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DRC-2021-012922

September 7, 2021

Sent VIA E-MAIL AND OVERNIGHT DELIVERY

Mr. Doug Hansen
Director
Division of Waste Management and Radiation Control
Utah Department of Environmental Quality
195 North 1950 West
Salt Lake City, UT 84114-4880

Re: Transmittal of Source Assessment Report for MW-29 White Mesa Mill Groundwater Discharge Permit UGW370004

Dear Mr. Hansen:

Enclosed are two copies of Energy Fuels Resource (USA) Inc.'s ("EFRI's") Source Assessment Report ("SAR") for MW-29 at the White Mesa Mill. This SAR addresses the constituents that were identified as exceeding the GWCL in the 1st Quarter 2021 as described in the Division of Waste Management and Radiation Control ("DWMRC")-approved Q1 2021 Plan and Time Schedule. EFRI submitted the Plan and Time Schedule for MW-29 on May 11, 2021. DWMRC approval of the Plan and Time Schedule was received by EFRI on June 9, 2021. Pursuant to the Plan and Time Schedule EFRI has prepared this SAR.

This transmittal also includes two CDs each containing a word searchable electronic copy of the report.

If you should have any questions regarding this report please contact me.

Yours very truly,

Kathy Weinel

ENERGY FUELS RESOURCES (USA) INC.
Kathy Weinel
Quality Assurance Manager

CC: David C. Frydenlund
Garrin Palmer
Logan Shumway
Scott Bakken
Stewart Smith (HGC)
Angie Persico (Intera)

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Div of Waste Management
and Radiation Control

SEP 09 2021

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White Mesa Uranium Mill

State of Utah Groundwater Discharge Permit No. UGW370004

Source Assessment Report Under Part I.G.4

For Exceedances in MW-29 in the First Quarter of 2021

Prepared by:

Energy Fuels Resources (USA) Inc.
225 Union Boulevard, Suite 600
Lakewood, CO 80228

September 7, 2021

EXECUTIVE SUMMARY

This Source Assessment Report ("SAR") is an assessment of the sources, extent, and potential dispersion of uranium in MW-29 at the White Mesa Mill ("the Mill") as required under State of Utah Groundwater Discharge Permit UGW370004 (the "GWDP") Part I.G.4, resulting from out-of-compliance status under Part I.G.2 of the GWDP of uranium in MW-29. Uranium occurs naturally at the Mill (INTERA, 2008) and has exhibited exceedances of the applicable Groundwater Compliance Limits ("GWCLs") in various other wells at the site over time and from time-to-time. As will be demonstrated in this SAR, the increased concentrations of uranium in MW-29 are the result of background influences and are not the result of any potential seepage from the Mill's tailings management system ("TMS"). Background influences affecting site wells potentially include (but are not limited to): a natural decreasing trend in pH across the site [evident until approximately 2016, when pH in most wells began to stabilize or trend upward]; changing water levels due to past seepage from the wildlife ponds and pumping of nitrate and chloroform plumes; changes resulting from enhanced oxygen transport to groundwater near wells via the well casings or as a result of wildlife pond seepage; and/or the geochemical influences of the existing chloroform and nitrate/chloride plumes.

Groundwater at the Mill site has been evaluated in multiple recent investigations and reports, including the Revised Background Groundwater Quality Report (INTERA, 2007a) and the New Wells Background Report (INTERA, 2008) (collectively with INTERA, 2007b, the "Background Reports"), the pH Report (INTERA, 2012), an isotopic investigation (Hurst and Solomon, 2008), a report discussing the occurrence and likely impact of naturally-occurring pyrite on perched (shallow) groundwater (the Pyrite Report [HGC, 2012a]), and multiple SARs.

At the time of the Background Reports, MW-29 had a limited data set comprised of eight data points per GWDP parameter. Significantly more data points are now available, providing a more robust understanding of the water quality and behavior of MW-29. In addition, uranium concentrations in MW-29 have been increasing since the well was installed in 2005. The trend in uranium concentrations was noted in the 2008 New Wells Background Report, the pH Report submitted to DWMRC on November 9, 2012, and the 2013 SAR for Total Dissolved Solids ("TDS") in MW-29. In addition, the increasing trend in uranium at MW-29 was already present at the time that the isotopic study (Hurst and Solomon, 2008) determined there were no impacts to groundwater from the TMS. Furthermore, the stable to decreasing behavior of the key indicator parameters chloride, fluoride and sulfate in MW-29 is inconsistent with a TMS impact.

As demonstrated herein, water level behavior at MW-29 is also important when assessing potential sources of contamination. The water level in MW-29 has increased since 2005 due to perched water mounding associated with the northern wildlife ponds. Although use of the northern ponds was discontinued in March 2012, and the central portion of the mound has diminished, this mound is still evident as water levels have not returned to pre-pond conditions; therefore, the mound is still expanding and causing increases in water levels at relatively distant wells such as MW-29. Increasing constituent concentrations in many wells (such as MW-29) are at least in part attributable to water level changes caused by the associated groundwater mound.

In sum, the increasing trend in uranium in MW-29 is from natural background influences, and not the result of any potential seepage from the Mill's TMS or other activities at the Mill. As a result, it is appropriate to adjust the GWCLs for uranium in MW-29 to account for these influences. In accordance with the DWMRC-approved Flowsheet (from INTERA [2007a], included as **Appendix E**), increasing trends of this nature (i.e., resulting from background influences such as increased water levels in MW-29 associated with the northern wildlife ponds and other factors) necessitate a modified approach for calculation of GWCLs. The modification in this approach considers a more recent dataset and the greater of (1) mean + 2σ, (2) highest historical value, (3) background x 1.5, or (4) the fractional approach (i.e., the prescribed fraction of the Utah Groundwater Quality Standards applicable to the class of water in the well), to determine representative and appropriate GWCLs for trending constituents. Regular revisions to GWCLs for constituents in wells with significantly increasing trends over time due to background is consistent with the United States Environmental Protection Agency's ("USEPA's") Unified Guidance (USEPA, 2009). Such revisions account for the trends and minimize unwarranted out-of-compliance status in such wells in the future.

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Background Reports	*collectively refers to relevant background reports for this well and site*: the Existing Wells Background Report (INTERA, 2007a), the Regional Background Report (INTERA, 2007b), and the New Wells Background Report (INTERA, 2008)
CAP	Corrective Action Plan
CFCs	chlorofluorocarbons
CIR	Contaminant Investigation Report
DF	Dilution Factor
Director	Director of the Division of Waste Management and Radiation Control
DWMRC	State of Utah Division of Waste Management and Radiation Control
EFRI	Energy Fuels Resources (USA) Inc.
GWCL	Groundwater Compliance Limit
GWDP	State of Utah Ground Water Discharge Permit UGW370004
GWQS	Groundwater Quality Standard
μg/L	micrograms per liter
mg/L	milligrams per liter
Mill	White Mesa Uranium Mill
OOC	out of compliance
Q1	first quarter
Q2	second quarter
SAR	Source Assessment Report
TDS	Total Dissolved Solids
TMS	Tailings Management System
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

Energy Fuels Resources (USA) Inc. ("EFRI") operates the White Mesa Uranium Mill (the "Mill"), located near Blanding, Utah (Figure 1A). Groundwater is regulated under the State of Utah Groundwater Discharge Permit UGW370004 (the "GWDP"). This is the Source Assessment Report ("SAR") required under Part I.G.4 of the GWDP, relating to Part I.G.2 of the GWDP with respect to uranium in groundwater compliance monitoring well MW-29.

Part I.G.2 of the GWDP provides that an out-of-compliance ("OOC") status exists when the concentration of a constituent in two consecutive samples from a compliance monitoring point exceeds a Groundwater Compliance Limit ("GWCL") in Table 2 of the GWDP. The GWDP was originally issued in March 2005, at which time GWCLs were set on an interim basis, based on fractions of State of Utah Ground Water Quality Standards ("GWQSs") or the equivalent, without reference to natural background at the Mill. The GWDP also required that EFRI prepare a background groundwater quality report to evaluate all historical data for the purposes of establishing background groundwater quality at the Mill site and developing GWCLs under the GWDP. As required by then Part I.H.3 of the GWDP, EFRI submitted three "Background Groundwater Quality Reports" (INTERA 2007a, 2007b, 2008) (collectively, the "Background Reports") to the Director (the "Director") of the State of Utah Division of Waste Management and Radiation Control ("DWMRC") (the Director was formerly the Executive Secretary of the Utah Radiation Control Board and the Co-Executive Secretary of the Utah Water Quality Board).

Based on a review of the Background Reports and other information and analyses, the Director re-opened the GWDP and modified the GWCLs to be equal to the mean concentration plus two standard deviations ("mean + 2σ") or the equivalent for each constituent in each well, based on an "intra-well" approach. That is, the compliance status for each constituent in a well is determined based on current concentrations of that constituent in that well compared to the historic concentrations for that constituent in that well, rather than compared to the concentrations of the same constituent in other monitoring wells. The modified GWCLs became effective on January 20, 2010. On January 19, 2018, March 19, 2019, and March 8, 2021, revised GWDPs were issued, which set revised GWCLs for certain constituents in certain monitoring wells as approved by the Director through previously approved SARs relating to those constituents in those wells. GWCLs apply to groundwater monitoring wells located in the perched aquifer at the Mill.

Figure 1B is a site map showing perched well and piezometer locations, second quarter ("Q2"), 2021 perched groundwater elevations, and other relevant site features, such as the locations of formerly used (unlined) wildlife ponds, the historical pond, and the boundaries of two shallow groundwater plumes (the nitrate/chloride plume and the chloroform plume) which are under active remediation by pumping. Specifically, Figure 1B shows the commingled nitrate and chloride components of the nitrate/chloride plume.

Figure 1C shows the same features as Figure 1B, except that water levels and plume boundaries are as they existed just prior to cessation of water delivery to the wildlife ponds in the first quarter ("Q1") of 2012. As shown in Figures 1B and 1C, perched groundwater flows generally to the southwest across the site, and the nitrate/chloride plume extends more than 1,000 feet upgradient of the tailings management system ("TMS") indicating an upgradient source. As discussed in HGC (2018), the chloroform plume originated from disposal of laboratory wastes to two former sanitary leach fields that were used prior to Mill construction and operation.

Groundwater quality at individual wells is impacted by transient conditions at the site. Currently the perched groundwater system that is monitored at the site does not approach steady state over much of the monitored area. A large part of the site perched water system is in a transient state and affected by long-term changes in water levels due to past and current activities unrelated to the disposal of materials to the TMS. Changes in water levels have historically been related to seepage from the unlined wildlife ponds; however past impacts related to the historical pond, and to a lesser extent formerly used sanitary leach fields, are also expected, as discussed in HGC (2018). Water levels have decreased at some locations due to chloroform and nitrate pumping and reduced recharge from the wildlife ponds.

Figure 2 is a plot of groundwater elevation over time at MW-29 since installation in 2005. Groundwater levels have increased by approximately 4 ½ feet since the well was installed. As discussed above, the increase is attributable to former wildlife pond recharge.

1.1 Source Assessment Report Organization

A description of the approach used for analysis is provided in Section 2.0; the results of the analyses are presented in Section 3.0; the calculation of GWCLs is provided in Section 4.0; and conclusions and recommendations are presented in Section 5.0. Section 6.0 lists references cited.

The analyses performed for this Report are organized in Appendices A through F. **Appendix A** contains a table showing exceedances; **Appendix B** contains the statistical analysis performed on uranium; **Appendix C** contains the indicator parameter analysis; **Appendix D** contains the mass balance analysis; and **Appendix E** contains the Groundwater Data Preparation and Statistical Process Flow for Calculating Groundwater Protection Standards, White Mesa Mill Site, San Juan County, Utah ("Flowsheet") that was developed based on the United States Environmental Protection Agency's ("USEPA") Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance (USEPA, 1989, 1992). This Flowsheet was approved by DWMRC prior to completion of the Background Reports. **Appendix F** is included on the compact disc that accompanies this SAR and contains the electronic input and output files used for statistical analysis.

Statistical analysis was performed using the software package "R." R is a free statistical package that allows the analyst to perform statistical analysis and format and output graphs more effectively than the Statistica software package used in the past. Input and output files included in **Appendix F** can be imported into either R or Statistica to replicate the results presented in this SAR.

2.0 CATEGORIES AND APPROACHES FOR ANALYSIS

Previously, EFRI has categorized wells and constituents in five categories as follows:

- Constituents Potentially Impacted by Decreasing pH Trends Across the Site
- Newly Installed Wells with Interim GWCLs
- Constituents in Wells with Previously Identified Rising Trends
- Pumping Wells
- Other Constituents

This SAR addresses one constituent (uranium) in one well (MW-29). Uranium in MW-29 falls within the third category: Constituents in Wells with Previously Identified Rising Trends. Uranium concentrations in MW-29 have been increasing since the well was installed in 2005. Trends in uranium concentrations in MW-29 were observed in the 2008 New Wells Background Report, the pH report submitted to DWMRC on November 9, 2012, and the 2013 SAR for Total Dissolved Solids ("TDS") in MW-29. This trend was already present at the time of the University of Utah isotopic study (Hurst and Solomon, 2008; described below) that determined there had been no impacts to groundwater from the TMS.

It is important to note that the initial GWCL for uranium in MW-29 was set using the minimum eight data points and does not accurately reflect the true natural variation that would be evident with a larger data set. There are now 40 data points available, which will undoubtedly affect the outcome of the analysis.

Additional factors that may have contributed to a change in behavior of groundwater conditions in MW-29 are discussed in Section 3.2.

2.1 Approach for Analysis

The first step in the analysis is to perform an assessment of the potential sources for the exceedances to determine whether they are due to background influences or Mill activities. If the exceedances are determined to be caused by background influences, then it is not necessary to perform any further evaluations on the extent and potential dispersion of the contamination or to perform an evaluation of potential remedial actions. Monitoring will continue; and, where appropriate, a revised GWCL is proposed to reflect changes in background conditions at the Mill site.

The analysis performed in this SAR considers all available data to date to help determine if there have been any changes in potential TMS seepage indicator parameters (e.g., chloride, sulfate, fluoride, and uranium) since the date of the New Wells Background Report and any potential influences of the nitrate/chloride plume that may suggest a change in the behavior of the groundwater in the well. Although MW-29 is located immediately downgradient of the nitrate/chloride plume, geochemical influences related to this plume are not yet expected to impact MW-29.

As discussed in the Background Reports (INTERA, 2007a, 2007b, 2008), indicator parameters of potential TMS seepage include chloride, sulfate, fluoride, and uranium. Chloride is the best indicator of potential TMS seepage for wells such as MW-29 located outside the nitrate/chloride plume. Sulfate and fluoride are useful indicator parameters under geochemical conditions allowing conservative (i.e., non-reactive) behavior. Uranium behavior may range from conservative to non-conservative depending on the geochemical conditions.

Groundwater impacted by any potential seepage from the TMS is expected to exhibit increasing concentrations of chloride, sulfate, fluoride, and uranium, among other constituents. While uranium can be the most mobile of trace metals under certain conditions, it is typically retarded behind chloride, fluoride, and sulfate due to possible sorption and precipitation and would likely not show increasing concentrations in groundwater until sometime after chloride, fluoride, and sulfate concentrations had begun to increase (INTERA, 2007a). Based on data provided in USEPA (2008), uranium is generally expected to sorb and have comparatively poor mobility at the near-neutral pH conditions encountered at MW-29. Regardless, although the absence of a rising trend in chloride, fluoride and sulfate concentrations would indicate that there has been no impact from the TMS, a rising trend in concentrations could also result from natural influences (INTERA, 2007a, Section 12.0).

The evaluation of SAR parameters and indicator parameters in MW-29 was supported by a statistical analysis that followed the process outlined in the Flowsheet (INTERA, 2007a) attached as **Appendix E.** As discussed in Section 1.2, the Flowsheet was designed based on USEPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (USEPA, 1989, 1992, 2009), and was approved by DWMRC prior to completion of the Background Reports (INTERA, 2007a, 2007b, 2008).

2.2 Approach for Setting Revised GWCLs

If the preceding approach indicates that the previous analysis in the Background Reports has not changed, or that the OOC status of uranium in MW-29 is due to natural or other site-wide influences, then new GWCLs may be proposed for the constituents. The revised GWCLs use the DWMRC-approved Flowsheet, including the last decision of the process that directs the analyst to consider a modified approach to determining a GWCL if an increasing trend is present.

2.3 University of Utah Study

At the request of the DWMRC, T. Grant Hurst and D. Kip Solomon of the Department of Geology and Geophysics of the University of Utah performed a groundwater study (the "University of Utah Study") at the Mill site in July 2007 (Hurst and Solomon, 2008). The purpose of this study was to characterize groundwater flow, chemical composition, noble gas composition, and water age to evaluate whether the increasing and elevated trace metal concentrations in monitoring wells at the Mill, all of which were identified in the Background Reports (INTERA, 2007a, 2007b, 2008), may indicate that potential seepage from the TMS is occurring.

To evaluate sources of solute concentrations at the Mill, low-flow groundwater sampling was used as a method for collecting groundwater quality samples from 15 monitoring wells. In addition, surface water samples were collected from TMS Cells 1, 3, and 4A, and two wildlife ponds. Passive diffusion samplers were also deployed and collected to characterize the dissolved gas composition of groundwater at different depths within the wells. Samples were collected and analyzed for the following constituents: tritium, nitrate, sulfate, deuterium and oxygen-18 of water, sulfur-34 and oxygen-18 of sulfate, trace metals (uranium, manganese, and selenium), and chlorofluorocarbons ("CFCs").

Hurst and Solomon (2008, page iii) concluded generally that,

> *[t]he data show that groundwater at the Mill is largely older than 50 years, based on apparent recharge dates from chlorofluorocarbons and tritium concentrations. Wells exhibiting groundwater that has recharged within the last 50 years appears to be a result of recharge from wildlife ponds near the site. Stable isotope fingerprints do not suggest contamination of groundwater by tailings cell leakage, evidence that is corroborated by trace metal concentrations similar to historically-observed observations.*

Hurst and Solomon (2008) also concluded that,

> *[i]n general, the data collected in this study do not provide evidence that tailings cell leakage is leading to contamination of groundwater in the area around the White Mesa Mill. Evidence of old water in the majority of wells, and significantly different isotopic fingerprints between wells with the highest concentrations of trace metals and surface water sites, supports this conclusion.*

It should be further noted that subsequent to the University of Utah Study EFRI submitted the *Contaminant Investigation Report ["CIR"], White Mesa Uranium Mill Site, Blanding Utah,* dated December 30, 2009 (INTERA, 2009), in connection with the nitrate/chloride plume at the Mill site. However, as discussed above, although MW-29 is located immediately downgradient of the nitrate/chloride plume, geochemical influences related to this plume are not yet expected to impact MW-29.

3.0 RESULTS OF ANALYSIS

This section describes the potential geochemical influences on groundwater in MW-29 and results of the analysis, summaries of which are presented in **Appendices B** and **C**. Supporting analyses are presented in **Appendices D** and **F**.

3.1 Site-Wide pH Changes

As has been documented in INTERA (2012), a decreasing trend in pH was observed in almost every groundwater monitoring well across the site, including upgradient and far downgradient monitoring wells; and decreasing pH is one of the most important contributors to increasing concentrations of many naturally-occurring parameters.

Hydro Geo Chem, Inc. (["HGC"]), 2012a) ("The Pyrite Report") attributed the decline in pH across the Mill site to the site-wide existence and oxidation of pyrite in the perched groundwater monitored at the site. Based on HGC (2012a), pyrite has been noted in approximately $^{2}/_{3}$ of the lithologic logs for wells installed at the site since 1999 and verified by laboratory analysis in core and cuttings from at least 25 monitoring wells, including MW-29, as well as MW-28, which is located upgradient of MW-29 (Figure 1B).

Pyrite may oxidize according to the following reaction (Williamson and Rimstidt, 1994):

$$FeS_{2(s)} + 7/2O_{2(g)} + H_2O \rightarrow Fe^{2+}_{(aq)} + 2SO_4^{2-}{}_{(aq)} + 2H^+ \qquad \text{(reaction 1)}$$

Reaction 1 will increase hydrogen ion (acid) concentrations, which results in decreasing pH. Oxidation of pyrite and the resulting decrease in pH enables subsequent pH-dependent reactions to occur, including the mobilization of naturally-occurring metals and metalloids (such as uranium) in the formation (McClean and Bledsoe, 1992). In addition, pyrite typically contains many contaminants including selenium (Deditius, 2011) that are expected to be released upon pyrite oxidation. Furthermore, naturally occurring uranium may be reduced and sorb onto pyrite (Descotes et al 2010; Glizaud, 2006) making it available for release upon oxidation. As discussed in EFRI (2021), bottle-roll tests using 'generic' pyrite resulted in bottle-roll solutions initially consisting of laboratory-grade DI water picking up between 25 micrograms per liter ("µg/L") and 3,420 µg/L uranium. Bottle-roll tests using pyrite-bearing core from the formation hosting perched groundwater at the site yielded bottle-roll solutions having as much as 6,700 µg/L uranium.

The likely causes for site-wide oxidation of pyrite include processes that increase oxygen transport to groundwater. Monitoring well casings themselves provide direct conduits for oxygen to impact groundwater in the immediate vicinities of the wells. Additional factors expected to increase oxygen transport to groundwater include: (1) infiltration of oxidized water from the wildlife ponds upgradient of the Mill site; (2) changing water levels and incorporation of oxygen in air-filled pore spaces into groundwater; (3) the introduction of oxygen during pumping related treatment of the nitrate/chloride plume; and (4) the introduction of oxygen during increased sampling of monitoring wells (INTERA, 2012).

Many of these mechanisms, in particular changing water levels, are expected to impact MW-29. Water levels at many site wells increased due to former seepage from the northern wildlife ponds located upgradient of the TMS. As shown in Figure 2, as a result of former wildlife pond seepage and expansion of the resulting perched groundwater mound, water levels at MW-29 increased by approximately 4.5 feet between 2005 and present.

As discussed in the pyrite report, between the time of installation and 2012, pH at MW-29 was trending downward, presumably as a result of pyrite oxidation. However, between 2012 and late 2016, pH at MW-29 appears to have stabilized; and subsequently, between late 2016 and the present time, pH at MW-29 appears to be on an upward trend, similar to most other MW-series wells at the site. Although pH is no longer decreasing, suggesting that pyrite oxidation has diminished, oxygen transport mechanisms are presumably still active, and are expected to impact the geochemistry at MW-29; in particular, groundwater in the vicinity of MW-29 is expected to become more oxidizing.

3.2 Changes in Groundwater in MW-29

At the time of the Background Reports, MW-29 had a limited data set composed of eight data points per GWDP parameter. At the time of this SAR, 40 data points are available, providing a more robust understanding of the water quality and behavior of MW-29. Other factors that may also contribute to the behavior of constituents in this well are discussed below.

As discussed in Section 1, Figure 1B shows water levels and chloroform, nitrate and chloride plume boundaries for Q2 of 2021. Figure 1C shows the same features as Figure 1B, except that water levels and plume boundaries are as they existed just prior to cessation of water delivery to the wildlife ponds. A comparison between Figure 1B and Figure 1C shows the substantial changes in water levels that have occurred in less than 10 years due to pumping and cessation of water delivery to the wildlife ponds. Currently, although water levels have declined substantially in the center of the perched groundwater mound associated with the northern wildlife ponds, water levels have not returned to pre-pond seepage conditions, and consequently the groundwater mound is still expanding.

The transient status of a large portion of the perched water system, manifested in long-term changes in saturated thicknesses and rates of groundwater flow, is expected to result in trends in pH and in the concentrations of many dissolved constituents that are unrelated to site operations. Changes in saturated thicknesses and rates of groundwater flow can result in changes in concentrations of dissolved constituents (or pH) for many reasons. For example, as discussed in HGC (2012), groundwater rising into a vadose zone having a different chemistry than the saturated zone can result in changes in pH and groundwater constituent concentrations. If the rise in groundwater represents a long-term trend, long-term changes in groundwater constituent concentrations (or pH) may result.

As noted in Section 3.1, as a result of enhanced transport of oxygen to groundwater in the vicinity of site monitoring wells, groundwater in the vicinity of MW-29 is expected to become more oxidizing. This expectation is consistent with decreasing ammonia concentrations. As shown in Figure 3, uranium concentrations at MW-29 have increased as the ammonia concentrations have generally decreased; and increasing uranium accompanied by decreasing ammonia is consistent with the findings of Miao et al (2013). Under geochemical conditions where groundwater becomes more oxidizing, naturally-occurring uranium is expected to become more mobile, leading to increased concentrations. In addition, as shown in Figure 4, both uranium and bicarbonate concentrations at MW-29 have generally increased. The nearly simultaneous increase in both uranium and bicarbonate is expected; as discussed in Desbarats et al (2017), and Drage and Kennedy (2013), increased bicarbonate enhances the mobility of uranium; and Jurgens et al (2010) note that high bicarbonate water leaches uranium from sediments. (With regard to Figures 3 and 4: subsequent to the Q2 of 2012, bicarbonate data provided in Figure 4 that were reported by the analytical laboratory as $CaCO_3$ have been converted to HCO_3 to be compatible with previous data; and the fourth quarter, 2005 uranium value of 49 µg/L is an extreme outlier and is not included in either Figure 3 or 4).

3.3 Indicator Parameter Analysis

As discussed in the Background Reports (INTERA, 2007a, 2007b, 2008), indicator parameters of potential TMS seepage include chloride, sulfate, fluoride, and uranium. Chloride is the best indicator of potential TMS seepage; however, chloride is problematic as an indicator parameter for those groundwater monitoring wells (such as MW-28, located upgradient of MW-29) impacted by the chloride component of the nitrate/chloride plume (EFRI, 2020b). Sulfate and fluoride are useful indicator parameters under geochemical conditions allowing conservative (i.e., non-reactive) behavior. Uranium behavior may range from conservative to non-conservative depending on the geochemical conditions.

Groundwater impacted by any potential seepage from the TMS is expected to exhibit increasing concentrations of chloride, sulfate, fluoride, and uranium, among other constituents. While uranium can be the most mobile of trace metals under certain conditions, it is typically retarded behind chloride, fluoride, and sulfate due to possible sorption and precipitation and would likely not show increasing concentrations in groundwater until sometime after chloride, fluoride, and sulfate concentrations had begun to increase (INTERA, 2007a). Based on data provided in USEPA (2008), uranium is generally expected to sorb and have comparatively poor mobility at the near-neutral to slightly acidic pH conditions encountered at MW-29. Regardless, although the absence of a rising trend in constituent concentrations would indicate that there has been no impact from the TMS, a rising trend in concentrations could also result from natural influences (INTERA, 2007a, Section 12.0).

In general, the behavior of the key indicator parameters, chloride, fluoride, and sulfate, in MW-29 has not changed significantly since the time of the 2008 New Wells Background Report or the 2013 SAR (INTERA 2013). A summary of statistical analysis of indicator parameters is included in **Appendix C-1**. **Appendix C-2** presents a comparison of descriptive statistics for indicator parameters from the 2008 New Wells Background Report, the 2013 SAR and this 2021 SAR. Data used in the analysis and data removed prior to analysis are presented in Appendices **C-3** and **C-4**, respectively. The distribution and identification of outliers and extreme outliers in indicator parameter concentration data sets are demonstrated in the box plots included in **Appendix C-5.** Histograms and time series plots included in Appendices **C-6** to **C-8** can be used to further visualize the distribution and behavior of indicator parameters over time.

Chloride concentrations in MW-29 have remained relatively stable between 35 and 40 milligrams per liter ("mg/L"). Fluoride and sulfate concentrations in MW-29 are exhibiting gradual statistically significant decreasing trends. Uranium concentrations in MW-29 are increasing significantly. An increasing trend in uranium was noted at the time of the 2008 background report, although the trend was not significant at that time. A statistically significant increasing trend in uranium concentrations was identified in the 2013 SAR. Despite the increasing trend, uranium concentrations in MW-29 remain relatively low compared to other wells at the Mill (Appendix B-9).

Although uranium concentrations display a significantly increasing trend, the Q2 2021 uranium concentration at MW-29 is about average for the site MW-series monitoring wells. In addition, the stable to decreasing concentrations of the most mobile indicator parameters chloride, fluoride and sulfate; and increasing concentrations of relatively low mobility uranium; constitutes behavior that is the *opposite* of expectation should increasing uranium result from TMS seepage.

3.4 Mass Balance Analyses

Since installation in 2005, water levels at MW-29 have risen by approximately 4.5 feet, and the saturated thickness has increased by about 25%. TMS solutions contain chloride, a conservative solute, at an average concentration exceeding 23,000 mg/L. If the water level changes at MW-29 were due to potential TMS seepage, and implied a mixture containing 20% TMS solution, then chloride concentrations at MW-29 would exceed 4,500 mg/L, rather than the measured values of less than 40 mg/L. This demonstrates that the observed increases in water levels at MW-29 could not result from potential TMS seepage.

An additional mass balance calculation based on indicator parameters chloride, fluoride, sulfate and uranium is provided in **Appendix D**. For this mass balance calculation, indicator parameters are assumed to be conservative tracers (INTERA, 2007a) and not subject to attenuation during transport. Therefore, if the TMS is a source of contamination at MW-29, and all four indicator parameters behave conservatively, then all four parameters should be increasing; however the most conservative parameters chloride, fluoride and sulfate are stable to decreasing; and only uranium is increasing.

Model calculations are presented in **Appendix D**. The mass balance calculations are based on dilution factors ("DFs") computed as the ratio of a particular constituent's current (Q2 2021) concentration in MW-29 to its average concentration in TMS Cell 1 solutions since 2003 (EFRI, 2020a) The DFs calculated for all indicator parameters based on the ratio of Cell 1 and MW-29 constituent concentrations vary by more than three orders of magnitude.

Based on the computed DFs for uranium, chloride and sulfate, the predicted MW-29 fluoride concentrations are 0.091, 3.3 and 31.2 mg/L, respectively; yet the most recent observed concentration of fluoride in MW-29 is 0.694 mg/L. The dissimilarity between predicted and measured fluoride concentrations and the large range in calculated DFs for the indicator parameters indicate that potential TMS seepage is not a contributor to the groundwater chemistry of MW-29. Instead, fluoride concentrations in MW-29 are similar to most natural waters (< 1 mg/L; Hem 1985) and are more consistent with natural processes.

Applying the same mass balance methodology to uranium, the predicted MW-29 uranium concentrations range from 123 μg/L (based on the fluoride DF) to 5,530 μg/L (based on the sulfate DF); yet the most recent observed concentration of uranium in MW-29 is 16.2 μg/L. All of the predicted concentrations of uranium substantially exceed the most recent observed uranium concentration of approximately 16.2 μg/L, an even more compelling indication that potential TMS seepage is not a contributor to the groundwater chemistry at MW-29.

As discussed above, chloride, fluoride and sulfate concentrations at MW-29 are stable to decreasing (**Appendix C**), which is inconsistent with potential TMS seepage. In addition, as discussed above, if water level changes at MW-29 were the result of TMS seepage, chloride concentrations would be orders of magnitude higher than measured in MW-29.

Furthermore, the ratios of indicator parameters in MW-29 differ substantially from ratios of the same constituents in Cell 1 solutions. The average chloride to average fluoride ratio in Cell 1 is approximately 11 while the Q2 2021 ratio in MW-29 is approximately 51; the average chloride to average sulfate ratio in Cell 1 is approximately 0.14 while the Q2 2021 ratio in MW-29 is approximately 0.015; and the ratio of average chloride to average uranium in Cell 1 is approximately 61 while the Q2 2021 ratio in MW-29 is approximately 2,185. None of these ratios are reflective of a TMS impact.

Overall, the mass balance analyses and geochemical considerations indicate that potential TMS seepage is not a contributor to the groundwater chemistry at MW-29. Increasing uranium at MW-29 is attributable to 1) a change in geochemistry to more oxidizing conditions, consistent with enhanced oxygen transport to groundwater via the well casing and as a result of rising water levels; and 2) increasing bicarbonate concentrations. Both are expected to enhance mobilization of naturally occurring uranium from the formations hosting the perched groundwater and to result in increased uranium concentrations in MW-29 groundwater.

3.5 Summary of Results

As discussed in the Background Reports (INTERA, 2007a, 2007b, 2008), indicator parameters of potential tailings system seepage include chloride, sulfate, fluoride, and uranium. Chloride is the best indicator of potential TMS seepage for wells such as MW-29 that are outside the nitrate/chloride plume that originates upgradient of the TMS.

As discussed above, chloride at MW-29 is stable; and fluoride and sulfate at MW-29 are decreasing. Only uranium displays an increasing trend. The behavior of chloride, fluoride and sulfate are inconsistent with a TMS impact; as are mass balance analyses based on chloride and other indicator parameters. Increasing uranium is attributable to mobilization of naturally occurring uranium from the formations hosting perched groundwater due to: 1) conditions that are increasingly oxidizing at MW-29 and 2) increases in bicarbonate concentrations at MW-29.

3.5.1 Uranium

As noted in Section 3.3 above, uranium concentrations are about average for the site and, as shown in **Appendix B,** are exhibiting a statistically significant increasing trend. Apparent changes in uranium concentrations occur after April 2011 at the time of well redevelopment that included surging and bailing. The subset of data post-2011 that were analyzed alongside the complete data set and presented in **Appendix B** are normally distributed and also exhibit a statistically significant increasing trend.

However, in addition to the behavior of indicator parameters discussed above in Section 3.5, which is inconsistent with a potential TMS impact, the ratio of average chloride to average uranium in Cell 1 is approximately 61 while the Q2 2021 ratio in MW-29 is approximately 2,185, also not reflective of a potential TMS impact. Furthermore, in performing the mass balance analyses discussed in Section 3.4, the calculated DFs for chloride, fluoride and sulfate over-predict the concentration of uranium at MW-29 by one to three orders of magnitude; and chloride concentrations would exceed 4,500 µg/L rather than the measured values of less than 40 µg/L if water level increases at MW-29 resulted from TMS seepage; both of which are inconsistent with a potential TMS impact. Finally, the stable to decreasing concentrations of the most mobile indicator parameters chloride, fluoride and sulfate; and increasing concentrations of relatively low mobility uranium; constitutes behavior that is the *opposite* of expectation should increasing uranium result from TMS seepage.

As discussed above in Section 3.4, the most likely mechanisms for increased uranium at MW-29 are 1) the change in geochemistry to more oxidizing conditions, consistent with enhanced oxygen transport to groundwater via the well casing and as a result of rising water levels; and 2) increasing bicarbonate concentrations. Both are expected to enhance mobilization of naturally occurring uranium from the formations hosting the perched groundwater and to result in increased uranium concentrations in MW-29 groundwater.

4.0 CALCULATIONS OF GROUNDWATER COMPLIANCE LIMITS

The findings of analyses discussed above support the conclusions that (1) MW-29 is not being impacted by any potential TMS seepage, and (2) increasing concentrations of uranium in MW-29 are the result of background influences. Although the nitrate/chloride plume does not yet impact MW-29, the plume does affect MW-28, which is located upgradient of MW-29. Furthermore, the existing GWCLs for MW-29 were developed at the time of the Background Report using eight data points that are no longer representative of current conditions at that location. Therefore, revision of the GWCL for uranium in MW-29 is proposed.

4.1 Evaluation of Modified Approaches to Calculation of GWCLs for Trending Constituents

According to the DWMRC-approved Flowsheet (**Appendix E**), if an increasing trend is present, a modified approach should be considered for determining GWCLs. Uranium concentrations in MW-29 are exhibiting a statistically significant increasing trend that can be attributed to 1) a change in geochemistry to more oxidizing conditions, consistent with enhanced oxygen transport to groundwater via the well casing and as a result of rising water levels and 2) increases in bicarbonate concentrations at MW-29.

The Flowsheet contemplates GWCLs being set in various circumstances based on (1) the fractional approach; (2) the highest historical value; and (3) the mean + 2σ, and states that for rising trends a modified approach can be considered. In proposing a modified approach for the GWCL for uranium in MW-29, the following alternative approaches to calculating a GWCL have been considered, in addition to the fractional approach, highest historical value, and mean + 2σ:

1. 1.5 times background concentration as defined in Utah Administrative Code ("UAC") R317-6-4.3.

The UAC R317-6-4.3 recognizes that "contaminants" may be present as part of naturally occurring background conditions:

> *When a contaminant is present in a detectable amount as a background concentration, the concentration of the pollutant may not exceed the greater of 1.5 times the background concentration or 0.5 times the ground water quality standard or background plus two standard deviations...*

In this rule, background concentration is defined as the "concentration of a pollutant in ground water upgradient or lateral hydraulically equivalent point from a facility, practice or activity which has not been affected by that facility, practice or activity." Background at the Mill has been determined on an intra-well basis, as defined in the Background Reports. Therefore, to be conservative, the mean concentration is proposed to be used as background for the purposes of this calculation. The mean concentration would assume all data to date (or a data subset as described below), after following the data quality steps of the Flowsheet.

2. Using a recent subset of data to calculate GWCLs.

This approach follows the DWMRC-approved Flowsheet (**Appendix E**) by taking into account increasing trends and processing the data consistently with previously determined GWCLs. In this approach, the complete data set, which exhibits an increasing trend for uranium over the history of the well record, is divided into a subset of data based on identification of a point of inflection where the results have shifted. This approach is appropriate in wells, such as MW-29, that have been thoroughly investigated and where the causes of increasing trends are not due to any potential TMS seepage or other Mill-related impacts that are not already being addressed. For purposes of this modified approach and to be consistent with previous SARs, a point of inflection was identified in the uranium data sets and data from post-April 2011 were evaluated (**Appendix B**) in addition to the full data set. Both the full and post-April 2011 uranium data sets are normally distributed, and exhibit statistically significant increasing trends.

These two modified approaches have been considered for developing revised GWCLs for uranium in MW-29, which is increasing in concentration for reasons other than any potential TMS impact. Based on this analysis, the most appropriate GWCL for uranium in MW-29, considering increasing trends, is proposed as the highest of the following: (1) fractional approach; (2) highest historical value; (3) mean + 2σ, calculated using either the full data set or the post-April 2011 data set; or (4) 1.5 times background, calculated using either the full data set or the post-April 2011 data set. This modified approach of choosing the highest of these values combines elements from the Flowsheet and from previously approved GWCLs (DWMRC, 2016).

4.2 Proposed Revised GWCLs

In accordance with the Flowsheet, the increasing trend identified for uranium warrants a modified approach to the calculation of GWCLs. Two data sets were evaluated for use in calculating GWCLs. Both data sets exhibit statistically significant increasing trends and are normally distributed. Considering the increasing trends, a modified approach of choosing the highest of the following: (1) fractional approach; (2) highest historical value; (3) mean + 2σ, calculated using either the full data set or the post-April 2011 data set; or (4) 1.5 times background, calculated using either the full data set or the post-April 2011 data set, would be appropriate. Flowsheet analysis has been performed for both data sets and is summarized in **Appendix B.**

Proposed GWCLs determined according to the Flowsheet using all data to date and the post-April 2011 data are presented in **Table 1** and **Appendix B-1.** In both data sets, the modified approach of 1.5 times background is the proposed GWCL because it is the greater of: (1) the fractional approach; (2) the highest historical value, (3) the mean + 2σ, or (4) 1.5 times background, calculated using either the full data set or the post-April 2011 data set. In light of the findings of this SAR and the significant increasing trend in uranium concentrations, the GWCL of 20.2 ug/L which was calculated using the post-

2011 data set is recommended.

Table 1 Proposed GWCL

Parameter	GWCL[a]	Revised GWCL	Rationale
Uranium (ug/L) (full data set)	15	18.4	Modified Approach- 1.5 x background
Uranium (ug/L) (post-2011 data set)	15	20.2	Modified Approach- 1.5 x background

Notes:
a = 2021 GWDP No.UGW370004.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Background groundwater quality at the Mill site was thoroughly studied as described in the Background Reports (INTERA, 2007a, 2007b, 2008) and in the University of Utah Study (Hurst and Solomon, 2008). The Background Reports and the University of Utah Study concluded that groundwater at the Mill site has not been impacted by Mill operations. These studies also acknowledged that there are natural influences operating at the Mill site that have caused increasing trends and general variability in background groundwater quality. Note that the increasing trend in uranium at MW-29 was already present at the time that Hurst and Solomon (2008) determined that there were no impacts to groundwater from the TMS.

Consistent with the conclusions of the Background Reports and the University of Utah Study, the conclusion of this SAR is that groundwater in MW-29 is not impacted by potential TMS seepage. Mass balance calculations have demonstrated that concentrations of SAR parameters and indicator parameters are consistent with background conditions, and not the result of potential TMS seepage. Increasing uranium at MW-29 is attributed to mobilization of naturally occurring uranium from the formations hosting perched groundwater due to: 1) conditions that are increasingly oxidizing at MW-29 due to enhanced oxygen transport to groundwater via the well casing and as a result of rising water levels; and 2) increases in bicarbonate concentrations at MW-29.

One goal of this SAR was to identify any changes in circumstances identified in previous studies. Accordingly. the change in MW-29 uranium concentrations is attributed to the ongoing changes in background conditions described above.

Furthermore, increases in water levels at MW-29 related to former wildlife pond recharge, and increased sampling frequency, may influence constituent concentrations. Both conditions could contribute to increasing uranium concentrations and both are unrelated to the TMS.

In addition to the above factors, a site-wide comparison of constituent concentrations in MW-29 shows that even though many constituents have significant increasing long-term trends, their concentrations are less than or within the range of site-wide background concentrations. This constitutes further evidence that uranium concentrations in MW-29 are likely due to background influences and the water level increases, and not to potential TMS seepage.

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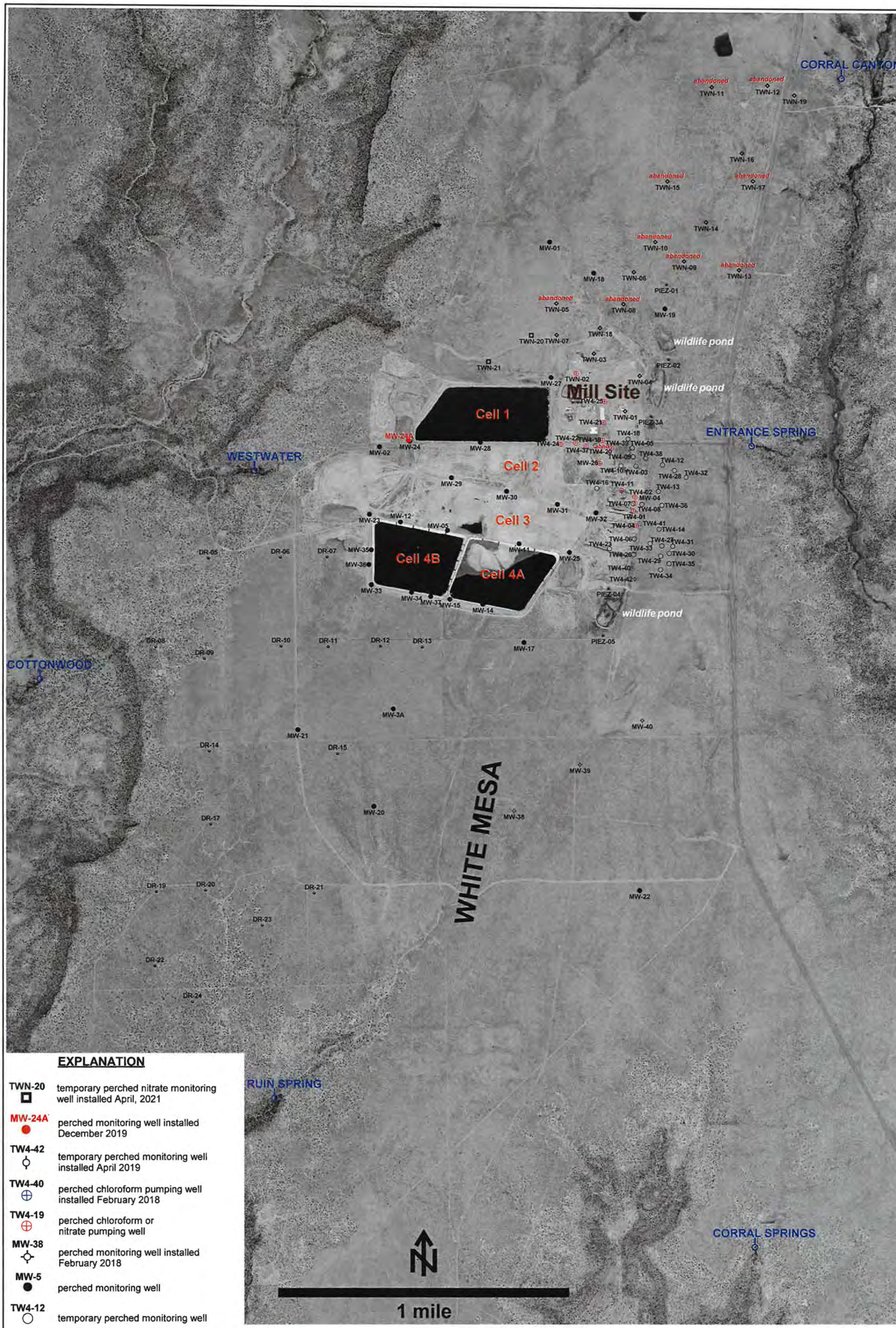
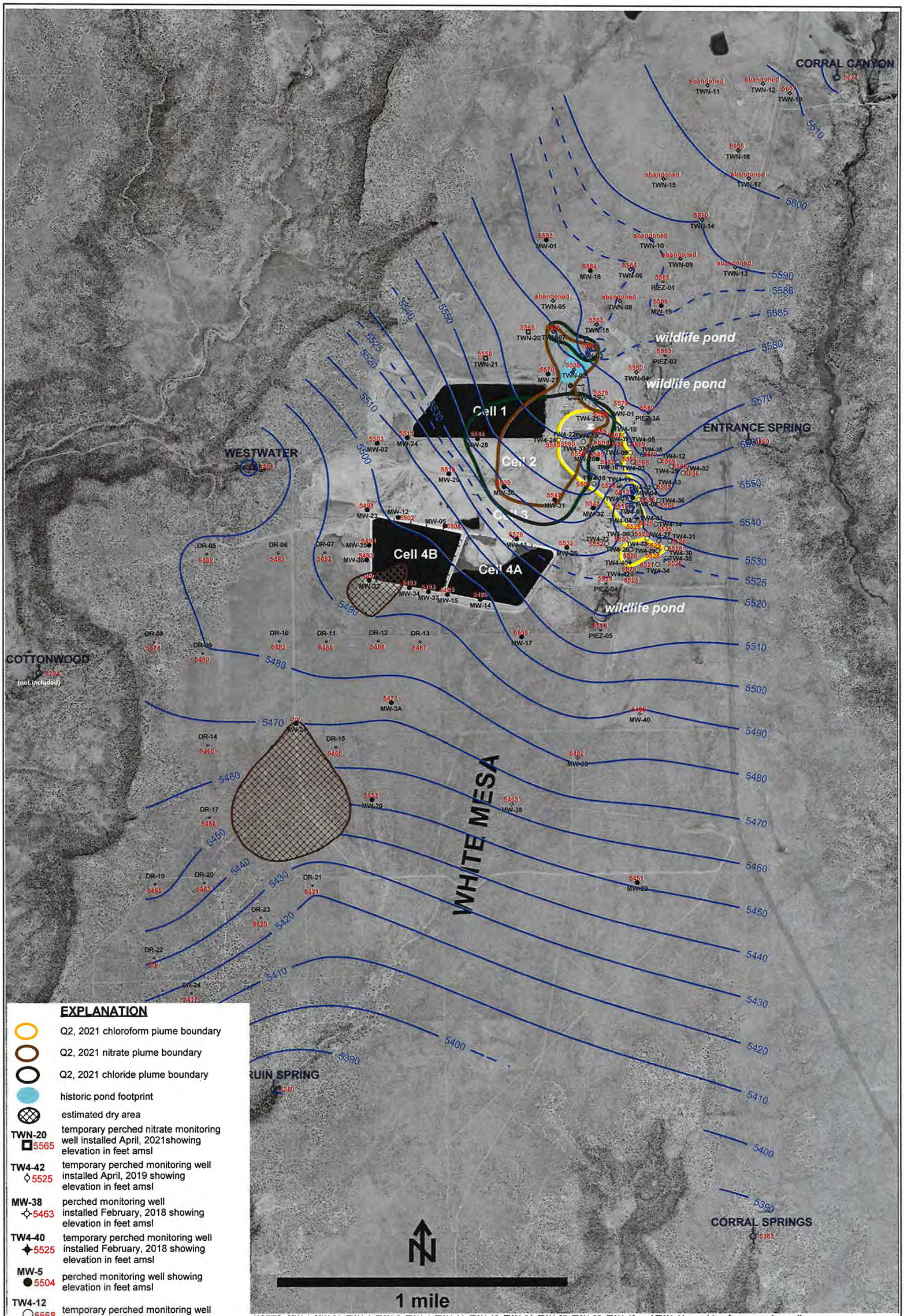
FIGURES



HYDRO GEO CHEM, INC.

WHITE MESA SITE PLAN SHOWING LOCATIONS OF PERCHED WELLS AND PIEZOMETERS

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/MW29 MW29SAR/Figures/Uwelloc0621.srf	1A



EXPLANATION

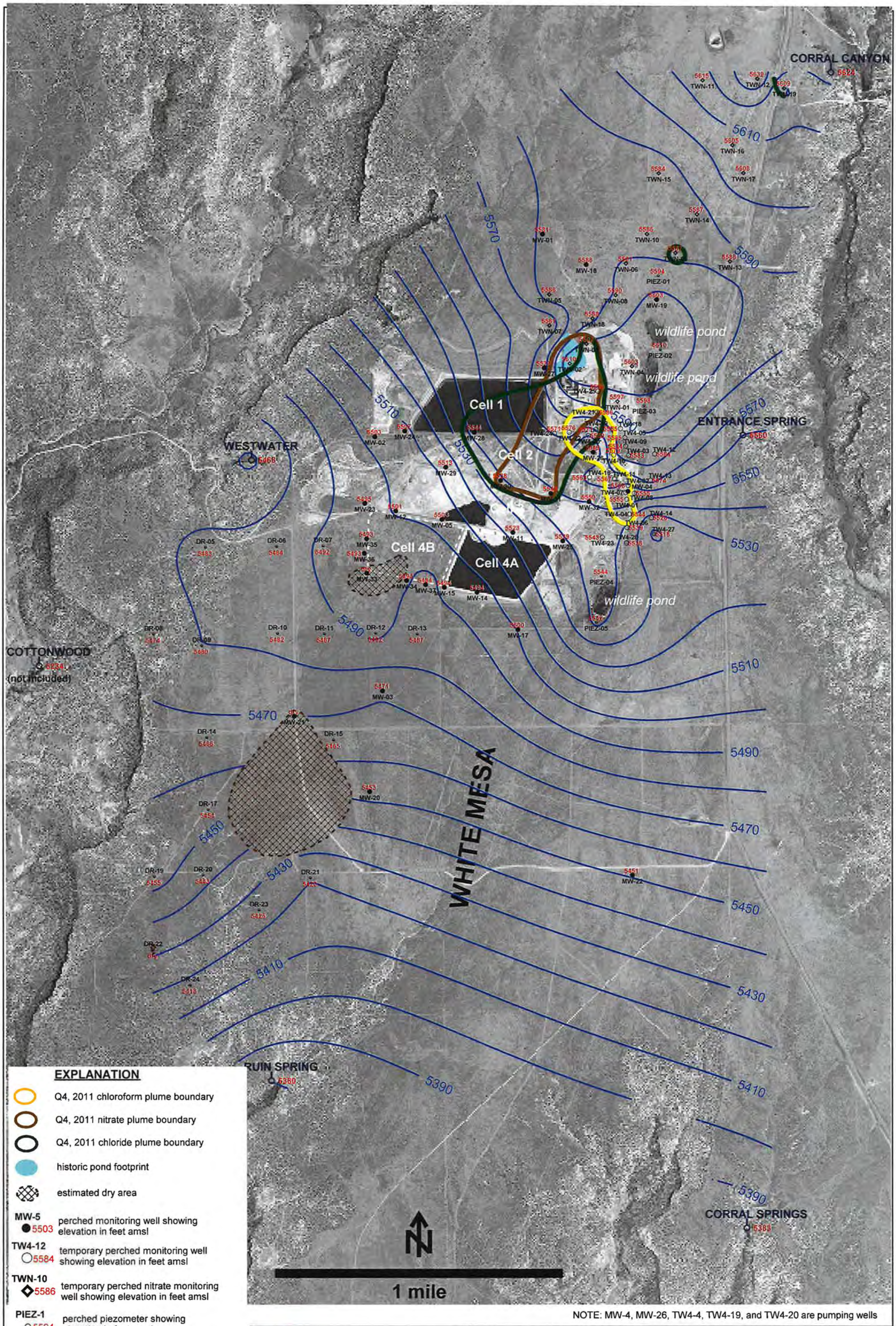
- Q2, 2021 chloroform plume boundary
- Q2, 2021 nitrate plume boundary
- Q2, 2021 chloride plume boundary
- historic pond footprint
- estimated dry area
- TWN-20 5565 — temporary perched nitrate monitoring well installed April, 2021showing elevation in feet amsl
- TW4-42 5525 — temporary perched monitoring well installed April, 2019 showing elevation in feet amsl
- MW-38 5463 — perched monitoring well installed February, 2018 showing elevation in feet amsl
- TW4-40 5525 — temporary perched monitoring well installed February, 2018 showing elevation in feet amsl
- MW-5 5504 — perched monitoring well showing elevation in feet amsl
- TW4-12 5568 — temporary perched monitoring well showing elevation in feet amsl
- TWN-7 5569 — temporary perched nitrate monitoring well showing elevation in feet amsl
- PIEZ-1 5588 — perched piezometer showing elevation in feet amsl
- RUIN SPRING 5380 — seep or spring showing elevation in feet amsl

NOTES: MW-4, MW-26, TW4-1, TW4-2, TW4-4, TW4-11, TW4-19, TW4-21, TW4-37, TW4-39, TW4-40 and TW4-41 are chloroform pumping wells; TW4-22, TW4-24, TW4-25 and TWN-2 are nitrate pumping wells; TW4-1, TW4-2 and TW4-11 water levels are below the base of the Burro Canyon Formation

HYDRO GEO CHEM, INC.

KRIGED 2nd QUARTER, 2021 WATER LEVELS AND PLUME BOUNDARIES WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
		H :/718000/MW29/MW29SAR Figures/Uwl_Plumes_2Q21.srf	1B



NOTE: MW-4, MW-26, TW4-4, TW4-19, and TW4-20 are pumping wells

HYDRO GEO CHEM, INC.

KRIGED 4th QUARTER, 2011 WATER LEVELS AND PLUME BOUNDARIES WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
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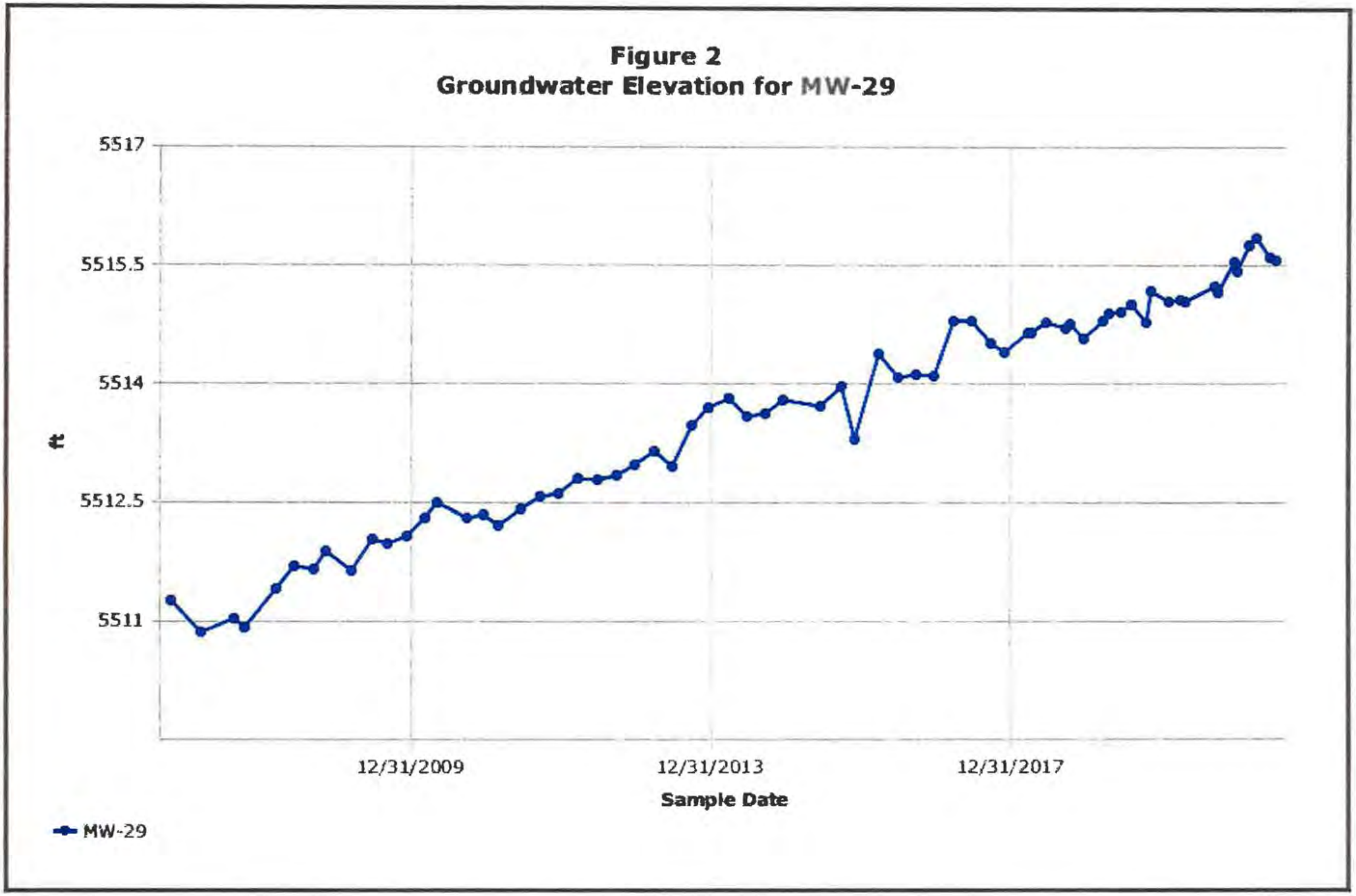


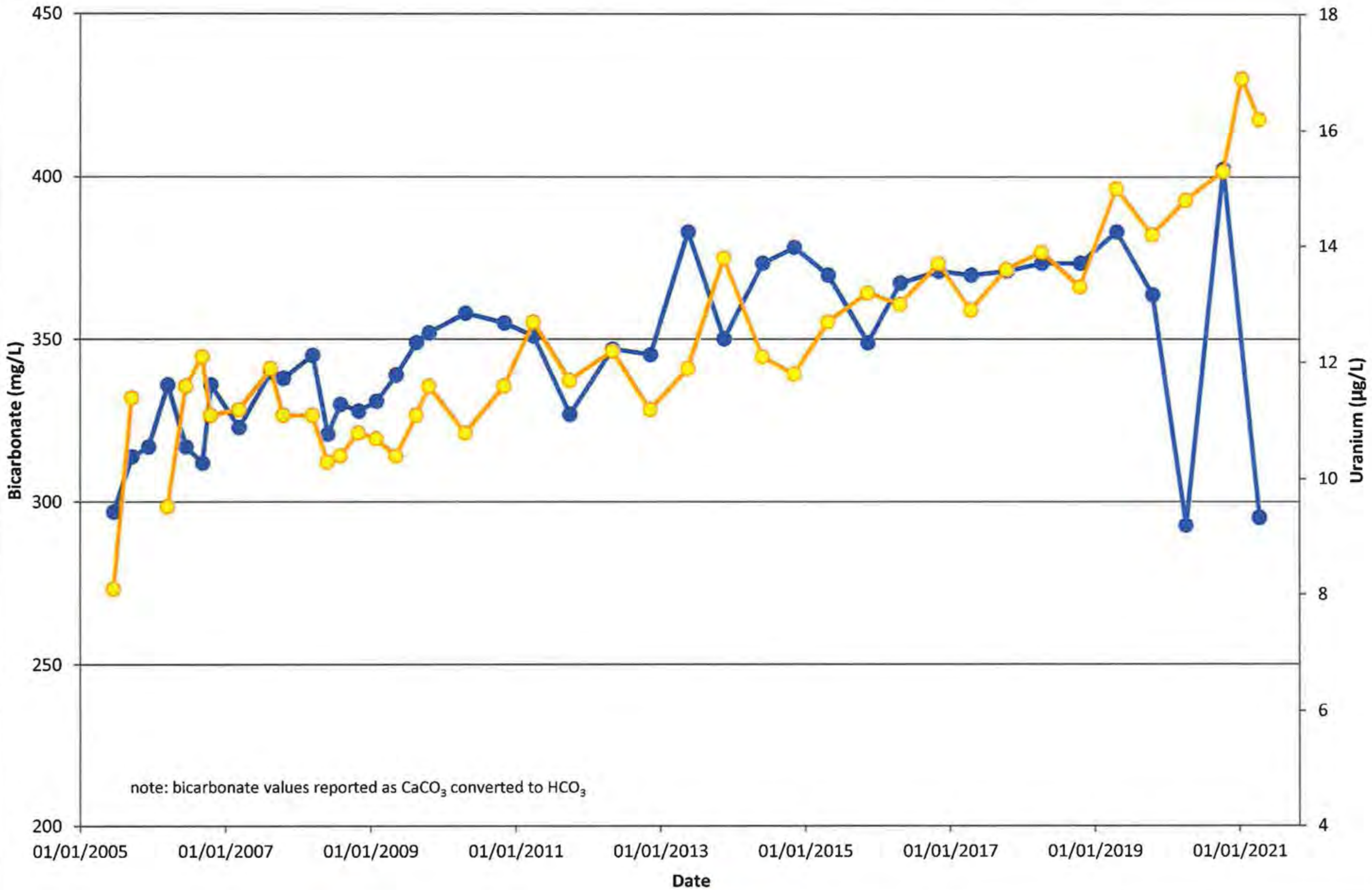
Figure 2
Groundwater Elevation for MW-29
5517
5515.5
5514
5512.5
5511
ft
12/31/2009
12/31/2013
12/31/2017
Sample Date
MW-29

HYDRO GEO CHEM, INC.

MW-29 URANIUM (µg/L) AND AMMONIA (mg/L)

Approved	Date	Author	Date	File Name	Figure
SJS	8/17/21	SJS	8/17/21	U and NH3	3

H:\718000\MW29\MW29_AllAnalyt_080321.xlsx: Fig 3 U and NH3



HYDRO GEO CHEM, INC.

MW-29 URANIUM (µg/L) AND BICARBONATE (mg/L)					
Approved: SJS	Date 8/17/21	Author SJS	Date 8/17/21	File Name U and bicarb	Figure 4

H:\718000\MW29\MW29_AllAnalyt_080321.xlsx: Fig 4 U and bicarb

APPENDICES

APPENDIX A

Appendix A – GWCL Exceedances for First Quarter 2021 under the March 8, 2021 GWDP

			Q2 2019 Results						Q3 2019 Results						Q4 2019 Results					
Monitoring Well (Water Class)	Constituent Exceeding GWCL	GWCL in March 19, 2019 GWDP	Q2 2019 Sample Date	Q2 2019 Result	May 2019 Monthly Sample Date	May 2019 Monthly Result	June 2019 Monthly Sample Date	June 2019 Monthly Result	Q3 2019 Sample Date	Q3 2019 Result	August 2019 Monthly Sample Date	August 2019 Monthly Result	Sept. 2019 Monthly Sample Date	Sept. 2019 Monthly Result	Q4 2019 Sample Date	Q4 2019 Result	November 2019 Monthly Sample Date	November 2019 Monthly Result	December 2019 Monthly Sample Date	December 2019 Monthly Result
Required Quarterly Sampling Wells																				
MW-11 (Class II)	Chloride (mg/L)	39.16	4/24/2019	34	5/7/2019	NA	6/3/2019	NA	7/16/2019	**48.4**	8/5/2019	NA	9/24/2019	NA	10/15/2019	30.8	11/12/2019	39.1	12/3/2019	35.4
	Sulfate (mg/L)	1309		1160		NA		NA		**1410**		NA		NA		1290		1140		1100
	TDS (mg/L)	2528		1890		NA		NA		1890		NA		NA		2100		NA		NA
	Manganese (ug/L)	164.67		**181**		**210**		**210**		**199**		**202**		**174**		**185**		**206**		**167**
MW-25 (Class III)	Cadmium (ug/L)	1.5	4/10/2019	1.30	5/8/2019	1.41	6/4/2019	1.47	7/15/2019	1.23	8/6/2019	1.37	9/23/2019	1.38	10/9/2019	1.45	11/13/2019	1.36	12/4/2019	1.45
MW-26 (Class III)	Nitrate + Nitrite (as N) (mg/L)	0.62	4/24/2019	**3.00**	5/7/2019	**0.986**	6/4/2019	**3.16**	7/16/2019	**2.06**	8/6/2019	**3.10**	9/24/2019	**1.59**	10/9/2019	**2.35**	11/13/2019	**2.90**	12/4/2019	**2.32**
	Chloroform (ug/L)	70		**4140**		**1140**		**778**		**3110**		**1090**		**1540**		**1710**		**1280**		**1110**
	Chloride (mg/L)	58.31		**82.0**		**73.0**		**72.6**		**75.2**		**83.5**		**62.1**		**73.8**		**62.3**		57.7
	TDS (mg/L)	3284.19		2820		NA		NA		3100		NA		NA		2920		NA		NA
	Carbon Tetrachloride	5		<1.00		NA		NA		<1.00		<1.00		<1.00		<1.00		NA		NA
	Methylene Chloride (ug/L)	5		4.16		1.69		<1.00		**10.7**		1.12		3.35		2.95		1.73		2.64
MW-30 (Class II)	Nitrate + Nitrite (as N) (mg/L)	2.5	4/9/2019	**18.5**	5/7/2019	**17.9**	6/3/2019	**15.8**	7/16/2019	**19.3**	8/6/2019	**15.8**	9/24/2019	**17.9**	10/8/2019	**18.2**	11/13/2019	**17.2**	12/4/2019	**17.8**
	Chloride (mg/L)	128		**138**		**175**		**165**		**181**		**190**		**176**		**170**		**180**		**185**
	Selenium (ug/L)	47.2		**53.6**		47.1		**49.9**		**48.4**		**50.9**		**49.1**		**56.8**		**47.8**		**56.4**
	Uranium (ug/L)	8.32		**8.62**		8.15		**8.88**		**9.03**		**9.39**		8.12		**8.69**		**9.29**		**8.99**
MW-31 (Class III)	Nitrate + Nitrite (as N) (mg/L)	5	4/10/2019	**19.7**	5/7/2019	**18.9**	6/3/2019	**19.7**	7/15/2019	**19.8**	8/5/2019	**17.0**	9/23/2019	**19.5**	10/9/2019	**19.8**	11/12/2019	**18.8**	12/3/2019	**18.3**
	Sulfate (mg/L)	993		917		NA		NA		**1150**		NA		NA		**1010**		990		**1020**
	TDS (mg/L)	2132		2080		NA		NA		**2580**		NA		NA		**2280**		**2650**		2030
	Uranium (ug/L)	15		14		NA		NA		14.3		NA		NA		14.4		NA		NA
	Chloride (mg/L)	143		**294**		**346**		**325**		**374**		**372**		**365**		**318**		**338**		**343**
Required Semi-Annual Sampling Wells																				
MW-12 (Class III)	Uranium (ug/L)	23.5	4/25/2019	23.2	NS	NA	NS	NA	7/11/2019	23.1	NS	NA	NS	NA	10/23/2019	21.6	NS	NA	NS	NA
	Selenium (ug/L)	39		33.9						NA						30.3				
MW-24 (Class III)	Beryllium (ug/L)	2	5/2/2019	**2.83**	NS	NA	NS	NA	7/18/2019	**2.94**	NS	NA	NS	NA	11/6/2019	**3.25**	NS	NA	NS	NA
	Cadmium (ug/L)	6.43		**8.24**		NA		NA		**8.37**		NA		NA		**9.31**		NA		NA
	Fluoride (mg/L)	0.47		**0.839**		NA		NA		**0.996**		NA		NA		**0.667**		NA		NA
	Nickel (mg/L)	50		**63.9**		NA		NA		**70.6**		NA		NA		**75.4**		NA		NA
	Manganese (ug/L)	7507		7020		NA		NA		NA		NA		NA		**7700**		NA		NA
	Thallium (ug/L)	2.01		**2.73**		NA		NA		**2.61**		NA		NA		**2.88**		NA		NA
	Gross Alpha (pCi/L)	7.5		3.32		NA		NA		NA		NA		NA		2.86		NA		NA
	Sulfate (mg/L)	2903		2790		NA		NA		NA		NA		NA		2630		NA		NA
	Field pH (S.U.)	5.03 - 8.5		**4.53**		NA		NA		5.03		NA		NA		5.19		NA		NA
MW-27 (Class III)	Nitrate + Nitrite (as N) (mg/L)	5.6	4/23/2019	**6.33**	NS	NA	NS	NA	7/12/2019 8/15/2019	**6.50**	NS	NA	NS	NA	10/22/2019	**6.27**	NS	NA	NS	NA
MW-28 (Class III)	Chloride (mg/L)	105	4/24/2019	**165**	NS	NA	NS	NA	7/12/2019 8/16/2019	**133**	NS	NA	NS	NA	10/22/2019	**149**	NS	NA	NS	NA
	Selenium (ug/L)	11.1		**12.4**		NA		NA		10.6		NA		NA		**16.5**		NA		NA
	Nitrate + Nitrite (as N) (mg/L)	5		3.7		NA		NA		NA		NA		NA		**5.14**		NA		NA
	Gross Alpha (pCi/L)	2.42		1.94		NA		NA		1.20		NA		NA		<1.00		NA		NA
	Uranium (ug/L)	4.9		**9.60**		NA		NA		**7.83**		NA		NA		**12.4**		NA		NA
MW-29 (Class III)	Uranium (ug/L)	15	4/24/2019	15.00	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	10/22/2019	14.20	NS	NA	NS	NA
MW-32 (Class III)	Chloride (mg/L)	35.39	4/9/2019	34.5	NS	NA	NS	NA	8/15/2019	**35.7**	NS	NA	NS	NA	10/8/2019	35.3	NS	NA	NS	NA

Notes:

NS= Not Required and Not Sampled

NA= Not Applicable

Exceedances are shown in yellow

Appendix A – GWCL Exceedances for First Quarter 2021 under the March 8, 2021 GWDP

			Q1 2020 Results						Q2 2020 Results						Q3 2020 Results						Q4 2020 Results					
Monitoring Well (Water Class)	Constituent Exceeding GWCL	GWCL in March 19, 2019 GWDP	Q1 2020 Sample Date	Q1 2020 Result	February 2020 Monthly Sample Date	February 2020 Monthly Result	March 2020 Monthly Sample Date	March 2020 Monthly Result	Q2 2020 Sample Date	Q2 2020 Result	May 2020 Monthly Sample Date	May 2020 Monthly Result	June 2020 Monthly Sample Date	June 2020 Monthly Result	Q3 2020 Sample Date	Q3 2020 Result	August 2020 Monthly Sample Date	August 2020 Monthly Result	September 2020 Monthly Sample Date	September 2020 Monthly Result	Q4 2020 Sample Date	Q4 2020 Result	November 2020 Monthly Sample Date	November 2020 Monthly Result	December 2020 Monthly Sample Date	December 2020 Monthly Result
Required Quarterly Sampling Wells																										
MW-11 (Class II)	Chloride (mg/L)	39.16	1/15/2020 1/28/2020	38.9	2/4/2020	***42.1***	3/10/2020	***41.0***	4/8/2020	38.3	5/5/2020	39.0	6/2/2020	***40.1***	7/7/2020	***42.1***	8/11/2020	***43.9***	9/2/2020	***40.6***	10/12/2020	***44.8***	11/16/2020	33.7	12/7/2020	37.4
	Sulfate (mg/L)	1309		1180		1260		1120		1180		1180		***1310***		1260		1220		1170		1300		858		***1330***
	TDS (mg/L)	2528		1920		NA		NA		1920		NA		NA		***2590***		NA		NA		992		2040		1990
	Manganese (ug/L)	164.67		***169***		***227***		***183***		***189***		***206***		***211***		***178***		***276***		***230***		***211***		***174***		***212***
MW-25 (Class III)	Cadmium (ug/L)	1.5	1/15/2020	1.35	2/5/2020	***1.52***	3/11/2020	1.41	4/7/2020	1.46	5/6/2020	***1.52***	6/3/2020	1.46	7/7/2020	1.39	8/10/2020	***1.54***	9/2/2020	***1.61***	10/13/2020	1.43	11/17/2020	1.23	12/8/2020	***1.59***
MW-26 (Class III)	Nitrate + Nitrite (as N) (mg/L)	0.62	1/15/2020	***0.873***	2/4/2020	***0.978***	3/10/2020	***1.60***	4/8/2020	***0.747***	5/6/2020	***1.16***	6/3/2020	***3.44***	7/9/2020	***1.360***	8/11/2020	0.407	9/2/2020	***0.623***	10/15/2020	***0.936***	11/17/2020	0.379	12/8/2020	0.611
	Chloroform (ug/L)	70		***1260***		***1640***		***1720***		***1420***		***1200***		***1530***		***4030***		***1940***		***1070***		***872***		***2800***		***1200***
	Chloride (mg/L)	58.31		***78.8***		***66.9***		***76.9***		***62.8***		***73.8***		***63.7***		***67.6***		57.5		***59.8***		57.2		36.4		42.1
	TDS (mg/L)	3284.19		3010		NA		NA		2600		NA		NA		***3880***		NA		NA		***4860***		2980		3040
	Carbon Tetrachloride	5		<1.00		NA		NA		<1.00		NA		NA		<1.00		NA		NA		<1.00		NA		NA
	Methylene Chloride (ug/L)	5		2.79		2.76		4.44		1.94		1.48		2.35		***6.59***		2.67		<1.00		<1.00		***14.60***		1.52
MW-30 (Class II)	Nitrate + Nitrite (as N) (mg/L)	2.5	1/15/2020	***16.4***	2/5/2020	***17.8***	3/11/2020	***19.0***	4/6/2020	***18.1***	5/6/2020	***18.6***	6/3/2020	***18.3***	7/6/2020	***18.4***	8/11/2020	***21.1***	9/1/2020	***18.3***	10/13/2020	***16.8***	11/17/2020	***13.4***	12/8/2020	***12.0***
	Chloride (mg/L)	128		***182***		***187***		***182***		***195***		***177***		***180***		***185***		***183***		***166***		***183***		***150***		***166***
	Selenium (ug/L)	47.2		***49.7***		***49.9***		***48.1***		***54.4***		***51.5***		***50.5***		***51.8***		***56.0***		***55.3***		***53.5***		***54.9***		***51.8***
	Uranium (ug/L)	8.32		***8.88***		***9.06***		***9.50***		***9.24***		***8.94***		***9.28***		***9.76***		***10.6***		***9.90***		***9.92***		***9.95***		***9.56***
MW-31 (Class III)	Nitrate + Nitrite (as N) (mg/L)	5	1/14/2020	***17.5***	2/4/2020	***18.0***	3/10/2020	***19.2***	4/6/2020	***18.8***	5/5/2020	***20.1***	6/2/2020	***18.7***	7/7/2020	***19.2***	8/10/2020	***21.6***	9/1/2020	***18.4***	10/19/2020	***18.6***	11/16/2020	***16.5***	12/7/2020	***18.8***
	Sulfate (mg/L)	993		***1120***		***1150***		***1080***		***1130***		***1080***		***1130***		***1150***		***1100***		***1110***		***1100***		676		922
	TDS (mg/L)	2132		***2220***		***2240***		***2380***		***2400***		***2330***		***2440***		***2400***		***2580***		***2650***		***2370***		***2490***		***2560***
	Uranium (ug/L)	15		14.8		NA		NA		***15.5***		NA		NA		***18.1***		***19.7***		***18.5***		***19.3***		***17.8***		***19.5***
	Chloride (mg/L)	143		***381***		***370***		***368***		***376***		***361***		***377***		***370***		***368***		***367***		***345***		***251***		***311***
Required Semi-Annual Sampling Wells																										
MW-12 (Class III)	Uranium (ug/L)	23.5	1/16/2020	21.9	NS	NA	NS	NA	4/9/2020	***23.7***	NS	NA	NS	NA	7/8/2020	***25.6***	NS	NA	NS	NA	10/20/2020	***26.2***	NS	NA	NS	NA
	Selenium (ug/L)	39		NA						***41.2***						***40.1***						***52.7***				
MW-24 (Class III)	Beryllium (ug/L)	2	1/22/2020	***2.07***	NS	NA	NS	NA	4/22/2020	***2.95***	NS	NA	NS	NA	7/10/2020	***2.59***	NS	NA	NS	NA	10/28/2020	***2.47***	NS	NA	NS	NA
	Cadmium (ug/L)	6.43		***7.30***		NA		NA		***8.46***		NA		NA		***8.43***		NA		NA		***8.12***		NA		NA
	Fluoride (mg/L)	0.47		***0.805***		NA		NA		***0.732***		NA		NA		***1.08***		NA		NA		***0.976***		NA		NA
	Nickel (mg/L)	50		***68.1***		NA		NA		***72.6***		NA		NA		***76.7***		NA		NA		***77.3***		NA		NA
	Manganese (ug/L)	7507		7010		NA		NA		***7750***		NA		NA		***8010***		NA		NA		7480		NA		NA
	Thallium (ug/L)	2.01		1.92		NA		NA		***2.81***		NA		NA		***3.07***		NA		NA		***2.92***		NA		NA
	Gross Alpha (pCi/L)	7.5		4.95		NA		NA		5.69		NA		NA		3.72		NA		NA		***9.03***		NA		NA
	Sulfate (mg/L)	2903		***2960***		NA		NA		2870		NA		NA		***2920***		NA		NA		***3220***		NA		NA
	Field pH (S.U.)	5.03 - 8.5		6.01		NA		NA		5.60		NA		NA		5.70		NA		NA		5.19		NA		NA
MW-27 (Class III)	Nitrate + Nitrite (as N) (mg/L)	5.6	1/16/2020	***6.18***	NS	NA	NS	NA	4/8/2020	***6.43***	NS	NA	NS	NA	7/8/2020	***6.62***	NS	NA	NS	NA	10/21/2020	***6.52***	NS	NA	NS	NA
MW-28 (Class III)	Chloride (mg/L)	105	1/16/2020	***151***	NS	NA	NS	NA	4/15/2020	***129***	NS	NA	NS	NA	7/8/2020	***140***	NS	NA	NS	NA	10/23/2020	***127***	NS	NA	NS	NA
	Selenium (ug/L)	11.1		***13.4***		NA		NA		10.2		NA		NA		***15.5***		NA		NA		9.90		NA		NA
	Nitrate + Nitrite (as N) (mg/L)	5		NA		NA		NA		2.6		NA		NA		4.58		NA		NA		2.39		NA		NA
	Gross Alpha (pCi/L)	2.42		1.79		NA		NA		1.69		NA		NA		1.60		NA		NA		1.68		NA		NA
	Uranium (ug/L)	4.9		***7.56***		NA		NA		***5.91***		NA		NA		***11.80***		NA		NA		***5.88***		NA		NA
MW-29 (Class III)	Uranium (ug/L)	15	NS	NA	NS	NA	NS	NA	4/8/2020	14.8	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	10/13/2020	***15.3***	NS	NA	NS	NA
MW-32 (Class III)	Chloride (mg/L)	35.39	1/14/2020	***38.0***	NS	NA	NS	NA	4/7/2020	***36.4***	NS	NA	NS	NA	7/6/2020	33.0	NS	NA	NS	NA	10/12/2020	***36.3***	NS	NA	NS	NA

Notes:

NS= Not Required and Not Sampled

NA= Not Applicable

Exceedances are shown in yellow

Appendix A – GWCL Exceedances for First Quarter 2021 under the March 8, 2021 GWDP

Q1 2021 Results								
Monitoring Well (Water Class)	**Constituent Exceeding GWCL**	**GWCL in March 8, 2021 GWDP**	**Q1 2021 Sample Date**	**Q1 2021 Result**	**February 2021 Monthly Sample Date**	**February 2021 Monthly Result**	**March 2021 Monthly Sample Date**	**March 2021 Monthly Result**
Required Quarterly Sampling Wells								
MW-11 (Class II)	Chloride (mg/L)	39.16	1/21/2021	*46.4*	2/9/2021	*46.4*	3/8/2021	*46.9*
	Sulfate (mg/L)	1309		1140		1260		1270
	TDS (mg/L)	2528		2010		2160		1950
	Manganese (ug/L)	237		185		*254*		221
MW-25 (Class III)	Cadmium (ug/L)	1.6	1/11/2021	1.50	2/10/2021	1.55	3/9/2021	1.57
MW-26 (Class III)	Nitrate + Nitrite (as N) (mg/L)	0.62	1/14/2021	0.619	2/10/2021	*0.764*	3/9/2021	0.617
	Chloroform (ug/L)	70		*2200*		*1930*		*2190*
	Chloride (mg/L)	58.31		57.4		*71.3*		*63.9*
	TDS (mg/L)	3284.19		3100		2700		3060
	Carbon Tetrachloride	5		*26.1*		NA		NA
	Methylene Chloride (ug/L)	5		*7.65*		3.43		1.27
MW-30 (Class II)	Nitrate + Nitrite (as N) (mg/L)	2.5	1/11/2021	*17.7*	2/10/2021	*14.3*	3/9/2021	*17.0*
	Chloride (mg/L)	128		*184*		*189*		*192*
	Selenium (ug/L)	53.6		*55.6*		*55.3*		*56.3*
	Uranium (ug/L)	9.82		*9.86*		*11.6*		*10.2*
MW-31 (Class III)	Nitrate + Nitrite (as N) (mg/L)	5	1/12/2021	*17.1*	2/9/2021	*14.3*	3/8/2021	*17.4*
	Sulfate (mg/L)	993		*1070*		*1130*		*1210*
	TDS (mg/L)	2132		*2460*		*2960*		*2400*
	Uranium (ug/L)	15		*19.7*		*22.2*		*20.2*
	Chloride (mg/L)	143		*354*		*380*		*388*
Required SemiAnnual Sampling Wells								
MW-12 (Class III)	Uranium (ug/L)	23.5	1/14/2021	*25.0*	NS	NA	NS	NA
	Selenium (ug/L)	39		35.1				
MW-24 (Class III)	Beryllium (ug/L)	2	1/14/2021	*2.75*	NS	NA	NS	NA
	Cadmium (ug/L)	6.43		*8.79*		NA		NA
	Fluoride (mg/L)	0.47		*0.916*		NA		NA
	Nickel (mg/L)	50		*70.4*		NA		NA
	Manganese (ug/L)	7507		7460		NA		NA
	Thallium (ug/L)	2.01		*2.74*		NA		NA
	Gross Alpha (pCi/L)	7.5		2.94		NA		NA
	Sulfate (mg/L)	2903		*2980*		NA		NA
	Field pH (S.U.)	5.03 - 8.5		5.08		NA		NA
MW-27 (Class III)	Nitrate + Nitrite (as N) (mg/L)	5.6	1/14/2021	5.16	NS	NA	NS	NA
MW-28 (Class III)	Chloride (mg/L)	105	1/15/2021	*128*	NS	NA	NS	NA
	Selenium (ug/L)	11.1		*14.0*		NA		NA
	Nitrate + Nitrite (as N) (mg/L)	5		3.44		NA		NA
	Gross Alpha (pCi/L)	2.42		1.81		NA		NA
	Uranium (ug/L)	4.9		*10.3*		NA		NA
MW-29 (Class III)	Uranium (ug/L)	15	1/15/2021	*16.9*	NS	NA	NS	NA
MW-32 (Class III)	Chloride (mg/L)	35.39	1/14/2021	*36.9*	NS	NA	NS	NA

Notes:

NS= Not Required and Not Sampled
NA= Not Applicable

Exceedances are shown in yellow

These GWCLs were reset with the issuance of the March 8, 2021 GWDP. These parameters are no longer in exceedance as of March 8, 2021. These constituents will be dropped after this quarter.

These GWCLs were reset with the issuance of the March 8, 2021 GWDP. The new GWCLs (shown above) became effective on March 8, 2021 and the first exceedance under the revised GWDP was noted in the March monthly data.

APPENDIX B

Appendix B-1: Summary of Statistical Analysis for Out of Compliance Constituents in MW-29

Well	Data Set	Constituent	Units	N	% Non-Detected Values	Mean	Standard Deviation	Shapiro-Wilk Test for Normality		Normally or Lognormally distributed?	Mann Kendall Trend Analysis		Linear Trend Analysis		Significant Trend	Previously Identified Increasing Trend?	Current GWCL[a]	Mean + 2σ	Mean x 1.5	Upper Tolerance Limit (UTL)	Highest Historical Value (HHV)	Fractional Approach GWCL	Flowsheet GWCL	Rationale	Modified GWCL	Rationale
								W	p		S	p	r^2	p												
MW-29	ALL 2021 SAR Data	Uranium	µg/L	41	0	12.27	1.80	0.98	0.57	Normal	557	0	0.77	3.59E-14	Increasing	NA	15	15.86	18.40	16.07	16.90	15	15.9	Mean + 2σ	18.4	Mean x 1.5
	GWCL Subset Post April 11, 2011	Uranium	µg/L	21	0	13.50	1.51	0.97	0.84	Normal	156	1.43E-06	0.78	9.89E-08	Increasing	NA	15	16.52	20.24	17.09	16.90	15	16.5	Mean + 2σ	20.2	Mean x 1.5

Notes:

σ = sigma
µg/L = micrograms per liter
N = number of valid data points

p = probability
W = Shapiro Wilk test value
S = Mann-Kendall statistic

r^2 = The measure of how well the trendline fits the data where r2=1 represents a perfect fit.
FA= Fraction of GWQS as defined in UAC R317-6
NA= Not Applicable

Distribution = Distribution as determined by the Shapiro-Wilk distribution test for constituents with % Detect > 50% and N>8
Mean = The arithmatic mean as determined for normally or log-normally distributed constituents with % Detect > 50%
Standard Deviation = The standard deviation as determined for normally or log-normally distributed constituents with % Detect > 85%
Highest Historical Value = The highest observed value for constituents with % Detect < 50%
Flowsheet GWCL does not take into account increasing trends
a = GWCL is based on the GWDP using 11 data points available at the time of the background report (INTERA, 2008)

ALL 2021 SAR Data = All data with extremes removed
GWCL Subset Post 2011 = All data post April 11, 2011

INTERA

Appendix B-2: Comparison of Calculated and Measured TDS in MW-29

Date Sampled	Alkalinity (mg/L as HCO_3)	Calcium (mg/L)	Chloride (mg/L)	Potassium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Sulfate (mg/L)	Measured TDS (mg/L)	Calculated TDS (mg/L)	Ratio
6/21/2005	155	452	80	11.6	148	302	2010	3720	3159	85%
9/22/2005	152	514	96	10.6	166	286	2310	3590	3535	98%
12/14/2005	165	532	86	12.5	203	303	2380	3770	3682	98%
3/22/2006	152	515	83	11.8	188	294	2320	3640	3564	98%
6/23/2006	174	491	91	11.9	167	276	2190	3540	3401	96%
9/12/2006	95	521	73	12.2	190	299	2380	3720	3570	96%
10/24/2006	156	518	86	12.1	184	294	2520	3600	3770	105%
3/15/2007	139	519	97	14.3	192	332	2340	3800	3633	96%
6/20/2007	151	521	94	12.4	188	291	2360	3770	3617	96%
8/28/2007	161	530	95	11.1	180	266	2440	3700	3683	100%
10/23/2007	162	538	99	11.4	184	282	2370	3600	3646	101%
3/12/2008	159	490	99	11.4	160	292	2310	3640	3521	97%
6/3/2008	149	514	103	11.1	167	303	2360	3580	3607	101%
8/6/2008	160	546	99	11.5	179	311	2340	3590	3647	102%
11/5/2008	154	546	99	12.0	176	312	2340	3650	3639	100%
2/4/2009	154	479	91	11.0	157	286	2340	3730	3518	94%
5/12/2009	156	483	81	10.2	162	289	2410	3620	3591	99%
8/17/2009	153	526	100	11.7	169	302	2360	3680	3622	98%
10/12/2009	158	512	104	11.4	168	308	2380	3710	3641	98%
1/19/2010	165	517	102	11.6	168	0.6	2340	3490	3304	95%
4/19/2010	158	500	108	11.4	163	303	2310	3670	3553	97%
11/12/2010	157	492	107	11.7	162	288	2290	3630	3508	97%
4/11/2011	155	513	109	11.9	167	310	2090	3690	3356	91%
10/5/2011	146	505	143	11.1	167	270	2340	3610	3582	99%
5/8/2012	160	522	114	12.9	177	298	2290	3820	3574	94%
11/14/2012	151	507	115	13.7	175	309	1710	3610	2981	83%
5/15/2013	156	487	102	11.4	163	338	2030	3480	3288	94%
12/4/2013	176	475	109	10.6	162	287	2270	3610	3489	97%
6/18/2014	293	554	114	12.5	180	313	2410	3680	3876	105%
11/5/2014	176	478	117	11.9	162	277	2250	3660	3472	95%
4/21/2015	183	531	125	12.0	186	329	2490	3370	3856	114%
11/10/2015	161	531	116	11.0	181	308	2440	3450	3748	109%
4/20/2016	151	506	121	11.2	175	296	2350	3540	3610	102%
11/1/2016	153	487	126	12.8	168	296	2280	3660	3522	96%
4/19/2017	151	485	120	12.6	168	308	1970	3450	3215	93%
10/18/2017	174	484	123	13.0	184	311	1960	3440	3249	94%
4/19/2018	153	532	138	12.9	180	313	2280	3460	3608	104%
10/30/2018	159	580	119	13.3	203	365	2040	3380	3479	103%
4/24/2019	181	574	165	12.9	198	380	2390	3500	3900	111%
10/22/2019	285	569	149	11.9	209	351	2420	3780	3995	106%
4/15/2020	181	538	129	12.9	190	344	2280	3520	3674	104%

Appendix B-3: Charge Balance Calculations for Major Cations and Anions in MW-29

Well	Date	Calcium (meq/L)	Sodium (meq/L)	Magnesium (meq/L)	Potassium (meq/L)	Total Cation Charge (meq/L)	HCO_3 (meq/L)	Chloride (meq/L)	SO_4 (meq/L)	Total Anion Charge (meq/L)	Charge Balance Error
MW-29	6/22/2005	23.35	19.23	18.26	0.42	**61.26**	-4.87	-1.13	-56.21	**-62.21**	-0.77%
MW-29	9/22/2005	23.90	19.23	18.92	0.42	**62.47**	-5.15	-1.10	-59.13	**-65.38**	-2.27%
MW-29	12/14/2005	25.35	19.53	19.58	0.44	**64.90**	-5.20	-1.02	-57.67	**-63.88**	0.79%
MW-29	3/21/2006	24.75	18.79	19.42	0.42	**63.38**	-5.51	-1.16	-56.42	**-63.09**	0.23%
MW-29	6/21/2006	23.10	18.83	18.68	0.44	**61.06**	-5.20	-1.07	-57.67	**-63.94**	-2.31%
MW-29	9/12/2006	24.55	19.05	18.92	0.44	**62.96**	-5.11	-1.04	-56.63	**-62.79**	0.14%
MW-29	10/24/2006	25.05	19.83	19.25	0.44	**64.58**	-5.51	-1.10	-62.04	**-68.65**	-3.06%
MW-29	3/15/2007	25.20	18.83	19.42	0.44	**63.89**	-5.29	-1.10	-57.88	**-64.27**	-0.30%
MW-29	8/22/2007	24.60	19.14	19.25	0.42	**63.41**	-5.57	-1.04	-58.09	**-64.70**	-1.01%
MW-29	10/24/2007	25.45	18.49	19.74	0.44	**64.12**	-5.54	-1.04	-58.09	**-64.67**	-0.43%
MW-29	3/19/2008	23.00	20.27	16.95	0.44	**60.66**	-5.65	-1.10	-59.13	**-65.88**	-4.13%
MW-29	6/3/2008	23.45	21.14	17.94	0.43	**62.96**	-5.26	-1.07	-59.13	**-65.46**	-1.95%
MW-29	8/5/2008	26.15	21.49	19.58	0.45	**67.66**	-5.41	-0.99	-58.51	**-64.90**	2.08%
MW-29	11/5/2008	25.85	22.10	19.00	0.46	**67.41**	-5.38	-0.90	-60.80	**-67.07**	0.25%
MW-29	2/3/2009	25.35	16.40	18.76	0.35	**60.86**	-5.42	-0.87	-56.42	**-62.72**	-1.51%
MW-29	5/13/2009	21.81	19.10	16.54	0.39	**57.83**	-5.56	-0.85	-58.09	**-64.49**	-5.45%
MW-29	8/24/2009	24.75	21.79	18.10	0.45	**65.09**	-5.72	-0.96	-56.63	**-63.31**	1.39%
MW-29	10/26/2009	24.35	19.79	17.77	0.43	**62.35**	-5.77	-0.99	-61.63	**-68.38**	-4.62%
MW-29	4/27/2010	25.25	22.44	18.51	0.45	**66.65**	-5.87	-0.99	-57.67	**-64.53**	1.62%
MW-29	11/9/2010	23.45	19.75	17.36	0.45	**61.00**	-5.82	-1.10	-56.01	**-62.92**	-1.55%
MW-29	4/5/2011	24.05	21.57	17.52	0.44	**63.59**	-5.75	-1.07	-54.13	**-60.96**	2.12%
MW-29	10/5/2011	23.75	18.92	17.52	0.43	**60.62**	-5.36	-1.04	-59.34	**-65.74**	-4.05%
MW-29	5/8/2012	24.75	21.18	18.68	0.51	**65.12**	-5.69	-1.13	-57.26	**-64.07**	0.81%
MW-29	11/14/2012	24.10	21.18	18.02	0.44	**63.74**	-5.66	-1.04	-27.90	**-34.60**	29.64%
MW-29	5/23/2013	21.91	20.57	17.28	0.44	**60.20**	-6.28	-0.99	-51.01	**-58.28**	1.62%
MW-29	11/20/2013	23.10	19.83	17.03	0.46	**60.43**	-5.74	-0.98	-57.26	**-63.98**	-2.85%
MW-29	6/3/2014	23.85	20.49	18.18	0.43	**62.96**	-6.12	-1.05	-52.26	**-59.43**	2.88%
MW-29	11/10/2014	28.94	24.84	21.97	0.43	**76.17**	-6.20	-1.14	-57.46	**-64.80**	8.07%
MW-29	4/30/2015	24.65	21.57	18.10	0.45	**64.77**	-6.06	-1.13	-61.63	**-68.82**	-3.03%
MW-29	11/16/2015	24.45	21.31	18.10	0.42	**64.29**	-5.72	-1.03	-57.05	**-63.79**	0.39%
MW-29	4/27/2016	24.85	21.14	17.77	0.42	**64.18**	-6.02	-1.09	-56.84	**-63.94**	0.19%
MW-29	11/8/2016	23.75	19.36	17.44	0.46	**61.01**	-6.08	-1.08	-47.68	**-54.84**	5.32%
MW-29	04/20/2017	22.70	20.31	17.19	0.46	**60.67**	-6.06	-1.11	-51.84	**-59.01**	1.39%
MW-29	10/16/2017	24.00	20.18	18.10	0.48	**62.77**	-6.08	-1.05	-49.55	**-56.68**	5.09%
MW-29	4/11/2018	25.45	20.23	19.00	0.43	**65.11**	-6.12	-1.10	-49.97	**-57.18**	6.48%
MW-29	10/22/2018	26.70	23.27	19.58	0.48	**70.03**	-6.12	-0.98	-51.43	**-58.52**	8.95%
MW-29	4/24/2019	26.15	23.62	19.00	0.47	**69.24**	-6.28	-1.07	-45.18	**-52.53**	13.73%
MW-29	10/22/2019	26.40	21.49	19.83	0.43	**68.15**	-5.96	-1.07	-56.84	**-63.87**	3.24%
MW-29	4/8/2020	25.95	21.66	19.33	0.54	**67.48**	-4.80	-1.03	-54.97	**-60.80**	5.21%
MW-29	10/13/2020	22.85	19.92	17.44	0.42	**60.64**	-6.60	-1.05	-61.21	**-68.86**	-6.34%
MW-29	4/14/2021	22.75	19.53	17.61	0.47	**60.36**	-4.84	-1.00	-49.14	**-54.97**	4.67%

meq/L= milliequivalent per liter

HCO_3 = Bicarbonate

SO_4 = Sulfate

Appendix B-4: Descriptive Statistics for Out of Compliance Constituents in MW-29

Data Set	Analyte	Units	% Non-Detects	N	Distribution	Mean	Min. Conc.	Max. Conc.	Std. Dev.	Range	Geometric Mean	Skewness	Q25	Median	Q75
2008 Background Report	Uranium	µg/L	0	8	Non Parametric	11.2	9.5	12.1	0.8	2.6	11.2	-1.60	11.1	11.3	11.8
2021 SAR ALL	Uranium	µg/L	0	41	Normal	12.3	8.1	16.9	1.8	8.8	12.1	0.52	11.1	11.9	13.3
Subset Post April 11, 2011	Uranium	µg/L	0	21	Normal	13.50	11.2	16.9	1.5	5.7	13.4	0.62	12.2	13.3	14.2

ALL 2021 SAR Data = All data with extremes removed
GWCL Subset Post 2011 = All data post April 11, 2011

µg/L = micrograms per liter
N = number of valid data points

Appendix B-5: MW-29 Data Used for Analysis

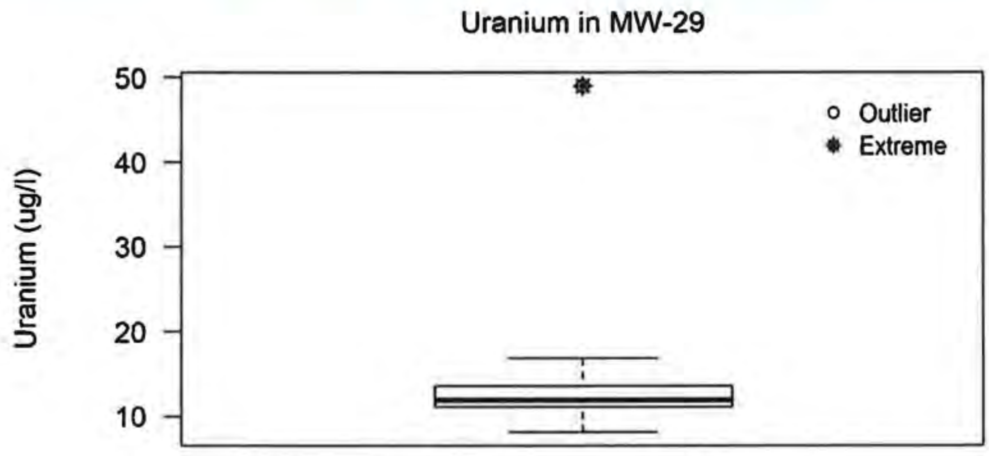
Well	Date Sampled	Parameter Name	Report Result	Report Units	Qualifier
MW-29	6/22/2005	Uranium	8.1	ug/l	
MW-29	9/22/2005	Uranium	11.4	ug/l	
MW-29	3/21/2006	Uranium	9.5	ug/l	
MW-29	6/21/2006	Uranium	11.6	ug/l	
MW-29	9/12/2006	Uranium	12.1	ug/l	
MW-29	10/24/2006	Uranium	11.1	ug/l	
MW-29	3/15/2007	Uranium	11.2	ug/l	
MW-29	8/22/2007	Uranium	11.9	ug/l	
MW-29	10/24/2007	Uranium	11.1	ug/l	
MW-29	3/19/2008	Uranium	11.1	ug/l	
MW-29	6/3/2008	Uranium	10.3	ug/l	
MW-29	8/5/2008	Uranium	10.4	ug/l	
MW-29	11/5/2008	Uranium	10.8	ug/l	
MW-29	2/3/2009	Uranium	10.7	ug/l	
MW-29	5/13/2009	Uranium	10.4	ug/l	
MW-29	8/24/2009	Uranium	11.1	ug/l	
MW-29	10/26/2009	Uranium	11.6	ug/l	
MW-29	4/27/2010	Uranium	10.8	ug/l	
MW-29	11/9/2010	Uranium	11.6	ug/l	
MW-29	4/5/2011	Uranium	12.7	ug/l	
MW-29	10/5/2011	Uranium	11.7	ug/l	
MW-29	5/8/2012	Uranium	12.2	ug/l	
MW-29	11/14/2012	Uranium	11.2	ug/l	
MW-29	5/23/2013	Uranium	11.9	ug/l	
MW-29	11/20/2013	Uranium	13.8	ug/l	
MW-29	6/3/2014	Uranium	12.1	ug/l	
MW-29	11/10/2014	Uranium	11.8	ug/l	
MW-29	4/30/2015	Uranium	12.7	ug/l	
MW-29	11/16/2015	Uranium	13.2	ug/l	
MW-29	4/27/2016	Uranium	13.0	ug/l	
MW-29	11/8/2016	Uranium	13.7	ug/l	
MW-29	4/20/2017	Uranium	12.9	ug/l	
MW-29	10/16/2017	Uranium	13.6	ug/l	
MW-29	4/11/2018	Uranium	13.9	ug/l	
MW-29	10/22/2018	Uranium	13.3	ug/l	
MW-29	4/24/2019	Uranium	15.0	ug/l	
MW-29	10/22/2019	Uranium	14.2	ug/l	
MW-29	4/8/2020	Uranium	14.8	ug/l	
MW-29	10/13/2020	Uranium	15.3	ug/l	
MW-29	1/15/2021	Uranium	16.9	ug/l	
MW-29	4/14/2021	Uranium	16.2	ug/l	

Appendix B-6: Extreme Outliers Removed from Analysis

Reason	Location ID	Date Sampled	Parameter Name	Report Result	Report Units
		Removed			
Extreme (High)	MW-29	12/14/2005	Uranium	49.0	ug/l

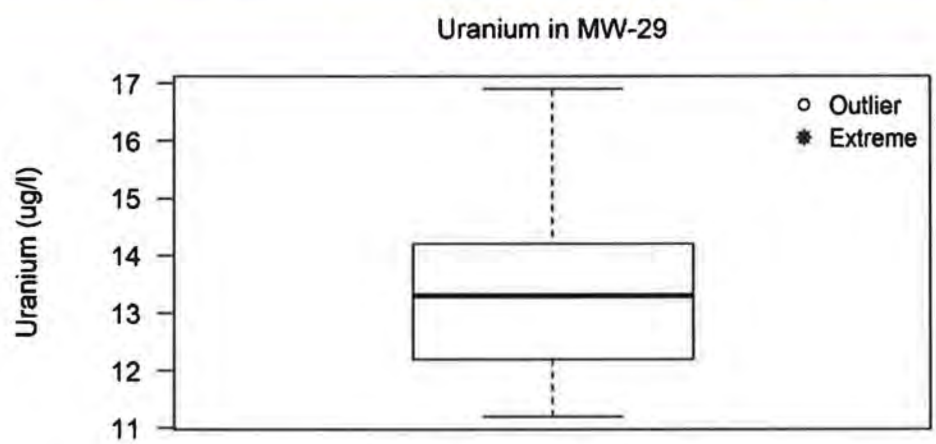
Appendix B-7: Box Plots

Uranium in MW-29 for All Data



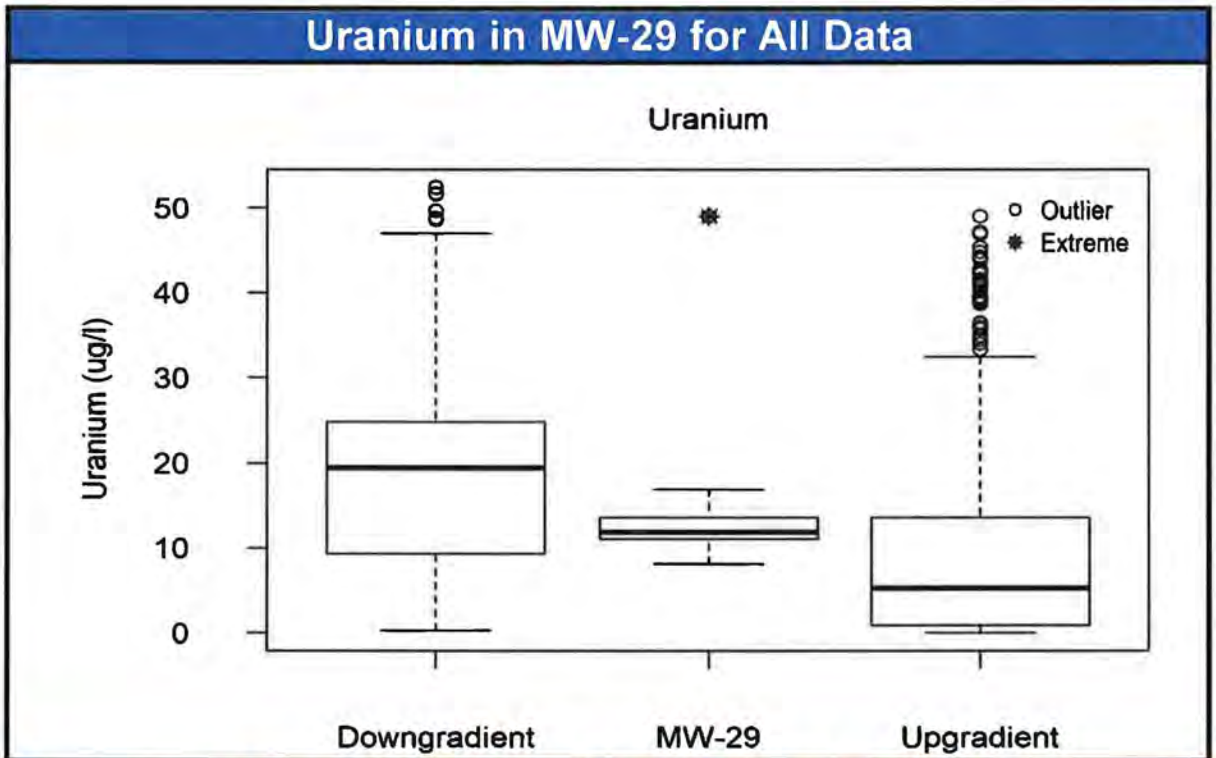
Percent nondetect: 0%
Min: 8.1, Mean: 13.14, Max: 49, Std Dev: 5.94
Upper extreme threshold (Q75 + 3xH): 20.8
Lower extreme threshold (Q25 - 3xH): 3.825

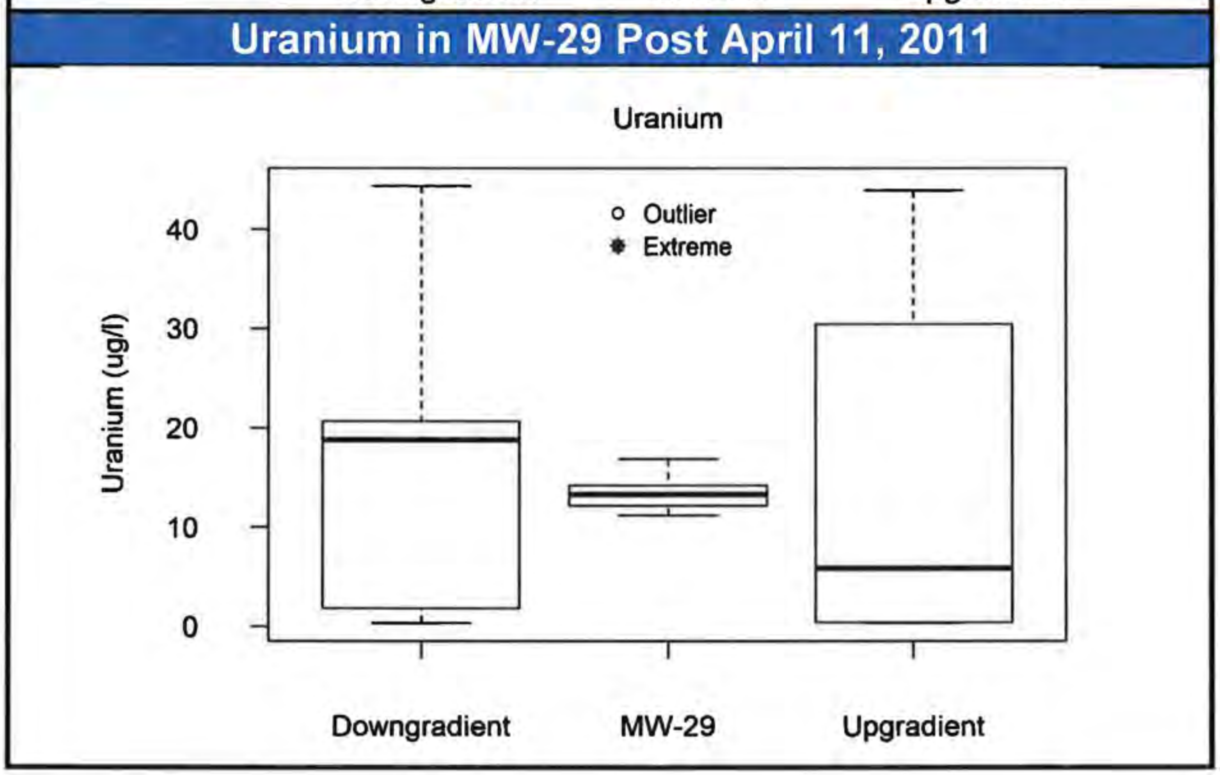
Uranium in MW-29 Post April 11, 2011



Percent nondetect: 0%
Min: 11.2, Mean: 13.5, Max: 16.9, Std Dev: 1.51
Upper extreme threshold (Q75 + 3xH): 20.2
Lower extreme threshold (Q25 - 3xH): 6.2

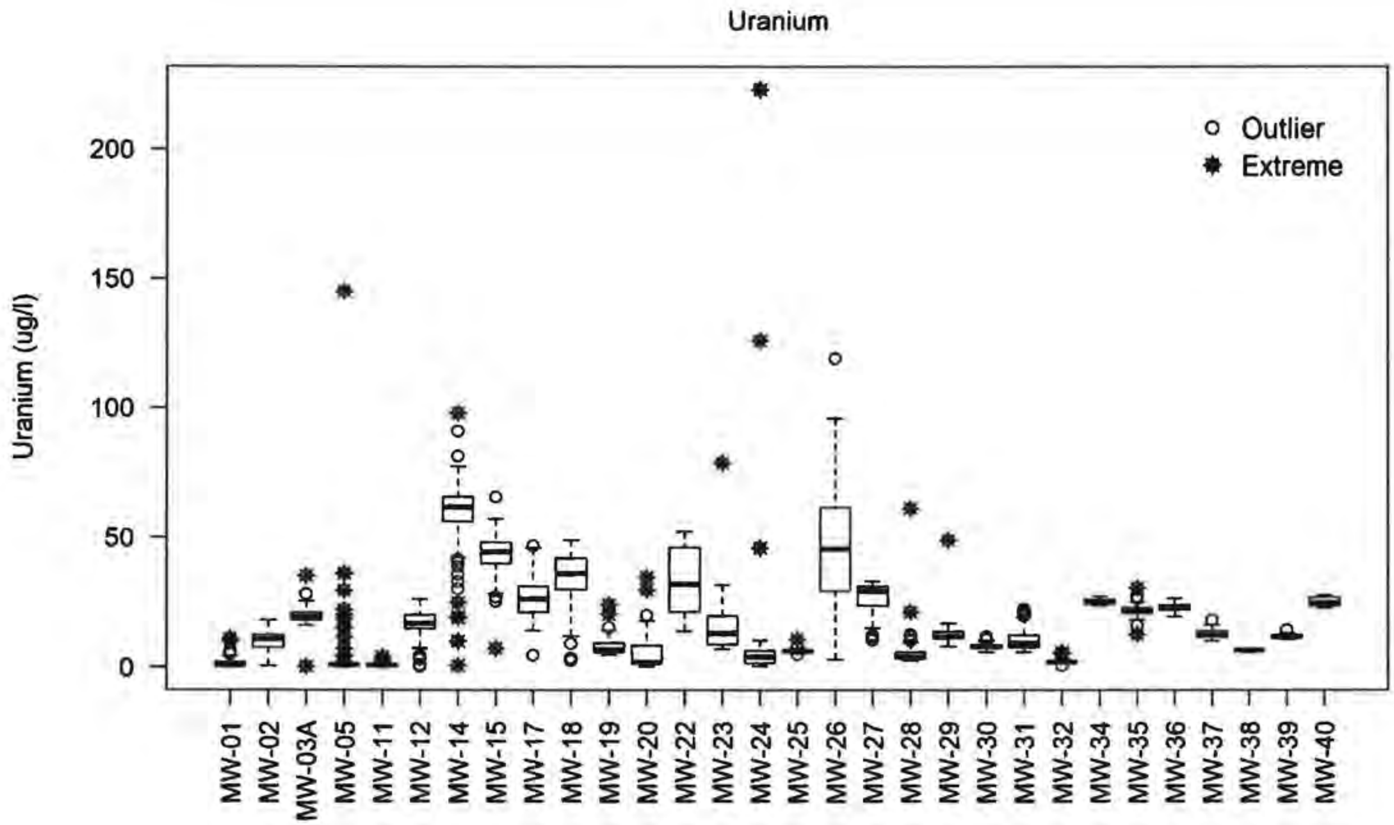
Appendix B-8: Box Plots for MW-29 and Upgradient and Downgradient Wells





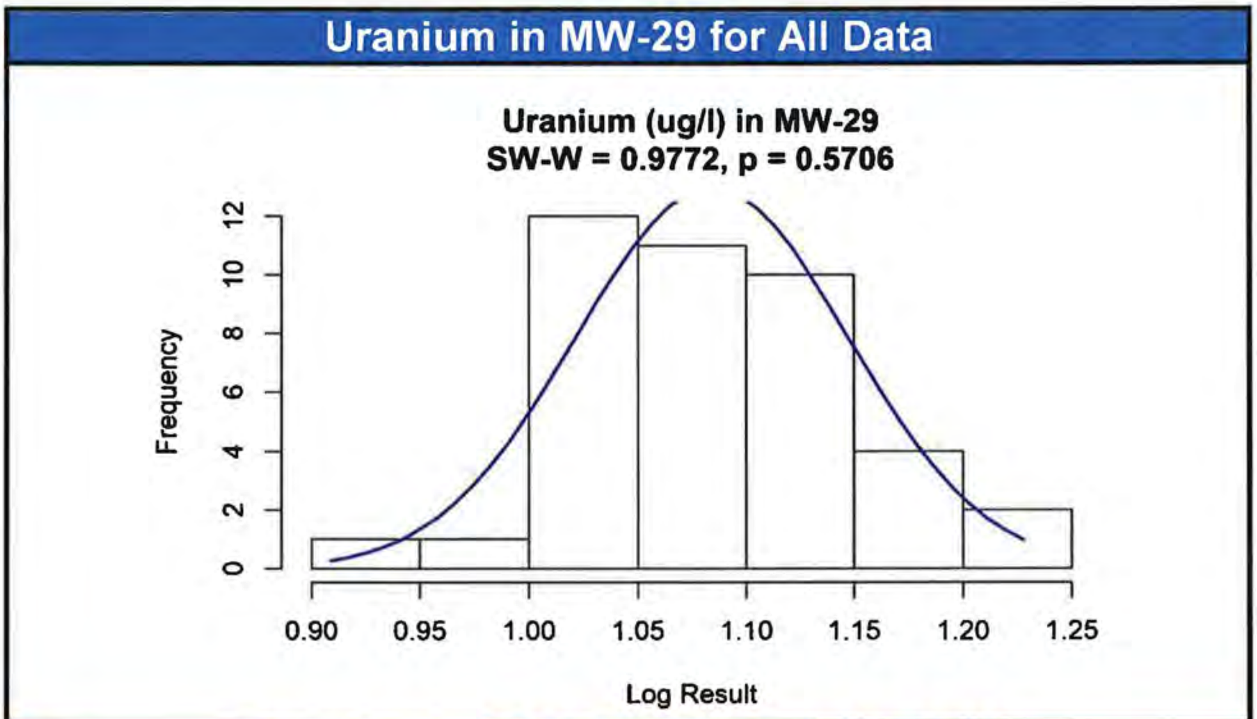
Notes
All available data used in box plots
Downgradient wells: MW-3A, MW-20, and MW-22.
Upgradient wells: MW-1, MW-18, and MW-19

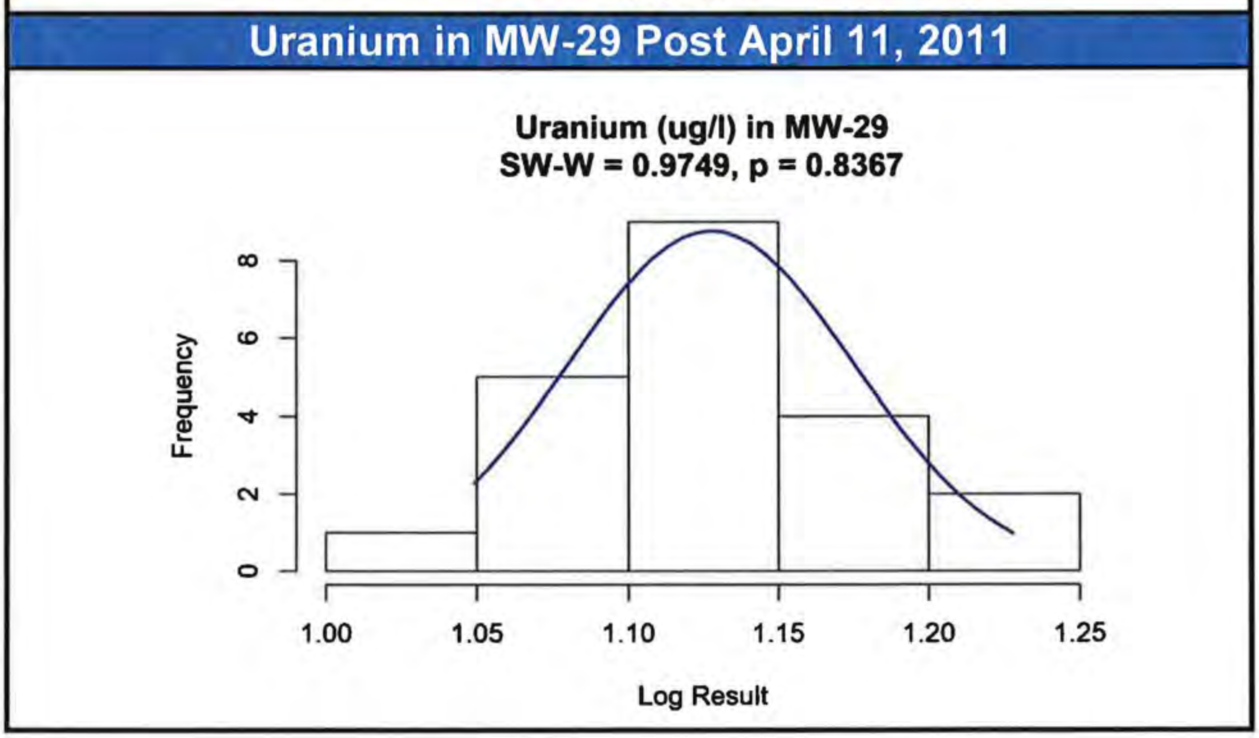
Appendix B-9: Box Plots for SAR Parameters in Groundwater Monitoring Wells



Notes
All available data used in box plots

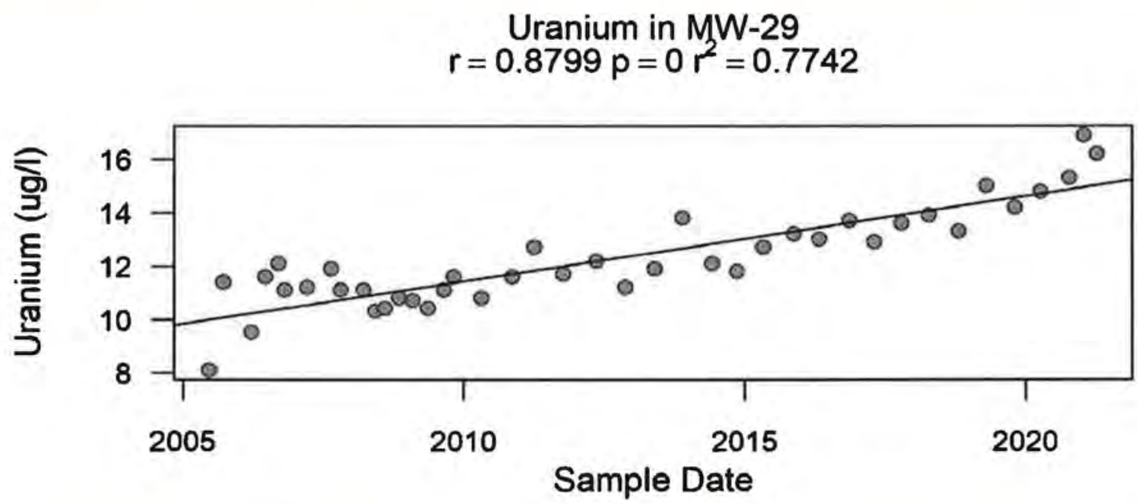
Appendix B-10: Histograms



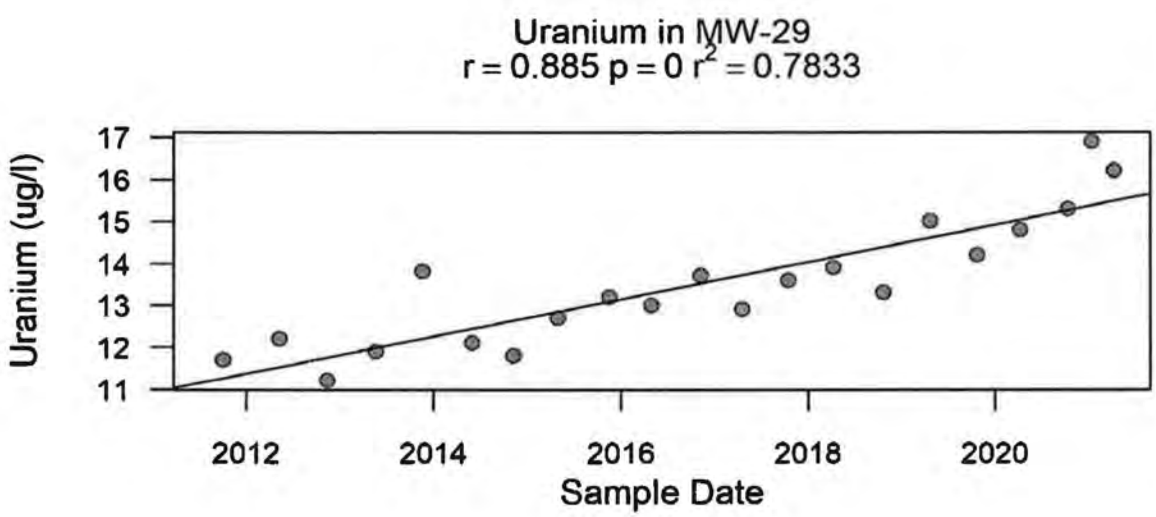


Appendix B-11: Timeseries Plots

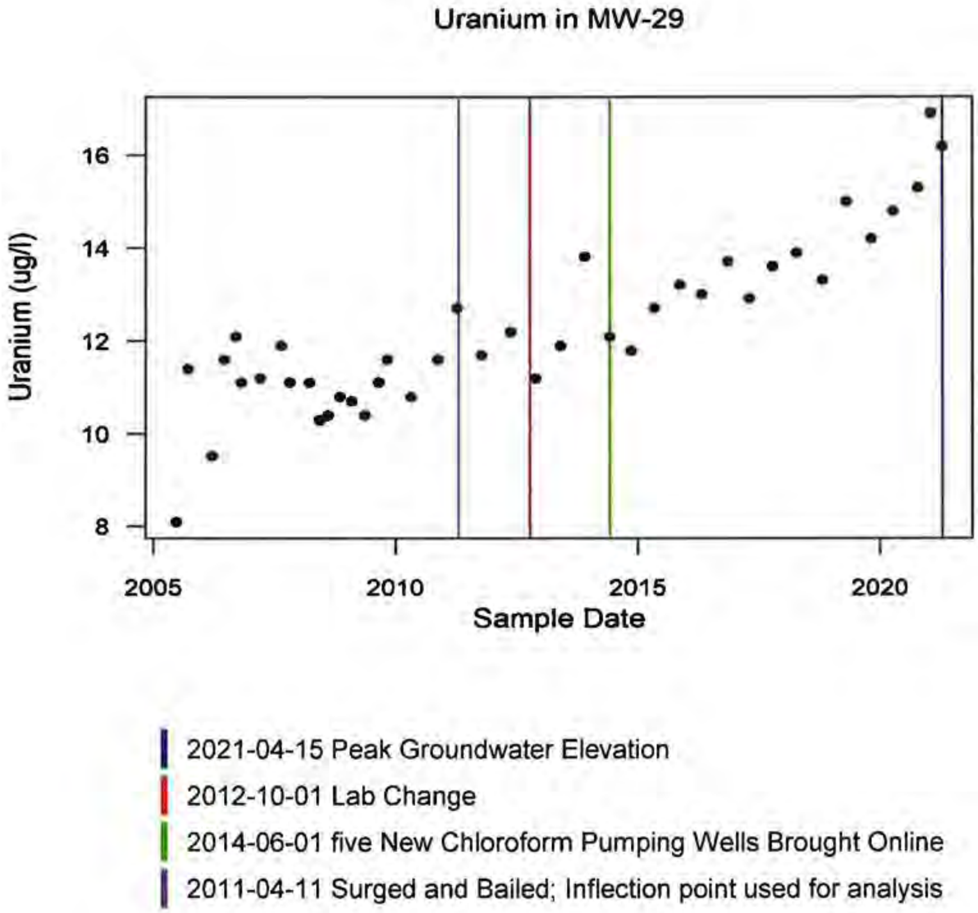
Uranium in MW-29 for All Data



Uranium in MW-29 Post April 11, 2011



Appendix B-12: Timeseries Plots with Events



APPENDIX C

Appendix C-1: Summary of Statistical Analysis for Indicator Parameters in MW-29

Well	Constituent	N	% Non-Detected Values	Mean	Standard Deviation	Shapiro-Wilk Test for Normality		Normally or Lognormally distributed?	Least Squares Regression Trend Analysis[a]		Mann-Kendall Trend Analysis[b]		Background Report Significant Trend?	2021 Significant Trend
						W	p		r^2	p	S	p		
MW-29	Chloride (mg/L)	62	0	37	2.5	0.9109	3.53E-03	Not normal	NA	NA	-55	0.27	NA	No Trend
MW-29	Fluoride (mg/L)	40	2.4	0.754	0.15	0.3441	2.59E-12	Not normal	NA	NA	-345	5.51E-05	NA	Decreasing
MW-29	Sulfate (mg/L)	41	0	2711.9	166.2	0.8971	1.02E-03	Not normal	NA	NA	-280	1.73E-03	NA	Decreasing
MW-29	Uranium (µg/L)	52	0	12.27	1.80	0.9772	5.71E-01	Normal	0.774	3.6E-14	557	0	NA	Increasing

Notes:

σ = sigma
%ND = percent of non-detected values
µg/L = micrograms per liter
mg/L = milligrams per liter

N = number of valid data points
p = probability
W = Shapiro-Wilk test value
r^2 = The measure of how well the trendline fits the data where r2=1 represents a perfect fit.

S = Mann-Kendall statistic

a = A regression test was performed on data that was determined to have normal or log-normal distribution
b = The Mann-Kendall test was performed on data that are not normally or lognormally distributed

Appendix C-2: Descriptive Statistics of Indicator Parameters in MW-29

Data Set	2008 Background Report				2013 SAR				2021 SAR			
Analyte	Chloride	Fluoride	Sulfate	Uranium	Chloride	Fluoride	Sulfate	Uranium	Chloride	Fluoride	Sulfate	Uranium
Units	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	ug/L
% Non-Detects	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0%
N	10	10	10	8	24	23	23	23	41	41	43	41
Normally or Lognormallly Distributed?	Normal or Lognormal	Normal or Lognormal	Normal or Lognormal	Not Normal	Not Normal	Normal or Lognormal	Normal or Lognormal	Not Normal	Not normal	Not normal	Not normal	Normal
Mean	38.3	0.9	2785	11.2	37.0	0.79	2787	11.0	37.0	0.75	2712	12.27
Min. Conc.	36.0	0.7	2700	9.5	30.0	0.68	2600	8.0	30.0	0.05	2290	8.1
Max. Conc.	41.0	1.1	2980	12.1	41.0	0.95	2980	13.0	41.0	1.1	2980	16.9
Std. Dev.	1.6	0.1	81	0.8	3.0	0.06	89	1.0	2.5	0.15	166.24	1.80
Range	5.0	0.4	280	2.6	11.0	0.27	380	5.0	11.0	1.05	690	8.8
Geometric Mean	38.3	0.8	2784	11.2	37.0	0.79	2786	11.0	37.0	0.72	2707	12.14
Skewness	0.2	1.2	1.7	-1.6	-0.92	0.83	0.4	-1.3	-1.0	-2.14	-0.84	0.52
25th Quartile	37.0	0.8	2720	11.1	35.0	0.76	2720	11.0	35.4	0.699	2680	11.1
Median	38.5	0.8	2775	11.3	37.0	0.78	2780	11.0	37.2	0.76	2750	11.9
75th Quartile	39.0	0.9	2790	11.8	39.0	0.83	2840	12.0	39.0	0.81	2790	13.3

Appendix C-3: Data Used for Statistical Analysis

Well	Sample Date	Parameter	Result	Units	Qualifier
MW-29	06/22/2005	Chloride	40	mg/L	
MW-29	09/22/2005	Chloride	39	mg/L	
MW-29	12/14/2005	Chloride	36	mg/L	
MW-29	03/21/2006	Chloride	41	mg/L	
MW-29	06/21/2006	Chloride	38	mg/L	
MW-29	09/12/2006	Chloride	37	mg/L	
MW-29	10/24/2006	Chloride	39	mg/L	
MW-29	03/15/2007	Chloride	39	mg/L	
MW-29	08/22/2007	Chloride	37	mg/L	
MW-29	10/24/2007	Chloride	37	mg/L	
MW-29	03/19/2008	Chloride	39	mg/L	
MW-29	06/03/2008	Chloride	38	mg/L	
MW-29	08/05/2008	Chloride	35	mg/L	
MW-29	11/05/2008	Chloride	32	mg/L	
MW-29	02/03/2009	Chloride	31	mg/L	
MW-29	05/13/2009	Chloride	30	mg/L	
MW-29	08/24/2009	Chloride	34	mg/L	
MW-29	10/26/2009	Chloride	35	mg/L	
MW-29	04/27/2010	Chloride	35	mg/L	
MW-29	11/09/2010	Chloride	39	mg/L	
MW-29	04/05/2011	Chloride	38	mg/L	
MW-29	10/05/2011	Chloride	37	mg/L	
MW-29	05/08/2012	Chloride	40	mg/L	
MW-29	11/14/2012	Chloride	37	mg/L	
MW-29	05/23/2013	Chloride	35	mg/L	
MW-29	11/20/2013	Chloride	35	mg/L	
MW-29	06/03/2014	Chloride	37	mg/L	
MW-29	11/10/2014	Chloride	40	mg/L	
MW-29	04/30/2015	Chloride	40	mg/L	
MW-29	11/16/2015	Chloride	36	mg/L	
MW-29	04/27/2016	Chloride	39	mg/L	
MW-29	11/08/2016	Chloride	38	mg/L	
MW-29	04/20/2017	Chloride	39	mg/L	
MW-29	10/16/2017	Chloride	37	mg/L	
MW-29	04/11/2018	Chloride	39	mg/L	
MW-29	10/22/2018	Chloride	35	mg/L	
MW-29	04/24/2019	Chloride	38	mg/L	
MW-29	10/22/2019	Chloride	38	mg/L	
MW-29	04/08/2020	Chloride	37	mg/L	
MW-29	10/13/2020	Chloride	37	mg/L	
MW-29	04/14/2021	Chloride	35	mg/L	
MW-29	06/22/2005	Fluoride	1.10	mg/L	
MW-29	09/22/2005	Fluoride	0.90	mg/L	
MW-29	12/14/2005	Fluoride	0.80	mg/L	
MW-29	03/21/2006	Fluoride	0.90	mg/L	
MW-29	06/21/2006	Fluoride	0.80	mg/L	
MW-29	09/12/2006	Fluoride	0.70	mg/L	
MW-29	10/24/2006	Fluoride	0.80	mg/L	

Appendix C-3: Data Used for Statistical Analysis

Well	Sample Date	Parameter	Result	Units	Qualifier
MW-29	03/15/2007	Fluoride	0.90	mg/L	
MW-29	08/22/2007	Fluoride	1.00	mg/L	
MW-29	10/24/2007	Fluoride	0.80	mg/L	
MW-29	03/19/2008	Fluoride	0.80	mg/L	
MW-29	06/03/2008	Fluoride	0.80	mg/L	
MW-29	08/05/2008	Fluoride	0.80	mg/L	
MW-29	11/05/2008	Fluoride	0.80	mg/L	
MW-29	02/03/2009	Fluoride	0.80	mg/L	
MW-29	05/13/2009	Fluoride	0.80	mg/L	
MW-29	08/24/2009	Fluoride	0.80	mg/L	
MW-29	10/26/2009	Fluoride	0.80	mg/L	
MW-29	04/27/2010	Fluoride	0.76	mg/L	
MW-29	11/09/2010	Fluoride	0.74	mg/L	
MW-29	04/05/2011	Fluoride	0.68	mg/L	
MW-29	10/05/2011	Fluoride	0.79	mg/L	
MW-29	05/08/2012	Fluoride	0.76	mg/L	
MW-29	11/14/2012	Fluoride	0.72	mg/L	
MW-29	05/23/2013	Fluoride	0.77	mg/L	
MW-29	11/20/2013	Fluoride	0.75	mg/L	
MW-29	06/03/2014	Fluoride	0.70	mg/L	
MW-29	11/10/2014	Fluoride	0.62	mg/L	
MW-29	04/30/2015	Fluoride	0.10	mg/L	U
MW-29	11/16/2015	Fluoride	0.64	mg/L	
MW-29	04/27/2016	Fluoride	0.68	mg/L	
MW-29	11/08/2016	Fluoride	0.66	mg/L	
MW-29	04/20/2017	Fluoride	0.74	mg/L	
MW-29	10/16/2017	Fluoride	0.82	mg/L	
MW-29	04/11/2018	Fluoride	1.00	mg/L	
MW-29	10/22/2018	Fluoride	0.68	mg/L	
MW-29	04/24/2019	Fluoride	0.76	mg/L	
MW-29	10/22/2019	Fluoride	0.56	mg/L	
MW-29	04/08/2020	Fluoride	0.60	mg/L	
MW-29	10/13/2020	Fluoride	0.89	mg/L	
MW-29	04/14/2021	Fluoride	0.69	mg/L	
MW-29	06/22/2005	Sulfate	2700.00	mg/L	
MW-29	09/22/2005	Sulfate	2840.00	mg/L	D
MW-29	12/14/2005	Sulfate	2770.00	mg/L	
MW-29	03/21/2006	Sulfate	2710.00	mg/L	D
MW-29	06/21/2006	Sulfate	2770.00	mg/L	
MW-29	09/12/2006	Sulfate	2720.00	mg/L	D
MW-29	10/24/2006	Sulfate	2980.00	mg/L	D
MW-29	03/15/2007	Sulfate	2780.00	mg/L	D
MW-29	08/22/2007	Sulfate	2790.00	mg/L	D
MW-29	10/24/2007	Sulfate	2790.00	mg/L	D
MW-29	03/19/2008	Sulfate	2840.00	mg/L	D
MW-29	06/03/2008	Sulfate	2840.00	mg/L	D
MW-29	08/05/2008	Sulfate	2810.00	mg/L	D
MW-29	11/05/2008	Sulfate	2920.00	mg/L	D

Appendix C-3: Data Used for Statistical Analysis

Well	Sample Date	Parameter	Result	Units	Qualifier
MW-29	02/03/2009	Sulfate	2710.00	mg/L	D
MW-29	05/13/2009	Sulfate	2790.00	mg/L	D
MW-29	08/24/2009	Sulfate	2720.00	mg/L	D
MW-29	10/26/2009	Sulfate	2960.00	mg/L	D
MW-29	04/27/2010	Sulfate	2770.00	mg/L	D
MW-29	11/09/2010	Sulfate	2690.00	mg/L	D
MW-29	04/05/2011	Sulfate	2600	mg/L	D
MW-29	10/05/2011	Sulfate	2850	mg/L	D
MW-29	05/08/2012	Sulfate	2750	mg/L	D
MW-29	05/23/2013	Sulfate	2450	mg/L	
MW-29	11/20/2013	Sulfate	2750	mg/L	
MW-29	06/03/2014	Sulfate	2510	mg/L	
MW-29	11/10/2014	Sulfate	2760	mg/L	
MW-29	04/30/2015	Sulfate	2960	mg/L	
MW-29	11/16/2015	Sulfate	2740	mg/L	
MW-29	02/10/2016	Sulfate	2710	mg/L	
MW-29	04/27/2016	Sulfate	2730	mg/L	
MW-29	09/01/2016	Sulfate	2750	mg/L	
MW-29	11/08/2016	Sulfate	2290	mg/L	
MW-29	01/26/2017	Sulfate	2670	mg/L	
MW-29	04/20/2017	Sulfate	2490	mg/L	
MW-29	08/15/2017	Sulfate	2780	mg/L	
MW-29	10/16/2017	Sulfate	2380	mg/L	
MW-29	04/11/2018	Sulfate	2400	mg/L	
MW-29	10/22/2018	Sulfate	2470	mg/L	
MW-29	10/22/2019	Sulfate	2730	mg/L	
MW-29	04/08/2020	Sulfate	2640	mg/L	
MW-29	10/13/2020	Sulfate	2940	mg/L	
MW-29	04/14/2021	Sulfate	2360	mg/L	
MW-29	06/22/2005	Uranium	8	ug/L	
MW-29	09/22/2005	Uranium	11	ug/L	
MW-29	03/21/2006	Uranium	10	ug/L	
MW-29	06/21/2006	Uranium	12	ug/L	
MW-29	09/12/2006	Uranium	12	ug/L	
MW-29	10/24/2006	Uranium	11	ug/L	
MW-29	03/15/2007	Uranium	11	ug/L	
MW-29	08/22/2007	Uranium	12	ug/L	
MW-29	10/24/2007	Uranium	11	ug/L	
MW-29	03/19/2008	Uranium	11	ug/L	
MW-29	06/03/2008	Uranium	10	ug/L	
MW-29	08/05/2008	Uranium	10	ug/L	
MW-29	11/05/2008	Uranium	11	ug/L	
MW-29	02/03/2009	Uranium	11	ug/L	
MW-29	05/13/2009	Uranium	10	ug/L	
MW-29	08/24/2009	Uranium	11	ug/L	
MW-29	10/26/2009	Uranium	12	ug/L	
MW-29	04/27/2010	Uranium	11	ug/L	
MW-29	11/09/2010	Uranium	11.60	ug/L	

Appendix C-3: Data Used for Statistical Analysis

Well	Sample Date	Parameter	Result	Units	Qualifier
MW-29	04/05/2011	Uranium	12.70	ug/L	
MW-29	10/05/2011	Uranium	11.70	ug/L	
MW-29	05/08/2012	Uranium	12.20	ug/L	
MW-29	11/14/2012	Uranium	11.20	ug/L	
MW-29	05/23/2013	Uranium	11.90	ug/L	
MW-29	11/20/2013	Uranium	13.80	ug/L	
MW-29	06/03/2014	Uranium	12.10	ug/L	
MW-29	11/10/2014	Uranium	11.80	ug/L	
MW-29	04/30/2015	Uranium	12.70	ug/L	
MW-29	11/16/2015	Uranium	13.20	ug/L	
MW-29	04/27/2016	Uranium	13.00	ug/L	
MW-29	11/08/2016	Uranium	13.70	ug/L	
MW-29	04/20/2017	Uranium	12.90	ug/L	
MW-29	10/16/2017	Uranium	13.60	ug/L	
MW-29	04/11/2018	Uranium	13.90	ug/L	
MW-29	10/22/2018	Uranium	13.30	ug/L	
MW-29	04/24/2019	Uranium	15.00	ug/L	
MW-29	10/22/2019	Uranium	14.20	ug/L	
MW-29	04/08/2020	Uranium	14.80	ug/L	
MW-29	10/13/2020	Uranium	15.30	ug/L	
MW-29	01/15/2021	Uranium	16.90	ug/L	
MW-29	04/14/2021	Uranium	16.20	ug/L	

Notes:

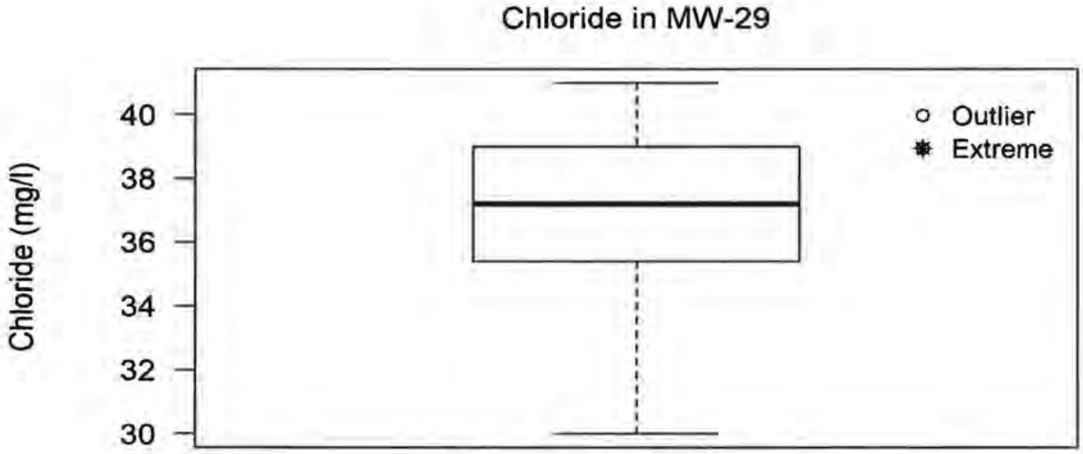
D = Analyte reporting limit increased due to same matrix interference

U = Analyte undetected

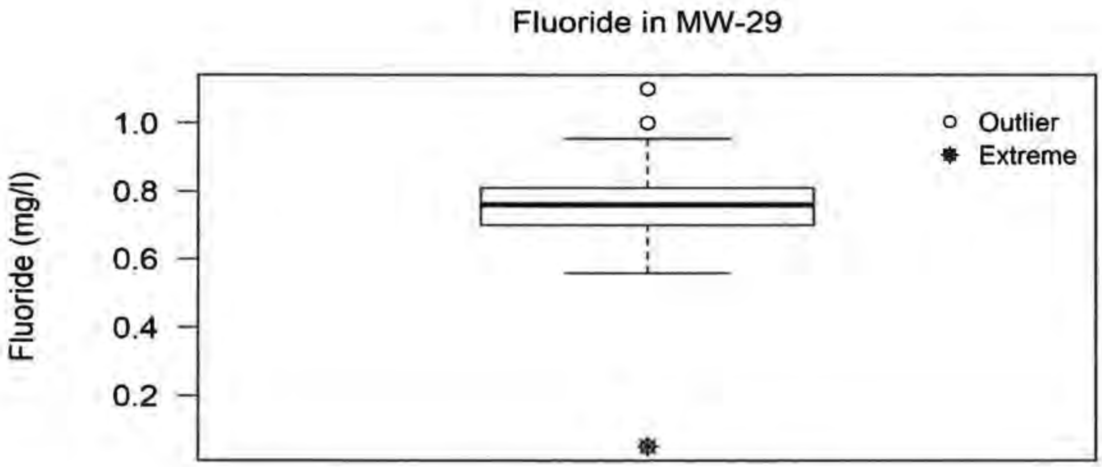
Appendix C-4: Indicator Parameter Data Removed from Analysis

Reason	Location ID	Date Sampled	Parameter Name	Report Result	Report Units
Removed					
Extreme (High)	MW-29	12/14/2005	Uranium	49.0	ug/l
Extreme (Low)	MW-29	11/14/2012	Sulfate	1340.0	mg/l
Extreme (Low)	MW-29	04/24/2019	Sulfate	2170.0	mg/l
Not Removed					
Extreme (Low)	MW-29	04/30/2015	Fluoride	0.05	mg/l

Appendix C-5: Box Plots for Indicator Parameters in MW-29

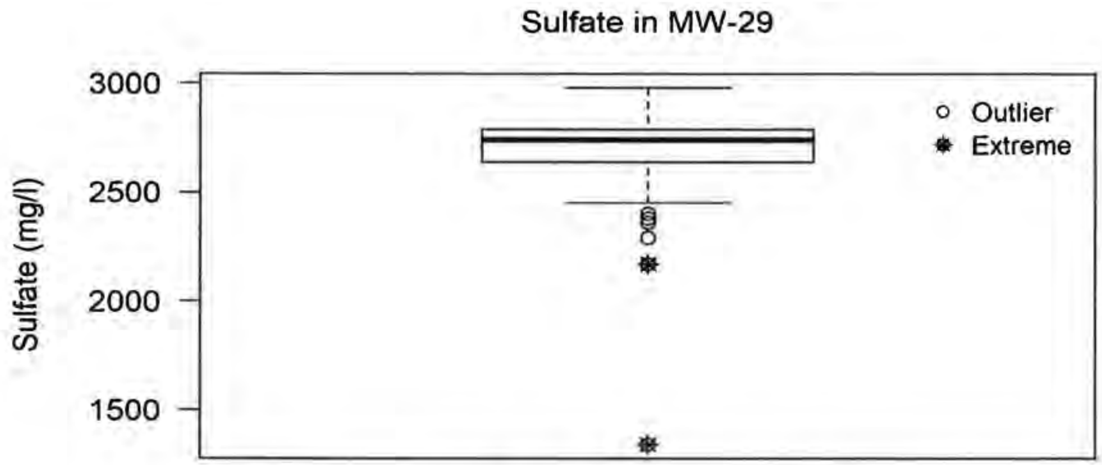


Percent nondetect: 0%
Min: 30, Mean: 37.04, Max: 41, Std Dev: 2.46
Upper extreme threshold (Q75 + 3xH): 49.8
Lower extreme threshold (Q25 - 3xH): 24.6

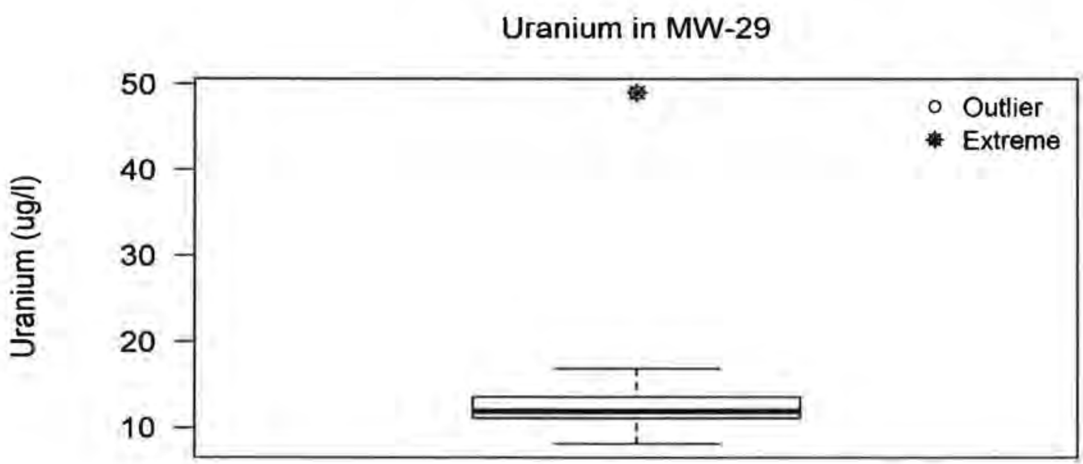


Percent nondetect: 2%
Min: 0.05, Mean: 0.75, Max: 1.1, Std Dev: 0.15
Upper extreme threshold (Q75 + 3xH): 1.143
Lower extreme threshold (Q25 - 3xH): 0.366

Appendix C-5: Box Plots for Indicator Parameters in MW-29

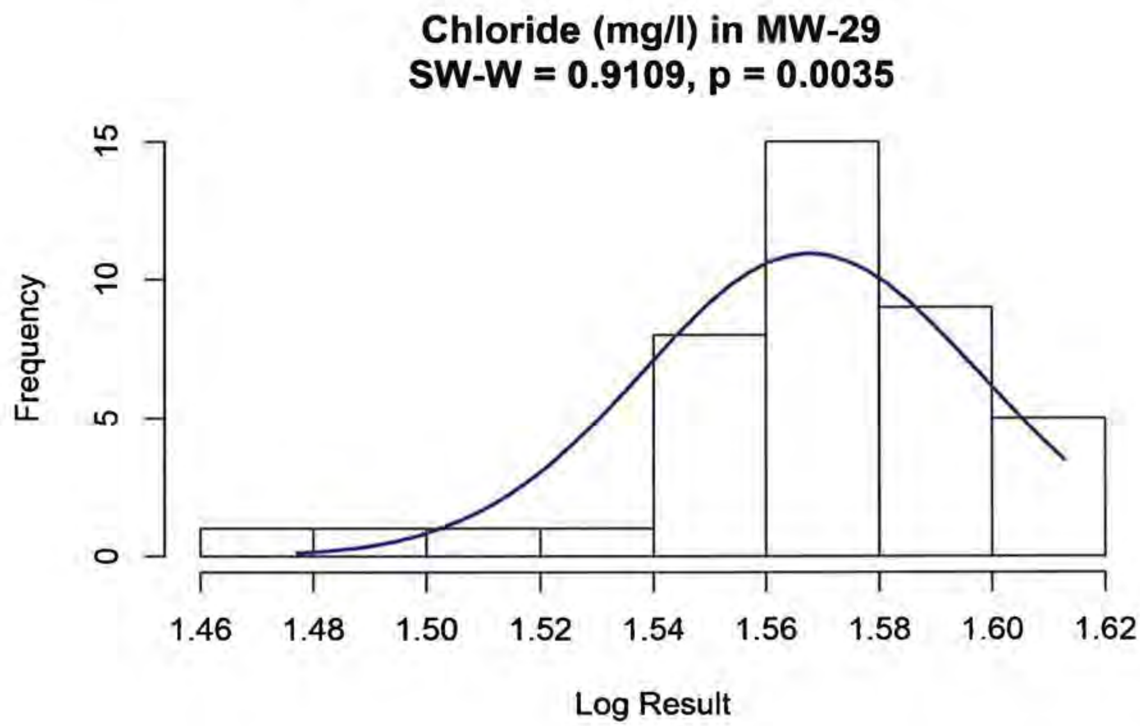


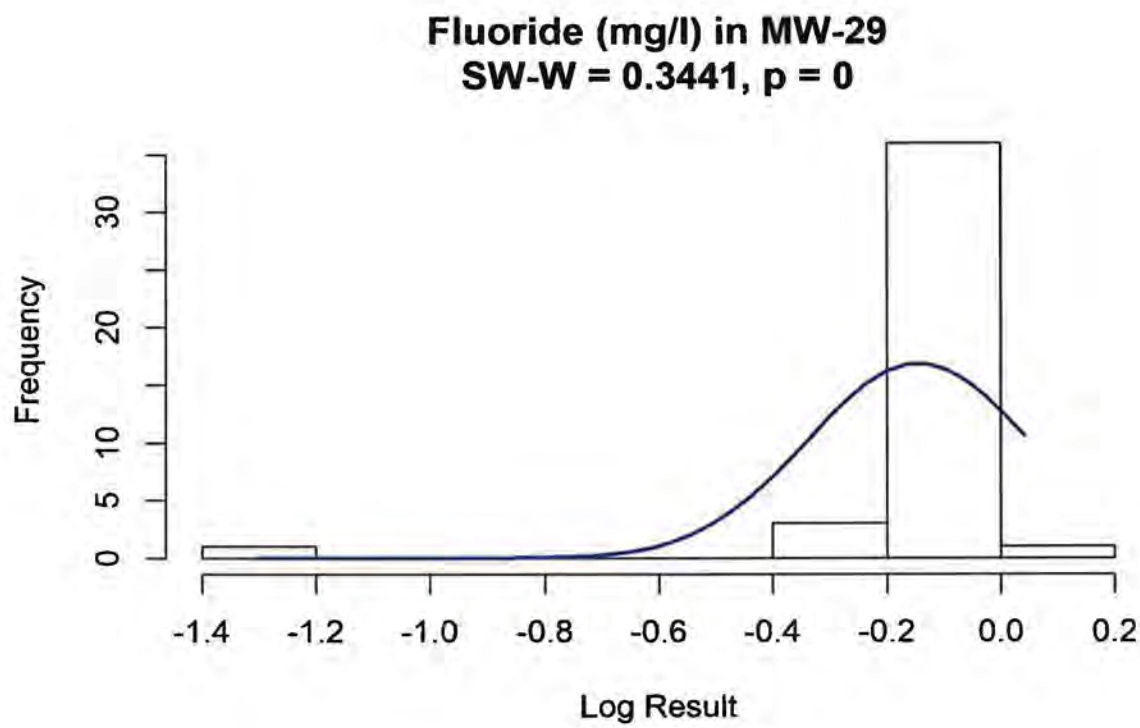
Percent nondetect: 0%
Min: 1340, Mean: 2669.33, Max: 2980, Std Dev: 271.98
Upper extreme threshold (Q75 + 3xH): 3240
Lower extreme threshold (Q25 - 3xH): 2190



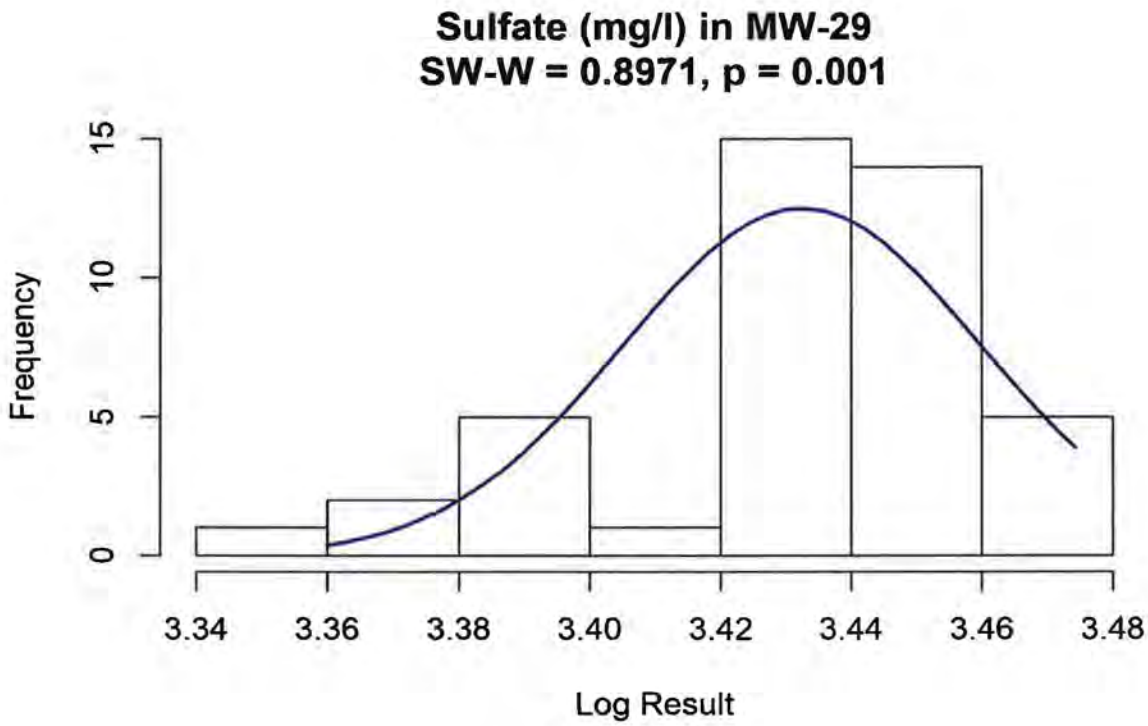
Percent nondetect: 0%
Min: 8.1, Mean: 13.14, Max: 49, Std Dev: 5.94
Upper extreme threshold (Q75 + 3xH): 20.8
Lower extreme threshold (Q25 - 3xH): 3.825

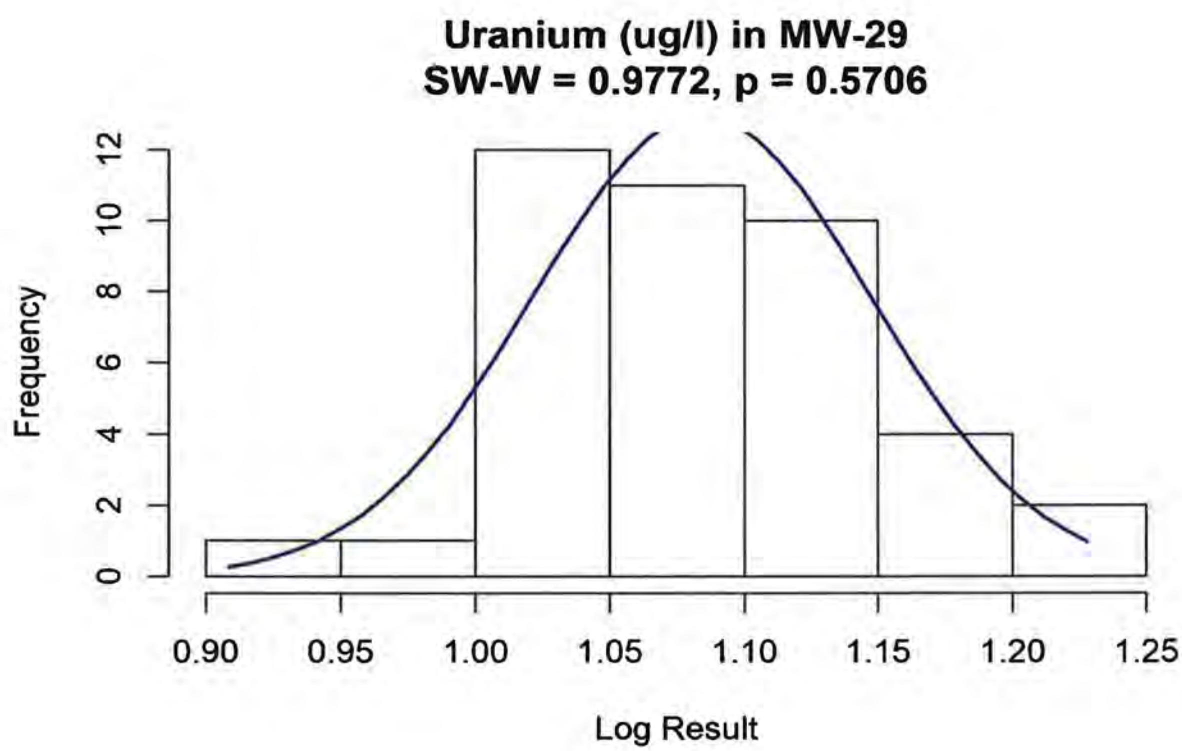
Appendix C-6: Histograms for Indicator Parameters in MW-29



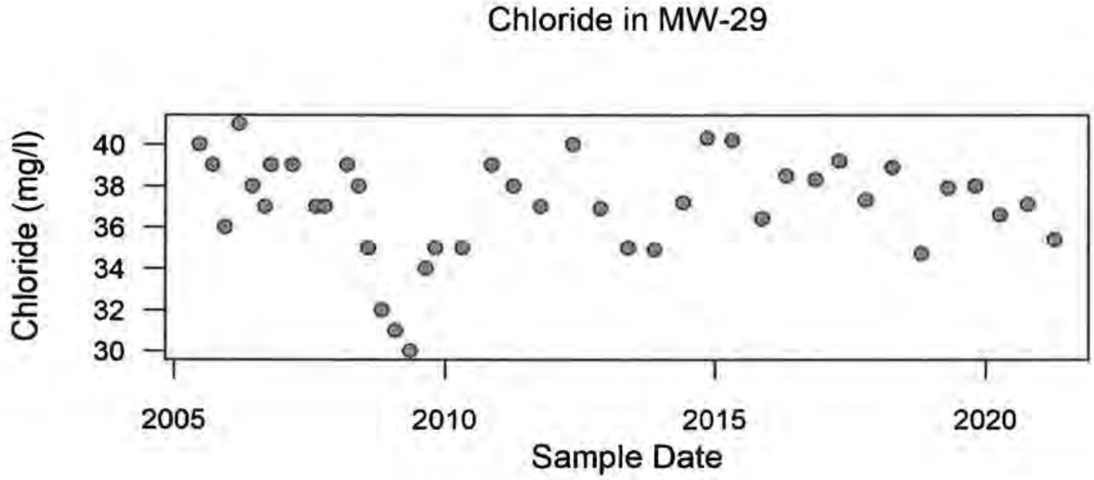


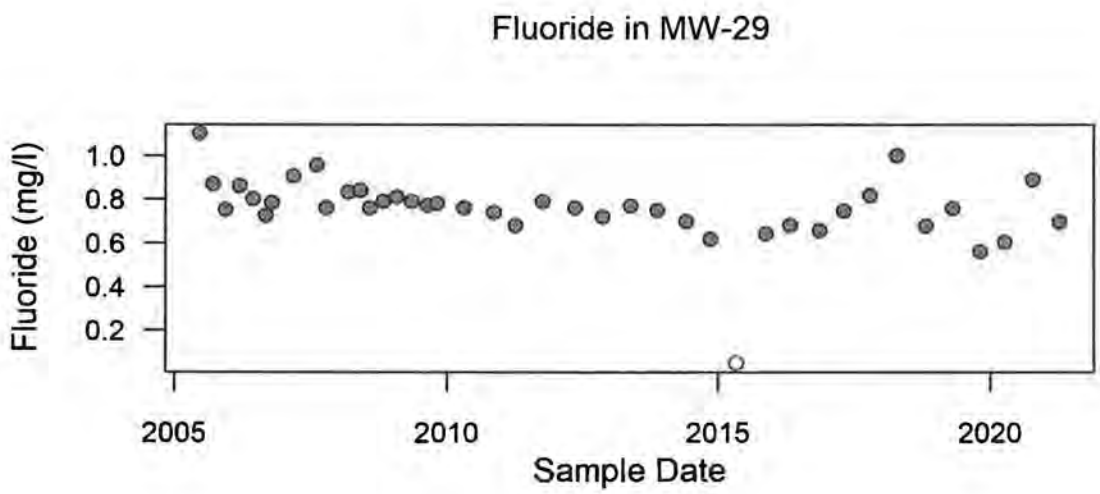
Appendix C-6: Histograms for Indicator Parameters in MW-29





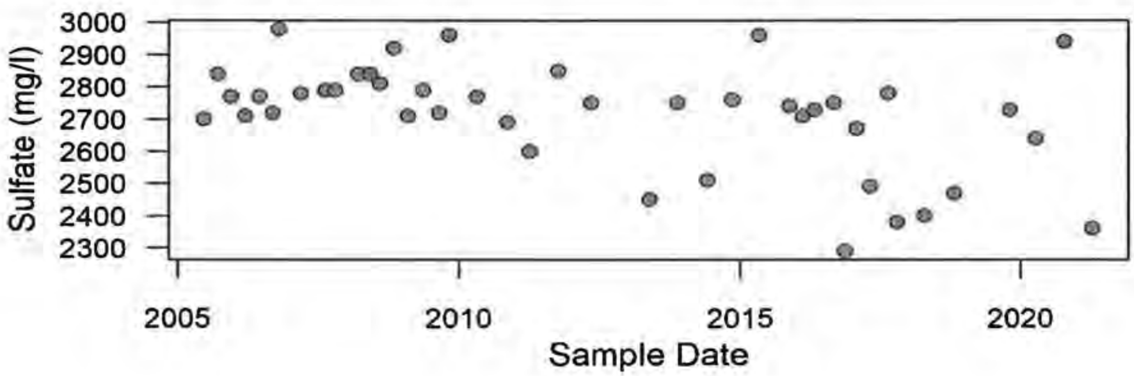
Appendix C-7: Time Series Plots and Linear Regressions for Indicator Parameters in MW-29





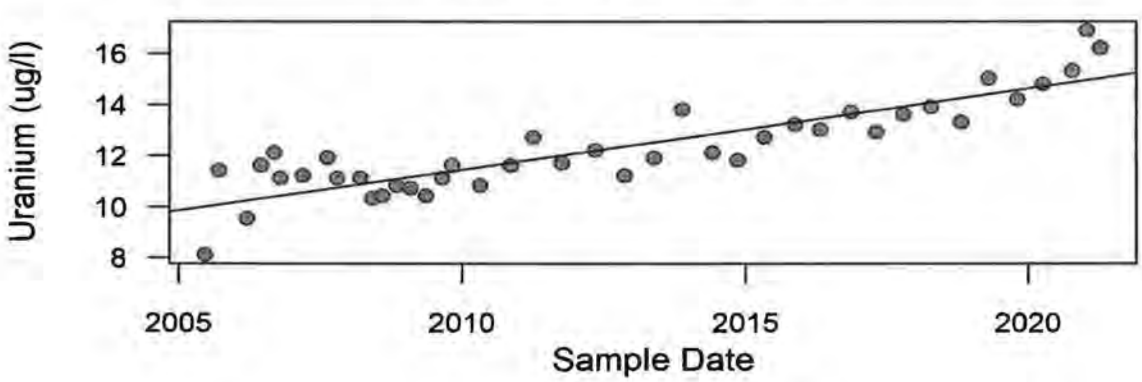
Appendix C-7: Time Series Plots and Linear Regressions for Indicator Parameters in MW-29

Sulfate in MW-29

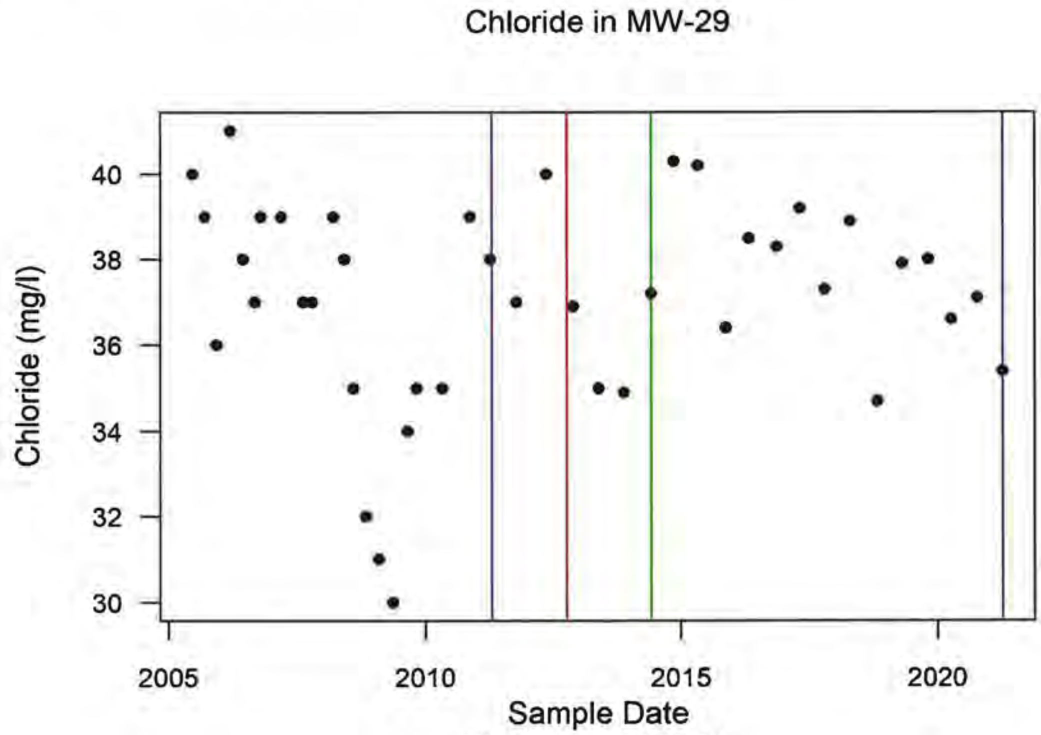


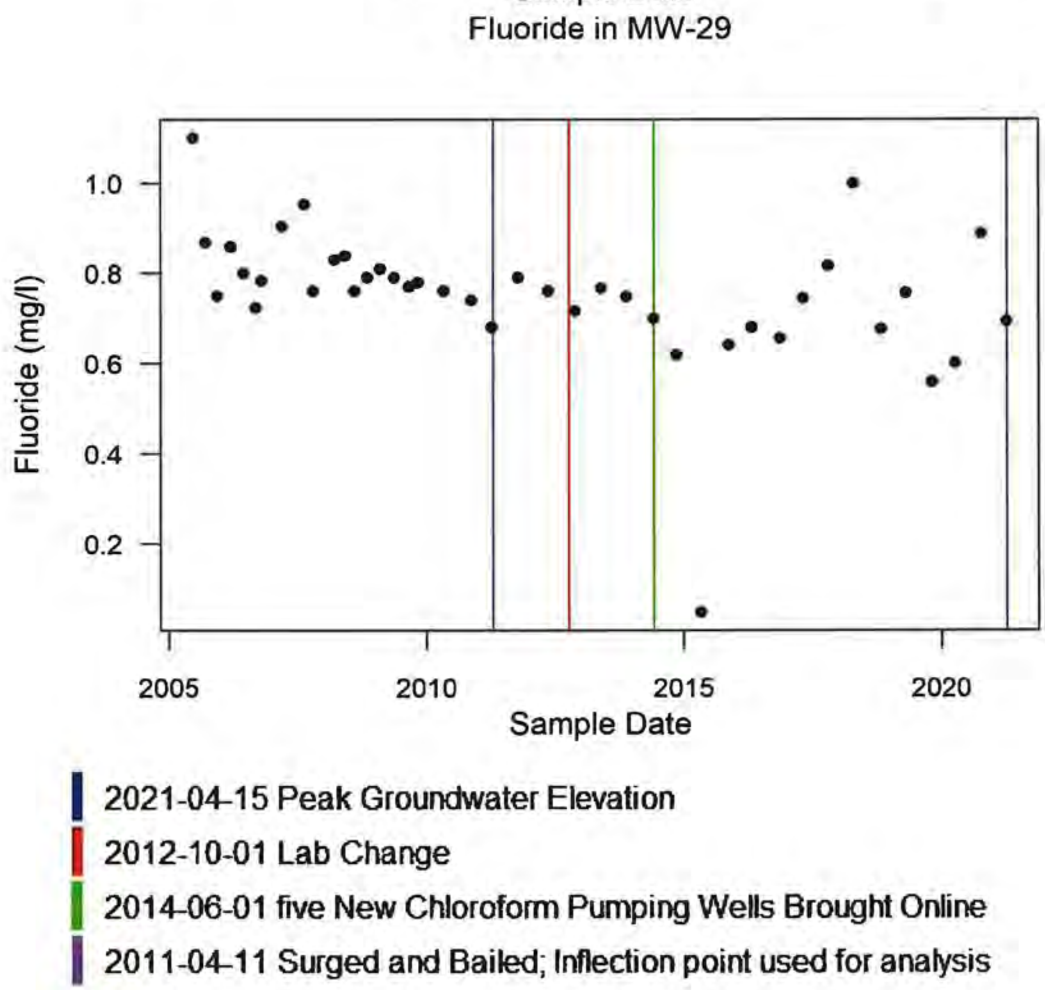
Uranium in MW-29

$r = 0.8799$ $p = 0$ $r^2 = 0.7742$

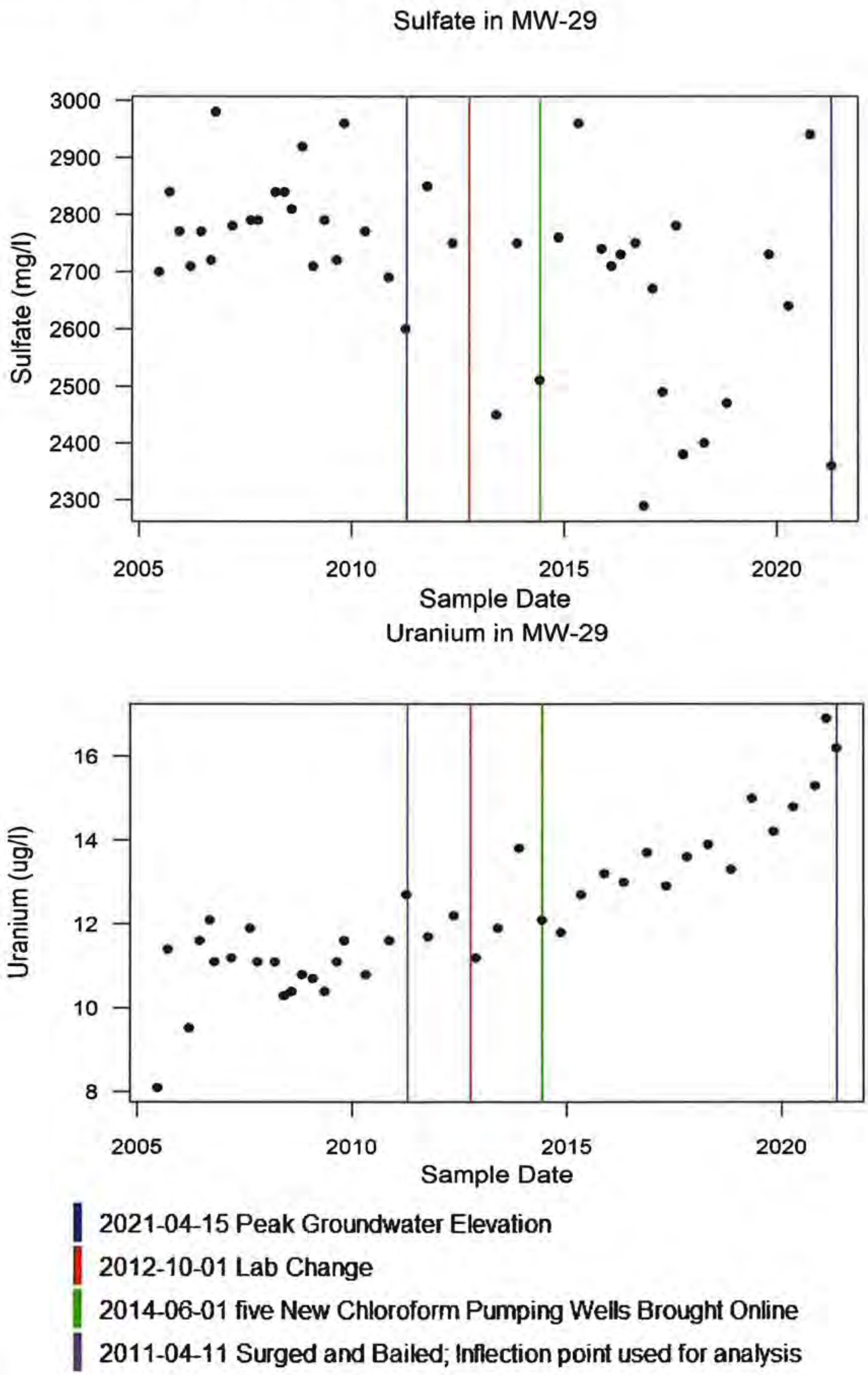


Appendix C-8: Time Series with Events





Appendix C-8: Time Series with Events



APPENDIX D

Dilution Factors and Predicted Fluoride, Uranium and Sulfate Concentrations

	fluoride (mg/L)	uranium (ug/L)	chloride (mg/L)	sulfate (mg/L)
MW-29 concentration (latest)	**0.694**	16.2	35.4	2,360
Cell 1 concentration (average since 2003)	2.24E+03	3.98E+05	2.42E+04	1.70E+05
Dilution factor (DF) = C_{mw29}/C_{cell1}	3.10E-04	4.07E-05	1.46E-03	1.39E-02
		fluoride based on uranium dilution (mg/L)	fluoride based on chloride dilution (mg/L)	fluoride based on sulfate dilution (mg/L)
Predicted diluted fluoride ($C_{cell1\ F}$ x DF)	–	**0.091**	**3.3**	**31.2**

	fluoride (mg/L)	uranium (ug/L)	chloride (mg/L)	sulfate (mg/L)
MW-29 concentration (latest)	0.694	**16.2**	35.4	2,360
Cell 1 concentration (average since 2003)	2.24E+03	3.98E+05	2.42E+04	1.70E+05
Dilution factor (DF) = C_{mw29}/C_{cell1}	3.10E-04	4.07E-05	1.46E-03	1.39E-02
	uranium based on fluoride dilution (ug/L)		uranium based on chloride dilution (ug/L)	uranium based on sulfate dilution (ug/L)
Predicted diluted uranium ($C_{cell1\ U}$ x DF)	**123**	–	**581**	**5,530**

	fluoride (mg/L)	uranium (ug/L)	chloride (mg/L)	sulfate (mg/L)
MW-29 concentration (latest)	0.694	16.2	35.4	**2,360**
Cell 1 concentration (average since 2003)	2.24E+03	3.98E+05	2.42E+04	1.70E+05
Dilution factor (DF) = C_{mw29}/C_{cell1}	3.10E-04	4.07E-05	1.46E-03	1.39E-02
	sulfate based on fluoride dilution (mg/L)	sulfate based on uranium dilution (mg/L)	sulfate based on chloride dilution (mg/L)	
Predicted diluted sulfate ($C_{cell1\ SO4}$ x DF)	**53**	**6.91**	**248.0**	–

NOTES:

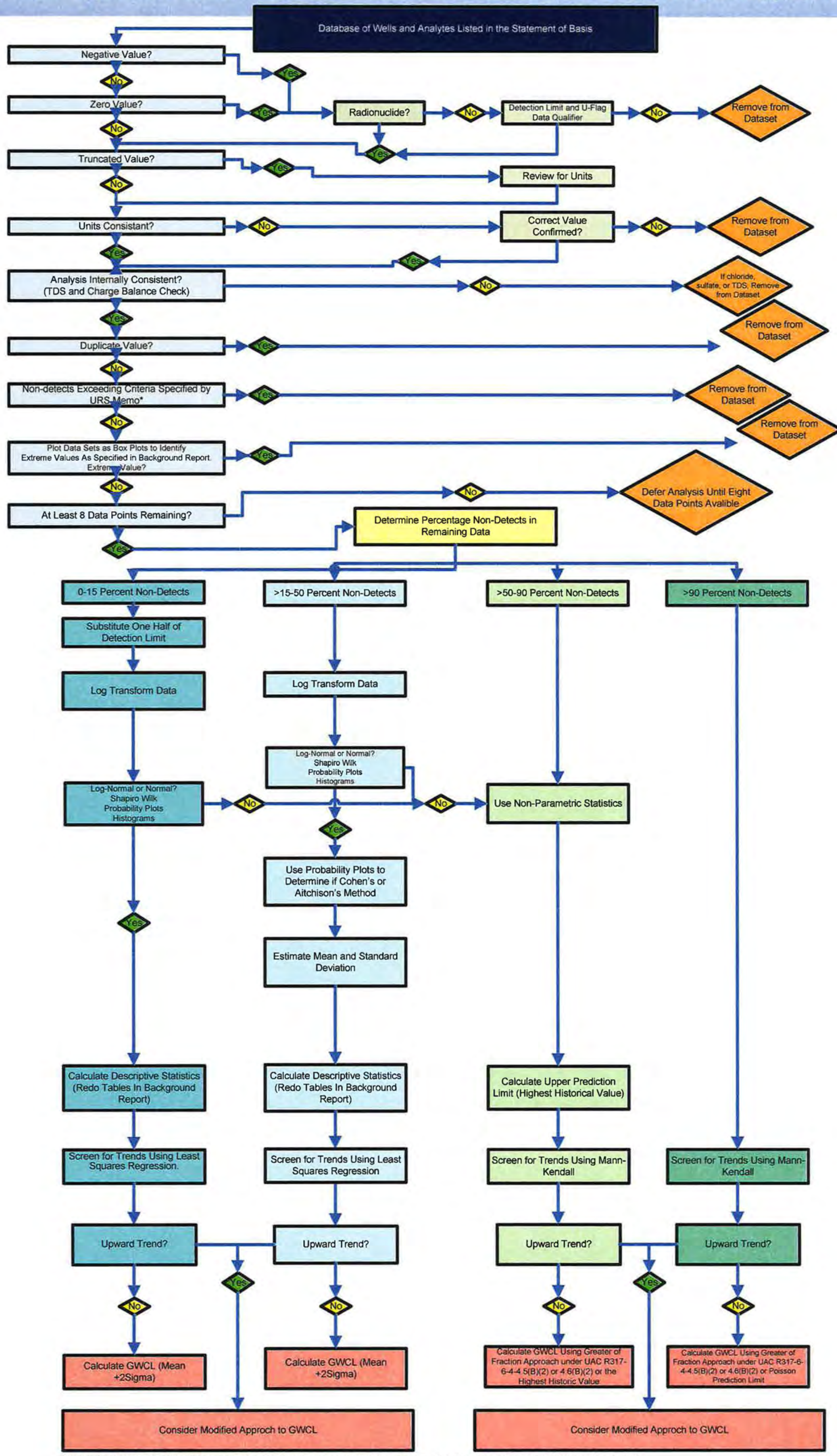
C_{mw29} = latest concentration at MW-29

C_{cell1} = average concentration in cell 1

ug/L = micrograms per liter

APPENDIX E

Appendix E. Flowsheet
Groundwater Data Preparation and Statistical Process Flow for Calculating Groundwater Protection Standards, White Mesa Mill Site, San Juan County, Utah



*A non-detect considered "insensitive" will be the maximum reporting limit in a dataset and will exceed other non-detects by, for example, an order of magnitude (e.g., <10 versus <1.0 µg/L). In some cases, insensitive non-detects may also exceed detectable values in a dataset (e.g., <10 versus 3.5 µg/L).

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APPENDIX F
Input and Output Files (Electronic Only)