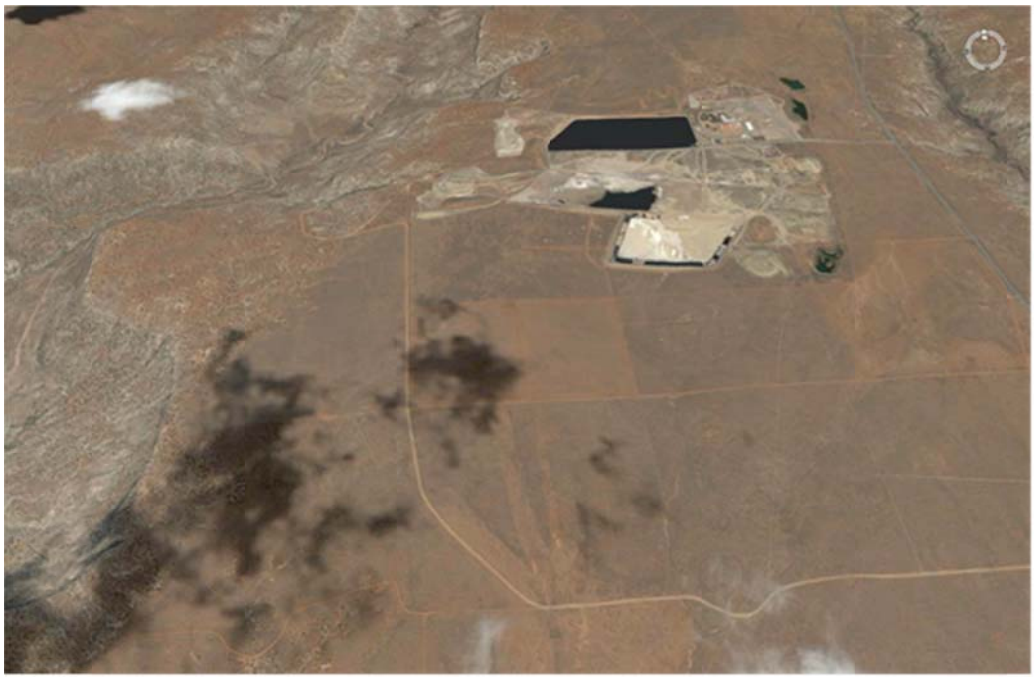
SOURCE ASSESSMENT REPORT
WHITE MESA URANIUM MILL

Blanding, Utah



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EXECUTIVE SUMMARY

This report is an assessment of the sources, extent, and potential dispersion of the specific constituents which have exhibited two consecutive exceedances of their respective Groundwater Compliance Limits ("GWCLs"), and an evaluation of potential remedial action to restore and maintain groundwater quality to assure that Goundwater Discharge Permit ("GWDP") limits will not be exceeded at the compliance monitoring point and that, to the extend applicable, discharge minimization technology and best available technology will be reestablished.

Given the recent analyses in the Background Reports and other recent analyses and investigations at the site, Energy Fuels Resources (USA) Inc. ("EFRI") believes that all of the consecutive exceedances addressed in this report, other than the exceedances in MW-27, MW-30, and MW-31, are likely due to background influences, including a natural decreasing trend in pH across the site and other factors.

Exceedances in MW-27, MW-30, and MW-31 are likely due to the proximity of these wells to the existing nitrate/chloride plume and not to any potential tailings seepage. Any potential increases in concentrations in these wells are already being addressed by the corrective action being implemented for the nitrate/chloride plume.

MW-35 has also had some consecutive exceedances. However, MW-35 is a newly installed well for which background concentrations have not been established, and the interim GWCLs have been set at a fraction of the Groundwater Quality Standards ("GWQSs"). The Background Report for MW-35 will be submitted under separate cover after eight quarters of data are available for each constituent in that well.

As the results of the geochemical and mass balance analysis will demonstrate, each exceedance can be attributed to natural background and site-wide influences (decreasing pH) or to impacts at the site that are already being addressed with corrective action. Therefore, revised GWCLs have been proposed in this report. EFRI maintains that GWCLs for constituents in wells with significantly increasing trends that are the result of background influences should be revised regularly, as is recommended by the United States Environmental Protection Agency's Unified Guidance (USEPA, 2009), to account for the trends and to minimize unwarranted out-of-compliance status in such wells.

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ABBREVIATIONS AND ACRONYMS

CFCs	chlorofluorocarbons
CIR	Contaminant Investigation Report
Director	Director of the Division of Radiation Control
DRC	State of Utah Division of 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
mean + 2σ	mean plus two sigma
µg/L	micrograms per liter
mg/L	milligrams per liter
Mill	White Mesa Uranium Mill
Notice	Notice of Violation and Compliance Order, Docket No.UGWll-02
Q/A	quality assurance
RL	reporting limit
SAR	Source Assessment Report
TDS	Total Dissolved Solids
UDEQ	State of Utah Department of Environmental Quality
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

Energy Fuels Resources (USA) Inc. ("EFRI") (formerly named Denison Mines (USA) Corp.) operates the White Mesa Uranium Mill (the "Mill"), located near Blanding, Utah (Figure 1), under 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 violations of Part I.G.2 of the GWDP.

Part I.G.2 of the GWDP provides that out-of-compliance 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 site. 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 site and developing GWCLs under the GWDP. As required by then Part I.H.3 of the GWDP, EFRI submitted the following to the Director (the "Director") of the Utah Division of Radiation Control ("DRC") (the Director was formerly the Executive Secretary of the Utah Radiation Control Board and the Co-Executive Secretary of the Utah Water Quality Board):

- A Revised Background Groundwater Quality Report: Existing Wells for Denison Mines (USA) Corp.'s Mill Site, San Juan County, Utah, October 2007, prepared by INTERA, Inc. (the "Existing Wells Background Report").
- A Revised Addendum: Evaluation of Available Pre-Operational and Regional Background Data, Background Groundwater Quality Report: Existing Wells for Denison Mines (USA) Corp.'s Mill Site, San Juan County, Utah, November 16, 2007, prepared by INTERA, Inc. (the "Regional Background Report").
- A Revised Addendum: Background Groundwater Quality Report: New Wells for Denison Mines (USA) Corp.'s Mill Site, San Juan County, Utah, April 30, 2008, prepared by INTERA, Inc. (the "New Wells Background Report," and together with the "Existing Wells Background Report" and the "Regional Background Report," the "Background Reports").

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 or the equivalent. The modified GWCLs became effective on January 20, 2010.

The Director issued a Notice of Violation and Compliance Order, Docket No.UGWll-02 (the "Notice"), dated May 9, 2011, based on the DRC findings from the review of the Mill's first, second, and third quarter 2010 Groundwater Monitoring Reports. The Notice cited five violations of the GWDP, including a violation under the Utah Water Quality Act (UC 19-5-107) and Part I.C.1 of the GWDP, in that six contaminants have exceeded their respective GWCLs, as defined in Table 2 of the GWDP, for two consecutive sampling events. Section E.4 of the Notice ordered EFRI to prepare and submit, within 30 calendar days of receipt of the Notice, a written plan and time schedule for Director approval to fully comply with the requirements of Part I.G.4(c) of the GWDP, including, but not limited to:

(i) Submittal of a written assessment of the source(s) of the six contaminants and multiple wells listed in Table 3 of the Notice, including: cadmium, manganese, selenium, thallium, uranium, and total dissolved solids ("TDS").

(ii) Submittal of a written evaluation of the extent and potential dispersion of said groundwater contamination.

(iii) Submittal of a written evaluation of any and all potential remedial actions to restore and maintain groundwater quality at the facility, for the point-of-compliance wells and contaminants in question, to ensure that: 1) shallow groundwater quality at the facility will be restored, and 2) the contaminant concentrations in said point-of-compliance wells will be returned to and maintained in compliance with their respective GWCLs.

On February 14, 2011, EFRI submitted a notice (the "4th Quarter 2010 Exceedance Notice") to the Director under Part I.G.1(a) of the GWDP providing notice that the concentrations of specific constituents in the monitoring wells at the Mill exceeded their respective GWCLs for the fourth quarter of 2010 and indicating which of those constituents had two consecutive exceedances during that quarter. On May 13, 2011, EFRI submitted a notice (the "1st Quarter 2011 Exceedance Notice") to the Director under Part I.G.1 (a) of the GWDP providing notice that the concentrations of specific constituents in the monitoring wells at the Mill exceeded their respective GWCLs for the first quarter of 2011 and indicating which of those constituents had two consecutive exceedances during that quarter. Some constituents had two consecutive exceedances during the first quarter of 2011 that had not already been properly identified as having had two consecutive exceedances in the first, second, or third quarters of 2010, as identified in the Notice, or in the fourth quarter of 2010, as identified in the 4th Quarter 2010 Exceedance Notice. In response to the Notice, EFRI submitted the *Plan and Time Schedule Under Part I.G.4(d) for Violations of Part I.G.2 for Constituents in the First, Second, Third and Fourth Quarters of 2010 and First Quarter of 2011* dated June 13, 2011 ("Initial Plan and Schedule"). Although not subject to the Notice, the Initial Plan and Schedule also covered the constituents in violation of Part I.G.2 of the GWDP that were identified as being in violation in

the 4th Quarter 2010 Exceedance Notice and/or the 1st Quarter 2011 Exceedance Notice. On August 8, 2011, EFRI submitted a notice (the "2nd Quarter 2011 Exceedance Notice") to the Director under Part I.G.1(a) of the GWDP providing notice that the concentrations of specific constituents in the monitoring wells at the Mill exceeded their respective GWCLs for the second quarter of 2011 and indicating which of those constituents had two consecutive exceedances during that quarter. On September 7, 2011, EFRI submitted the *Plan and Time Schedule Under Part I.G.4(d) for Violations of Part I.G.2 for Constituents in the Second Quarter of 2011* dated September 7, 2011 ("Q2 2011 Plan and Schedule"). The Q2 2011 Plan and Schedule covered the constituents in violation of Part I.G.2 of the GWDP that were identified as being in violation in the Second Quarter 2011 Exceedance Notice.

Subsequent to the February 14, 2011, May 13, 2011, and August 8, 2011 Exceedance Notices, EFRI submitted the following Exceedance Notices (the "Exceedance Notices"):

- November 3, 2011 for Q3 2011
- February 15, 2012 for Q4 2011
- May 11, 2012 for Q1 2012
- July 27, 2012 for Q2 2012

In the four subsequent Exceedance Notices listed above, only one additional well was identified as having consecutive exceedances of the respective GWCLs. The additional exceedance, TDS in MW-31, was identified in the First Quarter 2012 Exceedance Notice dated May 11, 2012. EFRI requested that no additional plan and time schedule be prepared and that this exceedance be addressed in conjunction with the sulfate exceedances as described in the June 13, 2011, Initial Plan and Time Schedule. DRC agreed with this request in correspondence dated August 1, 2012.

This SAR covers the constituents in violation of Part I.G.2 of the GWDP that were identified as being in violation during all four quarters of 2010 and 2011 and the first and second quarters of 2012 pursuant to the foregoing Exceedance Notices. The constituents covered by this SAR are listed below in Table 1.

1.1 Source Assessment Report Layout

An overview of Sections 2.0 through 6.0 and the appendices included with this Report is provided below.

Constituents and wells subject to this Report are discussed in Section 2.0. A description of the approach used for analysis is provided in Section 3.0, and the results of analysis are presented in

Section 4.0. Conclusions and recommendations are reviewed in Section 5.0, and references are included in Section 6.0.

The appendices are comprised of the analyses performed for this Report and are organized in the following manner: Appendix A contains a table showing exceedances. Appendix B contains the geochemical analysis performed on the constituents in wells with exceedances. Appendix C contains the indicator parameter analysis performed on wells with consecutive exceedances. Appendix D contains the pH analysis performed on wells that have exceedances of constituents that are sensitive to low pH. Appendix E contains data plots for all of the constituents with exceedances using all available data to date, compared to the data plots from the Background Reports, as well as current data plots of all indicator parameters and plots of indicator parameters from the Background Reports. Appendix F contains the Flowsheet developed based on the United States Environmental Protection Agency's ("USEPA") *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (USEPA, 2009), and was approved by DRC prior to completion of the Background Reports. Appendix G is included on the compact disc that accompanies this Report and contains the electronic input and output files used for statistical analysis.

2.0 CONSTITUENTS AND WELLS SUBJECT TO THIS REPORT

The following consecutive exceedances have been identified in the Exceedance Notices as being out of compliance under Part I.G.2 of the GWDP in all four quarters of 2010 and 2011, and in the first and second quarters of 2012. These constituents and wells are also displayed on Figure 2 and listed in Appendix A.

Table 1
Constituents and Wells Subject to This Source Assessment Report

Constituents	POC Well
Cadmium	MW-24
Manganese	MW-11 MW-35*
Selenium	MW-12 MW-30 MW-3 MW-3A MW-35*
Thallium	MW-18 MW-24 MW-35*
Uranium	MW-26 MW-5 MW-25 MW-35*
TDS	MW-18 MW-27 MW-31
Sulfate	MW-31 MW-3A
Fluoride	MW-3
Gross Alpha	MW-35*

* Background groundwater sampling and analysis is being completed, and EFRI will submit a background report for Director approval after at least eight quarters of data are available for each constituent in MW-35.

It should be noted that the Notice and the Exceedance Notices identify a number of wells with consecutive exceedances of nitrate + nitrite and/or chloride, chloroform and dichloromethane, and pH (less than the respective GWCLs for pH in a number of wells). However, none of those constituents are included in this SAR for the reasons stated in the Notice. That is, chloroform and dichloromethane are associated with the existing chloroform plume at the Mill, as

contemplated in the August 23, 1999, DRC Notice of Violation and Groundwater Corrective Action Order. Nitrate + nitrite and chloride are associated with the nitrate/chloride plume, addressed by the Draft Corrective Action Plan, dated May 2012. With respect to pH, a separate Plan and Time Schedule submitted April 13, 2012, was accepted by DRC as specified in a Stipulated Consent Agreement dated July 12, 2012. PH will be addressed in a separate report submitted under separate cover as specified in the July 12, 2012, Stipulated Consent Agreement.

3.0 CATEGORIES AND APPROACH FOR ANALYSIS

The out-of-compliance constituents and wells can be grouped into five categories:

1. Constituents in wells with previously identified rising trends.
2. Constituents in pumping wells.
3. Constituents potentially impacted by decreasing trends in pH across the site.
4. Newly installed wells with interim GWCLs.
5. Other constituents and wells.

3.1 Approach for Analysis

The first step in the analysis is to perform an assessment of the potential sources for each exceedance to determine whether the exceedance is due to background influences or Mill activities. If an exceedance is 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, revised GWCLs are proposed to reflect changes in background conditions at the site.

The assessment for potential sources for each exceedance was accomplished by performing a geochemical analysis to evaluate the behavior of the constituents in the well in question to determine if there have been any changes in the behavior of indicator parameters, such as chloride, sulfate, fluoride, and uranium, since the date of the Background Reports that may suggest a change in the behavior of that well.

As discussed in detail in Section 9.0 of the Existing Wells Background Report, chloride is the best indicator of potential tailings cell leakage, followed by fluoride, then sulfate (due to mobility and abundance in tailings). Uranium is probably the most mobile of trace (metal) elements and is the best indicator parameter for metals and radionuclides. Any potential seepage from tailings impoundments would be expected to exhibit rising concentrations of chloride and possibly fluoride, sulfate, and uranium. However, while uranium may be the most mobile of trace (metal) elements, it is typically retarded behind chloride and would likely not be expressed in groundwater until sometime after chloride concentrations had begun to rise. This is because uranium is a metal cation and behaves as other metals with respect to pH. It is important to note, however, that while a lack of a rising trend in chloride would indicate that there has been no impact from tailings, a rising trend in chloride could also be due to some natural influences (see Section 12.0 of the Existing Wells Background Report). Therefore, in situations where there is a

significant rising trend in chloride, other evaluations would need to be performed, such as a determination as to whether any other indicator parameters have demonstrated a significant rising trend and whether or not the concentrations and mass balance indicate a potential tailings cell leak.

The geochemical analysis was supported by a statistical analysis that followed the process outlined in the Groundwater Data Preparation and Statistical Process Flow for Calculating Groundwater Protection Standards, White Mesa Mill Site, San Juan County, Utah (Flowsheet) (INTERA, 2007), a copy of which is attached as Appendix F. The Flowsheet was designed based on USEPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (USEPA, 2009), and was approved by DRC prior to completion of the Background Reports.

If it was determined through the geochemical analysis of the indicator parameters that the behavior of a particular well has changed since the Background Reports, a mass balance analysis was performed to evaluate the observed concentrations of the constituent in light of the concentrations in Mill tailings and the presence or absence of any mounding at the location of the well in question.

In any case where the well in question (any well that was determined to have changed behavior since the Background Reports) is distant from the Mill's tailings cells, a hydrogeologic analysis was performed to determine the plausibility of impact from Mill tailings.

If significant changes were identified that could not be attributed to background influences, then further analysis was proposed to identify the source, extent, and potential dispersion of the contamination, as well as to identify potential remedial actions. Additional analysis specific to each category is described below.

3.1.1 Constituents in Wells with Previously Identified Rising Trends

The following out-of-compliance constituents were identified in the Background Reports as having statistically significant rising trends due to natural background influences:

Table 2
Constituents in Wells with Previously Identified Rising Trends

Constituent	Well	Reference
Manganese	MW-11	Table 16, Existing Wells Background Report
Selenium	MW-12	Table 16, Existing Wells Background Report
	MW-3	Table 16, Existing Wells Background Report
Thallium	MW-18	Table 16, Existing Wells Background Report
Uranium	MW-26	Table 16, Existing Wells Background Report

For constituents in wells with previously identified rising trends, the approach for analysis began as described in Section 3.1 above. If no significant changes were identified, that would suggest that the previous analysis conducted in the Background Reports for the constituents in question has not changed. Revised GWCLs, using all available data and following the Flowsheet (INTERA, 2007), are proposed to better reflect background concentrations at the site.

As recommended by USEPA's Unified Guidance (USEPA, 2009), GWCLs for constituents in wells with significantly increasing trends should be revised regularly to account for the trends and to minimize unwarranted out-of-compliance status in such wells.

3.1.2 Constituents in Pumping Wells

Of the constituents listed in Table 1 above, uranium in MW-26 is the only out-of-compliance constituent in a pumping well. MW-26 is included in Table 1 because of consecutive exceedances of the GWCL for uranium in the first and second quarters of 2010. Subsequent data show that the concentrations of uranium in MW-26 in the sampling events in 2010 and through the second quarter of 2012 range from 18.2 to 72.7 micrograms per liter (µg/L), with 12 of the 28 sample results being less than the GWCL of 41.8 µg/L. The most recent result was 18.2 µg/L for the May 2012 monthly sampling event. This erratic behavior is not unexpected for a pumping well such as MW-26, and is not inconsistent with natural background.

The primary focus of this source assessment for uranium in MW-26 is to determine whether or not there is any new information that would suggest that the previous analysis conducted in the Existing Wells Background Report has changed since the date of that report. This analysis included a geochemical analysis that evaluated the behavior of all of the constituents in MW- 26 to determine if there were any changes in the behavior of indicator parameters, such as chloride, sulfate, fluoride, and uranium, since the date of the Existing Wells Background Report that may suggest a change in the behavior of that well since the date of that report.

MW-26 was also included in the category of constituents that may be impacted by a significantly decreasing trend in pH. Additional analysis was performed with respect to pH in MW-26. Those analyses are described in more detail in Section 3.1.3 below.

3.1.3 Constituents Potentially Impacted by Decreasing pH Trends Across the Site

EFRI has observed a decreasing trend in pH in almost every groundwater monitoring well across the Mill site, including the ones that are upgradient and far downgradient. The mobility in groundwater of the following out-of-compliance constituents is sensitive to decreases in pH:

Table 3
Out-of-Compliance Constituents Potentially Impacted by Decreasing pH Trends Across the Site

Constituent	Well
Cadmium	MW-24
Manganese	MW-11
Selenium	MW-12
	MW-3
	MW-30
	MW-3A
Thallium	MW-18
	MW-24
Uranium	MW-5
	MW-25
	MW-26

Note: A number of the constituents listed in Table 3 are also found in MW-35 and would similarly be impacted by decreasing pH trends across the site. However, MW-35 is a newly installed well and is discussed separately in Section 3.1.4 below.

The first step for this category was to perform a geochemical analysis evaluating the behavior of all the constituents in the well in question to determine if there have been any changes in the behavior of indicator parameters, such as chloride, sulfate, fluoride, and uranium, since the date of the Background Reports that may suggest a change in the behavior of that well since the dates of those reports.

If it was determined through the geochemical analysis of the indicator parameters that the behavior of a particular well has changed since the Background Reports, a mass balance analysis was performed to evaluate the observed concentrations of the constituent in light of the concentrations in Mill tailings and the presence or absence of any mounding at the location of the well in question. In cases where the wells in question (wells that were determined to have changed behavior since the Background Reports) are distant from the Mill's tailings cells, a hydrogeologic analysis was performed to determine the plausibility of any potential impact from Mill tailings.

In addition to the aforementioned approach, a pH analysis was performed for each well that contains constituents that may be influenced by a decreasing pH trend. This analysis reviewed the behavior of pH in the well in question to determine if there has been a significant decrease in pH in the well. If there was a significant decreasing trend in pH in that well, the impact from any such decrease on the constituent in question was also analyzed.

3.1.4 Newly Installed Wells with Interim GWCLs

MW-35 was installed in August and September of 2010 as required by the GWDP. Sampling commenced in the fourth quarter of 2010. Eight consecutive quarters of groundwater sampling and analysis have been completed as of the third quarter 2012; however, because some data has been rejected as a result of the quality assurance (Q/A) analysis required by the Flowsheet, one or more additional quarters of sampling are required. Upon receipt of at least eight quarters of data for each constituent in MW-35, EFRI will submit a background report for Director approval. As an interim measure, GWCLs were set by the Director at one-quarter of the State GWQSs. Manganese, uranium, gross alpha, selenium, and thallium exceeded the interim GWCLs in MW-35. However, since background has not been established in MW-35, the exceedances of these interim GWCLs do not represent exceedances of background values or impacts to groundwater from Mill activities.

EFRI is preparing a Background Report for MW-35 where all available data will be used to calculate proposed GWCLs using the Flowsheet. The results of analysis from the GWDP constituents will be presented in the MW-35 Background Report, which is currently expected to be submitted during the first quarter 2013.

3.1.5 Other Constituents and Wells

The out-of-compliance constituents listed in Table 4 do not fall into one of the previous categories:

Table 4
Other Constituents and Wells

Constituent	Well
TDS	MW-18
	MW-27
	MW-31
Sulfate	MW-3A
	MW-31
Fluoride	MW-3

Although these constituents do not fall into one of the previous categories, the primary focus for the source assessment for these wells is the same as in the previous categories: to determine whether or not there is any new information that would suggest that the previous analysis conducted in the Background Reports has changed since the dates of those reports.

The first step for this category was to perform a geochemical analysis evaluating the behavior of all the constituents in the well in question to determine if there have been any changes in the behavior of indicator parameters, such as chloride, sulfate, fluoride, and uranium, since the dates

of the Background Reports that may suggest a change in the behavior of that well since the dates of those reports.

If it was determined through the geochemical analysis of the indicator parameters that the behavior of a particular well has changed since the Background Reports, a mass balance analysis was performed to evaluate the observed concentrations of the constituent in light of the concentrations in Mill tailings and the presence or absence of any mounding at the location of the well in question. In cases where the wells in question (wells that were determined to have changed behavior since the Background Reports) are distant from the Mill's tailings cells, a hydrogeologic analysis was performed to determine the plausibility of impact from Mill tailings.

3.2 Approach for Setting Revised GWCLs

If the foregoing approaches result in the conclusion that the previous analysis in the Background Reports has not changed and that the out-of-compliance status of a constituent in a well is due to natural influences, then, except in those cases specified below, a proposed new GWCL was proposed for the constituent. In proposing revised GWCLs, we have adopted the approach in the Flowsheet.

For some constituents, most notably uranium in MW-5, manganese in MW-11, and TDS in MW-31, the revised GWCLs from the application of the Flowsheet will not be set high enough to avoid renewed out-of-compliance status in the near future. For those constituents, we propose that DRC and EFRI enter into discussions to determine if there are any other approaches that will allow the GWCLs to be set in a manner that better reflects changing background conditions and avoids unwarranted out-of-compliance situations. With respect to uranium in MW-5, we also propose that further study be undertaken to better understand the recent increase in variability, as discussed in more detail in Section 4.3.5 below.

In addition, as will be discussed in more detail below, we have proposed continued sampling in pumping well MW-26 and upgradient wells MW-1, MW-18, and MW-19 for information purposes only, and to eliminate the GWCLs for those wells. As a pumping well, MW-26 is being manipulated, and the impact on the quality of the water in that well from the pumping is unclear and cannot be predicted with enough certainty to establish compliance standards under the GWDP. MW-1, MW-18, and MW-19 are far upgradient from the Mill site and cannot be impacted by Mill activities. It is therefore not appropriate to establish compliance standards under the GWDP for those wells. However, although EFRI proposes that the GWCLs in those wells be eliminated, EFRI proposes to continue monitoring those wells at their normal, un-accelerated frequency for informational purposes only, and to help define background conditions at the site.

Appendix B-1 summarizes the GWCLs for all out-of-compliance constituents listed in Table 1 based on an application of the Flowsheet. Revised GWCLs for MW-26 and MW-18 are included on that table for completeness and to show recalculated GWCLs based on the Flowsheet. Those would be the appropriate revised GWCLs, if revised GWCLs were for those wells. However, EFRI is not proposing that GWCLs be set in those wells.

It is assumed that once revised GWCLs are set for the various constituents, accelerated monitoring for those constituents will cease.

3.3 University of Utah Study

At the request of DRC, 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 to characterize groundwater flow, chemical composition, noble gas composition, and age (Hurst and Solomon, 2008), to determine whether or not the increasing and elevated trace metal concentrations in monitoring wells at the Mill site, all of which were identified in the Background Reports, may indicate that potential leakage from tailings cells is occurring.

In order to evaluate sources of solute concentrations at the Mill site, low-flow groundwater sampling was implemented in 15 monitoring wells. In addition, surface water samples were collected from tailings cells 1, 3, and 4A, and two wildlife ponds. Passive diffusion samplers were also deployed and collected in order to characterize the dissolved gas composition of groundwater at different depths within the wells. Samples were collected and analyzed for the following: 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"). The 15 wells sampled included the following seven wells listed on Table 1 above: MW-3, MW-3A, MW-5, MW-11, MW-18, MW-27, MW-30, and MW-31.

Hurst and Solomon 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, page iii)

More specific observations relative to the seven wells included in Table 1 are as follows:

With respect to CFC age dating, MW-3, MW-5, MW-11, MW-18, and MW-31 were found to exhibit CFC recharge dates of the 1960s and 1970s, indicating that the water in those wells predated construction of the Mill in 1980. Data was not available for MW-30. MW-3A exhibited recharge dates of the late 1980s, but Solomon and Hurst concluded that MW-3A was "pumped dry . . . because of low-yielding characteristics, and well MW-3A was subsequently sampled using [EFRI] dedicated bladder pumps. Potential CFC contamination could have occurred in these wells, as well as MW-3, because of exposure to atmosphere after pumping the boreholes dry." (Hurst and Solomon, 2008, page 23)

Tritium concentrations in MW-3, MW-3A, MW-5, MW-18, MW-30, and MW-31 were found to be non-detect, indicating that impacts from wide-scale atmospheric injection of tritium during above-ground thermonuclear weapons testing in the 1950s and 1960s, expected to be found in surface waters such as Mill tailings, were not observed in those wells. Concentrations in MW-11 were non-detect on first sampling and very low at 0.16 TU on a repeat sample. MW-27 displayed the highest tritium concentration on-site at 8.67 TU. With respect to this result for MW-27, Hurst and Solomon noted that "[t]he fact that significant and measurable quantities of tritium are present in MW-27, MW-19 and the wildlife ponds, indicates recharge to the aquifer from the wildlife ponds is occurring." (Hurst and Solomon, 2008, page 27)

With respect to dissolved gas composition of groundwater, Hurst and Solomon noted that "some samples near the wildlife ponds have helium isotope values that are consistent with transport of young water being recharged at the ponds [eg., MW-27 (shallow and deep) and MW-30 (shallow)" (Hurst and Solomon, 2008, page 33) and that "[s]amples from MW-11 . . . contain the largest amounts of terrigenic helium and thus contain the largest components of old water." (Hurst and Solomon, 2008, page 37)

With respect to deuterium and oxygen-18 ratios in water, Hurst and Solomon concluded that "MW-11 does not show an evaporated signal suggesting that neither pond water or leakage from tailing cells is present at this well today" (Hurst and Solomon, 2008, page 44) and "[m]onitoring wells MW-3, MW-3A, . . . MW-18, . . . have more depleted $\delta^{18}O$. These wells have elevated uranium concentrations, but as they do not bear an evaporated stable isotope signal it does not appear that the elevated uranium values are the result of leakage from tailing cells (or wildlife ponds.)." (Hurst and Solomon, 2008, page 44)

With respect to isotope ratios of $^{34}S/^{32}S$ and $^{18}O/^{16}O$ as sulfur-34 and oxygen-18 in the dissolved sulfate molecule, Hurst and Solomon observed that "MW-27 is also similar in isotopic composition to the surface water sites. This suggests groundwater there has been influenced by

the wildlife ponds found directly upgradient" (Hurst and Solomon, 2008, page 47), and "[w]ells MW-3 . . . and MW-18 . . . exhibited elevated concentrations of uranium but are isotopically distinct from the surface water sites" (Hurst and Solomon, 2008, page 48), and "MW-27 exhibits an isotopic fingerprint very similar to that of the wildlife ponds, as well as similar sulfate concentrations." (Hurst and Solomon, 2008, page 50)

Hurst and Solomon also observed that "[b]ecause of the consistent similarities in δ^{34} values, $\delta^{18}O$ values, and sulfate concentrations between MW-27 and the wildlife ponds, it is likely that water in MW-27 has its origin in the wildlife ponds" (Hurst and Solomon, 2008, page 53), and "[w]hen compared with isotope fingerprints observed in the tailings cells, fingerprints of monitoring wells exhibit strong differences, with the exception of MW-27. This suggests that elevated concentrations of trace metals seen in wells down-gradient of the facility are not being caused by tailings cell leakage." (Hurst and Solomon, 2008, page 52)

Hurst and Solomon (2008) conclude 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. The only evidence linking surface waters to recharging groundwater is seen in MW-27 and MW-19. Measurable tritium and CFC concentrations indicate relatively young water, with low concentrations of selenium, manganese, and uranium. Furthermore, stable isotope fingerprints of δD and $\delta^{18}O$ suggest mixing between wildlife pond recharge and older groundwater in MW-19 and MW-27. $D^{34}S\text{-}SO_4$ and $\delta^{18}O\text{-}SO_4$ fingerprints closely relate MW-27 to wildlife pond water, while the exceptionally low concentration of sulfate in MW-27, the only groundwater site to exhibit sulfate levels below 100 mg/L, suggest no leachate from the tailings cells has reached the well."

It should be further noted that, subsequent to the University of Utah Study, EFRI submitted a *Contaminant Investigation Report, White Mesa Uranium Mill Site, Blanding Utah*, dated December 30, 2009, as amended ("CIR") in connection with the nitrate/chloride plume at the Mill site. In the CIR, EFRI observed that a historical pond had existed for many years at a location upgradient from MW-27 and much closer to MW-27 than the wildlife ponds. This historical pond could also have been a contributor of surface water to MW-27.

4.0 RESULTS OF ANALYSIS

This section describes the results of the analysis, a summary of which is displayed in Appendix B-1, Appendix C-1, Appendix D-1, and Appendices E-1 through E-3.

4.1 Constituents in Wells with Previously Identified Rising Trends

Constituents with previously identified rising trends, as shown in Table 2, were subjected to a geochemical analysis that compared current data and analysis to the results of analysis at the time of the Background Reports to determine if the behavior of the well had changed since the dates of those reports.

4.1.1 Manganese

Manganese in MW-11 was found to have a significantly increasing trend at the time of the Background Report, as indicated in Appendix E-1. At the time of the Existing Wells Background Report, concentrations of manganese were below the GWQS of 800 µg/L and also below the average concentrations of manganese found in other wells at the site, which ranged from non-detect to over 5,000 µg/L (see Table 16 of the Existing Wells Background Report and Table 10 of the New Wells Background Report). The mean manganese concentration in MW-11 at the time of the Existing Wells Background Report was 87.75 µg/L, and the GWCL was set at 131.29 µg/L.

As indicated in Appendix E-1, manganese continues to demonstrate a significantly increasing trend. The mean concentration of manganese in MW-11 at the time of this SAR is now 104.89 µg/L (Appendix B-1), which is still well below the GWQS of 800 µg/L.

Regression plots for the indicator parameters chloride, sulfate, fluoride, and uranium at the time of this SAR and the time of the Existing Wells Background Report are provided in Appendices E-2 and E-3, respectively. A review of these regression plots shows that the well is not behaving differently now than it was at the time of the Existing Wells Background Report. Sulfate concentrations in MW-11 are significantly increasing, as they were at the time of the Existing Wells Background Report. In Section 11.2 of the Existing Wells Background Report, we noted that a number of wells, including MW-11, had significantly increasing trends in sulfate, but that the most significant increasing trend, which represented the highest percentage increase in sulfate, was in upgradient well MW-18. This fact, and the fact that none of the wells with increasing trends in sulfate had significant increasing trends in chloride, led to the conclusion in the Background Reports that the increasing trends in sulfate at the Mill site were due to natural causes. Chloride concentrations in MW-11 are now significantly decreasing, whereas at the time of the Existing Wells Background Report they were not trending at all, and fluoride and uranium

continue to not demonstrate a significantly increasing trend. In fact, uranium is trending (albeit not significantly) downwards.

Further, as noted in Section 3.3 above, MW-11 was included in the University of Utah Study, where Hurst and Solomon concluded that "[s]table 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." With regard to MW-11, specifically, Hurst and Solomon concluded that "[s]amples from MW-11 . . . contained the largest amounts of terrigenic helium and thus contain the largest components of old water," and "MW-11 does not show an evaporated signal suggesting that neither pond water or leakage from tailing cells is present at this well today."

As a result of the foregoing, no significant changes were identified that would suggest that the previous analysis conducted in the Existing Wells Background Report for Manganese in MW-11 has changed. We have therefore concluded that the increasing trend in Manganese in MW-11 continues to be caused by natural influences and that the resulting exceedances are due to natural influences. The GWCL for manganese in MW-11 should therefore be changed to reflect these influences. As a result, we propose a new GWCL for manganese in MW-11 of 164.67 µg/L, which, in accordance with the Flow Sheet, is based on mean + 2σ, based on all data available to date (Appendix B-1).

4.1.2 Selenium

Concentrations of selenium in MW-12 and in far downgradient well MW-3 were each identified as having a significantly increasing trend at the time of the Existing Wells Background Report. Significantly increasing trends of selenium concentrations were also identified in upgradient well MW-19 at that time and as of the date of this SAR (see Appendix E-1). Indicator parameter uranium in MW-12 is showing a significantly increasing trend, which was also identified at the time of the Existing Wells Background Report. Other indicator parameters in MW-12 are not showing significantly increasing trends. See Appendices E-2 and E-3 for indicator parameter regression plots at the time of this SAR and the time of the Existing Wells Background Report, respectively.

Indicator parameters fluoride, sulfate, and uranium in MW-3 are showing statistically significant trends at the time of this SAR (see Appendix E-2). Sulfate and uranium were also trending upward significantly at the time of the Existing Wells Background Report (see Appendix E-3), while the statistically significant increasing trend in fluoride in MW-3 is a newly identified trend. However, chloride in MW-3 is not trending upward significantly today nor was it trending upward significantly at the time of the Existing Wells Background Report (see Appendices E-2

and E-3). Although fluoride is an indicator parameter and has recently demonstrated an upward trend, MW-3 is approximately 2,000 feet downgradient from the Mill's tailings cells, and it is extremely unlikely that any potential tailings cell leakage could reach MW-3 during the 30 years that the Mill has been in operation. As indicated in Section 4.2 of HGC (2012b), the estimated average travel time for a conservative solute, assuming no hydrodynamic dispersion, from tailings cell 4B to Ruin Spring along a path that crosses near MW-3, is 0.90 feet/year. It would therefore be expected to take over 2,000 years for any potential tailings solutions from the tailings cells to reach MW-3. Further, and more importantly, it is inconceivable that, even if any potential tailings cell leakage could have reached MW-3 in the 30 years of Mill operations, a rising trend in fluoride would be observed without an equal or more pronounced rising trend in chloride. We can therefore conclude that the rising trend in fluoride in MW-3, like the rising trends in sulfate and uranium, has not been caused by Mill operations, and is the result of natural influences.

Further, as noted in Section 3.3 above, MW-3 was included in the University of Utah Study, where Hurst and Solomon concluded that "[s]table 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." With regard to MW-3, specifically, Hurst and Solomon (2008) concluded that "[m]onitoring wells MW-3, MW-3A, . . . MW-18, . . . have more depleted $\delta^{18}O$. These wells have elevated uranium concentrations, but as they do not bear an evaporated stable isotope signal it does not appear that the elevated uranium values are the result of leakage from tailing cells (or wildlife ponds)."

Because selenium has been identified as having significantly increasing trends in upgradient (MW-19) and far downgradient wells at the site, and because the wells in question (MW-12 and MW-3) do not show a significant change in behavior, in the case of MW-12, or a change in behavior that could conceivably be caused by Mill operations in the case of MW-3, selenium in these wells can be attributed to natural causes.

The GWCLs for selenium in MW-12 and MW-3 should therefore be changed to reflect these natural influences. The current GWCLs for selenium in MW-12 and MW-3 are 25 µg/L and 37 µg/L, respectively, which were both below the GWQS of 50 µg/L. The newly proposed GWCLs for selenium in MW-12 and MW-3 are 39 µg/L and 52.8 µg/L, respectively (Appendix B-1). In accordance with the Flowsheet, these proposed GWCLs represent the highest historical value of selenium in each of the wells.

4.1.3 Thallium

A statistically significant increasing trend in thallium was identified in MW-18 at the time of the Existing Wells Background Report (see Appendix E-1). The results of the geochemical analysis show that thallium concentrations in MW-18 continue to exhibit a statistically significant increasing trend (see Appendix E-1). As indicated in Appendix E-2, indicator parameters chloride, sulfate, and uranium are showing significantly increasing trends. Sulfate and uranium were identified as having significantly increasing trends at the time of the Existing Wells Background Report (see Appendix E-3). An increasing trend in chloride was observed in MW-18 at the time of the Existing Wells Background Report, although it was not statistically significant at that time (see Appendix E-3 and Section 12 of the Existing Wells Background Report). This increasing trend in chloride is now significant. However, MW-18 is located so far upgradient from the Mill site that these trends could not possibly be impacted by Mill activities. In addition, as discussed in more detail in Section 3.3 above, MW-18 was included in the University of Utah Study in which Hurst and Solomon concluded that "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 concentrations." Hurst and Solomon made this conclusion in light of the documented trends in thallium, sulfate, and uranium in MW-18 at that time.

A possible explanation for the increasing trend in chloride in MW-18, along with increasing trends in uranium and chloride in nearby upgradient well MW-19, was discussed in detail in Section 12 of the Existing Wells Background Report, where it was posited that the increasing trends in uranium and chloride in those wells could be attributed to the rise in water levels seen in the wells since 1993 that have resulted from the periodic recharge of the upper wildlife pond at the Mill site. Another possible explanation for the increasing trend in chloride in MW-18 is influence from the nitrate/chloride plume, which has been observed at locations upgradient of the Mill site. Therefore the now-significant increasing trend in chloride in MW-18 is not unexpected and is consistent with the previous observations in the Existing Wells Background Report. In any event, given the location of MW-18, the increasing trends in the constituents in MW-18, including the increasing trends in the indicator parameters, cannot possibly be due to Mill influences.

Therefore, we have concluded that the behavior of constituents in MW-18 has not changed significantly since the time of the Background Reports. The trend in thallium concentrations in MW-18 is therefore the result of natural background influences.

The current GWCL for thallium in MW-18 is 1.95 mg/L, which is below the GWQS of 2.0 mg/L. Appendix B-1 sets out a revised GWCL for thallium in MW-18 of 4.0 mg/L based on the highest historic value, in accordance with the Flowsheet. That would be the appropriate GWCL,

were a revised GWCL to be adopted. However, for the reasons discussed in Section 3.2 above, EFRI is not proposing that such a revised GWCL be adopted for MW-18. Rather, as discussed in Section 3.2 above, EFRI proposes that the GWDP be amended to remove all GWCLs from MW-18 and upgradient wells MW-1 and MW-19.

4.1.4 Uranium

Uranium in MW-26 was identified as having a statistically significant increasing trend at the time of the Existing Wells Background Report and continues to have a significant increasing trend today (see Appendix E-1). Since MW-26 is a pumping well associated with the existing chloroform plume at the Mill site, there are many factors at play, which are discussed in more detail in Section 4.2 below.

The geochemical analysis of uranium and other indicator parameters in MW-26 shows that the behavior in the well, while inconsistent and erratic, has not changed significantly since the time of the Existing Wells Background Report. As mentioned above, uranium concentrations in MW-26 continue to show a significantly increasing trend. A newly identified significantly increasing trend in chloride was identified, which could represent water drawn into the well from the nitrate/chloride plume and/or the chloroform plume (which is also associated with relatively high concentrations of chloride). Other indicator parameters, namely fluoride and sulfate, were not found to have significantly increasing trends at the time of the Existing Wells Background Report or at the time of this SAR. See Appendices E-2 and E-3 for regression plots for these indicator parameters at the time of this SAR and the Existing Wells Background Report, respectively.

Because MW-26 continues to demonstrate erratic behavior consistent with its behavior at the time of the Existing Wells Background Report, and for the reasons discussed in more detail in Section 4.2 below relating to pumping wells generally, we have concluded that the behavior of the constituents in MW-26 has not changed significantly since the Existing Wells Background Report.

The current GWCL for uranium in MW-26 is 41.85 µg/L, which is above the GWQS of 30 µg/L. Appendix B-1 sets out a revised GWCL for uranium in MW-26 of 79.57 µg/L, based on mean + 2 σ using all available data, in accordance with the Flowsheet. That would be the appropriate GWCL, were a revised GWCL to be adopted. However, as discussed in the July 13, 2011 Initial Plan and Time Schedule and in Sections 3.2 and 4.2 of this report, since GWCLs for pumping wells have no meaning, EFRI does not propose that a revised GWCL for uranium in MW-26 be adopted. Instead, EFRI proposes that all GWCLs in MW-26 be eliminated.

4.2 Constituents in Pumping Wells

The geochemical analysis of uranium in MW-26 included identifying extreme values (of which there were none) (see Appendix B-6). The Shapiro-Wilk normality test was used to determine that the data were not normally or lognormally distributed (see Appendices B-1 and B-7). Trend tests were conducted using Mann-Kendall, and uranium showed a significantly increasing trend (see Appendices B-1, B-9, and E-1), which had been identified at the time of the Background Report (see Appendix E-1).

Indicator parameters were analyzed using box plots to identify and omit extreme outliers, and the Shapiro-Wilk normality test was used to determine the distribution of each constituent's data set (see Appendices C-4 and C-5). Trend tests were conducted using either least squared regressions if the data were lognormally or normally distributed, or Mann-Kendall if the data were not lognormally or normally distributed (see Appendices C-1, C-6, and C-7). Chloride is the only indicator parameter which shows a significantly increasing trend, which was not previously identified at the time of the Existing Wells Background Report (see Appendices E-2 and E-3 for regression plots for the indicator constituents at the time of this SAR and the time of the Existing Wells Background Report). Fluoride is showing a significantly decreasing trend today, and there is no significant trend of sulfate in MW-26. Neither fluoride nor sulfate showed a significant trend, either increasing or decreasing, at the time of the Existing Wells Background Report.

Field measurements of pH in MW-26 were also analyzed using the same methods described above. Field pH was not lognormally or normally distributed, and the Mann-Kendall trend test showed that there was not a significantly increasing or decreasing trend in pH (see Appendices D-1 and D-5). In fact, MW-26 is one of the few wells that does not have any trend in pH.

MW-26 is being manipulated, and the impact on the quality of the water in that well from the pumping is unclear and cannot be predicted with enough certainty to establish compliance standards under the GWDP. For example, pumping wells are intended to pull water in from areas of the perched aquifer that would normally flow into other wells. In fact, the pumping wells are having the effect of drawing down water levels in other wells (e.g., see Appendix D, Figure 2, in the second quarter 2007 Chloroform Monitoring report). This water may be associated with its own background quality that will impact the water quality in the pumping well. Any increasing or decreasing trends in constituents in pumping wells, such as MW-26, are therefore not unexpected and should be given little, if any, weight in analyzing potential impacts to groundwater from Mill activities.

As stated in the September 2009 Statement of Basis (page 23) in support of the January 20, 2010, revisions to the GWDP, "[i]t should be noted that, because MW-26 is a pumping well for chloroform removal, concentrations of all constituents in that well are subject to potential

variation over time as a result of the pumping activity. This will be taken into account by the Executive Secretary in determining compliance for this well."

For informational purposes, an updated GWCL for uranium in MW-26 of 79.57 µg/L, based on mean + 2σ using all of the available data to date, has been calculated in accordance with the Flowsheet (Appendix B-1). That would be the appropriate GWCL, were a revised GWCL to be adopted. However, as discussed above, since GWCLs for pumping wells have no meaning, EFRI does not propose that a revised GWCL for uranium in MW-26 be adopted. Further, EFRI proposes that the Mill will continue to pump and monitor MW-26, but that the GWDP be amended to remove all GWCLs for all constituents in MW-26.

4.3 Constituents Potentially Impacted by Decreasing pH Trends Across the Site

A pH analysis was performed in addition to the geochemical analysis for the wells/constituents in this category (see Appendix D-1). The pH analysis included using box plots to identify and omit extreme outliers, performing the Shapiro-Wilk test of normality, and then testing for trends using either the least squares regression or the Mann-Kendall method (see Appendices D-2 through D-5). The trend analysis will determine whether the decreasing trends in pH that are apparent in almost every groundwater well across the site are statistically significant or not.

The decreasing trend in pH across the site is the subject of another report that EFRI is working on concurrently with this SAR (HGC, 2012a).

4.3.1 Cadmium

Cadmium in MW-24 may potentially be impacted by decreasing pH in that well.

Results of the geochemical analysis of cadmium concentrations in MW-24 show that there is a significantly increasing trend, which did not exist at the time of the New Wells Background Report (see Appendix E-1). However, early data show that cadmium was reported as non-detected at a Reporting Limit ("RL") of 0.5 µg/L almost exclusively from 2005-2007. These non-detected values are partially responsible for the increasing trend. More importantly, however, indicator parameters in MW-24 do not exhibit any significantly increasing trends now or at the time of the Background Report (see Appendices E-2 and E-3, respectively). For this reason, we have concluded that MW-24 is not being impacted by any potential tailings seepage.

The pH analysis in MW-24 indicates a significantly decreasing trend in pH (see Appendices D-1 and D-4). The cause of the decreasing trend in pH in MW-24, and in most other monitor wells at the site, including upgradient and far downgradient wells, is being investigated and will be the subject of a separate report (see HGC, 2012a). However, in the absence of increasing trends in

any of the indicator parameters of chloride, sulfate, fluoride, and uranium, and most particularly chloride, in MW-24, we have ruled out any potential seepage from the tailings cells as being the cause of the decreasing trend in pH in MW-24. This is because chloride moves in groundwater at the speed of water, whereas pH moves by chemical reaction. Carbonate in the subsurface formations will neutralize the pH in any potential tailings seepage, thereby increasing the pH in the seepage as it is carried by the water through the formations. As a result, any low pH associated with potential tailings seepage cannot be detected any faster than the water in the formation, and will neutralize as it flows through carbonatious formations, becoming less detectable (effectively diluted) as it travels. Since chloride moves with the speed of the water in the formation, any influence of pH cannot be detected any faster than chloride. Therefore, it is not possible to see a significant impact in the form of a declining trend in pH caused by any potential tailings seepage without also seeing a significant increase in chloride.

However, the decreasing trend in pH in MW-24 is the likely cause of the increasing trend in cadmium in that well. The dominant cadmium species in groundwater below pH values of 8.2 is Cd^{2+} (Rai and Zachara, 1984). At low pH (greater abundance of H_30^+ ions) there is greater competition for negative adsorption sites that might remove Cd^{2+} ions from solution. Therefore, Cd^{2+} concentrations are expected to increase in groundwater as pH falls.

The mobility of cadmium is therefore increased in groundwater with low pH, and since the increasing trend in cadmium cannot be correlated with a significantly increasing trend in any of the indicator parameters, the concentration of cadmium in MW-24 can be attributed to natural background and site-wide influences. The GWCL for cadmium in MW-24 should therefore be changed to reflect these natural influences.

The current GWCL for cadmium in MW-24 is 2.5 µg/L, which is below the GWQS of 5.0 µg/L. In accordance with the Flowsheet, we propose a revised GWCL for cadmium in MW-24 of 4.28 µg/L (Appendix B-1), which is the highest historical value of cadmium in MW-24.

4.3.2 Manganese

Manganese in MW-11 may potentially be impacted by decreasing pH in that well.

Results of the geochemical analysis for manganese in MW-11 are presented above in Section 4.1.1, in which we conclude that no significant changes were identified that would suggest that the previous analysis conducted in the Existing Wells Background Report for manganese in MW-11 has changed. As a result, we have concluded that the increasing trend in manganese in MW-11 continues to be caused by natural influences and that the resulting exceedances are due to natural influences.

In addition to having a previously identified increasing trend, manganese in MW-11 could also be impacted by the decreasing trend in pH across the site. An analysis performed on the field measurements for pH in MW-11 shows a significantly decreasing trend in pH (see Appendices D-1 and D-4). The cause of the decreasing trend in pH in MW-11, and in most other monitor wells at the site, including upgradient and far downgradient wells, is being investigated and will be the subject of a separate report (see HGC, 2012a). However, in the absence of increasing trends in MW-11 in any of the indicator parameters of chloride, fluoride, and uranium, and most particularly chloride, which is significantly decreasing, we have ruled out any potential seepage from the tailings cells as being the cause of the decreasing trend in pH in MW-11 for the reasons stated in Section 4.3.1 above. MW-11 has a previously identified increasing trend in sulfate, but this has been determined to be the result of natural influences (see Section 4.1.1, above).

However, the decreasing trend in pH in MW-11 is a likely cause of or contributor to the increasing trend in manganese in that well. Manganese can exist in +2, +3, +4, and +7 oxidation states. Under the reducing conditions that exist in groundwater at the Mill site, the dominant form of manganese in solution is the cation Mn^{2+}. At low pH (greater abundance of H_30^+ ions) there is greater competition for negative adsorption sites that might remove Mn^{2+} ions from solution. Therefore, Mn^{2+} concentrations are expected to increase in groundwater as pH falls.

The mobility of manganese is therefore increased in groundwater with low pH, and since the increasing trend in manganese cannot be correlated with a significantly increasing trend of any of the indicator parameters other than the previously identified increasing trend in sulfate, the concentration of manganese in MW-11 can be attributed to natural background and site-wide influences. The GWCL for manganese in MW-11 should therefore be changed to reflect these natural influences. As discussed in Section 4.1.1 above, we propose that the GWCL for manganese in MW-11 be changed to 164.67 µg/L.

4.3.3 Selenium

Selenium in MW-3, MW-3A, MW-12, and MW-30 may potentially be impacted by decreasing pH in those wells.

Results of the geochemical analysis for selenium in MW-3 and MW-12, presented in Section 4.1.2, indicate that MW-12 and MW-3 do not show a significant change in behavior, in the case of MW-12, or a change in behavior that could conceivably be caused by Mill operations in the case of MW-3, and that selenium in these wells can therefore be attributed to natural causes.

Geochemical analysis for selenium in MW-3A shows that while selenium concentrations have a significantly increasing trend today, they did not have a significantly increasing trend at the time of the New Wells Background Report (see Appendix E-1). None of the indicator parameters in MW-3A are showing significantly increasing trends today or at the time of the New Wells Background Report (see Appendices E-2 and E-3, respectively). It is also worth noting that MW-3, which neighbors MW-3A, has a significantly increasing trend in selenium and had a significantly increasing trend at the time of the Existing Wells Background Report (see Appendix E-1), which has been attributed to natural causes (see Section 4.1.2 above).

Selenium concentrations in MW-30 are showing a significantly increasing trend (see Appendix E-1). Chloride concentrations in MW-30 are also exhibiting a statistically significant increasing trend (see Appendix E-2). MW-30 is located at the margins of the nitrate/chloride plume (Figure 3), and it is likely that groundwater in this well is being impacted by that plume. As discussed in Section 5.0, the nitrate/chloride plume is already being addressed by separate corrective actions. Sulfate is showing a significant decreasing trend in MW-30, and fluoride is also showing a decreasing trend (although not statistically significant), while uranium is relatively low for the site but is showing an upward trend that is not statistically significant.

Selenium concentrations in MW-12, MW-30, and far downgradient wells MW-3 and MW-3A may be impacted by decreasing trends in pH across the site. Each of these wells has a significantly decreasing trend in pH (Appendices D-1 and D-4). Native selenium is stable in mildly oxidizing to extremely reducing conditions (Brookins, 1988). Decreasing pH may increase the solubility of native selenium (Mayland et al., 1991), which could be the cause of or contribute to the increasing trends in selenium in those wells.

For the reasons discussed in Section 4.1.2 above, we have concluded that MW-3 and MW-12 are not being impacted by any potential tailings cell seepage. For the same reasons as for MW-3, and including the fact that there are no increasing trends in any of the indicator parameters in MW-3A, we have concluded that any potential tailings cell seepage could not have impacted MW-3A, which is located right next to MW-3. As a result, decreasing trends in pH in those wells cannot be attributed to any potential tailings cell seepage. With the exception of chloride, which is associated with the nitrate/chloride plume, none of the other indicator parameters in MW-30 have exhibited increasing trends (see Appendix E-2).

Further, as noted in Section 3.3 above, MW-3, MW-3A and MW-30 were included in the University of Utah Study, where Hurst and Solomon concluded that "[s]table 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." With regard to MW-3 and MW-3A, specifically, Hurst and Solomon concluded, as noted above, that

"[m]onitoring wells MW-3, MW-3A, . . . MW-18, . . . have more depleted $\delta^{18}O$. These wells have elevated uranium concentrations, but as they do not bear an evaporated stable isotope signal it does not appear that the elevated uranium values are the result of leakage from tailing cells (or wildlife ponds)."

For these reasons, selenium concentrations in MW-3, MW-3A, MW-12, and MW-30 are the result of background and/or site-wide influences, such as the decreasing trends in pH. New GWCLs for selenium are therefore proposed as follows:

- MW-3: The current GWCL is 37 µg/L, which is lower than the GWQS of 50 µg/L. In accordance with the Flowsheet, the proposed revised GWCL is 52.8 µg/L, which is the highest historical value.
- MW-3A: The current GWCL is 89 µg/L, which exceeds the GWQS of 50 µg/L. In accordance with the Flowsheet, the proposed revised GWCL is 109.58 µg/L, which is mean + 2σ, based on all data available to date.
- MW-12: The current GWCL is 25 µg/L, which is lower than the GWQS of 50 µg/L. In accordance with the Flowsheet, the proposed revised GWCL is 39 µg/L, which is the highest historical value.
- MW-30: The current GWCL is 34 µg/L, which is lower than the GWQS of 50 µg/L. In accordance with the Flowsheet, the proposed revised GWCL is 47.2 µg/L, which is the highest historical value.

4.3.4 Thallium

Thallium in MW-18 and MW-24 may potentially be impacted by decreasing pH in those wells. Both MW-18 and MW-24 have significantly decreasing trends in pH (see Appendices D-1 and D-4).

The results from the geochemical analysis of thallium in upgradient well MW-18 are presented in Section 4.1.3 above, because thallium in MW-18 was also identified as having an increasing trend at the time of the Existing Wells Background Report. In that analysis, we concluded that the behavior of constituents in MW-18 has not changed significantly since the time of the Existing Wells Background Report, and that the trend in thallium concentrations in MW-18 is therefore the result of natural background influences.

Geochemical analysis of thallium in MW-24 showed a significantly increasing trend at the time of this SAR, but not at the time of the New Wells Background Report (see Appendix E-1). This increasing trend could be partially related to the early non-detected data (Appendix E-1), or to the decreasing trend in pH. Indicator parameters chloride, fluoride, sulfate, and uranium in MW-24

do not show any significantly increasing trends at the time of the New Wells Background Report or at the time of this SAR (see Appendices E-2 and E-3, respectively).

For the reasons discussed in Sections 4.1.3 and 4.3.1 above, we have concluded that potential tailings cell seepage is not impacting MW-18 or MW-24. In particular, there are no increasing trends in any of the indicator parameters in MW-24, and MW-18 is located far upgradient from the Mill site. As a result, decreasing trends in pH in those wells cannot be attributed to any potential tailings cell seepage.

However, the decreasing trends in pH in MW-18 and MW-24 are a likely cause of or contributor to the increasing trends in thallium in those wells. Under the reducing conditions that exist in groundwater at the Mill site, the dominant form of thallium in solution is the cation Tl^+. At low pH (greater abundance of H_30^+ ions) there is greater competition for negative adsorption sites that might remove Tl^+ ions from solution. Therefore, Tl^+ concentrations are expected to increase in groundwater as pH falls.

The mobility of thallium may therefore be increased in groundwater with a low pH. For these reasons, thallium concentrations in MW-18 and MW-24 are considered to be the result of background and site-wide influences.

The GWCL for thallium in MW-24 should therefore be changed to reflect these natural influences. The current GWCL for thallium in MW-24 is 1 µg/L, which is lower than the GWQS of 2 µg/L. The proposed GWCL for thallium in MW-24 is 1.57 µg/L, which, in accordance with the Flowsheet, is the highest historical value, based on the high number of non-detected values in that data set (50 percent).

If a revised GWCL were to be set for thallium in MW-18, it would be 1.57 µg/L, in accordance with the Flowsheet (Appendix B-1). However, as discussed in Sections 3.2 and 4.1.3 above, we do not believe GWCLs should be set for MW-18 and upgradient wells MW-1 and MW-19, and EFRI proposes that the GWDP be amended to remove all GWCLs from those wells.

4.3.5 Uranium

Uranium in MW-5, MW-25, and MW-26 may potentially be impacted by decreasing pH.

As discussed below, uranium is potentially impacted by decreases in pH. Four wells have exceedances in uranium: MW-26, MW-25, MW-5, and MW-35. MW-35 is a new well for which background is currently being established, and is addressed in Section 4.4, below. Uranium in MW-26, MW-25 and MW-5 is addressed below.

The geochemical results and circumstances surrounding the concentrations of uranium in pumping well MW-26 have been discussed in Sections 4.1.4 and 4.2, above. As mentioned in Section 4.2, above, pH is not showing a decreasing trend in MW-26. However, for the reasons discussed in Sections 4.1.4 and 4.2, MW-26 is being manipulated, and the impact on the quality of the water in that well from the pumping is unclear and cannot be predicted with enough certainty to establish compliance standards under the GWDP. Therefore, since GWCLs for pumping wells have no meaning, EFRI does not intend to propose revised GWCLs for MW-26 (although the revised GWCL that would be established by application of the Flowsheet is set out in Section 4.1.4 above).

The geochemical analysis of uranium in MW-25 shows a significantly increasing trend at the time of this SAR, but not at the time of the New Wells Background Report (see Appendix E-1). However, other indicator parameters (chloride, fluoride, and sulfate) do not exhibit statistically significant increasing trends at this time or at the time of the New Wells Background Report (see Appendices E-2 and E-3). In fact, chloride, fluoride, and sulfate are trending downward. The pH analysis showed that pH in MW-25 is significantly decreasing (see Appendices D-1 and D-4). For the reasons discussed in Section 4.3.1 above, decreasing pH without increasing chloride is not indicative of any potential tailings cell leakage. We have therefore concluded that potential tailings cell seepage is not impacting MW-25. In particular, there are no increasing trends in any of the indicator parameters in MW-25 other than uranium. It is extremely unlikely that any potential tailings cell seepage could be impacting MW-25 without an increasing trend in chloride and the other indicator parameters. As a result, neither the decreasing trend in pH nor the increasing trend in uranium in MW-25 can be attributed to any potential tailings cell seepage.

MW-5 is one of the original monitoring wells at the Mill site. The time versus concentration plot for the second quarter of 2012 (DUSA, 2012), a copy of which is included in Appendix E-1, shows that since the end of 2010, concentrations of uranium in MW-5 have been erratic and have included some values that are an order of magnitude higher than the mean. Two of these values, the 11/11/2010 value of 11.6 µg/L, and the 02/14/2011 value of 29.5 µg/L, have caused the exceedances that have led to MW-5 being listed on Table 1. Since then, an additional elevated value of 18.6 µg/L was reported during the first quarter of 2012. These concentrations are unusually high for this well. Geochemical analysis of uranium in MW-5 requires identification and omission of extreme outliers (any value over three times the standard deviation on either side of the mean) (see the Flowsheet, Appendix F). After the extreme outliers were identified and omitted (Appendix B-2), there were no longer any values that were out of compliance. The five values that were identified and omitted are listed in Table 5:

Table 5
Extreme Outliers Identified and Omitted from Geochemical Analysis

Date	Uranium (µg/L)
11/11/2010	11.60
02/14/2011	29.50
04/12/2011	7.16
10/10/2011	4.52
02/28/2012	18.60

After these values were omitted, the test for normality showed that the data set was neither normal nor lognormal, therefore subjecting these data to Mann-Kendall trend analysis. The trend analysis performed on the data with extreme outliers removed, as required by the Flowsheet, shows a significantly decreasing trend at this time (see Appendix E-1). This decreasing trend, although not significant, was also identified at the time of the Existing Wells Background Report (see Appendix E-1). Chloride and sulfate concentrations are not significantly increasing at this time or at the time of the Existing Wells Background Report (see Appendices E-2 and E-3). Concentrations of fluoride in MW-5 are significantly increasing, and this trend was also identified at the time of the Existing Wells Background Report (see Appendices E-2 and E-3). However, fluoride concentrations in MW-5 appear to be decreasing since 2008.

Exploratory statistics were also performed on the uranium data set from MW-5. The same steps of the geochemical analysis were performed on the data while including the identified extreme outliers in the data set. The results of these exploratory statistics are displayed in Table 6 below. The data are still not normal or lognormal, requiring the trend analysis to be done using Mann-Kendall. The Mann-Kendall trend test did not identify a statistically significant increasing trend in the uranium data from MW-5 with the extreme outliers included.

Table 6
Exploratory Statistics Performed on Uranium in MW-5

Data	N	Mean	SD	W	p	S	p	Significant Trend	Mean + 2 σ
Without Extremes	87	0.95	0.69	0.943681	0.000878	-917	3.75E-04	decreasing	2.3218
With Extremes	92	1.674	3.76	0.3348	0	-484	0.0511	none	9.185232

Note: Acronyms for Table 6 are defined in Appendix B-1.

It is extremely unlikely that any potential uranium from mill tailings would travel to MW-5 faster than chloride or sulfate. The results of the geochemical analysis on indicator parameters

show a significantly decreasing trend in chloride in MW-5, and a decreasing trend in sulfate, although that trend is not statistically significant.

Further, as noted in Section 3.3 above, MW-5 was included in the University of Utah Study, where Hurst and Solomon concluded that "[s]table 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." These observations were made in light of the documented rising trend in fluoride in MW-5 at that time.

Uranium oxides are stable mineral phases at mildly to strongly reducing conditions such as those found in groundwater at White Mesa (Brookins, 1988). A decrease in pH increases the solubility of uranium oxides, causing concentrations of uranium to increase in groundwater. The mobility of uranium in groundwater may therefore be increased in groundwater with a low pH. The pH analysis shows pH is significantly decreasing in MW-25 and it is decreasing in MW-5, although not statistically significantly in MW-5 (see Appendices D-1 and D-4).

For the reasons described above, uranium in MW-5, MW-25, and MW-26 can be attributed to natural background and site-wide influences. The GWCL for uranium in MW-25 should therefore be changed to reflect these natural influences. The current GWCL for uranium in MW-25 is 6.5 µg/L, which is lower than the GWQS of 30 µg/L. In accordance with the Flowsheet, the proposed GWCL for uranium in MW-25 is 7.25 µg/L, which is mean + 2σ, based on all data available to date.

The current GWCL for uranium in MW-5 is 7.5 µg/L, based on the Fractional Approach, which is lower than the GWQS of 30 µg/L. In accordance with the Flowsheet, the proposed GWCL for uranium in MW-5 would remain at 7.5 µg/L, based on the Fractional Approach. The application of the Flowsheet would therefore result in no change to the GWCL for MW-5 in light of natural increases in background.

EFRI therefore proposes that the current GWCL for uranium in MW-5 of 7.5 µg/L be retained at this time, as required by the flowsheet, and that EFRI and DRC discuss further study for uranium in MW-5 to determine the recent variability in uranium in that well. Possible avenues for further study include taking split samples from the well to rule out laboratory error, and an evaluation of the integrity of the well.

4.4 Newly Installed Wells with Interim GWCLs

As described in Section 3.1.4, MW-35 is a newly installed well that had GWCLs set by the Director as an interim measure. A background report for all GWDP constituents in MW-35 is being prepared by EFRI concurrently with this SAR.

For completeness, a geochemical analysis for the indicator parameters (chloride, sulfate, and fluoride) has been performed. The results of the geochemical analysis show that none of the aforementioned constituents have a statistically significant increasing trend (see Appendix E-2). The concentrations of all constituents in MW-35 are likely to be consistent with background.

4.5 Other Constituents and Wells

The wells and constituents in this category were subjected to the same geochemical analysis as the categories above. The primary focus of this analysis was to determine whether or not there is any new information that would suggest that the previous analysis conducted in the Background Reports has changed since the dates of those reports.

4.5.1 Total Dissolved Solids (TDS)

The concentration of TDS has been out of compliance in MW-18, MW-27, and MW-31, as indicated in Table 1 above.

The results of the geochemical analysis of TDS in MW-18 show that concentrations are significantly trending upwards (see Appendices B-1 and E-1). As discussed in Section 4.1.3 above, indicator parameters chloride, sulfate, and uranium are showing significantly increasing trends in MW-18 at the time of this SAR (see Appendix E-2). Sulfate and uranium were identified as having significantly increasing trends at the time of the Existing Wells Background Report (see Appendix E-3). The significantly increasing trend in chloride is a newly identified trend, but was contemplated at the time of the Existing Wells Background Report (see the discussion in Section 4.1.3 above). MW-18 is located upgradient of the Mill site, and cannot be impacted by Mill site activities. The behavior of constituents analyzed in this study (thallium, TDS, and indicator parameters) in this well has not changed significantly since the time of the Existing Wells Background Report. In addition, MW-18 was included in the University of Utah Study, in which Hurst and Solomon (2008) concluded that "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 concentrations." These conclusions were made in light of the increasing trends in thallium, sulfate and uranium in MW-18 at that time. Therefore, for the reasons discussed in detail in Section 4.1.3 above, MW-18 is not being impacted by Mill activities, and the increasing trend in TDS concentrations in MW-18 is therefore the result of natural background influences.

The geochemical evaluation of TDS in MW-27 and MW-31 shows that TDS concentrations in these wells are exhibiting statistically significant increasing trends at this time, although not at the time of the New Wells Background Report (see Appendix E-1). Indicator parameters chloride and sulfate are also showing significantly increasing trends in these wells today, but not at the

time of the New Wells Background Report, although fluoride and uranium are currently showing significant downward trends in MW-27, fluoride is showing a significantly decreasing trend and uranium is trending downward in MW-31 (see Appendices E-2 and E-3). The location of these two wells is important when determining potential sources of contamination. Both MW-27 and MW-31 are located at the margin of the nitrate/chloride plume (Figure 3), which has been the subject of many studies that are described in detail in the following reports:

- Nitrate Contamination Investigation Report (INTERA, 2009)
- Quarterly Nitrate Reports (EFRI, 2009–2012)

A mass balance was performed and presented in the December 30, 2009, Nitrate Contamination Investigation Report, where one of the suggested possibilities was a groundwater mound from the tailings cells that might cause elevated nitrate and chloride concentrations upgradient in the area of the nitrate/chloride plume. The nitrate/chloride plume with associated sulfate in groundwater is the cause of the increase in TDS observed in monitor wells MW-27 and MW-31 located at the margins of the plume in areas where increases would be expected. A calculation for nitrate to evaluate this possibility (a calculation for chloride would be similar) suggests that on the order of 11 percent tailings solution (assuming the highest recently observed nitrate concentration in the tailings of 290 mg/L) would have to mix with unimpacted groundwater (assuming 1 mg/L) to account for the observed mass of nitrate in groundwater, assuming an average nitrate concentration in the plume above the 20 mg/L isopleth of 30 mg/L.

The size of the nitrate plume above 20 mg/L is approximately 40 acres, or 1,800,000 square feet in map area. Assuming 45 feet of saturation (INTERA, 2009) and a porosity of 0.2, there are 16,200,000 cubic feet or 121,176,000 gallons of groundwater in that area. Eleven percent of that is 13,329,360 gallons (approximately 41 acre feet), which is a conservative estimate of the volume of tailings solution that would have to be mixed with groundwater to account for the mass of nitrate in the portion of the plume above 20 mg/L nitrate.

Assume:

- Nitrate concentration in tailings solution 290 mg/L
- Nitrate concentration in un-impacted groundwater 1 mg/L
- Average plume concentration 30 mg/L

Mixing equation: $C_t*V_t + C_g*V_g = C_m*V_m$ (eq 1)

Where: C_t = Concentration of nitrate in tailings solutions

V_t = Volume of tailings solutions

C_g = Concentration of nitrate in unimpacted groundwater

V_g = Volume of unimpacted groundwater

C_m = Concentration of nitrate in mixture of groundwater and tailings solutions

V_m = Volume of mixture of groundwater and tailings solutions

Another equation: $V_t + V_g = V_m$ (eq 2)

Substituting eq2 in eq1: $C_t*V_t + C_g*V_g = C_m* (V_t + V_g)$ (eq 3)

Substitute nitrate concentrations in eq 3:

$290*V_t + 1*V_g = 30*(V_t + V_g)$

$290*V_t + 1*V_g = 30*V_t + 30*V_g$

$260*V_t = 29*V_g$

$V_t = 29/260*V_g = 0.11*V_g$

The volume of tailings solution would have to be 11 percent of the volume of un-impacted groundwater in the mixture.

That theoretical volume of potential seepage from the tailings cells would certainly generate a detectable groundwater mound. Such a mound would have to be on the order of 5 feet on average over the entire 40 acres, but would likely be much higher than that at the centroid of the theoretical plume (beneath the tailings cells) and would taper off toward the edges of the plume. However, no such mounding exists under the tailings cells. While groundwater mounding can be observed towards the eastern portion of the site, away from the tailings cells, it is clearly related to the wildlife ponds and not the tailings cells. Equally as important, if the concentration of nitrate in tailings documented in the Statement of Basis for the 2005 GWDP (24 mg/L) or as documented in the annual tailings sampling and analysis, were used in the calculation, no amount of tailings solution would bring the plume concentration to 30 mg/L.

It is also important to note that, as discussed in more detail in Section 3.3 above, MW-27 and MW-31 were included in the University of Utah Study, in which Hurst and Solomon concluded that "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 concentrations." With respect to MW-27, specifically, Hurst and Solomon noted that "$D^{34}S$-SO_4 and $ð^{18}O$-SO_4 fingerprints closely relate MW-27 to wildlife pond water, while the exceptionally low concentration of sulfate in MW-27, the only groundwater site to exhibit sulfate levels below 100 mg/L, suggest no leachate from the tailings cells has reached the well."

We therefore conclude that the increased nitrate and chloride concentrations around MW-27 and MW-31 are not caused by any potential tailings cell seepage. Since nitrate and chloride form a substantial part of TDS, it is expected that increases in nitrate and chloride in MW-27 and MW-31 would lead to corresponding increases in TDS in those wells. As a result, the out-of-compliance status of TDS in MW-27 and MW-31 is likely due to the impacted groundwater of the nitrate/chloride plume.

Since the nitrate/chloride plume is being addressed separately, we propose that the GWCLs in MW-27 and MW-31 be adjusted to take the nitrate/chloride plume into account. The current GWCLs for TDS in MW-27 and MW-31 are 1,075 and 1,320 mg/L, respectively. The newly calculated proposed GWCLs for TDS in MW-27 and MW-31 are 1,185.72, and 1,410.57 mg/L, respectively, which were calculated in accordance with the Flowsheet as the mean + 2σ, based on all data available to date.

For the reasons discussed in Section 3.2 above, EFRI proposes that the GWCL for TDS in MW-18 be eliminated. However, Appendix B-1 sets out a revised GWCL for TDS in MW-18 of 3,280 mg/L were such a GWCL to be adopted.

4.5.2 Sulfate

Sulfate concentrations have been out-of-compliance in MW-31 and far downgradient well MW-3A.

The geochemical analysis of sulfate in MW-3A shows that there is not a statistically significant increasing trend at the time of this SAR or at the time of the New Wells Background Report (see Appendix E-1). Other indicator parameters (chloride, fluoride, and uranium) do not exhibit significantly increasing trends at the time of this SAR or at the time of the Background Report (see Appendices E-2 and E-3). Although sulfate is an indicator parameter, it is not demonstrating an upward trend. Further, MW-3A is approximately 2,000 feet downgradient from the Mill's tailings cells, and it is extremely unlikely that any potential tailings cells leakage could reach MW-3A during the 30 years that the Mill has been in operation. As indicated in Section 4.2 of HGC (2012b), travel times in the perched aquifer at the Mill are estimated to be 0.9 feet per year in the area between the Mill's tailings cells and MW-3A, resulting in a travel time of over 2,000 years from the tailings cells to MW-3A. Further, and more importantly, even if any potential tailings cell leakage could have reached MW-3A in the 30 years of Mill operations, a rising trend in chloride would be observed before any other individual constituents would be impacted in that well. We can therefore conclude that the sulfate in MW-3A has not been caused by Mill operations and is the result of natural influences.

As discussed in Section 4.5.1 above, MW-31 is located on the downgradient margin of the nitrate/chloride plume (Figure 3). Sulfate in MW-31 has a significantly increasing trend (see

Appendix E-2). This trend was not apparent at the time of the Background Report (see Appendix E-3). TDS and indicator parameter chloride are also showing significantly increasing trends (see Appendices E-1 and E-2), although fluoride is showing a significantly decreasing trend and uranium is trending downward in MW-31.

As discussed above, MW-3A and MW-31 were included in the University of Utah Study, where Hurst and Solomon concluded that "[s]table 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." However, groundwater in MW-31 is being impacted by the nitrate/ chloride plume.

Current sulfate concentrations in MW-31 are among the lowest at the Site. Other monitor wells show sulfate concentrations that are three to seven times higher than those in MW-31. A mass balance for sulfate would therefore be unlikely to be useful in identifying a potential tailings seepage source given that nearby wells all show significantly higher sulfate concentrations, which have previously been determined to represent background. Table 7 gives the range of sulfate concentrations in nearby wells.

Table 7
Sulfate Concentration Ranges in Monitor Wells near MW-32

Monitor Well	Sulfate Concentration Range (mg/L)
MW-31	436-552
MW-25	1520-2160
MW-11	895-1507
MW-29	2600-2980
MW-30	696-977

Further, the highest value (552 mg/L sulfate in November 2011) is only 7 percent higher than the average concentration of 517 mg/L, which is close to the 5 percent error for acceptable laboratory performance.

Thus, the increasing sulfate trend in MW-31 is unlikely to be the result of any potential tailings seepage, and should be attributable to natural causes. The current GWCLs for sulfate in MW-3A and MW-31 are 3,640 and 532 mg/L, respectively. Proposed GWCLs for sulfate in MW-3A and MW-31 are 3,949.27 and 552 mg/L, respectively. Both values were calculated following the Flowsheet using the updated mean + 2σ, taking into account all available data at the time of this SAR for MW-3A and the highest historical value for MW-31.

4.5.3 Fluoride

Fluoride concentrations in far downgradient well MW-3 have been out of compliance as shown in Table 1.

Results of the geochemical analysis show that concentrations of fluoride are showing a statistically significant increasing trend at this time, but did not exhibit such a trend at the time of the Existing Wells Background Report (see Appendix E-1). Indicator parameters sulfate and uranium are also showing significantly increasing trends at this time, which were identified at the time of the Existing Wells Background Report; however, chloride is not demonstrating an increasing trend at this time, nor did it demonstrate an increasing trend at the time of the Existing Wells Background Report (see Appendices E-2 and E-3).

As discussed in Section 4.1.2 above, although fluoride is an indicator parameter and has recently demonstrated an upward trend, MW-3 is approximately 2,000 feet downgradient from the Mill's tailings cells, and it is extremely unlikely that any potential tailings cell leakage could reach MW-3 during the 30 years that the Mill has been in operation. As indicated in Section 4.2 of HGC (2012b), travel times in the perched aquifer at the Mill are estimated to be 0.90 feet per year in the area between the Mill's tailings cells and MW-3, resulting in a travel time of over 2,000 years from the tailings cells to MW-3. Further, and more importantly, it is inconceivable that, even if any potential tailings cell leakage could have reached MW-3 in the 30 years of Mill operations, a rising trend in fluoride would be observed without an equal or more pronounced rising trend in chloride. We can therefore conclude that the rising trend in fluoride in MW-3, like the rising trends in sulfate and uranium, has not been caused by Mill operations, and is the result of natural influences.

Further, as noted above, MW-3 was included in the University of Utah Study, where Hurst and Solomon concluded that "[s]table 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," and that MW-3, along with MW-3A and MW-18 "have elevated uranium concentrations, but as they do not bear an evaporated stable isotope signal it does not appear that the elevated uranium values are the result of leakage from tailing cells (or wildlife ponds.)."

As a result, the GWCL for fluoride in MW-3 should be revised to reflect these natural influences. The current GWCL for fluoride in MW-3 is 0.68 mg/L, which is below the GWQS of 4 mg/L. We propose that the GWCL be updated to 2.0 mg/L for fluoride in MW-3, which was calculated following the Flowsheet using the Fractional Approach.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Background at the Mill site was recently thoroughly studied in the Background Reports and in the University of Utah Study. Both the Background Reports and the University of Utah Study concluded that groundwater at the site has not been impacted by Mill operations. Both of those studies also acknowledged that there are natural influences at play at the site that have given rise to increasing water trends and general variability of background groundwater at the site.

The focus of this SAR was therefore to identify any changes in the circumstances identified in those studies. A geochemical analysis for the indicator parameters for each of the wells (other than MW-35) in question was performed. For newly installed monitoring well MW-35, background has not yet been established, and revised GWCLs for MW-35 will be established in a separate background groundwater quality report for that well.

As identified at the time of the Background Reports, evidence of a site-wide decline in pH can be observed when plotting field measurements against time. A secondary pH analysis was performed on wells with constituents whose mobility may be affected by groundwater with low pH.

The results of the analyses show that there has not been a significant change in the behavior of most of the wells and constituents in question. This means that the exceedances observed at the Mill site in these wells are the result of natural background influences, which may include the decreasing pH across the Site.

Table 8
Summary of Findings

Well	Out-of-Compliance Constituent	Summary	Path Forward
MW-03	Fluoride	Far downgradient. No significantly increasing trend in chloride. Consistent with background conditions.	Revise GWCL
MW-03	Selenium	Far downgradient. No significantly increasing trend in chloride. Previously identified increasing trend. Consistent with background conditions.	Revise GWCL
MW-03A	Selenium	Far downgradient. No significantly increasing trends in indicator parameters. Previously identified increasing trend in neighboring well MW-3. Consistent with background conditions.	Revise GWCL
MW-03A	Sulfate	No significantly increasing trend in sulfate or any indicator parameters. Far downgradient. Consistent with background conditions.	Revise GWCL

Well	Out-of-Compliance Constituent	Summary	Path Forward
MW-05	Uranium	U and Cl in MW-5 are showing a significantly decreasing trend. Fluoride is the only significantly increasing indicator parameter. Fluoride in MW-5 was significantly increasing at the time of the background report. No exceedances after performing Flowsheet statistical analysis.	Maintain Existing GWCL, and further study
MW-11	Manganese	Previously identified increasing trend. Consistent with background conditions. Only significantly increasing indicator parameter is SO4, which was showing a significant increasing trend at the time of the background report.	Revise GWCL
MW-12	Selenium	Previously identified increasing trend. Consistent with background conditions. Only significantly increasing indicator parameter is U, which was showing a significantly increasing trend at the time of the background report.	Revise GWCL
MW-18	TDS @ 180	Far upgradient. Consistent with background conditions.	Eliminate GWCL
MW-18	Thallium	Far upgradient. Previously identified increasing trend. Consistent with background conditions.	Eliminate GWCL
MW-24	Cadmium	No significantly increasing trends in indicator parameters. Natural background influences.	Revise GWCL
MW-24	Thallium	No significantly increasing trends in indicator parameters. Natural background influences.	Revise GWCL
MW-25	Uranium	No significantly increasing trends in (other) indicator parameters.	Revise GWCL
MW-26	Uranium	Pumping well. Previously identified increasing trend.	Pumping Well, eliminate GWCL
MW-27	TDS @ 180	SO4, TDS, and Cl are showing a newly identified significantly increasing trend. MW-27 is located at the margin of the nitrate/chloride plume.	Revise GWCL, continue remedial action on the nitrate/chloride plume
MW-30	Selenium	Cl is showing a newly identified significantly increasing trend. No significantly increasing trends in other indicator parameters. MW-31 is located at the margin of the nitrate/chloride plume.	Revise GWCL, continue remedial action on the nitrate/chloride plume
MW-31	Sulfate	SO4, TDS, and Cl are showing a newly identified significantly increasing trend. MW-31 is located at the margin of the nitrate/chloride plume.	Revise GWCL, continue remedial action on the nitrate/chloride plume
MW-31	TDS @ 180	SO4, TDS, and Cl are showing a newly identified significantly increasing trend. MW-31 is located at the margin of the nitrate/chloride plume.	Revise GWCL, continue remedial action on the nitrate/chloride plume

Well	Out-of-Compliance Constituent	Summary	Path Forward
MW-35	Manganese	No significantly increasing trend in any indicator parameters. Likely background conditions for new well MW-35.	Submit Background Report for MW-35
MW-35	Uranium	No significantly increasing trend in any indicator parameters. Likely background conditions for new well MW-35.	Submit Background Report for MW-35
MW-35	Gross Alpha	No significantly increasing trend in any indicator parameters. Likely background conditions for new well MW-35.	Submit Background Report for MW-35

Increasing TDS in monitor wells MW-27 and MW-31 and increasing chloride in MW-30 are related to the nitrate/chloride plume and not to any potential tailings seepage. These wells are at the margin of the plume at locations that might be expected to see minor changes in TDS. Any potential increases in concentrations in these wells are already being addressed by the corrective action being implanted for the nitrate/chloride plume. The slight increase in sulfate in monitor well MW-31 will also be addressed by that corrective action. However, it is unlikely that the sulfate increase in MW-31 is due to any Mill-related source, given that sulfate concentrations in that well are substantially lower than any sulfate concentrations in any nearby wells.

With respect to the second quarter 2011 consecutive exceedances observed at MW-35, background has not yet been set for that well. The exceedances therefore do not represent exceedances of natural background at the site or an impact to groundwater due to Mill activities. With respect to MW-18, which is far upgradient of the Mill site, the second quarter 2011 consecutive exceedance of TDS should be considered to represent natural variation in background, without further assessment. Rising trends in other constituents in MW-18, including sulfate, which is a component of TDS, have already been analyzed in the Background Reports and University of Utah Study, and have been determined to be the result of natural background influences.

As the results of the geochemical and mass balance analysis demonstrate, each exceedance can be attributed to natural background and site-wide influences (decreasing pH) or to impacts at the Mill site that are already being addressed with corrective action. Revised GWCLs have been proposed, as appropriate. EFRI maintains that GWCLs for constituents in wells with significantly increasing trends should be revised regularly, as is recommended by the USEPA's Unified Guidance (USEPA, 2009), to account for the trends and to minimize unwarranted out-of-compliance status in such wells.

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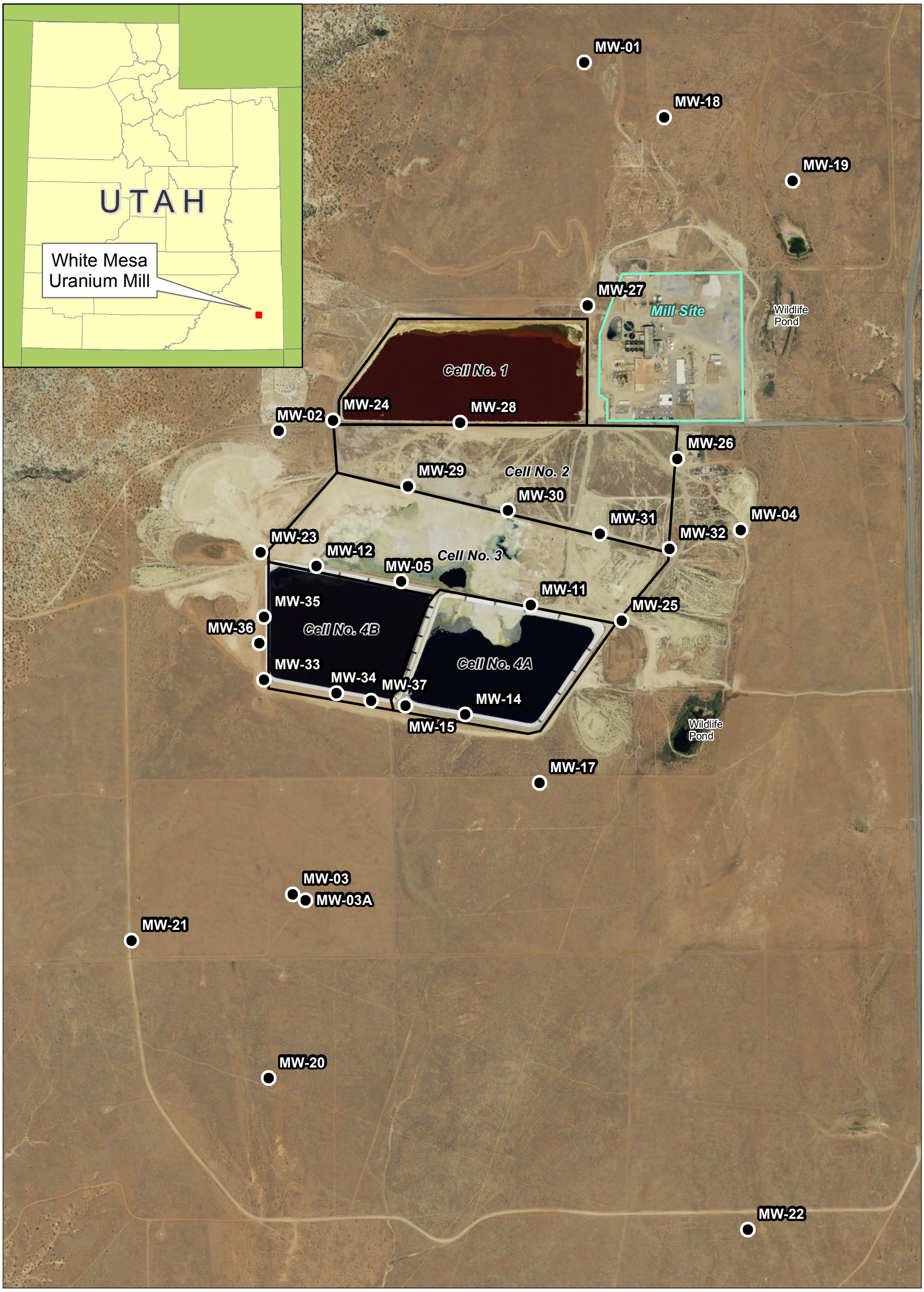
FIGURES



N

1,000 500 0 1,000
Feet

Legend
Groundwater Monitoring Wells

Source(s): Aerial – NAIP Utah 2011;
Wells – HGC, Inc., May 2008 report.

Figure 1
Location of White Mesa Mill Site
White Mesa Uranium Mill

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N

500 250 0 500
Feet

Legend

Monitoring Wells

Constituent

- Cadmium
- Fluoride
- Manganese
- Selenium
- Sulfate
- Thallium
- Uranium
- TDS

* MW-35 is a new well for which background has not yet been established. Interim GWCLs were set at a Fraction of the GWQS. Manganese, selenium, thallium, uranium, and gross alpha concentrations have exceeded the interim GWCLs.
A Background Report for MW-35 will be submitted to the Utah DRC after eight quarters of data are available for the constituents in that well.

INTERA

Source(s): Aerial – NAIP Utah 2011;
Wells – HGC, Inc., May 2008 report;

Figure 2
Wells with GWCL exceedences
during 2010, 2011, and 1Q and 2Q 2012
White Mesa Uranium Mill

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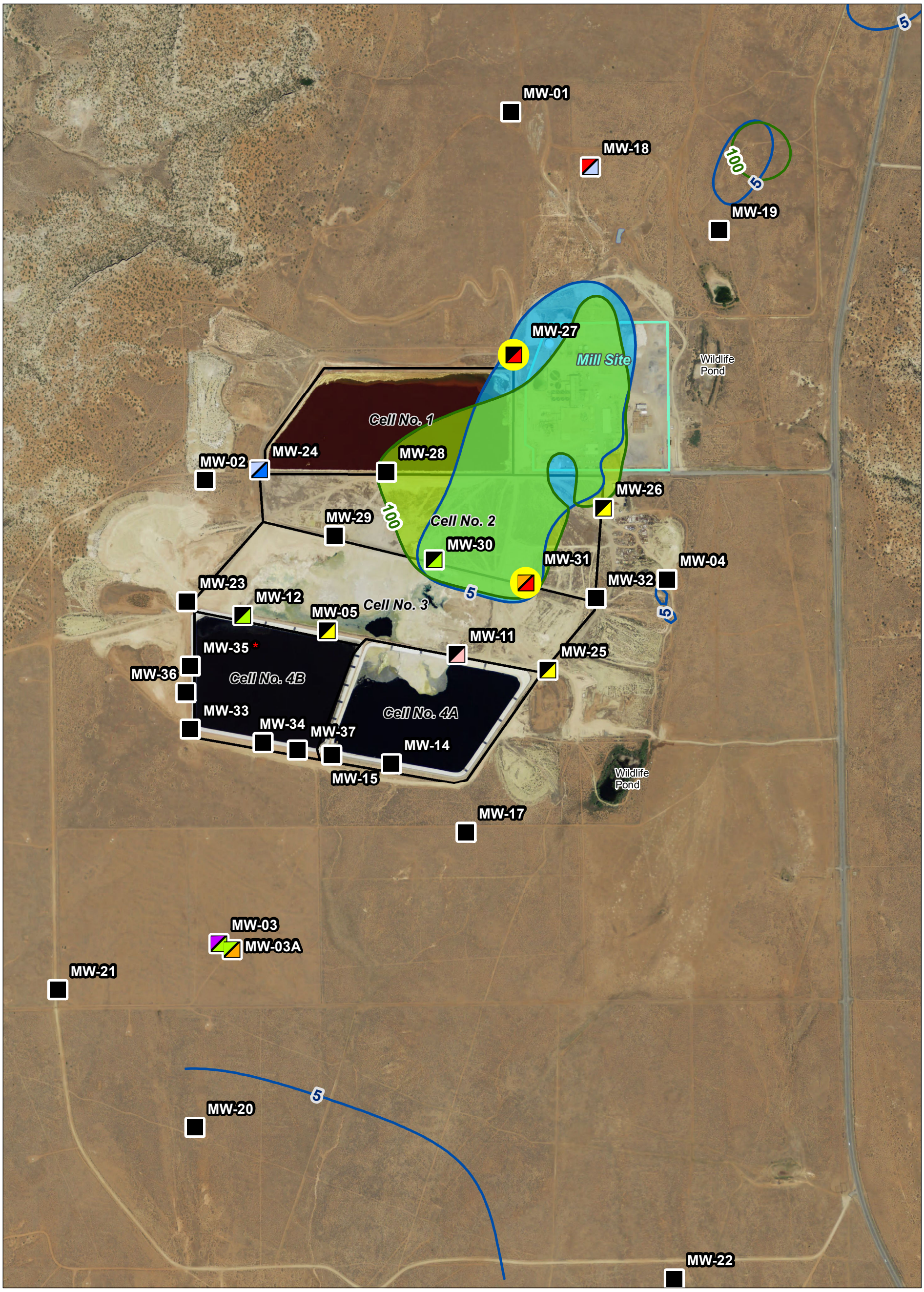

N

1,000 500 0 1,000
Feet

Legend

Monitoring Wells

Constituent

- Cadmium
- Fluoride
- Manganese
- Selenium
- Sulfate
- Thallium
- Uranium
- TDS

Chloride 100 mg/L

Nitrate 5 mg/L

* See Note Figure 2

Source(s): Aerial – NAIP Utah 2011;
Wells – HGC, Inc., May 2008 report;
Nitrate and chloride data collected June 2012.

Figure 3
Nitrate/Chloride Plume
and GWCL Exceedances
White Mesa Uranium Mill

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APPENDIX A

Exceedance Notice Table

Appendix A – GWCL Exceedances Second Quarter 2012 under the July 14, 2011 GWDP

Q1 2010 Results					Q2 2010 Results						Q3 2010 Results						Q4 2010 Results					
Monitoring Well (Water Class)	Constituent Exceeding GWCL	GWCL in July 14, 2011 GWDP	Q1 2010 Sample Date	Q1 2010 Result	Q2 2010 Sample Date	Q2 2010 Result	May 2010 Monthly Sample Date	May 2010 Monthly Result	June 2010 Monthly Sample Date	June 2010 Monthly Result	July 2010 Monthly Sample Date	July 2010 Monthly Result	August 2010 Monthly Sample Date	August 2010 Monthly Result	Q3 2010 Sample Date	Q3 2010 Result	October 2010 Monthly Sample Date	October 2010 Monthly Result	Q4 2010 Sample Date	Q4 2010 Result	December 2010 Monthly Sample Date	December 2010 Monthly Result
Required Quarterly Sampling Wells																						
MW-11 (Class II)	Manganese (ug/L)	131.29	2/10/10	***134***	4/28/10	***137***	5/24/10	122	6/16/10	99	7/20/10	123	8/25/10	138	9/8/10	128	10/20/10	***141***	11/11/10	***133***	12/15/10	***158***
	Tetrahydrofuran (ug/L)	11.5	2/10/10	***12***	4/28/10	5.2	5/24/10	<1.0	6/16/10	<1.0	7/27/10	2.17	8/25/10	<1.0	9/8/10	<1.0		<1.0		<1.0		<1.0
MW-14 (Class III)	Manganese (ug/L)	2230.30	2/2/10	2060	4/21/10	2070	5/21/10	NA	6/16/10	NA	7/20/10	NA	8/25/10	NA	9/8/10	1920	10/20/10	NA	11/10/10	1980	12/15/10	NA
	Field pH (S.U.)	6.5 - 8.5		***6.45***		***6.29***		***6.36***		***6.45***		7.19		***6.48***		6.51		6.60		***6.37***		***6.47***
MW-25 (Class III)	Field pH (S.U.)	6.5 - 8.5	2/26/2010	6.53	4/28/2010	7.2	NS	NA	NS	NA	NS	NA	NS	NA	9/8/2010	6.58	NS	NA	11/10/10	***6.36***	NS	NA
	Uranium	6.5		5.93		6.43	NS	NA	NS	NA	NS	NA	NS	NA		***6.57***	NS	NA		5.89	NS	NA
MW-26 (Class III)	Nitrate + Nitrite (as N) (mg/L)	0.62	2/2/10	***1.3***	4/22/10	***2***	5/21/10	0.3	6/16/10	0.4	7/21/10	0.6	8/16/10	0.6	9/26/10	***0.7***	10/20/10	0.4	11/15/10	0.2	12/15/10	0.4
	Uranium (ug/L)	41.8		***58.7***		***66.7***		37.4		36.6		34.4		***71.8***		***72.7***		37.5		30.4		29.6
	Chloroform (ug/L)	70		***700***		***1700***		***800***		***940***		***900***		***2800***		***2100***		***1000***		***1900***		***1400***
	Chloride (mg/L)	58.31		***72***		57		***80***		47		52		49		***64***		52		48		52
	Field pH (S.U.)	6.74 - 8.5		***6.59***		7.18		***6.36***		6.98		***6.45***		***6.39***		***6.60***		***6.61***		***6.49***		***6.45***
	Dichloromethane (Methylene Chloride) (ug/L)	5		1		***9.9***		NR		2.2		***12***		***24***		***45***		***5.5***		***16***		1.2
	TDS (mg/L)	3284.19		3100		3280		NS		NS		NS		NS		***3440***		NS		3140		NS
	Gross Alpha minus Rn & U (pCi/L)	4.69		2.4		0.6		NS		NS		NS		NS		2.5		NS		***6.4***		NS
MW-30 (Class II)	Nitrate + Nitrite (as N) (mg/L)	2.5	2/9/10	***16.1***	4/27/10	***15.8***	5/21/10	***17***	6/15/10	***15.3***	7/21/10	***16***	8/24/10	***16***	9/14/10	***15***	10/19/10	***15***	11/9/10	***15***	12/14/10	***16***
	Chloride (mg/L)	128		127		97		NS		NS	NS	NS	NS	NS		111		NS		126		NS
	Field pH (S.U.)	6.5 - 8.5		6.81		6.55		6.62		7.47	7/21/2010	6.82	8/24/10	6.73		6.80		6.77		6.75		6.65
	Uranium (ug/L)	8.32		6.82		6.82		NS		NS	NS	NS	NS	NS		7.10		NS		6.64		NS
	Selenium (ug/L)	34		32		***35.3***		NS		NS	7/27/10	33.5	8/24/10	***35.6***		32.6		32.4		32.2		30.5
MW-31 (Class III)	Nitrate + Nitrite (as N) (mg/L)	5	2/9/10	***21.7***	4/20/10	***22.5***	5/21/10	***23***	6/15/10	***21.1***	7/21/10	***20***	8/24/10	***22***	9/13/10	***21***	10/19/10	***20***	11/9/10	***20***	12/14/10	***20***
	TDS (mg/L)	1320		1150		1220	NS	NA	NS	NA	NS	NA	NS	NA		***1330***	NS	NA		1320		NS
	Chloride (mg/L)	143		128		128	NS	NA	NS	NA	NS	NA	NS	NA		139	NS	NA		138		NS
	Field pH (S.U.)	6.5 - 8.5		6.96		7.38	5/21/10	6.95	6/15/10	7.01	7/21/10	7.8	8/24/10	7.1		7.66	10/19/10	6.92		6.98		6.95
	Sulfate (mg/L)	532		507		522	NS	NA	NS	NA	NS	NA	NS	NA		527	NS	NA		***539***		NS
MW-35 (Class II)	Manganese (ug/L)	200	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	11/30/10	***698***	NS	NA
	Thallium (ug/l)	0.5	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA		***1.14***	NS	NA
	Gross Alpha minus Rn & U (pCi/L)	3.75	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA		2.6	NS	NA
	Selenium (ug/L)	12.5	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA		ND	NS	NA
	Uranium (ug/L)	7.5	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA		***27.2***	NS	NA
Required Semi-Annual Sampling Wells																						
MW-2 (Class III)	Gross Alpha minus Rn & U (pCi/L)	3.2	NS	NA		1.2	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA		***3.5***	NS	NA
MW-3 (Class III)	Selenium (ug/L)	37	NS	NA	5/3/10	***37.2***	NS	NA	NS	NA	NS	NA	NS	NA	9/20/10	35.5	NS	NA	11/19/10	***38.8***	NS	NA
	Field pH (S.U.)	6.5 - 8.5	NS	NA		***6.14 (6.25)***	NS	NA	NS	NA	NS	NA	NS	NA		***6.39***	NS	NA		***6.35***	NS	NA
	Fluoride (Mg/L)	0.68	NS	NA		***0.71***	NS	NA	NS	NA	NS	NA	NS	NA		0.63	NS	NA		***0.77***	NS	NA
MW-3A (Class III)	Field pH (S.U.)	6.5 - 8.5	NS	NA	5/4/10	***6.23 (6.24)***	NS	NA	NS	NA	NS	NA	NS	NA	9/21/10	***6.42***	NS	NA	11/22/10	***6.21***	NS	NA
	Sulfate (mg/L)	3640	NS	NA		***3680***	NS	NA	NS	NA	NS	NA	NS	NA		3630	NS	NA		***3850***	NS	NA
	TDS (mg/L)	5805	NS	NA		***5860***	NS	NA	NS	NA	NS	NA	NS	NA		5470	NS	NA		5330	NS	NA
	Selenium (ug/L)	89	NS	NA		81.4	NS	NA	NS	NA	NS	NA	NS	NA		NS	NS	NA		***94.8***	NS	NA
MW-5 (Class II)	Uranium (ug/L)	7.5	NS	NA	4/26/10	0.39	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	11/11/10	***11.6***	NS	NA
MW-12 (Class III)	Field pH (S.U.)	6.5 - 8.5	NS	NA	4/27/10	7.16	NS	NA	NS	NA	NS	NA	NS	NA	9/20/10	6.62	NS	NA	11/19/10	***6.47***	NS	NA
	Selenium (ug/L)	25	NS	NA		***25.7***	NS	NA	NS	NA	NS	NA	NS	NA		***31.9***	NS	NA		***27.6***	NS	NA
MW-15 (Class III)	Selenium (ug/L)	128.7	NS	NA	4/21/10	100	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	11/11/10	99.5	NS	NA
	Iron (ug/L)	81.7	NS	NA		ND	NS	NA	NS	NA	NS	NA	NS	NA		NA	NS	NA		ND	NS	NA
MW-18 (Class III)	Thallium (ug/l)	1.95	NS	NA	5/4/10	***3.73***	NS	NA	NS	NA	NS	NA	NS	NA	9/15/10	***3.64***	NS	NA	11/18/10	***3.57***	NS	NA
	Sulfate (mg/L)	1938.9	NS	NA		***1950***	NS	NA	NS	NA	NS	NA	NS	NA		1930	NS	NA		1910	NS	NA
	Field pH (S.U.)	6.25-8.5	NS	NA		***6.2***	NS	NA	NS	NA	NS	NA	NS	NA		7.23	NS	NA		6.37	NS	NA
	TDS (mg/L)	3198.77	NS	NA		***3280***	NS	NA	NS	NA	NS	NA	NS	NA		3190	NS	NA		3030	NS	NA

Appendix A – GWCL Exceedances Second Quarter 2012 under the July 14, 2011 GWDP

Q1 2010 Results					Q2 2010 Results						Q3 2010 Results						Q4 2010 Results					
Monitoring Well (Water Class)	Constituent Exceeding GWCL	GWCL in July 14, 2011 GWDP	Q1 2010 Sample Date	Q1 2010 Result	Q2 2010 Sample Date	Q2 2010 Result	May 2010 Monthly Sample Date	May 2010 Monthly Result	June 2010 Monthly Sample Date	June 2010 Monthly Result	July 2010 Monthly Sample Date	July 2010 Monthly Result	August 2010 Monthly Sample Date	August 2010 Monthly Result	Q3 2010 Sample Date	Q3 2010 Result	October 2010 Monthly Sample Date	October 2010 Monthly Result	Q4 2010 Sample Date	Q4 2010 Result	December 2010 Monthly Sample Date	December 2010 Monthly Result
Required Quarterly Sampling Wells																						
MW-19 (Class III)	Field pH (S.U.)	6.78-8.5	NS	NA	5/4/10	***6.61 (6.66)***	NS	NA	NS	NA	NS	NA	NS	NA	9/15/10	6.93	NS	NA	11/18/10	6.8	NS	NA
	Nitrate + Nitrite (as N) (mg/L)	2.83	NS	NA		2.6	NS	NA	NS	NA	NS	NA	NS	NA		NS	NA	NA		2.4	NS	NA
MW-23 (Class III)	Field pH (S.U.)	6.5 - 8.5	NS	NA	4/22/10	***6.18***	NS	NA	NS	NA	NS	NA	NS	NA	9/14/10	7.05	NS	NA	11/22/10	***6.44***	NS	NA
	Manganese (ug/L)	550	NS	NA		184	NS	NA	NS	NA	NS	NA	NS	NA		NS	NS	NA		65	NS	NA
MW-24 (Class III)	Cadmium (ug/L)	2.5	NS	NA	5/6/10	***4.28***	NS	NA	NS	NA	NS	NA	NS	NA	9/21/10	***5.06***	NS	NA	11/17/10	***3.22***	NS	NA
	Thallium (ug/L)	1	NS	NA		***1.3***	NS	NA	NS	NA	NS	NA	NS	NA		***1.57***	NS	NA		***1.09***	NS	NA
	Field pH (S.U.)	6.5 - 8.5	NS	NA		***5.91 (5.78)***	NS	NA	NS	NA	NS	NA	NS	NA		6.64	NS	NA		***6.1***	NS	NA
MW-27 (Class III)	Nitrate + Nitrite (as N) (mg/L)	5.6	NS	NA	5/3/10	***5.8***	NS	NA	NS	NA	NS	NA	NS	NA	9/14/10	***5.9***	NS	NA	11/12/10	***5.7***	NS	NA
	Chloride (mg/L)	38	NS	NA		***42***	NS	NA	NS	NA	NS	NA	NS	NA		***42***	NS	NA		***45***	NS	NA
	Sulfate (mg/L)	462	NS	NA		***469***	NS	NA	NS	NA	NS	NA	NS	NA		461	NS	NA		452	NS	NA
	Field pH (S.U.)	6.5-8.5	NS	NA		6.78	NS	NA	NS	NA	NS	NA	NS	NA		7.68	NS	NA		6.89	NS	NA
	TDS (mg/L)	1075	NS	NA		***1160***	NS	NA	NS	NA	NS	NA	NS	NA		1060	NS	NA		***1110***	NS	NA
	Gross Alpha minus Rn & U (pCi/L)	2	NS	NA		1.6	NS	NA	NS	NA	NS	NA	NS	NA		NA	NS	NA		***2.4***	NS	NA
MW-28 (Class III)	Chloride (mg/L)	105	NS	NA	4/19/10	***108***	NS	NA	NS	NA	NS	NA	NS	NA	9/14/10	***106***	NS	NA	11/12/10	***107***	NS	NA
	Manganese (ug/L)	1837	NS	NA		1550	NS	NA	NS	NA	NS	NA	NS	NA		NA	NS	NA		1510	NS	NA
	Field pH (S.U.)	6.1 - 8.5	NS	NA		***5.67***	NS	NA	NS	NA	NS	NA	NS	NA		***5.91***	NS	NA		***5.72***	NS	NA
MW-29 (Class III)	Iron (ug/L)	1869	NS	NA	4/27/10	1630	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA	11/9/10	1490	NS	NA
	Manganese (ug/L)	5624	NS	NA		4820	NS	NA	NS	NA	NS	NA	NS	NA			NS	NA		4890	NS	NA
	TDS (mg/L)	4400	NS	NA		4400	NS	NA	NS	NA	NS	NA	NS	NA			NS	NA		4390	NS	NA
	Field pH (S.U.)	6.46 - 8.5	NS	NA		6.82	NS	NA	NS	NA	NS	NA	NS	NA			NS	NA		***6.17***	NS	NA
MW-32 (Class III)	Gross Alpha minus Rn & U (pCi/L)	3.33	NS	NA	4/20/10	***4.5***	NS	NA	NS	NA	NS	NA	NS	NA	9/13/10	2.9	NS	NA	11/10/10	***8.8***	NS	NA
	Field pH (S.U.)	6.4 - 8.5	NS	NA		***6.03***	NS	NA	NS	NA	NS	NA	NS	NA		***6.33***	NS	NA		***6.05***	NS	NA

Notes:
GWCL values are taken from February 15, 2011 version of GWDP.
NS = Not Required and Not Sampled
NR = Required and Not Reported
NA = Not Applicable
Exceedances are shown in yellow
Values in () parentheses are the field pH measurements for the resampled analyses.

Pursuant to the October 26, 2011 DRC letter gross alpha monitoring in MW-26 returned to the routine frquency of quarterly. These samples were inadvertantly collected and are for information only.

Appendix A – GWCL Exceedances for Second Quarter 2012 under the July 14, 2011 GWDP

			Q1 2011 Results						Q2 2011 Results						Q3 2011 Results						Q4 2011 Results					
Monitoring Well (Water Class)	Constituent Exceeding GWCL	GWCL in July 14, 2011 GWDP	January 2011 Monthly Sample Date	January 2011 Monthly Sample Result	Q1 2011 Sample Date	Q1 2011 Result	March 2011 Monthly Sample Date	March 2011 Monthly Result	Q2 2011 Sample Date	Q2 2011 Result	May 2011 Monthly Sample Date	May 2011 Monthly Result	June 2011 Monthly Sample Date	June 2011 Monthly Result	July 2011 Monthly Sample Date	July 2011 Monthly Result	Q3 2011 Sample Date	Q3 2011 Result	September 2011 Monthly Sample Date	September 2011 Monthly Result	Q4 2011 Sample Date	Q4 2011 Result	November 2011 Monthly Sample Date	November 2011 Monthly Result	December 2011 Monthly Sample Date	December 2011 Monthly Result
Required Quarterly Sampling Wells																										
MW-11 (Class II)	Manganese (ug/L)	131.29	1/11/11	121	2/2/11	***145***	3/15/11	68	4/4/2011	***148***	5/10/2011	***170***	6/15/2011	121	7/6/2011	***151***	8/3/2011 8/30/11	118	9/7/2011	106	10/4/2011	112	11/9/2011	105	12/14/2011	100
	Tetrahydrofuran (ug/L)	11.5		<1.0		<1.0		<1.0		<1.0		<1.0	6/20/2011	<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0
MW-14 (Class III)	Manganese (ug/L)	2230.30	1/11/11	NA	2/7/11	2020	3/14/11	NA	4/4/2011	2140	5/10/2011	NA	6/15/2011	NA	7/5/2011	NA	8/3/2011	1990	9/8/2011	NA	10/4/2011	1960	11/9/2011	NA	12/12/2011	NA
	Field pH (S.U.)	6.5 - 8.5		***6.37***		***6.22***		6.76		6.63		***6.37***		***5.83***		***6.4***		***6.23 (6.41)***		6.50		6.71 (6.82)		6.63		6.84
MW-25 (Class III)	Field pH (S.U.)	6.5 - 8.5	1/11/11	***6.44***	2/2/11	6.66	3/15/11	6.79	4/4/2011	6.7	5/11/2011	***6.1***	6/20/2011	***5.77***	7/6/2011	***6.29***	8/3/2011 8/30/11	***6.42 (6.54)***	9/7/2011	6.54	10/4/2011	6.6	11/9/2011	6.51	1212/2011	6.87
	Uranium	6.5		***7.02***		4.77		***6.8***		5.56		***6.72***		***7.06***		***6.74***	8/3/2011	6.37		5.96		5.27		***6.56***		6.1
MW-26 (Class III)	Nitrate + Nitrite (as N) (mg/L)	0.62	1/12/11	0.2	2/16/11	0.25	3/15/11	0.6	4/1/2011	***0.8***	5/10/2011	0.4	6/20/2011	0.3	7/6/2011	***0.9***	8/3/2011 8/30/11	0.6	9/7/2011	***2.4***	10/12/2011	***0.9***	11/9/2011	***1.3***	12/14/2011	***2.3***
	Uranium (ug/L)	41.8		32		***69.3***		31.8		***60.2***		***57.4***		18.5		***57.1***		19.0		***56.1***		***58.9***		***55.6***		***57***
	Chloroform (ug/L)	70		***800***		***730***		***1200***		***390***		***1900***		***730***		***300***		***1000***		***1300***		***440***		***1200***		***1400***
	Chloride (mg/L)	58.31		52		***59***		***64***		***64***		54		39		***64***		***60***		***66***		***61***		55		***62***
	Field pH (S.U.)	6.74 - 8.5		6.83		***6.06***		6.89		***6.22***		***6.43***		***6.52***		***6.35***		***6.07 (6.58)***		***6.71***		6.82		6.75		7.1
	Dichloromethane (Methylene Chloride) (ug/L)	5		<1.0		***10***		***14***		3.1		***20***		***7***		2.4		***10***		***7.9***		2.6		***8.9***		***11***
	TDS (mg/L)	3284.19		3100		3270		3140		***3310***		3140		3020		3270		3190		3200		3190		3220		3160
	Gross Alpha minus Rn & U (pCi/L)	4.69		NS		3		2.7		3.3		3.9		4.3		2.8		2.7		2.5		2.2		NS		NS
MW-30 (Class II)	Nitrate + Nitrite (as N) (mg/L)	2.5	1/10/11	***15***	2/1/11	***16***	3/14/11	***17***	4/11/2011	***16***	5/10/2011	***16***	6/20/2011	***17***	7/5/2011	***17***	8/3/2011	***14***	9/7/2011	***16***	10/4/2011	***16***	11/8/2011	***16***	12/12/2011	***16***
	Chloride (mg/L)	128		NS		***134***		NS		***134***		128		127		127		126		***145***		***129***		122		124
	Field pH (S.U.)	6.5 - 8.5		6.65		6.96		7.10		6.83		6.7		***5.66***		6.65		6.61		6.80		6.96 (6.73)		6.83		7.14
	Uranium (ug/L)	8.32		NS		5.97		NS		6.49		NS		NS		NS		8		NS		***9.83***		NS		NS
	Selenium (ug/L)	34		***36.2***		***34.7***		***34***		***44.4***		***38.3***		***38.7***		32.4		***39.7***		32.4		***36.6***		***36.8***		***38***
MW-31 (Class III)	Nitrate + Nitrite (as N) (mg/L)	5	1/10/11	***19***	2/1/11	***21***	3/14/11	***22***	4/1/2011	***21***	5/10/2011	***20***	6/20/2011	***22***	7/5/2011	***22***	8/2/2011	***20***	9/6/2011	***21***	10/3/2011	***21***	11/8/2011	***21***	12/12/2011	***21***
	TDS (mg/L)	1320		1240		1220		1250		***1370***		1290		***1330***		1280		1300		1300		1320		1290		***1330***
	Chloride (mg/L)	143		NS		***145***		NS		143		143		***145***		***148***		***148***		***148***		***145***		***145***		***148***
	Field pH (S.U.)	6.5 - 8.5		6.65		7.21		7.43		7.01		6.73		***6.16***		6.64		6.67		7.03		7.28 (7.34)		7.01		7.46
	Sulfate (mg/L)	532		NS		***538***		531		503		512		***540***		532		***537***		***541***		***539***		***552***		530
MW-35 (Class II)	Manganese (ug/L)	200	NS	NA	2/15/11	***248***	NS	NA	6/7/2011	***369***	NS	NA	NS	NA	7/20/11	***348***	8/30/2011	***267***	9/7/11	***270***	10/3/11	***271***	11/8/2011	***283***	12/14/11	***247***
	Thallium (ug/l)	0.5	NS	NA		< 0.50	NS	NA		< 0.50	NS	NA	NS	NA		NS		***0.52***		NS		***0.57***		< 0.50		***0.63***
	Gross Alpha minus Rn & U (pCi/L)	3.75	NS	NA		2.6	NS	NA		3.7	NS	NA	NS	NA		NS		***4.5***		NS		***4.4***		***4.7***		***4.2***
	Selenium (ug/L)	12.5	NS	NA		ND	NS	NA		ND	NS	NA	NS	NA		NA		9.3		NA		10.5		NA		NA
	Uranium (ug/L)	7.5	NS	NA		***12.7***	NS	NA		***21.7***	NS	NA	NS	NA		***24.2***		***18.3***		***22.3***		***20.1***		***24***		***23.6***
Required Semi-Annual Sampling Wells																										
MW-2 (Class III)	Gross Alpha minus Rn & U (pCi/L)	3.2	NS	NA		1.1	NS	NA	4/12/2011	1.2	NS	NA	NS	NA	NS	NA	8/8/2011	0.5	NS	NA	10/5/2011	1.3	NS	NA	NS	NA
MW-3 (Class III)	Selenium (ug/L)	37	NS	NA	2/15/11	***40.5***	NS	NA	4/13/2011	***45.4***	NS	NA	NS	NA	NS	NA	8/10/2011	***46***	NS	NA	10/10/2011	***46.7***	NS	NA	NS	NA
	Field pH (S.U.)	6.5 - 8.5	NS	NA		***6.09***	NS	NA		***6.46***	NS	NA	NS	NA	NS	NA		***6.32***	NS	NA		6.53 (6.83)	NS	NA	NS	NA
	Fluoride (Mg/L)	0.68	NS	NA		***0.69***	NS	NA		0.68	NS	NA	NS	NA	NS	NA		***0.96***	NS	NA		***0.91***	NS	NA	NS	NA
MW-3A (Class III)	Field pH (S.U.)	6.5 - 8.5	NS	NA	2/16/11	***6.05***	NS	NA	4/13/2011	6.58	NS	NA	NS	NA	NS	NA	8/11/2011	***6.19***	NS	NA	10/11/2011	6.5 (6.92)	NS	NA	NS	NA
	Sulfate (mg/L)	3640	NS	NA		***3730***	NS	NA		3350	NS	NA	NS	NA	NS	NA		3560	NS	NA		***3750***	NS	NA	NS	NA
	TDS (mg/L)	5805	NS	NA		5770	NS	NA		5720	NS	NA	NS	NA	NS	NA		***5810***	NS	NA		5630	NS	NA	NS	NA
	Selenium (ug/L)	89	NS	NA		***99***	NS	NA		85.8	NS	NA	NS	NA	NS	NA		88.5	NS	NA		***95***	NS	NA	NS	NA
MW-5 (Class II)	Uranium (ug/L)	7.5	NS	NA	2/14/11	***29.5***	NS	NA	4/12/2011	7.16	NS	NA	NS	NA	NS	NA	8/9/2011	0.5	NS	NA	10/10/2011	4.52	NS	NA	NS	NA
MW-12 (Class III)	Field pH (S.U.)	6.5 - 8.5	NS	NA	2/15/11	***6.43***	NS	NA	4/5/2011	6.67	NS	NA	NS	NA	NS	NA	8/9/2011	***6.13***	NS	NA	10/6/2011	6.7 (6.97)	NS	NA	NS	NA
	Selenium (ug/L)	25	NS	NA		***39***	NS	NA		21.7	NS	NA	NS	NA	NS	NA		***25.4***	NS	NA		***35.4***	NS	NA	NS	NA
MW-15 (Class III)	Selenium (ug/L)	128.7	NS	NA	NS	NA	NS	NA	4/12/2011	116	NS	NA	NS	NA	NS	NA	NS	***NA***	NS	NA	10/10/2011	112	NS	NA	NS	NA
	Iron (ug/L)	81.7	NS	NA		NA	NS	NA		<0.50	NS	NA	NS	NA	NS	NA	NS	NA	NS	NA		***137***	NS	NA	NS	NA
MW-18 (Class III)	Thallium (ug/l)	1.95	NS	NA	2/15/11	***3.49***	NS	NA	4/6/2011	***3.74***	NS	NA	NS	NA	NS	NA	8/10/2011 9/21/11	***4.0 3.39***	NS	NA	10/11/2011	***3.83***	NS	NA	NS	NA
	Sulfate (mg/L)	1938.9	NS	NA		1770	NS	NA		1780	NS	NA	NS	NA	NS	NA		1910	NS	NA		***2020***	NS	NA	NS	NA
	Field pH (S.U.)	6.25-8.5	NS	NA		6.27	NS	NA		6.71	NS	NA	NS	NA	NS	NA		***5.95 (6.30)***	NS	NA		6.55 (6.63)	NS	NA	NS	NA
	TDS (mg/L)	3198.77	NS	NA		***3250***	NS	NA		***3250***	NS	NA	NS	NA	NS	NA		3190	NS	NA		***3220***	NS	NA	NS	NA

Appendix A – GWCL Exceedances for Second Quarter 2012 under the July 14, 2011 GWDP

			Q1 2011 Results						Q2 2011 Results						Q3 2011 Results						Q4 2011 Results					
Monitoring Well (Water Class)	**Constituent Exceeding GWCL**	**GWCL in July 14, 2011 GWDP**	**January 2011 Monthly Sample Date**	**January 2011 Monthly Sample Result**	**Q1 2011 Sample Date**	**Q1 2011 Result**	**March 2011 Monthly Sample Date**	**March 2011 Monthly Result**	**Q2 2011 Sample Date**	**Q2 2011 Result**	**May 2011 Monthly Sample Date**	**May 2011 Monthly Result**	**June 2011 Monthly Sample Date**	**June 2011 Monthly Result**	**July 2011 Monthly Sample Date**	**July 2011 Monthly Result**	**Q3 2011 Sample Date**	**Q3 2011 Result**	**September 2011 Monthly Sample Date**	**September 2011 Monthly Result**	**Q4 2011 Sample Date**	**Q4 2011 Result**	**November 2011 Monthly Sample Date**	**November 2011 Monthly Result**	**December 2011 Monthly Sample Date**	**December 2011 Monthly Result**
Required Quarterly Sampling Wells																										
MW-19 (Class III)	Field pH (S.U.)	6.78-8.5	NS	NA	2/21/2011	6.78	NS	NA	4/5/2011	7.03	NS	NA	NS	NA	NS	NA	7/20/3011	***6.65***	NS	NA	10/12/2011	6.88 (7.02)	NS	NA	NS	NA
	Nitrate + Nitrite (as N) (mg/L)	2.83	NS	NA		NS	NS	NA		2.6	NS	NA	NS	NA	NS	NA		NS	NS	NA		***4.0***	NS	NA	NS	NA
MW-23 (Class III)	Field pH (S.U.)	6.5 - 8.5	NS	NA	2/9/2011	***6.13***	NS	NA	4/5/2011	7.14	NS	NA	NS	NA	NS	NA	8/4/2011	***6.38***	NS	NA	10/6/2011	6.56 (6.77)	NS	NA	NS	NA
	Manganese (ug/L)	550	NS	NA		NS	NS	NA		32	NS	NA	NS	NA	NS	NA		NS	NS	NA		***551***	NS	NA	NS	NA
MW-24 (Class III)	Cadmium (ug/L)	2.5	NS	NA	2/10/2011	***2.78***	NS	NA	4/5/2011	***2.61***	NS	NA	NS	NA	NS	NA	8/4/2011	1.46	NS	NA	10/11/2011	1.78	NS	NA	NS	NA
	Thallium (ug/L)	1	NS	NA		***1.42***	NS	NA		***1.07***	NS	NA	NS	NA	NS	NA		<0.50	NS	NA		0.62	NS	NA	NS	NA
	Field pH (S.U.)	6.5 - 8.5	NS	NA		***5.73***	NS	NA		***6.12***	NS	NA	NS	NA	NS	NA		***6.45***	NS	NA		***6.44***	NS	NA	NS	NA
MW-27 (Class III)	Nitrate + Nitrite (as N) (mg/L)	5.6	NS	NA	2/9/2011	***6***	NS	NA	4/5/2011	***6.4***	NS	NA	NS	NA	NS	NA	8/8/2011	***6***	NS	NA	10/5/2011	***6.3***	NS	NA	NS	NA
	Chloride (mg/L)	38	NS	NA		***46***	NS	NA		***43***	NS	NA	NS	NA	NS	NA		***43***	NS	NA		***44***	NS	NA	NS	NA
	Sulfate (mg/L)	462	NS	NA		455	NS	NA		442	NS	NA	NS	NA	NS	NA		424	NS	NA		456	NS	NA	NS	NA
	Field pH (S.U.)	6.5-8.5	NS	NA		6.71	NS	NA		6.79	NS	NA	NS	NA	NS	NA		***6.39***	NS	NA		7.17 (7.24)	NS	NA	NS	NA
	TDS (mg/L)	1075	NS	NA		***1090***	NS	NA		***1190***	NS	NA	NS	NA	NS	NA		***1090***	NS	NA		***1110***	NS	NA	NS	NA
	Gross Alpha minus Rn & U (pCi/L)	2	NS	NA		0.7	NS	NA		1.1	NS	NA	NS	NA	NS	NA		0.8	NS	NA		1.5	NS	NA	NS	NA
MW-28 (Class III)	Chloride (mg/L)	105	NS	NA	2/14/2011	***114***	NS	NA	4/11/2011	***109***	NS	NA	NS	NA	NS	NA	8/8/2011	105	NS	NA	10/5/2011	***143***	NS	NA	NS	NA
	Manganese (ug/L)	1837	NS	NA		NA	NS	NA		1690	NS	NA	NS	NA	NS	NA		NA	NS	NA		1540	NS	NA	NS	NA
	Field pH (S.U.)	6.1 - 8.5	NS	NA		***5.69***	NS	NA		***6.01***	NS	NA	NS	NA	NS	NA		***5.78***	NS	NA		***6.07*** (6.11)	NS	NA	NS	NA
MW-29 (Class III)	Iron (ug/L)	1869	NS	NA	NS	NA	NS	NA	4/18/2011	***3010***	NS	NA	NS	NA	NS	NA	8/9/2011	1080	NS	NA	10/5/2011	1220	NS	NA	NS	NA
	Manganese (ug/L)	5624	NS	NA	NS	NA	NS	NA		4900	NS	NA	NS	NA	NS	NA		NA	NS	NA		4800	NS	NA	NS	NA
	TDS (mg/L)	4400	NS	NA	NS	NA	NS	NA		4080	NS	NA	NS	NA	NS	NA		NA	NS	NA		4280	NS	NA	NS	NA
	Field pH (S.U.)	6.46 - 8.5	NS	NA	NS	NA	NS	NA		***6.45***	NS	NA	NS	NA	NS	NA		***6.20***	NS	NA		6.52	NS	NA	NS	NA
MW-32 (Class III)	Gross Alpha minus Rn & U (pCi/L)	3.33	NS	NA	2/9/2011	1.5	NS	NA	4/1/2011	***4.6***	NS	NA	NS	NA	NS	NA	8/2/2011 8/30/11	1.9	NS	NA	10/3/2011	***3.7***	NS	NA	NS	NA
	Field pH (S.U.)	6.4 - 8.5	NS	NA		***5.99***	NS	NA		***6.14***	NS	NA	NS	NA	NS	NA		***6.10 (6.20)***	NS	NA		***6.35***	NS	NA	NS	NA

Notes:
GWCL values are taken from July 14, 2011 version of GWDP.
NS = Not Required and Not Sampled
NR = Required and Not Reported
NA = Not Applicable
Exceedances are shown in yellow
Values in () parentheses are the field pH measurements for the resampled analyses.
Pursuant to the October 26, 2011 DRC letter gross alpha monitoring in MW-26 returned to the routine frquency of quarterly. These samples were inadvertantly collected and are for information only.

Appendix A – GWCL Exceedances for Second Quarter 2012 under the July 14, 2011 GWDP

			Q1 2012 Results						Q2 2012 Results						
Monitoring Well (Water Class)	**Constituent Exceeding GWCL**	**GWCL in July 14, 2011 GWDP**	**January 2012 Monthly Sample Date**	**January 2012 Monthly Result**	**Q1 2012 Sample Date**	**Q1 2012 Result**	**March 2012 Monthly Sample Date**	**March 2012 Monthly Result**	**April 2012 Monthly Sample Date**	**April 2012 Monthly Result**	**Q2 2012 Sample Date**	**Q2 2012 Result**	**June 2012 Monthly Sample Date**	**June 2012 Monthly Result**	**Sample Frequency**
Required Quarterly Sampling Wells															
MW-11 (Class II)	Manganese (ug/L)	131.29	1/26/2012	102	2/13/2012	***154***	3/13/2012	121	4/10/2012	***132***	5/8/2012	127	6/19/2012	122	Quarterly
	Tetrahydrofuran (ug/L)	11.5		<1.0		2.51		<1.0		<1.0		<1.0		NA	Quarterly
MW-14 (Class III)	Manganese (ug/L)	2230.30	1/24/2012	NA	2/21/2012	1790	3/14/2012	NA	4/12/2012	NA	5/9/2012	***2360***	6/19/2012	NA	Quarterly
	Field pH (S.U.)	6.5 - 8.5		***6.36***		6.57		6.51		6.97		6.73		6.90	Quarterly
MW-25 (Class III)	Field pH (S.U.)	6.5 - 8.5	1/25/2012	6.63	2/14/2012	6.83	3/14/2012	6.55	4/9/2012	6.58	5/2/2012	6.73	6/18/2012	6.99	Quarterly
	Uranium	6.5		***6.6***		6.5		***6.93***		***6.52***		5.90		***7.6***	Quarterly
MW-26 (Class III)	Nitrate + Nitrite (as N) (mg/L)	0.62	1/25/2012	***1.9***	2/15/2012	***1.2***	3/14/2012	***3***	4/11/2012	***3.4***	5/7/2012 6/26/2012	***2.9***	6/19/2012	***2.3***	Quarterly
	Uranium (ug/L)	41.8		***64.6***	2/21/2012	***59.4***		31.2		***42.2***		18.2		***66.0***	Quarterly
	Chloroform (ug/L)	70		***1900***	2/15/2012	***3300***		***2900***		***2900***		***1700***		***2400***	Quarterly
	Chloride (mg/L)	58.31		***68***		40		***74***		***82***		***74***		***85***	Quarterly
	Field pH (S.U.)	6.74 - 8.5		***6.59***	2/15/2012 2/21/2012 3/8/2012	***6.72*** (6.91) (***6.71***)		***6.39***		6.88		7.00 (7.01)		7.00	Quarterly
	Dichloromethane (Methylene Chloride) (ug/L)	5		***13***	2/15/2012	***24***		***27***		***20***		***10***		***16***	Quarterly
	TDS (mg/L)	3284.19		3250		3150		3220		3140		3240		3200	Quarterly
	Gross Alpha minus Rn & U (pCi/L)	4.69	NS	NA	2/21/2012	1.5		4		2.3		3.1		NA	Quarterly
MW-30 (Class II)	Nitrate + Nitrite (as N) (mg/L)	2.5	1/24/2012	***17***	2/14/2012	***17***	3/14/2012	***18***	4/10/2012	***17***	5/2/2012	***16***	6/18/2012	***15.0***	Quarterly
	Chloride (mg/L)	128		124		126		128		128		124		***131***	Quarterly
	Field pH (S.U.)	6.5 - 8.5		6.52		7.12		6.86		7.66		6.95		7.10	Quarterly
	Uranium (ug/L)	8.32	NS	NA		7.42		***8.38***		7.84		6.81		7.8	Quarterly
	Selenium (ug/L)	34	1/24/2012	33.3		***35***		***39.5***		***39.1***		32.3		***37***	Quarterly
MW-31 (Class III)	Nitrate + Nitrite (as N) (mg/L)	5	1/24/2012	***21***	2/13/2012	***21***	3/13/2012	***22***	***4/9/2012***	***21***	5/2/2012	***20***	6/18/2012 6/29/2012	***21.6***	Quarterly
	TDS (mg/L)	1320		***1360***		1240		***1400***		***1380***		***1410***		***1460***	Quarterly
	Chloride (mg/L)	143		***155***		***150***		***152***		***160***		***151***		138	Quarterly
	Field pH (S.U.)	6.5 - 8.5		6.78		7.37		7.13		7.14		7.19		7.28 7.63	Quarterly
	Sulfate (mg/L)	532		***539***		***538***		517		***547***		532		497	Quarterly
MW-35 (Class II)	Manganese (ug/L)	200	1/24/2012	***264***	2/14/12	***253***	3/13/12	***269***	***4/10/2012***	***277***	5/2/2012	***258***	6/19/2012	***304***	Quarterly
	Thallium (ug/l)	0.5		< 0.50		***0.65***		***0.71***		***0.59***		***0.66***		< 0.50	Quarterly
	Gross Alpha minus Rn & U (pCi/L)	3.75		***6.5***		***4.1***		***6.2***		***4.1***		***4.5***		***4.9***	Quarterly
	Selenium (ug/L)	12.5	NS	NA		***19.7***	NS	NA		NS		11.4		7.0	Quarterly
	Uranium (ug/L)	7.5	1/24/2012	***16.1***		***24.7***	3/13/12	***24.9***		***22.4***		***22.2***		***22.5***	Quarterly
Required Semi-Annual Sampling Wells															
MW-2 (Class III)	Gross Alpha minus Rn & U (pCi/L)	3.2	NS	NA	2/22/2012	0.6	NS	NA	NS	NA	5/9/2012	0.6	NS	NA	Semi-Annually
MW-3 (Class III)	Selenium (ug/L)	37	NS	NA	2/29/2012	***43.1***	NS	NA	NS	NA	5/14/2012	***52.8***	NS	NA	Semi-Annually
	Field pH (S.U.)	6.5 - 8.5	NS	NA		6.63	NS	NA	NS	NA		6.67	NS	NA	Semi-Annually
	Fluoride (Mg/L)	0.68	NS	NA		***0.86***	NS	NA	NS	NA		***1.04***	NS	NA	Semi-Annually
MW-3A (Class III)	Field pH (S.U.)	6.5 - 8.5	NS	NA	3/1/2012	***6.46***	NS	NA	NS	NA	5/15/2012	6.68	NS	NA	Semi-Annually
	Sulfate (mg/L)	3640	NS	NA		3020	NS	NA	NS	NA		3220	NS	NA	Semi-Annually
	TDS (mg/L)	5805	NS	NA		5690	NS	NA	NS	NA		5730	NS	NA	Semi-Annually
	Selenium (ug/L)	89	NS	NA		65.8	NS	NA	NS	NA		85.1	NS	NA	Semi-Annually
MW-5 (Class II)	Uranium (ug/L)	7.5	NS	NA	2/28/2012	***18.6***	NS	NA	NS	NA	5/9/2012	1.23	NS	NA	Semi-Annually
MW-12 (Class III)	Field pH (S.U.)	6.5 - 8.5	NS	NA	2/29/2012	6.81	NS	NA	NS	NA	5/10/2012	6.91	NS	NA	Semi-Annually
	Selenium (ug/L)	25	NS	NA		***27.2***	NS	NA	NS	NA		19.6	NS	NA	Semi-Annually
MW-15 (Class III)	Selenium (ug/L)	128.7	NS	NA	2/22/2012	NA	NS	NA	NS	NA	5/9/2012	***152***	NS	NA	Semi-Annually
	Iron (ug/L)	81.7	NS	NA		< 30	NS	NA	NS	NA		< 30	NS	NA	Semi-Annually
MW-18 (Class III)	Thallium (ug/l)	1.95	NS	NA	2/27/2012	***3.63***	NS	NA	NS	NA	4/30/2012	***3.51***	NS	NA	Semi-Annually
	Sulfate (mg/L)	1938.9	NS	NA		1920	NS	NA	NS	NA		1790	NS	NA	Semi-Annually
	Field pH (S.U.)	6.25-8.5	NS	NA		6.6	NS	NA	NS	NA		6.59	NS	NA	Semi-Annually
	TDS (mg/L)	3198.77	NS	NA		***3230***	NS	NA	NS	NA		***3280***	NS	NA	Semi-Annually

Appendix A – GWCL Exceedances for Second Quarter 2012 under the July 14, 2011 GWDP

			Q1 2012 Results						Q2 2012 Results						
Monitoring Well (Water Class)	**Constituent Exceeding GWCL**	**GWCL in July 14, 2011 GWDP**	**January 2012 Monthly Sample Date**	**January 2012 Monthly Result**	**Q1 2012 Sample Date**	**Q1 2012 Result**	**March 2012 Monthly Sample Date**	**March 2012 Monthly Result**	**April 2012 Monthly Sample Date**	**April 2012 Monthly Result**	**Q2 2012 Sample Date**	**Q2 2012 Result**	**June 2012 Monthly Sample Date**	**June 2012 Monthly Result**	**Sample Frequency**
Required Quarterly Sampling Wells															
MW-19 (Class III)	Field pH (S.U.)	6.78-8.5	NS	NA	2/28/2012	6.83	NS	NA	NS	NA	5/16/2012	6.86	NS	NA	Semi-Annually
	Nitrate + Nitrite (as N) (mg/L)	2.83	NS	NA		***3.9***	NS	NA	NS	NA		***3.7***	NS	NA	Semi-Annually
MW-23 (Class III)	Field pH (S.U.)	6.5 - 8.5	NS	NA	2/20/2012	6.61	NS	NA	NS	NA	5/16/2012	6.74	NS	NA	Semi-Annually
	Manganese (ug/L)	550	NS	NA		51	NS	NA	NS	NA		49	NS	NA	Semi-Annually
MW-24 (Class III)	Cadmium (ug/L)	2.5	NS	NA	2/23/2012	2.25	NS	NA	NS	NA	5/10/2012	2.01	NS	NA	Semi-Annually
	Thallium (ug/L)	1	NS	NA		0.96	NS	NA	NS	NA		0.74	NS	NA	Semi-Annually
	Field pH (S.U.)	6.5 - 8.5	NS	NA		***6.03***	NS	NA	NS	NA		***6.21***	NS	NA	Semi-Annually
MW-27 (Class III)	Nitrate + Nitrite (as N) (mg/L)	5.6	NS	NA	2/28/2012	***6.4***	NS	NA	NS	NA	5/1/2012	***6.2***	NS	NA	Semi-Annually
	Chloride (mg/L)	38	NS	NA		***45***	NS	NA	NS	NA		***46***	NS	NA	Semi-Annually
	Sulfate (mg/L)	462	NS	NA		451	NS	NA	NS	NA		446	NS	NA	Semi-Annually
	Field pH (S.U.)	6.5-8.5	NS	NA		7.24	NS	NA	NS	NA		7.03	NS	NA	Semi-Annually
	TDS (mg/L)	1075	NS	NA		***1140***	NS	NA	NS	NA		***1170***	NS	NA	Semi-Annually
	Gross Alpha minus Rn & U (pCi/L)	2	NS	NA		***2.3***	NS	NA	NS	NA		0.8	NS	NA	Semi-Annually
MW-28 (Class III)	Chloride (mg/L)	105	NS	NA	2/28/2012	***109***	NS	NA	NS	NA	5/8/2012	***114***	NS	NA	Semi-Annually
	Manganese (ug/L)	1837	NS	NA		NA	NS	NA	NS	NA		***1850***	NS	NA	Semi-Annually
	Field pH (S.U.)	6.1 - 8.5	NS	NA		6.22	NS	NA	NS	NA		6.15	NS	NA	Semi-Annually
MW-29 (Class III)	Iron (ug/L)	1869	NS	NA	2/22/2012	1310	NS	NA	NS	NA	5/8/2012	1400	NS	NA	Semi-Annually
	Manganese (ug/L)	5624	NS	NA		NA	NS	NA	NS	NA		***6140***	NS	NA	Semi-Annually
	TDS (mg/L)	4400	NS	NA		NA	NS	NA	NS	NA		***4600***	NS	NA	Semi-Annually
	Field pH (S.U.)	6.46 - 8.5	NS	NA		7.12	NS	NA	NS	NA		6.47	NS	NA	Semi-Annually
MW-32 (Class III)	Gross Alpha minus Rn & U (pCi/L)	3.33	NS	NA	2/21/2012	1.8	NS	NA	NS	NA	4/30/2012	2.4	NS	NA	Semi-Annually
	Field pH (S.U.)	6.4 - 8.5	NS	NA		6.57	NS	NA	NS	NA		6.40	NS	NA	Semi-Annually

Notes:
GWCL values are taken from February 15, 2011 version of GWDP.
NS = Not Required and Not Sampled
NR = Required and Not Reported
NA = Not Applicable
Exceedances are shown in yellow
Values in () parentheses are the field pH measurements for the resampled analyses.

Pursuant to the October 26, 2011 DRC letter, gross alpha monitoring in MW-26 returned to the routine frquency of quarterly. These samples were inadvertantly collected and are for information only.

NA = Pursuant to the April 16, 2012 DRC letter, THF monitoring in MW-11 returned to the routine frequency of quarterly.

APPENDIX B

Geochemical Analysis for Wells and Constituents with Consecutive Exceedances

B-1 Geochemical Analysis Summary Table

Appendix B-1

Summary of Geochemical Analysis for Constituents and Wells with Out-of-Compliance Status

Well	Constituent	N	% Non-Detected Values	Mean	Standard Deviation	Shapiro-Wilks Test for Normality[a]			Least Squares Regression Trend Analysis[b]		Mann-Kendall Trend Analysis[c]		Significant Trend	Previously Identified Increasing Trend?	Significantly Decreasing pH trend?	Highest Historical Value (HHV)	Mean + 2σ	Fractional Approach GWCL	BKG Rpt Proposed GWCL	Current GWCL	Flowsheet GWCL	Flowsheet GWCL Rationale
						W	p	Normally or Lognormally distributed?	r^2	p	S	p										
MW-03	Fluoride	44	1	0.54	0.22	0.895028	0.000768	No			486	4.26E-07	increasing	No	Yes	1.04	0.97	2	0.68	0.68	2	Fractional Approach GWCL
MW-03	Selenium	85	31	13.27	13.78	0.931482	0.000221	No			2209	0	increasing	Yes	Yes	52.80	40.83	25	37	37	52.8	HHV
MW-03A	Selenium	22	0	83.09	13.25	0.967852	0.661372	Yes	0.213411	0.030429			increasing	No	Yes	107.00	109.58	25	89	89	109.58	Mean + 2σ
MW-03A	Sulfate	23	0	3583.48	182.90	0.968435	0.651605	Yes	0.067465	0.231354			none	No	Yes	3870.00	3949.27	NA	3640	3640	3949.27	Mean + 2σ
MW-5	Uranium	87	17	0.95	0.69	0.943681	0.000878	No			-917	3.75E-04	decreasing	No (decreasing)	No	3.40	2.32	7.5	7.5	7.5	7.5	Fractional Approach GWCL
MW-11	Manganese	53	0	104.89	29.89	0.961043	0.081636	Yes	0.311211	0.000014			increasing	Yes	Yes	170.00	164.67	200	200	131.29	164.67	Mean + 2σ
MW-12	Selenium	55	36	9.57	10.26	0.906000	0.000405	No			937	3.46E-12	increasing	Yes	Yes	39.00	30.08	25	25	25	39	HHV
MW-18	TDS @ 180	23	0	3033.91	241.88	0.762690	0.000103	No			144	7.82E-05	increasing	No	Yes	3280.00	3517.68	NA	3198	3198	3280	HHV
MW-18	Thallium	26	0	2.30	1.19	0.874748	0.004468	No			225	3.96E-07	increasing	Yes	Yes	4.00	4.68	0.5	1.95	1.95	4.00	HHV
MW-24	Cadmium	27	44	1.28	1.06	0.803511	0.000158	No			197	8.97E-06	increasing	No	Yes	4.28	3.39	2.5	2.5	2.5	4.28	HHV
MW-24	Thallium	28	50	0.71	0.31	0.756784	0.000020	No			182	6.27E-05	increasing	No	Yes	1.57	1.33	1	1	1	1.57	HHV
MW-25	Uranium	41	0	6.14	0.55	0.982722	0.777429	Yes	0.167702	0.007842			increasing	No	Yes	7.06	7.25	7.5	6.5	6.5	7.25	Mean + 2σ
MW-26	Uranium	83	0	38.86	20.36	0.961779	0.014478	No			1436	8.33E-09	increasing	Yes	No	119.00	79.57	15	NA	41.85	119	HHV
MW-27	TDS @ 180	36	0	1075.39	55.16	0.979069	0.713951	Yes	0.503853	0.000001			increasing	No	No	1190.00	1185.72	NA	1075	1075	1185.72	Mean + 2σ
MW-30	Selenium	44	0	34.13	4.08	0.928738	0.009438	No			450	2.73E-06	increasing	No	Yes	47.20	42.29	12.5	34	34	47.2	HHV
MW-31	Sulfate	39	0	517.33	24.15	0.883904	0.000787	No			274	4.73E-04	increasing	No	No	552.00	565.63	NA	532	532	552	HHV
MW-31	TDS @ 180	51	0	1257.65	76.46	0.985350	0.777020	Yes	0.130100	0.009317			increasing	No	No	1460.00	1410.57	NA	1320	1320	1410.57	Mean + 2σ

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
N/A = not applicable
p = probability
W = Shapiro Wilk test value

r2 = The measure of how well the trendline fits the data where r2=1 represents a perfect fit.
S = MannKendall statistic
S.U. = standard units

a = The Shapiro-Wilk Distribution test was performed on data with % Detect > 50%. For % Detect > 85%, 1/2 the detection limit was substituted for non-detected values, and for % Detect > 50% and < 85% the test was done on detected values only

b = A regression test was performed on data that was determined to have either a normal or log-normal distribution and % Detect > 50%. 1/2 of the detection limit was used for non-detected values

c = The Mann-Kendall test was performed on data with either a non-parametric distribution or with % Detect < 50%, it was not performed on constituents where N < 8

Distribution = Distribution as determined by the Shapiro-Wilk distribution test for constituents with % Detect > 50% and N>8

Regression Trend = The result of the linear regression test analysis using 1/2 of the detection limit for values reported as "not detected"

Mann-Kendall Trend = The result of the Mann-Kendall test for non-parametric distributions and for % Detect < 50%

Mean = The arithmatic, Cohen, or Aitchison 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 Observed Value = The highest observed value for constituents with % Detect < 50%

Fractional Approach GWCL = 1/4 of the GWQS for Class II water; 1/2 of the GWQS for Class III water.

Flowsheet GWCL = The Groundwater Compliance Limit as determined by the Flow Sheet for calculating the GWCL based on the % Detect

Flowsheet GWCL are included for MW-18 and MW-26,. However , as discussed in Section 3.2, EFRI is not proposing revised GWCLs for these wells, but instead proposes that GWCLs for these wells be eliminated together with all GWCLs for all constituetns in MW-1 and MW-19.

B-2 Comparison of Calculated and Measured TDS for Samples with Complete Major Ions

Appendix B-2
Comparison of Calculated and Measured TDS for Samples with Complete Major Ions

Well	Sample Date	CO_3+HCO_3 as Alkalinity (mg/L)	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
MW-11	12/16/1982	399	36	24.4	5.7	8.8	550	926	1812	1949.9	107.61%
MW-11	5/24/1983	363	31	26.8	4.7	7.7	530	943	1728	1906.2	110.31%
MW-11	10/26/1983	402	28	26	5	6.7	540	922	1697	1929.7	113.71%
MW-11	11/27/2000	382	94	37.3	7.6	30.6	487	1140	2130	2178.5	102.28%
MW-11	11/6/2001	375	82.9	42.4	7	25.4	574	1150	2100	2256.7	107.46%
MW-11	9/10/2002	372	95.6	33.8	7.38	30	540	1220	2118	2298.8	108.54%
MW-11	6/21/2005	364	58.7	31	6.3	18.2	544	1090	1950	2112.2	108.32%
MW-11	9/22/2005	378	50.7	33	6.3	15.3	551	968	1930	2002.3	103.75%
MW-11	12/13/2005	375	61.2	36	6.8	19.3	544	1070	1930	2112.3	109.45%
MW-11	3/21/2006	381	55.2	33	6.2	16.8	551	1120	1920	2163.2	112.67%
MW-11	6/20/2006	374	62.1	31	7.3	20.1	554	1150	2000	2198.5	109.93%
MW-11	9/13/2006	380	51.1	29	6.7	14.9	558	1060	1910	2099.7	109.93%
MW-11	10/25/2006	378	67.9	32	7.2	21.7	559	1200	1860	2265.8	121.82%
MW-11	3/15/2007	375	69.2	31	7.6	22.1	571	1120	2040	2195.9	107.64%
MW-11	8/21/2007	383	39.2	30	6.2	10.9	668	1060	1800	2197.3	122.07%
MW-11	10/30/2007	378	40.3	29	7.5	11.1	580	1020	1890	2065.9	109.31%
MW-11	3/18/2008	380	38.1	29	6	10	606	1040	1750	2109.1	120.52%
MW-11	6/16/2008	356	40.8	30	6.1	10.7	632	1050	1790	2125.6	118.75%
MW-11	8/5/2008	380	40.6	29	6	10.6	631	1060	1780	2157.2	121.19%
MW-11	11/10/2008	351	42.4	30	6.2	11	655	1100	1830	2195.6	119.98%
MW-11	2/16/2009	356	44.4	29	6.33	12.4	581	977	1910	2006.1	105.03%
MW-11	5/17/2009	366	36	26	5.9	10	548	1060	1850	2051.9	110.91%
MW-11	8/31/2009	374	41.9	26	6.1	11.2	602	1090	1840	2151.2	116.91%
MW-11	10/19/2009	389	41.8	30	6	11.4	641	1040	1830	2159.2	117.99%
MW-11	2/10/2010	410	67	33	6.8	19.7	567	1140	2040	2243.5	109.98%
MW-11	4/28/2010	387	75.9	32	7.13	23.1	642	1150	2140	2317.1	108.28%
MW-11	9/8/2010	410	70	31	7.02	20.9	614	1140	1960	2292.9	116.99%
MW-11	11/11/2010	387	68	34	6.9	20.1	573	1180	2080	2269.0	109.09%
MW-11	2/2/2011	385	70.6	32	6.83	21.2	601	1190	2130	2306.6	108.29%
MW-11	4/4/2011	387	78.2	31	7.3	23.4	622	1140	2100	2288.9	109.00%
MW-11	8/3/2011	347	59.4	31	6.6	17.3	628	1090	1940	2179.3	112.34%
MW-11	10/4/2011	363	59.4	28	6.5	17.3	580	1140	1930	2194.2	113.69%
MW-11	2/13/2012	360	75	31	6.9	22.9	626	1160	2090	2281.8	109.18%
MW-11	5/8/2012	376	63.7	30	7	19.3	517	1090	2040	2103.0	103.09%
MW-12	5/4/1983	507	530	80.5	12	270	310	2420	4026	4129.5	102.57%
MW-12	10/27/1983	529	530	53.9	13	210	290	2338	3922	3963.9	101.07%
MW-12	11/28/2000	422	499	57	11.8	216	248	2000	3860	3453.8	89.48%
MW-12	9/10/2002	418	473	61.6	12.2	212	311	2250	3914	3737.8	95.50%
MW-12	6/22/2005	402	466	55	11.4	203	262	2120	3680	3519.4	95.64%
MW-12	12/13/2005	439	544	53	12.8	228	271	2210	3750	3757.8	100.21%
MW-12	6/22/2006	422	522	61	14.9	220	318	2270	3860	3827.9	99.17%
MW-12	10/30/2006	390	521	61	13.4	224	313	2390	3740	3912.4	104.61%
MW-12	10/23/2007	439	524	58	13.2	224	282	2290	3630	3830.2	105.52%
MW-12	6/17/2008	399	525	54	13	207	300	2270	3530	3768.0	106.74%
MW-12	11/11/2008	430	544	56	12.9	219	308	2340	3800	3909.9	102.89%
MW-12	5/16/2009	445	448	51	12.8	190	273	2350	3820	3769.8	98.69%
MW-12	10/13/2009	443	506	67	12.9	213	307	2550	3830	4098.9	107.02%
MW-12	4/27/2010	442	522	64	12.7	215	317	2390	3780	3962.7	104.83%
MW-12	11/19/2010	421	510	63	12.7	214	306	2480	3830	4006.7	104.61%
MW-12	4/5/2011	419	520	64	13	217	324	2220	3600	3777.0	104.92%
MW-12	10/6/2011	381	505	61	12.4	210	276	2430	3860	3875.4	100.40%
MW-12	5/10/2012	420	523	63	14.9	223	299	2320	3980	3862.9	97.06%
MW-18	12/1/2000	411	467	47.3	7	88.3	180	1600	2770	2800.6	101.10%
MW-18	11/6/2001	380	432	47.6	7.8	73.8	155	1380	2460	2476.2	100.66%
MW-18	9/9/2002	410	453	40.6	7.51	93.2	192	1940	2846	3136.3	110.20%
MW-18	6/21/2006	439	534	50	10	121	176	1700	3030	3030.0	100.00%
MW-18	10/26/2006	419	515	50	8.6	117	179	1870	2940	3158.6	107.44%
MW-18	10/30/2007	429	501	48	9.5	104	196	1700	2780	2987.5	107.46%
MW-18	6/4/2008	423	546	55	9.6	126	193	1870	3100	3222.6	103.95%
MW-18	11/4/2008	436	578	42	9.47	132	197	1880	3110	3274.5	105.29%

Appendix B-2
Comparison of Calculated and Measured TDS for Samples with Complete Major Ions

Well	Sample Date	CO_3+HCO_3 as Alkalinity (mg/L)	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
MW-18	5/27/2009	449	543	68	8.7	129	188	1930	3200	3315.7	103.62%
MW-18	10/21/2009	468	549	58	8.9	128	179	1900	3150	3290.9	104.47%
MW-18	11/18/2010	469	564	52	9.6	126	174	1910	3090	3304.6	106.94%
MW-18	4/6/2011	473	566	46	9.6	130	187	1780	2970	3191.6	107.46%
MW-18	10/11/2011	435	586	53	9	132	161	2020	3220	3396.0	105.47%
MW-18	4/30/2012	471	562	55	11.6	131	155	1790	3280	3175.6	96.82%
MW-24	6/23/2005	628	634	71	23.2	186	449	2450	4200	4441.2	105.74%
MW-24	9/25/2005	421	513	52	50.5	190	454	2850	4340	4530.5	104.39%
MW-24	12/14/2005	253	512	45	13.6	194	454	2680	4170	4151.6	99.56%
MW-24	3/27/2006	451	353	47	10	135	309	2470	2910	3775.0	129.73%
MW-24	6/22/2006	626	454	30	15.6	173	478	2580	3980	4356.6	109.46%
MW-24	9/15/2006	436	492	62	14.5	176	461	2290	3890	3931.5	101.07%
MW-24	10/24/2006	399	489	46	14.3	176	458	2680	3820	4262.3	111.58%
MW-24	3/16/2007	387	478	45	13.6	178	425	2520	4140	4046.6	97.74%
MW-24	6/20/2007	295	496	44	14.8	181	454	2680	4160	4164.8	100.12%
MW-24	8/28/2007	311	504	45	12.6	187	427	2720	4280	4206.6	98.29%
MW-24	10/23/2007	300	509	45	14.5	183	495	2620	4030	4166.5	103.39%
MW-24	3/12/2008	520	462	44	12.9	167	469	2560	4090	4234.9	103.54%
MW-24	5/29/2008	188	500	45	12.7	186	502	2770	4030	4203.7	104.31%
MW-24	8/7/2008	270	492	39	13	181	514	2730	4270	4239.0	99.27%
MW-24	11/11/2008	225	494	43	13.2	182	517	2800	4170	4274.2	102.50%
MW-24	2/5/2009	231	466	44	14	164	538	2630	4310	4087.0	94.83%
MW-24	5/30/2009	233	441	44	12.2	164	489	2670	4220	4053.2	96.05%
MW-24	8/24/2009	142	503	37	13.1	177	518	2740	4210	4130.1	98.10%
MW-24	10/28/2009	257	488	46	12.6	177	488	2950	4120	4418.6	107.25%
MW-24	1/19/2010	270	492	46	13	175	500	2740	4080	4236.0	103.82%
MW-24	5/6/2010	306	485	46	12.5	178	510	2560	3960	4097.5	103.47%
MW-24	11/17/2010	197	478	48	12.8	173	475	2760	4070	4143.8	101.81%
MW-24	4/5/2011	173	474	45	12.5	169	508	2560	3870	3941.5	101.85%
MW-24	10/11/2011	327	488	39	9.3	120	356	2500	3740	3839.3	102.66%
MW-24	5/10/2012	222	507	42	13.7	171	474	2490	4170	3919.7	94.00%
MW-25	6/23/2005	392	358	34	9.1	128	282	1600	2860	2803.1	98.01%
MW-25	9/22/2005	403	376	34	9.6	135	285	1670	2890	2912.6	100.78%
MW-25	12/13/2005	396	386	33	10	139	290	1860	2850	3114.0	109.26%
MW-25	3/22/2006	406	347	32	9.7	122	291	1710	2850	2917.7	102.38%
MW-25	6/20/2006	409	378	32	10.2	138	284	1680	2850	2931.2	102.85%
MW-25	9/12/2006	398	385	30	10.8	135	287	1570	2800	2815.8	100.56%
MW-25	10/24/2006	405	400	33	10	138	295	1880	2740	3161.0	115.36%
MW-25	3/16/2007	390	386	32	10.1	135	289	1750	2970	2992.1	100.74%
MW-25	6/20/2007	403	395	31	9.9	140	269	1740	2900	2987.9	103.03%
MW-25	8/27/2007	412	390	33	9.52	136	274	1850	2810	3104.5	110.48%
MW-25	10/25/2007	410	392	32	10.1	115	272	1710	2740	2941.1	107.34%
MW-25	3/18/2008	415	353	32	9.8	120	306	1750	2710	2985.8	110.18%
MW-25	6/12/2008	381	383	25	9.48	130	306	1610	2770	2844.5	102.69%
MW-25	8/4/2008	400	391	28	10	134	310	1710	2700	2983.0	110.48%
MW-25	11/10/2008	392	383	30	9.8	129	321	1800	2870	3064.8	106.79%
MW-25	2/3/2009	392	331	31	8.4	116	255	1630	2750	2763.4	100.49%
MW-25	5/13/2009	399	333	30	8.5	116	279	1690	2710	2855.5	105.37%
MW-25	8/24/2009	418	361	30	9.9	121	310	1580	2740	2829.9	103.28%
MW-25	10/13/2009	412	352	34	9.78	116	296	1650	2690	2869.8	106.68%
MW-25	2/3/2010	432	351	31	9.5	116	300	1630	2670	2869.5	107.47%
MW-25	4/28/2010	424	368	31	9.74	122	317	1660	2730	2931.7	107.39%
MW-25	9/8/2010	435	367	31	9.6	125	306	1760	2790	3033.6	108.73%
MW-25	11/10/2010	413	354	31	9.3	116	277	1650	2800	2850.3	101.80%
MW-25	2/2/2011	405	358	30	9.26	119	298	1690	2720	2909.3	106.96%
MW-25	4/4/2011	408	354	31	9.7	117	310	1620	2660	2849.7	107.13%
MW-25	10/4/2011	387	354	32	9.2	120	276	1680	2700	2858.2	105.86%
MW-25	2/14/2012	404	371	30	9.6	123	314	1630	2770	2881.6	104.03%
MW-25	5/2/2012	410	351	30	11.9	118	269	1670	2850	2859.9	100.35%
MW-26	6/21/2005	411	424	52	10.1	154	234	1880	3200	3165.1	98.91%

Appendix B-2
Comparison of Calculated and Measured TDS for Samples with Complete Major Ions

Well	Sample Date	CO_3+HCO_3 as Alkalinity (mg/L)	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
MW-26	9/22/2005	409	481	53	10.3	165	213	1850	3160	3181.3	100.67%
MW-26	12/14/2005	409	496	53	10.5	170	220	1890	3240	3248.5	100.26%
MW-26	3/22/2006	412	499	51	10.5	168	211	1920	3150	3271.5	103.86%
MW-26	6/20/2006	406	478	52	11.2	168	194	1830	3130	3139.2	100.29%
MW-26	9/12/2006	396	488	49	11	162	197	1770	3090	3073.0	99.45%
MW-26	10/24/2006	415	531	57	11	171	194	2100	3080	3479.0	112.95%
MW-26	3/16/2007	395	508	58	10.5	175	170	1980	3250	3296.5	101.43%
MW-26	6/20/2007	410	508	54	11.8	177	207	1940	3250	3307.8	101.78%
MW-26	8/21/2007	412	501	60	10.3	176	208	1920	3200	3287.3	102.73%
MW-26	10/23/2007	411	508	55	10.2	179	162	1930	3060	3255.2	106.38%
MW-26	3/12/2008	390	492	69	11.1	154	194	1850	3110	3160.1	101.61%
MW-26	5/27/2008	380	488	56	10.4	166	228	2010	1630	3338.4	204.81%
MW-26	8/12/2008	388	522	50	10.3	169	220	2020	3170	3379.3	106.60%
MW-26	11/13/2008	388	511	59	9.6	179	164	2160	3170	3470.6	109.48%
MW-26	2/2/2009	392	484	49	9.8	162	177	1880	3260	3153.8	96.74%
MW-26	5/18/2009	400	448	58	10	152	202	1910	3340	3180.0	95.21%
MW-26	8/19/2009	387	487	63	9.7	131	176	1520	3010	2773.7	92.15%
MW-26	10/13/2009	415	502	58	11.2	157	212	1890	3140	3245.2	103.35%
MW-26	2/2/2010	417	495	72	10.6	165	173	1840	3100	3172.6	102.34%
MW-26	4/22/2010	419	501	57	10.9	158	169	1960	3080	3274.9	106.33%
MW-26	9/16/2010	436	506	64	11	166	178	2010	3440	3371.0	97.99%
MW-26	11/15/2010	414	474	48	11	153	213	1880	3000	3193.0	106.43%
MW-26	2/16/2011	418	511	59	11.2	168	174	1780	2930	3121.2	106.53%
MW-26	4/1/2011	414	519	64	11.6	163	200	1850	3030	3221.6	106.32%
MW-26	10/12/2011	376	519	61	10.9	165	169	2070	3190	3370.9	105.67%
MW-26	5/7/2012	398	449	74	11.3	153	195	1930	3240	3210.3	99.08%
MW-27	6/23/2005	419	151	34	3.9	66.4	72.7	402	1050	1149.0	109.43%
MW-27	9/22/2005	430	156	35	4	69.3	73.2	403	1010	1170.5	115.89%
MW-27	12/14/2005	439	161	33	4.2	70.8	75.2	398	1020	1181.2	115.80%
MW-27	3/21/2006	439	152	34	3.9	67.6	71.8	362	1010	1130.3	111.91%
MW-27	6/22/2006	436	147	32	5	66.3	79.5	360	954	1125.8	118.01%
MW-27	9/12/2006	423	168	34	4.4	72.3	77.6	417	1020	1196.3	117.28%
MW-27	10/24/2006	446	174	37	4.4	74.6	80.2	432	1030	1248.2	121.18%
MW-27	3/14/2007	429	168	36	4.5	73.3	78.9	420	1050	1209.7	115.21%
MW-27	8/28/2007	450	176	35	4.36	76	74.5	452	1040	1267.9	121.91%
MW-27	10/22/2007	448	170	37	4.3	73.2	74.1	406	1020	1212.6	118.88%
MW-27	3/17/2008	456	156	37	4.6	66.7	71	428	1050	1219.3	116.12%
MW-27	6/2/2008	424	177	39	4.36	77.3	75.5	453	1030	1250.2	121.37%
MW-27	8/6/2008	440	186	40	4.52	81.2	77.9	456	1100	1285.6	116.87%
MW-27	11/4/2008	434	184	28	4.39	79.9	77.1	461	1120	1268.4	113.25%
MW-27	2/16/2009	436	181	41	4.82	82.2	77.9	442	1150	1264.9	109.99%
MW-27	5/29/2009	446	155	42	4	71.2	74.1	414	1130	1206.3	106.75%
MW-27	8/18/2009	439	170	40	4.3	73.3	70.3	480	1100	1276.9	116.08%
MW-27	10/12/2009	456	169	44	4.45	73.5	70.7	456	1030	1273.7	123.66%
MW-27	5/3/2010	466	173	42	4.14	75.8	71.9	469	1110	1301.8	117.28%
MW-27	11/12/2010	459	167	45	4.3	72.1	65.8	452	1080	1265.2	117.15%
MW-27	4/5/2011	461	173	43	4.1	74.9	71.7	442	1080	1269.7	117.56%
MW-27	10/5/2011	424	177	44	4	76.7	61.5	456	1110	1243.2	112.00%
MW-27	5/1/2012	449	177	46	5.4	77.3	61.6	446	1170	1262.3	107.89%
MW-3	10/31/1979	278	243	12.6	16.7	75	282	930	2102	1837.3	87.41%
MW-3	1/31/1980	356	365	25	16	91	345	2100	2530	3298.0	130.36%
MW-3	4/30/1980	415	410	30	18	110	405	1900	3254	3288.0	101.04%
MW-3	5/19/1980	451	401	50	18	171	575	2430	4362	4096.0	93.90%
MW-3	6/16/1980	451	489	51	23	132	642	2625	4716	4413.0	93.58%
MW-3	7/16/1980	464	461	62	38	203	442	2450	4024	4120.0	102.39%
MW-3	8/19/1980	372	473	65	37	198	653	2975	4908	4773.0	97.25%
MW-3	9/1/1980	451	469	62	44	210	586	2800	4593	4622.0	100.63%
MW-3	10/1/1980	415	481	65	46	205	677	3050	4828	4939.0	102.30%
MW-3	11/11/1980	458	479	64	26	210	567	2750	4522	4554.0	100.71%
MW-3	12/10/1980	476	489	65	32	222	699	3060	4982	5043.0	101.22%

Appendix B-2
Comparison of Calculated and Measured TDS for Samples with Complete Major Ions

Well	Sample Date	CO_3+HCO_3 as Alkalinity (mg/L)	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
MW-3	1/22/1981	476	457	71	42	195	756	3012	5053	5009.0	99.13%
MW-3	2/12/1981	451	457	65	27	154	704	2780	4804	4638.0	96.54%
MW-3	3/18/1981	464	473	66	30	229	745	3150	5122	5157.0	100.68%
MW-3	4/13/1981	439	473	66	16	224	703	3030	5130	4951.0	96.51%
MW-3	6/24/1981	464	505	69	38	210	685	3040	5387	5011.0	93.02%
MW-3	9/1/1981	229	38	3	5	19	27	42	256	363.0	141.80%
MW-3	1/27/1982	464	481	64	58	229	757	3100	4990	5153.0	103.27%
MW-3	12/13/1982	463	480	53	16	185	810	3259	5366	5266.0	98.14%
MW-3	4/21/1983	444	470	66.5	22	260	770	3226	4880	5258.5	107.76%
MW-3	10/26/1983	524	450	56.6	21	210	800	3226	5127	5287.6	103.13%
MW-3	11/30/2000	598	434	62	19.9	218	807	2920	5320	5058.9	95.09%
MW-3	11/6/2001	537	470	82.5	20.2	244	882	3230	5380	5465.7	101.59%
MW-3	9/12/2002	543	443	65.1	21.7	226	813	3500	5394	5611.8	104.04%
MW-3	9/23/2005	433	441	65	22.6	226	760	3330	5360	5277.6	98.46%
MW-3	12/13/2005	403	475	65	23.3	252	752	3300	5180	5270.3	101.74%
MW-3	6/25/2006	354	415	63	26.5	234	678	4030	5050	5800.5	114.86%
MW-3	9/14/2006	447	454	63	23.4	228	731	3150	5090	5096.4	100.13%
MW-3	10/27/2006	357	447	63	23.7	240	706	3490	5100	5326.7	104.45%
MW-3	10/31/2007	516	482	63	23.3	246	804	3120	5010	5254.3	104.88%
MW-3	5/28/2008	364	488	64	22.2	247	846	3340	4800	5371.2	111.90%
MW-3	11/3/2008	311	484	59	23	249	836	3340	5220	5302.0	101.57%
MW-3	5/28/2009	302	462	68	23.1	243	780	3420	5250	5298.1	100.92%
MW-3	10/26/2009	233	445	46	24	237	748	3730	5100	5463.0	107.12%
MW-3	11/19/2010	234	468	63	24.8	248	780	3430	5150	5247.8	101.90%
MW-3	4/13/2011	246	448	64	24	238	760	3060	4730	4840.0	102.33%
MW-3	10/10/2011	204	451	63	24.2	245	692	3470	5120	5149.2	100.57%
MW-30	6/22/2005	215	302	125	8.9	83.7	113	977	1940	1824.6	94.05%
MW-30	9/22/2005	207	304	125	8.7	84.8	103	822	1780	1654.5	92.95%
MW-30	12/14/2005	195	316	128	8.5	84.5	102	904	1800	1738.0	96.56%
MW-30	3/22/2006	195	312	125	8.3	82.4	111	911	1740	1744.7	100.27%
MW-30	6/21/2006	201	324	124	179	76.5	106	876	1700	1886.5	110.97%
MW-30	9/13/2006	209	307	118	8.5	76	110	910	1790	1738.5	97.12%
MW-30	10/25/2006	203	301	124	8.5	78.6	114	871	1650	1700.1	103.04%
MW-30	3/15/2007	190	288	125	8.2	73.7	102	838	1690	1624.9	96.15%
MW-30	8/22/2007	193	286	126	7.3	72.3	108	852	1700	1644.6	96.74%
MW-30	10/24/2007	197	294	122	8.1	72.9	110	871	1650	1675.0	101.52%
MW-30	3/19/2008	197	270	118	7.8	68.9	108	853	1610	1622.7	100.79%
MW-30	6/3/2008	180	278	125	7.29	71.3	109	842	1500	1612.6	107.51%
MW-30	8/4/2008	190	297	121	7.64	75.8	115	831	1640	1637.4	99.84%
MW-30	11/5/2008	179	287	162	7.43	73.3	111	799	1610	1618.7	100.54%
MW-30	2/3/2009	185	268	113	6.9	67.3	99.7	795	1640	1534.9	93.59%
MW-30	5/13/2009	186	245	122	6.5	65.1	104	808	1560	1536.6	98.50%
MW-30	8/24/2009	192	278	118	7.4	69.1	111	781	1530	1556.5	101.73%
MW-30	10/14/2009	190	269	129	7.44	68.5	109	769	1620	1541.9	95.18%
MW-30	1/20/2010	196	258	106	6.85	68	101	722	1540	1457.9	94.67%
MW-30	2/9/2010	198	251	127	6.9	65.1	103	767	1510	1518.0	100.53%
MW-30	4/27/2010	196	278	97	7.14	71.5	111	798	1480	1558.6	105.31%
MW-30	9/14/2010	200	262	111	6.88	67	106	756	1700	1508.9	88.76%
MW-30	11/9/2010	190	251	126	6.9	64.1	94.7	720	1700	1452.7	85.45%
MW-30	2/1/2011	185	263	134	6.56	67.5	102	796	1550	1554.1	100.26%
MW-30	4/11/2011	187	269	134	7.2	67.9	107	746	1520	1518.1	99.88%
MW-30	8/3/2011	176	263	126	6.8	66.7	102	768	1550	1508.5	97.32%
MW-30	10/4/2011	175	266	129	6.7	68.3	93.1	759	1550	1497.1	96.59%
MW-30	2/14/2012	178	272	126	6.6	70	102	728	1550	1482.6	95.65%
MW-30	5/2/2012	185	269	124	7.7	69.3	87.9	696	1600	1438.9	89.93%
MW-31	6/22/2005	206	156	139	5.6	78.6	90.3	504	1290	1179.5	91.43%
MW-31	9/22/2005	204	166	136	5.8	82.3	93.2	436	1280	1123.3	87.76%
MW-31	12/14/2005	198	179	135	6	86.6	96.1	509	1290	1209.7	93.78%
MW-31	3/22/2006	207	174	133	6.1	87.9	88.4	485	1280	1181.4	92.30%
MW-31	6/21/2006	207	186	138	6.5	87.3	97.6	522	1300	1244.4	95.72%

Appendix B-2
Comparison of Calculated and Measured TDS for Samples with Complete Major Ions

Well	Sample Date	CO_3+HCO_3 as Alkalinity (mg/L)	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
MW-31	9/13/2006	211	175	131	6.1	82.5	96.1	516	1320	1217.7	92.25%
MW-31	10/25/2006	204	175	127	6.1	85.3	98.7	526	1220	1222.1	100.17%
MW-31	3/15/2007	210	171	132	6.6	86.1	94.6	516	1280	1216.3	95.02%
MW-31	8/27/2007	210	178	136	6.23	85.8	93.1	532	1240	1241.1	100.09%
MW-31	10/24/2007	209	172	122	6.4	83.8	93.3	497	1200	1183.5	98.63%
MW-31	3/19/2008	212	161	124	6.2	78.2	91	521	1220	1193.4	97.82%
MW-31	6/3/2008	197	163	128	5.96	80.8	93.7	514	1180	1182.5	100.21%
MW-31	8/4/2008	210	180	124	6.07	88.3	94.4	499	1240	1201.8	96.92%
MW-31	11/11/2008	205	180	119	6.2	84.9	97	541	1220	1233.1	101.07%
MW-31	2/3/2009	205	169	115	5.4	80.1	82.8	488	1210	1145.3	94.65%
MW-31	5/13/2009	209	146	124	5.1	72.7	84	493	1230	1133.8	92.18%
MW-31	8/24/2009	215	169	122	6	79.4	92.7	460	1230	1144.1	93.02%
MW-31	10/14/2009	214	170	138	6.09	78.5	93.6	497	1200	1197.2	99.77%
MW-31	2/9/2010	224	170	128	6.2	80.2	92.2	507	1150	1207.6	105.01%
MW-31	4/20/2010	220	162	128	5.8	79.4	91.3	522	1110	1208.5	108.87%
MW-31	9/13/2010	226	164	139	5.74	78.1	91	527	1330	1230.8	92.54%
MW-31	11/9/2010	216	166	138	5.9	77.8	85.4	539	1320	1228.1	93.04%
MW-31	2/1/2011	211	168	145	5.75	79.6	91.6	538	1240	1239.0	99.92%
MW-31	4/1/2011	213	172	143	6.1	80.1	95	503	1210	1212.2	100.18%
MW-31	8/2/2011	0.8	172	148	5.7	81.2	95.3	537	1300	1040.0	80.00%
MW-31	10/3/2011	202	177	145	5.9	83.3	85.5	539	1320	1237.7	93.77%
MW-31	2/13/2012	203	190	150	6	87.9	97.2	538	1240	1272.1	102.59%
MW-31	5/2/2012	208	187	151	7	88	87.9	532	1410	1260.9	89.43%
MW-35	12/1/2010	412	490	69	11.7	142	379	2310	3620	3813.7	105.35%
MW-35	2/15/2011	266	289	41	7.7	86.6	227	1140	1940	2057.3	106.05%
MW-35	4/12/2011	410	522	64	11.8	150	425	2190	3580	3772.8	105.39%
MW-35	10/3/2011	385	502	61	11	149	352	2400	3750	3860.0	102.93%
MW-35	2/14/2012	398	532	59	11.5	159	414	2330	3840	3903.5	101.65%
MW-35	5/2/2012	407	502	59	12.2	151	342	2240	3960	3713.2	93.77%
MW-3A	6/23/2005	170	441	63	26.4	284	698	3380	5540	5062.4	91.38%
MW-3A	9/25/2005	342	471	64	26.6	298	715	3560	5560	5476.6	98.50%
MW-3A	12/14/2005	302	482	60	26.6	314	707	3520	5360	5411.6	100.96%
MW-3A	3/27/2006	323	480	56	26.7	318	706	3490	5410	5399.7	99.81%
MW-3A	6/25/2006	375	443	61	30.2	282	679	3510	5700	5380.2	94.39%
MW-3A	9/19/2006	356	467	70	27.7	293	722	3440	5580	5375.7	96.34%
MW-3A	10/26/2006	409	460	57	26.8	288	737	3270	5520	5247.8	95.07%
MW-3A	3/14/2007	381	478	62	26.9	309	754	3810	5770	5820.9	100.88%
MW-3A	10/31/2007	324	479	60	29.3	310	741	3470	5270	5413.3	102.72%
MW-3A	5/28/2008	384	496	61	28.6	306	827	3550	5070	5652.6	111.49%
MW-3A	11/3/2008	287	498	56	28.6	310	811	3570	5600	5560.6	99.30%
MW-3A	2/9/2009	265	481	49	28.6	320	761	3730	5690	5634.6	99.03%
MW-3A	5/28/2009	306	436	60	28.1	303	674	3640	5660	5447.1	96.24%
MW-3A	8/18/2009	305	486	57	28.6	308	764	3840	5760	5788.6	100.50%
MW-3A	10/28/2009	424	478	42	28	298	773	3870	5570	5913.0	106.16%
MW-3A	11/22/2010	346	463	59	27.8	312	754	3850	5660	5811.8	102.68%
MW-3A	4/13/2011	375	473	65	28.6	295	814	3350	5240	5400.6	103.06%
MW-3A	10/11/2011	376	474	59	27.3	301	708	3750	5630	5695.3	101.16%
MW-5	5/19/1980	403	192	60	18	49	478	1290	2392	2490.0	104.10%
MW-5	6/16/1980	390	152	57	14	54	462	1200	2300	2329.0	101.26%
MW-5	7/16/1980	403	160	60	23	49	435	1100	2060	2230.0	108.25%
MW-5	8/19/1980	390	152	60	20	46	465	1150	2218	2283.0	102.93%
MW-5	9/1/1980	708	156	51	15	41	500	960	2172	2431.0	111.92%
MW-5	10/1/1980	415	152	55	20	42	443	1060	2096	2187.0	104.34%
MW-5	11/11/1980	366	152	49	10	29	428	1050	1960	2084.0	106.33%
MW-5	12/9/1980	390	176	52	13	27	460	1150	2105	2268.0	107.74%
MW-5	1/22/1981	378	161	53	13	30	467	1140	2072	2242.0	108.20%
MW-5	2/11/1981	360	176	54	10	37	487	1260	2192	2384.0	108.76%
MW-5	3/17/1981	378	168	55	13	51	473	1210	2256	2348.0	104.08%
MW-5	4/21/1981	390	176	53	13	46	467	1220	2309	2365.0	102.43%
MW-5	6/18/1981	403	168	53	12	41	437	1105	2114	2219.0	104.97%

Appendix B-2
Comparison of Calculated and Measured TDS for Samples with Complete Major Ions

Well	Sample Date	CO_3+HCO_3 as Alkalinity (mg/L)	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
MW-5	8/18/1981	415	168	52	12	48	426	1115	2119	2236.0	105.52%
MW-5	9/1/1981	215	28	4	4	12	38	28	229	329.0	143.67%
MW-5	1/26/1982	354	200	51	22	83	490	1260	2273	2460.0	108.23%
MW-5	12/13/1982	377	143	47.1	7.4	40	431	1182	2180	2227.5	102.18%
MW-5	5/24/1983	372	150	48.1	6.5	42	460	1228	2236	2306.6	103.16%
MW-5	10/27/1983	396	150	46.8	7	41	480	1183	2093	2303.8	110.07%
MW-5	11/28/2000	381	142	57.4	7.6	40.6	440	1140	2160	2208.6	102.25%
MW-5	11/6/2001	374	135	67.9	7.1	37.7	388	1090	2030	2099.7	103.43%
MW-5	9/10/2002	388	122	55.8	7.73	43.4	488	1470	2212	2574.9	116.41%
MW-5	6/21/2005	369	122	48	6.9	35.8	442	1070	1950	2093.7	107.37%
MW-5	12/13/2005	384	134	51	7.6	39.9	462	1130	2020	2208.5	109.33%
MW-5	3/23/2006	384	142	51	7.7	43.5	456	1130	2080	2214.2	106.45%
MW-5	6/23/2006	387	148	50	9.2	41.6	524	1090	2020	2249.8	111.38%
MW-5	10/27/2006	375	141	52	7.9	41.3	454	1200	2000	2271.2	113.56%
MW-5	10/29/2007	378	138	50	8.4	39.3	476	1130	2040	2219.7	108.81%
MW-5	6/18/2008	357	135	50	7.5	38	503	1090	1900	2180.5	114.76%
MW-5	11/11/2008	368	143	47	7.7	39.2	521	1170	1980	2295.9	115.95%
MW-5	5/16/2009	383	130	44	7	38	467	1130	2000	2199.0	109.95%
MW-5	10/12/2009	393	139	51	7.77	39.4	531	1140	2000	2301.2	115.06%
MW-5	4/26/2010	399	140	52	7.66	39.9	519	1160	2130	2317.6	108.81%
MW-5	11/11/2010	390	146	52	9.2	40.6	487	1260	2200	2384.8	108.40%
MW-5	4/12/2011	395	164	54	9.2	44.2	535	1250	2260	2451.4	108.47%
MW-5	10/10/2011	361	151	50	8	41.4	470	1240	2110	2321.4	110.02%

Notes:

CO_3= Carbonate

HCO_3= Bicarbonate

TDS= Total Dissolved Solids

Ratio= Difference between measured and calculated values

Bold values are not internally consistent and have been removed from the dataset prior to statistical analysis.

B-3 Charge Balance Calculations for Wells with Exceedances

Appendix B-3
Charge Balance Calculations for Wells with Exceedances

Well	Date	Ca	Na	Mg	K	Total Cation Charge	HCO3	Cl	SO4	Total Anion Charge	Percent Difference
MW-11	12/16/1982	1.80	23.92	0.72	0.15	26.59	-6.54	-0.69	-19.28	-26.51	0.31%
MW-11	5/24/1983	1.55	23.05	0.63	0.12	25.35	-5.95	-0.76	-19.63	-26.34	-3.88%
MW-11	10/26/1983	1.40	23.49	0.55	0.13	25.56	-6.59	-0.73	-19.20	-26.52	-3.73%
MW-11	5/11/1999	2.18	23.05	1.06	0.15	26.45	-6.18	-0.93	-19.67	-26.78	-1.25%
MW-11	11/27/2000	4.69	21.18	2.52	0.19	28.59	-6.26	-1.05	-23.73	-31.05	**-8.61%**
MW-11	11/6/2001	4.14	24.97	2.09	0.18	31.37	-6.15	-1.20	-23.94	-31.28	0.28%
MW-11	9/10/2002	4.77	23.49	2.47	0.19	30.92	-6.10	-0.95	-25.40	-32.45	-4.96%
MW-11	6/21/2005	2.93	23.66	1.50	0.16	28.25	-5.97	-0.87	-22.69	-29.53	-4.54%
MW-11	9/22/2005	2.53	23.97	1.26	0.16	27.92	-6.19	-0.93	-20.15	-27.28	2.29%
MW-11	12/13/2005	3.05	23.66	1.59	0.17	28.48	-6.15	-1.02	-22.28	-29.44	-3.37%
MW-11	3/21/2006	2.75	23.97	1.38	0.16	28.26	-6.24	-0.93	-23.32	-30.49	**-7.89%**
MW-11	6/20/2006	3.10	24.10	1.65	0.19	29.04	-6.13	-0.87	-23.94	-30.95	**-6.58%**
MW-11	9/13/2006	2.55	24.27	1.23	0.17	28.22	-6.23	-0.82	-22.07	-29.11	-3.17%
MW-11	10/25/2006	3.39	24.31	1.79	0.18	29.67	-6.19	-0.90	-24.98	-32.08	**-8.11%**
MW-11	3/15/2007	3.45	24.84	1.82	0.19	30.30	-6.15	-0.87	-23.32	-30.34	-0.12%
MW-11	8/21/2007	1.96	29.06	0.90	0.16	32.07	-6.28	-0.85	-22.07	-29.19	**8.97%**
MW-11	10/30/2007	2.01	25.23	0.91	0.19	28.34	-6.19	-0.82	-21.24	-28.25	0.34%
MW-11	3/18/2008	1.90	26.36	0.82	0.15	29.24	-6.23	-0.82	-21.65	-28.70	1.84%
MW-11	6/16/2008	2.04	27.49	0.88	0.16	30.56	-5.83	-0.85	-21.86	-28.54	**6.61%**
MW-11	8/5/2008	2.03	27.45	0.87	0.15	30.50	-6.23	-0.82	-22.07	-29.11	4.54%
MW-11	11/10/2008	2.12	28.49	0.91	0.16	31.67	-5.75	-0.85	-22.90	-29.50	**6.85%**
MW-11	2/16/2009	2.22	25.27	1.02	0.16	28.67	-5.83	-0.82	-20.34	-26.99	**5.85%**
MW-11	5/17/2009	1.80	23.84	0.82	0.15	26.61	-6.00	-0.73	-22.07	-28.80	**-8.24%**
MW-11	8/31/2009	2.09	26.19	0.92	0.16	29.35	-6.13	-0.73	-22.69	-29.56	-0.69%
MW-11	10/19/2009	2.09	27.88	0.94	0.15	31.06	-6.38	-0.85	-21.65	-28.87	**7.04%**
MW-11	2/10/2010	3.34	24.66	1.62	0.17	29.80	-6.72	-0.93	-23.73	-31.38	**-5.31%**
MW-11	4/28/2010	3.79	27.93	1.90	0.18	33.80	-6.34	-0.90	-23.94	-31.19	**7.72%**
MW-11	9/8/2010	3.49	26.71	1.72	0.18	32.10	-6.72	-0.87	-23.73	-31.33	2.40%
MW-11	11/11/2010	3.39	24.92	1.65	0.18	30.15	-6.34	-0.96	-24.57	-31.87	**-5.71%**
MW-11	2/2/2011	3.52	26.14	1.74	0.17	31.58	-6.31	-0.90	-24.78	-31.99	-1.28%
MW-11	4/4/2011	3.90	27.06	1.93	0.19	33.07	-6.34	-0.87	-23.73	-30.95	**6.41%**
MW-11	8/3/2011	2.96	27.32	1.42	0.17	31.87	-5.69	-0.87	-22.69	-29.25	**8.21%**
MW-11	10/4/2011	2.96	25.23	1.42	0.17	29.78	-5.95	-0.79	-23.73	-30.47	-2.32%
MW-11	2/13/2012	3.74	27.23	1.88	0.18	33.03	-5.90	-0.87	-24.15	-30.93	**6.38%**
MW-11	5/8/2012	3.18	22.49	1.59	0.18	27.43	-6.16	-0.85	-22.69	-29.70	**-8.27%**
MW-12	5/4/1983	26.45	13.48	22.22	0.31	62.46	-8.31	-2.27	-50.38	-60.96	2.39%
MW-12	10/27/1983	26.45	12.61	17.28	0.33	56.68	-8.67	-1.52	-48.68	-58.87	-3.87%
MW-12	5/12/1999	23.65	12.05	17.77	0.31	53.79	-6.82	-1.66	-43.51	-51.99	3.35%
MW-12	11/28/2000	24.90	10.79	17.77	0.30	53.76	-6.92	-1.61	-41.64	-50.16	**6.70%**
MW-12	9/10/2002	23.60	13.53	17.44	0.31	54.89	-6.85	-1.74	-46.84	-55.43	-0.99%
MW-12	6/22/2005	23.25	11.40	16.70	0.29	51.65	-6.59	-1.55	-44.14	-52.28	-1.22%
MW-12	12/13/2005	27.15	11.79	18.76	0.33	58.02	-7.19	-1.49	-46.01	-54.70	**5.73%**
MW-12	6/22/2006	26.05	13.83	18.10	0.38	58.37	-6.92	-1.72	-47.26	-55.90	4.23%
MW-12	10/30/2006	26.00	13.61	18.43	0.34	58.39	-6.39	-1.72	-49.76	-57.87	0.89%
MW-12	10/23/2007	26.15	12.27	18.43	0.34	57.19	-7.19	-1.64	-47.68	-56.51	1.19%
MW-12	6/17/2008	26.20	13.05	17.03	0.33	56.61	-6.54	-1.52	-47.26	-55.32	2.28%
MW-12	11/11/2008	27.15	13.40	18.02	0.33	58.90	-7.05	-1.58	-48.72	-57.34	2.63%
MW-12	5/16/2009	22.36	11.87	15.63	0.33	50.19	-7.29	-1.44	-48.93	-57.66	**-14.87%**
MW-12	10/13/2009	25.25	13.35	17.53	0.33	56.46	-7.26	-1.89	-53.09	-62.24	**-10.23%**
MW-12	4/27/2010	26.05	13.79	17.69	0.32	57.85	-7.24	-1.81	-49.76	-58.81	-1.65%
MW-12	11/19/2010	25.45	13.31	17.61	0.32	56.69	-6.90	-1.78	-51.63	-60.31	**-6.38%**
MW-12	4/5/2011	25.95	14.09	17.86	0.33	58.23	-6.87	-1.81	-46.22	-54.89	**5.74%**
MW-12	10/6/2011	25.20	12.01	17.28	0.32	54.80	-6.24	-1.72	-50.59	-58.56	**-6.85%**
MW-12	5/10/2012	26.10	13.01	18.35	0.38	57.84	-6.88	-1.78	-48.30	-56.96	1.51%
MW-18	5/12/1999	21.01	8.00	6.67	0.16	35.84	-6.52	-0.99	-27.90	-35.41	1.21%
MW-18	12/1/2000	23.30	7.83	7.27	0.18	38.58	-6.74	-1.33	-33.31	-41.38	**-7.26%**
MW-18	11/6/2001	21.56	6.74	6.07	0.20	34.57	-6.23	-1.34	-28.73	-36.30	-5.00%
MW-18	9/9/2002	22.61	8.35	7.67	0.19	38.82	-6.72	-1.15	-40.39	-48.25	**-24.31%**
MW-18	6/21/2006	26.65	7.66	9.96	0.26	44.52	-7.19	-1.41	-35.39	-44.00	1.16%
MW-18	10/26/2006	25.70	7.79	9.63	0.22	43.33	-6.87	-1.41	-38.93	-47.21	**-8.95%**
MW-18	10/30/2007	25.00	8.53	8.56	0.24	42.33	-7.03	-1.35	-35.39	-43.78	-3.43%
MW-18	6/4/2008	27.25	8.39	10.37	0.25	46.26	-6.93	-1.55	-38.93	-47.42	-2.51%
MW-18	11/4/2008	28.84	8.57	10.86	0.24	48.52	-7.15	-1.18	-39.14	-47.47	2.16%
MW-18	5/27/2009	27.10	8.18	10.62	0.22	46.11	-7.36	-1.92	-40.18	-49.46	**-7.26%**
MW-18	10/21/2009	27.40	7.79	10.53	0.23	45.94	-7.67	-1.64	-39.56	-48.86	**-6.36%**
MW-18	11/18/2010	28.15	7.57	10.37	0.25	46.33	-7.69	-1.47	-39.77	-48.92	**-5.59%**
MW-18	4/6/2011	28.24	8.13	10.70	0.25	47.32	-7.75	-1.30	-37.06	-46.11	2.56%
MW-18	10/11/2011	29.24	7.00	10.86	0.23	47.34	-7.13	-1.49	-42.06	-50.68	**-7.06%**

Appendix B-3
Charge Balance Calculations for Wells with Exceedances

Well	Date	Ca	Na	Mg	K	Total Cation Charge	HCO3	Cl	SO4	Total Anion Charge	Percent Difference
MW-18	4/30/2012	28.05	6.74	10.78	0.30	45.86	-7.72	-1.55	-37.27	-46.54	-1.47%
MW-24	6/23/2005	31.64	19.53	15.31	0.59	67.07	-10.29	-2.00	-51.01	-63.30	**5.61%**
MW-24	9/25/2005	25.60	19.75	15.63	1.29	62.27	-6.90	-1.47	-59.34	-67.70	**-8.72%**
MW-24	12/14/2005	25.55	19.75	15.96	0.35	61.61	-4.15	-1.27	-55.80	-61.21	0.65%
MW-24	3/27/2006	17.62	13.44	11.11	0.26	42.42	-7.39	-1.33	-51.42	-60.14	**-41.77%**
MW-24	6/22/2006	22.66	20.79	14.24	0.40	58.08	-10.26	-0.85	-53.71	-64.82	**-11.60%**
MW-24	9/15/2006	24.55	20.05	14.48	0.37	59.46	-7.15	-1.75	-47.68	-56.57	4.86%
MW-24	10/24/2006	24.40	19.92	14.48	0.37	59.17	-6.54	-1.30	-55.80	-63.63	**-7.54%**
MW-24	3/16/2007	23.85	18.49	14.65	0.35	57.33	-6.34	-1.27	-52.47	-60.08	-4.78%
MW-24	6/20/2007	24.75	19.75	14.89	0.38	59.77	-4.83	-1.24	-55.80	-61.87	-3.51%
MW-24	8/28/2007	25.15	18.57	15.39	0.32	59.43	-5.10	-1.27	-56.63	-63.00	**-5.99%**
MW-24	10/23/2007	25.40	21.53	15.06	0.37	62.36	-4.92	-1.27	-54.55	-60.73	2.61%
MW-24	3/12/2008	23.06	20.40	13.74	0.33	57.53	-8.52	-1.24	-53.30	-63.06	**-9.62%**
MW-24	5/29/2008	24.95	21.84	15.31	0.32	62.42	-3.08	-1.27	-57.67	-62.02	0.64%
MW-24	8/7/2008	24.55	22.36	14.89	0.33	62.14	-4.42	-1.10	-56.84	-62.36	-0.36%
MW-24	11/11/2008	24.65	22.49	14.98	0.34	62.45	-3.69	-1.21	-58.29	-63.20	-1.19%
MW-24	2/5/2009	23.25	23.40	13.50	0.36	60.51	-3.79	-1.24	-54.76	-59.78	1.20%
MW-24	5/30/2009	22.01	21.27	13.50	0.31	57.08	-3.82	-1.24	-55.59	-60.65	**-6.24%**
MW-24	8/24/2009	25.10	22.53	14.56	0.34	62.53	-2.33	-1.04	-57.05	-60.42	3.38%
MW-24	10/28/2009	24.35	21.23	14.56	0.32	60.47	-4.21	-1.30	-61.42	-66.93	**-10.68%**
MW-24	1/19/2010	24.55	21.75	14.40	0.33	61.03	-4.42	-1.30	-57.05	-62.77	-2.84%
MW-24	5/6/2010	24.20	22.18	14.65	0.32	61.35	-5.01	-1.30	-53.30	-59.61	2.84%
MW-24	11/17/2010	23.85	20.66	14.24	0.33	59.08	-3.23	-1.35	-57.46	-62.04	**-5.02%**
MW-24	4/5/2011	23.65	22.10	13.91	0.32	59.98	-2.84	-1.27	-53.30	-57.40	4.29%
MW-24	10/11/2011	24.35	15.48	9.87	0.24	49.95	-5.36	-1.10	-52.05	-58.51	**-17.13%**
MW-24	5/10/2012	25.30	20.62	14.07	0.35	60.34	-3.64	-1.18	-51.84	-56.66	**6.09%**
MW-25	6/23/2005	17.87	12.27	10.53	0.23	40.90	-6.42	-0.96	-33.31	-40.69	0.49%
MW-25	9/22/2005	18.76	12.40	11.11	0.25	42.51	-6.60	-0.96	-34.77	-42.33	0.43%
MW-25	12/13/2005	19.26	12.61	11.44	0.26	43.57	-6.49	-0.93	-38.72	-46.15	**-5.91%**
MW-25	3/22/2006	17.32	12.66	10.04	0.25	40.26	-6.65	-0.90	-35.60	-43.16	**-7.20%**
MW-25	6/20/2006	18.86	12.35	11.36	0.26	42.83	-6.70	-0.90	-34.98	-42.58	0.58%
MW-25	9/12/2006	19.21	12.48	11.11	0.28	43.08	-6.52	-0.85	-32.69	-40.06	**7.02%**
MW-25	10/24/2006	19.96	12.83	11.36	0.26	44.40	-6.64	-0.93	-39.14	-46.71	**-5.19%**
MW-25	3/16/2007	19.26	12.57	11.11	0.26	43.20	-6.39	-0.90	-36.43	-43.73	-1.22%
MW-25	6/20/2007	19.71	11.70	11.52	0.25	43.19	-6.60	-0.87	-36.23	-43.71	-1.20%
MW-25	8/27/2007	19.46	11.92	11.19	0.24	42.81	-6.75	-0.93	-38.52	-46.20	**-7.90%**
MW-25	10/25/2007	19.56	11.83	9.46	0.26	41.11	-6.72	-0.90	-35.60	-43.22	**-5.13%**
MW-25	3/18/2008	17.62	13.31	9.87	0.25	41.05	-6.80	-0.90	-36.43	-44.14	**-7.52%**
MW-25	6/12/2008	19.11	13.31	10.70	0.24	43.36	-6.24	-0.71	-33.52	-40.47	**6.67%**
MW-25	8/4/2008	19.51	13.48	11.03	0.26	44.28	-6.56	-0.79	-35.60	-42.95	3.01%
MW-25	11/10/2008	19.11	13.96	10.62	0.25	43.94	-6.42	-0.85	-37.48	-44.75	-1.83%
MW-25	2/3/2009	16.52	11.09	9.55	0.21	37.37	-6.42	-0.87	-33.94	-41.23	**-10.34%**
MW-25	5/13/2009	16.62	12.14	9.55	0.22	38.52	-6.54	-0.85	-35.19	-42.57	**-10.53%**
MW-25	8/24/2009	18.01	13.48	9.96	0.25	41.71	-6.85	-0.85	-32.89	-40.59	2.68%
MW-25	10/13/2009	17.57	12.88	9.55	0.25	40.24	-6.75	-0.96	-34.35	-42.06	-4.54%
MW-25	2/3/2010	17.52	13.05	9.55	0.24	40.35	-7.08	-0.87	-33.94	-41.89	-3.81%
MW-25	4/28/2010	18.36	13.79	10.04	0.25	42.44	-6.95	-0.87	-34.56	-42.38	0.13%
MW-25	9/8/2010	18.31	13.31	10.29	0.25	42.16	-7.13	-0.87	-36.64	-44.65	**-5.91%**
MW-25	11/10/2010	17.67	12.05	9.55	0.24	39.50	-6.77	-0.87	-34.35	-42.00	**-6.32%**
MW-25	2/2/2011	17.87	12.96	9.79	0.24	40.86	-6.64	-0.85	-35.19	-42.67	-4.44%
MW-25	4/4/2011	17.67	13.48	9.63	0.25	41.03	-6.69	-0.87	-33.73	-41.29	-0.64%
MW-25	10/4/2011	17.67	12.01	9.87	0.24	39.78	-6.34	-0.90	-34.98	-42.22	**-6.14%**
MW-25	2/14/2012	18.51	13.66	10.12	0.25	42.54	-6.62	-0.85	-33.94	-41.40	2.67%
MW-25	5/2/2012	17.52	11.70	9.71	0.30	39.23	-6.72	-0.85	-34.77	-42.33	**-7.91%**
MW-26	6/21/2005	21.16	10.18	12.67	0.26	44.27	-6.74	-1.47	-39.14	-47.34	**-6.95%**
MW-26	9/22/2005	24.00	9.26	13.58	0.26	47.11	-6.70	-1.49	-38.52	-46.71	0.84%
MW-26	12/14/2005	24.75	9.57	13.99	0.27	48.58	-6.70	-1.49	-39.35	-47.55	2.12%
MW-26	3/22/2006	24.90	9.18	13.82	0.27	48.17	-6.75	-1.44	-39.97	-48.16	0.02%
MW-26	6/20/2006	23.85	8.44	13.82	0.29	46.40	-6.65	-1.47	-38.10	-46.22	0.39%
MW-26	9/12/2006	24.35	8.57	13.33	0.28	46.53	-6.49	-1.38	-36.85	-44.72	3.89%
MW-26	10/24/2006	26.50	8.44	14.07	0.28	49.29	-6.80	-1.61	-43.72	-52.13	**-5.76%**
MW-26	3/16/2007	25.35	7.39	14.40	0.27	47.41	-6.47	-1.64	-41.22	-49.33	-4.05%
MW-26	6/20/2007	25.35	9.00	14.56	0.30	49.22	-6.72	-1.52	-40.39	-48.63	1.20%
MW-26	8/21/2007	25.00	9.05	14.48	0.26	48.79	-6.75	-1.69	-39.97	-48.42	0.77%
MW-26	10/23/2007	25.35	7.05	14.73	0.26	47.39	-6.74	-1.55	-40.18	-48.47	-2.28%
MW-26	3/12/2008	24.55	8.44	12.67	0.28	45.95	-6.39	-1.95	-38.52	-46.85	-1.97%
MW-26	5/27/2008	24.35	9.92	13.66	0.27	48.20	-6.23	-1.58	-41.85	-49.65	-3.03%
MW-26	8/12/2008	26.05	9.57	13.91	0.26	49.79	-6.36	-1.41	-42.06	-49.82	-0.07%

Appendix B-3
Charge Balance Calculations for Wells with Exceedances

Well	Date	Ca	Na	Mg	K	Total Cation Charge	HCO3	Cl	SO4	Total Anion Charge	Percent Difference
MW-26	11/13/2008	25.50	7.13	14.73	0.25	47.61	-6.36	-1.66	-44.97	-52.99	**-11.31%**
MW-26	2/2/2009	24.15	7.70	13.33	0.25	45.43	-6.42	-1.38	-39.14	-46.95	-3.33%
MW-26	5/18/2009	22.36	8.79	12.51	0.26	43.91	-6.56	-1.64	-39.77	-47.96	**-9.23%**
MW-26	8/19/2009	24.30	7.66	10.78	0.25	42.99	-6.34	-1.78	-31.65	-39.77	**7.49%**
MW-26	10/13/2009	25.05	9.22	12.92	0.29	47.48	-6.80	-1.64	-39.35	-47.79	-0.65%
MW-26	2/2/2010	24.70	7.53	13.58	0.27	46.08	-6.83	-2.03	-38.31	-47.17	-2.38%
MW-26	4/22/2010	25.00	7.35	13.00	0.28	45.63	-6.87	-1.61	-40.81	-49.28	**-8.00%**
MW-26	9/16/2010	25.25	7.74	13.66	0.28	46.93	-7.15	-1.81	-41.85	-50.80	**-8.23%**
MW-26	11/15/2010	23.65	9.26	12.59	0.28	45.79	-6.78	-1.35	-39.14	-47.28	-3.25%
MW-26	2/16/2011	25.50	7.57	13.82	0.29	47.18	-6.85	-1.66	-37.06	-45.57	3.40%
MW-26	4/1/2011	25.90	8.70	13.41	0.30	48.31	-6.78	-1.81	-38.52	-47.11	2.49%
MW-26	10/12/2011	25.90	7.35	13.58	0.28	47.11	-6.16	-1.72	-43.10	-50.98	**-8.22%**
MW-26	5/7/2012	22.41	8.48	12.59	0.29	43.77	-6.52	-2.09	-40.18	-48.79	**-11.48%**
MW-27	6/23/2005	7.54	3.16	5.46	0.10	16.26	-6.87	-0.96	-8.37	-16.20	0.40%
MW-27	9/22/2005	7.78	3.18	5.70	0.10	16.77	-7.05	-0.99	-8.39	-16.42	2.08%
MW-27	12/14/2005	8.03	3.27	5.83	0.11	17.24	-7.19	-0.93	-8.29	-16.41	4.80%
MW-27	3/21/2006	7.59	3.12	5.56	0.10	16.37	-7.19	-0.96	-7.54	-15.69	4.16%
MW-27	6/22/2006	7.34	3.46	5.46	0.13	16.38	-7.15	-0.90	-7.50	-15.54	**5.09%**
MW-27	9/12/2006	8.38	3.38	5.95	0.11	17.82	-6.93	-0.96	-8.68	-16.57	**7.00%**
MW-27	10/24/2006	8.68	3.49	6.14	0.11	18.42	-7.31	-1.04	-8.99	-17.35	**5.84%**
MW-27	3/14/2007	8.38	3.43	6.03	0.12	17.96	-7.03	-1.02	-8.74	-16.79	**6.52%**
MW-27	8/28/2007	8.78	3.24	6.25	0.11	18.39	-7.37	-0.99	-9.41	-17.77	3.35%
MW-27	10/22/2007	8.48	3.22	6.02	0.11	17.84	-7.34	-1.04	-8.45	-16.84	**5.61%**
MW-27	3/17/2008	7.78	3.09	5.49	0.12	16.48	-7.47	-1.04	-8.91	-17.43	**-5.75%**
MW-27	6/2/2008	8.83	3.28	6.36	0.11	18.59	-6.95	-1.10	-9.43	-17.48	**5.97%**
MW-27	8/6/2008	9.28	3.39	6.68	0.12	19.47	-7.21	-1.13	-9.49	-17.83	**8.40%**
MW-27	11/4/2008	9.18	3.35	6.57	0.11	19.22	-7.11	-0.79	-9.60	-17.50	**8.96%**
MW-27	2/16/2009	9.03	3.39	6.76	0.12	19.31	-7.15	-1.16	-9.20	-17.50	**9.34%**
MW-27	5/29/2009	7.73	3.22	5.86	0.10	16.92	-7.31	-1.18	-8.62	-17.11	-1.15%
MW-27	8/18/2009	8.48	3.06	6.03	0.11	17.68	-7.19	-1.13	-9.99	-18.32	-3.58%
MW-27	10/12/2009	8.43	3.08	6.05	0.11	17.67	-7.47	-1.24	-9.49	-18.21	-3.04%
MW-27	1/18/2010	8.78	3.06	6.20	0.11	18.15	-7.87	-1.04	-9.33	-18.24	-0.48%
MW-27	5/3/2010	8.63	3.13	6.24	0.11	18.10	-7.64	-1.18	-9.76	-18.59	-2.66%
MW-27	11/12/2010	8.33	2.86	5.93	0.11	17.24	-7.52	-1.27	-9.41	-18.20	**-5.59%**
MW-27	4/5/2011	8.63	3.12	6.16	0.10	18.02	-7.56	-1.21	-9.20	-17.97	0.28%
MW-27	10/5/2011	8.83	2.68	6.31	0.10	17.92	-6.95	-1.24	-9.49	-17.68	1.33%
MW-27	5/1/2012	8.83	2.68	6.36	0.14	18.01	-7.36	-1.30	-9.29	-17.94	0.39%
MW-3	10/31/1979	12.13	12.27	6.17	0.43	30.99	-4.56	-0.36	-19.36	-24.27	**21.68%**
MW-3	1/31/1980	18.21	15.01	7.49	0.41	41.12	-5.83	-0.71	-43.72	-50.26	**-22.23%**
MW-3	4/30/1980	20.46	17.62	9.05	0.46	47.59	-6.80	-0.85	-39.56	-47.20	0.81%
MW-3	5/19/1980	20.01	25.01	14.07	0.46	59.55	-7.39	-1.41	-50.59	-59.39	0.27%
MW-3	6/16/1980	24.40	27.93	10.86	0.59	63.78	-7.39	-1.44	-54.65	-63.48	0.47%
MW-3	7/16/1980	23.01	19.23	16.70	0.97	59.91	-7.60	-1.75	-51.01	-60.36	-0.76%
MW-3	8/19/1980	23.60	28.40	16.29	0.95	69.25	-6.10	-1.83	-61.94	-69.87	-0.90%
MW-3	9/1/1980	23.40	25.49	17.28	1.13	67.30	-7.39	-1.75	-58.29	-67.43	-0.20%
MW-3	10/1/1980	24.00	29.45	16.87	1.18	71.50	-6.80	-1.83	-63.50	-72.13	-0.89%
MW-3	11/11/1980	23.90	24.66	17.28	0.66	66.51	-7.51	-1.81	-57.25	-66.57	-0.08%
MW-3	12/10/1980	24.40	30.40	18.27	0.82	73.89	-7.80	-1.83	-63.71	-73.34	0.75%
MW-3	1/22/1981	22.81	32.88	16.05	1.07	72.81	-7.80	-2.00	-62.71	-72.51	0.41%
MW-3	2/12/1981	22.81	30.62	12.67	0.69	66.79	-7.39	-1.83	-57.88	-67.10	-0.47%
MW-3	3/18/1981	23.60	32.41	18.84	0.77	75.62	-7.60	-1.86	-65.58	-75.05	0.76%
MW-3	4/13/1981	23.60	30.58	18.43	0.41	73.02	-7.19	-1.86	-63.08	-72.14	1.21%
MW-3	6/24/1981	25.20	29.80	17.28	0.97	73.25	-7.60	-1.95	-63.29	-72.84	0.56%
MW-3	9/1/1981	1.90	1.17	1.56	0.13	4.76	-3.75	-0.08	-0.87	-4.71	1.05%
MW-3	1/27/1982	24.00	32.93	18.84	1.48	77.26	-7.60	-1.81	-64.54	-73.95	4.28%
MW-3	12/13/1982	23.95	35.23	15.22	0.41	74.82	-7.59	-1.49	-67.85	-76.93	-2.83%
MW-3	4/21/1983	23.45	33.49	21.39	0.56	78.90	-7.28	-1.88	-67.16	-76.32	3.28%
MW-3	10/26/1983	22.46	34.80	17.28	0.54	75.07	-8.59	-1.60	-67.16	-77.35	-3.03%
MW-3	5/11/1999	21.71	32.88	19.75	0.55	74.89	-8.05	-1.71	-67.66	-77.42	-3.38%
MW-3	11/30/2000	21.66	35.10	17.94	0.51	75.21	-9.80	-1.75	-60.79	-72.34	3.81%
MW-3	11/6/2001	23.45	38.36	20.08	0.52	82.41	-8.80	-2.33	-67.25	-78.37	4.90%
MW-3	9/12/2002	22.11	35.36	18.60	0.56	76.62	-8.90	-1.84	-72.87	-83.60	**-9.11%**
MW-3	9/23/2005	22.01	33.06	18.60	0.58	74.24	-7.10	-1.83	-69.33	-78.26	**-5.41%**
MW-3	12/13/2005	23.70	32.71	20.74	0.60	77.75	-6.60	-1.83	-68.70	-77.14	0.78%
MW-3	6/25/2006	20.71	29.49	19.26	0.68	70.13	-5.80	-1.78	-83.90	-91.48	**-30.44%**

B-4 Descriptive Statistics of Wells and Constituents with Exceedances

Appendix B-4:
Descriptive Statistics of Wells and Constituents with Exceedances

Well	Analyte	Units	Non-Detects	N	%Non-Detects	Mean	Geometric Mean	Std. Dev.	Q25	Median	Q75	Min. Conc.	Max. Conc.	Range	Skewness
MW-11	Manganese	ug/L	0	53	0	104.89	100.48	29.89	79.00	102.00	128.00	40.00	170.00	130.00	0.12
MW-12	Selenium	ug/L	20	55	36	9.55	4.91	10.27	2.00	4.00	17.00	1.00	39.00	38.00	1.21
MW-18	TDS @ 180	mg/L	0	23	0	3033.91	3023.72	241.88	2970.00	3100.00	3200.00	2350.00	3280.00	930.00	-1.81
MW-18	Thallium	ug/L	2	28	7	2.17	1.80	1.24	1.06	1.69	3.54	0.50	4.00	3.50	0.25
MW-24	Cadmium	ug/L	12	27	44	1.28	0.96	1.06	0.50	0.59	2.01	0.50	4.28	3.78	1.32
MW-24	Thallium	ug/L	14	28	50	0.71	0.66	0.31	0.50	0.52	0.83	0.50	1.57	1.07	1.56
MW-25	Uranium	ug/L	0	40	0	6.11	6.09	0.51	5.87	6.02	6.51	4.77	7.06	2.29	-0.18
MW-26	Uranium	ug/L	0	82	0	38.52	33.33	20.26	22.60	33.10	57.00	9.48	119.00	109.52	0.90
MW-27	TDS @ 180	mg/L	0	36	0	1075.39	1074.01	55.16	1030.00	1080.00	1110.00	954.00	1190.00	236.00	-0.04
MW-3	Fluoride	mg/L	1	42	2	0.52	0.48	0.21	0.40	0.50	0.60	0.07	1.04	0.97	0.67
MW-3	Selenium	ug/L	26	84	31	13.43	6.84	13.79	2.00	8.95	20.40	1.00	52.80	51.80	1.14
MW-30	Selenium	ug/L	0	44	0	34.13	33.91	4.08	31.25	32.50	36.40	29.00	47.20	18.20	1.22
MW-31	Sulfate	mg/L	0	39	0	517.33	516.76	24.15	503.00	522.00	538.00	436.00	552.00	116.00	-1.30
MW-31	TDS @ 180	mg/L	0	51	0	1257.65	1255.39	76.46	1210.00	1240.00	1300.00	1110.00	1460.00	350.00	0.34
MW-3A	Selenium	ug/L	0	22	0	83.09	82.03	13.25	73.90	83.90	94.30	54.40	107.00	52.60	-0.23
MW-3A	Sulfate	mg/L	0	22	0	3579.09	3574.45	185.96	3470.00	3560.00	3730.00	3220.00	3870.00	650.00	-0.12
MW-5	Uranium	ug/L	15	87	17	0.92	0.66	0.71	0.40	0.79	1.19	0.04	3.40	3.36	1.32

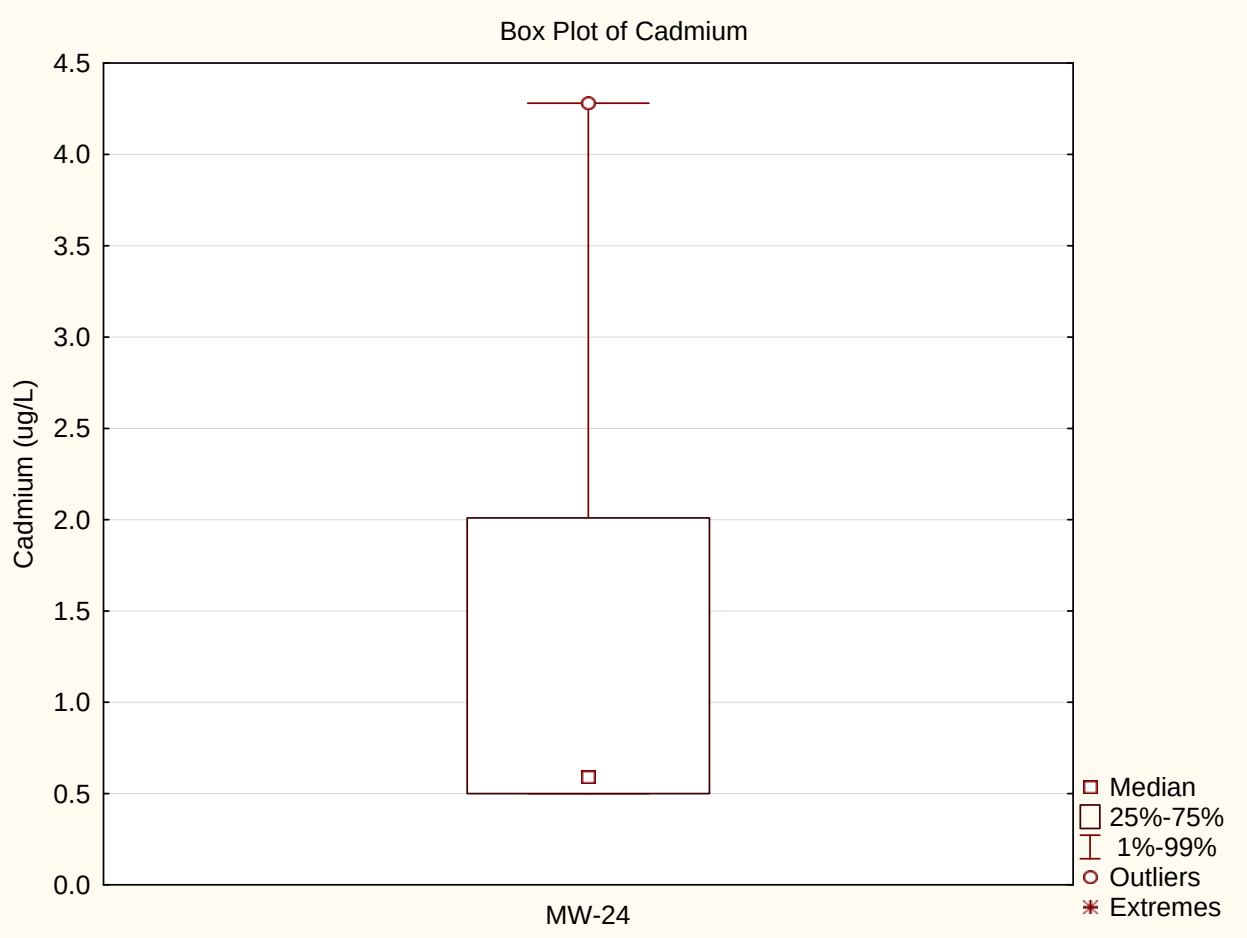
B-5 Data Omitted from Statistical Analysis

Appendix B-5 Data Omitted from Statistical Analysis

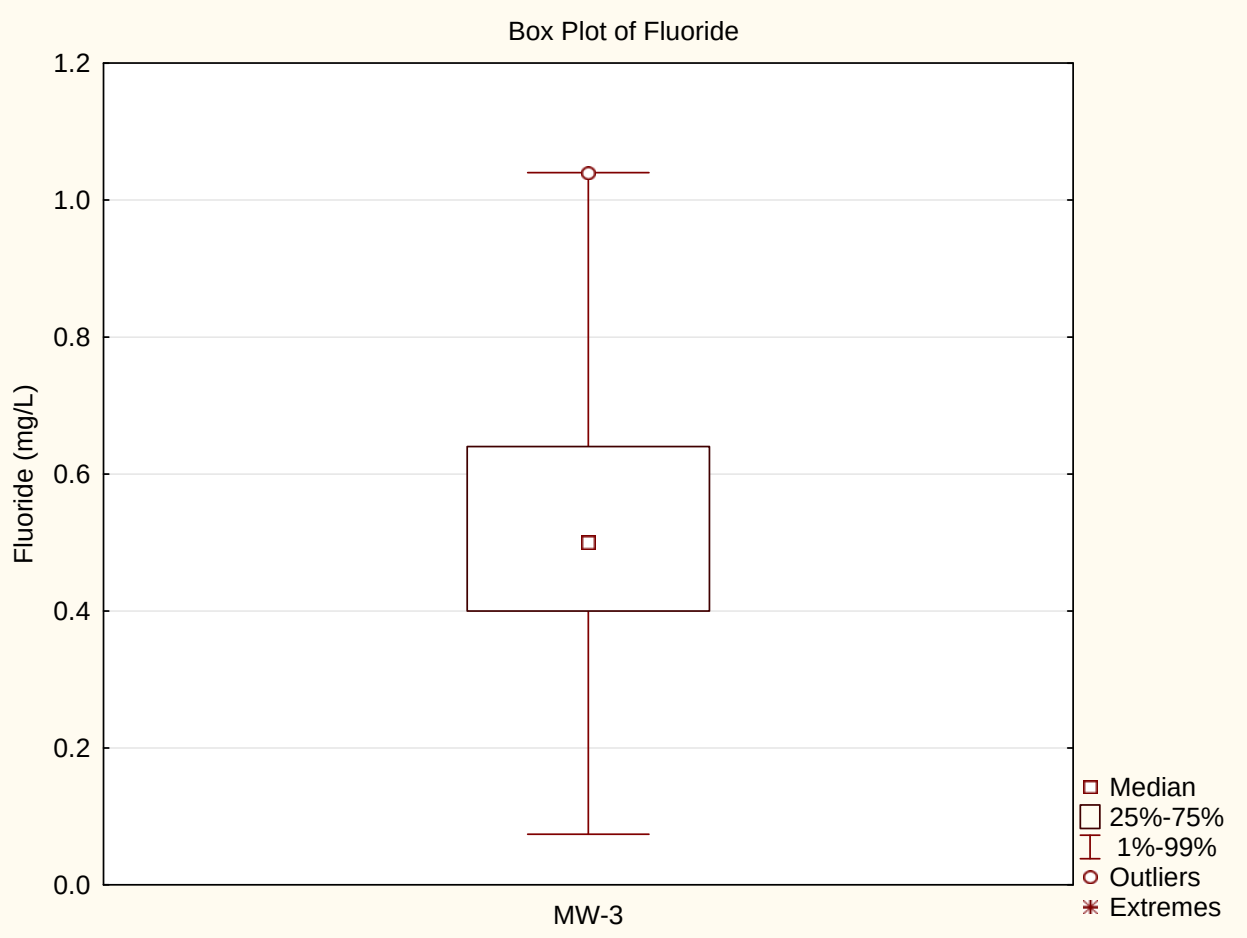
Reason	Well	Sample Date	Report/ Reviewed	Chemical	Result	Qual	Detection Limit	Units
Insensitive detection limit	MW-03	12/28/1981		Selenium	0.01	U	0.01	mg/L
Insensitive detection limit	MW-03	4/21/1983		Selenium	0.01	U	0.01	mg/L
Zero value	MW-03	6/15/1984		Selenium	0		0	mg/L
Zero value	MW-03	3/27/1986		Selenium	0	U	0	mg/L
Zero value	MW-03	9/4/1986		Selenium	0		0	mg/L
Insensitive detection limit	MW-03A	12/14/2005	9/14/2007	Selenium	5	U	5	ug/L
Insensitive detection limit	MW-05	12/9/1980	9/7/2007	Uranium	1	U	1	ug/L
Insensitive detection limit	MW-05	2/11/1981	9/13/2007	Uranium	1	U	1	ug/L
Insensitive detection limit	MW-05	9/1/1981	9/13/2007	Uranium	1	U	1	ug/L
Insensitive detection limit	MW-05	1/26/1982		Uranium	1	U	1	ug/L
Insensitive detection limit	MW-05	8/3/1982		Uranium	1	U	1	ug/L
Insensitive detection limit	MW-05	12/13/1982		Uranium	1	U	1	ug/L
Insensitive detection limit	MW-05	5/24/1983	9/1/2007	Uranium	1	U	1	ug/L
Insensitive detection limit	MW-05	9/24/2003	9/13/2007	Uranium	1	U	1	ug/L
Insensitive detection limit	MW-05	3/19/2004	9/13/2007	Uranium	1	U	1	ug/L
Insensitive detection limit	MW-05	5/27/2004	9/13/2007	Uranium	1	U	1	ug/L
Insensitive detection limit	MW-05	9/14/2004	9/13/2007	Uranium	1	U	1	ug/L
Insensitive detection limit	MW-05	11/9/2004	9/13/2007	Uranium	1	U	1	ug/L
Extreme Outlier	MW-05	11/11/2010	C10110584	Uranium	11.6		0.3	ug/L
Extreme Outlier	MW-05	2/14/2011	C11020544	Uranium	29.5		0.3	ug/L
Extreme Outlier	MW-05	4/12/2011	C11040506 -005	Uranium	7.16		0.3	ug/L
Zero value	MW-11	6/12/1984		Manganese	0		0	mg/L
Insensitive detection limit	MW-12	5/4/1983	Sept 2007	Selenium	0.01	U	0.01	mg/L
Zero value	MW-12	9/4/1986		Selenium	0		0	mg/L
Insensitive detection limit	MW-12	6/27/1995	8/31/2007	Selenium	0.01	U	0.01	mg/L
Insensitive detection limit	MW-12	12/13/2005	9/14/2007	Selenium	5	U	5	ug/L
Insensitive detection limit	MW-12	3/27/2006	9/17/2007	Selenium	5	U	5	ug/L
Insensitive detection limit	MW-12	10/30/2006	9/18/2007	Selenium	23.8	U	23.8	ug/L
Insensitive detection limit	MW-18	5/12/1999	9/6/2007	Thallium	0.001	U	0.001	mg/L
Insensitive detection limit	MW-18	12/1/2000	9/6/2007	Thallium	0.001	U	0.001	mg/L
Insensitive detection limit	MW-18	11/6/2001	9/10/2007	Thallium	0.01	U	0.01	mg/L
Insensitive detection limit	MW-18	9/9/2002	9/11/2007	Thallium	1	U	1	ug/L
Insensitive detection limit	MW-18	9/9/2002	9/20/2007	Thallium	0.01	U	0.01	mg/L
Insensitive detection limit	MW-24	6/23/2005		Cadmium	1	U	1	ug/L
Insensitive detection limit	MW-24	6/23/2005		Thallium	1	U	1	ug/L
Insensitive detection limit	MW-24	7/26/2005	9/13/2007	Cadmium	0.71	D U	0.71	ug/L
Zero value	MW-24	8/4/2011	C11080269-001A	Thallium	0	U	0	ug/L
Extreme Outlier	MW-05	10/10/2011	C11100567 -004	Uranium	4.52		0.3	ug/L
Extreme Outlier	MW-05	2/28/2012	C12030065 -003A	Uranium	18.6		0.3	ug/L

B-6 Box Plots for Constituents and Wells with Consecutive Exceedances

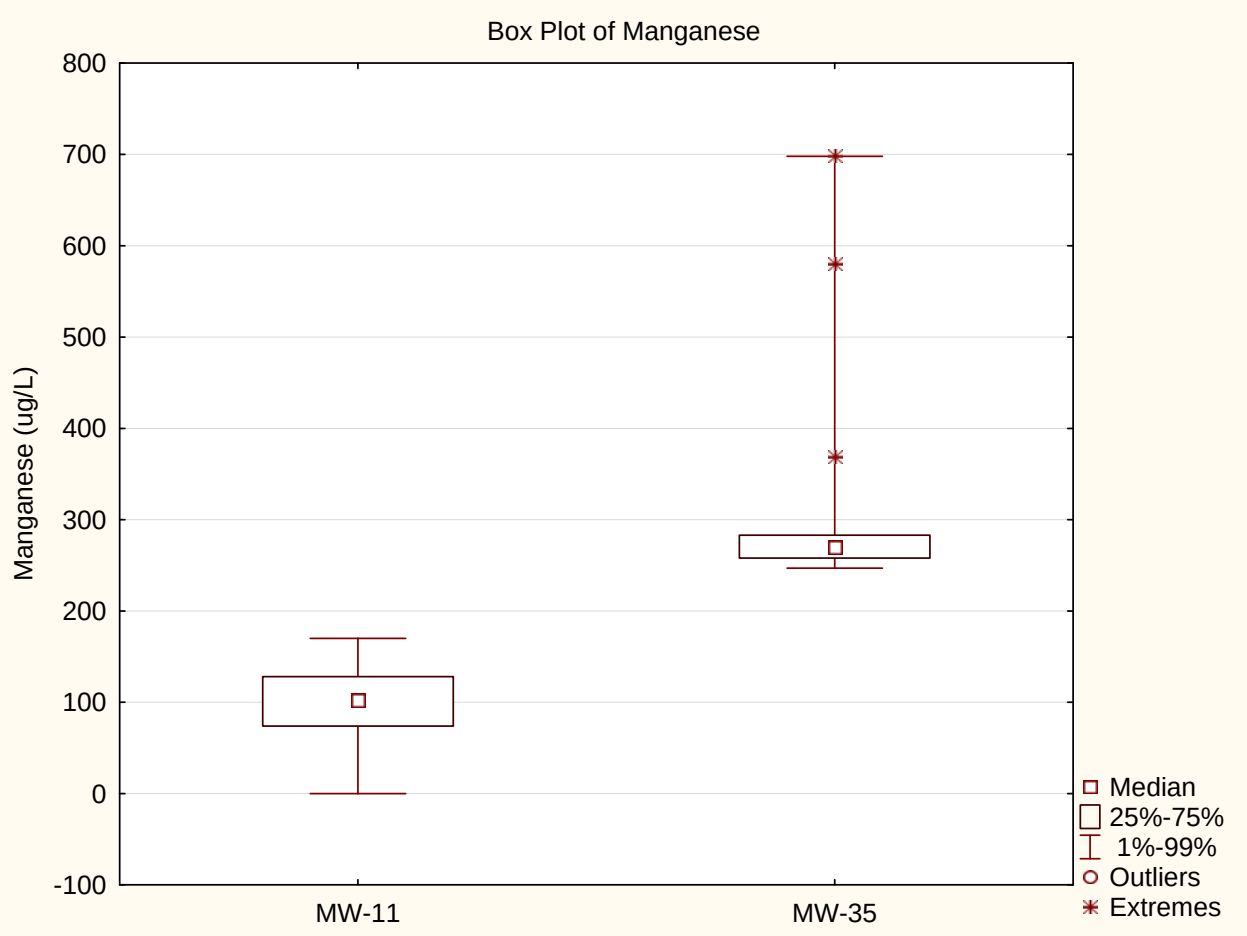
Appendix B-6
Box Plots for Constituents and Wells with Consecutive Exceedances



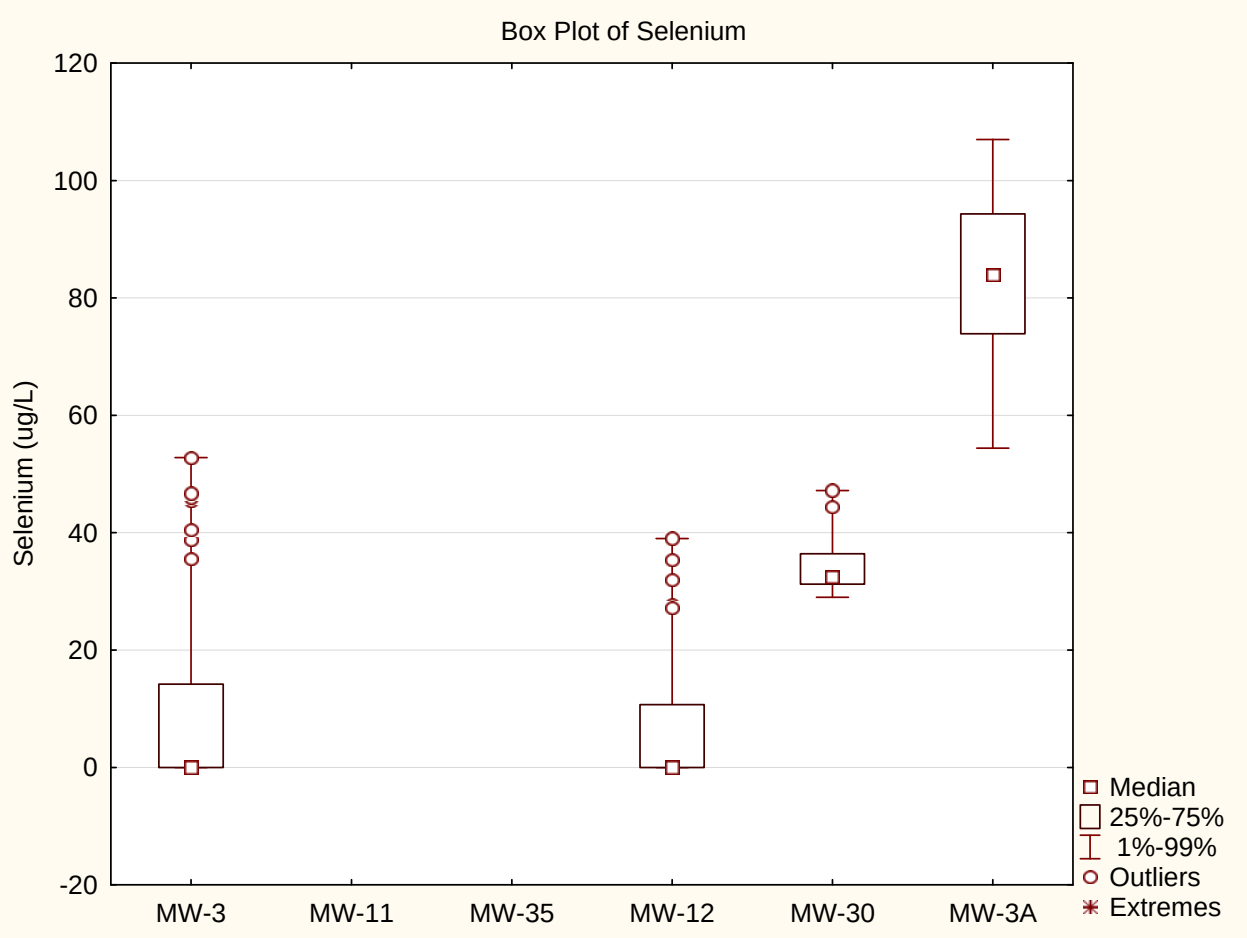
Appendix B-6
Box Plots for Constituents and Wells with Consecutive Exceedances



Appendix B-6
Box Plots for Constituents and Wells with Consecutive Exceedances



Appendix B-6
Box Plots for Constituents and Wells with Consecutive Exceedances



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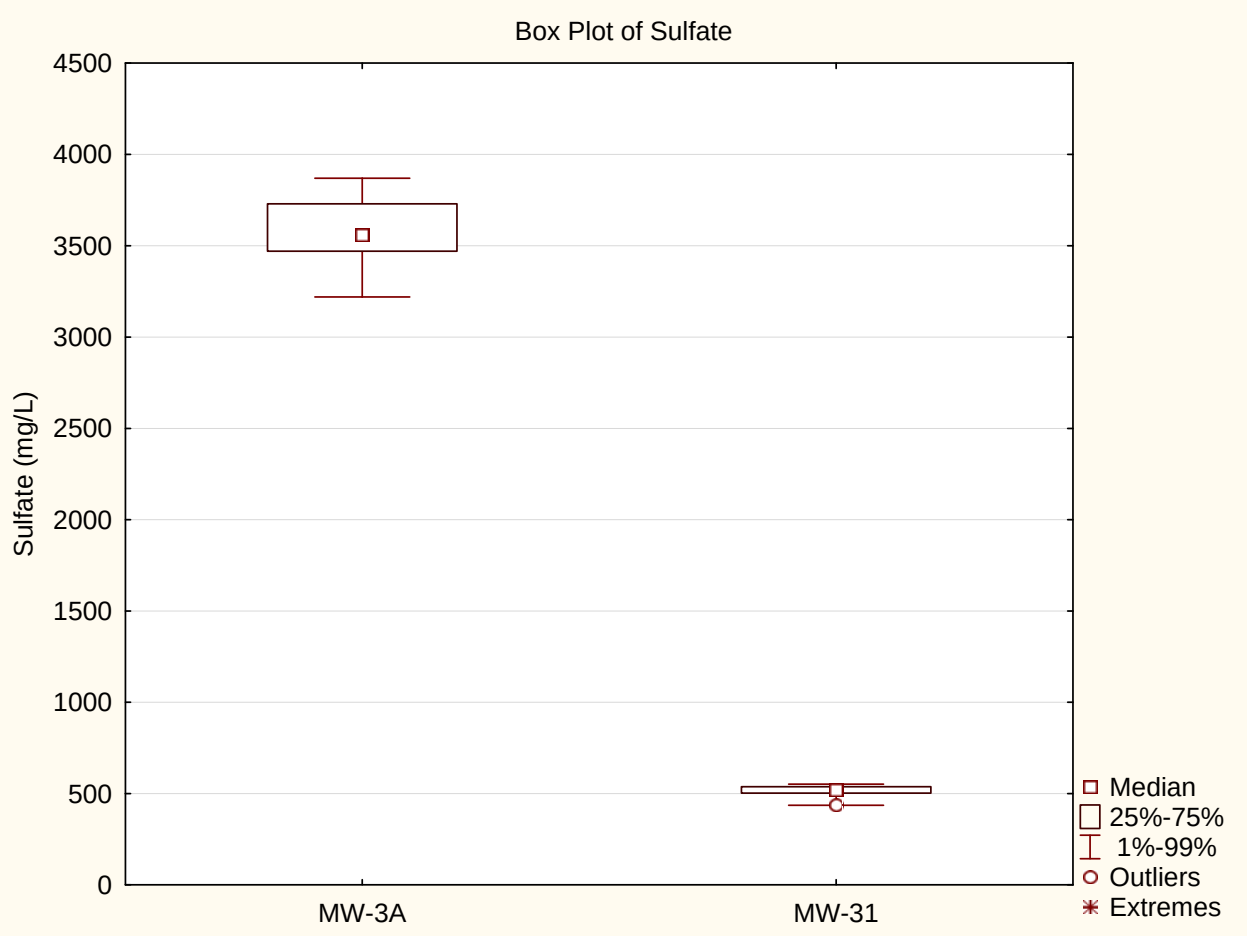
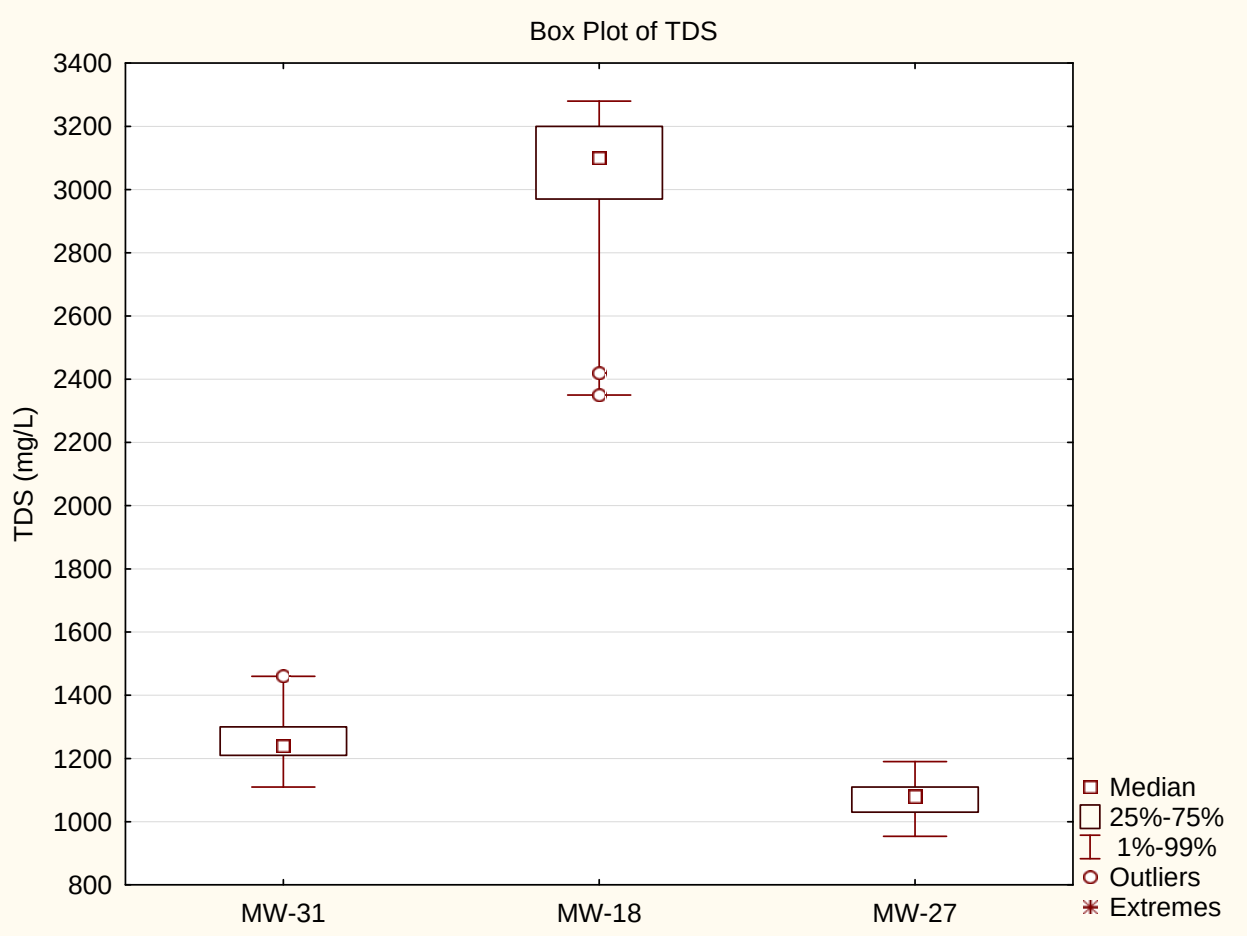
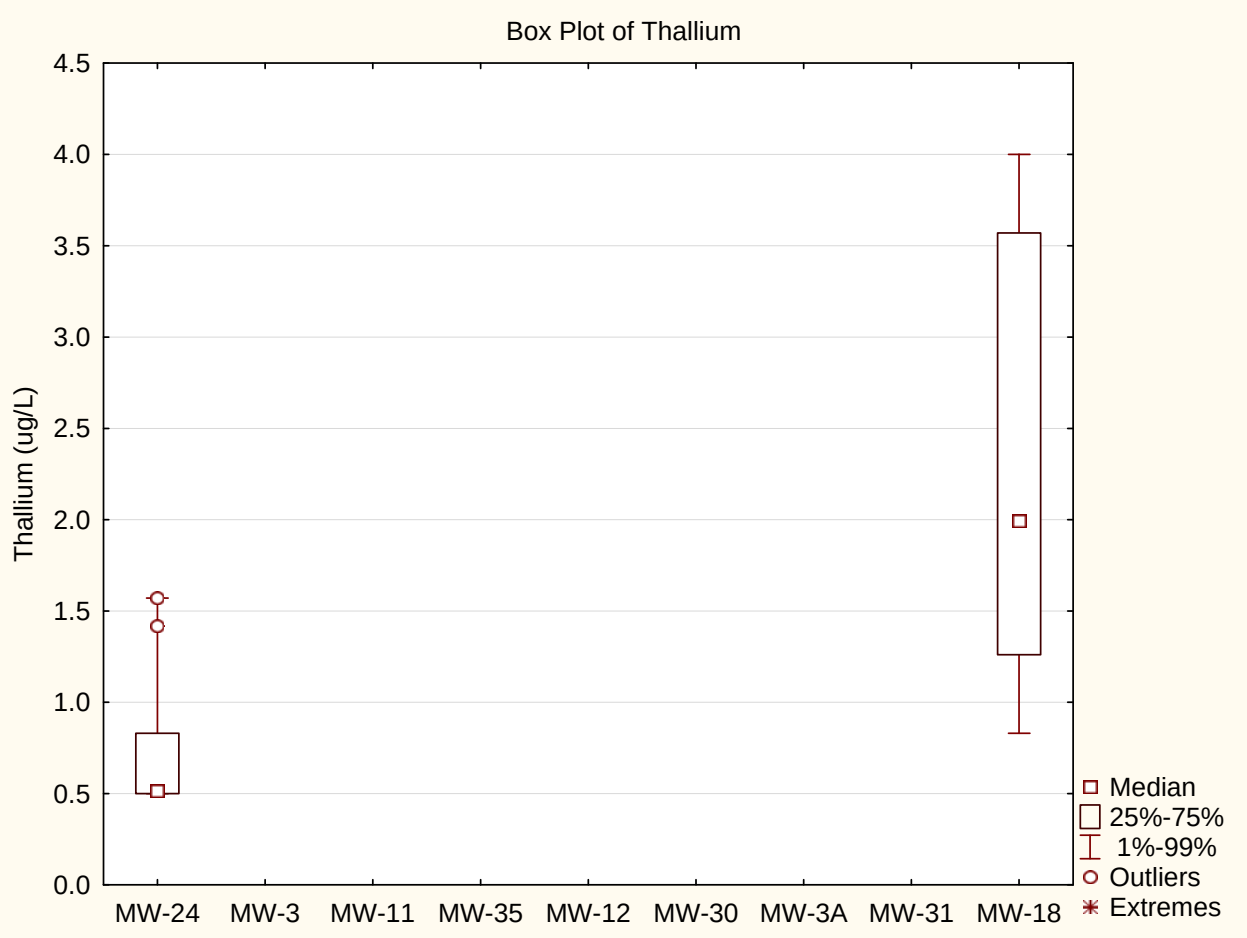
Box Plots for Constituents and Wells with Consecutive Exceedances



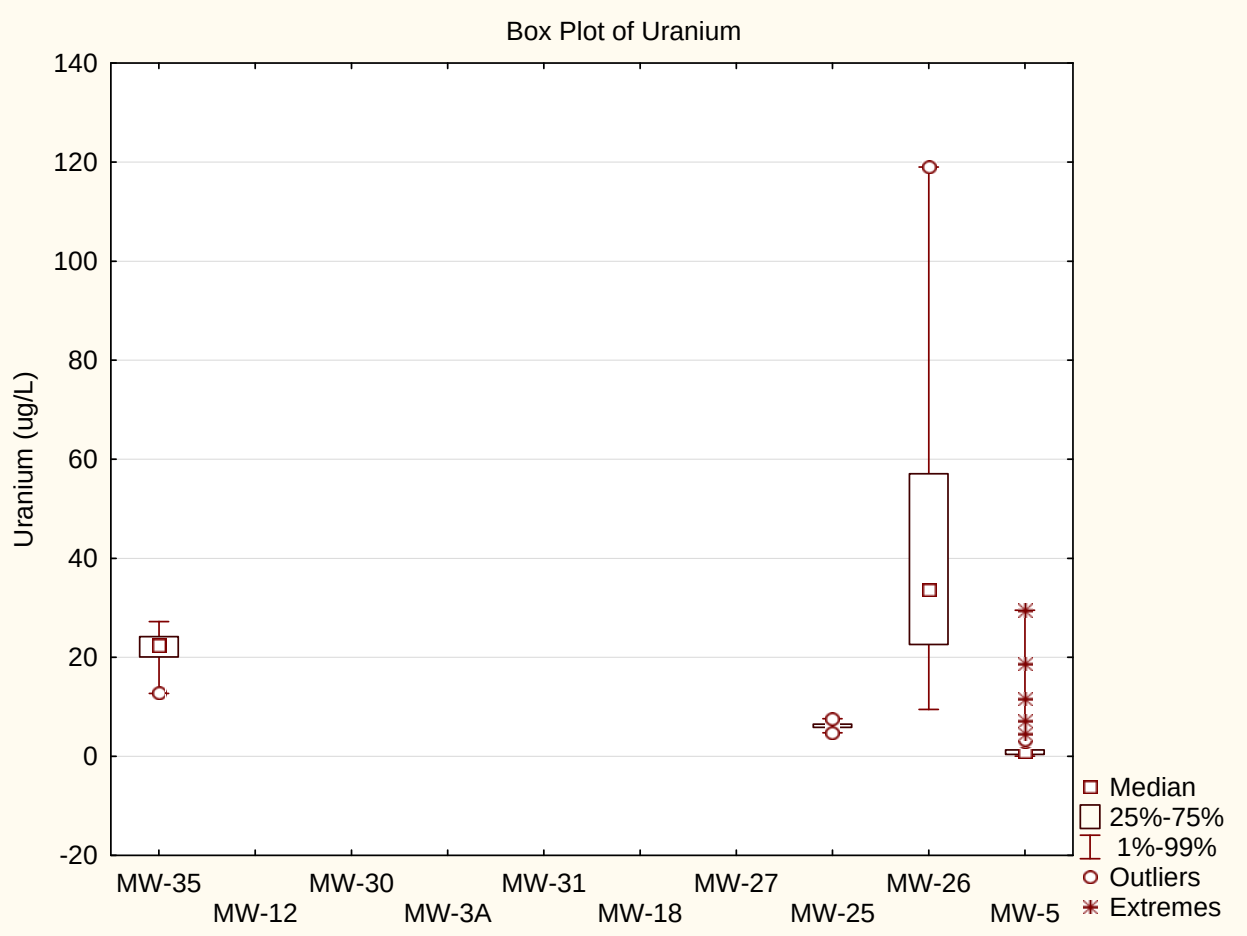
Appendix B-6
Box Plots for Constituents and Wells with Consecutive Exceedances



Appendix B-6
Box Plots for Constituents and Wells with Consecutive Exceedances

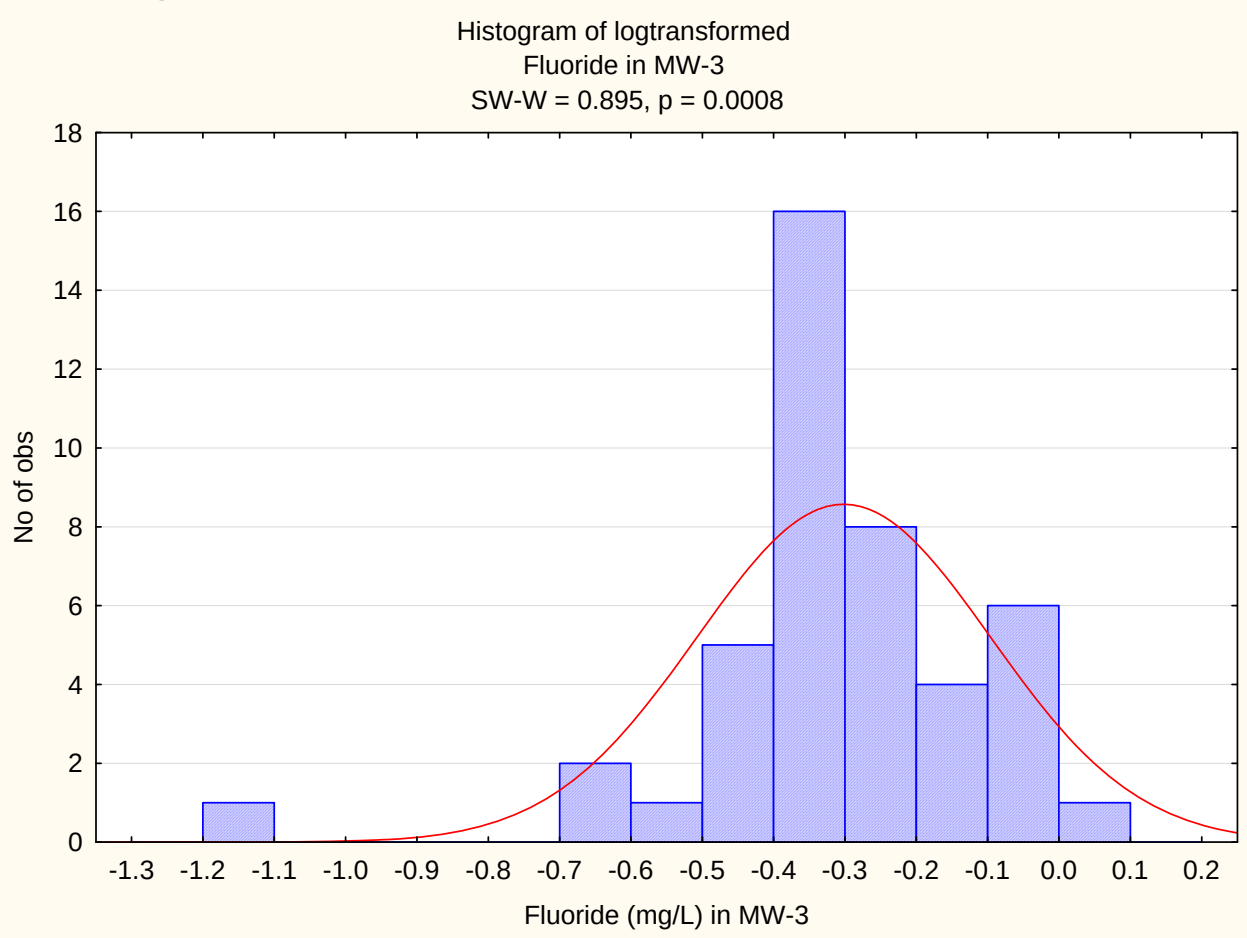


Appendix B-6
Box Plots for Constituents and Wells with Consecutive Exceedances

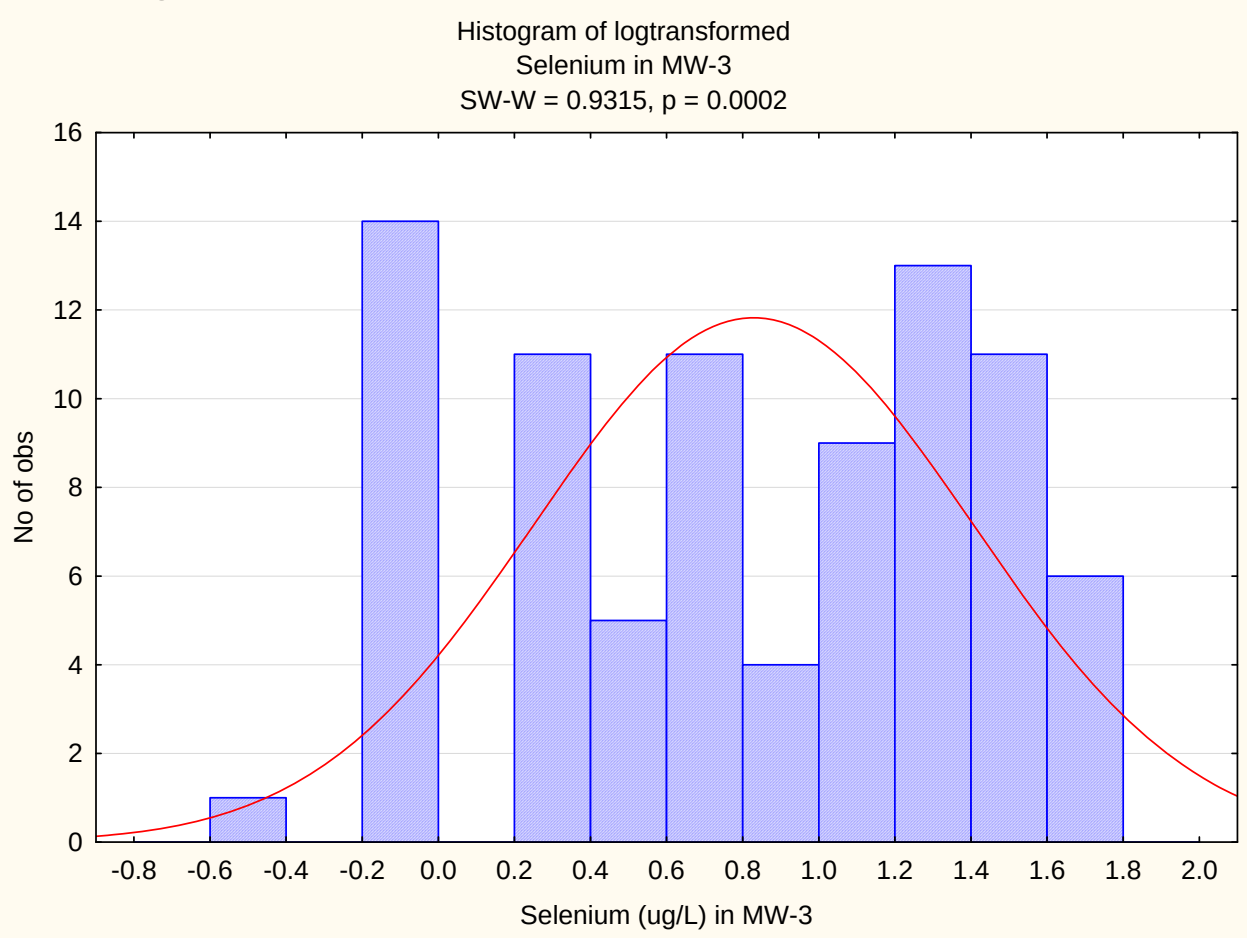


B-7 Histograms for Constituents and Wells with Consecutive Exceedances

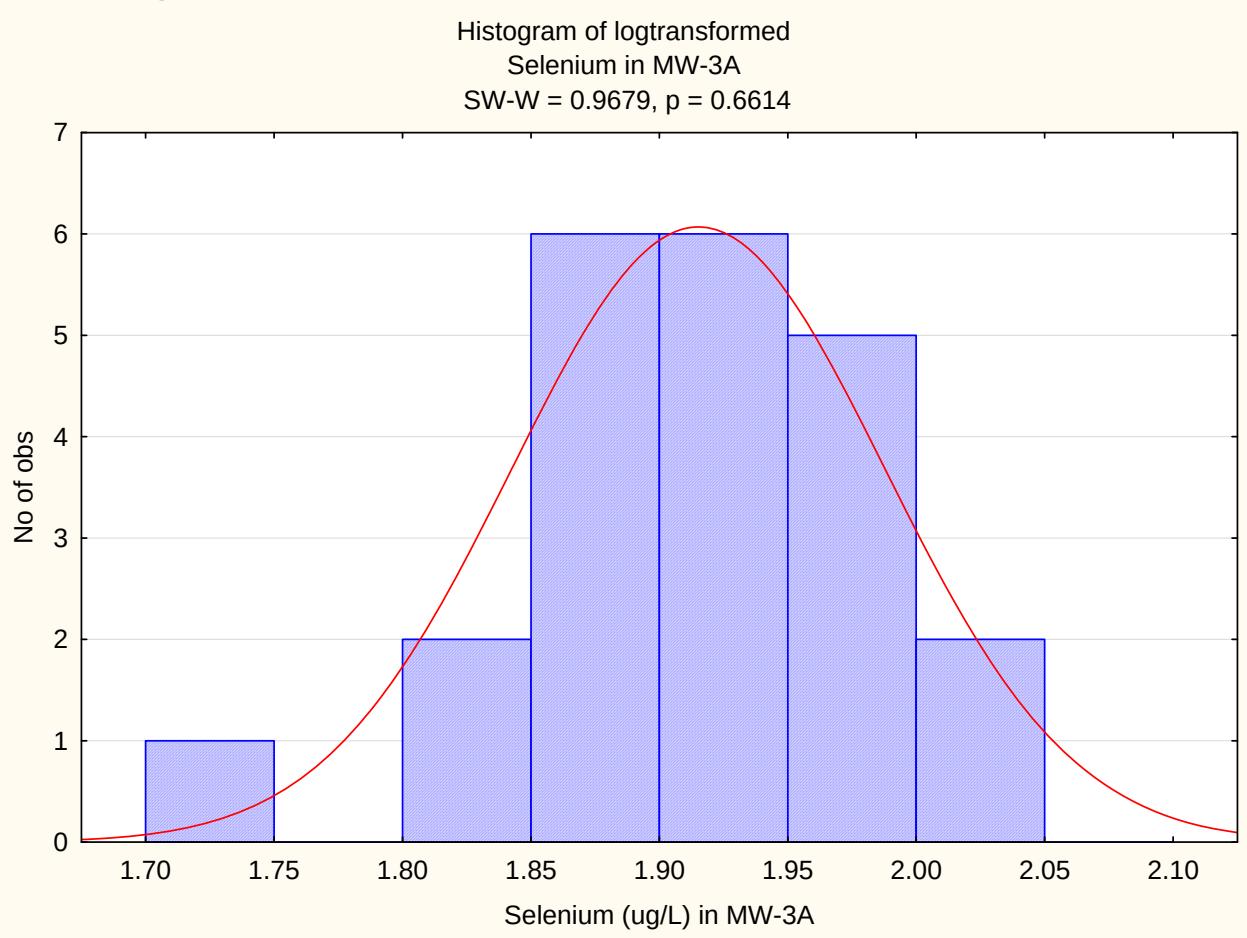
Appendix B-7
Histograms for Constituents and Wells with Consecutive Exceedances



Appendix B-7
Histograms for Constituents and Wells with Consecutive Exceedances



Appendix B-7
Histograms for Constituents and Wells with Consecutive Exceedances



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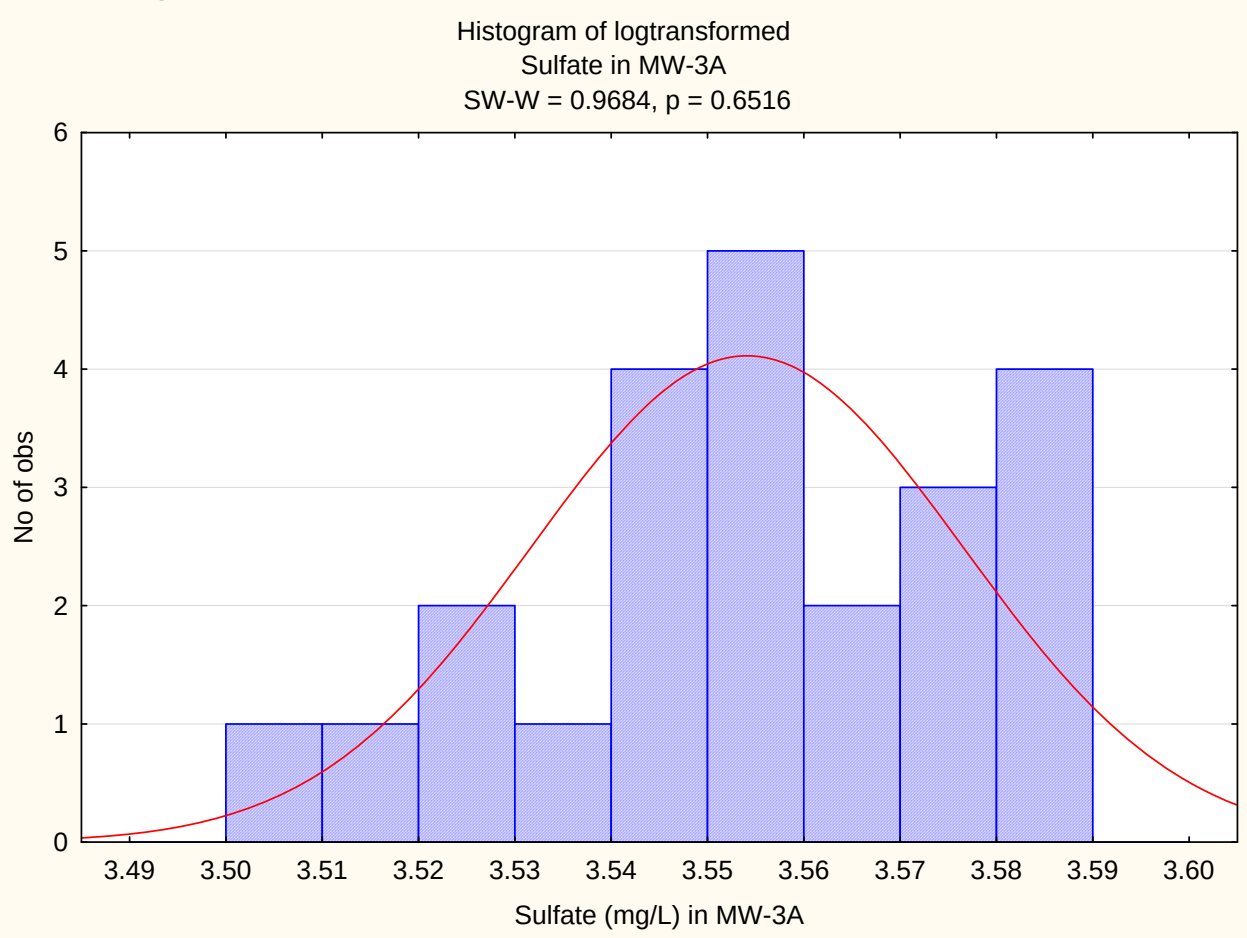
Histograms for Constituents and Wells with Consecutive Exceedances



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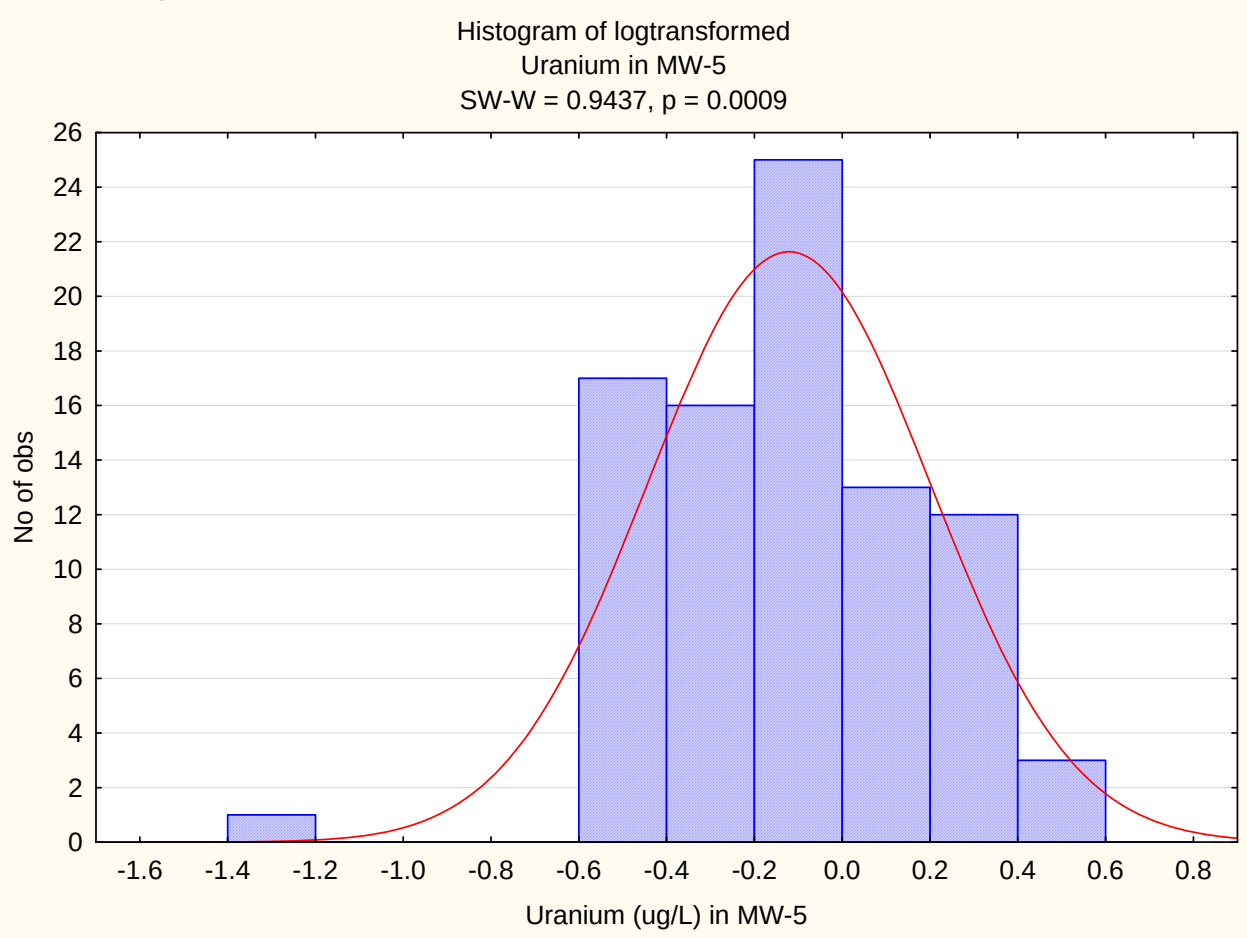
Histograms for Constituents and Wells with Consecutive Exceedances



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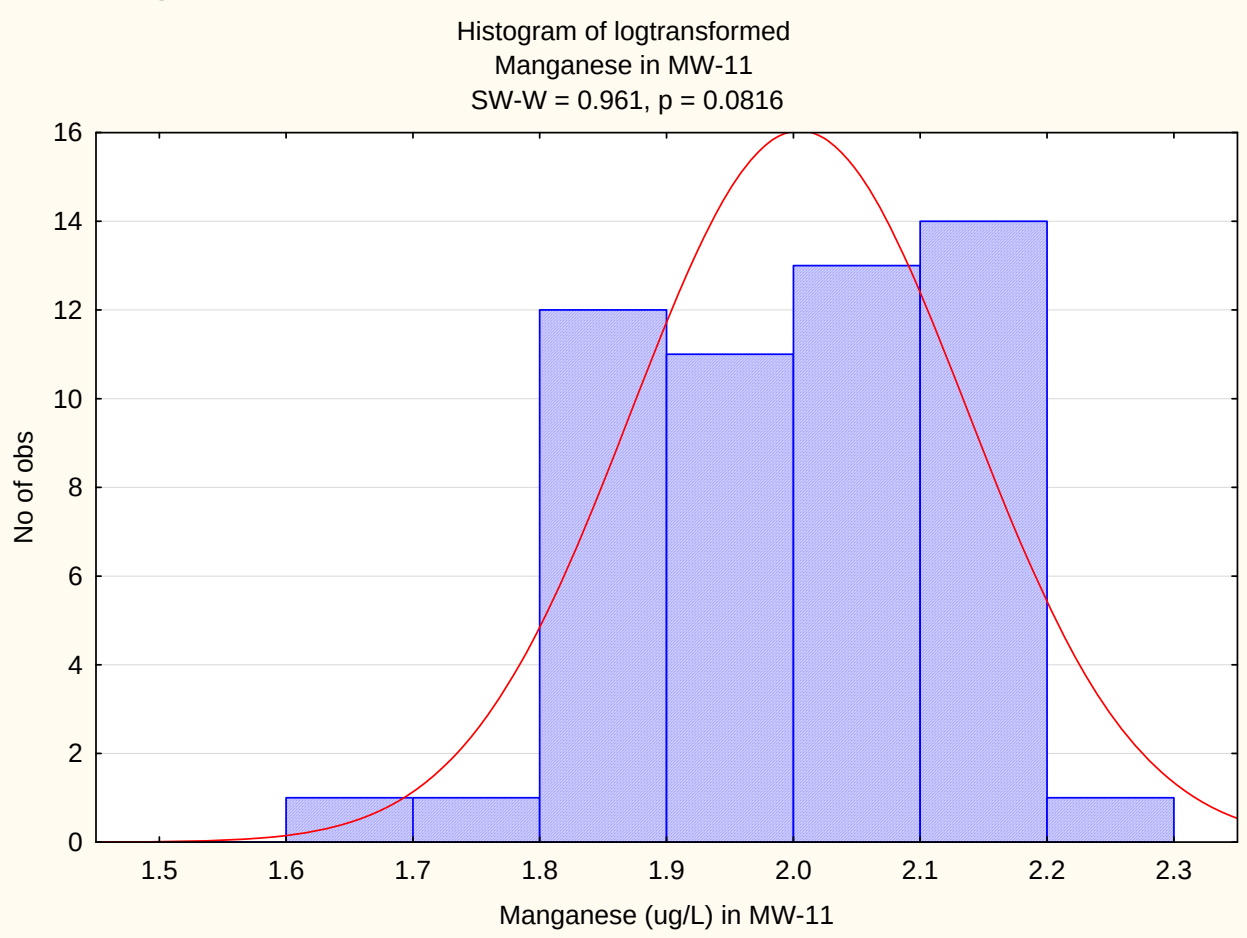
Histograms for Constituents and Wells with Consecutive Exceedances



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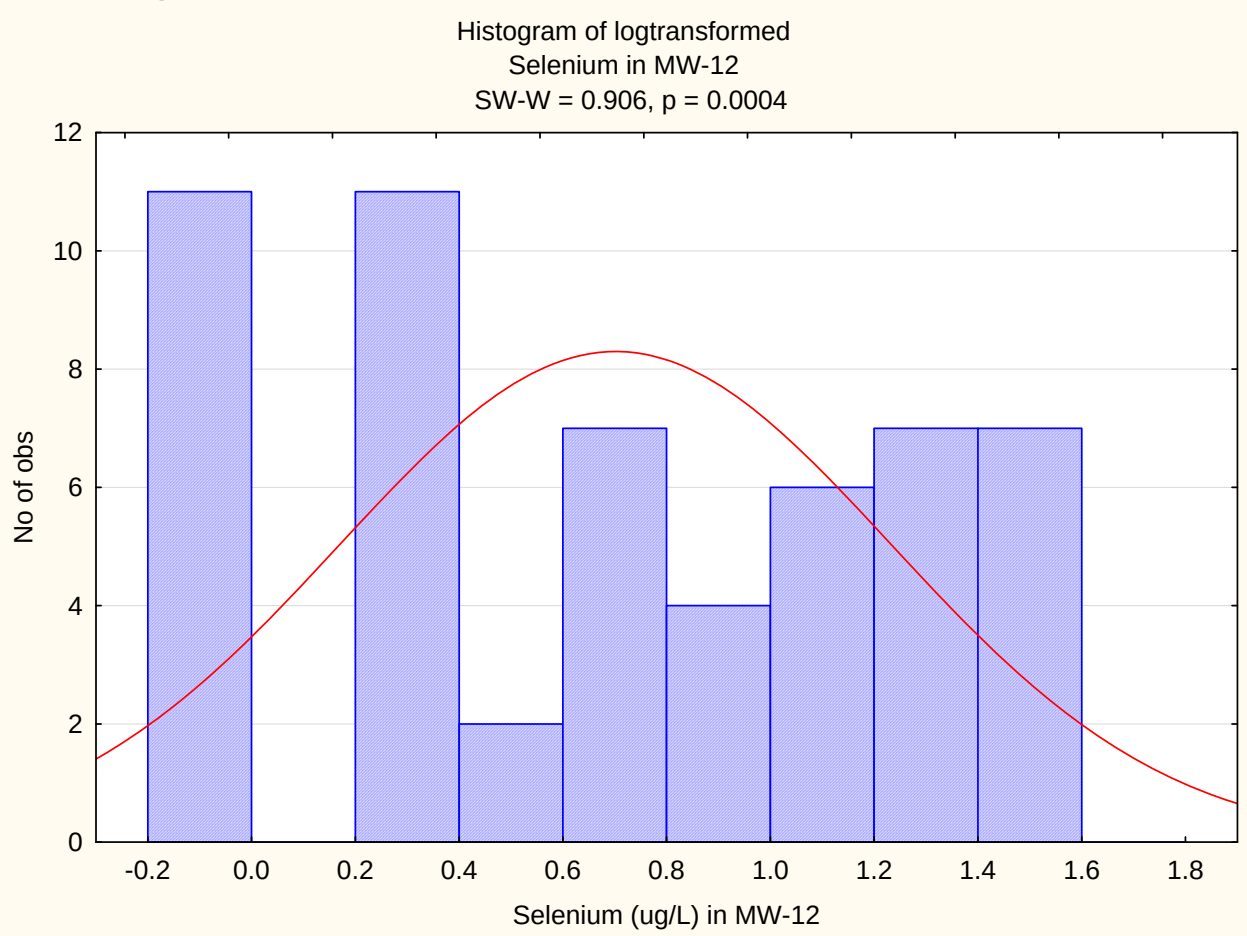
Histograms for Constituents and Wells with Consecutive Exceedances



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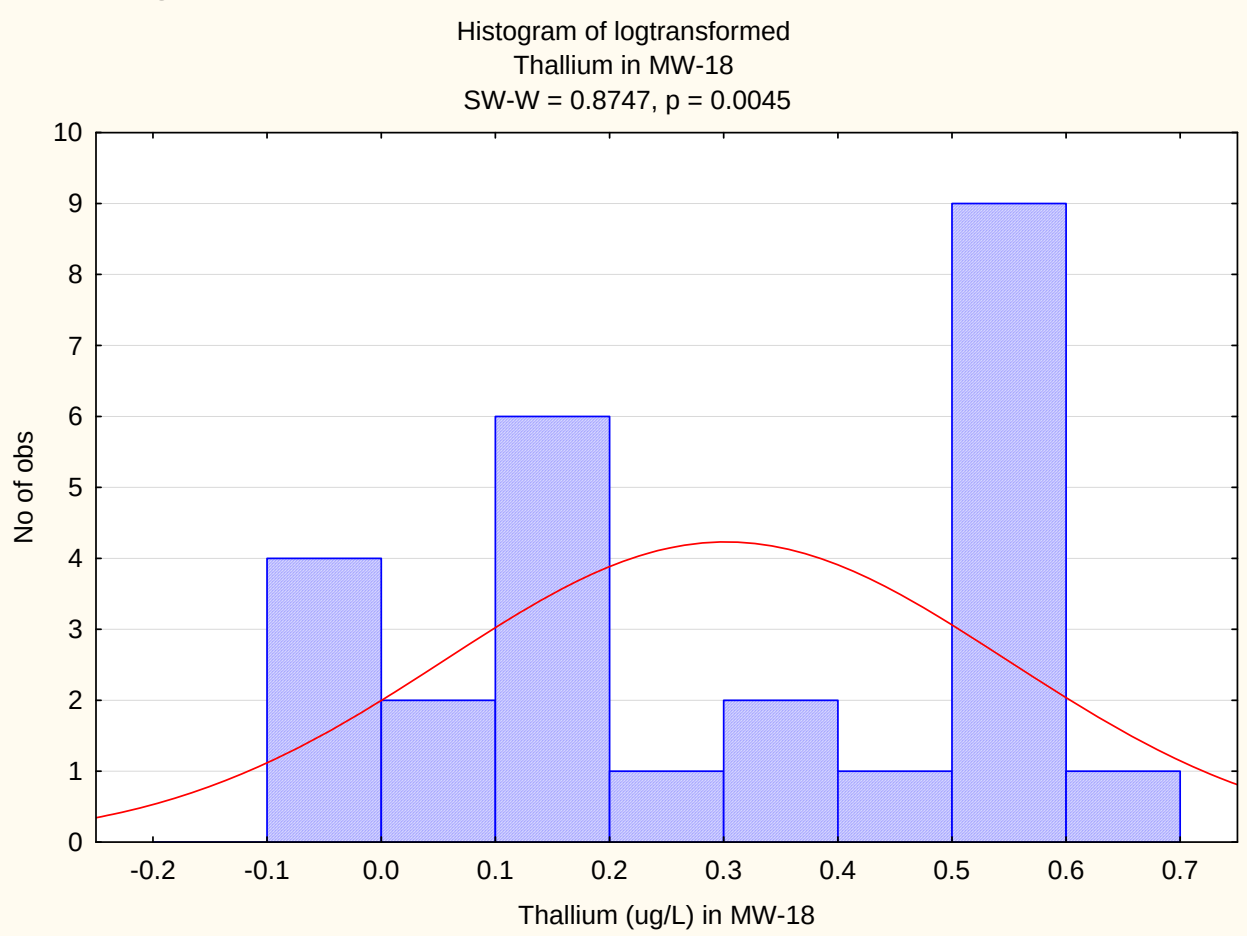

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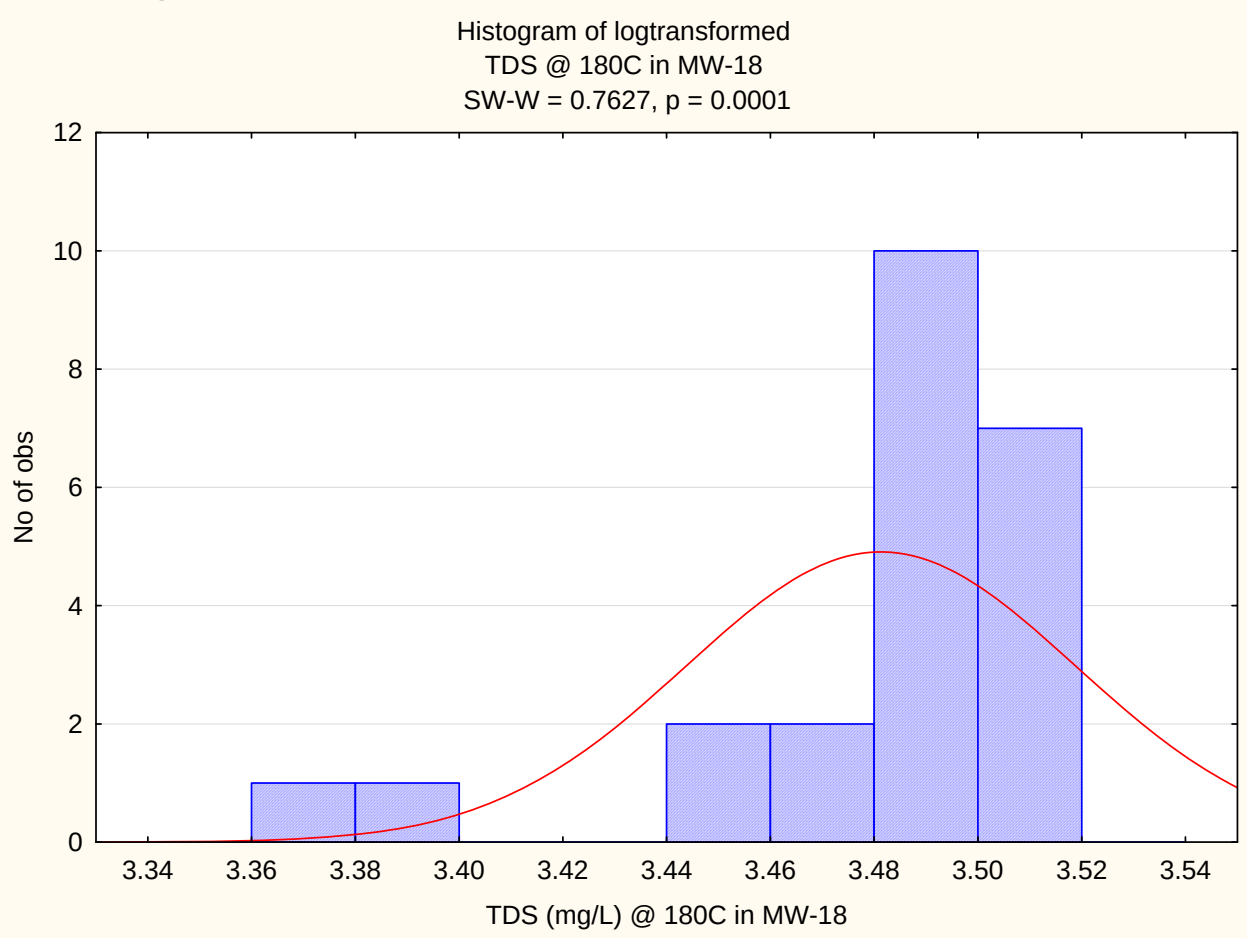
Histograms for Constituents and Wells with Consecutive Exceedances



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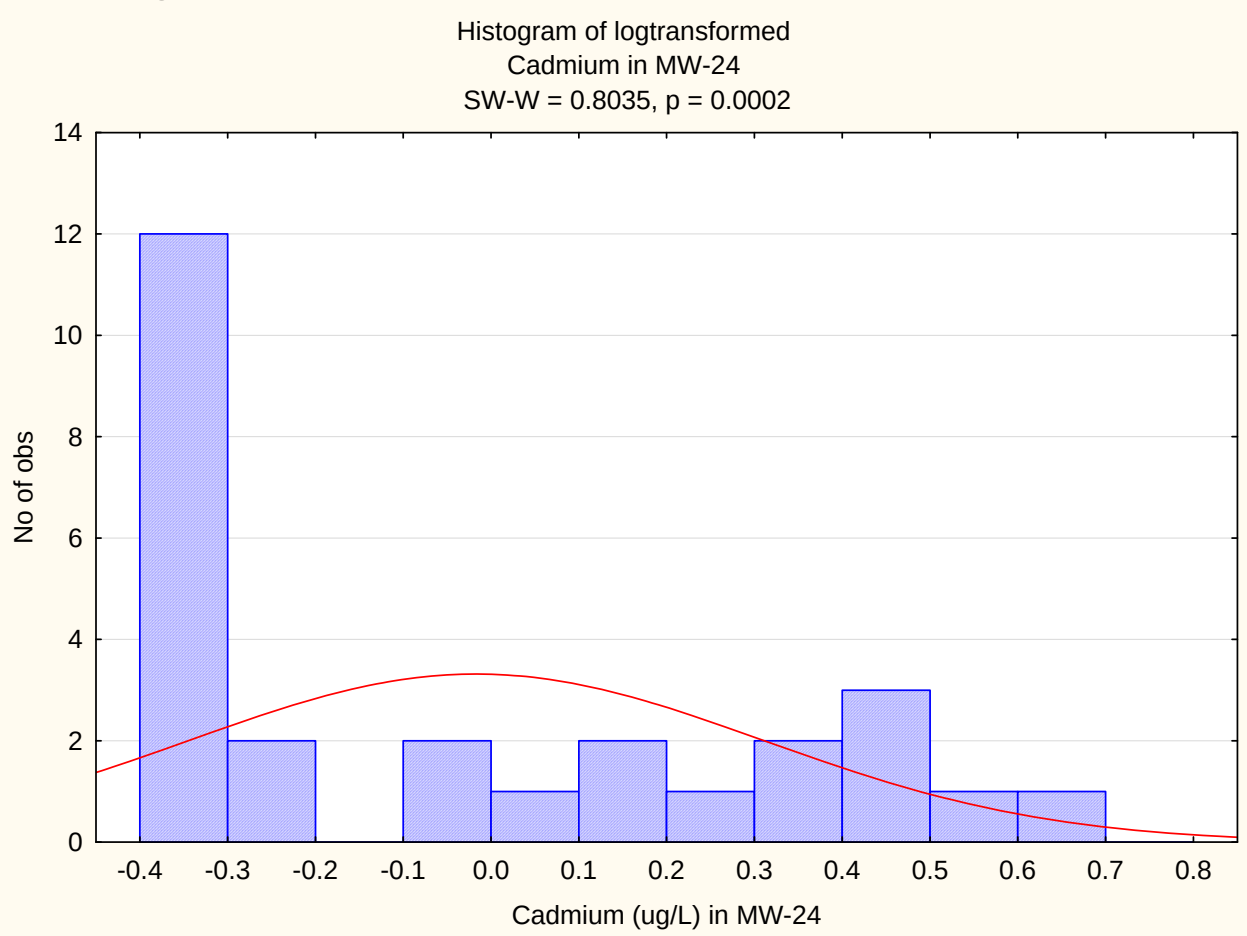

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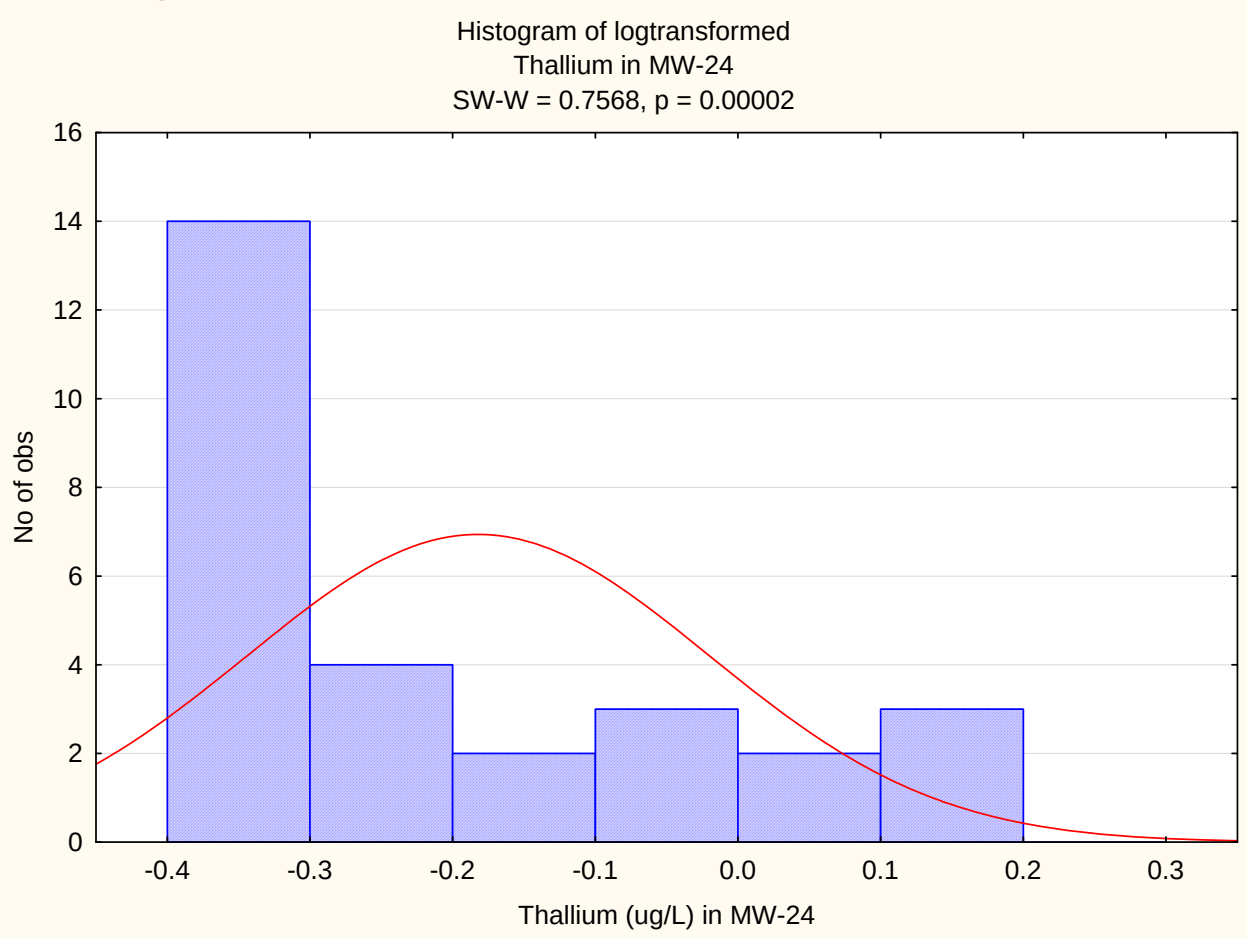
Histograms for Constituents and Wells with Consecutive Exceedances



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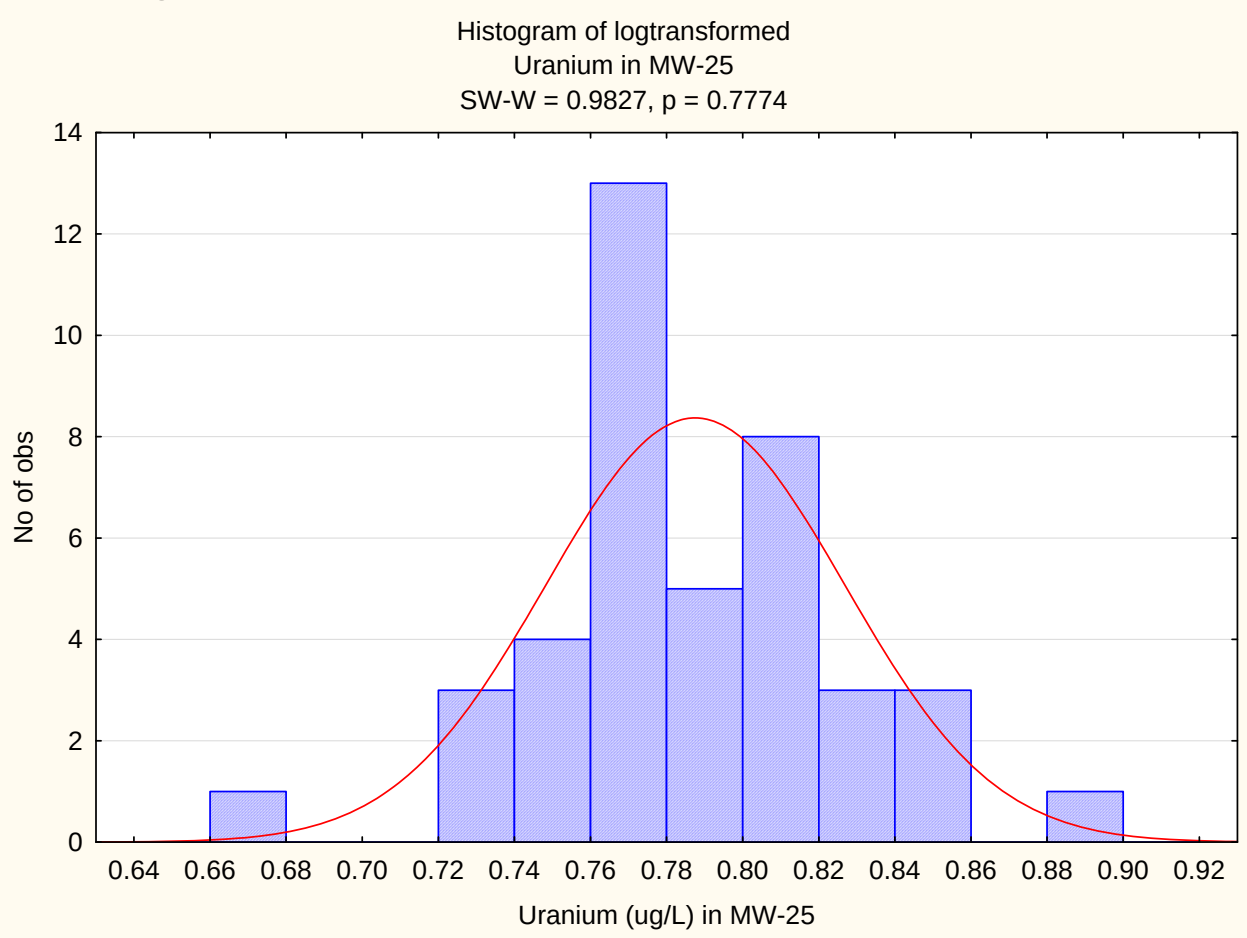
Histograms for Constituents and Wells with Consecutive Exceedances



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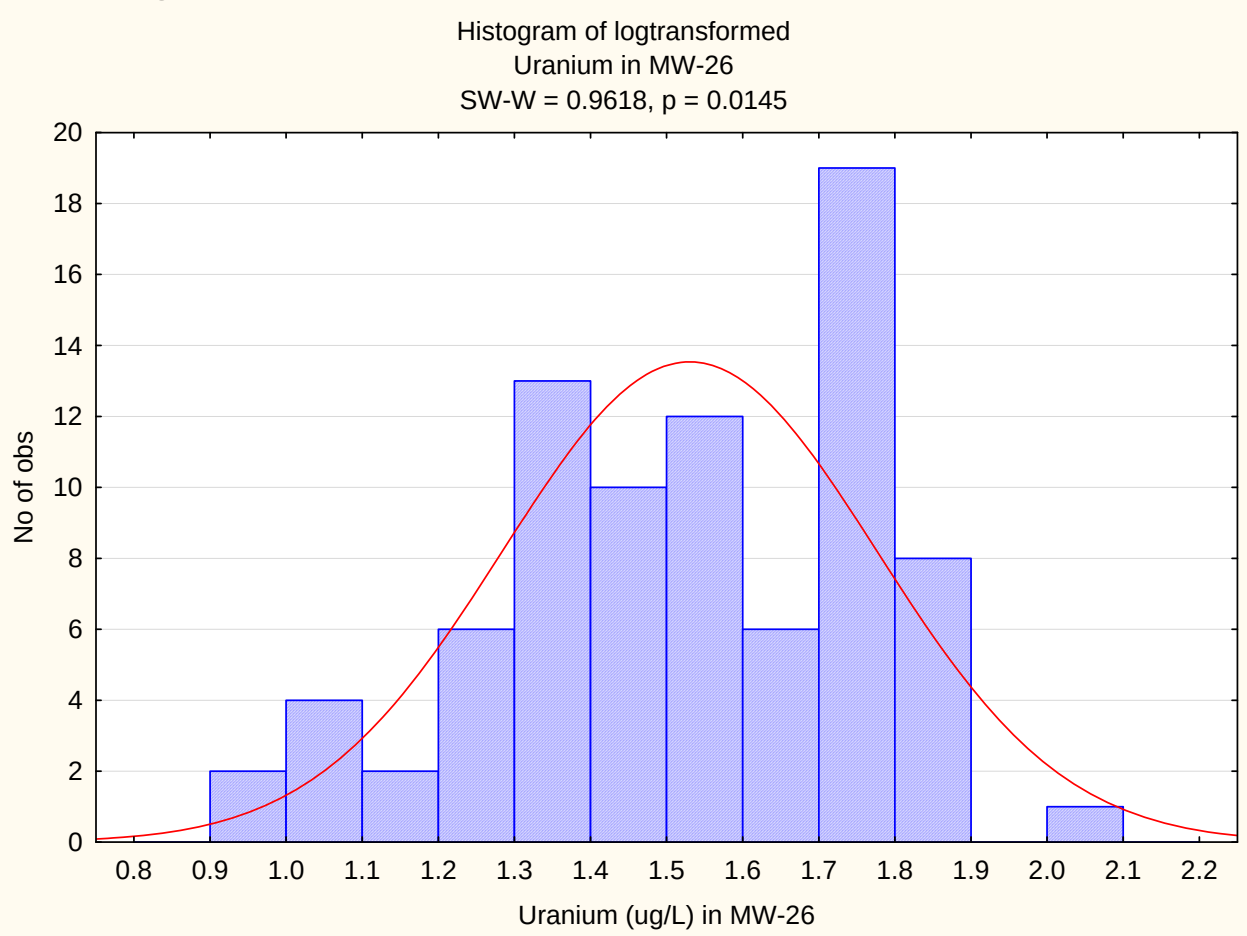
Histograms for Constituents and Wells with Consecutive Exceedances



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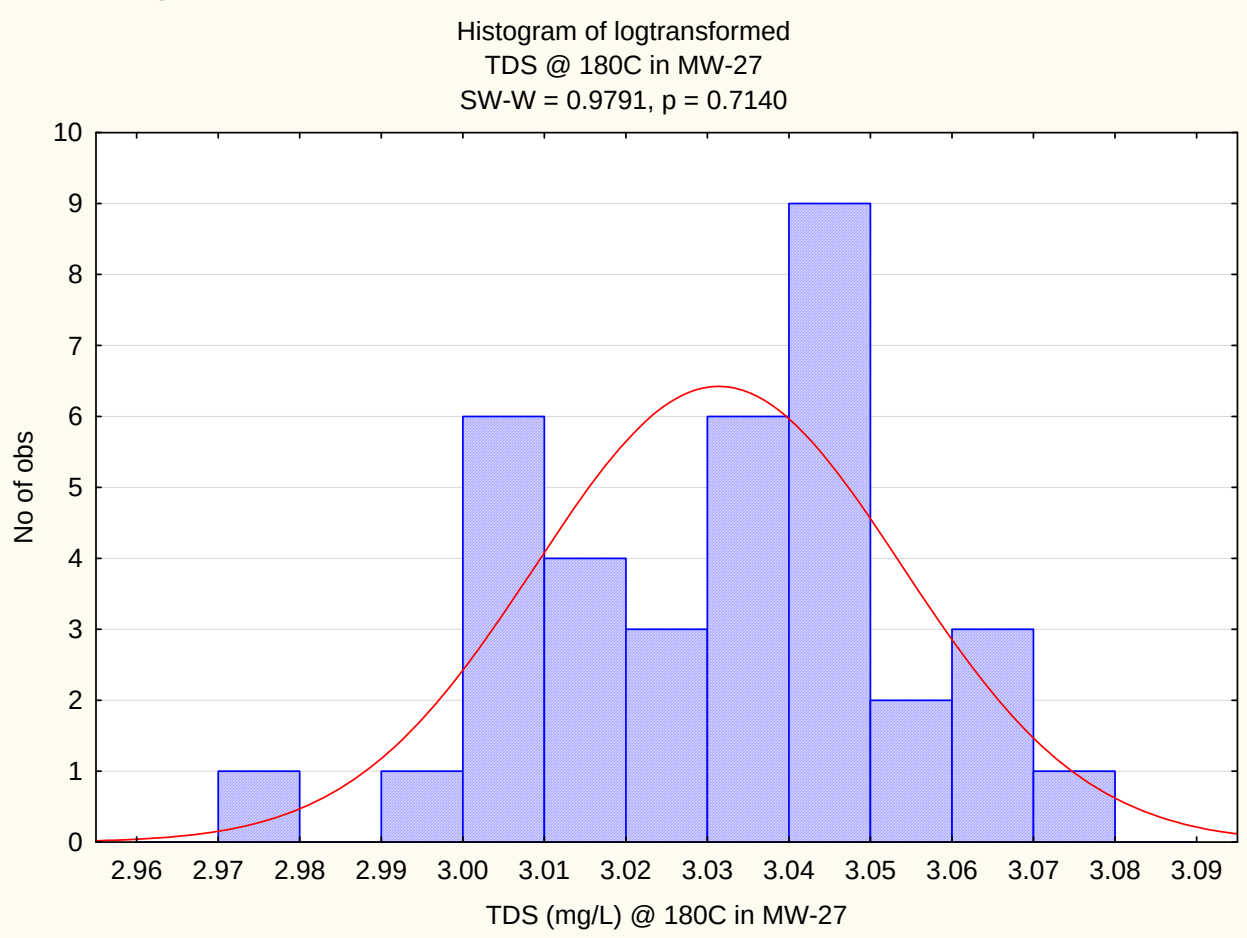
Histograms for Constituents and Wells with Consecutive Exceedances



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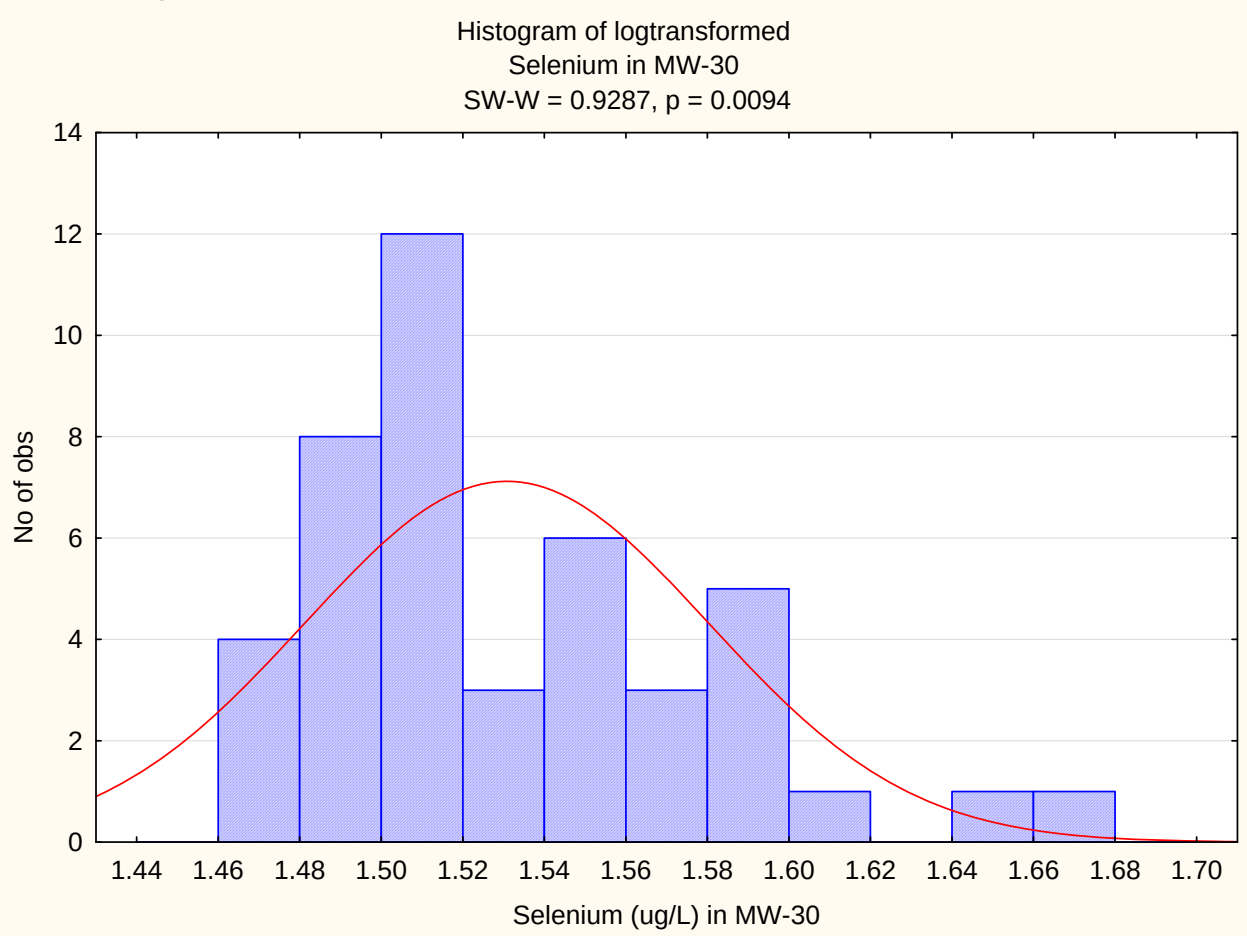

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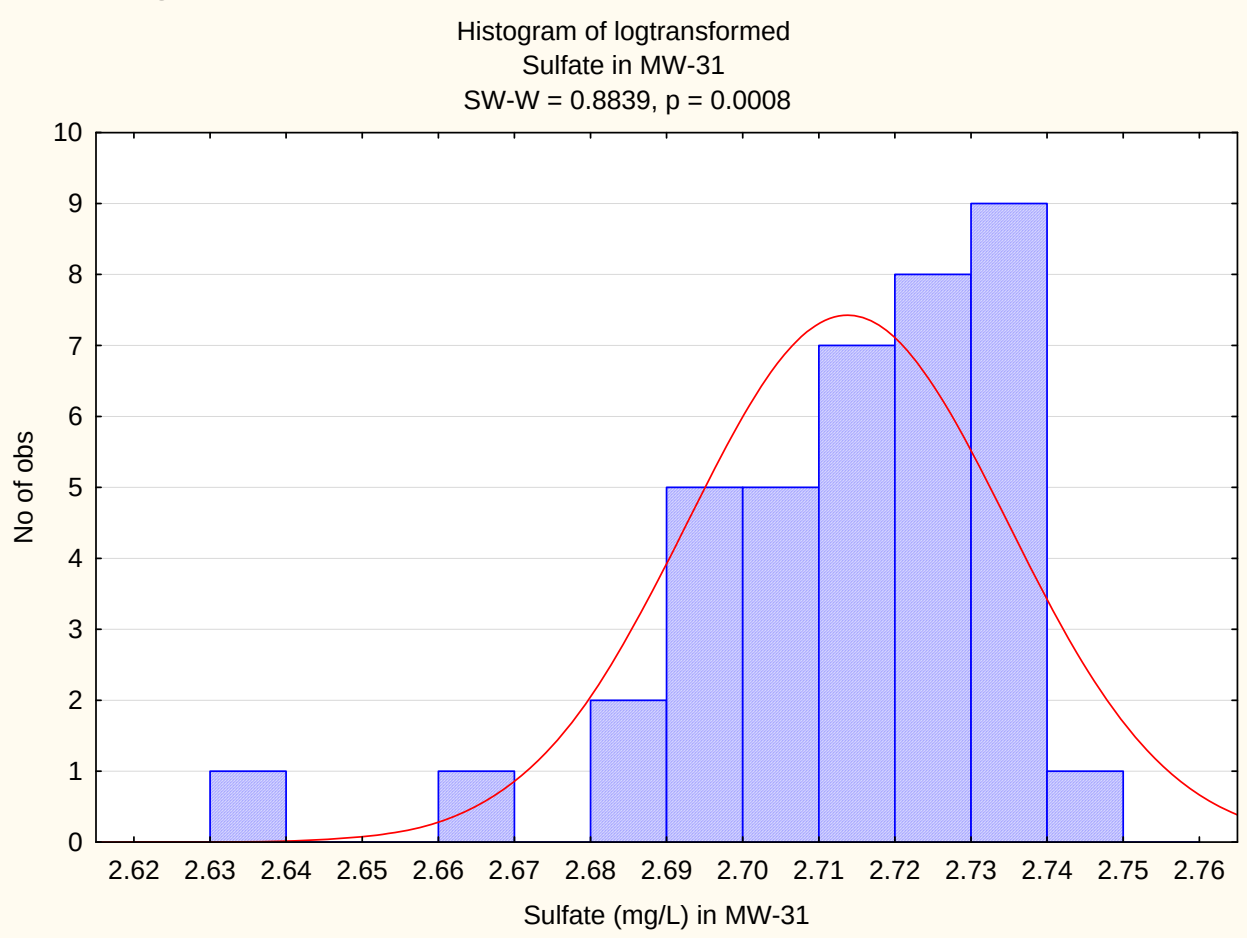

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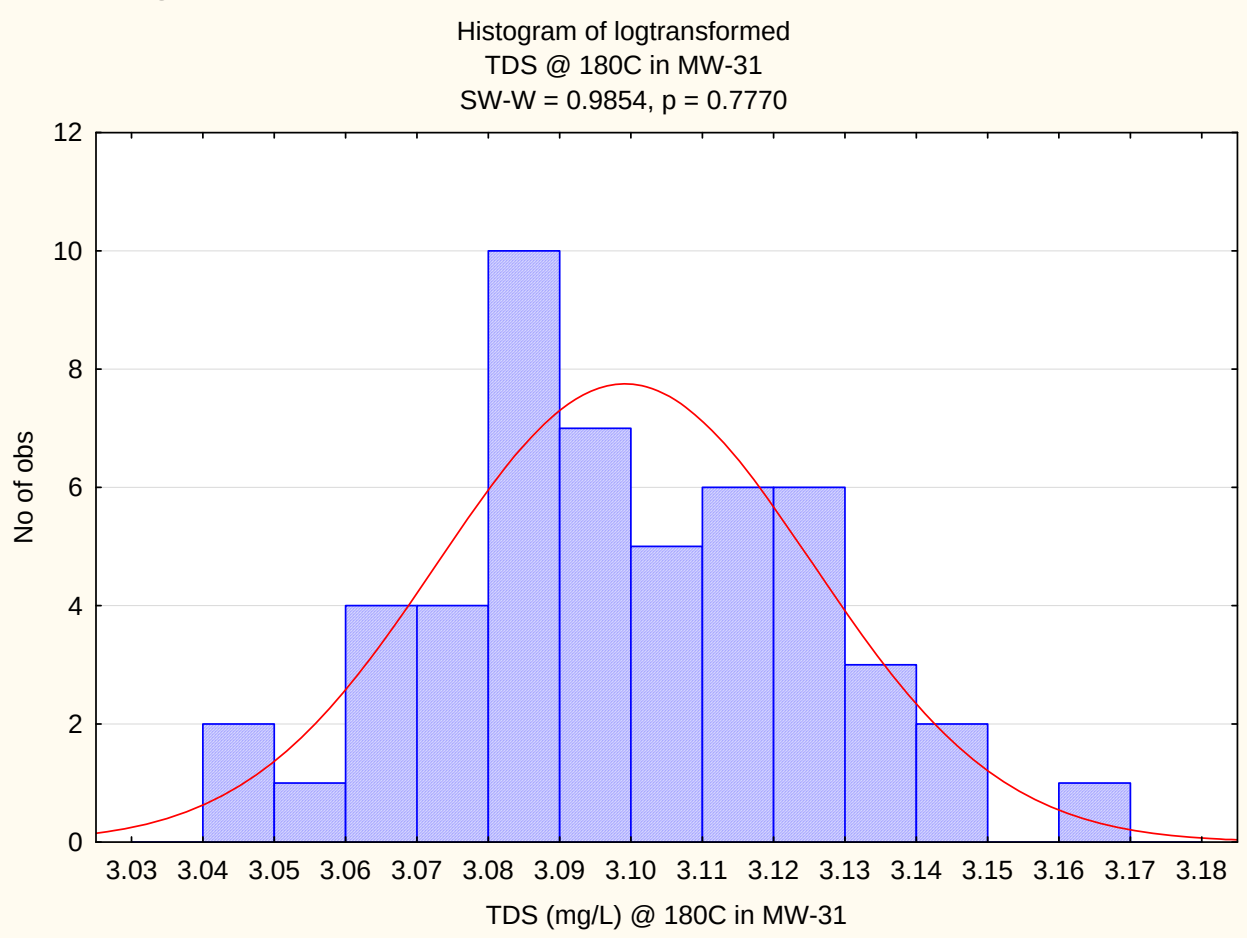
Histograms for Constituents and Wells with Consecutive Exceedances



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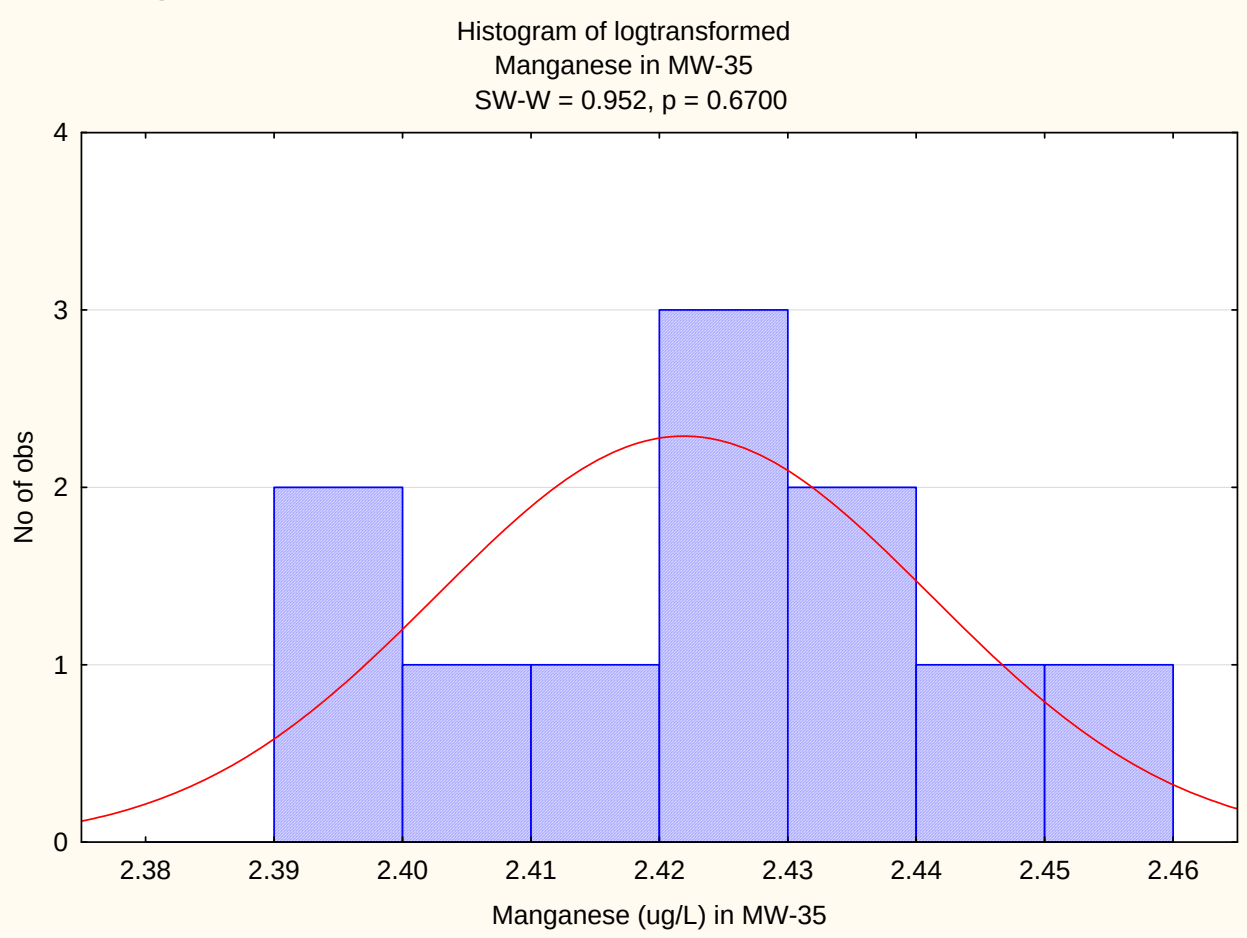
Histograms for Constituents and Wells with Consecutive Exceedances



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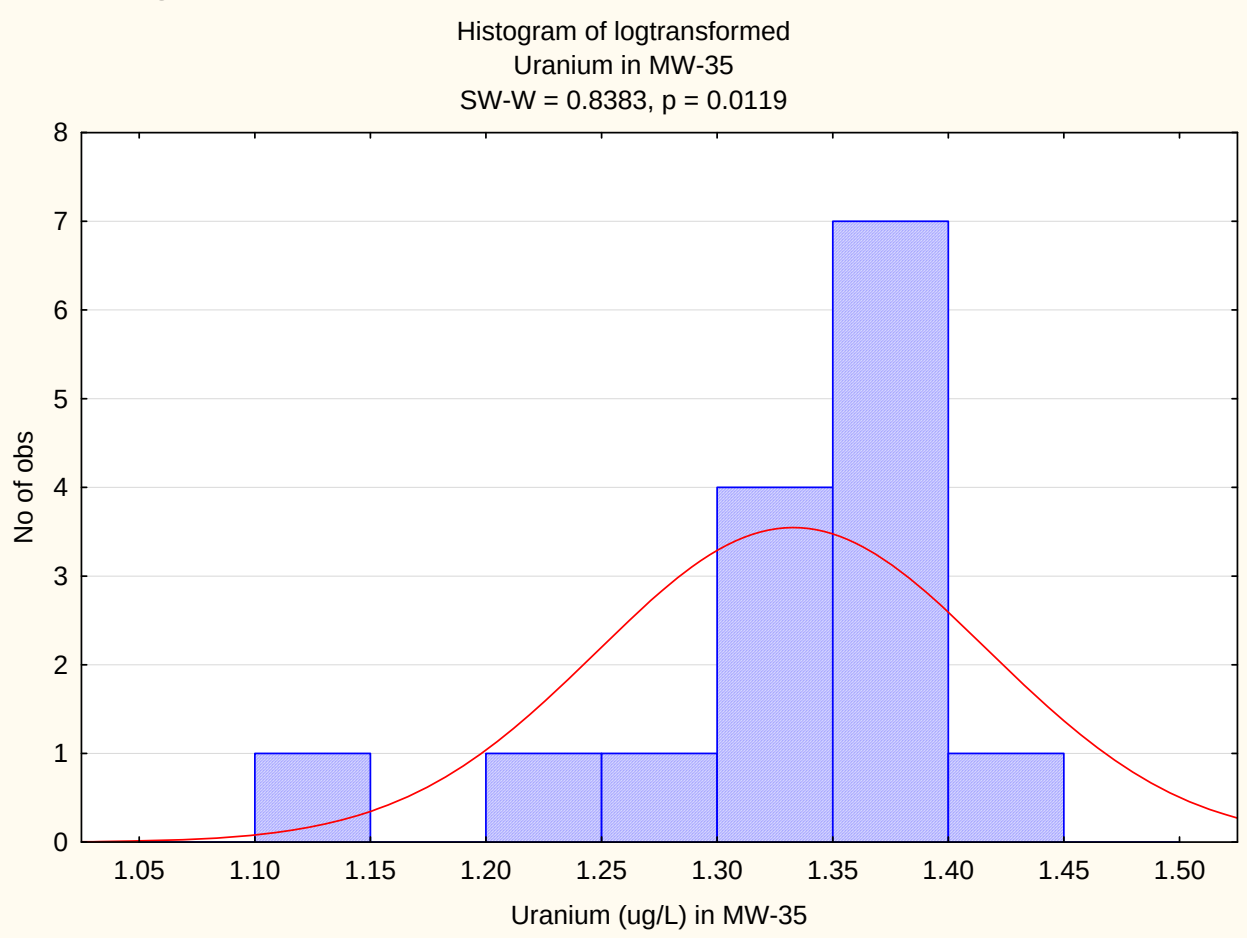
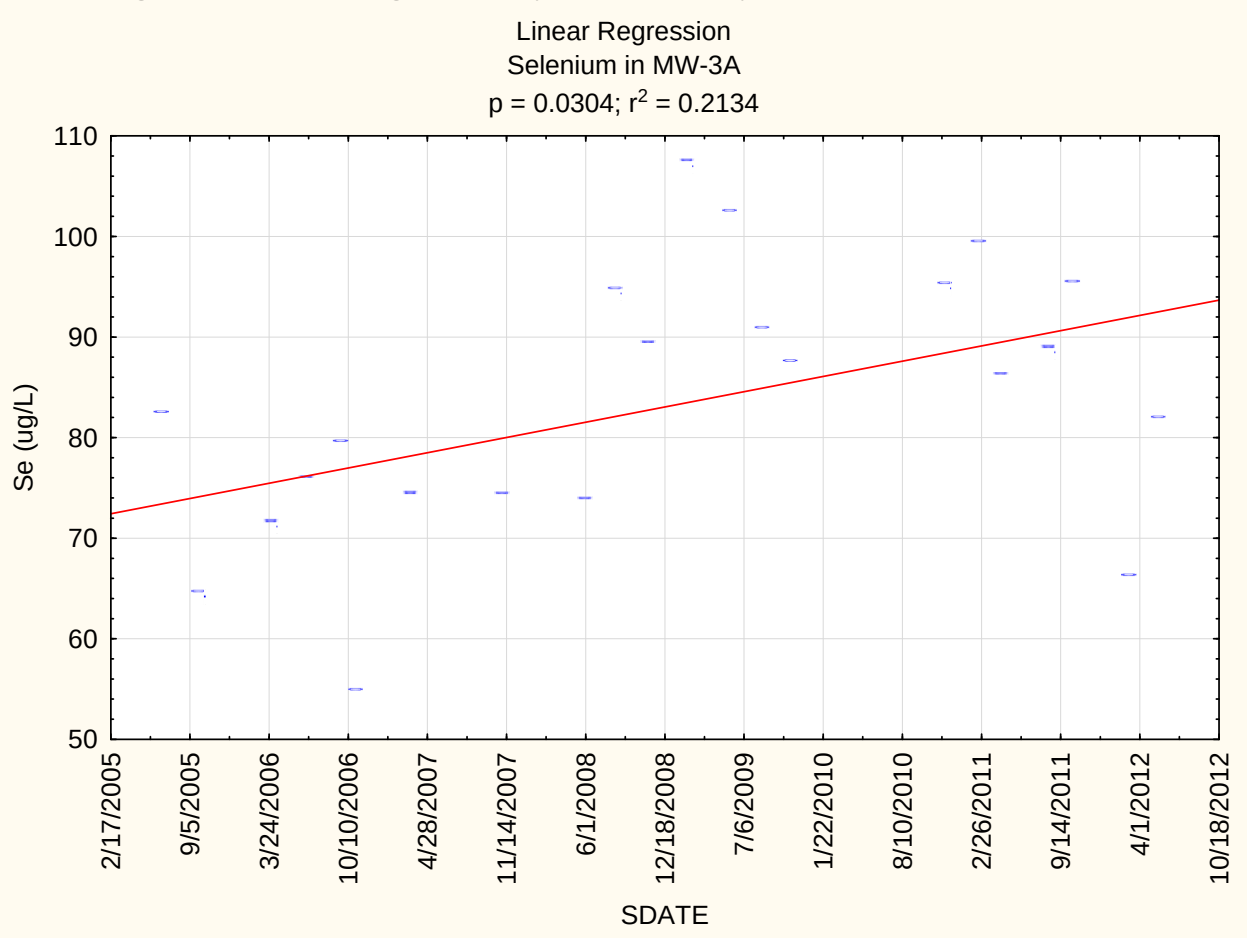
Histograms for Constituents and Wells with Consecutive Exceedances

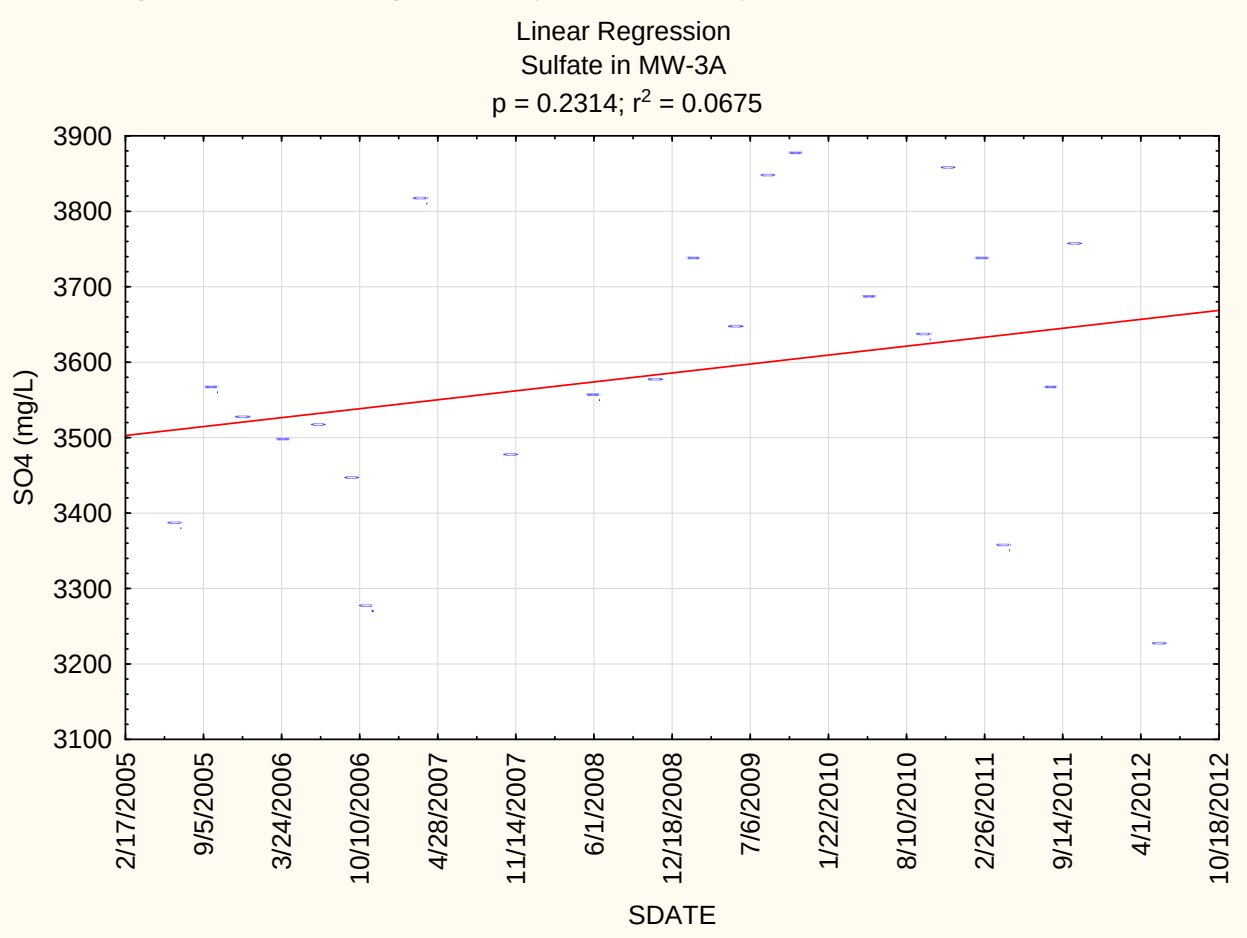


B-8 Regressions for Lognormally or Normally Distributed Constituents

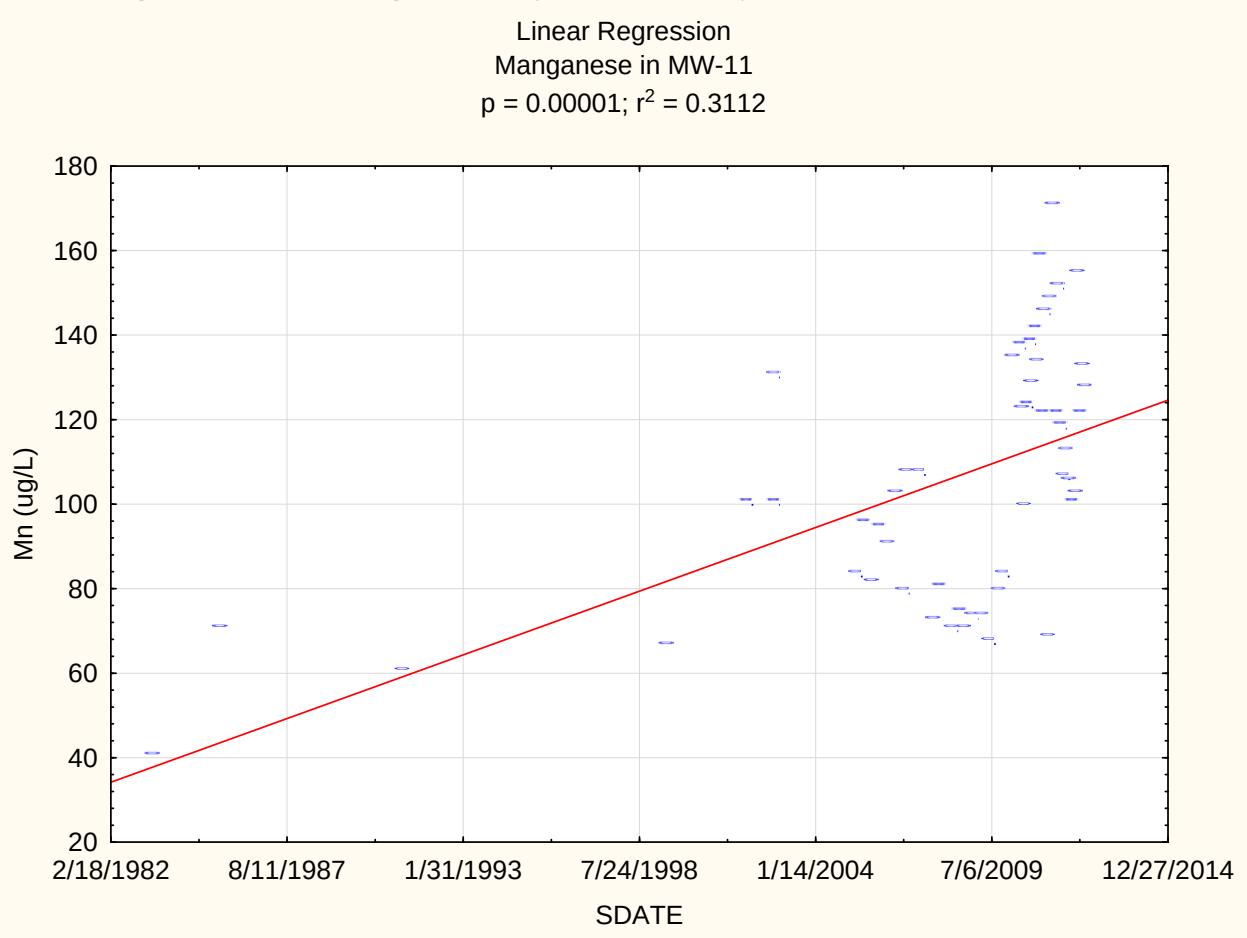
Appendix B-8
Regressions for Lognormally or Normally Distributed Constituents



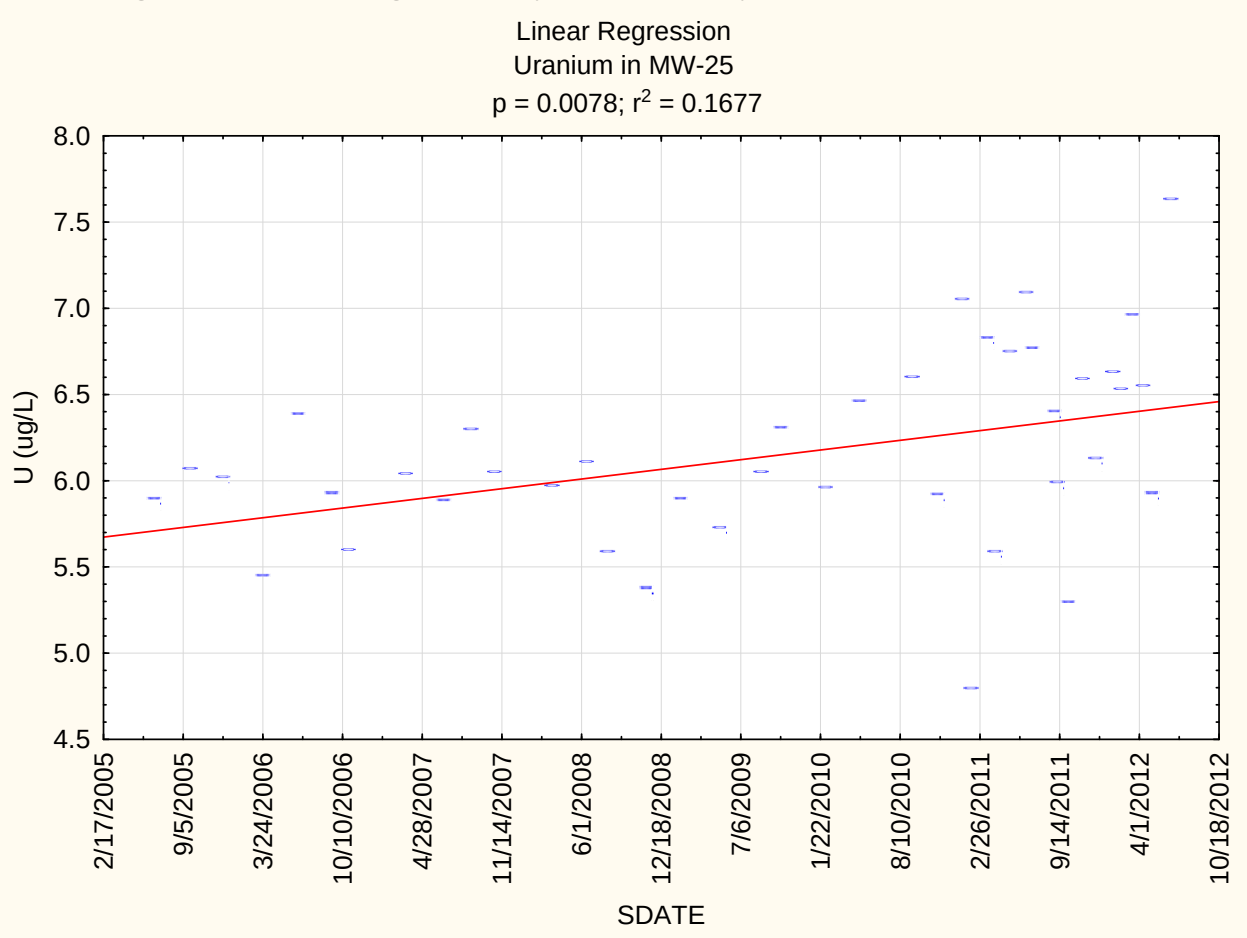
Appendix B-8
Regressions for Lognormally or Normally Distributed Constituents



Appendix B-8
Regressions for Lognormally or Normally Distributed Constituents



Appendix B-8
Regressions for Lognormally or Normally Distributed Constituents



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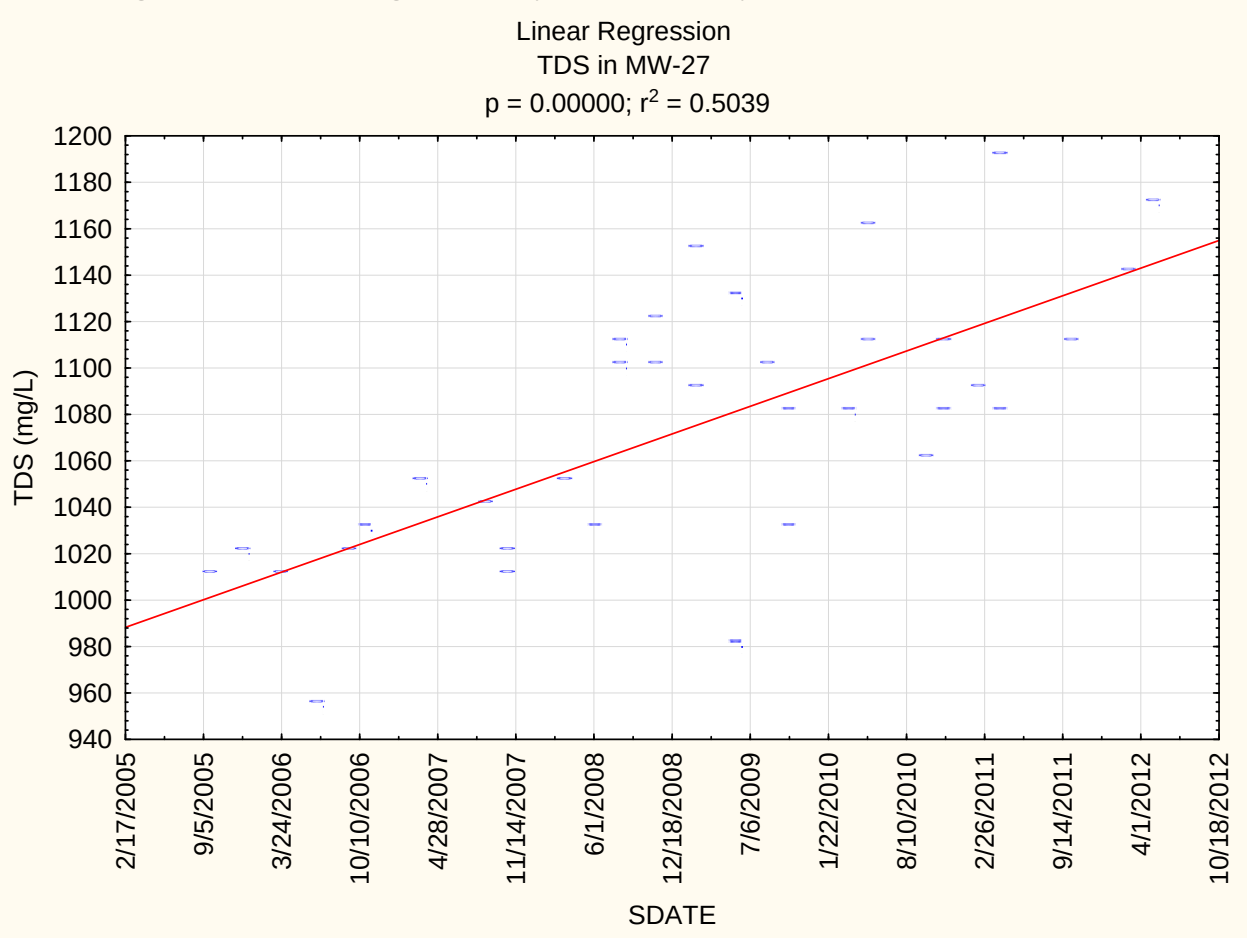
Regressions for Lognormally or Normally Distributed Constituents



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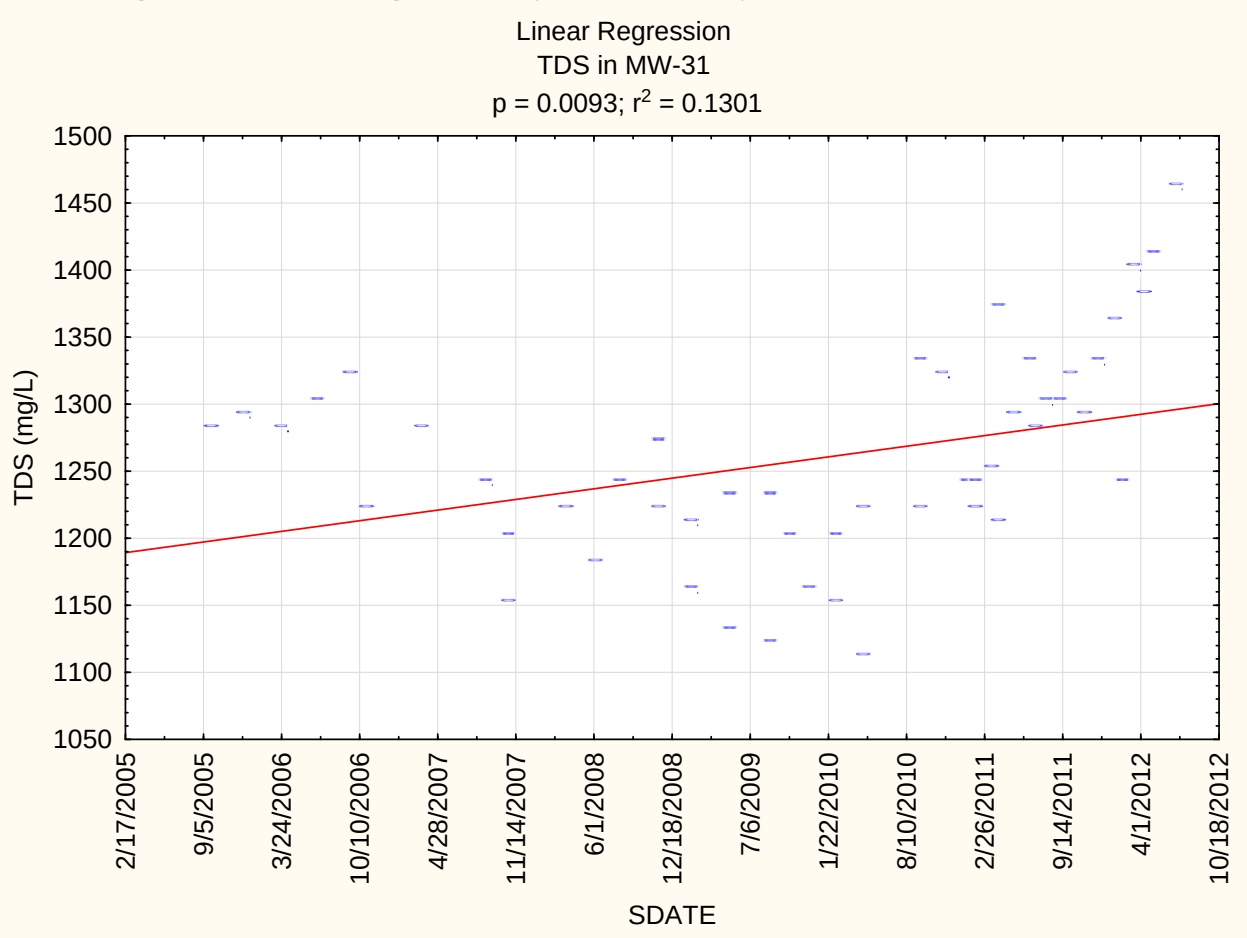
Regressions for Lognormally or Normally Distributed Constituents



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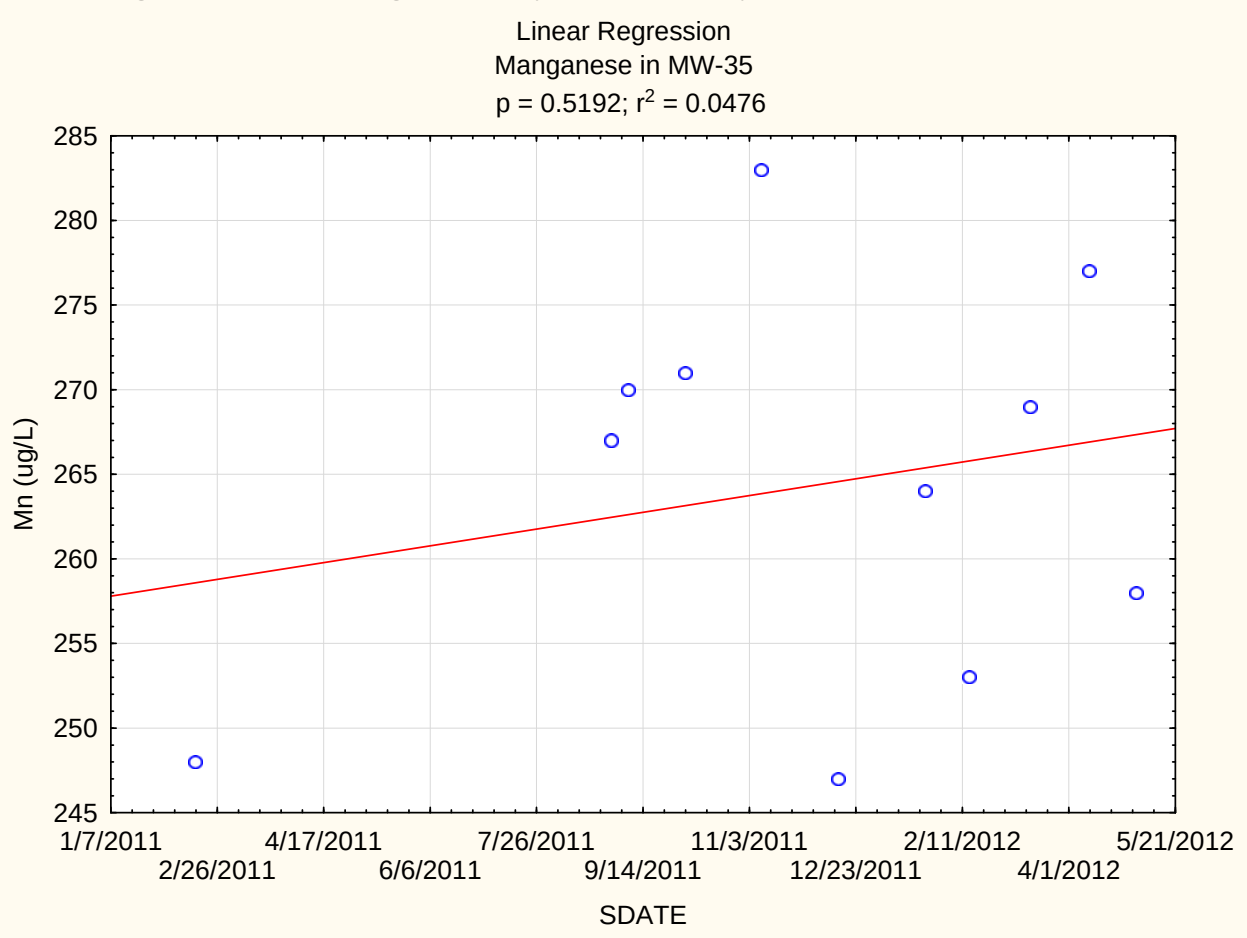
Regressions for Lognormally or Normally Distributed Constituents



B-9 Mann-Kendall Analysis for Constituents Not Lognormally or Normally Distributed

Appendix B-9
Mann-Kendall Analysis for Constituents not Lognormally or Normally Distributed

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	9/13/2012 9:07:26 PM
From File	Cadmium.wst
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Cadmium ug/L-mw-24

General Statistics

Number of Values	27
Minimum	0.5
Maximum	4.28
Mean	1.277
Geometric Mean	0.957
Median	0.59
Standard Deviation	1.057
SEM	0.203

Mann-Kendall Test

Test Value (S)	197
Critical Value (0.05)	1.645
Standard Deviation of S	45.7
Standardized Value of S	4.289
Approximate p-value	8.9739E-06

Statistically significant evidence of an increasing trend at the specified level of significance.

Appendix B-9
Mann-Kendall Analysis for Constituents not Lognormally or Normally Distributed

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	9/13/2012 9:08:24 PM
From File	Fluoride.wst
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Fluoride mg/L-mw-3

General Statistics

Number of Values	44
Minimum	0.074
Maximum	1.04
Mean	0.545
Geometric Mean	0.501
Median	0.5
Standard Deviation	0.211
SEM	0.0318

Mann-Kendall Test

Test Value (S)	486
Critical Value (0.05)	1.645
Standard Deviation of S	98.52
Standardized Value of S	4.923
Approximate p-value	4.2634E-07

Statistically significant evidence of an increasing trend at the specified level of significance.

Appendix B-9
Mann-Kendall Analysis for Constituents not Lognormally or Normally Distributed

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	9/13/2012 9:10:13 PM
From File	Selenium.wst
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Selenium ug/L-mw-12

General Statistics

Number of Values	55
Minimum	0.001
Maximum	39
Mean	6.429
Geometric Mean	0.0426
Median	0.004
Standard Deviation	11.02
SEM	1.486

Mann-Kendall Test

Test Value (S)	937
Critical Value (0.05)	1.645
Standard Deviation of S	136.5
Standardized Value of S	6.859
Approximate p-value	3.456E-12

Statistically significant evidence of an increasing trend at the specified level of significance.

Selenium ug/L-mw-3

General Statistics

Number of Values	84
Minimum	0.001
Maximum	52.8
Mean	8.337
Geometric Mean	0.0534
Median	0.0095
Standard Deviation	14.66
SEM	1.6

Mann-Kendall Test

Test Value (S)	2209
Critical Value (0.05)	1.645
Standard Deviation of S	257.8
Standardized Value of S	8.566

Approximate p-value	0

Statistically significant evidence of an increasing trend at the specified level of significance.

Selenium ug/L-mw-30

General Statistics

Number of Values	44
Minimum	29
Maximum	47.2
Mean	34.13
Geometric Mean	33.91
Median	32.5
Standard Deviation	4.083
SEM	0.616

Mann-Kendall Test

Test Value (S)	450
Critical Value (0.05)	1.645
Standard Deviation of S	98.76
Standardized Value of S	4.546
Approximate p-value	2.7303E-06

Statistically significant evidence of an increasing trend at the specified level of significance.

Appendix B-9
Mann-Kendall Analysis for Constituents not Lognormally or Normally Distributed

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	9/13/2012 9:18:09 PM
From File	Sulfate.wst
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Sulfate mg/L-mw-31

General Statistics

Number of Values	39
Minimum	436
Maximum	552
Mean	517.3
Geometric Mean	516.8
Median	522
Standard Deviation	24.15
SEM	3.867

Mann-Kendall Test

Test Value (S)	274
Critical Value (0.05)	1.645
Standard Deviation of S	82.58
Standardized Value of S	3.306
Approximate p-value	0.00047306

Statistically significant evidence of an increasing trend at the specified level of significance.

Appendix B-9
Mann-Kendall Analysis for Constituents not Lognormally or Normally Distributed

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	9/13/2012 9:15:46 PM
From File	TDS.wst
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

TDS mg/L-mw-18

General Statistics

Number of Values	23
Minimum	2350
Maximum	3280
Mean	3034
Geometric Mean	3024
Median	3100
Standard Deviation	241.9
SEM	50.44

Mann-Kendall Test

Test Value (S)	144
Critical Value (0.05)	1.645
Standard Deviation of S	37.82
Standardized Value of S	3.781
Approximate p-value	7.8209E-05

Statistically significant evidence of an increasing trend at the specified level of significance.

TDS mg/L-mw-31

General Statistics

Number of Values	51
Minimum	1110
Maximum	1460
Mean	1258
Geometric Mean	1255
Median	1240
Standard Deviation	76.46
SEM	10.71

Mann-Kendall Test

Test Value (S)	396
Critical Value (0.05)	1.645
Standard Deviation of S	122.8
Standardized Value of S	3.218

Appendix B-9
Mann-Kendall Analysis for Constituents not Lognormally or Normally Distributed

Approximate p-value 0.00064636

Statistically significant evidence of an increasing trend at the specified level of significance.

Appendix B-9
Mann-Kendall Analysis for Constituents not Lognormally or Normally Distributed

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	9/13/2012 9:16:54 PM
From File	Thallium.wst
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Thallium-mw-18

General Statistics

Number of Values	26
Minimum	0.83
Maximum	4
Mean	2.302
Geometric Mean	1.992
Median	1.99
Standard Deviation	1.187
SEM	0.233

Mann-Kendall Test

Test Value (S)	225
Critical Value (0.05)	1.645
Standard Deviation of S	45.37
Standardized Value of S	4.937
Approximate p-value	3.9604E-07

Statistically significant evidence of an increasing trend at the specified level of significance.

Thallium-mw-24

General Statistics

Number of Values	28
Minimum	0.5
Maximum	1.57
Mean	0.706
Geometric Mean	0.656
Median	0.515
Standard Deviation	0.313
SEM	0.0592

Mann-Kendall Test

Test Value (S)	182
Critical Value (0.05)	1.645
Standard Deviation of S	47.19
Standardized Value of S	3.835

Appendix B-9
Mann-Kendall Analysis for Constituents not Lognormally or Normally Distributed

Approximate p-value 6.2736E-05

Statistically significant evidence of an increasing trend at the specified level of significance.

Appendix B-9
Mann-Kendall Analysis for Constituents not Lognormally or Normally Distributed

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	9/14/2012 3:51:05 PM
From File	Uranium.wst
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Uranium ug/L-mw-26

General Statistics

Number of Values	83
Minimum	9.48
Maximum	119
Mean	38.86
Geometric Mean	33.61
Median	33.6
Standard Deviation	20.36
SEM	2.235

Mann-Kendall Test

Test Value (S)	1436
Critical Value (0.05)	1.645
Standard Deviation of S	254.3
Standardized Value of S	5.644
Approximate p-value	8.3278E-09

Statistically significant evidence of an increasing trend at the specified level of significance.

Uranium ug/L-mw-35

General Statistics

Number of Values	15
Minimum	12.7
Maximum	27.2
Mean	21.79
Geometric Mean	21.45
Median	22.4
Standard Deviation	3.71
SEM	0.958

Mann-Kendall Test

Test Value (S)	11
Tabulated p-value	0.313
Standard Deviation of S	20.21
Standardized Value of S	0.495

Approximate p-value	0.31

Insufficient evidence to identify a significant trend at the specified level of significance.

Uranium ug/L-mw-5

General Statistics

Number of Values	87
Minimum	0.04
Maximum	3.4
Mean	0.95
Geometric Mean	0.743
Median	0.791
Standard Deviation	0.686
SEM	0.0735

Mann-Kendall Test

Test Value (S)	-917
Critical Value (0.05)	-1.645
Standard Deviation of S	271.7
Standardized Value of S	-3.371
Approximate p-value	0.00037481

Statistically significant evidence of a decreasing trend at the specified level of significance.

APPENDIX C

Geochemical Analysis for Indicator Parameters in Wells with Consecutive Exceedances

C-1 Indicator Parameter Analysis Summary Table

Appendix C-1
Indicator Parameter Analysis Summary Table

Well	Parameter	N	Mean	Shapiro Wilks Test for Normality[a]			Least Squares Regression Trend Analysis[b]		Mann-Kendall Trend Analysis[c]		Significant Trend
				W	P	Normally or Lognormally Distributed?	R^2	p	S	p	
MW-03	Chloride	84	64.78	0.951985	0.003627	No			-642	0.00565	Decreasing
MW-03	Fluoride	44	0.54	0.878543	0.000254	No			497	2.57E-07	Increasing
MW-03	Sulfate	90	3091.67	0.8724	0	No			1055	0.00011941	Increasing
MW-03	Uranium	85	22.93	0.914540	0.000032	No			708	7.54E-04	Increasing
MW-03A	Chloride	19	59.16	0.831107	0.003356	No			-28	0.171	None
MW-03A	Fluoride	19	1.24	0.9505	0.4022	Yes	0.095334	0.198376			None
MW-03A	Sulfate	23	3583.48	0.956940	0.404451	Yes	0.075173	0.205511			None
MW-03A	Uranium	19	20.53	0.9358	0.2449	Yes	0.235296	0.035283			Decreasing
MW-05	Chloride	123	52.49	0.973761	0.016807	No			-1344	0.00164	Decreasing
MW-05	Fluoride	44	0.88	0.8447	0.00003	No			280	0.00235	Increasing
MW-05	Sulfate	90	1133.28	0.9761	0.0956	Yes	0.008872	0.377201			Decreasing
MW-05	Uranium	87	0.95	0.931516	0.000186	No			-865	3.75E-04	Decreasing
MW-11	Chloride	121	32.37	0.157212	0.000000	No			-801	0.0362	Decreasing
MW-11	Fluoride	35	0.54	0.911485	0.008169	No			-98	0.0833	None
MW-11	Sulfate	87	1038.97	0.9666	0.0238	No			2015	7.516E-14	Increasing
MW-11	Uranium	104	0.74	0.586407	0.000000	No			-174	0.303	None
MW-12	Chloride	100	59.49	0.904525	0.000003	No			-1321	3.25E-05	Decreasing
MW-12	Fluoride	20	0.28	0.924357	0.120215	Yes	0.179192	0.062920			Decreasing
MW-12	Sulfate	71	2320.23	0.9551	0.0126	No			-539	0.00378	Decreasing
MW-12	Uranium	97	15.49	0.7322	0	No			2066	5.952E-11	Increasing
MW-18	Chloride	27	46.87	0.937094	0.103303	Yes	0.191858	0.022304			Increasing
MW-18	Fluoride	20	0.25	0.504478	0.000000	No			-122	3.6062E-05	Decreasing
MW-18	Sulfate	30	1668.47	0.8998	0.0083	No			255	2.8869E-06	Increasing
MW-18	Uranium	33	33.23	0.704	0	No			292	3.2586E-06	Increasing

Appendix C-1
Indicator Parameter Analysis Summary Table

Well	Parameter	N	Mean	Shapiro Wilks Test for Normality[a]			Least Squares Regression Trend Analysis[b]		Mann-Kendall Trend Analysis[c]		Significant Trend
				W	P	Normally or Lognormally Distributed?	R^2	p	S	p	
MW-24	Chloride	22	44.82	0.891355	0.020038	No			-39	0.137	None
MW-24	Fluoride	26	0.18	0.9512	0.2477	Yes	0.100989	0.113641			Decreasing
MW-24	Sulfate	26	2651.92	0.9787	0.845	Yes	0.020837	0.481722			None
MW-24	Uranium	24	2.97	0.9153	0.046	No			-77	0.0297	Decreasing
MW-25	Chloride	28	31.21	0.861340	0.001597	No			-117	0.0094	Decreasing
MW-25	Fluoride	29	0.33	0.9462	0.1459	Yes	0.076238	0.147097			None
MW-25	Sulfate	29	1692.76	0.9471	0.1535	Yes	0.093612	0.106494			None
MW-25	Uranium	41	6.11	0.982722	0.777429	Yes	0.167711	0.007840			Increasing
MW-26	Chloride	49	57.77	0.969850	0.238862	Yes	0.124006	0.013086			Increasing
MW-26	Fluoride	29	0.28	0.9391	0.0952	Yes	0.202891	0.014205			Decreasing
MW-26	Sulfate	31	1903.87	0.9056	0.01	No			41	0.248	None
MW-26	Uranium	83	38.52	0.961779	0.014478	No			1436	8.33E-09	Increasing
MW-27	Chloride	27	39.37	0.936008	0.097123	Yes	0.856640	0.000000			Increasing
MW-27	Fluoride	25	0.72	0.9785	0.8543	Yes	0.350983	0.001806			Decreasing
MW-27	Sulfate	27	432.78	0.8964	0.0111	No			154	0.00070277	Increasing
MW-27	Uranium	23	30.59	0.9757	0.8214	Yes	0.412236	0.000957			Decreasing
MW-30	Chloride	37	124.56	0.907222	0.004708	No			137	0.0368	Increasing
MW-30	Fluoride	29	0.36	0.9431	0.1206	Yes	0.026177	0.401753			None
MW-30	Sulfate	29	812.62	0.9846	0.937	Yes	0.799048	0.000000			Decreasing
MW-30	Uranium	31	6.99	0.935229	0.060949	Yes	0.094116	0.093219			None
MW-31	Chloride	37	137.50	0.970404	0.419417	Yes	0.367596	0.000070			Increasing
MW-31	Fluoride	27	0.88	0.9816	0.8971	Yes	0.228389	0.011696			Decreasing
MW-31	Sulfate	39	517.33	0.883904	0.000787	No			274	4.73E-04	Increasing
MW-31	Uranium	28	7.26	0.9494	0.1919	Yes	0.021673	0.454716			None

Appendix C-1
Indicator Parameter Analysis Summary Table

Well	Parameter	N	Mean	Shapiro Wilks Test for Normality[a]			Least Squares Regression Trend Analysis[b]		Mann-Kendall Trend Analysis[c]		Significant Trend
				W	P	Normally or Lognormally Distributed?	R^2	p	S	p	
MW-35	Chloride	7	61.571	0.779212	0.025361	No	0.040405	0.633134			None
MW-35	Fluoride	8	0.370	0.959394	0.804309	Yes	0.249516	0.253704			None
MW-35	Sulfate	7	2307.143	0.918085	0.454660	Yes			-4	0.319	None
MW-35	Uranium	17	22.829	0.897873	0.062587	Yes	0.000012	0.989343			None

Notes:

σ = sigma

µg/L = micrograms per liter

mg/L = milligrams per liter

W = Shapiro Wilk test value

N = number of valid data points

N/A = not applicable

p = probability

R2 = The measure of how well the trendline fits the data where r2=1 represents a perfect fit.

S = MannKendall statistic

S.U. = standard units

a = The Shapiro-Wilk Distribution test was performed on data with % Detect > 50%. For % Detect > 85%, 1/2 the detection limit was substituted for non-detected values, and for % Detect > 50% and < 85% the test was done on detected values only

b = A regression test was performed on data that was determined to have either a normal or log-normal distribution and % Detect > 50%. 1/2 of the detection limit was used for non-detected values

c = The Mann-Kendall test was performed on data with either a non-parametric distribution or with % Detect < 50%

Distribution = Distribution as determined by the Shapiro-Wilk distribution test for constituents with % Detect > 50%

Regression Trend = The result of the linear regression test analysis using 1/2 of the detection limit for values reported as "not detected"

Mann-Kendall Trend = The result of the Mann-Kendall test for non-parametric distributions and for % Detect < 50%

Mean = The arithmatic, Cohen, or Aitchison mean as determined for normally or log-normally distributed constituents with % Detect > 50%

C-2 Descriptive Statistics of Indicator Parameters in Wells with Constituents with Exceedances

Appendix C-2
Descriptive Statistics of Indicator Parameters in Wells with Constituents with Exceedances

Well	Chemical	Units	N	Mean	Std.Dev.	Geometric Mean	Q25	Median	Q75	Minimum	Maximum	Range	Skewness
MW-11	Chloride	mg/L	120	32.371	3.1762	32.219	30.850	32.000	34.000	24.400	43.200	18.800	0.55959
MW-11	Fluoride	mg/L	35	0.541	0.0582	0.538	0.500	0.540	0.560	0.440	0.705	0.265	1.36437
MW-11	Sulfate	mg/L	87	1038.966	90.7839	1035.166	968.000	1023.000	1090.000	895.000	1309.000	414.000	0.69692
MW-11	Uranium	µg/L	104	0.788	0.5850	0.481	0.300	0.746	1.017	0.000	3.030	3.030	1.56474
MW-12	Chloride	mg/L	100	59.485	6.0627	59.159	56.050	60.150	63.000	37.600	80.500	42.900	-0.51853
MW-12	Fluoride	mg/L	20	0.282	0.0428	0.278	0.255	0.300	0.310	0.186	0.350	0.164	-0.56084
MW-12	Sulfate	mg/L	71	2320.225	140.8901	2315.873	2240.000	2338.000	2430.000	1850.000	2560.000	710.000	-0.65857
MW-12	Uranium	µg/L	97	15.487	4.0309	14.703	14.179	16.000	18.000	3.000	23.500	20.500	-1.14186
MW-18	Chloride	mg/L	27	46.870	12.6399	45.153	35.000	47.600	53.000	19.900	75.000	55.100	0.29082
MW-18	Fluoride	mg/L	20	0.246	0.0847	0.212	0.210	0.220	0.300	0.009	0.400	0.391	-0.54295
MW-18	Sulfate	mg/L	30	1668.467	249.1623	1649.304	1446.000	1720.000	1910.000	1069.000	2020.000	951.000	-0.46360
MW-18	Uranium	µg/L	33	33.226	14.3669	27.742	18.209	40.300	42.700	2.687	49.000	46.313	-0.97195
MW-2	Chloride	mg/L	94	8.276	3.6748	7.640	6.000	7.000	10.000	2.700	20.000	17.300	1.56646
MW-2	Fluoride	mg/L	37	0.314	0.0524	0.310	0.290	0.300	0.330	0.214	0.450	0.236	0.38685
MW-2	Sulfate	mg/L	87	1825.391	197.6087	1813.253	1788.000	1864.000	1970.000	1075.000	2147.000	1072.000	-1.55666
MW-2	Uranium	µg/L	80	9.477	4.2428	7.969	6.559	10.175	12.269	0.703	18.000	17.297	-0.35943
MW-24	Chloride	mg/L	22	44.818	2.7192	44.739	44.000	45.000	46.000	39.000	52.000	13.000	-0.00827
MW-24	Fluoride	mg/L	26	0.181	0.0722	0.170	0.130	0.163	0.220	0.100	0.360	0.260	1.16884
MW-24	Sulfate	mg/L	26	2651.923	154.5320	2647.567	2560.000	2675.000	2740.000	2290.000	2950.000	660.000	-0.06258
MW-24	Uranium	µg/L	24	2.969	3.1294	1.962	1.035	1.560	2.930	0.500	10.400	9.900	1.63900
MW-25	Chloride	mg/L	28	31.214	1.8926	31.156	30.000	31.000	32.000	25.000	34.000	9.000	-1.17933
MW-25	Fluoride	mg/L	29	0.326	0.0208	0.326	0.310	0.321	0.340	0.280	0.375	0.095	-0.11361
MW-25	Sulfate	mg/L	29	1692.759	80.3962	1690.955	1630.000	1680.000	1740.000	1570.000	1880.000	310.000	0.82188
MW-25	Uranium	µg/L	40	6.108	0.5057	6.087	5.870	6.020	6.510	4.770	7.060	2.290	-0.18200
MW-26	Chloride	mg/L	48	57.771	9.0981	57.092	52.000	56.500	63.500	39.000	82.000	43.000	0.64686
MW-26	Fluoride	mg/L	29	0.284	0.0378	0.282	0.260	0.280	0.290	0.210	0.400	0.190	1.19637
MW-26	Sulfate	mg/L	31	1903.871	116.2089	1900.311	1850.000	1890.000	1960.000	1520.000	2160.000	640.000	-0.70410
MW-26	Uranium	µg/L	82	38.524	20.2576	33.332	22.600	33.100	57.000	9.480	119.000	109.520	0.89575
MW-27	Chloride	mg/L	27	39.370	4.3778	39.134	35.000	40.000	43.000	32.000	46.000	14.000	-0.04408
MW-27	Fluoride	mg/L	25	0.723	0.0505	0.721	0.700	0.720	0.749	0.610	0.824	0.214	0.03361
MW-27	Sulfate	mg/L	27	432.778	30.0248	431.727	414.000	442.000	455.000	360.000	480.000	120.000	-0.93690
MW-27	Uranium	µg/L	23	30.587	1.4477	30.554	29.500	30.700	31.800	27.700	33.100	5.400	-0.29327
MW-3	Chloride	mg/L	84	64.783	3.2254	64.704	63.000	65.000	66.050	56.000	76.000	20.000	0.17801
MW-3	Fluoride	mg/L	44	0.543	0.2061	0.501	0.400	0.505	0.640	0.074	1.040	0.966	0.59349
MW-3	Sulfate	mg/L	90	3091.667	418.0796	3060.274	2920.000	3201.500	3381.000	1890.000	4030.000	2140.000	-0.97033
MW-3	Uranium	µg/L	87	22.931	11.0063	19.651	15.000	21.940	30.200	1.000	67.164	66.164	0.69939
MW-30	Chloride	mg/L	36	124.556	6.6222	124.383	122.000	125.000	127.500	106.000	145.000	39.000	-0.07691
MW-30	Fluoride	mg/L	29	0.361	0.0238	0.360	0.349	0.360	0.370	0.300	0.423	0.123	0.17838
MW-30	Sulfate	mg/L	29	812.621	67.2237	809.974	767.000	799.000	853.000	696.000	977.000	281.000	0.40812
MW-30	Uranium	µg/L	29	6.988	0.5963	6.964	6.670	6.880	7.250	5.790	8.380	2.590	0.42210

Appendix C-2
Descriptive Statistics of Indicator Parameters in Wells with Constituents with Exceedances

Well	Chemical	Units	N	Mean	Std.Dev.	Geometric Mean	Q25	Median	Q75	Minimum	Maximum	Range	Skewness
MW-31	Chloride	mg/L	36	137.500	11.2415	137.048	128.000	138.000	146.500	115.000	160.000	45.000	-0.12349
MW-31	Fluoride	mg/L	27	0.876	0.0480	0.875	0.840	0.880	0.910	0.780	0.989	0.209	0.25119
MW-31	Sulfate	mg/L	38	517.868	24.2389	517.291	504.000	522.000	538.000	436.000	552.000	116.000	-1.37715
MW-31	Uranium	µg/L	28	7.260	0.7254	7.226	6.790	7.150	7.640	5.770	9.320	3.550	0.96898
MW-3A	Chloride	mg/L	19	59.158	5.9466	58.844	57.000	60.000	62.000	42.000	70.000	28.000	-1.31589
MW-3A	Fluoride	mg/L	19	1.238	0.2014	1.223	1.060	1.177	1.400	0.940	1.600	0.660	0.30560
MW-3A	Sulfate	mg/L	23	3596.522	192.3446	3591.556	3470.000	3560.000	3750.000	3220.000	3870.000	650.000	-0.21868
MW-3A	Uranium	µg/L	18	20.533	3.0978	20.327	19.000	19.600	22.400	16.500	28.200	11.700	1.02078
MW-5	Chloride	mg/L	123	52.491	4.6723	52.288	49.900	52.000	55.000	37.500	69.700	32.200	0.57027
MW-5	Fluoride	mg/L	44	0.885	0.1899	0.860	0.765	0.920	0.980	0.330	1.300	0.970	-0.65166
MW-5	Sulfate	mg/L	90	1133.278	105.1179	1128.602	1055.000	1130.000	1200.000	860.000	1518.000	658.000	0.76178
MW-5	Uranium	µg/L	101	0.960	0.6483	0.770	0.448	0.980	1.045	0.040	3.400	3.360	1.50046

C-3 Data Omitted from Statistical Analysis

Appendix C-3
Data Omitted from Statistical Analysis

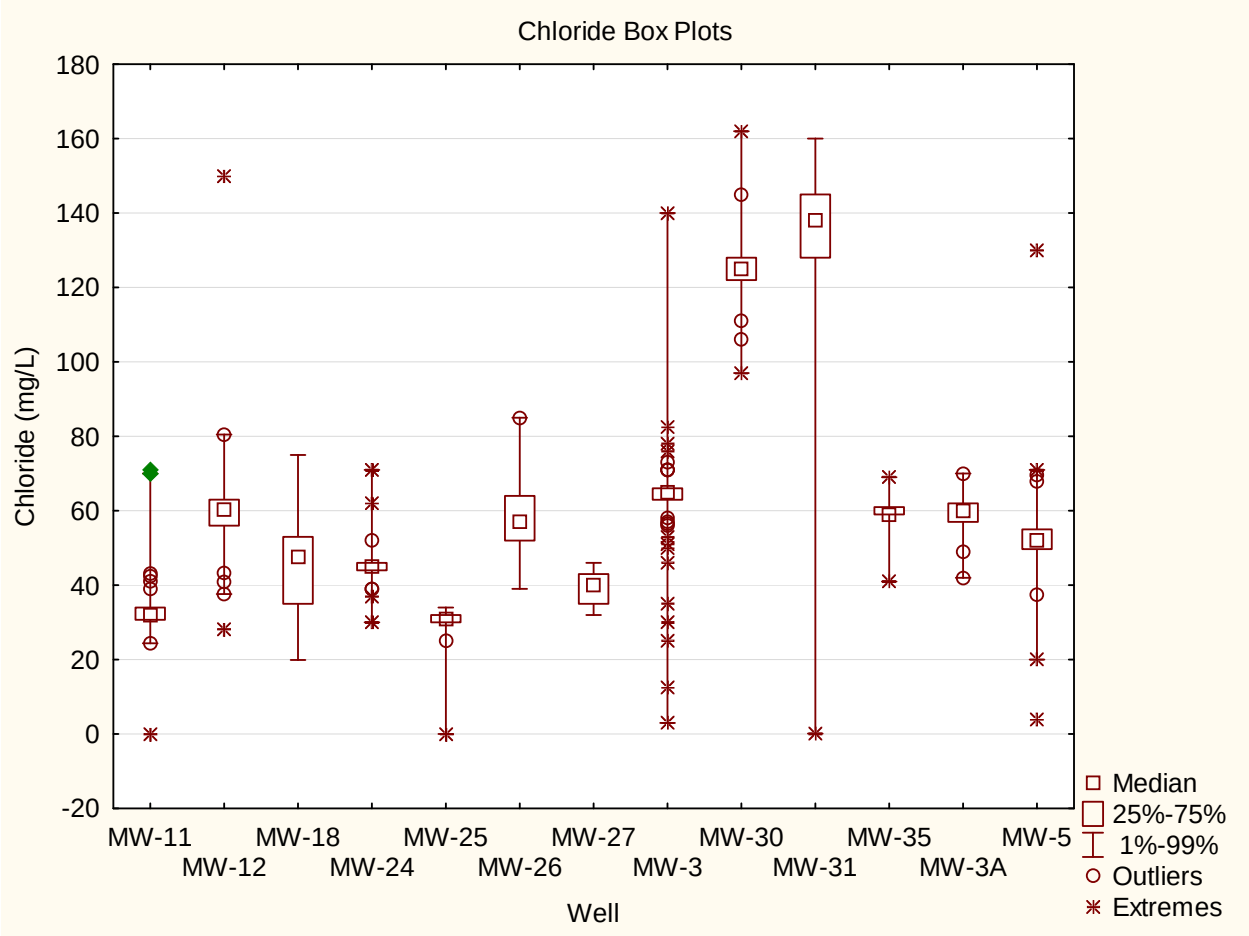
Reason	Well	Sample Date	Reviewed/ Report	Chemical	Result	Units	Qualifier
Extreme Outlier	MW-11	12/15/1985	8/30/2007	Chloride	71	mg/L	
Extreme Outlier	MW-11	6/26/1986		Chloride	70	mg/L	
Extreme Outlier	MW-11	3/15/2007	9/20/2007	Chloride	0.031	mg/L	
Extreme Outlier	MW-24	6/23/2005	9/24/2007	Chloride	71	mg/L	D
Extreme Outlier	MW-24	6/22/2006	9/18/2007	Chloride	30	mg/L	
Extreme Outlier	MW-24	9/15/2006	9/17/2007	Chloride	62	mg/L	
Extreme Outlier	MW-24	8/24/2009	C09081027-005	Chloride	37	mg/L	
Extreme Outlier	MW-25	6/20/2007	9/18/2007	Chloride	0.031	mg/L	
Extreme Outlier	MW-3	10/31/1979	8/30/2007	Chloride	12.6	mg/L	
Extreme Outlier	MW-3	1/31/1980	8/31/2007	Chloride	25	mg/L	
Extreme Outlier	MW-3	4/30/1980	8/31/2007	Chloride	30	mg/L	
Extreme Outlier	MW-3	5/19/1980	9/4/2007	Chloride	50	mg/L	
Extreme Outlier	MW-3	6/16/1980	9/4/2007	Chloride	51	mg/L	
Extreme Outlier	MW-3	9/1/1981	9/13/2007	Chloride	3	mg/L	
Extreme Outlier	MW-3	12/13/1982		Chloride	53	mg/L	
Extreme Outlier	MW-3	9/30/1985	8/30/2007	Chloride	78	mg/L	
Extreme Outlier	MW-3	12/15/1985	8/30/2007	Chloride	35	mg/L	
Extreme Outlier	MW-3	6/26/1986		Chloride	140	mg/L	
Extreme Outlier	MW-3	11/6/2001	9/10/2007	Chloride	82.5	mg/L	
Extreme Outlier	MW-3	10/26/2009	C09101105-001	Chloride	46	mg/L	
Extreme Outlier	MW-30	11/5/2008	C08110279-003	Chloride	162	mg/L	
Extreme Outlier	MW-30	4/27/2010	C10041010	Chloride	97	mg/L	
Extreme Outlier	MW-31	3/15/2007	9/20/2007	Chloride	0.132	mg/L	
Extreme Outlier	MW-5	9/1/1981	9/13/2007	Chloride	4	mg/L	
Extreme Outlier	MW-5	12/28/1981		Chloride	20	mg/L	
Extreme Outlier	MW-5	12/15/1985	8/30/2007	Chloride	71	mg/L	
Extreme Outlier	MW-5	6/26/1986		Chloride	130	mg/L	
Extreme Outlier	MW-25	6/22/2007	C07061184	Fluoride	0.432766	mg/L	
Extreme Outlier	MW-26	4/1/2005	C05040027	Fluoride	0.93	mg/L	
Extreme Outlier	MW-26	6/23/2005	C05060997	Fluoride	0.42	mg/L	
Extreme Outlier	MW-26	5/7/2012	C12050272-003	Fluoride	0.54	mg/L	
Extreme Outlier	MW-30	6/24/2005	C05061037	Fluoride	0.46	mg/L	
Extreme Outlier	MW-30	10/27/2006	C06101300	Fluoride	0.492675	mg/L	
Extreme Outlier	MW-31	10/27/2006	C06101300	Fluoride	1.183244	mg/L	
Extreme Outlier	MW-31	11/14/2008	C08110568	Fluoride	0.32	mg/L	
Extreme Outlier	MW-3A	9/14/2006	C06090583	Fluoride	0.020307	mg/L	U
Extreme Outlier	MW-5	9/1/1980	9/6/2007	Fluoride	1.68	mg/L	
Extreme Outlier	MW-11	2/15/1984	9/23/2007	Sulfate	2250	mg/L	
Extreme Outlier	MW-11	12/15/1985	8/30/2007	Sulfate	79	mg/L	
Extreme Outlier	MW-11	11/12/1992	9/5/2007	Sulfate	1507	mg/L	
Extreme Outlier	MW-3	10/31/1979	8/30/2007	Sulfate	930	mg/L	

Appendix C-3
Data Omitted from Statistical Analysis

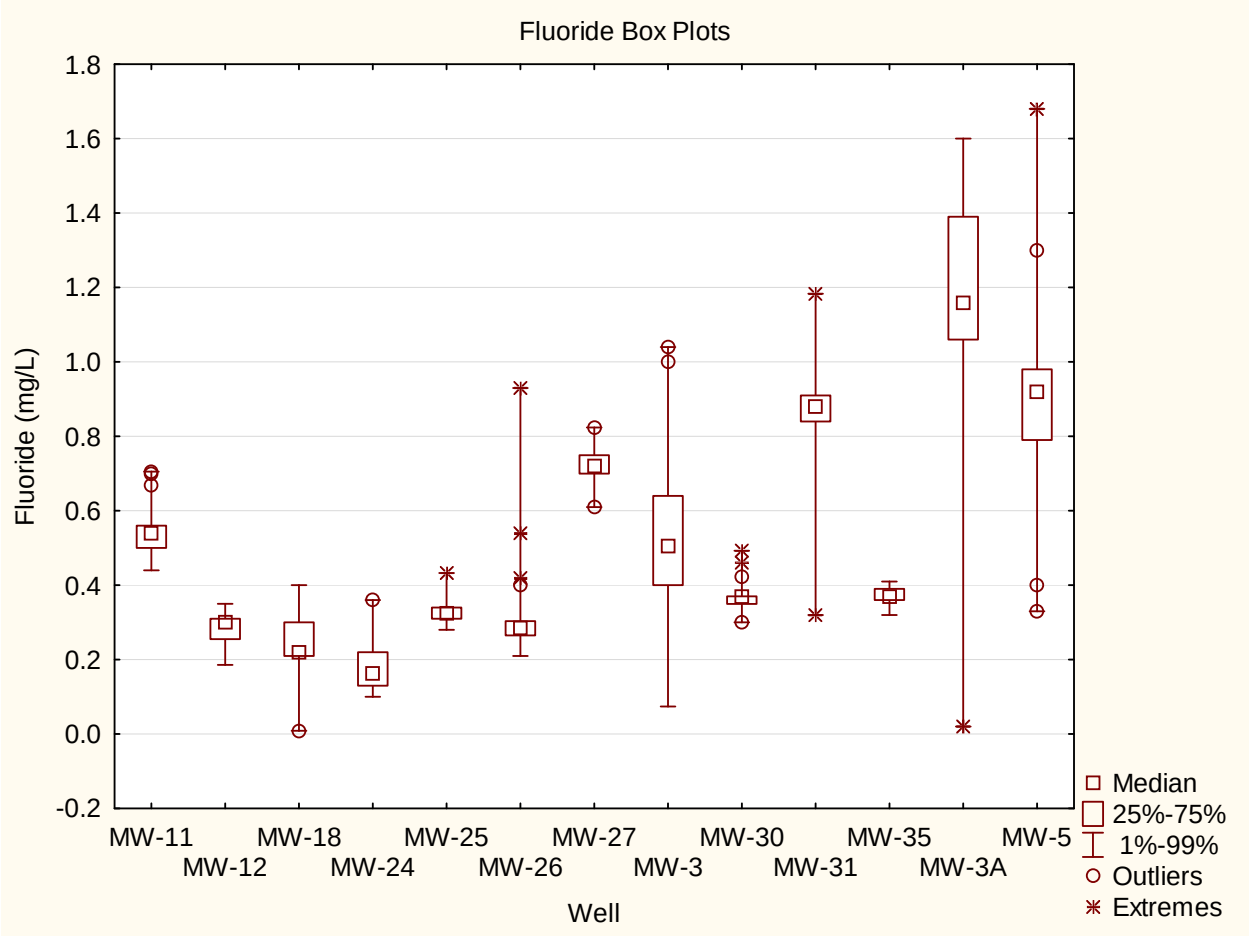
Reason	Well	Sample Date	Reviewed/ Report	Chemical	Result	Units	Qualifier
Extreme Outlier	MW-3	9/1/1981	9/13/2007	Sulfate	42	mg/L	
Extreme Outlier	MW-5	9/1/1981	9/13/2007	Sulfate	28	mg/L	
Extreme Outlier	MW-5	12/15/1985	8/30/2007	Sulfate	7820	mg/L	
Extreme Outlier	MW-5	6/26/1986		Sulfate	1890	mg/L	
Extreme Outlier	MW-11	6/10/1993	9/6/2007	Uranium	4	ug/L	
Extreme Outlier	MW-24	6/23/2005	9/24/2007	Uranium	46	ug/L	D
Extreme Outlier	MW-24	7/26/2005	9/13/2007	Uranium	126	ug/L	
Extreme Outlier	MW-24	9/25/2005	9/14/2007	Uranium	223	ug/L	
Extreme Outlier	MW-30	8/4/2008	C08080344	Uranium	11	ug/L	
Extreme Outlier	MW-30	10/4/2011	C11100300-010	Uranium	9.83	ug/L	
Extreme Outlier	MW-3A	6/23/2005	9/24/2007	Uranium	35.2	ug/L	
Extreme Outlier	MW-3A	12/14/2005	9/14/2007	Uranium	0.3	ug/L	U
Extreme Outlier	MW-3A	5/15/2012	C12050723-002	Uranium	100	ug/L	
Extreme Outlier	MW-5	9/19/1995	8/31/2007	Uranium	4.7	ug/L	
Extreme Outlier	MW-5	11/11/2010	C10110584	Uranium	11.6	ug/L	
Extreme Outlier	MW-5	2/14/2011	C11020544	Uranium	29.5	ug/L	
Extreme Outlier	MW-5	4/12/2011	C11040506-005	Uranium	7.16	ug/L	
Extreme Outlier	MW-5	10/10/2011	C11100567-004	Uranium	4.52	ug/L	
Extreme Outlier	MW-5	2/28/2012	C12030065-003A	Uranium	18.6	ug/L	

C-4 Box Plots for Indicator Parameters in Wells with Constituents with Exceedances

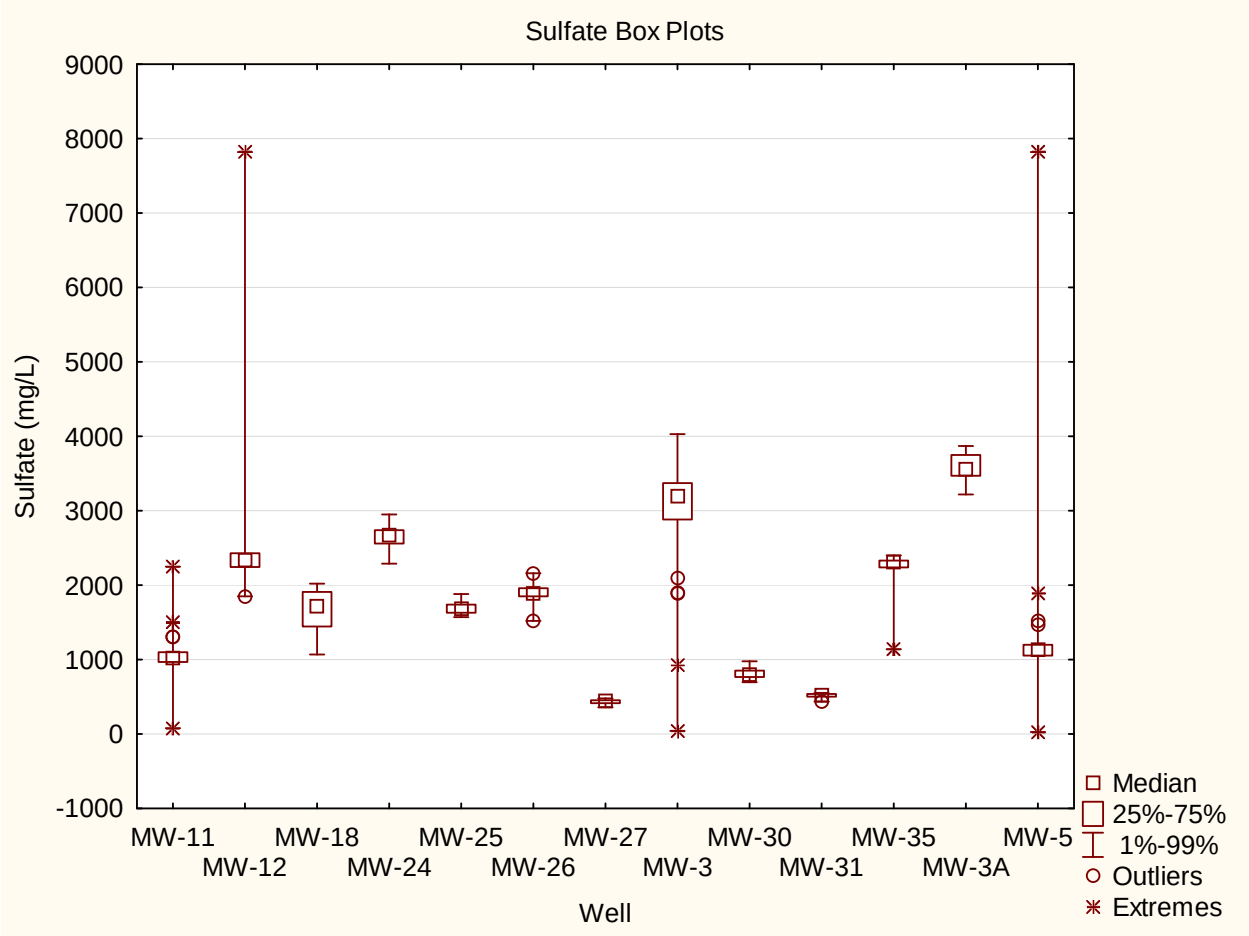
Appendix C-4
Box Plots for Indicator Parameters in Wells with Constituents with Exceedances



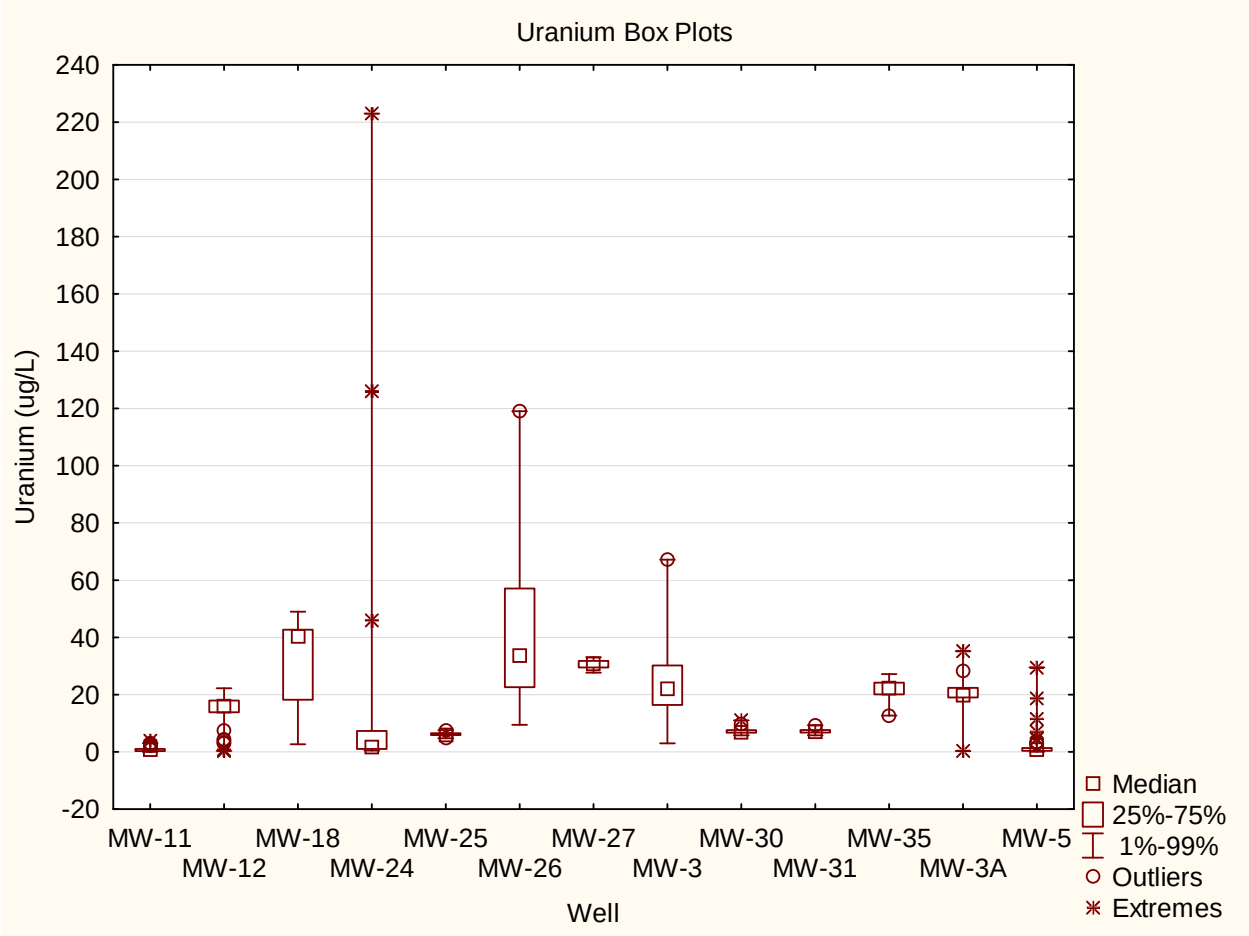
Appendix C-4
Box Plots for Indicator Parameters in Wells with Constituents with Exceedances



Appendix C-4
Box Plots for Indicator Parameters in Wells with Constituents with Exceedances

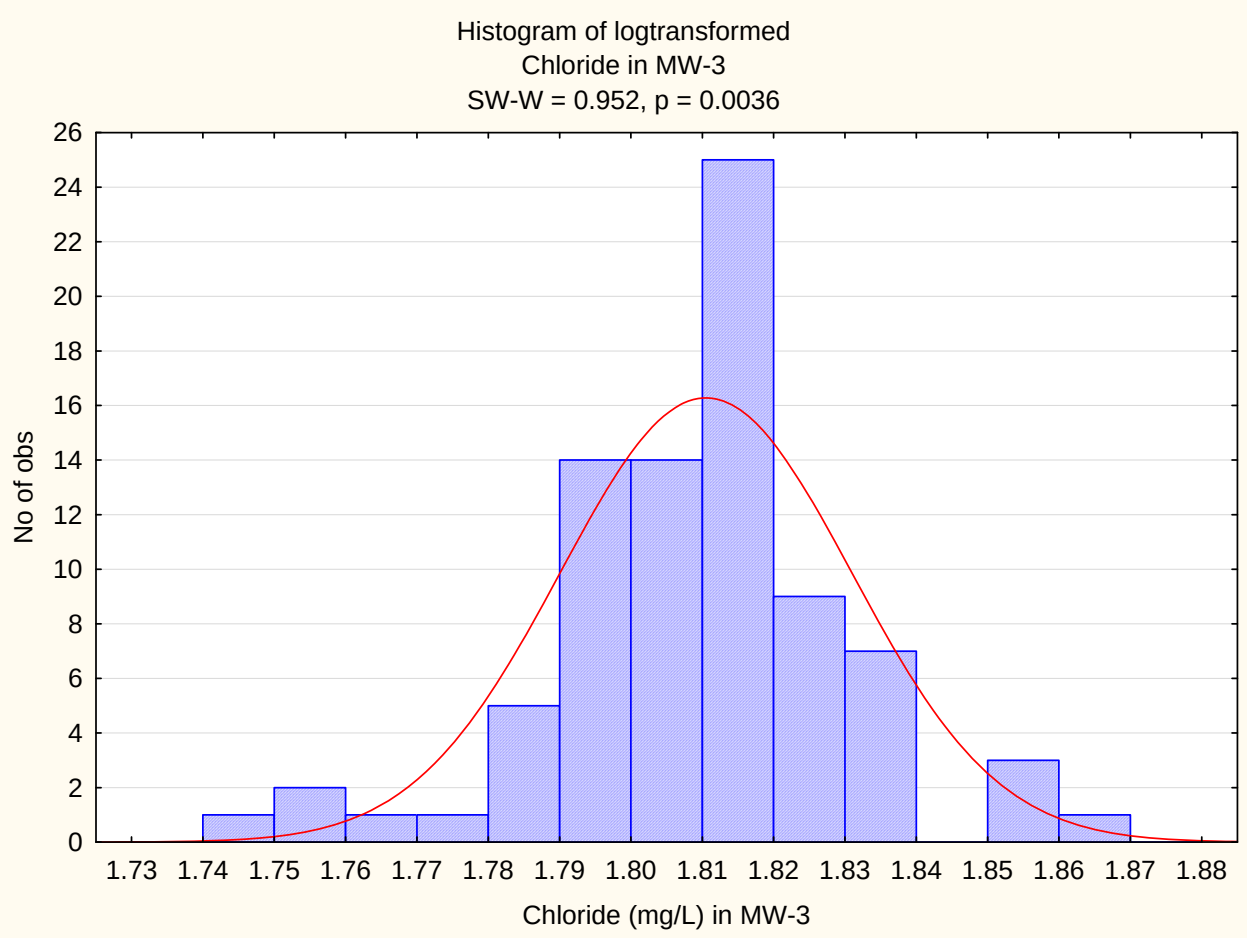


Appendix C-4
Box Plots for Indicator Parameters in Wells with Constituents with Exceedances

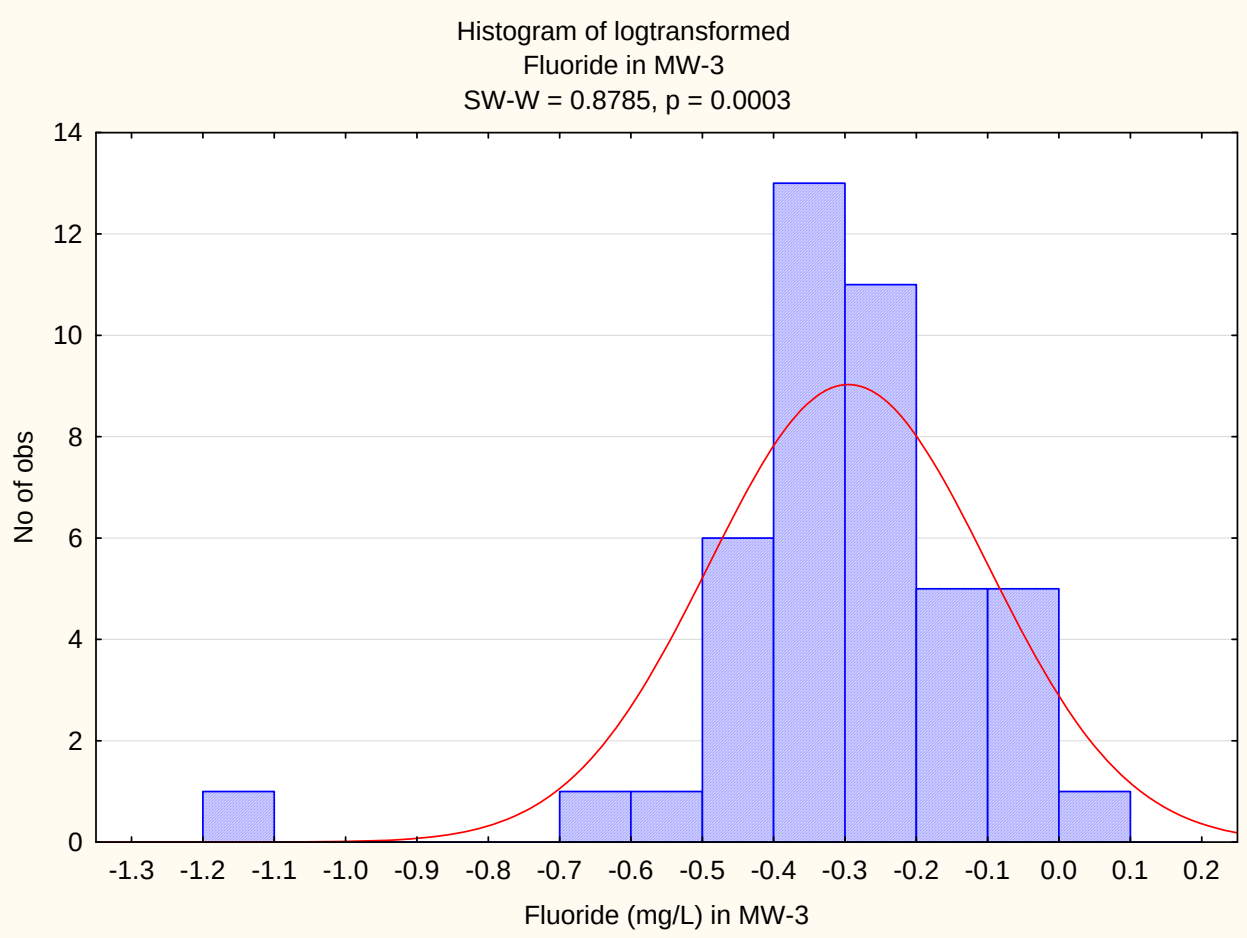


C-5 Histograms for Indicator Parameters in Wells with Constituents with Exceedances

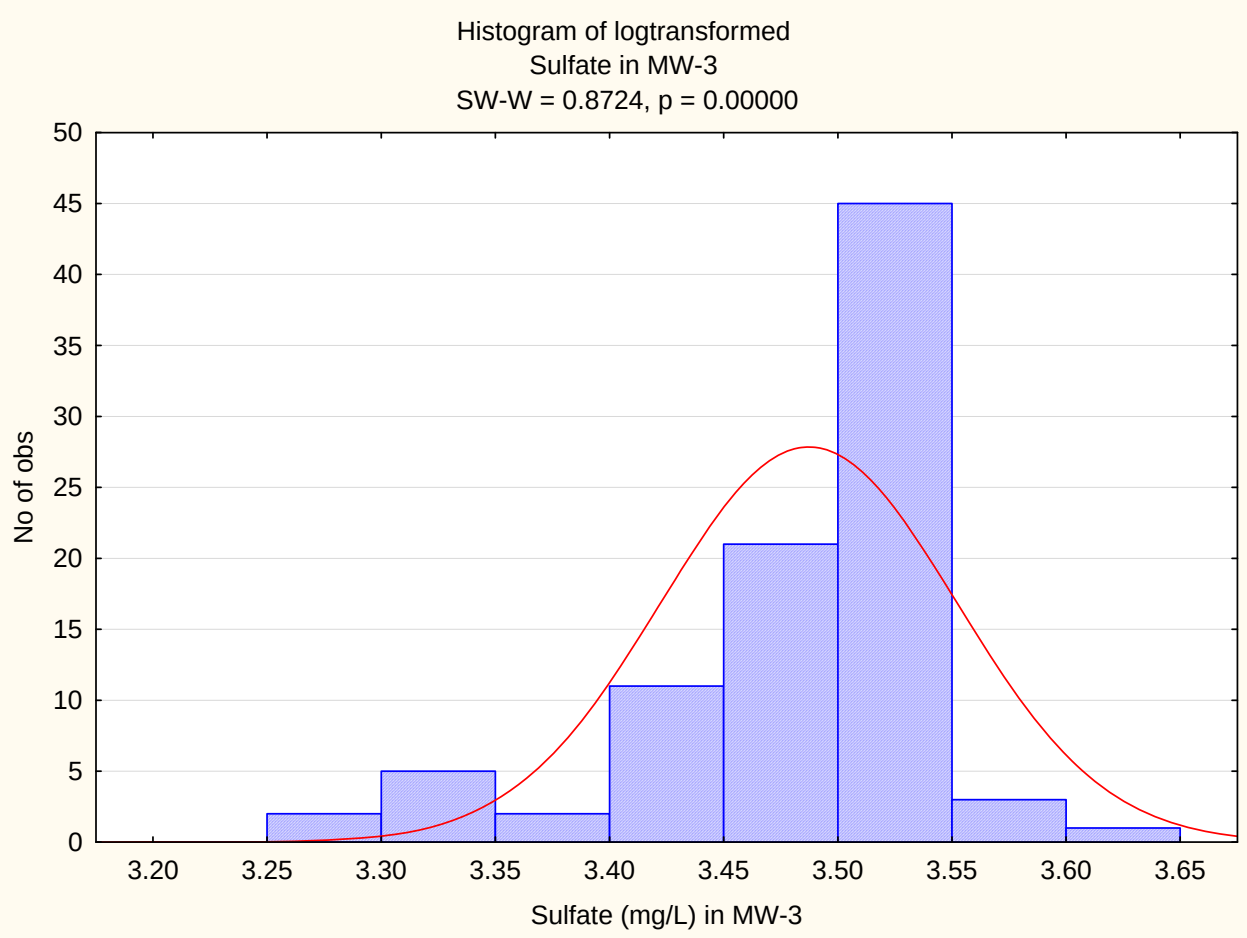
Appendix C-5
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



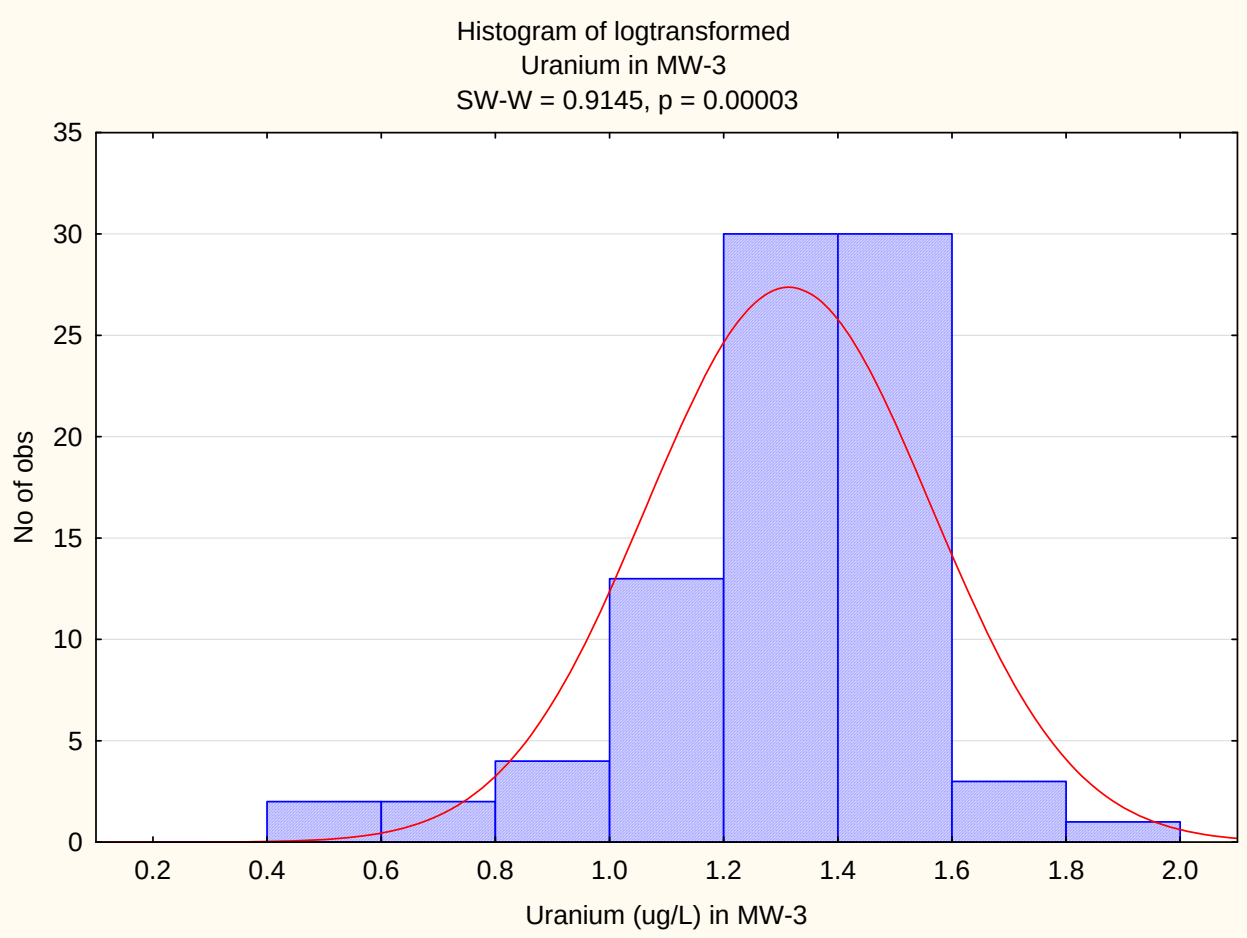
Appendix C-5
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



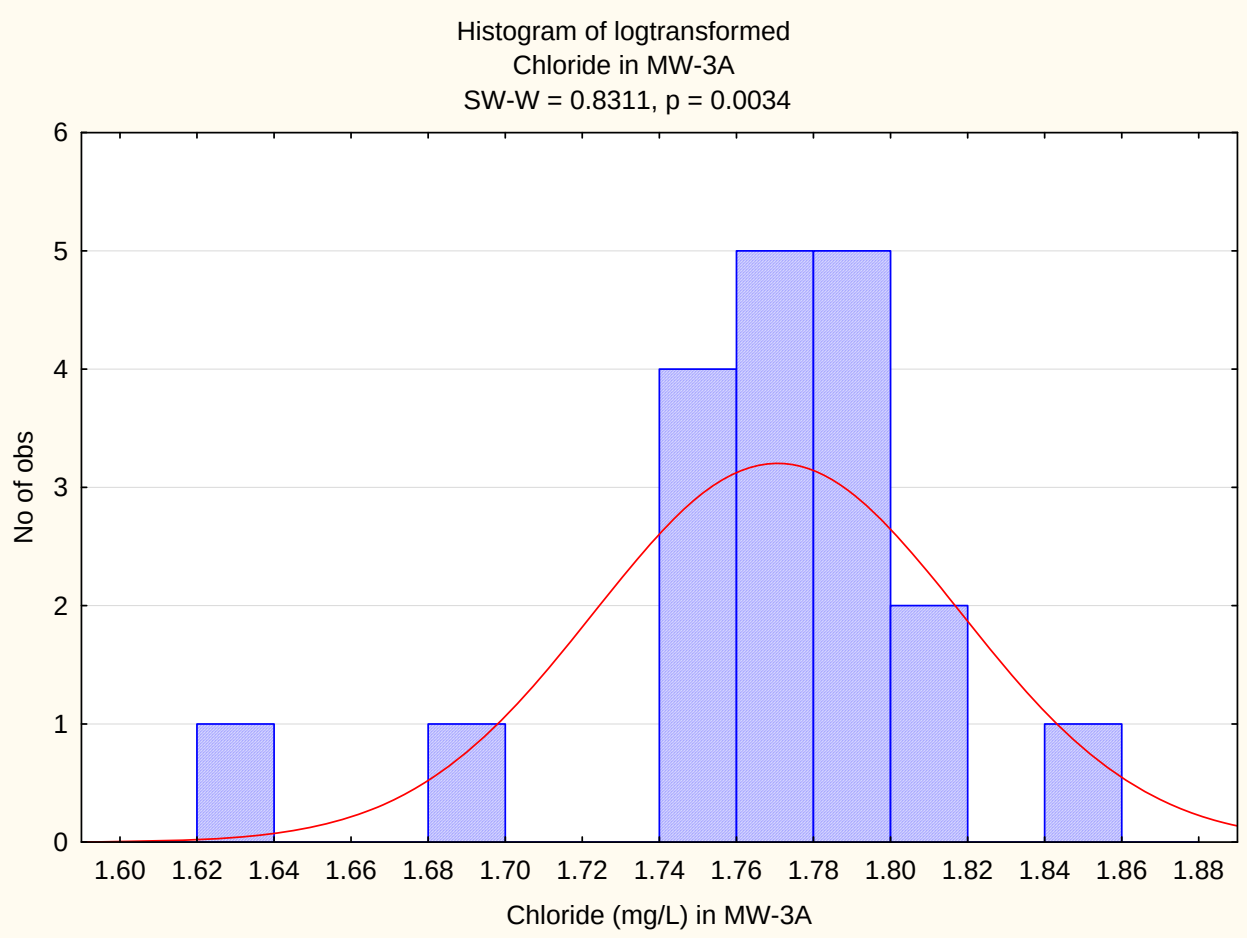
Appendix C-5
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



Appendix C-5
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



Appendix C-5
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



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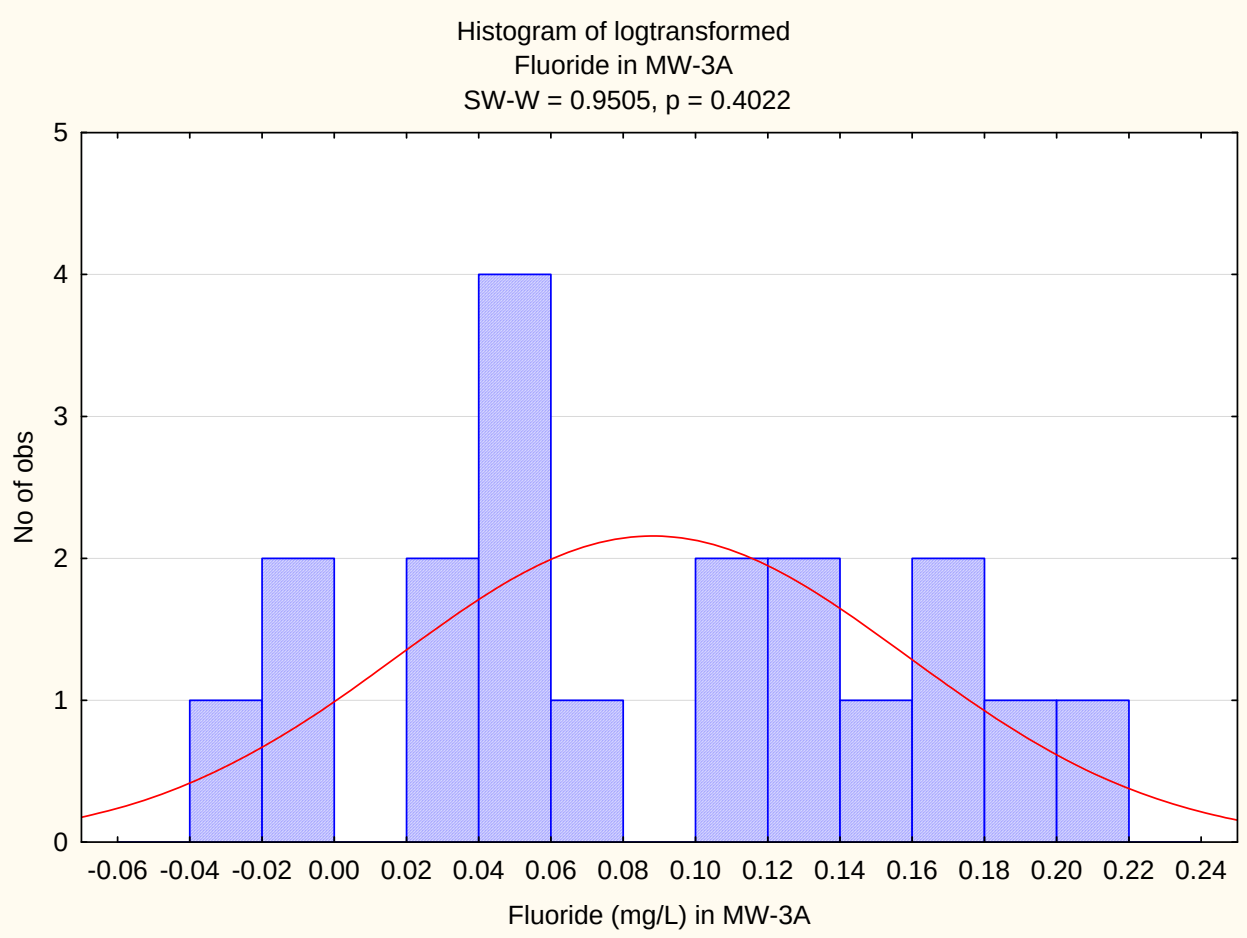
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



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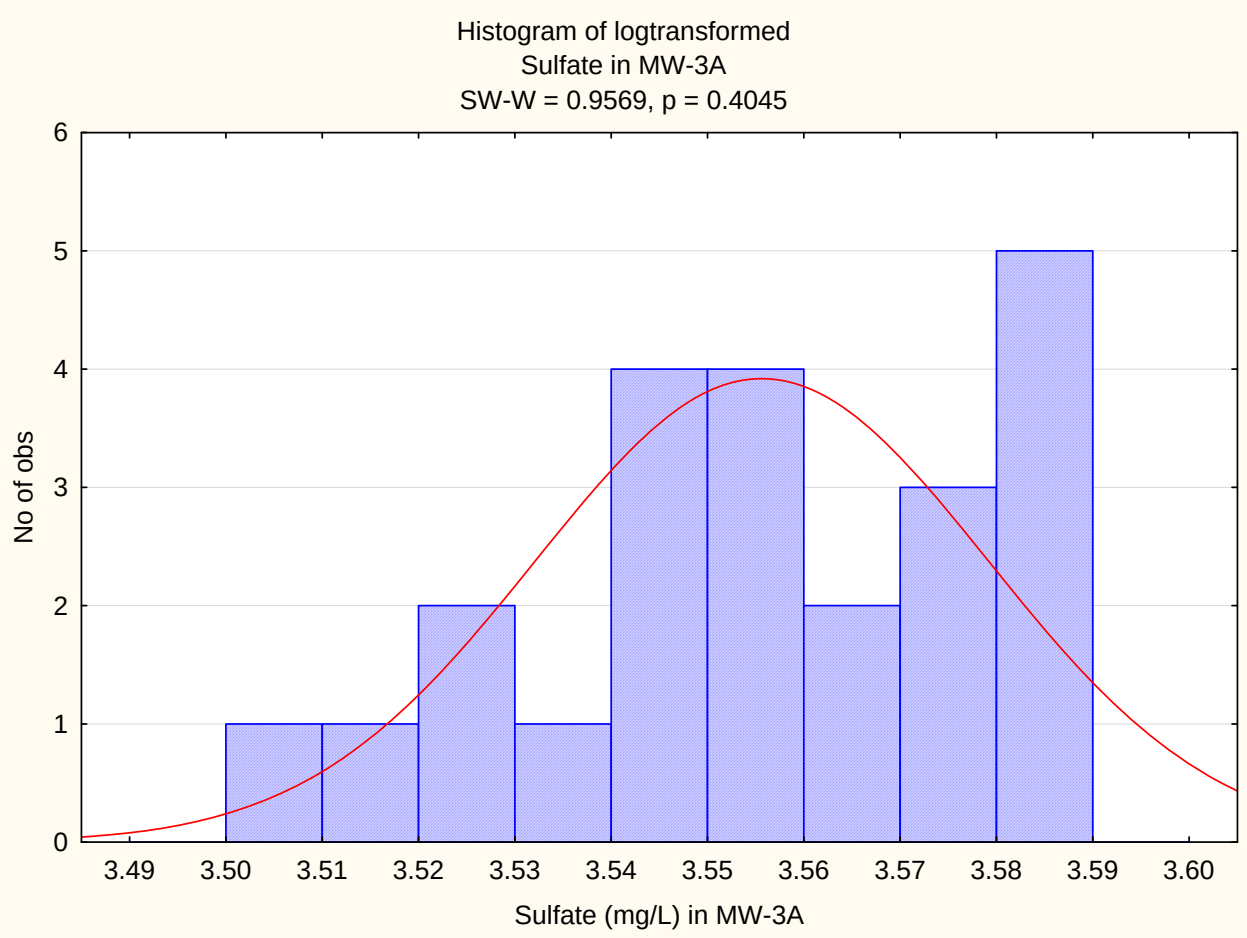
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



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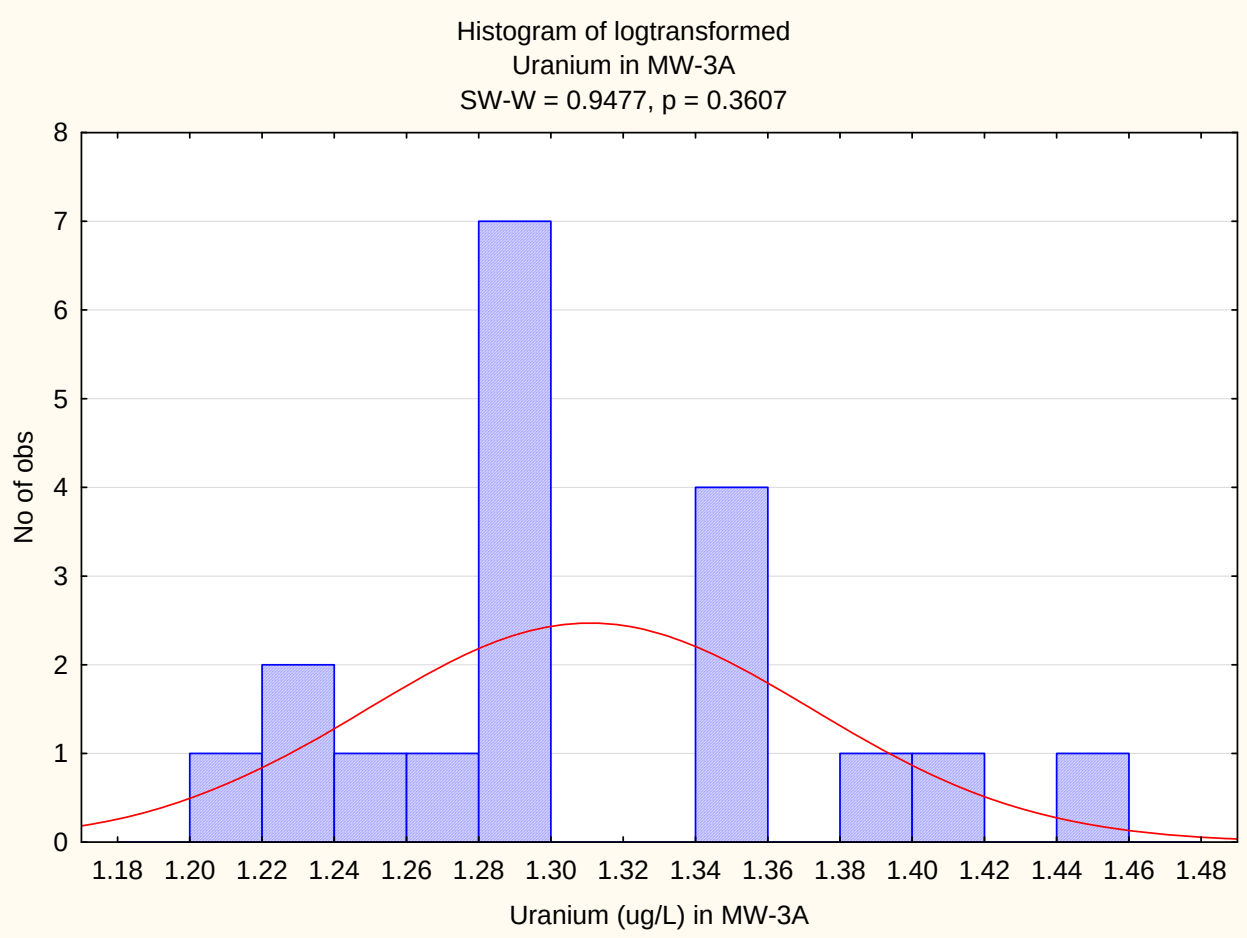

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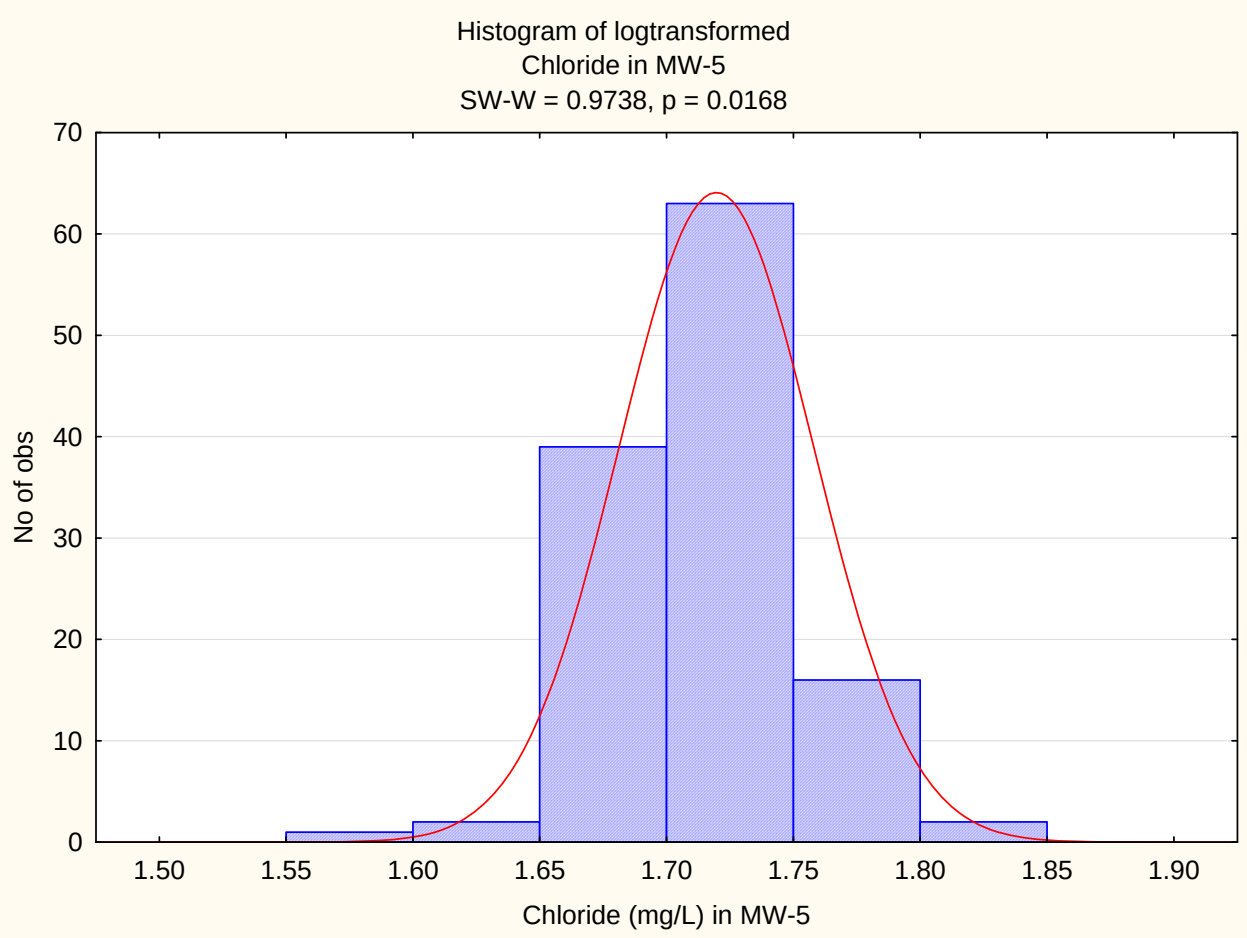
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



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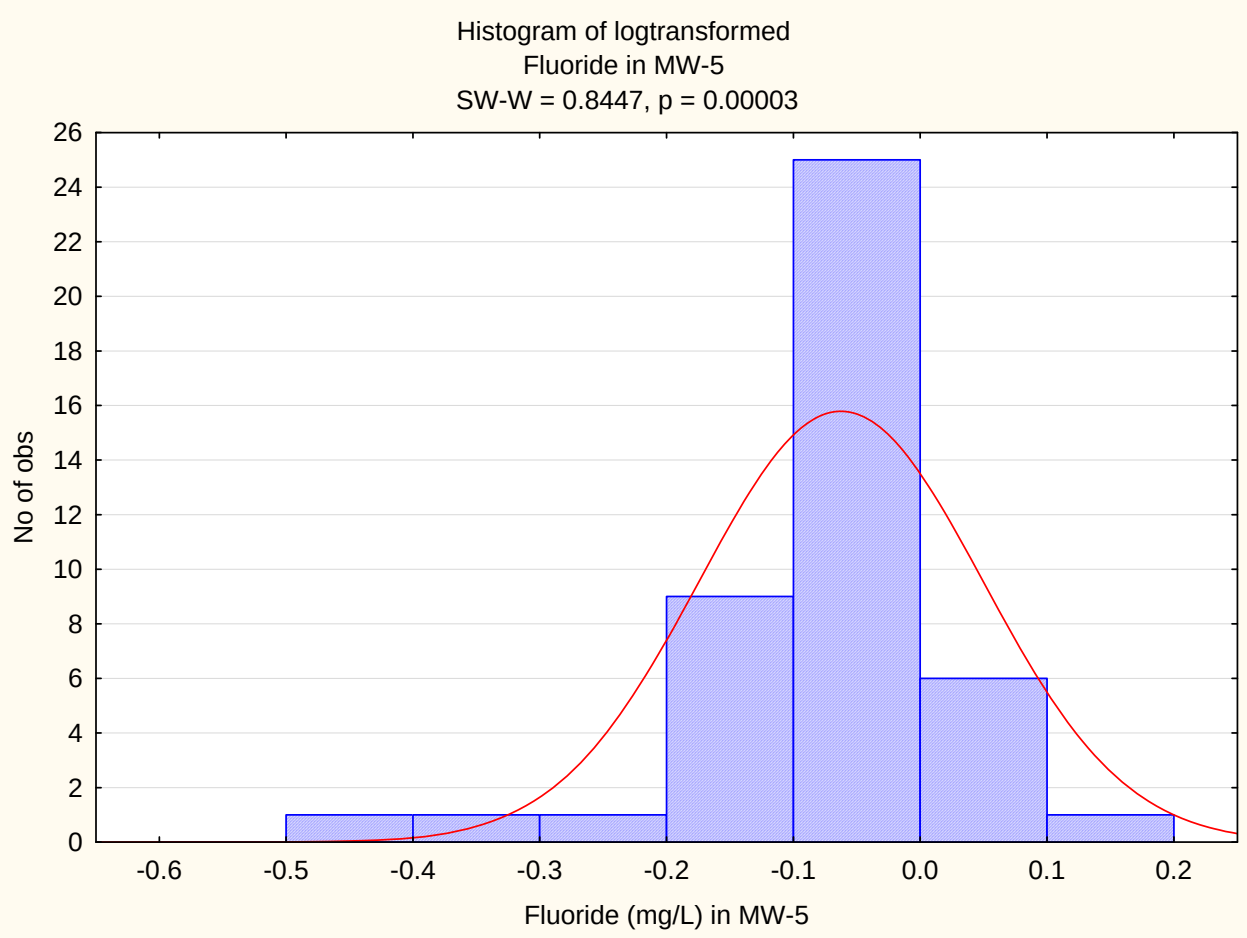

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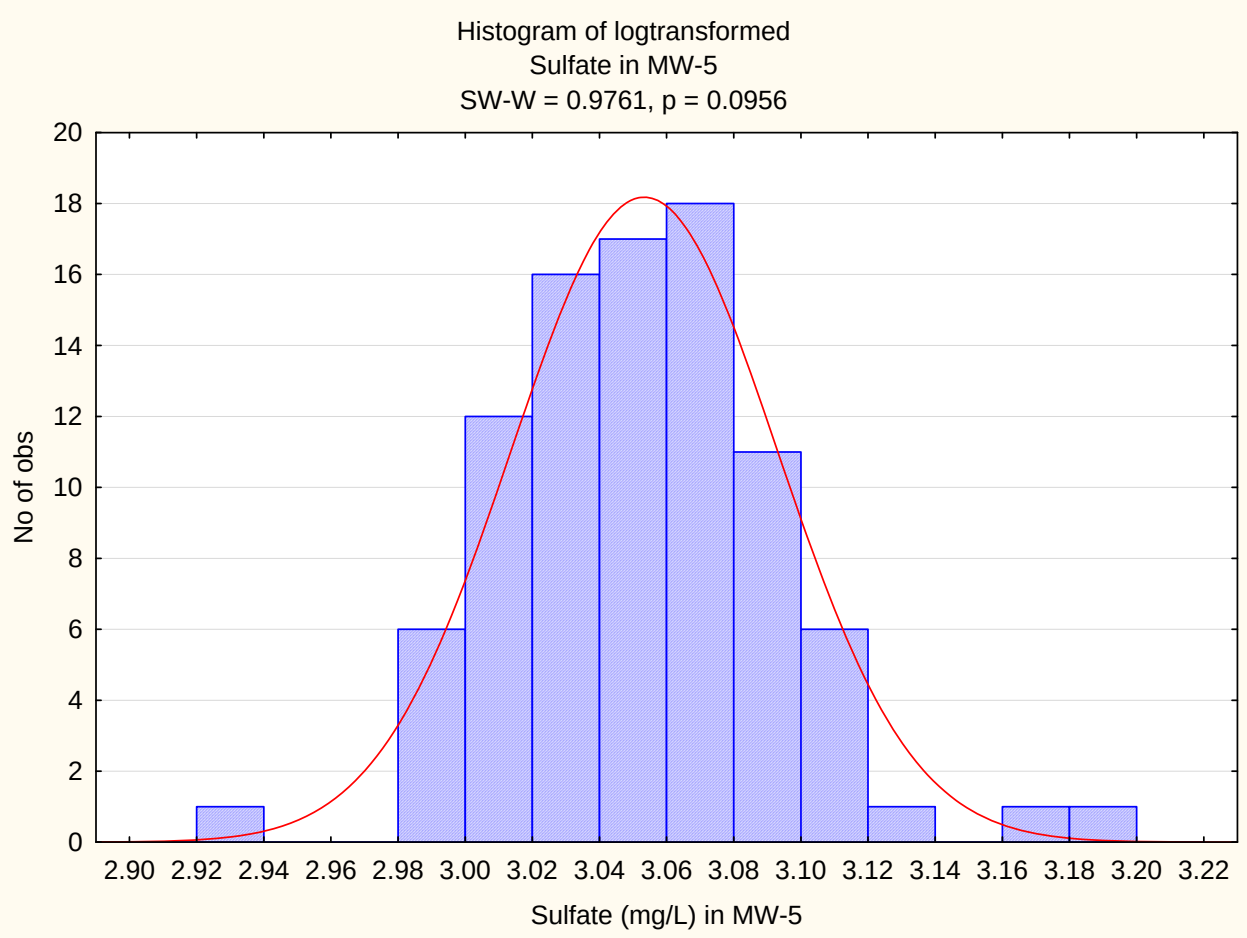

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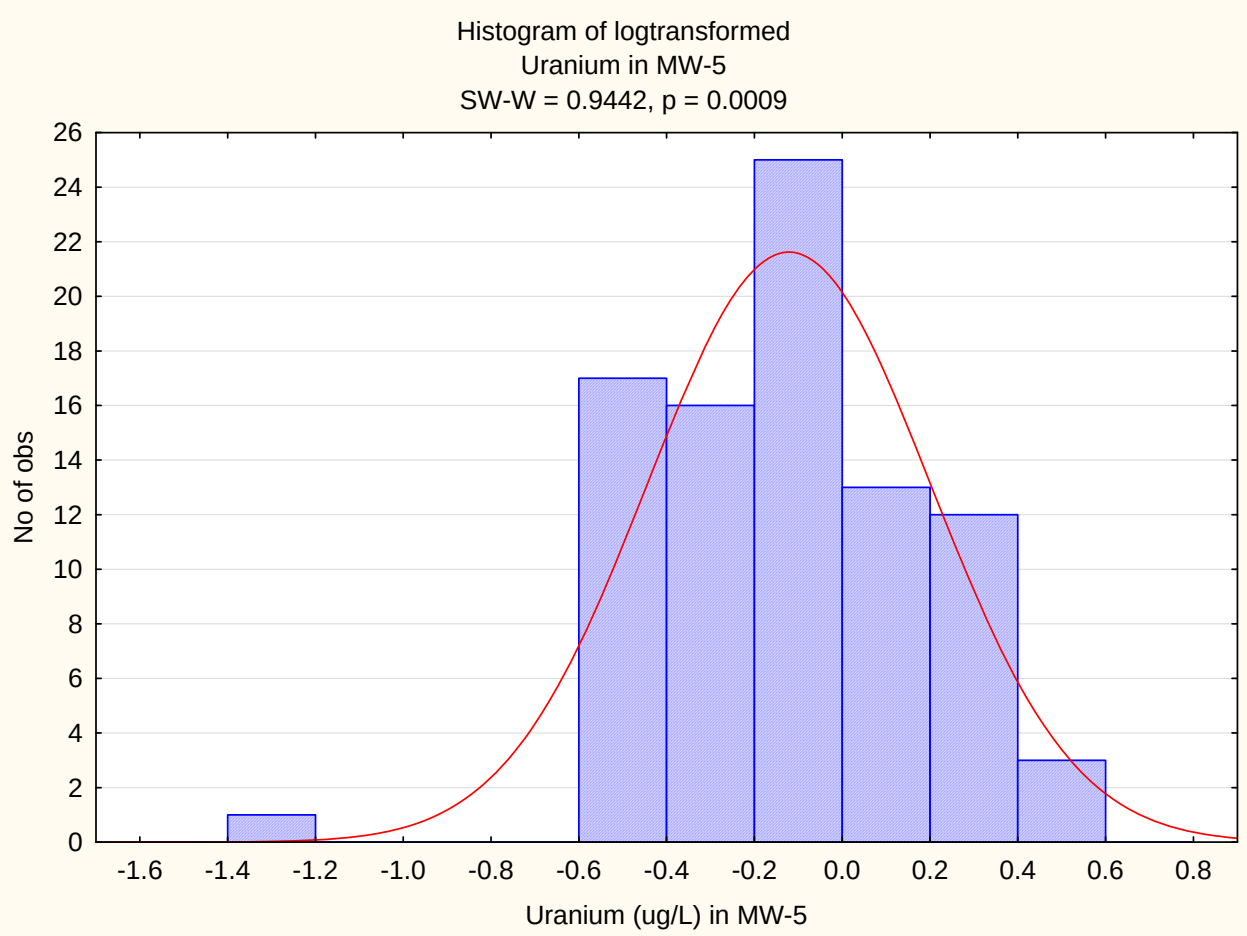
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



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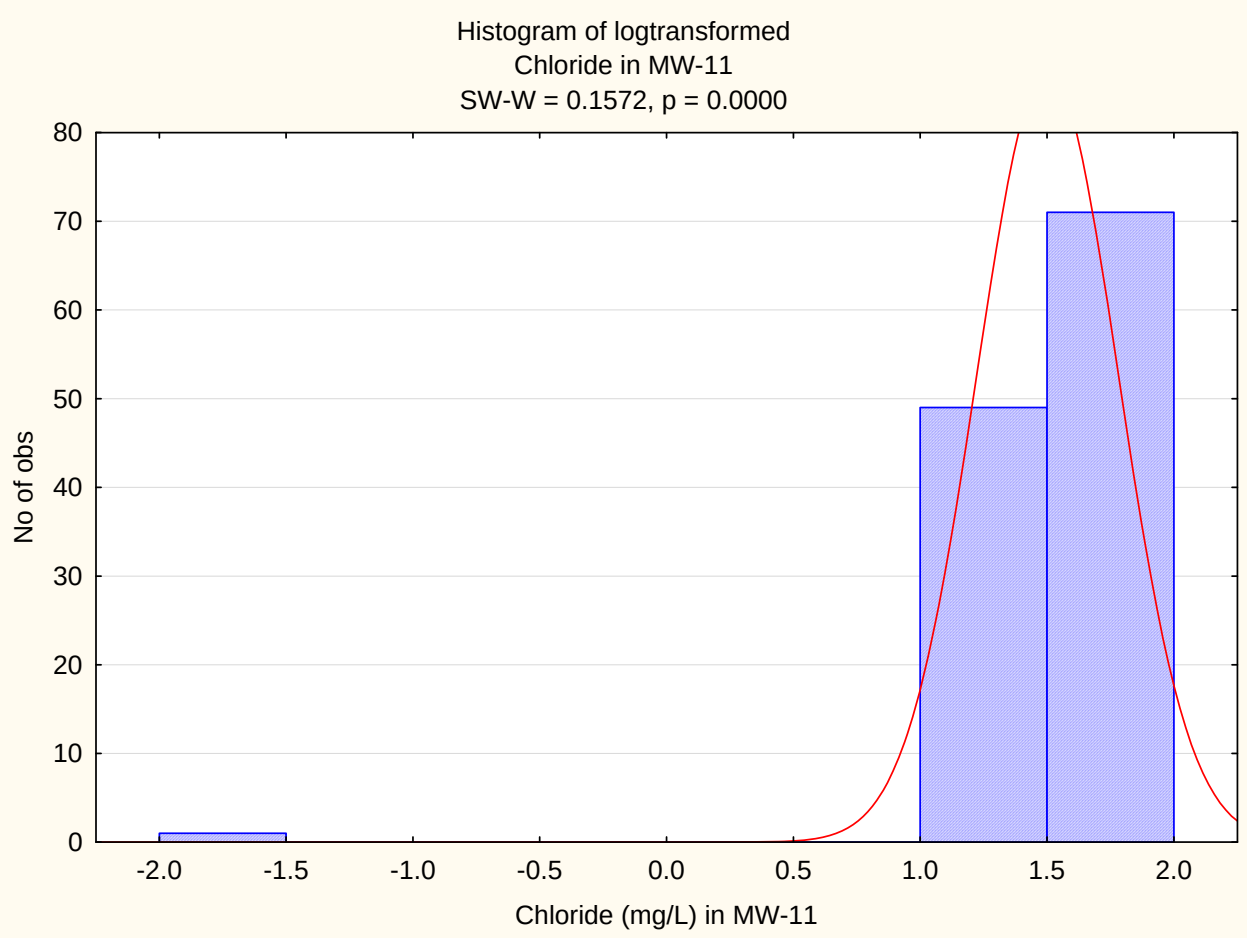
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



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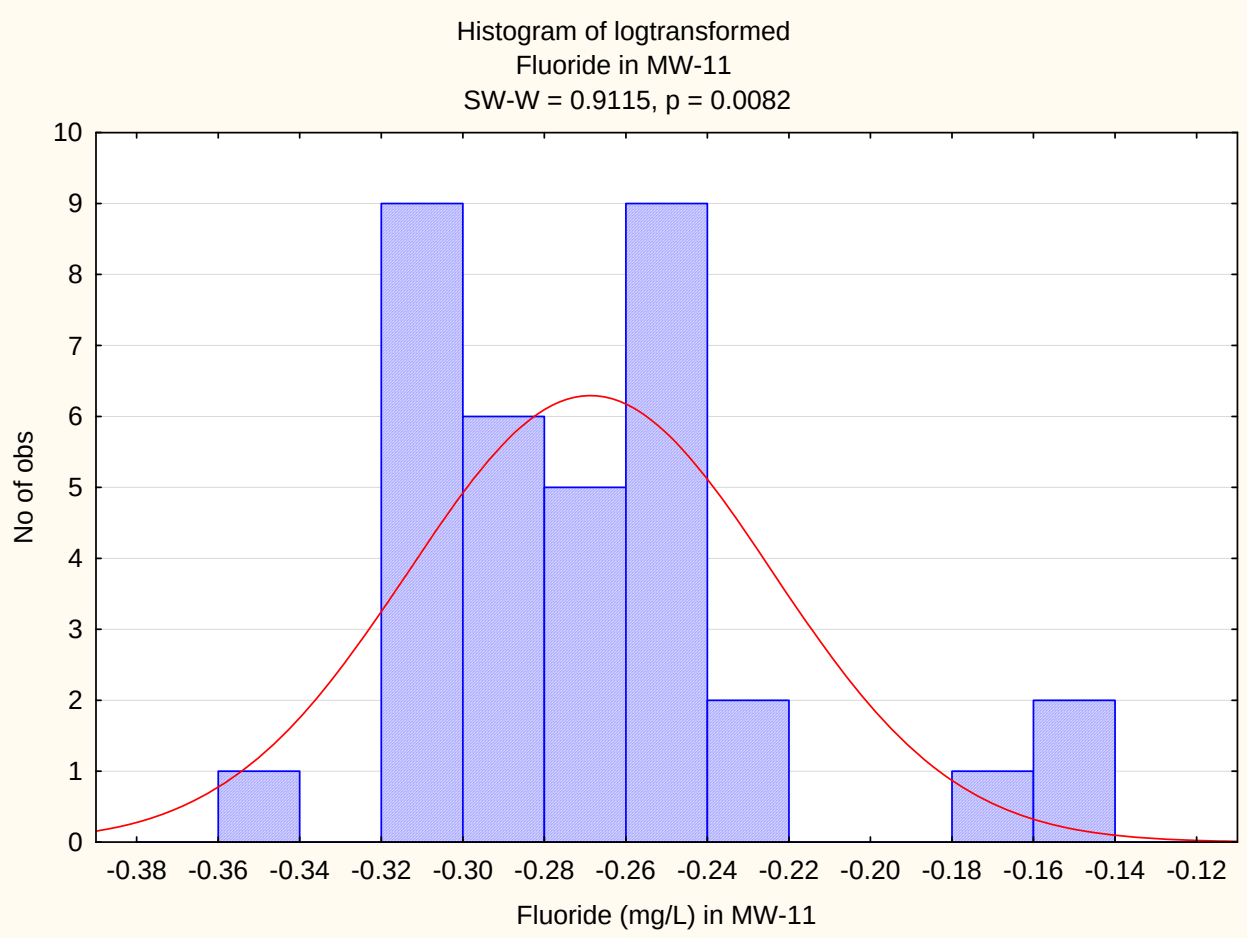
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



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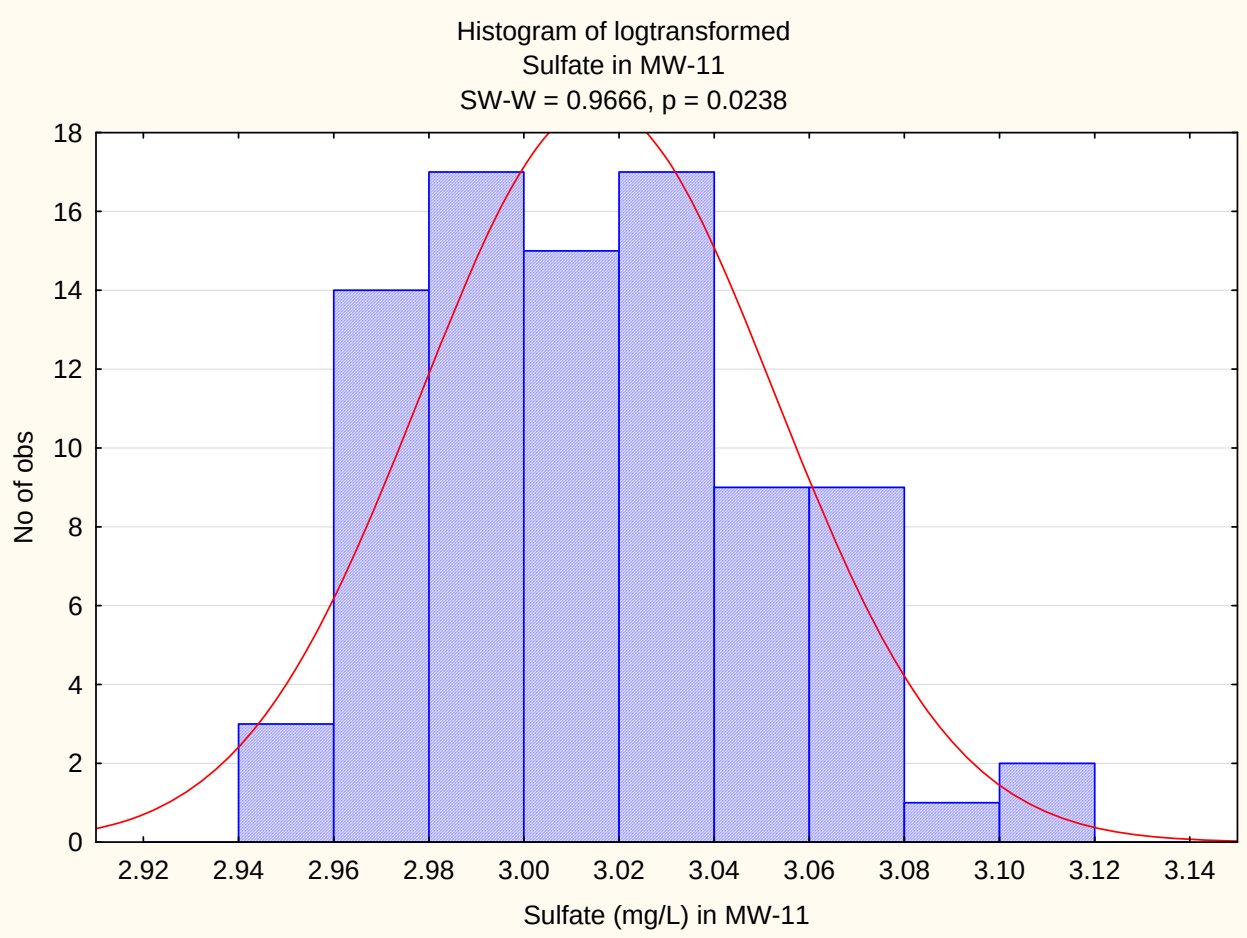
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



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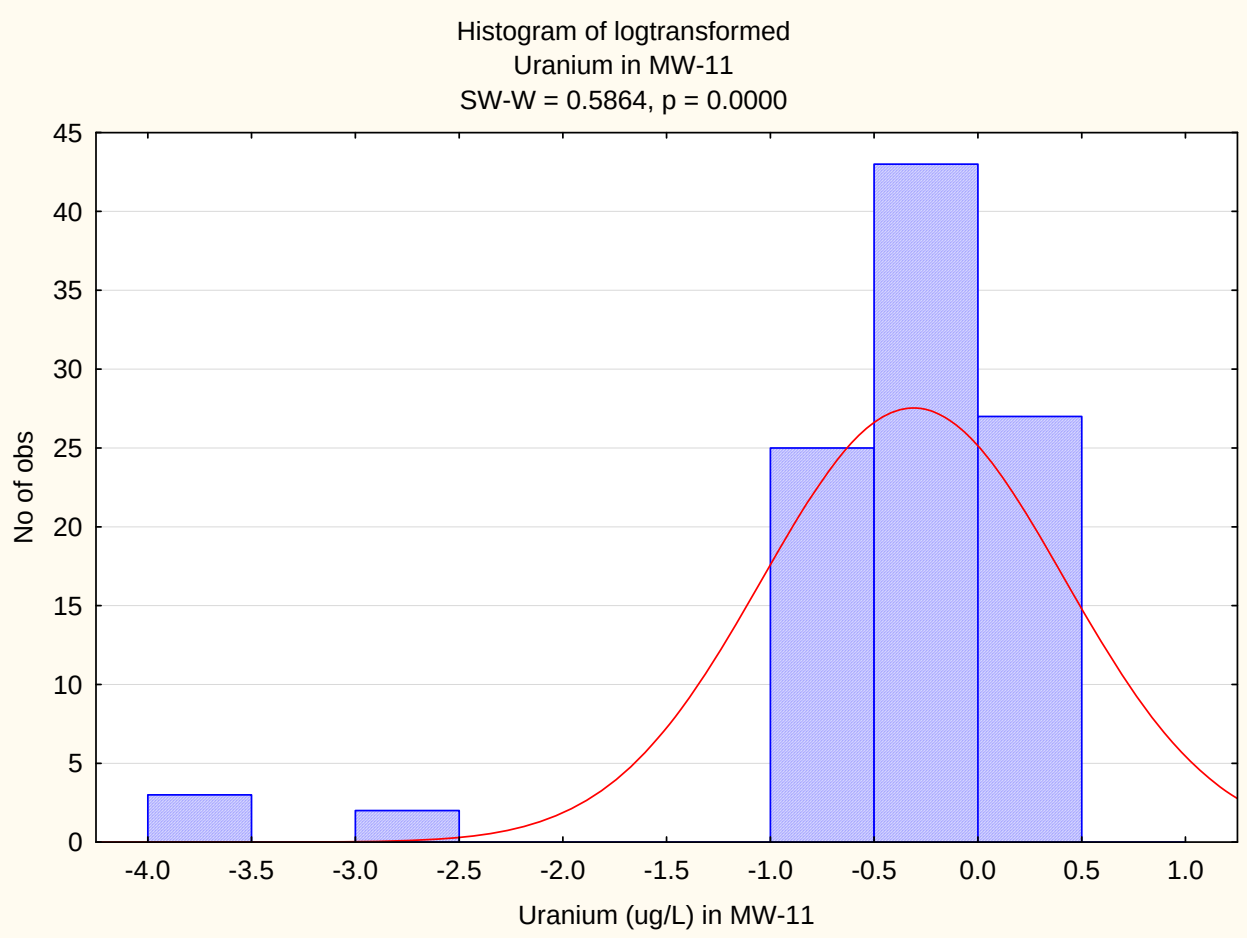
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



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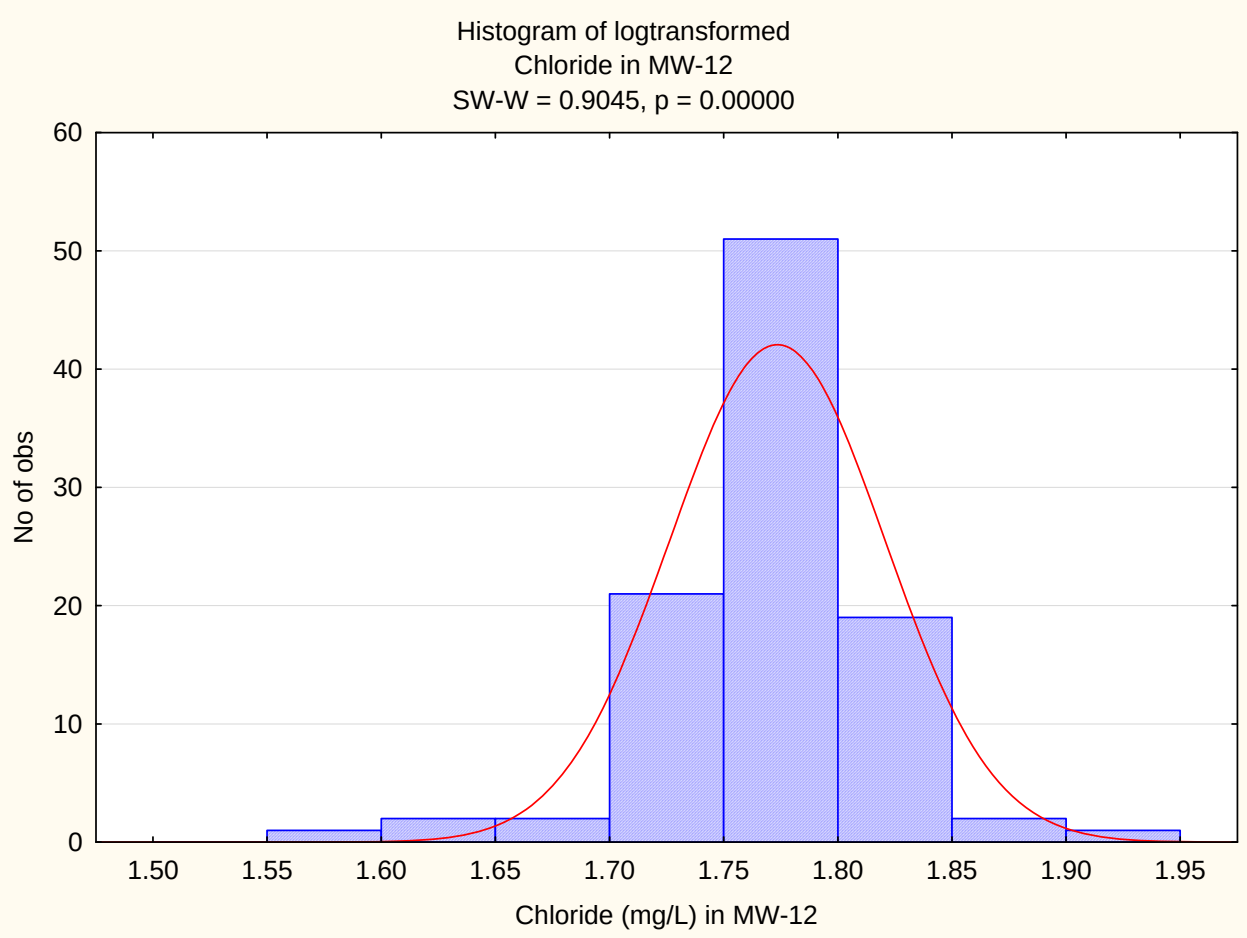
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



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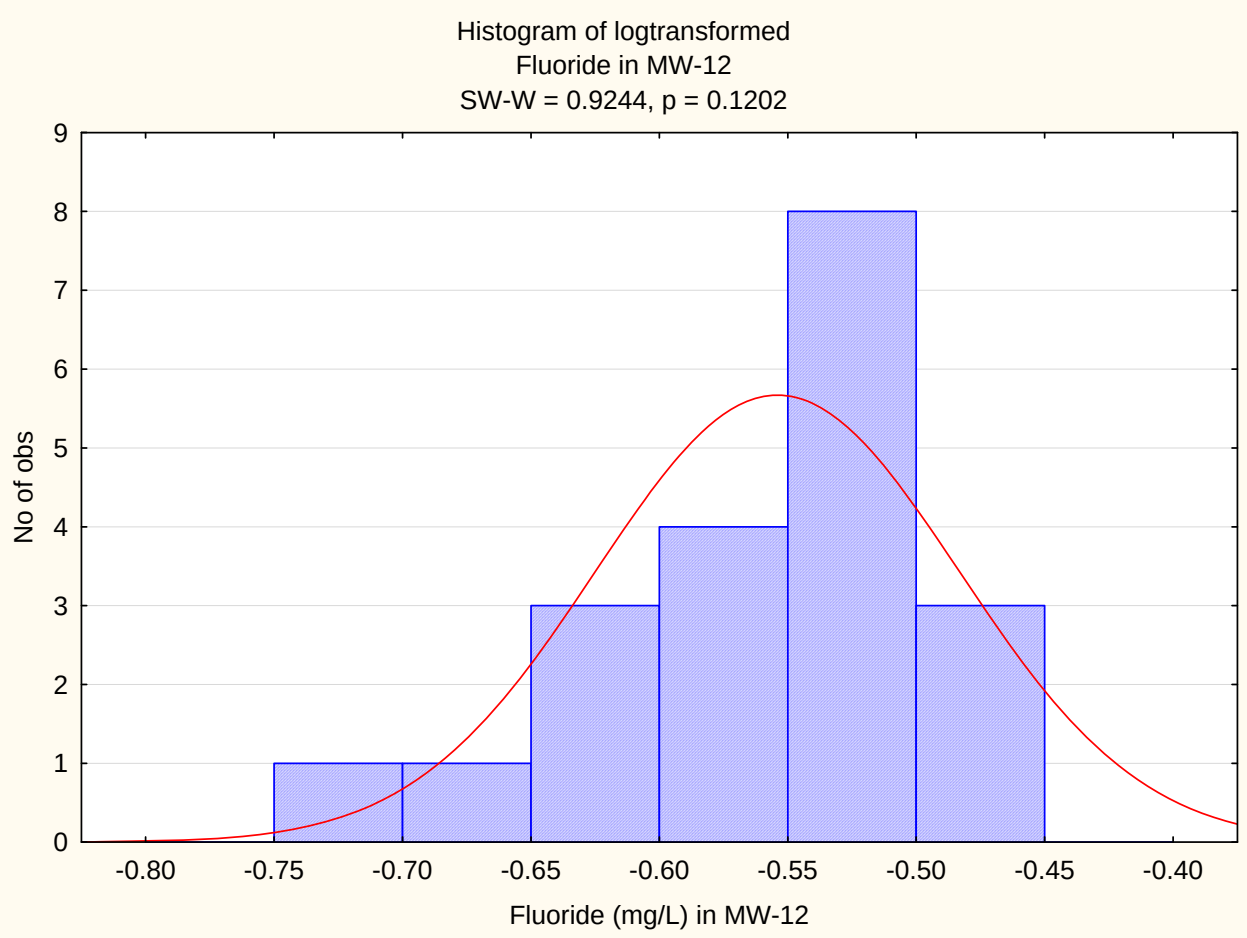

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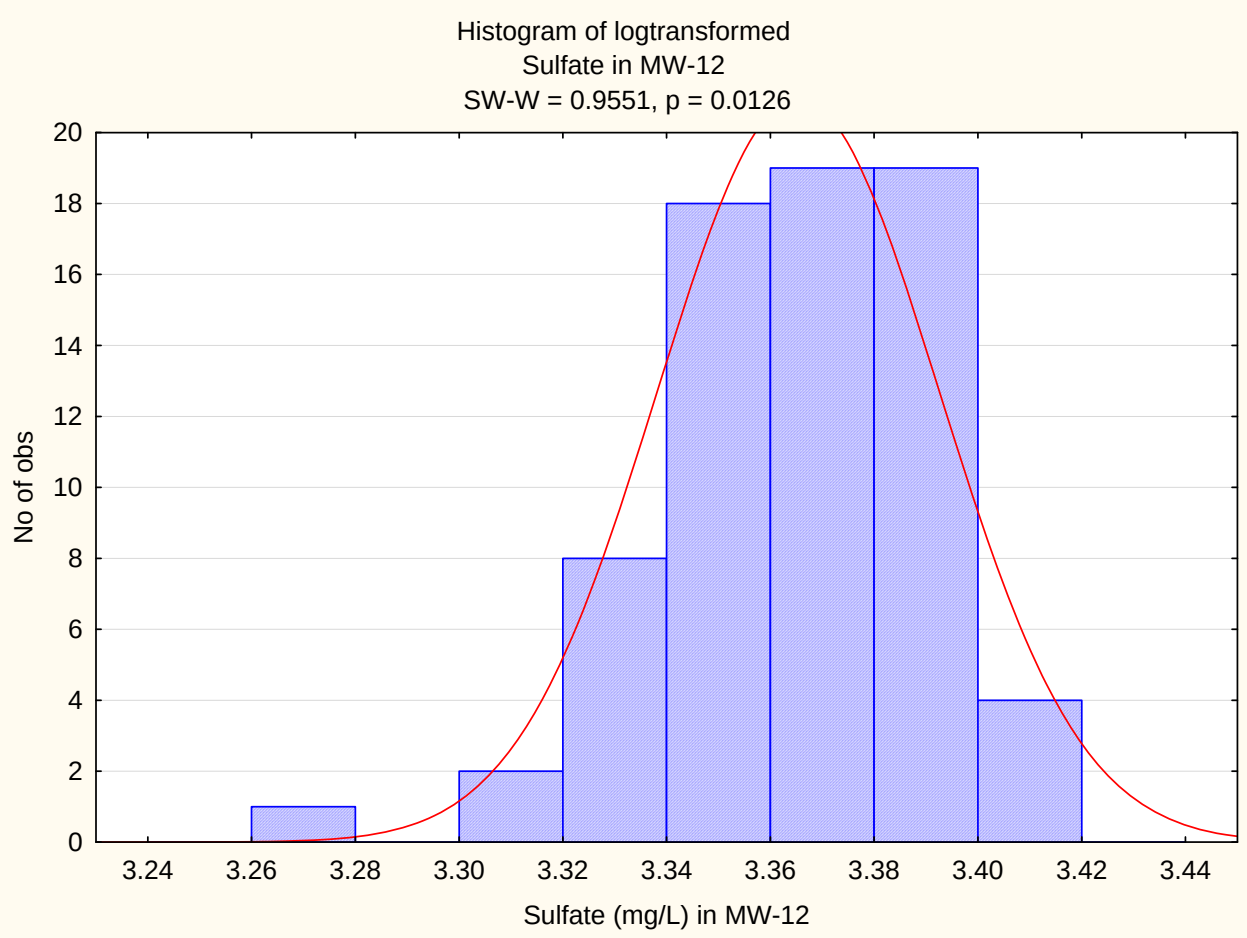
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



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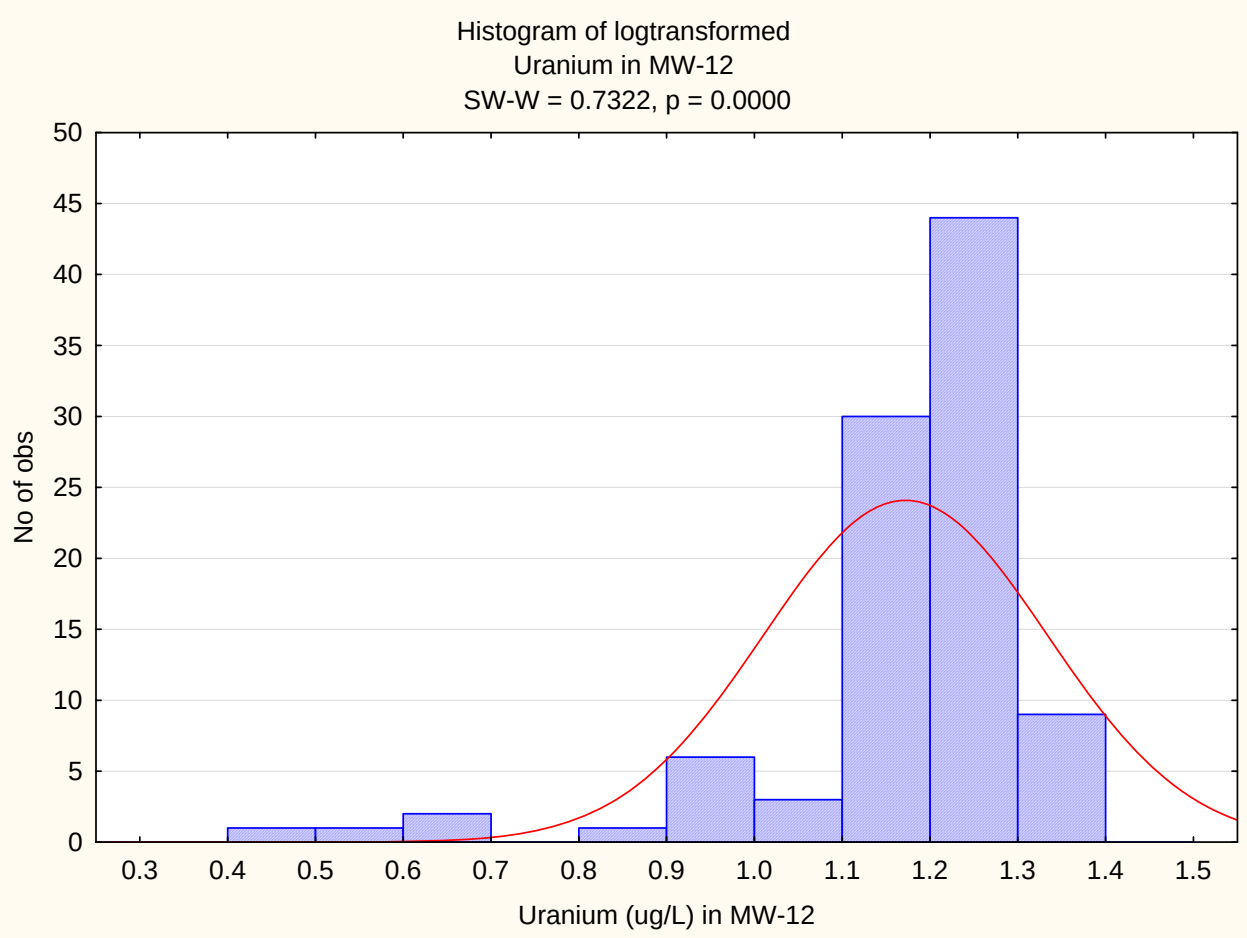
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



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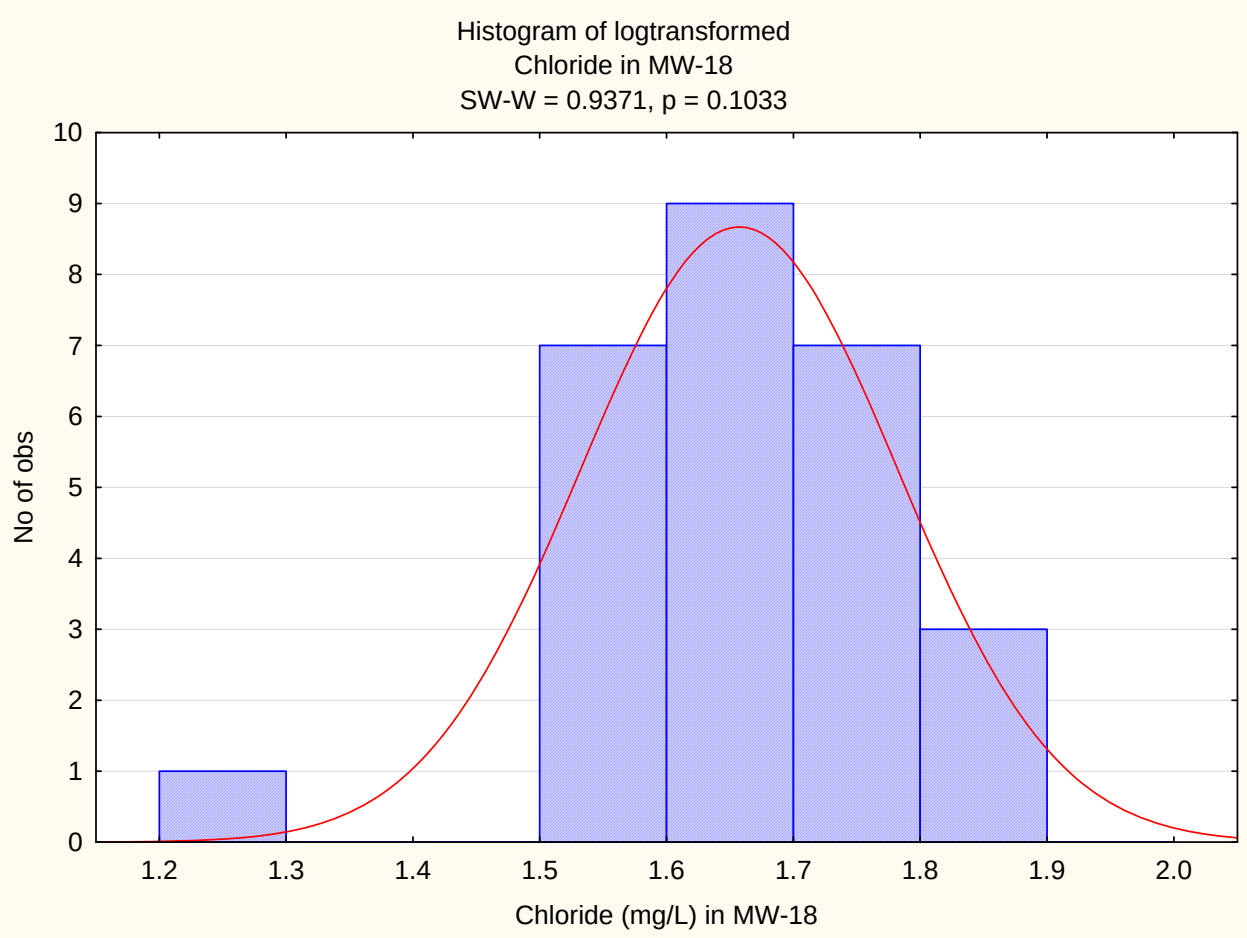

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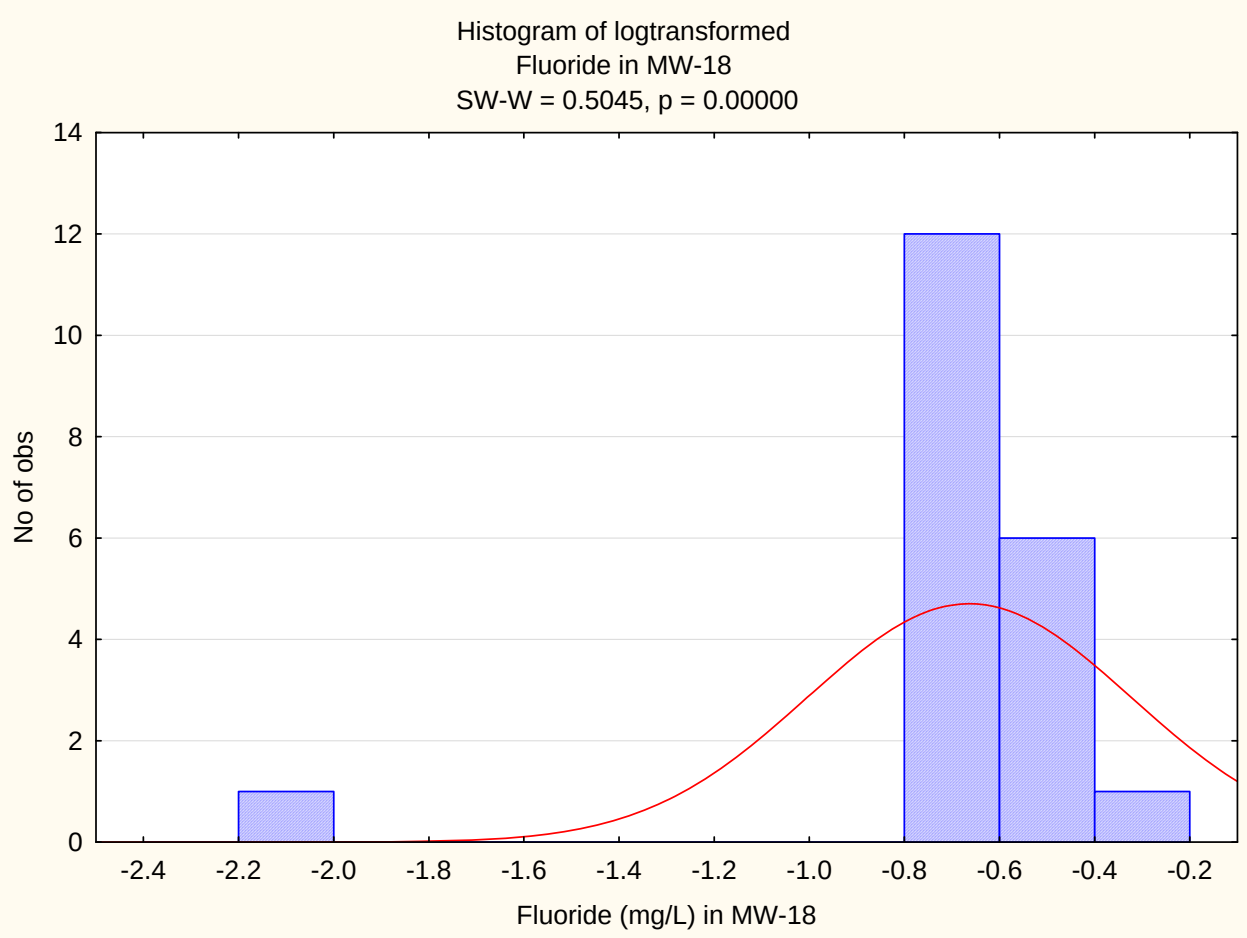

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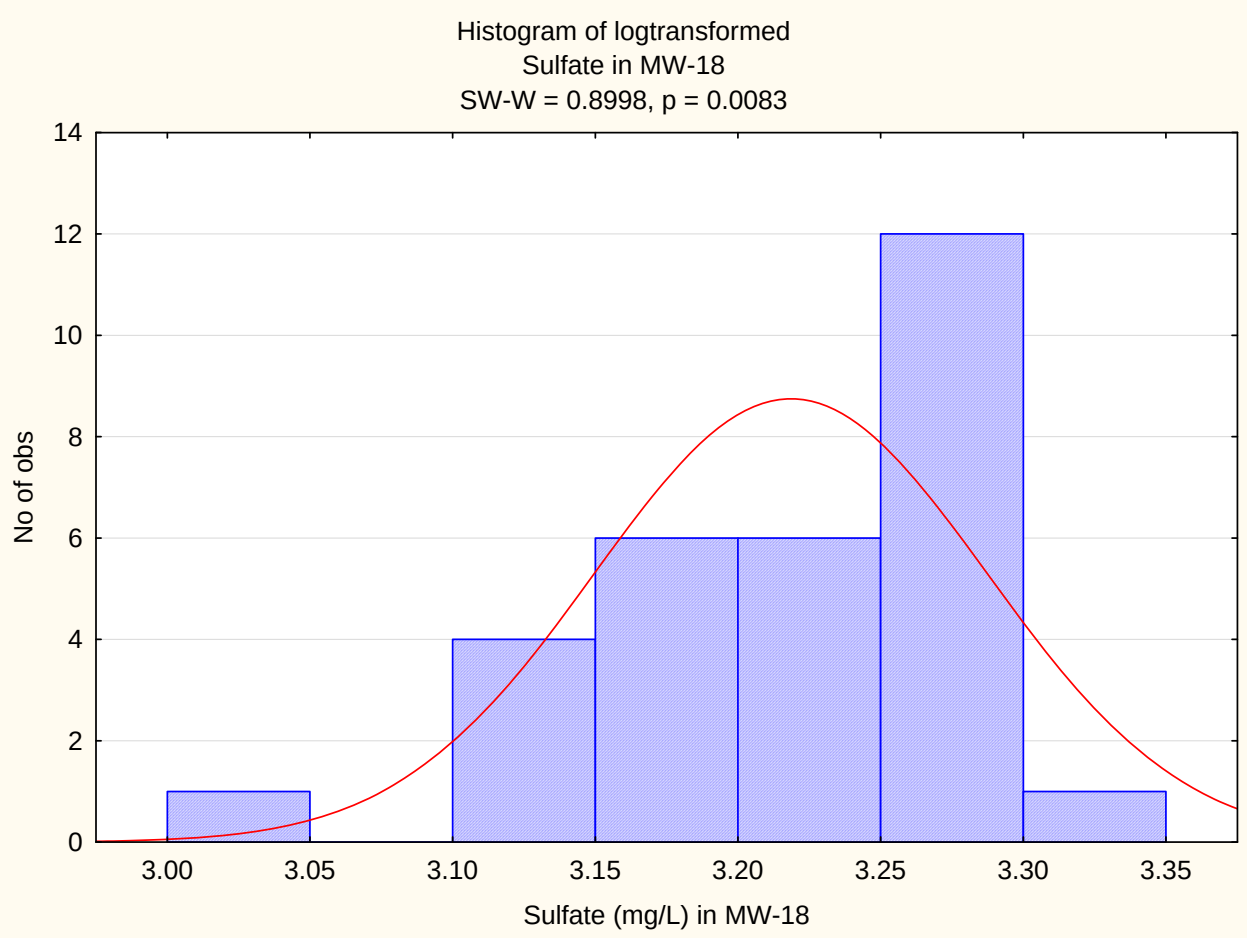
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



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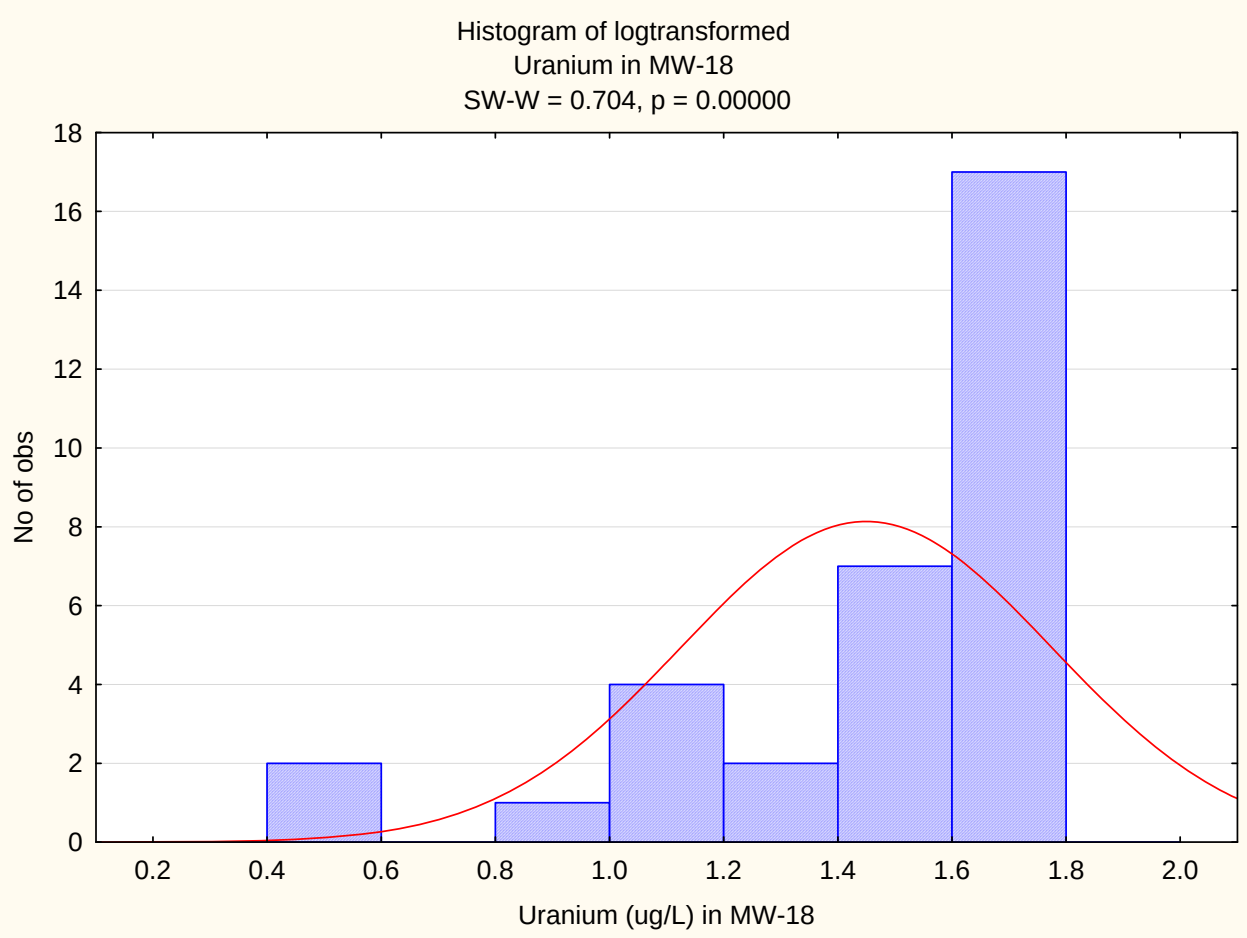
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



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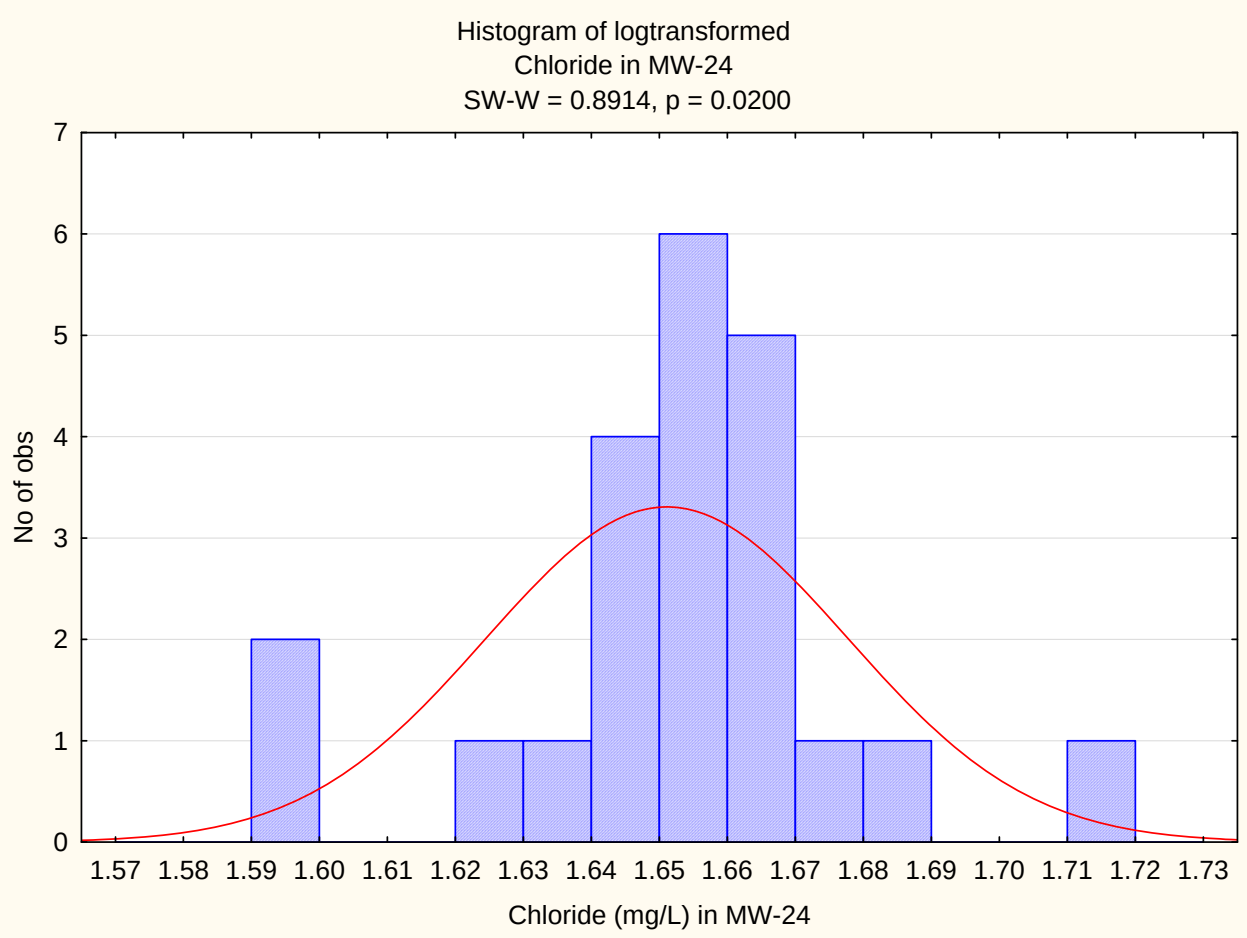

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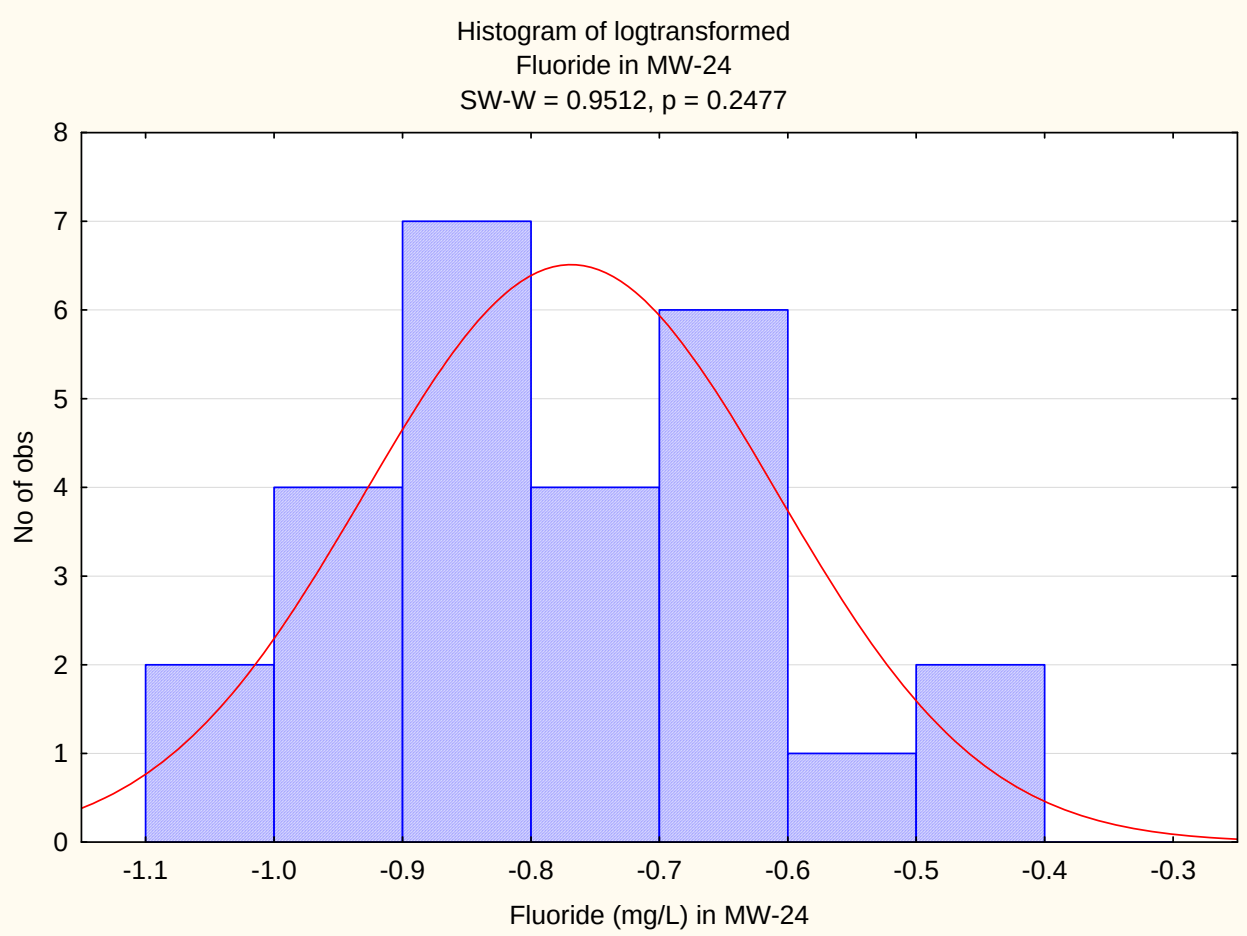
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



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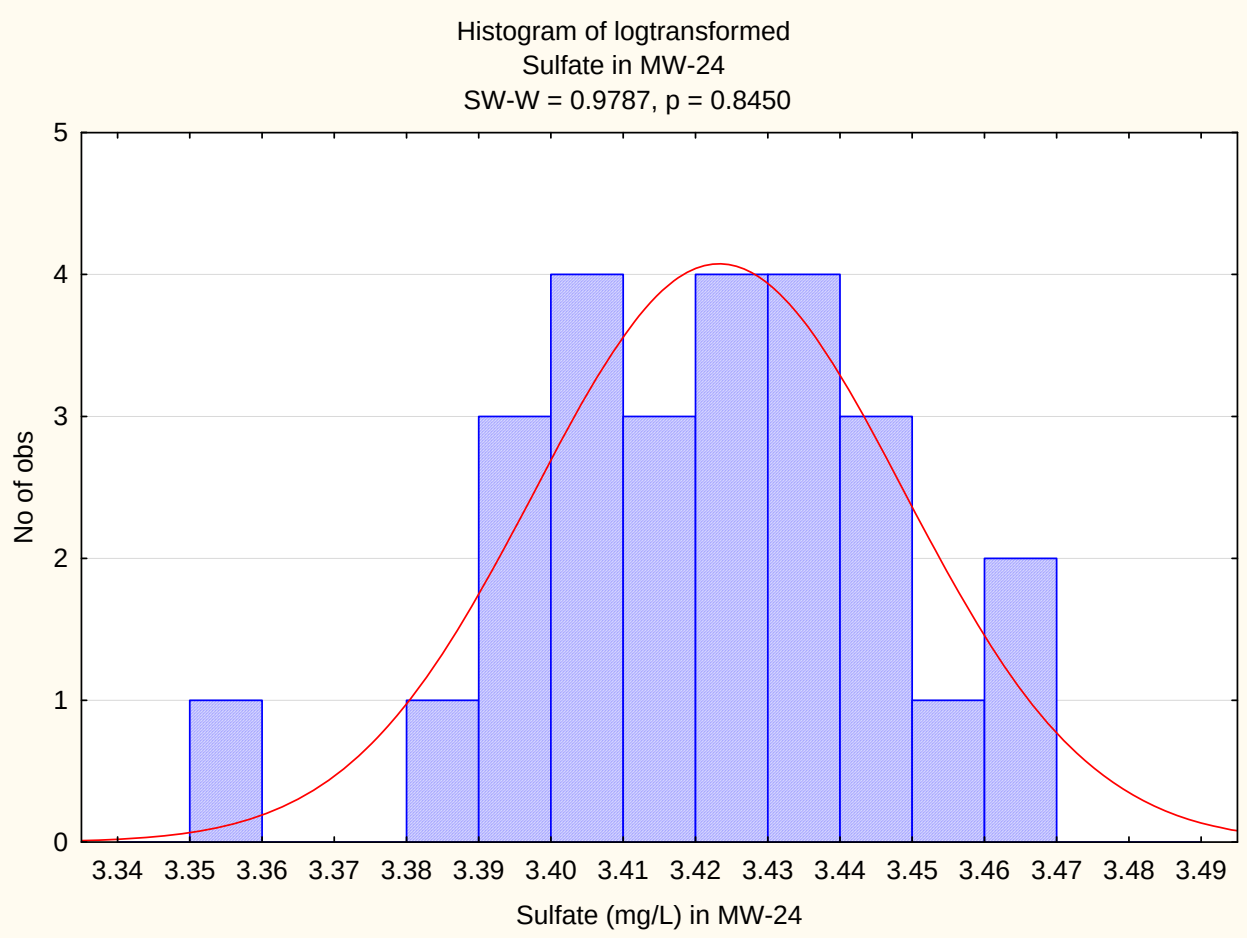
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



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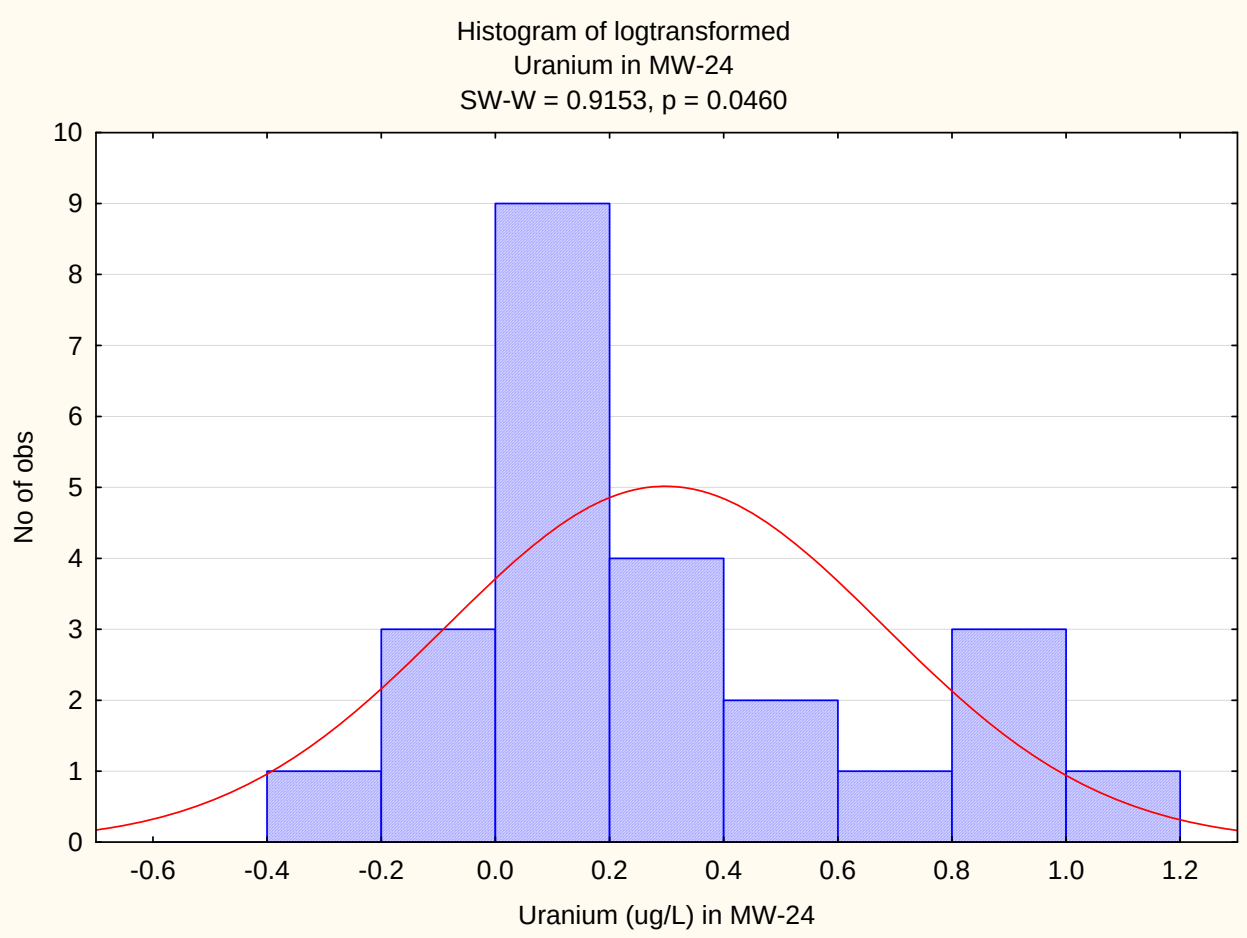
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



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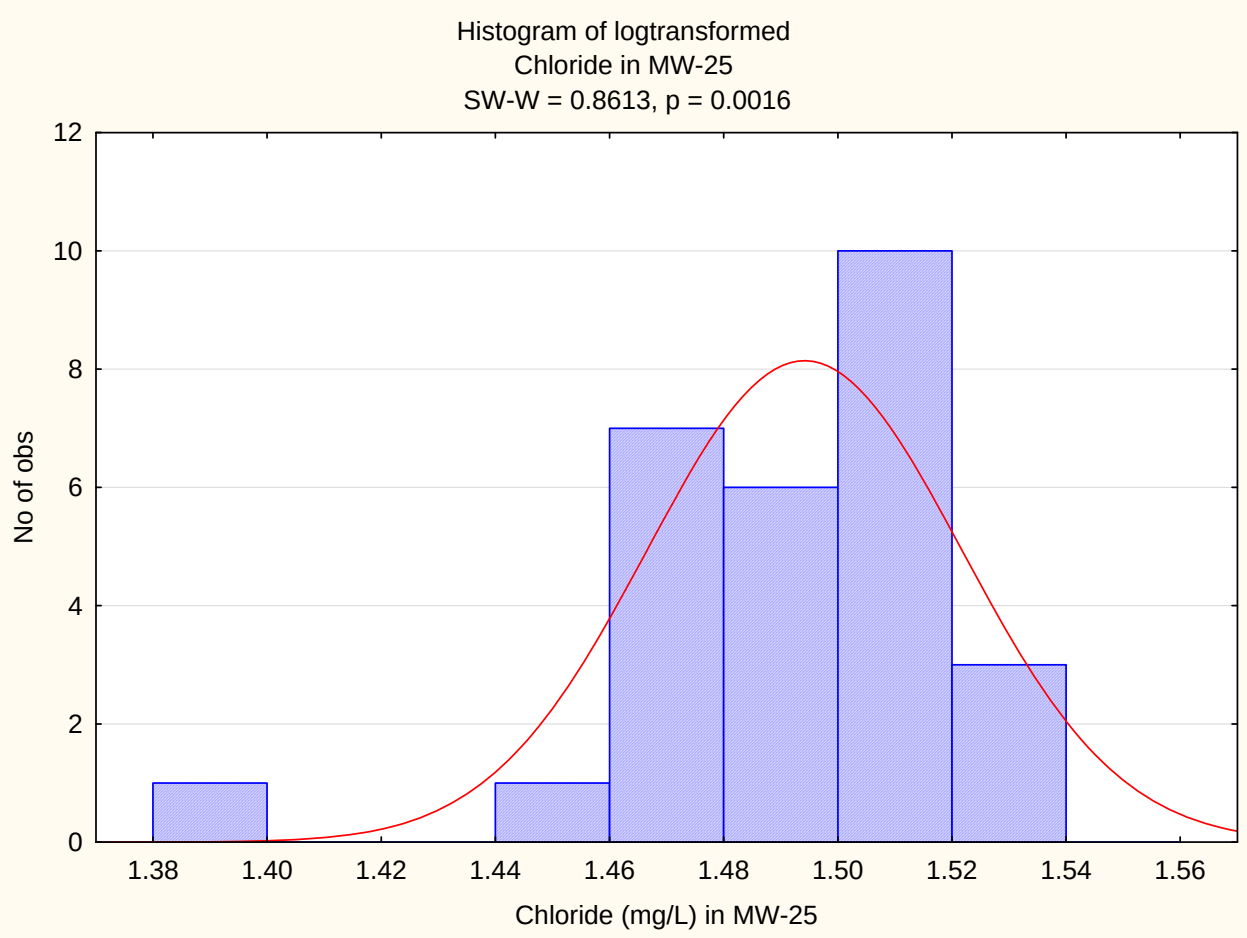

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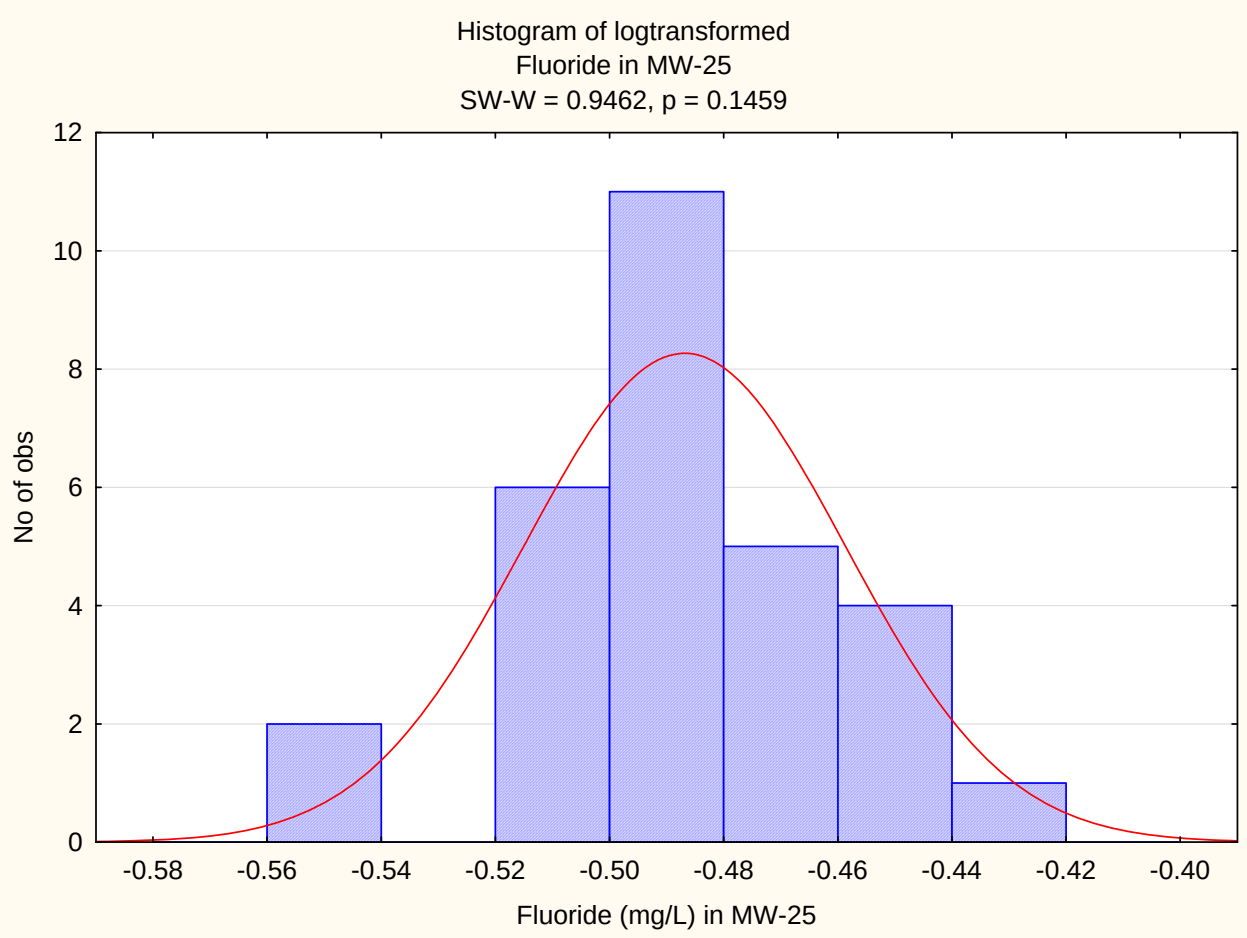
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



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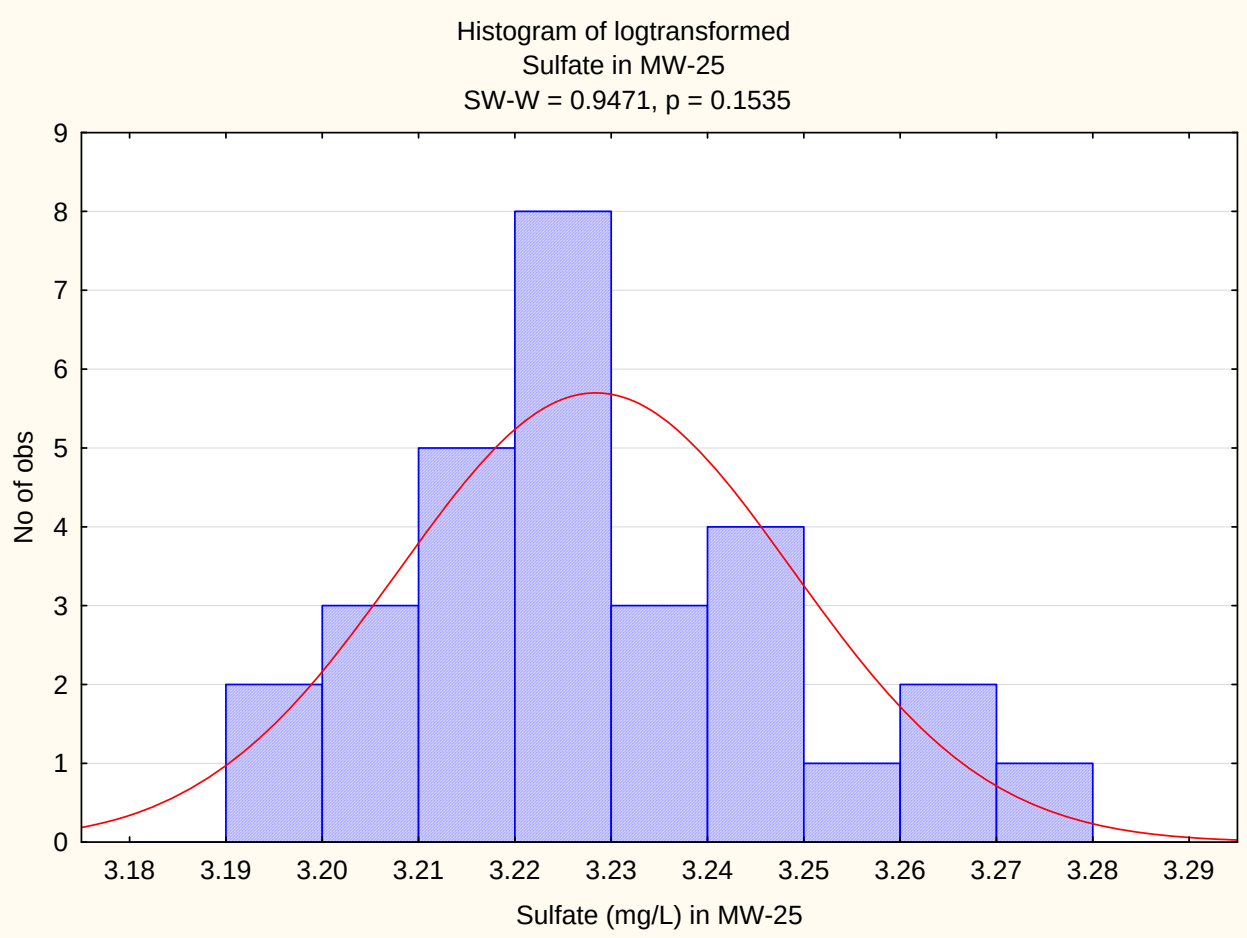

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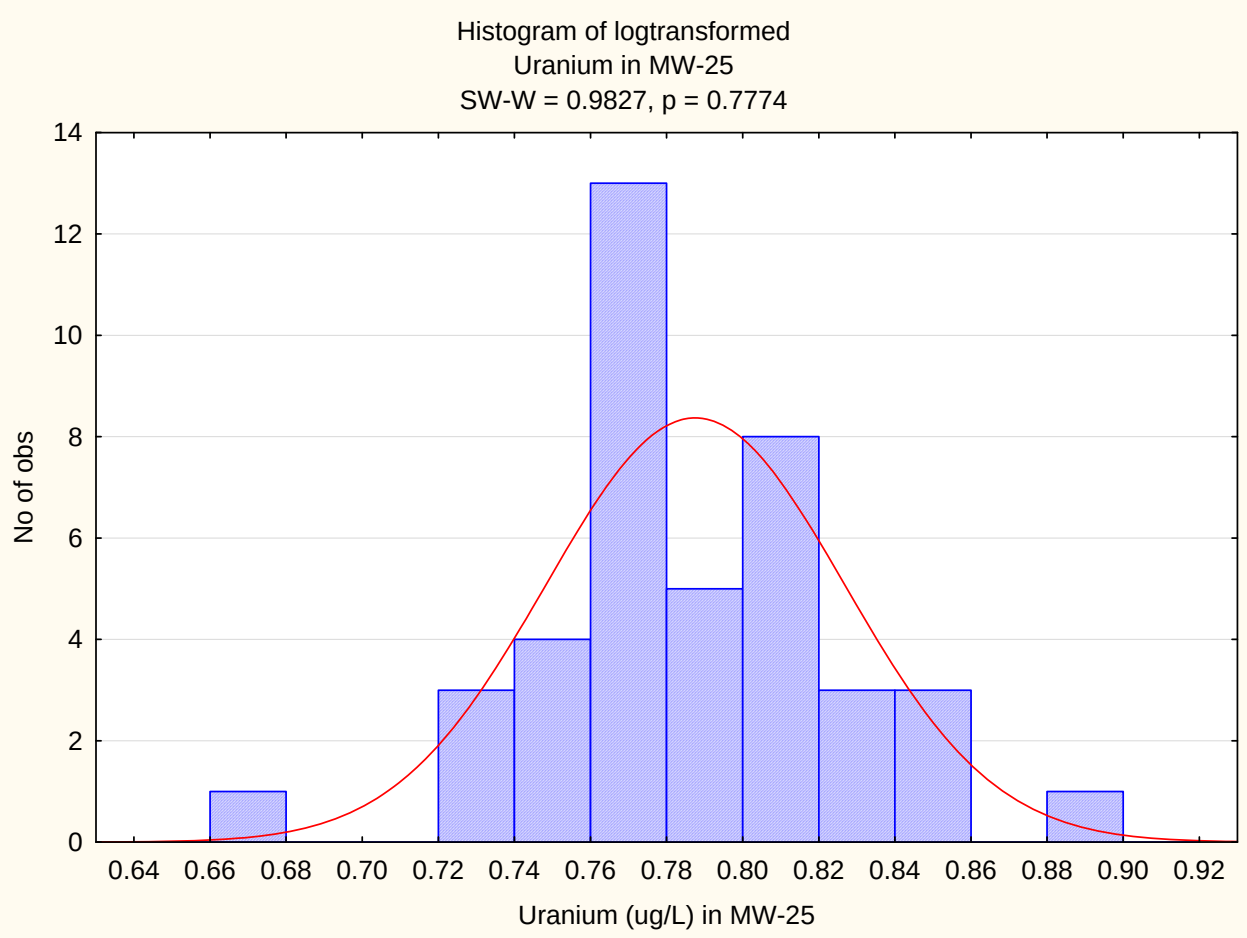

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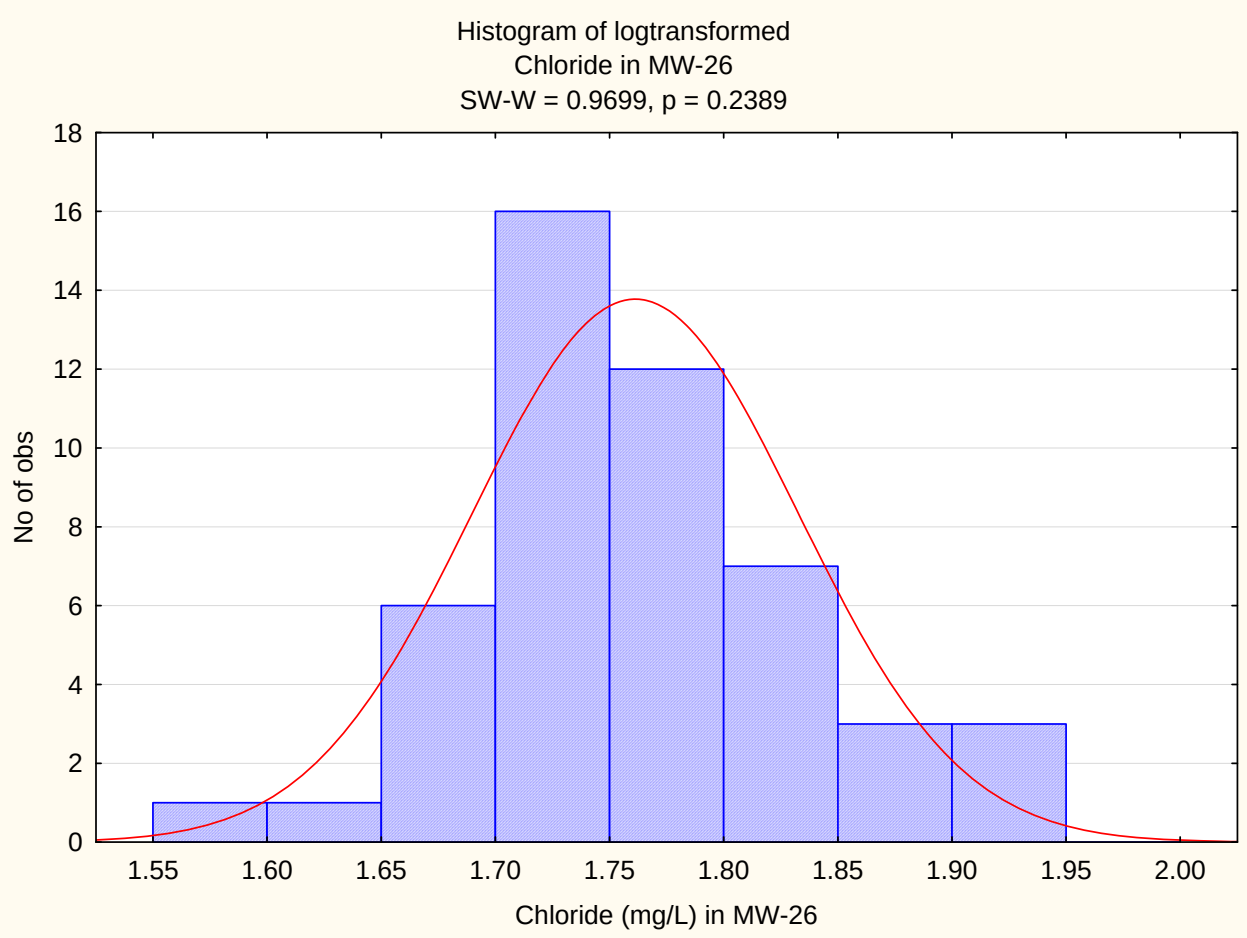

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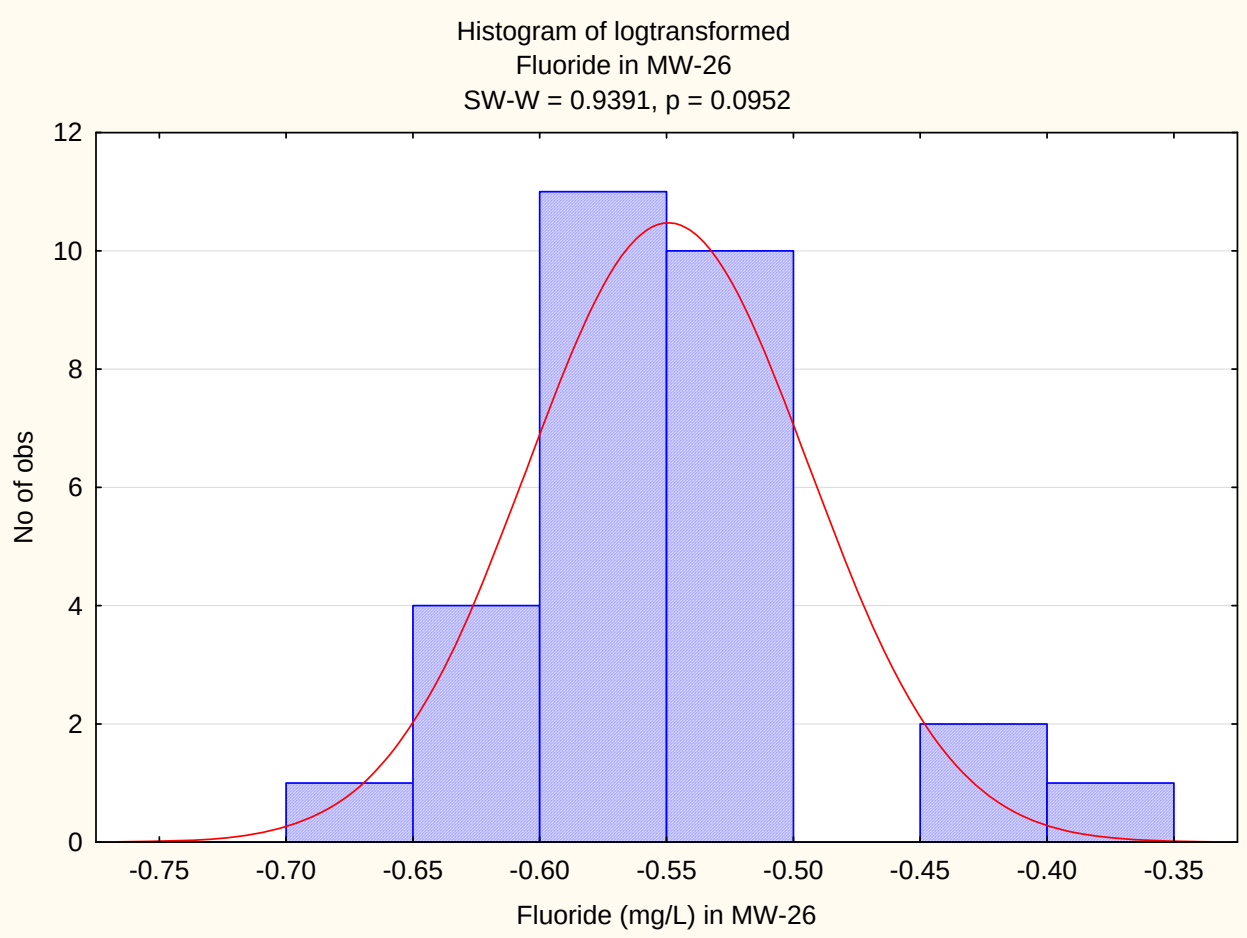

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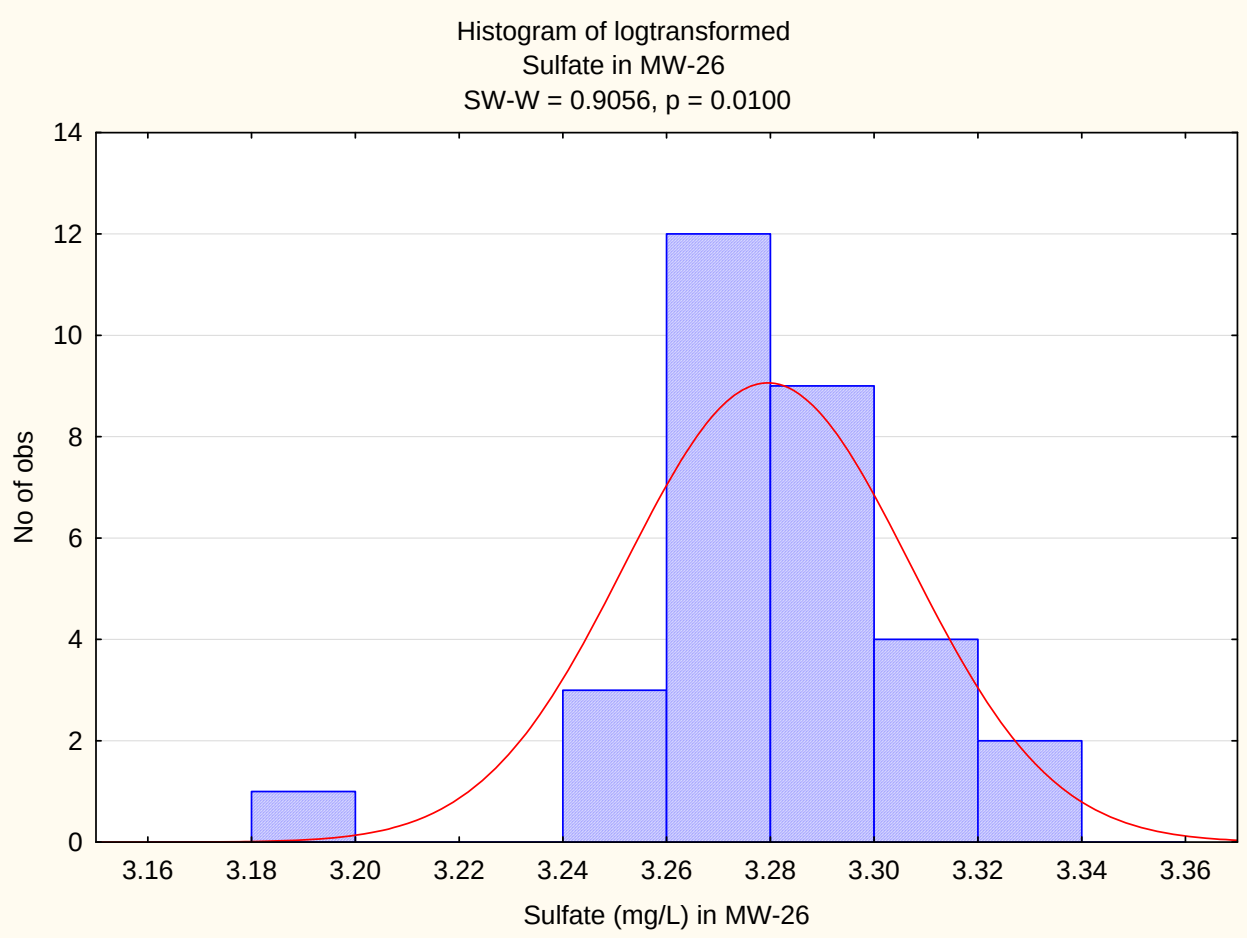

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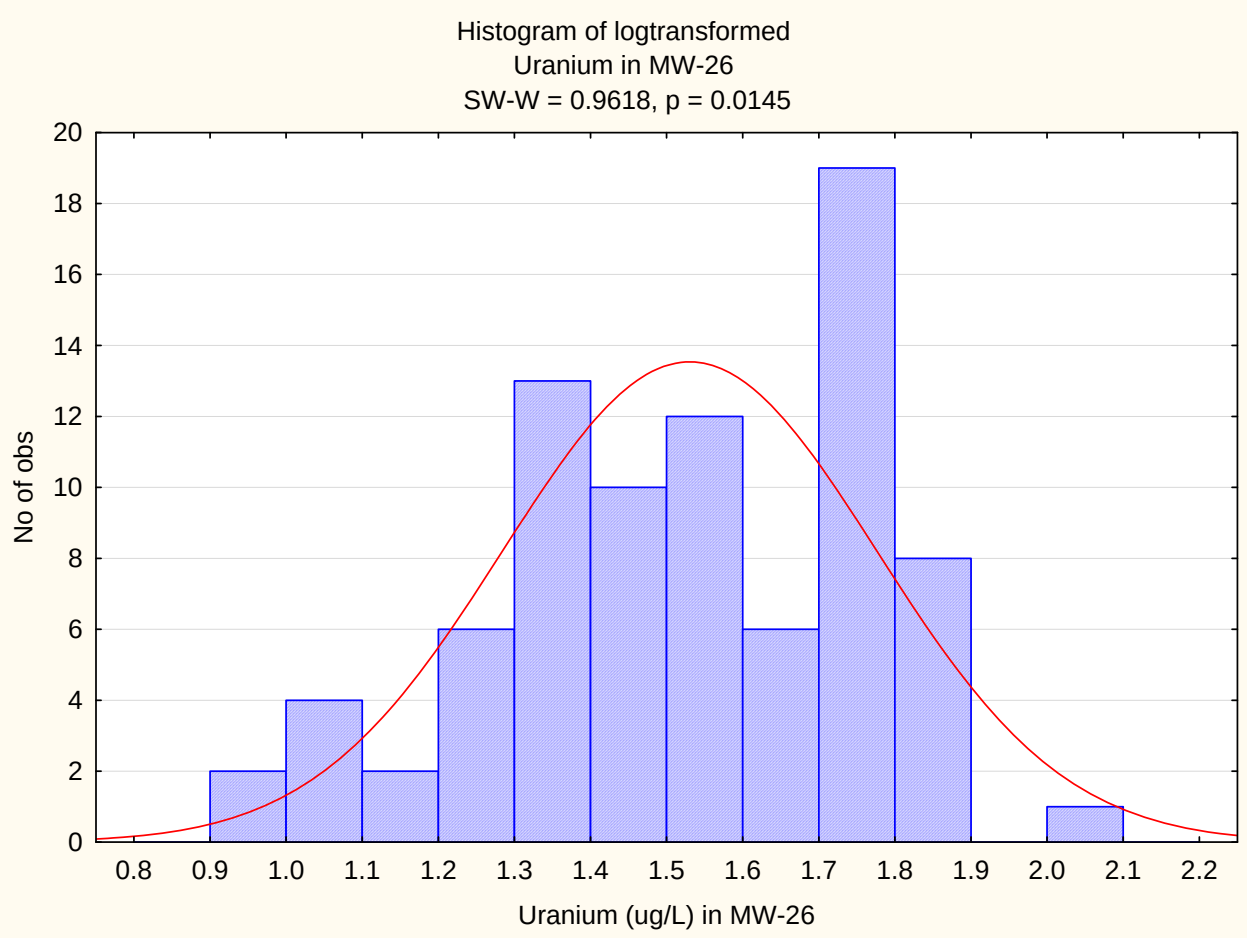

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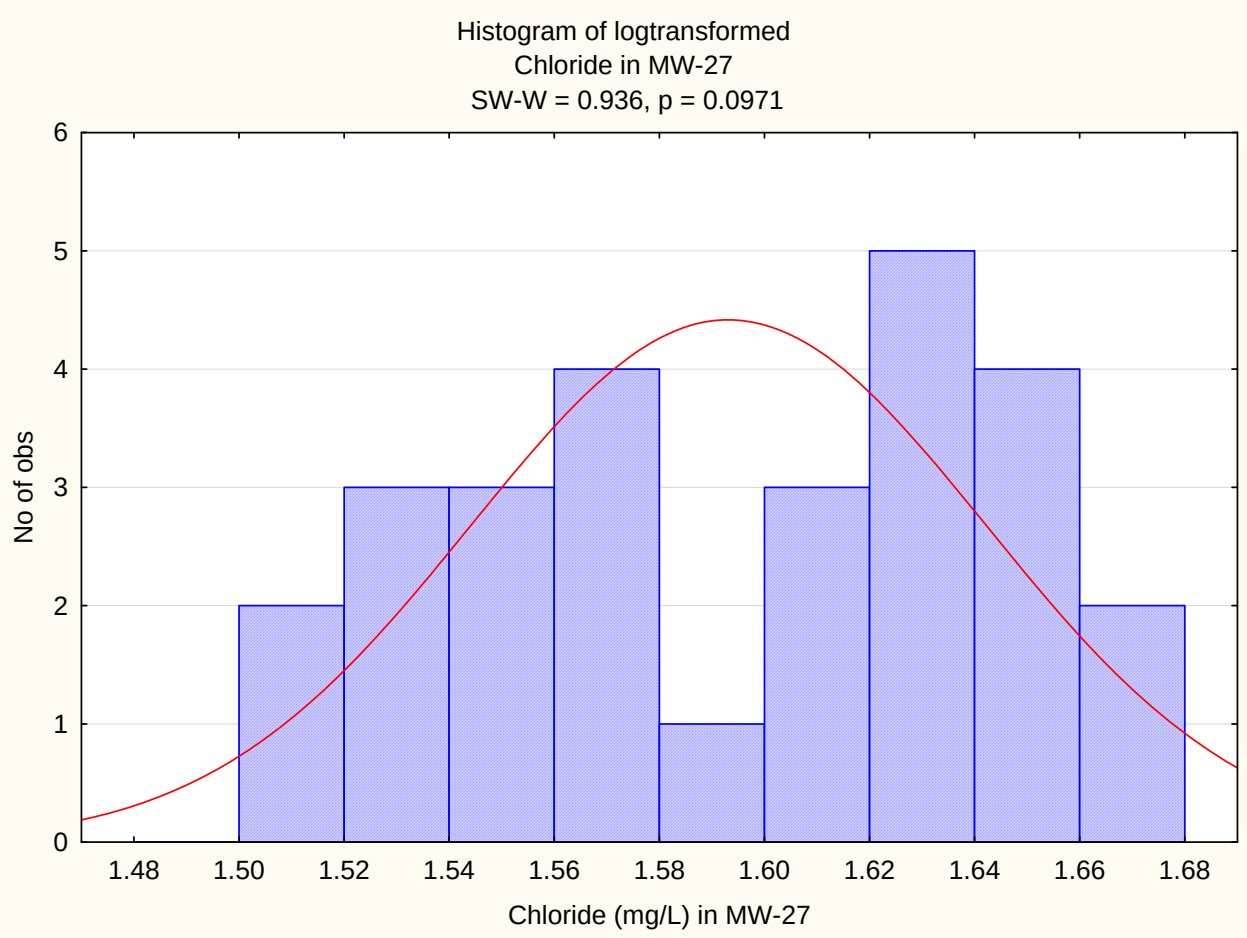

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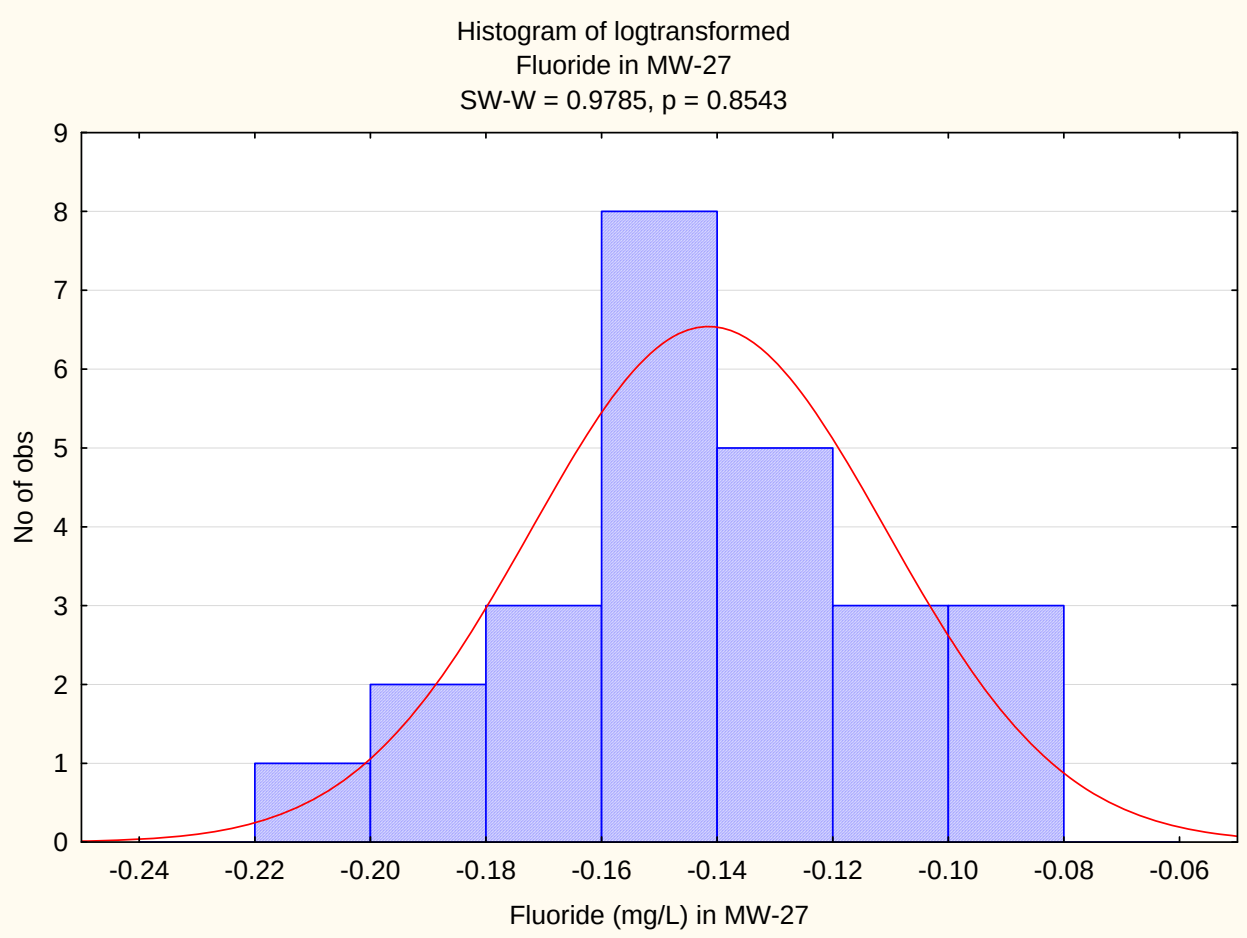
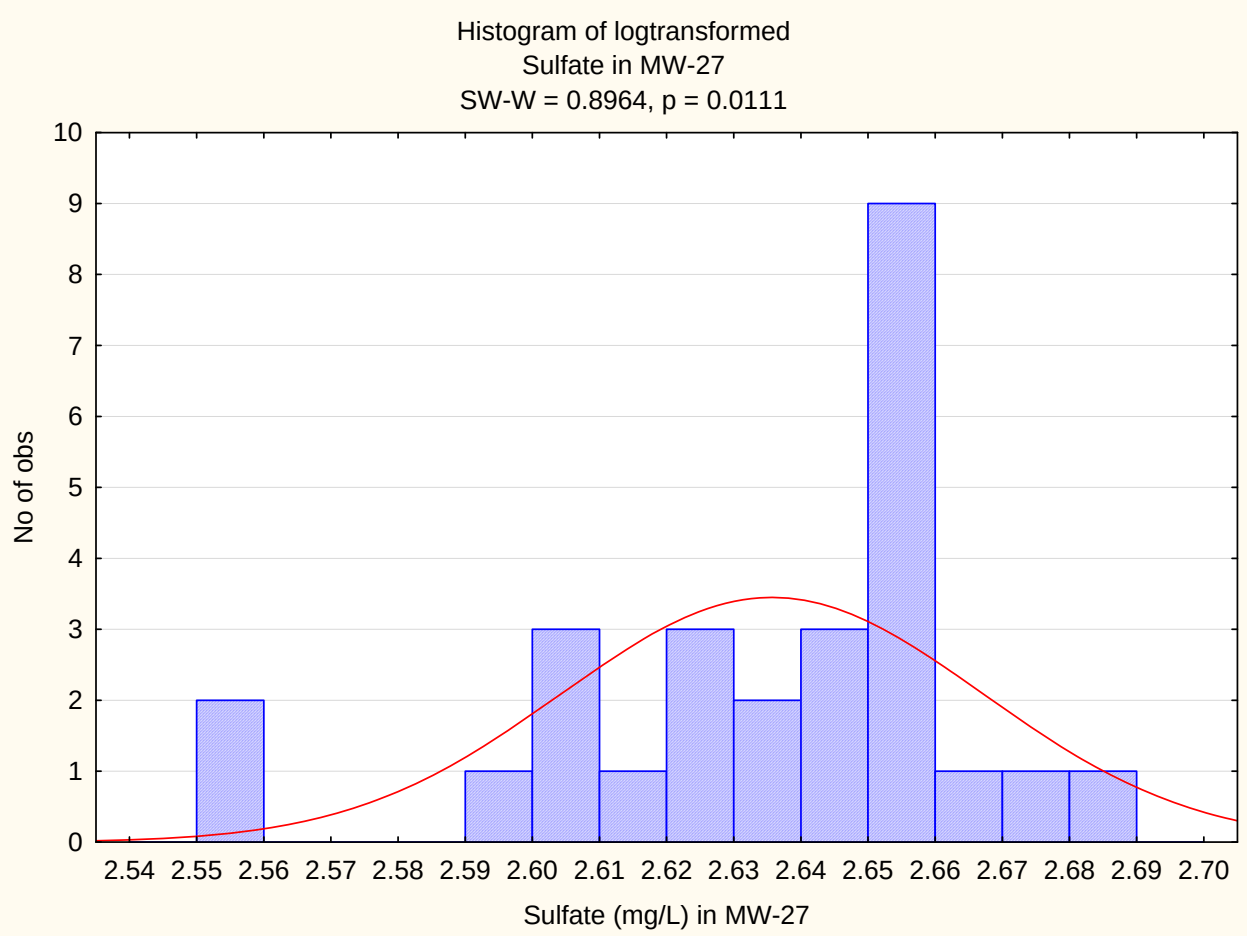


Appendix C-5
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



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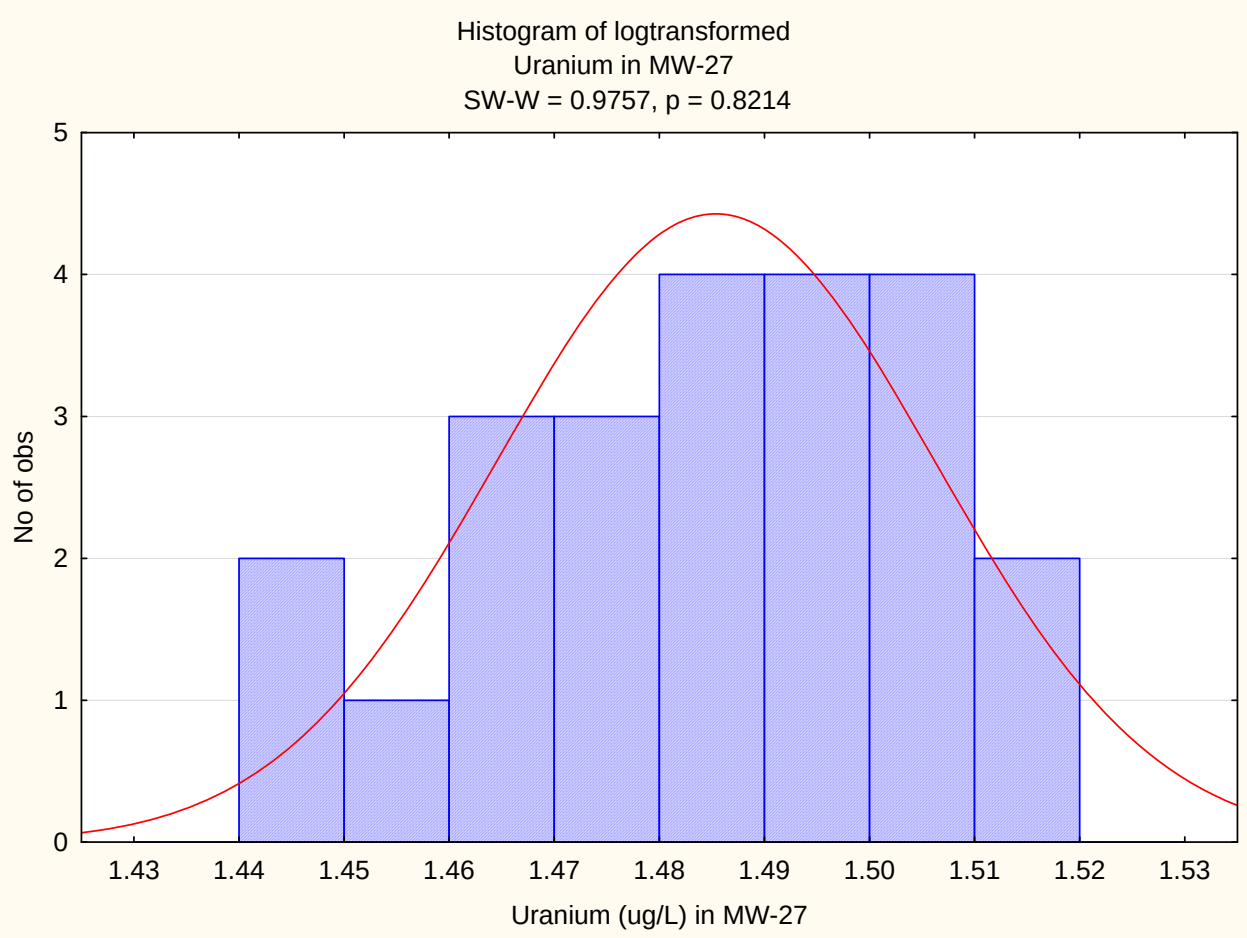

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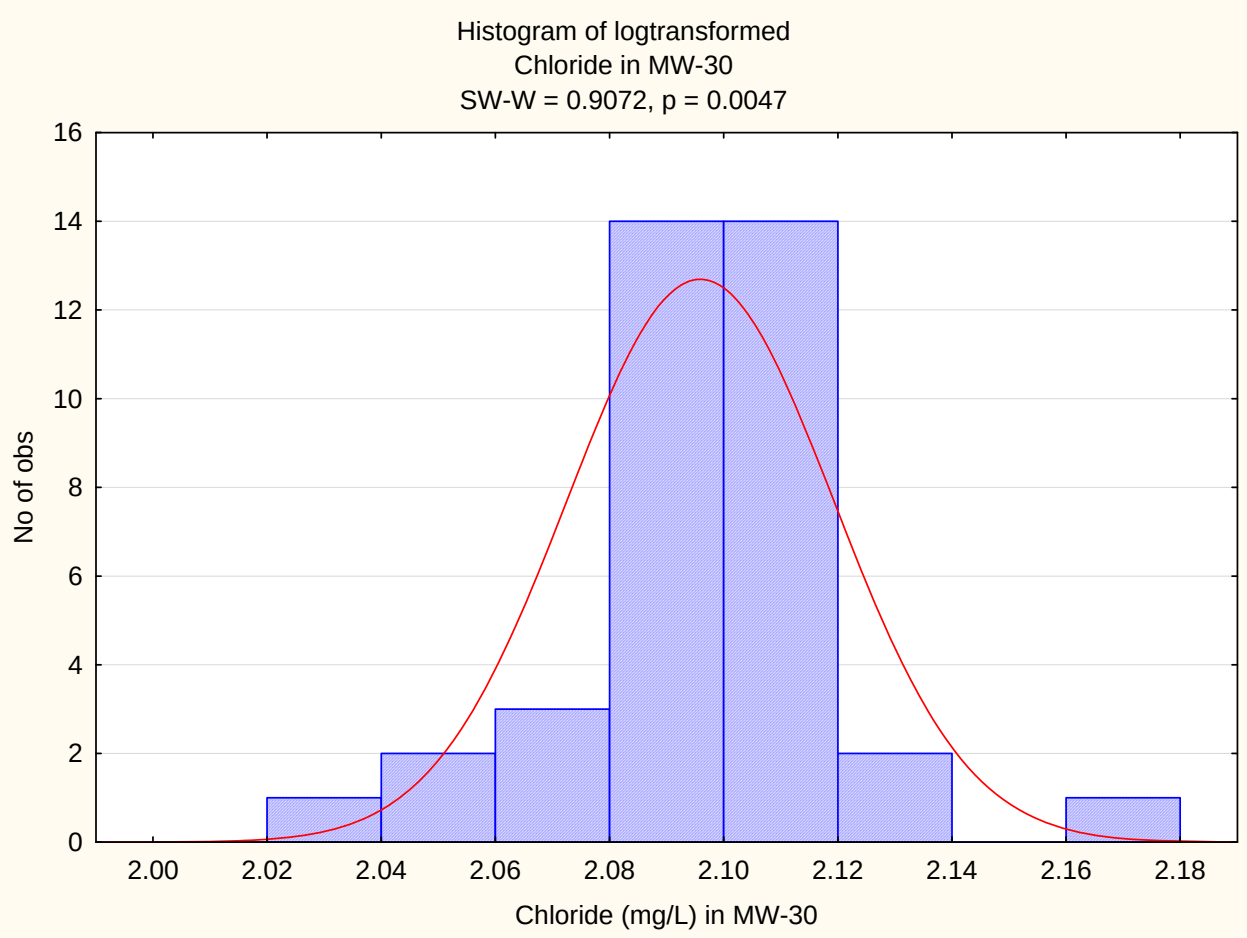

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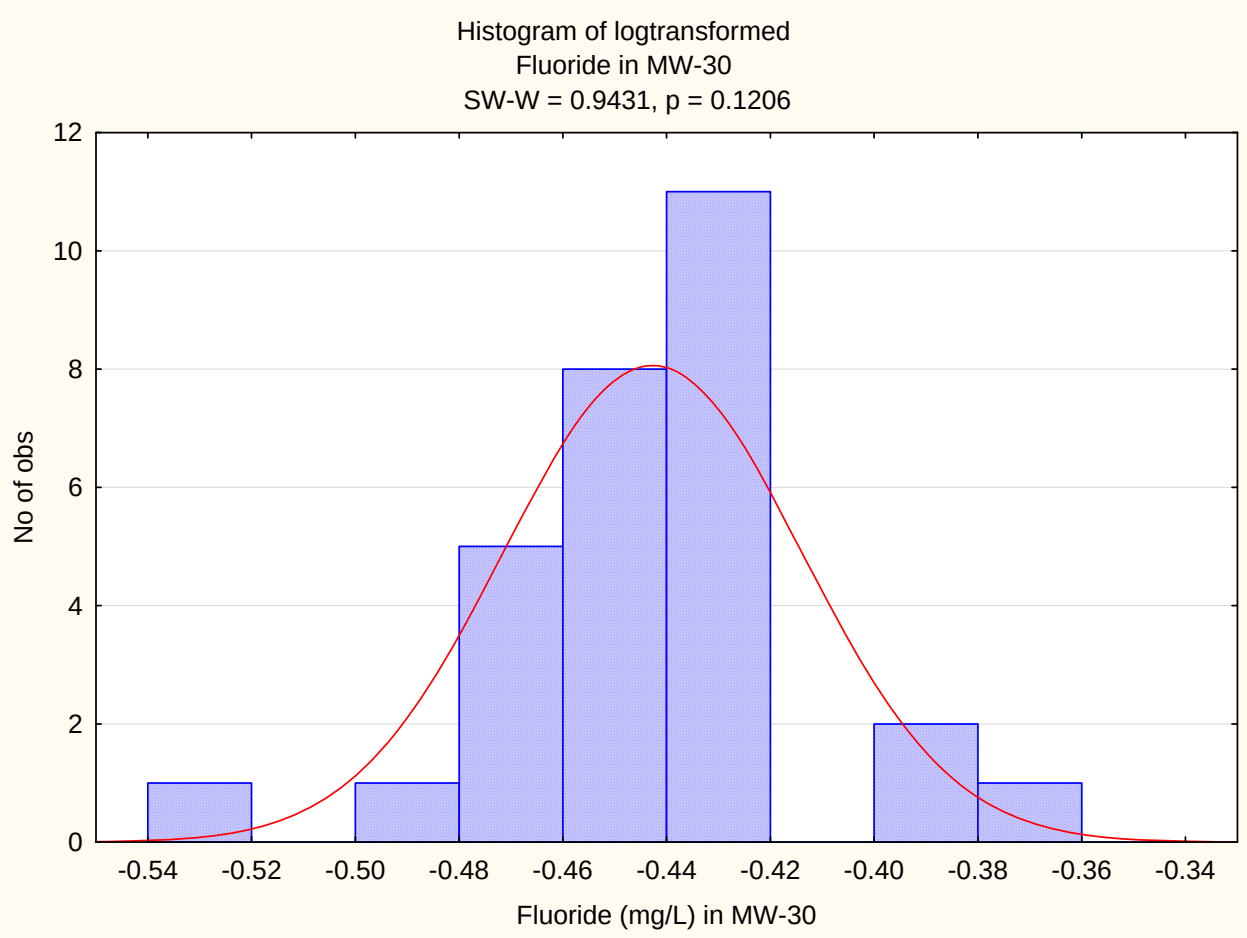

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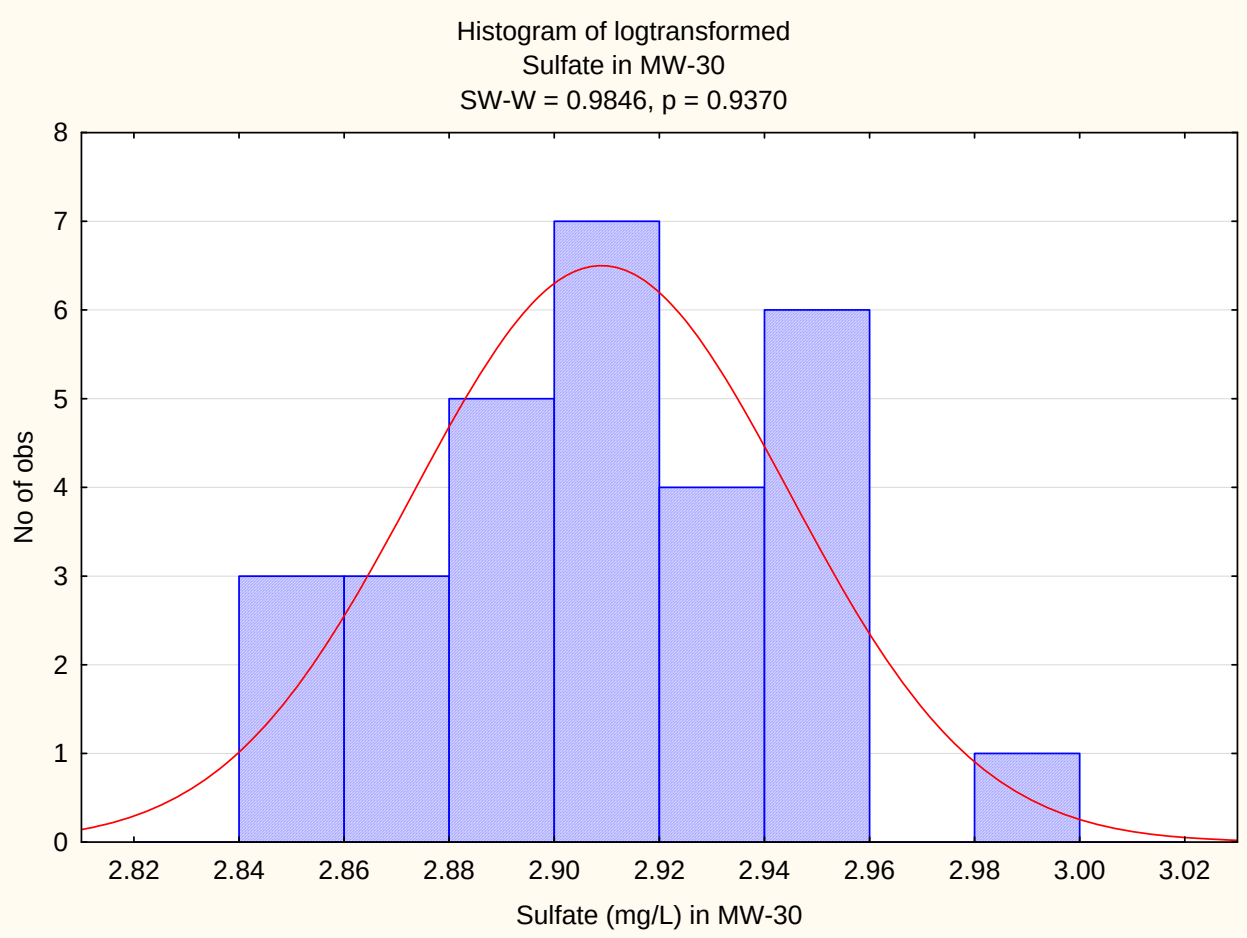

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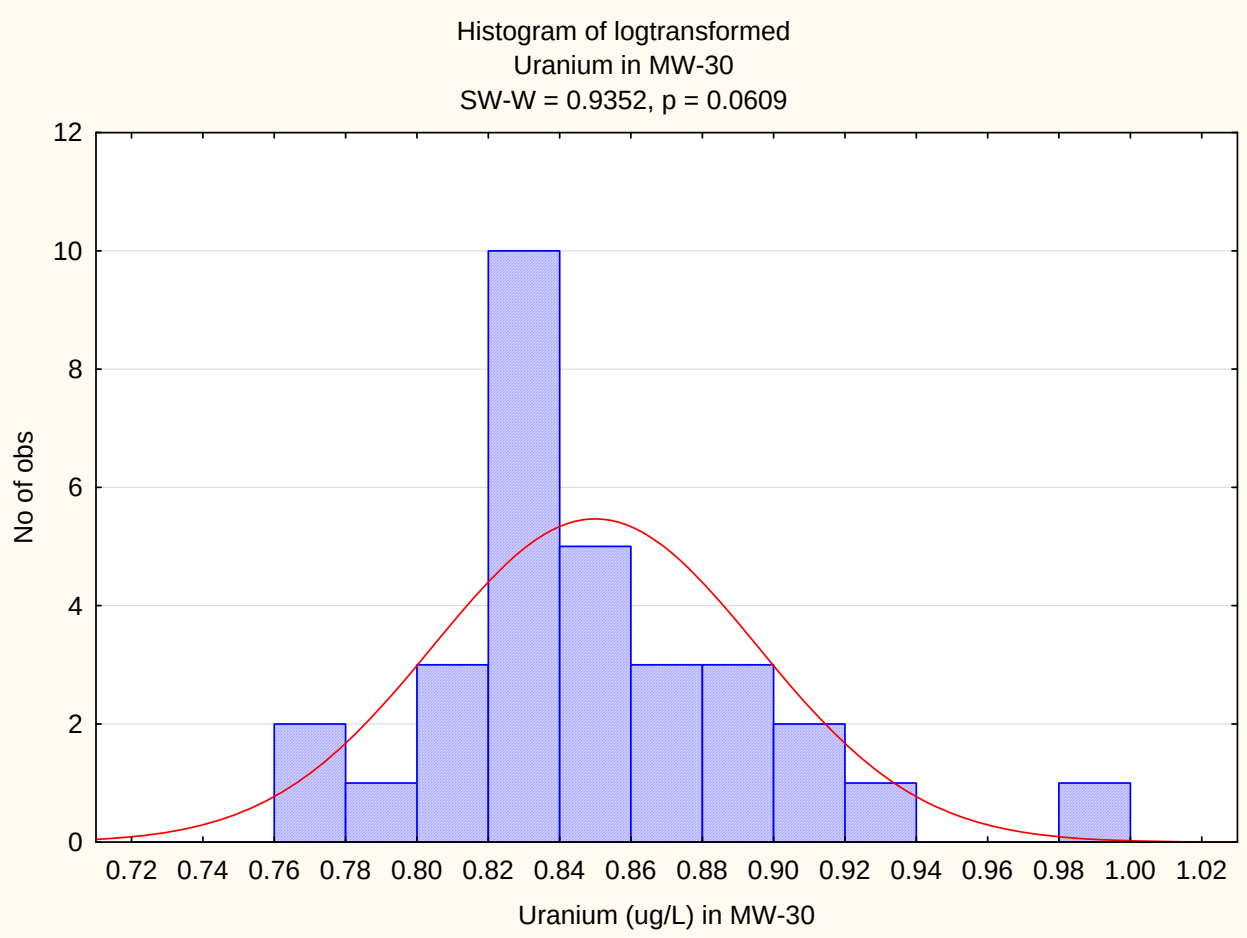

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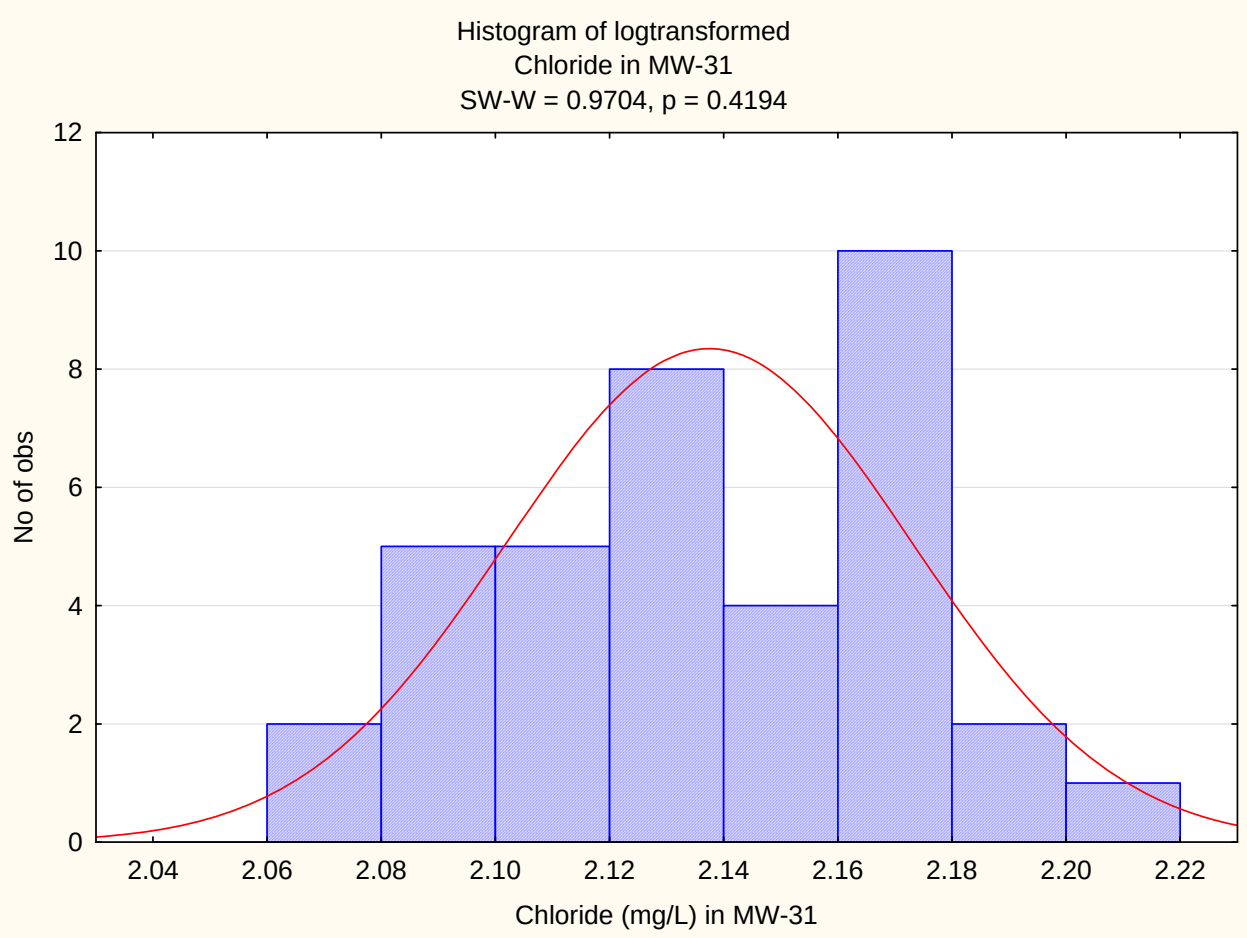

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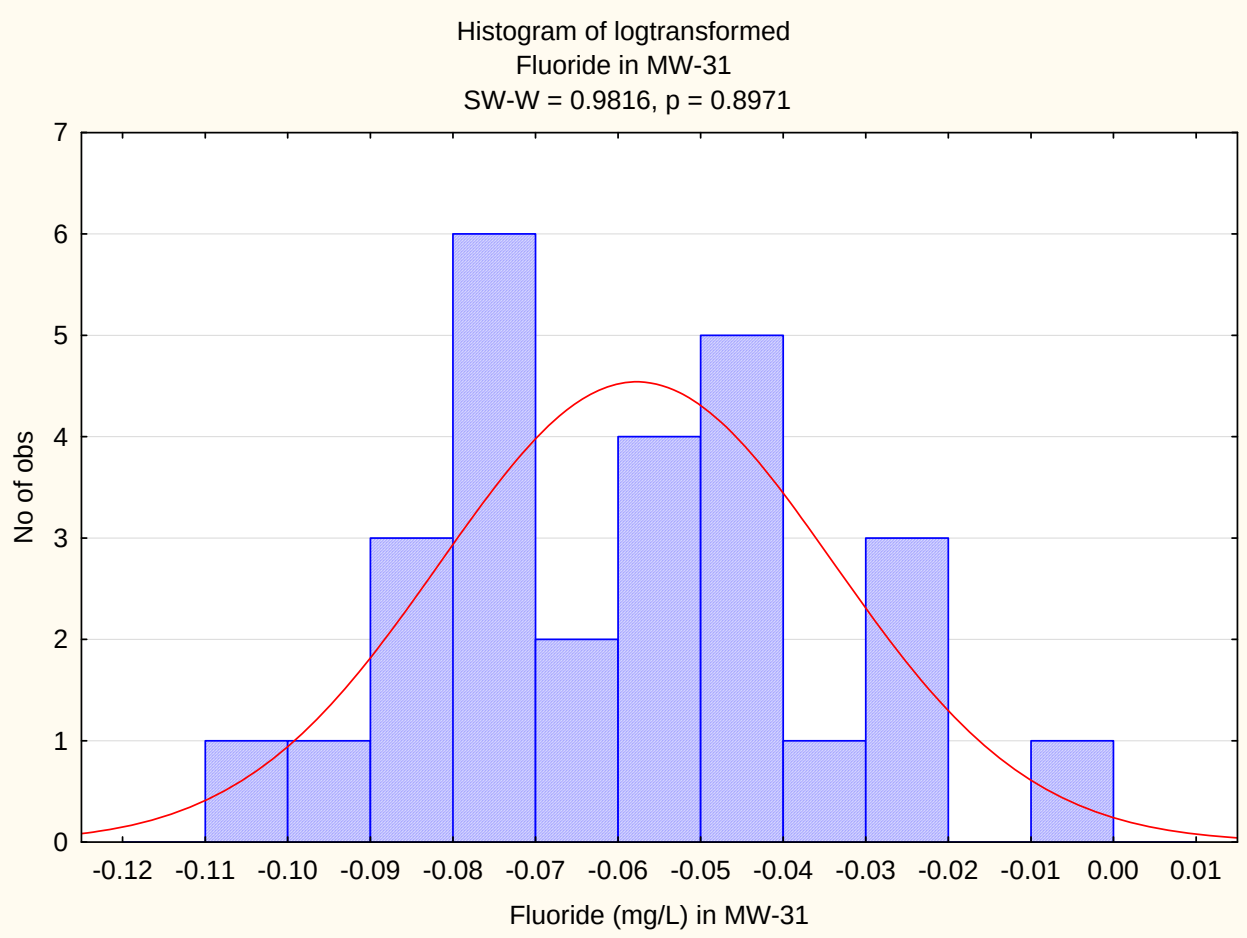

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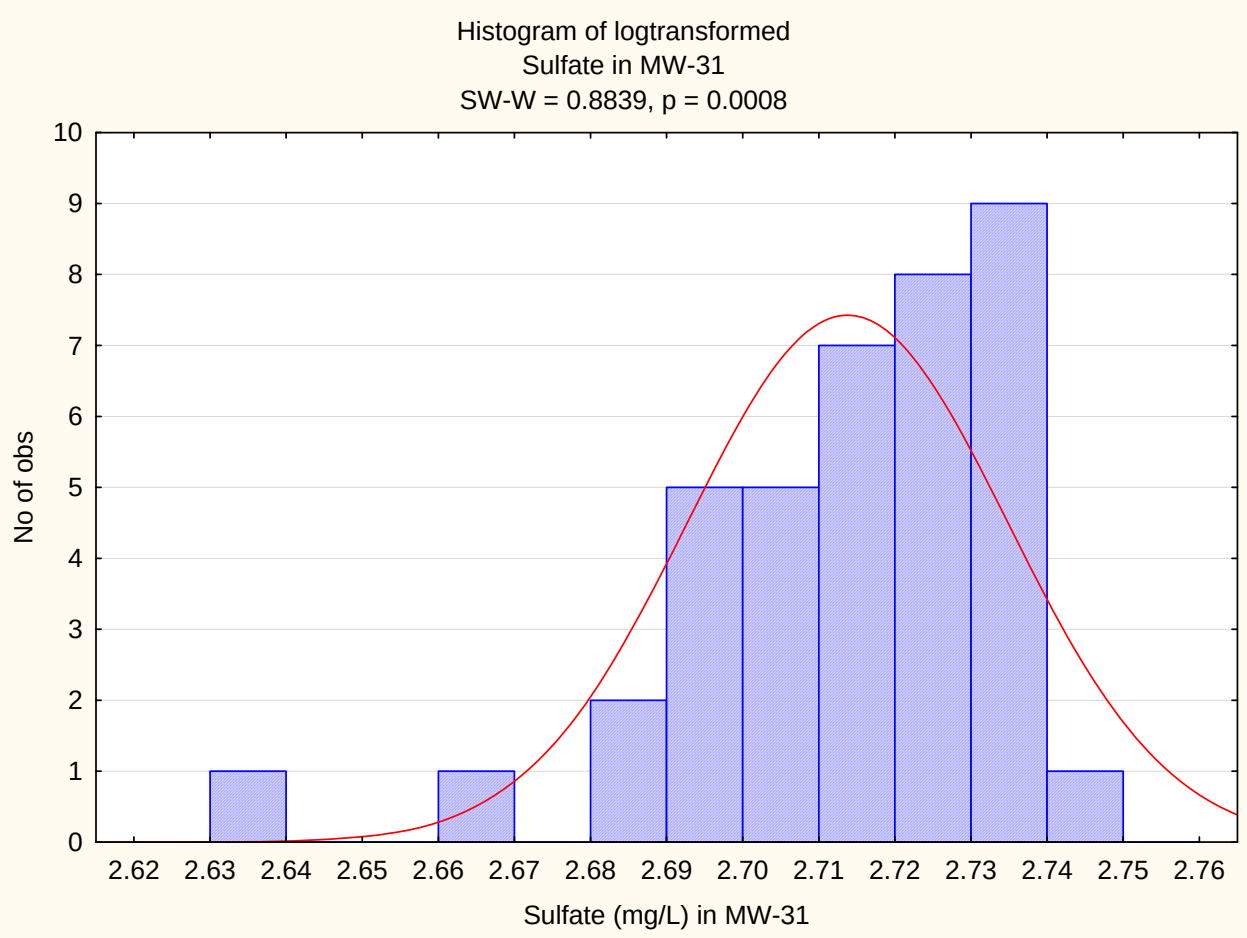

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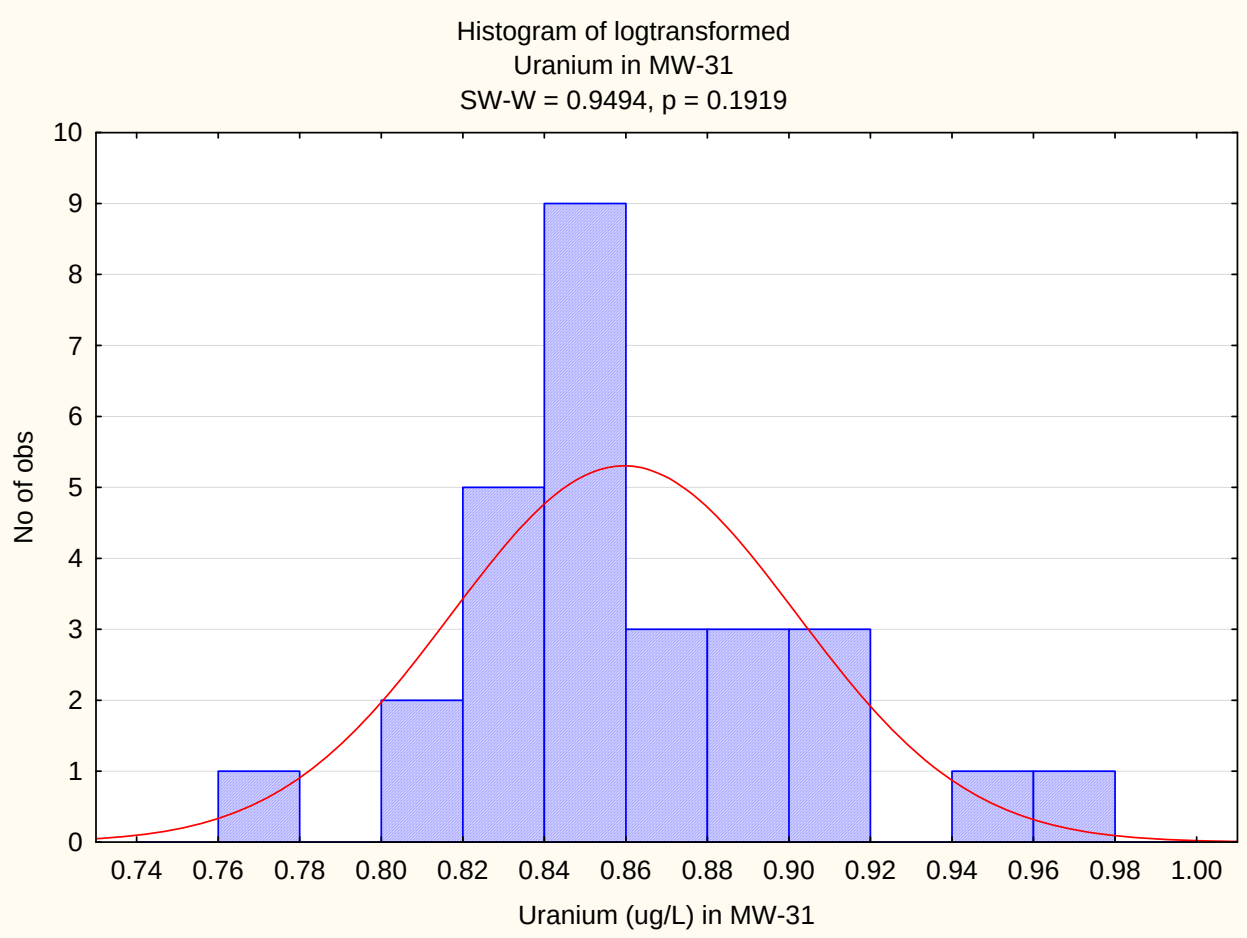
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



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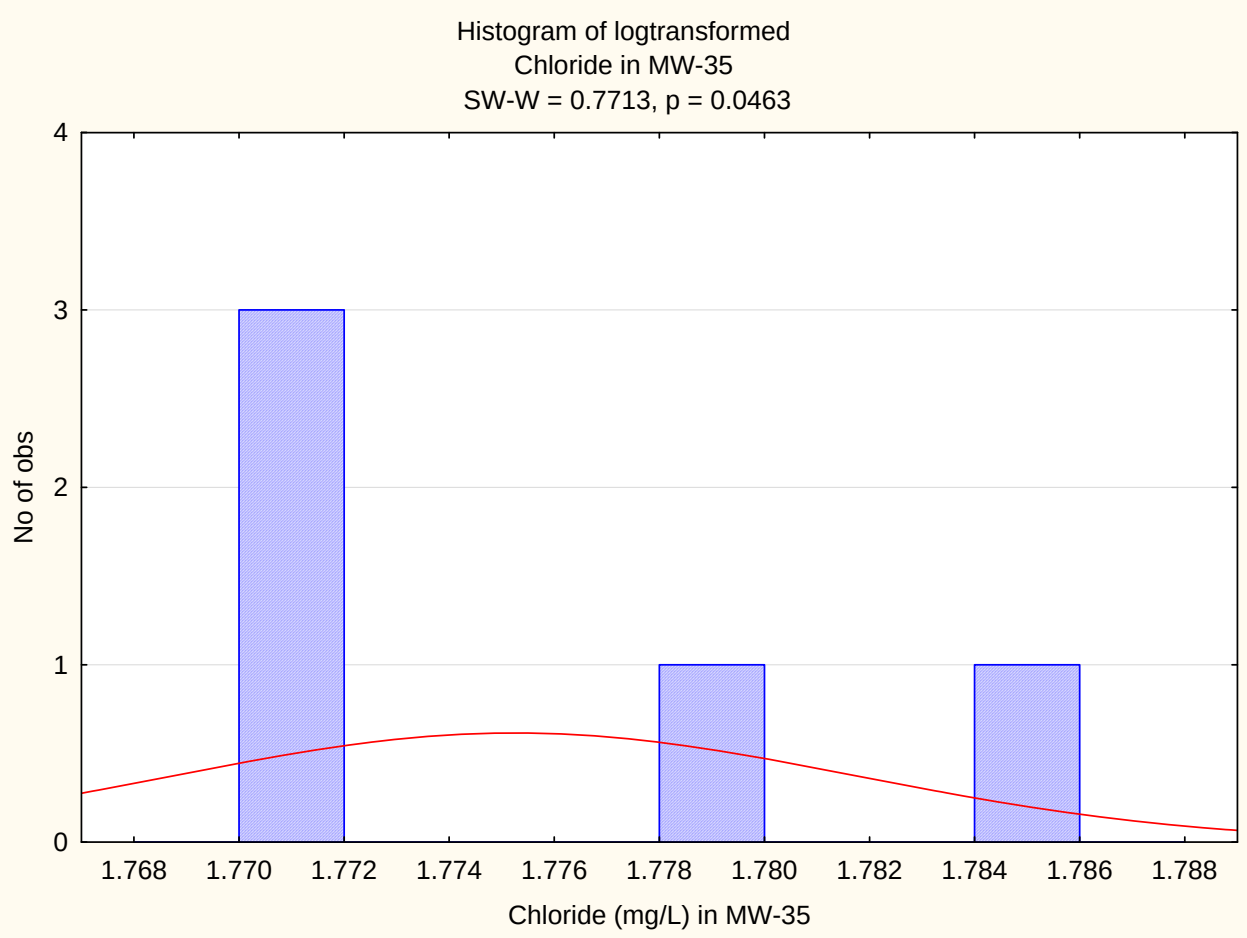
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



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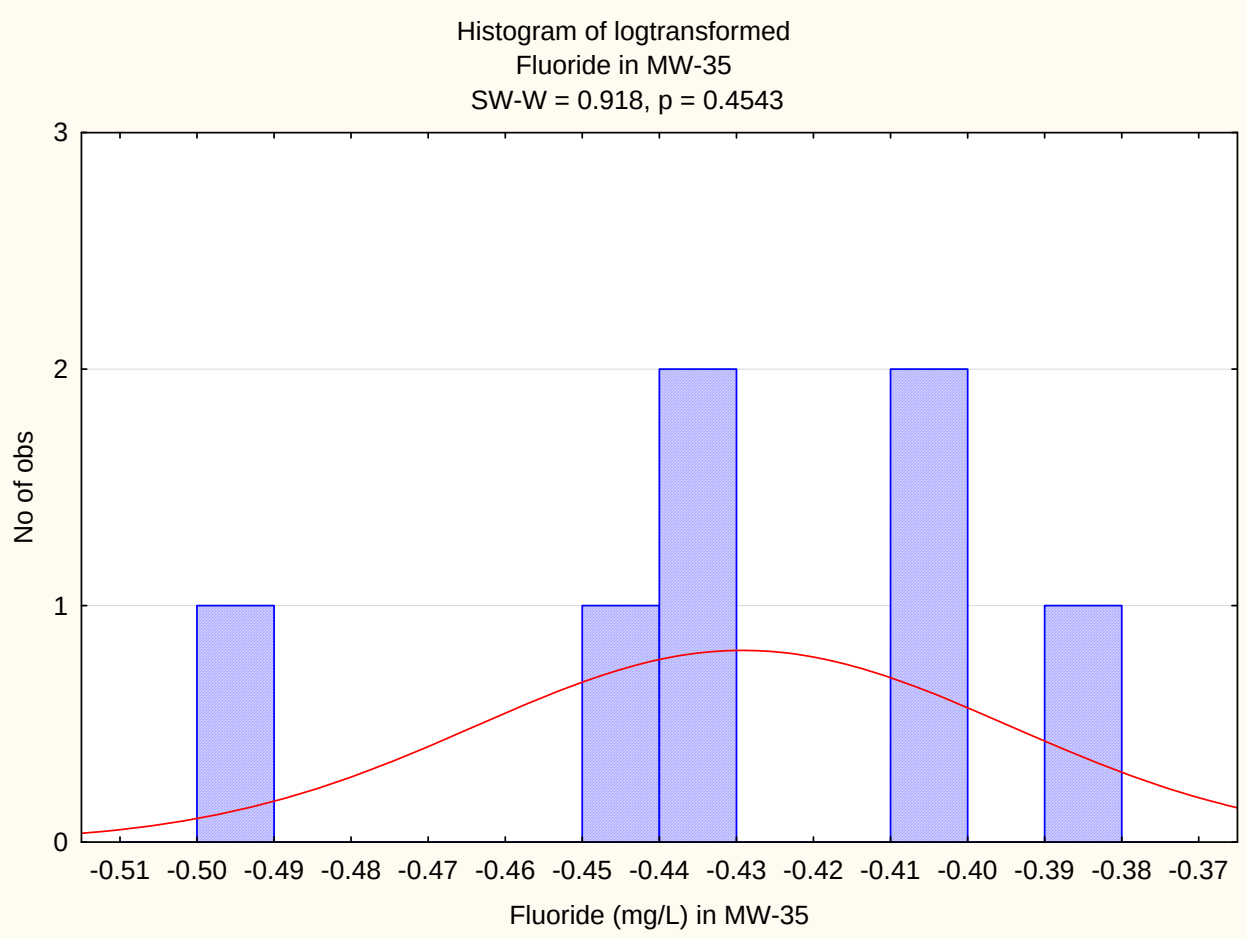
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



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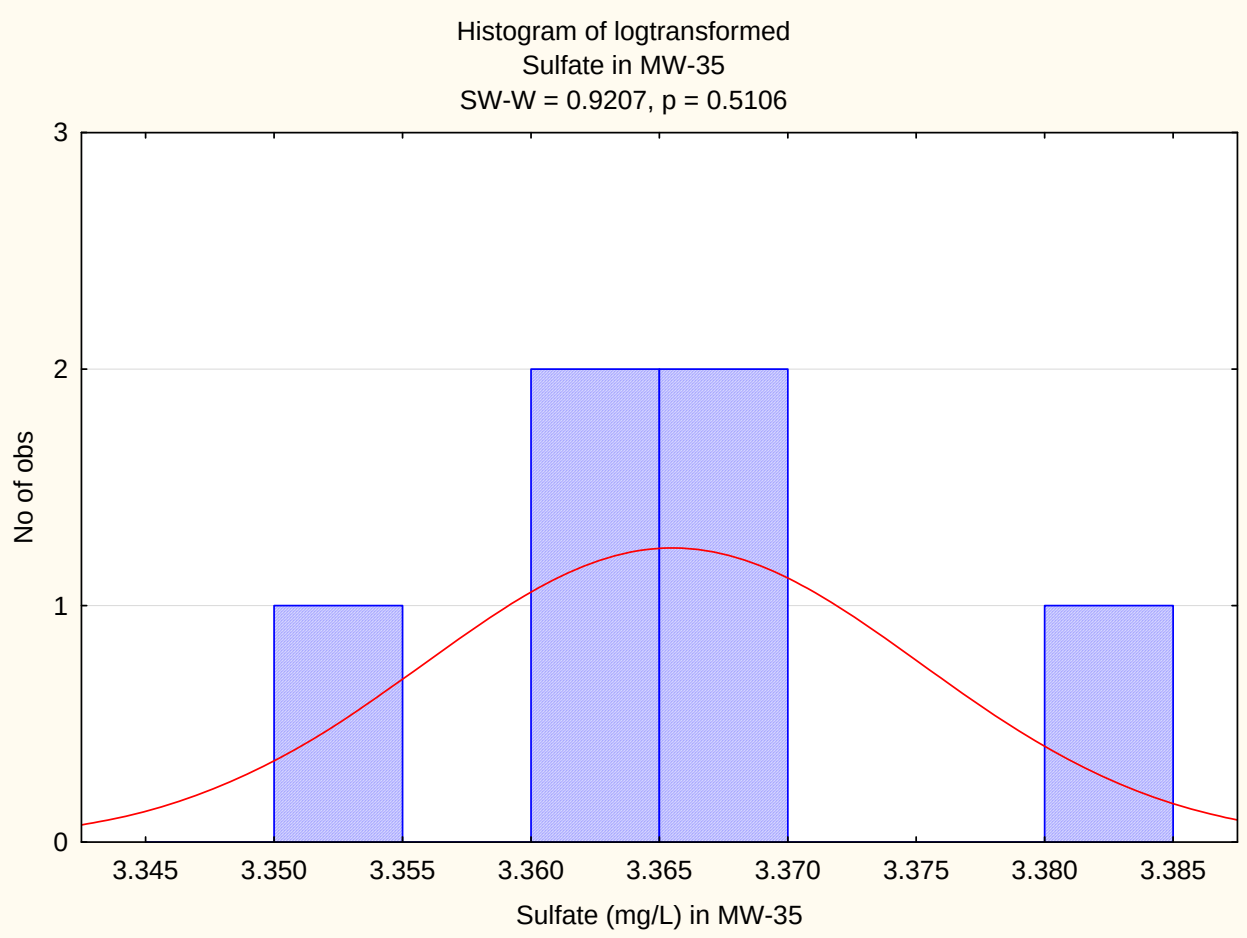

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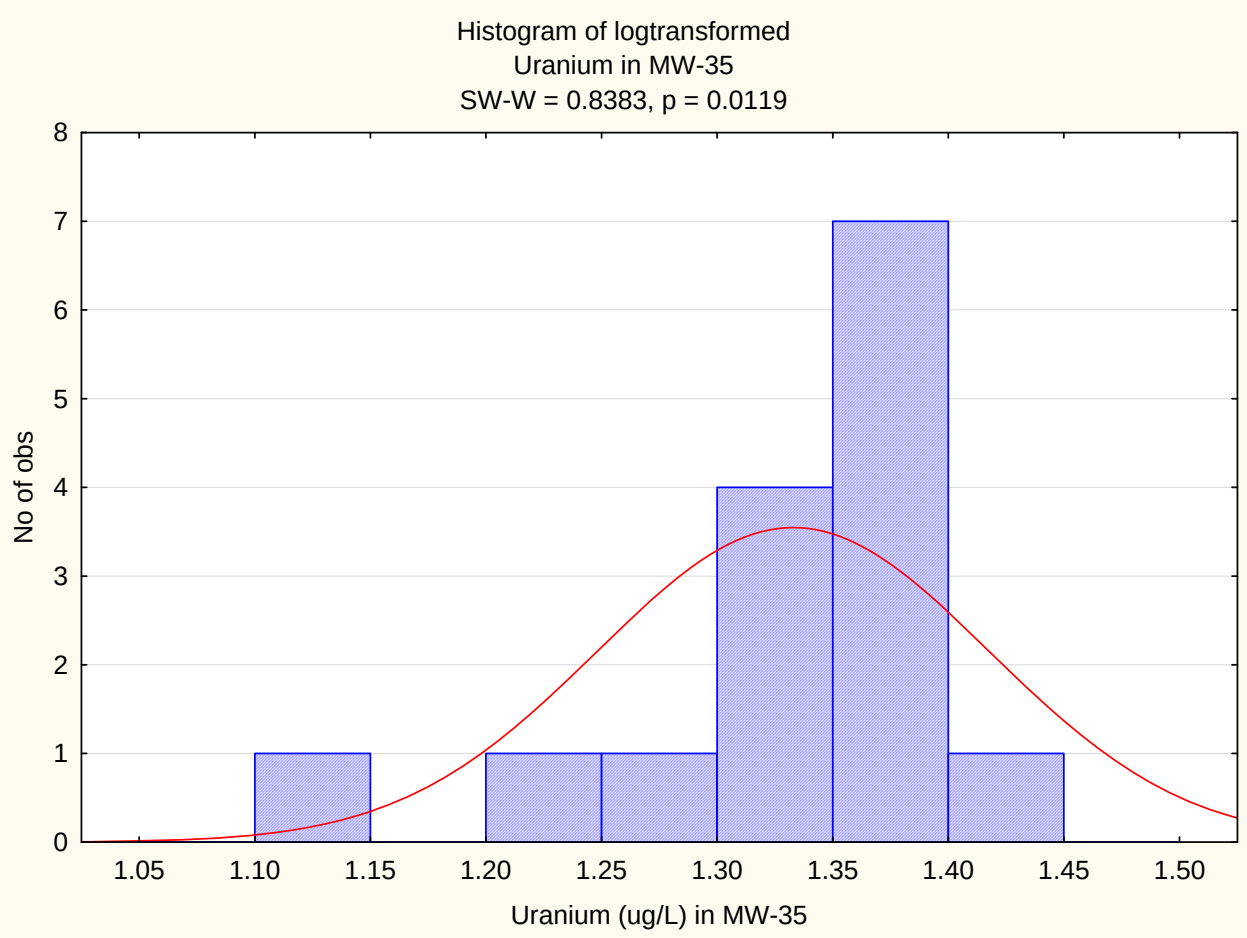
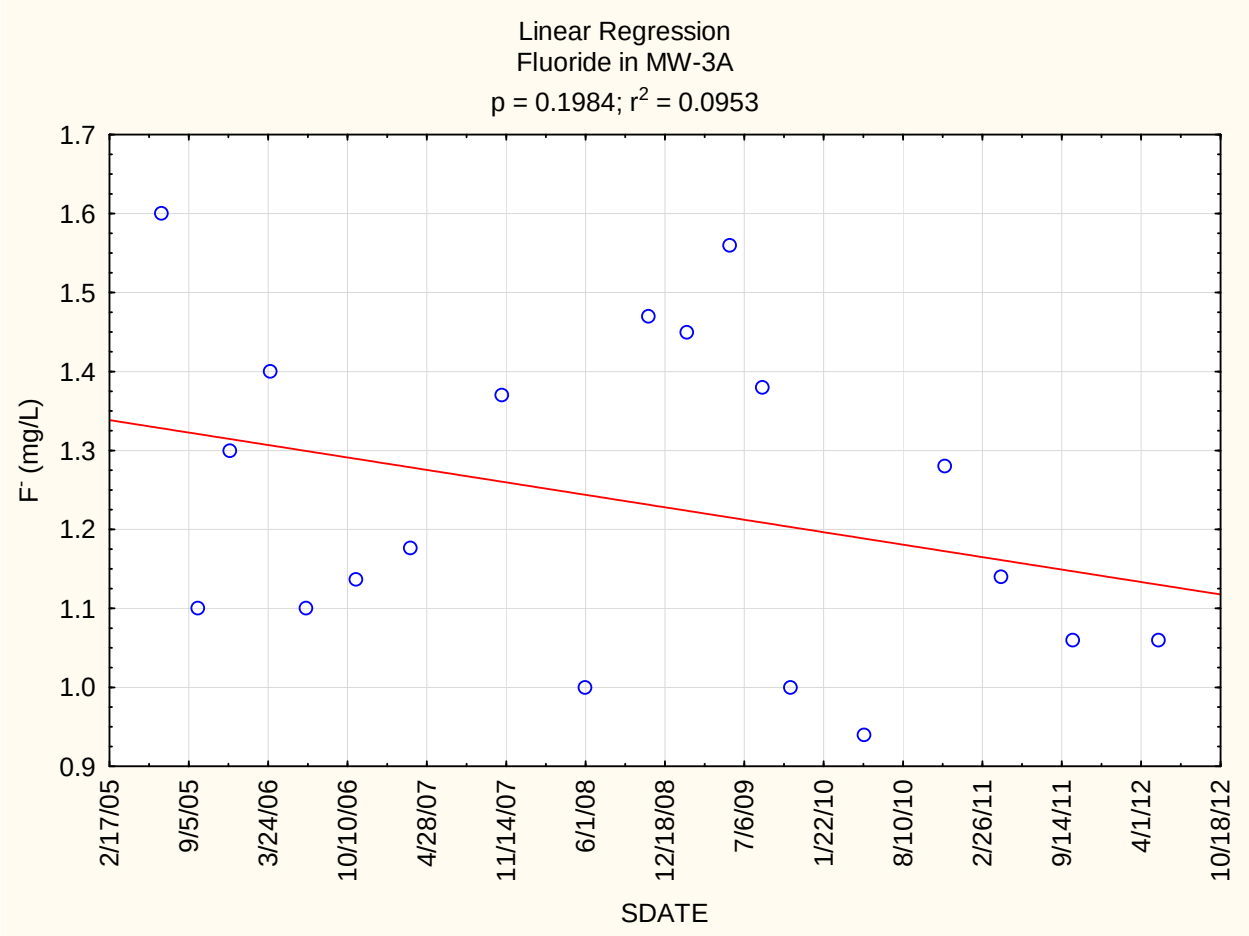
Histograms for Indicator Parameters in Wells with Constituents with Exceedances



C-6 Linear Regressions for Lognormally or Normally Distributed Constituents

Appendix C-6
Linear Regressions for Lognormally or Normally Distributed Constituents



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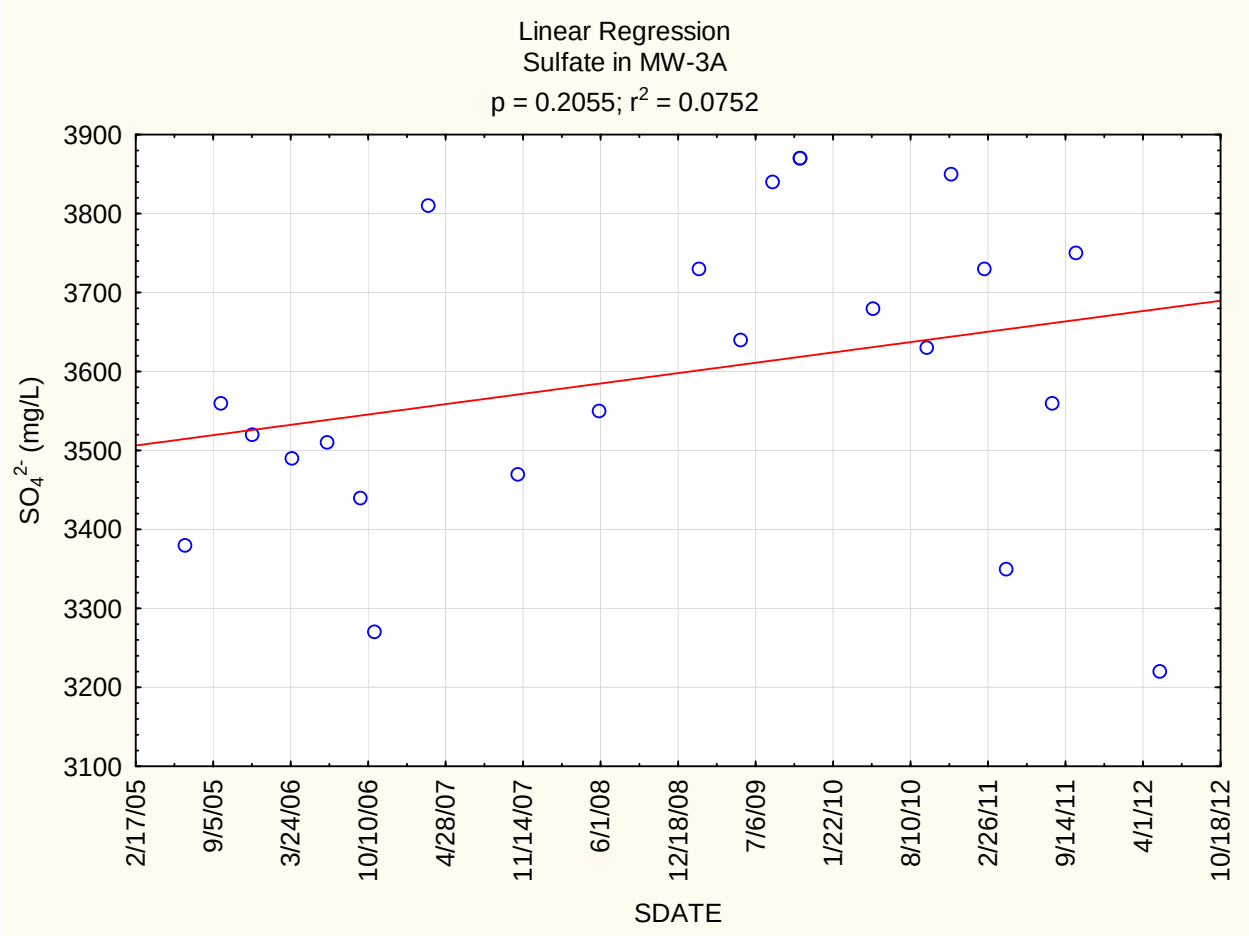

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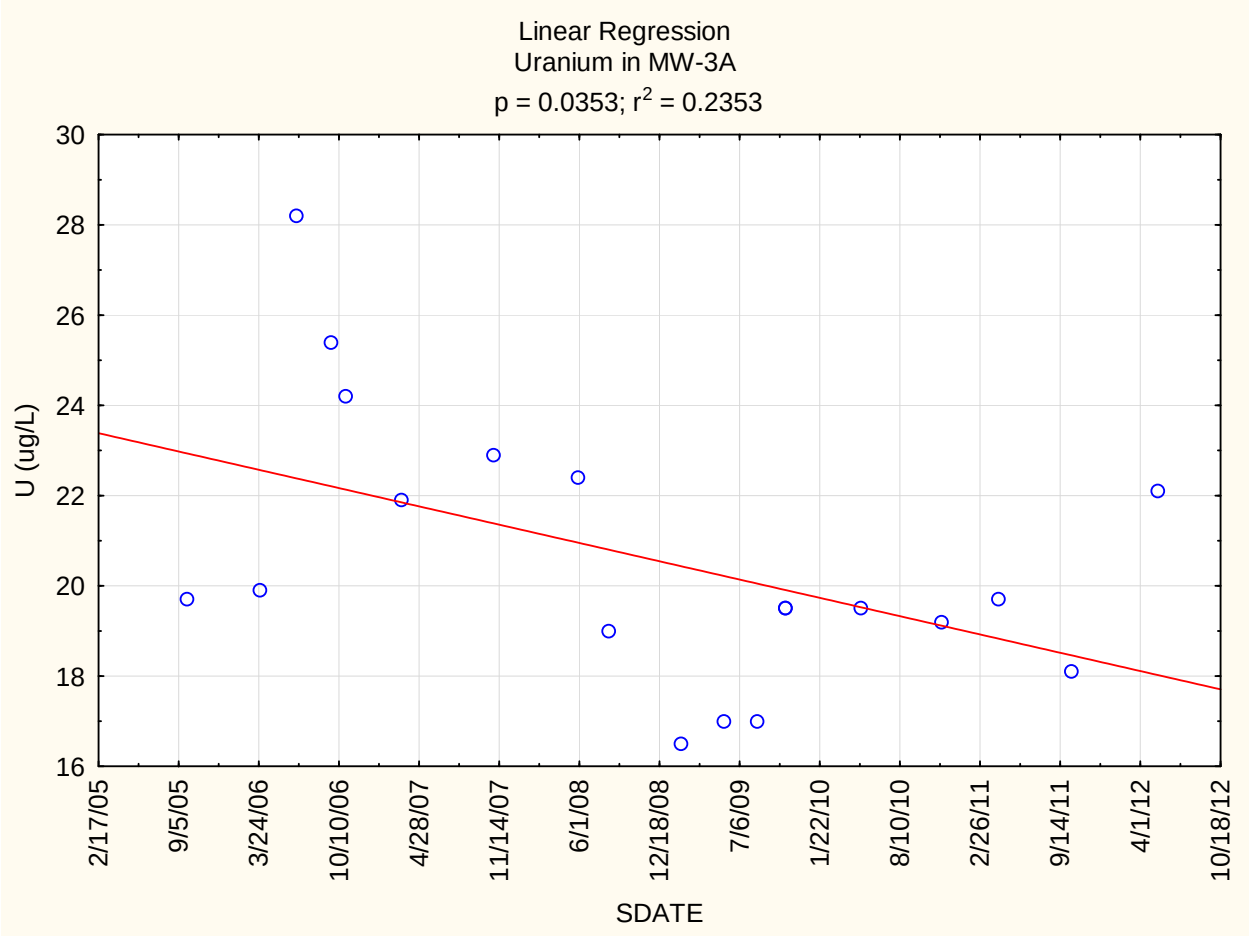
Linear Regressions for Lognormally or Normally Distributed Constituents



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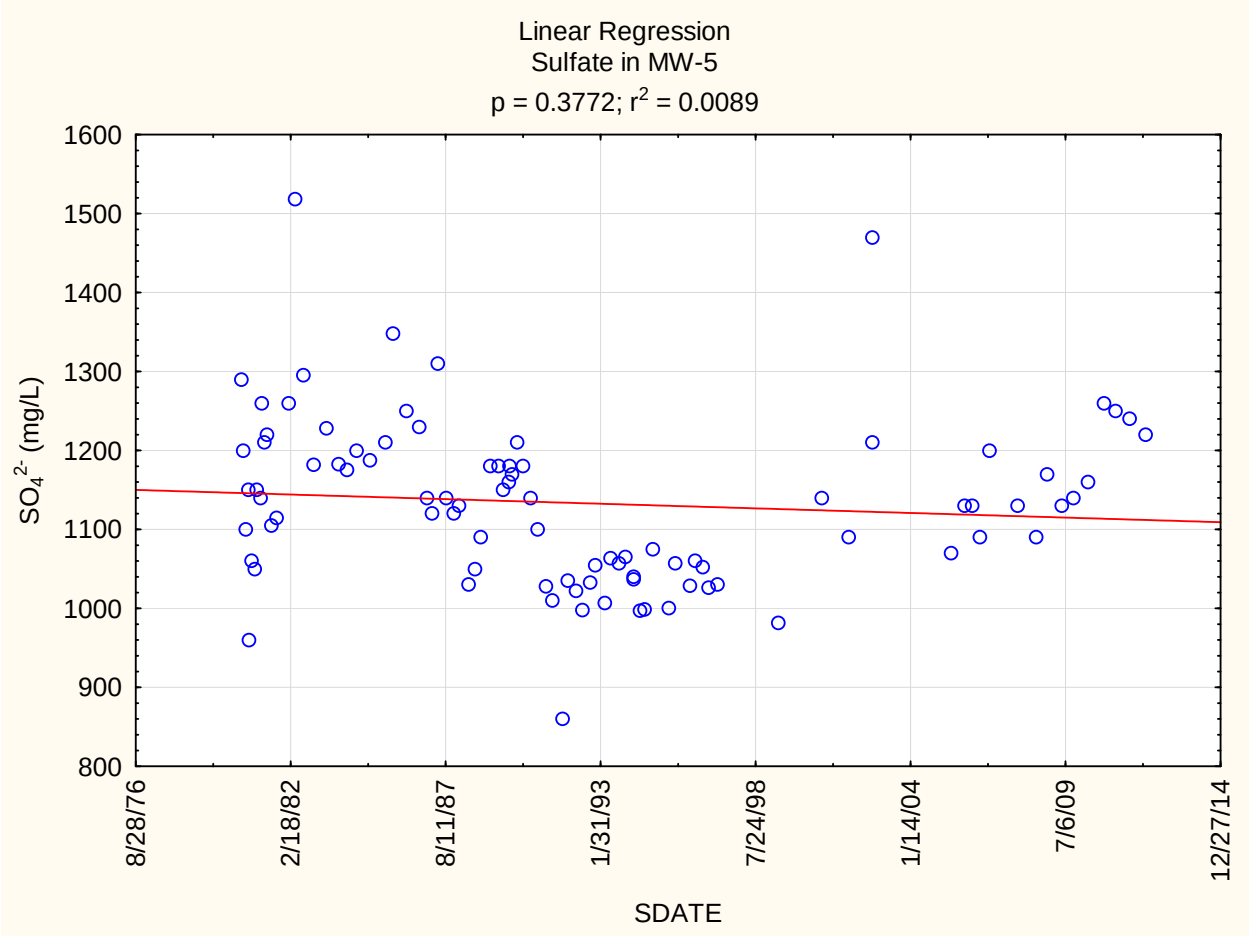

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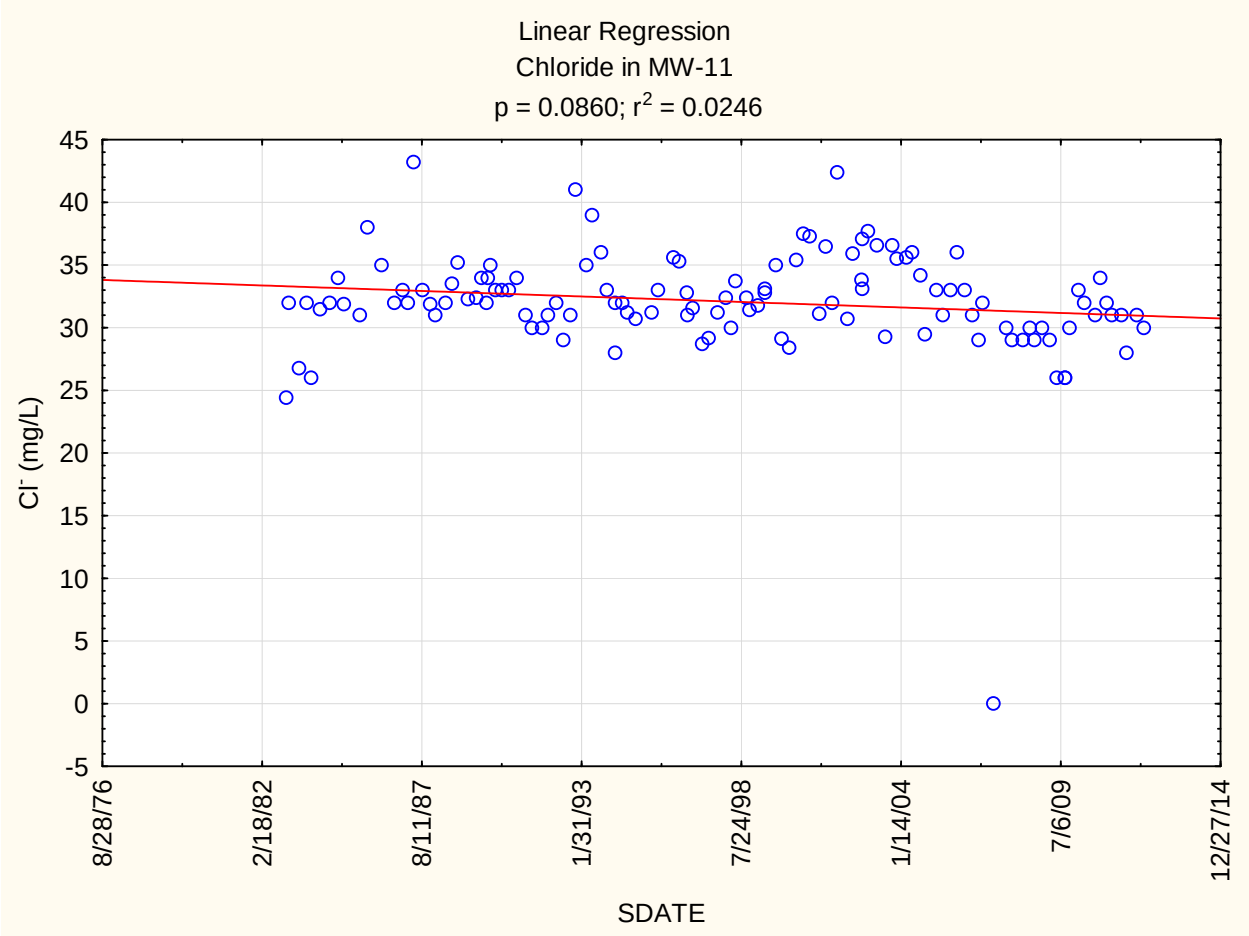

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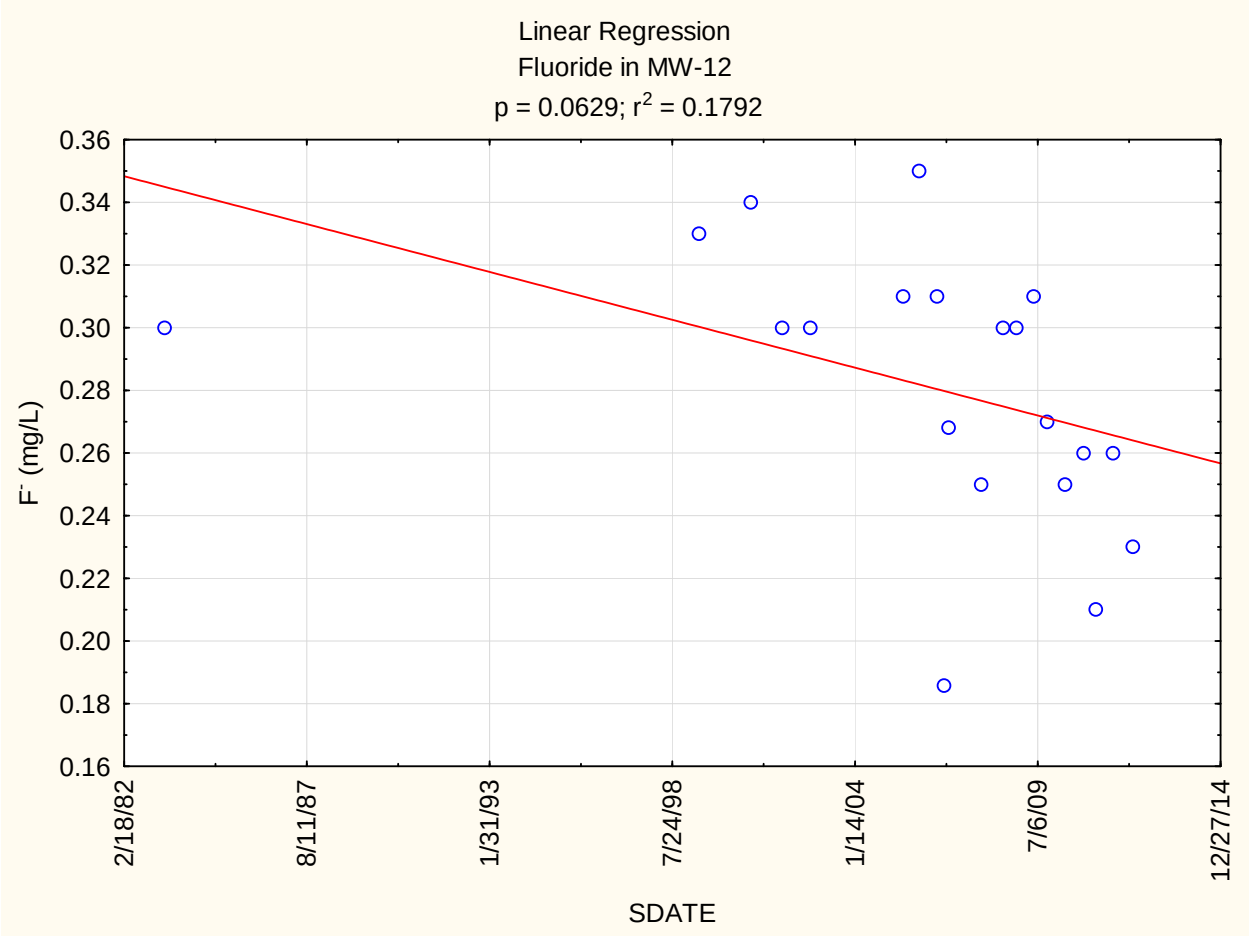

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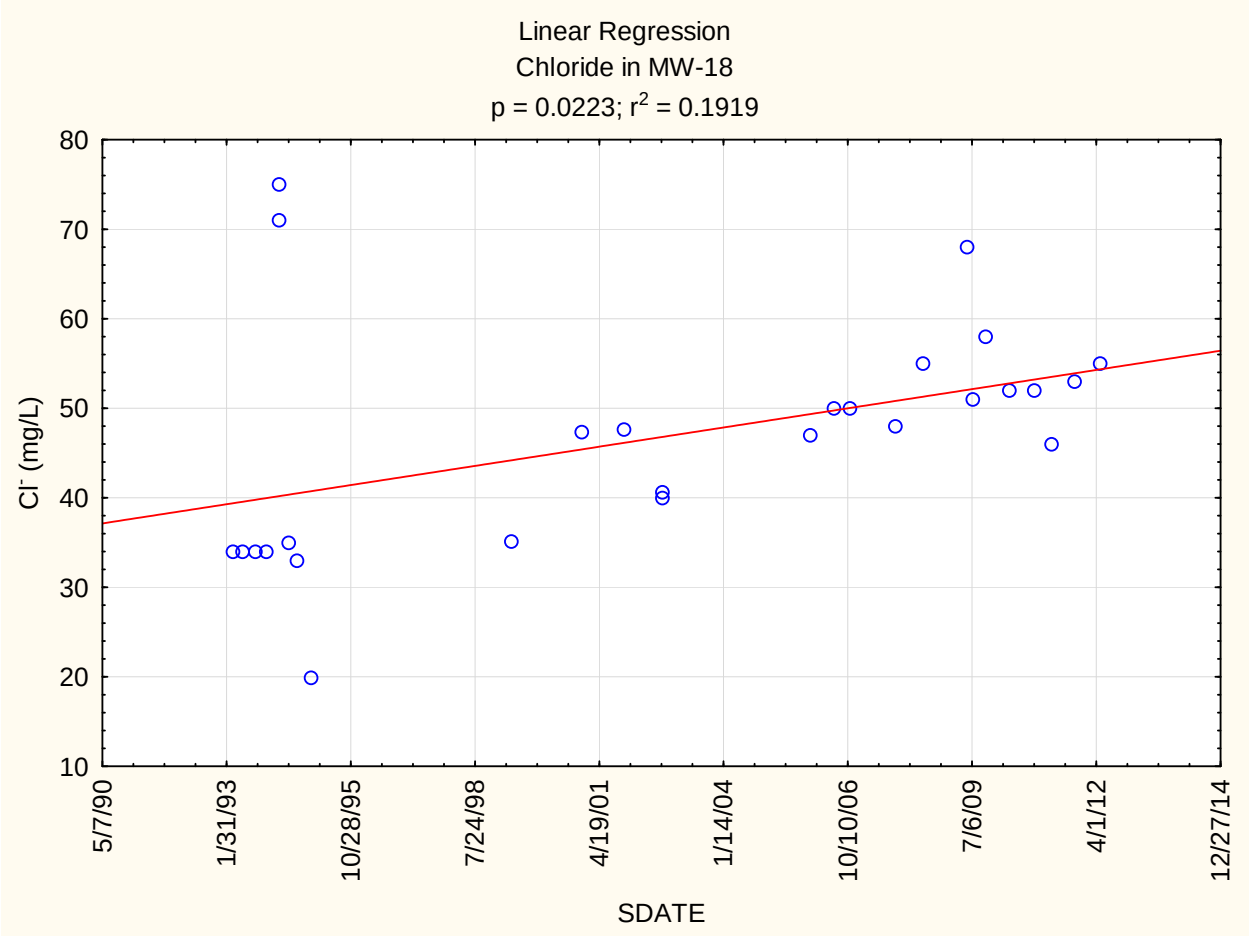

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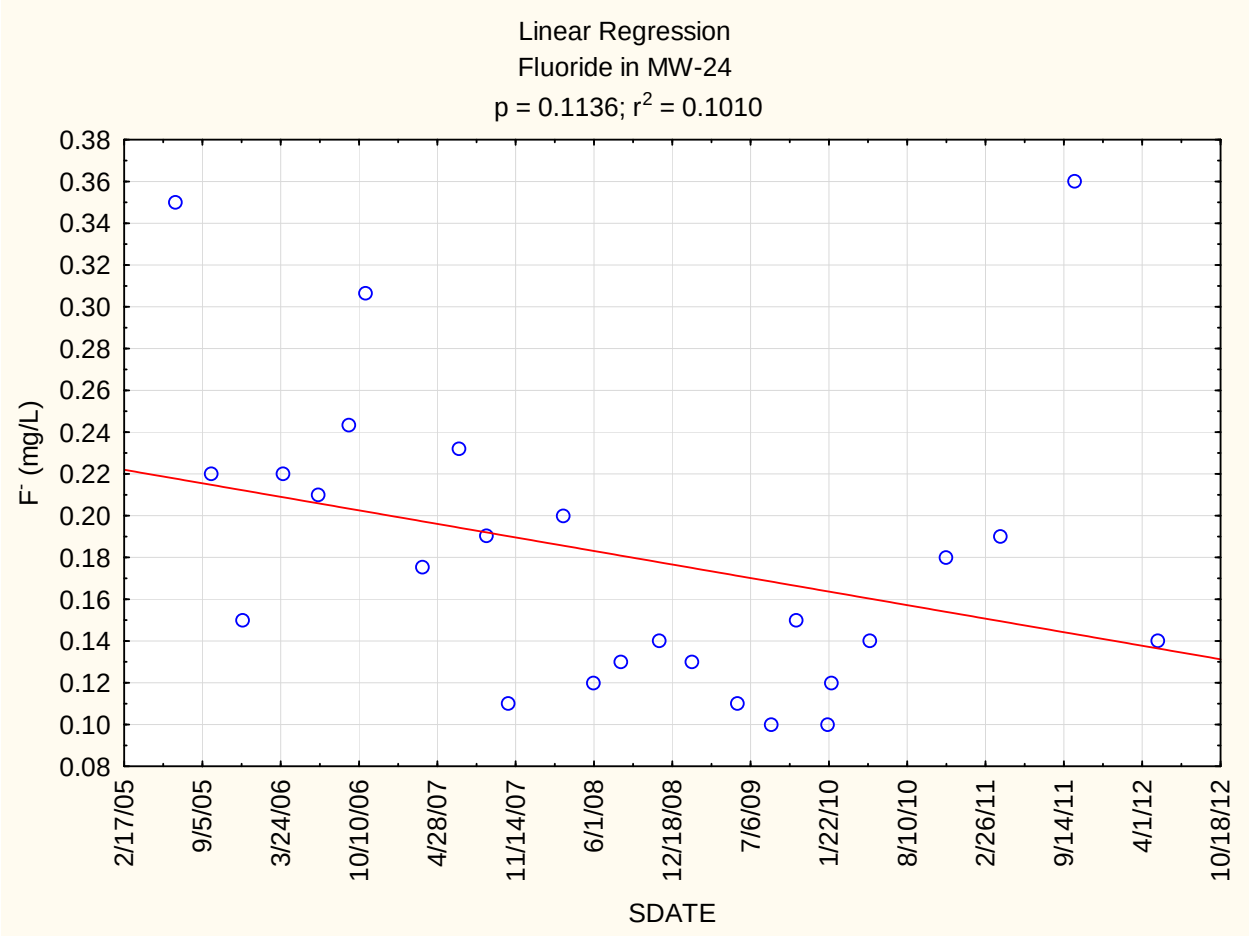

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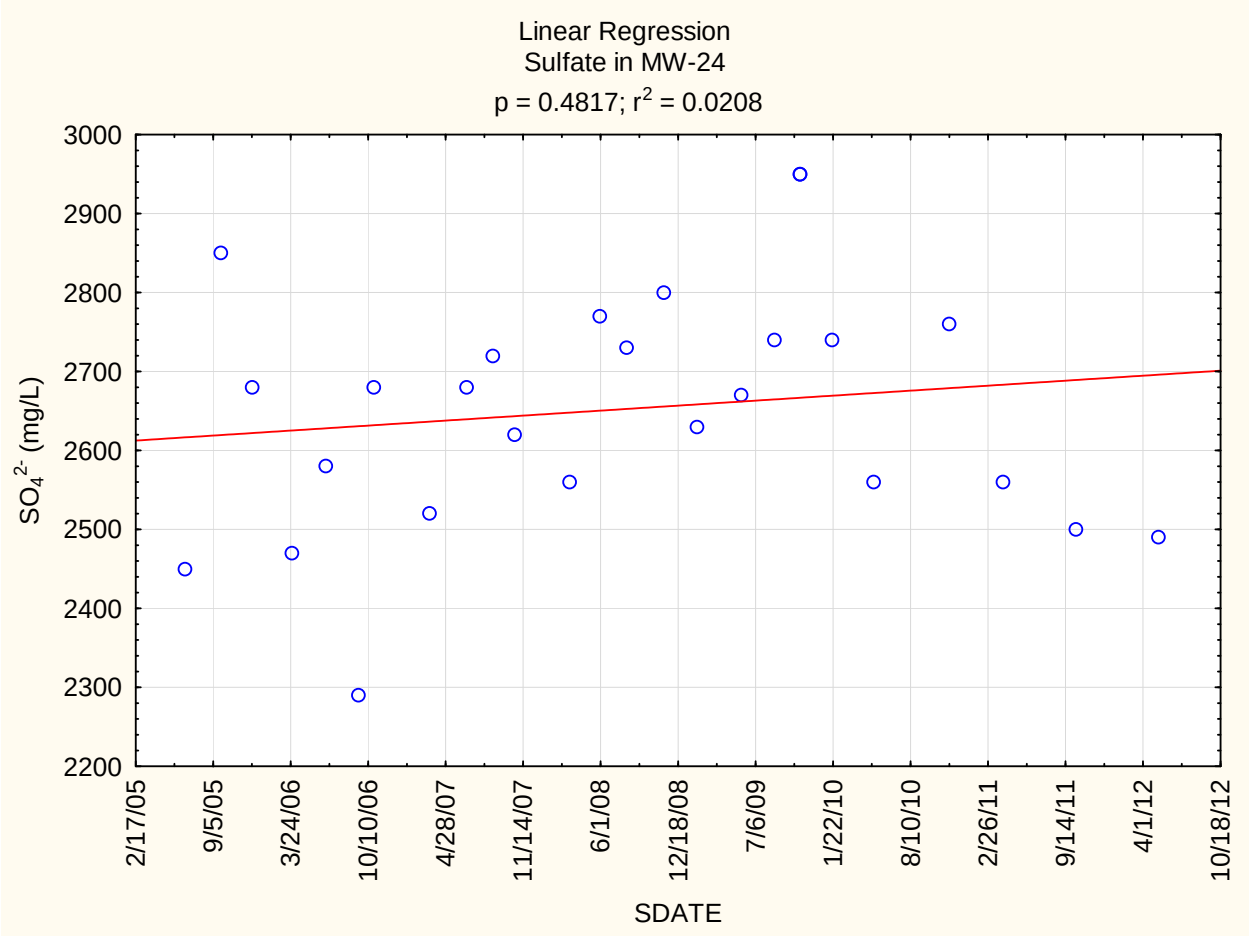

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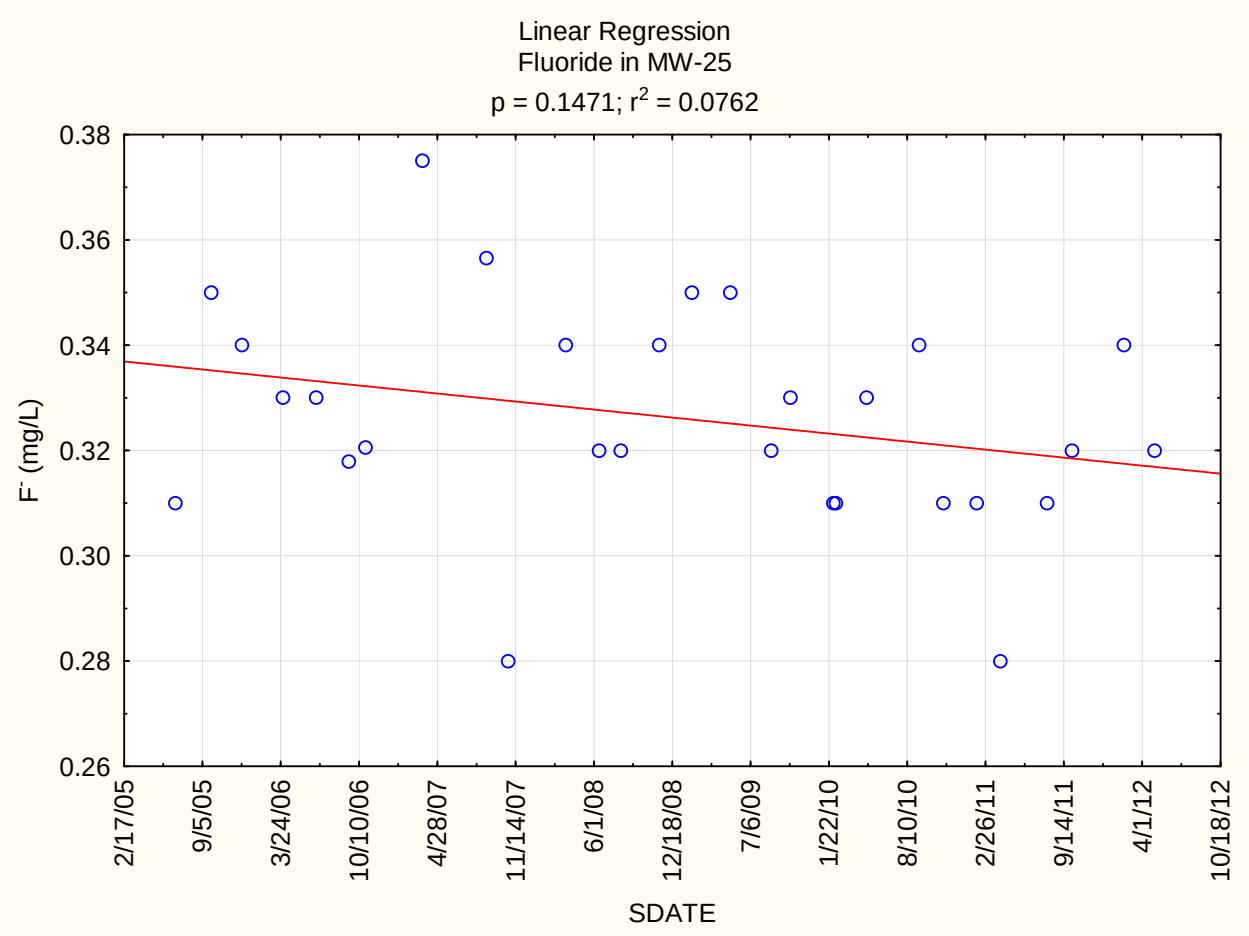

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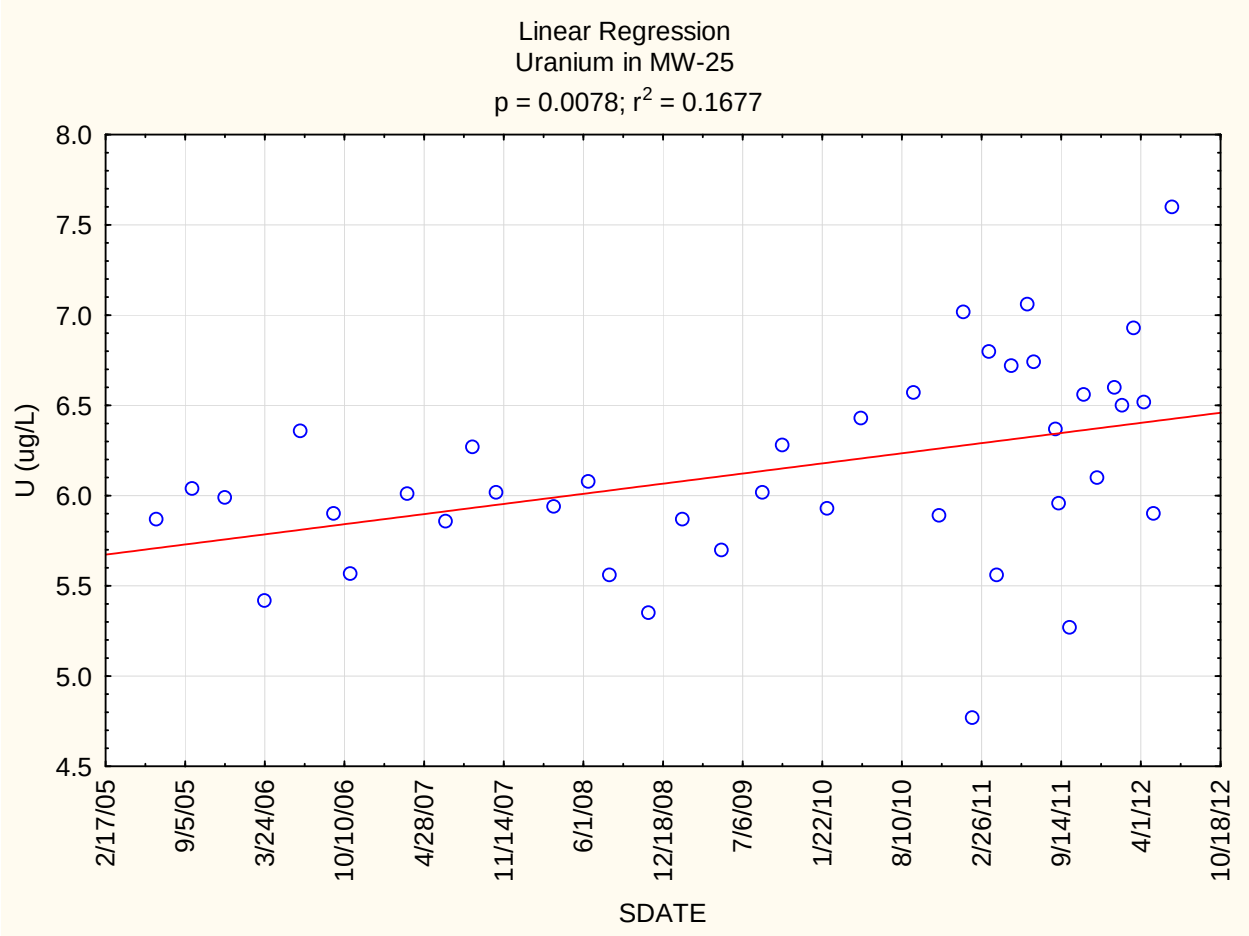

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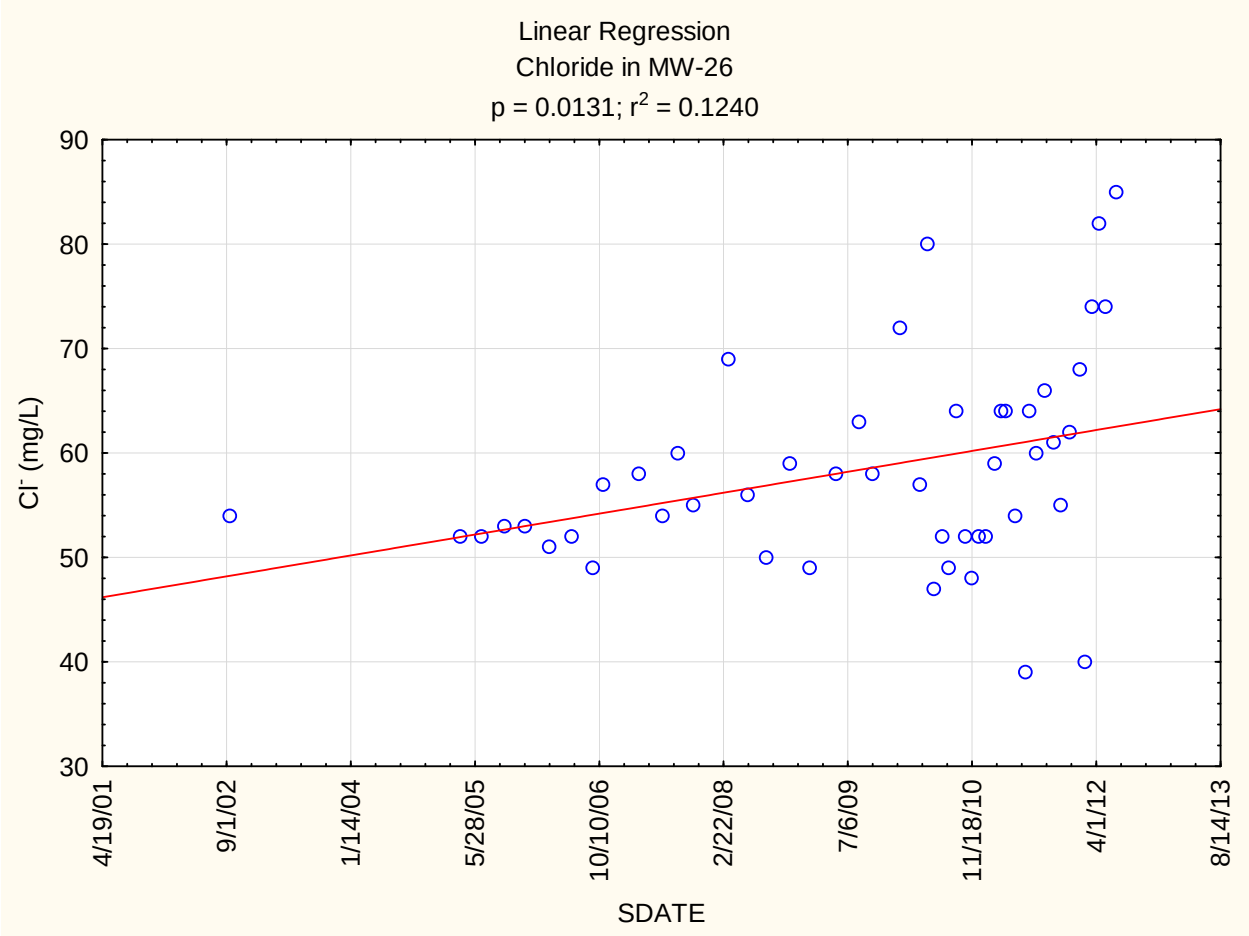

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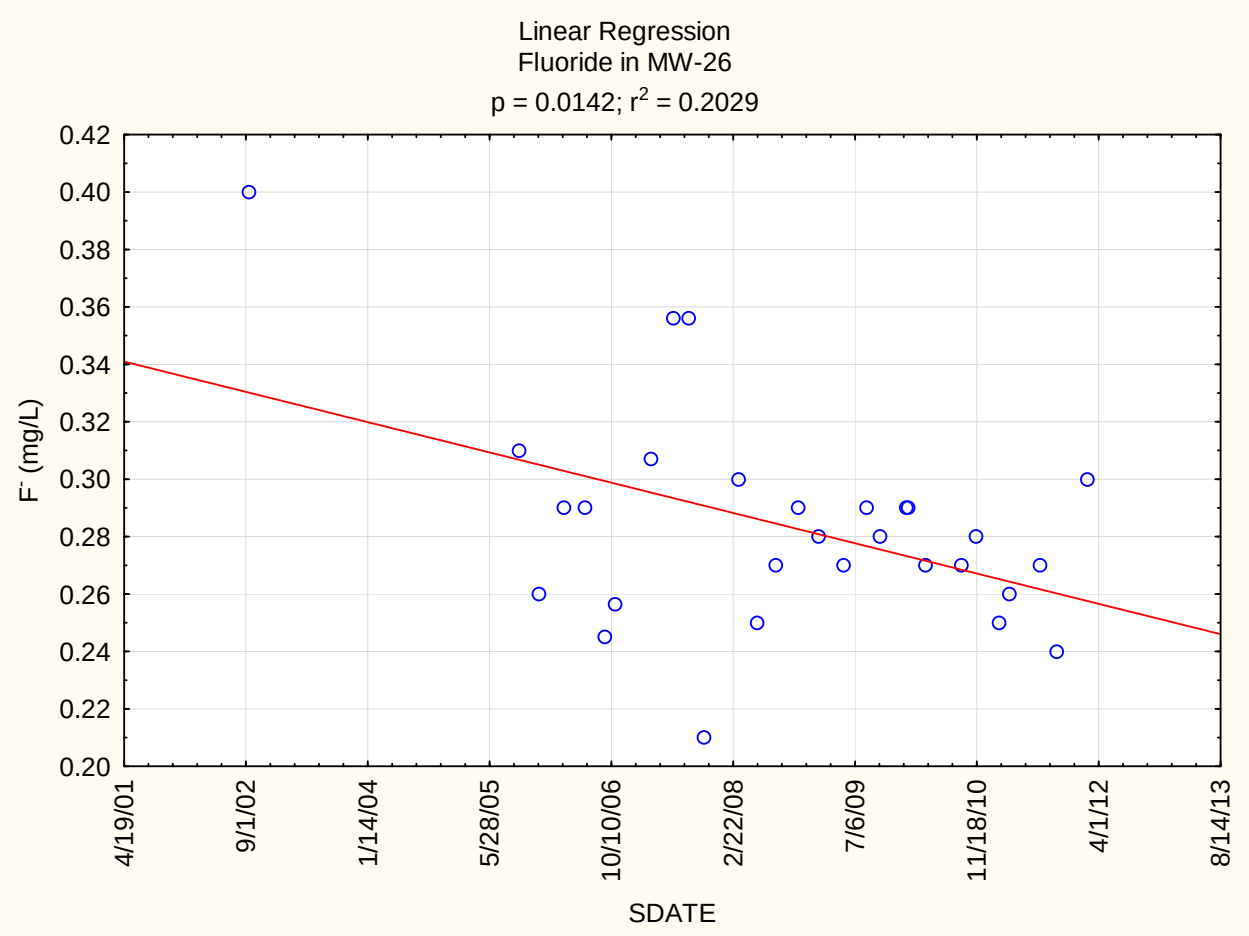

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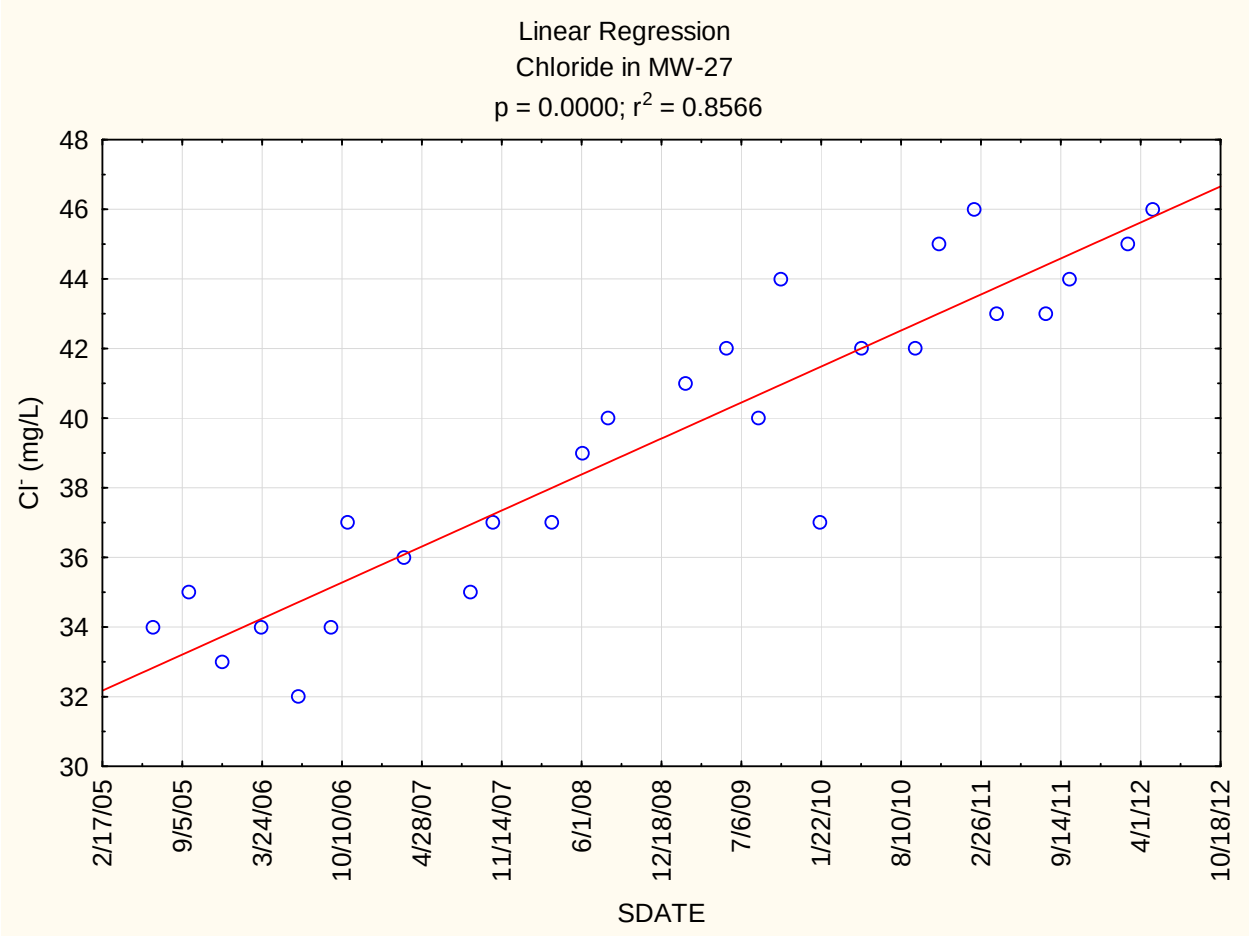

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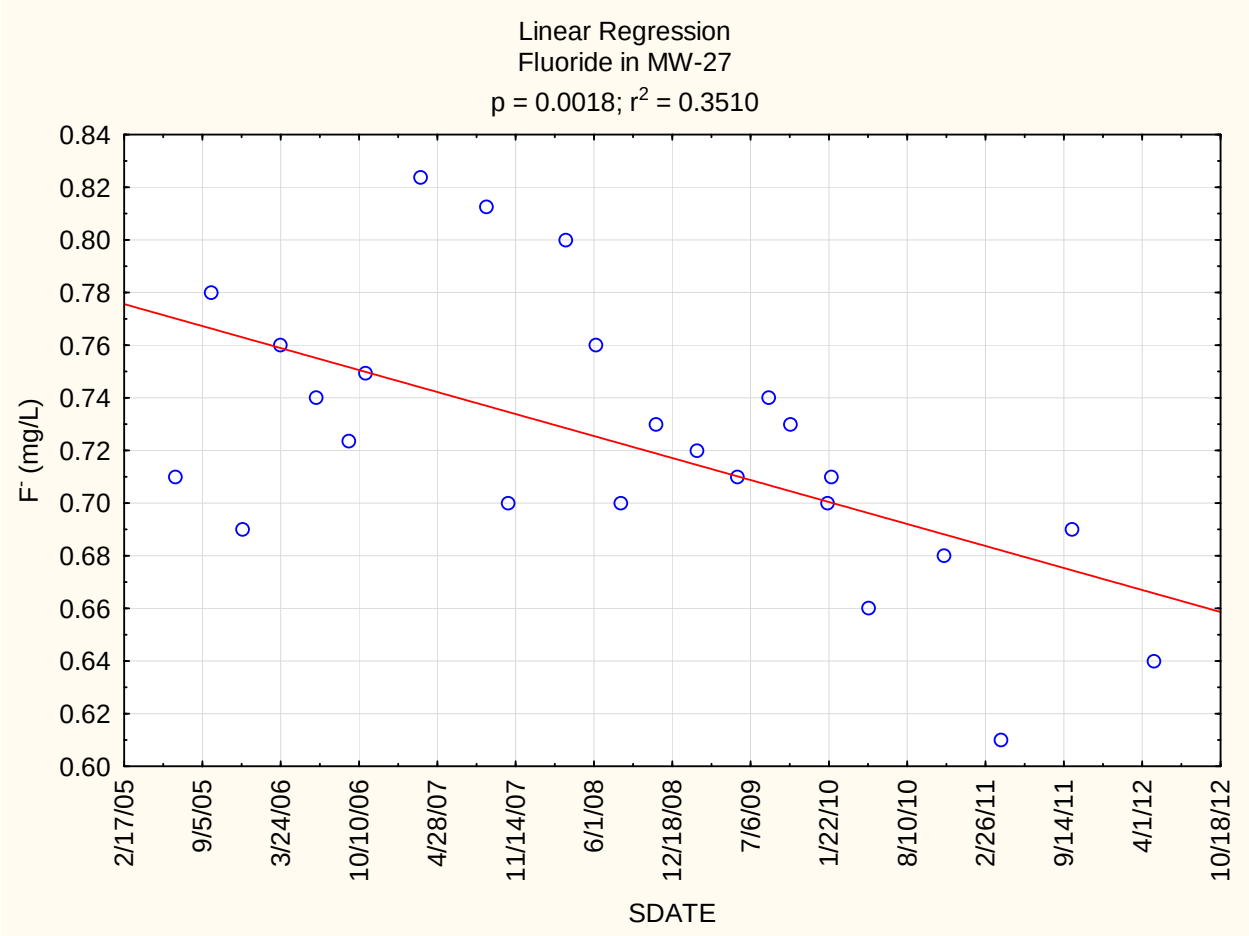

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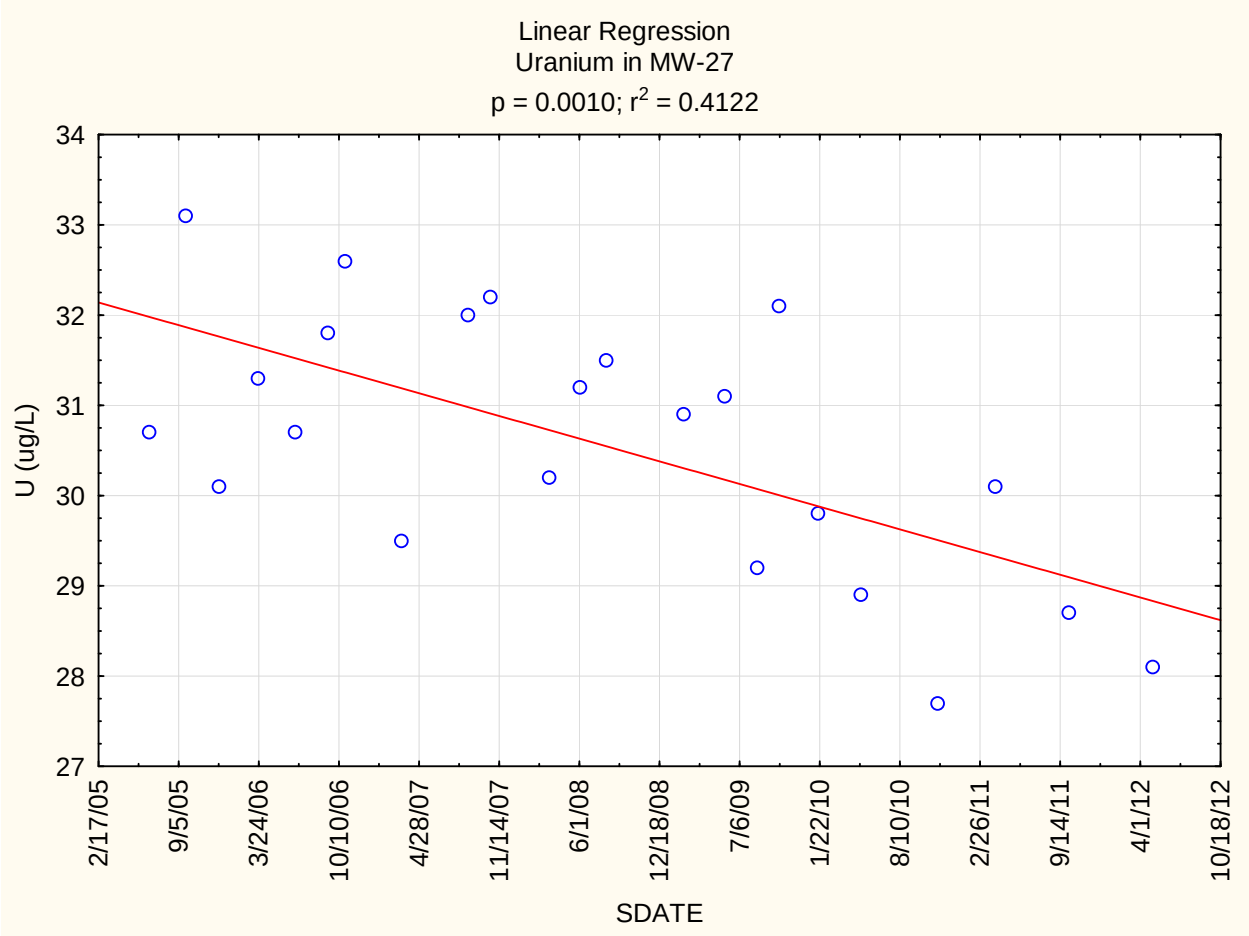

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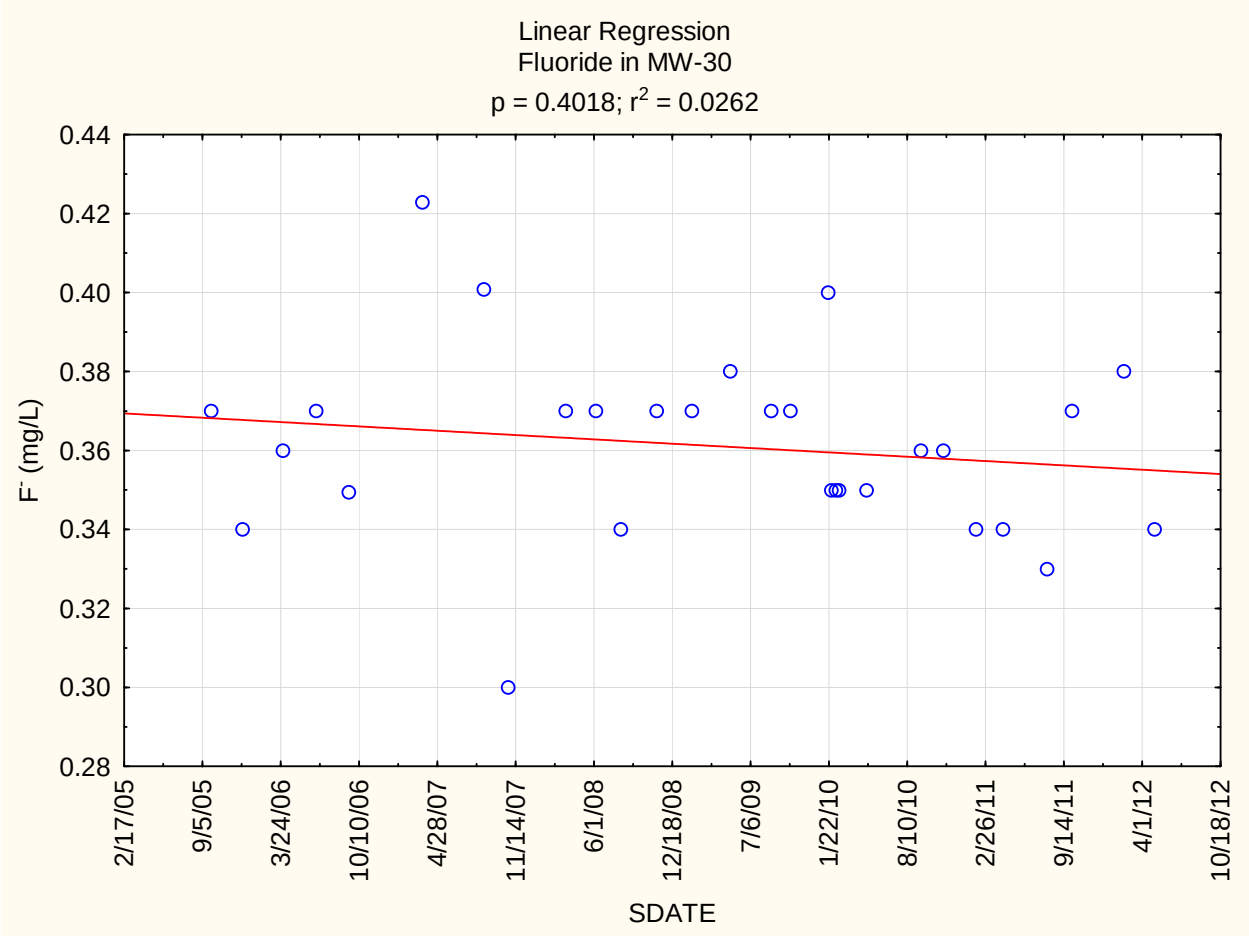

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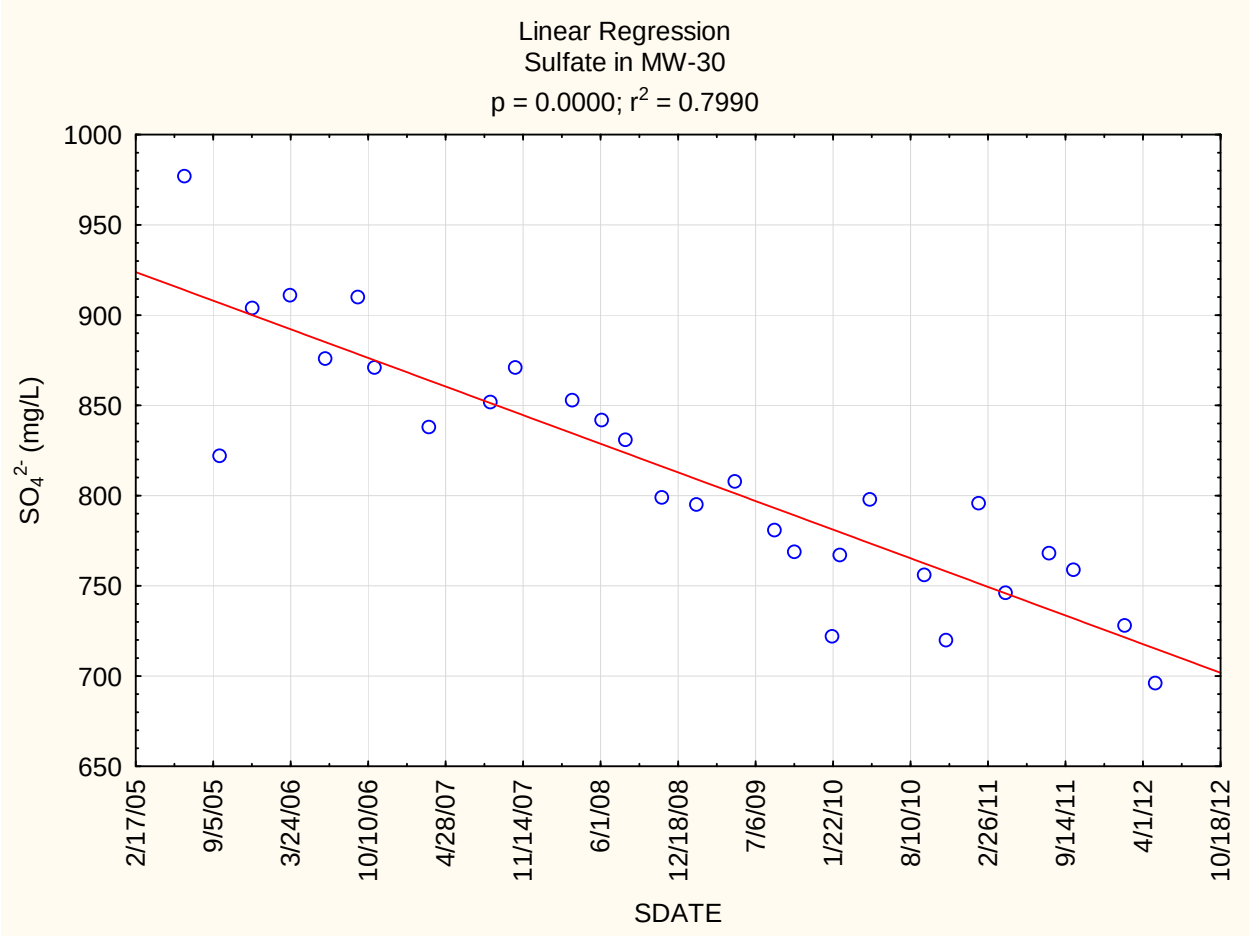

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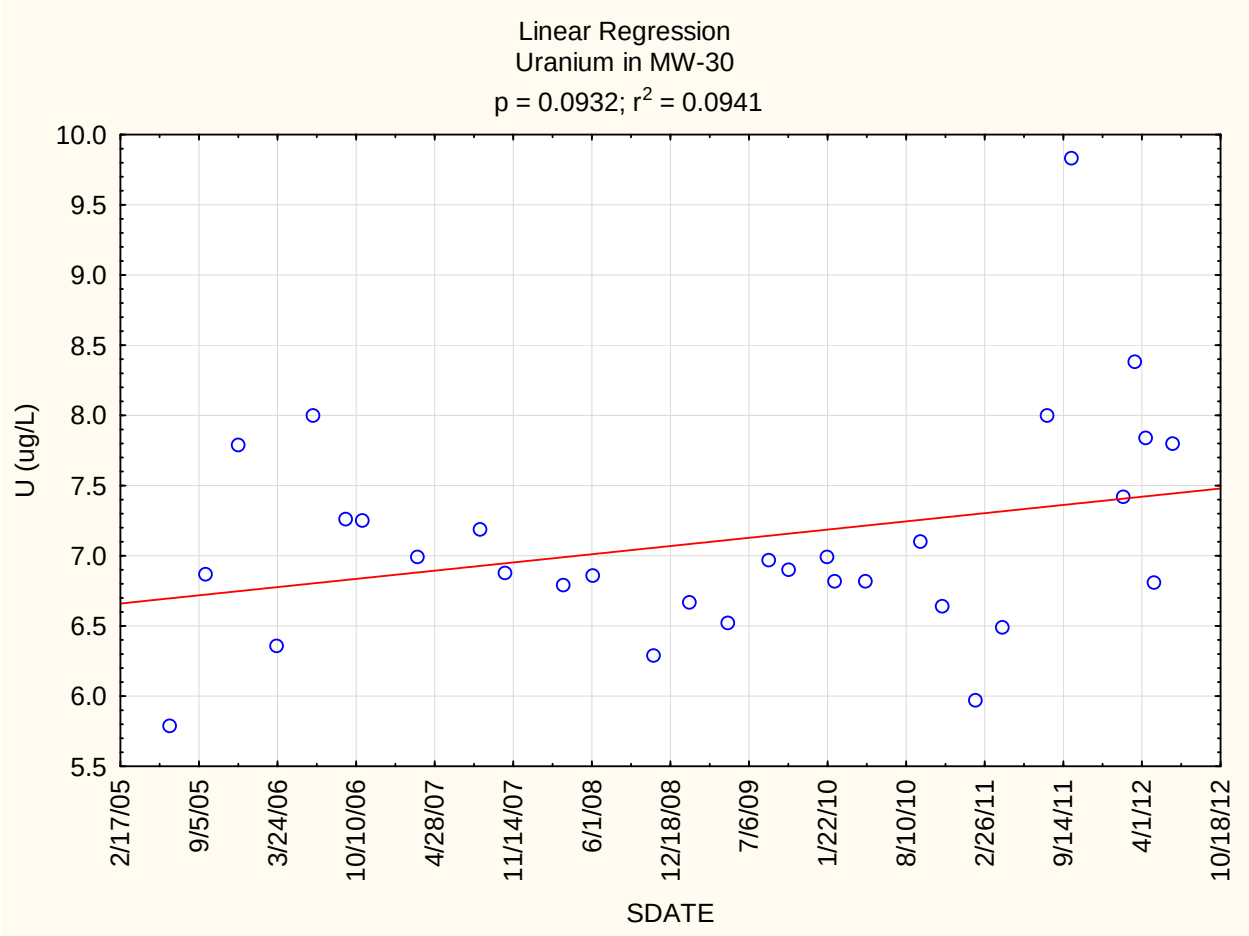
Linear Regressions for Lognormally or Normally Distributed Constituents



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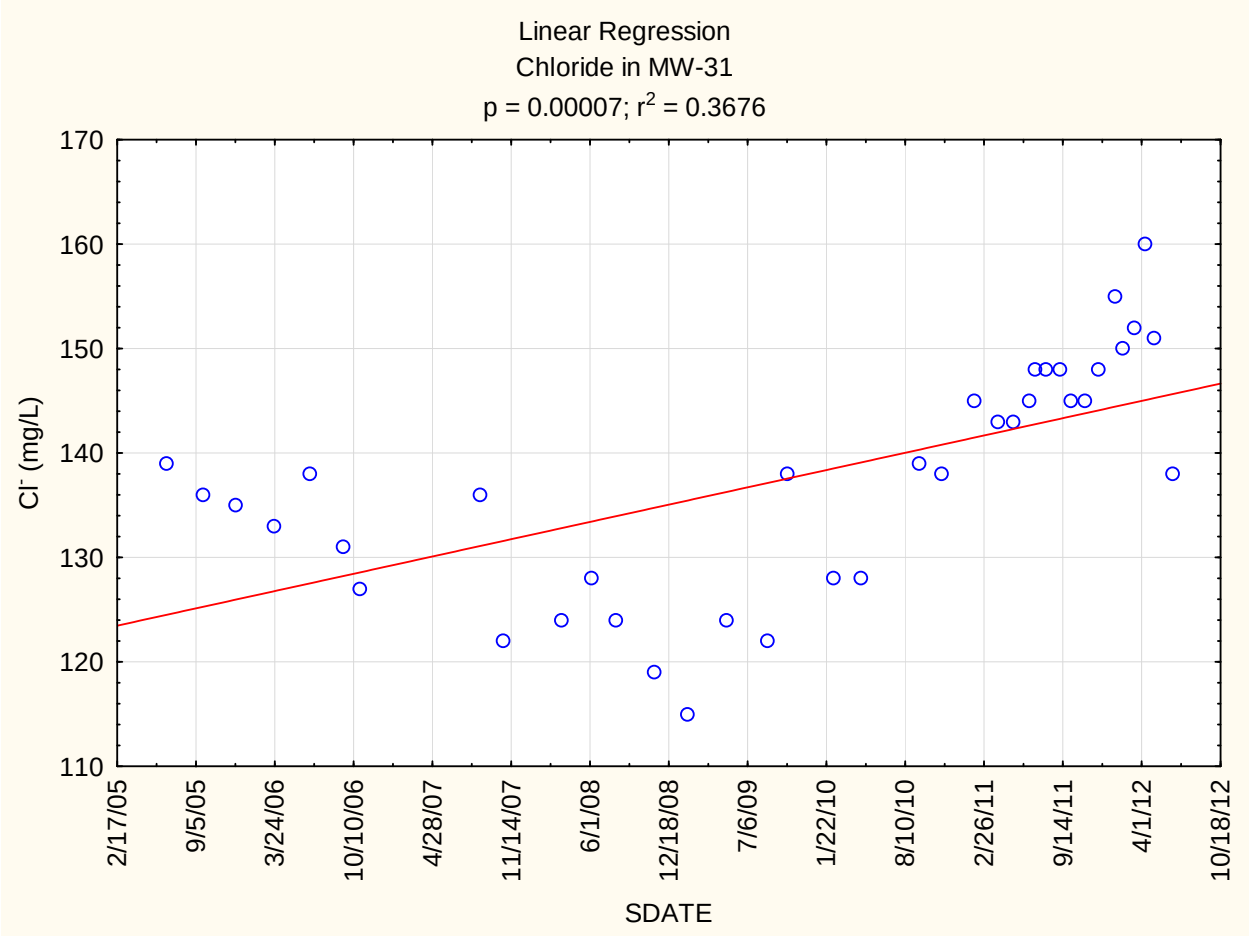

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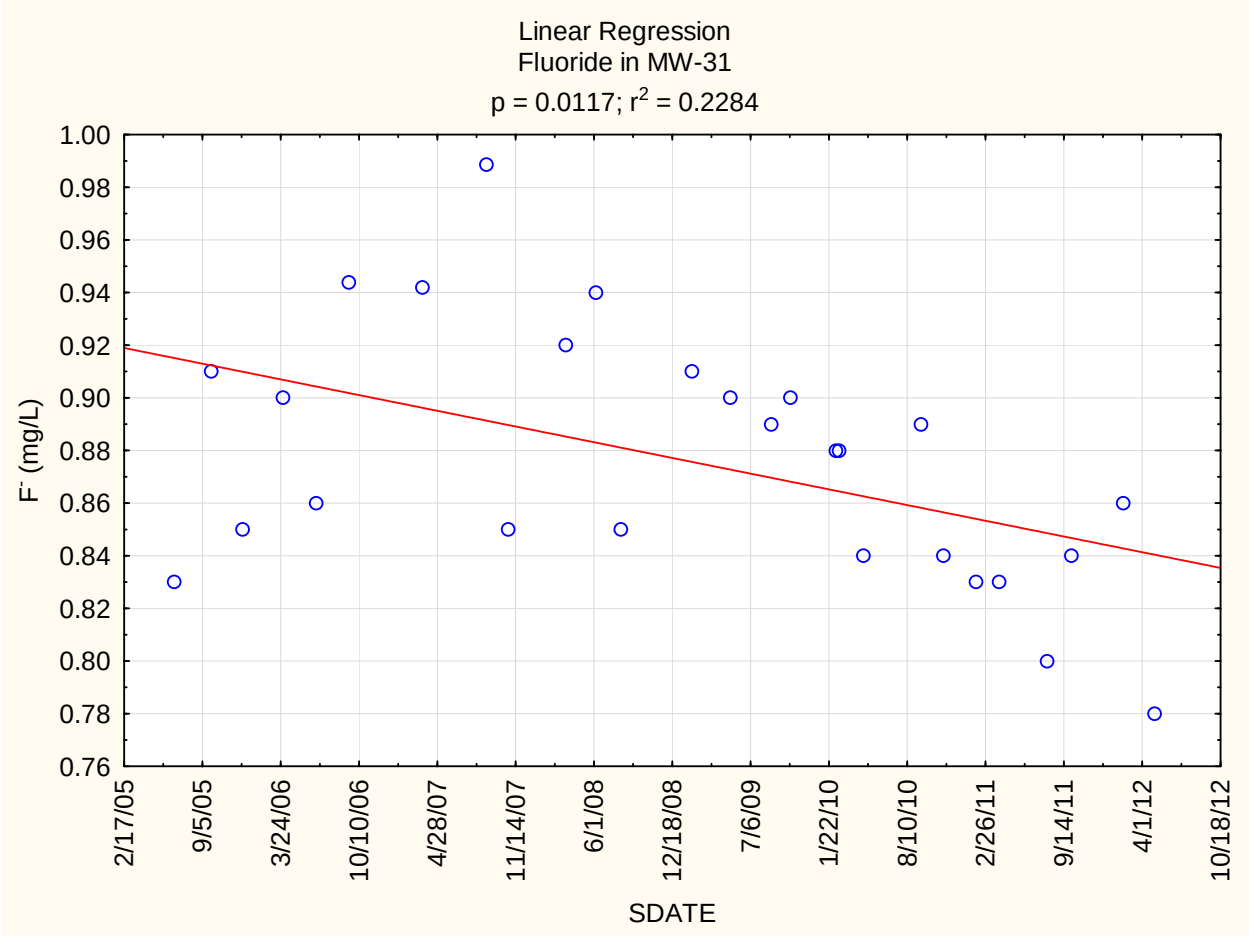

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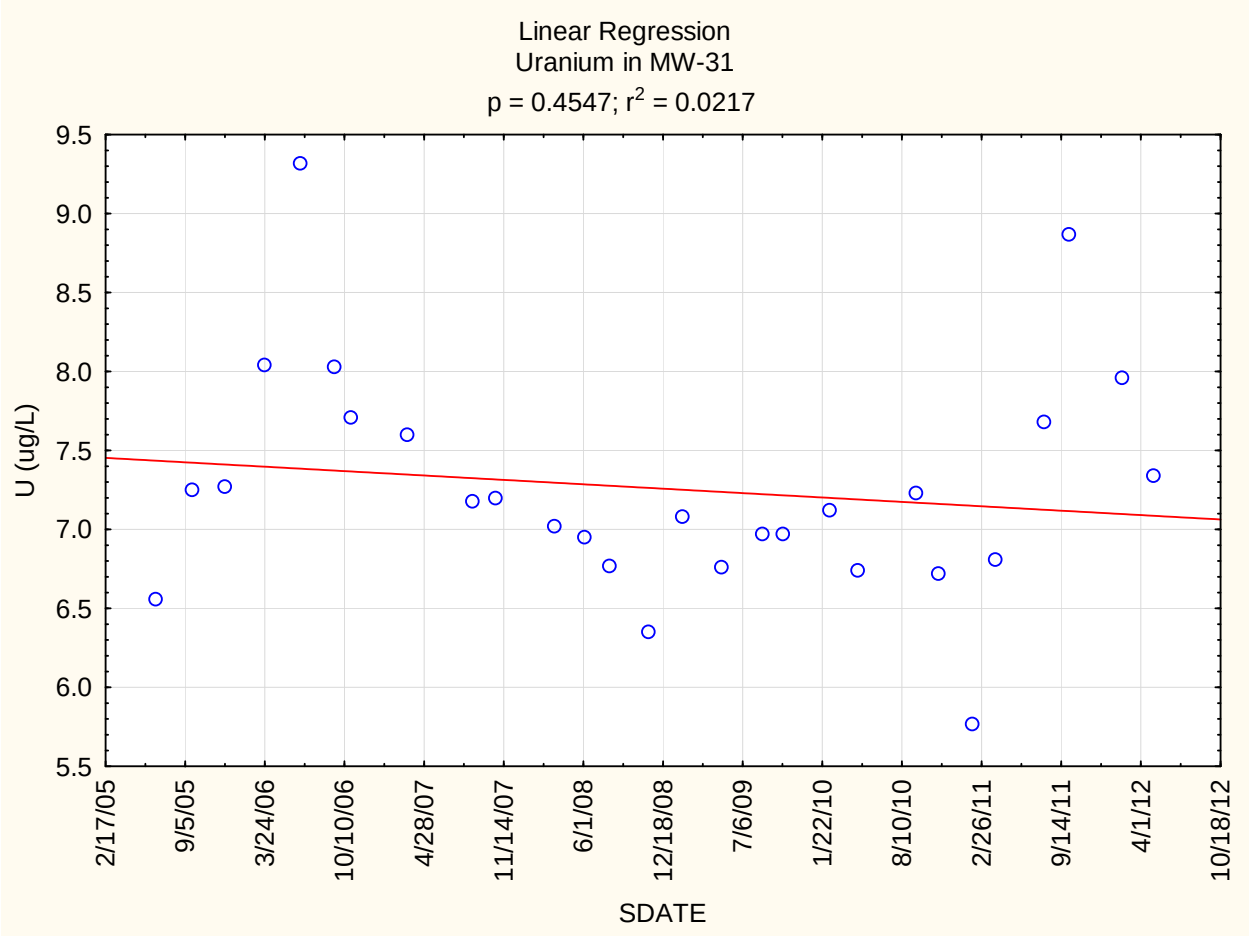

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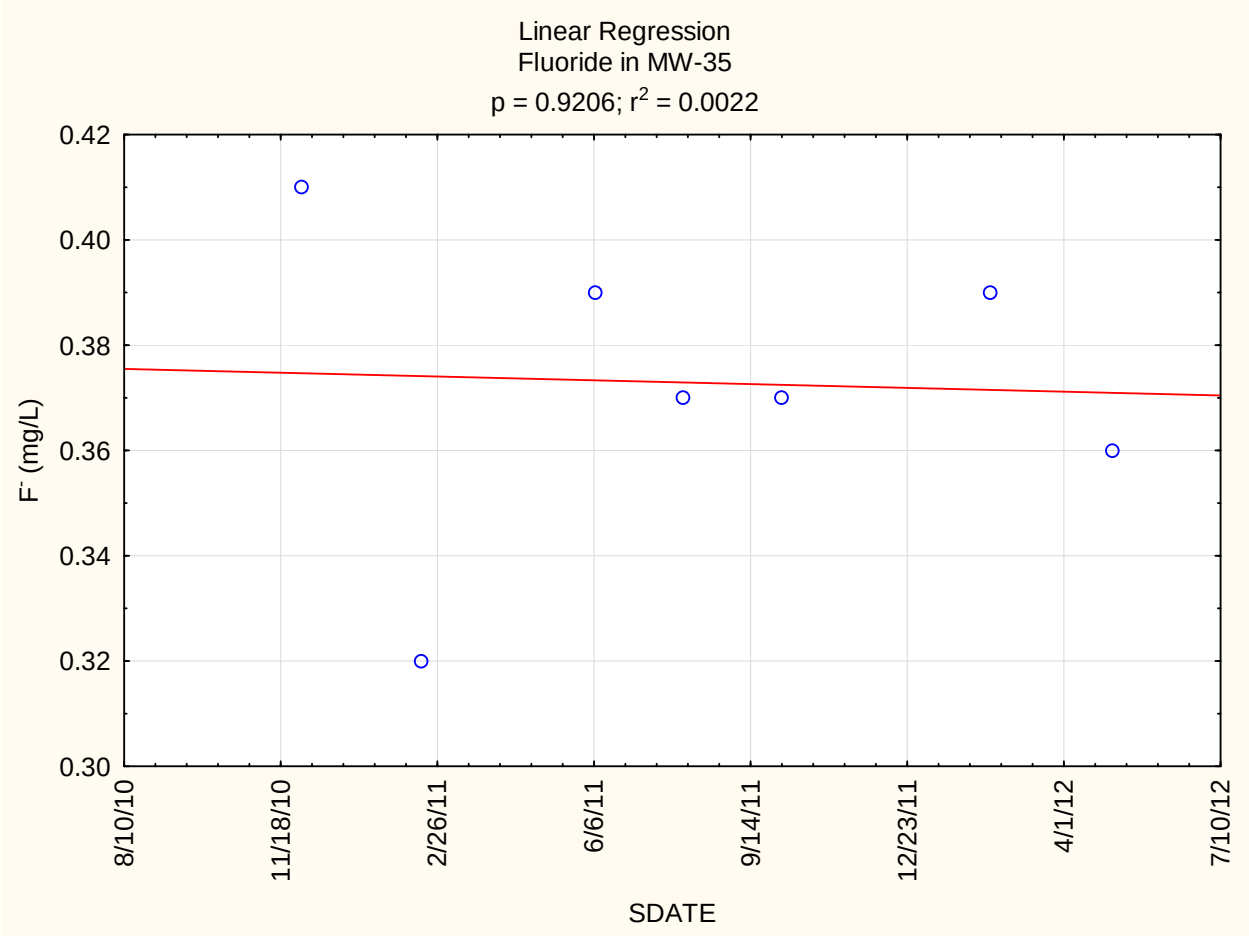

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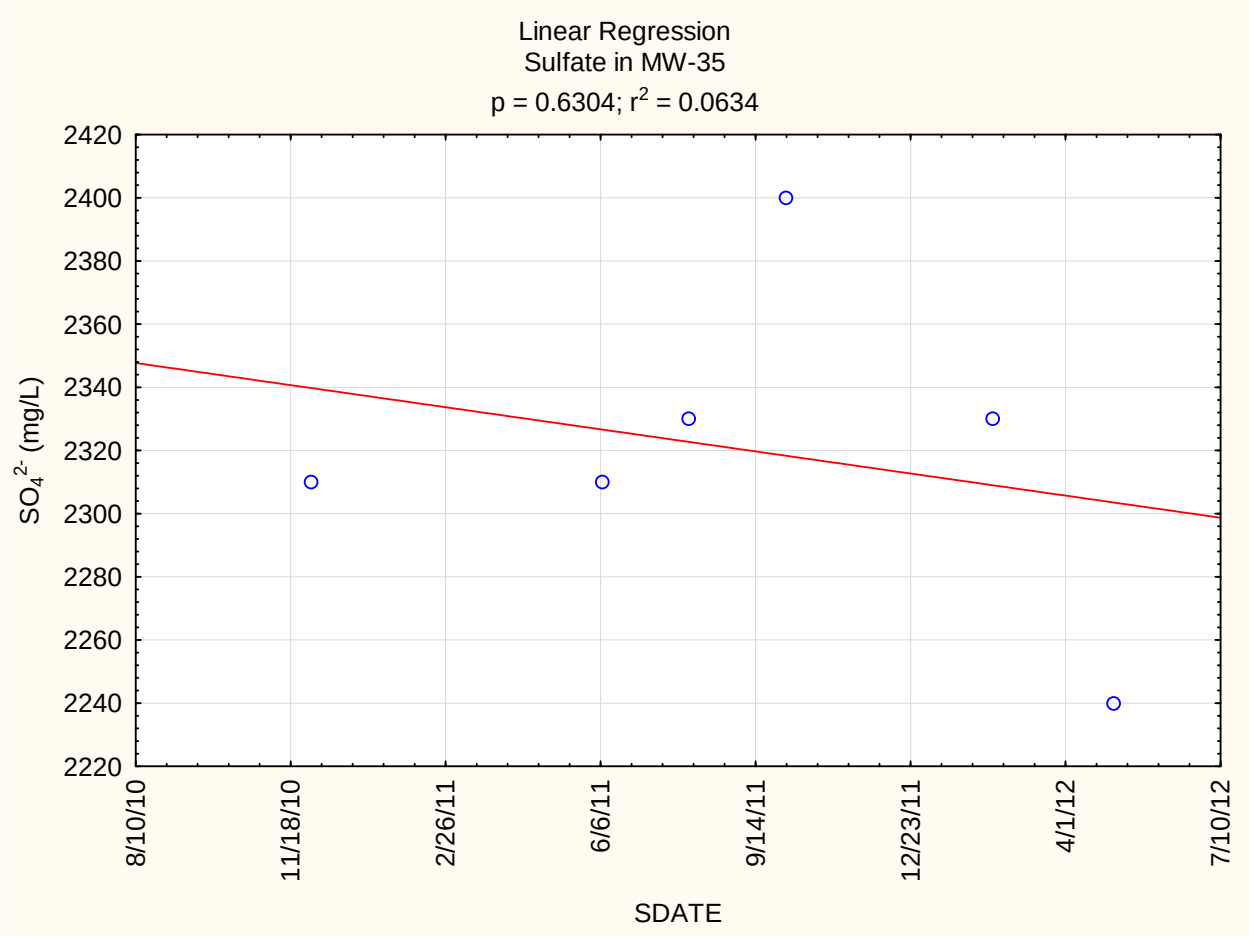
Linear Regressions for Lognormally or Normally Distributed Constituents



C-7 Mann-Kendall Analysis for Constituents Not Lognormally or Normally Distributed

Appendix C-7
Mann-Kendall Analysis for Constituents not Lognormally or Normally Distributed

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	9/14/2012 5:10:08 PM
From File	Chloride.wst
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Chloride (mg/L)-mw-11

General Statistics

Number of Values	121
Minimum	0.031
Maximum	43.2
Mean	32.1
Geometric Mean	30.42
Median	32
Standard Deviation	4.318
SEM	0.393

Mann-Kendall Test

Test Value (S)	-801
Critical Value (0.05)	-1.645
Standard Deviation of S	445.4
Standardized Value of S	-1.796
Approximate p-value	0.0362

Statistically significant evidence of a decreasing trend at the specified level of significance.

Chloride (mg/L)-mw-12

General Statistics

Number of Values	99
Minimum	37.6
Maximum	80.5
Mean	59.49
Geometric Mean	59.16
Median	60.3
Standard Deviation	6.093
SEM	0.612

Mann-Kendall Test

Test Value (S)	-1321
Critical Value (0.05)	-1.645
Standard Deviation of S	330.5
Standardized Value of S	-3.994

Approximate p-value	3.2505E-05

Statistically significant evidence of a decreasing trend at the specified level of significance.

Chloride (mg/L)-mw-18

General Statistics

Number of Values	27
Minimum	19.9
Maximum	75
Mean	46.87
Geometric Mean	45.15
Median	47.6
Standard Deviation	12.64
SEM	2.433

Mann-Kendall Test

Test Value (S)	166
Critical Value (0.05)	1.645
Standard Deviation of S	47.85
Standardized Value of S	3.448
Approximate p-value	0.00028186

Statistically significant evidence of an increasing trend at the specified level of significance.

Chloride (mg/L)-mw-24

General Statistics

Number of Values	22
Minimum	39
Maximum	52
Mean	44.82
Geometric Mean	44.74
Median	45
Standard Deviation	2.719
SEM	0.58

Mann-Kendall Test

Test Value (S)	-39
Tabulated p-value	0.144
Standard Deviation of S	34.68
Standardized Value of S	-1.096
Approximate p-value	0.137

Insufficient evidence to identify a significant trend at the specified level of significance.

Appendix C-7
Mann-Kendall Analysis for Constituents not Lognormally or Normally Distributed

Chloride (mg/L)-mw-25

General Statistics

Number of Values	28
Minimum	25
Maximum	34
Mean	31.21
Geometric Mean	31.16
Median	31
Standard Deviation	1.893
SEM	0.358

Mann-Kendall Test

Test Value (S)	-117
Critical Value (0.05)	-1.645
Standard Deviation of S	49.37
Standardized Value of S	-2.349
Approximate p-value	0.0094

Statistically significant evidence of a decreasing trend at the specified level of significance.

Chloride (mg/L)-mw-26

General Statistics

Number of Values	49
Minimum	39
Maximum	85
Mean	58.33
Geometric Mean	57.56
Median	57
Standard Deviation	9.807
SEM	1.401

Mann-Kendall Test

Test Value (S)	352
Critical Value (0.05)	1.645
Standard Deviation of S	115.7
Standardized Value of S	3.033
Approximate p-value	0.00121

Statistically significant evidence of an increasing trend at the specified level of significance.

Chloride (mg/L)-mw-27

General Statistics

Number of Values	27

Minimum	32
Maximum	46
Mean	39.37
Geometric Mean	39.13
Median	40
Standard Deviation	4.378
SEM	0.843

Mann-Kendall Test

Test Value (S)	273
Critical Value (0.05)	1.645
Standard Deviation of S	47.74
Standardized Value of S	5.698
Approximate p-value	6.073E-09

Statistically significant evidence of an increasing trend at the specified level of significance.

Chloride (mg/L)-mw-3

General Statistics

Number of Values	83
Minimum	56
Maximum	73
Mean	64.65
Geometric Mean	64.58
Median	65
Standard Deviation	2.996
SEM	0.329

Mann-Kendall Test

Test Value (S)	-642
Critical Value (0.05)	-1.645
Standard Deviation of S	253
Standardized Value of S	-2.533
Approximate p-value	0.00565

Statistically significant evidence of a decreasing trend at the specified level of significance.

Chloride (mg/L)-mw-30

General Statistics

Number of Values	37
Minimum	106
Maximum	145
Mean	124.7
Geometric Mean	124.6

Median	125
Standard Deviation	6.615
SEM	1.087

Mann-Kendall Test

Test Value (S)	137
Critical Value (0.05)	1.645
Standard Deviation of S	76.04
Standardized Value of S	1.788
Approximate p-value	0.0368

Statistically significant evidence of an increasing trend at the specified level of significance.

Chloride (mg/L)-mw-31

General Statistics

Number of Values	37
Minimum	115
Maximum	160
Mean	137.5
Geometric Mean	137.1
Median	138
Standard Deviation	11.08
SEM	1.822

Mann-Kendall Test

Test Value (S)	344
Critical Value (0.05)	1.645
Standard Deviation of S	76.21
Standardized Value of S	4.5
Approximate p-value	3.3905E-06

Statistically significant evidence of an increasing trend at the specified level of significance.

Chloride (mg/L)-mw-35

General Statistics

Number of Values	5
Minimum	59
Maximum	61
Mean	59.6
Geometric Mean	59.59
Median	59
Standard Deviation	0.894
SEM	0.4

Mann-Kendall Test

Test Value (S)	-3
Tabulated p-value	0.408
Standard Deviation of S	3.606
Standardized Value of S	-0.555
Approximate p-value	0.29

Insufficient evidence to identify a significant trend at the specified level of significance.

Chloride (mg/L)-mw-3a

General Statistics

Number of Values	19
Minimum	42
Maximum	70
Mean	59.16
Geometric Mean	58.84
Median	60
Standard Deviation	5.947
SEM	1.364

Mann-Kendall Test

Test Value (S)	-28
Tabulated p-value	0.166
Standard Deviation of S	28.4
Standardized Value of S	-0.951
Approximate p-value	0.171

Insufficient evidence to identify a significant trend at the specified level of significance.

Chloride (mg/L)-mw-5

General Statistics

Number of Values	123
Minimum	37.5
Maximum	69.7
Mean	52.49
Geometric Mean	52.29
Median	52
Standard Deviation	4.672
SEM	0.421

Mann-Kendall Test

Test Value (S)	-1344
Critical Value (0.05)	-1.645
Standard Deviation of S	456.7

Appendix C-7
Mann-Kendall Analysis for Constituents not Lognormally or Normally Distributed

Standardized Value of S -2.941

Approximate p-value 0.00164

Statistically significant evidence of a decreasing trend at the specified level of significance.

Appendix C-7
Mann-Kendall Analysis for Constituents not Lognormally or Normally Distributed

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	9/14/2012 5:12:31 PM
From File	Fluoride.wst
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Fluoride (mg/L)-mw-11

General Statistics

Number of Values	35
Minimum	0.44
Maximum	0.705
Mean	0.541
Geometric Mean	0.538
Median	0.54
Standard Deviation	0.0582
SEM	0.00984

Mann-Kendall Test

Test Value (S)	-98
Critical Value (0.05)	-1.645
Standard Deviation of S	70.11
Standardized Value of S	-1.383
Approximate p-value	0.0833

Insufficient evidence to identify a significant trend at the specified level of significance.

Fluoride (mg/L)-mw-12

General Statistics

Number of Values	20
Minimum	0.186
Maximum	0.35
Mean	0.282
Geometric Mean	0.278
Median	0.3
Standard Deviation	0.0428
SEM	0.00957

Mann-Kendall Test

Test Value (S)	-85
Tabulated p-value	0.003
Standard Deviation of S	30.46
Standardized Value of S	-2.758

Approximate p-value	0.00291

Statistically significant evidence of a decreasing trend at the specified level of significance.

Fluoride (mg/L)-mw-18

General Statistics

Number of Values	20
Minimum	0.0089
Maximum	0.4
Mean	0.246
Geometric Mean	0.212
Median	0.22
Standard Deviation	0.0847
SEM	0.0189

Mann-Kendall Test

Test Value (S)	-122
Tabulated p-value	0
Standard Deviation of S	30.48
Standardized Value of S	-3.969
Approximate p-value	3.6062E-05

Statistically significant evidence of a decreasing trend at the specified level of significance.

Fluoride (mg/L)-mw-24

General Statistics

Number of Values	26
Minimum	0.1
Maximum	0.36
Mean	0.181
Geometric Mean	0.17
Median	0.163
Standard Deviation	0.0722
SEM	0.0141

Mann-Kendall Test

Test Value (S)	-98
Critical Value (0.05)	-1.645
Standard Deviation of S	45.26
Standardized Value of S	-2.143
Approximate p-value	0.0161

Statistically significant evidence of a decreasing trend at the specified level of significance.

Appendix C-7
Mann-Kendall Analysis for Constituents not Lognormally or Normally Distributed

Fluoride (mg/L)-mw-25

General Statistics

Number of Values	29
Minimum	0.28
Maximum	0.375
Mean	0.326
Geometric Mean	0.326
Median	0.321
Standard Deviation	0.0208
SEM	0.00387

Mann-Kendall Test

Test Value (S)	-87
Critical Value (0.05)	-1.645
Standard Deviation of S	52.6
Standardized Value of S	-1.635
Approximate p-value	0.051

Insufficient evidence to identify a significant trend at the specified level of significance.

Fluoride (mg/L)-mw-26

General Statistics

Number of Values	29
Minimum	0.21
Maximum	0.4
Mean	0.284
Geometric Mean	0.282
Median	0.28
Standard Deviation	0.0378
SEM	0.00702

Mann-Kendall Test

Test Value (S)	-93
Critical Value (0.05)	-1.645
Standard Deviation of S	52.82
Standardized Value of S	-1.742
Approximate p-value	0.0408

Statistically significant evidence of a decreasing trend at the specified level of significance.

Fluoride (mg/L)-mw-27

General Statistics

Number of Values	25

Minimum	0.61
Maximum	0.824
Mean	0.723
Geometric Mean	0.721
Median	0.72
Standard Deviation	0.0505
SEM	0.0101

Mann-Kendall Test

Test Value (S)	-134
Critical Value (0.05)	-1.645
Standard Deviation of S	42.68
Standardized Value of S	-3.116
Approximate p-value	0.00091706

Statistically significant evidence of a decreasing trend at the specified level of significance.

Fluoride (mg/L)-mw-3

General Statistics

Number of Values	44
Minimum	0.074
Maximum	1.04
Mean	0.543
Geometric Mean	0.501
Median	0.505
Standard Deviation	0.206
SEM	0.0311

Mann-Kendall Test

Test Value (S)	497
Critical Value (0.05)	1.645
Standard Deviation of S	98.79
Standardized Value of S	5.021
Approximate p-value	2.5719E-07

Statistically significant evidence of an increasing trend at the specified level of significance.

Fluoride (mg/L)-mw-30

General Statistics

Number of Values	29
Minimum	0.3
Maximum	0.423
Mean	0.361
Geometric Mean	0.36

Median	0.36
Standard Deviation	0.0238
SEM	0.00442

Mann-Kendall Test

Test Value (S)	-66
Critical Value (0.05)	-1.645
Standard Deviation of S	52.15
Standardized Value of S	-1.246
Approximate p-value	0.106

Insufficient evidence to identify a significant trend at the specified level of significance.

Fluoride (mg/L)-mw-31

General Statistics

Number of Values	27
Minimum	0.78
Maximum	0.989
Mean	0.876
Geometric Mean	0.875
Median	0.88
Standard Deviation	0.048
SEM	0.00924

Mann-Kendall Test

Test Value (S)	-147
Critical Value (0.05)	-1.645
Standard Deviation of S	47.77
Standardized Value of S	-3.056
Approximate p-value	0.00112

Statistically significant evidence of a decreasing trend at the specified level of significance.

Fluoride (mg/L)-mw-35

General Statistics

Number of Values	7
Minimum	0.32
Maximum	0.41
Mean	0.373
Geometric Mean	0.372
Median	0.37
Standard Deviation	0.0287
SEM	0.0108

Mann-Kendall Test

Test Value (S)	-5
Tabulated p-value	0.281
Standard Deviation of S	6.506
Standardized Value of S	-0.615
Approximate p-value	0.269

Insufficient evidence to identify a significant trend at the specified level of significance.

Fluoride (mg/L)-mw-3a

General Statistics

Number of Values	19
Minimum	0.94
Maximum	1.6
Mean	1.238
Geometric Mean	1.223
Median	1.177
Standard Deviation	0.201
SEM	0.0462

Mann-Kendall Test

Test Value (S)	-38
Tabulated p-value	0.093
Standard Deviation of S	28.53
Standardized Value of S	-1.297
Approximate p-value	0.0973

Insufficient evidence to identify a significant trend at the specified level of significance.

Fluoride (mg/L)-mw-5

General Statistics

Number of Values	44
Minimum	0.33
Maximum	1.3
Mean	0.885
Geometric Mean	0.86
Median	0.92
Standard Deviation	0.19
SEM	0.0286

Mann-Kendall Test

Test Value (S)	280
Critical Value (0.05)	1.645
Standard Deviation of S	98.69

Appendix C-7
Mann-Kendall Analysis for Constituents not Lognormally or Normally Distributed

Standardized Value of S 2.827

Approximate p-value 0.00235

Statistically significant evidence of an increasing trend at the specified level of significance.

Appendix C-7
Mann-Kendall Analysis for Constituents not Lognormally or Normally Distributed

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	9/14/2012 5:14:25 PM
From File	Sulfate.wst
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Sulfate (mg/L)-mw-11

General Statistics

Number of Values	87
Minimum	895
Maximum	1309
Mean	1039
Geometric Mean	1035
Median	1023
Standard Deviation	90.78
SEM	9.733

Mann-Kendall Test

Test Value (S)	2015
Critical Value (0.05)	1.645
Standard Deviation of S	272.6
Standardized Value of S	7.387
Approximate p-value	7.516E-14

Statistically significant evidence of an increasing trend at the specified level of significance.

Sulfate (mg/L)-mw-12

General Statistics

Number of Values	71
Minimum	1850
Maximum	2560
Mean	2320
Geometric Mean	2316
Median	2338
Standard Deviation	140.9
SEM	16.72

Mann-Kendall Test

Test Value (S)	-539
Critical Value (0.05)	-1.645
Standard Deviation of S	201.4
Standardized Value of S	-2.671

Approximate p-value	0.00378

Statistically significant evidence of a decreasing trend at the specified level of significance.

Sulfate (mg/L)-mw-18

General Statistics

Number of Values	30
Minimum	1069
Maximum	2020
Mean	1668
Geometric Mean	1649
Median	1720
Standard Deviation	249.2
SEM	45.49

Mann-Kendall Test

Test Value (S)	255
Critical Value (0.05)	1.645
Standard Deviation of S	56.01
Standardized Value of S	4.535
Approximate p-value	2.8869E-06

Statistically significant evidence of an increasing trend at the specified level of significance.

Sulfate (mg/L)-mw-24

General Statistics

Number of Values	26
Minimum	2290
Maximum	2950
Mean	2652
Geometric Mean	2648
Median	2675
Standard Deviation	154.5
SEM	30.31

Mann-Kendall Test

Test Value (S)	41
Critical Value (0.05)	1.645
Standard Deviation of S	45.27
Standardized Value of S	0.884
Approximate p-value	0.188

Insufficient evidence to identify a significant trend at the specified level of significance.

Sulfate (mg/L)-mw-25

General Statistics

Number of Values	29
Minimum	1570
Maximum	1880
Mean	1693
Geometric Mean	1691
Median	1680
Standard Deviation	80.4
SEM	14.93

Mann-Kendall Test

Test Value (S)	-72
Critical Value (0.05)	-1.645
Standard Deviation of S	53.19
Standardized Value of S	-1.335
Approximate p-value	0.0909

Insufficient evidence to identify a significant trend at the specified level of significance.

Sulfate (mg/L)-mw-26

General Statistics

Number of Values	31
Minimum	1520
Maximum	2160
Mean	1904
Geometric Mean	1900
Median	1890
Standard Deviation	116.2
SEM	20.87

Mann-Kendall Test

Test Value (S)	41
Critical Value (0.05)	1.645
Standard Deviation of S	58.7
Standardized Value of S	0.681
Approximate p-value	0.248

Insufficient evidence to identify a significant trend at the specified level of significance.

Sulfate (mg/L)-mw-27

General Statistics

Number of Values	27

Minimum	360
Maximum	480
Mean	432.8
Geometric Mean	431.7
Median	442
Standard Deviation	30.02
SEM	5.778

Mann-Kendall Test

Test Value (S)	154
Critical Value (0.05)	1.645
Standard Deviation of S	47.91
Standardized Value of S	3.194
Approximate p-value	0.00070277

Statistically significant evidence of an increasing trend at the specified level of significance.

Sulfate (mg/L)-mw-3

General Statistics

Number of Values	90
Minimum	1890
Maximum	4030
Mean	3092
Geometric Mean	3060
Median	3202
Standard Deviation	418.1
SEM	44.07

Mann-Kendall Test

Test Value (S)	1055
Critical Value (0.05)	1.645
Standard Deviation of S	286.9
Standardized Value of S	3.674
Approximate p-value	0.00011941

Statistically significant evidence of an increasing trend at the specified level of significance.

Sulfate (mg/L)-mw-30

General Statistics

Number of Values	29
Minimum	696
Maximum	977
Mean	812.6
Geometric Mean	810

Median	799
Standard Deviation	67.22
SEM	12.48

Mann-Kendall Test

Test Value (S)	-307
Critical Value (0.05)	-1.645
Standard Deviation of S	53.3
Standardized Value of S	-5.741
Approximate p-value	4.7066E-09

Statistically significant evidence of a decreasing trend at the specified level of significance.

Sulfate (mg/L)-mw-31

General Statistics

Number of Values	39
Minimum	436
Maximum	552
Mean	517.3
Geometric Mean	516.8
Median	522
Standard Deviation	24.15
SEM	3.867

Mann-Kendall Test

Test Value (S)	274
Critical Value (0.05)	1.645
Standard Deviation of S	82.58
Standardized Value of S	3.306
Approximate p-value	0.00047306

Statistically significant evidence of an increasing trend at the specified level of significance.

Sulfate (mg/L)-mw-35

General Statistics

Number of Values	6
Minimum	2240
Maximum	2400
Mean	2320
Geometric Mean	2320
Median	2320
Standard Deviation	51.38
SEM	20.98

Mann-Kendall Test

Test Value (S)	1
Tabulated p-value	0.5
Standard Deviation of S	5.132
Standardized Value of S	0
Approximate p-value	0.5

Insufficient evidence to identify a significant trend at the specified level of significance.

Sulfate (mg/L)-mw-3a

General Statistics

Number of Values	23
Minimum	3220
Maximum	3870
Mean	3597
Geometric Mean	3592
Median	3560
Standard Deviation	192.3
SEM	40.11

Mann-Kendall Test

Test Value (S)	52
Critical Value (0.05)	1.645
Standard Deviation of S	37.82
Standardized Value of S	1.348
Approximate p-value	0.0888

Insufficient evidence to identify a significant trend at the specified level of significance.

Sulfate (mg/L)-mw-5

General Statistics

Number of Values	90
Minimum	860
Maximum	1518
Mean	1133
Geometric Mean	1129
Median	1130
Standard Deviation	105.1
SEM	11.08

Mann-Kendall Test

Test Value (S)	-619
Critical Value (0.05)	-1.645
Standard Deviation of S	286.8

Appendix C-7
Mann-Kendall Analysis for Constituents not Lognormally or Normally Distributed

Standardized Value of S -2.155

Approximate p-value 0.0156

Statistically significant evidence of a decreasing trend at the specified level of significance.

Appendix C-7
Mann-Kendall Analysis for Constituents not Lognormally or Normally Distributed

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	9/14/2012 5:17:42 PM
From File	Uranium.wst
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Uranium (ug/L)-mw-11

General Statistics

Number of Values	100
Minimum	0.00015
Maximum	3.03
Mean	0.747
Geometric Mean	0.396
Median	0.723
Standard Deviation	0.625
SEM	0.0625

Mann-Kendall Test

Test Value (S)	-174
Critical Value (0.05)	-1.645
Standard Deviation of S	335.2
Standardized Value of S	-0.516
Approximate p-value	0.303

Insufficient evidence to identify a significant trend at the specified level of significance.

Uranium (ug/L)-mw-12

General Statistics

Number of Values	97
Minimum	3
Maximum	23.5
Mean	15.49
Geometric Mean	14.7
Median	16
Standard Deviation	4.031
SEM	0.409

Mann-Kendall Test

Test Value (S)	2066
Critical Value (0.05)	1.645
Standard Deviation of S	320.6
Standardized Value of S	6.441

Approximate p-value	5.952E-11

Statistically significant evidence of an increasing trend at the specified level of significance.

Uranium (ug/L)-mw-18

General Statistics

Number of Values	33
Minimum	2.687
Maximum	49
Mean	33.23
Geometric Mean	27.74
Median	40.3
Standard Deviation	14.37
SEM	2.501

Mann-Kendall Test

Test Value (S)	292
Critical Value (0.05)	1.645
Standard Deviation of S	64.54
Standardized Value of S	4.509
Approximate p-value	3.2586E-06

Statistically significant evidence of an increasing trend at the specified level of significance.

Uranium (ug/L)-mw-24

General Statistics

Number of Values	24
Minimum	0.5
Maximum	10.4
Mean	2.969
Geometric Mean	1.962
Median	1.56
Standard Deviation	3.129
SEM	0.639

Mann-Kendall Test

Test Value (S)	-77
Critical Value (0.05)	-1.645
Standard Deviation of S	40.3
Standardized Value of S	-1.886
Approximate p-value	0.0297

Statistically significant evidence of a decreasing trend at the specified level of significance.

Uranium (ug/L)-mw-25

General Statistics

Number of Values	41
Minimum	4.77
Maximum	7.6
Mean	6.144
Geometric Mean	6.12
Median	6.02
Standard Deviation	0.551
SEM	0.0861

Mann-Kendall Test

Test Value (S)	250
Critical Value (0.05)	1.645
Standard Deviation of S	89.01
Standardized Value of S	2.797
Approximate p-value	0.00258

Statistically significant evidence of an increasing trend at the specified level of significance.

Uranium (ug/L)-mw-26

General Statistics

Number of Values	83
Minimum	9.48
Maximum	119
Mean	38.86
Geometric Mean	33.61
Median	33.6
Standard Deviation	20.36
SEM	2.235

Mann-Kendall Test

Test Value (S)	1436
Critical Value (0.05)	1.645
Standard Deviation of S	254.3
Standardized Value of S	5.644
Approximate p-value	8.3278E-09

Statistically significant evidence of an increasing trend at the specified level of significance.

Uranium (ug/L)-mw-27

General Statistics

Number of Values	23

Minimum	27.7
Maximum	33.1
Mean	30.59
Geometric Mean	30.55
Median	30.7
Standard Deviation	1.448
SEM	0.302

Mann-Kendall Test

Test Value (S)	-105
Critical Value (0.05)	-1.645
Standard Deviation of S	37.84
Standardized Value of S	-2.749
Approximate p-value	0.00299

Statistically significant evidence of a decreasing trend at the specified level of significance.

Uranium (ug/L)-mw-3

General Statistics

Number of Values	85
Minimum	3
Maximum	67.16
Mean	23.2
Geometric Mean	20.32
Median	21.94
Standard Deviation	10.87
SEM	1.179

Mann-Kendall Test

Test Value (S)	708
Critical Value (0.05)	1.645
Standard Deviation of S	263.4
Standardized Value of S	2.684
Approximate p-value	0.00364

Statistically significant evidence of an increasing trend at the specified level of significance.

Uranium (ug/L)-mw-30

General Statistics

Number of Values	31
Minimum	5.79
Maximum	9.83
Mean	7.106
Geometric Mean	7.068

Median	6.9
Standard Deviation	0.78
SEM	0.14

Mann-Kendall Test

Test Value (S)	48
Critical Value (0.05)	1.645
Standard Deviation of S	58.81
Standardized Value of S	0.799
Approximate p-value	0.212

Insufficient evidence to identify a significant trend at the specified level of significance.

Uranium (ug/L)-mw-31

General Statistics

Number of Values	28
Minimum	5.77
Maximum	9.32
Mean	7.26
Geometric Mean	7.226
Median	7.15
Standard Deviation	0.725
SEM	0.137

Mann-Kendall Test

Test Value (S)	-57
Critical Value (0.05)	-1.645
Standard Deviation of S	50.61
Standardized Value of S	-1.107
Approximate p-value	0.134

Insufficient evidence to identify a significant trend at the specified level of significance.

Uranium (ug/L)-mw-35

General Statistics

Number of Values	15
Minimum	12.7
Maximum	27.2
Mean	21.79
Geometric Mean	21.45
Median	22.4
Standard Deviation	3.71
SEM	0.958

Appendix C-7
Mann-Kendall Analysis for Constituents not Lognormally or Normally Distributed

Mann-Kendall Test

Test Value (S)	11
Tabulated p-value	0.313
Standard Deviation of S	20.21
Standardized Value of S	0.495
Approximate p-value	0.31

Insufficient evidence to identify a significant trend at the specified level of significance.

Uranium (ug/L)-mw-3a

General Statistics

Number of Values	19
Minimum	16.5
Maximum	28.2
Mean	20.62
Geometric Mean	20.42
Median	19.7
Standard Deviation	3.032
SEM	0.696

Mann-Kendall Test

Test Value (S)	-52
Tabulated p-value	0.034
Standard Deviation of S	28.48
Standardized Value of S	-1.79
Approximate p-value	0.0367

Statistically significant evidence of a decreasing trend at the specified level of significance.

Uranium (ug/L)-mw-5

General Statistics

Number of Values	87
Minimum	0.04
Maximum	3.4
Mean	0.924
Geometric Mean	0.659
Median	0.791
Standard Deviation	0.713
SEM	0.0764

Mann-Kendall Test

Test Value (S)	-865
Critical Value (0.05)	-1.645
Standard Deviation of S	272.3

Appendix C-7
Mann-Kendall Analysis for Constituents not Lognormally or Normally Distributed

Standardized Value of S -3.173

Approximate p-value 0.00075379

Statistically significant evidence of a decreasing trend at the specified level of significance.

APPENDIX D

pH Analysis

D-1 pH Analysis Summary Table

Appendix D-1
pH Analysis Summary

Well	N	Mean (s.u.)	Minimum (s.u.)	Maximum (s.u.)	Standard Deviation (s.u.)	Shapiro-Wilks Test for Normality[a]			Least Squares Regression Trend Analysis[b]		Mann-Kendall Trend Analysis[c]		Significantly Decreasing Trend?
						W	p	Normally or Lognormally Distributed?	r^2	p	S	p	
MW-03	45	6.58	5.95	7.11	0.27	0.983963	0.780179	Yes	0.280593	0.000183			Yes
MW-03A	28	6.53	5.90	7.62	0.35	0.938171	0.099306	Yes	0.182652	0.023303			Yes
MW-05	63	7.52	7.00	8.10	0.24	0.987479	0.772470	Yes	0.044041	0.098781			No
MW-11	91	7.68	6.25	9.00	0.39	0.971125	0.040562	No			-924	7.76E-04	Yes
MW-12	65	6.87	5.86	7.90	0.33	0.961503	0.041082	No			-631	1.79E-04	Yes
MW-18	38	6.65	5.82	7.38	0.39	0.971791	0.442039	Yes	0.327534	0.000174			Yes
MW-24	25	6.50	5.73	7.54	0.48	0.965518	0.534824	Yes	0.448802	0.000249			yes
MW-25	41	6.64	5.77	7.25	0.26	0.934116	0.019825	No			-180	0.0221	yes
MW-26	86	6.64	5.61	7.88	0.36	0.967922	0.030927	No			160	0.277	No
MW-27	31	7.06	6.39	7.68	0.30	0.955437	0.220044	Yes	0.059184	0.187248			No
MW-30	48	6.88	6.52	7.47	0.20	0.977907	0.494726	Yes	0.107125	0.023161			Yes
MW-31	48	7.13	6.16	7.80	0.28	0.953423	0.054804	Yes	0.066966	0.075734			No
MW-35	16	6.70	6.25	7.46	0.33	0.940310	0.352828	Yes	0.229342	0.060555			No

σ = sigma
W = Shapiro Wilk test value
S.U. = standard units
N = number of valid data points

S = MannKendall statistic
N/A = not applicable
p = probability
R2 = The measure of how well the trendline fits the data where r2=1 represents a perfect fit.

a = The Shapiro-Wilk Distribution test was performed on data with % Detect > 50%. For % Detect > 85%, 1/2 the detection limit was substituted for non-detected values, and for % Detect > 50% and < 85% the test was done on detected values only

b = A regression test was performed on data that was determined to have either a normal or log-normal distribution and % Detect > 50%. 1/2 of the detection limit was used for non-detected values

c = The Mann-Kendall test was performed on data with either a non-parametric distribution or with % Detect < 50%, it was not performed on constituents where N < 8

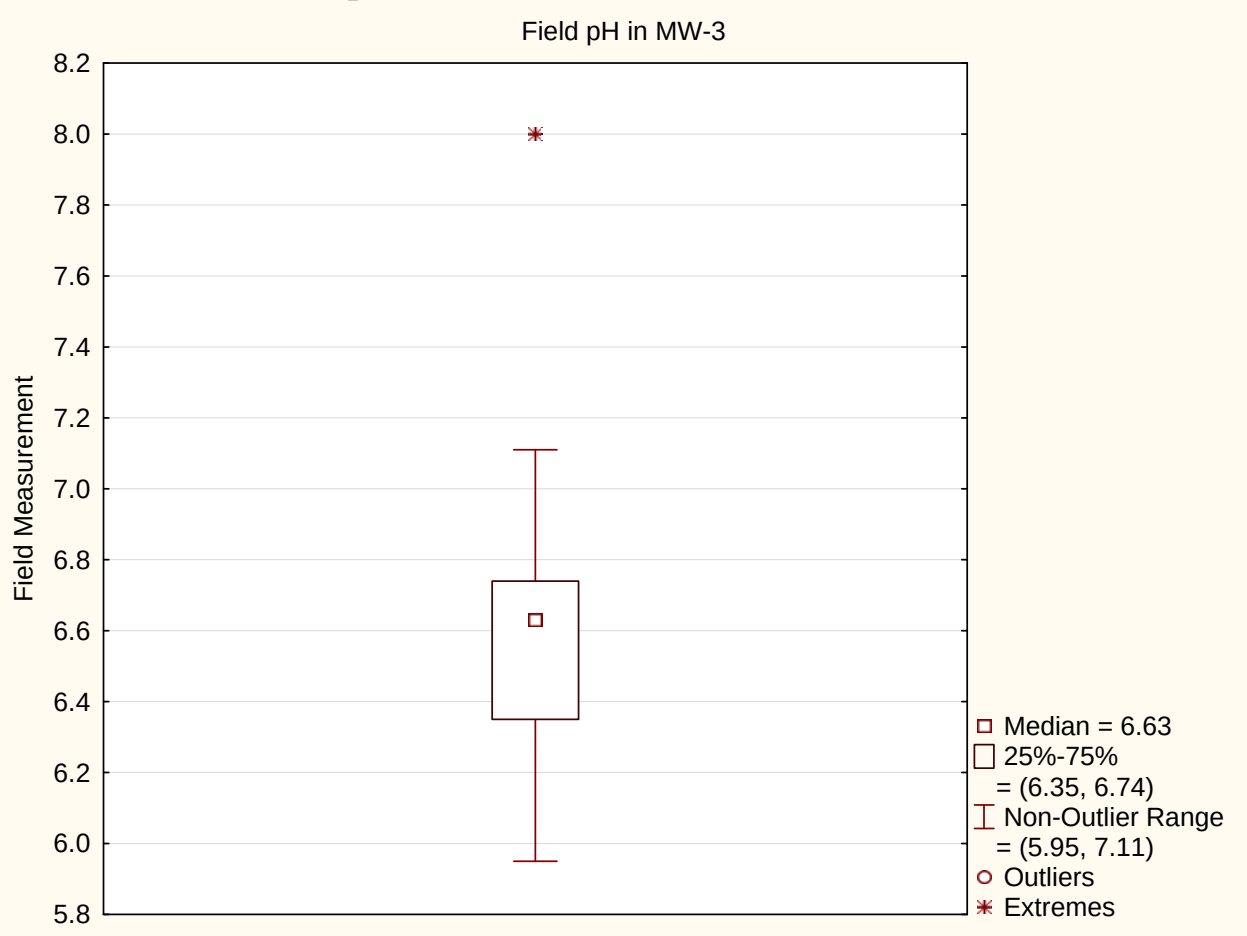
Distribution = Distribution as determined by the Shapiro-Wilk distribution test for constituents with % Detect > 50% and N>8

Regression Trend = The result of the linear regression test analysis using 1/2 of the detection limit for values reported as "not detected"

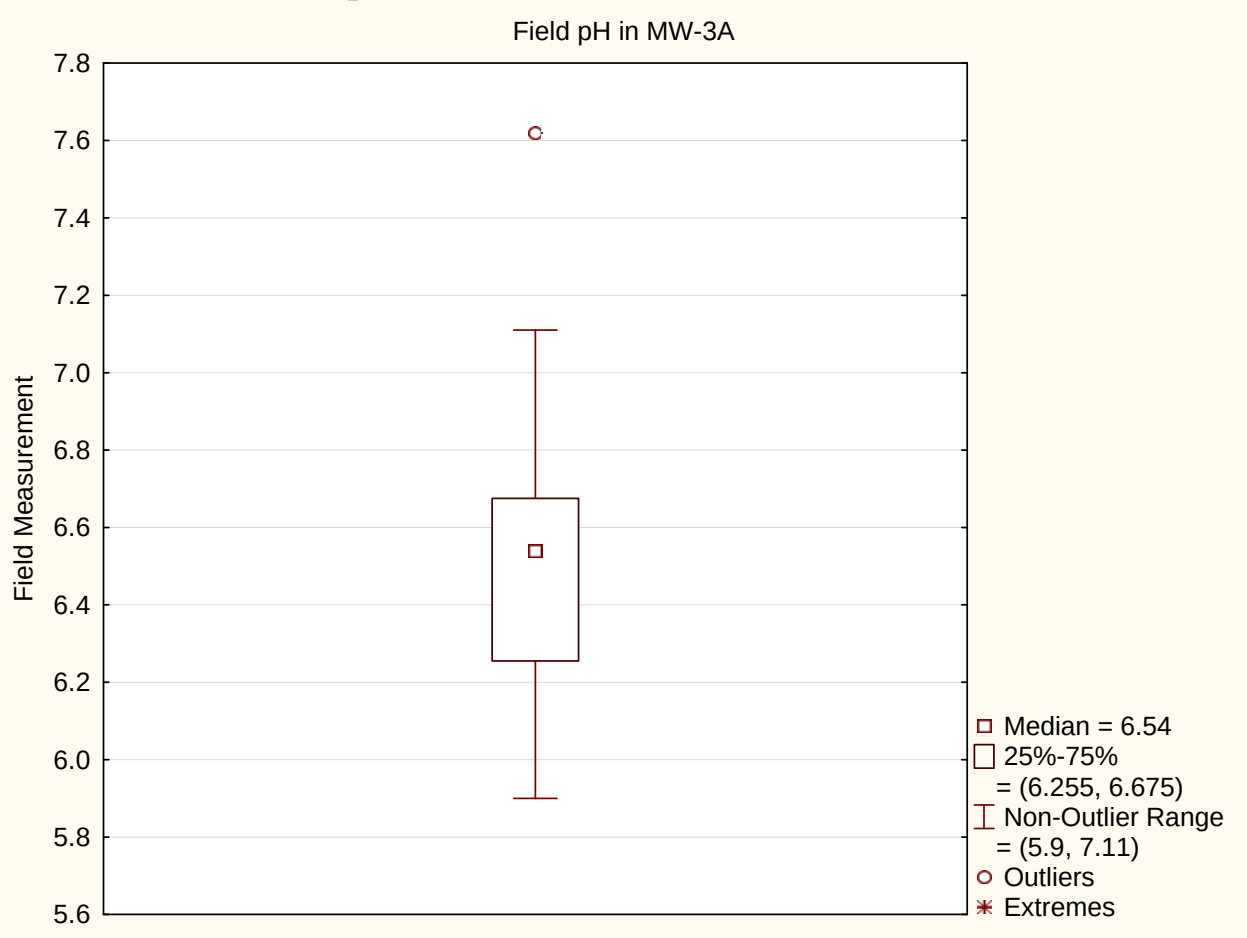
Mann-Kendall Trend = The result of the Mann-Kendall test for non-parametric distributions and for % Detect < 50%

D-2 Box Plots for pH in Wells with Constituents with Exceedances

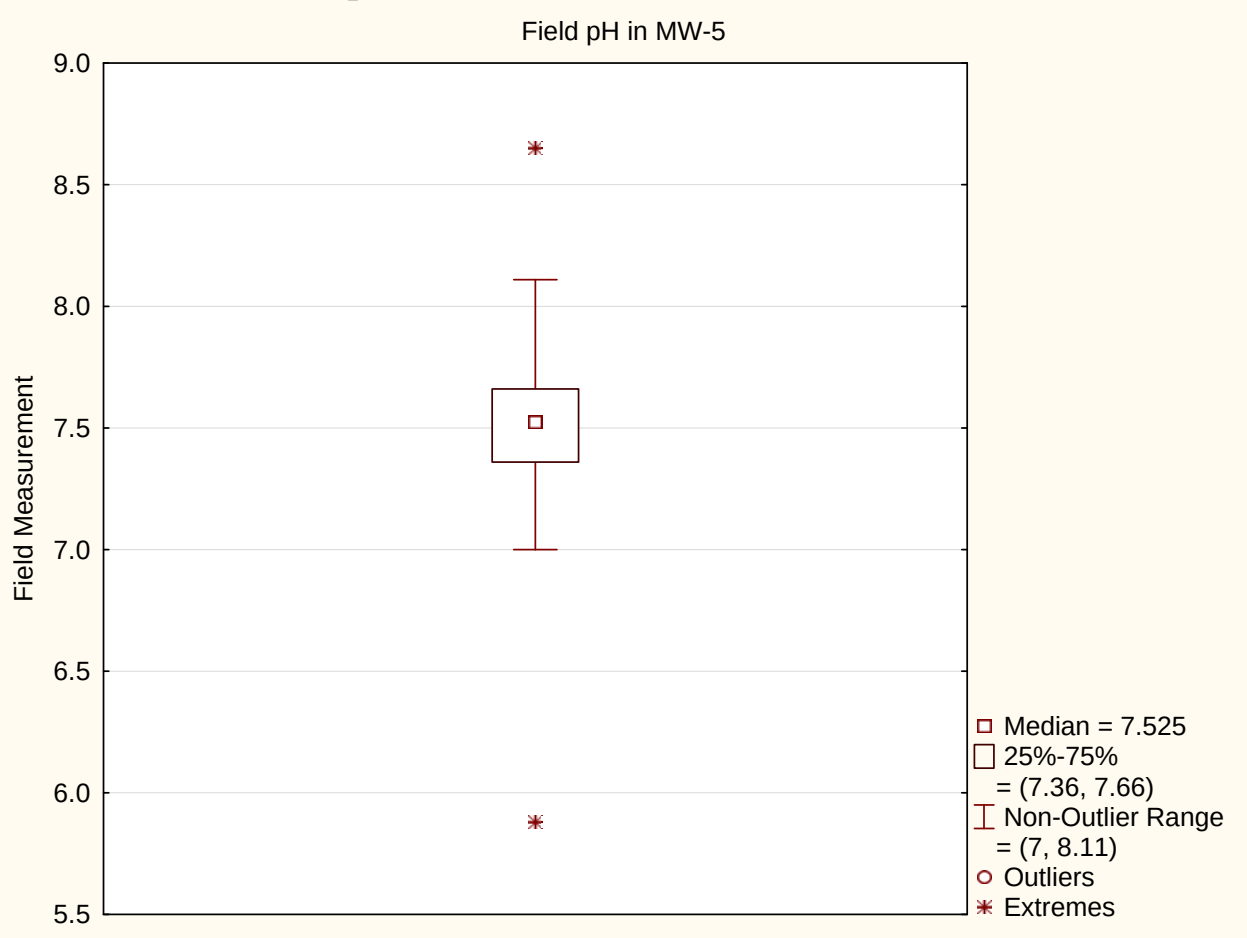
Appendix D-2
Box Plots for pH in Wells with Constituents with Exceedances



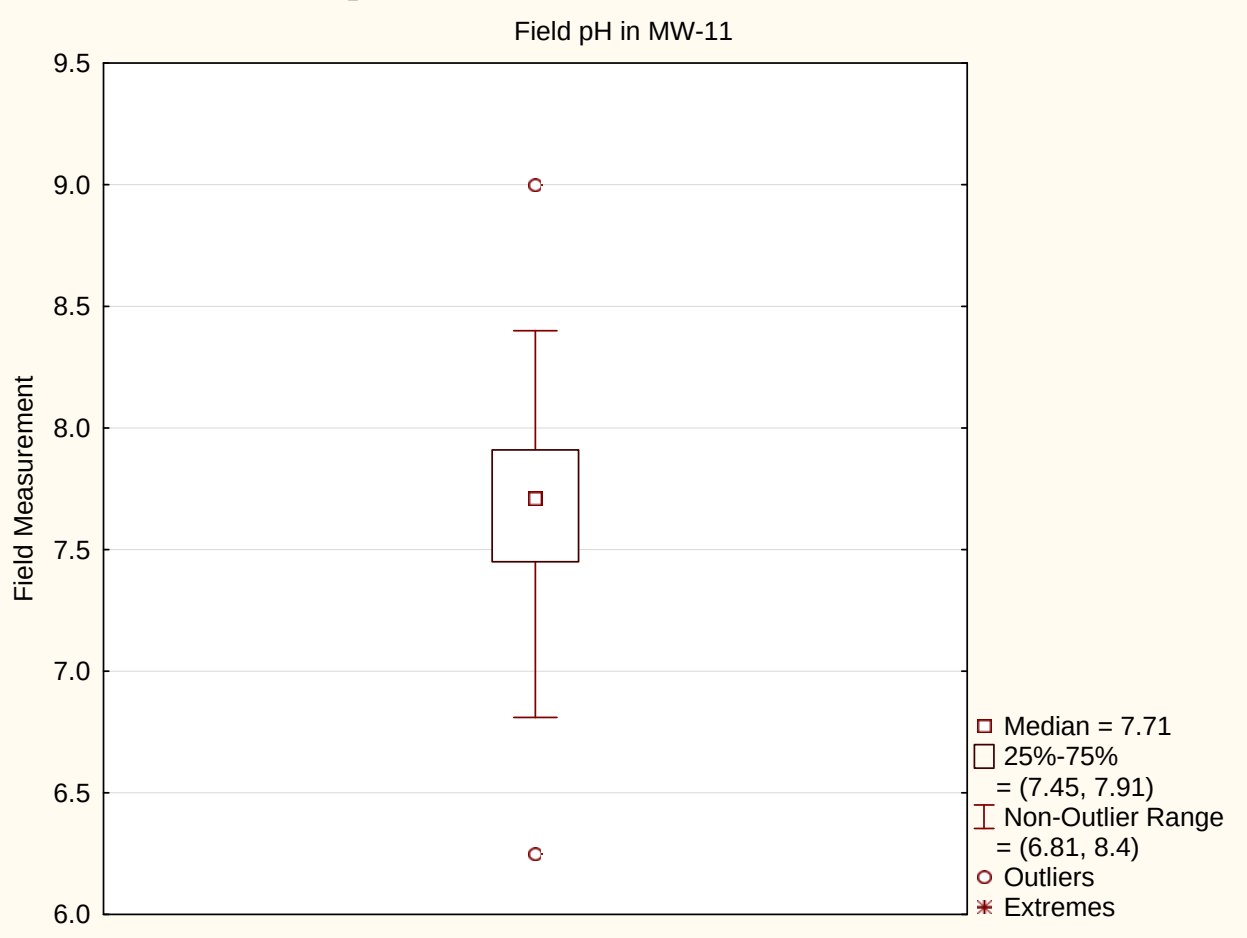
Appendix D-2
Box Plots for pH in Wells with Constituents with Exceedances



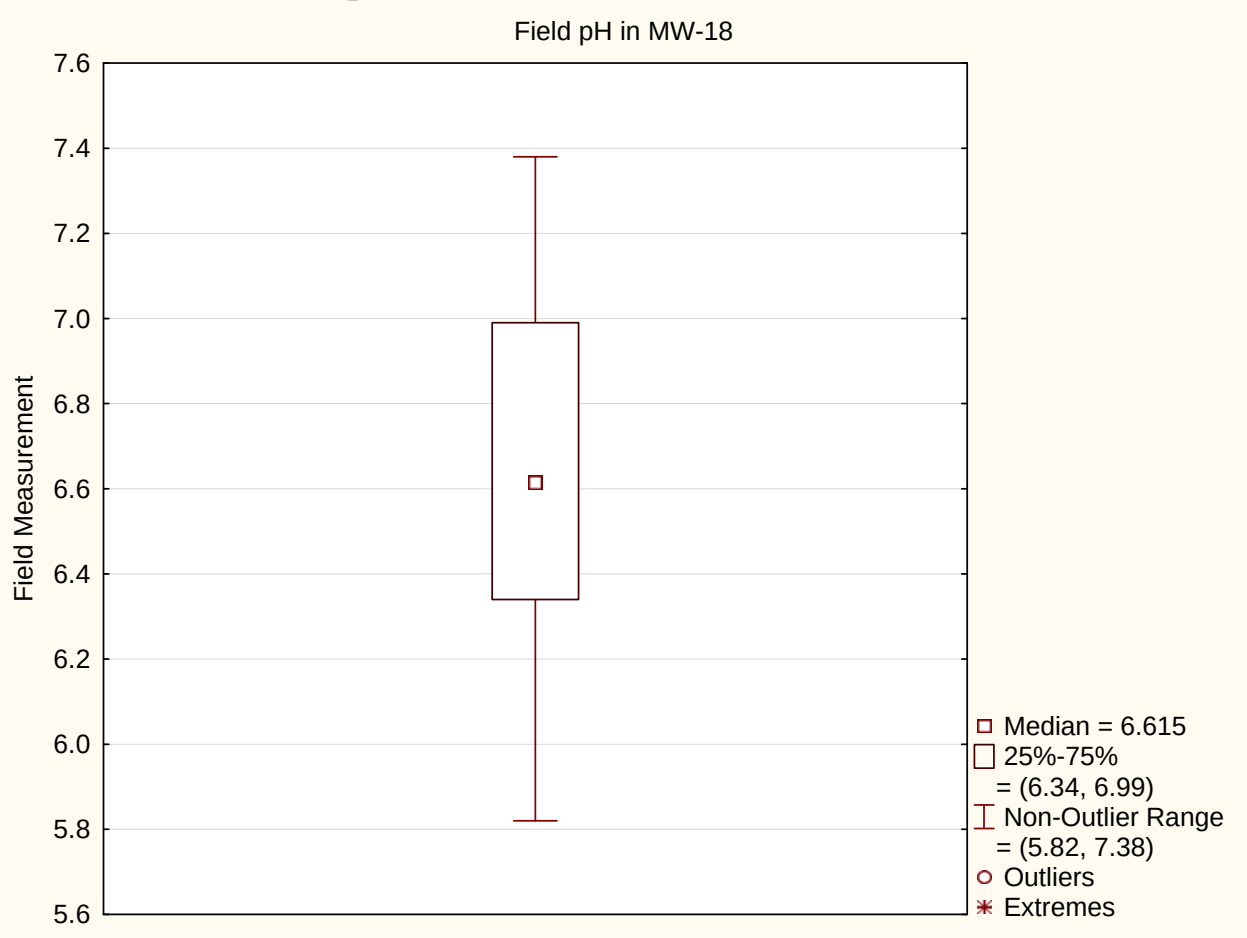
Appendix D-2
Box Plots for pH in Wells with Constituents with Exceedances



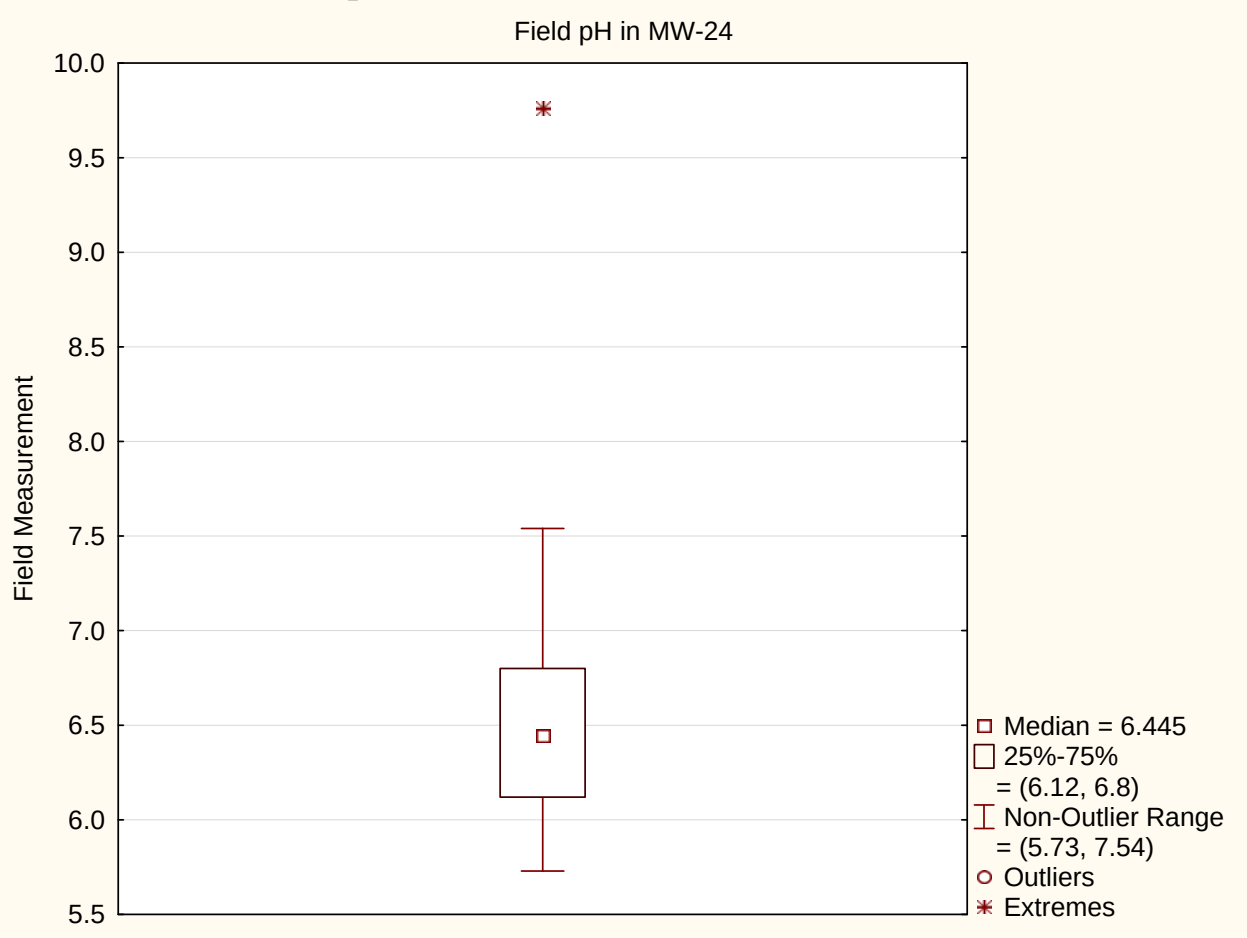
Appendix D-2
Box Plots for pH in Wells with Constituents with Exceedances



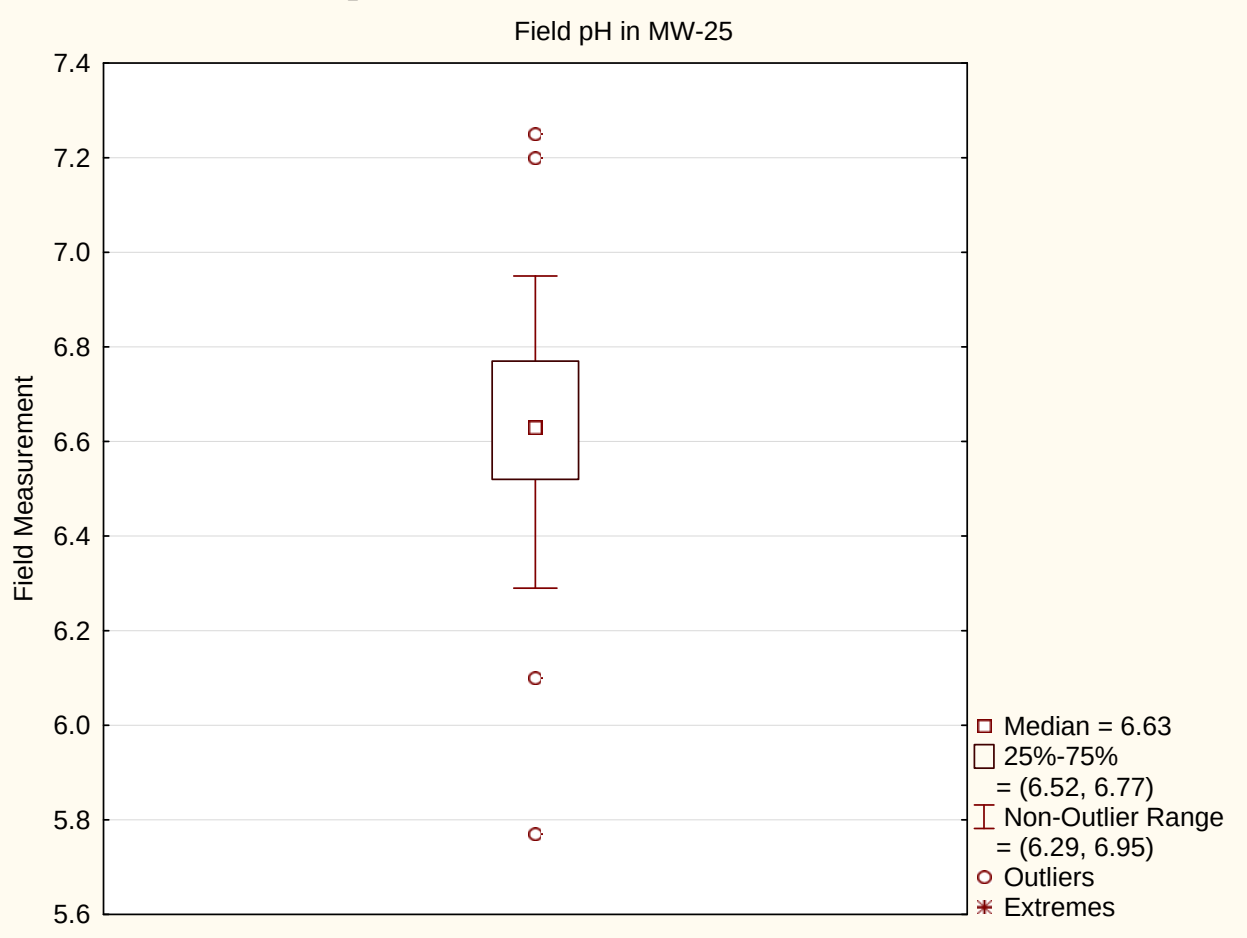
Appendix D-2
Box Plots for pH in Wells with Constituents with Exceedances



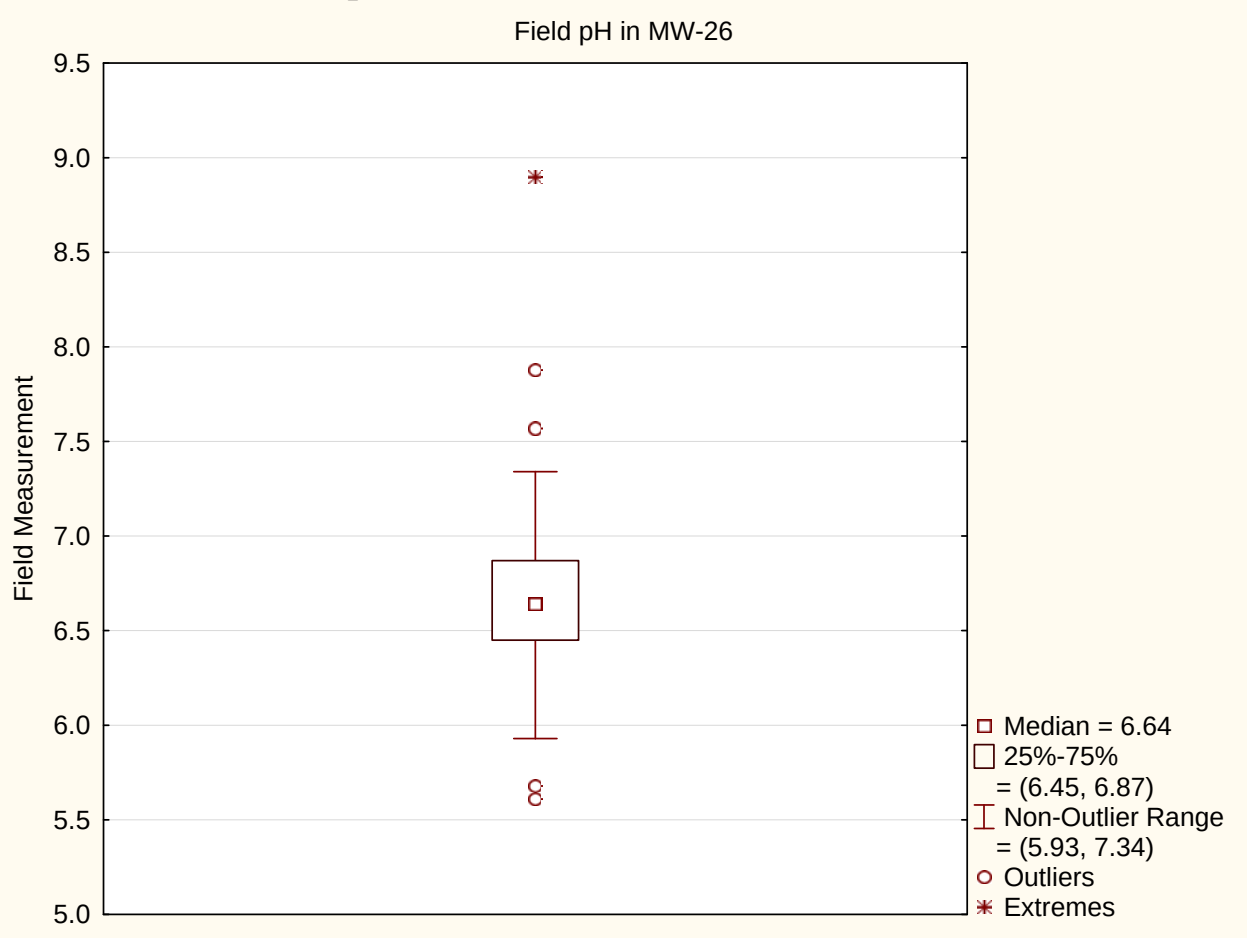
Appendix D-2
Box Plots for pH in Wells with Constituents with Exceedances



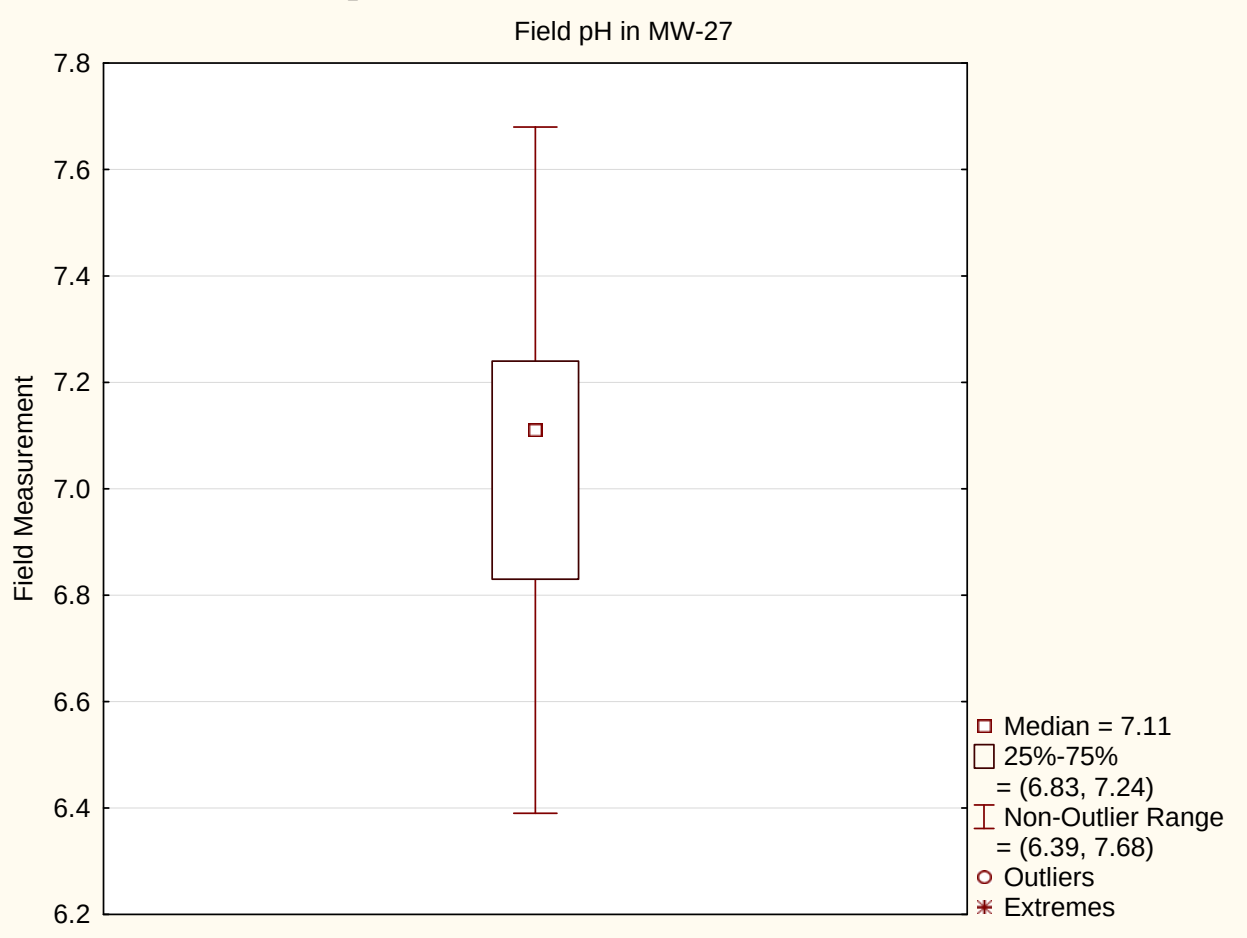
Appendix D-2
Box Plots for pH in Wells with Constituents with Exceedances



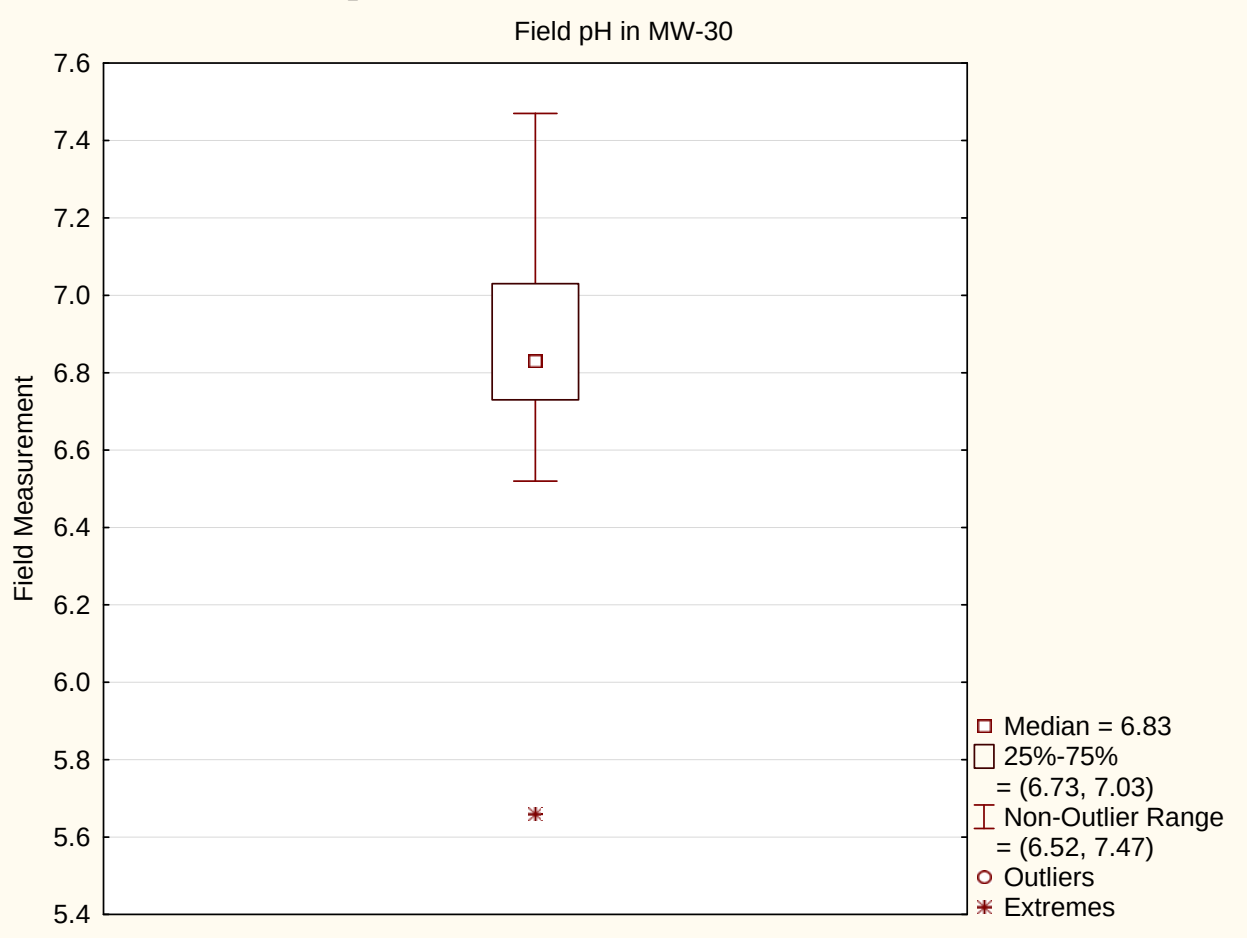
Appendix D-2
Box Plots for pH in Wells with Constituents with Exceedances



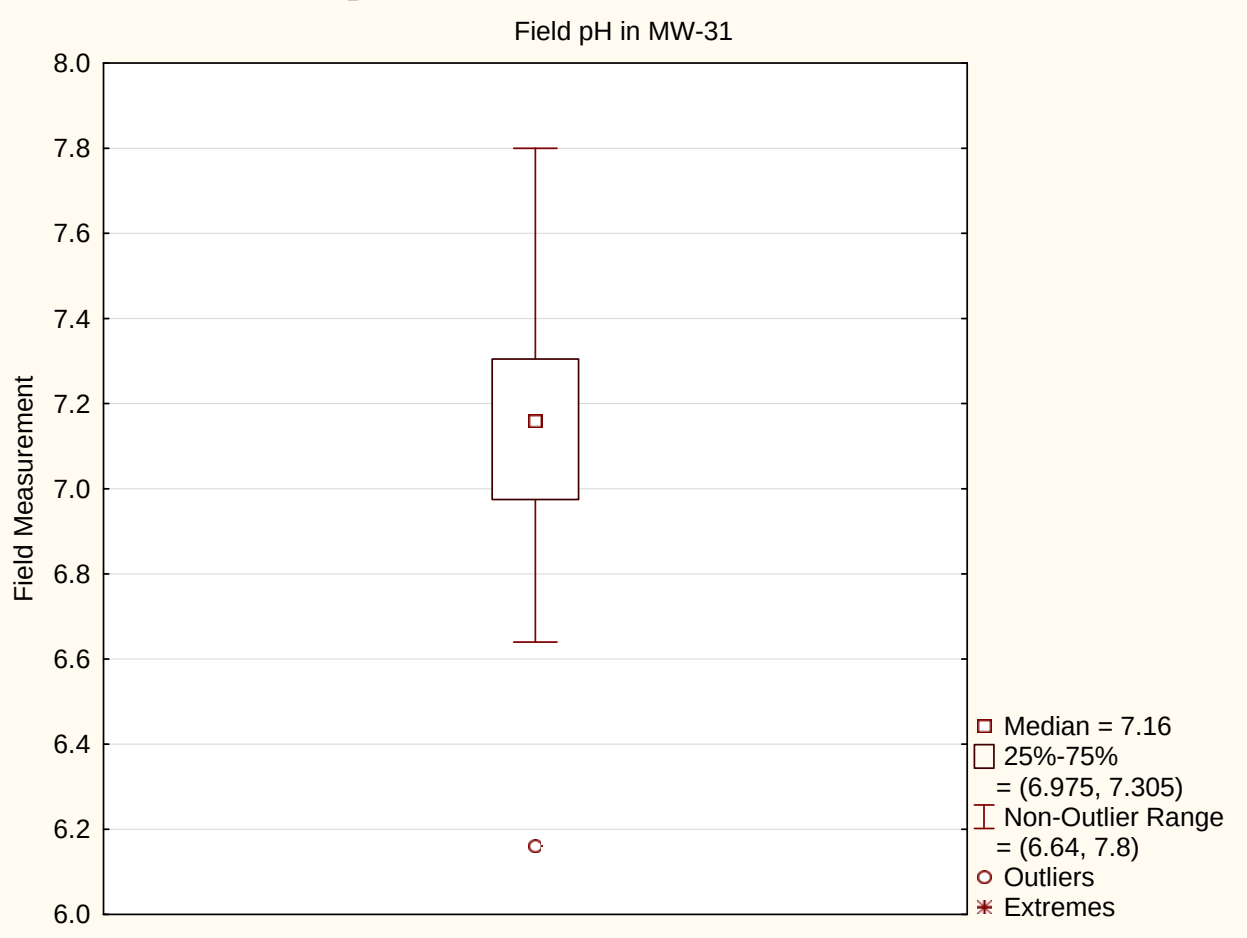
Appendix D-2
Box Plots for pH in Wells with Constituents with Exceedances



Appendix D-2
Box Plots for pH in Wells with Constituents with Exceedances

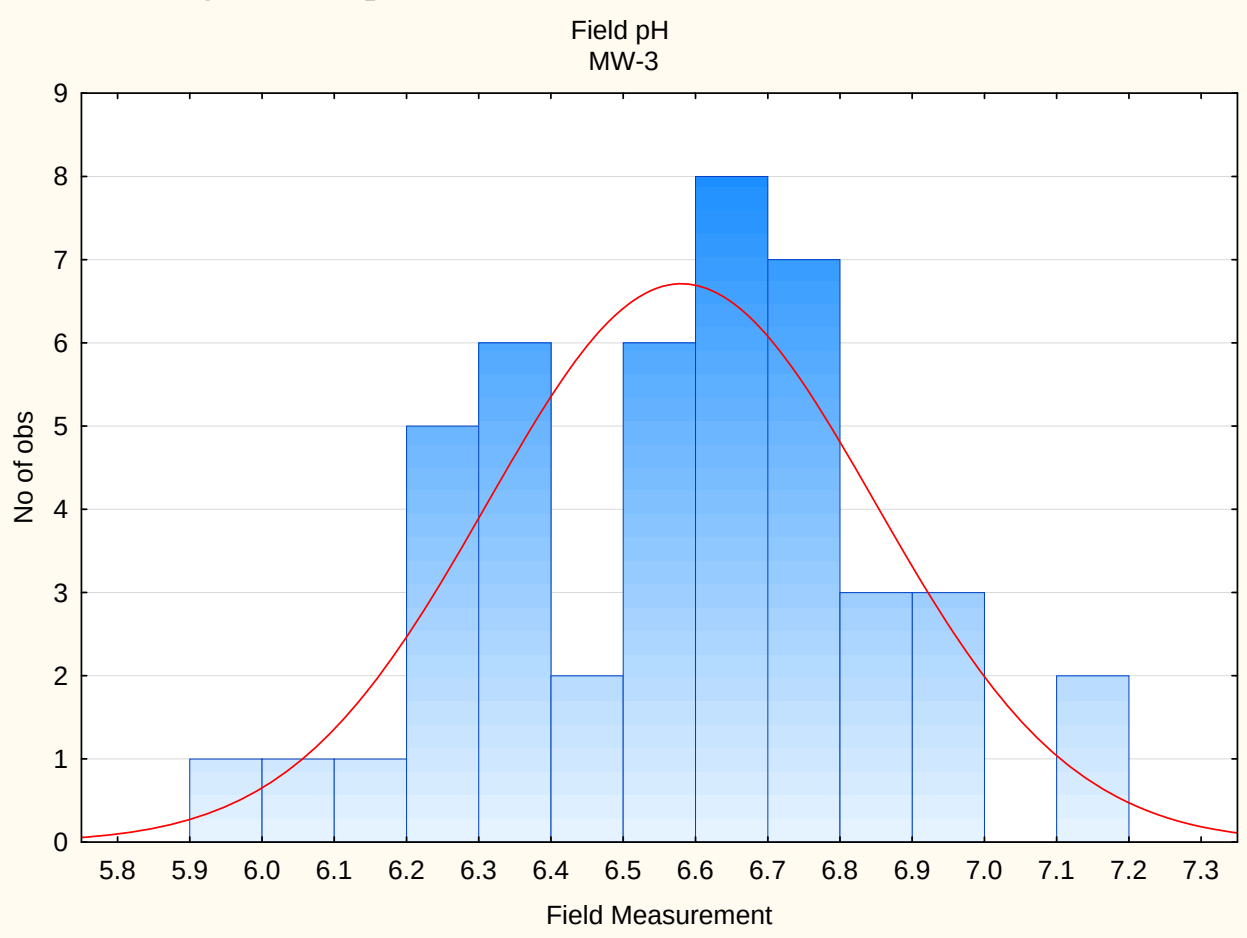


Appendix D-2
Box Plots for pH in Wells with Constituents with Exceedances

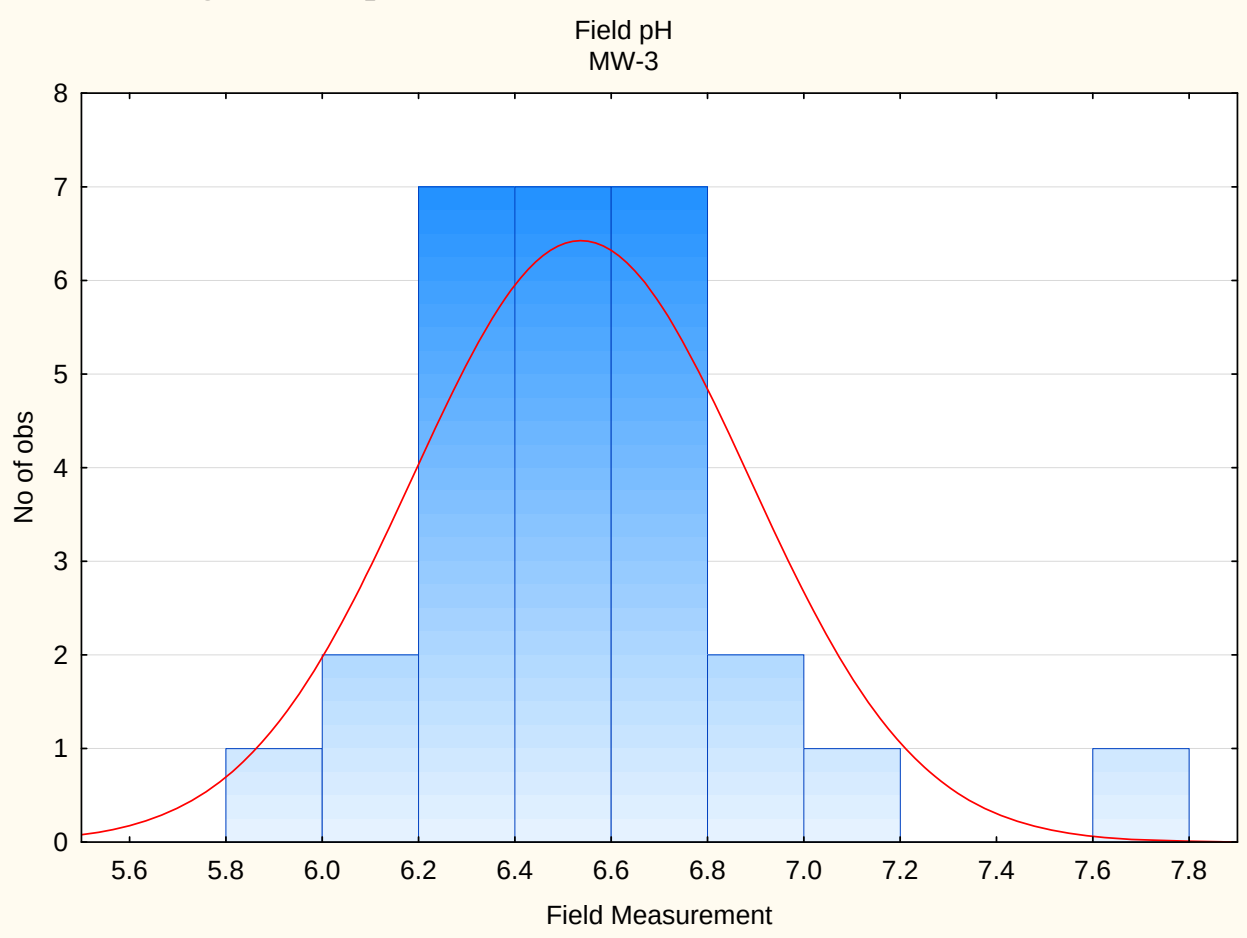


D-3 Histograms for pH in Wells with Constituents with Exceedances

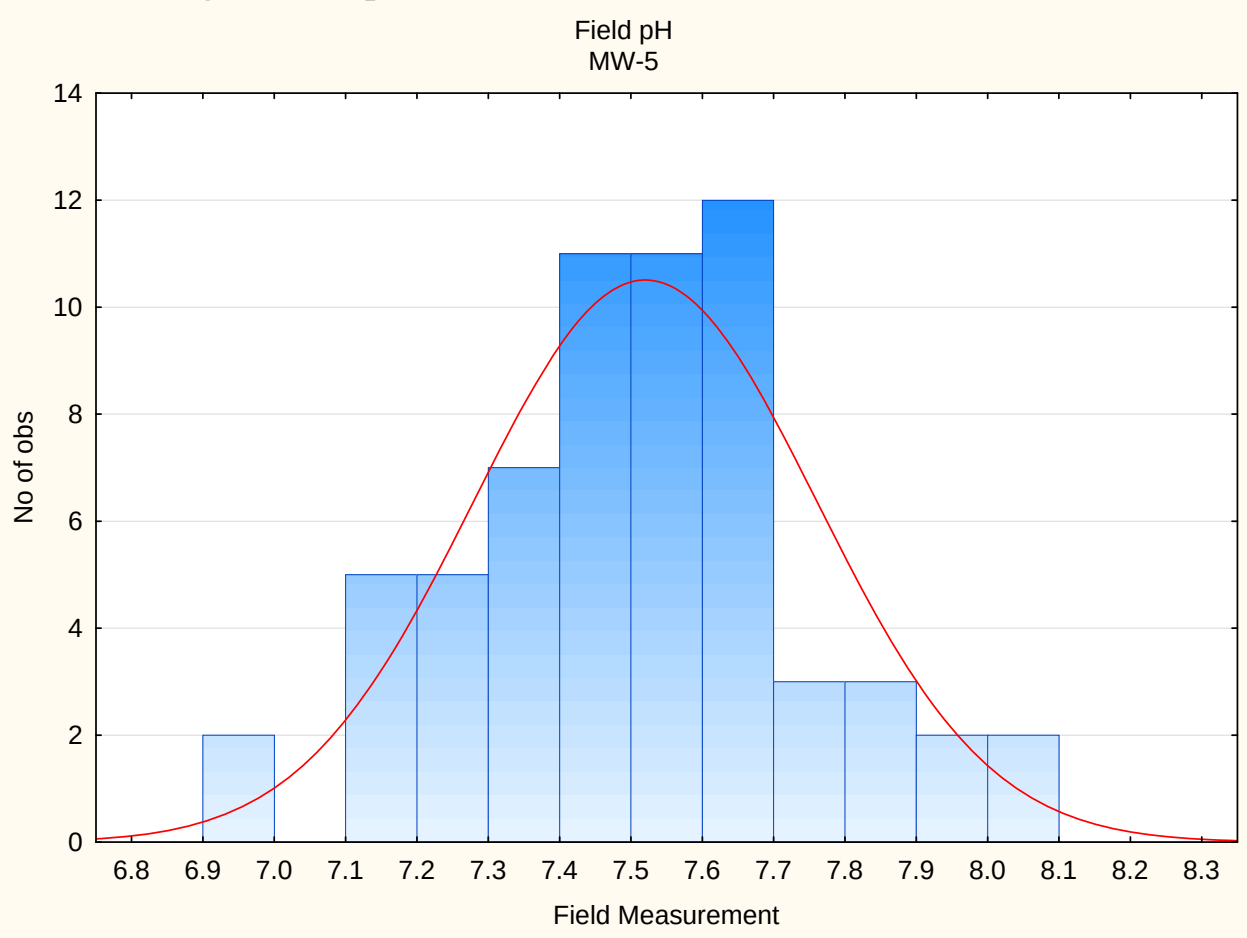
Appendix D-3
Histograms for pH in Wells with Constituents with Exceedances



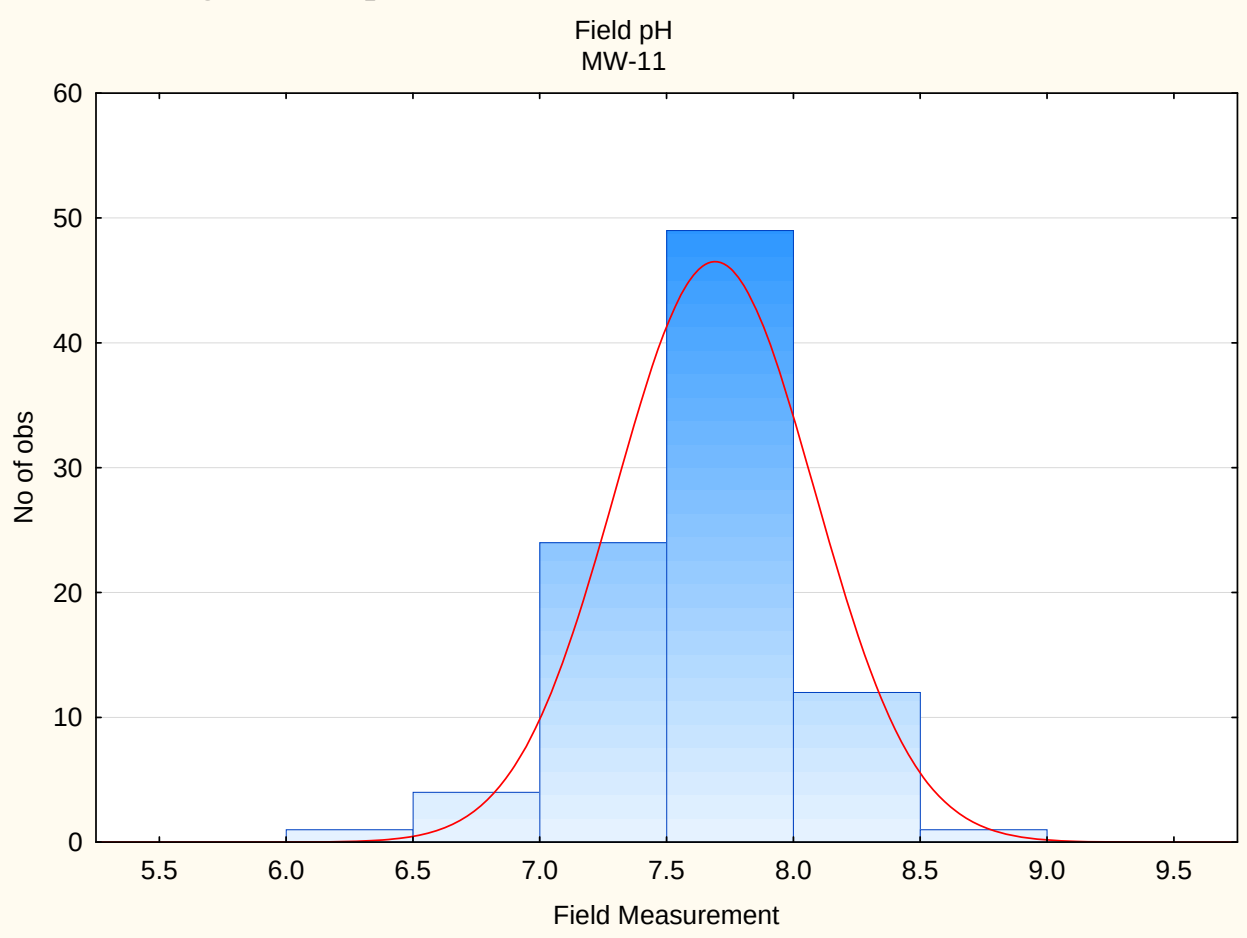
Appendix D-3
Histograms for pH in Wells with Constituents with Exceedances



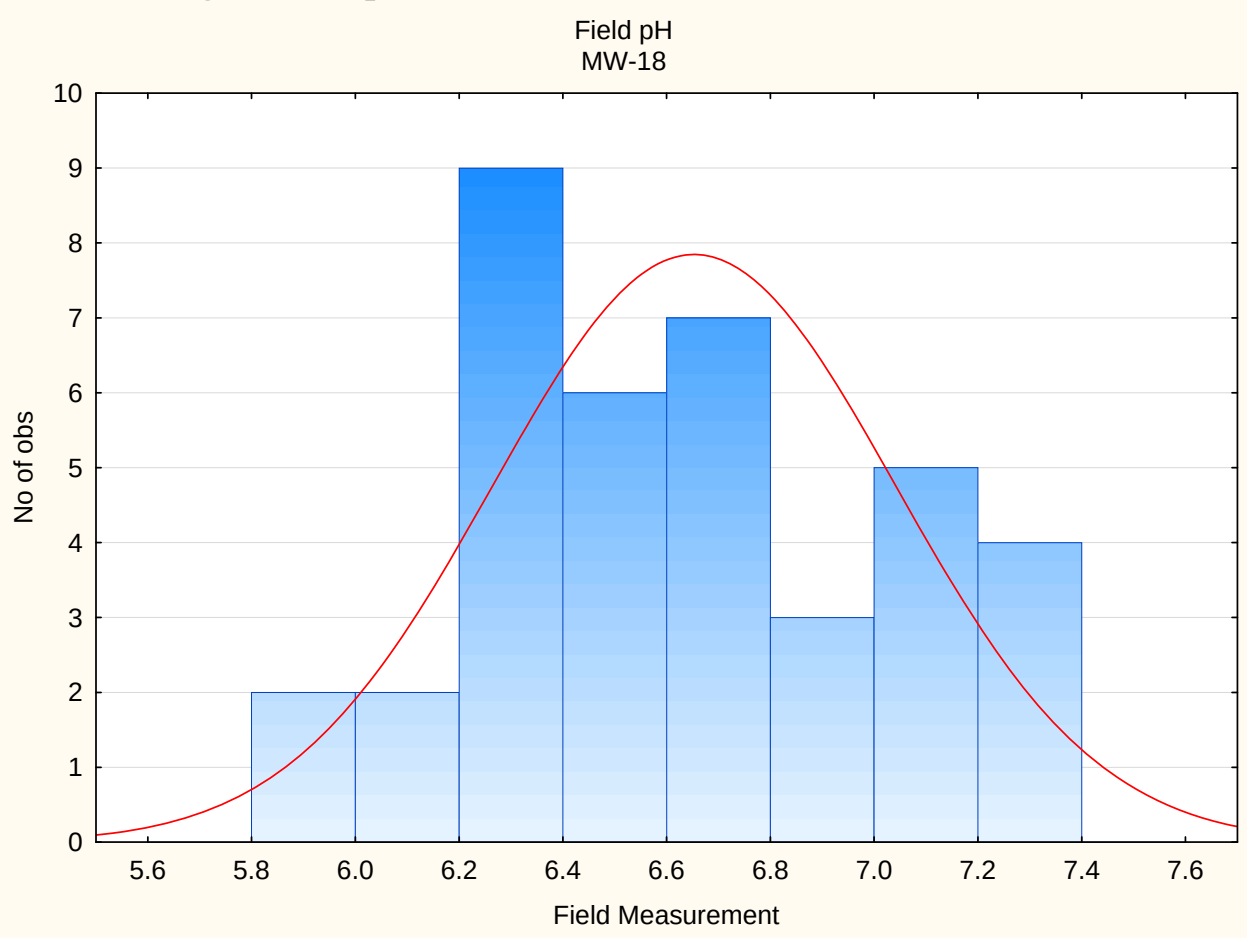
Appendix D-3
Histograms for pH in Wells with Constituents with Exceedances



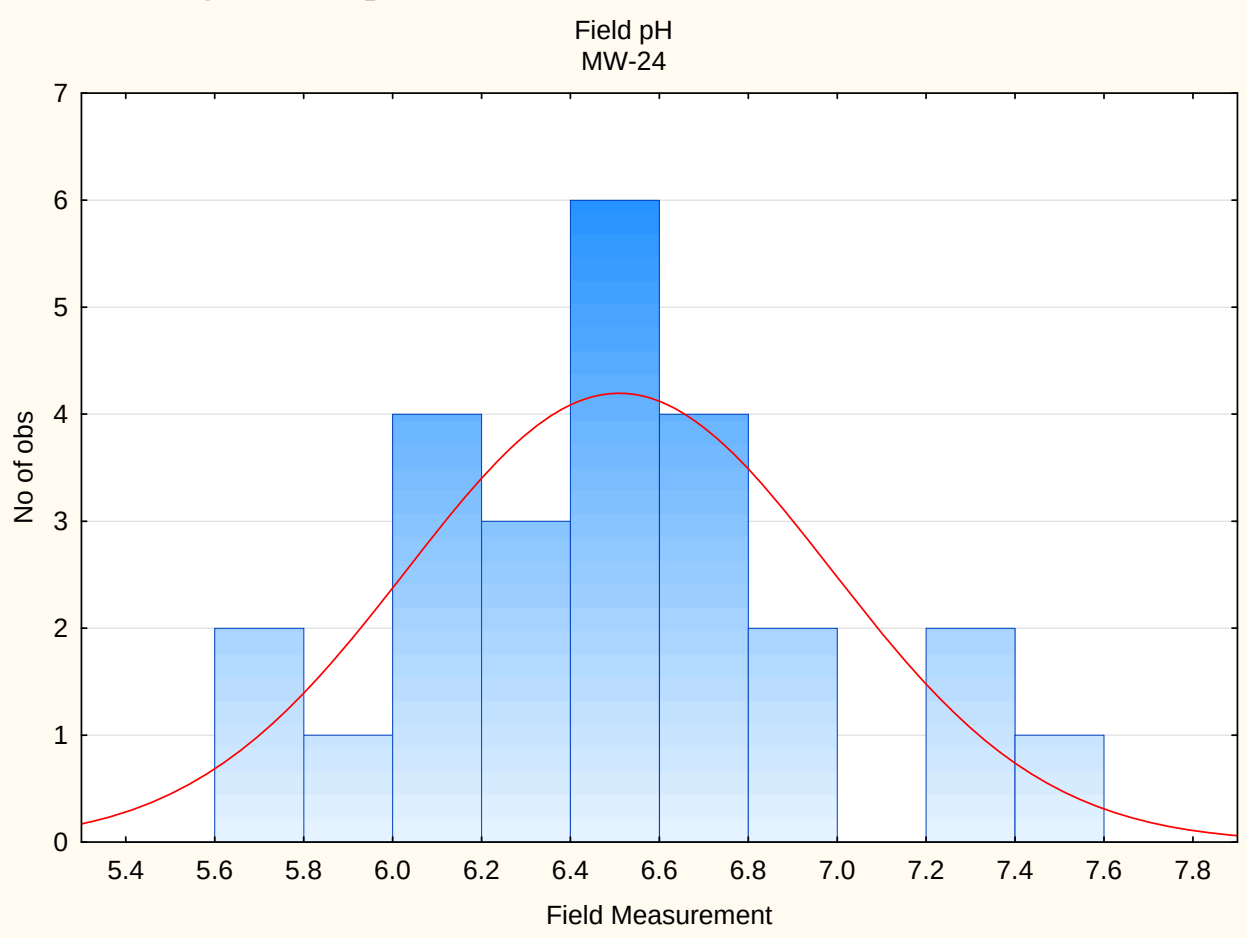
Appendix D-3
Histograms for pH in Wells with Constituents with Exceedances



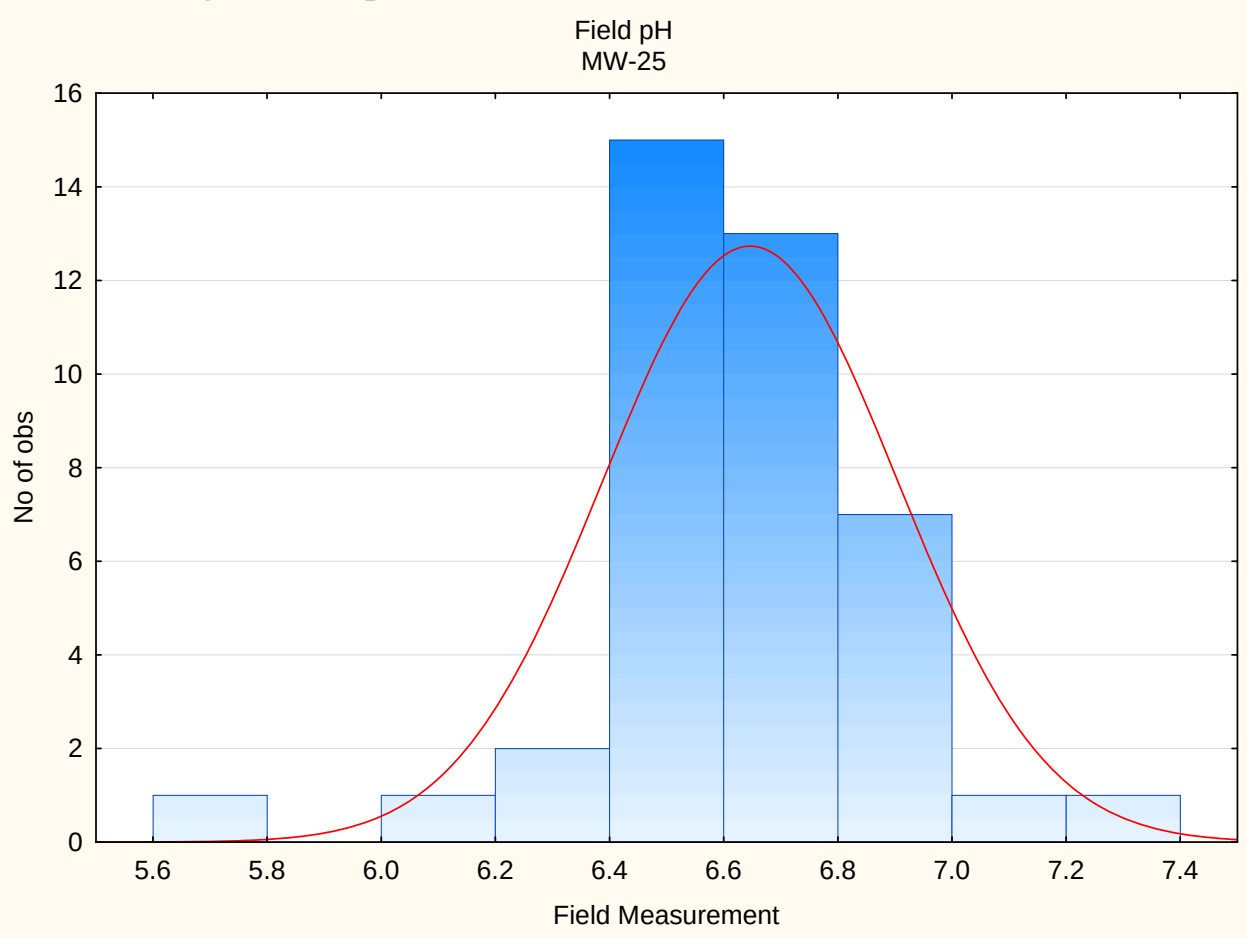
Appendix D-3
Histograms for pH in Wells with Constituents with Exceedances



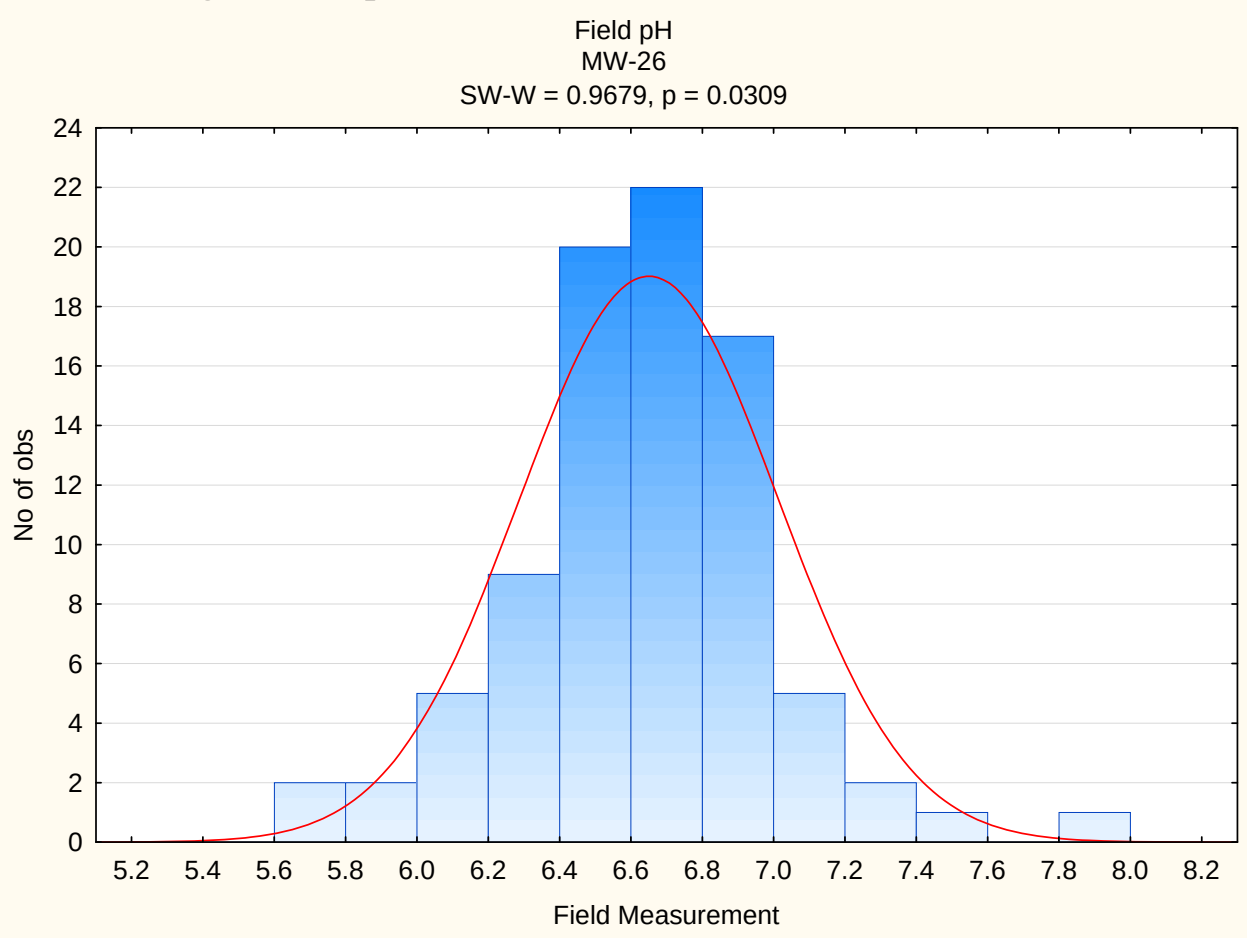
Appendix D-3
Histograms for pH in Wells with Constituents with Exceedances



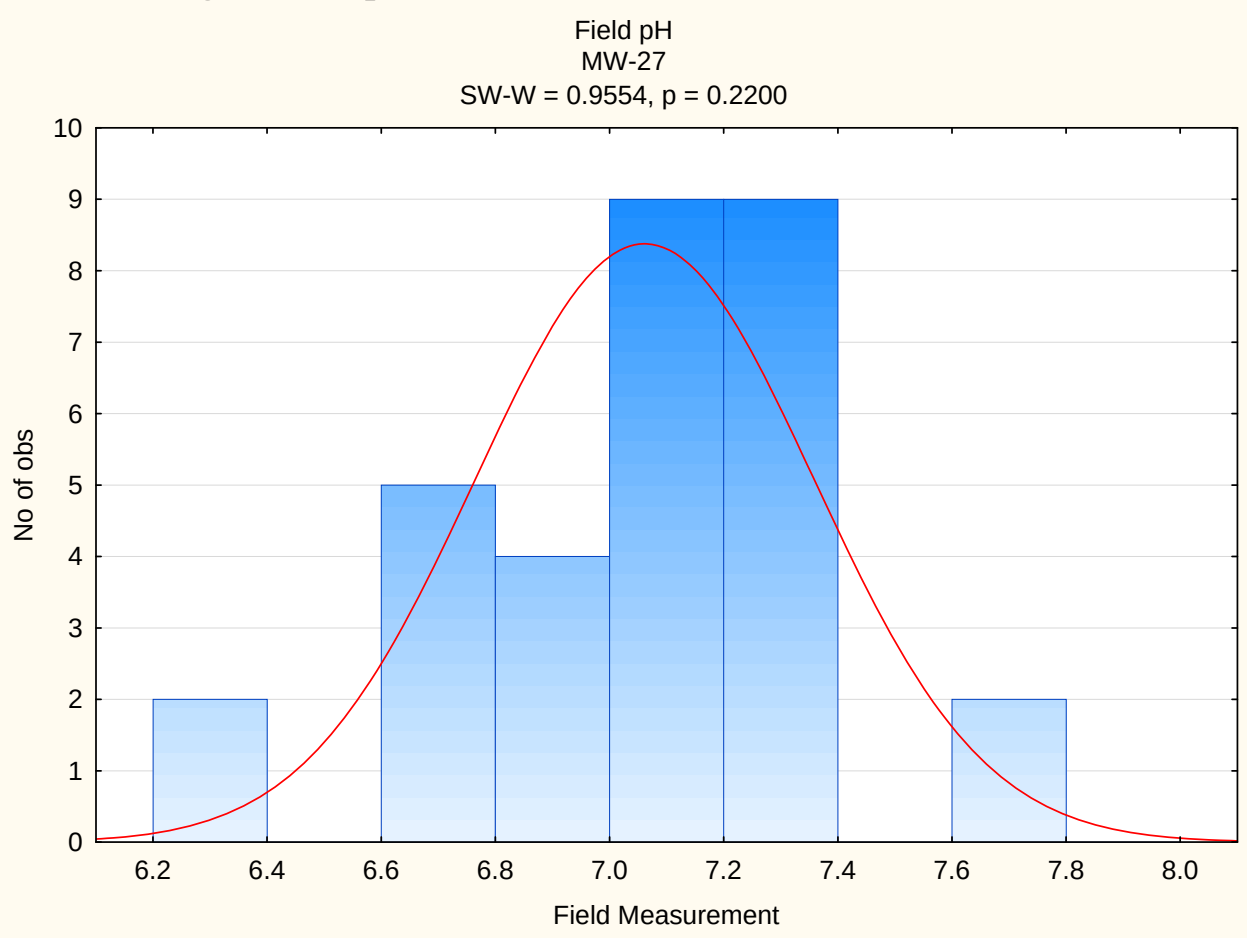
Appendix D-3
Histograms for pH in Wells with Constituents with Exceedances



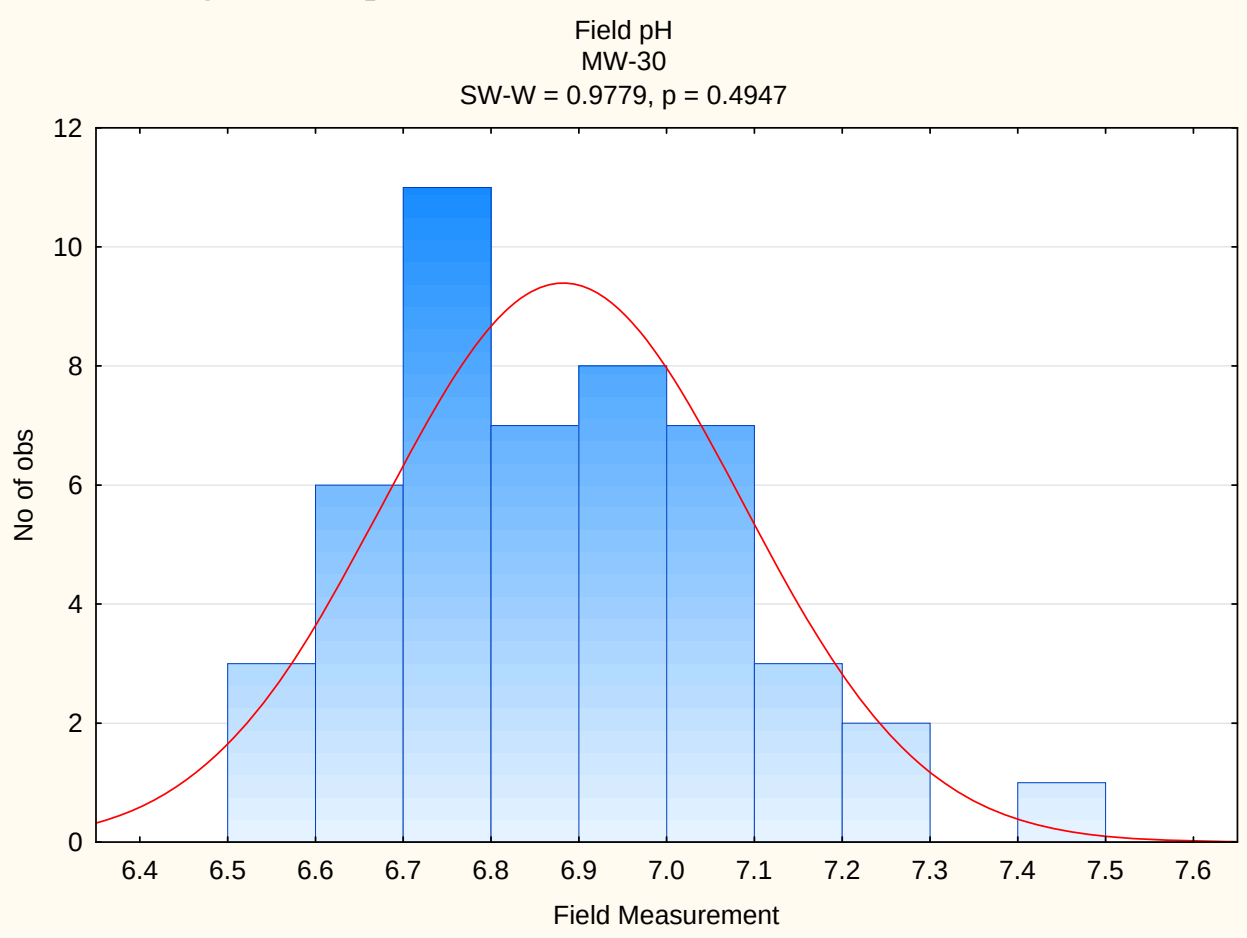
Appendix D-3
Histograms for pH in Wells with Constituents with Exceedances



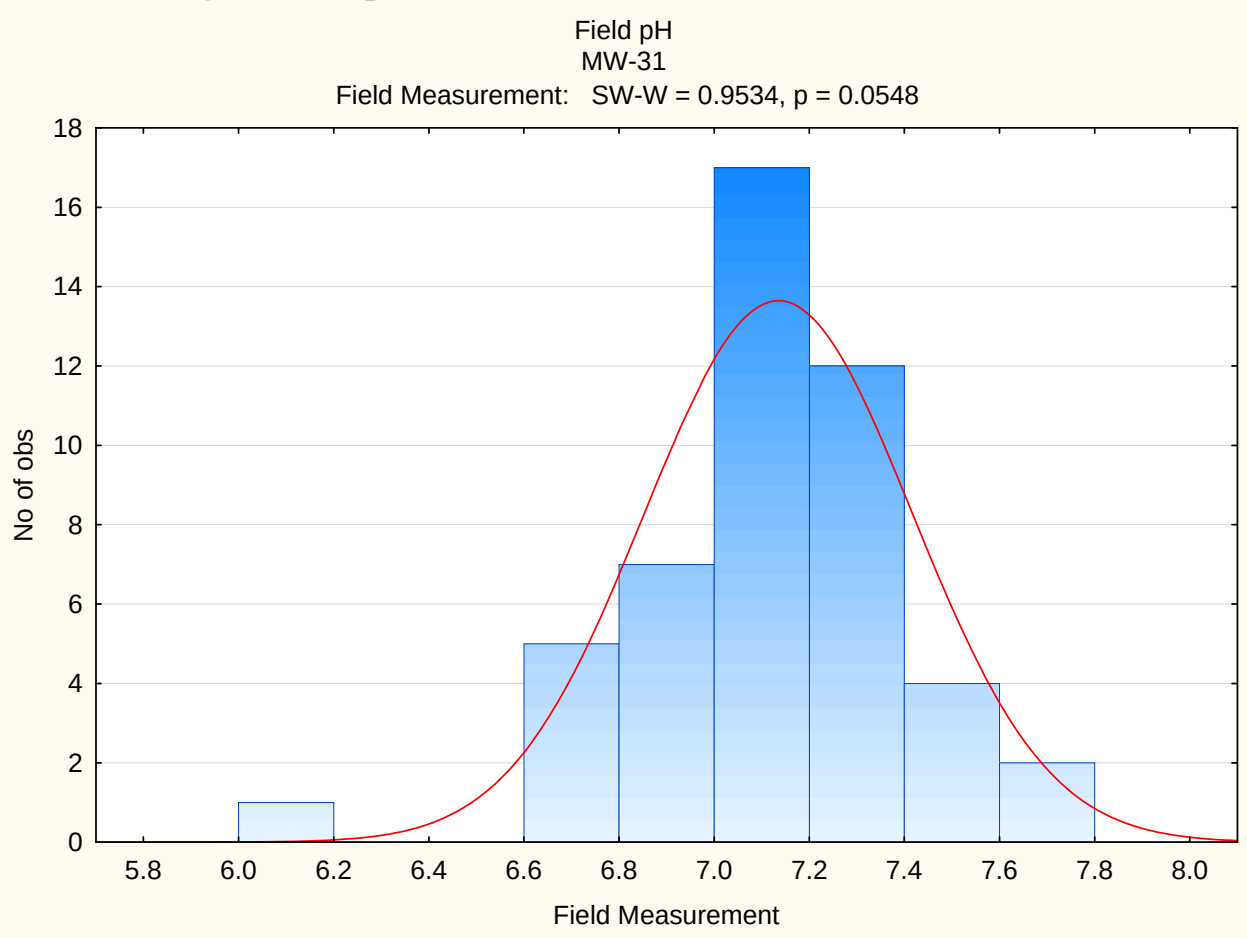
Appendix D-3
Histograms for pH in Wells with Constituents with Exceedances



Appendix D-3
Histograms for pH in Wells with Constituents with Exceedances

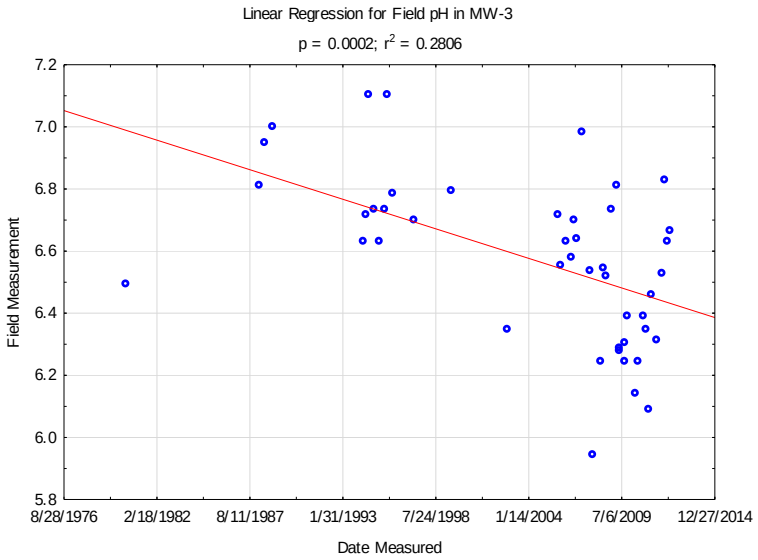


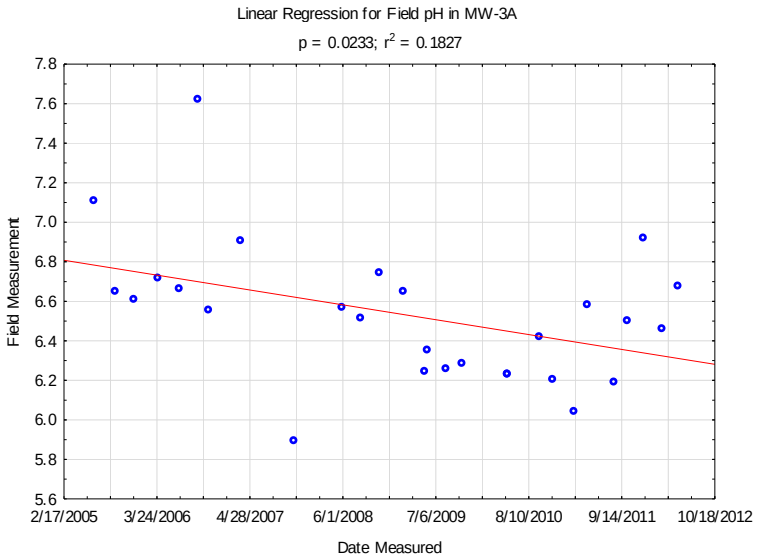
Appendix D-3
Histograms for pH in Wells with Constituents with Exceedances



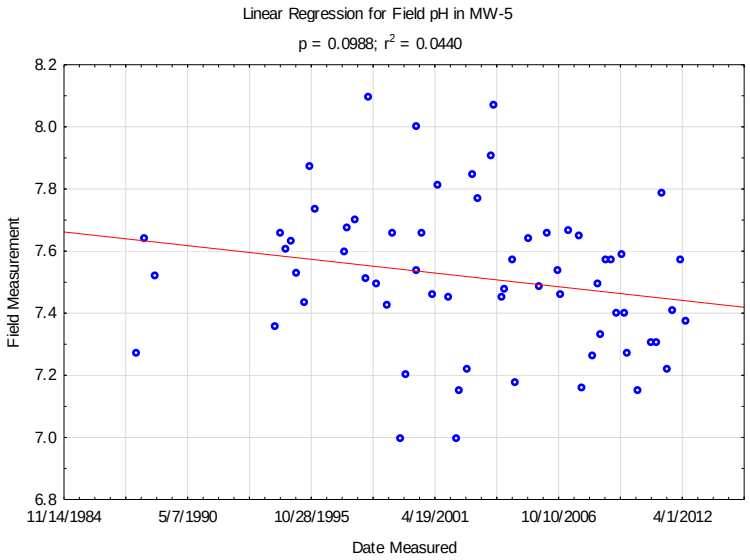
D-4 Linear Regressions for pH in all Wells with Exceedances

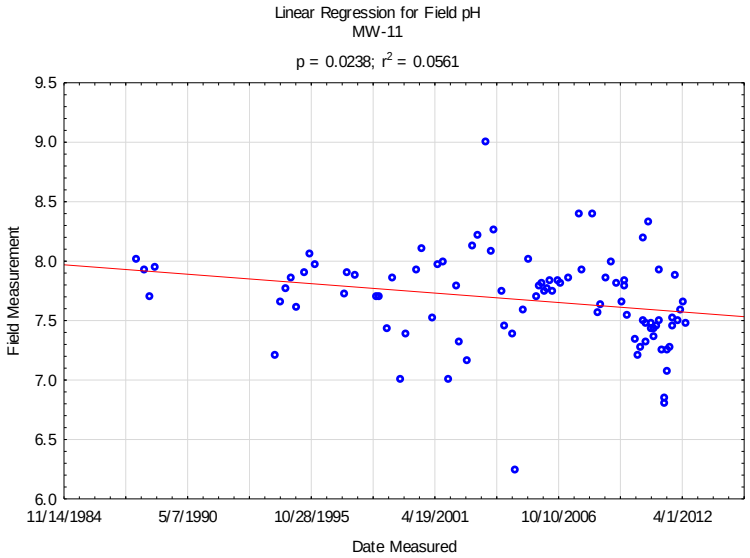
Appendix D-4
Linear Regressions for pH in all Wells with Exceedances



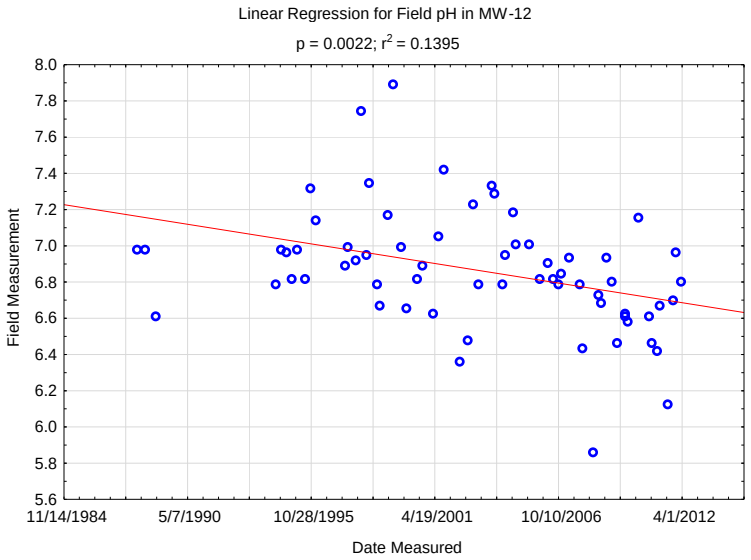


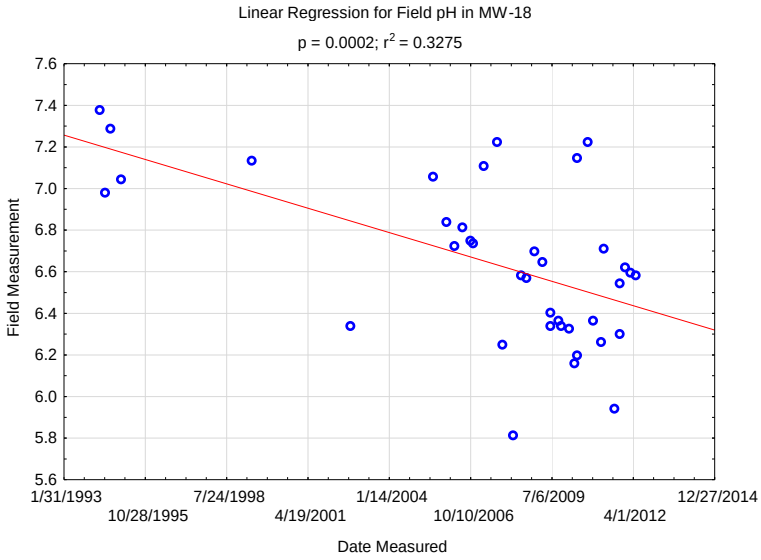
Appendix D-4
Linear Regressions for pH in all Wells with Exceedances



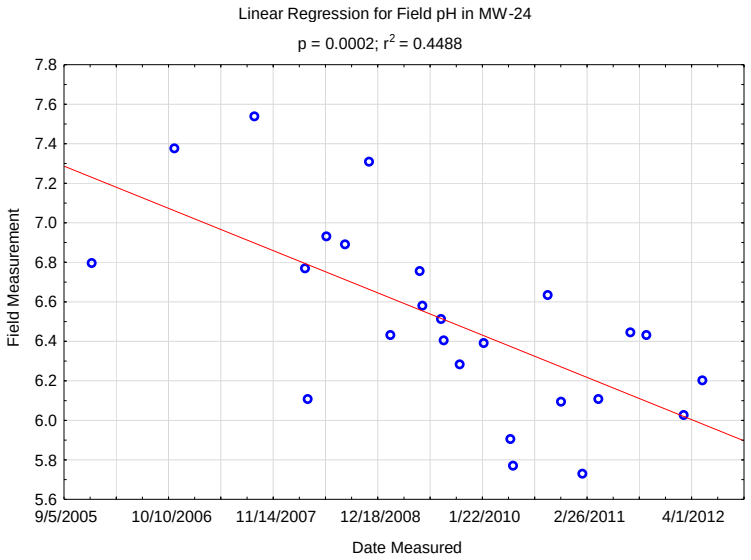


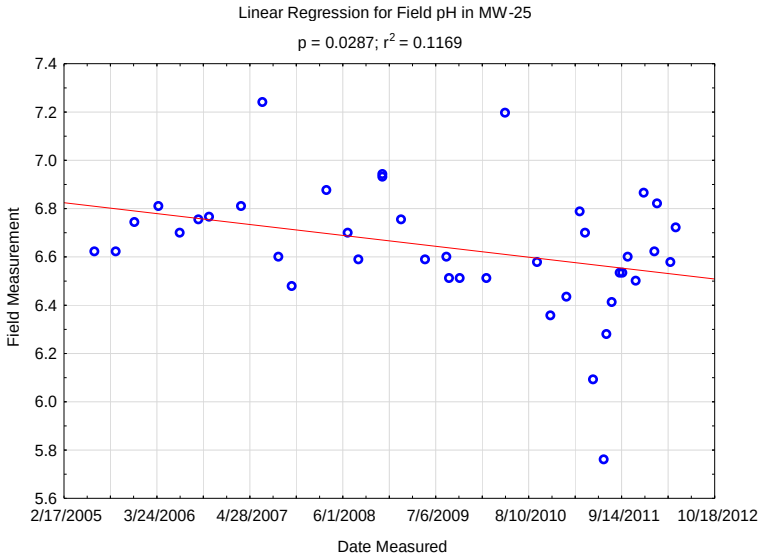
Appendix D-4
Linear Regressions for pH in all Wells with Exceedances



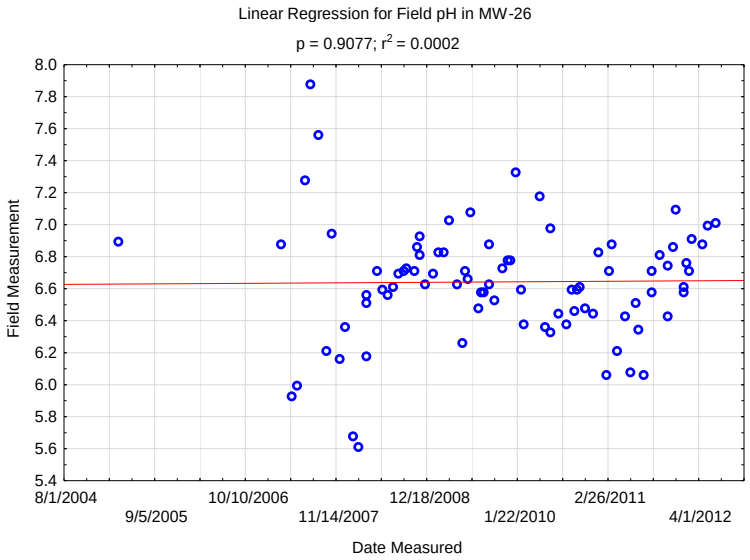


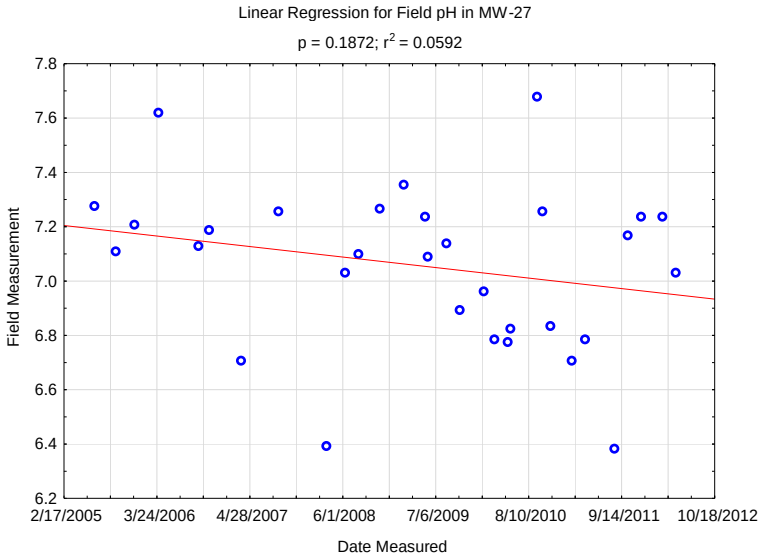
Appendix D-4
Linear Regressions for pH in all Wells with Exceedances



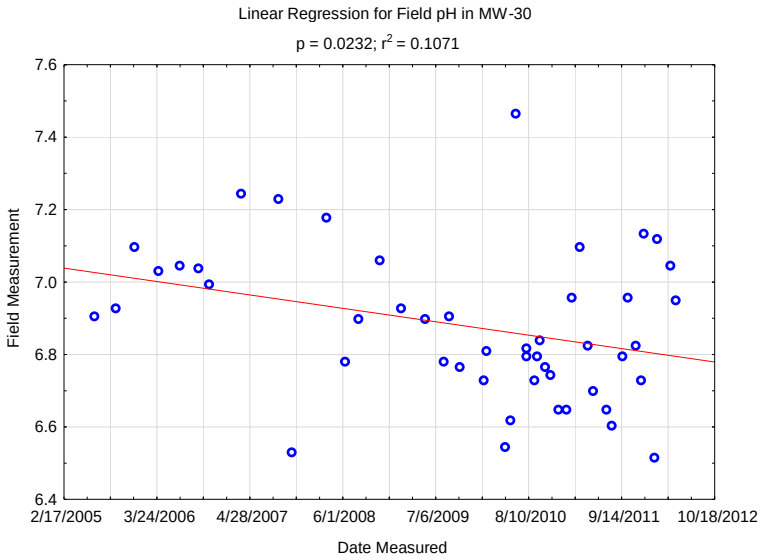


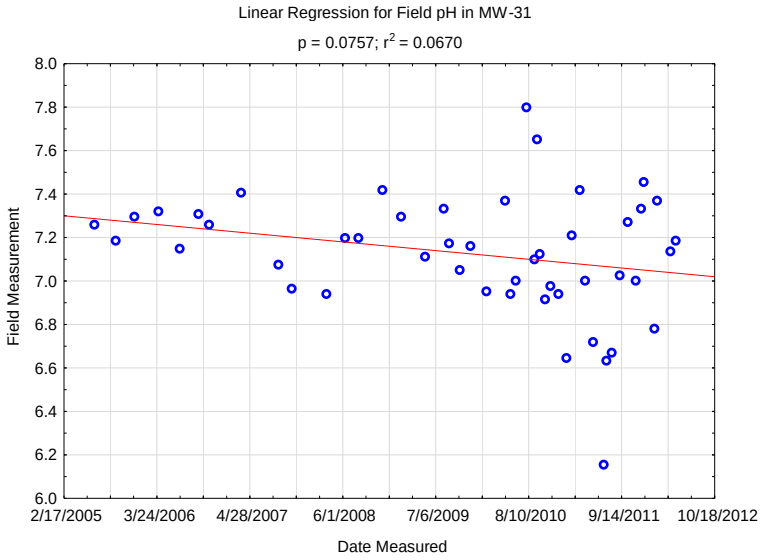
Appendix D-4
Linear Regressions for pH in all Wells with Exceedances





Appendix D-4
Linear Regressions for pH in all Wells with Exceedances





D-5 Mann-Kendall Analysis for Constituents not Lognormally or Normally Distributed

Appendix D-5
Mann-Kendall Analysis for Constituents not Lognormally or Normally Distributed

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	9/9/2012 3:32:28 PM
From File	Sheet1.wst
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

pH-mw-11

General Statistics

Number of Values	91
Minimum	6.25
Maximum	9
Mean	7.679
Geometric Mean	7.669
Median	7.71
Standard Deviation	0.39
SEM	0.0409

Mann-Kendall Test

Test Value (S)	-924
Critical Value (0.05)	-1.645
Standard Deviation of S	291.7
Standardized Value of S	-3.165
Approximate p-value	0.0007762

Statistically significant evidence of a decreasing trend at the specified level of significance.

pH-mw-12

General Statistics

Number of Values	65
Minimum	5.86
Maximum	7.9
Mean	6.869
Geometric Mean	6.861
Median	6.82
Standard Deviation	0.331
SEM	0.0411

Mann-Kendall Test

Test Value (S)	-631
Critical Value (0.05)	-1.645
Standard Deviation of S	176.5
Standardized Value of S	-3.569

Approximate p-value	0.0001792

Statistically significant evidence of a decreasing trend at the specified level of significance.

pH-mw-25

General Statistics

Number of Values	41
Minimum	5.77
Maximum	7.25
Mean	6.641
Geometric Mean	6.636
Median	6.63
Standard Deviation	0.257
SEM	0.0401

Mann-Kendall Test

Test Value (S)	-180
Critical Value (0.05)	-1.645
Standard Deviation of S	88.96
Standardized Value of S	-2.012
Approximate p-value	0.0221

Statistically significant evidence of a decreasing trend at the specified level of significance.

pH-mw-26

General Statistics

Number of Values	86
Minimum	5.61
Maximum	7.88
Mean	6.643
Geometric Mean	6.633
Median	6.64
Standard Deviation	0.361
SEM	0.0389

Mann-Kendall Test

Test Value (S)	160
Critical Value (0.05)	1.645
Standard Deviation of S	268
Standardized Value of S	0.593
Approximate p-value	0.277

Insufficient evidence to identify a significant trend at the specified level of significance.

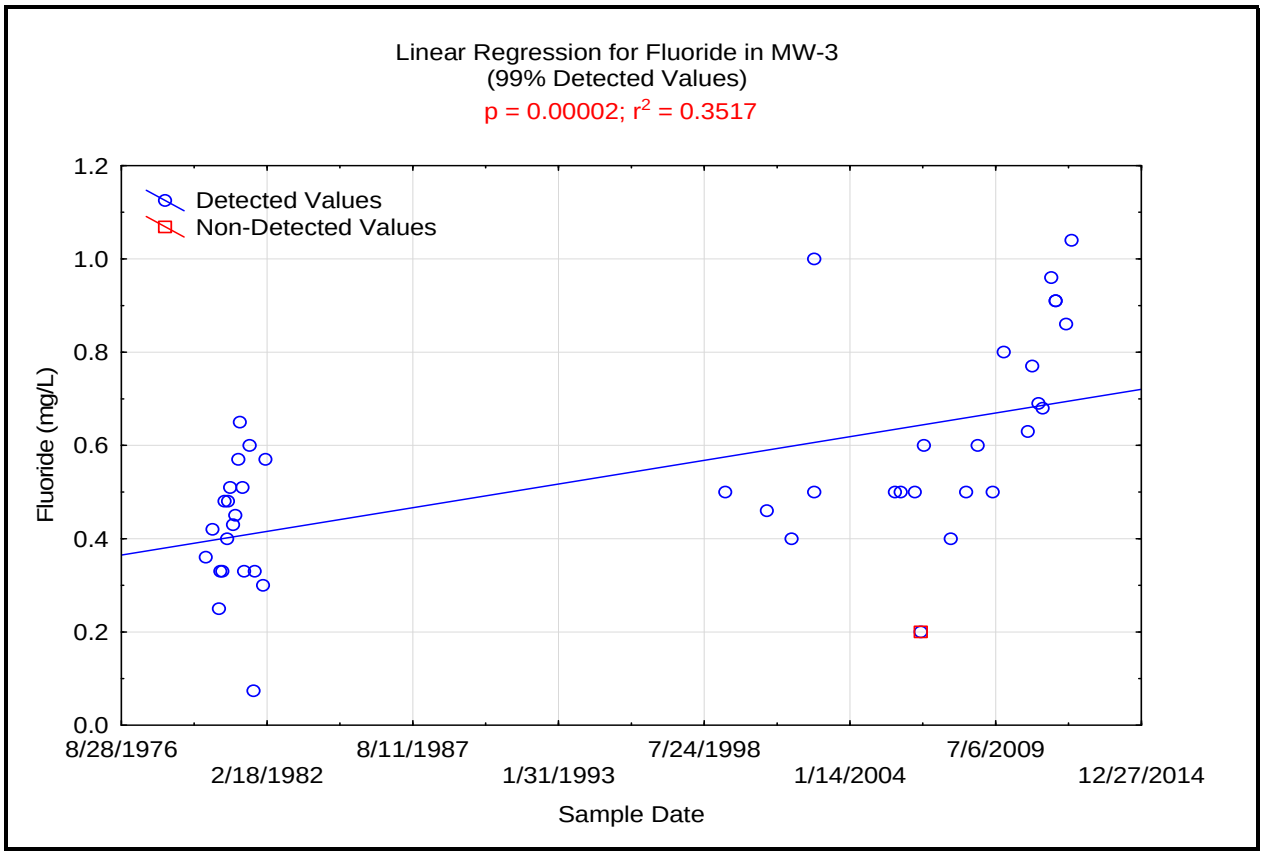
APPENDIX E

Time Concentration Plots for Parameters with Consecutive Exceedances

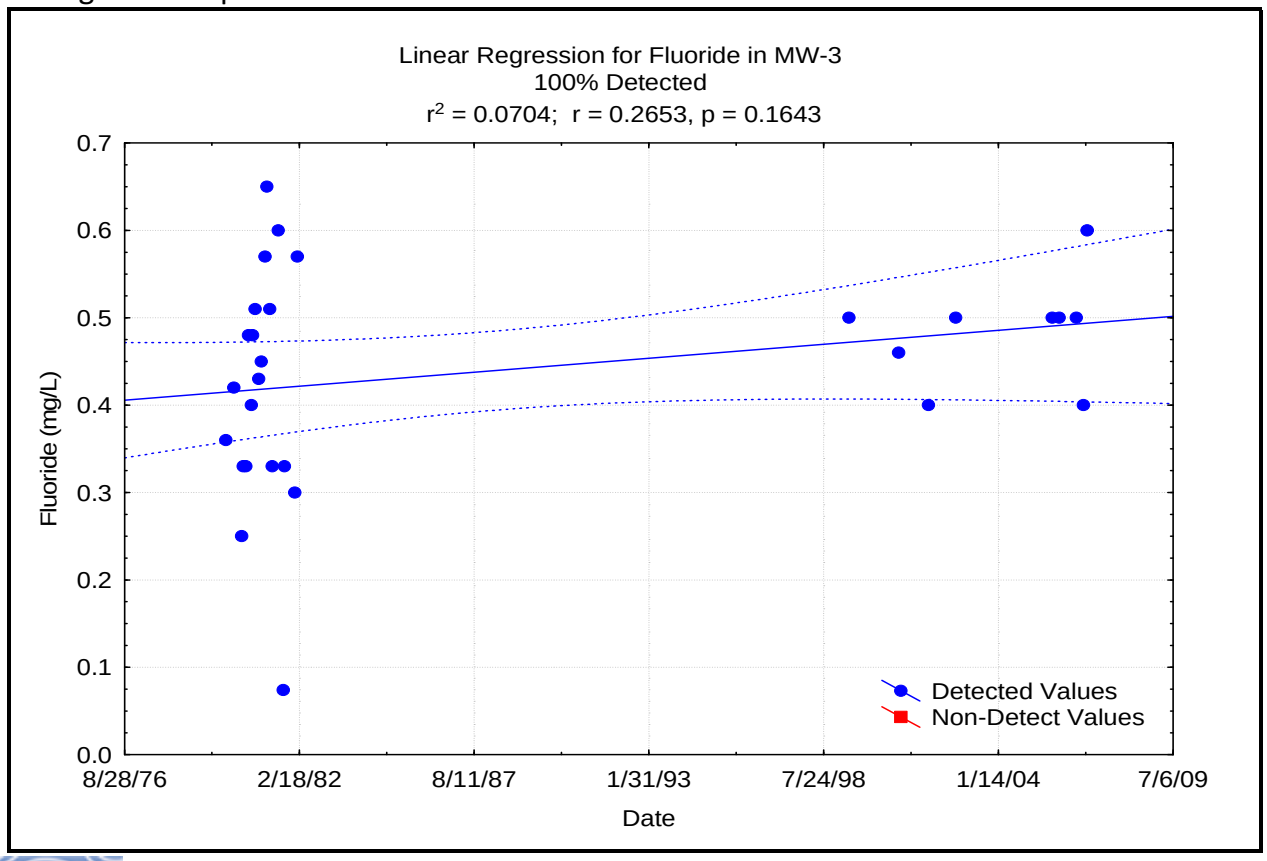
E-1 Linear Regression for All Constituents with Exceedances Compared to Linear Regressions from Background Reports

Appendix E-1
Linear Regression for All Constituents with Exceedances Compared to Linear Regressions from Background Reports

SAR Trend Plot

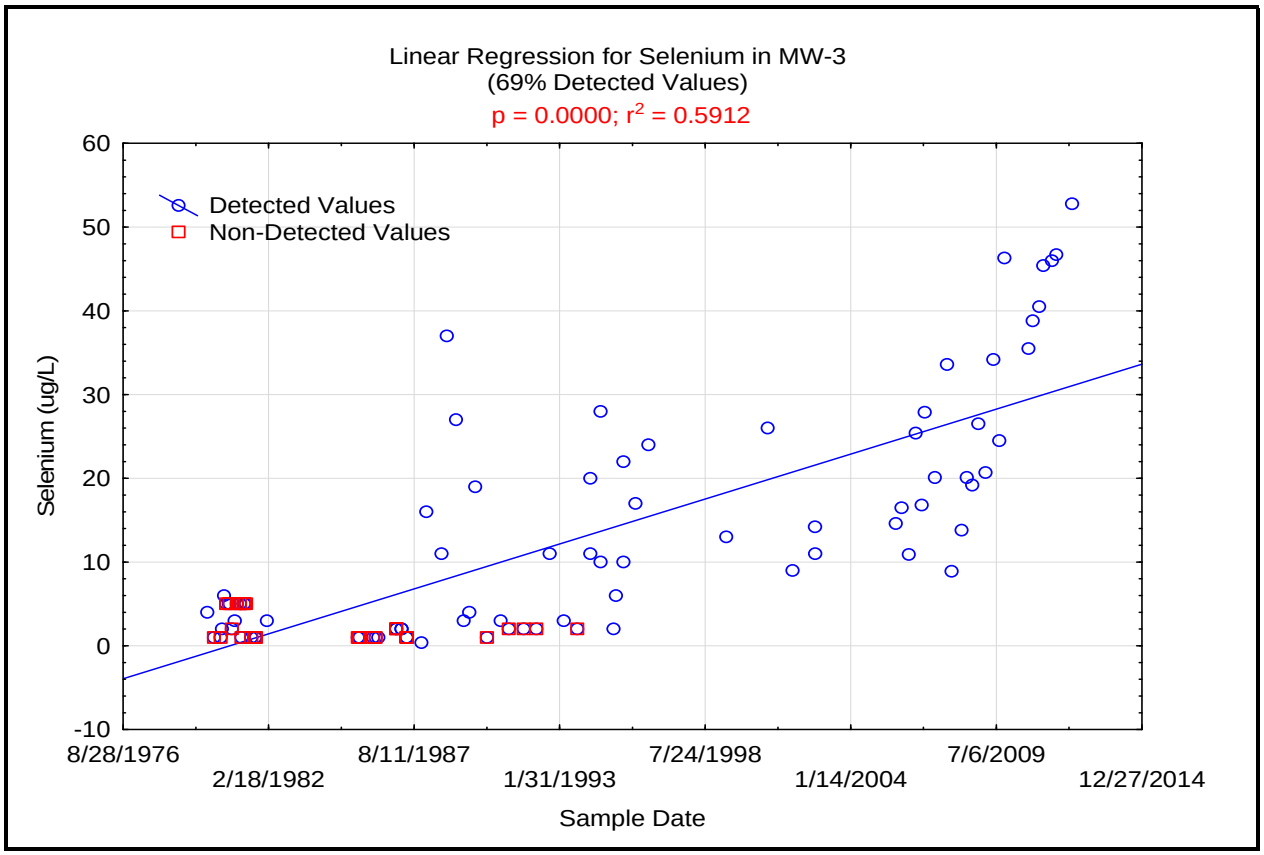


Background Report Trend Plot

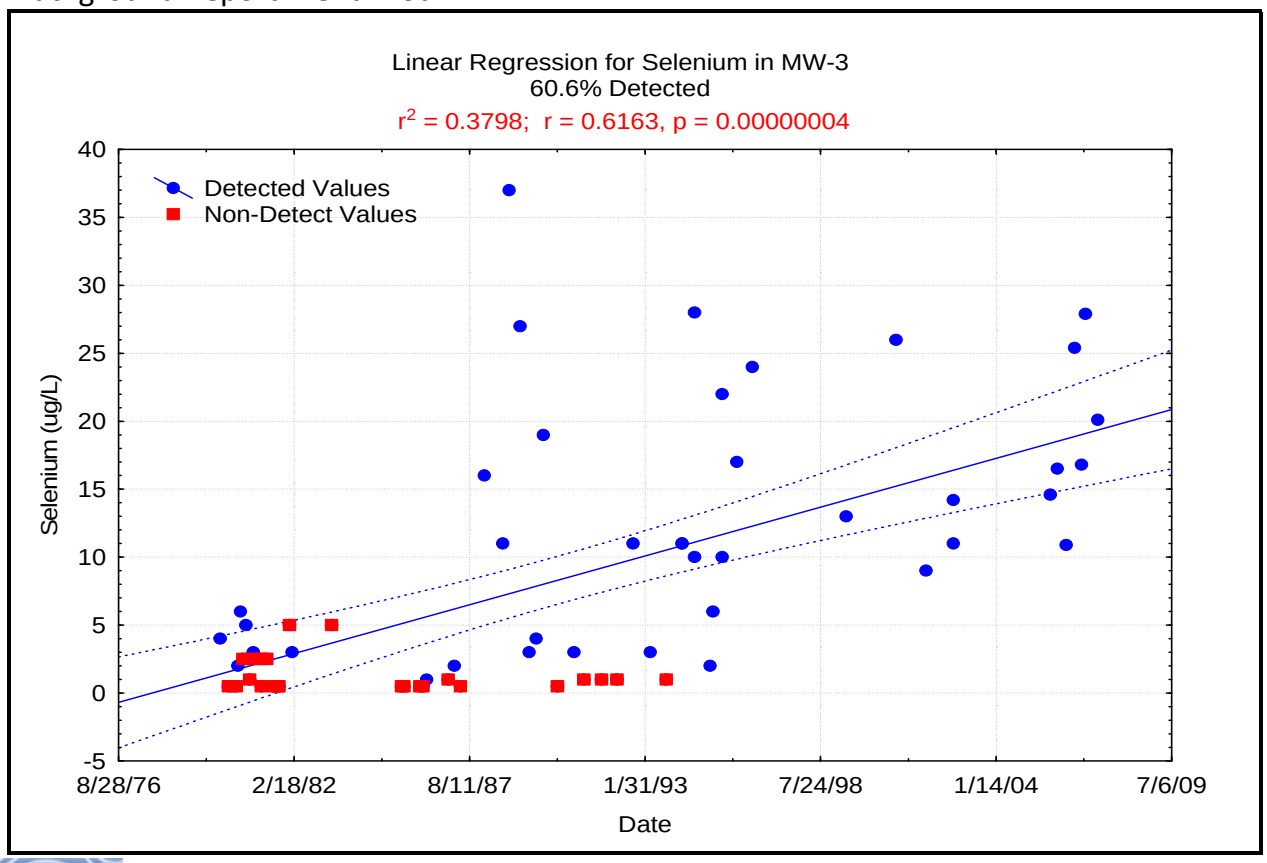


Appendix E-1
Linear Regression for All Constituents with Exceedances Compared to Linear Regressions from Background Reports

SAR Trend Plot

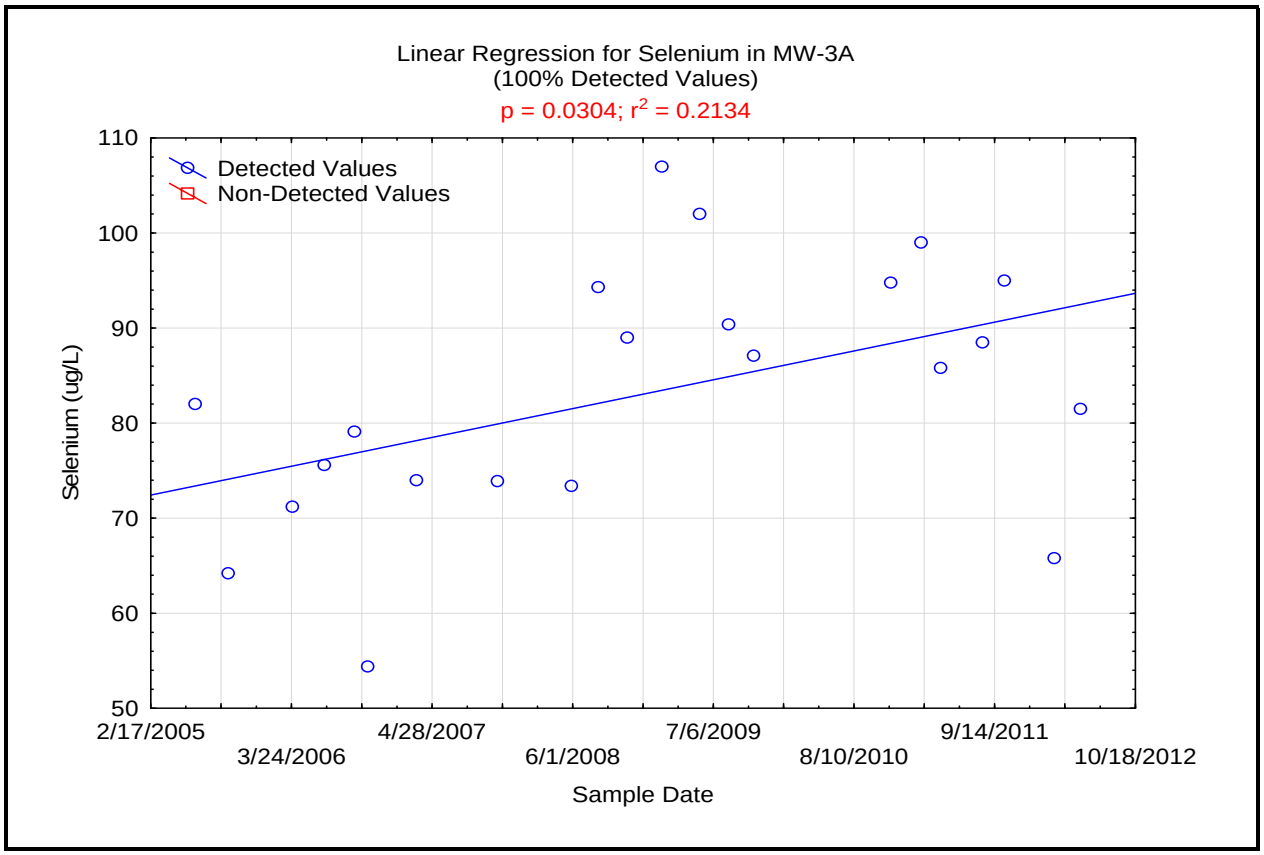


Background Report Trend Plot

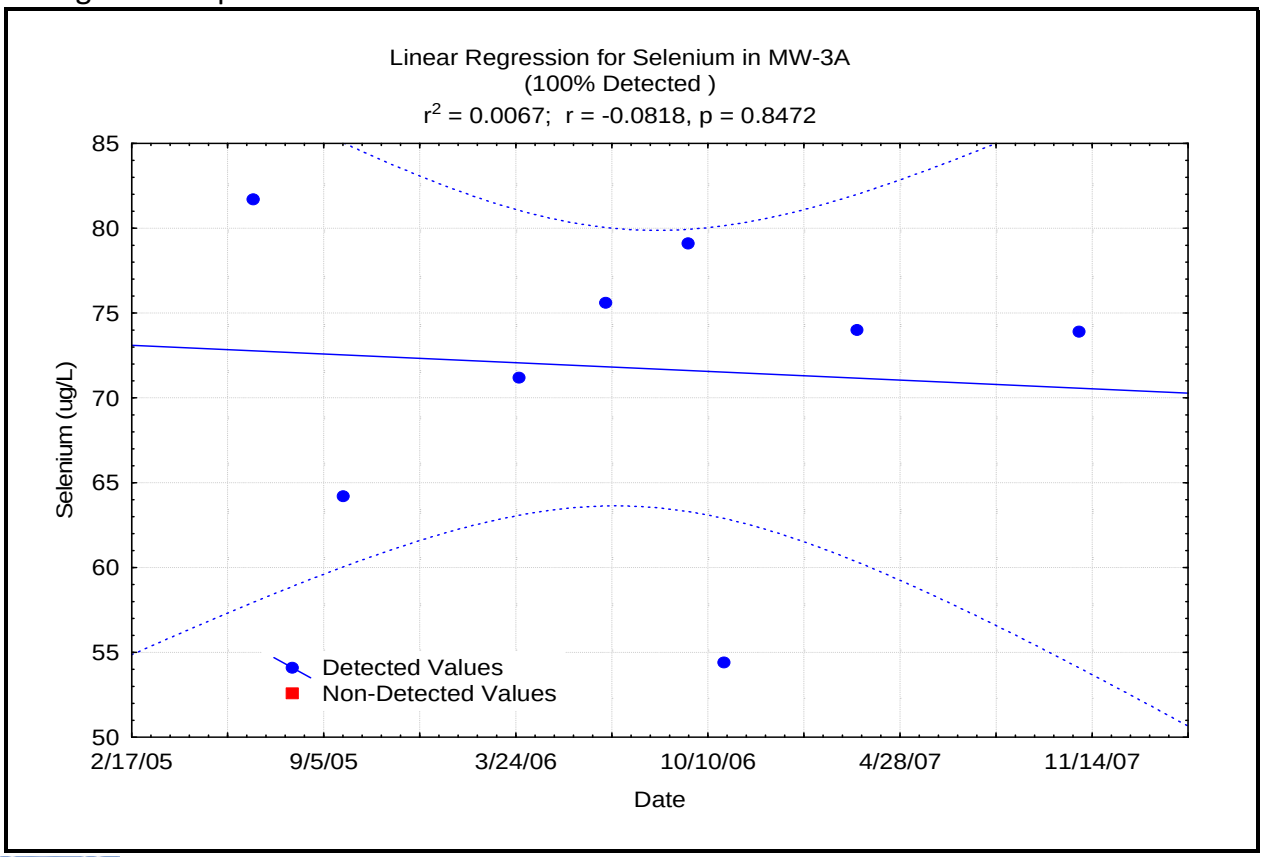


Appendix E-1
Linear Regression for All Constituents with Exceedances Compared to Linear Regressions from Background Reports

SAR Trend Plot

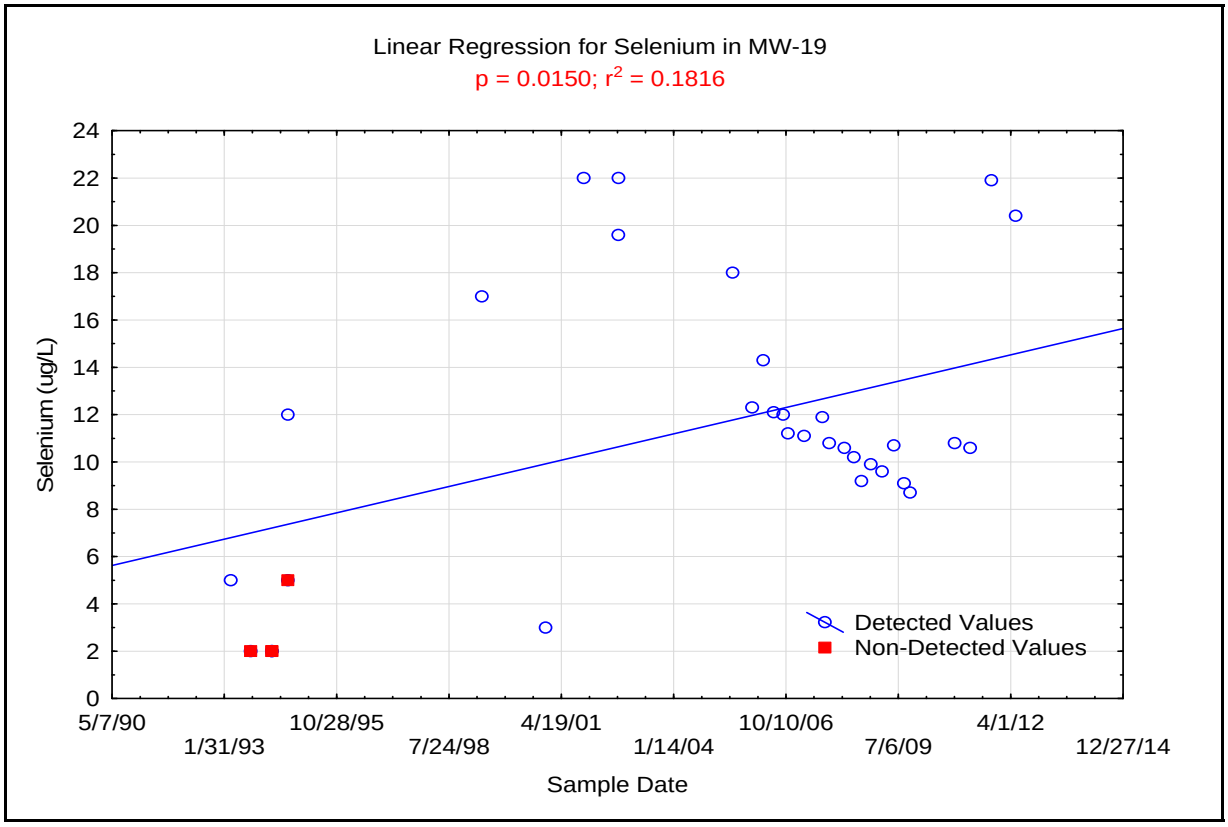


Background Report Trend Plot

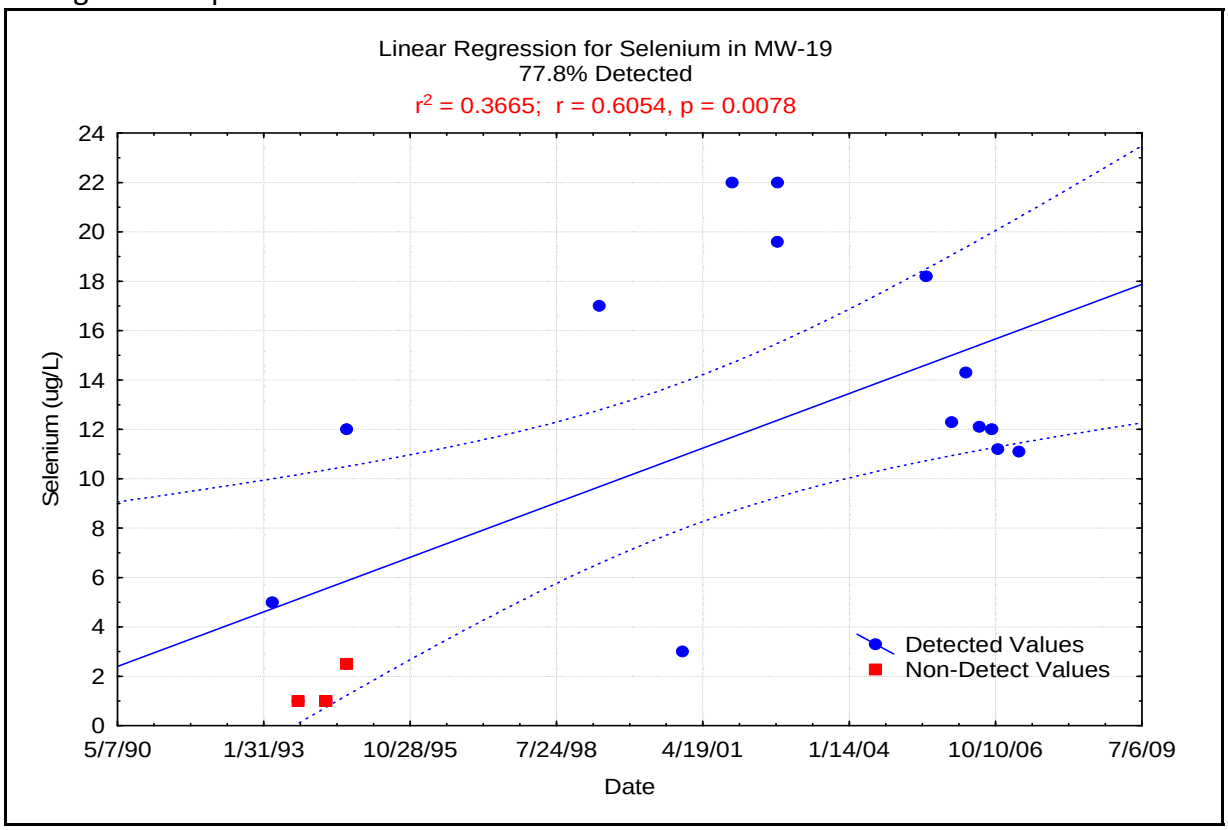


Appendix E-1
Linear Regression for All Constituents with Exceedances Compared to Linear Regressions from Background Reports

Current Trend Plot

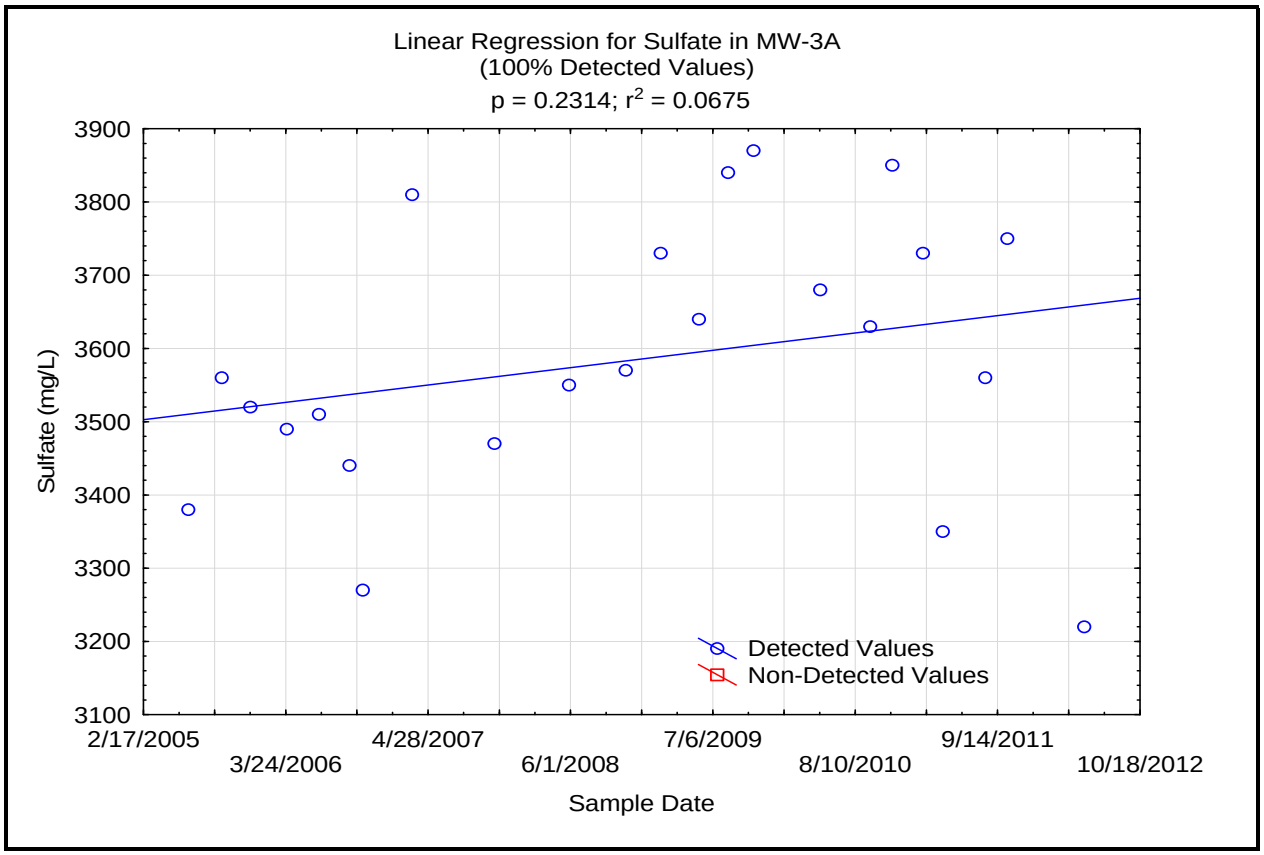


Background Report Trend Plot

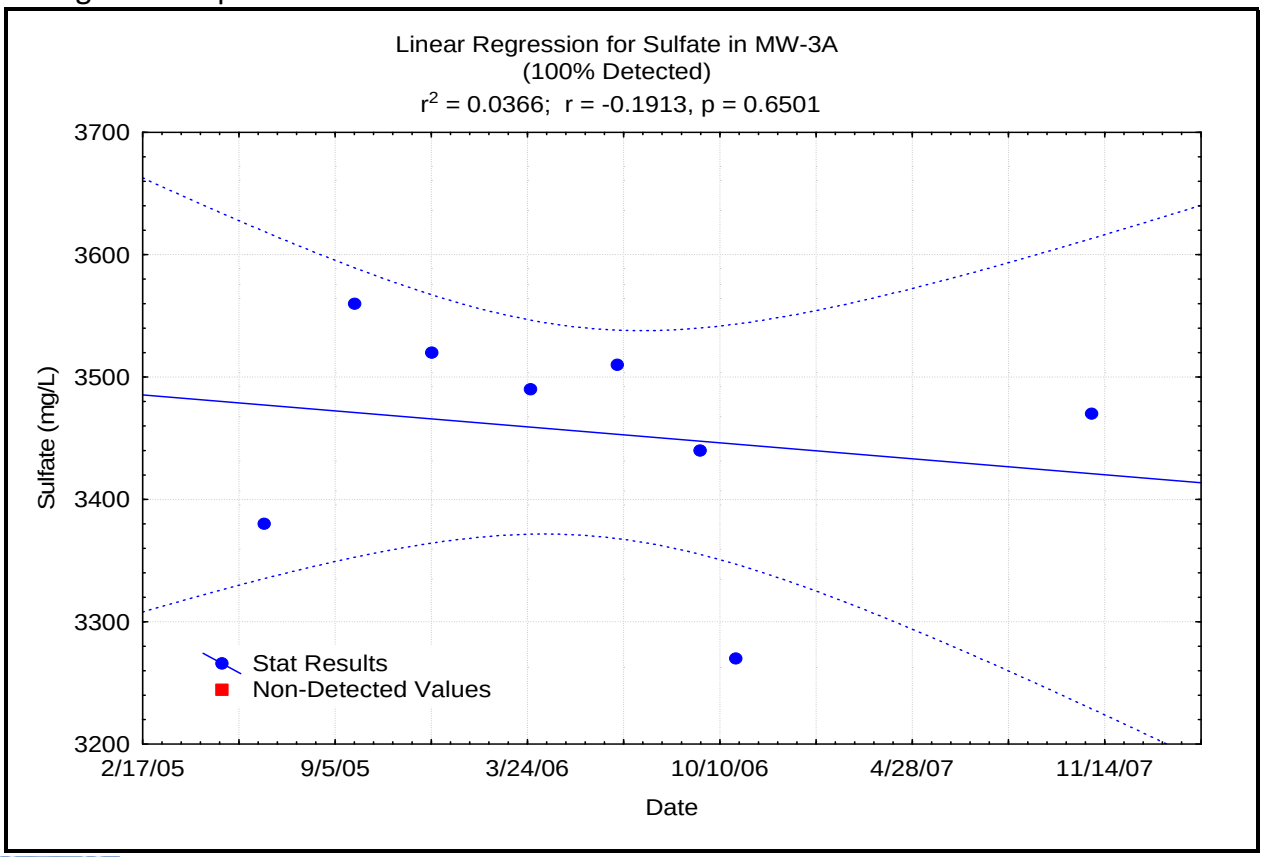


Appendix E-1
Linear Regression for All Constituents with Exceedances Compared to Linear Regressions from Background Reports

SAR Trend Plot

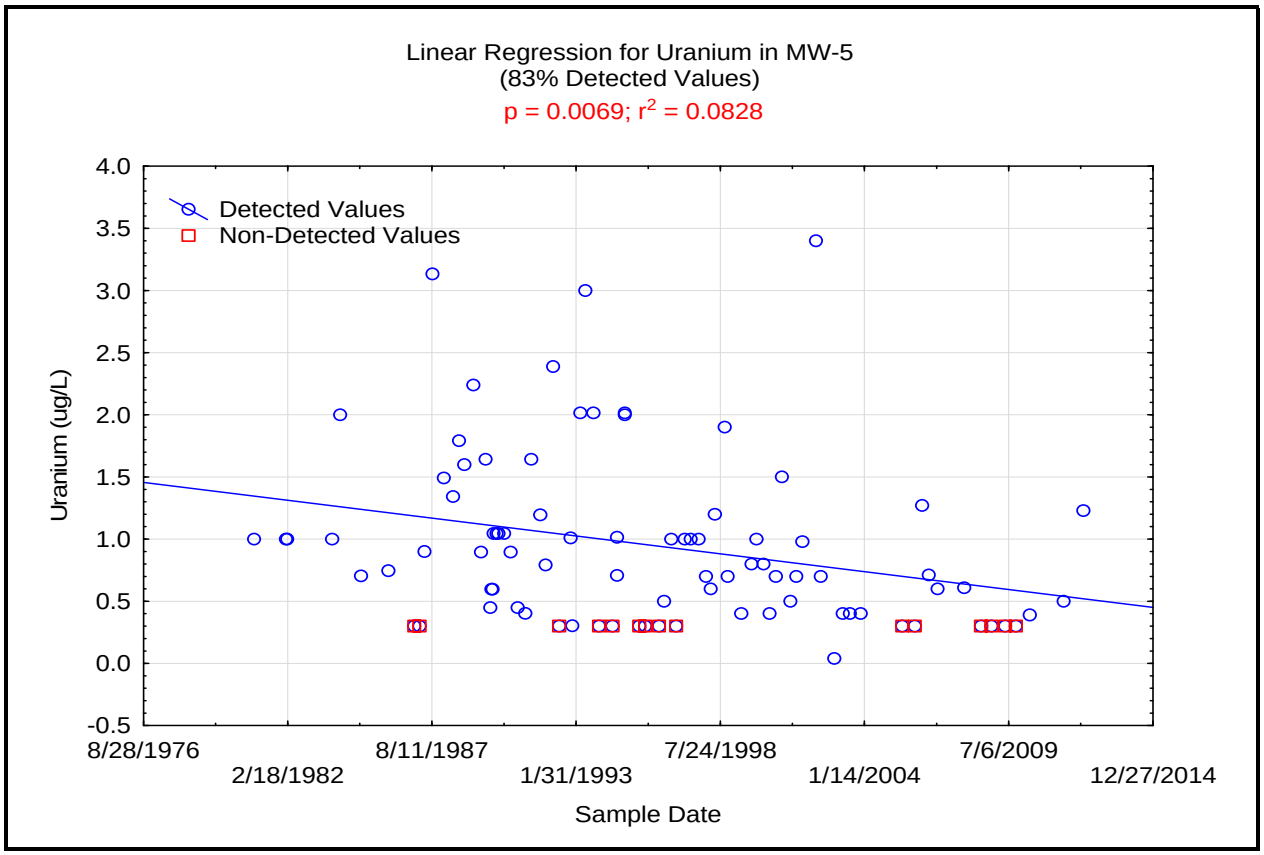


Background Report Trend Plot

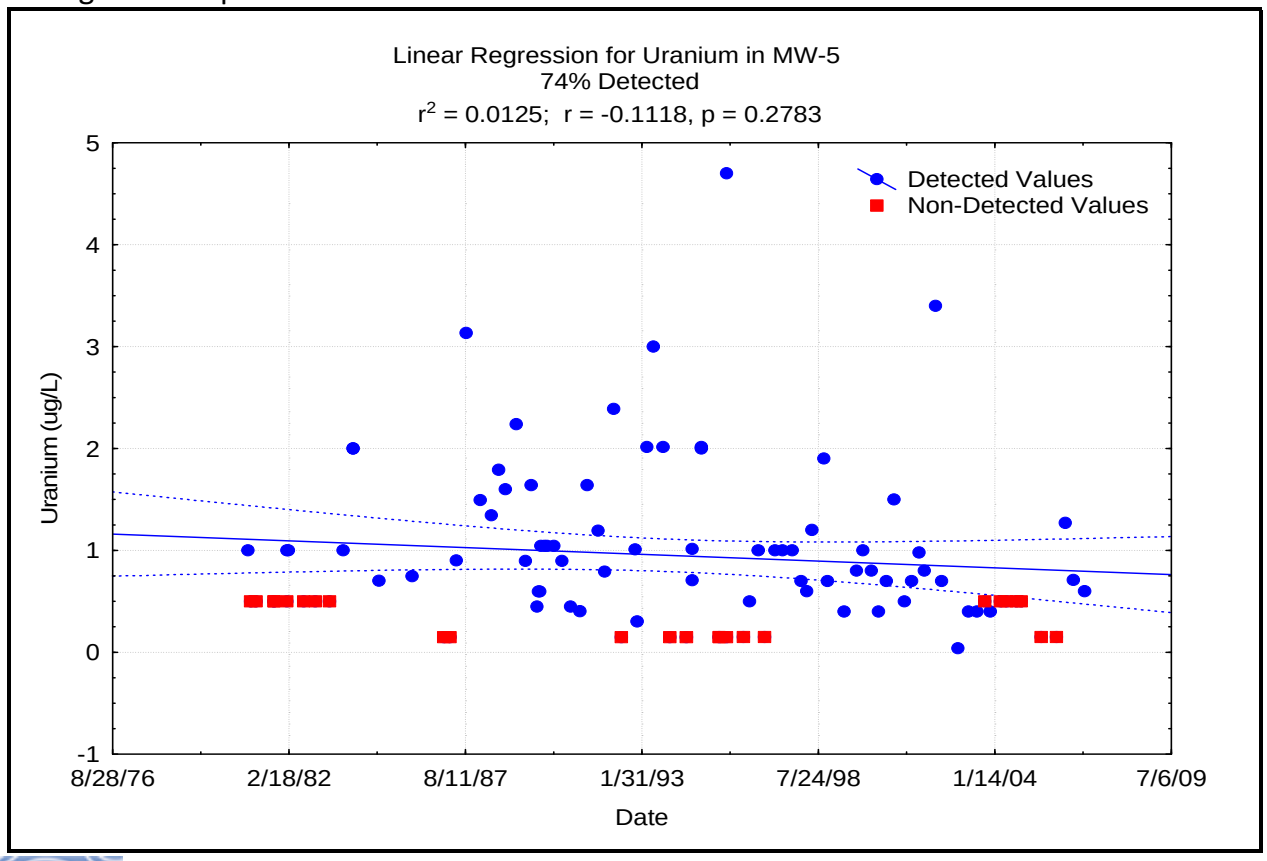


Appendix E-1
Linear Regression for All Constituents with Exceedances Compared to Linear Regressions from Background Reports

SAR Trend Plot

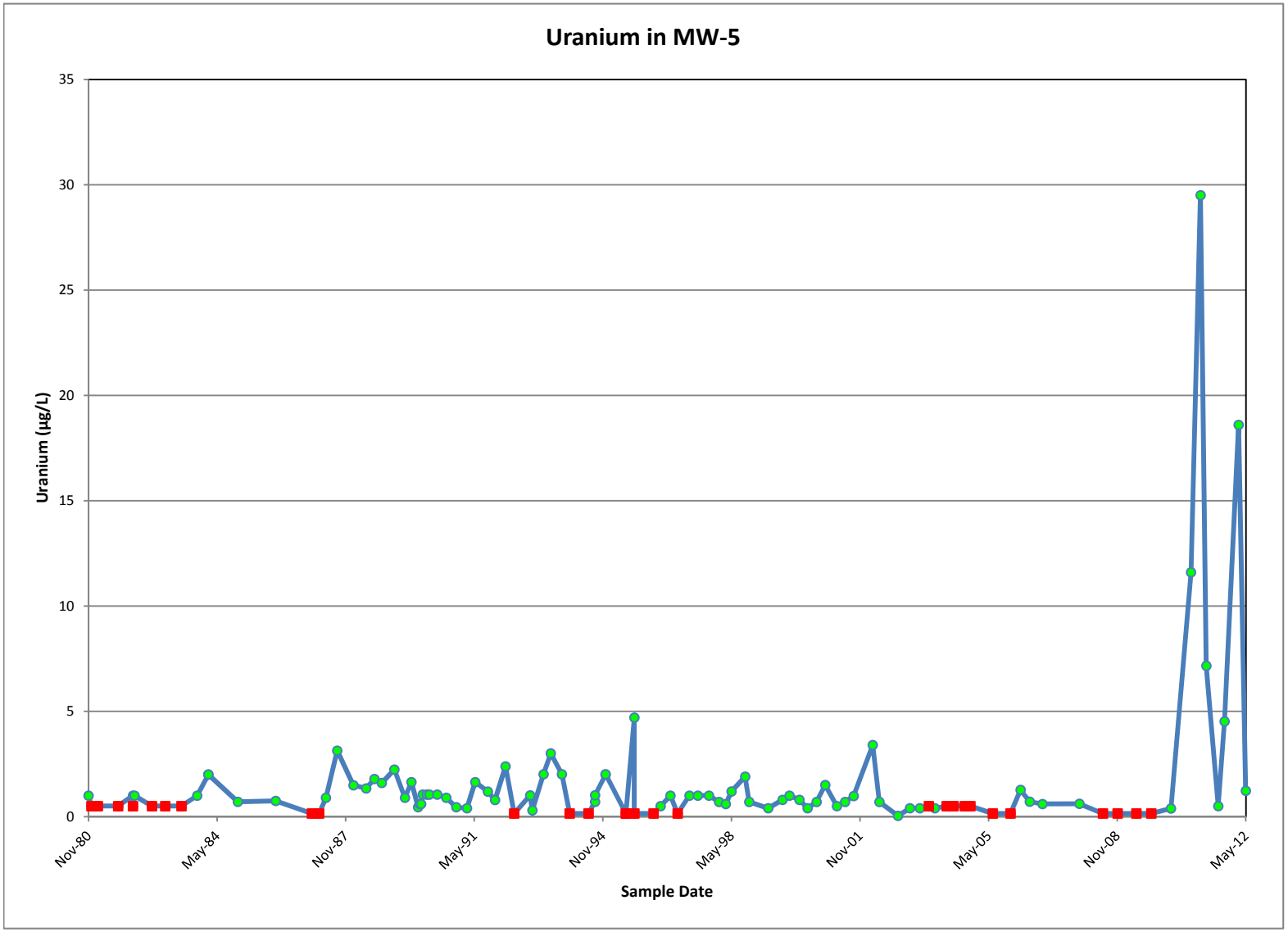


Background Report Trend Plot



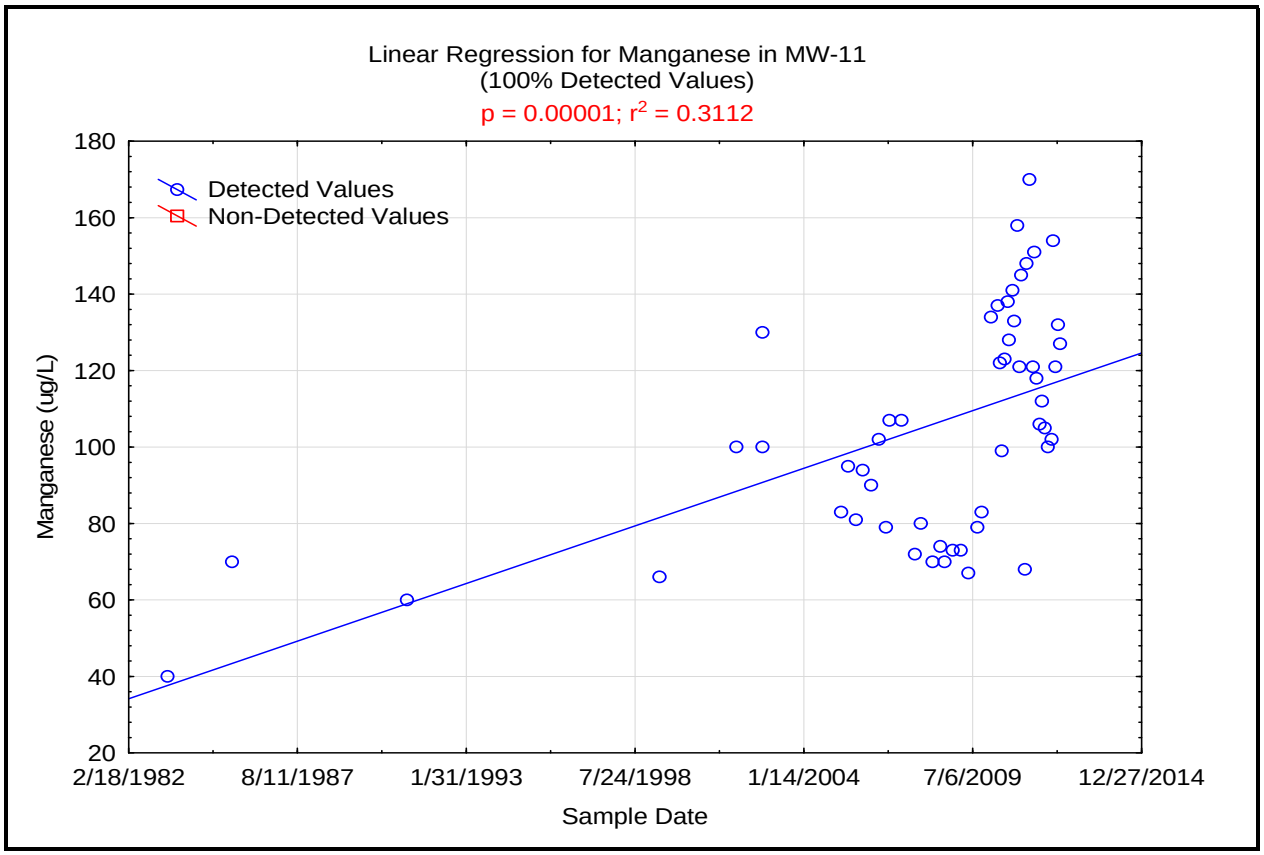
Appendix E-1
Linear Regression for All Constituents with Exceedances
Compared to Linear Regressions from Background Reports

Second Quarter Time Concentration Plot for Uranium in MW-5.

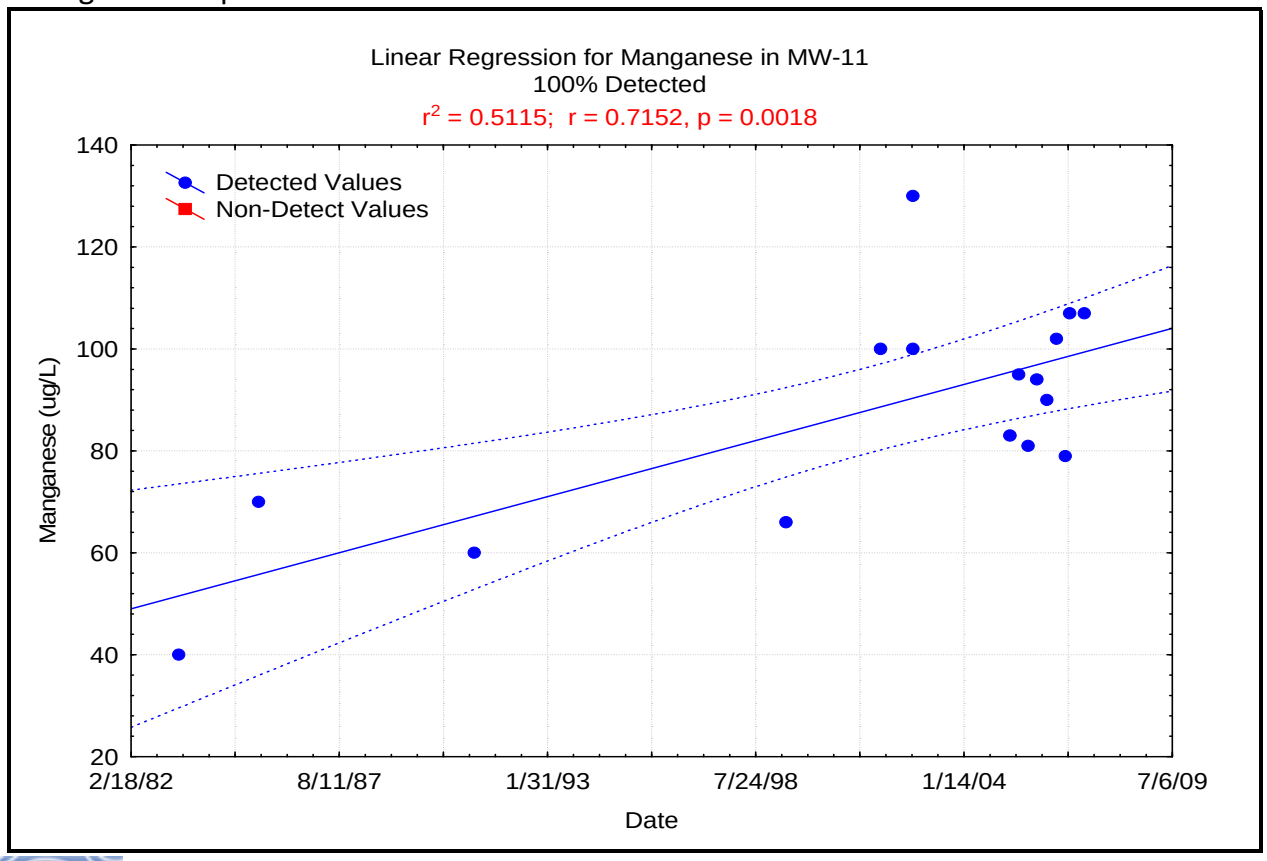


Appendix E-1
Linear Regression for All Constituents with Exceedances Compared to Linear Regressions from Background Reports

SAR Trend Plot

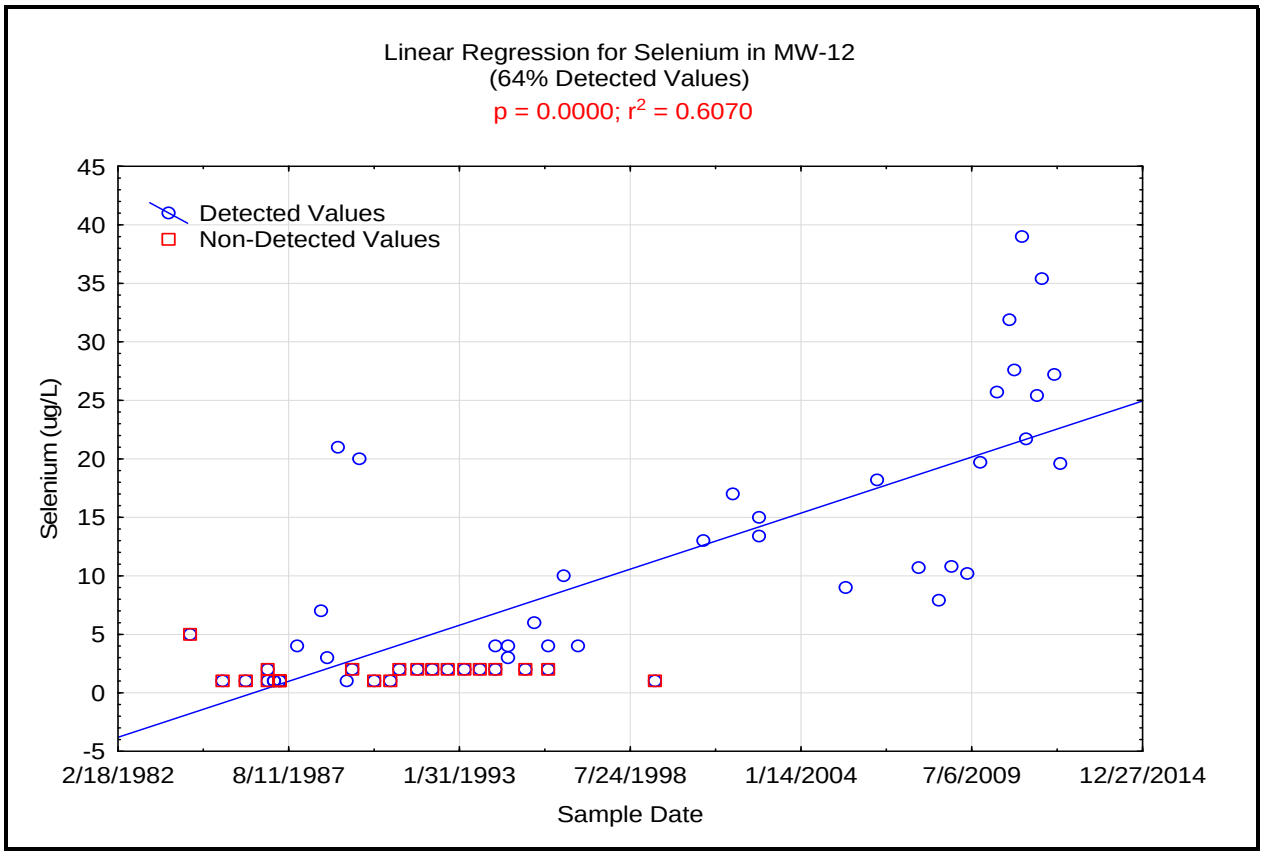


Background Report Trend Plot



Appendix E-1
Linear Regression for All Constituents with Exceedances Compared to Linear Regressions from Background Reports

SAR Trend Plot



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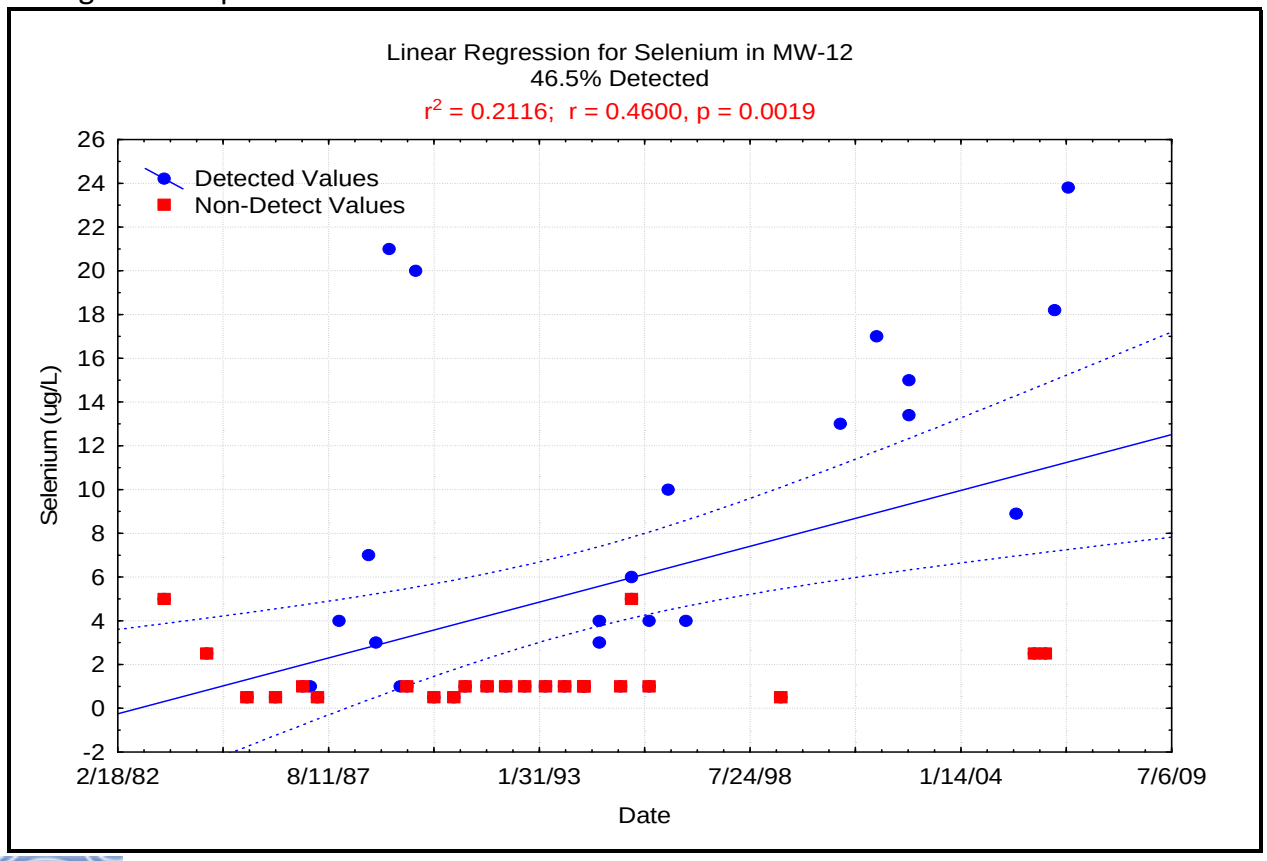
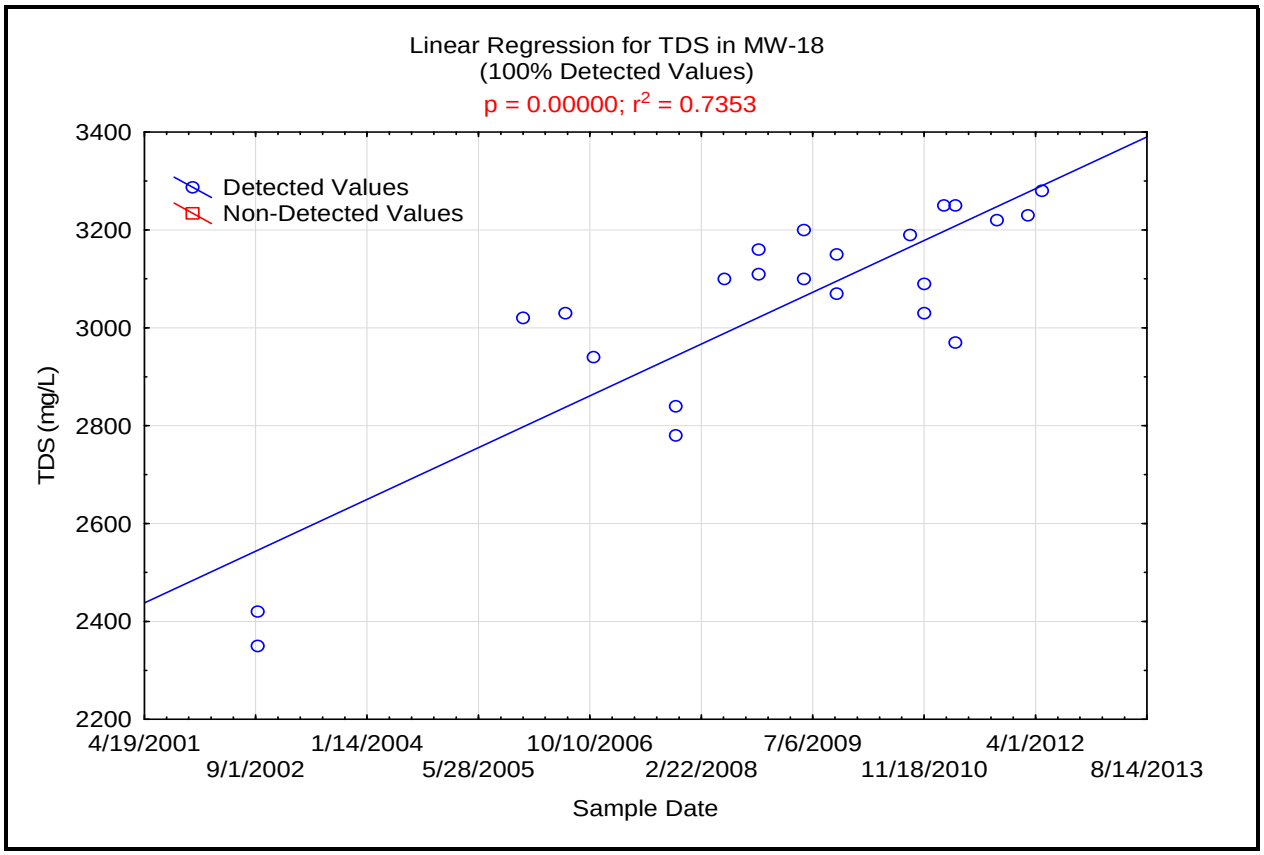
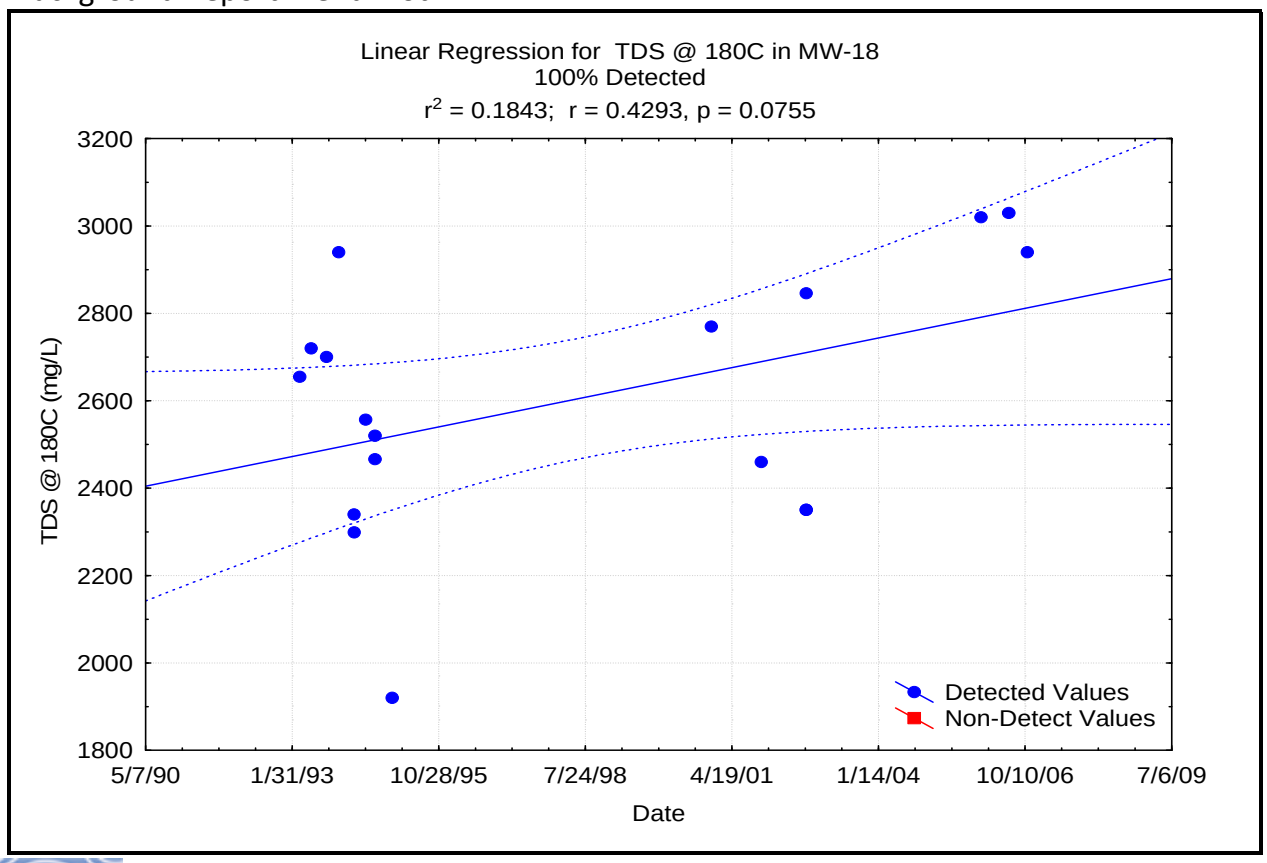


Appendix E-1
Linear Regression for All Constituents with Exceedances Compared to Linear Regressions from Background Reports

SAR Trend Plot

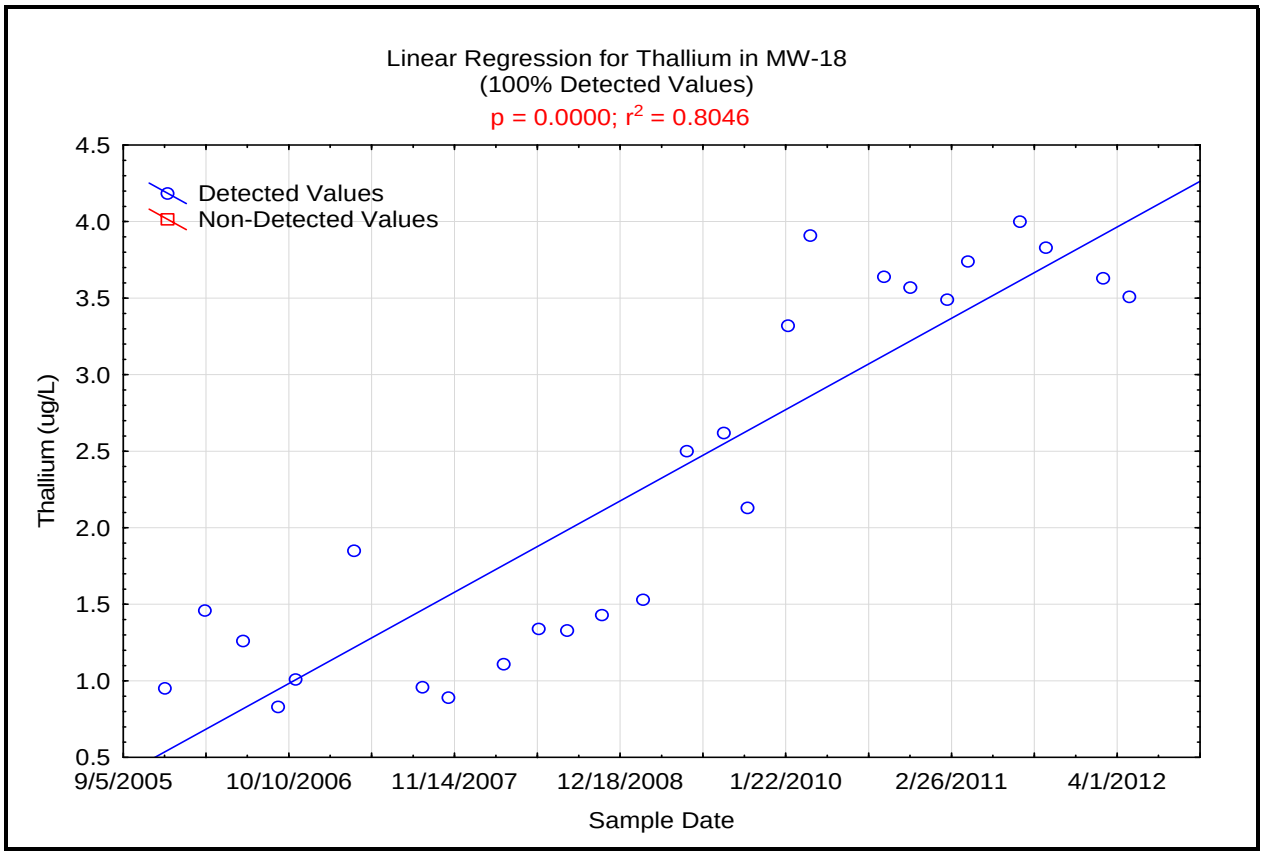


Background Report Trend Plot

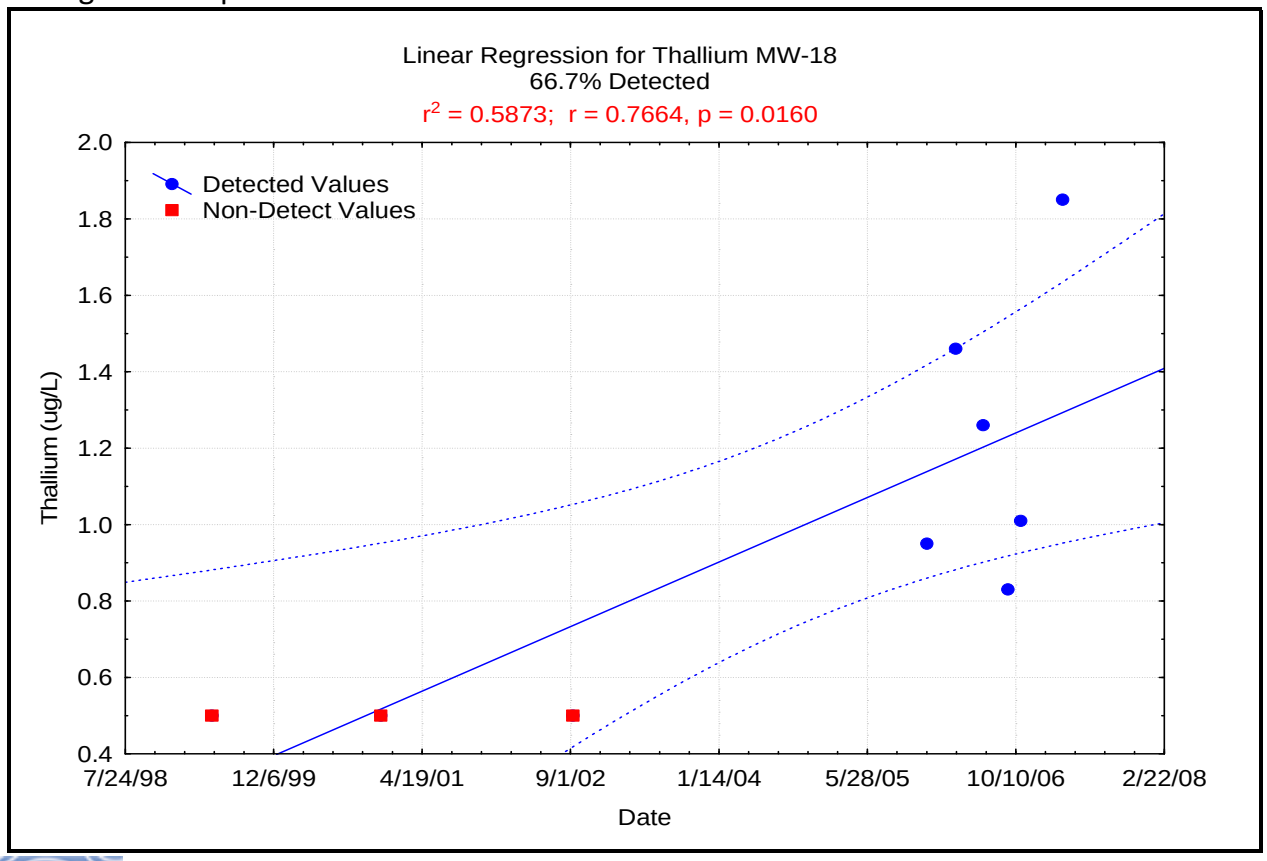


Appendix E-1
Linear Regression for All Constituents with Exceedances Compared to Linear Regressions from Background Reports

SAR Trend Plot

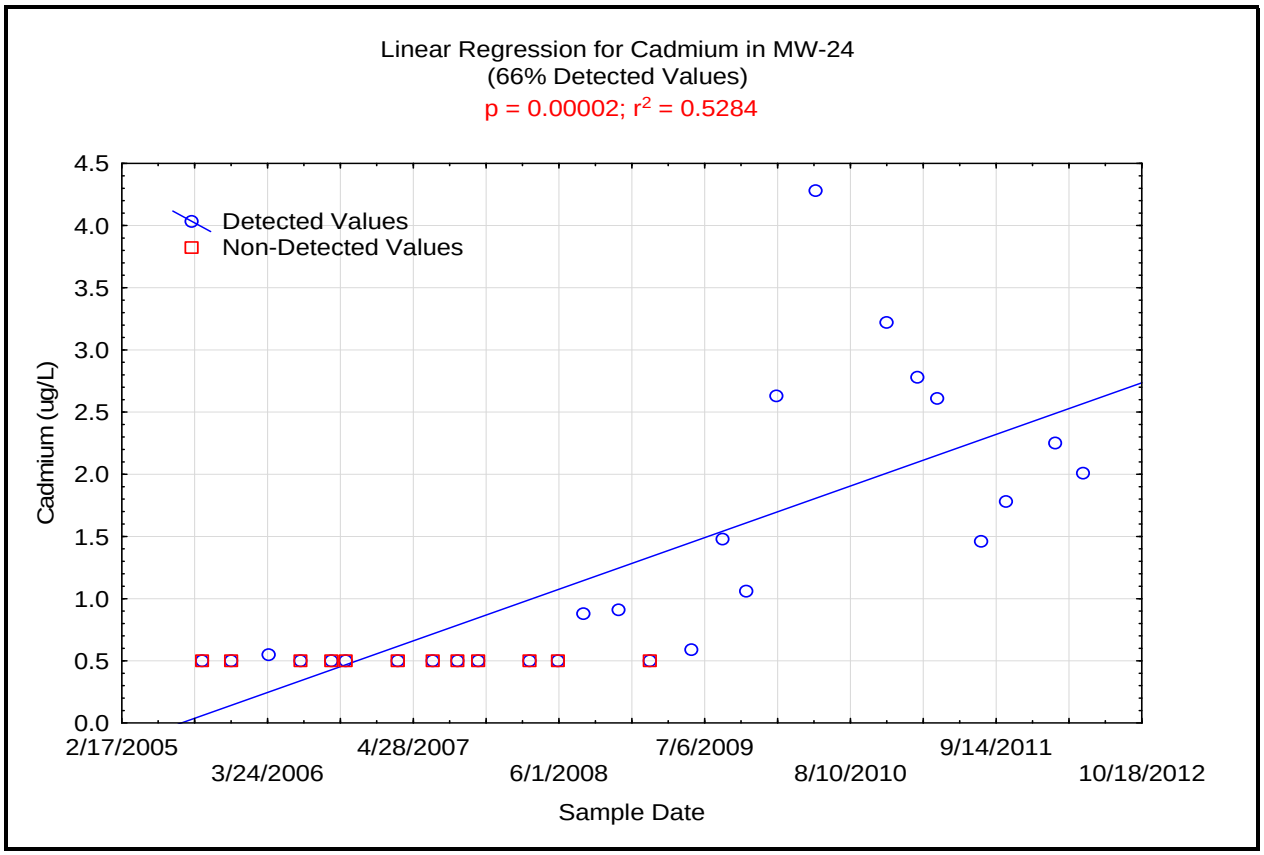


Background Report Trend Plot

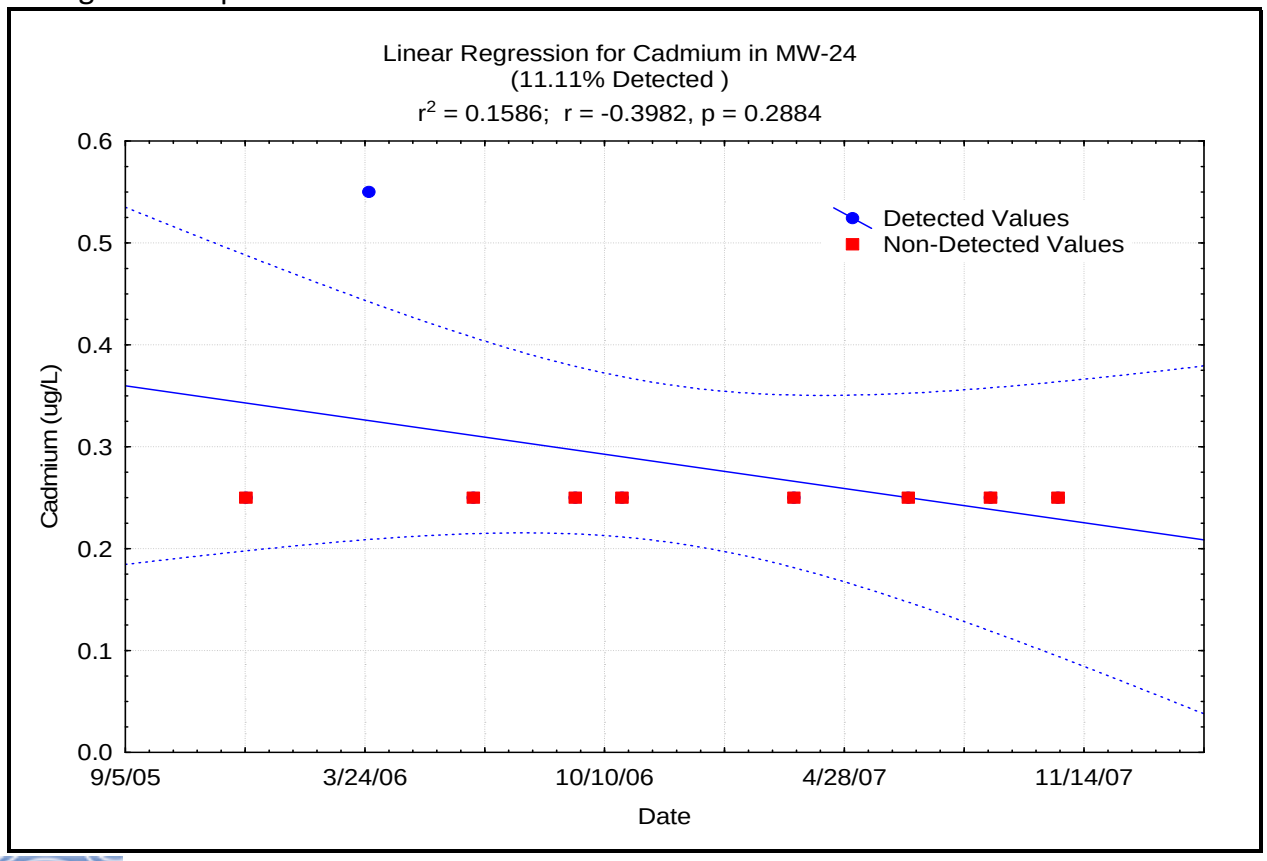


Appendix E-1
Linear Regression for All Constituents with Exceedances Compared to Linear Regressions from Background Reports

SAR Trend Plot

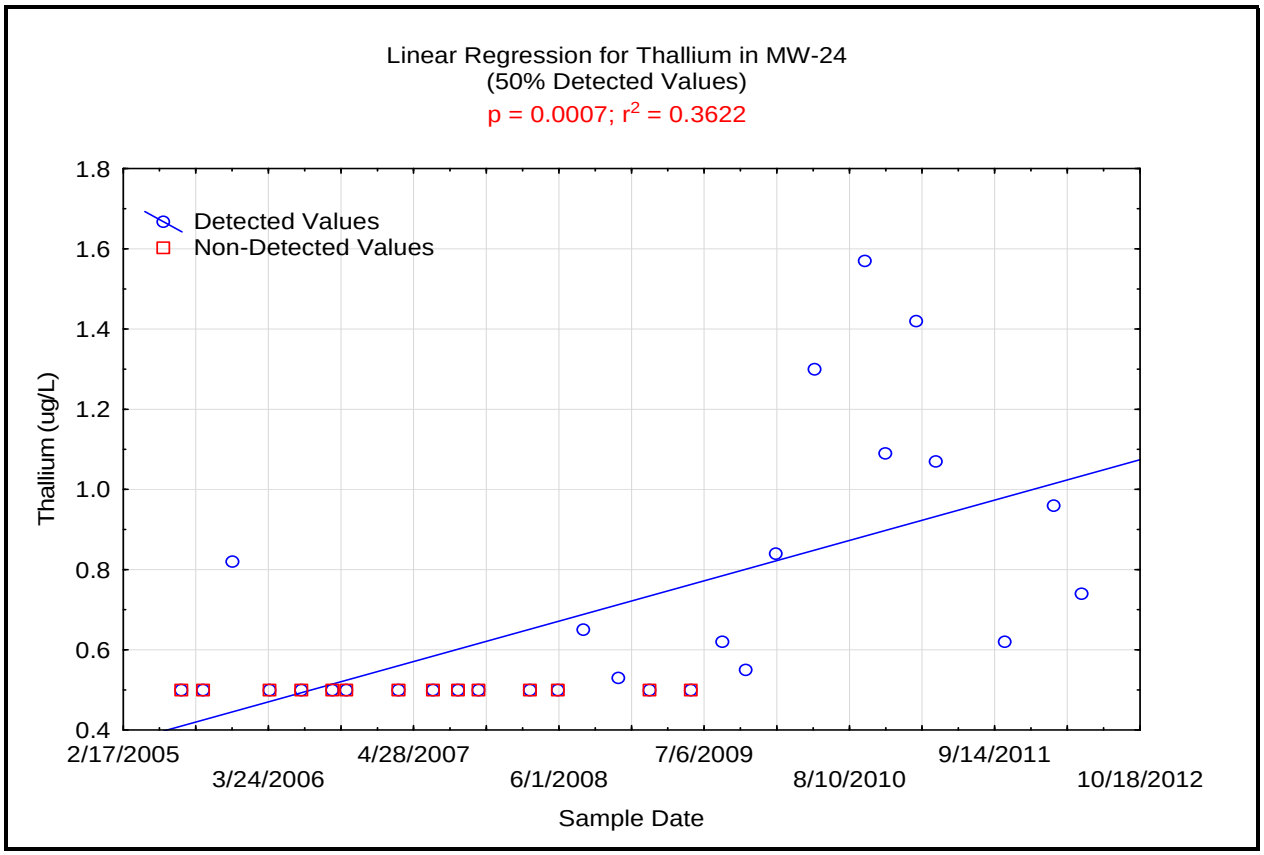


Background Report Trend Plot

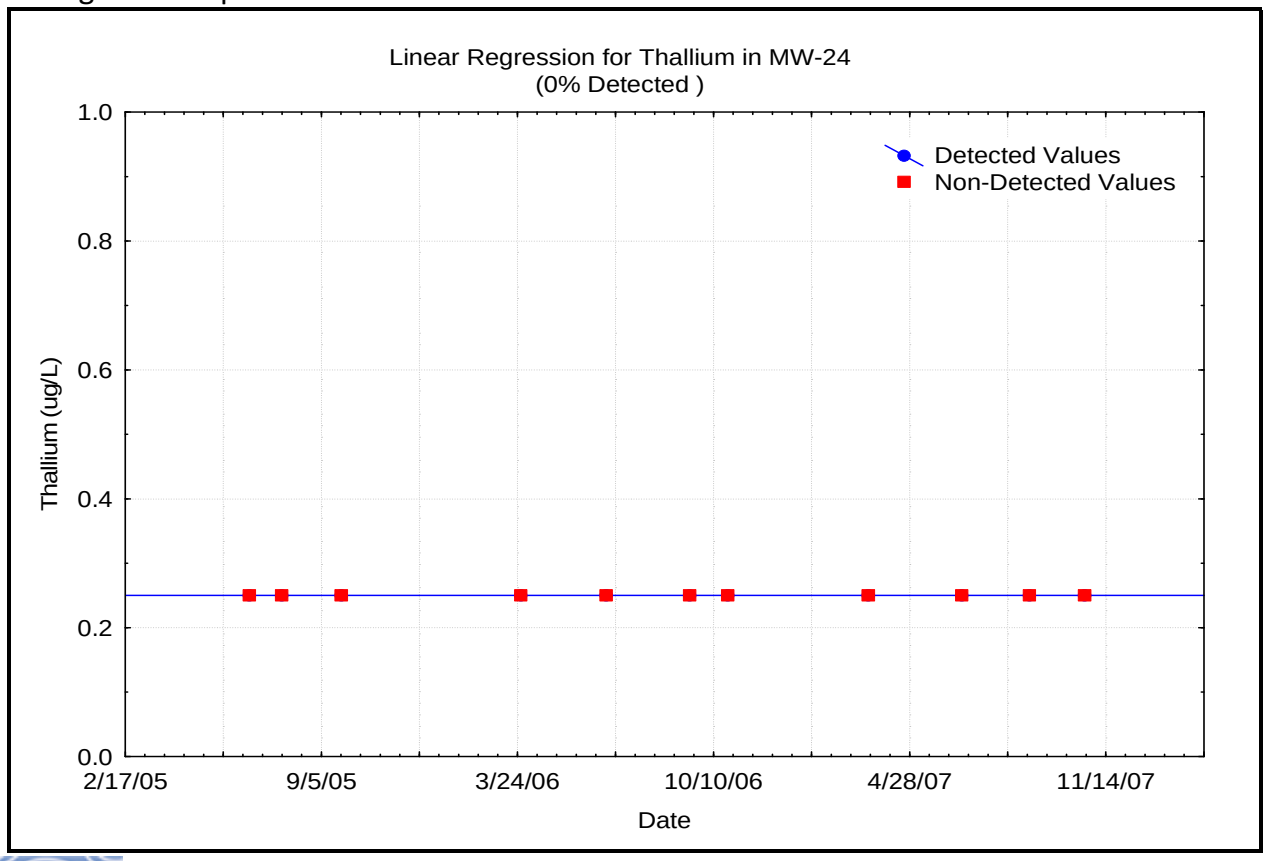


Appendix E-1
Linear Regression for All Constituents with Exceedances Compared to Linear Regressions from Background Reports

SAR Trend Plot

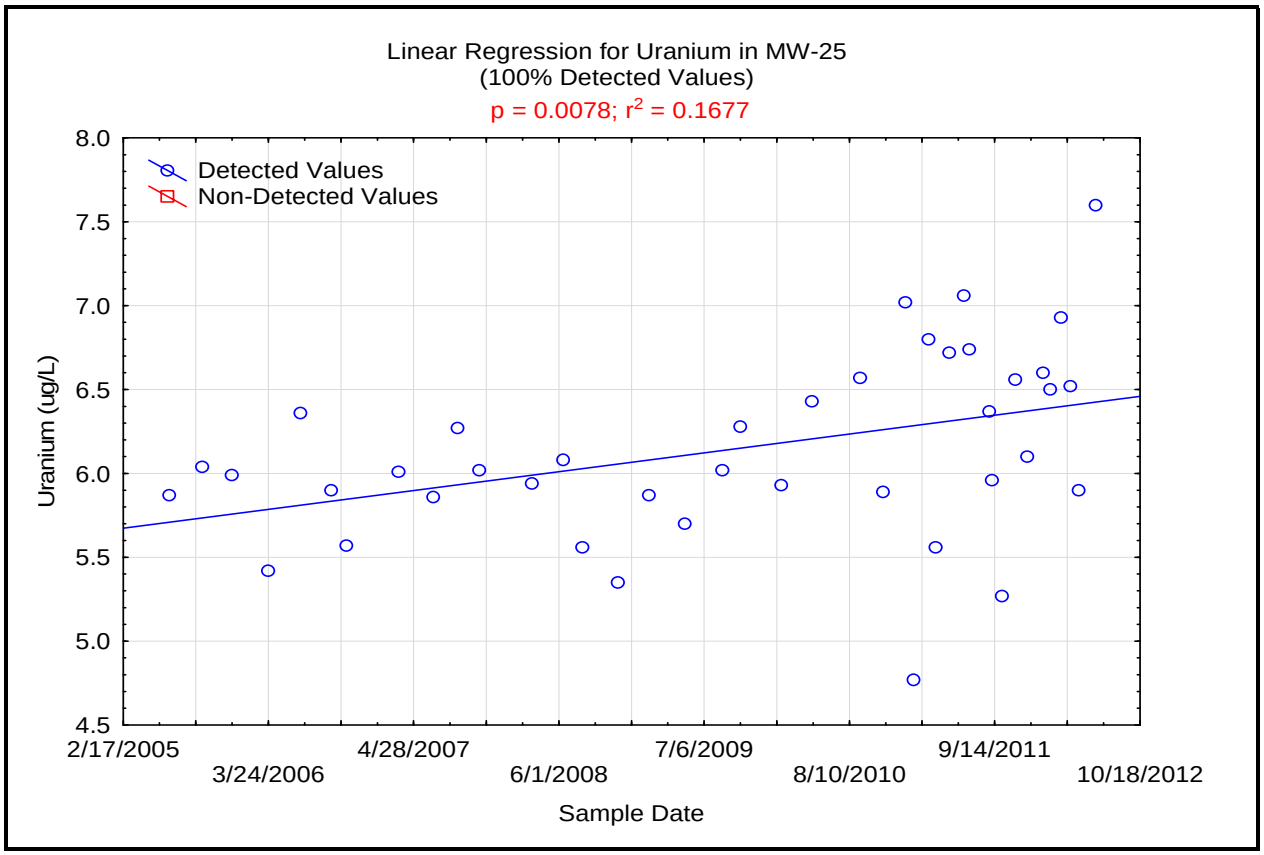


Background Report Trend Plot

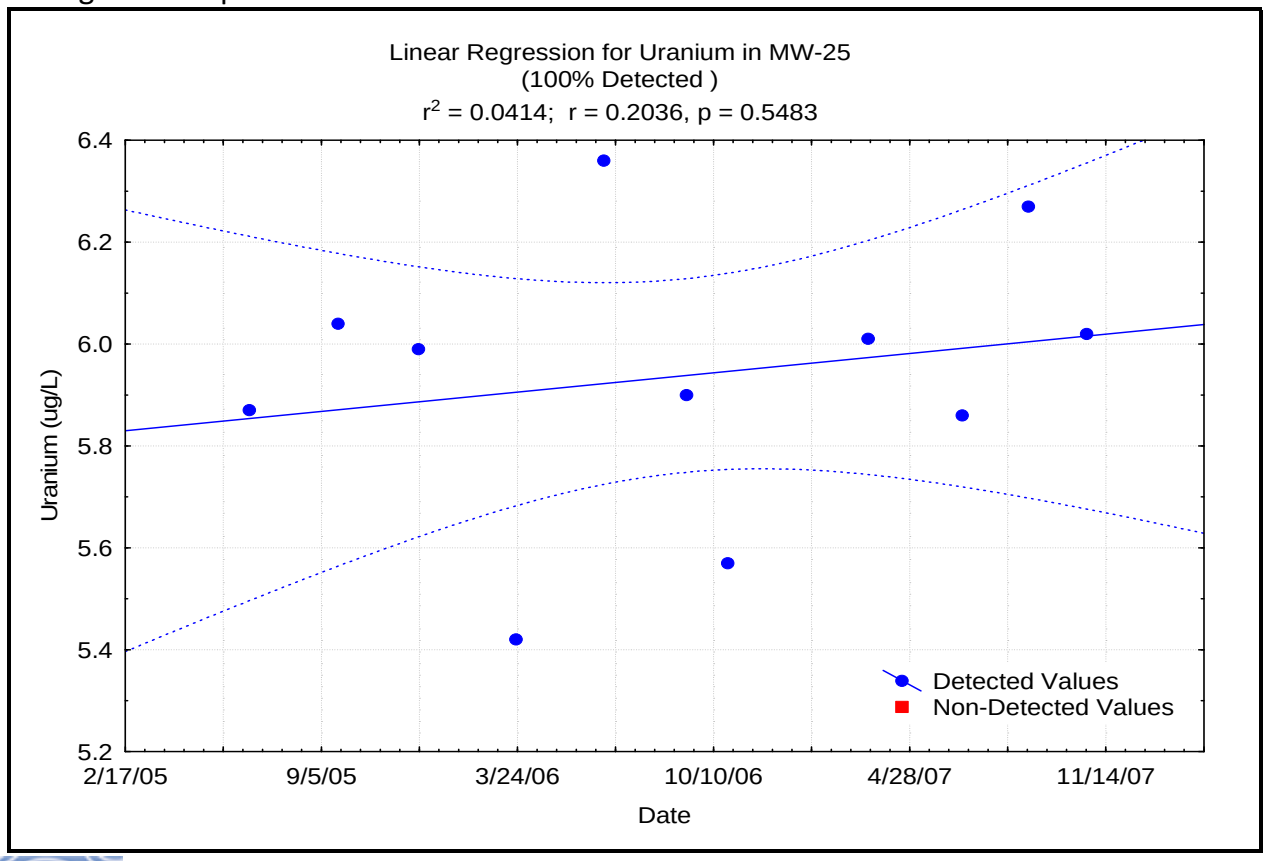


Appendix E-1
Linear Regression for All Constituents with Exceedances Compared to Linear Regressions from Background Reports

SAR Trend Plot

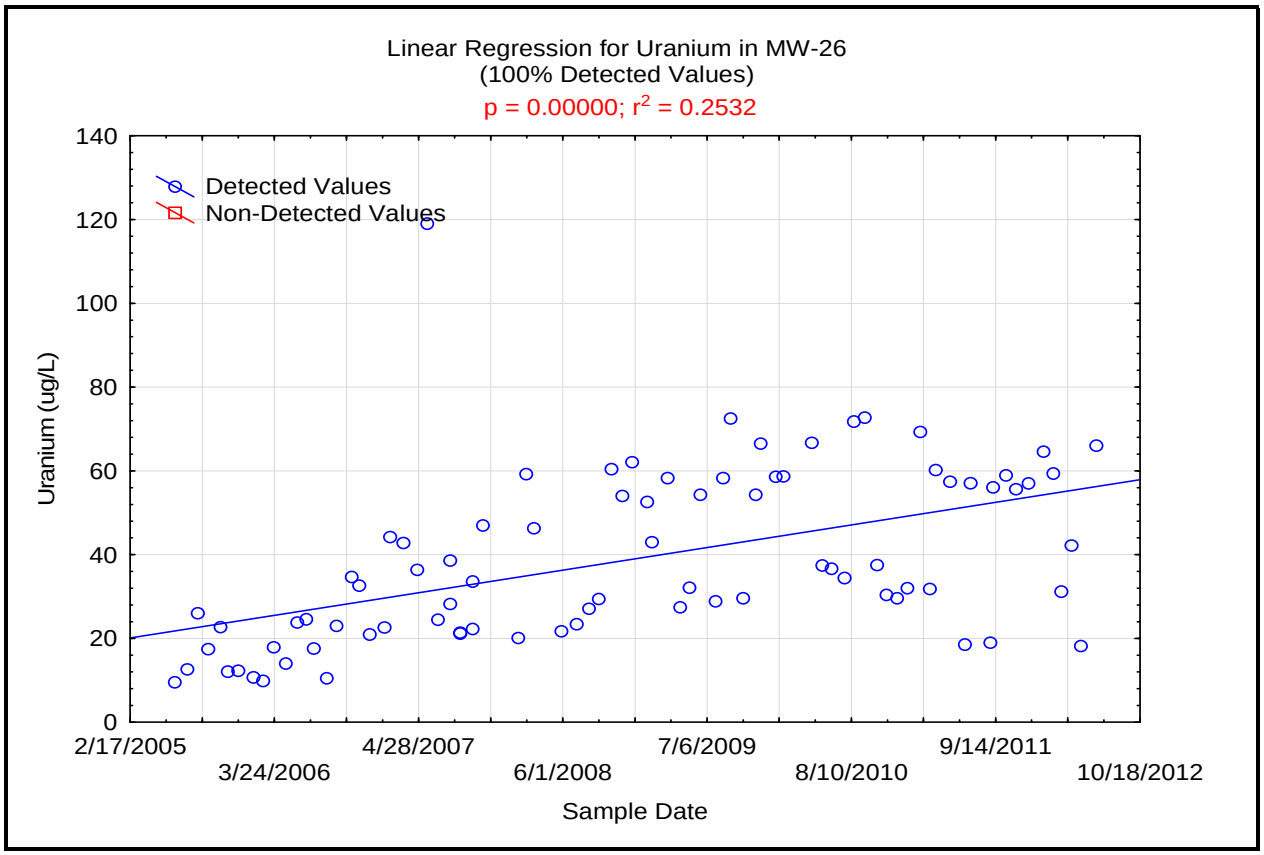


Background Report Trend Plot

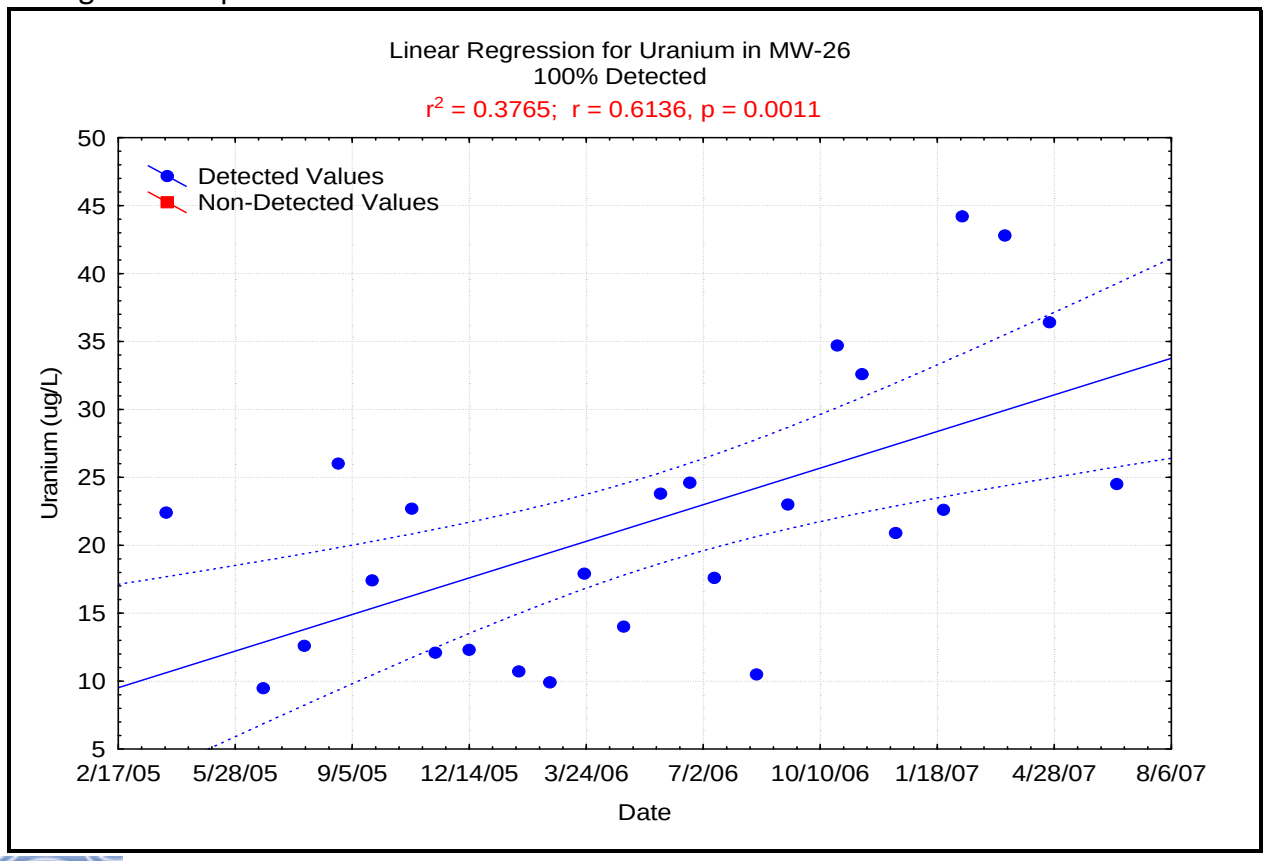


Appendix E-1
Linear Regression for All Constituents with Exceedances Compared to Linear Regressions from Background Reports

SAR Trend Plot

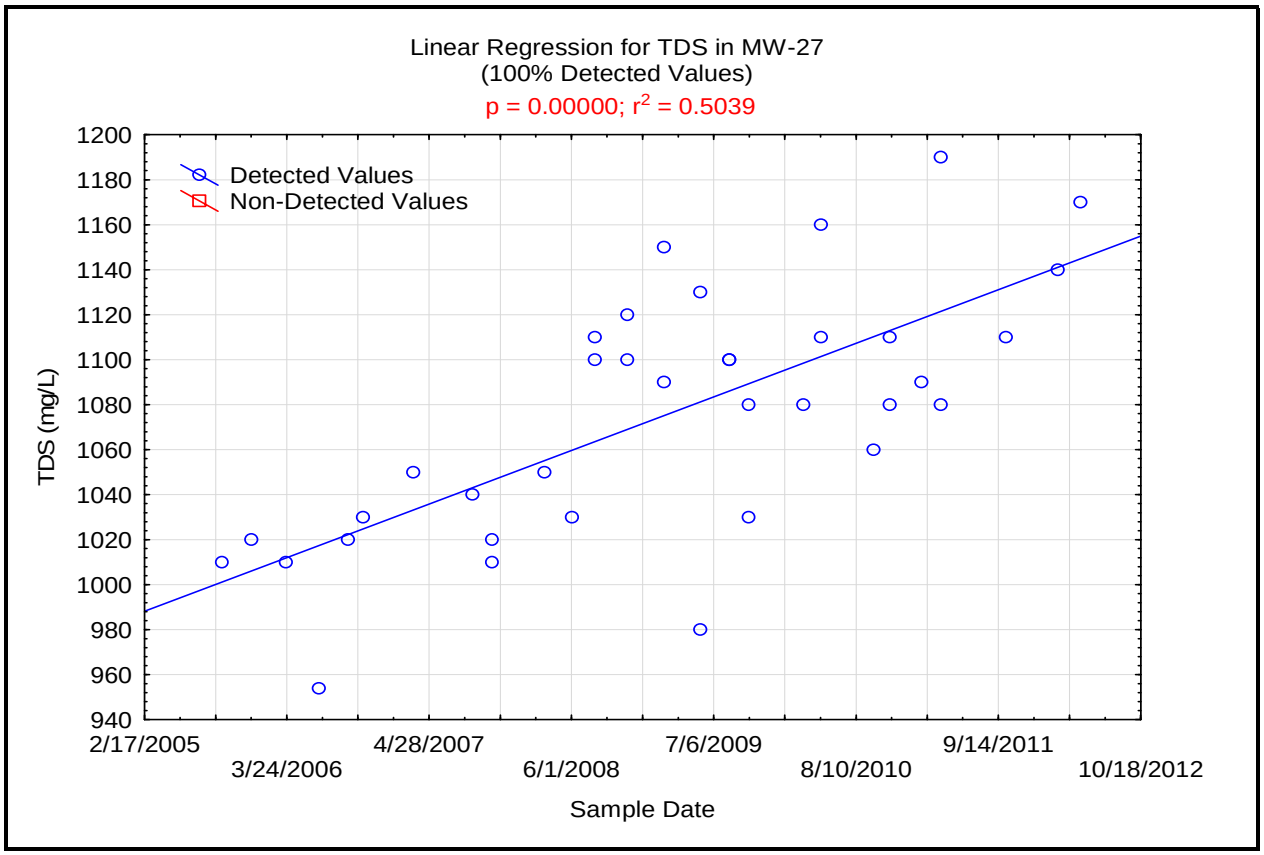


Background Report Trend Plot



Appendix E-1
Linear Regression for All Constituents with Exceedances Compared to Linear Regressions from Background Reports

SAR Trend Plot



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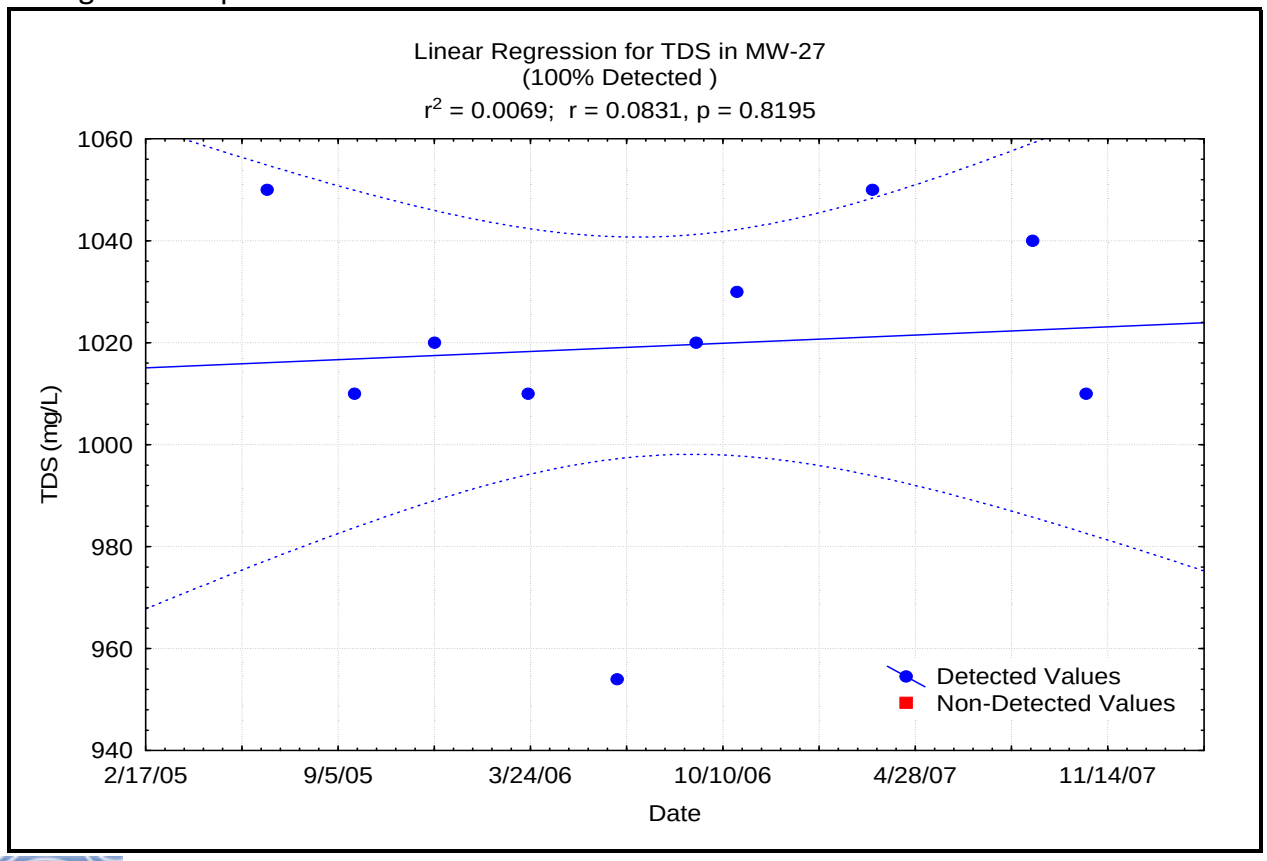
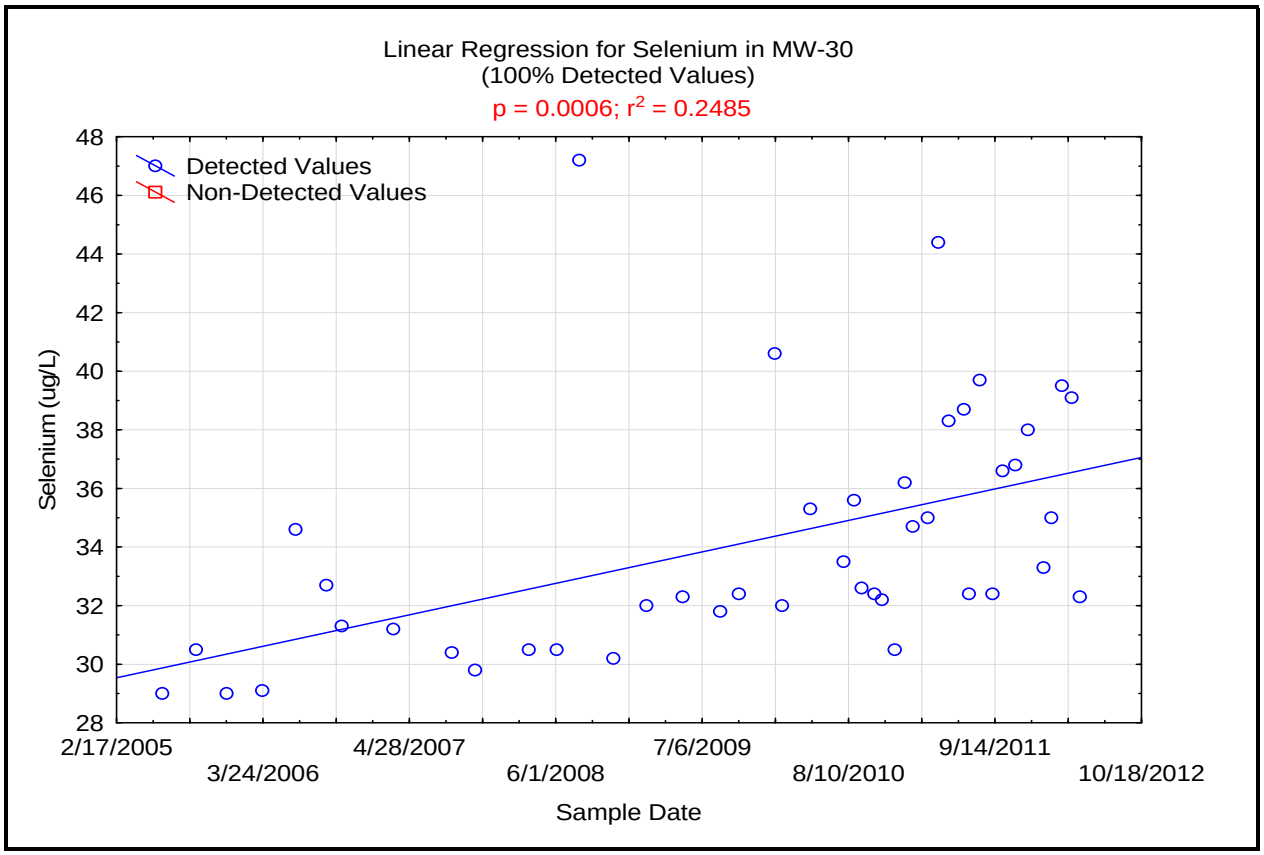


Appendix E-1
Linear Regression for All Constituents with Exceedances Compared to Linear Regressions from Background Reports

SAR Trend Plot



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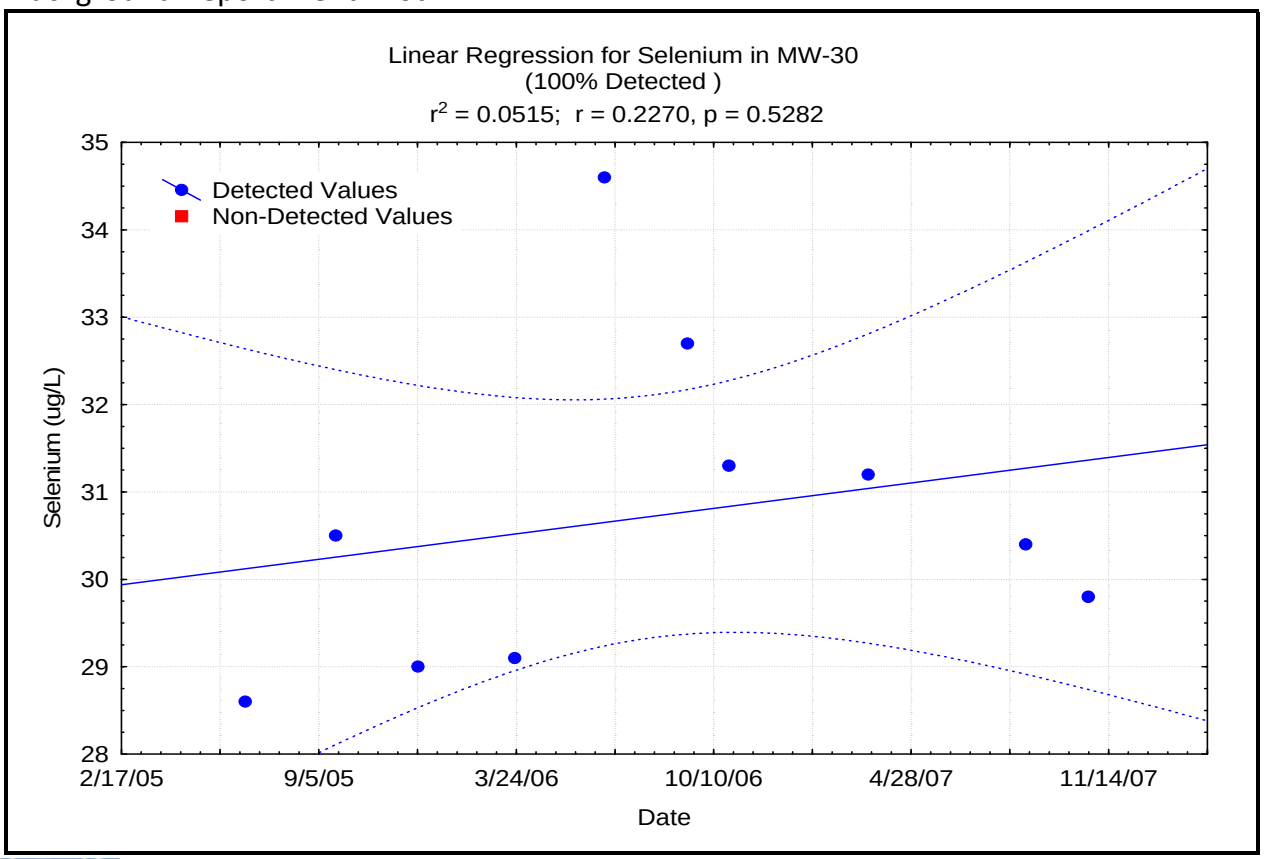
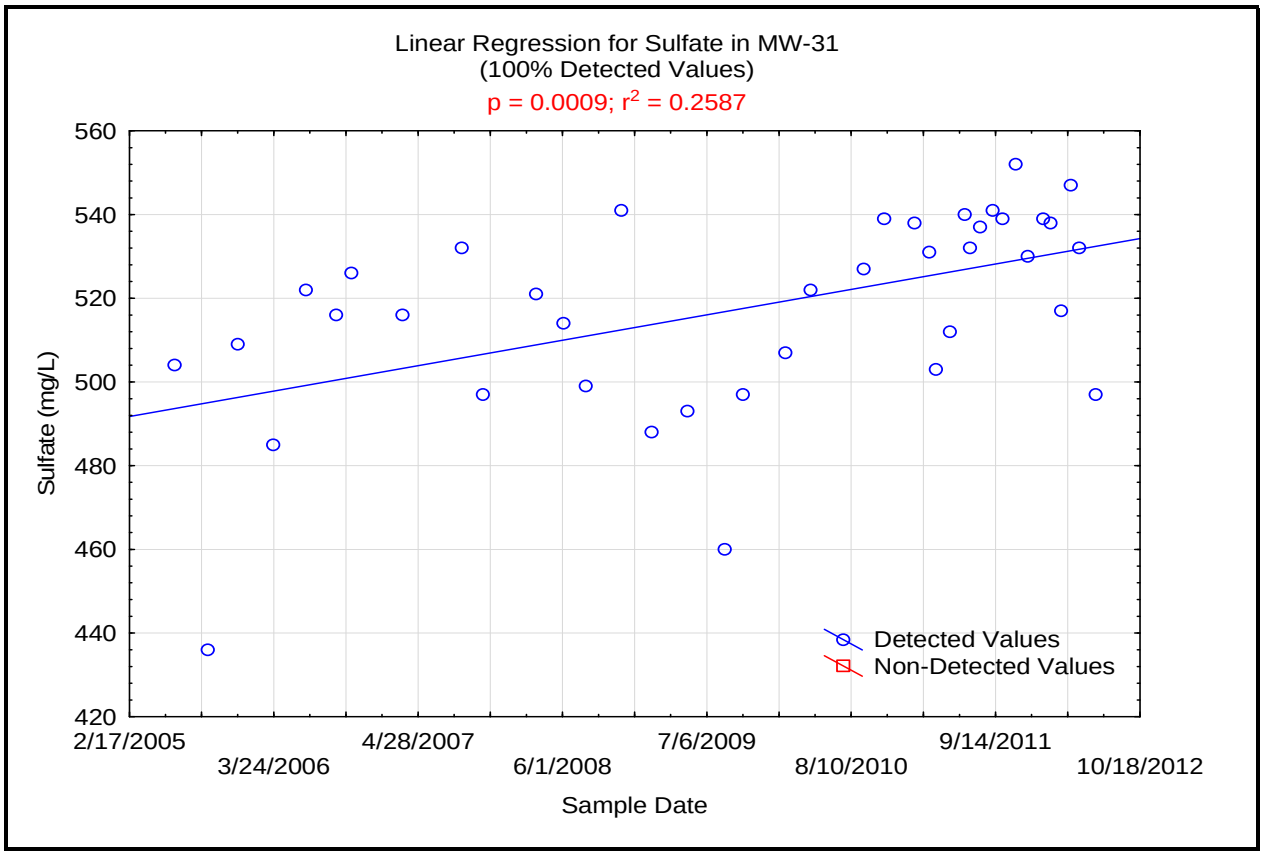


Appendix E-1
Linear Regression for All Constituents with Exceedances Compared to Linear Regressions from Background Reports

SAR Trend Plot



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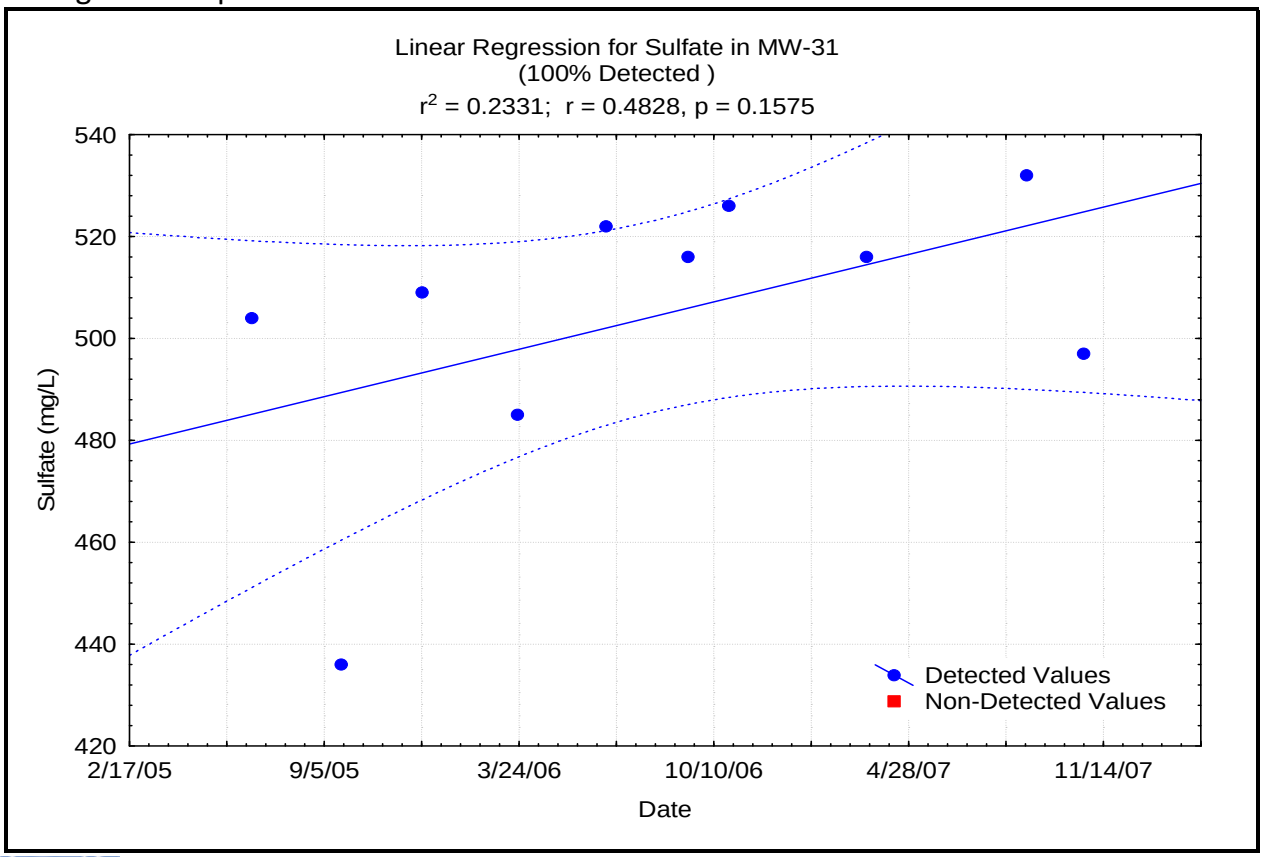
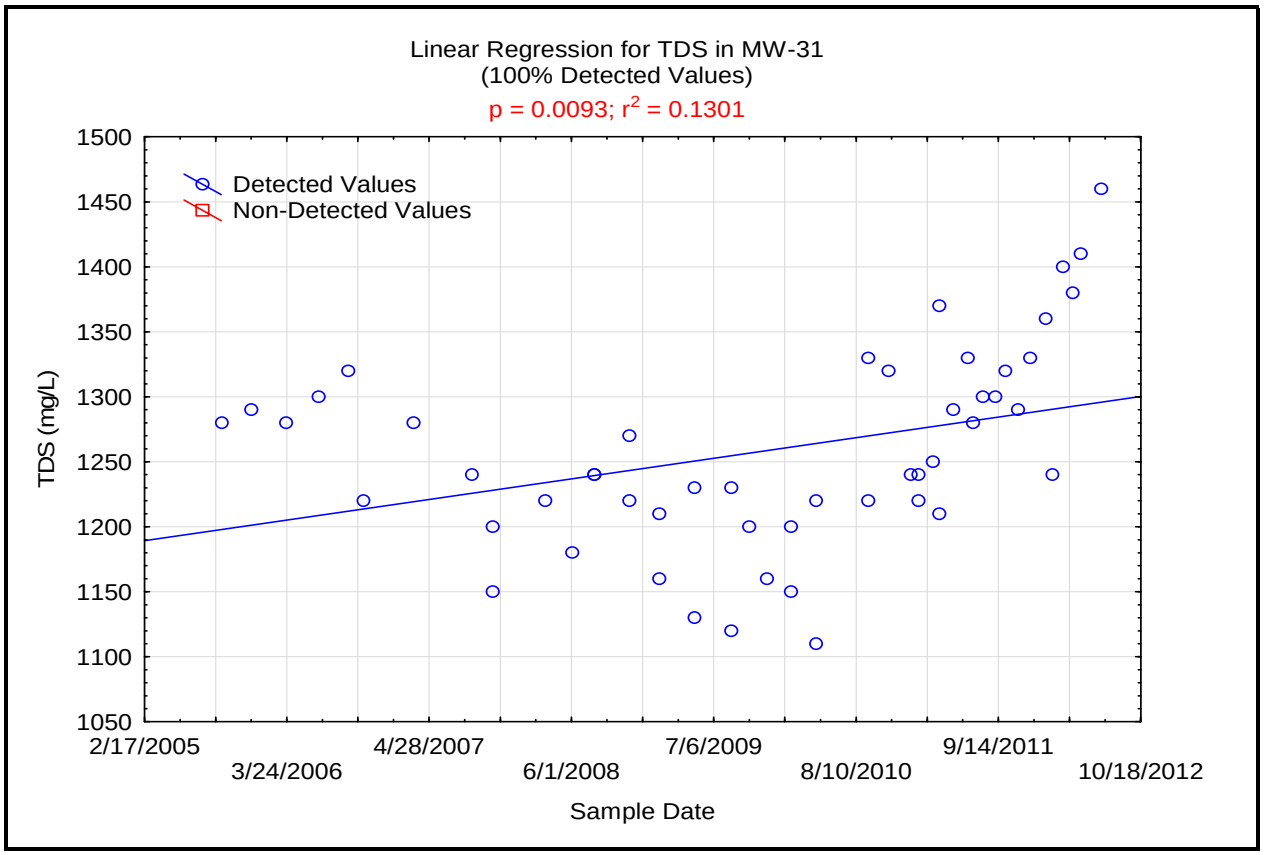
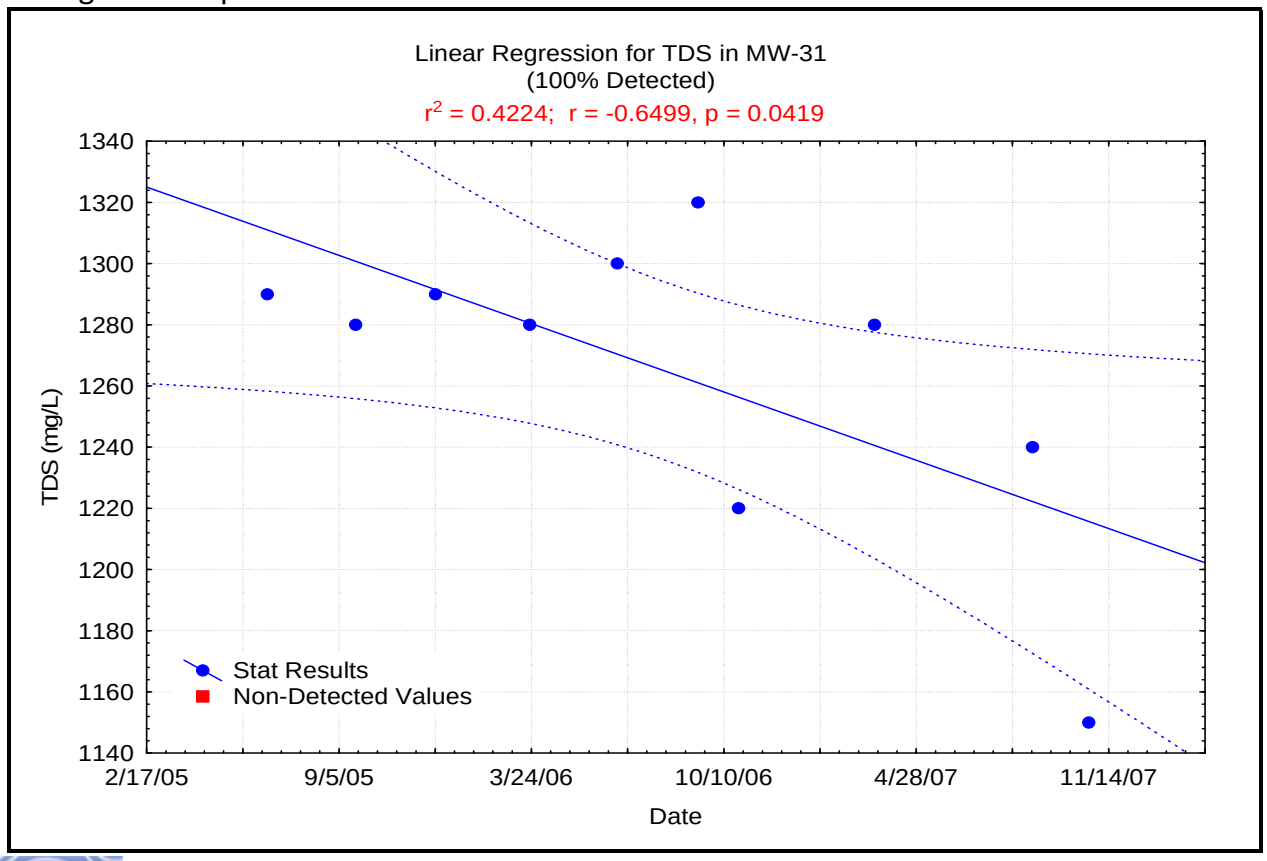


Appendix E-1
Linear Regression for All Constituents with Exceedances Compared to Linear Regressions from Background Reports

SAR Trend Plot

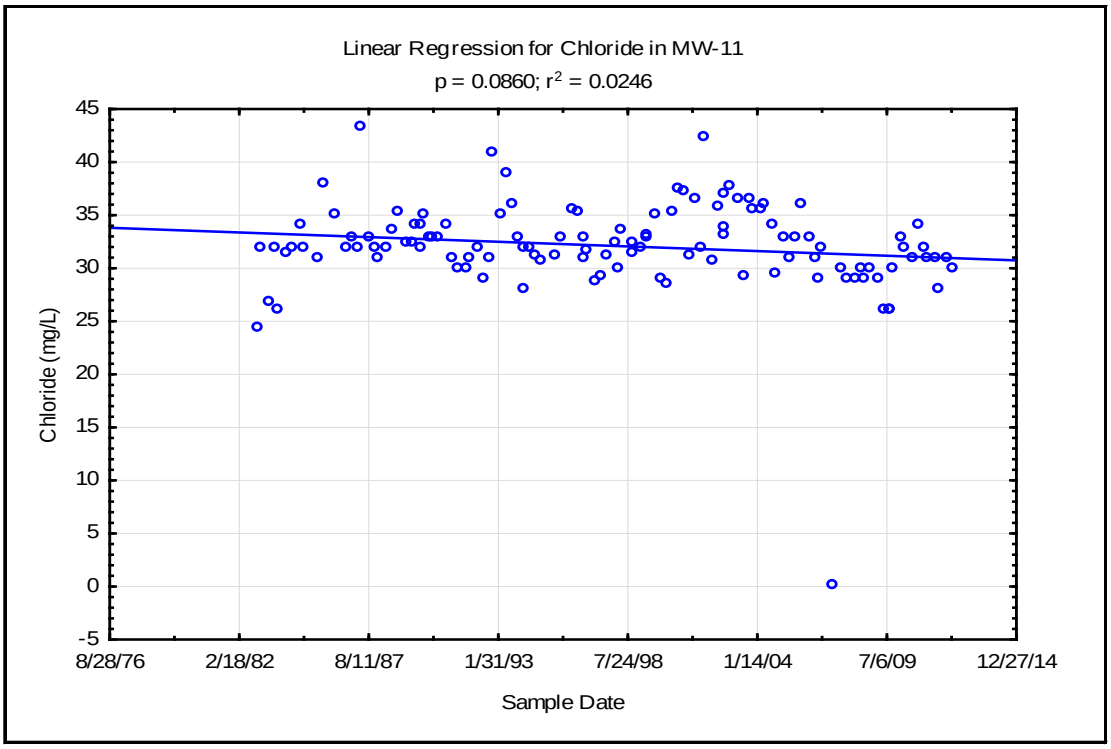


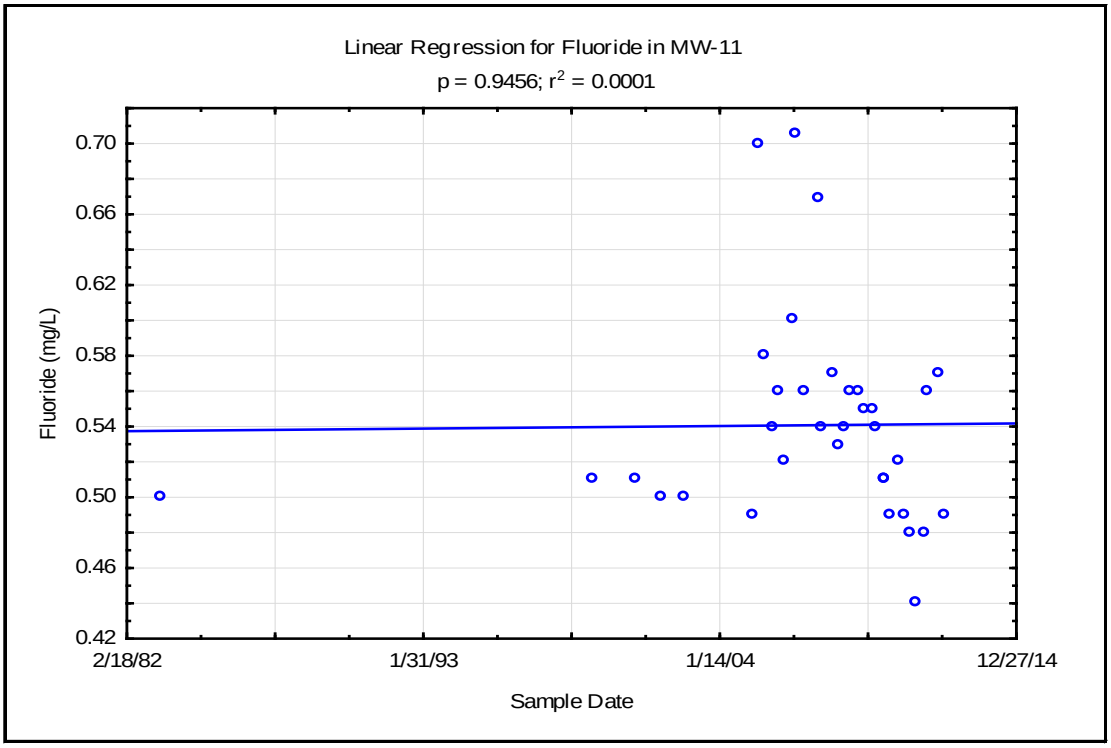
Background Report Trend Plot



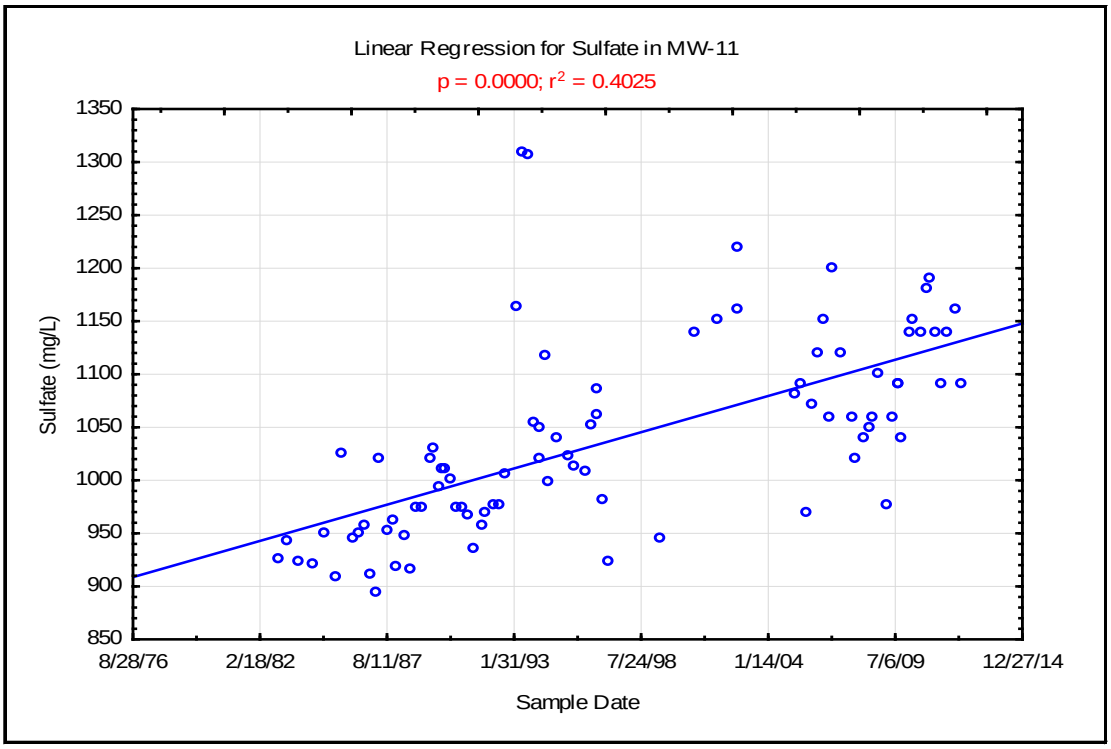
E-2 Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances

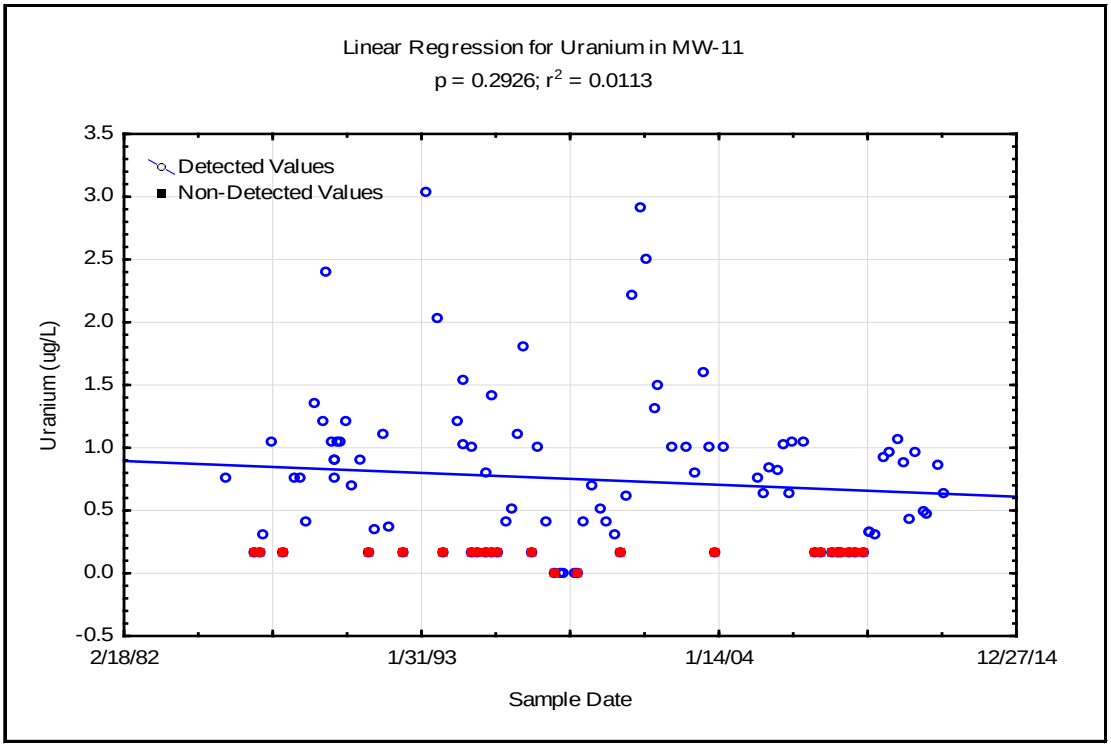
Appendix E-2
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances



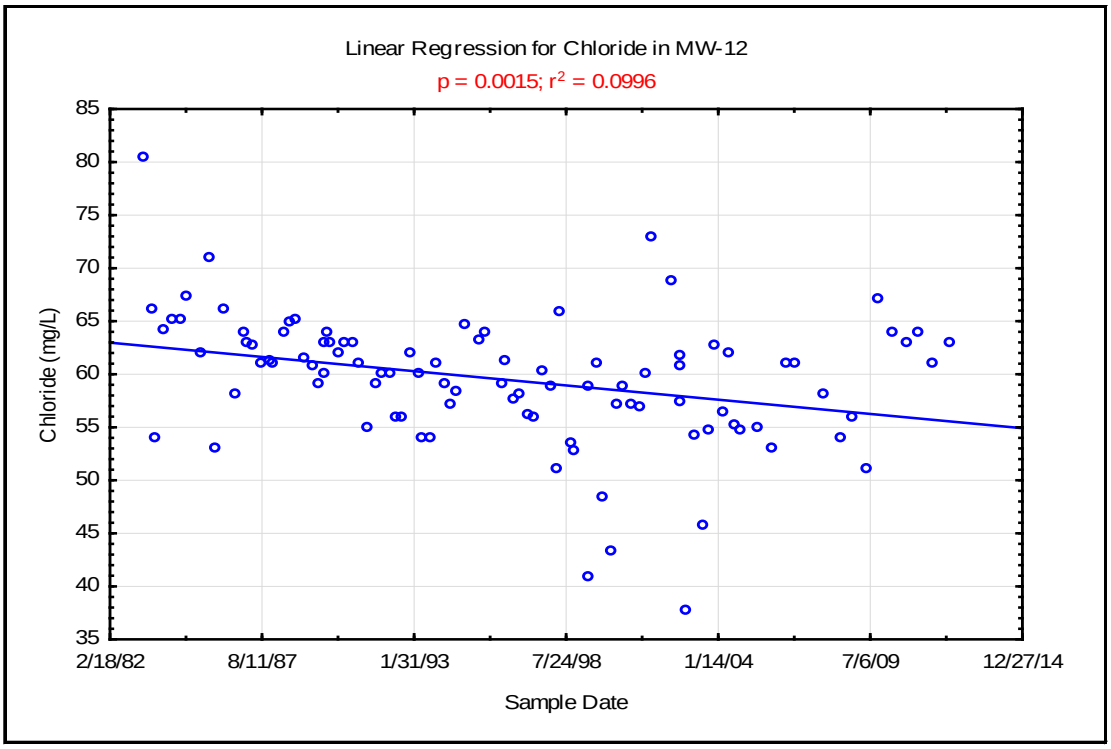


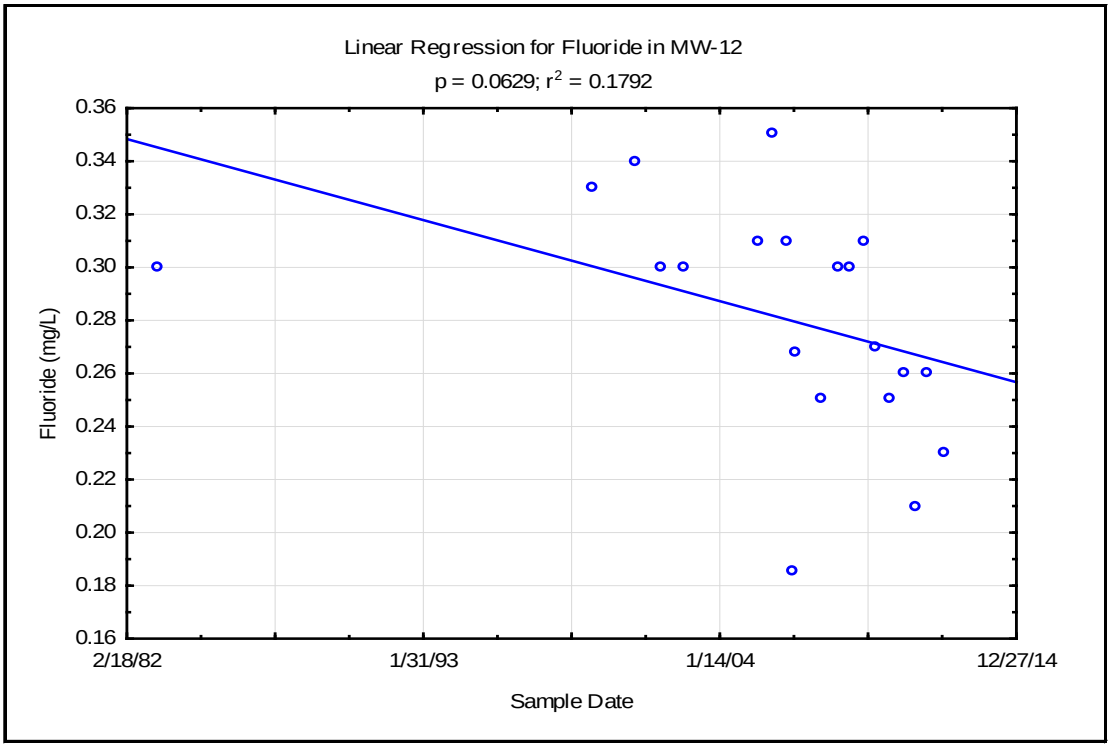
Appendix E-2
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances



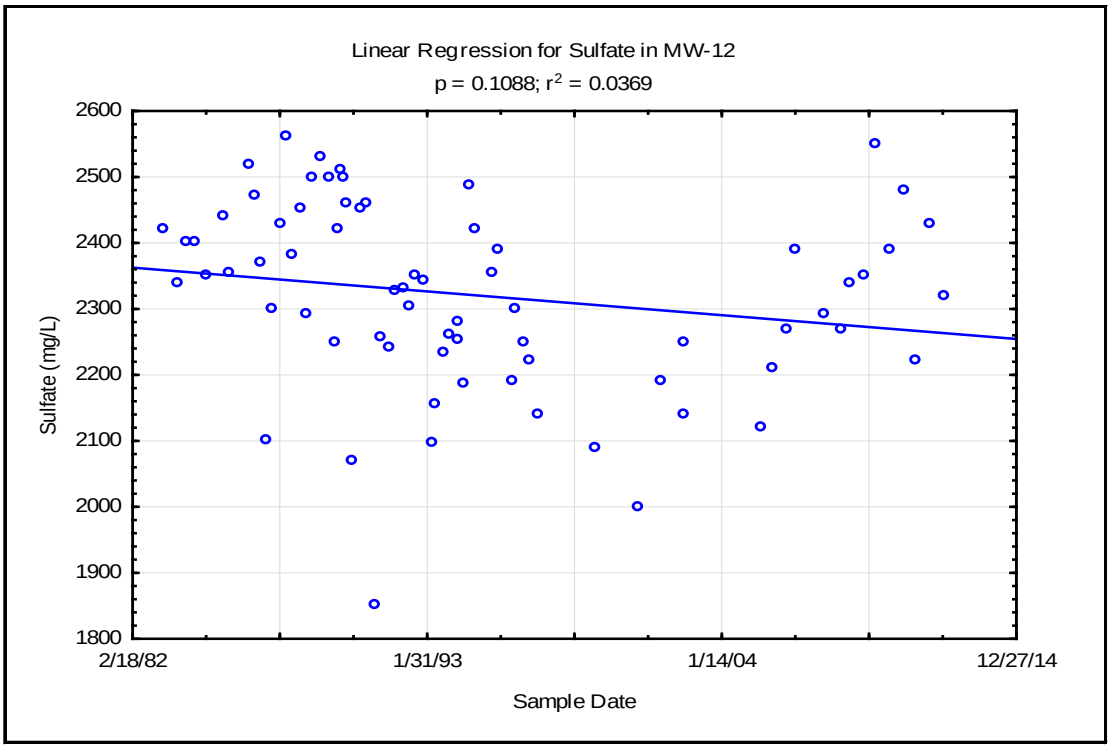


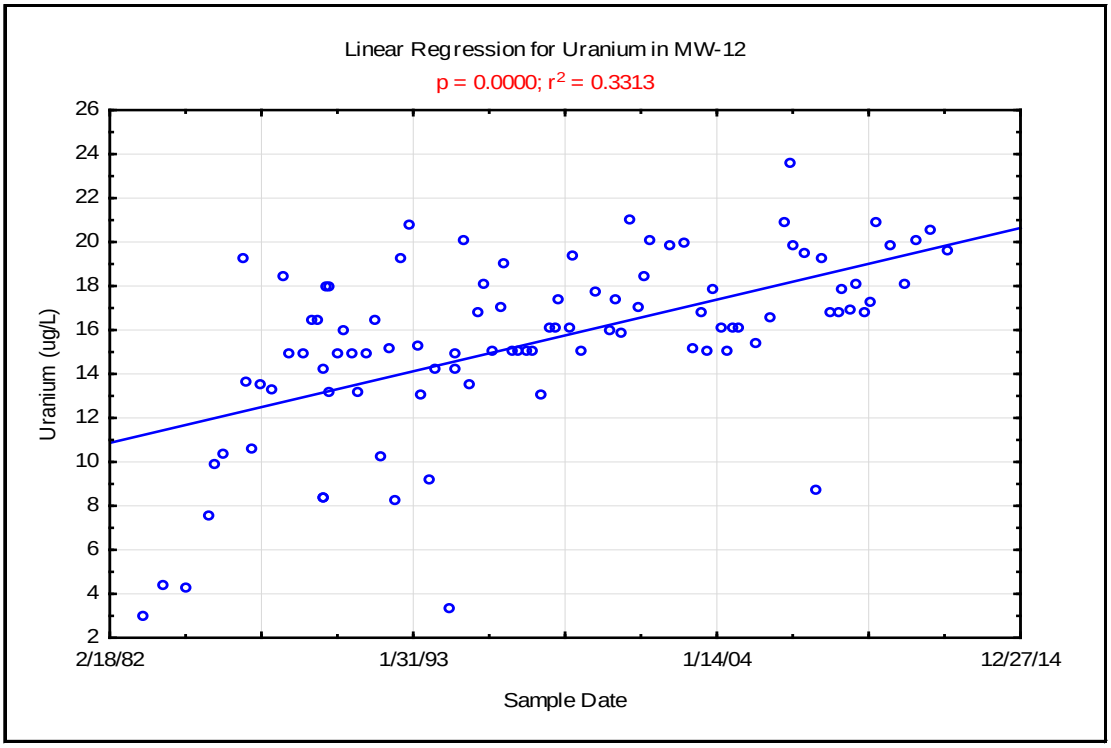
Appendix E-2
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances



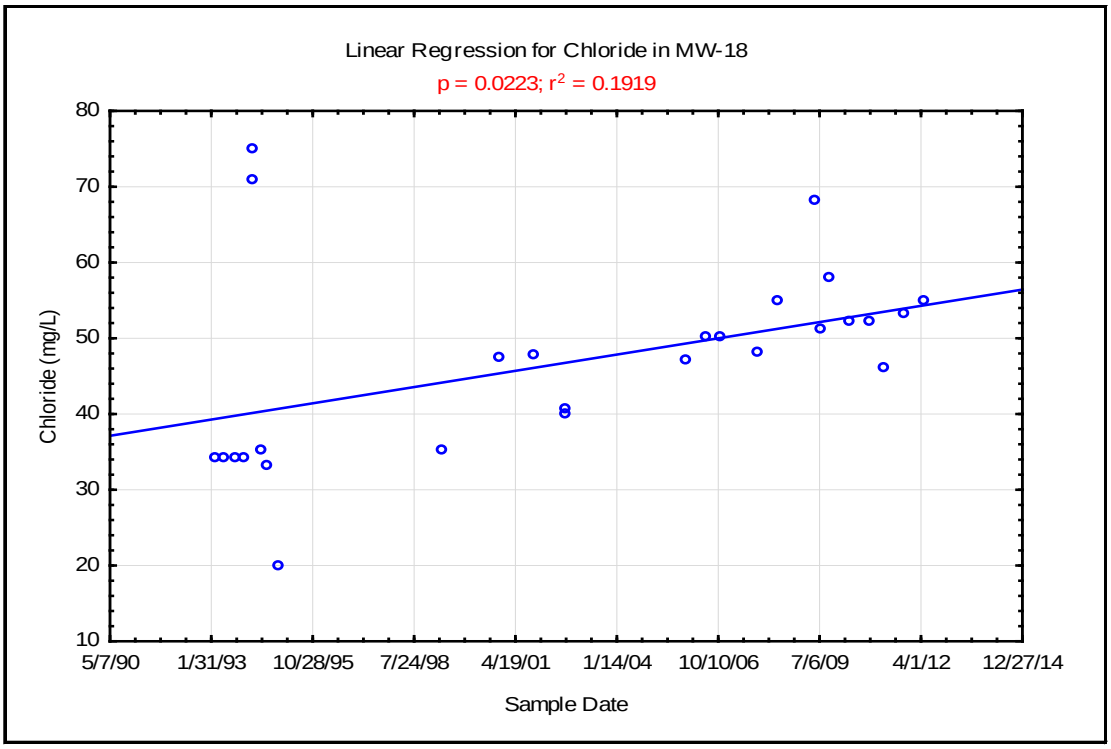


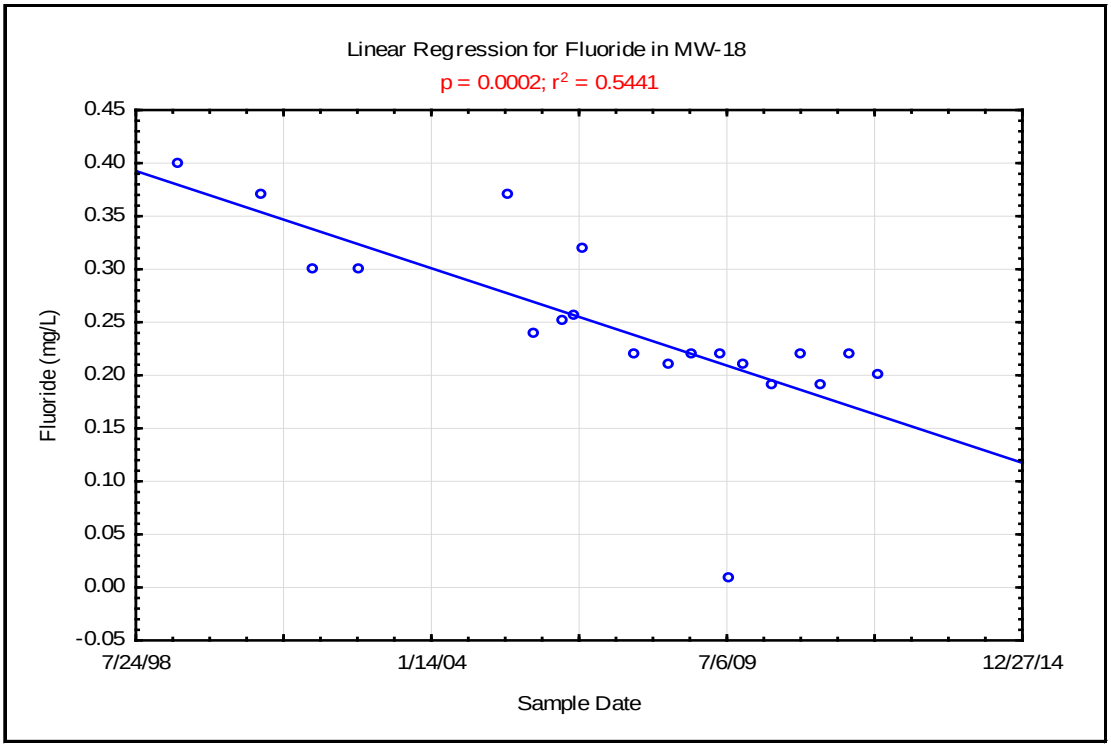
Appendix E-2
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances



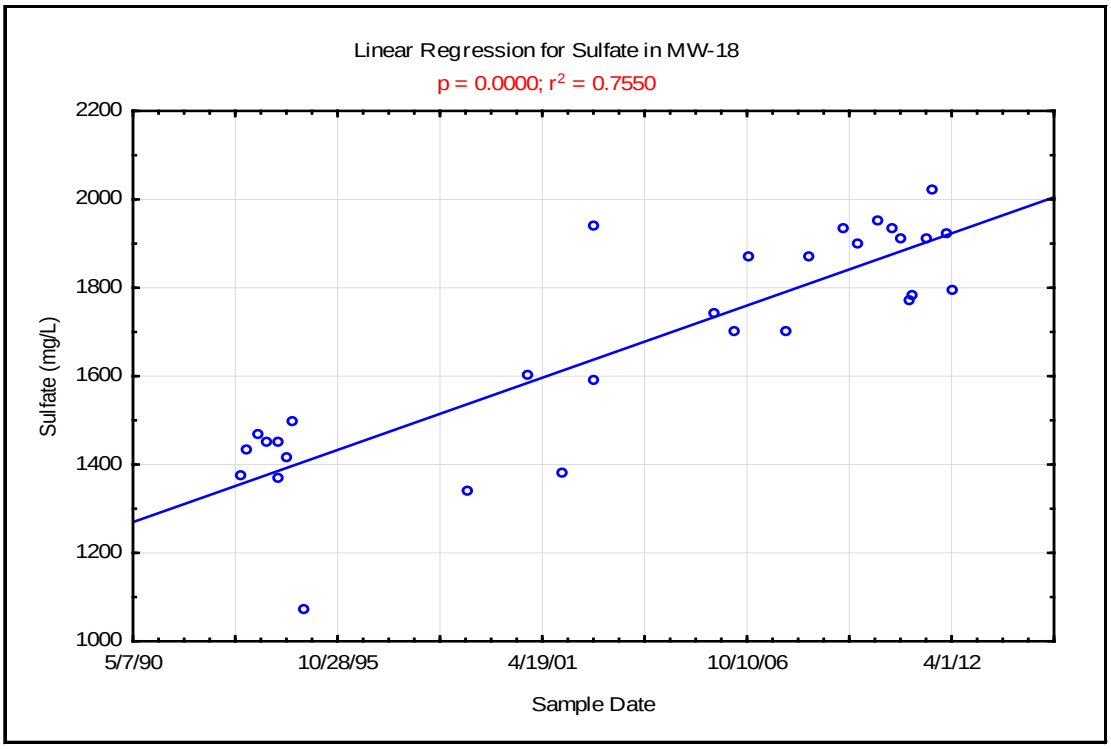


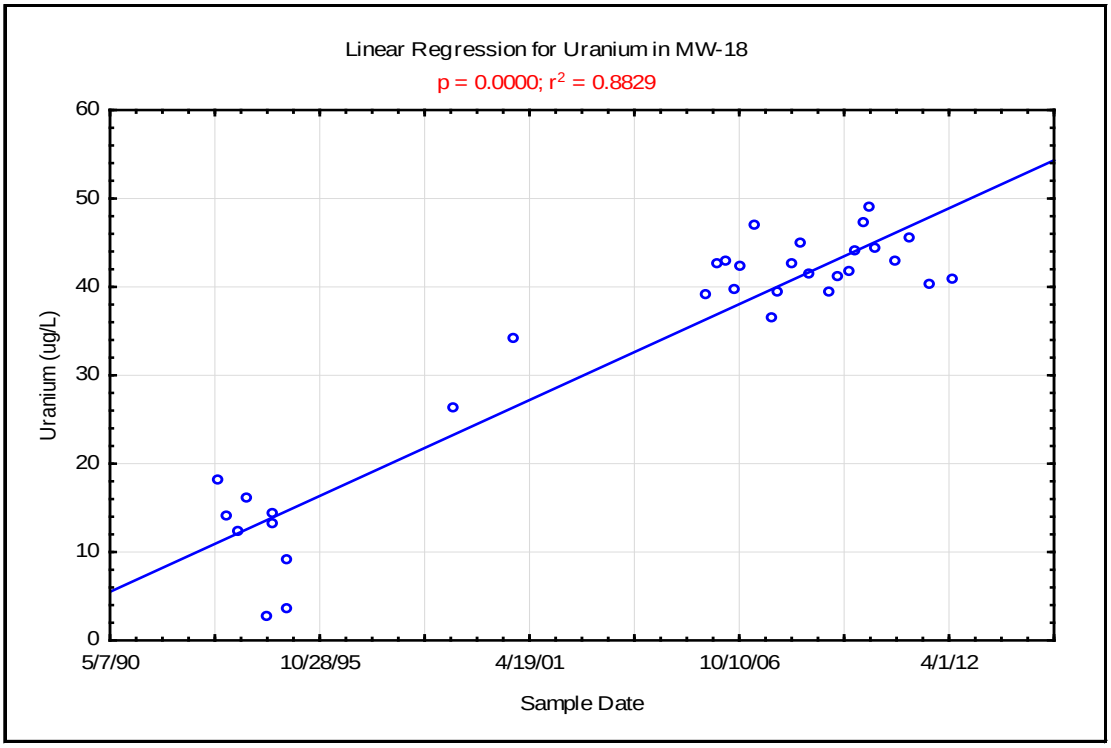
Appendix E-2
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances



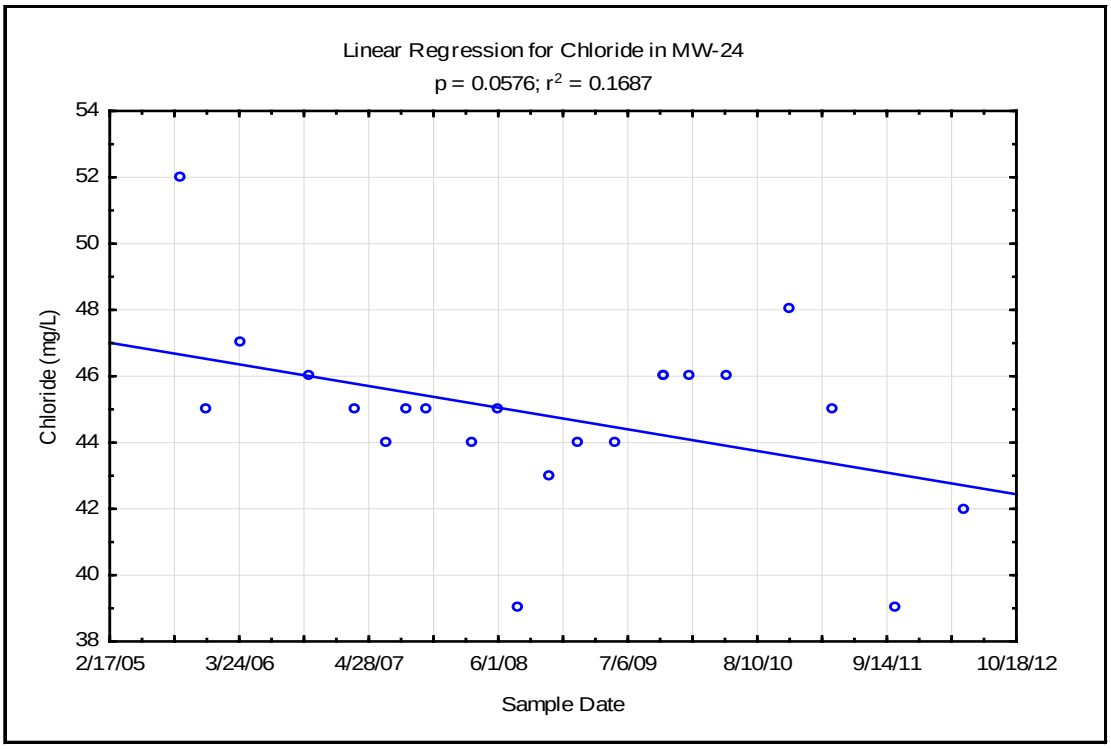


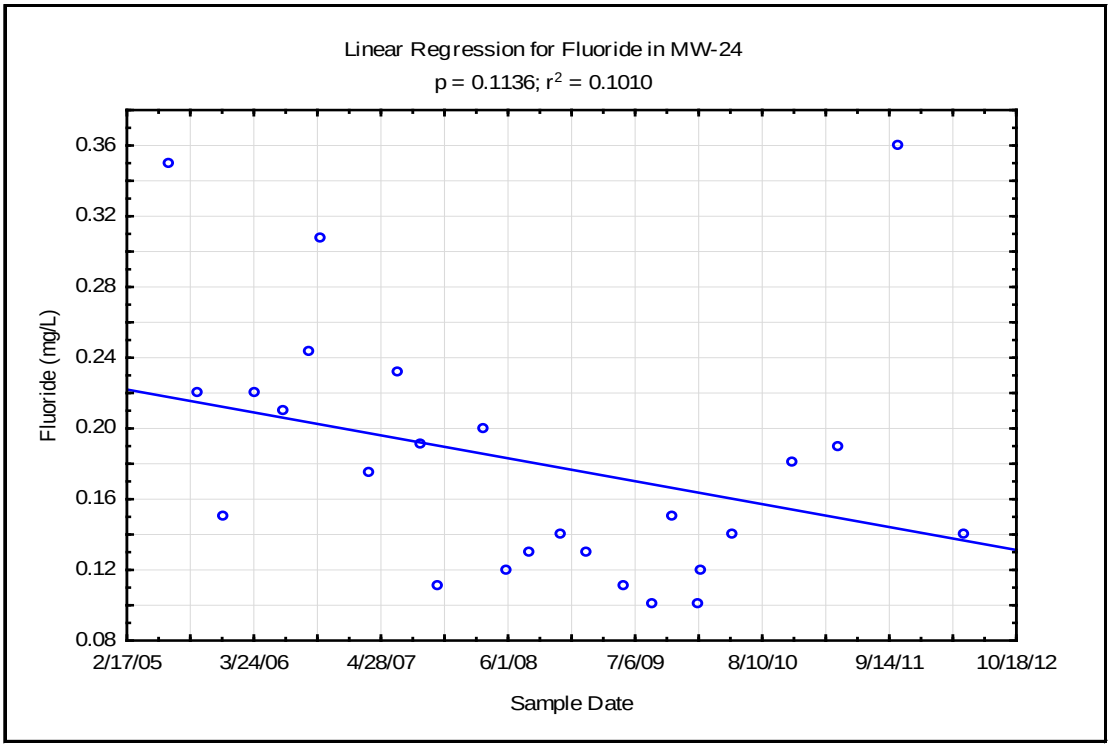
Appendix E-2
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances



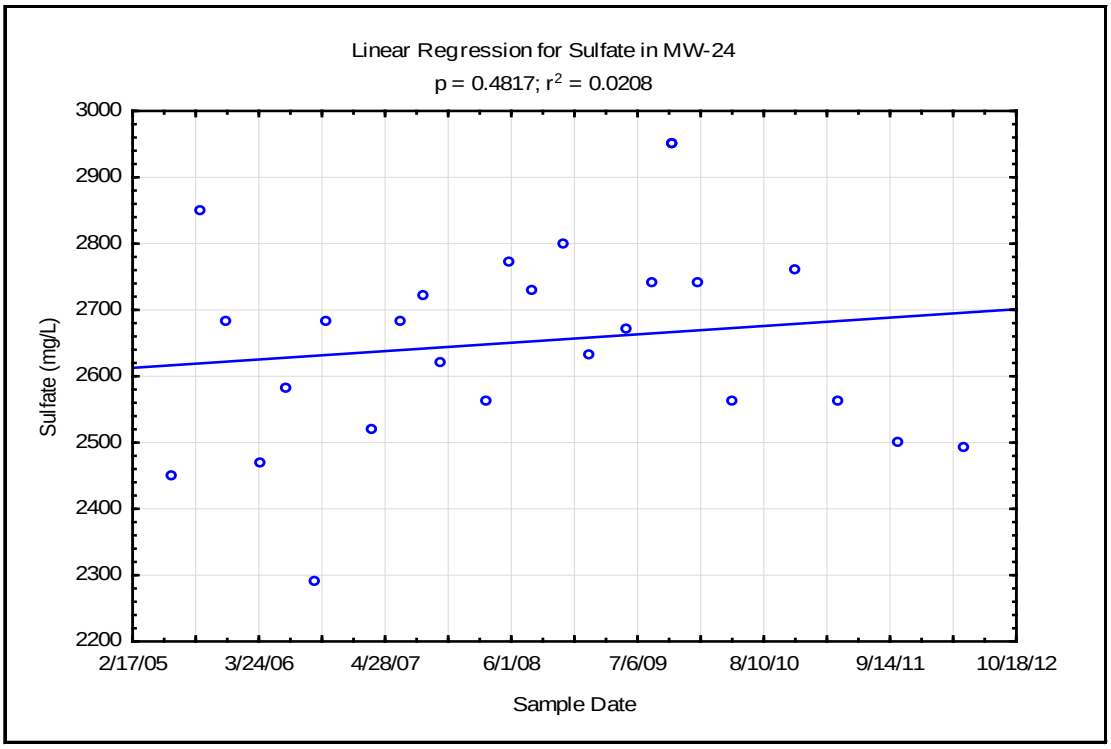


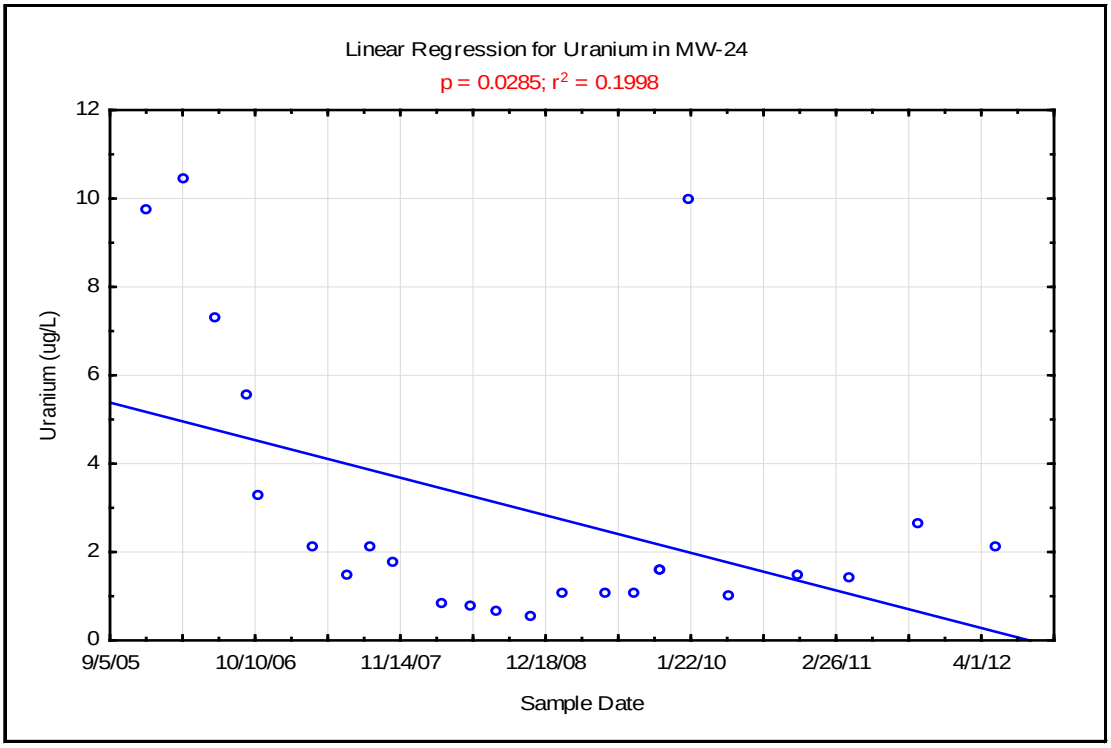
Appendix E-2
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances





Appendix E-2
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances





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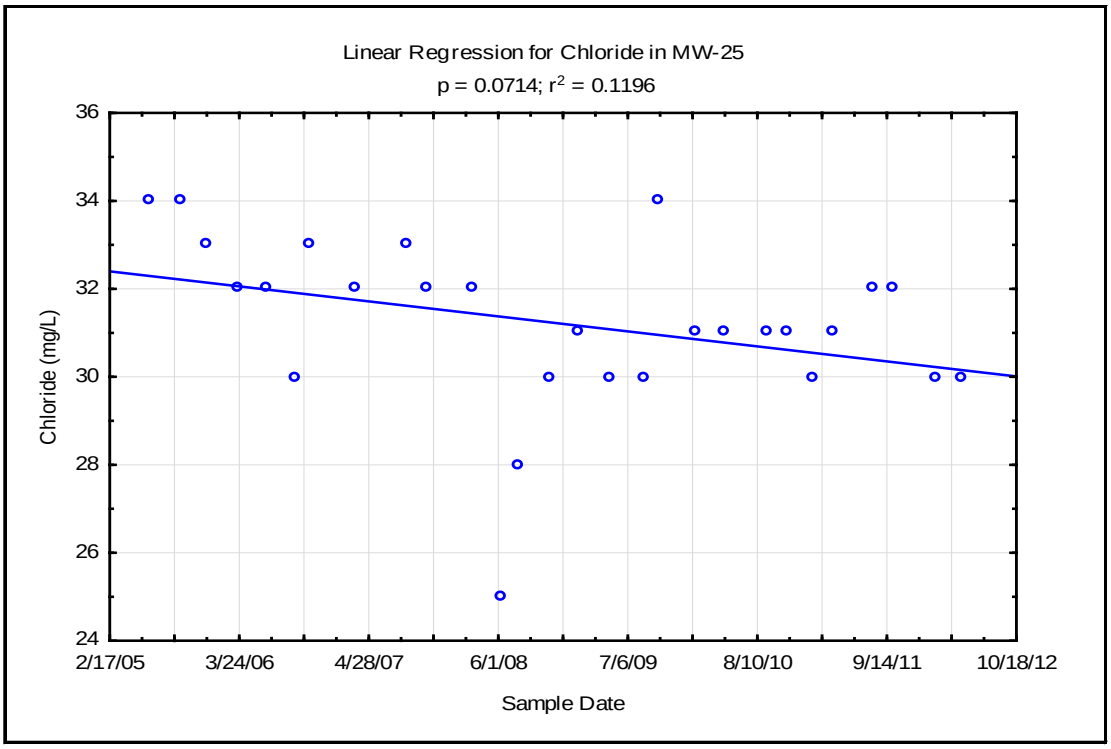
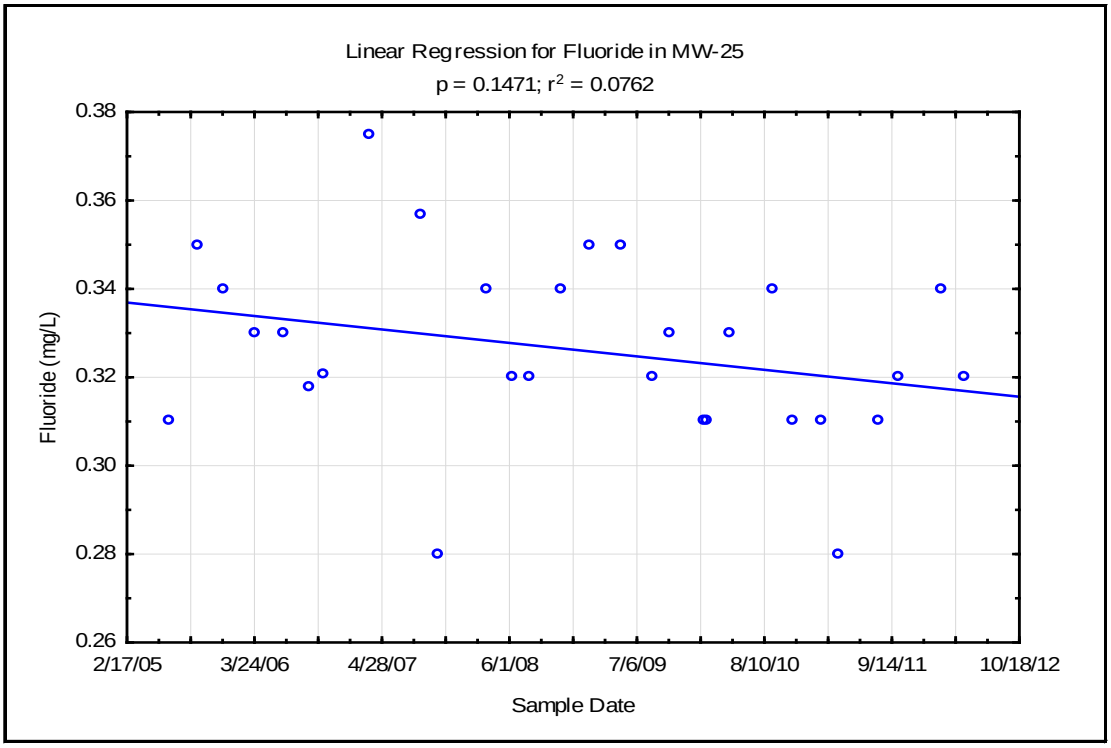
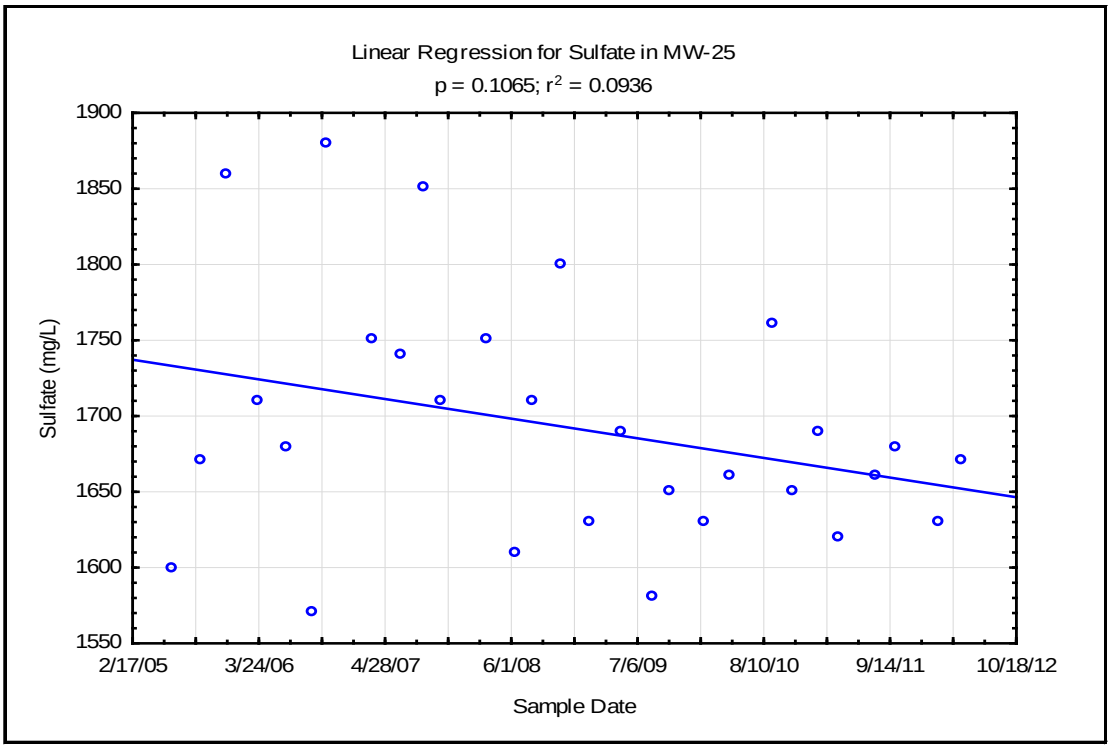
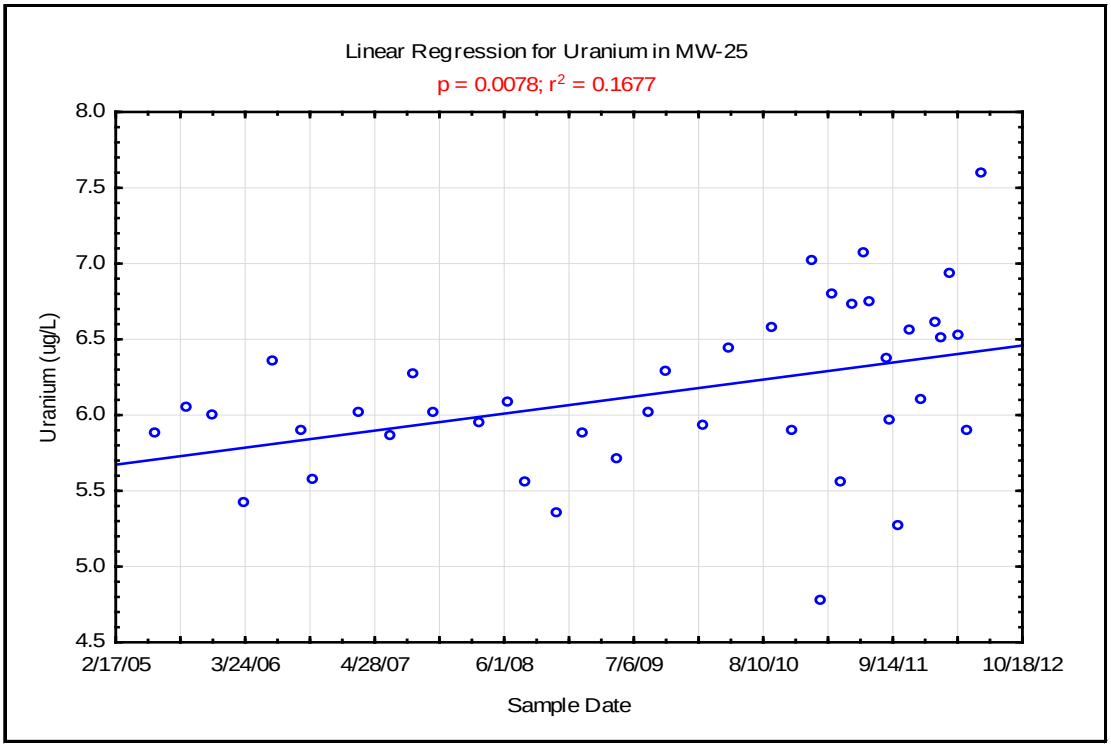
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances



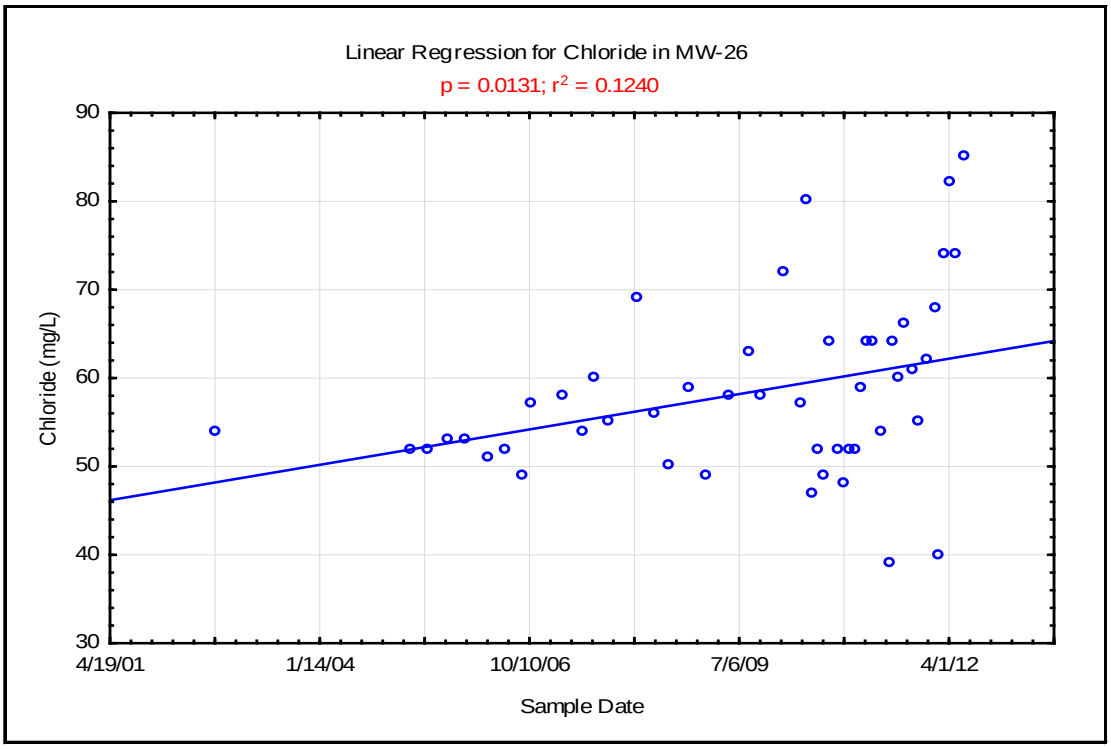


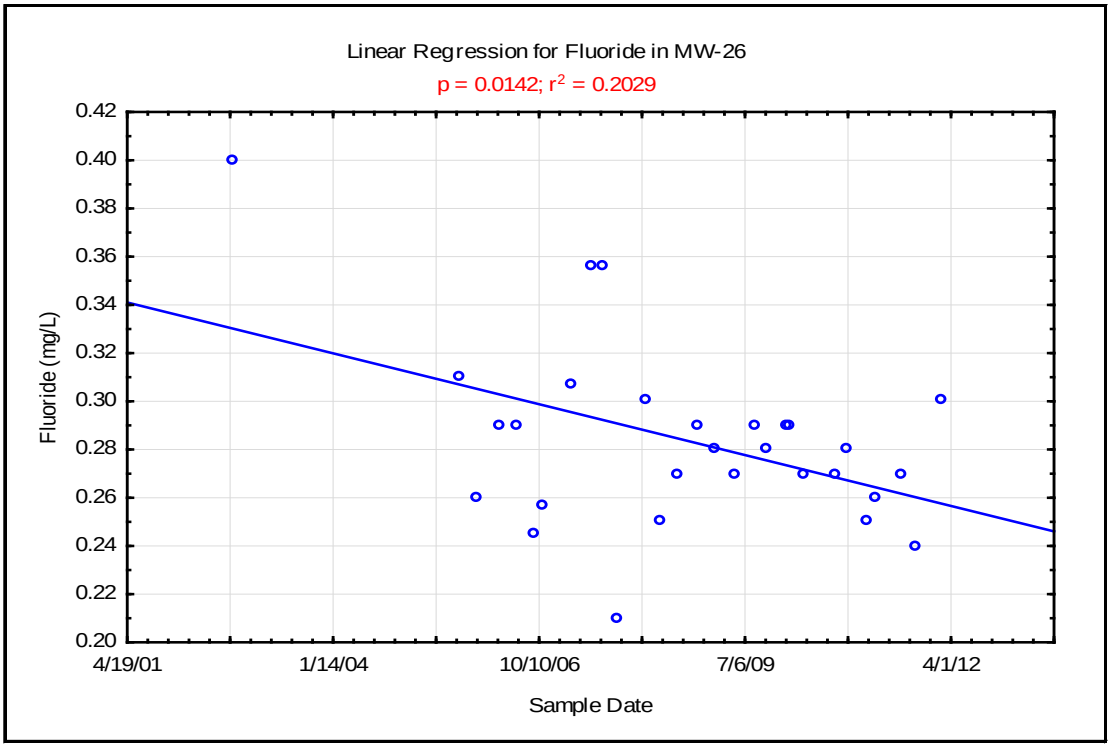
Appendix E-2
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances





Appendix E-2
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances





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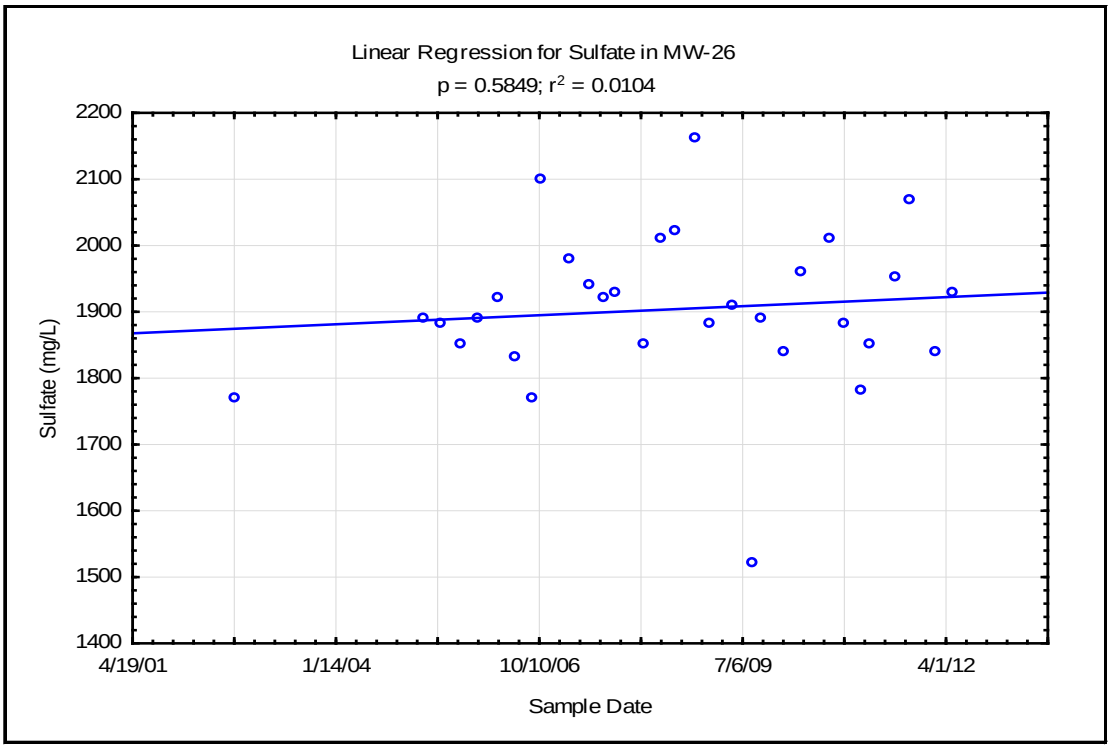
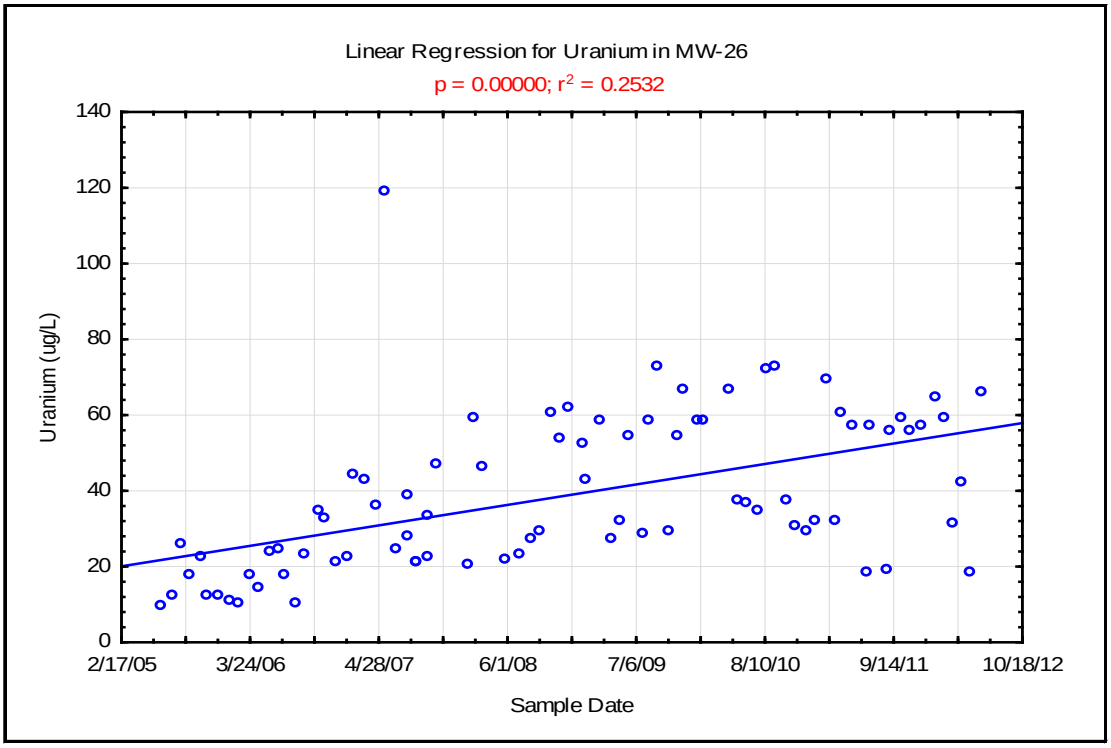
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances





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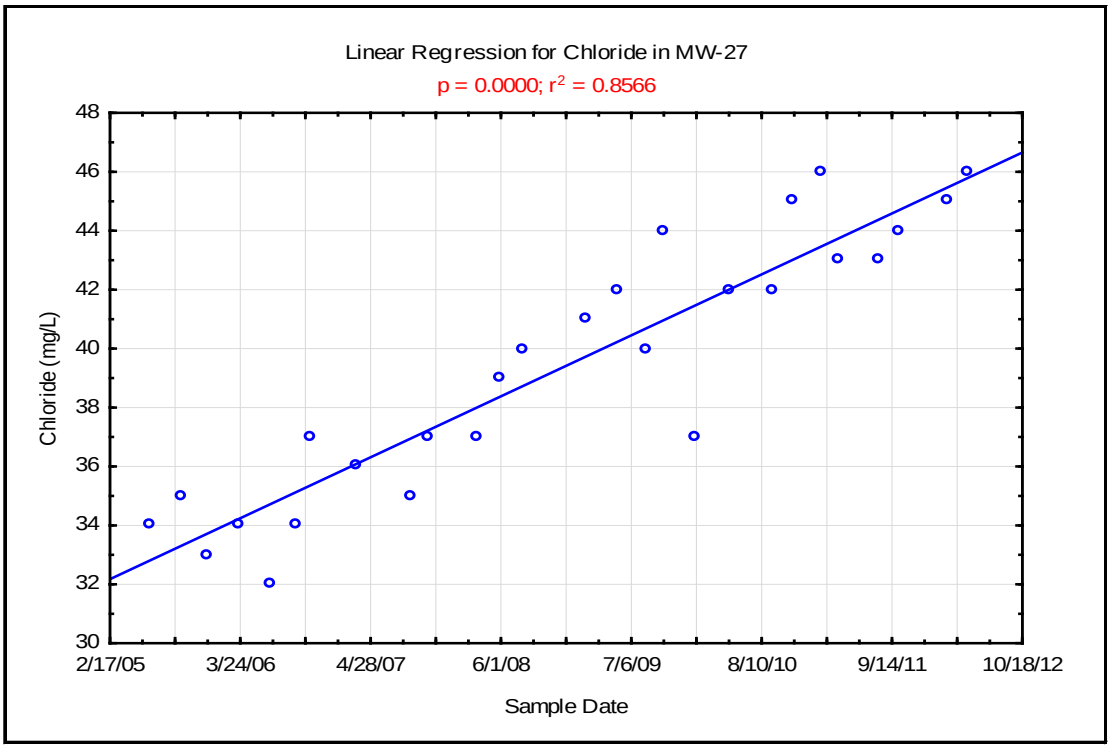
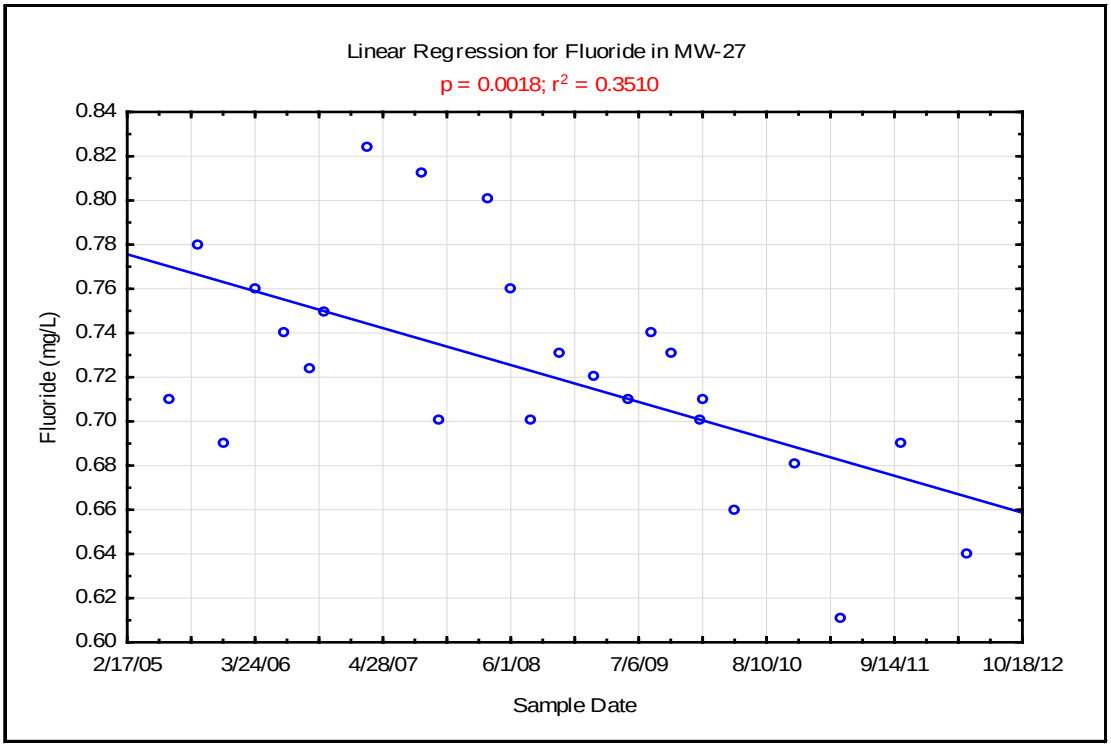
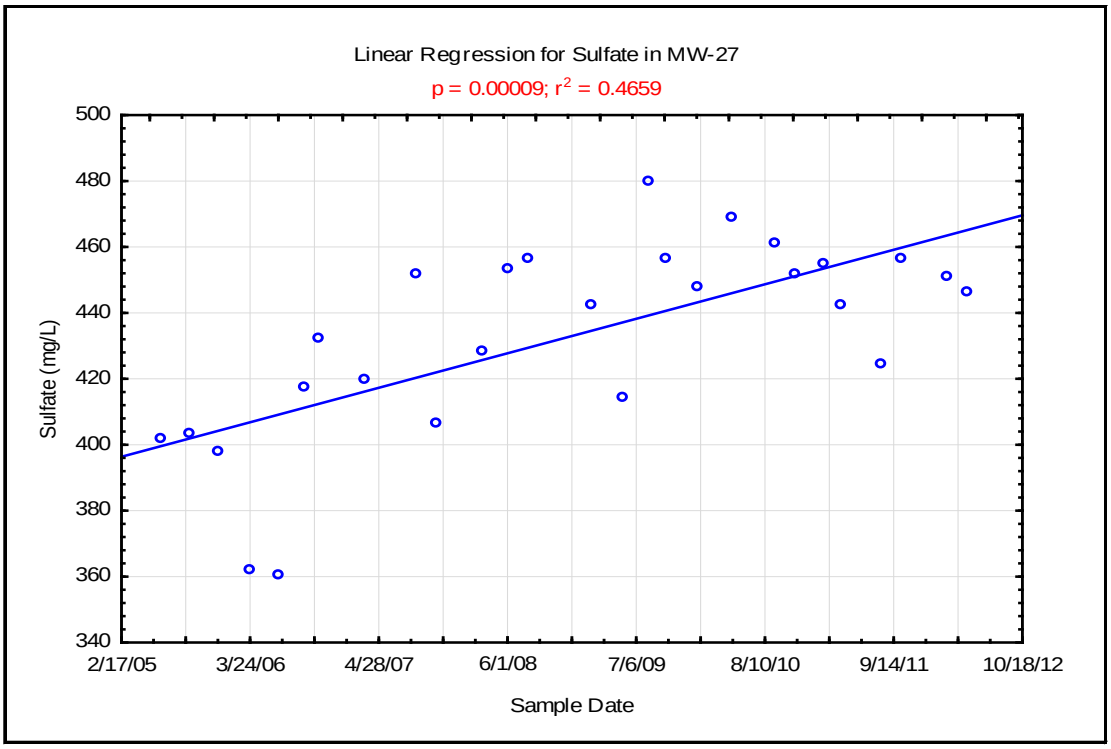
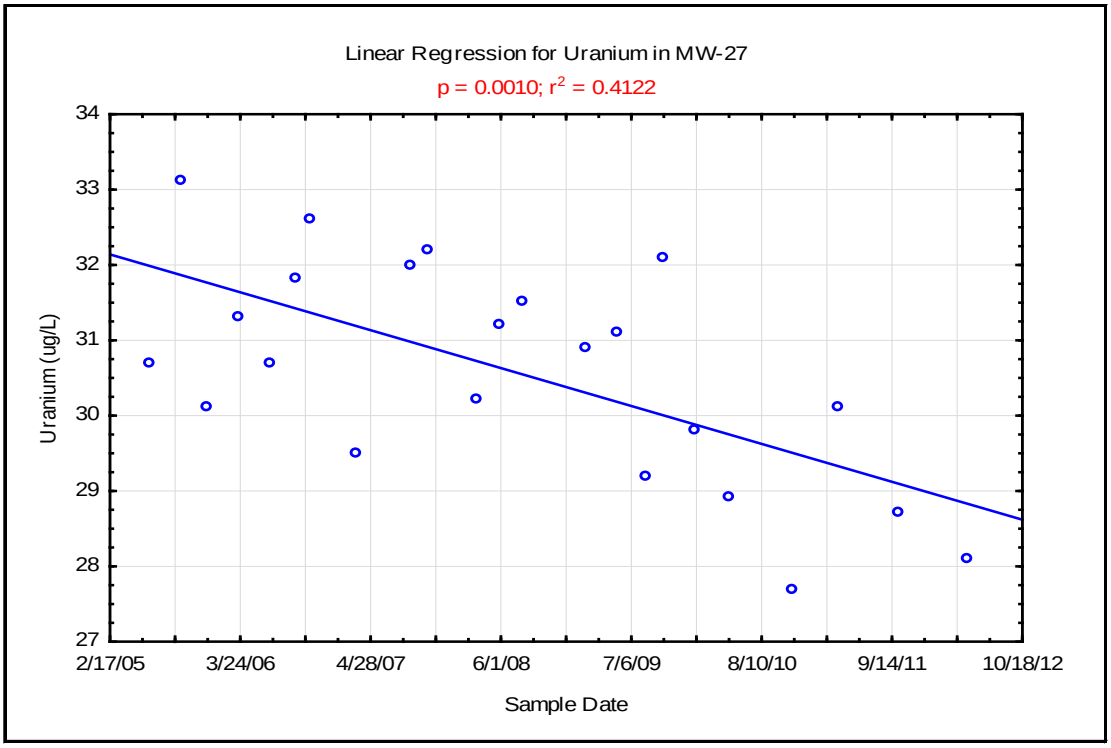
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances





Appendix E-2
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances





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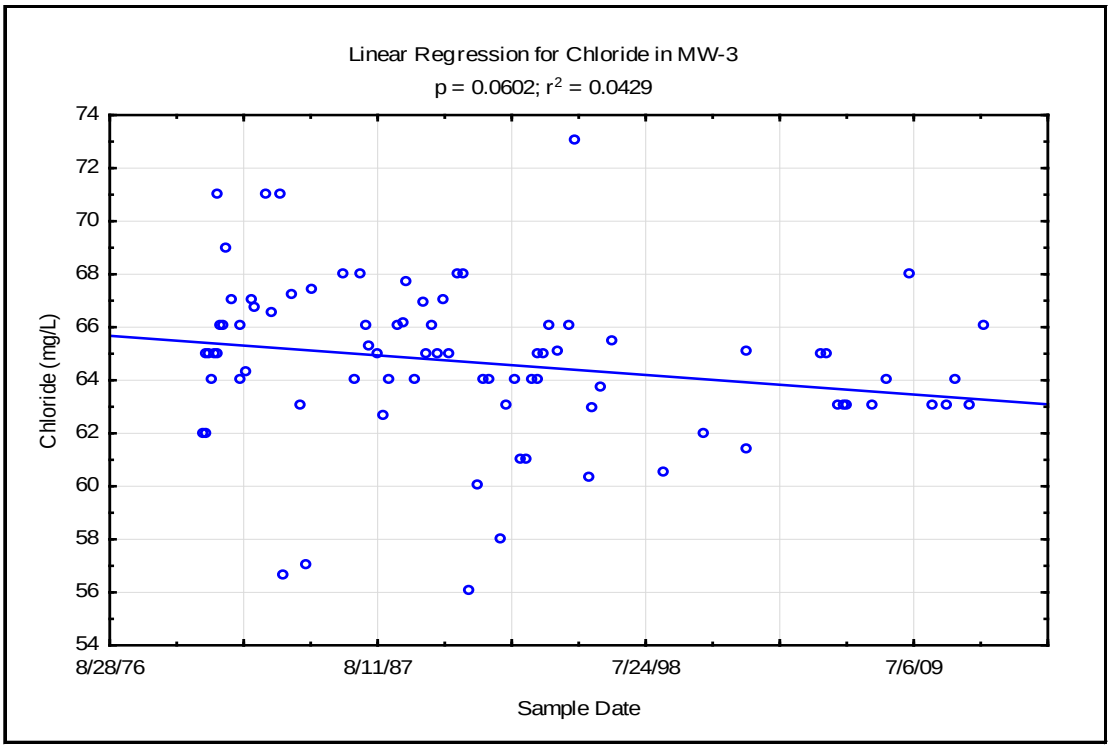

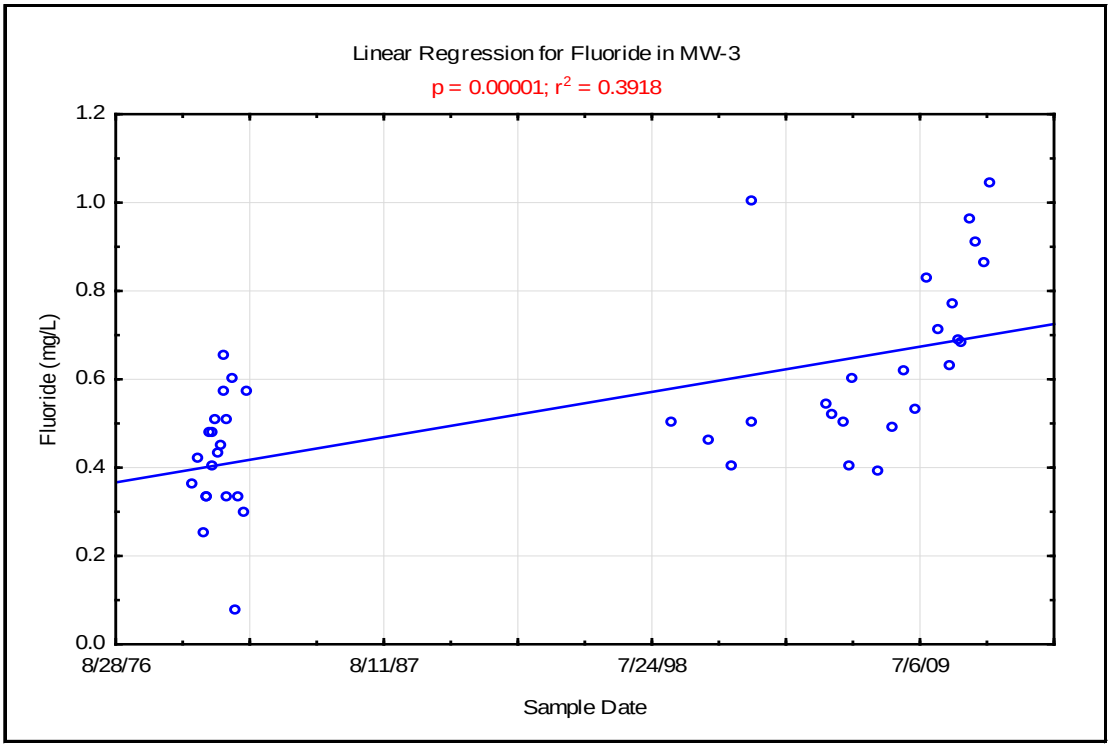

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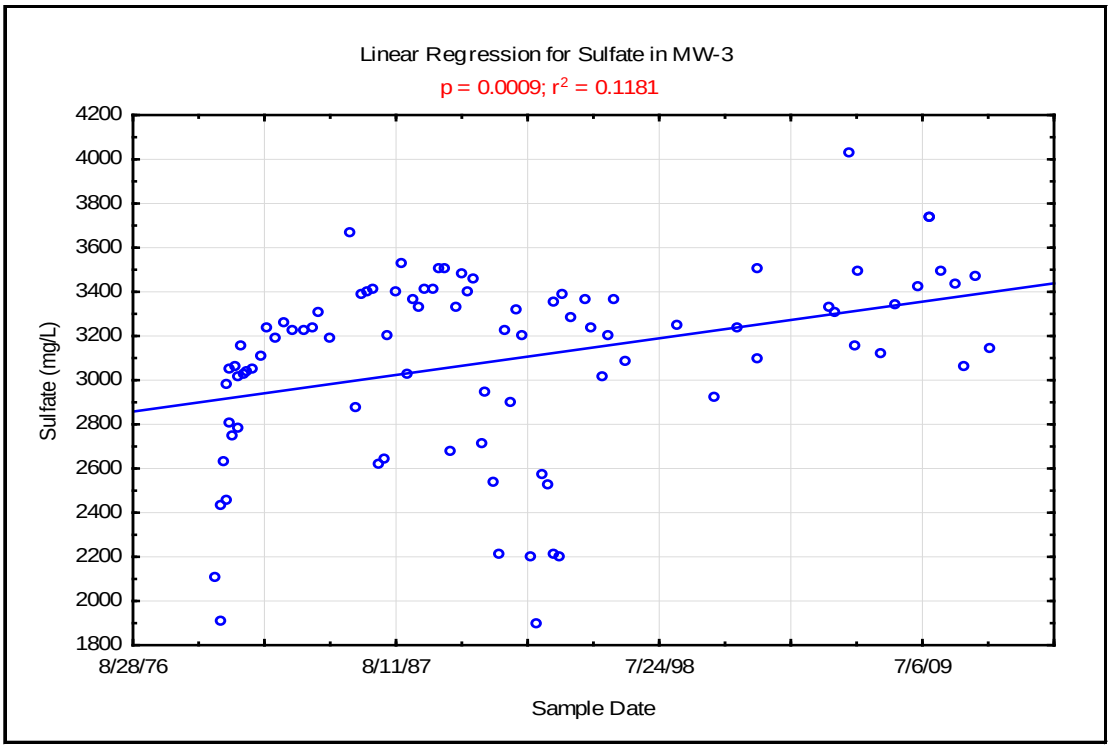

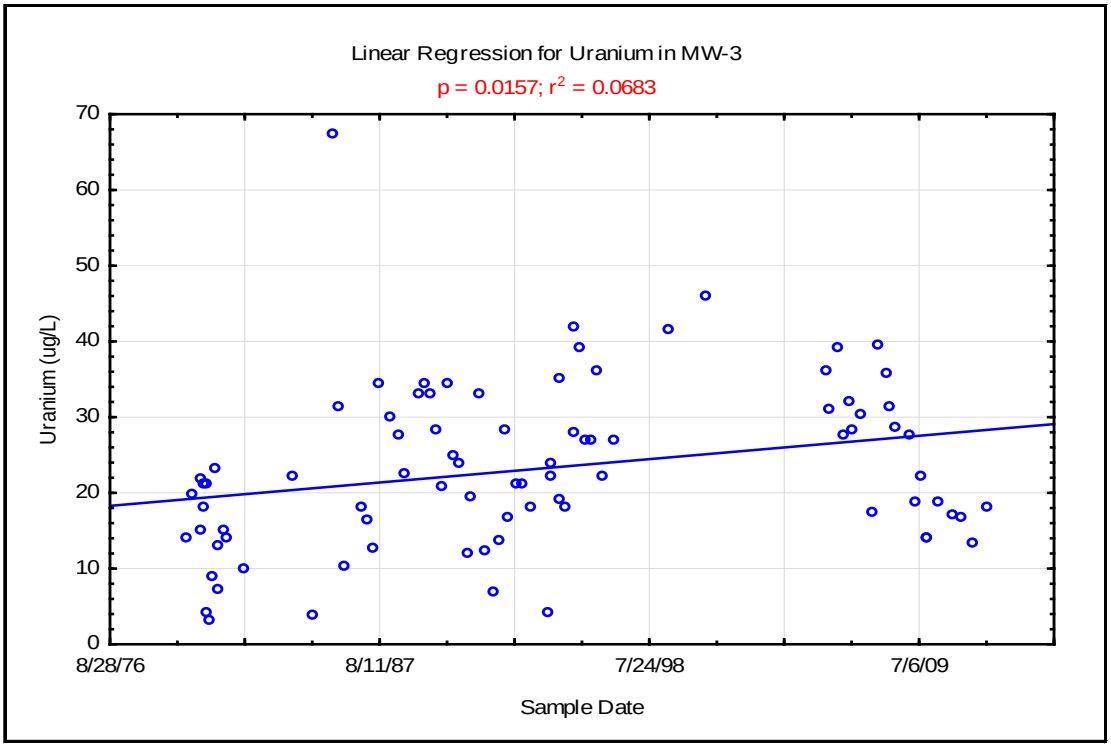

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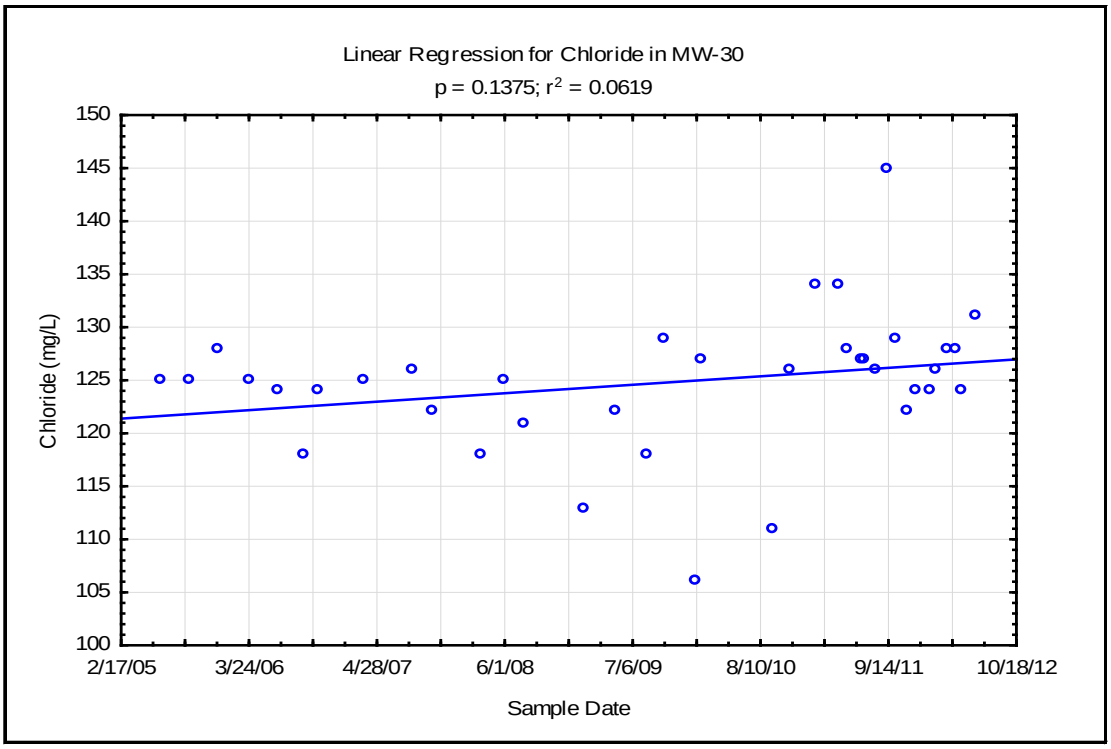
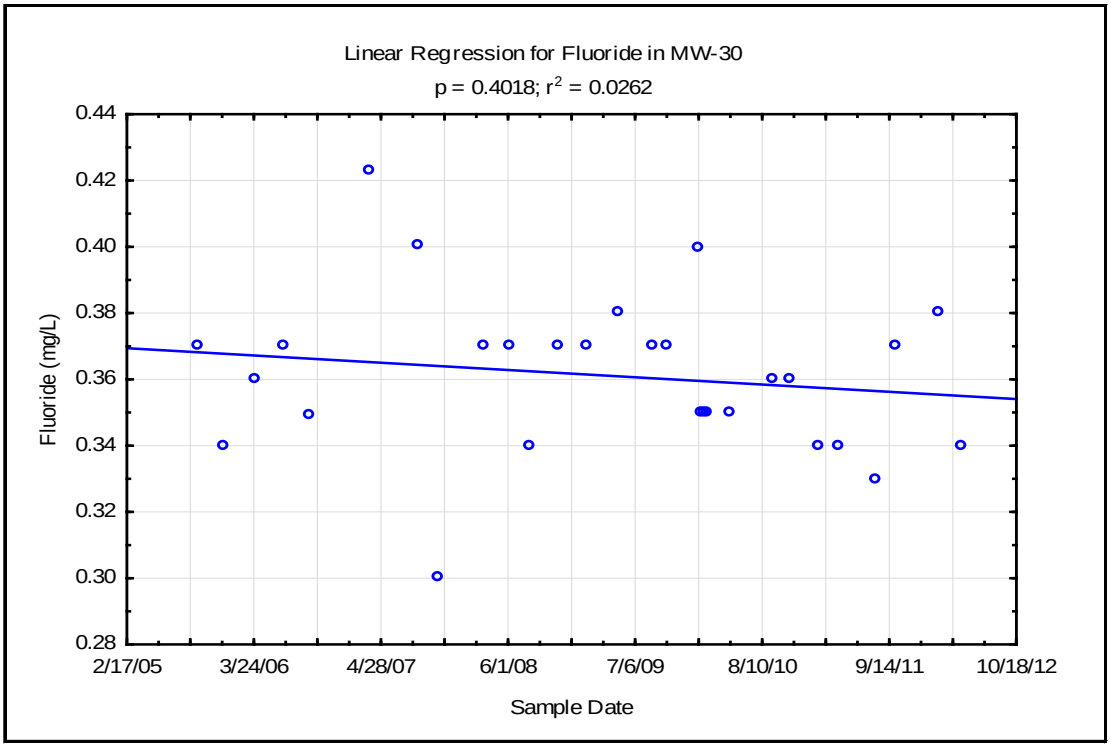
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances





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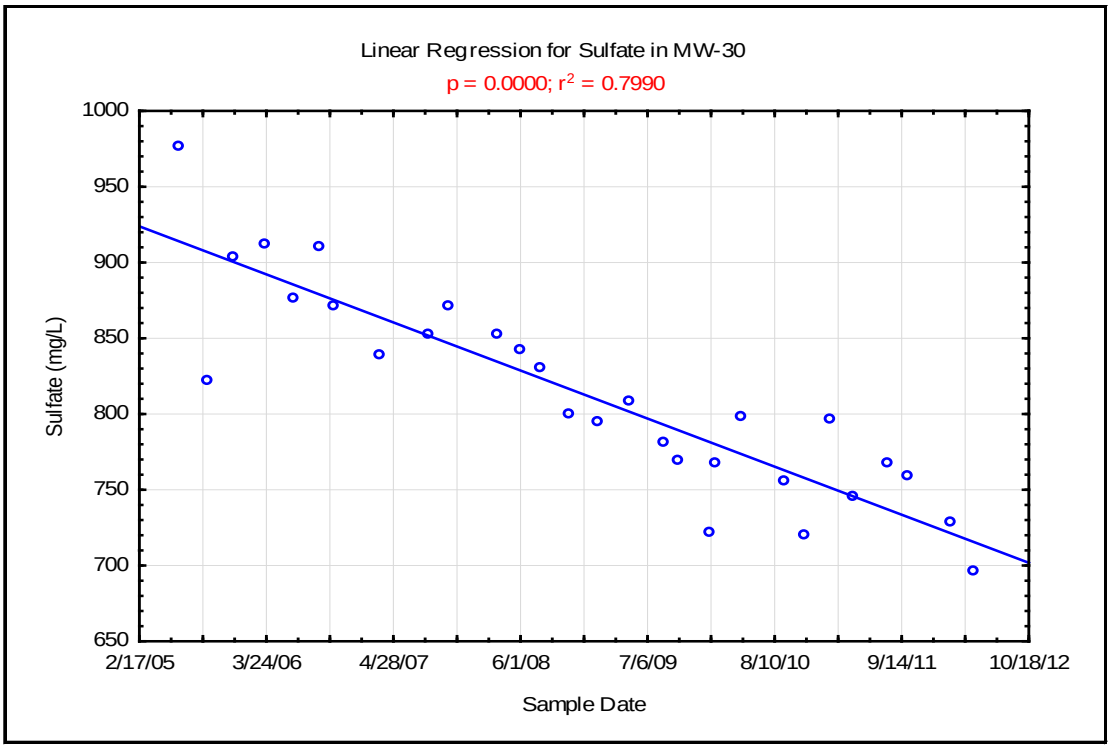

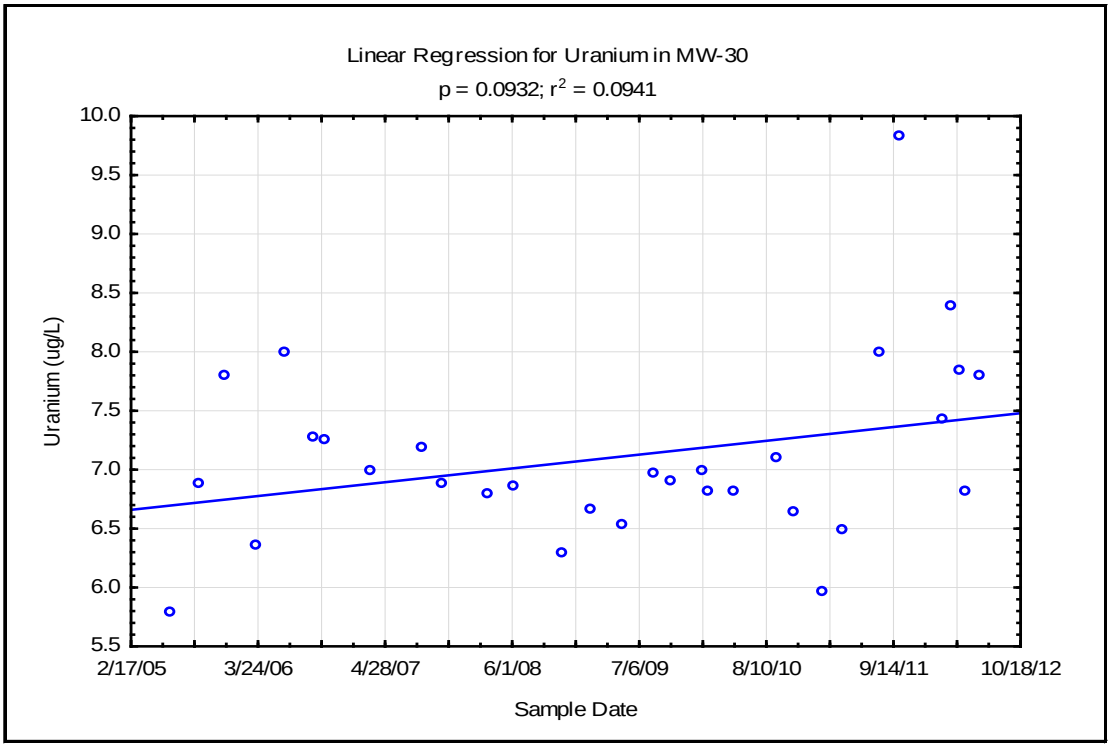

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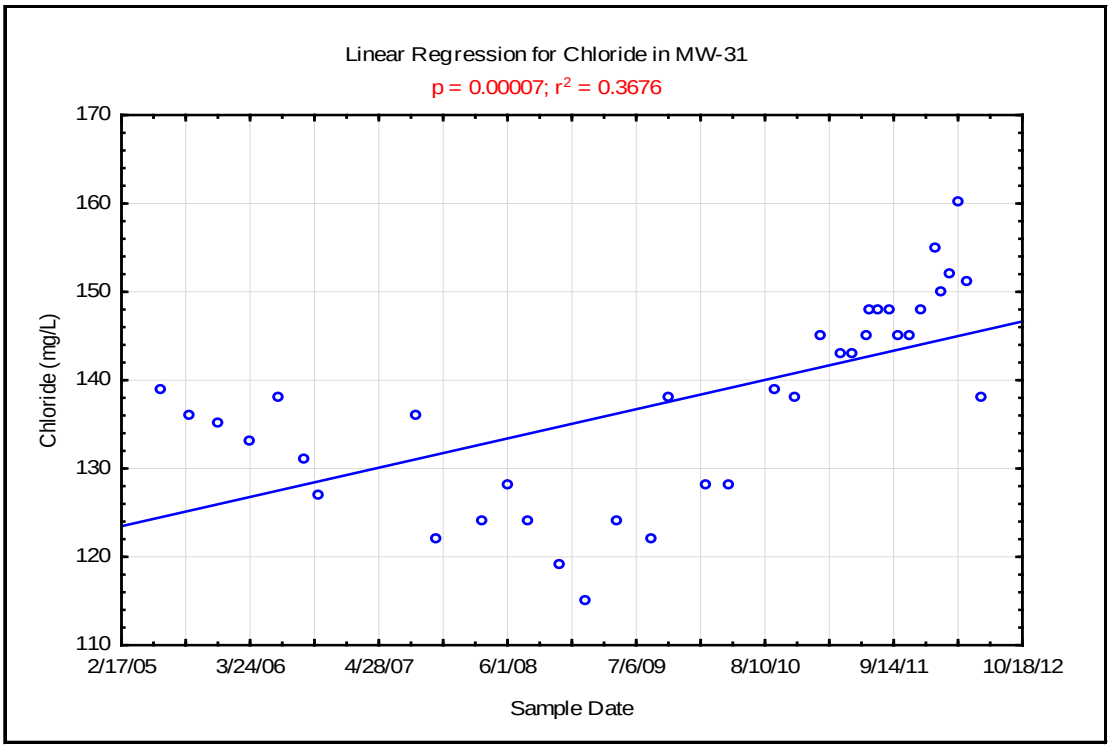
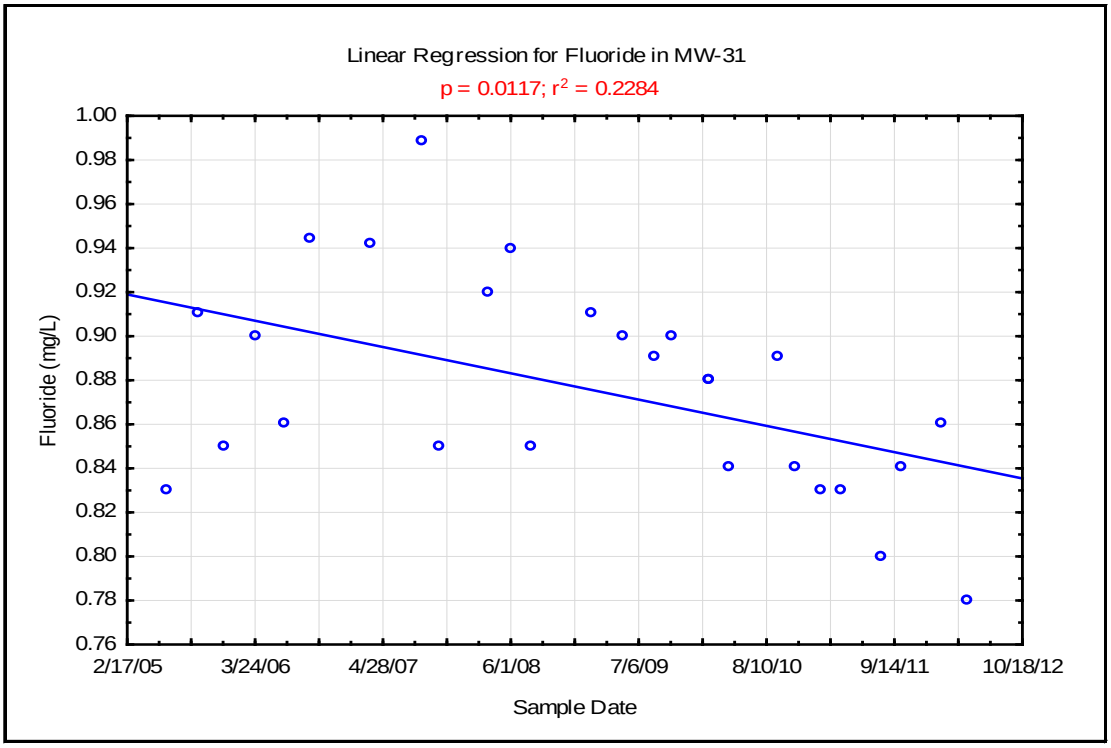
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances





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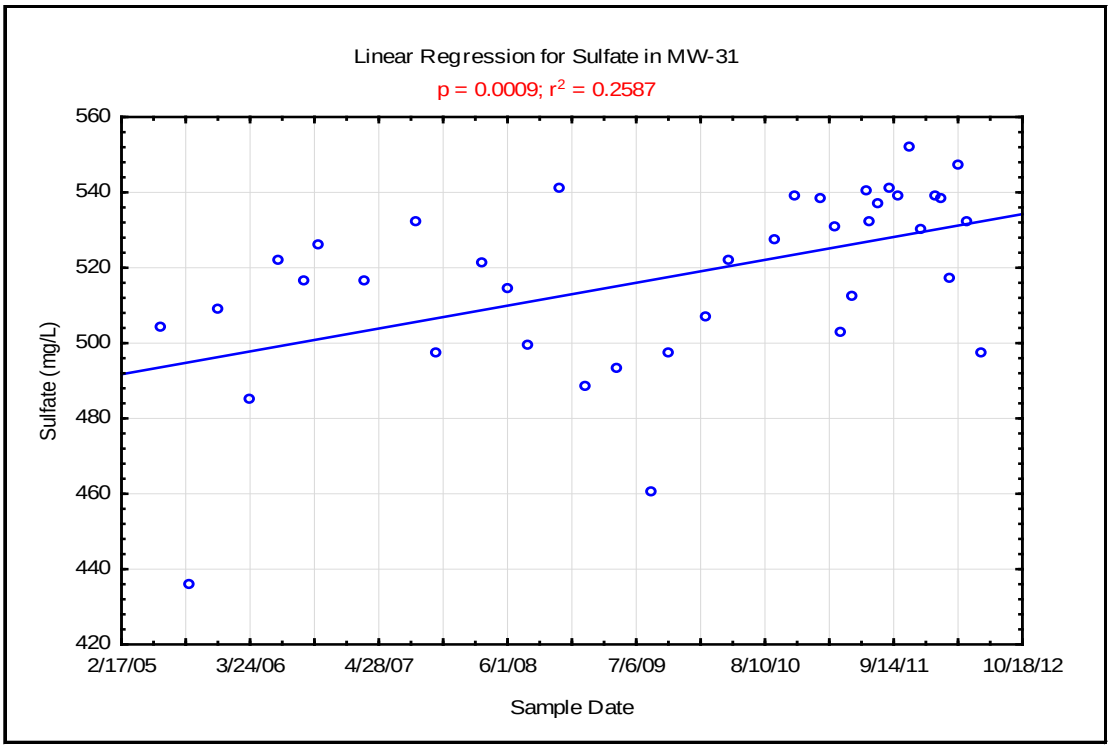
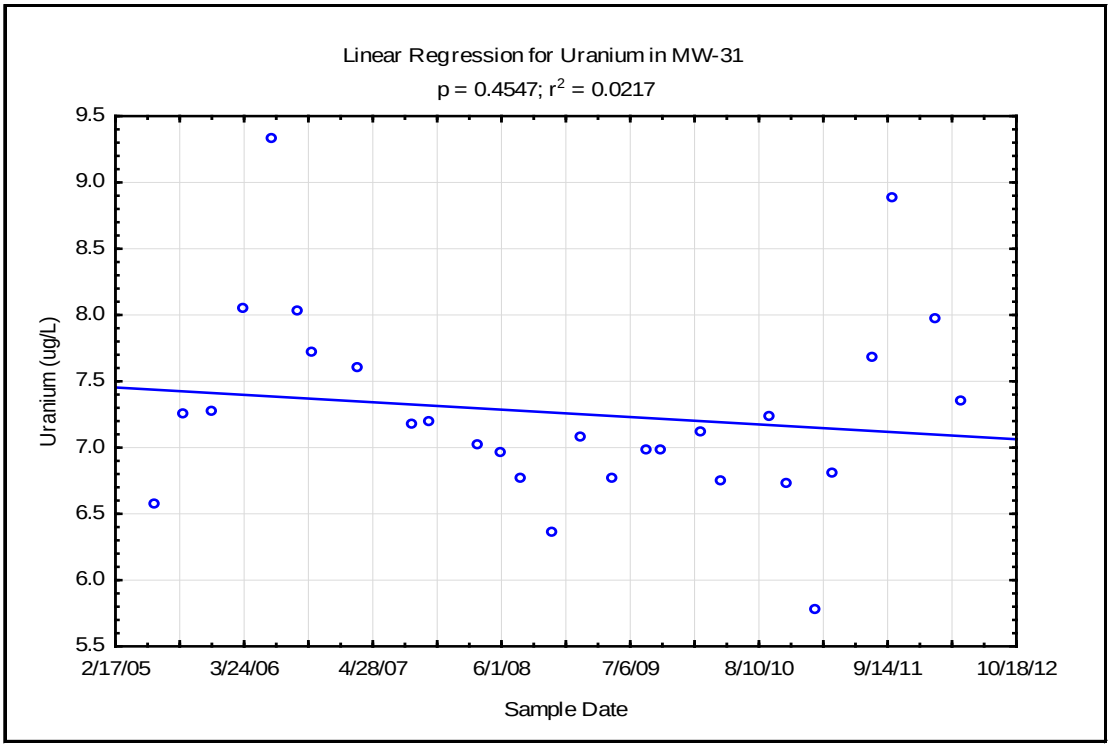
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances





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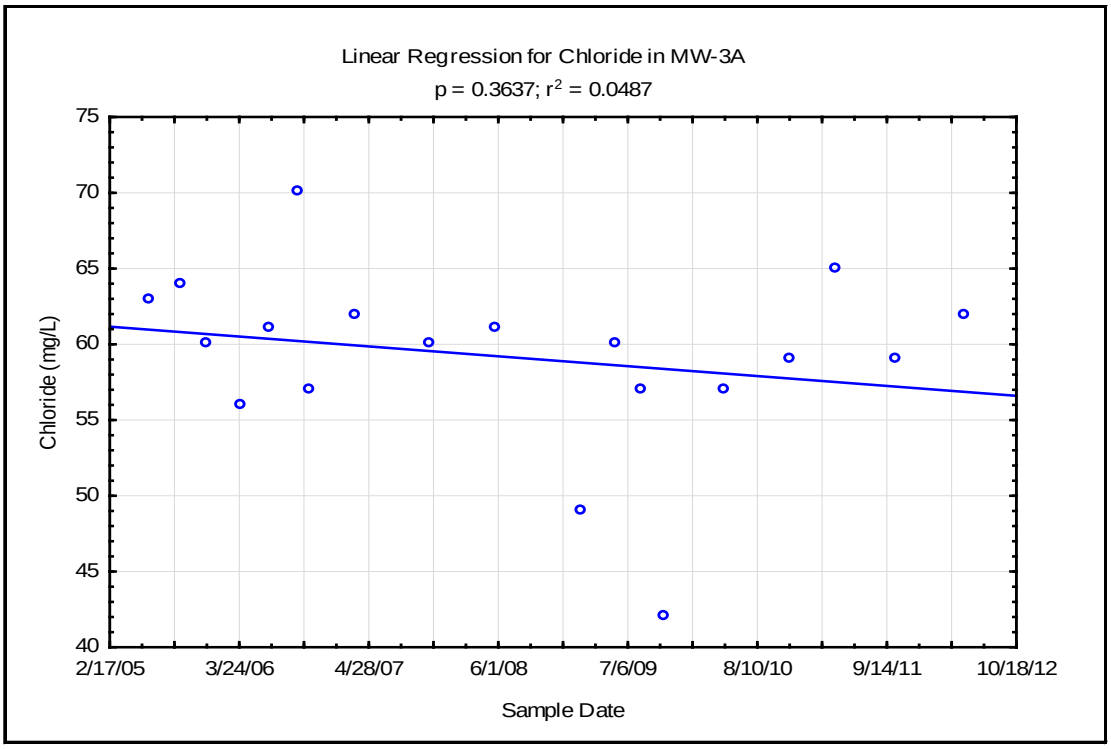
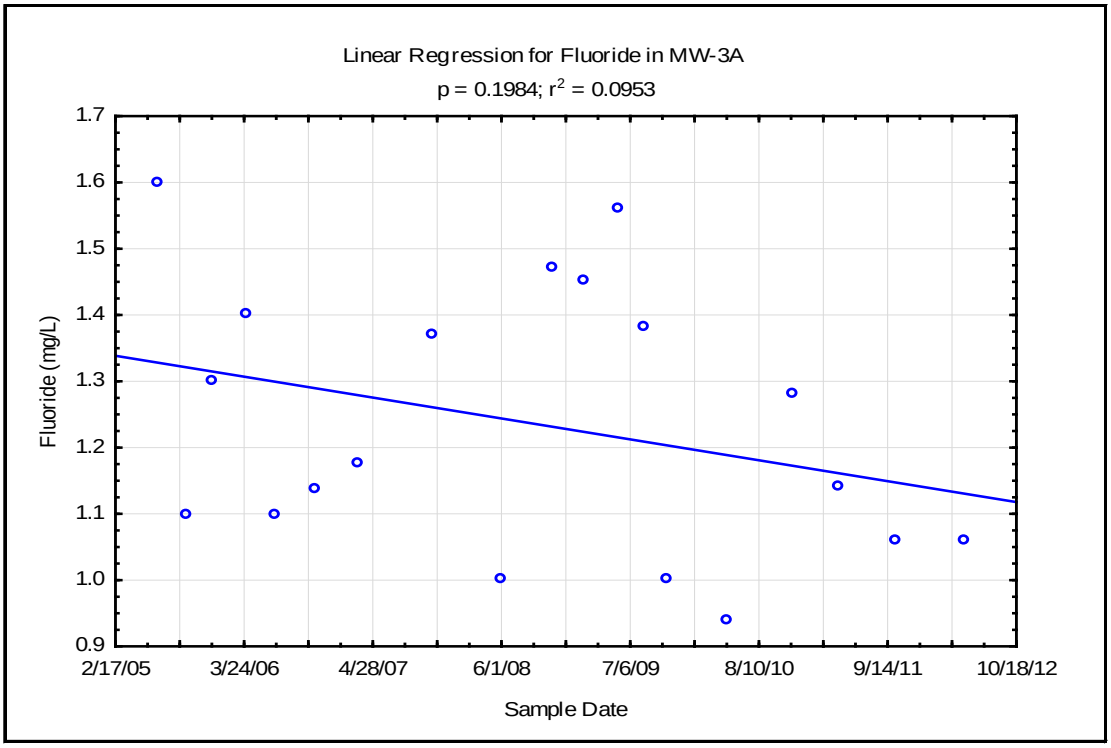
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances





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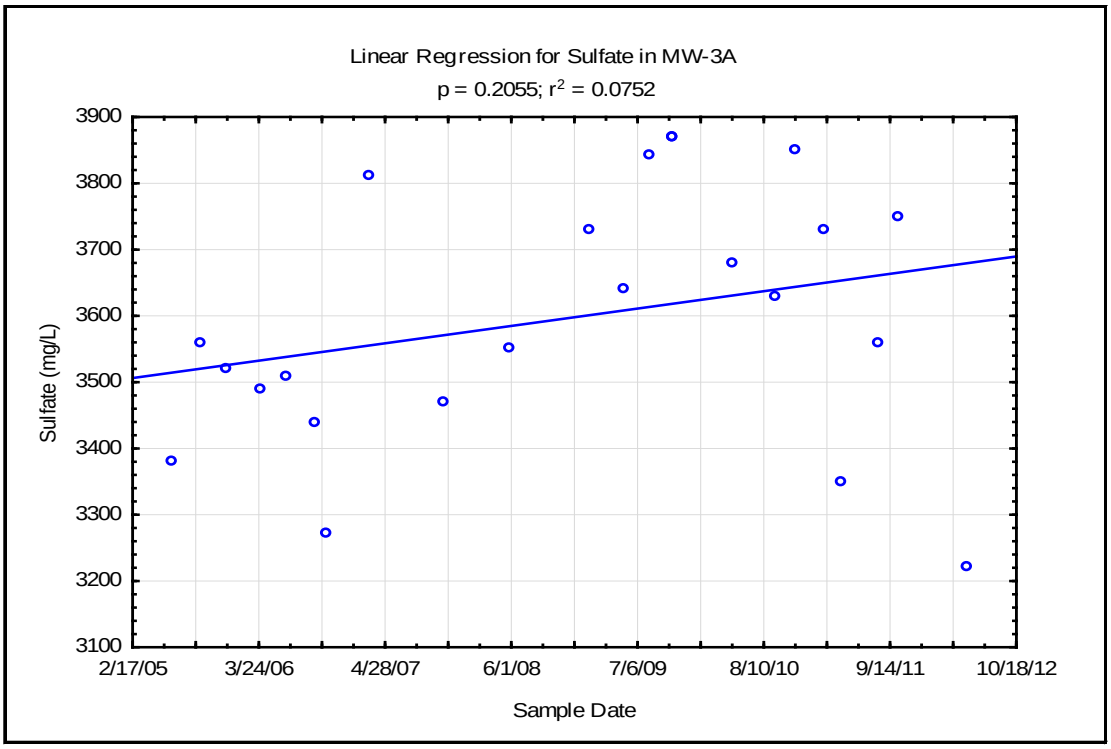
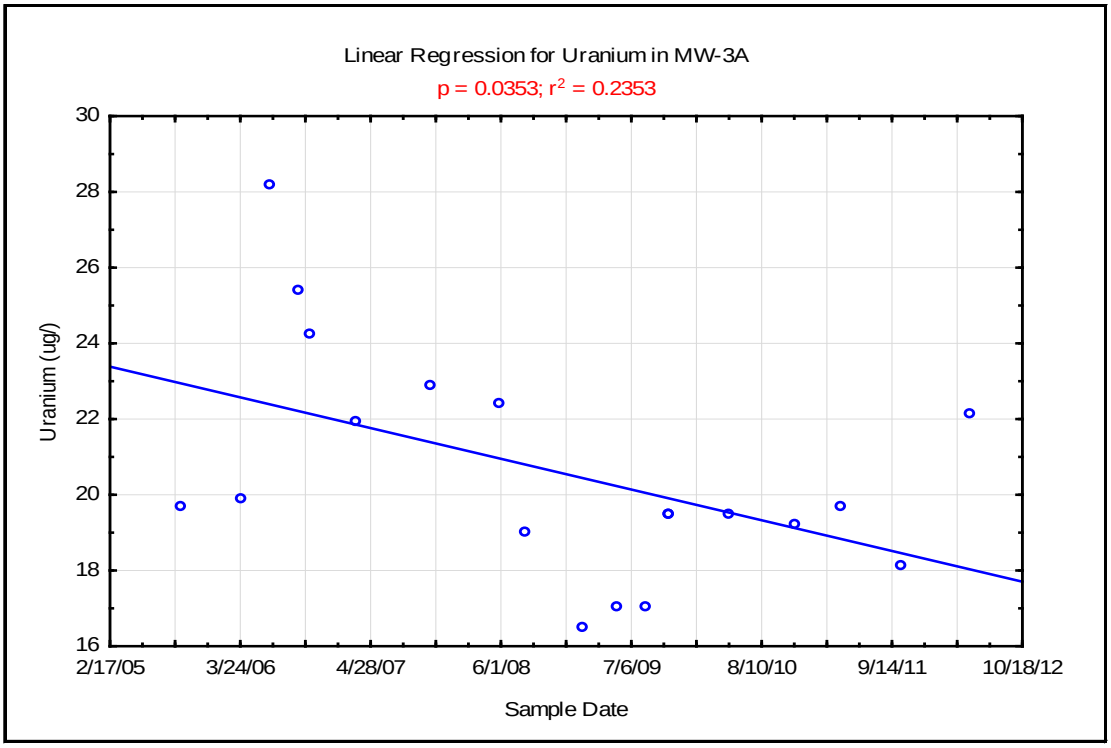
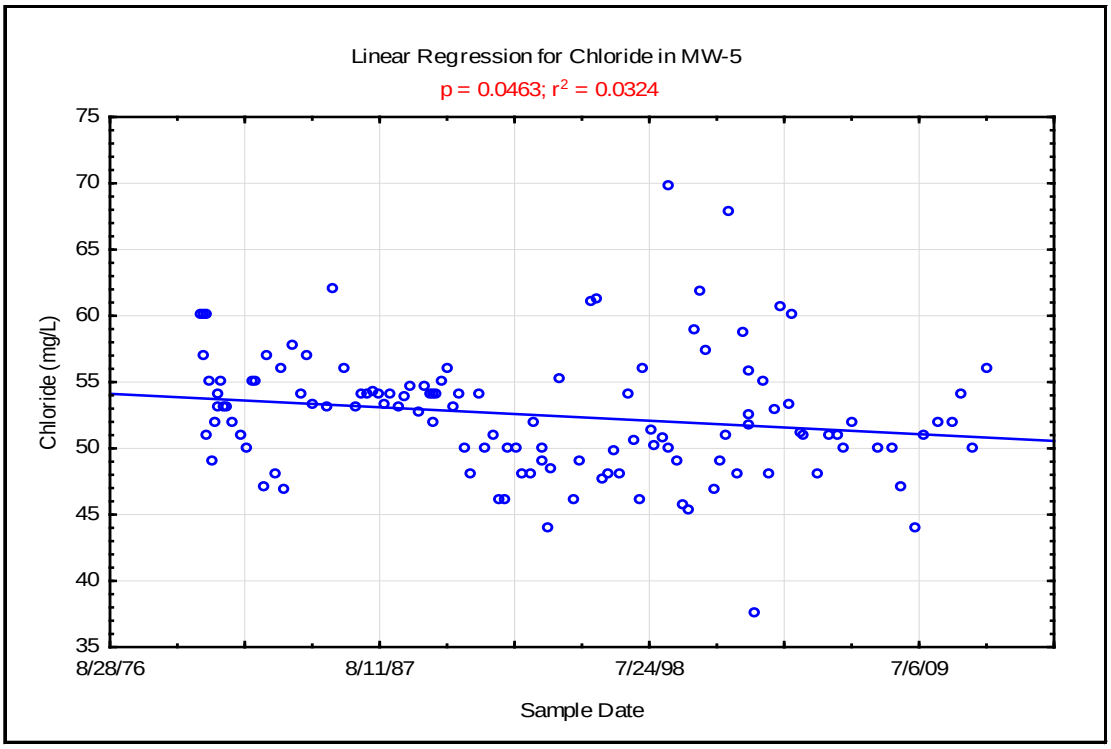
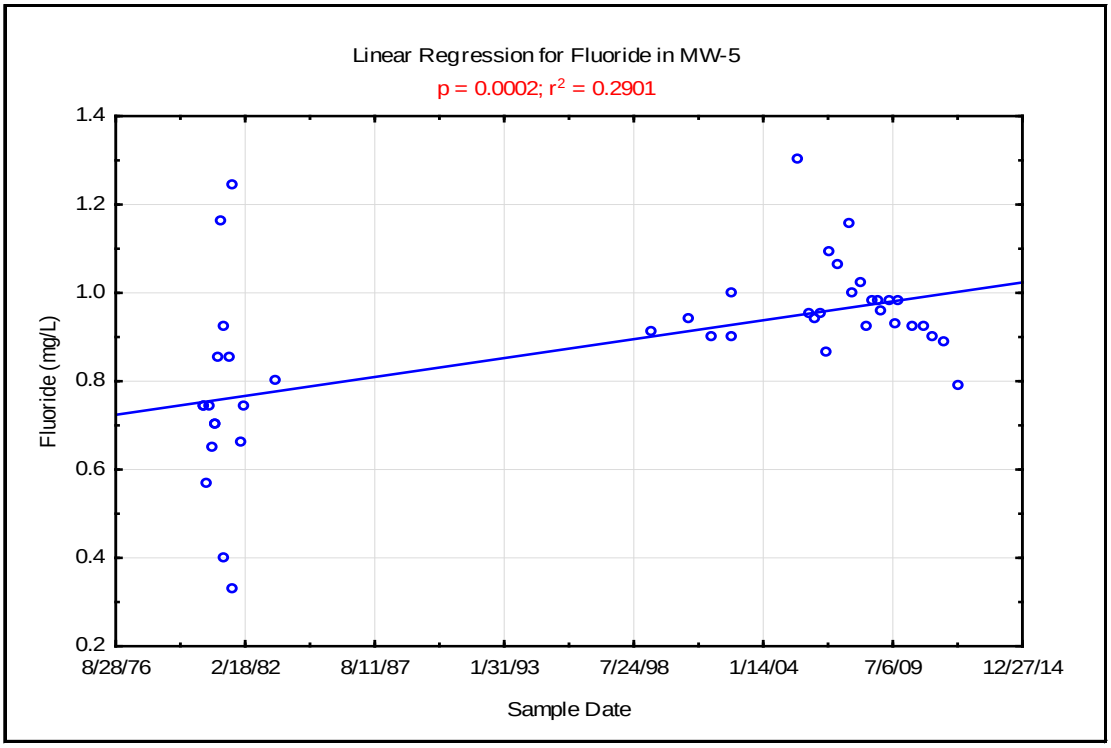
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances



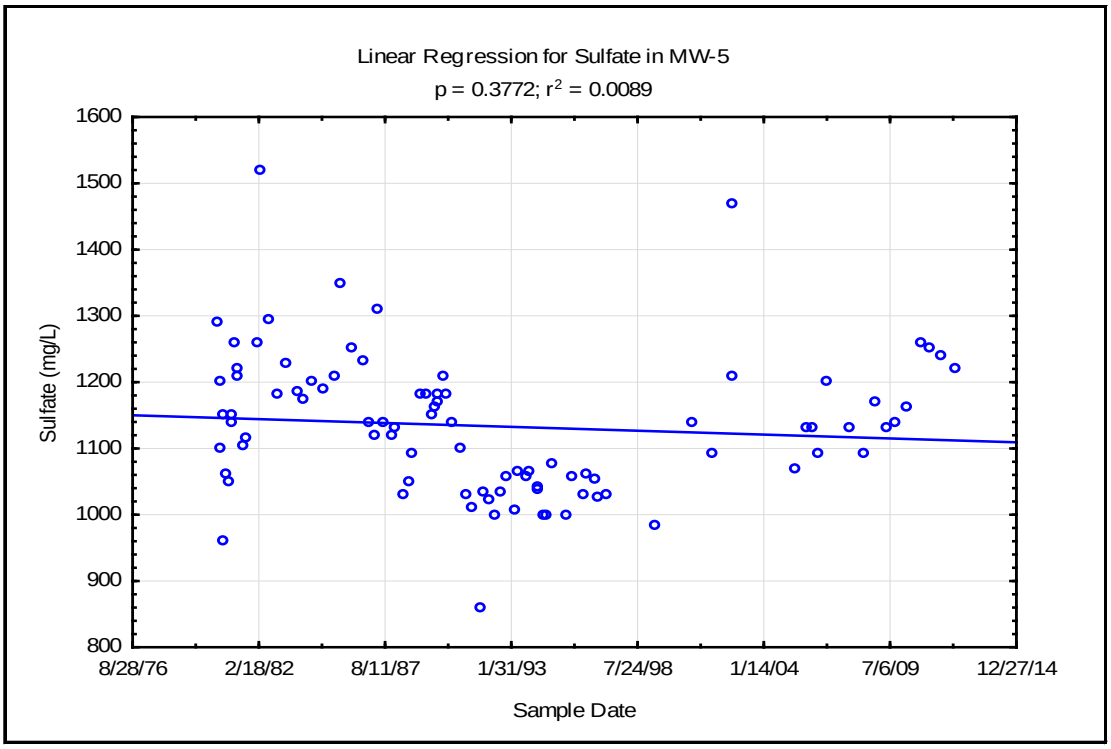


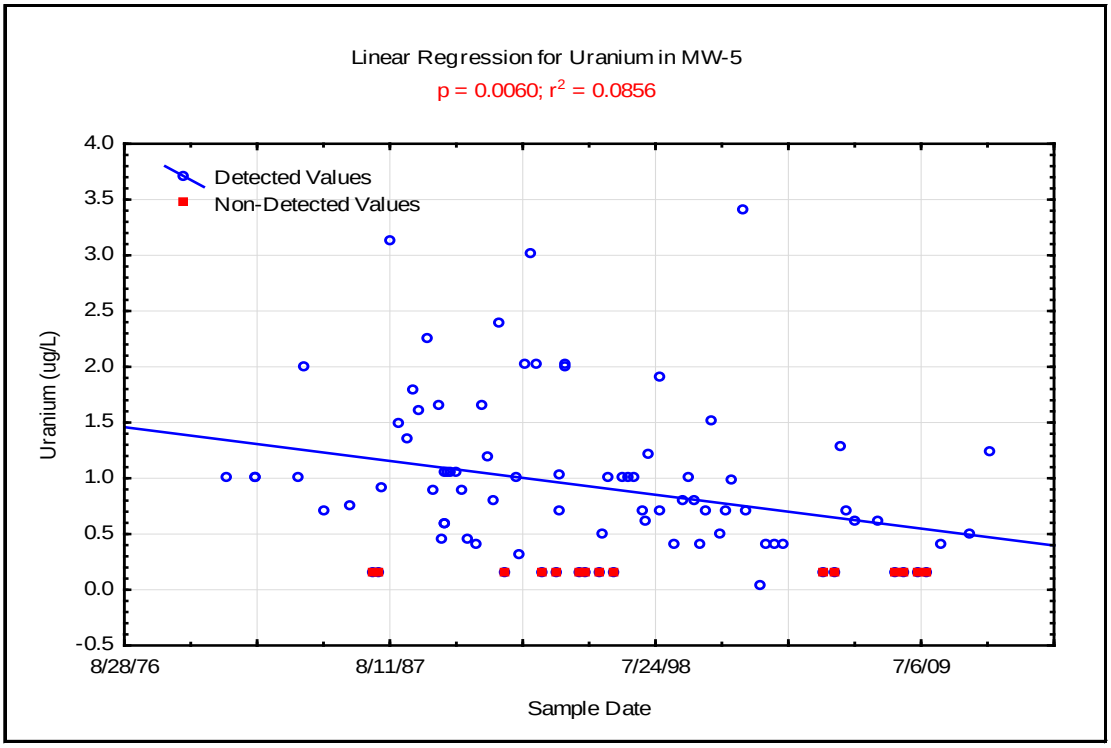
Appendix E-2
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances





Appendix E-2
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances





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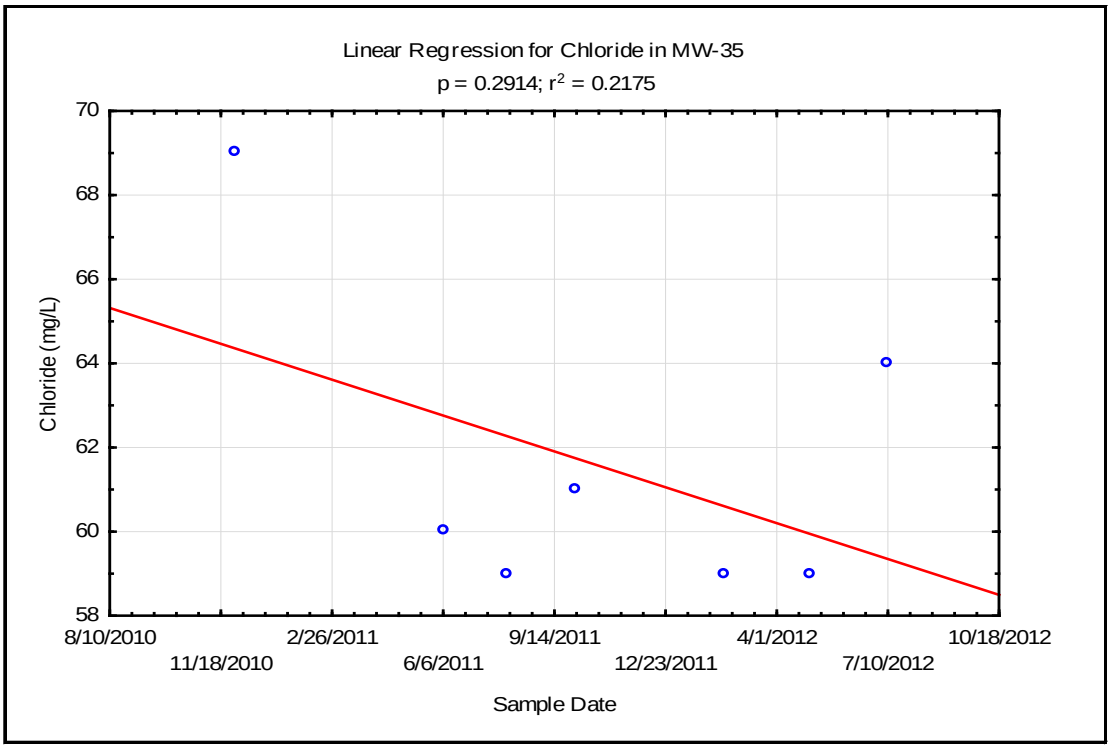
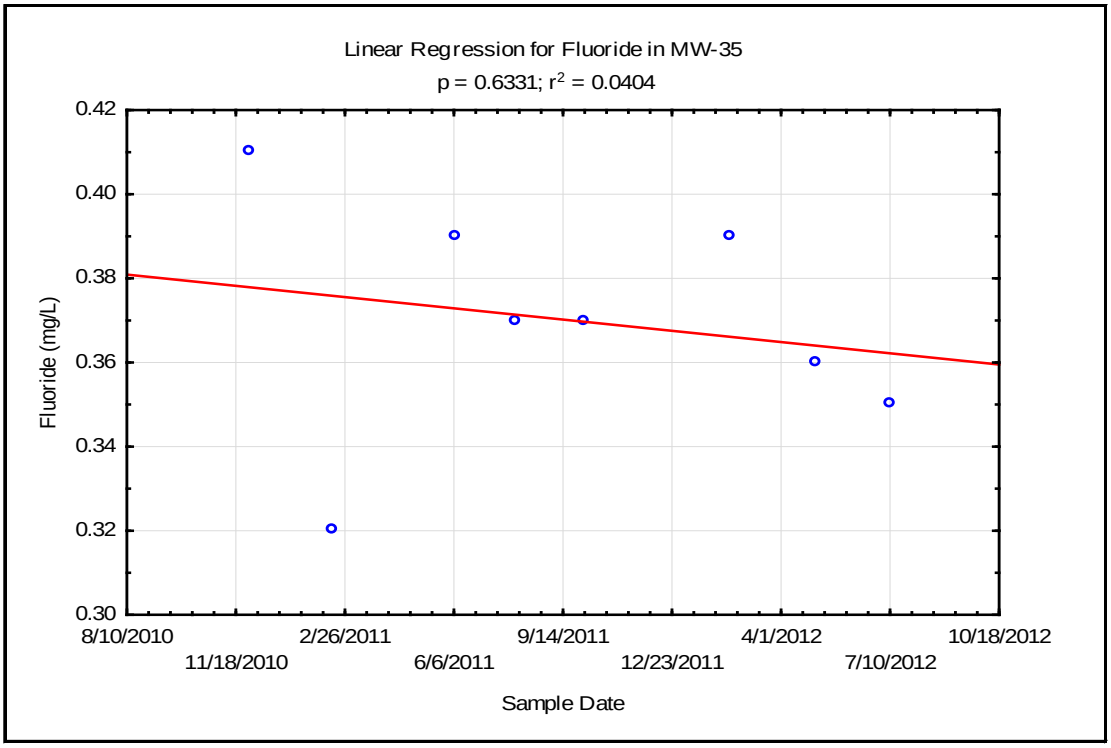
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances





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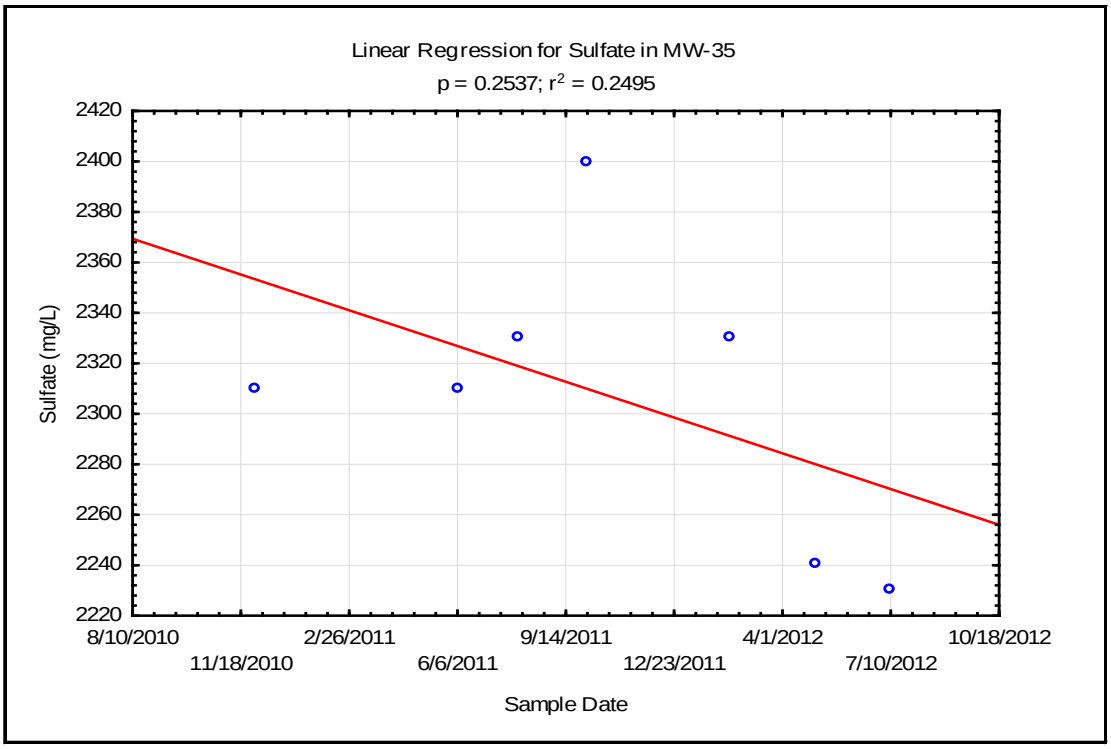
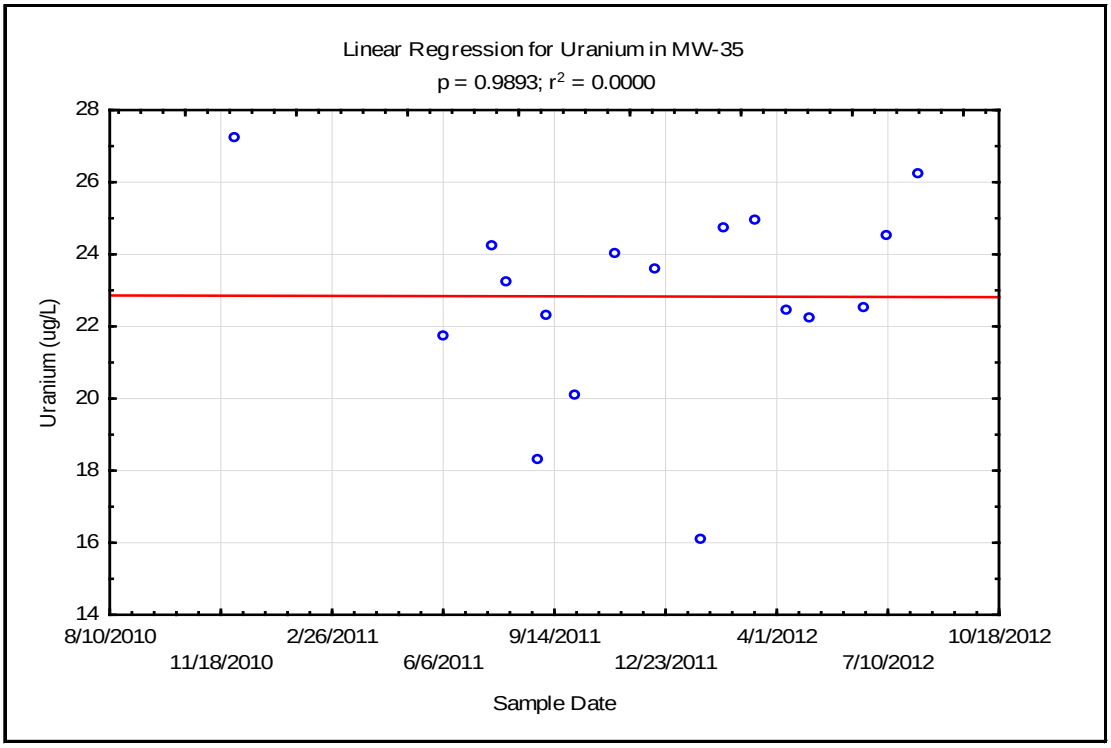
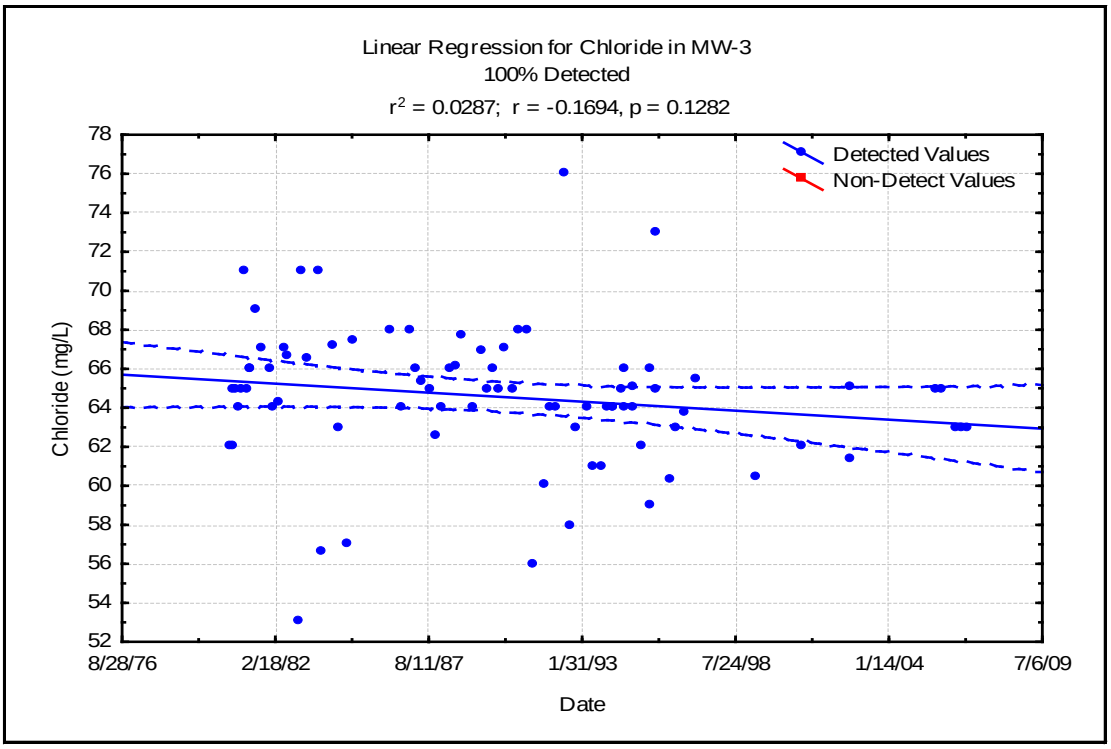
Linear Regressions for All Indicator Parameters of Wells with Constituents with Exceedances

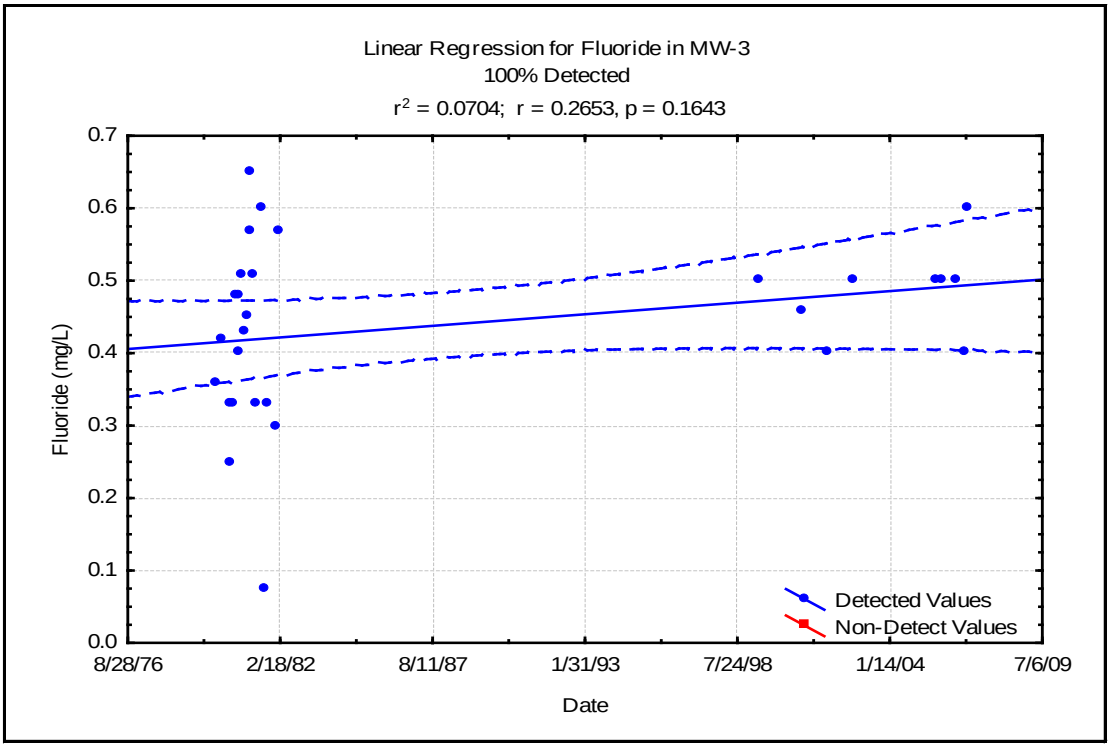




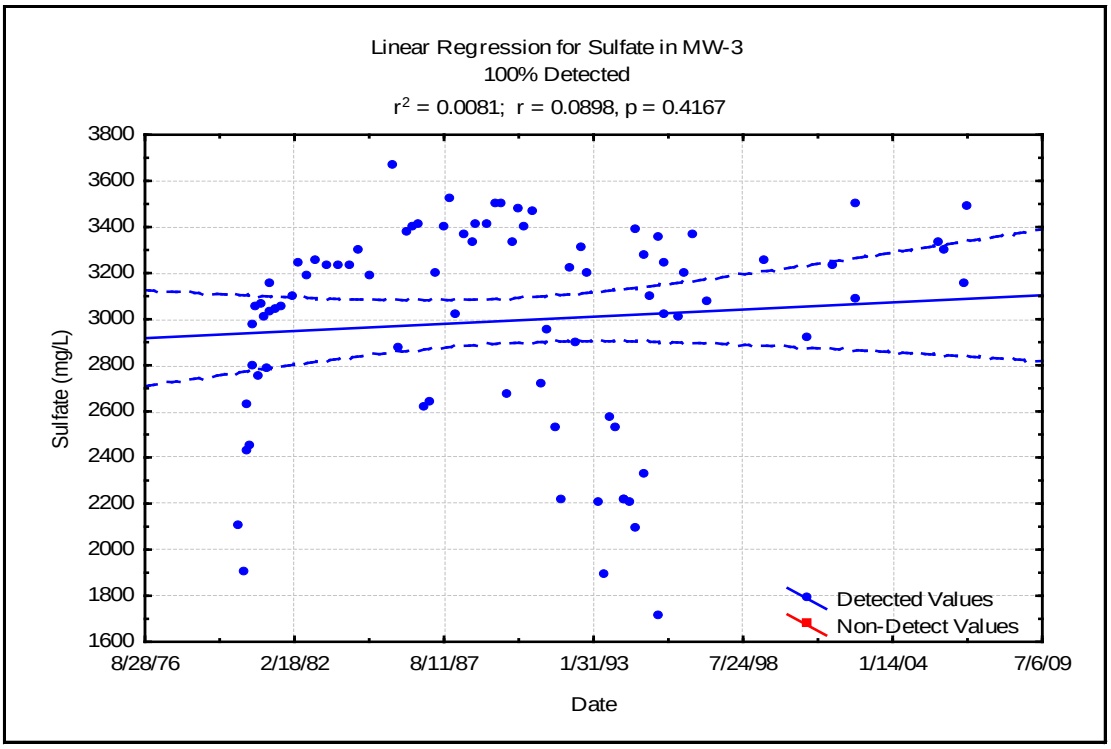
E-3 Linear Regressions from the Background Reports for All Indicator Parameters of Wells with Constituents with Exceedances

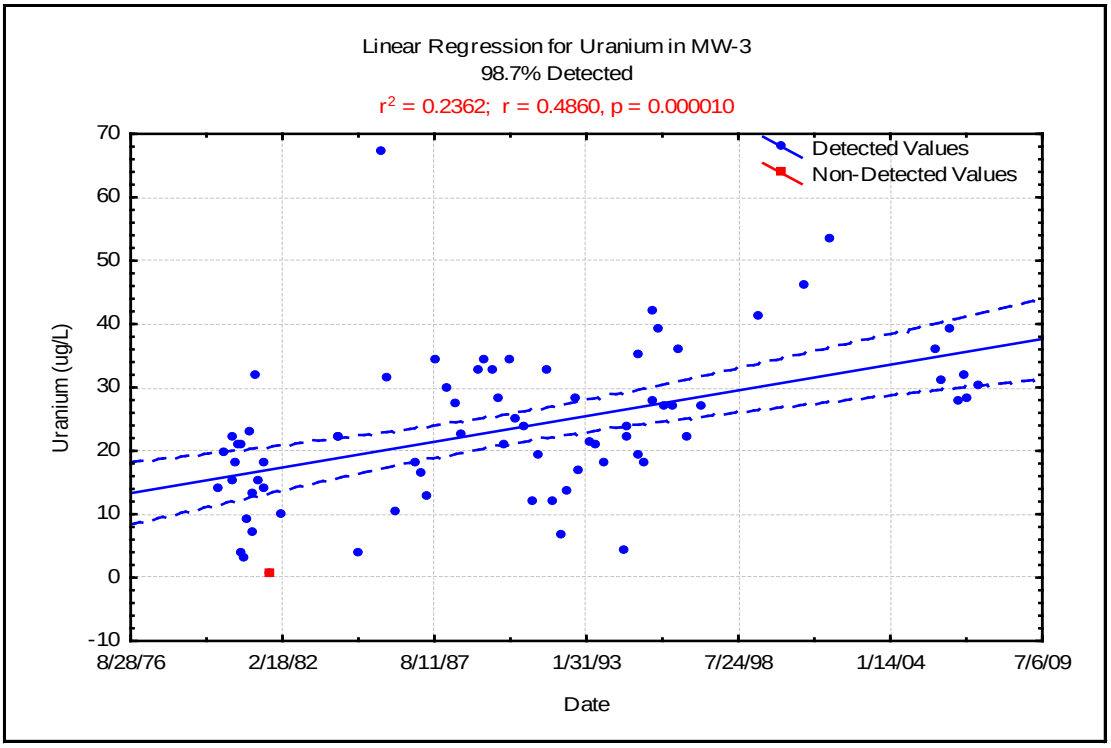
Appendix E-3
Linear Regressions from the Background Reports for All Indicator Parameters of Wells with Constituents with Exceedances





Appendix E-3
Linear Regressions from the Background Reports for All Indicator Parameters of Wells with Constituents with Exceedances





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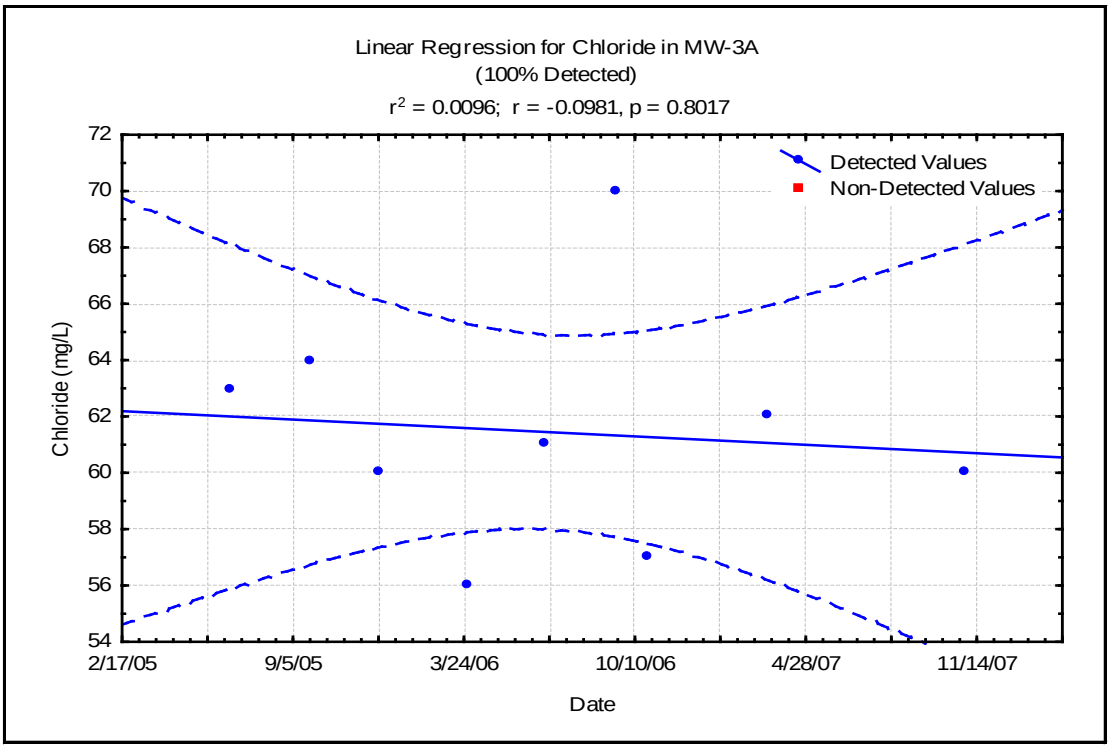
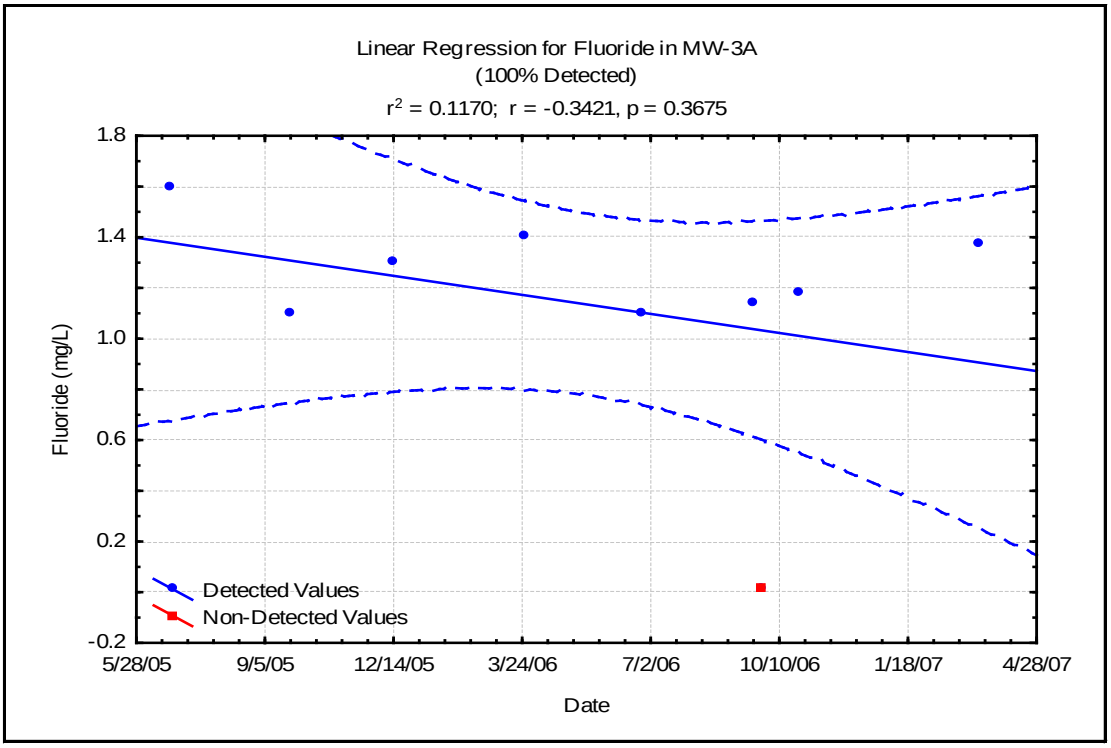
Linear Regressions from the Background Reports for All Indicator Parameters of Wells with Constituents with Exceedances





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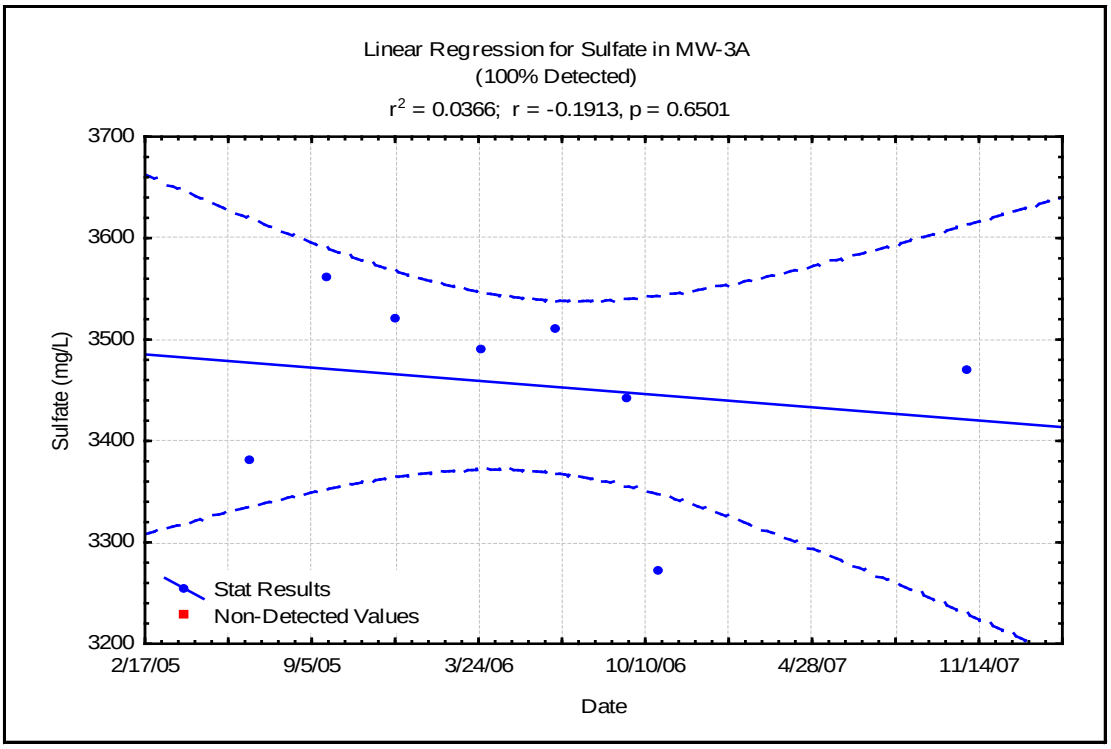
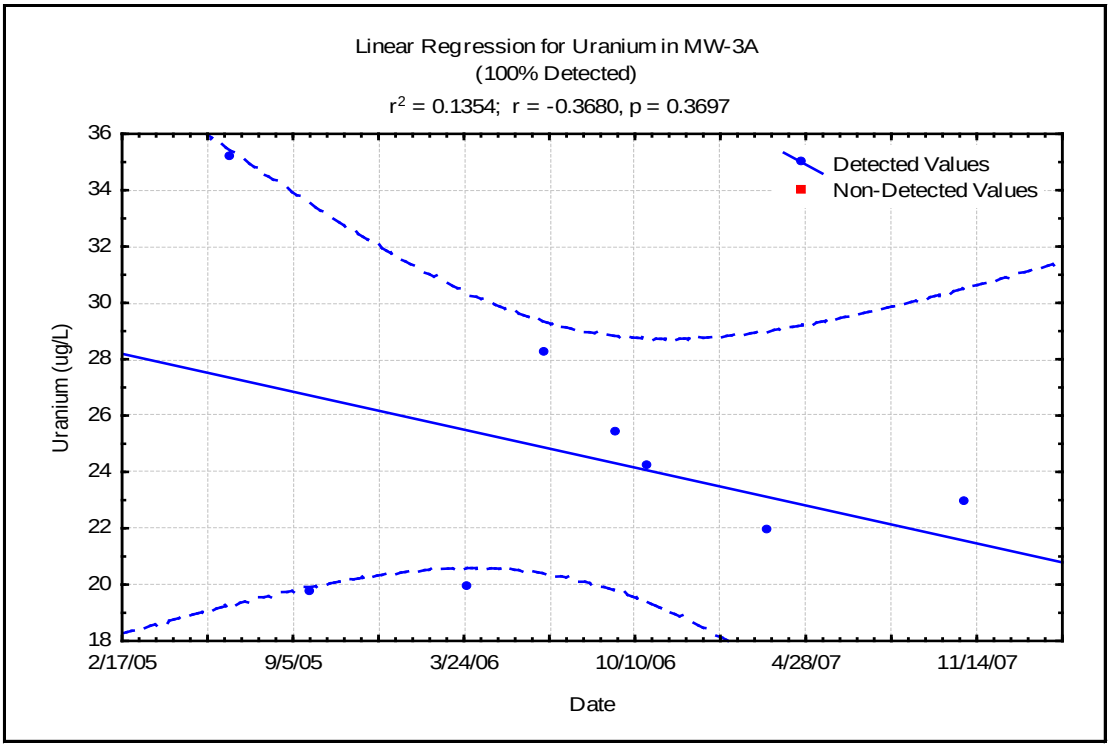
Linear Regressions from the Background Reports for All Indicator Parameters of Wells with Constituents with Exceedances





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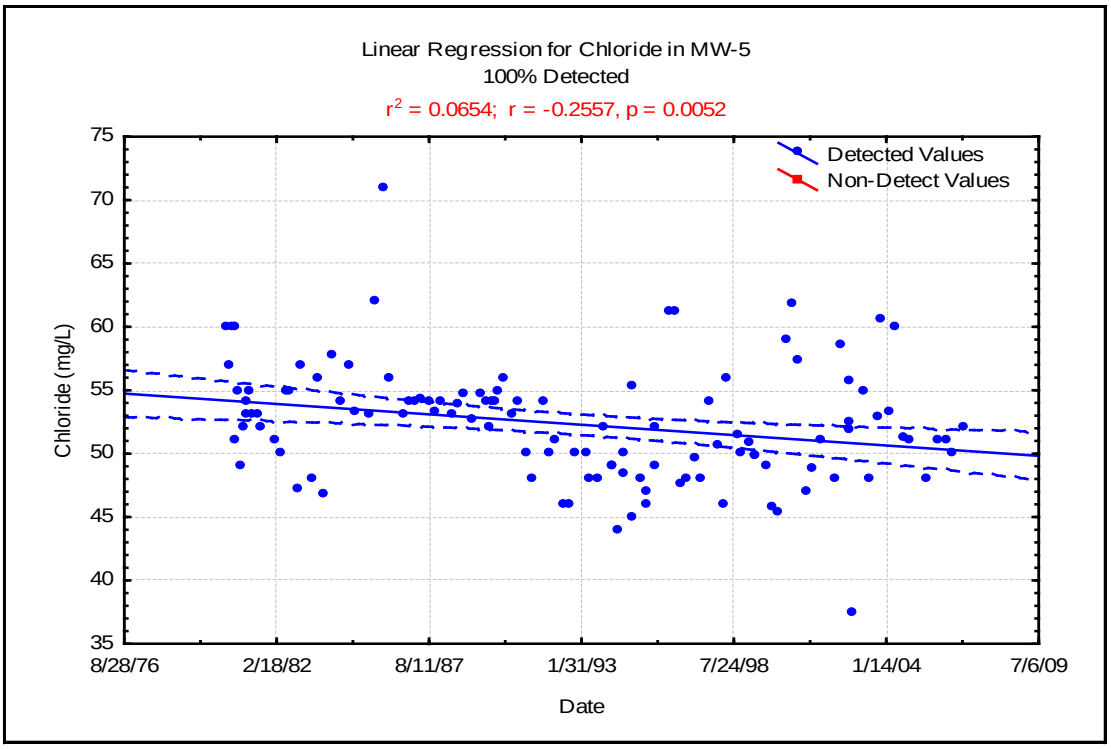

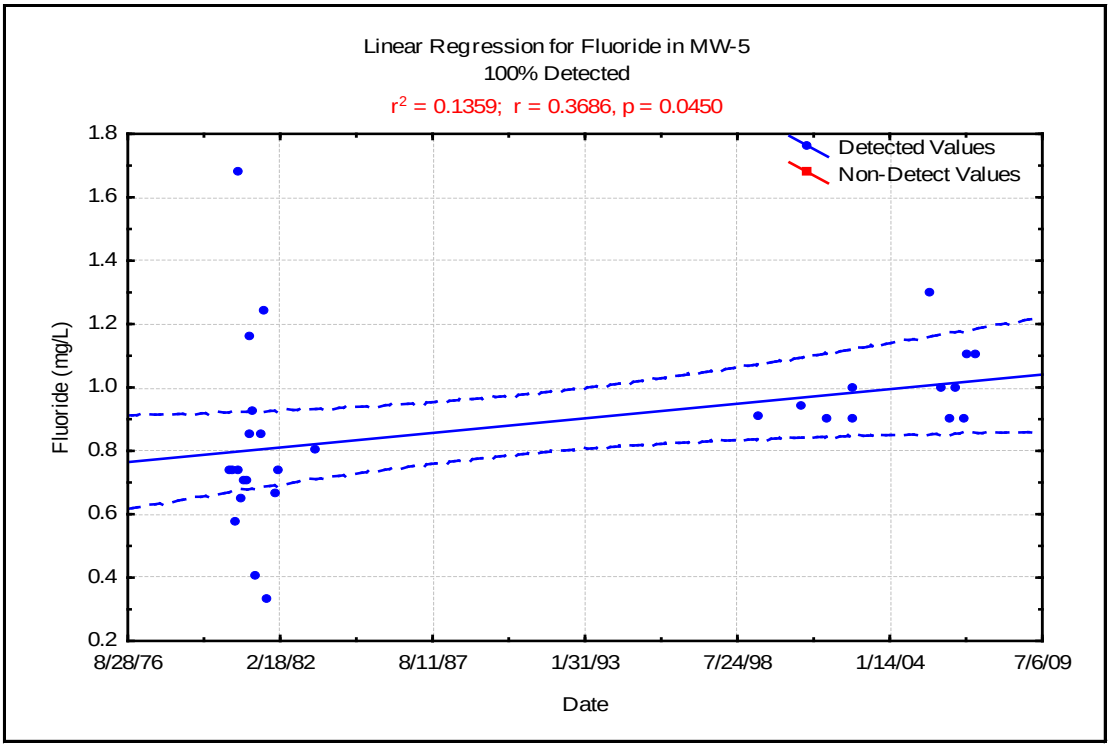

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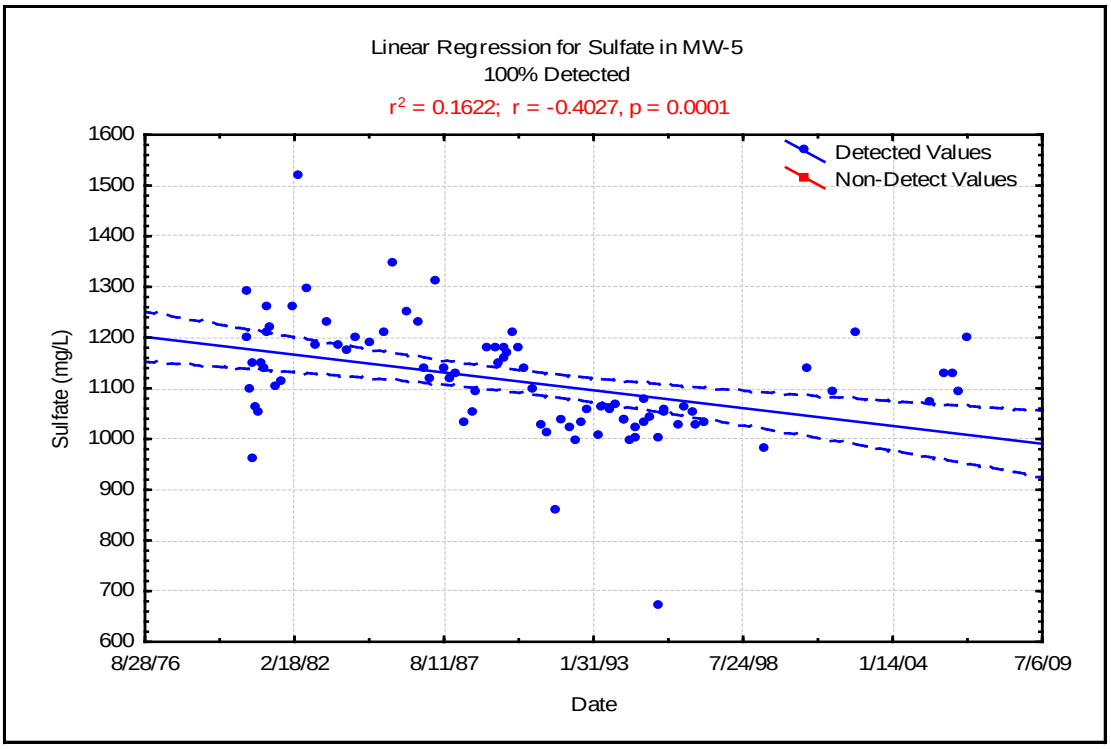
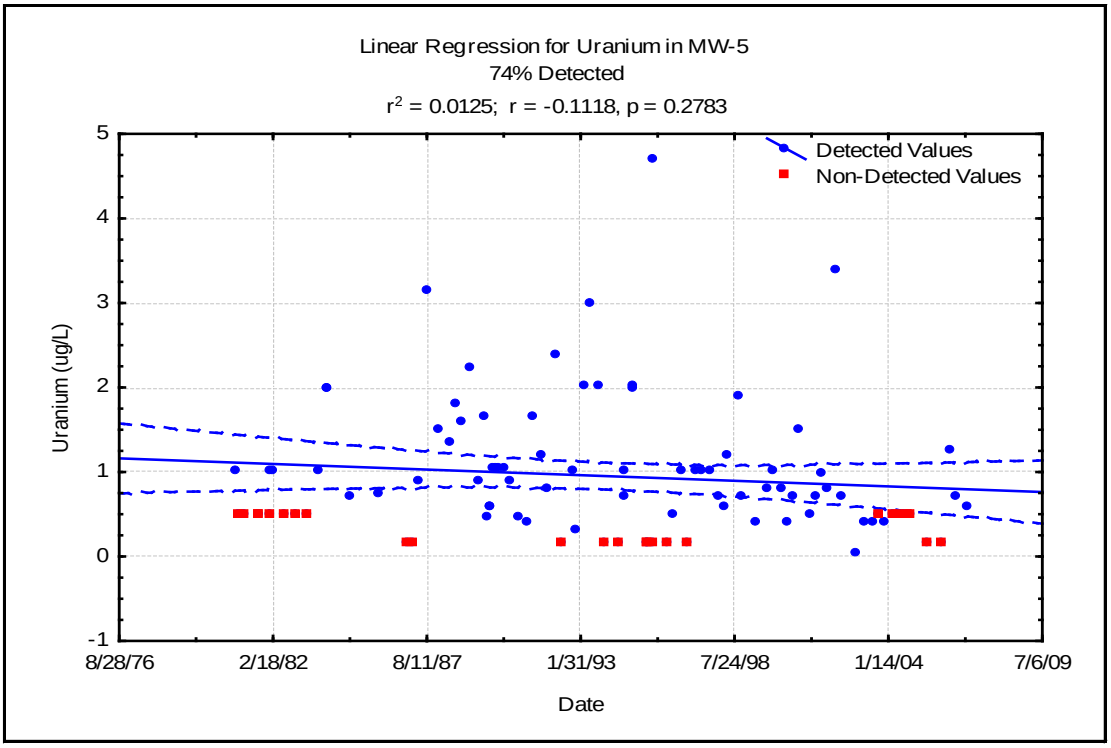
Linear Regressions from the Background Reports for All Indicator Parameters of Wells with Constituents with Exceedances





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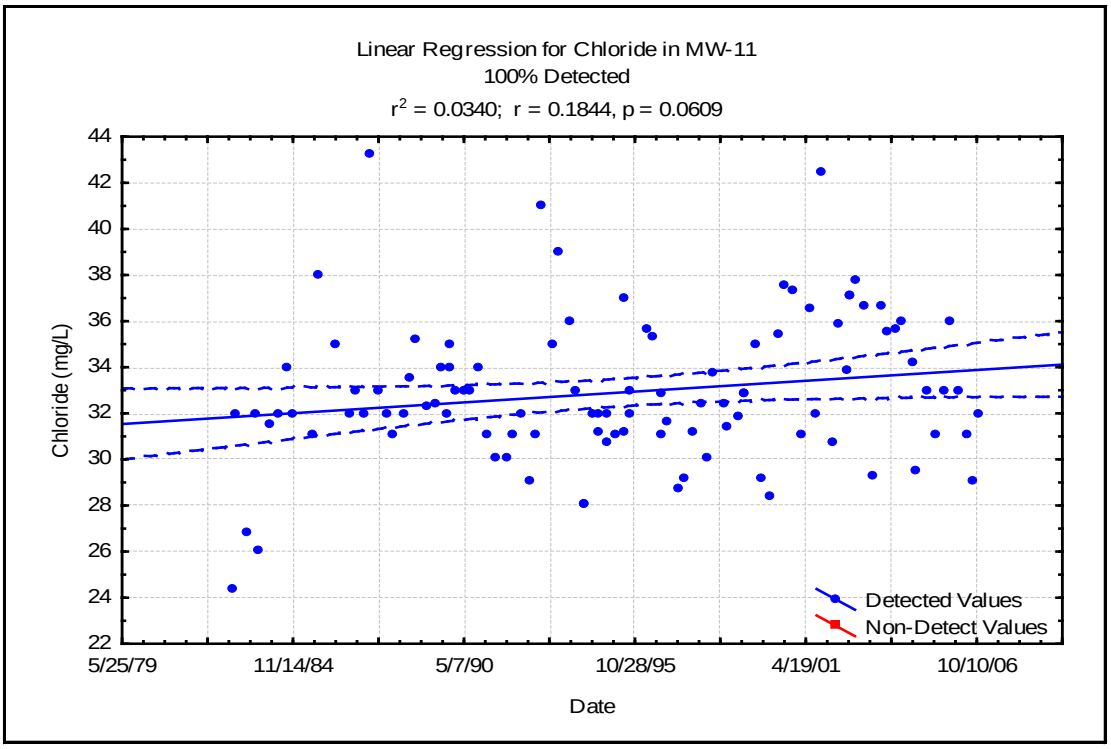
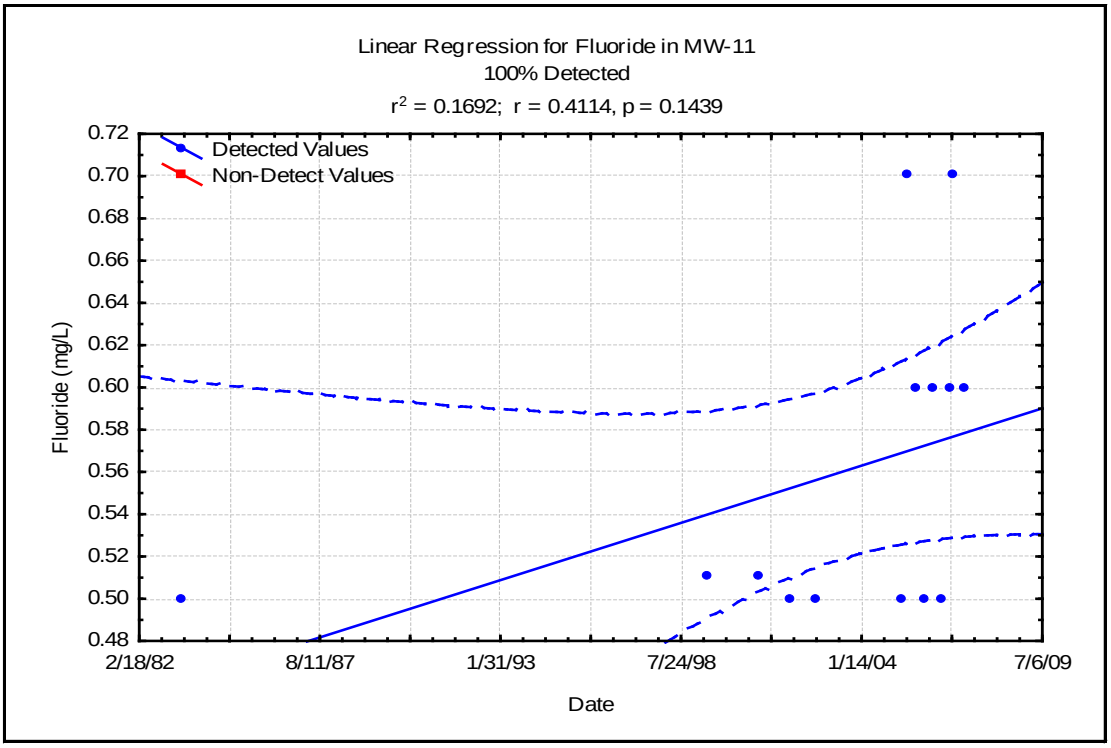
Linear Regressions from the Background Reports for All Indicator Parameters of Wells with Constituents with Exceedances





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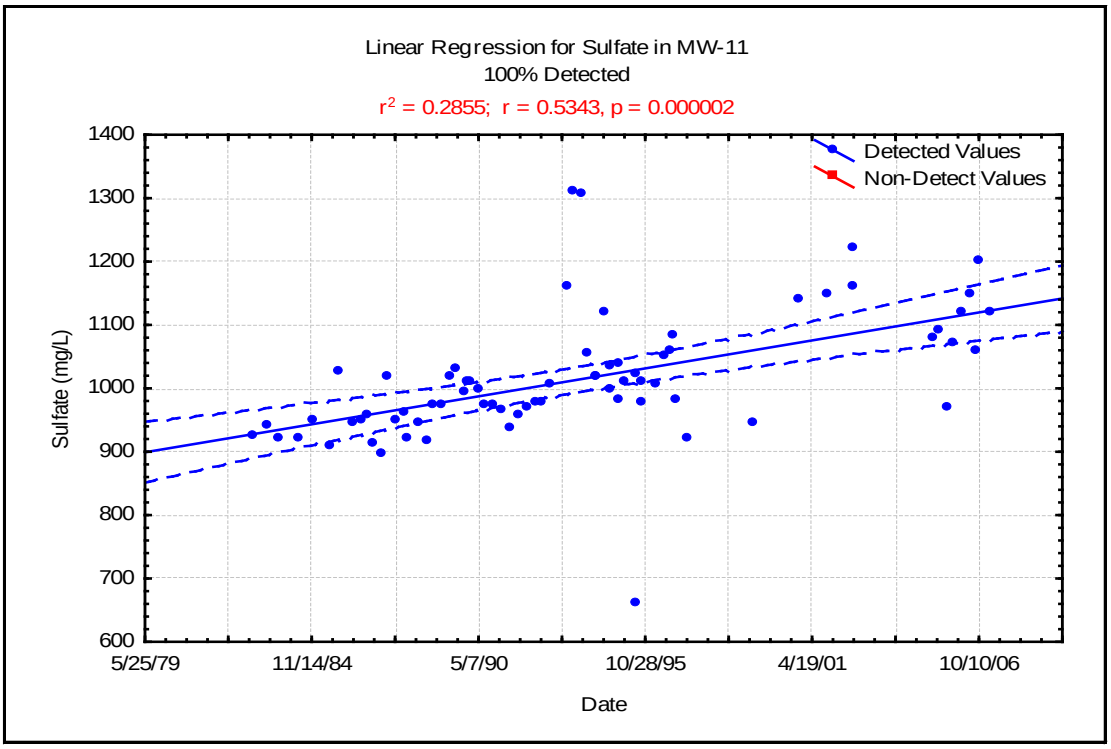

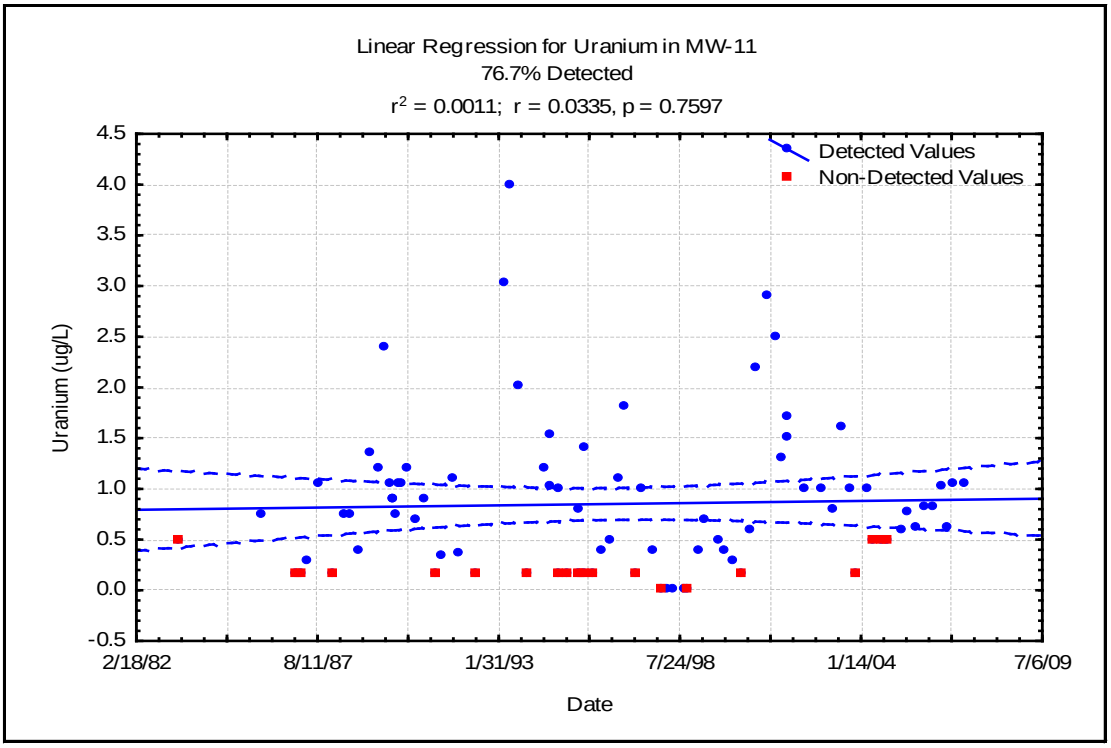

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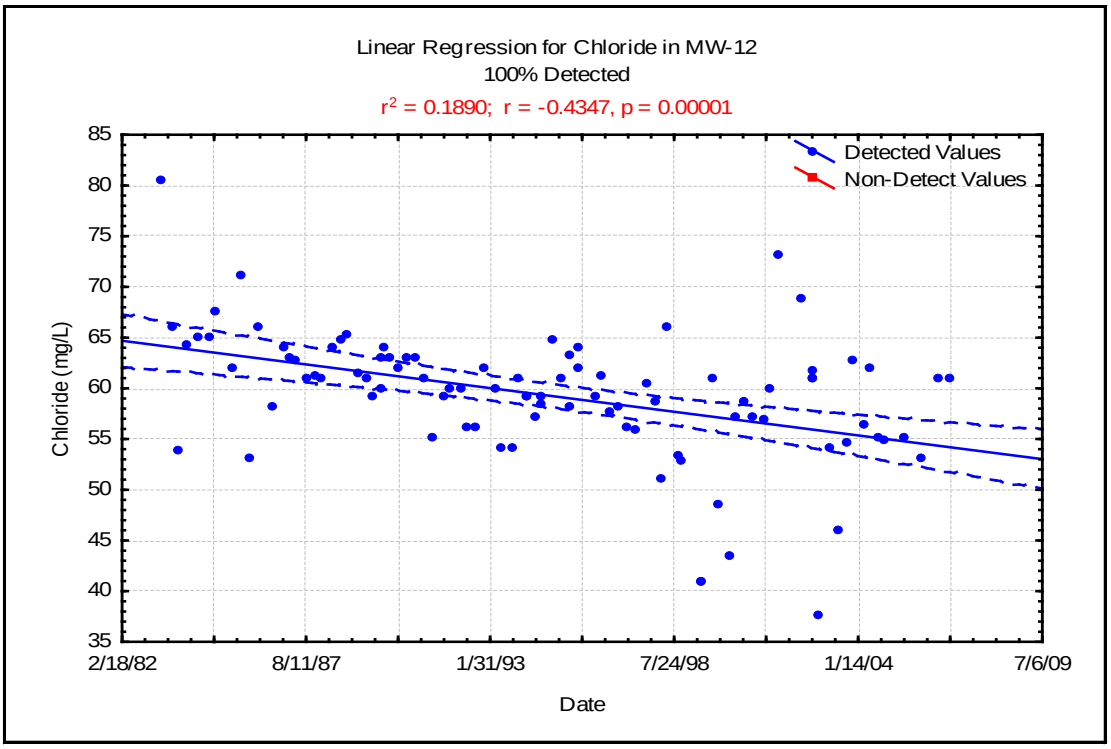

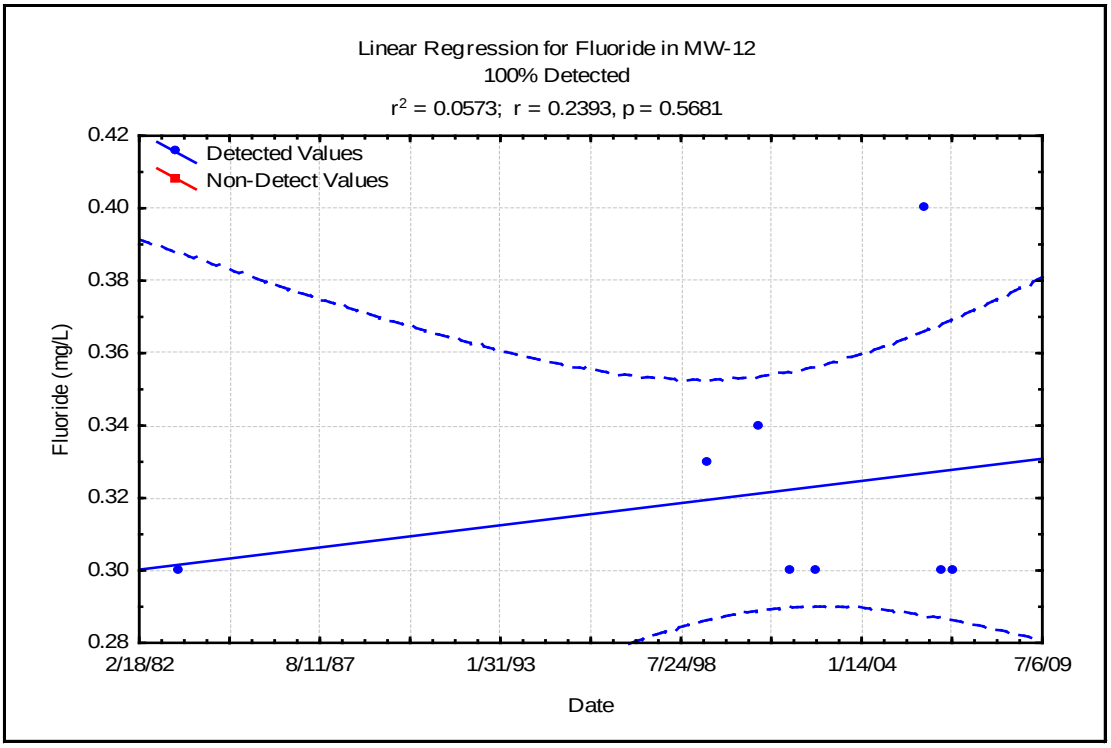

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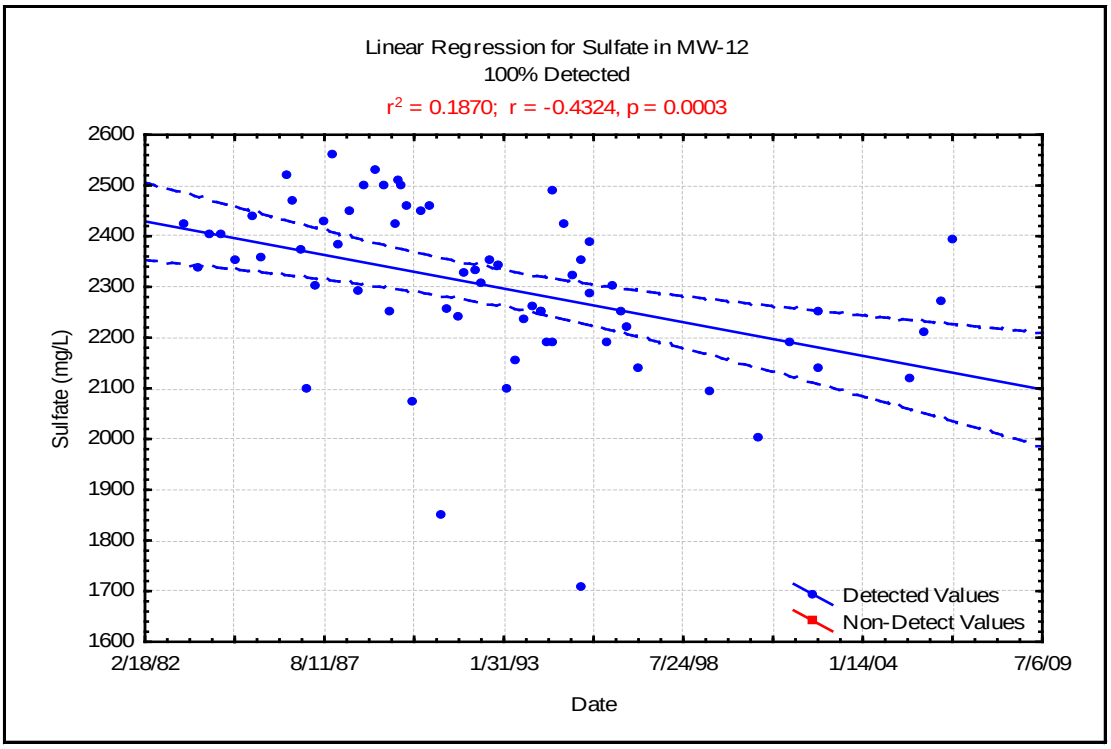

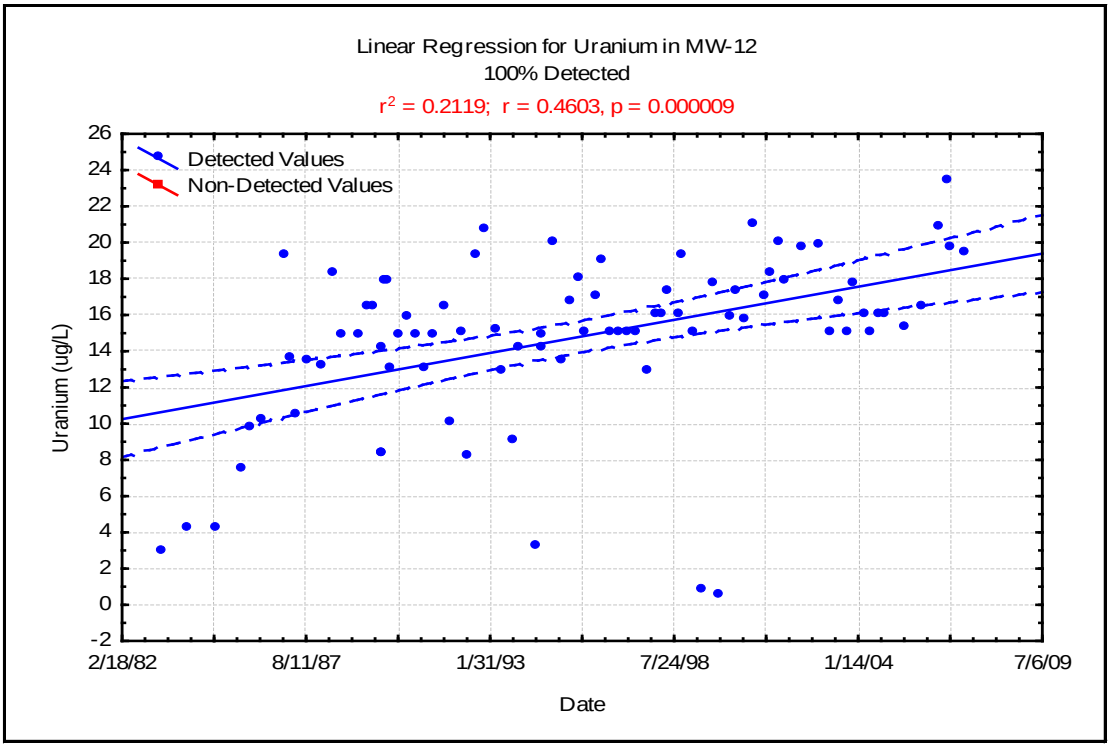

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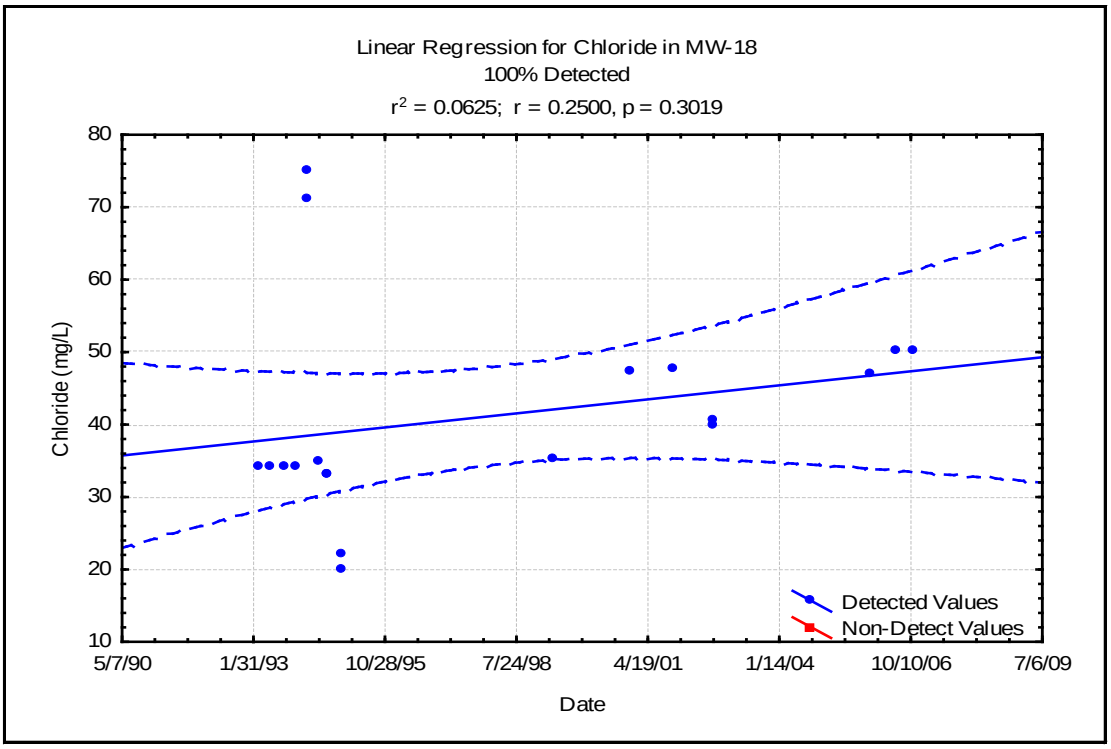

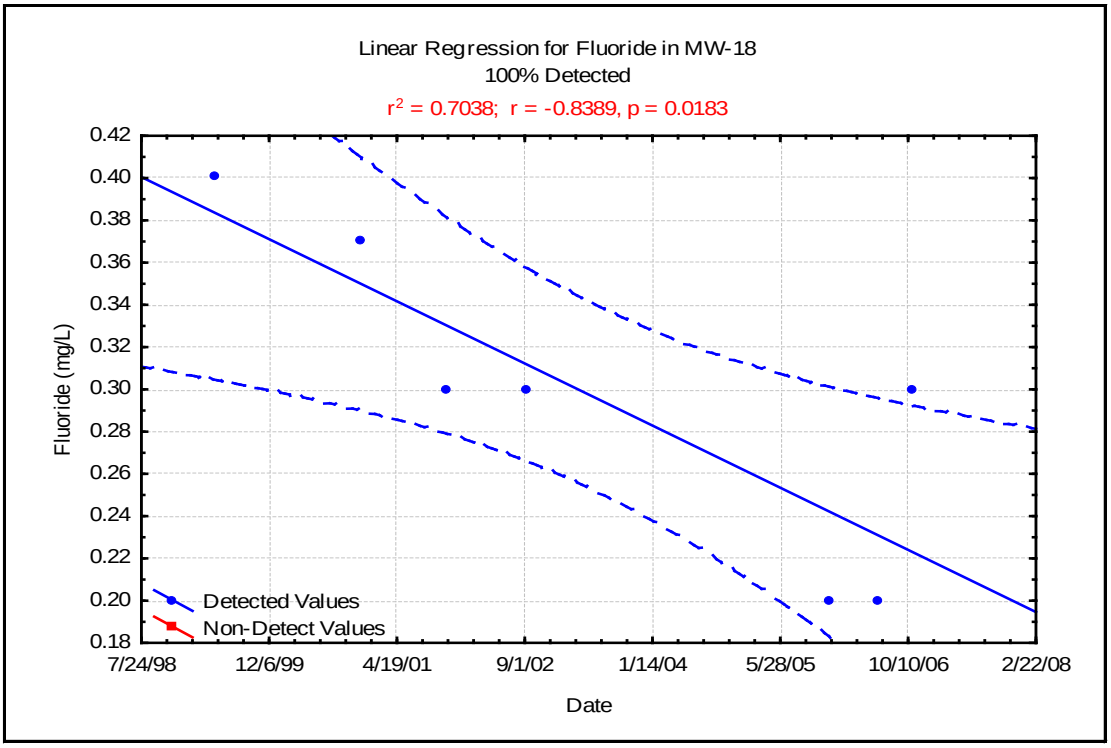

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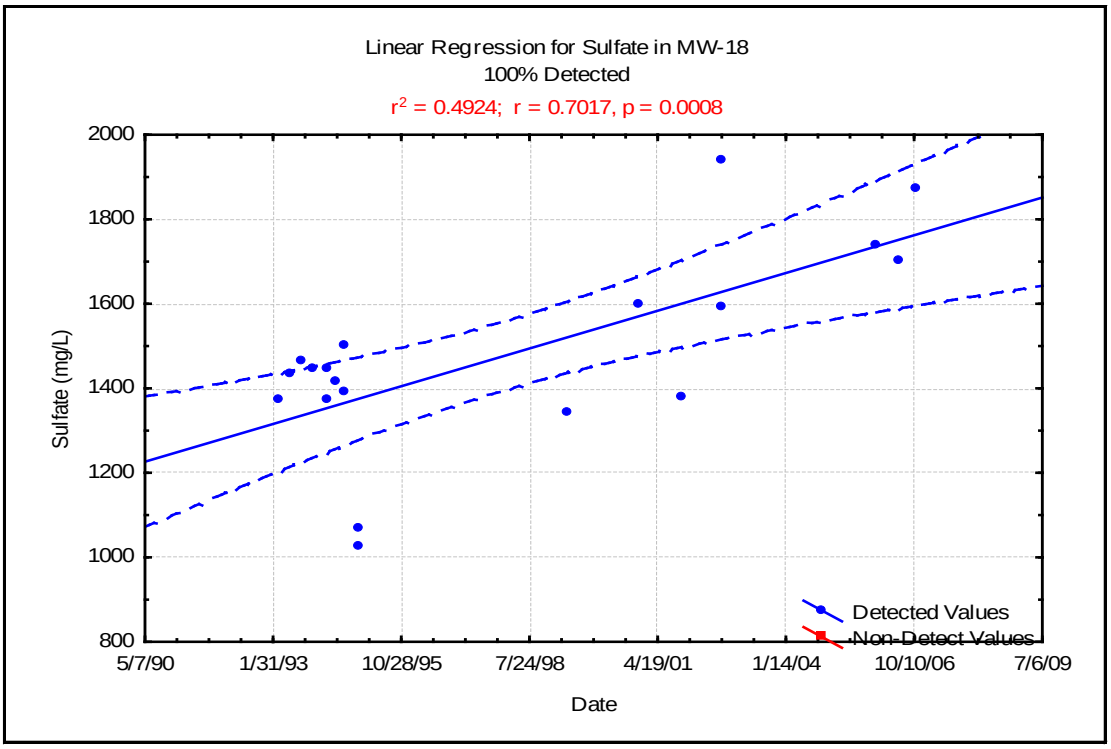
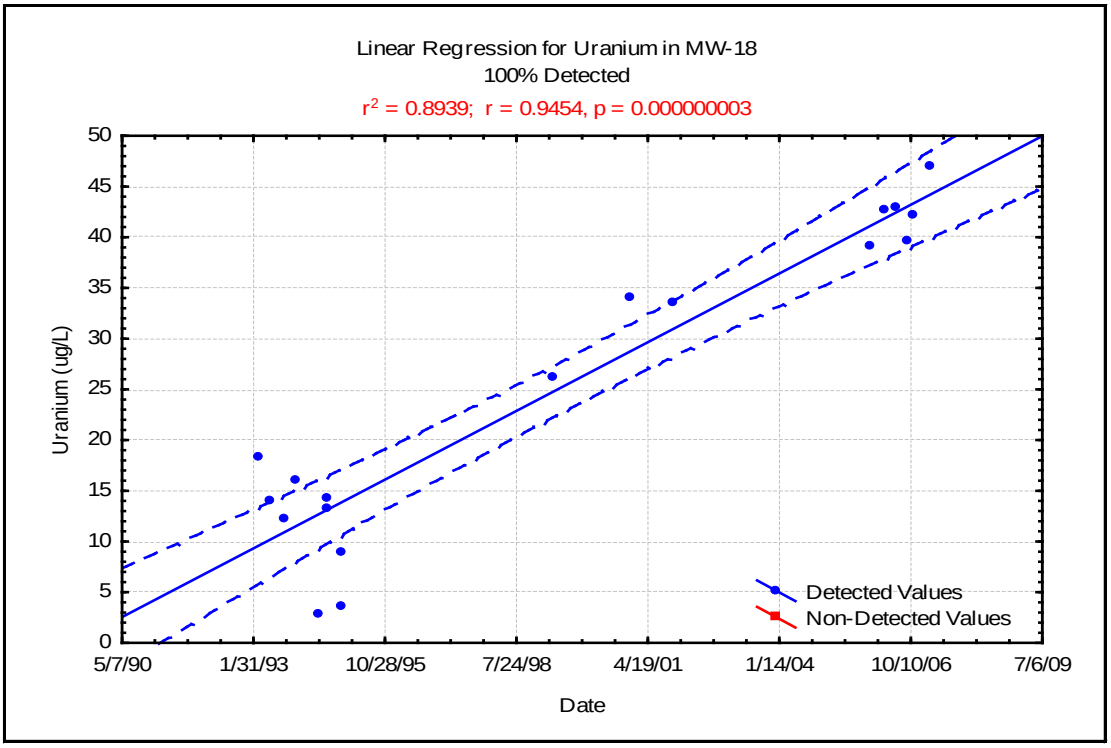
Linear Regressions from the Background Reports for All Indicator Parameters of Wells with Constituents with Exceedances





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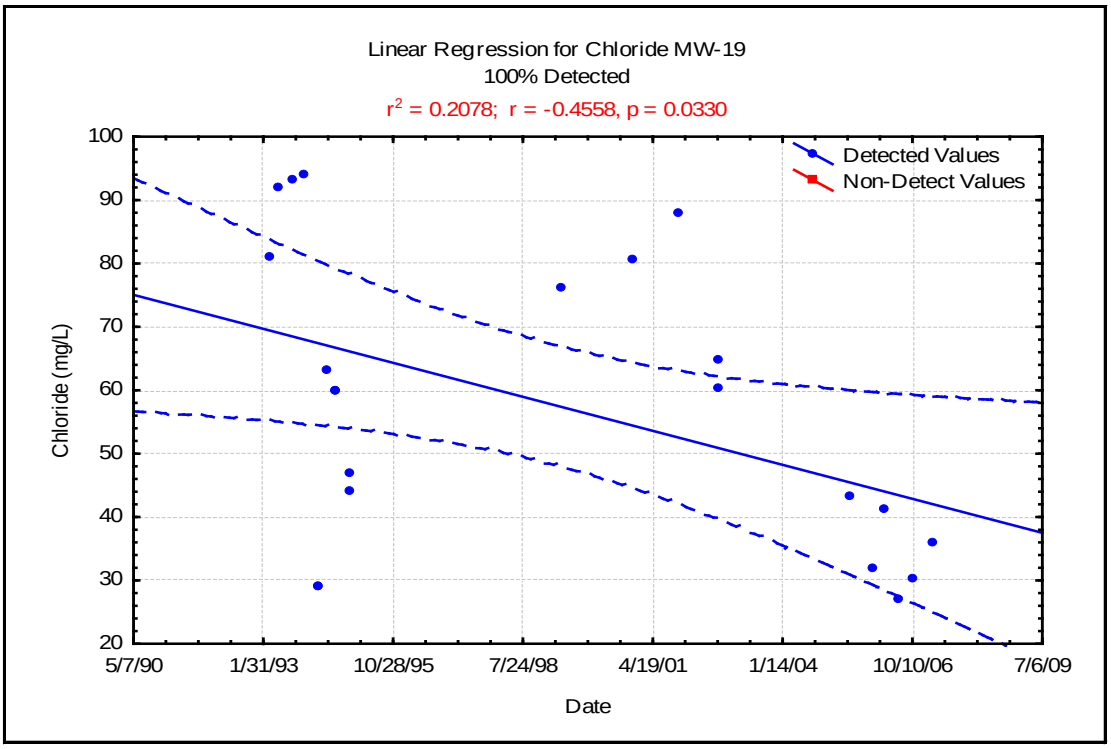
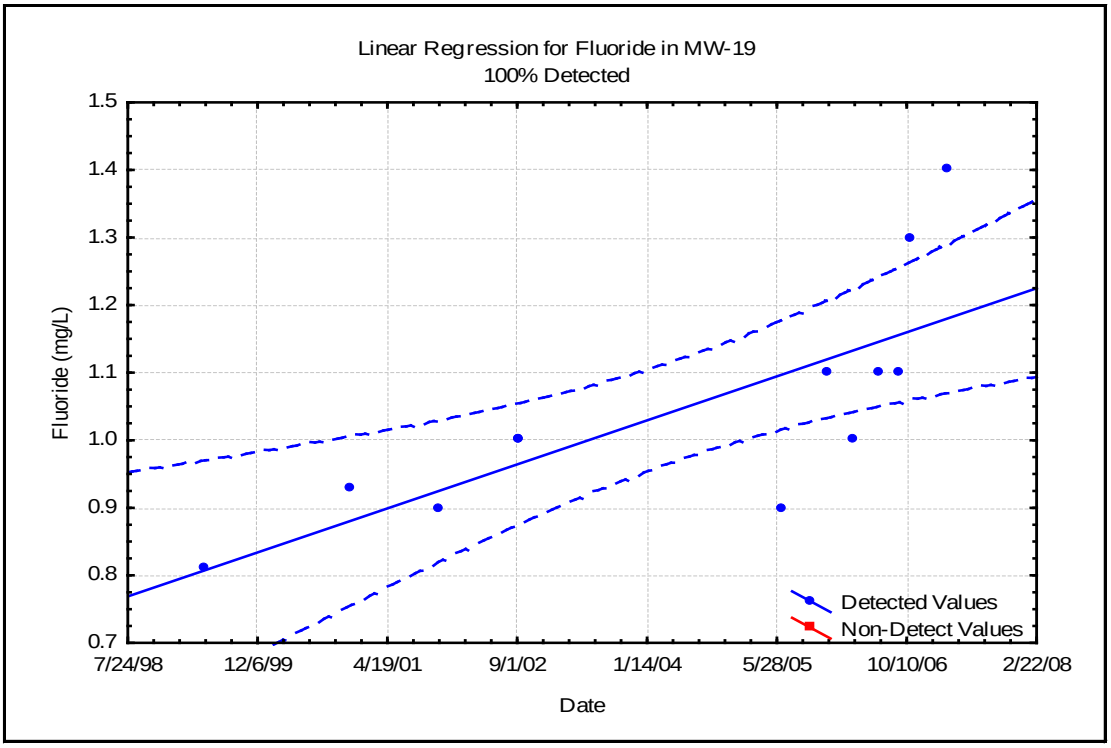
Linear Regressions from the Background Reports for All Indicator Parameters of Wells with Constituents with Exceedances





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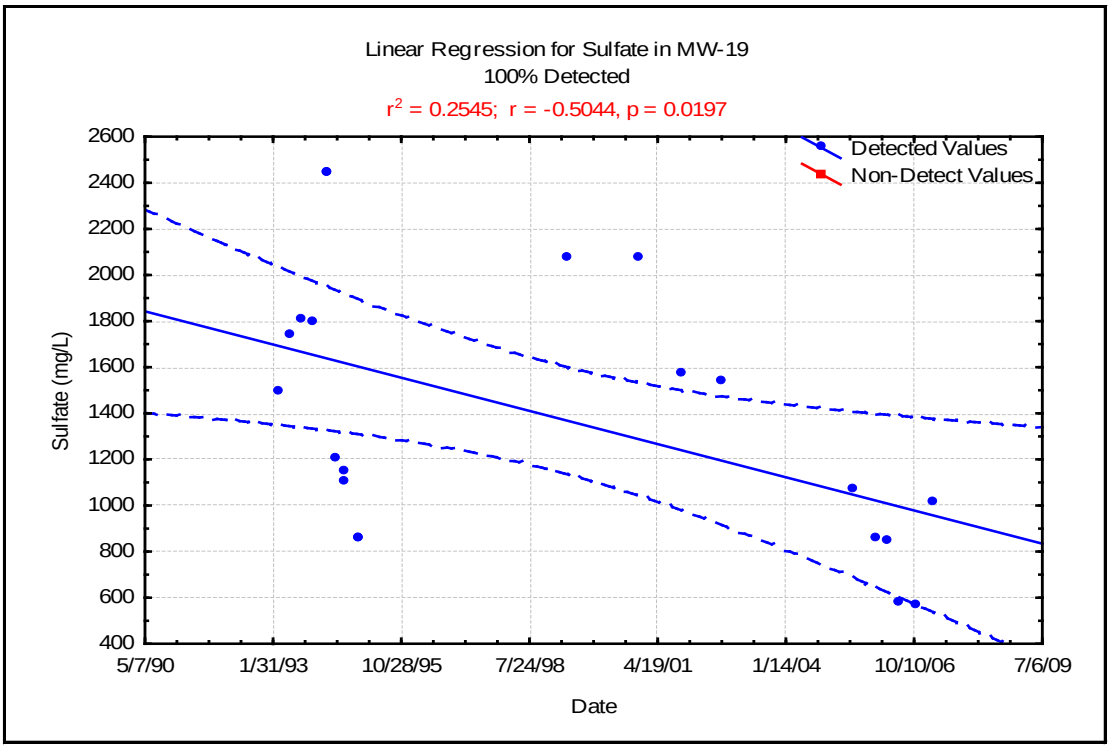

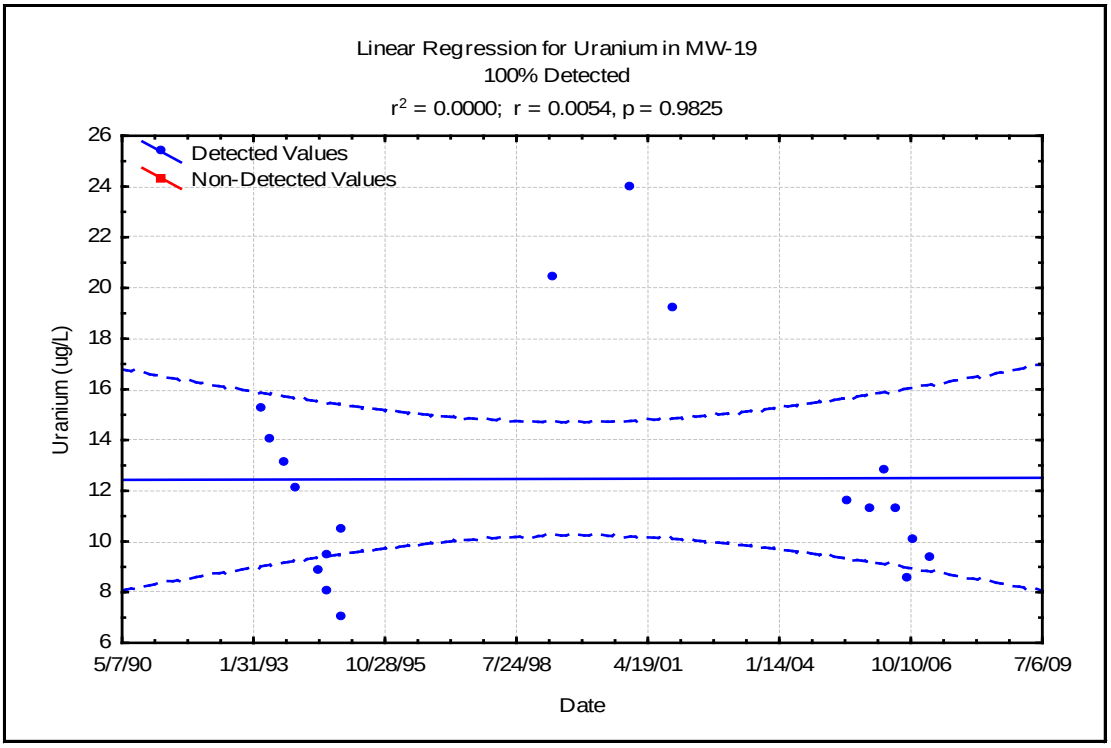

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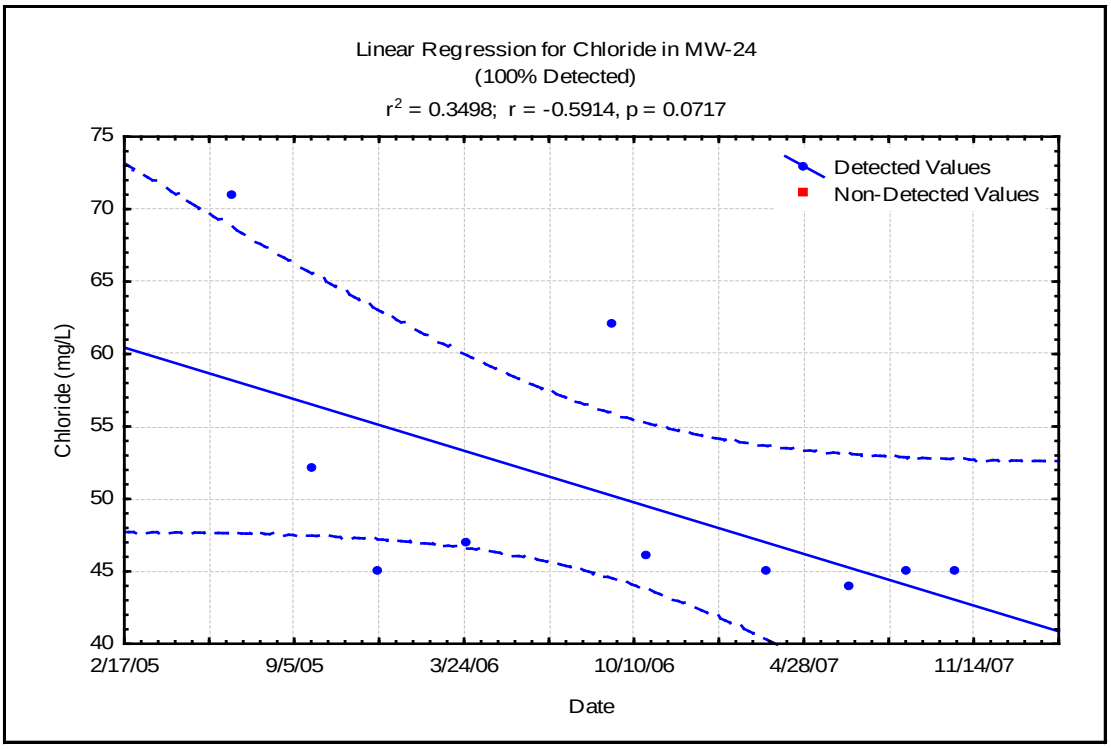

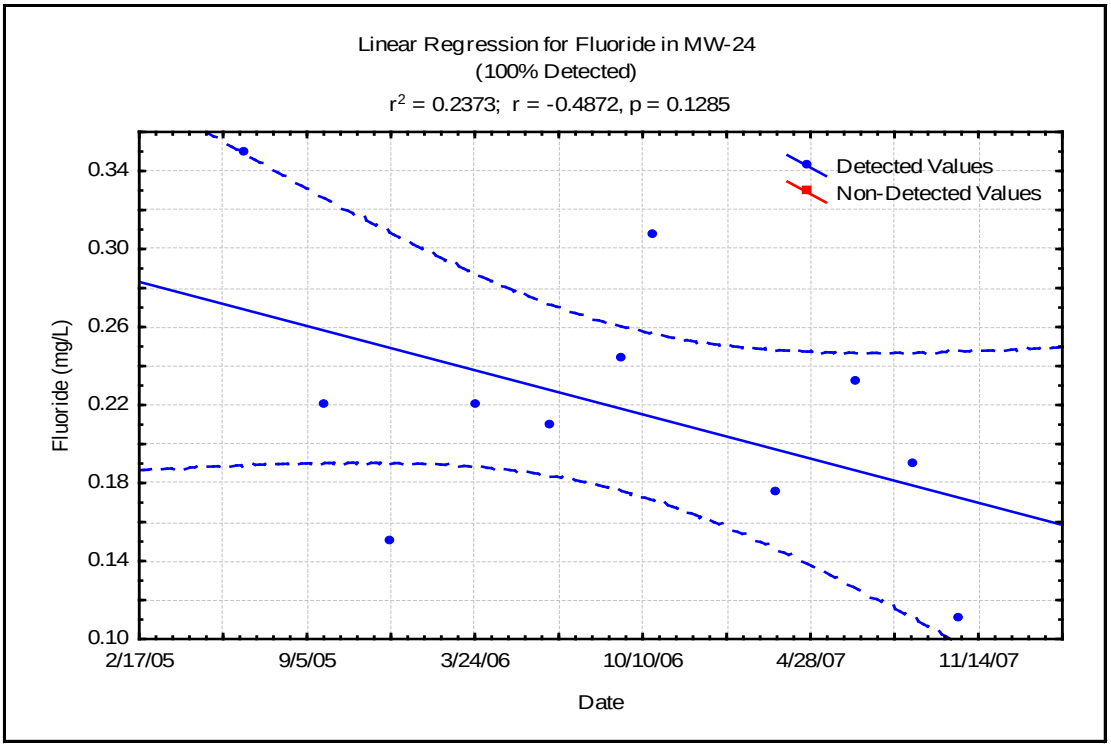

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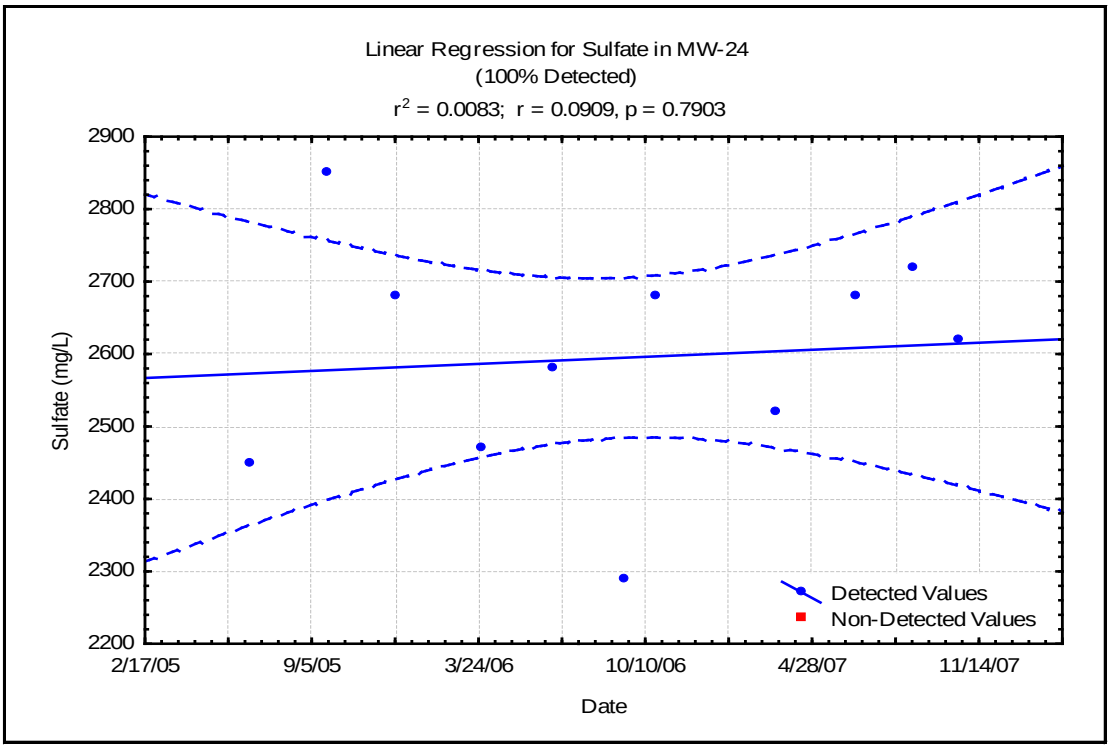

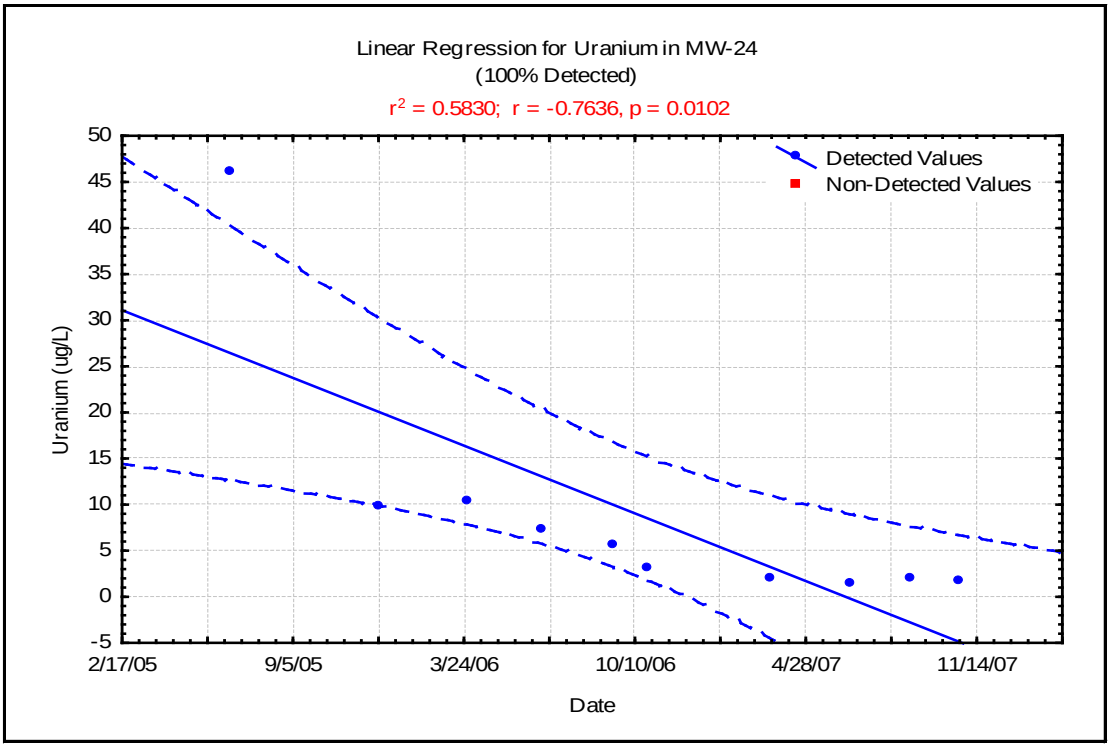

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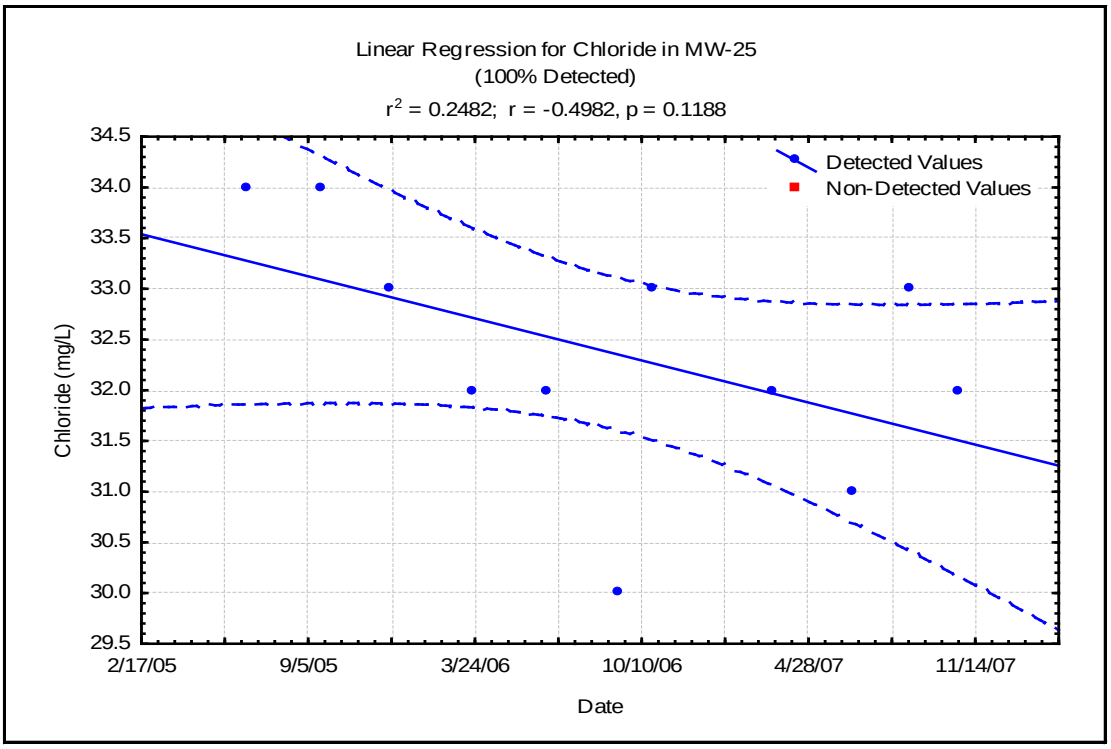

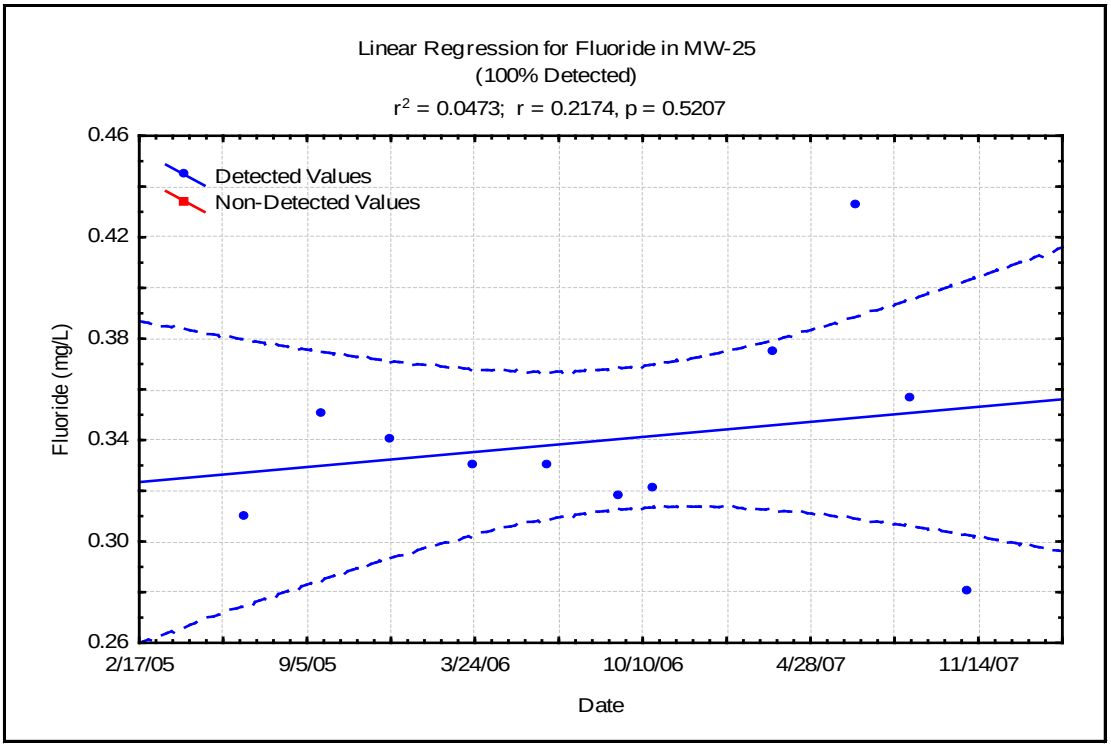

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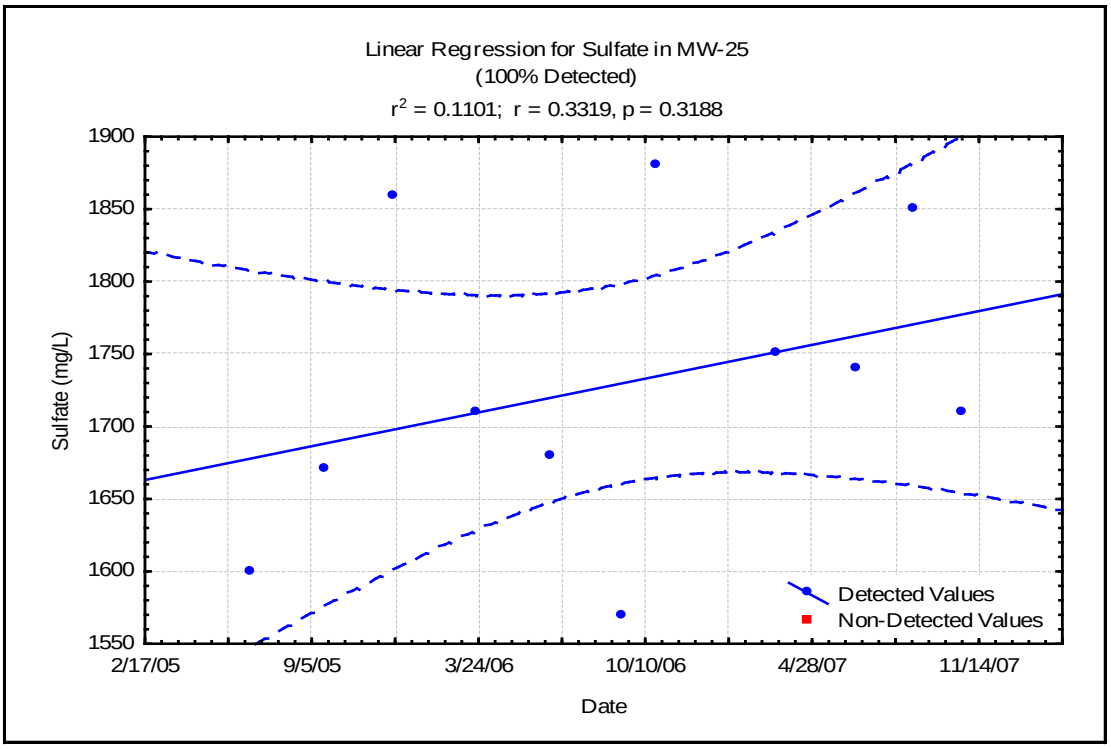

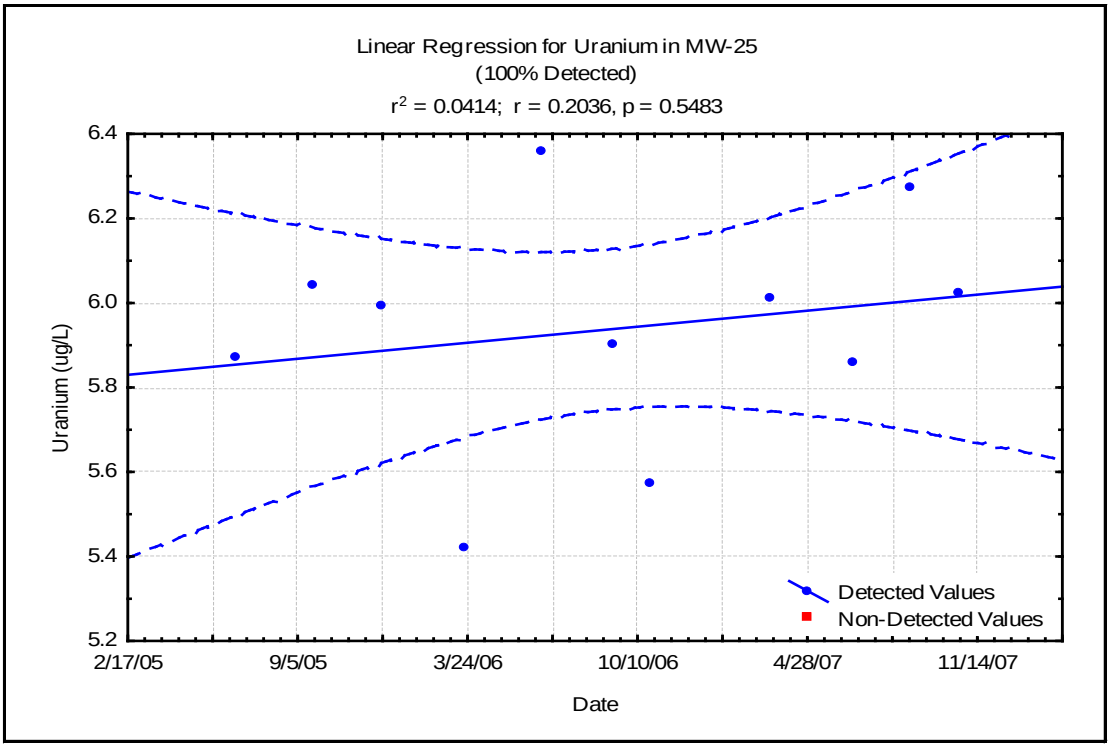

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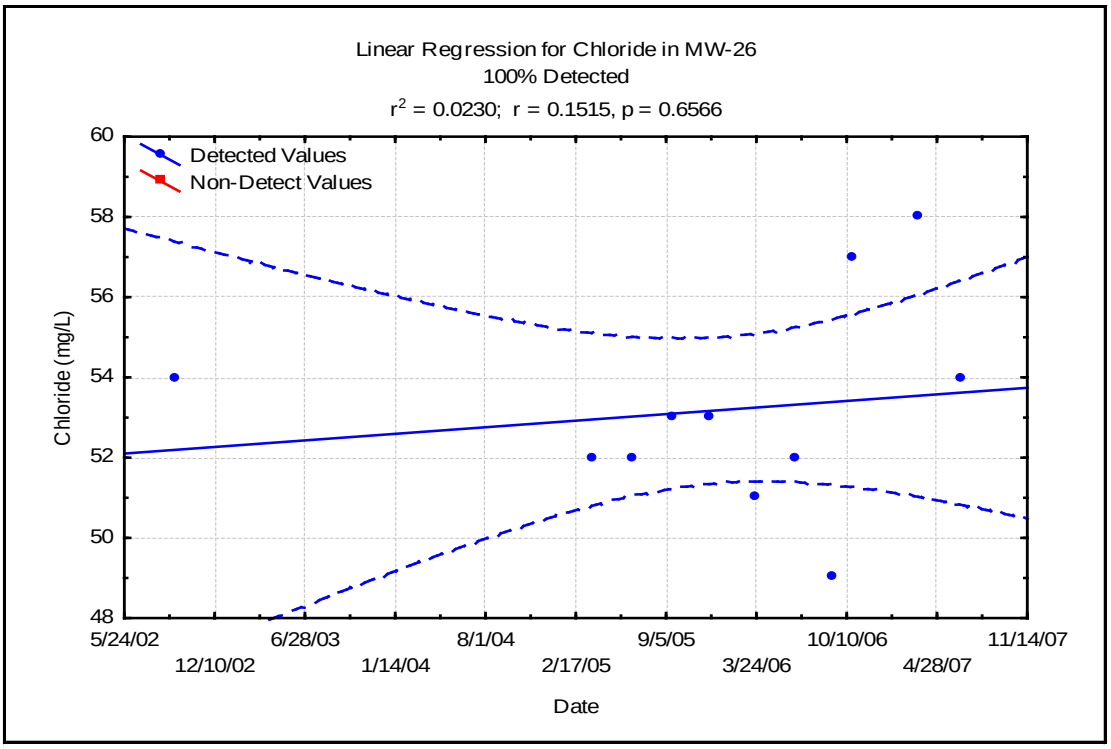

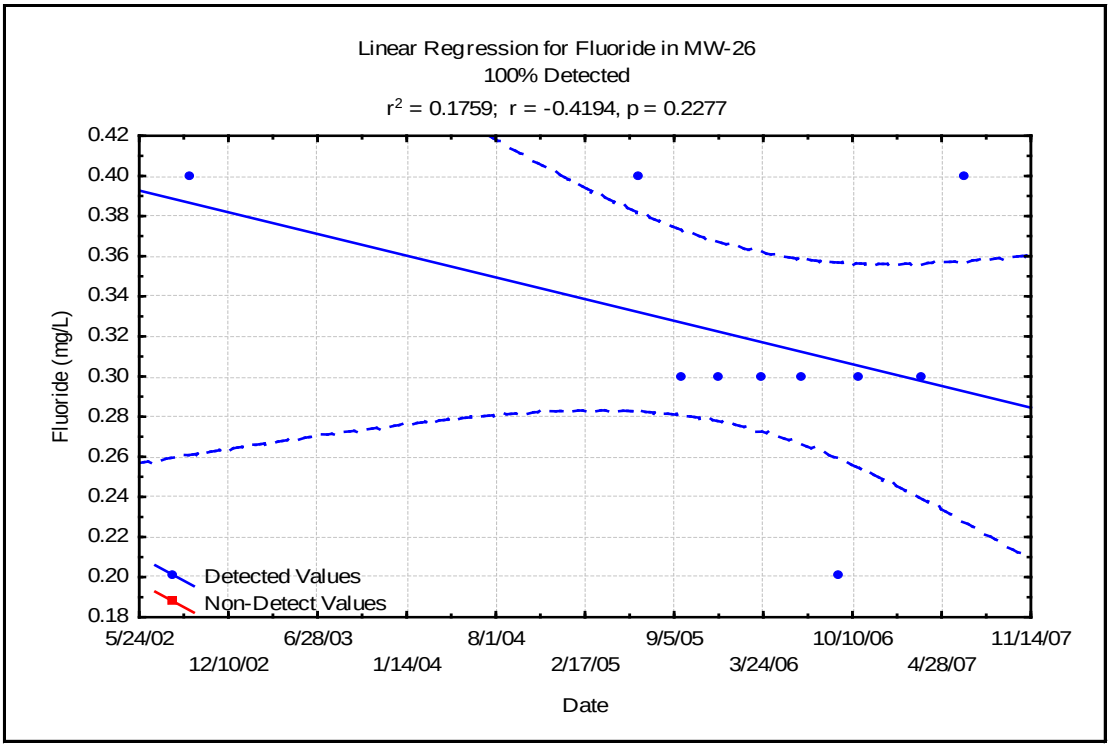

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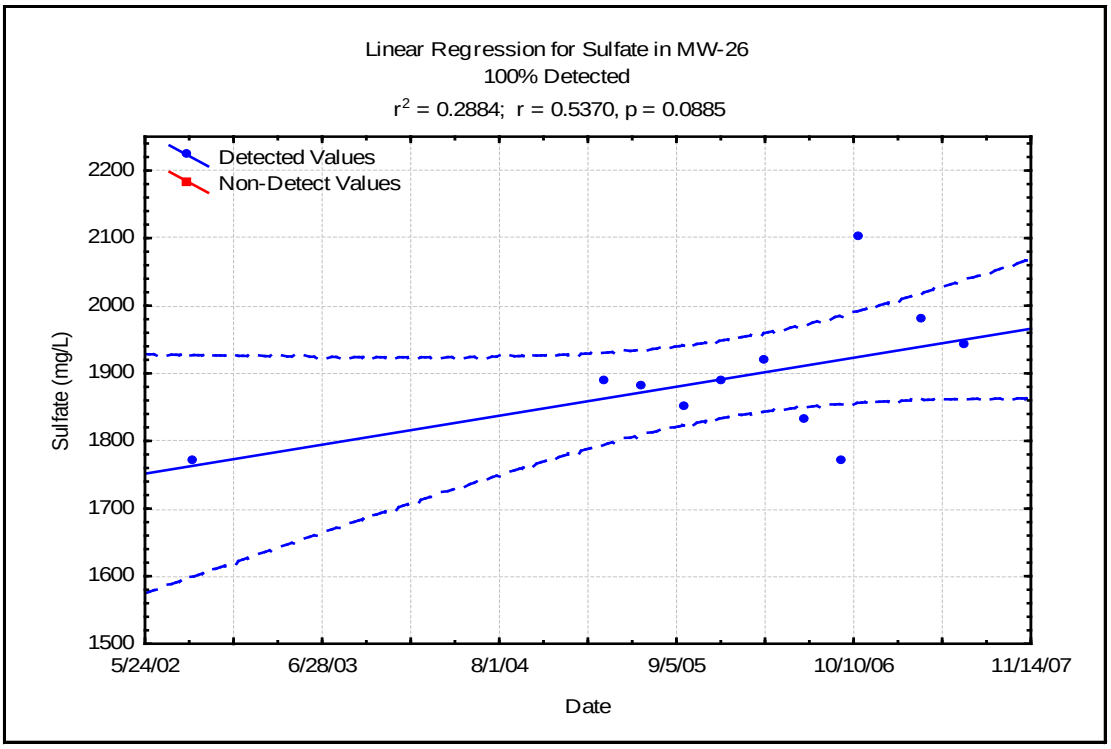

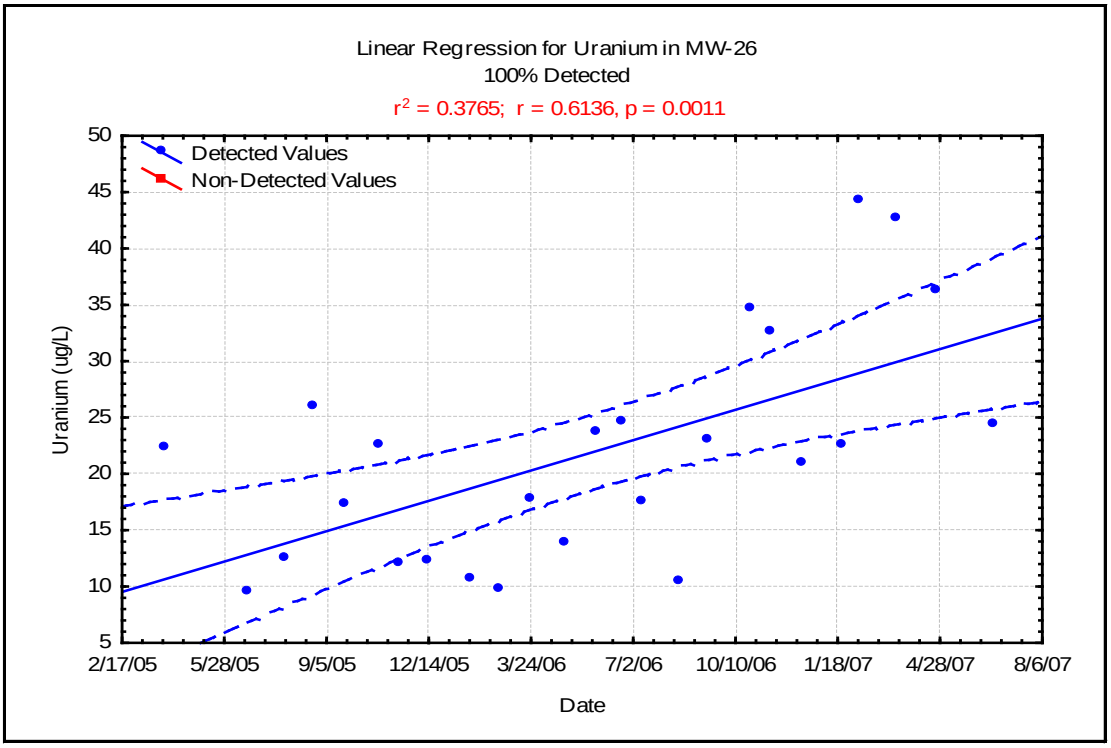

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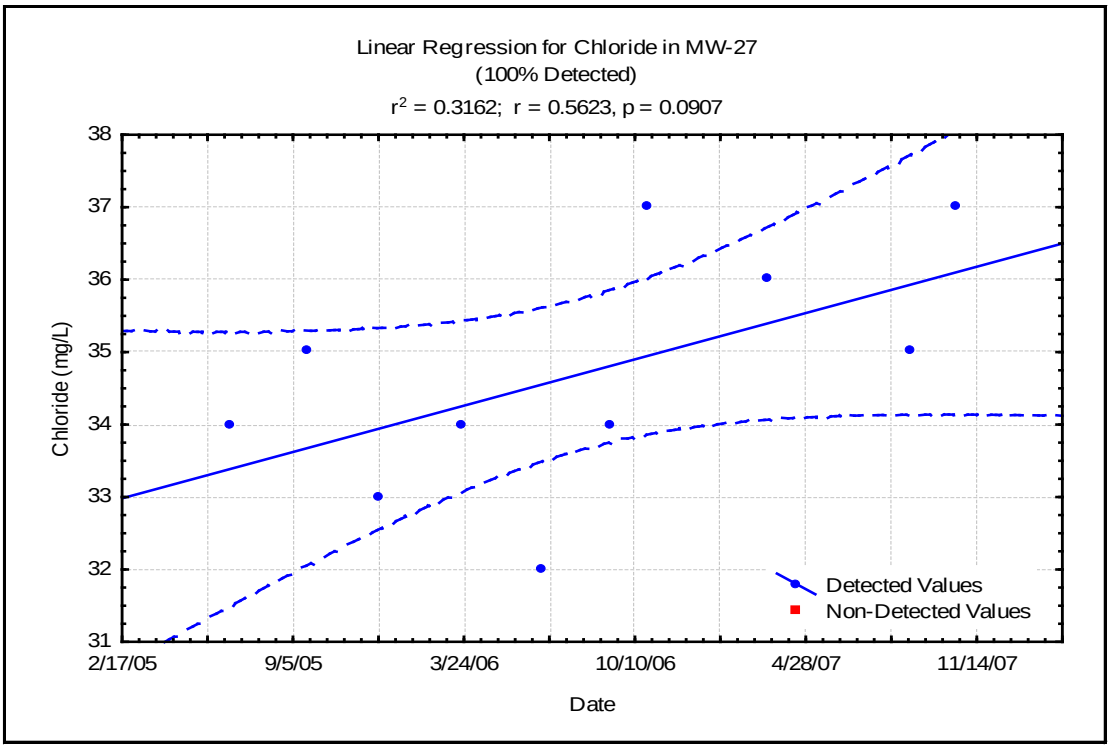

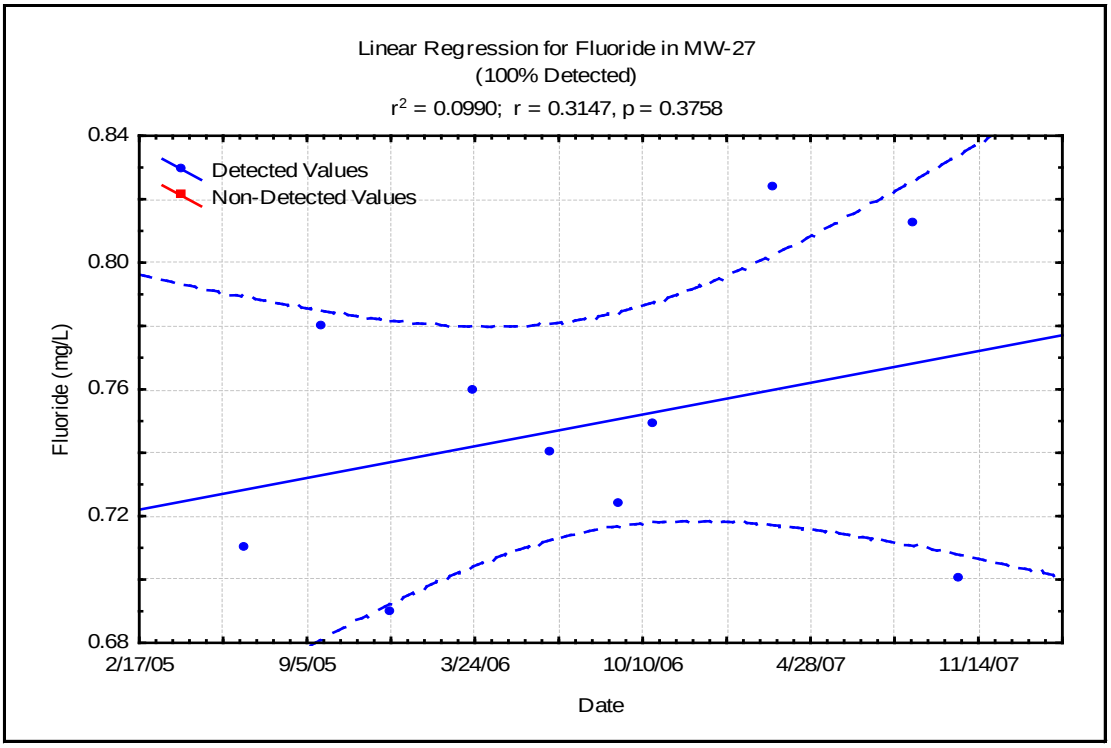

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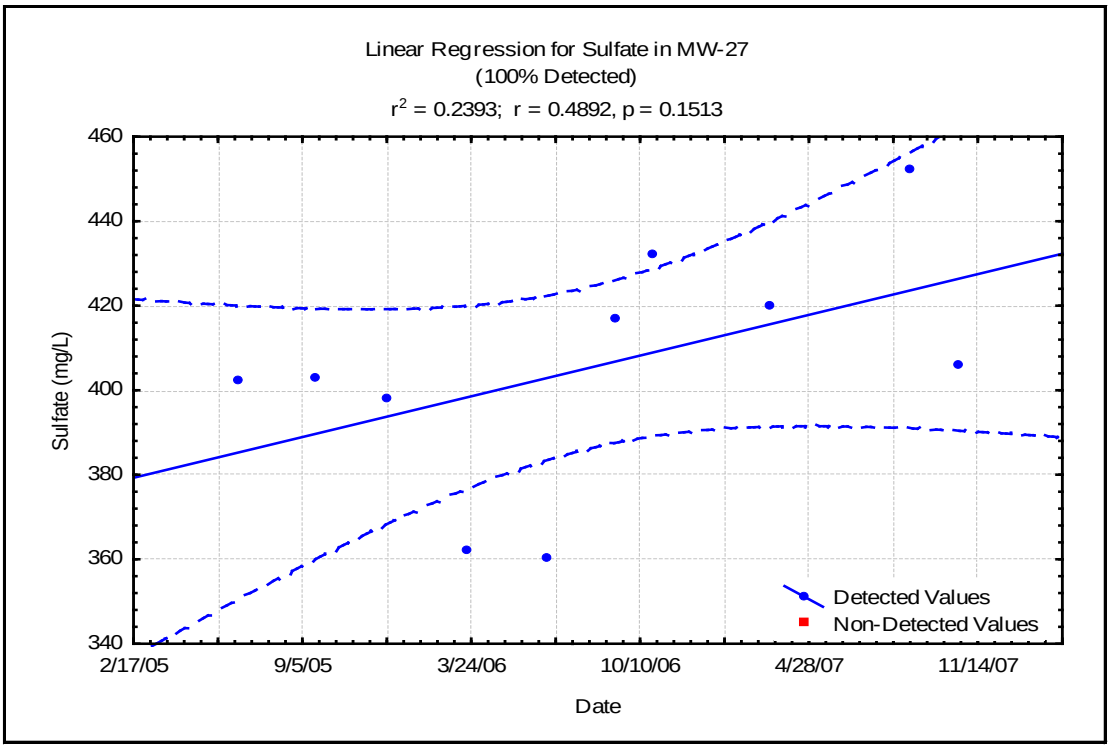

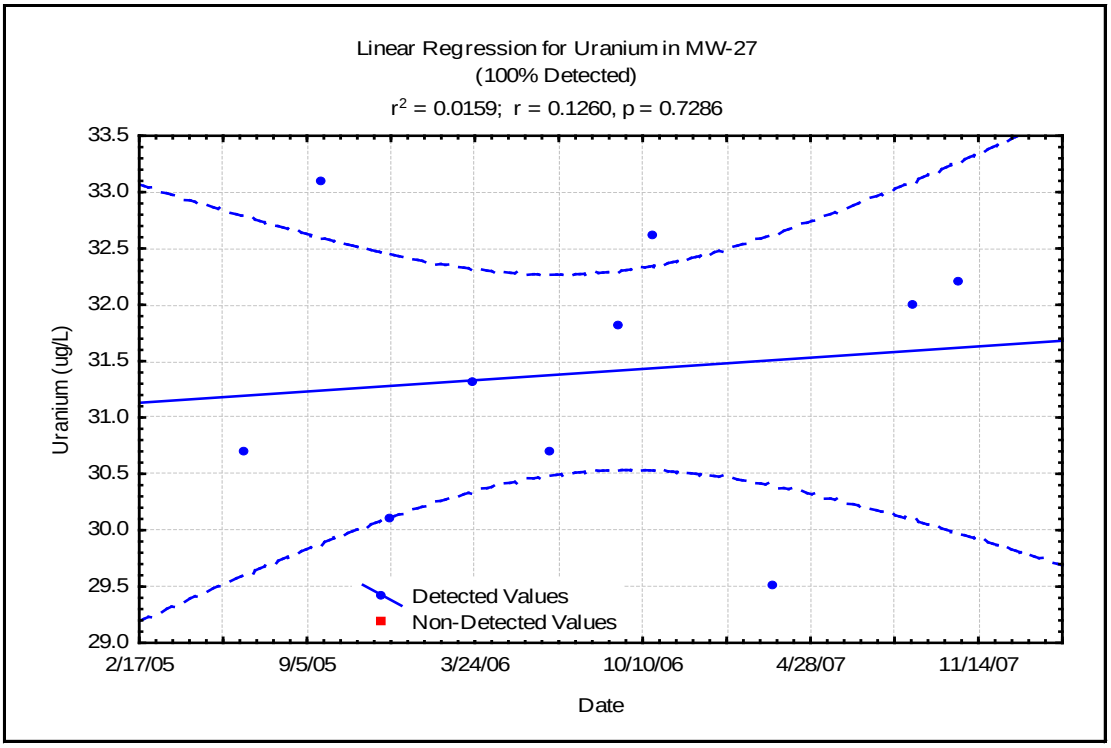

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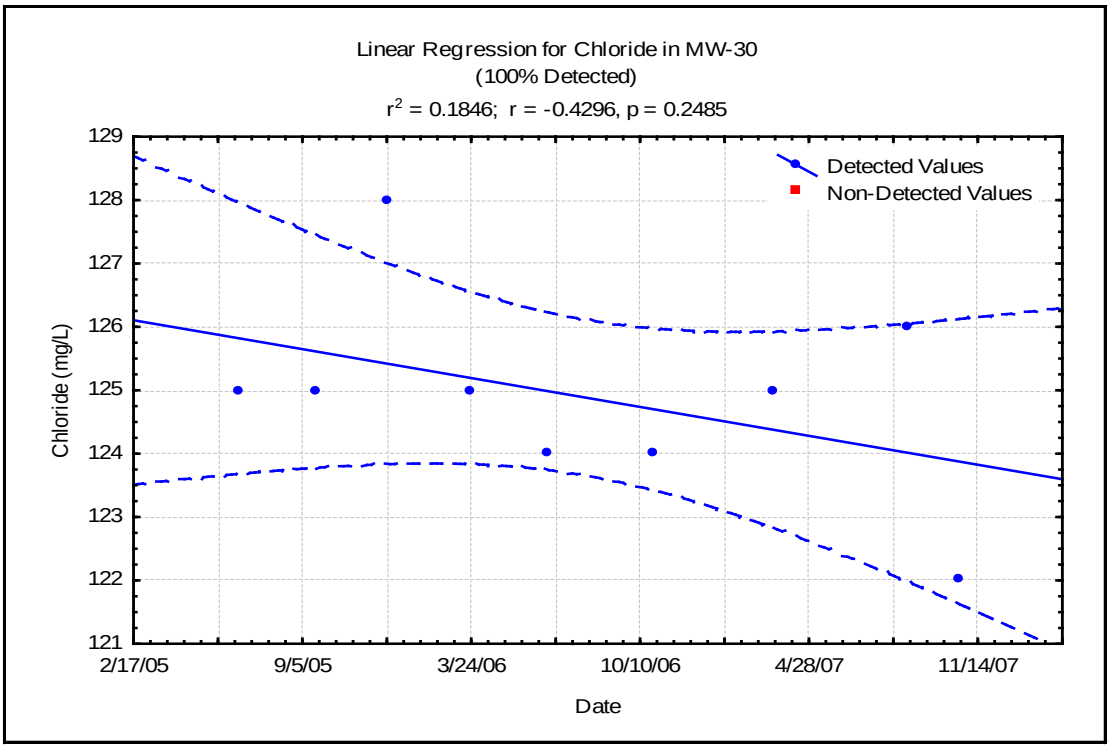

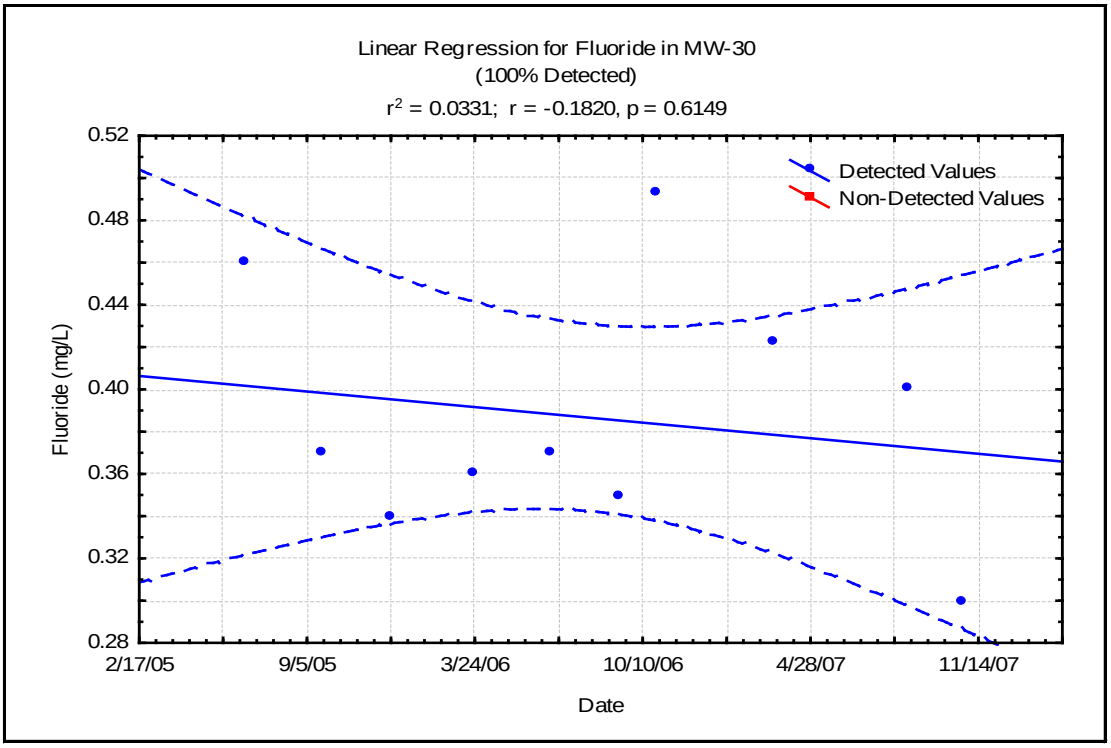

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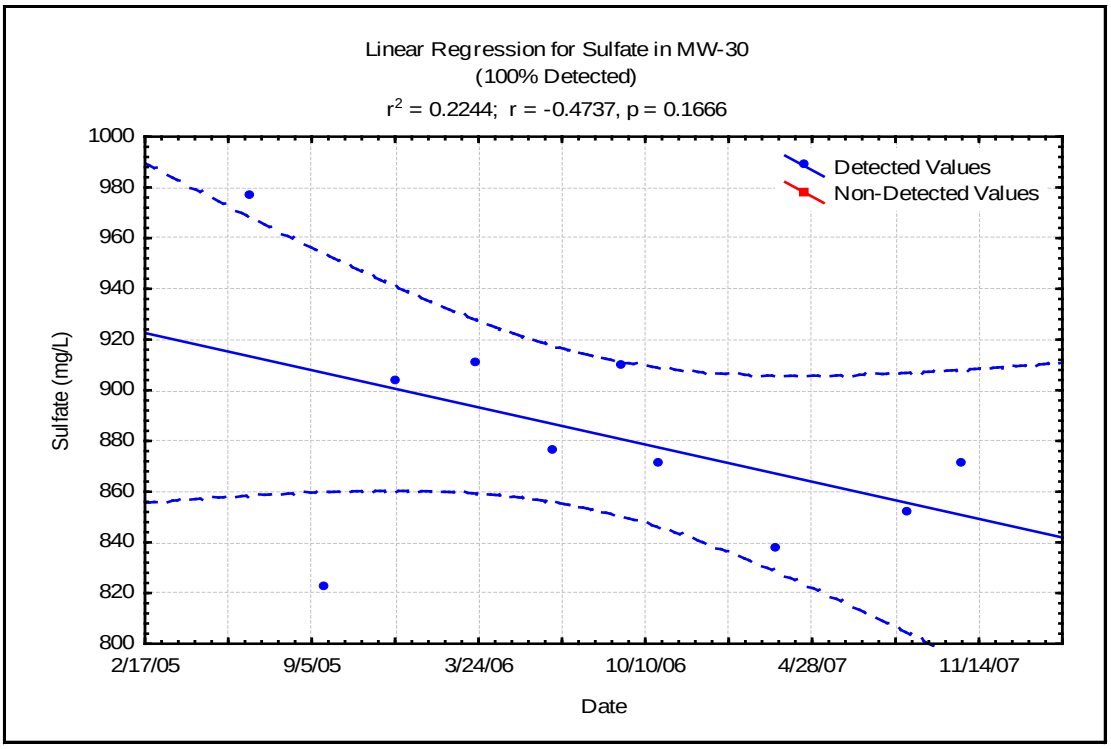

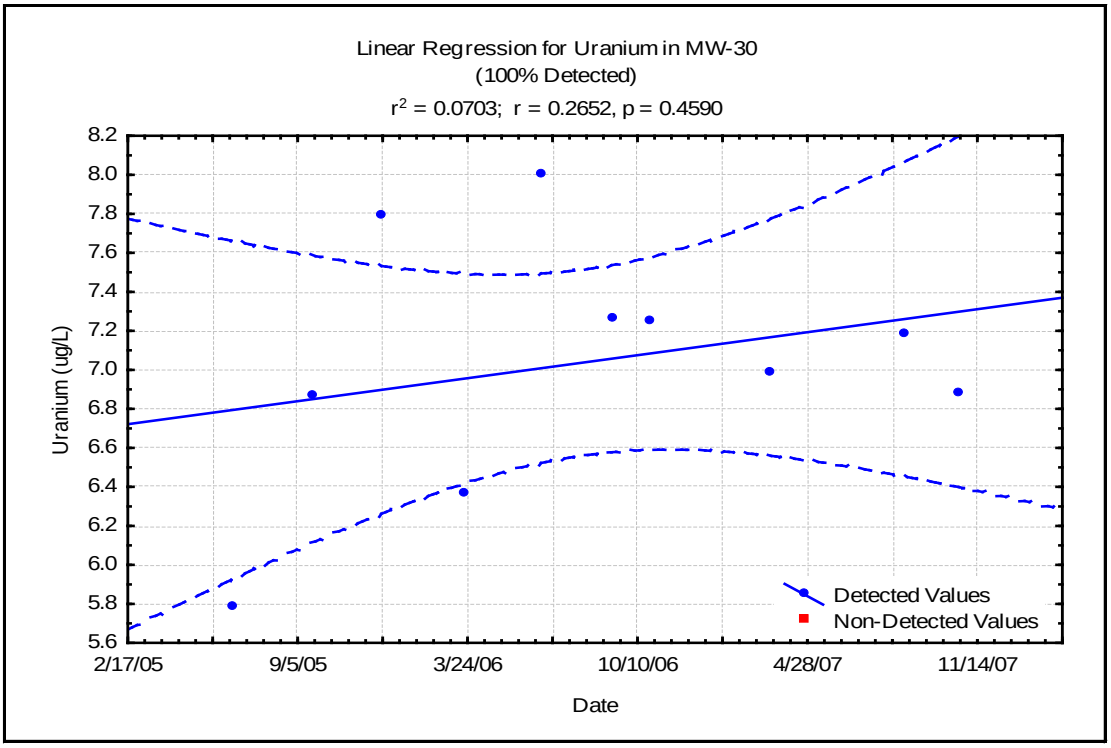

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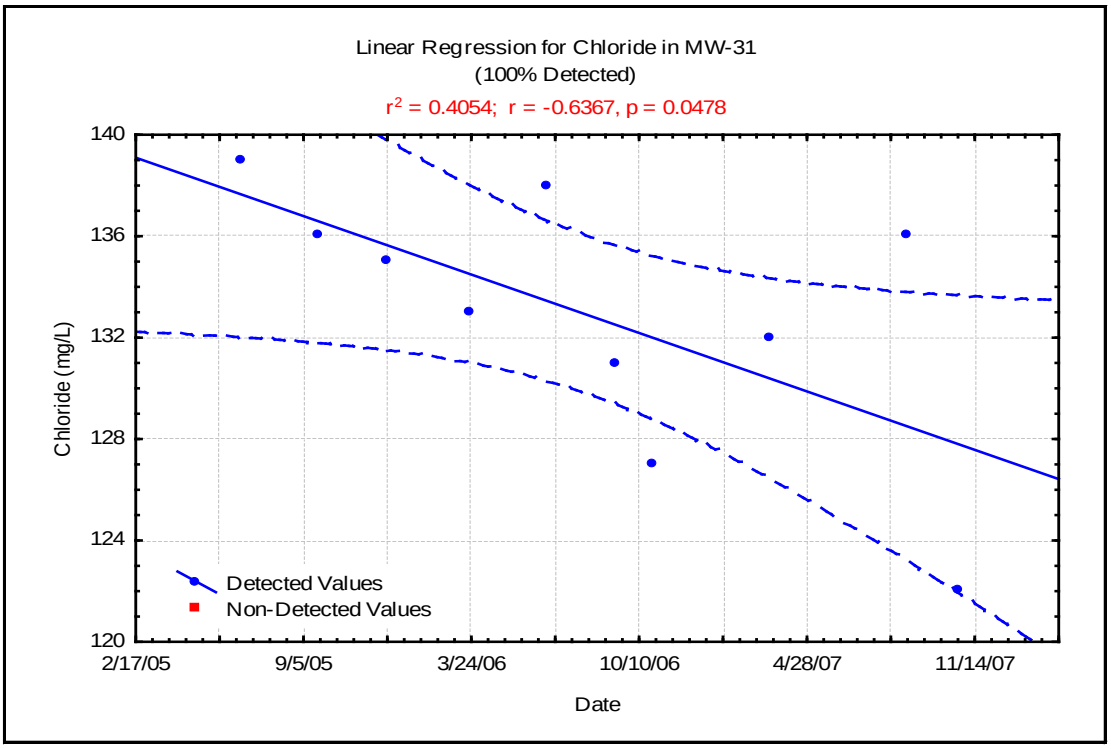

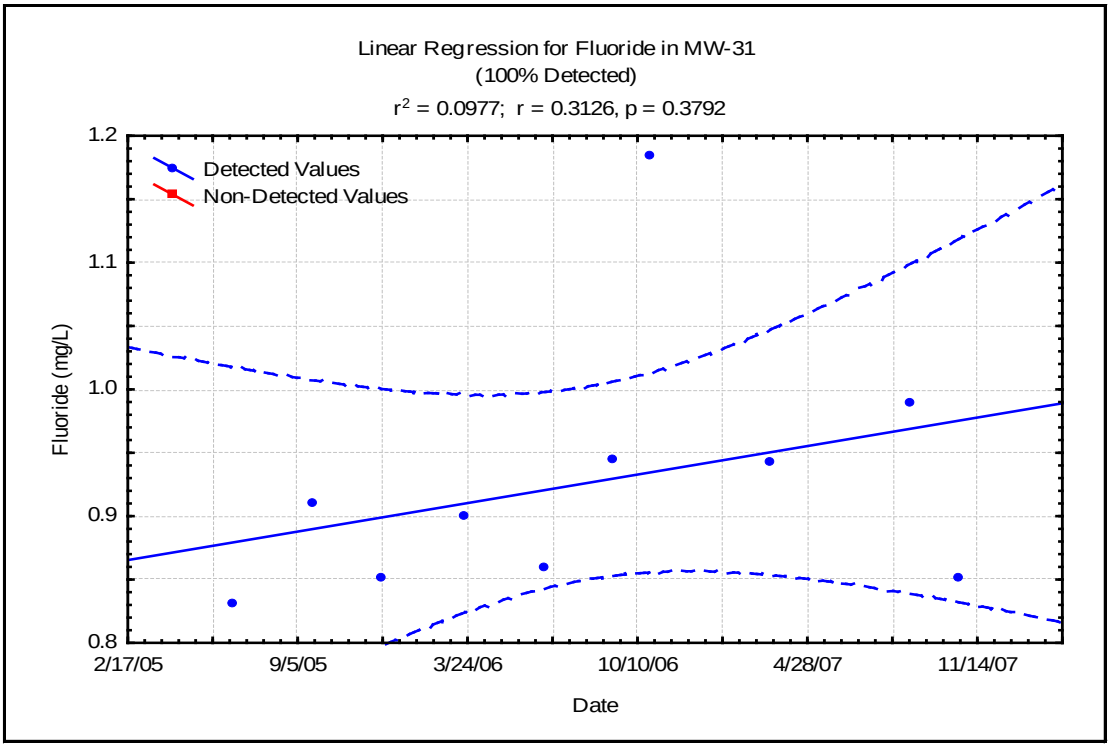

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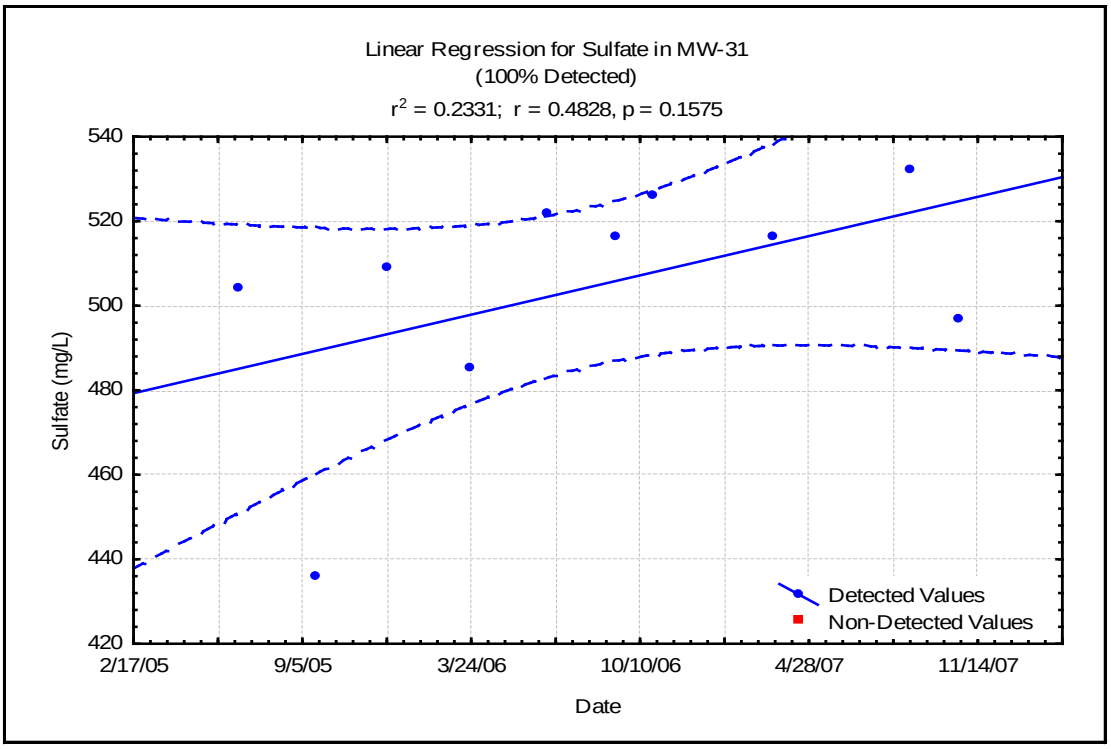
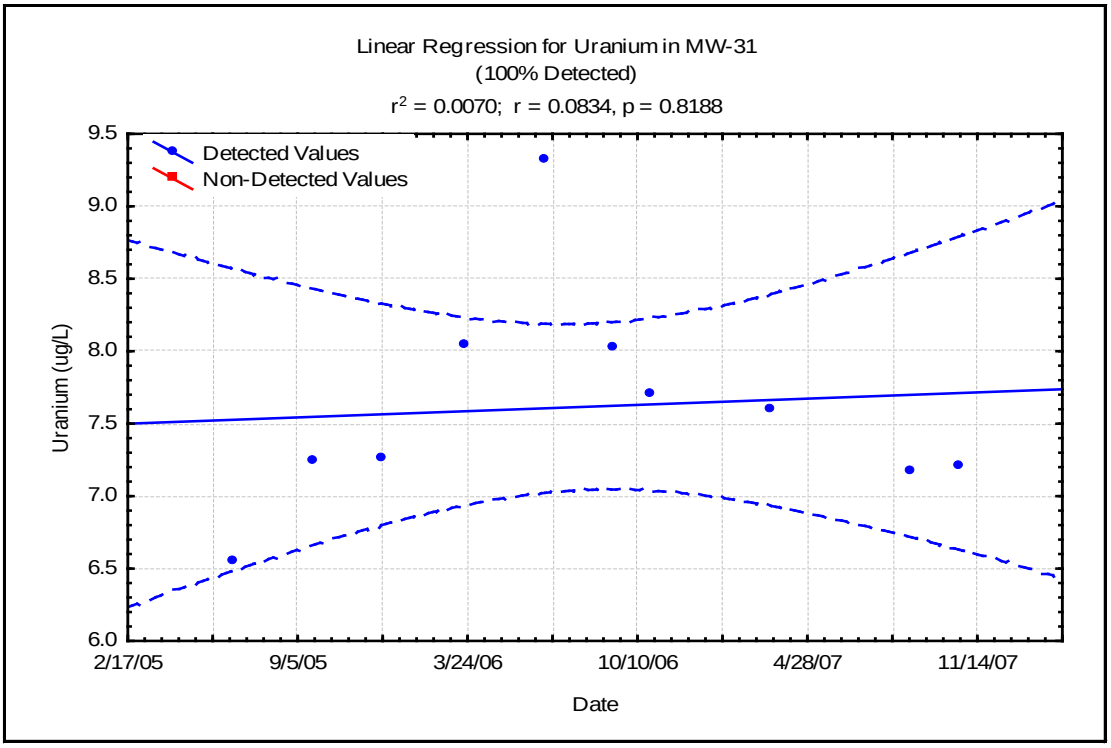


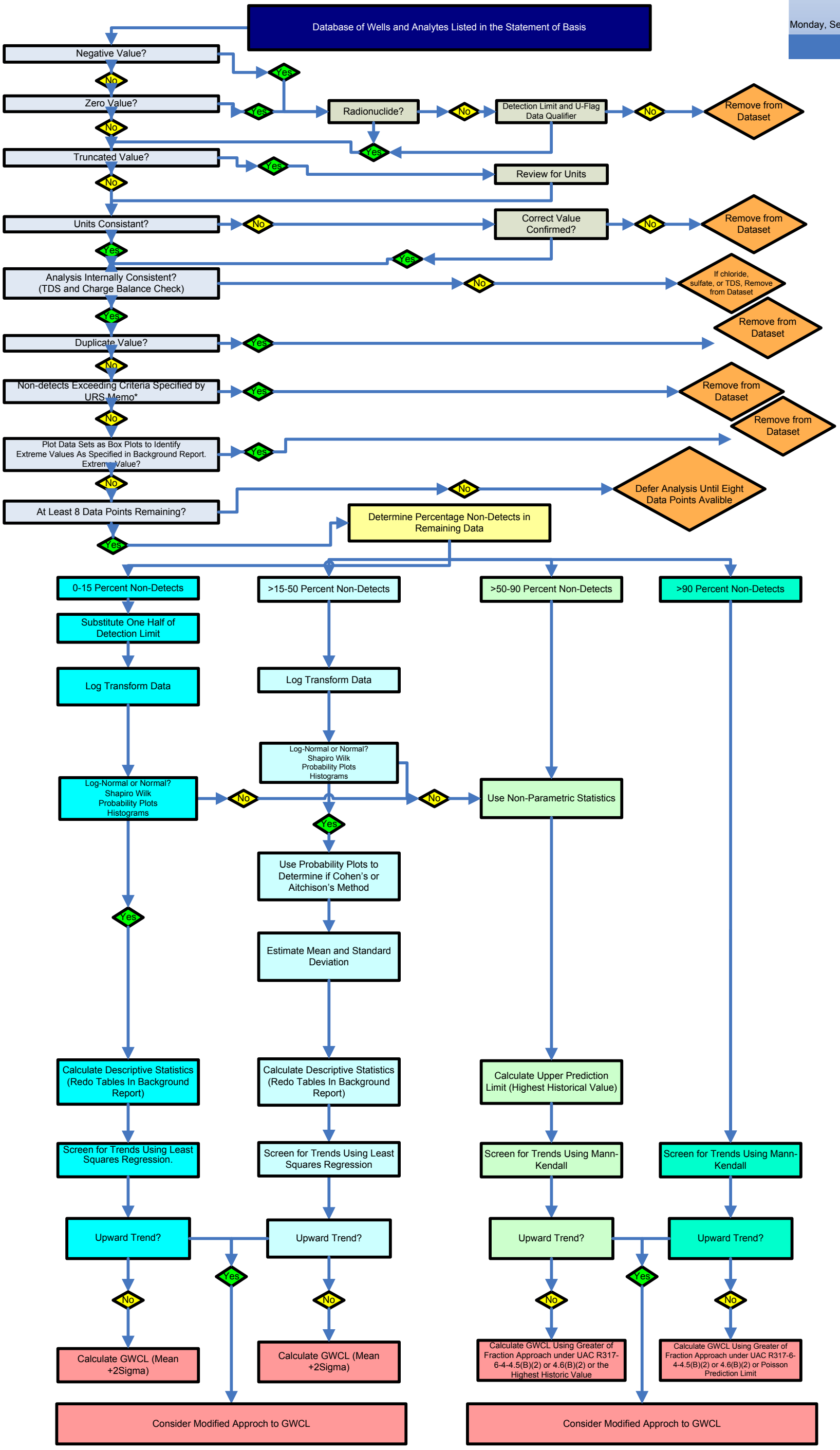


APPENDIX F

Flowsheet (Groundwater Data Preparation and Statistical Process Flow for Calculating Groundwater Protection Standards, White Mesa Mill Site (INTERA, 2007))

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

Monday, September 24, 2012



*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).

Figure 1
Groundwater Data Preparation and Statistical Process Flow for Calculating Ground Water Compliance Limits, White Mesa Mill Site, San Juan County, Utah.

INTERA

APPENDIX G

Input and Output Files (Electronic Only)