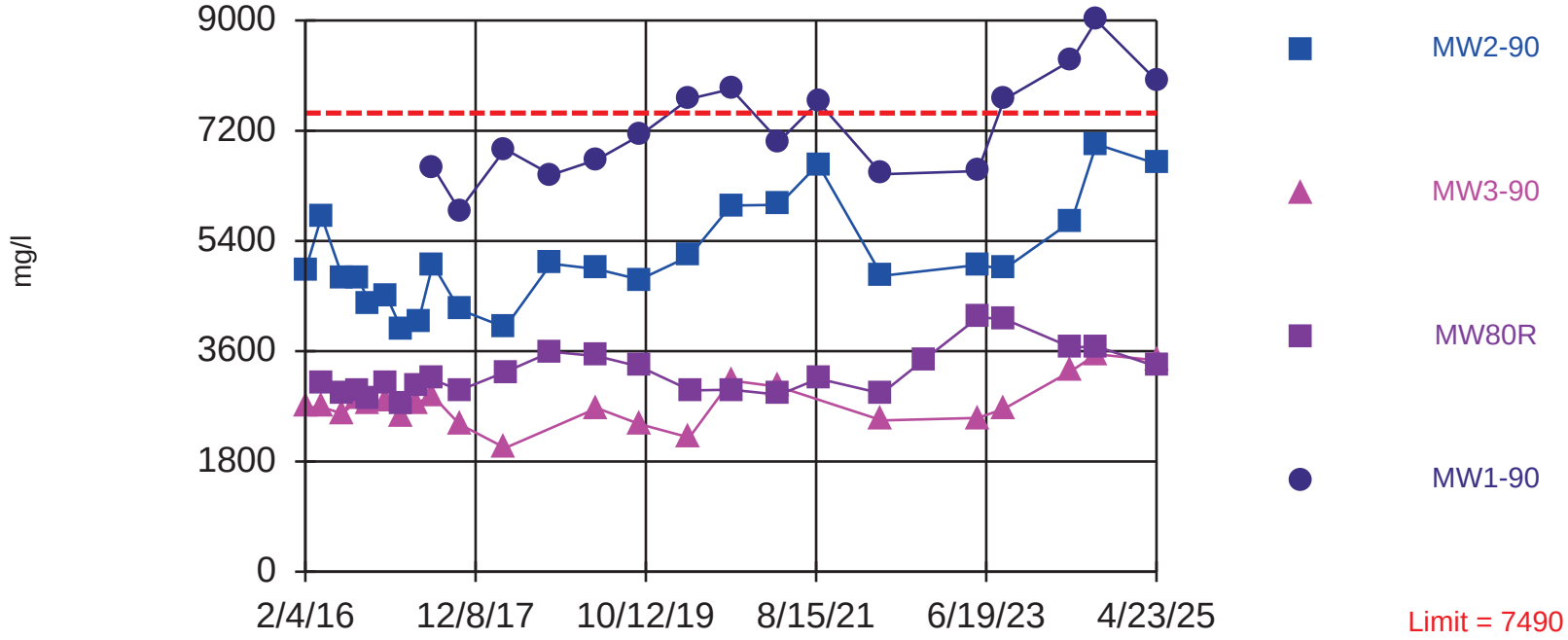
Prediction Limit, Alt. Values Analysis Run 7/8/2025 12:41 PM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Exceeds Limit: MW1-90

# Sulfate, as SO4

Interwell Non-parametric




Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 56 background values. Annual per-constituent alpha = 0.004891. Individual comparison alpha = 0.0006126 (1 of 2). Comparing 4 points to limit. Seasonality was not detected with 95% confidence.

Prediction Limit Analysis Run 7/8/2025 11:08 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

# Prediction Limit

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Working_Heskett_SanitasAppIII - Copy Printed 7/8/2025, 11:20 AM

| Constituent | Well | Upper Lim. | Lower Lim. | Date | Observ. | Sig. | Bg N | %NDs | Transform | Alpha | Method |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Boron, total (mg/l) | MW2-90 | 0.820 | n/a | 4/23/2025 | 0.5ND | No | 56 | 35.71 | n/a | 0.000... | NP Inter (normality) ... |
| Boron, total (mg/l) | MW3-90 | 0.820 | n/a | 4/23/2025 | 0.5ND | No | 56 | 35.71 | n/a | 0.000... | NP Inter (normality) ... |
| Boron, total (mg/l) | MW80R | 0.820 | n/a | 4/23/2025 | 0.5ND | No | 56 | 35.71 | n/a | 0.000... | NP Inter (normality) ... |
| Boron, total (mg/l) | MW1-90 | 0.820 | n/a | 4/23/2025 | 0.5ND | No | 56 | 35.71 | n/a | 0.000... | NP Inter (normality) ... |
| Calcium, Total (mg/l) | MW2-90 | 600 | n/a | 4/23/2025 | 559 | No | 56 | 0 | n/a | 0.000... | NP Inter (normality) ... |
| **Calcium, Total (mg/l)** | **MW3-90** | **600** | **n/a** | **4/23/2025** | **649** | **Yes** | **56** | **0** | **n/a** | **0.000...** | **NP Inter (normality) ...** |
| Calcium, Total (mg/l) | MW80R | 600 | n/a | 4/23/2025 | 487 | No | 56 | 0 | n/a | 0.000... | NP Inter (normality) ... |
| Calcium, Total (mg/l) | MW1-90 | 600 | n/a | 4/23/2025 | 444 | No | 56 | 0 | n/a | 0.000... | NP Inter (normality) ... |
| Chloride (mg/l) | MW2-90 | 271 | n/a | 4/23/2025 | 72.1 | No | 56 | 0 | n/a | 0.000... | NP Inter (normality) ... |
| Chloride (mg/l) | MW3-90 | 271 | n/a | 4/23/2025 | 43.6 | No | 56 | 0 | n/a | 0.000... | NP Inter (normality) ... |
| Chloride (mg/l) | MW80R | 271 | n/a | 4/23/2025 | 130 | No | 56 | 0 | n/a | 0.000... | NP Inter (normality) ... |
| Chloride (mg/l) | MW1-90 | 271 | n/a | 4/23/2025 | 77.6 | No | 56 | 0 | n/a | 0.000... | NP Inter (normality) ... |
| **Fluoride (mg/l)** | **MW2-90** | **1.01** | **n/a** | **4/23/2025** | **1.13** | **Yes** | **56** | **0** | **n/a** | **0.000...** | **NP Inter (normality) ...** |
| Fluoride (mg/l) | MW3-90 | 1.01 | n/a | 4/23/2025 | 0.12 | No | 56 | 0 | n/a | 0.000... | NP Inter (normality) ... |
| Fluoride (mg/l) | MW80R | 1.01 | n/a | 4/23/2025 | 0.21 | No | 56 | 0 | n/a | 0.000... | NP Inter (normality) ... |
| **Fluoride (mg/l)** | **MW1-90** | **1.01** | **n/a** | **4/23/2025** | **1.21** | **Yes** | **56** | **0** | **n/a** | **0.000...** | **NP Inter (normality) ...** |
| pH, Field (pH units) | MW2-90 | 7.10 | 6.40 | 4/23/2025 | 6.93 | No | 56 | 0 | n/a | 0.001225 | NP Inter (normality) ... |
| pH, Field (pH units) | MW3-90 | 7.10 | 6.40 | 4/23/2025 | 6.85 | No | 56 | 0 | n/a | 0.001225 | NP Inter (normality) ... |
| pH, Field (pH units) | MW80R | 7.10 | 6.40 | 4/23/2025 | 6.98 | No | 56 | 0 | n/a | 0.001225 | NP Inter (normality) ... |
| pH, Field (pH units) | MW1-90 | 7.10 | 6.40 | 4/23/2025 | 6.86 | No | 56 | 0 | n/a | 0.001225 | NP Inter (normality) ... |
| Solids, total dissolved (mg/l) | MW2-90 | 12000 | n/a | 4/23/2025 | 8452 | No | 56 | 0 | n/a | 0.000... | NP Inter (normality) ... |
| Solids, total dissolved (mg/l) | MW3-90 | 12000 | n/a | 4/23/2025 | 5503 | No | 56 | 0 | n/a | 0.000... | NP Inter (normality) ... |
| Solids, total dissolved (mg/l) | MW80R | 12000 | n/a | 4/23/2025 | 5284 | No | 56 | 0 | n/a | 0.000... | NP Inter (normality) ... |
| Solids, total dissolved (mg/l) | MW1-90 | 12000 | n/a | 4/23/2025 | 10859 | No | 56 | 0 | n/a | 0.000... | NP Inter (normality) ... |
| Sulfate, as SO4 (mg/l) | MW2-90 | 7490 | n/a | 4/23/2025 | 6660 | No | 56 | 0 | n/a | 0.000... | NP Inter (normality) ... |
| Sulfate, as SO4 (mg/l) | MW3-90 | 7490 | n/a | 4/23/2025 | 3450 | No | 56 | 0 | n/a | 0.000... | NP Inter (normality) ... |
| Sulfate, as SO4 (mg/l) | MW80R | 7490 | n/a | 4/23/2025 | 3350 | No | 56 | 0 | n/a | 0.000... | NP Inter (normality) ... |
| **Sulfate, as SO4 (mg/l)** | **MW1-90** | **7490** | **n/a** | **4/23/2025** | **8020** | **Yes** | **56** | **0** | **n/a** | **0.000...** | **NP Inter (normality) ...** |

# Appendix C Ash SPLP Laboratory Report

MINNESOTA VALLEY TESTING LABORATORIES, INC.
1126 North Front St. ~ New Ulm, MN 56073 ~ 800-782-3557 ~ Fax 507-359-2890
2616 East Broadway Ave. ~ Bismarck, ND 58501 ~ 800-279-6885 ~ Fax 701-258-9724
51 West Lincoln Way ~ Nevada, IA 50201 ~ 800-362-0855 ~ Fax 515-382-3885
www.mvtl.com

MEMBER ACIL



Report Date: 8 Sep 11
Lab Number: 11-M2450
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit I Bottom Ash
Sample Site: MDU Heskett

| | As Received Result | | Method RL | Method Reference | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| SPLP Extraction | | | | 1312 | 22 Jul 11 | SS |
| pH | 12.2 | units | N/A | SM4500 H+ B | 22 Jul 11 17:00 | Claudette |
| Specific Conductance | 8778 | umhos/cm | N/A | SM2510-B | 22 Jul 11 17:00 | Claudette |
| Total Suspended Solids | 3 | mg/l | 1 | SM2540-D | 22 Jul 11 14:00 | CLB |
| Total Alkalinity | 1120 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Phenolphthalein Alk | 1090 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Bicarbonate | < 4 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Carbonate | 60 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Hydroxide | 1060 | mg/l CaCO3 | 0 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Tot Dis Solids(Summation) | 4860 | mg/l | NA | SM1030-F | 3 Aug 11 8:40 | Calculated |
| Total Hardness as CaCO3 | 524 | mg/l | NA | SM2340-B | 3 Aug 11 8:40 | Calculated |
| Hardness in grains/gallon | 30.7 | gr/gal | NA | SM2340-B | 3 Aug 11 8:40 | Calculated |
| Cation Summation | 74.3 | meq/L | NA | SM1030-F | 3 Aug 11 8:40 | Calculated |
| Anion Summation | 74.6 | meq/L | NA | SM1030-F | 28 Jul 11 14:30 | Calculated |
| Percent Error | -0.24 | % | NA | SM1030-F | 3 Aug 11 8:40 | Calculated |
| Sodium Adsorption Ratio | 27.1 | | NA | USDA 20b | 3 Aug 11 8:40 | Calculated |
| Gross Alpha Radiation | Attached | pCi/l | | | 22 Aug 11 2:03 | |
| Radon 222 | Attached | | | | 28 Jul 11 4:37 | |
| Radium 226 | Attached | pCi/l | | | 22 Aug 11 22:20 | |
| Radium 228 | Attached | pCi/l | | | 16 Aug 11 16:50 | |
| Total Organic Carbon | 0.7 | mg/l | 0.5 | SM5310-C | 1 Aug 11 8:00 | Eric |
| Fluoride | < 0.1 | mg/l | 0.10 | SM4500-F-C | 4 Aug 11 17:00 | CLB |
| Sulfate | 2440 | mg/l | 5.00 | ASTM D516-02 | 27 Jul 11 9:00 | KMP |
| Chloride | 50.5 | mg/l | 1.0 | SM4500-Cl-E | 27 Jul 11 14:00 | KMP |
| Nitrate-Nitrite as N | 0.21 | mg/l | 0.10 | EPA 353.2 | 28 Jul 11 14:30 | KMP |
| Ammonia-Nitrogen as N | 0.32 | mg/l | 0.10 | EPA 350.1 | 28 Jul 11 10:45 | KMP |
| Phosphorus as P - Total | < 0.1 | mg/l | 0.10 | EPA 365.1 | 28 Jul 11 13:00 | KMP |
| Mercury - Total | < 0.0002 | mg/l | 0.0002 | EPA 245.1 | 28 Jul 11 8:00 | Eric |
| Chemical Oxygen Demand | < 5 | mg/l | 5.0 | HACH 8000 | 1 Aug 11 8:30 | Wayne |
| Calcium - Total | 210 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Magnesium - Total | < 2.5 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Sodium - Total | 1440 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Potassium - Total | 44.8 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Aluminum - Total | < 0.5 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Iron - Total | < 0.5 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Strontium - Total | 28.2 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Titanium - Total | < 0.5 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Boron - Total | < 0.5 | mg/l | 0.10 | 6010 | 11 Aug 11 8:40 | Stacy |

RL = Method Reporting Limit

Elevated "Less Than Result" (<): @ = Due to sample matrix
! = Due to sample quantity
# = Due to sample concentration
+ = Due to extract volume

CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

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51 West Lincoln Way ~ Nevada, IA 50201 ~ 800-362-0855 ~ Fax 515-382-3885
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MEMBER ACIL



Report Date: 8 Sep 11
Lab Number: 11-M2450
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit I Bottom Ash
Sample Site: MDU Heskett

| | As Received Result | | Method RL | Method Reference | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| Antimony - Total | < 0.002 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Arsenic - Total | 0.0044 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Barium - Total | 0.1135 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Beryllium - Total | < 0.001 | mg/l | 0.0010 | 6020 | 25 Jul 11 16:18 | Claudette |
| Cadmium - Total | 0.00164 | mg/l | 0.00100 | 6020 | 25 Jul 11 16:18 | Claudette |
| Chromium - Total | 0.0065 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Cobalt - Total | < 0.002 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Copper - Total | 0.0213 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Lead - Total | < 0.002 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Manganese - Total | 0.0027 | mg/l | 0.0010 | 6020 | 25 Jul 11 16:18 | Claudette |
| Molybdenum - Total | 0.6860 | mg/l | 0.0020 | 6020 | 26 Jul 11 12:46 | Claudette |
| Nickel - Total | 0.0074 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Selenium - Total | 0.0133 | mg/l | 0.0020 | 6020 | 26 Jul 11 9:46 | Claudette |
| Silver - Total | < 0.001 | mg/l | 0.0010 | 6020 | 25 Jul 11 16:18 | Claudette |
| Thallium - Total | < 0.002 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Tin - Total | < 0.05 | mg/l | 0.0500 | 6020 | 25 Jul 11 16:18 | Claudette |
| Vanadium - Total | 0.0189 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Zinc - Total | 0.0151 | mg/l | 0.0100 | 6020 | 25 Jul 11 16:18 | Claudette |
| Uranium | < 0.002 | mg/l | 0.002 | 6020 | 25 Jul 11 16:18 | Claudette |

All analyses were performed on the extract from Method 1312 (SPLP) with a modified solution to solids ratio of 4:1.

Approved by: D. Zander

RL = Method Reporting Limit

Elevated "Less Than Result" (<): @ = Due to sample matrix
! = Due to sample quantity
# = Due to sample concentration
+ = Due to extract volume

CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

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MEMBER ACIL



Report Date: 8 Sep 11
Lab Number: 11-M2451
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit II Sand Ash
Sample Site: MDU Heskett

| | As Received Result | | Method RL | Method Reference | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| SPLP Extraction | | | | 1312 | 22 Jul 11 | SS |
| pH | 11.1 | units | N/A | SM4500 H+ B | 22 Jul 11 17:00 | Claudette |
| Specific Conductance | 20110 | umhos/cm | N/A | SM2510-B | 22 Jul 11 17:00 | Claudette |
| Total Suspended Solids | 21 | mg/l | 1 | SM2540-D | 22 Jul 11 14:00 | CLB |
| Total Alkalinity | 203 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Phenolphthalein Alk | 171 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Bicarbonate | < 4 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Carbonate | 64 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Hydroxide | 139 | mg/l CaCO3 | 0 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Tot Dis Solids(Summation) | 22500 | mg/l | NA | SM1030-F | 3 Aug 11 8:40 | Calculated |
| Total Hardness as CaCO3 | 1200 | mg/l | NA | SM2340-B | 3 Aug 11 8:40 | Calculated |
| Hardness in grains/gallon | 70.2 | gr/gal | NA | SM2340-B | 3 Aug 11 8:40 | Calculated |
| Cation Summation | 318 | meq/L | NA | SM1030-F | 3 Aug 11 8:40 | Calculated |
| Anion Summation | 314 | meq/L | NA | SM1030-F | 28 Jul 11 14:30 | Calculated |
| Percent Error | 0.65 | % | NA | SM1030-F | 3 Aug 11 8:40 | Calculated |
| Sodium Adsorption Ratio | 80.9 | | NA | USDA 20b | 3 Aug 11 8:40 | Calculated |
| Gross Alpha Radiation | Attached | pCi/l | | | 22 Aug 11 2:03 | |
| Radon 222 | See Attached | | | | 28 Jul 11 4:37 | |
| Radium 226 | Attached | pCi/l | | | 22 Aug 11 22:20 | |
| Radium 228 | Attached | pCi/l | | | 16 Aug 11 16:50 | |
| Total Organic Carbon | < 0.5 | mg/l | 0.5 | SM5310-C | 1 Aug 11 8:00 | Eric |
| Fluoride | < 0.1 | mg/l | 0.10 | SM4500-F-C | 4 Aug 11 17:00 | CLB |
| Sulfate | 14900 | mg/l | 5.00 | ASTM D516-02 | 27 Jul 11 9:00 | KMP |
| Chloride | 2.0 | mg/l | 1.0 | SM4500-Cl-E | 27 Jul 11 14:00 | KMP |
| Nitrate-Nitrite as N | < 0.1 | mg/l | 0.10 | EPA 353.2 | 28 Jul 11 14:30 | KMP |
| Ammonia-Nitrogen as N | 0.10 | mg/l | 0.10 | EPA 350.1 | 28 Jul 11 10:45 | KMP |
| Phosphorus as P - Total | < 0.1 | mg/l | 0.10 | EPA 365.1 | 28 Jul 11 13:00 | KMP |
| Mercury - Total | < 0.0002 | mg/l | 0.0002 | EPA 245.1 | 28 Jul 11 8:00 | Eric |
| Chemical Oxygen Demand | < 5 | mg/l | 5.0 | HACH 8000 | 1 Aug 11 8:30 | Wayne |
| Calcium - Total | 481 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Magnesium - Total | < 5 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Sodium - Total | 6500 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Potassium - Total | 459 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Aluminum - Total | 1.09 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Iron - Total | < 1 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Strontium - Total | 66.0 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Titanium - Total | < 1 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Boron - Total | 5.96 | mg/l | 0.10 | 6010 | 11 Aug 11 8:40 | Stacy |

RL = Method Reporting Limit

Elevated "Less Than Result" (<): @ = Due to sample matrix
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Report Date: 8 Sep 11
Lab Number: 11-M2451
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit II Sand Ash
Sample Site: MDU Heskett

| | As Received Result | | Method RL | Method Reference | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| Antimony - Total | < 0.002 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Arsenic - Total | 0.0822 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Barium - Total | 0.0930 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Beryllium - Total | < 0.001 | mg/l | 0.0010 | 6020 | 25 Jul 11 16:18 | Claudette |
| Cadmium - Total | 0.00182 | mg/l | 0.00100 | 6020 | 25 Jul 11 16:18 | Claudette |
| Chromium - Total | 0.0244 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Cobalt - Total | < 0.002 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Copper - Total | 0.1108 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Lead - Total | < 0.002 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Manganese - Total | 0.0052 | mg/l | 0.0010 | 6020 | 25 Jul 11 16:18 | Claudette |
| Molybdenum - Total | 0.1000 | mg/l | 0.0020 | 6020 | 26 Jul 11 12:46 | Claudette |
| Nickel - Total | 0.0136 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Selenium - Total | 0.0937 | mg/l | 0.0020 | 6020 | 26 Jul 11 9:46 | Claudette |
| Silver - Total | < 0.001 | mg/l | 0.0010 | 6020 | 25 Jul 11 16:18 | Claudette |
| Thallium - Total | < 0.002 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Tin - Total | < 0.05 | mg/l | 0.0500 | 6020 | 25 Jul 11 16:18 | Claudette |
| Vanadium - Total | 0.3026 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Zinc - Total | 0.0327 | mg/l | 0.0100 | 6020 | 25 Jul 11 16:18 | Claudette |
| Uranium | < 0.002 | mg/l | 0.002 | 6020 | 25 Jul 11 16:18 | Claudette |

All analyses were performed on the extract from Method 1312 (SPLP) with a modified solution to solids ratio of 4:1.

Approved by: D. Zorder

RL = Method Reporting Limit

Elevated "Less Than Result" (<): @ = Due to sample matrix
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CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

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Report Date: 8 Sep 11
Lab Number: 11-M2452
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit I Fly Ash
Sample Site: MDU Heskett

| | As Received Result | | Method RL | Method Reference | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| SPLP Extraction | | | | 1312 | 22 Jul 11 | SS |
| pH | 12.9 | units | N/A | SM4500 H+ B | 22 Jul 11 17:00 | Claudette |
| Specific Conductance | 50660 | umhos/cm | N/A | SM2510-B | 22 Jul 11 17:00 | Claudette |
| Total Suspended Solids | 30 | mg/l | 1 | SM2540-D | 22 Jul 11 14:00 | CLB |
| Total Alkalinity | 7020 | mg/l CaCO3 | 4 | SM2320-B | 25 Jul 11 17:00 | Claudette |
| Phenolphthalein Alk | 6900 | mg/l CaCO3 | 4 | SM2320-B | 25 Jul 11 17:00 | Claudette |
| Bicarbonate | < 4 | mg/l CaCO3 | 4 | SM2320-B | 25 Jul 11 17:00 | Claudette |
| Carbonate | 240 | mg/l CaCO3 | 4 | SM2320-B | 25 Jul 11 17:00 | Claudette |
| Hydroxide | 6780 | mg/l CaCO3 | 0 | SM2320-B | 25 Jul 11 17:00 | Claudette |
| Tot Dis Solids(Summation) | 42200 | mg/l | NA | SM1030-F | 3 Aug 11 8:40 | Calculated |
| Total Hardness as CaCO3 | 1750 | mg/l | NA | SM2340-B | 3 Aug 11 8:40 | Calculated |
| Hardness in grains/gallon | 102 | gr/gal | NA | SM2340-B | 3 Aug 11 8:40 | Calculated |
| Cation Summation | 663 | meq/L | NA | SM1030-F | 3 Aug 11 8:40 | Calculated |
| Anion Summation | 613 | meq/L | NA | SM1030-F | 28 Jul 11 14:30 | Calculated |
| Percent Error | 3.99 | % | NA | SM1030-F | 3 Aug 11 8:40 | Calculated |
| Sodium Adsorption Ratio | 143 | | NA | USDA 20b | 3 Aug 11 8:40 | Calculated |
| Gross Alpha Radiation | Attached | pCi/l | | | 22 Aug 11 2:03 | |
| Radon 222 | Attached | | | | 28 Jul 11 4:37 | |
| Radium 226 | Attached | pCi/l | | | 22 Aug 11 22:20 | |
| Radium 228 | Attached | pCi/l | | | 16 Aug 11 16:50 | |
| Total Organic Carbon | 1.5 | mg/l | 0.5 | SM5310-C | 1 Aug 11 8:00 | Eric |
| Fluoride | 5.60 | mg/l | 0.10 | SM4500-F-C | 10 Aug 11 17:00 | CLB |
| Sulfate | 22600 | mg/l | 5.00 | ASTM D516-02 | 27 Jul 11 9:00 | KMP |
| Chloride | 53.8 | mg/l | 1.0 | SM4500-Cl-E | 27 Jul 11 14:00 | KMP |
| Nitrate-Nitrite as N | 0.68 | mg/l | 0.10 | EPA 353.2 | 28 Jul 11 14:30 | KMP |
| Ammonia-Nitrogen as N | 7.22 | mg/l | 0.10 | EPA 350.1 | 28 Jul 11 10:45 | KMP |
| Phosphorus as P - Total | < 0.1 | mg/l | 0.10 | EPA 365.1 | 28 Jul 11 13:00 | KMP |
| Mercury - Total | < 0.0002 | mg/l | 0.0002 | EPA 245.1 | 28 Jul 11 8:00 | Eric |
| Chemical Oxygen Demand | 22.4 | mg/l | 5.0 | HACH 8000 | 1 Aug 11 8:30 | Wayne |
| Calcium - Total | 700 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Magnesium - Total | < 25 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Sodium - Total | 14100 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Potassium - Total | 580 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Aluminum - Total | < 5 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Iron - Total | < 5 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Strontium - Total | 59.5 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Titanium - Total | < 5 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Boron - Total | 1.89 | mg/l | 0.10 | 6010 | 11 Aug 11 8:40 | Stacy |

RL = Method Reporting Limit

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Report Date: 8 Sep 11
Lab Number: 11-M2452
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit I Fly Ash
Sample Site: MDU Heskett

| | As Received Result | | Method RL | Method Reference | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| Antimony - Total | < 0.002 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Arsenic - Total | 0.1128 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Barium - Total | 0.0906 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Beryllium - Total | < 0.001 | mg/l | 0.0010 | 6020 | 25 Jul 11 16:18 | Claudette |
| Cadmium - Total | 0.00244 | mg/l | 0.00100 | 6020 | 25 Jul 11 16:18 | Claudette |
| Chromium - Total | 0.0270 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Cobalt - Total | < 0.002 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Copper - Total | 0.2934 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Lead - Total | 0.0161 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Manganese - Total | 0.0102 | mg/l | 0.0010 | 6020 | 25 Jul 11 16:18 | Claudette |
| Molybdenum - Total | 0.9246 | mg/l | 0.0020 | 6020 | 26 Jul 11 12:46 | Claudette |
| Nickel - Total | 0.0175 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Selenium - Total | 0.1959 | mg/l | 0.0020 | 6020 | 26 Jul 11 9:46 | Claudette |
| Silver - Total | < 0.001 | mg/l | 0.0010 | 6020 | 25 Jul 11 16:18 | Claudette |
| Thallium - Total | < 0.002 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Tin - Total | < 0.05 | mg/l | 0.0500 | 6020 | 25 Jul 11 16:18 | Claudette |
| Vanadium - Total | 0.0158 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Zinc - Total | 0.3984 | mg/l | 0.0100 | 6020 | 25 Jul 11 16:18 | Claudette |
| Uranium | < 0.002 | mg/l | 0.002 | 6020 | 25 Jul 11 16:18 | Claudette |

All analyses were performed on the extract from Method 1312 (SPLP) with a modified solution to solids ratio of 4:1.

Approved by: D. Zorda

RL = Method Reporting Limit

Elevated "Less Than Result" (<): @ = Due to sample matrix
! = Due to sample quantity
# = Due to sample concentration
+ = Due to extract volume

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MEMBER ACIL



Report Date: 8 Sep 11
Lab Number: 11-M2453
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit II Fly Ash
Sample Site: MDU Heskett

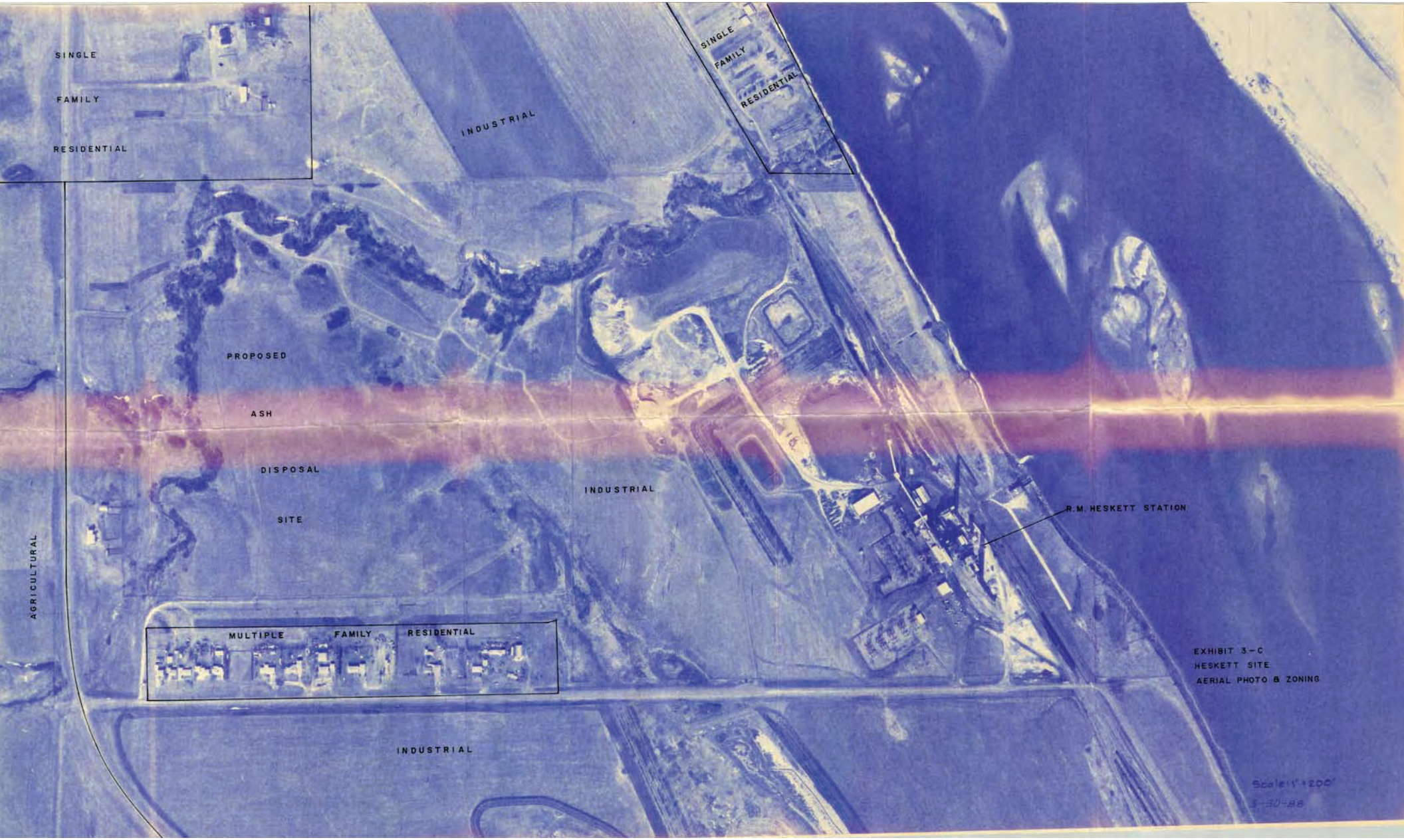
| | As Received Result | | Method RL | Method Reference | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| SPLP Extraction | | | | 1312 | 22 Jul 11 | SS |
| pH | 12.8 | units | N/A | SM4500 H+ B | 22 Jul 11 17:00 | Claudette |
| Specific Conductance | 27240 | umhos/cm | N/A | SM2510-B | 22 Jul 11 17:00 | Claudette |
| Total Suspended Solids | 13 | mg/l | 1 | SM2540-D | 22 Jul 11 14:00 | CLB |
| Total Alkalinity | 4570 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Phenolphthalein Alk | 4520 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Bicarbonate | < 4 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Carbonate | 100 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Hydroxide | 4470 | mg/l CaCO3 | 0 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Tot Dis Solids(Summation) | 16000 | mg/l | NA | SM1030-F | 3 Aug 11 8:40 | Calculated |
| Total Hardness as CaCO3 | 1960 | mg/l | NA | SM2340-B | 3 Aug 11 8:40 | Calculated |
| Hardness in grains/gallon | 115 | gr/gal | NA | SM2340-B | 3 Aug 11 8:40 | Calculated |
| Cation Summation | 252 | meq/L | NA | SM1030-F | 9 Aug 11 9:09 | Calculated |
| Anion Summation | 247 | meq/L | NA | SM1030-F | 28 Jul 11 14:30 | Calculated |
| Percent Error | 1.00 | % | NA | SM1030-F | 9 Aug 11 9:09 | Calculated |
| Sodium Adsorption Ratio | 46.1 | | NA | USDA 20b | 3 Aug 11 8:40 | Calculated |
| Gross Alpha Radiation | Attached | pCi/l | | | 22 Aug 11 2:03 | |
| Radon 222 | Attached | | | | 28 Jul 11 4:37 | |
| Radium 226 | Attached | pCi/l | | | 22 Aug 11 22:20 | |
| Radium 228 | Attached | pCi/l | | | 16 Aug 11 16:50 | |
| Total Organic Carbon | 1.6 | mg/l | 0.5 | SM5310-C | 1 Aug 11 8:00 | Eric |
| Fluoride | 3.60 | mg/l | 0.10 | SM4500-F-C | 4 Aug 11 17:00 | CLB |
| Sulfate | 7400 | mg/l | 5.00 | ASTM D516-02 | 27 Jul 11 9:00 | KMP |
| Chloride | 66.0 | mg/l | 1.0 | SM4500-Cl-E | 27 Jul 11 14:00 | KMP |
| Nitrate-Nitrite as N | 0.38 | mg/l | 0.10 | EPA 353.2 | 28 Jul 11 14:30 | KMP |
| Ammonia-Nitrogen as N | 15.0 | mg/l | 0.10 | EPA 350.1 | 28 Jul 11 10:45 | KMP |
| Phosphorus as P - Total | < 0.1 | mg/l | 0.10 | EPA 365.1 | 28 Jul 11 13:00 | KMP |
| Mercury - Total | < 0.0002 | mg/l | 0.0002 | EPA 245.1 | 28 Jul 11 8:00 | Eric |
| Chemical Oxygen Demand | 9.4 | mg/l | 5.0 | HACH 8000 | 1 Aug 11 8:30 | Wayne |
| Calcium - Total | 785 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Magnesium - Total | < 5 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Sodium - Total | 4720 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Potassium - Total | 275 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Aluminum - Total | < 1 | mg/l | 0.10 | 6010 | 9 Aug 11 9:09 | Stacy |
| Iron - Total | < 1 | mg/l | 0.10 | 6010 | 9 Aug 11 9:09 | Stacy |
| Strontium - Total | 85.0 | mg/l | 0.10 | 6010 | 9 Aug 11 9:09 | Stacy |
| Titanium - Total | < 1 | mg/l | 0.10 | 6010 | 9 Aug 11 9:09 | Stacy |
| Boron - Total | < 1 | mg/l | 0.10 | 6010 | 11 Aug 11 8:40 | Stacy |

RL = Method Reporting Limit

Elevated "Less Than Result" (<): @ = Due to sample matrix
! = Due to sample quantity
# = Due to sample concentration
+ = Due to extract volume

CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

**Appendix D Aerial Photo (March 30, 1988)**


SINGLE
FAMILY
RESIDENTIAL
INDUSTRIAL
SINGLE
FAMILY
RESIDENTIAL
PROPOSED
ASH
DISPOSAL
SITE
INDUSTRIAL
R.M. HESKETT STATION
AGRICULTURAL
MULTIPLE
FAMILY
RESIDENTIAL
INDUSTRIAL
EXHIBIT 3-C
HESKETT SITE
AERIAL PHOTO & ZONING
Scale 1"=200'
1-30-86

# Appendix E Boring Logs

EXHIBIT 5-E

LITHOLOGIC LOGS

Wells 10, 11, 12 and 13

| | |
|---|---|
| 0-1 | Top soil, silty, clayey, sandy, brown, calcareous; with some limestone pebbles. |
| 1-11 | Silt, clayey, brownish-tan, slightly indurated, very dry, calcareous; with thin coarse-grained, clean silt lenses and a few small (less than .5 in.) iron oxide concretions. Abundant small gypsum crystals (less than .13 in. long). Some small, black flakes of organic plant material. Cannonball-Ludlow Formations. |
| 11-14 | Silt, as above, with some (less than 20%) very fine- to fine-grained sand interspersed. |
| 14-30 | Silt, as above, clayey, less sand than above interval, oxidized; with very fine-grained silty sand lenses and very few gypsum crystals. |
| 30-41 | Silt, very clayey, with some (less than 20%) very fine-grained sand interspersed, steel-gray (color change), moderately indurated; with fewer small gypsum crystals than above intervals. |
| 41-59 | Silt, as above, very clayey, with some (less than 20%) fine- to medium-grained sand interspersed in a silt and clay matrix. |
| 59-65 | Silt, as above, with abundant (more than 20%) fine- to medium-grained sand interspersed. |
| 65-81 | Silt, clayey, steel-gray to bluish, moderately indurated; with thin coarse-grained silt to very fine-grained sand lenses in an otherwise fine silt to clay matrix. |
| 81-84 | Clay, silty, steel-gray to bluish, moderately indurated, dense. |
| 84-91 | Siltstone, sandy, clayey, steel-gray to bluish, slightly indurated; with small fine-grained sand lenses and abundant (more than 20%) sand interspersed in the matrix. |
| 91-110 | Silt, clayey, bluish-gray, moderately indurated; with thin (less than 1 foot) mudstone lenses. |
| 110-120 | Silt, very clayey, steel-gray to bluish, moderately indurated, very dense. Cannonball-Ludlow Formations. |

Wells 20 and 21

| | |
|---|---|
| 0-1 | Top soil, silty, sandy, clayey, dark-brown, calcareous; with some limestone and granite pebbles. |
| 1-21 | Silt, clayey, with minor amounts (less than 10%) of very fine-grained sand interspersed, brownish-tan, slightly indurated, calcareous, oxidized; with small iron oxide concretions and abundant small gypsum crystals. Cannonball-Ludlow Formations. |
| 21-26 | Silt, as above, steel-gray (color change). |
| 26-49 | Silt, clayey, with some (less than 20%) very fine- to medium-grained sand interspersed, steel-gray to bluish, slightly indurated; with very few small gypsum crystals and some thin (less than 1 foot) siltstone lenses. |
| 49-53 | Silt, as above, with abundant (more than 20%) fine- to medium-grained sand interspersed. |
| 53-63 | Silt, as above, clayey, less sand, with thin (less than 1 foot) siltstone to mudstone lenses. |
| 63-80 | Silt, very clayey, steel-gray to bluish, moderately indurated, very dense. Cannonball-Ludlow Formations. |

Wells 30, 31, 32 and 33

| | |
|---|---|
| 0-1 | Top soil, silty, sandy, brownish, calcareous; with some granite and limestone pebbles. |
| 1-2 | Pebble-loam (glacial till), silty, sandy, clayey, yellowish-brown, dry, calcareous. |
| 2-31 | Silt, clayey, with minor amounts (less than 10%) of very fine-grained sand interspersed, brownish-tan, slightly indurated, calcareous, oxidized; with small iron oxide concretions. Some small, black flakes organic plant material. Cannonball-Ludlow Formations. |
| 31-44 | Silt, clayey, steel-gray (color change), slightly indurated, calcareous; with small iron oxide concretions, thin coarse silt lenses, small gypsum crystals and gray to reddish-brown mottling. |

| | |
|---|---|
| 44-61 | Silt, as above, with some (less than 20%) fine- to medium-grained sand interspersed. |
| 61-65 | Silt, as above, with abundant (more than 20%) fine- to medium-grained sand interspersed, dense. |
| 65-76 | Silt, as above, clayey, less sand, some thin (less than 1 foot) lenses of siltstone to mudstone. |
| 76-80 | Siltstone, sandy, clayey, steel-gray to bluish, slightly indurated; with small fine-grained sand lenses and abundant (more than 20%) fine-grained sand interspersed in the matrix. |
| 80-92 | Silt, clayey, steel-gray to bluish, moderately indurated, with some (less than 20%) very fine- to fine grained sand interspersed. |
| 92-120 | Silt, very clayey, steel-gray to bluish, moderately indurated, very dense. Cannonball-Ludlow Formations. |

Well 40

| | |
|---|---|
| 0-1 | Top soil, sandy, silty, brownish-tan, calcareous; with some granite and limestone pebbles. |
| 1-5 | Pebble-loam (glacial till), sandy, silty, with detrital lignite and organic matter, yellowish-brown, very dry, calcareous. |
| 5-22 | Sand, very fine- to medium-grained, unconsolidated, with thin lenses of clay and detrital lignite, brownish-yellow, calcareous. |
| 22-40 | Silt, clayey, with minor amounts (less than 10%) very fine-grained sand interspersed, brownish-tan, slightly indurated, calcareous, oxidized; with small iron oxide concretions and small gypsum crystals; Cannonball-Ludlow Formations. |
| 40-51 | Silt, clayey, with minor amounts (less than 10%) of very fine-grained sand interspersed, steel-gray (color change), moderately indurated; with some reddish-brown mottling and some very thin (less than 6 inches) mudstone lenses. |
| 51-58 | Silt, as above, with abundant (more than 20%) fine-grained sand and thin silty-clay lenses. |

| | |
|---|---|
| 58-62 | Siltstone, sandy, clayey, steel-gray to bluish, moderately indurated; with small fine-grained sand lenses and abundant (more than 20%) sand interspersed in the matrix. |
| 62-70 | Silt, clayey, with some (less than 20%) fine- to medium-grained sand interspersed, steel-gray to bluish, moderately indurated; with thin (less than 2 feet) sandy lenses. |
| 70-80 | Silt, as above, very clayey, some (less than 10%) fine-grained sand interspersed; less sand than above interval. |
| 80-120 | Silt, as above, dark-steel-gray. Cannonball-Ludlow Formations. |

Wells 41, 42 and 43

| | |
|---|---|
| 0-1 | Top soil, sandy, silty, dark-brown, calcareous; with some granite and limestone pebbles. |
| 1-4 | Pebble-loam (glacial till), sandy, silty, clayey, yellowish-brown, very dry, calcareous. |
| 4-40 | Silt, clayey, with some (less than 20% ) very fine-grained sand interspersed, brownish-tan, unconsolidated, noncompacted, calcareous to 25 feet, oxidized; with small iron oxide concretions and abundant small gypsum crystals. Cannonball-Ludlow Formations. |
| 40-51 | Silt, clayey, with minor amounts (less than 10%) of very fine-grained sand interspersed, steel-gray (color change), moderately indurated; with some reddish-brown mottling and some very thin (less than 6 inches) mudstone lenses. |
| 51-58 | Silt, as above, with abundant (more than 20%) fine-grained sand and thin silty-clay lenses. |
| 58-62 | Siltstone, sandy, clayey, steel-gray to bluish, moderately indurated; with small fine-grained sand lenses and abundant (more than 20%) sand interspersed in the matrix. |
| 62-70 | Silt, clayey, with some (less than 20%) fine- to medium-grained sand interspersed, steel-gray to bluish, moderately indurated; with thin (less than 2 feet) sandy lenses. |

| | |
|---|---|
| 70-80 | Silt, as above, very clayey, some (less than 10%) fine-grained sand interspersed; less sand than above interval. |

Wells 43 and 44

| | |
|---|---|
| 0-2 | Top soil, clayey, silty, some sand, brownish-tan to light-gray, calcareous. |
| 2-20 | Silt, clayey, with some (less than 20%) fine-grained sand interspersed, brownish-tan, slightly indurated, very dry, calcareous; with small iron oxide concretions, abundant small gypsum crystals and occasional thin silt lenses. Cannonball-Ludlow Formations. |
| 20-25 | Silt, as above, very clayey, oxidized, with minor amounts (less than 10%) of fine-grained sand. |
| 25-35 | Silt, as above, dark-brownish-tan to bluish-gray (color change), with thin very fine-grained sand lenses. |
| 35-60 | Silt, clayey, with some (less than 20%) fine- to medium-grained sand interspersed, steel-gray to bluish, moderately indurated; with some indurated silty sand lenses. Cannonball-Ludlow Formations. |

Wells 50, 51 and 52

| | |
|---|---|
| 0-4 | Top soil, clayey, silty, very dark-brown. |
| 4-10 | Clay, silty, with some (less than 20%) fine-grained sand, dark-brownish-tan, soft, cohesive, wet, sticky; with some pebbles. |
| 10-22 | Silt, very clayey, with some (less than 20%) very fine-grained sand interspersed, brownish-tan, slightly indurated, calcareous, dense; with abundant small gypsum crystals and very thin silt and sand lenses; Cannonball-Ludlow Formations. |
| 22-23 | Sandstone, fine-grained, silty, indurated, oxidized, dark-brown. |
| 23-30 | Silt, very clayey, with some (less than 20%) very fine-grained sand interspersed, steel-gray (color change), moderately indurated; with thin medium grained sand lenses. |

| | |
|---|---|
| 30-40 | Silt, as above, very clayey, less sand than above interval, dark-steel-gray. Cannonball-Ludlow Formations. |

Wells 53 and 54

| | |
|---|---|
| 0-4 | Top soil, clayey, silty, very dark-brown, wet, sticky. |
| 4-15 | Clay, silty, with some (less than 20%) fine- to medium-grained sand interspersed, brownish-tan, slightly indurated, dry, calcareous; with small iron oxide concretions, small gypsum crystals and occasional reddish-brown mottling; Cannonball-Ludlow Formations. |
| 15-20 | Sand, very fine-grained to medium-grained, silty, clayey, unconsolidated, yellowish-brown, oxidized. |
| 20-30 | Silt, clayey, with some (less than 20%) fine-grained sand interspersed, steel-gray (color change), slightly indurated; with clay and sand lenses, some small concretions and some small gypsum crystals. |
| 30-45 | Silt, as above, very clayey. |
| 45-60 | Silt, as above, clayey, brownish-gray, moderately indurated, some reddish-brown mottling. Cannonball-Ludlow Formations. |

Wells 55 and 56

| | |
|---|---|
| 0-5 | Sandy-loam (glacial), with fine- to medium-grained sand, silty, calcareous; with small granite and limestone pebbles. |
| 5-26 | Clay, silty, with minor amounts (less than 10%) of very fine-grained sand, dark-brownish-tan, moderately indurated, brittle, very dry, calcareous; with small iron oxide concretions, small gypsum crystals and occasional thin sandstone laminae. Some small, black flakes of organic plant material. Cannonball-Ludlow Formations. |
| 26-35 | Clay, as above, very silty, sandy, brownish-tan, oxidized. |

| | |
|---|---|
| 35-40 | Silt, clayey, with some (less than 20%) very fine- to fine-grained sand interspersed, steel-gray (color change) moderately indurated; with small gypsum crystals and occasional clay lenses. |
| 40-60 | Silt, as above, with minor amounts (less than 10%) of fine-grained sand interspersed. |
| 60-85 | Silt, as above, clayey, less sand than above interval. |
| 85-100 | Silt, as above, very clayey, with minor amounts (less than 10%) of sand interspersed, light-gray. Cannonball-Ludlow Formations. |

Wells 60, 61 and 62

| | |
|---|---|
| 0-2 | Top soil, silty, clayey, dark-brown to tanish-brown, calcareous. |
| 2-25 | Silt, very clayey, with some minor amounts (less than 10%) of very fine- to fine-grained sand interspersed, brownish-tan, slightly indurated, dry, calcareous; with abundant small gypsum crystals and thin silt and sand lenses; Cannonball-Ludlow Formations. |
| 25-29 | Silt, as above, with abundant (more than 20%) fine- to medium-grained sand interspersed. |
| 29-36 | Silt, as above, clayey, less sand than above interval, dark-brownish-tan, oxidized. |
| 36-60 | Silt, very clayey, with some (less than 20%) very fine-grained sand interspersed, steel-gray (color change), moderately indurated; with thin (less than 1 foot) sandy-silt lenses. Cannonball-Ludlow Formations. |

Well 70 0-2 Pebble-loam (glacial till), clayey, sandy, yellowish-brown, unconsolidated, damp, calcareous.

2-21 Silty, clayey, with some (less than 20%) fine-grained sand interspersed, brownish-tan, moderately indurated, very dry, calcareous, oxidized; with small iron oxide concretions and abundant small gypsum crystals. Cannonball-Ludlow Formations.

| | |
|---|---|
| 21-24 | Shale, silty, steel- to dark-gray (color change), indurated, fissile, very dry; with occasional thin silt and sand lenses. |
| 24-31 | Silt, clayey, with abundant (more than 30%) sand, steel-gray, moderately indurated. |
| 31-62 | Silt, clayey, with some (less than 20%) very fine- to fine- grained sand interspersed, steel-gray, moderately indurated; with some small gypsum crystals and small iron oxide concretions. |
| 62-76 | Silt, as above, with some (less than 20%) fine-grained sand interspersed. |
| 76-82 | Silt, as above, with abundant (more than 20%) fine- to medium-grained sand. |
| 82-100 | Silt, as above, clayey, with some (less than 20%) fine-grained sand interspersed, dark-gray. Cannonball-Ludlow Formations. |

The litnologic logs for wells 1-4 were described by personal from Water Supply Incorporated (WS), Bismarck, North Dakota. The wells were installed during a previous ground water investigation at Heskett Station.

Well WS 2

| | |
|---|---|
| 0-1 | Top soil, silty, black. |
| 1-4 | Pebble-loam (glacial till), silty, clayey, some cobbles, yellowish-brown. |
| 4-7 | Gravel, sand and rocks. |
| 7-21 | Sand, fine- to coarse-grained, some pebbles. |
| 21-39 | Clay, silty, sandy, yellowish-brown to gray. |
| 39-52 | Clay, silty, sandy, gray. |
| 52-67 | Sand, fine-grained, bluish, with some clay layers. |
| 67-89 | Clay, silty, sandy, brown to gray. |

Wells WS 1, 1A and 1B

| | |
|---|---|
| 0-1 | Top soil, silty, black |
| 1-4 | Clay, (glacial), silty, with pebbles, yellowish-brown. |
| 4-21 | Sand, fine- to medium-grained, yellowish-brown; with clay and silt lenses. |
| 21-25 | Clay, silty, yellowish-brown. |
| 25-30 | Sand, fine-grained, yellowish-brown, some indurated layers. |
| 30-35 | Clay, silty, yellowish-brown. |
| 35-45 | Sand, fine-grained, yellowish-brown. |
| 45-50 | Clay, silty, sandy, gray, about 50 percent shale. |
| 50-56 | Sand, fine-grained, with clay layers. |
| 56-73 | Clay, silty, sandy, gray. |

WEll WS 4, 4A and 4B

| | |
|---|---|
| 0-13 | Pebble-loam (glacial till), silty, sandy, with some cobbles, yellowish-brown. |
| 13-23 | Sand, fine- to medium-grained, yellowish-brown. |
| 23-25 | Slay, silty, sandy, yellowish-brown. |
| 25-27 | Sandstone, indurated. |
| 27-30 | Clay, sandy, silty, gray. |
| 30-36 | Sand, fine-grained, gray. |
| 36-52 | Clay, silty, sandy, gray; with some sand layers. |

Wells WS 3 and 3A

| | |
|---|---|
| 0-1 | Top soil, silty, black. |
| 1-12 | Pebble-loam, clayey, silty, with some cobbles, yellowish-brown. |
| 12-16 | Clay, silty, gray; with some shale layers. |
| 16-18 | Limestone, indurated. |
| 18-23 | Clay, silty, yellowish-brown; with some sand layers. |
| 23-44 | Sand, fine- to medium-grained, gray; with some clay layers. |
| 44-50 | Clay, silty, medium-gray. |

Barr Engineering Company
234 West Century Avenue
Bismarck, ND 58503
Telephone: 701-255-5460

# LOG OF BORING MW-44 R



Project:Heskett Station
Project No.:34301012
Location:Mandan, ND
Coordinates:Lat: 46.86620° Long: -100.89313°
Datum:

Surface Elevation:
Drilling Method:HSA
Sampling Method:Split Spoon
Completion Depth:46.0 ft

Unique Well No.:MW-44 R

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION |
|---|---|---|---|---|---|---|
| 0 | | 1 | 3-3-5-8 | OL/OH | | 0-1': TOPSOIL (OL/OH): Very Dark Brown (2.5/2 7.5YR); low to medium plasticity; roots, fine to medium grained sand. |
| | | | | | | 1-46': SANDY CLAY (CL): Brown (5/4 7.5YR) to Dark Gray (4/1 7.5YR); medium to high plasticity; massive; fine to medium grained sand. Moist; 20% gravel, 30% sand, 50% fines. At 1-5': Gravel sized inclusions. |
| | | 2 | 9-9-7-7 | | | Moist; 10% gravel, 20% sand, 70% fines. |
| 5 | | 3 | 7-5-5-7 | | | Moist; 0% gravel, 30% sand, 70% fines. |
| | | 4 | 7-9-11-13 | | | Moist; 0% gravel, 20% sand, 80% fines. |
| | | 5 | 7-9-12-13 | | | At 8': Oxidized staining. |
| 10 | | 6 | 6-7-11-13 | | | |
| | | 7 | 7-10-12-14 | CL | | |
| 15 | | 8 | 6-10-14-14 | | | |
| 20 | | 9 | 10-10-13-16 | | | At 20': Interbedded layer of sand. |
| 25 | | 10 | 10-10-12-16 | CL | | (CL): At 24': Color change to dark brown (3/3 7.5YR). Moist; 0% gravel, 20% sand, 80% fines. At 25': Sand lens. |

WELL OR PIEZOMETER CONSTRUCTION DETAIL

PRO. CASING
Diameter: 4" by 4"
Type: Steel
Interval: 3' up & 3' down

RISER CASING
Diameter: 2"
Type: Schd 40 PVC
Interval: Stick up to screen (23')

GROUT
Type: Cement
Interval: 0-0.5' BGS

SEAL
Type: Bentonite Chips
Interval: 0.5-21' BGS

SANDPACK
Type: Granusil
Interval: 21-46' BGS

SCREEN
Diameter: 2"
Type: No. 10 Slot
Interval: 23-43' BGS

Elevation, feet

Date Boring Started: 10/20/14
Date Boring Completed: 10/20/14
Logged By: JEG3
Drilling Contractor: Midwest Testing (Terracon)
Drill Rig:

Remarks: Water encountered at 28.7' BGS in MW-44R while drilling on 10/2014

Additional data may have been collected in the field which is not included on this log.
Weather:

O:\GINT\PROJECTS\34301012.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Barr Engineering Company
234 West Century Avenue
Bismarck, ND 58503
Telephone: 701-255-5460

# LOG OF BORING MW-44 R



Project:Heskett Station
Project No.:34301012
Location:Mandan, ND
Coordinates:Lat: 46.86620° Long: -100.89313°
Datum:

Surface Elevation:
Drilling Method:HSA
Sampling Method:Split Spoon
Completion Depth:46.0 ft

Unique Well No.:MW-44 R

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 30 | | 11 | 8-12-14-18. | CL | | (CL): At 24': Color change to dark brown (3/3 7.5YR). *(continued)*<br>Wet; 0% gravel, 20% sand, 80% fines.<br>At 30.5': Sand lens. | | |
| 35 | | 12 | 8-13-16-27. | | | (CL): At 32': Color change to dark gray (4/1 7.5YR). | | |
| 40 | | 13 | 11-19-25-27. | CL | | | | |
| 45 | | 14 | 14-18-27-34. | SC | | (SC): At 45.8': Clayey Sand (SC), fine to medium grained, low to medium plasticity, dark greenish gray (4/10G Gley 2). | | |
| 50 | | | | | | | | |
| 55 | | | | | | | | |

**PRO. CASING**
Diameter: 4" by 4"
Type: Steel
Interval: 3' up & 3' down

**RISER CASING**
Diameter: 2"
Type: Schd 40 PVC
Interval: Stick up to screen (23')

**GROUT**
Type: Cement
Interval: 0-0.5' BGS

**SEAL**
Type: Bentonite
Interval: Chips 0.5-21' BGS

**SANDPACK**
Type: Granusil
Interval: 21-46' BGS

**SCREEN**
Diameter: 2"
Type: No. 10 Slot
Interval: 23-43' BGS

Date Boring Started: 10/20/14
Date Boring Completed: 10/20/14
Logged By: JEG3
Drilling Contractor: Midwest Testing (Terracon)
Drill Rig:

Remarks: Water encountered at 28.7' BGS in MW-44R while drilling on 10/2014

Additional data may have been collected in the field which is not included on this log.
Weather:

O:\GINT\PROJECTS\34301012.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

State of North Dakota

# BOARD OF WATER WELL CONTRACTORS

900 E. BOULEVARD • BISMARCK, NORTH DAKOTA 58505

## MONITORING WELL REPORT

State law requires that this report be filed with the State Board of Water Well Contractors within 30 days after completion or abandonment of the well.

**1. WELL OWNER**

Name MDU-Heskett Station

Address 2025 38th Street

Mandan, North Dakota

**2. WELL LOCATION (MW-44R)**

Address (if in city) (see attached drawing)

County Morton

SE ¼ SE ¼ SW ¼ Sec. 10 Twp. 139 N. Rge. 81 W.

Lat. 46.86620 Long.: -100.89313

Altitude:

**3. METHOD DRILLED**

■ Auger Other

**4. WELL CONSTRUCTION**

Diameter of Hole 8 inches Depth 46 feet

Riser: ■ PVC □ Other

■ Threaded □ Solvent □ Other

Riser rating SDR Schedule 40

Diameter 2.0 inches

From +2 ft. to 23 ft.

Was a well screen installed? ■ Yes □ No

Material Schedule 40 PVC Diameter 2.0 inches

Slot Size #10 set from 23 feet to 43 feet

Sand packed from 21 ft to 46 ft

Depth grouted from 1 ft to 21 ft

Grouting Material

Bentonite x Other

If other explain:

One foot concrete collar at surface

Well head completion:

24" above grade Other x

If other, specify 4" x 4" x 5' steel cover

Was protective casing installed? ■ Yes □ No

Was well disinfected upon completion? □ Yes ■ No

**5. WATER LEVEL**

Static water level 28.5 feet below surface

If flowing: closed in pressure psi or ft. above land surface

**6. WELL LOG**

| Formation | Depth (Ft.) From | To |
|---|---|---|
| Topsoil | 0 | 0.5 |
| Sandy lean clay | 0.5 | 5 |
| Sandy fat clay | 5 | 46 |

(Use separate sheet if necessary)

**7. WAS THE HOLE PLUGGED OR ABANDONED?**

□ Yes ■ No

If so, how?

**8. REMARKS**

3 steel bumpers installed around well head

**9. DATE COMPLETED** 10-21-14

**10. CONTRACTOR CERTIFICATION**

This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Midwest Testing Laboratory, Inc. 444

Monitoring Well Contractor Certificate No.

P.O. Box 2084, Bismarck, ND 58502-2084

Address

Signature 10-22-14

Date

Barr Engineering Company
234 West Century Avenue
Bismarck, ND 58503
Telephone: 701-255-5460

# LOG OF BORING MW-80 R



Project:Heskett Station
Project No.:34301012
Location:Mandan, ND
Coordinates:Lat: 46.86789° Long: -100.89320°
Datum:

Surface Elevation:
Drilling Method:HSA
Sampling Method:Split Spoon
Completion Depth:27.0 ft

Unique Well No.:MW-80 R

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION |
|---|---|---|---|---|---|---|
| 0 | | | | OL/OH | | 0-0.5': TOPSOIL (OL/OH): Black; organic roots. |
| | | 1 | 4-4-4-5. | | | 0.5-27': SANDY CLAY (CL): Brown (4/4 7.5 YR) to Black (2.5/1 7.5YR); medium to high plasticity; fine to medium grained sand. Moist; 0% gravel, 30% sand, 70% fines. |
| | | | | | | At 2': Gravel inclusions. |
| | | 2 | 4-5-7-9. | | | Moist; 10% gravel, 30% sand, 60% fines. |
| | | | | CL | | |
| 5 | | 3 | 4-4-5-8. | | | Moist; 0% gravel, 20% sand, 80% fines. |
| | | 4 | 4-4-6-6. | | | |
| | | | | CL | | (CL): At 8': Color change to 2.5/1 7.5YR black, no odor. |
| | | 5 | 3-4-5-6. | | | (CL): At 9': Color change to 2.5/2 7.5YR very dark brown. |
| 10 | | | | CL | | Moist; 0% gravel, 20% sand, 80% fines. |
| | | 6 | 1-3-3-4. | | | (CL): At 11': Color change to 3/3 7.5YR dark brown. |
| | | | | CL | | Moist; 0% gravel, 20% sand, 80% fines. |
| | | 7 | 1-1-2-1. | | | (CL): At 13': Color change to 4/4 7.5YR brown. Wet; 0% gravel, 20% sand, 80% fines. |
| 15 | | 8 | 1-2-2-1. | | | |
| 20 | | | | CL | | |
| | | 9 | 7-11-12-17. | | | At 21': Thin sand lens less than 0.1" thick. Wet; 0% gravel, 20% sand, 80% fines. At 21.5': Thin sand lens less than 0.1" thick. |
| 25 | | 10 | 7-11-17-17. | | | Wet; 0% gravel, 20% sand, 80% fines. At 26.5': Thin sand lens less than 0.1" thick. |

WELL OR PIEZOMETER CONSTRUCTION DETAIL

PRO. CASING
Diameter: 4" by 4"
Type: Steel
Interval: 3' up & 3' down

RISER CASING
Diameter: 2"
Type: Schd 40 PVC
Interval: Stick up to screen (7')

GROUT
Type: Cement
Interval: 0-0.5' BGS

SEAL
Type: Bentonite Chips
Interval: 0.5-5' BGS

SANDPACK
Type: Granusil
Interval: 5-27' BGS

SCREEN
Diameter: 2"
Type: No 10 Slot
Interval: 7-27' BGS

Elevation, feet

Date Boring Started: 10/20/14
Date Boring Completed: 10/20/14
Logged By: JEG3
Drilling Contractor: Midwest Testing (Terracon)
Drill Rig:

Remarks: Water encountered at 11.8' BGS in MW-80R while drilling on 10/20/14

Additional data may have been collected in the field which is not included on this log.
Weather:

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State of North Dakota

# BOARD OF WATER WELL CONTRACTORS

900 E. BOULEVARD • BISMARCK, NORTH DAKOTA 58505

## MONITORING WELL REPORT

State law requires that this report be filed with the State Board of Water Well Contractors within 30 days after completion or abandonment of the well.

**1. WELL OWNER**

Name MDU-Heskett Station

Address 2025 38th Street

Mandan, North Dakota

**2. WELL LOCATION (MW-80R)**

Address (if in city) (see attached drawing)

County Morton

NE ¼ SE ¼ SW ¼ Sec. 10 Twp. 139 N. Rge. 81 W.

Lat. 46.86789 Long.: -100.89320

Altitude:

**3. METHOD DRILLED**

■ Auger Other

**4. WELL CONSTRUCTION**

Diameter of Hole 8 inches Depth 27 feet

Riser: ■ PVC □ Other

■ Threaded □ Solvent □ Other

Riser rating SDR Schedule 40

Diameter 2.0 inches

From +2.5 ft. to 7 ft.

Was a well screen installed? ■ Yes □ No

Material Schedule 40 PVC Diameter 2.0 inches

Slot Size #10 set from 7 feet to 27 feet

Sand packed from 5 ft to 27 ft

Depth grouted from 1 ft to 5 ft

Grouting Material

Bentonite x Other

If other explain:

One foot concrete collar at surface

Well head completion:

24" above grade Other x

If other, specify 4" x 4" x 5' steel cover

Was protective casing installed? ■ Yes □ No

Was well disinfected upon completion? □ Yes ■ No

**5. WATER LEVEL**

Static water level 12 feet below surface

If flowing: closed in pressure psi or ft. above land surface

**6. WELL LOG**

| Formation | Depth (Ft.) From | To |
|---|---|---|
| Topsoil | 0 | 0.5 |
| Sandy lean clay | 0.5 | 27 |

(Use separate sheet if necessary)

7. WAS THE HOLE PLUGGED OR ABANDONED?

□ Yes ■ No

If so, how?

**8. REMARKS**

3 steel bumpers installed around well head

**9. DATE COMPLETED** 10-21-14

**10. CONTRACTOR CERTIFICATION**

This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Midwest Testing Laboratory, Inc. 444

Monitoring Well Contractor Certificate No.

P.O. Box 2084, Bismarck, ND 58502-2084

Address

Signature 10-22-14

Date

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

# LOG OF BORING MW-101
**DRAFT**



Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438844.919° Long: 1868647.777°
Datum:NAD 83

Surface Elevation:1716.6 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:58.0 ft

Unique Well No.:

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | TOPSOIL: Brown (5/4 7.5YR). | | |
| | | 1 | 4-4-4-6. | | | SANDY LEAN CLAY WITH GRAVEL (CL): fine to medium grained; Brown (5/3 7.5YR); moist; thinly laminated; some mottling; low plasticity; [Cannonball Formation]. | PRO. CASING<br>Diameter: **4"**<br>Type: **Steel pipe**<br>Interval: **3.5' ags - 1.5' bgs** | 1715 |
| | | 2 | 4-6-6-7. | | | At 2': Start to see gravel inclusions. | | |
| | | | | | | At 4': Oxidized staining. | RISER CASING<br>Diameter: **2"**<br>Type: **PVC SCH 80**<br>Interval: **2.98' ags - 34' bgs** | |
| 5 | | 3 | 7-9-14-16. | | | At 5': Oxidized staining. | | 1710 |
| | | 4 | 8-9-12-15. | | | At 7': Oxidized staining and white staining. | GROUT<br>Type: **Neat cement**<br>Interval: **0 - 29' bgs** | |
| | | 5 | 10-15-21-26. | | | | SEAL<br>Type: **Bentonite chips**<br>Interval: **29 - 32' bgs** | |
| 10 | | 6 | 7-18-24-27. | CL | | At 11': Oxidized staining. | SANDPACK<br>Type: **Silica 40-70**<br>Interval: **32 - 56' bgs** | 1705 |
| | | 7 | 8-12-19-23. | | | | | |
| 15 | | 8 | 8-14-18-23. | | | At 15': Gypsum.<br>16-20': No recovery. | SCREEN<br>Diameter: **2"; No.6 slot**<br>Type: **PVC SCH 80**<br>Interval: **34 - 54' bgs** | 1700 |
| 20 | | 9 | 7-10-13-15. | | | At 20.5': Gypsum.<br>LEAN CLAY (CL): Dark Brown (3/2 7.5YR); oxidized staining, some mottling; medium to high plasticity; [Cannonball Formation]. | | 1695 |
| | | 10 | 7-9-13-15. | CL | | At 22': Color change to Brown (4/2 7.5YR).<br>At 24': Interbedded sand, fine grained. | | |
| 25 | | | | | | | | |

Date Boring Started: 8/18/15
Date Boring Completed: 8/19/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: Hole caved in from 56 - 58' bgs.
DTW = 36.66' TOR on 9/23/2015 (elev. 1682.87)

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

# LOG OF BORING MW-101
**DRAFT**



Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438844.919° Long: 1868647.777°
Datum:NAD 83

Surface Elevation:1716.6 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:58.0 ft

Unique Well No.:

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 25 | | 11 | 7-11-13-15. | CL | | LEAN CLAY (CL): Dark Brown (3/2 7.5YR); oxidized staining, some mottling; medium to high plasticity; [Cannonball Formation]. *(continued)*<br>At 25' and 25.5': Gypsum. | | |
| | | 12 | 8-11-15-19. | | | At 26.5': Gypsum. | PRO. CASING<br>Diameter: **4"**<br>Type: **Steel pipe**<br>Interval: **3.5' ags - 1.5' bgs** | 1690 |
| | | 13 | 8-11-13-15. | | | | RISER CASING<br>Diameter: **2"**<br>Type: **PVC SCH 80**<br>Interval: **2.98' ags - 34' bgs** | |
| 30 | | 14 | 6-11-14-17. | | | At 29.5': Gypsum. | | 1685 |
| | | 15 | 8-13-17-22. | | | At 33': Gypsum. | GROUT<br>Type: **Neat cement**<br>Interval: **0 - 29' bgs** | |
| 35 | | 16 | 8-14-19-21. | | | At 34.5': Gypsum.<br>At 35.5-36': Color change to Black (2.5/1 7.5YR), turns back to brown. | SEAL<br>Type: **Bentonite chips**<br>Interval: **29 - 32' bgs** | 1680 |
| | | 17 | 11-16-20-27. | CH | | FAT CLAY (CH): Black (2.5/1 7.5YR); very stiff; hight plasticity; wet at 43'; [Cannonball Formation]. | SANDPACK<br>Type: **Silica 40-70**<br>Interval: **32 - 56' bgs** | |
| | | 18 | 9-13-20-25. | | | At 38': Oxidized staining. | SCREEN<br>Diameter: **2"; No.6 slot**<br>Type: **PVC SCH 80**<br>Interval: **34 - 54' bgs** | |
| 40 | | 19 | 7-14-23-26. | | | At 41': Oxidized staining. | | 1675 |
| | | 20 | 9-16-23-26. | | | | | |
| 45 | | | | | | | | 1670 |
| 50 | | | | | | | | |

Date Boring Started: 8/18/15
Date Boring Completed: 8/19/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: Hole caved in from 56 - 58' bgs.
DTW = 36.66' TOR on 9/23/2015 (elev. 1682.87)

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

# LOG OF BORING MW-101
**DRAFT**



Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438844.919° Long: 1868647.777°
Datum:NAD 83

Surface Elevation:1716.6 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:58.0 ft

Unique Well No.:

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 50 | | | | CH | | FAT CLAY (CH): Black (2.5/1 7.5YR); very stiff; hight plasticity; wet at 43'; [Cannonball Formation]. *(continued)* | PRO. CASING<br>Diameter: **4"**<br>Type: **Steel pipe**<br>Interval: **3.5' ags - 1.5' bgs**<br>RISER CASING<br>Diameter: **2"**<br>Type: **PVC SCH 80**<br>Interval: **2.98' ags - 34' bgs**<br>GROUT<br>Type: **Neat cement**<br>Interval: **0 - 29' bgs**<br>SEAL<br>Type: **Bentonite chips**<br>Interval: **29 - 32' bgs**<br>SANDPACK<br>Type: **Silica 40-70**<br>Interval: **32 - 56' bgs**<br>SCREEN<br>Diameter: **2"; No.6 slot**<br>Type: **PVC SCH 80**<br>Interval: **34 - 54' bgs** | 1665 |
| 55 | | | | | | | | 1660 |
| 60 | | | | | | End of boring 58.0 feet | | |
| 65 | | | | | | | | |
| 70 | | | | | | | | |
| 75 | | | | | | | | |

Date Boring Started: 8/18/15
Date Boring Completed: 8/19/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: Hole caved in from 56 - 58' bgs.
DTW = 36.66' TOR on 9/23/2015 (elev. 1682.87)

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

# LOG OF BORING MW-102
**DRAFT**



Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438161.145° Long: 1868782.871°
Datum:NAD 83

Surface Elevation:1703.8 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:46.0 ft

Unique Well No.:

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | TOPSOIL: Brown (5/4 7.5YR). | | |
| | | 1 | 3-3-3-2. | | | LEAN CLAY (CL): medium grained; Brown (4/3 7.5YR); moist; low to medium plasticity; with gravel to 4'; [Cannonball Formation]. | PRO. CASING<br>Diameter: **4"**<br>Type: **Steel pipe**<br>Interval: **3.5' ags - 1.5' bgs** | |
| | | 2 | 3-2-2-3. | | | | | 1700 |
| 5 | | 3 | 3-3-4-5. | CL | | | RISER CASING<br>Diameter: **2"**<br>Type: **PVC SCH 80**<br>Interval: **2.85' ags - 10' bgs** | |
| | | 4 | 3-4-5-7. | | | | GROUT<br>Type: **None**<br>Interval: **None** | |
| | | 5 | 4-8-7-4. | | | | | 1695 |
| | | | | ML | | SANDY SILT WITH GRAVEL (ML): Strong Brown (5/6 7.5YR); fine to coarse sand, fine to medium gravel, unconsolidated; [Cannonball Formation]. | SEAL<br>Type: **Bentonite chips**<br>Interval: **0 - 8' bgs** | |
| 10 | | 6 | 4-3-5-9. | CL | | LEAN CLAY WITH GRAVEL (CL): fine to medium grained; Brown (5/3 7.5YR); some mottling; medium plasticity; [Cannonball Formation]. | | |
| | | 7 | 3-5-7-9. | | | LEAN CLAY (CL): Dark Brown (3/2 7.5YR); medium to high plasticity; [Cannonball Formation]. | SANDPACK<br>Type: **Silica 40-70**<br>Interval: **8 - 31' bgs** | |
| | ▼ | | | | | | | 1690 |
| 15 | | 8 | 6-8-12-14. | | | | SCREEN<br>Diameter: **2"; No.6 slot**<br>Type: **PVC SCH 80**<br>Interval: **20 - 30' bgs** | |
| | | 9 | 6-10-12-16. | | | | | |
| | | 10 | 5-9-14-16. | CL | | | | 1685 |
| 20 | | 11 | 5-12-15-18. | | | At 21': Color changes to Black (2.5/1). | | |
| | | 12 | 9-15-18-22. | | | | | 1680 |
| 25 | | | | | | | | |

Date Boring Started: 8/18/15
Date Boring Completed: 8/18/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: Lithological descriptions for a hole that was abandoned. Monitoring well blind drilled and installed next to abandoned hole.
DTW = 17.09' TOR on 8/21/2015 (elev. 1689.51

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

# LOG OF BORING MW-102
**DRAFT**



Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438161.145° Long: 1868782.871°
Datum:NAD 83

Surface Elevation:1703.8 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:46.0 ft

Unique Well No.:

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 25 | | 13 | 9-14-19-22. | | | LEAN CLAY (CL): Dark Brown (3/2 7.5YR); medium to high plasticity; [Cannonball Formation]. *(continued)* | PRO. CASING<br>Diameter: **4"**<br>Type: **Steel pipe**<br>Interval: **3.5' ags - 1.5' bgs** | |
| | | 14 | 10-17-18-24. | | | | | |
| | | 15 | 6-15-18-26. | | | At 29': Gypsum. | | 1675 |
| 30 | | 16 | 7-14-18-22. | | | | RISER CASING<br>Diameter: **2"**<br>Type: **PVC SCH 80**<br>Interval: **2.85' ags - 10' bgs** | |
| | | 17 | 11-16-20-27. | | | At 33.5' and 34': Gypsum. | GROUT<br>Type: **None**<br>Interval: **None** | 1670 |
| 35 | | 18 | 10-14-15-24. | CL | | | SEAL<br>Type: **Bentonite chips**<br>Interval: **0 - 8' bgs** | |
| | | 19 | 13-19-25-35. | | | | SANDPACK<br>Type: **Silica 40-70**<br>Interval: **8 - 31' bgs** | |
| | | 20 | 8-17-26-31. | | | | | 1665 |
| 40 | | 21 | 10-20-27-38. | | | | SCREEN<br>Diameter: **2"; No.6 slot**<br>Type: **PVC SCH 80**<br>Interval: **20 - 30' bgs** | |
| | | 22 | 13-20-27-37. | | | | | 1660 |
| 45 | | 23 | 15-27-27-32. | SM | | SILTY SAND (SM): fine to medium grained; Dark Gray (4/1 7.5YR); wet; [Cannonball Formation]. | | |
| | | | | | | End of boring 46.0 feet | | |
| 50 | | | | | | | | |

Date Boring Started: 8/18/15
Date Boring Completed: 8/18/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: Lithological descriptions for a hole that was abandoned. Monitoring well blind drilled and installed next to abandoned hole.
DTW = 17.09' TOR on 8/21/2015 (elev. 1689.51

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

# LOG OF BORING MW-103
**DRAFT**



Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 437578.205° Long: 1869355.992°
Datum:NAD 83

Surface Elevation:1714.7 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:44.0 ft

Unique Well No.:

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | OL/OH | | TOPSOIL (OL/OH): Brown (5/4 7.5YR). | | |
| | | 1 | 3-4-5-5. | | | LEAN CLAY (CL): Very Dark Gray (3/1 7.5YR); moist; stiff; medium to high plasticity; [Cannonball Formation]. | PRO. CASING<br>Diameter: **4"**<br>Type: **Steel pipe**<br>Interval: **3.5' ags - 1.5' bgs** | |
| | | 2 | 5-5-8-8. | CL | | | RISER CASING<br>Diameter: **2"**<br>Type: **PVC SCH 80**<br>Interval: **2.79' ags - 24' bgs** | |
| 5 | | 3 | 5-8-10-11. | | | | GROUT<br>Type: **Neat cement**<br>Interval: **0 - 19' bgs** | 1710 |
| | | 4 | 6-9-15-15. | | | POORLY GRADED SAND WITH GRAVEL (SP): fine to coarse grained; Brown (5/4 7.5YR); some oxidized staining, some mottling; [Cannonball Formation]. | SEAL<br>Type: **Bentonite chips**<br>Interval: **19 - 22' bgs** | |
| | | 5 | 5-6-5-4. | SP | | | SANDPACK<br>Type: **Silica 40-70**<br>Interval: **22 - 44' bgs** | |
| 10 | | 6 | 4-5-5-7. | | | | SCREEN<br>Diameter: **2"; No.6 slot**<br>Type: **PVC SCH 80**<br>Interval: **24 - 44' bgs** | 1705 |
| | | 7 | 2-2-2-3. | SP-SM | | POORLY GRADED SAND WITH SILT (SP-SM): fine to medium grained; Brown (5/4 7.5YR); [Cannonball Formation]. | | |
| 15 | | 8 | 3-3-3-3. | | | | | 1700 |
| | | | | | | NO RECOVERY (16 - 20'). | | |
| 20 | | 9 | 3-3-5-5. | CL | | SANDY LEAN CLAY (CL): fine to medium grained; Light Brown (6/4 7.5YR); wet; some mottling and oxidized staining, cohesive; low to medium plasticity; [Cannonball Formation]. | | 1695 |
| 25 | | | | | | | | 1690 |

Date Boring Started: 8/19/15
Date Boring Completed: 8/20/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 33.24' TOR on 8/20/2015 (elev. 1684.29)

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

# LOG OF BORING MW-103
**DRAFT**



Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 437578.205° Long: 1869355.992°
Datum:NAD 83

Surface Elevation:1714.7 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:44.0 ft

Unique Well No.:

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 25 | | 10 | 2-2-4-4. | CL | | SANDY LEAN CLAY (CL): fine to medium grained; Light Brown (6/4 7.5YR); wet; some mottling and oxidized staining, cohesive; low to medium plasticity; [Cannonball Formation]. *(continued)* | PRO. CASING<br>Diameter: **4"**<br>Type: **Steel pipe**<br>Interval: **3.5' ags - 1.5' bgs** | |
| 30 | | | | SM | | SILTY SAND WITH GRAVEL (SM): wet; [Cannonball Formation]. | RISER CASING<br>Diameter: **2"**<br>Type: **PVC SCH 80**<br>Interval: **2.79' ags - 24' bgs** | 1685 |
| | | 11 | 10-10-7-9. | | | LEAN CLAY (CL): Brown (4/4 7.5YR); moist; oxidized staining; medium to high plasticity; [Cannonball Formation]. | GROUT<br>Type: **Neat cement**<br>Interval: **0 - 19' bgs** | |
| | | 12 | 8-15-17-22. | | | At 32.5': Sand lens, color changes to Black (2.5/1 7.5YR). | | |
| 35 | | 13 | 7-19-15-25. | | | At 33.5': Sand lens.<br>At 34': Interbedded sand with oxidized staining. | SEAL<br>Type: **Bentonite chips**<br>Interval: **19 - 22' bgs** | 1680 |
| | | 14 | 11-16-21-50 for 5". | CL | | At 36.5': Sand lens.<br>At 37': Sand lens.<br>At 37.5': Color change to Gray (5/1 7.5YR).<br>At 38-38.5': 6" thick layer of hard material. | SANDPACK<br>Type: **Silica 40-70**<br>Interval: **22 - 44' bgs** | |
| | | 15 | 50 for 2"`-. | | | | SCREEN<br>Diameter: **2"; No.6 slot**<br>Type: **PVC SCH 80**<br>Interval: **24 - 44' bgs** | |
| 40 | | 16 | 12-17-22-30. | | | At 42-42.5': Silt layer. | | 1675 |
| | | 17 | 9-18-24-50. | | | At 43.5-44': Silt layer. | | |
| 45 | | | | | | End of boring 44.0 feet | | |
| 50 | | | | | | | | |

Date Boring Started: 8/19/15
Date Boring Completed: 8/20/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 33.24' TOR on 8/20/2015 (elev. 1684.29)

Additional data may have been collected in the field which is not included on this log.
Weather:

M:\GINT\PROJECTS\34300014.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

# LOG OF BORING MW-104
**DRAFT**



Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438853.542° Long: 1869832.72°
Datum:NAD 83

Surface Elevation:1681.5 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:32.0 ft

Unique Well No.:

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | TOPSOIL: Brown (5/4 7.5YR). | | |
| | | 1 | 4-5-5-5. | CL | | LEAN CLAY WITH SAND (CL): fine to medium grained; Brown (5/4 7.5YR); moist; gravel; medium plasticity; [Cannonball Formation]. | PRO. CASING<br>Diameter: **4"**<br>Type: **Steel pipe**<br>Interval: **3.5' ags - 1.5' bgs** | 1680 |
| | | 2 | 3-5-6-8. | | | | | |
| 5 | | 3 | 3-7-9-10. | CL | | LEAN CLAY (CL): Brown (4/4 7.5YR); oxidized staining and mottling; medium to high plasticity; with gypsum throughout; [Cannonball Formation]. | RISER CASING<br>Diameter: **2"**<br>Type: **PVC SCH 80**<br>Interval: **3.06' ags - 9' bgs** | 1675 |
| | | 4 | 5-7-9-10. | | | | GROUT<br>Type: **None**<br>Interval: **None** | |
| | | 5 | 5-9-9-10. | | | | | |
| 10 | | 6 | 5-7-9-10. | | | At 12': Heavily oxidized. | SEAL<br>Type: **Bentonite chips**<br>Interval: **0 - 7' bgs** | 1670 |
| | | 7 | 5-8-8-12. | | | | SANDPACK<br>Type: **Silica 40-70**<br>Interval: **7 - 32' bgs** | |
| 15 | | 8 | 5-9-11-15. | | | At 15': Start seeing black staining. | SCREEN<br>Diameter: **2"; No.6 slot**<br>Type: **PVC SCH 80**<br>Interval: **9 - 29' bgs** | |
| | | 9 | 6-9-11-13. | | | At 17': Heavily oxidized. | | 1665 |
| | | 10 | 4-7-16-19. | SM | | SILTY SAND (SM): Strong Brown (5/6 7.5YR); wet; [Cannonball Formation]. | | |
| 20 | | | | | | At 19.5': Color change to Brown (5/4 7.5YR). | | |
| | | 11 | 5-16-22-26. | | | At 21': Oxidized layer. | | 1660 |
| | | 12 | 7-11-14-16. | CH | | FAT CLAY (CH): Dark Gray (4/1 7.5YR); moist; stiff; high plasticity; with interbedded sand layers below 27'; [Cannonball Formation]. | | |
| 25 | | | | | | | | |

Date Boring Started: 8/20/15
Date Boring Completed: 8/20/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 13.25' TOR on 8/21/2015 (elev. 1671.26)

Additional data may have been collected in the field which is not included on this log.
Weather:

M:\GINT\PROJECTS\34300014.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

# LOG OF BORING MW-104
**DRAFT**



Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438853.542° Long: 1869832.72°
Datum:NAD 83

Surface Elevation:1681.5 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:32.0 ft

Unique Well No.:

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 25 | | 13 | 6-12-16-17. | | | FAT CLAY (CH): Dark Gray (4/1 7.5YR); moist; stiff; high plasticity; with interbedded sand layers below 27'; [Cannonball Formation]. *(continued)* | | 1655 |
| | | 14 | 8-12-16-21. | CH | | | | |
| | | 15 | 8-12-16-20. | | | | | |
| 30 | | 16 | | | | Driller notes: sluff. | | 1650 |
| | | | | | | End of boring 32.0 feet | | |
| 35 | | | | | | | | |
| 40 | | | | | | | | |
| 45 | | | | | | | | |
| 50 | | | | | | | | |

PRO. CASING
Diameter: **4"**
Type: **Steel pipe**
Interval: **3.5' ags - 1.5' bgs**

RISER CASING
Diameter: **2"**
Type: **PVC SCH 80**
Interval: **3.06' ags - 9' bgs**

GROUT
Type: **None**
Interval: **None**

SEAL
Type: **Bentonite chips**
Interval: **0 - 7' bgs**

SANDPACK
Type: **Silica 40-70**
Interval: **7 - 32' bgs**

SCREEN
Diameter: **2"; No.6 slot**
Type: **PVC SCH 80**
Interval: **9 - 29' bgs**

Date Boring Started: 8/20/15
Date Boring Completed: 8/20/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 13.25' TOR on 8/21/2015 (elev. 1671.26)

Additional data may have been collected in the field which is not included on this log.
Weather:

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

# LOG OF BORING MW-105
**DRAFT**



Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438042.079° Long: 1870325.657°
Datum:NAD 83

Surface Elevation:1686.0 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:30.0 ft

Unique Well No.:

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | TOPSOIL: Brown (5/4 7.5YR). | | |
| | | 1 | 6-7-6-5. | | | SANDY LEAN CLAY (CL): fine to medium grained; Brown (4/2 7.5YR); moist; gravel; medium plasticity; [Cannonball Formation]. | PRO. CASING<br>Diameter: **4"**<br>Type: **Steel pipe**<br>Interval: **3.5' ags - 1.5' bgs** | 1685 |
| | | 2 | 5-5-5-6. | | | | | |
| | | 3 | 3-2-4-5. | CL | | | RISER CASING<br>Diameter: **2"**<br>Type: **PVC SCH 80**<br>Interval: **3.16' ags - 10' bgs** | 1680 |
| 5 | | 4 | 2-2-2-3. | | | | | |
| | | 5 | 2-1-2-2. | | | LEAN CLAY (CL): Brown (4/2 7.5YR); soft; high plasticity; wet at 16'; [Cannonball Formation]. | GROUT<br>Type: **None**<br>Interval: **None** | |
| 10 | | 6 | 2-1-2-1. | | | At 10.5': Color change to Reddish-Yellow (6/6 7.5YR). | SEAL<br>Type: **Bentonite chips**<br>Interval: **0 - 7' bgs** | 1675 |
| | | 7 | 2-1-1-3. | | | | SANDPACK<br>Type: **Silica 40-70**<br>Interval: **7 - 30' bgs** | |
| 15 | | 8 | 4-3-5-5. | CL | | At 14.5-15.5': Gravel inclusions.<br>At 15.5': Color change to Brown (4/3 7.5YR). | SCREEN<br>Diameter: **2"; No.6 slot**<br>Type: **PVC SCH 80**<br>Interval: **10 - 30' bgs** | 1670 |
| | | 9 | 7-9-11-13. | | | At 18': Color change to Brown (5/3 7.5YR). | | |
| 20 | | 10 | 7-9-11-13. | | | | | |
| | | 11 | 7-9-13-15. | | | | | 1665 |
| | | 12 | 19-26-28-30. | SP-SM | | POORLY GRADED SAND WITH SILT (SP-SM): medium to coarse grained; Brown (5/4 7.5YR); [Cannonball Formation]. | | |
| 25 | | | | | | | | |

Date Boring Started: 8/17/15
Date Boring Completed: 8/17/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 13.22' TOR on 8/21/2015 (elev. 1675.92)

Additional data may have been collected in the field which is not included on this log.
Weather:

M:\GINT\PROJECTS\34300014.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

# LOG OF BORING MW-105
**DRAFT**



Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438042.079° Long: 1870325.657°
Datum:NAD 83

Surface Elevation:1686.0 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:30.0 ft

Unique Well No.:

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 25 | | 13 | 15-25-31-40. | | | | | |
| | | 14 | 10-15-18-30. | CL | | FAT CLAY (CL): Dark Brown (3/4 7.5YR); high plasticity; sand lens at 26.5'; [Cannonball Formation].<br>At 26': Color change to Gray (5/1 7.5YR). | | 1660 |
| | | 15 | 11-16-22-32. | | | | | |
| 30 | | | | | | End of boring 30.0 feet | | |
| 35 | | | | | | | | |
| 40 | | | | | | | | |
| 45 | | | | | | | | |
| 50 | | | | | | | | |

PRO. CASING
Diameter: **4"**
Type: **Steel pipe**
Interval: **3.5' ags - 1.5' bgs**

RISER CASING
Diameter: **2"**
Type: **PVC SCH 80**
Interval: **3.16' ags - 10' bgs**

GROUT
Type: **None**
Interval: **None**

SEAL
Type: **Bentonite chips**
Interval: **0 - 7' bgs**

SANDPACK
Type: **Silica 40-70**
Interval: **7 - 30' bgs**

SCREEN
Diameter: **2"; No.6 slot**
Type: **PVC SCH 80**
Interval: **10 - 30' bgs**

Date Boring Started: 8/17/15
Date Boring Completed: 8/17/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 13.22' TOR on 8/21/2015 (elev. 1675.92)

Additional data may have been collected in the field which is not included on this log.
Weather:

M:\GINT\PROJECTS\34300014.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

STATE OF NORTH DAKOTA

# BOARD OF WATER WELL CONTRACTORS

900 E. BOULEVARD - BISMARCK, NORTH DAKOTA 58501

## WELL DRILLER'S REPORT

State law requires that this report be filed with the State Board of Water Well Contractors within 30 days after completion or abandonment of the well.

**1. WELL OWNER**

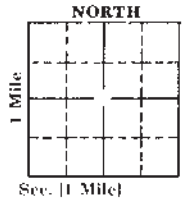
Name Montana Dakota Utilities

Address Bismarck, ND

**2. WELL LOCATION**

Sketch map location must agree with written location.

Hoskett Ash
Dispoal Site
#1-90
139-81-10CAD
Top nof pipe
1675.54
Ground level
1673.6




County Morton

SE ¼ NE ¼ SW ¼ Sec. 10 Twp. 139 N. Rg. 81 W.

**3. PROPOSED USE**

☐ Geothermal ☒ Monitoring
☐ Domestic ☐ Irrigation ☐ Industrial
☐ Stock ☐ Municipal ☐ Test Hole

**4. METHOD DRILLED**

☐ Cable ☐ Reverse Rotary ☐ Bored
☒ Forward Rotary ☐ Jetted ☐ Auger
If other, specify

**5. WATER QUALITY**

Was a water sample collected for:
Chemical Analysis? ☐ Yes ☐ No
Bacteriological Analysis? ☐ Yes ☐ No
If so, to what laboratory was it sent

**6. WELL CONSTRUCTION**

Diameter of hole 5 inches. Depth 15 feet.
Casing: ☐ Steel ☒ Plastic ☐ Concrete
☐ Threaded ☐ Welded ☐ Other
If other, specify

| Pipe Weight: | Diameter: | From: | To: |
|---|---|---|---|
| SDR-21 ~~lb/ft.~~ | 2 inches | ±2.0 feet | 5 feet |
| lb/ft. | inches | feet | feet |
| lb/ft. | inches | feet | feet |

Was perforated pipe used? ☐ Yes ☒ No
Perforated pipe set from ft to feet
Was casing left open end? ☐ Yes ☒ No
Was a well screened installed? ☒ Yes ☐ No
Material PVC Diameter 2 inches
(stainless steel, bronze, etc.)
Slot size 10 set from 5 feet to 15 feet
Slot size set from feet to feet
Was a packer or seal used? ☒ Yes ☐ No
If so, what material cse bentonite Depth 3 to 4 Ft.
Type of well: Straight screen ☐ Gravel packed ☒
Depth grouted: From 3 To surface
Grouting Material: Cement X Other
If other explain: w/bentonite
Well head completion: Pitless unit
12" above grade X Other
If other, specify
Was pump installed: ☐ Yes ☒ No
Was well disinfected upon completion? ☐ Yes ☒ No

**7. WATER LEVEL**

Static water level 12.3 feet below land surface
If flowing: closed-in pressure psi
GPM flow through inch pipe
Controlled by: ☐ Valve ☐ Reducers ☐ Other
If other, specify

**8. WELL TEST DATA**

☐ Pump ☐ Bailer ☐ Other
Pumping level below land surface:
ft. after hrs. pumping gpm
ft. after hrs. pumping gpm
ft. after hrs. pumping gpm

**9. WELL LOG**

| Formation | Depth (ft.) From | To |
|---|---|---|
| Clay, fill | 0 | 3 |
| Sand, fine to medium, yellowish brown | 3 | 6 |
| Clay, silty, yellowish brown, bedrock | 6 | 13 |
| Clay, silty, medium gray | 13 | 15 |

(Use separate sheet if necessary.)

**10. DATE COMPLETED** 2/5/90

**11. WAS WELL PLUGGED OR ABANDONED?**

☐ Yes ☒ No
If so, how

**12. REMARKS:**

2" PVC cap on bottom of screen
160# of silica sand pack

**13. DRILLER'S CERTIFICATION**

This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Water Supply, Inc. 46
Driller's or Firm's Name Certificate No
Box 1191 - Bismarck, ND 58502
Address
Signed by Lewis Knutson 2/5/90
Date

WHITE - DRILLER'S COPY YELLOW - BOARD'S COPY PINK - CUSTOMER'S COPY

STATE OF NORTH DAKOTA

# BOARD OF WATER WELL CONTRACTORS

900 E. BOULEVARD - BISMARCK, NORTH DAKOTA 58501

## WELL DRILLER'S REPORT

State law requires that this report be filed with the State Board of Water Well Contractors within 30 days after completion or abandonment of the well.

**1. WELL OWNER**

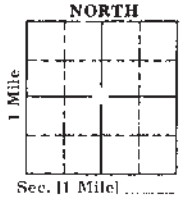
Name: Montana Dakota Utilities

Address: Bismarck, ND

**2. WELL LOCATION**

Sketch map location must agree with written location.

Heskett Ash
Disposal Site
#2-90
139-81-10CAB1
Top of pipe
1686.54
Ground level
1684.3




County: Morton

SW ¼ NE ¼ NW ¼ Sec. 10 Twp. 139 N. Rg. 81 W.

**3. PROPOSED USE**

[ ] Domestic [ ] Irrigation [X] Monitoring
[ ] Stock [ ] Municipal [ ] Industrial
[ ] Test Hole

**4. METHOD DRILLED**

[ ] Cable [ ] Reverse Rotary [ ] Bored
[X] Forward Rotary [ ] Jetted [ ] Auger
If other, specify

**5. WATER QUALITY**

Was a water sample collected for:
Chemical Analysis? [ ] Yes [ ] No
Bacteriological Analysis? [ ] Yes [ ] No
If so, to what laboratory was it sent?

**6. WELL CONSTRUCTION**

Diameter of hole 5 inches. Depth 23 feet.
Casing: [ ] Steel [X] Plastic [ ] Concrete
[ ] Threaded [ ] Welded [ ] Other
If other, specify

| Pipe Weight: | Diameter: | From: | To: |
|---|---|---|---|
| SDR-21 ~~XXX~~ | 2 inches | +2.3 feet | 13 feet |
| lb/ft. | inches | feet | feet |
| lb/ft. | inches | feet | feet |

Was perforated pipe used? [ ] Yes [X] No
Perforated pipe set from ft to feet
Was casing left open end? [ ] Yes [X] No
Was a well screened installed? [X] Yes [ ] No
Material PVC Diameter 2 inches
(stainless steel, bronze, etc.)
Slot size 10 set from 13 feet to 23 feet
Slot size set from feet to feet
Was a packer or seal used? [X] Yes [ ] No
If so, what material: se bentonit Depth 11 to 12 Ft.
Type of well: Straight screen [ ] Gravel packed [X]
Depth grouted: From 11 To surface
Grouting Material: Cement X Other
If other explain: w/bentonite
Well head completion: Pitless unit
12" above grade X Other
If other, specify
Was pump installed: [ ] Yes [X] No
Was well disinfected upon completion? [ ] Yes [X] No

**7. WATER LEVEL**

Static water level dry feet below land surface
If flowing: closed-in pressure psi
GPM flow through inch pipe
Controlled by: [ ] Valve [ ] Reducers [ ] Other
If other, specify

**8. WELL TEST DATA**

[ ] Pump [ ] Bailer [ ] Other
Pumping level below land surface:
ft. after hrs. pumping gpm
ft. after hrs. pumping gpm
ft. after hrs. pumping gpm

**9. WELL LOG**

| Formation | Depth (ft.) From | To |
|---|---|---|
| Topsoil, silty, black | 0 | 1 |
| Sand, fine, yellowish gray | 1 | 6.5 |
| Clay, silty, yellowish brown, till | 6.5 | 11 |
| Clay, silty, medium gray | 11 | 13 |
| Sand | 13 | 15.5 |
| Clay, silty, medium gray, bedrock | 15.5 | 23 |

(Use separate sheet if necessary.)

**10. DATE COMPLETED** 2/5/90

**11. WAS WELL PLUGGED OR ABANDONED?**

[ ] Yes [X] No
If so, how

**12. REMARKS:**

2" PVC cap on bottom of screen
160# silica sand pack

**13. DRILLER'S CERTIFICATION**

This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Water Supply, Inc. 46
Driller's or Firm's Name Certificate No.
Box 1191 - Bismarck, ND 58502
Address
Signed by Lewis Knutson 2/5/90
Date

WHITE-DRILLER'S COPY YELLOW-BOARD'S COPY PINK-CUSTOMER'S COPY

STATE OF NORTH DAKOTA
BOARD OF WATER WELL CONTRACTORS
900 E. BOULEVARD · BISMARCK, NORTH DAKOTA 58501

# WELL DRILLER'S REPORT

State law requires that this report be filed with the State Board of Water Well Contractors within 30 days after completion or abandonment of the well.

**1. WELL OWNER**

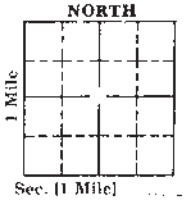
Name Montana Dakota Utilities

Address Bismarck, ND

**2. WELL LOCATION**

Sketch map location must agree with written location.

Heskett Ash Disposal Site #3-90
139-81-10CAB2
Top of pipe 1685.92
Ground level 1683.6




County Morton

SW ¼ NE ¼ NW ¼ Sec. 10 Twp. 139 N. Rg. 81 W.

**3. PROPOSED USE**

☐ Geothermal ☒ Monitoring
☐ Domestic ☐ Irrigation ☐ Industrial
☐ Stock ☐ Municipal ☐ Test Hole

**4. METHOD DRILLED**

☐ Cable ☐ Reverse Rotary ☐ Bored
☒ Forward Rotary ☐ Jetted ☐ Auger
If other, specify

**5. WATER QUALITY**

Was a water sample collected for:
Chemical Analysis? ☐ Yes ☐ No
Bacteriological Analysis? ☐ Yes ☐ No
If so, to what laboratory was it sent

**6. WELL CONSTRUCTION**

Diameter of hole 5 inches. Depth 20 feet.
Casing: ☐ Steel ☒ Plastic ☐ Concrete
☐ Threaded ☐ Welded ☐ Other
If other, specify

| Pipe Weight: | Diameter: | From: | To: |
|---|---|---|---|
| SDR-21 ~~xxxx~~ lb/ft. | 2 inches | +2.3 feet | 10 feet |
| lb/ft. | inches | feet | feet |
| lb/ft. | inches | feet | feet |

Was perforated pipe used? ☐ Yes ☒ No
Perforated pipe set from ft to feet
Was casing left open end? ☐ Yes ☒ No
Was a well screened installed? ☒ Yes ☐ No
Material PVC Diameter 2 inches
(stainless steel, bronze, etc.)
Slot size 10 set from 10 feet to 20 feet
Slot size set from feet to feet
Was a packer or seal used? ☒ Yes ☐ No
If so, what material ~~cse~~ bentonite Depth 7.5 to 9 Ft.
Type of well: Straight screen ☐ Gravel packed XX
Depth grouted: From 7.5 To surface
Grouting Material: Cement X Other
If other explain: w/bentonite
Well head completion: Pitless unit
12" above grade X Other
If other, specify
Was pump installed: ☐ Yes ☒ No
Was well disinfected upon completion? ☐ Yes ☒ No

**7. WATER LEVEL**

Static water level dry feet below land surface
If flowing: closed-in pressure psi
GPM flow through inch pipe
Controlled by: ☐ Valve ☐ Reducers ☐ Other
If other, specify

**8. WELL TEST DATA**

☐ Pump ☐ Bailer ☐ Other
Pumping level below land surface:
ft. after hrs. pumping gpm
ft. after hrs. pumping gpm
ft. after hrs. pumping gpm

**9. WELL LOG**

| Formation | Depth (ft.) From | To |
|---|---|---|
| Topsoil, silty, black | 0 | 1 |
| Clay, silty, yellowish brown, till | 1 | 7 |
| Sand, fine, yellowish brown | 7 | 8 |
| Clay, silty, medium gray, till | 8 | 15 |
| Clay, silty to sandy, medium gray, abt 40% sand | 15 | 20 |

(Use separate sheet if necessary.)

**10. DATE COMPLETED** 2/5/90

**11. WAS WELL PLUGGED OR ABANDONED?**

☐ Yes ☒ No
If so, how.

**12. REMARKS:**

2" PVC cap on bottom of screen
160# silica sand pack

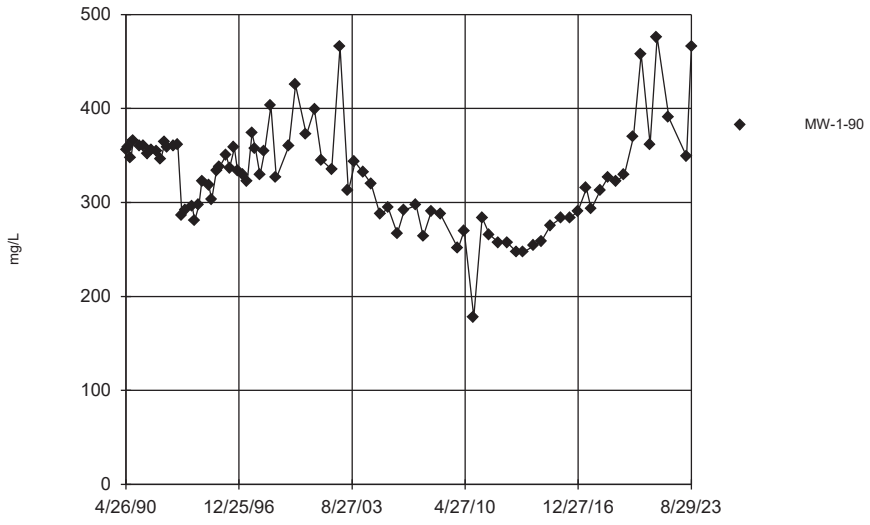
**13. DRILLER'S CERTIFICATION**

This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Water Supply, Inc. 46
Driller's or Firm's Name Certificate No.
Box 1191 - Bismarck, ND 58502
Address
Signed by Lewis Knutson 2/5/90
Date

# Appendix F MW1-90 Time Series Plots

## Alkalinity, bicarbonate



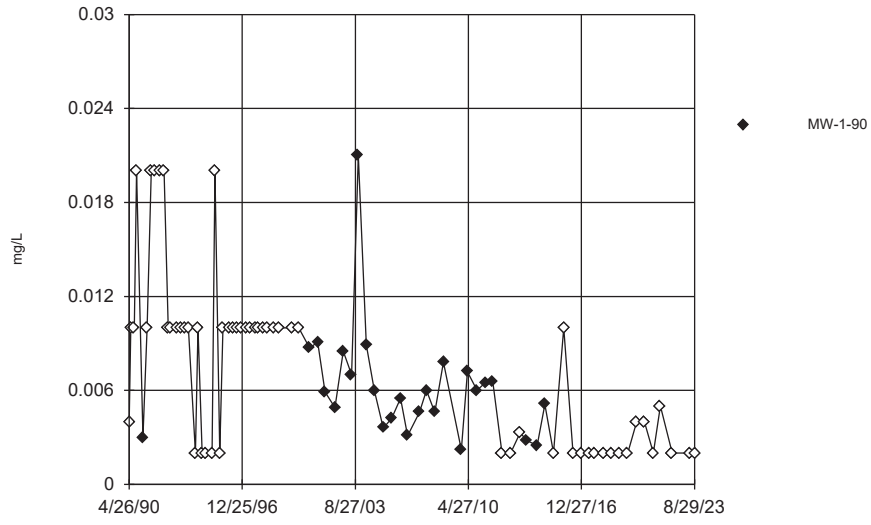

Time Series Analysis Run 10/3/2025 10:46 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190



Hollow symbols indicate censored values.

## Arsenic



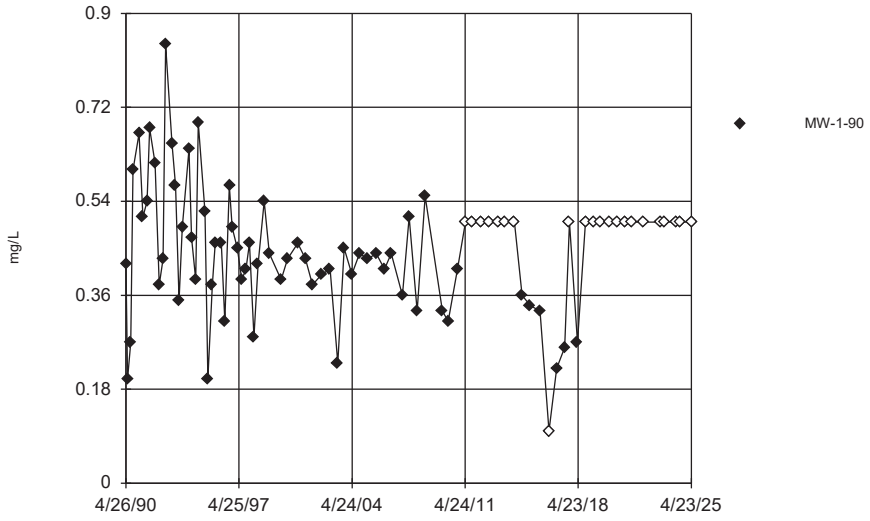

Time Series Analysis Run 10/3/2025 10:46 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190



Hollow symbols indicate censored values.

## Boron

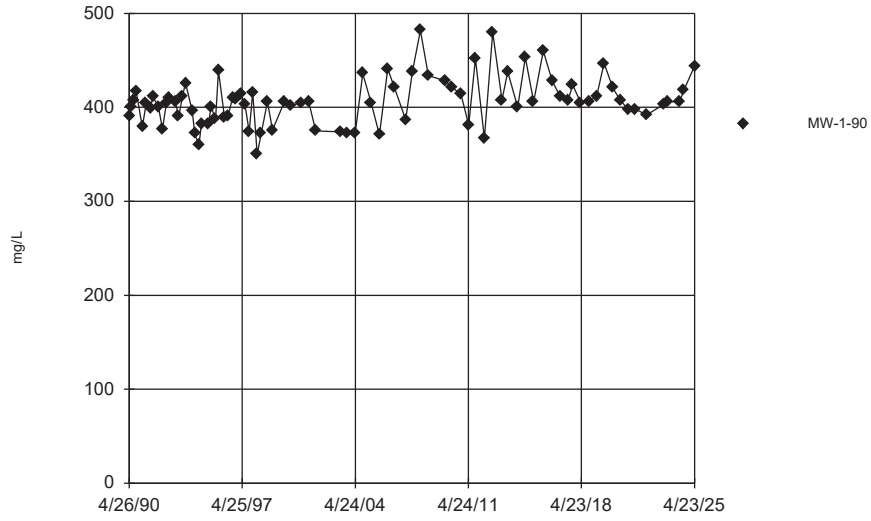



Time Series Analysis Run 10/3/2025 10:46 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190



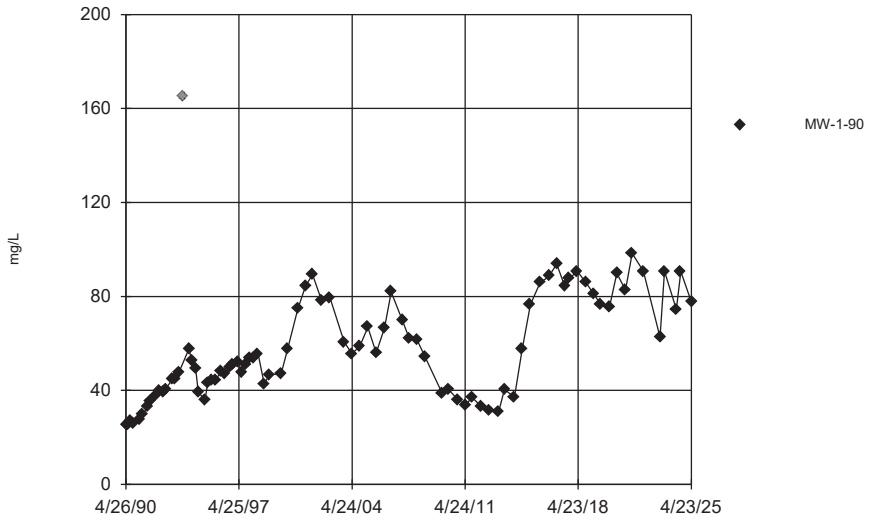
## Calcium




Time Series Analysis Run 10/3/2025 10:46 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

## Chloride

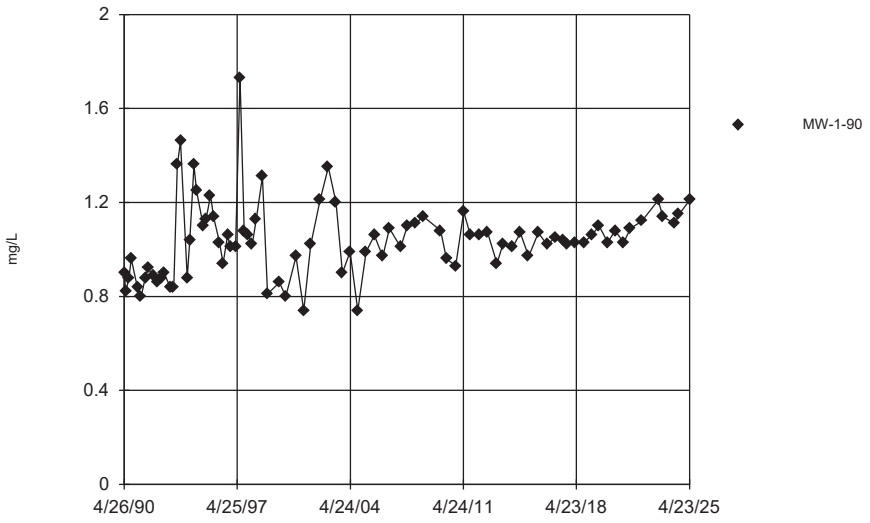



Time Series Analysis Run 10/3/2025 10:46 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.10.1.01 Software licensed to Barr Engineering Company. UG

## Fluoride

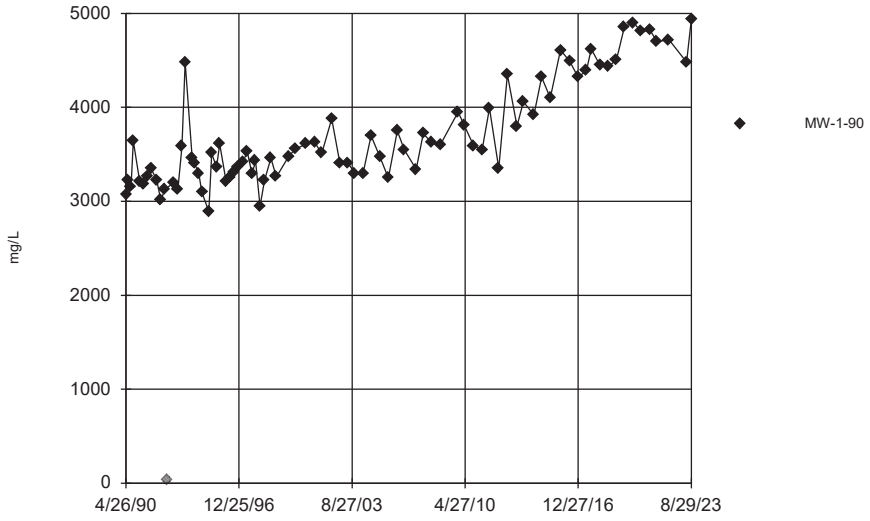



Time Series Analysis Run 10/3/2025 10:46 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.10.1.01 Software licensed to Barr Engineering Company. UG

## Hardness

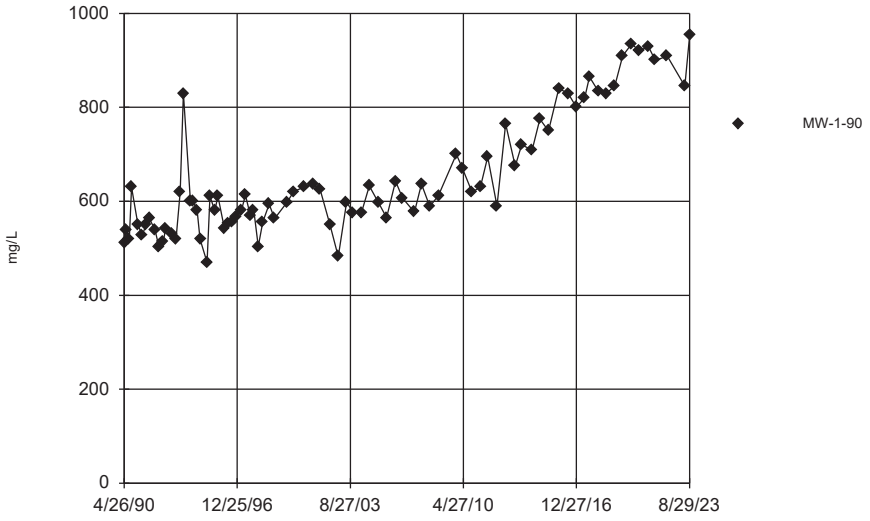



Time Series Analysis Run 10/3/2025 10:46 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.10.1.01 Software licensed to Barr Engineering Company. UG

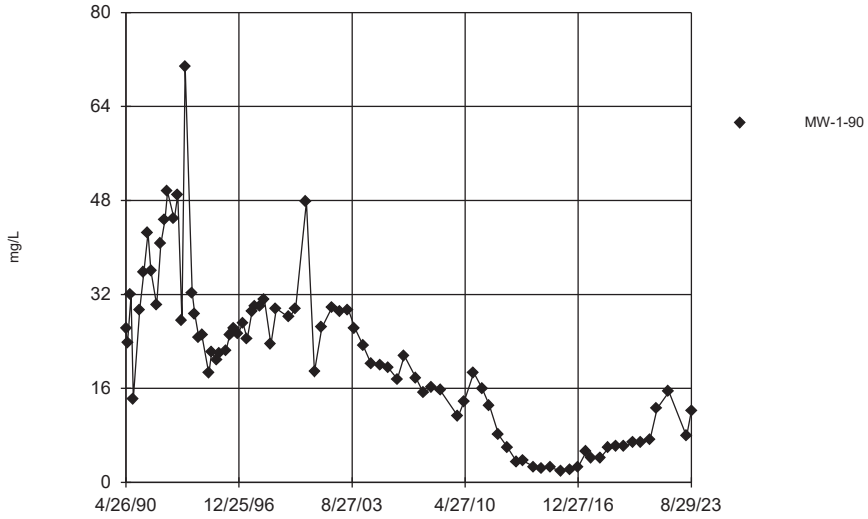
## Magnesium




Time Series Analysis Run 10/3/2025 10:46 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

## Nitrogen

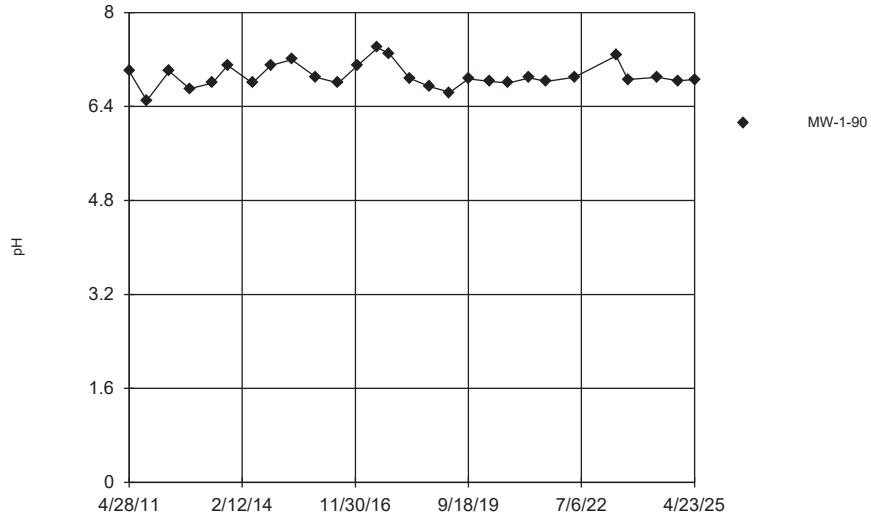



Time Series Analysis Run 10/3/2025 10:46 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190



## pH

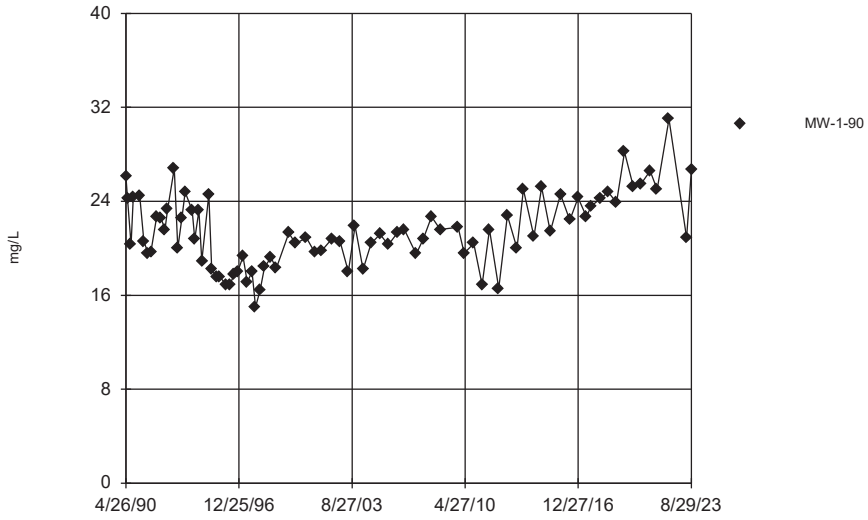



Time Series Analysis Run 10/3/2025 10:46 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190



## Potassium

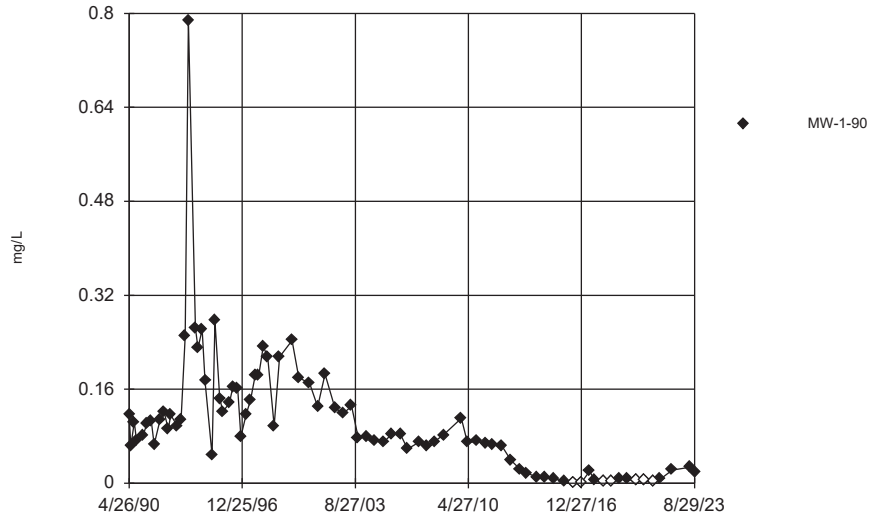



Time Series Analysis Run 10/3/2025 10:46 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190


Hollow symbols indicate censored values.

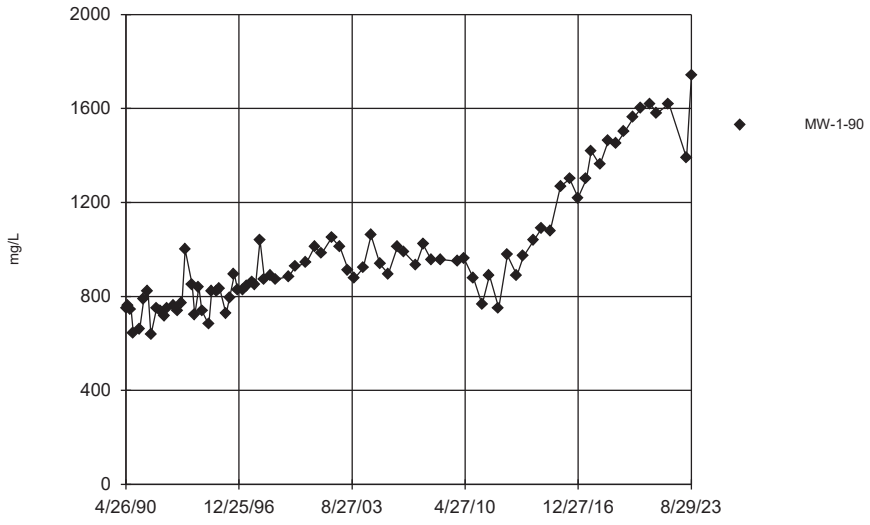
## Selenium




Time Series Analysis Run 10/3/2025 10:46 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

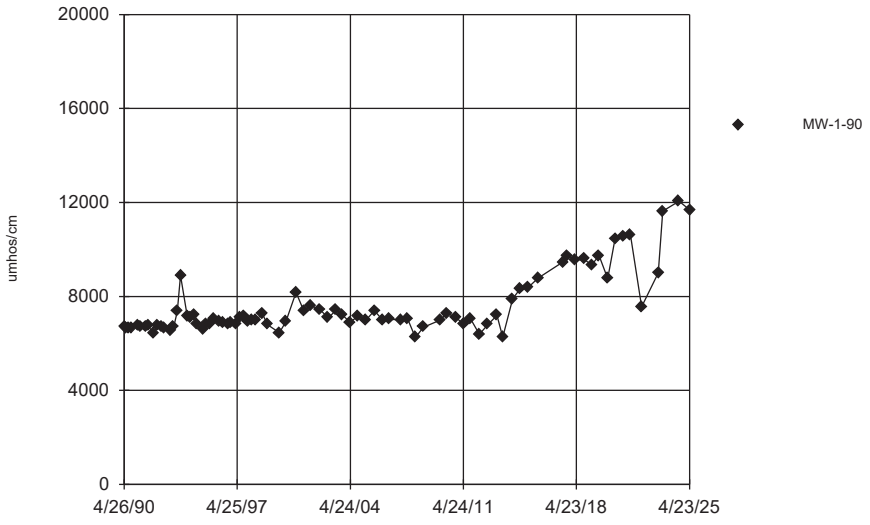
## Sodium




Time Series Analysis Run 10/3/2025 10:46 AM
R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190



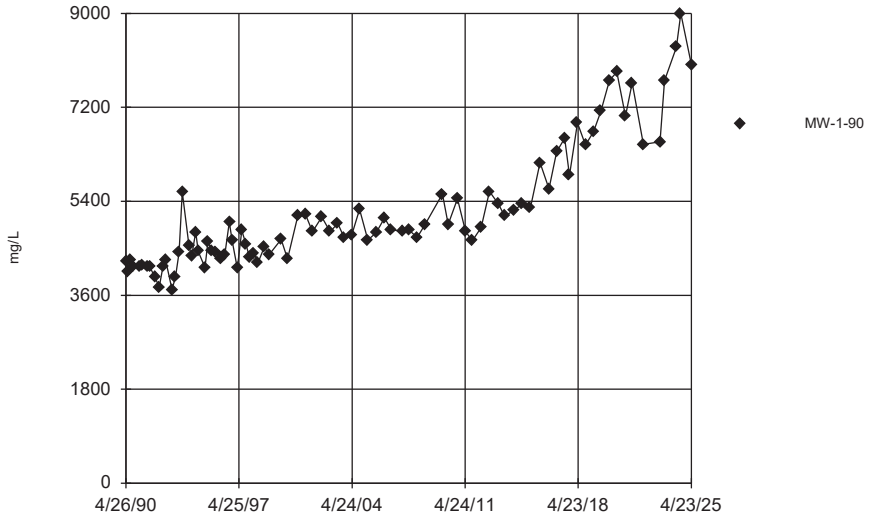
## Specific conductance




Time Series Analysis Run 10/3/2025 10:46 AM
R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190



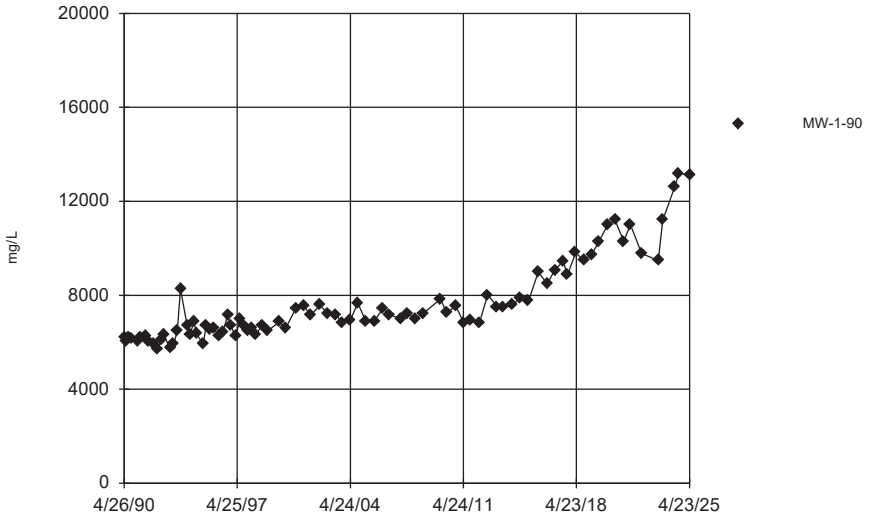
## Sulfate




Time Series Analysis Run 10/3/2025 10:46 AM
R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190



## TDS




Time Series Analysis Run 10/3/2025 10:46 AM
R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

# Appendix G Geochemist's Workbench Results

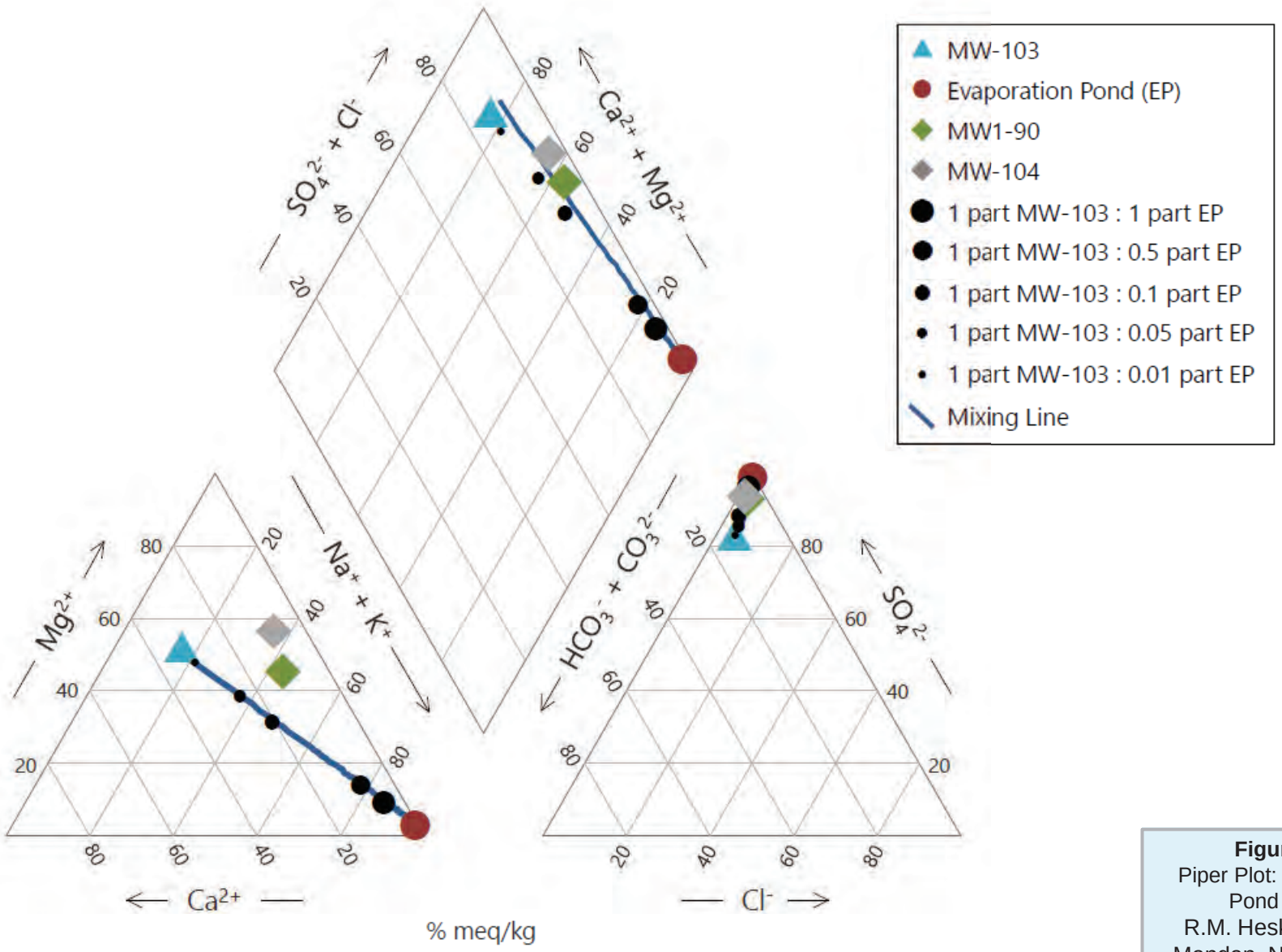
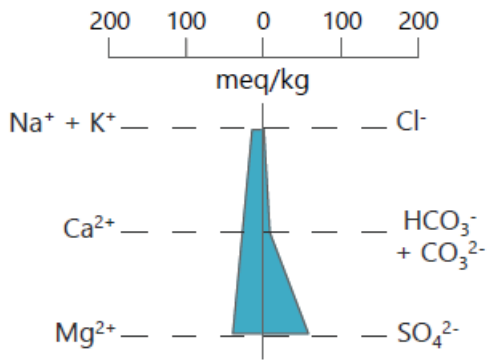
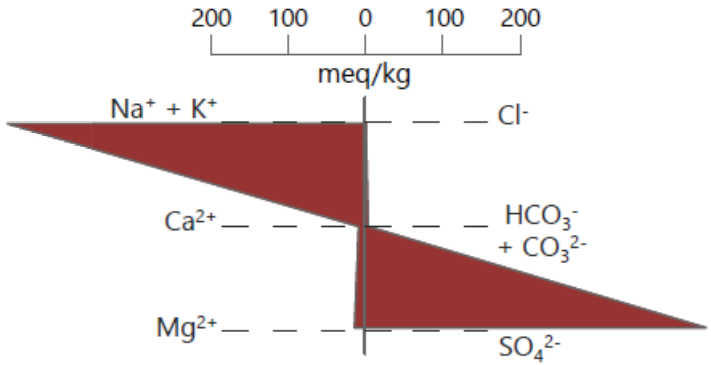



**Figure G.1**
Piper Plot: Evaporation Pond Mixing
R.M. Heskett Station
Mandan, North Dakota

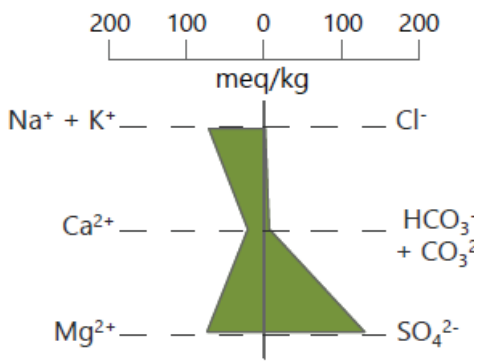
BARR



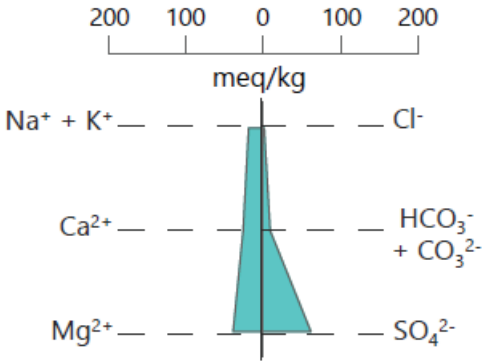

**MW103**



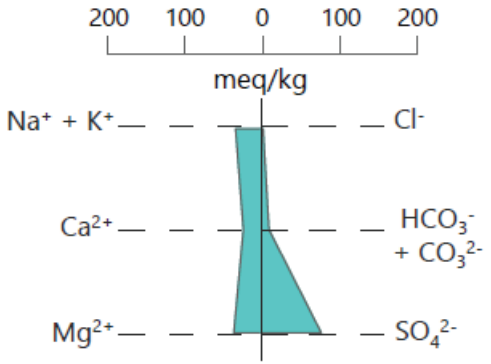

**Evaporation Pond (EP)**



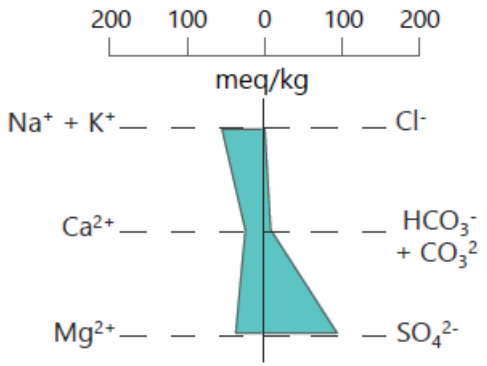

**MW1-90**



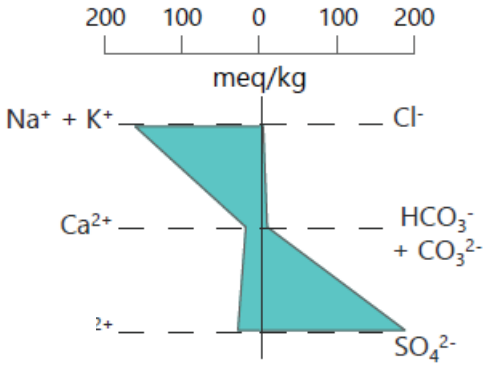

**1 part MW-103 : 0.01 part EP**



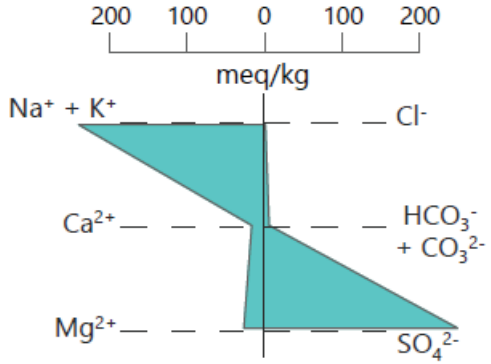

**1 part MW-103 : 0.05 part EP**




**1 part MW-103 : 0.1 part EP**




**1 part MW-103 : 0.5 part EP**




**1 part MW-103 : 1 part EP**

**Figure G.2**
Stiff Plot: Evaporation Pond Mixing
R.M. Heskett Station
Mandan, North Dakota

BARR

Table G.1
Geochemist's Workbench Mixing Model Results

| Description | | Upgradient | Evap Pond | Mixing Evap Pond into MW-103 | | | | | Downgradient | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | | MW-103 | Evap Pond | 1 : 0.01 | 1 : 0.05 | 1 : 0.1 | 1 : 0.5 | 1 : 1 | MW1-90 | MW-104 |
| Sample Date | | 8/23/2021 | 9/16/2014 | n/a | | | | | 8/28/2023 | 8/24/2021 |
| HCO3- | mg/l | 645 | 340 | 642 | 630 | 617 | 543 | 492 | 568 | 820 |
| Ca++ | mg/l | 500 | 125 | 496 | 482 | 466 | 375 | 313 | 406 | 422 |
| Cl- | mg/l | 119 | 79.8 | 119 | 117 | 115 | 106 | 99 | 90.7 | 94.1 |
| F- | mg/l | 0.30 | 0.1 | 0.30 | 0.29 | 0.28 | 0.23 | 0.20 | 1.14 | 0.54 |
| Mg++ | mg/l | 464 | 165 | 461 | 450 | 437 | 364 | 315 | 953 | 1,640 |
| K+ | mg/l | 20.0 | 734 | 27.1 | 54.0 | 84.9 | 258 | 377 | 26.7 | 34 |
| Na+ | mg/l | 266 | 10,600 | 368 | 758 | 1,210 | 3,710 | 5,430 | 1,740 | 1,940 |
| SO4-- | mg/l | 3,000 | 22,100 | 3,190 | 3,910 | 4,740 | 9,370 | 12,500 | 7,710 | 11,600 |
| pH | SU | 6.6 | 10.7 | 6.6 | 6.7 | 6.7 | 7.4 | 8.9 | 6.9 | 6.9 |
| TDS | mg/kg | 4,950 | 34,100 | 5,240 | 6,350 | 7,610 | 14,700 | 19,600 | 13,100 | 16,500 |

**Table G.1**
GWB Mixing Model Results
R.M. Heskett Station
Mandan, North Dakota

BARR

# Alternative Source Demonstration: August 2024 Event

## *R.M. Heskett Station*

Prepared for
Montana-Dakota Utilities Co.

March 2025

4300 MarketPointe Drive, Suite 200
Minneapolis, MN 55435
952.832.2600
www.barr.com

# Certification

I hereby certify that I, or my agent, have examined this written demonstration and attest that this Coal Combustion Residuals Facility Alternative Source Demonstration (ASD) is accurate and has been prepared in accordance with good engineering practice, including consideration of applicable industry standards and the requirements of 40 CFR § 257.94. I further certify that this report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the state of North Dakota.

| Revision | Date | Summary of Revisions |
|---|---|---|
| **0** | March 17, 2025 | August 2024 Event Alternative Source Demonstration |
| | | |
| | | |

# Alternative Source Demonstration: August 2024 Event

## March 2025

## Contents


1 Introduction ..... 1

2 August 2024 SSIs ..... 2

2.1 August 2024 Sampling Event ..... 2

2.2 Verification Sampling ..... 2

3 Alternative Source Demonstration ..... 4

3.1 Source Hypothesis #1: CCR Unit Release ..... 4

3.2 Source Hypothesis #2: Natural Variations in Pre-Landfill and Site-Specific Background Water Quality ..... 6

3.2.1 Fluoride at MW1-90 and MW2-90 ..... 6

3.2.2 TDS at MW1-90 ..... 7

3.2.3 Sulfate at MW1-90 ..... 7

3.3 Source Hypothesis #3: Evaporation Pond Release ..... 8

3.3.1 Fluoride, Sulfate, and TDS at MW1-90 ..... 8

4 Conclusions ..... 10

5 References ..... 12

## List of Tables


| | |
|---|---|
| Table 1 | Verification Resampling Results for Potential SSI Well-Parameter Pairs |
| Table 2 | Fluoride Concentrations in Morton County, North Dakota |
| Table 3 | Summary of SSIs and Alternative Sources |


## List of Figures


| | |
|---|---|
| Figure 1 | Site Layout and CCR Monitoring Well Network |
| Figure 2 | Piper Plot: Alternative Source Demonstration |


## List of Appendices


| | |
|---|---|
| Appendix A | Appendix III Time Series Plots |
| Appendix B | Prediction Limit Plots |
| Appendix C | Ash SPLP Laboratory Report (2011) |
| Appendix D | Aerial Photo (March 30, 1988) |
| Appendix E | Boring Logs |
| Appendix F | MW1-90 Time Series Plots |
| Appendix G | Geochemist's Workbench Results |

## Abbreviations

| | |
|---|---|
| ASD | Alternative Source Demonstration |
| CCR | Coal Combustion Residuals |
| NDDEQ | North Dakota Department of Environmental Quality |
| MDU | Montana-Dakota Utilities Co. |
| SPLP | Synthetic Precipitation Leaching Procedure |
| SSI | Statistically Significant Increase |
| TDS | Total Dissolved Solids |
| US EPA | United States Environmental Protection Agency |

# 1 Introduction

Montana-Dakota Utilities Co. (MDU) owns and operated R.M. Heskett Station (Site) located in Mandan, Morton County, North Dakota (Figure 1). The Site was comprised of two coal-fired electric generating units which are now decommissioned, demolished, and the areas reclaimed. One coal combustion residual (CCR) unit, as defined by 40 CFR § 257.53 and North Dakota Administrative Code (NDAC) 33.1-20-08-01, is located on the property. The CCR unit is a lined landfill containing coal combustion by-products, asbestos wastes generated from construction activity associated with MDU-owned facilities, decommissioning wastes, and ash derived from burning tire-derived fuel at the facility. Final closure of the landfill was competed in 2024.

The CCR Rule (US EPA, 2015) § 257.94(e)(2) allows for an alternative source demonstration (ASD) in the event of an identified statistically significant increase (SSI) in a water quality parameter in a downgradient monitoring well over background levels:

> *The owner or 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 to include obtaining a certification from a qualified professional engineer verifying the accuracy of the information in the report.*

The purpose of this work is to evaluate the data collected as part of the August 2024 monitoring event, along with historical data, to demonstrate if the SSIs are the results of a "source other than the CCR unit" or due to natural variation in groundwater quality or an error in sampling, analysis, or statistical evaluation. Nothing in the foregoing citation of the rule requires that the owner/operator disprove any and all potential counter-arguments that EPA or others may offer to refute this demonstration. Such arguments if valid, would need to follow requirements of the rule to show a basis in fact that includes rule requirements that are based on site-specific information, and must be certified by a North Dakota licensed professional engineer.

# 2 August 2024 SSIs

Sampling for the second detection monitoring event in 2024 was conducted August 28, 2024. Final laboratory results were received September 20, 2024. Nine potential SSIs over background were identified, and four were verified by resampling (see time series plots in Appendix A and prediction limit plots in Appendix B):

- fluoride, sulfate, and TDS at MW1-90
- fluoride at MW2-90

Evaluations were undertaken to review potential alternative sources for the SSI. These evaluations included comparing leaching tests of on-site CCR materials, leachate collected in the Evaporation Pond (non-CCR unit), regional (background) groundwater quality data, groundwater quality data from additional site wells, and groundwater quality data collected at the Site prior to construction of the CCR unit.

Several characteristics of the CCR unit, site geology, groundwater monitoring well locations, and historical groundwater quality data prompted consideration of potential alternative sources for the SSIs, including elevated water quality parameters in pre-landfill and upgradient groundwater monitoring data, site-specific geologic conditions, and/or leakage from the Evaporation Pond (non-CCR unit).

A successful demonstration of alternative sources for the SSIs are discussed in Section 3.

## 2.1 August 2024 Sampling Event

Concentrations for potential SSIs observed in August 2024 are shown on time series graphs in Appendix A and are consistent with those observed during the prior detection monitoring events.

Trend analysis results through 2023 indicate:

- that fluoride at MW2-90, though above the prediction limit, does not have a statistically significant trend
- that fluoride at MW1-90 has a statistically significant increasing trend
- that sulfate at MW1-90, though above the prediction limit, does not have a statistically significant trend
- that TDS at MW1-90 has a statistically significant increasing trend

## 2.2 Verification Sampling

Verification resampling was conducted in November 2024 for the five well-parameter pairs with potential SSIs. Four potential SSIs were not resampled since successful ASDs have been completed in the past, so those SSIs were verified.

Table1 Verification Resampling Results for Potential SSI Well-Parameter Pairs

| Well | Parameter | Interwell Prediction Limit (mg/L) | August 2024 (mg/L) | November 2024 (mg/L) |
|---|---|---|---|---|
| MW3-90 | Calcium | 600 | **604** | 580 |
| MW-80R | pH | 6.4 – 7.1 | **7.8** | 7.0 |
| MW1-90 | pH | 6.4 – 7.1 | **7.3** | 6.8 |
| MW2-90 | pH | 6.4 – 7.1 | **7.5** | 7.0 |
| MW3-90 | pH | 6.4 – 7.1 | **7.6** | 6.8 |

**Bolded values** indicate concentrations exceed the associated interwell prediction limits (PL).

# 3 Alternative Source Demonstration

The purpose of this ASD Report is to evaluate whether the August 2024 SSIs were due to a CCR unit release or due to another source or to error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. For each SSI, four hypotheses regarding the potential source of the SSI are assessed: (1) a release of leachate from the CCR unit, (2) natural variations in non-landfill or regional groundwater quality are the source of one or more of the SSIs, (3) a release of leachate from the Evaporation Pond (a source other than a CCR unit) is the source of one or more of the SSIs, and (4) statistical bias due to background well selection.

Successful demonstrations of alternative sources have previously been documented for all three parameters with SSIs at locations within the previous monitoring network. The associated ASD Reports (included as appendices to Barr, 2019; Barr, 2020; Barr, 2021; Barr, 2022; Barr, 2023; Barr, 2024; and Barr, 2025) documented that each of the SSIs could be explained by natural groundwater quality variability based on concentrations that were either present at the Site before the landfill was constructed, consistent with regional groundwater quality data (from specific geology present at site), and/or associated with a release from the Evaporation Pond (non-CCR unit). Note that in this and previous ASDs the lines of evidence are intended to provide sufficient weight of evidence in demonstration of the ASD. This means that if one or more lines of evidence are refuted, sufficient evidence remains to support validity of the ASD.

## 3.1 Source Hypothesis #1: CCR Unit Release

To accept the hypothesis that a release of leachate from the CCR unit is the source of the SSI, it would be assumed that groundwater chemistry at one or more potentially impacted wells (MW1-90 and/or MW2-90) would be geochemically similar to impacted water from the CCR unit represented by leach testing results. However, if these liquids are geochemically dissimilar, this indicates that a source "other than the CCR unit" may be responsible for the SSI. Therefore, major ion chemistry from the CCR groundwater monitoring locations (upgradient and downgradient) was compared to CCR Synthetic Precipitation Leaching Procedure (SPLP; EPA Method 1312) data collected July 2011 (Appendix C).

To further test the hypothesis of a source other than the CCR unit, a Piper diagram (Figure 2) was used to visually compare the CCR SPLP results (Appendix C) and the measured groundwater quality at the Site. Piper diagrams are plots of major ion chemistry of water samples (calcium, magnesium, potassium, sodium, chloride, sulfate, and [bi]carbonate) that are used to differentiate between water types and to identify potential mixing of water types. The Piper diagram provides a means to identify or "fingerprint" water samples by their common characteristics (major ions) to assess which types of water are similar or dissimilar to potential source water types (Helsel et al., 2020). On the Piper diagram depicted in Figure 2, downgradient well compositions are shown as circular points, CCR SPLP compositions as orange triangles, and the range of upgradient compositions as a yellow polygon. All of the downgradient wells plot within the range of upgradient groundwater chemistry. The CCR SPLP results do not.

Downgradient water quality (including the SSI parameter-well pairs) is characterized as an intermediate-sulfate type water, whereas the ash SPLP results are sodium-sulfate type water. The major difference observed between the downgradient water quality and the SPLP results is the dominant cation composition (no cation strongly dominant vs. heavily dominant sodium). All of the SSI well-parameter pairs are clustered with data from that of the upgradient wells, which are intermediate-sulfate water, rather than near the ash SPLP results, which are high sulfate. These results indicate that the water chemistry at the downgradient locations is more like upgradient groundwater than would be expected from a potential release from the CCR unit. **Therefore, we reject the hypothesis that the CCR unit is the source of the sulfate observed at MW1-90.**

The EPA has offered criticism of ASDs using Piper Plots, as part of its determinations under Part A and Part B demonstrations under the CCR rule. In these determinations, the EPA has made the argument without accompanying supporting evidence that Piper Plots are not suitable for ASDs because of one or more of the following reasons:

a. *Leachate is not groundwater, and therefore different water types cannot be directly compared*. This position is inconsistent with the fundamental premise within the CCR Rule that SSIs are due to changes that occur in groundwater due to a release of leachate from a CCR unit. Statistical methods are a means of making this comparison, Piper Plots are another. The utility of Piper Plots is that they are a useful means of visualizing data and are part of the professional standard of care for comparing the dissolved constituents for any type of solution chemistry for any type of water. If the groundwater were influenced by a release of leachate, it is likely that the change in equilibrium chemistry within the flow system would show some influence on major ion composition. Therefore, Piper Plots are a valuable tool for comparing leachate and groundwater chemistry.

b. *There may be reactions in the subsurface that might influence the results and thereby reduce or add constituents to the downgradient groundwater*. While this may be true at some scale for some parameters, it is generally not true of Appendix III parameters which are major ions that are generally not reactive in the subsurface. As stated in the preamble to the CCR Rule, EPA states that it selected the Appendix III parameters as indicators of coal ash leachate because they are mobile (and hence not reactive) in the subsurface.

c. *Using a single leach test cannot represent the water quality found at a downgradient monitoring well*. The issue is whether a single leach sample is representative of leachate as a distinct water type. As long as the leachate sample is sufficiently different from groundwater, it is useful in assessing the potential effects of a release on downgradient groundwater. In this ASD, several leach tests are used, and they are all more similar to each other than they are to groundwater samples in terms of both the overall concentration of parameters and the proportionate ratios of various parameters along the flow path (which generally do not change along the flow path due to dilution). Therefore, Piper Plots not only show the differences between the two water types; they can also demonstrate the effects of dilution that allows for assessment of a release.

## 3.2 Source Hypothesis #2: Natural Variations in Pre-Landfill and Site-Specific Background Water Quality

As Source Hypothesis #1 (CCR Unit Release) was rejected as a potential source of the SSIs, a second hypothesis was evaluated to identify the potential source of concentrations of SSI parameters and further reinforce the demonstration that the SSIs were not related to the CCR unit. To do this, we evaluated the SSIs by comparison to historical groundwater quality data collected at the Site before the landfill was constructed (pre-landfill data), additional upgradient well data, and/or regional groundwater quality data from the Cannonball Formation and associated units to determine if natural variation is a potential alternative source for the SSIs.

Results from groundwater samples collected in 1986 were included in the 1989 Special Use Disposal Site Permit Application (Permit Application; MDU, 1989). The 1986 samples were collected prior to construction of the CCR unit; an aerial photograph from March 30, 1988, shows the area of the current CCR unit is undisturbed (Appendix D) on the date that this image was taken.

Discussion of pre-landfill groundwater samples in the Permit Application notes that high calcium, chloride, fluoride, sulfate, TDS, and other parameters were observed at the Site.

### 3.2.1 Fluoride at MW1-90 and MW2-90

Source Hypothesis #2 was tested by comparing fluoride concentrations collected as part of several regional groundwater quality studies on the Cannonball Formation and associated units. A summary of the range of fluoride concentrations in the Cannonball Formation and associated units is included in Table 1 below. As above, the Cannonball is the specific geologic formation present at the Site, and the results are specific to the local area of the Site. Consideration of this information is required to establish a professional standard of care.

Table 2 Fluoride Concentrations in Morton County, North Dakota

| Reference | Fluoride Conc. Range | Formation/Units | Data Source Location |
|---|---|---|---|
| Ackerman, D.J., 1980. Ground-Water Resources of Morton County, North Dakota. North Dakota Geological Survey Bulletin 72, Part III. 51 p. | 0.0 to 4.0 mg/L | Cannonball and Ludlow formations, undifferentiated | Morton County |
| Crosby, O.A. and Klausing, R.L., 1984. Hydrology of Area 47, Northern Great Plains and Rocky Mountain Coal Provinces, North Dakota, South Dakota, and Montana. USGS Water-Resources Investigations Open-File Report 83-221, 93 p. | 0.1 to 6.3 mg/L | Entire Fort Union Formation (includes Cannonball Formation) | Morton County |

The Ackerman study provides summary statistics for the fluoride concentrations observed in Morton County. Forty-six samples were analyzed for fluoride; of those, 20 (or 43%) had concentrations greater than 1.3 mg/L (Ackerman, 1980). The fluoride concentration observed at MW1-90 and MW2-90 in August

2024 (1.15 mg/L and 1.05 mg/L, respectively) are within the range of values consistent with naturally occurring concentrations of fluoride associated with the Cannonball Formation in Morton County. However, a statistically significant increasing trend for fluoride at MW1-90 was observed, while no trend was observed at MW2-90. **Therefore, we accept the hypothesis that fluoride concentrations observed at MW1-90 and MW2-90 are consistent with regional (background) groundwater data; however, additional source considerations were evaluated, as described in Section 3.3.**

### 3.2.2 TDS at MW1-90

As noted in previous sections, high variability and concentrations of various parameters have been noted in groundwater at the Site and in the region. This observation extends to TDS. The maximum TDS concentration reported in the 1989 Permit Application from 1986 (pre-landfill) was 14,917 mg/L (Well 60), with similar concentrations observed two years later, indicating that high TDS pre-dates landfill construction.

Based on presence of gypsum in native subsurface deposits and documentation of elevated TDS in pre-landfill groundwater, the hypothesis that the SSI for TDS at MW1-90 may be due to natural conditions is probable. Significantly increasing TDS concentrations were observed in other monitoring system wells, including upgradient wells MW-13, MW-103, and MW-44R. Because the elevated TDS was documented prior to the placement of ash, there is evidence that concentrations observed more recently are due to natural or pre-existing conditions unrelated to the CCR Unit. **TDS concentrations at MW1-90 may be due to natural conditions; however, additional source considerations were evaluated, as described in Section 3.3.**

### 3.2.3 Sulfate at MW1-90

Like the other parameters discussed, there are variable sulfate concentrations both at the Site and in the region. The maximum sulfate concentration reported in the 1989 Permit Application from 1986 (pre-landfill) was 11,632 mg/L (Well 60), indicating that high sulfate concentrations pre-date construction of the CCR unit.

Sulfate and TDS concentrations are strongly related as sulfate accounts for 50-70% of TDS. Gypsum, a source of groundwater sulfate, is well-documented on site as discussed in Section 3.2.1 and Section 3.2.4. As noted, the boring logs for CCR wells and pre-landfill wells note gypsum occurrences across the Site (Appendix E). As groundwater fluctuates and surface water infiltration occurs, periodic dissolution of gypsum into the water column may occur, resulting in elevated sulfate. Because the elevated sulfate was documented prior to the placement of ash, there is evidence that the concentrations observed more recently are due to natural or pre-existing conditions unrelated to the CCR Unit.

These results support the hypothesis that the SSI for sulfate at MW1-90 is due to natural variation in groundwater quality. **Therefore, we accept the hypothesis that sulfate concentrations observed at MW1-90 are due to variability in natural conditions and are consistent with regional and Site background groundwater data.**

## 3.3 Source Hypothesis #3: Evaporation Pond Release

Two conditions are necessary to accept the hypothesis that a release of Evaporation Pond water is the source of one or more of the SSIs: (1) mechanism of release (such as an issue with the Evaporation Pond liner integrity) and (2) geochemically similar groundwater chemistry at one or more of the potentially impacted wells with water from the Evaporation Pond. Based on proximity, only the SSIs observed at MW1-90 (fluoride, sulfate, and TDS) are being evaluated for this potential source.

### 3.3.1 Fluoride, Sulfate, and TDS at MW1-90

A statistically significant increasing trend in fluoride and TDS was observed at MW1-90 following the August 2024 detection monitoring event. Past ASD Reports (Barr, 2020; Barr, 2021; Barr, 2022) attributed elevated TDS concentrations at MW-104 to either natural conditions or a release from the Evaporation Pond. MW-104 is located between the CCR unit and the Evaporation Pond (a non-CCR unit), approximately 225 feet southwest of MW1-90, which is located north of the Evaporation Pond. The Evaporation Pond was designed and constructed to collect surface water run-off from the Site as well as leachate from the CCR Unit. It is not a CCR unit as defined in § 257.53. Due to the relative proximity of MW1-90 to the Evaporation Pond and MW-104, an evaluation was conducted to assess the Evaporation Pond liner integrity and potential impacts to downgradient wells and determine the geochemical feasibility of Evaporation Pond water contributing to the conditions observed at MW1-90.

#### *Liner Integrity Evaluation*

In the 2010 Annual Report for the Special Waste Disposal Permit (SP-087), it was noted that erosion was encountered at the Evaporation Pond. More specifically, "cuts in the banks of the pond ranged from 8 to 24-inches. Erosion was caused from storm water running into the evaporation pond from closed Slots and the haul road" (MDU, 2011). No repairs were made at that time due to standing water in the pond. Similar erosional features were noted in the 2011 and 2012 Annual Reports, citing erosion cuts of 8 to 48 inches (MDU, 2012; MDU, 2013). These erosion cuts were repaired in 2013 during the construction of Slot 10. Additionally, the 2013 Annual Report stated that "the west wall of the evaporation pond was raised and graded to reroute storm water that accumulates outside of the ash disposal area from the cover of Phase I ash disposal site away from the pond during rain events" (MDU, 2014).

These reports did not specify if the erosional cuts were 8 to 48 inches wide or 8 to 48 inches deep. Based on the Phase I Development "as-constructed" Plan Sheets (January and November 1990), the Evaporation Pond was built with a 3-foot-thick compacted clay liner (MDU, 1989, Exhibit 6-B). If the erosional cuts were up to 48 inches deep, then the cuts would extend through the entirety of the liner thickness, creating a conduit for Evaporation Pond water to enter the groundwater. Additionally, no details were provided on the materials used for repairing the Evaporation Pond (i.e., if the liner was impacted, whether the erosion cuts were filled in with a comparable clay liner material).

Additionally, the integrity of the Evaporation Pond liner may have been compromised due to cation exchange. Time series plots of groundwater quality at well MW1-90 (Appendix F) show an increase in sodium; this increase is most apparent at MW1-90 between 2012 and 2024. The Evaporation Pond liner may be composed of a clay with sodium as its main interlayer cation (e.g., sodium-montmorillonite and/or

sodium-bentonite, which are common in the area (Groenewold et al., 1983)), and cation exchange processes can occur between the sodium in the clay and positively charged cations concentrated in the Evaporation Pond water (calcium, magnesium, potassium, and aluminum), increasing the concentration of dissolved sodium as it is released from the clay structure. Over time, this exchange may decrease swelling potential and increase hydraulic conductivity of the clay constituting the pond liner, resulting in increased leakage of Evaporation Pond water.

### *Potential Downgradient Effects*

The base of the Evaporation Pond sits at approximately 1675 feet above MSL, whereas historical groundwater elevations in MW-104 and MW1-90 remain below 1675 feet MSL. Therefore, any water leaking from the Evaporation Pond would move radially outward from the pond through the unsaturated zone downward into the groundwater, toward both MW-104 and MW1-90, reaching both wells downgradient of the Pond.

Groundwater monitoring data have consistently been collected from MW1-90 since 1990. As seen in the time series plots (Appendix F; 1990-2024), in approximately 2010 the concentrations of chloride, sulfate, TDS, magnesium, sodium, and specific conductance at MW1-90 began increasing more rapidly. To a lesser extent, changes in concentrations were observed around this same time for potassium, nitrogen, and total alkalinity. This timing corresponds to when the erosional cuts at the Evaporation Pond were first observed in the Annual Monitoring Reports. The increasing trends have continued, despite reports of the erosional cuts being repaired in 2013, except for chloride, which has since leveled off.

### *Geochemical Feasibility*

A simple mixing model was developed in April 2019 (Barr, 2020) to determine the potential of producing a similar water quality to that observed at MW-104 and MW1-90 when mixing Evaporation Pond water with unimpacted upgradient water. This mixing model was conducted in Geochemist's Workbench® v.12.0, using data from water samples collected from the Evaporation Pond and upgradient monitoring well MW-103. The mixing model assumes a starting concentration equal to the upgradient groundwater concentrations and then iteratively mixes it with incremental amounts of Evaporation Pond water. The upgradient groundwater concentrations used in the model were from a sample from upgradient monitoring well MW-103 collected in April 2019, which is assumed to represent the long-term composition of groundwater in that vicinity due to the fairly stable concentrations of major ions exhibited in samples from MW-103 (Barr, 2020). The Evaporation Pond concentrations used in the model were from a sample collected from the pond in September 2014, which is assumed for the purposes of the model to represent a typical Evaporation Pond water composition during the period when the pond liner was compromised.

The results of the model are provided in Appendix G. Figure G.1 shows the results of the mixing model on a Piper diagram. Downgradient wells MW-104 and MW1-90 are shown as gray and green diamonds, respectively. The blue line represents the various possible outcomes when mixing the upgradient water (represented by a blue triangle) with the Evaporation Pond (represented by a red circle). The black circles represent specific proportions (1-part upgradient water to 0.01-, 0.05-, 0.1-, 0.5-, and 1-part Evaporation

Pond water). Figure G.2 shows the results as Stiff plots. Table G.1 provides the numerical inputs and results of the various mixing proportions.

As shown on Figure G.1, the downgradient well compositions are similar to the chemistry anticipated if the Evaporation Pond is mixing with upgradient groundwater emanating from the proximity of monitoring well MW-103. The path of the mixing reaction from MW-103 to the Evaporation Pond transects MW1-90 when 1-part upgradient (MW-103) water is mixed with as little as 0.05-part Evaporation Pond water. Therefore, it appears plausible that a relatively small portion of Evaporation Pond water would be needed to "impact" groundwater from upgradient to get a similar chemistry as observed downgradient in MW1-90. The geometry of the Stiff plots in Figure G.2 shows the similarity in ionic composition in the mixing models.

Recorded measurements of fluoride concentrations in the Evaporation Pond have generally been low (<0.3 mg/L), and therefore a release from the Evaporation Pond is unlikely to be a direct source of fluoride to groundwater. However, the Evaporation Pond water has several characteristics that can lead to the release of fluoride from clays and other minerals in aquifer sediments. The pH of the Evaporation Pond is high (≥10), meaning that the water has a high concentration of hydroxide ions. Hydroxide and fluoride have similar ionic radii and charge. Mineralogically, this means that fluoride can easily substitute for hydroxide within mineral structures. In addition, fluoride can sorb to clay, particularly in slightly acidic conditions. A release of high-pH water provides ample hydroxide that can replace fluoride in mineral structures and cause the desorption of fluoride from clay minerals, leading to an increase in fluoride concentrations in groundwater (Edmunds and Smedley, 2013; McMahon et al., 2020).

Based on the description of erosional features extending upwards of 48 inches into the liner of the Evaporation Pond in 2010-2013, corresponding with the increased concentrations of several parameters observed in downgradient monitoring well MW1-90, it is possible that a release from the Evaporation Pond occurred starting in approximately 2011. Furthermore, the results of the geochemical model along with the general proximity and hydraulic position of MW1-90 relative to the Evaporation Pond support the hypothesis that the SSI for fluoride, sulfate, and TDS at MW1-90 are due to a "source other than the CCR unit." **Therefore, we accept the hypothesis that the fluoride, sulfate, and TDS concentrations observed at MW1-90 are consistent with a potential release from the Evaporation Pond, a non-CCR unit.**

# 4 Conclusions

Four SSIs were identified from the August 2024 detection monitoring event. This report demonstrates that a "source other than the CCR unit" caused the SSIs (natural variation in background and/or pre-landfill groundwater quality and the Evaporation Pond), as allowed by § 257.94(e)(2). The results of this alternative source demonstration are summarized in Table 2 below.

Table 3 Summary of SSIs and Alternative Sources

| Well | Parameter | Report Section | Evidence for Alternative Source |
|---|---|---|---|
| MW2-90 | Fluoride | 3.2.1 | Natural variation (geologic background) |
| MW1-90 | Fluoride | 3.2.1, 3.3.1 | Natural variation (geologic background) and/or Other (Evaporation Pond, a non-CCR unit) |
| MW1-90 | Sulfate | 3.2.3, 3.3.1 | Natural variation (pre-landfill values, upgradient groundwater, and geologic background) and/or Other (Evaporation Pond, a non-CCR unit) |
| MW1-90 | TDS | 3.2.2, 3.3.1 | Natural variation (pre-landfill values, upgradient groundwater, and geologic background) and/or Other (Evaporation Pond, a non-CCR unit) |

Based on the foregoing, the alternative source demonstration presented herein meets the requirements of CCR Rule § 257.94(e)(2).

# 5 References


Barr Engineering Co., 2017, Groundwater Monitoring System Documentation. R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. October 2017.

Barr Engineering Co., 2018, 2017 Annual Groundwater Monitoring and Corrective Action Report. R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. January 2018.

Barr Engineering Co., 2019, 2018 Annual Groundwater Monitoring and Corrective Action Report. R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. January 2019.

Barr Engineering Co., 2020, 2019 Annual Groundwater Monitoring and Corrective Action Report. R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. January 2020.

Barr Engineering Co., 2021, 2020 Annual Groundwater Monitoring and Corrective Action Report. R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. January 2021.

Barr Engineering Co., 2022, 2021 Annual Groundwater Monitoring and Corrective Action Report. R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. January 2022.

Barr Engineering Co., 2023, 2022 Annual Groundwater Monitoring and Corrective Action Report. R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. January 2023.

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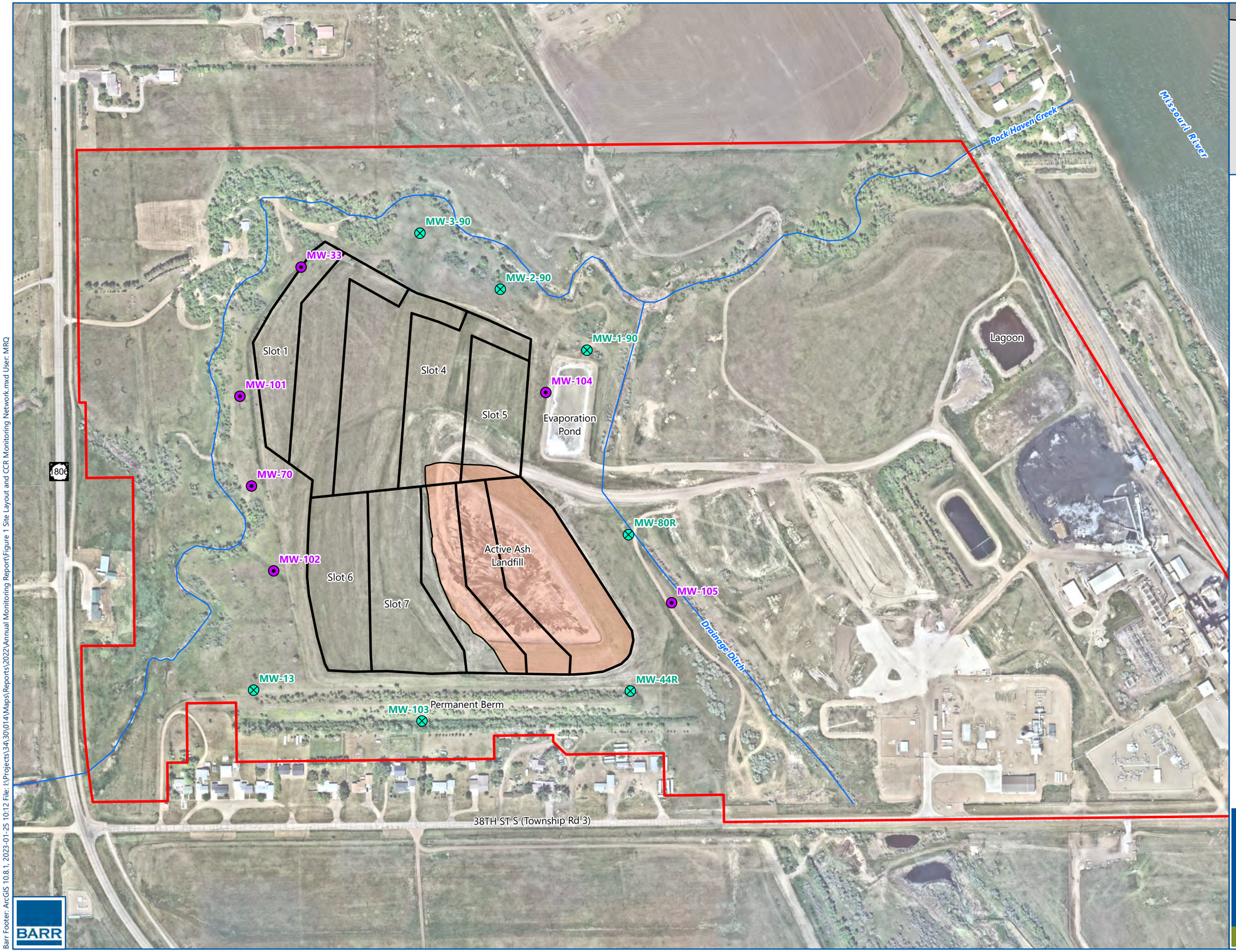
Barr Engineering Co., 2025, 2024 Annual Groundwater Monitoring and Corrective Action Report. R.M. Heskett Station. Prepared for Montana-Dakota Utilities Co. January 2025.

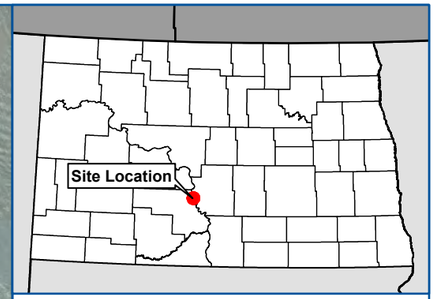
Helsel, D.R., Hirsch, R.M., Ryberg, K.R., Archfield, S.A., and Gilroy, E.J., 2020, Statistical methods in water resources: U.S. Geological Survey Techniques and Methods, book 4, chapter A3, 458 p.

Montana-Dakota Utilities Co. (MDU), 1989, R.M. Heskett Station Special Use Disposal Site Permit Application. Submitted to North Dakota State Department of Health, March 1, 1989.

US EPA, 2015, Hazardous and Solid Waste Management Systems; Management of Coal Combustion Residuals from Electric Utility, CFR Parts 257 and 261, Federal Register, Vol. 80, No. 74, April 17, 2015.

# Figures




- Monitoring Well Location
- Monitoring Well Location - Water Level Only
- Property Boundary
- Existing Slot Boundaries
- Active Portion of Landfill

Image Source: NearMap June 2022

0 350 700
Feet

# SITE LAYOUT AND CCR MONITORING NETWORK
Heskett Station
Montana Dakota Utilities
Mandan, North Dakota

FIGURE 1

BARR

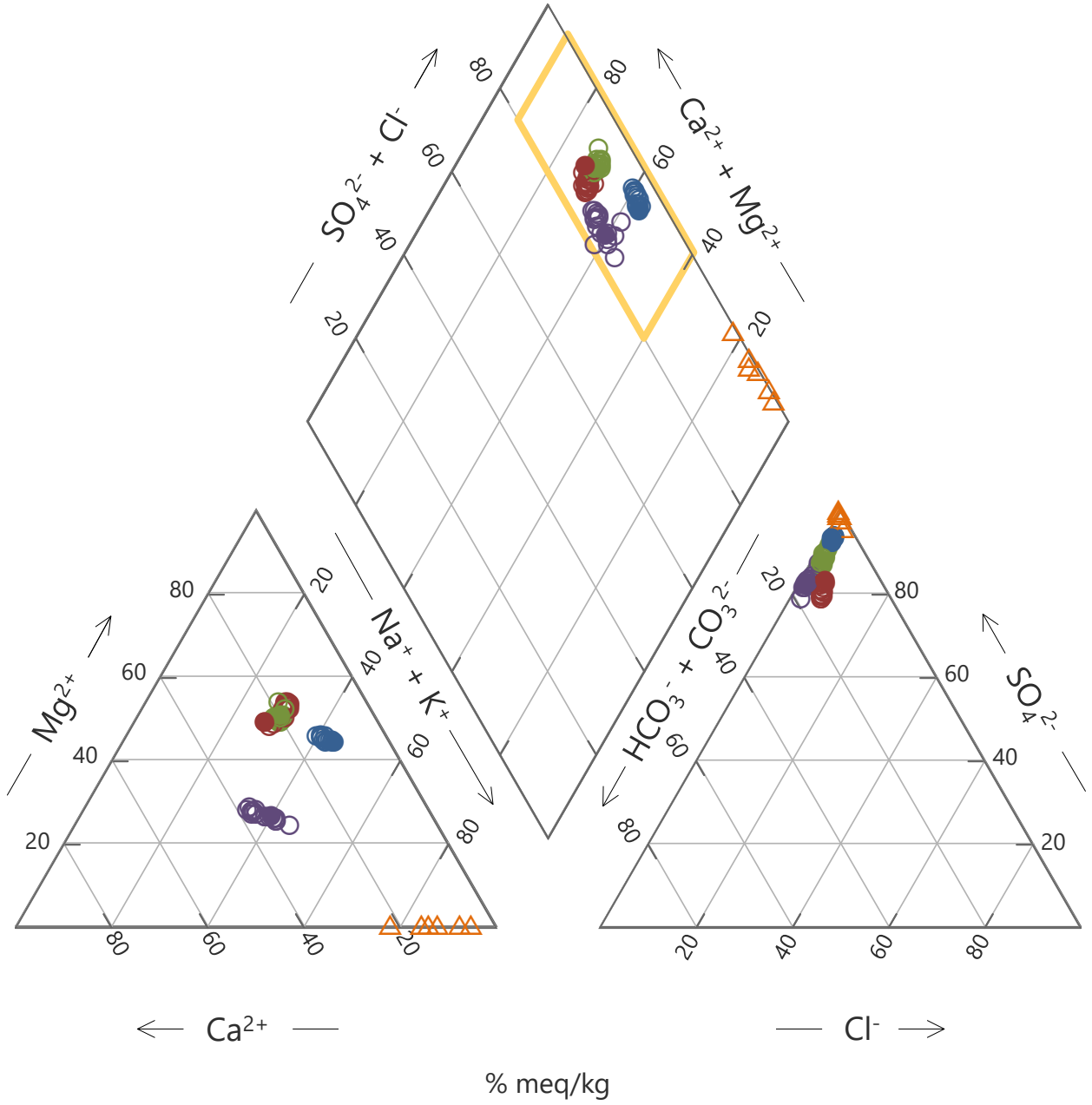



Figure 2
PIPER PLOT: ALTERNATIVE SOURCE DEMONSTRATION
R.M. Heskett Station
Mandan, North Dakota

BARR

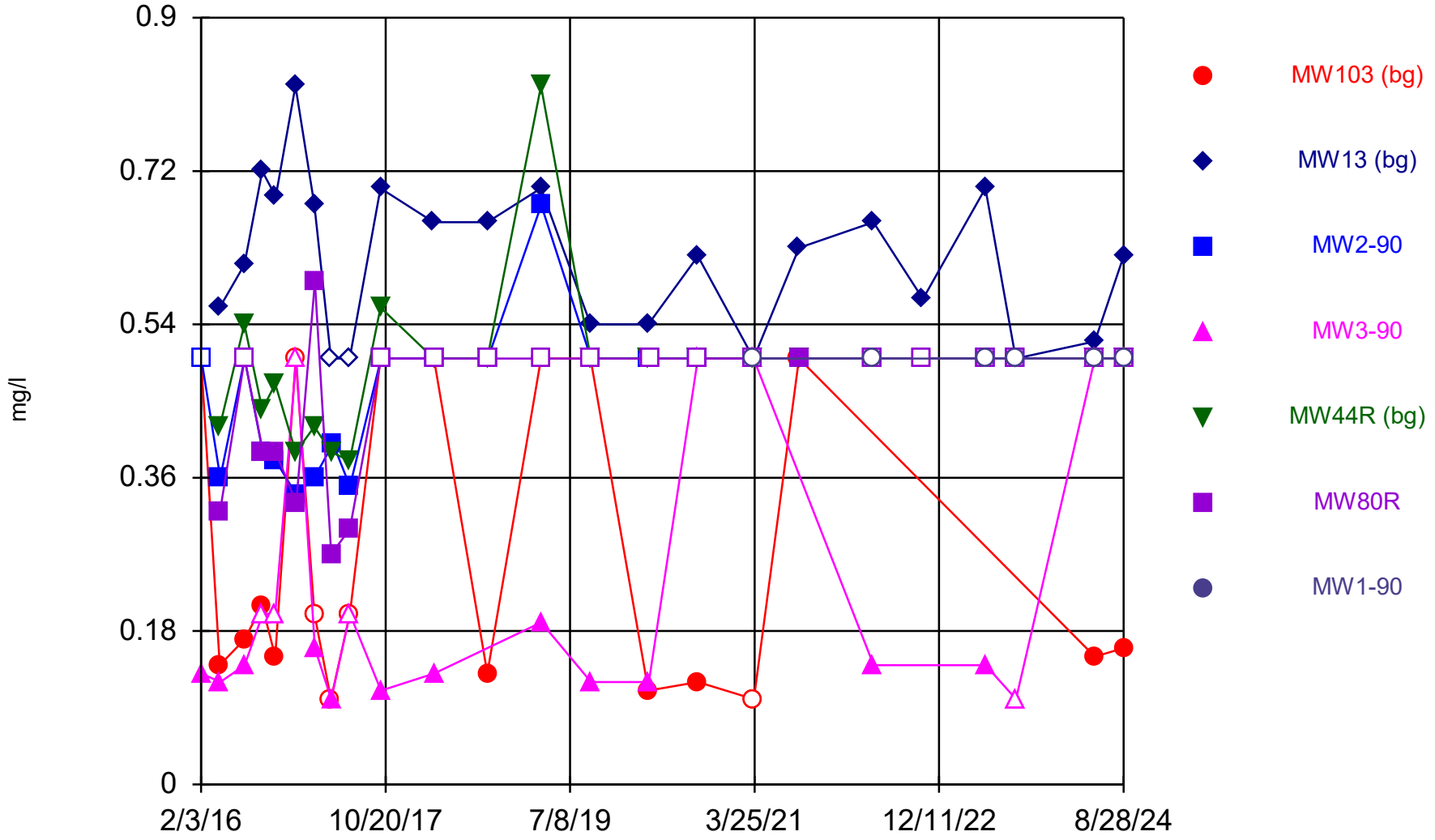
# Appendices

# Appendix A

## Appendix III Time Series Plots

Hollow symbols indicate censored values.

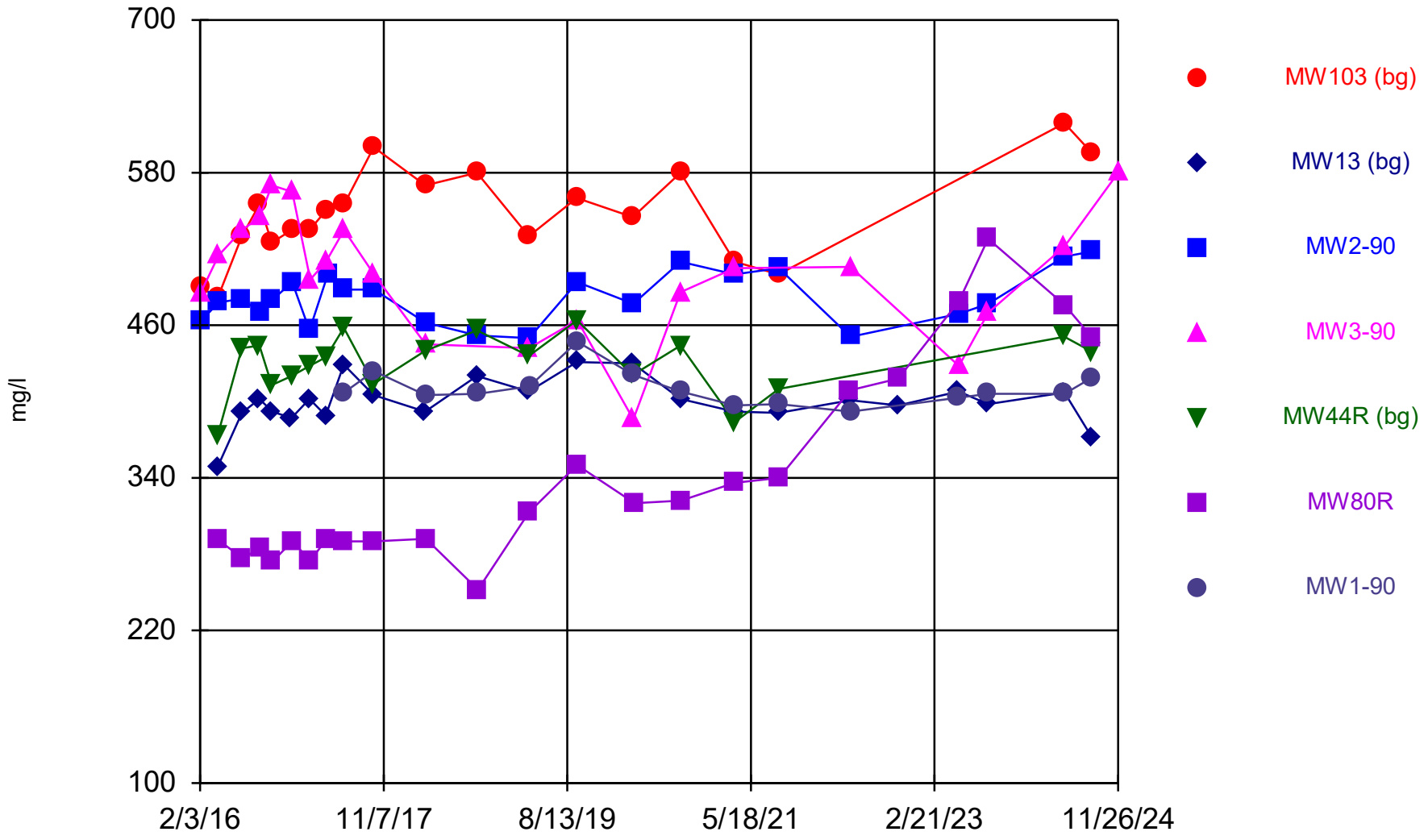
# Boron, total




Time Series Analysis Run 3/17/2025 10:27 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

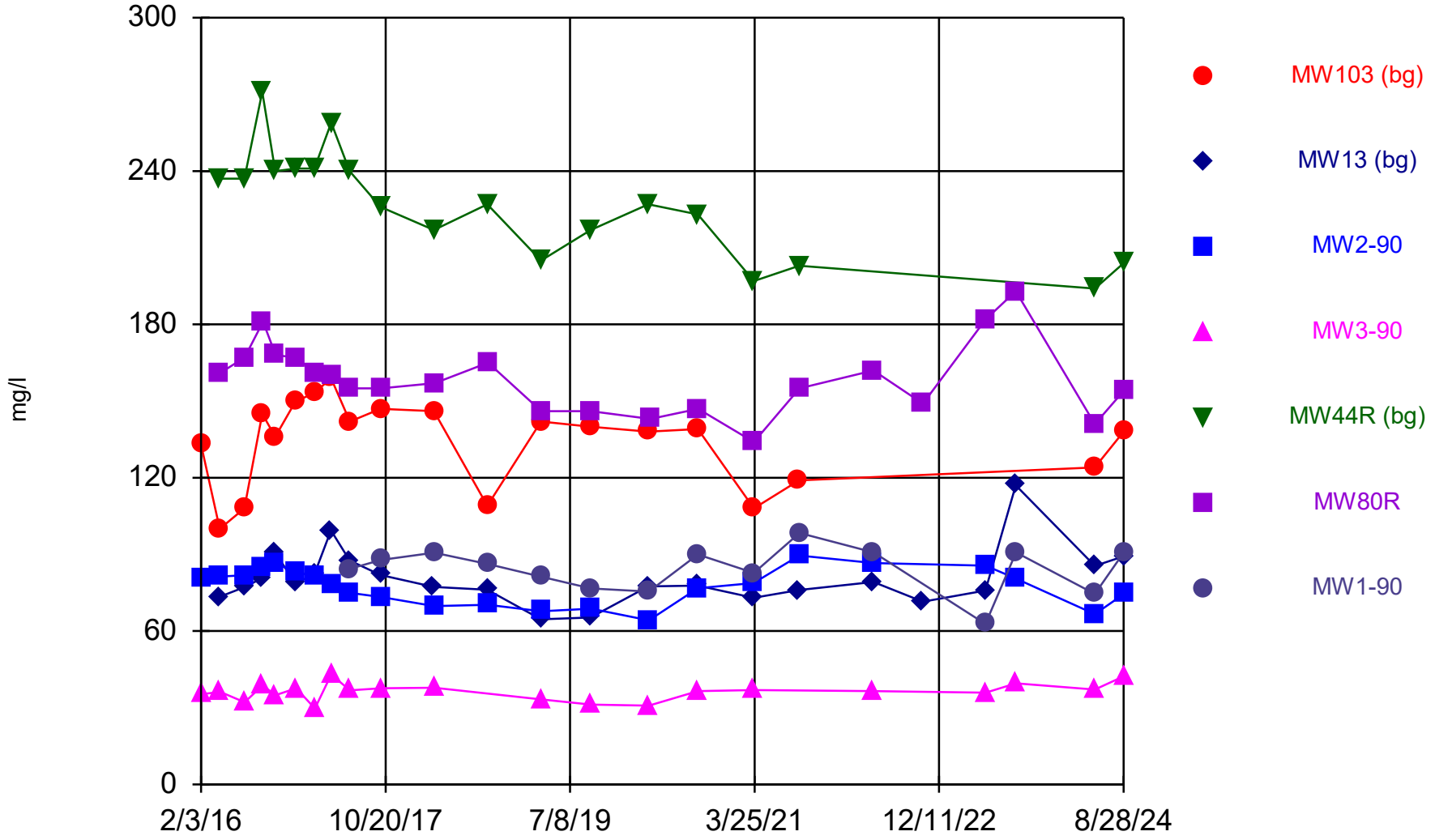
# Calcium, Total




Time Series Analysis Run 3/17/2025 10:27 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

# Chloride




Time Series Analysis Run 3/17/2025 10:27 AM

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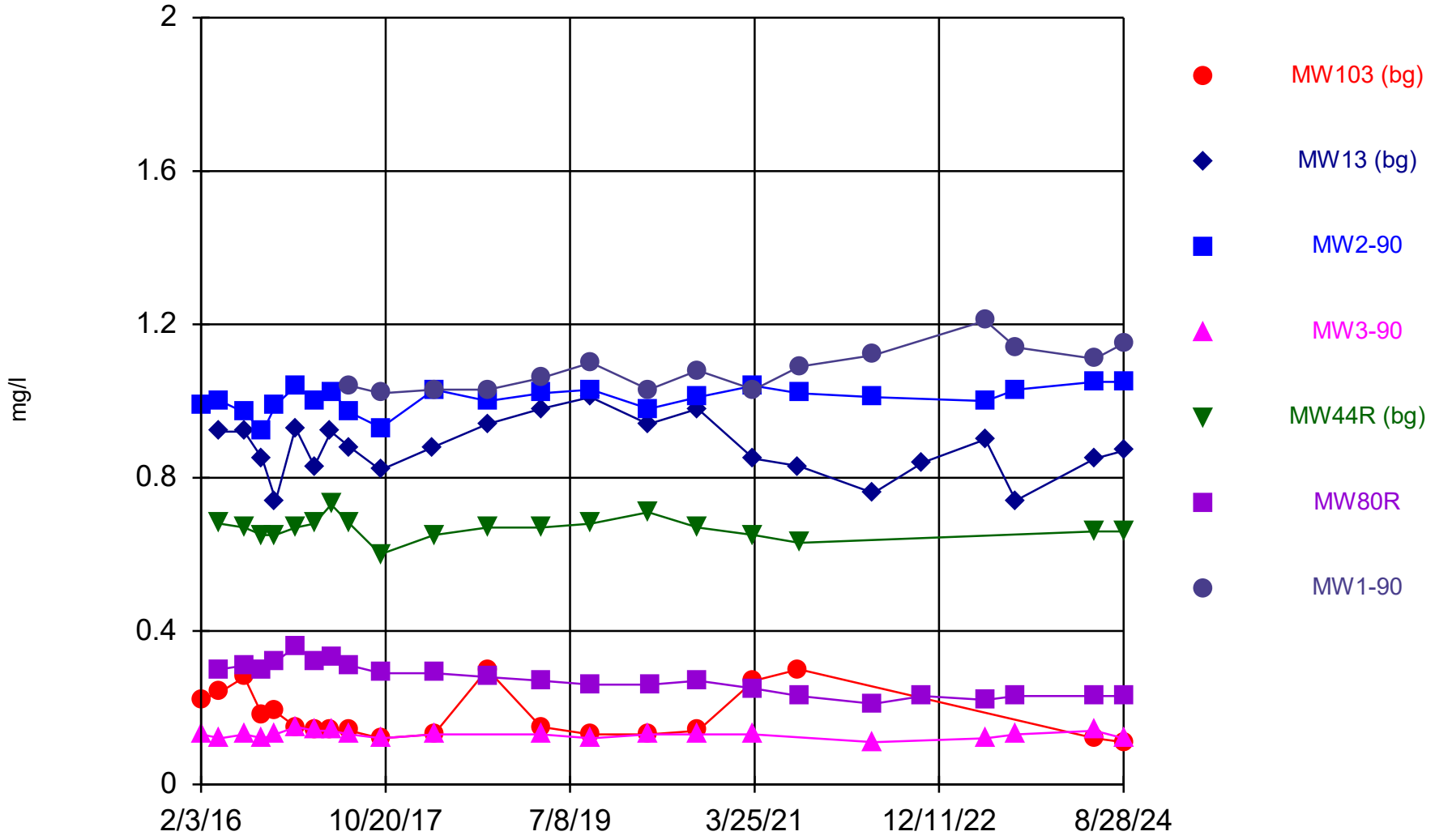
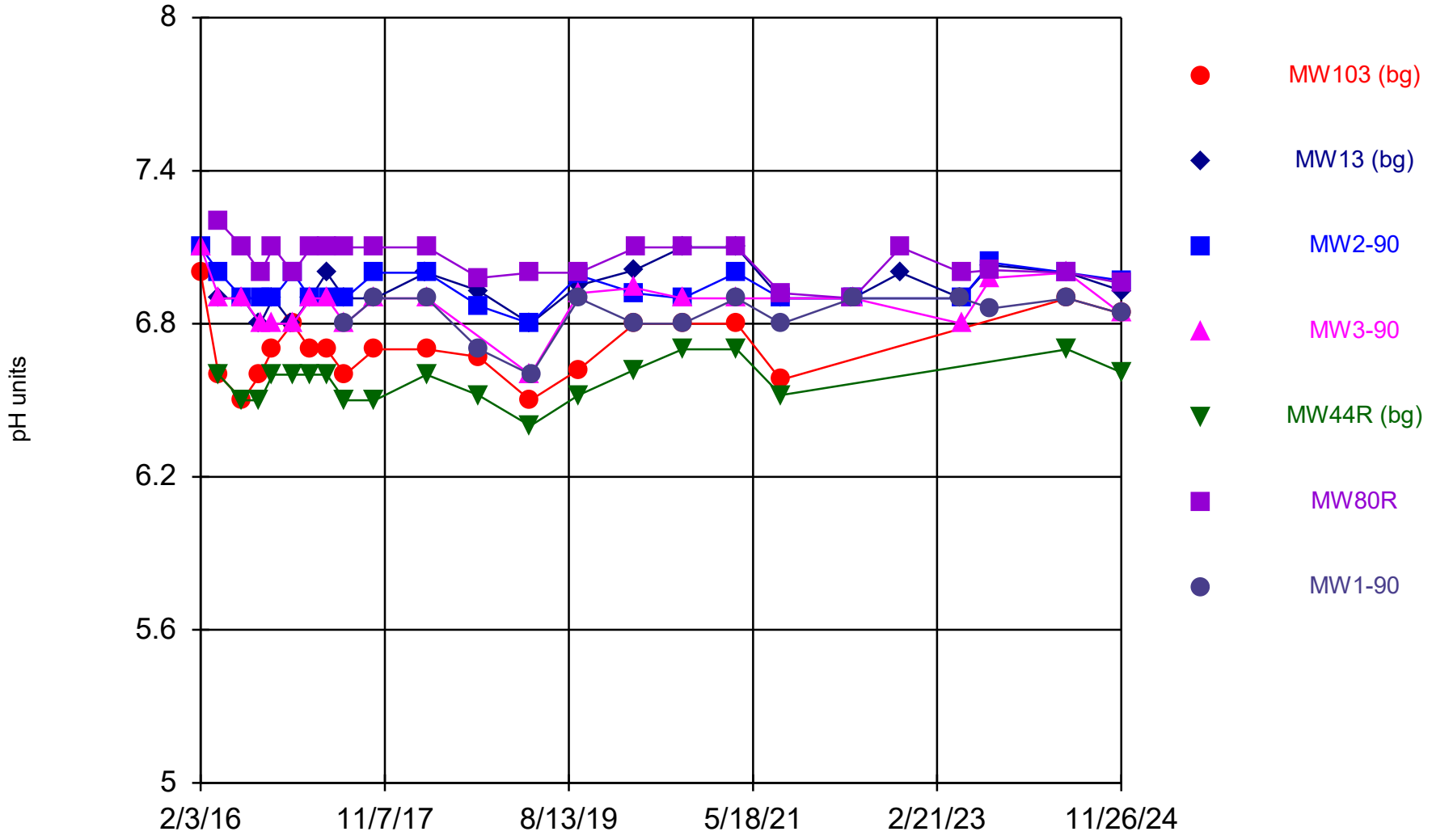
# Fluoride




Time Series Analysis Run 3/17/2025 10:27 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

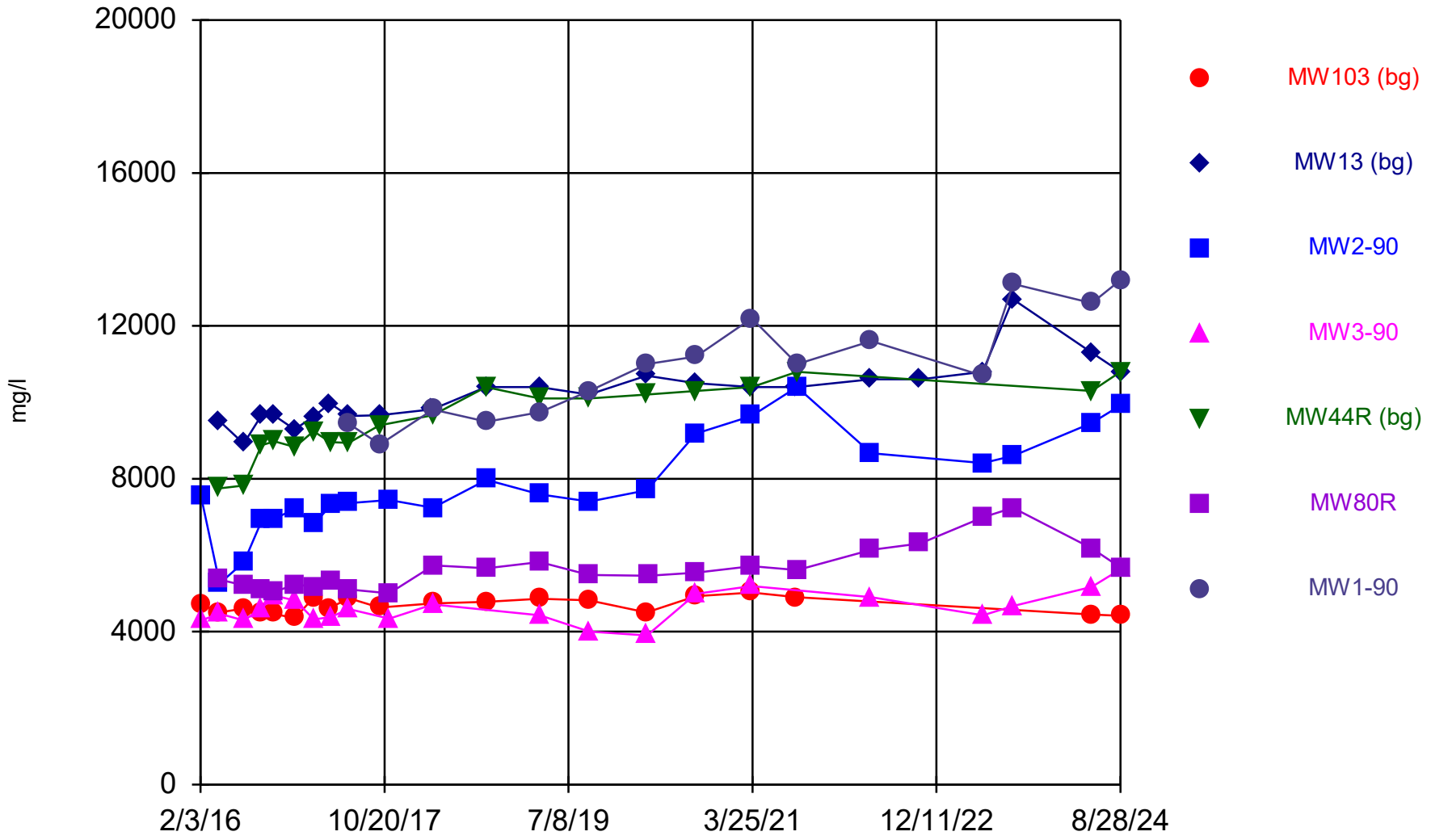
# pH, Field




Time Series Analysis Run 3/17/2025 10:27 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

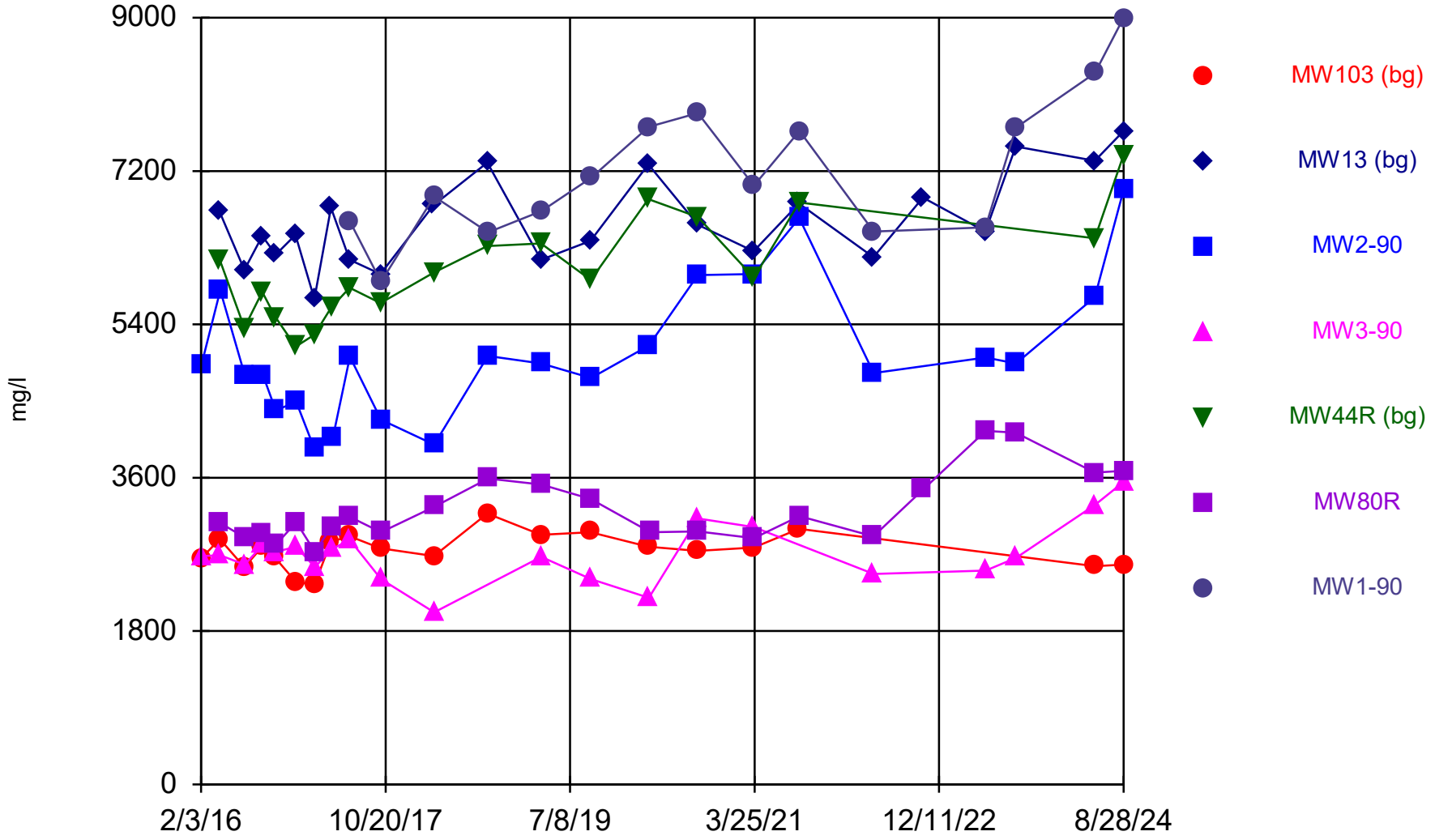
# Solids, total dissolved




Time Series Analysis Run 3/17/2025 10:27 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

# Sulfate, as SO4




Time Series Analysis Run 3/17/2025 10:27 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

# Appendix B

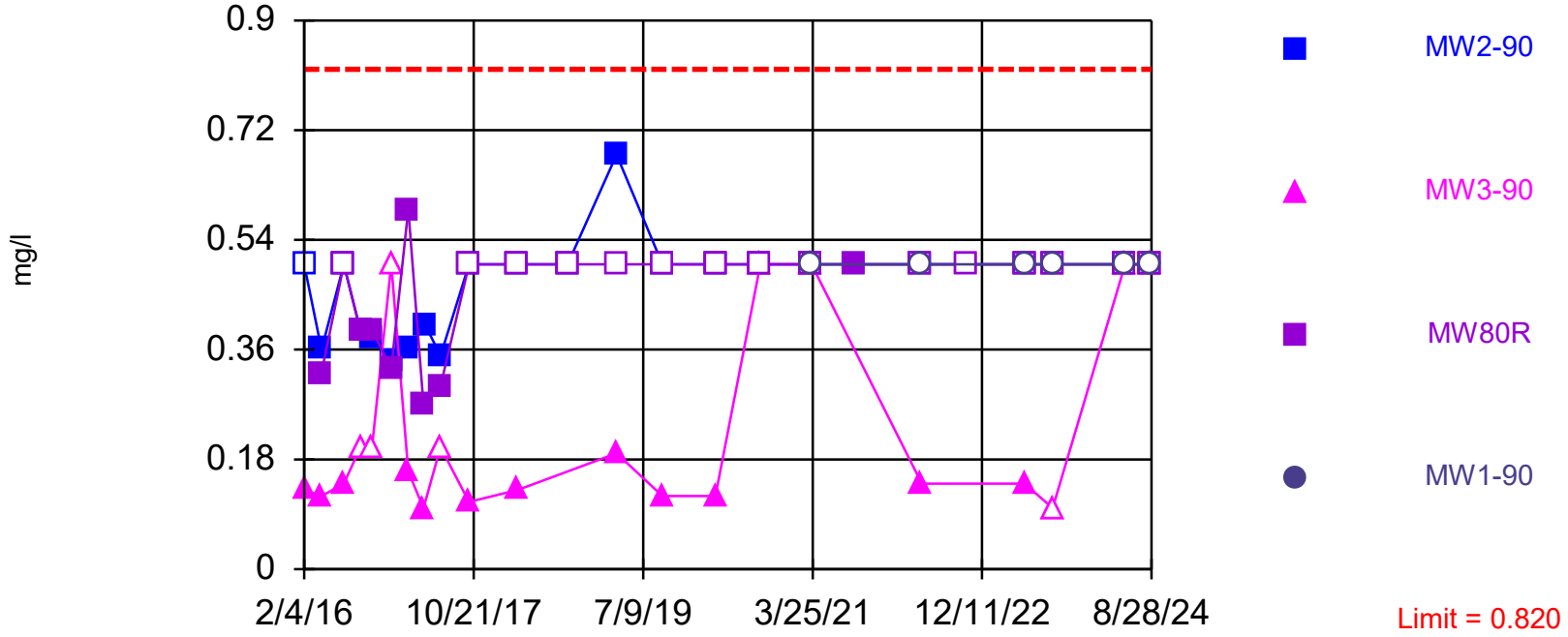
## Prediction Limit Plots

Hollow symbols indicate censored values.

Within Limit

# Boron, total

Interwell Non-parametric




Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 56 background values. 35.71% NDs. Annual per-constituent alpha = 0.004891. Individual comparison alpha = 0.0006126 (1 of 2). Comparing 4 points to limit. Seasonality was not detected with 95% confidence.

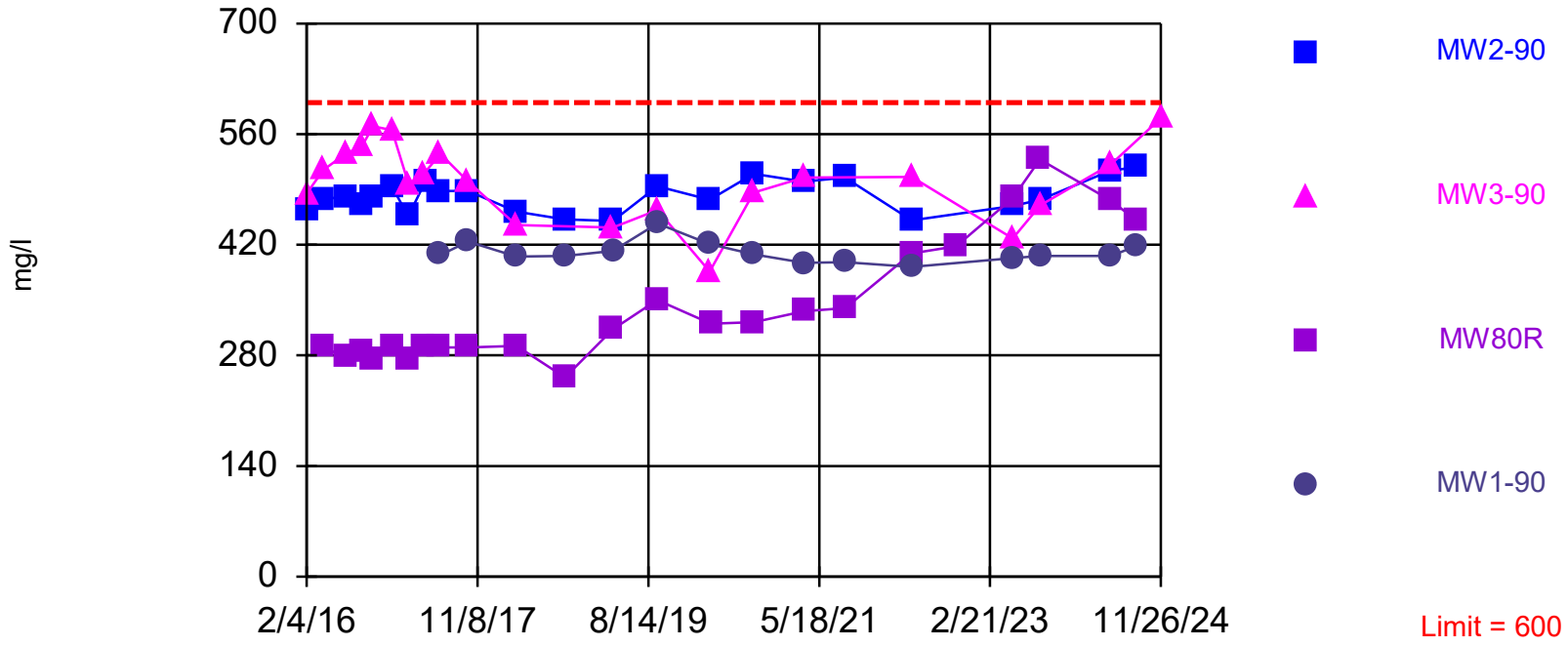
Prediction Limit Analysis Run 3/17/2025 10:32 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Within Limit

# Calcium, Total

Interwell Non-parametric

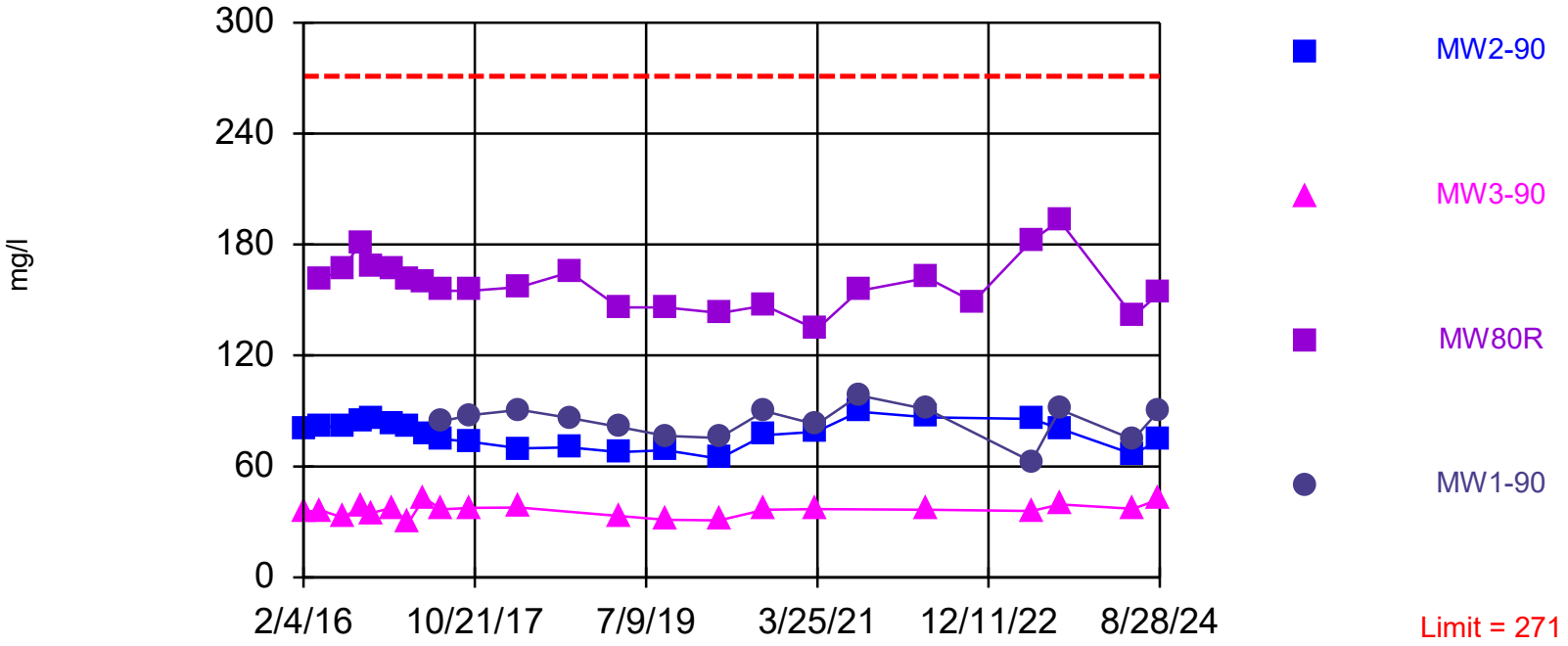



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 56 background values. Annual per-constituent alpha = 0.004891. Individual comparison alpha = 0.0006126 (1 of 2). Comparing 4 points to limit. Seasonality was not detected with 95% confidence.

Within Limit

# Chloride

Interwell Non-parametric




Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 56 background values. Annual per-constituent alpha = 0.004891. Individual comparison alpha = 0.0006126 (1 of 2). Comparing 4 points to limit. Seasonality was not detected with 95% confidence.

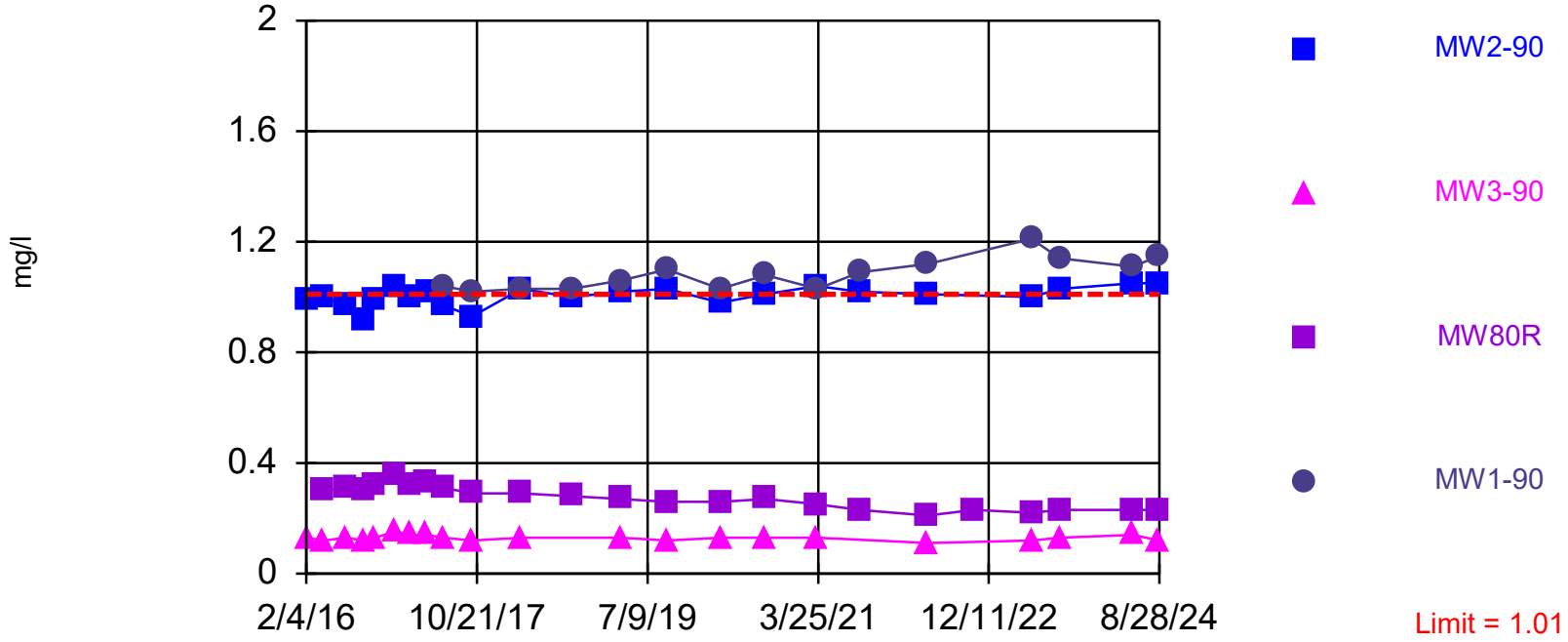
Prediction Limit Analysis Run 3/17/2025 10:32 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Exceeds Limit: MW2-90, MW1-90

# Fluoride

Interwell Non-parametric




Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 56 background values. Annual per-constituent alpha = 0.004891. Individual comparison alpha = 0.0006126 (1 of 2). Comparing 4 points to limit. Seasonality was not detected with 95% confidence.

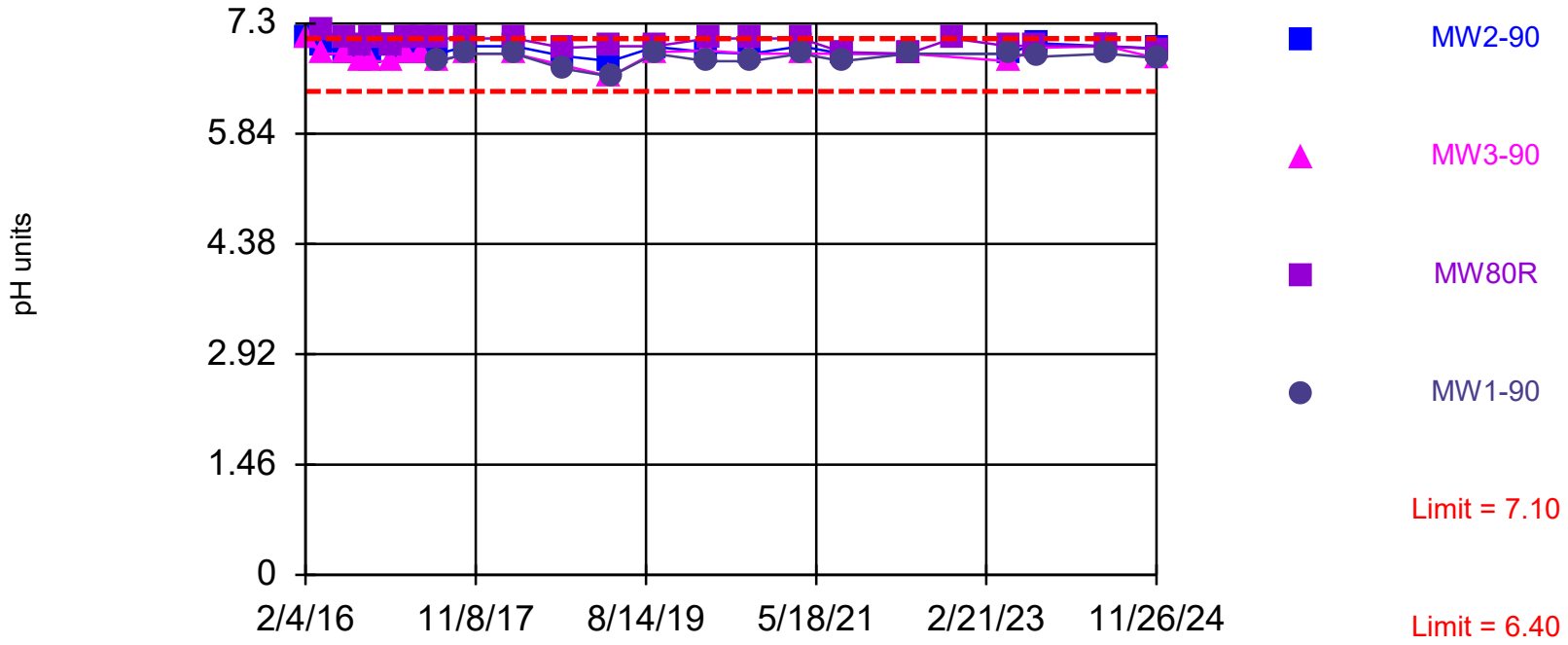
Prediction Limit Analysis Run 3/17/2025 10:32 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Within Limits

# pH, Field

Interwell Non-parametric




Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limits are highest and lowest of 56 background values. Annual per-constituent alpha = 0.009781. Individual comparison alpha = 0.001225 (1 of 2). Comparing 4 points to limit. Seasonality was not detected with 95% confidence.

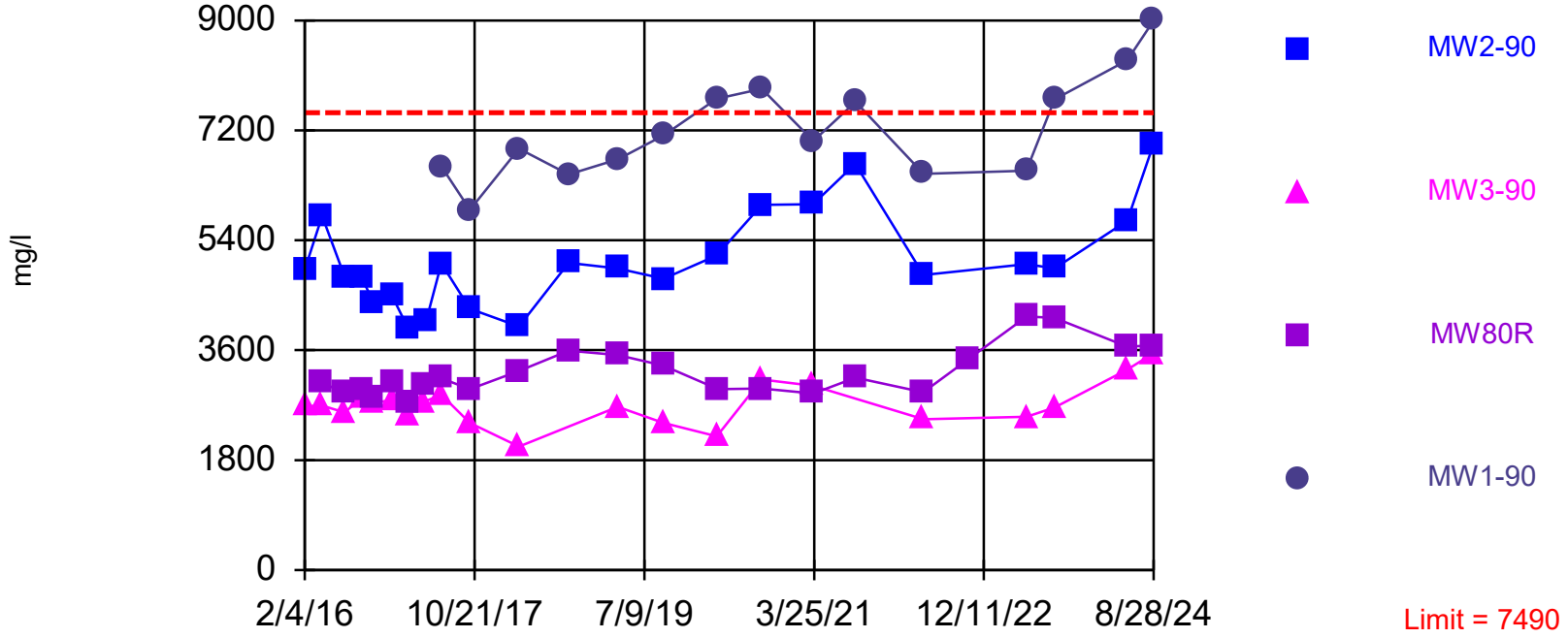
Prediction Limit Analysis Run 3/17/2025 10:32 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Exceeds Limit: MW1-90

# Sulfate, as SO4

Interwell Non-parametric




Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 56 background values. Annual per-constituent alpha = 0.004891. Individual comparison alpha = 0.0006126 (1 of 2). Comparing 4 points to limit. Seasonality was not detected with 95% confidence.

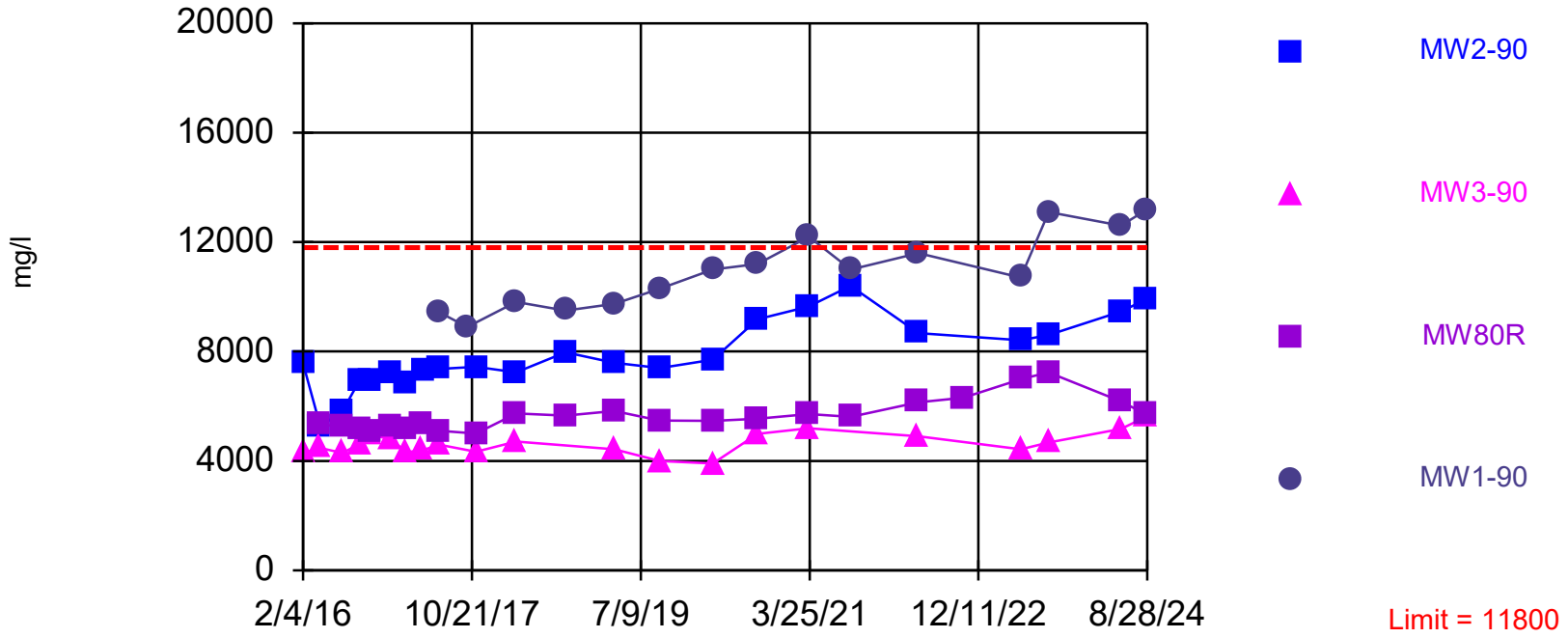
Prediction Limit Analysis Run 3/17/2025 10:32 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

Exceeds Limit: MW1-90

# Solids, total dissolved, Alt. Values

Interwell Non-parametric




Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 54 background values. Annual per-constituent alpha = 0.005242. Individual comparison alpha = 0.0006568 (1 of 2). Comparing 4 points to limit. Seasonality was not detected with 95% confidence.

Prediction Limit, Alt. Values Analysis Run 11/21/2024 10:39 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII

# Prediction Limit

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: Heskett_SanitasAppIII Printed 3/17/2025, 10:33 AM

| Constituent | Well | Upper Lim. | Lower Lim. | Date | Observ. | Sig. | Bg N | %NDs | ND Adj. | Transform | Alpha | Method |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Boron, total (mg/l) | MW2-90 | 0.820 | n/a | 8/28/2024 | 0.5ND | No | 56 | 35.71 | n/a | n/a | 0.0006126 | NP Inter (normality) 1 of 2 |
| Boron, total (mg/l) | MW3-90 | 0.820 | n/a | 8/28/2024 | 0.5ND | No | 56 | 35.71 | n/a | n/a | 0.0006126 | NP Inter (normality) 1 of 2 |
| Boron, total (mg/l) | MW80R | 0.820 | n/a | 8/28/2024 | 0.5ND | No | 56 | 35.71 | n/a | n/a | 0.0006126 | NP Inter (normality) 1 of 2 |
| Boron, total (mg/l) | MW1-90 | 0.820 | n/a | 8/28/2024 | 0.5ND | No | 56 | 35.71 | n/a | n/a | 0.0006126 | NP Inter (normality) 1 of 2 |
| Calcium, Total (mg/l) | MW2-90 | 600 | n/a | 8/28/2024 | 518 | No | 56 | 0 | n/a | n/a | 0.0006126 | NP Inter (normality) 1 of 2 |
| Calcium, Total (mg/l) | MW3-90 | 600 | n/a | 11/26/2024 | 580 | No | 56 | 0 | n/a | n/a | 0.0006126 | NP Inter (normality) 1 of 2 |
| Calcium, Total (mg/l) | MW80R | 600 | n/a | 8/28/2024 | 450 | No | 56 | 0 | n/a | n/a | 0.0006126 | NP Inter (normality) 1 of 2 |
| Calcium, Total (mg/l) | MW1-90 | 600 | n/a | 8/28/2024 | 419 | No | 56 | 0 | n/a | n/a | 0.0006126 | NP Inter (normality) 1 of 2 |
| Chloride (mg/l) | MW2-90 | 271 | n/a | 8/28/2024 | 74.4 | No | 56 | 0 | n/a | n/a | 0.0006126 | NP Inter (normality) 1 of 2 |
| Chloride (mg/l) | MW3-90 | 271 | n/a | 8/28/2024 | 42.3 | No | 56 | 0 | n/a | n/a | 0.0006126 | NP Inter (normality) 1 of 2 |
| Chloride (mg/l) | MW80R | 271 | n/a | 8/28/2024 | 154 | No | 56 | 0 | n/a | n/a | 0.0006126 | NP Inter (normality) 1 of 2 |
| Chloride (mg/l) | MW1-90 | 271 | n/a | 8/28/2024 | 90.6 | No | 56 | 0 | n/a | n/a | 0.0006126 | NP Inter (normality) 1 of 2 |
| **Fluoride (mg/l)** | **MW2-90** | **1.01** | **n/a** | **8/28/2024** | **1.05** | **Yes** | **56** | **0** | **n/a** | **n/a** | **0.0006126** | **NP Inter (normality) 1 of 2** |
| Fluoride (mg/l) | MW3-90 | 1.01 | n/a | 8/28/2024 | 0.12 | No | 56 | 0 | n/a | n/a | 0.0006126 | NP Inter (normality) 1 of 2 |
| Fluoride (mg/l) | MW80R | 1.01 | n/a | 8/28/2024 | 0.23 | No | 56 | 0 | n/a | n/a | 0.0006126 | NP Inter (normality) 1 of 2 |
| **Fluoride (mg/l)** | **MW1-90** | **1.01** | **n/a** | **8/28/2024** | **1.15** | **Yes** | **56** | **0** | **n/a** | **n/a** | **0.0006126** | **NP Inter (normality) 1 of 2** |
| pH, Field (pH units) | MW2-90 | 7.10 | 6.40 | 11/26/2024 | 6.97 | No | 56 | 0 | n/a | n/a | 0.001225 | NP Inter (normality) 1 of 2 |
| pH, Field (pH units) | MW3-90 | 7.10 | 6.40 | 11/26/2024 | 6.84 | No | 56 | 0 | n/a | n/a | 0.001225 | NP Inter (normality) 1 of 2 |
| pH, Field (pH units) | MW80R | 7.10 | 6.40 | 11/26/2024 | 6.96 | No | 56 | 0 | n/a | n/a | 0.001225 | NP Inter (normality) 1 of 2 |
| pH, Field (pH units) | MW1-90 | 7.10 | 6.40 | 11/26/2024 | 6.84 | No | 56 | 0 | n/a | n/a | 0.001225 | NP Inter (normality) 1 of 2 |
| Sulfate, as SO4 (mg/l) | MW2-90 | 7490 | n/a | 8/28/2024 | 6980 | No | 56 | 0 | n/a | n/a | 0.0006126 | NP Inter (normality) 1 of 2 |
| Sulfate, as SO4 (mg/l) | MW3-90 | 7490 | n/a | 8/28/2024 | 3550 | No | 56 | 0 | n/a | n/a | 0.0006126 | NP Inter (normality) 1 of 2 |
| Sulfate, as SO4 (mg/l) | MW80R | 7490 | n/a | 8/28/2024 | 3680 | No | 56 | 0 | n/a | n/a | 0.0006126 | NP Inter (normality) 1 of 2 |
| **Sulfate, as SO4 (mg/l)** | **MW1-90** | **7490** | **n/a** | **8/28/2024** | **9000** | **Yes** | **56** | **0** | **n/a** | **n/a** | **0.0006126** | **NP Inter (normality) 1 of 2** |
| Solids, total dissolved (mg/l) | MW2-90 | 11800 | n/a | 8/28/2024 | 9920 | No | 54 | 0 | n/a | n/a | 0.000... | NP Inter (normality) ... |
| Solids, total dissolved (mg/l) | MW3-90 | 11800 | n/a | 8/28/2024 | 5630 | No | 54 | 0 | n/a | n/a | 0.000... | NP Inter (normality) ... |
| Solids, total dissolved (mg/l) | MW80R | 11800 | n/a | 8/28/2024 | 5680 | No | 54 | 0 | n/a | n/a | 0.000... | NP Inter (normality) ... |
| **Solids, total dissolved (mg/l)** | **MW1-90** | 11800 | **n/a** | **8/28/2024** | **13200** | **Yes** | **54** | **0** | **n/a** | **n/a** | **0.000...** | **NP Inter (normality) ...** |

# Appendix C

## Ash SPLP Laboratory Report (2011)

# MINNESOTA VALLEY TESTING LABORATORIES, INC.

1126 North Front St. ~ New Ulm, MN 56073 ~ 800-782-3557 ~ Fax 507-359-2890
2616 East Broadway Ave. ~ Bismarck, ND 58501 ~ 800-279-6885 ~ Fax 701-258-9724
51 West Lincoln Way ~ Nevada, IA 50201 ~ 800-362-0855 ~ Fax 515-382-3885
www.mvtl.com

MEMBER ACIL




Report Date: 8 Sep 11
Lab Number: 11-M2450
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit I Bottom Ash
Sample Site: MDU Heskett

| | As Received Result | | Method RL | Method Reference | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| SPLP Extraction | | | | 1312 | 22 Jul 11 | SS |
| pH | 12.2 | units | N/A | SM4500 H+ B | 22 Jul 11 17:00 | Claudette |
| Specific Conductance | 8778 | umhos/cm | N/A | SM2510-B | 22 Jul 11 17:00 | Claudette |
| Total Suspended Solids | 3 | mg/l | 1 | SM2540-D | 22 Jul 11 14:00 | CLB |
| Total Alkalinity | 1120 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Phenolphthalein Alk | 1090 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Bicarbonate | < 4 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Carbonate | 60 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Hydroxide | 1060 | mg/l CaCO3 | 0 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Tot Dis Solids(Summation) | 4860 | mg/l | NA | SM1030-F | 3 Aug 11 8:40 | Calculated |
| Total Hardness as CaCO3 | 524 | mg/l | NA | SM2340-B | 3 Aug 11 8:40 | Calculated |
| Hardness in grains/gallon | 30.7 | gr/gal | NA | SM2340-B | 3 Aug 11 8:40 | Calculated |
| Cation Summation | 74.3 | meq/L | NA | SM1030-F | 3 Aug 11 8:40 | Calculated |
| Anion Summation | 74.6 | meq/L | NA | SM1030-F | 28 Jul 11 14:30 | Calculated |
| Percent Error | -0.24 | % | NA | SM1030-F | 3 Aug 11 8:40 | Calculated |
| Sodium Adsorption Ratio | 27.1 | | NA | USDA 20b | 3 Aug 11 8:40 | Calculated |
| Gross Alpha Radiation | Attached | pCi/l | | | 22 Aug 11 2:03 | |
| Radon 222 | Attached | | | | 28 Jul 11 4:37 | |
| Radium 226 | Attached | pCi/l | | | 22 Aug 11 22:20 | |
| Radium 228 | Attached | pCi/l | | | 16 Aug 11 16:50 | |
| Total Organic Carbon | 0.7 | mg/l | 0.5 | SM5310-C | 1 Aug 11 8:00 | Eric |
| Fluoride | < 0.1 | mg/l | 0.10 | SM4500-F-C | 4 Aug 11 17:00 | CLB |
| Sulfate | 2440 | mg/l | 5.00 | ASTM D516-02 | 27 Jul 11 9:00 | KMP |
| Chloride | 50.5 | mg/l | 1.0 | SM4500-Cl-E | 27 Jul 11 14:00 | KMP |
| Nitrate-Nitrite as N | 0.21 | mg/l | 0.10 | EPA 353.2 | 28 Jul 11 14:30 | KMP |
| Ammonia-Nitrogen as N | 0.32 | mg/l | 0.10 | EPA 350.1 | 28 Jul 11 10:45 | KMP |
| Phosphorus as P - Total | < 0.1 | mg/l | 0.10 | EPA 365.1 | 28 Jul 11 13:00 | KMP |
| Mercury - Total | < 0.0002 | mg/l | 0.0002 | EPA 245.1 | 28 Jul 11 8:00 | Eric |
| Chemical Oxygen Demand | < 5 | mg/l | 5.0 | HACH 8000 | 1 Aug 11 8:30 | Wayne |
| Calcium - Total | 210 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Magnesium - Total | < 2.5 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Sodium - Total | 1440 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Potassium - Total | 44.8 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Aluminum - Total | < 0.5 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Iron - Total | < 0.5 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Strontium - Total | 28.2 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Titanium - Total | < 0.5 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Boron - Total | < 0.5 | mg/l | 0.10 | 6010 | 11 Aug 11 8:40 | Stacy |

RL = Method Reporting Limit

Elevated "Less Than Result" (<): @ = Due to sample matrix
! = Due to sample quantity
# = Due to sample concentration
+ = Due to extract volume

CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

MINNESOTA VALLEY TESTING LABORATORIES, INC.
1126 North Front St. ~ New Ulm, MN 56073 ~ 800-782-3557 ~ Fax 507-359-2890
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www.mvtl.com
MEMBER ACIL



Report Date: 8 Sep 11
Lab Number: 11-M2450
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit I Bottom Ash
Sample Site: MDU Heskett

| | As Received Result | | Method RL | Method Reference | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| Antimony - Total | < 0.002 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Arsenic - Total | 0.0044 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Barium - Total | 0.1135 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Beryllium - Total | < 0.001 | mg/l | 0.0010 | 6020 | 25 Jul 11 16:18 | Claudette |
| Cadmium - Total | 0.00164 | mg/l | 0.00100 | 6020 | 25 Jul 11 16:18 | Claudette |
| Chromium - Total | 0.0065 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Cobalt - Total | < 0.002 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Copper - Total | 0.0213 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Lead - Total | < 0.002 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Manganese - Total | 0.0027 | mg/l | 0.0010 | 6020 | 25 Jul 11 16:18 | Claudette |
| Molybdenum - Total | 0.6860 | mg/l | 0.0020 | 6020 | 26 Jul 11 12:46 | Claudette |
| Nickel - Total | 0.0074 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Selenium - Total | 0.0133 | mg/l | 0.0020 | 6020 | 26 Jul 11 9:46 | Claudette |
| Silver - Total | < 0.001 | mg/l | 0.0010 | 6020 | 25 Jul 11 16:18 | Claudette |
| Thallium - Total | < 0.002 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Tin - Total | < 0.05 | mg/l | 0.0500 | 6020 | 25 Jul 11 16:18 | Claudette |
| Vanadium - Total | 0.0189 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Zinc - Total | 0.0151 | mg/l | 0.0100 | 6020 | 25 Jul 11 16:18 | Claudette |
| Uranium | < 0.002 | mg/l | 0.002 | 6020 | 25 Jul 11 16:18 | Claudette |

All analyses were performed on the extract from Method 1312 (SPLP) with a modified solution to solids ratio of 4:1.

Approved by: D. Zander

RL = Method Reporting Limit

Elevated "Less Than Result" (<): @ = Due to sample matrix
! = Due to sample quantity
# = Due to sample concentration
+ = Due to extract volume

CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

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MEMBER ACIL



Report Date: 8 Sep 11
Lab Number: 11-M2451
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit II Sand Ash
Sample Site: MDU Heskett

| | As Received Result | | Method RL | Method Reference | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| SPLP Extraction | | | | 1312 | 22 Jul 11 | SS |
| pH | 11.1 | units | N/A | SM4500 H+ B | 22 Jul 11 17:00 | Claudette |
| Specific Conductance | 20110 | umhos/cm | N/A | SM2510-B | 22 Jul 11 17:00 | Claudette |
| Total Suspended Solids | 21 | mg/l | 1 | SM2540-D | 22 Jul 11 14:00 | CLB |
| Total Alkalinity | 203 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Phenolphthalein Alk | 171 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Bicarbonate | < 4 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Carbonate | 64 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Hydroxide | 139 | mg/l CaCO3 | 0 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Tot Dis Solids(Summation) | 22500 | mg/l | NA | SM1030-F | 3 Aug 11 8:40 | Calculated |
| Total Hardness as CaCO3 | 1200 | mg/l | NA | SM2340-B | 3 Aug 11 8:40 | Calculated |
| Hardness in grains/gallon | 70.2 | gr/gal | NA | SM2340-B | 3 Aug 11 8:40 | Calculated |
| Cation Summation | 318 | meq/L | NA | SM1030-F | 3 Aug 11 8:40 | Calculated |
| Anion Summation | 314 | meq/L | NA | SM1030-F | 28 Jul 11 14:30 | Calculated |
| Percent Error | 0.65 | % | NA | SM1030-F | 3 Aug 11 8:40 | Calculated |
| Sodium Adsorption Ratio | 80.9 | | NA | USDA 20b | 3 Aug 11 8:40 | Calculated |
| Gross Alpha Radiation | Attached | pCi/l | | | 22 Aug 11 2:03 | |
| Radon 222 | See Attached | | | | 28 Jul 11 4:37 | |
| Radium 226 | Attached | pCi/l | | | 22 Aug 11 22:20 | |
| Radium 228 | Attached | pCi/l | | | 16 Aug 11 16:50 | |
| Total Organic Carbon | < 0.5 | mg/l | 0.5 | SM5310-C | 1 Aug 11 8:00 | Eric |
| Fluoride | < 0.1 | mg/l | 0.10 | SM4500-F-C | 4 Aug 11 17:00 | CLB |
| Sulfate | 14900 | mg/l | 5.00 | ASTM D516-02 | 27 Jul 11 9:00 | KMP |
| Chloride | 2.0 | mg/l | 1.0 | SM4500-Cl-E | 27 Jul 11 14:00 | KMP |
| Nitrate-Nitrite as N | < 0.1 | mg/l | 0.10 | EPA 353.2 | 28 Jul 11 14:30 | KMP |
| Ammonia-Nitrogen as N | 0.10 | mg/l | 0.10 | EPA 350.1 | 28 Jul 11 10:45 | KMP |
| Phosphorus as P - Total | < 0.1 | mg/l | 0.10 | EPA 365.1 | 28 Jul 11 13:00 | KMP |
| Mercury - Total | < 0.0002 | mg/l | 0.0002 | EPA 245.1 | 28 Jul 11 8:00 | Eric |
| Chemical Oxygen Demand | < 5 | mg/l | 5.0 | HACH 8000 | 1 Aug 11 8:30 | Wayne |
| Calcium - Total | 481 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Magnesium - Total | < 5 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Sodium - Total | 6500 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Potassium - Total | 459 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Aluminum - Total | 1.09 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Iron - Total | < 1 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Strontium - Total | 66.0 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Titanium - Total | < 1 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Boron - Total | 5.96 | mg/l | 0.10 | 6010 | 11 Aug 11 8:40 | Stacy |

RL = Method Reporting Limit

Elevated "Less Than Result" (<): @ = Due to sample matrix
! = Due to sample quantity
# = Due to sample concentration
+ = Due to extract volume

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www.mvtl.com
MEMBER ACIL



Report Date: 8 Sep 11
Lab Number: 11-M2451
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit II Sand Ash
Sample Site: MDU Heskett

| | As Received Result | | Method RL | Method Reference | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| Antimony - Total | < 0.002 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Arsenic - Total | 0.0822 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Barium - Total | 0.0930 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Beryllium - Total | < 0.001 | mg/l | 0.0010 | 6020 | 25 Jul 11 16:18 | Claudette |
| Cadmium - Total | 0.00182 | mg/l | 0.00100 | 6020 | 25 Jul 11 16:18 | Claudette |
| Chromium - Total | 0.0244 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Cobalt - Total | < 0.002 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Copper - Total | 0.1108 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Lead - Total | < 0.002 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Manganese - Total | 0.0052 | mg/l | 0.0010 | 6020 | 25 Jul 11 16:18 | Claudette |
| Molybdenum - Total | 0.1000 | mg/l | 0.0020 | 6020 | 26 Jul 11 12:46 | Claudette |
| Nickel - Total | 0.0136 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Selenium - Total | 0.0937 | mg/l | 0.0020 | 6020 | 26 Jul 11 9:46 | Claudette |
| Silver - Total | < 0.001 | mg/l | 0.0010 | 6020 | 25 Jul 11 16:18 | Claudette |
| Thallium - Total | < 0.002 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Tin - Total | < 0.05 | mg/l | 0.0500 | 6020 | 25 Jul 11 16:18 | Claudette |
| Vanadium - Total | 0.3026 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Zinc - Total | 0.0327 | mg/l | 0.0100 | 6020 | 25 Jul 11 16:18 | Claudette |
| Uranium | < 0.002 | mg/l | 0.002 | 6020 | 25 Jul 11 16:18 | Claudette |

All analyses were performed on the extract from Method 1312 (SPLP) with a modified solution to solids ratio of 4:1.

Approved by: D. Zander

RL = Method Reporting Limit

Elevated "Less Than Result" (<): @ = Due to sample matrix
! = Due to sample quantity
# = Due to sample concentration
+ = Due to extract volume

CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

MINNESOTA VALLEY TESTING LABORATORIES, INC.
1126 North Front St. ~ New Ulm, MN 56073 ~ 800-782-3557 ~ Fax 507-359-2890
2616 East Broadway Ave. ~ Bismarck, ND 58501 ~ 800-279-6885 ~ Fax 701-258-9724
51 West Lincoln Way ~ Nevada, IA 50201 ~ 800-362-0855 ~ Fax 515-382-3885
www.mvtl.com

MEMBER ACIL



Report Date: 8 Sep 11
Lab Number: 11-M2452
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit I Fly Ash
Sample Site: MDU Heskett

| | As Received Result | | Method RL | Method Reference | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| SPLP Extraction | | | | 1312 | 22 Jul 11 | SS |
| pH | 12.9 | units | N/A | SM4500 H+ B | 22 Jul 11 17:00 | Claudette |
| Specific Conductance | 50660 | umhos/cm | N/A | SM2510-B | 22 Jul 11 17:00 | Claudette |
| Total Suspended Solids | 30 | mg/l | 1 | SM2540-D | 22 Jul 11 14:00 | CLB |
| Total Alkalinity | 7020 | mg/l CaCO3 | 4 | SM2320-B | 25 Jul 11 17:00 | Claudette |
| Phenolphthalein Alk | 6900 | mg/l CaCO3 | 4 | SM2320-B | 25 Jul 11 17:00 | Claudette |
| Bicarbonate | < 4 | mg/l CaCO3 | 4 | SM2320-B | 25 Jul 11 17:00 | Claudette |
| Carbonate | 240 | mg/l CaCO3 | 4 | SM2320-B | 25 Jul 11 17:00 | Claudette |
| Hydroxide | 6780 | mg/l CaCO3 | 0 | SM2320-B | 25 Jul 11 17:00 | Claudette |
| Tot Dis Solids(Summation) | 42200 | mg/l | NA | SM1030-F | 3 Aug 11 8:40 | Calculated |
| Total Hardness as CaCO3 | 1750 | mg/l | NA | SM2340-B | 3 Aug 11 8:40 | Calculated |
| Hardness in grains/gallon | 102 | gr/gal | NA | SM2340-B | 3 Aug 11 8:40 | Calculated |
| Cation Summation | 663 | meq/L | NA | SM1030-F | 3 Aug 11 8:40 | Calculated |
| Anion Summation | 613 | meq/L | NA | SM1030-F | 28 Jul 11 14:30 | Calculated |
| Percent Error | 3.99 | % | NA | SM1030-F | 3 Aug 11 8:40 | Calculated |
| Sodium Adsorption Ratio | 143 | | NA | USDA 20b | 3 Aug 11 8:40 | Calculated |
| Gross Alpha Radiation | Attached | pCi/l | | | 22 Aug 11 2:03 | |
| Radon 222 | Attached | | | | 28 Jul 11 4:37 | |
| Radium 226 | Attached | pCi/l | | | 22 Aug 11 22:20 | |
| Radium 228 | Attached | pCi/l | | | 16 Aug 11 16:50 | |
| Total Organic Carbon | 1.5 | mg/l | 0.5 | SM5310-C | 1 Aug 11 8:00 | Eric |
| Fluoride | 5.60 | mg/l | 0.10 | SM4500-F-C | 10 Aug 11 17:00 | CLB |
| Sulfate | 22600 | mg/l | 5.00 | ASTM D516-02 | 27 Jul 11 9:00 | KMP |
| Chloride | 53.8 | mg/l | 1.0 | SM4500-Cl-E | 27 Jul 11 14:00 | KMP |
| Nitrate-Nitrite as N | 0.68 | mg/l | 0.10 | EPA 353.2 | 28 Jul 11 14:30 | KMP |
| Ammonia-Nitrogen as N | 7.22 | mg/l | 0.10 | EPA 350.1 | 28 Jul 11 10:45 | KMP |
| Phosphorus as P - Total | < 0.1 | mg/l | 0.10 | EPA 365.1 | 28 Jul 11 13:00 | KMP |
| Mercury - Total | < 0.0002 | mg/l | 0.0002 | EPA 245.1 | 28 Jul 11 8:00 | Eric |
| Chemical Oxygen Demand | 22.4 | mg/l | 5.0 | HACH 8000 | 1 Aug 11 8:30 | Wayne |
| Calcium - Total | 700 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Magnesium - Total | < 25 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Sodium - Total | 14100 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Potassium - Total | 580 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Aluminum - Total | < 5 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Iron - Total | < 5 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Strontium - Total | 59.5 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Titanium - Total | < 5 | mg/l | 0.10 | 6010 | 2 Aug 11 9:30 | Stacy |
| Boron - Total | 1.89 | mg/l | 0.10 | 6010 | 11 Aug 11 8:40 | Stacy |

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51 West Lincoln Way ~ Nevada, IA 50201 ~ 800-362-0855 ~ Fax 515-382-3885
www.mvtl.com



Report Date: 8 Sep 11
Lab Number: 11-M2452
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit I Fly Ash
Sample Site: MDU Heskett

| | As Received Result | | Method RL | Method Reference | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| Antimony - Total | < 0.002 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Arsenic - Total | 0.1128 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Barium - Total | 0.0906 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Beryllium - Total | < 0.001 | mg/l | 0.0010 | 6020 | 25 Jul 11 16:18 | Claudette |
| Cadmium - Total | 0.00244 | mg/l | 0.00100 | 6020 | 25 Jul 11 16:18 | Claudette |
| Chromium - Total | 0.0270 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Cobalt - Total | < 0.002 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Copper - Total | 0.2934 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Lead - Total | 0.0161 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Manganese - Total | 0.0102 | mg/l | 0.0010 | 6020 | 25 Jul 11 16:18 | Claudette |
| Molybdenum - Total | 0.9246 | mg/l | 0.0020 | 6020 | 26 Jul 11 12:46 | Claudette |
| Nickel - Total | 0.0175 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Selenium - Total | 0.1959 | mg/l | 0.0020 | 6020 | 26 Jul 11 9:46 | Claudette |
| Silver - Total | < 0.001 | mg/l | 0.0010 | 6020 | 25 Jul 11 16:18 | Claudette |
| Thallium - Total | < 0.002 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Tin - Total | < 0.05 | mg/l | 0.0500 | 6020 | 25 Jul 11 16:18 | Claudette |
| Vanadium - Total | 0.0158 | mg/l | 0.0020 | 6020 | 25 Jul 11 16:18 | Claudette |
| Zinc - Total | 0.3984 | mg/l | 0.0100 | 6020 | 25 Jul 11 16:18 | Claudette |
| Uranium | < 0.002 | mg/l | 0.002 | 6020 | 25 Jul 11 16:18 | Claudette |

All analyses were performed on the extract from Method 1312 (SPLP) with a modified solution to solids ratio of 4:1.

Approved by: D. Zarda

RL = Method Reporting Limit

Elevated "Less Than Result" (<): @ = Due to sample matrix
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CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

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MEMBER ACIL



Report Date: 8 Sep 11
Lab Number: 11-M2453
Work Order #:81-818
Account #: 013479
Date Sampled:
Date Received: 28 Jun 11 9:00
PO #: 131460 OP

Duane Leingang
Montana Dakota Utilities
PO Box 40
Mandan ND 58554

Sample Description: Unit II Fly Ash
Sample Site: MDU Heskett

| | As Received Result | | Method RL | Method Reference | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| SPLP Extraction | | | | 1312 | 22 Jul 11 | SS |
| pH | 12.8 | units | N/A | SM4500 H+ B | 22 Jul 11 17:00 | Claudette |
| Specific Conductance | 27240 | umhos/cm | N/A | SM2510-B | 22 Jul 11 17:00 | Claudette |
| Total Suspended Solids | 13 | mg/l | 1 | SM2540-D | 22 Jul 11 14:00 | CLB |
| Total Alkalinity | 4570 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Phenolphthalein Alk | 4520 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Bicarbonate | < 4 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Carbonate | 100 | mg/l CaCO3 | 4 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Hydroxide | 4470 | mg/l CaCO3 | 0 | SM2320-B | 22 Jul 11 17:00 | Claudette |
| Tot Dis Solids(Summation) | 16000 | mg/l | NA | SM1030-F | 3 Aug 11 8:40 | Calculated |
| Total Hardness as CaCO3 | 1960 | mg/l | NA | SM2340-B | 3 Aug 11 8:40 | Calculated |
| Hardness in grains/gallon | 115 | gr/gal | NA | SM2340-B | 3 Aug 11 8:40 | Calculated |
| Cation Summation | 252 | meq/L | NA | SM1030-F | 9 Aug 11 9:09 | Calculated |
| Anion Summation | 247 | meq/L | NA | SM1030-F | 28 Jul 11 14:30 | Calculated |
| Percent Error | 1.00 | % | NA | SM1030-F | 9 Aug 11 9:09 | Calculated |
| Sodium Adsorption Ratio | 46.1 | | NA | USDA 20b | 3 Aug 11 8:40 | Calculated |
| Gross Alpha Radiation | Attached | pCi/l | | | 22 Aug 11 2:03 | |
| Radon 222 | Attached | | | | 28 Jul 11 4:37 | |
| Radium 226 | Attached | pCi/l | | | 22 Aug 11 22:20 | |
| Radium 228 | Attached | pCi/l | | | 16 Aug 11 16:50 | |
| Total Organic Carbon | 1.6 | mg/l | 0.5 | SM5310-C | 1 Aug 11 8:00 | Eric |
| Fluoride | 3.60 | mg/l | 0.10 | SM4500-F-C | 4 Aug 11 17:00 | CLB |
| Sulfate | 7400 | mg/l | 5.00 | ASTM D516-02 | 27 Jul 11 9:00 | KMP |
| Chloride | 66.0 | mg/l | 1.0 | SM4500-Cl-E | 27 Jul 11 14:00 | KMP |
| Nitrate-Nitrite as N | 0.38 | mg/l | 0.10 | EPA 353.2 | 28 Jul 11 14:30 | KMP |
| Ammonia-Nitrogen as N | 15.0 | mg/l | 0.10 | EPA 350.1 | 28 Jul 11 10:45 | KMP |
| Phosphorus as P - Total | < 0.1 | mg/l | 0.10 | EPA 365.1 | 28 Jul 11 13:00 | KMP |
| Mercury - Total | < 0.0002 | mg/l | 0.0002 | EPA 245.1 | 28 Jul 11 8:00 | Eric |
| Chemical Oxygen Demand | 9.4 | mg/l | 5.0 | HACH 8000 | 1 Aug 11 8:30 | Wayne |
| Calcium - Total | 785 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Magnesium - Total | < 5 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Sodium - Total | 4720 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Potassium - Total | 275 | mg/l | 1.0 | 6010 | 3 Aug 11 8:40 | Stacy |
| Aluminum - Total | < 1 | mg/l | 0.10 | 6010 | 9 Aug 11 9:09 | Stacy |
| Iron - Total | < 1 | mg/l | 0.10 | 6010 | 9 Aug 11 9:09 | Stacy |
| Strontium - Total | 85.0 | mg/l | 0.10 | 6010 | 9 Aug 11 9:09 | Stacy |
| Titanium - Total | < 1 | mg/l | 0.10 | 6010 | 9 Aug 11 9:09 | Stacy |
| Boron - Total | < 1 | mg/l | 0.10 | 6010 | 11 Aug 11 8:40 | Stacy |

RL = Method Reporting Limit

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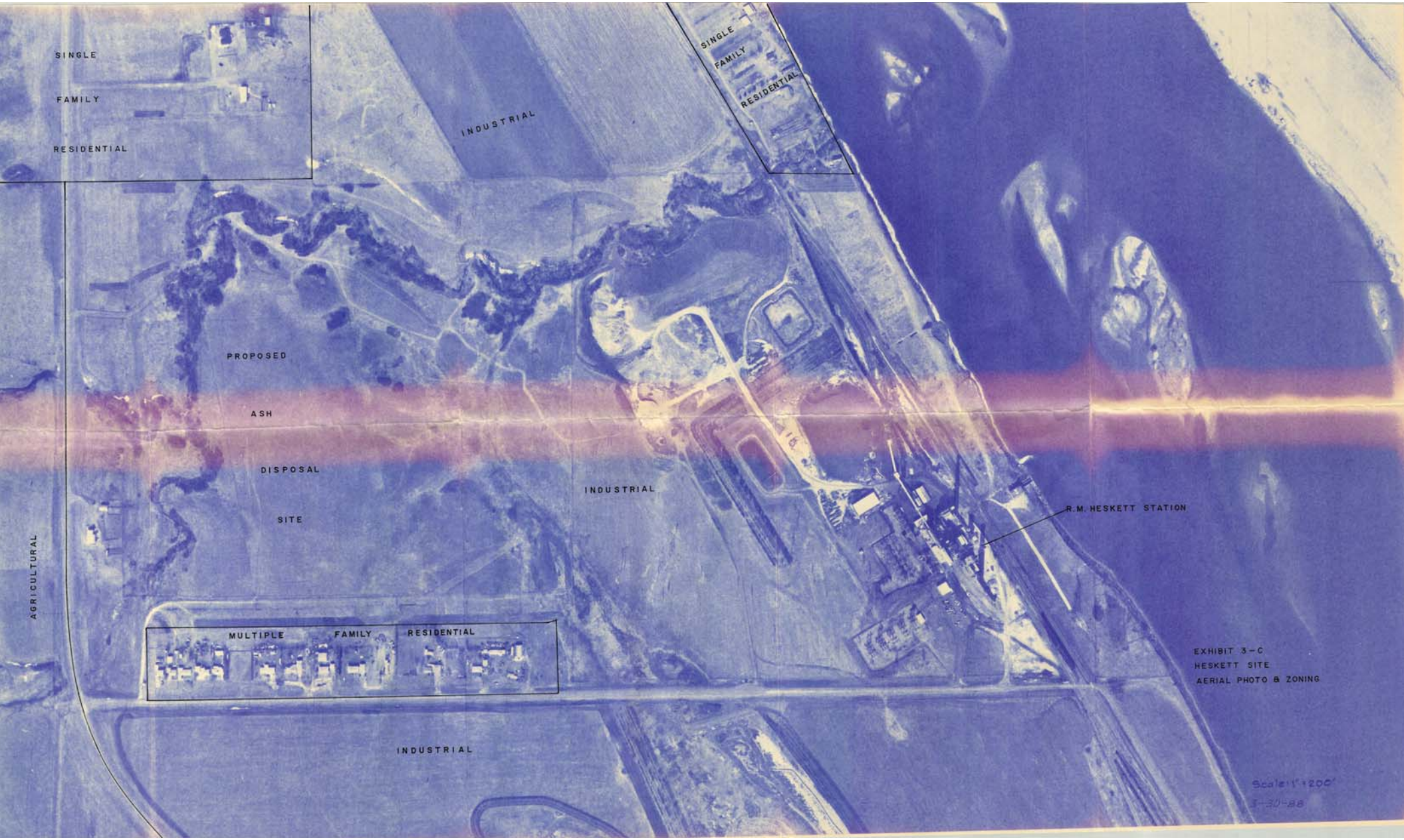
CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

# Appendix D

## Aerial Photo (March 30, 1988)


SINGLE
FAMILY
RESIDENTIAL
INDUSTRIAL
SINGLE
FAMILY
RESIDENTIAL
PROPOSED
ASH
DISPOSAL
SITE
INDUSTRIAL
R.M. HESKETT STATION
AGRICULTURAL
MULTIPLE FAMILY RESIDENTIAL
INDUSTRIAL
EXHIBIT 3-C
HESKETT SITE
AERIAL PHOTO & ZONING
Scale 1"=200'
1-30-88

# Appendix E

## Boring Logs

EXHIBIT 5-E

LITHOLOGIC LOGS

Wells 10, 11, 12 and 13

| | |
|---|---|
| 0-1 | Top soil, silty, clayey, sandy, brown, calcareous; with some limestone pebbles. |
| 1-11 | Silt, clayey, brownish-tan, slightly indurated, very dry, calcareous; with thin coarse-grained, clean silt lenses and a few small (less than .5 in.) iron oxide concretions. Abundant small gypsum crystals (less than .13 in. long). Some small, black flakes of organic plant material. Cannonball-Ludlow Formations. |
| 11-14 | Silt, as above, with some (less than 20%) very fine- to fine-grained sand interspersed. |
| 14-30 | Silt, as above, clayey, less sand than above interval, oxidized; with very fine-grained silty sand lenses and very few gypsum crystals. |
| 30-41 | Silt, very clayey, with some (less than 20%) very fine-grained sand interspersed, steel-gray (color change), moderately indurated; with fewer small gypsum crystals than above intervals. |
| 41-59 | Silt, as above, very clayey, with some (less than 20%) fine- to medium-grained sand interspersed in a silt and clay matrix. |
| 59-65 | Silt, as above, with abundant (more than 20%) fine- to medium-grained sand interspersed. |
| 65-81 | Silt, clayey, steel-gray to bluish, moderately indurated; with thin coarse-grained silt to very fine-grained sand lenses in an otherwise fine silt to clay matrix. |
| 81-84 | Clay, silty, steel-gray to bluish, moderately indurated, dense. |
| 84-91 | Siltstone, sandy, clayey, steel-gray to bluish, slightly indurated; with small fine-grained sand lenses and abundant (more than 20%) sand interspersed in the matrix. |
| 91-110 | Silt, clayey, bluish-gray, moderately indurated; with thin (less than 1 foot) mudstone lenses. |
| 110-120 | Silt, very clayey, steel-gray to bluish, moderately indurated, very dense. Cannonball-Ludlow Formations. |

Wells 20 and 21

| | |
|---|---|
| 0-1 | Top soil, silty, sandy, clayey, dark-brown, calcareous; with some limestone and granite pebbles. |
| 1-21 | Silt, clayey, with minor amounts (less than 10%) of very fine-grained sand interspersed, brownish-tan, slightly indurated, calcareous, oxidized; with small iron oxide concretions and abundant small gypsum crystals. Cannonball-Ludlow Formations. |
| 21-26 | Silt, as above, steel-gray (color change). |
| 26-49 | Silt, clayey, with some (less than 20%) very fine- to medium-grained sand interspersed, steel-gray to bluish, slightly indurated; with very few small gypsum crystals and some thin (less than 1 foot) siltstone lenses. |
| 49-53 | Silt, as above, with abundant (more than 20%) fine- to medium-grained sand interspersed. |
| 53-63 | Silt, as above, clayey, less sand, with thin (less than 1 foot) siltstone to mudstone lenses. |
| 63-80 | Silt, very clayey, steel-gray to bluish, moderately indurated, very dense. Cannonball-Ludlow Formations. |

Wells 30, 31, 32 and 33

| | |
|---|---|
| 0-1 | Top soil, silty, sandy, brownish, calcareous; with some granite and limestone pebbles. |
| 1-2 | Pebble-loam (glacial till), silty, sandy, clayey, yellowish-brown, dry, calcareous. |
| 2-31 | Silt, clayey, with minor amounts (less than 10%) of very fine-grained sand interspersed, brownish-tan, slightly indurated, calcareous, oxidized; with small iron oxide concretions. Some small, black flakes organic plant material. Cannonball-Ludlow Formations. |
| 31-44 | Silt, clayey, steel-gray (color change), slightly indurated, calcareous; with small iron oxide concretions, thin coarse silt lenses, small gypsum crystals and gray to reddish-brown mottling. |

| | |
|---|---|
| 44-61 | Silt, as above, with some (less than 20%) fine- to medium-grained sand interspersed. |
| 61-65 | Silt, as above, with abundant (more than 20%) fine- to medium-grained sand interspersed, dense. |
| 65-76 | Silt, as above, clayey, less sand, some thin (less than 1 foot) lenses of siltstone to mudstone. |
| 76-80 | Siltstone, sandy, clayey, steel-gray to bluish, slightly indurated; with small fine-grained sand lenses and abundant (more than 20%) fine-grained sand interspersed in the matrix. |
| 80-92 | Silt, clayey, steel-gray to bluish, moderately indurated, with some (less than 20%) very fine- to fine grained sand interspersed. |
| 92-120 | Silt, very clayey, steel-gray to bluish, moderately indurated, very dense. Cannonball-Ludlow Formations. |

Well 40

| | |
|---|---|
| 0-1 | Top soil, sandy, silty, brownish-tan, calcareous; with some granite and limestone pebbles. |
| 1-5 | Pebble-loam (glacial till), sandy, silty, with detrital lignite and organic matter, yellowish-brown, very dry, calcareous. |
| 5-22 | Sand, very fine- to medium-grained, unconsolidated, with thin lenses of clay and detrital lignite, brownish-yellow, calcareous. |
| 22-40 | Silt, clayey, with minor amounts (less than 10%) very fine-grained sand interspersed, brownish-tan, slightly indurated, calcareous, oxidized; with small iron oxide concretions and small gypsum crystals; Cannonball-Ludlow Formations. |
| 40-51 | Silt, clayey, with minor amounts (less than 10%) of very fine-grained sand interspersed, steel-gray (color change), moderately indurated; with some reddish-brown mottling and some very thin (less than 6 inches) mudstone lenses. |
| 51-58 | Silt, as above, with abundant (more than 20%) fine-grained sand and thin silty-clay lenses. |

| | |
|---|---|
| 58-62 | Siltstone, sandy, clayey, steel-gray to bluish, moderately indurated; with small fine-grained sand lenses and abundant (more than 20%) sand interspersed in the matrix. |
| 62-70 | Silt, clayey, with some (less than 20%) fine- to medium-grained sand interspersed, steel-gray to bluish, moderately indurated; with thin (less than 2 feet) sandy lenses. |
| 70-80 | Silt, as above, very clayey, some (less than 10%) fine-grained sand interspersed; less sand than above interval. |
| 80-120 | Silt, as above, dark-steel-gray. Cannonball-Ludlow Formations. |

Wells 41, 42 and 43

| | |
|---|---|
| 0-1 | Top soil, sandy, silty, dark-brown, calcareous; with some granite and limestone pebbles. |
| 1-4 | Pebble-loam (glacial till), sandy, silty, clayey, yellowish-brown, very dry, calcareous. |
| 4-40 | Silt, clayey, with some (less than 20% ) very fine-grained sand interspersed, brownish-tan, unconsolidated, noncompacted, calcareous to 25 feet, oxidized; with small iron oxide concretions and abundant small gypsum crystals. Cannonball-Ludlow Formations. |
| 40-51 | Silt, clayey, with minor amounts (less than 10%) of very fine-grained sand interspersed, steel-gray (color change), moderately indurated; with some reddish-brown mottling and some very thin (less than 6 inches) mudstone lenses. |
| 51-58 | Silt, as above, with abundant (more than 20%) fine-grained sand and thin silty-clay lenses. |
| 58-62 | Siltstone, sandy, clayey, steel-gray to bluish, moderately indurated; with small fine-grained sand lenses and abundant (more than 20%) sand interspersed in the matrix. |
| 62-70 | Silt, clayey, with some (less than 20%) fine- to medium-grained sand interspersed, steel-gray to bluish, moderately indurated; with thin (less than 2 feet) sandy lenses. |

| | |
|---|---|
| 70-80 | Silt, as above, very clayey, some (less than 10%) fine-grained sand interspersed; less sand than above interval. |

Wells 43 and 44

| | |
|---|---|
| 0-2 | Top soil, clayey, silty, some sand, brownish-tan to light-gray, calcareous. |
| 2-20 | Silt, clayey, with some (less than 20%) fine-grained sand interspersed, brownish-tan, slightly indurated, very dry, calcareous; with small iron oxide concretions, abundant small gypsum crystals and occasional thin silt lenses. Cannonball-Ludlow Formations. |
| 20-25 | Silt, as above, very clayey, oxidized, with minor amounts (less than 10%) of fine-grained sand. |
| 25-35 | Silt, as above, dark-brownish-tan to bluish-gray (color change), with thin very fine-grained sand lenses. |
| 35-60 | Silt, clayey, with some (less than 20%) fine- to medium-grained sand interspersed, steel-gray to bluish, moderately indurated; with some indurated silty sand lenses. Cannonball-Ludlow Formations. |

Wells 50, 51 and 52

| | |
|---|---|
| 0-4 | Top soil, clayey, silty, very dark-brown. |
| 4-10 | Clay, silty, with some (less than 20%) fine-grained sand, dark-brownish-tan, soft, cohesive, wet, sticky; with some pebbles. |
| 10-22 | Silt, very clayey, with some (less than 20%) very fine-grained sand interspersed, brownish-tan, slightly indurated, calcareous, dense; with abundant small gypsum crystals and very thin silt and sand lenses; Cannonball-Ludlow Formations. |
| 22-23 | Sandstone, fine-grained, silty, indurated, oxidized, dark-brown. |
| 23-30 | Silt, very clayey, with some (less than 20%) very fine-grained sand interspersed, steel-gray (color change), moderately indurated; with thin medium grained sand lenses. |

| | |
|---|---|
| 30-40 | Silt, as above, very clayey, less sand than above interval, dark-steel-gray. Cannonball-Ludlow Formations. |

Wells 53 and 54

| | |
|---|---|
| 0-4 | Top soil, clayey, silty, very dark-brown, wet, sticky. |
| 4-15 | Clay, silty, with some (less than 20%) fine- to medium-grained sand interspersed, brownish-tan, slightly indurated, dry, calcareous; with small iron oxide concretions, small gypsum crystals and occasional reddish-brown mottling; Cannonball-Ludlow Formations. |
| 15-20 | Sand, very fine-grained to medium-grained, silty, clayey, unconsolidated, yellowish-brown, oxidized. |
| 20-30 | Silt, clayey, with some (less than 20%) fine-grained sand interspersed, steel-gray (color change), slightly indurated; with clay and sand lenses, some small concretions and some small gypsum crystals. |
| 30-45 | Silt, as above, very clayey. |
| 45-60 | Silt, as above, clayey, brownish-gray, moderately indurated, some reddish-brown mottling. Cannonball-Ludlow Formations. |

Wells 55 and 56

| | |
|---|---|
| 0-5 | Sandy-loam (glacial), with fine- to medium-grained sand, silty, calcareous; with small granite and limestone pebbles. |
| 5-26 | Clay, silty, with minor amounts (less than 10%) of very fine-grained sand, dark-brownish-tan, moderately indurated, brittle, very dry, calcareous; with small iron oxide concretions, small gypsum crystals and occasional thin sandstone laminae. Some small, black flakes of organic plant material. Cannonball-Ludlow Formations. |
| 26-35 | Clay, as above, very silty, sandy, brownish-tan, oxidized. |

35-40 Silt, clayey, with some (less than 20%) very fine- to fine-grained sand interspersed, steel-gray (color change) moderately indurated; with small gypsum crystals and occasional clay lenses.

40-60 Silt, as above, with minor amounts (less than 10%) of fine-grained sand interspersed.

60-85 Silt, as above, clayey, less sand than above interval.

85-100 Silt, as above, very clayey, with minor amounts (less than 10%) of sand interspersed, light-gray. Cannonball-Ludlow Formations.

Wells 60, 61 and 62

0-2 Top soil, silty, clayey, dark-brown to tanish-brown, calcareous.

2-25 Silt, very clayey, with some minor amounts (less than 10%) of very fine- to fine-grained sand interspersed, brownish-tan, slightly indurated, dry, calcareous; with abundant small gypsum crystals and thin silt and sand lenses; Cannonball-Ludlow Formations.

25-29 Silt, as above, with abundant (more than 20%) fine- to medium-grained sand interspersed.

29-36 Silt, as above, clayey, less sand than above interval, dark-brownish-tan, oxidized.

36-60 Silt, very clayey, with some (less than 20%) very fine-grained sand interspersed, steel-gray (color change), moderately indurated; with thin (less than 1 foot) sandy-silt lenses. Cannonball-Ludlow Formations.

Well 70 0-2 Pebble-loam (glacial till), clayey, sandy, yellowish-brown, unconsolidated, damp, calcareous.

2-21 Silty, clayey, with some (less than 20%) fine-grained sand interspersed, brownish-tan, moderately indurated, very dry, calcareous, oxidized; with small iron oxide concretions and abundant small gypsum crystals. Cannonball-Ludlow Formations.

| | |
|---|---|
| 21-24 | Shale, silty, steel- to dark-gray (color change), indurated, fissile, very dry; with occasional thin silt and sand lenses. |
| 24-31 | Silt, clayey, with abundant (more than 30%) sand, steel-gray, moderately indurated. |
| 31-62 | Silt, clayey, with some (less than 20%) very fine- to fine- grained sand interspersed, steel-gray, moderately indurated; with some small gypsum crystals and small iron oxide concretions. |
| 62-76 | Silt, as above, with some (less than 20%) fine-grained sand interspersed. |
| 76-82 | Silt, as above, with abundant (more than 20%) fine- to medium-grained sand. |
| 82-100 | Silt, as above, clayey, with some (less than 20%) fine-grained sand interspersed, dark-gray. Cannonball-Ludlow Formations. |

The litnologic logs for wells 1-4 were described by personal from Water Supply Incorporated (WS), Bismarck, North Dakota. The wells were installed during a previous ground water investigation at Heskett Station.

Well WS 2

| | |
|---|---|
| 0-1 | Top soil, silty, black. |
| 1-4 | Pebble-loam (glacial till), silty, clayey, some cobbles, yellowish-brown. |
| 4-7 | Gravel, sand and rocks. |
| 7-21 | Sand, fine- to coarse-grained, some pebbles. |
| 21-39 | Clay, silty, sandy, yellowish-brown to gray. |
| 39-52 | Clay, silty, sandy, gray. |
| 52-67 | Sand, fine-grained, bluish, with some clay layers. |
| 67-89 | Clay, silty, sandy, brown to gray. |

Wells WS 1, 1A and 1B

| | |
|---|---|
| 0-1 | Top soil, silty, black |
| 1-4 | Clay, (glacial), silty, with pebbles, yellowish-brown. |
| 4-21 | Sand, fine- to medium-grained, yellowish-brown; with clay and silt lenses. |
| 21-25 | Clay, silty, yellowish-brown. |
| 25-30 | Sand, fine-grained, yellowish-brown, some indurated layers. |
| 30-35 | Clay, silty, yellowish-brown. |
| 35-45 | Sand, fine-grained, yellowish-brown. |
| 45-50 | Clay, silty, sandy, gray, about 50 percent shale. |
| 50-56 | Sand, fine-grained, with clay layers. |
| 56-73 | Clay, silty, sandy, gray. |

WEll WS 4, 4A and 4B

| | |
|---|---|
| 0-13 | Pebble-loam (glacial till), silty, sandy, with some cobbles, yellowish-brown. |
| 13-23 | Sand, fine- to medium-grained, yellowish-brown. |
| 23-25 | Slay, silty, sandy, yellowish-brown. |
| 25-27 | Sandstone, indurated. |
| 27-30 | Clay, sandy, silty, gray. |
| 30-36 | Sand, fine-grained, gray. |
| 36-52 | Clay, silty, sandy, gray; with some sand layers. |

Wells WS 3 and 3A

| | |
|---|---|
| 0-1 | Top soil, silty, black. |
| 1-12 | Pebble-loam, clayey, silty, with some cobbles, yellowish-brown. |
| 12-16 | Clay, silty, gray; with some shale layers. |
| 16-18 | Limestone, indurated. |
| 18-23 | Clay, silty, yellowish-brown; with some sand layers. |
| 23-44 | Sand, fine- to medium-grained, gray; with some clay layers. |
| 44-50 | Clay, silty, medium-gray. |

Barr Engineering Company
234 West Century Avenue
Bismarck, ND 58503
Telephone: 701-255-5460

# LOG OF BORING MW-44 R



Project:Heskett Station
Project No.:34301012
Location:Mandan, ND
Coordinates:Lat: 46.86620° Long: -100.89313°
Datum:

Surface Elevation:
Drilling Method:HSA
Sampling Method:Split Spoon
Completion Depth:46.0 ft

Unique Well No.:MW-44 R

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION |
|---|---|---|---|---|---|---|
| 0 | | 1 | 3-3-5-8. | OL/OH | | 0-1': TOPSOIL (OL/OH): Very Dark Brown (2.5/2 7.5YR); low to medium plasticity; roots, fine to medium grained sand. |
| | | | | | | 1-46': SANDY CLAY (CL): Brown (5/4 7.5YR) to Dark Gray (4/1 7.5YR); medium to high plasticity; massive; fine to medium grained sand. Moist; 20% gravel, 30% sand, 50% fines. At 1-5': Gravel sized inclusions. |
| | | 2 | 9-9-7-7. | | | Moist; 10% gravel, 20% sand, 70% fines. |
| 5 | | 3 | 7-5-5-7. | | | Moist; 0% gravel, 30% sand, 70% fines. |
| | | 4 | 7-9-11-13. | | | Moist; 0% gravel, 20% sand, 80% fines. |
| | | 5 | 7-9-12-13. | | | At 8': Oxidized staining. |
| 10 | | 6 | 6-7-11-13. | | | |
| | | 7 | 7-10-12-14. | CL | | |
| 15 | | 8 | 6-10-14-14. | | | |
| 20 | | 9 | 10-10-13-16. | | | At 20': Interbedded layer of sand. |
| 25 | | 10 | 10-10-12-16. | CL | | (CL): At 24': Color change to dark brown (3/3 7.5YR). Moist; 0% gravel, 20% sand, 80% fines. At 25': Sand lens. |

WELL OR PIEZOMETER CONSTRUCTION DETAIL

PRO. CASING
Diameter: 4" by 4"
Type: Steel
Interval: 3' up & 3' down

RISER CASING
Diameter: 2"
Type: Schd 40 PVC
Interval: Stick up to screen (23')

GROUT
Type: Cement
Interval: 0-0.5' BGS

SEAL
Type: Bentonite Chips
Interval: 0.5-21' BGS

SANDPACK
Type: Granusil
Interval: 21-46' BGS

SCREEN
Diameter: 2"
Type: No. 10 Slot
Interval: 23-43' BGS

Elevation, feet

Date Boring Started: 10/20/14
Date Boring Completed: 10/20/14
Logged By: JEG3
Drilling Contractor: Midwest Testing (Terracon)
Drill Rig:

Remarks: Water encountered at 28.7' BGS in MW-44R while drilling on 10/2014

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
234 West Century Avenue
Bismarck, ND 58503
Telephone: 701-255-5460

# LOG OF BORING MW-44 R



Project:Heskett Station
Project No.:34301012
Location:Mandan, ND
Coordinates:Lat: 46.86620° Long: -100.89313°
Datum:

Surface Elevation:
Drilling Method:HSA
Sampling Method:Split Spoon
Completion Depth:46.0 ft

Unique Well No.:MW-44 R

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 30 | | 11 | 8-12-14-18. | CL | | (CL): At 24': Color change to dark brown (3/3 7.5YR). *(continued)*<br>Wet; 0% gravel, 20% sand, 80% fines.<br>At 30.5': Sand lens. | | |
| 35 | | 12 | 8-13-16-27. | | | (CL): At 32': Color change to dark gray (4/1 7.5YR). | | |
| 40 | | 13 | 11-19-25-27. | CL | | | | |
| 45 | | 14 | 14-18-27-34. | SC | | (SC): At 45.8': Clayey Sand (SC), fine to medium grained, low to medium plasticity, dark greenish gray (4/10G Gley 2). | | |
| 50 | | | | | | | | |
| 55 | | | | | | | | |

**PRO. CASING**
Diameter: **4" by 4"**
Type: **Steel**
Interval: **3' up & 3' down**

**RISER CASING**
Diameter: **2"**
Type: **Schd 40 PVC**
Interval: **Stick up to screen (23')**

**GROUT**
Type: **Cement**
Interval: **0-0.5' BGS**

**SEAL**
Type: **Bentonite**
Interval: **Chips 0.5-21' BGS**

**SANDPACK**
Type: **Granusil**
Interval: **21-46' BGS**

**SCREEN**
Diameter: **2"**
Type: **No. 10 Slot**
Interval: **23-43' BGS**

Date Boring Started: 10/20/14
Date Boring Completed: 10/20/14
Logged By: JEG3
Drilling Contractor: Midwest Testing (Terracon)
Drill Rig:

Remarks: Water encountered at 28.7' BGS in MW-44R while drilling on 10/2014

Additional data may have been collected in the field which is not included on this log.
Weather:

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State of North Dakota

# BOARD OF WATER WELL CONTRACTORS

900 E. BOULEVARD • BISMARCK, NORTH DAKOTA 58505

## MONITORING WELL REPORT

State law requires that this report be filed with the State Board of Water Well Contractors within 30 days after completion or abandonment of the well.

**1. WELL OWNER**

Name MDU-Heskett Station

Address 2025 38th Street

Mandan, North Dakota

**2. WELL LOCATION** **(MW-44R)**

Address (if in city) (see attached drawing)

County Morton

SE ¼ SE ¼ SW ¼ Sec. 10 Twp. 139 N. Rge. 81 W.

Lat. 46.86620 Long.: -100.89313

Altitude:

**3. METHOD DRILLED**

■ Auger Other

**4. WELL CONSTRUCTION**

Diameter of Hole 8 inches Depth 46 feet

Riser: ■ PVC □ Other

■ Threaded □ Solvent □ Other

Riser rating SDR Schedule 40

Diameter 2.0 inches

From +2 ft. to 23 ft.

Was a well screen installed? ■ Yes □ No

Material Schedule 40 PVC Diameter 2.0 inches

Slot Size #10 set from 23 feet to 43 feet

Sand packed from 21 ft to 46 ft

Depth grouted from 1 ft to 21 ft

Grouting Material

Bentonite x Other

If other explain:

One foot concrete collar at surface

Well head completion:

24" above grade Other x

If other, specify 4" x 4" x 5' steel cover

Was protective casing installed? ■ Yes □ No

Was well disinfected upon completion? □ Yes ■ No

**5. WATER LEVEL**

Static water level 28.5 feet below surface

If flowing: closed in pressure psi or ft. above land surface

**6. WELL LOG**

| Formation | Depth (Ft.) From | To |
|---|---|---|
| Topsoil | 0 | 0.5 |
| Sandy lean clay | 0.5 | 5 |
| Sandy fat clay | 5 | 46 |

(Use separate sheet if necessary)

7. WAS THE HOLE PLUGGED OR ABANDONED?

□ Yes ■ No

If so, how?

**8. REMARKS**

3 steel bumpers installed around well head

**9. DATE COMPLETED** 10-21-14

**10. CONTRACTOR CERTIFICATION**

This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Midwest Testing Laboratory, Inc. 444

Monitoring Well Contractor Certificate No.

P.O. Box 2084, Bismarck, ND 58502-2084

Address

Signature 10-22-14

Date

Barr Engineering Company
234 West Century Avenue
Bismarck, ND 58503
Telephone: 701-255-5460

# LOG OF BORING MW-80 R

SHEET 1 OF 1

Project:Heskett Station
Project No.:34301012
Location:Mandan, ND
Coordinates:Lat: 46.86789° Long: -100.89320°
Datum:

Surface Elevation:
Drilling Method:HSA
Sampling Method:Split Spoon
Completion Depth:27.0 ft

Unique Well No.:MW-80 R

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | OL/OH | | 0-0.5': TOPSOIL (OL/OH): Black; organic roots. | | |
| | | 1 | 4-4-4-5. | | | 0.5-27': SANDY CLAY (CL): Brown (4/4 7.5 YR) to Black (2.5/1 7.5YR); medium to high plasticity; fine to medium grained sand. Moist; 0% gravel, 30% sand, 70% fines. | PRO. CASING<br>Diameter: 4" by 4"<br>Type: Steel<br>Interval: 3' up & 3' down | |
| | | 2 | 4-5-7-9. | | | At 2': Gravel inclusions. Moist; 10% gravel, 30% sand, 60% fines. | | |
| 5 | | 3 | 4-4-5-8. | CL | | Moist; 0% gravel, 20% sand, 80% fines. | RISER CASING<br>Diameter: 2"<br>Type: Schd 40 PVC<br>Interval: Stick up to screen (7') | |
| | | 4 | 4-4-6-6. | | | | | |
| | | 5 | 3-4-5-6. | CL | | (CL): At 8': Color change to 2.5/1 7.5YR black, no odor. | GROUT<br>Type: Cement<br>Interval: 0-0.5' BGS | |
| 10 | | 6 | 1-3-3-4. | CL | | (CL): At 9': Color change to 2.5/2 7.5YR very dark brown. Moist; 0% gravel, 20% sand, 80% fines. | SEAL<br>Type: Bentonite<br>Interval: Chips 0.5-5' BGS | |
| | | 7 | 1-1-2-1. | CL | | (CL): At 11': Color change to 3/3 7.5YR dark brown. Moist; 0% gravel, 20% sand, 80% fines. | SANDPACK<br>Type: Granusil<br>Interval: 5-27' BGS | |
| 15 | | 8 | 1-2-2-1. | | | (CL): At 13': Color change to 4/4 7.5YR brown. Wet; 0% gravel, 20% sand, 80% fines. | SCREEN<br>Diameter: 2"<br>Type: No 10 Slot<br>Interval: 7-27' BGS | |
| 20 | | 9 | 7-11-12-17. | CL | | At 21': Thin sand lens less than 0.1" thick. Wet; 0% gravel, 20% sand, 80% fines. At 21.5': Thin sand lens less than 0.1" thick. | | |
| 25 | | 10 | 7-11-17-17. | | | Wet; 0% gravel, 20% sand, 80% fines. At 26.5': Thin sand lens less than 0.1" thick. | | |

Date Boring Started: 10/20/14
Date Boring Completed: 10/20/14
Logged By: JEG3
Drilling Contractor: Midwest Testing (Terracon)
Drill Rig:

Remarks: Water encountered at 11.8' BGS in MW-80R while drilling on 10/20/14

Additional data may have been collected in the field which is not included on this log.
Weather:

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State of North Dakota

# BOARD OF WATER WELL CONTRACTORS

900 E. BOULEVARD • BISMARCK, NORTH DAKOTA 58505

## MONITORING WELL REPORT

State law requires that this report be filed with the State Board of Water Well Contractors within 30 days after completion or abandonment of the well.

**1. WELL OWNER**

Name MDU-Heskett Station

Address 2025 38th Street

Mandan, North Dakota

**2. WELL LOCATION** **(MW-80R)**

Address (if in city) (see attached drawing)

County Morton

NE ¼ SE ¼ SW ¼ Sec. 10 Twp. 139 N. Rge. 81 W.

Lat. 46.86789 Long.: -100.89320

Altitude:

**3. METHOD DRILLED**

■ Auger Other

**4. WELL CONSTRUCTION**

Diameter of Hole 8 inches Depth 27 feet

Riser: ■ PVC □ Other

■ Threaded □ Solvent □ Other

Riser rating SDR Schedule 40

Diameter 2.0 inches

From +2.5 ft. to 7 ft.

Was a well screen installed? ■ Yes □ No

Material Schedule 40 PVC Diameter 2.0 inches

Slot Size #10 set from 7 feet to 27 feet

Sand packed from 5 ft to 27 ft

Depth grouted from 1 ft to 5 ft

Grouting Material

Bentonite x Other

If other explain:

One foot concrete collar at surface

Well head completion:

24" above grade Other x

If other, specify 4" x 4" x 5' steel cover

Was protective casing installed? ■ Yes □ No

Was well disinfected upon completion? □ Yes ■ No

**5. WATER LEVEL**

Static water level 12 feet below surface

If flowing: closed in pressure psi or ft. above land surface

**6. WELL LOG**

| Formation | Depth (Ft.) From | To |
|---|---|---|
| Topsoil | 0 | 0.5 |
| Sandy lean clay | 0.5 | 27 |

(Use separate sheet if necessary)

7. WAS THE HOLE PLUGGED OR ABANDONED?

□ Yes ■ No

If so, how?

**8. REMARKS**

3 steel bumpers installed around well head

**9. DATE COMPLETED** 10-21-14

**10. CONTRACTOR CERTIFICATION**

This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Midwest Testing Laboratory, Inc. 444

Monitoring Well Contractor Certificate No.

P.O. Box 2084, Bismarck, ND 58502-2084

Address

Signature 10-22-14

Date

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

# LOG OF BORING MW-101
**DRAFT**



Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438844.919° Long: 1868647.777°
Datum:NAD 83

Surface Elevation:1716.6 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:58.0 ft

Unique Well No.:

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | TOPSOIL: Brown (5/4 7.5YR). | | |
| | | 1 | 4-4-4-6. | | | SANDY LEAN CLAY WITH GRAVEL (CL): fine to medium grained; Brown (5/3 7.5YR); moist; thinly laminated; some mottling; low plasticity; [Cannonball Formation]. | PRO. CASING<br>Diameter: **4"**<br>Type: **Steel pipe**<br>Interval: **3.5' ags - 1.5' bgs** | 1715 |
| | | 2 | 4-6-6-7. | | | At 2': Start to see gravel inclusions. | | |
| | | | | | | At 4': Oxidized staining. | RISER CASING<br>Diameter: **2"**<br>Type: **PVC SCH 80**<br>Interval: **2.98' ags - 34' bgs** | |
| 5 | | 3 | 7-9-14-16. | | | At 5': Oxidized staining. | | 1710 |
| | | 4 | 8-9-12-15. | | | At 7': Oxidized staining and white staining. | GROUT<br>Type: **Neat cement**<br>Interval: **0 - 29' bgs** | |
| | | 5 | 10-15-21-26. | | | | SEAL<br>Type: **Bentonite chips**<br>Interval: **29 - 32' bgs** | |
| 10 | | 6 | 7-18-24-27. | CL | | At 11': Oxidized staining. | SANDPACK<br>Type: **Silica 40-70**<br>Interval: **32 - 56' bgs** | 1705 |
| | | 7 | 8-12-19-23. | | | | | |
| 15 | | 8 | 8-14-18-23. | | | At 15': Gypsum.<br>16-20': No recovery. | SCREEN<br>Diameter: **2"; No.6 slot**<br>Type: **PVC SCH 80**<br>Interval: **34 - 54' bgs** | 1700 |
| 20 | | 9 | 7-10-13-15. | | | At 20.5': Gypsum.<br>LEAN CLAY (CL): Dark Brown (3/2 7.5YR); oxidized staining, some mottling; medium to high plasticity; [Cannonball Formation]. | | 1695 |
| | | 10 | 7-9-13-15. | CL | | At 22': Color change to Brown (4/2 7.5YR).<br>At 24': Interbedded sand, fine grained. | | |
| 25 | | | | | | | | |

Date Boring Started: 8/18/15
Date Boring Completed: 8/19/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: Hole caved in from 56 - 58' bgs.
DTW = 36.66' TOR on 9/23/2015 (elev. 1682.87)

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

# LOG OF BORING MW-101
**DRAFT**



Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438844.919° Long: 1868647.777°
Datum:NAD 83

Surface Elevation:1716.6 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:58.0 ft

Unique Well No.:

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 25 | | 11 | 7-11-13-15. | CL | | LEAN CLAY (CL): Dark Brown (3/2 7.5YR); oxidized staining, some mottling; medium to high plasticity; [Cannonball Formation]. *(continued)*<br>At 25' and 25.5': Gypsum. | | |
| | | 12 | 8-11-15-19. | | | At 26.5': Gypsum. | PRO. CASING<br>Diameter: **4"**<br>Type: **Steel pipe**<br>Interval: **3.5' ags - 1.5' bgs** | 1690 |
| | | 13 | 8-11-13-15. | | | | RISER CASING<br>Diameter: **2"**<br>Type: **PVC SCH 80**<br>Interval: **2.98' ags - 34' bgs** | |
| 30 | | 14 | 6-11-14-17. | | | At 29.5': Gypsum. | | 1685 |
| | | 15 | 8-13-17-22. | | | At 33': Gypsum. | GROUT<br>Type: **Neat cement**<br>Interval: **0 - 29' bgs** | |
| 35 | | 16 | 8-14-19-21. | | | At 34.5': Gypsum.<br>At 35.5-36': Color change to Black (2.5/1 7.5YR), turns back to brown. | SEAL<br>Type: **Bentonite chips**<br>Interval: **29 - 32' bgs** | 1680 |
| | | 17 | 11-16-20-27. | CH | | FAT CLAY (CH): Black (2.5/1 7.5YR); very stiff; hight plasticity; wet at 43'; [Cannonball Formation]. | SANDPACK<br>Type: **Silica 40-70**<br>Interval: **32 - 56' bgs** | |
| | | 18 | 9-13-20-25. | | | At 38': Oxidized staining. | SCREEN<br>Diameter: **2"; No.6 slot**<br>Type: **PVC SCH 80**<br>Interval: **34 - 54' bgs** | |
| 40 | | 19 | 7-14-23-26. | | | At 41': Oxidized staining. | | 1675 |
| | | 20 | 9-16-23-26. | | | | | |
| 45 | | | | | | | | 1670 |
| 50 | | | | | | | | |

Date Boring Started: 8/18/15
Date Boring Completed: 8/19/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: Hole caved in from 56 - 58' bgs.
DTW = 36.66' TOR on 9/23/2015 (elev. 1682.87)

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

# LOG OF BORING MW-101
**DRAFT**



Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438844.919° Long: 1868647.777°
Datum:NAD 83

Surface Elevation:1716.6 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:58.0 ft

Unique Well No.:

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 50 | | | | CH | | FAT CLAY (CH): Black (2.5/1 7.5YR); very stiff; hight plasticity; wet at 43'; [Cannonball Formation]. *(continued)* | PRO. CASING<br>Diameter: **4"**<br>Type: **Steel pipe**<br>Interval: **3.5' ags - 1.5' bgs**<br>RISER CASING<br>Diameter: **2"**<br>Type: **PVC SCH 80**<br>Interval: **2.98' ags - 34' bgs**<br>GROUT<br>Type: **Neat cement**<br>Interval: **0 - 29' bgs**<br>SEAL<br>Type: **Bentonite chips**<br>Interval: **29 - 32' bgs**<br>SANDPACK<br>Type: **Silica 40-70**<br>Interval: **32 - 56' bgs**<br>SCREEN<br>Diameter: **2"; No.6 slot**<br>Type: **PVC SCH 80**<br>Interval: **34 - 54' bgs** | 1665 |
| 55 | | | | | | | | 1660 |
| 60 | | | | | | End of boring 58.0 feet | | |
| 65 | | | | | | | | |
| 70 | | | | | | | | |
| 75 | | | | | | | | |

Date Boring Started: 8/18/15
Date Boring Completed: 8/19/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: Hole caved in from 56 - 58' bgs.
DTW = 36.66' TOR on 9/23/2015 (elev. 1682.87)

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

# LOG OF BORING MW-102
**DRAFT**



Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438161.145° Long: 1868782.871°
Datum:NAD 83

Surface Elevation:1703.8 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:46.0 ft

Unique Well No.:

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | TOPSOIL: Brown (5/4 7.5YR). | | |
| | | 1 | 3-3-3-2. | | | LEAN CLAY (CL): medium grained; Brown (4/3 7.5YR); moist; low to medium plasticity; with gravel to 4'; [Cannonball Formation]. | PRO. CASING<br>Diameter: **4"**<br>Type: **Steel pipe**<br>Interval: **3.5' ags - 1.5' bgs** | |
| | | 2 | 3-2-2-3. | | | | | 1700 |
| 5 | | 3 | 3-3-4-5. | CL | | | RISER CASING<br>Diameter: **2"**<br>Type: **PVC SCH 80**<br>Interval: **2.85' ags - 10' bgs** | |
| | | 4 | 3-4-5-7. | | | | GROUT<br>Type: **None**<br>Interval: **None** | |
| | | 5 | 4-8-7-4. | ML | | SANDY SILT WITH GRAVEL (ML): Strong Brown (5/6 7.5YR); fine to coarse sand, fine to medium gravel, unconsolidated; [Cannonball Formation]. | | 1695 |
| 10 | | 6 | 4-3-5-9. | CL | | LEAN CLAY WITH GRAVEL (CL): fine to medium grained; Brown (5/3 7.5YR); some mottling; medium plasticity; [Cannonball Formation]. | SEAL<br>Type: **Bentonite chips**<br>Interval: **0 - 8' bgs** | |
| | | 7 | 3-5-7-9. | | | LEAN CLAY (CL): Dark Brown (3/2 7.5YR); medium to high plasticity; [Cannonball Formation]. | SANDPACK<br>Type: **Silica 40-70**<br>Interval: **8 - 31' bgs** | |
| 15 | | 8 | 6-8-12-14. | | | | SCREEN<br>Diameter: **2"; No.6 slot**<br>Type: **PVC SCH 80**<br>Interval: **20 - 30' bgs** | 1690 |
| | | 9 | 6-10-12-16. | | | | | |
| | | 10 | 5-9-14-16. | CL | | | | 1685 |
| 20 | | 11 | 5-12-15-18. | | | At 21': Color changes to Black (2.5/1). | | |
| | | 12 | 9-15-18-22. | | | | | 1680 |
| 25 | | | | | | | | |

Date Boring Started: 8/18/15
Date Boring Completed: 8/18/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: Lithological descriptions for a hole that was abandoned. Monitoring well blind drilled and installed next to abandoned hole.
DTW = 17.09' TOR on 8/21/2015 (elev. 1689.51

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

# LOG OF BORING MW-102
**DRAFT**



Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438161.145° Long: 1868782.871°
Datum:NAD 83

Surface Elevation:1703.8 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:46.0 ft

Unique Well No.:

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 25 | | 13 | 9-14-19-22. | | | LEAN CLAY (CL): Dark Brown (3/2 7.5YR); medium to high plasticity; [Cannonball Formation]. *(continued)* | PRO. CASING<br>Diameter: **4"**<br>Type: **Steel pipe**<br>Interval: **3.5' ags - 1.5' bgs** | |
| | | 14 | 10-17-18-24. | | | | | |
| | | 15 | 6-15-18-26. | | | At 29': Gypsum. | | 1675 |
| 30 | | 16 | 7-14-18-22. | | | | RISER CASING<br>Diameter: **2"**<br>Type: **PVC SCH 80**<br>Interval: **2.85' ags - 10' bgs** | |
| | | 17 | 11-16-20-27. | | | At 33.5' and 34': Gypsum. | GROUT<br>Type: **None**<br>Interval: **None** | 1670 |
| 35 | | 18 | 10-14-15-24. | CL | | | SEAL<br>Type: **Bentonite chips**<br>Interval: **0 - 8' bgs** | |
| | | 19 | 13-19-25-35. | | | | SANDPACK<br>Type: **Silica 40-70**<br>Interval: **8 - 31' bgs** | |
| | | 20 | 8-17-26-31. | | | | | 1665 |
| 40 | | 21 | 10-20-27-38. | | | | SCREEN<br>Diameter: **2"; No.6 slot**<br>Type: **PVC SCH 80**<br>Interval: **20 - 30' bgs** | |
| | | 22 | 13-20-27-37. | | | | | 1660 |
| 45 | | 23 | 15-27-27-32. | SM | | SILTY SAND (SM): fine to medium grained; Dark Gray (4/1 7.5YR); wet; [Cannonball Formation]. | | |
| | | | | | | End of boring 46.0 feet | | |
| 50 | | | | | | | | |

Date Boring Started: 8/18/15
Date Boring Completed: 8/18/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: Lithological descriptions for a hole that was abandoned. Monitoring well blind drilled and installed next to abandoned hole.
DTW = 17.09' TOR on 8/21/2015 (elev. 1689.51

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

# LOG OF BORING MW-103
**DRAFT**



Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 437578.205° Long: 1869355.992°
Datum:NAD 83

Surface Elevation:1714.7 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:44.0 ft

Unique Well No.:

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | OL/OH | | TOPSOIL (OL/OH): Brown (5/4 7.5YR). | | |
| | | 1 | 3-4-5-5. | | | LEAN CLAY (CL): Very Dark Gray (3/1 7.5YR); moist; stiff; medium to high plasticity; [Cannonball Formation]. | PRO. CASING<br>Diameter: **4"**<br>Type: **Steel pipe**<br>Interval: **3.5' ags - 1.5' bgs** | |
| | | 2 | 5-5-8-8. | CL | | | RISER CASING<br>Diameter: **2"**<br>Type: **PVC SCH 80**<br>Interval: **2.79' ags - 24' bgs** | 1710 |
| 5 | | 3 | 5-8-10-11. | | | | GROUT<br>Type: **Neat cement**<br>Interval: **0 - 19' bgs** | |
| | | 4 | 6-9-15-15. | | | POORLY GRADED SAND WITH GRAVEL (SP): fine to coarse grained; Brown (5/4 7.5YR); some oxidized staining, some mottling; [Cannonball Formation]. | SEAL<br>Type: **Bentonite chips**<br>Interval: **19 - 22' bgs** | |
| | | 5 | 5-6-5-4. | SP | | | SANDPACK<br>Type: **Silica 40-70**<br>Interval: **22 - 44' bgs** | 1705 |
| 10 | | 6 | 4-5-5-7. | | | | SCREEN<br>Diameter: **2"; No.6 slot**<br>Type: **PVC SCH 80**<br>Interval: **24 - 44' bgs** | |
| | | 7 | 2-2-2-3. | SP-SM | | POORLY GRADED SAND WITH SILT (SP-SM): fine to medium grained; Brown (5/4 7.5YR); [Cannonball Formation]. | | |
| 15 | | 8 | 3-3-3-3. | | | | | 1700 |
| | | | | | | NO RECOVERY (16 - 20'). | | |
| 20 | | 9 | 3-3-5-5. | CL | | SANDY LEAN CLAY (CL): fine to medium grained; Light Brown (6/4 7.5YR); wet; some mottling and oxidized staining, cohesive; low to medium plasticity; [Cannonball Formation]. | | 1695 |
| 25 | | | | | | | | 1690 |

Date Boring Started: 8/19/15
Date Boring Completed: 8/20/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 33.24' TOR on 8/20/2015 (elev. 1684.29)

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

# LOG OF BORING MW-103
**DRAFT**



Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 437578.205° Long: 1869355.992°
Datum:NAD 83

Surface Elevation:1714.7 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:44.0 ft

Unique Well No.:

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 25 | | 10 | 2-2-4-4. | CL | | SANDY LEAN CLAY (CL): fine to medium grained; Light Brown (6/4 7.5YR); wet; some mottling and oxidized staining, cohesive; low to medium plasticity; [Cannonball Formation]. *(continued)* | PRO. CASING<br>Diameter: **4"**<br>Type: **Steel pipe**<br>Interval: **3.5' ags - 1.5' bgs** | |
| 30 | | | | SM | | SILTY SAND WITH GRAVEL (SM): wet; [Cannonball Formation]. | RISER CASING<br>Diameter: **2"**<br>Type: **PVC SCH 80**<br>Interval: **2.79' ags - 24' bgs** | 1685 |
| | | 11 | 10-10-7-9. | | | LEAN CLAY (CL): Brown (4/4 7.5YR); moist; oxidized staining; medium to high plasticity; [Cannonball Formation]. | GROUT<br>Type: **Neat cement**<br>Interval: **0 - 19' bgs** | |
| | | 12 | 8-15-17-22. | | | At 32.5': Sand lens, color changes to Black (2.5/1 7.5YR). | | |
| 35 | | 13 | 7-19-15-25. | | | At 33.5': Sand lens.<br>At 34': Interbedded sand with oxidized staining. | SEAL<br>Type: **Bentonite chips**<br>Interval: **19 - 22' bgs** | 1680 |
| | | 14 | 11-16-21-50 for 5". | CL | | At 36.5': Sand lens.<br>At 37': Sand lens.<br>At 37.5': Color change to Gray (5/1 7.5YR).<br>At 38-38.5': 6" thick layer of hard material. | SANDPACK<br>Type: **Silica 40-70**<br>Interval: **22 - 44' bgs** | |
| | | 15 | 50 for 2"`-. | | | | SCREEN<br>Diameter: **2"; No.6 slot**<br>Type: **PVC SCH 80**<br>Interval: **24 - 44' bgs** | |
| 40 | | 16 | 12-17-22-30. | | | At 42-42.5': Silt layer. | | 1675 |
| | | 17 | 9-18-24-50. | | | At 43.5-44': Silt layer. | | |
| 45 | | | | | | End of boring 44.0 feet | | |
| 50 | | | | | | | | |

Date Boring Started: 8/19/15
Date Boring Completed: 8/20/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 33.24' TOR on 8/20/2015 (elev. 1684.29)

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

# LOG OF BORING MW-104
**DRAFT**



Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438853.542° Long: 1869832.72°
Datum:NAD 83

Surface Elevation:1681.5 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:32.0 ft

Unique Well No.:

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | TOPSOIL: Brown (5/4 7.5YR). | | |
| | | 1 | 4-5-5-5. | CL | | LEAN CLAY WITH SAND (CL): fine to medium grained; Brown (5/4 7.5YR); moist; gravel; medium plasticity; [Cannonball Formation]. | PRO. CASING<br>Diameter: **4"**<br>Type: **Steel pipe**<br>Interval: **3.5' ags - 1.5' bgs** | 1680 |
| | | 2 | 3-5-6-8. | | | | | |
| 5 | | 3 | 3-7-9-10. | CL | | LEAN CLAY (CL): Brown (4/4 7.5YR); oxidized staining and mottling; medium to high plasticity; with gypsum throughout; [Cannonball Formation]. | RISER CASING<br>Diameter: **2"**<br>Type: **PVC SCH 80**<br>Interval: **3.06' ags - 9' bgs** | 1675 |
| | | 4 | 5-7-9-10. | | | | GROUT<br>Type: **None**<br>Interval: **None** | |
| | | 5 | 5-9-9-10. | | | | SEAL<br>Type: **Bentonite chips**<br>Interval: **0 - 7' bgs** | |
| 10 | | 6 | 5-7-9-10. | | | At 12': Heavily oxidized. | | 1670 |
| | | 7 | 5-8-8-12. | | | | SANDPACK<br>Type: **Silica 40-70**<br>Interval: **7 - 32' bgs** | |
| 15 | | 8 | 5-9-11-15. | | | At 15': Start seeing black staining. | SCREEN<br>Diameter: **2"; No.6 slot**<br>Type: **PVC SCH 80**<br>Interval: **9 - 29' bgs** | |
| | | 9 | 6-9-11-13. | | | At 17': Heavily oxidized. | | 1665 |
| | | 10 | 4-7-16-19. | SM | | SILTY SAND (SM): Strong Brown (5/6 7.5YR); wet; [Cannonball Formation]. | | |
| 20 | | | | | | At 19.5': Color change to Brown (5/4 7.5YR). | | |
| | | 11 | 5-16-22-26. | | | At 21': Oxidized layer. | | 1660 |
| | | 12 | 7-11-14-16. | CH | | FAT CLAY (CH): Dark Gray (4/1 7.5YR); moist; stiff; high plasticity; with interbedded sand layers below 27'; [Cannonball Formation]. | | |
| 25 | | | | | | | | |

Date Boring Started: 8/20/15
Date Boring Completed: 8/20/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 13.25' TOR on 8/21/2015 (elev. 1671.26)

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

# LOG OF BORING MW-104
**DRAFT**



Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438853.542° Long: 1869832.72°
Datum:NAD 83

Surface Elevation:1681.5 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:32.0 ft

Unique Well No.:

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 25 | | 13 | 6-12-16-17. | | | FAT CLAY (CH): Dark Gray (4/1 7.5YR); moist; stiff; high plasticity; with interbedded sand layers below 27'; [Cannonball Formation]. *(continued)* | | 1655 |
| | | 14 | 8-12-16-21. | CH | | | | |
| | | 15 | 8-12-16-20. | | | | | |
| 30 | | 16 | | | | Driller notes: sluff. | | 1650 |
| | | | | | | End of boring 32.0 feet | | |
| 35 | | | | | | | | |
| 40 | | | | | | | | |
| 45 | | | | | | | | |
| 50 | | | | | | | | |

PRO. CASING
Diameter: **4"**
Type: **Steel pipe**
Interval: **3.5' ags - 1.5' bgs**

RISER CASING
Diameter: **2"**
Type: **PVC SCH 80**
Interval: **3.06' ags - 9' bgs**

GROUT
Type: **None**
Interval: **None**

SEAL
Type: **Bentonite chips**
Interval: **0 - 7' bgs**

SANDPACK
Type: **Silica 40-70**
Interval: **7 - 32' bgs**

SCREEN
Diameter: **2"; No.6 slot**
Type: **PVC SCH 80**
Interval: **9 - 29' bgs**

Date Boring Started: 8/20/15
Date Boring Completed: 8/20/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 13.25' TOR on 8/21/2015 (elev. 1671.26)

Additional data may have been collected in the field which is not included on this log.
Weather:

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

# LOG OF BORING MW-105
**DRAFT**



Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438042.079° Long: 1870325.657°
Datum:NAD 83

Surface Elevation:1686.0 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:30.0 ft

Unique Well No.:

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | TOPSOIL: Brown (5/4 7.5YR). | | |
| | | 1 | 6-7-6-5. | | | SANDY LEAN CLAY (CL): fine to medium grained; Brown (4/2 7.5YR); moist; gravel; medium plasticity; [Cannonball Formation]. | PRO. CASING<br>Diameter: **4"**<br>Type: **Steel pipe**<br>Interval: **3.5' ags - 1.5' bgs** | 1685 |
| | | 2 | 5-5-5-6. | | | | | |
| | | 3 | 3-2-4-5. | CL | | | RISER CASING<br>Diameter: **2"**<br>Type: **PVC SCH 80**<br>Interval: **3.16' ags - 10' bgs** | 1680 |
| 5 | | 4 | 2-2-2-3. | | | | | |
| | | 5 | 2-1-2-2. | | | LEAN CLAY (CL): Brown (4/2 7.5YR); soft; high plasticity; wet at 16'; [Cannonball Formation]. | GROUT<br>Type: **None**<br>Interval: **None** | |
| 10 ▼ | | 6 | 2-1-2-1. | | | At 10.5': Color change to Reddish-Yellow (6/6 7.5YR). | SEAL<br>Type: **Bentonite chips** ▼<br>Interval: **0 - 7' bgs** | 1675 |
| | | 7 | 2-1-1-3. | | | | SANDPACK<br>Type: **Silica 40-70**<br>Interval: **7 - 30' bgs** | |
| 15 | | 8 | 4-3-5-5. | CL | | At 14.5-15.5': Gravel inclusions.<br>At 15.5': Color change to Brown (4/3 7.5YR). | SCREEN<br>Diameter: **2"; No.6 slot**<br>Type: **PVC SCH 80**<br>Interval: **10 - 30' bgs** | 1670 |
| | | 9 | 7-9-11-13. | | | | | |
| | | 10 | 7-9-11-13. | | | At 18': Color change to Brown (5/3 7.5YR). | | |
| 20 | | 11 | 7-9-13-15. | | | | | 1665 |
| | | 12 | 19-26-28-30. | SP-SM | | POORLY GRADED SAND WITH SILT (SP-SM): medium to coarse grained; Brown (5/4 7.5YR); [Cannonball Formation]. | | |
| 25 | | | | | | | | |

Date Boring Started: 8/17/15
Date Boring Completed: 8/17/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 13.22' TOR on 8/21/2015 (elev. 1675.92)

Additional data may have been collected in the field which is not included on this log.
Weather:

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Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

# LOG OF BORING MW-105
**DRAFT**



Project:R.M. Haskett Station CCR Monitoring Network
Project No.:34300014.12
Location:Mandan, ND
Coordinates:Lat: 438042.079° Long: 1870325.657°
Datum:NAD 83

Surface Elevation:1686.0 ft
Drilling Method:HSA
Sampling Method:SPT
Completion Depth:30.0 ft

Unique Well No.:

| Depth, feet | Sample Type & Recovery | Sample No. | Blows/6in. | USCS | Graphic Log | LITHOLOGIC DESCRIPTION | WELL OR PIEZOMETER CONSTRUCTION DETAIL | Elevation, feet |
|---|---|---|---|---|---|---|---|---|
| 25 | | 13 | 15-25-31-40. | | | | | |
| | | 14 | 10-15-18-30. | CL | | FAT CLAY (CL): Dark Brown (3/4 7.5YR); high plasticity; sand lens at 26.5'; [Cannonball Formation].<br>At 26': Color change to Gray (5/1 7.5YR). | | 1660 |
| | | 15 | 11-16-22-32. | | | | | |
| 30 | | | | | | End of boring 30.0 feet | | |
| 35 | | | | | | | | |
| 40 | | | | | | | | |
| 45 | | | | | | | | |
| 50 | | | | | | | | |

PRO. CASING
Diameter: **4"**
Type: **Steel pipe**
Interval: **3.5' ags - 1.5' bgs**

RISER CASING
Diameter: **2"**
Type: **PVC SCH 80**
Interval: **3.16' ags - 10' bgs**

GROUT
Type: **None**
Interval: **None**

SEAL
Type: **Bentonite chips**
Interval: **0 - 7' bgs**

SANDPACK
Type: **Silica 40-70**
Interval: **7 - 30' bgs**

SCREEN
Diameter: **2"; No.6 slot**
Type: **PVC SCH 80**
Interval: **10 - 30' bgs**

Date Boring Started: 8/17/15
Date Boring Completed: 8/17/15
Logged By: JEG3
Drilling Contractor: Terracon
Drill Rig: Rig mounted HSA

Remarks: DTW = 13.22' TOR on 8/21/2015 (elev. 1675.92)

Additional data may have been collected in the field which is not included on this log.
Weather:

M:\GINT\PROJECTS\34300014.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

STATE OF NORTH DAKOTA

# BOARD OF WATER WELL CONTRACTORS

900 E. BOULEVARD • BISMARCK, NORTH DAKOTA 58501

# WELL DRILLER'S REPORT

State law requires that this report be filed with the State Board of Water Well Contractors within 30 days after completion or abandonment of the well.

**1. WELL OWNER**

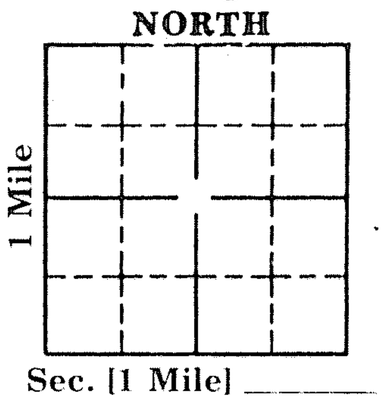
Name Montana Dakota Utilities

Address Bismarck, ND

**2. WELL LOCATION**

Sketch map location must agree with written location.

Heskett Ash
Dispoal Site
#1-90
139-81-10CAD
Top nof pipe
1675.54
Ground level
1673.6




County Morton

SE ¼ NE ¼ SW ¼ Sec. 10 Twp. 139 N. Rg. 81 W.

**3. PROPOSED USE**

☐ Domestic ☐ Geothermal ☒ Monitoring
☐ Stock ☐ Irrigation ☐ Industrial
☐ Municipal ☐ Test Hole

**4. METHOD DRILLED**

☐ Cable ☐ Reverse Rotary ☐ Bored
☒ Forward Rotary ☐ Jetted ☐ Auger

If other, specify

**5. WATER QUALITY**

Was a water sample collected for:
Chemical Analysis? ☐ Yes ☐ No
Bacteriological Analysis? ☐ Yes ☐ No
If so, to what laboratory was it sent

**6. WELL CONSTRUCTION**

Diameter of hole 5 inches. Depth 15 feet.

Casing: ☐ Steel ☒ Plastic ☐ Concrete
☐ Threaded ☐ Welded ☐ Other

If other, specify

| Pipe Weight: | Diameter: | From: | To: |
|---|---|---|---|
| SDR-21 lb/ft. | 2 inches | ±2.0 feet | 5 feet |
| lb/ft. | inches | feet | feet |
| lb/ft. | inches | feet | feet |

Was perforated pipe used? ☐ Yes ☒ No

Perforated pipe set from ft to feet

Was casing left open end? ☐ Yes ☒ No

Was a well screened installed? ☒ Yes ☐ No

Material PVC Diameter 2 inches
(stainless steel, bronze, etc.)

Slot size 10 set from 5 feet to 15 feet

Slot size set from feet to feet

Was a packer or seal used? ☒ Yes ☐ No

If so, what material cse bentonite Depth 3 to 4 Ft.

Type of well: Straight screen ☐ Gravel packed ☒

Depth grouted: From 3 To surface

Grouting Material: Cement X Other

If other explain: w/bentonite

Well head completion: Pitless unit

12" above grade X Other

If other, specify

Was pump installed: ☐ Yes ☒ No

Was well disinfected upon completion? ☐ Yes ☒ No

**7. WATER LEVEL**

Static water level 12.3 feet below land surface

If flowing: closed-in pressure psi

GPM flow through inch pipe

Controlled by: ☐ Valve ☐ Reducers ☐ Other

If other, specify

**8. WELL TEST DATA**

☐ Pump ☐ Bailer ☐ Other

Pumping level below land surface:

ft. after hrs. pumping gpm

ft. after hrs. pumping gpm

ft. after hrs. pumping gpm

**9. WELL LOG**

| Formation | Depth (ft.) From | To |
|---|---|---|
| Clay, fill | 0 | 3 |
| Sand, fine to medium, yellowish brown | 3 | 6 |
| Clay, silty, yellowish brown, bedrock | 6 | 13 |
| Clay, silty, medium gray | 13 | 15 |

(Use separate sheet if necessary.)

**10. DATE COMPLETED** 2/5/90

**11. WAS WELL PLUGGED OR ABANDONED?**

☐ Yes ☒ No

If so, how

**12. REMARKS:**

2" PVC cap on bottom of screen
160# of silica sand pack

**13. DRILLER'S CERTIFICATION**

This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Water Supply, Inc. 46
Driller's or Firm's Name Certificate No

Box 1191 - Bismarck, ND 58502
Address

Lewis Knutson 2/5/90
Signed by Lewis Knutson Date

WHITE—DRILLER'S COPY YELLOW—BOARD'S COPY PINK—CUSTOMER'S COPY

STATE OF NORTH DAKOTA

# BOARD OF WATER WELL CONTRACTORS

900 E. BOULEVARD • BISMARCK, NORTH DAKOTA 58501

# WELL DRILLER'S REPORT

State law requires that this report be filed with the State Board of Water Well Contractors within 30 days after completion or abandonment of the well.

**1. WELL OWNER**

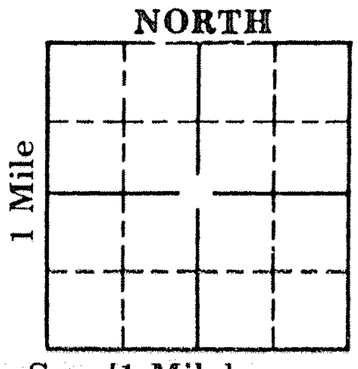
Name Montana Dakota Utilities

Address Bismarck, ND

**2. WELL LOCATION**

Sketch map location must agree with written location.

Heskett Ash
Disposal Site
#2-90
139--81-10CAB1
Top of pipe
1686.54
Ground level
1684.3




County Morton

SW ¼NE ¼ NW ¼ Sec. 10 Twp. 139 N. Rg. 81 W.

**3. PROPOSED USE**

☐ Domestic ☐ Geothermal ☒ Monitoring
☐ Stock ☐ Irrigation ☐ Industrial
☐ Municipal ☐ Test Hole

**4. METHOD DRILLED**

☐ Cable ☐ Reverse Rotary ☐ Bored
☒ Forward Rotary ☐ Jetted ☐ Auger

If other, specify

**5. WATER QUALITY**

Was a water sample collected for:
Chemical Analysis? ☐ Yes ☐ No
Bacteriological Analysis? ☐ Yes ☐ No
If so, to what laboratory was it sent

**6. WELL CONSTRUCTION**

Diameter of hole 5 inches. Depth 23 feet.

Casing: ☐ Steel ☒ Plastic ☐ Concrete
☐ Threaded ☐ Welded ☐ Other

If other, specify

| Pipe Weight: | Diameter: | From: | To: |
|---|---|---|---|
| SDR-21 ~~lb/ft.~~ | 2 inches | +2.3 feet | 13 feet |
| lb/ft. | inches | feet | feet |
| lb/ft. | inches | feet | feet |

Was perforated pipe used? ☐ Yes ☒ No

Perforated pipe set from ft to feet

Was casing left open end? ☐ Yes ☒ No

Was a well screened installed? ☒ Yes ☐ No

Material PVC Diameter 2 inches
(stainless steel, bronze, etc.)

Slot size 10 set from 13 feet to 23 feet

Slot size set from feet to feet

Was a packer or seal used? ☒ Yes ☐ No

If so, what material ~~cse~~ bentonite Depth 11 to 12 Ft.

Type of well: Straight screen ☐ Gravel packed ☒

Depth grouted: From 11 To surface

Grouting Material: Cement X Other

If other explain: w/bentonite

Well head completion: Pitless unit

12" above grade X Other

If other, specify

Was pump installed: ☐ Yes ☒ No

Was well disinfected upon completion? ☐ Yes ☒ No

**7. WATER LEVEL**

Static water level dry feet below land surface

If flowing: closed-in pressure psi

GPM flow through inch pipe

Controlled by: ☐ Valve ☐ Reducers ☐ Other

If other, specify

**8. WELL TEST DATA**

☐ Pump ☐ Bailer ☐ Other

Pumping level below land surface:

ft. after hrs. pumping gpm

ft. after hrs. pumping gpm

ft. after hrs. pumping gpm

**9. WELL LOG**

| Formation | Depth (ft.) From | To |
|---|---|---|
| Topsoil, silty, black | 0 | 1 |
| Sand, fine, yellowish gray | 1 | 6.5 |
| Clay, silty, yellowish brown, till | 6.5 | 11 |
| Clay, silty, medium gray | 11 | 13 |
| Sand | 13 | 15.5 |
| Clay, silty, medium gray, bedrock | 15.5 | 23 |

(Use separate sheet if necessary.)

**10. DATE COMPLETED** 2/5/90

**11. WAS WELL PLUGGED OR ABANDONED?**

☐ Yes ☒ No

If so, how

**12. REMARKS:**

2" PVC cap on bottom of screen
160# silica sand pack

**13. DRILLER'S CERTIFICATION**

This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Water Supply, Inc. 46
Driller's or Firm's Name Certificate No.

Box 1191 - Bismarck, ND 58502
Address

Lewis Knutson 2/5/90
Signed by Lewis Knutson Date

WHITE—DRILLER'S COPY YELLOW—BOARD'S COPY PINK—CUSTOMER'S COPY

STATE OF NORTH DAKOTA

# BOARD OF WATER WELL CONTRACTORS

900 E. BOULEVARD • BISMARCK, NORTH DAKOTA 58501

# WELL DRILLER'S REPORT

State law requires that this report be filed with the State Board of Water Well Contractors within 30 days after completion or abandonment of the well.

**1. WELL OWNER**

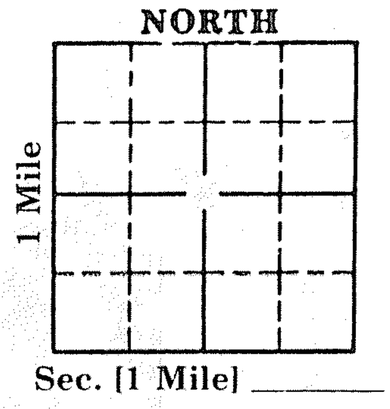
Name Montana Dakota Utilities

Address Bismarck, ND

**2. WELL LOCATION**

Sketch map location must agree with written location.

Heskett Ash Disposal Site #3-90
139-81-10CAB2
Top of pipe 1685.92
Ground level 1683.6




County Morton

SW ¼ NE ¼ NW ¼ Sec. 10 Twp. 139 N. Rg. 81 W.

**3. PROPOSED USE**

☐ Domestic ☐ Stock ☐ Geothermal ☐ Irrigation ☐ Municipal ☒ Monitoring ☐ Industrial ☐ Test Hole

**4. METHOD DRILLED**

☐ Cable ☐ Reverse Rotary ☐ Bored
☒ Forward Rotary ☐ Jetted ☐ Auger

If other, specify

**5. WATER QUALITY**

Was a water sample collected for:
Chemical Analysis? ☐ Yes ☐ No
Bacteriological Analysis? ☐ Yes ☐ No
If so, to what laboratory was it sent

**6. WELL CONSTRUCTION**

Diameter of hole 5 inches. Depth 20 feet.

Casing: ☐ Steel ☒ Plastic ☐ Concrete ☐ Threaded ☐ Welded ☐ Other

If other, specify

| Pipe Weight: | Diameter: | From: | To: |
|---|---|---|---|
| SDR-21 ~~XXXX~~ lb/ft. | 2 inches | +2.3 feet | 10 feet |
| lb/ft. | inches | feet | feet |
| lb/ft. | inches | feet | feet |

Was perforated pipe used? ☐ Yes ☒ No

Perforated pipe set from ft to feet

Was casing left open end? ☐ Yes ☒ No

Was a well screened installed? ☒ Yes ☐ No

Material PVC Diameter 2 inches
(stainless steel, bronze, etc.)

Slot size 10 set from 10 feet to 20 feet

Slot size set from feet to feet

Was a packer or seal used? ☒ Yes ☐ No

If so, what material cse bentonite Depth 7.5 to 9 Ft.

Type of well: Straight screen ☐ Gravel packed ☒

Depth grouted: From 7.5 To surface

Grouting Material: Cement X Other

If other explain: w/bentonite

Well head completion: Pitless unit

12" above grade X Other

If other, specify

Was pump installed: ☐ Yes ☒ No

Was well disinfected upon completion? ☐ Yes ☒ No

**7. WATER LEVEL**

Static water level dry feet below land surface

If flowing: closed-in pressure psi

GPM flow through inch pipe

Controlled by: ☐ Valve ☐ Reducers ☐ Other

If other, specify

**8. WELL TEST DATA**

☐ Pump ☐ Bailer ☐ Other

Pumping level below land surface:

ft. after hrs. pumping gpm

ft. after hrs. pumping gpm

ft. after hrs. pumping gpm

**9. WELL LOG**

| Formation | Depth (ft.) From | To |
|---|---|---|
| Topsoil, silty, black | 0 | 1 |
| Clay, silty, yellowish brown, till | 1 | 7 |
| Sand, fine, yellowish brown | 7 | 8 |
| Clay, silty, medium gray, till | 8 | 15 |
| Clay, silty to sandy, medium gray, abt 40% sand | 15 | 20 |

(Use separate sheet if necessary.)

**10. DATE COMPLETED** 2/5/90

**11. WAS WELL PLUGGED OR ABANDONED?**

☐ Yes ☒ No

If so, how

**12. REMARKS:**

2" PVC cap on bottom of screen
160# silica sand pack

**13. DRILLER'S CERTIFICATION**

This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Water Supply, Inc. 46
Driller's or Firm's Name Certificate No.

Box 1191 - Bismarck, ND 58502
Address

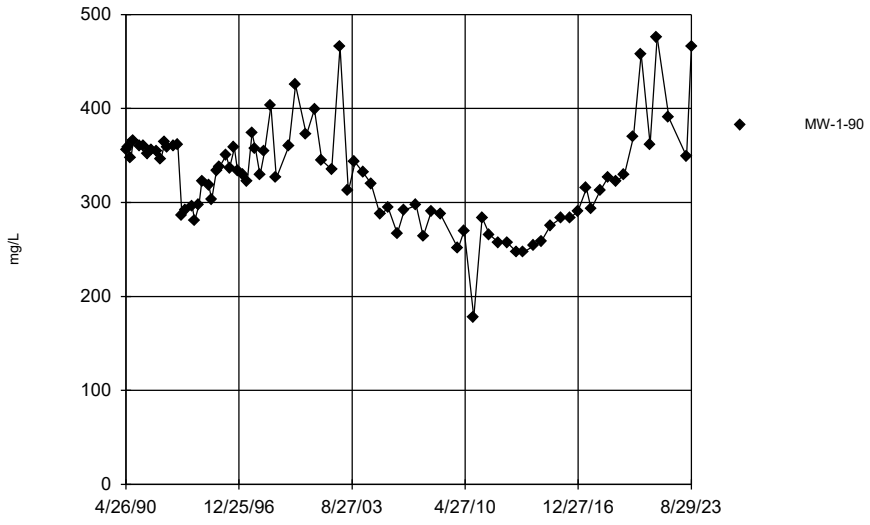
Lewis Knutson 2/5/90
Signed by Lewis Knutson Date

WHITE: DRILLER'S COPY YELLOW: BOARD'S COPY PINK: CUSTOMER'S COPY

# Appendix F

## MW1-90 Time Series Plots

## Alkalinity, bicarbonate



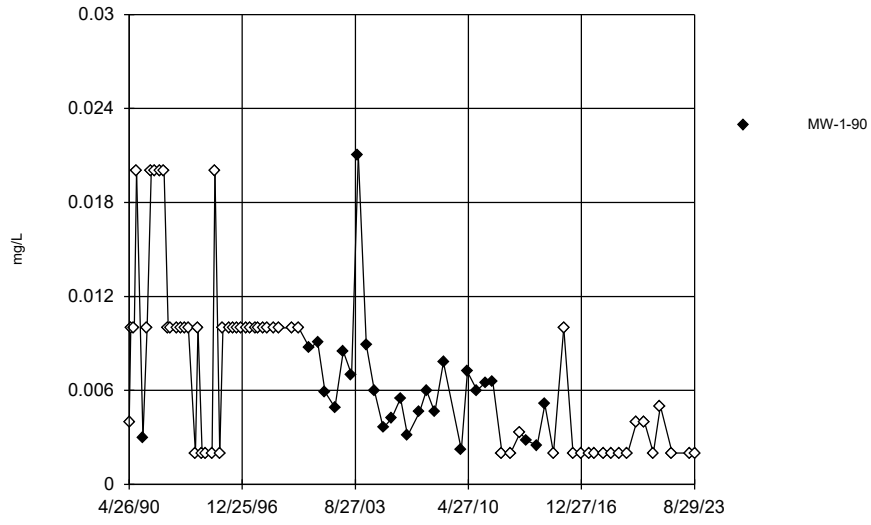

Time Series Analysis Run 3/17/2025 11:13 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190



Hollow symbols indicate censored values.

## Arsenic



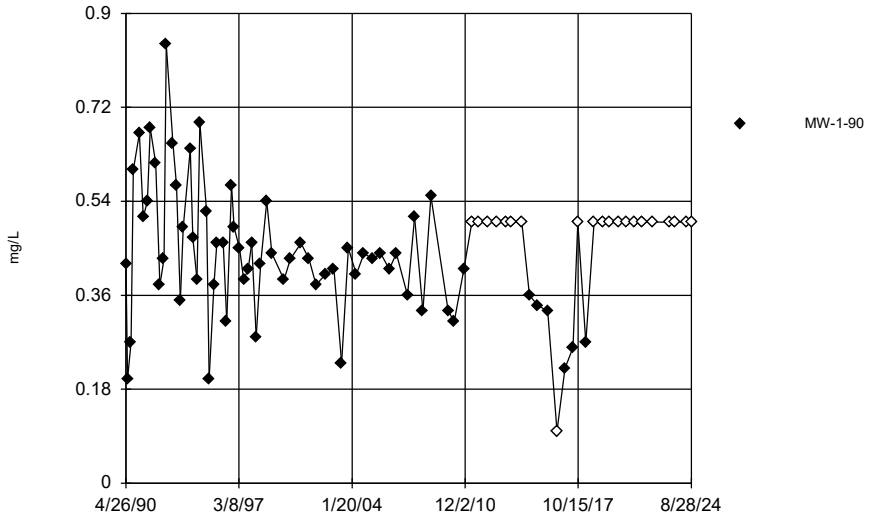

Time Series Analysis Run 3/17/2025 11:13 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190



Hollow symbols indicate censored values.

## Boron

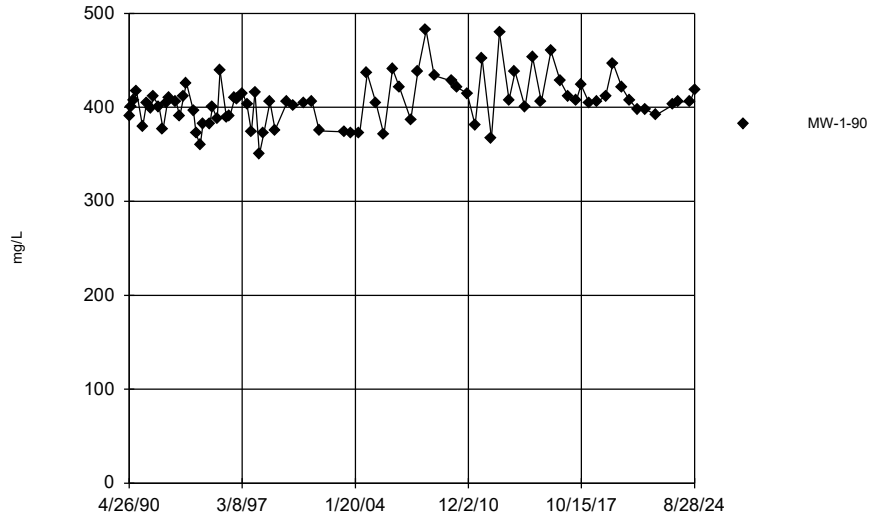



Time Series Analysis Run 3/17/2025 11:13 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190



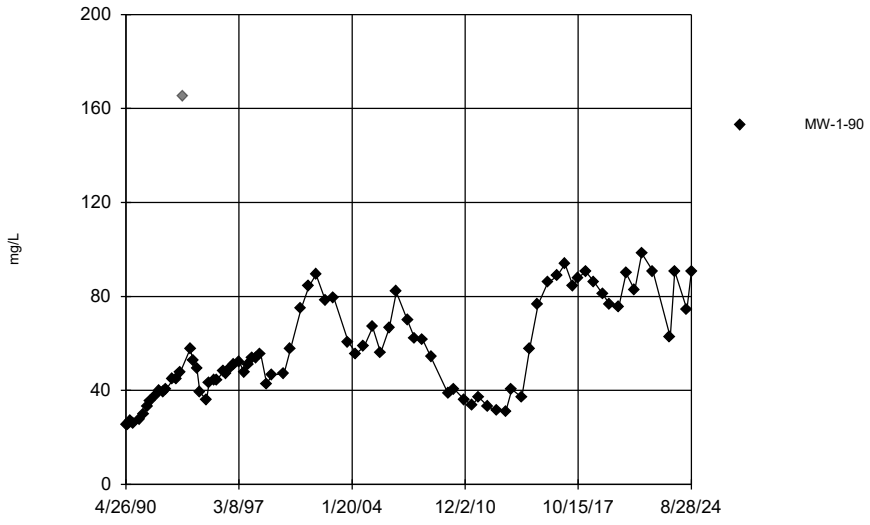
## Calcium




Time Series Analysis Run 3/17/2025 11:13 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

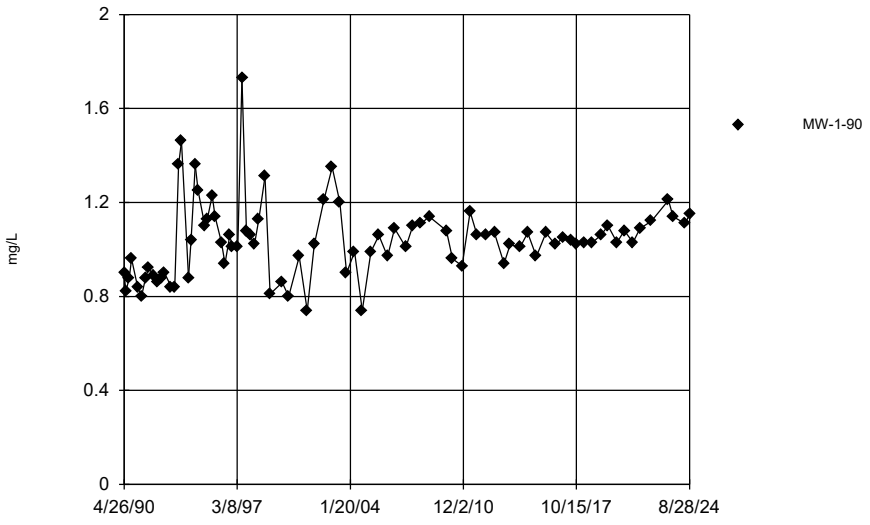
## Chloride




Time Series Analysis Run 3/17/2025 11:13 AM
R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190



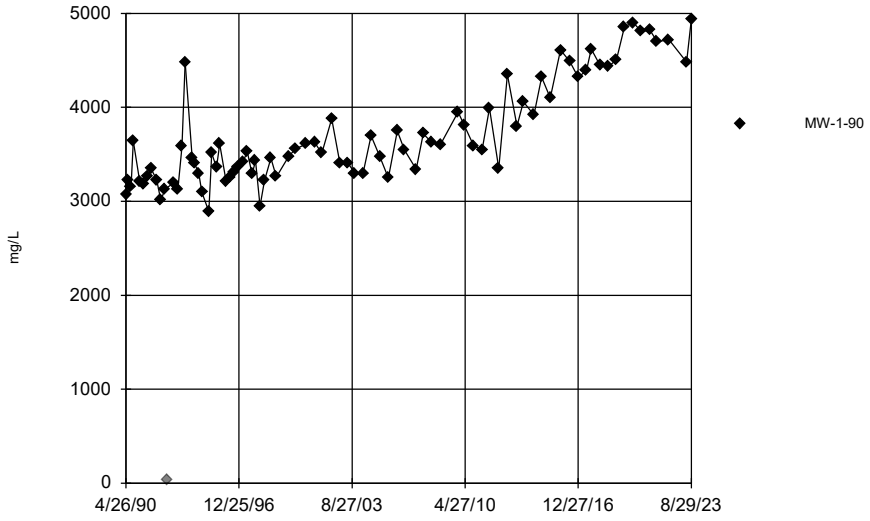
## Fluoride




Time Series Analysis Run 3/17/2025 11:13 AM
R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190



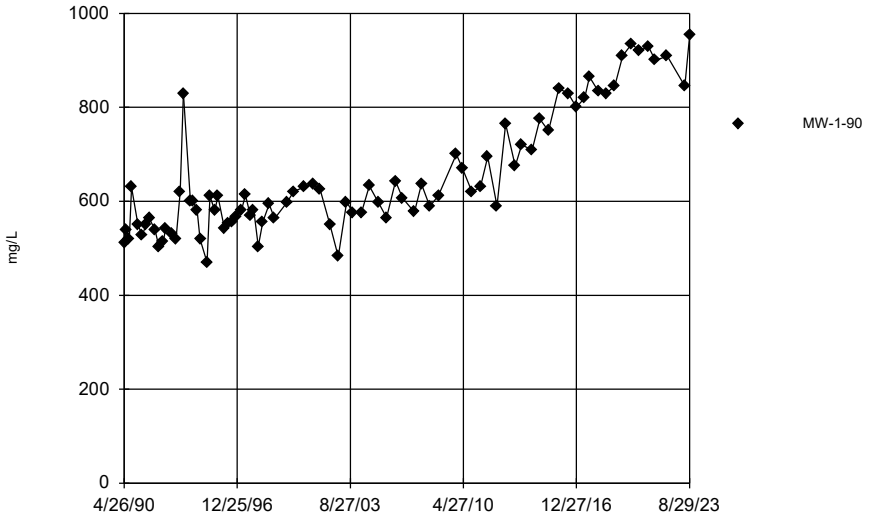
## Hardness




Time Series Analysis Run 3/17/2025 11:13 AM
R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

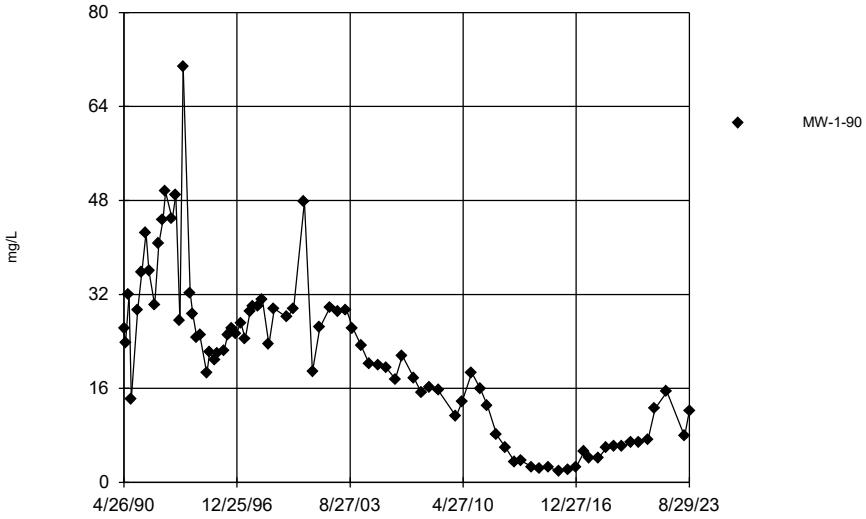


## Magnesium




Time Series Analysis Run 3/17/2025 11:13 AM
R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

## Nitrogen

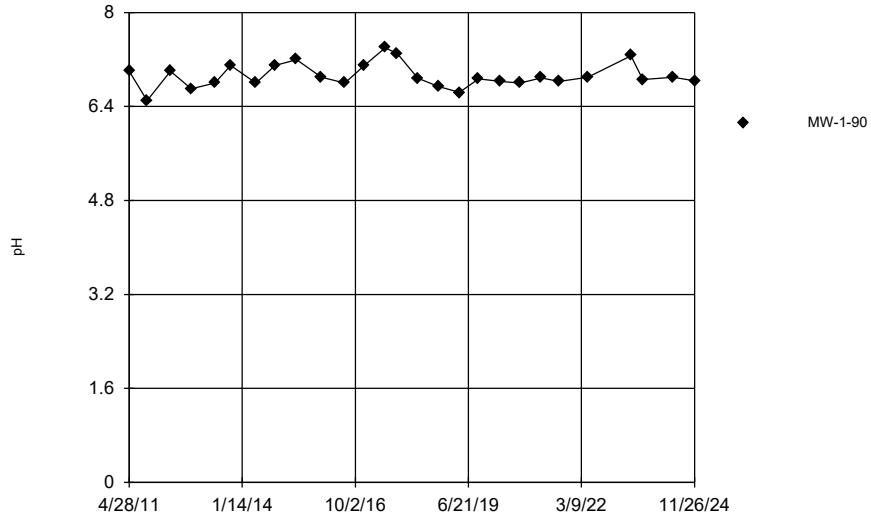



Time Series Analysis Run 3/17/2025 11:13 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190



## pH

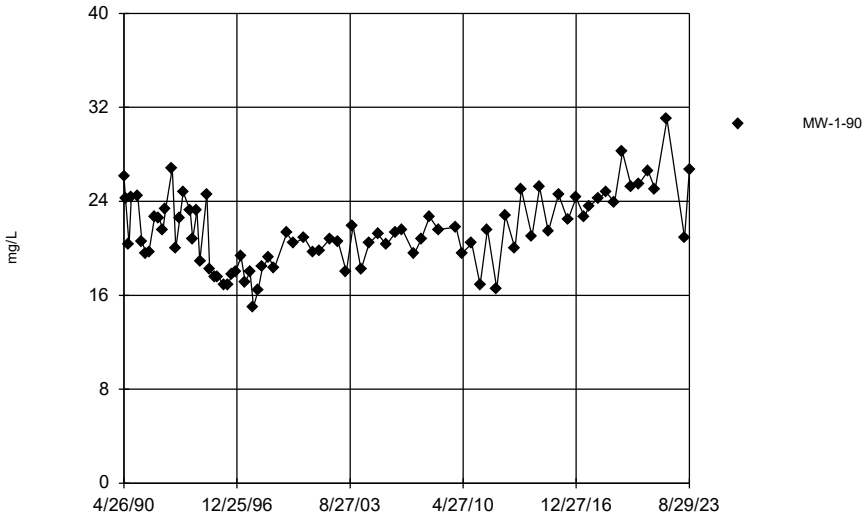



Time Series Analysis Run 3/17/2025 11:13 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190



## Potassium

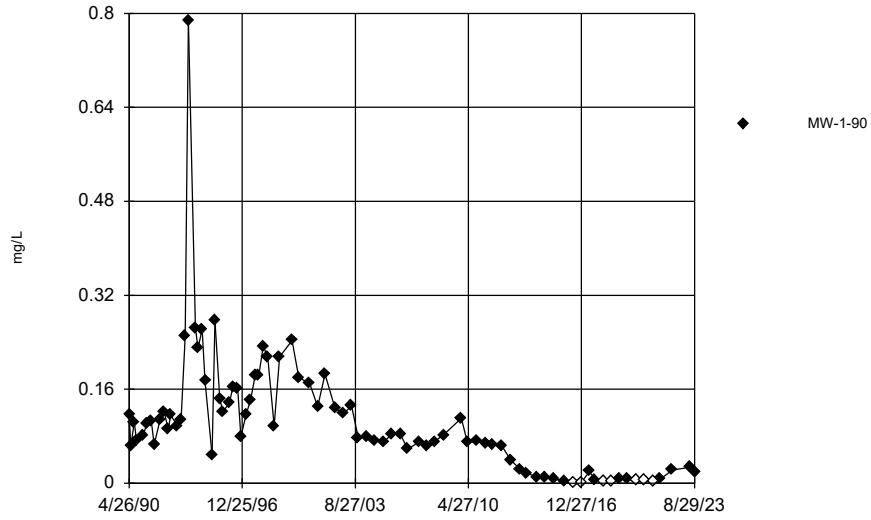



Time Series Analysis Run 3/17/2025 11:13 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190


Hollow symbols indicate censored values.

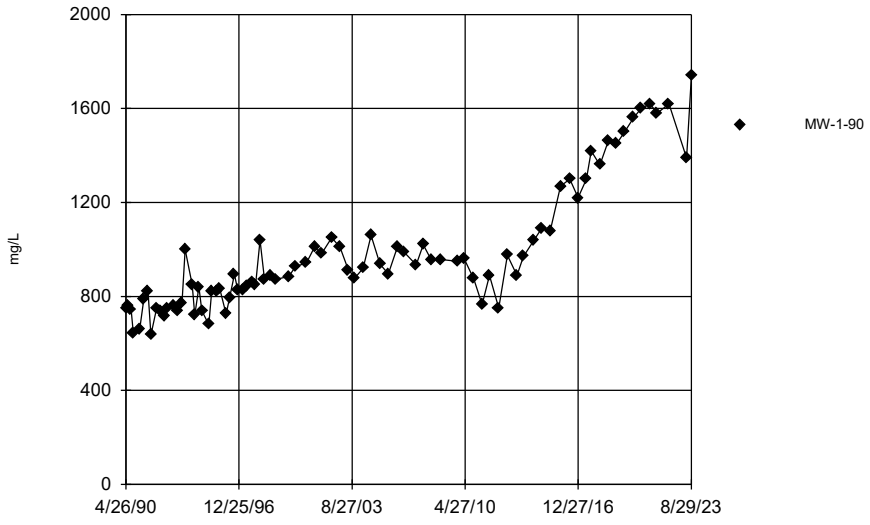
## Selenium




Time Series Analysis Run 3/17/2025 11:13 AM

R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

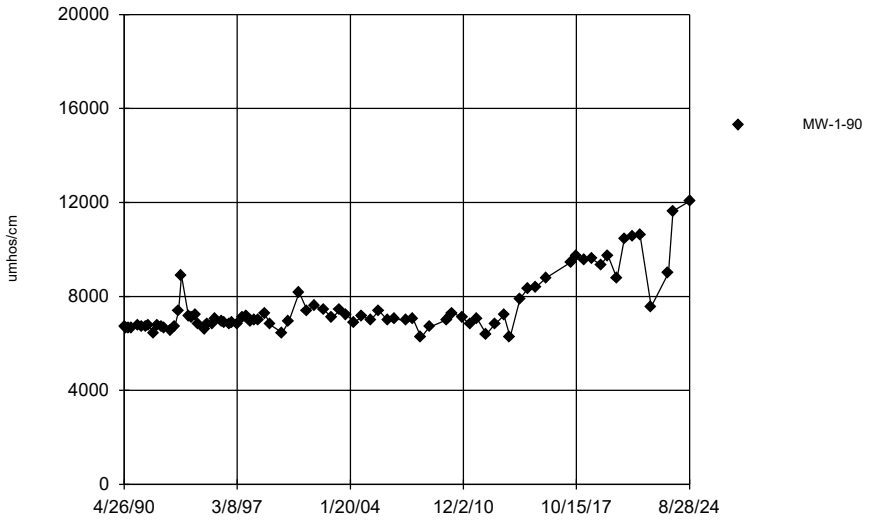
## Sodium




Time Series Analysis Run 3/17/2025 11:13 AM
R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.10.0.24 Software licensed to Barr Engineering Company. UG

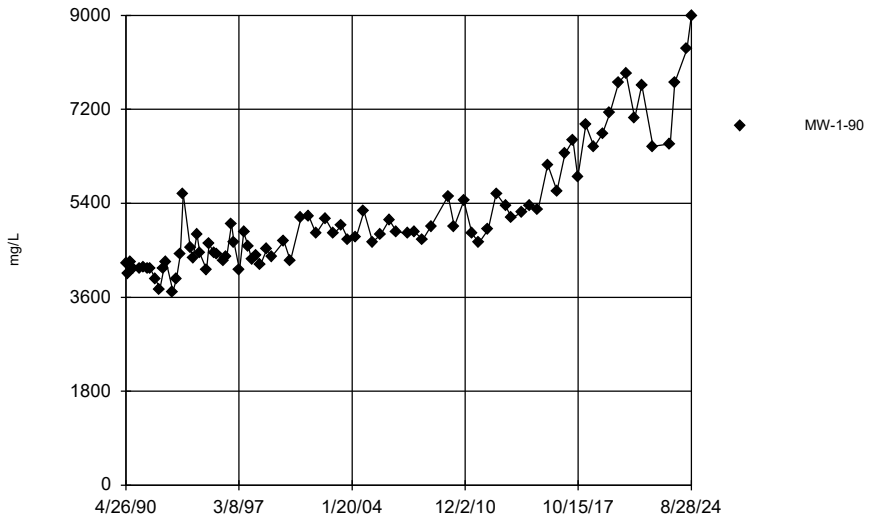
## Specific conductance




Time Series Analysis Run 3/17/2025 11:13 AM
R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.10.0.24 Software licensed to Barr Engineering Company. UG

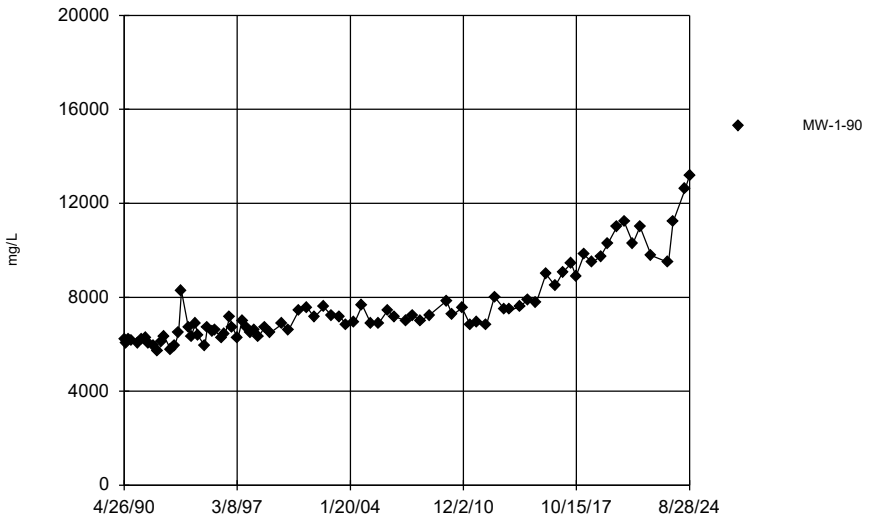
## Sulfate




Time Series Analysis Run 3/17/2025 11:13 AM
R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

Sanitas™ v.10.0.24 Software licensed to Barr Engineering Company. UG

## TDS




Time Series Analysis Run 3/17/2025 11:13 AM
R.M. Heskett Station Client: Montana-Dakota Utilities Co. Data: MDUHeskett_AMR_MW190

# Appendix G

## Geochemist's Workbench Results

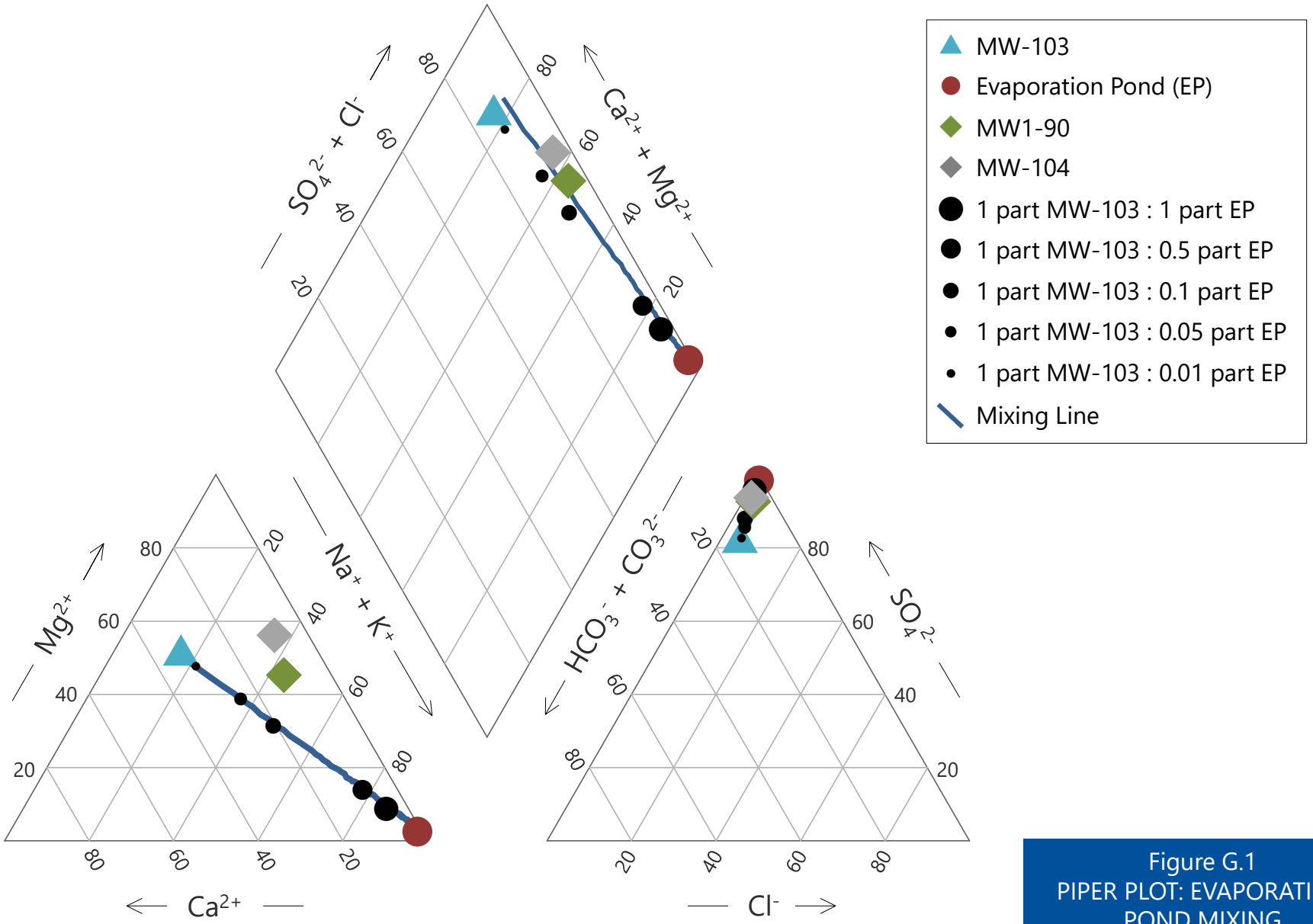
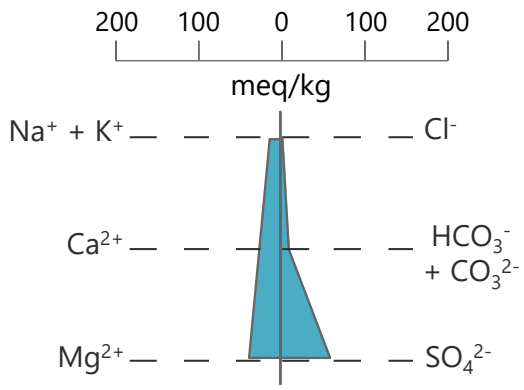
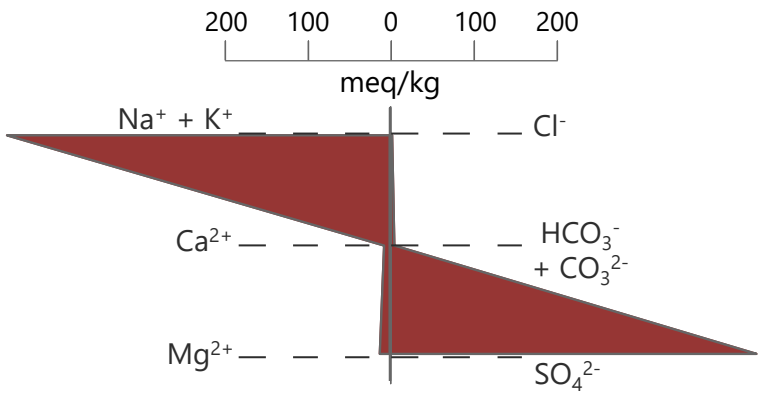



Figure G.1
PIPER PLOT: EVAPORATION POND MIXING
R.M. Heskett Station
Mandan, North Dakota

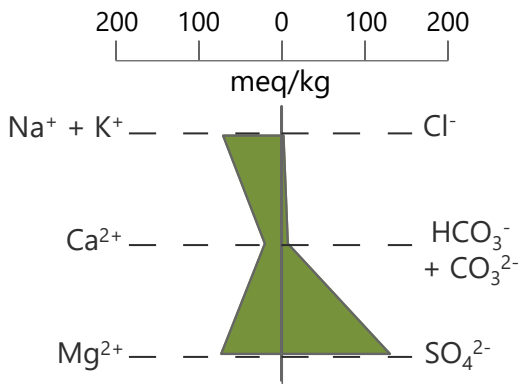
BARR



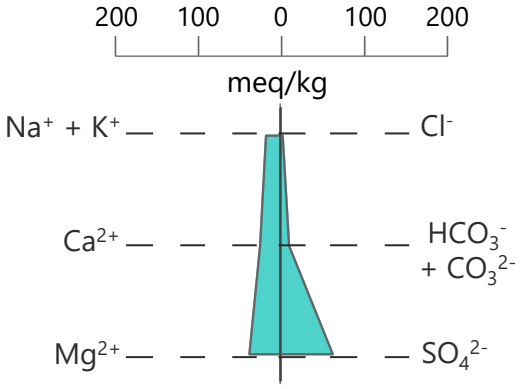

**MW103**



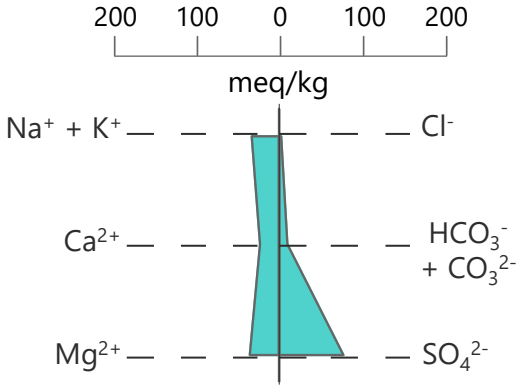

**Evaporation Pond (EP)**



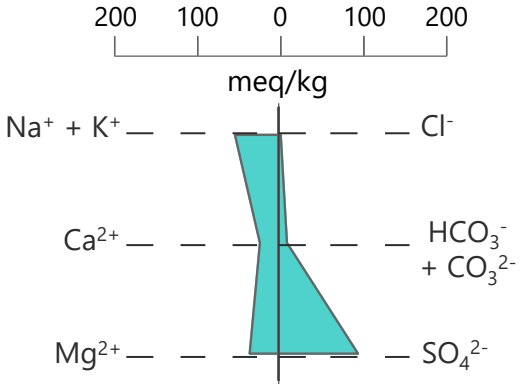

**MW1-90**



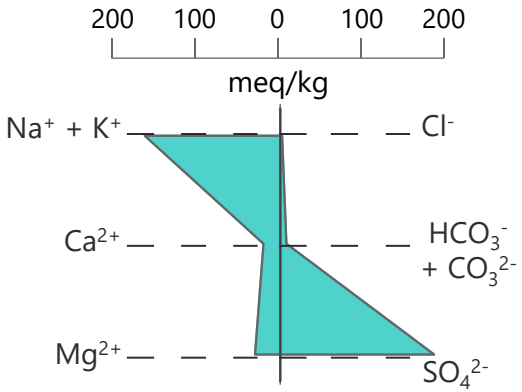

**1 part MW-103 : 0.01 part EP**



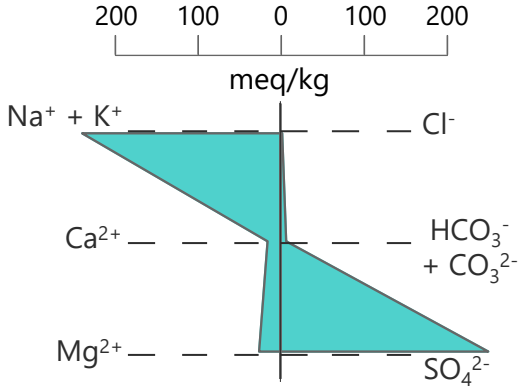

**1 part MW-103 : 0.05 part EP**




**1 part MW-103 : 0.1 part EP**




**1 part MW-103 : 0.5 part EP**




**1 part MW-103 : 1 part EP**

BARR

Figure G.2
STIFF PLOT: EVAPORATION POND MIXING
R.M. Heskett Station
Mandan, North Dakota

**Table G.1**
**Geochemist's Workbench Mixing Model Results**

| Description | | Upgradient | Evap Pond | Mixing Evap Pond into MW-103 | | | | | Downgradient | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | | MW-103 | Evap Pond | 1 : 0.01 | 1 : 0.05 | 1 : 0.1 | 1 : 0.5 | 1 : 1 | MW1-90 | MW-104 |
| Sample Date | | 8/23/2021 | 9/16/2014 | n/a | | | | | 8/28/2023 | 8/24/2021 |
| HCO3- | mg/l | 645 | 340 | 642 | 630 | 617 | 543 | 492 | 568 | 820 |
| Ca++ | mg/l | 500 | 125 | 496 | 482 | 466 | 375 | 313 | 406 | 422 |
| Cl- | mg/l | 119 | 79.8 | 119 | 117 | 115 | 106 | 99 | 90.7 | 94.1 |
| F- | mg/l | 0.30 | 0.1 | 0.30 | 0.29 | 0.28 | 0.23 | 0.20 | 1.14 | 0.54 |
| Mg++ | mg/l | 464 | 165 | 461 | 450 | 437 | 364 | 315 | 953 | 1,640 |
| K+ | mg/l | 20.0 | 734 | 27.1 | 54.0 | 84.9 | 258 | 377 | 26.7 | 34 |
| Na+ | mg/l | 266 | 10,600 | 368 | 758 | 1,210 | 3,710 | 5,430 | 1,740 | 1,940 |
| SO4-- | mg/l | 3,000 | 22,100 | 3,190 | 3,910 | 4,740 | 9,370 | 12,500 | 7,710 | 11,600 |
| pH | SU | 6.6 | 10.7 | 6.6 | 6.7 | 6.7 | 7.4 | 8.9 | 6.9 | 6.9 |
| TDS | mg/kg | 4,950 | 34,100 | 5,240 | 6,350 | 7,610 | 14,700 | 19,600 | 13,100 | 16,500 |

# Appendix C

## Groundwater Elevation and Flow Rate

Appendix C
Groundwater Elevations
2025 Annual Monitoring Report
Heskett CCR Groundwater Compliance

| Location | Date | Top of Riser Elevation ft amsl | Depth to Water ft | Water Level Elevation ft amsl |
|---|---|---|---|---|
| MW-13 | 4/23/2025 | 1724.27 | 30.48 | 1693.79 |
| MW-13 | 8/14/2025 | 1724.27 | 29.78 | 1694.49 |
| MW1-90 | 4/23/2025 | 1675.86 | 11.09 | 1664.77 |
| MW1-90 | 8/14/2025 | 1675.86 | 11.72 | 1664.14 |
| MW2-90 | 4/23/2025 | 1687.08 | 20.65 | 1666.43 |
| MW2-90 | 8/14/2025 | 1687.08 | 21.18 | 1665.9 |
| MW-33 | 4/23/2025 | 1717.95 | 40.62 | 1677.33 |
| MW-33 | 8/14/2025 | 1717.95 | 41.08 | 1676.87 |
| MW3-90 | 4/23/2025 | 1686.46 | 17.85 | 1668.61 |
| MW3-90 | 8/14/2025 | 1686.46 | 19.15 | 1667.31 |
| MW-44R | 4/23/2025 | 1711.57 | 27.1 | 1684.47 |
| MW-44R | 8/14/2025 | 1711.57 | 27.26 | 1684.31 |
| MW-70 | 4/23/2025 | 1706.34 | 20.45 | 1685.89 |
| MW-70 | 8/14/2025 | 1706.34 | 20.74 | 1685.6 |
| MW-80R | 4/23/2025 | 1686.78 | 14.04 | 1672.74 |
| MW-80R | 8/14/2025 | 1686.78 | 14.07 | 1672.71 |
| MW-101 | 4/23/2025 | 1719.53 | 36.2 | 1683.33 |
| MW-101 | 8/14/2025 | 1719.53 | 36.24 | 1683.29 |
| MW-102 | 4/23/2025 | 1706.64 | 16.83 | 1689.81 |
| MW-102 | 8/14/2025 | 1706.64 | 16.88 | 1689.76 |
| MW-103 | 4/23/2025 | 1717.53 | 31.48 | 1686.05 |
| MW-103 | 8/14/2025 | 1717.53 | 30.96 | 1686.57 |
| MW-104 | 4/23/2025 | 1684.51 | 13.73 | 1670.78 |
| MW-104 | 8/14/2025 | 1684.51 | 13.84 | 1670.67 |
| MW-105 | 4/23/2025 | 1689.14 | 12.7 | 1676.44 |
| MW-105 | 8/14/2025 | 1689.14 | 13 | 1676.14 |

## Heskett Groundwater Velocity Calculation

| | |
|---|---|
| **Sampling Date** | 4/23/2025 |

*Upgradient: MW13*

| | | | |
|---|---|---|---|
| **Top of Casing Elevation** | 1724.27 | ft amsl | *Groundwater Monitoring System Report (Barr, 2016)* |
| **Depth to Water** | 30.48 | ft below TOC | |
| **Water Level Elevation** | 1693.79 | ft amsl | |

*Downgradient: MW1-90*

| | | | |
|---|---|---|---|
| **Top of Casing Elevation** | 1675.86 | ft amsl | *Groundwater Monitoring System Report (Barr, 2016)* |
| **Depth to Water** | 11.09 | ft below TOC | |
| **Water Level Elevation** | 1664.77 | ft amsl | |

| | | | |
|---|---|---|---|
| **horizontal hydraulic conductivity (Kh)** | 1.00E-04 | cm/s | *Groundwater Monitoring System Documentation (Barr, 2017)* |
| | 2.83E-01 | ft/day | |
| **porosity (n)** | 0.25 | | *Groundwater Monitoring System Documentation (Barr, 2017)* |
| **horizontal distance** | 1850 | ft | |
| **WL elevation difference** | 29.02 | ft | |
| **gradient (i)** | 0.016 | ft/ft | |
| **linear velocity (V)** | 0.0177863 | ft/day | |
| **V** | **6.5** | ft/yr | |

Appendix C
Groundwater Flow Rate
202**5** Annual Monitoring Report Heskett
CCR Groundwater Compliance

## Heskett Groundwater Velocity Calculation

| | |
|---|---|
| **Sampling Date** | 8/14/2025 |

*Upgradient: MW13*

| | | | |
|---|---|---|---|
| **Top of Casing Elevation** | 1724.27 | ft amsl | *Groundwater Monitoring System Report (Barr, 2016)* |
| **Depth to Water** | 29.78 | ft below TOC | |
| **Water Level Elevation** | 1694.49 | ft amsl | |

*Downgradient: MW1-90*

| | | | |
|---|---|---|---|
| **Top of Casing Elevation** | 1675.86 | ft amsl | *Groundwater Monitoring System Report (Barr, 2016)* |
| **Depth to Water** | 11.72 | ft below TOC | |
| **Water Level Elevation** | 1664.14 | ft amsl | |

| | | | |
|---|---|---|---|
| **horizontal hydraulic** | 1.00E-04 | cm/s | *Groundwater Monitoring System Documentation (Barr, 2017)* |
| **conductivity (Kh)** | 2.83E-01 | ft/day | |
| **porosity (n)** | 0.25 | | *Groundwater Monitoring System Documentation (Barr, 2017)* |
| **horizontal distance** | 1850 | ft | |
| **WL elevation difference** | 30.35 | ft | |
| **gradient (i)** | 0.016 | ft/ft | |
| **linear velocity (V)** | 0.0186014 | ft/day | |
| **V** | **6.8** | ft/yr | |