2024 ANNUAL WATER QUALITY REPORT

FOR THE

MONONA COUNTY SANITARY LANDFILL

67-SDP-01-75C

TURIN, IOWA

by:

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November, 2024

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6036-23A.320

Table of Contents

Section 1.0 Background Information

1.1 Report Priority

This report is considered to be low priority for review. SSI were identified in MW-1 for barium, chloride, and cis-1,2-dichloroethylene. The SSI do not approach GWPS. IAC 567, Chapter 114 does not have a requirement to collect Appendix II samples in the event of a detected SSI. Additional testing requirements are at the discretion of the IDNR based on any perceived release from the facility. The sample parameters were changed in 2023 based on the IDNR request to do so. No release is interpreted based on water quality findings to date.

1.2 Period of Report Coverage

Water quality data evaluation is based on a running compilation of data beginning October 4, 2018. Statistical evaluations herein are based on the 2024 water quality data collected April 18, 2024 and October 17, 2024.

1.3 Current Site Map

Figure 1 is attached illustrating the current site features, monitoring well locations, and subsurface gas probe locations.

1.4 Site Status and Applicable Rules

Site Location

The Monona County Sanitary Landfill is located in the SW¼ of the SW¼ lying north and east of Monona County Road L-16, and the south 100 feet of the south 20 rods of the NW¼ of the SW¼ of Section 13, T83N, R44W, Monona County, Iowa. The site encompasses approximately 23 acres. The facility is closed under the Iowa Department of Natural Resources (IDNR) Permit Number 67-SDP-01-75C.

Landfill Layout & History

The site is situated in rolling terrain on land that was previously a ravine. Drainage from the site is predominantly to ditches outside of the waste boundary that pass through the sedimentation basin in the north-central portion of the site. The facility was closed in 2016.

Applicable Rules

Iowa Administrative Code (IAC) 567-114 is applicable to the site.

1.5 Summary of the Hydrologic Monitoring System Plan (HMSP)

The geology and hydrogeology at the site are described in the Hydrogeologic Assessment Report dated January 6, 2012 by Terracon (Doc #68181). Previous land use is agricultural land.

The Hydrogeologic Assessment Report dated January 6, 2012 (Doc #68181) concluded that the water table at the landfill is located within the uppermost aquifer (see Hydrogeologic Assessment Report in Attachment A, Section 6.5, page 9). There are five (5) monitoring wells existing in the Uppermost Aquifer system (MW-1, MW-3R, MW-4, MW-5, and MW-7).

MW-3R, MW-4, and MW-5 are the background wells for the uppermost aquifer at this site (Figure 2). Flow paths across the site (Figure 2) appear to converge toward MW-1 and MW-7 near the north waste boundary (downgradient). The rule (IAC 114.22(1)) allows the convergence of flow paths to be appropriate in the minimization of the overall length of the downgradient dimension of the facility. MW-1 and MW-7 appear to be appropriately located as downgradient uppermost aquifer wells.

The IDNR Letter dated July 5, 2018 (Doc # 92740) required the collection of water samples for total metals. The total metal analyses were added to the water quality testing beginning October 4, 2018. The sample portion collected for total metals analyses is collected by No-Purge methods.

A variance request dated November 21, 2018, was submitted to IDNR requesting the elimination of several testing parameters previously required at the site under Iowa Administrative Code (IAC) 567, Chapter 114 and the Closure Permit. The variance request was approved by IDNR on March 25, 2019 (Doc #94705) and was incorporated into the Closure Permit on March 26, 2019 (Doc # 94716). A second variance request requesting the use of three (3) upgradient wells and two (2) downgradient wells was submitted on April 24, 2019 (Doc #94983). This variance was approved on August 2, 2019 (Doc #95638) and was incorporated into the Revised Closure Permit issued August 2, 2019 (Doc #95637).

The January 24, 2023 IDNR letter (Doc #105574) required that a leachate sample be collected from leachate piezometer LW-1 and analyzed for Appendix I compounds. Further, the January 24, 2023 IDNR Comment letter (Doc #105574) required that the testing parameters in all HMSP monitoring wells be changed to include any Appendix I compound that was detected in the leachate (at peizometer LW-1). The initial sampling of LW-1 was completed April 19, 2023. The following Appendix I compounds were detected in leachate from LW-1 on *April 19, 2023*:

Compound	LW-1
Antimony, total (ug/L)	5.2
Arsenic, total (ug/L)	217.0
Barium, total (ug/L)	3,140.0
Cadmium, total (ug/L)	2.4
Chromium, total (ug/L)	30.2
Cobalt, total (ug/L)	60.9
Copper, total (ug/L)	619.0
Nickel, total (ug/L)	803.0
Lead, total (ug/L)	37.3
Selenium, total (ug/L)	6.3
Vanadium, total (ug/L)	27.2
Zinc, total (ug/L)	1,440

Note that were no VOC compounds detected in leachate at LW-1.

In addition, MW-1 was also analyzed for Appendix I compounds (in addition to the historically tested parameters) on April 19, 2023 based on the fact that there were known historic impacts to MW-1 over time. Barium, cobalt, nickel, and cis-1,2-dichloroethene were the only Appendix I compounds detected at MW-1 on *April 19, 2023*.

The HMSP sampling parameters were amended based on the April 19, 2023 water quality results completed at leachate piezometer LW-1. Beginning on October 25, 2023 the water samples collected at all site monitoring wells are analyzed for the compounds listed in the Table above. Water collected at MW-1 is also analyzed for cis-1,2-dichloroethene and chloride based on recent historic detections at MW-1.

The Site Plan and the approved monitoring network are illustrated on Figure 1. The Water Table Contour Map is included as Figure 2.

The current HMSP is summarized in Table 1. The HMSP Implementation Schedule for 2025 is itemized in Table 2.

MONITORING WELL MAINTENANCE PERFORMANCE REEVALUATION

Table 3 outlines the status of well performance and maintenance activities performed as required by IAC 567-114.21.

Formal Monitoring Well Maintenance Performance Reevaluations have been performed in November 1992; October 1998; October 2003; November 2008; October 2013; April 2019; and April 2024.

The most recent Monitoring Well Maintenance Performance Reevaluation Plan (MWMPRP) was submitted to IDNR for review on May 10, 2024 (Doc #110033). The report recommended no changes to the monitoring well system or the Hydrologic Monitoring System Plan. As per IDNR Regulations, the MWMPRP is required every 5 years, and should be completed again in 2029.

Review of the water elevation data for 2024 does not indicate excessive variability compared to historic water elevation data. Water elevation data is summarized in Table 4. Based on the available water elevation data, the semi-annual water level measurements are interpreted to be sufficient to gauge notable changes in the site hydrology. The October 2024 Water Table Contour Map is included as Figure 2.

High & Low Water Levels

Current year water elevation data is included in Table 4. Historic water elevation data is included in the Table 4 Supplement. The maximum depth to water and the minimum depth to water are included on Table 4.

Well Depth & Sedimentation

Well depth measurements were made in October 2024. Review of the well depth data included on Table 4 indicate that well sedimentation is estimated to be less than one (1) foot at all site monitoring wells, except MW-4. The well depth discrepancy at MW-4 was recorded as 6.19 feet on April 18, 2024 (Table 4).

Two (2) sets of tubing and a 4 foot bailer were removed from MW-4 on October 17, 2024. The well was unable to be sampled during the Fall, 2024 semi-annual sampling event due to the removal of objects in the well. The removal of obstructions resulted in suspended sediment (and elevated turbidity) in the water column.

In April, 2025, the well will again be sampled and additional well development will be performed at MW-4.

Well Recharge Rates & Chemistry

Horizontal hydraulic conductivity testing results from 1992, 2012, and 2019 (Appendix A) ranged between 10^{-4} cm/sec and 10^{-5} cm/sec. Hydraulic conductivity testing results for April 18, 2024 also ranged between 10^{-4} cm/sec and 10^{-5} cm/sec (Table 4 and Appendix A). Well recovery information indicates that recharge to the individual wells remains sufficient to promote collection of representative water quality samples and the wells were functioning as intended. Monitoring well recharge reevaluation is due every five (5) years according to 114.21(2)”d” and should be evaluated again in 2029.

Based on the apparent static condition of the water surfaces across the site, it appears that the semi-annual water elevation data is sufficient to adequately monitor the hydrologic condition of the site. Further, the wells are interpreted to be appropriately located to detect any impact, should it occur.

No changes or modifications to the site monitoring wells are recommended.

Section 2.0 Reporting Period Monitoring Activities

Field sampling information for the April 18, 2024 and October 17, 2024 sampling episodes is included on the field forms (IDNR Form 542-1322) in Appendix B.

A comprehensive summary of Analytical Data for the episodes between October 4, 2018 and October 17, 2024 is included in Table 9.

The background wells are MW-3R, MW-4, and MW-5. Downgradient wells include MW-1 and MW-7.

Section 3.0 Data Evaluation and Summary

Statistical Evaluation is prepared by Otter Creek Environmental Services for the April 18, 2024 and October 17, 2024 monitoring episodes. The Groundwater Statistics Report for the Monona County Landfill, First Semi-Annual Monitoring Event in 2024, dated May, 2024 is included in Appendix C.1. The Groundwater Statistics Report for the Monona County Landfill, Second Semi-Annual Monitoring Event in 2024, dated November, 2024 is included in Appendix C.2.

The Keystone Analytical Reports for the laboratory testing for sampling episodes on April 18, 2024 and October 17, 2024 are included in Appendix D.

QUALITY ASSURANCE/QUALITY CONTROL

A blind duplicate sample was collected at MW-3R during the April 18, 2024 sampling episode. A blind duplicate was collected at MW-1 during the October 17, 2024 sampling episode.

The purpose of the field duplicate is to evaluate the precision of sample collection and analysis process from the field through the laboratory. The calculation of the Relative Percent Difference (RPD) for duplicate pair results is used as a means to evaluate the precision. Iron is excluded from use in duplication due to the rapid oxidation rate, as it is problematic to duplicate.

The Quality Control (QC) limit for the RPD on field duplicates is established at thirty percent (30%) for duplicate pairs that have reported concentrations five (5) times greater than the laboratory Reporting Limit. For samples and respective duplicates with reported analyte concentrations nearer the Reporting Limit, the RPD calculations demonstrate greater variability and the RPD can be very large. RPD values are considered non-representative in the following conditions:

a) Both the original and/or the duplicate results are less than five (5) times the Reporting Limit.
b) One or both results are qualified, flagged, or estimated.
c) One or both results are non-detected.

The results of the blind duplicate and the monitoring well results (both April 18, 2024 and October 17, 2024) were within the limits established and indicate that the data quality is acceptable without restriction.

BACKGROUND DATA VALIDATION

The background data utilized herein has been restricted to include only sample results that have been collected by "No Purge" methods. A summary of the recorded field turbidity measurements is included in Appendix E.

Upgradient Data, Table 1, Attachment B to Fall Statistical Evaluation Report (Appendices C) includes a summary of the background data. The site prediction limits established are based on the background collected since October 4, 2018.

SITE SPECIFIC GWPS

The Statewide Standards for Protected Groundwater as published in IAC 567, Chapter 137, are utilized as the Groundwater Protection Standards (GWPS) for all compounds, except arsenic and cobalt. The calculated prediction limits for arsenic and cobalt (based on the site background) exceed the published in IAC 567, Chapter 137 Statewide Standards.

Table 5 indicates that the prediction limit for the following compounds *exceed* the published IAC 567, Chapter 137 Statewide Standard:

Compound	***Prediction Limit***	***IAC 137 GWPS***
Arsenic	57.3 ug/L	10.0 ug/L
Cobalt	7.05 ug/L	2.1 ug/L

The Site-Specific GWPS should not be set lower than the Site Prediction Limit calculated from the site background data. For this report, the prediction limits itemized above are utilized as the Site-Specific GWPS for the HMSP Systems. For all other compounds the published IAC 567, Chapter 137 Statewide Standard are utilized as the GWPS. Note that there are no published GWPS for chloride. Site-Specific GWPS were approved by IDNR on July 8, 2021 (Doc #100801) and again on May 20, 2022 (Doc #103262).

EXCEEDANCE OF A BACKGROUND STANDARD

The detected concentrations of each compound are compared to the site prediction limit for each respective compound calculated based on the background data set. A detected and verified concentration for a compound that is in excess of the calculated site prediction limit is recorded on Table 6 and Table 7. Table 6 is a summary of all compounds at site monitoring wells that have exceeded the prediction limit *in the current year* (highlighted in light brown). Table 7 is a summary of all compounds at site monitoring wells that have exceeded the prediction limit *to date* (highlighted in light brown).

As reported in Table 6, there are three (3) compounds that have exceeded a background standard (Prediction Limit) in 2024. There are no detected compounds to date that exceed a GWPS (Table 7). IAC 567, Chapter 114 does not have a requirement to collect Appendix II samples in the event of a detected SSI. Additional testing requirements are at the discretion of the IDNR based on any perceived release from the facility. IDNR amended the required sampling in 2023. No release is interpreted based on water quality findings to date.

CONFIDENCE INTERVAL EVALUATION

The detections that exceed the current site prediction limits are utilized to calculate the 95% lower confidence limits (LCL) in accordance with the 2009 Unified Guidance for Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities by US EPA. The 95% LCL values are compared to applicable GWPS. Any 95% LCL value that exceeds an applicable GWPS is recorded as an SSL.

Table 7 includes a summary of the Confidence Limits (95% LCL). *There are no Statistically Significant Levels (SSL) recorded to date.* The Confidence Intervals (95% LCL and 95% UCL) for inorganic compounds are summarized in Table 1 of Attachment C of the Otter Creek Reports (Appendix C.1 and Appendix C.2).

RESPONSES TO WATER QUALITY RESULTS

Based on the minor nature of the recorded statistical exceedances, there is no recommendation to perform additional sampling in accordance with IAC 114.26(7) at this time.

CORRECTIVE ACTION EVALUATIONS & MONITORING

Corrective Action and Corrective Action Monitoring are not required at this time.

Section 4.0 Leachate Collection System Performance Evaluation

The site was not constructed with a formal leachate collection system (LCS). The current LCS consists of a leachate piezometer (LW-1). Leachate levels are measured at LW-1 on a semi-annual basis. If leachate levels exceed 12", the leachate is required to be pumped from LW-1 until levels drop down below 12". Leachate removed from LW-1 would be hauled to a holding tank at the transfer station building and disposed of at the City of Onawa POTW. Leachate has not been extracted from LW-1 since closure was completed in 2016. Leachate thickness measurements in LW-1 did not exceed 12 inches in 2024.

The 2024 leachate liquid elevation at LW-1 and extraction volumes (0 gallons) are summarized in Table 12. The leachate thickness in LW-1 has been recorded during 2024 as 0.1 feet in both April and October.

Based on the available leachate thickness data collected since closure in 2016, it is apparent that leachate levels are consistently well below 12 inches and that there are no significant findings during any monitoring episode.

Section 5.0 Gas Monitoring

Explosive gas monitoring was performed semi-annually in 2024, per IAC 567-114.26(15) and as modified by the IDNR Letter dated June 23, 2024 (Doc #110240). Results of the explosive gas monitoring indicate that explosive gases were within applicable limits along the entire site perimeter and in the equipment building. Gas monitoring results for 2024 are summarized in the Table 13.

Based on the available data collected since closure in 2016, it is apparent that explosive gas concentrations have not been detected.

Section 6.0 Recommendations/Requests

Continue to perform water sampling in accordance with the plan summarized in Table 2.

Continue to perform semi-annual water level measurements in April and October of each year and reevaluate the data in the Annual Groundwater Quality Report in January of each year.

Continue to perform semi-annual leachate level measurements in April and October of each year and reevaluate the data in the Annual Leachate Control System Performance Evaluation in November of each year.

Continue to perform semi-annual explosive gas monitoring in April and October of each year and reevaluate the data in the Annual Groundwater Quality Report in November of each year.

Perform Monitoring Well Maintenance Performance Reevaluation in 2029.

Figures

LIDAR CONTOURS DATE: SPRING 2009

0 50 100 200 400

PROPERTY BOUNDARY

MW-6

MW-7

MW-1

LW-1

MW-4

MW-3R

MW-5

COUNTY ROAD E-16

PROPERTY BOUNDARY

WASTE BOUNDARY

N

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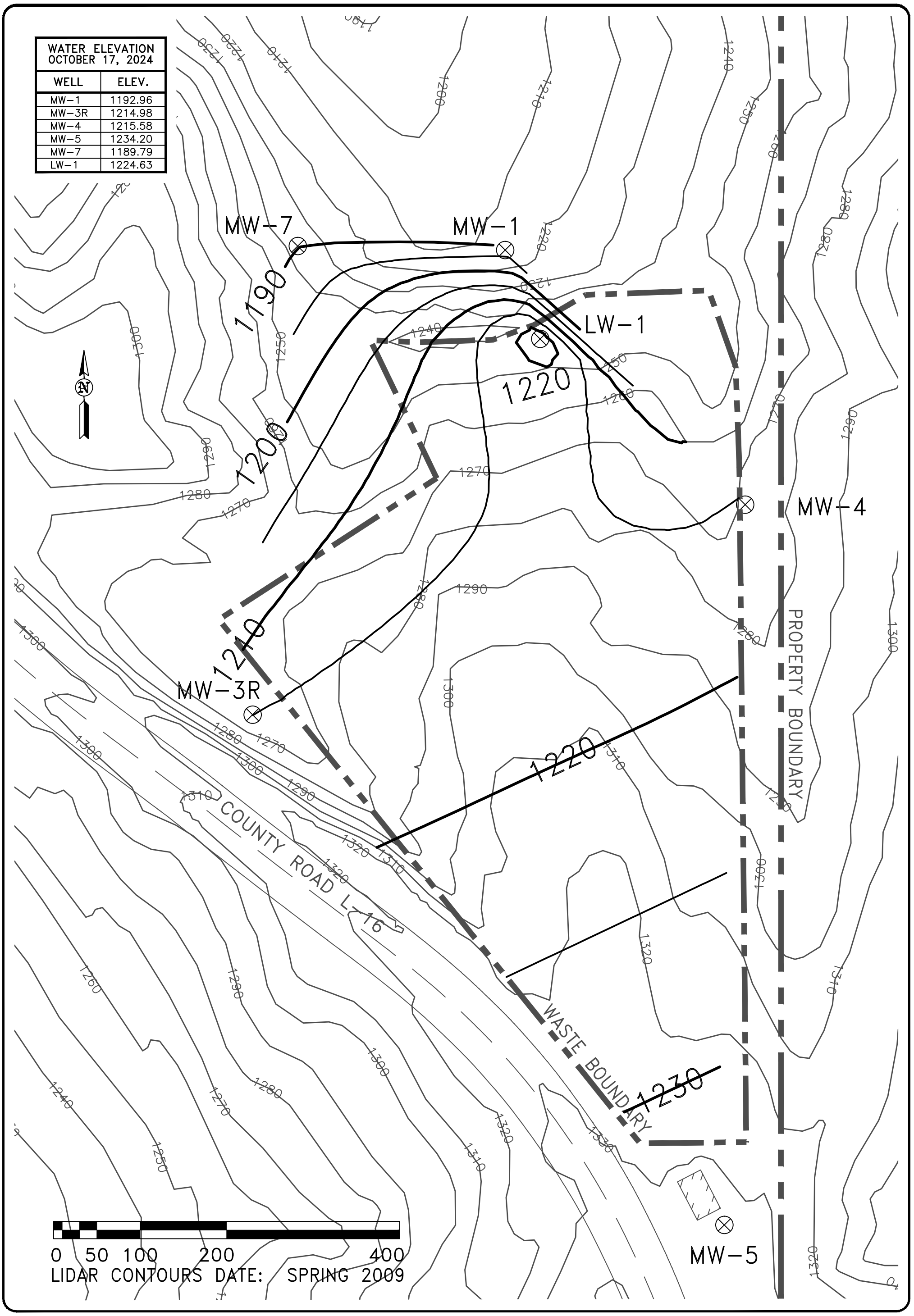
SITE PLAN

MONONA COUNTY SANITARY LANDFILL
TURIN, IOWA

FIGURE: 1

REVISION	NO.	DATE
DRAWN DRA	PROJECT NO. 6036	DATE 10-27-23

WATER ELEVATION OCTOBER 17, 2024	
WELL	ELEV.
MW-1	1192.96
MW-3R	1214.98
MW-4	1215.58
MW-5	1234.20
MW-7	1189.79
LW-1	1224.63



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WATER TABLE MAP

MONONA COUNTY SANITARY LANDFILL
TURIN, IOWA

FIGURE: 1

REVISION	NO.	DATE
DRAWN DRA	PROJECT NO. 6036	DATE 10-22-24

Tables
(in IDNR Format)

Table Index

Table 1 – Monitoring Program Summary

Table 1
Monitoring Program Summary
Annual Water Quality Report
Monona County Sanitary Landfill
Permit No. 67-SDP-01-75C

Monitoring Well	Formation	Current Monitoring Program	Change for next sampling event	Historic - Constituents over the Prediction Limit	Spring 2024 - Constituents over the Prediction Limit	Fall 2024 - Constituents over the Prediction Limit	Historic - Constituents w/95% LCL over GWPS	Spring 2024 - Constituents w/95% LCL over GWPS	Fall 2024 - Constituents w/95% LCL over GWPS	Total # of Samples in each monitoring program since October 4, 2018		
										Detection	Assessment	Corrective Action
MW-3R (b)	Loess	Background	NC	None	None	None	None	None	None	13	0	0
MW-4 (b)	Loess	Background	NC	None	None	None	None	None	None	13	0	0
MW-5 (b)	Loess	Background	NC	None	None	None	None	None	None	13	0	0
MW-1	Loess	Detection	NC	**barium, nickel, chloride, cis-1,2-DCE**	**barium, chloride, cis-1,2-DCE**	**chloride, cis-1,2-DCE**	None	None	None	13	0	0
MW-7	Loess	Detection	NC	**cadmium**	None	None	None	None	None	13	0	0

Table 2 – Monitoring Program Implementation Schedule

Table 2
Monitoring Program Implementation Schedule
Annual Water Quality Report
Monona County Sanitary Landfill
Permit No. 67-SDP-01-75C

Monitoring Well	Recent Sampling Dates and Constituents	Upcoming Sampling Dates and Constituents		Supplemental Sample Dates	
		April, 2025	October, 2025	Previously Collected	Next Event
MW-3R (b)	10/4/18, 4/15/19, 10/8/19, 4/8/20, 10/2/20, 4/12/21, 10/26/21, 4/12/22, 10/7/22, 4/19/23, 10/25/23	List #1	List #1	N/A	N/A
MW-4 (b)	10/4/18, 4/15/19, 10/8/19, 4/8/20, 10/2/20, 4/12/21, 10/26/21, 4/12/22, 10/7/22, 4/19/23, 10/25/23	List #1	List #1	N/A	N/A
MW-5 (b)	10/4/18, 4/15/19, 10/8/19, 4/8/20, 10/2/20, 4/12/21, 10/26/21, 4/12/22, 10/7/22, 4/19/23, 10/25/23	List #1	List #1	N/A	N/A
MW-1	10/4/18, 4/15/19, 10/8/19, 4/8/20, 10/2/20, 4/12/21, 10/26/21, 4/12/22, 10/7/22, 4/19/23, 10/25/23	List #1 & List #2	List #1 & List #2	N/A	N/A
MW-7	10/4/18, 4/15/19, 10/8/19, 4/8/20, 10/2/20, 4/12/21, 10/26/21, 4/12/22, 10/7/22, 4/19/23, 10/25/23	List #1	List #1	N/A	N/A

(b) background well

List #1 - Total Metals (Sb, As, Ba, Cd, Cr, Co, Cu, Pb, Ni, Se, V, Zn)
List #2 - Chloride, cis-1,2-dichloroethene

TABLE 2 Supplement - Sampling to Date

	10/4/2018	**4/15/2019**	**10/8/2019**	**4/8/2020**	**10/2/2020**
MW-1	List 1+List 2	List 1+List 2	List 1+List 2	List 1+List 2	List 1+List 2
MW-3R	List 1	List 1	List 1	List 1	List 1
MW-4	List 1	List 1	List 1	List 1	List 1
MW-5	List 1	List 1	List 1	List 1	List 1
MW-7	List 1	List 1	List 1	List 1	List 1
Duplicate	MW-7	MW-1	MW-7	MW-3R	MW-1

	4/12/2021	**10/26/2021**	**4/12/2022**	**10/7/2022**
MW-1	List 1+List 2	List 1+List 2	List 1+List 2	List 1+List 2
MW-3R	List 1	List 1	List 1	List 1+List 2
MW-4	List 1	List 1	List 1	List 1+List 2
MW-5	List 1	List 1	List 1	List 1+List 2
MW-7	List 1	List 1	List 1	List 1+List 2
Duplicate	MW-7	MW-5	MW-7	MW-3R

	4/19/2023	**10/25/2023**	**4/19/2023**	**10/25/2023**
MW-1	Appendix I+ List 1+List 2	List 3+List 4	List 3+List 4	List 3+List 4
MW-3R	List 1	List 3	List 3	List 3
MW-4	List 1	List 3	List 3	List 3
MW-5	List 1	List 3	List 3	List 3
MW-7	List 1	List 3	List 3	List 3
LW-1	Appendix I	---	---	---
Duplicate	MW-5	MW-3R	MW-3R	MW-1

List #1 – Total Metals (As, Ba, Cd, Cr, Cu, Pb, Fe, Hg, Mg, Zn)
List #2 – Chloride, COD, Nitrogen (as Ammonia)
List #3 – Total Metals (Sb, As, Ba, Cd, Cr, Co, Cu, Pb, Ni, Se, V, Zn)
List #4 – Chloride, cis-1,2-dichloroethene

Table 3 – Monitoring Well Maintenance Performance Reevaluation Schedule

Table 3
Monitoring Well Maintenance and Performance Revaluation Schedule
Annual Water Quality Report
Monona County Sanitary Landfill
Permit No. 67-SDP-01-75C

Compliance with:	Monitoring Calendar Years									
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
567 IAC 114.21(2)"a" - high and low water levels (biennial)	X	X	X	X	X	X	X	X	X	X
567 IAC 114.21(2)"b" - changes in the hydrologic setting and flow paths (biennial)	X	X	X	X	X	X	X	X	X	X
567 IAC 114.21(2)"c" - well depths (annual)	X	X	X	X	X	X	X	X	X	X
567 IAC 114.21(2)"d" - in-situ permeability testing (1 per 5 years)	X						X			

Compliance with:	Monitoring Calendar Years									
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
567 IAC 114.21(2)"a" - high and low water levels (biennial)	X	X	X	X	X	X	X	X	X	X
567 IAC 114.21(2)"b" - changes in the hydrologic setting and flow paths (biennial)	X	X	X	X	X	X	X	X	X	X
567 IAC 114.21(2)"c" - well depths (annual)	X	X	X	X	X	X	X	X	X	X
567 IAC 114.21(2)"d" - in-situ permeability testing (1 per 5 years)		X					X			

Compliance with:	Monitoring Calendar Years									
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
567 IAC 114.21(2)"a" - high and low water levels (biennial)	X	X	X	X	X	X	X	X	X	X
567 IAC 114.21(2)"b" - changes in the hydrologic setting and flow paths (biennial)	X	X	X	X	X	X	X	X	X	X
567 IAC 114.21(2)"c" - well depths (annual)	X	X	X	X	X	X	X	X	X	X
567 IAC 114.21(2)"d" - in-situ permeability testing (1 per 5 years)		X						X		

Compliance with:	Monitoring Calendar Years									
	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
567 IAC 114.21(2)"a" - high and low water levels (biennial)	X	X	X	P	P	P	P	P	P	P
567 IAC 114.21(2)"b" - changes in the hydrologic setting and flow paths (biennial)	X	X	X	P	P	P	P	P	P	P
567 IAC 114.21(2)"c" - well depths (annual)	X	X	X	P	P	P	P	P	P	P
567 IAC 114.21(2)"d" - in-situ permeability testing (1 per 5 years)			X					P		

X = completed
P = Planned
N/A = Not Applicable

Table 4 – Monitoring Well Maintenance Performance Reevaluation Summary

Table 4
Monitoring Well Maintenance and Performance Summary
Annual Water Quality Report
Monona County Sanitary Landfill
Permit No. 67-SDP-01-75C

Well	Top of casing	Top of Screen	Total Depth		Date of Measurements		Maximum Depth Discrepancy (ft)	Hydraulic Cond. (cm/sec)/date	Most Recent Hydraulic Conductivity	
					4/18/2024	10/17/2024			**4/18/2024**	Change
MW-3R (b)	1266.2	1215.2	66.7	Groundwater Level (ft)	51.21	51.22	0	4.20E-05 11/24/1992	3.26E-05	Minor
				Groundwater Elevation (Ft MSL)	1214.99	1214.98				
				Measured Well Depth (ft)	66.7	66.7				
				Submerged (+) or Exposed screen (-)	-0.21	-0.22				
MW-4 (b)	1275.6	1208.6	82	Groundwater Level (ft)	56.92	56.04	6.19	3.00E-05 11/24/1992	4.92E-05	Minor
				Groundwater Elevation (Ft MSL)	1218.68	1219.56				
				Measured Well Depth (ft)	75.81	79.81				
				Submerged (+) or Exposed screen (-)	10.08	10.96				
MW-5 (b)	1335.64	1229	121.64	Groundwater Level (ft)	101.35	101.53	0.14	1.60E-05 11/24/1992	3.03E-05	Minor
				Groundwater Elevation (Ft MSL)	1234.29	1234.11				
				Measured Well Depth (ft)	121.5	121.5				
				Submerged (+) or Exposed screen (-)	5.29	5.11				
MW-1	1219.49	1192.3	42.19	Groundwater Level (ft)	27.16	26.77	-0.31	8.10E-05 11/24/1992	2.68E-04	Minor
				Groundwater Elevation (Ft MSL)	1192.33	1192.72				
				Measured Well Depth (ft)	42.5	42.5				
				Submerged (+) or Exposed screen (-)	0.03	0.42				
MW-7	1236.98	1197.2	54.78	Groundwater Level (ft)	47.35	47.79	0.28	2.40E-05 1/6/2012	6.70E-05	Minor
				Groundwater Elevation (Ft MSL)	1189.63	1189.19				
				Measured Well Depth (ft)	54.5	54.5				
				Submerged (+) or Exposed screen (-)	-7.57	-8.01				

Water Elevation Data
Monona County Landfill
67-SDP-1-75P

Well/TOC	MW-1	1219.73	MW-3R	1266.2	MW-4	1271.62	MW-5	1335.73	MW-7	1236.98
	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation
04/01/13	NT	NT	NT	NT	65.70	1205.92	104.45	1231.28	NT	NT
05/01/13	15.00	1204.73	NT	NT	64.50	1207.12	104.80	1230.93	NT	NT
06/01/13	15.00	1204.73	NT	NT	64.45	1207.17	104.65	1231.08	NT	NT
07/01/13	15.10	1204.63	NT	NT	64.45	1207.17	104.66	1231.07	NT	NT
08/01/13	18.30	1201.43	NT	NT	64.40	1207.22	104.65	1231.08	NT	NT
09/01/13	18.85	1200.88	50.90	1215.30	64.55	1207.07	104.80	1230.93	NT	NT
10/01/13	19.94	1199.79	51.11	1215.09	64.61	1207.01	104.78	1230.95	NT	NT
04/16/14	30.35	1189.38	52.20	1214.00	64.40	1207.22	105.00	1230.73	49.80	1187.18
10/21/14	29.15	1190.58	46.35	1219.85	64.70	1206.92	105.20	1230.53	49.30	1187.68
04/15/15	29.10	1190.63	48.50	1217.70	64.70	1206.92	105.25	1230.48	49.30	1187.68
10/07/15	28.45	1191.28	49.00	1217.20	65.45	1206.17	105.00	1230.73	49.00	1187.98
04/12/16	27.67	1192.06	50.07	1216.13	64.55	1207.07	105.00	1230.73	48.27	1188.71
10/11/16	27.40	1192.33	50.10	1216.10	63.51	1208.11	104.33	1231.40	47.82	1189.16
04/10/17	28.25	1191.48	50.80	1215.40	63.92	1207.70	104.04	1231.69	47.32	1189.66
10/12/17	28.00	1191.73	51.03	1215.17	62.20	1209.42	103.47	1232.26	48.20	1188.78
04/10/18	28.25	1191.48	50.10	1216.10	61.70	1209.92	103.10	1232.63	48.30	1188.68
10/04/18	27.68	1192.05	48.81	1217.39	61.20	1210.42	103.03	1232.70	48.15	1188.83
04/15/19	28.25	1191.48	50.10	1216.10	60.33	1211.29	102.32	1233.41	47.32	1189.66
10/08/19	25.85	1193.88	46.94	1219.26	59.63	1211.99	102.15	1233.58	46.80	1190.18
04/08/20	25.07	1194.66	46.22	1219.98	58.47	1213.15	101.66	1234.07	46.41	1190.57
10/02/20	25.53	1194.20	46.27	1219.93	57.91	1213.71	101.65	1234.08	46.26	1190.72
04/12/21	25.90	1193.83	46.90	1219.30	56.87	1214.75	101.05	1234.68	46.38	1190.60
10/26/21	26.25	1193.48	47.41	1218.79	55.89	1215.73	100.44	1235.29	46.56	1190.42
04/12/22	26.43	1193.30	47.65	1218.55	55.50	1216.12	99.81	1235.92	46.36	1190.62
10/07/22	26.89	1192.84	49.09	1217.11	56.25	1215.37	100.50	1235.23	47.17	1189.81
04/19/23	26.67	1193.06	48.62	1217.58	57.45	1214.17	99.80	1235.93	46.70	1190.28
10/25/23	27.15	1192.58	50.30	1215.90	56.36	1215.26	100.60	1235.13	47.30	1189.68
04/18/24	27.16	1192.57	51.21	1214.99	56.92	1214.70	101.35	1234.38	47.35	1189.63
10/17/24	26.77	1192.96	51.22	1214.98	56.04	1215.58	101.53	1234.20	47.19	1189.79

Table 5 – Background and GWPS Summary

Table 5
Background and GWPS Summary
Annual Water Quality Report
Monona County Sanitary Landfill
Permit No. 67-SDP-01-75C

Interwell Background Well (MW-3R, MW-4, and MW-5)

Inorganics - Appendix I										
Constituent	**Units**	**Model Type**	**Samples - N**	**Detections**	**Mean**	**SD**	**Prediction Limit**	**Confidence**	**GWPS**	**Source**
Antimony (Sb)	µg/l	nonparametric	8	0			2.0000	0.96	6	SS
Arsenic (As)	µg/l	nonparametric	38	16			57.3000	0.99	**57.3**	**Site**
Barium (Ba)	µg/l	lognormal	33	38	5.6380	0.4707	895.4363		2000	SS
Cadmium (Cd)	µg/l	nonparametric	38	2			2.2000	0.99	5	SS
Chromium (Cr)	µg/l	nonparametric	35	19			19.5000	0.99	100	SS
Cobalt (Co)	µg/l	normal	11	7	1.2364	2.0127	7.0458		**7.05**	**Site**
Copper (Cu)	µg/l	nonparametric	38	17			26.5000	0.99	1300	SS
Lead (Pb)	µg/l	nonparametric	34	5			7.6000	0.99	**15**	SS
Nickel	µg/l	normal	11	6	6.2455	7.7551	28.6291		100	SS
Selenium	µg/l	nonparametric	11	0			4.0000	0.98	50	SS
Vanadium	µg/l	nonparametric	8	0			20.0000	0.96	20	SS
Zinc (Zn)	µg/l	nonparametric	38	13			67.9000	0.99	2000	SS

= Prediction limit exceeds the GWPS. A Site-Specific GWPS is warranted

* = insufficant data

Table 6 – Summary of Detections Relative to Background and GWPS

Table 6
Summary of Well/Detected Constituent Pairs that Exceed the Background Standard
Annual Water Quality Report
Monona County Sanitary Landfill
Permit No. 67-SDP-01-75C

Well	Constituent	Date	Units	Most recent result	Background Standard	GWPS
MW-1	Barium	4/18/2024	ug/L	1100	913.229	2000
MW-1	chloride	4/18/2024	ug/L	249	50.00	---
MW-1	chloride	10/17/2024	ug/L	239	50.00	---
MW-1	cis-1,2-dichloroethene	4/18/2024	ug/L	1.60	1.00	70
MW-1	cis-1,2-dichloroethene	10/17/2024	ug/L	1.20	1.00	70

Table 7 – Summary of Ongoing and Newly Identified SSI

Table 7
Summary of Ongoing & Newly Identified SSI
Annual Water Quality Report
Monona County Sanitary Landfill
Permit No. 67-SDP-01-75C

KEY:	SSI	SSL LCL>GWPS

Note: The absence of shading indicates that the condition does not exist.

Monitoring Well	Compound	Sample Date	Each Result (ug/L)	Prediction Limit (ug/L)	95% LCL (ug/L)	GWPS Limit (ug/L)	Initial Exceedance	Resamples Due	5th Background Sample
MW-1	Barium	10/4/2018	1000.0	1265.4698	---	2000	10/26/2021	NA	10/2/2020
MW-1	Barium	4/15/2019	1060.0	1265.4698	---	2000	10/26/2021	NA	10/2/2020
MW-1	Barium	10/8/2019	1020.0	1265.4698	---	2000	10/26/2021	NA	10/2/2020
MW-1	Barium	4/8/2020	995.0	1265.4698	993.163	2000	10/26/2021	NA	10/2/2020
MW-1	Barium	10/2/2020	1000.0	1265.4698	993.163	2000	10/26/2021	NA	10/2/2020
MW-1	Barium	4/12/2021	1060.0	1265.4698	993.163	2000	10/26/2021	NA	10/2/2020
MW-1	Barium	10/26/2021	960.0	824.2049	954.925	2000	10/26/2021	NA	10/2/2020
MW-1	Barium	4/12/2022	1030.0	793.2172	962.249	2000	10/26/2021	NA	10/2/2020
MW-1	Barium	10/7/2022	1000.0	995.9742	962.249	2000	10/26/2021	NA	10/2/2020
MW-1	Barium	4/19/2023	1020.0	975.7976	966.086	2000	10/26/2021	NA	10/2/2020
MW-1	Barium	10/25/2023	1090.0	921.2112	989.443	2000	10/26/2021	NA	10/2/2020
MW-1	Barium	4/18/2024	1100.0	913.2290	993.784	2000	10/26/2021	NA	10/2/2020
MW-1	Barium	10/17/2024	895.0	895.4363	915.136	2000	10/26/2021	NA	10/2/2020
MW-1	Nickel	4/19/2023	21.7	19.6000	---	100	4/19/2023	NA	10/2/2020
MW-1	Nickel	10/25/2023	21.9	19.6000	---	100	4/19/2023	NA	10/2/2020
MW-1	Nickel	4/18/2024	25.9	32.4174	19.38	100	4/19/2023	NA	10/2/2020
MW-1	Nickel	10/17/2024	21.9	28.6291	20.456	100	4/19/2023	NA	10/2/2020
MW-1	Chloride	10/4/2018	176.0	50.0000	---	---	10/4/2018	NA	10/2/2020
MW-1	Chloride	4/15/2019	191.0	50.0000	---	---	10/4/2018	NA	10/2/2020
MW-1	Chloride	10/8/2019	201.0	50.0000	---	---	10/4/2018	NA	10/2/2020
MW-1	Chloride	4/8/2020	212.0	50.0000	181.752	---	10/4/2018	NA	10/2/2020
MW-1	Chloride	10/2/2020	178.0	50.0000	182.960	---	10/4/2018	NA	10/2/2020
MW-1	Chloride	4/12/2021	160.0	50.0000	167.571	---	10/4/2018	NA	10/2/2020
MW-1	Chloride	10/26/2021	170.0	50.0000	160.455	---	10/4/2018	NA	10/2/2020
MW-1	Chloride	4/12/2022	187.0	50.0000	163.791	---	10/4/2018	NA	10/2/2020
MW-1	Chloride	10/7/2022	204.0	50.0000	163.481	---	10/4/2018	NA	10/2/2020
MW-1	Chloride	4/19/2023	223.0	50.0000	169.263	---	10/4/2018	NA	10/2/2020
MW-1	Chloride	10/25/2023	239.0	50.0000	193.675	---	10/4/2018	NA	10/2/2020
MW-1	Chloride	4/18/2024	249.0	50.0000	211.715	---	10/4/2018	NA	10/2/2020
MW-1	Chloride	10/17/2024	239.0	50.0000	228.186	---	10/4/2018	NA	10/2/2020
MW-1	cis-1,2-dichloroethene	4/19/2023	2.3	1.0	---	70	4/19/2023	NA	10/2/2020
MW-1	cis-1,2-dichloroethene	10/25/2023	2.6	1.0	---	70	4/19/2023	NA	10/2/2020
MW-1	cis-1,2-dichloroethene	4/18/2024	1.6	1.0	---	70	4/19/2023	NA	10/2/2020
MW-1	cis-1,2-dichloroethene	10/17/2024	1.2	1.0	1.173	70	4/19/2023	NA	10/2/2020

Bold GWPS *= A Site Specific GWPS that is equal to the Prediction Limit. All other GWPS are IAC 567-137 Statewide Standards for Protected Groundwater.*

Table 7
Summary of Ongoing & Newly Identified SSI
Annual Water Quality Report
Monona County Sanitary Landfill
Permit No. 67-SDP-01-75C

KEY:	SSI	SSL LCL>GWPS

Note: The absence of shading indicates that the condition does not exist.

Monitoring Well	Compound	Sample Date	Each Result (ug/L)	Prediction Limit (ug/L)	95% LCL (ug/L)	GWPS Limit (ug/L)	Initial Exceedance	Resamples Due	5th Background Sample
MW-7	Cadmium	10/4/2018	<0.8	0.8	---	5	10/26/2021	NA	10/2/2020
MW-7	Cadmium	4/15/2019	<0.8	0.8	---	5	10/26/2021	NA	10/2/2020
MW-7	Cadmium	10/8/2019	<0.8	0.8	---	5	10/26/2021	NA	10/2/2020
MW-7	Cadmium	4/8/2020	<0.8	0.8	0.4	5	10/26/2021	NA	10/2/2020
MW-7	Cadmium	10/2/2020	0.9	0.8	0.309	5	10/26/2021	NA	10/2/2020
MW-7	Cadmium	4/12/2021	1.3	0.8	0.373	5	10/26/2021	NA	10/2/2020
MW-7	Cadmium	10/26/2021	<0.8	2.2	0.373	5	10/26/2021	NA	10/2/2020
MW-7	Cadmium	4/12/2022	<0.8	2.2	0.373	5	10/26/2021	NA	10/2/2020
MW-7	Cadmium	10/7/2022	<0.8	2.2	0.235	5	10/26/2021	NA	10/2/2020
MW-7	Cadmium	4/19/2023	<0.8	2.2	0.400	5	10/26/2021	NA	10/2/2020
MW-7	Cadmium	10/25/2023	<0.8	2.2	0.400	5	10/26/2021	NA	10/2/2020
MW-7	Cadmium	4/18/2024	<0.8	2.2	0.400	5	10/26/2021	NA	10/2/2020
MW-7	Cadmium	10/17/2024	<0.8	2.2	0.400	5	10/26/2021	NA	10/2/2020

Bold GWPS *= A Site Specific GWPS that is equal to the Prediction Limit. All other GWPS are IAC 567-137 Statewide Standards for Protected Groundwater.*

Table 8 – **NOT USED**

Table 8

Summary of Ongoing & Newly Identified SSL
Annual Water Quality Report
Monona County Sanitary Landfill
Permit No. 67-SDP-01-75C

NOT REQUIRED

Table 9 – Analytical Data Summary

Table 1

Analytical Data Summary for LW-1

Constituents	Units	4/19/2023
1,1,1,2-Tetrachloroethane	ug/L	<5
1,1,1-Trichloroethane	ug/L	<5
1,1,2,2-Tetrachloroethane	ug/L	<5
1,1,2-Trichloroethane	ug/L	<5
1,1-Dichloroethane	ug/L	<5
1,1-Dichloroethylene	ug/L	<5
1,2,3-Trichloropropane	ug/L	<5
1,2-Dibromo-3-chloropropane	ug/L	<25
1,2-Dibromoethane	ug/L	<5
1,2-Dichlorobenzene	ug/L	<5
1,2-Dichloroethane	ug/L	<5
1,2-Dichloropropane	ug/L	<5
1,4-Dichlorobenzene	ug/L	<5
2-Butanone (MEK)	ug/L	<50
2-Hexanone (MBK)	ug/L	<25
4-Methyl-2-pentanone (MIBK)	ug/L	<25
Acetone	ug/L	<50
Acrylonitrile	ug/L	<25
Antimony, total	ug/L	5.2
Arsenic, total	ug/L	217
Barium, total	ug/L	3140
Benzene	ug/L	<5
Beryllium, total	ug/L	<4
Bromochloromethane	ug/L	<5
Bromodichloromethane	ug/L	<5
Bromoform	ug/L	<5
Bromomethane	ug/L	<5
Cadmium, total	ug/L	2.4
Carbon Disulfide	ug/L	<5
Carbon Tetrachloride	ug/L	<5
Chlorobenzene	ug/L	<5
Chloroethane	ug/L	<5
Chloroform	ug/L	<5
Chloromethane	ug/L	<5
Chromium, total	ug/L	30.2
cis-1,2-Dichloroethylene	ug/L	<5
cis-1,3-Dichloropropene	ug/L	<5
Cobalt, total	ug/L	60.9
Copper, total	ug/L	619
Dibromochloromethane	ug/L	<5
Dibromomethane	ug/L	<5
Ethylbenzene	ug/L	<5
Lead, total	ug/L	37.3
Methyl Iodide	ug/L	<5
Methylene Chloride	ug/L	<25
Nickel, total	ug/L	803
Selenium, total	ug/L	6.3
Silver, total	ug/L	<4
Styrene	ug/L	<5
Tetrachloroethylene	ug/L	<5
Thallium, total	ug/L	<2
Toluene	ug/L	<5
trans-1,2-Dichloroethylene	ug/L	<5
trans-1,3-Dichloropropene	ug/L	<5

* - The displayed value is the arithmetic mean of multiple database matches.

Table 1

Analytical Data Summary for LW-1

Constituents	Units	4/19/2023
trans-1,4-Dichloro-2-butene	ug/L	<25
Trichloroethylene	ug/L	<5
Trichlorofluoromethane	ug/L	<5
Vanadium, total	ug/L	27.2
Vinyl Acetate	ug/L	<25
Vinyl Chloride	ug/L	<5
Xylenes, total	ug/L	<10
Zinc, total	ug/L	1440

* - The displayed value is the arithmetic mean of multiple database matches.

Table 2

Analytical Data Summary for MW-1

Constituents	Units	4/10/2018	10/4/2018	4/15/2019	10/8/2019	4/8/2020	10/2/2020	4/12/2021	10/26/2021	4/12/2022	10/7/2022	4/19/2023	10/25/2023
1,1,1,2-Tetrachloroethane	ug/L											<1	
1,1,1-Trichloroethane	ug/L											<1	
1,1,2,2-Tetrachloroethane	ug/L											<1	
1,1,2-Trichloroethane	ug/L											<1	
1,1-Dichloroethane	ug/L											<1	
1,1-Dichloroethylene	ug/L											<1	
1,2,3-Trichloropropane	ug/L											<1	
1,2-Dibromo-3-chloropropane	ug/L											<5	
1,2-Dibromoethane	ug/L											<1	
1,2-Dichlorobenzene	ug/L											<1	
1,2-Dichloroethane	ug/L											<1	
1,2-Dichloropropane	ug/L											<1	
1,4-Dichlorobenzene	ug/L											<1	
2-Butanone (MEK)	ug/L											<10	
2-Hexanone (MBK)	ug/L											<5	
4-Methyl-2-pentanone (MIBK)	ug/L											<5	
Acetone	ug/L											<10	
Acrylonitrile	ug/L											<5	
Antimony, total	ug/L											<2	<2
Arsenic, total	ug/L		<4.0	<4.0	<4.0	4.2	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Barium, total	ug/L		1000	1060	1020	995	1000	1060	960	1030	1000	1020	1090
Benzene	ug/L											<1	
Beryllium, total	ug/L											<4	
Boron, total	ug/L		<100										
Bromochloromethane	ug/L											<1	
Bromodichloromethane	ug/L											<1	
Bromoform	ug/L											<1	
Bromomethane	ug/L											<1	
Cadmium, total	ug/L		<.8	<.8	<.8	<.8	<.8	<.8	<.8	<.8	<.8	<.8	<.8
Carbon Disulfide	ug/L											<1	
Carbon Tetrachloride	ug/L											<1	
Chemical Oxygen Demand	mg/L	52	32	<20	38	30	<20	<20	<20	24	<20	<20	
Chloride	mg/L	126	176	191	201	212	178	160	170	187	204	223	239
Chlorobenzene	ug/L											<1	
Chloroethane	ug/L											<1	
Chloroform	ug/L											<1	
Chloromethane	ug/L											<1	
Chromium, total	ug/L			<8	<8	<8	<8	<8	<8	<8	<8	<8	<8
cis-1,2-Dichloroethylene	ug/L											2.3	2.6
cis-1,3-Dichloropropene	ug/L											<1	
Cobalt, total	ug/L		4.5									3.0	3.1
Copper, total	ug/L		<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
Dibromochloromethane	ug/L											<1	
Dibromomethane	ug/L											<1	
Ethylbenzene	ug/L											<1	
Iron, dissolved	ug/L	2070	1740										
Iron, total	ug/L		1370	1440	1320	1470	1350	1260	1200	1090	1190	1090	
Lead, total	ug/L			<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
Magnesium, total	mg/L		128	135	134	123	112	116	123	121	129	118	
Manganese, total	ug/L		2140	1770									
Mercury, total	ug/L		<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	
Methyl Iodide	ug/L											<1	
Methylene Chloride	ug/L											<5	
Molybdenum, total	ug/L		<4										

* - The displayed value is the arithmetic mean of multiple database matches.

Table 2

Analytical Data Summary for MW-1

Constituents	4/18/2024	10/17/2024
1,1,1,2-Tetrachloroethane		
1,1,1-Trichloroethane		
1,1,2,2-Tetrachloroethane		
1,1,2-Trichloroethane		
1,1-Dichloroethane		
1,1-Dichloroethylene		
1,2,3-Trichloropropane		
1,2-Dibromo-3-chloropropane		
1,2-Dibromoethane		
1,2-Dichlorobenzene		
1,2-Dichloroethane		
1,2-Dichloropropane		
1,4-Dichlorobenzene		
2-Butanone (MEK)		
2-Hexanone (MBK)		
4-Methyl-2-pentanone (MIBK)		
Acetone		
Acrylonitrile		
Antimony, total	<2	<2
Arsenic, total	<4.0	<4.0
Barium, total	1100	895
Benzene		
Beryllium, total		
Boron, total		
Bromochloromethane		
Bromodichloromethane		
Bromoform		
Bromomethane		
Cadmium, total	<.8	<.8
Carbon Disulfide		
Carbon Tetrachloride		
Chemical Oxygen Demand		
Chloride	249	239
Chlorobenzene		
Chloroethane		
Chloroform		
Chloromethane		
Chromium, total	<8	<8
cis-1,2-Dichloroethylene	1.6	1.2
cis-1,3-Dichloropropene		
Cobalt, total	3.6	3.6
Copper, total	<4	<4
Dibromochloromethane		
Dibromomethane		
Ethylbenzene		
Iron, dissolved		
Iron, total		
Lead, total	<4	<4
Magnesium, total		
Manganese, total		
Mercury, total		
Methyl Iodide		
Methylene Chloride		
Molybdenum, total		

* - The displayed value is the arithmetic mean of multiple database matches.

Table 2

Analytical Data Summary for MW-1

Constituents	Units	4/10/2018	10/4/2018	4/15/2019	10/8/2019	4/8/2020	10/2/2020	4/12/2021	10/26/2021	4/12/2022	10/7/2022	4/19/2023	10/25/2023
Nickel, total	ug/L		33.1									21.7	21.9
Nitrogen, Ammonia	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Phosphorus, total	mg/L		<1										
Selenium, total	ug/L		<4									<4	<4
Silver, total	ug/L											<4	
Styrene	ug/L											<1	
Tetrachloroethylene	ug/L											<1	
Thallium, total	ug/L											<2	
Toluene	ug/L											<1	
trans-1,2-Dichloroethylene	ug/L											<1	
trans-1,3-Dichloropropene	ug/L											<1	
trans-1,4-Dichloro-2-butene	ug/L											<5	
Trichloroethylene	ug/L											<1	
Trichlorofluoromethane	ug/L											<1	
Vanadium, total	ug/L											<20	<20
Vinyl Acetate	ug/L											<5	
Vinyl Chloride	ug/L											<1	
Xylenes, total	ug/L											<2	
Zinc, total	ug/L		44.9	<20.0	29.9	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	44.1

* - The displayed value is the arithmetic mean of multiple database matches.

Table 2

Analytical Data Summary for MW-1

Constituents	4/18/2024	10/17/2024
Nickel, total	25.9	21.9
Nitrogen, Ammonia		
Phosphorus, total		
Selenium, total	<4	<4
Silver, total		
Styrene		
Tetrachloroethylene		
Thallium, total		
Toluene		
trans-1,2-Dichloroethylene		
trans-1,3-Dichloropropene		
trans-1,4-Dichloro-2-butene		
Trichloroethylene		
Trichlorofluoromethane		
Vanadium, total	<20	<20
Vinyl Acetate		
Vinyl Chloride		
Xylenes, total		
Zinc, total	<20.0	<20.0

* - The displayed value is the arithmetic mean of multiple database matches.

Table 3

Analytical Data Summary for MW-3R

Constituents	Units	4/10/2018	10/4/2018	4/15/2019	10/8/2019	4/8/2020	10/2/2020	4/12/2021	10/26/2021	4/12/2022	10/7/2022	4/19/2023	10/25/2023	4/18/2024
Antimony, total	ug/L												<2	<2
Arsenic, total	ug/L		<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
Barium, total	ug/L		325	175	352	350	328	324	302	332	307	324	306	336
Boron, total	ug/L		103											
Cadmium, total	ug/L		<.8	<.8	<.8	<.8	<.8	<.8	<.8	<.8	<.8	<.8	<.8	<.8
Chemical Oxygen Demand	mg/L	<10	<20								<20			
Chloride	mg/L	<10.0	<10.0								6.3			
Chromium, total	ug/L			<8.0	10.4	11.2	10.7	11.1	10.6	11.6	11.0	11.5	11.8	11.8
Cobalt, total	ug/L		<.8										<.4	<.4
Copper, total	ug/L		<4.0	15.4	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Iron, dissolved	ug/L	<100	<100											
Iron, total	ug/L		<100	517	<100	212	<100	<100	<100	<100	<100	<100		
Lead, total	ug/L			5.6	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Magnesium, total	mg/L		39.1	14.8	38.0	37.3	39.5	34.3	36.1	36.7	36.2	34.7		
Manganese, total	ug/L		5	214										
Mercury, total	ug/L		<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5		
Molybdenum, total	ug/L		<4											
Nickel, total	ug/L		<4										<4	<4
Nitrogen, Ammonia	mg/L	<1	<1								<1			
Phosphorus, total	mg/L		<1											
Selenium, total	ug/L		<4										<4	<4
Vanadium, total	ug/L												<20	<20
Zinc, total	ug/L		<20.0	59.3	14.1	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0

* - The displayed value is the arithmetic mean of multiple database matches.

Table 3

Analytical Data Summary for MW-3R

Constituents	10/17/2024
Antimony, total	<2
Arsenic, total	<4
Barium, total	319
Boron, total	
Cadmium, total	<.8
Chemical Oxygen Demand	
Chloride	
Chromium, total	12.5
Cobalt, total	<.4
Copper, total	<4.0
Iron, dissolved	
Iron, total	
Lead, total	<4.0
Magnesium, total	
Manganese, total	
Mercury, total	
Molybdenum, total	
Nickel, total	<4
Nitrogen, Ammonia	
Phosphorus, total	
Selenium, total	<4
Vanadium, total	<20
Zinc, total	<20.0

* - The displayed value is the arithmetic mean of multiple database matches.

Table 4

Analytical Data Summary for MW-4

Constituents	Units	4/10/2018	10/4/2018	4/15/2019	10/8/2019	4/8/2020	10/2/2020	4/12/2021	10/26/2021	4/12/2022	10/7/2022	4/19/2023	10/25/2023	4/18/2024
Antimony, total	ug/L												<2	<2
Arsenic, total	ug/L		57.3	<4.0	49.0	16.7	36.3	31.2	20.8	20.4	19.8	23.9	21.4	26.9
Barium, total	ug/L		228	154	218	295	922	744	251	442	395	445	347	490
Boron, total	ug/L		103											
Cadmium, total	ug/L		<.8	<.8	<.8	<.8	<.8	<.8	<.8	<.8	<.8	<.8	<.8	<.8
Chemical Oxygen Demand	mg/L	<10	<20								<20			
Chloride	mg/L	<10	<10								5			
Chromium, total	ug/L			<8.0	<8.0	<8.0	<8.0	9.0	<8.0	<8.0	<8.0	<8.0	10.4	13.1
Cobalt, total	ug/L		1.4										.4	1.0
Copper, total	ug/L		6.9	<4.0	6.9	4.1	15.1	16.7	4.3	7.0	5.6	4.8	<4.0	6.5
Iron, dissolved	ug/L	<100	<100											
Iron, total	ug/L		1480	2770		2930	3860	9090	1210	782	665	1040		
Lead, total	ug/L			<4.0	<4.0	<4.0	<4.0	4.2	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Magnesium, total	mg/L		27.6	34.7	34.7	36.4	39.2	41.5	24.4	37.1	31.4	30.6		
Manganese, total	ug/L		3880	202										
Mercury, total	ug/L		<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5		
Molybdenum, total	ug/L		16											
Nickel, total	ug/L		<4.0										9.7	10.1
Nitrogen, Ammonia	mg/L	<1	<1								<1			
Phosphorus, total	mg/L		<1											
Selenium, total	ug/L		<4										<4	<4
Vanadium, total	ug/L												<20	<20
Zinc, total	ug/L		31.9	<20.0	24.6	<20.0	32.5	40.9	<20.0	<20.0	22.0	<20.0	<20.0	<20.0

* - The displayed value is the arithmetic mean of multiple database matches.

Table 5

Analytical Data Summary for MW-5

Constituents	Units	4/10/2018	10/4/2018	4/15/2019	10/8/2019	4/8/2020	10/2/2020	4/12/2021	10/26/2021	4/12/2022	10/7/2022	4/19/2023	10/25/2023	4/18/2024
Antimony, total	ug/L												<2	<2
Arsenic, total	ug/L		6.4	<4.0	<4.0	6.0	<4.0	4.0	5.6	<4.0	<4.0	<4.0	4.6	<4.0
Barium, total	ug/L		317.0	80.7	166.0	484.0	177.0	254.0	341.0	195.0	155.0	146.0	243.0	175.0
Boron, total	ug/L		190											
Cadmium, total	ug/L		<.8	<.8	<.8	.8	<.8	<.8	2.2	<.8	<.8	<.8	<.8	<.8
Chemical Oxygen Demand	mg/L	22	<20								<20			
Chloride	mg/L	48.0	50.0								38.3			
Chromium, total	ug/L			<8.0	<8.0	13.4	<8.0	14.3	10.8	16.8	<8.0	<8.0	19.5	<8.0
Cobalt, total	ug/L		6.3										3.5	.5
Copper, total	ug/L		16.4	<4.0	<4.0	26.5	<4.0	8.4	14.7	4.6	<4.0	<4.0	8.9	<4.0
Iron, dissolved	ug/L	<100	<100											
Iron, total	ug/L		18600	1940	1070	32700	1790	10100	15000	2170	1640	373		
Lead, total	ug/L			<4.0	<4.0	15.5	<4.0	4.9	7.6	<4.0	<4.0	<4.0	4.6	<4.0
Magnesium, total	mg/L		35.3	24.1	23.6	48.8	23.6	28.5	30.7	25.5	22.2	22.6		
Manganese, total	ug/L		428	<4										
Mercury, total	ug/L		<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5		
Molybdenum, total	ug/L		<4											
Nickel, total	ug/L		19.5										19.6	5.8
Nitrogen, Ammonia	mg/L	<1	<1								<1			
Phosphorus, total	mg/L		<1											
Selenium, total	ug/L		<4										<4	<4
Vanadium, total	ug/L												<20	<20
Zinc, total	ug/L		67.9	<20.0	44.6	65.8	<20.0	24.5	46.4	<20.0	<20.0	<20.0	36.5	<20.0

* - The displayed value is the arithmetic mean of multiple database matches.

Table 5

Analytical Data Summary for MW-5

Constituents	10/17/2024
Antimony, total	<2
Arsenic, total	<4.0
Barium, total	150.0
Boron, total	
Cadmium, total	<.8
Chemical Oxygen Demand	
Chloride	
Chromium, total	<8.0
Cobalt, total	.5
Copper, total	<4.0
Iron, dissolved	
Iron, total	
Lead, total	<4.0
Magnesium, total	
Manganese, total	
Mercury, total	
Molybdenum, total	
Nickel, total	4.0
Nitrogen, Ammonia	
Phosphorus, total	
Selenium, total	<4
Vanadium, total	<20
Zinc, total	<20.0

* - The displayed value is the arithmetic mean of multiple database matches.

Table 6

Analytical Data Summary for MW-7

Constituents	Units	4/10/2018	10/4/2018	4/15/2019	10/8/2019	4/8/2020	10/2/2020	4/12/2021	10/26/2021	4/12/2022	10/7/2022	4/19/2023	10/25/2023	4/18/2024
Antimony, total	ug/L												<2	<2
Arsenic, total	ug/L		<4.0	27.2	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Barium, total	ug/L		150	279	178	187	190	195	163	190	153	159	172	188
Boron, total	ug/L		<100											
Cadmium, total	ug/L		<.8	<.8	<.8	<.8	.9	1.3	<.8	<.8	<.8	<.8	<.8	<.8
Chemical Oxygen Demand	mg/L	<10	<20								<20			
Chloride	mg/L	<10.0	10.0								7.1			
Chromium, total	ug/L			<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8
Cobalt, total	ug/L		<.8										<.4	<.4
Copper, total	ug/L		<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Iron, dissolved	ug/L	<100	<100											
Iron, total	ug/L		<100	<100	<100	<100	<100	<100	<100	<100	<100	<100		
Lead, total	ug/L			<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
Magnesium, total	mg/L		22.2	25.6	26.8	27.4	32.1	28.8	28.2	28.6	24.2	23.8		
Manganese, total	ug/L		583	687										
Mercury, total	ug/L		<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5		
Molybdenum, total	ug/L		7.2											
Nickel, total	ug/L		<4										<4	<4
Nitrogen, Ammonia	mg/L	<1	<1								<1			
Phosphorus, total	mg/L		<1											
Selenium, total	ug/L		<4										<4	<4
Vanadium, total	ug/L												<20	<20
Zinc, total	ug/L		23.6	31.5	<8.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0

* - The displayed value is the arithmetic mean of multiple database matches.

Table 6

Analytical Data Summary for MW-7

Constituents	10/17/2024
Antimony, total	<2
Arsenic, total	<4.0
Barium, total	170
Boron, total	
Cadmium, total	<.8
Chemical Oxygen Demand	
Chloride	
Chromium, total	<8
Cobalt, total	<.4
Copper, total	9.8
Iron, dissolved	
Iron, total	
Lead, total	<4
Magnesium, total	
Manganese, total	
Mercury, total	
Molybdenum, total	
Nickel, total	7
Nitrogen, Ammonia	
Phosphorus, total	
Selenium, total	<4
Vanadium, total	<20
Zinc, total	<20.0

* - The displayed value is the arithmetic mean of multiple database matches.

Table 10 – **NOT USED**

Table 10

Historic SSI & SSL
Annual Water Quality Report
Monona County Sanitary Landfill
Permit No. 67-SDP-01-75C

NOT REQUIRED

Table 11 – **NOT USED**

Table 11

Corrective Action Trend Analysis
Annual Water Quality Report
Monona County Sanitary Landfill
Permit No. 67-SDP-01-75C

NOT REQUIRED

Table 12 – Leachate Summary

Table 12
Leachate Elevation Data
Annual Water Quality Report
Monona County Landfill
67-SDP-1-75P

	LW-1 (Starting October, 2015) 26.45		Top PVC	**1250.98**
	Leachate * Depth (ft)	Leachate Thickness (ft)	Gallons Extracted	Leachate Elevation (MSL)
04/18/24	26.35	0.10	0.00	1224.63
10/17/24	26.35	0.10	0.00	1224.63
* IDNR Letter dated June 13, 2024 (Doc #110240) reduced the frequency of leachate measurements to semi-annual (April and October measurements by HLW).				
			0.00 total gallons extracted	

Table 13 – Gas Monitoring Summary

Table 13
Explosive Gas Monitoring
Annual Water Quality Report
Monona County Landfill
Permit No. 67-SDP-01-75C

18-Apr-24		
Ambient Air Location	**Oxygen %**	**Lower Explosive Limit %**
MW-1	NA	0
MW-2	NA	0
MW-3R	NA	0
MW-4	NA	0
MW-5	NA	0
Shop	NA	0
Collected by: HLW		

17-Oct-24		
Ambient Air Location	**Oxygen %**	**Lower Explosive Limit %**
MW-1	20.9	0
MW-2	20.9	0
MW-3R	20.9	0
MW-4	20.9	0
MW-5	20.9	0
Shop	20.9	0
Collected by: HLW		

* IDNR Letter dated June 13, 2024 (Doc #110240) reduced the frequency of gas monitoring to semi-annual (April and October).

Appendix A

Hydraulic Conductivity Data

TABLE 2

Hydraulic Conductivity Summary Data

Monona County Sanitary Landfill

Well No.	Installation Date	11/24/1992 K cm/sec	1/6/2012 K cm/sec	4/15/2019 K cm/sec	4/18/2024 K cm/sec
MW-1	3/24/1992	8.10E-05	8.10E-05	1.81E-04	2.68E-04
MW-3R	9/10/2013	4.20E-05	4.20E-05	3.71E-05	3.26E-05
MW-4	11/6/1992	3.00E-05	3.00E-05	4.16E-05	4.92E-05
MW-5	11/12/1992	1.60E-05	1.60E-05	4.43E-05	3.03E-05
MW-7	10/6/2011	DNE	2.40E-05	5.15E-05	6.70E-05

DNE = Does not exist

Appendix B

Field Sampling Forms

Monona County Sanitary Landfill
PERMIT # 67-SDP-1-75C

4/18/2024 Sampled by: Todd Whipple Weather conditions: Overcast, calm, 48 degrees

IDNR Form 542-1322

Monitoring Well: MW 1 (dg)

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1219.49
Well Depth	42.19
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1219.49
Well Depth	42.19
Top Screen	1192.30
Bottom Screen	1177.30
Bottom Well	1176.99
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	37.00
Top sample	1182.49
Bottom sample	1178.49
Turbidity(NTU)	1.67

Date	Time	Water Level	Water Elevation	Notes
4/18/2024	12:05	27.16	1192.33	

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		1.67
Appendix I	Metals	250	250		1.67
Appendix I	VOC	120	120		1.67
Full Appendix II	10 more containers	5620			
Fe, dissolved - filtered	dissolved metals	250			
chloride, ammonia	chloride, ammonia	250	250		
COD	COD	125	125		
Total			755	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1219.49	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	42.19	Before purging	4/18/2024	12:05	27.16	1192.33	5	2.0	no
		After purging				1219.49			
		Top of Screen after construction				1192.30			
						27.19	feet above (+) or below (-) top screen		
		Bottom of Well after construction				1177.30			
		Bottom of Well	4/18/2024		42.50	1176.99			
						-0.31	feet sedimentation		
		Recovery		12:17	30.20	1189.29			
		Recovery		12:18	29.35	1190.14			
		Recovery		12:19	29.02	1190.47			
		Recovery		12:20	28.60	1190.89			
		Recovery		12:21	28.21	1191.28			
		Recovery		12:24	27.71	1191.78	pH	Conductivity	Temp.(C)
		Recovery		12:31	27.30	1192.19			

IDNR Form 542-1322

Monitoring Well: MW 3R

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1266.2
Well Depth	66.70
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1266.2
Well Depth	66.70
Top Screen	1215.20
Bottom Screen	1200.20
Bottom Well	1199.50
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	60.00
Top sample	1206.20
Bottom sample	1202.20
Turbidity(NTU)	2.05

Date	Time	Water Level	Water Elevation	Notes
4/18/2024	10:29	51.21	1214.99	

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		2.05
Appendix I	Metals	250	250		2.05
Appendix I	VOC	120			
Full Appendix II	10 more containers	5620			
Fe, dissolved - filtered	dissolved metals	250			
chloride, ammonia	chloride, ammonia	250			
COD	COD	250			
Total			260	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1266.2	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	66.00	Before purging	4/18/2024	10:29	51.21	1214.99	5	2.1	no
		After purging				1266.20			
		Top of Screen after construction				1215.20			
						51.00	feet above (+) or below (-) top screen		
		Bottom of Well after construction				1199.50			
		Bottom of Well	4/18/2024		66.70	1199.50			
						0.00	feet sedimentation		
		Recovery		10:33	58.80	1207.40			
		Recovery		10:35	57.60	1208.60			
		Recovery		10:36	57.31	1208.89			
		Recovery		10:37	57.08	1209.12			
		Recovery		10:40	56.52	1209.68			
		Recovery		11:16	53.22	1212.98			
		Recovery		11:53	52.10	1214.10			
		Recovery		12:35	51.47	1214.73	pH	Conductivity	Temp.(C)
		Recovery				1266.20			

IDNR Form 542-1322

Monitoring Well: MW 4

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1275.6
Well Depth	82.00
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1275.6
Well Depth	82.00
Top Screen	1208.60
Bottom Screen	1193.60
Bottom Well	1193.60
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	70.00
Top sample	1205.60
Bottom sample	1201.60
Turbidity(NTU)	33.70

Date	Time	Water Level	Water Elevation	Notes
4/18/2024	10:50	56.92	1218.68	

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		33.70
Appendix I	Metals	250	250		33.70
Appendix I	VOC	120	0		
Full Appendix II	10 more containers	5620			
Fe, dissolved - filtered	dissolved metals	250			
chloride, ammonia	chloride, ammonia	250			
COD	COD	125			
Total			260	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1275.6	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	82.00	Before purging	4/18/2024	10:50	56.92	1218.68	5	1.2	no
		After purging				1275.60			
		Top of Screen after construction				1208.60			
						67.00	feet above (+) or below (-) top screen		
		Bottom of Well after construction				1193.60			
		Bottom of Well	4/18/2024		75.81	1199.79			
						6.19	feet sedimentation		
		Recovery		11:03	73.35	1202.25			
		Recovery		11:04	71.46	1204.14			
		Recovery		11:05	70.83	1204.77			
		Recovery		11:06	70.30	1205.30			
		Recovery		11:07	69.81	1205.79			
		Recovery		11:09	69.24	1206.36			
		Recovery		11:47	59.25	1216.35			
		Recovery		12:45	57.28	1218.32	pH	Conductivity	Temp.(C)
		Recovery				1275.60			

IDNR Form 542-1322

Monitoring Well: MW-5

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1335.64
Well Depth	121.64
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1335.64
Well Depth	121.64
Top Screen	1229.00
Bottom Screen	1214.00
Bottom Well	1214.00
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	115.00
Top sample	1220.64
Bottom sample	1216.64
Turbidity(NTU)	7.76

Date	Time	Water Level	Water Elevation	Notes
4/18/2024	9:52	101.35	1234.29	

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		7.76
Appendix I	Metals	250	250		7.76
Appendix I	VOC	120			
Full Appendix II	10 more containers	5620			
Fe, dissolved - filtered	dissolved metals	250			
chloride, ammonia	chloride, ammonia	250			
COD	COD	125			
Total			260	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1335.64	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	121.64	Before purging	4/18/2024	9:52	101.35	1234.29	5	1.5	no
		After purging				1335.64			
		Top of Screen after construction				1229.00			
						106.64	feet above (+) or below (-) top screen		
		Bottom of Well after construction				1214.00			
		Bottom of Well	4/18/2024		121.50	1214.14			
						0.14	feet sedimentation		
		Recovery		10:06	115.90	1219.74			
		Recovery		10:07	114.30	1221.34			
		Recovery		10:08	113.01	1222.63			
		Recovery		10:09	112.10	1223.54			
		Recovery		10:10	111.20	1224.44			
		Recovery		11:13	102.77	1232.87			
		Recovery		11:50	102.09	1233.55			
		Recovery		12:49	101.73	1233.91	pH	Conductivity	Temp.(C)
		Recovery				1335.64			

IDNR Form 542-1322

Monitoring Well: MW 7

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1236.98
Well Depth	54.78
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1236.98
Well Depth	54.78
Top Screen	1197.20
Bottom Screen	1182.20
Bottom Well	1182.20
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	48.00
Top sample	1188.98
Bottom sample	1184.98
Turbidity(NTU)	2.03

Date	Time	Water Level	Water Elevation	Notes
4/18/2024	11:28	47.35	1189.63	

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		2.03
Appendix I	Metals	250	250		2.03
Appendix I	VOC	120			
Full Appendix II	10 more containers	5620			
Fe, dissolved - filtered	dissolved metals	250			
chloride, ammonia	chloride, ammonia	250			
COD	COD	125			
Total			260	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1236.98	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	54.78	Before purging	4/18/2024	11:28	47.35	1189.63	2.5	2.1	yes
		After purging				1236.98			
		Top of Screen after construction				1197.20			
						39.78	feet above (+) or below (-) top screen		
		Bottom of Well after construction				1182.20			
		Bottom of Well	4/18/2024		54.50	1182.48			
						0.28	feet sedimentation		
		Recovery		11:35	51.40	1185.58			
		Recovery		11:36	50.29	1186.69			
		Recovery		11:37	50.10	1186.88			
		Recovery		11:38	49.90	1187.08			
		Recovery		11:39	49.71	1187.27			
		Recovery		11:56	48.54	1188.44			
		Recovery		12:35	47.76	1189.22			
		Recovery				1236.98	pH	Conductivity	Temp.(C)
		Recovery				1236.98			

Monona County Sanitary Landfill
PERMIT # 67-SDP-1-75C

10/17/2024 Sampled by: Todd Whipple Weather conditions: Overcast, calm, 48 degrees

IDNR Form 542-1322

Monitoring Well: MW 1 (dg)

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1219.49
Well Depth	42.19
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1219.49
Well Depth	42.19
Top Screen	1192.30
Bottom Screen	1177.30
Bottom Well	1176.99
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	37.00
Top sample	1182.49
Bottom sample	1178.49
Turbidity(NTU)	2.95

Date	Time	Water Level	Water Elevation	Notes
10/17/2024	10:15	26.77	1192.72	

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		2.95
Appendix I	Metals	250	250		2.95
Appendix I	VOC	120	120		2.95
Full Appendix II	10 more containers	5620			
Fe, dissolved - filtered	dissolved metals	250			
chloride, ammonia	chloride, ammonia	250	250		
COD	COD	125	125		
Total			755	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1219.49	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?	
Well Depth	42.19	Before purging	10/17/2024	10:15	26.77	1192.72		0.0		
		After purging				1219.49				
		Top of Screen after construction				1192.30				
						27.19	feet above (+) or below (-) top screen			
		Bottom of Well after construction				1177.30				
		Bottom of Well	10/17/2024		42.50	1176.99				
						-0.31	feet sedimentation			
		Recovery				1219.49				
		Recovery				1219.49				
		Recovery				1219.49				
		Recovery				1219.49				
		Recovery				1219.49				
		Recovery				1219.49	pH	Conductivity	Temp.(C)	
		Recovery				1219.49				

IDNR Form 542-1322

Monitoring Well: MW 3R

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1266.2
Well Depth	66.70
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1266.2
Well Depth	66.70
Top Screen	1215.20
Bottom Screen	1200.20
Bottom Well	1199.50
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	60.00
Top sample	1206.20
Bottom sample	1202.20
Turbidity(NTU)	2.26

Date	Time	Water Level	Water Elevation	Notes
10/17/2024	9:56	51.22	1214.98	

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		2.26
Appendix I	Metals	250	250		2.26
Appendix I	VOC	120			
Full Appendix II	10 more containers	5620			
Fe, dissolved - filtered	dissolved metals	250			
chloride, ammonia	chloride, ammonia	250			
COD	COD	250			
Total			260	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1266.2	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?	
Well Depth	66.00	Before purging	10/17/2024	9:56	51.22	1214.98		0.0		
		After purging				1266.20				
		Top of Screen after construction				1215.20				
						51.00	feet above (+) or below (-) top screen			
		Bottom of Well after construction				1199.50				
		Bottom of Well	10/17/2024		66.70	1199.50				
						0.00	feet sedimentation			
		Recovery				1266.20				
		Recovery				1266.20				
		Recovery				1266.20				
		Recovery				1266.20				
		Recovery				1266.20				
		Recovery				1266.20				
		Recovery				1266.20				
		Recovery				1266.20				
		Recovery				1266.20	pH	Conductivity	Temp.(C)	
		Recovery				1266.20				

IDNR Form 542-1322

Monitoring Well: MW 4

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1275.6
Well Depth	82.00
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1275.6
Well Depth	82.00
Top Screen	1208.60
Bottom Screen	1193.60
Bottom Well	1193.60
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	
Top sample	1275.60
Bottom sample	1271.60
Turbidity(NTU)	

no sample

Date	Time	Water Level	Water Elevation	Notes
10/17/2024	10:50	56.04	1219.56	

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		0.00
Appendix I	Metals	250	250		0.00
Appendix I	VOC	120	0		
Full Appendix II	10 more containers	5620			
Fe, dissolved - filtered	dissolved metals	250			
chloride, ammonia	chloride, ammonia	250			
COD	COD	125			
Total			260	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1275.6	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	82.00	Before purging	10/17/2024	10:50	56.04	1219.56		0.0	
		After purging				1275.60			
		Top of Screen after construction				1208.60			
						67.00	feet above (+) or below (-) top screen		
		Bottom of Well after construction				1193.60			
		Bottom of Well	10/17/2024		80.00	1195.60			
						2.00	feet sedimentation		
		Recovery				1275.60			
		Recovery				1275.60			
		Recovery				1275.60			
		Recovery				1275.60			
		Recovery				1275.60			
		Recovery				1275.60			
		Recovery				1275.60			
		Recovery				1275.60	pH	Conductivity	Temp.(C)
		Recovery				1275.60			

IDNR Form 542-1322

Monitoring Well: MW-5

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1335.64
Well Depth	121.64
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1335.64
Well Depth	121.64
Top Screen	1229.00
Bottom Screen	1214.00
Bottom Well	1214.00
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	110.00
Top sample	1225.64
Bottom sample	1221.64
Turbidity(NTU)	58.93

Date	Time	Water Level	Water Elevation	Notes
10/17/2024	9:08	101.53	1234.11	

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		58.93
Appendix I	Metals	250	250		58.93
Appendix I	VOC	120			
Full Appendix II	10 more containers	5620			
Fe, dissolved - filtered	dissolved metals	250			
chloride, ammonia	chloride, ammonia	250			
COD	COD	125			
Total			260	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1335.64	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	121.64	Before purging	10/17/2024	9:08	101.53	1234.11		0.0	
		After purging				1335.64			
		Top of Screen after construction				1229.00			
						106.64	feet above (+) or below (-) top screen		
		Bottom of Well after construction				1214.00			
		Bottom of Well	10/17/2024		121.50	1214.14			
						0.14	feet sedimentation		
		Recovery				1335.64			
		Recovery				1335.64			
		Recovery				1335.64			
		Recovery				1335.64			
		Recovery				1335.64			
		Recovery				1335.64			
		Recovery				1335.64			
		Recovery				1335.64	pH	Conductivity	Temp.(C)
		Recovery				1335.64			

IDNR Form 542-1322

Monitoring Well: MW 7

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1236.98
Well Depth	54.78
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1236.98
Well Depth	54.78
Top Screen	1197.20
Bottom Screen	1182.20
Bottom Well	1182.20
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	48.50
Top sample	1188.48
Bottom sample	1184.48
Turbidity(NTU)	2.38

Date	Time	Water Level	Water Elevation	Notes
10/17/2024	10:32	47.79	1189.19	

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		2.38
Appendix I	Metals	250	250		2.38
Appendix I	VOC	120			
Full Appendix II	10 more containers	5620			
Fe, dissolved - filtered	dissolved metals	250			
chloride, ammonia	chloride, ammonia	250			
COD	COD	125			
Total			260	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1236.98	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	54.78	Before purging	10/17/2024	10:32	47.79	1189.19		0.0	
		After purging				1236.98			
		Top of Screen after construction				1197.20			
						39.78	feet above (+) or below (-) top screen		
		Bottom of Well after construction				1182.20			
		Bottom of Well	10/17/2024		54.50	1182.48			
						0.28	feet sedimentation		
		Recovery				1236.98			
		Recovery				1236.98			
		Recovery				1236.98			
		Recovery				1236.98			
		Recovery				1236.98			
		Recovery				1236.98			
		Recovery				1236.98			
		Recovery				1236.98	pH	Conductivity	Temp.(C)
		Recovery				1236.98			

Appendix C

Statistical Reports

Results of the Ground Water Statistics

for Monona County Sanitary Landfill

First Semi-Annual Monitoring Event in 2024

Prepared for:
Monona County Sanitary Landfill
31342 Hwy 37
Turin, IA 51040

Prepared by:
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Otter Creek Environmental Services, L.L.C.
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May 2024

INTRODUCTION

This report contains the results of the statistical analyses used to evaluate the ground water data obtained during the first semi-annual monitoring event in 2024 at Monona County Sanitary Landfill. The ground water at Monona County Sanitary Landfill is monitored by a network of wells including MW-1, MW-3R (upgradient), MW-4 (upgradient), MW-5 (upgradient), and MW-7. Monitoring wells MW-1, MW-3R, MW-4, MW-5, and MW-7 were sampled on April 18, 2024 and analyzed for the parameters required by permit. The statistical plan is designed to detect a release from the facility at the earliest indication so that it is protective of human health and the environment. The interwell methodology is described and then applied to the Monona County Sanitary Landfill data. The statistical plan conforms with IAC 567, Chapter 113.10, USEPA Guidance document ("*Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Unified Guidance"*, March 2009), and the American Society for Testing and Materials (ASTM) standard D6312-98, *Developing Appropriate Statistical Approaches for Ground-Water Detection Monitoring Programs.*

Ground Water Monitoring Program

The groundwater monitoring network for Monona County Sanitary Landfill includes MW-1, MW-3R, MW-4, MW-5, and MW-7. Each of the groundwater monitoring wells is to be sampled at least semiannually and analyzed for the trace metals including antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, nickel, selenium, vanadium, and zinc. The ground water data obtained during the first semi-annual monitoring event in 2024 are summarized in Attachment A.

STATISTICAL METHODOLOGIES FOR DETECTION MONITORING

IAC 567, Chapter 113.10(4) provides several options for statistically evaluating the ground water data at those wells that monitor the open cells or contiguous MSWLF units. The preferred methods for comparing ground water data are using either prediction limits or using control charts. The site prediction limit method was applied to the Monona County Sanitary Landfill data using the DUMPStat® statistical program. DUMPStat® is a program for the statistical analysis of groundwater monitoring data using methods described in "Statistical Methods for Groundwater Monitoring" by Dr. Robert D. Gibbons. The DUMPStat program is completely consistent with all USEPA regulations and guidance and the ASTM D6312-98 guidance.

Interwell Statistics: Upgradient versus Downgradient Comparisons

Interwell statistics are appropriate when the upgradient and downgradient wells monitor the same ground water formation and there is similar variability in the upgradient and downgradient zones. Site prediction limits are determined by pooling the historical ground water data from hydraulically upgradient wells. This statistical method compares the current downgradient determinations to site prediction limits and checks for exceedances. The type of prediction limit utilized (e.g., parametric or nonparametric) is based on the detection frequency and the data distribution of each parameter in the background data. The distribution of the background data is tested for normality using the Shapiro-Wilk test (Gibbons, 1994 and USEPA 1992). If the constituent is normally distributed, a normal prediction limit is used. If normality is rejected by the Shapiro-Wilk test, the background data is transformed by taking the natural logarithm. The Shapiro-Wilk

test is then reapplied on the transformed data. If it is not rejected, lognormal prediction limits are used. If after transforming the data, normality is still rejected, nonparametric prediction limits are used for that analyte. The nonparametric prediction limit is the largest determination in the background measurements. For constituents where the background detection frequency is greater than 0% but less than 50%, nonparametric prediction limits will be used. If the detection frequency is 0% after thirteen samples have been collected, the practical quantitation limit (PQL) becomes the nonparametric prediction limit.

Results of the Interwell Statistics – Trace Metals

The background data used in this statistical analysis includes the ground water data collected from ground water wells MW-3R, MW-4, and MW-5 during the period from October 2018 through the current data. A summary of the background data from monitoring wells MW-3R, MW-4, and MW-5 is listed in Attachment B, Table 1 "Upgradient Data". This statistical method compares the current downgradient determinations to site prediction limits and checks for exceedances.

Table 2 "Most Current Downgradient Monitoring Data", summarizes the current data from downgradient wells MW-1 and MW-7, compared to the site prediction limits. Prediction limit exceedances are flagged with asterisks. For the most current data, the site prediction limit exceedances detected are summarized in the table below.

Prediction Limit Exceedances during the First Semi-Annual Monitoring Event in 2024

Well	Parameter	Result	Prediction Limit	Prediction Limit Type	Verified/ Awaiting verification
MW-1	Barium, µg/L	1100	913.2290	Lognormal	Verified

The detection frequencies of the parameters in the up and down gradient monitoring wells are summarized in Table 3. Barium, chromium, cobalt, and nickel were detected at a frequency greater than or equal to 50% in the upgradient well so these metals were tested for normality. The remainder of the metals are rarely detected (less than 50%) in the upgradient wells so nonparametric prediction limits were be used in those cases.

Table 4 summarizes the results of the Shapiro-Wilk test. Table 5 is a summary of the statistics and prediction limits determined for the metals. Table 8 is a historical summary of the data at those wells that have indicated an exceedance. Time series graphs of each of the parameters at each well with the corresponding prediction limits are attached.

A statistical power curve indicates the expected false assessments for the site as a whole. The false positive rate for interwell analyses is the percentage of failures when the upgradient versus downgradient true mean difference equals zero. False negative rate indicates the chance of missing contamination at a single well for a single constituent. The statistical power is a function of the number of wells included, the number of constituents compared, the detection frequencies, and the data distributions involved. For interwell analysis, the site-wide false positive rate is 3% and the test becomes sensitive to 4 standard deviation unit increases over background.

Volatile Organic Compounds

Volatile Organic Compounds (VOCs) are generally man-made compounds not present in ambient ground water. If VOCs are detected above their statistical limit (i.e., the laboratory PQL or reporting limit), a verification resample will be conducted at the next scheduled sampling event. A statistical exceedance will be indicated if the VOC detection is confirmed by the subsequent monitoring.

Ground water well MW-1 was monitored for *cis*-1,2-dichloroethene during the first semi-annual monitoring event in 2024, because it was previously detected in 2023. There is a current detection of *cis*-1,2-Dichloroethene (1.6 µg/L) above the site-specific reporting limit at MW-1. The *cis*-1,2-dichloroethene detection is statistically since it confirms the October 2023 monitoring.

Exceedances

The current and previous verified exceedances were evaluated against the ground water protection standards (GWPS) using confidence limits calculated in accordance with the Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, USEPA, March 2009 (Attachment C). The analysis was conducted to evaluate whether verified concentrations are significantly above the water quality standard. The 95% lower confidence limit (LCL) for the mean of the historical data was used to evaluate whether the regulated unit is in compliance with the ground-water protection standards under 40 CFR 264 (e.g. whether the verified constituent is detected at a significant level above the GWPS). An exceedance is verified if the LCL is above the Regulatory GWPS.

The calculated 95% LCLs do not exceed the GWPS.

Attachment A

Ground Water Data obtained during the First Semi-Annual Monitoring Event in 2024

Table 1

Analytical Data Summary for 4/18/2024

Constituents	Units	MW-1	MW-3R	MW-4	MW-5	MW-7
Antimony, total	ug/L	<2	<2	<2	<2	<2
Arsenic, total	ug/L	<4.0	<4.0	26.9	<4.0	<4.0
Barium, total	ug/L	1100	336	490	175	188
Cadmium, total	ug/L	<.8	<.8	<.8	<.8	<.8
Chloride	mg/L	249				
Chromium, total	ug/L	<8.0	11.8	13.1	<8.0	<8.0
cis-1,2-Dichloroethylene	ug/L	1.6				
Cobalt, total	ug/L	3.6	<.4	1.0	.5	<.4
Copper, total	ug/L	<4.0	<4.0	6.5	<4.0	<4.0
Lead, total	ug/L	<4	<4	<4	<4	<4
Nickel, total	ug/L	25.9	<4.0	10.1	5.8	<4.0
Selenium, total	ug/L	<4	<4	<4	<4	<4
Vanadium, total	ug/L	<20	<20	<20	<20	<20
Zinc, total	ug/L	<20	<20	<20	<20	<20

* - The displayed value is the arithmetic mean of multiple database matches.

Attachment B

Summary Tables and Graphs for the Interwell Comparisons

Table 1

Upgradient Data

Constituent	Units	Well	Date		Result	Adjusted	
Antimony, total	ug/L	MW-3R	10/25/2023	ND	2.0000		
Antimony, total	ug/L	MW-3R	04/18/2024	ND	2.0000		
Arsenic, total	ug/L	MW-3R	10/04/2018	ND	4.0000		
Arsenic, total	ug/L	MW-3R	04/15/2019	ND	4.0000		
Arsenic, total	ug/L	MW-3R	10/08/2019	ND	4.0000		
Arsenic, total	ug/L	MW-3R	04/08/2020	ND	4.0000		
Arsenic, total	ug/L	MW-3R	10/02/2020	ND	4.0000		
Arsenic, total	ug/L	MW-3R	04/12/2021	ND	4.0000		
Arsenic, total	ug/L	MW-3R	10/26/2021	ND	4.0000		
Arsenic, total	ug/L	MW-3R	04/12/2022	ND	4.0000		
Arsenic, total	ug/L	MW-3R	10/07/2022	ND	4.0000		
Arsenic, total	ug/L	MW-3R	04/19/2023	ND	4.0000		
Arsenic, total	ug/L	MW-3R	10/25/2023	ND	4.0000		
Arsenic, total	ug/L	MW-3R	04/18/2024	ND	4.0000		
Barium, total	ug/L	MW-3R	10/04/2018		325.0000		
Barium, total	ug/L	MW-3R	04/15/2019		175.0000		
Barium, total	ug/L	MW-3R	10/08/2019		352.0000		
Barium, total	ug/L	MW-3R	04/08/2020		350.0000		
Barium, total	ug/L	MW-3R	10/02/2020		328.0000		
Barium, total	ug/L	MW-3R	04/12/2021		324.0000		
Barium, total	ug/L	MW-3R	10/26/2021		302.0000		
Barium, total	ug/L	MW-3R	04/12/2022		332.0000		
Barium, total	ug/L	MW-3R	10/07/2022		307.0000		
Barium, total	ug/L	MW-3R	04/19/2023		324.0000		
Barium, total	ug/L	MW-3R	10/25/2023		306.0000		
Barium, total	ug/L	MW-3R	04/18/2024		336.0000		
Cadmium, total	ug/L	MW-3R	10/04/2018	ND	0.8000		
Cadmium, total	ug/L	MW-3R	04/15/2019	ND	0.8000		
Cadmium, total	ug/L	MW-3R	10/08/2019	ND	0.8000		
Cadmium, total	ug/L	MW-3R	04/08/2020	ND	0.8000		
Cadmium, total	ug/L	MW-3R	10/02/2020	ND	0.8000		
Cadmium, total	ug/L	MW-3R	04/12/2021	ND	0.8000		
Cadmium, total	ug/L	MW-3R	10/26/2021	ND	0.8000		
Cadmium, total	ug/L	MW-3R	04/12/2022	ND	0.8000		
Cadmium, total	ug/L	MW-3R	10/07/2022	ND	0.8000		
Cadmium, total	ug/L	MW-3R	04/19/2023	ND	0.8000		
Cadmium, total	ug/L	MW-3R	10/25/2023	ND	0.8000		
Cadmium, total	ug/L	MW-3R	04/18/2024	ND	0.8000		
Chromium, total	ug/L	MW-3R	04/15/2019	ND	8.0000		
Chromium, total	ug/L	MW-3R	10/08/2019		10.4000		
Chromium, total	ug/L	MW-3R	04/08/2020		11.2000		
Chromium, total	ug/L	MW-3R	10/02/2020		10.7000		
Chromium, total	ug/L	MW-3R	04/12/2021		11.1000		
Chromium, total	ug/L	MW-3R	10/26/2021		10.6000		
Chromium, total	ug/L	MW-3R	04/12/2022		11.6000		
Chromium, total	ug/L	MW-3R	10/07/2022		11.0000		
Chromium, total	ug/L	MW-3R	04/19/2023		11.5000		
Chromium, total	ug/L	MW-3R	10/25/2023		11.8000		
Chromium, total	ug/L	MW-3R	04/18/2024		11.8000		
Cobalt, total	ug/L	MW-3R	10/04/2018	ND	0.8000	0.4000	**
Cobalt, total	ug/L	MW-3R	10/25/2023	ND	0.4000		
Cobalt, total	ug/L	MW-3R	04/18/2024	ND	0.4000		
Copper, total	ug/L	MW-3R	10/04/2018	ND	4.0000		
Copper, total	ug/L	MW-3R	04/15/2019		15.4000		*
Copper, total	ug/L	MW-3R	10/08/2019	ND	4.0000		
Copper, total	ug/L	MW-3R	04/08/2020	ND	4.0000		
Copper, total	ug/L	MW-3R	10/02/2020	ND	4.0000		
Copper, total	ug/L	MW-3R	04/12/2021	ND	4.0000		
Copper, total	ug/L	MW-3R	10/26/2021	ND	4.0000		
Copper, total	ug/L	MW-3R	04/12/2022	ND	4.0000		
Copper, total	ug/L	MW-3R	10/07/2022	ND	4.0000		
Copper, total	ug/L	MW-3R	04/19/2023	ND	4.0000		
Copper, total	ug/L	MW-3R	10/25/2023	ND	4.0000		
Copper, total	ug/L	MW-3R	04/18/2024	ND	4.0000		
Lead, total	ug/L	MW-3R	04/15/2019		5.6000		
Lead, total	ug/L	MW-3R	10/08/2019	ND	4.0000		
Lead, total	ug/L	MW-3R	04/08/2020	ND	4.0000		
Lead, total	ug/L	MW-3R	10/02/2020	ND	4.0000		
Lead, total	ug/L	MW-3R	04/12/2021	ND	4.0000		
Lead, total	ug/L	MW-3R	10/26/2021	ND	4.0000		
Lead, total	ug/L	MW-3R	04/12/2022	ND	4.0000		
Lead, total	ug/L	MW-3R	10/07/2022	ND	4.0000		
Lead, total	ug/L	MW-3R	04/19/2023	ND	4.0000		
Lead, total	ug/L	MW-3R	10/25/2023	ND	4.0000		

* - Outlier for that well and constituent.
** - ND value replaced with median RL.
*** - ND value replaced with manual RL.
ND = Not detected, Result = detection limit.

Table 1

Upgradient Data

Constituent	Units	Well	Date		Result	Adjusted	
Lead, total	ug/L	MW-3R	04/18/2024	ND	4.0000		
Nickel, total	ug/L	MW-3R	10/04/2018	ND	4.0000		
Nickel, total	ug/L	MW-3R	10/25/2023	ND	4.0000		
Nickel, total	ug/L	MW-3R	04/18/2024	ND	4.0000		
Selenium, total	ug/L	MW-3R	10/04/2018	ND	4.0000		
Selenium, total	ug/L	MW-3R	10/25/2023	ND	4.0000		
Selenium, total	ug/L	MW-3R	04/18/2024	ND	4.0000		
Vanadium, total	ug/L	MW-3R	10/25/2023	ND	20.0000		
Vanadium, total	ug/L	MW-3R	04/18/2024	ND	20.0000		
Zinc, total	ug/L	MW-3R	10/04/2018	ND	20.0000		
Zinc, total	ug/L	MW-3R	04/15/2019		59.3000		
Zinc, total	ug/L	MW-3R	10/08/2019		14.1000		
Zinc, total	ug/L	MW-3R	04/08/2020	ND	20.0000		
Zinc, total	ug/L	MW-3R	10/02/2020	ND	20.0000		
Zinc, total	ug/L	MW-3R	04/12/2021	ND	20.0000		
Zinc, total	ug/L	MW-3R	10/26/2021	ND	20.0000		
Zinc, total	ug/L	MW-3R	04/12/2022	ND	20.0000		
Zinc, total	ug/L	MW-3R	10/07/2022	ND	20.0000		
Zinc, total	ug/L	MW-3R	04/19/2023	ND	20.0000		
Zinc, total	ug/L	MW-3R	10/25/2023	ND	20.0000		
Zinc, total	ug/L	MW-3R	04/18/2024	ND	20.0000		
Antimony, total	ug/L	MW-4	10/25/2023	ND	2.0000		
Antimony, total	ug/L	MW-4	04/18/2024	ND	2.0000		
Arsenic, total	ug/L	MW-4	10/04/2018		57.3000		
Arsenic, total	ug/L	MW-4	04/15/2019	ND	4.0000		
Arsenic, total	ug/L	MW-4	10/08/2019		49.0000		
Arsenic, total	ug/L	MW-4	04/08/2020		16.7000		
Arsenic, total	ug/L	MW-4	10/02/2020		36.3000		
Arsenic, total	ug/L	MW-4	04/12/2021		31.2000		
Arsenic, total	ug/L	MW-4	10/26/2021		20.8000		
Arsenic, total	ug/L	MW-4	04/12/2022		20.4000		
Arsenic, total	ug/L	MW-4	10/07/2022		19.8000		
Arsenic, total	ug/L	MW-4	04/19/2023		23.9000		
Arsenic, total	ug/L	MW-4	10/25/2023		21.4000		
Arsenic, total	ug/L	MW-4	04/18/2024		26.9000		
Barium, total	ug/L	MW-4	10/04/2018		228.0000		
Barium, total	ug/L	MW-4	04/15/2019		154.0000		
Barium, total	ug/L	MW-4	10/08/2019		218.0000		
Barium, total	ug/L	MW-4	04/08/2020		295.0000		
Barium, total	ug/L	MW-4	10/02/2020		922.0000		
Barium, total	ug/L	MW-4	04/12/2021		744.0000		
Barium, total	ug/L	MW-4	10/26/2021		251.0000		
Barium, total	ug/L	MW-4	04/12/2022		442.0000		
Barium, total	ug/L	MW-4	10/07/2022		395.0000		
Barium, total	ug/L	MW-4	04/19/2023		445.0000		
Barium, total	ug/L	MW-4	10/25/2023		347.0000		
Barium, total	ug/L	MW-4	04/18/2024		490.0000		
Cadmium, total	ug/L	MW-4	10/04/2018	ND	0.8000		
Cadmium, total	ug/L	MW-4	04/15/2019	ND	0.8000		
Cadmium, total	ug/L	MW-4	10/08/2019	ND	0.8000		
Cadmium, total	ug/L	MW-4	04/08/2020	ND	0.8000		
Cadmium, total	ug/L	MW-4	10/02/2020	ND	0.8000		
Cadmium, total	ug/L	MW-4	04/12/2021	ND	0.8000		
Cadmium, total	ug/L	MW-4	10/26/2021	ND	0.8000		
Cadmium, total	ug/L	MW-4	04/12/2022	ND	0.8000		
Cadmium, total	ug/L	MW-4	10/07/2022	ND	0.8000		
Cadmium, total	ug/L	MW-4	04/19/2023	ND	0.8000		
Cadmium, total	ug/L	MW-4	10/25/2023	ND	0.8000		
Cadmium, total	ug/L	MW-4	04/18/2024	ND	0.8000		
Chromium, total	ug/L	MW-4	04/15/2019	ND	8.0000		
Chromium, total	ug/L	MW-4	10/08/2019	ND	8.0000		
Chromium, total	ug/L	MW-4	04/08/2020	ND	8.0000		
Chromium, total	ug/L	MW-4	10/02/2020	ND	8.0000		
Chromium, total	ug/L	MW-4	04/12/2021		9.0000		
Chromium, total	ug/L	MW-4	10/26/2021	ND	8.0000		
Chromium, total	ug/L	MW-4	04/12/2022	ND	8.0000		
Chromium, total	ug/L	MW-4	10/07/2022	ND	8.0000		
Chromium, total	ug/L	MW-4	04/19/2023	ND	8.0000		
Chromium, total	ug/L	MW-4	10/25/2023		10.4000		
Chromium, total	ug/L	MW-4	04/18/2024		13.1000		
Cobalt, total	ug/L	MW-4	10/04/2018		1.4000		
Cobalt, total	ug/L	MW-4	10/25/2023		0.4000		
Cobalt, total	ug/L	MW-4	04/18/2024		1.0000		
Copper, total	ug/L	MW-4	10/04/2018		6.9000		

* - Outlier for that well and constituent.
** - ND value replaced with median RL.
*** - ND value replaced with manual RL.
ND = Not detected, Result = detection limit.

Table 1

Upgradient Data

Constituent	Units	Well	Date		Result	Adjusted	
Copper, total	ug/L	MW-4	04/15/2019	ND	4.0000		
Copper, total	ug/L	MW-4	10/08/2019		6.9000		
Copper, total	ug/L	MW-4	04/08/2020		4.1000		
Copper, total	ug/L	MW-4	10/02/2020		15.1000		
Copper, total	ug/L	MW-4	04/12/2021		16.7000		
Copper, total	ug/L	MW-4	10/26/2021		4.3000		
Copper, total	ug/L	MW-4	04/12/2022		7.0000		
Copper, total	ug/L	MW-4	10/07/2022		5.6000		
Copper, total	ug/L	MW-4	04/19/2023		4.8000		
Copper, total	ug/L	MW-4	10/25/2023	ND	4.0000		
Copper, total	ug/L	MW-4	04/18/2024		6.5000		
Lead, total	ug/L	MW-4	04/15/2019	ND	4.0000		
Lead, total	ug/L	MW-4	10/08/2019	ND	4.0000		
Lead, total	ug/L	MW-4	04/08/2020	ND	4.0000		
Lead, total	ug/L	MW-4	10/02/2020	ND	4.0000		
Lead, total	ug/L	MW-4	04/12/2021		4.2000		
Lead, total	ug/L	MW-4	10/26/2021	ND	4.0000		
Lead, total	ug/L	MW-4	04/12/2022	ND	4.0000		
Lead, total	ug/L	MW-4	10/07/2022	ND	4.0000		
Lead, total	ug/L	MW-4	04/19/2023	ND	4.0000		
Lead, total	ug/L	MW-4	10/25/2023	ND	4.0000		
Lead, total	ug/L	MW-4	04/18/2024	ND	4.0000		
Nickel, total	ug/L	MW-4	10/04/2018	ND	4.0000		
Nickel, total	ug/L	MW-4	10/25/2023		9.7000		
Nickel, total	ug/L	MW-4	04/18/2024		10.1000		
Selenium, total	ug/L	MW-4	10/04/2018	ND	4.0000		
Selenium, total	ug/L	MW-4	10/25/2023	ND	4.0000		
Selenium, total	ug/L	MW-4	04/18/2024	ND	4.0000		
Vanadium, total	ug/L	MW-4	10/25/2023	ND	20.0000		
Vanadium, total	ug/L	MW-4	04/18/2024	ND	20.0000		
Zinc, total	ug/L	MW-4	10/04/2018		31.9000		
Zinc, total	ug/L	MW-4	04/15/2019	ND	20.0000		
Zinc, total	ug/L	MW-4	10/08/2019		24.6000		
Zinc, total	ug/L	MW-4	04/08/2020	ND	20.0000		
Zinc, total	ug/L	MW-4	10/02/2020		32.5000		
Zinc, total	ug/L	MW-4	04/12/2021		40.9000		
Zinc, total	ug/L	MW-4	10/26/2021	ND	20.0000		
Zinc, total	ug/L	MW-4	04/12/2022	ND	20.0000		
Zinc, total	ug/L	MW-4	10/07/2022		22.0000		
Zinc, total	ug/L	MW-4	04/19/2023	ND	20.0000		
Zinc, total	ug/L	MW-4	10/25/2023	ND	20.0000		
Zinc, total	ug/L	MW-4	04/18/2024	ND	20.0000		
Antimony, total	ug/L	MW-5	10/25/2023	ND	2.0000		
Antimony, total	ug/L	MW-5	04/18/2024	ND	2.0000		
Arsenic, total	ug/L	MW-5	10/04/2018		6.4000		
Arsenic, total	ug/L	MW-5	04/15/2019	ND	4.0000		
Arsenic, total	ug/L	MW-5	10/08/2019	ND	4.0000		
Arsenic, total	ug/L	MW-5	04/08/2020		6.0000		
Arsenic, total	ug/L	MW-5	10/02/2020	ND	4.0000		
Arsenic, total	ug/L	MW-5	04/12/2021		4.0000		
Arsenic, total	ug/L	MW-5	10/26/2021		5.6000		
Arsenic, total	ug/L	MW-5	04/12/2022	ND	4.0000		
Arsenic, total	ug/L	MW-5	10/07/2022	ND	4.0000		
Arsenic, total	ug/L	MW-5	04/19/2023	ND	4.0000		
Arsenic, total	ug/L	MW-5	10/25/2023		4.6000		
Arsenic, total	ug/L	MW-5	04/18/2024	ND	4.0000		
Barium, total	ug/L	MW-5	10/04/2018		317.0000		
Barium, total	ug/L	MW-5	04/15/2019		80.7000		
Barium, total	ug/L	MW-5	10/08/2019		166.0000		
Barium, total	ug/L	MW-5	04/08/2020		484.0000		
Barium, total	ug/L	MW-5	10/02/2020		177.0000		
Barium, total	ug/L	MW-5	04/12/2021		254.0000		
Barium, total	ug/L	MW-5	10/26/2021		341.0000		
Barium, total	ug/L	MW-5	04/12/2022		195.0000		
Barium, total	ug/L	MW-5	10/07/2022		155.0000		
Barium, total	ug/L	MW-5	04/19/2023		146.0000		
Barium, total	ug/L	MW-5	10/25/2023		243.0000		
Barium, total	ug/L	MW-5	04/18/2024		175.0000		
Cadmium, total	ug/L	MW-5	10/04/2018	ND	0.8000		
Cadmium, total	ug/L	MW-5	04/15/2019	ND	0.8000		
Cadmium, total	ug/L	MW-5	10/08/2019	ND	0.8000		
Cadmium, total	ug/L	MW-5	04/08/2020		0.8000		
Cadmium, total	ug/L	MW-5	10/02/2020	ND	0.8000		
Cadmium, total	ug/L	MW-5	04/12/2021	ND	0.8000		

* - Outlier for that well and constituent.
** - ND value replaced with median RL.
*** - ND value replaced with manual RL.
ND = Not detected, Result = detection limit.

Table 1

Upgradient Data

Constituent	Units	Well	Date		Result	Adjusted	
Cadmium, total	ug/L	MW-5	10/26/2021		2.2000		
Cadmium, total	ug/L	MW-5	04/12/2022	ND	0.8000		
Cadmium, total	ug/L	MW-5	10/07/2022	ND	0.8000		
Cadmium, total	ug/L	MW-5	04/19/2023	ND	0.8000		
Cadmium, total	ug/L	MW-5	10/25/2023	ND	0.8000		
Cadmium, total	ug/L	MW-5	04/18/2024	ND	0.8000		
Chromium, total	ug/L	MW-5	04/15/2019	ND	8.0000		
Chromium, total	ug/L	MW-5	10/08/2019	ND	8.0000		
Chromium, total	ug/L	MW-5	04/08/2020		13.4000		
Chromium, total	ug/L	MW-5	10/02/2020	ND	8.0000		
Chromium, total	ug/L	MW-5	04/12/2021		14.3000		
Chromium, total	ug/L	MW-5	10/26/2021		10.8000		
Chromium, total	ug/L	MW-5	04/12/2022		16.8000		
Chromium, total	ug/L	MW-5	10/07/2022	ND	8.0000		
Chromium, total	ug/L	MW-5	04/19/2023	ND	8.0000		
Chromium, total	ug/L	MW-5	10/25/2023		19.5000		
Chromium, total	ug/L	MW-5	04/18/2024	ND	8.0000		
Cobalt, total	ug/L	MW-5	10/04/2018		6.3000		
Cobalt, total	ug/L	MW-5	10/25/2023		3.5000		
Cobalt, total	ug/L	MW-5	04/18/2024		0.5000		
Copper, total	ug/L	MW-5	10/04/2018		16.4000		
Copper, total	ug/L	MW-5	04/15/2019	ND	4.0000		
Copper, total	ug/L	MW-5	10/08/2019	ND	4.0000		
Copper, total	ug/L	MW-5	04/08/2020		26.5000		
Copper, total	ug/L	MW-5	10/02/2020	ND	4.0000		
Copper, total	ug/L	MW-5	04/12/2021		8.4000		
Copper, total	ug/L	MW-5	10/26/2021		14.7000		
Copper, total	ug/L	MW-5	04/12/2022		4.6000		
Copper, total	ug/L	MW-5	10/07/2022	ND	4.0000		
Copper, total	ug/L	MW-5	04/19/2023	ND	4.0000		
Copper, total	ug/L	MW-5	10/25/2023		8.9000		
Copper, total	ug/L	MW-5	04/18/2024	ND	4.0000		
Lead, total	ug/L	MW-5	04/15/2019	ND	4.0000		
Lead, total	ug/L	MW-5	10/08/2019	ND	4.0000		
Lead, total	ug/L	MW-5	04/08/2020		15.5000		*
Lead, total	ug/L	MW-5	10/02/2020	ND	4.0000		
Lead, total	ug/L	MW-5	04/12/2021		4.9000		
Lead, total	ug/L	MW-5	10/26/2021		7.6000		
Lead, total	ug/L	MW-5	04/12/2022	ND	4.0000		
Lead, total	ug/L	MW-5	10/07/2022	ND	4.0000		
Lead, total	ug/L	MW-5	04/19/2023	ND	4.0000		
Lead, total	ug/L	MW-5	10/25/2023		4.6000		
Lead, total	ug/L	MW-5	04/18/2024	ND	4.0000		
Nickel, total	ug/L	MW-5	10/04/2018		19.5000		
Nickel, total	ug/L	MW-5	10/25/2023		19.6000		
Nickel, total	ug/L	MW-5	04/18/2024		5.8000		
Selenium, total	ug/L	MW-5	10/04/2018	ND	4.0000		
Selenium, total	ug/L	MW-5	10/25/2023	ND	4.0000		
Selenium, total	ug/L	MW-5	04/18/2024	ND	4.0000		
Vanadium, total	ug/L	MW-5	10/25/2023	ND	20.0000		
Vanadium, total	ug/L	MW-5	04/18/2024	ND	20.0000		
Zinc, total	ug/L	MW-5	10/04/2018		67.9000		
Zinc, total	ug/L	MW-5	04/15/2019	ND	20.0000		
Zinc, total	ug/L	MW-5	10/08/2019		44.6000		
Zinc, total	ug/L	MW-5	04/08/2020		65.8000		
Zinc, total	ug/L	MW-5	10/02/2020	ND	20.0000		
Zinc, total	ug/L	MW-5	04/12/2021		24.5000		
Zinc, total	ug/L	MW-5	10/26/2021		46.4000		
Zinc, total	ug/L	MW-5	04/12/2022	ND	20.0000		
Zinc, total	ug/L	MW-5	10/07/2022	ND	20.0000		
Zinc, total	ug/L	MW-5	04/19/2023	ND	20.0000		
Zinc, total	ug/L	MW-5	10/25/2023		36.5000		
Zinc, total	ug/L	MW-5	04/18/2024	ND	20.0000		

* - Outlier for that well and constituent.
** - ND value replaced with median RL.
*** - ND value replaced with manual RL.
ND = Not detected, Result = detection limit.

Table 2

Most Current Downgradient Monitoring Data

Constituent	Units	Well	Date		Result		Pred. Limit
Antimony, total	ug/L	MW-1	04/18/2024	ND	2.0000		2.0000
Arsenic, total	ug/L	MW-1	04/18/2024	ND	4.0000		57.3000
Barium, total	ug/L	MW-1	04/18/2024		1100.0000	***	913.2290
Cadmium, total	ug/L	MW-1	04/18/2024	ND	0.8000		2.2000
Chromium, total	ug/L	MW-1	04/18/2024	ND	8.0000		19.5000
Cobalt, total	ug/L	MW-1	04/18/2024		3.6000		8.1103
Copper, total	ug/L	MW-1	04/18/2024	ND	4.0000		26.5000
Lead, total	ug/L	MW-1	04/18/2024	ND	4.0000		7.6000
Nickel, total	ug/L	MW-1	04/18/2024		25.9000		32.4174
Selenium, total	ug/L	MW-1	04/18/2024	ND	4.0000		4.0000
Vanadium, total	ug/L	MW-1	04/18/2024	ND	20.0000		20.0000
Zinc, total	ug/L	MW-1	04/18/2024	ND	20.0000		67.9000
Antimony, total	ug/L	MW-7	04/18/2024	ND	2.0000		2.0000
Arsenic, total	ug/L	MW-7	04/18/2024	ND	4.0000		57.3000
Barium, total	ug/L	MW-7	04/18/2024		188.0000		913.2290
Cadmium, total	ug/L	MW-7	04/18/2024	ND	0.8000		2.2000
Chromium, total	ug/L	MW-7	04/18/2024	ND	8.0000		19.5000
Cobalt, total	ug/L	MW-7	04/18/2024	ND	0.4000		8.1103
Copper, total	ug/L	MW-7	04/18/2024	ND	4.0000		26.5000
Lead, total	ug/L	MW-7	04/18/2024	ND	4.0000		7.6000
Nickel, total	ug/L	MW-7	04/18/2024	ND	4.0000		32.4174
Selenium, total	ug/L	MW-7	04/18/2024	ND	4.0000		4.0000
Vanadium, total	ug/L	MW-7	04/18/2024	ND	20.0000		20.0000
Zinc, total	ug/L	MW-7	04/18/2024	ND	20.0000		67.9000

* - Current value failed - awaiting verification.
** - Current value passed - previous exceedance not verified.
*** - Current value failed - exceedance verified.
**** - Current value passed - awaiting one more verification.
***** - Insufficient background data to compute prediction limit.
ND = Not Detected, Result = detection limit.

Table 3

Detection Frequencies in Upgradient and Downgradient Wells

Constituent	Upgradient Detect	Upgradient N	Upgradient Proportion	Downgradient Detect	Downgradient N	Downgradient Proportion
Antimony, total	0	6	0.000	0	5	0.000
Arsenic, total	16	36	0.444	2	24	0.083
Barium, total	36	36	1.000	24	24	1.000
Cadmium, total	2	36	0.056	2	24	0.083
Chromium, total	18	33	0.545	0	22	0.000
Cobalt, total	6	9	0.667	4	7	0.571
Copper, total	16	35	0.457	0	24	0.000
Lead, total	5	32	0.156	0	22	0.000
Nickel, total	5	9	0.556	4	7	0.571
Selenium, total	0	9	0.000	0	7	0.000
Vanadium, total	0	6	0.000	0	5	0.000
Zinc, total	13	36	0.361	5	24	0.208

N = Total number of measurements in all wells.
Detect = Total number of detections in all wells.
Proportion = Detect/N.

Table 4

Shapiro-Wilk Multiple Group Test of Normality

Constituent	Detect	N	Detect Freq	G raw	G log	G cbrt	G sqrt	G sqr	G cub	Crit Value	Dist Form	Model Type
Antimony, total	0	6	0.000									nonpar
Arsenic, total	16	36	0.444	4.650	5.309					2.326	non-norm	nonpar
Barium, total	36	36	1.000	3.497	1.099					2.326	lognor	lognor
Cadmium, total	2	36	0.056	16.893	16.893					2.326	non-norm	nonpar
Chromium, total	18	33	0.545	5.476	5.636					2.326	non-norm	nonpar
Cobalt, total	6	9	0.667	1.178	0.387					2.326	normal	normal
Copper, total	16	35	0.457	5.718	4.674					2.326	non-norm	nonpar
Lead, total	5	32	0.156	6.746	6.507					2.326	non-norm	nonpar
Nickel, total	5	9	0.556	2.289	2.540					2.326	normal	normal
Selenium, total	0	9	0.000	0.857	0.857					2.326	normal	nonpar
Vanadium, total	0	6	0.000									nonpar
Zinc, total	13	36	0.361	7.472	6.545					2.326	non-norm	nonpar

* - Distribution override for that constituent.
Fit to distribution is confirmed if G <= critical value.
Model type may not match distributional form when detection frequency < 50%.

Table 5

Summary Statistics and Prediction Limits

Constituent	Units	Detect	N	Mean	SD	alpha	Factor	Pred Limit	Type		Conf
Antimony, total	ug/L	0	6					2.0000	nonpar	***	0.93
Arsenic, total	ug/L	16	36					57.3000	nonpar		0.99
Barium, total	ug/L	36	36	5.6519	0.4715	0.0100	2.4712	913.2290	lognor		
Cadmium, total	ug/L	2	36					2.2000	nonpar		0.99
Chromium, total	ug/L	18	33					19.5000	nonpar		0.99
Cobalt, total	ug/L	6	9	1.4556	2.1801	0.0100	3.0525	8.1103	normal		
Copper, total	ug/L	16	35					26.5000	nonpar		0.99
Lead, total	ug/L	5	32					7.6000	nonpar		0.99
Nickel, total	ug/L	5	9	7.1889	8.2649	0.0100	3.0525	32.4174	normal		
Selenium, total	ug/L	0	9					4.0000	nonpar	***	0.97
Vanadium, total	ug/L	0	6					20.0000	nonpar	***	0.93
Zinc, total	ug/L	13	36					67.9000	nonpar		0.99

Conf = confidence level for passing initial test or one verification resample at all downgradient wells for a single constituent (nonparametric test only).
* - Insufficient Data.
** - Calculated limit raised to Manual Reporting Limit.
*** - Nonparametric limit based on ND value.
For transformed data, mean and SD in transformed units and prediction limit in original units.
All sample sizes and statistics are based on outlier free data.
For nonparametric limits, median reporting limits are substituted for extreme reporting limit values.

Table 6

Dixon's Test Outliers
1% Significance Level

Constituent	Units	Well	Date	Result	ND Qualifier	Date Range	N	Critical Value
Copper, total	ug/L	MW-3R	04/15/2019	15.4000		10/04/2018-04/18/2024	12	0.6425
Lead, total	ug/L	MW-5	04/08/2020	15.5000		04/15/2019-04/18/2024	11	0.6736

N = Total number of independent measurements in background at each well.
Date Range = Dates of the first and last measurements included in background at each well.
Critical Value depends on the significance level and on N-1 when the two most extreme values are tested or N for the most extreme value.

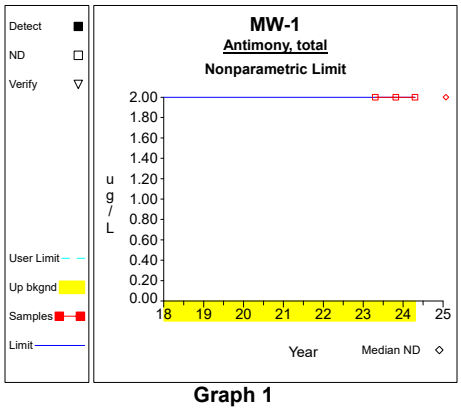
Table 8

Historical Downgradient Data for Constituent-Well Combinations that Failed the Current Statistical Evaluation or are in Verification Resampling Mode

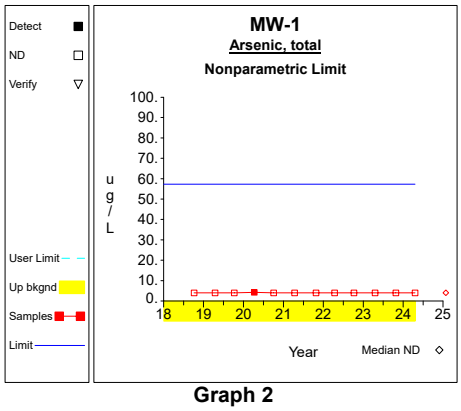
Constituent	Units	Well	Date	Result		Pred. Limit
Barium, total	ug/L	MW-1	10/04/2018	1000.0000	*	913.2290
Barium, total	ug/L	MW-1	04/15/2019	1060.0000	*	913.2290
Barium, total	ug/L	MW-1	10/08/2019	1020.0000	*	913.2290
Barium, total	ug/L	MW-1	04/08/2020	995.0000	*	913.2290
Barium, total	ug/L	MW-1	10/02/2020	1000.0000	*	913.2290
Barium, total	ug/L	MW-1	04/12/2021	1060.0000	*	913.2290
Barium, total	ug/L	MW-1	10/26/2021	960.0000	*	913.2290
Barium, total	ug/L	MW-1	04/12/2022	1030.0000	*	913.2290
Barium, total	ug/L	MW-1	10/07/2022	1000.0000	*	913.2290
Barium, total	ug/L	MW-1	04/19/2023	1020.0000	*	913.2290
Barium, total	ug/L	MW-1	10/25/2023	1090.0000	*	913.2290
Barium, total	ug/L	MW-1	04/18/2024	1100.0000	*	913.2290

* - Significantly increased over background.
** - Detect at limit for 100% NDs in background (NPPL only).
*** - Manual exclusion.
ND = Not Detected, Result = detection limit.

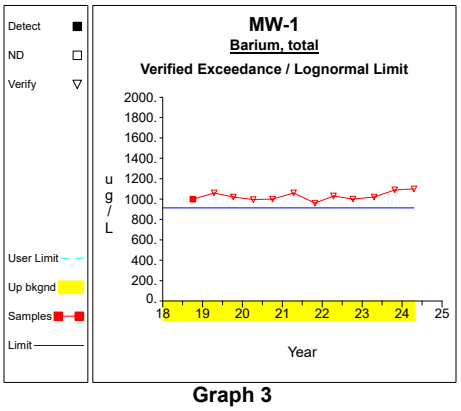
Up vs. Down Prediction Limits



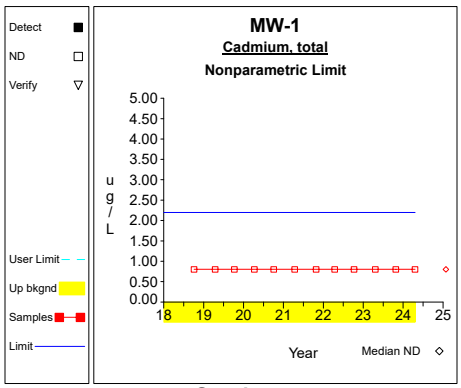
Graph 1



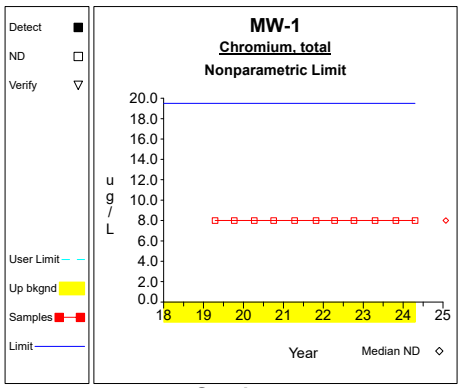
Graph 2



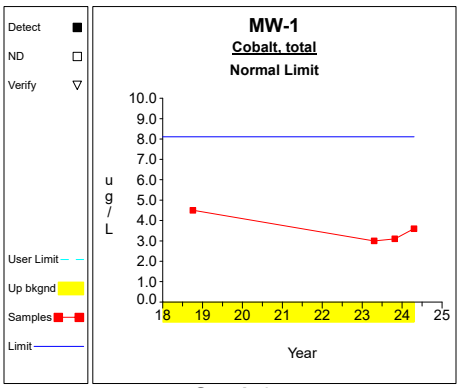
Graph 3



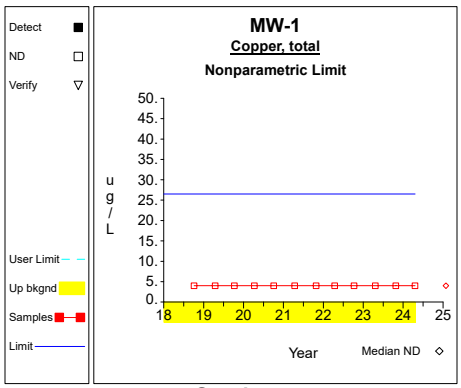
Graph 4



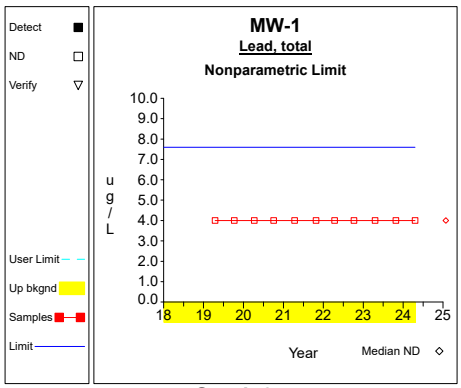
Graph 5



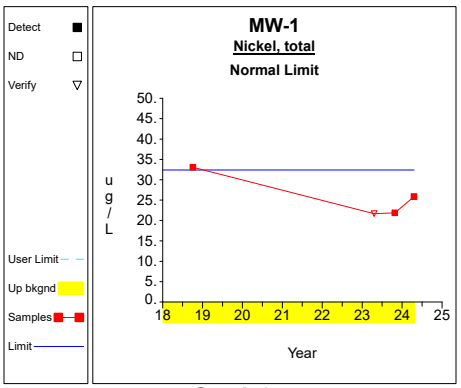
Graph 6



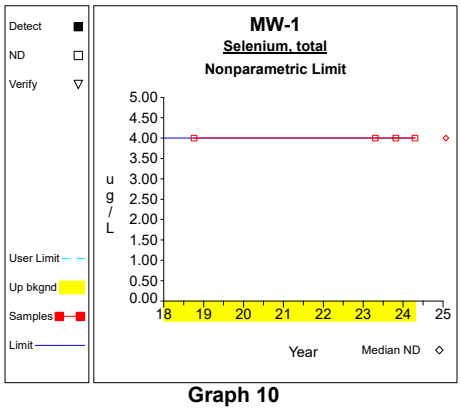
Graph 7



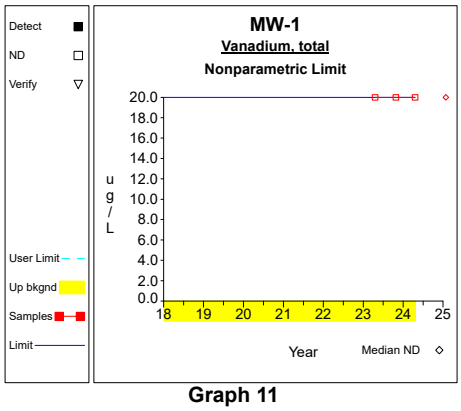
Graph 8



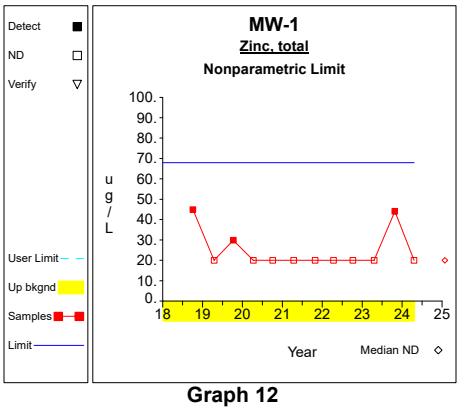
Graph 9



Graph 10



Graph 11



Graph 12

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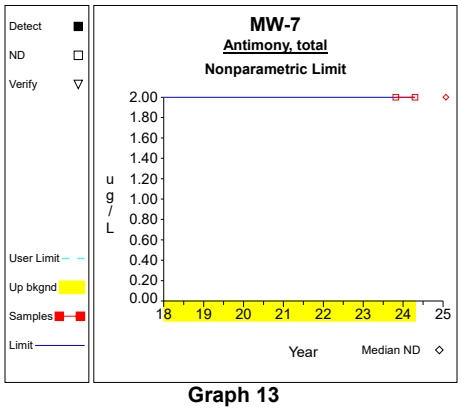
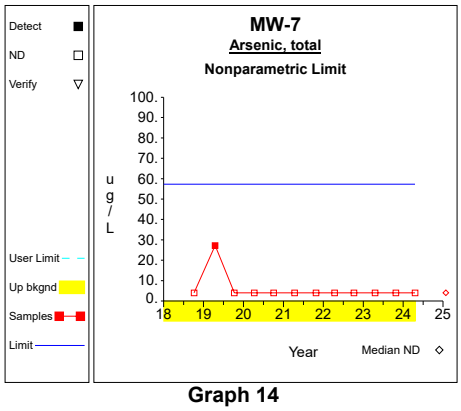
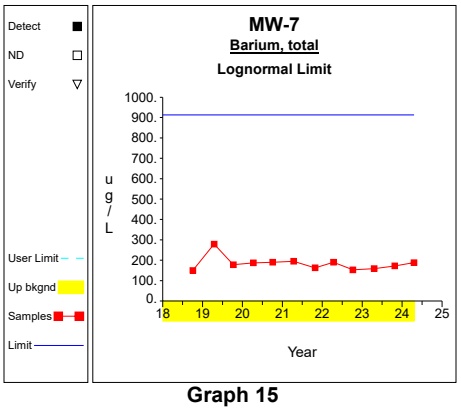
Up vs. Down Prediction Limits



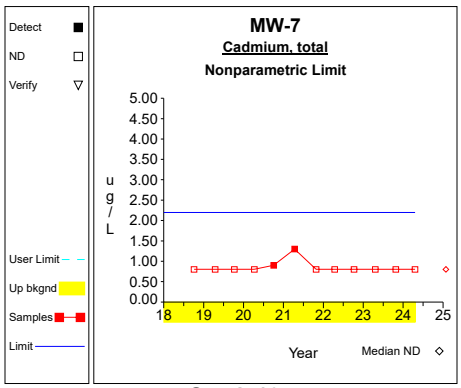
Graph 13



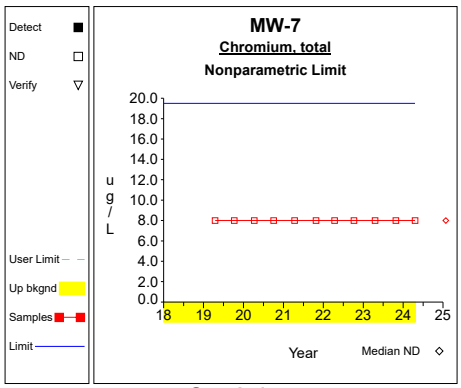
Graph 14



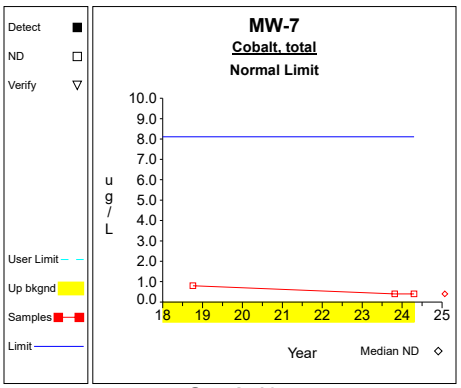
Graph 15



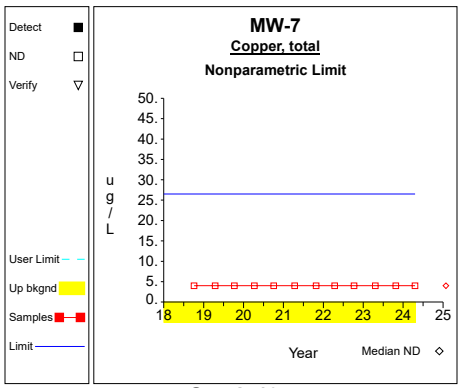
Graph 16



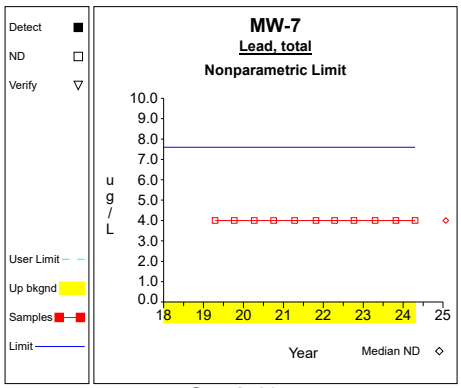
Graph 17



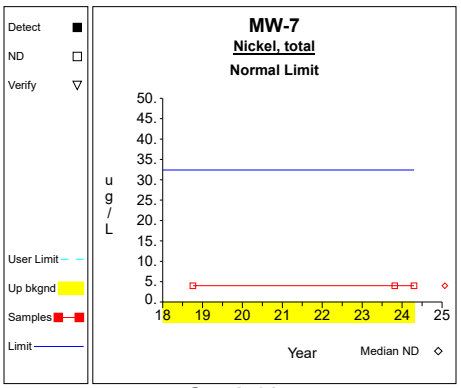
Graph 18



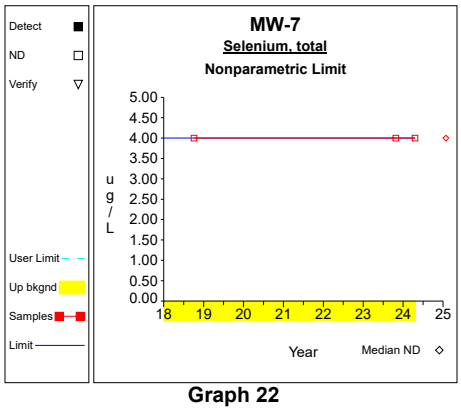
Graph 19



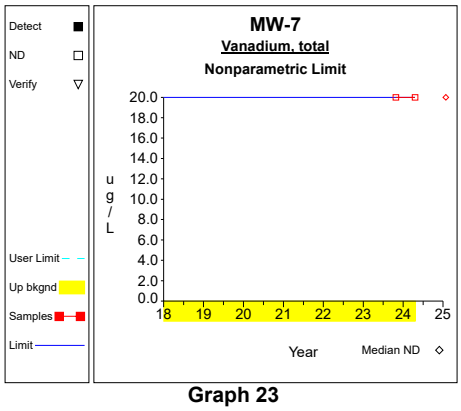
Graph 20



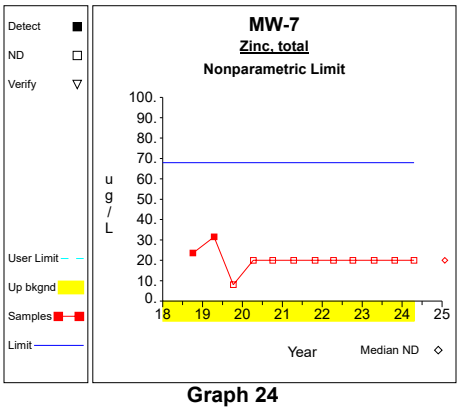
Graph 21



Graph 22



Graph 23

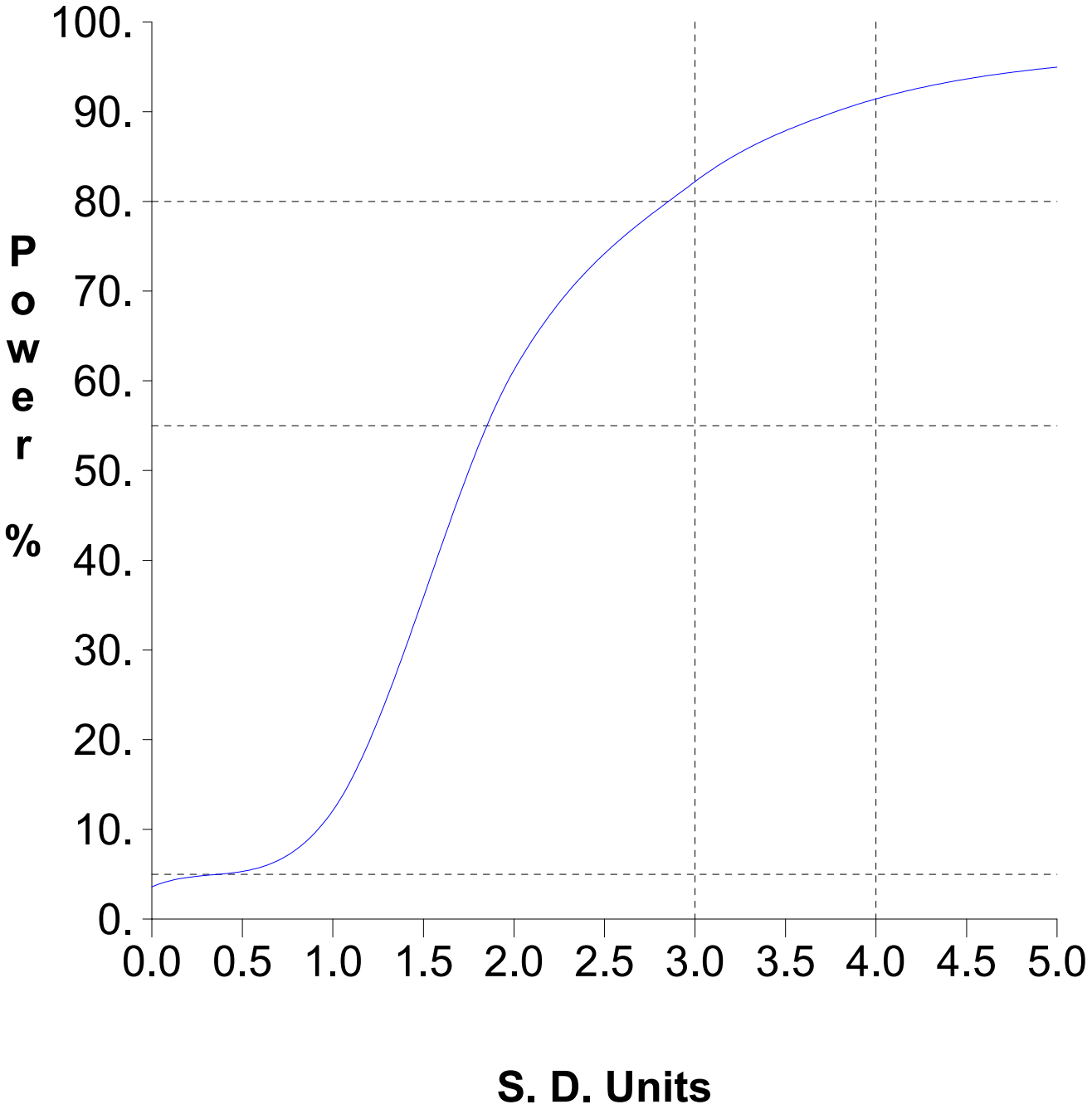


Graph 24

Prepared by: Otter Creek Environmental

False Positive and False Negative Rates for Current

Upgradient vs. Downgradient Monitoring Program



Worksheet 1 - Upgradient vs. Downgradient Comparisons
Antimony, total (ug/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = median(X) = **2.0**	Compute nonparametric prediction limit as median reporting limit in background.
2	Conf = **0.933**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Arsenic, total (ug/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **57.3**	Compute nonparametric prediction limit as largest background measurement.
2	Conf = **0.99**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Barium, total (ug/L)
Lognormal Prediction Limit

Step	Equation	Description
1	$Y = \log_e(X)$	Transform to natural logarithmic scale.
2	$\overline{Y}$ = **sum[Y]** / **N** = **203.469** / **36** = **5.652**	Compute mean on a natural log scale.
3	$S_Y = ((\textbf{sum[Y}^{\textbf{2}}\textbf{]} - \textbf{sum[Y]}^2/\textbf{N}) / (\textbf{N}-1))^{1/2}$ $= ((\textbf{1157.765} - \textbf{41399.45}/\textbf{36}) / (\textbf{36}-1))^{1/2}$ = **0.471**	Compute sd on a natural log scale.
4	alpha = min[$(1-.95^{1/\textbf{K}})^{1/2}$, .01] = min[$(1-.95^{1/\textbf{24}})^{1/2}$, .01] = **0.01**	Adjusted per comparison false positive rate. Pass initial or 1 resample.
5	PL = $\exp[\overline{\textbf{Y}} + \textbf{tS}_{\textbf{Y}}(1+1/\textbf{N})^{1/2}]$ = exp[**5.652** + (**2.438*****0.471**)(1+1/**36**)$^{1/2}$] = **913.229**	One-sided lognormal prediction limit (t is Student's t on N-1 degrees of freedom and 1-alpha confidence level).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Cadmium, total (ug/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **2.2**	Compute nonparametric prediction limit as largest background measurement.
2	Conf = **0.99**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Chromium, total (ug/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **19.5**	Compute nonparametric prediction limit as largest background measurement.
2	Conf = **0.99**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Cobalt, total (ug/L)
Normal Prediction Limit

Step	Equation	Description
1	$\overline{X}_1 = \mathbf{sum[X_1]} / \mathbf{N_1}$ $= \mathbf{13.1} / \mathbf{6}$ $= \mathbf{2.183}$	Compute mean of N_1 detected measurements.
2	$S_1 = ((\mathbf{sum[X_1^2]} - \mathbf{sum[X_1]}^2/\mathbf{N_1}) / (\mathbf{N_1}-1))^{½}$ $= ((\mathbf{55.31} - \mathbf{171.61}/\mathbf{6}) / (\mathbf{6}-1))^{½}$ $= \mathbf{2.311}$	Compute sd of N_1 detected measurements.
3	$\overline{X} = (1 - \mathbf{N_0}/\mathbf{N}) \overline{\mathbf{X}}_\mathbf{1}$ $= (1 - \mathbf{3}/\mathbf{9}) \mathbf{2.183}$ $= \mathbf{1.456}$	Use Aitchison's method to adjust mean for presence of nondetects.
4	$S = [(1 - \mathbf{N_0}/\mathbf{N}) * \mathbf{S_1}^2 + (\mathbf{N_0}/\mathbf{N}) (1 - (\mathbf{N_0}-1)/(\mathbf{N}-1)) \overline{\mathbf{X}}_\mathbf{1}^2]^{½}$ $= [(1 - \mathbf{3}/\mathbf{9}) * \mathbf{2.311}^2 + (\mathbf{3}/\mathbf{9}) (1 - (\mathbf{3}-1)/(\mathbf{9}-1)) \mathbf{2.183}^2]^{½}$ $= \mathbf{2.18}$	Use Aitchison's method to adjust sd for presence of nondetects.
5	$\text{alpha} = \min[(1-.95^{1/\mathbf{K}})^{½}, .01]$ $= \min[(1-.95^{1/\mathbf{24}})^{½}, .01]$ $= \mathbf{0.01}$	Adjusted per comparison false positive rate. Pass initial or 1 resample.
6	$PL = \overline{\mathbf{X}} + \mathbf{tS}(1+1/\mathbf{N})^{½}$ $= \mathbf{1.456} + (\mathbf{2.896}*\mathbf{2.18})(1+1/\mathbf{9})^{½}$ $= \mathbf{8.11}$	One-sided normal prediction limit (t is Student's t on N-1 degrees of freedom and 1-alpha confidence level).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Copper, total (ug/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **26.5**	Compute nonparametric prediction limit as largest background measurement.
2	Conf = **0.99**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Lead, total (ug/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **7.6**	Compute nonparametric prediction limit as largest background measurement.
2	Conf = **0.99**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Nickel, total (ug/L)
Normal Prediction Limit

Step	Equation	Description
1	$\overline{X}_1 = \mathbf{sum[X_1]} / \mathbf{N_1}$ $= \mathbf{64.7} / \mathbf{5}$ $= \mathbf{12.94}$	Compute mean of N_1 detected measurements.
2	$S_1 = ((\mathbf{sum[X_1^2]} - \mathbf{sum[X_1]}^2/\mathbf{N_1}) / (\mathbf{N_1}-1))^{½}$ $= ((\mathbf{994.15} - \mathbf{4186.09}/\mathbf{5}) / (\mathbf{5}-1))^{½}$ $= \mathbf{6.264}$	Compute sd of N_1 detected measurements.
3	$\overline{X} = (1 - \mathbf{N_0}/\mathbf{N}) \overline{\mathbf{X}}_1$ $= (1 - \mathbf{4}/\mathbf{9}) \mathbf{12.94}$ $= \mathbf{7.189}$	Use Aitchison's method to adjust mean for presence of nondetects.
4	$S = [(1 - \mathbf{N_0}/\mathbf{N}) * \mathbf{S_1}^2 + (\mathbf{N_0}/\mathbf{N}) (1 - (\mathbf{N_0}-1)/(\mathbf{N}-1)) \overline{\mathbf{X}}_1^2]^{½}$ $= [(1 - \mathbf{4}/\mathbf{9}) * \mathbf{6.264}^2 + (\mathbf{4}/\mathbf{9}) (1 - (\mathbf{4}-1)/(\mathbf{9}-1)) \mathbf{12.94}^2]^{½}$ $= \mathbf{8.265}$	Use Aitchison's method to adjust sd for presence of nondetects.
5	$\text{alpha} = \min[(1-.95^{1/\mathbf{K}})^{½}, .01]$ $= \min[(1-.95^{1/\mathbf{24}})^{½}, .01]$ $= \mathbf{0.01}$	Adjusted per comparison false positive rate. Pass initial or 1 resample.
6	$PL = \overline{\mathbf{X}} + \mathbf{tS}(1+1/\mathbf{N})^{½}$ $= \mathbf{7.189} + (\mathbf{2.896}*\mathbf{8.265})(1+1/\mathbf{9})^{½}$ $= \mathbf{32.417}$	One-sided normal prediction limit (t is Student's t on N-1 degrees of freedom and 1-alpha confidence level).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Selenium, total (ug/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = median(X) = **4.0**	Compute nonparametric prediction limit as median reporting limit in background.
2	Conf = **0.965**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Vanadium, total (ug/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = median(X) = **20.0**	Compute nonparametric prediction limit as median reporting limit in background.
2	Conf = **0.933**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Zinc, total (ug/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **67.9**	Compute nonparametric prediction limit as largest background measurement.
2	Conf = **0.99**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Attachment C

Assessment Statistics

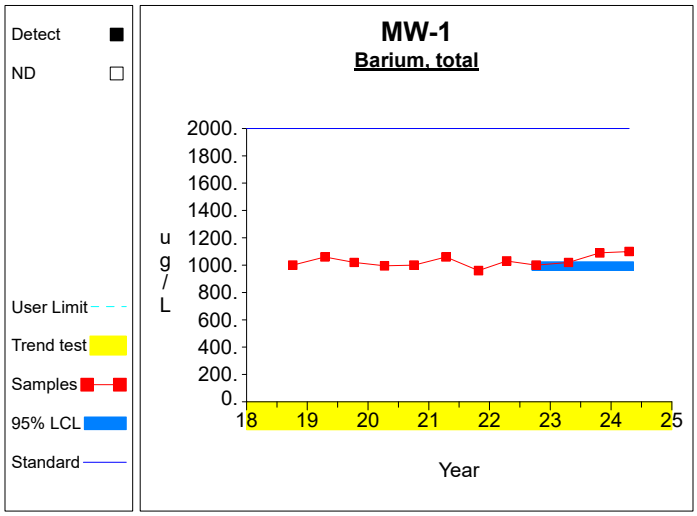
Table 1

Confidence Intervals for Comparing the Mean of the Last 4 Measurements to an Assessment Monitoring Standard

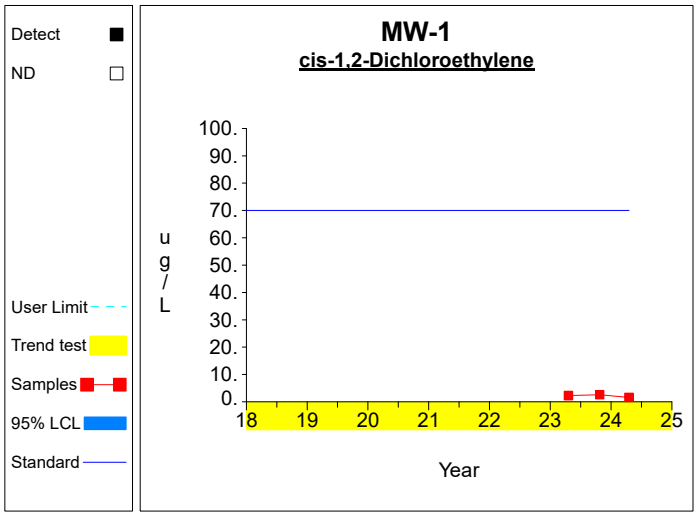
Constituent	Units	Well	N	Mean	SD	Factor	95% LCL	95% UCL	Standard	Trend	
Barium, total	ug/L	MW-1	4	1052.500	49.917	1.176	993.784	1111.216	2000.000		
cis-1,2-Dichloroethylene	ug/L	MW-1	3								*
Nickel, total	ug/L	MW-1	4	25.650	5.330	1.176	19.380	31.920	100.000		

* - Insufficient Data
** - Significant Exceedance
LCL = Lower Confidence Limit
UCL = Upper Confidence Limit

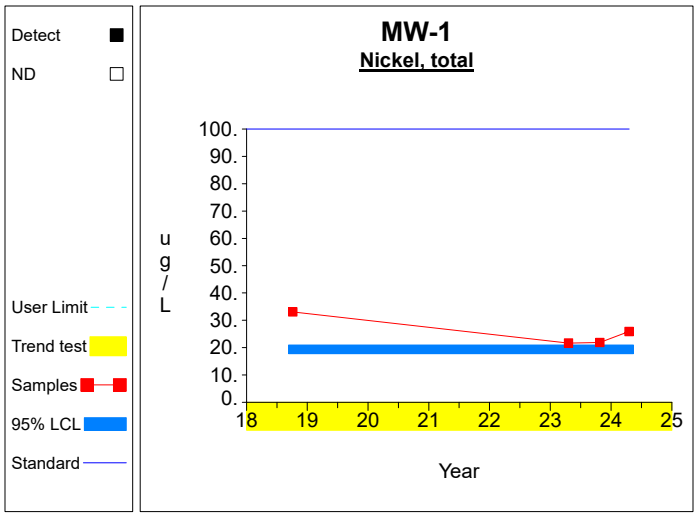
Confidence Limits (Assessment)



Graph 1



Graph 2



Graph 3

Prepared by: Otter Creek Environmental

Worksheet 6 - Assessment Monitoring
Barium, total (ug/L) at MW-1

Step	Equation	Description
1	$\overline{X}$ = **sum[X]** / **N** = **4210.0** / **4** = **1052.5**	Compute the mean of the last 4 measurements.
2	S = ((**sum[X^2]** - **sum[X]**^{2}/**N**) / (**N**-1))^{½} = ((**4.44**x**10^6** - **1.77**x**10^7**/**4**) / (**4**-1))^{½} = **49.917**	Compute sd of the last 4 measurements.
3	LCL = $\overline{\mathbf{X}}$ - **tS**/**N**^{½} = **1052.5** - **2.353** * **49.917**/**4**^{½} = **993.784**	Compute lower confidence limit for the mean of the last 4 measurements.
4	UCL = $\overline{\mathbf{X}}$ + **tS**/**N**^{½} = **1052.5** + **2.353** * **49.917**/**4**^{½} = **1111.216**	Compute upper confidence limit for the mean of the last 4 measurements.
5	N' = **N** * (**N**-1) / 2 = **12** * (**12**-1) / 2 = **66**	Number of sample pairs during trend detection period.
6	S = **8.389**	Sen's estimator of trend.
7	var(S) = **207.0**	Variance estimate for slope.
8	M(S) = (**N**' ± **Z**$_{.995}$ * **var(S)**^{½}) / 2 = (**66** ± **2.576** * **207.0**^{½}) / 2 = [**14.469**, **51.531**]	Ordinal positions for two-sided lower confidence limits for slope. The LCL and UCL are the Mth largest slope estimates for the values shown. When the values are not integers, interpolation is used.
9	CL(S) = [**-18.607**, **32.2**]	Two-sided confidence interval for slope.
10	the interval includes 0	There is no significant trend.

Worksheet 6 - Assessment Monitoring
cis-1,2-Dichloroethylene (ug/L) at MW-1

Insufficient data to perform analysis

Worksheet 6 - Assessment Monitoring
Nickel, total (ug/L) at MW-1

Step	Equation	Description
1	$\overline{X}$ = **sum[X]** / **N** = **102.6** / **4** = **25.65**	Compute the mean of the last 4 measurements.
2	S = ((**sum[X^2]** - **sum[X]**^{2}/**N**) / (**N**-1))^{½} = ((**2716.92** - **10526.76**/**4**) / (**4**-1))^{½} = **5.33**	Compute sd of the last 4 measurements.
3	LCL = $\overline{\mathbf{X}}$ - **tS**/**N**^{½} = **25.65** - **2.353** * **5.33**/**4**^{½} = **19.38**	Compute lower confidence limit for the mean of the last 4 measurements.
4	UCL = $\overline{\mathbf{X}}$ + **tS**/**N**^{½} = **25.65** + **2.353** * **5.33**/**4**^{½} = **31.92**	Compute upper confidence limit for the mean of the last 4 measurements.
5	N' = **N** * (**N**-1) / 2 = **4** * (**4**-1) / 2 = **6**	Number of sample pairs during trend detection period.
6	S = **-0.457**	Sen's estimator of trend.
7	var(S) = **8.667**	Variance estimate for slope.
8	M(S) = (**N'** ± **Z**$_{.995}$ * **var(S)**^{½}) / 2 = (**6** ± **2.576** * **8.667**^{½}) / 2 = [**-0.792**, **6.792**]	Ordinal positions for two-sided lower confidence limits for slope. The LCL and UCL are the Mth largest slope estimates for the values shown. When the values are not integers, interpolation is used.
9	CL(S) = [**-2.511**, **8.309**]	Two-sided confidence interval for slope.
10	the interval includes 0	There is no significant trend.

Results of the Ground Water Statistics

for Monona County Sanitary Landfill

Second Semi-Annual Monitoring Event in 2024

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INTRODUCTION

This report contains the results of the statistical analyses used to evaluate the ground water data obtained during the second semi-annual monitoring event in 2024 at Monona County Sanitary Landfill. The ground water at Monona County Sanitary Landfill is monitored by a network of wells including MW-1, MW-3R (upgradient), MW-4 (upgradient), MW-5 (upgradient), and MW-7. Monitoring wells MW-1, MW-3R, MW-5, and MW-7 were sampled on October 17, 2024 and analyzed for the parameters required by permit. The statistical plan is designed to detect a release from the facility at the earliest indication so that it is protective of human health and the environment. The interwell methodology is described and then applied to the Monona County Sanitary Landfill data. The statistical plan conforms with IAC 567, Chapter 113.10, USEPA Guidance document ("*Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Unified Guidance"*, March 2009), and the American Society for Testing and Materials (ASTM) standard D6312-98, *Developing Appropriate Statistical Approaches for Ground-Water Detection Monitoring Programs*.

Ground Water Monitoring Program

The groundwater monitoring network for Monona County Sanitary Landfill includes MW-1, MW-3R, MW-4, MW-5, and MW-7. Each of the groundwater monitoring wells is to be sampled at least semiannually and analyzed for the trace metals including antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, nickel, selenium, vanadium, and zinc. The ground water data obtained during the second semi-annual monitoring event in 2024 are summarized in Attachment A.

STATISTICAL METHODOLOGIES FOR DETECTION MONITORING

IAC 567, Chapter 113.10(4) provides several options for statistically evaluating the ground water data at those wells that monitor the open cells or contiguous MSWLF units. The preferred methods for comparing ground water data are using either prediction limits or using control charts. The site prediction limit method was applied to the Monona County Sanitary Landfill data using the DUMPStat® statistical program. DUMPStat® is a program for the statistical analysis of groundwater monitoring data using methods described in "Statistical Methods for Groundwater Monitoring" by Dr. Robert D. Gibbons. The DUMPStat program is completely consistent with all USEPA regulations and guidance and the ASTM D6312-98 guidance.

Interwell Statistics: Upgradient versus Downgradient Comparisons

Interwell statistics are appropriate when the upgradient and downgradient wells monitor the same ground water formation and there is similar variability in the upgradient and downgradient zones. Site prediction limits are determined by pooling the historical ground water data from hydraulically upgradient wells. This statistical method compares the current downgradient determinations to site prediction limits and checks for exceedances. The type of prediction limit utilized (e.g., parametric or nonparametric) is based on the detection frequency and the data distribution of each parameter in the background data. The distribution of the background data is tested for normality using the Shapiro-Wilk test (Gibbons, 1994 and USEPA 1992). If the constituent is normally distributed, a normal prediction limit is used. If normality is rejected by the Shapiro-Wilk test, the background data is transformed by taking the natural logarithm. The Shapiro-Wilk

test is then reapplied on the transformed data. If it is not rejected, lognormal prediction limits are used. If after transforming the data, normality is still rejected, nonparametric prediction limits are used for that analyte. The nonparametric prediction limit is the largest determination in the background measurements. For constituents where the background detection frequency is greater than 0% but less than 50%, nonparametric prediction limits will be used. If the detection frequency is 0% after thirteen samples have been collected, the practical quantitation limit (PQL) becomes the nonparametric prediction limit.

Results of the Interwell Statistics – Trace Metals

The background data used in this statistical analysis includes the ground water data collected from ground water wells MW-3R, MW-4, and MW-5 during the period from October 2018 through the current data. A summary of the background data from monitoring wells MW-3R, MW-4, and MW-5 is listed in Attachment B, Table 1 "Upgradient Data". This statistical method compares the current downgradient determinations to site prediction limits and checks for exceedances.

Table 2 "Most Current Downgradient Monitoring Data", summarizes the current data from downgradient wells MW-1 and MW-7, compared to the site prediction limits. Prediction limit exceedances are flagged with asterisks. For the most current data, there are no site prediction limit exceedances detected.

The detection frequencies of the parameters in the up and down gradient monitoring wells are summarized in Table 3. Barium, chromium, cobalt, and nickel were detected at a frequency greater than or equal to 50% in the upgradient well so these metals were tested for normality. The remainder of the metals are rarely detected (less than 50%) in the upgradient wells so nonparametric prediction limits were be used in those cases.

Table 4 summarizes the results of the Shapiro-Wilk test. Table 5 is a summary of the statistics and prediction limits determined for the metals. Table 8 is a historical summary of the data at those wells that have indicated an exceedance. Time series graphs of each of the parameters at each well with the corresponding prediction limits are attached.

A statistical power curve indicates the expected false assessments for the site as a whole. The false positive rate for interwell analyses is the percentage of failures when the upgradient versus downgradient true mean difference equals zero. False negative rate indicates the chance of missing contamination at a single well for a single constituent. The statistical power is a function of the number of wells included, the number of constituents compared, the detection frequencies, and the data distributions involved. For interwell analysis, the site-wide false positive rate is 3% and the test becomes sensitive to 4 standard deviation unit increases over background.

Volatile Organic Compounds

Volatile Organic Compounds (VOCs) are generally man-made compounds not present in ambient ground water. If VOCs are detected above their statistical limit (i.e., the laboratory PQL or reporting limit), a verification resample will be conducted at the next scheduled sampling event. A statistical exceedance will be indicated if the VOC detection is confirmed by the subsequent monitoring.

Ground water well MW-1 was monitored for *cis*-1,2-dichloroethene during the second semi-annual monitoring event in 2024, because it was previously detected in 2023. There is a current detection of *cis*-

1,2-Dichloroethene (1.2 µg/L) above the site-specific reporting limit at MW-1. The *cis*-1,2-dichloroethene detection is statistically since it confirms the April 2024 monitoring.

Exceedances

The current and previous verified exceedances were evaluated against the ground water protection standards (GWPS) using confidence limits calculated in accordance with the Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, USEPA, March 2009 (Attachment C). The analysis was conducted to evaluate whether verified concentrations are significantly above the water quality standard. The 95% lower confidence limit (LCL) for the mean of the historical data was used to evaluate whether the regulated unit is in compliance with the ground-water protection standards under 40 CFR 264 (e.g. whether the verified constituent is detected at a significant level above the GWPS). An exceedance is verified if the LCL is above the Regulatory GWPS.

The calculated 95% LCLs do not exceed the GWPS.

Attachment A

Ground Water Data obtained during the Second Semi-Annual Monitoring Event in 2024

Table 1

Analytical Data Summary for 10/17/2024

Constituents	Units	MW-1	MW-3R	MW-5	MW-7
Antimony, total	ug/L	<2	<2	<2	<2
Arsenic, total	ug/L	<4	<4	<4	<4
Barium, total	ug/L	895	319	150	170
Cadmium, total	ug/L	<.8	<.8	<.8	<.8
Chloride	mg/L	239			
Chromium, total	ug/L	<8.0	12.5	<8.0	<8.0
cis-1,2-Dichloroethylene	ug/L	1.2			
Cobalt, total	ug/L	3.6	<.4	.5	<.4
Copper, total	ug/L	<4.0	<4.0	<4.0	9.8
Lead, total	ug/L	<4	<4	<4	<4
Nickel, total	ug/L	21.9	<4.0	4.0	7.0
Selenium, total	ug/L	<4	<4	<4	<4
Vanadium, total	ug/L	<20	<20	<20	<20
Zinc, total	ug/L	<20	<20	<20	<20

* - The displayed value is the arithmetic mean of multiple database matches.

Attachment B

Summary Tables and Graphs for the Interwell Comparisons

Table 1

Upgradient Data

Constituent	Units	Well	Date		Result	Adjusted	
Antimony, total	ug/L	MW-3R	10/25/2023	ND	2.0000		
Antimony, total	ug/L	MW-3R	04/18/2024	ND	2.0000		
Antimony, total	ug/L	MW-3R	10/17/2024	ND	2.0000		
Antimony, total	ug/L	MW-4	10/25/2023	ND	2.0000		
Antimony, total	ug/L	MW-4	04/18/2024	ND	2.0000		
Antimony, total	ug/L	MW-5	10/25/2023	ND	2.0000		
Antimony, total	ug/L	MW-5	04/18/2024	ND	2.0000		
Antimony, total	ug/L	MW-5	10/17/2024	ND	2.0000		
Arsenic, total	ug/L	MW-3R	10/04/2018	ND	4.0000		
Arsenic, total	ug/L	MW-3R	04/15/2019	ND	4.0000		
Arsenic, total	ug/L	MW-3R	10/08/2019	ND	4.0000		
Arsenic, total	ug/L	MW-3R	04/08/2020	ND	4.0000		
Arsenic, total	ug/L	MW-3R	10/02/2020	ND	4.0000		
Arsenic, total	ug/L	MW-3R	04/12/2021	ND	4.0000		
Arsenic, total	ug/L	MW-3R	10/26/2021	ND	4.0000		
Arsenic, total	ug/L	MW-3R	04/12/2022	ND	4.0000		
Arsenic, total	ug/L	MW-3R	10/07/2022	ND	4.0000		
Arsenic, total	ug/L	MW-3R	04/19/2023	ND	4.0000		
Arsenic, total	ug/L	MW-3R	10/25/2023	ND	4.0000		
Arsenic, total	ug/L	MW-3R	04/18/2024	ND	4.0000		
Arsenic, total	ug/L	MW-3R	10/17/2024	ND	4.0000		
Arsenic, total	ug/L	MW-4	10/04/2018		57.3000		
Arsenic, total	ug/L	MW-4	04/15/2019	ND	4.0000		
Arsenic, total	ug/L	MW-4	10/08/2019		49.0000		
Arsenic, total	ug/L	MW-4	04/08/2020		16.7000		
Arsenic, total	ug/L	MW-4	10/02/2020		36.3000		
Arsenic, total	ug/L	MW-4	04/12/2021		31.2000		
Arsenic, total	ug/L	MW-4	10/26/2021		20.8000		
Arsenic, total	ug/L	MW-4	04/12/2022		20.4000		
Arsenic, total	ug/L	MW-4	10/07/2022		19.8000		
Arsenic, total	ug/L	MW-4	04/19/2023		23.9000		
Arsenic, total	ug/L	MW-4	10/25/2023		21.4000		
Arsenic, total	ug/L	MW-4	04/18/2024		26.9000		
Arsenic, total	ug/L	MW-5	10/04/2018		6.4000		
Arsenic, total	ug/L	MW-5	04/15/2019	ND	4.0000		
Arsenic, total	ug/L	MW-5	10/08/2019	ND	4.0000		
Arsenic, total	ug/L	MW-5	04/08/2020		6.0000		
Arsenic, total	ug/L	MW-5	10/02/2020	ND	4.0000		
Arsenic, total	ug/L	MW-5	04/12/2021		4.0000		
Arsenic, total	ug/L	MW-5	10/26/2021		5.6000		
Arsenic, total	ug/L	MW-5	04/12/2022	ND	4.0000		
Arsenic, total	ug/L	MW-5	10/07/2022	ND	4.0000		
Arsenic, total	ug/L	MW-5	04/19/2023	ND	4.0000		
Arsenic, total	ug/L	MW-5	10/25/2023		4.6000		
Arsenic, total	ug/L	MW-5	04/18/2024	ND	4.0000		
Arsenic, total	ug/L	MW-5	10/17/2024	ND	4.0000		
Barium, total	ug/L	MW-3R	10/04/2018		325.0000		
Barium, total	ug/L	MW-3R	04/15/2019		175.0000		
Barium, total	ug/L	MW-3R	10/08/2019		352.0000		
Barium, total	ug/L	MW-3R	04/08/2020		350.0000		
Barium, total	ug/L	MW-3R	10/02/2020		328.0000		
Barium, total	ug/L	MW-3R	04/12/2021		324.0000		
Barium, total	ug/L	MW-3R	10/26/2021		302.0000		
Barium, total	ug/L	MW-3R	04/12/2022		332.0000		
Barium, total	ug/L	MW-3R	10/07/2022		307.0000		
Barium, total	ug/L	MW-3R	04/19/2023		324.0000		
Barium, total	ug/L	MW-3R	10/25/2023		306.0000		
Barium, total	ug/L	MW-3R	04/18/2024		336.0000		
Barium, total	ug/L	MW-3R	10/17/2024		319.0000		
Barium, total	ug/L	MW-4	10/04/2018		228.0000		
Barium, total	ug/L	MW-4	04/15/2019		154.0000		
Barium, total	ug/L	MW-4	10/08/2019		218.0000		
Barium, total	ug/L	MW-4	04/08/2020		295.0000		
Barium, total	ug/L	MW-4	10/02/2020		922.0000		
Barium, total	ug/L	MW-4	04/12/2021		744.0000		
Barium, total	ug/L	MW-4	10/26/2021		251.0000		
Barium, total	ug/L	MW-4	04/12/2022		442.0000		
Barium, total	ug/L	MW-4	10/07/2022		395.0000		
Barium, total	ug/L	MW-4	04/19/2023		445.0000		
Barium, total	ug/L	MW-4	10/25/2023		347.0000		
Barium, total	ug/L	MW-4	04/18/2024		490.0000		
Barium, total	ug/L	MW-5	10/04/2018		317.0000		
Barium, total	ug/L	MW-5	04/15/2019		80.7000		
Barium, total	ug/L	MW-5	10/08/2019		166.0000		

* - Outlier for that well and constituent.
** - ND value replaced with median RL.
*** - ND value replaced with manual RL.
ND = Not detected, Result = detection limit.

Table 1

Upgradient Data

Constituent	Units	Well	Date		Result	Adjusted	
Barium, total	ug/L	MW-5	04/08/2020		484.0000		
Barium, total	ug/L	MW-5	10/02/2020		177.0000		
Barium, total	ug/L	MW-5	04/12/2021		254.0000		
Barium, total	ug/L	MW-5	10/26/2021		341.0000		
Barium, total	ug/L	MW-5	04/12/2022		195.0000		
Barium, total	ug/L	MW-5	10/07/2022		155.0000		
Barium, total	ug/L	MW-5	04/19/2023		146.0000		
Barium, total	ug/L	MW-5	10/25/2023		243.0000		
Barium, total	ug/L	MW-5	04/18/2024		175.0000		
Barium, total	ug/L	MW-5	10/17/2024		150.0000		
Cadmium, total	ug/L	MW-3R	10/04/2018	ND	0.8000		
Cadmium, total	ug/L	MW-3R	04/15/2019	ND	0.8000		
Cadmium, total	ug/L	MW-3R	10/08/2019	ND	0.8000		
Cadmium, total	ug/L	MW-3R	04/08/2020	ND	0.8000		
Cadmium, total	ug/L	MW-3R	10/02/2020	ND	0.8000		
Cadmium, total	ug/L	MW-3R	04/12/2021	ND	0.8000		
Cadmium, total	ug/L	MW-3R	10/26/2021	ND	0.8000		
Cadmium, total	ug/L	MW-3R	04/12/2022	ND	0.8000		
Cadmium, total	ug/L	MW-3R	10/07/2022	ND	0.8000		
Cadmium, total	ug/L	MW-3R	04/19/2023	ND	0.8000		
Cadmium, total	ug/L	MW-3R	10/25/2023	ND	0.8000		
Cadmium, total	ug/L	MW-3R	04/18/2024	ND	0.8000		
Cadmium, total	ug/L	MW-3R	10/17/2024	ND	0.8000		
Cadmium, total	ug/L	MW-4	10/04/2018	ND	0.8000		
Cadmium, total	ug/L	MW-4	04/15/2019	ND	0.8000		
Cadmium, total	ug/L	MW-4	10/08/2019	ND	0.8000		
Cadmium, total	ug/L	MW-4	04/08/2020	ND	0.8000		
Cadmium, total	ug/L	MW-4	10/02/2020	ND	0.8000		
Cadmium, total	ug/L	MW-4	04/12/2021	ND	0.8000		
Cadmium, total	ug/L	MW-4	10/26/2021	ND	0.8000		
Cadmium, total	ug/L	MW-4	04/12/2022	ND	0.8000		
Cadmium, total	ug/L	MW-4	10/07/2022	ND	0.8000		
Cadmium, total	ug/L	MW-4	04/19/2023	ND	0.8000		
Cadmium, total	ug/L	MW-4	10/25/2023	ND	0.8000		
Cadmium, total	ug/L	MW-4	04/18/2024	ND	0.8000		
Cadmium, total	ug/L	MW-5	10/04/2018	ND	0.8000		
Cadmium, total	ug/L	MW-5	04/15/2019	ND	0.8000		
Cadmium, total	ug/L	MW-5	10/08/2019	ND	0.8000		
Cadmium, total	ug/L	MW-5	04/08/2020		0.8000		
Cadmium, total	ug/L	MW-5	10/02/2020	ND	0.8000		
Cadmium, total	ug/L	MW-5	04/12/2021	ND	0.8000		
Cadmium, total	ug/L	MW-5	10/26/2021		2.2000		
Cadmium, total	ug/L	MW-5	04/12/2022	ND	0.8000		
Cadmium, total	ug/L	MW-5	10/07/2022	ND	0.8000		
Cadmium, total	ug/L	MW-5	04/19/2023	ND	0.8000		
Cadmium, total	ug/L	MW-5	10/25/2023	ND	0.8000		
Cadmium, total	ug/L	MW-5	04/18/2024	ND	0.8000		
Cadmium, total	ug/L	MW-5	10/17/2024	ND	0.8000		
Chromium, total	ug/L	MW-3R	04/15/2019	ND	8.0000		
Chromium, total	ug/L	MW-3R	10/08/2019		10.4000		
Chromium, total	ug/L	MW-3R	04/08/2020		11.2000		
Chromium, total	ug/L	MW-3R	10/02/2020		10.7000		
Chromium, total	ug/L	MW-3R	04/12/2021		11.1000		
Chromium, total	ug/L	MW-3R	10/26/2021		10.6000		
Chromium, total	ug/L	MW-3R	04/12/2022		11.6000		
Chromium, total	ug/L	MW-3R	10/07/2022		11.0000		
Chromium, total	ug/L	MW-3R	04/19/2023		11.5000		
Chromium, total	ug/L	MW-3R	10/25/2023		11.8000		
Chromium, total	ug/L	MW-3R	04/18/2024		11.8000		
Chromium, total	ug/L	MW-3R	10/17/2024		12.5000		
Chromium, total	ug/L	MW-4	04/15/2019	ND	8.0000		
Chromium, total	ug/L	MW-4	10/08/2019	ND	8.0000		
Chromium, total	ug/L	MW-4	04/08/2020	ND	8.0000		
Chromium, total	ug/L	MW-4	10/02/2020	ND	8.0000		
Chromium, total	ug/L	MW-4	04/12/2021		9.0000		
Chromium, total	ug/L	MW-4	10/26/2021	ND	8.0000		
Chromium, total	ug/L	MW-4	04/12/2022	ND	8.0000		
Chromium, total	ug/L	MW-4	10/07/2022	ND	8.0000		
Chromium, total	ug/L	MW-4	04/19/2023	ND	8.0000		
Chromium, total	ug/L	MW-4	10/25/2023		10.4000		
Chromium, total	ug/L	MW-4	04/18/2024		13.1000		
Chromium, total	ug/L	MW-5	04/15/2019	ND	8.0000		
Chromium, total	ug/L	MW-5	10/08/2019	ND	8.0000		
Chromium, total	ug/L	MW-5	04/08/2020		13.4000		

* - Outlier for that well and constituent.
** - ND value replaced with median RL.
*** - ND value replaced with manual RL.
ND = Not detected, Result = detection limit.

Table 1

Upgradient Data

Constituent	Units	Well	Date		Result	Adjusted	
Chromium, total	ug/L	MW-5	10/02/2020	ND	8.0000		
Chromium, total	ug/L	MW-5	04/12/2021		14.3000		
Chromium, total	ug/L	MW-5	10/26/2021		10.8000		
Chromium, total	ug/L	MW-5	04/12/2022		16.8000		
Chromium, total	ug/L	MW-5	10/07/2022	ND	8.0000		
Chromium, total	ug/L	MW-5	04/19/2023	ND	8.0000		
Chromium, total	ug/L	MW-5	10/25/2023		19.5000		
Chromium, total	ug/L	MW-5	04/18/2024	ND	8.0000		
Chromium, total	ug/L	MW-5	10/17/2024	ND	8.0000		
Cobalt, total	ug/L	MW-3R	10/04/2018	ND	0.8000	0.4000	**
Cobalt, total	ug/L	MW-3R	10/25/2023	ND	0.4000		
Cobalt, total	ug/L	MW-3R	04/18/2024	ND	0.4000		
Cobalt, total	ug/L	MW-3R	10/17/2024	ND	0.4000		
Cobalt, total	ug/L	MW-4	10/04/2018		1.4000		
Cobalt, total	ug/L	MW-4	10/25/2023		0.4000		
Cobalt, total	ug/L	MW-4	04/18/2024		1.0000		
Cobalt, total	ug/L	MW-5	10/04/2018		6.3000		
Cobalt, total	ug/L	MW-5	10/25/2023		3.5000		
Cobalt, total	ug/L	MW-5	04/18/2024		0.5000		
Cobalt, total	ug/L	MW-5	10/17/2024		0.5000		
Copper, total	ug/L	MW-3R	10/04/2018	ND	4.0000		
Copper, total	ug/L	MW-3R	04/15/2019		15.4000		
Copper, total	ug/L	MW-3R	10/08/2019	ND	4.0000		
Copper, total	ug/L	MW-3R	04/08/2020	ND	4.0000		
Copper, total	ug/L	MW-3R	10/02/2020	ND	4.0000		
Copper, total	ug/L	MW-3R	04/12/2021	ND	4.0000		
Copper, total	ug/L	MW-3R	10/26/2021	ND	4.0000		
Copper, total	ug/L	MW-3R	04/12/2022	ND	4.0000		
Copper, total	ug/L	MW-3R	10/07/2022	ND	4.0000		
Copper, total	ug/L	MW-3R	04/19/2023	ND	4.0000		
Copper, total	ug/L	MW-3R	10/25/2023	ND	4.0000		
Copper, total	ug/L	MW-3R	04/18/2024	ND	4.0000		
Copper, total	ug/L	MW-3R	10/17/2024	ND	4.0000		
Copper, total	ug/L	MW-4	10/04/2018		6.9000		
Copper, total	ug/L	MW-4	04/15/2019	ND	4.0000		
Copper, total	ug/L	MW-4	10/08/2019		6.9000		
Copper, total	ug/L	MW-4	04/08/2020		4.1000		
Copper, total	ug/L	MW-4	10/02/2020		15.1000		
Copper, total	ug/L	MW-4	04/12/2021		16.7000		
Copper, total	ug/L	MW-4	10/26/2021		4.3000		
Copper, total	ug/L	MW-4	04/12/2022		7.0000		
Copper, total	ug/L	MW-4	10/07/2022		5.6000		
Copper, total	ug/L	MW-4	04/19/2023		4.8000		
Copper, total	ug/L	MW-4	10/25/2023	ND	4.0000		
Copper, total	ug/L	MW-4	04/18/2024		6.5000		
Copper, total	ug/L	MW-5	10/04/2018		16.4000		
Copper, total	ug/L	MW-5	04/15/2019	ND	4.0000		
Copper, total	ug/L	MW-5	10/08/2019	ND	4.0000		
Copper, total	ug/L	MW-5	04/08/2020		26.5000		
Copper, total	ug/L	MW-5	10/02/2020	ND	4.0000		
Copper, total	ug/L	MW-5	04/12/2021		8.4000		
Copper, total	ug/L	MW-5	10/26/2021		14.7000		
Copper, total	ug/L	MW-5	04/12/2022		4.6000		
Copper, total	ug/L	MW-5	10/07/2022	ND	4.0000		
Copper, total	ug/L	MW-5	04/19/2023	ND	4.0000		
Copper, total	ug/L	MW-5	10/25/2023		8.9000		
Copper, total	ug/L	MW-5	04/18/2024	ND	4.0000		
Copper, total	ug/L	MW-5	10/17/2024	ND	4.0000		
Lead, total	ug/L	MW-3R	04/15/2019		5.6000		
Lead, total	ug/L	MW-3R	10/08/2019	ND	4.0000		
Lead, total	ug/L	MW-3R	04/08/2020	ND	4.0000		
Lead, total	ug/L	MW-3R	10/02/2020	ND	4.0000		
Lead, total	ug/L	MW-3R	04/12/2021	ND	4.0000		
Lead, total	ug/L	MW-3R	10/26/2021	ND	4.0000		
Lead, total	ug/L	MW-3R	04/12/2022	ND	4.0000		
Lead, total	ug/L	MW-3R	10/07/2022	ND	4.0000		
Lead, total	ug/L	MW-3R	04/19/2023	ND	4.0000		
Lead, total	ug/L	MW-3R	10/25/2023	ND	4.0000		
Lead, total	ug/L	MW-3R	04/18/2024	ND	4.0000		
Lead, total	ug/L	MW-3R	10/17/2024	ND	4.0000		
Lead, total	ug/L	MW-4	04/15/2019	ND	4.0000		
Lead, total	ug/L	MW-4	10/08/2019	ND	4.0000		
Lead, total	ug/L	MW-4	04/08/2020	ND	4.0000		
Lead, total	ug/L	MW-4	10/02/2020	ND	4.0000		

* - Outlier for that well and constituent.
** - ND value replaced with median RL.
*** - ND value replaced with manual RL.
ND = Not detected, Result = detection limit.

Table 1

Upgradient Data

Constituent	Units	Well	Date		Result	Adjusted	
Lead, total	ug/L	MW-4	04/12/2021		4.2000		
Lead, total	ug/L	MW-4	10/26/2021	ND	4.0000		
Lead, total	ug/L	MW-4	04/12/2022	ND	4.0000		
Lead, total	ug/L	MW-4	10/07/2022	ND	4.0000		
Lead, total	ug/L	MW-4	04/19/2023	ND	4.0000		
Lead, total	ug/L	MW-4	10/25/2023	ND	4.0000		
Lead, total	ug/L	MW-4	04/18/2024	ND	4.0000		
Lead, total	ug/L	MW-5	04/15/2019	ND	4.0000		
Lead, total	ug/L	MW-5	10/08/2019	ND	4.0000		
Lead, total	ug/L	MW-5	04/08/2020		15.5000		*
Lead, total	ug/L	MW-5	10/02/2020	ND	4.0000		
Lead, total	ug/L	MW-5	04/12/2021		4.9000		
Lead, total	ug/L	MW-5	10/26/2021		7.6000		
Lead, total	ug/L	MW-5	04/12/2022	ND	4.0000		
Lead, total	ug/L	MW-5	10/07/2022	ND	4.0000		
Lead, total	ug/L	MW-5	04/19/2023	ND	4.0000		
Lead, total	ug/L	MW-5	10/25/2023		4.6000		
Lead, total	ug/L	MW-5	04/18/2024	ND	4.0000		
Lead, total	ug/L	MW-5	10/17/2024	ND	4.0000		
Nickel, total	ug/L	MW-3R	10/04/2018	ND	4.0000		
Nickel, total	ug/L	MW-3R	10/25/2023	ND	4.0000		
Nickel, total	ug/L	MW-3R	04/18/2024	ND	4.0000		
Nickel, total	ug/L	MW-3R	10/17/2024	ND	4.0000		
Nickel, total	ug/L	MW-4	10/04/2018	ND	4.0000		
Nickel, total	ug/L	MW-4	10/25/2023		9.7000		
Nickel, total	ug/L	MW-4	04/18/2024		10.1000		
Nickel, total	ug/L	MW-5	10/04/2018		19.5000		
Nickel, total	ug/L	MW-5	10/25/2023		19.6000		
Nickel, total	ug/L	MW-5	04/18/2024		5.8000		
Nickel, total	ug/L	MW-5	10/17/2024		4.0000		
Selenium, total	ug/L	MW-3R	10/04/2018	ND	4.0000		
Selenium, total	ug/L	MW-3R	10/25/2023	ND	4.0000		
Selenium, total	ug/L	MW-3R	04/18/2024	ND	4.0000		
Selenium, total	ug/L	MW-3R	10/17/2024	ND	4.0000		
Selenium, total	ug/L	MW-4	10/04/2018	ND	4.0000		
Selenium, total	ug/L	MW-4	10/25/2023	ND	4.0000		
Selenium, total	ug/L	MW-4	04/18/2024	ND	4.0000		
Selenium, total	ug/L	MW-5	10/04/2018	ND	4.0000		
Selenium, total	ug/L	MW-5	10/25/2023	ND	4.0000		
Selenium, total	ug/L	MW-5	04/18/2024	ND	4.0000		
Selenium, total	ug/L	MW-5	10/17/2024	ND	4.0000		
Vanadium, total	ug/L	MW-3R	10/25/2023	ND	20.0000		
Vanadium, total	ug/L	MW-3R	04/18/2024	ND	20.0000		
Vanadium, total	ug/L	MW-3R	10/17/2024	ND	20.0000		
Vanadium, total	ug/L	MW-4	10/25/2023	ND	20.0000		
Vanadium, total	ug/L	MW-4	04/18/2024	ND	20.0000		
Vanadium, total	ug/L	MW-5	10/25/2023	ND	20.0000		
Vanadium, total	ug/L	MW-5	04/18/2024	ND	20.0000		
Vanadium, total	ug/L	MW-5	10/17/2024	ND	20.0000		
Zinc, total	ug/L	MW-3R	10/04/2018	ND	20.0000		
Zinc, total	ug/L	MW-3R	04/15/2019		59.3000		
Zinc, total	ug/L	MW-3R	10/08/2019		14.1000		
Zinc, total	ug/L	MW-3R	04/08/2020	ND	20.0000		
Zinc, total	ug/L	MW-3R	10/02/2020	ND	20.0000		
Zinc, total	ug/L	MW-3R	04/12/2021	ND	20.0000		
Zinc, total	ug/L	MW-3R	10/26/2021	ND	20.0000		
Zinc, total	ug/L	MW-3R	04/12/2022	ND	20.0000		
Zinc, total	ug/L	MW-3R	10/07/2022	ND	20.0000		
Zinc, total	ug/L	MW-3R	04/19/2023	ND	20.0000		
Zinc, total	ug/L	MW-3R	10/25/2023	ND	20.0000		
Zinc, total	ug/L	MW-3R	04/18/2024	ND	20.0000		
Zinc, total	ug/L	MW-3R	10/17/2024	ND	20.0000		
Zinc, total	ug/L	MW-4	10/04/2018		31.9000		
Zinc, total	ug/L	MW-4	04/15/2019	ND	20.0000		
Zinc, total	ug/L	MW-4	10/08/2019		24.6000		
Zinc, total	ug/L	MW-4	04/08/2020	ND	20.0000		
Zinc, total	ug/L	MW-4	10/02/2020		32.5000		
Zinc, total	ug/L	MW-4	04/12/2021		40.9000		
Zinc, total	ug/L	MW-4	10/26/2021	ND	20.0000		
Zinc, total	ug/L	MW-4	04/12/2022	ND	20.0000		
Zinc, total	ug/L	MW-4	10/07/2022		22.0000		
Zinc, total	ug/L	MW-4	04/19/2023	ND	20.0000		
Zinc, total	ug/L	MW-4	10/25/2023	ND	20.0000		
Zinc, total	ug/L	MW-4	04/18/2024	ND	20.0000		

* - Outlier for that well and constituent.
** - ND value replaced with median RL.
*** - ND value replaced with manual RL.
ND = Not detected, Result = detection limit.

Table 1

Upgradient Data

Constituent	Units	Well	Date		Result	Adjusted	
Zinc, total	ug/L	MW-5	10/04/2018		67.9000		
Zinc, total	ug/L	MW-5	04/15/2019	ND	20.0000		
Zinc, total	ug/L	MW-5	10/08/2019		44.6000		
Zinc, total	ug/L	MW-5	04/08/2020		65.8000		
Zinc, total	ug/L	MW-5	10/02/2020	ND	20.0000		
Zinc, total	ug/L	MW-5	04/12/2021		24.5000		
Zinc, total	ug/L	MW-5	10/26/2021		46.4000		
Zinc, total	ug/L	MW-5	04/12/2022	ND	20.0000		
Zinc, total	ug/L	MW-5	10/07/2022	ND	20.0000		
Zinc, total	ug/L	MW-5	04/19/2023	ND	20.0000		
Zinc, total	ug/L	MW-5	10/25/2023		36.5000		
Zinc, total	ug/L	MW-5	04/18/2024	ND	20.0000		
Zinc, total	ug/L	MW-5	10/17/2024	ND	20.0000		

* - Outlier for that well and constituent.
** - ND value replaced with median RL.
*** - ND value replaced with manual RL.
ND = Not detected, Result = detection limit.

Table 2

Most Current Downgradient Monitoring Data

Constituent	Units	Well	Date		Result		Pred. Limit
Antimony, total	ug/L	MW-1	10/17/2024	ND	2.0000		2.0000
Antimony, total	ug/L	MW-7	10/17/2024	ND	2.0000		2.0000
Arsenic, total	ug/L	MW-1	10/17/2024	ND	4.0000		57.3000
Arsenic, total	ug/L	MW-7	10/17/2024	ND	4.0000		57.3000
Barium, total	ug/L	MW-1	10/17/2024		895.0000	**	895.4363
Barium, total	ug/L	MW-7	10/17/2024		170.0000		895.4363
Cadmium, total	ug/L	MW-1	10/17/2024	ND	0.8000		2.2000
Cadmium, total	ug/L	MW-7	10/17/2024	ND	0.8000		2.2000
Chromium, total	ug/L	MW-1	10/17/2024	ND	8.0000		19.5000
Chromium, total	ug/L	MW-7	10/17/2024	ND	8.0000		19.5000
Cobalt, total	ug/L	MW-1	10/17/2024		3.6000		7.0458
Cobalt, total	ug/L	MW-7	10/17/2024	ND	0.4000		7.0458
Copper, total	ug/L	MW-1	10/17/2024	ND	4.0000		26.5000
Copper, total	ug/L	MW-7	10/17/2024		9.8000		26.5000
Lead, total	ug/L	MW-1	10/17/2024	ND	4.0000		7.6000
Lead, total	ug/L	MW-7	10/17/2024	ND	4.0000		7.6000
Nickel, total	ug/L	MW-1	10/17/2024		21.9000		28.6291
Nickel, total	ug/L	MW-7	10/17/2024		7.0000		28.6291
Selenium, total	ug/L	MW-1	10/17/2024	ND	4.0000		4.0000
Selenium, total	ug/L	MW-7	10/17/2024	ND	4.0000		4.0000
Vanadium, total	ug/L	MW-1	10/17/2024	ND	20.0000		20.0000
Vanadium, total	ug/L	MW-7	10/17/2024	ND	20.0000		20.0000
Zinc, total	ug/L	MW-1	10/17/2024	ND	20.0000		67.9000
Zinc, total	ug/L	MW-7	10/17/2024	ND	20.0000		67.9000

* - Current value failed - awaiting verification.
** - Current value passed - previous exceedance not verified.
*** - Current value failed - exceedance verified.
**** - Current value passed - awaiting one more verification.
***** - Insufficient background data to compute prediction limit.
ND = Not Detected, Result = detection limit.

Table 3

Detection Frequencies in Upgradient and Downgradient Wells

Constituent	Upgradient Detect	Upgradient N	Upgradient Proportion	Downgradient Detect	Downgradient N	Downgradient Proportion
Antimony, total	0	8	0.000	0	7	0.000
Arsenic, total	16	38	0.421	2	26	0.077
Barium, total	38	38	1.000	26	26	1.000
Cadmium, total	2	38	0.053	2	26	0.077
Chromium, total	19	35	0.543	0	24	0.000
Cobalt, total	7	11	0.636	5	9	0.556
Copper, total	17	38	0.447	1	26	0.038
Lead, total	5	34	0.147	0	24	0.000
Nickel, total	6	11	0.545	6	9	0.667
Selenium, total	0	11	0.000	0	9	0.000
Vanadium, total	0	8	0.000	0	7	0.000
Zinc, total	13	38	0.342	5	26	0.192

N = Total number of measurements in all wells.
Detect = Total number of detections in all wells.
Proportion = Detect/N.

Table 4

Shapiro-Wilk Multiple Group Test of Normality

Constituent	Detect	N	Detect Freq	G raw	G log	G cbrt	G sqrt	G sqr	G cub	Crit Value	Dist Form	Model Type
Antimony, total	0	8	0.000	0.700	0.700					2.326	normal	nonpar
Arsenic, total	16	38	0.421	4.980	5.637					2.326	non-norm	nonpar
Barium, total	38	38	1.000	3.891	1.490					2.326	lognor	lognor
Cadmium, total	2	38	0.053	16.373	16.373					2.326	non-norm	nonpar
Chromium, total	19	35	0.543	5.320	5.577					2.326	non-norm	nonpar
Cobalt, total	7	11	0.636	0.554	1.245					2.326	normal	normal
Copper, total	17	38	0.447	15.877	14.840					2.326	non-norm	nonpar
Lead, total	5	34	0.147	17.559	17.320					2.326	non-norm	nonpar
Nickel, total	6	11	0.545	2.179	2.069					2.326	normal	normal
Selenium, total	0	11	0.000	1.585	1.585					2.326	normal	nonpar
Vanadium, total	0	8	0.000	0.700	0.700					2.326	normal	nonpar
Zinc, total	13	38	0.342	7.927	6.983					2.326	non-norm	nonpar

* - Distribution override for that constituent.
Fit to distribution is confirmed if G <= critical value.
Model type may not match distributional form when detection frequency < 50%.

Table 5

Summary Statistics and Prediction Limits

Constituent	Units	Detect	N	Mean	SD	alpha	Factor	Pred Limit	Type		Conf
Antimony, total	ug/L	0	8					2.0000	nonpar	***	0.96
Arsenic, total	ug/L	16	38					57.3000	nonpar		0.99
Barium, total	ug/L	38	38	5.6380	0.4707	0.0100	2.4631	895.4363	lognor		
Cadmium, total	ug/L	2	38					2.2000	nonpar		0.99
Chromium, total	ug/L	19	35					19.5000	nonpar		0.99
Cobalt, total	ug/L	7	11	1.2364	2.0127	0.0100	2.8863	7.0458	normal		
Copper, total	ug/L	17	38					26.5000	nonpar		0.99
Lead, total	ug/L	5	34					7.6000	nonpar		0.99
Nickel, total	ug/L	6	11	6.2455	7.7551	0.0100	2.8863	28.6291	normal		
Selenium, total	ug/L	0	11					4.0000	nonpar	***	0.98
Vanadium, total	ug/L	0	8					20.0000	nonpar	***	0.96
Zinc, total	ug/L	13	38					67.9000	nonpar		0.99

Conf = confidence level for passing initial test or one verification resample at all downgradient wells for a single constituent (nonparametric test only).
* - Insufficient Data.
** - Calculated limit raised to Manual Reporting Limit.
*** - Nonparametric limit based on ND value.
For transformed data, mean and SD in transformed units and prediction limit in original units.
All sample sizes and statistics are based on outlier free data.
For nonparametric limits, median reporting limits are substituted for extreme reporting limit values.

Table 6

Dixon's Test Outliers
1% Significance Level

Constituent	Units	Well	Date	Result	ND Qualifier	Date Range	N	Critical Value
Lead, total	ug/L	MW-5	04/08/2020	15.5000		04/15/2019-10/17/2024	12	0.6425

N = Total number of independent measurements in background at each well.
Date Range = Dates of the first and last measurements included in background at each well.
Critical Value depends on the significance level and on N-1 when the two most extreme values are tested or N for the most extreme value.

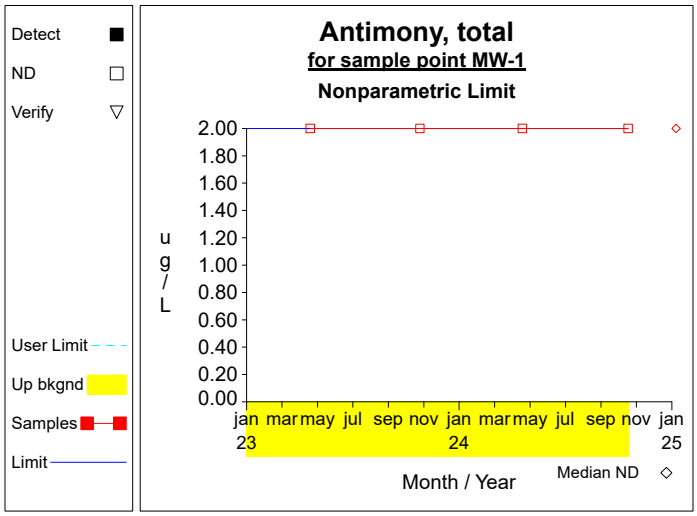
Table 8

Historical Downgradient Data for Constituent-Well Combinations that Failed the Current Statistical Evaluation or are in Verification Resampling Mode

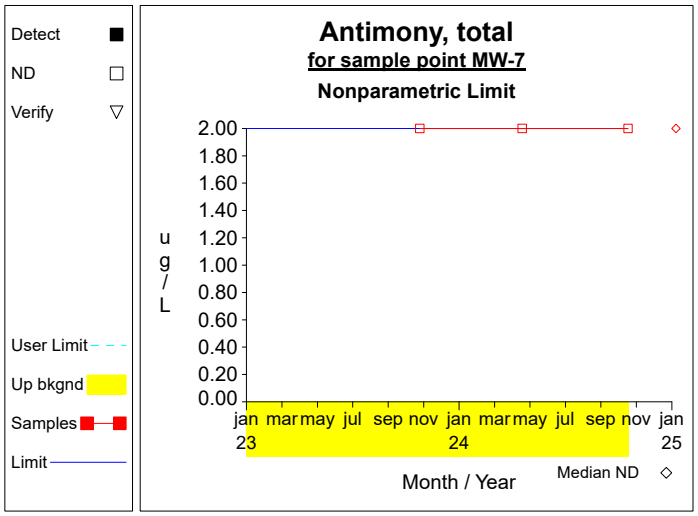
Constituent	Units	Well	Date	Result		Pred. Limit
Barium, total	ug/L	MW-1	10/04/2018	1000.0000	*	895.4363
Barium, total	ug/L	MW-1	04/15/2019	1060.0000	*	895.4363
Barium, total	ug/L	MW-1	10/08/2019	1020.0000	*	895.4363
Barium, total	ug/L	MW-1	04/08/2020	995.0000	*	895.4363
Barium, total	ug/L	MW-1	10/02/2020	1000.0000	*	895.4363
Barium, total	ug/L	MW-1	04/12/2021	1060.0000	*	895.4363
Barium, total	ug/L	MW-1	10/26/2021	960.0000	*	895.4363
Barium, total	ug/L	MW-1	04/12/2022	1030.0000	*	895.4363
Barium, total	ug/L	MW-1	10/07/2022	1000.0000	*	895.4363
Barium, total	ug/L	MW-1	04/19/2023	1020.0000	*	895.4363
Barium, total	ug/L	MW-1	10/25/2023	1090.0000	*	895.4363
Barium, total	ug/L	MW-1	04/18/2024	1100.0000	*	895.4363
Barium, total	ug/L	MW-1	10/17/2024	895.0000		895.4363

* - Significantly increased over background.
** - Detect at limit for 100% NDs in background (NPPL only).
*** - Manual exclusion.
ND = Not Detected, Result = detection limit.

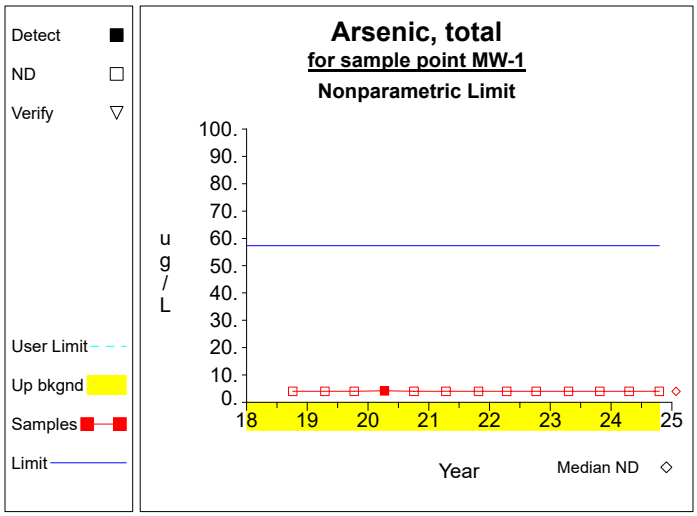
Up vs. Down Prediction Limits



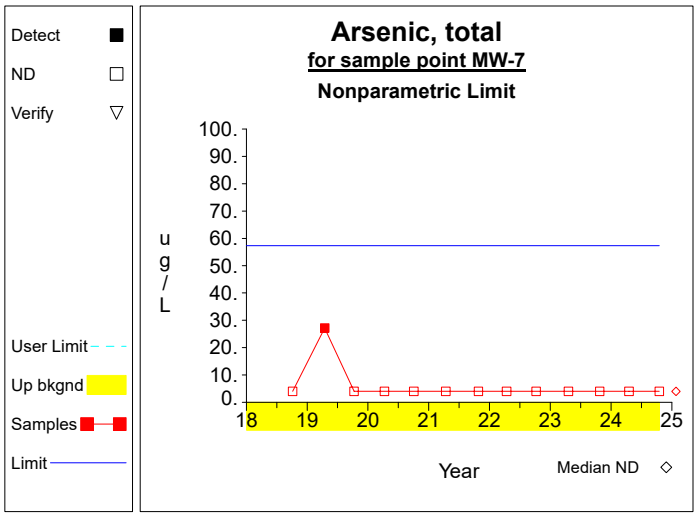
Graph 1



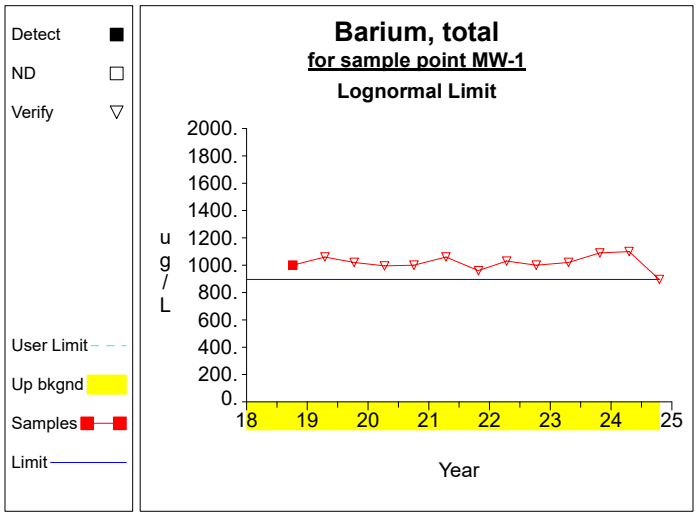
Graph 2



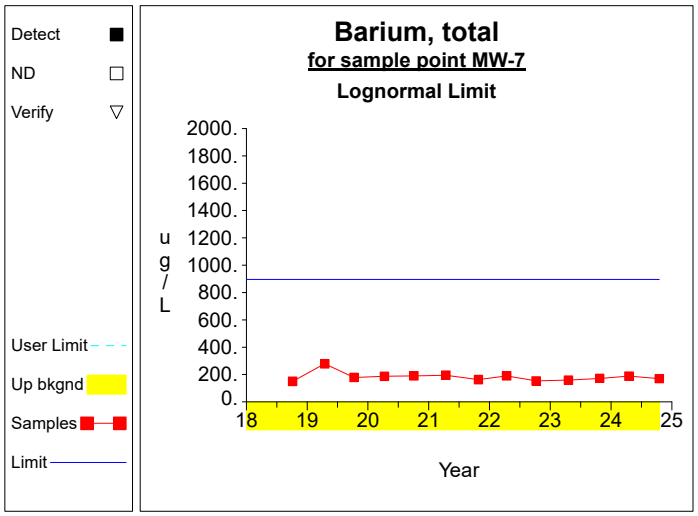
Graph 3



Graph 4



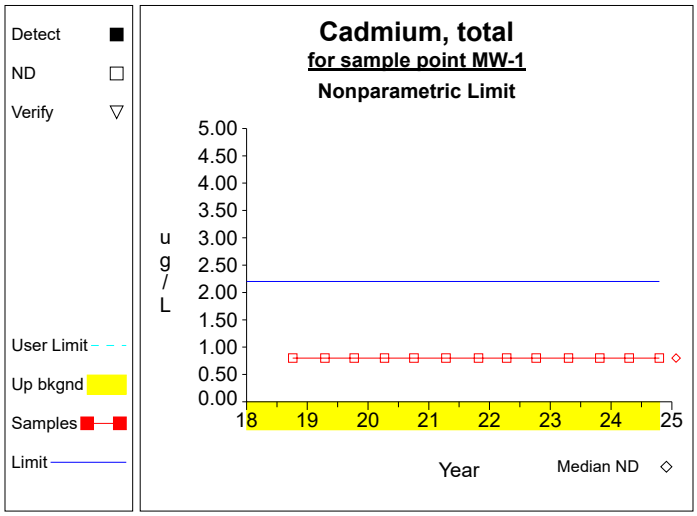
Graph 5



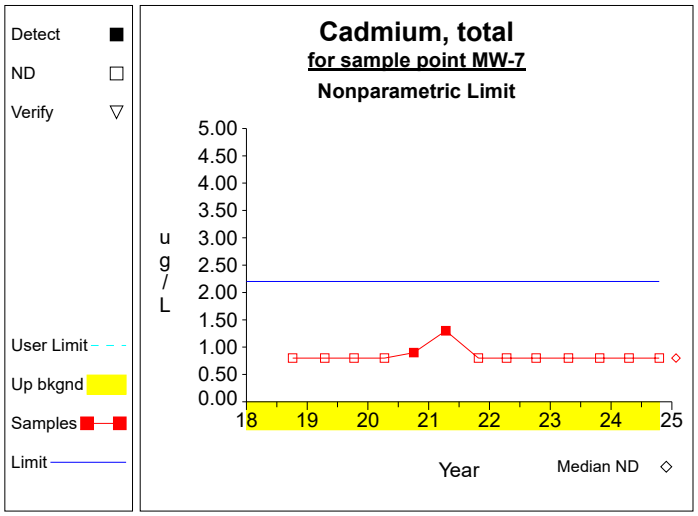
Graph 6

Prepared by: Otter Creek Environmental

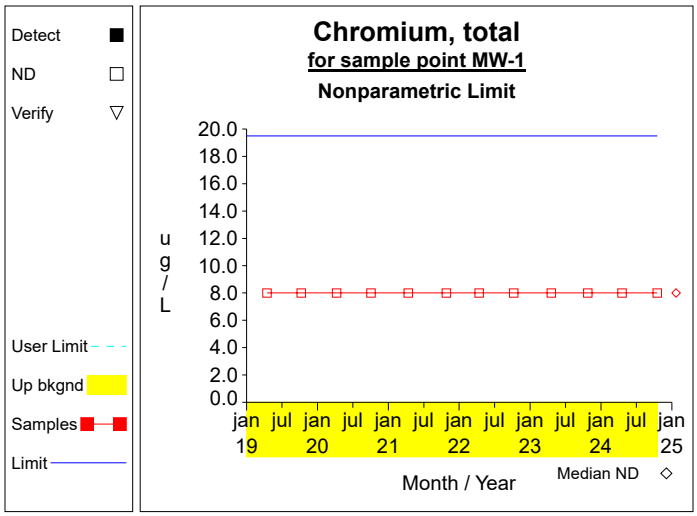
Up vs. Down Prediction Limits



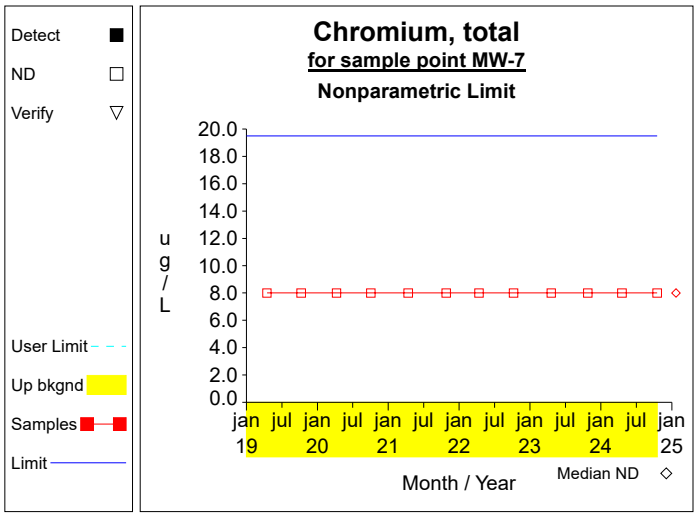
Graph 7



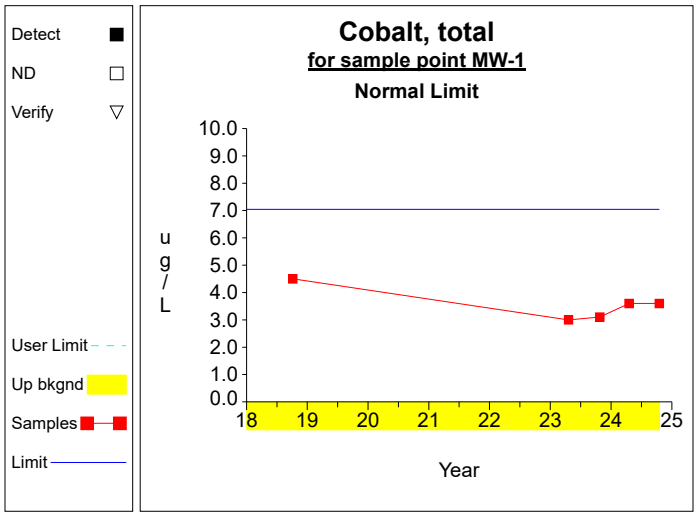
Graph 8



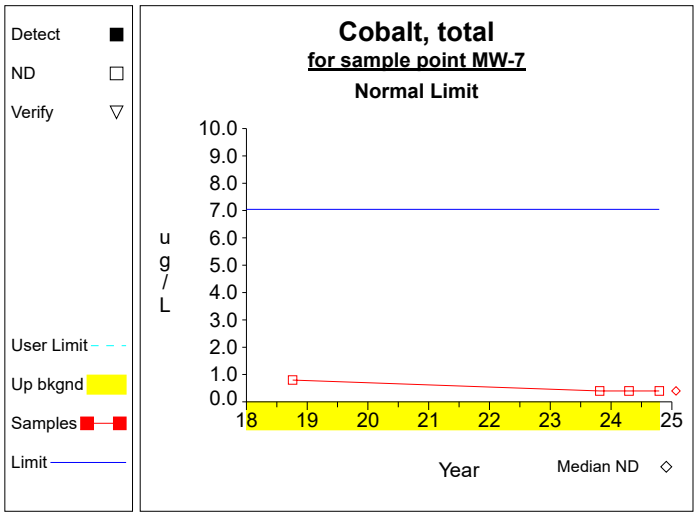
Graph 9



Graph 10



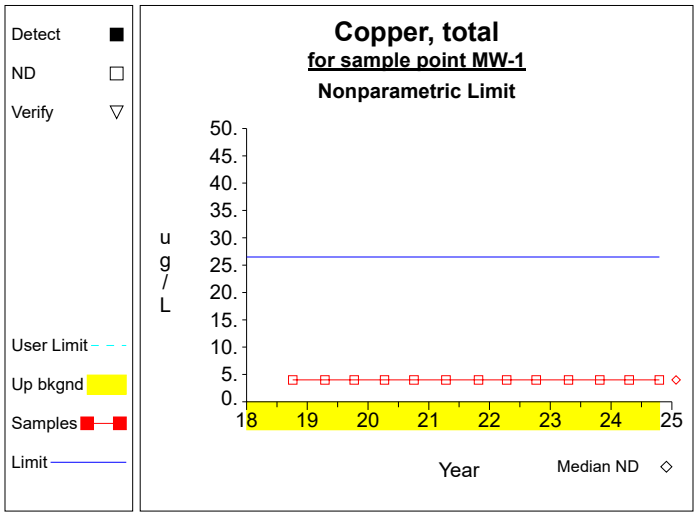
Graph 11



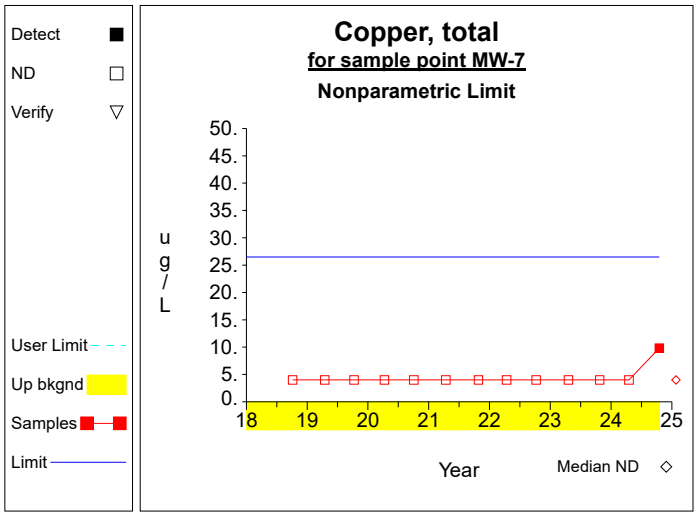
Graph 12

Prepared by: Otter Creek Environmental

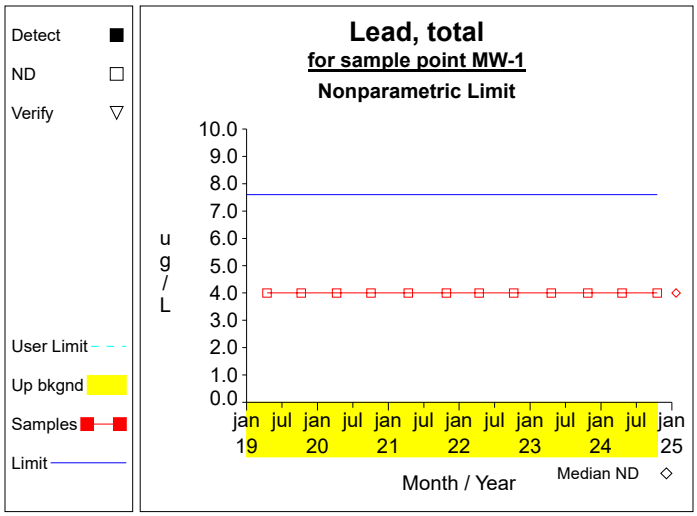
Up vs. Down Prediction Limits



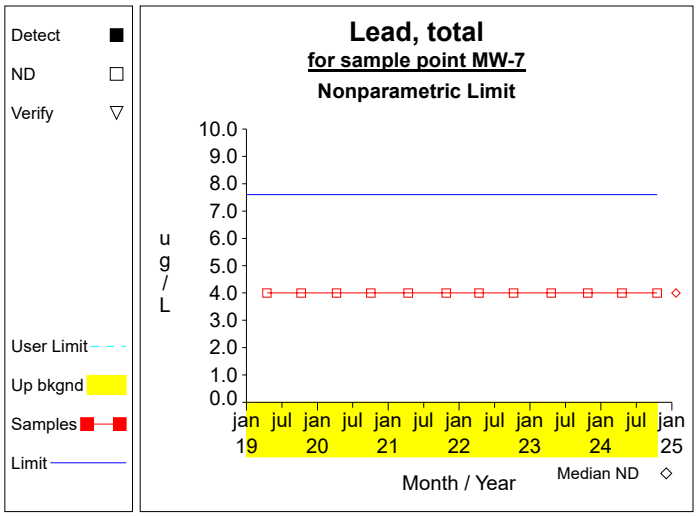
Graph 13



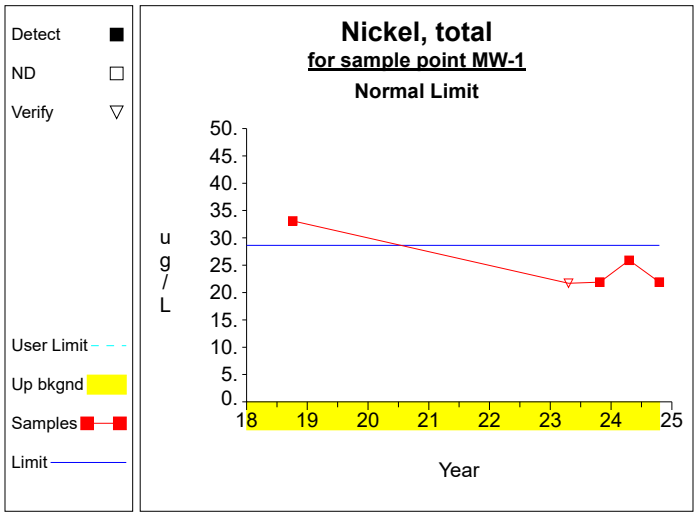
Graph 14



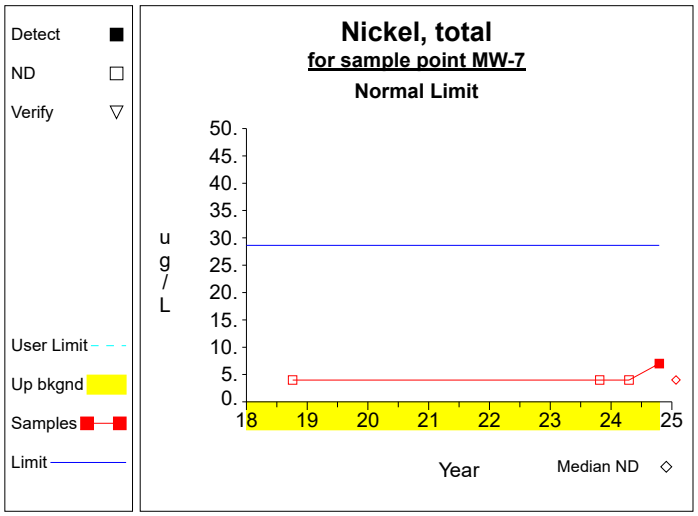
Graph 15



Graph 16



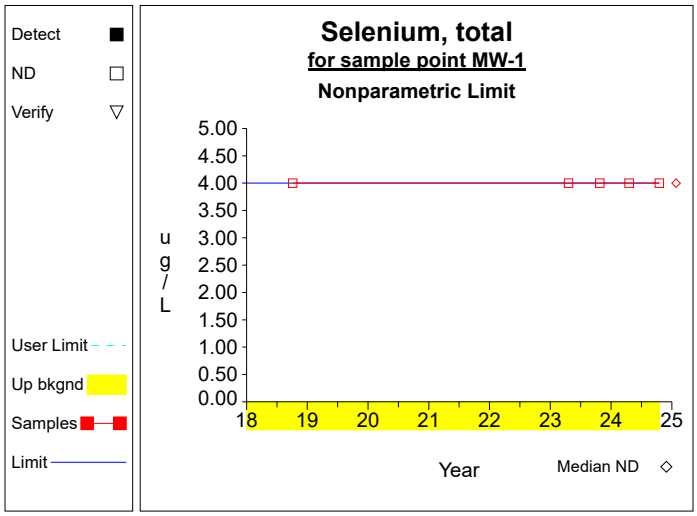
Graph 17



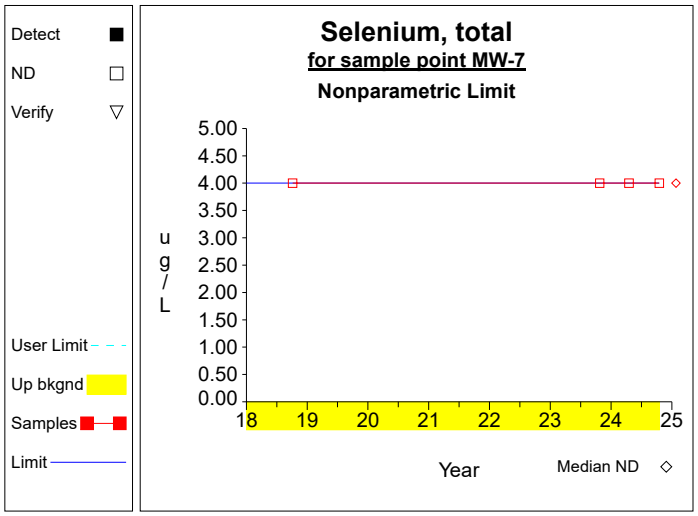
Graph 18

Prepared by: Otter Creek Environmental

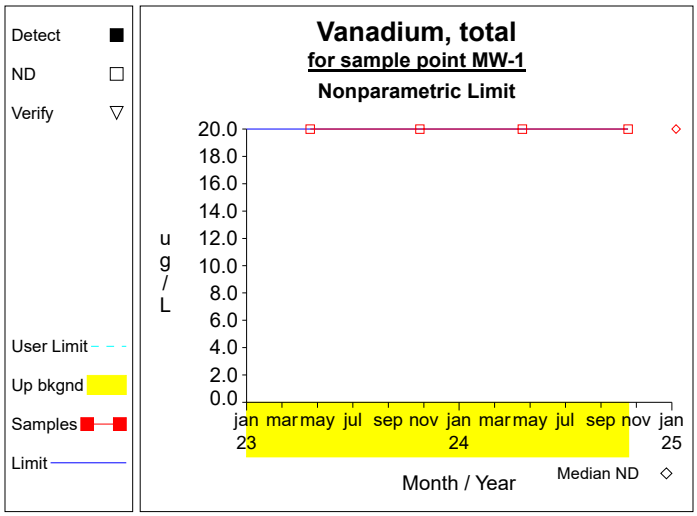
Up vs. Down Prediction Limits



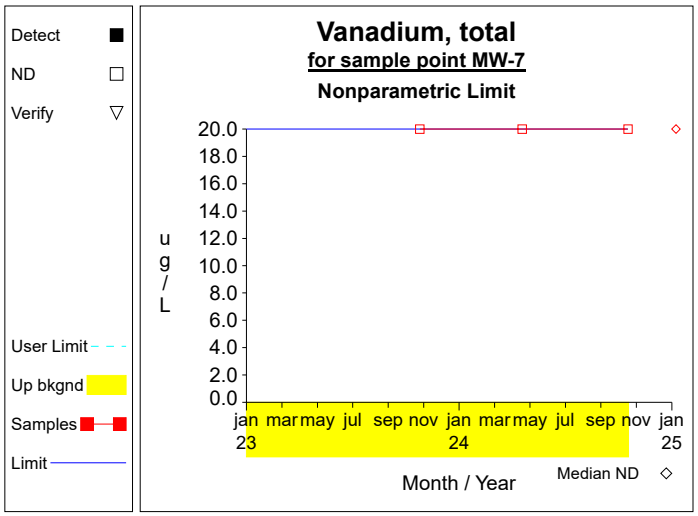
Graph 19



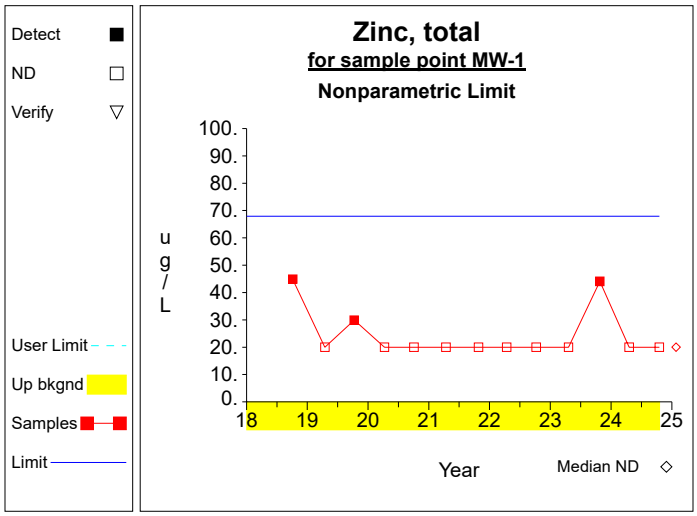
Graph 20



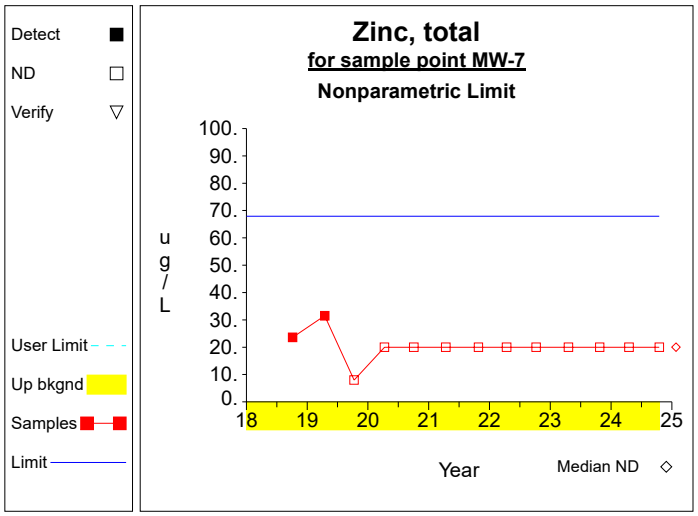
Graph 21



Graph 22



Graph 23

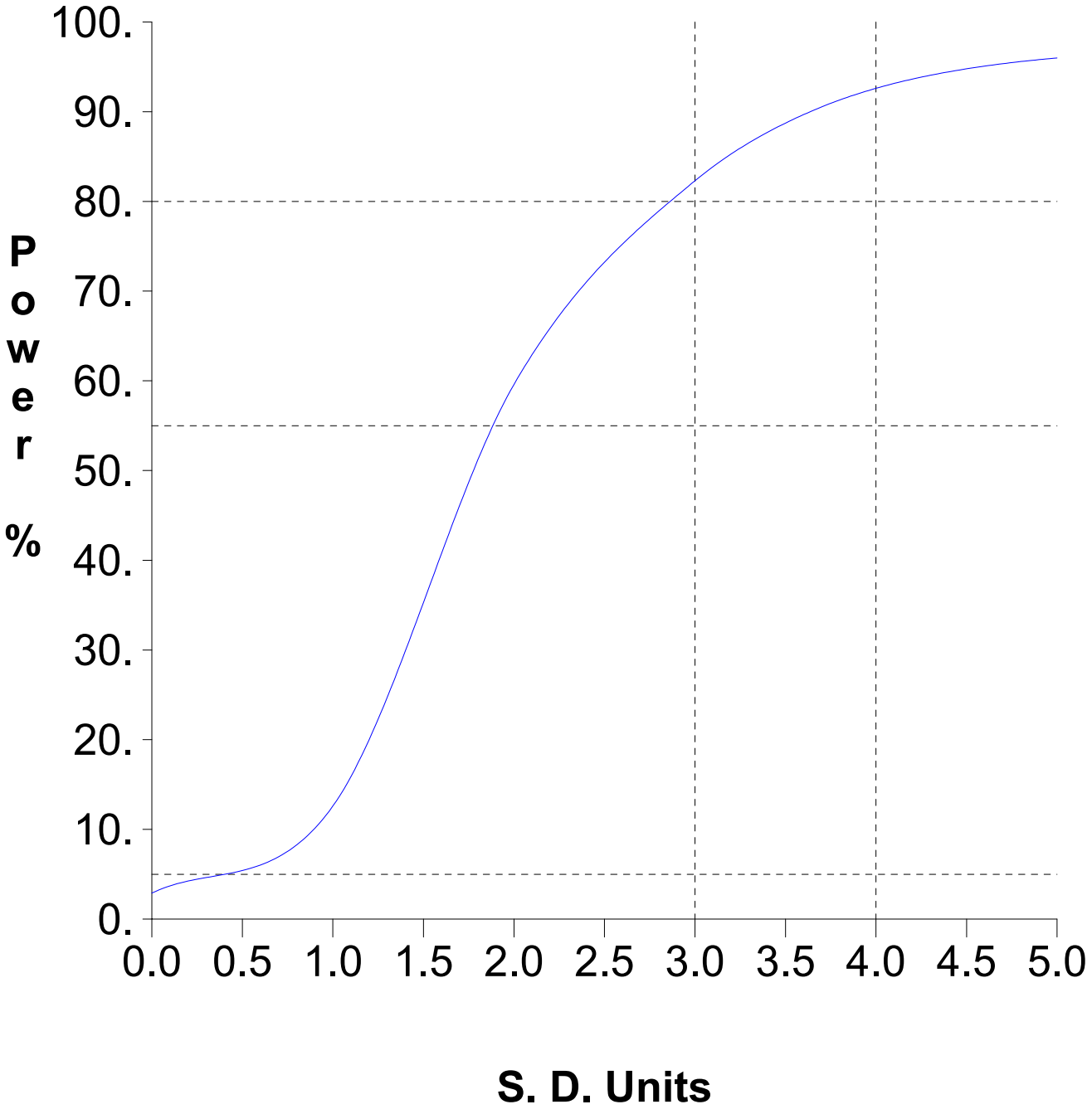


Graph 24

Prepared by: Otter Creek Environmental

False Positive and False Negative Rates for Current

Upgradient vs. Downgradient Monitoring Program



Worksheet 1 - Upgradient vs. Downgradient Comparisons
Antimony, total (ug/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = median(X) = **2.0**	Compute nonparametric prediction limit as median reporting limit in background.
2	Conf = **0.958**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Arsenic, total (ug/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **57.3**	Compute nonparametric prediction limit as largest background measurement.
2	Conf = **0.99**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Barium, total (ug/L)
Lognormal Prediction Limit

Step	Equation	Description
1	$Y = \log_e(X)$	Transform to natural logarithmic scale.
2	$\overline{Y}$ = **sum[Y]** / **N** = **214.244** / **38** = **5.638**	Compute mean on a natural log scale.
3	$S_Y = ((\mathbf{sum[Y^2]} - \mathbf{sum[Y]}^2/\mathbf{N}) / (\mathbf{N}-1))^{½}$ $= ((\mathbf{1216.108} - \mathbf{45900.652}/\mathbf{38}) / (\mathbf{38}-1))^{½}$ = **0.471**	Compute sd on a natural log scale.
4	alpha = min[$(1-.95^{1/\mathbf{K}})^{½}$, .01] = min[$(1-.95^{1/\mathbf{24}})^{½}$, .01] = **0.01**	Adjusted per comparison false positive rate. Pass initial or 1 resample.
5	$PL = \exp[\overline{\mathbf{Y}} + \mathbf{tS_Y}(1+1/\mathbf{N})^{½}]$ $= \exp[\mathbf{5.638}$ $+ (\mathbf{2.431}*\mathbf{0.471})(1+1/\mathbf{38})^{½}]$ = **895.436**	One-sided lognormal prediction limit (t is Student's t on N-1 degrees of freedom and 1-alpha confidence level).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Cadmium, total (ug/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **2.2**	Compute nonparametric prediction limit as largest background measurement.
2	Conf = **0.99**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Chromium, total (ug/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **19.5**	Compute nonparametric prediction limit as largest background measurement.
2	Conf = **0.99**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Cobalt, total (ug/L)
Normal Prediction Limit

Step	Equation	Description
1	$\overline{X}_1$ = **sum[X_1]** / **N_1** = **13.6** / **7** = **1.943**	Compute mean of N_1 detected measurements.
2	S_1 = ((**sum[X_1^2]**-**sum[X_1]**^{2}/**N_1**) / (**N_1**-1))^{½} = ((**55.56**-**184.96**/**7**) / (**7**-1))^{½} = **2.204**	Compute sd of N_1 detected measurements.
3	$\overline{X}$ = (1 - **N_0**/**N**) **$\overline{X}_1$** = (1 - **4**/**11**) **1.943** = **1.236**	Use Aitchison's method to adjust mean for presence of nondetects.
4	S = [(1 - **N_0**/**N**) * **S_1^2** + (**N_0**/**N**) (1 - (**N_0**-1)/(**N**-1)) **$\overline{X}_1^2$**]^{½} = [(1 - **4**/**11**) * **2.204**^{2} + (**4**/**11**) (1 - (**4**-1)/(**11**-1)) **1.943**^{2}]^{½} = **2.013**	Use Aitchison's method to adjust sd for presence of nondetects.
5	alpha = min[(1-.95$^{1/K}$)^{½}, .01] = min[(1-.95$^{1/24}$)^{½}, .01] = **0.01**	Adjusted per comparison false positive rate. Pass initial or 1 resample.
6	PL = **$\overline{X}$** + **tS**(1+1/**N**)^{½} = **1.236** + (**2.763*****2.013**)(1+1/**11**)^{½} = **7.046**	One-sided normal prediction limit (t is Student's t on N-1 degrees of freedom and 1-alpha confidence level).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Copper, total (ug/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **26.5**	Compute nonparametric prediction limit as largest background measurement.
2	Conf = **0.99**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Lead, total (ug/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **7.6**	Compute nonparametric prediction limit as largest background measurement.
2	Conf = **0.99**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Nickel, total (ug/L)
Normal Prediction Limit

Step	Equation	Description
1	$\overline{X}_1$ = **sum[X_1]** / **N_1** = **68.7** / **6** = **11.45**	Compute mean of N_1 detected measurements.
2	S_1 = ((**sum[X_1^2]**-**sum[X_1]**^{2}/**N_1**) / (**N_1**-1))^{½} = ((**1010.15**-**4719.69**/**6**) / (**6**-1))^{½} = **6.686**	Compute sd of N_1 detected measurements.
3	$\overline{X}$ = (1 - **N_0**/**N**) $\overline{\mathbf{X}}_1$ = (1 - **5**/**11**) **11.45** = **6.245**	Use Aitchison's method to adjust mean for presence of nondetects.
4	S = [(1 - **N_0**/**N**) * **S_1^2** + (**N_0**/**N**) (1 - (**N_0**-1)/(**N**-1)) $\overline{\mathbf{X}}_1^2$]^{½} = [(1 - **5**/**11**) * **6.686**^{2} + (**5**/**11**) (1 - (**5**-1)/(**11**-1)) **11.45**^{2}]^{½} = **7.755**	Use Aitchison's method to adjust sd for presence of nondetects.
5	alpha = min[(1-.95$^{1/\mathbf{K}}$)^{½}, .01] = min[(1-.95$^{1/\mathbf{24}}$)^{½}, .01] = **0.01**	Adjusted per comparison false positive rate. Pass initial or 1 resample.
6	PL = $\overline{\mathbf{X}}$ + **tS**(1+1/**N**)^{½} = **6.245** + (**2.763*****7.755**)(1+1/**11**)^{½} = **28.629**	One-sided normal prediction limit (t is Student's t on N-1 degrees of freedom and 1-alpha confidence level).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Selenium, total (ug/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = median(X) = **4.0**	Compute nonparametric prediction limit as median reporting limit in background.
2	Conf = **0.975**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Vanadium, total (ug/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = median(X) = **20.0**	Compute nonparametric prediction limit as median reporting limit in background.
2	Conf = **0.958**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Zinc, total (ug/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **67.9**	Compute nonparametric prediction limit as largest background measurement.
2	Conf = **0.99**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Attachment C

Assessment Statistics

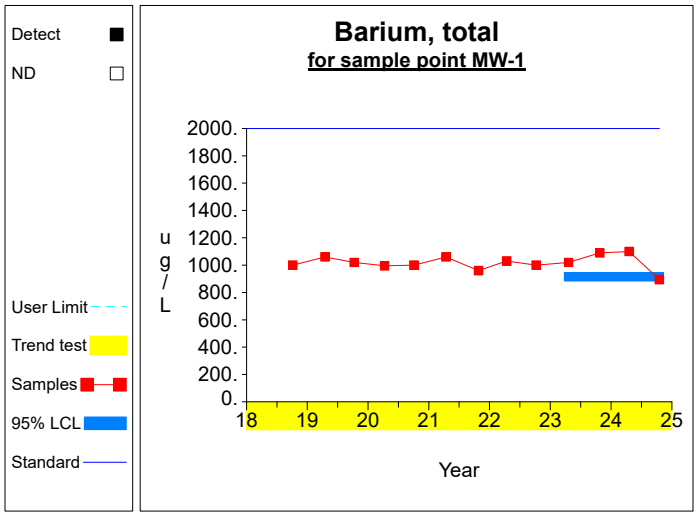
Table 1

Confidence Intervals for Comparing the Mean of the Last 4 Measurements to an Assessment Monitoring Standard

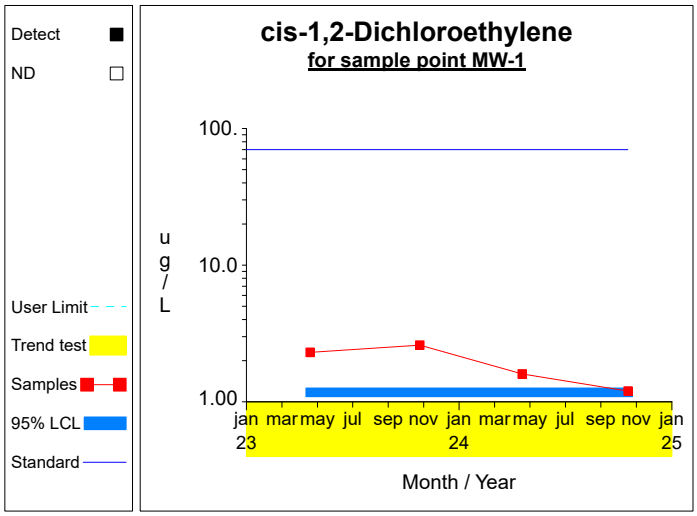
Constituent	Units	Well	N	Mean	SD	Factor	95% LCL	95% UCL	Standard	Trend
Barium, total	ug/L	MW-1	4	1026.250	94.461	1.176	915.136	1137.364	2000.000	
cis-1,2-Dichloroethylene	ug/L	MW-1	4	1.925	0.640	1.176	1.173	2.677	70.000	
Nickel, total	ug/L	MW-1	4	22.850	2.036	1.176	20.456	25.244	100.000	

* - Insufficient Data
** - Significant Exceedance
LCL = Lower Confidence Limit
UCL = Upper Confidence Limit

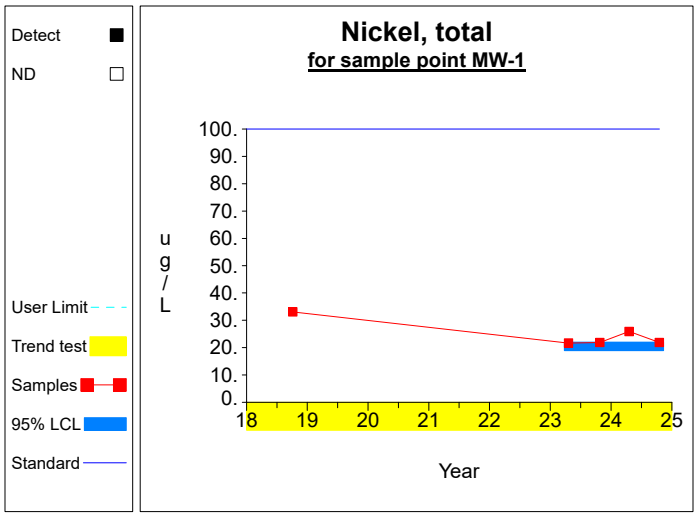
Confidence Limits (Assessment)



Graph 1



Graph 2



Graph 3

Worksheet 6 - Assessment Monitoring
Barium, total (ug/L) at MW-1

Step	Equation	Description
1	$\overline{X}$ = **sum[X]** / **N** = **4105.0** / **4** = **1026.25**	Compute the mean of the last 4 measurements.
2	S = ((**sum[X^2]** - **sum[X]**^{2}/**N**) / (**N**-1))^{½} = ((**4.24**x**10^6** - **1.69**x**10^7**/**4**) / (**4**-1))^{½} = **94.461**	Compute sd of the last 4 measurements.
3	LCL = $\overline{\mathbf{X}}$ - **tS**/**N**^{½} = **1026.25** - **2.353** * **94.461**/**4**^{½} = **915.136**	Compute lower confidence limit for the mean of the last 4 measurements.
4	UCL = $\overline{\mathbf{X}}$ + **tS**/**N**^{½} = **1026.25** + **2.353** * **94.461**/**4**^{½} = **1137.364**	Compute upper confidence limit for the mean of the last 4 measurements.
5	N' = **N** * (**N**-1) / 2 = **13** * (**13**-1) / 2 = **78**	Number of sample pairs during trend detection period.
6	S = **2.994**	Sen's estimator of trend.
7	var(S) = **263.0**	Variance estimate for slope.
8	M(S) = (**N**' ± **Z**$_{.995}$ * **var(S)**^{½}) / 2 = (**78** ± **2.576** * **263.0**^{½}) / 2 = [**18.112**, **59.888**]	Ordinal positions for two-sided lower confidence limits for slope. The LCL and UCL are the Mth largest slope estimates for the values shown. When the values are not integers, interpolation is used.
9	CL(S) = [**-28.909**, **26.45**]	Two-sided confidence interval for slope.
10	the interval includes 0	There is no significant trend.

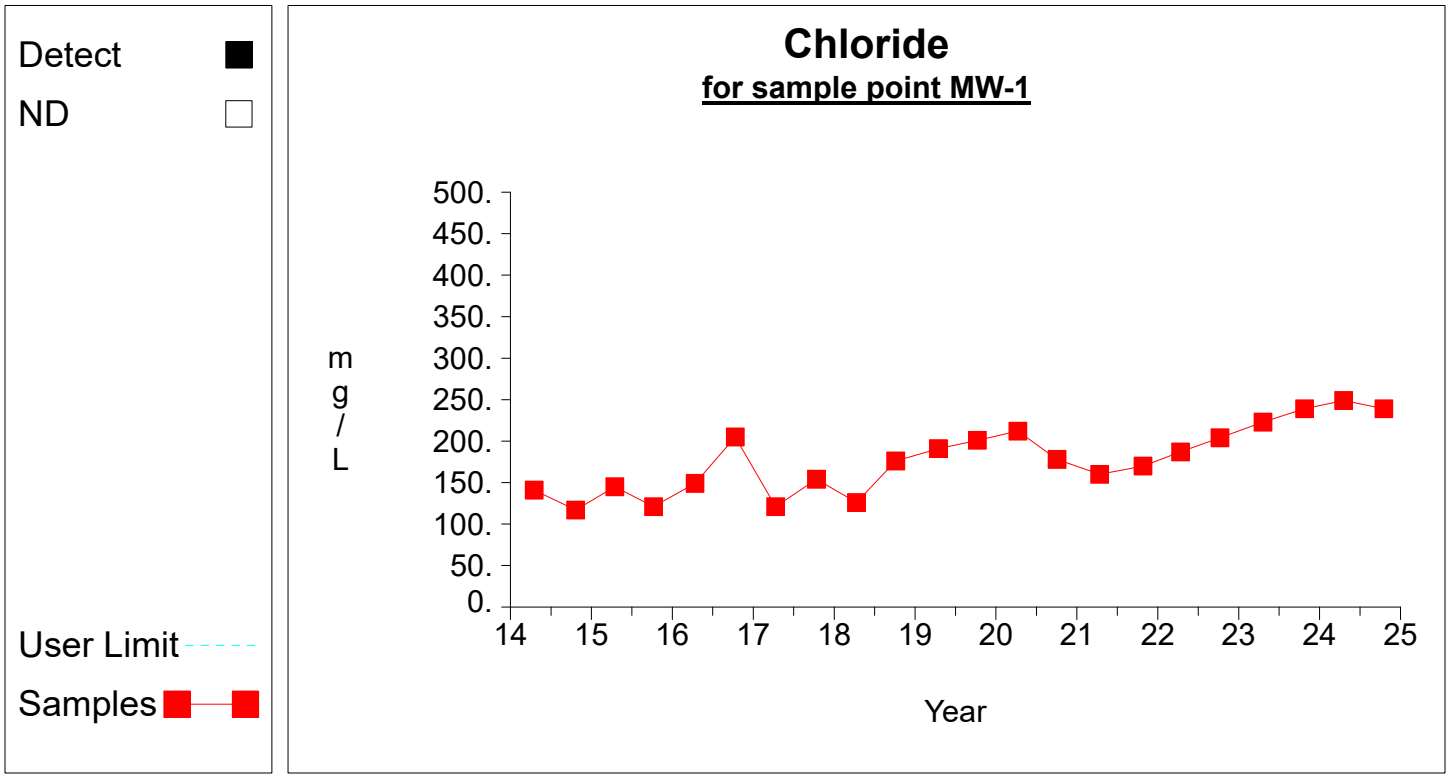
Worksheet 6 - Assessment Monitoring
cis-1,2-Dichloroethylene (ug/L) at MW-1

Step	Equation	Description
1	$\overline{X}$ = **sum[X]** / **N** = **7.7** / **4** = **1.925**	Compute the mean of the last 4 measurements.
2	S = ((**sum[X^2]** - **sum[X]**^{2}/**N**) / (**N**-1))^{½} = ((**16.05** - **59.29**/**4**) / (**4**-1))^{½} = **0.64**	Compute sd of the last 4 measurements.
3	LCL = $\overline{\mathbf{X}}$ - **tS**/**N**^{½} = **1.925** - **2.353** * **0.64**/**4**^{½} = **1.173**	Compute lower confidence limit for the mean of the last 4 measurements.
4	UCL = $\overline{\mathbf{X}}$ + **tS**/**N**^{½} = **1.925** + **2.353** * **0.64**/**4**^{½} = **2.677**	Compute upper confidence limit for the mean of the last 4 measurements.
5	N' = **N** * (**N**-1) / 2 = **4** * (**4**-1) / 2 = **6**	Number of sample pairs during trend detection period.
6	S = **-0.77**	Sen's estimator of trend.
7	var(S) = **8.667**	Variance estimate for slope.
8	M(S) = (**N'** ± **Z**$_{.995}$ * **var(S)**^{½}) / 2 = (**6** ± **2.576** * **8.667**^{½}) / 2 = [**-0.792**, **6.792**]	Ordinal positions for two-sided lower confidence limits for slope. The LCL and UCL are the Mth largest slope estimates for the values shown. When the values are not integers, interpolation is used.
9	CL(S) = [**-2.077**, **0.579**]	Two-sided confidence interval for slope.
10	the interval includes 0	There is no significant trend.

Worksheet 6 - Assessment Monitoring
Nickel, total (ug/L) at MW-1

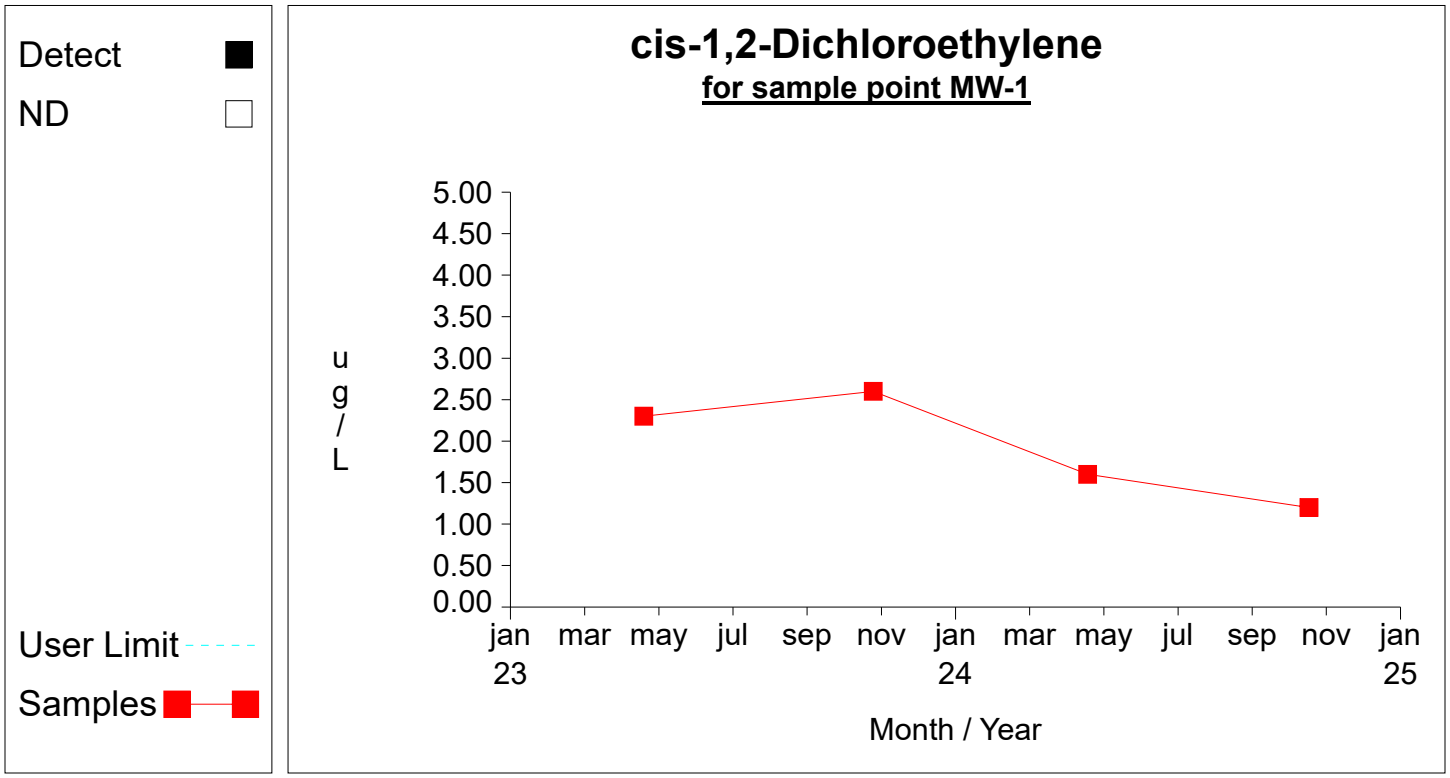
Step	Equation	Description
1	$\overline{X}$ = **sum[X]** / **N** = **91.4** / **4** = **22.85**	Compute the mean of the last 4 measurements.
2	S = ((**sum[X^2]** - **sum[X]**^{2}/**N**) / (**N**-1))^{½} = ((**2100.92** - **8353.96**/**4**) / (**4**-1))^{½} = **2.036**	Compute sd of the last 4 measurements.
3	LCL = $\overline{\mathbf{X}}$ - **tS**/**N**^{½} = **22.85** - **2.353** * **2.036**/**4**^{½} = **20.456**	Compute lower confidence limit for the mean of the last 4 measurements.
4	UCL = $\overline{\mathbf{X}}$ + **tS**/**N**^{½} = **22.85** + **2.353** * **2.036**/**4**^{½} = **25.244**	Compute upper confidence limit for the mean of the last 4 measurements.
5	N' = **N** * (**N**-1) / 2 = **5** * (**5**-1) / 2 = **10**	Number of sample pairs during trend detection period.
6	S = **-0.65**	Sen's estimator of trend.
7	var(S) = **15.667**	Variance estimate for slope.
8	M(S) = (**N'** ± **Z**$_{.995}$ * **var(S)**^{½}) / 2 = (**10** ± **2.576** * **15.667**^{½}) / 2 = [**-0.098**, **10.098**]	Ordinal positions for two-sided lower confidence limits for slope. The LCL and UCL are the Mth largest slope estimates for the values shown. When the values are not integers, interpolation is used.
9	CL(S) = [**-8.044**, **8.309**]	Two-sided confidence interval for slope.
10	the interval includes 0	There is no significant trend.

Time Series



Graph 1

Time Series



Graph 2

Appendix D

Laboratory Reports for Reporting Period

With Chain of Custody

Microbac Laboratories, Inc., Newton

CERTIFICATE OF ANALYSIS

1HD1698

Project Description

6036

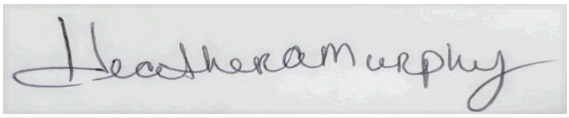
For:

Todd Whipple

HLW Engineering

PO Box 314

Story City, IA 50248



Heather Murphy

Customer Relationship Specialist

Thursday, May 9, 2024

Please find enclosed the analytical results for the samples you submitted to Microbac Laboratories. Review and compilation of your report was completed by Microbac Laboratories, Inc., Newton. If you have any questions, comments, or require further assistance regarding this report, please contact your service representative listed above.

I certify that all test results meet all of the requirements of the accrediting authority listed within this report. Analytical results are reported on a 'as received' basis unless specified otherwise. Analytical results for solids with units ending in (dry) are reported on a dry weight basis. A statement of uncertainty for each analysis is available upon request. This laboratory report shall not be reproduced, except in full, without the written approval of Microbac Laboratories. The reported results are related only to the samples analyzed as received.

MICROBAC®

Microbac Laboratories, Inc., Newton

CERTIFICATE OF ANALYSIS

1HD1698

HLW Engineering

Todd Whipple
PO Box 314
Story City, IA 50248

Project Name: 6036

Project / PO Number: N/A
Received: 04/19/2024
Reported: 05/09/2024

Sample Summary Report

Sample Name	Laboratory ID	Client Matrix	Sample Type	Sample Begin	Sample Taken	Lab Received
MW-1	1HD1698-01	Aqueous	GRAB		04/18/24 12:05	04/19/24 11:08
MW-3R	1HD1698-02	Aqueous	GRAB		04/18/24 10:29	04/19/24 11:08
MW-4	1HD1698-03	Aqueous	GRAB		04/18/24 10:50	04/19/24 11:08
MW-5	1HD1698-04	Aqueous	GRAB		04/18/24 09:52	04/19/24 11:08
MW-7	1HD1698-05	Aqueous	GRAB		04/18/24 11:28	04/19/24 11:08
Duplicate	1HD1698-06	Aqueous	GRAB		04/18/24 00:00	04/19/24 11:08

Analytical Testing Parameters

Client Sample ID:	MW-1		
Sample Matrix:	Aqueous	**Collected By:**	Whipple, Todd
Lab Sample ID:	1HD1698-01	**Collection Date:**	04/18/2024 12:05

Determination of Volatile Organic Compounds	Result	RL	Units	DF	Note	Prepared	Analyzed	Analyst
EPA 5030B/EPA 8260B								
cis-1,2-Dichloroethylene	**1.6**	1.0	ug/L	1		04/25/24 0000	04/25/24 1839	LJS
Surrogate: Dibromofluoromethane	91.8	Limit: 80-126	% Rec	1		04/25/24 0000	04/25/24 1839	LJS
Surrogate: 1,2-Dichloroethane-d4	96.0	Limit: 63-138	% Rec	1		04/25/24 0000	04/25/24 1839	LJS
Surrogate: Toluene-d8	96.8	Limit: 87-116	% Rec	1		04/25/24 0000	04/25/24 1839	LJS
Surrogate: 4-Bromofluorobenzene	97.5	Limit: 85-111	% Rec	1		04/25/24 0000	04/25/24 1839	LJS

Determination of Inorganic Anions	Result	RL	Units	DF	Note	Prepared	Analyzed	Analyst
EPA 9056								
Chloride	**249**	10.0	mg/L	10		05/02/24 0000	05/02/24 1551	MID

Determination of Total Metals	Result	RL	Units	DF	Note	Prepared	Analyzed	Analyst
EPA 3005A/EPA 6020A								
Antimony, total	<0.0020	0.0020	mg/L	4		04/24/24 1610	04/26/24 0326	JAR
Arsenic, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0326	JAR
Barium, total	**1.10**	0.0040	mg/L	4		04/24/24 1610	04/26/24 0326	JAR
Cadmium, total	<0.0008	0.0008	mg/L	4		04/24/24 1610	04/26/24 0326	JAR
Chromium, total	<0.0080	0.0080	mg/L	4		04/24/24 1610	04/26/24 0326	JAR
Cobalt, total	**0.0036**	0.0004	mg/L	4		04/24/24 1610	04/26/24 0326	JAR
Copper, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0326	JAR
Lead, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0326	JAR
Nickel, total	**0.0259**	0.0040	mg/L	4		04/24/24 1610	04/26/24 0326	JAR
Selenium, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0326	JAR
Vanadium, total	<0.0200	0.0200	mg/L	4		04/24/24 1610	04/26/24 0326	JAR
Zinc, total	<0.0200	0.0200	mg/L	4		04/24/24 1610	04/26/24 0326	JAR

Client Sample ID: MW-3R
Sample Matrix: Aqueous
Lab Sample ID: 1HD1698-02
Collected By: Whipple, Todd
Collection Date: 04/18/2024 10:29

Determination of Total Metals	Result	RL	Units	DF	Note	Prepared	Analyzed	Analyst
EPA 3005A/EPA 6020A								
Antimony, total	<0.0020	0.0020	mg/L	4		04/24/24 1610	04/26/24 0332	JAR
Arsenic, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0332	JAR
Barium, total	**0.336**	0.0040	mg/L	4		04/24/24 1610	04/26/24 0332	JAR
Cadmium, total	<0.0008	0.0008	mg/L	4		04/24/24 1610	04/26/24 0332	JAR
Chromium, total	**0.0118**	0.0080	mg/L	4		04/24/24 1610	04/26/24 0332	JAR
Cobalt, total	<0.0004	0.0004	mg/L	4		04/24/24 1610	04/26/24 0332	JAR
Copper, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0332	JAR
Lead, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0332	JAR
Nickel, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0332	JAR
Selenium, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0332	JAR
Vanadium, total	<0.0200	0.0200	mg/L	4		04/24/24 1610	04/26/24 0332	JAR
Zinc, total	<0.0200	0.0200	mg/L	4		04/24/24 1610	04/26/24 0332	JAR

Client Sample ID: MW-4
Sample Matrix: Aqueous
Lab Sample ID: 1HD1698-03
Collected By: Whipple, Todd
Collection Date: 04/18/2024 10:50

Determination of Total Metals	Result	RL	Units	DF	Note	Prepared	Analyzed	Analyst
EPA 3005A/EPA 6020A								
Antimony, total	<0.0020	0.0020	mg/L	4		04/24/24 1610	04/26/24 0338	JAR
Arsenic, total	**0.0269**	0.0040	mg/L	4		04/24/24 1610	04/26/24 0338	JAR
Barium, total	**0.490**	0.0040	mg/L	4		04/24/24 1610	04/26/24 0338	JAR
Cadmium, total	<0.0008	0.0008	mg/L	4		04/24/24 1610	04/26/24 0338	JAR
Chromium, total	**0.0131**	0.0080	mg/L	4		04/24/24 1610	04/26/24 0338	JAR
Cobalt, total	**0.0010**	0.0004	mg/L	4		04/24/24 1610	04/26/24 0338	JAR
Copper, total	**0.0065**	0.0040	mg/L	4		04/24/24 1610	04/26/24 0338	JAR
Lead, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0338	JAR
Nickel, total	**0.0101**	0.0040	mg/L	4		04/24/24 1610	04/26/24 0338	JAR
Selenium, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0338	JAR
Vanadium, total	<0.0200	0.0200	mg/L	4		04/24/24 1610	04/26/24 0338	JAR
Zinc, total	<0.0200	0.0200	mg/L	4		04/24/24 1610	04/26/24 0338	JAR

Client Sample ID: MW-5
Sample Matrix: Aqueous
Lab Sample ID: 1HD1698-04
Collected By: Whipple, Todd
Collection Date: 04/18/2024 9:52

Determination of Total Metals	Result	RL	Units	DF	Note	Prepared	Analyzed	Analyst
EPA 3005A/EPA 6020A								
Antimony, total	<0.0020	0.0020	mg/L	4		04/24/24 1610	04/26/24 0344	JAR
Arsenic, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0344	JAR
Barium, total	**0.175**	0.0040	mg/L	4		04/24/24 1610	04/26/24 0344	JAR
Cadmium, total	<0.0008	0.0008	mg/L	4		04/24/24 1610	04/26/24 0344	JAR
Chromium, total	<0.0080	0.0080	mg/L	4		04/24/24 1610	04/26/24 0344	JAR
Cobalt, total	**0.0005**	0.0004	mg/L	4		04/24/24 1610	04/26/24 0344	JAR
Copper, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0344	JAR
Lead, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0344	JAR
Nickel, total	**0.0058**	0.0040	mg/L	4		04/24/24 1610	04/26/24 0344	JAR
Selenium, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0344	JAR
Vanadium, total	<0.0200	0.0200	mg/L	4		04/24/24 1610	04/26/24 0344	JAR
Zinc, total	<0.0200	0.0200	mg/L	4		04/24/24 1610	04/26/24 0344	JAR

Client Sample ID: MW-7
Sample Matrix: Aqueous
Lab Sample ID: 1HD1698-05
Collected By: Whipple, Todd
Collection Date: 04/18/2024 11:28

Determination of Total Metals	Result	RL	Units	DF	Note	Prepared	Analyzed	Analyst
EPA 3005A/EPA 6020A								
Antimony, total	<0.0020	0.0020	mg/L	4		04/24/24 1610	04/26/24 0351	JAR
Arsenic, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0351	JAR
Barium, total	**0.188**	0.0040	mg/L	4		04/24/24 1610	04/26/24 0351	JAR
Cadmium, total	<0.0008	0.0008	mg/L	4		04/24/24 1610	04/26/24 0351	JAR
Chromium, total	<0.0080	0.0080	mg/L	4		04/24/24 1610	04/26/24 0351	JAR
Cobalt, total	<0.0004	0.0004	mg/L	4		04/24/24 1610	04/26/24 0351	JAR
Copper, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0351	JAR
Lead, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0351	JAR
Nickel, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0351	JAR
Selenium, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0351	JAR
Vanadium, total	<0.0200	0.0200	mg/L	4		04/24/24 1610	04/26/24 0351	JAR
Zinc, total	<0.0200	0.0200	mg/L	4		04/24/24 1610	04/26/24 0351	JAR

Client Sample ID:	Duplicate		
Sample Matrix:	Aqueous	**Collected By:**	Whipple, Todd
Lab Sample ID:	1HD1698-06	**Collection Date:**	04/18/2024

Determination of Total Metals	Result	RL	Units	DF	Note	Prepared	Analyzed	Analyst
EPA 3005A/EPA 6020A								
Antimony, total	<0.0020	0.0020	mg/L	4		04/24/24 1610	04/26/24 0357	JAR
Arsenic, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0357	JAR
Barium, total	**0.333**	0.0040	mg/L	4		04/24/24 1610	04/26/24 0357	JAR
Cadmium, total	<0.0008	0.0008	mg/L	4		04/24/24 1610	04/26/24 0357	JAR
Chromium, total	**0.0118**	0.0080	mg/L	4		04/24/24 1610	04/26/24 0357	JAR
Cobalt, total	<0.0004	0.0004	mg/L	4		04/24/24 1610	04/26/24 0357	JAR
Copper, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0357	JAR
Lead, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0357	JAR
Nickel, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0357	JAR
Selenium, total	<0.0040	0.0040	mg/L	4		04/24/24 1610	04/26/24 0357	JAR
Vanadium, total	<0.0200	0.0200	mg/L	4		04/24/24 1610	04/26/24 0357	JAR
Zinc, total	<0.0200	0.0200	mg/L	4		04/24/24 1610	04/26/24 0357	JAR

Batch Log Summary

Method	Batch	Laboratory ID	Client / Source ID
EPA 6020A	1HD1478	1HD1478-BLK1	
		1HD1478-BS1	
		1HD1478-MS1	1HD0315-03RE3
		1HD1478-MSD1	1HD0315-03RE3
		1HD1478-PS1	1HD0315-03RE3
		1HD1698-01	MW-1
		1HD1698-02	MW-3R
		1HD1698-03	MW-4
		1HD1698-04	MW-5
		1HD1698-05	MW-7
		1HD1698-06	Duplicate

Method	Batch	Laboratory ID	Client / Source ID
EPA 8260B	1HD1572	1HD1572-BS1	
		1HD1572-BS1	
		1HD1572-BSD1	
		1HD1572-BSD1	
		1HD1572-BLK1	
		1HD1572-BLK1	
		1HD1698-01	MW-1
		1HD1698-01	MW-1
		1HD1572-MS1	1HD1698-01
		1HD1572-MS1	1HD1698-01
		1HD1572-MSD1	1HD1698-01
		1HD1572-MSD1	1HD1698-01

Method	Batch	Laboratory ID	Client / Source ID
EPA 9056	1HE0195	1HE0195-BLK1	
		1HE0195-MRL1	
		1HE0195-BS1	
		1HE0195-BSD1	
		1HE0195-MS1	1HD1652-01
		1HE0195-MSD1	1HD1652-01
		1HD1698-01	MW-1
		1HE0195-BLK2	

Batch Quality Control Summary: Microbac Laboratories, Inc., Newton

Determination of Volatile Organic Compounds	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes

Batch 1HD1572 - EPA 5030B - EPA 8260B

Determination of Volatile Organic Compounds	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Blank (1HD1572-BLK1)			Prepared: 04/25/24 00:00 Analyzed: 04/25/24 10:53							
cis-1,2-Dichloroethylene	<1.0	1.0	ug/L							
Surrogate: Dibromofluoromethane	*45.9*		ug/L	*50.2*		*91.4*	*80-126*			
Surrogate: 1,2-Dichloroethane-d4	*47.5*		ug/L	*50.1*		*94.9*	*63-138*			
Surrogate: Toluene-d8	*49.0*		ug/L	*50.4*		*97.2*	*87-116*			
Surrogate: 4-Bromofluorobenzene	*48.4*		ug/L	*50.1*		*96.6*	*85-111*			
LCS (1HD1572-BS1)			Prepared: 04/25/24 00:00 Analyzed: 04/25/24 09:45							
cis-1,2-Dichloroethylene	44.41	1.0	ug/L	50.0		88.8	81-137			
Surrogate: Dibromofluoromethane	*46.3*		ug/L	*50.2*		*92.2*	*80-126*			
Surrogate: 1,2-Dichloroethane-d4	*46.8*		ug/L	*50.1*		*93.5*	*63-138*			
Surrogate: Toluene-d8	*49.6*		ug/L	*50.4*		*98.3*	*87-116*			
Surrogate: 4-Bromofluorobenzene	*50.0*		ug/L	*50.1*		*99.8*	*85-111*			
LCS Dup (1HD1572-BSD1)			Prepared: 04/25/24 00:00 Analyzed: 04/25/24 10:07							
cis-1,2-Dichloroethylene	52.28	1.0	ug/L	50.0		105	81-137	16.3	27	
Surrogate: Dibromofluoromethane	*46.2*		ug/L	*50.2*		*92.2*	*80-126*			
Surrogate: 1,2-Dichloroethane-d4	*46.2*		ug/L	*50.1*		*92.2*	*63-138*			
Surrogate: Toluene-d8	*49.4*		ug/L	*50.4*		*98.0*	*87-116*			
Surrogate: 4-Bromofluorobenzene	*50.3*		ug/L	*50.1*		*100*	*85-111*			
Matrix Spike (1HD1572-MS1)	**Source: 1HD1698-01**		Prepared: 04/25/24 00:00 Analyzed: 04/25/24 19:02							
cis-1,2-Dichloroethylene	546.4	10.0	ug/L	505	ND	108	67-153			
Surrogate: Dibromofluoromethane	*467*		ug/L	*502*		*93.2*	*80-126*			
Surrogate: 1,2-Dichloroethane-d4	*474*		ug/L	*501*		*94.7*	*63-138*			
Surrogate: Toluene-d8	*499*		ug/L	*504*		*99.0*	*87-116*			
Surrogate: 4-Bromofluorobenzene	*500*		ug/L	*501*		*99.6*	*85-111*			
Matrix Spike Dup (1HD1572-MSD1)	**Source: 1HD1698-01**		Prepared: 04/25/24 00:00 Analyzed: 04/25/24 19:25							
cis-1,2-Dichloroethylene	527.8	10.0	ug/L	505	ND	105	67-153	3.46	22	
Surrogate: Dibromofluoromethane	*471*		ug/L	*502*		*93.8*	*80-126*			
Surrogate: 1,2-Dichloroethane-d4	*473*		ug/L	*501*		*94.4*	*63-138*			
Surrogate: Toluene-d8	*498*		ug/L	*504*		*98.8*	*87-116*			
Surrogate: 4-Bromofluorobenzene	*500*		ug/L	*501*		*99.8*	*85-111*			

Determination of Inorganic Anions	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1HE0195 - General Prep HPLC/IC - EPA 9056										
Blank (1HE0195-BLK1)			Prepared: 05/02/24 00:00 Analyzed: 05/02/24 10:15							
Chloride	<1.0	1.0	mg/L							
Blank (1HE0195-BLK2)			Prepared: 05/02/24 00:00 Analyzed: 05/02/24 16:59							
Chloride	<1.0	1.0	mg/L							
LCS (1HE0195-BS1)			Prepared: 05/02/24 00:00 Analyzed: 05/02/24 11:00							
Chloride	15.33	1.0	mg/L	15.4		99.2	80-120			

Determination of Inorganic Anions	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1HE0195 - General Prep HPLC/IC - EPA 9056										
LCS Dup (1HE0195-BSD1)			Prepared: 05/02/24 00:00 Analyzed: 05/02/24 11:23							
Chloride	15.09	1.0	mg/L	15.4		97.6	80-120	1.61	10	
Matrix Spike (1HE0195-MS1)	**Source: 1HD1652-01**		Prepared: 05/02/24 00:00 Analyzed: 05/02/24 13:15							
Chloride	291.2	10.0	mg/L	154	142.9	96.0	81-116			
Matrix Spike Dup (1HE0195-MSD1)	**Source: 1HD1652-01**		Prepared: 05/02/24 00:00 Analyzed: 05/02/24 13:37							
Chloride	291.5	10.0	mg/L	154	142.9	96.2	81-116	0.0858	10	

Determination of Total Metals	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1HD1478 - EPA 3005A Total Recoverable Metals - EPA 6020A										
Blank (1HD1478-BLK1)			Prepared: 04/24/24 16:10 Analyzed: 04/26/24 01:29							
Antimony, total	<0.0020	0.0020	mg/L							
Arsenic, total	<0.0040	0.0040	mg/L							
Barium, total	<0.0040	0.0040	mg/L							
Cadmium, total	<0.0008	0.0008	mg/L							
Chromium, total	<0.0080	0.0080	mg/L							
Cobalt, total	<0.0004	0.0004	mg/L							
Copper, total	<0.0040	0.0040	mg/L							
Lead, total	<0.0040	0.0040	mg/L							
Nickel, total	<0.0040	0.0040	mg/L							
Selenium, total	<0.0040	0.0040	mg/L							
Vanadium, total	<0.0200	0.0200	mg/L							
Zinc, total	<0.0200	0.0200	mg/L							
LCS (1HD1478-BS1)			Prepared: 04/24/24 16:10 Analyzed: 04/26/24 01:47							
Antimony, total	0.0956	0.0020	mg/L	0.100		95.6	80-120			
Arsenic, total	0.100	0.0040	mg/L	0.100		100	80-120			
Barium, total	0.110	0.0040	mg/L	0.100		110	80-120			
Cadmium, total	0.0986	0.0008	mg/L	0.100		98.6	80-120			
Chromium, total	0.0969	0.0080	mg/L	0.100		96.9	80-120			
Cobalt, total	0.103	0.0004	mg/L	0.100		103	80-120			
Copper, total	0.105	0.0040	mg/L	0.100		105	80-120			
Lead, total	0.102	0.0040	mg/L	0.100		102	80-120			
Nickel, total	0.102	0.0040	mg/L	0.100		102	80-120			
Selenium, total	0.1045	0.0040	mg/L	0.100		104	80-120			
Vanadium, total	0.0974	0.0200	mg/L	0.100		97.4	80-120			
Zinc, total	0.105	0.0200	mg/L	0.100		105	80-120			
Matrix Spike (1HD1478-MS1)	**Source: 1HD0315-03RE3**		Prepared: 04/24/24 16:10 Analyzed: 04/26/24 02:00							
Antimony, total	0.0956	0.0020	mg/L	0.100	ND	95.6	75-125			
Arsenic, total	0.101	0.0040	mg/L	0.100	0.0015	99.6	75-125			
Barium, total	0.356	0.0040	mg/L	0.100	0.262	94.0	75-125			
Cadmium, total	0.0955	0.0008	mg/L	0.100	ND	95.5	75-125			
Chromium, total	0.0944	0.0080	mg/L	0.100	0.0007	93.6	75-125			

Determination of Total Metals	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1HD1478 - EPA 3005A Total Recoverable Metals - EPA 6020A										
Matrix Spike (1HD1478-MS1)	**Source: 1HD0315-03RE3**			Prepared: 04/24/24 16:10 Analyzed: 04/26/24 02:00						
Cobalt, total	0.101	0.0004	mg/L	0.100	ND	101	75-125			
Copper, total	0.251	0.0040	mg/L	0.100	0.135	116	75-125			
Lead, total	0.0986	0.0040	mg/L	0.100	ND	98.6	75-125			
Nickel, total	0.0998	0.0040	mg/L	0.100	ND	99.8	75-125			
Selenium, total	0.1018	0.0040	mg/L	0.100	ND	102	75-125			
Vanadium, total	0.102	0.0200	mg/L	0.100	ND	102	75-125			
Zinc, total	0.103	0.0200	mg/L	0.100	ND	103	75-125			
Matrix Spike Dup (1HD1478-MSD1)	**Source: 1HD0315-03RE3**			Prepared: 04/24/24 16:10 Analyzed: 04/26/24 02:06						
Antimony, total	0.0972	0.0020	mg/L	0.100	ND	97.2	75-125	1.65	20	
Arsenic, total	0.103	0.0040	mg/L	0.100	0.0015	101	75-125	1.43	20	
Barium, total	0.366	0.0040	mg/L	0.100	0.262	104	75-125	2.91	20	
Cadmium, total	0.0963	0.0008	mg/L	0.100	ND	96.3	75-125	0.835	20	
Chromium, total	0.0954	0.0080	mg/L	0.100	0.0007	94.6	75-125	1.07	20	
Cobalt, total	0.104	0.0004	mg/L	0.100	ND	104	75-125	2.44	20	
Copper, total	0.339	0.0040	mg/L	0.100	0.135	204	75-125	29.8	20	QM-07
Lead, total	0.0999	0.0040	mg/L	0.100	ND	99.9	75-125	1.22	20	
Nickel, total	0.102	0.0040	mg/L	0.100	ND	102	75-125	2.55	20	
Selenium, total	0.1011	0.0040	mg/L	0.100	ND	101	75-125	0.694	20	
Vanadium, total	0.102	0.0200	mg/L	0.100	ND	102	75-125	0.427	20	
Zinc, total	0.104	0.0200	mg/L	0.100	ND	104	75-125	1.05	20	
Post Spike (1HD1478-PS1)	**Source: 1HD0315-03RE3**			Prepared: 04/24/24 16:10 Analyzed: 04/26/24 02:12						
Antimony, total	0.0750		mg/L	0.0800	0.0002	93.5	80-120			
Arsenic, total	0.0818		mg/L	0.0800	0.0015	100	80-120			
Barium, total	0.343		mg/L	0.0800	0.262	102	80-120			
Cadmium, total	0.0747		mg/L	0.0800	0.00004	93.3	80-120			
Chromium, total	0.0758		mg/L	0.0800	0.0007	93.8	80-120			
Cobalt, total	0.0831		mg/L	0.0800	0.00008	104	80-120			
Copper, total	0.214		mg/L	0.0800	0.135	98.3	80-120			
Lead, total	0.0797		mg/L	0.0800	0.0001	99.4	80-120			
Nickel, total	0.0816		mg/L	0.0800	0.0006	101	80-120			
Selenium, total	0.0760		mg/L	0.0800	0.0002	94.8	80-120			
Vanadium, total	0.0836		mg/L	0.0800	0.0056	97.5	80-120			
Zinc, total	0.0840		mg/L	0.0800	0.0075	95.6	80-120			

Definitions

QM-07: The spike recovery and/or RPD was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
RL: Reporting Limit
RPD: Relative Percent Difference

Cooler Receipt Log

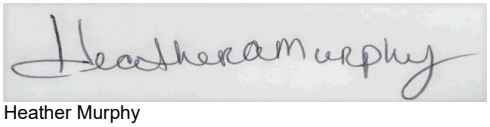
Cooler ID: Default Cooler Temp: 1.3°C

Cooler Inspection Checklist

Custody Seals	No	Containers Intact	Yes
COC/Labels Agree	Yes	Preservation Confirmed	No
Received On Ice	Yes		

Report Comments

Reviewed and Approved By:



Heather Murphy
Customer Relationship Specialist
heather.murphy@microbac.com
05/09/24 11:54

CHAIN OF CUSTODY RECORD

Keystone LABORATORIES
A Microbac Company

600 East 17th Street South
Newton, IA 50208
~~641-792-9451~~

1HD1698

HLW Engineering
PM: Heather Murphy

SITE INFORMATION

Sampler: Todd Whipple

Project: Monona Co

6030

REPORT TO

Todd Whipple
HLW Engineering
PO Box 314
Story City, IA 50248

Logan Persinger
Monona County Sanitary Landfill
31342 Hwy 37
Turin, IA 51040

SPECIAL INSTRUCTIONS

None

Turn Around Time

☐ Standard ☐ RUSH, need by ___/___/___

LAB USE ONLY

Work Order 1HD1698

Temperature 1.3

Turn-Cooler: No

- ☐ Custody Seal
- ☒ Containers Intact
- ☐ COC/Labels Agree
- ☐ Preservation Confirmed
- ☒ Received on Ice

Number	Sample Identification / Client ID	Matrix	Sample Type	Date	Time	Number of Containers	Analyses	Lab Sample Number
-001	MW-1	Water	GRAB	4/18/24	12:05	5	8260@cis-1,2-dce as-t-6020 cd-t-6020 co-t-6020 cu-t-6020 pb-t-6020 se-t-6020 zn-t-6020 8260-base-analysis ba-t-6020 cl-9056-w cr-t-6020 ni-t-6020 sb-t-6020 v-t-6020	01
-001	MW-3R	Water	GRAB	4/18/24	10:29	1	as-t-6020 cd-t-6020 cr-t-6020 ni-t-6020 sb-t-6020 v-t-6020 ba-t-6020 co-t-6020 cu-t-6020 pb-t-6020 se-t-6020 zn-t-6020	02

Todd Whipple 4/19/24
Relinquished By Date/Time

Received By Date/Time

Relinquished By Date/Time

Schuka 4/19/24 11:08
Received for Lab By Date/Time

Remarks:

Original - Lab Copy Yellow - Sampler Copy

CHAIN OF CUSTODY RECORD

Keystone LABORATORIES
A Microbac Company

600 East 17th Street South
Newton, IA 50208
~~641-792-9451~~

1HD1698

HLW Engineering
PM: Heather Murphy

www.keystonelabs.com

SITE INFORMATION

Sampler: Todd Whipple

Project: Monona Co
0036

REPORT TO

Todd Whipple
HLW Engineering
PO Box 314
Story City, IA 50248

INVOICE TO

Logan Persinger
Monona County Sanitary Landfill
31342 Hwy 37
Turin, IA 51040

SPECIAL INSTRUCTIONS

None

Turn Around Time

☐ Standard ☐ RUSH, need by ___/___/___

LAB USE ONLY

Work Order 1HD1698

Temperature 1.3

Turn-Cooler: No

- ☐ Custody Seal
- ☐ Containers Intact
- ☐ COC/Labels Agree
- ☐ Preservation Confirmed
- ☒ Received on Ice

Number	Sample Identification / Client ID	Matrix	Sample Type	Date	Time	Number of Containers	Analyses	Lab Sample Number
-001	MW-4	Water	GRAB	4/18/24	10:50	1	as-t-6020, ba-t-6020, cd-t-6020, co-t-6020, cr-t-6020, cu-t-6020, ni-t-6020, pb-t-6020, sb-t-6020, se-t-6020, v-t-6020, zn-t-6020	03
-001	MW-5	Water	GRAB	4/18/24	9:52	1	as-t-6020, ba-t-6020, cd-t-6020, co-t-6020, cr-t-6020, cu-t-6020, ni-t-6020, pb-t-6020, sb-t-6020, se-t-6020, v-t-6020, zn-t-6020	04

Relinquished By [signature] Date/Time 4/19/24

Received By Date/Time

Relinquished By Date/Time

Received for Lab By [signature] Date/Time 4/19/24 11:08

Remarks:

Original - Lab Copy Yellow - Sampler Copy

CHAIN OF CUSTODY RECORD

Keystone LABORATORIES
A Microbac Company

600 East 17th Street S
Newton, IA 50208
~~641-792-9451~~

1HD1698

HLW Engineering
PM: Heather Murphy

SITE INFORMATION

Sampler: Todds Whipple

Project: Monona Co

0000

REPORT TO

Todd Whipple
HLW Engineering
PO Box 314
Story City, IA 50248

INVOICE TO

Logan Persinger
Monona County Sanitary Landfill
31342 Hwy 37
Turin, IA 51040

SPECIAL INSTRUCTIONS

None

Turn Around Time

☐ Standard ☐ RUSH, need by ___/___/___

LAB USE ONLY

Work Order 1HD1698
Temperature 1.3
Turn-Cooler: No

☐ Custody Seal
☐ Containers Intact
☐ COC/Labels Agree
☐ Preservation Confirmed
☒ Received on Ice

Number	Sample Identification / Client ID	Matrix	Sample Type	Date	Time	Number of Containers	Analyses	Lab Sample Number
-001	MW-7	Water	GRAB	4/18/24	11:28	1	as-t-6020, ba-t-6020, cd-t-6020, co-t-6020, cr-t-6020, cu-t-6020, ni-t-6020, pb-t-6020, sb-t-6020, se-t-6020, v-t-6020, zn-t-6020	05
-001	Duplicate	Water	GRAB	4/18/24	✓	1	as-t-6020, ba-t-6020, cd-t-6020, co-t-6020, cr-t-6020, cu-t-6020, ni-t-6020, pb-t-6020, sb-t-6020, se-t-6020, v-t-6020, zn-t-6020	06

Relinquished By: Todd Whipple Date/Time: 4/19/24

Received By ____ Date/Time ____

Relinquished By ____ Date/Time ____

Received for Lab By: [signature] Date/Time: 4/19/24 11:09

Remarks:

Original - Lab Copy Yellow - Sampler Copy

Microbac Laboratories, Inc., Newton

CERTIFICATE OF ANALYSIS

1HJ1528

Project Description

6036

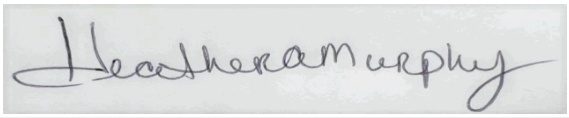
For:

Todd Whipple

HLW Engineering

204 West Broad St

Story City, IA 50248



Heather Murphy

Customer Relationship Specialist

Monday, November 4, 2024

Please find enclosed the analytical results for the samples you submitted to Microbac Laboratories. Review and compilation of your report was completed by Microbac Laboratories, Inc., Newton. If you have any questions, comments, or require further assistance regarding this report, please contact your service representative listed above.

I certify that all test results meet all of the requirements of the accrediting authority listed within this report. Analytical results are reported on a 'as received' basis unless specified otherwise. Analytical results for solids with units ending in (dry) are reported on a dry weight basis. A statement of uncertainty for each analysis is available upon request. This laboratory report shall not be reproduced, except in full, without the written approval of Microbac Laboratories. The reported results are related only to the samples analyzed as received.

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Microbac Laboratories, Inc., Newton

CERTIFICATE OF ANALYSIS

1HJ1528

HLW Engineering

Todd Whipple
204 West Broad St
Story City, IA 50248

Project Name: 6036

Project / PO Number: N/A
Received: 10/18/2024
Reported: 11/04/2024

Sample Summary Report

Sample Name	Laboratory ID	Client Matrix	Sample Type	Sample Begin	Sample Taken	Lab Received
MW-1	1HJ1528-01	Aqueous	GRAB		10/17/24 10:15	10/18/24 10:44
MW-3R	1HJ1528-02	Aqueous	GRAB		10/17/24 09:56	10/18/24 10:44
MW-5	1HJ1528-03	Aqueous	GRAB		10/17/24 09:08	10/18/24 10:44
MW-7	1HJ1528-04	Aqueous	GRAB		10/17/24 10:32	10/18/24 10:44
Duplicate	1HJ1528-05	Aqueous	GRAB		10/17/24 00:00	10/18/24 10:44

Analytical Testing Parameters

Client Sample ID:	MW-1		
Sample Matrix:	Aqueous	**Collected By:**	Whipple, Todd
Lab Sample ID:	1HJ1528-01	**Collection Date:**	10/17/2024 10:15

Determination of Volatile Organic Compounds	Result	RL	Units	DF	Note	Prepared	Analyzed	Analyst
EPA 5030B/EPA 8260B								
cis-1,2-Dichloroethylene	**1.2**	1.0	ug/L	1		10/28/24 0000	10/28/24 1600	CSM
Surrogate: Dibromofluoromethane	96.5	Limit: 57-134	% Rec	1		10/28/24 0000	10/28/24 1600	CSM
Surrogate: 1,2-Dichloroethane-d4	93.0	Limit: 53-140	% Rec	1		10/28/24 0000	10/28/24 1600	CSM
Surrogate: Toluene-d8	96.0	Limit: 86-114	% Rec	1		10/28/24 0000	10/28/24 1600	CSM
Surrogate: 4-Bromofluorobenzene	94.4	Limit: 78-121	% Rec	1		10/28/24 0000	10/28/24 1600	CSM

Determination of Inorganic Anions	Result	RL	Units	DF	Note	Prepared	Analyzed	Analyst
EPA 9056								
Chloride	**239**	5.0	mg/L	5		10/31/24 0000	10/31/24 2051	EPP

Determination of Total Metals	Result	RL	Units	DF	Note	Prepared	Analyzed	Analyst
EPA 3005A/EPA 6020A								
Antimony, total	<0.0020	0.0020	mg/L	4		10/22/24 0806	10/22/24 2244	RVV
Arsenic, total	<0.0040	0.0040	mg/L	4		10/22/24 0806	10/22/24 2244	RVV
Barium, total	**0.895**	0.0040	mg/L	4		10/22/24 0806	10/22/24 2244	RVV
Cadmium, total	<0.0008	0.0008	mg/L	4		10/22/24 0806	10/22/24 2244	RVV
Chromium, total	<0.0080	0.0080	mg/L	4		10/22/24 0806	10/22/24 2244	RVV
Cobalt, total	**0.0036**	0.0004	mg/L	4		10/22/24 0806	10/22/24 2244	RVV
Copper, total	<0.0040	0.0040	mg/L	4		10/22/24 0806	10/22/24 2244	RVV
Lead, total	<0.0040	0.0040	mg/L	4		10/22/24 0806	10/22/24 2244	RVV
Nickel, total	**0.0219**	0.0040	mg/L	4		10/22/24 0806	10/22/24 2244	RVV
Selenium, total	<0.0040	0.0040	mg/L	4		10/22/24 0806	10/22/24 2244	RVV
Vanadium, total	<0.0200	0.0200	mg/L	4		10/22/24 0806	10/22/24 2244	RVV
Zinc, total	<0.0200	0.0200	mg/L	4		10/22/24 0806	10/22/24 2244	RVV

Client Sample ID: MW-3R
Sample Matrix: Aqueous
Lab Sample ID: 1HJ1528-02
Collected By: Whipple, Todd
Collection Date: 10/17/2024 9:56

Determination of Total Metals	Result	RL	Units	DF	Note	Prepared	Analyzed	Analyst
EPA 3005A/EPA 6020A								
Antimony, total	<0.0020	0.0020	mg/L	4		10/22/24 0806	10/22/24 2250	RVV
Arsenic, total	<0.0040	0.0040	mg/L	4		10/22/24 0806	10/22/24 2250	RVV
Barium, total	**0.319**	0.0040	mg/L	4		10/22/24 0806	10/22/24 2250	RVV
Cadmium, total	<0.0008	0.0008	mg/L	4		10/22/24 0806	10/22/24 2250	RVV
Chromium, total	**0.0125**	0.0080	mg/L	4		10/22/24 0806	10/22/24 2250	RVV
Cobalt, total	<0.0004	0.0004	mg/L	4		10/22/24 0806	10/22/24 2250	RVV
Copper, total	<0.0040	0.0040	mg/L	4		10/22/24 0806	10/22/24 2250	RVV
Lead, total	<0.0040	0.0040	mg/L	4		10/22/24 0806	10/22/24 2250	RVV
Nickel, total	<0.0040	0.0040	mg/L	4		10/22/24 0806	10/22/24 2250	RVV
Selenium, total	<0.0040	0.0040	mg/L	4		10/22/24 0806	10/22/24 2250	RVV
Vanadium, total	<0.0200	0.0200	mg/L	4		10/22/24 0806	10/22/24 2250	RVV
Zinc, total	<0.0200	0.0200	mg/L	4		10/22/24 0806	10/22/24 2250	RVV

Client Sample ID: MW-5
Sample Matrix: Aqueous
Lab Sample ID: 1HJ1528-03
Collected By: Whipple, Todd
Collection Date: 10/17/2024 9:08

Determination of Total Metals	Result	RL	Units	DF	Note	Prepared	Analyzed	Analyst
EPA 3005A/EPA 6020A								
Antimony, total	<0.0020	0.0020	mg/L	4		10/22/24 0806	10/22/24 2256	RVV
Arsenic, total	<0.0040	0.0040	mg/L	4		10/22/24 0806	10/22/24 2256	RVV
Barium, total	**0.150**	0.0040	mg/L	4		10/22/24 0806	10/22/24 2256	RVV
Cadmium, total	<0.0008	0.0008	mg/L	4		10/22/24 0806	10/22/24 2256	RVV
Chromium, total	<0.0080	0.0080	mg/L	4		10/22/24 0806	10/22/24 2256	RVV
Cobalt, total	**0.0005**	0.0004	mg/L	4		10/22/24 0806	10/22/24 2256	RVV
Copper, total	<0.0040	0.0040	mg/L	4		10/22/24 0806	10/22/24 2256	RVV
Lead, total	<0.0040	0.0040	mg/L	4		10/22/24 0806	10/22/24 2256	RVV
Nickel, total	<0.0040	0.0040	mg/L	4		10/22/24 0806	10/22/24 2256	RVV
Selenium, total	<0.0040	0.0040	mg/L	4		10/22/24 0806	10/22/24 2256	RVV
Vanadium, total	<0.0200	0.0200	mg/L	4		10/22/24 0806	10/22/24 2256	RVV
Zinc, total	<0.0200	0.0200	mg/L	4		10/22/24 0806	10/22/24 2256	RVV

Client Sample ID: MW-7
Sample Matrix: Aqueous
Lab Sample ID: 1HJ1528-04
Collected By: Whipple, Todd
Collection Date: 10/17/2024 10:32

Determination of Total Metals	Result	RL	Units	DF	Note	Prepared	Analyzed	Analyst
EPA 3005A/EPA 6020A								
Antimony, total	<0.0020	0.0020	mg/L	4		10/22/24 0806	10/22/24 2302	RVV
Arsenic, total	<0.0040	0.0040	mg/L	4		10/22/24 0806	10/22/24 2302	RVV
Barium, total	**0.170**	0.0040	mg/L	4		10/22/24 0806	10/22/24 2302	RVV
Cadmium, total	<0.0008	0.0008	mg/L	4		10/22/24 0806	10/22/24 2302	RVV
Chromium, total	<0.0080	0.0080	mg/L	4		10/22/24 0806	10/22/24 2302	RVV
Cobalt, total	<0.0004	0.0004	mg/L	4		10/22/24 0806	10/22/24 2302	RVV
Copper, total	**0.0098**	0.0040	mg/L	4		10/22/24 0806	10/22/24 2302	RVV
Lead, total	<0.0040	0.0040	mg/L	4		10/22/24 0806	10/22/24 2302	RVV
Nickel, total	**0.0070**	0.0040	mg/L	4		10/22/24 0806	10/22/24 2302	RVV
Selenium, total	<0.0040	0.0040	mg/L	4		10/22/24 0806	10/22/24 2302	RVV
Vanadium, total	<0.0200	0.0200	mg/L	4		10/22/24 0806	10/22/24 2302	RVV
Zinc, total	<0.0200	0.0200	mg/L	4		10/22/24 0806	10/22/24 2302	RVV

Client Sample ID: Duplicate
Sample Matrix: Aqueous
Lab Sample ID: 1HJ1528-05
Collected By: Whipple, Todd
Collection Date: 10/17/2024

Determination of Total Metals	Result	RL	Units	DF	Note	Prepared	Analyzed	Analyst
EPA 3005A/EPA 6020A								
Antimony, total	<0.0020	0.0020	mg/L	4		10/22/24 0806	10/22/24 2321	RVV
Arsenic, total	<0.0040	0.0040	mg/L	4		10/22/24 0806	10/22/24 2321	RVV
Barium, total	**0.930**	0.0040	mg/L	4		10/22/24 0806	10/22/24 2321	RVV
Cadmium, total	<0.0008	0.0008	mg/L	4		10/22/24 0806	10/22/24 2321	RVV
Chromium, total	<0.0080	0.0080	mg/L	4		10/22/24 0806	10/22/24 2321	RVV
Cobalt, total	**0.0043**	0.0004	mg/L	4		10/22/24 0806	10/22/24 2321	RVV
Copper, total	<0.0040	0.0040	mg/L	4		10/22/24 0806	10/22/24 2321	RVV
Lead, total	<0.0040	0.0040	mg/L	4		10/22/24 0806	10/22/24 2321	RVV
Nickel, total	**0.0257**	0.0040	mg/L	4		10/22/24 0806	10/22/24 2321	RVV
Selenium, total	<0.0040	0.0040	mg/L	4		10/22/24 0806	10/22/24 2321	RVV
Vanadium, total	<0.0200	0.0200	mg/L	4		10/22/24 0806	10/22/24 2321	RVV
Zinc, total	<0.0200	0.0200	mg/L	4		10/22/24 0806	10/22/24 2321	RVV

Batch Log Summary

Method	Batch	Laboratory ID	Client / Source ID
EPA 6020A	1HJ1261	1HJ1261-BLK1	
		1HJ1261-BS1	
		1HJ1261-MS1	1HJ1342-01
		1HJ1261-MSD1	1HJ1342-01
		1HJ1261-PS1	1HJ1342-01
		1HJ1528-01	MW-1
		1HJ1528-02	MW-3R
		1HJ1528-03	MW-5
		1HJ1528-04	MW-7
		1HJ1528-05	Duplicate

Method	Batch	Laboratory ID	Client / Source ID
EPA 8260B	1HJ1707	1HJ1707-BS1	
		1HJ1707-BS1	
		1HJ1707-BSD1	
		1HJ1707-BSD1	
		1HJ1707-BLK1	
		1HJ1707-BLK1	
		1HJ1528-01	MW-1
		1HJ1528-01	MW-1
		1HJ1707-MS1	1HJ1376-03
		1HJ1707-MS1	1HJ1376-03
		1HJ1707-MSD1	1HJ1376-03
		1HJ1707-MSD1	1HJ1376-03

Method	Batch	Laboratory ID	Client / Source ID
EPA 9056	1HK0019	1HK0019-BLK1	
		1HK0019-BS1	
		1HK0019-BSD1	
		1HK0019-MS1	1HJ1373-01
		1HK0019-MSD1	1HJ1373-01
		1HK0019-BLK2	
		1HJ1528-01	MW-1

Batch Quality Control Summary: Microbac Laboratories, Inc., Newton

Determination of Volatile Organic Compounds	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1HJ1707 - EPA 5030B - EPA 8260B										
Blank (1HJ1707-BLK1)	Prepared: 10/28/24 00:00 Analyzed: 10/28/24 10:22									

Determination of Volatile Organic Compounds	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1HJ1707 - EPA 5030B - EPA 8260B										
Blank (1HJ1707-BLK1)			Prepared: 10/28/24 00:00 Analyzed: 10/28/24 10:22							
cis-1,2-Dichloroethylene	<1.0	1.0	ug/L							
Surrogate: Dibromofluoromethane	*46.2*		ug/L	*50.2*		*92.0*	*57-134*			
Surrogate: 1,2-Dichloroethane-d4	*44.2*		ug/L	*50.4*		*87.9*	*53-140*			
Surrogate: Toluene-d8	*48.3*		ug/L	*50.5*		*95.8*	*86-114*			
Surrogate: 4-Bromofluorobenzene	*47.8*		ug/L	*50.2*		*95.2*	*78-121*			
LCS (1HJ1707-BS1)			Prepared: 10/28/24 00:00 Analyzed: 10/28/24 08:51							
cis-1,2-Dichloroethylene	38.64	1.0	ug/L	50.4		76.7	65-149			
Surrogate: Dibromofluoromethane	*44.9*		ug/L	*50.2*		*89.5*	*57-134*			
Surrogate: 1,2-Dichloroethane-d4	*43.3*		ug/L	*50.4*		*86.1*	*53-140*			
Surrogate: Toluene-d8	*48.7*		ug/L	*50.5*		*96.5*	*86-114*			
Surrogate: 4-Bromofluorobenzene	*49.2*		ug/L	*50.2*		*98.0*	*78-121*			
LCS Dup (1HJ1707-BSD1)			Prepared: 10/28/24 00:00 Analyzed: 10/28/24 09:14							
cis-1,2-Dichloroethylene	37.91	1.0	ug/L	50.4		75.3	65-149	1.91	30	
Surrogate: Dibromofluoromethane	*45.2*		ug/L	*50.2*		*90.1*	*57-134*			
Surrogate: 1,2-Dichloroethane-d4	*43.1*		ug/L	*50.4*		*85.6*	*53-140*			
Surrogate: Toluene-d8	*48.8*		ug/L	*50.5*		*96.8*	*86-114*			
Surrogate: 4-Bromofluorobenzene	*49.6*		ug/L	*50.2*		*98.8*	*78-121*			
Matrix Spike (1HJ1707-MS1)	**Source: 1HJ1376-03**		Prepared: 10/28/24 00:00 Analyzed: 10/28/24 19:07							
cis-1,2-Dichloroethylene	384.6	10.0	ug/L	504	ND	76.4	47-162			
Surrogate: Dibromofluoromethane	*488*		ug/L	*502*		*97.3*	*57-134*			
Surrogate: 1,2-Dichloroethane-d4	*465*		ug/L	*504*		*92.3*	*53-140*			
Surrogate: Toluene-d8	*493*		ug/L	*505*		*97.7*	*86-114*			
Surrogate: 4-Bromofluorobenzene	*486*		ug/L	*502*		*96.9*	*78-121*			
Matrix Spike Dup (1HJ1707-MSD1)	**Source: 1HJ1376-03**		Prepared: 10/28/24 00:00 Analyzed: 10/28/24 19:30							
cis-1,2-Dichloroethylene	433.5	10.0	ug/L	504	ND	86.1	47-162	12.0	22	
Surrogate: Dibromofluoromethane	*495*		ug/L	*502*		*98.6*	*57-134*			
Surrogate: 1,2-Dichloroethane-d4	*463*		ug/L	*504*		*91.9*	*53-140*			
Surrogate: Toluene-d8	*492*		ug/L	*505*		*97.5*	*86-114*			
Surrogate: 4-Bromofluorobenzene	*490*		ug/L	*502*		*97.6*	*78-121*			

Determination of Inorganic Anions	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1HK0019 - General Prep HPLC/IC - EPA 9056										
Blank (1HK0019-BLK1)			Prepared: 10/31/24 00:00 Analyzed: 10/31/24 10:18							
Chloride	<1.0	1.0	mg/L							
Blank (1HK0019-BLK2)			Prepared: 10/31/24 00:00 Analyzed: 10/31/24 19:20							
Chloride	<1.0	1.0	mg/L							
LCS (1HK0019-BS1)			Prepared: 10/31/24 00:00 Analyzed: 10/31/24 15:06							

Determination of Inorganic Anions	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1HK0019 - General Prep HPLC/IC - EPA 9056										
LCS (1HK0019-BS1)				Prepared: 10/31/24 00:00 Analyzed: 10/31/24 15:06						
Chloride	15.59	1.0	mg/L	15.3		102	80-120			
LCS Dup (1HK0019-BSD1)				Prepared: 10/31/24 00:00 Analyzed: 10/31/24 15:24						
Chloride	15.44	1.0	mg/L	15.3		101	80-120	0.980	10	
Matrix Spike (1HK0019-MS1)	**Source: 1HJ1373-01**			Prepared: 10/31/24 00:00 Analyzed: 10/31/24 16:55						
Chloride	318.2	5.0	mg/L	76.5	247.8	92.1	81-116			
Matrix Spike Dup (1HK0019-MSD1)	**Source: 1HJ1373-01**			Prepared: 10/31/24 00:00 Analyzed: 10/31/24 17:13						
Chloride	318.4	5.0	mg/L	76.5	247.8	92.3	81-116	0.0644	10	

Determination of Total Metals	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1HJ1261 - EPA 3005A Total Recoverable Metals - EPA 6020A										
Blank (1HJ1261-BLK1)				Prepared: 10/22/24 08:06 Analyzed: 10/22/24 20:17						
Antimony, total	<0.0020	0.0020	mg/L							
Arsenic, total	<0.0040	0.0040	mg/L							
Barium, total	<0.0040	0.0040	mg/L							
Cadmium, total	<0.0008	0.0008	mg/L							
Chromium, total	<0.0080	0.0080	mg/L							
Cobalt, total	<0.0004	0.0004	mg/L							
Copper, total	<0.0040	0.0040	mg/L							
Lead, total	<0.0040	0.0040	mg/L							
Nickel, total	<0.0040	0.0040	mg/L							
Selenium, total	<0.0040	0.0040	mg/L							
Vanadium, total	<0.0200	0.0200	mg/L							
Zinc, total	<0.0200	0.0200	mg/L							
LCS (1HJ1261-BS1)				Prepared: 10/22/24 08:06 Analyzed: 10/22/24 20:23						
Antimony, total	0.0960	0.0020	mg/L	0.100		96.0	80-120			
Arsenic, total	0.0956	0.0040	mg/L	0.100		95.6	80-120			
Barium, total	0.106	0.0040	mg/L	0.100		106	80-120			
Cadmium, total	0.0945	0.0008	mg/L	0.100		94.5	80-120			
Chromium, total	0.0946	0.0080	mg/L	0.100		94.6	80-120			
Cobalt, total	0.0979	0.0004	mg/L	0.100		97.9	80-120			
Copper, total	0.0977	0.0040	mg/L	0.100		97.7	80-120			
Lead, total	0.0957	0.0040	mg/L	0.100		95.7	80-120			
Nickel, total	0.100	0.0040	mg/L	0.100		100	80-120			
Selenium, total	0.0899	0.0040	mg/L	0.100		89.9	80-120			
Vanadium, total	0.0984	0.0200	mg/L	0.100		98.4	80-120			
Zinc, total	0.0953	0.0200	mg/L	0.100		95.3	80-120			
Matrix Spike (1HJ1261-MS1)	**Source: 1HJ1342-01**			Prepared: 10/22/24 08:06 Analyzed: 10/22/24 20:35						
Antimony, total	0.0972	0.0020	mg/L	0.100	ND	97.2	75-125			
Arsenic, total	0.103	0.0040	mg/L	0.100	0.0091	94.3	75-125			
Barium, total	0.461	0.0040	mg/L	0.100	0.376	85.5	75-125			

Determination of Total Metals	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1HJ1261 - EPA 3005A Total Recoverable Metals - EPA 6020A										
Matrix Spike (1HJ1261-MS1)	**Source: 1HJ1342-01**			Prepared: 10/22/24 08:06 Analyzed: 10/22/24 20:35						
Cadmium, total	0.0935	0.0008	mg/L	0.100	0.0002	93.2	75-125			
Chromium, total	0.0961	0.0080	mg/L	0.100	0.0021	94.1	75-125			
Cobalt, total	0.101	0.0004	mg/L	0.100	0.0042	96.8	75-125			
Copper, total	0.0935	0.0040	mg/L	0.100	0.0029	90.6	75-125			
Lead, total	0.0960	0.0040	mg/L	0.100	0.0006	95.4	75-125			
Nickel, total	0.102	0.0040	mg/L	0.100	0.0063	96.0	75-125			
Selenium, total	0.0929	0.0040	mg/L	0.100	0.0019	90.9	75-125			
Vanadium, total	0.102	0.0200	mg/L	0.100	ND	102	75-125			
Zinc, total	0.0960	0.0200	mg/L	0.100	ND	96.0	75-125			
Matrix Spike Dup (1HJ1261-MSD1)	**Source: 1HJ1342-01**			Prepared: 10/22/24 08:06 Analyzed: 10/22/24 20:54						
Antimony, total	0.0926	0.0020	mg/L	0.100	ND	92.6	75-125	4.87	20	
Arsenic, total	0.0985	0.0040	mg/L	0.100	0.0091	89.4	75-125	4.88	20	
Barium, total	0.458	0.0040	mg/L	0.100	0.376	81.7	75-125	0.830	20	
Cadmium, total	0.0911	0.0008	mg/L	0.100	0.0002	90.9	75-125	2.53	20	
Chromium, total	0.0906	0.0080	mg/L	0.100	0.0021	88.5	75-125	5.94	20	
Cobalt, total	0.0978	0.0004	mg/L	0.100	0.0042	93.6	75-125	3.16	20	
Copper, total	0.0911	0.0040	mg/L	0.100	0.0029	88.1	75-125	2.61	20	
Lead, total	0.0911	0.0040	mg/L	0.100	0.0006	90.5	75-125	5.22	20	
Nickel, total	0.0977	0.0040	mg/L	0.100	0.0063	91.4	75-125	4.59	20	
Selenium, total	0.0882	0.0040	mg/L	0.100	0.0019	86.3	75-125	5.14	20	
Vanadium, total	0.0982	0.0200	mg/L	0.100	ND	98.2	75-125	4.00	20	
Zinc, total	0.0914	0.0200	mg/L	0.100	ND	91.4	75-125	4.92	20	
Post Spike (1HJ1261-PS1)	**Source: 1HJ1342-01**			Prepared: 10/22/24 08:06 Analyzed: 10/22/24 21:00						
Antimony, total	0.0757		mg/L	0.0800	0.0001	94.4	80-120			
Arsenic, total	0.0828		mg/L	0.0800	0.0089	92.4	80-120			
Barium, total	0.434		mg/L	0.0800	0.368	81.6	80-120			
Cadmium, total	0.0725		mg/L	0.0800	0.0002	90.3	80-120			
Chromium, total	0.0744		mg/L	0.0800	0.0021	90.4	80-120			
Cobalt, total	0.0807		mg/L	0.0800	0.0041	95.7	80-120			
Copper, total	0.0743		mg/L	0.0800	0.0029	89.2	80-120			
Lead, total	0.0746		mg/L	0.0800	0.0006	92.5	80-120			
Nickel, total	0.0826		mg/L	0.0800	0.0062	95.6	80-120			
Selenium, total	0.0692		mg/L	0.0800	0.0019	84.2	80-120			
Vanadium, total	0.0798		mg/L	0.0800	0.0067	91.4	80-120			
Zinc, total	0.0746		mg/L	0.0800	0.0080	83.3	80-120			

Definitions

RL: Reporting Limit
RPD: Relative Percent Difference

Cooler Receipt Log

Cooler ID: Default Cooler Temp: 4.1°C

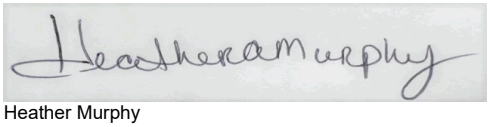
Cooler Inspection Checklist

Custody Seals	No	Containers Intact	Yes
COC/Labels Agree	Yes	Preservation Confirmed	No
Received On Ice	Yes		

Report Comments

The data and information on this, and other accompanying documents, represents only the sample(s) analyzed. This report is incomplete unless all pages indicated in the footnote are present and an authorized signature is included. ***The services were provided under and subject to Microbac's standard terms and conditions which can be located and reviewed at <https://www.microbac.com/standard-terms-conditions>.***

Reviewed and Approved By:



Heather Murphy
Customer Relationship Specialist
heather.murphy@microbac.com
11/04/24 16:56

CHAIN OF CUSTODY RECORD

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641-792-

1HJ1528
HLW Engineering
PM: Heather Murphy

Page 1 of
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SITE INFORMATION

Sampler: Todd Whipple

Project: Monona Co
6036

REPORT TO

Todd Whipple
HLW Engineering
204 West Broad St
Story City, IA 50248

INVOICE TO

Logan Persinger
Monona County Sanitary Landfill
31342 Hwy 37
Turin, IA 51040

SPECIAL INSTRUCTIONS

None

Turn Around Time

☐ Standard ☐ RUSH, need by ___/___/___

LAB USE ONLY

Work Order 1HJ1528
Temperature 4.1
Turn-Cooler: No

- ☐ Custody Seal
- ☒ Containers Intact
- ☒ COC/Labels Agree
- ☐ Preservation Confirmed
- ☒ Received on Ice

Number	Sample Identification / Client ID	Matrix	Sample Type	Date	Time	Number of Containers	Analyses	Lab Sample Number
-001	MW-1	Aqueous	GRAB	10/17/24	10:15	5	8260@cis-1,2-dce; 8260-base-analysis; as-t-6020; ba-t-6020; cd-t-6020; cl-9056-w; co-t-6020; cr-t-6020; cu-t-6020; ni-t-6020; pb-t-6020; sb-t-6020; se-t-6020; v-t-6020; zn-t-6020	01
-001	MW-3R	Aqueous	GRAB	10/17/24	9:54	1	as-t-6020; ba-t-6020; cd-t-6020; co-t-6020; cr-t-6020; cu-t-6020; ni-t-6020; pb-t-6020; sb-t-6020; se-t-6020; v-t-6020; zn-t-6020	02

Relinquished By: Todd Whipple — Date/Time: 10/18/24

Relinquished By — Date/Time

Received By — Date/Time

Received for Lab By: [illegible] — Date/Time: 10/18/24 10:44

Remarks:

Original - Lab Copy Yellow - Sampler Copy

CHAIN OF CUSTODY RECORD

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600 East 17
Newton, IA
641-792-84

1 H J 1 5 2 8

HLW Engineering
PM: Heather Murphy

Page 2 of
Printed: 9/30/2024 3:47:57P

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SITE INFORMATION

Sampler: TODD WHIPPLE

Project: Monona Co
6036

REPORT TO

Todd Whipple
HLW Engineering
204 West Broad St
Story City, IA 50248

INVOICE TO

Logan Persinger
Monona County Sanitary Landfill
31342 Hwy 37
Turin, IA 51040

SPECIAL INSTRUCTIONS

None

Turn Around Time
☐ Standard ☐ RUSH, need by ___/___/___

LAB USE ONLY

Work Order 1HJ1528
Temperature 4.1
Turn-Cooler: No

- ☐ Custody Seal
- ☐ Containers Intact
- ☐ COC/Labels Agree
- ☐ Preservation Confirmed
- ☒ Received on Ice

Number	Sample Identification / Client ID	Matrix	Sample Type	Date	Time	Number of Containers	Analyses	Lab Sample Number
-001	MW-4	Aqueous	GRAB	10/17/24	—	0	as-t-6020, ba-t-6020, cd-t-6020, co-t-6020, cr-t-6020, cu-t-6020, ni-t-6020, pb-t-6020, sb-t-6020, se-t-6020, v-t-6020, zn-t-6020	
-001	MW-5	Aqueous	GRAB	10/17/24	9:08	1	as-t-6020, ba-t-6020, cd-t-6020, co-t-6020, cr-t-6020, cu-t-6020, ni-t-6020, pb-t-6020, sb-t-6020, se-t-6020, v-t-6020, zn-t-6020	03

Relinquished By: Todd Whipple Date/Time: 10/18/24

Received By: ____ Date/Time: ____

Relinquished By: ____ Date/Time: ____

Received for Lab By: [illegible] 10/18/24 Date/Time: 10:44

Remarks:

Original - Lab Copy Yellow - Sampler Copy

CHAIN OF CUSTODY RECORD

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641-79

1HJ1528
HLW Engineering
PM: Heather Murphy

Printed: 9/30/2024 3:47:57P
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SITE INFORMATION
Sampler: Todd Whipple
Project: Monona Co
6036

REPORT TO
Todd Whipple
HLW Engineering
204 West Broad St
Story City, IA 50248

INVOICE TO
Logan Persinger
Monona County Sanitary Landfill
31342 Hwy 37
Turin, IA 51040

SPECIAL INSTRUCTIONS
None

Turn Around Time
☐ Standard ☐ RUSH, need by ___/___/___

LAB USE ONLY
Work Order 1HJ1528
Temperature 4.1
Turn-Cooler: No

- ☐ Custody Seal
- ☒ Containers Intact
- ☒ COC/Labels Agree
- ☐ Preservation Confirmed
- ☒ Received on Ice

Number	Sample Identification / Client ID	Matrix	Sample Type	Date	Time	Number of Containers	Analyses	Lab Sample Number
-001	MW-7	Aqueous	GRAB	10/17/24	10:32	1	as-t-6020, ba-t-6020, cd-t-6020, co-t-6020, cr-t-6020, cu-t-6020, ni-t-6020, pb-t-6020, sb-t-6020, se-t-6020, v-t-6020, zn-t-6020	04
-001	Duplicate	Aqueous	GRAB	10/17/24	✓	1	as-t-6020, ba-t-6020, cd-t-6020, co-t-6020, cr-t-6020, cu-t-6020, ni-t-6020, pb-t-6020, sb-t-6020, se-t-6020, v-t-6020, zn-t-6020	05

Relinquished By Todd Whipple Date/Time 10/18/24

Received By Date/Time

Relinquished By Date/Time

Received for Lab By 10/18/24 10:44 Date/Time

Remarks:

Original - Lab Copy Yellow - Sampler Copy

Appendix E

Summary of Field Turbidity

Monona County Sanitary Landfill

Field Turbidity Over Time

No-Purge Sampling

	10/4/18	4/15/19	10/8/19	4/8/20	10/2/20	4/12/21	10/26/21	4/12/22	10/7/22	4/19/23	10/25/23	4/18/24	10/17/24	Max	Min	Ave	Std Dev
Well	**NTU**	**NTU**	**NTU**	**NTU**	**NTU**	**NTU**	**NTU**	**NTU**	**NTU**	**NTU**	**NTU**	**NTU**	**NTU**				
MW-1	**2.03**	**2.79**	**2.36**	**1.08**	**12.9**	**1.46**	**1.34**	**1.14**	**5.71**	**1.26**	**4.18**	**1.67**	**2.95**	**12.90**	**1.08**	**3.14**	**3.23**
MW-3R	**1.07**	**2.49**	**2.46**	**1.82**	**3.07**	**1**	**2.53**	**3.63**	**5.7**	**2.25**	**2.92**	**2.05**	**2.26**	**5.70**	**1.00**	**2.56**	**1.19**
MW-4	**16.1**	**42.4**	**69.6**	**37.9**	**101**	**151**	**17.63**	**30.3**	**10.5**	**13.3**	**5.07**	**33.7**		**151.00**	**5.07**	**44.04**	**43.42**
MW-5	**1.04**	**39.5**	**18.1**	**426**	**29.5**	**88.7**	**207.8**	**46**	**12.1**	**11.3**	**99.26**	**7.76**	**58.93**	**426.00**	**1.04**	**80.46**	**117.93**
MW-7	**1.25**	**1.6**	**1.06**	**0.66**	**0.86**	**0.92**	**1.33**	**2.07**	**1.55**	**1.11**	**2.37**	**2.03**	**2.38**	**2.38**	**0.66**	**1.48**	**0.58**
Max	**16.10**	**42.40**	**69.60**	**426.00**	**101.00**	**151.00**	**207.80**	**46.00**	**12.10**	**13.30**	**99.26**	**33.70**	**58.93**				
Min	**1.04**	**1.60**	**1.06**	**0.66**	**0.86**	**0.92**	**1.33**	**1.14**	**1.55**	**1.11**	**2.37**	**1.67**	**2.26**				
Median	**1.25**	**2.79**	**2.46**	**1.82**	**12.90**	**1.46**	**2.53**	**3.63**	**5.71**	**2.25**	**4.18**	**2.05**	**2.67**				
Average	**4.30**	**17.76**	**18.72**	**93.49**	**29.47**	**48.62**	**46.13**	**16.63**	**7.11**	**5.84**	**22.76**	**9.44**	**16.63**				