Geosyntec consultants

1255 Roberts Blvd.., Suite 200
Kennesaw, Georgia 30144
Tel (678) 202-9500 Fax (678) 202-9501

17 January 2019

Mr. David Brownlee
Georgia Department of Natural Resources
2 Martin Luther King Jr. Drive S.E., Suite 1054
Atlanta, GA 30334-9000

Subject: **Transmittal of Semi-annual Groundwater Monitoring Report #21**
July 2018 through December 2018
Chemtrade Site, HSI#10498
East Point, GA

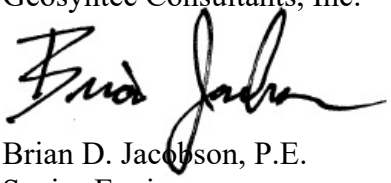
Dear Mr. Brownlee:

On behalf of Chemtrade Solutions LLC, we are pleased to provide you with a paper copy of the Semi-annual Groundwater Monitoring Report #21, July 2018 through December 2018 for the above referenced site. Two electronic copies are also attached.

Responses to Comments provided by GaEPD on 6 September 2017 and 17 September 2018 are also attached to this submittal.

If you have any questions regarding this report, please feel free to give me a call at (678) 202-9500.

Sincerely,
Geosyntec Consultants, Inc.



Brian D. Jacobson, P.E.
Senior Engineer

Prepared for

Chemtrade Solutions LLC
90 East Halsey Road
Parsippany, New Jersey 07054

SEMI-ANNUAL GROUNDWATER MONITORING REPORT NO. 21 JULY THROUGH DECEMBER 2018

CHEMTRADE SITE
EAST POINT, GEORGIA
HSI# 10498

Prepared by

Geosyntec consultants

engineers | scientists | innovators

1255 Roberts Boulevard, Suite 200
Kennesaw, Georgia 30144

Project Number GR5060

January 2019

PROFESSIONAL ENGINEER CERTIFICATION

I certify that I am a qualified engineer who has received a baccalaureate or post-graduate degree in the natural science or engineering and have sufficient training and experience in environmental assessment and corrective measures, as demonstrated by state registration and completion of accredited university courses, that enable me to make sound professional judgments. I further certify that this report was prepared by myself or by a subordinate working under my direction.

17 JANUARY 2019

Brian D. Jacobson, P.E.
Registered Professional Engineer
Georgia Registration #23332

Geosyntec consultants

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1. INTRODUCTION

1.1 Background

1.1.1 Site Location and Description

The Chemtrade Solutions LLC (Chemtrade), formerly the General Chemical LCC, facility (Site) is located on Central Avenue in the City of East Point, Fulton County, Georgia (**Figure 1-1**). The approximate Site location corresponds to latitude of 33.67 and longitude of 84.44. The Site property is bounded by North Martin Street and the John D. Milner Sports Complex on the north side, Randall and Bayard Streets on the east side, Central Avenue and an industrial (metal recycling) facility on the south side, and Central Avenue on the west side. The general area surrounding the Site consists of industrial land uses bordered by some residential properties toward the north and northeast directions. Another industrial site is located on the adjacent property to the northwest of the Site.

The Site, as shown in an aerial view on **Figure 1-1**, consists of a process building, a warehouse structure, and an office building. During operation, there were four Hi-Clay Alumina (HCA) storage cells (herein referred to as HCA cells) located on the Site. These cells were removed during the period of 2003 to 2005, and the area was returned to beneficial use in 2006.

1.1.2 Summary of Recent Regulatory Activities

Subsequent to the issue of the 2002 Corrective Action Plan (CAP), General Chemical voluntarily elected to remove the HCA material from the on-site cells.

Following excavation and removal of the HCA, a revised CAP was issued by General Chemical on 2 October 2006. A Georgia Environmental Protection Division (GaEPD) letter dated 16 January 2007 provided comments and a request for additional work followed by resubmission of the revised CAP.

General Chemical submitted a revised CAP incorporating GaEPD comments on 30 March 2007.

GaEPD completed review and issued a conditional approval of the revised CAP on 4 September 2007. Pursuant to the revised CAP, groundwater and surface water samples were collected for aluminum and sulfate analysis.

General Chemical submitted a voluntary remediation plan application (VRPA) in January 2013. The VRPA proposed: (i) delineation of the horizontal extent of sulfate contamination in groundwater; (ii) continued semi-annual sampling of monitoring wells screened in the partially weathered rock (PWR) and surface water sampling locations; (iii) conduct a storm water drain assessment and implement any necessary repairs to prevent groundwater from entering the storm drain system; and (iv) institutional controls on affected properties through the placement of unified environmental covenants.

In a letter dated 10 April 2013, GaEPD approved the VRPA. GaEPD issued comments on the VRPA on 12 April 2013.

General Chemical LLC was acquired by Chemtrade Solutions LLC on 24 January 2014. The General Chemical LLC name will be used when historically accurate and Chemtrade Solutions will be used for activities after the acquisition date.

1.2 Objectives and Scope

The objective of this report is to present the results for the semi-annual groundwater monitoring activities conducted at the Site in October 2018. This is the eleventh semi-annual report submitted to Georgia EPD following approval of the VRPA in April 2013. However, this report is issued as "Semi-Annual Groundwater Monitoring Report No. 21" to avoid confusion with previous reports issued under the CAP. This report provides a summary of the activities performed and the results of the field and laboratory measurements that were obtained during this monitoring period.

This report presents the results of the following activities:

- Sampling of 6 on-site wells (**Figure 1-2**);
- Sampling of 3 off-site wells (**Figure 1-2**); and
- Sampling of surface water at one on-site and three off-site locations (**Figure 1-3**).

1.3 Overview

This semi-annual groundwater monitoring report summarizes the results of field sampling activities performed by Geosyntec in October 2018. The report is organized as follows:

- Section 2 presents a summary of site characterization information including site geology and hydrogeology, field investigations, nature and extent of environmental impact, and site-specific groundwater and contaminant transport conceptual modeling.

- Section 3 presents the results from sampling of monitoring wells and stormwater from the Site.

- Section 4 discusses the sampling procedures used to obtain groundwater and stormwater samples from the Site

- Section 5 summarizes the results of quality assurance/quality control (QA/QC) evaluation of the data obtained during this monitoring period.

- Section 6 presents conclusions that are based on the data and provide recommendations for future activities.

- Data from this monitoring period are presented in the Appendices. Analytical laboratory reports for water samples are presented in **Appendix A**. Field Forms used during well sampling are presented in **Appendix B**. Mann-Kendall trend analysis output is presented in **Appendix C**.

2 SITE CHARACTERIZATION

2.1 Site Geology and Hydrogeology

This section presents an overview of the Site hydrogeologic conditions. Information on the Site hydrogeology was obtained during the Site investigation activities, conducted in May 1998 in support of the Compliance Status Report (CSR) [Geosyntec, 1999].

The occurrence and movement of groundwater in the Piedmont formation is generally within two hydrogeologic units. A shallow hydrogeologic unit typically occurs within the soils and saprolite (weathered residuum which mantles bedrock). A layer of partially weathered rock (PWR) typically forms a transition between the saprolite and the fractured bedrock. A deeper hydrogeologic unit generally occurs within the fractured bedrock.

Groundwater in the shallow hydrogeologic unit usually occurs under water table (i.e., unconfined) conditions. Groundwater flow is controlled by local topographic features, where recharge occurs in upland areas and discharge occurs in drainage features such as streams, rivers, or lakes. Recharge to the shallow hydrogeologic unit is primarily the result of infiltrating precipitation. Groundwater in the deeper water-bearing zone is associated with secondary porosity (fractures or open spaces) within the crystalline bedrock and flow is controlled by the distribution and degree of interconnection of these openings in the rock. The deeper hydrogeologic unit is fully saturated.

Based on the results of the field investigation, the shallow hydrogeologic unit is conceptualized as an unconfined, homogeneous, and isotropic deposit of sandy clay with a hydraulic conductivity of approximately 4×10^{-5} to 2×10^{-4} cm/s, a hydraulic gradient of approximately 0.003 to 0.03, and an effective porosity of about 20 percent. Groundwater is believed to generally flow at about 16.4 ft per year from west to east across the Site and advection is believed to be the dominant contaminant transport mechanism.

The Site is in an area of relatively steep topography adjacent to a small intermittent stream that discharges to the South River. As can be seen on the aerial photograph of the Site presented in **Figure 1.2**, industrial operations at the Site have resulted in regrading and leveling of a significant portion of the Site (i.e., vegetated areas east of the process buildings). Groundwater flow at the Site is generally west to east.

The lithology of the Site consists primarily of clayey fill material overlying saprolite as depicted on **Figure**s **2-1 through 2-3**, which illustrate hydrogeologic cross-sections that show the Site features and geology. The fill material, which varies in thickness, covers most of the Site and consists of sandy to gravelly red micaceous clay. The saprolite, encountered in all fourteen of the monitoring wells drilled at the Site, consists of highly weathered schist consisting of orange to red clay with kaolinite and mica. Foliation and other relict rock texture are still well preserved and were visible in samples, but the material comprises mostly clay and mica which is formed by the deep weathering of the feldspar minerals. Competent bedrock, as defined by auger refusal, was generally encountered between 20 to 60 feet below ground surface (bgs).

2.2 Summary of Previous Site Investigations

The aluminum concentrations observed in the Site soil during the CSR investigation are within the range typically seen in Piedmont soils (i.e., 70,000 to 100,000 mg/kg). The samples, in which the aluminum concentrations were elevated, were limited to locations of accumulation of more strongly weathered material. Therefore, based on detected concentrations of aluminum in soil samples, industrial activities at the Site have not resulted in a significant increase in aluminum concentrations in the soil [Geosyntec, 1999].

The HCA was removed between 2003 and 2006. Sulfate concentrations vary according to the nature of the material analyzed and were related to the proximity to former HCA cells. In places where the undisturbed soils directly underlie former HCA cells, sulfate concentrations in these soils were typically higher than those of other undisturbed soils. Following removal of the HCA, underlying soils were sampled and analyzed for sulfate, and soils exhibiting sulfate concentrations over 10,300 mg/kg (95% Upper Confidence Limit for all samples was 3,143 mg/kg) were removed.

3. GROUNDWATER AND STORM DRAIN SAMPLING

This section presents the details of the sampling of six on-site wells, and three off-site groundwater wells and one on-site and three off-site stormwater storm drains.

3.1 Groundwater Potentiometric Conditions

Groundwater elevations were measured prior to sampling wells during the October sampling event. The measurements were performed on 24 October 2018. All monitoring wells were gauged. The results of the groundwater elevation measurements are provided in **Table 3-1**.

The potentiometric map for October 2018 readings is shown in **Figure 3-1**. This map shows the typical Piedmont pattern of flow following topography towards surface water features, which act as collectors and discharge points for the groundwater. Since there are no streams at the Site, the groundwater is flowing towards the local topographic low which is aligned parallel with North Martin Street and the storm drain system. The general potentiometric pattern is consistent with the overall drainage flow pattern to the east-southeast towards the South River.

Water level measurements were recorded in wells screened in saprolite and shallow competent rock. In preparing the potentiometric map from water level measurements, generally no distinction was made as to whether the wells were shallow or deep, in saprolite or bedrock. Such distinctions were not appropriate for two reasons: (i) the Piedmont is characterized by a single saturated zone consisting of saprolite and bedrock that are hydraulically connected; and (ii) the vertical components of the head gradient are similar or small compared to the horizontal components.

3.2 Groundwater Sampling

3.2.1 Introduction

Groundwater samples were collected on 24-25 October 2018. Groundwater samples were submitted for analysis for sulfate using EPA Method 9056A and aluminum using EPA Method 6010D. The pH was measured in the field using EPA Method 150.1. The groundwater sampling results are presented in **Table 3-2**. Laboratory results are presented in **Appendix A** and field forms are presented in **Appendix B**.

3.2.2 Groundwater Constituent Summary

Sulfate was detected at the nine monitoring wells sampled during the October 2018 sampling event. The sulfate concentrations were typically lower in the off-site wells, 116 mg/l at EPW-01 at the northwestern boundary of the Site, and 5.3 mg/l at EPW-02 to the east of the Site. Sulfate concentration in off-site well EPW-03D was 30.3 mg/l. On-site well OW-1A at the western boundary was measured at 46.7 mg/l. The background monitoring well GCW-01D at the upgradient edge of the Site had 180 mg/l of sulfate. The results indicate groundwater entering the Site contains background concentrations of sulfate between 46.7 and 116 mg/l as measured at OW-1A and EPW-01. These values are also consistent with the upgradient storm drain location SW-09 where sulfate was measured at 100 mg/l. The sulfate concentration along the northern property boundary at GCW-04D was 3,590 mg/l in October 2018. GCW-04D well is located outside the former impoundment areas. Sulfate concentrations at the eastern boundary at GCW-02D and GCW-03D were 1,880 and 3,710 mg/l, respectively. The source area monitoring well (GCW-05) sulfate concentration was 525 mg/l. October 2018 sampling results indicate sulfate concentrations were generally similar to April 2018 sulfate concentrations.

Aluminum was detected at six of the nine monitoring wells sampled during the October 2018 sampling event. The concentrations were low at the off-site wells, 14 mg/l at EPW-01 at the northwestern boundary of the Site and not detected (<0.1 mg/l) at EPW-02 and EPW-03D, located to the east and northeast of the Site, respectively. On-site well OW-1A at the western boundary had 0.55 mg/l of aluminum. The background monitoring well GCW- 01D at the upgradient edge of the Site contained 4.4 mg/l. The results indicate groundwater entering the Site contains background concentrations of aluminum between 0.55 and 14 mg/l as measured at OW-1A and EPW-01. These values are also consistent with the upgradient storm drain location SW-09 where aluminum was not detected (<0.1 mg/l). The aluminum concentration along the northern property boundary at GCW-04D was 406 mg/l.

Aluminum concentrations at GCW-04D have been low since it was measured at 0.1 mg/l in March 2015 through May 2016 when it was measured at 0.6 mg/L. Aluminum concentration is directly related to pH. The pH at GCW-04D increased to background levels between March 2015 and May 2016, resulting in the decrease in aluminum concentration. During the October 2016 sampling event, the pH dropped to 3.6, resulting in an increase in the aluminum concentration. The pH remained low, and resulting aluminum concentration remained high, until the April 2018 sampling event in which the

pH was measured to be 6.2, resulting in an aluminum concentration of 0.91 mg/l. In October 2018, the pH dropped to 3.0, resulting in an increased aluminum concentration of 406 mg/l. Aluminum concentrations at the eastern boundary at GCW-02D and GCW-03D were 121 and 300 mg/l, respectively. The source area monitoring well (GCW-05) aluminum concentration was not detected (<0.1 mg/l).

The pH measurements were generally consistent with past measurements. The off-site wells EPW-01, -02, and -03 ranged from 3.9 to 5.5 standard units (s.u.). The upgradient wells GCW-01D and OW-1A were measured to be 3.7 and 4.0 s.u. respectively. The pH along the northern property boundary at well GCW-04D was 3.0 s.u. The northern and eastern wells GCW-02D and GCW-03D were measured at 3.0 and 3.1 s.u. The pH for source area monitoring well (GCW-05) was measured at 6.6 s.u.

3.2.3 Comparison to Previous Results for Groundwater

Table 3-3 summarizes statistical trend analysis of both aluminum and sulfate data in groundwater. Mann-Kendall trend analysis was performed using available data for each monitoring well at a 95% confidence level. The data used for the Mann-Kendall trend analysis calculations is presented in **Appendix C**. The procedure and methodologies employed in the analysis of the data are consistent with Georgia EPD and United States Environmental Protection Agency (EPA) recommended procedures. These methods meet the performance criteria specified in the rules of the Georgia EPD, Chapter 391-3-4-.14(19) and the technical standards described in the EPA "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Unified Guidance," dated March 2009.

Historical trend graphs for sulfate and pH are shown in **Figure 3-2**. The Mann-Kendall groundwater trend summary is shown on **Figure 3-7**. Sulfate concentrations generally decreased or were stable in off-site and on-site wells in groundwater. The sulfate concentrations in monitoring wells GCW-01D, GCW-02D, GCW-03D, GCW-04D, GCW-05, EPW-03D, and OW-1A showed a statistically significant decreasing trend. EPW-01 has historically shown an increasing trend, but the Mann-Kendall trend analysis conducted using the October 2018 sampling data shows that there is neither a statistically significant increasing nor decreasing trend. Neither a decreasing nor an increasing trend was calculated for sulfate concentration in monitoring well EPW-02. Similarly, aluminum concentrations also decreased or were stable in groundwater. A statistically significant decreasing trend was calculated for aluminum in monitoring wells GCW-01D, GCW-02D, GCW-04D, EPW-02 and OW-01A. Neither decreasing nor increasing trends

were calculated for aluminum in the remainder of the wells. The pH measurements were generally stable. The pH measured at on-site wells was generally lower than the pH measured at the off-site wells except for GCW-05 in the source area which had a higher pH than background.

Several conditions not related to the Site may slow the return of the Site to background concentrations of site constituents, following removal of source materials. These include the following:

- The pH of the groundwater in upgradient wells (OW-1A and GCW-01D) is low. Measured pH values 4.0 and 3.7 s.u. respectively. The low pH condition of groundwater entering the Site will slow a return to background conditions for pH and aluminum.

- The pH of rainwater at the Site was measured at less than 5 during the HCA removal, therefore infiltrating rainfall will not have a significant effect in terms of raising the groundwater pH in the short-term.

- The area surrounding the Site has a number of other sources of sulfate in groundwater resulting from previous operations. Potential sulfate sources include a former battery cracking plant, a former fertilizer manufacturer, two off-site HCA disposal areas operated by others, and a former agricultural chemical manufacturer.

- The former fertilizer manufacturer (Furman Fertilizer, now MGA Holdings) operated an acid pit (Sanborn, 1925). Downgradient of the acid pits at delineation boring DB-05 sulfate was observed at a concentration of 1,000 mg/l. The delineation boring location is upgradient and side gradient to the former HCA impoundments shown in **Figure 1-2**.

It is encouraging that no significant impacts have been detected at downgradient wells EPW-02 or EPW-03D. The sulfate concentrations at EPW-02 appear stable and are similar or lower than regional background conditions of 46.7 to 116 mg/l as observed at well EPW-01. EPW-03D is located approximately 200 feet from the Site boundary. Sulfate concentrations at EPW-03D are similar to the regional background, and trends are decreasing. The pH trend at the EPW-03D is stable and typical for the Piedmont with measurements generally between 5 and 7 s.u. The decreasing sulfate concentrations and

stable pH indicate impacts from the Site, if they ever existed, are minimal and decreasing with time. The concentration of constituents of concern from both on-site and off-site sources appear to have attenuated to background levels prior to reaching EPW-02 or EPW-03D.

The removal of the HCA source material appears to be resulting in the Site returning to background conditions over time. The sulfate concentrations are in decline at downgradient wells. However, it will take time for residuals to mix with infiltration and incoming groundwater and for geochemical conditions to stabilize.

The groundwater measurements were compared to Type 4 Risk Reduction Standards (RRS) of 1,200 mg/l for sulfate and 102 mg/l for aluminum. The measured concentrations were interpolated to develop limits of area in excess of the Type 4 RRs. Comparisons of the Site groundwater to Type 4 RRS for sulfate and aluminum are presented in **Figures 3-4 and 3-5**.

3.3 Storm Drain Sampling

3.3.1 Introduction

Storm drain water samples were collected from one on-site and three off-site storm drains in October 2018. Surface water flows in the storm drain system in the following sequence: SW-09, SW-06, SW-02, SW-07 from upstream to downstream. The purpose of the storm drain sampling program was to evaluate potential impacts to the storm drain system as requested by Georgia EPD. Stormwater samples were submitted for analysis for sulfate using EPA Method 9056A and aluminum using EPA Method 6010D. The pH was measured in the field using EPA Method 150.1. The stormwater sampling locations are shown on **Figure 1-3**. The stormwater sampling results are presented in **Table 3-4**. Laboratory results are presented in **Appendix A** and field forms are presented in **Appendix B**.

3.3.2 Storm Drain Constituent Summary

Sulfate was detected in the four storm drain samples during the October 2018 sampling event. The upgradient (SW-09) sulfate concentration was measured at 100 mg/l. A sample was collected cross-gradient (SW-06) at a location in the John D. Milner Sports Complex. Sulfate was measured at 1,940 mg/l. At the on-site location (SW-02), sulfate was measured at 1,240 mg/l. The sulfate concentration at the discharge of the storm drain

to surface water at SW-07 was measured at 469 mg/l. The sulfate concentrations in storm drains are illustrated in **Figure 3-6**.

Aluminum was detected in three of the four storm drain water monitoring locations during the October 2018 sampling event. The upgradient (SW-09) aluminum concentration was not detected (<0.1 mg/l). The sample for aluminum collected cross-gradient (SW-06) was measured at 193.0 mg/l. At the on-site location (SW-02) aluminum was measured at 112.0 mg/l. The aluminum concentration at the discharge of the storm drain to surface water at SW-07 was measured at 39.2 mg/l.

3.3.3 Comparison to Previous Results for Storm Drains

Table 3-5 summarizes statistical trend analysis of both aluminum and sulfate data in storm drains. Mann-Kendall trend analysis was performed using available data for each storm drain at a 95% confidence level. The data used for the Mann-Kendall trend analysis calculations is presented in **Appendix C**. The procedure and methodologies employed in the analysis of the data are consistent with Georgia EPD and United States Environmental Protection Agency (EPA) recommended procedures. These methods meet the performance criteria specified in the rules of the Georgia EPD, Chapter 391-3-4-.14(19) and the technical standards described in the EPA "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Unified Guidance," dated March 2009.

Historical trend graphs for sulfate, aluminum, and pH are shown in **Figure 3-3**. The Mann-Kendall stormwater trend summary is shown on **Figure 3-8**. Sulfate and aluminum concentrations were generally stable. A statistically significant increasing trend was calculated for sulfate and aluminum in SW-06 (cross-gradient storm drain). Neither decreasing nor increasing trends were calculated for sulfate and aluminum in the remainder of the sampling locations. The pH measurements were relatively stable showing minor changes between sampling events at the same location. The pH measured upgradient was generally higher than the pH measured at the on-site, cross-gradient, and downgradient storm drains.

Several conditions not related to the Site may slow the return of the Site to background concentrations of site constituents, following removal of source materials. These include the following:

- The pH of rainwater at the Site was measured at less than 5 during the HCA removal, therefore infiltrating rainfall will not have a significant effect in terms of raising the stormwater pH.

- The area surrounding the Site has a number of other sources of sulfate in groundwater resulting from previous operations. Potential sulfate sources include a former battery cracking plant, a former fertilizer manufacturer, two off-site HCA disposal areas operated by others, and a former agricultural chemical manufacturer.

- The former fertilizer manufacturer (Furman Fertilizer, now MGA Holdings) operated an acid pit (Sanborn, 1925). Downgradient of the acid pits at delineation boring DB-05 sulfate was observed at a concentration of 1,000 mg/l. The delineation boring location is upgradient and side gradient to the former HCA impoundments.

4. SAMPLE COLLECTION PROCEDURES

4.1 Summary

In October 2018, samples were collected from nine monitoring wells. Samples from monitoring wells were collected using dedicated tubing and low-flow purging techniques. Dedicated 1/8" polyethylene sampling tubing has been installed in each well. The end of the tubing is set in the middle of the screened interval. The end of tubing for EPW-01, EPW-02, and OW-01A is approximately 5 feet off the bottom of the well. Samples were placed in 250 ml and 150 ml polyethylene containers for aluminum and sulfate analyses, respectively. The containers for aluminum were preserved with approximately 2 ml of nitric acid and ice. Sulfate samples were preserved with ice. The sampling containers and preservatives were provided by Pace Analytical Services, LLC. located in Peachtree Corners, Georgia. The containers were labeled and stored on ice in a cooler until time for shipment to the laboratory. The samples were packed in ice in a cooler and hand delivered by a courier to the laboratory. Chain-of-custody documents were completed and included with each shipment.

4.2 Monitoring Well Sampling Procedure

Monitoring wells were sampled using peristaltic pumps. The samples were collected in general accordance with EPA Region 4 Science and Ecosystem Support Division Operating Procedure for "Groundwater Sampling" (SESDPROC-301-R4) using the appropriate procedures for the “Low-Flow” method. There were no variations in the sampling procedures. Peristaltic pumps were used since the depth to water was less than 30 ft bgs, which is the maximum practical lift a peristaltic pump can achieve per the SESDPROC-301-R4. The advantages of peristaltic pumps are that they produce low rates of flow with minimal surging and can be decontaminated more thoroughly when compared to bailers or other types of pumps by simply replacing the tubing in the pump head. The pump-head tubing is silicone, while the down-hole tubing is polyethylene. The sample tubing is polyethylene instead of Teflon lined since the constituent concentrations are high (i.e., ppm not ppb) and sulfate and aluminum do not bind to polyethylene tubing.

Low flow purging was conducted by purging groundwater from the well at a low, constant rate for an extended period of time with the pump intake (i.e., the end of the dedicated tubing) set directly opposite the middle of the well screen. This method creates a

localized flow system in the well directly between the screen and pump intake, eliminating the need to remove large volumes of casing storage while ensuring that the sample collected is representative of the surrounding ground water. For this project, a purge rate of approximately 350 mL/min was extracted until stabilization of field parameters, as outlined in the SESDPROC-301-R4, was achieved. Additionally, a purge volume of two and one-half to five gallons was removed, when possible, to represent at least one and one-half to three pore volumes of the screened zone of the well.

To ensure that the samples collected are representative of the ground water in the formation, field parameters were measured throughout the purging process at least every 5 minutes. Temperature (^{o}C), conductivity (mS/cm), pH (s.u.), redox potential (mV), dissolved oxygen (mg/l), and turbidity (NTU) were measured using a Horiba U-52 or equivalent water quality meter. Measurements were taken in an enclosed flow-through cell to minimize the effects of contact with air.

After the field parameters stabilized, the flow-through cell was disconnected, and the sample was collected directly from the pump discharge tubing without adjusting the flow rate. This method ensured that the sample was representative of the groundwater at the respective location.

Historical groundwater field parameters are recorded in **Table 3-6**.

4.3 Groundwater Sampling Decontamination Procedure

Down well tubing was dedicated to each monitoring well by securing to the well cap and placing the tubing completely in the well when not in use. Pump-head tubing for the peristaltic pump was discarded after each use.

4.4 Storm Drain Sampling Procedure

Storm drain water was sampled using peristaltic pumps or by hand. Four locations were sampled for sulfate and aluminum in October 2018. The samples were collected in general accordance with EPA Region 4 Science and Ecosystem Support Division Operating Procedure for "Surface Water Sampling" (SESDPROC-201-R4). Storm drain locations SW-02, SW-06, and SW-9 were sampled using the appropriate SESDPROC-201-R4 procedure for the “Peristaltic Pumps” method as these three sampling locations are storm drain manholes. Storm drain location SW-07 was sampled using the appropriate SESDPROC-201-R4 procedure for the “Dipping Using Sample Container” method as

this sampling location is a storm drain outlet to a stream. There were no variations in the sampling procedures.

Storm drain water sampling was performed at the upgradient (SW-09), on-site (SW-02) and cross-gradient (SW-06) locations by lowering polyethylene tubing into storm drain manholes and placing the end of the tube near the outlet for the manhole. This ensured water from multiple inlets was mixed prior to sample collection. The downgradient (SW-07) sample was collected by hand at the outlet to the storm drain at the discharge to the stream.

For peristaltic pump samples, a purge rate of approximately 500 mL/min was maintained until the turbidity was stable at less than 10 NTUs or until other field parameters were stable. To ensure that the samples collected are representative of the storm drain water, field parameters were measured twice prior to sampling the location. Temperature (^{o}C), conductivity (mS/cm), pH (s.u.), redox potential (mV), dissolved oxygen (mg/l), and turbidity (NTU) are measured using a Horiba U-52 or equivalent water quality meter. Measurements were taken in an enclosed flow-through cell for SW-02, SW-06, and SW-09 to minimize the effects of contact with air.

After the field parameters have stabilized, the flow-through cell was disconnected, and the sample was collected directly from the pump discharge tubing without adjusting the flow rate. This method ensures that the sample is representative of the storm drain water surrounding the respective location.

For hand sampling (i.e., for SW-07), a location near the center of the flow and free of surface debris was selected. The sample was collected from beneath the surface by inserting the container opening down into the water then inverting underwater. Two sets of field parameters were measured by inserting the water quality instrument in the flow at the sampling location.

Historical storm drain field parameters are recorded in **Table 3-7**.

4.5 Storm Drain Sampling Decontamination Procedure

Drop tubing and pump-head tubing for the peristaltic pump were discarded after each use.

5. QUALITY ASSURANCE/QUALITY CONTROL

The field and analytical data from this semi-annual groundwater monitoring period was reviewed by Mr. Brian Jacobson with Geosyntec. The data review included evaluation of the field and laboratory quality assurance/quality control (QA/QC) parameters in order to assess the integrity of the data obtained for this project including: documentation, holding times, laboratory control samples, and laboratory matrix spike analyses. The documentation and results of the QA/QC analyses are found in the laboratory reports provided in **Appendix A**. Evaluation of these parameters was used to assess the precision, accuracy, representativeness, comparability, and completeness of the data.

Based on the review of the field and laboratory data, the data obtained from this field investigation are considered to be of acceptable quality and are fully usable with the qualifications as designated by the data validation process. Details of the QA/QC review of the data are presented in the following sections.

5.1 Documentation

Field sampling forms and chain-of-custody forms were evaluated for completeness. Field records were considered to be usable and to provide a reasonable record of field activities and samples collected. This review indicated that field sampling and custody transfer procedures were adequately documented and the integrity of the samples was not compromised.

5.2 Holding Times

All samples were processed and analyzed by the laboratory using the correct analytical methods and within the prescribed holding times.

5.3 Reporting Limits

The laboratory reporting limits for sulfate by Method 9056A varied from 5 to 500 mg/l depending on the required dilution to measure a result. The laboratory reporting limit for aluminum by Method 6010D varied from 0.1 to 1.0 mg/l. The required quantitation limits for this project were met for all data, except in cases where sample dilution was required because of high concentrations of target analytes or matrix interference.

5.4 Accuracy

The accuracy of the data was evaluated by examining the percent recovery (%R) of matrix spikes and matrix spike duplicate (MS and MSD), and laboratory control samples (LCS). The %Rs met the laboratory-specific QC limits for the laboratory QC LCS samples. The MS samples for sulfate and aluminum were outside the %R limits for MS, the MSD sample for sulfate was outside the %R limits for MSD, and the MSD for aluminum was within the %R limits for MSD. The low recoveries were due to the low spike concentration in relation to the actual sample concentration of aluminum and sulfate (sample concentration much greater than the spiked amount). The data were judged acceptable for use based on the acceptable %R for the LCS samples.

5.5 Representativeness

Representativeness was evaluated to assess the degree to which sample results represent the actual concentrations of constituents in groundwater. Representativeness was evaluated qualitatively by reviewing sampling procedures and laboratory analytical procedures. Based on this review, the samples yielded results that provided a good qualitative representation of constituent concentrations in groundwater.

A qualitative evaluation of representativeness was also performed by examining the analysis of laboratory method blanks. Constituents were not detected above the reporting limit in any of the method blanks. This evaluation further demonstrates that the analytical data are representative of actual conditions.

5.6 Comparability

The current field and laboratory methods were compared to methods used during past monitoring periods in order to evaluate the comparability of data obtained during the current monitoring period to data previously obtained. The recommended reporting limits were used for all constituents. The data presented in this report are consistent with the data presented in previous reports.

5.7 Completeness

Completeness was measured by determining the percentage of usable data obtained from samples for this project. The project sample results were found to be 100 percent complete and usable without qualification.

6. CONCLUSIONS

6.1 Groundwater

The results of over ten years of data collection indicate concentrations of constituents of concern are generally showing significant decreasing trends or stability for on-site monitoring wells. The HCA source material has been removed for over ten years. While many factors can influence concentrations at any given point in time, (e.g., time since removal of the source, hydrogeologic conditions, and precipitation patterns) it is encouraging to see that the general trend of concentrations of monitored constituents is decreasing. Groundwater levels (elevations) have been generally stable since 2008.

Sulfate concentrations show a statistically significant decreasing trend in the six on-site groundwater wells. The decreasing trends are consistent with source removal followed by natural attenuation of the remaining pore water.

Aluminum concentrations show a statistically significant decreasing trend at five of the nine wells and no statistically significant trend at the remainder of the wells. Total aluminum concentration is pH dependent and since Piedmont soils contain high levels of naturally occurring aluminum, fluctuations in aluminum concentrations may occur between sampling events. Additionally, aluminum hydroxide can migrate as a colloid in groundwater. As shown in **Figure 6-1**, on-site wells consistently had aluminum concentrations above solubility limits indicating solid colloidal aluminum was likely being measured in the groundwater samples. Elimination of the colloidal aluminum would result in at least an order of magnitude reduction in total aluminum measured. For example, as shown on **Figure 6-1**, the measured total aluminum concentration was 26 mg/l, whereas the maximum soluble concentration at pH 4.0 is 0.6 mg/l, a 98 percent decrease from the reported value. The natural filtering of the aluminum floc particles by the soil as the water migrates off site may explain the rapid reduction in observed aluminum concentrations with increasing distance from the former source area.

The pH measurements were generally stable between the sampling events. While this is encouraging, we believe that local precipitation which has been measured with a pH less than 5 standard units will limit recovery of groundwater pH. The depressed pH will continue to allow naturally occurring aluminum to be mobilized from site soils. However, the aluminum does not appear to be migrating off site.

6.2 Storm Drains

Storm drains at the Site have been sampled during 24 sampling events. Storm drain water and groundwater are related due to leaks in the storm drains that allow the infiltration/exfiltration of stormwater and groundwater depending on the relative water levels. The stormwater constituent concentrations and pH will vary slowly due to the low groundwater flow velocity across the Site (previously estimated at 16.4 ft. per year). The potential presence of off-site sources may slow the return of the stormwater to background conditions. Factors that may slow a return to background include the following:

- The pH of the groundwater in upgradient wells (OW-1A and GCW-01D) is low. Measured pH values were 4.0 and 3.7 s.u., respectively. The low pH values of groundwater entering the Site will slow a return to background conditions of stormwater mixed with groundwater exiting the Site. The pH of stormwater in the cross-gradient sampling location (SW-06) was measured at 3.4 s.u. This water mixes with on-site stormwater lowering the pH.

- The pH of rainwater at the Site was measured at less than 5 during the HCA removal, therefore infiltrated rainfall and stormwater will not have a significant effect in terms of raising the stormwater pH in the short-term.

- The area surrounding the Site has a number of other sources of sulfate in groundwater resulting from previous operations. These sources may be contributing to the elevated sulfate concentrations noted at SW-02 that were measured at 1,240 mg/l. Potential sulfate sources include a former battery cracking plant, a former fertilizer manufacturer, two off-site HCA disposal areas operated by others, and a former agricultural chemical manufacturer.

The sulfate concentrations at the upgradient monitoring point (SW-09) were lower than on-site (SW-02) or cross-gradient (SW-06) monitoring points. Downgradient (SW-07) sulfate concentration at the exit to the storm drain and the start of open channel flow was measured at 469 mg/l which is greater than the background concentration of 100 mg/l.

The cross-gradient (SW-06) concentrations of sulfate and aluminum were higher than the on-site (SW-02) concentrations during the last sampling event. Since the on-site source has been removed and potential off-site sources likely remain the relative contribution

from the Site would be expected to continue to decrease with time. As presented in **Figure 3-3**, the time trend analysis shows a continued impact from the cross-gradient SW-06, which is consistent with source removal on site and active potential impacts by a residual plume.

6.2 East Point Storm Drain Negotiations

The City of East Point requested a series of meetings during the period of February to March 2017 to discuss storm drain concerns related to the Newell Recycling property and the adjacent Chemtrade site. The meeting participants included representatives from The City of East Point, Newell Recycling, Chemtrade, and GaEPD. Chemtrade requested a meeting to discuss access and scope of work with the City of East Point on August 3rd, August 18th, and December 18th 2017. Chemtrade restarted the process of negotiations with the City of East Point on January 12th, 2018. A site meeting was conducted on June 7th, 2018 to discuss logistics of installing the liner in a section of storm drain. The City of East Point was cooperative with scheduling work in the fall pending reaching an agreement with the City for a letter of No Further Action (NFA). The NFA discussions have not progressed to date. After receiving permission from the City of East Point Chemtrade installed a cured-in-place pipe (CIPP) to seal 242 feet storm drain between SW-07AA and SW-07X. The manholes at each end of the work and a manhole in the center were also replaced to facilitate CIPP installation. The work was performed during December 2018 and confirmation sampling to evaluate the benefit of the improvements will be performed during the next sampling event.

7. REFERENCES

Geosyntec (1999), "*Compliance Status Report*", General Chemical Corporation, East Point, Georgia", prepared by Geosyntec Consultants, February 1999

Geosyntec (2002), "*Revised Corrective Action Plan, General Chemical Corporation, East Point, Georgia"*, prepared by Geosyntec Consultants, February 2002

Geosyntec (2006), "*Site restoration Report, General Chemical Corporation, East Point, Georgia"*, prepared by Geosyntec Consultants, February 2006

Geosyntec (2007), "*Revised Corrective Action Plan, General Chemical Corporation, East Point, Georgia"*, prepared by Geosyntec Consultants, February 2007

Geosyntec (2013), "*Voluntary Remediation Plan Application, General Chemical Corporation, East Point, Georgia"*, prepared by Geosyntec Consultants, January 2013

TABLES

Table 3-1
Well Construction Data and Groundwater Elevations
Chemtrade Solutions Site
East Point, Georgia

Location	Well Casing Elevation	Adjacent Soil Elevation	Screen Interval (ft bgs)	Depth to Water (ft)	Groundwater Elevation (ft msl)
				Oct-18	Oct-18
GCW-01S	1023.6	1024	182	13.2	1010.4
GCW-01M	1023.8	1024	34-44	13.2	1010.6
GCW-01D	1023.9	1024	58-68	12.2	1011.7
GCW-02S	983.6	984	16-26	4.8	978.8
GCW-02D	983.4	984	34-44	4.4	979.1
GCW-02V	984.7	985.0	85.5-95.5	4.7	980.0
GCW-03S	981.3	981.6	11-21	5.0	976.3
GCW-03D	981.2	982	28-38	4.7	976.5
GCW-04S	996.6	997.0	13-23	10.2	986.4
GCW-04M	997.0	997.4	30-40	9.9	987.2
GCW-04D	996.8	997.1	50-60	10.0	986.8
GCW-04V	996.7	997.0	114-124	9.9	986.8
GCW-05	995.1	994.9	80-90	6.5	988.6
EPW-01	1017.5	1017.7	24.51[(1)]	19.9	997.6
EPW-02	980.0	980.3	19.41[(1)]	10.4	969.6
EPW-03S	984.5	984.8	12-22	10.1	974.4
EPW-03M	984.3	984.6	29-39	9.9	974.5
EPW-03D	984.6	984.9	46-56	9.8	974.8
OW-1A[(2)]	1030.6	1027.9	23.5-33.5[(3)]	15.1	1015.6

Notes:
[(1)]: Screen length is unknown. Total depth of the well is indicated in the table.
[(2)]: Well OW-1A has a casing extending above ground surface 2.7 ft.
[(3)]: Screen interval measured 7 November 2012.
NA: Not available

Table 3-2
Groundwater Sampling Results
Chemtrade Solutions Site
East Point, Georgia

Location	Description	pH (-) EPA 150.1	Sulfate (mg/l) EPA 9056A	Aluminum (mg/l) EPA 6010D	Type 4 RRS Exceeded? (1)	
					Sulfate	Aluminum
GCW-01D	Upgradient	3.7	180	4	No	No
GCW-02D	Source Area (Adjacent)	3.0	1,880	121	Yes	Yes
GCW-03D	Source Area (Adjacent)	3.1	3,710	300	Yes	Yes
GCW-04D	Source Area	3.0	3,590	406	Yes	Yes
GCW-05	Source Area	6.6	525	< 0.1	No	No
EPW-01	Upgradient	3.9	116	14	No	No
EPW-02	Downgradient	4.9	5	< 0.1	No	No
EPW-03D	Downgradient	5.5	30	< 0.1	No	No
OW-1A	Upgradient	4.0	47	1	No	No
DUP-02-1018(2)	Upgradient	3.9	118	14	No	No

Notes:
(1): Type 4 RRS for sulfate is 1,200 mg/l and Type 4 RRS for aluminum is 102 mg/l.
(2): Duplicate was taken from EPW-01.

Table 3-3
Summary of Statistical Trend Analysis
Groundwater Samples
Chemtrade Solutions Site
East Point, Georgia

Well ID	Parameter	Mann-Kendall Trend Analysis at 95% Confidence Level
GCW-01D	Alumimum	Decreasing
GCW-02D		Decreasing
GCW-03D		No trend
GCW-04D		Decreasing
GCW-05		No trend
EPW-01		No trend
EPW-02		Decreasing
EPW-03D		No trend
OW-1A		Decreasing
GCW-01D	Sulfate	Decreasing
GCW-02D		Decreasing
GCW-03D		Decreasing
GCW-04D		Decreasing
GCW-05		Decreasing
EPW-01		No trend
EPW-02		No trend
EPW-03D		Decreasing
OW-1A		Decreasing

Table 3-4
Storm Drain Sampling Results
October 2018
Chemtrade Solutions Site
East Point, Georgia

Location	Description	pH (-) EPA 150.1	Sulfate (mg/l) EPA 9056A	Aluminum (mg/l) EPA 6010D
SW-02	On-site	3.9	1,240	112
SW-06	Cross-Gradient	3.4	1,940	193
SW-07	Downgradient	3.9	469	39
SW-09	Upgradient	6.4	100	<0.1
DUP-01-1018[(2)]	Cross-Gradient	3.4	2,010	191

Table 3-5
Summary of Statistical Trend Analysis
Storm Drain Samples
Chemtrade Solutions Site
East Point, Georgia

Sample Location	Parameter	Mann-Kendall Trend Analysis at 95% Confidence Level
SW-02	Alumimum	No trend
SW-06		Increasing
SW-07		No trend
SW-09		No trend
SW-02	Sulfate	No trend
SW-06		Increasing
SW-07		No trend
SW-09		No trend

Table 3-6
Groundwater Field Parameters
Chemtrade Solutions Site
East Point, Georgia

Location	Date	pH	DO	ORP	Conductivity	Temperature	Turbidity
		ATC	(mg/L)	(mV)	(mS/cm)	(°C)	
GCW-01D	May-16	3.7	5.8	438	0.4	21	1.8
GCW-01D	Oct-16	4.2	6.3	459	0.3	21.3	6.1
GCW-01D	Apr-17	4.2	7.4	449	0.4	22.7	3.9
GCW-01D	Oct-17	4.1	5.5	355	0.4	20.3	3.6
GCW-01D	Apr-18	3.9	10.3	422	0.3	19.1	10.9
GCW-01D	Oct-18	3.7	8.4	483	0.4	17.8	1.6
GCW-02D	May-16	3.4	1.1	454	2.5	17.4	0.3
GCW-02D	Oct-16	4	0	538	2.3	17.7	0
GCW-02D	Apr-17	3.46	0	448	2.4	17.9	2.97
GCW-02D	Oct-17	3.6	0	469	2	16.5	5.2
GCW-02D	Apr-18	3.6	0	428	1.8	16.6	0
GCW-02D	Oct-18	3	0	516	2.1	19.3	0.7
GCW-03D	May-16	3.3	1.4	427	3.6	18.4	1
GCW-03D	Oct-16	3.2	0	459	3.3	19.8	0.5
GCW-03D	Apr-17	3.2	0	455	3.6	19.4	0.8
GCW-03D	Oct-17	4.3	0	439	3.2	14.6	0
GCW-03D	Apr-18	3.1	8.8	456	3.1	17	4.2
GCW-03D	Oct-18	3.1	0	472	3.3	19.1	23.4
GCW-04D	May-16	6.2	4.1	186	0.1	19.8	6.3
GCW-04D	Oct-16	3.6	0	451	2.2	19.6	0
GCW-04D	Apr-17	3.42	0	408	2.67	19.52	6.94
GCW-04D	Oct-17	3.5	0	348	2.4	19.6	3.5
GCW-04D	Apr-18	6.2	3.2	258	0.1	18.1	2.8
GCW-04D	Oct-18	3	0	420	2.5	20	0.1
GCW-05	May-16	6.5	0.7	-75	1.3	17.7	4.8
GCW-05	Oct-16	7.9	0.1	-41	1	18.8	0.7
GCW-05	Apr-17	6.9	0	10	1.64	24.06	59.1
GCW-05	Oct-17	7.3	0	-73	1.3	18.1	3
GCW-05	Apr-18	6.9	2.3	38	0.7	20.2	32
GCW-05	Oct-18	6.6	0	-82	1.3	18.9	3.8
EPW-01	May-16	3.8	1.3	402	0.3	17.2	3
EPW-01	Oct-16	4.8	4.7	438	0.2	21.8	0
EPW-01	Apr-17	4.2	0	358	0.2	17.7	4.2
EPW-01	Oct-17	4.3	3.2	267	0.2	17.4	2.5
EPW-01	Apr-18	4.9	0.8	289	0.1	16.2	0.1
EPW-01	Oct-18	3.9	0.5	378	0.2	17.3	2.3

Table 3-6
Groundwater Field Parameters
Chemtrade Solutions Site
East Point, Georgia

Location	Date	pH	DO	ORP	Conductivity	Temperature	Turbidity
		ATC	(mg/L)	(mV)	(mS/cm)	(°C)	
EPW-02	May-16	4.9	3.3	227	0.1	19.6	0.1
EPW-02	Oct-16	5.5	2.8	339	0.1	27.1	1.5
EPW-02	Apr-17	5.22	2.29	333	0.086	19.42	0
EPW-02	Oct-17	5.4	3.7	-66	0.1	20.1	4
EPW-02	Apr-18	5.6	1.6	101	0.1	19.2	0
EPW-02	Oct-18	4.9	2.3	326	0.1	21.6	0.3
EPW-03D	May-16	5.4	4.5	269	0.3	19.5	0
EPW-03D	Oct-16	6.7	4.6	358	0.3	19.4	0
EPW-03D	Apr-17	5.99	5.33	370	0.273	19.92	4.2
EPW-03D	Oct-17	6.2	3	272	0.2	16.2	0.2
EPW-03D	Apr-18	5.8	3.4	248	0.2	20.6	0
EPW-03D	Oct-18	5.5	4.1	490	0.3	23	0
OW-1A	May-16	3.9	6	420	0.2	20	0.9
OW-1A	Oct-16	5.1	8.9	423	0.1	19.5	4.6
OW-1A	Apr-17	4.4	6.9	429	0.1	20.6	16.9
OW-1A	Oct-17	4.4	4.7	436	0.1	16.3	0
OW-1A	Apr-18	4.4	5.7	364	0.1	17.4	0
OW-1A	Oct-18	4	7.3	463	0.2	18.2	6.9

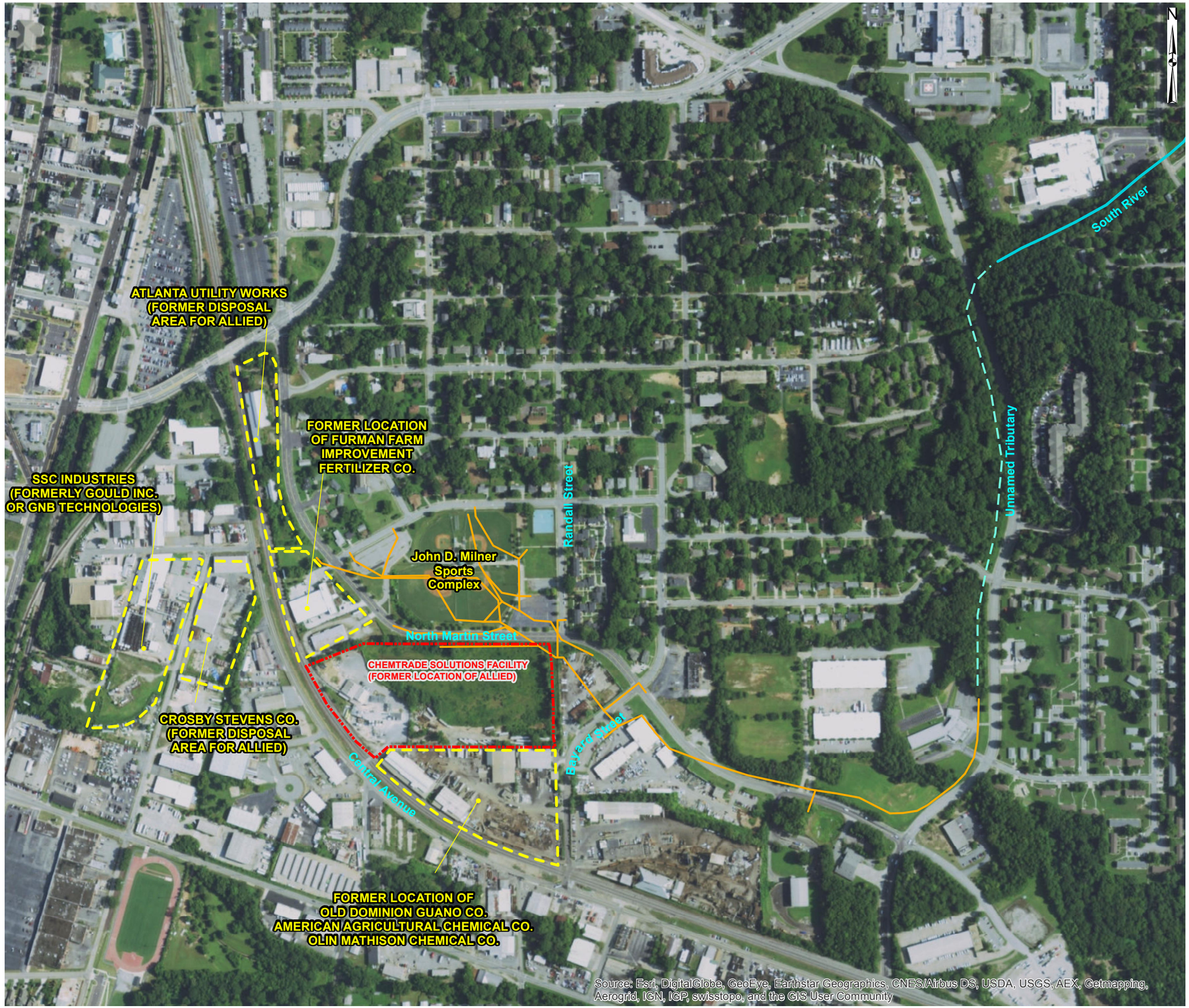
Table 3-7
Storm Drain Field Parameters
Chemtrade Solutions Site
East Point, Georgia

Location	Date	pH	DO	ORP	Conductivity	Temperature	Turbidity
		ATC	(mg/L)	(mV)	(mS/cm)	(°C)	
SW-02	May-16	4.1	7.7	352	1.4	17.7	13
SW-02	Oct-16	3.4	6.9	396	0	24.5	225
SW-02	Apr-17	4.1	6.2	362	1.3	19.6	18.4
SW-02	Oct-17	5	4.5	304	0.9	17.9	19.4
SW-02	Apr-18	4.2	13.1	314	0.8	15.9	25.9
SW-02	Oct-18	3.9	10.2	375	1.6	18.3	2.6
SW-06	May-16	4.2	5.8	306	0.6	19	25.1
SW-06	Oct-16	3.7	5.3	409	2	31.8	2
SW-06	Apr-17	4	9.4	416	1.7	18.2	4
SW-06	Oct-17	4	9.6	404	2	19.7	28.1
SW-06	Apr-18	4.1	8	343	0.9	15.1	8.3
SW-06	Oct-18	3.4	6.6	489	2	22.3	2.6
SW-07	May-16	4	7.2	306	0.8	17.2	4.6
SW-07	Oct-16	4.5	9.1	381	0.5	20.3	1.8
SW-07	Apr-17	4.4	8.2	315	0.6	17.8	3.8
SW-07	Oct-17	4.7	6.9	251	0.8	18.7	13.2
SW-07	Apr-18	4.6	11.3	284	0.4	16.9	5.1
SW-07	Oct-18	3.9	8.5	462	0.7	21.2	0.2
SW-09	May-16	5.9	6.6	79	0.3	18.1	0.8
SW-09	Oct-16	14	6	-87	10.1	29.1	172
SW-09	Apr-17	7	7.3	48	0.3	18.4	61.5
SW-09	Oct-17	6.7	3.9	61	0.4	21.1	25.3
SW-09	Apr-18	6.1	7.7	79	0.2	15.9	9.6
SW-09	Oct-18	6.4	9.1	75	0.3	20.1	3.7

FIGURES

SITE VICINITY MAP

Chemtrade Solutions
EAST POINT, GEORGIA



Legend

- Approximate Property Line
- Approximate Site Property
- Storm Drain
- Unnamed Tributary
- SouthRiver

500 250 0 500 1,000
Feet

Geosyntec consultants

ATLANTA, GEORGIA

October 2018	SCALE: 1" = 500'
PROJECT NO. GR5060	FIGURE NO. 1-1
DOCUMENT NO.	FILE NO. Figure 1-1.mxd

N:\genchem\GIS\MXDs\Figure 1-1.mxd
/SColsky 5/24/2017

Legend
- Monitoring Well selection
- Excavation Cell
- Approximate Property Boundary

Geosyntec consultants
Kennesaw, GA

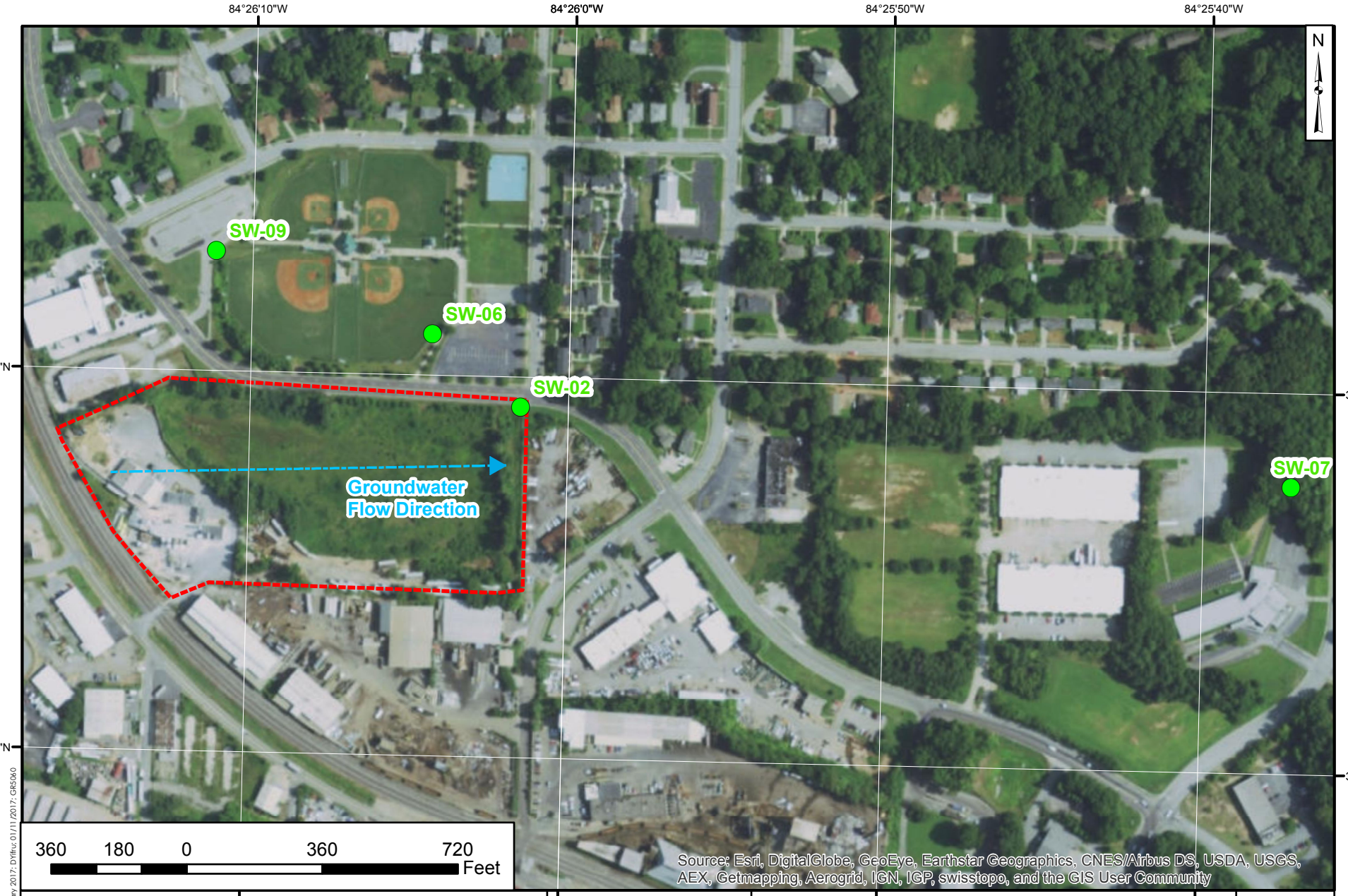
October 2018

MONITORING WELLS LOCATION MAP

Chemtrade Solutions, East Point, GA

Figure
1-2

N:\genchem\gis\MXDs\January 2017; dyifru; 01-12-2017



Legend

Surface Water Sample Location

Approximate Property Boundary

Geosyntec consultants
Kennesaw, GA

October 2018

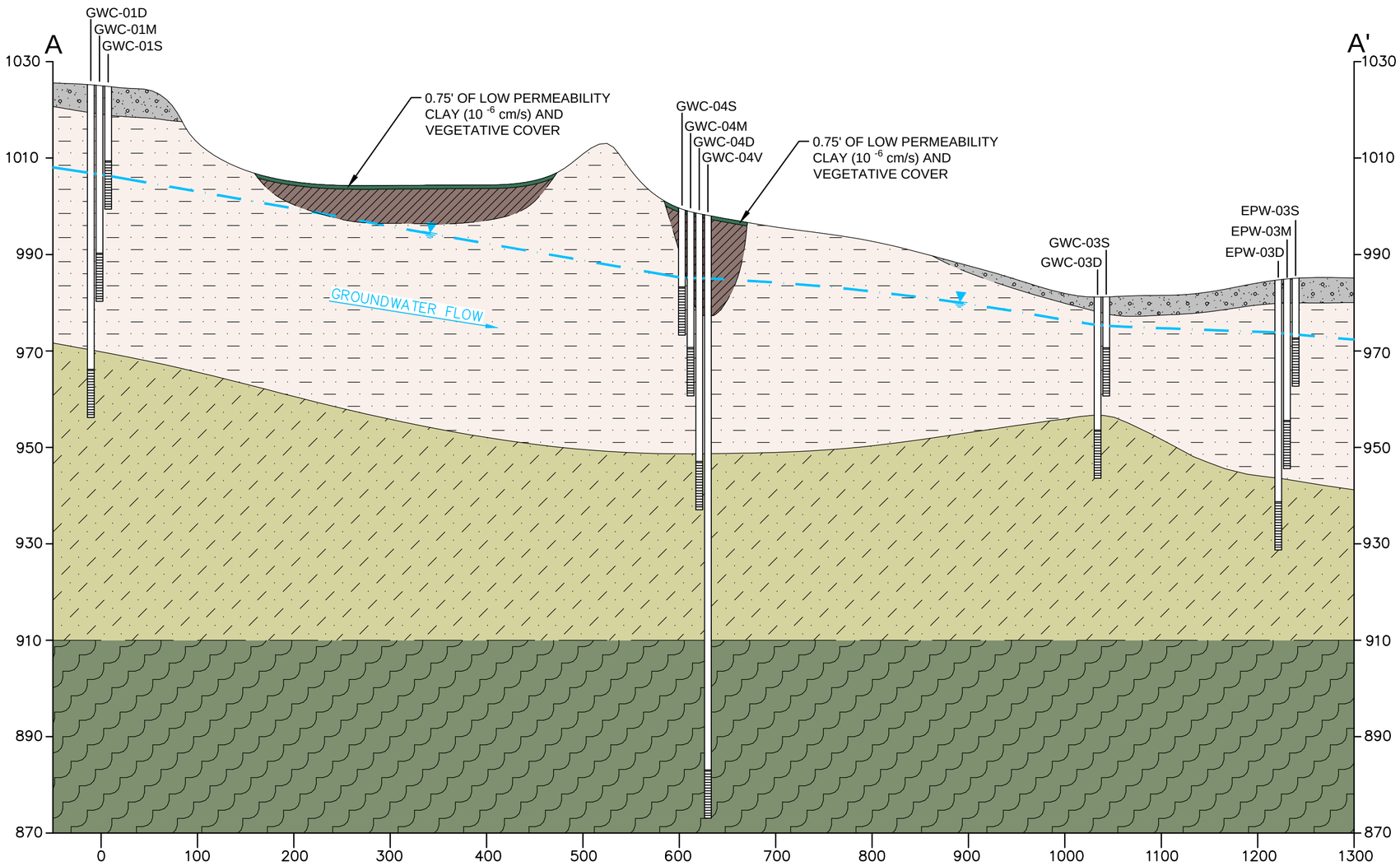
STORM DRAIN SAMPLE LOCATION MAP

Chemtrade Solutions, Atlanta, GA

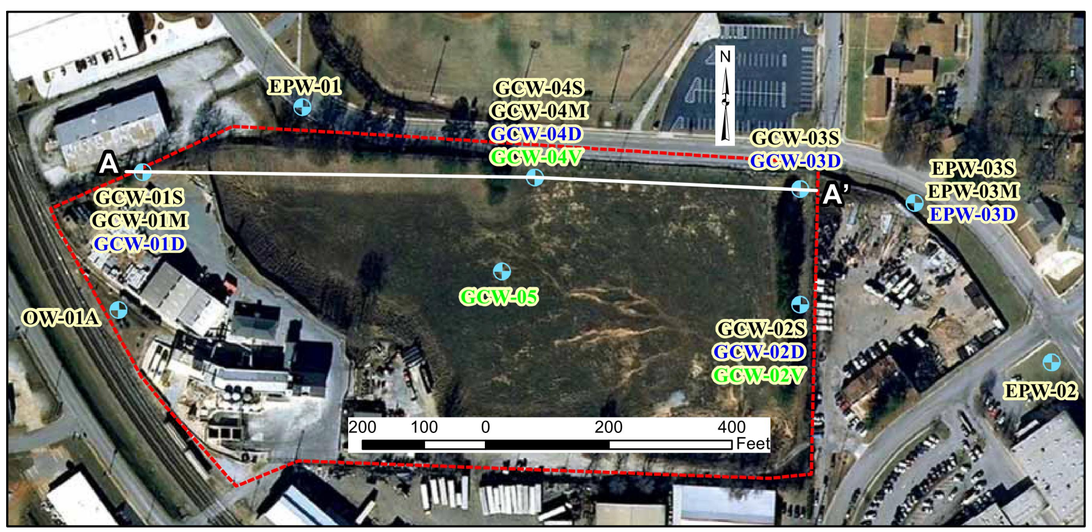
Figure
1-3

N:\genchem\gis\MXDs\January 2017; DYfru; 01/11/2017; GR5060

GEOLOGIC AND HYDROGEOLOGIC CROSS SECTION ALONG A-A'



KEY MAP



LEGEND

- 0.75' THICK LOW PERMEABILITY CLAY (10 $^{-6}$ cm/s) AND VEGETATIVE COVER
- GRAVELLEY CLAY, FILL
- CLAY, FILL AFTER EXCAVATION
- SILTY SAND, RELICT SCHISTOCITY, MICACEOUS (SAPROLITE)
- PARTRIALLY WEATHERED SCHIST
- BEDROCK (SCHIST)
- LITHOLOGIC CONTACT, DASHED WHERE INFERRED
- MONITORING WELL SCREEN ZONE WITH WATER ELEVATION (FEET MSL), NOVEMBER, 2012

0 100' 200'

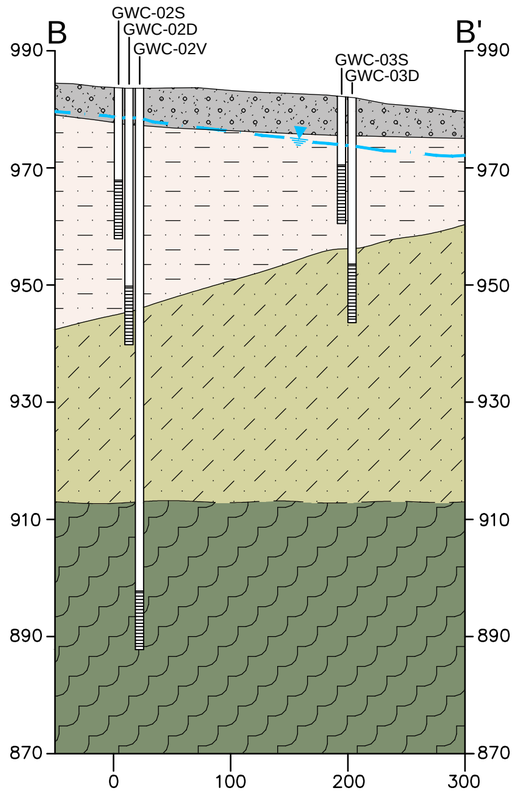
HORIZONTAL SCALE IN FEET
VERTICAL EXAGGERATION = 5X

Geosyntec consultants

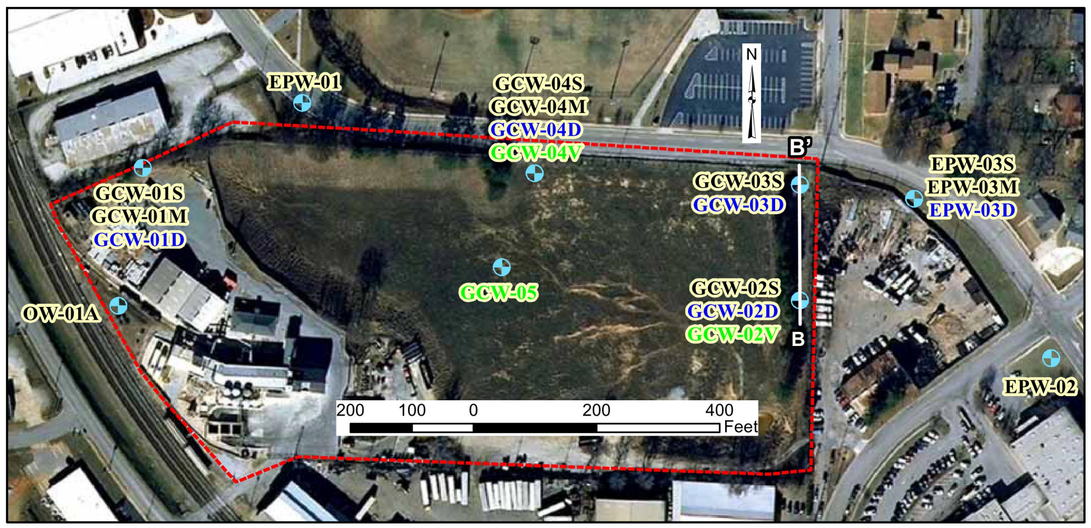
DATE:	JUN-13	SCALE:	AS SHOWN
PROJECT NO.	GR5060/12	FILE NO.	5060F001
DOCUMENT NO.	GA 130020	FIGURE NO.	2-1

L:\CADD\G\GENERAL CHEMICAL\MODIFICATION\HYDROGEOLOGIC CROSS SECTION GR3712.08.03\FIGURES\5060F001

GEOLOGIC AND HYDROGEOLOGIC CROSS SECTION ALONG B-B'



KEY MAP



LEGEND

- GRAVELLEY CLAY, FILL
- SILTY SAND, RELICT SCHISTOCITY, MICACEOUS (SAPROLITE)
- PARTRIALLY WEATHERED SCHIST
- BEDROCK (SCHIST)
- LITHOLOGIC CONTACT, DASHED WHERE INFERRED
- MONITORING WELL SCREEN ZONE WITH WATER ELEVATION (FEET MSL), NOVEMBER, 2012

0 100' 200'

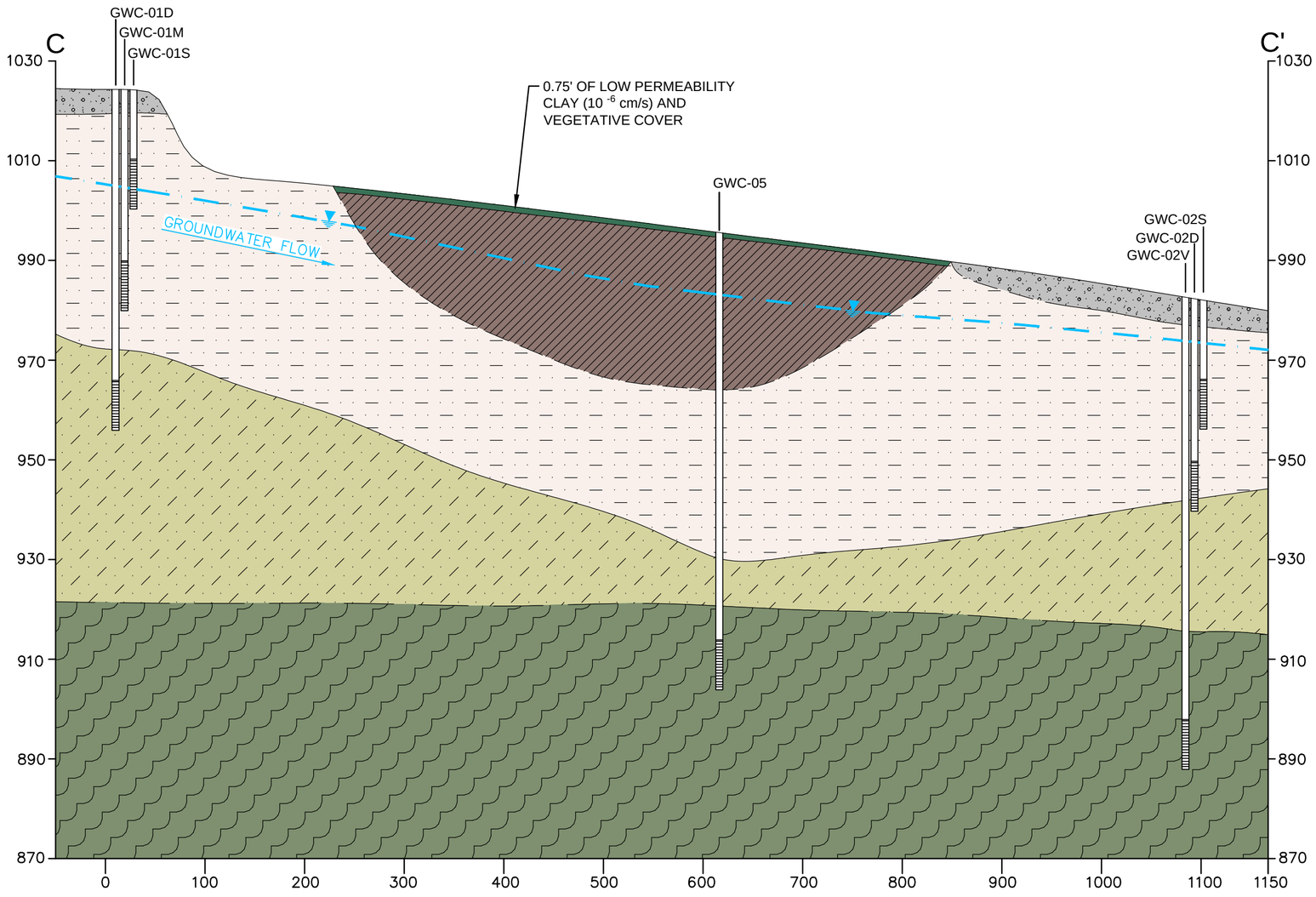
HORIZONTAL SCALE IN FEET
VERTICAL EXAGGERATION = 5X

Geosyntec consultants

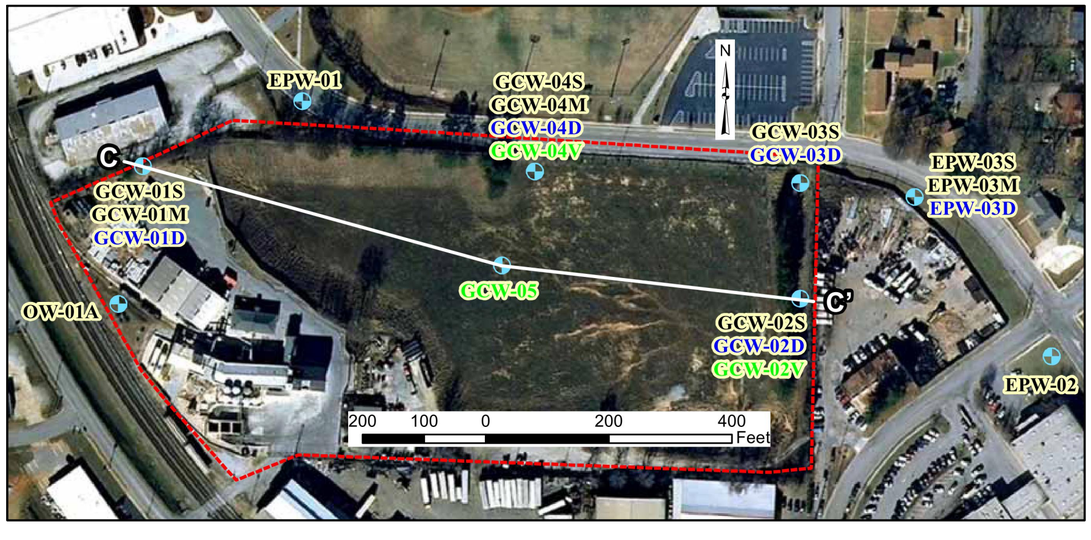
DATE:	JUN-13	SCALE:	AS SHOWN
PROJECT NO.	GR5060/12	FILE NO.	5060F001
DOCUMENT NO.	GA 130020	FIGURE NO.	2-2

L:\CADD\GA\GENERAL CHEMICAL\MODIFICATION\HYDROGEOLOGIC CROSS SECTION GR3712.08.03\FIGURES\5060F001

GEOLOGIC AND HYDROGEOLOGIC CROSS SECTION ALONG C-C'



KEY MAP



LEGEND

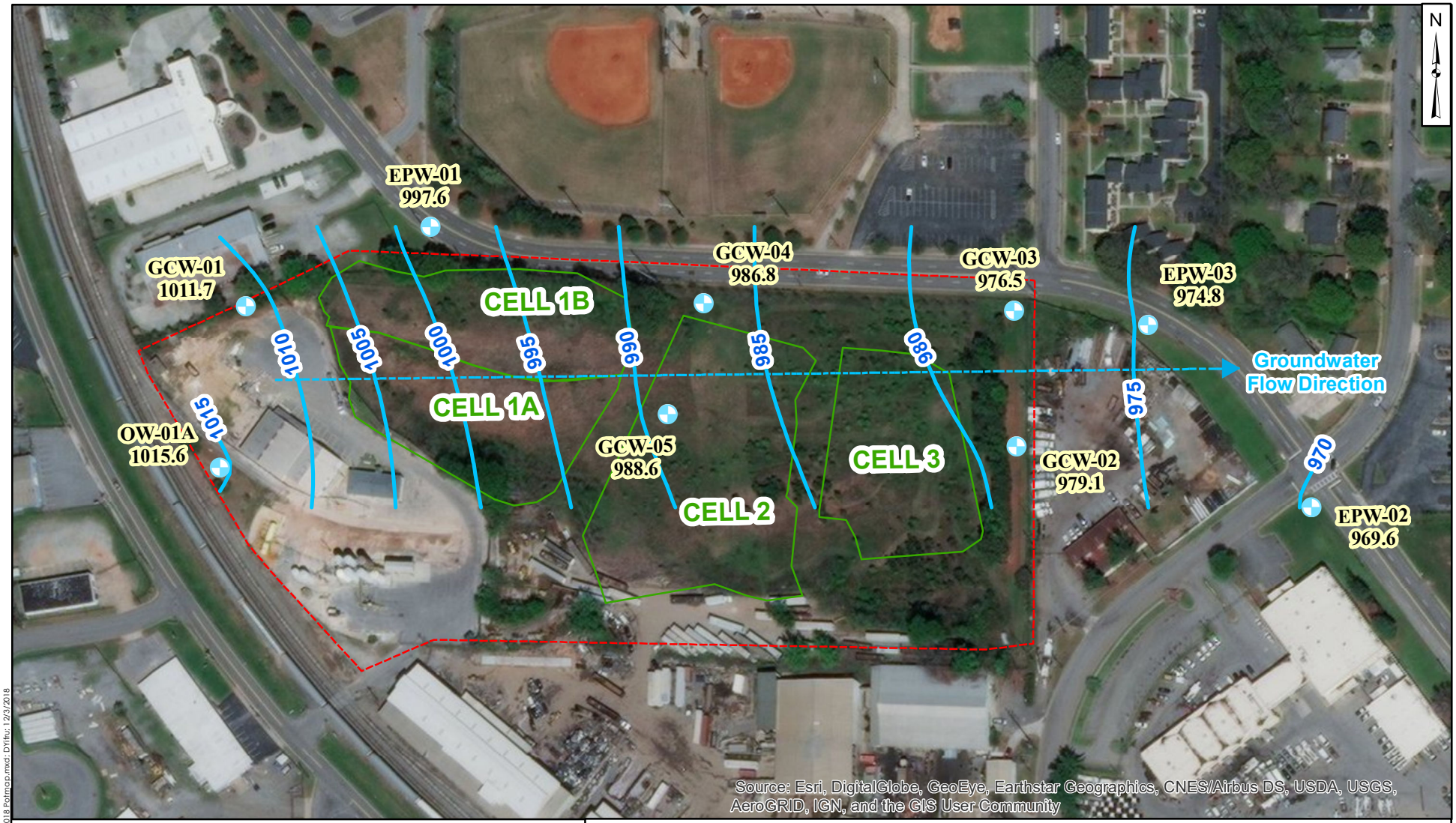
- 0.75' THICK LOW PERMEABILITY CLAY (10 $^{-6}$ cm/s) AND VEGETATIVE COVER
- GRAVELLEY CLAY, FILL
- CLAY, FILL AFTER EXCAVATION
- SILTY SAND, RELICT SCHISTOCITY, MICACEOUS (SAPROLITE)
- PARTRIALLY WEATHERED SCHIST
- BEDROCK (SCHIST)
- LITHOLOGIC CONTACT, DASHED WHERE INFERRED
- MONITORING WELL SCREEN ZONE WITH WATER ELEVATION (FEET MSL), NOVEMBER, 2012

0 100' 200'
HORIZONTAL SCALE IN FEET
VERTICAL EXAGGERATION = 5X

Geosyntec consultants

DATE:	JUN-13	SCALE:	AS SHOWN
PROJECT NO.	GR5060/12	FILE NO.	5060F001
DOCUMENT NO.	GA 130020	FIGURE NO.	2-3

L:\CADD\G\GENERAL CHEMICAL\MODIFICATION\HYDROGEOLOGIC CROSS SECTION GR3712.08.03\FIGURES\5060F001



Legend

- Monitoring Well (Groundwater Elevation in ft MSL)
- October 2018 Groundwater Elevation Contour
- Excavation Cell
- Approximate Property Boundary

200 100 0 200 Feet

Geosyntec consultants

Kennesaw, GA

December 2018

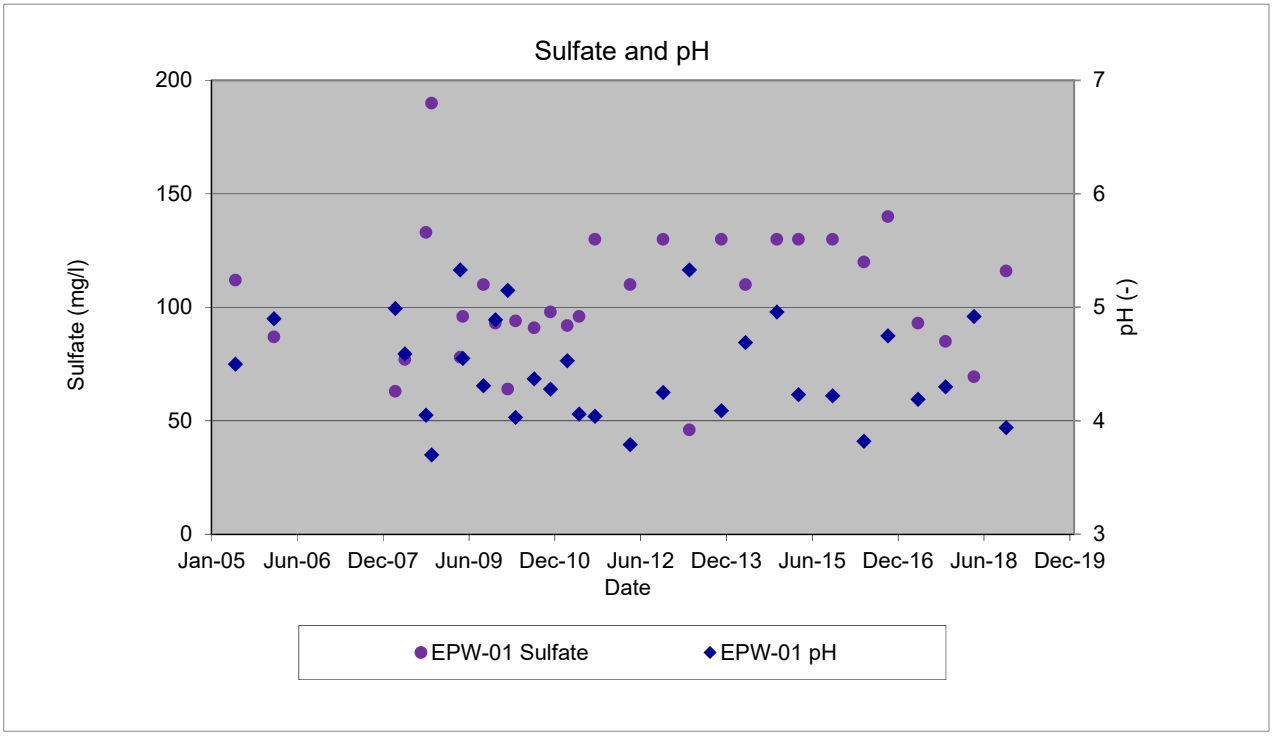
POTENTIOMETRIC SURFACE MAP

Chemtrade Solutions, East Point, GA

Figure 3-1

N:\gencherm\GIS\MXDs\October 2018\Fig 3-1 October 2018 Potmap.mxd : DYlfu; 12/3/2018

Figure 3-2
EPW-01 Sulfate and pH Trends and Aluminum and pH Trends
Chemtrade Solutions Site
East Point, Georgia



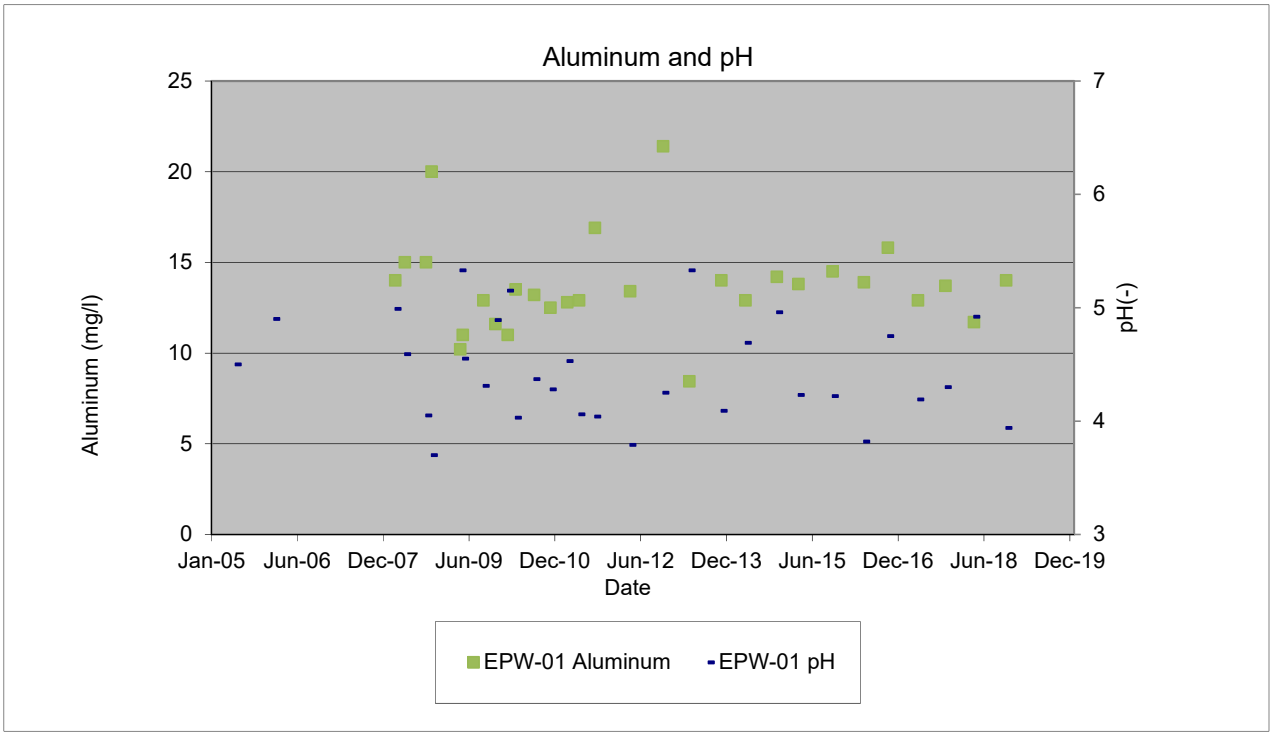
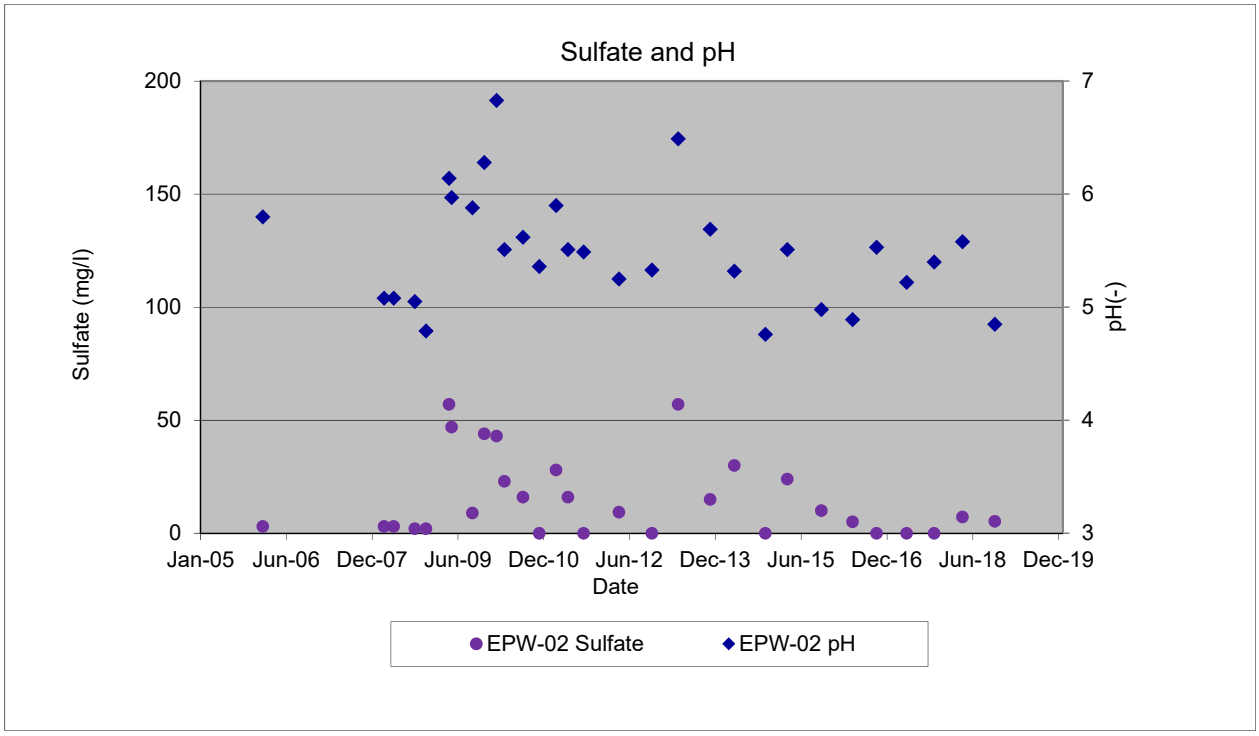


Figure 3-2 (Cont)
EPW-02 Sulfate and pH Trends and Aluminum and pH Trends
Chemtrade Solutions Site
East Point, Georgia



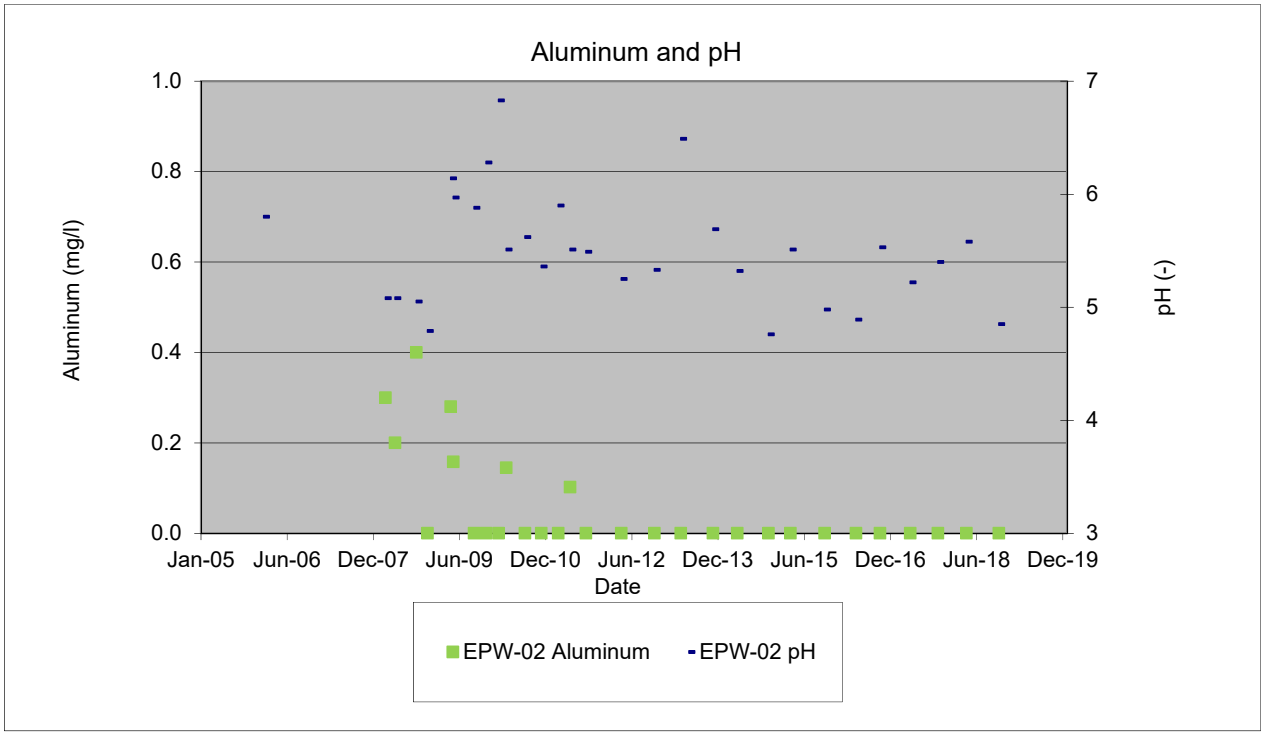
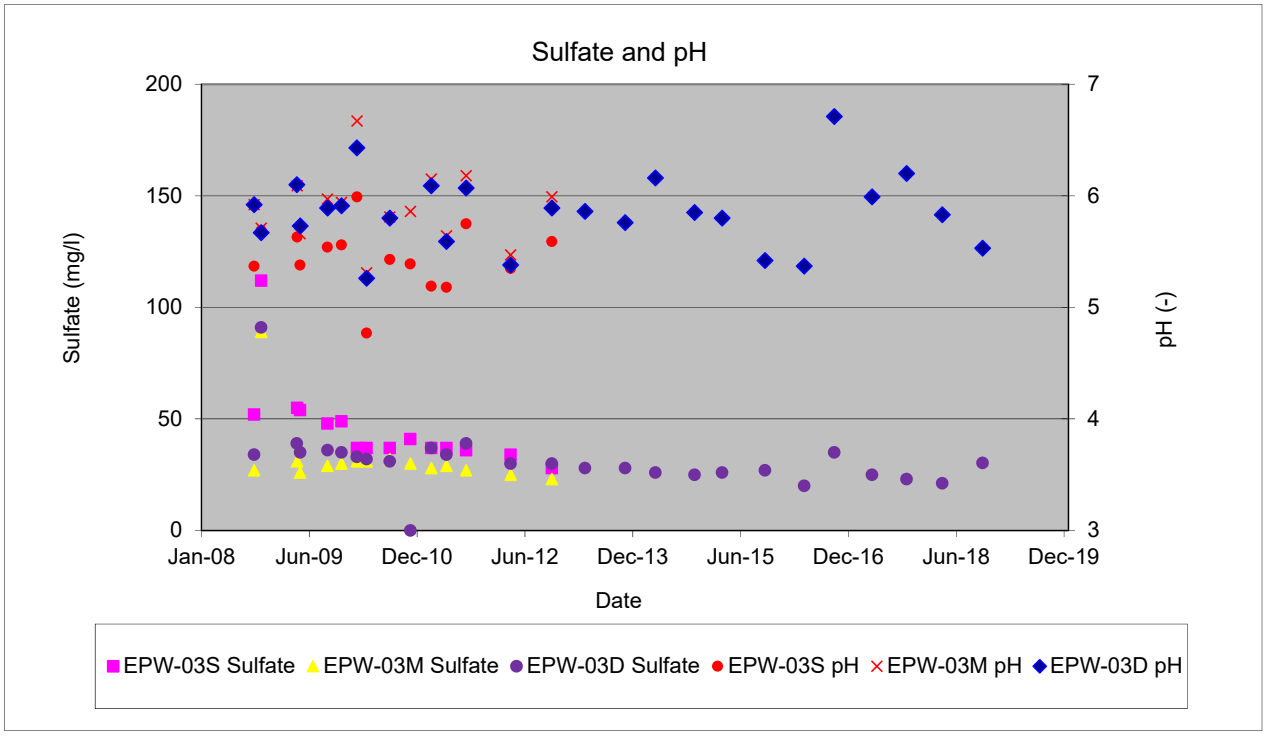


Figure 3-2 (Cont)
EPW-03S -M -D Sulfate and pH Trends and Aluminum and pH Trends
Chemtrade Solutions Site
East Point, Georgia



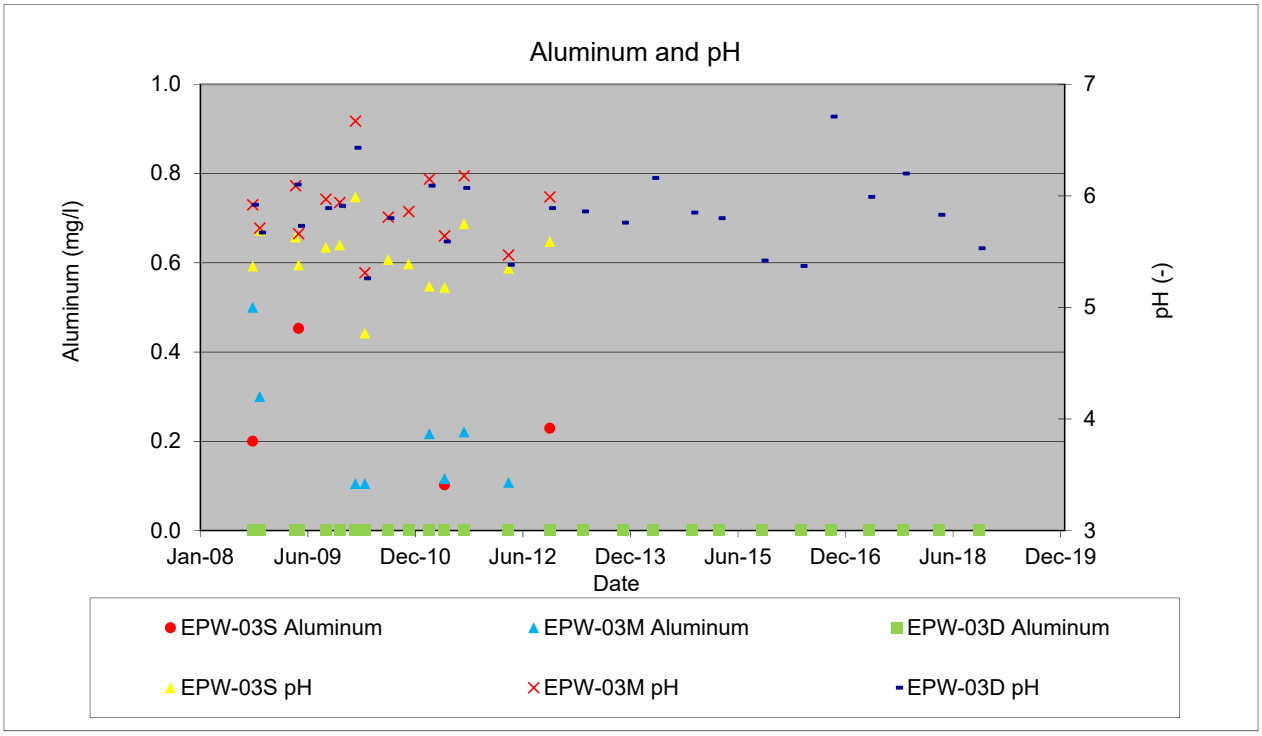
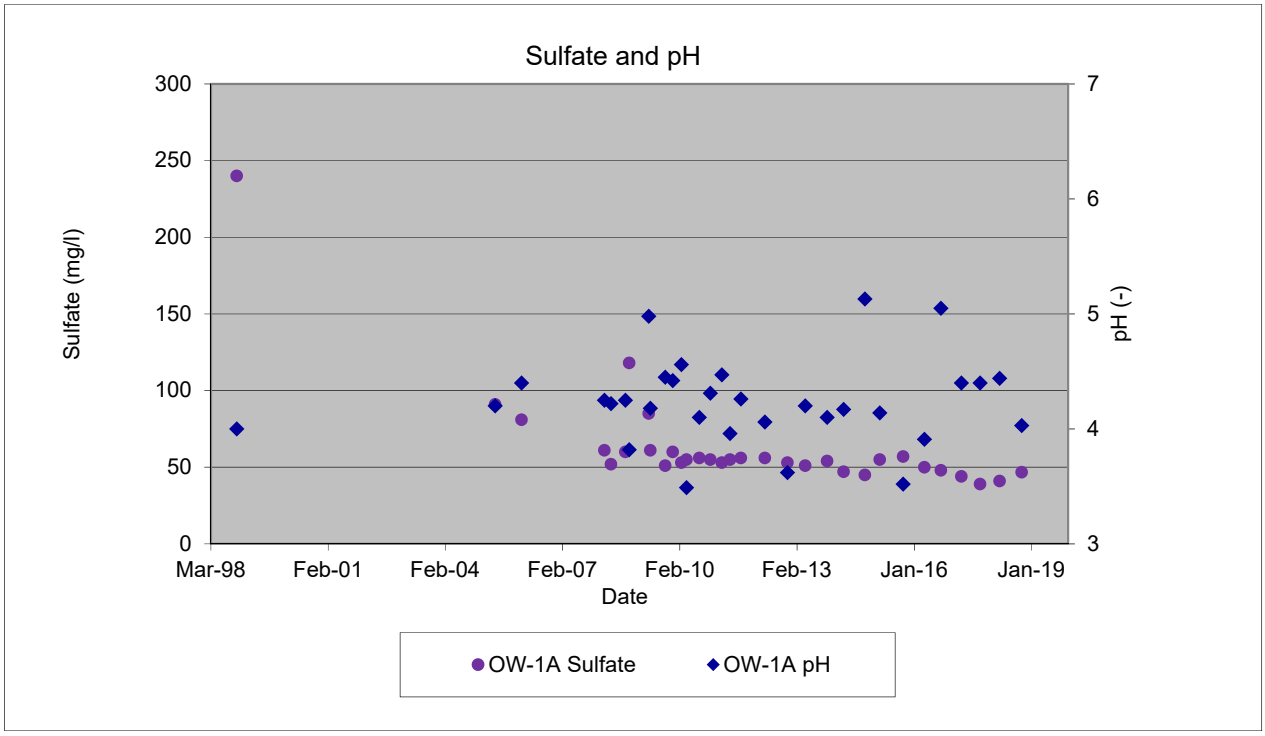


Figure 3-2 (Cont)
OW-1A Sulfate and pH Trends and Aluminum and pH Trends
Chemtrade Solutions Site
East Point, Georgia



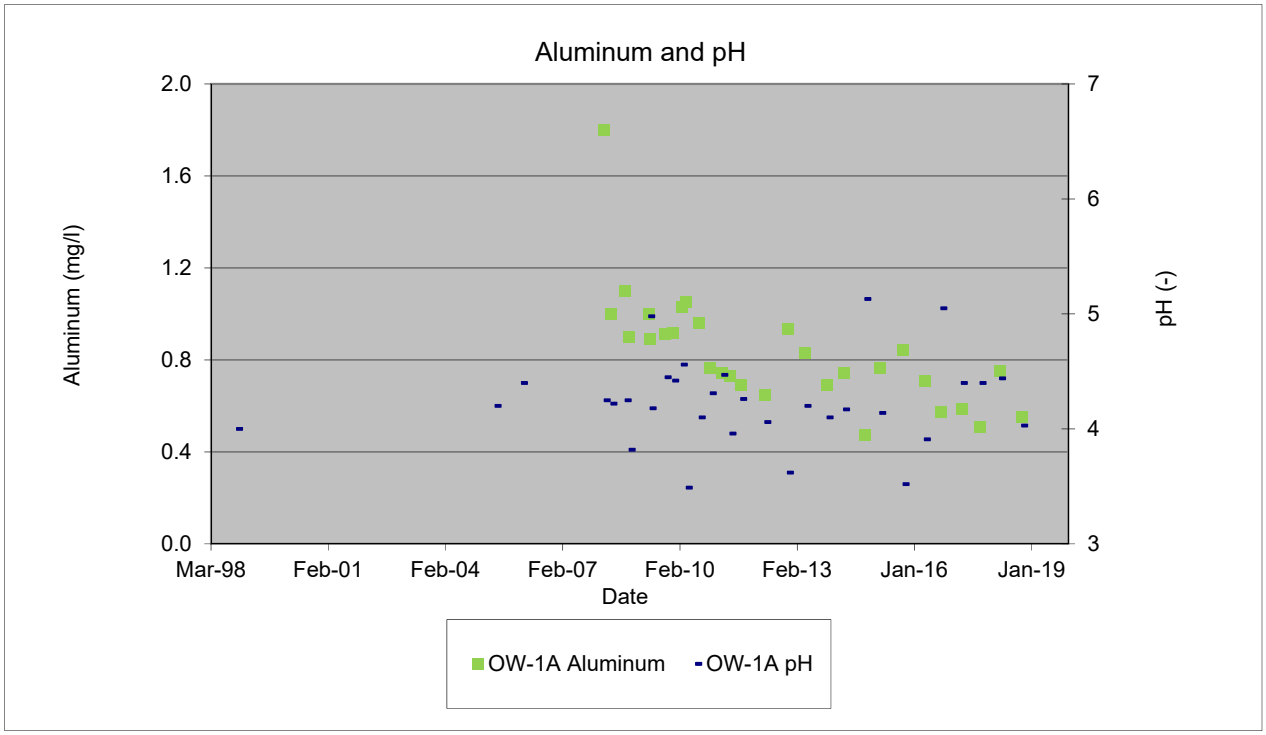
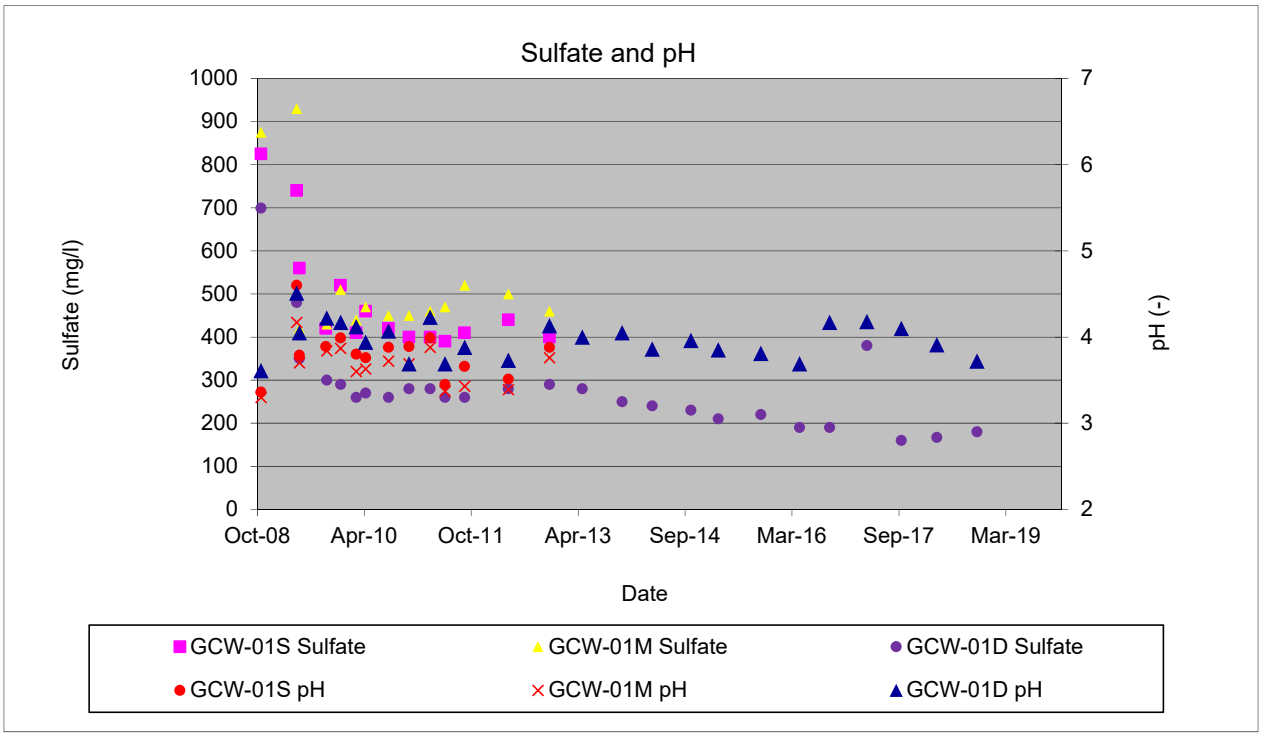


Figure 3-2 (Cont)
GCW-01S -M -D Sulfate and pH Trends and Aluminum and pH Trends
Chemtrade Solutions Site
East Point, Georgia



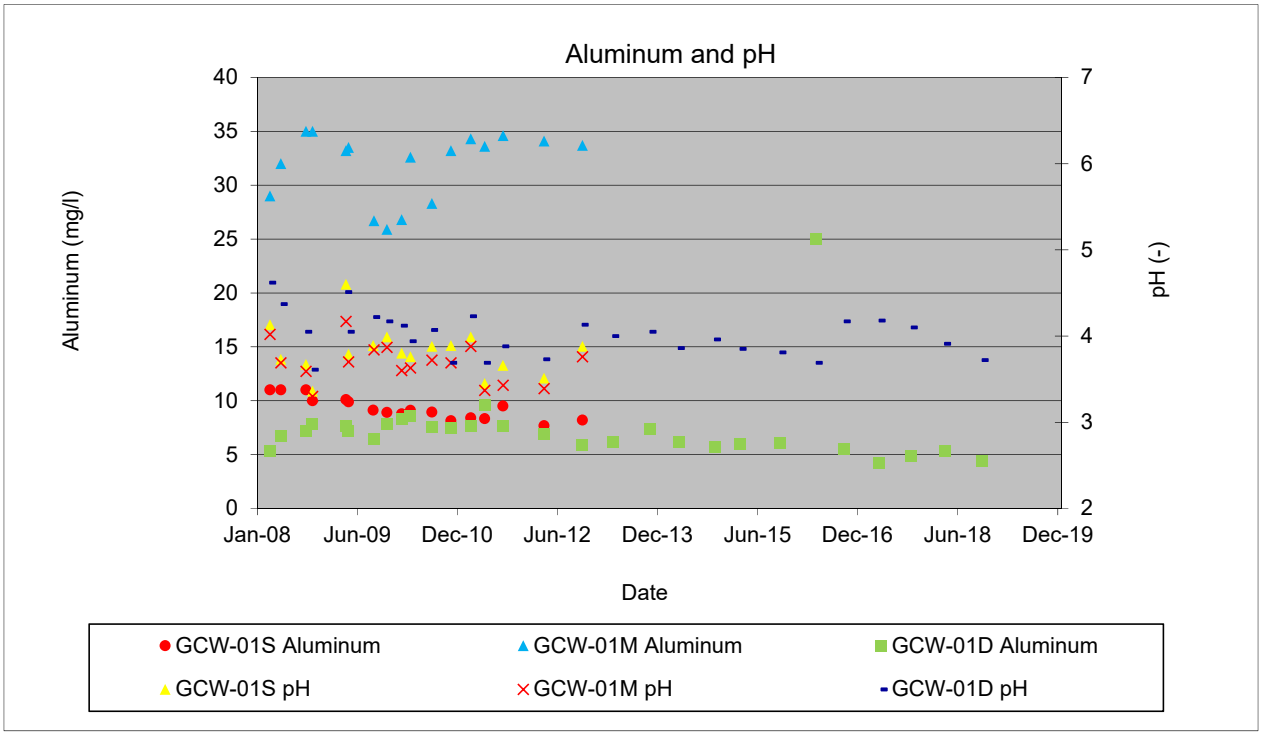
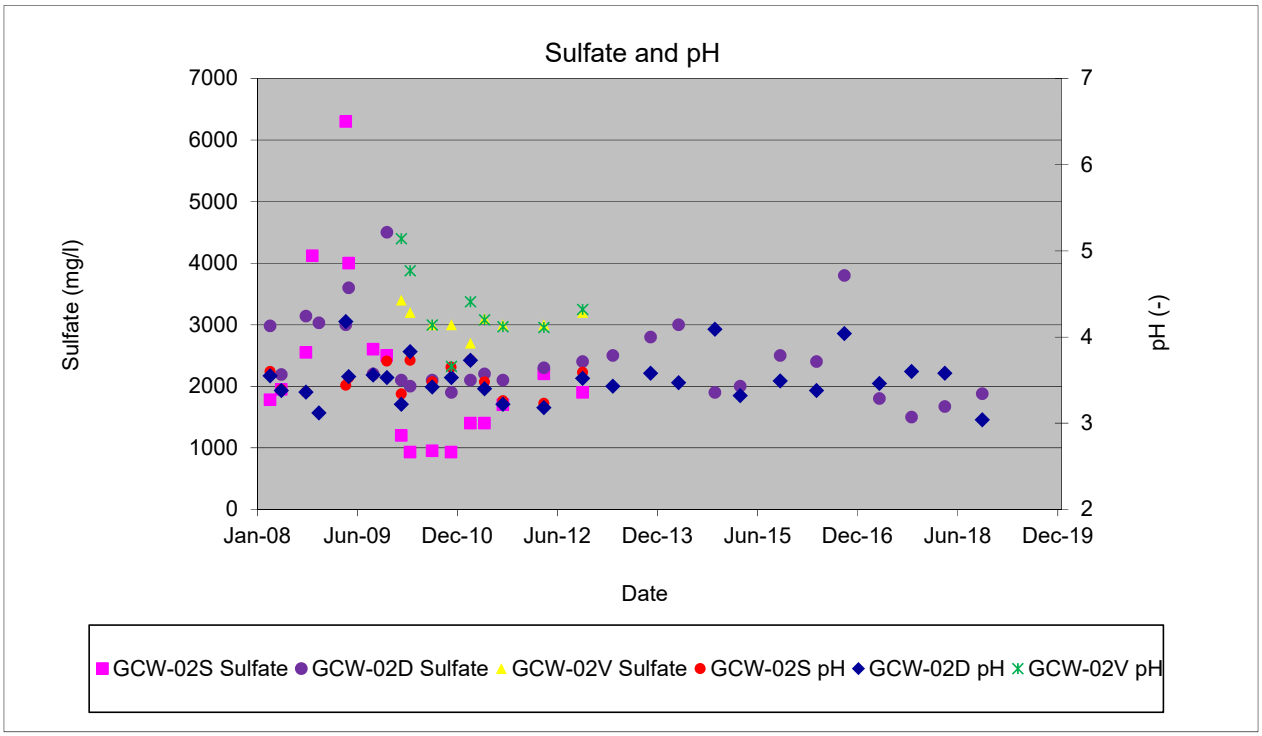


Figure 3-2 (Cont)
GCW-02S -D-V Sulfate and pH Trends and Aluminum and pH Trends
Chemtrade Solutions Site
East Point, Georgia



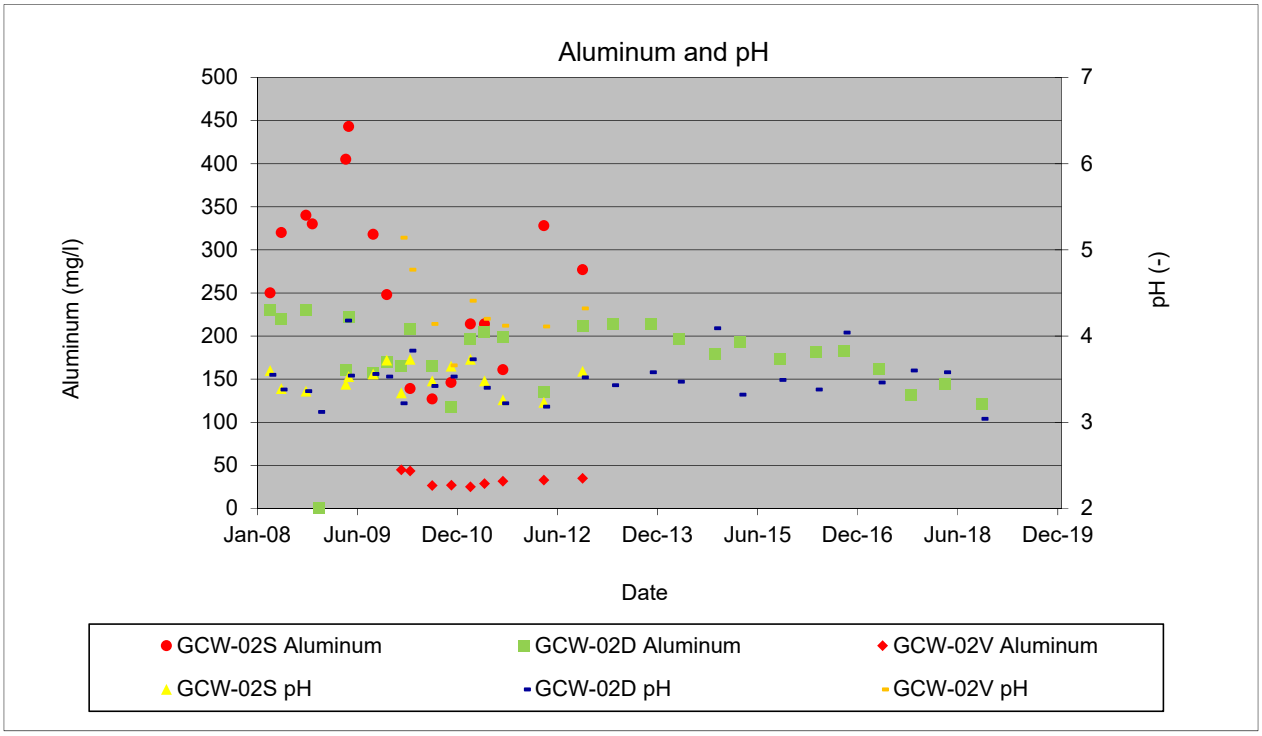
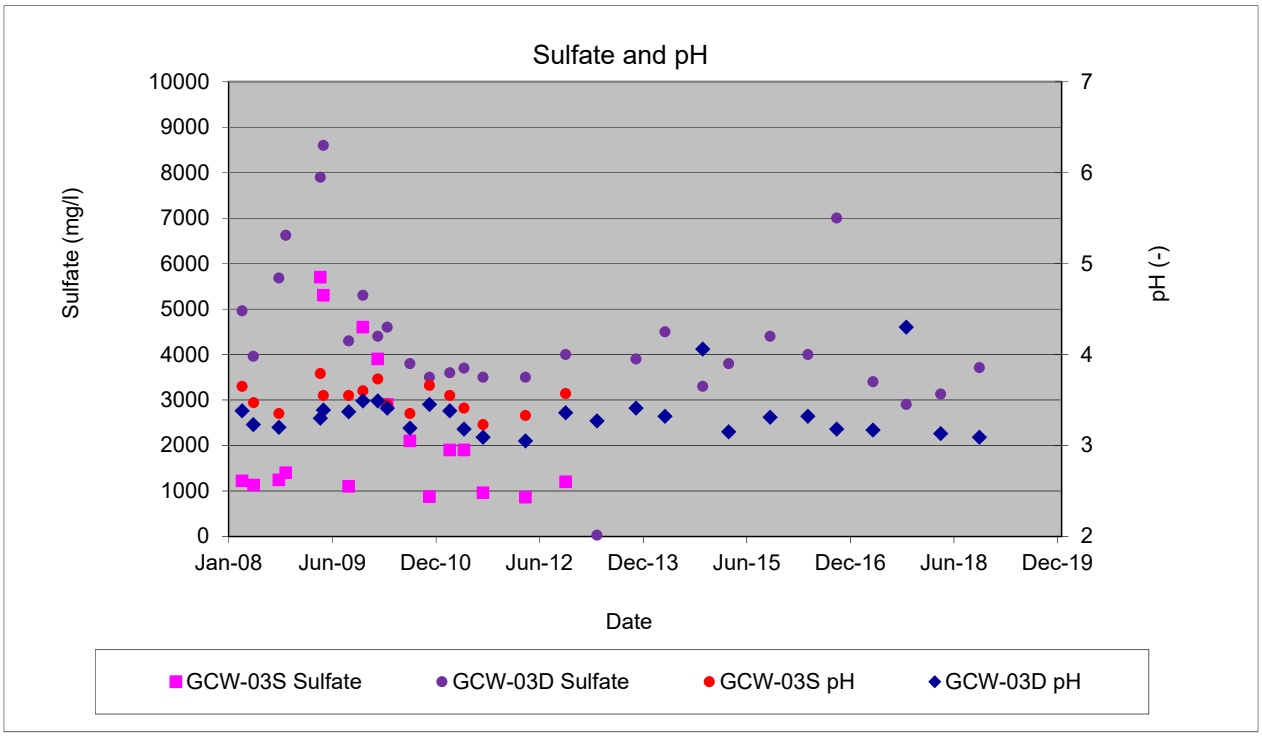


Figure 3-2 (Cont)
GCW-03S -D Sulfate and pH Trends and Aluminum and pH Trends
Chemtrade Solutions Site
East Point, Georgia



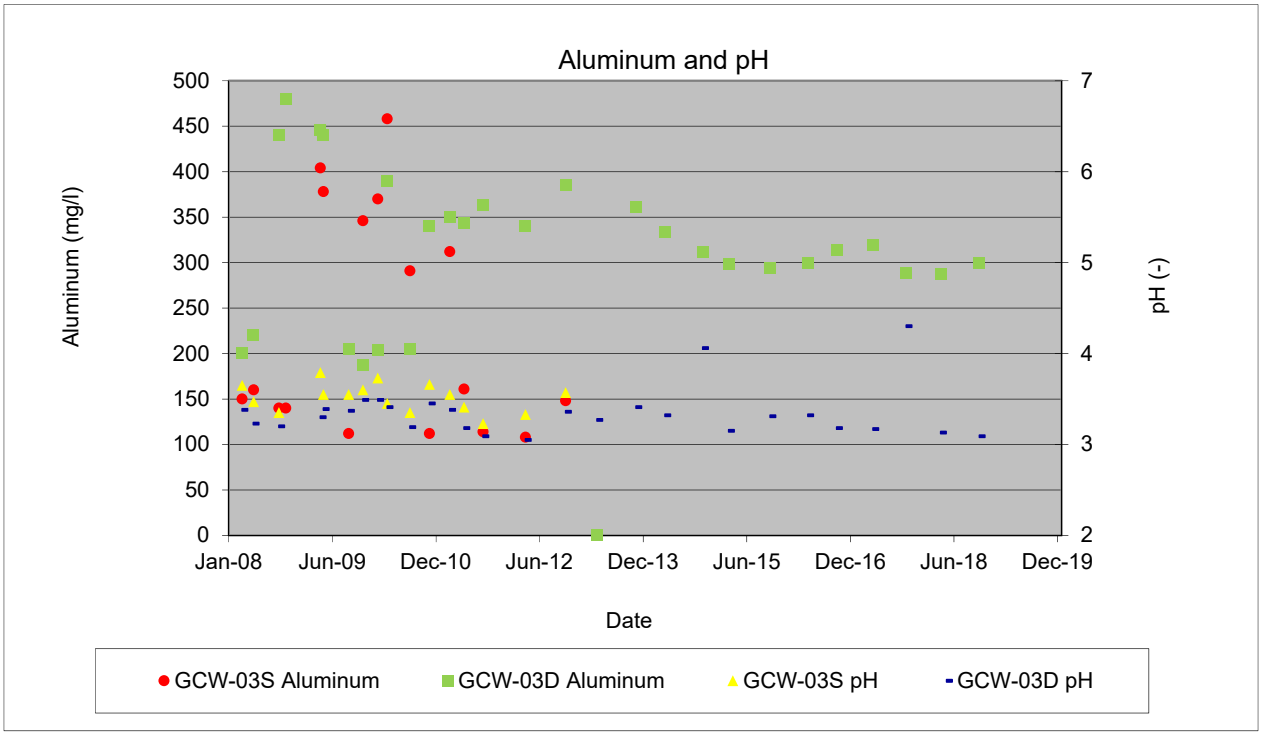
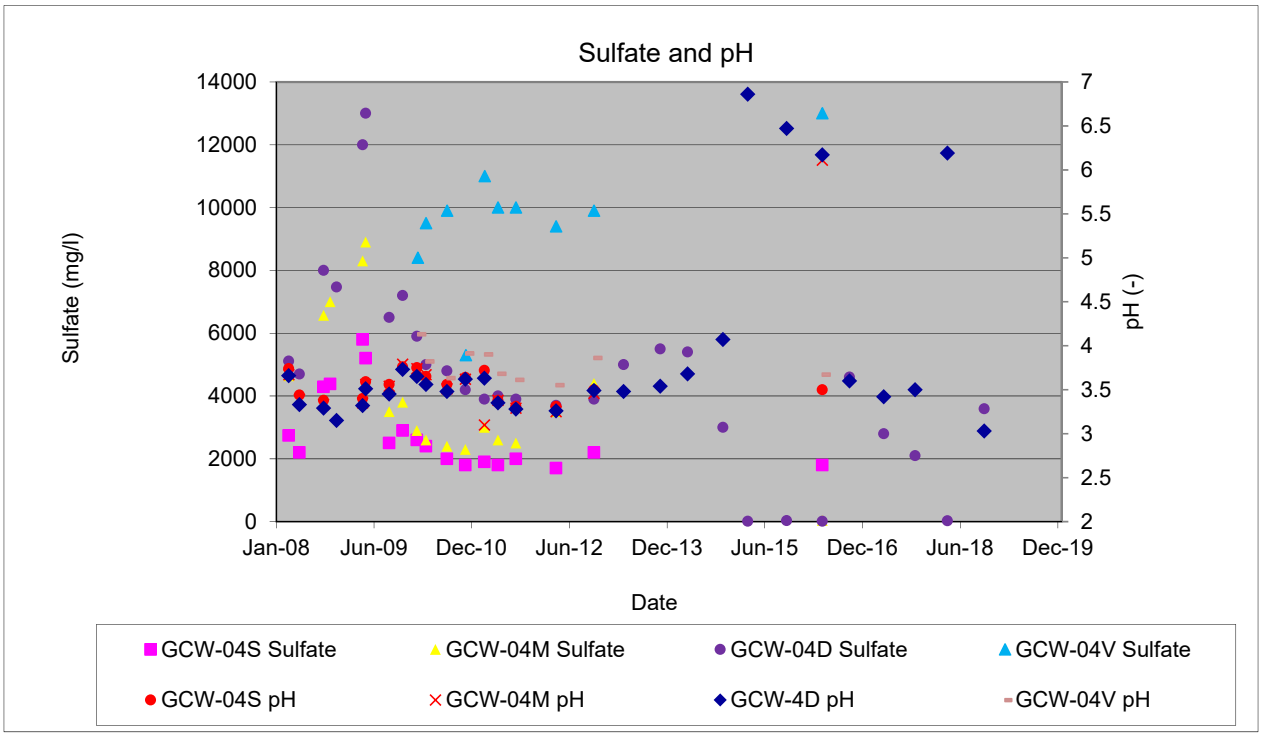


Figure 3-2 (Cont)
GCW-04S -M -D -V Sulfate and pH Trends and Aluminum and pH Trends
Chemtrade Solutions Site
East Point, Georgia



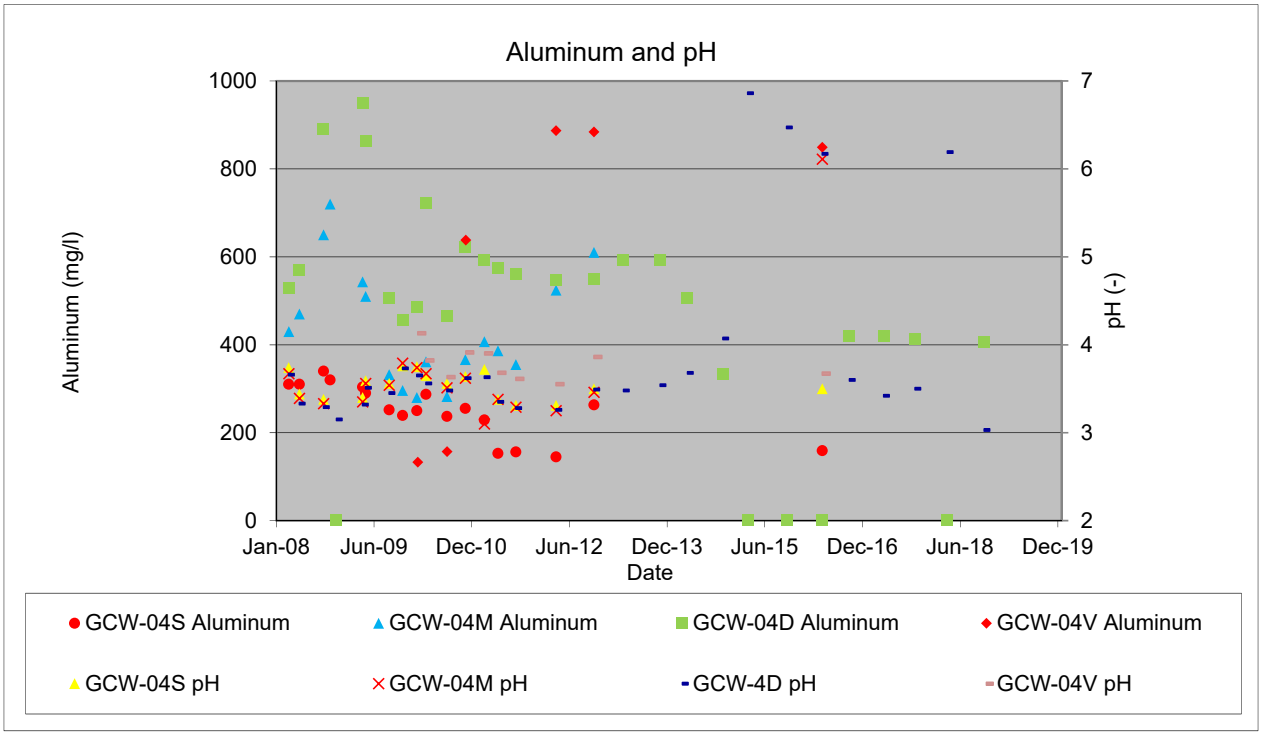
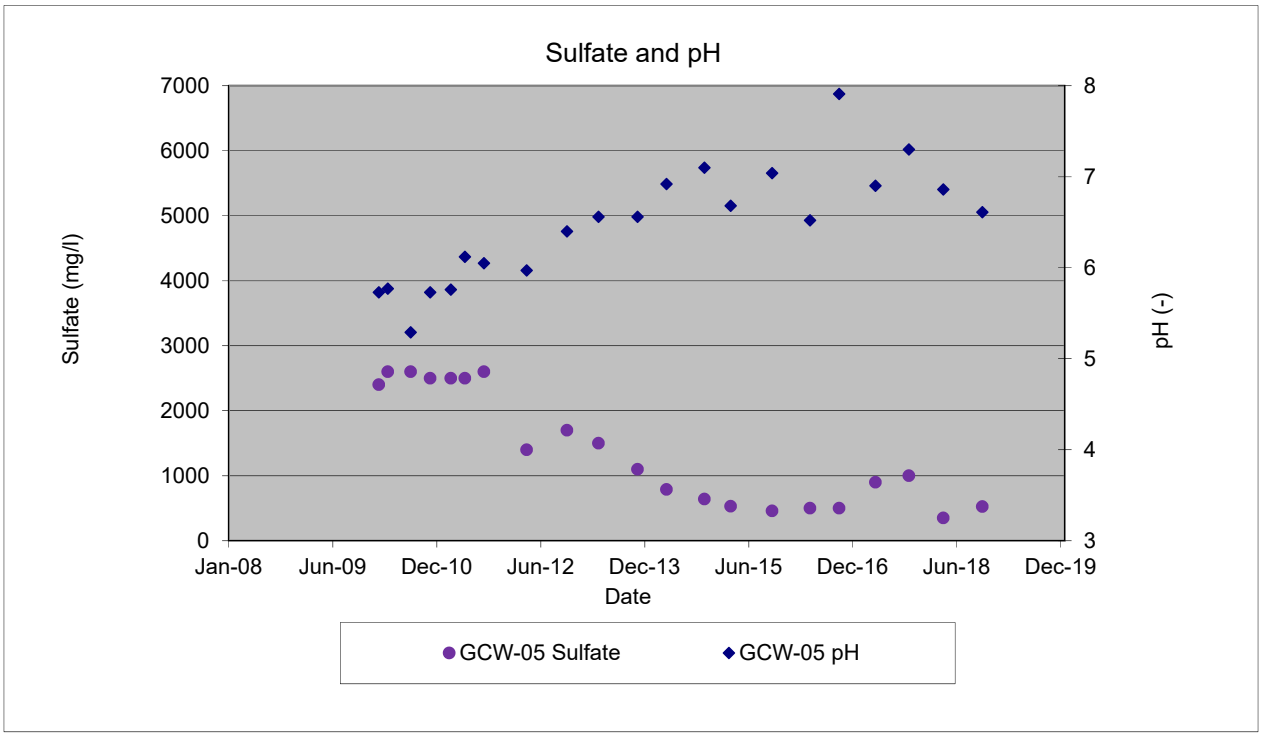


Figure 3-2 (Cont)
GCW-05 Sulfate and pH Trends and Aluminum and pH Trends
Chemtrade Solutions Site
East Point, Georgia



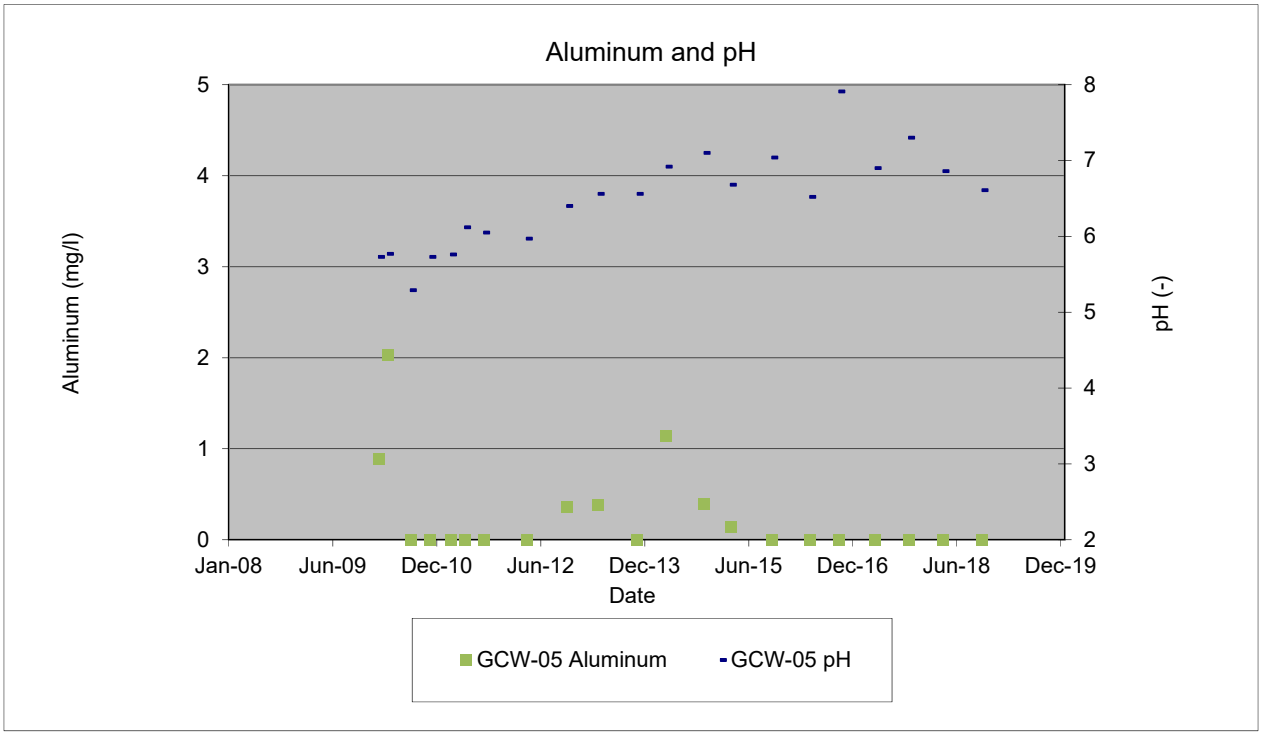
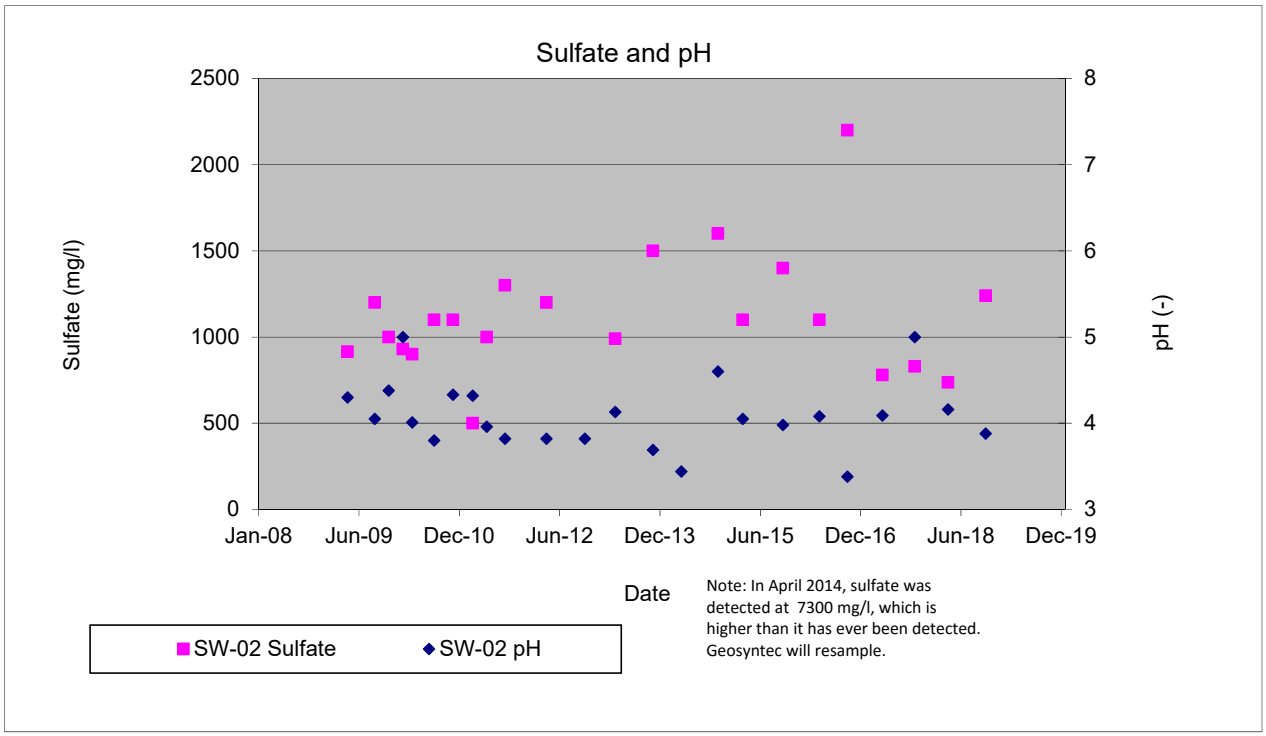


Figure 3-3
SW-02 (On-site) Sulfate and pH Trends and Aluminum and pH Trends
Chemtrade Solutions Site
East Point, Georgia



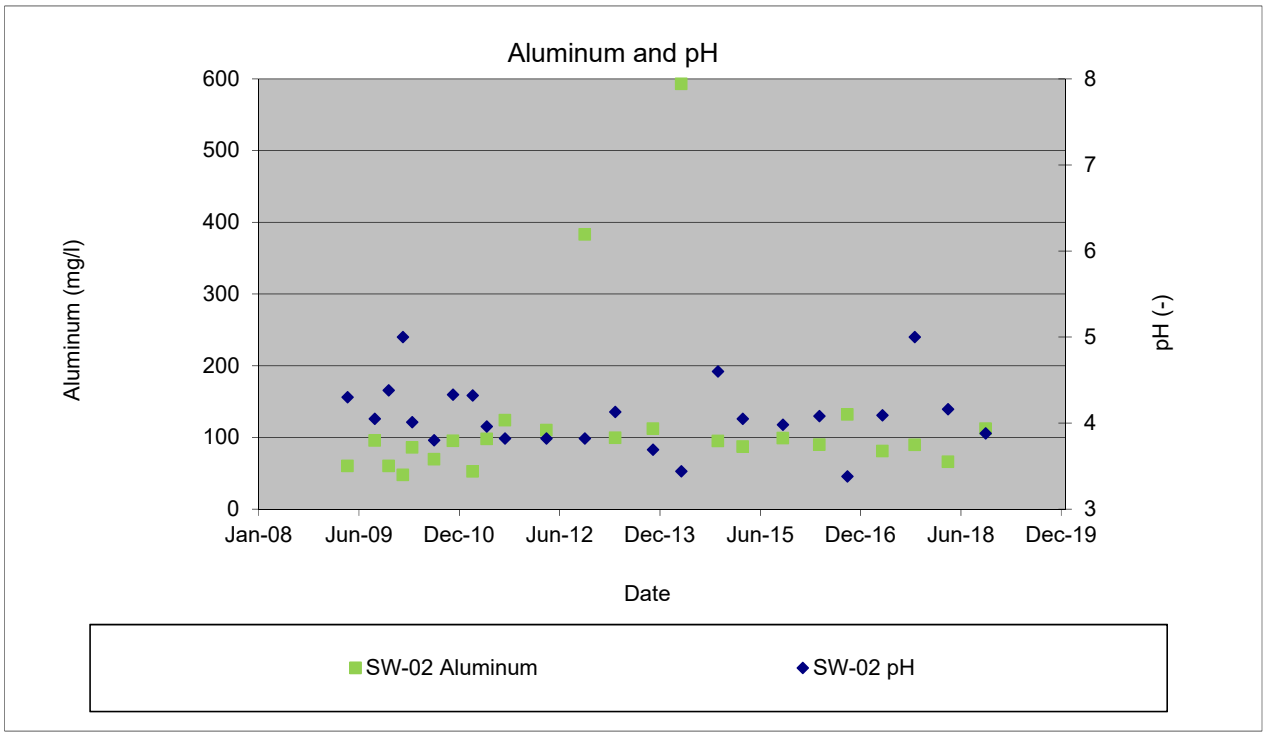
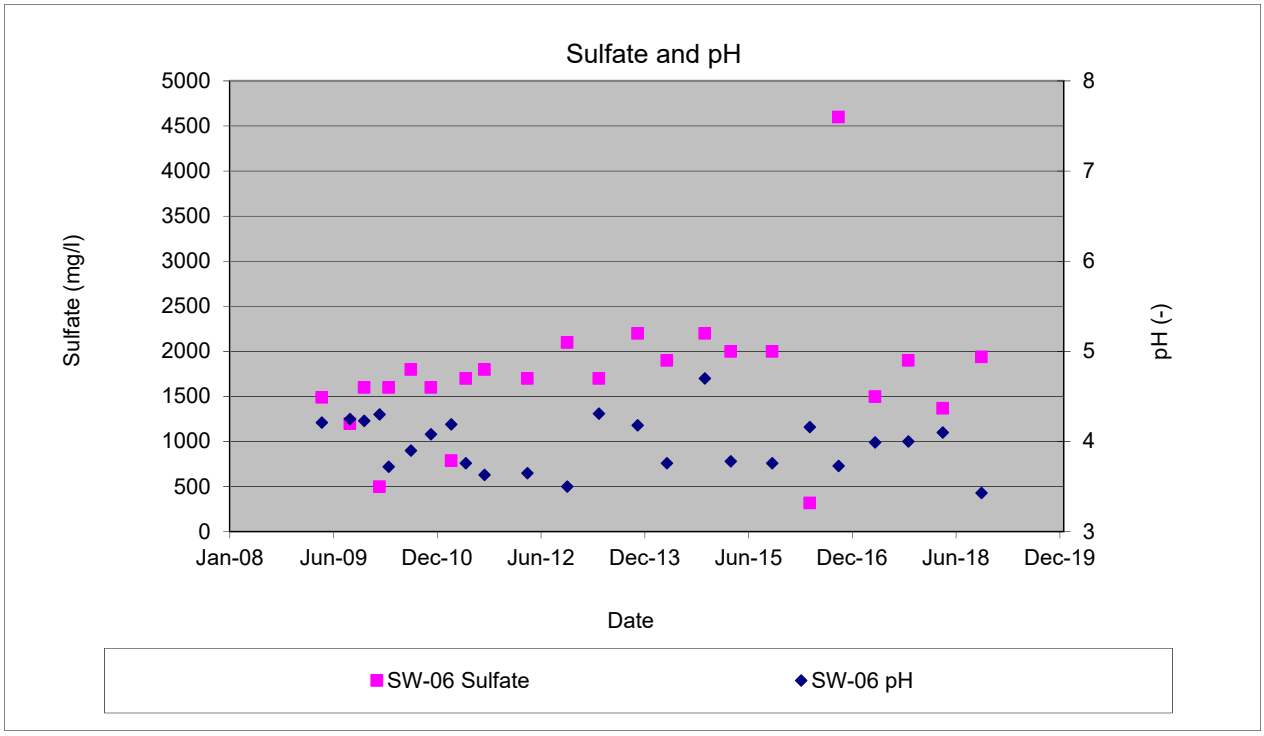


Figure 3-3 (Cont)
SW-06 (John D Milner Sports Complex) Sulfate and pH Trends and Aluminum and pH Trends
Chemtrade Solutions Site
East Point, Georgia



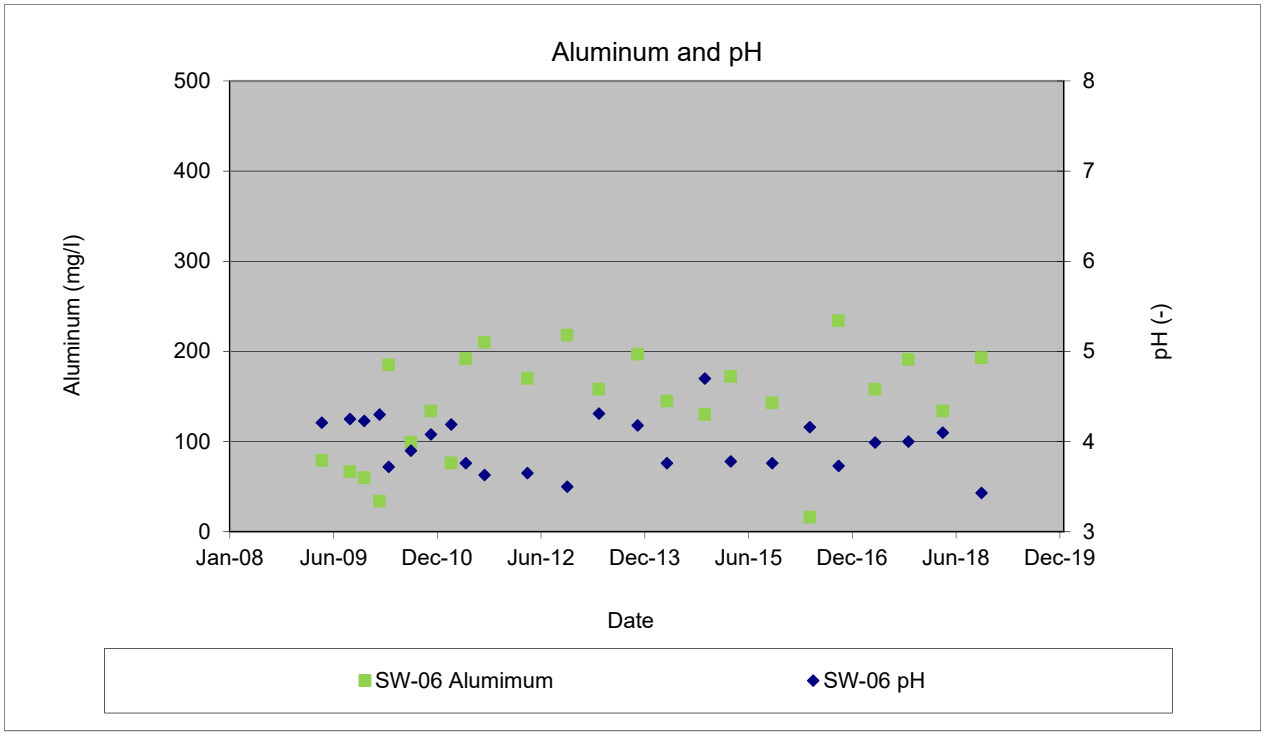
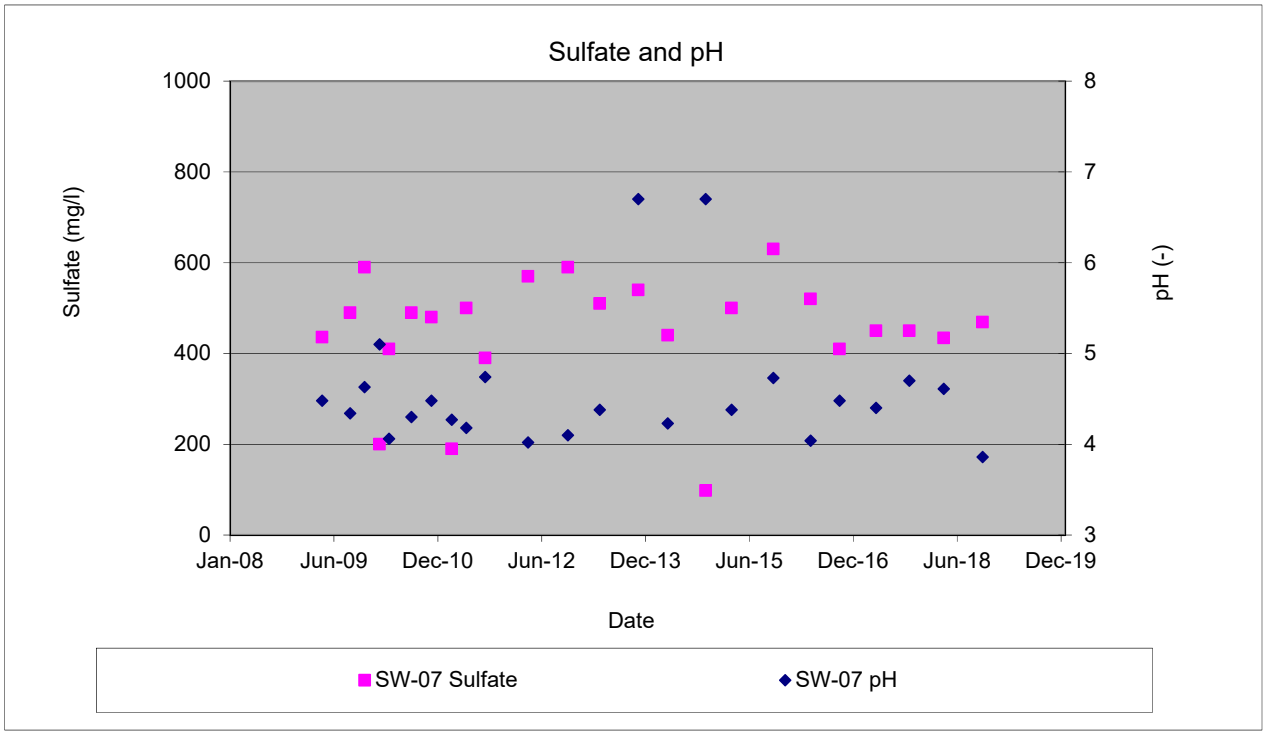


Figure 3-3 (Cont)
SW-07 (Unnamed Tributary) Sulfate and pH Trends and Aluminum and pH Trends
Chemtrade Solutions Site
East Point, Georgia



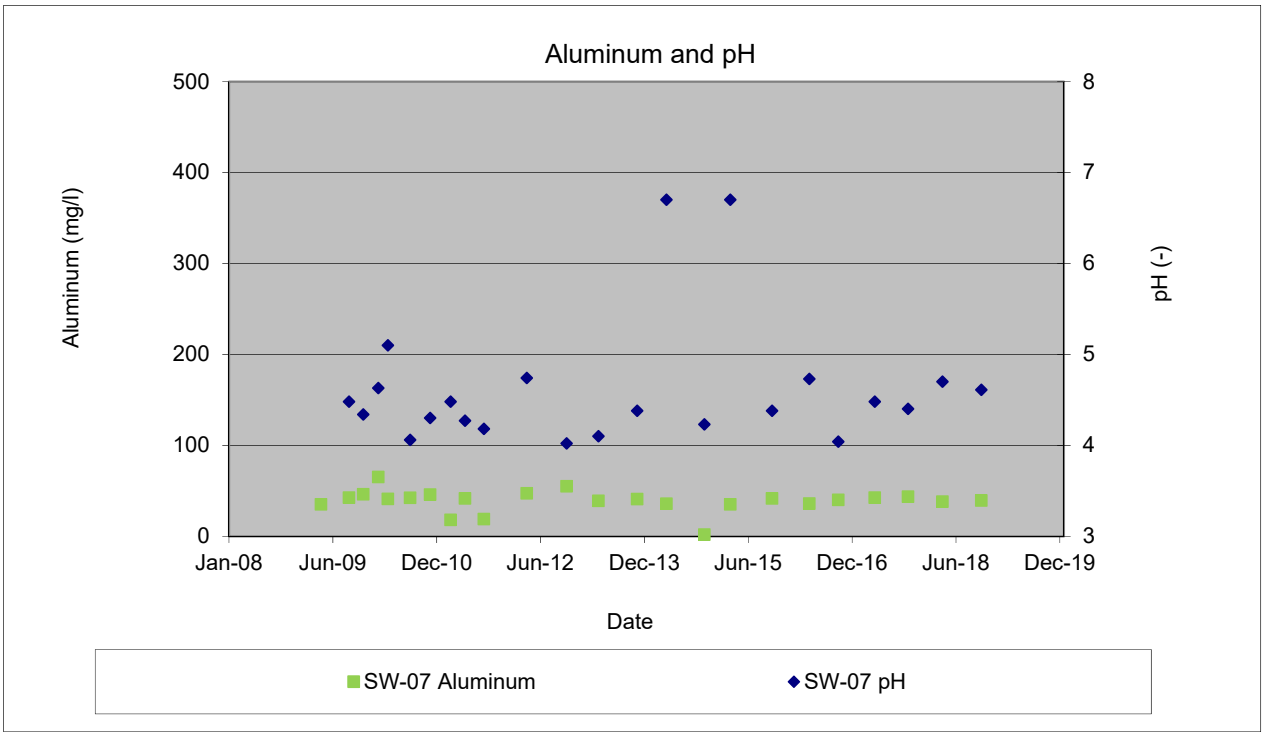
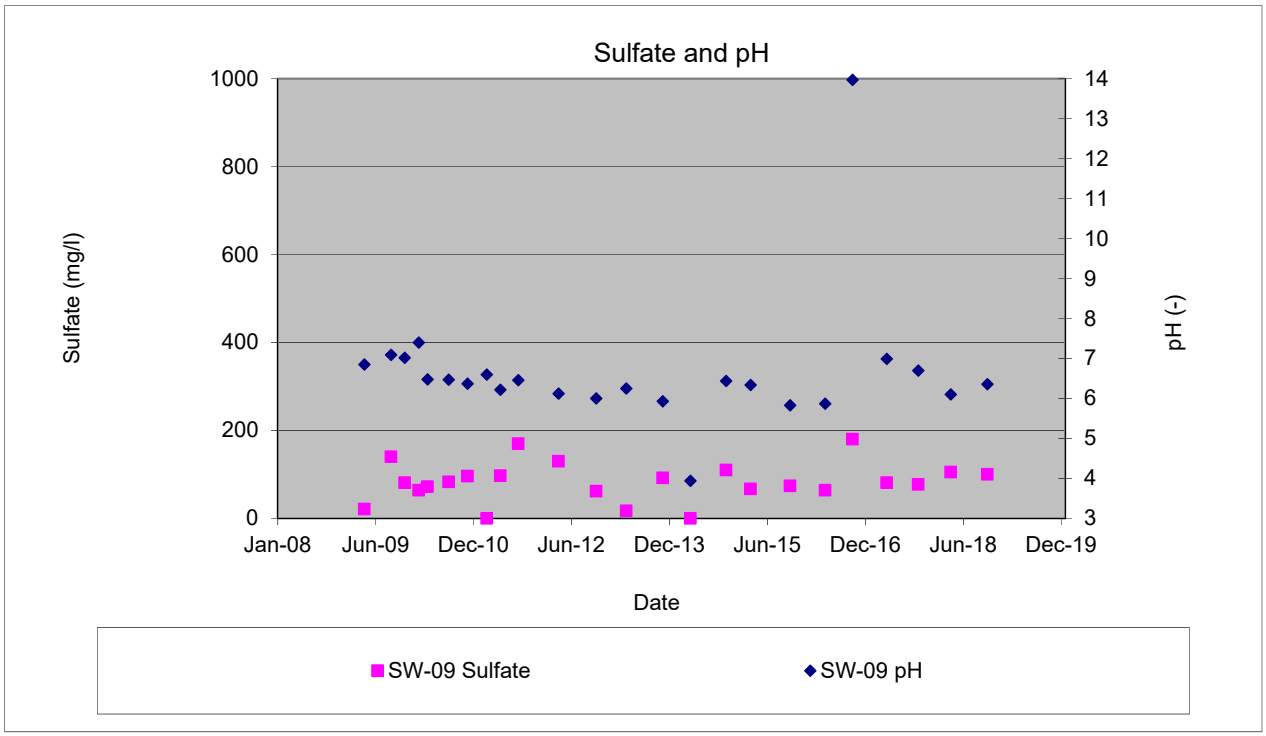
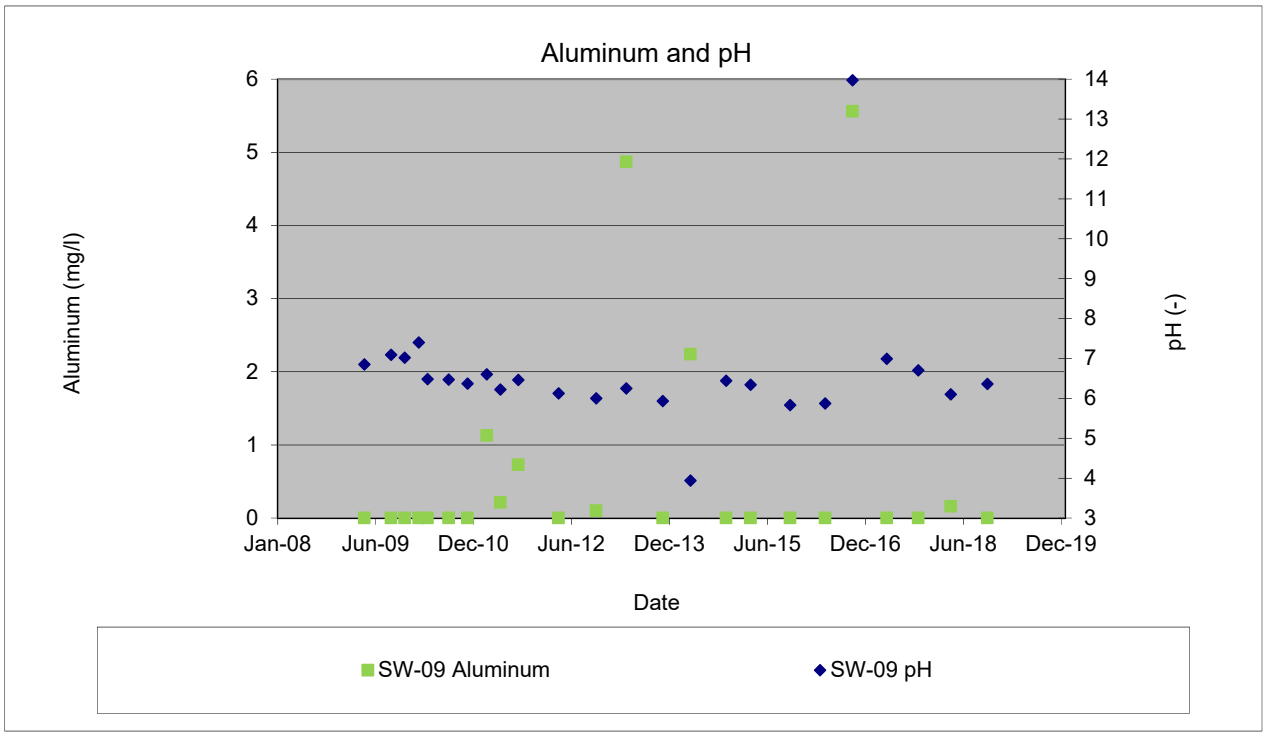
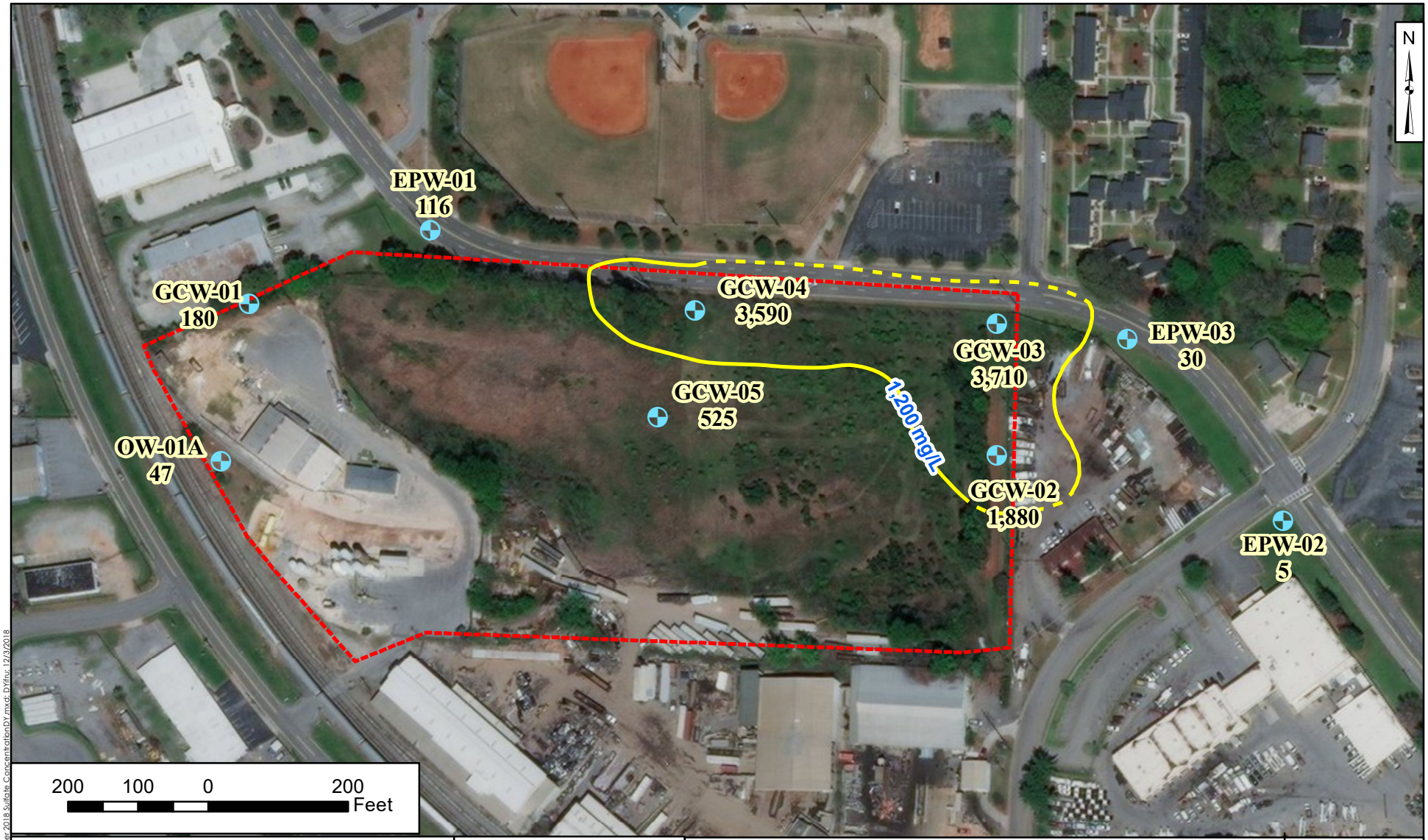


Figure 3-3 (Cont)
SW-09 (Upgradient) Sulfate and pH Trends and Aluminum and pH Trends
Chemtrade Solutions Site
East Point, Georgia







Legend

- Monitoring Well
- Sulfate Concentration (Inferred)
- Sulfate Concentration (mg/L)
- Approximate Property Boundary

Geosyntec consultants
Kennesaw, GA

December 2018

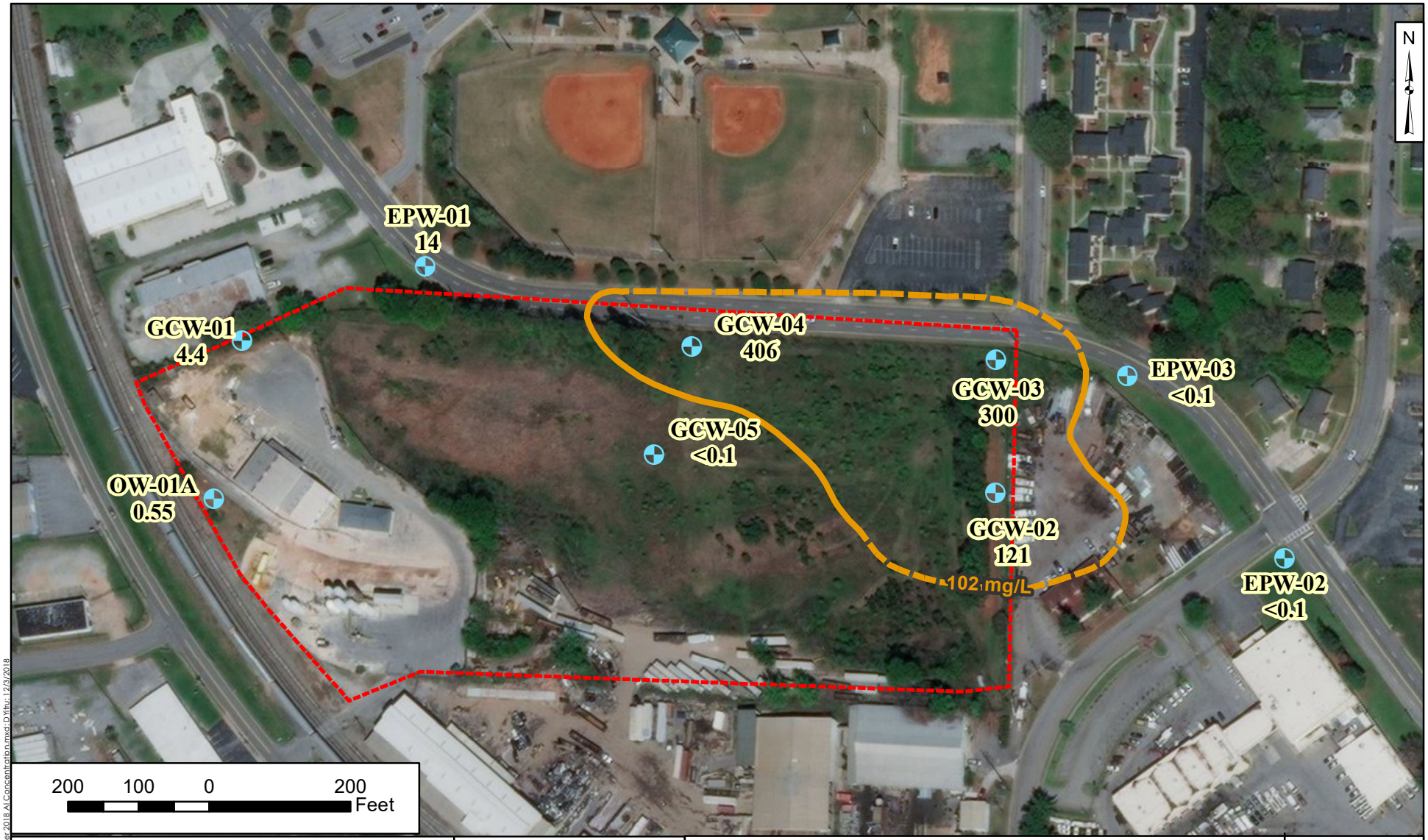
OCTOBER 2018 SULFATE CONCENTRATION ABOVE THE TYPE 4 RRS

Chemtrade Solutions, East Point, GA

Figure

3-4

N:\Agenchem\GIS\MXDs\October 2018\Fig 3-4 October 2018 Sulfate Concentration DY.mxd: DYlou: 12/3/2018



Legend

- Monitoring Well
- Aluminum Concentration (mg/L)
- Aluminum Concentration (inferred)
- Approximate Property Boundary

Geosyntec consultants
Kennesaw, GA

December 2018

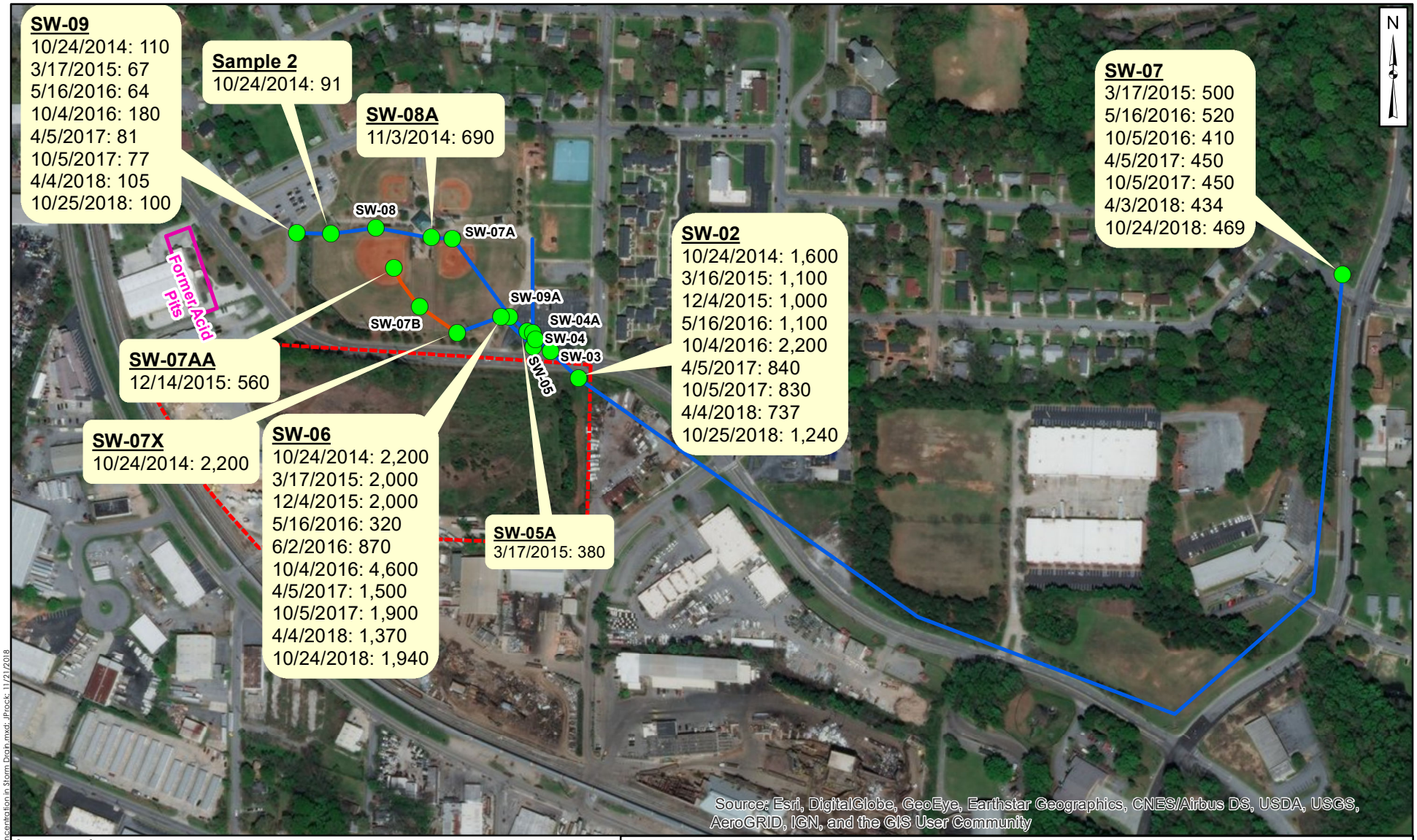
OCTOBER 2018 ALUMINUM CONCENTRATION ABOVE THE TYPE 4 RRS

Chemtrade Solutions, East Point, GA

Figure

3-5

N:\gencherm\GIS\MXDs\October 2018\Fig 3-5 October 2018 Al Concentration.mxd - DYiu - 12/3/2018



Legend

- Former Acid Pits
- Approximate Property Boundary
- Storm Drain Sample (Sulfate Concentration in mg/L)
- Storm Drain
- High Sulfate Storm Drain

400 200 0 400 800 Feet

Geosyntec consultants
Kennesaw, GA
October 2018

SULFATE CONCENTRATION IN STORM DRAIN

Chemtrade Solutions, East Point, GA

Figure **3-6**

N:\Agenchem\GIS\MXDs\October 2018\Fig 3-6 Sulfate Concentration in Storm Drain.mxd: JProck: 11/21/2018

150 75 0 150 Feet

Legend

Monitoring Wells and Results

- Downgradient Well; Decreasing Aluminum Trend; No Sulfate Trend
- Downgradient Well; No Aluminum Trend; Decreasing Sulfate Trend
- Source Area Well; Decreasing Aluminum and Sulfate Trends
- Source Area Well; No Aluminum Trend; Decreasing Sulfate Trend
- Upgradient Well; Decreasing Aluminum and Sulfate Trends
- Upgradient Well; No Aluminum or Sulfate Trends
- Approximate Property Boundary

Note: The Type 4 RRS for sulfate is 1,200 mg/l and Type 4 RRS for aluminum is 102 mg/l.

Geosyntec consultants
Kennesaw, GA

December 2018

GROUNDWATER TREND SUMMARY

Chemtrade Solutions, East Point, GA

Figure 3-7

\\Ato-01\gis$\genchem\GIS\MXDs\October 2018\Fig 3-7 Groundwater Trend Summary.mxd, NCarusi, 12/12/2018

Legend

Surface Water Samples and Results

- Cross-Gradient; Increasing Aluminum and Sulfate Trends
- Downgradient; No Aluminum or Sulfate Trends
- On-site; No Aluminum or Sulfate Trends
- Upgradient; No Aluminum or Sulfate Trends
- Approximate Property Boundary

Note: No applicable cleanup criteria has been established for site stormwater data.

Geosyntec consultants
Kennesaw, GA

December 2018

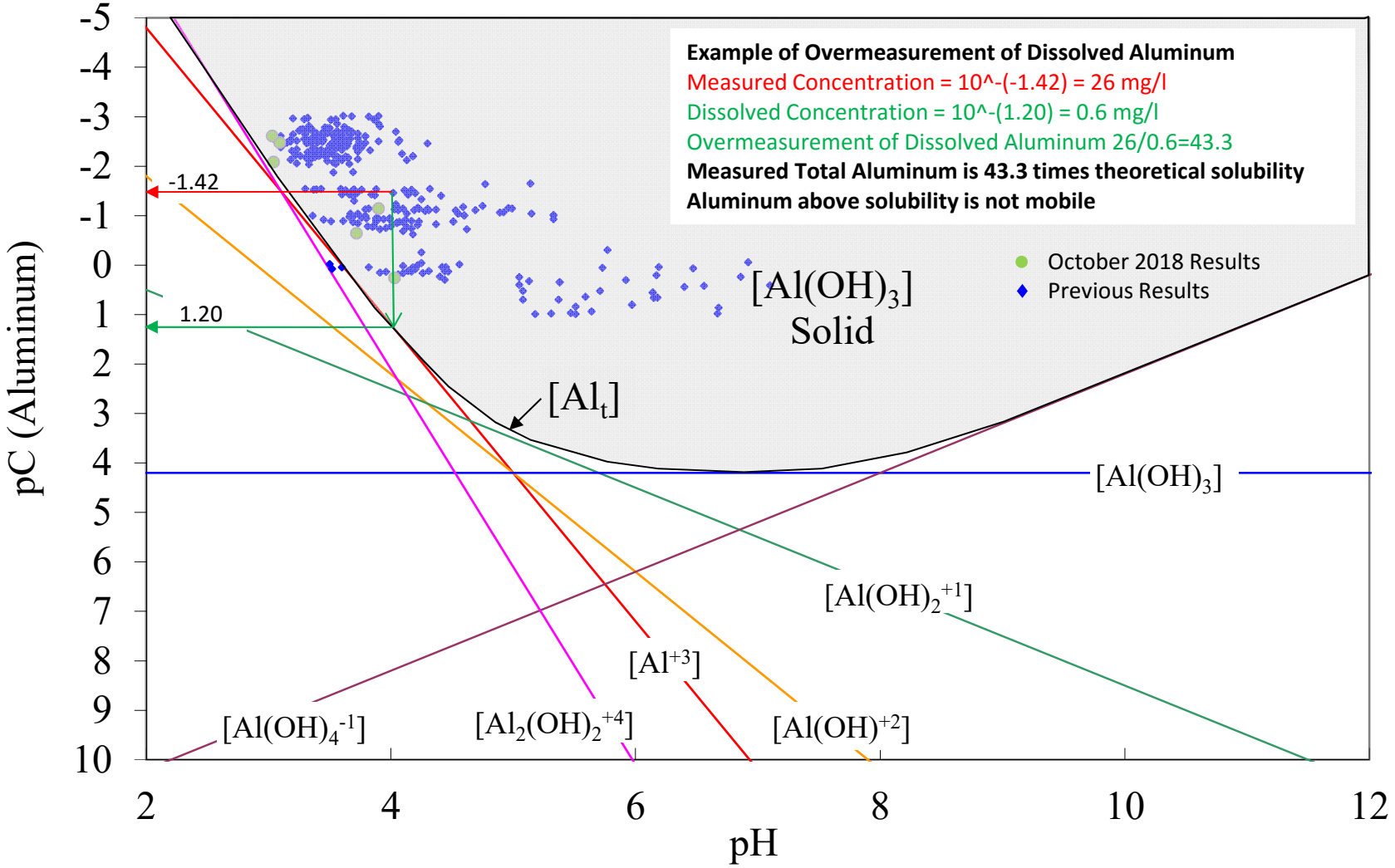
STORMWATER TREND SUMMARY

Chemtrade Solutions, Atlanta, GA

Figure **3-8**

\\Ato-01\gis$\geochem\GIS\MXDs\October 2018\Fig 3-8 Stormwater Trend Summary.mxd - NC auso - 12/12/2018

Figure 6-1
Chemtrade Solutions
Groundwater Sampling
October 2018
Aluminum Results Analysis



APPENDIX A

GROUNDWATER AND STORM DRAIN LABORATORY RESULTS

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

November 06, 2018

Brian Jacobson
Geosyntec Consultants, Inc.
1255 Roberts Blvd NW
Suite 200
Kennesaw, GA 30144

RE: Project: Chemtrade
Pace Project No.: 2610895

Dear Brian Jacobson:
Enclosed are the analytical results for sample(s) received by the laboratory on October 26, 2018. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Betsy McDaniel
betsy.mcdaniel@pacelabs.com
(770)734-4200
Project Manager

Enclosures

cc: Shira Colsky, Geosyntec Consultants, Inc.

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

CERTIFICATIONS

Project: Chemtrade
Pace Project No.: 2610895

Atlanta Certification IDs

110 Technology Parkway Peachtree Corners, GA 30092
Florida DOH Certification #: E87315
Georgia DW Inorganics Certification #: 812
Georgia DW Microbiology Certification #: 812
North Carolina Certification #: 381
South Carolina Certification #: 98011001
Texas Certification #: T104704397-08-TX
Virginia Certification #: 460204

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

SAMPLE SUMMARY

Project: Chemtrade
Pace Project No.: 2610895

Lab ID	Sample ID	Matrix	Date Collected	Date Received
2610895001	**Dup-01-1018**	Water	10/24/18 16:50	10/26/18 15:00
2610895002	**Dup-02-1018**	Water	10/25/18 10:25	10/26/18 15:00
2610895003	**SW-02-1018**	Water	10/25/18 15:05	10/26/18 15:00
2610895004	**SW-06-1018**	Water	10/24/18 16:50	10/26/18 15:00
2610895005	**SW-07-1018**	Water	10/24/18 16:15	10/26/18 15:00
2610895006	**SW-09-1018**	Water	10/25/18 09:10	10/26/18 15:00
2610895007	**EPW-01-1018**	Water	10/25/18 10:25	10/26/18 15:00
2610895008	**EPW-02-1018**	Water	10/25/18 10:30	10/26/18 15:00
2610895009	**EPW-03D-1018**	Water	10/24/18 13:55	10/26/18 15:00
2610895010	**OW-1A-1018**	Water	10/26/18 09:45	10/26/18 15:00
2610895011	**GCW-01D-1018**	Water	10/26/18 09:05	10/26/18 15:00
2610895012	**GCW-02D-1018**	Water	10/25/18 14:37	10/26/18 15:00
2610895013	**GCW-03D-1018**	Water	10/25/18 14:30	10/26/18 15:00
2610895014	**GCW-04D-1018**	Water	10/25/18 12:22	10/26/18 15:00
2610895015	**GCW-05-1018**	Water	10/25/18 12:15	10/26/18 15:00

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

SAMPLE ANALYTE COUNT

Project: Chemtrade
Pace Project No.: 2610895

Lab ID	Sample ID	Method	Analysts	Analytes Reported
2610895001	**Dup-01-1018**	EPA 6010D	AAP	1
		EPA 9056A	RLC	1
2610895002	**Dup-02-1018**	EPA 6010D	AAP	1
		EPA 9056A	MWB	1
2610895003	**SW-02-1018**	EPA 6010D	AAP	1
		EPA 9056A	MWB	1
2610895004	**SW-06-1018**	EPA 6010D	AAP	1
		EPA 9056A	RLC	1
2610895005	**SW-07-1018**	EPA 6010D	AAP	1
		EPA 9056A	MWB	1
2610895006	**SW-09-1018**	EPA 6010D	AAP	1
		EPA 9056A	MWB	1
2610895007	**EPW-01-1018**	EPA 6010D	AAP	1
		EPA 9056A	MWB	1
2610895008	**EPW-02-1018**	EPA 6010D	AAP	1
		EPA 9056A	MWB	1
2610895009	**EPW-03D-1018**	EPA 6010D	AAP	1
		EPA 9056A	MWB	1
2610895010	**OW-1A-1018**	EPA 6010D	AAP	1
		EPA 9056A	MWB	1
2610895011	**GCW-01D-1018**	EPA 6010D	AAP	1
		EPA 9056A	MWB	1
2610895012	**GCW-02D-1018**	EPA 6010D	AAP	1
		EPA 9056A	RLC	1
2610895013	**GCW-03D-1018**	EPA 6010D	AAP	1
		EPA 9056A	RLC	1
2610895014	**GCW-04D-1018**	EPA 6010D	AAP	1
		EPA 9056A	RLC	1
2610895015	**GCW-05-1018**	EPA 6010D	AAP	1
		EPA 9056A	MWB	1

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

ANALYTICAL RESULTS

Project: Chemtrade
Pace Project No.: 2610895

Sample: Dup-01-1018 **Lab ID: 2610895001** Collected: 10/24/18 16:50 Received: 10/26/18 15:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D		Preparation Method: EPA 3010A					
Aluminum	**191**	mg/L	1.0	10	10/31/18 16:22	11/05/18 10:43	7429-90-5	
9056 IC Anions	Analytical Method: EPA 9056A							
Sulfate	**2010**	mg/L	250	50		11/06/18 11:01	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

ANALYTICAL RESULTS

Project: Chemtrade
Pace Project No.: 2610895

Sample: Dup-02-1018 **Lab ID: 2610895002** Collected: 10/25/18 10:25 Received: 10/26/18 15:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D		Preparation Method: EPA 3010A					
Aluminum	**13.6**	mg/L	0.10	1	10/31/18 16:22	11/02/18 16:53	7429-90-5	
9056 IC Anions	Analytical Method: EPA 9056A							
Sulfate	**118**	mg/L	25.0	5		11/05/18 18:26	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

ANALYTICAL RESULTS

Project: Chemtrade
Pace Project No.: 2610895

Sample: SW-02-1018 **Lab ID: 2610895003** Collected: 10/25/18 15:05 Received: 10/26/18 15:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Aluminum	**112**	mg/L	0.10	1	10/31/18 16:22	11/02/18 16:57	7429-90-5	
9056 IC Anions	Analytical Method: EPA 9056A							
Sulfate	**1240**	mg/L	125	25		11/05/18 18:48	14808-79-8	M1

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

ANALYTICAL RESULTS

Project: Chemtrade
Pace Project No.: 2610895

Sample: SW-06-1018 **Lab ID: 2610895004** Collected: 10/24/18 16:50 Received: 10/26/18 15:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D		Preparation Method: EPA 3010A					
Aluminum	**193**	mg/L	1.0	10	10/31/18 16:22	11/05/18 10:47	7429-90-5	
9056 IC Anions	Analytical Method: EPA 9056A							
Sulfate	**1940**	mg/L	250	50		11/06/18 11:21	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

ANALYTICAL RESULTS

Project: Chemtrade
Pace Project No.: 2610895

Sample: SW-07-1018 **Lab ID: 2610895005** Collected: 10/24/18 16:15 Received: 10/26/18 15:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D		Preparation Method: EPA 3010A					
Aluminum	**39.2**	mg/L	0.10	1	10/31/18 16:22	11/02/18 17:05	7429-90-5	
9056 IC Anions	Analytical Method: EPA 9056A							
Sulfate	**469**	mg/L	50.0	10		11/05/18 19:34	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

ANALYTICAL RESULTS

Project: Chemtrade
Pace Project No.: 2610895

Sample: SW-09-1018 **Lab ID: 2610895006** Collected: 10/25/18 09:10 Received: 10/26/18 15:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D		Preparation Method: EPA 3010A					
Aluminum	ND	mg/L	0.10	1	10/31/18 16:22	11/02/18 17:08	7429-90-5	
9056 IC Anions	Analytical Method: EPA 9056A							
Sulfate	**100**	mg/L	25.0	5		11/05/18 19:56	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

ANALYTICAL RESULTS

Project: Chemtrade
Pace Project No.: 2610895

Sample: EPW-01-1018 **Lab ID: 2610895007** Collected: 10/25/18 10:25 Received: 10/26/18 15:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D		Preparation Method: EPA 3010A					
Aluminum	**14.0**	mg/L	0.10	1	10/31/18 16:22	11/02/18 17:12	7429-90-5	
9056 IC Anions	Analytical Method: EPA 9056A							
Sulfate	**116**	mg/L	25.0	5		11/05/18 20:19	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

ANALYTICAL RESULTS

Project: Chemtrade
Pace Project No.: 2610895

Sample: EPW-02-1018 **Lab ID: 2610895008** Collected: 10/25/18 10:30 Received: 10/26/18 15:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D		Preparation Method: EPA 3010A					
Aluminum	ND	mg/L	0.10	1	10/31/18 16:22	11/02/18 17:16	7429-90-5	
9056 IC Anions	Analytical Method: EPA 9056A							
Sulfate	**5.3**	mg/L	5.0	1		10/31/18 17:32	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

ANALYTICAL RESULTS

Project: Chemtrade
Pace Project No.: 2610895

Sample: EPW-03D-1018 **Lab ID: 2610895009** Collected: 10/24/18 13:55 Received: 10/26/18 15:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D		Preparation Method: EPA 3010A					
Aluminum	ND	mg/L	0.10	1	10/31/18 16:22	11/02/18 17:27	7429-90-5	
9056 IC Anions	Analytical Method: EPA 9056A							
Sulfate	**30.3**	mg/L	5.0	1		10/31/18 19:31	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

ANALYTICAL RESULTS

Project: Chemtrade
Pace Project No.: 2610895

Sample: OW-1A-1018 **Lab ID: 2610895010** Collected: 10/26/18 09:45 Received: 10/26/18 15:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Aluminum	**0.55**	mg/L	0.10	1	10/31/18 16:22	11/02/18 17:31	7429-90-5	
9056 IC Anions	Analytical Method: EPA 9056A							
Sulfate	**46.7**	mg/L	5.0	1		10/31/18 19:54	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

ANALYTICAL RESULTS

Project: Chemtrade
Pace Project No.: 2610895

Sample: GCW-01D-1018 **Lab ID: 2610895011** Collected: 10/26/18 09:05 Received: 10/26/18 15:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D		Preparation Method: EPA 3010A					
Aluminum	**4.4**	mg/L	0.10	1	10/31/18 16:22	11/02/18 17:35	7429-90-5	
9056 IC Anions	Analytical Method: EPA 9056A							
Sulfate	**180**	mg/L	25.0	5		11/05/18 22:12	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

ANALYTICAL RESULTS

Project: Chemtrade
Pace Project No.: 2610895

Sample: GCW-02D-1018 **Lab ID: 2610895012** Collected: 10/25/18 14:37 Received: 10/26/18 15:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D		Preparation Method: EPA 3010A					
Aluminum	**121**	mg/L	0.10	1	10/31/18 16:22	11/02/18 17:39	7429-90-5	M1
9056 IC Anions	Analytical Method: EPA 9056A							
Sulfate	**1880**	mg/L	250	50		11/06/18 11:42	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

ANALYTICAL RESULTS

Project: Chemtrade
Pace Project No.: 2610895

Sample: GCW-03D-1018 **Lab ID: 2610895013** Collected: 10/25/18 14:30 Received: 10/26/18 15:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D		Preparation Method: EPA 3010A					
Aluminum	**300**	mg/L	1.0	10	10/31/18 16:22	11/05/18 10:50	7429-90-5	
9056 IC Anions	Analytical Method: EPA 9056A							
Sulfate	**3710**	mg/L	500	100		11/06/18 12:03	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

ANALYTICAL RESULTS

Project: Chemtrade
Pace Project No.: 2610895

Sample: GCW-04D-1018 **Lab ID: 2610895014** Collected: 10/25/18 12:22 Received: 10/26/18 15:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Aluminum	**406**	mg/L	1.0	10	10/31/18 16:22	11/05/18 10:54	7429-90-5	
9056 IC Anions	Analytical Method: EPA 9056A							
Sulfate	**3590**	mg/L	500	100		11/06/18 12:23	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

ANALYTICAL RESULTS

Project: Chemtrade
Pace Project No.: 2610895

Sample: GCW-05-1018 **Lab ID: 2610895015** Collected: 10/25/18 12:15 Received: 10/26/18 15:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D		Preparation Method: EPA 3010A					
Aluminum	ND	mg/L	0.10	1	10/31/18 16:22	11/02/18 18:01	7429-90-5	
9056 IC Anions	Analytical Method: EPA 9056A							
Sulfate	**525**	mg/L	125	25		11/05/18 23:43	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

QUALITY CONTROL DATA

Project: Chemtrade
Pace Project No.: 2610895

QC Batch: 16345 Analysis Method: EPA 6010D
QC Batch Method: EPA 3010A Analysis Description: 6010D MET
Associated Lab Samples: 2610895001, 2610895002, 2610895003, 2610895004, 2610895005, 2610895006, 2610895007, 2610895008, 2610895009, 2610895010, 2610895011, 2610895012, 2610895013, 2610895014, 2610895015

METHOD BLANK: 73097 Matrix: Water
Associated Lab Samples: 2610895001, 2610895002, 2610895003, 2610895004, 2610895005, 2610895006, 2610895007, 2610895008, 2610895009, 2610895010, 2610895011, 2610895012, 2610895013, 2610895014, 2610895015

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Aluminum	mg/L	ND	0.10	11/02/18 16:42	

LABORATORY CONTROL SAMPLE: 73098

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Aluminum	mg/L	1	0.99	99	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 73099 73100

Parameter	Units	2610895012 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Aluminum	mg/L	121	1	1	124	122	265	111	75-125	1	20	M1

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

QUALITY CONTROL DATA

Project: Chemtrade
Pace Project No.: 2610895

QC Batch: 16301 Analysis Method: EPA 9056A
QC Batch Method: EPA 9056A Analysis Description: 9056 IC Anions
Associated Lab Samples: 2610895001, 2610895002, 2610895003, 2610895004, 2610895005, 2610895006, 2610895007, 2610895008, 2610895009, 2610895010, 2610895011, 2610895012, 2610895013, 2610895014, 2610895015

METHOD BLANK: 72871 Matrix: Water
Associated Lab Samples: 2610895001, 2610895002, 2610895003, 2610895004, 2610895005, 2610895006, 2610895007, 2610895008, 2610895009, 2610895010, 2610895011, 2610895012, 2610895013, 2610895014, 2610895015

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Sulfate	mg/L	ND	5.0	10/31/18 13:11	

LABORATORY CONTROL SAMPLE: 72872

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	10	11.0	110	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 72876 72877

Parameter	Units	2610895003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Sulfate	mg/L	1240	10	10	418	418	-8230	-8230	90-110	0	15	E,M1

MATRIX SPIKE SAMPLE: 72881

Parameter	Units	2610909007 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	ND	10	12.2	115	90-110	M1

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

QUALIFIERS

Project: Chemtrade
Pace Project No.: 2610895

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

ANALYTE QUALIFIERS

E	Analyte concentration exceeded the calibration range. The reported result is estimated.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

Pace Analytical Services, LLC
110 Technology Parkway
Peachtree Corners, GA 30092
(770)734-4200

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Chemtrade
Pace Project No.: 2610895

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
2610895001	**Dup-01-1018**	EPA 3010A	16345	EPA 6010D	16424
2610895002	**Dup-02-1018**	EPA 3010A	16345	EPA 6010D	16424
2610895003	**SW-02-1018**	EPA 3010A	16345	EPA 6010D	16424
2610895004	**SW-06-1018**	EPA 3010A	16345	EPA 6010D	16424
2610895005	**SW-07-1018**	EPA 3010A	16345	EPA 6010D	16424
2610895006	**SW-09-1018**	EPA 3010A	16345	EPA 6010D	16424
2610895007	**EPW-01-1018**	EPA 3010A	16345	EPA 6010D	16424
2610895008	**EPW-02-1018**	EPA 3010A	16345	EPA 6010D	16424
2610895009	**EPW-03D-1018**	EPA 3010A	16345	EPA 6010D	16424
2610895010	**OW-1A-1018**	EPA 3010A	16345	EPA 6010D	16424
2610895011	**GCW-01D-1018**	EPA 3010A	16345	EPA 6010D	16424
2610895012	**GCW-02D-1018**	EPA 3010A	16345	EPA 6010D	16424
2610895013	**GCW-03D-1018**	EPA 3010A	16345	EPA 6010D	16424
2610895014	**GCW-04D-1018**	EPA 3010A	16345	EPA 6010D	16424
2610895015	**GCW-05-1018**	EPA 3010A	16345	EPA 6010D	16424
2610895001	**Dup-01-1018**	EPA 9056A	16301		
2610895002	**Dup-02-1018**	EPA 9056A	16301		
2610895003	**SW-02-1018**	EPA 9056A	16301		
2610895004	**SW-06-1018**	EPA 9056A	16301		
2610895005	**SW-07-1018**	EPA 9056A	16301		
2610895006	**SW-09-1018**	EPA 9056A	16301		
2610895007	**EPW-01-1018**	EPA 9056A	16301		
2610895008	**EPW-02-1018**	EPA 9056A	16301		
2610895009	**EPW-03D-1018**	EPA 9056A	16301		
2610895010	**OW-1A-1018**	EPA 9056A	16301		
2610895011	**GCW-01D-1018**	EPA 9056A	16301		
2610895012	**GCW-02D-1018**	EPA 9056A	16301		
2610895013	**GCW-03D-1018**	EPA 9056A	16301		
2610895014	**GCW-04D-1018**	EPA 9056A	16301		
2610895015	**GCW-05-1018**	EPA 9056A	16301		

Pace Analytical®
www.pacelabs.com

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: 1 of 2

2264949

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:
Company: Geosyntec Consultants	Report To: Brian Jacobson	Attention:
Address: 1255 Roberts Blvd NW #200	Copy To: Shira Colsky	Company Name:
Kennesaw, GA 30144	—	Address:
Email To: bdjacobson@geosyntec.com	Purchase Order No.: GR5060	Pace Quote Reference:
Phone: 678-202-6539 Fax: 678-202-9501	Project Name: Chemtrade	Pace Project Manager:
Requested Due Date/TAT: Normal TAT	Project Number: —	Pace Profile #:

REGULATORY AGENCY: ☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER ☐ UST ☐ RCRA ☐ OTHER

Site Location STATE: GA

ITEM #	Section D Required Client Information: SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE	Matrix Codes: Drinking Water DW, Water WT, Waste Water WW, Product P, Soil/Solid SL, Oil OL, Wipe WP, Air AR, Tissue TS, Other OT	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED: COMPOSITE START DATE	COMPOSITE START TIME	COMPOSITE END/GRAB DATE	COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Y/N	Analysis Test: Metals (All only)	Sulfate	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
																				N	N	N	
1	DUP-01-1018	WT	G	—	—	10/24	1650		2	1		1								1	1	N	
2	DUP-02-1018	WT	G	—	—	10/25	1025		2	1		1								1	1	N	
3	SW-02-1018	WT	G	—	—	10/25	1505		2	1		1								1	1	N	
4	SW-06-1018	WT	G	—	—	10/24	1650		2	1		1								1	1	N	
5	SW-07-1018	WT	G	—	—	10/24	1615		2	1		1								1	1	N	
6	SW-09-1018	WT	G	—	—	10/25	0910		2	1		1								1	1	N	
7	EPW-01-1018	WT	G	—	—	10/25	1025		2	1		1								1	1	N	
8	EPW-02-1018	WT	G	—	—	10/25	1030		2	1		1								1	1	N	
9	EPW-03D-1018	WT	G	—	—	10/24	1355		2	1		1								1	1	N	
10	OW-1A-1018	WT	G	—	—	10/26	0945		2	1		1								1	1	N	
11	GCW-01D-1018	WT	G	—	—	10/26	0905		2	1		1								1	1	N	
12	GCW-02D-1018	WT	G	—	—	10/25	1437		2	1		1								1	1	N	

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
	Joel Prock / Sampler	10/26/18	1245	M Zalman	10/26/18	1500	

WO#: 2610895

Page 24 of 26

2610895

SAMPLER NAME AND SIGNATURE			Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
PRINT Name of SAMPLER:	Joel Prock		2.0	Y	Y	Y
SIGNATURE of SAMPLER:		DATE Signed (MM/DD/YY): 10/26/18				

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-C-010-rev.00, 09Nov2017

Pace Analytical®
www.pacelabs.com

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: 2 of 2

2264950

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:
Company: Geosyntec Consultants	Report To: Brian Jacobson	Attention:
Address: 1255 Roberts Blvd NW #200 Kennesaw, GA 30144	Copy To: Shira Colsky	Company Name:
Email To: bdjacobson@geosyntec.com	Purchase Order No.: GR5060	Address:
Phone: 678-202-9535 Fax: 678-202-9501	Project Name: Chemtrade	Pace Quote Reference:
Requested Due Date/TAT: Normal TAT	Project Number: —	Pace Project Manager:
		Pace Profile #:

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER

☐ UST ☐ RCRA ☐ OTHER

Site Location STATE: GA

ITEM #	Section D Required Client Information — SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE	Matrix Codes: Drinking Water DW, Water WT, Waste Water WW, Product P, Soil/Solid SL, Oil OL, Wipe WP, Air AR, Tissue TS, Other OT	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED: COMPOSITE START DATE	COMPOSITE START TIME	COMPOSITE END/GRAB DATE	COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Requested Analysis Filtered (Y/N) Y/N	Analysis Test: Metals (All analytes)	Sulfate	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1	GCW-03D-1018	WT	G	—	—	10/25	1430		2	1		1						Y	1	1	N	
2	GCW-04D-1018	WT	G	—	—	10/25	1222		2	1		1						Y	1	1	N	
3	GCW-05-1018	WT	G	—	—	10/25	1245		2	1		1						Y	1	1	N	
4																						
5																						
6																						
7																						
8																						
9																						
10																						
11																						
12																						

WO#: 2610895

PM: BM Due Date: 11/06/18

CLIENT: Geosyntec

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS: Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
	JP Prock/Sampler	10/26/18	1245	M Rahman	10/26/18	1500				
							2.0	Y	Y	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Joel Prock

SIGNATURE of SAMPLER: JP Prock DATE Signed (MM/DD/YY): 10/26/18

ORIGINAL

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-C-010-rev.00, 09Nov2017

Sample Condition Upon Receipt

Face Analytical

Client Name: GeoSyntec Consult Project # _____

WO#: 2610895

PM: BM **Due Date: 11/06/18**

CLIENT: Geosyntec

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☑ Pace ☐ Other

Tracking #: _____

Custody Seal on Cooler/Box Present: ☑ yes ☐ no Seals intact: ☑ yes

Packing Material: ☐ Bubble Wrap ☐ Bubble Bags ☑ None ☐ Other _____

Thermometer Used 83 **Type of Ice:** (Wet) Blue None ☐ Samples on ice, cooling process has begun

Cooler Temperature 2.0 **Biological Tissue is Frozen:** Yes No

Temp should be above freezing to 6°C

Date and Initials of person examining contents: 10/26/18 MP

Comments:

Chain of Custody Present:	☑ Yes	☐ No	☐ N/A	1.
Chain of Custody Filled Out:	☑ Yes	☐ No	☐ N/A	2.
Chain of Custody Relinquished:	☑ Yes	☐ No	☐ N/A	3.
Sampler Name & Signature on COC:	☑ Yes	☐ No	☐ N/A	4.
Samples Arrived within Hold Time:	☑ Yes	☐ No	☐ N/A	5.
Short Hold Time Analysis (<72hr):	☐ Yes	☑ No	☐ N/A	6.
Rush Turn Around Time Requested:	☐ Yes	☑ No	☐ N/A	7.
Sufficient Volume:	☑ Yes	☐ No	☐ N/A	8.
Correct Containers Used:	☑ Yes	☐ No	☐ N/A	9.
-Pace Containers Used:	☑ Yes	☐ No	☐ N/A	
Containers Intact:	☑ Yes	☐ No	☐ N/A	10.
Filtered volume received for Dissolved tests	☐ Yes	☐ No	☑ N/A	11.
Sample Labels match COC:	☑ Yes	☐ No	☐ N/A	12.
-Includes date/time/ID/Analysis Matrix: W				
All containers needing preservation have been checked.	☑ Yes	☐ No	☐ N/A	13.
All containers needing preservation are found to be in compliance with EPA recommendation.	☑ Yes	☐ No	☐ N/A	
exceptions: VOA, coliform, TOC, O&G, WI-DRO (water)	☐ Yes	☑ No		Initial when completed _____ Lot # of added preservative _____
Samples checked for dechlorination:	☐ Yes	☐ No	☑ N/A	14.
Headspace in VOA Vials (>6mm):	☐ Yes	☐ No	☑ N/A	15.
Trip Blank Present:	☐ Yes	☐ No	☑ N/A	16.
Trip Blank Custody Seals Present	☐ Yes	☐ No	☑ N/A	
Pace Trip Blank Lot # (if purchased): _____				

Client Notification/ Resolution: Field Data Required? Y / N

Person Contacted: _____ Date/Time: _____

Comments/ Resolution: _____

Project Manager Review: _____ **Date:** _____

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers)

APPENDIX B

GROUNDWATER AND STORM DRAIN SAMPLING FORMS

Geosyntec consultants

Water Level Measurements

Project.: Chemtrade, East Point; Date: 10/24/18

Project No.: GR5060 ; Measured By: SDP/CR

Well	Time	DTW	Screen Interval	Notes
GCW-01S	0915	13.23	15-25	missing 1 bolt
GCW-01M	0900	13.23	34-44	missing 2 bolts
GCW-01D	0910	12.19	58-68	
GCW-02S	1119	4.81	16-26	
GCW-02D	1124	4.39	34-44	vault flooded
GCW-02V	1114	4.70	85.5-95.5	
GCW-03S	1117	5.01	11-21	1 bolt missing
GCW-03D	1121	4.68	38-28	missing 1 bolt
GCW-04S	1007	10.20	13-23	missing 2 bolts
GCW-04M	1002	9.86	30-40	missing all bolts
GCW-04D	CR 10 0947	10.00	50-60	missing 2 bolts
GCW-04V	0956	9.94	114-124	missing 1 bolt
GCW-05	1018	6.46	80-90	
EPW-01	1055	19.89	24.51[1]	vault cap missing; well plug has inadequate seal
EPW-02	1037	10.35	19.41[1]	missing vault cap; well ~~casing~~ vault filled w/ grass SP
EPW-03S	1045	10.06	12-22	
EPW-03M	1049	9.85	29-39	
EPW-03D	1043	9.82	46-56	missing 1 bolt
OW-1A	0915	15.05	23.5-33.5	

Notes:

1. "Screen Interval" measurements indicate total well depth below ground surface.

Ground Water Sampling Measurements for Low-Flow Purging

Site: Chemtrade
Monitoring Well: EPW-01
Sample ID: EPW-01-1018

Project No.: GR5060.2018
Sampling Date: 10/25/18
Sampler: J. Prock

Time	Start Purge	Readings	Start Samp.	End Samp.	Temperature (°C)	pH	Redox Potential (± mv)	Conductivity (mS/cm)	Turbidity (NTU)	DO (mg/L)	Appearance of Water
0935	X				–	–	–	–	–	–	clear
0940		X			17.30	3.91	412	0.270	5.29	1.00	"
0945		X			17.43	3.87	439	0.265	6.11	0.30	"
0950		X			17.54	3.87	448	0.263	4.31	0.05	"
0955		X			17.62	3.87	443	0.260	2.55	0.57	"
1000		X			17.79	3.91	429	0.255	3.72	0.39	"
1005		X			17.73	3.92	406	0.253	3.65	0.41	"
1010		X			17.64	3.93	390	0.252	1.89	0.37	"
1015		X			17.36	3.94	385	0.250	2.47	0.42	"
1020		X			17.27	3.94	378	0.248	2.33	0.45	"
1025			X	X	–	–	–	–	–	–	"
											JP

Meter Calibration

Meter Number: UMLARVO

Parameter	*Date & Time Calibrated & Acceptance*		*Calibration Results*
pH		±0.2 SU	pH 4:_____; pH 7:_____; pH 10:_____
Conductivity		±0.2 mS	4.48 mS/cm fluid reads _____
Turbidity		±2 NTU	0 NTU solution reads _____

Split, Blank, Duplicate, & Filtered Samples

Sample ID	Description
DUP-02-1018	Field Duplicate

Miscellaneous

Depth to Water (after sample): 21.83 ft
Total Purge Volume ~3 gal
Pump Rate: 350 ~~in~~ mL JP
1 min, 0 sec.

Weather: 56°F, Overcast

Notes: (well condition, nearby activities or changes in land use, odors, problems, deviations from plan, etc.)
Procedures followed during purging and sampling were in accordance with most recent USEPA SESD sampling procedures (SESDPROC-301-R4).

Ground Water Sampling Measurements for Low-Flow Purging

Site: Chemtrade
Monitoring Well: EPW-02
Sample ID: EPW-02-1018

Project No.: GR5060.2018
Sampling Date: 10/25/18
Sampler: CR / J.Prock

Time	Start Purge	Readings	Start Samp.	End Samp.	Temperature (°C)	pH	Redox Potential (± mv)	Conductivity (mS/cm)	Turbidity (NTU)	DO (mg/L)	Appearance of Water
0845	X				—	—	—	—	—	—	—
0920	X				—	—	—	—	—	—	—
0925		X			21.67	5.36	96	.120	13.9	.81	highly turbid
0930		X			21.83	5.29	94	.117	5.43	1.16	clear
0935		X			21.83	5.19	112	.112	3.86	1.61	"
0940		X			21.85	5.09	138	.110	2.22	1.85	"
0945		X			21.87	5.02	163	.109	3.01	1.99	"
0950		X			21.92	4.98	199	.108	2.03	2.06	"
0955		X			21.94	4.95	205	.108	1.89	2.07	"
1000		X			21.87	4.95	221	.108	1.51	2.11	"
1005		X			21.65	4.93	244	.106	.76	2.31	"
1010		X			21.54	4.87	253	.104	.57	2.56	"

Meter Calibration

Meter Number: YBVRAGF5

Parameter	*Date & Time Calibrated & Acceptance*		*Calibration Results*
pH		±0.2 SU	pH 4:_____; pH 7:_____; pH 10:_____
Conductivity		±0.2 mS	4.48 mS/cm fluid reads _____
Turbidity		±2 NTU	0 NTU solution reads _____

Split, Blank, Duplicate, & Filtered Samples

Sample ID	Description

Miscellaneous

Depth to Water (after sample): — ft
Total Purge Volume — gal
Pump Rate: 400 ~~in~~ mL (CR)
1 min, 80 sec.

Weather: 56°F, Overcast

Notes: (well condition, nearby activities or changes in land use, odors, problems, deviations from plan, etc.)

Procedures followed during purging and sampling were in accordance with most recent USEPA SESD sampling procedures (SESDPROC-301-R4). pump stopped at 0854 to change battery. water has a lot of sediment and smells like sulfur pump had to be stopped and restarted to adjust tubing to achieve steady flow

Ground Water Sampling Measurements for Low-Flow Purging

Site: Chemtrade
Monitoring Well: EPW-02
Sample ID: EPW-02-1018

Project No.: GR5060.2018
Sampling Date: 10/25/18
Sampler: CR / J. Prock

Time	Start Purge	Readings	Start Samp.	End Samp.	Temperature (°C)	pH	Redox Potential (± mv)	Conductivity (mS/cm)	Turbidity (NTU)	DO (mg/L)	Appearance of Water
1015		X			21.56	4.86	324	.104	.38	2.53	clear
1020		X			21.56	4.85	327	.105	.38	2.53	"
1025		X			21.62	4.85	326	.106	.31	2.30	"
1030			X		—	—	—	—	—	—	—
1033				X	—	—	—	—	—	—	—
										JPR	

Meter Calibration

Meter Number: YBURAGF5

Parameter	*Date & Time Calibrated & Acceptance*		*Calibration Results*
pH		±0.2 SU	pH 4:_____; pH 7:_____; pH 10:_____
Conductivity		±0.2 mS	4.48 mS/cm fluid reads _____
Turbidity		±2 NTU	0 NTU solution reads _____

Split, Blank, Duplicate, & Filtered Samples

Sample ID	Description

Miscellaneous

Depth to Water (after sample): 12.95 ft
Total Purge Volume ~7 gal
Pump Rate: 400 ~~in~~ mL (CR)
1 min, 00 sec.

Weather: 56°F, Overcast

Notes: (well condition, nearby activities or changes in land use, odors, problems, deviations from plan, etc.)
Procedures followed during purging and sampling were in accordance with most recent USEPA SESD sampling procedures (SESDPROC-301-R4).

Ground Water Sampling Measurements for Low-Flow Purging

Site: Chemtrade
Monitoring Well: EPW-03D
Sample ID: EPW-03D-1018

Project No.: GR5060.2018
Sampling Date: 10/24/2018
Sampler: J. Prack

Time	Start Purge	Readings	Start Samp.	End Samp.	Temperature (°C)	pH	Redox Potential (± mv)	Conductivity (mS/cm)	Turbidity (NTU)	DO (mg/L)	Appearance of Water
1310	X	–									JP
1320	X				–	–	–	–	–	–	clear
1330		X			23.25	5.58	465	0.321	0.32	4.14	clear
1335		X			22.93	5.56	473.	0.315	0.31	4.14	clear
1340		X			22.78	5.55	481	0.312	0.00	4.03	clear
1345		X			22.90	5.54	487	0.309	0.00	4.07	clear
1350		X			22.95	5.53	490	0.308	0.00	4.05	clear
1355			X	X	–	–	–	–	–	–	–
										JP	

Meter Calibration

Meter Number: YBDRA6F5

Parameter	*Date & Time Calibrated & Acceptance*		*Calibration Results*
pH		±0.2 SU	pH 4:_____; pH 7:_____; pH 10:_____
Conductivity		±0.2 mS	4.48 mS/cm fluid reads _____
Turbidity		±2 NTU	0 NTU solution reads _____

Split, Blank, Duplicate, & Filtered Samples

Sample ID	Description

Miscellaneous

Depth to Water (after sample): 10.22 ft
Total Purge Volume 22.5 gal
Pump Rate: 300 ~~in~~ mL/min (JP)
1 min, 0 sec.

Weather: 68°F, Sunny

Notes: (well condition, nearby activities or changes in land use, odors, problems, deviations from plan, etc.)

Procedures followed during purging and sampling were in accordance with most recent USEPA SESD sampling procedures (SESDPROC-301-R4).

Purging began @ 1310, stopped to replace seal in Horiba, restarted @ 1320
Well in good condition; vault lid missing 1 bolt

Ground Water Sampling Measurements for Low-Flow Purging

Site: Chemtrade
Monitoring Well: GCW-02D
Sample ID: GCW-02D-1018

Project No.: GR5060.2018
Sampling Date: 10/25/18
Sampler: CR/J. Prock

Time	Start Purge	Readings	Start Samp.	End Samp.	Temper-ature (°C)	pH	Redox Potential (± mv)	Conduc-tivity (mS/cm)	Turbidity (NTU)	DO (mg/L)	Appearance of Water
1405	X				—	—	—	—	—	—	—
1410		X			19.11	3.00	517	2.43	1.03	0.00	clear
1415		X			19.19	3.01	518	2.34	.88	0.00	"
1420		X			19.20	3.01	518	2.25	.75	0.00	"
1425		X			19.26	3.02	517	2.18	.76	0.00	"
1430		X			19.28	3.03	518	2.13	.80	0.00	"
1435		X			19.31	3.04	516	2.09	.66	0.00	"
1437			X		—	—	—	—	—	—	—
1440				X	—	—	—	—	—	—	—

JP

Meter Calibration

Meter Number: YBDRAGF5

Parameter	*Date & Time Calibrated & Acceptance*		*Calibration Results*
pH		±0.2 SU	pH 4:_____; pH 7:_____; pH 10:_____
Conductivity		±0.2 mS	4.48 mS/cm fluid reads _____
Turbidity		±2 NTU	0 NTU solution reads _____

Split, Blank, Duplicate, & Filtered Samples

Sample ID	Description

Miscellaneous

Depth to Water (after sample): 4.47 ft
Total Purge Volume ≈ 3 gal
Pump Rate: 350 ~~in~~ mL (CR)
1 min, 00 sec.

Weather: 60°F, Overcast

Notes: (well condition, nearby activities or changes in land use, odors, problems, deviations from plan, etc.)
Procedures followed during purging and sampling were in accordance with most recent USEPA SESD sampling procedures (SESDPROC-301-R4).

Ground Water Sampling Measurements for Low-Flow Purging

Site: Chemtrade
Monitoring Well: GCW-030
Sample ID: GCW-030-1018

Project No.: GR5060.2018
Sampling Date: 10/25/18
Sampler: J. Prock

Time	Start Purge	Readings	Start Samp.	End Samp.	Temperature (°C)	pH	Redox Potential (± mv)	Conductivity (mS/cm)	Turbidity (NTU)	DO (mg/L)	Appearance of Water
1405	X				-	-	-	-	-	-	clear
1410		X			19.10	3.12	458	3.25	1.90	0.46	clear
1415		X			18.98	3.10	481	3.28	2.24	0.00	"
1420		X			19.02	3.09	485	3.28	14.2	0.00	"
1425		X			19.11	3.09	472	3.27	23.4	0.00	"
1430			X	X	—	—	—	—	—	—	"

JP

Meter Calibration

Meter Number: UMLARUO

Parameter	*Date & Time Calibrated & Acceptance*		*Calibration Results*
pH		±0.2 SU	pH 4:_____; pH 7:_____; pH 10:_____
Conductivity		±0.2 mS	4.48 mS/cm fluid reads _____
Turbidity		±2 NTU	0 NTU solution reads _____

Split, Blank, Duplicate, & Filtered Samples

Sample ID	Description

Miscellaneous

Depth to Water (after sample): 5.04 ft
Total Purge Volume ~1.5 gal
Pump Rate: 300 ~~in~~ mL (JP)
1 min, 0 sec.

Weather: 60°F Overcast

Notes: (well condition, nearby activities or changes in land use, odors, problems, deviations from plan, etc.)
Procedures followed during purging and sampling were in accordance with most recent USEPA SESD sampling procedures (SESDPROC-301-R4).

missing 1 bolt

Ground Water Sampling Measurements for Low-Flow Purging

Site: Chemtrade
Monitoring Well: GCW-04D
Sample ID: GCW-04D-1018

Project No.: GR5060.2018
Sampling Date: 10/25/18
Sampler: CR

Time	Start Purge	Readings	Start Samp.	End Samp.	Temperature (°C)	pH	Redox Potential (± mv)	Conductivity (mS/cm)	Turbidity (NTU)	DO (mg/L)	Appearance of Water
1135	X				—	—	—	—	—	—	—
1145		X			19.92	5.85	368	.139	7.41	1.41	clear
1150		X			19.98	5.85	370	.140	6.08	1.06	"
1155		X			19.96	5.82	374	.140	4.92	.96	"
1200		X			19.90	5.63	383	0.141	4.44	0.76	"
1205		X			19.77	3.92	442	1.91	4.30	0.00	"
1210		X			20.02	3.02	435	2.41	4.12	0.00	"
1215		X			20.02	3.02	425	2.49	4.4	0.00	"
1220		X			19.99	3.03	420	2.52	4.14	0.00	"
1222			X	X	—	—	—	—	—	—	—
										JP	

Meter Calibration

Meter Number: YBDRAGF5

Parameter	*Date & Time Calibrated*	*Acceptance*	*Calibration Results*
pH		±0.2 SU	pH 4: ____; pH 7: ____; pH 10: ____
Conductivity		±0.2 mS	4.48 mS/cm fluid reads ____
Turbidity		±2 NTU	0 NTU solution reads ____

Split, Blank, Duplicate, & Filtered Samples

Sample ID	Description

Miscellaneous

Depth to Water (after sample): 11.82 ft
Total Purge Volume ≈ 3 gal
Pump Rate: 300 ~~in~~ mL (CR)
1 min, 00 sec.

Weather: 57°F, Overcast

Notes: (well condition, nearby activities or changes in land use, odors, problems, deviations from plan, etc.)
Procedures followed during purging and sampling were in accordance with most recent USEPA SESD sampling procedures (SESDPROC-301-R4).

Ground Water Sampling Measurements for Low-Flow Purging

Site: Chemtrade
Monitoring Well: GCW-05
Sample ID: GCW-05-1018

Project No.: GR5060.2018
Sampling Date: 10/25/18
Sampler: S. Prock

Time	Start Purge	Readings	Start Samp.	End Samp.	Temperature (°C)	pH	Redox Potential (± mv)	Conductivity (mS/cm)	Turbidity (NTU)	DO (mg/L)	Appearance of Water
1140	X				–	–	–	–	–	–	clear
1145		X			18.64	6.43	-47	1.22	4.45	6.49	clear
1150		X			18.64	6.56	-69	1.28	21.4	0.02	"
1155		X			18.97	6.59	-73	1.29	4.48	2.33	"
1200		X			18.91	6.60	-80	1.29	4.59	0.00	"
1205		X			18.92	6.60	-82	1.29	4.62	0.00	"
1210		X			18.94	6.61	-82	1.28	3.81	0.00	"
1215			X	X	–	–	–	–	–	–	"

SP

Meter Calibration

Meter Number: UMLARUO

Parameter	*Date & Time Calibrated & Acceptance*		*Calibration Results*
pH		±0.2 SU	pH 4:_____; pH 7:_____; pH 10:_____
Conductivity		±0.2 mS	4.48 mS/cm fluid reads _____
Turbidity		±2 NTU	0 NTU solution reads _____

Split, Blank, Duplicate, & Filtered Samples

Sample ID	Description

Miscellaneous

Depth to Water (after sample): 18.06 ft
Total Purge Volume ~2.5 gal
Pump Rate: 300 ~~in~~ mL (SP)
1 min, 0 sec.

Weather: 57°F, Overcast

Notes: (well condition, nearby activities or changes in land use, odors, problems, deviations from plan, etc.)
Procedures followed during purging and sampling were in accordance with most recent USEPA SESD sampling procedures (SESDPROC-301-R4).

Purge water has sulfur odor.

Ground Water Sampling Measurements for Low-Flow Purging

Site: Chemtrade
Monitoring Well: GCW-01D
Sample ID: GCW-01D-1018

Project No.: GR5060.2018
Sampling Date: 10/26/18
Sampler: J. Prock

Time	Start Purge	Readings	Start Samp.	End Samp.	Temperature (°C)	pH	Redox Potential (± mv)	Conductivity (mS/cm)	Turbidity (NTU)	DO (mg/L)	Appearance of Water
0820	X				–	–	–	–	–	–	clear
0825		X			17.85	3.77	451	0.419	4.67	11.65	"
0830		X			18.59	3.76	465	0.410	1.66	9.53	"
0835		X			18.55	3.74	472	0.408	1.76	9.11	"
0840		X			18.03	3.73	476	0.407	2.12	8.14	"
0845		X (JP)			Pump battery replaced						(JP)
0850		X			18.12	3.73	479	0.413	3.29	8.66	clear
0855		X			18.17	3.73	481	0.406	1.40	8.29	"
0900		X			17.84	3.72	483	0.406	1.56	8.40	"
0905			X	X	–	–	–	–	–	–	"
											(JP)

Meter Calibration

Meter Number: UMLARJO

Parameter	*Date & Time Calibrated & Acceptance*		*Calibration Results*
pH		±0.2 SU	pH 4:_____; pH 7:_____; pH 10:_____
Conductivity		±0.2 mS	4.48 mS/cm fluid reads _____
Turbidity		±2 NTU	0 NTU solution reads _____

Split, Blank, Duplicate, & Filtered Samples

Sample ID	Description

Miscellaneous

Depth to Water (after sample): 12.77 (JP) ft
Total Purge Volume ~2.5 gal
Pump Rate: 300 ~~in~~ mL (JP)
1 min, 0 sec.

Weather: 49°F, Light rain

Notes: (well condition, nearby activities or changes in land use, odors, problems, deviations from plan, etc.)
Procedures followed during purging and sampling were in accordance with most recent USEPA SESD sampling procedures (SESDPROC-301-R4).

0845 Pump battery replaced

Ground Water Sampling Measurements for Low-Flow Purging

Site: Chemtrade
Monitoring Well: OW-1A
Sample ID: OW-1A-1018

Project No.: GR5060.2018
Sampling Date: 10/26/18
Sampler: J. Brock

Time	Start Purge	Readings	Start Samp.	End Samp.	Temperature (°C)	pH	Redox Potential (± mv)	Conductivity (mS/cm)	Turbidity (NTU)	DO (mg/L)	Appearance of Water
0920	X										clear
0925		X			17.81	4.03	453	0.164	5.74	8.14	"
0930		X			13.18	4.03	462	0.160	6.66	7.25	"
0935		X			18.27	4.03	466	0.160	6.26	7.21	"
0940		X			18.21	4.03	463	0.160	6.91	7.33	"
0945			X	X							
										SP	

Meter Calibration

Meter Number: UMLARVO

Parameter	*Date & Time Calibrated & Acceptance*		*Calibration Results*
pH		±0.2 SU	pH 4:_____; pH 7:_____; pH 10:_____
Conductivity		±0.2 mS	4.48 mS/cm fluid reads _____
Turbidity		±2 NTU	0 NTU solution reads _____

Split, Blank, Duplicate, & Filtered Samples

Sample ID	Description

Miscellaneous

Depth to Water (after sample): 14.87 ft
Total Purge Volume ~1.5 gal
Pump Rate: 300 ~~in~~ mL
1 min, 0 sec.

Weather: 47°F, Heavy Rain

Notes: (well condition, nearby activities or changes in land use, odors, problems, deviations from plan, etc.)
Procedures followed during purging and sampling were in accordance with most recent USEPA SESD sampling procedures (SESDPROC-301-R4).

Stormwater Sampling Measurements

Site: Chemtrade
Project No.: GR5060.2018
Stormwater Location: SW-02
Sampling Date: 10/25/18
Sample ID: SW-02-1018
Sampler: J. Prock

Time	Start Purge	Readings	Start Samp.	End Samp.	Temperature (°C)	pH	Redox Potential (± mv)	Conductivity (mS/cm)	Turbidity (NTU)	DO (mg/L)	Appearance of Water
1455		X			18.45	3.82	378	1.63	3.52	9.72	clear
1500		X			18.28	3.88	375	1.61	2.57	10.20	"
1505			X	X	—	—	—	—	—	—	"

JP

Meter Calibration

Meter Number: UMLARVO

Parameter	*Date & Time Calibrated & Acceptance*		*Calibration Results*
pH		±0.2 SU	pH 4:_____; pH 7:_____; pH 10:_____
Conductivity		±0.2 mS	4.48 mS/cm fluid reads _____
Turbidity		±2 NTU	0 NTU solution reads _____

Split, Blank, Duplicate, & Filtered Samples

Sample ID	Description

Miscellaneous

Pump Rate: 500 ~~in~~ mL (JP)

1 min, 0 sec.

Weather: 60°F, Overcast

Notes: (well condition, nearby activities or changes in land use, odors, problems, deviations from plan, etc.)

water is clear

Stormwater Sampling Measurements

Site: Chemtrade
Stormwater Location: SW-06
Sample ID: SW-06-1018

Project No.: GR5060.2018
Sampling Date: 10/24/18
Sampler: J. Prock

Time	Start Purge	Readings	Start Samp.	End Samp.	Temperature (°C)	pH	Redox Potential (± mv)	Conductivity (mS/cm)	Turbidity (NTU)	DO (mg/L)	Appearance of Water
1640		X			22.33	3.46	512	1.96	3.65	8.70	clear
1645		X			22.25	3.43	489	2.02	2.58	6.62	clear
1650			X	X	—	—	—	—	—	—	clear

SP

Meter Calibration

Meter Number: YBIXA6P5

Parameter	*Date & Time Calibrated & Acceptance*		*Calibration Results*
pH		±0.2 SU	pH 4:_____; pH 7:_____; pH 10:_____
Conductivity		±0.2 mS	4.48 mS/cm fluid reads _____
Turbidity		±2 NTU	0 NTU solution reads _____

Split, Blank, Duplicate, & Filtered Samples

Sample ID	Description
DUP-01-1018	Field Duplicate

Miscellaneous

Pump Rate: 500 ~~in~~ mL (SP)
1 min, 0 sec.

Weather: 68° F, Sunny

Notes: (well condition, nearby activities or changes in land use, odors, problems, deviations from plan, etc.)

water is clear

Stormwater Sampling Measurements

Site: Chemtrade
Project No.: GR5060.2018
Stormwater Location: SW-07
Sampling Date: 10/24/18
Sample ID: SW-07-1018
Sampler: J. Prock

Time	Start Purge	Readings	Start Samp.	End Samp.	Temperature (°C)	pH	Redox Potential (± mv)	Conductivity (mS/cm)	Turbidity (NTU)	DO (mg/L)	Appearance of Water
~~1405~~ @1605		X			21.30	3.82	464	0.733	0.61	10.96	clear, slightly turbid
~~1410~~ @1610		X			21.15	3.86	462	0.735	0.21	8.50	"
~~1415~~ @1615			X	X	—	—	—	—	—	—	"

JP

Meter Calibration

Meter Number: YB DRA 6F5

Parameter	*Date & Time Calibrated & Acceptance*		*Calibration Results*
pH		±0.2 SU	pH 4: ____; pH 7: ____; pH 10: ____
Conductivity		±0.2 mS	4.48 mS/cm fluid reads ____
Turbidity		±2 NTU	0 NTU solution reads ____

Split, Blank, Duplicate, & Filtered Samples

Sample ID	Description

Miscellaneous

Pump Rate: — in
— min, — sec.

Weather: 68°F, Sunny

Notes: (well condition, nearby activities or changes in land use, odors, problems, deviations from plan, etc.)

slightly turbid grab sample taken directly from stream

Stormwater Sampling Measurements

Site: Chemtrade
Project No.: GR5060.2018
Stormwater Location: SW-09
Sampling Date: 10/25/18
Sample ID: SW-09-1018
Sampler: J. Prock

Time	Start Purge	Readings	Start Samp.	End Samp.	Temperature (°C)	pH	Redox Potential (± mv)	Conductivity (mS/cm)	Turbidity (NTU)	DO (mg/L)	Appearance of Water
0900		X			20.45	5.90	106	0.359	3.30	8.66	slightly turbid, light brown
0905		X			20.11	6.36	75	0.346	3.70	9.05	slightly turbid
0910			X	X	-	-	-	-	-	-	"

JP

Meter Calibration

Meter Number: VMLARVO

Parameter	*Date & Time Calibrated*	*Acceptance*	*Calibration Results*
pH	Not calibrated	±0.2 SU	pH 4: 3.66 ; pH 7: - ; pH 10: -
Conductivity	/	±0.2 mS	4.48 mS/cm fluid reads 4.54
Turbidity	/	±2 NTU	0 NTU solution reads -

Split, Blank, Duplicate, & Filtered Samples

Sample ID	Description

Miscellaneous

Pump Rate: 400 ~~in~~ mL (JP)
1 min, 0 sec.

Weather: 52°F, Overcast

Notes: (well condition, nearby activities or changes in land use, odors, problems, deviations from plan, etc.)

Water slightly turbid

APPENDIX C

MANN-KENDALL TREND ANALYSIS DATA

(provided in electronic submittal only)

Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: EPW-01

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
15	14	1	1	0
15	14	1	2	0
20	14	6	3	0
10.2	14	-3.8	3	1
11	14	-3	3	2
12.9	14	-1.1	3	3
11.6	14	-2.4	3	4
11	14	-3	3	5
13.5	14	-0.5	3	6
13.2	14	-0.8	3	7
12.5	14	-1.5	3	8
12.8	14	-1.2	3	9
12.9	14	-1.1	3	10
16.9	14	2.9	4	10
13.4	14	-0.6	4	11
21.4	14	7.4	5	11
8.44	14	-5.56	5	12
14	14	0	5	12
12.9	14	-1.1	5	13
14.2	14	0.2	6	13
13.8	14	-0.2	6	14
14.5	14	0.5	7	14
13.9	14	-0.1	7	15
15.8	14	1.8	8	15
12.9	14	-1.1	8	16
13.7	14	-0.3	8	17
11.7	14	-2.3	8	18
14	14	0	8	18
15	15	0	8	18
20	15	5	9	18
10.2	15	-4.8	9	19
11	15	-4	9	20
12.9	15	-2.1	9	21
11.6	15	-3.4	9	22
11	15	-4	9	23
13.5	15	-1.5	9	24
13.2	15	-1.8	9	25
12.5	15	-2.5	9	26
12.8	15	-2.2	9	27
12.9	15	-2.1	9	28
16.9	15	1.9	10	28
13.4	15	-1.6	10	29
21.4	15	6.4	11	29
8.44	15	-6.56	11	30
14	15	-1	11	31
12.9	15	-2.1	11	32

14.2	15	-0.8	11	33
13.8	15	-1.2	11	34
14.5	15	-0.5	11	35
13.9	15	-1.1	11	36
15.8	15	0.8	12	36
12.9	15	-2.1	12	37
13.7	15	-1.3	12	38
11.7	15	-3.3	12	39
14	15	-1	12	40
20	15	5	13	40
10.2	15	-4.8	13	41
11	15	-4	13	42
12.9	15	-2.1	13	43
11.6	15	-3.4	13	44
11	15	-4	13	45
13.5	15	-1.5	13	46
13.2	15	-1.8	13	47
12.5	15	-2.5	13	48
12.8	15	-2.2	13	49
12.9	15	-2.1	13	50
16.9	15	1.9	14	50
13.4	15	-1.6	14	51
21.4	15	6.4	15	51
8.44	15	-6.56	15	52
14	15	-1	15	53
12.9	15	-2.1	15	54
14.2	15	-0.8	15	55
13.8	15	-1.2	15	56
14.5	15	-0.5	15	57
13.9	15	-1.1	15	58
15.8	15	0.8	16	58
12.9	15	-2.1	16	59
13.7	15	-1.3	16	60
11.7	15	-3.3	16	61
14	15	-1	16	62
10.2	20	-9.8	16	63
11	20	-9	16	64
12.9	20	-7.1	16	65
11.6	20	-8.4	16	66
11	20	-9	16	67
13.5	20	-6.5	16	68
13.2	20	-6.8	16	69
12.5	20	-7.5	16	70
12.8	20	-7.2	16	71
12.9	20	-7.1	16	72
16.9	20	-3.1	16	73
13.4	20	-6.6	16	74
21.4	20	1.4	17	74
8.44	20	-11.56	17	75
14	20	-6	17	76
12.9	20	-7.1	17	77
14.2	20	-5.8	17	78
13.8	20	-6.2	17	79
14.5	20	-5.5	17	80
13.9	20	-6.1	17	81
15.8	20	-4.2	17	82
12.9	20	-7.1	17	83

13.7	20	-6.3	17	84
11.7	20	-8.3	17	85
14	20	-6	17	86
11	10.2	0.8	18	86
12.9	10.2	2.7	19	86
11.6	10.2	1.4	20	86
11	10.2	0.8	21	86
13.5	10.2	3.3	22	86
13.2	10.2	3	23	86
12.5	10.2	2.3	24	86
12.8	10.2	2.6	25	86
12.9	10.2	2.7	26	86
16.9	10.2	6.7	27	86
13.4	10.2	3.2	28	86
21.4	10.2	11.2	29	86
8.44	10.2	-1.76	29	87
14	10.2	3.8	30	87
12.9	10.2	2.7	31	87
14.2	10.2	4	32	87
13.8	10.2	3.6	33	87
14.5	10.2	4.3	34	87
13.9	10.2	3.7	35	87
15.8	10.2	5.6	36	87
12.9	10.2	2.7	37	87
13.7	10.2	3.5	38	87
11.7	10.2	1.5	39	87
14	10.2	3.8	40	87
12.9	11	1.9	41	87
11.6	11	0.6	42	87
11	11	0	42	87
13.5	11	2.5	43	87
13.2	11	2.2	44	87
12.5	11	1.5	45	87
12.8	11	1.8	46	87
12.9	11	1.9	47	87
16.9	11	5.9	48	87
13.4	11	2.4	49	87
21.4	11	10.4	50	87
8.44	11	-2.56	50	88
14	11	3	51	88
12.9	11	1.9	52	88
14.2	11	3.2	53	88
13.8	11	2.8	54	88
14.5	11	3.5	55	88
13.9	11	2.9	56	88
15.8	11	4.8	57	88
12.9	11	1.9	58	88
13.7	11	2.7	59	88
11.7	11	0.7	60	88
14	11	3	61	88
11.6	12.9	-1.3	61	89
11	12.9	-1.9	61	90
13.5	12.9	0.6	62	90
13.2	12.9	0.3	63	90
12.5	12.9	-0.4	63	91
12.8	12.9	-0.1	63	92

12.9	12.9	0	63	92
16.9	12.9	4	64	92
13.4	12.9	0.5	65	92
21.4	12.9	8.5	66	92
8.44	12.9	-4.46	66	93
14	12.9	1.1	67	93
12.9	12.9	0	67	93
14.2	12.9	1.3	68	93
13.8	12.9	0.9	69	93
14.5	12.9	1.6	70	93
13.9	12.9	1	71	93
15.8	12.9	2.9	72	93
12.9	12.9	0	72	93
13.7	12.9	0.8	73	93
11.7	12.9	-1.2	73	94
14	12.9	1.1	74	94
11	11.6	-0.6	74	95
13.5	11.6	1.9	75	95
13.2	11.6	1.6	76	95
12.5	11.6	0.9	77	95
12.8	11.6	1.2	78	95
12.9	11.6	1.3	79	95
16.9	11.6	5.3	80	95
13.4	11.6	1.8	81	95
21.4	11.6	9.8	82	95
8.44	11.6	-3.16	82	96
14	11.6	2.4	83	96
12.9	11.6	1.3	84	96
14.2	11.6	2.6	85	96
13.8	11.6	2.2	86	96
14.5	11.6	2.9	87	96
13.9	11.6	2.3	88	96
15.8	11.6	4.2	89	96
12.9	11.6	1.3	90	96
13.7	11.6	2.1	91	96
11.7	11.6	0.1	92	96
14	11.6	2.4	93	96
13.5	11	2.5	94	96
13.2	11	2.2	95	96
12.5	11	1.5	96	96
12.8	11	1.8	97	96
12.9	11	1.9	98	96
16.9	11	5.9	99	96
13.4	11	2.4	100	96
21.4	11	10.4	101	96
8.44	11	-2.56	101	97
14	11	3	102	97
12.9	11	1.9	103	97
14.2	11	3.2	104	97
13.8	11	2.8	105	97
14.5	11	3.5	106	97
13.9	11	2.9	107	97
15.8	11	4.8	108	97
12.9	11	1.9	109	97
13.7	11	2.7	110	97
11.7	11	0.7	111	97
14	11	3	112	97

13.2	13.5	-0.3	112	98
12.5	13.5	-1	112	99
12.8	13.5	-0.7	112	100
12.9	13.5	-0.6	112	101
16.9	13.5	3.4	113	101
13.4	13.5	-0.1	113	102
21.4	13.5	7.9	114	102
8.44	13.5	-5.06	114	103
14	13.5	0.5	115	103
12.9	13.5	-0.6	115	104
14.2	13.5	0.7	116	104
13.8	13.5	0.3	117	104
14.5	13.5	1	118	104
13.9	13.5	0.4	119	104
15.8	13.5	2.3	120	104
12.9	13.5	-0.6	120	105
13.7	13.5	0.2	121	105
11.7	13.5	-1.8	121	106
14	13.5	0.5	122	106
12.5	13.2	-0.7	122	107
12.8	13.2	-0.4	122	108
12.9	13.2	-0.3	122	109
16.9	13.2	3.7	123	109
13.4	13.2	0.2	124	109
21.4	13.2	8.2	125	109
8.44	13.2	-4.76	125	110
14	13.2	0.8	126	110
12.9	13.2	-0.3	126	111
14.2	13.2	1	127	111
13.8	13.2	0.6	128	111
14.5	13.2	1.3	129	111
13.9	13.2	0.7	130	111
15.8	13.2	2.6	131	111
12.9	13.2	-0.3	131	112
13.7	13.2	0.5	132	112
11.7	13.2	-1.5	132	113
14	13.2	0.8	133	113
12.8	12.5	0.3	134	113
12.9	12.5	0.4	135	113
16.9	12.5	4.4	136	113
13.4	12.5	0.9	137	113
21.4	12.5	8.9	138	113
8.44	12.5	-4.06	138	114
14	12.5	1.5	139	114
12.9	12.5	0.4	140	114
14.2	12.5	1.7	141	114
13.8	12.5	1.3	142	114
14.5	12.5	2	143	114
13.9	12.5	1.4	144	114
15.8	12.5	3.3	145	114
12.9	12.5	0.4	146	114
13.7	12.5	1.2	147	114
11.7	12.5	-0.8	147	115
14	12.5	1.5	148	115
12.9	12.8	0.1	149	115

16.9	12.8	4.1	150	115
13.4	12.8	0.6	151	115
21.4	12.8	8.6	152	115
8.44	12.8	-4.36	152	116
14	12.8	1.2	153	116
12.9	12.8	0.1	154	116
14.2	12.8	1.4	155	116
13.8	12.8	1	156	116
14.5	12.8	1.7	157	116
13.9	12.8	1.1	158	116
15.8	12.8	3	159	116
12.9	12.8	0.1	160	116
13.7	12.8	0.9	161	116
11.7	12.8	-1.1	161	117
14	12.8	1.2	162	117
16.9	12.9	4	163	117
13.4	12.9	0.5	164	117
21.4	12.9	8.5	165	117
8.44	12.9	-4.46	165	118
14	12.9	1.1	166	118
12.9	12.9	0	166	118
14.2	12.9	1.3	167	118
13.8	12.9	0.9	168	118
14.5	12.9	1.6	169	118
13.9	12.9	1	170	118
15.8	12.9	2.9	171	118
12.9	12.9	0	171	118
13.7	12.9	0.8	172	118
11.7	12.9	-1.2	172	119
14	12.9	1.1	173	119
13.4	16.9	-3.5	173	120
21.4	16.9	4.5	174	120
8.44	16.9	-8.46	174	121
14	16.9	-2.9	174	122
12.9	16.9	-4	174	123
14.2	16.9	-2.7	174	124
13.8	16.9	-3.1	174	125
14.5	16.9	-2.4	174	126
13.9	16.9	-3	174	127
15.8	16.9	-1.1	174	128
12.9	16.9	-4	174	129
13.7	16.9	-3.2	174	130
11.7	16.9	-5.2	174	131
14	16.9	-2.9	174	132
21.4	13.4	8	175	132
8.44	13.4	-4.96	175	133
14	13.4	0.6	176	133
12.9	13.4	-0.5	176	134
14.2	13.4	0.8	177	134
13.8	13.4	0.4	178	134
14.5	13.4	1.1	179	134
13.9	13.4	0.5	180	134
15.8	13.4	2.4	181	134
12.9	13.4	-0.5	181	135
13.7	13.4	0.3	182	135
11.7	13.4	-1.7	182	136

14	13.4	0.6	183	136
8.44	21.4	-12.96	183	137
14	21.4	-7.4	183	138
12.9	21.4	-8.5	183	139
14.2	21.4	-7.2	183	140
13.8	21.4	-7.6	183	141
14.5	21.4	-6.9	183	142
13.9	21.4	-7.5	183	143
15.8	21.4	-5.6	183	144
12.9	21.4	-8.5	183	145
13.7	21.4	-7.7	183	146
11.7	21.4	-9.7	183	147
14	21.4	-7.4	183	148
14	8.44	5.56	184	148
12.9	8.44	4.46	185	148
14.2	8.44	5.76	186	148
13.8	8.44	5.36	187	148
14.5	8.44	6.06	188	148
13.9	8.44	5.46	189	148
15.8	8.44	7.36	190	148
12.9	8.44	4.46	191	148
13.7	8.44	5.26	192	148
11.7	8.44	3.26	193	148
14	8.44	5.56	194	148
12.9	14	-1.1	194	149
14.2	14	0.2	195	149
13.8	14	-0.2	195	150
14.5	14	0.5	196	150
13.9	14	-0.1	196	151
15.8	14	1.8	197	151
12.9	14	-1.1	197	152
13.7	14	-0.3	197	153
11.7	14	-2.3	197	154
14	14	0	197	154
14.2	12.9	1.3	198	154
13.8	12.9	0.9	199	154
14.5	12.9	1.6	200	154
13.9	12.9	1	201	154
15.8	12.9	2.9	202	154
12.9	12.9	0	202	154
13.7	12.9	0.8	203	154
11.7	12.9	-1.2	203	155
14	12.9	1.1	204	155
13.8	14.2	-0.4	204	156
14.5	14.2	0.3	205	156
13.9	14.2	-0.3	205	157
15.8	14.2	1.6	206	157
12.9	14.2	-1.3	206	158
13.7	14.2	-0.5	206	159
11.7	14.2	-2.5	206	160
14	14.2	-0.2	206	161
14.5	13.8	0.7	207	161
13.9	13.8	0.1	208	161

15.8	13.8	2	209	161
12.9	13.8	-0.9	209	162
13.7	13.8	-0.1	209	163
11.7	13.8	-2.1	209	164
14	13.8	0.2	210	164
13.9	14.5	-0.6	210	165
15.8	14.5	1.3	211	165
12.9	14.5	-1.6	211	166
13.7	14.5	-0.8	211	167
11.7	14.5	-2.8	211	168
14	14.5	-0.5	211	169
15.8	13.9	1.9	212	169
12.9	13.9	-1	212	170
13.7	13.9	-0.2	212	171
11.7	13.9	-2.2	212	172
14	13.9	0.1	213	172
12.9	15.8	-2.9	213	173
13.7	15.8	-2.1	213	174
11.7	15.8	-4.1	213	175
14	15.8	-1.8	213	176
13.7	12.9	0.8	214	176
11.7	12.9	-1.2	214	177
14	12.9	1.1	215	177
11.7	13.7	-2	215	178
14	13.7	0.3	216	178
14	11.7	2.3	217	178

S Statistic = 217 - 178 = 39

Tied Group	Value	Members
1	14	3
2	15	2
3	11	2
4	12.9	4

Time Period	Observations
3/12/2008	1
5/12/2008	1
9/23/2008	1
10/29/2008	1
4/29/2009	1
5/15/2009	1
9/23/2009	1
12/8/2009	1
2/25/2010	1
4/15/2010	1
8/11/2010	1
11/23/2010	1
3/10/2011	1
5/24/2011	1
9/1/2011	1

4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/19/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 258
B = 0
C = 30
D = 0
E = 22
F = 0
a = 51156
b = 197316
c = 1624
Group Variance = 2827.67
Z-Score = 0.714611
Comparison Level at 95% confidence level = -1.65463 (downward trend)
0.714611 >= -1.65463 indicating no evidence of a downward trend

Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: EPW-01

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
15	14	1	1	0
15	14	1	2	0
20	14	6	3	0
10.2	14	-3.8	3	1
11	14	-3	3	2
12.9	14	-1.1	3	3
11.6	14	-2.4	3	4
11	14	-3	3	5
13.5	14	-0.5	3	6
13.2	14	-0.8	3	7
12.5	14	-1.5	3	8
12.8	14	-1.2	3	9
12.9	14	-1.1	3	10
16.9	14	2.9	4	10
13.4	14	-0.6	4	11
21.4	14	7.4	5	11
8.44	14	-5.56	5	12
14	14	0	5	12
12.9	14	-1.1	5	13
14.2	14	0.2	6	13
13.8	14	-0.2	6	14
14.5	14	0.5	7	14
13.9	14	-0.1	7	15
15.8	14	1.8	8	15
12.9	14	-1.1	8	16
13.7	14	-0.3	8	17
11.7	14	-2.3	8	18
14	14	0	8	18
15	15	0	8	18
20	15	5	9	18
10.2	15	-4.8	9	19
11	15	-4	9	20
12.9	15	-2.1	9	21
11.6	15	-3.4	9	22
11	15	-4	9	23
13.5	15	-1.5	9	24
13.2	15	-1.8	9	25
12.5	15	-2.5	9	26
12.8	15	-2.2	9	27
12.9	15	-2.1	9	28
16.9	15	1.9	10	28
13.4	15	-1.6	10	29
21.4	15	6.4	11	29
8.44	15	-6.56	11	30
14	15	-1	11	31
12.9	15	-2.1	11	32

14.2	15	-0.8	11	33
13.8	15	-1.2	11	34
14.5	15	-0.5	11	35
13.9	15	-1.1	11	36
15.8	15	0.8	12	36
12.9	15	-2.1	12	37
13.7	15	-1.3	12	38
11.7	15	-3.3	12	39
14	15	-1	12	40
20	15	5	13	40
10.2	15	-4.8	13	41
11	15	-4	13	42
12.9	15	-2.1	13	43
11.6	15	-3.4	13	44
11	15	-4	13	45
13.5	15	-1.5	13	46
13.2	15	-1.8	13	47
12.5	15	-2.5	13	48
12.8	15	-2.2	13	49
12.9	15	-2.1	13	50
16.9	15	1.9	14	50
13.4	15	-1.6	14	51
21.4	15	6.4	15	51
8.44	15	-6.56	15	52
14	15	-1	15	53
12.9	15	-2.1	15	54
14.2	15	-0.8	15	55
13.8	15	-1.2	15	56
14.5	15	-0.5	15	57
13.9	15	-1.1	15	58
15.8	15	0.8	16	58
12.9	15	-2.1	16	59
13.7	15	-1.3	16	60
11.7	15	-3.3	16	61
14	15	-1	16	62
10.2	20	-9.8	16	63
11	20	-9	16	64
12.9	20	-7.1	16	65
11.6	20	-8.4	16	66
11	20	-9	16	67
13.5	20	-6.5	16	68
13.2	20	-6.8	16	69
12.5	20	-7.5	16	70
12.8	20	-7.2	16	71
12.9	20	-7.1	16	72
16.9	20	-3.1	16	73
13.4	20	-6.6	16	74
21.4	20	1.4	17	74
8.44	20	-11.56	17	75
14	20	-6	17	76
12.9	20	-7.1	17	77
14.2	20	-5.8	17	78
13.8	20	-6.2	17	79
14.5	20	-5.5	17	80
13.9	20	-6.1	17	81
15.8	20	-4.2	17	82
12.9	20	-7.1	17	83

13.7	20	-6.3	17	84
11.7	20	-8.3	17	85
14	20	-6	17	86
11	10.2	0.8	18	86
12.9	10.2	2.7	19	86
11.6	10.2	1.4	20	86
11	10.2	0.8	21	86
13.5	10.2	3.3	22	86
13.2	10.2	3	23	86
12.5	10.2	2.3	24	86
12.8	10.2	2.6	25	86
12.9	10.2	2.7	26	86
16.9	10.2	6.7	27	86
13.4	10.2	3.2	28	86
21.4	10.2	11.2	29	86
8.44	10.2	-1.76	29	87
14	10.2	3.8	30	87
12.9	10.2	2.7	31	87
14.2	10.2	4	32	87
13.8	10.2	3.6	33	87
14.5	10.2	4.3	34	87
13.9	10.2	3.7	35	87
15.8	10.2	5.6	36	87
12.9	10.2	2.7	37	87
13.7	10.2	3.5	38	87
11.7	10.2	1.5	39	87
14	10.2	3.8	40	87
12.9	11	1.9	41	87
11.6	11	0.6	42	87
11	11	0	42	87
13.5	11	2.5	43	87
13.2	11	2.2	44	87
12.5	11	1.5	45	87
12.8	11	1.8	46	87
12.9	11	1.9	47	87
16.9	11	5.9	48	87
13.4	11	2.4	49	87
21.4	11	10.4	50	87
8.44	11	-2.56	50	88
14	11	3	51	88
12.9	11	1.9	52	88
14.2	11	3.2	53	88
13.8	11	2.8	54	88
14.5	11	3.5	55	88
13.9	11	2.9	56	88
15.8	11	4.8	57	88
12.9	11	1.9	58	88
13.7	11	2.7	59	88
11.7	11	0.7	60	88
14	11	3	61	88
11.6	12.9	-1.3	61	89
11	12.9	-1.9	61	90
13.5	12.9	0.6	62	90
13.2	12.9	0.3	63	90
12.5	12.9	-0.4	63	91
12.8	12.9	-0.1	63	92

12.9	12.9	0	63	92
16.9	12.9	4	64	92
13.4	12.9	0.5	65	92
21.4	12.9	8.5	66	92
8.44	12.9	-4.46	66	93
14	12.9	1.1	67	93
12.9	12.9	0	67	93
14.2	12.9	1.3	68	93
13.8	12.9	0.9	69	93
14.5	12.9	1.6	70	93
13.9	12.9	1	71	93
15.8	12.9	2.9	72	93
12.9	12.9	0	72	93
13.7	12.9	0.8	73	93
11.7	12.9	-1.2	73	94
14	12.9	1.1	74	94
11	11.6	-0.6	74	95
13.5	11.6	1.9	75	95
13.2	11.6	1.6	76	95
12.5	11.6	0.9	77	95
12.8	11.6	1.2	78	95
12.9	11.6	1.3	79	95
16.9	11.6	5.3	80	95
13.4	11.6	1.8	81	95
21.4	11.6	9.8	82	95
8.44	11.6	-3.16	82	96
14	11.6	2.4	83	96
12.9	11.6	1.3	84	96
14.2	11.6	2.6	85	96
13.8	11.6	2.2	86	96
14.5	11.6	2.9	87	96
13.9	11.6	2.3	88	96
15.8	11.6	4.2	89	96
12.9	11.6	1.3	90	96
13.7	11.6	2.1	91	96
11.7	11.6	0.1	92	96
14	11.6	2.4	93	96
13.5	11	2.5	94	96
13.2	11	2.2	95	96
12.5	11	1.5	96	96
12.8	11	1.8	97	96
12.9	11	1.9	98	96
16.9	11	5.9	99	96
13.4	11	2.4	100	96
21.4	11	10.4	101	96
8.44	11	-2.56	101	97
14	11	3	102	97
12.9	11	1.9	103	97
14.2	11	3.2	104	97
13.8	11	2.8	105	97
14.5	11	3.5	106	97
13.9	11	2.9	107	97
15.8	11	4.8	108	97
12.9	11	1.9	109	97
13.7	11	2.7	110	97
11.7	11	0.7	111	97
14	11	3	112	97

13.2	13.5	-0.3	112	98
12.5	13.5	-1	112	99
12.8	13.5	-0.7	112	100
12.9	13.5	-0.6	112	101
16.9	13.5	3.4	113	101
13.4	13.5	-0.1	113	102
21.4	13.5	7.9	114	102
8.44	13.5	-5.06	114	103
14	13.5	0.5	115	103
12.9	13.5	-0.6	115	104
14.2	13.5	0.7	116	104
13.8	13.5	0.3	117	104
14.5	13.5	1	118	104
13.9	13.5	0.4	119	104
15.8	13.5	2.3	120	104
12.9	13.5	-0.6	120	105
13.7	13.5	0.2	121	105
11.7	13.5	-1.8	121	106
14	13.5	0.5	122	106
12.5	13.2	-0.7	122	107
12.8	13.2	-0.4	122	108
12.9	13.2	-0.3	122	109
16.9	13.2	3.7	123	109
13.4	13.2	0.2	124	109
21.4	13.2	8.2	125	109
8.44	13.2	-4.76	125	110
14	13.2	0.8	126	110
12.9	13.2	-0.3	126	111
14.2	13.2	1	127	111
13.8	13.2	0.6	128	111
14.5	13.2	1.3	129	111
13.9	13.2	0.7	130	111
15.8	13.2	2.6	131	111
12.9	13.2	-0.3	131	112
13.7	13.2	0.5	132	112
11.7	13.2	-1.5	132	113
14	13.2	0.8	133	113
12.8	12.5	0.3	134	113
12.9	12.5	0.4	135	113
16.9	12.5	4.4	136	113
13.4	12.5	0.9	137	113
21.4	12.5	8.9	138	113
8.44	12.5	-4.06	138	114
14	12.5	1.5	139	114
12.9	12.5	0.4	140	114
14.2	12.5	1.7	141	114
13.8	12.5	1.3	142	114
14.5	12.5	2	143	114
13.9	12.5	1.4	144	114
15.8	12.5	3.3	145	114
12.9	12.5	0.4	146	114
13.7	12.5	1.2	147	114
11.7	12.5	-0.8	147	115
14	12.5	1.5	148	115
12.9	12.8	0.1	149	115

16.9	12.8	4.1	150	115
13.4	12.8	0.6	151	115
21.4	12.8	8.6	152	115
8.44	12.8	-4.36	152	116
14	12.8	1.2	153	116
12.9	12.8	0.1	154	116
14.2	12.8	1.4	155	116
13.8	12.8	1	156	116
14.5	12.8	1.7	157	116
13.9	12.8	1.1	158	116
15.8	12.8	3	159	116
12.9	12.8	0.1	160	116
13.7	12.8	0.9	161	116
11.7	12.8	-1.1	161	117
14	12.8	1.2	162	117
16.9	12.9	4	163	117
13.4	12.9	0.5	164	117
21.4	12.9	8.5	165	117
8.44	12.9	-4.46	165	118
14	12.9	1.1	166	118
12.9	12.9	0	166	118
14.2	12.9	1.3	167	118
13.8	12.9	0.9	168	118
14.5	12.9	1.6	169	118
13.9	12.9	1	170	118
15.8	12.9	2.9	171	118
12.9	12.9	0	171	118
13.7	12.9	0.8	172	118
11.7	12.9	-1.2	172	119
14	12.9	1.1	173	119
13.4	16.9	-3.5	173	120
21.4	16.9	4.5	174	120
8.44	16.9	-8.46	174	121
14	16.9	-2.9	174	122
12.9	16.9	-4	174	123
14.2	16.9	-2.7	174	124
13.8	16.9	-3.1	174	125
14.5	16.9	-2.4	174	126
13.9	16.9	-3	174	127
15.8	16.9	-1.1	174	128
12.9	16.9	-4	174	129
13.7	16.9	-3.2	174	130
11.7	16.9	-5.2	174	131
14	16.9	-2.9	174	132
21.4	13.4	8	175	132
8.44	13.4	-4.96	175	133
14	13.4	0.6	176	133
12.9	13.4	-0.5	176	134
14.2	13.4	0.8	177	134
13.8	13.4	0.4	178	134
14.5	13.4	1.1	179	134
13.9	13.4	0.5	180	134
15.8	13.4	2.4	181	134
12.9	13.4	-0.5	181	135
13.7	13.4	0.3	182	135
11.7	13.4	-1.7	182	136

14	13.4	0.6	183	136
8.44	21.4	-12.96	183	137
14	21.4	-7.4	183	138
12.9	21.4	-8.5	183	139
14.2	21.4	-7.2	183	140
13.8	21.4	-7.6	183	141
14.5	21.4	-6.9	183	142
13.9	21.4	-7.5	183	143
15.8	21.4	-5.6	183	144
12.9	21.4	-8.5	183	145
13.7	21.4	-7.7	183	146
11.7	21.4	-9.7	183	147
14	21.4	-7.4	183	148
14	8.44	5.56	184	148
12.9	8.44	4.46	185	148
14.2	8.44	5.76	186	148
13.8	8.44	5.36	187	148
14.5	8.44	6.06	188	148
13.9	8.44	5.46	189	148
15.8	8.44	7.36	190	148
12.9	8.44	4.46	191	148
13.7	8.44	5.26	192	148
11.7	8.44	3.26	193	148
14	8.44	5.56	194	148
12.9	14	-1.1	194	149
14.2	14	0.2	195	149
13.8	14	-0.2	195	150
14.5	14	0.5	196	150
13.9	14	-0.1	196	151
15.8	14	1.8	197	151
12.9	14	-1.1	197	152
13.7	14	-0.3	197	153
11.7	14	-2.3	197	154
14	14	0	197	154
14.2	12.9	1.3	198	154
13.8	12.9	0.9	199	154
14.5	12.9	1.6	200	154
13.9	12.9	1	201	154
15.8	12.9	2.9	202	154
12.9	12.9	0	202	154
13.7	12.9	0.8	203	154
11.7	12.9	-1.2	203	155
14	12.9	1.1	204	155
13.8	14.2	-0.4	204	156
14.5	14.2	0.3	205	156
13.9	14.2	-0.3	205	157
15.8	14.2	1.6	206	157
12.9	14.2	-1.3	206	158
13.7	14.2	-0.5	206	159
11.7	14.2	-2.5	206	160
14	14.2	-0.2	206	161
14.5	13.8	0.7	207	161
13.9	13.8	0.1	208	161

15.8	13.8	2	209	161
12.9	13.8	-0.9	209	162
13.7	13.8	-0.1	209	163
11.7	13.8	-2.1	209	164
14	13.8	0.2	210	164
13.9	14.5	-0.6	210	165
15.8	14.5	1.3	211	165
12.9	14.5	-1.6	211	166
13.7	14.5	-0.8	211	167
11.7	14.5	-2.8	211	168
14	14.5	-0.5	211	169
15.8	13.9	1.9	212	169
12.9	13.9	-1	212	170
13.7	13.9	-0.2	212	171
11.7	13.9	-2.2	212	172
14	13.9	0.1	213	172
12.9	15.8	-2.9	213	173
13.7	15.8	-2.1	213	174
11.7	15.8	-4.1	213	175
14	15.8	-1.8	213	176
13.7	12.9	0.8	214	176
11.7	12.9	-1.2	214	177
14	12.9	1.1	215	177
11.7	13.7	-2	215	178
14	13.7	0.3	216	178
14	11.7	2.3	217	178

S Statistic = 217 - 178 = 39

Tied Group	Value	Members
1	14	3
2	15	2
3	11	2
4	12.9	4

Time Period	Observations
3/12/2008	1
5/12/2008	1
9/23/2008	1
10/29/2008	1
4/29/2009	1
5/15/2009	1
9/23/2009	1
12/8/2009	1
2/25/2010	1
4/15/2010	1
8/11/2010	1
11/23/2010	1
3/10/2011	1
5/24/2011	1
9/1/2011	1

4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/19/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 258
B = 0
C = 30
D = 0
E = 22
F = 0
a = 51156
b = 197316
c = 1624
Group Variance = 2827.67
Z-Score = 0.714611
Comparison Level at 95% confidence level = 1.65463 (upward trend)
0.714611 <= 1.65463 indicating no evidence of an upward trend

Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: EPW-02

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
0.2	0.3	-0.1	0	1
0.4	0.3	0.1	1	1
ND<0	0.3	-0.3	1	2
0.3	0.3	0	1	2
0.2	0.3	-0.1	1	3
ND<0	0.3	-0.3	1	4
ND<0	0.3	-0.3	1	5
ND<0	0.3	-0.3	1	6
0.1	0.3	-0.2	1	7
ND<0	0.3	-0.3	1	8
ND<0	0.3	-0.3	1	9
ND<0	0.3	-0.3	1	10
0.1	0.3	-0.2	1	11
ND<0	0.3	-0.3	1	12
ND<0	0.3	-0.3	1	13
ND<0	0.3	-0.3	1	14
ND<0	0.3	-0.3	1	15
ND<0	0.3	-0.3	1	16
ND<0	0.3	-0.3	1	17
ND<0	0.3	-0.3	1	18
ND<0	0.3	-0.3	1	19
ND<0	0.3	-0.3	1	20
ND<0	0.3	-0.3	1	21
ND<0	0.3	-0.3	1	22
ND<0	0.3	-0.3	1	23
ND<0	0.3	-0.3	1	24
ND<0	0.3	-0.3	1	25
ND<0	0.3	-0.3	1	26
0.4	0.2	0.2	2	26
ND<0	0.2	-0.2	2	27
0.3	0.2	0.1	3	27
0.2	0.2	0	3	27
ND<0	0.2	-0.2	3	28
ND<0	0.2	-0.2	3	29
ND<0	0.2	-0.2	3	30
0.1	0.2	-0.1	3	31
ND<0	0.2	-0.2	3	32
ND<0	0.2	-0.2	3	33
ND<0	0.2	-0.2	3	34
0.1	0.2	-0.1	3	35
ND<0	0.2	-0.2	3	36
ND<0	0.2	-0.2	3	37
ND<0	0.2	-0.2	3	38
ND<0	0.2	-0.2	3	39
ND<0	0.2	-0.2	3	40
ND<0	0.2	-0.2	3	41

ND<0	0.2	-0.2	3	42
ND<0	0.2	-0.2	3	43
ND<0	0.2	-0.2	3	44
ND<0	0.2	-0.2	3	45
ND<0	0.2	-0.2	3	46
ND<0	0.2	-0.2	3	47
ND<0	0.2	-0.2	3	48
ND<0	0.2	-0.2	3	49
ND<0	0.2	-0.2	3	50
ND<0	0.4	-0.4	3	51
0.3	0.4	-0.1	3	52
0.2	0.4	-0.2	3	53
ND<0	0.4	-0.4	3	54
ND<0	0.4	-0.4	3	55
ND<0	0.4	-0.4	3	56
0.1	0.4	-0.3	3	57
ND<0	0.4	-0.4	3	58
ND<0	0.4	-0.4	3	59
ND<0	0.4	-0.4	3	60
0.1	0.4	-0.3	3	61
ND<0	0.4	-0.4	3	62
ND<0	0.4	-0.4	3	63
ND<0	0.4	-0.4	3	64
ND<0	0.4	-0.4	3	65
ND<0	0.4	-0.4	3	66
ND<0	0.4	-0.4	3	67
ND<0	0.4	-0.4	3	68
ND<0	0.4	-0.4	3	69
ND<0	0.4	-0.4	3	70
ND<0	0.4	-0.4	3	71
ND<0	0.4	-0.4	3	72
ND<0	0.4	-0.4	3	73
ND<0	0.4	-0.4	3	74
ND<0	0.4	-0.4	3	75
ND<0	0.4	-0.4	3	76
0.3	ND<0	0.3	4	76
0.2	ND<0	0.2	5	76
ND<0	ND<0	0	5	76
ND<0	ND<0	0	5	76
ND<0	ND<0	0	5	76
0.1	ND<0	0.1	6	76
ND<0	ND<0	0	6	76
ND<0	ND<0	0	6	76
ND<0	ND<0	0	6	76
0.1	ND<0	0.1	7	76
ND<0	ND<0	0	7	76
ND<0	ND<0	0	7	76
ND<0	ND<0	0	7	76
ND<0	ND<0	0	7	76
ND<0	ND<0	0	7	76
ND<0	ND<0	0	7	76
ND<0	ND<0	0	7	76
ND<0	ND<0	0	7	76
ND<0	ND<0	0	7	76
ND<0	ND<0	0	7	76
ND<0	ND<0	0	7	76
ND<0	ND<0	0	7	76
ND<0	ND<0	0	7	76

ND<0	ND<0	0	7	76
ND<0	ND<0	0	7	76
ND<0	ND<0	0	7	76
0.2	0.3	-0.1	7	77
ND<0	0.3	-0.3	7	78
ND<0	0.3	-0.3	7	79
ND<0	0.3	-0.3	7	80
0.1	0.3	-0.2	7	81
ND<0	0.3	-0.3	7	82
ND<0	0.3	-0.3	7	83
ND<0	0.3	-0.3	7	84
0.1	0.3	-0.2	7	85
ND<0	0.3	-0.3	7	86
ND<0	0.3	-0.3	7	87
ND<0	0.3	-0.3	7	88
ND<0	0.3	-0.3	7	89
ND<0	0.3	-0.3	7	90
ND<0	0.3	-0.3	7	91
ND<0	0.3	-0.3	7	92
ND<0	0.3	-0.3	7	93
ND<0	0.3	-0.3	7	94
ND<0	0.3	-0.3	7	95
ND<0	0.3	-0.3	7	96
ND<0	0.3	-0.3	7	97
ND<0	0.3	-0.3	7	98
ND<0	0.3	-0.3	7	99
ND<0	0.3	-0.3	7	100
ND<0	0.2	-0.2	7	101
ND<0	0.2	-0.2	7	102
ND<0	0.2	-0.2	7	103
0.1	0.2	-0.1	7	104
ND<0	0.2	-0.2	7	105
ND<0	0.2	-0.2	7	106
ND<0	0.2	-0.2	7	107
0.1	0.2	-0.1	7	108
ND<0	0.2	-0.2	7	109
ND<0	0.2	-0.2	7	110
ND<0	0.2	-0.2	7	111
ND<0	0.2	-0.2	7	112
ND<0	0.2	-0.2	7	113
ND<0	0.2	-0.2	7	114
ND<0	0.2	-0.2	7	115
ND<0	0.2	-0.2	7	116
ND<0	0.2	-0.2	7	117
ND<0	0.2	-0.2	7	118
ND<0	0.2	-0.2	7	119
ND<0	0.2	-0.2	7	120
ND<0	0.2	-0.2	7	121
ND<0	0.2	-0.2	7	122
ND<0	0.2	-0.2	7	123
ND<0	ND<0	0	7	123
ND<0	ND<0	0	7	123
0.1	ND<0	0.1	8	123
ND<0	ND<0	0	8	123
ND<0	ND<0	0	8	123
ND<0	ND<0	0	8	123

0.1	ND<0	0.1	9	123
ND<0	ND<0	0	9	123
ND<0	ND<0	0	9	123
ND<0	ND<0	0	9	123
ND<0	ND<0	0	9	123
ND<0	ND<0	0	9	123
ND<0	ND<0	0	9	123
ND<0	ND<0	0	9	123
ND<0	ND<0	0	9	123
ND<0	ND<0	0	9	123
ND<0	ND<0	0	9	123
ND<0	ND<0	0	9	123
ND<0	ND<0	0	9	123
ND<0	ND<0	0	9	123
ND<0	ND<0	0	9	123
ND<0	ND<0	0	9	123
ND<0	ND<0	0	9	123
ND<0	ND<0	0	9	123
0.1	ND<0	0.1	10	123
ND<0	ND<0	0	10	123
ND<0	ND<0	0	10	123
ND<0	ND<0	0	10	123
0.1	ND<0	0.1	11	123
ND<0	ND<0	0	11	123
ND<0	ND<0	0	11	123
ND<0	ND<0	0	11	123
ND<0	ND<0	0	11	123
ND<0	ND<0	0	11	123
ND<0	ND<0	0	11	123
ND<0	ND<0	0	11	123
ND<0	ND<0	0	11	123
ND<0	ND<0	0	11	123
ND<0	ND<0	0	11	123
ND<0	ND<0	0	11	123
ND<0	ND<0	0	11	123
ND<0	ND<0	0	11	123
ND<0	ND<0	0	11	123
ND<0	ND<0	0	11	123
0.1	ND<0	0.1	12	123
ND<0	ND<0	0	12	123
ND<0	ND<0	0	12	123
ND<0	ND<0	0	12	123
0.1	ND<0	0.1	13	123
ND<0	ND<0	0	13	123
ND<0	ND<0	0	13	123
ND<0	ND<0	0	13	123
ND<0	ND<0	0	13	123
ND<0	ND<0	0	13	123
ND<0	ND<0	0	13	123
ND<0	ND<0	0	13	123
ND<0	ND<0	0	13	123
ND<0	ND<0	0	13	123
ND<0	ND<0	0	13	123
ND<0	ND<0	0	13	123
ND<0	ND<0	0	13	123
ND<0	ND<0	0	13	123
ND<0	ND<0	0	13	123
ND<0	ND<0	0	13	123
ND<0	ND<0	0	13	123

ND<0	0.1	-0.1	13	124
ND<0	0.1	-0.1	13	125
ND<0	0.1	-0.1	13	126
0.1	0.1	0	13	126
ND<0	0.1	-0.1	13	127
ND<0	0.1	-0.1	13	128
ND<0	0.1	-0.1	13	129
ND<0	0.1	-0.1	13	130
ND<0	0.1	-0.1	13	131
ND<0	0.1	-0.1	13	132
ND<0	0.1	-0.1	13	133
ND<0	0.1	-0.1	13	134
ND<0	0.1	-0.1	13	135
ND<0	0.1	-0.1	13	136
ND<0	0.1	-0.1	13	137
ND<0	0.1	-0.1	13	138
ND<0	0.1	-0.1	13	139
ND<0	0.1	-0.1	13	140
ND<0	0.1	-0.1	13	141
ND<0	ND<0	0	13	141
ND<0	ND<0	0	13	141
0.1	ND<0	0.1	14	141
ND<0	ND<0	0	14	141
ND<0	ND<0	0	14	141
ND<0	ND<0	0	14	141
ND<0	ND<0	0	14	141
ND<0	ND<0	0	14	141
ND<0	ND<0	0	14	141
ND<0	ND<0	0	14	141
ND<0	ND<0	0	14	141
ND<0	ND<0	0	14	141
ND<0	ND<0	0	14	141
ND<0	ND<0	0	14	141
ND<0	ND<0	0	14	141
ND<0	ND<0	0	14	141
ND<0	ND<0	0	14	141
ND<0	ND<0	0	14	141
ND<0	ND<0	0	14	141
0.1	ND<0	0.1	15	141
ND<0	ND<0	0	15	141
ND<0	ND<0	0	15	141
ND<0	ND<0	0	15	141
ND<0	ND<0	0	15	141
ND<0	ND<0	0	15	141
ND<0	ND<0	0	15	141
ND<0	ND<0	0	15	141
ND<0	ND<0	0	15	141
ND<0	ND<0	0	15	141
ND<0	ND<0	0	15	141
ND<0	ND<0	0	15	141
ND<0	ND<0	0	15	141
ND<0	ND<0	0	15	141
ND<0	ND<0	0	15	141
ND<0	ND<0	0	15	141
0.1	ND<0	0.1	16	141

ND<0	ND<0	0	16	141
ND<0	ND<0	0	16	141
ND<0	ND<0	0	16	141
ND<0	ND<0	0	16	141
ND<0	ND<0	0	16	141
ND<0	ND<0	0	16	141
ND<0	ND<0	0	16	141
ND<0	ND<0	0	16	141
ND<0	ND<0	0	16	141
ND<0	ND<0	0	16	141
ND<0	ND<0	0	16	141
ND<0	ND<0	0	16	141
ND<0	ND<0	0	16	141
ND<0	ND<0	0	16	141
ND<0	ND<0	0	16	141

ND<0	0.1	-0.1	16	142
ND<0	0.1	-0.1	16	143
ND<0	0.1	-0.1	16	144
ND<0	0.1	-0.1	16	145
ND<0	0.1	-0.1	16	146
ND<0	0.1	-0.1	16	147
ND<0	0.1	-0.1	16	148
ND<0	0.1	-0.1	16	149
ND<0	0.1	-0.1	16	150
ND<0	0.1	-0.1	16	151
ND<0	0.1	-0.1	16	152
ND<0	0.1	-0.1	16	153
ND<0	0.1	-0.1	16	154
ND<0	0.1	-0.1	16	155
ND<0	0.1	-0.1	16	156

ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156

ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156

ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156

ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156
ND<0	ND<0	0	16	156

S Statistic = 16 - 156 = -140

Tied Group	Value	Members
1	0.3	2
2	0.2	2
3	0	22
4	0.1	2

Time Period	Observations
3/12/2008	1
5/12/2008	1
9/23/2008	1
12/3/2008	1
4/29/2009	1
5/15/2009	1
9/24/2009	1
12/8/2009	1
2/25/2010	1
4/15/2010	1
8/11/2010	1
11/23/2010	1
3/10/2011	1
5/24/2011	1
9/1/2011	1

4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 22692
B = 0
C = 9240
D = 0
E = 468
F = 0
a = 51156
b = 197316
c = 1624
Group Variance = 1581.33
Z-Score = -3.49545
Comparison Level at 95% confidence level = -1.65463 (downward trend)
-3.49545 < -1.65463 indicating a downward trend

Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: GCW-03D

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
220	200	20	1	0
440	200	240	2	0
480	200	280	3	0
446	200	246	4	0
440	200	240	5	0
205	200	5	6	0
187	200	-13	6	1
204	200	4	7	1
390	200	190	8	1
205	200	5	9	1
340	200	140	10	1
350	200	150	11	1
343	200	143	12	1
363	200	163	13	1
340	200	140	14	1
385	200	185	15	1
331	200	131	16	1
361	200	161	17	1
333	200	133	18	1
312	200	112	19	1
298	200	98	20	1
294	200	94	21	1
300	200	100	22	1
314	200	114	23	1
319	200	119	24	1
288	200	88	25	1
287	200	87	26	1
300	200	100	27	1
440	220	220	28	1
480	220	260	29	1
446	220	226	30	1
440	220	220	31	1
205	220	-15	31	2
187	220	-33	31	3
204	220	-16	31	4
390	220	170	32	4
205	220	-15	32	5
340	220	120	33	5
350	220	130	34	5
343	220	123	35	5
363	220	143	36	5
340	220	120	37	5
385	220	165	38	5
331	220	111	39	5
361	220	141	40	5
333	220	113	41	5

312	220	92	42	5
298	220	78	43	5
294	220	74	44	5
300	220	80	45	5
314	220	94	46	5
319	220	99	47	5
288	220	68	48	5
287	220	67	49	5
300	220	80	50	5
480	440	40	51	5
446	440	6	52	5
440	440	0	52	5
205	440	-235	52	6
187	440	-253	52	7
204	440	-236	52	8
390	440	-50	52	9
205	440	-235	52	10
340	440	-100	52	11
350	440	-90	52	12
343	440	-97	52	13
363	440	-77	52	14
340	440	-100	52	15
385	440	-55	52	16
331	440	-109	52	17
361	440	-79	52	18
333	440	-107	52	19
312	440	-128	52	20
298	440	-142	52	21
294	440	-146	52	22
300	440	-140	52	23
314	440	-126	52	24
319	440	-121	52	25
288	440	-152	52	26
287	440	-153	52	27
300	440	-140	52	28
446	480	-34	52	29
440	480	-40	52	30
205	480	-275	52	31
187	480	-293	52	32
204	480	-276	52	33
390	480	-90	52	34
205	480	-275	52	35
340	480	-140	52	36
350	480	-130	52	37
343	480	-137	52	38
363	480	-117	52	39
340	480	-140	52	40
385	480	-95	52	41
331	480	-149	52	42
361	480	-119	52	43
333	480	-147	52	44
312	480	-168	52	45
298	480	-182	52	46
294	480	-186	52	47
300	480	-180	52	48
314	480	-166	52	49
319	480	-161	52	50

288	480	-192	52	51
287	480	-193	52	52
300	480	-180	52	53
440	446	-6	52	54
205	446	-241	52	55
187	446	-259	52	56
204	446	-242	52	57
390	446	-56	52	58
205	446	-241	52	59
340	446	-106	52	60
350	446	-96	52	61
343	446	-103	52	62
363	446	-83	52	63
340	446	-106	52	64
385	446	-61	52	65
331	446	-115	52	66
361	446	-85	52	67
333	446	-113	52	68
312	446	-134	52	69
298	446	-148	52	70
294	446	-152	52	71
300	446	-146	52	72
314	446	-132	52	73
319	446	-127	52	74
288	446	-158	52	75
287	446	-159	52	76
300	446	-146	52	77
205	440	-235	52	78
187	440	-253	52	79
204	440	-236	52	80
390	440	-50	52	81
205	440	-235	52	82
340	440	-100	52	83
350	440	-90	52	84
343	440	-97	52	85
363	440	-77	52	86
340	440	-100	52	87
385	440	-55	52	88
331	440	-109	52	89
361	440	-79	52	90
333	440	-107	52	91
312	440	-128	52	92
298	440	-142	52	93
294	440	-146	52	94
300	440	-140	52	95
314	440	-126	52	96
319	440	-121	52	97
288	440	-152	52	98
287	440	-153	52	99
300	440	-140	52	100
187	205	-18	52	101
204	205	-1	52	102
390	205	185	53	102
205	205	0	53	102
340	205	135	54	102
350	205	145	55	102

343	205	138	56	102
363	205	158	57	102
340	205	135	58	102
385	205	180	59	102
331	205	126	60	102
361	205	156	61	102
333	205	128	62	102
312	205	107	63	102
298	205	93	64	102
294	205	89	65	102
300	205	95	66	102
314	205	109	67	102
319	205	114	68	102
288	205	83	69	102
287	205	82	70	102
300	205	95	71	102
204	187	17	72	102
390	187	203	73	102
205	187	18	74	102
340	187	153	75	102
350	187	163	76	102
343	187	156	77	102
363	187	176	78	102
340	187	153	79	102
385	187	198	80	102
331	187	144	81	102
361	187	174	82	102
333	187	146	83	102
312	187	125	84	102
298	187	111	85	102
294	187	107	86	102
300	187	113	87	102
314	187	127	88	102
319	187	132	89	102
288	187	101	90	102
287	187	100	91	102
300	187	113	92	102
390	204	186	93	102
205	204	1	94	102
340	204	136	95	102
350	204	146	96	102
343	204	139	97	102
363	204	159	98	102
340	204	136	99	102
385	204	181	100	102
331	204	127	101	102
361	204	157	102	102
333	204	129	103	102
312	204	108	104	102
298	204	94	105	102
294	204	90	106	102
300	204	96	107	102
314	204	110	108	102
319	204	115	109	102
288	204	84	110	102
287	204	83	111	102
300	204	96	112	102

205	390	-185	112	103
340	390	-50	112	104
350	390	-40	112	105
343	390	-47	112	106
363	390	-27	112	107
340	390	-50	112	108
385	390	-5	112	109
331	390	-59	112	110
361	390	-29	112	111
333	390	-57	112	112
312	390	-78	112	113
298	390	-92	112	114
294	390	-96	112	115
300	390	-90	112	116
314	390	-76	112	117
319	390	-71	112	118
288	390	-102	112	119
287	390	-103	112	120
300	390	-90	112	121
340	205	135	113	121
350	205	145	114	121
343	205	138	115	121
363	205	158	116	121
340	205	135	117	121
385	205	180	118	121
331	205	126	119	121
361	205	156	120	121
333	205	128	121	121
312	205	107	122	121
298	205	93	123	121
294	205	89	124	121
300	205	95	125	121
314	205	109	126	121
319	205	114	127	121
288	205	83	128	121
287	205	82	129	121
300	205	95	130	121
350	340	10	131	121
343	340	3	132	121
363	340	23	133	121
340	340	0	133	121
385	340	45	134	121
331	340	-9	134	122
361	340	21	135	122
333	340	-7	135	123
312	340	-28	135	124
298	340	-42	135	125
294	340	-46	135	126
300	340	-40	135	127
314	340	-26	135	128
319	340	-21	135	129
288	340	-52	135	130
287	340	-53	135	131
300	340	-40	135	132
343	350	-7	135	133

363	350	13	136	133
340	350	-10	136	134
385	350	35	137	134
331	350	-19	137	135
361	350	11	138	135
333	350	-17	138	136
312	350	-38	138	137
298	350	-52	138	138
294	350	-56	138	139
300	350	-50	138	140
314	350	-36	138	141
319	350	-31	138	142
288	350	-62	138	143
287	350	-63	138	144
300	350	-50	138	145
363	343	20	139	145
340	343	-3	139	146
385	343	42	140	146
331	343	-12	140	147
361	343	18	141	147
333	343	-10	141	148
312	343	-31	141	149
298	343	-45	141	150
294	343	-49	141	151
300	343	-43	141	152
314	343	-29	141	153
319	343	-24	141	154
288	343	-55	141	155
287	343	-56	141	156
300	343	-43	141	157
340	363	-23	141	158
385	363	22	142	158
331	363	-32	142	159
361	363	-2	142	160
333	363	-30	142	161
312	363	-51	142	162
298	363	-65	142	163
294	363	-69	142	164
300	363	-63	142	165
314	363	-49	142	166
319	363	-44	142	167
288	363	-75	142	168
287	363	-76	142	169
300	363	-63	142	170
385	340	45	143	170
331	340	-9	143	171
361	340	21	144	171
333	340	-7	144	172
312	340	-28	144	173
298	340	-42	144	174
294	340	-46	144	175
300	340	-40	144	176
314	340	-26	144	177
319	340	-21	144	178
288	340	-52	144	179
287	340	-53	144	180

300	340	-40	144	181
331	385	-54	144	182
361	385	-24	144	183
333	385	-52	144	184
312	385	-73	144	185
298	385	-87	144	186
294	385	-91	144	187
300	385	-85	144	188
314	385	-71	144	189
319	385	-66	144	190
288	385	-97	144	191
287	385	-98	144	192
300	385	-85	144	193
361	331	30	145	193
333	331	2	146	193
312	331	-19	146	194
298	331	-33	146	195
294	331	-37	146	196
300	331	-31	146	197
314	331	-17	146	198
319	331	-12	146	199
288	331	-43	146	200
287	331	-44	146	201
300	331	-31	146	202
333	361	-28	146	203
312	361	-49	146	204
298	361	-63	146	205
294	361	-67	146	206
300	361	-61	146	207
314	361	-47	146	208
319	361	-42	146	209
288	361	-73	146	210
287	361	-74	146	211
300	361	-61	146	212
312	333	-21	146	213
298	333	-35	146	214
294	333	-39	146	215
300	333	-33	146	216
314	333	-19	146	217
319	333	-14	146	218
288	333	-45	146	219
287	333	-46	146	220
300	333	-33	146	221
298	312	-14	146	222
294	312	-18	146	223
300	312	-12	146	224
314	312	2	147	224
319	312	7	148	224
288	312	-24	148	225
287	312	-25	148	226
300	312	-12	148	227
294	298	-4	148	228
300	298	2	149	228

314	298	16	150	228
319	298	21	151	228
288	298	-10	151	229
287	298	-11	151	230
300	298	2	152	230
300	294	6	153	230
314	294	20	154	230
319	294	25	155	230
288	294	-6	155	231
287	294	-7	155	232
300	294	6	156	232
314	300	14	157	232
319	300	19	158	232
288	300	-12	158	233
287	300	-13	158	234
300	300	0	158	234
319	314	5	159	234
288	314	-26	159	235
287	314	-27	159	236
300	314	-14	159	237
288	319	-31	159	238
287	319	-32	159	239
300	319	-19	159	240
287	288	-1	159	241
300	288	12	160	241
300	287	13	161	241

S Statistic = 161 - 241 = -80

Tied Group	Value	Members
1	440	2
2	205	2
3	340	2
4	300	2

Time Period	Observations
3/12/2008	1
5/10/2008	1
9/22/2008	1
10/28/2008	1
4/28/2009	1
5/14/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/24/2011	1
9/1/2011	1

4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 72
B = 0
C = 0
D = 0
E = 8
F = 0
a = 51156
b = 197316
c = 1624
Group Variance = 2838
Z-Score = -1.48293
Comparison Level at 95% confidence level = -1.65463 (downward trend)
-1.48293 >= -1.65463 indicating no evidence of a downward trend

Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: GCW-03D

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
220	200	20	1	0
440	200	240	2	0
480	200	280	3	0
446	200	246	4	0
440	200	240	5	0
205	200	5	6	0
187	200	-13	6	1
204	200	4	7	1
390	200	190	8	1
205	200	5	9	1
340	200	140	10	1
350	200	150	11	1
343	200	143	12	1
363	200	163	13	1
340	200	140	14	1
385	200	185	15	1
331	200	131	16	1
361	200	161	17	1
333	200	133	18	1
312	200	112	19	1
298	200	98	20	1
294	200	94	21	1
300	200	100	22	1
314	200	114	23	1
319	200	119	24	1
288	200	88	25	1
287	200	87	26	1
300	200	100	27	1
440	220	220	28	1
480	220	260	29	1
446	220	226	30	1
440	220	220	31	1
205	220	-15	31	2
187	220	-33	31	3
204	220	-16	31	4
390	220	170	32	4
205	220	-15	32	5
340	220	120	33	5
350	220	130	34	5
343	220	123	35	5
363	220	143	36	5
340	220	120	37	5
385	220	165	38	5
331	220	111	39	5
361	220	141	40	5
333	220	113	41	5

312	220	92	42	5
298	220	78	43	5
294	220	74	44	5
300	220	80	45	5
314	220	94	46	5
319	220	99	47	5
288	220	68	48	5
287	220	67	49	5
300	220	80	50	5
480	440	40	51	5
446	440	6	52	5
440	440	0	52	5
205	440	-235	52	6
187	440	-253	52	7
204	440	-236	52	8
390	440	-50	52	9
205	440	-235	52	10
340	440	-100	52	11
350	440	-90	52	12
343	440	-97	52	13
363	440	-77	52	14
340	440	-100	52	15
385	440	-55	52	16
331	440	-109	52	17
361	440	-79	52	18
333	440	-107	52	19
312	440	-128	52	20
298	440	-142	52	21
294	440	-146	52	22
300	440	-140	52	23
314	440	-126	52	24
319	440	-121	52	25
288	440	-152	52	26
287	440	-153	52	27
300	440	-140	52	28
446	480	-34	52	29
440	480	-40	52	30
205	480	-275	52	31
187	480	-293	52	32
204	480	-276	52	33
390	480	-90	52	34
205	480	-275	52	35
340	480	-140	52	36
350	480	-130	52	37
343	480	-137	52	38
363	480	-117	52	39
340	480	-140	52	40
385	480	-95	52	41
331	480	-149	52	42
361	480	-119	52	43
333	480	-147	52	44
312	480	-168	52	45
298	480	-182	52	46
294	480	-186	52	47
300	480	-180	52	48
314	480	-166	52	49
319	480	-161	52	50

288	480	-192	52	51
287	480	-193	52	52
300	480	-180	52	53
440	446	-6	52	54
205	446	-241	52	55
187	446	-259	52	56
204	446	-242	52	57
390	446	-56	52	58
205	446	-241	52	59
340	446	-106	52	60
350	446	-96	52	61
343	446	-103	52	62
363	446	-83	52	63
340	446	-106	52	64
385	446	-61	52	65
331	446	-115	52	66
361	446	-85	52	67
333	446	-113	52	68
312	446	-134	52	69
298	446	-148	52	70
294	446	-152	52	71
300	446	-146	52	72
314	446	-132	52	73
319	446	-127	52	74
288	446	-158	52	75
287	446	-159	52	76
300	446	-146	52	77
205	440	-235	52	78
187	440	-253	52	79
204	440	-236	52	80
390	440	-50	52	81
205	440	-235	52	82
340	440	-100	52	83
350	440	-90	52	84
343	440	-97	52	85
363	440	-77	52	86
340	440	-100	52	87
385	440	-55	52	88
331	440	-109	52	89
361	440	-79	52	90
333	440	-107	52	91
312	440	-128	52	92
298	440	-142	52	93
294	440	-146	52	94
300	440	-140	52	95
314	440	-126	52	96
319	440	-121	52	97
288	440	-152	52	98
287	440	-153	52	99
300	440	-140	52	100
187	205	-18	52	101
204	205	-1	52	102
390	205	185	53	102
205	205	0	53	102
340	205	135	54	102
350	205	145	55	102

343	205	138	56	102
363	205	158	57	102
340	205	135	58	102
385	205	180	59	102
331	205	126	60	102
361	205	156	61	102
333	205	128	62	102
312	205	107	63	102
298	205	93	64	102
294	205	89	65	102
300	205	95	66	102
314	205	109	67	102
319	205	114	68	102
288	205	83	69	102
287	205	82	70	102
300	205	95	71	102
204	187	17	72	102
390	187	203	73	102
205	187	18	74	102
340	187	153	75	102
350	187	163	76	102
343	187	156	77	102
363	187	176	78	102
340	187	153	79	102
385	187	198	80	102
331	187	144	81	102
361	187	174	82	102
333	187	146	83	102
312	187	125	84	102
298	187	111	85	102
294	187	107	86	102
300	187	113	87	102
314	187	127	88	102
319	187	132	89	102
288	187	101	90	102
287	187	100	91	102
300	187	113	92	102
390	204	186	93	102
205	204	1	94	102
340	204	136	95	102
350	204	146	96	102
343	204	139	97	102
363	204	159	98	102
340	204	136	99	102
385	204	181	100	102
331	204	127	101	102
361	204	157	102	102
333	204	129	103	102
312	204	108	104	102
298	204	94	105	102
294	204	90	106	102
300	204	96	107	102
314	204	110	108	102
319	204	115	109	102
288	204	84	110	102
287	204	83	111	102
300	204	96	112	102

205	390	-185	112	103
340	390	-50	112	104
350	390	-40	112	105
343	390	-47	112	106
363	390	-27	112	107
340	390	-50	112	108
385	390	-5	112	109
331	390	-59	112	110
361	390	-29	112	111
333	390	-57	112	112
312	390	-78	112	113
298	390	-92	112	114
294	390	-96	112	115
300	390	-90	112	116
314	390	-76	112	117
319	390	-71	112	118
288	390	-102	112	119
287	390	-103	112	120
300	390	-90	112	121
340	205	135	113	121
350	205	145	114	121
343	205	138	115	121
363	205	158	116	121
340	205	135	117	121
385	205	180	118	121
331	205	126	119	121
361	205	156	120	121
333	205	128	121	121
312	205	107	122	121
298	205	93	123	121
294	205	89	124	121
300	205	95	125	121
314	205	109	126	121
319	205	114	127	121
288	205	83	128	121
287	205	82	129	121
300	205	95	130	121
350	340	10	131	121
343	340	3	132	121
363	340	23	133	121
340	340	0	133	121
385	340	45	134	121
331	340	-9	134	122
361	340	21	135	122
333	340	-7	135	123
312	340	-28	135	124
298	340	-42	135	125
294	340	-46	135	126
300	340	-40	135	127
314	340	-26	135	128
319	340	-21	135	129
288	340	-52	135	130
287	340	-53	135	131
300	340	-40	135	132
343	350	-7	135	133

363	350	13	136	133
340	350	-10	136	134
385	350	35	137	134
331	350	-19	137	135
361	350	11	138	135
333	350	-17	138	136
312	350	-38	138	137
298	350	-52	138	138
294	350	-56	138	139
300	350	-50	138	140
314	350	-36	138	141
319	350	-31	138	142
288	350	-62	138	143
287	350	-63	138	144
300	350	-50	138	145
363	343	20	139	145
340	343	-3	139	146
385	343	42	140	146
331	343	-12	140	147
361	343	18	141	147
333	343	-10	141	148
312	343	-31	141	149
298	343	-45	141	150
294	343	-49	141	151
300	343	-43	141	152
314	343	-29	141	153
319	343	-24	141	154
288	343	-55	141	155
287	343	-56	141	156
300	343	-43	141	157
340	363	-23	141	158
385	363	22	142	158
331	363	-32	142	159
361	363	-2	142	160
333	363	-30	142	161
312	363	-51	142	162
298	363	-65	142	163
294	363	-69	142	164
300	363	-63	142	165
314	363	-49	142	166
319	363	-44	142	167
288	363	-75	142	168
287	363	-76	142	169
300	363	-63	142	170
385	340	45	143	170
331	340	-9	143	171
361	340	21	144	171
333	340	-7	144	172
312	340	-28	144	173
298	340	-42	144	174
294	340	-46	144	175
300	340	-40	144	176
314	340	-26	144	177
319	340	-21	144	178
288	340	-52	144	179
287	340	-53	144	180

300	340	-40	144	181
331	385	-54	144	182
361	385	-24	144	183
333	385	-52	144	184
312	385	-73	144	185
298	385	-87	144	186
294	385	-91	144	187
300	385	-85	144	188
314	385	-71	144	189
319	385	-66	144	190
288	385	-97	144	191
287	385	-98	144	192
300	385	-85	144	193
361	331	30	145	193
333	331	2	146	193
312	331	-19	146	194
298	331	-33	146	195
294	331	-37	146	196
300	331	-31	146	197
314	331	-17	146	198
319	331	-12	146	199
288	331	-43	146	200
287	331	-44	146	201
300	331	-31	146	202
333	361	-28	146	203
312	361	-49	146	204
298	361	-63	146	205
294	361	-67	146	206
300	361	-61	146	207
314	361	-47	146	208
319	361	-42	146	209
288	361	-73	146	210
287	361	-74	146	211
300	361	-61	146	212
312	333	-21	146	213
298	333	-35	146	214
294	333	-39	146	215
300	333	-33	146	216
314	333	-19	146	217
319	333	-14	146	218
288	333	-45	146	219
287	333	-46	146	220
300	333	-33	146	221
298	312	-14	146	222
294	312	-18	146	223
300	312	-12	146	224
314	312	2	147	224
319	312	7	148	224
288	312	-24	148	225
287	312	-25	148	226
300	312	-12	148	227
294	298	-4	148	228
300	298	2	149	228

314	298	16	150	228
319	298	21	151	228
288	298	-10	151	229
287	298	-11	151	230
300	298	2	152	230
300	294	6	153	230
314	294	20	154	230
319	294	25	155	230
288	294	-6	155	231
287	294	-7	155	232
300	294	6	156	232
314	300	14	157	232
319	300	19	158	232
288	300	-12	158	233
287	300	-13	158	234
300	300	0	158	234
319	314	5	159	234
288	314	-26	159	235
287	314	-27	159	236
300	314	-14	159	237
288	319	-31	159	238
287	319	-32	159	239
300	319	-19	159	240
287	288	-1	159	241
300	288	12	160	241
300	287	13	161	241

S Statistic = 161 - 241 = -80

Tied Group	Value	Members
1	440	2
2	205	2
3	340	2
4	300	2

Time Period	Observations
3/12/2008	1
5/10/2008	1
9/22/2008	1
10/28/2008	1
4/28/2009	1
5/14/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/24/2011	1
9/1/2011	1

4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 72
B = 0
C = 0
D = 0
E = 8
F = 0
a = 51156
b = 197316
c = 1624
Group Variance = 2838
Z-Score = -1.48293
Comparison Level at 95% confidence level = 1.65463 (upward trend)
-1.48293 <= 1.65463 indicating no evidence of an upward trend

Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: GCW-01D

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
6.7	5.3	1.4	1	0
7.2	5.3	1.9	2	0
7.8	5.3	2.5	3	0
7.6	5.3	2.3	4	0
7.2	5.3	1.9	5	0
6.5	5.3	1.2	6	0
7.8	5.3	2.5	7	0
8.3	5.3	3	8	0
8.5	5.3	3.2	9	0
7.5	5.3	2.2	10	0
7.4	5.3	2.1	11	0
7.6	5.3	2.3	12	0
9.6	5.3	4.3	13	0
7.6	5.3	2.3	14	0
6.9	5.3	1.6	15	0
5.9	5.3	0.6	16	0
6.1	5.3	0.8	17	0
7.4	5.3	2.1	18	0
6.2	5.3	0.9	19	0
5.7	5.3	0.4	20	0
6	5.3	0.7	21	0
6.1	5.3	0.8	22	0
25	5.3	19.7	23	0
5.49	5.3	0.19	24	0
4.2	5.3	-1.1	24	1
4.89	5.3	-0.41	24	2
5.3	5.3	0	24	2
4.4	5.3	-0.9	24	3
7.2	6.7	0.5	25	3
7.8	6.7	1.1	26	3
7.6	6.7	0.9	27	3
7.2	6.7	0.5	28	3
6.5	6.7	-0.2	28	4
7.8	6.7	1.1	29	4
8.3	6.7	1.6	30	4
8.5	6.7	1.8	31	4
7.5	6.7	0.8	32	4
7.4	6.7	0.7	33	4
7.6	6.7	0.9	34	4
9.6	6.7	2.9	35	4
7.6	6.7	0.9	36	4
6.9	6.7	0.2	37	4
5.9	6.7	-0.8	37	5
6.1	6.7	-0.6	37	6
7.4	6.7	0.7	38	6
6.2	6.7	-0.5	38	7

5.7	6.7	-1	38	8
6	6.7	-0.7	38	9
6.1	6.7	-0.6	38	10
25	6.7	18.3	39	10
5.49	6.7	-1.21	39	11
4.2	6.7	-2.5	39	12
4.89	6.7	-1.81	39	13
5.3	6.7	-1.4	39	14
4.4	6.7	-2.3	39	15
7.8	7.2	0.6	40	15
7.6	7.2	0.4	41	15
7.2	7.2	0	41	15
6.5	7.2	-0.7	41	16
7.8	7.2	0.6	42	16
8.3	7.2	1.1	43	16
8.5	7.2	1.3	44	16
7.5	7.2	0.3	45	16
7.4	7.2	0.2	46	16
7.6	7.2	0.4	47	16
9.6	7.2	2.4	48	16
7.6	7.2	0.4	49	16
6.9	7.2	-0.3	49	17
5.9	7.2	-1.3	49	18
6.1	7.2	-1.1	49	19
7.4	7.2	0.2	50	19
6.2	7.2	-1	50	20
5.7	7.2	-1.5	50	21
6	7.2	-1.2	50	22
6.1	7.2	-1.1	50	23
25	7.2	17.8	51	23
5.49	7.2	-1.71	51	24
4.2	7.2	-3	51	25
4.89	7.2	-2.31	51	26
5.3	7.2	-1.9	51	27
4.4	7.2	-2.8	51	28
7.6	7.8	-0.2	51	29
7.2	7.8	-0.6	51	30
6.5	7.8	-1.3	51	31
7.8	7.8	0	51	31
8.3	7.8	0.5	52	31
8.5	7.8	0.7	53	31
7.5	7.8	-0.3	53	32
7.4	7.8	-0.4	53	33
7.6	7.8	-0.2	53	34
9.6	7.8	1.8	54	34
7.6	7.8	-0.2	54	35
6.9	7.8	-0.9	54	36
5.9	7.8	-1.9	54	37
6.1	7.8	-1.7	54	38
7.4	7.8	-0.4	54	39
6.2	7.8	-1.6	54	40
5.7	7.8	-2.1	54	41
6	7.8	-1.8	54	42
6.1	7.8	-1.7	54	43
25	7.8	17.2	55	43
5.49	7.8	-2.31	55	44
4.2	7.8	-3.6	55	45

4.89	7.8	-2.91	55	46
5.3	7.8	-2.5	55	47
4.4	7.8	-3.4	55	48
7.2	7.6	-0.4	55	49
6.5	7.6	-1.1	55	50
7.8	7.6	0.2	56	50
8.3	7.6	0.7	57	50
8.5	7.6	0.9	58	50
7.5	7.6	-0.1	58	51
7.4	7.6	-0.2	58	52
7.6	7.6	0	58	52
9.6	7.6	2	59	52
7.6	7.6	0	59	52
6.9	7.6	-0.7	59	53
5.9	7.6	-1.7	59	54
6.1	7.6	-1.5	59	55
7.4	7.6	-0.2	59	56
6.2	7.6	-1.4	59	57
5.7	7.6	-1.9	59	58
6	7.6	-1.6	59	59
6.1	7.6	-1.5	59	60
25	7.6	17.4	60	60
5.49	7.6	-2.11	60	61
4.2	7.6	-3.4	60	62
4.89	7.6	-2.71	60	63
5.3	7.6	-2.3	60	64
4.4	7.6	-3.2	60	65
6.5	7.2	-0.7	60	66
7.8	7.2	0.6	61	66
8.3	7.2	1.1	62	66
8.5	7.2	1.3	63	66
7.5	7.2	0.3	64	66
7.4	7.2	0.2	65	66
7.6	7.2	0.4	66	66
9.6	7.2	2.4	67	66
7.6	7.2	0.4	68	66
6.9	7.2	-0.3	68	67
5.9	7.2	-1.3	68	68
6.1	7.2	-1.1	68	69
7.4	7.2	0.2	69	69
6.2	7.2	-1	69	70
5.7	7.2	-1.5	69	71
6	7.2	-1.2	69	72
6.1	7.2	-1.1	69	73
25	7.2	17.8	70	73
5.49	7.2	-1.71	70	74
4.2	7.2	-3	70	75
4.89	7.2	-2.31	70	76
5.3	7.2	-1.9	70	77
4.4	7.2	-2.8	70	78
7.8	6.5	1.3	71	78
8.3	6.5	1.8	72	78
8.5	6.5	2	73	78
7.5	6.5	1	74	78
7.4	6.5	0.9	75	78
7.6	6.5	1.1	76	78

9.6	6.5	3.1	77	78
7.6	6.5	1.1	78	78
6.9	6.5	0.4	79	78
5.9	6.5	-0.6	79	79
6.1	6.5	-0.4	79	80
7.4	6.5	0.9	80	80
6.2	6.5	-0.3	80	81
5.7	6.5	-0.8	80	82
6	6.5	-0.5	80	83
6.1	6.5	-0.4	80	84
25	6.5	18.5	81	84
5.49	6.5	-1.01	81	85
4.2	6.5	-2.3	81	86
4.89	6.5	-1.61	81	87
5.3	6.5	-1.2	81	88
4.4	6.5	-2.1	81	89
8.3	7.8	0.5	82	89
8.5	7.8	0.7	83	89
7.5	7.8	-0.3	83	90
7.4	7.8	-0.4	83	91
7.6	7.8	-0.2	83	92
9.6	7.8	1.8	84	92
7.6	7.8	-0.2	84	93
6.9	7.8	-0.9	84	94
5.9	7.8	-1.9	84	95
6.1	7.8	-1.7	84	96
7.4	7.8	-0.4	84	97
6.2	7.8	-1.6	84	98
5.7	7.8	-2.1	84	99
6	7.8	-1.8	84	100
6.1	7.8	-1.7	84	101
25	7.8	17.2	85	101
5.49	7.8	-2.31	85	102
4.2	7.8	-3.6	85	103
4.89	7.8	-2.91	85	104
5.3	7.8	-2.5	85	105
4.4	7.8	-3.4	85	106
8.5	8.3	0.2	86	106
7.5	8.3	-0.8	86	107
7.4	8.3	-0.9	86	108
7.6	8.3	-0.7	86	109
9.6	8.3	1.3	87	109
7.6	8.3	-0.7	87	110
6.9	8.3	-1.4	87	111
5.9	8.3	-2.4	87	112
6.1	8.3	-2.2	87	113
7.4	8.3	-0.9	87	114
6.2	8.3	-2.1	87	115
5.7	8.3	-2.6	87	116
6	8.3	-2.3	87	117
6.1	8.3	-2.2	87	118
25	8.3	16.7	88	118
5.49	8.3	-2.81	88	119
4.2	8.3	-4.1	88	120
4.89	8.3	-3.41	88	121
5.3	8.3	-3	88	122
4.4	8.3	-3.9	88	123

7.5	8.5	-1	88	124
7.4	8.5	-1.1	88	125
7.6	8.5	-0.9	88	126
9.6	8.5	1.1	89	126
7.6	8.5	-0.9	89	127
6.9	8.5	-1.6	89	128
5.9	8.5	-2.6	89	129
6.1	8.5	-2.4	89	130
7.4	8.5	-1.1	89	131
6.2	8.5	-2.3	89	132
5.7	8.5	-2.8	89	133
6	8.5	-2.5	89	134
6.1	8.5	-2.4	89	135
25	8.5	16.5	90	135
5.49	8.5	-3.01	90	136
4.2	8.5	-4.3	90	137
4.89	8.5	-3.61	90	138
5.3	8.5	-3.2	90	139
4.4	8.5	-4.1	90	140
7.4	7.5	-0.1	90	141
7.6	7.5	0.1	91	141
9.6	7.5	2.1	92	141
7.6	7.5	0.1	93	141
6.9	7.5	-0.6	93	142
5.9	7.5	-1.6	93	143
6.1	7.5	-1.4	93	144
7.4	7.5	-0.1	93	145
6.2	7.5	-1.3	93	146
5.7	7.5	-1.8	93	147
6	7.5	-1.5	93	148
6.1	7.5	-1.4	93	149
25	7.5	17.5	94	149
5.49	7.5	-2.01	94	150
4.2	7.5	-3.3	94	151
4.89	7.5	-2.61	94	152
5.3	7.5	-2.2	94	153
4.4	7.5	-3.1	94	154
7.6	7.4	0.2	95	154
9.6	7.4	2.2	96	154
7.6	7.4	0.2	97	154
6.9	7.4	-0.5	97	155
5.9	7.4	-1.5	97	156
6.1	7.4	-1.3	97	157
7.4	7.4	0	97	157
6.2	7.4	-1.2	97	158
5.7	7.4	-1.7	97	159
6	7.4	-1.4	97	160
6.1	7.4	-1.3	97	161
25	7.4	17.6	98	161
5.49	7.4	-1.91	98	162
4.2	7.4	-3.2	98	163
4.89	7.4	-2.51	98	164
5.3	7.4	-2.1	98	165
4.4	7.4	-3	98	166
9.6	7.6	2	99	166

7.6	7.6	0	99	166
6.9	7.6	-0.7	99	167
5.9	7.6	-1.7	99	168
6.1	7.6	-1.5	99	169
7.4	7.6	-0.2	99	170
6.2	7.6	-1.4	99	171
5.7	7.6	-1.9	99	172
6	7.6	-1.6	99	173
6.1	7.6	-1.5	99	174
25	7.6	17.4	100	174
5.49	7.6	-2.11	100	175
4.2	7.6	-3.4	100	176
4.89	7.6	-2.71	100	177
5.3	7.6	-2.3	100	178
4.4	7.6	-3.2	100	179
7.6	9.6	-2	100	180
6.9	9.6	-2.7	100	181
5.9	9.6	-3.7	100	182
6.1	9.6	-3.5	100	183
7.4	9.6	-2.2	100	184
6.2	9.6	-3.4	100	185
5.7	9.6	-3.9	100	186
6	9.6	-3.6	100	187
6.1	9.6	-3.5	100	188
25	9.6	15.4	101	188
5.49	9.6	-4.11	101	189
4.2	9.6	-5.4	101	190
4.89	9.6	-4.71	101	191
5.3	9.6	-4.3	101	192
4.4	9.6	-5.2	101	193
6.9	7.6	-0.7	101	194
5.9	7.6	-1.7	101	195
6.1	7.6	-1.5	101	196
7.4	7.6	-0.2	101	197
6.2	7.6	-1.4	101	198
5.7	7.6	-1.9	101	199
6	7.6	-1.6	101	200
6.1	7.6	-1.5	101	201
25	7.6	17.4	102	201
5.49	7.6	-2.11	102	202
4.2	7.6	-3.4	102	203
4.89	7.6	-2.71	102	204
5.3	7.6	-2.3	102	205
4.4	7.6	-3.2	102	206
5.9	6.9	-1	102	207
6.1	6.9	-0.8	102	208
7.4	6.9	0.5	103	208
6.2	6.9	-0.7	103	209
5.7	6.9	-1.2	103	210
6	6.9	-0.9	103	211
6.1	6.9	-0.8	103	212
25	6.9	18.1	104	212
5.49	6.9	-1.41	104	213
4.2	6.9	-2.7	104	214
4.89	6.9	-2.01	104	215
5.3	6.9	-1.6	104	216

4.4	6.9	-2.5	104	217
6.1	5.9	0.2	105	217
7.4	5.9	1.5	106	217
6.2	5.9	0.3	107	217
5.7	5.9	-0.2	107	218
6	5.9	0.1	108	218
6.1	5.9	0.2	109	218
25	5.9	19.1	110	218
5.49	5.9	-0.41	110	219
4.2	5.9	-1.7	110	220
4.89	5.9	-1.01	110	221
5.3	5.9	-0.6	110	222
4.4	5.9	-1.5	110	223
7.4	6.1	1.3	111	223
6.2	6.1	0.1	112	223
5.7	6.1	-0.4	112	224
6	6.1	-0.1	112	225
6.1	6.1	0	112	225
25	6.1	18.9	113	225
5.49	6.1	-0.61	113	226
4.2	6.1	-1.9	113	227
4.89	6.1	-1.21	113	228
5.3	6.1	-0.8	113	229
4.4	6.1	-1.7	113	230
6.2	7.4	-1.2	113	231
5.7	7.4	-1.7	113	232
6	7.4	-1.4	113	233
6.1	7.4	-1.3	113	234
25	7.4	17.6	114	234
5.49	7.4	-1.91	114	235
4.2	7.4	-3.2	114	236
4.89	7.4	-2.51	114	237
5.3	7.4	-2.1	114	238
4.4	7.4	-3	114	239
5.7	6.2	-0.5	114	240
6	6.2	-0.2	114	241
6.1	6.2	-0.1	114	242
25	6.2	18.8	115	242
5.49	6.2	-0.71	115	243
4.2	6.2	-2	115	244
4.89	6.2	-1.31	115	245
5.3	6.2	-0.9	115	246
4.4	6.2	-1.8	115	247
6	5.7	0.3	116	247
6.1	5.7	0.4	117	247
25	5.7	19.3	118	247
5.49	5.7	-0.21	118	248
4.2	5.7	-1.5	118	249
4.89	5.7	-0.81	118	250
5.3	5.7	-0.4	118	251
4.4	5.7	-1.3	118	252
6.1	6	0.1	119	252
25	6	19	120	252

5.49	6	-0.51	120	253
4.2	6	-1.8	120	254
4.89	6	-1.11	120	255
5.3	6	-0.7	120	256
4.4	6	-1.6	120	257
25	6.1	18.9	121	257
5.49	6.1	-0.61	121	258
4.2	6.1	-1.9	121	259
4.89	6.1	-1.21	121	260
5.3	6.1	-0.8	121	261
4.4	6.1	-1.7	121	262
5.49	25	-19.51	121	263
4.2	25	-20.8	121	264
4.89	25	-20.11	121	265
5.3	25	-19.7	121	266
4.4	25	-20.6	121	267
4.2	5.49	-1.29	121	268
4.89	5.49	-0.6	121	269
5.3	5.49	-0.19	121	270
4.4	5.49	-1.09	121	271
4.89	4.2	0.69	122	271
5.3	4.2	1.1	123	271
4.4	4.2	0.2	124	271
5.3	4.89	0.41	125	271
4.4	4.89	-0.49	125	272
4.4	5.3	-0.9	125	273

S Statistic = 125 - 273 = -148

Tied Group	Value	Members
1	5.3	2
2	7.2	2
3	7.8	2
4	7.6	3
5	7.4	2
6	6.1	2

Time Period	Observations
3/11/2008	1
5/13/2008	1
9/23/2008	1
10/29/2008	1
4/29/2009	1
5/13/2009	1
9/29/2009	1
12/9/2009	1
2/26/2010	1
4/15/2010	1
8/10/2010	1
11/22/2010	1
3/10/2011	1

5/25/2011	1
9/2/2011	1
4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/26/2018	1

There are 0 time periods with multiple data

A = 156
B = 0
C = 6
D = 0
E = 16
F = 0
a = 51156
b = 197316
c = 1624
Group Variance = 2833.33
Z-Score = -2.76165
Comparison Level at 95% confidence level = -1.65463 (downward trend)
-2.76165 < -1.65463 indicating a downward trend

Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: GCW-02D

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
220	230	-10	0	1
230	230	0	0	1
240	230	10	1	1
160	230	-70	1	2
222	230	-8	1	3
157	230	-73	1	4
170	230	-60	1	5
165	230	-65	1	6
208	230	-22	1	7
165	230	-65	1	8
118	230	-112	1	9
196	230	-34	1	10
205	230	-25	1	11
199	230	-31	1	12
135	230	-95	1	13
212	230	-18	1	14
214	230	-16	1	15
214	230	-16	1	16
197	230	-33	1	17
179	230	-51	1	18
193	230	-37	1	19
173	230	-57	1	20
181	230	-49	1	21
500	230	270	2	21
162	230	-68	2	22
132	230	-98	2	23
144	230	-86	2	24
121	230	-109	2	25
230	220	10	3	25
240	220	20	4	25
160	220	-60	4	26
222	220	2	5	26
157	220	-63	5	27
170	220	-50	5	28
165	220	-55	5	29
208	220	-12	5	30
165	220	-55	5	31
118	220	-102	5	32
196	220	-24	5	33
205	220	-15	5	34
199	220	-21	5	35
135	220	-85	5	36
212	220	-8	5	37
214	220	-6	5	38
214	220	-6	5	39
197	220	-23	5	40

179	220	-41	5	41
193	220	-27	5	42
173	220	-47	5	43
181	220	-39	5	44
500	220	280	6	44
162	220	-58	6	45
132	220	-88	6	46
144	220	-76	6	47
121	220	-99	6	48
240	230	10	7	48
160	230	-70	7	49
222	230	-8	7	50
157	230	-73	7	51
170	230	-60	7	52
165	230	-65	7	53
208	230	-22	7	54
165	230	-65	7	55
118	230	-112	7	56
196	230	-34	7	57
205	230	-25	7	58
199	230	-31	7	59
135	230	-95	7	60
212	230	-18	7	61
214	230	-16	7	62
214	230	-16	7	63
197	230	-33	7	64
179	230	-51	7	65
193	230	-37	7	66
173	230	-57	7	67
181	230	-49	7	68
500	230	270	8	68
162	230	-68	8	69
132	230	-98	8	70
144	230	-86	8	71
121	230	-109	8	72
160	240	-80	8	73
222	240	-18	8	74
157	240	-83	8	75
170	240	-70	8	76
165	240	-75	8	77
208	240	-32	8	78
165	240	-75	8	79
118	240	-122	8	80
196	240	-44	8	81
205	240	-35	8	82
199	240	-41	8	83
135	240	-105	8	84
212	240	-28	8	85
214	240	-26	8	86
214	240	-26	8	87
197	240	-43	8	88
179	240	-61	8	89
193	240	-47	8	90
173	240	-67	8	91
181	240	-59	8	92
500	240	260	9	92
162	240	-78	9	93

132	240	-108	9	94
144	240	-96	9	95
121	240	-119	9	96
222	160	62	10	96
157	160	-3	10	97
170	160	10	11	97
165	160	5	12	97
208	160	48	13	97
165	160	5	14	97
118	160	-42	14	98
196	160	36	15	98
205	160	45	16	98
199	160	39	17	98
135	160	-25	17	99
212	160	52	18	99
214	160	54	19	99
214	160	54	20	99
197	160	37	21	99
179	160	19	22	99
193	160	33	23	99
173	160	13	24	99
181	160	21	25	99
500	160	340	26	99
162	160	2	27	99
132	160	-28	27	100
144	160	-16	27	101
121	160	-39	27	102
157	222	-65	27	103
170	222	-52	27	104
165	222	-57	27	105
208	222	-14	27	106
165	222	-57	27	107
118	222	-104	27	108
196	222	-26	27	109
205	222	-17	27	110
199	222	-23	27	111
135	222	-87	27	112
212	222	-10	27	113
214	222	-8	27	114
214	222	-8	27	115
197	222	-25	27	116
179	222	-43	27	117
193	222	-29	27	118
173	222	-49	27	119
181	222	-41	27	120
500	222	278	28	120
162	222	-60	28	121
132	222	-90	28	122
144	222	-78	28	123
121	222	-101	28	124
170	157	13	29	124
165	157	8	30	124
208	157	51	31	124
165	157	8	32	124
118	157	-39	32	125
196	157	39	33	125

205	157	48	34	125
199	157	42	35	125
135	157	-22	35	126
212	157	55	36	126
214	157	57	37	126
214	157	57	38	126
197	157	40	39	126
179	157	22	40	126
193	157	36	41	126
173	157	16	42	126
181	157	24	43	126
500	157	343	44	126
162	157	5	45	126
132	157	-25	45	127
144	157	-13	45	128
121	157	-36	45	129
165	170	-5	45	130
208	170	38	46	130
165	170	-5	46	131
118	170	-52	46	132
196	170	26	47	132
205	170	35	48	132
199	170	29	49	132
135	170	-35	49	133
212	170	42	50	133
214	170	44	51	133
214	170	44	52	133
197	170	27	53	133
179	170	9	54	133
193	170	23	55	133
173	170	3	56	133
181	170	11	57	133
500	170	330	58	133
162	170	-8	58	134
132	170	-38	58	135
144	170	-26	58	136
121	170	-49	58	137
208	165	43	59	137
165	165	0	59	137
118	165	-47	59	138
196	165	31	60	138
205	165	40	61	138
199	165	34	62	138
135	165	-30	62	139
212	165	47	63	139
214	165	49	64	139
214	165	49	65	139
197	165	32	66	139
179	165	14	67	139
193	165	28	68	139
173	165	8	69	139
181	165	16	70	139
500	165	335	71	139
162	165	-3	71	140
132	165	-33	71	141
144	165	-21	71	142
121	165	-44	71	143

165	208	-43	71	144
118	208	-90	71	145
196	208	-12	71	146
205	208	-3	71	147
199	208	-9	71	148
135	208	-73	71	149
212	208	4	72	149
214	208	6	73	149
214	208	6	74	149
197	208	-11	74	150
179	208	-29	74	151
193	208	-15	74	152
173	208	-35	74	153
181	208	-27	74	154
500	208	292	75	154
162	208	-46	75	155
132	208	-76	75	156
144	208	-64	75	157
121	208	-87	75	158
118	165	-47	75	159
196	165	31	76	159
205	165	40	77	159
199	165	34	78	159
135	165	-30	78	160
212	165	47	79	160
214	165	49	80	160
214	165	49	81	160
197	165	32	82	160
179	165	14	83	160
193	165	28	84	160
173	165	8	85	160
181	165	16	86	160
500	165	335	87	160
162	165	-3	87	161
132	165	-33	87	162
144	165	-21	87	163
121	165	-44	87	164
196	118	78	88	164
205	118	87	89	164
199	118	81	90	164
135	118	17	91	164
212	118	94	92	164
214	118	96	93	164
214	118	96	94	164
197	118	79	95	164
179	118	61	96	164
193	118	75	97	164
173	118	55	98	164
181	118	63	99	164
500	118	382	100	164
162	118	44	101	164
132	118	14	102	164
144	118	26	103	164
121	118	3	104	164
205	196	9	105	164

199	196	3	106	164
135	196	-61	106	165
212	196	16	107	165
214	196	18	108	165
214	196	18	109	165
197	196	1	110	165
179	196	-17	110	166
193	196	-3	110	167
173	196	-23	110	168
181	196	-15	110	169
500	196	304	111	169
162	196	-34	111	170
132	196	-64	111	171
144	196	-52	111	172
121	196	-75	111	173
199	205	-6	111	174
135	205	-70	111	175
212	205	7	112	175
214	205	9	113	175
214	205	9	114	175
197	205	-8	114	176
179	205	-26	114	177
193	205	-12	114	178
173	205	-32	114	179
181	205	-24	114	180
500	205	295	115	180
162	205	-43	115	181
132	205	-73	115	182
144	205	-61	115	183
121	205	-84	115	184
135	199	-64	115	185
212	199	13	116	185
214	199	15	117	185
214	199	15	118	185
197	199	-2	118	186
179	199	-20	118	187
193	199	-6	118	188
173	199	-26	118	189
181	199	-18	118	190
500	199	301	119	190
162	199	-37	119	191
132	199	-67	119	192
144	199	-55	119	193
121	199	-78	119	194
212	135	77	120	194
214	135	79	121	194
214	135	79	122	194
197	135	62	123	194
179	135	44	124	194
193	135	58	125	194
173	135	38	126	194
181	135	46	127	194
500	135	365	128	194
162	135	27	129	194
132	135	-3	129	195
144	135	9	130	195

121	135	-14	130	196
214	212	2	131	196
214	212	2	132	196
197	212	-15	132	197
179	212	-33	132	198
193	212	-19	132	199
173	212	-39	132	200
181	212	-31	132	201
500	212	288	133	201
162	212	-50	133	202
132	212	-80	133	203
144	212	-68	133	204
121	212	-91	133	205
214	214	0	133	205
197	214	-17	133	206
179	214	-35	133	207
193	214	-21	133	208
173	214	-41	133	209
181	214	-33	133	210
500	214	286	134	210
162	214	-52	134	211
132	214	-82	134	212
144	214	-70	134	213
121	214	-93	134	214
197	214	-17	134	215
179	214	-35	134	216
193	214	-21	134	217
173	214	-41	134	218
181	214	-33	134	219
500	214	286	135	219
162	214	-52	135	220
132	214	-82	135	221
144	214	-70	135	222
121	214	-93	135	223
179	197	-18	135	224
193	197	-4	135	225
173	197	-24	135	226
181	197	-16	135	227
500	197	303	136	227
162	197	-35	136	228
132	197	-65	136	229
144	197	-53	136	230
121	197	-76	136	231
193	179	14	137	231
173	179	-6	137	232
181	179	2	138	232
500	179	321	139	232
162	179	-17	139	233
132	179	-47	139	234
144	179	-35	139	235
121	179	-58	139	236
173	193	-20	139	237
181	193	-12	139	238

500	193	307	140	238
162	193	-31	140	239
132	193	-61	140	240
144	193	-49	140	241
121	193	-72	140	242
181	173	8	141	242
500	173	327	142	242
162	173	-11	142	243
132	173	-41	142	244
144	173	-29	142	245
121	173	-52	142	246
500	181	319	143	246
162	181	-19	143	247
132	181	-49	143	248
144	181	-37	143	249
121	181	-60	143	250
162	500	-338	143	251
132	500	-368	143	252
144	500	-356	143	253
121	500	-379	143	254
132	162	-30	143	255
144	162	-18	143	256
121	162	-41	143	257
144	132	12	144	257
121	132	-11	144	258
121	144	-23	144	259

S Statistic = 144 - 259 = -115

Tied Group Value		Members
1	230	2
2	165	2
3	214	2

Time Period	Observations
3/12/2008	1
5/12/2008	1
9/23/2008	1
12/3/2008	1
4/28/2009	1
5/14/2009	1
9/24/2009	1
12/8/2009	1
2/25/2010	1
4/14/2010	1
8/12/2010	1
11/24/2010	1
3/8/2011	1
5/24/2011	1
9/1/2011	1
4/11/2012	1

11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 54
B = 0
C = 0
D = 0
E = 6
F = 0
a = 51156
b = 197316
c = 1624
Group Variance = 2839
Z-Score = -2.13955
Comparison Level at 95% confidence level = -1.65463 (downward trend)
-2.13955 < -1.65463 indicating a downward trend

Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: GCW-03D

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
220	200	20	1	0
440	200	240	2	0
480	200	280	3	0
446	200	246	4	0
440	200	240	5	0
205	200	5	6	0
187	200	-13	6	1
204	200	4	7	1
390	200	190	8	1
205	200	5	9	1
340	200	140	10	1
350	200	150	11	1
343	200	143	12	1
363	200	163	13	1
340	200	140	14	1
385	200	185	15	1
331	200	131	16	1
361	200	161	17	1
333	200	133	18	1
312	200	112	19	1
298	200	98	20	1
294	200	94	21	1
300	200	100	22	1
314	200	114	23	1
319	200	119	24	1
288	200	88	25	1
287	200	87	26	1
300	200	100	27	1
440	220	220	28	1
480	220	260	29	1
446	220	226	30	1
440	220	220	31	1
205	220	-15	31	2
187	220	-33	31	3
204	220	-16	31	4
390	220	170	32	4
205	220	-15	32	5
340	220	120	33	5
350	220	130	34	5
343	220	123	35	5
363	220	143	36	5
340	220	120	37	5
385	220	165	38	5
331	220	111	39	5
361	220	141	40	5
333	220	113	41	5

312	220	92	42	5
298	220	78	43	5
294	220	74	44	5
300	220	80	45	5
314	220	94	46	5
319	220	99	47	5
288	220	68	48	5
287	220	67	49	5
300	220	80	50	5
480	440	40	51	5
446	440	6	52	5
440	440	0	52	5
205	440	-235	52	6
187	440	-253	52	7
204	440	-236	52	8
390	440	-50	52	9
205	440	-235	52	10
340	440	-100	52	11
350	440	-90	52	12
343	440	-97	52	13
363	440	-77	52	14
340	440	-100	52	15
385	440	-55	52	16
331	440	-109	52	17
361	440	-79	52	18
333	440	-107	52	19
312	440	-128	52	20
298	440	-142	52	21
294	440	-146	52	22
300	440	-140	52	23
314	440	-126	52	24
319	440	-121	52	25
288	440	-152	52	26
287	440	-153	52	27
300	440	-140	52	28
446	480	-34	52	29
440	480	-40	52	30
205	480	-275	52	31
187	480	-293	52	32
204	480	-276	52	33
390	480	-90	52	34
205	480	-275	52	35
340	480	-140	52	36
350	480	-130	52	37
343	480	-137	52	38
363	480	-117	52	39
340	480	-140	52	40
385	480	-95	52	41
331	480	-149	52	42
361	480	-119	52	43
333	480	-147	52	44
312	480	-168	52	45
298	480	-182	52	46
294	480	-186	52	47
300	480	-180	52	48
314	480	-166	52	49
319	480	-161	52	50

288	480	-192	52	51
287	480	-193	52	52
300	480	-180	52	53
440	446	-6	52	54
205	446	-241	52	55
187	446	-259	52	56
204	446	-242	52	57
390	446	-56	52	58
205	446	-241	52	59
340	446	-106	52	60
350	446	-96	52	61
343	446	-103	52	62
363	446	-83	52	63
340	446	-106	52	64
385	446	-61	52	65
331	446	-115	52	66
361	446	-85	52	67
333	446	-113	52	68
312	446	-134	52	69
298	446	-148	52	70
294	446	-152	52	71
300	446	-146	52	72
314	446	-132	52	73
319	446	-127	52	74
288	446	-158	52	75
287	446	-159	52	76
300	446	-146	52	77
205	440	-235	52	78
187	440	-253	52	79
204	440	-236	52	80
390	440	-50	52	81
205	440	-235	52	82
340	440	-100	52	83
350	440	-90	52	84
343	440	-97	52	85
363	440	-77	52	86
340	440	-100	52	87
385	440	-55	52	88
331	440	-109	52	89
361	440	-79	52	90
333	440	-107	52	91
312	440	-128	52	92
298	440	-142	52	93
294	440	-146	52	94
300	440	-140	52	95
314	440	-126	52	96
319	440	-121	52	97
288	440	-152	52	98
287	440	-153	52	99
300	440	-140	52	100
187	205	-18	52	101
204	205	-1	52	102
390	205	185	53	102
205	205	0	53	102
340	205	135	54	102
350	205	145	55	102

343	205	138	56	102
363	205	158	57	102
340	205	135	58	102
385	205	180	59	102
331	205	126	60	102
361	205	156	61	102
333	205	128	62	102
312	205	107	63	102
298	205	93	64	102
294	205	89	65	102
300	205	95	66	102
314	205	109	67	102
319	205	114	68	102
288	205	83	69	102
287	205	82	70	102
300	205	95	71	102
204	187	17	72	102
390	187	203	73	102
205	187	18	74	102
340	187	153	75	102
350	187	163	76	102
343	187	156	77	102
363	187	176	78	102
340	187	153	79	102
385	187	198	80	102
331	187	144	81	102
361	187	174	82	102
333	187	146	83	102
312	187	125	84	102
298	187	111	85	102
294	187	107	86	102
300	187	113	87	102
314	187	127	88	102
319	187	132	89	102
288	187	101	90	102
287	187	100	91	102
300	187	113	92	102
390	204	186	93	102
205	204	1	94	102
340	204	136	95	102
350	204	146	96	102
343	204	139	97	102
363	204	159	98	102
340	204	136	99	102
385	204	181	100	102
331	204	127	101	102
361	204	157	102	102
333	204	129	103	102
312	204	108	104	102
298	204	94	105	102
294	204	90	106	102
300	204	96	107	102
314	204	110	108	102
319	204	115	109	102
288	204	84	110	102
287	204	83	111	102
300	204	96	112	102

205	390	-185	112	103
340	390	-50	112	104
350	390	-40	112	105
343	390	-47	112	106
363	390	-27	112	107
340	390	-50	112	108
385	390	-5	112	109
331	390	-59	112	110
361	390	-29	112	111
333	390	-57	112	112
312	390	-78	112	113
298	390	-92	112	114
294	390	-96	112	115
300	390	-90	112	116
314	390	-76	112	117
319	390	-71	112	118
288	390	-102	112	119
287	390	-103	112	120
300	390	-90	112	121
340	205	135	113	121
350	205	145	114	121
343	205	138	115	121
363	205	158	116	121
340	205	135	117	121
385	205	180	118	121
331	205	126	119	121
361	205	156	120	121
333	205	128	121	121
312	205	107	122	121
298	205	93	123	121
294	205	89	124	121
300	205	95	125	121
314	205	109	126	121
319	205	114	127	121
288	205	83	128	121
287	205	82	129	121
300	205	95	130	121
350	340	10	131	121
343	340	3	132	121
363	340	23	133	121
340	340	0	133	121
385	340	45	134	121
331	340	-9	134	122
361	340	21	135	122
333	340	-7	135	123
312	340	-28	135	124
298	340	-42	135	125
294	340	-46	135	126
300	340	-40	135	127
314	340	-26	135	128
319	340	-21	135	129
288	340	-52	135	130
287	340	-53	135	131
300	340	-40	135	132
343	350	-7	135	133

363	350	13	136	133
340	350	-10	136	134
385	350	35	137	134
331	350	-19	137	135
361	350	11	138	135
333	350	-17	138	136
312	350	-38	138	137
298	350	-52	138	138
294	350	-56	138	139
300	350	-50	138	140
314	350	-36	138	141
319	350	-31	138	142
288	350	-62	138	143
287	350	-63	138	144
300	350	-50	138	145
363	343	20	139	145
340	343	-3	139	146
385	343	42	140	146
331	343	-12	140	147
361	343	18	141	147
333	343	-10	141	148
312	343	-31	141	149
298	343	-45	141	150
294	343	-49	141	151
300	343	-43	141	152
314	343	-29	141	153
319	343	-24	141	154
288	343	-55	141	155
287	343	-56	141	156
300	343	-43	141	157
340	363	-23	141	158
385	363	22	142	158
331	363	-32	142	159
361	363	-2	142	160
333	363	-30	142	161
312	363	-51	142	162
298	363	-65	142	163
294	363	-69	142	164
300	363	-63	142	165
314	363	-49	142	166
319	363	-44	142	167
288	363	-75	142	168
287	363	-76	142	169
300	363	-63	142	170
385	340	45	143	170
331	340	-9	143	171
361	340	21	144	171
333	340	-7	144	172
312	340	-28	144	173
298	340	-42	144	174
294	340	-46	144	175
300	340	-40	144	176
314	340	-26	144	177
319	340	-21	144	178
288	340	-52	144	179
287	340	-53	144	180

300	340	-40	144	181
331	385	-54	144	182
361	385	-24	144	183
333	385	-52	144	184
312	385	-73	144	185
298	385	-87	144	186
294	385	-91	144	187
300	385	-85	144	188
314	385	-71	144	189
319	385	-66	144	190
288	385	-97	144	191
287	385	-98	144	192
300	385	-85	144	193
361	331	30	145	193
333	331	2	146	193
312	331	-19	146	194
298	331	-33	146	195
294	331	-37	146	196
300	331	-31	146	197
314	331	-17	146	198
319	331	-12	146	199
288	331	-43	146	200
287	331	-44	146	201
300	331	-31	146	202
333	361	-28	146	203
312	361	-49	146	204
298	361	-63	146	205
294	361	-67	146	206
300	361	-61	146	207
314	361	-47	146	208
319	361	-42	146	209
288	361	-73	146	210
287	361	-74	146	211
300	361	-61	146	212
312	333	-21	146	213
298	333	-35	146	214
294	333	-39	146	215
300	333	-33	146	216
314	333	-19	146	217
319	333	-14	146	218
288	333	-45	146	219
287	333	-46	146	220
300	333	-33	146	221
298	312	-14	146	222
294	312	-18	146	223
300	312	-12	146	224
314	312	2	147	224
319	312	7	148	224
288	312	-24	148	225
287	312	-25	148	226
300	312	-12	148	227
294	298	-4	148	228
300	298	2	149	228

314	298	16	150	228
319	298	21	151	228
288	298	-10	151	229
287	298	-11	151	230
300	298	2	152	230
300	294	6	153	230
314	294	20	154	230
319	294	25	155	230
288	294	-6	155	231
287	294	-7	155	232
300	294	6	156	232
314	300	14	157	232
319	300	19	158	232
288	300	-12	158	233
287	300	-13	158	234
300	300	0	158	234
319	314	5	159	234
288	314	-26	159	235
287	314	-27	159	236
300	314	-14	159	237
288	319	-31	159	238
287	319	-32	159	239
300	319	-19	159	240
287	288	-1	159	241
300	288	12	160	241
300	287	13	161	241

S Statistic = 161 - 241 = -80

Tied Group	Value	Members
1	440	2
2	205	2
3	340	2
4	300	2

Time Period	Observations
3/12/2008	1
5/10/2008	1
9/22/2008	1
10/28/2008	1
4/28/2009	1
5/14/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/24/2011	1
9/1/2011	1

4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 72
B = 0
C = 0
D = 0
E = 8
F = 0
a = 51156
b = 197316
c = 1624
Group Variance = 2838
Z-Score = -1.48293
Comparison Level at 95% confidence level = -1.65463 (downward trend)
-1.48293 >= -1.65463 indicating no evidence of a downward trend

Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: GCW-03D

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
220	200	20	1	0
440	200	240	2	0
480	200	280	3	0
446	200	246	4	0
440	200	240	5	0
205	200	5	6	0
187	200	-13	6	1
204	200	4	7	1
390	200	190	8	1
205	200	5	9	1
340	200	140	10	1
350	200	150	11	1
343	200	143	12	1
363	200	163	13	1
340	200	140	14	1
385	200	185	15	1
331	200	131	16	1
361	200	161	17	1
333	200	133	18	1
312	200	112	19	1
298	200	98	20	1
294	200	94	21	1
300	200	100	22	1
314	200	114	23	1
319	200	119	24	1
288	200	88	25	1
287	200	87	26	1
300	200	100	27	1
440	220	220	28	1
480	220	260	29	1
446	220	226	30	1
440	220	220	31	1
205	220	-15	31	2
187	220	-33	31	3
204	220	-16	31	4
390	220	170	32	4
205	220	-15	32	5
340	220	120	33	5
350	220	130	34	5
343	220	123	35	5
363	220	143	36	5
340	220	120	37	5
385	220	165	38	5
331	220	111	39	5
361	220	141	40	5
333	220	113	41	5

312	220	92	42	5
298	220	78	43	5
294	220	74	44	5
300	220	80	45	5
314	220	94	46	5
319	220	99	47	5
288	220	68	48	5
287	220	67	49	5
300	220	80	50	5
480	440	40	51	5
446	440	6	52	5
440	440	0	52	5
205	440	-235	52	6
187	440	-253	52	7
204	440	-236	52	8
390	440	-50	52	9
205	440	-235	52	10
340	440	-100	52	11
350	440	-90	52	12
343	440	-97	52	13
363	440	-77	52	14
340	440	-100	52	15
385	440	-55	52	16
331	440	-109	52	17
361	440	-79	52	18
333	440	-107	52	19
312	440	-128	52	20
298	440	-142	52	21
294	440	-146	52	22
300	440	-140	52	23
314	440	-126	52	24
319	440	-121	52	25
288	440	-152	52	26
287	440	-153	52	27
300	440	-140	52	28
446	480	-34	52	29
440	480	-40	52	30
205	480	-275	52	31
187	480	-293	52	32
204	480	-276	52	33
390	480	-90	52	34
205	480	-275	52	35
340	480	-140	52	36
350	480	-130	52	37
343	480	-137	52	38
363	480	-117	52	39
340	480	-140	52	40
385	480	-95	52	41
331	480	-149	52	42
361	480	-119	52	43
333	480	-147	52	44
312	480	-168	52	45
298	480	-182	52	46
294	480	-186	52	47
300	480	-180	52	48
314	480	-166	52	49
319	480	-161	52	50

288	480	-192	52	51
287	480	-193	52	52
300	480	-180	52	53
440	446	-6	52	54
205	446	-241	52	55
187	446	-259	52	56
204	446	-242	52	57
390	446	-56	52	58
205	446	-241	52	59
340	446	-106	52	60
350	446	-96	52	61
343	446	-103	52	62
363	446	-83	52	63
340	446	-106	52	64
385	446	-61	52	65
331	446	-115	52	66
361	446	-85	52	67
333	446	-113	52	68
312	446	-134	52	69
298	446	-148	52	70
294	446	-152	52	71
300	446	-146	52	72
314	446	-132	52	73
319	446	-127	52	74
288	446	-158	52	75
287	446	-159	52	76
300	446	-146	52	77
205	440	-235	52	78
187	440	-253	52	79
204	440	-236	52	80
390	440	-50	52	81
205	440	-235	52	82
340	440	-100	52	83
350	440	-90	52	84
343	440	-97	52	85
363	440	-77	52	86
340	440	-100	52	87
385	440	-55	52	88
331	440	-109	52	89
361	440	-79	52	90
333	440	-107	52	91
312	440	-128	52	92
298	440	-142	52	93
294	440	-146	52	94
300	440	-140	52	95
314	440	-126	52	96
319	440	-121	52	97
288	440	-152	52	98
287	440	-153	52	99
300	440	-140	52	100
187	205	-18	52	101
204	205	-1	52	102
390	205	185	53	102
205	205	0	53	102
340	205	135	54	102
350	205	145	55	102

343	205	138	56	102
363	205	158	57	102
340	205	135	58	102
385	205	180	59	102
331	205	126	60	102
361	205	156	61	102
333	205	128	62	102
312	205	107	63	102
298	205	93	64	102
294	205	89	65	102
300	205	95	66	102
314	205	109	67	102
319	205	114	68	102
288	205	83	69	102
287	205	82	70	102
300	205	95	71	102
204	187	17	72	102
390	187	203	73	102
205	187	18	74	102
340	187	153	75	102
350	187	163	76	102
343	187	156	77	102
363	187	176	78	102
340	187	153	79	102
385	187	198	80	102
331	187	144	81	102
361	187	174	82	102
333	187	146	83	102
312	187	125	84	102
298	187	111	85	102
294	187	107	86	102
300	187	113	87	102
314	187	127	88	102
319	187	132	89	102
288	187	101	90	102
287	187	100	91	102
300	187	113	92	102
390	204	186	93	102
205	204	1	94	102
340	204	136	95	102
350	204	146	96	102
343	204	139	97	102
363	204	159	98	102
340	204	136	99	102
385	204	181	100	102
331	204	127	101	102
361	204	157	102	102
333	204	129	103	102
312	204	108	104	102
298	204	94	105	102
294	204	90	106	102
300	204	96	107	102
314	204	110	108	102
319	204	115	109	102
288	204	84	110	102
287	204	83	111	102
300	204	96	112	102

205	390	-185	112	103
340	390	-50	112	104
350	390	-40	112	105
343	390	-47	112	106
363	390	-27	112	107
340	390	-50	112	108
385	390	-5	112	109
331	390	-59	112	110
361	390	-29	112	111
333	390	-57	112	112
312	390	-78	112	113
298	390	-92	112	114
294	390	-96	112	115
300	390	-90	112	116
314	390	-76	112	117
319	390	-71	112	118
288	390	-102	112	119
287	390	-103	112	120
300	390	-90	112	121
340	205	135	113	121
350	205	145	114	121
343	205	138	115	121
363	205	158	116	121
340	205	135	117	121
385	205	180	118	121
331	205	126	119	121
361	205	156	120	121
333	205	128	121	121
312	205	107	122	121
298	205	93	123	121
294	205	89	124	121
300	205	95	125	121
314	205	109	126	121
319	205	114	127	121
288	205	83	128	121
287	205	82	129	121
300	205	95	130	121
350	340	10	131	121
343	340	3	132	121
363	340	23	133	121
340	340	0	133	121
385	340	45	134	121
331	340	-9	134	122
361	340	21	135	122
333	340	-7	135	123
312	340	-28	135	124
298	340	-42	135	125
294	340	-46	135	126
300	340	-40	135	127
314	340	-26	135	128
319	340	-21	135	129
288	340	-52	135	130
287	340	-53	135	131
300	340	-40	135	132
343	350	-7	135	133

363	350	13	136	133
340	350	-10	136	134
385	350	35	137	134
331	350	-19	137	135
361	350	11	138	135
333	350	-17	138	136
312	350	-38	138	137
298	350	-52	138	138
294	350	-56	138	139
300	350	-50	138	140
314	350	-36	138	141
319	350	-31	138	142
288	350	-62	138	143
287	350	-63	138	144
300	350	-50	138	145
363	343	20	139	145
340	343	-3	139	146
385	343	42	140	146
331	343	-12	140	147
361	343	18	141	147
333	343	-10	141	148
312	343	-31	141	149
298	343	-45	141	150
294	343	-49	141	151
300	343	-43	141	152
314	343	-29	141	153
319	343	-24	141	154
288	343	-55	141	155
287	343	-56	141	156
300	343	-43	141	157
340	363	-23	141	158
385	363	22	142	158
331	363	-32	142	159
361	363	-2	142	160
333	363	-30	142	161
312	363	-51	142	162
298	363	-65	142	163
294	363	-69	142	164
300	363	-63	142	165
314	363	-49	142	166
319	363	-44	142	167
288	363	-75	142	168
287	363	-76	142	169
300	363	-63	142	170
385	340	45	143	170
331	340	-9	143	171
361	340	21	144	171
333	340	-7	144	172
312	340	-28	144	173
298	340	-42	144	174
294	340	-46	144	175
300	340	-40	144	176
314	340	-26	144	177
319	340	-21	144	178
288	340	-52	144	179
287	340	-53	144	180

300	340	-40	144	181
331	385	-54	144	182
361	385	-24	144	183
333	385	-52	144	184
312	385	-73	144	185
298	385	-87	144	186
294	385	-91	144	187
300	385	-85	144	188
314	385	-71	144	189
319	385	-66	144	190
288	385	-97	144	191
287	385	-98	144	192
300	385	-85	144	193
361	331	30	145	193
333	331	2	146	193
312	331	-19	146	194
298	331	-33	146	195
294	331	-37	146	196
300	331	-31	146	197
314	331	-17	146	198
319	331	-12	146	199
288	331	-43	146	200
287	331	-44	146	201
300	331	-31	146	202
333	361	-28	146	203
312	361	-49	146	204
298	361	-63	146	205
294	361	-67	146	206
300	361	-61	146	207
314	361	-47	146	208
319	361	-42	146	209
288	361	-73	146	210
287	361	-74	146	211
300	361	-61	146	212
312	333	-21	146	213
298	333	-35	146	214
294	333	-39	146	215
300	333	-33	146	216
314	333	-19	146	217
319	333	-14	146	218
288	333	-45	146	219
287	333	-46	146	220
300	333	-33	146	221
298	312	-14	146	222
294	312	-18	146	223
300	312	-12	146	224
314	312	2	147	224
319	312	7	148	224
288	312	-24	148	225
287	312	-25	148	226
300	312	-12	148	227
294	298	-4	148	228
300	298	2	149	228

314	298	16	150	228
319	298	21	151	228
288	298	-10	151	229
287	298	-11	151	230
300	298	2	152	230
300	294	6	153	230
314	294	20	154	230
319	294	25	155	230
288	294	-6	155	231
287	294	-7	155	232
300	294	6	156	232
314	300	14	157	232
319	300	19	158	232
288	300	-12	158	233
287	300	-13	158	234
300	300	0	158	234
319	314	5	159	234
288	314	-26	159	235
287	314	-27	159	236
300	314	-14	159	237
288	319	-31	159	238
287	319	-32	159	239
300	319	-19	159	240
287	288	-1	159	241
300	288	12	160	241
300	287	13	161	241

S Statistic = 161 - 241 = -80

Tied Group	Value	Members
1	440	2
2	205	2
3	340	2
4	300	2

Time Period	Observations
3/12/2008	1
5/10/2008	1
9/22/2008	1
10/28/2008	1
4/28/2009	1
5/14/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/24/2011	1
9/1/2011	1

4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 72
B = 0
C = 0
D = 0
E = 8
F = 0
a = 51156
b = 197316
c = 1624
Group Variance = 2838
Z-Score = -1.48293
Comparison Level at 95% confidence level = 1.65463 (upward trend)
-1.48293 <= 1.65463 indicating no evidence of an upward trend

Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: GCW-04D

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
570	530	40	1	0
890	530	360	2	0
920	530	390	3	0
950	530	420	4	0
864	530	334	5	0
506	530	-24	5	1
456	530	-74	5	2
486	530	-44	5	3
723	530	193	6	3
464	530	-66	6	4
622	530	92	7	4
593	530	63	8	4
575	530	45	9	4
561	530	31	10	4
546	530	16	11	4
550	530	20	12	4
593	530	63	13	4
592	530	62	14	4
505	530	-25	14	5
333	530	-197	14	6
0.6	530	-529.4	14	7
0.9	530	-529.1	14	8
0.6	530	-529.4	14	9
419	530	-111	14	10
420	530	-110	14	11
412	530	-118	14	12
0.91	530	-529.09	14	13
406	530	-124	14	14
890	570	320	15	14
920	570	350	16	14
950	570	380	17	14
864	570	294	18	14
506	570	-64	18	15
456	570	-114	18	16
486	570	-84	18	17
723	570	153	19	17
464	570	-106	19	18
622	570	52	20	18
593	570	23	21	18
575	570	5	22	18
561	570	-9	22	19
546	570	-24	22	20
550	570	-20	22	21
593	570	23	23	21
592	570	22	24	21
505	570	-65	24	22

333	570	-237	24	23
0.6	570	-569.4	24	24
0.9	570	-569.1	24	25
0.6	570	-569.4	24	26
419	570	-151	24	27
420	570	-150	24	28
412	570	-158	24	29
0.91	570	-569.09	24	30
406	570	-164	24	31
920	890	30	25	31
950	890	60	26	31
864	890	-26	26	32
506	890	-384	26	33
456	890	-434	26	34
486	890	-404	26	35
723	890	-167	26	36
464	890	-426	26	37
622	890	-268	26	38
593	890	-297	26	39
575	890	-315	26	40
561	890	-329	26	41
546	890	-344	26	42
550	890	-340	26	43
593	890	-297	26	44
592	890	-298	26	45
505	890	-385	26	46
333	890	-557	26	47
0.6	890	-889.4	26	48
0.9	890	-889.1	26	49
0.6	890	-889.4	26	50
419	890	-471	26	51
420	890	-470	26	52
412	890	-478	26	53
0.91	890	-889.09	26	54
406	890	-484	26	55
950	920	30	27	55
864	920	-56	27	56
506	920	-414	27	57
456	920	-464	27	58
486	920	-434	27	59
723	920	-197	27	60
464	920	-456	27	61
622	920	-298	27	62
593	920	-327	27	63
575	920	-345	27	64
561	920	-359	27	65
546	920	-374	27	66
550	920	-370	27	67
593	920	-327	27	68
592	920	-328	27	69
505	920	-415	27	70
333	920	-587	27	71
0.6	920	-919.4	27	72
0.9	920	-919.1	27	73
0.6	920	-919.4	27	74
419	920	-501	27	75
420	920	-500	27	76

412	920	-508	27	77
0.91	920	-919.09	27	78
406	920	-514	27	79
864	950	-86	27	80
506	950	-444	27	81
456	950	-494	27	82
486	950	-464	27	83
723	950	-227	27	84
464	950	-486	27	85
622	950	-328	27	86
593	950	-357	27	87
575	950	-375	27	88
561	950	-389	27	89
546	950	-404	27	90
550	950	-400	27	91
593	950	-357	27	92
592	950	-358	27	93
505	950	-445	27	94
333	950	-617	27	95
0.6	950	-949.4	27	96
0.9	950	-949.1	27	97
0.6	950	-949.4	27	98
419	950	-531	27	99
420	950	-530	27	100
412	950	-538	27	101
0.91	950	-949.09	27	102
406	950	-544	27	103
506	864	-358	27	104
456	864	-408	27	105
486	864	-378	27	106
723	864	-141	27	107
464	864	-400	27	108
622	864	-242	27	109
593	864	-271	27	110
575	864	-289	27	111
561	864	-303	27	112
546	864	-318	27	113
550	864	-314	27	114
593	864	-271	27	115
592	864	-272	27	116
505	864	-359	27	117
333	864	-531	27	118
0.6	864	-863.4	27	119
0.9	864	-863.1	27	120
0.6	864	-863.4	27	121
419	864	-445	27	122
420	864	-444	27	123
412	864	-452	27	124
0.91	864	-863.09	27	125
406	864	-458	27	126
456	506	-50	27	127
486	506	-20	27	128
723	506	217	28	128
464	506	-42	28	129
622	506	116	29	129
593	506	87	30	129

575	506	69	31	129
561	506	55	32	129
546	506	40	33	129
550	506	44	34	129
593	506	87	35	129
592	506	86	36	129
505	506	-1	36	130
333	506	-173	36	131
0.6	506	-505.4	36	132
0.9	506	-505.1	36	133
0.6	506	-505.4	36	134
419	506	-87	36	135
420	506	-86	36	136
412	506	-94	36	137
0.91	506	-505.09	36	138
406	506	-100	36	139
486	456	30	37	139
723	456	267	38	139
464	456	8	39	139
622	456	166	40	139
593	456	137	41	139
575	456	119	42	139
561	456	105	43	139
546	456	90	44	139
550	456	94	45	139
593	456	137	46	139
592	456	136	47	139
505	456	49	48	139
333	456	-123	48	140
0.6	456	-455.4	48	141
0.9	456	-455.1	48	142
0.6	456	-455.4	48	143
419	456	-37	48	144
420	456	-36	48	145
412	456	-44	48	146
0.91	456	-455.09	48	147
406	456	-50	48	148
723	486	237	49	148
464	486	-22	49	149
622	486	136	50	149
593	486	107	51	149
575	486	89	52	149
561	486	75	53	149
546	486	60	54	149
550	486	64	55	149
593	486	107	56	149
592	486	106	57	149
505	486	19	58	149
333	486	-153	58	150
0.6	486	-485.4	58	151
0.9	486	-485.1	58	152
0.6	486	-485.4	58	153
419	486	-67	58	154
420	486	-66	58	155
412	486	-74	58	156
0.91	486	-485.09	58	157
406	486	-80	58	158

464	723	-259	58	159
622	723	-101	58	160
593	723	-130	58	161
575	723	-148	58	162
561	723	-162	58	163
546	723	-177	58	164
550	723	-173	58	165
593	723	-130	58	166
592	723	-131	58	167
505	723	-218	58	168
333	723	-390	58	169
0.6	723	-722.4	58	170
0.9	723	-722.1	58	171
0.6	723	-722.4	58	172
419	723	-304	58	173
420	723	-303	58	174
412	723	-311	58	175
0.91	723	-722.09	58	176
406	723	-317	58	177
622	464	158	59	177
593	464	129	60	177
575	464	111	61	177
561	464	97	62	177
546	464	82	63	177
550	464	86	64	177
593	464	129	65	177
592	464	128	66	177
505	464	41	67	177
333	464	-131	67	178
0.6	464	-463.4	67	179
0.9	464	-463.1	67	180
0.6	464	-463.4	67	181
419	464	-45	67	182
420	464	-44	67	183
412	464	-52	67	184
0.91	464	-463.09	67	185
406	464	-58	67	186
593	622	-29	67	187
575	622	-47	67	188
561	622	-61	67	189
546	622	-76	67	190
550	622	-72	67	191
593	622	-29	67	192
592	622	-30	67	193
505	622	-117	67	194
333	622	-289	67	195
0.6	622	-621.4	67	196
0.9	622	-621.1	67	197
0.6	622	-621.4	67	198
419	622	-203	67	199
420	622	-202	67	200
412	622	-210	67	201
0.91	622	-621.09	67	202
406	622	-216	67	203
575	593	-18	67	204

561	593	-32	67	205
546	593	-47	67	206
550	593	-43	67	207
593	593	0	67	207
592	593	-1	67	208
505	593	-88	67	209
333	593	-260	67	210
0.6	593	-592.4	67	211
0.9	593	-592.1	67	212
0.6	593	-592.4	67	213
419	593	-174	67	214
420	593	-173	67	215
412	593	-181	67	216
0.91	593	-592.09	67	217
406	593	-187	67	218
561	575	-14	67	219
546	575	-29	67	220
550	575	-25	67	221
593	575	18	68	221
592	575	17	69	221
505	575	-70	69	222
333	575	-242	69	223
0.6	575	-574.4	69	224
0.9	575	-574.1	69	225
0.6	575	-574.4	69	226
419	575	-156	69	227
420	575	-155	69	228
412	575	-163	69	229
0.91	575	-574.09	69	230
406	575	-169	69	231
546	561	-15	69	232
550	561	-11	69	233
593	561	32	70	233
592	561	31	71	233
505	561	-56	71	234
333	561	-228	71	235
0.6	561	-560.4	71	236
0.9	561	-560.1	71	237
0.6	561	-560.4	71	238
419	561	-142	71	239
420	561	-141	71	240
412	561	-149	71	241
0.91	561	-560.09	71	242
406	561	-155	71	243
550	546	4	72	243
593	546	47	73	243
592	546	46	74	243
505	546	-41	74	244
333	546	-213	74	245
0.6	546	-545.4	74	246
0.9	546	-545.1	74	247
0.6	546	-545.4	74	248
419	546	-127	74	249
420	546	-126	74	250
412	546	-134	74	251
0.91	546	-545.09	74	252

406	546	-140	74	253
593	550	43	75	253
592	550	42	76	253
505	550	-45	76	254
333	550	-217	76	255
0.6	550	-549.4	76	256
0.9	550	-549.1	76	257
0.6	550	-549.4	76	258
419	550	-131	76	259
420	550	-130	76	260
412	550	-138	76	261
0.91	550	-549.09	76	262
406	550	-144	76	263
592	593	-1	76	264
505	593	-88	76	265
333	593	-260	76	266
0.6	593	-592.4	76	267
0.9	593	-592.1	76	268
0.6	593	-592.4	76	269
419	593	-174	76	270
420	593	-173	76	271
412	593	-181	76	272
0.91	593	-592.09	76	273
406	593	-187	76	274
505	592	-87	76	275
333	592	-259	76	276
0.6	592	-591.4	76	277
0.9	592	-591.1	76	278
0.6	592	-591.4	76	279
419	592	-173	76	280
420	592	-172	76	281
412	592	-180	76	282
0.91	592	-591.09	76	283
406	592	-186	76	284
333	505	-172	76	285
0.6	505	-504.4	76	286
0.9	505	-504.1	76	287
0.6	505	-504.4	76	288
419	505	-86	76	289
420	505	-85	76	290
412	505	-93	76	291
0.91	505	-504.09	76	292
406	505	-99	76	293
0.6	333	-332.4	76	294
0.9	333	-332.1	76	295
0.6	333	-332.4	76	296
419	333	86	77	296
420	333	87	78	296
412	333	79	79	296
0.91	333	-332.09	79	297
406	333	73	80	297
0.9	0.6	0.3	81	297
0.6	0.6	0	81	297

419	0.6	418.4	82	297
420	0.6	419.4	83	297
412	0.6	411.4	84	297
0.91	0.6	0.31	85	297
406	0.6	405.4	86	297
0.6	0.9	-0.3	86	298
419	0.9	418.1	87	298
420	0.9	419.1	88	298
412	0.9	411.1	89	298
0.91	0.9	0.01	90	298
406	0.9	405.1	91	298
419	0.6	418.4	92	298
420	0.6	419.4	93	298
412	0.6	411.4	94	298
0.91	0.6	0.31	95	298
406	0.6	405.4	96	298
420	419	1	97	298
412	419	-7	97	299
0.91	419	-418.09	97	300
406	419	-13	97	301
412	420	-8	97	302
0.91	420	-419.09	97	303
406	420	-14	97	304
0.91	412	-411.09	97	305
406	412	-6	97	306
406	0.91	405.09	98	306

S Statistic = 98 - 306 = -208

Tied Group	Value	Members
1	593	2
2	0.6	2

Time Period	Observations
3/11/2008	1
5/10/2008	1
9/22/2008	1
12/3/2008	1
4/28/2009	1
5/15/2009	1
9/23/2009	1
12/7/2009	1
2/24/2010	1
4/16/2010	1
8/11/2010	1
11/22/2010	1
3/8/2011	1
5/23/2011	1
8/31/2011	1
4/11/2012	1
11/8/2012	1

4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/19/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 36
B = 0
C = 0
D = 0
E = 4
F = 0
a = 51156
b = 197316
c = 1624
Group Variance = 2840
Z-Score = -3.88429
Comparison Level at 95% confidence level = -1.65463 (downward trend)
-3.88429 < -1.65463 indicating a downward trend

Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: GCW-05

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
2.03	0.883	1.147	1	0
ND<0	0.883	-0.883	1	1
ND<0	0.883	-0.883	1	2
ND<0	0.883	-0.883	1	3
ND<0	0.883	-0.883	1	4
ND<0	0.883	-0.883	1	5
ND<0	0.883	-0.883	1	6
0.4	0.883	-0.483	1	7
0.4	0.883	-0.483	1	8
ND<0	0.883	-0.883	1	9
1.1	0.883	0.217	2	9
0.4	0.883	-0.483	2	10
0.1	0.883	-0.783	2	11
ND<0	0.883	-0.883	2	12
ND<0	0.883	-0.883	2	13
ND<0	0.883	-0.883	2	14
ND<0	0.883	-0.883	2	15
ND<0	0.883	-0.883	2	16
ND<0	0.883	-0.883	2	17
ND<0	0.883	-0.883	2	18
ND<0	2.03	-2.03	2	19
ND<0	2.03	-2.03	2	20
ND<0	2.03	-2.03	2	21
ND<0	2.03	-2.03	2	22
ND<0	2.03	-2.03	2	23
ND<0	2.03	-2.03	2	24
0.4	2.03	-1.63	2	25
0.4	2.03	-1.63	2	26
ND<0	2.03	-2.03	2	27
1.1	2.03	-0.93	2	28
0.4	2.03	-1.63	2	29
0.1	2.03	-1.93	2	30
ND<0	2.03	-2.03	2	31
ND<0	2.03	-2.03	2	32
ND<0	2.03	-2.03	2	33
ND<0	2.03	-2.03	2	34
ND<0	2.03	-2.03	2	35
ND<0	2.03	-2.03	2	36
ND<0	2.03	-2.03	2	37
ND<0	ND<0	0	2	37
ND<0	ND<0	0	2	37
ND<0	ND<0	0	2	37
ND<0	ND<0	0	2	37
ND<0	ND<0	0	2	37
0.4	ND<0	0.4	3	37

0.4	ND<0	0.4	4	37
ND<0	ND<0	0	4	37
1.1	ND<0	1.1	5	37
0.4	ND<0	0.4	6	37
0.1	ND<0	0.1	7	37
ND<0	ND<0	0	7	37
ND<0	ND<0	0	7	37
ND<0	ND<0	0	7	37
ND<0	ND<0	0	7	37
ND<0	ND<0	0	7	37
ND<0	ND<0	0	7	37
ND<0	ND<0	0	7	37

ND<0	ND<0	0	7	37
ND<0	ND<0	0	7	37
ND<0	ND<0	0	7	37
ND<0	ND<0	0	7	37
0.4	ND<0	0.4	8	37
0.4	ND<0	0.4	9	37
ND<0	ND<0	0	9	37
1.1	ND<0	1.1	10	37
0.4	ND<0	0.4	11	37
0.1	ND<0	0.1	12	37
ND<0	ND<0	0	12	37
ND<0	ND<0	0	12	37
ND<0	ND<0	0	12	37
ND<0	ND<0	0	12	37
ND<0	ND<0	0	12	37
ND<0	ND<0	0	12	37
ND<0	ND<0	0	12	37

ND<0	ND<0	0	12	37
ND<0	ND<0	0	12	37
ND<0	ND<0	0	12	37
0.4	ND<0	0.4	13	37
0.4	ND<0	0.4	14	37
ND<0	ND<0	0	14	37
1.1	ND<0	1.1	15	37
0.4	ND<0	0.4	16	37
0.1	ND<0	0.1	17	37
ND<0	ND<0	0	17	37
ND<0	ND<0	0	17	37
ND<0	ND<0	0	17	37
ND<0	ND<0	0	17	37
ND<0	ND<0	0	17	37
ND<0	ND<0	0	17	37
ND<0	ND<0	0	17	37

ND<0	ND<0	0	17	37
ND<0	ND<0	0	17	37
0.4	ND<0	0.4	18	37
0.4	ND<0	0.4	19	37
ND<0	ND<0	0	19	37
1.1	ND<0	1.1	20	37
0.4	ND<0	0.4	21	37
0.1	ND<0	0.1	22	37
ND<0	ND<0	0	22	37
ND<0	ND<0	0	22	37
ND<0	ND<0	0	22	37

ND<0	ND<0	0	22	37
ND<0	ND<0	0	22	37
ND<0	ND<0	0	22	37
ND<0	ND<0	0	22	37
ND<0	ND<0	0	22	37
0.4	ND<0	0.4	23	37
0.4	ND<0	0.4	24	37
ND<0	ND<0	0	24	37
1.1	ND<0	1.1	25	37
0.4	ND<0	0.4	26	37
0.1	ND<0	0.1	27	37
ND<0	ND<0	0	27	37
ND<0	ND<0	0	27	37
ND<0	ND<0	0	27	37
ND<0	ND<0	0	27	37
ND<0	ND<0	0	27	37
ND<0	ND<0	0	27	37
ND<0	ND<0	0	27	37
0.4	ND<0	0.4	28	37
0.4	ND<0	0.4	29	37
ND<0	ND<0	0	29	37
1.1	ND<0	1.1	30	37
0.4	ND<0	0.4	31	37
0.1	ND<0	0.1	32	37
ND<0	ND<0	0	32	37
ND<0	ND<0	0	32	37
ND<0	ND<0	0	32	37
ND<0	ND<0	0	32	37
ND<0	ND<0	0	32	37
ND<0	ND<0	0	32	37
ND<0	ND<0	0	32	37
0.4	0.4	0	32	37
ND<0	0.4	-0.4	32	38
1.1	0.4	0.7	33	38
0.4	0.4	0	33	38
0.1	0.4	-0.3	33	39
ND<0	0.4	-0.4	33	40
ND<0	0.4	-0.4	33	41
ND<0	0.4	-0.4	33	42
ND<0	0.4	-0.4	33	43
ND<0	0.4	-0.4	33	44
ND<0	0.4	-0.4	33	45
ND<0	0.4	-0.4	33	46
ND<0	0.4	-0.4	33	47
1.1	0.4	0.7	34	47
0.4	0.4	0	34	47
0.1	0.4	-0.3	34	48
ND<0	0.4	-0.4	34	49
ND<0	0.4	-0.4	34	50
ND<0	0.4	-0.4	34	51
ND<0	0.4	-0.4	34	52
ND<0	0.4	-0.4	34	53
ND<0	0.4	-0.4	34	54
ND<0	0.4	-0.4	34	55

1.1	ND<0	1.1	35	55
0.4	ND<0	0.4	36	55
0.1	ND<0	0.1	37	55
ND<0	ND<0	0	37	55
ND<0	ND<0	0	37	55
ND<0	ND<0	0	37	55
ND<0	ND<0	0	37	55
ND<0	ND<0	0	37	55
ND<0	ND<0	0	37	55
ND<0	ND<0	0	37	55
0.4	1.1	-0.7	37	56
0.1	1.1	-1	37	57
ND<0	1.1	-1.1	37	58
ND<0	1.1	-1.1	37	59
ND<0	1.1	-1.1	37	60
ND<0	1.1	-1.1	37	61
ND<0	1.1	-1.1	37	62
ND<0	1.1	-1.1	37	63
ND<0	1.1	-1.1	37	64
0.1	0.4	-0.3	37	65
ND<0	0.4	-0.4	37	66
ND<0	0.4	-0.4	37	67
ND<0	0.4	-0.4	37	68
ND<0	0.4	-0.4	37	69
ND<0	0.4	-0.4	37	70
ND<0	0.4	-0.4	37	71
ND<0	0.4	-0.4	37	72
ND<0	0.1	-0.1	37	73
ND<0	0.1	-0.1	37	74
ND<0	0.1	-0.1	37	75
ND<0	0.1	-0.1	37	76
ND<0	0.1	-0.1	37	77
ND<0	0.1	-0.1	37	78
ND<0	0.1	-0.1	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79

ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79

S Statistic = 37 - 79 = -42

Tied Group	Value	Members
1	0	14
2	0.4	3

Time Period	Observations
2/26/2010	1
4/14/2010	1
8/12/2010	1
11/22/2010	1
3/10/2011	1
5/23/2011	1
8/31/2011	1
4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/19/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 6072
B = 0
C = 2190
D = 0
E = 188
F = 0
a = 19740
b = 71820
c = 840
Group Variance = 759.333
Z-Score = -1.48788
Comparison Level at 95% confidence level = -1.65463 (downward trend)
-1.48788 >= -1.65463 indicating no evidence of a downward trend

Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: GCW-05

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
2.03	0.883	1.147	1	0
ND<0	0.883	-0.883	1	1
ND<0	0.883	-0.883	1	2
ND<0	0.883	-0.883	1	3
ND<0	0.883	-0.883	1	4
ND<0	0.883	-0.883	1	5
ND<0	0.883	-0.883	1	6
0.4	0.883	-0.483	1	7
0.4	0.883	-0.483	1	8
ND<0	0.883	-0.883	1	9
1.1	0.883	0.217	2	9
0.4	0.883	-0.483	2	10
0.1	0.883	-0.783	2	11
ND<0	0.883	-0.883	2	12
ND<0	0.883	-0.883	2	13
ND<0	0.883	-0.883	2	14
ND<0	0.883	-0.883	2	15
ND<0	0.883	-0.883	2	16
ND<0	0.883	-0.883	2	17
ND<0	0.883	-0.883	2	18
ND<0	2.03	-2.03	2	19
ND<0	2.03	-2.03	2	20
ND<0	2.03	-2.03	2	21
ND<0	2.03	-2.03	2	22
ND<0	2.03	-2.03	2	23
ND<0	2.03	-2.03	2	24
0.4	2.03	-1.63	2	25
0.4	2.03	-1.63	2	26
ND<0	2.03	-2.03	2	27
1.1	2.03	-0.93	2	28
0.4	2.03	-1.63	2	29
0.1	2.03	-1.93	2	30
ND<0	2.03	-2.03	2	31
ND<0	2.03	-2.03	2	32
ND<0	2.03	-2.03	2	33
ND<0	2.03	-2.03	2	34
ND<0	2.03	-2.03	2	35
ND<0	2.03	-2.03	2	36
ND<0	2.03	-2.03	2	37
ND<0	ND<0	0	2	37
ND<0	ND<0	0	2	37
ND<0	ND<0	0	2	37
ND<0	ND<0	0	2	37
ND<0	ND<0	0	2	37
0.4	ND<0	0.4	3	37

0.4	ND<0	0.4	4	37
ND<0	ND<0	0	4	37
1.1	ND<0	1.1	5	37
0.4	ND<0	0.4	6	37
0.1	ND<0	0.1	7	37
ND<0	ND<0	0	7	37
ND<0	ND<0	0	7	37
ND<0	ND<0	0	7	37
ND<0	ND<0	0	7	37
ND<0	ND<0	0	7	37
ND<0	ND<0	0	7	37
ND<0	ND<0	0	7	37

ND<0	ND<0	0	7	37
ND<0	ND<0	0	7	37
ND<0	ND<0	0	7	37
ND<0	ND<0	0	7	37
0.4	ND<0	0.4	8	37
0.4	ND<0	0.4	9	37
ND<0	ND<0	0	9	37
1.1	ND<0	1.1	10	37
0.4	ND<0	0.4	11	37
0.1	ND<0	0.1	12	37
ND<0	ND<0	0	12	37
ND<0	ND<0	0	12	37
ND<0	ND<0	0	12	37
ND<0	ND<0	0	12	37
ND<0	ND<0	0	12	37
ND<0	ND<0	0	12	37
ND<0	ND<0	0	12	37

ND<0	ND<0	0	12	37
ND<0	ND<0	0	12	37
ND<0	ND<0	0	12	37
0.4	ND<0	0.4	13	37
0.4	ND<0	0.4	14	37
ND<0	ND<0	0	14	37
1.1	ND<0	1.1	15	37
0.4	ND<0	0.4	16	37
0.1	ND<0	0.1	17	37
ND<0	ND<0	0	17	37
ND<0	ND<0	0	17	37
ND<0	ND<0	0	17	37
ND<0	ND<0	0	17	37
ND<0	ND<0	0	17	37
ND<0	ND<0	0	17	37
ND<0	ND<0	0	17	37

ND<0	ND<0	0	17	37
ND<0	ND<0	0	17	37
0.4	ND<0	0.4	18	37
0.4	ND<0	0.4	19	37
ND<0	ND<0	0	19	37
1.1	ND<0	1.1	20	37
0.4	ND<0	0.4	21	37
0.1	ND<0	0.1	22	37
ND<0	ND<0	0	22	37
ND<0	ND<0	0	22	37
ND<0	ND<0	0	22	37

ND<0	ND<0	0	22	37
ND<0	ND<0	0	22	37
ND<0	ND<0	0	22	37
ND<0	ND<0	0	22	37
ND<0	ND<0	0	22	37
0.4	ND<0	0.4	23	37
0.4	ND<0	0.4	24	37
ND<0	ND<0	0	24	37
1.1	ND<0	1.1	25	37
0.4	ND<0	0.4	26	37
0.1	ND<0	0.1	27	37
ND<0	ND<0	0	27	37
ND<0	ND<0	0	27	37
ND<0	ND<0	0	27	37
ND<0	ND<0	0	27	37
ND<0	ND<0	0	27	37
ND<0	ND<0	0	27	37
ND<0	ND<0	0	27	37
0.4	ND<0	0.4	28	37
0.4	ND<0	0.4	29	37
ND<0	ND<0	0	29	37
1.1	ND<0	1.1	30	37
0.4	ND<0	0.4	31	37
0.1	ND<0	0.1	32	37
ND<0	ND<0	0	32	37
ND<0	ND<0	0	32	37
ND<0	ND<0	0	32	37
ND<0	ND<0	0	32	37
ND<0	ND<0	0	32	37
ND<0	ND<0	0	32	37
ND<0	ND<0	0	32	37
0.4	0.4	0	32	37
ND<0	0.4	-0.4	32	38
1.1	0.4	0.7	33	38
0.4	0.4	0	33	38
0.1	0.4	-0.3	33	39
ND<0	0.4	-0.4	33	40
ND<0	0.4	-0.4	33	41
ND<0	0.4	-0.4	33	42
ND<0	0.4	-0.4	33	43
ND<0	0.4	-0.4	33	44
ND<0	0.4	-0.4	33	45
ND<0	0.4	-0.4	33	46
ND<0	0.4	-0.4	33	47
1.1	0.4	0.7	34	47
0.4	0.4	0	34	47
0.1	0.4	-0.3	34	48
ND<0	0.4	-0.4	34	49
ND<0	0.4	-0.4	34	50
ND<0	0.4	-0.4	34	51
ND<0	0.4	-0.4	34	52
ND<0	0.4	-0.4	34	53
ND<0	0.4	-0.4	34	54
ND<0	0.4	-0.4	34	55

1.1	ND<0	1.1	35	55
0.4	ND<0	0.4	36	55
0.1	ND<0	0.1	37	55
ND<0	ND<0	0	37	55
ND<0	ND<0	0	37	55
ND<0	ND<0	0	37	55
ND<0	ND<0	0	37	55
ND<0	ND<0	0	37	55
ND<0	ND<0	0	37	55
ND<0	ND<0	0	37	55
0.4	1.1	-0.7	37	56
0.1	1.1	-1	37	57
ND<0	1.1	-1.1	37	58
ND<0	1.1	-1.1	37	59
ND<0	1.1	-1.1	37	60
ND<0	1.1	-1.1	37	61
ND<0	1.1	-1.1	37	62
ND<0	1.1	-1.1	37	63
ND<0	1.1	-1.1	37	64
0.1	0.4	-0.3	37	65
ND<0	0.4	-0.4	37	66
ND<0	0.4	-0.4	37	67
ND<0	0.4	-0.4	37	68
ND<0	0.4	-0.4	37	69
ND<0	0.4	-0.4	37	70
ND<0	0.4	-0.4	37	71
ND<0	0.4	-0.4	37	72
ND<0	0.1	-0.1	37	73
ND<0	0.1	-0.1	37	74
ND<0	0.1	-0.1	37	75
ND<0	0.1	-0.1	37	76
ND<0	0.1	-0.1	37	77
ND<0	0.1	-0.1	37	78
ND<0	0.1	-0.1	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79

ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79
ND<0	ND<0	0	37	79

S Statistic = 37 - 79 = -42

Tied Group	Value	Members
1	0	14
2	0.4	3

Time Period	Observations
2/26/2010	1
4/14/2010	1
8/12/2010	1
11/22/2010	1
3/10/2011	1
5/23/2011	1
8/31/2011	1
4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/19/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 6072
B = 0
C = 2190
D = 0
E = 188
F = 0
a = 19740
b = 71820
c = 840
Group Variance = 759.333
Z-Score = -1.48788
Comparison Level at 95% confidence level = 1.65463 (upward trend)
-1.48788 <= 1.65463 indicating no evidence of an upward trend

Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: OW-01A

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
1	1.8	-0.8	0	1
1.1	1.8	-0.7	0	2
0.9	1.8	-0.9	0	3
1	1.8	-0.8	0	4
0.9	1.8	-0.9	0	5
0.9	1.8	-0.9	0	6
0.9	1.8	-0.9	0	7
1	1.8	-0.8	0	8
1.1	1.8	-0.7	0	9
1	1.8	-0.8	0	10
0.8	1.8	-1	0	11
0.7	1.8	-1.1	0	12
0.7	1.8	-1.1	0	13
0.7	1.8	-1.1	0	14
0.6	1.8	-1.2	0	15
0.9	1.8	-0.9	0	16
0.8	1.8	-1	0	17
0.7	1.8	-1.1	0	18
0.7	1.8	-1.1	0	19
0.5	1.8	-1.3	0	20
0.8	1.8	-1	0	21
0.8	1.8	-1	0	22
0.7	1.8	-1.1	0	23
0.572	1.8	-1.228	0	24
0.587	1.8	-1.213	0	25
0.508	1.8	-1.292	0	26
0.75	1.8	-1.05	0	27
0.55	1.8	-1.25	0	28
1.1	1	0.1	1	28
0.9	1	-0.1	1	29
1	1	0	1	29
0.9	1	-0.1	1	30
0.9	1	-0.1	1	31
0.9	1	-0.1	1	32
1	1	0	1	32
1.1	1	0.1	2	32
1	1	0	2	32
0.8	1	-0.2	2	33
0.7	1	-0.3	2	34
0.7	1	-0.3	2	35
0.7	1	-0.3	2	36
0.6	1	-0.4	2	37
0.9	1	-0.1	2	38
0.8	1	-0.2	2	39
0.7	1	-0.3	2	40
0.7	1	-0.3	2	41

0.5	1	-0.5	2	42
0.8	1	-0.2	2	43
0.8	1	-0.2	2	44
0.7	1	-0.3	2	45
0.572	1	-0.428	2	46
0.587	1	-0.413	2	47
0.508	1	-0.492	2	48
0.75	1	-0.25	2	49
0.55	1	-0.45	2	50
0.9	1.1	-0.2	2	51
1	1.1	-0.1	2	52
0.9	1.1	-0.2	2	53
0.9	1.1	-0.2	2	54
0.9	1.1	-0.2	2	55
1	1.1	-0.1	2	56
1.1	1.1	0	2	56
1	1.1	-0.1	2	57
0.8	1.1	-0.3	2	58
0.7	1.1	-0.4	2	59
0.7	1.1	-0.4	2	60
0.7	1.1	-0.4	2	61
0.6	1.1	-0.5	2	62
0.9	1.1	-0.2	2	63
0.8	1.1	-0.3	2	64
0.7	1.1	-0.4	2	65
0.7	1.1	-0.4	2	66
0.5	1.1	-0.6	2	67
0.8	1.1	-0.3	2	68
0.8	1.1	-0.3	2	69
0.7	1.1	-0.4	2	70
0.572	1.1	-0.528	2	71
0.587	1.1	-0.513	2	72
0.508	1.1	-0.592	2	73
0.75	1.1	-0.35	2	74
0.55	1.1	-0.55	2	75
1	0.9	0.1	3	75
0.9	0.9	0	3	75
0.9	0.9	0	3	75
0.9	0.9	0	3	75
1	0.9	0.1	4	75
1.1	0.9	0.2	5	75
1	0.9	0.1	6	75
0.8	0.9	-0.1	6	76
0.7	0.9	-0.2	6	77
0.7	0.9	-0.2	6	78
0.7	0.9	-0.2	6	79
0.6	0.9	-0.3	6	80
0.9	0.9	0	6	80
0.8	0.9	-0.1	6	81
0.7	0.9	-0.2	6	82
0.7	0.9	-0.2	6	83
0.5	0.9	-0.4	6	84
0.8	0.9	-0.1	6	85
0.8	0.9	-0.1	6	86
0.7	0.9	-0.2	6	87
0.572	0.9	-0.328	6	88
0.587	0.9	-0.313	6	89

0.508	0.9	-0.392	6	90
0.75	0.9	-0.15	6	91
0.55	0.9	-0.35	6	92
0.9	1	-0.1	6	93
0.9	1	-0.1	6	94
0.9	1	-0.1	6	95
1	1	0	6	95
1.1	1	0.1	7	95
1	1	0	7	95
0.8	1	-0.2	7	96
0.7	1	-0.3	7	97
0.7	1	-0.3	7	98
0.7	1	-0.3	7	99
0.6	1	-0.4	7	100
0.9	1	-0.1	7	101
0.8	1	-0.2	7	102
0.7	1	-0.3	7	103
0.7	1	-0.3	7	104
0.5	1	-0.5	7	105
0.8	1	-0.2	7	106
0.8	1	-0.2	7	107
0.7	1	-0.3	7	108
0.572	1	-0.428	7	109
0.587	1	-0.413	7	110
0.508	1	-0.492	7	111
0.75	1	-0.25	7	112
0.55	1	-0.45	7	113
0.9	0.9	0	7	113
0.9	0.9	0	7	113
1	0.9	0.1	8	113
1.1	0.9	0.2	9	113
1	0.9	0.1	10	113
0.8	0.9	-0.1	10	114
0.7	0.9	-0.2	10	115
0.7	0.9	-0.2	10	116
0.7	0.9	-0.2	10	117
0.6	0.9	-0.3	10	118
0.9	0.9	0	10	118
0.8	0.9	-0.1	10	119
0.7	0.9	-0.2	10	120
0.7	0.9	-0.2	10	121
0.5	0.9	-0.4	10	122
0.8	0.9	-0.1	10	123
0.8	0.9	-0.1	10	124
0.7	0.9	-0.2	10	125
0.572	0.9	-0.328	10	126
0.587	0.9	-0.313	10	127
0.508	0.9	-0.392	10	128
0.75	0.9	-0.15	10	129
0.55	0.9	-0.35	10	130
0.9	0.9	0	10	130
1	0.9	0.1	11	130
1.1	0.9	0.2	12	130
1	0.9	0.1	13	130
0.8	0.9	-0.1	13	131
0.7	0.9	-0.2	13	132

0.7	0.9	-0.2	13	133
0.7	0.9	-0.2	13	134
0.6	0.9	-0.3	13	135
0.9	0.9	0	13	135
0.8	0.9	-0.1	13	136
0.7	0.9	-0.2	13	137
0.7	0.9	-0.2	13	138
0.5	0.9	-0.4	13	139
0.8	0.9	-0.1	13	140
0.8	0.9	-0.1	13	141
0.7	0.9	-0.2	13	142
0.572	0.9	-0.328	13	143
0.587	0.9	-0.313	13	144
0.508	0.9	-0.392	13	145
0.75	0.9	-0.15	13	146
0.55	0.9	-0.35	13	147
1	0.9	0.1	14	147
1.1	0.9	0.2	15	147
1	0.9	0.1	16	147
0.8	0.9	-0.1	16	148
0.7	0.9	-0.2	16	149
0.7	0.9	-0.2	16	150
0.7	0.9	-0.2	16	151
0.6	0.9	-0.3	16	152
0.9	0.9	0	16	152
0.8	0.9	-0.1	16	153
0.7	0.9	-0.2	16	154
0.7	0.9	-0.2	16	155
0.5	0.9	-0.4	16	156
0.8	0.9	-0.1	16	157
0.8	0.9	-0.1	16	158
0.7	0.9	-0.2	16	159
0.572	0.9	-0.328	16	160
0.587	0.9	-0.313	16	161
0.508	0.9	-0.392	16	162
0.75	0.9	-0.15	16	163
0.55	0.9	-0.35	16	164
1.1	1	0.1	17	164
1	1	0	17	164
0.8	1	-0.2	17	165
0.7	1	-0.3	17	166
0.7	1	-0.3	17	167
0.7	1	-0.3	17	168
0.6	1	-0.4	17	169
0.9	1	-0.1	17	170
0.8	1	-0.2	17	171
0.7	1	-0.3	17	172
0.7	1	-0.3	17	173
0.5	1	-0.5	17	174
0.8	1	-0.2	17	175
0.8	1	-0.2	17	176
0.7	1	-0.3	17	177
0.572	1	-0.428	17	178
0.587	1	-0.413	17	179
0.508	1	-0.492	17	180
0.75	1	-0.25	17	181
0.55	1	-0.45	17	182

1	1.1	-0.1	17	183
0.8	1.1	-0.3	17	184
0.7	1.1	-0.4	17	185
0.7	1.1	-0.4	17	186
0.7	1.1	-0.4	17	187
0.6	1.1	-0.5	17	188
0.9	1.1	-0.2	17	189
0.8	1.1	-0.3	17	190
0.7	1.1	-0.4	17	191
0.7	1.1	-0.4	17	192
0.5	1.1	-0.6	17	193
0.8	1.1	-0.3	17	194
0.8	1.1	-0.3	17	195
0.7	1.1	-0.4	17	196
0.572	1.1	-0.528	17	197
0.587	1.1	-0.513	17	198
0.508	1.1	-0.592	17	199
0.75	1.1	-0.35	17	200
0.55	1.1	-0.55	17	201
0.8	1	-0.2	17	202
0.7	1	-0.3	17	203
0.7	1	-0.3	17	204
0.7	1	-0.3	17	205
0.6	1	-0.4	17	206
0.9	1	-0.1	17	207
0.8	1	-0.2	17	208
0.7	1	-0.3	17	209
0.7	1	-0.3	17	210
0.5	1	-0.5	17	211
0.8	1	-0.2	17	212
0.8	1	-0.2	17	213
0.7	1	-0.3	17	214
0.572	1	-0.428	17	215
0.587	1	-0.413	17	216
0.508	1	-0.492	17	217
0.75	1	-0.25	17	218
0.55	1	-0.45	17	219
0.7	0.8	-0.1	17	220
0.7	0.8	-0.1	17	221
0.7	0.8	-0.1	17	222
0.6	0.8	-0.2	17	223
0.9	0.8	0.1	18	223
0.8	0.8	0	18	223
0.7	0.8	-0.1	18	224
0.7	0.8	-0.1	18	225
0.5	0.8	-0.3	18	226
0.8	0.8	0	18	226
0.8	0.8	0	18	226
0.7	0.8	-0.1	18	227
0.572	0.8	-0.228	18	228
0.587	0.8	-0.213	18	229
0.508	0.8	-0.292	18	230
0.75	0.8	-0.05	18	231
0.55	0.8	-0.25	18	232
0.7	0.7	0	18	232

0.7	0.7	0	18	232
0.6	0.7	-0.1	18	233
0.9	0.7	0.2	19	233
0.8	0.7	0.1	20	233
0.7	0.7	0	20	233
0.7	0.7	0	20	233
0.5	0.7	-0.2	20	234
0.8	0.7	0.1	21	234
0.8	0.7	0.1	22	234
0.7	0.7	0	22	234
0.572	0.7	-0.128	22	235
0.587	0.7	-0.113	22	236
0.508	0.7	-0.192	22	237
0.75	0.7	0.05	23	237
0.55	0.7	-0.15	23	238
0.7	0.7	0	23	238
0.6	0.7	-0.1	23	239
0.9	0.7	0.2	24	239
0.8	0.7	0.1	25	239
0.7	0.7	0	25	239
0.7	0.7	0	25	239
0.5	0.7	-0.2	25	240
0.8	0.7	0.1	26	240
0.8	0.7	0.1	27	240
0.7	0.7	0	27	240
0.572	0.7	-0.128	27	241
0.587	0.7	-0.113	27	242
0.508	0.7	-0.192	27	243
0.75	0.7	0.05	28	243
0.55	0.7	-0.15	28	244
0.6	0.7	-0.1	28	245
0.9	0.7	0.2	29	245
0.8	0.7	0.1	30	245
0.7	0.7	0	30	245
0.7	0.7	0	30	245
0.5	0.7	-0.2	30	246
0.8	0.7	0.1	31	246
0.8	0.7	0.1	32	246
0.7	0.7	0	32	246
0.572	0.7	-0.128	32	247
0.587	0.7	-0.113	32	248
0.508	0.7	-0.192	32	249
0.75	0.7	0.05	33	249
0.55	0.7	-0.15	33	250
0.9	0.6	0.3	34	250
0.8	0.6	0.2	35	250
0.7	0.6	0.1	36	250
0.7	0.6	0.1	37	250
0.5	0.6	-0.1	37	251
0.8	0.6	0.2	38	251
0.8	0.6	0.2	39	251
0.7	0.6	0.1	40	251
0.572	0.6	-0.028	40	252
0.587	0.6	-0.013	40	253
0.508	0.6	-0.092	40	254
0.75	0.6	0.15	41	254

0.55	0.6	-0.05	41	255
0.8	0.9	-0.1	41	256
0.7	0.9	-0.2	41	257
0.7	0.9	-0.2	41	258
0.5	0.9	-0.4	41	259
0.8	0.9	-0.1	41	260
0.8	0.9	-0.1	41	261
0.7	0.9	-0.2	41	262
0.572	0.9	-0.328	41	263
0.587	0.9	-0.313	41	264
0.508	0.9	-0.392	41	265
0.75	0.9	-0.15	41	266
0.55	0.9	-0.35	41	267
0.7	0.8	-0.1	41	268
0.7	0.8	-0.1	41	269
0.5	0.8	-0.3	41	270
0.8	0.8	0	41	270
0.8	0.8	0	41	270
0.7	0.8	-0.1	41	271
0.572	0.8	-0.228	41	272
0.587	0.8	-0.213	41	273
0.508	0.8	-0.292	41	274
0.75	0.8	-0.05	41	275
0.55	0.8	-0.25	41	276
0.7	0.7	0	41	276
0.5	0.7	-0.2	41	277
0.8	0.7	0.1	42	277
0.8	0.7	0.1	43	277
0.7	0.7	0	43	277
0.572	0.7	-0.128	43	278
0.587	0.7	-0.113	43	279
0.508	0.7	-0.192	43	280
0.75	0.7	0.05	44	280
0.55	0.7	-0.15	44	281
0.5	0.7	-0.2	44	282
0.8	0.7	0.1	45	282
0.8	0.7	0.1	46	282
0.7	0.7	0	46	282
0.572	0.7	-0.128	46	283
0.587	0.7	-0.113	46	284
0.508	0.7	-0.192	46	285
0.75	0.7	0.05	47	285
0.55	0.7	-0.15	47	286
0.8	0.5	0.3	48	286
0.8	0.5	0.3	49	286
0.7	0.5	0.2	50	286
0.572	0.5	0.072	51	286
0.587	0.5	0.087	52	286
0.508	0.5	0.008	53	286
0.75	0.5	0.25	54	286
0.55	0.5	0.05	55	286
0.8	0.8	0	55	286
0.7	0.8	-0.1	55	287

0.572	0.8	-0.228	55	288
0.587	0.8	-0.213	55	289
0.508	0.8	-0.292	55	290
0.75	0.8	-0.05	55	291
0.55	0.8	-0.25	55	292
0.7	0.8	-0.1	55	293
0.572	0.8	-0.228	55	294
0.587	0.8	-0.213	55	295
0.508	0.8	-0.292	55	296
0.75	0.8	-0.05	55	297
0.55	0.8	-0.25	55	298
0.572	0.7	-0.128	55	299
0.587	0.7	-0.113	55	300
0.508	0.7	-0.192	55	301
0.75	0.7	0.05	56	301
0.55	0.7	-0.15	56	302
0.587	0.572	0.015	57	302
0.508	0.572	-0.064	57	303
0.75	0.572	0.178	58	303
0.55	0.572	-0.022	58	304
0.508	0.587	-0.079	58	305
0.75	0.587	0.163	59	305
0.55	0.587	-0.037	59	306
0.75	0.508	0.242	60	306
0.55	0.508	0.042	61	306
0.55	0.75	-0.2	61	307

S Statistic = 61 - 307 = -246

Tied Group	Value	Members
1	1	4
2	1.1	2
3	0.9	5
4	0.8	4
5	0.7	6

Time Period	Observations
3/12/2008	1
5/13/2008	1
9/23/2008	1
10/29/2008	1
4/29/2009	1
5/13/2009	1
9/29/2009	1
12/8/2009	1
2/26/2010	1
4/14/2010	1
8/12/2010	1
11/22/2010	1
3/10/2011	1
5/25/2011	1

9/2/2011	1
4/13/2012	1
11/9/2012	1
4/22/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/26/2018	1

There are 0 time periods with multiple data

A = 1140
B = 0
C = 228
D = 0
E = 76
F = 0
a = 51156
b = 197316
c = 1624
Group Variance = 2778.67
Z-Score = -4.6478
Comparison Level at 95% confidence level = -1.65463 (downward trend)
-4.6478 < -1.65463 indicating a downward trend

Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: SW-02

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
95.6	60	35.6	1	0
60.2	60	0.2	2	0
47.7	60	-12.3	2	1
86	60	26	3	1
69.4	60	9.4	4	1
95.2	60	35.2	5	1
52.5	60	-7.5	5	2
97.8	60	37.8	6	2
124	60	64	7	2
110	60	50	8	2
383	60	323	9	2
99.4	60	39.4	10	2
112	60	52	11	2
593	60	533	12	2
94.8	60	34.8	13	2
87	60	27	14	2
99	60	39	15	2
89.7	60	29.7	16	2
132	60	72	17	2
80.8	60	20.8	18	2
89.5	60	29.5	19	2
66	60	6	20	2
112	60	52	21	2
60.2	95.6	-35.4	21	3
47.7	95.6	-47.9	21	4
86	95.6	-9.6	21	5
69.4	95.6	-26.2	21	6
95.2	95.6	-0.4	21	7
52.5	95.6	-43.1	21	8
97.8	95.6	2.2	22	8
124	95.6	28.4	23	8
110	95.6	14.4	24	8
383	95.6	287.4	25	8
99.4	95.6	3.8	26	8
112	95.6	16.4	27	8
593	95.6	497.4	28	8
94.8	95.6	-0.8	28	9
87	95.6	-8.6	28	10
99	95.6	3.4	29	10
89.7	95.6	-5.9	29	11
132	95.6	36.4	30	11
80.8	95.6	-14.8	30	12
89.5	95.6	-6.1	30	13
66	95.6	-29.6	30	14
112	95.6	16.4	31	14

47.7	60.2	-12.5	31	15
86	60.2	25.8	32	15
69.4	60.2	9.2	33	15
95.2	60.2	35	34	15
52.5	60.2	-7.7	34	16
97.8	60.2	37.6	35	16
124	60.2	63.8	36	16
110	60.2	49.8	37	16
383	60.2	322.8	38	16
99.4	60.2	39.2	39	16
112	60.2	51.8	40	16
593	60.2	532.8	41	16
94.8	60.2	34.6	42	16
87	60.2	26.8	43	16
99	60.2	38.8	44	16
89.7	60.2	29.5	45	16
132	60.2	71.8	46	16
80.8	60.2	20.6	47	16
89.5	60.2	29.3	48	16
66	60.2	5.8	49	16
112	60.2	51.8	50	16
86	47.7	38.3	51	16
69.4	47.7	21.7	52	16
95.2	47.7	47.5	53	16
52.5	47.7	4.8	54	16
97.8	47.7	50.1	55	16
124	47.7	76.3	56	16
110	47.7	62.3	57	16
383	47.7	335.3	58	16
99.4	47.7	51.7	59	16
112	47.7	64.3	60	16
593	47.7	545.3	61	16
94.8	47.7	47.1	62	16
87	47.7	39.3	63	16
99	47.7	51.3	64	16
89.7	47.7	42	65	16
132	47.7	84.3	66	16
80.8	47.7	33.1	67	16
89.5	47.7	41.8	68	16
66	47.7	18.3	69	16
112	47.7	64.3	70	16
69.4	86	-16.6	70	17
95.2	86	9.2	71	17
52.5	86	-33.5	71	18
97.8	86	11.8	72	18
124	86	38	73	18
110	86	24	74	18
383	86	297	75	18
99.4	86	13.4	76	18
112	86	26	77	18
593	86	507	78	18
94.8	86	8.8	79	18
87	86	1	80	18
99	86	13	81	18
89.7	86	3.7	82	18
132	86	46	83	18
80.8	86	-5.2	83	19

89.5	86	3.5	84	19
66	86	-20	84	20
112	86	26	85	20
95.2	69.4	25.8	86	20
52.5	69.4	-16.9	86	21
97.8	69.4	28.4	87	21
124	69.4	54.6	88	21
110	69.4	40.6	89	21
383	69.4	313.6	90	21
99.4	69.4	30	91	21
112	69.4	42.6	92	21
593	69.4	523.6	93	21
94.8	69.4	25.4	94	21
87	69.4	17.6	95	21
99	69.4	29.6	96	21
89.7	69.4	20.3	97	21
132	69.4	62.6	98	21
80.8	69.4	11.4	99	21
89.5	69.4	20.1	100	21
66	69.4	-3.4	100	22
112	69.4	42.6	101	22
52.5	95.2	-42.7	101	23
97.8	95.2	2.6	102	23
124	95.2	28.8	103	23
110	95.2	14.8	104	23
383	95.2	287.8	105	23
99.4	95.2	4.2	106	23
112	95.2	16.8	107	23
593	95.2	497.8	108	23
94.8	95.2	-0.4	108	24
87	95.2	-8.2	108	25
99	95.2	3.8	109	25
89.7	95.2	-5.5	109	26
132	95.2	36.8	110	26
80.8	95.2	-14.4	110	27
89.5	95.2	-5.7	110	28
66	95.2	-29.2	110	29
112	95.2	16.8	111	29
97.8	52.5	45.3	112	29
124	52.5	71.5	113	29
110	52.5	57.5	114	29
383	52.5	330.5	115	29
99.4	52.5	46.9	116	29
112	52.5	59.5	117	29
593	52.5	540.5	118	29
94.8	52.5	42.3	119	29
87	52.5	34.5	120	29
99	52.5	46.5	121	29
89.7	52.5	37.2	122	29
132	52.5	79.5	123	29
80.8	52.5	28.3	124	29
89.5	52.5	37	125	29
66	52.5	13.5	126	29
112	52.5	59.5	127	29
124	97.8	26.2	128	29

110	97.8	12.2	129	29
383	97.8	285.2	130	29
99.4	97.8	1.6	131	29
112	97.8	14.2	132	29
593	97.8	495.2	133	29
94.8	97.8	-3	133	30
87	97.8	-10.8	133	31
99	97.8	1.2	134	31
89.7	97.8	-8.1	134	32
132	97.8	34.2	135	32
80.8	97.8	-17	135	33
89.5	97.8	-8.3	135	34
66	97.8	-31.8	135	35
112	97.8	14.2	136	35
110	124	-14	136	36
383	124	259	137	36
99.4	124	-24.6	137	37
112	124	-12	137	38
593	124	469	138	38
94.8	124	-29.2	138	39
87	124	-37	138	40
99	124	-25	138	41
89.7	124	-34.3	138	42
132	124	8	139	42
80.8	124	-43.2	139	43
89.5	124	-34.5	139	44
66	124	-58	139	45
112	124	-12	139	46
383	110	273	140	46
99.4	110	-10.6	140	47
112	110	2	141	47
593	110	483	142	47
94.8	110	-15.2	142	48
87	110	-23	142	49
99	110	-11	142	50
89.7	110	-20.3	142	51
132	110	22	143	51
80.8	110	-29.2	143	52
89.5	110	-20.5	143	53
66	110	-44	143	54
112	110	2	144	54
99.4	383	-283.6	144	55
112	383	-271	144	56
593	383	210	145	56
94.8	383	-288.2	145	57
87	383	-296	145	58
99	383	-284	145	59
89.7	383	-293.3	145	60
132	383	-251	145	61
80.8	383	-302.2	145	62
89.5	383	-293.5	145	63
66	383	-317	145	64
112	383	-271	145	65
112	99.4	12.6	146	65
593	99.4	493.6	147	65

94.8	99.4	-4.6	147	66
87	99.4	-12.4	147	67
99	99.4	-0.4	147	68
89.7	99.4	-9.7	147	69
132	99.4	32.6	148	69
80.8	99.4	-18.6	148	70
89.5	99.4	-9.9	148	71
66	99.4	-33.4	148	72
112	99.4	12.6	149	72
593	112	481	150	72
94.8	112	-17.2	150	73
87	112	-25	150	74
99	112	-13	150	75
89.7	112	-22.3	150	76
132	112	20	151	76
80.8	112	-31.2	151	77
89.5	112	-22.5	151	78
66	112	-46	151	79
112	112	0	151	79
94.8	593	-498.2	151	80
87	593	-506	151	81
99	593	-494	151	82
89.7	593	-503.3	151	83
132	593	-461	151	84
80.8	593	-512.2	151	85
89.5	593	-503.5	151	86
66	593	-527	151	87
112	593	-481	151	88
87	94.8	-7.8	151	89
99	94.8	4.2	152	89
89.7	94.8	-5.1	152	90
132	94.8	37.2	153	90
80.8	94.8	-14	153	91
89.5	94.8	-5.3	153	92
66	94.8	-28.8	153	93
112	94.8	17.2	154	93
99	87	12	155	93
89.7	87	2.7	156	93
132	87	45	157	93
80.8	87	-6.2	157	94
89.5	87	2.5	158	94
66	87	-21	158	95
112	87	25	159	95
89.7	99	-9.3	159	96
132	99	33	160	96
80.8	99	-18.2	160	97
89.5	99	-9.5	160	98
66	99	-33	160	99
112	99	13	161	99
132	89.7	42.3	162	99
80.8	89.7	-8.9	162	100
89.5	89.7	-0.2	162	101
66	89.7	-23.7	162	102

112	89.7	22.3	163	102
80.8	132	-51.2	163	103
89.5	132	-42.5	163	104
66	132	-66	163	105
112	132	-20	163	106
89.5	80.8	8.7	164	106
66	80.8	-14.8	164	107
112	80.8	31.2	165	107
66	89.5	-23.5	165	108
112	89.5	22.5	166	108
112	66	46	167	108

S Statistic = 167 - 108 = 59

Tied Group	Value	Members
1	112	2

Time Period	Observations
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/16/2014	1
10/29/2014	1
3/16/2015	1
10/23/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 18
B = 0
C = 0
D = 0
E = 2
F = 0
a = 29256
b = 109296
c = 1104

Group Variance = 1624.33
Z-Score = 1.4391
Comparison Level at 95% confidence level = -1.65463 (downward trend)
1.4391 >= -1.65463 indicating no evidence of a downward trend

Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: SW-02

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
95.6	60	35.6	1	0
60.2	60	0.2	2	0
47.7	60	-12.3	2	1
86	60	26	3	1
69.4	60	9.4	4	1
95.2	60	35.2	5	1
52.5	60	-7.5	5	2
97.8	60	37.8	6	2
124	60	64	7	2
110	60	50	8	2
383	60	323	9	2
99.4	60	39.4	10	2
112	60	52	11	2
593	60	533	12	2
94.8	60	34.8	13	2
87	60	27	14	2
99	60	39	15	2
89.7	60	29.7	16	2
132	60	72	17	2
80.8	60	20.8	18	2
89.5	60	29.5	19	2
66	60	6	20	2
112	60	52	21	2
60.2	95.6	-35.4	21	3
47.7	95.6	-47.9	21	4
86	95.6	-9.6	21	5
69.4	95.6	-26.2	21	6
95.2	95.6	-0.4	21	7
52.5	95.6	-43.1	21	8
97.8	95.6	2.2	22	8
124	95.6	28.4	23	8
110	95.6	14.4	24	8
383	95.6	287.4	25	8
99.4	95.6	3.8	26	8
112	95.6	16.4	27	8
593	95.6	497.4	28	8
94.8	95.6	-0.8	28	9
87	95.6	-8.6	28	10
99	95.6	3.4	29	10
89.7	95.6	-5.9	29	11
132	95.6	36.4	30	11
80.8	95.6	-14.8	30	12
89.5	95.6	-6.1	30	13
66	95.6	-29.6	30	14
112	95.6	16.4	31	14

47.7	60.2	-12.5	31	15
86	60.2	25.8	32	15
69.4	60.2	9.2	33	15
95.2	60.2	35	34	15
52.5	60.2	-7.7	34	16
97.8	60.2	37.6	35	16
124	60.2	63.8	36	16
110	60.2	49.8	37	16
383	60.2	322.8	38	16
99.4	60.2	39.2	39	16
112	60.2	51.8	40	16
593	60.2	532.8	41	16
94.8	60.2	34.6	42	16
87	60.2	26.8	43	16
99	60.2	38.8	44	16
89.7	60.2	29.5	45	16
132	60.2	71.8	46	16
80.8	60.2	20.6	47	16
89.5	60.2	29.3	48	16
66	60.2	5.8	49	16
112	60.2	51.8	50	16
86	47.7	38.3	51	16
69.4	47.7	21.7	52	16
95.2	47.7	47.5	53	16
52.5	47.7	4.8	54	16
97.8	47.7	50.1	55	16
124	47.7	76.3	56	16
110	47.7	62.3	57	16
383	47.7	335.3	58	16
99.4	47.7	51.7	59	16
112	47.7	64.3	60	16
593	47.7	545.3	61	16
94.8	47.7	47.1	62	16
87	47.7	39.3	63	16
99	47.7	51.3	64	16
89.7	47.7	42	65	16
132	47.7	84.3	66	16
80.8	47.7	33.1	67	16
89.5	47.7	41.8	68	16
66	47.7	18.3	69	16
112	47.7	64.3	70	16
69.4	86	-16.6	70	17
95.2	86	9.2	71	17
52.5	86	-33.5	71	18
97.8	86	11.8	72	18
124	86	38	73	18
110	86	24	74	18
383	86	297	75	18
99.4	86	13.4	76	18
112	86	26	77	18
593	86	507	78	18
94.8	86	8.8	79	18
87	86	1	80	18
99	86	13	81	18
89.7	86	3.7	82	18
132	86	46	83	18
80.8	86	-5.2	83	19

89.5	86	3.5	84	19
66	86	-20	84	20
112	86	26	85	20
95.2	69.4	25.8	86	20
52.5	69.4	-16.9	86	21
97.8	69.4	28.4	87	21
124	69.4	54.6	88	21
110	69.4	40.6	89	21
383	69.4	313.6	90	21
99.4	69.4	30	91	21
112	69.4	42.6	92	21
593	69.4	523.6	93	21
94.8	69.4	25.4	94	21
87	69.4	17.6	95	21
99	69.4	29.6	96	21
89.7	69.4	20.3	97	21
132	69.4	62.6	98	21
80.8	69.4	11.4	99	21
89.5	69.4	20.1	100	21
66	69.4	-3.4	100	22
112	69.4	42.6	101	22
52.5	95.2	-42.7	101	23
97.8	95.2	2.6	102	23
124	95.2	28.8	103	23
110	95.2	14.8	104	23
383	95.2	287.8	105	23
99.4	95.2	4.2	106	23
112	95.2	16.8	107	23
593	95.2	497.8	108	23
94.8	95.2	-0.4	108	24
87	95.2	-8.2	108	25
99	95.2	3.8	109	25
89.7	95.2	-5.5	109	26
132	95.2	36.8	110	26
80.8	95.2	-14.4	110	27
89.5	95.2	-5.7	110	28
66	95.2	-29.2	110	29
112	95.2	16.8	111	29
97.8	52.5	45.3	112	29
124	52.5	71.5	113	29
110	52.5	57.5	114	29
383	52.5	330.5	115	29
99.4	52.5	46.9	116	29
112	52.5	59.5	117	29
593	52.5	540.5	118	29
94.8	52.5	42.3	119	29
87	52.5	34.5	120	29
99	52.5	46.5	121	29
89.7	52.5	37.2	122	29
132	52.5	79.5	123	29
80.8	52.5	28.3	124	29
89.5	52.5	37	125	29
66	52.5	13.5	126	29
112	52.5	59.5	127	29
124	97.8	26.2	128	29

110	97.8	12.2	129	29
383	97.8	285.2	130	29
99.4	97.8	1.6	131	29
112	97.8	14.2	132	29
593	97.8	495.2	133	29
94.8	97.8	-3	133	30
87	97.8	-10.8	133	31
99	97.8	1.2	134	31
89.7	97.8	-8.1	134	32
132	97.8	34.2	135	32
80.8	97.8	-17	135	33
89.5	97.8	-8.3	135	34
66	97.8	-31.8	135	35
112	97.8	14.2	136	35
110	124	-14	136	36
383	124	259	137	36
99.4	124	-24.6	137	37
112	124	-12	137	38
593	124	469	138	38
94.8	124	-29.2	138	39
87	124	-37	138	40
99	124	-25	138	41
89.7	124	-34.3	138	42
132	124	8	139	42
80.8	124	-43.2	139	43
89.5	124	-34.5	139	44
66	124	-58	139	45
112	124	-12	139	46
383	110	273	140	46
99.4	110	-10.6	140	47
112	110	2	141	47
593	110	483	142	47
94.8	110	-15.2	142	48
87	110	-23	142	49
99	110	-11	142	50
89.7	110	-20.3	142	51
132	110	22	143	51
80.8	110	-29.2	143	52
89.5	110	-20.5	143	53
66	110	-44	143	54
112	110	2	144	54
99.4	383	-283.6	144	55
112	383	-271	144	56
593	383	210	145	56
94.8	383	-288.2	145	57
87	383	-296	145	58
99	383	-284	145	59
89.7	383	-293.3	145	60
132	383	-251	145	61
80.8	383	-302.2	145	62
89.5	383	-293.5	145	63
66	383	-317	145	64
112	383	-271	145	65
112	99.4	12.6	146	65
593	99.4	493.6	147	65

94.8	99.4	-4.6	147	66
87	99.4	-12.4	147	67
99	99.4	-0.4	147	68
89.7	99.4	-9.7	147	69
132	99.4	32.6	148	69
80.8	99.4	-18.6	148	70
89.5	99.4	-9.9	148	71
66	99.4	-33.4	148	72
112	99.4	12.6	149	72
593	112	481	150	72
94.8	112	-17.2	150	73
87	112	-25	150	74
99	112	-13	150	75
89.7	112	-22.3	150	76
132	112	20	151	76
80.8	112	-31.2	151	77
89.5	112	-22.5	151	78
66	112	-46	151	79
112	112	0	151	79
94.8	593	-498.2	151	80
87	593	-506	151	81
99	593	-494	151	82
89.7	593	-503.3	151	83
132	593	-461	151	84
80.8	593	-512.2	151	85
89.5	593	-503.5	151	86
66	593	-527	151	87
112	593	-481	151	88
87	94.8	-7.8	151	89
99	94.8	4.2	152	89
89.7	94.8	-5.1	152	90
132	94.8	37.2	153	90
80.8	94.8	-14	153	91
89.5	94.8	-5.3	153	92
66	94.8	-28.8	153	93
112	94.8	17.2	154	93
99	87	12	155	93
89.7	87	2.7	156	93
132	87	45	157	93
80.8	87	-6.2	157	94
89.5	87	2.5	158	94
66	87	-21	158	95
112	87	25	159	95
89.7	99	-9.3	159	96
132	99	33	160	96
80.8	99	-18.2	160	97
89.5	99	-9.5	160	98
66	99	-33	160	99
112	99	13	161	99
132	89.7	42.3	162	99
80.8	89.7	-8.9	162	100
89.5	89.7	-0.2	162	101
66	89.7	-23.7	162	102

112	89.7	22.3	163	102
80.8	132	-51.2	163	103
89.5	132	-42.5	163	104
66	132	-66	163	105
112	132	-20	163	106
89.5	80.8	8.7	164	106
66	80.8	-14.8	164	107
112	80.8	31.2	165	107
66	89.5	-23.5	165	108
112	89.5	22.5	166	108
112	66	46	167	108

S Statistic = 167 - 108 = 59

Tied Group	Value	Members
1	112	2

Time Period	Observations
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/16/2014	1
10/29/2014	1
3/16/2015	1
10/23/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 18
B = 0
C = 0
D = 0
E = 2
F = 0
a = 29256
b = 109296
c = 1104

Group Variance = 1624.33
Z-Score = 1.4391
Comparison Level at 95% confidence level = 1.65463 (upward trend)
1.4391 <= 1.65463 indicating no evidence of an upward trend

Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: SW-06

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
66.6	79	-12.4	0	1
60	79	-19	0	2
33.8	79	-45.2	0	3
185	79	106	1	3
99.1	79	20.1	2	3
134	79	55	3	3
76.3	79	-2.7	3	4
192	79	113	4	4
210	79	131	5	4
170	79	91	6	4
218	79	139	7	4
158	79	79	8	4
197	79	118	9	4
145	79	66	10	4
130	79	51	11	4
172	79	93	12	4
143	79	64	13	4
16.1	79	-62.9	13	5
234	79	155	14	5
158	79	79	15	5
191	79	112	16	5
134	79	55	17	5
193	79	114	18	5
60	66.6	-6.6	18	6
33.8	66.6	-32.8	18	7
185	66.6	118.4	19	7
99.1	66.6	32.5	20	7
134	66.6	67.4	21	7
76.3	66.6	9.7	22	7
192	66.6	125.4	23	7
210	66.6	143.4	24	7
170	66.6	103.4	25	7
218	66.6	151.4	26	7
158	66.6	91.4	27	7
197	66.6	130.4	28	7
145	66.6	78.4	29	7
130	66.6	63.4	30	7
172	66.6	105.4	31	7
143	66.6	76.4	32	7
16.1	66.6	-50.5	32	8
234	66.6	167.4	33	8
158	66.6	91.4	34	8
191	66.6	124.4	35	8
134	66.6	67.4	36	8
193	66.6	126.4	37	8

33.8	60	-26.2	37	9
185	60	125	38	9
99.1	60	39.1	39	9
134	60	74	40	9
76.3	60	16.3	41	9
192	60	132	42	9
210	60	150	43	9
170	60	110	44	9
218	60	158	45	9
158	60	98	46	9
197	60	137	47	9
145	60	85	48	9
130	60	70	49	9
172	60	112	50	9
143	60	83	51	9
16.1	60	-43.9	51	10
234	60	174	52	10
158	60	98	53	10
191	60	131	54	10
134	60	74	55	10
193	60	133	56	10
185	33.8	151.2	57	10
99.1	33.8	65.3	58	10
134	33.8	100.2	59	10
76.3	33.8	42.5	60	10
192	33.8	158.2	61	10
210	33.8	176.2	62	10
170	33.8	136.2	63	10
218	33.8	184.2	64	10
158	33.8	124.2	65	10
197	33.8	163.2	66	10
145	33.8	111.2	67	10
130	33.8	96.2	68	10
172	33.8	138.2	69	10
143	33.8	109.2	70	10
16.1	33.8	-17.7	70	11
234	33.8	200.2	71	11
158	33.8	124.2	72	11
191	33.8	157.2	73	11
134	33.8	100.2	74	11
193	33.8	159.2	75	11
99.1	185	-85.9	75	12
134	185	-51	75	13
76.3	185	-108.7	75	14
192	185	7	76	14
210	185	25	77	14
170	185	-15	77	15
218	185	33	78	15
158	185	-27	78	16
197	185	12	79	16
145	185	-40	79	17
130	185	-55	79	18
172	185	-13	79	19
143	185	-42	79	20
16.1	185	-168.9	79	21
234	185	49	80	21
158	185	-27	80	22

191	185	6	81	22
134	185	-51	81	23
193	185	8	82	23
134	99.1	34.9	83	23
76.3	99.1	-22.8	83	24
192	99.1	92.9	84	24
210	99.1	110.9	85	24
170	99.1	70.9	86	24
218	99.1	118.9	87	24
158	99.1	58.9	88	24
197	99.1	97.9	89	24
145	99.1	45.9	90	24
130	99.1	30.9	91	24
172	99.1	72.9	92	24
143	99.1	43.9	93	24
16.1	99.1	-83	93	25
234	99.1	134.9	94	25
158	99.1	58.9	95	25
191	99.1	91.9	96	25
134	99.1	34.9	97	25
193	99.1	93.9	98	25
76.3	134	-57.7	98	26
192	134	58	99	26
210	134	76	100	26
170	134	36	101	26
218	134	84	102	26
158	134	24	103	26
197	134	63	104	26
145	134	11	105	26
130	134	-4	105	27
172	134	38	106	27
143	134	9	107	27
16.1	134	-117.9	107	28
234	134	100	108	28
158	134	24	109	28
191	134	57	110	28
134	134	0	110	28
193	134	59	111	28
192	76.3	115.7	112	28
210	76.3	133.7	113	28
170	76.3	93.7	114	28
218	76.3	141.7	115	28
158	76.3	81.7	116	28
197	76.3	120.7	117	28
145	76.3	68.7	118	28
130	76.3	53.7	119	28
172	76.3	95.7	120	28
143	76.3	66.7	121	28
16.1	76.3	-60.2	121	29
234	76.3	157.7	122	29
158	76.3	81.7	123	29
191	76.3	114.7	124	29
134	76.3	57.7	125	29
193	76.3	116.7	126	29
210	192	18	127	29

170	192	-22	127	30
218	192	26	128	30
158	192	-34	128	31
197	192	5	129	31
145	192	-47	129	32
130	192	-62	129	33
172	192	-20	129	34
143	192	-49	129	35
16.1	192	-175.9	129	36
234	192	42	130	36
158	192	-34	130	37
191	192	-1	130	38
134	192	-58	130	39
193	192	1	131	39
170	210	-40	131	40
218	210	8	132	40
158	210	-52	132	41
197	210	-13	132	42
145	210	-65	132	43
130	210	-80	132	44
172	210	-38	132	45
143	210	-67	132	46
16.1	210	-193.9	132	47
234	210	24	133	47
158	210	-52	133	48
191	210	-19	133	49
134	210	-76	133	50
193	210	-17	133	51
218	170	48	134	51
158	170	-12	134	52
197	170	27	135	52
145	170	-25	135	53
130	170	-40	135	54
172	170	2	136	54
143	170	-27	136	55
16.1	170	-153.9	136	56
234	170	64	137	56
158	170	-12	137	57
191	170	21	138	57
134	170	-36	138	58
193	170	23	139	58
158	218	-60	139	59
197	218	-21	139	60
145	218	-73	139	61
130	218	-88	139	62
172	218	-46	139	63
143	218	-75	139	64
16.1	218	-201.9	139	65
234	218	16	140	65
158	218	-60	140	66
191	218	-27	140	67
134	218	-84	140	68
193	218	-25	140	69
197	158	39	141	69
145	158	-13	141	70

130	158	-28	141	71
172	158	14	142	71
143	158	-15	142	72
16.1	158	-141.9	142	73
234	158	76	143	73
158	158	0	143	73
191	158	33	144	73
134	158	-24	144	74
193	158	35	145	74
145	197	-52	145	75
130	197	-67	145	76
172	197	-25	145	77
143	197	-54	145	78
16.1	197	-180.9	145	79
234	197	37	146	79
158	197	-39	146	80
191	197	-6	146	81
134	197	-63	146	82
193	197	-4	146	83
130	145	-15	146	84
172	145	27	147	84
143	145	-2	147	85
16.1	145	-128.9	147	86
234	145	89	148	86
158	145	13	149	86
191	145	46	150	86
134	145	-11	150	87
193	145	48	151	87
172	130	42	152	87
143	130	13	153	87
16.1	130	-113.9	153	88
234	130	104	154	88
158	130	28	155	88
191	130	61	156	88
134	130	4	157	88
193	130	63	158	88
143	172	-29	158	89
16.1	172	-155.9	158	90
234	172	62	159	90
158	172	-14	159	91
191	172	19	160	91
134	172	-38	160	92
193	172	21	161	92
16.1	143	-126.9	161	93
234	143	91	162	93
158	143	15	163	93
191	143	48	164	93
134	143	-9	164	94
193	143	50	165	94
234	16.1	217.9	166	94
158	16.1	141.9	167	94
191	16.1	174.9	168	94
134	16.1	117.9	169	94

193	16.1	176.9	170	94
158	234	-76	170	95
191	234	-43	170	96
134	234	-100	170	97
193	234	-41	170	98
191	158	33	171	98
134	158	-24	171	99
193	158	35	172	99
134	191	-57	172	100
193	191	2	173	100
193	134	59	174	100

S Statistic = 174 - 100 = 74

Tied Group	Value	Members
1	134	2
2	158	2

Time Period	Observations
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/16/2014	1
10/29/2014	1
3/16/2015	1
10/22/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/24/2018	1

There are 0 time periods with multiple data

A = 36
B = 0
C = 0
D = 0
E = 4
F = 0
a = 29256
b = 109296

c = 1104
Group Variance = 1623.33
Z-Score = 1.81184
Comparison Level at 95% confidence level = 1.65463 (upward trend)
1.81184 > 1.65463 indicating an upward trend

Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: SW-07

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
42.5	35	7.5	1	0
46.1	35	11.1	2	0
65.2	35	30.2	3	0
41.1	35	6.1	4	0
42.2	35	7.2	5	0
45.8	35	10.8	6	0
17.9	35	-17.1	6	1
41.5	35	6.5	7	1
18.8	35	-16.2	7	2
47.1	35	12.1	8	2
55	35	20	9	2
38.9	35	3.9	10	2
40.8	35	5.8	11	2
35.8	35	0.8	12	2
1.8	35	-33.2	12	3
87	35	52	13	3
41.6	35	6.6	14	3
36	35	1	15	3
40	35	5	16	3
42.4	35	7.4	17	3
43.5	35	8.5	18	3
38	35	3	19	3
39.2	35	4.2	20	3
46.1	42.5	3.6	21	3
65.2	42.5	22.7	22	3
41.1	42.5	-1.4	22	4
42.2	42.5	-0.3	22	5
45.8	42.5	3.3	23	5
17.9	42.5	-24.6	23	6
41.5	42.5	-1	23	7
18.8	42.5	-23.7	23	8
47.1	42.5	4.6	24	8
55	42.5	12.5	25	8
38.9	42.5	-3.6	25	9
40.8	42.5	-1.7	25	10
35.8	42.5	-6.7	25	11
1.8	42.5	-40.7	25	12
87	42.5	44.5	26	12
41.6	42.5	-0.9	26	13
36	42.5	-6.5	26	14
40	42.5	-2.5	26	15
42.4	42.5	-0.1	26	16
43.5	42.5	1	27	16
38	42.5	-4.5	27	17
39.2	42.5	-3.3	27	18

65.2	46.1	19.1	28	18
41.1	46.1	-5	28	19
42.2	46.1	-3.9	28	20
45.8	46.1	-0.3	28	21
17.9	46.1	-28.2	28	22
41.5	46.1	-4.6	28	23
18.8	46.1	-27.3	28	24
47.1	46.1	1	29	24
55	46.1	8.9	30	24
38.9	46.1	-7.2	30	25
40.8	46.1	-5.3	30	26
35.8	46.1	-10.3	30	27
1.8	46.1	-44.3	30	28
87	46.1	40.9	31	28
41.6	46.1	-4.5	31	29
36	46.1	-10.1	31	30
40	46.1	-6.1	31	31
42.4	46.1	-3.7	31	32
43.5	46.1	-2.6	31	33
38	46.1	-8.1	31	34
39.2	46.1	-6.9	31	35
41.1	65.2	-24.1	31	36
42.2	65.2	-23	31	37
45.8	65.2	-19.4	31	38
17.9	65.2	-47.3	31	39
41.5	65.2	-23.7	31	40
18.8	65.2	-46.4	31	41
47.1	65.2	-18.1	31	42
55	65.2	-10.2	31	43
38.9	65.2	-26.3	31	44
40.8	65.2	-24.4	31	45
35.8	65.2	-29.4	31	46
1.8	65.2	-63.4	31	47
87	65.2	21.8	32	47
41.6	65.2	-23.6	32	48
36	65.2	-29.2	32	49
40	65.2	-25.2	32	50
42.4	65.2	-22.8	32	51
43.5	65.2	-21.7	32	52
38	65.2	-27.2	32	53
39.2	65.2	-26	32	54
42.2	41.1	1.1	33	54
45.8	41.1	4.7	34	54
17.9	41.1	-23.2	34	55
41.5	41.1	0.4	35	55
18.8	41.1	-22.3	35	56
47.1	41.1	6	36	56
55	41.1	13.9	37	56
38.9	41.1	-2.2	37	57
40.8	41.1	-0.3	37	58
35.8	41.1	-5.3	37	59
1.8	41.1	-39.3	37	60
87	41.1	45.9	38	60
41.6	41.1	0.5	39	60
36	41.1	-5.1	39	61
40	41.1	-1.1	39	62
42.4	41.1	1.3	40	62

43.5	41.1	2.4	41	62
38	41.1	-3.1	41	63
39.2	41.1	-1.9	41	64
45.8	42.2	3.6	42	64
17.9	42.2	-24.3	42	65
41.5	42.2	-0.7	42	66
18.8	42.2	-23.4	42	67
47.1	42.2	4.9	43	67
55	42.2	12.8	44	67
38.9	42.2	-3.3	44	68
40.8	42.2	-1.4	44	69
35.8	42.2	-6.4	44	70
1.8	42.2	-40.4	44	71
87	42.2	44.8	45	71
41.6	42.2	-0.6	45	72
36	42.2	-6.2	45	73
40	42.2	-2.2	45	74
42.4	42.2	0.2	46	74
43.5	42.2	1.3	47	74
38	42.2	-4.2	47	75
39.2	42.2	-3	47	76
17.9	45.8	-27.9	47	77
41.5	45.8	-4.3	47	78
18.8	45.8	-27	47	79
47.1	45.8	1.3	48	79
55	45.8	9.2	49	79
38.9	45.8	-6.9	49	80
40.8	45.8	-5	49	81
35.8	45.8	-10	49	82
1.8	45.8	-44	49	83
87	45.8	41.2	50	83
41.6	45.8	-4.2	50	84
36	45.8	-9.8	50	85
40	45.8	-5.8	50	86
42.4	45.8	-3.4	50	87
43.5	45.8	-2.3	50	88
38	45.8	-7.8	50	89
39.2	45.8	-6.6	50	90
41.5	17.9	23.6	51	90
18.8	17.9	0.9	52	90
47.1	17.9	29.2	53	90
55	17.9	37.1	54	90
38.9	17.9	21	55	90
40.8	17.9	22.9	56	90
35.8	17.9	17.9	57	90
1.8	17.9	-16.1	57	91
87	17.9	69.1	58	91
41.6	17.9	23.7	59	91
36	17.9	18.1	60	91
40	17.9	22.1	61	91
42.4	17.9	24.5	62	91
43.5	17.9	25.6	63	91
38	17.9	20.1	64	91
39.2	17.9	21.3	65	91
18.8	41.5	-22.7	65	92

47.1	41.5	5.6	66	92
55	41.5	13.5	67	92
38.9	41.5	-2.6	67	93
40.8	41.5	-0.7	67	94
35.8	41.5	-5.7	67	95
1.8	41.5	-39.7	67	96
87	41.5	45.5	68	96
41.6	41.5	0.1	69	96
36	41.5	-5.5	69	97
40	41.5	-1.5	69	98
42.4	41.5	0.9	70	98
43.5	41.5	2	71	98
38	41.5	-3.5	71	99
39.2	41.5	-2.3	71	100
47.1	18.8	28.3	72	100
55	18.8	36.2	73	100
38.9	18.8	20.1	74	100
40.8	18.8	22	75	100
35.8	18.8	17	76	100
1.8	18.8	-17	76	101
87	18.8	68.2	77	101
41.6	18.8	22.8	78	101
36	18.8	17.2	79	101
40	18.8	21.2	80	101
42.4	18.8	23.6	81	101
43.5	18.8	24.7	82	101
38	18.8	19.2	83	101
39.2	18.8	20.4	84	101
55	47.1	7.9	85	101
38.9	47.1	-8.2	85	102
40.8	47.1	-6.3	85	103
35.8	47.1	-11.3	85	104
1.8	47.1	-45.3	85	105
87	47.1	39.9	86	105
41.6	47.1	-5.5	86	106
36	47.1	-11.1	86	107
40	47.1	-7.1	86	108
42.4	47.1	-4.7	86	109
43.5	47.1	-3.6	86	110
38	47.1	-9.1	86	111
39.2	47.1	-7.9	86	112
38.9	55	-16.1	86	113
40.8	55	-14.2	86	114
35.8	55	-19.2	86	115
1.8	55	-53.2	86	116
87	55	32	87	116
41.6	55	-13.4	87	117
36	55	-19	87	118
40	55	-15	87	119
42.4	55	-12.6	87	120
43.5	55	-11.5	87	121
38	55	-17	87	122
39.2	55	-15.8	87	123
40.8	38.9	1.9	88	123
35.8	38.9	-3.1	88	124

1.8	38.9	-37.1	88	125
87	38.9	48.1	89	125
41.6	38.9	2.7	90	125
36	38.9	-2.9	90	126
40	38.9	1.1	91	126
42.4	38.9	3.5	92	126
43.5	38.9	4.6	93	126
38	38.9	-0.9	93	127
39.2	38.9	0.3	94	127
35.8	40.8	-5	94	128
1.8	40.8	-39	94	129
87	40.8	46.2	95	129
41.6	40.8	0.8	96	129
36	40.8	-4.8	96	130
40	40.8	-0.8	96	131
42.4	40.8	1.6	97	131
43.5	40.8	2.7	98	131
38	40.8	-2.8	98	132
39.2	40.8	-1.6	98	133
1.8	35.8	-34	98	134
87	35.8	51.2	99	134
41.6	35.8	5.8	100	134
36	35.8	0.2	101	134
40	35.8	4.2	102	134
42.4	35.8	6.6	103	134
43.5	35.8	7.7	104	134
38	35.8	2.2	105	134
39.2	35.8	3.4	106	134
87	1.8	85.2	107	134
41.6	1.8	39.8	108	134
36	1.8	34.2	109	134
40	1.8	38.2	110	134
42.4	1.8	40.6	111	134
43.5	1.8	41.7	112	134
38	1.8	36.2	113	134
39.2	1.8	37.4	114	134
41.6	87	-45.4	114	135
36	87	-51	114	136
40	87	-47	114	137
42.4	87	-44.6	114	138
43.5	87	-43.5	114	139
38	87	-49	114	140
39.2	87	-47.8	114	141
36	41.6	-5.6	114	142
40	41.6	-1.6	114	143
42.4	41.6	0.8	115	143
43.5	41.6	1.9	116	143
38	41.6	-3.6	116	144
39.2	41.6	-2.4	116	145
40	36	4	117	145
42.4	36	6.4	118	145
43.5	36	7.5	119	145
38	36	2	120	145

39.2	36	3.2	121	145
42.4	40	2.4	122	145
43.5	40	3.5	123	145
38	40	-2	123	146
39.2	40	-0.8	123	147
43.5	42.4	1.1	124	147
38	42.4	-4.4	124	148
39.2	42.4	-3.2	124	149
38	43.5	-5.5	124	150
39.2	43.5	-4.3	124	151
39.2	38	1.2	125	151

S Statistic = 125 - 151 = -26

Tied Group Value	Members

Time Period	Observations
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/22/2013	1
11/12/2013	1
4/16/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1
10/24/2018	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 29256
b = 109296
c = 1104
Group Variance = 1625.33

Z-Score = -0.62011
Comparison Level at 95% confidence level = -1.65463 (downward trend)
-0.62011 >= -1.65463 indicating no evidence of a downward trend

Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: SW-07

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
42.5	35	7.5	1	0
46.1	35	11.1	2	0
65.2	35	30.2	3	0
41.1	35	6.1	4	0
42.2	35	7.2	5	0
45.8	35	10.8	6	0
17.9	35	-17.1	6	1
41.5	35	6.5	7	1
18.8	35	-16.2	7	2
47.1	35	12.1	8	2
55	35	20	9	2
38.9	35	3.9	10	2
40.8	35	5.8	11	2
35.8	35	0.8	12	2
1.8	35	-33.2	12	3
87	35	52	13	3
41.6	35	6.6	14	3
36	35	1	15	3
40	35	5	16	3
42.4	35	7.4	17	3
43.5	35	8.5	18	3
38	35	3	19	3
39.2	35	4.2	20	3
46.1	42.5	3.6	21	3
65.2	42.5	22.7	22	3
41.1	42.5	-1.4	22	4
42.2	42.5	-0.3	22	5
45.8	42.5	3.3	23	5
17.9	42.5	-24.6	23	6
41.5	42.5	-1	23	7
18.8	42.5	-23.7	23	8
47.1	42.5	4.6	24	8
55	42.5	12.5	25	8
38.9	42.5	-3.6	25	9
40.8	42.5	-1.7	25	10
35.8	42.5	-6.7	25	11
1.8	42.5	-40.7	25	12
87	42.5	44.5	26	12
41.6	42.5	-0.9	26	13
36	42.5	-6.5	26	14
40	42.5	-2.5	26	15
42.4	42.5	-0.1	26	16
43.5	42.5	1	27	16
38	42.5	-4.5	27	17
39.2	42.5	-3.3	27	18

65.2	46.1	19.1	28	18
41.1	46.1	-5	28	19
42.2	46.1	-3.9	28	20
45.8	46.1	-0.3	28	21
17.9	46.1	-28.2	28	22
41.5	46.1	-4.6	28	23
18.8	46.1	-27.3	28	24
47.1	46.1	1	29	24
55	46.1	8.9	30	24
38.9	46.1	-7.2	30	25
40.8	46.1	-5.3	30	26
35.8	46.1	-10.3	30	27
1.8	46.1	-44.3	30	28
87	46.1	40.9	31	28
41.6	46.1	-4.5	31	29
36	46.1	-10.1	31	30
40	46.1	-6.1	31	31
42.4	46.1	-3.7	31	32
43.5	46.1	-2.6	31	33
38	46.1	-8.1	31	34
39.2	46.1	-6.9	31	35
41.1	65.2	-24.1	31	36
42.2	65.2	-23	31	37
45.8	65.2	-19.4	31	38
17.9	65.2	-47.3	31	39
41.5	65.2	-23.7	31	40
18.8	65.2	-46.4	31	41
47.1	65.2	-18.1	31	42
55	65.2	-10.2	31	43
38.9	65.2	-26.3	31	44
40.8	65.2	-24.4	31	45
35.8	65.2	-29.4	31	46
1.8	65.2	-63.4	31	47
87	65.2	21.8	32	47
41.6	65.2	-23.6	32	48
36	65.2	-29.2	32	49
40	65.2	-25.2	32	50
42.4	65.2	-22.8	32	51
43.5	65.2	-21.7	32	52
38	65.2	-27.2	32	53
39.2	65.2	-26	32	54
42.2	41.1	1.1	33	54
45.8	41.1	4.7	34	54
17.9	41.1	-23.2	34	55
41.5	41.1	0.4	35	55
18.8	41.1	-22.3	35	56
47.1	41.1	6	36	56
55	41.1	13.9	37	56
38.9	41.1	-2.2	37	57
40.8	41.1	-0.3	37	58
35.8	41.1	-5.3	37	59
1.8	41.1	-39.3	37	60
87	41.1	45.9	38	60
41.6	41.1	0.5	39	60
36	41.1	-5.1	39	61
40	41.1	-1.1	39	62
42.4	41.1	1.3	40	62

43.5	41.1	2.4	41	62
38	41.1	-3.1	41	63
39.2	41.1	-1.9	41	64
45.8	42.2	3.6	42	64
17.9	42.2	-24.3	42	65
41.5	42.2	-0.7	42	66
18.8	42.2	-23.4	42	67
47.1	42.2	4.9	43	67
55	42.2	12.8	44	67
38.9	42.2	-3.3	44	68
40.8	42.2	-1.4	44	69
35.8	42.2	-6.4	44	70
1.8	42.2	-40.4	44	71
87	42.2	44.8	45	71
41.6	42.2	-0.6	45	72
36	42.2	-6.2	45	73
40	42.2	-2.2	45	74
42.4	42.2	0.2	46	74
43.5	42.2	1.3	47	74
38	42.2	-4.2	47	75
39.2	42.2	-3	47	76
17.9	45.8	-27.9	47	77
41.5	45.8	-4.3	47	78
18.8	45.8	-27	47	79
47.1	45.8	1.3	48	79
55	45.8	9.2	49	79
38.9	45.8	-6.9	49	80
40.8	45.8	-5	49	81
35.8	45.8	-10	49	82
1.8	45.8	-44	49	83
87	45.8	41.2	50	83
41.6	45.8	-4.2	50	84
36	45.8	-9.8	50	85
40	45.8	-5.8	50	86
42.4	45.8	-3.4	50	87
43.5	45.8	-2.3	50	88
38	45.8	-7.8	50	89
39.2	45.8	-6.6	50	90
41.5	17.9	23.6	51	90
18.8	17.9	0.9	52	90
47.1	17.9	29.2	53	90
55	17.9	37.1	54	90
38.9	17.9	21	55	90
40.8	17.9	22.9	56	90
35.8	17.9	17.9	57	90
1.8	17.9	-16.1	57	91
87	17.9	69.1	58	91
41.6	17.9	23.7	59	91
36	17.9	18.1	60	91
40	17.9	22.1	61	91
42.4	17.9	24.5	62	91
43.5	17.9	25.6	63	91
38	17.9	20.1	64	91
39.2	17.9	21.3	65	91
18.8	41.5	-22.7	65	92

47.1	41.5	5.6	66	92
55	41.5	13.5	67	92
38.9	41.5	-2.6	67	93
40.8	41.5	-0.7	67	94
35.8	41.5	-5.7	67	95
1.8	41.5	-39.7	67	96
87	41.5	45.5	68	96
41.6	41.5	0.1	69	96
36	41.5	-5.5	69	97
40	41.5	-1.5	69	98
42.4	41.5	0.9	70	98
43.5	41.5	2	71	98
38	41.5	-3.5	71	99
39.2	41.5	-2.3	71	100
47.1	18.8	28.3	72	100
55	18.8	36.2	73	100
38.9	18.8	20.1	74	100
40.8	18.8	22	75	100
35.8	18.8	17	76	100
1.8	18.8	-17	76	101
87	18.8	68.2	77	101
41.6	18.8	22.8	78	101
36	18.8	17.2	79	101
40	18.8	21.2	80	101
42.4	18.8	23.6	81	101
43.5	18.8	24.7	82	101
38	18.8	19.2	83	101
39.2	18.8	20.4	84	101
55	47.1	7.9	85	101
38.9	47.1	-8.2	85	102
40.8	47.1	-6.3	85	103
35.8	47.1	-11.3	85	104
1.8	47.1	-45.3	85	105
87	47.1	39.9	86	105
41.6	47.1	-5.5	86	106
36	47.1	-11.1	86	107
40	47.1	-7.1	86	108
42.4	47.1	-4.7	86	109
43.5	47.1	-3.6	86	110
38	47.1	-9.1	86	111
39.2	47.1	-7.9	86	112
38.9	55	-16.1	86	113
40.8	55	-14.2	86	114
35.8	55	-19.2	86	115
1.8	55	-53.2	86	116
87	55	32	87	116
41.6	55	-13.4	87	117
36	55	-19	87	118
40	55	-15	87	119
42.4	55	-12.6	87	120
43.5	55	-11.5	87	121
38	55	-17	87	122
39.2	55	-15.8	87	123
40.8	38.9	1.9	88	123
35.8	38.9	-3.1	88	124

1.8	38.9	-37.1	88	125
87	38.9	48.1	89	125
41.6	38.9	2.7	90	125
36	38.9	-2.9	90	126
40	38.9	1.1	91	126
42.4	38.9	3.5	92	126
43.5	38.9	4.6	93	126
38	38.9	-0.9	93	127
39.2	38.9	0.3	94	127
35.8	40.8	-5	94	128
1.8	40.8	-39	94	129
87	40.8	46.2	95	129
41.6	40.8	0.8	96	129
36	40.8	-4.8	96	130
40	40.8	-0.8	96	131
42.4	40.8	1.6	97	131
43.5	40.8	2.7	98	131
38	40.8	-2.8	98	132
39.2	40.8	-1.6	98	133
1.8	35.8	-34	98	134
87	35.8	51.2	99	134
41.6	35.8	5.8	100	134
36	35.8	0.2	101	134
40	35.8	4.2	102	134
42.4	35.8	6.6	103	134
43.5	35.8	7.7	104	134
38	35.8	2.2	105	134
39.2	35.8	3.4	106	134
87	1.8	85.2	107	134
41.6	1.8	39.8	108	134
36	1.8	34.2	109	134
40	1.8	38.2	110	134
42.4	1.8	40.6	111	134
43.5	1.8	41.7	112	134
38	1.8	36.2	113	134
39.2	1.8	37.4	114	134
41.6	87	-45.4	114	135
36	87	-51	114	136
40	87	-47	114	137
42.4	87	-44.6	114	138
43.5	87	-43.5	114	139
38	87	-49	114	140
39.2	87	-47.8	114	141
36	41.6	-5.6	114	142
40	41.6	-1.6	114	143
42.4	41.6	0.8	115	143
43.5	41.6	1.9	116	143
38	41.6	-3.6	116	144
39.2	41.6	-2.4	116	145
40	36	4	117	145
42.4	36	6.4	118	145
43.5	36	7.5	119	145
38	36	2	120	145

39.2	36	3.2	121	145
42.4	40	2.4	122	145
43.5	40	3.5	123	145
38	40	-2	123	146
39.2	40	-0.8	123	147
43.5	42.4	1.1	124	147
38	42.4	-4.4	124	148
39.2	42.4	-3.2	124	149
38	43.5	-5.5	124	150
39.2	43.5	-4.3	124	151
39.2	38	1.2	125	151

S Statistic = 125 - 151 = -26

Tied Group Value	Members

Time Period	Observations
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/22/2013	1
11/12/2013	1
4/16/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1
10/24/2018	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 29256
b = 109296
c = 1104
Group Variance = 1625.33

Z-Score = -0.62011
Comparison Level at 95% confidence level = 1.65463 (upward trend)
-0.62011 <= 1.65463 indicating no evidence of an upward trend

Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: SW-09

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
ND<0	ND<0	0	0	0
ND<0	ND<0	0	0	0
ND<0	ND<0	0	0	0
ND<0	ND<0	0	0	0
ND<0	ND<0	0	0	0
ND<0	ND<0	0	0	0
1.13	ND<0	1.13	1	0
0.212	ND<0	0.212	2	0
0.728	ND<0	0.728	3	0
ND<0	ND<0	0	3	0
0.1	ND<0	0.1	4	0
4.87	ND<0	4.87	5	0
ND<0	ND<0	0	5	0
2.24	ND<0	2.24	6	0
ND<0	ND<0	0	6	0
ND<0	ND<0	0	6	0
ND<0	ND<0	0	6	0
ND<0	ND<0	0	6	0
5.56	ND<0	5.56	7	0
ND<0	ND<0	0	7	0
ND<0	ND<0	0	7	0
0.16	ND<0	0.16	8	0
ND<0	ND<0	0	8	0
ND<0	ND<0	0	8	0
ND<0	ND<0	0	8	0
ND<0	ND<0	0	8	0
ND<0	ND<0	0	8	0
ND<0	ND<0	0	8	0
1.13	ND<0	1.13	9	0
0.212	ND<0	0.212	10	0
0.728	ND<0	0.728	11	0
ND<0	ND<0	0	11	0
0.1	ND<0	0.1	12	0
4.87	ND<0	4.87	13	0
ND<0	ND<0	0	13	0
2.24	ND<0	2.24	14	0
ND<0	ND<0	0	14	0
ND<0	ND<0	0	14	0
ND<0	ND<0	0	14	0
ND<0	ND<0	0	14	0
5.56	ND<0	5.56	15	0
ND<0	ND<0	0	15	0
ND<0	ND<0	0	15	0
0.16	ND<0	0.16	16	0
ND<0	ND<0	0	16	0

ND<0	ND<0	0	16	0
ND<0	ND<0	0	16	0
ND<0	ND<0	0	16	0
ND<0	ND<0	0	16	0
1.13	ND<0	1.13	17	0
0.212	ND<0	0.212	18	0
0.728	ND<0	0.728	19	0
ND<0	ND<0	0	19	0
0.1	ND<0	0.1	20	0
4.87	ND<0	4.87	21	0
ND<0	ND<0	0	21	0
2.24	ND<0	2.24	22	0
ND<0	ND<0	0	22	0
ND<0	ND<0	0	22	0
ND<0	ND<0	0	22	0
ND<0	ND<0	0	22	0
5.56	ND<0	5.56	23	0
ND<0	ND<0	0	23	0
ND<0	ND<0	0	23	0
0.16	ND<0	0.16	24	0
ND<0	ND<0	0	24	0
ND<0	ND<0	0	24	0
ND<0	ND<0	0	24	0
ND<0	ND<0	0	24	0
1.13	ND<0	1.13	25	0
0.212	ND<0	0.212	26	0
0.728	ND<0	0.728	27	0
ND<0	ND<0	0	27	0
0.1	ND<0	0.1	28	0
4.87	ND<0	4.87	29	0
ND<0	ND<0	0	29	0
2.24	ND<0	2.24	30	0
ND<0	ND<0	0	30	0
ND<0	ND<0	0	30	0
ND<0	ND<0	0	30	0
ND<0	ND<0	0	30	0
5.56	ND<0	5.56	31	0
ND<0	ND<0	0	31	0
ND<0	ND<0	0	31	0
0.16	ND<0	0.16	32	0
ND<0	ND<0	0	32	0
ND<0	ND<0	0	32	0
ND<0	ND<0	0	32	0
1.13	ND<0	1.13	33	0
0.212	ND<0	0.212	34	0
0.728	ND<0	0.728	35	0
ND<0	ND<0	0	35	0
0.1	ND<0	0.1	36	0
4.87	ND<0	4.87	37	0
ND<0	ND<0	0	37	0
2.24	ND<0	2.24	38	0
ND<0	ND<0	0	38	0
ND<0	ND<0	0	38	0
ND<0	ND<0	0	38	0
ND<0	ND<0	0	38	0
5.56	ND<0	5.56	39	0
ND<0	ND<0	0	39	0

ND<0	ND<0	0	39	0
0.16	ND<0	0.16	40	0
ND<0	ND<0	0	40	0
ND<0	ND<0	0	40	0
1.13	ND<0	1.13	41	0
0.212	ND<0	0.212	42	0
0.728	ND<0	0.728	43	0
ND<0	ND<0	0	43	0
0.1	ND<0	0.1	44	0
4.87	ND<0	4.87	45	0
ND<0	ND<0	0	45	0
2.24	ND<0	2.24	46	0
ND<0	ND<0	0	46	0
ND<0	ND<0	0	46	0
ND<0	ND<0	0	46	0
ND<0	ND<0	0	46	0
5.56	ND<0	5.56	47	0
ND<0	ND<0	0	47	0
ND<0	ND<0	0	47	0
0.16	ND<0	0.16	48	0
ND<0	ND<0	0	48	0
1.13	ND<0	1.13	49	0
0.212	ND<0	0.212	50	0
0.728	ND<0	0.728	51	0
ND<0	ND<0	0	51	0
0.1	ND<0	0.1	52	0
4.87	ND<0	4.87	53	0
ND<0	ND<0	0	53	0
2.24	ND<0	2.24	54	0
ND<0	ND<0	0	54	0
ND<0	ND<0	0	54	0
ND<0	ND<0	0	54	0
ND<0	ND<0	0	54	0
5.56	ND<0	5.56	55	0
ND<0	ND<0	0	55	0
ND<0	ND<0	0	55	0
0.16	ND<0	0.16	56	0
ND<0	ND<0	0	56	0
0.212	1.13	-0.918	56	1
0.728	1.13	-0.402	56	2
ND<0	1.13	-1.13	56	3
0.1	1.13	-1.03	56	4
4.87	1.13	3.74	57	4
ND<0	1.13	-1.13	57	5
2.24	1.13	1.11	58	5
ND<0	1.13	-1.13	58	6
ND<0	1.13	-1.13	58	7
ND<0	1.13	-1.13	58	8
ND<0	1.13	-1.13	58	9
5.56	1.13	4.43	59	9
ND<0	1.13	-1.13	59	10
ND<0	1.13	-1.13	59	11
0.16	1.13	-0.97	59	12
ND<0	1.13	-1.13	59	13
0.728	0.212	0.516	60	13

ND<0	0.212	-0.212	60	14
0.1	0.212	-0.112	60	15
4.87	0.212	4.658	61	15
ND<0	0.212	-0.212	61	16
2.24	0.212	2.028	62	16
ND<0	0.212	-0.212	62	17
ND<0	0.212	-0.212	62	18
ND<0	0.212	-0.212	62	19
ND<0	0.212	-0.212	62	20
5.56	0.212	5.348	63	20
ND<0	0.212	-0.212	63	21
ND<0	0.212	-0.212	63	22
0.16	0.212	-0.052	63	23
ND<0	0.212	-0.212	63	24
ND<0	0.728	-0.728	63	25
0.1	0.728	-0.628	63	26
4.87	0.728	4.142	64	26
ND<0	0.728	-0.728	64	27
2.24	0.728	1.512	65	27
ND<0	0.728	-0.728	65	28
ND<0	0.728	-0.728	65	29
ND<0	0.728	-0.728	65	30
ND<0	0.728	-0.728	65	31
5.56	0.728	4.832	66	31
ND<0	0.728	-0.728	66	32
ND<0	0.728	-0.728	66	33
0.16	0.728	-0.568	66	34
ND<0	0.728	-0.728	66	35
0.1	ND<0	0.1	67	35
4.87	ND<0	4.87	68	35
ND<0	ND<0	0	68	35
2.24	ND<0	2.24	69	35
ND<0	ND<0	0	69	35
ND<0	ND<0	0	69	35
ND<0	ND<0	0	69	35
ND<0	ND<0	0	69	35
5.56	ND<0	5.56	70	35
ND<0	ND<0	0	70	35
ND<0	ND<0	0	70	35
0.16	ND<0	0.16	71	35
ND<0	ND<0	0	71	35
4.87	0.1	4.77	72	35
ND<0	0.1	-0.1	72	36
2.24	0.1	2.14	73	36
ND<0	0.1	-0.1	73	37
ND<0	0.1	-0.1	73	38
ND<0	0.1	-0.1	73	39
ND<0	0.1	-0.1	73	40
5.56	0.1	5.46	74	40
ND<0	0.1	-0.1	74	41
ND<0	0.1	-0.1	74	42
0.16	0.1	0.06	75	42
ND<0	0.1	-0.1	75	43
ND<0	4.87	-4.87	75	44
2.24	4.87	-2.63	75	45

ND<0	4.87	-4.87	75	46
ND<0	4.87	-4.87	75	47
ND<0	4.87	-4.87	75	48
ND<0	4.87	-4.87	75	49
5.56	4.87	0.69	76	49
ND<0	4.87	-4.87	76	50
ND<0	4.87	-4.87	76	51
0.16	4.87	-4.71	76	52
ND<0	4.87	-4.87	76	53
2.24	ND<0	2.24	77	53
ND<0	ND<0	0	77	53
ND<0	ND<0	0	77	53
ND<0	ND<0	0	77	53
ND<0	ND<0	0	77	53
5.56	ND<0	5.56	78	53
ND<0	ND<0	0	78	53
ND<0	ND<0	0	78	53
0.16	ND<0	0.16	79	53
ND<0	ND<0	0	79	53
ND<0	2.24	-2.24	79	54
ND<0	2.24	-2.24	79	55
ND<0	2.24	-2.24	79	56
ND<0	2.24	-2.24	79	57
5.56	2.24	3.32	80	57
ND<0	2.24	-2.24	80	58
ND<0	2.24	-2.24	80	59
0.16	2.24	-2.08	80	60
ND<0	2.24	-2.24	80	61
ND<0	ND<0	0	80	61
ND<0	ND<0	0	80	61
ND<0	ND<0	0	80	61
5.56	ND<0	5.56	81	61
ND<0	ND<0	0	81	61
ND<0	ND<0	0	81	61
0.16	ND<0	0.16	82	61
ND<0	ND<0	0	82	61
ND<0	ND<0	0	82	61
ND<0	ND<0	0	82	61
5.56	ND<0	5.56	83	61
ND<0	ND<0	0	83	61
ND<0	ND<0	0	83	61
0.16	ND<0	0.16	84	61
ND<0	ND<0	0	84	61
ND<0	ND<0	0	84	61
5.56	ND<0	5.56	85	61
ND<0	ND<0	0	85	61
ND<0	ND<0	0	85	61
0.16	ND<0	0.16	86	61
ND<0	ND<0	0	86	61
5.56	ND<0	5.56	87	61
ND<0	ND<0	0	87	61
ND<0	ND<0	0	87	61
0.16	ND<0	0.16	88	61

ND<0	ND<0	0	88	61
ND<0	5.56	-5.56	88	62
ND<0	5.56	-5.56	88	63
0.16	5.56	-5.4	88	64
ND<0	5.56	-5.56	88	65
ND<0	ND<0	0	88	65
0.16	ND<0	0.16	89	65
ND<0	ND<0	0	89	65
0.16	ND<0	0.16	90	65
ND<0	ND<0	0	90	65
ND<0	0.16	-0.16	90	66

S Statistic = 90 - 66 = 24

Tied Group	Value	Members
1	0	16

Time Period	Observations
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/16/2014	1
10/29/2014	1
3/16/2015	1
10/21/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 8880
B = 0
C = 3360
D = 0
E = 240
F = 0
a = 29256
b = 109296
c = 1104

Group Variance = 1132
Z-Score = 0.683604
Comparison Level at 95% confidence level = -1.65463 (downward trend)
0.683604 >= -1.65463 indicating no evidence of a downward trend

Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: SW-09

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
ND<0	ND<0	0	0	0
ND<0	ND<0	0	0	0
ND<0	ND<0	0	0	0
ND<0	ND<0	0	0	0
ND<0	ND<0	0	0	0
ND<0	ND<0	0	0	0
1.13	ND<0	1.13	1	0
0.212	ND<0	0.212	2	0
0.728	ND<0	0.728	3	0
ND<0	ND<0	0	3	0
0.1	ND<0	0.1	4	0
4.87	ND<0	4.87	5	0
ND<0	ND<0	0	5	0
2.24	ND<0	2.24	6	0
ND<0	ND<0	0	6	0
ND<0	ND<0	0	6	0
ND<0	ND<0	0	6	0
ND<0	ND<0	0	6	0
5.56	ND<0	5.56	7	0
ND<0	ND<0	0	7	0
ND<0	ND<0	0	7	0
0.16	ND<0	0.16	8	0
ND<0	ND<0	0	8	0
ND<0	ND<0	0	8	0
ND<0	ND<0	0	8	0
ND<0	ND<0	0	8	0
ND<0	ND<0	0	8	0
ND<0	ND<0	0	8	0
1.13	ND<0	1.13	9	0
0.212	ND<0	0.212	10	0
0.728	ND<0	0.728	11	0
ND<0	ND<0	0	11	0
0.1	ND<0	0.1	12	0
4.87	ND<0	4.87	13	0
ND<0	ND<0	0	13	0
2.24	ND<0	2.24	14	0
ND<0	ND<0	0	14	0
ND<0	ND<0	0	14	0
ND<0	ND<0	0	14	0
ND<0	ND<0	0	14	0
5.56	ND<0	5.56	15	0
ND<0	ND<0	0	15	0
ND<0	ND<0	0	15	0
0.16	ND<0	0.16	16	0
ND<0	ND<0	0	16	0

ND<0	ND<0	0	16	0
ND<0	ND<0	0	16	0
ND<0	ND<0	0	16	0
ND<0	ND<0	0	16	0
1.13	ND<0	1.13	17	0
0.212	ND<0	0.212	18	0
0.728	ND<0	0.728	19	0
ND<0	ND<0	0	19	0
0.1	ND<0	0.1	20	0
4.87	ND<0	4.87	21	0
ND<0	ND<0	0	21	0
2.24	ND<0	2.24	22	0
ND<0	ND<0	0	22	0
ND<0	ND<0	0	22	0
ND<0	ND<0	0	22	0
ND<0	ND<0	0	22	0
5.56	ND<0	5.56	23	0
ND<0	ND<0	0	23	0
ND<0	ND<0	0	23	0
0.16	ND<0	0.16	24	0
ND<0	ND<0	0	24	0
ND<0	ND<0	0	24	0
ND<0	ND<0	0	24	0
ND<0	ND<0	0	24	0
1.13	ND<0	1.13	25	0
0.212	ND<0	0.212	26	0
0.728	ND<0	0.728	27	0
ND<0	ND<0	0	27	0
0.1	ND<0	0.1	28	0
4.87	ND<0	4.87	29	0
ND<0	ND<0	0	29	0
2.24	ND<0	2.24	30	0
ND<0	ND<0	0	30	0
ND<0	ND<0	0	30	0
ND<0	ND<0	0	30	0
ND<0	ND<0	0	30	0
5.56	ND<0	5.56	31	0
ND<0	ND<0	0	31	0
ND<0	ND<0	0	31	0
0.16	ND<0	0.16	32	0
ND<0	ND<0	0	32	0
ND<0	ND<0	0	32	0
ND<0	ND<0	0	32	0
1.13	ND<0	1.13	33	0
0.212	ND<0	0.212	34	0
0.728	ND<0	0.728	35	0
ND<0	ND<0	0	35	0
0.1	ND<0	0.1	36	0
4.87	ND<0	4.87	37	0
ND<0	ND<0	0	37	0
2.24	ND<0	2.24	38	0
ND<0	ND<0	0	38	0
ND<0	ND<0	0	38	0
ND<0	ND<0	0	38	0
ND<0	ND<0	0	38	0
5.56	ND<0	5.56	39	0
ND<0	ND<0	0	39	0

ND<0	ND<0	0	39	0
0.16	ND<0	0.16	40	0
ND<0	ND<0	0	40	0
ND<0	ND<0	0	40	0
1.13	ND<0	1.13	41	0
0.212	ND<0	0.212	42	0
0.728	ND<0	0.728	43	0
ND<0	ND<0	0	43	0
0.1	ND<0	0.1	44	0
4.87	ND<0	4.87	45	0
ND<0	ND<0	0	45	0
2.24	ND<0	2.24	46	0
ND<0	ND<0	0	46	0
ND<0	ND<0	0	46	0
ND<0	ND<0	0	46	0
ND<0	ND<0	0	46	0
5.56	ND<0	5.56	47	0
ND<0	ND<0	0	47	0
ND<0	ND<0	0	47	0
0.16	ND<0	0.16	48	0
ND<0	ND<0	0	48	0
1.13	ND<0	1.13	49	0
0.212	ND<0	0.212	50	0
0.728	ND<0	0.728	51	0
ND<0	ND<0	0	51	0
0.1	ND<0	0.1	52	0
4.87	ND<0	4.87	53	0
ND<0	ND<0	0	53	0
2.24	ND<0	2.24	54	0
ND<0	ND<0	0	54	0
ND<0	ND<0	0	54	0
ND<0	ND<0	0	54	0
ND<0	ND<0	0	54	0
5.56	ND<0	5.56	55	0
ND<0	ND<0	0	55	0
ND<0	ND<0	0	55	0
0.16	ND<0	0.16	56	0
ND<0	ND<0	0	56	0
0.212	1.13	-0.918	56	1
0.728	1.13	-0.402	56	2
ND<0	1.13	-1.13	56	3
0.1	1.13	-1.03	56	4
4.87	1.13	3.74	57	4
ND<0	1.13	-1.13	57	5
2.24	1.13	1.11	58	5
ND<0	1.13	-1.13	58	6
ND<0	1.13	-1.13	58	7
ND<0	1.13	-1.13	58	8
ND<0	1.13	-1.13	58	9
5.56	1.13	4.43	59	9
ND<0	1.13	-1.13	59	10
ND<0	1.13	-1.13	59	11
0.16	1.13	-0.97	59	12
ND<0	1.13	-1.13	59	13
0.728	0.212	0.516	60	13

ND<0	0.212	-0.212	60	14
0.1	0.212	-0.112	60	15
4.87	0.212	4.658	61	15
ND<0	0.212	-0.212	61	16
2.24	0.212	2.028	62	16
ND<0	0.212	-0.212	62	17
ND<0	0.212	-0.212	62	18
ND<0	0.212	-0.212	62	19
ND<0	0.212	-0.212	62	20
5.56	0.212	5.348	63	20
ND<0	0.212	-0.212	63	21
ND<0	0.212	-0.212	63	22
0.16	0.212	-0.052	63	23
ND<0	0.212	-0.212	63	24
ND<0	0.728	-0.728	63	25
0.1	0.728	-0.628	63	26
4.87	0.728	4.142	64	26
ND<0	0.728	-0.728	64	27
2.24	0.728	1.512	65	27
ND<0	0.728	-0.728	65	28
ND<0	0.728	-0.728	65	29
ND<0	0.728	-0.728	65	30
ND<0	0.728	-0.728	65	31
5.56	0.728	4.832	66	31
ND<0	0.728	-0.728	66	32
ND<0	0.728	-0.728	66	33
0.16	0.728	-0.568	66	34
ND<0	0.728	-0.728	66	35
0.1	ND<0	0.1	67	35
4.87	ND<0	4.87	68	35
ND<0	ND<0	0	68	35
2.24	ND<0	2.24	69	35
ND<0	ND<0	0	69	35
ND<0	ND<0	0	69	35
ND<0	ND<0	0	69	35
ND<0	ND<0	0	69	35
5.56	ND<0	5.56	70	35
ND<0	ND<0	0	70	35
ND<0	ND<0	0	70	35
0.16	ND<0	0.16	71	35
ND<0	ND<0	0	71	35
4.87	0.1	4.77	72	35
ND<0	0.1	-0.1	72	36
2.24	0.1	2.14	73	36
ND<0	0.1	-0.1	73	37
ND<0	0.1	-0.1	73	38
ND<0	0.1	-0.1	73	39
ND<0	0.1	-0.1	73	40
5.56	0.1	5.46	74	40
ND<0	0.1	-0.1	74	41
ND<0	0.1	-0.1	74	42
0.16	0.1	0.06	75	42
ND<0	0.1	-0.1	75	43
ND<0	4.87	-4.87	75	44
2.24	4.87	-2.63	75	45

ND<0	4.87	-4.87	75	46
ND<0	4.87	-4.87	75	47
ND<0	4.87	-4.87	75	48
ND<0	4.87	-4.87	75	49
5.56	4.87	0.69	76	49
ND<0	4.87	-4.87	76	50
ND<0	4.87	-4.87	76	51
0.16	4.87	-4.71	76	52
ND<0	4.87	-4.87	76	53
2.24	ND<0	2.24	77	53
ND<0	ND<0	0	77	53
ND<0	ND<0	0	77	53
ND<0	ND<0	0	77	53
ND<0	ND<0	0	77	53
5.56	ND<0	5.56	78	53
ND<0	ND<0	0	78	53
ND<0	ND<0	0	78	53
0.16	ND<0	0.16	79	53
ND<0	ND<0	0	79	53
ND<0	2.24	-2.24	79	54
ND<0	2.24	-2.24	79	55
ND<0	2.24	-2.24	79	56
ND<0	2.24	-2.24	79	57
5.56	2.24	3.32	80	57
ND<0	2.24	-2.24	80	58
ND<0	2.24	-2.24	80	59
0.16	2.24	-2.08	80	60
ND<0	2.24	-2.24	80	61
ND<0	ND<0	0	80	61
ND<0	ND<0	0	80	61
ND<0	ND<0	0	80	61
5.56	ND<0	5.56	81	61
ND<0	ND<0	0	81	61
ND<0	ND<0	0	81	61
0.16	ND<0	0.16	82	61
ND<0	ND<0	0	82	61
ND<0	ND<0	0	82	61
ND<0	ND<0	0	82	61
5.56	ND<0	5.56	83	61
ND<0	ND<0	0	83	61
ND<0	ND<0	0	83	61
0.16	ND<0	0.16	84	61
ND<0	ND<0	0	84	61
ND<0	ND<0	0	84	61
5.56	ND<0	5.56	85	61
ND<0	ND<0	0	85	61
ND<0	ND<0	0	85	61
0.16	ND<0	0.16	86	61
ND<0	ND<0	0	86	61
5.56	ND<0	5.56	87	61
ND<0	ND<0	0	87	61
ND<0	ND<0	0	87	61
0.16	ND<0	0.16	88	61

ND<0	ND<0	0	88	61
ND<0	5.56	-5.56	88	62
ND<0	5.56	-5.56	88	63
0.16	5.56	-5.4	88	64
ND<0	5.56	-5.56	88	65
ND<0	ND<0	0	88	65
0.16	ND<0	0.16	89	65
ND<0	ND<0	0	89	65
0.16	ND<0	0.16	90	65
ND<0	ND<0	0	90	65
ND<0	0.16	-0.16	90	66

S Statistic = 90 - 66 = 24

Tied Group	Value	Members
1	0	16

Time Period	Observations
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/16/2014	1
10/29/2014	1
3/16/2015	1
10/21/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 8880
B = 0
C = 3360
D = 0
E = 240
F = 0
a = 29256
b = 109296
c = 1104

Group Variance = 1132
Z-Score = 0.683604
Comparison Level at 95% confidence level = 1.65463 (upward trend)
0.683604 <= 1.65463 indicating no evidence of an upward trend

Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: EPW-01

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
87	112	-25	0	1
63	112	-49	0	2
77	112	-35	0	3
133	112	21	1	3
190	112	78	2	3
78	112	-34	2	4
96	112	-16	2	5
110	112	-2	2	6
93	112	-19	2	7
64	112	-48	2	8
94	112	-18	2	9
91	112	-21	2	10
98	112	-14	2	11
92	112	-20	2	12
96	112	-16	2	13
130	112	18	3	13
110	112	-2	3	14
130	112	18	4	14
46	112	-66	4	15
130	112	18	5	15
110	112	-2	5	16
130	112	18	6	16
130	112	18	7	16
130	112	18	8	16
120	112	8	9	16
140	112	28	10	16
93	112	-19	10	17
85	112	-27	10	18
69.4	112	-42.6	10	19
118	112	6	11	19
63	87	-24	11	20
77	87	-10	11	21
133	87	46	12	21
190	87	103	13	21
78	87	-9	13	22
96	87	9	14	22
110	87	23	15	22
93	87	6	16	22
64	87	-23	16	23
94	87	7	17	23
91	87	4	18	23
98	87	11	19	23
92	87	5	20	23
96	87	9	21	23
130	87	43	22	23
110	87	23	23	23

130	87	43	24	23
46	87	-41	24	24
130	87	43	25	24
110	87	23	26	24
130	87	43	27	24
130	87	43	28	24
130	87	43	29	24
120	87	33	30	24
140	87	53	31	24
93	87	6	32	24
85	87	-2	32	25
69.4	87	-17.6	32	26
118	87	31	33	26
77	63	14	34	26
133	63	70	35	26
190	63	127	36	26
78	63	15	37	26
96	63	33	38	26
110	63	47	39	26
93	63	30	40	26
64	63	1	41	26
94	63	31	42	26
91	63	28	43	26
98	63	35	44	26
92	63	29	45	26
96	63	33	46	26
130	63	67	47	26
110	63	47	48	26
130	63	67	49	26
46	63	-17	49	27
130	63	67	50	27
110	63	47	51	27
130	63	67	52	27
130	63	67	53	27
130	63	67	54	27
120	63	57	55	27
140	63	77	56	27
93	63	30	57	27
85	63	22	58	27
69.4	63	6.4	59	27
118	63	55	60	27
133	77	56	61	27
190	77	113	62	27
78	77	1	63	27
96	77	19	64	27
110	77	33	65	27
93	77	16	66	27
64	77	-13	66	28
94	77	17	67	28
91	77	14	68	28
98	77	21	69	28
92	77	15	70	28
96	77	19	71	28
130	77	53	72	28
110	77	33	73	28
130	77	53	74	28
46	77	-31	74	29

130	77	53	75	29
110	77	33	76	29
130	77	53	77	29
130	77	53	78	29
130	77	53	79	29
120	77	43	80	29
140	77	63	81	29
93	77	16	82	29
85	77	8	83	29
69.4	77	-7.6	83	30
118	77	41	84	30
190	133	57	85	30
78	133	-55	85	31
96	133	-37	85	32
110	133	-23	85	33
93	133	-40	85	34
64	133	-69	85	35
94	133	-39	85	36
91	133	-42	85	37
98	133	-35	85	38
92	133	-41	85	39
96	133	-37	85	40
130	133	-3	85	41
110	133	-23	85	42
130	133	-3	85	43
46	133	-87	85	44
130	133	-3	85	45
110	133	-23	85	46
130	133	-3	85	47
130	133	-3	85	48
130	133	-3	85	49
120	133	-13	85	50
140	133	7	86	50
93	133	-40	86	51
85	133	-48	86	52
69.4	133	-63.6	86	53
118	133	-15	86	54
78	190	-112	86	55
96	190	-94	86	56
110	190	-80	86	57
93	190	-97	86	58
64	190	-126	86	59
94	190	-96	86	60
91	190	-99	86	61
98	190	-92	86	62
92	190	-98	86	63
96	190	-94	86	64
130	190	-60	86	65
110	190	-80	86	66
130	190	-60	86	67
46	190	-144	86	68
130	190	-60	86	69
110	190	-80	86	70
130	190	-60	86	71
130	190	-60	86	72
130	190	-60	86	73
120	190	-70	86	74

140	190	-50	86	75
93	190	-97	86	76
85	190	-105	86	77
69.4	190	-120.6	86	78
118	190	-72	86	79
96	78	18	87	79
110	78	32	88	79
93	78	15	89	79
64	78	-14	89	80
94	78	16	90	80
91	78	13	91	80
98	78	20	92	80
92	78	14	93	80
96	78	18	94	80
130	78	52	95	80
110	78	32	96	80
130	78	52	97	80
46	78	-32	97	81
130	78	52	98	81
110	78	32	99	81
130	78	52	100	81
130	78	52	101	81
130	78	52	102	81
120	78	42	103	81
140	78	62	104	81
93	78	15	105	81
85	78	7	106	81
69.4	78	-8.6	106	82
118	78	40	107	82
110	96	14	108	82
93	96	-3	108	83
64	96	-32	108	84
94	96	-2	108	85
91	96	-5	108	86
98	96	2	109	86
92	96	-4	109	87
96	96	0	109	87
130	96	34	110	87
110	96	14	111	87
130	96	34	112	87
46	96	-50	112	88
130	96	34	113	88
110	96	14	114	88
130	96	34	115	88
130	96	34	116	88
130	96	34	117	88
120	96	24	118	88
140	96	44	119	88
93	96	-3	119	89
85	96	-11	119	90
69.4	96	-26.6	119	91
118	96	22	120	91
93	110	-17	120	92
64	110	-46	120	93
94	110	-16	120	94
91	110	-19	120	95

98	110	-12	120	96
92	110	-18	120	97
96	110	-14	120	98
130	110	20	121	98
110	110	0	121	98
130	110	20	122	98
46	110	-64	122	99
130	110	20	123	99
110	110	0	123	99
130	110	20	124	99
130	110	20	125	99
130	110	20	126	99
120	110	10	127	99
140	110	30	128	99
93	110	-17	128	100
85	110	-25	128	101
69.4	110	-40.6	128	102
118	110	8	129	102
64	93	-29	129	103
94	93	1	130	103
91	93	-2	130	104
98	93	5	131	104
92	93	-1	131	105
96	93	3	132	105
130	93	37	133	105
110	93	17	134	105
130	93	37	135	105
46	93	-47	135	106
130	93	37	136	106
110	93	17	137	106
130	93	37	138	106
130	93	37	139	106
130	93	37	140	106
120	93	27	141	106
140	93	47	142	106
93	93	0	142	106
85	93	-8	142	107
69.4	93	-23.6	142	108
118	93	25	143	108
94	64	30	144	108
91	64	27	145	108
98	64	34	146	108
92	64	28	147	108
96	64	32	148	108
130	64	66	149	108
110	64	46	150	108
130	64	66	151	108
46	64	-18	151	109
130	64	66	152	109
110	64	46	153	109
130	64	66	154	109
130	64	66	155	109
130	64	66	156	109
120	64	56	157	109
140	64	76	158	109
93	64	29	159	109
85	64	21	160	109

69.4	64	5.4	161	109
118	64	54	162	109
91	94	-3	162	110
98	94	4	163	110
92	94	-2	163	111
96	94	2	164	111
130	94	36	165	111
110	94	16	166	111
130	94	36	167	111
46	94	-48	167	112
130	94	36	168	112
110	94	16	169	112
130	94	36	170	112
130	94	36	171	112
130	94	36	172	112
120	94	26	173	112
140	94	46	174	112
93	94	-1	174	113
85	94	-9	174	114
69.4	94	-24.6	174	115
118	94	24	175	115
98	91	7	176	115
92	91	1	177	115
96	91	5	178	115
130	91	39	179	115
110	91	19	180	115
130	91	39	181	115
46	91	-45	181	116
130	91	39	182	116
110	91	19	183	116
130	91	39	184	116
130	91	39	185	116
130	91	39	186	116
120	91	29	187	116
140	91	49	188	116
93	91	2	189	116
85	91	-6	189	117
69.4	91	-21.6	189	118
118	91	27	190	118
92	98	-6	190	119
96	98	-2	190	120
130	98	32	191	120
110	98	12	192	120
130	98	32	193	120
46	98	-52	193	121
130	98	32	194	121
110	98	12	195	121
130	98	32	196	121
130	98	32	197	121
130	98	32	198	121
120	98	22	199	121
140	98	42	200	121
93	98	-5	200	122
85	98	-13	200	123
69.4	98	-28.6	200	124
118	98	20	201	124

96	92	4	202	124
130	92	38	203	124
110	92	18	204	124
130	92	38	205	124
46	92	-46	205	125
130	92	38	206	125
110	92	18	207	125
130	92	38	208	125
130	92	38	209	125
130	92	38	210	125
120	92	28	211	125
140	92	48	212	125
93	92	1	213	125
85	92	-7	213	126
69.4	92	-22.6	213	127
118	92	26	214	127
130	96	34	215	127
110	96	14	216	127
130	96	34	217	127
46	96	-50	217	128
130	96	34	218	128
110	96	14	219	128
130	96	34	220	128
130	96	34	221	128
130	96	34	222	128
120	96	24	223	128
140	96	44	224	128
93	96	-3	224	129
85	96	-11	224	130
69.4	96	-26.6	224	131
118	96	22	225	131
110	130	-20	225	132
130	130	0	225	132
46	130	-84	225	133
130	130	0	225	133
110	130	-20	225	134
130	130	0	225	134
130	130	0	225	134
130	130	0	225	134
120	130	-10	225	135
140	130	10	226	135
93	130	-37	226	136
85	130	-45	226	137
69.4	130	-60.6	226	138
118	130	-12	226	139
130	110	20	227	139
46	110	-64	227	140
130	110	20	228	140
110	110	0	228	140
130	110	20	229	140
130	110	20	230	140
130	110	20	231	140
120	110	10	232	140
140	110	30	233	140
93	110	-17	233	141

85	110	-25	233	142
69.4	110	-40.6	233	143
118	110	8	234	143
46	130	-84	234	144
130	130	0	234	144
110	130	-20	234	145
130	130	0	234	145
130	130	0	234	145
130	130	0	234	145
120	130	-10	234	146
140	130	10	235	146
93	130	-37	235	147
85	130	-45	235	148
69.4	130	-60.6	235	149
118	130	-12	235	150
130	46	84	236	150
110	46	64	237	150
130	46	84	238	150
130	46	84	239	150
130	46	84	240	150
120	46	74	241	150
140	46	94	242	150
93	46	47	243	150
85	46	39	244	150
69.4	46	23.4	245	150
118	46	72	246	150
110	130	-20	246	151
130	130	0	246	151
130	130	0	246	151
130	130	0	246	151
120	130	-10	246	152
140	130	10	247	152
93	130	-37	247	153
85	130	-45	247	154
69.4	130	-60.6	247	155
118	130	-12	247	156
130	110	20	248	156
130	110	20	249	156
130	110	20	250	156
120	110	10	251	156
140	110	30	252	156
93	110	-17	252	157
85	110	-25	252	158
69.4	110	-40.6	252	159
118	110	8	253	159
130	130	0	253	159
130	130	0	253	159
120	130	-10	253	160
140	130	10	254	160
93	130	-37	254	161
85	130	-45	254	162
69.4	130	-60.6	254	163
118	130	-12	254	164

130	130	0	254	164
120	130	-10	254	165
140	130	10	255	165
93	130	-37	255	166
85	130	-45	255	167
69.4	130	-60.6	255	168
118	130	-12	255	169
120	130	-10	255	170
140	130	10	256	170
93	130	-37	256	171
85	130	-45	256	172
69.4	130	-60.6	256	173
118	130	-12	256	174
140	120	20	257	174
93	120	-27	257	175
85	120	-35	257	176
69.4	120	-50.6	257	177
118	120	-2	257	178
93	140	-47	257	179
85	140	-55	257	180
69.4	140	-70.6	257	181
118	140	-22	257	182
85	93	-8	257	183
69.4	93	-23.6	257	184
118	93	25	258	184
69.4	85	-15.6	258	185
118	85	33	259	185
118	69.4	48.6	260	185

S Statistic = 260 - 185 = 75

Tied Group	Value	Members
1	96	2
2	110	3
3	93	2
4	130	6

Time Period	Observations
6/1/2005	1
2/1/2006	1
3/12/2008	1
5/12/2008	1
9/23/2008	1
10/29/2008	1
4/29/2009	1
5/15/2009	1
9/23/2009	1
12/8/2009	1
2/25/2010	1
4/15/2010	1
8/11/2010	1

11/23/2010	1
3/10/2011	1
5/24/2011	1
9/1/2011	1
4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/19/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 612
B = 0
C = 126
D = 0
E = 40
F = 0
a = 62310
b = 242730
c = 1860
Group Variance = 3427.67
Z-Score = 1.26396
Comparison Level at 95% confidence level = -1.65463 (downward trend)
1.26396 >= -1.65463 indicating no evidence of a downward trend

Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: EPW-01

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
87	112	-25	0	1
63	112	-49	0	2
77	112	-35	0	3
133	112	21	1	3
190	112	78	2	3
78	112	-34	2	4
96	112	-16	2	5
110	112	-2	2	6
93	112	-19	2	7
64	112	-48	2	8
94	112	-18	2	9
91	112	-21	2	10
98	112	-14	2	11
92	112	-20	2	12
96	112	-16	2	13
130	112	18	3	13
110	112	-2	3	14
130	112	18	4	14
46	112	-66	4	15
130	112	18	5	15
110	112	-2	5	16
130	112	18	6	16
130	112	18	7	16
130	112	18	8	16
120	112	8	9	16
140	112	28	10	16
93	112	-19	10	17
85	112	-27	10	18
69.4	112	-42.6	10	19
118	112	6	11	19
63	87	-24	11	20
77	87	-10	11	21
133	87	46	12	21
190	87	103	13	21
78	87	-9	13	22
96	87	9	14	22
110	87	23	15	22
93	87	6	16	22
64	87	-23	16	23
94	87	7	17	23
91	87	4	18	23
98	87	11	19	23
92	87	5	20	23
96	87	9	21	23
130	87	43	22	23
110	87	23	23	23

130	87	43	24	23
46	87	-41	24	24
130	87	43	25	24
110	87	23	26	24
130	87	43	27	24
130	87	43	28	24
130	87	43	29	24
120	87	33	30	24
140	87	53	31	24
93	87	6	32	24
85	87	-2	32	25
69.4	87	-17.6	32	26
118	87	31	33	26
77	63	14	34	26
133	63	70	35	26
190	63	127	36	26
78	63	15	37	26
96	63	33	38	26
110	63	47	39	26
93	63	30	40	26
64	63	1	41	26
94	63	31	42	26
91	63	28	43	26
98	63	35	44	26
92	63	29	45	26
96	63	33	46	26
130	63	67	47	26
110	63	47	48	26
130	63	67	49	26
46	63	-17	49	27
130	63	67	50	27
110	63	47	51	27
130	63	67	52	27
130	63	67	53	27
130	63	67	54	27
120	63	57	55	27
140	63	77	56	27
93	63	30	57	27
85	63	22	58	27
69.4	63	6.4	59	27
118	63	55	60	27
133	77	56	61	27
190	77	113	62	27
78	77	1	63	27
96	77	19	64	27
110	77	33	65	27
93	77	16	66	27
64	77	-13	66	28
94	77	17	67	28
91	77	14	68	28
98	77	21	69	28
92	77	15	70	28
96	77	19	71	28
130	77	53	72	28
110	77	33	73	28
130	77	53	74	28
46	77	-31	74	29

130	77	53	75	29
110	77	33	76	29
130	77	53	77	29
130	77	53	78	29
130	77	53	79	29
120	77	43	80	29
140	77	63	81	29
93	77	16	82	29
85	77	8	83	29
69.4	77	-7.6	83	30
118	77	41	84	30
190	133	57	85	30
78	133	-55	85	31
96	133	-37	85	32
110	133	-23	85	33
93	133	-40	85	34
64	133	-69	85	35
94	133	-39	85	36
91	133	-42	85	37
98	133	-35	85	38
92	133	-41	85	39
96	133	-37	85	40
130	133	-3	85	41
110	133	-23	85	42
130	133	-3	85	43
46	133	-87	85	44
130	133	-3	85	45
110	133	-23	85	46
130	133	-3	85	47
130	133	-3	85	48
130	133	-3	85	49
120	133	-13	85	50
140	133	7	86	50
93	133	-40	86	51
85	133	-48	86	52
69.4	133	-63.6	86	53
118	133	-15	86	54
78	190	-112	86	55
96	190	-94	86	56
110	190	-80	86	57
93	190	-97	86	58
64	190	-126	86	59
94	190	-96	86	60
91	190	-99	86	61
98	190	-92	86	62
92	190	-98	86	63
96	190	-94	86	64
130	190	-60	86	65
110	190	-80	86	66
130	190	-60	86	67
46	190	-144	86	68
130	190	-60	86	69
110	190	-80	86	70
130	190	-60	86	71
130	190	-60	86	72
130	190	-60	86	73
120	190	-70	86	74

140	190	-50	86	75
93	190	-97	86	76
85	190	-105	86	77
69.4	190	-120.6	86	78
118	190	-72	86	79
96	78	18	87	79
110	78	32	88	79
93	78	15	89	79
64	78	-14	89	80
94	78	16	90	80
91	78	13	91	80
98	78	20	92	80
92	78	14	93	80
96	78	18	94	80
130	78	52	95	80
110	78	32	96	80
130	78	52	97	80
46	78	-32	97	81
130	78	52	98	81
110	78	32	99	81
130	78	52	100	81
130	78	52	101	81
130	78	52	102	81
120	78	42	103	81
140	78	62	104	81
93	78	15	105	81
85	78	7	106	81
69.4	78	-8.6	106	82
118	78	40	107	82
110	96	14	108	82
93	96	-3	108	83
64	96	-32	108	84
94	96	-2	108	85
91	96	-5	108	86
98	96	2	109	86
92	96	-4	109	87
96	96	0	109	87
130	96	34	110	87
110	96	14	111	87
130	96	34	112	87
46	96	-50	112	88
130	96	34	113	88
110	96	14	114	88
130	96	34	115	88
130	96	34	116	88
130	96	34	117	88
120	96	24	118	88
140	96	44	119	88
93	96	-3	119	89
85	96	-11	119	90
69.4	96	-26.6	119	91
118	96	22	120	91
93	110	-17	120	92
64	110	-46	120	93
94	110	-16	120	94
91	110	-19	120	95

98	110	-12	120	96
92	110	-18	120	97
96	110	-14	120	98
130	110	20	121	98
110	110	0	121	98
130	110	20	122	98
46	110	-64	122	99
130	110	20	123	99
110	110	0	123	99
130	110	20	124	99
130	110	20	125	99
130	110	20	126	99
120	110	10	127	99
140	110	30	128	99
93	110	-17	128	100
85	110	-25	128	101
69.4	110	-40.6	128	102
118	110	8	129	102
64	93	-29	129	103
94	93	1	130	103
91	93	-2	130	104
98	93	5	131	104
92	93	-1	131	105
96	93	3	132	105
130	93	37	133	105
110	93	17	134	105
130	93	37	135	105
46	93	-47	135	106
130	93	37	136	106
110	93	17	137	106
130	93	37	138	106
130	93	37	139	106
130	93	37	140	106
120	93	27	141	106
140	93	47	142	106
93	93	0	142	106
85	93	-8	142	107
69.4	93	-23.6	142	108
118	93	25	143	108
94	64	30	144	108
91	64	27	145	108
98	64	34	146	108
92	64	28	147	108
96	64	32	148	108
130	64	66	149	108
110	64	46	150	108
130	64	66	151	108
46	64	-18	151	109
130	64	66	152	109
110	64	46	153	109
130	64	66	154	109
130	64	66	155	109
130	64	66	156	109
120	64	56	157	109
140	64	76	158	109
93	64	29	159	109
85	64	21	160	109

69.4	64	5.4	161	109
118	64	54	162	109
91	94	-3	162	110
98	94	4	163	110
92	94	-2	163	111
96	94	2	164	111
130	94	36	165	111
110	94	16	166	111
130	94	36	167	111
46	94	-48	167	112
130	94	36	168	112
110	94	16	169	112
130	94	36	170	112
130	94	36	171	112
130	94	36	172	112
120	94	26	173	112
140	94	46	174	112
93	94	-1	174	113
85	94	-9	174	114
69.4	94	-24.6	174	115
118	94	24	175	115
98	91	7	176	115
92	91	1	177	115
96	91	5	178	115
130	91	39	179	115
110	91	19	180	115
130	91	39	181	115
46	91	-45	181	116
130	91	39	182	116
110	91	19	183	116
130	91	39	184	116
130	91	39	185	116
130	91	39	186	116
120	91	29	187	116
140	91	49	188	116
93	91	2	189	116
85	91	-6	189	117
69.4	91	-21.6	189	118
118	91	27	190	118
92	98	-6	190	119
96	98	-2	190	120
130	98	32	191	120
110	98	12	192	120
130	98	32	193	120
46	98	-52	193	121
130	98	32	194	121
110	98	12	195	121
130	98	32	196	121
130	98	32	197	121
130	98	32	198	121
120	98	22	199	121
140	98	42	200	121
93	98	-5	200	122
85	98	-13	200	123
69.4	98	-28.6	200	124
118	98	20	201	124

96	92	4	202	124
130	92	38	203	124
110	92	18	204	124
130	92	38	205	124
46	92	-46	205	125
130	92	38	206	125
110	92	18	207	125
130	92	38	208	125
130	92	38	209	125
130	92	38	210	125
120	92	28	211	125
140	92	48	212	125
93	92	1	213	125
85	92	-7	213	126
69.4	92	-22.6	213	127
118	92	26	214	127
130	96	34	215	127
110	96	14	216	127
130	96	34	217	127
46	96	-50	217	128
130	96	34	218	128
110	96	14	219	128
130	96	34	220	128
130	96	34	221	128
130	96	34	222	128
120	96	24	223	128
140	96	44	224	128
93	96	-3	224	129
85	96	-11	224	130
69.4	96	-26.6	224	131
118	96	22	225	131
110	130	-20	225	132
130	130	0	225	132
46	130	-84	225	133
130	130	0	225	133
110	130	-20	225	134
130	130	0	225	134
130	130	0	225	134
130	130	0	225	134
120	130	-10	225	135
140	130	10	226	135
93	130	-37	226	136
85	130	-45	226	137
69.4	130	-60.6	226	138
118	130	-12	226	139
130	110	20	227	139
46	110	-64	227	140
130	110	20	228	140
110	110	0	228	140
130	110	20	229	140
130	110	20	230	140
130	110	20	231	140
120	110	10	232	140
140	110	30	233	140
93	110	-17	233	141

85	110	-25	233	142
69.4	110	-40.6	233	143
118	110	8	234	143
46	130	-84	234	144
130	130	0	234	144
110	130	-20	234	145
130	130	0	234	145
130	130	0	234	145
130	130	0	234	145
120	130	-10	234	146
140	130	10	235	146
93	130	-37	235	147
85	130	-45	235	148
69.4	130	-60.6	235	149
118	130	-12	235	150
130	46	84	236	150
110	46	64	237	150
130	46	84	238	150
130	46	84	239	150
130	46	84	240	150
120	46	74	241	150
140	46	94	242	150
93	46	47	243	150
85	46	39	244	150
69.4	46	23.4	245	150
118	46	72	246	150
110	130	-20	246	151
130	130	0	246	151
130	130	0	246	151
130	130	0	246	151
120	130	-10	246	152
140	130	10	247	152
93	130	-37	247	153
85	130	-45	247	154
69.4	130	-60.6	247	155
118	130	-12	247	156
130	110	20	248	156
130	110	20	249	156
130	110	20	250	156
120	110	10	251	156
140	110	30	252	156
93	110	-17	252	157
85	110	-25	252	158
69.4	110	-40.6	252	159
118	110	8	253	159
130	130	0	253	159
130	130	0	253	159
120	130	-10	253	160
140	130	10	254	160
93	130	-37	254	161
85	130	-45	254	162
69.4	130	-60.6	254	163
118	130	-12	254	164

130	130	0	254	164
120	130	-10	254	165
140	130	10	255	165
93	130	-37	255	166
85	130	-45	255	167
69.4	130	-60.6	255	168
118	130	-12	255	169
120	130	-10	255	170
140	130	10	256	170
93	130	-37	256	171
85	130	-45	256	172
69.4	130	-60.6	256	173
118	130	-12	256	174
140	120	20	257	174
93	120	-27	257	175
85	120	-35	257	176
69.4	120	-50.6	257	177
118	120	-2	257	178
93	140	-47	257	179
85	140	-55	257	180
69.4	140	-70.6	257	181
118	140	-22	257	182
85	93	-8	257	183
69.4	93	-23.6	257	184
118	93	25	258	184
69.4	85	-15.6	258	185
118	85	33	259	185
118	69.4	48.6	260	185

S Statistic = 260 - 185 = 75

Tied Group	Value	Members
1	96	2
2	110	3
3	93	2
4	130	6

Time Period	Observations
6/1/2005	1
2/1/2006	1
3/12/2008	1
5/12/2008	1
9/23/2008	1
10/29/2008	1
4/29/2009	1
5/15/2009	1
9/23/2009	1
12/8/2009	1
2/25/2010	1
4/15/2010	1
8/11/2010	1

11/23/2010	1
3/10/2011	1
5/24/2011	1
9/1/2011	1
4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/19/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 612
B = 0
C = 126
D = 0
E = 40
F = 0
a = 62310
b = 242730
c = 1860
Group Variance = 3427.67
Z-Score = 1.26396
Comparison Level at 95% confidence level = 1.65463 (upward trend)
1.26396 <= 1.65463 indicating no evidence of an upward trend

Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: EPW-02

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
3	3	0	0	0
3	3	0	0	0
2	3	-1	0	1
2	3	-1	0	2
57	3	54	1	2
47	3	44	2	2
9	3	6	3	2
44	3	41	4	2
43	3	40	5	2
23	3	20	6	2
16	3	13	7	2
ND<0	3	-3	7	3
28	3	25	8	3
16	3	13	9	3
ND<0	3	-3	9	4
9.3	3	6.3	10	4
ND<0	3	-3	10	5
57	3	54	11	5
15	3	12	12	5
30	3	27	13	5
ND<0	3	-3	13	6
24	3	21	14	6
10	3	7	15	6
5.1	3	2.1	16	6
ND<0	3	-3	16	7
ND<0	3	-3	16	8
ND<0	3	-3	16	9
7.2	3	4.2	17	9
5.3	3	2.3	18	9
3	3	0	18	9
2	3	-1	18	10
2	3	-1	18	11
57	3	54	19	11
47	3	44	20	11
9	3	6	21	11
44	3	41	22	11
43	3	40	23	11
23	3	20	24	11
16	3	13	25	11
ND<0	3	-3	25	12
28	3	25	26	12
16	3	13	27	12
ND<0	3	-3	27	13
9.3	3	6.3	28	13
ND<0	3	-3	28	14
57	3	54	29	14

15	3	12	30	14
30	3	27	31	14
ND<0	3	-3	31	15
24	3	21	32	15
10	3	7	33	15
5.1	3	2.1	34	15
ND<0	3	-3	34	16
ND<0	3	-3	34	17
ND<0	3	-3	34	18
7.2	3	4.2	35	18
5.3	3	2.3	36	18
2	3	-1	36	19
2	3	-1	36	20
57	3	54	37	20
47	3	44	38	20
9	3	6	39	20
44	3	41	40	20
43	3	40	41	20
23	3	20	42	20
16	3	13	43	20
ND<0	3	-3	43	21
28	3	25	44	21
16	3	13	45	21
ND<0	3	-3	45	22
9.3	3	6.3	46	22
ND<0	3	-3	46	23
57	3	54	47	23
15	3	12	48	23
30	3	27	49	23
ND<0	3	-3	49	24
24	3	21	50	24
10	3	7	51	24
5.1	3	2.1	52	24
ND<0	3	-3	52	25
ND<0	3	-3	52	26
ND<0	3	-3	52	27
7.2	3	4.2	53	27
5.3	3	2.3	54	27
2	2	0	54	27
57	2	55	55	27
47	2	45	56	27
9	2	7	57	27
44	2	42	58	27
43	2	41	59	27
23	2	21	60	27
16	2	14	61	27
ND<0	2	-2	61	28
28	2	26	62	28
16	2	14	63	28
ND<0	2	-2	63	29
9.3	2	7.3	64	29
ND<0	2	-2	64	30
57	2	55	65	30
15	2	13	66	30
30	2	28	67	30
ND<0	2	-2	67	31
24	2	22	68	31

10	2	8	69	31
5.1	2	3.1	70	31
ND<0	2	-2	70	32
ND<0	2	-2	70	33
ND<0	2	-2	70	34
7.2	2	5.2	71	34
5.3	2	3.3	72	34
57	2	55	73	34
47	2	45	74	34
9	2	7	75	34
44	2	42	76	34
43	2	41	77	34
23	2	21	78	34
16	2	14	79	34
ND<0	2	-2	79	35
28	2	26	80	35
16	2	14	81	35
ND<0	2	-2	81	36
9.3	2	7.3	82	36
ND<0	2	-2	82	37
57	2	55	83	37
15	2	13	84	37
30	2	28	85	37
ND<0	2	-2	85	38
24	2	22	86	38
10	2	8	87	38
5.1	2	3.1	88	38
ND<0	2	-2	88	39
ND<0	2	-2	88	40
ND<0	2	-2	88	41
7.2	2	5.2	89	41
5.3	2	3.3	90	41
47	57	-10	90	42
9	57	-48	90	43
44	57	-13	90	44
43	57	-14	90	45
23	57	-34	90	46
16	57	-41	90	47
ND<0	57	-57	90	48
28	57	-29	90	49
16	57	-41	90	50
ND<0	57	-57	90	51
9.3	57	-47.7	90	52
ND<0	57	-57	90	53
57	57	0	90	53
15	57	-42	90	54
30	57	-27	90	55
ND<0	57	-57	90	56
24	57	-33	90	57
10	57	-47	90	58
5.1	57	-51.9	90	59
ND<0	57	-57	90	60
ND<0	57	-57	90	61
ND<0	57	-57	90	62
7.2	57	-49.8	90	63
5.3	57	-51.7	90	64

9	47	-38	90	65
44	47	-3	90	66
43	47	-4	90	67
23	47	-24	90	68
16	47	-31	90	69
ND<0	47	-47	90	70
28	47	-19	90	71
16	47	-31	90	72
ND<0	47	-47	90	73
9.3	47	-37.7	90	74
ND<0	47	-47	90	75
57	47	10	91	75
15	47	-32	91	76
30	47	-17	91	77
ND<0	47	-47	91	78
24	47	-23	91	79
10	47	-37	91	80
5.1	47	-41.9	91	81
ND<0	47	-47	91	82
ND<0	47	-47	91	83
ND<0	47	-47	91	84
7.2	47	-39.8	91	85
5.3	47	-41.7	91	86
44	9	35	92	86
43	9	34	93	86
23	9	14	94	86
16	9	7	95	86
ND<0	9	-9	95	87
28	9	19	96	87
16	9	7	97	87
ND<0	9	-9	97	88
9.3	9	0.3	98	88
ND<0	9	-9	98	89
57	9	48	99	89
15	9	6	100	89
30	9	21	101	89
ND<0	9	-9	101	90
24	9	15	102	90
10	9	1	103	90
5.1	9	-3.9	103	91
ND<0	9	-9	103	92
ND<0	9	-9	103	93
ND<0	9	-9	103	94
7.2	9	-1.8	103	95
5.3	9	-3.7	103	96
43	44	-1	103	97
23	44	-21	103	98
16	44	-28	103	99
ND<0	44	-44	103	100
28	44	-16	103	101
16	44	-28	103	102
ND<0	44	-44	103	103
9.3	44	-34.7	103	104
ND<0	44	-44	103	105
57	44	13	104	105
15	44	-29	104	106
30	44	-14	104	107

ND<0	44	-44	104	108
24	44	-20	104	109
10	44	-34	104	110
5.1	44	-38.9	104	111
ND<0	44	-44	104	112
ND<0	44	-44	104	113
ND<0	44	-44	104	114
7.2	44	-36.8	104	115
5.3	44	-38.7	104	116
23	43	-20	104	117
16	43	-27	104	118
ND<0	43	-43	104	119
28	43	-15	104	120
16	43	-27	104	121
ND<0	43	-43	104	122
9.3	43	-33.7	104	123
ND<0	43	-43	104	124
57	43	14	105	124
15	43	-28	105	125
30	43	-13	105	126
ND<0	43	-43	105	127
24	43	-19	105	128
10	43	-33	105	129
5.1	43	-37.9	105	130
ND<0	43	-43	105	131
ND<0	43	-43	105	132
ND<0	43	-43	105	133
7.2	43	-35.8	105	134
5.3	43	-37.7	105	135
16	23	-7	105	136
ND<0	23	-23	105	137
28	23	5	106	137
16	23	-7	106	138
ND<0	23	-23	106	139
9.3	23	-13.7	106	140
ND<0	23	-23	106	141
57	23	34	107	141
15	23	-8	107	142
30	23	7	108	142
ND<0	23	-23	108	143
24	23	1	109	143
10	23	-13	109	144
5.1	23	-17.9	109	145
ND<0	23	-23	109	146
ND<0	23	-23	109	147
ND<0	23	-23	109	148
7.2	23	-15.8	109	149
5.3	23	-17.7	109	150
ND<0	16	-16	109	151
28	16	12	110	151
16	16	0	110	151
ND<0	16	-16	110	152
9.3	16	-6.7	110	153
ND<0	16	-16	110	154
57	16	41	111	154
15	16	-1	111	155

30	16	14	112	155
ND<0	16	-16	112	156
24	16	8	113	156
10	16	-6	113	157
5.1	16	-10.9	113	158
ND<0	16	-16	113	159
ND<0	16	-16	113	160
ND<0	16	-16	113	161
7.2	16	-8.8	113	162
5.3	16	-10.7	113	163
28	ND<0	28	114	163
16	ND<0	16	115	163
ND<0	ND<0	0	115	163
9.3	ND<0	9.3	116	163
ND<0	ND<0	0	116	163
57	ND<0	57	117	163
15	ND<0	15	118	163
30	ND<0	30	119	163
ND<0	ND<0	0	119	163
24	ND<0	24	120	163
10	ND<0	10	121	163
5.1	ND<0	5.1	122	163
ND<0	ND<0	0	122	163
ND<0	ND<0	0	122	163
ND<0	ND<0	0	122	163
7.2	ND<0	7.2	123	163
5.3	ND<0	5.3	124	163
16	28	-12	124	164
ND<0	28	-28	124	165
9.3	28	-18.7	124	166
ND<0	28	-28	124	167
57	28	29	125	167
15	28	-13	125	168
30	28	2	126	168
ND<0	28	-28	126	169
24	28	-4	126	170
10	28	-18	126	171
5.1	28	-22.9	126	172
ND<0	28	-28	126	173
ND<0	28	-28	126	174
ND<0	28	-28	126	175
7.2	28	-20.8	126	176
5.3	28	-22.7	126	177
ND<0	16	-16	126	178
9.3	16	-6.7	126	179
ND<0	16	-16	126	180
57	16	41	127	180
15	16	-1	127	181
30	16	14	128	181
ND<0	16	-16	128	182
24	16	8	129	182
10	16	-6	129	183
5.1	16	-10.9	129	184
ND<0	16	-16	129	185
ND<0	16	-16	129	186
ND<0	16	-16	129	187

7.2	16	-8.8	129	188
5.3	16	-10.7	129	189
9.3	ND<0	9.3	130	189
ND<0	ND<0	0	130	189
57	ND<0	57	131	189
15	ND<0	15	132	189
30	ND<0	30	133	189
ND<0	ND<0	0	133	189
24	ND<0	24	134	189
10	ND<0	10	135	189
5.1	ND<0	5.1	136	189
ND<0	ND<0	0	136	189
ND<0	ND<0	0	136	189
ND<0	ND<0	0	136	189
7.2	ND<0	7.2	137	189
5.3	ND<0	5.3	138	189
ND<0	9.3	-9.3	138	190
57	9.3	47.7	139	190
15	9.3	5.7	140	190
30	9.3	20.7	141	190
ND<0	9.3	-9.3	141	191
24	9.3	14.7	142	191
10	9.3	0.7	143	191
5.1	9.3	-4.2	143	192
ND<0	9.3	-9.3	143	193
ND<0	9.3	-9.3	143	194
ND<0	9.3	-9.3	143	195
7.2	9.3	-2.1	143	196
5.3	9.3	-4	143	197
57	ND<0	57	144	197
15	ND<0	15	145	197
30	ND<0	30	146	197
ND<0	ND<0	0	146	197
24	ND<0	24	147	197
10	ND<0	10	148	197
5.1	ND<0	5.1	149	197
ND<0	ND<0	0	149	197
ND<0	ND<0	0	149	197
ND<0	ND<0	0	149	197
7.2	ND<0	7.2	150	197
5.3	ND<0	5.3	151	197
15	57	-42	151	198
30	57	-27	151	199
ND<0	57	-57	151	200
24	57	-33	151	201
10	57	-47	151	202
5.1	57	-51.9	151	203
ND<0	57	-57	151	204
ND<0	57	-57	151	205
ND<0	57	-57	151	206
7.2	57	-49.8	151	207
5.3	57	-51.7	151	208
30	15	15	152	208
ND<0	15	-15	152	209

24	15	9	153	209
10	15	-5	153	210
5.1	15	-9.9	153	211
ND<0	15	-15	153	212
ND<0	15	-15	153	213
ND<0	15	-15	153	214
7.2	15	-7.8	153	215
5.3	15	-9.7	153	216
ND<0	30	-30	153	217
24	30	-6	153	218
10	30	-20	153	219
5.1	30	-24.9	153	220
ND<0	30	-30	153	221
ND<0	30	-30	153	222
ND<0	30	-30	153	223
7.2	30	-22.8	153	224
5.3	30	-24.7	153	225
24	ND<0	24	154	225
10	ND<0	10	155	225
5.1	ND<0	5.1	156	225
ND<0	ND<0	0	156	225
ND<0	ND<0	0	156	225
ND<0	ND<0	0	156	225
7.2	ND<0	7.2	157	225
5.3	ND<0	5.3	158	225
10	24	-14	158	226
5.1	24	-18.9	158	227
ND<0	24	-24	158	228
ND<0	24	-24	158	229
ND<0	24	-24	158	230
7.2	24	-16.8	158	231
5.3	24	-18.7	158	232
5.1	10	-4.9	158	233
ND<0	10	-10	158	234
ND<0	10	-10	158	235
ND<0	10	-10	158	236
7.2	10	-2.8	158	237
5.3	10	-4.7	158	238
ND<0	5.1	-5.1	158	239
ND<0	5.1	-5.1	158	240
ND<0	5.1	-5.1	158	241
7.2	5.1	2.1	159	241
5.3	5.1	0.2	160	241
ND<0	ND<0	0	160	241
ND<0	ND<0	0	160	241
7.2	ND<0	7.2	161	241
5.3	ND<0	5.3	162	241
ND<0	ND<0	0	162	241
7.2	ND<0	7.2	163	241
5.3	ND<0	5.3	164	241
7.2	ND<0	7.2	165	241

5.3	ND<0	5.3	166	241
5.3	7.2	-1.9	166	242

S Statistic = 166 - 242 = -76

Tied Group	Value	Members
1	3	3
2	2	2
3	57	2
4	16	2
5	0	7

Time Period	Observations
2/1/2006	1
3/12/2008	1
5/12/2008	1
9/23/2008	1
12/3/2008	1
4/29/2009	1
5/15/2009	1
9/24/2009	1
12/8/2009	1
2/25/2010	1
4/15/2010	1
8/11/2010	1
11/23/2010	1
3/10/2011	1
5/24/2011	1
9/1/2011	1
4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 918
B = 0
C = 216
D = 0
E = 54
F = 0
a = 56550
b = 219240
c = 1740
Group Variance = 3090.67
Z-Score = -1.34907

Comparison Level at 95% confidence level = -1.65463 (downward trend)
-1.34907 >= -1.65463 indicating no evidence of a downward trend

Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: EPW-02

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
3	3	0	0	0
3	3	0	0	0
2	3	-1	0	1
2	3	-1	0	2
57	3	54	1	2
47	3	44	2	2
9	3	6	3	2
44	3	41	4	2
43	3	40	5	2
23	3	20	6	2
16	3	13	7	2
ND<0	3	-3	7	3
28	3	25	8	3
16	3	13	9	3
ND<0	3	-3	9	4
9.3	3	6.3	10	4
ND<0	3	-3	10	5
57	3	54	11	5
15	3	12	12	5
30	3	27	13	5
ND<0	3	-3	13	6
24	3	21	14	6
10	3	7	15	6
5.1	3	2.1	16	6
ND<0	3	-3	16	7
ND<0	3	-3	16	8
ND<0	3	-3	16	9
7.2	3	4.2	17	9
5.3	3	2.3	18	9
3	3	0	18	9
2	3	-1	18	10
2	3	-1	18	11
57	3	54	19	11
47	3	44	20	11
9	3	6	21	11
44	3	41	22	11
43	3	40	23	11
23	3	20	24	11
16	3	13	25	11
ND<0	3	-3	25	12
28	3	25	26	12
16	3	13	27	12
ND<0	3	-3	27	13
9.3	3	6.3	28	13
ND<0	3	-3	28	14
57	3	54	29	14

15	3	12	30	14
30	3	27	31	14
ND<0	3	-3	31	15
24	3	21	32	15
10	3	7	33	15
5.1	3	2.1	34	15
ND<0	3	-3	34	16
ND<0	3	-3	34	17
ND<0	3	-3	34	18
7.2	3	4.2	35	18
5.3	3	2.3	36	18
2	3	-1	36	19
2	3	-1	36	20
57	3	54	37	20
47	3	44	38	20
9	3	6	39	20
44	3	41	40	20
43	3	40	41	20
23	3	20	42	20
16	3	13	43	20
ND<0	3	-3	43	21
28	3	25	44	21
16	3	13	45	21
ND<0	3	-3	45	22
9.3	3	6.3	46	22
ND<0	3	-3	46	23
57	3	54	47	23
15	3	12	48	23
30	3	27	49	23
ND<0	3	-3	49	24
24	3	21	50	24
10	3	7	51	24
5.1	3	2.1	52	24
ND<0	3	-3	52	25
ND<0	3	-3	52	26
ND<0	3	-3	52	27
7.2	3	4.2	53	27
5.3	3	2.3	54	27
2	2	0	54	27
57	2	55	55	27
47	2	45	56	27
9	2	7	57	27
44	2	42	58	27
43	2	41	59	27
23	2	21	60	27
16	2	14	61	27
ND<0	2	-2	61	28
28	2	26	62	28
16	2	14	63	28
ND<0	2	-2	63	29
9.3	2	7.3	64	29
ND<0	2	-2	64	30
57	2	55	65	30
15	2	13	66	30
30	2	28	67	30
ND<0	2	-2	67	31
24	2	22	68	31

10	2	8	69	31
5.1	2	3.1	70	31
ND<0	2	-2	70	32
ND<0	2	-2	70	33
ND<0	2	-2	70	34
7.2	2	5.2	71	34
5.3	2	3.3	72	34
57	2	55	73	34
47	2	45	74	34
9	2	7	75	34
44	2	42	76	34
43	2	41	77	34
23	2	21	78	34
16	2	14	79	34
ND<0	2	-2	79	35
28	2	26	80	35
16	2	14	81	35
ND<0	2	-2	81	36
9.3	2	7.3	82	36
ND<0	2	-2	82	37
57	2	55	83	37
15	2	13	84	37
30	2	28	85	37
ND<0	2	-2	85	38
24	2	22	86	38
10	2	8	87	38
5.1	2	3.1	88	38
ND<0	2	-2	88	39
ND<0	2	-2	88	40
ND<0	2	-2	88	41
7.2	2	5.2	89	41
5.3	2	3.3	90	41
47	57	-10	90	42
9	57	-48	90	43
44	57	-13	90	44
43	57	-14	90	45
23	57	-34	90	46
16	57	-41	90	47
ND<0	57	-57	90	48
28	57	-29	90	49
16	57	-41	90	50
ND<0	57	-57	90	51
9.3	57	-47.7	90	52
ND<0	57	-57	90	53
57	57	0	90	53
15	57	-42	90	54
30	57	-27	90	55
ND<0	57	-57	90	56
24	57	-33	90	57
10	57	-47	90	58
5.1	57	-51.9	90	59
ND<0	57	-57	90	60
ND<0	57	-57	90	61
ND<0	57	-57	90	62
7.2	57	-49.8	90	63
5.3	57	-51.7	90	64

9	47	-38	90	65
44	47	-3	90	66
43	47	-4	90	67
23	47	-24	90	68
16	47	-31	90	69
ND<0	47	-47	90	70
28	47	-19	90	71
16	47	-31	90	72
ND<0	47	-47	90	73
9.3	47	-37.7	90	74
ND<0	47	-47	90	75
57	47	10	91	75
15	47	-32	91	76
30	47	-17	91	77
ND<0	47	-47	91	78
24	47	-23	91	79
10	47	-37	91	80
5.1	47	-41.9	91	81
ND<0	47	-47	91	82
ND<0	47	-47	91	83
ND<0	47	-47	91	84
7.2	47	-39.8	91	85
5.3	47	-41.7	91	86
44	9	35	92	86
43	9	34	93	86
23	9	14	94	86
16	9	7	95	86
ND<0	9	-9	95	87
28	9	19	96	87
16	9	7	97	87
ND<0	9	-9	97	88
9.3	9	0.3	98	88
ND<0	9	-9	98	89
57	9	48	99	89
15	9	6	100	89
30	9	21	101	89
ND<0	9	-9	101	90
24	9	15	102	90
10	9	1	103	90
5.1	9	-3.9	103	91
ND<0	9	-9	103	92
ND<0	9	-9	103	93
ND<0	9	-9	103	94
7.2	9	-1.8	103	95
5.3	9	-3.7	103	96
43	44	-1	103	97
23	44	-21	103	98
16	44	-28	103	99
ND<0	44	-44	103	100
28	44	-16	103	101
16	44	-28	103	102
ND<0	44	-44	103	103
9.3	44	-34.7	103	104
ND<0	44	-44	103	105
57	44	13	104	105
15	44	-29	104	106
30	44	-14	104	107

ND<0	44	-44	104	108
24	44	-20	104	109
10	44	-34	104	110
5.1	44	-38.9	104	111
ND<0	44	-44	104	112
ND<0	44	-44	104	113
ND<0	44	-44	104	114
7.2	44	-36.8	104	115
5.3	44	-38.7	104	116
23	43	-20	104	117
16	43	-27	104	118
ND<0	43	-43	104	119
28	43	-15	104	120
16	43	-27	104	121
ND<0	43	-43	104	122
9.3	43	-33.7	104	123
ND<0	43	-43	104	124
57	43	14	105	124
15	43	-28	105	125
30	43	-13	105	126
ND<0	43	-43	105	127
24	43	-19	105	128
10	43	-33	105	129
5.1	43	-37.9	105	130
ND<0	43	-43	105	131
ND<0	43	-43	105	132
ND<0	43	-43	105	133
7.2	43	-35.8	105	134
5.3	43	-37.7	105	135
16	23	-7	105	136
ND<0	23	-23	105	137
28	23	5	106	137
16	23	-7	106	138
ND<0	23	-23	106	139
9.3	23	-13.7	106	140
ND<0	23	-23	106	141
57	23	34	107	141
15	23	-8	107	142
30	23	7	108	142
ND<0	23	-23	108	143
24	23	1	109	143
10	23	-13	109	144
5.1	23	-17.9	109	145
ND<0	23	-23	109	146
ND<0	23	-23	109	147
ND<0	23	-23	109	148
7.2	23	-15.8	109	149
5.3	23	-17.7	109	150
ND<0	16	-16	109	151
28	16	12	110	151
16	16	0	110	151
ND<0	16	-16	110	152
9.3	16	-6.7	110	153
ND<0	16	-16	110	154
57	16	41	111	154
15	16	-1	111	155

30	16	14	112	155
ND<0	16	-16	112	156
24	16	8	113	156
10	16	-6	113	157
5.1	16	-10.9	113	158
ND<0	16	-16	113	159
ND<0	16	-16	113	160
ND<0	16	-16	113	161
7.2	16	-8.8	113	162
5.3	16	-10.7	113	163
28	ND<0	28	114	163
16	ND<0	16	115	163
ND<0	ND<0	0	115	163
9.3	ND<0	9.3	116	163
ND<0	ND<0	0	116	163
57	ND<0	57	117	163
15	ND<0	15	118	163
30	ND<0	30	119	163
ND<0	ND<0	0	119	163
24	ND<0	24	120	163
10	ND<0	10	121	163
5.1	ND<0	5.1	122	163
ND<0	ND<0	0	122	163
ND<0	ND<0	0	122	163
ND<0	ND<0	0	122	163
7.2	ND<0	7.2	123	163
5.3	ND<0	5.3	124	163
16	28	-12	124	164
ND<0	28	-28	124	165
9.3	28	-18.7	124	166
ND<0	28	-28	124	167
57	28	29	125	167
15	28	-13	125	168
30	28	2	126	168
ND<0	28	-28	126	169
24	28	-4	126	170
10	28	-18	126	171
5.1	28	-22.9	126	172
ND<0	28	-28	126	173
ND<0	28	-28	126	174
ND<0	28	-28	126	175
7.2	28	-20.8	126	176
5.3	28	-22.7	126	177
ND<0	16	-16	126	178
9.3	16	-6.7	126	179
ND<0	16	-16	126	180
57	16	41	127	180
15	16	-1	127	181
30	16	14	128	181
ND<0	16	-16	128	182
24	16	8	129	182
10	16	-6	129	183
5.1	16	-10.9	129	184
ND<0	16	-16	129	185
ND<0	16	-16	129	186
ND<0	16	-16	129	187

7.2	16	-8.8	129	188
5.3	16	-10.7	129	189
9.3	ND<0	9.3	130	189
ND<0	ND<0	0	130	189
57	ND<0	57	131	189
15	ND<0	15	132	189
30	ND<0	30	133	189
ND<0	ND<0	0	133	189
24	ND<0	24	134	189
10	ND<0	10	135	189
5.1	ND<0	5.1	136	189
ND<0	ND<0	0	136	189
ND<0	ND<0	0	136	189
ND<0	ND<0	0	136	189
7.2	ND<0	7.2	137	189
5.3	ND<0	5.3	138	189
ND<0	9.3	-9.3	138	190
57	9.3	47.7	139	190
15	9.3	5.7	140	190
30	9.3	20.7	141	190
ND<0	9.3	-9.3	141	191
24	9.3	14.7	142	191
10	9.3	0.7	143	191
5.1	9.3	-4.2	143	192
ND<0	9.3	-9.3	143	193
ND<0	9.3	-9.3	143	194
ND<0	9.3	-9.3	143	195
7.2	9.3	-2.1	143	196
5.3	9.3	-4	143	197
57	ND<0	57	144	197
15	ND<0	15	145	197
30	ND<0	30	146	197
ND<0	ND<0	0	146	197
24	ND<0	24	147	197
10	ND<0	10	148	197
5.1	ND<0	5.1	149	197
ND<0	ND<0	0	149	197
ND<0	ND<0	0	149	197
ND<0	ND<0	0	149	197
7.2	ND<0	7.2	150	197
5.3	ND<0	5.3	151	197
15	57	-42	151	198
30	57	-27	151	199
ND<0	57	-57	151	200
24	57	-33	151	201
10	57	-47	151	202
5.1	57	-51.9	151	203
ND<0	57	-57	151	204
ND<0	57	-57	151	205
ND<0	57	-57	151	206
7.2	57	-49.8	151	207
5.3	57	-51.7	151	208
30	15	15	152	208
ND<0	15	-15	152	209

24	15	9	153	209
10	15	-5	153	210
5.1	15	-9.9	153	211
ND<0	15	-15	153	212
ND<0	15	-15	153	213
ND<0	15	-15	153	214
7.2	15	-7.8	153	215
5.3	15	-9.7	153	216
ND<0	30	-30	153	217
24	30	-6	153	218
10	30	-20	153	219
5.1	30	-24.9	153	220
ND<0	30	-30	153	221
ND<0	30	-30	153	222
ND<0	30	-30	153	223
7.2	30	-22.8	153	224
5.3	30	-24.7	153	225
24	ND<0	24	154	225
10	ND<0	10	155	225
5.1	ND<0	5.1	156	225
ND<0	ND<0	0	156	225
ND<0	ND<0	0	156	225
ND<0	ND<0	0	156	225
7.2	ND<0	7.2	157	225
5.3	ND<0	5.3	158	225
10	24	-14	158	226
5.1	24	-18.9	158	227
ND<0	24	-24	158	228
ND<0	24	-24	158	229
ND<0	24	-24	158	230
7.2	24	-16.8	158	231
5.3	24	-18.7	158	232
5.1	10	-4.9	158	233
ND<0	10	-10	158	234
ND<0	10	-10	158	235
ND<0	10	-10	158	236
7.2	10	-2.8	158	237
5.3	10	-4.7	158	238
ND<0	5.1	-5.1	158	239
ND<0	5.1	-5.1	158	240
ND<0	5.1	-5.1	158	241
7.2	5.1	2.1	159	241
5.3	5.1	0.2	160	241
ND<0	ND<0	0	160	241
ND<0	ND<0	0	160	241
7.2	ND<0	7.2	161	241
5.3	ND<0	5.3	162	241
ND<0	ND<0	0	162	241
7.2	ND<0	7.2	163	241
5.3	ND<0	5.3	164	241
7.2	ND<0	7.2	165	241

5.3	ND<0	5.3	166	241
5.3	7.2	-1.9	166	242

S Statistic = 166 - 242 = -76

Tied Group	Value	Members
1	3	3
2	2	2
3	57	2
4	16	2
5	0	7

Time Period	Observations
2/1/2006	1
3/12/2008	1
5/12/2008	1
9/23/2008	1
12/3/2008	1
4/29/2009	1
5/15/2009	1
9/24/2009	1
12/8/2009	1
2/25/2010	1
4/15/2010	1
8/11/2010	1
11/23/2010	1
3/10/2011	1
5/24/2011	1
9/1/2011	1
4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 918
B = 0
C = 216
D = 0
E = 54
F = 0
a = 56550
b = 219240
c = 1740
Group Variance = 3090.67
Z-Score = -1.34907

Comparison Level at 95% confidence level = 1.65463 (upward trend)
-1.34907 <= 1.65463 indicating no evidence of an upward trend

Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: GCW-03D

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
3960	4960	-1000	0	1
5680	4960	720	1	1
6620	4960	1660	2	1
7900	4960	2940	3	1
8600	4960	3640	4	1
4300	4960	-660	4	2
5300	4960	340	5	2
4400	4960	-560	5	3
4600	4960	-360	5	4
3800	4960	-1160	5	5
3500	4960	-1460	5	6
3600	4960	-1360	5	7
3700	4960	-1260	5	8
3500	4960	-1460	5	9
3500	4960	-1460	5	10
4000	4960	-960	5	11
3600	4960	-1360	5	12
3900	4960	-1060	5	13
4500	4960	-460	5	14
3300	4960	-1660	5	15
3800	4960	-1160	5	16
4400	4960	-560	5	17
4000	4960	-960	5	18
7000	4960	2040	6	18
3400	4960	-1560	6	19
2900	4960	-2060	6	20
3130	4960	-1830	6	21
3710	4960	-1250	6	22
5680	3960	1720	7	22
6620	3960	2660	8	22
7900	3960	3940	9	22
8600	3960	4640	10	22
4300	3960	340	11	22
5300	3960	1340	12	22
4400	3960	440	13	22
4600	3960	640	14	22
3800	3960	-160	14	23
3500	3960	-460	14	24
3600	3960	-360	14	25
3700	3960	-260	14	26
3500	3960	-460	14	27
3500	3960	-460	14	28
4000	3960	40	15	28
3600	3960	-360	15	29
3900	3960	-60	15	30
4500	3960	540	16	30

3300	3960	-660	16	31
3800	3960	-160	16	32
4400	3960	440	17	32
4000	3960	40	18	32
7000	3960	3040	19	32
3400	3960	-560	19	33
2900	3960	-1060	19	34
3130	3960	-830	19	35
3710	3960	-250	19	36
6620	5680	940	20	36
7900	5680	2220	21	36
8600	5680	2920	22	36
4300	5680	-1380	22	37
5300	5680	-380	22	38
4400	5680	-1280	22	39
4600	5680	-1080	22	40
3800	5680	-1880	22	41
3500	5680	-2180	22	42
3600	5680	-2080	22	43
3700	5680	-1980	22	44
3500	5680	-2180	22	45
3500	5680	-2180	22	46
4000	5680	-1680	22	47
3600	5680	-2080	22	48
3900	5680	-1780	22	49
4500	5680	-1180	22	50
3300	5680	-2380	22	51
3800	5680	-1880	22	52
4400	5680	-1280	22	53
4000	5680	-1680	22	54
7000	5680	1320	23	54
3400	5680	-2280	23	55
2900	5680	-2780	23	56
3130	5680	-2550	23	57
3710	5680	-1970	23	58
7900	6620	1280	24	58
8600	6620	1980	25	58
4300	6620	-2320	25	59
5300	6620	-1320	25	60
4400	6620	-2220	25	61
4600	6620	-2020	25	62
3800	6620	-2820	25	63
3500	6620	-3120	25	64
3600	6620	-3020	25	65
3700	6620	-2920	25	66
3500	6620	-3120	25	67
3500	6620	-3120	25	68
4000	6620	-2620	25	69
3600	6620	-3020	25	70
3900	6620	-2720	25	71
4500	6620	-2120	25	72
3300	6620	-3320	25	73
3800	6620	-2820	25	74
4400	6620	-2220	25	75
4000	6620	-2620	25	76
7000	6620	380	26	76
3400	6620	-3220	26	77

2900	6620	-3720	26	78
3130	6620	-3490	26	79
3710	6620	-2910	26	80
8600	7900	700	27	80
4300	7900	-3600	27	81
5300	7900	-2600	27	82
4400	7900	-3500	27	83
4600	7900	-3300	27	84
3800	7900	-4100	27	85
3500	7900	-4400	27	86
3600	7900	-4300	27	87
3700	7900	-4200	27	88
3500	7900	-4400	27	89
3500	7900	-4400	27	90
4000	7900	-3900	27	91
3600	7900	-4300	27	92
3900	7900	-4000	27	93
4500	7900	-3400	27	94
3300	7900	-4600	27	95
3800	7900	-4100	27	96
4400	7900	-3500	27	97
4000	7900	-3900	27	98
7000	7900	-900	27	99
3400	7900	-4500	27	100
2900	7900	-5000	27	101
3130	7900	-4770	27	102
3710	7900	-4190	27	103
4300	8600	-4300	27	104
5300	8600	-3300	27	105
4400	8600	-4200	27	106
4600	8600	-4000	27	107
3800	8600	-4800	27	108
3500	8600	-5100	27	109
3600	8600	-5000	27	110
3700	8600	-4900	27	111
3500	8600	-5100	27	112
3500	8600	-5100	27	113
4000	8600	-4600	27	114
3600	8600	-5000	27	115
3900	8600	-4700	27	116
4500	8600	-4100	27	117
3300	8600	-5300	27	118
3800	8600	-4800	27	119
4400	8600	-4200	27	120
4000	8600	-4600	27	121
7000	8600	-1600	27	122
3400	8600	-5200	27	123
2900	8600	-5700	27	124
3130	8600	-5470	27	125
3710	8600	-4890	27	126
5300	4300	1000	28	126
4400	4300	100	29	126
4600	4300	300	30	126
3800	4300	-500	30	127
3500	4300	-800	30	128
3600	4300	-700	30	129

3700	4300	-600	30	130
3500	4300	-800	30	131
3500	4300	-800	30	132
4000	4300	-300	30	133
3600	4300	-700	30	134
3900	4300	-400	30	135
4500	4300	200	31	135
3300	4300	-1000	31	136
3800	4300	-500	31	137
4400	4300	100	32	137
4000	4300	-300	32	138
7000	4300	2700	33	138
3400	4300	-900	33	139
2900	4300	-1400	33	140
3130	4300	-1170	33	141
3710	4300	-590	33	142
4400	5300	-900	33	143
4600	5300	-700	33	144
3800	5300	-1500	33	145
3500	5300	-1800	33	146
3600	5300	-1700	33	147
3700	5300	-1600	33	148
3500	5300	-1800	33	149
3500	5300	-1800	33	150
4000	5300	-1300	33	151
3600	5300	-1700	33	152
3900	5300	-1400	33	153
4500	5300	-800	33	154
3300	5300	-2000	33	155
3800	5300	-1500	33	156
4400	5300	-900	33	157
4000	5300	-1300	33	158
7000	5300	1700	34	158
3400	5300	-1900	34	159
2900	5300	-2400	34	160
3130	5300	-2170	34	161
3710	5300	-1590	34	162
4600	4400	200	35	162
3800	4400	-600	35	163
3500	4400	-900	35	164
3600	4400	-800	35	165
3700	4400	-700	35	166
3500	4400	-900	35	167
3500	4400	-900	35	168
4000	4400	-400	35	169
3600	4400	-800	35	170
3900	4400	-500	35	171
4500	4400	100	36	171
3300	4400	-1100	36	172
3800	4400	-600	36	173
4400	4400	0	36	173
4000	4400	-400	36	174
7000	4400	2600	37	174
3400	4400	-1000	37	175
2900	4400	-1500	37	176
3130	4400	-1270	37	177
3710	4400	-690	37	178

3800	4600	-800	37	179
3500	4600	-1100	37	180
3600	4600	-1000	37	181
3700	4600	-900	37	182
3500	4600	-1100	37	183
3500	4600	-1100	37	184
4000	4600	-600	37	185
3600	4600	-1000	37	186
3900	4600	-700	37	187
4500	4600	-100	37	188
3300	4600	-1300	37	189
3800	4600	-800	37	190
4400	4600	-200	37	191
4000	4600	-600	37	192
7000	4600	2400	38	192
3400	4600	-1200	38	193
2900	4600	-1700	38	194
3130	4600	-1470	38	195
3710	4600	-890	38	196
3500	3800	-300	38	197
3600	3800	-200	38	198
3700	3800	-100	38	199
3500	3800	-300	38	200
3500	3800	-300	38	201
4000	3800	200	39	201
3600	3800	-200	39	202
3900	3800	100	40	202
4500	3800	700	41	202
3300	3800	-500	41	203
3800	3800	0	41	203
4400	3800	600	42	203
4000	3800	200	43	203
7000	3800	3200	44	203
3400	3800	-400	44	204
2900	3800	-900	44	205
3130	3800	-670	44	206
3710	3800	-90	44	207
3600	3500	100	45	207
3700	3500	200	46	207
3500	3500	0	46	207
3500	3500	0	46	207
4000	3500	500	47	207
3600	3500	100	48	207
3900	3500	400	49	207
4500	3500	1000	50	207
3300	3500	-200	50	208
3800	3500	300	51	208
4400	3500	900	52	208
4000	3500	500	53	208
7000	3500	3500	54	208
3400	3500	-100	54	209
2900	3500	-600	54	210
3130	3500	-370	54	211
3710	3500	210	55	211
3700	3600	100	56	211

3500	3600	-100	56	212
3500	3600	-100	56	213
4000	3600	400	57	213
3600	3600	0	57	213
3900	3600	300	58	213
4500	3600	900	59	213
3300	3600	-300	59	214
3800	3600	200	60	214
4400	3600	800	61	214
4000	3600	400	62	214
7000	3600	3400	63	214
3400	3600	-200	63	215
2900	3600	-700	63	216
3130	3600	-470	63	217
3710	3600	110	64	217
3500	3700	-200	64	218
3500	3700	-200	64	219
4000	3700	300	65	219
3600	3700	-100	65	220
3900	3700	200	66	220
4500	3700	800	67	220
3300	3700	-400	67	221
3800	3700	100	68	221
4400	3700	700	69	221
4000	3700	300	70	221
7000	3700	3300	71	221
3400	3700	-300	71	222
2900	3700	-800	71	223
3130	3700	-570	71	224
3710	3700	10	72	224
3500	3500	0	72	224
4000	3500	500	73	224
3600	3500	100	74	224
3900	3500	400	75	224
4500	3500	1000	76	224
3300	3500	-200	76	225
3800	3500	300	77	225
4400	3500	900	78	225
4000	3500	500	79	225
7000	3500	3500	80	225
3400	3500	-100	80	226
2900	3500	-600	80	227
3130	3500	-370	80	228
3710	3500	210	81	228
4000	3500	500	82	228
3600	3500	100	83	228
3900	3500	400	84	228
4500	3500	1000	85	228
3300	3500	-200	85	229
3800	3500	300	86	229
4400	3500	900	87	229
4000	3500	500	88	229
7000	3500	3500	89	229
3400	3500	-100	89	230
2900	3500	-600	89	231
3130	3500	-370	89	232

3710	3500	210	90	232
3600	4000	-400	90	233
3900	4000	-100	90	234
4500	4000	500	91	234
3300	4000	-700	91	235
3800	4000	-200	91	236
4400	4000	400	92	236
4000	4000	0	92	236
7000	4000	3000	93	236
3400	4000	-600	93	237
2900	4000	-1100	93	238
3130	4000	-870	93	239
3710	4000	-290	93	240
3900	3600	300	94	240
4500	3600	900	95	240
3300	3600	-300	95	241
3800	3600	200	96	241
4400	3600	800	97	241
4000	3600	400	98	241
7000	3600	3400	99	241
3400	3600	-200	99	242
2900	3600	-700	99	243
3130	3600	-470	99	244
3710	3600	110	100	244
4500	3900	600	101	244
3300	3900	-600	101	245
3800	3900	-100	101	246
4400	3900	500	102	246
4000	3900	100	103	246
7000	3900	3100	104	246
3400	3900	-500	104	247
2900	3900	-1000	104	248
3130	3900	-770	104	249
3710	3900	-190	104	250
3300	4500	-1200	104	251
3800	4500	-700	104	252
4400	4500	-100	104	253
4000	4500	-500	104	254
7000	4500	2500	105	254
3400	4500	-1100	105	255
2900	4500	-1600	105	256
3130	4500	-1370	105	257
3710	4500	-790	105	258
3800	3300	500	106	258
4400	3300	1100	107	258
4000	3300	700	108	258
7000	3300	3700	109	258
3400	3300	100	110	258
2900	3300	-400	110	259
3130	3300	-170	110	260
3710	3300	410	111	260
4400	3800	600	112	260
4000	3800	200	113	260

7000	3800	3200	114	260
3400	3800	-400	114	261
2900	3800	-900	114	262
3130	3800	-670	114	263
3710	3800	-90	114	264
4000	4400	-400	114	265
7000	4400	2600	115	265
3400	4400	-1000	115	266
2900	4400	-1500	115	267
3130	4400	-1270	115	268
3710	4400	-690	115	269
7000	4000	3000	116	269
3400	4000	-600	116	270
2900	4000	-1100	116	271
3130	4000	-870	116	272
3710	4000	-290	116	273
3400	7000	-3600	116	274
2900	7000	-4100	116	275
3130	7000	-3870	116	276
3710	7000	-3290	116	277
2900	3400	-500	116	278
3130	3400	-270	116	279
3710	3400	310	117	279
3130	2900	230	118	279
3710	2900	810	119	279
3710	3130	580	120	279

S Statistic = 120 - 279 = -159

Tied Group	Value	Members
1	4400	2
2	3800	2
3	3500	3
4	3600	2
5	4000	2

Time Period	Observations
3/12/2008	1
5/10/2008	1
9/22/2008	1
10/28/2008	1
4/28/2009	1
5/14/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/24/2011	1

9/1/2011	1
4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 138
B = 0
C = 6
D = 0
E = 14
F = 0
a = 51156
b = 197316
c = 1624
Group Variance = 2834.33
Z-Score = -2.96778
Comparison Level at 95% confidence level = -1.65463 (downward trend)
-2.96778 < -1.65463 indicating a downward trend

Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: GCW-01D

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
290	328	-38	0	1
358	328	30	1	1
699	328	371	2	1
480	328	152	3	1
350	328	22	4	1
300	328	-28	4	2
290	328	-38	4	3
260	328	-68	4	4
270	328	-58	4	5
260	328	-68	4	6
280	328	-48	4	7
280	328	-48	4	8
260	328	-68	4	9
260	328	-68	4	10
280	328	-48	4	11
290	328	-38	4	12
280	328	-48	4	13
250	328	-78	4	14
240	328	-88	4	15
230	328	-98	4	16
210	328	-118	4	17
220	328	-108	4	18
190	328	-138	4	19
190	328	-138	4	20
380	328	52	5	20
160	328	-168	5	21
167	328	-161	5	22
180	328	-148	5	23
358	290	68	6	23
699	290	409	7	23
480	290	190	8	23
350	290	60	9	23
300	290	10	10	23
290	290	0	10	23
260	290	-30	10	24
270	290	-20	10	25
260	290	-30	10	26
280	290	-10	10	27
280	290	-10	10	28
260	290	-30	10	29
260	290	-30	10	30
280	290	-10	10	31
290	290	0	10	31
280	290	-10	10	32
250	290	-40	10	33
240	290	-50	10	34

230	290	-60	10	35
210	290	-80	10	36
220	290	-70	10	37
190	290	-100	10	38
190	290	-100	10	39
380	290	90	11	39
160	290	-130	11	40
167	290	-123	11	41
180	290	-110	11	42
699	358	341	12	42
480	358	122	13	42
350	358	-8	13	43
300	358	-58	13	44
290	358	-68	13	45
260	358	-98	13	46
270	358	-88	13	47
260	358	-98	13	48
280	358	-78	13	49
280	358	-78	13	50
260	358	-98	13	51
260	358	-98	13	52
280	358	-78	13	53
290	358	-68	13	54
280	358	-78	13	55
250	358	-108	13	56
240	358	-118	13	57
230	358	-128	13	58
210	358	-148	13	59
220	358	-138	13	60
190	358	-168	13	61
190	358	-168	13	62
380	358	22	14	62
160	358	-198	14	63
167	358	-191	14	64
180	358	-178	14	65
480	699	-219	14	66
350	699	-349	14	67
300	699	-399	14	68
290	699	-409	14	69
260	699	-439	14	70
270	699	-429	14	71
260	699	-439	14	72
280	699	-419	14	73
280	699	-419	14	74
260	699	-439	14	75
260	699	-439	14	76
280	699	-419	14	77
290	699	-409	14	78
280	699	-419	14	79
250	699	-449	14	80
240	699	-459	14	81
230	699	-469	14	82
210	699	-489	14	83
220	699	-479	14	84
190	699	-509	14	85
190	699	-509	14	86
380	699	-319	14	87

160	699	-539	14	88
167	699	-532	14	89
180	699	-519	14	90
350	480	-130	14	91
300	480	-180	14	92
290	480	-190	14	93
260	480	-220	14	94
270	480	-210	14	95
260	480	-220	14	96
280	480	-200	14	97
280	480	-200	14	98
260	480	-220	14	99
260	480	-220	14	100
280	480	-200	14	101
290	480	-190	14	102
280	480	-200	14	103
250	480	-230	14	104
240	480	-240	14	105
230	480	-250	14	106
210	480	-270	14	107
220	480	-260	14	108
190	480	-290	14	109
190	480	-290	14	110
380	480	-100	14	111
160	480	-320	14	112
167	480	-313	14	113
180	480	-300	14	114
300	350	-50	14	115
290	350	-60	14	116
260	350	-90	14	117
270	350	-80	14	118
260	350	-90	14	119
280	350	-70	14	120
280	350	-70	14	121
260	350	-90	14	122
260	350	-90	14	123
280	350	-70	14	124
290	350	-60	14	125
280	350	-70	14	126
250	350	-100	14	127
240	350	-110	14	128
230	350	-120	14	129
210	350	-140	14	130
220	350	-130	14	131
190	350	-160	14	132
190	350	-160	14	133
380	350	30	15	133
160	350	-190	15	134
167	350	-183	15	135
180	350	-170	15	136
290	300	-10	15	137
260	300	-40	15	138
270	300	-30	15	139
260	300	-40	15	140
280	300	-20	15	141
280	300	-20	15	142

260	300	-40	15	143
260	300	-40	15	144
280	300	-20	15	145
290	300	-10	15	146
280	300	-20	15	147
250	300	-50	15	148
240	300	-60	15	149
230	300	-70	15	150
210	300	-90	15	151
220	300	-80	15	152
190	300	-110	15	153
190	300	-110	15	154
380	300	80	16	154
160	300	-140	16	155
167	300	-133	16	156
180	300	-120	16	157
260	290	-30	16	158
270	290	-20	16	159
260	290	-30	16	160
280	290	-10	16	161
280	290	-10	16	162
260	290	-30	16	163
260	290	-30	16	164
280	290	-10	16	165
290	290	0	16	165
280	290	-10	16	166
250	290	-40	16	167
240	290	-50	16	168
230	290	-60	16	169
210	290	-80	16	170
220	290	-70	16	171
190	290	-100	16	172
190	290	-100	16	173
380	290	90	17	173
160	290	-130	17	174
167	290	-123	17	175
180	290	-110	17	176
270	260	10	18	176
260	260	0	18	176
280	260	20	19	176
280	260	20	20	176
260	260	0	20	176
260	260	0	20	176
280	260	20	21	176
290	260	30	22	176
280	260	20	23	176
250	260	-10	23	177
240	260	-20	23	178
230	260	-30	23	179
210	260	-50	23	180
220	260	-40	23	181
190	260	-70	23	182
190	260	-70	23	183
380	260	120	24	183
160	260	-100	24	184
167	260	-93	24	185
180	260	-80	24	186

260	270	-10	24	187
280	270	10	25	187
280	270	10	26	187
260	270	-10	26	188
260	270	-10	26	189
280	270	10	27	189
290	270	20	28	189
280	270	10	29	189
250	270	-20	29	190
240	270	-30	29	191
230	270	-40	29	192
210	270	-60	29	193
220	270	-50	29	194
190	270	-80	29	195
190	270	-80	29	196
380	270	110	30	196
160	270	-110	30	197
167	270	-103	30	198
180	270	-90	30	199
280	260	20	31	199
280	260	20	32	199
260	260	0	32	199
260	260	0	32	199
280	260	20	33	199
290	260	30	34	199
280	260	20	35	199
250	260	-10	35	200
240	260	-20	35	201
230	260	-30	35	202
210	260	-50	35	203
220	260	-40	35	204
190	260	-70	35	205
190	260	-70	35	206
380	260	120	36	206
160	260	-100	36	207
167	260	-93	36	208
180	260	-80	36	209
280	280	0	36	209
260	280	-20	36	210
260	280	-20	36	211
280	280	0	36	211
290	280	10	37	211
280	280	0	37	211
250	280	-30	37	212
240	280	-40	37	213
230	280	-50	37	214
210	280	-70	37	215
220	280	-60	37	216
190	280	-90	37	217
190	280	-90	37	218
380	280	100	38	218
160	280	-120	38	219
167	280	-113	38	220
180	280	-100	38	221
260	280	-20	38	222

260	280	-20	38	223
280	280	0	38	223
290	280	10	39	223
280	280	0	39	223
250	280	-30	39	224
240	280	-40	39	225
230	280	-50	39	226
210	280	-70	39	227
220	280	-60	39	228
190	280	-90	39	229
190	280	-90	39	230
380	280	100	40	230
160	280	-120	40	231
167	280	-113	40	232
180	280	-100	40	233
260	260	0	40	233
280	260	20	41	233
290	260	30	42	233
280	260	20	43	233
250	260	-10	43	234
240	260	-20	43	235
230	260	-30	43	236
210	260	-50	43	237
220	260	-40	43	238
190	260	-70	43	239
190	260	-70	43	240
380	260	120	44	240
160	260	-100	44	241
167	260	-93	44	242
180	260	-80	44	243
280	260	20	45	243
290	260	30	46	243
280	260	20	47	243
250	260	-10	47	244
240	260	-20	47	245
230	260	-30	47	246
210	260	-50	47	247
220	260	-40	47	248
190	260	-70	47	249
190	260	-70	47	250
380	260	120	48	250
160	260	-100	48	251
167	260	-93	48	252
180	260	-80	48	253
290	280	10	49	253
280	280	0	49	253
250	280	-30	49	254
240	280	-40	49	255
230	280	-50	49	256
210	280	-70	49	257
220	280	-60	49	258
190	280	-90	49	259
190	280	-90	49	260
380	280	100	50	260
160	280	-120	50	261
167	280	-113	50	262

180	280	-100	50	263
280	290	-10	50	264
250	290	-40	50	265
240	290	-50	50	266
230	290	-60	50	267
210	290	-80	50	268
220	290	-70	50	269
190	290	-100	50	270
190	290	-100	50	271
380	290	90	51	271
160	290	-130	51	272
167	290	-123	51	273
180	290	-110	51	274
250	280	-30	51	275
240	280	-40	51	276
230	280	-50	51	277
210	280	-70	51	278
220	280	-60	51	279
190	280	-90	51	280
190	280	-90	51	281
380	280	100	52	281
160	280	-120	52	282
167	280	-113	52	283
180	280	-100	52	284
240	250	-10	52	285
230	250	-20	52	286
210	250	-40	52	287
220	250	-30	52	288
190	250	-60	52	289
190	250	-60	52	290
380	250	130	53	290
160	250	-90	53	291
167	250	-83	53	292
180	250	-70	53	293
230	240	-10	53	294
210	240	-30	53	295
220	240	-20	53	296
190	240	-50	53	297
190	240	-50	53	298
380	240	140	54	298
160	240	-80	54	299
167	240	-73	54	300
180	240	-60	54	301
210	230	-20	54	302
220	230	-10	54	303
190	230	-40	54	304
190	230	-40	54	305
380	230	150	55	305
160	230	-70	55	306
167	230	-63	55	307
180	230	-50	55	308
220	210	10	56	308
190	210	-20	56	309

190	210	-20	56	310
380	210	170	57	310
160	210	-50	57	311
167	210	-43	57	312
180	210	-30	57	313
190	220	-30	57	314
190	220	-30	57	315
380	220	160	58	315
160	220	-60	58	316
167	220	-53	58	317
180	220	-40	58	318
190	190	0	58	318
380	190	190	59	318
160	190	-30	59	319
167	190	-23	59	320
180	190	-10	59	321
380	190	190	60	321
160	190	-30	60	322
167	190	-23	60	323
180	190	-10	60	324
160	380	-220	60	325
167	380	-213	60	326
180	380	-200	60	327
167	160	7	61	327
180	160	20	62	327
180	167	13	63	327

S Statistic = 63 - 327 = -264

Tied Group	Value	Members
1	290	3
2	260	4
3	280	4
4	190	2

Time Period	Observations
3/11/2008	1
5/13/2008	1
9/23/2008	1
10/29/2008	1
4/29/2009	1
5/13/2009	1
9/29/2009	1
12/9/2009	1
2/26/2010	1
4/15/2010	1
8/10/2010	1
11/22/2010	1
3/10/2011	1
5/25/2011	1
9/2/2011	1

4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/26/2018	1

There are 0 time periods with multiple data

A = 396
B = 0
C = 54
D = 0
E = 32
F = 0
a = 51156
b = 197316
c = 1624
Group Variance = 2820
Z-Score = -4.95258
Comparison Level at 95% confidence level = -1.65463 (downward trend)
-4.95258 < -1.65463 indicating a downward trend

Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: GCW-02D

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
2190	2980	-790	0	1
3140	2980	160	1	1
3030	2980	50	2	1
3000	2980	20	3	1
3600	2980	620	4	1
2200	2980	-780	4	2
4500	2980	1520	5	2
2100	2980	-880	5	3
2000	2980	-980	5	4
2100	2980	-880	5	5
1900	2980	-1080	5	6
2100	2980	-880	5	7
2200	2980	-780	5	8
2100	2980	-880	5	9
2300	2980	-680	5	10
2400	2980	-580	5	11
2500	2980	-480	5	12
2800	2980	-180	5	13
3000	2980	20	6	13
1900	2980	-1080	6	14
2000	2980	-980	6	15
2500	2980	-480	6	16
2400	2980	-580	6	17
3800	2980	820	7	17
1800	2980	-1180	7	18
1500	2980	-1480	7	19
1670	2980	-1310	7	20
1880	2980	-1100	7	21
3140	2190	950	8	21
3030	2190	840	9	21
3000	2190	810	10	21
3600	2190	1410	11	21
2200	2190	10	12	21
4500	2190	2310	13	21
2100	2190	-90	13	22
2000	2190	-190	13	23
2100	2190	-90	13	24
1900	2190	-290	13	25
2100	2190	-90	13	26
2200	2190	10	14	26
2100	2190	-90	14	27
2300	2190	110	15	27
2400	2190	210	16	27
2500	2190	310	17	27
2800	2190	610	18	27
3000	2190	810	19	27

1900	2190	-290	19	28
2000	2190	-190	19	29
2500	2190	310	20	29
2400	2190	210	21	29
3800	2190	1610	22	29
1800	2190	-390	22	30
1500	2190	-690	22	31
1670	2190	-520	22	32
1880	2190	-310	22	33
3030	3140	-110	22	34
3000	3140	-140	22	35
3600	3140	460	23	35
2200	3140	-940	23	36
4500	3140	1360	24	36
2100	3140	-1040	24	37
2000	3140	-1140	24	38
2100	3140	-1040	24	39
1900	3140	-1240	24	40
2100	3140	-1040	24	41
2200	3140	-940	24	42
2100	3140	-1040	24	43
2300	3140	-840	24	44
2400	3140	-740	24	45
2500	3140	-640	24	46
2800	3140	-340	24	47
3000	3140	-140	24	48
1900	3140	-1240	24	49
2000	3140	-1140	24	50
2500	3140	-640	24	51
2400	3140	-740	24	52
3800	3140	660	25	52
1800	3140	-1340	25	53
1500	3140	-1640	25	54
1670	3140	-1470	25	55
1880	3140	-1260	25	56
3000	3030	-30	25	57
3600	3030	570	26	57
2200	3030	-830	26	58
4500	3030	1470	27	58
2100	3030	-930	27	59
2000	3030	-1030	27	60
2100	3030	-930	27	61
1900	3030	-1130	27	62
2100	3030	-930	27	63
2200	3030	-830	27	64
2100	3030	-930	27	65
2300	3030	-730	27	66
2400	3030	-630	27	67
2500	3030	-530	27	68
2800	3030	-230	27	69
3000	3030	-30	27	70
1900	3030	-1130	27	71
2000	3030	-1030	27	72
2500	3030	-530	27	73
2400	3030	-630	27	74
3800	3030	770	28	74
1800	3030	-1230	28	75

1500	3030	-1530	28	76
1670	3030	-1360	28	77
1880	3030	-1150	28	78
3600	3000	600	29	78
2200	3000	-800	29	79
4500	3000	1500	30	79
2100	3000	-900	30	80
2000	3000	-1000	30	81
2100	3000	-900	30	82
1900	3000	-1100	30	83
2100	3000	-900	30	84
2200	3000	-800	30	85
2100	3000	-900	30	86
2300	3000	-700	30	87
2400	3000	-600	30	88
2500	3000	-500	30	89
2800	3000	-200	30	90
3000	3000	0	30	90
1900	3000	-1100	30	91
2000	3000	-1000	30	92
2500	3000	-500	30	93
2400	3000	-600	30	94
3800	3000	800	31	94
1800	3000	-1200	31	95
1500	3000	-1500	31	96
1670	3000	-1330	31	97
1880	3000	-1120	31	98
2200	3600	-1400	31	99
4500	3600	900	32	99
2100	3600	-1500	32	100
2000	3600	-1600	32	101
2100	3600	-1500	32	102
1900	3600	-1700	32	103
2100	3600	-1500	32	104
2200	3600	-1400	32	105
2100	3600	-1500	32	106
2300	3600	-1300	32	107
2400	3600	-1200	32	108
2500	3600	-1100	32	109
2800	3600	-800	32	110
3000	3600	-600	32	111
1900	3600	-1700	32	112
2000	3600	-1600	32	113
2500	3600	-1100	32	114
2400	3600	-1200	32	115
3800	3600	200	33	115
1800	3600	-1800	33	116
1500	3600	-2100	33	117
1670	3600	-1930	33	118
1880	3600	-1720	33	119
4500	2200	2300	34	119
2100	2200	-100	34	120
2000	2200	-200	34	121
2100	2200	-100	34	122
1900	2200	-300	34	123
2100	2200	-100	34	124

2200	2200	0	34	124
2100	2200	-100	34	125
2300	2200	100	35	125
2400	2200	200	36	125
2500	2200	300	37	125
2800	2200	600	38	125
3000	2200	800	39	125
1900	2200	-300	39	126
2000	2200	-200	39	127
2500	2200	300	40	127
2400	2200	200	41	127
3800	2200	1600	42	127
1800	2200	-400	42	128
1500	2200	-700	42	129
1670	2200	-530	42	130
1880	2200	-320	42	131
2100	4500	-2400	42	132
2000	4500	-2500	42	133
2100	4500	-2400	42	134
1900	4500	-2600	42	135
2100	4500	-2400	42	136
2200	4500	-2300	42	137
2100	4500	-2400	42	138
2300	4500	-2200	42	139
2400	4500	-2100	42	140
2500	4500	-2000	42	141
2800	4500	-1700	42	142
3000	4500	-1500	42	143
1900	4500	-2600	42	144
2000	4500	-2500	42	145
2500	4500	-2000	42	146
2400	4500	-2100	42	147
3800	4500	-700	42	148
1800	4500	-2700	42	149
1500	4500	-3000	42	150
1670	4500	-2830	42	151
1880	4500	-2620	42	152
2000	2100	-100	42	153
2100	2100	0	42	153
1900	2100	-200	42	154
2100	2100	0	42	154
2200	2100	100	43	154
2100	2100	0	43	154
2300	2100	200	44	154
2400	2100	300	45	154
2500	2100	400	46	154
2800	2100	700	47	154
3000	2100	900	48	154
1900	2100	-200	48	155
2000	2100	-100	48	156
2500	2100	400	49	156
2400	2100	300	50	156
3800	2100	1700	51	156
1800	2100	-300	51	157
1500	2100	-600	51	158
1670	2100	-430	51	159
1880	2100	-220	51	160

2100	2000	100	52	160
1900	2000	-100	52	161
2100	2000	100	53	161
2200	2000	200	54	161
2100	2000	100	55	161
2300	2000	300	56	161
2400	2000	400	57	161
2500	2000	500	58	161
2800	2000	800	59	161
3000	2000	1000	60	161
1900	2000	-100	60	162
2000	2000	0	60	162
2500	2000	500	61	162
2400	2000	400	62	162
3800	2000	1800	63	162
1800	2000	-200	63	163
1500	2000	-500	63	164
1670	2000	-330	63	165
1880	2000	-120	63	166
1900	2100	-200	63	167
2100	2100	0	63	167
2200	2100	100	64	167
2100	2100	0	64	167
2300	2100	200	65	167
2400	2100	300	66	167
2500	2100	400	67	167
2800	2100	700	68	167
3000	2100	900	69	167
1900	2100	-200	69	168
2000	2100	-100	69	169
2500	2100	400	70	169
2400	2100	300	71	169
3800	2100	1700	72	169
1800	2100	-300	72	170
1500	2100	-600	72	171
1670	2100	-430	72	172
1880	2100	-220	72	173
2100	1900	200	73	173
2200	1900	300	74	173
2100	1900	200	75	173
2300	1900	400	76	173
2400	1900	500	77	173
2500	1900	600	78	173
2800	1900	900	79	173
3000	1900	1100	80	173
1900	1900	0	80	173
2000	1900	100	81	173
2500	1900	600	82	173
2400	1900	500	83	173
3800	1900	1900	84	173
1800	1900	-100	84	174
1500	1900	-400	84	175
1670	1900	-230	84	176
1880	1900	-20	84	177
2200	2100	100	85	177

2100	2100	0	85	177
2300	2100	200	86	177
2400	2100	300	87	177
2500	2100	400	88	177
2800	2100	700	89	177
3000	2100	900	90	177
1900	2100	-200	90	178
2000	2100	-100	90	179
2500	2100	400	91	179
2400	2100	300	92	179
3800	2100	1700	93	179
1800	2100	-300	93	180
1500	2100	-600	93	181
1670	2100	-430	93	182
1880	2100	-220	93	183
2100	2200	-100	93	184
2300	2200	100	94	184
2400	2200	200	95	184
2500	2200	300	96	184
2800	2200	600	97	184
3000	2200	800	98	184
1900	2200	-300	98	185
2000	2200	-200	98	186
2500	2200	300	99	186
2400	2200	200	100	186
3800	2200	1600	101	186
1800	2200	-400	101	187
1500	2200	-700	101	188
1670	2200	-530	101	189
1880	2200	-320	101	190
2300	2100	200	102	190
2400	2100	300	103	190
2500	2100	400	104	190
2800	2100	700	105	190
3000	2100	900	106	190
1900	2100	-200	106	191
2000	2100	-100	106	192
2500	2100	400	107	192
2400	2100	300	108	192
3800	2100	1700	109	192
1800	2100	-300	109	193
1500	2100	-600	109	194
1670	2100	-430	109	195
1880	2100	-220	109	196
2400	2300	100	110	196
2500	2300	200	111	196
2800	2300	500	112	196
3000	2300	700	113	196
1900	2300	-400	113	197
2000	2300	-300	113	198
2500	2300	200	114	198
2400	2300	100	115	198
3800	2300	1500	116	198
1800	2300	-500	116	199
1500	2300	-800	116	200
1670	2300	-630	116	201

1880	2300	-420	116	202
2500	2400	100	117	202
2800	2400	400	118	202
3000	2400	600	119	202
1900	2400	-500	119	203
2000	2400	-400	119	204
2500	2400	100	120	204
2400	2400	0	120	204
3800	2400	1400	121	204
1800	2400	-600	121	205
1500	2400	-900	121	206
1670	2400	-730	121	207
1880	2400	-520	121	208
2800	2500	300	122	208
3000	2500	500	123	208
1900	2500	-600	123	209
2000	2500	-500	123	210
2500	2500	0	123	210
2400	2500	-100	123	211
3800	2500	1300	124	211
1800	2500	-700	124	212
1500	2500	-1000	124	213
1670	2500	-830	124	214
1880	2500	-620	124	215
3000	2800	200	125	215
1900	2800	-900	125	216
2000	2800	-800	125	217
2500	2800	-300	125	218
2400	2800	-400	125	219
3800	2800	1000	126	219
1800	2800	-1000	126	220
1500	2800	-1300	126	221
1670	2800	-1130	126	222
1880	2800	-920	126	223
1900	3000	-1100	126	224
2000	3000	-1000	126	225
2500	3000	-500	126	226
2400	3000	-600	126	227
3800	3000	800	127	227
1800	3000	-1200	127	228
1500	3000	-1500	127	229
1670	3000	-1330	127	230
1880	3000	-1120	127	231
2000	1900	100	128	231
2500	1900	600	129	231
2400	1900	500	130	231
3800	1900	1900	131	231
1800	1900	-100	131	232
1500	1900	-400	131	233
1670	1900	-230	131	234
1880	1900	-20	131	235
2500	2000	500	132	235
2400	2000	400	133	235

3800	2000	1800	134	235
1800	2000	-200	134	236
1500	2000	-500	134	237
1670	2000	-330	134	238
1880	2000	-120	134	239
2400	2500	-100	134	240
3800	2500	1300	135	240
1800	2500	-700	135	241
1500	2500	-1000	135	242
1670	2500	-830	135	243
1880	2500	-620	135	244
3800	2400	1400	136	244
1800	2400	-600	136	245
1500	2400	-900	136	246
1670	2400	-730	136	247
1880	2400	-520	136	248
1800	3800	-2000	136	249
1500	3800	-2300	136	250
1670	3800	-2130	136	251
1880	3800	-1920	136	252
1500	1800	-300	136	253
1670	1800	-130	136	254
1880	1800	80	137	254
1670	1500	170	138	254
1880	1500	380	139	254
1880	1670	210	140	254

S Statistic = 140 - 254 = -114

Tied Group	Value	Members
1	3000	2
2	2200	2
3	2100	4
4	2000	2
5	1900	2
6	2400	2
7	2500	2

Time Period	Observations
3/12/2008	1
5/12/2008	1
9/23/2008	1
12/3/2008	1
4/28/2009	1
5/14/2009	1
9/24/2009	1
12/8/2009	1
2/25/2010	1
4/14/2010	1
8/12/2010	1
11/24/2010	1

3/8/2011	1
5/24/2011	1
9/1/2011	1
4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 264
B = 0
C = 24
D = 0
E = 24
F = 0
a = 51156
b = 197316
c = 1624
Group Variance = 2827.33
Z-Score = -2.12515
Comparison Level at 95% confidence level = -1.65463 (downward trend)
-2.12515 < -1.65463 indicating a downward trend

Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: GCW-03D

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
3960	4960	-1000	0	1
5680	4960	720	1	1
6620	4960	1660	2	1
7900	4960	2940	3	1
8600	4960	3640	4	1
4300	4960	-660	4	2
5300	4960	340	5	2
4400	4960	-560	5	3
4600	4960	-360	5	4
3800	4960	-1160	5	5
3500	4960	-1460	5	6
3600	4960	-1360	5	7
3700	4960	-1260	5	8
3500	4960	-1460	5	9
3500	4960	-1460	5	10
4000	4960	-960	5	11
3600	4960	-1360	5	12
3900	4960	-1060	5	13
4500	4960	-460	5	14
3300	4960	-1660	5	15
3800	4960	-1160	5	16
4400	4960	-560	5	17
4000	4960	-960	5	18
7000	4960	2040	6	18
3400	4960	-1560	6	19
2900	4960	-2060	6	20
3130	4960	-1830	6	21
3710	4960	-1250	6	22
5680	3960	1720	7	22
6620	3960	2660	8	22
7900	3960	3940	9	22
8600	3960	4640	10	22
4300	3960	340	11	22
5300	3960	1340	12	22
4400	3960	440	13	22
4600	3960	640	14	22
3800	3960	-160	14	23
3500	3960	-460	14	24
3600	3960	-360	14	25
3700	3960	-260	14	26
3500	3960	-460	14	27
3500	3960	-460	14	28
4000	3960	40	15	28
3600	3960	-360	15	29
3900	3960	-60	15	30
4500	3960	540	16	30

3300	3960	-660	16	31
3800	3960	-160	16	32
4400	3960	440	17	32
4000	3960	40	18	32
7000	3960	3040	19	32
3400	3960	-560	19	33
2900	3960	-1060	19	34
3130	3960	-830	19	35
3710	3960	-250	19	36
6620	5680	940	20	36
7900	5680	2220	21	36
8600	5680	2920	22	36
4300	5680	-1380	22	37
5300	5680	-380	22	38
4400	5680	-1280	22	39
4600	5680	-1080	22	40
3800	5680	-1880	22	41
3500	5680	-2180	22	42
3600	5680	-2080	22	43
3700	5680	-1980	22	44
3500	5680	-2180	22	45
3500	5680	-2180	22	46
4000	5680	-1680	22	47
3600	5680	-2080	22	48
3900	5680	-1780	22	49
4500	5680	-1180	22	50
3300	5680	-2380	22	51
3800	5680	-1880	22	52
4400	5680	-1280	22	53
4000	5680	-1680	22	54
7000	5680	1320	23	54
3400	5680	-2280	23	55
2900	5680	-2780	23	56
3130	5680	-2550	23	57
3710	5680	-1970	23	58
7900	6620	1280	24	58
8600	6620	1980	25	58
4300	6620	-2320	25	59
5300	6620	-1320	25	60
4400	6620	-2220	25	61
4600	6620	-2020	25	62
3800	6620	-2820	25	63
3500	6620	-3120	25	64
3600	6620	-3020	25	65
3700	6620	-2920	25	66
3500	6620	-3120	25	67
3500	6620	-3120	25	68
4000	6620	-2620	25	69
3600	6620	-3020	25	70
3900	6620	-2720	25	71
4500	6620	-2120	25	72
3300	6620	-3320	25	73
3800	6620	-2820	25	74
4400	6620	-2220	25	75
4000	6620	-2620	25	76
7000	6620	380	26	76
3400	6620	-3220	26	77

2900	6620	-3720	26	78
3130	6620	-3490	26	79
3710	6620	-2910	26	80
8600	7900	700	27	80
4300	7900	-3600	27	81
5300	7900	-2600	27	82
4400	7900	-3500	27	83
4600	7900	-3300	27	84
3800	7900	-4100	27	85
3500	7900	-4400	27	86
3600	7900	-4300	27	87
3700	7900	-4200	27	88
3500	7900	-4400	27	89
3500	7900	-4400	27	90
4000	7900	-3900	27	91
3600	7900	-4300	27	92
3900	7900	-4000	27	93
4500	7900	-3400	27	94
3300	7900	-4600	27	95
3800	7900	-4100	27	96
4400	7900	-3500	27	97
4000	7900	-3900	27	98
7000	7900	-900	27	99
3400	7900	-4500	27	100
2900	7900	-5000	27	101
3130	7900	-4770	27	102
3710	7900	-4190	27	103
4300	8600	-4300	27	104
5300	8600	-3300	27	105
4400	8600	-4200	27	106
4600	8600	-4000	27	107
3800	8600	-4800	27	108
3500	8600	-5100	27	109
3600	8600	-5000	27	110
3700	8600	-4900	27	111
3500	8600	-5100	27	112
3500	8600	-5100	27	113
4000	8600	-4600	27	114
3600	8600	-5000	27	115
3900	8600	-4700	27	116
4500	8600	-4100	27	117
3300	8600	-5300	27	118
3800	8600	-4800	27	119
4400	8600	-4200	27	120
4000	8600	-4600	27	121
7000	8600	-1600	27	122
3400	8600	-5200	27	123
2900	8600	-5700	27	124
3130	8600	-5470	27	125
3710	8600	-4890	27	126
5300	4300	1000	28	126
4400	4300	100	29	126
4600	4300	300	30	126
3800	4300	-500	30	127
3500	4300	-800	30	128
3600	4300	-700	30	129

3700	4300	-600	30	130
3500	4300	-800	30	131
3500	4300	-800	30	132
4000	4300	-300	30	133
3600	4300	-700	30	134
3900	4300	-400	30	135
4500	4300	200	31	135
3300	4300	-1000	31	136
3800	4300	-500	31	137
4400	4300	100	32	137
4000	4300	-300	32	138
7000	4300	2700	33	138
3400	4300	-900	33	139
2900	4300	-1400	33	140
3130	4300	-1170	33	141
3710	4300	-590	33	142
4400	5300	-900	33	143
4600	5300	-700	33	144
3800	5300	-1500	33	145
3500	5300	-1800	33	146
3600	5300	-1700	33	147
3700	5300	-1600	33	148
3500	5300	-1800	33	149
3500	5300	-1800	33	150
4000	5300	-1300	33	151
3600	5300	-1700	33	152
3900	5300	-1400	33	153
4500	5300	-800	33	154
3300	5300	-2000	33	155
3800	5300	-1500	33	156
4400	5300	-900	33	157
4000	5300	-1300	33	158
7000	5300	1700	34	158
3400	5300	-1900	34	159
2900	5300	-2400	34	160
3130	5300	-2170	34	161
3710	5300	-1590	34	162
4600	4400	200	35	162
3800	4400	-600	35	163
3500	4400	-900	35	164
3600	4400	-800	35	165
3700	4400	-700	35	166
3500	4400	-900	35	167
3500	4400	-900	35	168
4000	4400	-400	35	169
3600	4400	-800	35	170
3900	4400	-500	35	171
4500	4400	100	36	171
3300	4400	-1100	36	172
3800	4400	-600	36	173
4400	4400	0	36	173
4000	4400	-400	36	174
7000	4400	2600	37	174
3400	4400	-1000	37	175
2900	4400	-1500	37	176
3130	4400	-1270	37	177
3710	4400	-690	37	178

3800	4600	-800	37	179
3500	4600	-1100	37	180
3600	4600	-1000	37	181
3700	4600	-900	37	182
3500	4600	-1100	37	183
3500	4600	-1100	37	184
4000	4600	-600	37	185
3600	4600	-1000	37	186
3900	4600	-700	37	187
4500	4600	-100	37	188
3300	4600	-1300	37	189
3800	4600	-800	37	190
4400	4600	-200	37	191
4000	4600	-600	37	192
7000	4600	2400	38	192
3400	4600	-1200	38	193
2900	4600	-1700	38	194
3130	4600	-1470	38	195
3710	4600	-890	38	196
3500	3800	-300	38	197
3600	3800	-200	38	198
3700	3800	-100	38	199
3500	3800	-300	38	200
3500	3800	-300	38	201
4000	3800	200	39	201
3600	3800	-200	39	202
3900	3800	100	40	202
4500	3800	700	41	202
3300	3800	-500	41	203
3800	3800	0	41	203
4400	3800	600	42	203
4000	3800	200	43	203
7000	3800	3200	44	203
3400	3800	-400	44	204
2900	3800	-900	44	205
3130	3800	-670	44	206
3710	3800	-90	44	207
3600	3500	100	45	207
3700	3500	200	46	207
3500	3500	0	46	207
3500	3500	0	46	207
4000	3500	500	47	207
3600	3500	100	48	207
3900	3500	400	49	207
4500	3500	1000	50	207
3300	3500	-200	50	208
3800	3500	300	51	208
4400	3500	900	52	208
4000	3500	500	53	208
7000	3500	3500	54	208
3400	3500	-100	54	209
2900	3500	-600	54	210
3130	3500	-370	54	211
3710	3500	210	55	211
3700	3600	100	56	211

3500	3600	-100	56	212
3500	3600	-100	56	213
4000	3600	400	57	213
3600	3600	0	57	213
3900	3600	300	58	213
4500	3600	900	59	213
3300	3600	-300	59	214
3800	3600	200	60	214
4400	3600	800	61	214
4000	3600	400	62	214
7000	3600	3400	63	214
3400	3600	-200	63	215
2900	3600	-700	63	216
3130	3600	-470	63	217
3710	3600	110	64	217
3500	3700	-200	64	218
3500	3700	-200	64	219
4000	3700	300	65	219
3600	3700	-100	65	220
3900	3700	200	66	220
4500	3700	800	67	220
3300	3700	-400	67	221
3800	3700	100	68	221
4400	3700	700	69	221
4000	3700	300	70	221
7000	3700	3300	71	221
3400	3700	-300	71	222
2900	3700	-800	71	223
3130	3700	-570	71	224
3710	3700	10	72	224
3500	3500	0	72	224
4000	3500	500	73	224
3600	3500	100	74	224
3900	3500	400	75	224
4500	3500	1000	76	224
3300	3500	-200	76	225
3800	3500	300	77	225
4400	3500	900	78	225
4000	3500	500	79	225
7000	3500	3500	80	225
3400	3500	-100	80	226
2900	3500	-600	80	227
3130	3500	-370	80	228
3710	3500	210	81	228
4000	3500	500	82	228
3600	3500	100	83	228
3900	3500	400	84	228
4500	3500	1000	85	228
3300	3500	-200	85	229
3800	3500	300	86	229
4400	3500	900	87	229
4000	3500	500	88	229
7000	3500	3500	89	229
3400	3500	-100	89	230
2900	3500	-600	89	231
3130	3500	-370	89	232

3710	3500	210	90	232
3600	4000	-400	90	233
3900	4000	-100	90	234
4500	4000	500	91	234
3300	4000	-700	91	235
3800	4000	-200	91	236
4400	4000	400	92	236
4000	4000	0	92	236
7000	4000	3000	93	236
3400	4000	-600	93	237
2900	4000	-1100	93	238
3130	4000	-870	93	239
3710	4000	-290	93	240
3900	3600	300	94	240
4500	3600	900	95	240
3300	3600	-300	95	241
3800	3600	200	96	241
4400	3600	800	97	241
4000	3600	400	98	241
7000	3600	3400	99	241
3400	3600	-200	99	242
2900	3600	-700	99	243
3130	3600	-470	99	244
3710	3600	110	100	244
4500	3900	600	101	244
3300	3900	-600	101	245
3800	3900	-100	101	246
4400	3900	500	102	246
4000	3900	100	103	246
7000	3900	3100	104	246
3400	3900	-500	104	247
2900	3900	-1000	104	248
3130	3900	-770	104	249
3710	3900	-190	104	250
3300	4500	-1200	104	251
3800	4500	-700	104	252
4400	4500	-100	104	253
4000	4500	-500	104	254
7000	4500	2500	105	254
3400	4500	-1100	105	255
2900	4500	-1600	105	256
3130	4500	-1370	105	257
3710	4500	-790	105	258
3800	3300	500	106	258
4400	3300	1100	107	258
4000	3300	700	108	258
7000	3300	3700	109	258
3400	3300	100	110	258
2900	3300	-400	110	259
3130	3300	-170	110	260
3710	3300	410	111	260
4400	3800	600	112	260
4000	3800	200	113	260

7000	3800	3200	114	260
3400	3800	-400	114	261
2900	3800	-900	114	262
3130	3800	-670	114	263
3710	3800	-90	114	264
4000	4400	-400	114	265
7000	4400	2600	115	265
3400	4400	-1000	115	266
2900	4400	-1500	115	267
3130	4400	-1270	115	268
3710	4400	-690	115	269
7000	4000	3000	116	269
3400	4000	-600	116	270
2900	4000	-1100	116	271
3130	4000	-870	116	272
3710	4000	-290	116	273
3400	7000	-3600	116	274
2900	7000	-4100	116	275
3130	7000	-3870	116	276
3710	7000	-3290	116	277
2900	3400	-500	116	278
3130	3400	-270	116	279
3710	3400	310	117	279
3130	2900	230	118	279
3710	2900	810	119	279
3710	3130	580	120	279

S Statistic = 120 - 279 = -159

Tied Group	Value	Members
1	4400	2
2	3800	2
3	3500	3
4	3600	2
5	4000	2

Time Period	Observations
3/12/2008	1
5/10/2008	1
9/22/2008	1
10/28/2008	1
4/28/2009	1
5/14/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/24/2011	1

9/1/2011	1
4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 138
B = 0
C = 6
D = 0
E = 14
F = 0
a = 51156
b = 197316
c = 1624
Group Variance = 2834.33
Z-Score = -2.96778
Comparison Level at 95% confidence level = -1.65463 (downward trend)
-2.96778 < -1.65463 indicating a downward trend

Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: GCW-04D

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
4700	5110	-410	0	1
8000	5110	2890	1	1
7470	5110	2360	2	1
12000	5110	6890	3	1
13000	5110	7890	4	1
6500	5110	1390	5	1
7200	5110	2090	6	1
5900	5110	790	7	1
5000	5110	-110	7	2
4800	5110	-310	7	3
4200	5110	-910	7	4
3900	5110	-1210	7	5
4000	5110	-1110	7	6
3900	5110	-1210	7	7
3700	5110	-1410	7	8
3900	5110	-1210	7	9
5000	5110	-110	7	10
5500	5110	390	8	10
5400	5110	290	9	10
3000	5110	-2110	9	11
9.8	5110	-5100.2	9	12
30	5110	-5080	9	13
12	5110	-5098	9	14
4600	5110	-510	9	15
2800	5110	-2310	9	16
2100	5110	-3010	9	17
26.2	5110	-5083.8	9	18
3590	5110	-1520	9	19
8000	4700	3300	10	19
7470	4700	2770	11	19
12000	4700	7300	12	19
13000	4700	8300	13	19
6500	4700	1800	14	19
7200	4700	2500	15	19
5900	4700	1200	16	19
5000	4700	300	17	19
4800	4700	100	18	19
4200	4700	-500	18	20
3900	4700	-800	18	21
4000	4700	-700	18	22
3900	4700	-800	18	23
3700	4700	-1000	18	24
3900	4700	-800	18	25
5000	4700	300	19	25
5500	4700	800	20	25
5400	4700	700	21	25

3000	4700	-1700	21	26
9.8	4700	-4690.2	21	27
30	4700	-4670	21	28
12	4700	-4688	21	29
4600	4700	-100	21	30
2800	4700	-1900	21	31
2100	4700	-2600	21	32
26.2	4700	-4673.8	21	33
3590	4700	-1110	21	34
7470	8000	-530	21	35
12000	8000	4000	22	35
13000	8000	5000	23	35
6500	8000	-1500	23	36
7200	8000	-800	23	37
5900	8000	-2100	23	38
5000	8000	-3000	23	39
4800	8000	-3200	23	40
4200	8000	-3800	23	41
3900	8000	-4100	23	42
4000	8000	-4000	23	43
3900	8000	-4100	23	44
3700	8000	-4300	23	45
3900	8000	-4100	23	46
5000	8000	-3000	23	47
5500	8000	-2500	23	48
5400	8000	-2600	23	49
3000	8000	-5000	23	50
9.8	8000	-7990.2	23	51
30	8000	-7970	23	52
12	8000	-7988	23	53
4600	8000	-3400	23	54
2800	8000	-5200	23	55
2100	8000	-5900	23	56
26.2	8000	-7973.8	23	57
3590	8000	-4410	23	58
12000	7470	4530	24	58
13000	7470	5530	25	58
6500	7470	-970	25	59
7200	7470	-270	25	60
5900	7470	-1570	25	61
5000	7470	-2470	25	62
4800	7470	-2670	25	63
4200	7470	-3270	25	64
3900	7470	-3570	25	65
4000	7470	-3470	25	66
3900	7470	-3570	25	67
3700	7470	-3770	25	68
3900	7470	-3570	25	69
5000	7470	-2470	25	70
5500	7470	-1970	25	71
5400	7470	-2070	25	72
3000	7470	-4470	25	73
9.8	7470	-7460.2	25	74
30	7470	-7440	25	75
12	7470	-7458	25	76
4600	7470	-2870	25	77
2800	7470	-4670	25	78

2100	7470	-5370	25	79
26.2	7470	-7443.8	25	80
3590	7470	-3880	25	81
13000	12000	1000	26	81
6500	12000	-5500	26	82
7200	12000	-4800	26	83
5900	12000	-6100	26	84
5000	12000	-7000	26	85
4800	12000	-7200	26	86
4200	12000	-7800	26	87
3900	12000	-8100	26	88
4000	12000	-8000	26	89
3900	12000	-8100	26	90
3700	12000	-8300	26	91
3900	12000	-8100	26	92
5000	12000	-7000	26	93
5500	12000	-6500	26	94
5400	12000	-6600	26	95
3000	12000	-9000	26	96
9.8	12000	-11990.2	26	97
30	12000	-11970	26	98
12	12000	-11988	26	99
4600	12000	-7400	26	100
2800	12000	-9200	26	101
2100	12000	-9900	26	102
26.2	12000	-11973.8	26	103
3590	12000	-8410	26	104
6500	13000	-6500	26	105
7200	13000	-5800	26	106
5900	13000	-7100	26	107
5000	13000	-8000	26	108
4800	13000	-8200	26	109
4200	13000	-8800	26	110
3900	13000	-9100	26	111
4000	13000	-9000	26	112
3900	13000	-9100	26	113
3700	13000	-9300	26	114
3900	13000	-9100	26	115
5000	13000	-8000	26	116
5500	13000	-7500	26	117
5400	13000	-7600	26	118
3000	13000	-10000	26	119
9.8	13000	-12990.2	26	120
30	13000	-12970	26	121
12	13000	-12988	26	122
4600	13000	-8400	26	123
2800	13000	-10200	26	124
2100	13000	-10900	26	125
26.2	13000	-12973.8	26	126
3590	13000	-9410	26	127
7200	6500	700	27	127
5900	6500	-600	27	128
5000	6500	-1500	27	129
4800	6500	-1700	27	130
4200	6500	-2300	27	131
3900	6500	-2600	27	132

4000	6500	-2500	27	133
3900	6500	-2600	27	134
3700	6500	-2800	27	135
3900	6500	-2600	27	136
5000	6500	-1500	27	137
5500	6500	-1000	27	138
5400	6500	-1100	27	139
3000	6500	-3500	27	140
9.8	6500	-6490.2	27	141
30	6500	-6470	27	142
12	6500	-6488	27	143
4600	6500	-1900	27	144
2800	6500	-3700	27	145
2100	6500	-4400	27	146
26.2	6500	-6473.8	27	147
3590	6500	-2910	27	148
5900	7200	-1300	27	149
5000	7200	-2200	27	150
4800	7200	-2400	27	151
4200	7200	-3000	27	152
3900	7200	-3300	27	153
4000	7200	-3200	27	154
3900	7200	-3300	27	155
3700	7200	-3500	27	156
3900	7200	-3300	27	157
5000	7200	-2200	27	158
5500	7200	-1700	27	159
5400	7200	-1800	27	160
3000	7200	-4200	27	161
9.8	7200	-7190.2	27	162
30	7200	-7170	27	163
12	7200	-7188	27	164
4600	7200	-2600	27	165
2800	7200	-4400	27	166
2100	7200	-5100	27	167
26.2	7200	-7173.8	27	168
3590	7200	-3610	27	169
5000	5900	-900	27	170
4800	5900	-1100	27	171
4200	5900	-1700	27	172
3900	5900	-2000	27	173
4000	5900	-1900	27	174
3900	5900	-2000	27	175
3700	5900	-2200	27	176
3900	5900	-2000	27	177
5000	5900	-900	27	178
5500	5900	-400	27	179
5400	5900	-500	27	180
3000	5900	-2900	27	181
9.8	5900	-5890.2	27	182
30	5900	-5870	27	183
12	5900	-5888	27	184
4600	5900	-1300	27	185
2800	5900	-3100	27	186
2100	5900	-3800	27	187
26.2	5900	-5873.8	27	188
3590	5900	-2310	27	189

4800	5000	-200	27	190
4200	5000	-800	27	191
3900	5000	-1100	27	192
4000	5000	-1000	27	193
3900	5000	-1100	27	194
3700	5000	-1300	27	195
3900	5000	-1100	27	196
5000	5000	0	27	196
5500	5000	500	28	196
5400	5000	400	29	196
3000	5000	-2000	29	197
9.8	5000	-4990.2	29	198
30	5000	-4970	29	199
12	5000	-4988	29	200
4600	5000	-400	29	201
2800	5000	-2200	29	202
2100	5000	-2900	29	203
26.2	5000	-4973.8	29	204
3590	5000	-1410	29	205
4200	4800	-600	29	206
3900	4800	-900	29	207
4000	4800	-800	29	208
3900	4800	-900	29	209
3700	4800	-1100	29	210
3900	4800	-900	29	211
5000	4800	200	30	211
5500	4800	700	31	211
5400	4800	600	32	211
3000	4800	-1800	32	212
9.8	4800	-4790.2	32	213
30	4800	-4770	32	214
12	4800	-4788	32	215
4600	4800	-200	32	216
2800	4800	-2000	32	217
2100	4800	-2700	32	218
26.2	4800	-4773.8	32	219
3590	4800	-1210	32	220
3900	4200	-300	32	221
4000	4200	-200	32	222
3900	4200	-300	32	223
3700	4200	-500	32	224
3900	4200	-300	32	225
5000	4200	800	33	225
5500	4200	1300	34	225
5400	4200	1200	35	225
3000	4200	-1200	35	226
9.8	4200	-4190.2	35	227
30	4200	-4170	35	228
12	4200	-4188	35	229
4600	4200	400	36	229
2800	4200	-1400	36	230
2100	4200	-2100	36	231
26.2	4200	-4173.8	36	232
3590	4200	-610	36	233
4000	3900	100	37	233

3900	3900	0	37	233
3700	3900	-200	37	234
3900	3900	0	37	234
5000	3900	1100	38	234
5500	3900	1600	39	234
5400	3900	1500	40	234
3000	3900	-900	40	235
9.8	3900	-3890.2	40	236
30	3900	-3870	40	237
12	3900	-3888	40	238
4600	3900	700	41	238
2800	3900	-1100	41	239
2100	3900	-1800	41	240
26.2	3900	-3873.8	41	241
3590	3900	-310	41	242
3900	4000	-100	41	243
3700	4000	-300	41	244
3900	4000	-100	41	245
5000	4000	1000	42	245
5500	4000	1500	43	245
5400	4000	1400	44	245
3000	4000	-1000	44	246
9.8	4000	-3990.2	44	247
30	4000	-3970	44	248
12	4000	-3988	44	249
4600	4000	600	45	249
2800	4000	-1200	45	250
2100	4000	-1900	45	251
26.2	4000	-3973.8	45	252
3590	4000	-410	45	253
3700	3900	-200	45	254
3900	3900	0	45	254
5000	3900	1100	46	254
5500	3900	1600	47	254
5400	3900	1500	48	254
3000	3900	-900	48	255
9.8	3900	-3890.2	48	256
30	3900	-3870	48	257
12	3900	-3888	48	258
4600	3900	700	49	258
2800	3900	-1100	49	259
2100	3900	-1800	49	260
26.2	3900	-3873.8	49	261
3590	3900	-310	49	262
3900	3700	200	50	262
5000	3700	1300	51	262
5500	3700	1800	52	262
5400	3700	1700	53	262
3000	3700	-700	53	263
9.8	3700	-3690.2	53	264
30	3700	-3670	53	265
12	3700	-3688	53	266
4600	3700	900	54	266
2800	3700	-900	54	267
2100	3700	-1600	54	268
26.2	3700	-3673.8	54	269

3590	3700	-110	54	270
5000	3900	1100	55	270
5500	3900	1600	56	270
5400	3900	1500	57	270
3000	3900	-900	57	271
9.8	3900	-3890.2	57	272
30	3900	-3870	57	273
12	3900	-3888	57	274
4600	3900	700	58	274
2800	3900	-1100	58	275
2100	3900	-1800	58	276
26.2	3900	-3873.8	58	277
3590	3900	-310	58	278
5500	5000	500	59	278
5400	5000	400	60	278
3000	5000	-2000	60	279
9.8	5000	-4990.2	60	280
30	5000	-4970	60	281
12	5000	-4988	60	282
4600	5000	-400	60	283
2800	5000	-2200	60	284
2100	5000	-2900	60	285
26.2	5000	-4973.8	60	286
3590	5000	-1410	60	287
5400	5500	-100	60	288
3000	5500	-2500	60	289
9.8	5500	-5490.2	60	290
30	5500	-5470	60	291
12	5500	-5488	60	292
4600	5500	-900	60	293
2800	5500	-2700	60	294
2100	5500	-3400	60	295
26.2	5500	-5473.8	60	296
3590	5500	-1910	60	297
3000	5400	-2400	60	298
9.8	5400	-5390.2	60	299
30	5400	-5370	60	300
12	5400	-5388	60	301
4600	5400	-800	60	302
2800	5400	-2600	60	303
2100	5400	-3300	60	304
26.2	5400	-5373.8	60	305
3590	5400	-1810	60	306
9.8	3000	-2990.2	60	307
30	3000	-2970	60	308
12	3000	-2988	60	309
4600	3000	1600	61	309
2800	3000	-200	61	310
2100	3000	-900	61	311
26.2	3000	-2973.8	61	312
3590	3000	590	62	312
30	9.8	20.2	63	312
12	9.8	2.2	64	312

4600	9.8	4590.2	65	312
2800	9.8	2790.2	66	312
2100	9.8	2090.2	67	312
26.2	9.8	16.4	68	312
3590	9.8	3580.2	69	312
12	30	-18	69	313
4600	30	4570	70	313
2800	30	2770	71	313
2100	30	2070	72	313
26.2	30	-3.8	72	314
3590	30	3560	73	314
4600	12	4588	74	314
2800	12	2788	75	314
2100	12	2088	76	314
26.2	12	14.2	77	314
3590	12	3578	78	314
2800	4600	-1800	78	315
2100	4600	-2500	78	316
26.2	4600	-4573.8	78	317
3590	4600	-1010	78	318
2100	2800	-700	78	319
26.2	2800	-2773.8	78	320
3590	2800	790	79	320
26.2	2100	-2073.8	79	321
3590	2100	1490	80	321
3590	26.2	3563.8	81	321

S Statistic = 81 - 321 = -240

Tied Group Value	Members
1	5000	2
2	3900	3

Time Period	Observations
3/11/2008	1
5/10/2008	1
9/22/2008	1
12/3/2008	1
4/28/2009	1
5/15/2009	1
9/23/2009	1
12/7/2009	1
2/24/2010	1
4/16/2010	1
8/11/2010	1
11/22/2010	1
3/8/2011	1
5/23/2011	1
8/31/2011	1
4/11/2012	1
11/8/2012	1

4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/19/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 84
B = 0
C = 6
D = 0
E = 8
F = 0
a = 51156
b = 197316
c = 1624
Group Variance = 2837.33
Z-Score = -4.48686
Comparison Level at 95% confidence level = -1.65463 (downward trend)
-4.48686 < -1.65463 indicating a downward trend

Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: GCW-05

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
2600	2400	200	1	0
2600	2400	200	2	0
2500	2400	100	3	0
2500	2400	100	4	0
2500	2400	100	5	0
2600	2400	200	6	0
1400	2400	-1000	6	1
1700	2400	-700	6	2
1500	2400	-900	6	3
1100	2400	-1300	6	4
790	2400	-1610	6	5
640	2400	-1760	6	6
530	2400	-1870	6	7
460	2400	-1940	6	8
500	2400	-1900	6	9
500	2400	-1900	6	10
900	2400	-1500	6	11
1000	2400	-1400	6	12
350	2400	-2050	6	13
525	2400	-1875	6	14
2600	2600	0	6	14
2500	2600	-100	6	15
2500	2600	-100	6	16
2500	2600	-100	6	17
2600	2600	0	6	17
1400	2600	-1200	6	18
1700	2600	-900	6	19
1500	2600	-1100	6	20
1100	2600	-1500	6	21
790	2600	-1810	6	22
640	2600	-1960	6	23
530	2600	-2070	6	24
460	2600	-2140	6	25
500	2600	-2100	6	26
500	2600	-2100	6	27
900	2600	-1700	6	28
1000	2600	-1600	6	29
350	2600	-2250	6	30
525	2600	-2075	6	31
2500	2600	-100	6	32
2500	2600	-100	6	33
2500	2600	-100	6	34
2600	2600	0	6	34
1400	2600	-1200	6	35
1700	2600	-900	6	36

1500	2600	-1100	6	37
1100	2600	-1500	6	38
790	2600	-1810	6	39
640	2600	-1960	6	40
530	2600	-2070	6	41
460	2600	-2140	6	42
500	2600	-2100	6	43
500	2600	-2100	6	44
900	2600	-1700	6	45
1000	2600	-1600	6	46
350	2600	-2250	6	47
525	2600	-2075	6	48
2500	2500	0	6	48
2500	2500	0	6	48
2600	2500	100	7	48
1400	2500	-1100	7	49
1700	2500	-800	7	50
1500	2500	-1000	7	51
1100	2500	-1400	7	52
790	2500	-1710	7	53
640	2500	-1860	7	54
530	2500	-1970	7	55
460	2500	-2040	7	56
500	2500	-2000	7	57
500	2500	-2000	7	58
900	2500	-1600	7	59
1000	2500	-1500	7	60
350	2500	-2150	7	61
525	2500	-1975	7	62
2500	2500	0	7	62
2600	2500	100	8	62
1400	2500	-1100	8	63
1700	2500	-800	8	64
1500	2500	-1000	8	65
1100	2500	-1400	8	66
790	2500	-1710	8	67
640	2500	-1860	8	68
530	2500	-1970	8	69
460	2500	-2040	8	70
500	2500	-2000	8	71
500	2500	-2000	8	72
900	2500	-1600	8	73
1000	2500	-1500	8	74
350	2500	-2150	8	75
525	2500	-1975	8	76
2600	2500	100	9	76
1400	2500	-1100	9	77
1700	2500	-800	9	78
1500	2500	-1000	9	79
1100	2500	-1400	9	80
790	2500	-1710	9	81
640	2500	-1860	9	82
530	2500	-1970	9	83
460	2500	-2040	9	84
500	2500	-2000	9	85
500	2500	-2000	9	86

900	2500	-1600	9	87
1000	2500	-1500	9	88
350	2500	-2150	9	89
525	2500	-1975	9	90
1400	2600	-1200	9	91
1700	2600	-900	9	92
1500	2600	-1100	9	93
1100	2600	-1500	9	94
790	2600	-1810	9	95
640	2600	-1960	9	96
530	2600	-2070	9	97
460	2600	-2140	9	98
500	2600	-2100	9	99
500	2600	-2100	9	100
900	2600	-1700	9	101
1000	2600	-1600	9	102
350	2600	-2250	9	103
525	2600	-2075	9	104
1700	1400	300	10	104
1500	1400	100	11	104
1100	1400	-300	11	105
790	1400	-610	11	106
640	1400	-760	11	107
530	1400	-870	11	108
460	1400	-940	11	109
500	1400	-900	11	110
500	1400	-900	11	111
900	1400	-500	11	112
1000	1400	-400	11	113
350	1400	-1050	11	114
525	1400	-875	11	115
1500	1700	-200	11	116
1100	1700	-600	11	117
790	1700	-910	11	118
640	1700	-1060	11	119
530	1700	-1170	11	120
460	1700	-1240	11	121
500	1700	-1200	11	122
500	1700	-1200	11	123
900	1700	-800	11	124
1000	1700	-700	11	125
350	1700	-1350	11	126
525	1700	-1175	11	127
1100	1500	-400	11	128
790	1500	-710	11	129
640	1500	-860	11	130
530	1500	-970	11	131
460	1500	-1040	11	132
500	1500	-1000	11	133
500	1500	-1000	11	134
900	1500	-600	11	135
1000	1500	-500	11	136
350	1500	-1150	11	137
525	1500	-975	11	138

790	1100	-310	11	139
640	1100	-460	11	140
530	1100	-570	11	141
460	1100	-640	11	142
500	1100	-600	11	143
500	1100	-600	11	144
900	1100	-200	11	145
1000	1100	-100	11	146
350	1100	-750	11	147
525	1100	-575	11	148
640	790	-150	11	149
530	790	-260	11	150
460	790	-330	11	151
500	790	-290	11	152
500	790	-290	11	153
900	790	110	12	153
1000	790	210	13	153
350	790	-440	13	154
525	790	-265	13	155
530	640	-110	13	156
460	640	-180	13	157
500	640	-140	13	158
500	640	-140	13	159
900	640	260	14	159
1000	640	360	15	159
350	640	-290	15	160
525	640	-115	15	161
460	530	-70	15	162
500	530	-30	15	163
500	530	-30	15	164
900	530	370	16	164
1000	530	470	17	164
350	530	-180	17	165
525	530	-5	17	166
500	460	40	18	166
500	460	40	19	166
900	460	440	20	166
1000	460	540	21	166
350	460	-110	21	167
525	460	65	22	167
500	500	0	22	167
900	500	400	23	167
1000	500	500	24	167
350	500	-150	24	168
525	500	25	25	168
900	500	400	26	168
1000	500	500	27	168
350	500	-150	27	169
525	500	25	28	169
1000	900	100	29	169
350	900	-550	29	170
525	900	-375	29	171

350	1000	-650	29	172
525	1000	-475	29	173
525	350	175	30	173

S Statistic = 30 - 173 = -143

Tied Group	Value	Members
1	2600	3
2	2500	3
3	500	2

Time Period	Observations
2/26/2010	1
4/14/2010	1
8/12/2010	1
11/22/2010	1
3/10/2011	1
5/23/2011	1
8/31/2011	1
4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/19/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 150
B = 0
C = 12
D = 0
E = 14
F = 0
a = 19740
b = 71820
c = 840
Group Variance = 1088.33
Z-Score = -4.30435
Comparison Level at 95% confidence level = -1.65463 (downward trend)
-4.30435 < -1.65463 indicating a downward trend

Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: OW-01A

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
91	240	-149	0	1
81	240	-159	0	2
61	240	-179	0	3
52	240	-188	0	4
60	240	-180	0	5
118	240	-122	0	6
85	240	-155	0	7
61	240	-179	0	8
51	240	-189	0	9
60	240	-180	0	10
53	240	-187	0	11
55	240	-185	0	12
56	240	-184	0	13
55	240	-185	0	14
53	240	-187	0	15
55	240	-185	0	16
56	240	-184	0	17
56	240	-184	0	18
53	240	-187	0	19
51	240	-189	0	20
54	240	-186	0	21
47	240	-193	0	22
45	240	-195	0	23
55	240	-185	0	24
57	240	-183	0	25
50	240	-190	0	26
48	240	-192	0	27
44	240	-196	0	28
39	240	-201	0	29
41	240	-199	0	30
46.7	240	-193.3	0	31
81	91	-10	0	32
61	91	-30	0	33
52	91	-39	0	34
60	91	-31	0	35
118	91	27	1	35
85	91	-6	1	36
61	91	-30	1	37
51	91	-40	1	38
60	91	-31	1	39
53	91	-38	1	40
55	91	-36	1	41
56	91	-35	1	42
55	91	-36	1	43
53	91	-38	1	44
55	91	-36	1	45

56	91	-35	1	46
56	91	-35	1	47
53	91	-38	1	48
51	91	-40	1	49
54	91	-37	1	50
47	91	-44	1	51
45	91	-46	1	52
55	91	-36	1	53
57	91	-34	1	54
50	91	-41	1	55
48	91	-43	1	56
44	91	-47	1	57
39	91	-52	1	58
41	91	-50	1	59
46.7	91	-44.3	1	60
61	81	-20	1	61
52	81	-29	1	62
60	81	-21	1	63
118	81	37	2	63
85	81	4	3	63
61	81	-20	3	64
51	81	-30	3	65
60	81	-21	3	66
53	81	-28	3	67
55	81	-26	3	68
56	81	-25	3	69
55	81	-26	3	70
53	81	-28	3	71
55	81	-26	3	72
56	81	-25	3	73
56	81	-25	3	74
53	81	-28	3	75
51	81	-30	3	76
54	81	-27	3	77
47	81	-34	3	78
45	81	-36	3	79
55	81	-26	3	80
57	81	-24	3	81
50	81	-31	3	82
48	81	-33	3	83
44	81	-37	3	84
39	81	-42	3	85
41	81	-40	3	86
46.7	81	-34.3	3	87
52	61	-9	3	88
60	61	-1	3	89
118	61	57	4	89
85	61	24	5	89
61	61	0	5	89
51	61	-10	5	90
60	61	-1	5	91
53	61	-8	5	92
55	61	-6	5	93
56	61	-5	5	94
55	61	-6	5	95
53	61	-8	5	96
55	61	-6	5	97

56	61	-5	5	98
56	61	-5	5	99
53	61	-8	5	100
51	61	-10	5	101
54	61	-7	5	102
47	61	-14	5	103
45	61	-16	5	104
55	61	-6	5	105
57	61	-4	5	106
50	61	-11	5	107
48	61	-13	5	108
44	61	-17	5	109
39	61	-22	5	110
41	61	-20	5	111
46.7	61	-14.3	5	112
60	52	8	6	112
118	52	66	7	112
85	52	33	8	112
61	52	9	9	112
51	52	-1	9	113
60	52	8	10	113
53	52	1	11	113
55	52	3	12	113
56	52	4	13	113
55	52	3	14	113
53	52	1	15	113
55	52	3	16	113
56	52	4	17	113
56	52	4	18	113
53	52	1	19	113
51	52	-1	19	114
54	52	2	20	114
47	52	-5	20	115
45	52	-7	20	116
55	52	3	21	116
57	52	5	22	116
50	52	-2	22	117
48	52	-4	22	118
44	52	-8	22	119
39	52	-13	22	120
41	52	-11	22	121
46.7	52	-5.3	22	122
118	60	58	23	122
85	60	25	24	122
61	60	1	25	122
51	60	-9	25	123
60	60	0	25	123
53	60	-7	25	124
55	60	-5	25	125
56	60	-4	25	126
55	60	-5	25	127
53	60	-7	25	128
55	60	-5	25	129
56	60	-4	25	130
56	60	-4	25	131
53	60	-7	25	132
51	60	-9	25	133

54	60	-6	25	134
47	60	-13	25	135
45	60	-15	25	136
55	60	-5	25	137
57	60	-3	25	138
50	60	-10	25	139
48	60	-12	25	140
44	60	-16	25	141
39	60	-21	25	142
41	60	-19	25	143
46.7	60	-13.3	25	144
85	118	-33	25	145
61	118	-57	25	146
51	118	-67	25	147
60	118	-58	25	148
53	118	-65	25	149
55	118	-63	25	150
56	118	-62	25	151
55	118	-63	25	152
53	118	-65	25	153
55	118	-63	25	154
56	118	-62	25	155
56	118	-62	25	156
53	118	-65	25	157
51	118	-67	25	158
54	118	-64	25	159
47	118	-71	25	160
45	118	-73	25	161
55	118	-63	25	162
57	118	-61	25	163
50	118	-68	25	164
48	118	-70	25	165
44	118	-74	25	166
39	118	-79	25	167
41	118	-77	25	168
46.7	118	-71.3	25	169
61	85	-24	25	170
51	85	-34	25	171
60	85	-25	25	172
53	85	-32	25	173
55	85	-30	25	174
56	85	-29	25	175
55	85	-30	25	176
53	85	-32	25	177
55	85	-30	25	178
56	85	-29	25	179
56	85	-29	25	180
53	85	-32	25	181
51	85	-34	25	182
54	85	-31	25	183
47	85	-38	25	184
45	85	-40	25	185
55	85	-30	25	186
57	85	-28	25	187
50	85	-35	25	188
48	85	-37	25	189
44	85	-41	25	190

39	85	-46	25	191
41	85	-44	25	192
46.7	85	-38.3	25	193
51	61	-10	25	194
60	61	-1	25	195
53	61	-8	25	196
55	61	-6	25	197
56	61	-5	25	198
55	61	-6	25	199
53	61	-8	25	200
55	61	-6	25	201
56	61	-5	25	202
56	61	-5	25	203
53	61	-8	25	204
51	61	-10	25	205
54	61	-7	25	206
47	61	-14	25	207
45	61	-16	25	208
55	61	-6	25	209
57	61	-4	25	210
50	61	-11	25	211
48	61	-13	25	212
44	61	-17	25	213
39	61	-22	25	214
41	61	-20	25	215
46.7	61	-14.3	25	216
60	51	9	26	216
53	51	2	27	216
55	51	4	28	216
56	51	5	29	216
55	51	4	30	216
53	51	2	31	216
55	51	4	32	216
56	51	5	33	216
56	51	5	34	216
53	51	2	35	216
51	51	0	35	216
54	51	3	36	216
47	51	-4	36	217
45	51	-6	36	218
55	51	4	37	218
57	51	6	38	218
50	51	-1	38	219
48	51	-3	38	220
44	51	-7	38	221
39	51	-12	38	222
41	51	-10	38	223
46.7	51	-4.3	38	224
53	60	-7	38	225
55	60	-5	38	226
56	60	-4	38	227
55	60	-5	38	228
53	60	-7	38	229
55	60	-5	38	230
56	60	-4	38	231
56	60	-4	38	232

53	60	-7	38	233
51	60	-9	38	234
54	60	-6	38	235
47	60	-13	38	236
45	60	-15	38	237
55	60	-5	38	238
57	60	-3	38	239
50	60	-10	38	240
48	60	-12	38	241
44	60	-16	38	242
39	60	-21	38	243
41	60	-19	38	244
46.7	60	-13.3	38	245
55	53	2	39	245
56	53	3	40	245
55	53	2	41	245
53	53	0	41	245
55	53	2	42	245
56	53	3	43	245
56	53	3	44	245
53	53	0	44	245
51	53	-2	44	246
54	53	1	45	246
47	53	-6	45	247
45	53	-8	45	248
55	53	2	46	248
57	53	4	47	248
50	53	-3	47	249
48	53	-5	47	250
44	53	-9	47	251
39	53	-14	47	252
41	53	-12	47	253
46.7	53	-6.3	47	254
56	55	1	48	254
55	55	0	48	254
53	55	-2	48	255
55	55	0	48	255
56	55	1	49	255
56	55	1	50	255
53	55	-2	50	256
51	55	-4	50	257
54	55	-1	50	258
47	55	-8	50	259
45	55	-10	50	260
55	55	0	50	260
57	55	2	51	260
50	55	-5	51	261
48	55	-7	51	262
44	55	-11	51	263
39	55	-16	51	264
41	55	-14	51	265
46.7	55	-8.3	51	266
55	56	-1	51	267
53	56	-3	51	268
55	56	-1	51	269
56	56	0	51	269

56	56	0	51	269
53	56	-3	51	270
51	56	-5	51	271
54	56	-2	51	272
47	56	-9	51	273
45	56	-11	51	274
55	56	-1	51	275
57	56	1	52	275
50	56	-6	52	276
48	56	-8	52	277
44	56	-12	52	278
39	56	-17	52	279
41	56	-15	52	280
46.7	56	-9.3	52	281
53	55	-2	52	282
55	55	0	52	282
56	55	1	53	282
56	55	1	54	282
53	55	-2	54	283
51	55	-4	54	284
54	55	-1	54	285
47	55	-8	54	286
45	55	-10	54	287
55	55	0	54	287
57	55	2	55	287
50	55	-5	55	288
48	55	-7	55	289
44	55	-11	55	290
39	55	-16	55	291
41	55	-14	55	292
46.7	55	-8.3	55	293
55	53	2	56	293
56	53	3	57	293
56	53	3	58	293
53	53	0	58	293
51	53	-2	58	294
54	53	1	59	294
47	53	-6	59	295
45	53	-8	59	296
55	53	2	60	296
57	53	4	61	296
50	53	-3	61	297
48	53	-5	61	298
44	53	-9	61	299
39	53	-14	61	300
41	53	-12	61	301
46.7	53	-6.3	61	302
56	55	1	62	302
56	55	1	63	302
53	55	-2	63	303
51	55	-4	63	304
54	55	-1	63	305
47	55	-8	63	306
45	55	-10	63	307
55	55	0	63	307
57	55	2	64	307

50	55	-5	64	308
48	55	-7	64	309
44	55	-11	64	310
39	55	-16	64	311
41	55	-14	64	312
46.7	55	-8.3	64	313
56	56	0	64	313
53	56	-3	64	314
51	56	-5	64	315
54	56	-2	64	316
47	56	-9	64	317
45	56	-11	64	318
55	56	-1	64	319
57	56	1	65	319
50	56	-6	65	320
48	56	-8	65	321
44	56	-12	65	322
39	56	-17	65	323
41	56	-15	65	324
46.7	56	-9.3	65	325
53	56	-3	65	326
51	56	-5	65	327
54	56	-2	65	328
47	56	-9	65	329
45	56	-11	65	330
55	56	-1	65	331
57	56	1	66	331
50	56	-6	66	332
48	56	-8	66	333
44	56	-12	66	334
39	56	-17	66	335
41	56	-15	66	336
46.7	56	-9.3	66	337
51	53	-2	66	338
54	53	1	67	338
47	53	-6	67	339
45	53	-8	67	340
55	53	2	68	340
57	53	4	69	340
50	53	-3	69	341
48	53	-5	69	342
44	53	-9	69	343
39	53	-14	69	344
41	53	-12	69	345
46.7	53	-6.3	69	346
54	51	3	70	346
47	51	-4	70	347
45	51	-6	70	348
55	51	4	71	348
57	51	6	72	348
50	51	-1	72	349
48	51	-3	72	350
44	51	-7	72	351
39	51	-12	72	352
41	51	-10	72	353

46.7	51	-4.3	72	354
47	54	-7	72	355
45	54	-9	72	356
55	54	1	73	356
57	54	3	74	356
50	54	-4	74	357
48	54	-6	74	358
44	54	-10	74	359
39	54	-15	74	360
41	54	-13	74	361
46.7	54	-7.3	74	362
45	47	-2	74	363
55	47	8	75	363
57	47	10	76	363
50	47	3	77	363
48	47	1	78	363
44	47	-3	78	364
39	47	-8	78	365
41	47	-6	78	366
46.7	47	-0.3	78	367
55	45	10	79	367
57	45	12	80	367
50	45	5	81	367
48	45	3	82	367
44	45	-1	82	368
39	45	-6	82	369
41	45	-4	82	370
46.7	45	1.7	83	370
57	55	2	84	370
50	55	-5	84	371
48	55	-7	84	372
44	55	-11	84	373
39	55	-16	84	374
41	55	-14	84	375
46.7	55	-8.3	84	376
50	57	-7	84	377
48	57	-9	84	378
44	57	-13	84	379
39	57	-18	84	380
41	57	-16	84	381
46.7	57	-10.3	84	382
48	50	-2	84	383
44	50	-6	84	384
39	50	-11	84	385
41	50	-9	84	386
46.7	50	-3.3	84	387
44	48	-4	84	388
39	48	-9	84	389
41	48	-7	84	390
46.7	48	-1.3	84	391
39	44	-5	84	392

41	44	-3	84	393
46.7	44	2.7	85	393
41	39	2	86	393
46.7	39	7.7	87	393
46.7	41	5.7	88	393

S Statistic = 88 - 393 = -305

Tied Group	Value	Members
1	61	2
2	60	2
3	51	2
4	53	3
5	55	4
6	56	3

Time Period	Observations
11/1/1998	1
6/1/2005	1
2/1/2006	1
3/12/2008	1
5/13/2008	1
9/23/2008	1
10/29/2008	1
4/29/2009	1
5/13/2009	1
9/29/2009	1
12/8/2009	1
2/26/2010	1
4/14/2010	1
8/12/2010	1
11/22/2010	1
3/10/2011	1
5/25/2011	1
9/2/2011	1
4/13/2012	1
11/9/2012	1
4/22/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/26/2018	1

There are 0 time periods with multiple data

A = 342
B = 0
C = 36
D = 0

E = 30
F = 0
a = 68448
b = 267840
c = 1984
Group Variance = 3783.67
Z-Score = -4.94216
Comparison Level at 95% confidence level = -1.65463 (downward trend)
-4.94216 < -1.65463 indicating a downward trend

Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: SW-02

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
1200	915	285	1	0
1000	915	85	2	0
930	915	15	3	0
900	915	-15	3	1
1100	915	185	4	1
1100	915	185	5	1
500	915	-415	5	2
1000	915	85	6	2
1300	915	385	7	2
1200	915	285	8	2
3100	915	2185	9	2
990	915	75	10	2
1500	915	585	11	2
7300	915	6385	12	2
1600	915	685	13	2
1400	915	485	14	2
1100	915	185	15	2
2200	915	1285	16	2
1100	915	185	17	2
840	915	-75	17	3
830	915	-85	17	4
737	915	-178	17	5
1240	915	325	18	5
1000	1200	-200	18	6
930	1200	-270	18	7
900	1200	-300	18	8
1100	1200	-100	18	9
1100	1200	-100	18	10
500	1200	-700	18	11
1000	1200	-200	18	12
1300	1200	100	19	12
1200	1200	0	19	12
3100	1200	1900	20	12
990	1200	-210	20	13
1500	1200	300	21	13
7300	1200	6100	22	13
1600	1200	400	23	13
1400	1200	200	24	13
1100	1200	-100	24	14
2200	1200	1000	25	14
1100	1200	-100	25	15
840	1200	-360	25	16
830	1200	-370	25	17
737	1200	-463	25	18
1240	1200	40	26	18

930	1000	-70	26	19
900	1000	-100	26	20
1100	1000	100	27	20
1100	1000	100	28	20
500	1000	-500	28	21
1000	1000	0	28	21
1300	1000	300	29	21
1200	1000	200	30	21
3100	1000	2100	31	21
990	1000	-10	31	22
1500	1000	500	32	22
7300	1000	6300	33	22
1600	1000	600	34	22
1400	1000	400	35	22
1100	1000	100	36	22
2200	1000	1200	37	22
1100	1000	100	38	22
840	1000	-160	38	23
830	1000	-170	38	24
737	1000	-263	38	25
1240	1000	240	39	25
900	930	-30	39	26
1100	930	170	40	26
1100	930	170	41	26
500	930	-430	41	27
1000	930	70	42	27
1300	930	370	43	27
1200	930	270	44	27
3100	930	2170	45	27
990	930	60	46	27
1500	930	570	47	27
7300	930	6370	48	27
1600	930	670	49	27
1400	930	470	50	27
1100	930	170	51	27
2200	930	1270	52	27
1100	930	170	53	27
840	930	-90	53	28
830	930	-100	53	29
737	930	-193	53	30
1240	930	310	54	30
1100	900	200	55	30
1100	900	200	56	30
500	900	-400	56	31
1000	900	100	57	31
1300	900	400	58	31
1200	900	300	59	31
3100	900	2200	60	31
990	900	90	61	31
1500	900	600	62	31
7300	900	6400	63	31
1600	900	700	64	31
1400	900	500	65	31
1100	900	200	66	31
2200	900	1300	67	31
1100	900	200	68	31
840	900	-60	68	32

830	900	-70	68	33
737	900	-163	68	34
1240	900	340	69	34
1100	1100	0	69	34
500	1100	-600	69	35
1000	1100	-100	69	36
1300	1100	200	70	36
1200	1100	100	71	36
3100	1100	2000	72	36
990	1100	-110	72	37
1500	1100	400	73	37
7300	1100	6200	74	37
1600	1100	500	75	37
1400	1100	300	76	37
1100	1100	0	76	37
2200	1100	1100	77	37
1100	1100	0	77	37
840	1100	-260	77	38
830	1100	-270	77	39
737	1100	-363	77	40
1240	1100	140	78	40
500	1100	-600	78	41
1000	1100	-100	78	42
1300	1100	200	79	42
1200	1100	100	80	42
3100	1100	2000	81	42
990	1100	-110	81	43
1500	1100	400	82	43
7300	1100	6200	83	43
1600	1100	500	84	43
1400	1100	300	85	43
1100	1100	0	85	43
2200	1100	1100	86	43
1100	1100	0	86	43
840	1100	-260	86	44
830	1100	-270	86	45
737	1100	-363	86	46
1240	1100	140	87	46
1000	500	500	88	46
1300	500	800	89	46
1200	500	700	90	46
3100	500	2600	91	46
990	500	490	92	46
1500	500	1000	93	46
7300	500	6800	94	46
1600	500	1100	95	46
1400	500	900	96	46
1100	500	600	97	46
2200	500	1700	98	46
1100	500	600	99	46
840	500	340	100	46
830	500	330	101	46
737	500	237	102	46
1240	500	740	103	46
1300	1000	300	104	46

1200	1000	200	105	46
3100	1000	2100	106	46
990	1000	-10	106	47
1500	1000	500	107	47
7300	1000	6300	108	47
1600	1000	600	109	47
1400	1000	400	110	47
1100	1000	100	111	47
2200	1000	1200	112	47
1100	1000	100	113	47
840	1000	-160	113	48
830	1000	-170	113	49
737	1000	-263	113	50
1240	1000	240	114	50
1200	1300	-100	114	51
3100	1300	1800	115	51
990	1300	-310	115	52
1500	1300	200	116	52
7300	1300	6000	117	52
1600	1300	300	118	52
1400	1300	100	119	52
1100	1300	-200	119	53
2200	1300	900	120	53
1100	1300	-200	120	54
840	1300	-460	120	55
830	1300	-470	120	56
737	1300	-563	120	57
1240	1300	-60	120	58
3100	1200	1900	121	58
990	1200	-210	121	59
1500	1200	300	122	59
7300	1200	6100	123	59
1600	1200	400	124	59
1400	1200	200	125	59
1100	1200	-100	125	60
2200	1200	1000	126	60
1100	1200	-100	126	61
840	1200	-360	126	62
830	1200	-370	126	63
737	1200	-463	126	64
1240	1200	40	127	64
990	3100	-2110	127	65
1500	3100	-1600	127	66
7300	3100	4200	128	66
1600	3100	-1500	128	67
1400	3100	-1700	128	68
1100	3100	-2000	128	69
2200	3100	-900	128	70
1100	3100	-2000	128	71
840	3100	-2260	128	72
830	3100	-2270	128	73
737	3100	-2363	128	74
1240	3100	-1860	128	75
1500	990	510	129	75
7300	990	6310	130	75

1600	990	610	131	75
1400	990	410	132	75
1100	990	110	133	75
2200	990	1210	134	75
1100	990	110	135	75
840	990	-150	135	76
830	990	-160	135	77
737	990	-253	135	78
1240	990	250	136	78
7300	1500	5800	137	78
1600	1500	100	138	78
1400	1500	-100	138	79
1100	1500	-400	138	80
2200	1500	700	139	80
1100	1500	-400	139	81
840	1500	-660	139	82
830	1500	-670	139	83
737	1500	-763	139	84
1240	1500	-260	139	85
1600	7300	-5700	139	86
1400	7300	-5900	139	87
1100	7300	-6200	139	88
2200	7300	-5100	139	89
1100	7300	-6200	139	90
840	7300	-6460	139	91
830	7300	-6470	139	92
737	7300	-6563	139	93
1240	7300	-6060	139	94
1400	1600	-200	139	95
1100	1600	-500	139	96
2200	1600	600	140	96
1100	1600	-500	140	97
840	1600	-760	140	98
830	1600	-770	140	99
737	1600	-863	140	100
1240	1600	-360	140	101
1100	1400	-300	140	102
2200	1400	800	141	102
1100	1400	-300	141	103
840	1400	-560	141	104
830	1400	-570	141	105
737	1400	-663	141	106
1240	1400	-160	141	107
2200	1100	1100	142	107
1100	1100	0	142	107
840	1100	-260	142	108
830	1100	-270	142	109
737	1100	-363	142	110
1240	1100	140	143	110
1100	2200	-1100	143	111
840	2200	-1360	143	112
830	2200	-1370	143	113
737	2200	-1463	143	114

1240	2200	-960	143	115
840	1100	Same Date	143	115
830	1100	-270	143	116
737	1100	-363	143	117
1240	1100	140	144	117
830	840	-10	144	118
737	840	-103	144	119
1240	840	400	145	119
737	830	-93	145	120
1240	830	410	146	120
1240	737	503	147	120

S Statistic = 147 - 120 = 27

Tied Group	Value	Members
1	1200	2
2	1000	2
3	1100	4

Time Period	Observations
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/17/2014	1
10/29/2014	1
10/23/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	2
10/5/2017	1
4/4/2018	1
10/25/2018	1

There are 1 time periods with multiple data

A = 192
B = 18
C = 24
D = 0
E = 16
F = 2
a = 29256
b = 109296

c = 1104
Group Variance = 1613.7
Z-Score = 0.647236
Comparison Level at 95% confidence level = -1.65463 (downward trend)
0.647236 >= -1.65463 indicating no evidence of a downward trend

Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: SW-02

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
1200	915	285	1	0
1000	915	85	2	0
930	915	15	3	0
900	915	-15	3	1
1100	915	185	4	1
1100	915	185	5	1
500	915	-415	5	2
1000	915	85	6	2
1300	915	385	7	2
1200	915	285	8	2
3100	915	2185	9	2
990	915	75	10	2
1500	915	585	11	2
7300	915	6385	12	2
1600	915	685	13	2
1400	915	485	14	2
1100	915	185	15	2
2200	915	1285	16	2
1100	915	185	17	2
840	915	-75	17	3
830	915	-85	17	4
737	915	-178	17	5
1240	915	325	18	5
1000	1200	-200	18	6
930	1200	-270	18	7
900	1200	-300	18	8
1100	1200	-100	18	9
1100	1200	-100	18	10
500	1200	-700	18	11
1000	1200	-200	18	12
1300	1200	100	19	12
1200	1200	0	19	12
3100	1200	1900	20	12
990	1200	-210	20	13
1500	1200	300	21	13
7300	1200	6100	22	13
1600	1200	400	23	13
1400	1200	200	24	13
1100	1200	-100	24	14
2200	1200	1000	25	14
1100	1200	-100	25	15
840	1200	-360	25	16
830	1200	-370	25	17
737	1200	-463	25	18
1240	1200	40	26	18

930	1000	-70	26	19
900	1000	-100	26	20
1100	1000	100	27	20
1100	1000	100	28	20
500	1000	-500	28	21
1000	1000	0	28	21
1300	1000	300	29	21
1200	1000	200	30	21
3100	1000	2100	31	21
990	1000	-10	31	22
1500	1000	500	32	22
7300	1000	6300	33	22
1600	1000	600	34	22
1400	1000	400	35	22
1100	1000	100	36	22
2200	1000	1200	37	22
1100	1000	100	38	22
840	1000	-160	38	23
830	1000	-170	38	24
737	1000	-263	38	25
1240	1000	240	39	25
900	930	-30	39	26
1100	930	170	40	26
1100	930	170	41	26
500	930	-430	41	27
1000	930	70	42	27
1300	930	370	43	27
1200	930	270	44	27
3100	930	2170	45	27
990	930	60	46	27
1500	930	570	47	27
7300	930	6370	48	27
1600	930	670	49	27
1400	930	470	50	27
1100	930	170	51	27
2200	930	1270	52	27
1100	930	170	53	27
840	930	-90	53	28
830	930	-100	53	29
737	930	-193	53	30
1240	930	310	54	30
1100	900	200	55	30
1100	900	200	56	30
500	900	-400	56	31
1000	900	100	57	31
1300	900	400	58	31
1200	900	300	59	31
3100	900	2200	60	31
990	900	90	61	31
1500	900	600	62	31
7300	900	6400	63	31
1600	900	700	64	31
1400	900	500	65	31
1100	900	200	66	31
2200	900	1300	67	31
1100	900	200	68	31
840	900	-60	68	32

830	900	-70	68	33
737	900	-163	68	34
1240	900	340	69	34
1100	1100	0	69	34
500	1100	-600	69	35
1000	1100	-100	69	36
1300	1100	200	70	36
1200	1100	100	71	36
3100	1100	2000	72	36
990	1100	-110	72	37
1500	1100	400	73	37
7300	1100	6200	74	37
1600	1100	500	75	37
1400	1100	300	76	37
1100	1100	0	76	37
2200	1100	1100	77	37
1100	1100	0	77	37
840	1100	-260	77	38
830	1100	-270	77	39
737	1100	-363	77	40
1240	1100	140	78	40
500	1100	-600	78	41
1000	1100	-100	78	42
1300	1100	200	79	42
1200	1100	100	80	42
3100	1100	2000	81	42
990	1100	-110	81	43
1500	1100	400	82	43
7300	1100	6200	83	43
1600	1100	500	84	43
1400	1100	300	85	43
1100	1100	0	85	43
2200	1100	1100	86	43
1100	1100	0	86	43
840	1100	-260	86	44
830	1100	-270	86	45
737	1100	-363	86	46
1240	1100	140	87	46
1000	500	500	88	46
1300	500	800	89	46
1200	500	700	90	46
3100	500	2600	91	46
990	500	490	92	46
1500	500	1000	93	46
7300	500	6800	94	46
1600	500	1100	95	46
1400	500	900	96	46
1100	500	600	97	46
2200	500	1700	98	46
1100	500	600	99	46
840	500	340	100	46
830	500	330	101	46
737	500	237	102	46
1240	500	740	103	46
1300	1000	300	104	46

1200	1000	200	105	46
3100	1000	2100	106	46
990	1000	-10	106	47
1500	1000	500	107	47
7300	1000	6300	108	47
1600	1000	600	109	47
1400	1000	400	110	47
1100	1000	100	111	47
2200	1000	1200	112	47
1100	1000	100	113	47
840	1000	-160	113	48
830	1000	-170	113	49
737	1000	-263	113	50
1240	1000	240	114	50
1200	1300	-100	114	51
3100	1300	1800	115	51
990	1300	-310	115	52
1500	1300	200	116	52
7300	1300	6000	117	52
1600	1300	300	118	52
1400	1300	100	119	52
1100	1300	-200	119	53
2200	1300	900	120	53
1100	1300	-200	120	54
840	1300	-460	120	55
830	1300	-470	120	56
737	1300	-563	120	57
1240	1300	-60	120	58
3100	1200	1900	121	58
990	1200	-210	121	59
1500	1200	300	122	59
7300	1200	6100	123	59
1600	1200	400	124	59
1400	1200	200	125	59
1100	1200	-100	125	60
2200	1200	1000	126	60
1100	1200	-100	126	61
840	1200	-360	126	62
830	1200	-370	126	63
737	1200	-463	126	64
1240	1200	40	127	64
990	3100	-2110	127	65
1500	3100	-1600	127	66
7300	3100	4200	128	66
1600	3100	-1500	128	67
1400	3100	-1700	128	68
1100	3100	-2000	128	69
2200	3100	-900	128	70
1100	3100	-2000	128	71
840	3100	-2260	128	72
830	3100	-2270	128	73
737	3100	-2363	128	74
1240	3100	-1860	128	75
1500	990	510	129	75
7300	990	6310	130	75

1600	990	610	131	75
1400	990	410	132	75
1100	990	110	133	75
2200	990	1210	134	75
1100	990	110	135	75
840	990	-150	135	76
830	990	-160	135	77
737	990	-253	135	78
1240	990	250	136	78
7300	1500	5800	137	78
1600	1500	100	138	78
1400	1500	-100	138	79
1100	1500	-400	138	80
2200	1500	700	139	80
1100	1500	-400	139	81
840	1500	-660	139	82
830	1500	-670	139	83
737	1500	-763	139	84
1240	1500	-260	139	85
1600	7300	-5700	139	86
1400	7300	-5900	139	87
1100	7300	-6200	139	88
2200	7300	-5100	139	89
1100	7300	-6200	139	90
840	7300	-6460	139	91
830	7300	-6470	139	92
737	7300	-6563	139	93
1240	7300	-6060	139	94
1400	1600	-200	139	95
1100	1600	-500	139	96
2200	1600	600	140	96
1100	1600	-500	140	97
840	1600	-760	140	98
830	1600	-770	140	99
737	1600	-863	140	100
1240	1600	-360	140	101
1100	1400	-300	140	102
2200	1400	800	141	102
1100	1400	-300	141	103
840	1400	-560	141	104
830	1400	-570	141	105
737	1400	-663	141	106
1240	1400	-160	141	107
2200	1100	1100	142	107
1100	1100	0	142	107
840	1100	-260	142	108
830	1100	-270	142	109
737	1100	-363	142	110
1240	1100	140	143	110
1100	2200	-1100	143	111
840	2200	-1360	143	112
830	2200	-1370	143	113
737	2200	-1463	143	114

1240	2200	-960	143	115
840	1100	Same Date	143	115
830	1100	-270	143	116
737	1100	-363	143	117
1240	1100	140	144	117
830	840	-10	144	118
737	840	-103	144	119
1240	840	400	145	119
737	830	-93	145	120
1240	830	410	146	120
1240	737	503	147	120

S Statistic = 147 - 120 = 27

Tied Group	Value	Members
1	1200	2
2	1000	2
3	1100	4

Time Period	Observations
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/17/2014	1
10/29/2014	1
10/23/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	2
10/5/2017	1
4/4/2018	1
10/25/2018	1

There are 1 time periods with multiple data

A = 192
B = 18
C = 24
D = 0
E = 16
F = 2
a = 29256
b = 109296

c = 1104
Group Variance = 1613.7
Z-Score = 0.647236
Comparison Level at 95% confidence level = 1.65463 (upward trend)
0.647236 <= 1.65463 indicating no evidence of an upward trend

Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: SW-06

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
1200	1490	-290	0	1
1600	1490	110	1	1
500	1490	-990	1	2
1600	1490	110	2	2
1800	1490	310	3	2
1600	1490	110	4	2
790	1490	-700	4	3
1700	1490	210	5	3
1800	1490	310	6	3
1700	1490	210	7	3
2100	1490	610	8	3
1700	1490	210	9	3
2200	1490	710	10	3
1900	1490	410	11	3
2200	1490	710	12	3
2000	1490	510	13	3
2000	1490	510	14	3
320	1490	-1170	14	4
4600	1490	3110	15	4
1500	1490	10	16	4
1900	1490	410	17	4
1370	1490	-120	17	5
2010	1490	520	18	5
1600	1200	400	19	5
500	1200	-700	19	6
1600	1200	400	20	6
1800	1200	600	21	6
1600	1200	400	22	6
790	1200	-410	22	7
1700	1200	500	23	7
1800	1200	600	24	7
1700	1200	500	25	7
2100	1200	900	26	7
1700	1200	500	27	7
2200	1200	1000	28	7
1900	1200	700	29	7
2200	1200	1000	30	7
2000	1200	800	31	7
2000	1200	800	32	7
320	1200	-880	32	8
4600	1200	3400	33	8
1500	1200	300	34	8
1900	1200	700	35	8
1370	1200	170	36	8
2010	1200	810	37	8

500	1600	-1100	37	9
1600	1600	0	37	9
1800	1600	200	38	9
1600	1600	0	38	9
790	1600	-810	38	10
1700	1600	100	39	10
1800	1600	200	40	10
1700	1600	100	41	10
2100	1600	500	42	10
1700	1600	100	43	10
2200	1600	600	44	10
1900	1600	300	45	10
2200	1600	600	46	10
2000	1600	400	47	10
2000	1600	400	48	10
320	1600	-1280	48	11
4600	1600	3000	49	11
1500	1600	-100	49	12
1900	1600	300	50	12
1370	1600	-230	50	13
2010	1600	410	51	13
1600	500	1100	52	13
1800	500	1300	53	13
1600	500	1100	54	13
790	500	290	55	13
1700	500	1200	56	13
1800	500	1300	57	13
1700	500	1200	58	13
2100	500	1600	59	13
1700	500	1200	60	13
2200	500	1700	61	13
1900	500	1400	62	13
2200	500	1700	63	13
2000	500	1500	64	13
2000	500	1500	65	13
320	500	-180	65	14
4600	500	4100	66	14
1500	500	1000	67	14
1900	500	1400	68	14
1370	500	870	69	14
2010	500	1510	70	14
1800	1600	200	71	14
1600	1600	0	71	14
790	1600	-810	71	15
1700	1600	100	72	15
1800	1600	200	73	15
1700	1600	100	74	15
2100	1600	500	75	15
1700	1600	100	76	15
2200	1600	600	77	15
1900	1600	300	78	15
2200	1600	600	79	15
2000	1600	400	80	15
2000	1600	400	81	15
320	1600	-1280	81	16
4600	1600	3000	82	16
1500	1600	-100	82	17

1900	1600	300	83	17
1370	1600	-230	83	18
2010	1600	410	84	18
1600	1800	-200	84	19
790	1800	-1010	84	20
1700	1800	-100	84	21
1800	1800	0	84	21
1700	1800	-100	84	22
2100	1800	300	85	22
1700	1800	-100	85	23
2200	1800	400	86	23
1900	1800	100	87	23
2200	1800	400	88	23
2000	1800	200	89	23
2000	1800	200	90	23
320	1800	-1480	90	24
4600	1800	2800	91	24
1500	1800	-300	91	25
1900	1800	100	92	25
1370	1800	-430	92	26
2010	1800	210	93	26
790	1600	-810	93	27
1700	1600	100	94	27
1800	1600	200	95	27
1700	1600	100	96	27
2100	1600	500	97	27
1700	1600	100	98	27
2200	1600	600	99	27
1900	1600	300	100	27
2200	1600	600	101	27
2000	1600	400	102	27
2000	1600	400	103	27
320	1600	-1280	103	28
4600	1600	3000	104	28
1500	1600	-100	104	29
1900	1600	300	105	29
1370	1600	-230	105	30
2010	1600	410	106	30
1700	790	910	107	30
1800	790	1010	108	30
1700	790	910	109	30
2100	790	1310	110	30
1700	790	910	111	30
2200	790	1410	112	30
1900	790	1110	113	30
2200	790	1410	114	30
2000	790	1210	115	30
2000	790	1210	116	30
320	790	-470	116	31
4600	790	3810	117	31
1500	790	710	118	31
1900	790	1110	119	31
1370	790	580	120	31
2010	790	1220	121	31
1800	1700	100	122	31

1700	1700	0	122	31
2100	1700	400	123	31
1700	1700	0	123	31
2200	1700	500	124	31
1900	1700	200	125	31
2200	1700	500	126	31
2000	1700	300	127	31
2000	1700	300	128	31
320	1700	-1380	128	32
4600	1700	2900	129	32
1500	1700	-200	129	33
1900	1700	200	130	33
1370	1700	-330	130	34
2010	1700	310	131	34
1700	1800	-100	131	35
2100	1800	300	132	35
1700	1800	-100	132	36
2200	1800	400	133	36
1900	1800	100	134	36
2200	1800	400	135	36
2000	1800	200	136	36
2000	1800	200	137	36
320	1800	-1480	137	37
4600	1800	2800	138	37
1500	1800	-300	138	38
1900	1800	100	139	38
1370	1800	-430	139	39
2010	1800	210	140	39
2100	1700	400	141	39
1700	1700	0	141	39
2200	1700	500	142	39
1900	1700	200	143	39
2200	1700	500	144	39
2000	1700	300	145	39
2000	1700	300	146	39
320	1700	-1380	146	40
4600	1700	2900	147	40
1500	1700	-200	147	41
1900	1700	200	148	41
1370	1700	-330	148	42
2010	1700	310	149	42
1700	2100	-400	149	43
2200	2100	100	150	43
1900	2100	-200	150	44
2200	2100	100	151	44
2000	2100	-100	151	45
2000	2100	-100	151	46
320	2100	-1780	151	47
4600	2100	2500	152	47
1500	2100	-600	152	48
1900	2100	-200	152	49
1370	2100	-730	152	50
2010	2100	-90	152	51
2200	1700	500	153	51
1900	1700	200	154	51

2200	1700	500	155	51
2000	1700	300	156	51
2000	1700	300	157	51
320	1700	-1380	157	52
4600	1700	2900	158	52
1500	1700	-200	158	53
1900	1700	200	159	53
1370	1700	-330	159	54
2010	1700	310	160	54
1900	2200	-300	160	55
2200	2200	0	160	55
2000	2200	-200	160	56
2000	2200	-200	160	57
320	2200	-1880	160	58
4600	2200	2400	161	58
1500	2200	-700	161	59
1900	2200	-300	161	60
1370	2200	-830	161	61
2010	2200	-190	161	62
2200	1900	300	162	62
2000	1900	100	163	62
2000	1900	100	164	62
320	1900	-1580	164	63
4600	1900	2700	165	63
1500	1900	-400	165	64
1900	1900	0	165	64
1370	1900	-530	165	65
2010	1900	110	166	65
2000	2200	-200	166	66
2000	2200	-200	166	67
320	2200	-1880	166	68
4600	2200	2400	167	68
1500	2200	-700	167	69
1900	2200	-300	167	70
1370	2200	-830	167	71
2010	2200	-190	167	72
2000	2000	0	167	72
320	2000	-1680	167	73
4600	2000	2600	168	73
1500	2000	-500	168	74
1900	2000	-100	168	75
1370	2000	-630	168	76
2010	2000	10	169	76
320	2000	-1680	169	77
4600	2000	2600	170	77
1500	2000	-500	170	78
1900	2000	-100	170	79
1370	2000	-630	170	80
2010	2000	10	171	80
4600	320	4280	172	80
1500	320	1180	173	80
1900	320	1580	174	80
1370	320	1050	175	80

2010	320	1690	176	80
1500	4600	-3100	176	81
1900	4600	-2700	176	82
1370	4600	-3230	176	83
2010	4600	-2590	176	84
1900	1500	400	177	84
1370	1500	-130	177	85
2010	1500	510	178	85
1370	1900	-530	178	86
2010	1900	110	179	86
2010	1370	640	180	86

S Statistic = 180 - 86 = 94

Tied Group	Value	Members
1	1600	3
2	1800	2
3	1700	3
4	2200	2
5	1900	2
6	2000	2

Time Period	Observations
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/26/2010	1
4/15/2010	1
8/10/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/24/2013	1
11/13/2013	1
4/16/2014	1
10/29/2014	1
3/16/2015	1
10/22/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/24/2018	1

There are 0 time periods with multiple data

A = 204
B = 0
C = 12
D = 0

E = 20
F = 0
a = 29256
b = 109296
c = 1104
Group Variance = 1614
Z-Score = 2.31489
Comparison Level at 95% confidence level = 1.65463 (upward trend)
2.31489 > 1.65463 indicating an upward trend

Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: SW-07

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
490	436	54	1	0
590	436	154	2	0
200	436	-236	2	1
410	436	-26	2	2
490	436	54	3	2
480	436	44	4	2
190	436	-246	4	3
500	436	64	5	3
390	436	-46	5	4
570	436	134	6	4
590	436	154	7	4
510	436	74	8	4
540	436	104	9	4
440	436	4	10	4
98	436	-338	10	5
500	436	64	11	5
630	436	194	12	5
520	436	84	13	5
410	436	-26	13	6
450	436	14	14	6
450	436	14	15	6
434	436	-2	15	7
469	436	33	16	7
590	490	100	17	7
200	490	-290	17	8
410	490	-80	17	9
490	490	0	17	9
480	490	-10	17	10
190	490	-300	17	11
500	490	10	18	11
390	490	-100	18	12
570	490	80	19	12
590	490	100	20	12
510	490	20	21	12
540	490	50	22	12
440	490	-50	22	13
98	490	-392	22	14
500	490	10	23	14
630	490	140	24	14
520	490	30	25	14
410	490	-80	25	15
450	490	-40	25	16
450	490	-40	25	17
434	490	-56	25	18
469	490	-21	25	19

200	590	-390	25	20
410	590	-180	25	21
490	590	-100	25	22
480	590	-110	25	23
190	590	-400	25	24
500	590	-90	25	25
390	590	-200	25	26
570	590	-20	25	27
590	590	0	25	27
510	590	-80	25	28
540	590	-50	25	29
440	590	-150	25	30
98	590	-492	25	31
500	590	-90	25	32
630	590	40	26	32
520	590	-70	26	33
410	590	-180	26	34
450	590	-140	26	35
450	590	-140	26	36
434	590	-156	26	37
469	590	-121	26	38
410	200	210	27	38
490	200	290	28	38
480	200	280	29	38
190	200	-10	29	39
500	200	300	30	39
390	200	190	31	39
570	200	370	32	39
590	200	390	33	39
510	200	310	34	39
540	200	340	35	39
440	200	240	36	39
98	200	-102	36	40
500	200	300	37	40
630	200	430	38	40
520	200	320	39	40
410	200	210	40	40
450	200	250	41	40
450	200	250	42	40
434	200	234	43	40
469	200	269	44	40
490	410	80	45	40
480	410	70	46	40
190	410	-220	46	41
500	410	90	47	41
390	410	-20	47	42
570	410	160	48	42
590	410	180	49	42
510	410	100	50	42
540	410	130	51	42
440	410	30	52	42
98	410	-312	52	43
500	410	90	53	43
630	410	220	54	43
520	410	110	55	43
410	410	0	55	43
450	410	40	56	43

450	410	40	57	43
434	410	24	58	43
469	410	59	59	43
480	490	-10	59	44
190	490	-300	59	45
500	490	10	60	45
390	490	-100	60	46
570	490	80	61	46
590	490	100	62	46
510	490	20	63	46
540	490	50	64	46
440	490	-50	64	47
98	490	-392	64	48
500	490	10	65	48
630	490	140	66	48
520	490	30	67	48
410	490	-80	67	49
450	490	-40	67	50
450	490	-40	67	51
434	490	-56	67	52
469	490	-21	67	53
190	480	-290	67	54
500	480	20	68	54
390	480	-90	68	55
570	480	90	69	55
590	480	110	70	55
510	480	30	71	55
540	480	60	72	55
440	480	-40	72	56
98	480	-382	72	57
500	480	20	73	57
630	480	150	74	57
520	480	40	75	57
410	480	-70	75	58
450	480	-30	75	59
450	480	-30	75	60
434	480	-46	75	61
469	480	-11	75	62
500	190	310	76	62
390	190	200	77	62
570	190	380	78	62
590	190	400	79	62
510	190	320	80	62
540	190	350	81	62
440	190	250	82	62
98	190	-92	82	63
500	190	310	83	63
630	190	440	84	63
520	190	330	85	63
410	190	220	86	63
450	190	260	87	63
450	190	260	88	63
434	190	244	89	63
469	190	279	90	63
390	500	-110	90	64

570	500	70	91	64
590	500	90	92	64
510	500	10	93	64
540	500	40	94	64
440	500	-60	94	65
98	500	-402	94	66
500	500	0	94	66
630	500	130	95	66
520	500	20	96	66
410	500	-90	96	67
450	500	-50	96	68
450	500	-50	96	69
434	500	-66	96	70
469	500	-31	96	71
570	390	180	97	71
590	390	200	98	71
510	390	120	99	71
540	390	150	100	71
440	390	50	101	71
98	390	-292	101	72
500	390	110	102	72
630	390	240	103	72
520	390	130	104	72
410	390	20	105	72
450	390	60	106	72
450	390	60	107	72
434	390	44	108	72
469	390	79	109	72
590	570	20	110	72
510	570	-60	110	73
540	570	-30	110	74
440	570	-130	110	75
98	570	-472	110	76
500	570	-70	110	77
630	570	60	111	77
520	570	-50	111	78
410	570	-160	111	79
450	570	-120	111	80
450	570	-120	111	81
434	570	-136	111	82
469	570	-101	111	83
510	590	-80	111	84
540	590	-50	111	85
440	590	-150	111	86
98	590	-492	111	87
500	590	-90	111	88
630	590	40	112	88
520	590	-70	112	89
410	590	-180	112	90
450	590	-140	112	91
450	590	-140	112	92
434	590	-156	112	93
469	590	-121	112	94
540	510	30	113	94
440	510	-70	113	95

98	510	-412	113	96
500	510	-10	113	97
630	510	120	114	97
520	510	10	115	97
410	510	-100	115	98
450	510	-60	115	99
450	510	-60	115	100
434	510	-76	115	101
469	510	-41	115	102
440	540	-100	115	103
98	540	-442	115	104
500	540	-40	115	105
630	540	90	116	105
520	540	-20	116	106
410	540	-130	116	107
450	540	-90	116	108
450	540	-90	116	109
434	540	-106	116	110
469	540	-71	116	111
98	440	-342	116	112
500	440	60	117	112
630	440	190	118	112
520	440	80	119	112
410	440	-30	119	113
450	440	10	120	113
450	440	10	121	113
434	440	-6	121	114
469	440	29	122	114
500	98	402	123	114
630	98	532	124	114
520	98	422	125	114
410	98	312	126	114
450	98	352	127	114
450	98	352	128	114
434	98	336	129	114
469	98	371	130	114
630	500	130	131	114
520	500	20	132	114
410	500	-90	132	115
450	500	-50	132	116
450	500	-50	132	117
434	500	-66	132	118
469	500	-31	132	119
520	630	-110	132	120
410	630	-220	132	121
450	630	-180	132	122
450	630	-180	132	123
434	630	-196	132	124
469	630	-161	132	125
410	520	-110	132	126
450	520	-70	132	127
450	520	-70	132	128
434	520	-86	132	129

469	520	-51	132	130
450	410	40	133	130
450	410	40	134	130
434	410	24	135	130
469	410	59	136	130
450	450	0	136	130
434	450	-16	136	131
469	450	19	137	131
434	450	-16	137	132
469	450	19	138	132
469	434	35	139	132

S Statistic = 139 - 132 = 7

Tied Group	Value	Members
1	490	2
2	590	2
3	410	2
4	500	2
5	450	2

Time Period	Observations
2/15/2009	1
9/23/2009	1
12/7/2009	1
2/24/2010	1
4/15/2010	1
8/10/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/24/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1
10/24/2018	1

There are 0 time periods with multiple data

A = 90
B = 0
C = 0
D = 0
E = 10

F = 0
a = 29256
b = 109296
c = 1104
Group Variance = 1620.33
Z-Score = 0.149056
Comparison Level at 95% confidence level = -1.65463 (downward trend)
0.149056 >= -1.65463 indicating no evidence of a downward trend

Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: SW-07

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
490	436	54	1	0
590	436	154	2	0
200	436	-236	2	1
410	436	-26	2	2
490	436	54	3	2
480	436	44	4	2
190	436	-246	4	3
500	436	64	5	3
390	436	-46	5	4
570	436	134	6	4
590	436	154	7	4
510	436	74	8	4
540	436	104	9	4
440	436	4	10	4
98	436	-338	10	5
500	436	64	11	5
630	436	194	12	5
520	436	84	13	5
410	436	-26	13	6
450	436	14	14	6
450	436	14	15	6
434	436	-2	15	7
469	436	33	16	7
590	490	100	17	7
200	490	-290	17	8
410	490	-80	17	9
490	490	0	17	9
480	490	-10	17	10
190	490	-300	17	11
500	490	10	18	11
390	490	-100	18	12
570	490	80	19	12
590	490	100	20	12
510	490	20	21	12
540	490	50	22	12
440	490	-50	22	13
98	490	-392	22	14
500	490	10	23	14
630	490	140	24	14
520	490	30	25	14
410	490	-80	25	15
450	490	-40	25	16
450	490	-40	25	17
434	490	-56	25	18
469	490	-21	25	19

200	590	-390	25	20
410	590	-180	25	21
490	590	-100	25	22
480	590	-110	25	23
190	590	-400	25	24
500	590	-90	25	25
390	590	-200	25	26
570	590	-20	25	27
590	590	0	25	27
510	590	-80	25	28
540	590	-50	25	29
440	590	-150	25	30
98	590	-492	25	31
500	590	-90	25	32
630	590	40	26	32
520	590	-70	26	33
410	590	-180	26	34
450	590	-140	26	35
450	590	-140	26	36
434	590	-156	26	37
469	590	-121	26	38
410	200	210	27	38
490	200	290	28	38
480	200	280	29	38
190	200	-10	29	39
500	200	300	30	39
390	200	190	31	39
570	200	370	32	39
590	200	390	33	39
510	200	310	34	39
540	200	340	35	39
440	200	240	36	39
98	200	-102	36	40
500	200	300	37	40
630	200	430	38	40
520	200	320	39	40
410	200	210	40	40
450	200	250	41	40
450	200	250	42	40
434	200	234	43	40
469	200	269	44	40
490	410	80	45	40
480	410	70	46	40
190	410	-220	46	41
500	410	90	47	41
390	410	-20	47	42
570	410	160	48	42
590	410	180	49	42
510	410	100	50	42
540	410	130	51	42
440	410	30	52	42
98	410	-312	52	43
500	410	90	53	43
630	410	220	54	43
520	410	110	55	43
410	410	0	55	43
450	410	40	56	43

450	410	40	57	43
434	410	24	58	43
469	410	59	59	43
480	490	-10	59	44
190	490	-300	59	45
500	490	10	60	45
390	490	-100	60	46
570	490	80	61	46
590	490	100	62	46
510	490	20	63	46
540	490	50	64	46
440	490	-50	64	47
98	490	-392	64	48
500	490	10	65	48
630	490	140	66	48
520	490	30	67	48
410	490	-80	67	49
450	490	-40	67	50
450	490	-40	67	51
434	490	-56	67	52
469	490	-21	67	53
190	480	-290	67	54
500	480	20	68	54
390	480	-90	68	55
570	480	90	69	55
590	480	110	70	55
510	480	30	71	55
540	480	60	72	55
440	480	-40	72	56
98	480	-382	72	57
500	480	20	73	57
630	480	150	74	57
520	480	40	75	57
410	480	-70	75	58
450	480	-30	75	59
450	480	-30	75	60
434	480	-46	75	61
469	480	-11	75	62
500	190	310	76	62
390	190	200	77	62
570	190	380	78	62
590	190	400	79	62
510	190	320	80	62
540	190	350	81	62
440	190	250	82	62
98	190	-92	82	63
500	190	310	83	63
630	190	440	84	63
520	190	330	85	63
410	190	220	86	63
450	190	260	87	63
450	190	260	88	63
434	190	244	89	63
469	190	279	90	63
390	500	-110	90	64

570	500	70	91	64
590	500	90	92	64
510	500	10	93	64
540	500	40	94	64
440	500	-60	94	65
98	500	-402	94	66
500	500	0	94	66
630	500	130	95	66
520	500	20	96	66
410	500	-90	96	67
450	500	-50	96	68
450	500	-50	96	69
434	500	-66	96	70
469	500	-31	96	71
570	390	180	97	71
590	390	200	98	71
510	390	120	99	71
540	390	150	100	71
440	390	50	101	71
98	390	-292	101	72
500	390	110	102	72
630	390	240	103	72
520	390	130	104	72
410	390	20	105	72
450	390	60	106	72
450	390	60	107	72
434	390	44	108	72
469	390	79	109	72
590	570	20	110	72
510	570	-60	110	73
540	570	-30	110	74
440	570	-130	110	75
98	570	-472	110	76
500	570	-70	110	77
630	570	60	111	77
520	570	-50	111	78
410	570	-160	111	79
450	570	-120	111	80
450	570	-120	111	81
434	570	-136	111	82
469	570	-101	111	83
510	590	-80	111	84
540	590	-50	111	85
440	590	-150	111	86
98	590	-492	111	87
500	590	-90	111	88
630	590	40	112	88
520	590	-70	112	89
410	590	-180	112	90
450	590	-140	112	91
450	590	-140	112	92
434	590	-156	112	93
469	590	-121	112	94
540	510	30	113	94
440	510	-70	113	95

98	510	-412	113	96
500	510	-10	113	97
630	510	120	114	97
520	510	10	115	97
410	510	-100	115	98
450	510	-60	115	99
450	510	-60	115	100
434	510	-76	115	101
469	510	-41	115	102
440	540	-100	115	103
98	540	-442	115	104
500	540	-40	115	105
630	540	90	116	105
520	540	-20	116	106
410	540	-130	116	107
450	540	-90	116	108
450	540	-90	116	109
434	540	-106	116	110
469	540	-71	116	111
98	440	-342	116	112
500	440	60	117	112
630	440	190	118	112
520	440	80	119	112
410	440	-30	119	113
450	440	10	120	113
450	440	10	121	113
434	440	-6	121	114
469	440	29	122	114
500	98	402	123	114
630	98	532	124	114
520	98	422	125	114
410	98	312	126	114
450	98	352	127	114
450	98	352	128	114
434	98	336	129	114
469	98	371	130	114
630	500	130	131	114
520	500	20	132	114
410	500	-90	132	115
450	500	-50	132	116
450	500	-50	132	117
434	500	-66	132	118
469	500	-31	132	119
520	630	-110	132	120
410	630	-220	132	121
450	630	-180	132	122
450	630	-180	132	123
434	630	-196	132	124
469	630	-161	132	125
410	520	-110	132	126
450	520	-70	132	127
450	520	-70	132	128
434	520	-86	132	129

469	520	-51	132	130
450	410	40	133	130
450	410	40	134	130
434	410	24	135	130
469	410	59	136	130
450	450	0	136	130
434	450	-16	136	131
469	450	19	137	131
434	450	-16	137	132
469	450	19	138	132
469	434	35	139	132

S Statistic = 139 - 132 = 7

Tied Group	Value	Members
1	490	2
2	590	2
3	410	2
4	500	2
5	450	2

Time Period	Observations
2/15/2009	1
9/23/2009	1
12/7/2009	1
2/24/2010	1
4/15/2010	1
8/10/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/24/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1
10/24/2018	1

There are 0 time periods with multiple data

A = 90
B = 0
C = 0
D = 0
E = 10

F = 0
a = 29256
b = 109296
c = 1104
Group Variance = 1620.33
Z-Score = 0.149056
Comparison Level at 95% confidence level = 1.65463 (upward trend)
0.149056 <= 1.65463 indicating no evidence of an upward trend

Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: SW-09

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
140	21	119	1	0
81	21	60	2	0
64	21	43	3	0
72	21	51	4	0
83	21	62	5	0
96	21	75	6	0
ND<0	21	-21	6	1
97	21	76	7	1
170	21	149	8	1
130	21	109	9	1
62	21	41	10	1
17	21	-4	10	2
92	21	71	11	2
ND<0	21	-21	11	3
110	21	89	12	3
67	21	46	13	3
74	21	53	14	3
64	21	43	15	3
180	21	159	16	3
81	21	60	17	3
77	21	56	18	3
105	21	84	19	3
100	21	79	20	3
81	140	-59	20	4
64	140	-76	20	5
72	140	-68	20	6
83	140	-57	20	7
96	140	-44	20	8
ND<0	140	-140	20	9
97	140	-43	20	10
170	140	30	21	10
130	140	-10	21	11
62	140	-78	21	12
17	140	-123	21	13
92	140	-48	21	14
ND<0	140	-140	21	15
110	140	-30	21	16
67	140	-73	21	17
74	140	-66	21	18
64	140	-76	21	19
180	140	40	22	19
81	140	-59	22	20
77	140	-63	22	21
105	140	-35	22	22
100	140	-40	22	23

64	81	-17	22	24
72	81	-9	22	25
83	81	2	23	25
96	81	15	24	25
ND<0	81	-81	24	26
97	81	16	25	26
170	81	89	26	26
130	81	49	27	26
62	81	-19	27	27
17	81	-64	27	28
92	81	11	28	28
ND<0	81	-81	28	29
110	81	29	29	29
67	81	-14	29	30
74	81	-7	29	31
64	81	-17	29	32
180	81	99	30	32
81	81	0	30	32
77	81	-4	30	33
105	81	24	31	33
100	81	19	32	33
72	64	8	33	33
83	64	19	34	33
96	64	32	35	33
ND<0	64	-64	35	34
97	64	33	36	34
170	64	106	37	34
130	64	66	38	34
62	64	-2	38	35
17	64	-47	38	36
92	64	28	39	36
ND<0	64	-64	39	37
110	64	46	40	37
67	64	3	41	37
74	64	10	42	37
64	64	0	42	37
180	64	116	43	37
81	64	17	44	37
77	64	13	45	37
105	64	41	46	37
100	64	36	47	37
83	72	11	48	37
96	72	24	49	37
ND<0	72	-72	49	38
97	72	25	50	38
170	72	98	51	38
130	72	58	52	38
62	72	-10	52	39
17	72	-55	52	40
92	72	20	53	40
ND<0	72	-72	53	41
110	72	38	54	41
67	72	-5	54	42
74	72	2	55	42
64	72	-8	55	43
180	72	108	56	43
81	72	9	57	43

77	72	5	58	43
105	72	33	59	43
100	72	28	60	43
96	83	13	61	43
ND<0	83	-83	61	44
97	83	14	62	44
170	83	87	63	44
130	83	47	64	44
62	83	-21	64	45
17	83	-66	64	46
92	83	9	65	46
ND<0	83	-83	65	47
110	83	27	66	47
67	83	-16	66	48
74	83	-9	66	49
64	83	-19	66	50
180	83	97	67	50
81	83	-2	67	51
77	83	-6	67	52
105	83	22	68	52
100	83	17	69	52
ND<0	96	-96	69	53
97	96	1	70	53
170	96	74	71	53
130	96	34	72	53
62	96	-34	72	54
17	96	-79	72	55
92	96	-4	72	56
ND<0	96	-96	72	57
110	96	14	73	57
67	96	-29	73	58
74	96	-22	73	59
64	96	-32	73	60
180	96	84	74	60
81	96	-15	74	61
77	96	-19	74	62
105	96	9	75	62
100	96	4	76	62
97	ND<0	97	77	62
170	ND<0	170	78	62
130	ND<0	130	79	62
62	ND<0	62	80	62
17	ND<0	17	81	62
92	ND<0	92	82	62
ND<0	ND<0	0	82	62
110	ND<0	110	83	62
67	ND<0	67	84	62
74	ND<0	74	85	62
64	ND<0	64	86	62
180	ND<0	180	87	62
81	ND<0	81	88	62
77	ND<0	77	89	62
105	ND<0	105	90	62
100	ND<0	100	91	62
170	97	73	92	62

130	97	33	93	62
62	97	-35	93	63
17	97	-80	93	64
92	97	-5	93	65
ND<0	97	-97	93	66
110	97	13	94	66
67	97	-30	94	67
74	97	-23	94	68
64	97	-33	94	69
180	97	83	95	69
81	97	-16	95	70
77	97	-20	95	71
105	97	8	96	71
100	97	3	97	71
130	170	-40	97	72
62	170	-108	97	73
17	170	-153	97	74
92	170	-78	97	75
ND<0	170	-170	97	76
110	170	-60	97	77
67	170	-103	97	78
74	170	-96	97	79
64	170	-106	97	80
180	170	10	98	80
81	170	-89	98	81
77	170	-93	98	82
105	170	-65	98	83
100	170	-70	98	84
62	130	-68	98	85
17	130	-113	98	86
92	130	-38	98	87
ND<0	130	-130	98	88
110	130	-20	98	89
67	130	-63	98	90
74	130	-56	98	91
64	130	-66	98	92
180	130	50	99	92
81	130	-49	99	93
77	130	-53	99	94
105	130	-25	99	95
100	130	-30	99	96
17	62	-45	99	97
92	62	30	100	97
ND<0	62	-62	100	98
110	62	48	101	98
67	62	5	102	98
74	62	12	103	98
64	62	2	104	98
180	62	118	105	98
81	62	19	106	98
77	62	15	107	98
105	62	43	108	98
100	62	38	109	98
92	17	75	110	98
ND<0	17	-17	110	99

110	17	93	111	99
67	17	50	112	99
74	17	57	113	99
64	17	47	114	99
180	17	163	115	99
81	17	64	116	99
77	17	60	117	99
105	17	88	118	99
100	17	83	119	99
ND<0	92	-92	119	100
110	92	18	120	100
67	92	-25	120	101
74	92	-18	120	102
64	92	-28	120	103
180	92	88	121	103
81	92	-11	121	104
77	92	-15	121	105
105	92	13	122	105
100	92	8	123	105
110	ND<0	110	124	105
67	ND<0	67	125	105
74	ND<0	74	126	105
64	ND<0	64	127	105
180	ND<0	180	128	105
81	ND<0	81	129	105
77	ND<0	77	130	105
105	ND<0	105	131	105
100	ND<0	100	132	105
67	110	-43	132	106
74	110	-36	132	107
64	110	-46	132	108
180	110	70	133	108
81	110	-29	133	109
77	110	-33	133	110
105	110	-5	133	111
100	110	-10	133	112
74	67	7	134	112
64	67	-3	134	113
180	67	113	135	113
81	67	14	136	113
77	67	10	137	113
105	67	38	138	113
100	67	33	139	113
64	74	-10	139	114
180	74	106	140	114
81	74	7	141	114
77	74	3	142	114
105	74	31	143	114
100	74	26	144	114
180	64	116	145	114
81	64	17	146	114
77	64	13	147	114
105	64	41	148	114

100	64	36	149	114
81	180	-99	149	115
77	180	-103	149	116
105	180	-75	149	117
100	180	-80	149	118
77	81	-4	149	119
105	81	24	150	119
100	81	19	151	119
105	77	28	152	119
100	77	23	153	119
100	105	-5	153	120

S Statistic = 153 - 120 = 33

Tied Group	Value	Members
1	81	2
2	64	2
3	0	2

Time Period	Observations
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/25/2010	1
4/15/2010	1
8/10/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/24/2013	1
11/13/2013	1
4/15/2014	1
10/29/2014	1
3/16/2015	1
10/21/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 54
B = 0
C = 0
D = 0
E = 6
F = 0
a = 29256

b = 109296
c = 1104
Group Variance = 1622.33
Z-Score = 0.794474
Comparison Level at 95% confidence level = -1.65463 (downward trend)
0.794474 >= -1.65463 indicating no evidence of a downward trend

Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: SW-09

Original Data (Not Transformed)
Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
140	21	119	1	0
81	21	60	2	0
64	21	43	3	0
72	21	51	4	0
83	21	62	5	0
96	21	75	6	0
ND<0	21	-21	6	1
97	21	76	7	1
170	21	149	8	1
130	21	109	9	1
62	21	41	10	1
17	21	-4	10	2
92	21	71	11	2
ND<0	21	-21	11	3
110	21	89	12	3
67	21	46	13	3
74	21	53	14	3
64	21	43	15	3
180	21	159	16	3
81	21	60	17	3
77	21	56	18	3
105	21	84	19	3
100	21	79	20	3
81	140	-59	20	4
64	140	-76	20	5
72	140	-68	20	6
83	140	-57	20	7
96	140	-44	20	8
ND<0	140	-140	20	9
97	140	-43	20	10
170	140	30	21	10
130	140	-10	21	11
62	140	-78	21	12
17	140	-123	21	13
92	140	-48	21	14
ND<0	140	-140	21	15
110	140	-30	21	16
67	140	-73	21	17
74	140	-66	21	18
64	140	-76	21	19
180	140	40	22	19
81	140	-59	22	20
77	140	-63	22	21
105	140	-35	22	22
100	140	-40	22	23

64	81	-17	22	24
72	81	-9	22	25
83	81	2	23	25
96	81	15	24	25
ND<0	81	-81	24	26
97	81	16	25	26
170	81	89	26	26
130	81	49	27	26
62	81	-19	27	27
17	81	-64	27	28
92	81	11	28	28
ND<0	81	-81	28	29
110	81	29	29	29
67	81	-14	29	30
74	81	-7	29	31
64	81	-17	29	32
180	81	99	30	32
81	81	0	30	32
77	81	-4	30	33
105	81	24	31	33
100	81	19	32	33
72	64	8	33	33
83	64	19	34	33
96	64	32	35	33
ND<0	64	-64	35	34
97	64	33	36	34
170	64	106	37	34
130	64	66	38	34
62	64	-2	38	35
17	64	-47	38	36
92	64	28	39	36
ND<0	64	-64	39	37
110	64	46	40	37
67	64	3	41	37
74	64	10	42	37
64	64	0	42	37
180	64	116	43	37
81	64	17	44	37
77	64	13	45	37
105	64	41	46	37
100	64	36	47	37
83	72	11	48	37
96	72	24	49	37
ND<0	72	-72	49	38
97	72	25	50	38
170	72	98	51	38
130	72	58	52	38
62	72	-10	52	39
17	72	-55	52	40
92	72	20	53	40
ND<0	72	-72	53	41
110	72	38	54	41
67	72	-5	54	42
74	72	2	55	42
64	72	-8	55	43
180	72	108	56	43
81	72	9	57	43

77	72	5	58	43
105	72	33	59	43
100	72	28	60	43
96	83	13	61	43
ND<0	83	-83	61	44
97	83	14	62	44
170	83	87	63	44
130	83	47	64	44
62	83	-21	64	45
17	83	-66	64	46
92	83	9	65	46
ND<0	83	-83	65	47
110	83	27	66	47
67	83	-16	66	48
74	83	-9	66	49
64	83	-19	66	50
180	83	97	67	50
81	83	-2	67	51
77	83	-6	67	52
105	83	22	68	52
100	83	17	69	52
ND<0	96	-96	69	53
97	96	1	70	53
170	96	74	71	53
130	96	34	72	53
62	96	-34	72	54
17	96	-79	72	55
92	96	-4	72	56
ND<0	96	-96	72	57
110	96	14	73	57
67	96	-29	73	58
74	96	-22	73	59
64	96	-32	73	60
180	96	84	74	60
81	96	-15	74	61
77	96	-19	74	62
105	96	9	75	62
100	96	4	76	62
97	ND<0	97	77	62
170	ND<0	170	78	62
130	ND<0	130	79	62
62	ND<0	62	80	62
17	ND<0	17	81	62
92	ND<0	92	82	62
ND<0	ND<0	0	82	62
110	ND<0	110	83	62
67	ND<0	67	84	62
74	ND<0	74	85	62
64	ND<0	64	86	62
180	ND<0	180	87	62
81	ND<0	81	88	62
77	ND<0	77	89	62
105	ND<0	105	90	62
100	ND<0	100	91	62
170	97	73	92	62

130	97	33	93	62
62	97	-35	93	63
17	97	-80	93	64
92	97	-5	93	65
ND<0	97	-97	93	66
110	97	13	94	66
67	97	-30	94	67
74	97	-23	94	68
64	97	-33	94	69
180	97	83	95	69
81	97	-16	95	70
77	97	-20	95	71
105	97	8	96	71
100	97	3	97	71
130	170	-40	97	72
62	170	-108	97	73
17	170	-153	97	74
92	170	-78	97	75
ND<0	170	-170	97	76
110	170	-60	97	77
67	170	-103	97	78
74	170	-96	97	79
64	170	-106	97	80
180	170	10	98	80
81	170	-89	98	81
77	170	-93	98	82
105	170	-65	98	83
100	170	-70	98	84
62	130	-68	98	85
17	130	-113	98	86
92	130	-38	98	87
ND<0	130	-130	98	88
110	130	-20	98	89
67	130	-63	98	90
74	130	-56	98	91
64	130	-66	98	92
180	130	50	99	92
81	130	-49	99	93
77	130	-53	99	94
105	130	-25	99	95
100	130	-30	99	96
17	62	-45	99	97
92	62	30	100	97
ND<0	62	-62	100	98
110	62	48	101	98
67	62	5	102	98
74	62	12	103	98
64	62	2	104	98
180	62	118	105	98
81	62	19	106	98
77	62	15	107	98
105	62	43	108	98
100	62	38	109	98
92	17	75	110	98
ND<0	17	-17	110	99

110	17	93	111	99
67	17	50	112	99
74	17	57	113	99
64	17	47	114	99
180	17	163	115	99
81	17	64	116	99
77	17	60	117	99
105	17	88	118	99
100	17	83	119	99
ND<0	92	-92	119	100
110	92	18	120	100
67	92	-25	120	101
74	92	-18	120	102
64	92	-28	120	103
180	92	88	121	103
81	92	-11	121	104
77	92	-15	121	105
105	92	13	122	105
100	92	8	123	105
110	ND<0	110	124	105
67	ND<0	67	125	105
74	ND<0	74	126	105
64	ND<0	64	127	105
180	ND<0	180	128	105
81	ND<0	81	129	105
77	ND<0	77	130	105
105	ND<0	105	131	105
100	ND<0	100	132	105
67	110	-43	132	106
74	110	-36	132	107
64	110	-46	132	108
180	110	70	133	108
81	110	-29	133	109
77	110	-33	133	110
105	110	-5	133	111
100	110	-10	133	112
74	67	7	134	112
64	67	-3	134	113
180	67	113	135	113
81	67	14	136	113
77	67	10	137	113
105	67	38	138	113
100	67	33	139	113
64	74	-10	139	114
180	74	106	140	114
81	74	7	141	114
77	74	3	142	114
105	74	31	143	114
100	74	26	144	114
180	64	116	145	114
81	64	17	146	114
77	64	13	147	114
105	64	41	148	114

100	64	36	149	114
81	180	-99	149	115
77	180	-103	149	116
105	180	-75	149	117
100	180	-80	149	118
77	81	-4	149	119
105	81	24	150	119
100	81	19	151	119
105	77	28	152	119
100	77	23	153	119
100	105	-5	153	120

S Statistic = 153 - 120 = 33

Tied Group	Value	Members
1	81	2
2	64	2
3	0	2

Time Period	Observations
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/25/2010	1
4/15/2010	1
8/10/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/24/2013	1
11/13/2013	1
4/15/2014	1
10/29/2014	1
3/16/2015	1
10/21/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1
10/25/2018	1

There are 0 time periods with multiple data

A = 54
B = 0
C = 0
D = 0
E = 6
F = 0
a = 29256

b = 109296
c = 1104
Group Variance = 1622.33
Z-Score = 0.794474
Comparison Level at 95% confidence level = 1.65463 (upward trend)
0.794474 <= 1.65463 indicating no evidence of an upward trend

Geosyntec consultants

1255 Roberts Boulevard, Suite 200
Kennesaw, Georgia 30144
PH 678.202.9500
FAX 678.202.9501
www.geosyntec.com

17 January 2019

Mr. David Brownlee
Georgia Department of Natural Resources
2 Martin Luther King Jr. Drive S.E., Suite 1054
Atlanta, GA 30334-9000

Subject: **Response to Comments on the *January 2017 Semi-Annual Groundwater Monitoring Report No. 17 (VRP Progress Report #8)* and *July 2017 Semi-Annual Groundwater Monitoring Report No. 18 (VRP Progress Report #9)***
General Chemical (Chemtrade) Site, HSI # 10498
East Point, Fulton County

Dear Mr. Brownlee:

Geosyntec Consultants (Geosyntec) has prepared this letter on behalf of Chemtrade Solutions (formerly General Chemical) in response to your 6 September 2017 letter providing comments on the *Voluntary Remediation Program (VRP) Progress Report #8* (Report, dated 17 January 2017) and the *VRP Progress Report #9* (Report, dated 11 July 2017) for the Chemtrade Site in East Point, Georgia (Site). This letter provides the Georgia Environmental Protection Division (EPD) comments followed by responses to each comment.

GA EPD COMMENTS

Comment No. 1:

EPD encourages Chemtrade Logistics (Chemtrade) to complete the negotiations with the City of East Point and schedule the site related corrective measures (i.e., slip line the storm water drains or perform any necessary repairs to prevent groundwater from entering the storm drain system) as soon as practicable. Additionally, in light of the increasing trend in sulfate concentrations at EPW-01, Chemtrade should consider slip-lining the stormwater conveyance to SW-09 and SW-07AA to protect against further damage to the City of East Point's concrete stormwater conveyance system from groundwater impacted by Chemtrade's historical activities.

EPD has issued a second letter, dated September 1, 2017, notifying MGA Holdings LLC that its property may be a potential upgradient source of groundwater and surface water impacts to the Chemtrade site, and that EPD believes a release requiring notification has occurred at that site. However, while EPD acknowledges a potential second source, EPD cautions Chemtrade against delay in implementing a remediation plan that would protect against further damage from impacts caused by Chemtrade.

Response:

Chemtrade installed a cured-in-place pipe (CIPP) to seal the storm drains from SW-07AA to SW-07X. The manholes at each end of the work and a manhole in the center were also replaced to facilitate CIPP installation. The work was performed during December 2018 and confirmation sampling to evaluate the benefit of the improvements will be performed during the next sampling event.

The sulfate concentrations at EPW-01 do not show a stable trend according to the Mann-Kendall analysis (see Table 3-3). Additionally, this location is upgradient of the former HCA disposal areas and is potentially impacted by the offsite source related to the former acid pit. Storm drains upgradient of SW-07AA are also upgradient of the site and impacts are likely from other sources.

Comment No. 2:

Please update the cost estimate for the remaining corrective measures to be completed at the site with an update to the associated financial assurance mechanism, as necessary. Please provide EPD with a status update and any necessary update to the associated financial assurance mechanism.

Response:

The cost estimate will be revised prior to the July 2019 Semi-Annual Report to allow the expense of the recent CIPP lining to be fully captured and deducted from the current cost estimate.

Comment No. 3:

While Figures 3-4 and 3-5 illustrate groundwater concentrations and the lateral extent of the area exceeding the Type 4 compliance criteria, the final Compliance Status Report, necessary for the site to be removed from the Hazardous Site Inventory (HSI), must include a complete definition of the horizontal and vertical extent of such soil contamination. Satisfactory evidence of a complete definition of the horizontal and vertical extent of soil contamination shall consist of an appropriate number of data points at sufficient locations with concentrations that demonstrate compliance with Type 1 or Type 2 risk reduction standards (RRSs) or that reflect background concentrations. Additionally, Figure 3-6 does not include information regarding the in-stream water quality standards (ISWQS) or Type 1/Type 4 RRSs. Please ensure that future VRP Progress Reports include a comparison of site data to the applicable Type 1/4 RRSs/clean-up criteria in figures, tables and narrative format [Rule 391-3-19-.06(3)(b)2.].

Response:

Horizontal and vertical delineation of soil and groundwater contamination around the site is complete and will be demonstrated in the final Compliance Status Report (CSR). Perimeter delineation sampling was performed in September 2013 and the results were presented in the July through December 2013 Semi-Annual Report. A comment letter from EPD dated March 18, 2014 stated:

" The proposed soil and groundwater Type 1 and Type 4 risk reduction standard (RRS) for sulfate and aluminum are acceptable for use at the above referenced subject site, provided the surface water exposure pathway is eliminated. In addition, please note that based on these approved values, EPD concurs that no further soil delineation for sulfate and aluminum will be required at this time."

Chemtrade is lining the storm drains to eliminate the surface water exposure pathway. Since the pathway is to be eliminated, Type 1 and Type 4 RRS and ISWQS are not applicable.

Comment No. 4:

Several figures could be added or improved to support the narrative:

a. Figure 3-4 in the July 2017 report uses a purple-tinged line to show the delineation of the sulfate concentration above the Type 4 RRS, which is difficult to see. Please improve the visibility of these lines in future reports by using a different color.

b. Plotting the Mann Kendall results on a figure would be supportive of the narrative with regard to the trends being displayed at upgradient, source and downgradient wells and surface water. Please include such a figure.

Response:

a. Figure 3-4 has been updated to improve visibility.

b. Figure 3-7 has been added to illustrate the Mann-Kendall trends at upgradient, source, and downgradient wells. Figure 3-8 has been added to illustrate the Mann-Kendall trends at cross-gradient, upgradient, on-site, and downgradient storm drain locations.

Comment No. 5:

Please be aware the EPA recently issued an update to its Field Branches Quality System and Technical Procedures (FBQSTP) Operating Procedure for "Groundwater Sampling", SESDPROC-301-R4. Future reports should note whether the updated procedures were strictly adhered to, or if any variations occurred, and how such variations may have impacted the sampling are inadequate to document that approved sampling protocols were followed.

In addition, surface water sampling should follow the FBQSTP Operating Procedure for "Surface Water Sampling", SESDPROC-201-R4. As with the groundwater sampling procedures, Chemtrade should note whether SESDPROC-201-R4 was strictly adhered to, or if any variations occurred, and how such variations may have impacted the sampling.

Response:

Groundwater sampling was performed in accordance with SESDPROC-301-R4, as noted in the text and on field forms in the Semi-Annual Groundwater Monitoring Report No. 21. SW-02, SW-06, and SW-09 are storm drain manhole locations, which are accessed for sampling through grating or a manhole cover. They were sampled using the SESDPROC-201-R4 procedure for "Peristaltic Pumps". SW-7 is a storm drain discharge location to a stream. For SW-7 the sampling procedure used followed the SESDPROC-201-R4 procedure for "Dipping Using Sample Container". These procedures and any variations are noted in the text of the Semi-Annual Groundwater Monitoring Report No. 21.

Comment No. 6:

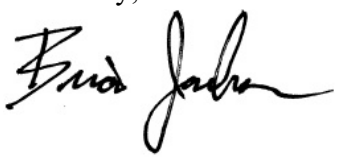
The Report lacks Tables of historic groundwater quality data as measured in the field (e.g., DO, pH, temperature, turbidity, conductivity, ORP, elevation data, etc.).

Response:

Tables of historic groundwater field parameter data and historical storm drain field parameter data have been included in the Semi-Annual Groundwater Monitoring Report No. 21 (Table 3-6 and Table 3-7).

We anticipate that these responses address the comments provided by EPD. Please feel free to contact us if there are further comments or questions.

Sincerely,



Brian D. Jacobson, P.E.
Senior Engineer

Copy to: Stephen Thorn, Chemtrade Solutions

Geosyntec consultants

1255 Roberts Boulevard, Suite 200
Kennesaw, Georgia 30144
PH 678.202.9500
FAX 678.202.9501
www.geosyntec.com

17 January 2019

Mr. David Brownlee
Georgia Department of Natural Resources
2 Martin Luther King Jr. Drive S.E., Suite 1054
Atlanta, GA 30334-9000

Subject: **Response to Comments on the *July 2018 Semi-Annual Groundwater Monitoring Report No. 20 (VRP Progress Report #11)***
General Chemical (Chemtrade) Site, HSI # 10498
East Point, Fulton County

Dear Mr. Brownlee:

Geosyntec Consultants (Geosyntec) has prepared this letter on behalf of Chemtrade Solutions (formerly General Chemical) in response to your 17 September 2018 letter providing comments on the *Voluntary Remediation Program (VRP) Progress Report #11* (Report, dated 20 July 2018) for the Chemtrade Site in East Point, Georgia (Site). This letter provides the Georgia Environmental Protection Division (EPD) comments followed by responses to each comment.

GA EPD COMMENTS

Comment No. 1:

Neither the Report nor any other correspondence received since EPD's September 6, 2017 letter has addressed all of EPD's comments made in that letter.

Response:

EPD's comments outlined in the 6 September 2017 letter have been addressed in the VRP Progress Report #12. Responses to EPD comments are provided herein and in the 17 January 2019 Response to Comments on the January 2017 Semi-Annual Groundwater Monitoring Report No. 17 (VRP Progress Report #8) and July 2017 Semi-Annual Groundwater Monitoring Report No. 18 (VRP Progress Report #9) letter.

Comment No. 2:

Groundwater sampling should be conducted in accordance with the most recent version of the USEPA Region 4 Science and Ecosystem Support Division Groundwater Sampling operating procedure. The most recent version of this operating procedure is SESDPROC-301-R4, dated April 2017 and is available at:

https://www.epa.gov/quality/proceduresgroundwater-sampling-science-and-ecosystem-support-division. This comment was noted previously in EPD comment letters.

Section 4.2 *Monitoring Well Sampling Procedure* of the Report noted that an older version of the groundwater sampling procedure was used. Also, on the sampling forms in Appendix B of the Report all handwritten text on the sampling forms should be legible.

Response:

Groundwater sampling during the October 2018 sampling event was conducted in accordance with the most recent version of the USEPA Region 4 Science and Ecosystem Support Division Groundwater Sampling operating procedure (SESDPROC-301-R4, dated April 2017). This is noted on each of the sampling forms and in Section 4.2 of the Voluntary Remediation Program (VRP) Progress Report #12. Surface water sampling during the October 2018 sampling event was conducted in accordance with the most recent version of the USEPA Region 4 Science and Ecosystem Support Division Groundwater Sampling operating procedure (SESDPROC-201-R4, dated December 2016). Any variations from the SESD procedures is noted in the report text. Handwritten text during sampling on the sampling forms was checked and found to be improved for this submittal. This check will be performed on all future reports prior to submittal to EPD.

Comment No. 3:

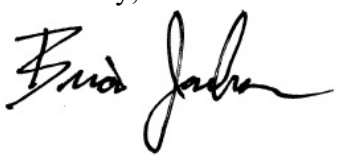
On future reports, please ensure all units of measurement on the sampling forms are correct. For example, the recorded temperatures in the Report for SW-07 and EPW-02 are approximately 66°F but are listed in °C.

Response:

Units of measurement on the sampling forms in Appendix B in the Voluntary Remediation Program (VRP) Progress Report #12 were checked and found to be correct. This check will be performed on all future reports prior to submittal to EPD.

We anticipate that these responses address the comments provided by EPD. Please feel free to contact us if there are further comments or questions.

Sincerely,



Brian D. Jacobson, P.E.
Senior Engineer

Copies to: Stephen Thorn, Chemtrade Solutions