Rio Algom Mining LLC

September 28, 2022

Mr. Doug Hansen
Utah Division of Environmental Quality
Division of Waste Management and Radiation Control (DWMRC)
PO Box 144880
195 North, 1950 West
Salt Lake City, Utah
84114-4880

RE: Addendum Background Groundwater Quality Report,
Rio Algom Mining LLC Lisbon Facility, San Juan County, Utah
Radioactive Materials License Number UT 1900481

Rio Algom Mining LLC (RAML) is pleased to submit the *Addendum Background Groundwater Quality Report* for the Lisbon Facility, Utah Division of Waste Management and Radiation Control (DWMRC) Radioactive Materials License UT 1900481. This document is a supplement to the *Background Groundwater Quality Report: Lisbon Facility* (Background Report), which RAML submitted to DWMRC on October 29, 2021.

As required by Confirmatory Action 1 in a DWMRC letter dated March 31, 2022, the enclosed document provides a complete statistical analysis and background concentrations for proposed constituent of concern (COC) total nitrate/nitrite now that the dataset includes at least 8 data points for nitrate/nitrite from the specified monitoring wells. Background concentrations for total nitrate/nitrite were performed following the statistical analysis methods described in the Background Report. RAML understands that following DWMRC review and approval, the updated nitrate/nitrite background analysis and concentrations will be added to the proposed COC concentrations for the North and South Burro Canyon Background Wells and Concentrations on Table 7 of the Background Report for inclusion in the License.

A hard copy of the report is enclosed and an electronic copy of the report is being sent to you by email, along with a link to download an electronic copy of the statistical analysis data files.

If you have any questions or need additional information, please do not hesitate to contact me at (916) 947-7637.

Sincerely,
Rio Algom Mining LLC

Sandra L. Ross
Manager US Legacy Assets

Enclosure: Addendum Background Groundwater Quality Report: Lisbon Facility (1 hard copy)

cc: Phil Goble, DWMRC (electronic only)
Jason Nguyen, LM DOE (electronic only)
Annelia Tinklenberg, INTERA, Inc. (electronic only)

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Addendum Background Groundwater Quality Report: Lisbon Facility

Radioactive Material License Number UT 1900481
San Juan County, Utah

Prepared for:

Rio Algom Mining LLC
P.O. Box 218
Grants, NM 87020

Prepared by:

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September 28, 2022

Addendum Background Groundwater Quality Report: Lisbon Facility

Radioactive Material License Number UT 1900481
San Juan County, Utah

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Prepared by:

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09/28/2022

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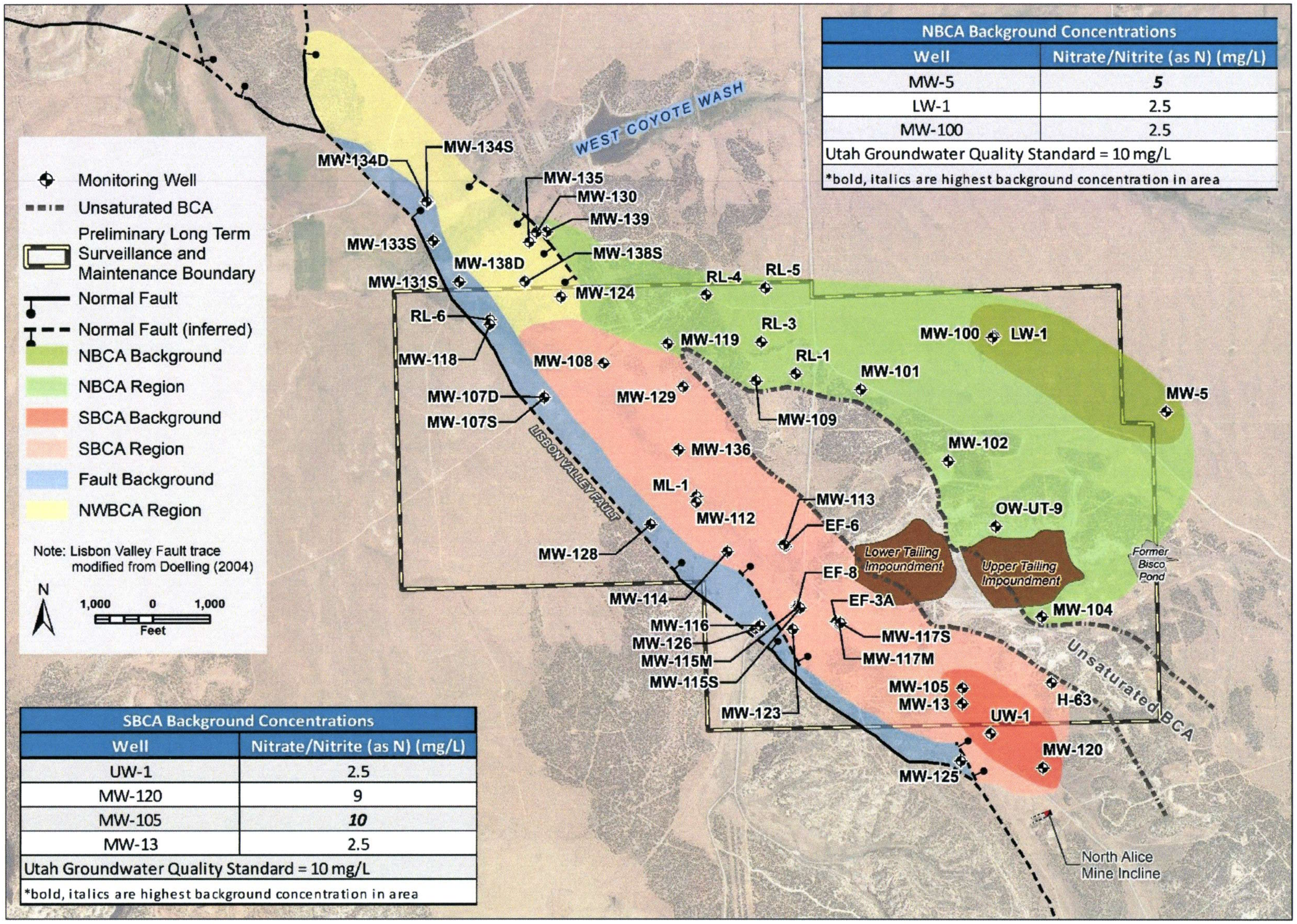
Utah Registration Number 10823695-2250
Expires 03/31/2023

EXECUTIVE SUMMARY

On behalf of Rio Algom Mining LLC (RAML), INTERA Incorporated (INTERA) has prepared this addendum to the *Background Groundwater Quality Report: Lisbon Facility* dated October 29, 2021 (2021 Background Report; INTERA, 2021b). The 2021 Background Report presents a technical evaluation of background groundwater quality at the Lisbon Facility (Site) performed in accordance with the *Work Plan for the Hydrogeological Supplemental Site Assessment, Phase 4, Lisbon Facility* (HSSA4 Work Plan) dated June 21, 2019 (INTERA, 2019) and the Stipulation and Consent Agreement (SCA) issued by the Utah Division of Waste Management and Radiation Control (DWMRC, 2019b).

Establishing appropriate background values is a necessary step for developing revised Alternate Concentration Limits (ACLs) and ultimate termination of RAML's Radioactive Material License Number UT 1900481 (License), Amendment 7 (DWMRC, 2021). A Request for Additional Information (RAI) from the Utah Division of Waste Management and Radiation Control (DWMRC), received on April 17, 2019 (DWMRC, 2019a), included a request for an evaluation of potential constituents of concern to be added to the regulatory monitoring program and License. The 2021 Background Report identified combined nitrate and nitrite (referred to as nitrate/nitrite) as a proposed constituent of concern (COC) that is not currently in the License. A robust statistical analysis and calculation of background nitrate/nitrite concentrations was not possible at that time due to lack of data. These data are now available, so as required by DWMRC (DWMRC, 2022), this addendum Background Report provides the nitrate/nitrite background analysis and concentrations for inclusion in the License.

In correspondence about the 2021 Background Report (DWMRC, 2022), DWMRC concurred with RAML about the following: (1) three different types of background groundwater exist in the Burro Canyon Aquifer (BCA) at the Site and they are referred to as the North BCA (NBCA), South BCA (SBCA), and Fault groundwater, which is limited to an area within the BCA along the Lisbon Valley Fault (LVF; **Figure ES-1**); (2) the screening process for selecting NBCA and SBCA background wells for the Site (outlined in Flowchart 1, **Appendix A**) is valid; (3) the reasoning for the absence of mill impacts to Fault wells (outlined in Flowchart 2, **Appendix A**) is justifiable; and (4) the statistical analysis process and methods used to calculate background concentrations (outlined in Flowchart 3, **Appendix A**) are appropriate and consistent with other facilities. Because the DWMRC agreed with the approach to selecting background wells and determining background concentrations in the 2021 Background Report, the same approach was used to determine nitrate/nitrite concentrations for the same set of NBCA and SBCA background wells in this addendum Background Report.



NBCA Background Concentrations	
Well	**Nitrate/Nitrite (as N) (mg/L)**
MW-5	***5***
LW-1	2.5
MW-100	2.5
Utah Groundwater Quality Standard = 10 mg/L	
*bold, italics are highest background concentration in area	

SBCA Background Concentrations	
Well	**Nitrate/Nitrite (as N) (mg/L)**
UW-1	2.5
MW-120	9
MW-105	***10***
MW-13	2.5
Utah Groundwater Quality Standard = 10 mg/L	
*bold, italics are highest background concentration in area	

Figure ES-1. Background Areas and Implementation.

Concentrations of nitrate/nitrite in NBCA and SBCA background wells were determined according to a statistical analysis flowchart (Flowchart 3, **Appendix A**). Final concentration values were calculated according to Utah Administrative Code (UAC) R317-6-4 using the mean as the background value referred to in the UAC, except when significant trends were observed. Modified approaches to final concentration values were considered when significant increasing or decreasing trends and rates of change were observed. The updated nitrate/nitrite concentrations for NBCA and SBCA background wells are shown in **Figure ES-1** and **Table 3**.

For compliance, it is recommended that the highest nitrate/nitrite concentrations observed within a given background area be used as the background concentration that is applicable to the respective downgradient region (**Figure ES-1**). In the NBCA, MW-5 exhibits the highest concentration of nitrate/nitrite, so the background concentration of 5 mg/L for this well is recommended for the NBCA region in the License (**Figure ES-1**). In the SBCA, MW-105 represents the highest concentrations of nitrate/nitrite, so the background concentration of 10 mg/L for this well is recommended for the SBCA region in the License (**Figure ES-1**). The northwest BCA (NWBCA) region in **Figure ES-1** is the focus of ongoing investigations based on the findings presented by INTERA (2021c). Because the NWBCA could be receiving groundwater from the NBCA and SBCA (INTERA, 2021b, 2021c), the highest concentration of nitrate/nitrite considering both the NBCA and SBCA background areas (10 mg/L) is recommended for the NWBCA region. Background compliance values are not recommended for Fault background wells because of the limited spatial distribution of fault-type groundwater and fluctuating geochemical conditions near the LVF (INTERA, 2018 Rev. 2021a; 2021b; 2021c).

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ACRONYMS AND ABBREVIATIONS

2021 Background Report	Background Groundwater Quality Report: Lisbon Facility (INTERA, 2021b)
95% UTL	95% upper tolerance limit
ACL	Alternate Concentration Limit
ANOVA	analysis of variance
ARD	acid rock drainage
BCA	Burro Canyon Aquifer
COC	Constituent of Concern (arsenic, molybdenum, selenium, and uranium)
CV	coefficient of variance
Dakota	Dakota Sandstone
DWMRC	Division of Waste Management and Radiation Control, Utah
ft	foot or feet
GWQS	Ground Water Quality Standard
HSSA3	third phase of investigation and reporting on the Site, presented in INTERA (2018 Rev. 2021a)
HSSA4 Work Plan	the Work Plan for the Hydrogeological Supplemental Site Assessment, Phase 4, Lisbon Facility (INTERA, 2019)
INTERA	INTERA Incorporated
KM	Kaplan-Meier
KS test	Kolmogorov-Smirnov Test
License	Radioactive Material License Number UT 1900481
LTI	Lower Tailing Impoundment
LVF	Lisbon Valley Fault
mg/L	milligrams per liter
mg/L/yr	mg/L per year
MK test	Mann-Kendall test
N	nitrogen
NBCA	northern BCA
ND	non-detect
NWBCA	The BCA region northwest of the Site
POC	Point of Compliance

POE	Point of Exposure
RAI	Request for Additional Information
RAML	Rio Algom Mining LLC
ROS	Regression on Order Statistics
SBCA	southern BCA
SCA	Stipulation and Consent Agreement
Site	Lisbon Facility
SW test	Shapiro-Wilk Test
TDS	total dissolved solids
UAC	Utah Administrative Code
USEPA	United States Environmental Protection Agency
USEPA Guidance	USEPA (2009, 2015)
UTI	Upper Tailing Impoundment
UTL	upper tolerance limits
WRS test	Wilcoxon Rank Sum Test

1.0 INTRODUCTION

On behalf of Rio Algom Mining LLC (RAML), INTERA Incorporated (INTERA) has prepared this addendum to the *Background Groundwater Quality Report: Lisbon Facility* dated October 29, 2021 (2021 Background Report; INTERA, 2021b). The 2021 Background Report presents a technical evaluation of background groundwater quality at the Lisbon Facility (Site) performed in accordance with the *Work Plan for the Hydrogeological Supplemental Site Assessment, Phase 4, Lisbon Facility* (HSSA4 Work Plan) dated June 21, 2019 (INTERA, 2019) and the Stipulation and Consent Agreement (SCA) issued by the Utah Division of Waste Management and Radiation Control (DWMRC, 2019b). Establishing appropriate background values is a necessary step for developing revised Alternate Concentration Limits (ACLs) and ultimate termination of RAML's Radioactive Material License Number UT 1900481 (License), Amendment 7 (DWMRC, 2021). A Request for Additional Information (RAI) from the Utah Division of Waste Management and Radiation Control (DWMRC) received on April 17, 2019 (DWMRC, 2019a) included a request for an evaluation of potential constituents of concern (COC) to be added to the regulatory monitoring program and License. The 2021 Background Report identified combined nitrate and nitrite (referred to as nitrate/nitrite) as a proposed COC that is not currently in the License. A robust statistical analysis and calculation of background nitrate/nitrite concentrations was not possible at that time due to lack of data. These data are now available, so as required by DWMRC (DWMRC, 2022), this addendum Background Report provides the nitrate/nitrite background analysis and concentrations for inclusion in the License.

1.1 Background Regulations

The License, Condition 29, requires RAML to monitor arsenic, bicarbonate, chloride, molybdenum, pH, selenium, sulfate, total dissolved solids (TDS), uranium, and water levels at background wells, trend wells, point of compliance (POC) wells, and point of exposure (POE) wells at the Site (**Figure 1**). Among the license parameters, arsenic, molybdenum, selenium, and uranium have compliance limits defined in the License. In previous reports (e.g., Lewis, 2001; Komex, 2004; Montgomery & Associates, 2013, 2014; INTERA, 2018 Rev. 2021a), arsenic, molybdenum, selenium, and uranium have been referred to as COCs, so this term continues to apply to these four constituents in this addendum Background Report. Another term suitable for COCs is compliance parameters. This terminology distinguishes these parameters from the parameters that the License requires to be monitored but does not establish compliance limits (bicarbonate, chloride, pH, sulfate, TDS, and water levels). The latter parameters are referred to as monitored parameters in the Background Report and this addendum. The 2021 Background Report presented an update of background conditions in the Burro Canyon Aquifer (BCA), which is the uppermost aquifer at the Site and the only aquifer with compliance wells and COC limits.

Part of the purpose of the 2021 Background Report was to evaluate multiple constituents as potential COCs to be added to the regulatory monitoring program and License. The evaluation presented in the 2021 Background Report showed that nitrate/nitrite behaves like current COCs for the Site (arsenic, molybdenum, selenium, and uranium) in that this constituent appears to be concentrated in tailing porewater and is similarly mobile as other COCs in the BCA (INTERA, 2021b). As a result, nitrate/nitrite was proposed as an additional COC for the regulatory monitoring program and License (INTERA, 2021b). For a robust statistical analysis and calculation of background concentrations, data from at least eight independent sampling events is recommended (USEPA, 2009). At the time that the 2021 Background Report was submitted, at least eight data points for nitrate/nitrite were not available for background wells. These data are now available, so the purpose of this addendum Background Report is to provide a statistical analysis and calculation of nitrate/nitrite background concentrations in background wells at the Site.

1.2 Scope of Addendum Background Report

This addendum Background Report provides a representative range of nitrate/nitrite background conditions for background wells along with all necessary information to support these calculations. The scope of this addendum Background Report is limited compared to the 2021 Background Report. Readers are referred to the 2021 Background Report for detailed information regarding Site mine and mill history, geology, and hydrology (INTERA, 2021b).

1.3 Summary of the Approach

In correspondence about the 2021 Background Report (DWMRC, 2022), DWMRC concurred with RAML about the following: (1) three different types of background groundwater exist in the BCA at the Site and they are referred to as the NBCA, SBCA, and Fault groundwater, which is limited to an area within the BCA along the Lisbon Valley Fault (LVF; **Figure 2**); (2) the screening process for selecting NBCA and SBCA background wells for the Site (outlined in Flowchart 1, **Appendix A**) is valid; (3) the reasoning for the absence of mill impacts to Fault wells (outlined in Flowchart 2, **Appendix A**) is justifiable; and (4) the statistical analysis process and methods used to calculate background concentrations (outlined in Flowchart 3, **Appendix A**) are appropriate and consistent with other facilities. Because the DWMRC agreed with the approach to selecting background wells and determining background concentrations in the 2021 Background Report, the same approach was used to determine nitrate/nitrite concentrations for the same set of NBCA and SBCA background wells in this addendum Background Report. This addendum Background Report presents the findings and interpretations of INTERA based on information about the Site provided in part by INTERA and in part by RAML. INTERA relies in good faith on the information provided by others, including analytical data, measurements, and previous investigations performed at the Site, but does not make any warranty, expressed or implied, that the information is accurate and complete. The calculations presented herein were completed using industry standard practices.

1.4 Overview of Groundwater Nitrogen Speciation

Dissolved nitrogen species in groundwater consist mainly of nitrate (NO_3), nitrite (NO_2), ammonium (NH_4), and various organic constituents (Hem, 1985). Dissolved nitrate is usually the most common form of dissolved nitrogen in near-surface groundwater environments because it is the most stable under conditions where oxygen is present. Naturally occurring high concentrations of nitrate can occur in groundwater, especially in shale and other fine-grained units. For example, Morrison et al. (2012) found naturally occurring nitrate concentrations in groundwater draining from the Mancos Shale to be as high as thousands of milligrams per liter (mg/L). Dissolved nitrogen may undergo several transformations resulting from incorporation of nitrogen into living organisms (assimilation), conversion of reduced nitrogen species (e.g., NH_4^+) to oxidized nitrogen species (e.g., NO_3) through biological nitrification, biologically mediated conversion of nitrate to nitrogen gas through denitrification, and volatilization of dissolved ammonia. Because dissolved nitrogen is subject to several transformation processes, it can be challenging to track the source of dissolved nitrogen species without additional measurements, such as the isotopic composition of nitrogen in various dissolved species.

Nitrate and nitrite concentrations in groundwater can be measured as separate constituents using Method 300.0 (USEPA, 1993a), which has a hold time for each constituent of 48 hours. This is the method by which nitrate (as nitrogen [N]) and nitrite (as N) concentrations were measured as separate constituents at the Site beginning in January 2018. Due to increased difficulties in shipping samples and meeting hold times, the analytical method was changed to the combined measurement of nitrate and nitrite (as N) using Method 353.2 (USEPA, 1993b) starting with the October 2021 sampling event. With preservation, the hold time using Method 353.2 is 28 days. This change in method is reasonable considering that the groundwater quality standard (GWQS) according to UAC R317-6-2 has a value for nitrate (as N) of 10 mg/L and it is the same as the GWQS for nitrate and nitrite (as N). Nitrite concentrations are often low or below detection, except in more reduced (e.g., low oxygen) environments, so nitrate and combined nitrate and nitrite concentrations are often the same value. For the statistical analysis included in this addendum Background Report, separate nitrate and nitrite results prior to October 2021 were summed to nitrate plus nitrite (as N) for combination with results obtained since that time. Throughout this addendum Background Report, the term nitrate/nitrite refers to the summed nitrate plus nitrite concentrations prior to October 2021 and the combined nitrate and nitrite measurements since October 2021.

2.0 ANALYSIS OF BACKGROUND GROUNDWATER QUALITY

The DWMRC requested an evaluation of potential COCs and an updated evaluation of Site background conditions using appropriate statistical methodologies (DWMRC, 2019a). The DWMRC also requested that proposed background concentrations be evaluated on an intrawell basis. In an intrawell approach, statistical analysis is completed on individual background wells, and each well represents an individual groundwater constituent population (USEPA, 2009). Because the DWMRC agreed with the approach to selecting background wells and determining background concentrations in the 2021 Background Report (DWMRC, 2022), the same approach was used to determine nitrate/nitrite concentrations for the same set of NBCA and SBCA background wells in this addendum Background Report. Details about the approach and methods are provided in the 2021 Background Report (INTERA, 2021b). Below are the results of the analysis of nitrate/nitrite concentrations.

2.1 Spatial Distribution of Groundwater Plume

Relatively elevated concentrations of nitrate/nitrite in the deep zone of the BCA, which is described by INTERA (2021c), derived from mill-related activities are delineated in an isoconcentration contour map (**Figure 3**). The contour lines in an isoconcentration contour map are drawn to represent areas of the same concentration of a given constituent. The contour lines shown in **Figure 3** were developed from October 2021 concentration values using the same approach as that for other COCs in the 2021 Background Report (INTERA, 2021b). The goal of the isoconcentration contour map is to delineate the extent of mill-related nitrate/nitrite in the deep zone of the BCA. As a result, some sampling locations are shown in **Figure 3** that were not used for contouring. Wells not used for contouring are those with likely natural sources (labels with blue backgrounds) and shallower wells in areas where multiple wells exist (labels with gray backgrounds). In many cases where multiple wells exist in a similar location, but are screened at different depths, the deeper well exhibits the highest concentrations of the COCs arsenic, molybdenum, selenium, and uranium (INTERA, 2021b). This observation is also the case for nitrate/nitrite, except in the EF-3A area (**Figure 3**).

Figure 3 shows that mill-related concentrations of nitrate/nitrite are distributed similarly as other COCs (INTERA, 2021b, 2021c) in both the NBCA and SBCA and have likely travelled along the NBCA flow pathway. Considering the Utah GWQS of 10 mg/L for nitrate/nitrite (as N; defined in UAC R317-6-2), concentrations above the GWQS extend from the UTI to MW-119 in the NBCA and occur in MW-123 and EF-8 among mill-impacted wells in the SBCA (**Figure 3**). In addition, although SBCA background well MW-105 did not exceed the nitrate/nitrite GWQS in October 2021, this well has typically shown concentrations above the GWQS over most of the monitoring period (**Appendix B** and **C**).

The longitudinal axis of the plume in the NBCA based on nitrate/nitrite concentrations (**Figure 3**) follows expected groundwater flow from the UTI and POC well OW-UT-9 based on groundwater elevations (INTERA, 2021b, 2021c). Wells MW-5, LW-1, and MW-100 appear to be well outside of the northern plume based on nitrate/nitrite concentrations (**Figure 3**) as well as concentrations of other COCs (INTERA, 2021b). In previous reports (INTERA, 2021b, 2021c) the 0.03 mg/L uranium isoconcentration contour line approximates the extents of the plumes in the NBCA and SBCA. The 5 mg/L nitrate/nitrite isoconcentration contour line in **Figure 3** represents a similar delineation as the 0.03 mg/L uranium contour line, and therefore this line most likely approximates the extent of nitrate/nitrite derived from the mill source.

The isoconcentration map shows that the plume in the SBCA is less extensive than in the NBCA (**Figure 3**). Relatively elevated concentrations of nitrate/nitrite appear to be limited to the area closest to the LTI (**Figure 3**). Assuming that the 5 mg/L nitrate/nitrite isoconcentration contour line in **Figure 3** reasonably approximates the extent of mill-derived nitrate/nitrite in the SBCA (see discussion above), a similar group of wells appears to be impacted based on nitrate/nitrite concentrations as concentrations of other COCs (INTERA, 2021b). The exception is EF-3A, which lies outside the 5 mg/L nitrate/nitrite isoconcentration contour line in **Figure 3**. EF-3A is mill-impacted based on decades of historical data and concentrations of other COCs (INTERA, 2018 Rev. 2021a, 2021b, 2021c). Wells MW-114, ML-1, ML-112, MW-129, and MW-108 all show nitrate/nitrite concentrations within the range of SBCA background wells MW-120, MW-13, UW-1, and MW-105.

Groundwater flow in the SBCA is inferred to be controlled by subsidiary faulting related to the main LVF (INTERA, 2018 Rev. 2021a, 2021b, 2021c). An observed geochemical gradient divide that exists for all COCs between the EF-3A area and MW-116/MW-126 area likely results from an inferred subsidiary fault (INTERA, 2021c). In the case of nitrate/nitrite, Fault wells MW-116 and MW-126 contain relatively low concentrations compared to nearby well MW-123 (**Figure 3**). These notable differences in nitrate/nitrite concentrations are consistent with a subsidiary fault being a barrier to flow between the two areas.

The relatively high nitrate/nitrite concentration of 16.4 mg/L in MW-130 (in the northwest area of the Site) for the October 2021 sampling event is a questionable value when compared to previous measurements, which were sometimes below laboratory reporting limits (**Appendix B**). During that same sampling event, the TDS concentration was an order of magnitude higher than previous TDS measurements (**Appendix B**). The saturated thickness in MW-130 has decreased over time since monitoring began in October 2020. In January 2022 the saturated thickness was approximately 0.5 ft, and the well was dry by the April 2022 sampling event. The notable changes in nitrate/nitrite and TDS concentrations in MW-130 are likely related to the water table dropping in this well.

Side-by-side boxplot figures for all BCA wells in the northern and southern regions of the Site are another way to delineate the mill-derived groundwater plume. The same approach to developing side-by-side boxplot figures in the 2021 Background Report (INTERA, 2021b) was used to generate the figures for nitrate/nitrite concentrations (**Figures 4** and **5)**. The boxplot figures are split into those for NBCA and SBCA wells using the same reasoning as that described in the 2021 Background Report (INTERA, 2021b). Results for some of the newer wells in the northwest area (MW-131S, MW-133S, MW-134S/D) are shown in both the NBCA and SBCA figures to help determine if the geochemical signature of groundwater in the northwest area is more like groundwater originating north or south of the unsaturated BCA boundary (**Figure 2**). Furthermore, the distinction between NBCA and SBCA becomes more uncertain in the northwest area of the Site, where groundwater flow in the BCA is expected to converge (INTERA, 2018 Rev. 2021a, 2021b, 2021c).

The BCA wells presented in **Figures 4** and **5** are displayed in order of decreasing water levels for different well designations (INTERA, 2021b, 2021c). The color coding in **Figures 4** and **5** corresponds to well designations established in the 2021 Background Report based on multiple lines of evidence (INTERA, 2021b). The data used to generate **Figures 4** and **5** are provided in **Appendix B**. Any values below reporting limits are plotted as half the reporting limit. Although substitution of censored values with arbitrary numbers is not recommended for many statistical analyses (USEPA, 2009, 2015), this was the simplest option for this exercise given the large amount of data being considered. Nitrate/nitrite has multiple reporting limits (**Appendix B**). The GWQS value for nitrate/nitrite is shown as a horizontal dashed line.

The nitrate/nitrite concentrations in NBCA wells are below the GWQS for most wells, except those located along the northern plume, spanning OW-UT-9 to MW-119 (**Figure 4**). The large range of nitrate/nitrite concentrations in MW-130 reflects concentrations below reporting limits to 16.4 mg/L during the October 2021 sampling event (**Appendix B**). This relatively large range in nitrate/nitrite concentrations is likely due to the lowering of the water table at this well (see discussion above in this section).

The nitrate/nitrite concentrations in SBCA wells are generally below the GWQS, except for MW-105 and MW-123 (**Figure 5**). The source of nitrate/nitrite in MW-105 is not the LTI, due to the upgradient location of MW-105 relative to the BCA near the LTI (INTERA, 2021b, 2021c). The source of nitrate in MW-105 is currently uncertain. Possible sources of nitrogen in this background area could include natural sources within the Burro Canyon Formation and off-site contamination from historical mining activities (e.g., North Alice Mine) and regional cattle ranching activities.

2.2 Statistical Analysis of Nitrate/Nitrite

For the statistical analysis in this addendum Background Report, at least eight data points for nitrate/nitrite concentrations were available for each NBCA and SBCA background well. The nitrate/nitrite concentrations considered in this analysis date back to January 2018 for wells MW-5 and MW-13, and October 2018 for LW-1, MW-100, MW-105, MW-120, and UW-1. Some Fault background wells had less than eight data points (MW-118, MW-131S, MW-134D, MW-134S, and MW-138D) after extreme outliers were removed (see Section 2.2.3). These Fault background wells underwent full statistical analysis despite the datasets containing less than the recommended minimum number of datapoints (USEPA, 2009) because background concentrations for Fault wells have been proposed to be monitored but not included in the License.

Before October 2021, nitrate (as N) and nitrite (as N) concentrations were measured as separate constituents using Method 300 (USEPA, 1993a). Due to increased difficulties in shipping samples and meeting hold times, the analytical method was changed to the combined measurement of nitrate/nitrite (as N) using Method 353.2 (USEPA, 1993b) starting with the October 2021 sampling event. This change in method is reasonable considering that the GWQS for nitrate (as N) is the same as that for nitrate/nitrite (as N), and nitrite has generally been below reporting limits for most wells and sampling events (**Appendix B**). The few exceptions are for MW-116, MW-126, MW-130, and OW-UT-9 on an irregular basis (**Appendix B**). For the statistical analysis included in this addendum Background Report, separate nitrate and nitrite results prior to October 2021 were summed to nitrate plus nitrite (as N) for combination with results obtained since that time. In cases when both the separate nitrate and nitrite concentrations were below the reporting limit, the reporting limit of nitrate (as N) was used for the reporting limit of summed nitrate and nitrite. The term nitrate/nitrite refers to the summed nitrate plus nitrite concentrations prior to October 2021 and the combined nitrate/nitrite measurements since October 2021. **Appendix C** includes timeseries plots for nitrate/nitrite concentrations in all background wells. The change from Method 300 to Method 353.2 by October 2021, which is shown as a vertical line in the **Appendix C** plots, generally did not result in notably different nitrate/nitrite concentrations. The exception is for MW-105, which shows a notable decrease in nitrate/nitrite concentrations beginning in October of 2021 (**Appendix C**).

Standard practice for determining background groundwater quality for a site is to follow statistical guidance provided by the USEPA (USEPA, 2009, 2015). USEPA Guidance was followed to provide summary statistics, distribution, outlier, and trend analysis for each background well dataset. Spatial heterogeneity among background concentrations was also evaluated with statistical tests recommended by USEPA Guidance. The statistical analysis was carried out with Excel, R (v. 3.6.2), and ProUCL (v. 5.1) software packages. All input and output files for statistical analysis are provided as electronic files in **Appendix E**.

Calculation of background concentrations of nitrate/nitrite followed a decision process flowchart included in **Appendix A** (Flowchart 3) and was the same as that presented in the 2021 Background Report (INTERA, 2021). Final background concentrations were calculated according to Utah Administrative Code (UAC) R317-6-4, except when significant increasing or decreasing trends and rates of change were observed and when datasets were highly censored (i.e., the percentage of non-detect results was greater than 50%). Concentration values calculated according to UAC R317-6-4 depend on the groundwater class defined in UAC R317-6-3. Groundwater class categories for each NBCA and SBCA background well in the 2021 Background Report (INTERA, 2021b) have not changed in this addendum Background Report. Results for the statistical evaluation decision points outlined in Flowchart 3 (**Appendix A**) are described below.

2.2.1 Percentage of Censored Values

The USEPA Guidance refers to censored values as non-detect values. The percentage of non-detects (NDs) has implications for the types of statistical tests that can be performed on a given dataset (Flowchart 3, **Appendix A**). All background wells in the NBCA and SBCA exhibit nitrate/nitrite concentration datasets with no NDs (**Table 1**). Fault wells exhibit nitrate/nitrite datasets that fall into all three of the major censored data categories in Flowchart 3 (**Appendix A**). Fault wells MW-131S and MW-134D exhibit nitrate/nitrite datasets that contain no ND values (**Table 2**). Fault wells MW-116, MW-126, and MW-128 exhibit nitrate/nitrite datasets that contain between 11 and 50 % NDs (**Table 2**), so according to Flowchart 3 (**Appendix A**), an adjusted mean and standard deviation are recommended for these wells (see Section 2.2.2). The remaining Fault wells exhibit nitrate/nitrite datasets that contain 51 to 100 % NDs (**Table 2**), so the types of statistical tests applied to these wells are limited.

2.2.2 Summary Statistics and Distribution Tests

Summary statistics and distribution tests were performed on all background well datasets according to Flowchart 3 (**Appendix A**). Distribution tests were performed before and after removal of extreme outliers (Section 2.2.3). **Tables 1** and **2** show the results after removal of extreme outliers, though all statistical results, before and after removal of extreme outliers, are included in **Appendix E** (electronic only). Parametric distribution test results for datasets with NDs > 50% are not shown in **Tables 1** and **2** because these datasets are nonparametric according to statistical analysis Flowchart 3 (**Appendix A**).

Results for background wells in the NBCA (MW-5, LW-1, and MW-100) and SBCA (UW-1, MW-13, MW-105, and MW-120) are shown in **Table 1**. NBCA wells LW-1, MW-5, and MW-100 do not fit a parametric distribution (normal, log normal, and/or gamma), while SBCA wells MW-105, MW-120, MW-13, and UW-1 all fit normal distributions, and are therefore parametric.

Results for Fault background wells are shown in **Table 2**. Fault background wells MW-116, MW-131S, and MW-134D fit parametric distributions. Wells MW-116, MW-126, and MW-128 all contain NDs between 11 and 50%. According to Flowchart 3 (**Appendix A**), the mean and standard deviation should be adjusted for these datasets using the Kaplan-Meier (KM) method or Regression on Order Statistics (ROS) method (USEPA, 2009, 2015). Both methods provide an adjusted mean and standard deviation for censored datasets by fitting detected values and NDs to a known distribution. The known distribution does not need to be parametric in the case of the KM method, whereas a parametric distribution is required for the ROS method. One advantage of the ROS method is that NDs can be imputed, which allows for additional statistical testing, such as outlier and trend analysis, with reasonable substitutions for each ND value. As a result, in this analysis, the ROS method was preferred for datasets with NDs within the 11-50% range. **Appendix D** includes the original reported values, ROS-imputed values, and adjusted mean and standard deviations for datasets with 11-50% NDs. In the case of nitrate/nitrite concentrations in MW-116, the censored dataset did fit a parametric distribution with ROS-imputed estimates (**Table 2**). In the case of nitrate/nitrite concentrations in MW-126 and MW-128, the censored datasets did not fit a parametric distribution with ROS-imputed estimates, so the KM method was used instead to estimate the mean and standard deviation (**Table 2**).

Fault background wells MW-107D/S, MW-118, MW-125, MW-133S, MW-134S, and RL-6 all contain censored values greater than 50%, so only nonparametric methods were applied to these datasets (**Table 2**).

2.2.3 Outlier Analysis

Each background well nitrate/nitrite dataset was evaluated for outliers following USEPA Guidance and the same approach as that described in the 2021 Background Report (INTERA, 2021b). Outliers were evaluated with boxplots and probability plots generated in R and Dixon's or Rosner's tests performed in ProUCL. **Appendix F** is a compilation of all the information considered prior to the decision to remove extreme outliers. In boxplots used for outlier analysis (**Appendix F**), non-extreme outliers are shown as open circles and extreme outliers are shown as stars. Following Flowchart 3 (**Appendix A**), extreme outliers were removed when at least two of the following criteria were met: (1) outliers appeared to be extreme based on boxplots; (2) outliers appeared to be extreme based on probability plots; and (3) the results from Rosner's or Dixon's test indicated the value is an outlier at the 1% significance level. Extreme outliers were identified and removed from 4 datasets, as indicated in **Tables 1** and **2**. Results for all calculations with and without the extremes removed are provided in **Appendix E**.

2.2.4 Trend Analysis

Following USEPA Guidance and the 2021 Background Report (INTERA, 2021b), the Mann-Kendall test (MK test) was performed on each nitrate/nitrite dataset for background wells to evaluate for trends over time. Results are included in **Appendix E** and summarized in **Tables 1** and **2** with the test statistic (S) and p-value. Positive and negative S values indicate an increasing and decreasing trend, respectively. The dataset is trending significantly when p-values are less than 0.05. The MK test is valuable for determining whether there is a significant increasing or decreasing trend, but it does not provide the rate of change. The rate of change can be determined by linear regression analysis for datasets with less than 10% NDs that are also determined to be parametric, after removing any extreme outliers (Flowchart 3, **Appendix A**). Prior to linear regression analysis sample dates were converted to years since the first sampling event in the dataset being considered. This conversion allows the resulting calculated slope to represent the rate of change in units of concentration over time in years. The ProUCL linear regression output files are included in **Appendix E** and **Tables 1** and **2** show the linear regression slope (in units of mg/L per year [mg/L/yr]) and associated p-value. The calculated slope is statistically significant at p-values less than 0.05.

Trend analysis results for NBCA and SBCA background wells are shown in **Table 1**. Among NBCA background wells, no statistically significant increasing or decreasing trends were observed with the nonparametric MK test. The SBCA background wells fit a parametric distribution, so both linear regression and the MK test were applied. A statistically significant decreasing trend is observed in SBCA background well MW-105, with a rate of decrease of nitrate/nitrite of -13 mg/L/yr. This statistically significantly decreasing rate and the possible causes are discussed further in Section 2.2.4.1. SBCA background well MW-120 shows a statistically significant increasing trend and linear regression results show that the rate of increase of nitrate/nitrite is 0.55 mg/L/yr. Fault background well trend results are shown in **Table 2**. Fault background well MW-128 shows a statistically significantly increasing trend with the MK test, though it is important to note that this dataset is censored at 31% and as a result, no linear regression analysis was conducted to obtain the rate of change. Continued monitoring of nitrate/nitrite in MW-128 will be necessary for determining whether this is a robust increasing trend. Both Fault background wells MW-131S and MW-134D are datasets with less than 10% NDs and fit a parametric distribution, so both the MK test and linear regression were applied. Trend tests suggest that nitrate/nitrite concentrations are increasing and decreasing in MW-131S and MW-134D, respectively, but these trends are not statistically significant (**Table 2**).

2.2.4.1 Statistically Significant Trends in SBCA Background Wells

Background wells that display statistically significant increasing or decreasing trends may require more frequent updates to background (USEPA, 2009) and this could be the case for SBCA background wells MW-105 and MW-120. The calculated rate of decrease of nitrate/nitrite concentrations in MW-105 of -13 mg/L/yr does not likely reflect reality and is more likely the mathematical result of concentrations being approximately 30 to 50 mg/L prior to October 2021 and less than 10 mg/L since October 2021 (**Appendix C**). This notable change in concentrations could be due to the following:

- The change in the nitrate/nitrite analysis method beginning in October 2021;
- Denitrification (the process whereby microorganisms convert nitrate to nitrogen gas) in the groundwater sampled at MW-105;
- Denitrification within the bottles of sampled groundwater at MW-105;
- A combination of the previously listed possibilities.

At this time, the reason(s) for the notable change in nitrate/nitrite concentrations in MW-105 is uncertain because the change in the nitrate/nitrite analysis method does not appear to impact other wells at the Site (**Appendix B**) and denitrification commonly occurs in anoxic (i.e., oxygen-free) environments. Compared to other wells at the Site, the redox conditions at MW-105 are relatively reducing but are not free of oxygen (INTERA, 2021b).

Nitrate/nitrite concentrations in MW-120, the farthest upgradient well in the SBCA, are higher than surrounding SBCA background wells, except for MW-105 (**Figure 3**). The source of nitrate/nitrite for MW-120 (and MW-105) is not the UTI or LTI due to the upgradient location of MW-120 relative to the BCA near the impoundments, and the source is currently uncertain. Possible sources of nitrogen in this area include natural sources within the Burro Canyon Formation and off-site contamination from historical mining activities (e.g., North Alice Mine) and regional cattle ranching activities.

2.2.5 Spatial Variation in Background Datasets

When spatial variation exists among background wells, characterization of background concentrations for a Site with a single value becomes unrealistic. Spatial variation in nitrate/nitrite concentrations among background wells was tested using the same approach as the 2021 Background Report (INTERA, 2021b). The analysis of variance (ANOVA) compares the means between two datasets that are normally distributed, and the two datasets should have equal variance (USEPA, 2009). **Tables 1** and **2** show that not all nitrate/nitrite datasets for background wells are normally or log normally distributed. Variance can be represented in multiple ways and in this case the coefficient of variance (CV), which is the standard deviation divided by the mean and multiplied by 100, was used. The CV values for nitrate/nitrite are plotted against the calculated mean values and are shown in **Figure 6**. Datasets with greater than 50% NDs are not plotted in **Figure 6**. Results for datasets with less than or equal to 50% NDs were calculated with any values below the reporting limit substituted with the appropriate values (Flowchart 3, **Appendix A**) or using the KM-adjusted mean and standard deviation (**Appendix D**).

Figure 6 shows that the variance for nitrate/nitrite, represented by the CV, is not always equal among background wells within different background areas of the Site (NBCA, SBCA, Fault), and in most cases, even within a single background area. This was also observed for other COCs, as well as the conservative element chloride in the 2021 Background Report (INTERA, 2021b). As a result, an alternative method to ANOVA is recommended to compare nitrate/nitrite concentrations among background wells within the NBCA and SBCA background areas.

An alternative to ANOVA for comparing datasets is the Wilcoxon Rank Sum Test (WRS test), also known as the Mann-Whitney U Test (USEPA, 2009). The WRS test can be used when the distributions of the datasets being tested are unknown or nonparametric. Because some of the background nitrate/nitrite datasets are nonparametric, the WRS test was used to compare medians between two datasets. The tests were performed using the R software program on NBCA and SBCA background datasets. The resulting test statistics and p-values are shown in matrix tables in **Figure 7**. In the matrix tables, each cell contains the results of comparing the wells in the adjoining row and column. Results with p-values less than 0.05 (shown in green text) imply that the two dataset medians are significantly unequal.

The WRS test results show that the compared medians for NBCA background wells appear equal (**Figure 7**). The WRS results for SBCA background wells show that nitrate/nitrite median concentrations are significantly unequal (**Figure 7**). These results are supported in the side-by-side boxplot figures shown above the test results. The WRS test results imply that spatial variation in nitrate/nitrite concentrations exists in the SBCA background but not necessarily the NBCA background area.

Nitrate/nitrite can behave conservatively in some environments and nonconservatively in other environments. For example, during the process of denitrification, which occurs under reducing conditions, nitrate is converted to nitrogen gas through a biologically mediated reaction that reduces the concentration of nitrate in groundwater. Because dissolved nitrogen is subject to several transformation processes (see Section 1.4), spatial variation in nitrate/nitrite concentrations within a given area are expected.

2.2.6 Background Concentrations of Nitrate/Nitrite in NBCA and SBCA

Concentrations of nitrate/nitrite in NBCA and SBCA background wells were determined according to Flowchart 3 (**Appendix A**). Although fault wells represent a distinct type of background groundwater for the Site, final background concentrations of nitrate/nitrite in fault wells were not calculated due to the limited spatial distribution of fault-type groundwater (INTERA, 2021b, 2021c) and fluctuating geochemical conditions near the LVF, as represented by significant increasing and decreasing trends in COC concentrations in Fault wells (INTERA, 2021b). In most cases, final concentration values for the NBCA and SBCA were calculated according to UAC R317-6-4 using the mean as the background value referred to in the UAC. Modified approaches to final concentration values were considered when statistically significant increasing or decreasing trends and rates of change were observed and when datasets were highly censored (i.e., the percentage of non-detect results was greater than 50%). According to UAC R317-6-4, there are a few ways of calculating background concentrations for a given well considering the groundwater class, which is defined in UAC R317-6-3. Groundwater classes are generally based on TDS concentrations and whether or not the GWQS (defined in UAC R317-6-2) is exceeded for one or more regulated constituents.

The class of groundwater in NBCA and SBCA background wells based on concentrations of TDS and other constituents in the GWQS list has not changed since the 2021 Background Report (INTERA, 2021b). According to UAC R317-6-3, a majority of groundwater samples from NBCA and SBCA background wells are clearly Class 2 based on TDS concentrations (**Appendix B**) because all wells, except some LW-1 samples, exhibit TDS concentrations between 500 mg/L and 3,000 mg/L during the monitoring period (fourth quarter 2012 to second quarter 2022). More recent samples of LW-1 exhibit TDS concentrations above 500 mg/L (**Appendix B**), so groundwater sampled from LW-1 is also considered to be Class 2.

The class of groundwater in NBCA and SBCA background wells based on comparisons with GWQS is also shown in **Table 3**. This analysis was presented in the 2021 Background Report (INTERA, 2021b). Groundwater sampled from NBCA wells LW-1 and MW-100 and SBCA wells MW-120, MW-13, and UW-1 should be considered Class 2 based on no observed exceedances. UAC R317-6-3 states that groundwater is considered Class 3 when one or more constituents exceeds a GWQS defined in UAC R317-6-2. NBCA well MW-5 has exhibited selenium concentrations above the GWQS for the duration of the monitoring period (INTERA, 2021b), so groundwater sampled from this well should be considered Class 3. Likewise, SBCA background well MW-105 exhibited nitrate concentrations above the GWQS when monitoring for this constituent began in 2018 until the second quarter of 2021 (**Appendix B**). Recent measurements of nitrate/nitrite combined using a new method (see Section 2.2) are below the GWQS (**Appendix B**). Because nitrate concentrations in groundwater sampled from MW-105 have been above the GWQS for most of the monitoring period, the groundwater in this area should also be considered Class 3.

Final nitrate/nitrite concentration values for the NBCA and SBCA were calculated according to UAC R317-6-4, USEPA Guidance (USEPA, 2009), or modified approaches and reported in **Table 3**. The highest value among the calculations is highlighted in gray and represents the recommended background concentration for nitrate/nitrite in each background well. The exception is MW-105, which is discussed below.

A modified approach to calculating background concentrations is recommended in cases where constituents show statistically significant increasing or decreasing concentrations, especially when the rate of change is relatively fast. Nitrate/nitrite concentrations in MW-105 fit a parametric distribution and the dataset exhibits a statistically significant decreasing trend at a calculated rate of -13 mg/L/yr (**Table 1**). At this time, the reason(s) for the decrease in nitrate/nitrate concentration in MW-105 is uncertain. Possible reasons for the decrease are discussed in Section 2.2.4.1. According to Flowchart 3 (**Appendix A**), a modified approach can be considered for the background concentration of nitrate/nitrite in this well. The options for calculating the nitrate/nitrite background concentration calculated according to UAC R317-6-4 give a highest value of 67.9 mg/L (**Table 3**). The two most recent sampling events for MW-105 resulted in nitrate/nitrite concentrations of 6 mg/L (October 16, 2021) and 3.58 mg/L (April 7, 2022; **Appendix B**). The recommended modified approach for MW-105 is to assume a background concentration of 10 mg/L (the GWQS) for the time being and continue to monitor nitrate/nitrite concentrations. If nitrate/nitrite concentrations continue to be below 10 mg/L for at least eight consecutive sampling events, the background concentration can be revised using the statistical methods outlined in Flowchart 3 (**Appendix A**) to better represent the dataset.

Nitrate/nitrite concentration data from MW-120 show a statistically significant increase at a rate of 0.55 mg/L/yr (**Table 1**). **Figure 8** shows observed nitrate/nitrite concentrations in MW-120, along with the significant linear regression results (**Table 1**, **Appendix E**). If the linear regression line for nitrate/nitrite concentration in MW-120 were to remain constant in the future, **Figure 8** shows that it would take approximately 1.4 years from the most recent sampling event (April 7, 2022) to reach and possibly exceed the highest background concentration of 5.12 mg/L calculated for this well according to UAC R317-6-4 (**Table 3**). A modified approach to calculating background concentrations of nitrate/nitrite in MW-120 is therefore recommended to prevent exceeding a compliance background concentration within the next couple of years.

USEPA Guidance recommends considering linear regression on trending parametric datasets (USEPA, 2009). As a result, the modified approach to calculating background nitrate/nitrite concentrations in MW-120 is to use the statistically significant linear regression line determined for the dataset to project some number of years from the most recent sampling event such that the calculated background concentration does not exceed the GWQS. This same approach was used for selenium in NBCA background wells LW-1 and MW-100 in the 2021 Background Report (INTERA, 2021b). **Figure 8** shows that assuming a constant rate of increase, MW-120 will exceed the GWQS after approximately 10.3 years since the most recent sampling event. At 8.5 years beyond the most recent sampling event the projected nitrate/nitrite concentration is 9.0 mg/L. The value of 9 mg/L was chosen for the modified approach background nitrate/nitrite concentration in MW-120 because it is unlikely to be exceeded within the next 8 years and it is below the GWQS (10 mg/L).

Nitrate/nitrite concentrations in SBCA wells MW-13 and UW-1 fit a parametric distribution and neither dataset exhibits a statistically significant increasing nor decreasing trend (**Table 1**). Background concentrations of nitrate/nitrite were calculated according to UAC R317-6-4 for both wells (**Table 3**).

3.0 CONCLUSIONS

This addendum Background Report provides background concentrations of nitrate/nitrite in groundwater that are applicable to different regions of the Site (**Figure 9**). Because the DWMRC agreed with the approach to selecting background wells and determining background concentrations in the 2021 Background Report (DWMRC, 2022), the same approach was used to determine nitrate/nitrite concentrations for the same set of NBCA and SBCA background wells in this addendum Background Report.

Recommendations for how to implement background concentrations of nitrate/nitrite in the BCA at the Site are the same as those given for other COCs in the 2021 Background Report (INTERA, 2021b) and are illustrated in **Figure 9**. The concentrations of nitrate/nitrite in NBCA and SBCA background wells (dark green and dark orange shaded areas, respectively) represent the range of background concentrations for the NBCA region (light green shading) and SBCA region (light orange shading). For compliance, it is recommended that the highest nitrate/nitrite concentrations observed within a given background area be used as the background concentration that is applicable to the respective downgradient region. In the NBCA, MW-5 exhibits the highest concentration of nitrate/nitrite (**Table 3**), so the background concentration of 5 mg/L for this well is recommended for the NBCA region in the License (**Table 4**). In the SBCA, MW-105 represents the highest concentrations of nitrate/nitrite (**Table 3),** so the background concentration of 10 mg/L for this well is recommended for the SBCA region in the License (**Table 4**). The NWBCA region in **Figure 9** is generally downgradient of mill-impacted groundwater. As a result, none of the wells in this region are proposed background wells. Because the NWBCA could be receiving groundwater from the NBCA and SBCA, it is recommended that background concentrations in both NBCA and SBCA background wells be considered to apply to the NWBCA region. It is recommended that the highest concentrations of nitrate/nitrite among the NBCA and SBCA background areas apply to the NWBCA region in the License (**Table 4**). In this case, the background concentration of 10 mg/L from MW-105 is recommended for the NWBCA region in the License (**Table 4**).

As in the 2021 Background Report (INTERA, 2021b), it is recommended that groundwater in Fault wells (blue-shaded region in **Figure 9**) be recognized as a distinct type of background groundwater at the Site, but it is not recommended that fault wells be used as compliance background wells due to the limited spatial distribution of fault-type groundwater and fluctuating geochemical conditions near the LVF (INTERA, 2021b, 2021c).

In the future, if concentrations of COCs in background wells exceed the background concentrations in the License, then repeat sampling is recommended to confirm the exceedance. If the exceedance is confirmed, a background evaluation is recommended to determine if there could be a mill-related cause. If the results cannot be related to mill impacts, it is recommended that an updated statistical analysis be performed to calculate new background concentrations.

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FIGURES

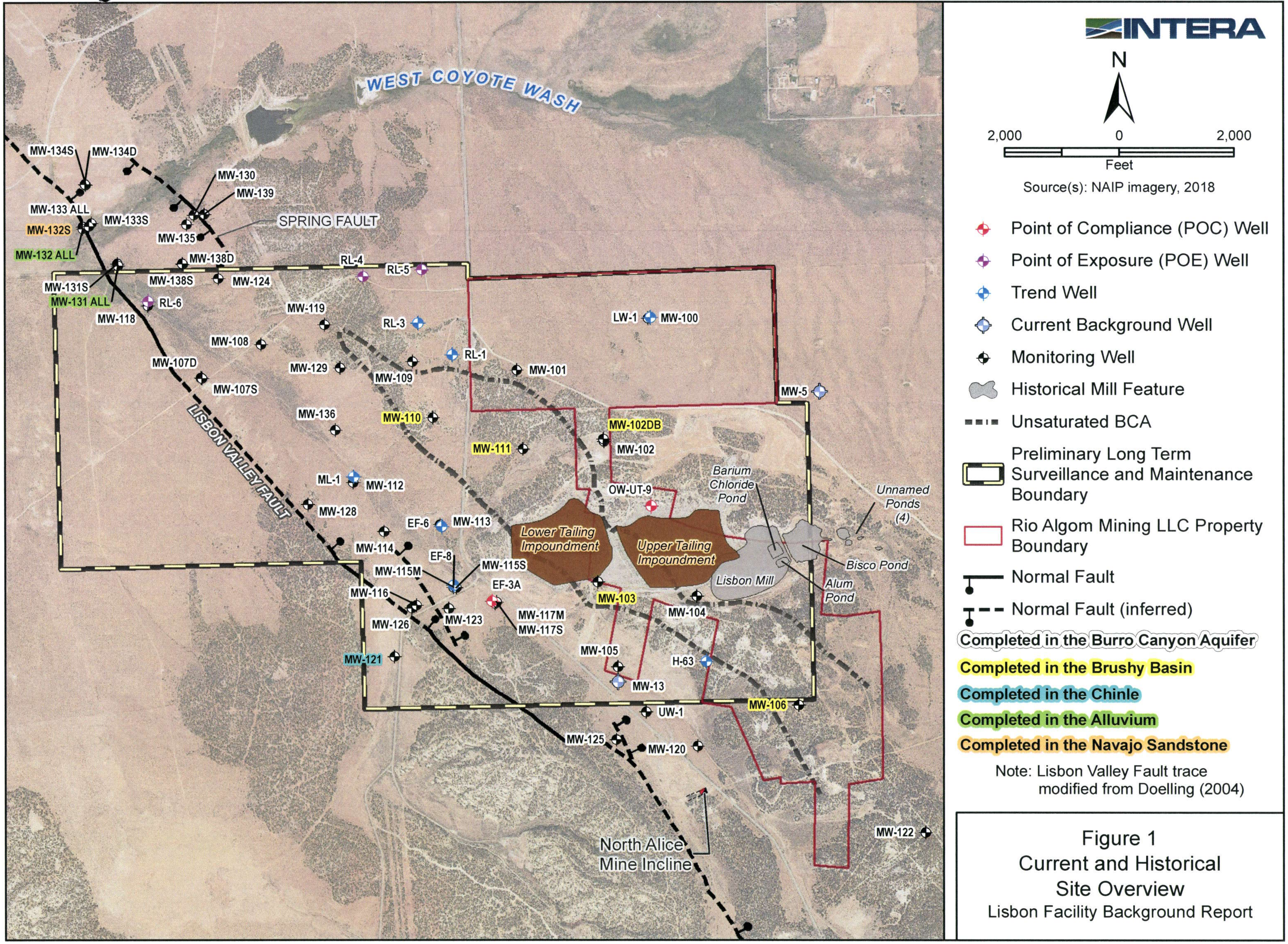

Figure 1
Current and Historical
Site Overview
Lisbon Facility Background Report

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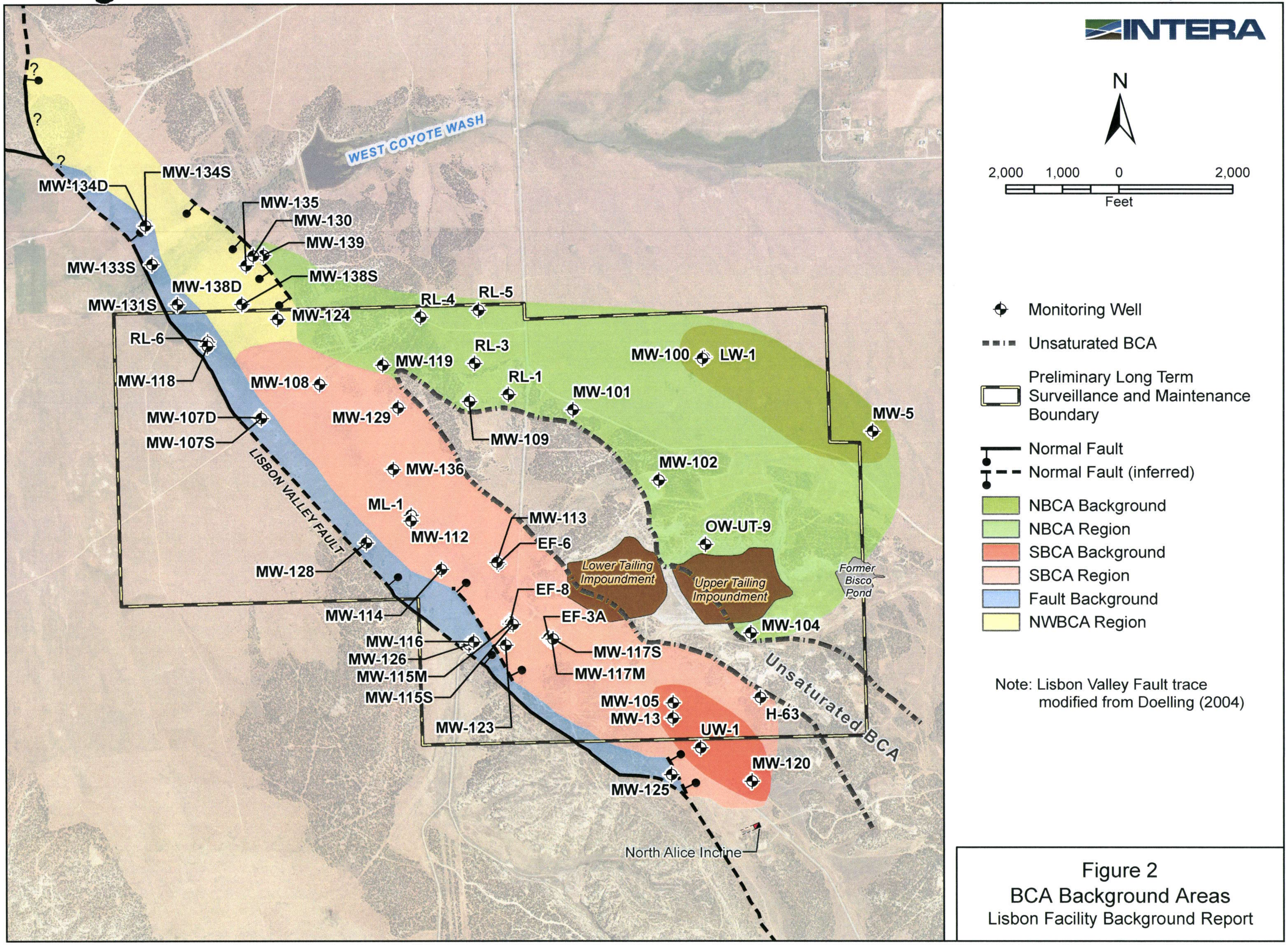

Figure 2
BCA Background Areas
Lisbon Facility Background Report

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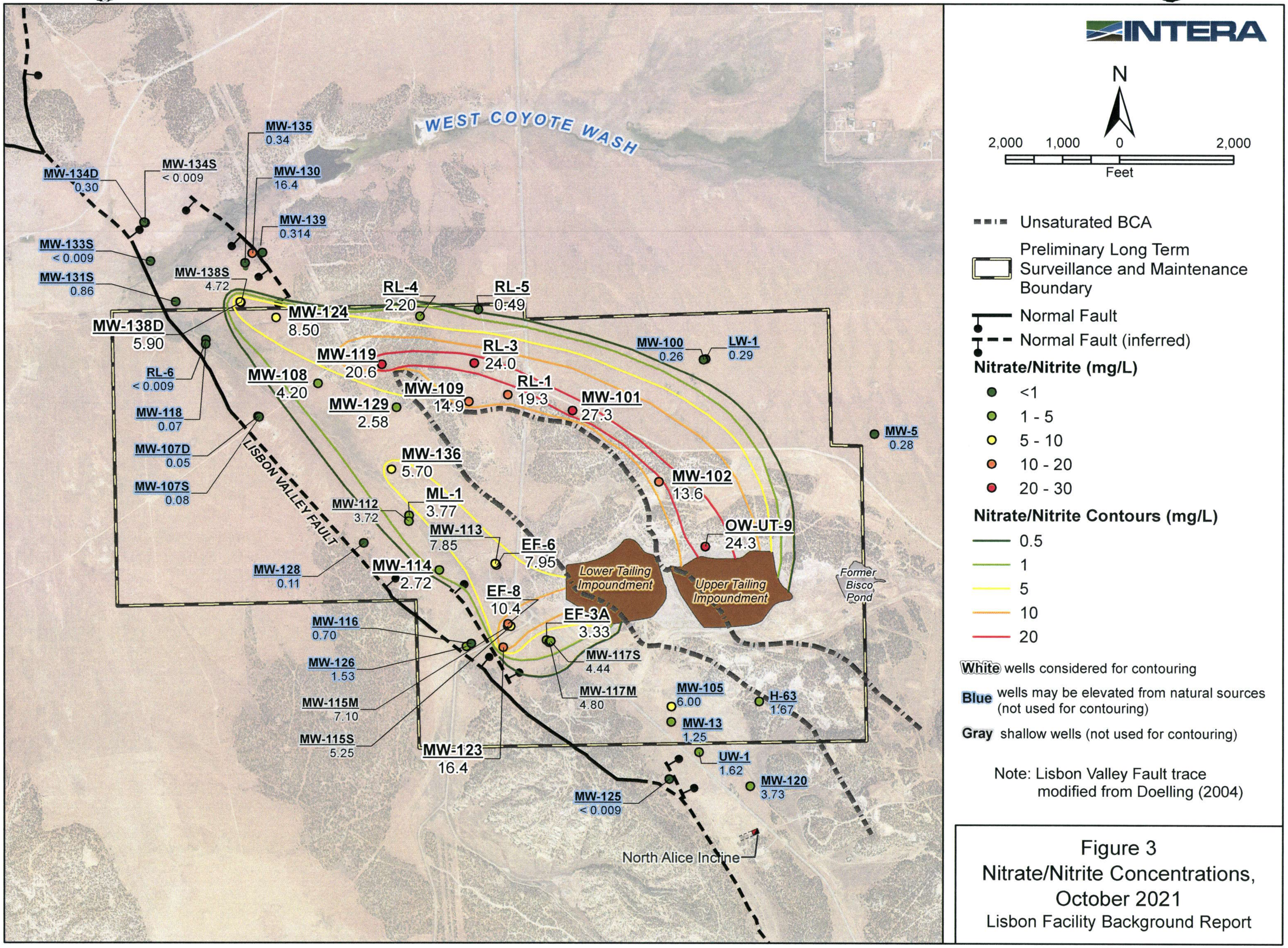

Figure 3
Nitrate/Nitrite Concentrations, October 2021
Lisbon Facility Background Report

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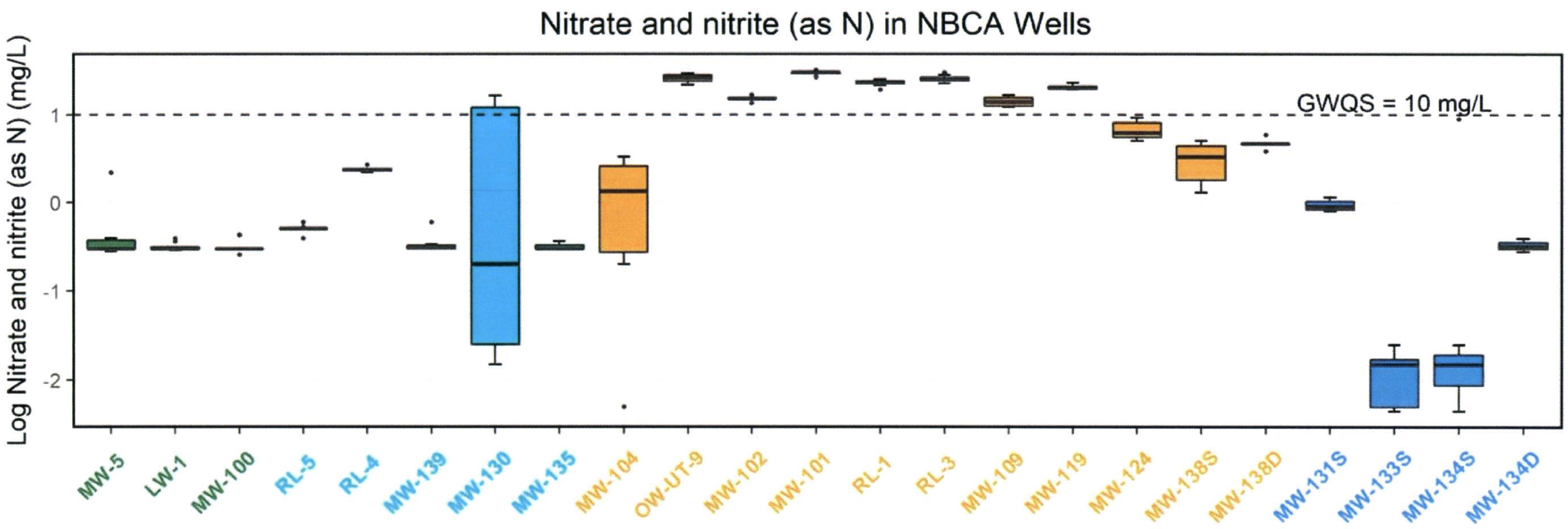


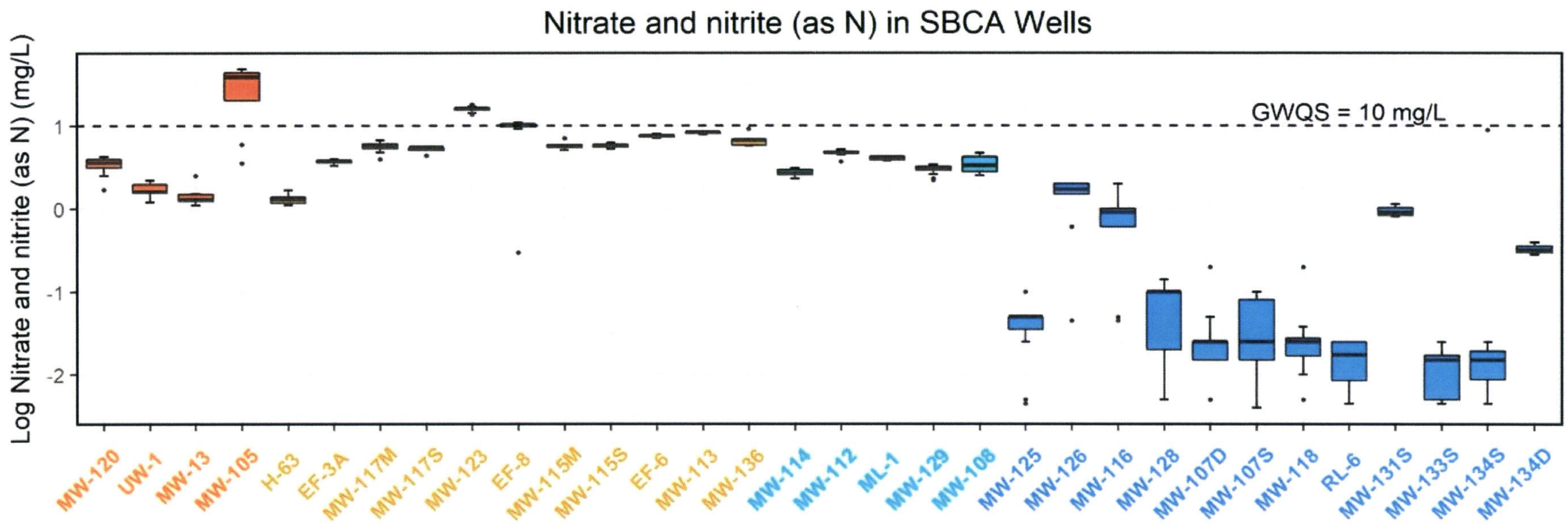
Boxplots of nitrate and nitrite concentrations for northern Burro Canyon Aquifer (NBCA) wells. Data begin at the first quarter of 2018, where available, or as soon as monitoring began in newer wells. Color coding corresponds to well designations established in the 2021 Background Report based on multiple lines of evidence (INTERA, 2021b). The Utah groundwater quality standard (GWQS) is 10 mg/L for combined nitrate and nitrite (as N) as defined in UAC R317-6-2.

INTERA

Figure 4

Nitrate/Nitrite: NBCA Wells

Lisbon Facility Background Report



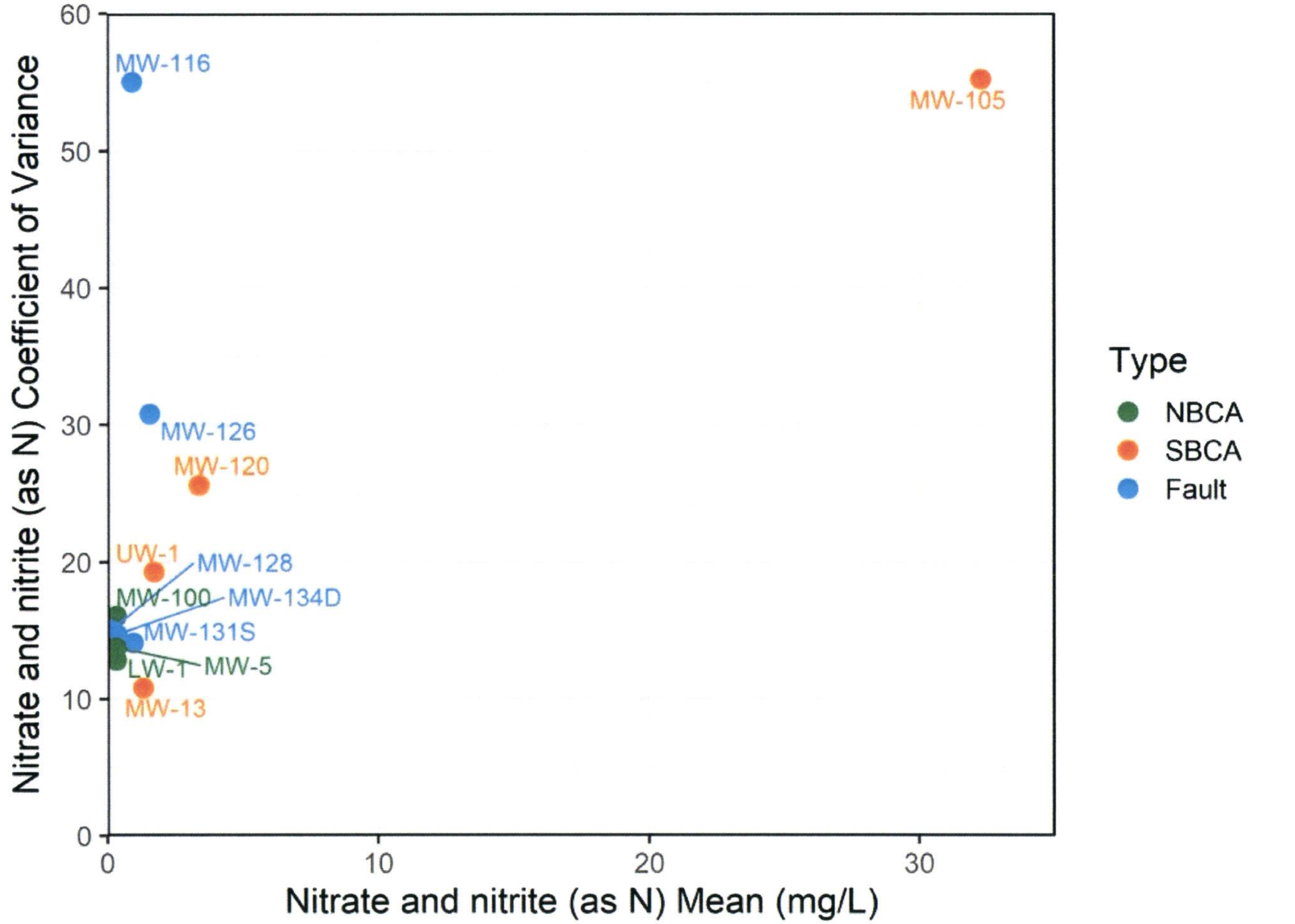
Boxplots of nitrate and nitrite concentrations for southern Burro Canyon Aquifer (SBCA) wells. Data begin at the first quarter of 2018, where available, or as soon as monitoring began in newer wells. Color coding corresponds to well designations established in the 2021 Background Report based on multiple lines of evidence (INTERA, 2021b). The Utah groundwater quality standard (GWQS) is 10 mg/L for combined nitrate and nitrite (as N) as defined in UAC R317-6-2.

Figure 5

Nitrate/Nitrite: SBCA Wells

Lisbon Facility Background Report

INTERA



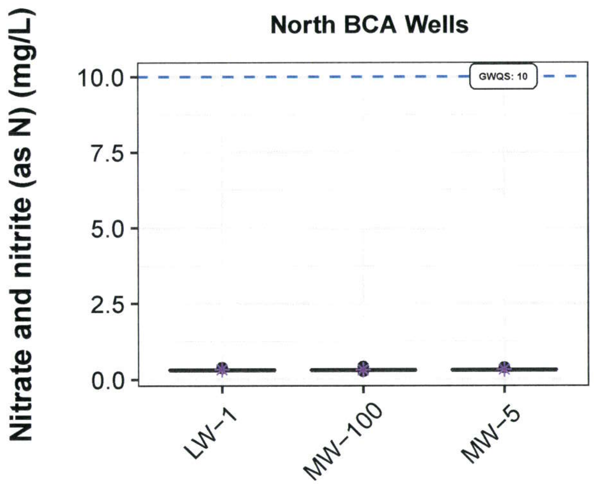
Coefficient of variance and mean values for nitrate and nitrite concentrations in background wells. Results for datasets with greater than 50% non-detect values are not shown. Results for datasets with less than or equal to 50% non-detect were calculated with any values below the reporting limit substituted with the appropriate values or using the Kaplan-Meier adjusted mean and standard deviation.

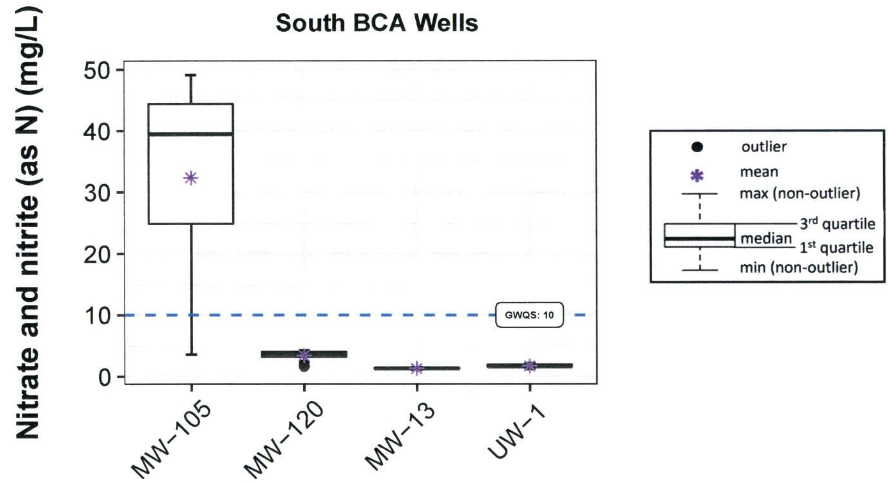
INTERA

Figure 6

Nitrate/Nitrite Variance in Background Wells

Lisbon Facility Background Report





p−value

	MW−100	MW−5
LW−1	0.7	1.0
MW−100	NA	0.7

statistic

	MW−100	MW−5
LW−1	35	32
MW−100	NA	29

p−value

	MW−120	MW−13	UW−1
MW−105	**0.004**	**9e−04**	**9e−04**
MW−120	NA	**9e−04**	**3e−03**
MW−13	NA	NA	**1e−02**

statistic

	MW−120	MW−13	UW−1
MW−105	60	64	64
MW−120	NA	64	61
MW−13	NA	NA	8

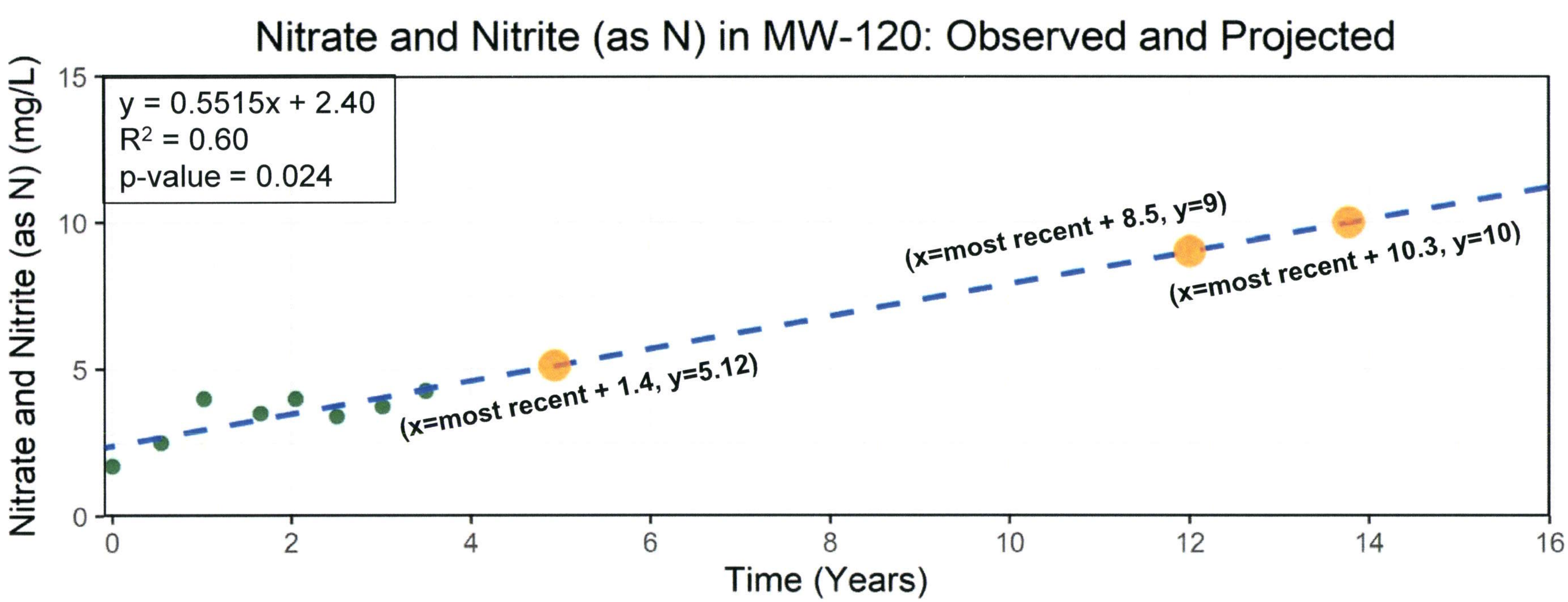
INTERA

Figure 7

Nitrate and nitrite (as N) in BCA Background Wells

Lisbon Facility Background Report

Boxplots of nitrate and nitrite (as n) concentrations for NBCA and SBCA background wells and tables of Wilcoxon Rank Sum p−values and test statistics between background wells in a given area are presented here. Bolded green p−values indicate that medians between the two datasets are significantly different at 95% confidence. NA's represent matching sites or >50% of data was censored and no statistics were calculated. Open circles on boxplots represent censored results.



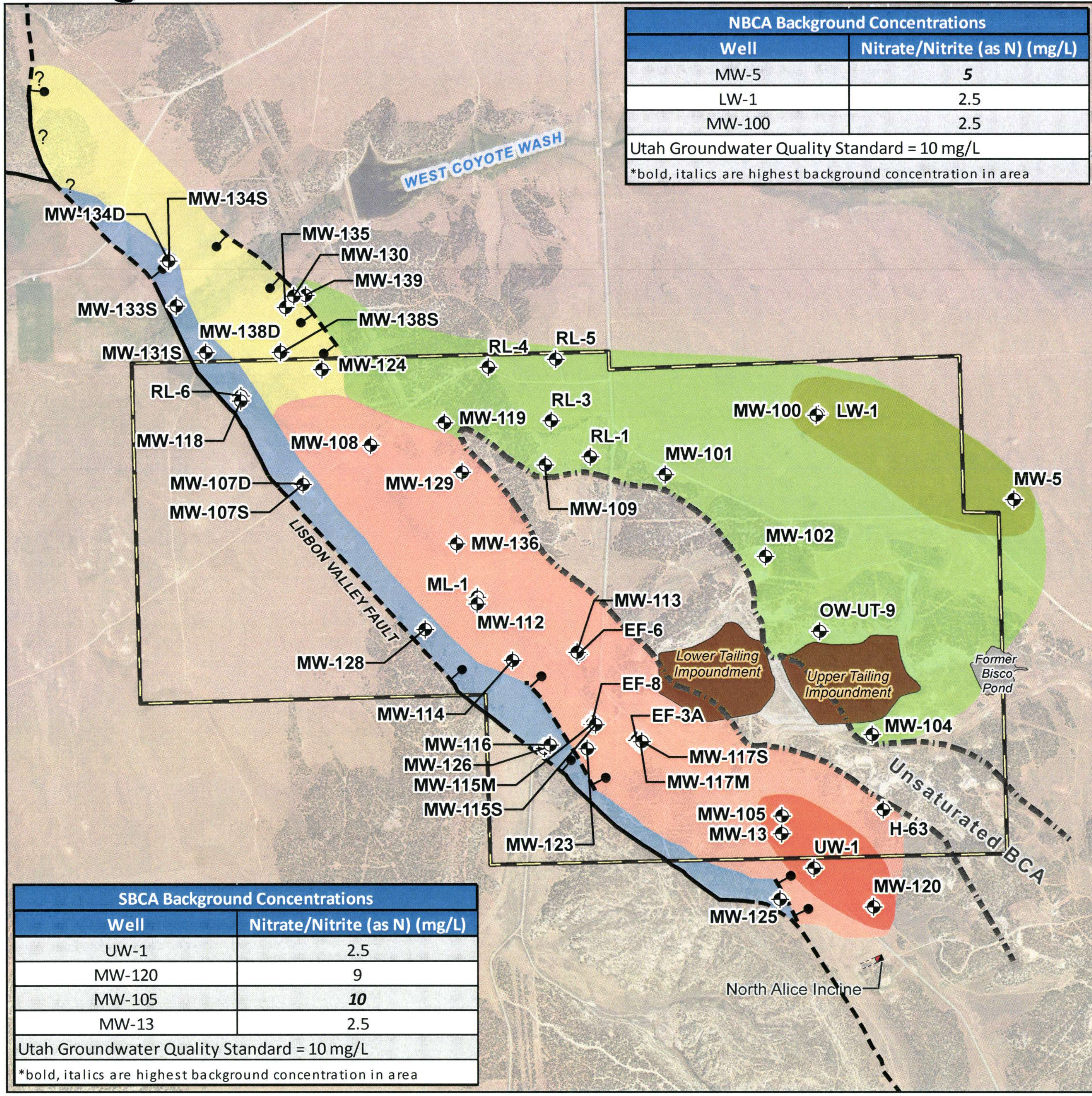
Observed nitrate and nitrite concentrations in MW-120 (green points) and the significant linear regression (blue dashed line) projected beyond the monitoring period. The lowest large orange dot represents the time it would take since the most recent sampling event to reach the mean plus two standard deviation value determined for this well in Table 3 assuming a constant rate of increase. The mean plus two standard deviation value is one of multiple options for determining the background concentration according to Utah Administrative Code (UAC) R317-6-4. The middle orange dot represents the time it would take to reach a concentration that is still below groundwater quality standard (GWQS) of 10 mg/L (UAC R317-6-2). The highest large orange dot represents the time it would take beyond the most recent sampling event to reach the GWQS of 10 mg/L assuming a constant rate of increase in this well.

INTERA

Figure 8

Nitrate/Nitrite in MW-120

Lisbon Facility Background Report



NBCA Background Concentrations

Well	Nitrate/Nitrite (as N) (mg/L)
MW-5	***5***
LW-1	2.5
MW-100	2.5
Utah Groundwater Quality Standard = 10 mg/L	
*bold, italics are highest background concentration in area	

SBCA Background Concentrations

Well	Nitrate/Nitrite (as N) (mg/L)
UW-1	2.5
MW-120	9
MW-105	***10***
MW-13	2.5
Utah Groundwater Quality Standard = 10 mg/L	
*bold, italics are highest background concentration in area	

Note: Lisbon Valley Fault trace modified from Doelling (2004)

INTERA

Figure 9
BCA Background Areas and Implementation
Lisbon Facility Background Report

FILE: S:\ABQ\RIOAL.RioAlgom\Graphics\Lisbon\MapDocs\Background_Report_2022\09_BaclgroundImplementation.mxd 9/16/2022

TABLES

TABLE 1
Statistics Summary for Nitrate/Nitrite in NBCA and SBCA Background Wells
Rio Algom Mining LLC, Lisbon Facility

Well	Background Area	Constituent	Dataset Description	N	% ND	Mean	SD	Min	Median	Max	Number of Outliers Removed	Shapiro-Wilk Test for Normality		Normal?	Shapiro -Wilk Test for log Normality		Log normal?	Kolmogorov-Smirnov Test		Gamma?	Linear Regression		Significant Trend?	Mann-Kendall Trend Test		Significant Trend?
												SW	p		SW	p		D	crt. value		Slope	p		S	p	
LW-1	NBCA	nitrate and nitrite (as N)	data since 10/09/2018	8	0%	0.320	0.041	0.29	0.30	0.40	0	0.667	0.0010	no	0.674	0.0012	no	0.448	0.293	no				4	0.334	Not significant
MW-100	NBCA	nitrate and nitrite (as N)	data since 10/09/2018	8	0%	0.311	0.050	0.26	0.30	0.43	0	0.605	1.0E-04	no	0.643	2.4E-04	no	0.461	0.293	no				1	0.500	Not significant
MW-5	NBCA	nitrate and nitrite (as N)	data since 1/24/2018	8	0%	0.320	0.044	0.28	0.30	0.40	1	0.705	0.0027	no	0.719	0.0037	no	0.433	0.293	no				-6	0.237	Not significant
MW-105	SBCA	nitrate and nitrite (as N)	data since 10/09/2018	8	0%	32.3	17.8	3.58	39.5	49.1	0	0.812	0.0547	yes	0.709	0.0036	no	0.330	0.298	no	-13.0	0.003	Significant	-24	0.002	Significant
MW-120	SBCA	nitrate and nitrite (as N)	data since 10/09/2018	8	0%	3.39	0.868	1.70	3.62	4.26	0	0.869	0.1485	yes	0.804	0.0283	no	0.292	0.294	yes	0.55	0.024	Significant	15	0.040	Significant
MW-13	SBCA	nitrate and nitrite (as N)	data since 1/24/2018	8	0%	1.32	0.143	1.10	1.30	1.51	1	0.951	0.8239	yes	0.954	0.8375	yes	0.171	0.294	yes	0.06	0.130	Not significant	11	0.106	Not significant
UW-1	SBCA	nitrate and nitrite (as N)	data since 10/09/2018	8	0%	1.72	0.331	1.20	1.61	2.20	0	0.941	0.6426	yes	0.941	0.6110	yes	0.225	0.294	yes	0.16	0.130	Not significant	13	0.067	Not significant

Notes:
All units are milligrams per liter, except linear regression slope, which is in milligrams per liter per year
N = size of dataset
% ND = percentage of non-detect reults
SD = standard deviation
SW = test statistic for the Shapiro-Wilk test for normality
p = p-value for statistical test
D = test statistic for the Kolmogorov-Smirnov test for a gamma distribution
crt. value = the critical value compared against the test statistic for the Kolmogorov-Smirnov Test
slope = slope for linear regression of normal datasets with less than 10% NDs
S = test statistic for the Mann-Kendall test for a significant trend

INTERA

TABLE 2
Statistics Summary for Nitrate/Nitrite in Fault Background Wells
Rio Algom Mining LLC, Lisbon Facility

Well	Background Area	Constituent	Dataset Description	N	% ND	Mean	SD	Min	Median	Max	Number of Outliers Removed	Shapiro-Wilk Test for Normality		Normal?	Shapiro -Wilk Test for log Normality		Log normal?	Kolmogorov-Smirnov Test		Gamma?	Linear Regression		Significant Trend?	Mann-Kendall Trend Test		Significant Trend?
												SW	p		SW	p		D	crt. value		Slope	p		S	p	
MW-107D	Fault	nitrate and nitrite (as N)	data since 1/23/2018	8	88%	0.036	0.018	0.01	0.05	0.05	1													0	0.500	Not significant
MW-107S	Fault	nitrate and nitrite (as N)	data since 1/23/2018	9	67%	0.052	0.035	0.01	0.05	0.10	0													1.37032	0.085	Not significant
MW-116	Fault	nitrate and nitrite (as N)	data since 1/22/2018	9	22%	0.907	0.499	0.38	0.90	2.00	0	0.885	0.1485	yes	0.949	0.7210	yes	0.135	0.280	yes				2	0.458	Not significant
MW-118	Fault	nitrate and nitrite (as N)	data since 10/9/2018	7	86%	0.0	0.0	0.01	0.0	0.05	1													40.6667	0.217	Not significant
MW-125	Fault	nitrate and nitrite (as N)	data since 1/24/2018	13	100%	100%	NDs																			
MW-126	Fault	nitrate and nitrite (as N)	data since 1/22/2018	13	15%	1.45	0.682	Kaplan-Meier Estimated Mean, SD																-10	0.288	Not significant
MW-128	Fault	nitrate and nitrite (as N)	data since 1/25/2018	13	31%	0.08	0.045	Kaplan-Meier Estimated Mean, SD																36	0.010	Significant
MW-131S	Fault	nitrate and nitrite (as N)	data since 10/20/2020	7	0%	0.94	0.132	0.80	0.90	1.14	0	0.916	0.6237	yes	0.920	0.6758	yes	0.177	0.311	yes	0.15	0.179	Not significant	10	0.086	Not significant
MW-133S	Fault	nitrate and nitrite (as N)	data since 8/4/2020	8	100%	100%	NDs																			
MW-134D	Fault	nitrate and nitrite (as N)	data since 10/27/2020	7	0%	0.33	0.049	0.28	0.32	0.4	0	0.815	0.0819	yes	0.839	0.1370	yes	0.301	0.311	yes	-0.61	0.122	Not significant	-0.7777	0.218	Not significant
MW-134S	Fault	nitrate and nitrite (as N)	data since 10/27/2020	7	86%	1.31	3.392	0.01	0.03	9	0													-0.4704	0.319	Not significant
RL-6	Fault	nitrate and nitrite (as N)	data since 10/9/2018	8	100%	100%	NDs																			

Notes:
All units are milligrams per liter, except linear regression slope, which is in milligrams per liter per year
N = size of dataset
% ND = percentage of non-detect reults
SD = standard deviation
SW = test statistic for the Shapiro-Wilk test for normality
p = p-value for statistical test
D = test statistic for the Kolmogorov-Smirnov test for a gamma distribution
crt. value = the critical value compared against the test statistic for the Kolmogorov-Smirnov Test
slope = slope for linear regression of normal datasets with less than 10% NDs
S = test statistic for the Mann-Kendall test for a significant trend

INTERA

TABLE 3
Summary of Nitrate/Nitrite (as N)
Concentrations in NBCA and SBCA Background Wells
Rio Algom Mining LLC, Lisbon Facility

Constituent	Well[1]	Groundwater Class Based on TDS	Groundwater Class Based on Other Constituents[2]	Distribution Description	1.25 x mean (Class 2) or 1.5 x mean (Class 3)	0.25 x GWQS (Class 2) or 0.5 x GWQS (Class 3)	mean + 2SD	95% UTL	Modified Approach
North BCA Wells									
Nitrate and nitrite (as N)	LW-1	2A	2B	0% NDs, nonparametric, no trend	0.40	2.5	0.40	0.40	
	MW-100			0% NDs, nonparametric, no trend	0.39	2.5	0.41	0.43	
	MW-5		3B	0% NDs, nonparametric, no trend	0.48	5	0.41	0.40	
South BCA Wells									
Nitrate and nitrite (as N)	MW-105	2A	3B	0% NDs, parametric, decreasing	**48.4**	5	**67.9**		**10**
	MW-120		2B	0% NDs, parametric, increasing	4.23	2.5	5.12		9
	MW-13			0% NDs, parametric, no trend	1.65	2.5	1.61		
	UW-1			0% NDs, parametric, no trend	2.15	2.5	2.38		

Notes:

1. Background concentrations are not calculated for fault wells due to lack of utility in performance monitoring
2. 3B classification is due to exceedance of a standard defined in UAC R317-6-2

TDS = total dissolved solids

UAC = Utah Administrative Code

GWQS = Ground Water Quality Standard defined in UAC R317-6-2

SD = standard deviation

95% UTL = upper tolerance limit on 95th percentile

NBCA = north Burro Canyon Aquifer

SBCA = south Burro Canyon Aquifer

2A = Groundwater class based on TDS in UAC R317-6-3

2B, 3B = Groundwater class based on comparison to GWQS according to UAC R317-6-3

NDs = non-detects

All values in units of milligrams per liter

Values chosen as selected background concentrations shaded dark gray

Values that exceed or are close to exceeding GWQS are shown in ***bold***

TABLE 4
Current and Proposed License Parameters
Rio Algom Mining LLC, Lisbon Facility

NBCA		SBCA		NWBCA	
Current and Proposed Compliance Parameters (COCs)		Current and Proposed Compliance Parameters (COCs)		Proposed Compliance Parameters (COCs)	
	[1]Background Concentration (mg/L)		[1]Background Concentration (mg/L)		[1]Background Concentration (mg/L)
arsenic	0.025	arsenic	0.034	arsenic	0.034
molybdenum	0.020	molybdenum	0.019	molybdenum	0.020
selenium	0.095	selenium	0.025	selenium	0.095
uranium	0.012	uranium	0.029	uranium	0.029
nitrate/nitrite (as N)	5.00	nitrate/nitrite (as N)	10.0	nitrate/nitrite (as N)	10.0
Current Monitored Parameters		Current Monitored Parameters		Proposed Monitored Parameters	
bicarbonate	-	bicarbonate	-	bicarbonate	-
chloride	-	chloride	-	chloride	-
pH	-	pH	-	pH	-
sulfate	-	sulfate	-	sulfate	-
total dissolved solids (TDS)	-	total dissolved solids (TDS)	-	total dissolved solids (TDS)	-
water levels	-	water levels	-	water levels	-

Notes:

Proposed background concentrations in the northwest Burro Canyon Aquifer (NWBCA) represent the highest concentrations among the north BCA (NBCA) and south BCA (SBCA) background concentrations. Background wells are not proposed for the NWBCA because this region is downgradient of mill-related impacts.

N = nitrogen

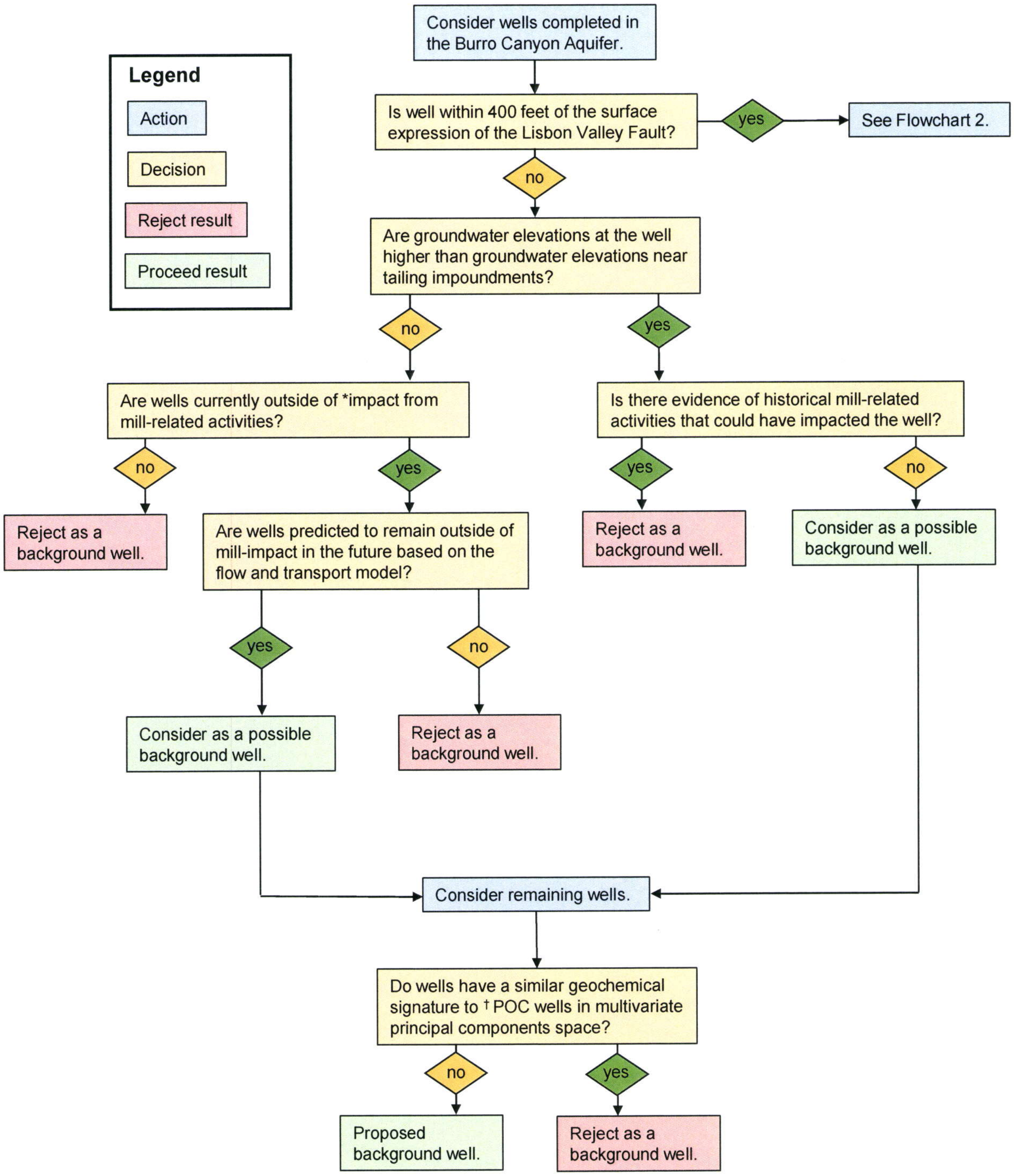
mg/L = milligrams per liter

1. Background concentrations apply to compliance parameters only; values represent the highest concentration for given background area

APPENDIX A

Flowcharts for Selecting Background Wells and Statistical Analysis

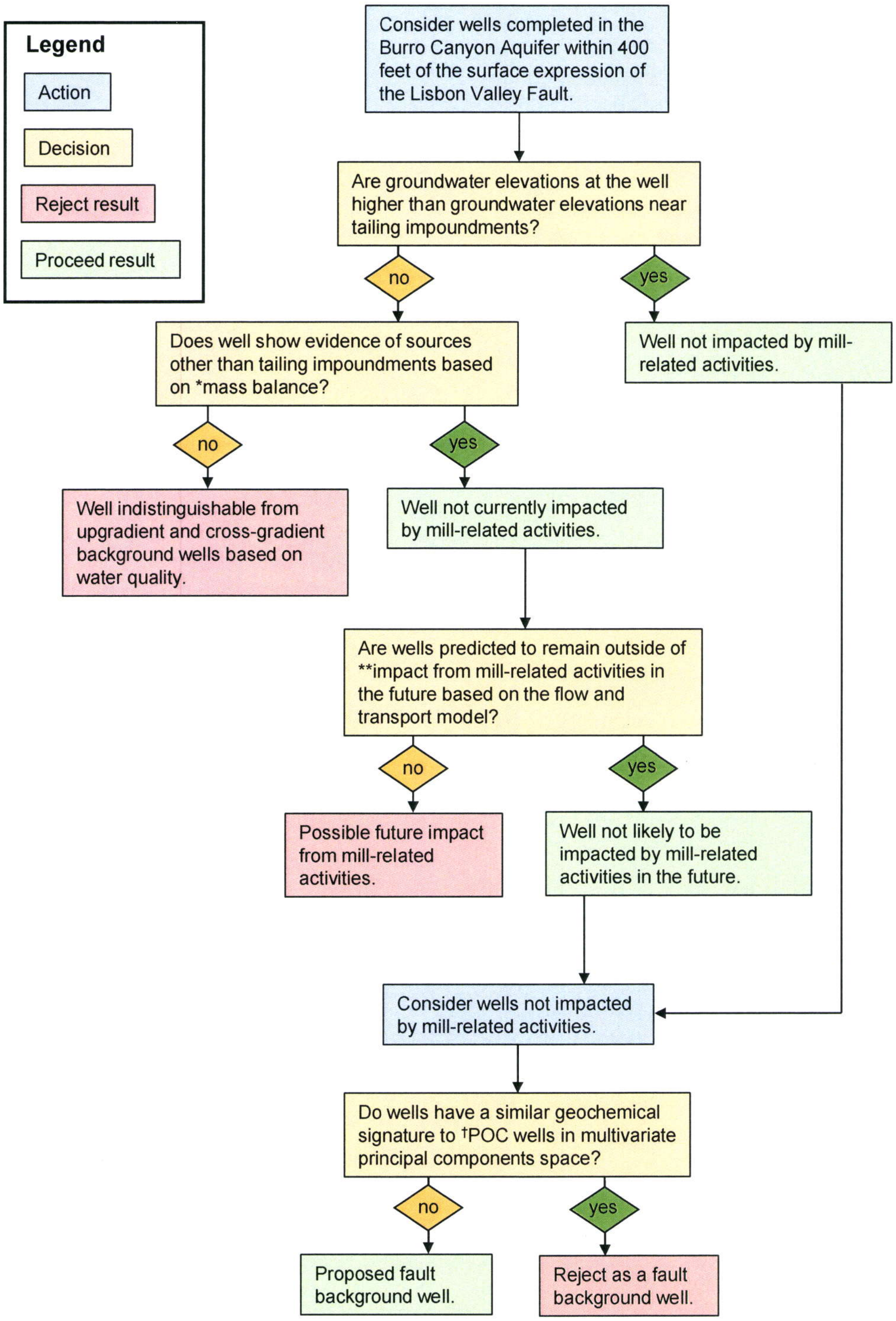
Flowchart 1. Selection of Upgradient and Cross-Gradient Background Wells



* Impact determined by mill-related concentrations of uranium in isoconcentration map because uranium appears to be the most mobile among the current constituents of concern.

†Point of Compliance

Flowchart 2. Determination of Mill-Related Impacts to Fault Wells

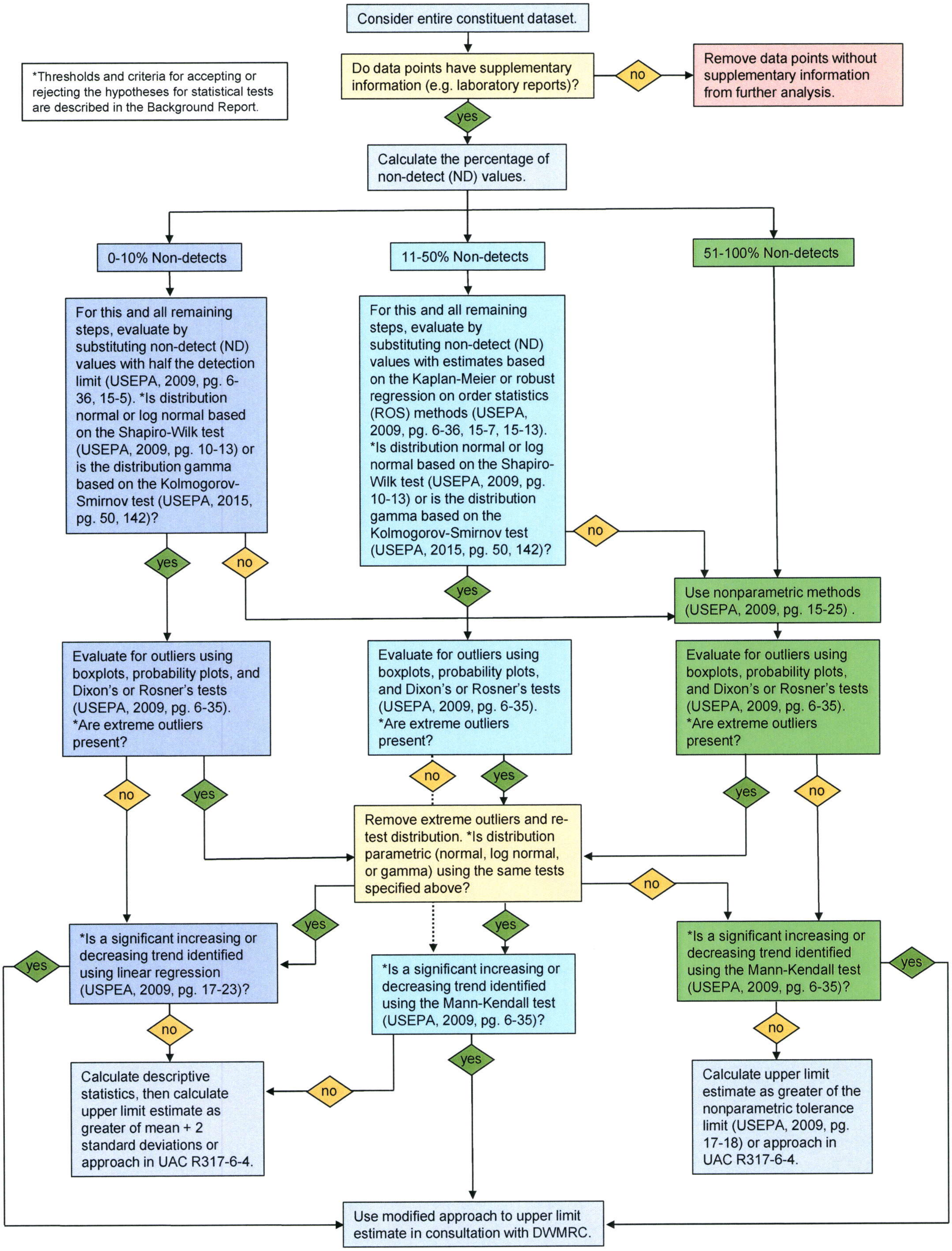


* See side-by-side boxplots for mass balance comparison.

** Impact determined by mill-related concentrations of uranium in isoconcentration map because uranium appears to be the most mobile among the current constituents of concern.

†Point of Compliance

Flowchart 3. Statistical Analysis and Calculation of Background Concentrations



APPENDIX B

Groundwater Monitoring Results for All Wells

APPENDIX B
Groundwater Monitoring Results for All Wells
Rio Algom Mining LLC Lisbon Facility

Station Name	Sample Date	Geologic Unit	Sample Type	Nitrate and Nitrite (as N)	Nitrate (as N)	Nitrite (as N)	Total Dissolved Solids
Units				mg/L	mg/L	mg/L	mg/L
EF-3A	11/1/2012	Kbc	FD				4770
	11/1/2012		N				5060
	4/5/2013		N				5270
	4/5/2013		FD				5350
	10/13/2013		N				5900
	12/14/2013		N				5310
	4/5/2014		N				5180
	10/28/2014		FS				6680
	10/28/2014		N				6460
	10/21/2015		N				5460
	10/22/2015		FD				5450
	10/12/2016		N				5300
	10/27/2017		N				5290
	1/22/2018		N		3.8	< 0.04	5500
	10/8/2018		N		3.6	< 0.1	5480
	10/8/2018		FD		3.7	< 0.1	5440
	4/25/2019		N		3.3	< 0.2	5500
	4/25/2019		FS	4.23	4.23	< 0.01	5490
	10/17/2019		N		3.7	< 0.1	5570
	10/17/2019		FD		3.7	< 0.1	5520
	6/2/2020		N		3.7	< 0.04	5570
	6/2/2020		FS	4.17	4.16	0.01	5760
	10/19/2020		N		4	< 0.04	5530
	4/14/2021		N		4	< 0.1	5520
	4/14/2021		FD		4	< 0.1	5510
	10/18/2021		N	3.33			5570
	4/7/2022		N	3.88			5740
EF-6	10/30/2012	Kbc	N				2180
	4/2/2013		FD				2190
	4/2/2013		N				2180
	10/11/2013		N				2210
	10/11/2013		FD				2230
	4/5/2014		N				2220
	4/5/2014		FD				2260
	9/24/2014		N				2220
	10/28/2014		N				2170
	10/23/2015		N				2160
	10/12/2016		N				2110
	10/24/2017		N				2110
	10/10/2018		N		7.3	< 0.05	2090
	4/30/2019		N		7.8	< 0.05	1980
	10/17/2019		N		7.3	< 0.05	2030
	6/2/2020		N		7.1	< 0.04	2040
	10/22/2020		FS	7.17	7.17	< 0.01	1870
	10/22/2020		N		7.8	< 0.04	1850
	4/13/2021		N		7.2	< 0.04	2030
	10/22/2021		N	7.95			1740
	4/6/2022		N	7.8			1750
EF-8	10/31/2012	Kbc	N				1270

APPENDIX B
Groundwater Monitoring Results for All Wells
Rio Algom Mining LLC Lisbon Facility

Station Name	Sample Date	Geologic Unit	Sample Type	Nitrate and Nitrite (as N)	Nitrate (as N)	Nitrite (as N)	Total Dissolved Solids
Units				mg/L	mg/L	mg/L	mg/L
EF-8	10/31/2012	Kbc	FD				1310
	11/28/2012		N				1330
	12/20/2012		N				1330
	1/28/2013		N				1350
	2/26/2013		N				1380
	4/5/2013		N				1400
	5/13/2013		N				1400
	6/9/2013		N				1400
	7/20/2013		N				1480
	8/15/2013		N				1450
	9/30/2013		N				1460
	10/14/2013		N				1430
	11/16/2013		N				1460
	12/14/2013		N				1470
	1/25/2014		N				1480
	2/22/2014		N				1520
	3/31/2014		N				1520
	4/6/2014		N				1570
	4/6/2014		FD				1550
	5/15/2014		N				1570
	6/30/2014		N				1600
	9/24/2014		N				1630
	10/29/2014		N				1630
	10/29/2014		FD				1610
	1/27/2015		N				1700
	4/15/2015		N				1710
	7/29/2015		N				1770
	10/21/2015		N				1800
	1/19/2016		N				1840
	4/27/2016		N				1880
	7/29/2016		N				1990
	10/12/2016		FS				1980
	10/12/2016		N				1970
	2/22/2017		N				2030
	2/22/2017		FD				2020
	4/25/2017		N				2050
	7/25/2017		N				2120
	7/25/2017		FD				2120
	10/24/2017		N				2170
	10/24/2017		FD				2190
	1/22/2018		N		9.6	< 0.01	2180
	4/17/2018		N		9.7	< 0.01	2160
	7/24/2018		N		9.7	< 0.05	2220
	7/24/2018		FD		9.8	< 0.05	2230
	10/8/2018		N		9.8	< 0.05	2260
	2/6/2019		N		9.2	< 0.05	2310
	4/24/2019		FD		10	< 0.007	2290
	4/24/2019		N		10	< 0.007	2310
	7/30/2019		N		10.1	< 0.05	2370

APPENDIX B
Groundwater Monitoring Results for All Wells
Rio Algom Mining LLC Lisbon Facility

Station Name	Sample Date	Geologic Unit	Sample Type	Nitrate and Nitrite (as N)	Nitrate (as N)	Nitrite (as N)	Total Dissolved Solids
Units				mg/L	mg/L	mg/L	mg/L
EF-8	10/17/2019	Kbc	N		10.1	< 0.05	2430
	2/4/2020		N		10.2	< 0.04	2440
	2/4/2020		FD		10.1	< 0.04	2440
	6/2/2020		N		10.4	< 0.04	2510
	8/4/2020		N		10.6	< 0.04	2510
	10/27/2020		N		0.3	< 0.04	2500
	2/17/2021		N		10.8	< 0.04	2530
	4/11/2021		N		11	< 0.04	2560
	7/20/2021		FD		10.7	< 0.04	2620
	7/20/2021		N		10.8	< 0.04	2610
	10/13/2021		N	10.4			2610
	1/13/2022		N	10.6			2640
	4/19/2022		N	10.6			2690
H-63	11/3/2012	Kbc	N				629
	4/3/2013		N				624
	10/12/2013		N				610
	10/12/2013		FD				606
	4/2/2014		N				614
	9/24/2014		N				616
	10/28/2014		N				618
	10/23/2015		N				615
	10/23/2015		FD				616
	10/13/2016		N				639
	10/25/2017		N				631
	10/9/2018		N		1.2	< 0.05	613
	4/25/2019		N		1.1	< 0.05	615
	10/18/2019		N		1.3	< 0.05	600
	10/18/2019		FD		1.2	< 0.05	601
	6/3/2020		N		1.1	< 0.04	607
	10/22/2020		N		1.3	< 0.04	610
	10/22/2020		FS	1.24	1.24	< 0.01	604
	4/14/2021		N		1.4	< 0.04	604
	10/16/2021		N	1.67			607
	4/7/2022		N	1.4			607
LW-1	11/2/2012	Kbc	N				358
	4/4/2013		N				367
	10/9/2013		N				352
	4/3/2014		N				355
	9/25/2014		N				356
	10/28/2014		N				340
	10/24/2015		N				356
	10/13/2016		N				473
	10/25/2017		N				471
	10/9/2018		N		0.3	< 0.05	461
	4/24/2019		N		0.3	< 0.05	463
	10/16/2019		N		0.3	< 0.05	415
	6/3/2020		N		0.3	< 0.04	545
	10/26/2020		N		0.3	< 0.04	574
	4/13/2021		N		0.4	< 0.04	429

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Rio Algom Mining LLC Lisbon Facility

Station Name	Sample Date	Geologic Unit	Sample Type	Nitrate and Nitrite (as N)	Nitrate (as N)	Nitrite (as N)	Total Dissolved Solids
Units				mg/L	mg/L	mg/L	mg/L
LW-1	4/13/2021	Kbc	FS	0.347	0.35	< 0.01	430
	10/18/2021		N	0.29			500
	4/8/2022		N	0.37			654
ML-1	10/30/2012	Kbc	N				922
	4/2/2013		N				927
	10/11/2013		N				895
	4/4/2014		N				866
	4/4/2014		FD				868
	9/24/2014		N				857
	10/28/2014		N				829
	10/23/2015		N				782
	10/12/2016		N				744
	10/24/2017		N				744
	10/10/2018		N		4.3	< 0.05	687
	4/28/2019		N		4.3	< 0.02	662
	10/17/2019		N		4	< 0.05	644
	6/2/2020		N		3.9	< 0.04	628
	6/2/2020		FD		3.9	< 0.04	627
	10/21/2020		N		4.3	< 0.04	609
	4/11/2021		N		4.2	< 0.04	588
	10/21/2021		N	3.77			557
	4/6/2022		N	3.89			537
MW-100	10/31/2012	Kbc	N				503
	11/7/2012		N				505
	4/4/2013		N				511
	4/4/2013		FD				502
	10/10/2013		N				525
	10/10/2013		FD				507
	4/3/2014		N				526
	10/24/2015		N				573
	10/13/2016		N				602
	10/25/2017		N				627
	10/9/2018		N		0.3	< 0.05	603
	4/24/2019		N		0.3	< 0.05	619
	10/16/2019		N		0.3	< 0.05	613
	10/16/2019		FD		0.3	< 0.05	609
	6/3/2020		N		0.3	< 0.04	624
	10/20/2020		N		0.3	< 0.04	622
	4/13/2021		N		0.3	< 0.04	633
	10/18/2021		FD	0.26			644
	10/18/2021		N	0.26			640
	4/8/2022		N	0.43			458
MW-101	10/30/2012	Kbc	N				13800
	11/6/2012		N				13700
	11/6/2012		FD				13100
	4/4/2013		FS				14200
	4/4/2013		N				13800
	10/13/2013		N				13900
	4/4/2014		FD				13600

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Station Name	Sample Date	Geologic Unit	Sample Type	Nitrate and Nitrite (as N)	Nitrate (as N)	Nitrite (as N)	Total Dissolved Solids
Units				mg/L	mg/L	mg/L	mg/L
MW-101	4/4/2014	Kbc	N				13800
	10/24/2015		N				13200
	10/13/2016		N				12700
	10/13/2016		FD				12600
	10/26/2017		N				12400
	1/25/2018		N		31.9	< 0.07	12500
	10/11/2018		N		30.5	< 0.3	12100
	4/30/2019		N		29.8	< 0.2	11800
	10/21/2019		N		30.1	< 0.2	11900
	6/1/2020		N		29.2	< 0.1	11600
	10/21/2020		N		29.2	< 0.2	11500
	4/8/2021		N		30	< 0.2	11400
	10/20/2021		N	27.3			11500
	4/5/2022		N	26.8			11200
MW-102	10/30/2012	Kbc	N				10900
	11/6/2012		FD				15000
	11/6/2012		N				13700
	4/3/2013		N				14900
	4/3/2013		FD				15300
	10/9/2013		N				14600
	4/4/2014		N				14700
	4/4/2014		FD				14900
	10/22/2015		N				14400
	10/13/2016		N				13500
	10/13/2016		FD				13600
	10/25/2017		N				12700
	10/25/2017		FD				12500
	1/25/2018		N		16.9	< 0.07	12200
	10/10/2018		N		15.3	< 0.1	12000
	4/30/2019		N		15.2	< 0.2	11000
	10/21/2019		N		14.9	< 0.1	10600
	5/31/2020		N		15.2	< 0.1	9480
	10/20/2020		N		15.5	< 0.2	10400
	4/8/2021		N		15.6	< 0.1	9550
	10/19/2021		N	13.6			9660
	4/5/2022		N	15.1			9190
MW-102DB	10/30/2012	Jmb	N				440
	11/6/2012		FS				480
	11/6/2012		N				460
	11/6/2012		FD				455
	4/2/2013		N				538
	4/2/2013		FD				458
	10/9/2013		N				563
	4/4/2014		N				596
	10/22/2015		N				505
	10/13/2016		N				530
	10/25/2017		N				519
	10/10/2018		N		< 0.02	< 0.02	618
	4/30/2019		N		< 0.04	< 0.05	491

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Station Name	Sample Date	Geologic Unit	Sample Type	Nitrate and Nitrite (as N)	Nitrate (as N)	Nitrite (as N)	Total Dissolved Solids
Units				mg/L	mg/L	mg/L	mg/L
MW-102DB	10/21/2019	Jmb	N		< 0.04	< 0.05	485
	5/31/2020		N		< 0.05	< 0.04	484
	10/22/2020		N		< 0.05	< 0.04	469
	4/8/2021		N		< 0.03	< 0.04	484
	10/21/2021		N	0.01			475
	4/6/2022		N	< 0.01			465
MW-103	10/31/2012	Jmb	N				618
	11/7/2012		N				4310
	4/5/2013		N				4200
	4/5/2013		FD				3950
	10/13/2013		N				4190
	4/4/2014		N				4280
	10/23/2015		N				4420
	10/13/2016		N				4540
	10/25/2017		N				4680
	1/24/2018		N		< 0.1	< 0.07	4360
	10/9/2018		N		< 0.1	< 0.1	4500
	10/9/2018		FD		< 0.1	< 0.1	4470
	4/25/2019		N		< 0.09	< 0.1	4350
	10/18/2019		N		0.2	< 0.05	4090
	6/3/2020		N		< 0.05	< 0.04	4280
	10/26/2020		N		< 0.05	< 0.04	874
	4/8/2021		N		0.7	< 0.04	3570
	10/22/2021		N	0.02			1590
	4/19/2022		N	1.19			4330
MW-104	10/29/2012	Kbc	N				1180
	11/7/2012		N				968
	11/28/2012		N				925
	4/5/2013		N				852
	10/14/2013		N				795
	11/17/2013		N				716
	4/6/2014		N				775
	10/25/2015		N				692
	10/11/2016		N				582
	10/24/2017		N				635
	10/10/2018		N		0.2	< 0.02	688
	4/25/2019		N		0.7	< 0.007	713
	10/18/2019		N		3.3	< 0.05	581
	10/27/2020		N		2.5	< 0.04	589
	4/12/2021		N		2.6	< 0.04	605
	4/19/2022		N	< 0.01			753
MW-105	10/31/2012	Kbc	N				555
	11/7/2012		N				862
	11/7/2012		FD				856
	4/3/2013		N				718
	10/12/2013		N				649
	10/12/2013		FD				1060
	4/4/2014		N				727
	10/23/2015		N				716

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Station Name	Sample Date	Geologic Unit	Sample Type	Nitrate and Nitrite (as N)	Nitrate (as N)	Nitrite (as N)	Total Dissolved Solids
Units				mg/L	mg/L	mg/L	mg/L
MW-105	10/23/2015	Kbc	FD				714
	10/13/2016		N				1130
	10/24/2017		N				929
	10/9/2018		N		45.6	< 0.05	975
	4/24/2019		N		49.1	< 0.007	1020
	10/18/2019		N		44	< 0.05	964
	6/3/2020		N		38.5	< 0.04	920
	6/3/2020		FD		39	< 0.04	922
	10/25/2020		N		40.4	< 0.04	949
	4/12/2021		N		31.1	< 0.04	866
	10/16/2021		N	6			596
	4/7/2022		N	3.58			575
MW-106	10/29/2012	Jmb	N				2050
	11/7/2012		N				2170
	11/28/2012		N				2220
	4/5/2013		N				2180
	10/9/2013		N				2150
	10/14/2013		N				2220
	11/17/2013		N				2200
	4/6/2014		N				2190
	10/25/2015		N				2140
	10/12/2016		N				2170
	10/24/2017		N				2150
	10/10/2018		N		< 0.02	< 0.02	2200
	4/29/2019		N		< 0.04	< 0.05	2260
	10/18/2019		N		0.1	< 0.05	2240
	6/1/2020		N		0.1	< 0.04	2240
	10/26/2020		N		0.3	< 0.04	2220
	4/12/2021		N		1.2	< 0.04	2140
	4/9/2022		N	6.4			2240
MW-107D	10/8/2013	Kbc	FD				774
	10/8/2013		N				739
	4/3/2014		N				744
	4/3/2014		FD				752
	10/21/2015		N				741
	10/11/2016		N				727
	10/26/2017		N				744
	1/23/2018		N		< 0.01	< 0.007	703
	10/9/2018		N		< 0.05	< 0.05	713
	4/23/2019		N		0.2	< 0.02	725
	10/16/2019		N		< 0.04	< 0.05	727
	5/28/2020		N		< 0.05	< 0.04	741
	10/21/2020		N		< 0.05	< 0.04	732
	4/7/2021		N		< 0.03	< 0.04	748
	10/13/2021		N	0.05			752
	4/6/2022		N	< 0.01			755
MW-107S	10/8/2013	Kbc	N				1900
	4/3/2014		N				1940
	10/21/2015		N				1830

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Units				mg/L	mg/L	mg/L	mg/L
MW-107S	10/11/2016	Kbc	N				1450
	10/26/2017		N				1290
	1/23/2018		N		< 0.01	< 0.007	1180
	10/9/2018		N		0.1	< 0.05	1450
	4/24/2019		N		< 0.008	< 0.007	1680
	10/16/2019		N		< 0.04	< 0.05	1460
	5/28/2020		N		< 0.05	< 0.04	1430
	10/21/2020		N		< 0.05	< 0.04	1640
	4/7/2021		N		< 0.03	< 0.04	1850
	10/13/2021		N	0.08			1990
	4/6/2022		N	0.1			2080
MW-108	10/12/2013	Kbc	N				734
	10/12/2013		FD				738
	4/3/2014		N				758
	10/20/2015		N				786
	10/11/2016		N				775
	10/25/2017		N				774
	1/23/2018		N		2.5	< 0.007	785
	10/9/2018		N		2.8	< 0.05	829
	4/23/2019		N		3.3	< 0.02	885
	4/23/2019		FD		3.3	< 0.02	887
	10/16/2019		N		2.8	< 0.05	833
	5/28/2020		N		2.9	< 0.04	864
	10/21/2020		N		3.6	< 0.04	896
	4/13/2021		N		4.2	< 0.04	966
	10/13/2021		N	4.2			1010
	4/7/2022		N	4.7			1030
MW-109	10/9/2013	Kbc	N				2440
	4/3/2014		N				3060
	9/25/2014		N				3400
	9/25/2014		FD				3130
	10/22/2015		FS				3600
	10/22/2015		N				3580
	10/13/2016		N				3910
	10/24/2017		N				3790
	10/10/2018		N		12.5	< 0.05	2820
	4/23/2019		N		15.3	< 0.1	4110
	10/21/2019		N		16.4	< 0.05	4340
	6/1/2020		N		12.2	< 0.04	2820
	10/26/2020		N		12.6	< 0.04	2850
	4/12/2021		N		13.2	< 0.04	3010
	10/20/2021		N	14.9			4010
	4/20/2022		N	16.6			4360
MW-110	9/25/2014	Jmb	N				594
	10/24/2015		N				661
	10/11/2016		N				674
	10/24/2017		N				712
	10/10/2018		N		26	< 0.02	679
	4/23/2019		N		23.5	< 0.02	719

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Station Name	Sample Date	Geologic Unit	Sample Type	Nitrate and Nitrite (as N)	Nitrate (as N)	Nitrite (as N)	Total Dissolved Solids
Units				mg/L	mg/L	mg/L	mg/L
MW-110	10/21/2019	Jmb	N		21.5	< 0.05	838
	6/1/2020		N		22.6	< 0.04	676
	10/26/2020		N		22.8	< 0.04	721
	4/12/2021		N		21.9	< 0.04	642
	4/7/2022		N	19			569
MW-111	11/17/2013	Jmb	N				492
	4/1/2014		N				518
	10/24/2015		N				544
	10/11/2016		N				540
	10/24/2017		N				579
	10/10/2018		N		2.3	< 0.02	486
	4/23/2019		N		3.3	< 0.05	545
	10/21/2019		N		2.6	< 0.05	367
	6/1/2020		N		2.2	< 0.04	526
	10/26/2020		N		2	< 0.04	494
	4/12/2021		N		2.1	< 0.04	533
	4/8/2022		N	2.87			563
MW-112	10/11/2013	Kbc	FS				664
	10/11/2013		N				673
	4/4/2014		N				675
	10/23/2015		N				678
	10/12/2016		N				661
	10/24/2017		N				701
	10/9/2018		N		4.5	< 0.05	680
	4/28/2019		N		5.2	< 0.02	673
	10/17/2019		N		4.8	< 0.05	672
	6/1/2020		N		4.7	< 0.04	673
	10/22/2020		N		4.7	< 0.04	629
	4/13/2021		N		5.2	< 0.04	687
	10/20/2021		N	3.72			687
	4/6/2022		N	4.77			690
MW-113	10/11/2013	Kbc	FD				2180
	10/11/2013		N				2150
	4/5/2014		N				2170
	10/23/2015		N				2170
	10/12/2016		N				2150
	10/24/2017		N				2180
	10/24/2017		FD				2180
	10/10/2018		N		8.4	< 0.05	2130
	4/30/2019		N		8.3	< 0.05	2120
	10/17/2019		N		8	< 0.05	2080
	6/2/2020		N		8.2	< 0.04	2080
	10/21/2020		N		8.5	< 0.04	2070
	10/21/2020		FD		8.4	< 0.04	2070
	4/13/2021		N		8.4	< 0.04	2060
	10/22/2021		N	7.85			2060
	4/6/2022		N	8.4			2050
MW-114	10/13/2013	Kbc	N				471
	10/13/2013		FD				474

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Station Name	Sample Date	Geologic Unit	Sample Type	Nitrate and Nitrite (as N)	Nitrate (as N)	Nitrite (as N)	Total Dissolved Solids
Units				mg/L	mg/L	mg/L	mg/L
MW-114	4/4/2014	Kbc	N				467
	10/23/2015		N				467
	10/12/2016		N				414
	10/24/2017		N				451
	10/9/2018		N		2.6	< 0.05	451
	4/28/2019		N		2.6	< 0.01	441
	10/17/2019		N		2.4	< 0.05	431
	6/1/2020		N		2.3	< 0.04	435
	10/22/2020		N		2.9	< 0.04	437
	4/11/2021		N		3.1	< 0.04	458
	4/11/2021		FD		3.1	< 0.04	423
	10/21/2021		FD	2.73			486
	10/21/2021		N	2.72			486
	4/6/2022		N	3.03			455
MW-115M	10/14/2013	Kbc	N				783
	11/16/2013		N				741
	4/5/2014		FS				780
	4/5/2014		N				724
	9/24/2014		FS				690
	9/24/2014		N				782
	10/21/2015		N				772
	10/12/2016		N				792
	10/24/2017		N				787
	10/8/2018		N		5.4	< 0.05	808
	4/28/2019		N		5.6	< 0.02	828
	10/17/2019		N		5.5	< 0.05	822
	5/28/2020		N		5.1	< 0.04	787
	10/22/2020		N		5.9	< 0.04	811
	4/11/2021		N		5.9	< 0.04	834
	10/22/2021		N	7.1			815
	4/5/2022		N	5.8			850
MW-115S	10/13/2013	Kbc	N				740
	10/13/2013		FD				751
	4/5/2014		N				729
	10/21/2015		N				767
	10/12/2016		N				792
	10/24/2017		N				813
	10/8/2018		N		5.6	< 0.05	809
	4/28/2019		N		6	< 0.02	816
	10/17/2019		N		5.7	< 0.05	819
	5/28/2020		N		5.4	< 0.04	802
	10/22/2020		N		5.9	< 0.04	775
	4/11/2021		N		5.9	< 0.04	823
	10/13/2021		N	5.25			828
	4/7/2022		N	6.2			816
MW-116	10/12/2013	Kbc	N				26600
	12/14/2013		N				22100
	4/5/2014		N				23400
	4/5/2014		FD				26300

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Station Name	Sample Date	Geologic Unit	Sample Type	Nitrate and Nitrite (as N)	Nitrate (as N)	Nitrite (as N)	Total Dissolved Solids
Units				mg/L	mg/L	mg/L	mg/L
MW-116	1/27/2015	Kbc	N				25900
	10/21/2015		N				25200
	10/11/2016		FS				26600
	10/11/2016		N				22000
	10/27/2017		N				25600
	1/22/2018		N		0.9	< 0.07	25500
	10/8/2018		N		1	< 0.5	25300
	4/30/2019		N		1.2	< 0.1	25400
	10/17/2019		N		< 0.09	< 0.1	25900
	6/1/2020		N		< 0.1	< 0.1	25000
	10/22/2020		N		1.1	0.9	23000
	4/12/2021		N		0.6	< 0.1	23600
	10/22/2021		FD	0.69			23200
	10/22/2021		N	0.7			23300
	4/20/2022		N	1			23600
MW-117M	10/14/2013	Kbc	N				1670
	4/5/2014		N				1730
	9/25/2014		N				1890
	10/21/2015		N				1720
	10/12/2016		N				1770
	10/24/2017		N				2050
	10/8/2018		N		6	< 0.05	2020
	4/29/2019		N		6.7	< 0.05	2320
	10/17/2019		N		5.7	< 0.05	1950
	6/3/2020		N		4	< 0.04	1660
	10/26/2020		N		5.5	< 0.04	1890
	4/12/2021		N		5.6	< 0.04	2000
	10/18/2021		N	4.8			2030
	4/7/2022		N	6.1			2150
MW-117S	10/12/2013	Kbc	N				861
	4/5/2014		N				676
	4/5/2014		FD				986
	9/25/2014		N				891
	10/21/2015		N				922
	10/21/2015		FD				927
	10/13/2016		N				951
	10/24/2017		N				945
	10/8/2018		N		5.4	< 0.05	896
	4/29/2019		N		5.5	< 0.05	947
	10/17/2019		N		5.5	< 0.05	900
	6/2/2020		N		5.1	< 0.04	868
	10/26/2020		N		5.5	< 0.04	870
	4/12/2021		N		5.6	< 0.04	978
	10/18/2021		N	4.44			843
	4/7/2022		N	5.1			843
MW-118	10/8/2013	Kbc	N				703
	4/3/2014		N				669
	10/20/2015		N				609
	10/11/2016		N				592

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Station Name	Sample Date	Geologic Unit	Sample Type	Nitrate and Nitrite (as N)	Nitrate (as N)	Nitrite (as N)	Total Dissolved Solids
Units				mg/L	mg/L	mg/L	mg/L
MW-118	10/25/2017	Kbc	N				681
	10/9/2018		N		< 0.05	< 0.05	599
	4/23/2019		N		< 0.02	< 0.02	687
	10/16/2019		N		< 0.04	< 0.05	638
	5/28/2020		N		< 0.05	< 0.04	1100
	10/25/2020		N		< 0.05	< 0.04	713
	4/13/2021		N		0.2	< 0.04	1500
	4/13/2021		FD		< 0.03	< 0.04	1510
	10/20/2021		N	0.038			1260
	4/6/2022		N	< 0.01			1190
MW-119	10/13/2013	Kbc	N				4110
	4/4/2014		N				4120
	10/24/2015		N				4400
	10/14/2016		N				4500
	10/24/2017		N				4690
	1/24/2018		N		20.2	< 0.04	4480
	10/10/2018		N		19.3	< 0.05	4650
	4/23/2019		N		19.6	< 0.1	4870
	10/17/2019		N		19.7	< 0.05	4960
	6/1/2020		N		20	< 0.04	5100
	10/26/2020		N		21	< 0.04	5170
	4/12/2021		N		23	< 0.04	5150
	10/20/2021		N	20.6			5270
	4/19/2022		N	22.2			5400
MW-120	10/13/2013	Kbc	N				521
	10/13/2013		FD				474
	4/2/2014		N				654
	9/24/2014		N				1140
	10/23/2015		N				924
	10/13/2016		N				1030
	10/25/2017		N				811
	10/9/2018		N		1.7	< 0.05	572
	4/24/2019		N		2.5	< 0.02	665
	10/18/2019		N		4	< 0.05	732
	6/3/2020		N		3.5	< 0.04	903
	10/26/2020		N		4	< 0.04	891
	4/12/2021		N		3.4	< 0.04	793
	4/13/2021		FD		3.2	< 0.04	501
	10/16/2021		N	3.73			844
	4/7/2022		N	4.26			883
MW-121	9/24/2014	Trc	N				427
	10/13/2016		N				422
	10/27/2017		N				381
	1/26/2018		N		2	< 0.0100	425
	10/11/2018		N		1.8	< 0.02	441
	4/25/2019		N		1.8	< 0.05	397
	10/21/2019		N		1.8	< 0.05	394
	6/1/2020		N		1.8	< 0.04	426
	10/26/2020		N		2.1	< 0.04	433

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Station Name	Sample Date	Geologic Unit	Sample Type	Nitrate and Nitrite (as N)	Nitrate (as N)	Nitrite (as N)	Total Dissolved Solids
Units				mg/L	mg/L	mg/L	mg/L
MW-121	4/12/2021	Trc	N		2.2	< 0.04	408
	10/22/2021		N	2.38			399
	4/20/2022		N	2.39			415
MW-123	10/27/2017	Kbc	N				3010
	1/22/2018		N		13.7	< 0.04	2820
	4/16/2018		N		14.5	< 0.01	2910
	7/25/2018		N		15	< 0.05	3020
	10/10/2018		N		16.7	< 0.05	3470
	2/7/2019		N		16.5	< 0.05	3540
	4/29/2019		N		16.5	< 0.05	3440
	7/30/2019		N		16.7	< 0.05	3610
	10/17/2019		N		16.7	< 0.05	3660
	6/3/2020		N		16.6	< 0.04	3610
	6/3/2020		FD		16.6	< 0.04	3600
	10/19/2020		N		15.7	< 0.04	3640
	4/13/2021		N		17.3	< 0.04	3760
	10/16/2021		N	16.4			3890
	4/5/2022		N	18.4			3880
MW-124	10/26/2017	Kbc	N				1390
	1/23/2018		N		5.1	< 0.01	1460
	4/18/2018		N		5	< 0.01	1460
	4/18/2018		FS	5.35	5.35	< 0.0100	1510
	7/24/2018		N		5.5	< 0.1	1570
	10/9/2018		N		6.1	< 0.05	1700
	10/9/2018		FD		6.1	< 0.05	1680
	2/6/2019		N		6.7	< 0.05	1870
	4/23/2019		N		7.2	< 0.05	1920
	4/23/2019		FS	7.45	7.45	< 0.01	1940
	7/29/2019		N		5.8	< 0.05	1750
	10/16/2019		N		5.6	< 0.05	1350
	10/16/2019		FS	5.95	5.95	< 0.01	1720
	2/3/2020		FS	5.85	5.85	< 0.01	1690
	2/3/2020		N		5.5	< 0.04	1640
	5/28/2020		N		5.1	< 0.04	1640
	8/4/2020		N		5.9	< 0.04	1680
	10/21/2020		N		7.1	< 0.04	1900
	2/17/2021		N		8	< 0.04	2070
	7/20/2021		N		8.6	< 0.04	2220
	10/18/2021		N	8.5			2300
	1/12/2022		N	9			2380
	4/20/2022		N	9.2			2470
MW-125	10/27/2017	Kbc	N				18700
	10/27/2017		FD				18200
	1/24/2018		N		< 0.1	< 0.07	14400
	4/16/2018		N		< 0.1	< 0.07	12900
	7/25/2018		N		< 0.2	< 0.3	15100
	10/10/2018		N		< 0.1	< 0.1	13600
	10/11/2018		FS	< 0.02	< 0.02	< 0.01	13600
	2/7/2019		N		< 0.2	< 0.2	15800

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Units				mg/L	mg/L	mg/L	mg/L
MW-125	4/25/2019	Kbc	N		< 0.2	< 0.2	17300
	7/29/2019		N		< 0.09	< 0.1	17000
	10/17/2019		N		< 0.09	< 0.1	15700
	6/2/2020		N		< 0.1	< 0.1	19000
	10/19/2020		N		< 0.05	< 0.04	16600
	4/12/2021		N		< 0.07	< 0.1	19600
	10/16/2021		N	< 0.009			21200
	4/20/2022		N	< 0.01			43300
MW-126	10/27/2017	Kbc	N				17900
	1/22/2018		N		1.6	< 0.07	25300
	4/16/2018		N		2	< 0.1	28100
	7/24/2018		N		2	< 0.5	32000
	10/10/2018		N		1.5	< 0.1	20000
	2/6/2019		N		2	< 0.5	20400
	4/30/2019		N		1.8	< 0.1	20900
	7/29/2019		N		< 0.09	< 0.1	21000
	10/17/2019		N		< 0.09	< 0.1	21800
	6/1/2020		N		< 0.1	0.6	21800
	10/22/2020		N		1.9	< 0.1	20800
	4/12/2021		N		1.7	< 0.1	21200
	10/16/2021		N	1.53			20400
	4/20/2022		N	2			19900
MW-128	10/27/2017	Kbc	N				873
	1/25/2018		N		< 0.01	< 0.007	1040
	4/17/2018		N		0.1	< 0.01	1010
	7/24/2018		N		< 0.02	< 0.02	1030
	10/10/2018		N		0.1	< 0.05	1030
	2/7/2019		N		0.1	< 0.05	1030
	4/24/2019		N		< 0.02	< 0.02	1040
	4/24/2019		FD		< 0.02	< 0.02	1040
	7/30/2019		N		0.1	< 0.05	1020
	10/17/2019		N		< 0.04	< 0.05	1030
	6/1/2020		N		0.1	< 0.04	1040
	10/21/2020		N		0.1	< 0.04	1030
	10/21/2020		FD		< 0.05	< 0.04	1030
	4/11/2021		N		0.1	< 0.04	1040
	10/15/2021		N	0.11			1040
	4/21/2022		N	0.14			1030
MW-129	10/27/2017	Kbc	N				499
	1/23/2018		N		2.2	< 0.007	452
	4/17/2018		N		3.4	< 0.01	496
	7/24/2018		N		3.2	< 0.01	497
	10/10/2018		N		3.2	< 0.02	503
	2/6/2019		N		3.1	< 0.01	499
	4/23/2019		N		3.1	< 0.02	500
	7/29/2019		N		2.9	< 0.05	500
	10/16/2019		N		3	< 0.05	501
	10/16/2019		FD		3	< 0.05	501
	5/28/2020		N		3	< 0.04	515

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Units				mg/L	mg/L	mg/L	mg/L
MW-129	10/20/2020	Kbc	N		3.2	< 0.04	504
	4/13/2021		N				498
	4/13/2021		FD				501
	10/15/2021		N	2.58			497
	4/21/2022		N	2.32			498
MW-13	11/3/2012	Kbc	N				549
	4/3/2013		FD				574
	4/3/2013		N				563
	10/12/2013		N				549
	4/2/2014		N				546
	9/25/2014		N				562
	9/25/2014		FD				561
	10/28/2014		N				558
	10/23/2015		N				563
	10/13/2016		N				590
	10/25/2017		N				592
	1/24/2018		N		1.2	< 0.01	574
	10/9/2018		N		1.1	< 0.05	572
	10/9/2018		FD		1.1	< 0.05	573
	4/25/2019		N		2.5	< 0.01	505
	10/18/2019		N		1.5	< 0.05	532
	6/2/2020		N		1.3	< 0.04	553
	10/20/2020		N		1.3	< 0.04	542
	10/20/2020		FD		1.4	< 0.04	540
	4/12/2021		N		1.4	< 0.04	560
	10/16/2021		N	1.25			577
	4/7/2022		N	1.51			588
MW-130	10/27/2020	Kbc	N		< 0.05	< 0.04	867
	2/18/2021		N		< 0.03	12	876
	4/12/2021		N		< 0.03	< 0.04	864
	7/19/2021		N		0.2	< 0.04	936
	10/16/2021		N	16.4			3890
MW-131 ALL	2/3/2020	Alluvium	N		0.2	< 0.04	679
	5/28/2020		N		0.3	< 0.04	688
	8/4/2020		N		0.3	< 0.04	679
	10/20/2020		N		0.3	< 0.04	673
	2/16/2021		N		0.3	< 0.04	679
	4/7/2021		N		0.3	< 0.04	677
	7/19/2021		N		0.3	< 0.04	685
	10/14/2021		N	0.32			686
	1/12/2022		N	0.32			679
	4/5/2022		N	0.34			673
MW-131S	10/20/2020	Kbc	N		1	< 0.04	763
	10/20/2020		FD		1	< 0.04	764
	2/16/2021		N		0.8	< 0.04	749
	2/16/2021		FD		1.1	< 0.04	738
	4/6/2021		N		0.8	< 0.04	740
	7/19/2021		N		0.9	< 0.04	760
	10/14/2021		N	0.86			753

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Units				**mg/L**	**mg/L**	**mg/L**	**mg/L**
MW-131S	1/14/2022	Kbc	N	1.06			783
	4/5/2022		N	1.14			790
MW-132 ALL	2/3/2020	Alluvium	N		< 0.05	< 0.04	1510
	5/27/2020		N		< 0.05	< 0.04	1530
	10/26/2020		N		< 0.05	< 0.04	1460
	2/16/2021		N		< 0.03	< 0.04	1200
	4/6/2021		N		< 0.03	< 0.04	1190
	7/19/2021		N		< 0.03	< 0.04	1260
	10/14/2021		FD	< 0.009			1260
	10/14/2021		N	< 0.009			1250
	1/11/2022		N	< 0.01			1220
	4/5/2022		N	< 0.01			1230
MW-133 ALL	2/3/2020	Alluvium	N		< 0.05	< 0.04	1330
	5/27/2020		N		< 0.05	< 0.04	1360
	10/26/2020		N		< 0.05	< 0.04	1070
	2/16/2021		N		< 0.03	< 0.04	1140
	4/7/2021		N		< 0.03	< 0.04	1190
	7/19/2021		N		< 0.03	< 0.04	1130
	10/14/2021		N	0.03			1050
	1/11/2022		N	< 0.01			1070
	4/4/2022		N	< 0.01			1070
MW-133S	8/4/2020	Kbc	N		< 0.05	< 0.04	1180
	10/26/2020		N		< 0.05	< 0.04	947
	2/16/2021		N		< 0.03	< 0.04	856
	4/7/2021		N		< 0.03	< 0.04	856
	7/19/2021		N		< 0.03	< 0.04	862
	10/14/2021		N	< 0.009			836
	1/12/2022		N	< 0.01			838
	4/5/2022		N	< 0.01			833
MW-134D	10/27/2020	Kbc	N		0.4	< 0.04	662
	2/16/2021		N		0.4	< 0.04	660
	4/7/2021		FD		0.3	< 0.04	657
	4/11/2021		N		0.3	< 0.04	658
	7/19/2021		N		0.3	< 0.04	665
	10/15/2021		N	0.28			660
	1/12/2022		N	0.32			654
	4/8/2022		N	0.32			665
MW-134S	10/27/2020	Kbc	N		< 0.05	< 0.04	881
	2/16/2021		N		< 0.03	< 0.04	888
	4/7/2021		N		< 0.03	< 0.04	895
	7/19/2021		N		< 0.03	< 0.04	900
	10/22/2021		N	< 0.009			877
	1/11/2022		N	< 0.01			895
	4/20/2022		N	9			893
MW-135	10/27/2020	Kbc	N		0.3	< 0.04	856
	10/27/2020		FD		0.3	< 0.04	853
	2/18/2021		N		0.3	< 0.04	855
	2/18/2021		FD		0.3	< 0.04	859
	4/7/2021		N		0.3	< 0.04	856

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Station Name	Sample Date	Geologic Unit	Sample Type	Nitrate and Nitrite (as N)	Nitrate (as N)	Nitrite (as N)	Total Dissolved Solids
Units				mg/L	mg/L	mg/L	mg/L
MW-135	7/20/2021	Kbc	FD		0.3	< 0.04	862
	7/20/2021		N		0.3	< 0.04	859
	10/20/2021		N	0.34			888
	4/6/2022		N	0.37			919
MW-136	2/3/2020	Kbc	N		5.8	< 0.04	1310
	5/28/2020		N		5.8	< 0.04	1350
	5/28/2020		FD		5.9	< 0.04	1350
	8/4/2020		FS	6.61	6.61	< 0.01	1310
	8/4/2020		N		6.2	< 0.04	1340
	10/21/2020		N		6.7	< 0.04	1370
	2/18/2021		N		6.9	< 0.04	1370
	7/20/2021		N		6.9	< 0.04	1420
	10/13/2021		N	5.7			1400
	1/13/2022		N	6.7			1420
	4/9/2022		N	9.2			1430
MW-138D	10/27/2020	Kbc	N		4.6	< 0.04	1410
	2/17/2021		N		4.5	< 0.04	1380
	2/17/2021		FS	4.35	4.35	< 0.01	1390
	4/7/2021		N		4.7	< 0.04	1390
	7/19/2021		FS	4.22	4.2	< 0.01	1400
	7/19/2021		N		4.6	< 0.04	1390
	10/15/2021		N	5.9			1740
	4/20/2022		N	3.8			1390
MW-138S	12/13/2019	Kbc	N		1.3	< 0.04	915
	2/4/2020		N		1.6	< 0.04	917
	6/2/2020		N		1.4	< 0.04	915
	6/2/2020		FS	1.8	1.8	< 0.01	906
	8/4/2020		N		2	< 0.04	946
	10/27/2020		N		4	< 0.04	1260
	2/18/2021		N		5	< 0.04	1430
	4/7/2021		N		3.3	< 0.04	1130
	7/19/2021		N		2.4	< 0.04	981
	10/14/2021		N	4.72			1490
	1/13/2022		N	4.9			1500
	4/6/2022		N	3.82			1280
MW-139	10/27/2020	Kbc	N		0.6	< 0.04	930
	2/18/2021		N		0.3	< 0.04	942
	4/7/2021		N		0.3	< 0.04	948
	4/7/2021		FS	0.693	0.69	< 0.01	940
	7/19/2021		N		0.3	< 0.04	974
	10/20/2021		FD	0.31			962
	10/20/2021		N	0.314			960
	1/13/2022		N	0.32			989
	4/20/2022		N	0.34			1040
MW-5	11/2/2012	Kbc	N				1490
	4/3/2013		N				1520
	10/10/2013		N				1470
	4/4/2014		N				1540
	9/25/2014		N				1550

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Station Name	Sample Date	Geologic Unit	Sample Type	Nitrate and Nitrite (as N)	Nitrate (as N)	Nitrite (as N)	Total Dissolved Solids
Units				mg/L	mg/L	mg/L	mg/L
MW-5	10/28/2014	Kbc	N				1520
	10/24/2015		N				1810
	10/13/2016		N				1630
	10/25/2017		N				1790
	1/24/2018		N		0.4	< 0.01	1650
	10/11/2018		N		0.3	< 0.02	1660
	10/11/2018		FS	0.32	0.32	< 0.0100	1580
	4/29/2019		N		0.3	< 0.02	1690
	10/21/2019		N		0.3	< 0.05	1690
	10/21/2019		FD		0.3	< 0.05	1680
	6/3/2020		N		0.3	< 0.04	1720
	6/3/2020		FS	0.34	0.34	< 0.01	1740
	10/20/2020		N		0.3	< 0.04	1720
	4/13/2021		N		2.2	< 0.04	1700
	4/13/2021		FD		0.5	< 0.04	1740
	10/18/2021		N	0.28			1750
	4/9/2022		N	0.38			1770
OW-UT-9	11/3/2012	Kbc	N				36200
	11/3/2012		FD				37000
	3/31/2013		N				37400
	4/1/2013		N				36800
	6/9/2013		N				36000
	10/13/2013		N				37100
	12/14/2013		N				37300
	3/31/2014		N				37200
	4/4/2014		N				25600
	6/30/2014		N				37500
	7/29/2014		N				33300
	8/17/2014		N				32100
	9/23/2014		N				37200
	10/29/2014		N				37000
	1/26/2015		N				37200
	2/24/2015		N				38200
	2/24/2015		FD				37500
	3/30/2015		N				37300
	3/30/2015		FD				37100
	4/15/2015		N				36100
	5/13/2015		N				36600
	5/14/2015		FD				36600
	6/26/2015		FD				36600
	6/26/2015		N				36300
	7/29/2015		N				35700
	10/23/2015		N				37300
	1/19/2016		N				36500
	4/27/2016		N				38800
	7/29/2016		N				37000
	10/12/2016		N				34200
	10/12/2016		FD				31900
	2/22/2017		N				38000

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Units				mg/L	mg/L	mg/L	mg/L
OW-UT-9	4/25/2017	Kbc	FD				32600
	4/25/2017		N				34100
	7/25/2017		N				37700
	10/27/2017		N				35800
	10/27/2017		FS				38400
	1/24/2018		N		23	5	36700
	1/24/2018		FD		22	1	36200
	4/17/2018		N		22	< 0.1	36600
	7/25/2018		N		23	< 0.2	35900
	10/11/2018		N		23	5	37700
	2/7/2019		N		22.7	0.7	37700
	4/29/2019		N		23.4	1	37400
	4/29/2019		FD		23	2	37200
	7/29/2019		N		23	< 0.5	38300
	7/29/2019		FD		24	< 0.5	37900
	10/21/2019		N		25	2	38800
	2/4/2020		N		23	1	38700
	6/1/2020		N		24	1	39000
	8/5/2020		N		25	2	38600
	8/5/2020		FD		24	2	38500
	10/21/2020		N		28	< 0.4	39000
	2/17/2021		N		28	< 0.4	38400
	4/8/2021		N		29	< 0.4	38800
	7/20/2021		N		29	< 0.4	38600
	10/19/2021		N	24.3			38000
	1/13/2022		N	27			38800
	4/6/2022		N	26.2			38800
RL-1	10/31/2012	Kbc	N				8680
	10/31/2012		FD				8820
	11/28/2012		N				9100
	12/20/2012		N				9150
	1/28/2013		N				8520
	2/26/2013		N				9110
	3/31/2013		N				8940
	4/2/2013		N				9360
	5/13/2013		N				9120
	6/9/2013		N				8620
	7/20/2013		N				9350
	8/15/2013		N				9300
	9/30/2013		N				9050
	10/14/2013		N				8720
	11/16/2013		N				9160
	12/14/2013		N				9430
	1/25/2014		N				9060
	2/22/2014		N				9320
	3/31/2014		N				9230
	4/6/2014		N				9460
	5/15/2014		N				9340
	6/30/2014		N				9230

APPENDIX B
Groundwater Monitoring Results for All Wells
Rio Algom Mining LLC Lisbon Facility

Station Name	Sample Date	Geologic Unit	Sample Type	Nitrate and Nitrite (as N)	Nitrate (as N)	Nitrite (as N)	Total Dissolved Solids
Units				mg/L	mg/L	mg/L	mg/L
RL-1	9/24/2014	Kbc	N				9330
RL-1	9/24/2014	Kbc	FD				9230
RL-1	10/29/2014	Kbc	N				9200
RL-1	1/27/2015	Kbc	N				9460
RL-1	4/15/2015	Kbc	N				9320
RL-1	7/29/2015	Kbc	N				9320
RL-1	10/22/2015	Kbc	FS				8250
RL-1	10/22/2015	Kbc	N				9430
RL-1	1/19/2016	Kbc	N				9290
RL-1	4/27/2016	Kbc	N				9280
RL-1	7/29/2016	Kbc	N				9340
RL-1	10/12/2016	Kbc	N				9250
RL-1	10/12/2016	Kbc	FD				9350
RL-1	2/22/2017	Kbc	N				9330
RL-1	4/25/2017	Kbc	N				9190
RL-1	7/25/2017	Kbc	N				9340
RL-1	10/26/2017	Kbc	N				9500
RL-1	10/26/2017	Kbc	FD				9570
RL-1	1/24/2018	Kbc	N		24	< 0.07	9620
RL-1	4/17/2018	Kbc	N		24.1	< 0.04	9160
RL-1	4/17/2018	Kbc	FD		24.2	< 0.04	9330
RL-1	7/24/2018	Kbc	N		24.4	< 0.1	9250
RL-1	10/9/2018	Kbc	N		24.4	< 0.1	9640
RL-1	2/6/2019	Kbc	N		23	< 0.1	9440
RL-1	4/29/2019	Kbc	N		23.5	< 0.2	9280
RL-1	7/30/2019	Kbc	N		24.6	< 0.1	9570
RL-1	7/30/2019	Kbc	FS	24.1	24	< 0.01	9190
RL-1	10/21/2019	Kbc	N		25	< 0.1	9740
RL-1	2/4/2020	Kbc	N		24.2	< 0.1	9630
RL-1	6/1/2020	Kbc	N		24	< 0.1	9690
RL-1	8/5/2020	Kbc	N		23.1	< 0.1	9310
RL-1	10/20/2020	Kbc	N		21.9	< 0.1	9360
RL-1	2/17/2021	Kbc	N		21.7	< 0.1	9090
RL-1	4/8/2021	Kbc	N		22.3	< 0.1	9430
RL-1	7/20/2021	Kbc	N		22.1	< 0.1	9400
RL-1	10/19/2021	Kbc	N	19.3			9590
RL-1	1/12/2022	Kbc	N	22.5			9620
RL-1	4/5/2022	Kbc	N	23.2			9380
RL-3	11/5/2012	Kbc	N				7090
RL-3	4/2/2013	Kbc	N				7620
RL-3	10/14/2013	Kbc	N				8310
RL-3	4/3/2014	Kbc	N				7960
RL-3	4/3/2014	Kbc	FD				8530
RL-3	9/25/2014	Kbc	N				7220
RL-3	10/29/2014	Kbc	N				8240
RL-3	10/20/2015	Kbc	N				7410
RL-3	10/13/2016	Kbc	N				7850
RL-3	10/26/2017	Kbc	N				8010
RL-3	1/23/2018	Kbc	N		25	< 0.07	7830

APPENDIX B
Groundwater Monitoring Results for All Wells
Rio Algom Mining LLC Lisbon Facility

Station Name	Sample Date	Geologic Unit	Sample Type	Nitrate and Nitrite (as N)	Nitrate (as N)	Nitrite (as N)	Total Dissolved Solids
Units				mg/L	mg/L	mg/L	mg/L
RL-3	10/9/2018	Kbc	N		27.8	< 0.1	9010
	2/6/2019		N		23	< 0.1	7590
	2/6/2019		FD		23	< 0.1	7550
	4/25/2019		N		26.4	< 0.07	8810
	4/25/2019		FS	25	25	< 0.01	8990
	7/30/2019		N		27.1	< 0.1	8940
	10/21/2019		N		26.4	< 0.1	8990
	2/4/2020		N		26	< 0.1	8900
	5/31/2020		N		25.2	< 0.1	8730
	8/5/2020		N		26.6	< 0.1	8730
	9/29/2020		N		26.1	< 0.1	8510
	10/21/2020		N		24.9	< 0.1	8390
	11/19/2020		N		24.2	< 0.1	7980
	12/8/2020		N		25.3	< 0.1	8290
	2/17/2021		N		25.4	< 0.1	8460
	3/23/2021		N		26	< 0.04	8400
	4/8/2021		N		25.7	< 0.1	8520
	5/19/2021		N		30	< 0.04	8540
	6/8/2021		N		23.3	< 0.1	8190
	7/20/2021		N		24.8	< 0.1	8470
	8/24/2021		N		26	< 0.1	8500
	9/23/2021		N		25.6	< 0.1	8610
	10/20/2021		FD	24.3			8480
	10/20/2021		N	24			7980
	11/16/2021		N	22.7			8390
	12/14/2021		N	25.2			8600
	1/13/2022		N	29			8570
	2/22/2022		N	25.4			8440
	3/22/2022		N	23.8			8220
	4/5/2022		N	24.5			8360
	5/17/2022		N	22.7			8330
	6/16/2022		N	25			8350
RL-4	11/1/2012	Kbc	N				546
	11/1/2012		FD				547
	4/4/2013		FD				550
	4/4/2013		N				562
	10/10/2013		N				540
	10/10/2013		FS				534
	10/10/2013		N				552
	10/10/2013		FS				528
	4/3/2014		N				548
	9/24/2014		N				557
	10/29/2014		N				543
	10/22/2015		N				571
	10/11/2016		N				578
	10/26/2017		N				604
	10/9/2018		N		2.4	< 0.05	600
	10/9/2018		FD		2.3	< 0.05	599
	4/29/2019		N		2.4	< 0.01	593

APPENDIX B
Groundwater Monitoring Results for All Wells
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Station Name	Sample Date	Geologic Unit	Sample Type	Nitrate and Nitrite (as N)	Nitrate (as N)	Nitrite (as N)	Total Dissolved Solids
Units				mg/L	mg/L	mg/L	mg/L
RL-4	10/16/2019	Kbc	N		2.3	< 0.05	597
	10/16/2019		FS	2.56	2.56	< 0.01	592
	6/1/2020		N		2.2	< 0.04	606
	10/21/2020		N		2.4	< 0.04	607
	4/8/2021		N		2.7	< 0.04	608
	10/13/2021		N	2.2			599
	4/6/2022		N	2.31			595
RL-5	11/2/2012	Kbc	N				369
	4/4/2013		N				380
	4/4/2013		FD				387
	10/9/2013		N				372
	4/3/2014		N				379
	9/24/2014		N				366
	10/29/2014		N				376
	10/29/2014		FD				379
	10/22/2015		N				409
	10/12/2016		N				366
	10/26/2017		N				391
	10/9/2018		N		0.5	< 0.05	374
	4/29/2019		N		0.5	< 0.01	368
	10/16/2019		N		0.5	< 0.05	359
	5/27/2020		N		0.4	< 0.04	372
	10/20/2020		N		0.5	< 0.04	372
	10/20/2020		FD		0.5	< 0.04	372
	4/8/2021		N		0.6	< 0.04	367
	10/13/2021		N	0.49			357
	4/6/2022		N	0.53			363
RL-6	11/1/2012	Kbc	N				1540
	4/4/2013		N				1580
	10/8/2013		N				1670
	4/3/2014		N				1630
	9/25/2014		N				1780
	10/28/2014		N				1720
	10/20/2015		N				1750
	10/11/2016		N				623
	10/25/2017		N				637
	10/9/2018		N		< 0.05	< 0.05	635
	4/23/2019		N		< 0.02	< 0.02	637
	4/23/2019		FD		< 0.02	< 0.02	633
	10/16/2019		N		< 0.04	< 0.05	628
	5/28/2020		N		< 0.05	< 0.04	660
	5/28/2020		FD		< 0.05	< 0.04	658
	10/20/2020		N		< 0.05	< 0.04	648
	4/13/2021		N		< 0.03	< 0.04	650
	4/13/2021		FS	< 0.02	< 0.02	< 0.01	650
	10/16/2021		N	< 0.009			659
	4/4/2022		N	< 0.01			654
UW-1	11/3/2012	Kbc	N				690
	4/3/2013		N				691

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Groundwater Monitoring Results for All Wells
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Station Name	Sample Date	Geologic Unit	Sample Type	Nitrate and Nitrite (as N)	Nitrate (as N)	Nitrite (as N)	Total Dissolved Solids
Units				mg/L	mg/L	mg/L	mg/L
UW-1	10/12/2013	Kbc	N				699
	4/2/2014		N				704
	10/23/2015		N				678
	10/13/2016		N				695
	10/24/2017		N				675
	10/9/2018		N		1.6	< 0.05	687
	4/24/2019		N		1.2	< 0.02	689
	10/21/2019		N		1.5	< 0.05	660
	6/3/2020		N		1.6	< 0.04	659
	10/26/2020		N		2.2	< 0.04	648
	4/12/2021		N		2.1	< 0.04	670
	10/16/2021		N	1.62			683
	4/20/2022		N	1.91			677

Notes

mg/L	milligrams per liter
N	normal sample
FD	field duplicate sample
FS	field split sample
Alluvium	Quaternary alluvium
Kbc	Burro Canyon Formation
Jmb	Brushy Basin Member of the Morrison Formation
Trc	Chinle Formation

APPENDIX C

Timeseries of Nitrate/Nitrite in Background Wells

Appendix C
Timeseries of Nitrate/Nitrite in Background Wells

This appendix provides the combined nitrate and nitrite concentrations (in milligrams per liter [mg/L]) over time for background wells in the following background groundwater areas identified for the Lisbon Facility: north Burro Canyon Aquifer (NBCA), south Burro Canyon Aquifer (SBCA), and wells completed in the Burro Canyon Aquifer that are within 400 feet of the surface expression of the Lisbon Valley Fault (Fault wells). The following wells are located in each background area:

- NBCA: MW-5, LW-1, MW-100
- SBCA: MW-120, UW-1, MW-13, MW-105
- Fault: MW-125, MW-116, MW-126, MW-128, MW-107S, MW-107D, MW-118, RL-6, MW-131S, MW-133S, MW-134S, MW-134D

The timeseries plots in this appendix show concentrations over time and whether the result was above the detection limit (indicated with "Y" and blue colored points) or below the detection limit (indicated with "N" and cyan colored points). The vertical dashed line in each plot separates the results from Method 300 (USEPA, 1993a) prior to October 2021, when nitrate (as nitrogen [N]) and nitrite (as N) concentrations were measured separately and then combined, and the results from Method 353.2 (USEPA, 1993b) during and after the October 2021 sampling event, when concentrations of nitrate and nitrite were measured as combined species (as N).

References

United States Environmental Protection Agency (USEPA). 1993a. Method 300.0 Determination of Inorganic Anions by Ion Chromatography. Office of Research and Development, Cincinnati, Ohio.

_____. 1993b. Method 353.2 Determination of Nitrate-Nitrite by Automated Colorimetry. Office of Research and Development, Cincinnati, Ohio.

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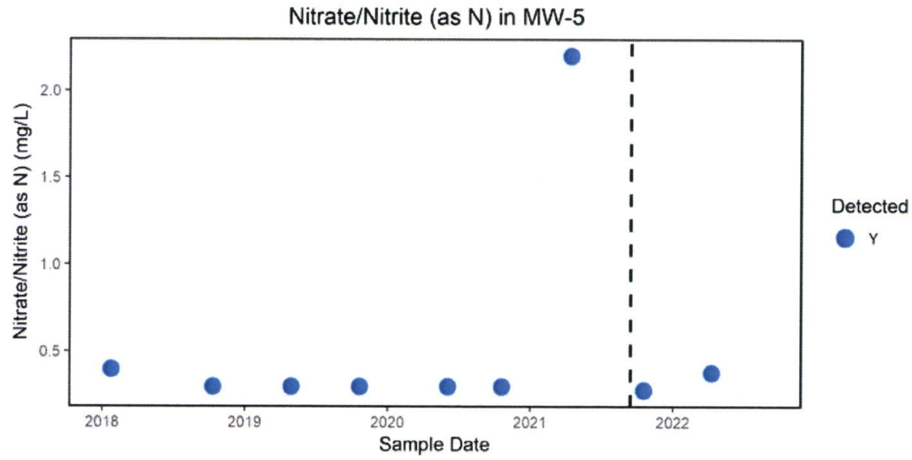
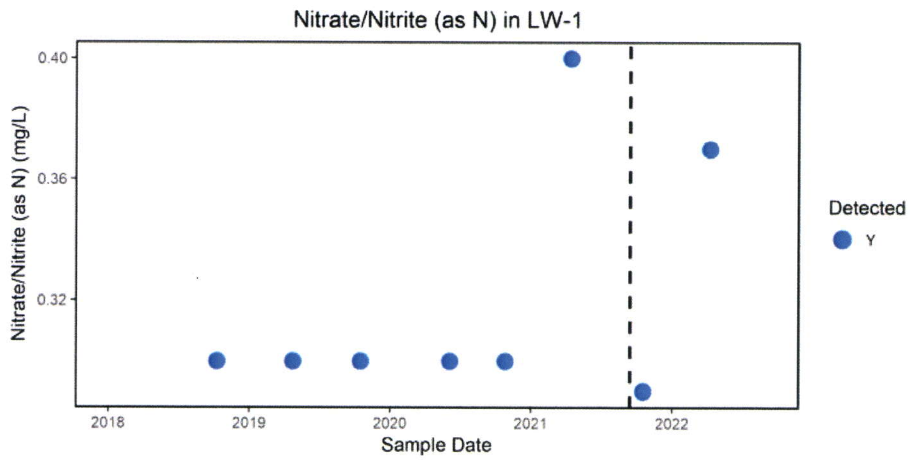
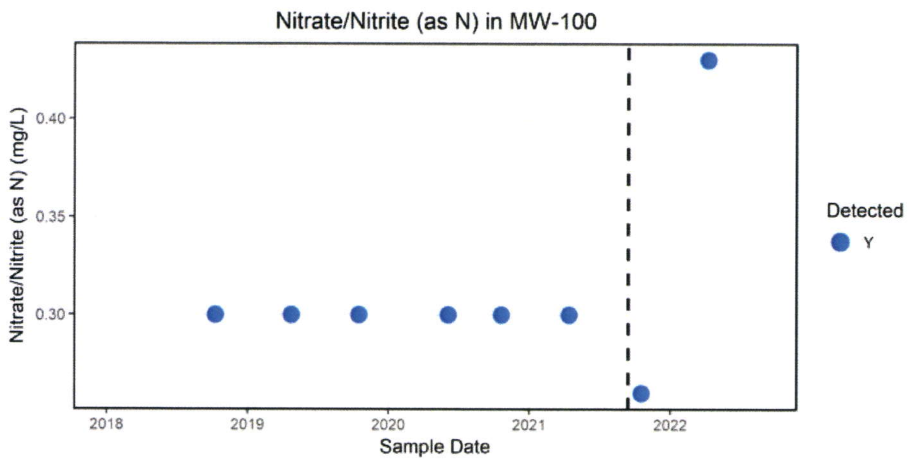
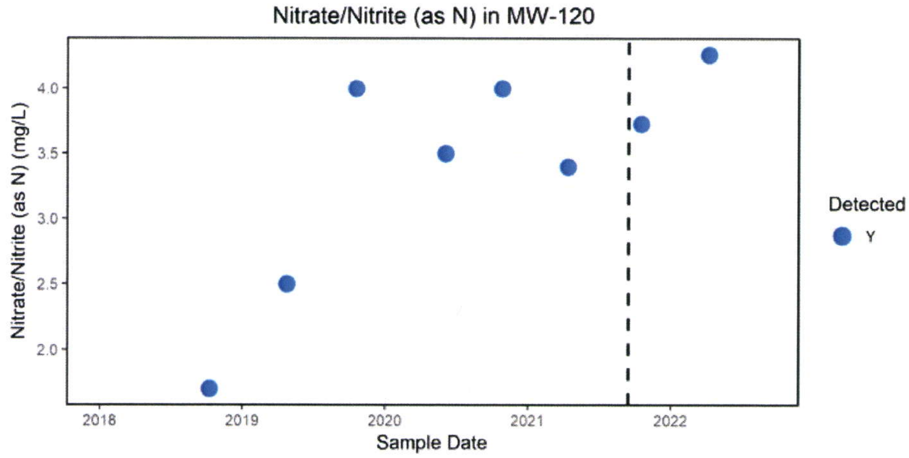
Timeseries of Nitrate/Nitrite in Background Wells
Rio Algom Mining LLC Lisbon Facility

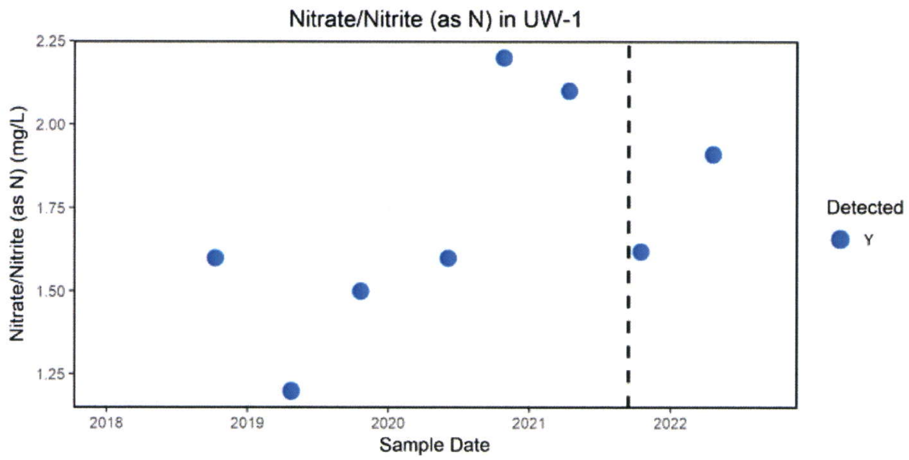


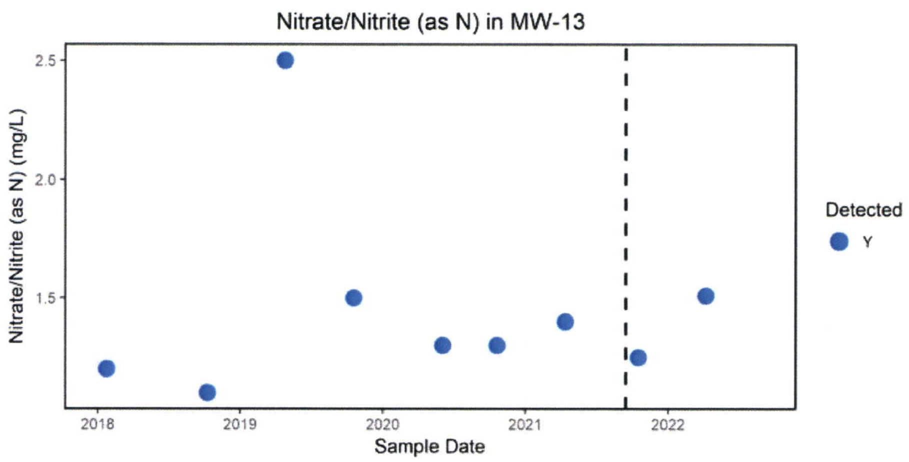




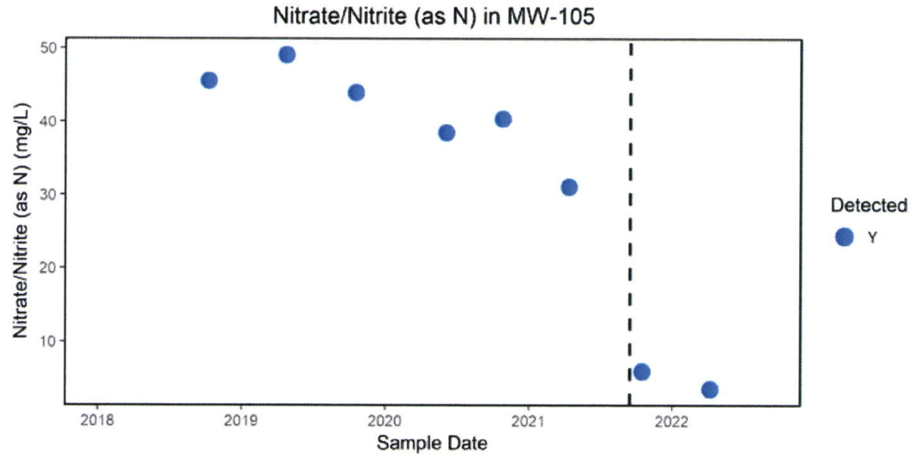
APPENDIX C
Timeseries of Nitrate/Nitrite in Background Wells
Rio Algom Mining LLC Lisbon Facility

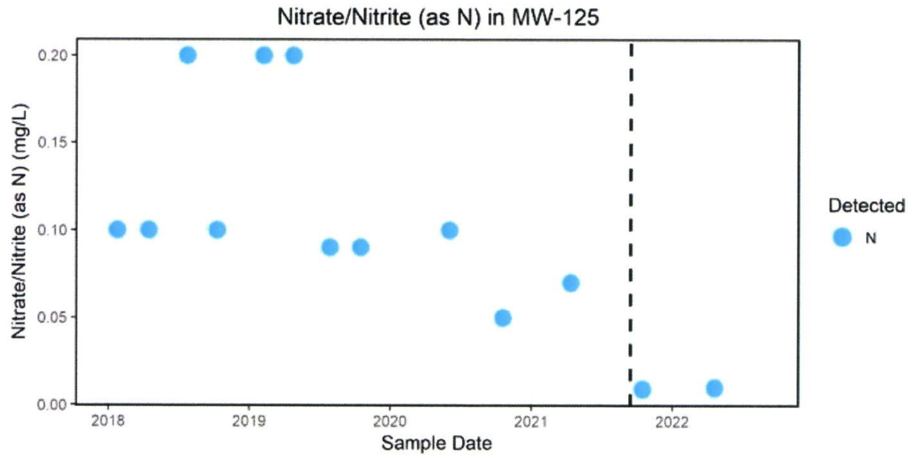


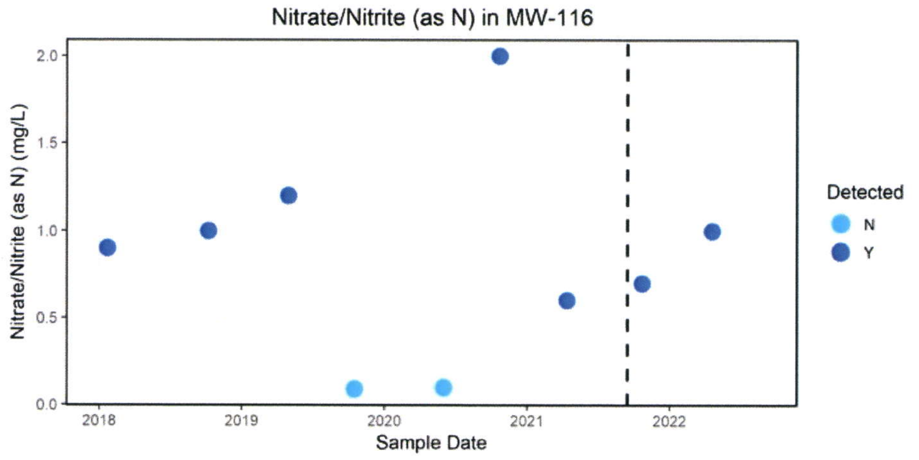




APPENDIX C
Timeseries of Nitrate/Nitrite in Background Wells
Rio Algom Mining LLC Lisbon Facility

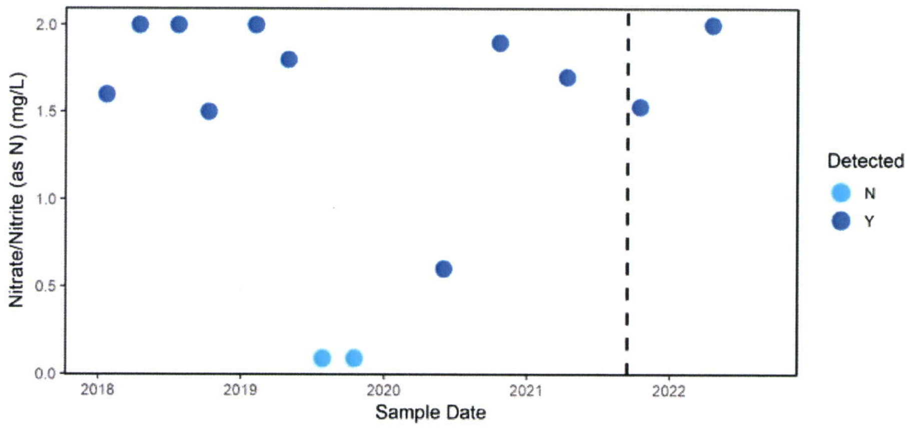




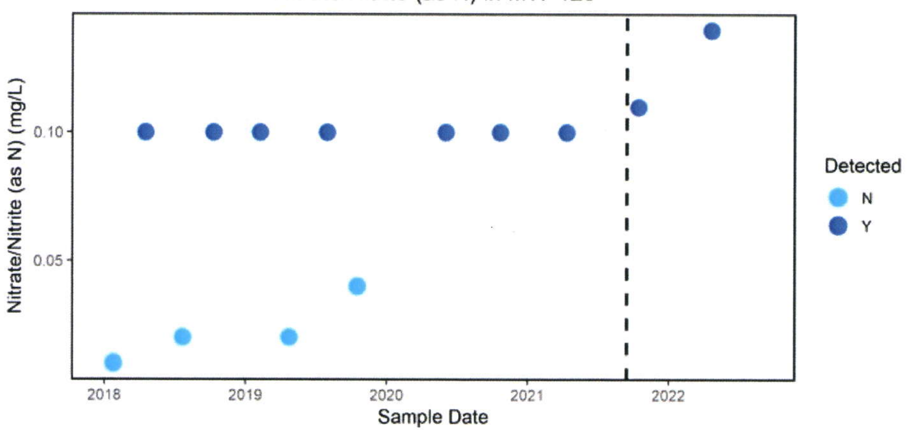


APPENDIX C
Timeseries of Nitrate/Nitrite in Background Wells
Rio Algom Mining LLC Lisbon Facility

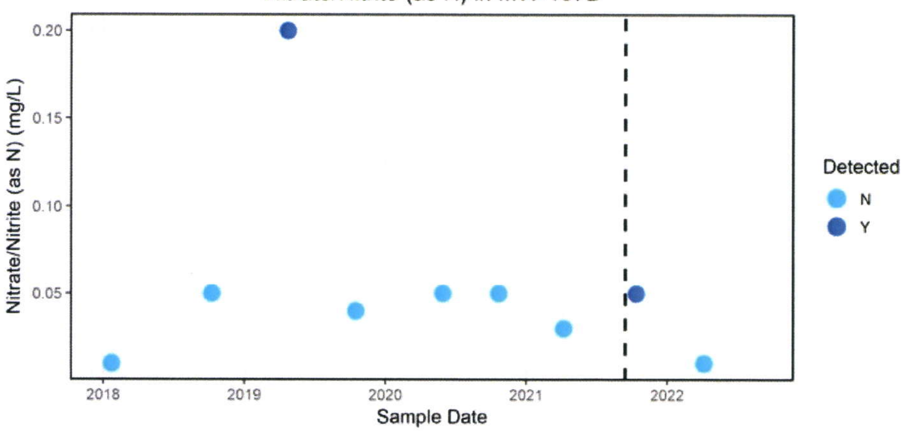
Nitrate/Nitrite (as N) in MW-126



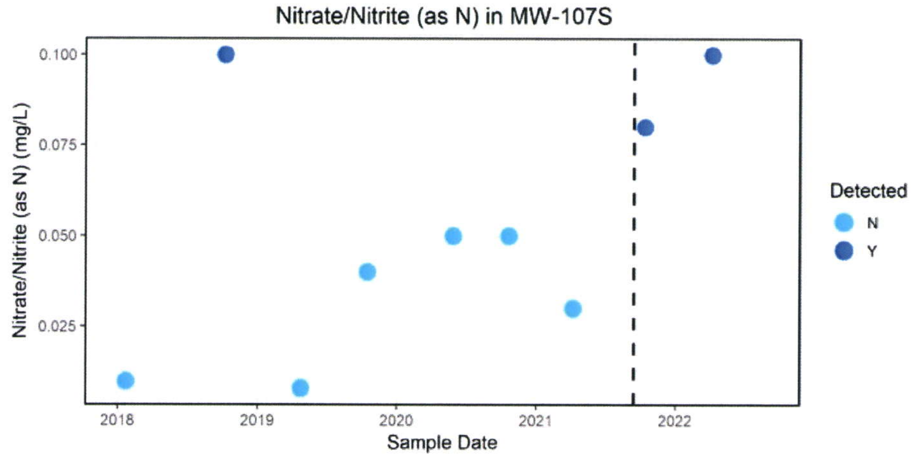
Nitrate/Nitrite (as N) in MW-128

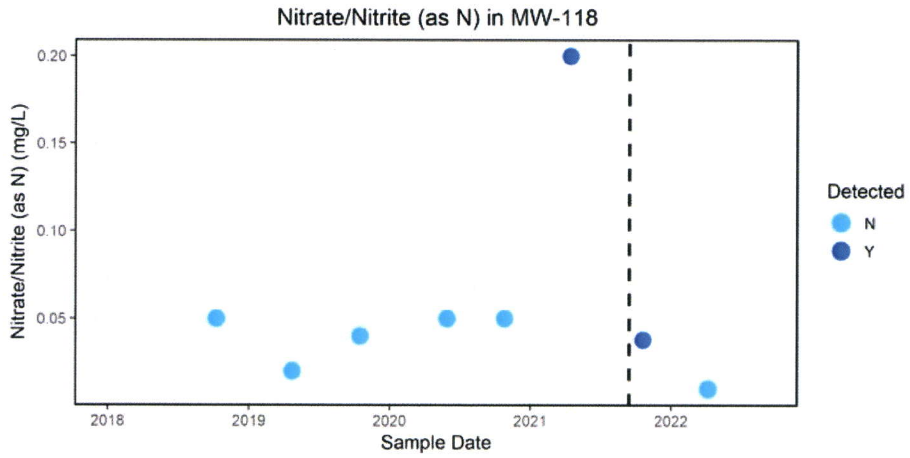


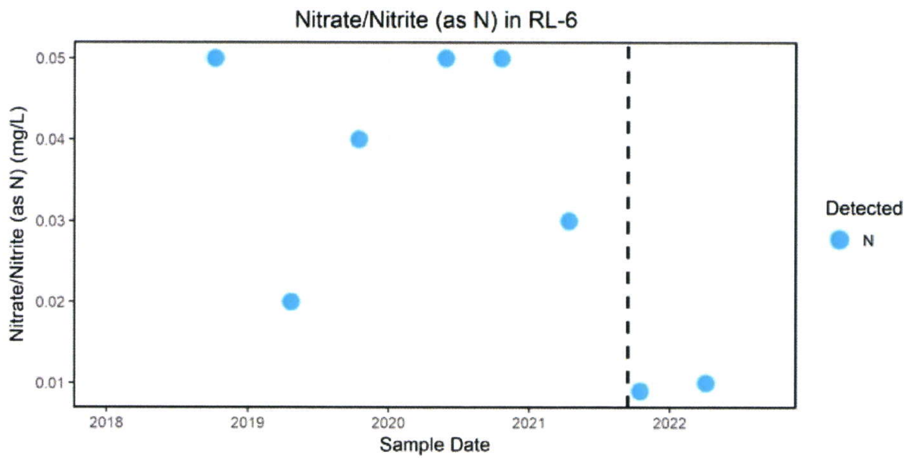
Nitrate/Nitrite (as N) in MW-107D



APPENDIX C
Timeseries of Nitrate/Nitrite in Background Wells
Rio Algom Mining LLC Lisbon Facility

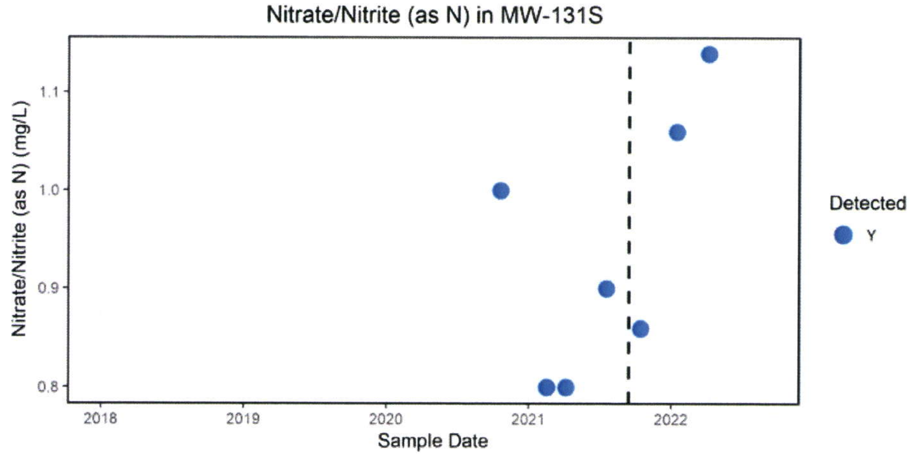


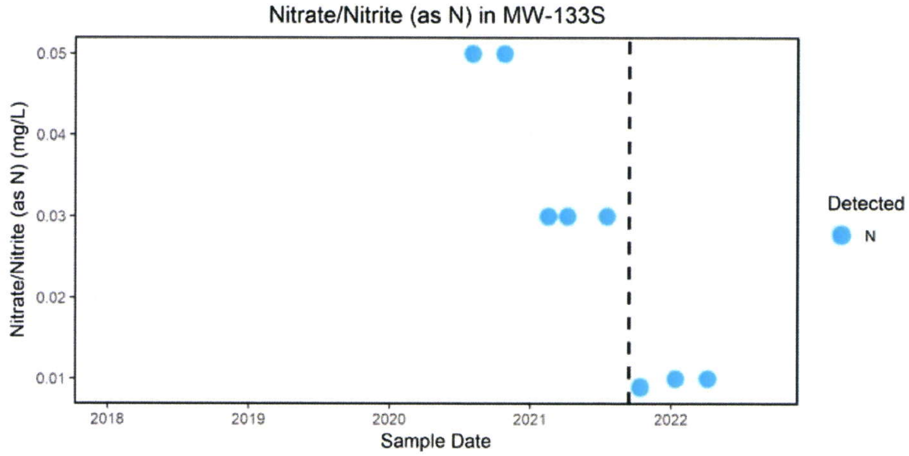


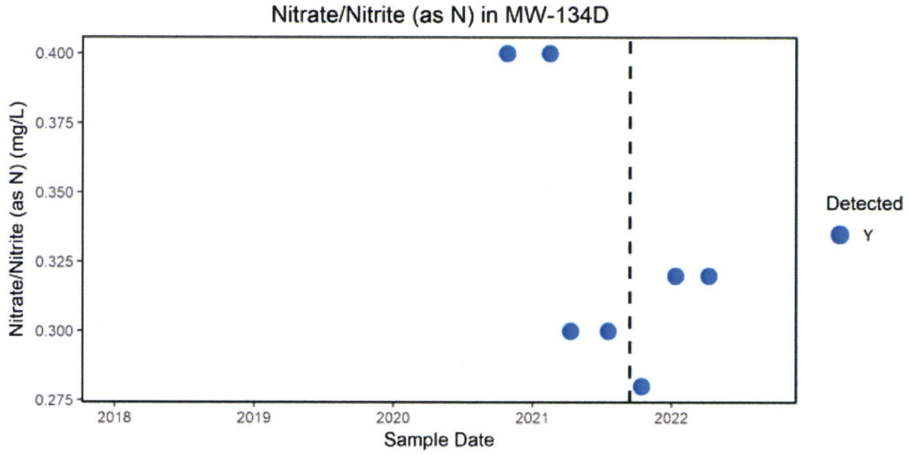


INTERA

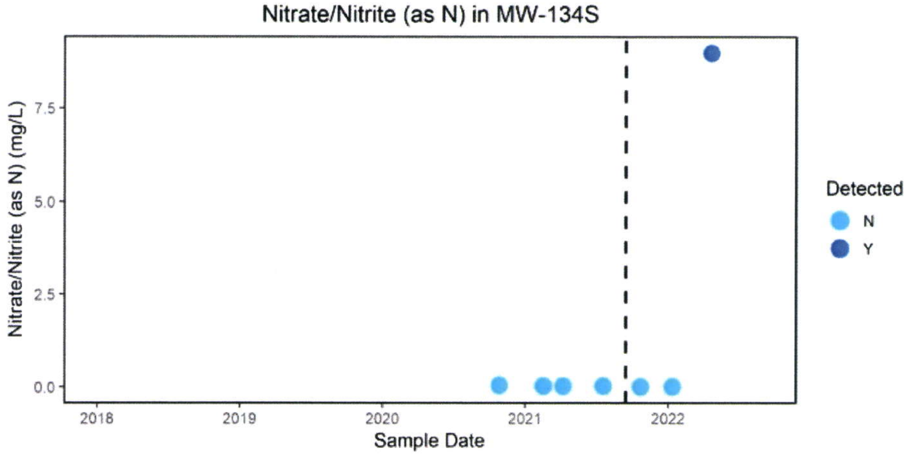
APPENDIX C
Timeseries of Nitrate/Nitrite in Background Wells
Rio Algom Mining LLC Lisbon Facility







APPENDIX C
Timeseries of Nitrate/Nitrite in Background Wells
Rio Algom Mining LLC Lisbon Facility

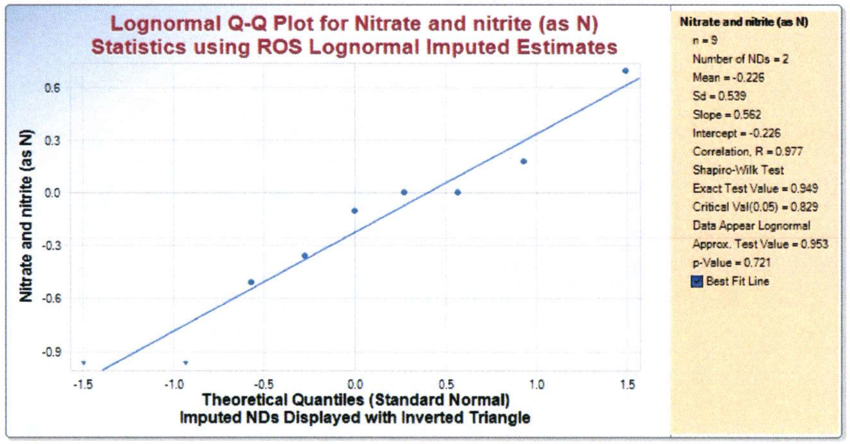


APPENDIX D

Datasets with 11 to 50% Non-Detect Values

Appendix D: Datasets with 11 to 50% Non-Detect Values

		Original	Ln ROS
Site	Date	NO3/NO2 (as N)	NO3/NO2 (as N)
		mg/L	mg/L
MW-116	1/22/2018	0.9	0.9
MW-116	10/8/2018	1	1
MW-116	4/30/2019	1.2	1.2
MW-116	10/17/2019	< 0.09	0.380411141
MW-116	6/1/2020	< 0.1	0.380411141
MW-116	10/22/2020	2	2
MW-116	4/12/2021	0.6	0.6
MW-116	10/22/2021	0.7	0.7
MW-116	4/20/2022	1	1



Lognormal GOF Test Results

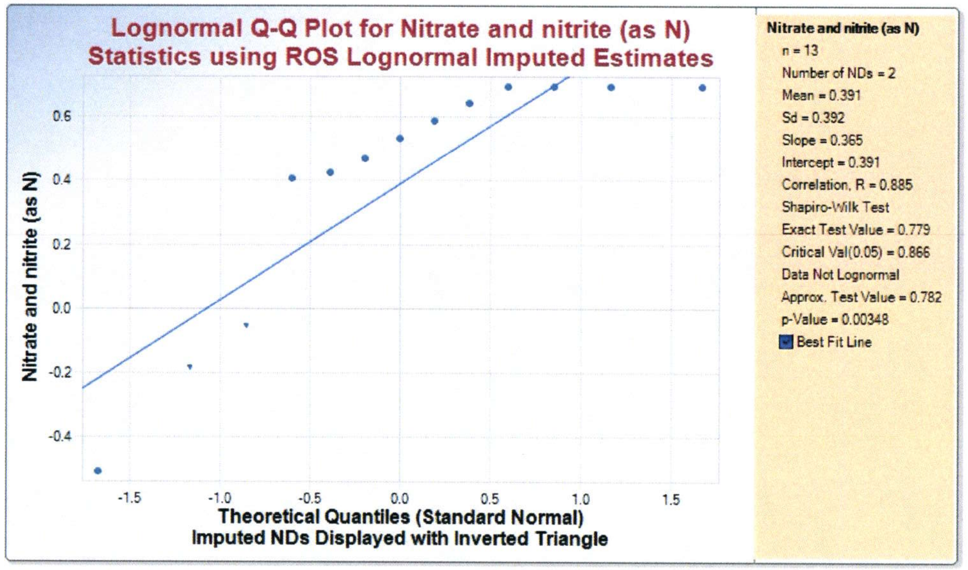
	No NDs	NDs = DL	NDs = DL/2	Log ROS
Correlation Coefficient R	0.845	0.917	0.863	0.924

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.732	0.788	Data Not Lognormal
Shapiro-Wilk (NDs = DL)	0.832	0.818	Data Appear Lognormal
Shapiro-Wilk (NDs = DL/2)	0.739	0.818	Data Not Lognormal
Shapiro-Wilk (Lognormal ROS Estimates)	0.845	0.818	Data Appear Lognormal
Lilliefors (Detects Only)	0.335	0.325	Data Not Lognormal
Lilliefors (NDs = DL)	0.277	0.283	Data Appear Lognormal
Lilliefors (NDs = DL/2)	0.331	0.283	Data Not Lognormal
Lilliefors (Lognormal ROS Estimates)	0.253	0.283	Data Appear Lognormal

INTERA

Appendix D: Datasets with 11 to 50% Non-Detect Values

		Original	Ln ROS
Site	Date	NO3/NO2 (as N)	NO3/NO2 (as N)
MW-126	1/22/2018	1.6	1.6
MW-126	4/16/2018	2	2.0
MW-126	7/24/2018	2	2.0
MW-126	10/10/2018	1.5	1.5
MW-126	2/6/2019	2	2.0
MW-126	4/30/2019	1.8	1.8
MW-126	7/29/2019	< 0.09	0.8296
MW-126	10/17/2019	< 0.09	0.9452
MW-126	6/1/2020	0.6	0.6
MW-126	10/22/2020	1.9	1.90
MW-126	4/12/2021	1.7	1.70
MW-126	10/16/2021	1.53	1.53
MW-126	4/20/2022	2	2
ROS Mean			1.570
ROS SD			0.483
KM mean			1.447
KM SD			0.682



Lognormal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Log ROS
Correlation Coefficient R	0.7746106	0.7821769	0.764399	0.8848178

	Test value	Crit. (0.05)	Conclusion with Alpha(0.0500000)
Shapiro-Wilk (Detects Only)	0.6241509	0.85	Data Not Lognormal
Shapiro-Wilk (NDs = DL)	0.6104816	0.866	Data Not Lognormal
Shapiro-Wilk (NDs = DL/2)	0.5848403	0.866	Data Not Lognormal
Shapiro-Wilk (Lognormal ROS Estimates)	0.7792656	0.866	Data Not Lognormal
Lilliefors (Detects Only)	0.3199896	0.2506	Data Not Lognormal
Lilliefors (NDs = DL)	0.3962135	0.2337	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.4030625	0.2337	Data Not Lognormal
Lilliefors (Lognormal ROS Estimates)	0.2842266	0.2337	Data Not Lognormal

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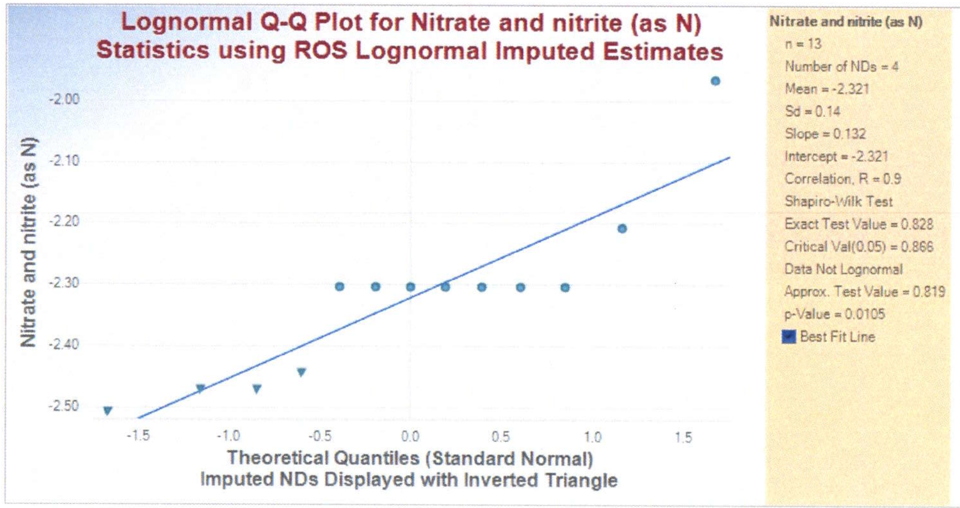
Appendix D: Datasets with 11 to 50% Non-Detect Values

		Original	Ln ROS
Site	Date	NO3/NO2 (as N)	NO3/NO2 (as N)
MW-128	1/25/2018	< 0.01	0.084628853
MW-128	4/17/2018	0.1	0.1
MW-128	7/24/2018	< 0.02	0.081655497
MW-128	10/10/2018	0.1	0.1
MW-128	2/7/2019	0.1	0.1
MW-128	4/24/2019	< 0.02	0.087073126
MW-128	7/30/2019	0.1	0.1
MW-128	10/17/2019	< 0.04	0.084628853
MW-128	6/1/2020	0.1	0.1
MW-128	10/21/2020	0.1	0.1
MW-128	4/11/2021	0.1	0.1
MW-128	10/15/2021	0.11	0.11
MW-128	4/21/2022	0.14	0.14
ROS Mean			0.099
ROS SD			0.015
KM mean			0.076
KM SD			0.045



Lognormal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Log ROS
Correlation Coefficient R	0.7012166	0.8576856	0.8473832	0.8996159

	Test value	Crit. (0.05)	Conclusion with Alpha(0.0500000)
Shapiro-Wilk (Detects Only)	0.5163915	0.829	Data Not Lognormal
Shapiro-Wilk (NDs = DL)	0.7358101	0.866	Data Not Lognormal
Shapiro-Wilk (NDs = DL/2)	0.7119502	0.866	Data Not Lognormal
Shapiro-Wilk (Lognormal ROS Estimates)	0.8283974	0.866	Data Not Lognormal
Lilliefors (Detects Only)	0.442634	0.2744	Data Not Lognormal
Lilliefors (NDs = DL)	0.3989281	0.2337	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.4107713	0.2337	Data Not Lognormal
Lilliefors (Lognormal ROS Estimates)	0.2928566	0.2337	Data Not Lognormal

APPENDIX E

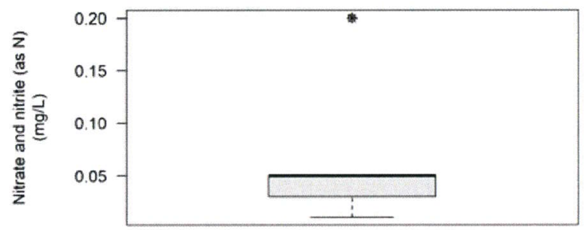
Statistical Analysis of Background Wells (Electronic Files)

APPENDIX F

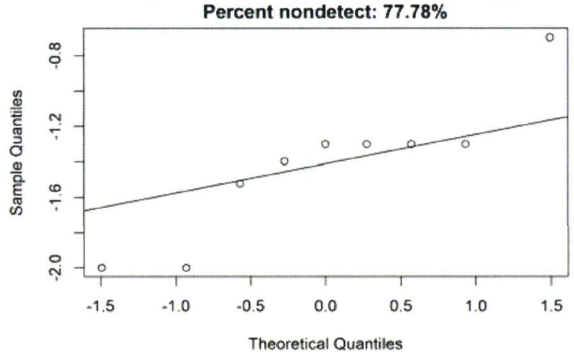
Datasets with Extreme Outliers Removed

Appendix F: Datasets with Extreme Outliers Removed

Site	Date	NO3/NO2 (as N) (mg/L)
MW-107D	1/23/2018	<0.01
MW-107D	10/9/2018	<0.05
MW-107D	4/23/2019	0.2
MW-107D	10/16/2019	<0.04
MW-107D	5/28/2020	<0.05
MW-107D	10/21/2020	<0.05
MW-107D	4/7/2021	<0.03
MW-107D	10/13/2021	0.05
MW-107D	4/6/2022	<0.01



Percent nondetect: 78%
Min: 0.01, Mean: 0.05, Max: 0.2, Std Dev: 0.06
Upper extreme threshold (Q75 + 3xH): 0.11
Lower extreme threshold (Q25 - 3xH): -0.03



Dixon's Outlier Test for Nitrate and nitrite (as N)

Total N = 9
Number NDs = 7
Number Detects = 2
Number Data (n) = 9
10% critical value: 0.441
5% critical value: 0.512
1% critical value: 0.635
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 0.2 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.769

For 10% significance level, 0.2 is an outlier.
For 5% significance level, 0.2 is an outlier.
For 1% significance level, 0.2 is an outlier.

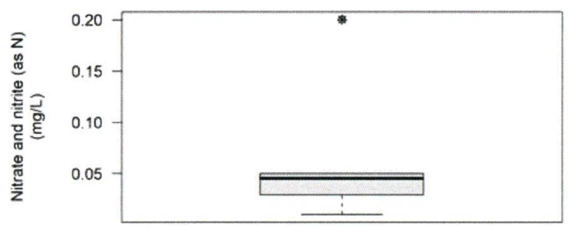
2. Data Value 0.005 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 0.005 is not an outlier.
For 5% significance level, 0.005 is not an outlier.
For 1% significance level, 0.005 is not an outlier.

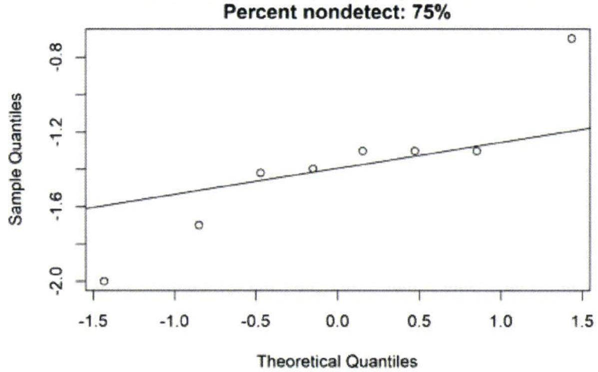
Appendix F: Datasets with Extreme Outliers Removed

Site	Date	NO3/NO2 (as N) (mg/L)
MW-118	10/09/2018	<0.05
MW-118	04/23/2019	<0.02
MW-118	10/16/2019	<0.04
MW-118	05/28/2020	<0.05
MW-118	10/25/2020	<0.05
MW-118	04/13/2021	0.2
MW-118	10/20/2021	0.038
MW-118	04/06/2022	<0.01



Percent nondetect: 75%
Min: 0.01, Mean: 0.06, Max: 0.2, Std Dev: 0.06
Upper extreme threshold (Q75 + 3xH): 0.0995
Lower extreme threshold (Q25 - 3xH): -0.016

Nitrate and nitrite (as N) (mg/L) in MW-118
Percent nondetect: 75%



Dixon's Outlier Test for Nitrate and nitrite (as N)

Total N = 8

Number NDs = 6

Number Detects = 2

Number Data (n) = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 0.2 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.853

For 10% significance level, 0.2 is an outlier.

For 5% significance level, 0.2 is an outlier.

For 1% significance level, 0.2 is an outlier.

2. Data Value 0.005 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.152

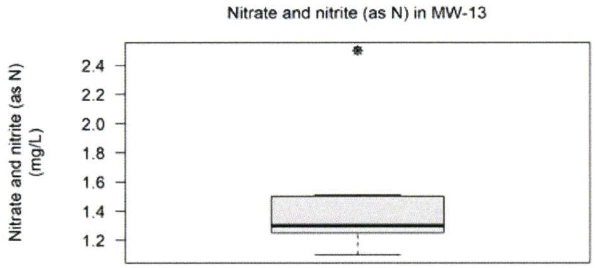
For 10% significance level, 0.005 is not an outlier.

For 5% significance level, 0.005 is not an outlier.

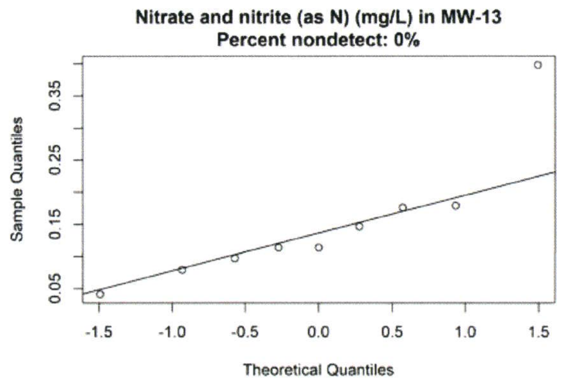
For 1% significance level, 0.005 is not an outlier.

Appendix F: Datasets with Extreme Outliers Removed

Site	Date	NO3/NO2 (as N) (mg/L)
MW-13	1/24/2018	1.2
MW-13	10/9/2018	1.1
MW-13	4/25/2019	2.5
MW-13	10/18/2019	1.5
MW-13	6/2/2020	1.3
MW-13	10/20/2020	1.3
MW-13	4/12/2021	1.4
MW-13	10/16/2021	1.25
MW-13	4/7/2022	1.51



Percent nondetect: 0%
Min: 1.1, Mean: 1.45, Max: 2.5, Std Dev: 0.42
Upper extreme threshold (Q75 + 3xH): 2.25
Lower extreme threshold (Q25 - 3xH): 0.5



Dixon's Outlier Test for Nitrate and nitrite (as N)

Total N = 9
Number NDs = 0
Number Detects = 9
Number Data (n) = 9
10% critical value: 0.441
5% critical value: 0.512
1% critical value: 0.635
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 2.5 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.762

For 10% significance level, 2.5 is an outlier.
For 5% significance level, 2.5 is an outlier.
For 1% significance level, 2.5 is an outlier.

2. Data Value 1.1 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.244

For 10% significance level, 1.1 is not an outlier.
For 5% significance level, 1.1 is not an outlier.
For 1% significance level, 1.1 is not an outlier.

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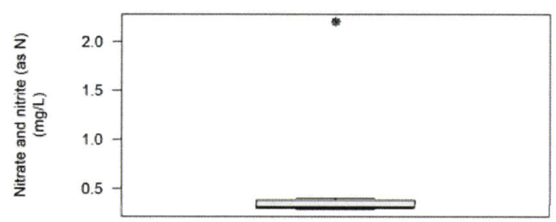
Appendix F: Datasets with Extreme Outliers Removed

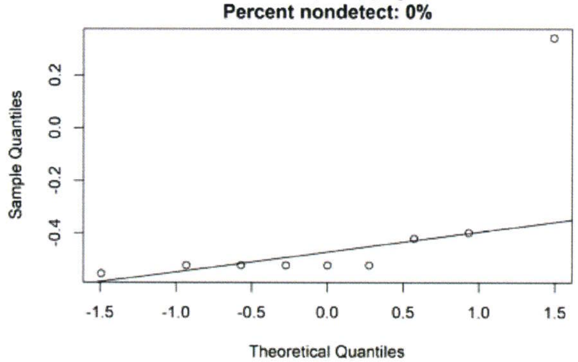
Site	Date	NO3/NO2 (as N) (mg/L)
MW-5	1/24/2018	0.4
MW-5	10/11/2018	0.3
MW-5	4/29/2019	0.3
MW-5	10/21/2019	0.3
MW-5	6/3/2020	0.3
MW-5	10/20/2020	0.3
MW-5	4/13/2021	2.2
MW-5	10/18/2021	0.28
MW-5	4/9/2022	0.38

Nitrate and nitrite (as N) in MW-5



Percent nondetect: 0%
Min: 0.28, Mean: 0.53, Max: 2.2, Std Dev: 0.63
Upper extreme threshold (Q75 + 3xH): 0.62
Lower extreme threshold (Q25 - 3xH): 0.0599999999999999

Nitrate and nitrite (as N) (mg/L) in MW-5
Percent nondetect: 0%



Dixon's Outlier Test for Nitrate and nitrite (as N)

Total N = 9
Number NDs = 0
Number Detects = 9
Number Data (n) = 9
10% critical value: 0.441
5% critical value: 0.512
1% critical value: 0.635
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 2.2 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.947

For 10% significance level, 2.2 is an outlier.
For 5% significance level, 2.2 is an outlier.
For 1% significance level, 2.2 is an outlier.

2. Data Value 0.28 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.167

For 10% significance level, 0.28 is not an outlier.
For 5% significance level, 0.28 is not an outlier.
For 1% significance level, 0.28 is not an outlier.