LMS/MND/S33123

Sitewide Groundwater Monitoring Report Mound, Ohio, Site

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Abbreviations

BVA	Buried Valley Aquifer
DCE	dichloroethene
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
H_α	alternative hypothesis
H_0	null hypothesis
MCL	maximum contaminant level
µg/L	micrograms per liter
MNA	monitored natural attenuation
nCi/L	nanocuries per liter
Ohio EPA	Ohio Environmental Protection Agency
PCE	tetrachloroethene
RAO	remedial action objective
RIN	report identification number
TCE	trichloroethene
VC	vinyl chloride
VOC	volatile organic compound

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1.0 Introduction

1.1 Purpose

This report was prepared in support of the selected remedies for Phase I and Parcels 6, 7, and 8 of the Mound, Ohio, Site as outlined in the *Operations and Maintenance Plan for the U.S. Department of Energy Mound, Ohio, Site* (DOE 2015), hereafter called the Sitewide Operations and Maintenance Plan. It summarizes the data collected in 2020 and documents the progress of the monitored natural attenuation (MNA) remedies for both areas of the Mound site. All sampling and data analyses were performed in accordance with the Sitewide Operations and Maintenance Plan, unless noted otherwise.

This report includes data collected during the groundwater and seep sampling performed in 2020. Time-series plots were used to determine changes in data over time (increasing or decreasing) and interpret the effectiveness of the MNA remedy. Trend analysis was performed on data from selected wells using the nonparametric Mann-Kendall test to further support the observed increases or decreases in concentrations and possible estimates about when remediation goals may be reached.

This report also documents operational changes that occurred during the reporting period, provides recommendations or changes to the current monitoring program, and identifies maintenance activities associated with the monitoring wells being sampled.

1.2 Project Description

The Mound site[1] is in Miamisburg, Ohio, approximately 10 miles southwest of Dayton. In 1995, the U.S. Department of Energy (DOE) Mound Plant, named after the Miamisburg Indian Mound adjacent to the site, comprised 120 buildings on 306 acres. The Great Miami River, west of the site, flows from northeast to southwest through Miamisburg and dominates the geography of the region surrounding the site. Figure 1 shows the locations of Phase I (in green) and Parcels 6, 7, and 8 (in purple).

DOE remediated the Mound site to an "industrial/commercial use" standard consistent with the exposure assumptions provided in the *Mound 2000 Residual Risk Evaluation Methodology, Mound Plant* (DOE 1997) and endorsed by the U.S. Environmental Protection Agency (EPA) and Ohio Environmental Protection Agency (Ohio EPA). The remedies for groundwater at the site combine groundwater monitoring and institutional controls in the form of deed restrictions on future land and groundwater use. These combined remedies will prevent current and future workers, the public, and the environment from being exposed to contaminated groundwater at the Mound site.

[1] The Mound site has also been called the Mound Laboratory, Mound Laboratories, the Mound Plant (EPA ID OH6890008984), the USDOE Mound Plant, the Mound Facility, the USDOE Mound Facility, the Miamisburg Environmental Management Project (MEMP), and the Miamisburg Closure Project (MCP). The Office of Legacy Management uses Mound, Ohio, Site as the formal name of the site.

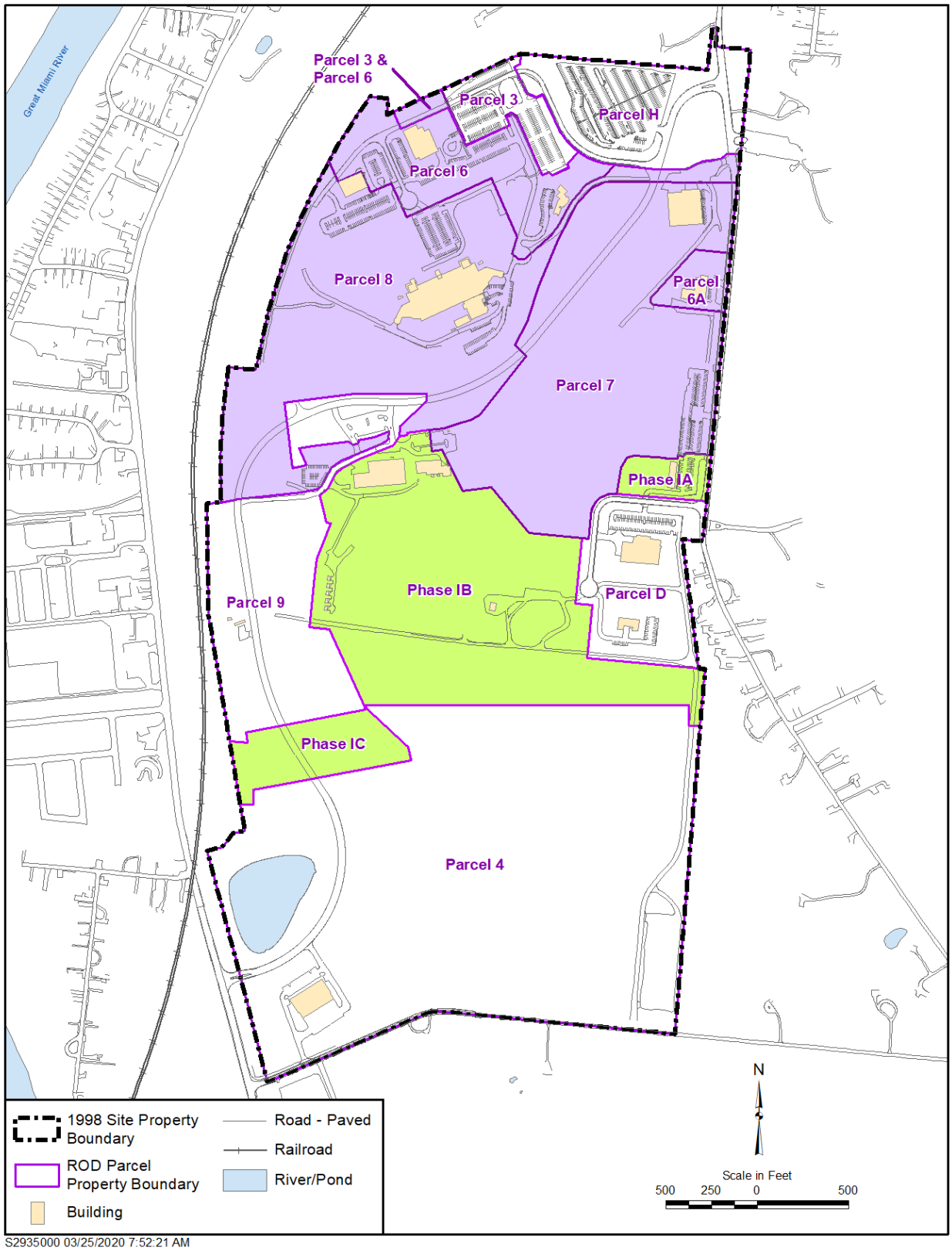


Figure 1. Locations of Phase I and Parcels 6, 7, and 8

The long-term remedial action objective (RAO) for groundwater is to meet Safe Drinking Water Act maximum contaminant levels (MCLs) through MNA in the Phase I and Parcels 6, 7, and 8 areas. Until these goals are achieved, the near-term RAO is to prohibit the extraction and use of groundwater underlying the premises unless prior written approval is obtained from EPA and Ohio EPA.

1.2.1 Phase I

Phase I is an approximately 52-acre area made up of three distinct sections. It lies on the southern border of the former production area of the Mound site. This area contains monitoring wells that are screened in both the Great Miami Buried Valley Aquifer (BVA) and the upgradient bedrock aquifer system. MNA is being used as the remedy for a small, discrete section of the bedrock groundwater system contaminated with trichloroethene (TCE) to ensure that concentrations of TCE within the bedrock groundwater are decreasing to levels below the Safe Drinking Water Act MCL and do not impact the downgradient BVA.

1.2.2 Parcels 6, 7, and 8

Parcels 6, 7, and 8 occupy approximately 101 acres of the northern portion of the Mound Plant site. The main production facilities were in an area called the Main Hill in Parcels 6 and 8. A tributary valley runs between these two parcels and Parcel 7; it contains a narrow tongue of glacial deposits that is hydraulically connected with the BVA. Groundwater within the fractured bedrock beneath the Main Hill area, and in topographic highs within Parcel 7, flows along horizontal bedding planes and fractures and ultimately discharges to naturally occurring seeps or to the downgradient BVA.

Two monitoring wells on the eastern edge of the BVA indicate volatile organic compound (VOC) impact, primarily TCE, that exceed MCLs of the Safe Drinking Water Act. MNA is the remedy for the VOCs in groundwater associated with the Main Hill. Sampling is being performed to assess the contaminant concentrations and verify that the BVA offsite and downgradient of these wells is not being adversely impacted.

Five seeps associated with this area are along the Main Hill of the plant property. Two of the five seeps are within the plant property boundary, and the remaining three are offsite to the north. Historically, these seeps have had elevated levels of tritium and VOCs. These seeps, and several downgradient wells, are being monitored to verify that source removal (buildings and soil) on the Main Hill result in decreasing concentrations over time.

1.3 Geology and Hydrology

The aquifer system at the Mound site consists of two distinct hydrogeologic environments: (1) groundwater flow through the Ordovician shale and limestone bedrock beneath the hills and (2) groundwater flow within the unconsolidated glacial deposits and alluvium associated with the BVA in the Great Miami River valley. A thin tributary valley along the southern edge of the Main Hill divides the two main portions of the Mound site and features a narrow tongue of glacial deposits that is hydraulically connected with the BVA.

The bedrock flow system is dominated by fracture flow and is not considered a highly productive aquifer. Groundwater flow in the bedrock typically mimics the topography, with groundwater discharging to the BVA or at seeps from the upper bedrock. The BVA is dominated by porous flow, with interbedded gravel deposits providing the major pathway for water movement. The unconsolidated deposits are Quaternary-age sediments that consist of both glacial and fluvial deposits. The BVA is a highly productive aquifer capable of yielding a significant quantity of water. It is designated a sole-source aquifer. Groundwater flow in the BVA flows south, following the downstream course of the Great Miami River. The general structure and flow characteristics for these two interconnected systems are depicted in Figure 2.

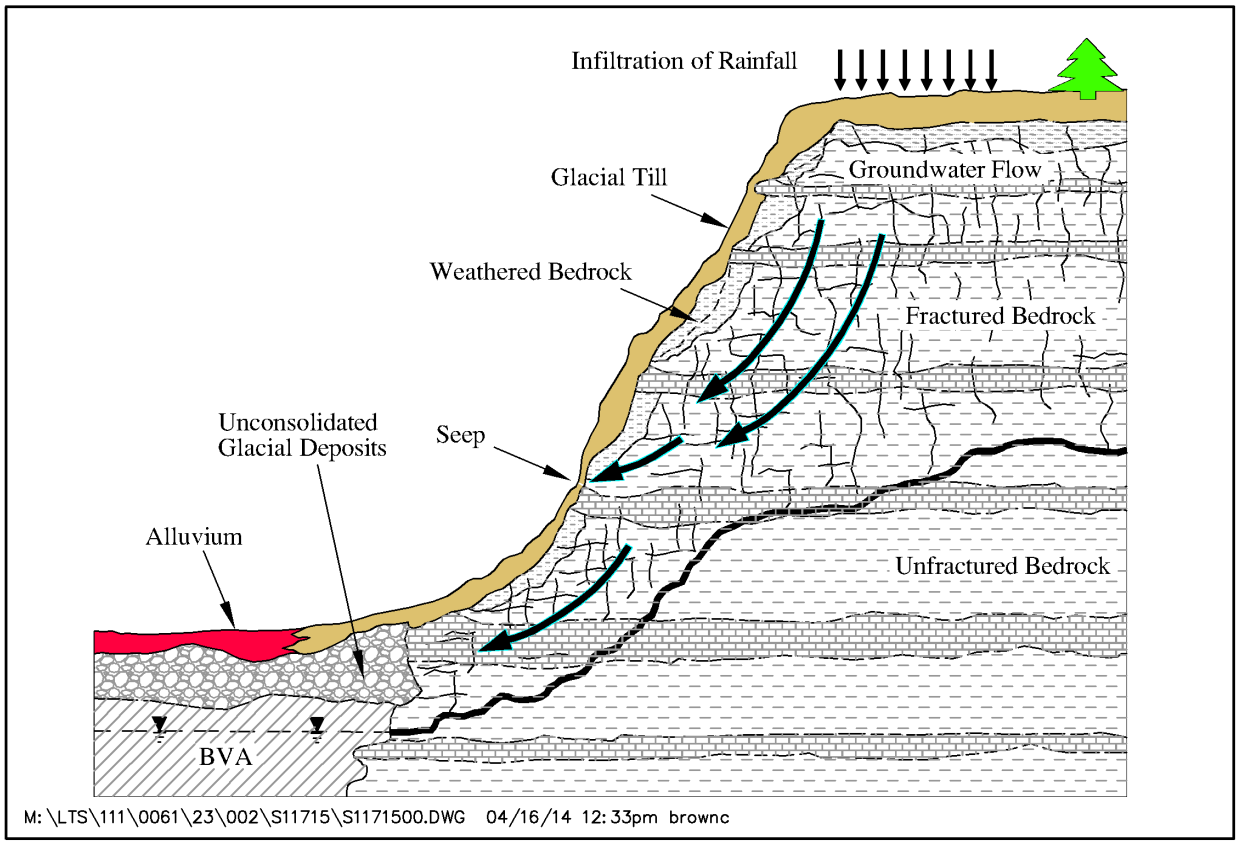


Figure 2. Generalized Cross Section Showing Flow from Bedrock to the BVA

For detailed descriptions of the geology, lithology, and groundwater flow regimes at the Mound site and specific hydrogeologic information for each area, refer to hydrogeologic investigation reports and work plans prepared for the site (DOE 1992; DOE 1994a; DOE 1994b; DOE 1995; and DOE 1999).

2.0 Monitoring Programs

2.1 Phase I

The Phase I groundwater monitoring program was established to verify that the BVA is not negatively affected by TCE-contaminated groundwater within the bedrock aquifer system. Groundwater in Phase I is monitored for TCE and its degradation products to verify that concentrations of TCE are decreasing by natural attenuation. The objective of this monitoring is to protect the BVA by verifying that the concentration of TCE near well 0411, well 0443, and seep 0617 is decreasing and to confirm that TCE is not adversely affecting the BVA.

Well P064 was added to the Phase I MNA remedy monitoring program starting in 2018 to monitor groundwater discharge from the bedrock to the BVA, and sampling at wells 0400, 0402, and P033 was discontinued. These changes to the monitoring program were approved by EPA and Ohio EPA during the August 17, 2017, Core Team meeting. The Core Team consists of representatives from DOE, EPA, and Ohio EPA.

2.1.1 Monitored Natural Attenuation of TCE

Under the Phase I MNA monitoring program, samples are collected semiannually from selected wells and one seep (Figure 3) and analyzed as outlined in Table 1. Sampling was performed in the first and third quarters of 2020.

Table 1. Remedy (MNA) Monitoring for Phase I

Monitoring Location	Area	Parameters
Well 0411	Well 0411 area	TCE DCE VC
Well 0443		
Well 0353	Bedrock monitoring	
Well 0444		
Well 0445		
Seep 0617		
Well P064	BVA monitoring	

Abbreviations:
DCE = dichloroethene
VC = vinyl chloride

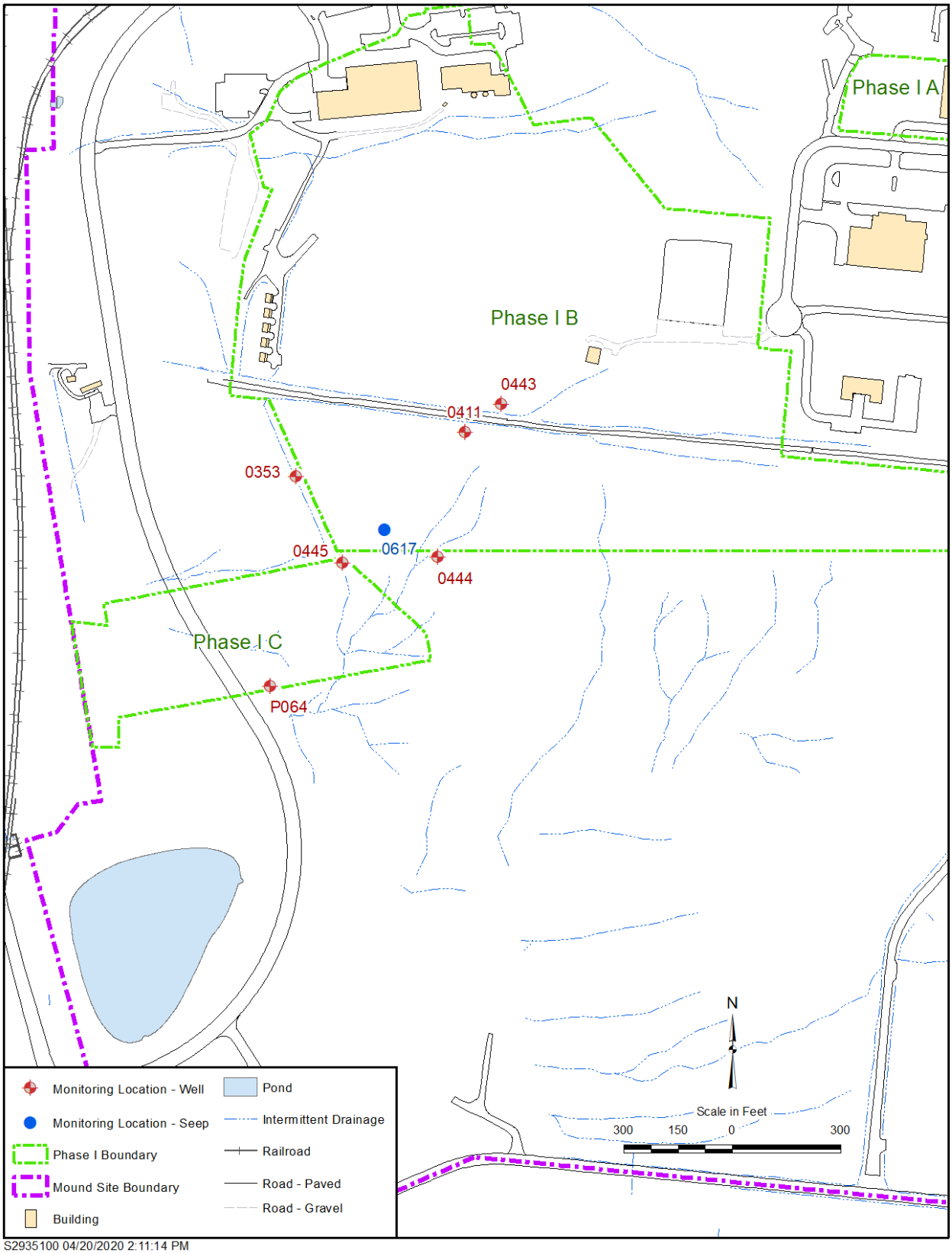


Figure 3. Phase I MNA Remedy Monitoring Locations

2.1.2 Triggers

The contaminant data are evaluated against previous data collected at each location to determine if MNA is adequately addressing groundwater impact and to monitor geochemical conditions in the aquifer. Trigger levels and response actions have been established for each contaminant as presented in the Sitewide Operations and Maintenance Plan (DOE 2015). The triggers and MCLs for each contaminant are summarized in Table 2.

Table 2. Trigger Levels for Phase I MNA Remedy

Location	TCE (µg/L)	DCE (µg/L)	Vinyl Chloride (µg/L)
Well 0353	5	70	2
Well 0411	30	70	2
Well 0443	18	70	2
Well 0444	5	70	2
Well 0445	5	70	2
Well P064	5	70	2
Seep 0617	16	70	2
MCL	5	70	2

Abbreviation:
µg/L = micrograms per liter

EPA and Ohio EPA must be notified if trigger levels are exceeded. After notification, the Core Team (EPA, Ohio EPA, and DOE) will determine an appropriate course of action.

2.2 Parcels 6, 7, and 8

Groundwater in the Parcels 6, 7, and 8 area is monitored for TCE and its degradation products to verify that the downgradient BVA is not affected and that concentrations are decreasing. In addition, groundwater discharging from seeps is monitored for tritium and TCE and its degradation products to verify that source removal has resulted in decreasing concentrations over time.

The sampling program focuses on the following areas:

- **Well 0315/0347 Area:** Wells at the edge of the BVA on the southwestern corner of Parcel 8 that have elevated concentrations of VOCs. The program consists of wells that have TCE concentrations greater than the MCL and downgradient wells to the west. Wells 0315 and 0347 (source wells) and other selected downgradient BVA wells are monitored for VOCs—namely, tetrachloroethene (PCE), dichloroethene (DCE) isomers, TCE, and vinyl chloride (VC).
- **Main Hill Seeps:** Seeps on the northern and southern sides of the Main Hill that have elevated concentrations of VOCs and tritium. The program consists of the downgradient seeps to the north and south and downgradient wells to the west. Water from seeps 0601, 0602, 0605, 0606, and 0607 is collected and analyzed for VOCs and tritium. Select wells within the BVA that are downgradient of the bedrock groundwater discharge area of the Main Hill are also sampled to monitor VOCs and tritium.

2.2.1 Monitored Natural Attenuation of TCE and Tritium

Under the Parcels 6, 7, and 8 MNA monitoring program, samples are collected quarterly for VOCs and semiannually for tritium in selected wells and seeps (Figure 4). Table 3 provides a summary of the monitoring locations as specified in the Sitewide Operations and Maintenance Plan.

Table 3. Monitoring for Parcels 6, 7, and 8 Area

Monitoring Location	Area	VOC	Tritium
Well 0315	Source wells	X	
Well 0347		X	
Well 0118	Downgradient BVA monitoring	X	X
Well 0124		X	
Well 0126		X	
Well 0138		X	X
Well 0346		X	X
Well 0379		X	X
Well 0386		X	
Well 0387		X	
Well 0389		X	
Well 0392		X	
Seep 0601	Main Hill seeps	X	X
Seep 0602		X	X
Seep 0605		X	X
Seep 0606		X	X
Seep 0607		X	X

Note:
VOCs monitored are PCE, TCE, *cis*-1,2-DCE, *trans*-1,2-DCE, and VC.

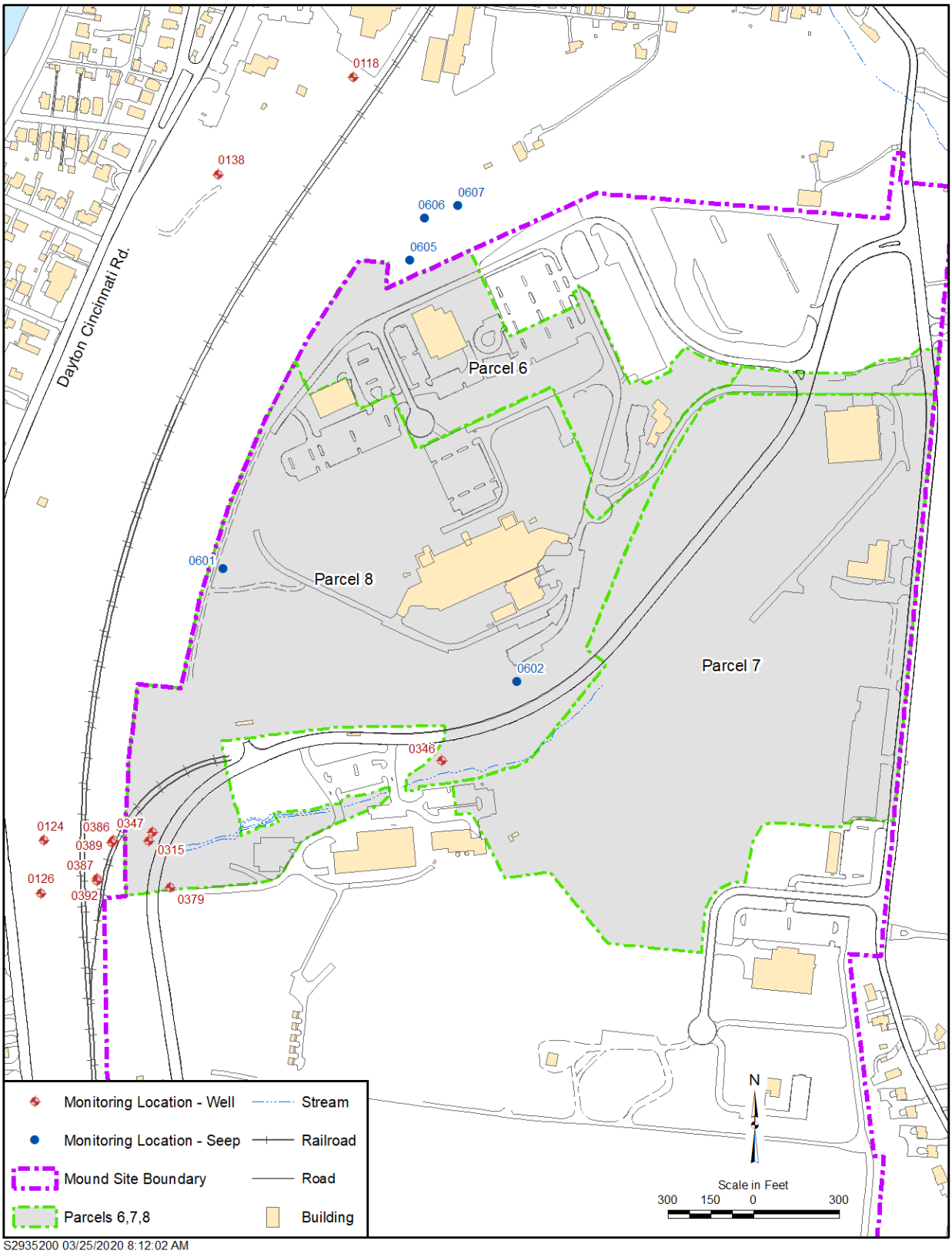


Figure 4. Parcels 6, 7, and 8 Remedy Monitoring Locations

2.2.2 Triggers

The contaminant data are evaluated against previous data collected at each location to determine if downward trends are occurring. Trigger levels and response actions have been established for specific contaminants at specified locations as presented in the Sitewide Operations and Maintenance Plan. The triggers and MCLs for each contaminant are summarized in Table 4.

Table 4. Trigger Levels for Parcels 6, 7, and 8 Monitoring Locations

Location	TCE (µg/L)	PCE (µg/L)	Tritium (nCi/L)
Well 0315	30		
Well 0347	30		
Well 0124	5		
Well 0126	5		
Well 0386	5		
Well 0387	5		
Well 0389	5		
Well 0392	5		
Seep 0601		75	1500
Seep 0605	150		
MCL	5	70	20

Abbreviations:
µg/L = micrograms per liter
nCi/L = nanocuries per liter

EPA and Ohio EPA must be notified if these trigger levels are exceeded. After notification, the Mound Core Team (EPA, Ohio EPA, and DOE) will determine an appropriate course of action.

2.3 Monitoring Network

The monitoring well and seep locations sampled under these programs were selected to provide data of sufficient quality to meet the objectives of the groundwater remedies for Phase I and Parcels 6, 7, and 8. These wells were initially installed to support various site characterization activities and were designed and constructed to provide high-quality groundwater data. Appendix A contains construction information for each well used to support these remedies.

2.4 Deviations from the Sitewide Operations and Maintenance Plan

Sampling was performed as outlined in the Sitewide Operations and Maintenance Plan, which compiles the sampling requirements outlined in previous regulator-approved plans for each area. Modifications to these monitoring programs (e.g., reduction in sampling frequency or discontinuation of monitoring locations) are also incorporated into the Sitewide Operations and Maintenance Plan.

Sampling was performed as follows:

- All required locations in Phase I were sampled in 2020.
- All required locations in Parcels 6, 7, and 8 were sampled in 2020 with the exception of seep 0602, which was dry (no visible flow) during the second and third quarter sampling events.
- Site-specific sampling methods for the Mound site were followed during these sampling events. These methods were approved by the Mound Core Team and are integrated into the Sitewide Operations and Maintenance Plan.

2.5 Trend Analysis Methodology

Groundwater data from select locations are evaluated for trends in contaminant concentrations to provide supporting evidence that contaminant concentrations are decreasing as a result of source removal at the site. Both graphical and statistical evaluations are performed to provide evidence of continued decreases in concentrations. Graphs of data over time depict the range and changes in concentrations, identify outliers, and show relationships between monitoring locations. Statistical evaluation can provide supporting evidence on the direction of changes over time, if they are significant, and estimate the magnitude of these changes. The computer program ProUCL (ProUCL, Version 5.1.002), developed by Lockheed Martin and EPA, was used to perform trend analysis. The method used was the Mann-Kendall test, a nonparametric statistical procedure that is appropriate for analyzing trends in data over time.

There is no requirement that the data be normally distributed or that the trend, if present, be linear. The Mann-Kendall test can be used if values are missing or below the detection limit. The assumption of independence requires that the time between samples be sufficiently large so there is no correlation between measurements collected at different times. All locations were previously evaluated for seasonality as part of the annual review in 2014 (DOE 2015). Those results indicated there are no seasonal trends in contaminant data collected from any of the monitoring locations.

The Mann-Kendall procedure tests whether to reject the null hypothesis (H_0) and accept the alternative hypothesis (H_α), where:

- H_0 asserts there is no monotonic trend in the series.
- H_α asserts that a monotonic trend exists.

The initial assumption of the Mann-Kendall test is that H_0 is true and the data must be convincing beyond a reasonable doubt before H_0 is rejected and H_α is accepted.

Results of the trend analyses for each monitoring program are presented in Section 3.0. For those locations that exhibit downward trends and currently exceed the MCL, the data were additionally evaluated using the Theil-Sen test to determine the linear rate of change in the concentrations to provide an approximate time frame when concentrations may reach MCLs. A summary of the Mann-Kendall and Theil-Sen statistical approaches used for this report, and the specified error rates and data assumptions, are presented in Appendix B. Data analysis reports for each well and parameter are also included in Appendix B.

3.0 Phase I MNA Remedy

3.1 Monitoring Results

Monitoring results for 2020 (Table 5) continue to show low levels of TCE and *cis*-1,2-DCE, a TCE degradation product, in source area wells 0411 and 0443 and seep 0617. Concentrations of TCE at these locations continue to exceed the MCL of 5 micrograms per liter (µg/L). All VOC concentrations were below the applicable trigger levels (Table 2). No detectable concentrations of *trans*-1,2-DCE or VC were reported at the two source wells and the seep monitoring locations. Downgradient BVA monitoring well P064 had low concentrations of TCE and *cis*-1,2-DCE that were below the MCL but indicated slight impact attributable to VOCs originating from the Phase I area. No detectable concentrations of *cis*-1,2-DCE, *trans*-1,2-DCE or VC were reported in the remainder of the bedrock wells.

Table 5. Summary of VOC Monitoring Results in Phase I for 2020

Well ID	Location	Parameter	First Semiannual Event	Second Semiannual Event
Source Area Wells and Seep				
0411	0411 Area	TCE (µg/L)	**9.7**	**9.2**
		cis-1,2-DCE (µg/L)	2.5 (J)	1.8 (J)
0443	0411 Area	TCE (µg/L)	**5.8**	**9.3**
		cis-1,2-DCE (µg/L)	0.66 (J)	0.50 (J)
0617	Seep/ Bedrock	TCE (µg/L)	**5.9**	4.2
		cis-1,2-DCE (µg/L)	1.6	1.0
Bedrock/BVA Monitoring Wells				
0353	Bedrock	TCE (µg/L)	ND (<1)	ND (<1)
		cis-1,2-DCE (µg/L)	ND (<1)	ND (<1)
0444	Bedrock	TCE (µg/L)	ND (<1)	ND (<1)
		cis-1,2-DCE (µg/L)	ND (<1)	ND (<1)
0445	Bedrock	TCE (µg/L)	ND (<1)	ND (<1)
		cis-1,2-DCE (µg/L)	ND (<1)	ND (<1)
P064	BVA	TCE (µg/L)	0.67 (J)	0.57 (J)
		cis-1,2-DCE (µg/L)	0.29 (J)	ND (<1)

Note:
Values in **bold** exceed the MCL of 5 µg/L for TCE.

Abbreviations:
J = estimated value less than the reporting limit
ND = not detected above reporting limit

The data collected during 2020 continue to indicate that impact is localized in the bedrock groundwater near wells 0411 and 0443 and seep 0617. No VOCs were reported in bedrock wells 0353, 0444, and 0445. Data from downgradient BVA monitoring well P064 indicate the concentrations of VOCs are low at the point where bedrock groundwater enters the BVA.

Data from this monitoring program has shown that impacted groundwater moves through the fractured bedrock associated with the drainage extending from wells 0411 and 0443 through seep 0617 and discharging near well P064. This groundwater movement is consistent with the conceptual model for groundwater at the site where the bedrock flow system is dominated by fracture flow and typically mimics the topography, with groundwater discharging to the BVA or at seeps from the upper bedrock. The lack of detections of VOCs in well 0353, which is located within a different drainage and in wells 0444 and 0445—located outside the drainage channel—supports the premise that movement is isolated to the fractured bedrock within the drainage where seep 0617 is located.

TCE concentrations in well 0411 (Figure 5) have decreased since monitoring began in 1999. Concentrations of TCE in this well have varied between 9 and 15 micrograms per liter (µg/L); however, in 2016 concentrations began to stabilize around 10 µg/L. Concentrations of TCE in well 0443 and seep 0617 have varied since monitoring of these locations started in 2002. Concentrations of TCE in well 0443 had been consistently greater than the MCL since 2010. The time-concentration plots for well 0443 and seep 0617 indicate that concentrations vary and are lower than those in well 0411.

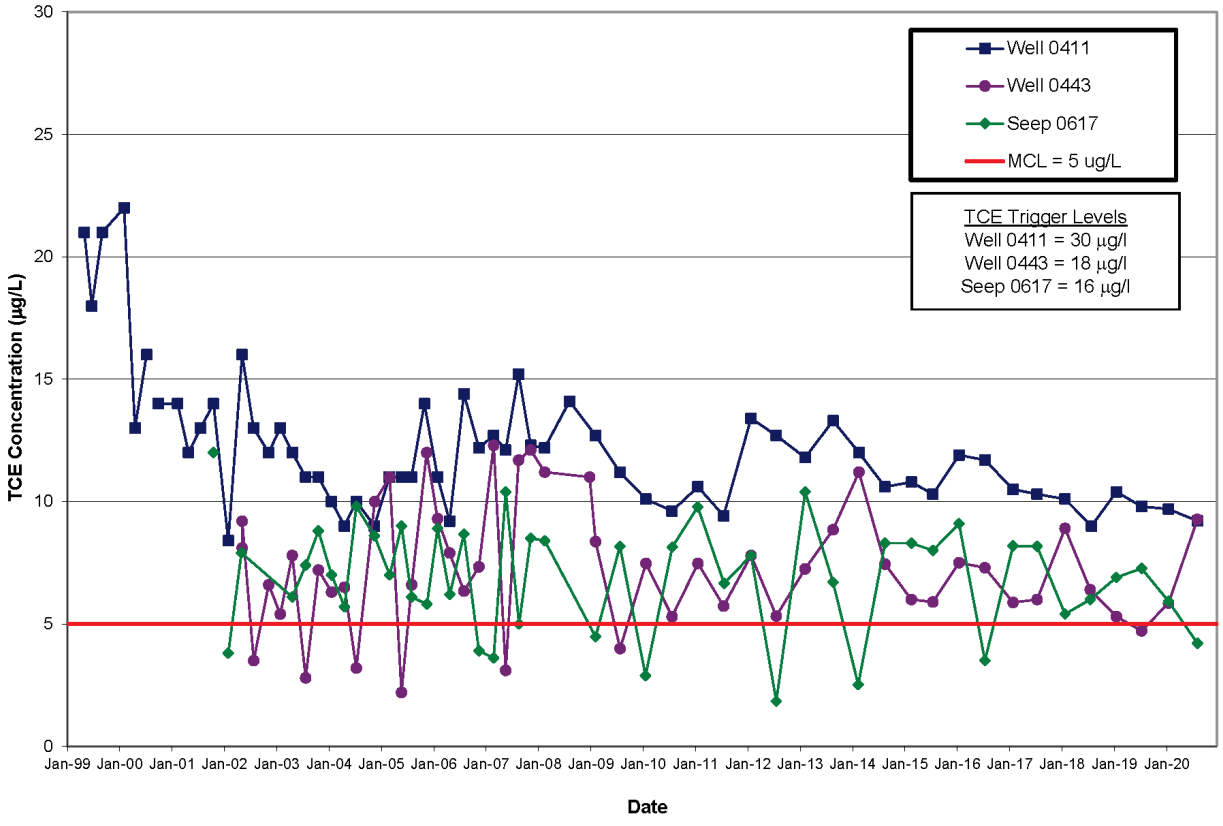


Figure 5. TCE Concentrations in Phase I, 1999–2020

The concentrations of *cis*-1,2-DCE in groundwater (Figure 6) continue to be varied. Concentrations greater than the reporting limit of 1 µg/L have consistently been reported in well 0411 and seep 0617. Historically, concentrations of *cis*-1,2-DCE in well 0411 were generally greater than those measured in seep 0617; however, over the past few years, the

concentrations in seep 0617 have been higher than or similar to concentrations in well 0411. Estimated detections lower than 1 µg/L have been reported in well 0443 since 2009. None of the locations had concentrations of *cis*-1,2-DCE that exceeded the MCL of 70 µg/L.

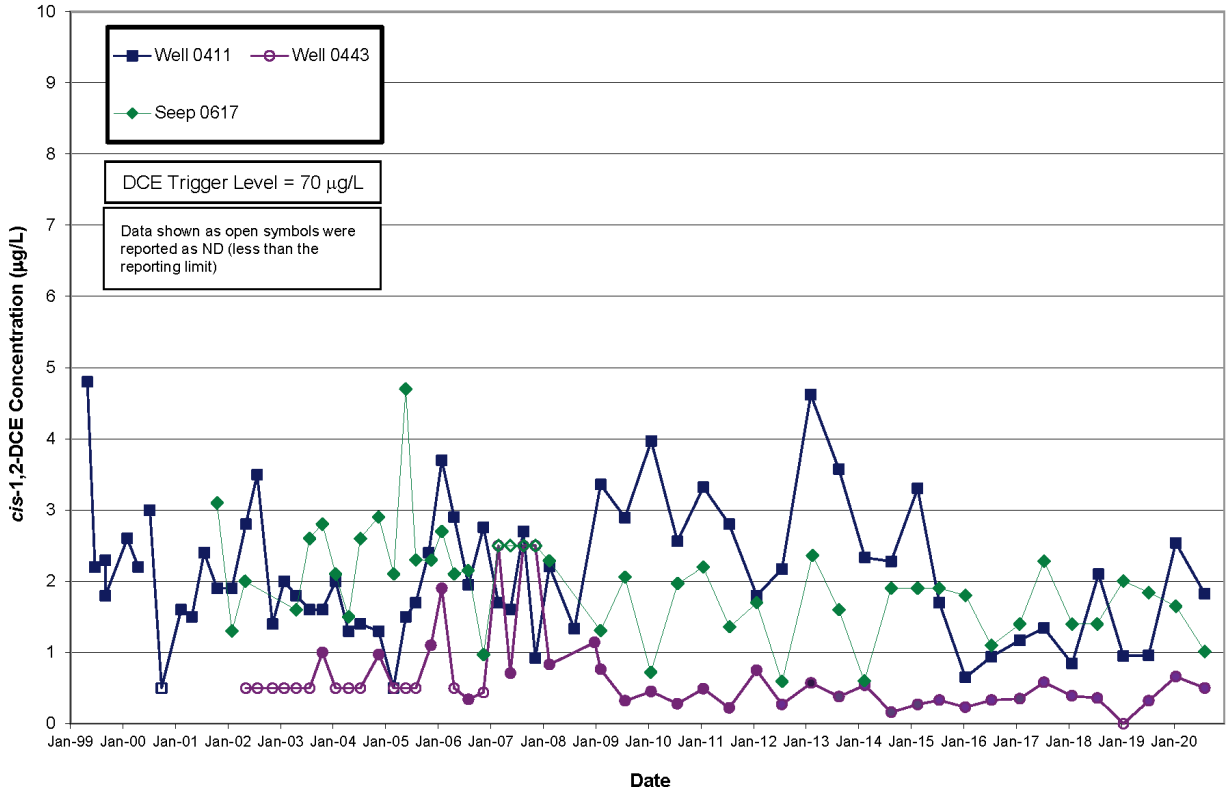


Figure 6. cis-*1,2-DCE Concentrations in Phase I, 1999–2020*

3.2 Trend Analysis

Mann-Kendall trend analysis was performed using data collected since 1999 for wells 0411 and 0443 and seep 0617. Downward trends were indicated for TCE in well 0411 and for *cis*-1,2-DCE in well 0443 and seep 0617 (Table 6). Trend analysis for well P064 was performed using data collected since its installation in 2017 and indicates a downward trend for TCE. Trend analysis was not performed for the remainder of the wells because results consistently showed nondetects or sporadic detections. Summary reports providing details for each statistical evaluation for each monitoring location are contained in Appendix B.

Table 6. Trend Analysis Results for TCE and DCE in Phase I

Location	Analyte	Trend
Well 0411	TCE	**Down**
Well 0443		None
Seep 0617		None
Well P064		**Down**
Well 0411	*cis*-1,2-DCE	None
Well 0443		**Down**
Seep 0617		**Down**
Well P064		None

The Theil-Sen test was used to estimate the magnitude of the downward trend in TCE concentrations in well 0411 indicated by the Mann-Kendall analysis. The slope calculated for the trend line using the Theil-Sen test suggests that the MCL may be reached by 2029. The remainder of the locations were less than the MCL or no trend was present; therefore, no time frames are estimated.

Table 7 summarizes the results from each annual trend analysis performed since 2007 in Phase I for source area monitoring wells 0411 and 0443 and seep 0617, and for well P064 since 2019. Results show continued downward trends in TCE concentrations in well 0411 since the monitoring program was started. Results also show continued downward trends in TCE concentrations for well P064 since 2019. No trends in the data are observed in TCE concentrations in well 0443 and 0617. No trends in the *cis*-1,2-DCE data have been observed at well 0411 since 2016 or at well P064 since 2019. Downward trends in *cis*-1,2-DCE have been observed at both well 0443 and seep 0617 since 2014 and 2012, respectively.

Table 7. Summary of Annual Trend Analysis Results for Phase I

Location	Analyte	Year													
		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Well 0411	TCE	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Well 0443		N	U	N	N	N	N	N	N	N	N	N	N	N	N
Well P064														D	D
Seep 0617		N	N	N	N	N	N	N	N	N	N	N	N	N	N
Well 0411	cDCE	---	N	N	N	N	N	N	U	U	N	N	N	N	N
Well 0443		---	U	N	N	N	N	N	D	D	D	D	D	D	D
Well P064														N	N
Seep 0617		---	N	N	N	N	D	D	D	D	D	D	D	D	D

Abbreviations:
D = downward trend
N = no trend (either upward or downward)
U = upward trend

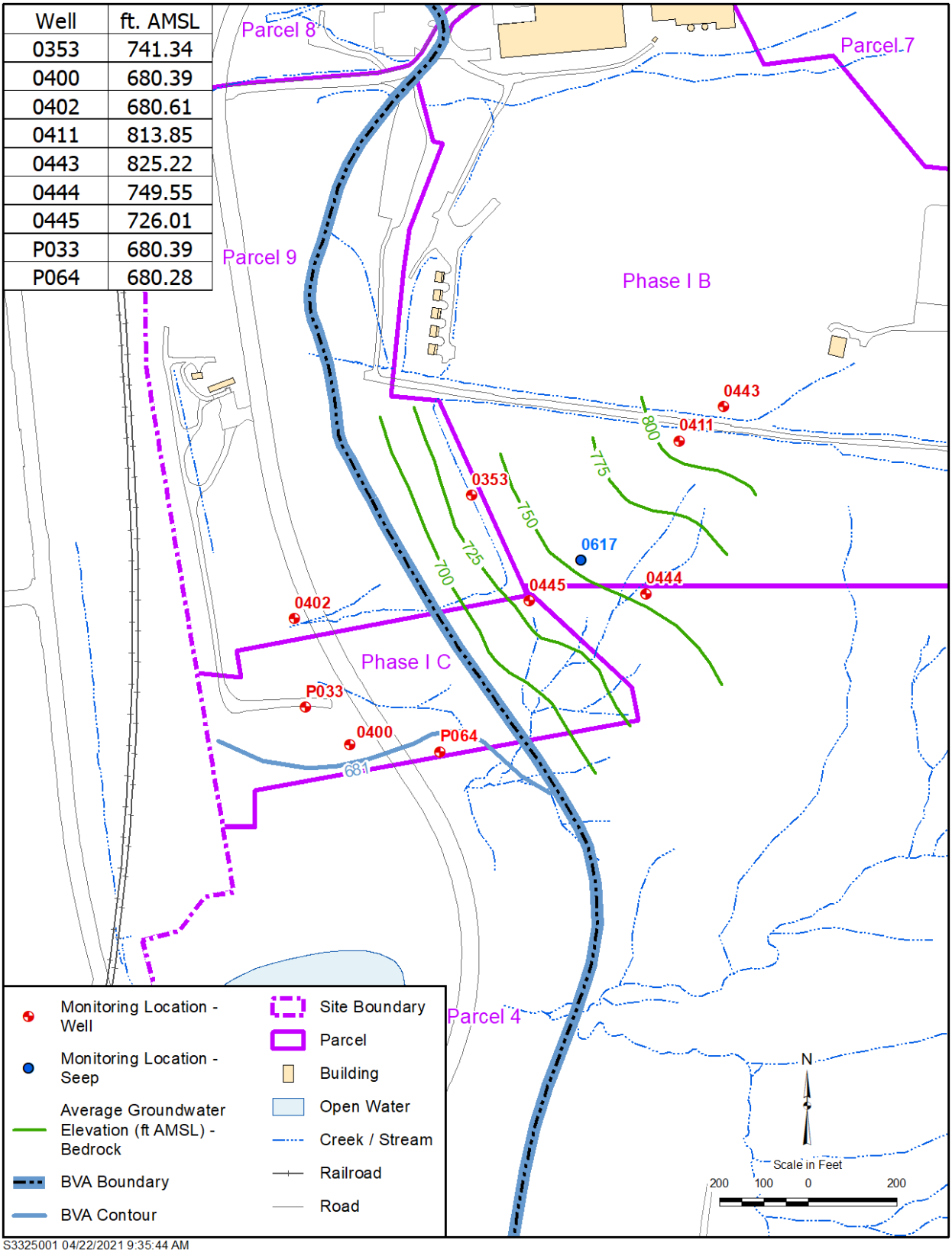
3.3 Groundwater Elevations

A map of the average groundwater elevations measured in the Phase I area during 2020 (Figure 7) represents the two flow regimes present at the Mound site: bedrock and the unconsolidated materials of the BVA. The approximate location of contact of the BVA with the bedrock is indicated in this figure. Groundwater originating from the area of wells 0411 and 0443 flows southwest within the bedrock, following the bedrock topography. This groundwater enters the BVA along this contact. Flow within the BVA is generally to the south-southeast (parallel to the bedrock contact). Appendix C presents a summary of the groundwater elevations measured during 2020.

3.4 Recommendations

No samples in 2020 were above trigger levels. Concentrations of TCE and *cis*-1,2-DCE in BVA monitoring wells continue to remain below MCLs, indicating no impacts to the BVA, and the absence of upward trends demonstrates that analyte concentrations are not statistically increasing.

Data from this monitoring program has shown that impacted groundwater moves through the fractured bedrock associated with the drainage extending from wells 0411 and 0443 through seep 0617 and discharging near well P064. The lack of detections of VOCs in the wells outside the seep 0617 drainage (wells 0353, 0444, and 0445) supports that movement is isolated to the fractured bedrock within the drainage where seep 0617 is located. Well 0353 was installed in 1993 and screened in the till at the top of fractured bedrock near the contact with the BVA. Wells 0444 and 0445 were installed in 2002 and are screened in the shallow fractured bedrock along the sides of the seep 0617 drainage. Data collected from each of these wells since installation have been ND, with the exception of an estimated value of 0.48 µg/l for PCE in well 0353 in 2003. These three wells have provided evidence where impacted groundwater does not flow; therefore, it is recommended to discontinue monitoring of VOCs in these wells as part of this program, as seep 0617 and downgradient well P064 provide better data to evaluate discharge of VOC impacted groundwater to the BVA. The remainder of the wells and seep 0617 would continue to be sampled semiannually.



Abbreviation: AMSL = above mean sea level

Figure 7. 2020 Average Groundwater Elevations in Phase I

4.0 Parcels 6, 7, and 8 MNA Remedy

4.1 Monitoring Results—VOCs

4.1.1 Seeps

Concentrations of TCE were reported in all of the Main Hill seeps; only seep 0602 had concentrations that exceeded the MCL of 5 µg/L (Table 8) in 2020. The trigger level of 150 µg/L for TCE in seep 0605 (Table 4) was not exceeded in 2020. Concentrations of PCE continued to be above the MCL of 5 µg/L in seep 0601 for all sampling events but remained well below the trigger level of 75 µg/L in 2020. Low concentrations of PCE (less than 1 µg/L) were reported as estimated values below the detection limit in seeps 0605 and 0607. *cis*-1,2-DCE was reported in all of the seeps, with seep 0602 having the highest concentrations; however, none of the concentrations exceeded the MCL of 70 µg/L. An estimated detection of *trans*-1,2-DCE (less than 1 µg/L) was reported in seep 0602 during the fourth quarter sampling event. No VC was detected in the seeps.

Table 8. Summary of VOC Results in the Main Hill Seeps for 2020

Location	Area	VOC Concentrations				
		VOC	Q1	Q2	Q3	Q4
0601	Onsite	PCE (µg/L)	**9.8**	**8.0**	**8.8**	**10.7**
		TCE (µg/L)	0.83 (J)	0.96 (J)	0.92 (J)	0.83 (J)
		cis-1,2-DCE (µg/L)	0.64 (J)	0.57 (J)	0.39 (J)	0.62 (J)
		trans-1,2-DCE (µg/L)	ND (<1)	ND (<1)	ND (<1)	ND (<1)
0602	Onsite	PCE (µg/L)	ND (<1)	DRY	DRY	ND (<1)
		TCE (µg/L)	**8.5**			**6.8**
		cis-1,2-DCE (µg/L)	3.4			4.0
		trans-1,2-DCE (µg/L)	ND (<1)			0.17 (J)
0605	Offsite	PCE (µg/L)	0.28 (J)	ND (< 1)	ND (< 1)	ND (<1)
		TCE (µg/L)	1.7	0.66 (J)	0.89 (J)	0.53 (J)
		cis-1,2-DCE (µg/L)	1.3	0.26 (J)	0.44 (J)	0.35 (J)
		trans-1,2-DCE (µg/L)	ND (<1)	ND (<1)	ND (<1)	ND (<1)
0606	Offsite	PCE (µg/L)	ND (<1)	ND (<1)	ND (<1)	ND (<1)
		TCE (µg/L)	ND (<1)	0.25 (J)	0.21 (J)	0.17 (J)
		cis-1,2-DCE (µg/L)	ND (<1)	ND (<1)	ND (< 1)	ND (<1)
		trans-1,2-DCE (µg/L)	ND (<1)	ND (<1)	ND (<1)	ND (<1)
0607	Offsite	PCE (µg/L)	ND (<1)	0.30 (J)	0.20 (J)	0.20 (J)
		TCE (µg/L)	0.48 (J)	1.8	1.39	1.3
		cis-1,2-DCE (µg/L)	0.24 (J)	0.56 (J)	0.78 (J)	1.4
		trans-1,2-DCE (µg/L)	ND (<1)	ND (<1)	ND (<1)	ND (<1)

Notes:
PCE trigger level at seep 0601 = 75 µg/L.
TCE trigger level at the seeps = 150 µg/L.
Values in **bold** exceed the MCL.

Abbreviations:
J = estimated value that is less than the reporting limit
ND = not detected
Q = quarter

A graph of TCE concentrations measured in the seeps following the remediation of contaminated buildings and soil on the Main Hill (completed in mid-2006) (Figure 8). After the completion of site improvements and the closure of the tritium capture pits on the Main Hill in 2011, VOC concentrations have been less variable and decreasing. Data from the past few years show that elevated concentrations of TCE only periodically occurred in seep 0602.

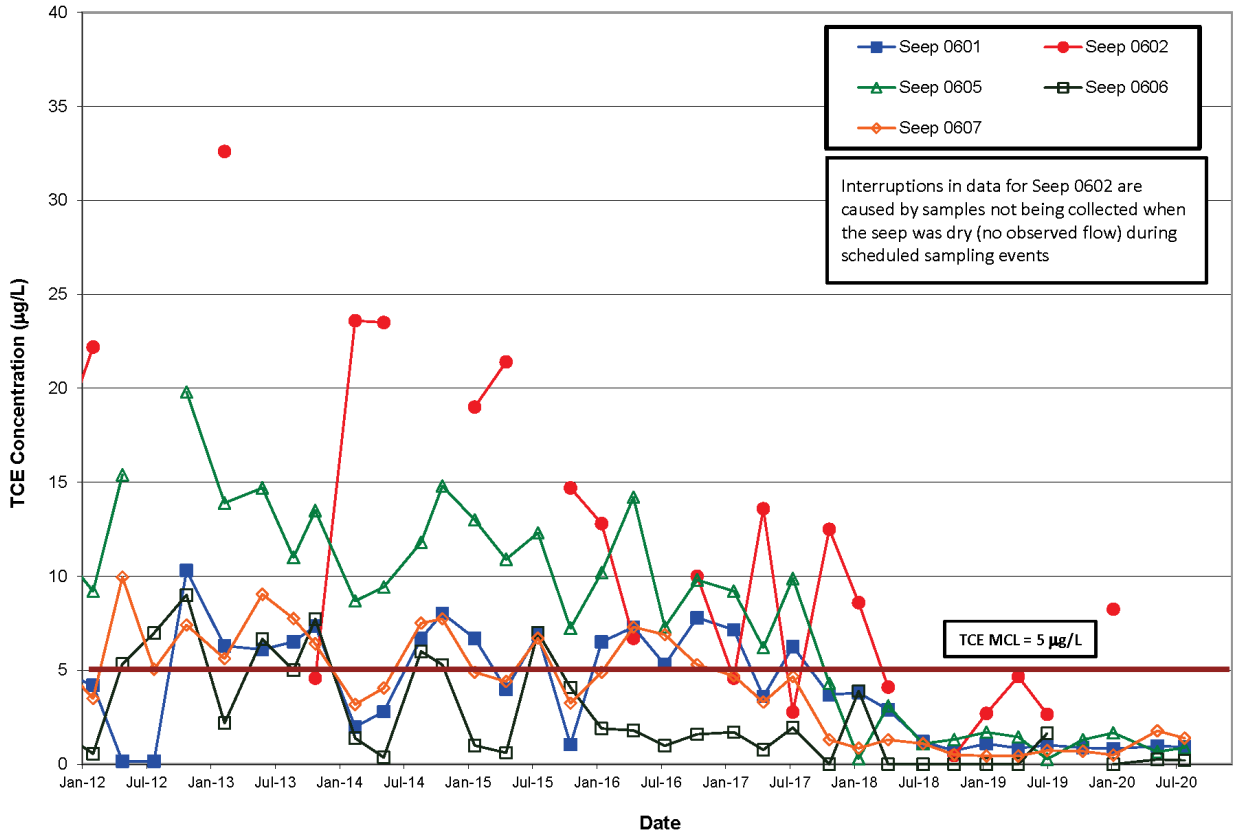


Figure 8. TCE Concentrations in Parcels 6, 7, and 8 Main Hill Seeps

Seep 0601 is the only location where PCE is routinely reported and PCE concentrations in this seep (Figure 9) are similar to those measured before remediation on the Main Hill. Estimated PCE concentrations at less than 1 µg/L were reported in seeps 0605 and 0607 during 2020.

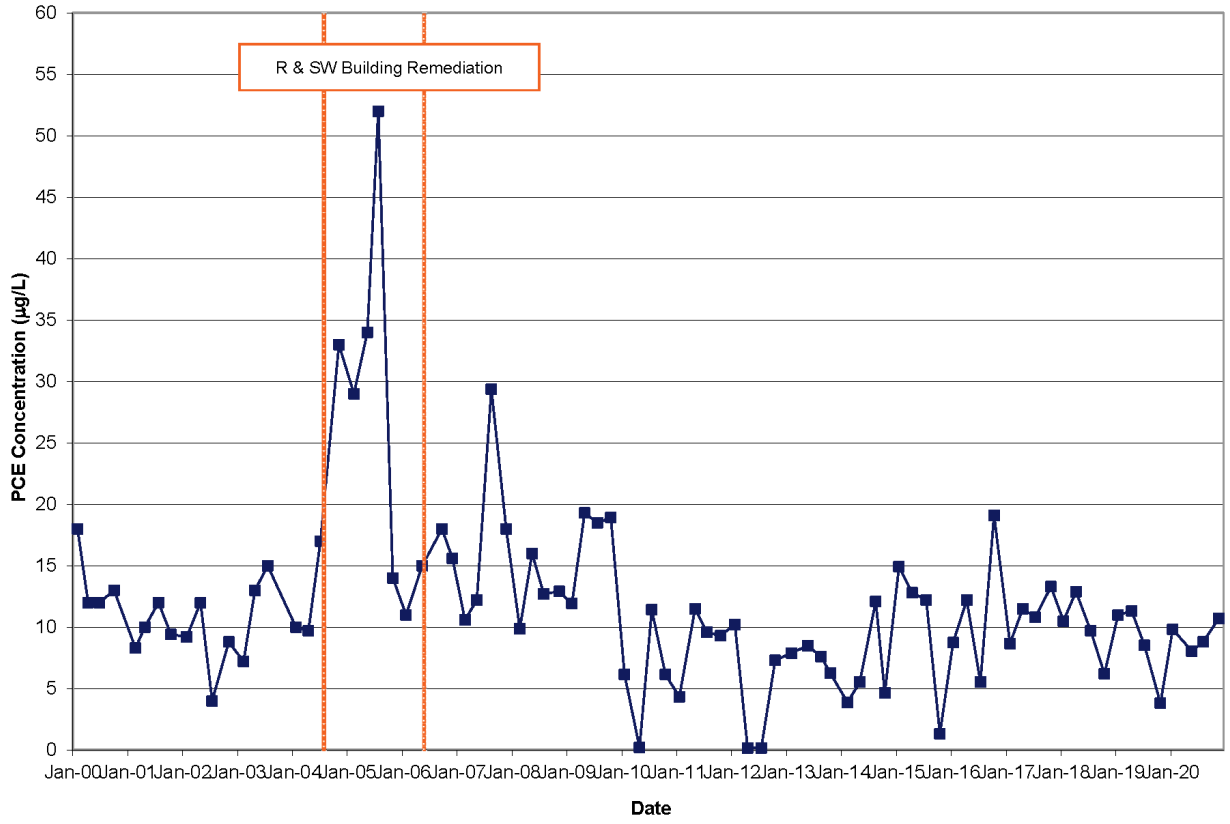


Figure 9. PCE Concentrations in Seep 0601 (Parcels 6, 7, and 8)

4.1.2 Groundwater

Monitoring results for 2020 (Table 9) continue to show TCE in wells 0347 and 0386 with estimated detections reported in wells 0124, 0315, and 0379; the highest concentrations are detected in well 0347 (source area well), where concentrations exceeded the MCL. The concentrations of TCE reported were also below the trigger level of 30 µg/L established for source area wells 0315 and 0347 (Table 4). Wells 0315, 0379, and 0386 are within the tributary valley downgradient of well 0347 (Figure 4). There were no detectable concentrations of TCE measured in the remaining wells.

Estimated detections of PCE less than 1 µg/L were reported in wells 0124, 0126, 0379, 0386, 0387, and 0392. These wells are located where the tributary valley enters the BVA. No trigger levels for PCE have been set for these locations. There were no detectable concentrations of PCE measured in the remaining wells. No detectable concentrations of *cis*-1,2-DCE, *trans*-1,2-DCE, or VC were reported in any of the wells monitored as part of this program.

Table 9. Summary of VOC Results in Parcels 6, 7, and 8 Groundwater for 2020

Location	Area	VOC Concentrations				
		VOC	Q1	Q2	Q3	Q4
Onsite Wells						
0315	Source Area	PCE (μg/L)	ND (<1)	ND (<1)	ND (<1)	ND (<1)
		TCE (μg/L)	0.61 (J)	0.57 (J)	0.42 (J)	0.64 (J)
0347		PCE (μg/L)	ND (<1)	ND (<1)	ND (<1)	ND (<1)
		TCE (μg/L)	**23.8**	**11.1**	**23.6**	**26.2**
0346	Onsite	PCE (μg/L)	ND (<1)	ND (<1)	ND (<1)	ND (<1)
		TCE (μg/L)	ND (<1)	ND (<1)	ND (<1)	ND (<1)
0379		PCE (μg/L)	0.35 (J)	0.21 (J)	0.45 (J)	0.41 (J)
		TCE (μg/L)	0.33 (J)	0.27 (J)	0.42 (J)	0.45 (J)
Downgradient Wells—Near (offsite)						
0386	BVA	PCE (μg/L)	ND (<1)	ND (<1)	0.20 (J)	ND (<1)
		TCE (μg/L)	1.6	0.99 (J)	0.79 (J)	0.59 (J)
0387		PCE (μg/L)	0.17 (J)	0.27 (J)	0.33 (J)	0.29 (J)
		TCE (μ/L)	ND (<1)	ND (<1)	ND (<1)	ND (<1)
0389		PCE (μg/L)	ND (<1)	ND (<1)	ND (<1)	ND (<1)
		TCE (μg/L)	ND (<1)	ND (<1)	ND (<1)	ND (<1)
0392		PCE (μg/L)	ND (<1)	ND (<1)	0.22 (J)	0.22 (J)
		TCE (μg/L)	ND (<1)	ND (<1)	ND (<1)	ND (<1)
Downgradient Wells—Far (offsite)						
0118	BVA	PCE (μg/L)	ND (<1)	ND (<1)	ND (<1)	ND (<1)
		TCE (μg/L)	ND (<1)	ND (<1)	ND (<1)	ND (<1)
0124		PCE (μg/L)	0.27 (J)	0.31 (J)	0.38 (J)	0.32 (J)
		TCE (μg/L)	ND (<1)	0.16 (J)	0.19 (J)	ND (<1)
0126		PCE (μg/L)	0.83 (J)	0.75 (J)	0.94 (J)	0.95 (J)
		TCE (μg/L)	ND (<1)	ND (<1)	ND (<1)	ND (<1)
0138		PCE (μg/L)	ND (<1)	ND (<1)	ND (<1)	ND (<1)
		TCE (μg/L)	ND (<1)	ND (<1)	ND (<1)	ND (<1)

Notes:
TCE trigger level for wells 0315 and 0347 = 30 μg/L.
TCE trigger level for other wells = 5 μg/L.
Values in **bold** exceed the MCL.

Abbreviations:
J = estimated value that is less than the reporting limit
ND = not detected
Q = quarter

TCE data from the Main Hill area indicate that the highest concentrations were measured in groundwater in well 0347. Historically, concentrations of TCE were higher in the seeps than in the groundwater monitoring wells; however, starting in 2018, it was observed that the concentrations of TCE in wells 0315 and 0347 were higher than those measured in the upgradient seeps.

A graph of TCE concentrations measured in select wells shows that concentrations in wells 0315 and 0347 have consistently been greater than the MCL of 5 µg/L (Figure 10), although TCE concentrations in well 0315 have generally been lower than the MCL in the past 5 years and reported as estimated values (less than 1 µg/L) for all 2020 sampling events. The concentrations of TCE in the downgradient wells have been below the MCL since 2000 and reported at or below 1 µg/L since 2016. The pattern in TCE concentrations in wells 0315 and 0347 has been similar since 2012. The concentrations in well 0347 have continued to be higher and have greater changes (increases and decreases) compared to those in well 0315. An overall decrease in TCE concentrations can be observed beginning at the same time. It is likely that surface water influences noted in previous reports (DOE 2014a; DOE 2014b) have been reduced or eliminated and that more recent data reflect TCE concentrations in groundwater not influenced by infiltration of surface water through the exposed tritium capture pits.

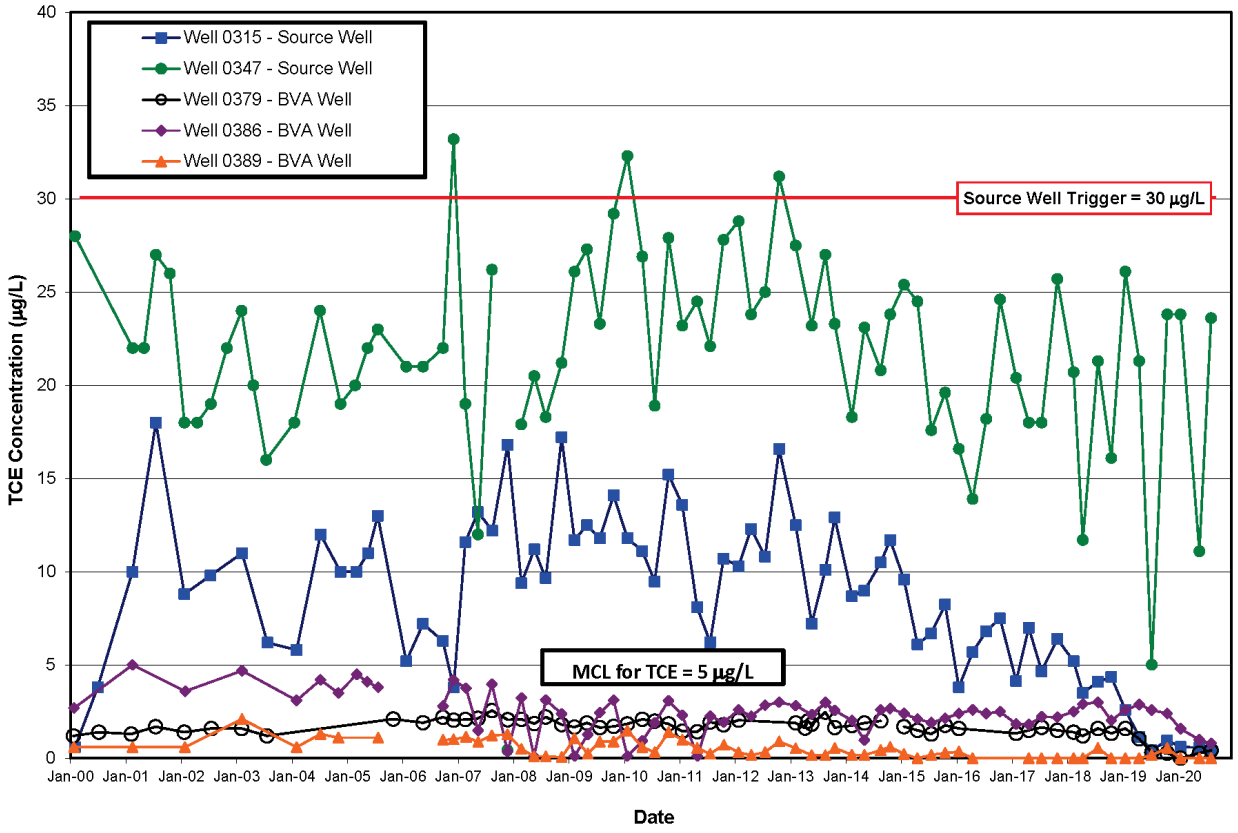


Figure 10. TCE Concentrations in Parcels 6, 7, and 8 Groundwater

Data collected over the past several years indicate variable concentrations of VOCs, primarily TCE, in the groundwater in Parcels 6, 7, and 8, as exhibited in the data from seep 0602 (Figure 8) and wells 0315 and 0347 (Figure 10). Seep 0602 and the downgradient wells 0315 and 0347 are in the tributary valley, which is along the southern edge of the Main Hill. As discussed in Section 1.3, the tributary valley is a narrow tongue of glacial deposits connected to the BVA that overlies the fractured bedrock at the site. Water infiltrating on the Main Hill moves through the fractured bedrock and ultimately discharges into the unconsolidated materials or seeps. This infiltrating surface water and precipitation contacts TCE-impacted soils on the Main

Hill resulting in TCE-impacted groundwater discharging to seeps or the tributary valley (DOE 2017). Annual average TCE concentrations from wells within the tributary valley show that the deep wells screened directly above the bedrock (wells 0347, 0386, and 0387) have the highest TCE concentrations and monitor the TCE-impacted groundwater discharging from the Main Hill through fractured bedrock.

4.2 Monitoring Results—Tritium

Tritium levels in the Main Hill seeps continued to be higher than those in the downgradient groundwater wells (Table 10). The highest tritium activity continued to be measured in seep 0601, which is onsite. No locations exceeded the MCL of 20 nanocuries per liter (nCi/L) or the trigger level of 1500 nCi/L in 2020 (Table 4). The downgradient wells had tritium levels similar to background (0.77 nCi/L) (DOE 1996).

Table 10. Summary of Tritium Results in the Main Hill Area for 2020

Location	Tritium Activity (nCi/L)	
	Semiannual Period 1	Semiannual Period 2
Seeps		
0601	6.4	13.0
0602	0.62	DRY
0605	2.1	1.8
0606	1.9	1.7
0607	1.1	2.5
Downgradient Wells		
0118	ND (<0.3)	ND (<0.3)
0138	ND (<0.3)	ND (<0.3)
0346	ND (<0.3)	ND (<0.3)
0347	0.91	1.1
0379	0.83	0.55

Note:
Tritium trigger level at the seeps = 1500 nCi/L.

Abbreviations:
J = estimated value that is less than the reporting limit
ND = not detected

Tritium levels in the seeps were highest during remediation activities on the Main Hill (2004−2006). Tritium data collected after building demolition and soil removal indicate decreasing levels in all of the seeps (Figure 11). The decrease in tritium levels in postremediation data supports that the majority of the source was removed from the Main Hill area and that, with continued flushing, levels have continued to decline. Starting in 2009, the tritium levels in all seeps except seep 0601 were lower than the MCL of 20 nCi/L. The levels of tritium in seep 0601 have been below the MCL since 2017.

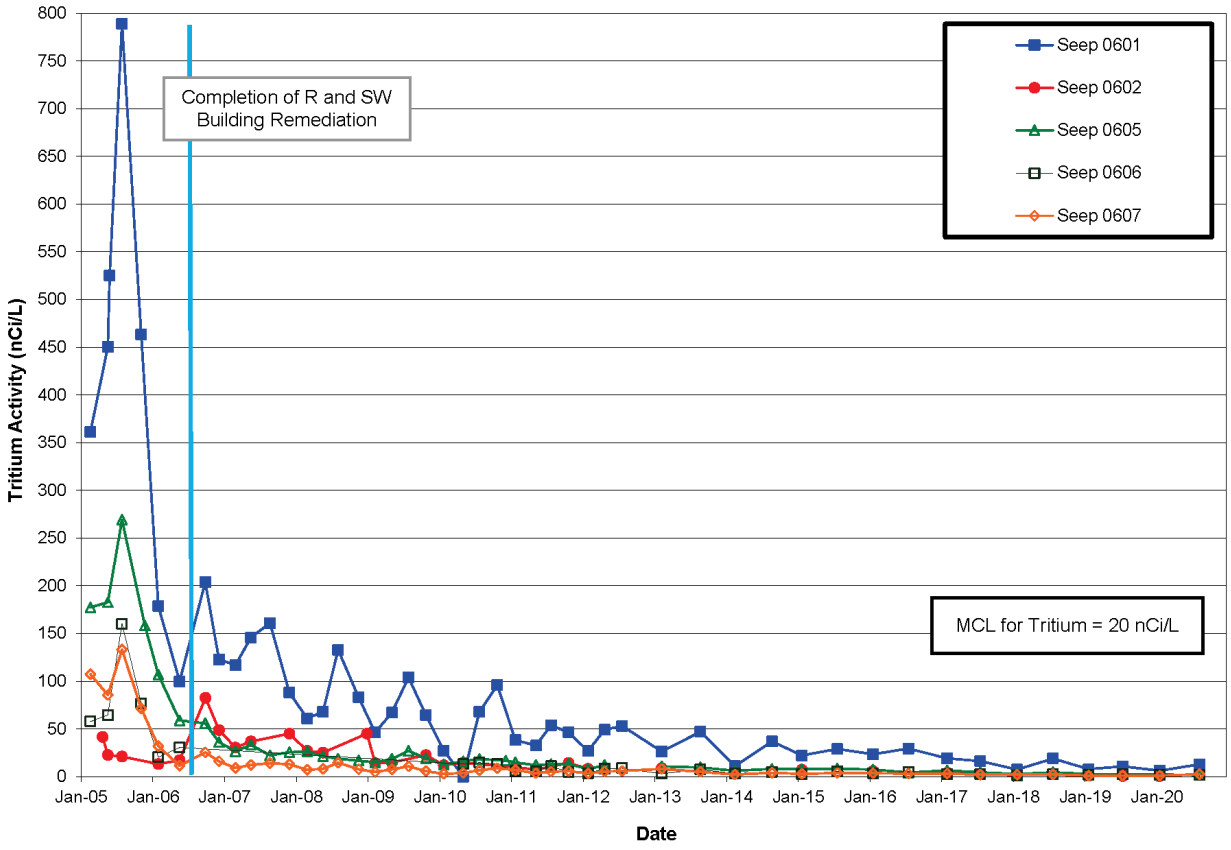


Figure 11. Tritium Activity in Parcels 6, 7, and 8 Main Hill Seeps

A graph of tritium levels in downgradient wells (Figure 12) when compared to Figure 11 illustrates that groundwater impact in the wells lagged behind impact expressed in the seeps. Groundwater impact increased near the end of remediation activities on the Main Hill; impact in the seeps occurred as remediation activities were being performed and began to decrease as activities were completed. The tritium levels in the wells also responded quickly to remediation activities. In general, the tritium levels in the wells have leveled off and are similar to background (0.77 nCi/L). Well 0347 historically had the highest levels of tritium and starting in 2016, the levels were similar to those measured in the other wells. All tritium levels in the monitoring wells were below the MCL of 20 nCi/L.

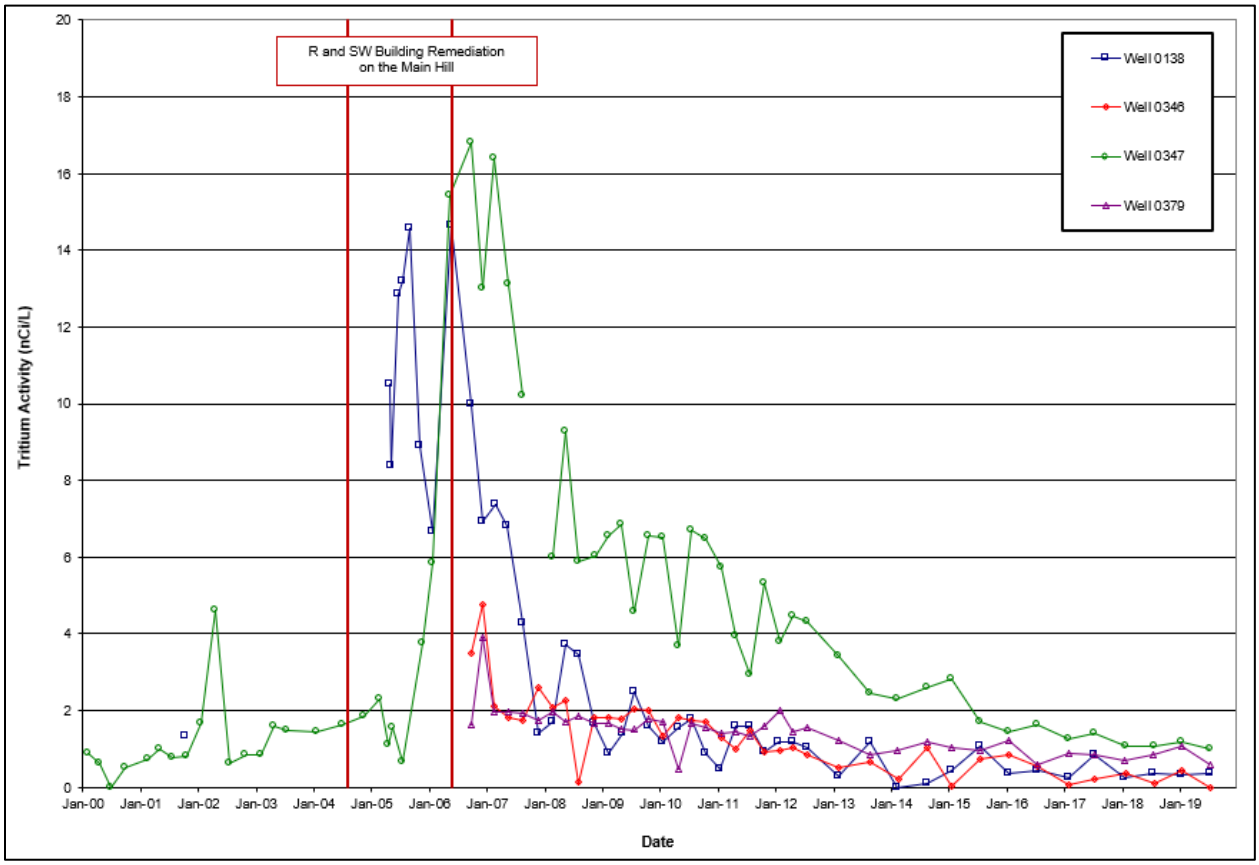


Figure 12. Tritium Activity in Parcels 6, 7, and 8 Wells 0138, 0346, 0347, and 0379

4.3 Trend Analysis

Trend analysis was performed on VOCs and tritium data using the nonparametric Mann-Kendall test. Trend analysis is reported for data collected since 2012 to better evaluate more recent trends. This period was selected to represent data collected after influences of surface water entering the subsurface were reduced or eliminated.

4.3.1 VOCs

Trend analysis of TCE data collected since 2012 indicates downward trends for all the seeps and wells (Table 11). Concentrations of PCE in seep 0601 were evaluated for a trend in PCE concentrations, and no statistically significant trend was indicated. Data from seeps 0602 and 0605 were evaluated for trends in *cis*-1,2-DCE concentrations (Table 11), and downward trends were determined by the nonparameteric Mann-Kendall test for both seeps. The Theil-Sen test was used to estimate the magnitude of the slope data collected for 2012−2020 time frame for well 0347. The slope of the trend line suggests that the MCL may be reached by 2040. Trend analysis was not performed on data from the remainder of the wells because results consistently showed nondetects or sporadic estimated detections. Summary reports providing details for each statistical evaluation for each monitoring location are in Appendix B.

Table 11. Trend Analysis Results for VOCs in Parcels 6, 7, and 8 (2012–2020)

Location	Trend
TCE	
Seep 0601	**Down**
Seep 0602	**Down**
Seep 0605	**Down**
Seep 0606	**Down**
Seep 0607	**Down**
Well 0315	**Down**
Well 0347	**Down**
Well 0386	**Down**
Well 0389	**Down**
PCE	
Seep 0601	None
***cis*-1,2-DCE**	
Seep 0602	**Down**
Seep 0605	**Down**

Table 12 summarizes the results from annual trend analyses of VOC data in Parcels 6, 7, and 8 since 2007. Results show that upward trends in TCE concentrations observed in the seeps (from 2007 to 2012) had reverted to either no trends or downward trends starting in 2013. Since 2017, the seeps and source wells 0315 and 0347 consistently exhibited downward trends. Downward trends in PCE and *cis*-1,2-DCE in seeps 0601 and 0605, respectively, started in 2011, and a downward trend in *cis*-1,2-DCE in seep 0602 started in 2016. The downward trends for all of these locations are attributable to source removal and subsequent efforts in 2011 to reduce the impact of surface water entering the subsurface on the Main Hill (DOE 2014a; DOE 2014b).

Table 12. Summary of Trend Analysis Results for VOCs in Parcels 6, 7, and 8

Location	Analyte	Year													
		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019*	2020*
Seep 0601	TCE	U	N	N	N	N	N	N	N	N	N	N	N	N	D
Seep 0602		U	U	U	U	U	U	N	N	N	N	D	D	D	D
Seep 0605		D	D	D	D	D	D	D	D	D	D	D	D	D	D
Seep 0606		---	---	---	N	N	N	N	N	N	N	D	D	D	D
Seep 0607		N	N	N	N	N	N	N	N	N	N	D	D	D	D
Well 0315		N	N	U	N	N	N	N	N	N	N	D	D	D	D
Well 0347		N	N	N	N	N	U	U	U	N	N	N	D	D	D
Well 0386		N	D	D	D	D	D	N	D	D	D	D	N	N	D
Well 0389		N	N	N	N	N	N	D	D	D	D	D	D	N	D
Seep 0601	PCE	---	---	N	N	D	D	D	D	D	D	D	D	D	N
Seep 0602	cDCE	---	---	---	---	N	N	N	N	N	D	D	D	D	D
Seep 0605		---	---	---	---	D	D	D	D	D	D	D	D	D	D

Note:
* Denotes trends using data collected from 2012 to 2020. Previous trending was performed using data from 2005 to 2020.

Abbreviations: D = downward trend; N = no trend (either upward or downward); U = upward trend

4.3.2 Tritium

Trend analysis for tritium data collected since 2012 was performed for all seeps and wells where detectable levels have been consistently measured. The trend analysis showed that downward trends in activity were observed in all seeps and wells (Table 13). Summary reports providing details for each statistical evaluation for each monitoring location are in Appendix B.

Table 13. Summary of Trend Analysis Results for Tritium in Parcels 6, 7, and 8 Seeps and Downgradient Wells

Location	Trend
Seeps	
Seep 0601	**Down**
Seep 0602	**Down**
Seep 0605	**Down**
Seep 0606	**Down**
Seep 0607	**Down**
Wells	
Well 0138	**Down**
Well 0346	**Down**
Well 0347	**Down**
Well 0379	**Down**

Table 14 summarizes the results from annual trend analysis of tritium data in Parcels 6, 7, and 8 since 2007. Results of the trend analysis of tritium data indicate downward trends starting in 2011 for all the seeps and wells, with the exception of well 0347, in which no trends were observed from 2011 through 2013, and downward trends have been observed since 2014. The downward trends determined from postremediation data support that the majority of the source of contamination was removed from the Main Hill area during remediation, and that flushing and radioactive decay have continued to lower the levels.

Table 14. Summary of Annual Trend Analysis Results for Tritium in Parcels 6, 7, and 8

Location	Analyte	Year													
		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Seep 0601	Tritium	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Seep 0602		N	N	N	N	D	D	D	D	D	D	D	D	D	D
Seep 0605		---	---	---	D	D	D	D	D	D	D	D	D	D	D
Seep 0606		D	D	D	D	D	D	D	D	D	D	D	D	D	D
Seep 0607		D	D	D	D	D	D	D	D	D	D	D	D	D	D
Well 0138		D	D	D	D	D	D	D	D	D	D	D	D	D	D
Well 0346		N	N	N	D	D	D	D	D	D	D	D	D	D	D
Well 0347		N	N	N	D	N	N	N	D	D	D	D	D	D	D
Well 0379		N	N	D	D	D	D	D	D	D	D	D	D	D	D

Abbreviations: D = downward trend; N = no trend (either upward or downward)

4.4 Groundwater Elevations

A map of the average groundwater elevations measured in the Parcels 6, 7, and 8 area during 2020 (Figure 13) represents the two flow regimes present at the Mound site: bedrock and the unconsolidated materials of the BVA. The approximate location of contact of the BVA with the bedrock is indicated on this figure. Groundwater originating from the Main Hill area flows within the bedrock, following the bedrock topography. This groundwater enters the BVA along this contact, and flow within the BVA is parallel to the bedrock contact. Appendix C presents a summary of the groundwater elevations measured during 2020.

4.5 Recommendations

TCE concentrations greater than the MCL continued to be measured in seep 0601 and in downgradient monitoring well 0347. The concentrations of VOCs continue to be variable at a few locations, although recent data (since 2012) indicate decreasing VOC concentrations at most locations. Quarterly sampling will continue at the seep and monitoring well locations in 2020 to determine if the system has stabilized since efforts were taken to reduce surface water infiltration into the subsurface (DOE 2014a; DOE 2014b) and to determine if VOCs continue to attenuate naturally. Evaluation of the 2020 data indicates that no changes to the VOC monitoring program should be made at this time.

All seeps and downgradient wells were below the MCL for tritium in 2020, and downward trends have been observed for all seeps and wells since 2011 and 2014, respectively. In accordance with the Sitewide Operations and Maintenance Plan (DOE 2015), 2 consecutive years of tritium levels below the MCL qualify for a recommendation to the Core Team to discontinue sampling. The calendar year 2018 report (DOE 2019) included a recommendation to discontinue tritium monitoring in Parcels 6, 7, and 8. In response to that recommendation, the regulators requested that four additional consecutive samples below the MCL be provided as additional data to support that the concentrations in seep 0601 would continue to remain less than the MCL. All the data collected in 2019 and 2020 (four data points) were below the MCL for seep 0601; thereby, fulfilling the data request. Beginning in calendar year 2021, the tritium monitoring program will be discontinued.

5.0 Inspection of the Monitoring System

A routine maintenance program has been established for long-term groundwater monitoring locations at the Mound site. This program includes periodic inspections that focus on the integrity of each well and the condition of the protective casing and surface pad, the surrounding area, and the access route. These inspections are usually performed during each sampling event. The wells and seep locations were in good condition in 2020.

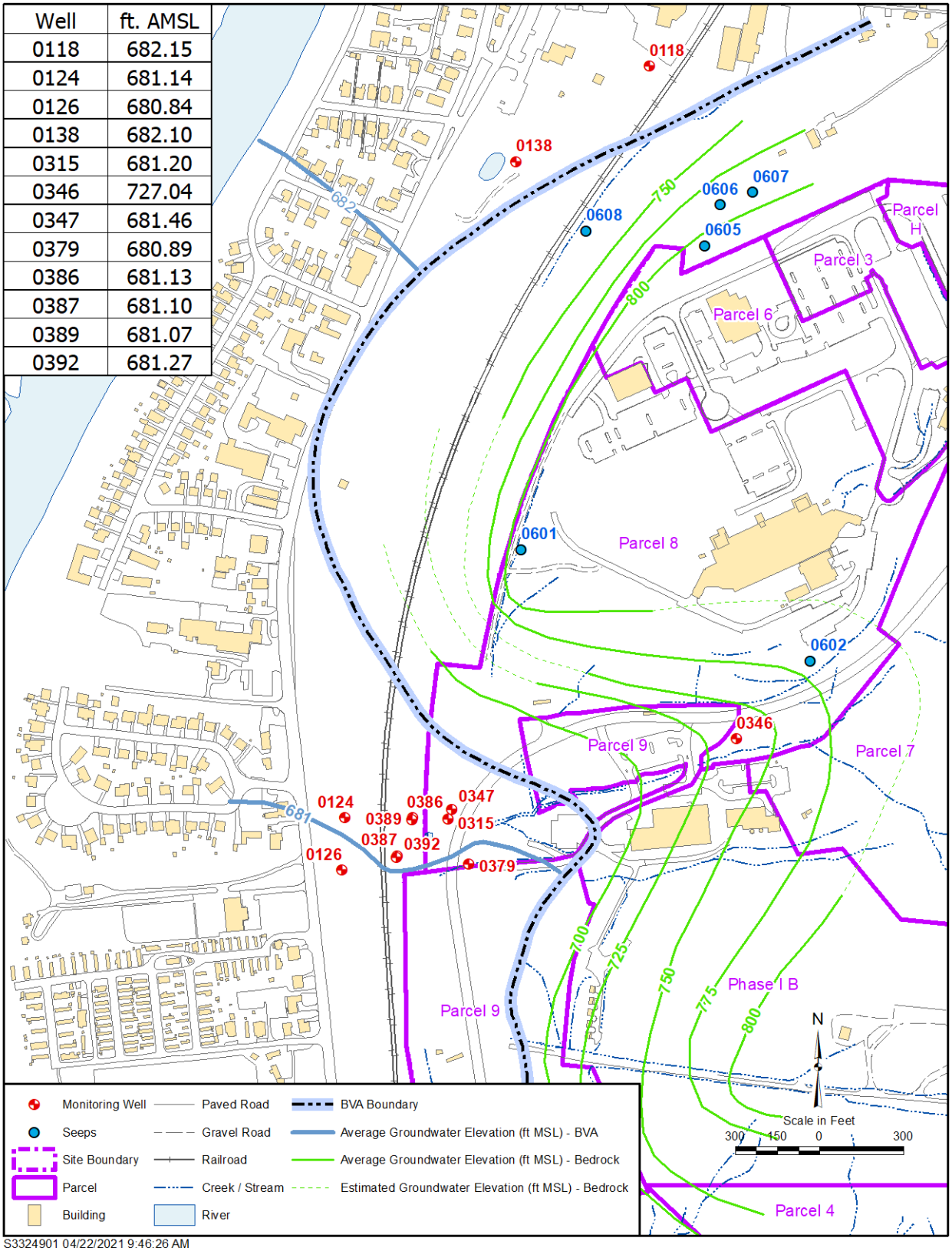


Figure 13. 2020 Averages for Groundwater Elevations in Parcels 6, 7, and 8

6.0 Data Validation

All data collected were validated in accordance with procedures specified in the Sitewide Operations and Maintenance Plan (DOE 2015). This procedure also fulfills the requirements of applicable procedures in the *Mound Methods Compendium* (MD-80045). Data validation was documented in reports prepared for each data package. All 2020 data, including data validation qualifiers, are summarized in Appendix D.

Laboratory performance is assessed by a review and evaluation of the following quality indicators:

- Sample shipping and receiving practices
- Chain of custody
- Laboratory blanks
- Preparation blanks
- Laboratory replicates
- Serial dilutions
- Detection limits
- Peak integrations
- Matrix spikes and matrix spike duplicates
- Holding times
- Instrument calibrations
- Interference check samples
- Radiochemical uncertainty
- Laboratory control samples
- Sample dilutions
- Surrogate recoveries
- Confirmation analyses
- Electronic data

Six report identification numbers (RINs) were established for the 2020 environmental sampling efforts at the Mound site. A RIN is a set of samples that is relinquished to the laboratory using a chain of custody form. Data Assessment Reports are prepared for each RIN and are presented in Appendix E.

The laboratory prepares an analytical package for each RIN that includes a summary of results, a complete set of supporting analytical data for every analysis reported, and an electronic data deliverable that is used to upload analytical data into databases for validation and qualification before the data are released. Every RIN received from the laboratory is thoroughly reviewed and evaluated before the data package is finalized and released to the public. Table 15 lists the RINs associated with this report.

Table 15. RINs for Mound Site Calendar Year 2020 Sampling

RIN	Area	Sampling Date(s)
MND01-01.2001010	Parcels 6, 7, and 8	January 27–28, 2020
MND01-01.2006012		June 1–3, 2020
MND01-01.2008013		August 17–18, 2020
MND01-01.2010014		November 30–December 1, 2020
MND01-02.2001006	Phase I	January 27–29, 2020
MND01-02.2008007		August 17–18, 2020

The Data Assessment Reports also summarize and assess the sampling quality control for each sampling event. The following items are included:

- Sampling protocol
- Trip blanks
- Outliers
- Equipment blanks
- Field duplicates

7.0 References

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Mound Methods Compendium, Issue 2, MD-80045, prepared by BWXT of Ohio Inc.

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Appendix A

Well Construction Summary

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Table A-1. Well Construction Summary

Location ID	Program	Northing	Easting	Ground Elevation (ft AMSL)	TOC Elevation (ft AMSL)	Well Depth (ft)	Top of Screen Elevation (ft AMSL)	Bottom of Screen Elevation (ft AMSL)	Screen Length (ft)	Well Material	Screened Formation
0118	Parcels 6, 7, 8	600464.95	1464737.80	705.36	704.86	40.1	674.73	664.73	10	4-inch SS	BVA
0124	Parcels 6, 7, 8	597789.14	1463654.10	704.18	705.12	55.9	659.18	649.18	10	4-inch SS	BVA
0126	Parcels 6, 7, 8	597603.58	1463643.30	704.61	705.54	54.8	660.78	650.78	10	4-inch SS	BVA
0138	Parcels 6, 7, 8	600124.02	1464263.30	698.59	697.76	40.2	667.59	657.59	10	4-inch SS	BVA
0315	Phase I	597786.28	1464020.40	722.57	723.99	54.8	679.17	669.17	10	4-inch SS	BVA
0346	Parcels 6, 7, 8	598070.11	1465048.90	743.50	742.97	45.5	702.50	697.50	5	4-inch SS	BVA
0347	Parcels 6, 7, 8	597819.31	1464034.10	723.76	725.20	68.4	666.76	656.76	10	4-inch SS	BVA
0353	Phase I	596686.11	1464609.40	744.04	745.33	19.3	731.04	726.04	5	4-inch SS	Bedrock
0379	Parcels 6, 7, 8	597624.41	1464095.90	715.24	716.11	40.9	685.24	675.24	10	4-inch SS	BVA
0386	Parcels 6, 7, 8	597789.23	1463896.00	725.16	724.79	86.6	648.16	638.16	10	4-inch SS	BVA
0387	Parcels 6, 7, 8	597654.63	1463839.50	721.26	720.89	81.6	644.26	639.26	5	4-inch SS	BVA
0389	Parcels 6, 7, 8	597781.29	1463891.90	724.96	724.65	51.7	682.96	672.96	10	4-inch SS	BVA
0392	Parcels 6, 7, 8	597648.77	1463838.30	721.18	720.84	44.7	681.18	676.18	5	4-inch SS	BVA
0411	Phase I	596808.81	1465077.10	834.83	836.57	39.7	806.89	796.89	10	2-inch SS	Bedrock
0443	Phase I	596886.22	1465177.11	856.89	858.78	39.6	829.20	819.20	10	2-inch PVC	Bedrock
0444	Phase I	596463.35	1465001.58	770.71	773.00	32.8	750.20	740.20	10	2-inch PVC	Bedrock
0445	Phase I	596448.12	1464738.54	741.29	743.43	42.5	710.93	700.93	10	2-inch PVC	Bedrock
P064	Phase I	596106.72	1464537.47	726.82	729.98	56.9	680.08	670.08	10	2-inch PVC	BVA
0601	Parcels 6, 7, 8	598743.22	1464280.80	817.52						Seep	Bedrock
0602	Parcels 6, 7, 8	598346.65	1465311.40	779.61						Seep	Bedrock
0605	Parcels 6, 7, 8	599824.63	1464935.40	817.70						Seep	Bedrock
0606	Parcels 6, 7, 8	599971.45	1464989.00	789.23						Seep	Bedrock
0607	Parcels 6, 7, 8	600015.30	1465105.70	797.00						Seep	Bedrock
0617	Phase I	596539.80	1464855.80	766.07						Seep	Bedrock

Abbreviations:
ft AMSL = feet above mean sea level
SS = stainless steel
TOC = top of casing

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Appendix B

Trending Summaries

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Mann-Kendall Test for Monotonic Trend
(from Visual Sample Plan [VSP] software version 7.10, 2018)

The purpose of the Mann-Kendall (MK) test (Mann 1945; Kendall 1975; Gilbert 1987) is to statistically assess if there is a monotonic upward or downward trend of the variable of interest over time. A monotonic upward (downward) trend means that the variable consistently increases (decreases) through time, but the trend may or may not be linear.

Selected Statistical Testing Approach

The MK test can be used in place of a parametric linear regression analysis that is used to test if the slope of the estimated linear regression line is different from zero. The regression analysis requires that the residuals from the fitted regression line be normally distributed; an assumption not required by the MK test. Hence, the MK test is a nonparametric (distribution-free) test.

The MK test is used to decide whether to reject the null hypothesis (H_0) that no monotonic trend exists in favor of the alternative hypothesis (H_a) that a monotonic trend exists.

One of three alternative hypotheses is chosen:

1. A monotonic downward trend exists.
2. Either a monotonic upward or monotonic downward trend exists.
3. A monotonic upward trend exists.

Assumptions

The following assumptions underlie the MK test:

1. When no trend is present, the measurements (observations or data) obtained over time are independent and identically distributed. The assumption of independence means that the observations are not serially correlated over time.
2. The observations obtained over time are representative of the true conditions at sampling times.
3. The sample collection, handling, and measurement methods provide unbiased and representative observations of the underlying populations over time.

The MK test does not require that the measurements or the residuals about a trend line be normally distributed or that the trend, if present, be linear.

The MK test can be computed if there are missing values (no measurements for some sampling times), but the performance of the test will be adversely affected. The assumption of independence requires that the time between samples be sufficiently long so that there is no correlation between measurements collected at different times.

References

Gilbert, R.O., 1987. *Statistical Methods for Environmental Pollution Monitoring*, Wiley & Sons, New York.

Kendall, M.G., 1975. *Rank Correlation Methods*, 4th ed., Charles Griffin, London.

Mann, H.B., 1945. "Non-parametric tests against trend," *Econometrica* 13:163–171.

Theil-Sen Test for Monotonic Trend
(from ProUCL software version 5.1, 2015)

In nonparametric statistics, the Theil–Sen test (Theil 1950; Sen 1968) is a method for robustly fitting a line to sample points in the plane (i.e., simple linear regression) by choosing the median of the slopes of all lines through pairs of points. This estimator can be computed efficiently, and is insensitive to outliers. It can be significantly more accurate than nonrobust simple linear regression (i.e., least squares) for skewed data, and competes well against least squares even for normally distributed data in terms of statistical power.

As defined by Theil, the Theil–Sen estimator of a set of two-dimensional points (x_i,y_i) is the median β of the slopes $(y_j - y_i)/(x_j - x_i)$ determined by all pairs of sample points. The null hypothesis is that the slope, β, of the regression line is some specified value β_0, namely,

$$H_0 : \beta = \beta_0$$

The null hypothesis asserts that for every unit increase in the value of the independent variable x, we would expect an increase (or decrease, depending of the sign of β_0) of approximately β_0 in the value of the dependent variable y (Hollander et al. 2014).

The estimation of the model is done by calculating the slopes (β) and intercepts (α) of a subpopulation of all possible combinations of sample points. The final slope and intercept are then defined as the spatial median of these slopes and intercepts. Once the slope β has been determined, a line can be determined from the sample points by setting the y-intercept α to be the median of the values $y_i - \beta x_i$. The fit line is then the line $y = \beta x + \alpha$ with coefficients β and α in slope-intercept form.

Assumptions

The following assumptions underlie the Theil-Sen test and slope estimation:

- The observations obtained over time are not serially correlated.
- The true trend is linear over time.
- There are no differences in the trend line for different seasons, (e.g., months or calendar quarters).
- There is no requirement that the measurements be normally distributed.
- The observations obtained over time are representative of the true conditions at sampling times.
- The sample collection, handling, and measurement methods provide unbiased and representative observations of the underlying populations over time.

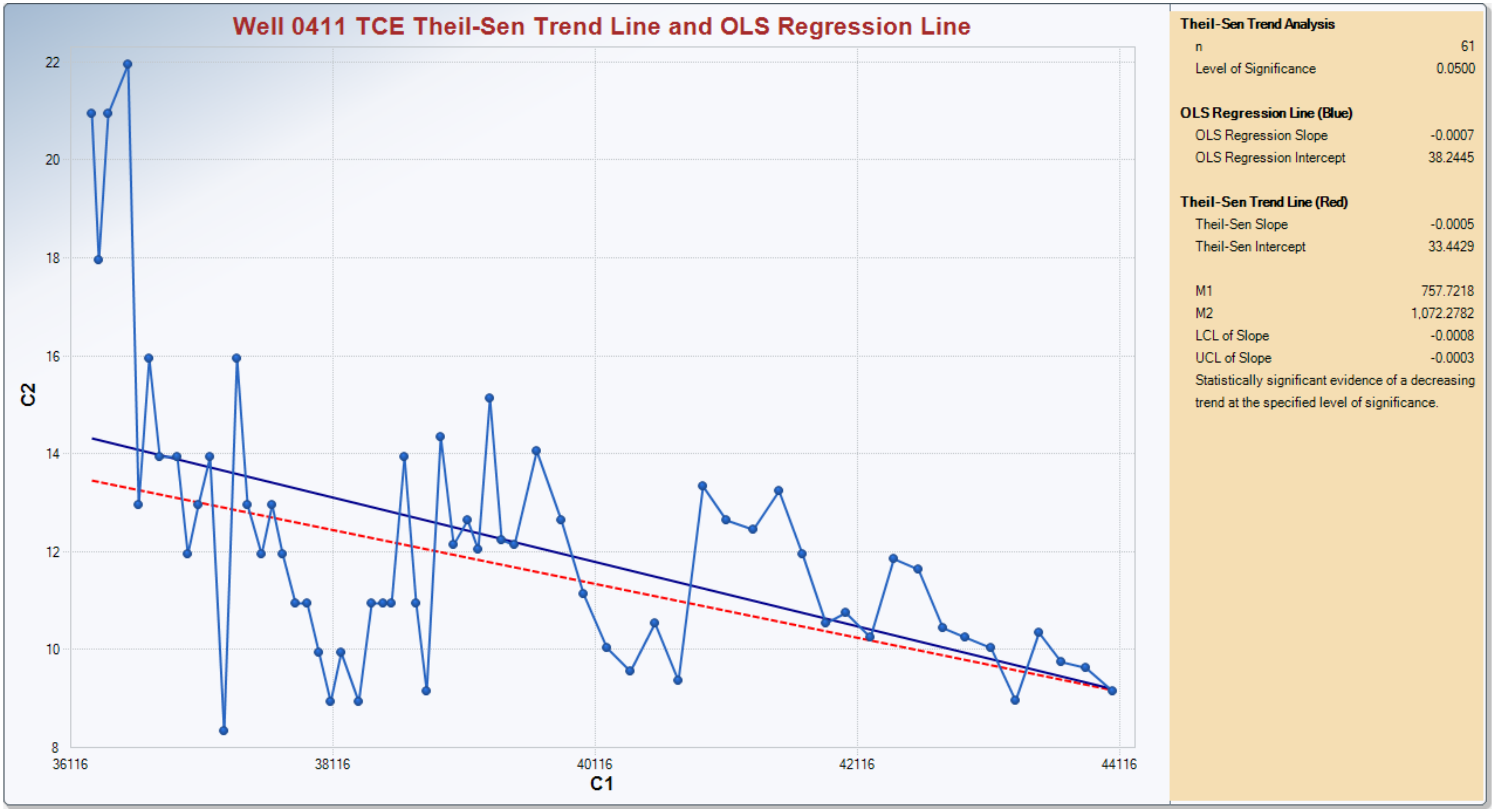
References

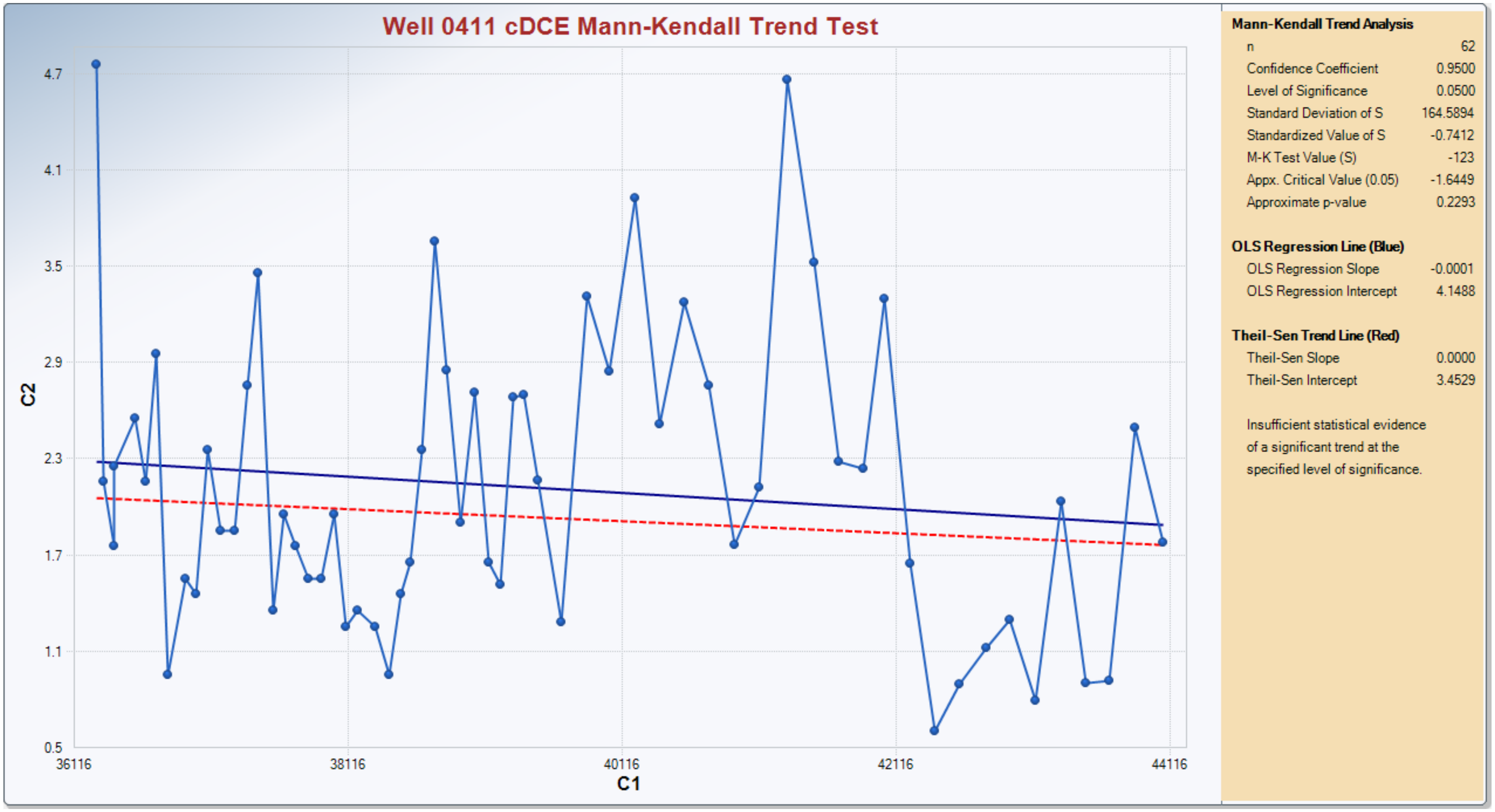
Gilbert, R.O. 1987. *Statistical Methods for Environmental Pollution Monitoring*, Wiley, New York.

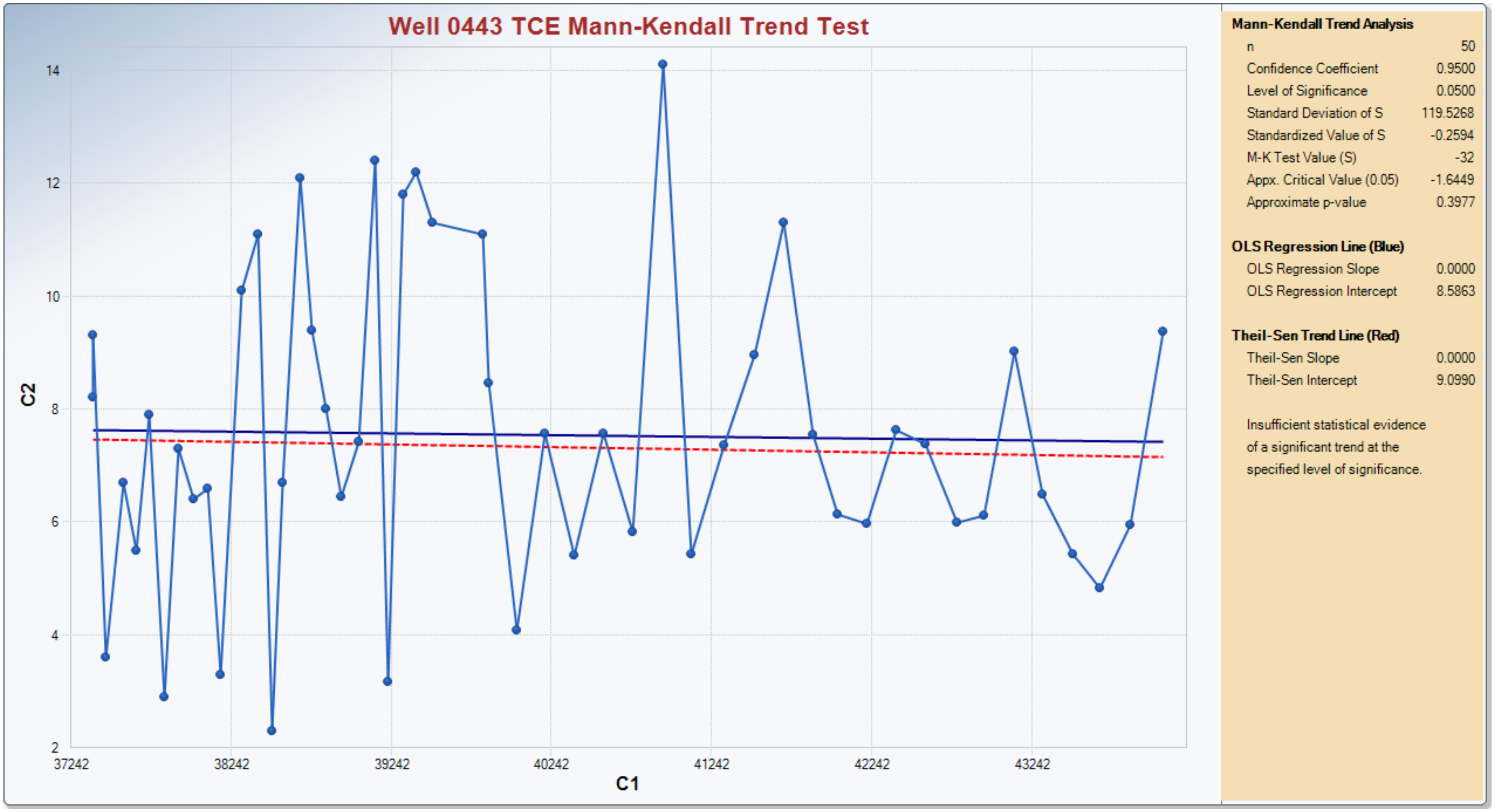
Hollander, M., D.A. Wolfe, and E. Chicken, 2014. *Nonparameteric Statistical Methods*, Wiley, New York.

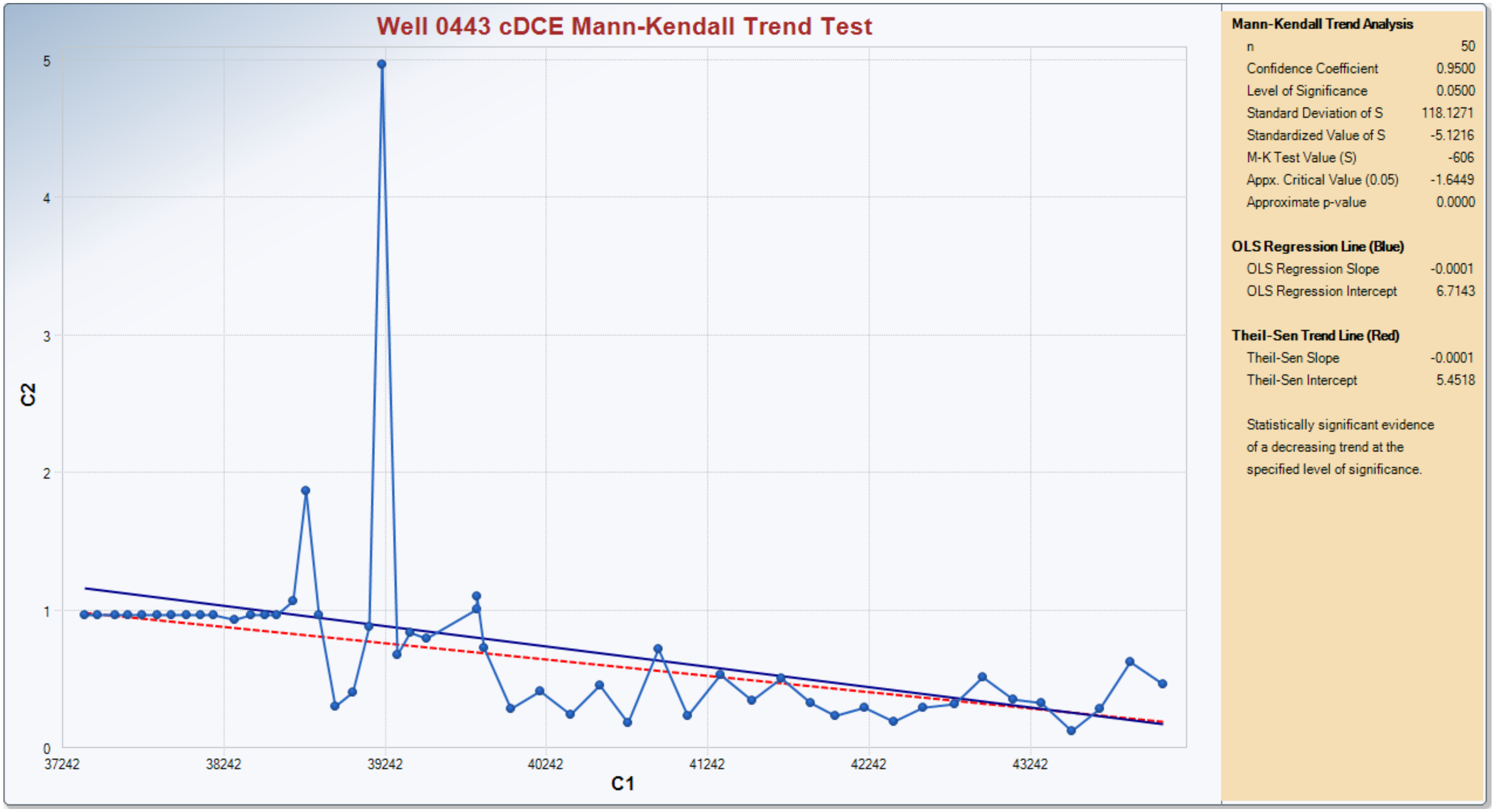
Sen, P.K., 1968. "Estimates of the regression coefficient based on Kendall's tau," *Journal of the American Statistical Association* 63:1379–1389.

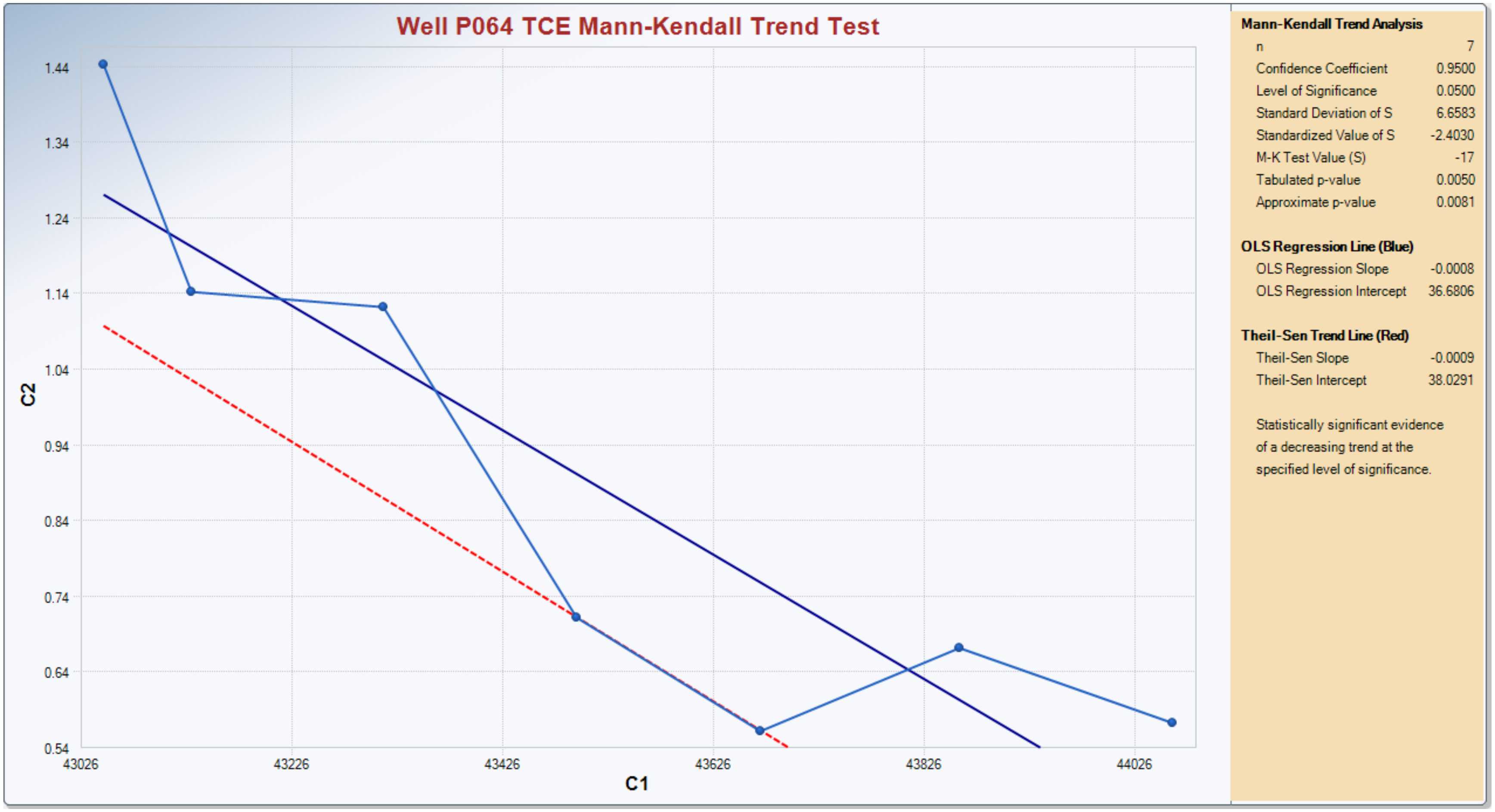
Theil, H. 1950. *A rank-invariant method of linear and polynomial regression analysis, 1,2, and 3*: Ned. Akad. Wentsch Proc., 53:386–392, 521–525, and 1397–1412.

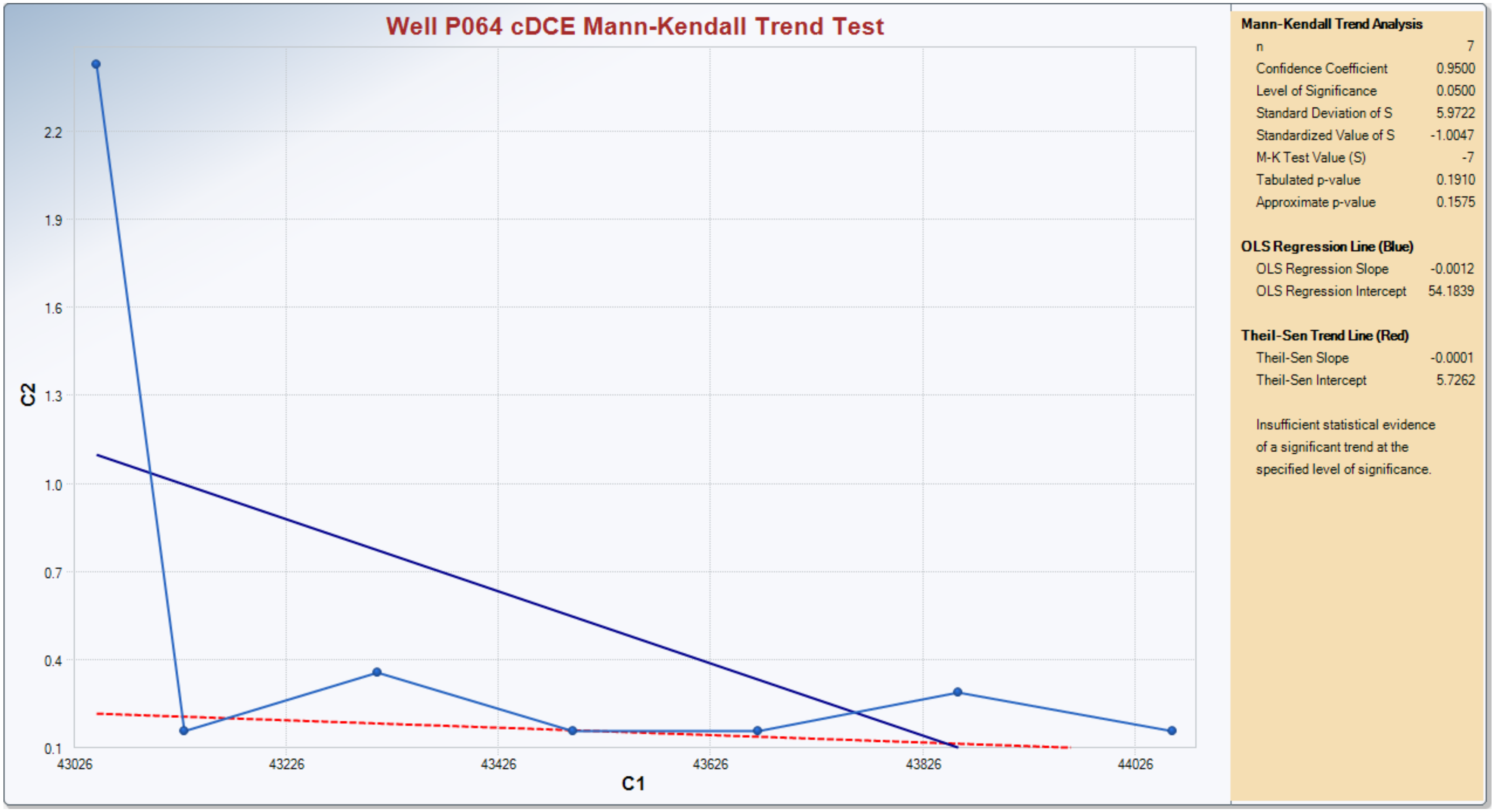

Well 0411 TCE Theil-Sen Trend Line and OLS Regression Line
C2
C1
22
20
18
16
14
12
10
8
36116
38116
40116
42116
44116
Theil-Sen Trend Analysis
n 61
Level of Significance 0.0500
OLS Regression Line (Blue)
OLS Regression Slope -0.0007
OLS Regression Intercept 38.2445
Theil-Sen Trend Line (Red)
Theil-Sen Slope -0.0005
Theil-Sen Intercept 33.4429
M1 757.7218
M2 1,072.2782
LCL of Slope -0.0008
UCL of Slope -0.0003
Statistically significant evidence of a decreasing trend at the specified level of significance.

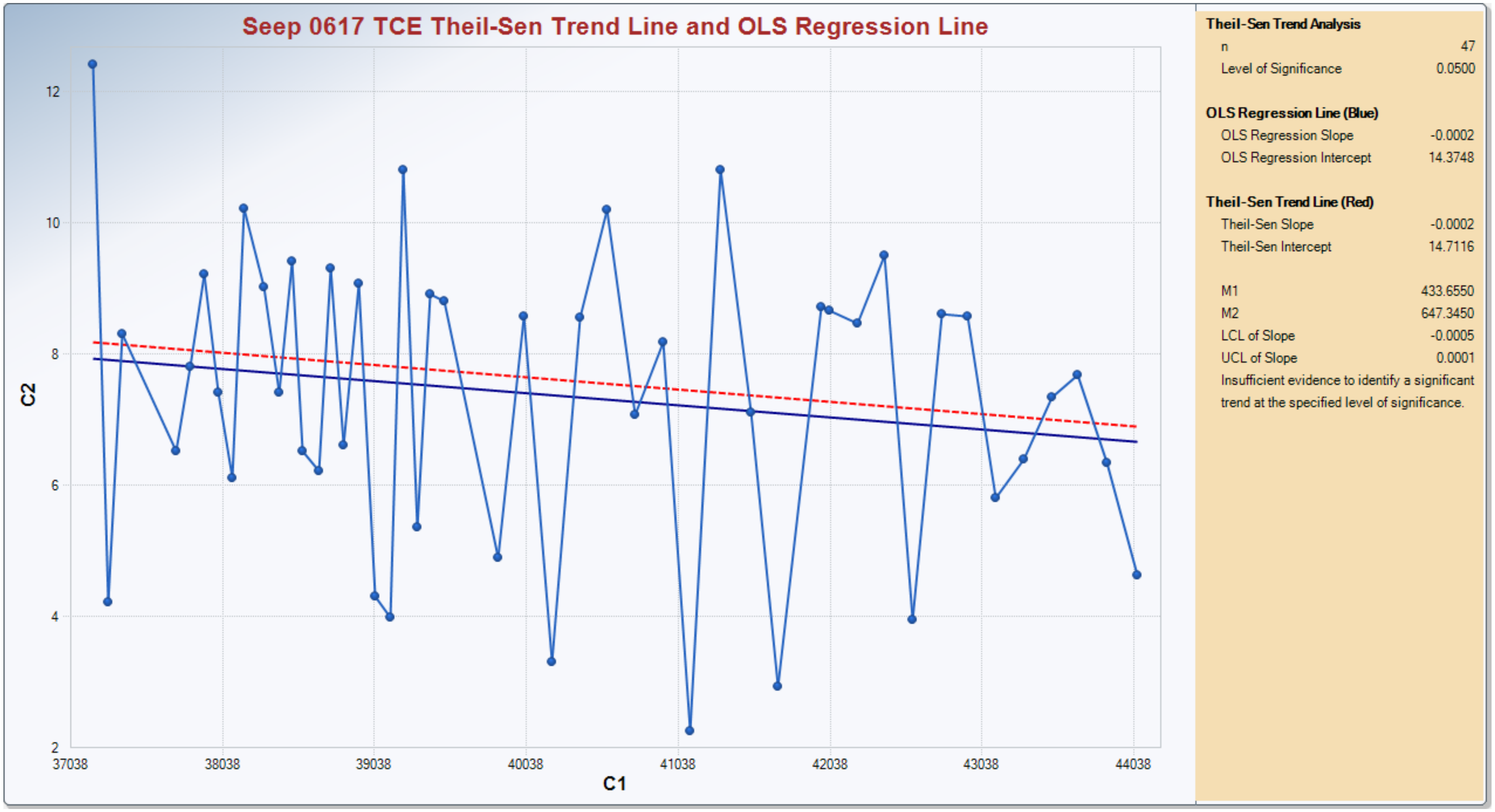

Well 0411 cDCE Mann-Kendall Trend Test
C2
C1
4.7
4.1
3.5
2.9
2.3
1.7
1.1
0.5
36116
38116
40116
42116
44116
Mann-Kendall Trend Analysis
n 62
Confidence Coefficient 0.9500
Level of Significance 0.0500
Standard Deviation of S 164.5894
Standardized Value of S -0.7412
M-K Test Value (S) -123
Appx. Critical Value (0.05) -1.6449
Approximate p-value 0.2293
OLS Regression Line (Blue)
OLS Regression Slope -0.0001
OLS Regression Intercept 4.1488
Theil-Sen Trend Line (Red)
Theil-Sen Slope 0.0000
Theil-Sen Intercept 3.4529
Insufficient statistical evidence
of a significant trend at the
specified level of significance.

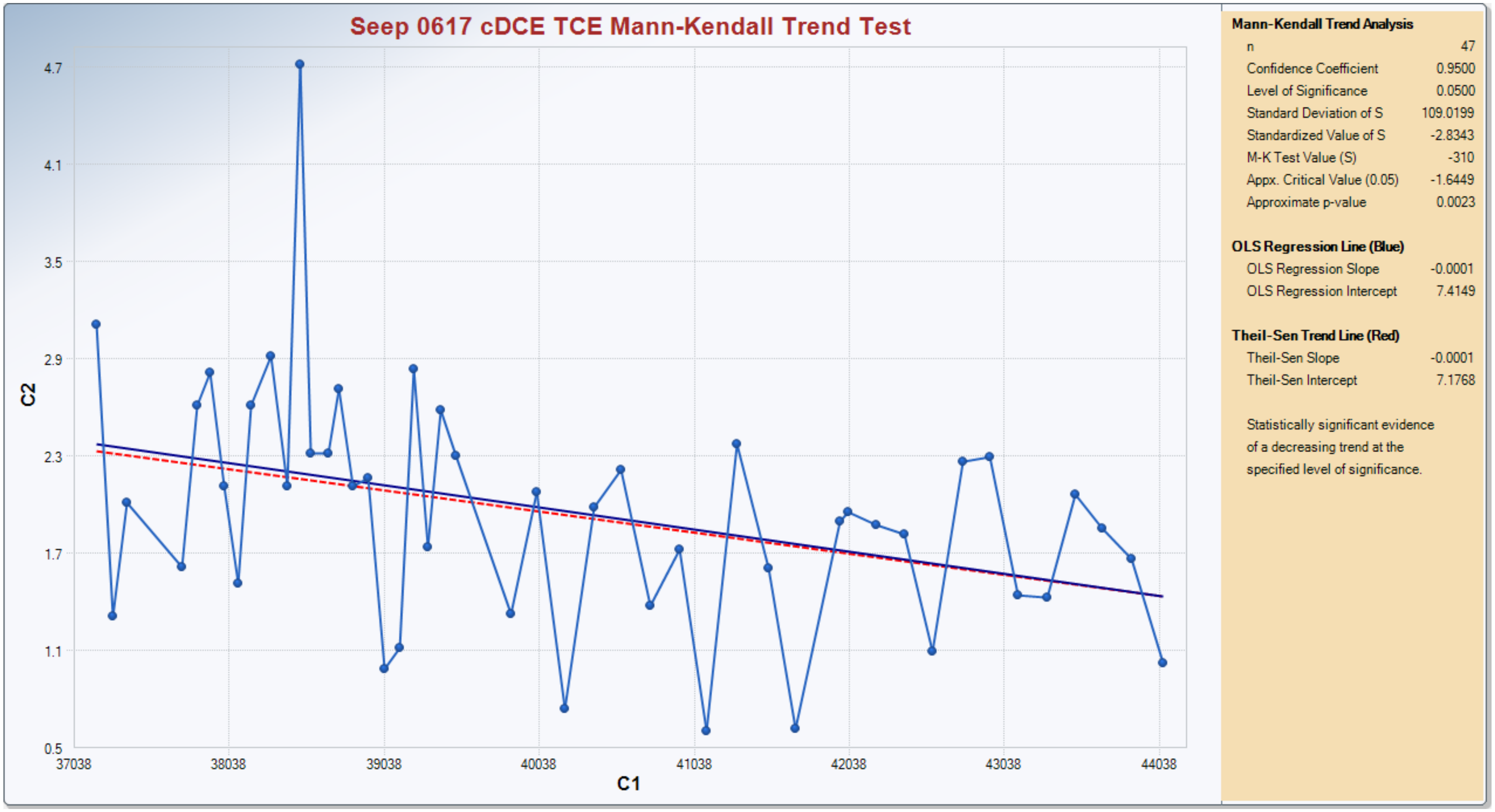

Well 0443 TCE Mann-Kendall Trend Test
C2
C1
14
12
10
8
6
4
2
37242
38242
39242
40242
41242
42242
43242
Mann-Kendall Trend Analysis
n 50
Confidence Coefficient 0.9500
Level of Significance 0.0500
Standard Deviation of S 119.5268
Standardized Value of S -0.2594
M-K Test Value (S) -32
Appx. Critical Value (0.05) -1.6449
Approximate p-value 0.3977
OLS Regression Line (Blue)
OLS Regression Slope 0.0000
OLS Regression Intercept 8.5863
Theil-Sen Trend Line (Red)
Theil-Sen Slope 0.0000
Theil-Sen Intercept 9.0990
Insufficient statistical evidence
of a significant trend at the
specified level of significance.

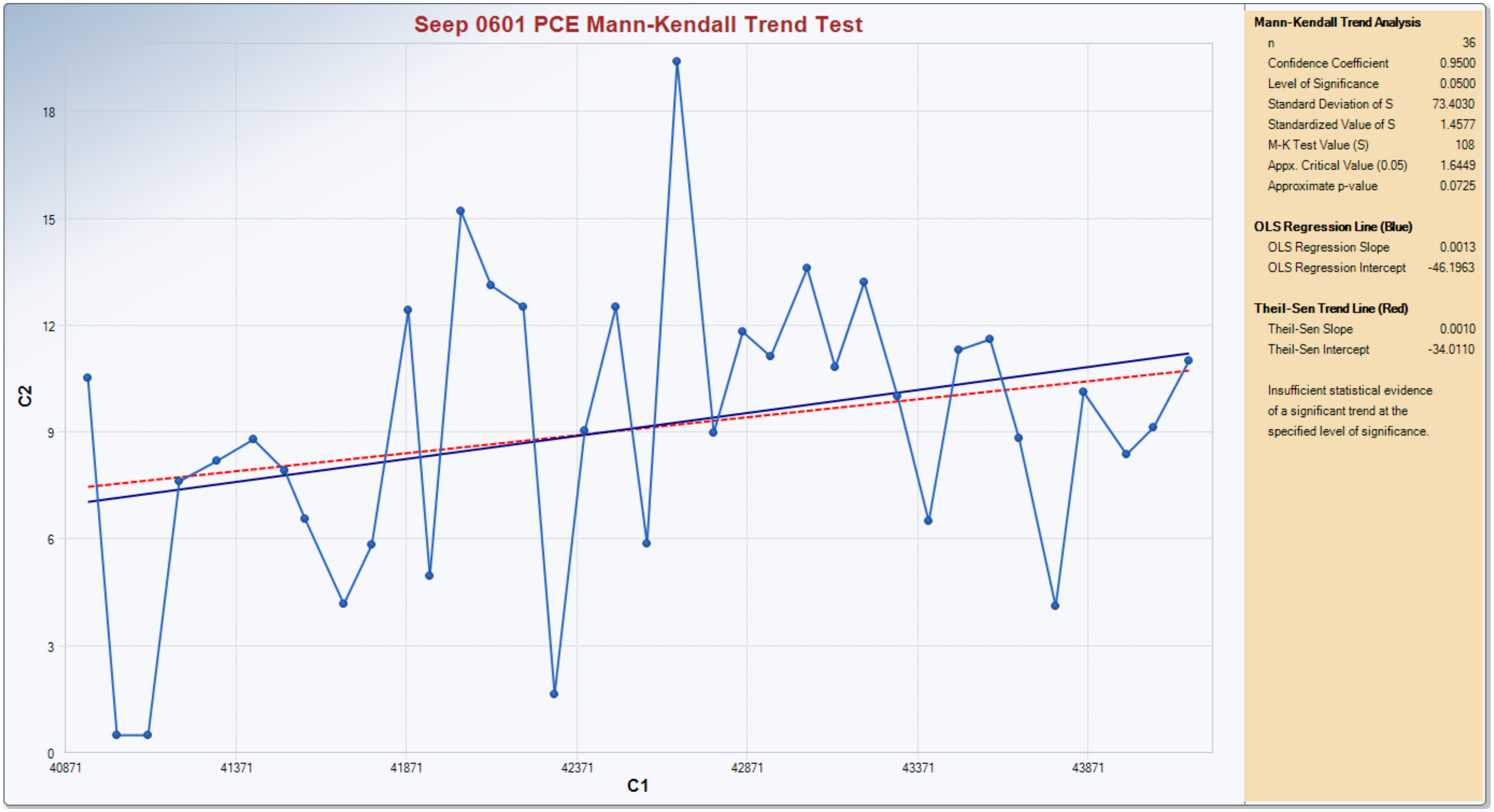

Well 0443 cDCE Mann-Kendall Trend Test
C2
C1
0
1
2
3
4
5
37242
38242
39242
40242
41242
42242
43242
Mann-Kendall Trend Analysis
n 50
Confidence Coefficient 0.9500
Level of Significance 0.0500
Standard Deviation of S 118.1271
Standardized Value of S -5.1216
M-K Test Value (S) -606
Appx. Critical Value (0.05) -1.6449
Approximate p-value 0.0000
OLS Regression Line (Blue)
OLS Regression Slope -0.0001
OLS Regression Intercept 6.7143
Theil-Sen Trend Line (Red)
Theil-Sen Slope -0.0001
Theil-Sen Intercept 5.4518
Statistically significant evidence
of a decreasing trend at the
specified level of significance.

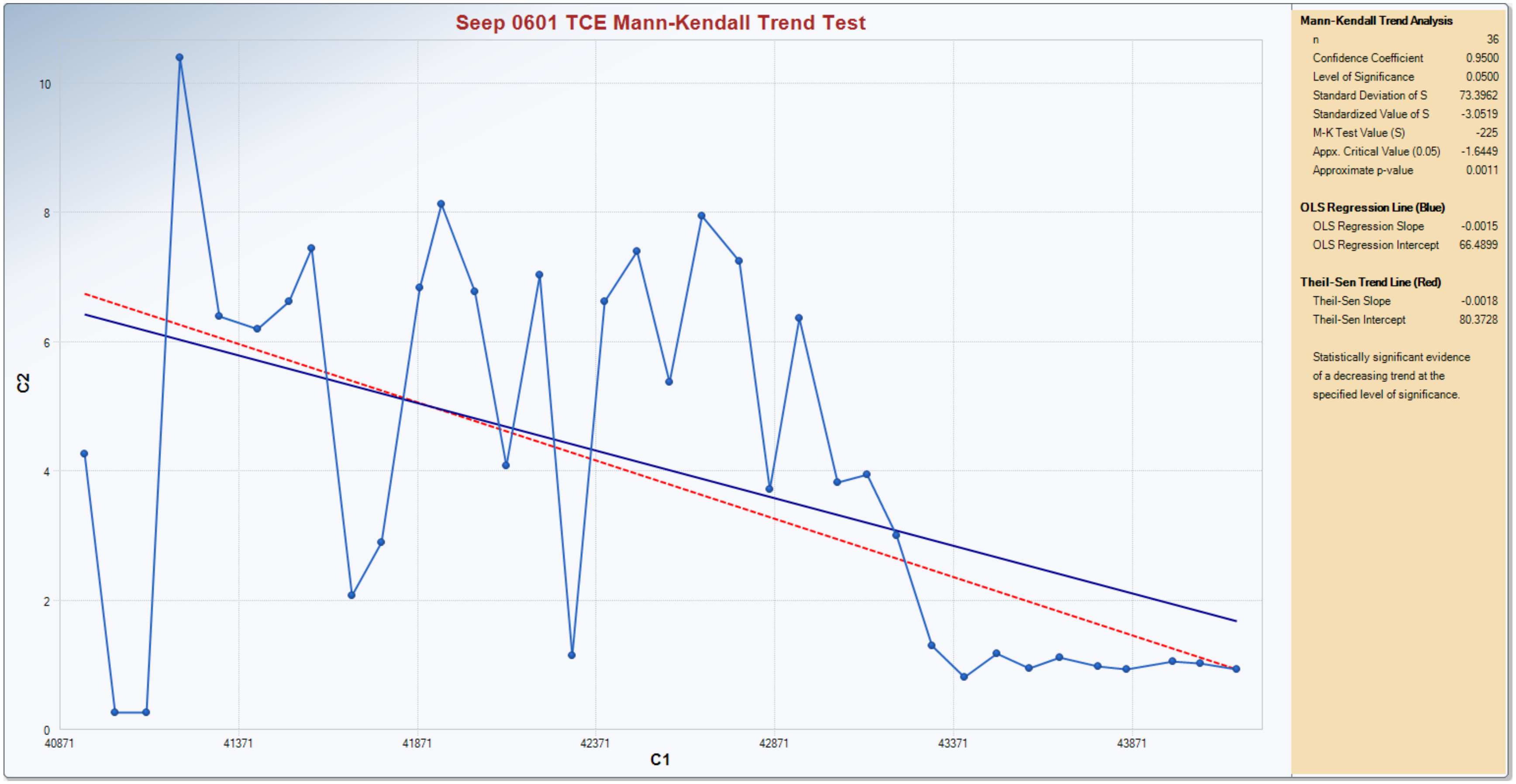

Well P064 TCE Mann-Kendall Trend Test
1.44
1.34
1.24
1.14
1.04
0.94
0.84
0.74
0.64
0.54
C2
43026
43226
43426
43626
43826
44026
C1
Mann-Kendall Trend Analysis
n 7
Confidence Coefficient 0.9500
Level of Significance 0.0500
Standard Deviation of S 6.6583
Standardized Value of S -2.4030
M-K Test Value (S) -17
Tabulated p-value 0.0050
Approximate p-value 0.0081
OLS Regression Line (Blue)
OLS Regression Slope -0.0008
OLS Regression Intercept 36.6806
Theil-Sen Trend Line (Red)
Theil-Sen Slope -0.0009
Theil-Sen Intercept 38.0291
Statistically significant evidence
of a decreasing trend at the
specified level of significance.

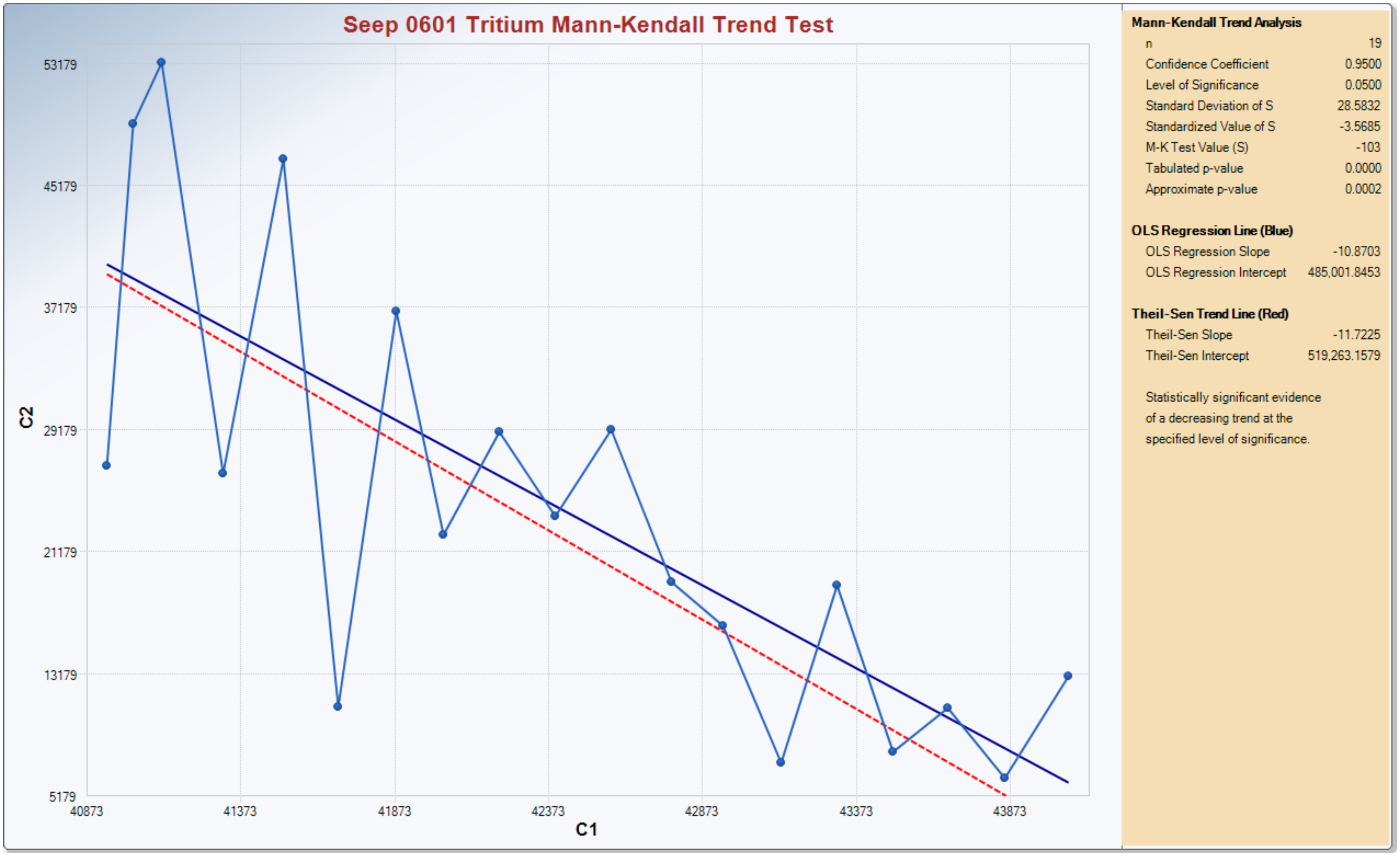

Well P064 cDCE Mann-Kendall Trend Test
C2
2.2
1.9
1.6
1.3
1.0
0.7
0.4
0.1
43026
43226
43426
43626
43826
44026
C1
Mann-Kendall Trend Analysis
n 7
Confidence Coefficient 0.9500
Level of Significance 0.0500
Standard Deviation of S 5.9722
Standardized Value of S -1.0047
M-K Test Value (S) -7
Tabulated p-value 0.1910
Approximate p-value 0.1575
OLS Regression Line (Blue)
OLS Regression Slope -0.0012
OLS Regression Intercept 54.1839
Theil-Sen Trend Line (Red)
Theil-Sen Slope -0.0001
Theil-Sen Intercept 5.7262
Insufficient statistical evidence of a significant trend at the specified level of significance.

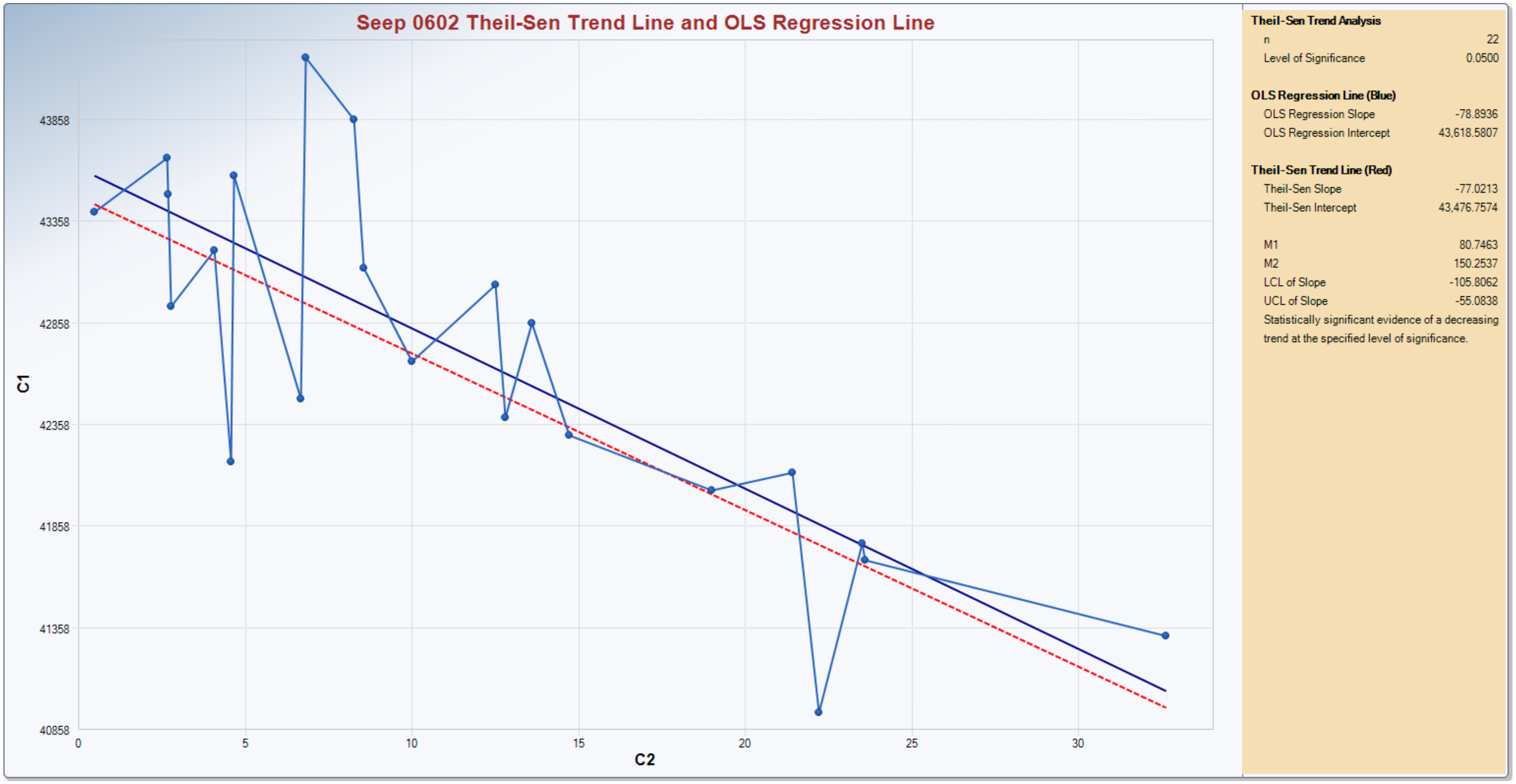

Seep 0617 TCE Theil-Sen Trend Line and OLS Regression Line
C2
C1
12
10
8
6
4
2
37038
38038
39038
40038
41038
42038
43038
44038
Theil-Sen Trend Analysis
n 47
Level of Significance 0.0500
OLS Regression Line (Blue)
OLS Regression Slope -0.0002
OLS Regression Intercept 14.3748
Theil-Sen Trend Line (Red)
Theil-Sen Slope -0.0002
Theil-Sen Intercept 14.7116
M1 433.6550
M2 647.3450
LCL of Slope -0.0005
UCL of Slope 0.0001
Insufficient evidence to identify a significant trend at the specified level of significance.

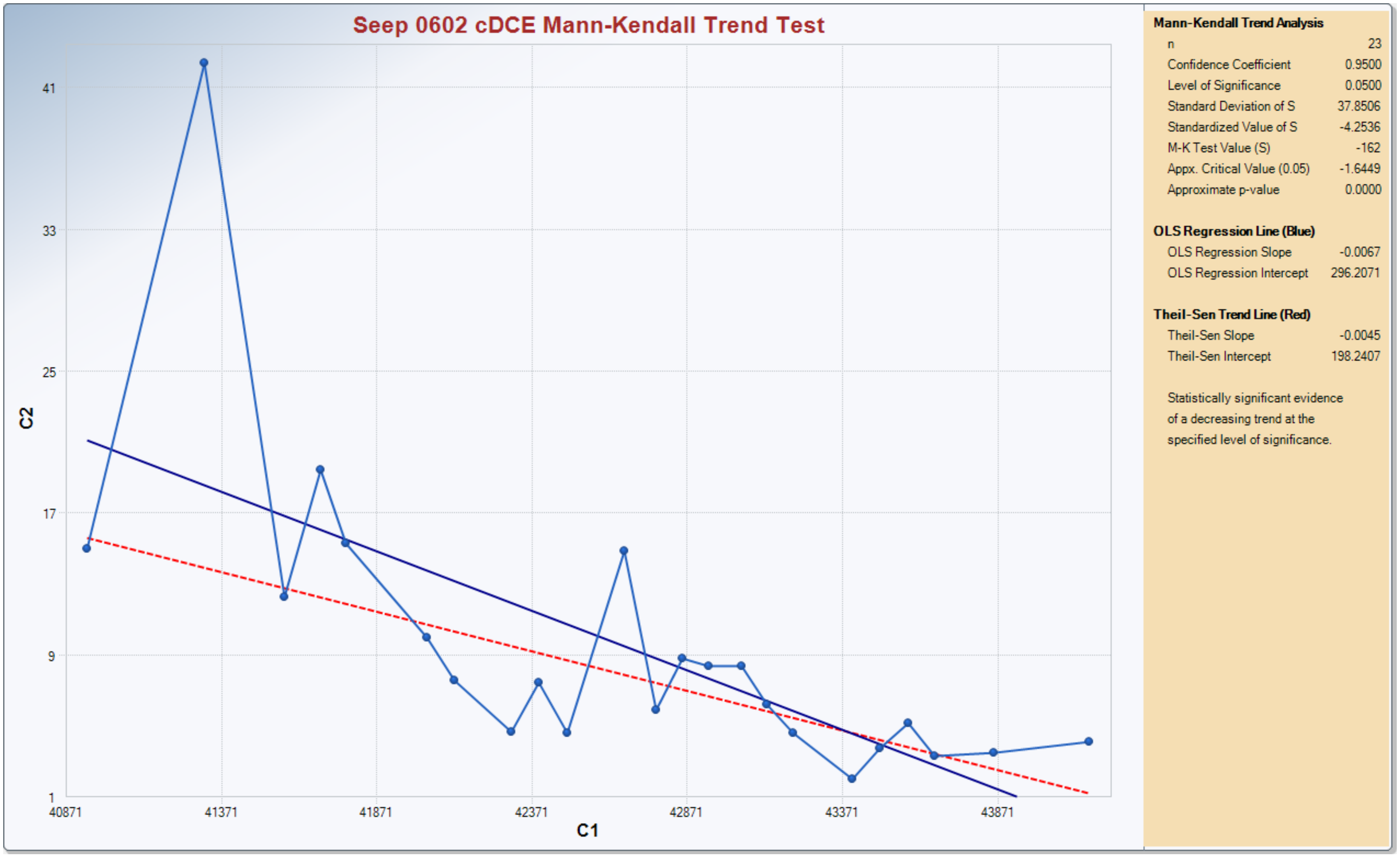

Seep 0617 cDCE TCE Mann-Kendall Trend Test
4.7
4.1
3.5
2.9
2.3
1.7
1.1
0.5
C2
37038
38038
39038
40038
41038
42038
43038
44038
C1
Mann-Kendall Trend Analysis
n 47
Confidence Coefficient 0.9500
Level of Significance 0.0500
Standard Deviation of S 109.0199
Standardized Value of S -2.8343
M-K Test Value (S) -310
Appx. Critical Value (0.05) -1.6449
Approximate p-value 0.0023
OLS Regression Line (Blue)
OLS Regression Slope -0.0001
OLS Regression Intercept 7.4149
Theil-Sen Trend Line (Red)
Theil-Sen Slope -0.0001
Theil-Sen Intercept 7.1768
Statistically significant evidence
of a decreasing trend at the
specified level of significance.

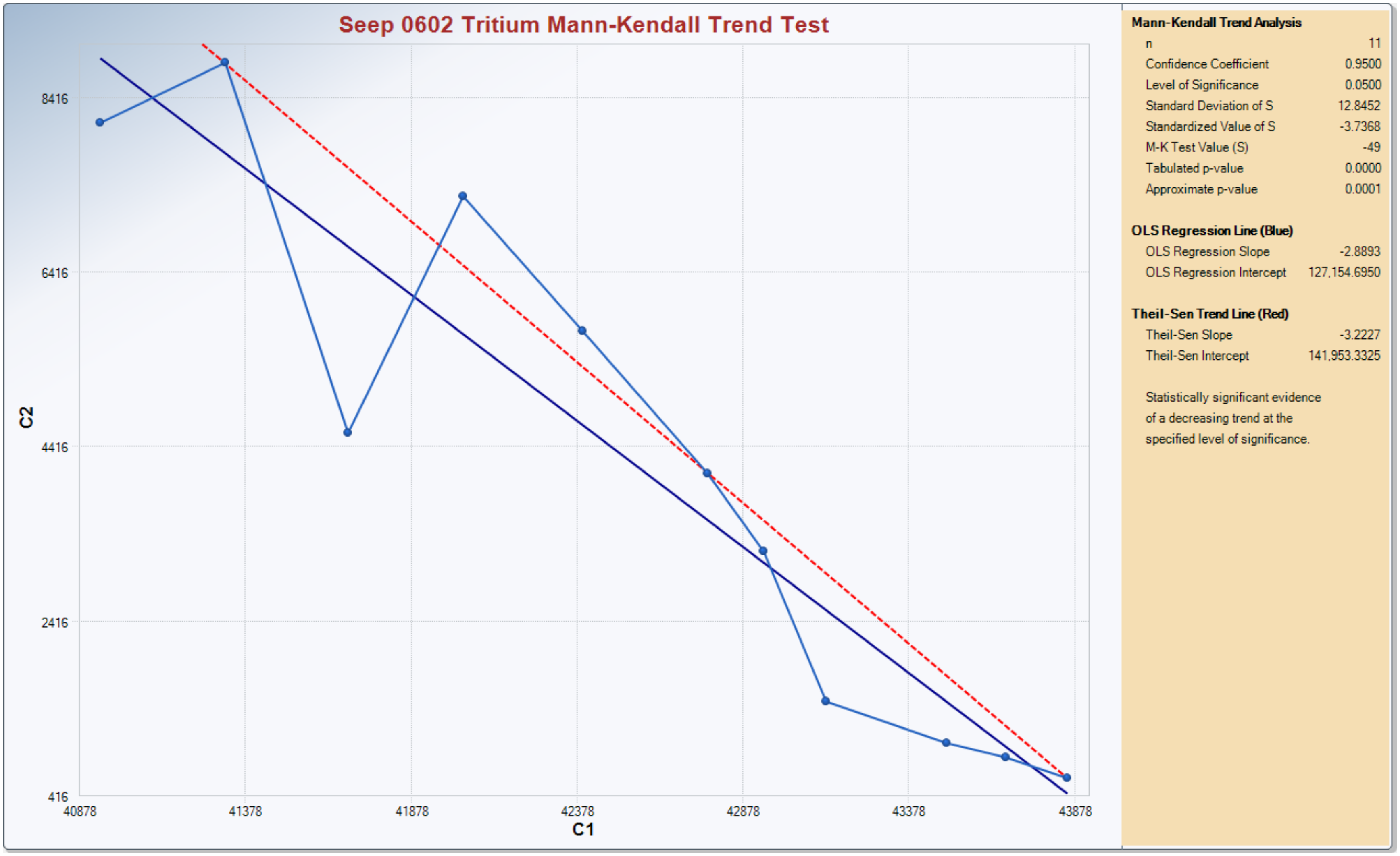

Seep 0601 PCE Mann-Kendall Trend Test
C2
C1
0
3
6
9
12
15
18
40871
41371
41871
42371
42871
43371
43871
Mann-Kendall Trend Analysis
n 36
Confidence Coefficient 0.9500
Level of Significance 0.0500
Standard Deviation of S 73.4030
Standardized Value of S 1.4577
M-K Test Value (S) 108
Appx. Critical Value (0.05) 1.6449
Approximate p-value 0.0725
OLS Regression Line (Blue)
OLS Regression Slope 0.0013
OLS Regression Intercept -46.1963
Theil-Sen Trend Line (Red)
Theil-Sen Slope 0.0010
Theil-Sen Intercept -34.0110
Insufficient statistical evidence
of a significant trend at the
specified level of significance.

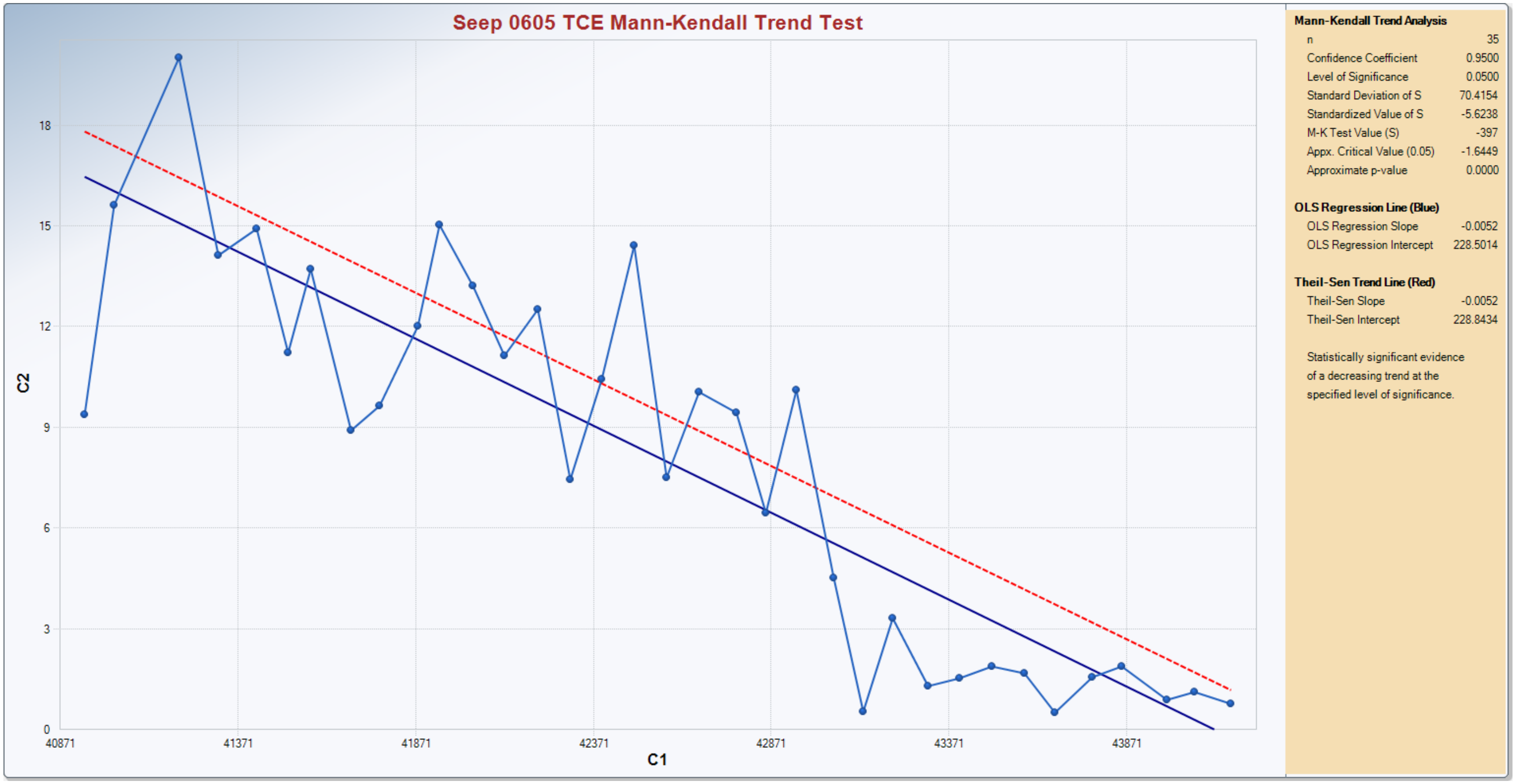

Seep 0601 TCE Mann-Kendall Trend Test
C2
C1
0
2
4
6
8
10
40871
41371
41871
42371
42871
43371
43871
Mann-Kendall Trend Analysis
n 36
Confidence Coefficient 0.9500
Level of Significance 0.0500
Standard Deviation of S 73.3962
Standardized Value of S -3.0519
M-K Test Value (S) -225
Appx. Critical Value (0.05) -1.6449
Approximate p-value 0.0011
OLS Regression Line (Blue)
OLS Regression Slope -0.0015
OLS Regression Intercept 66.4899
Theil-Sen Trend Line (Red)
Theil-Sen Slope -0.0018
Theil-Sen Intercept 80.3728
Statistically significant evidence
of a decreasing trend at the
specified level of significance.

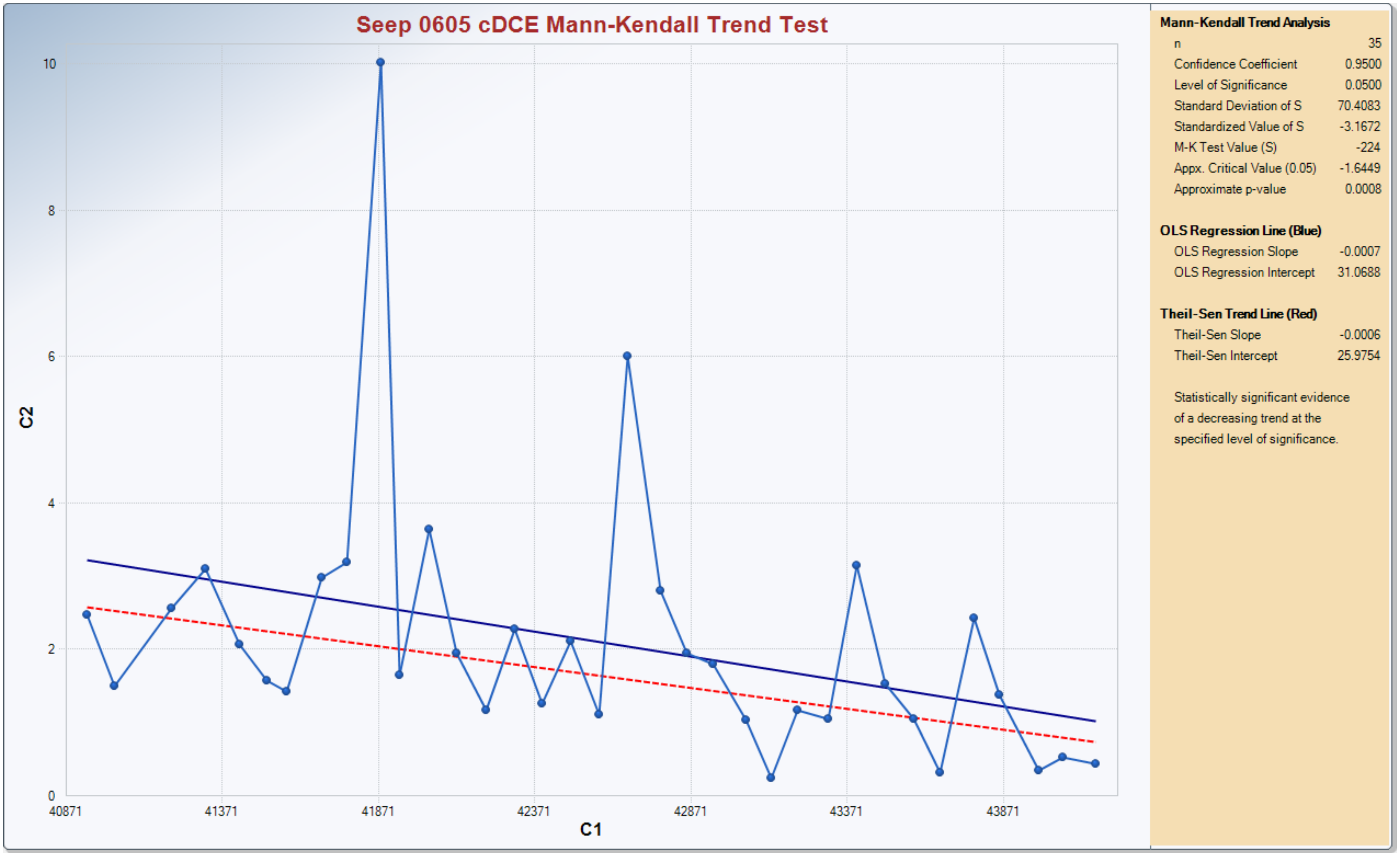

Seep 0601 Tritium Mann-Kendall Trend Test
53179
45179
37179
29179
21179
13179
5179
C2
40873
41373
41873
42373
42873
43373
43873
C1
Mann-Kendall Trend Analysis
n 19
Confidence Coefficient 0.9500
Level of Significance 0.0500
Standard Deviation of S 28.5832
Standardized Value of S -3.5685
M-K Test Value (S) -103
Tabulated p-value 0.0000
Approximate p-value 0.0002
OLS Regression Line (Blue)
OLS Regression Slope -10.8703
OLS Regression Intercept 485,001.8453
Theil-Sen Trend Line (Red)
Theil-Sen Slope -11.7225
Theil-Sen Intercept 519,263.1579
Statistically significant evidence
of a decreasing trend at the
specified level of significance.

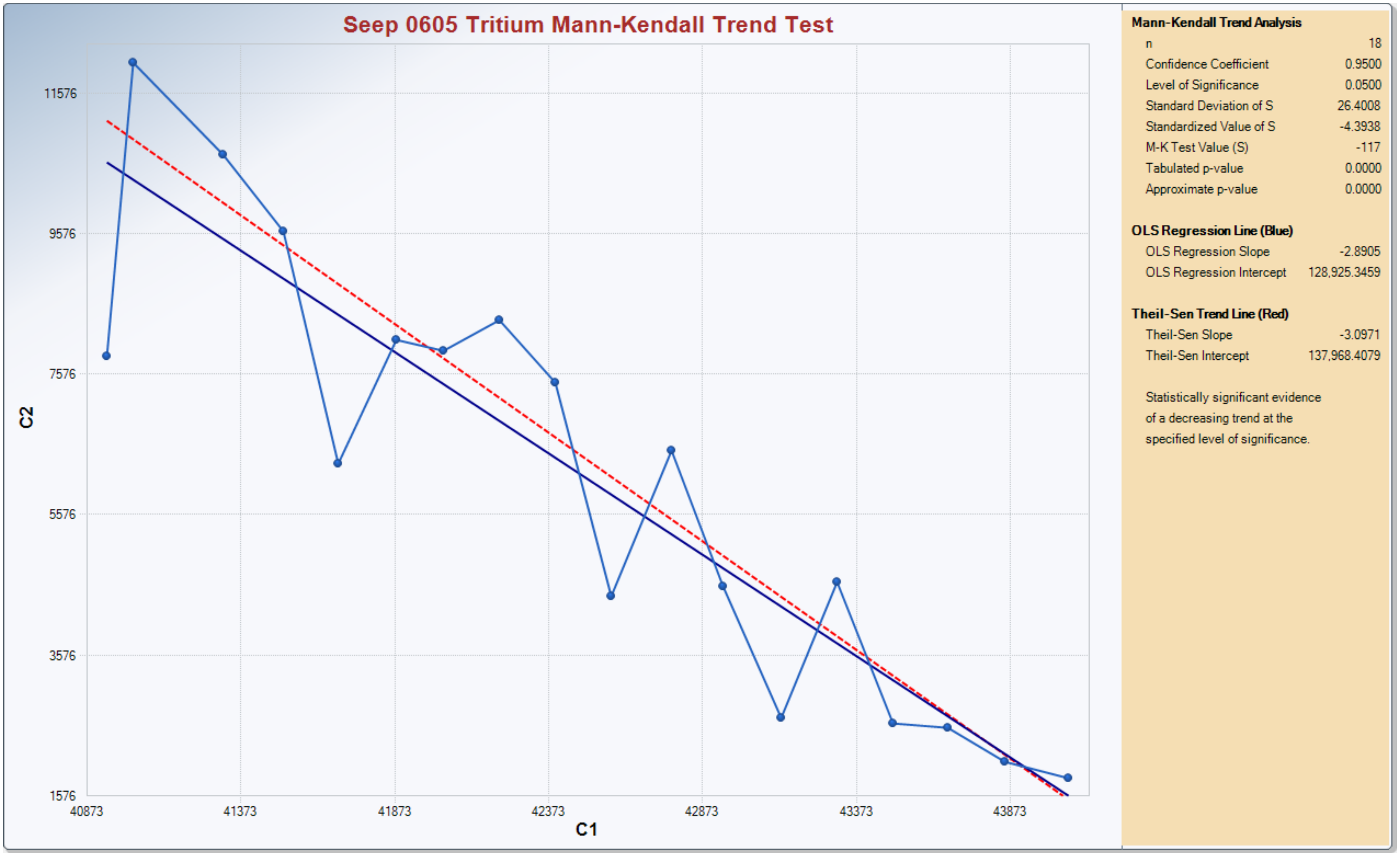

Seep 0602 Theil-Sen Trend Line and OLS Regression Line
C1
C2
43858
43358
42858
42358
41858
41358
40858
0
5
10
15
20
25
30
Theil-Sen Trend Analysis
n 22
Level of Significance 0.0500
OLS Regression Line (Blue)
OLS Regression Slope -78.8936
OLS Regression Intercept 43,618.5807
Theil-Sen Trend Line (Red)
Theil-Sen Slope -77.0213
Theil-Sen Intercept 43,476.7574
M1 80.7463
M2 150.2537
LCL of Slope -105.8062
UCL of Slope -55.0838
Statistically significant evidence of a decreasing trend at the specified level of significance.

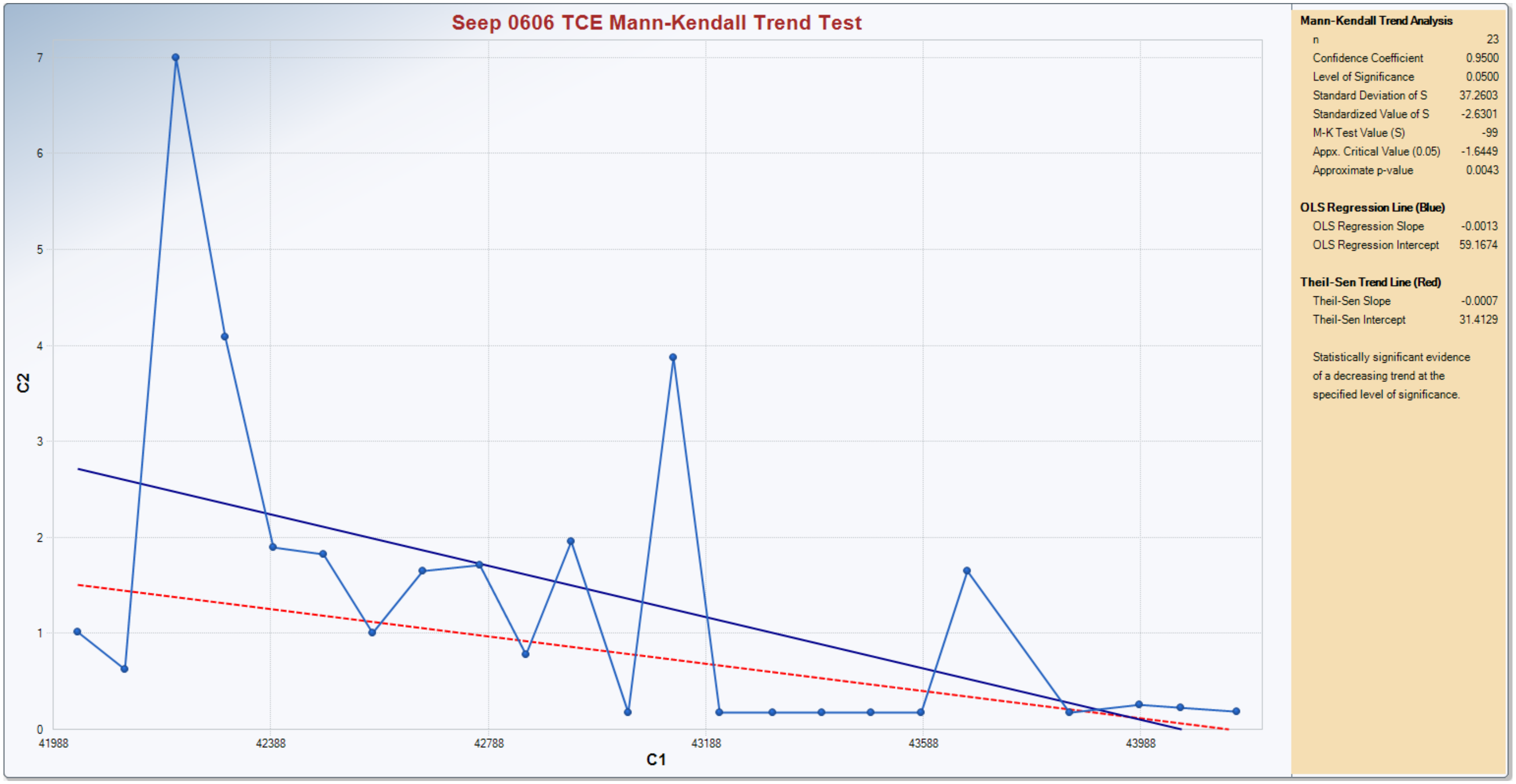

Seep 0602 cDCE Mann-Kendall Trend Test
C2
41
33
25
17
9
1
40871
41371
41871
42371
42871
43371
43871
C1
Mann-Kendall Trend Analysis
n 23
Confidence Coefficient 0.9500
Level of Significance 0.0500
Standard Deviation of S 37.8506
Standardized Value of S -4.2536
M-K Test Value (S) -162
Appx. Critical Value (0.05) -1.6449
Approximate p-value 0.0000
OLS Regression Line (Blue)
OLS Regression Slope -0.0067
OLS Regression Intercept 296.2071
Theil-Sen Trend Line (Red)
Theil-Sen Slope -0.0045
Theil-Sen Intercept 198.2407
Statistically significant evidence
of a decreasing trend at the
specified level of significance.

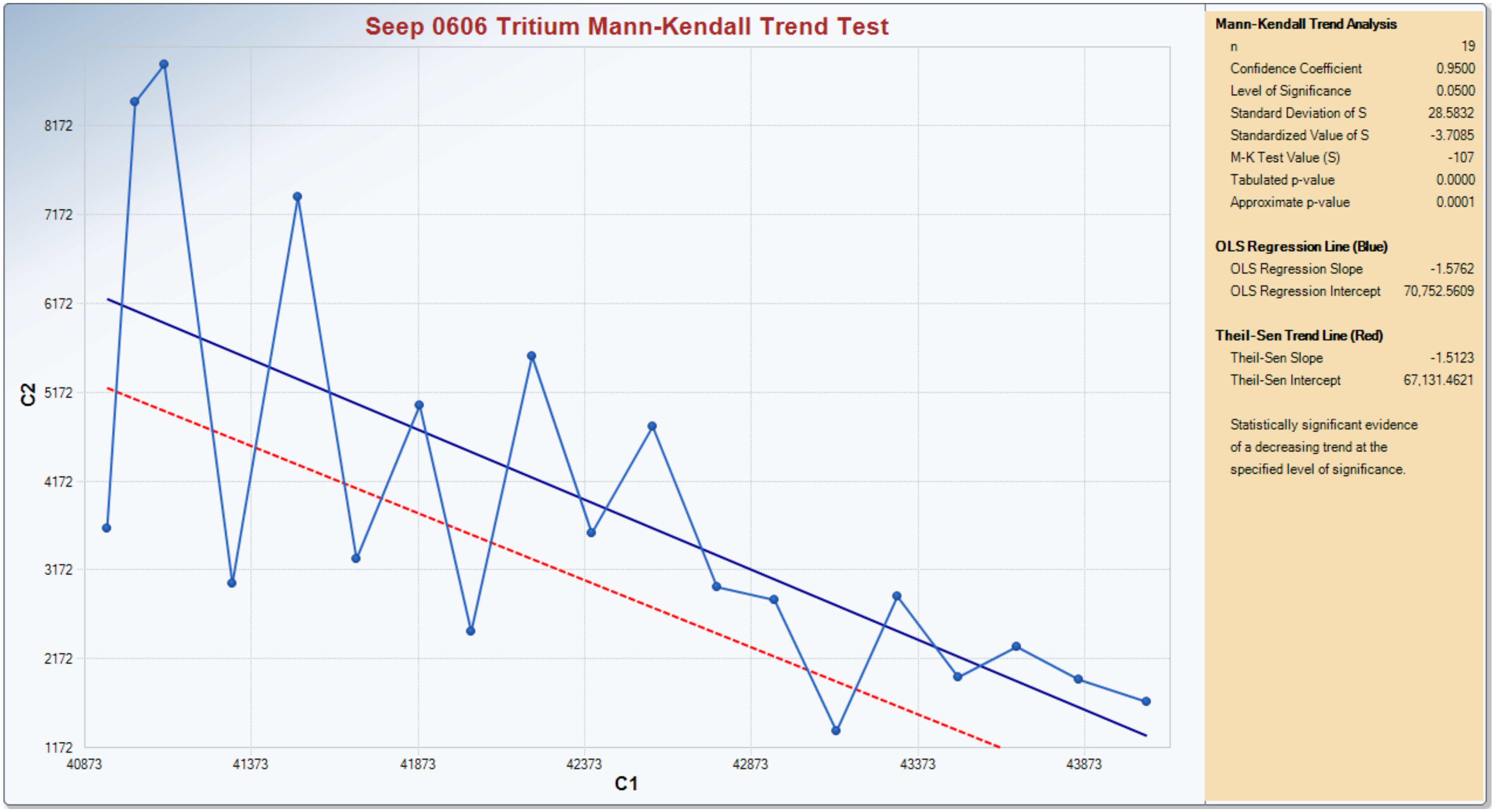

Seep 0602 Tritium Mann-Kendall Trend Test
C2
8416
6416
4416
2416
416
40878
41378
41878
42378
42878
43378
43878
C1
Mann-Kendall Trend Analysis
n 11
Confidence Coefficient 0.9500
Level of Significance 0.0500
Standard Deviation of S 12.8452
Standardized Value of S -3.7368
M-K Test Value (S) -49
Tabulated p-value 0.0000
Approximate p-value 0.0001
OLS Regression Line (Blue)
OLS Regression Slope -2.8893
OLS Regression Intercept 127,154.6950
Theil-Sen Trend Line (Red)
Theil-Sen Slope -3.2227
Theil-Sen Intercept 141,953.3325
Statistically significant evidence
of a decreasing trend at the
specified level of significance.

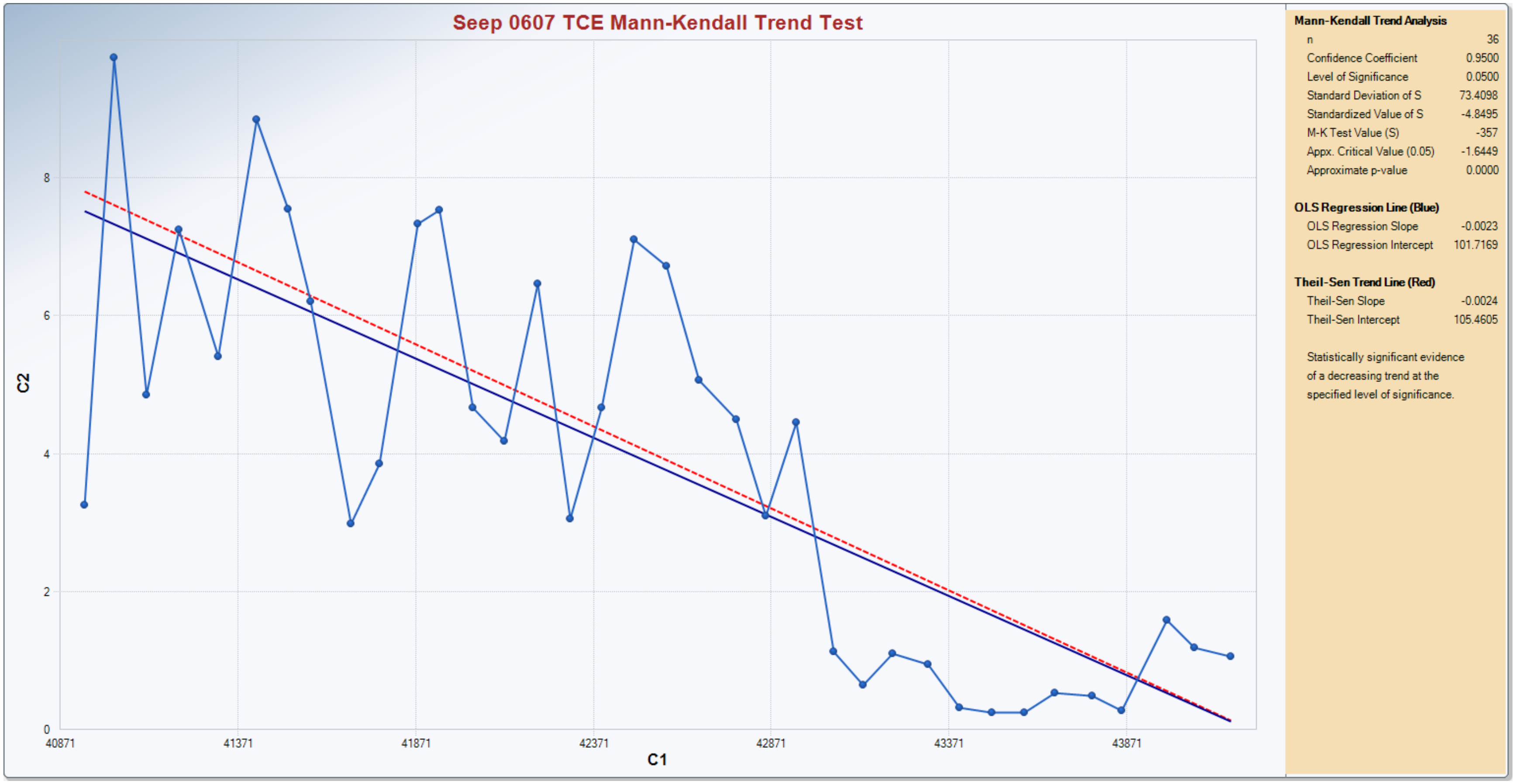

Seep 0605 TCE Mann-Kendall Trend Test
C2
18
15
12
9
6
3
0
40871
41371
41871
42371
42871
43371
43871
C1
Mann-Kendall Trend Analysis
n 35
Confidence Coefficient 0.9500
Level of Significance 0.0500
Standard Deviation of S 70.4154
Standardized Value of S -5.6238
M-K Test Value (S) -397
Appx. Critical Value (0.05) -1.6449
Approximate p-value 0.0000
OLS Regression Line (Blue)
OLS Regression Slope -0.0052
OLS Regression Intercept 228.5014
Theil-Sen Trend Line (Red)
Theil-Sen Slope -0.0052
Theil-Sen Intercept 228.8434
Statistically significant evidence
of a decreasing trend at the
specified level of significance.

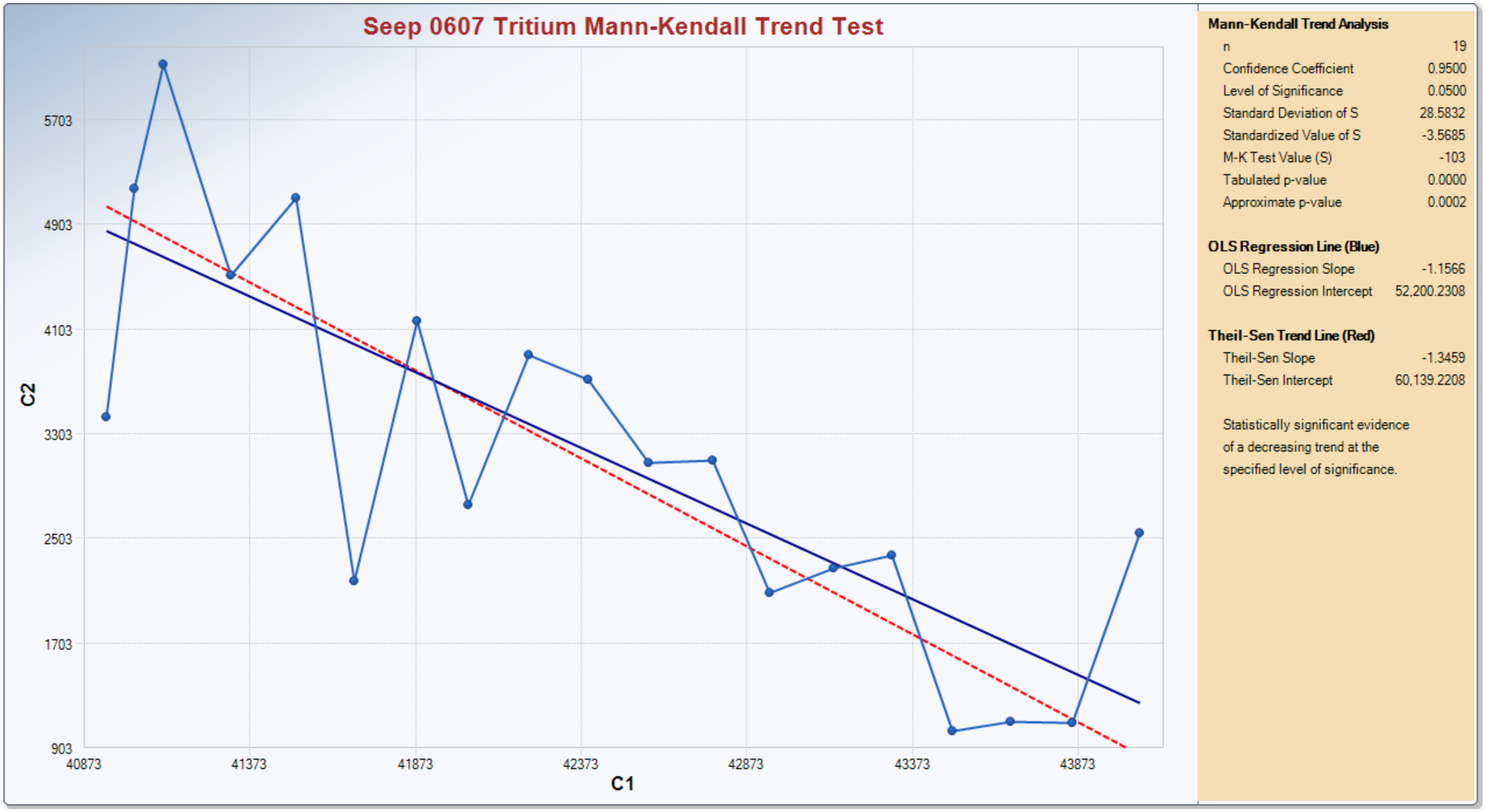

Seep 0605 cDCE Mann-Kendall Trend Test
C2
10
8
6
4
2
0
C1
40871
41371
41871
42371
42871
43371
43871
Mann-Kendall Trend Analysis
n 35
Confidence Coefficient 0.9500
Level of Significance 0.0500
Standard Deviation of S 70.4083
Standardized Value of S -3.1672
M-K Test Value (S) -224
Appx. Critical Value (0.05) -1.6449
Approximate p-value 0.0008
OLS Regression Line (Blue)
OLS Regression Slope -0.0007
OLS Regression Intercept 31.0688
Theil-Sen Trend Line (Red)
Theil-Sen Slope -0.0006
Theil-Sen Intercept 25.9754
Statistically significant evidence
of a decreasing trend at the
specified level of significance.

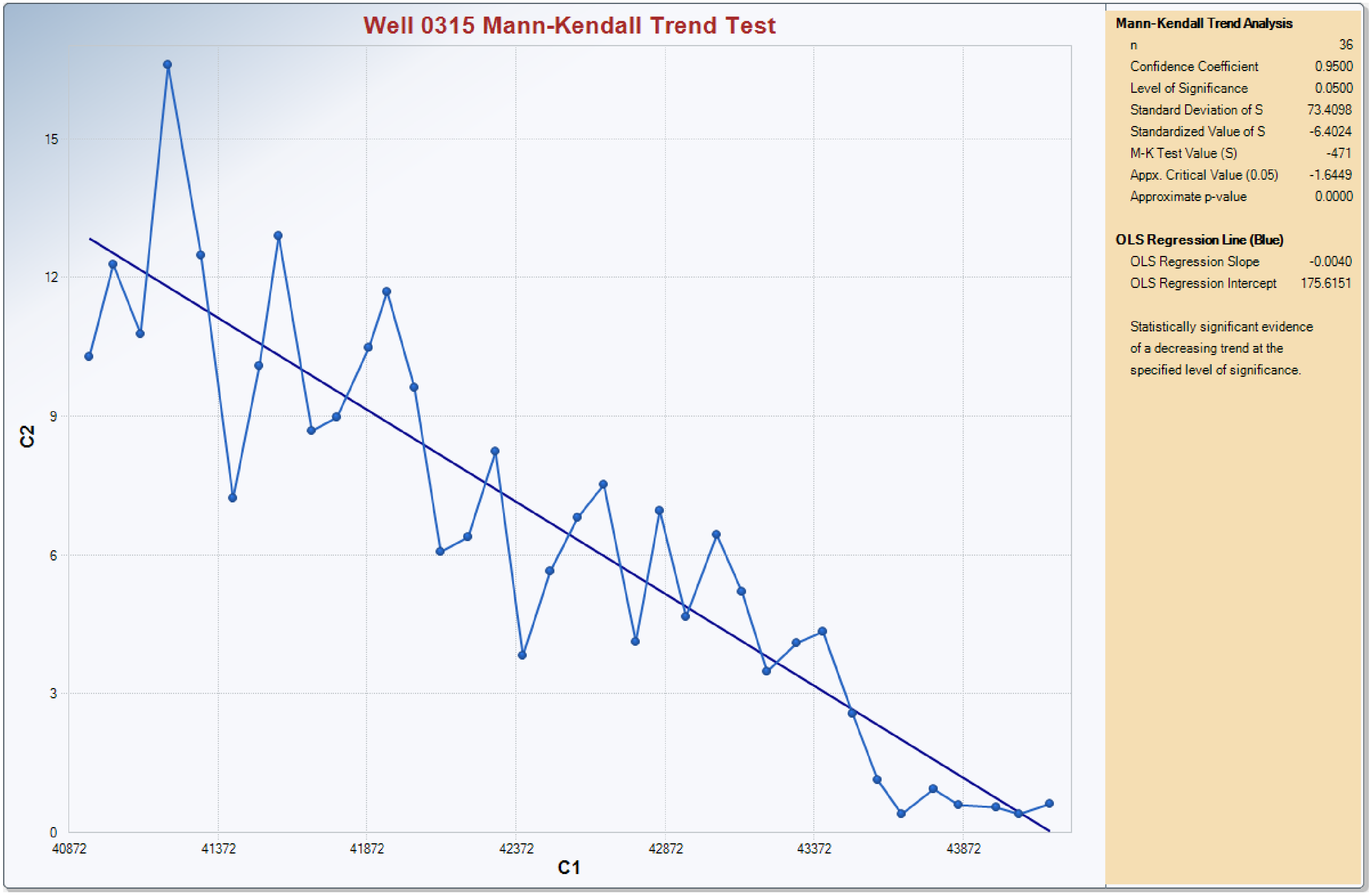

Seep 0605 Tritium Mann-Kendall Trend Test
C2
11576
9576
7576
5576
3576
1576
C1
40873
41373
41873
42373
42873
43373
43873
Mann-Kendall Trend Analysis
n 18
Confidence Coefficient 0.9500
Level of Significance 0.0500
Standard Deviation of S 26.4008
Standardized Value of S -4.3938
M-K Test Value (S) -117
Tabulated p-value 0.0000
Approximate p-value 0.0000
OLS Regression Line (Blue)
OLS Regression Slope -2.8905
OLS Regression Intercept 128,925.3459
Theil-Sen Trend Line (Red)
Theil-Sen Slope -3.0971
Theil-Sen Intercept 137,968.4079
Statistically significant evidence
of a decreasing trend at the
specified level of significance.

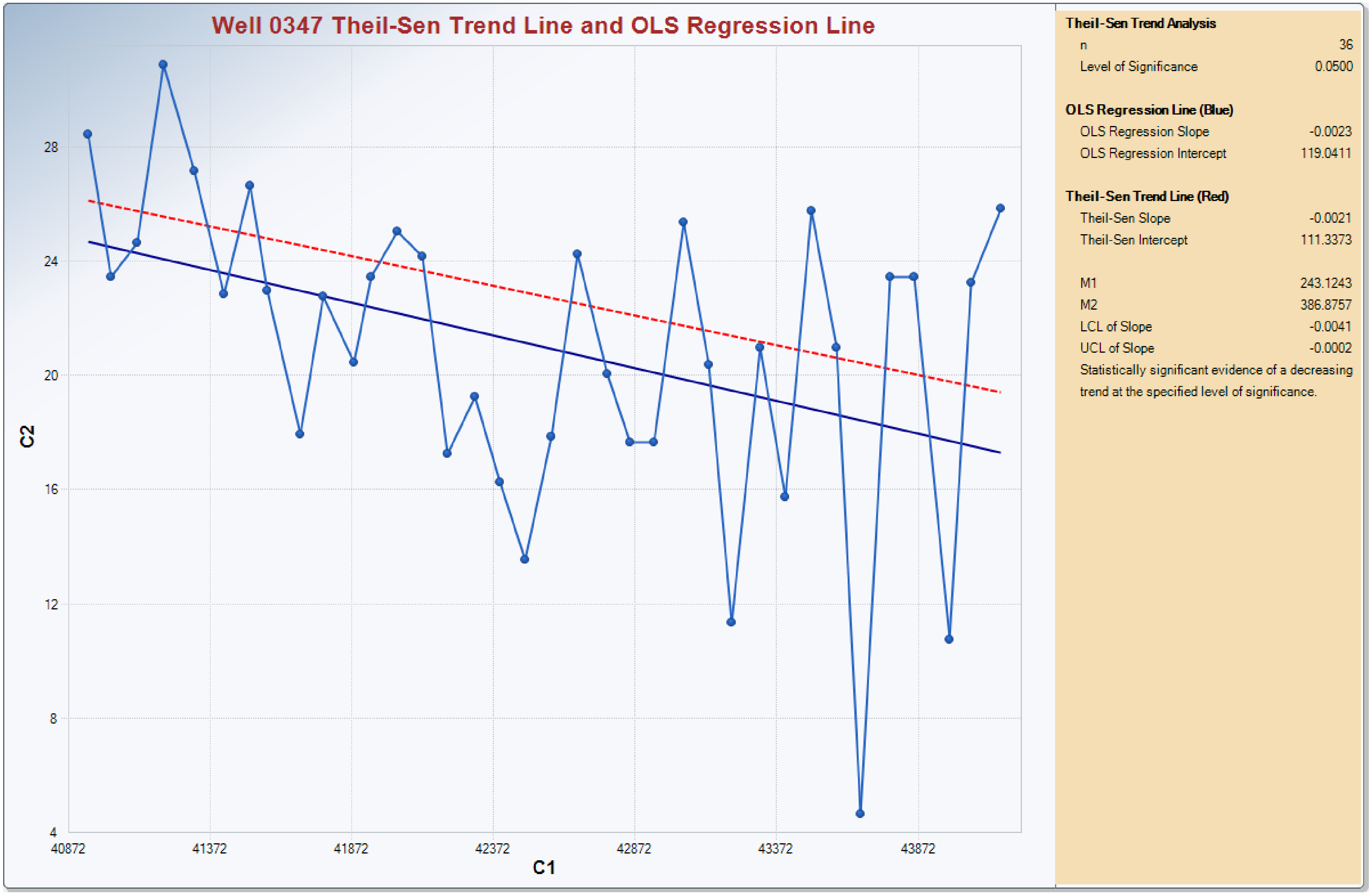

Seep 0606 TCE Mann-Kendall Trend Test
C2
C1
Mann-Kendall Trend Analysis
n 23
Confidence Coefficient 0.9500
Level of Significance 0.0500
Standard Deviation of S 37.2603
Standardized Value of S -2.6301
M-K Test Value (S) -99
Appx. Critical Value (0.05) -1.6449
Approximate p-value 0.0043
OLS Regression Line (Blue)
OLS Regression Slope -0.0013
OLS Regression Intercept 59.1674
Theil-Sen Trend Line (Red)
Theil-Sen Slope -0.0007
Theil-Sen Intercept 31.4129
Statistically significant evidence of a decreasing trend at the specified level of significance.

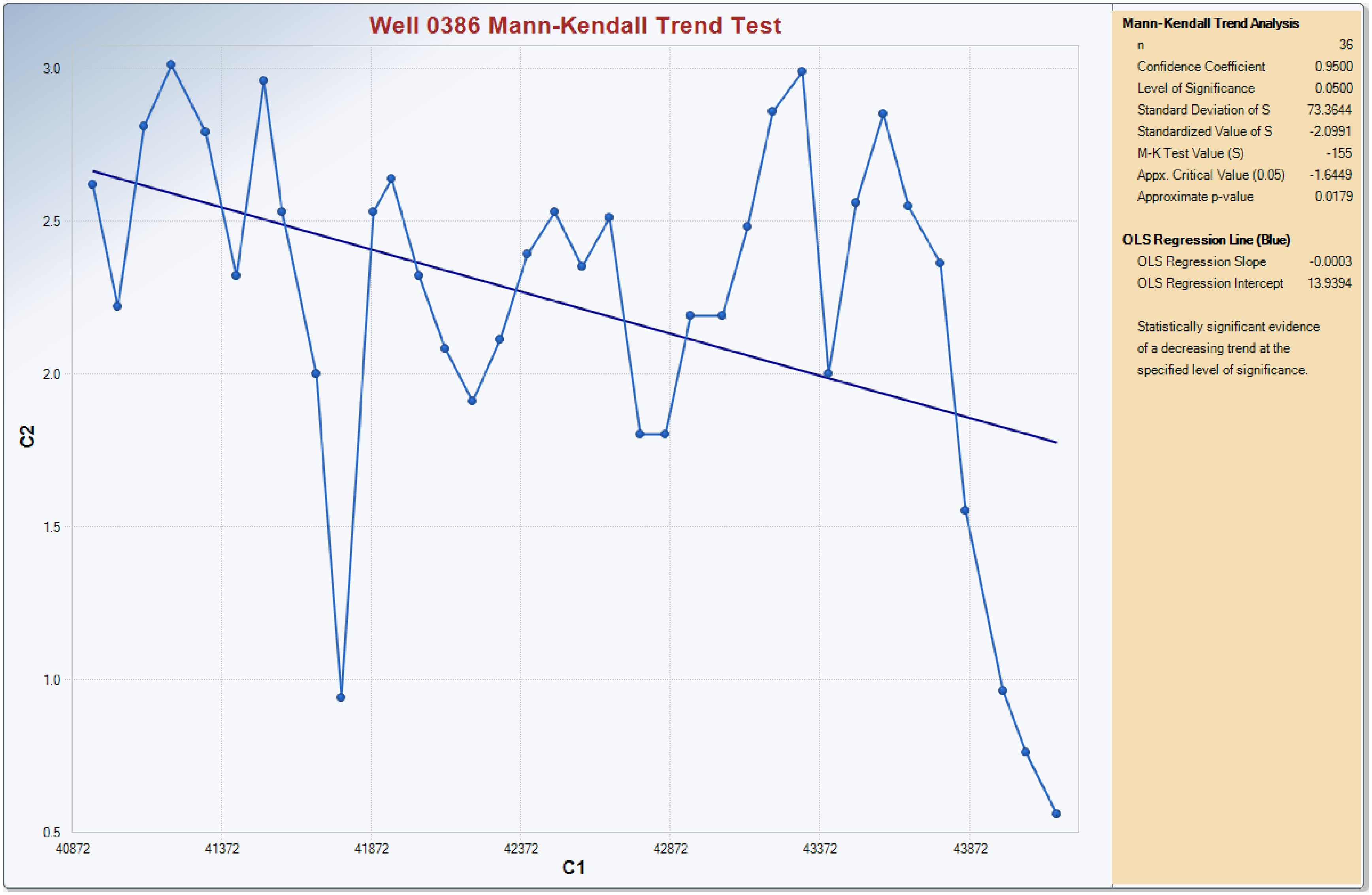

Seep 0606 Tritium Mann-Kendall Trend Test
C2
8172
7172
6172
5172
4172
3172
2172
1172
40873
41373
41873
42373
42873
43373
43873
C1
Mann-Kendall Trend Analysis
n 19
Confidence Coefficient 0.9500
Level of Significance 0.0500
Standard Deviation of S 28.5832
Standardized Value of S -3.7085
M-K Test Value (S) -107
Tabulated p-value 0.0000
Approximate p-value 0.0001
OLS Regression Line (Blue)
OLS Regression Slope -1.5762
OLS Regression Intercept 70,752.5609
Theil-Sen Trend Line (Red)
Theil-Sen Slope -1.5123
Theil-Sen Intercept 67,131.4621
Statistically significant evidence
of a decreasing trend at the
specified level of significance.

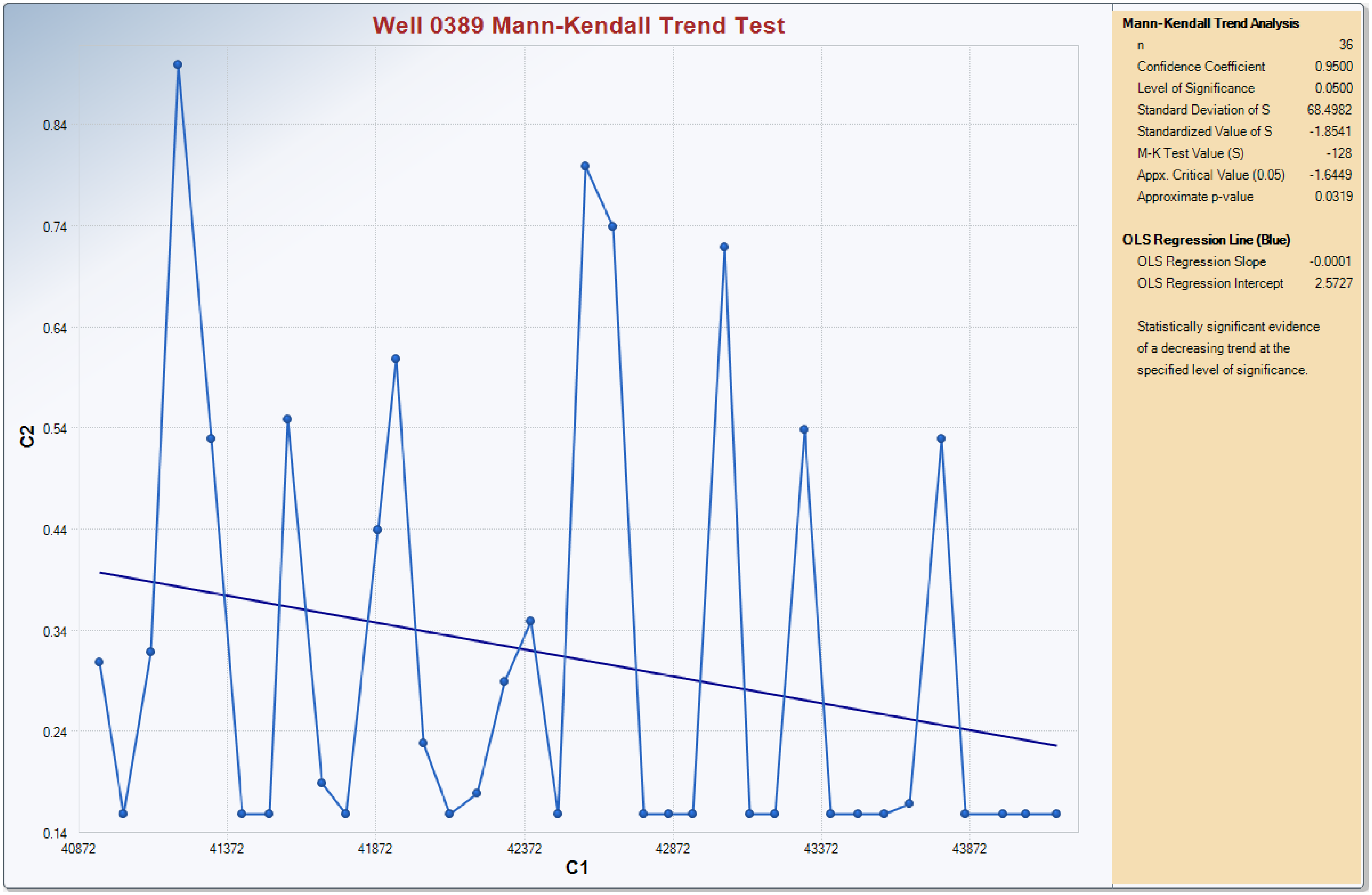

Seep 0607 TCE Mann-Kendall Trend Test
C2
C1
0
2
4
6
8
40871
41371
41871
42371
42871
43371
43871
Mann-Kendall Trend Analysis
n 36
Confidence Coefficient 0.9500
Level of Significance 0.0500
Standard Deviation of S 73.4098
Standardized Value of S -4.8495
M-K Test Value (S) -357
Appx. Critical Value (0.05) -1.6449
Approximate p-value 0.0000
OLS Regression Line (Blue)
OLS Regression Slope -0.0023
OLS Regression Intercept 101.7169
Theil-Sen Trend Line (Red)
Theil-Sen Slope -0.0024
Theil-Sen Intercept 105.4605
Statistically significant evidence
of a decreasing trend at the
specified level of significance.


Seep 0607 Tritium Mann-Kendall Trend Test
C2
5703
4903
4103
3303
2503
1703
903
40873
41373
41873
42373
42873
43373
43873
C1
Mann-Kendall Trend Analysis
n 19
Confidence Coefficient 0.9500
Level of Significance 0.0500
Standard Deviation of S 28.5832
Standardized Value of S -3.5685
M-K Test Value (S) -103
Tabulated p-value 0.0000
Approximate p-value 0.0002
OLS Regression Line (Blue)
OLS Regression Slope -1.1566
OLS Regression Intercept 52,200.2308
Theil-Sen Trend Line (Red)
Theil-Sen Slope -1.3459
Theil-Sen Intercept 60,139.2208
Statistically significant evidence
of a decreasing trend at the
specified level of significance.


Well 0315 Mann-Kendall Trend Test
C2
C1
0
3
6
9
12
15
40872
41372
41872
42372
42872
43372
43872
Mann-Kendall Trend Analysis
n 36
Confidence Coefficient 0.9500
Level of Significance 0.0500
Standard Deviation of S 73.4098
Standardized Value of S -6.4024
M-K Test Value (S) -471
Appx. Critical Value (0.05) -1.6449
Approximate p-value 0.0000
OLS Regression Line (Blue)
OLS Regression Slope -0.0040
OLS Regression Intercept 175.6151
Statistically significant evidence
of a decreasing trend at the
specified level of significance.


Well 0347 Theil-Sen Trend Line and OLS Regression Line
C2
C1
28
24
20
16
12
8
4
40872
41372
41872
42372
42872
43372
43872
Theil-Sen Trend Analysis
n 36
Level of Significance 0.0500
OLS Regression Line (Blue)
OLS Regression Slope -0.0023
OLS Regression Intercept 119.0411
Theil-Sen Trend Line (Red)
Theil-Sen Slope -0.0021
Theil-Sen Intercept 111.3373
M1 243.1243
M2 386.8757
LCL of Slope -0.0041
UCL of Slope -0.0002
Statistically significant evidence of a decreasing trend at the specified level of significance.


Well 0386 Mann-Kendall Trend Test
3.0
2.5
2.0
1.5
1.0
0.5
C2
40872
41372
41872
42372
42872
43372
43872
C1
Mann-Kendall Trend Analysis
n 36
Confidence Coefficient 0.9500
Level of Significance 0.0500
Standard Deviation of S 73.3644
Standardized Value of S -2.0991
M-K Test Value (S) -155
Appx. Critical Value (0.05) -1.6449
Approximate p-value 0.0179
OLS Regression Line (Blue)
OLS Regression Slope -0.0003
OLS Regression Intercept 13.9394
Statistically significant evidence
of a decreasing trend at the
specified level of significance.


Well 0389 Mann-Kendall Trend Test
C2
0.84
0.74
0.64
0.54
0.44
0.34
0.24
0.14
40872
41372
41872
42372
42872
43372
43872
C1
Mann-Kendall Trend Analysis
n 36
Confidence Coefficient 0.9500
Level of Significance 0.0500
Standard Deviation of S 68.4982
Standardized Value of S -1.8541
M-K Test Value (S) -128
Appx. Critical Value (0.05) -1.6449
Approximate p-value 0.0319
OLS Regression Line (Blue)
OLS Regression Slope -0.0001
OLS Regression Intercept 2.5727
Statistically significant evidence of a decreasing trend at the specified level of significance.

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Appendix C

2020 Groundwater Elevations

Table C-1. Phase I Groundwater Elevations

Well ID	Date/Time	Top of Casing Elevation (ft AMSL)	Groundwater Elevation (ft AMSL)	Depth from Top of Casing (ft)
0353	01/29/2020 12:40	745.33	743.10	2.23
0353	08/18/2020 10:30	745.33	739.58	5.75
0400	01/13/2020 00:00	705.11	680.53	24.58
0400	02/10/2020 00:00	705.11	681.45	23.66
0400	03/17/2020 00:00	705.11	682.00	23.11
0400	05/21/2020 00:00	705.11	684.21	20.90
0400	06/09/2020 00:00	705.11	681.77	23.34
0400	07/15/2020 00:00	705.11	679.16	25.95
0400	08/12/2020 00:00	705.11	679.15	25.96
0400	09/16/2020 00:00	705.11	678.90	26.21
0400	10/12/2020 00:00	705.11	678.09	27.02
0400	11/17/2020 00:00	705.11	679.19	25.92
0400	12/15/2020 00:00	705.11	679.89	25.22
0402	01/13/2020 00:00	704.02	680.67	23.35
0402	02/04/2020 09:52	704.02	681.39	22.63
0402	02/10/2020 00:00	704.02	681.50	22.52
0402	03/17/2020 00:00	704.02	681.97	22.05
0402	05/21/2020 00:00	704.02	684.37	19.65
0402	06/02/2020 09:15	704.02	682.75	21.27
0402	06/09/2020 00:00	704.02	681.83	22.19
0402	07/15/2020 00:00	704.02	679.31	24.71
0402	08/12/2020 00:00	704.02	679.31	24.71
0402	08/25/2020 12:15	704.02	678.96	25.06
0402	09/16/2020 00:00	704.02	679.01	25.01
0402	10/12/2020 00:00	704.02	678.24	25.78
0402	11/17/2020 00:00	704.02	679.27	24.75
0402	12/15/2020 00:00	704.02	680.02	24.00
0411	01/29/2020 13:45	836.57	818.82	17.75
0411	08/17/2020 11:07	836.57	808.87	27.70
0443	01/29/2020 13:06	858.78	828.78	30.00
0443	08/17/2020 10:15	858.78	821.66	37.12
0444	01/29/2020 10:00	773.00	751.49	21.51
0444	08/17/2020 12:43	773.00	747.60	25.40
0445	01/29/2020 10:30	743.43	726.47	16.96
0445	08/17/2020 13:30	743.43	725.55	17.88

Table C-1. Phase I Groundwater Elevations (continued)

Well ID	Date/Time	Top of Casing Elevation (ft AMSL)	Groundwater Elevation (ft AMSL)	Depth from Top of Casing (ft)
P033	01/13/2020 00:00	705.83	680.51	25.32
P033	02/10/2020 00:00	705.83	681.42	24.41
P033	03/17/2020 00:00	705.83	681.85	23.98
P033	05/21/2020 00:00	705.83	684.23	21.60
P033	06/09/2020 00:00	705.83	681.75	24.08
P033	07/15/2020 00:00	705.83	679.33	26.50
P033	08/12/2020 00:00	705.83	679.18	26.65
P033	09/16/2020 00:00	705.83	678.88	26.95
P033	10/12/2020 00:00	705.83	678.11	27.72
P033	11/17/2020 00:00	705.83	679.17	26.66
P033	12/15/2020 00:00	705.83	679.87	25.96
P064	01/13/2020 00:00	729.98	680.30	49.68
P064	01/29/2020 10:58	729.98	681.53	48.45
P064	02/10/2020 00:00	729.98	681.27	48.71
P064	03/17/2020 00:00	729.98	681.86	48.12
P064	05/21/2020 00:00	729.98	683.85	46.13
P064	06/09/2020 00:00	729.98	681.55	48.43
P064	07/15/2020 00:00	729.98	678.98	51.00
P064	08/12/2020 00:00	729.98	678.95	51.03
P064	08/18/2020 09:32	729.98	---	water below pump
P064	09/16/2020 00:00	729.98	678.56	51.42
P064	10/12/2020 00:00	729.98	677.87	52.11
P064	11/17/2020 00:00	729.98	678.94	51.04
P064	12/15/2020 00:00	729.98	679.68	50.30

Abbreviation:
ft AMSL = feet above mean sea level

Table C-2. Parcels 6, 7, and 8 Groundwater Elevations

Well ID	Date/Time	Top of Casing Elevation (ft AMSL)	Groundwater Elevation (ft AMSL)	Depth from Top of Casing (ft)
0118	01/27/2020 10:26	704.86	682.89	21.97
0118	06/01/2020 09:58	704.86	683.45	21.41
0118	08/17/2020 12:23	704.86	680.35	24.51
0118	12/01/2020 11:00	704.86	681.91	22.95
0124	01/27/2020 11:23	705.12	682.00	23.12
0124	06/01/2020 13:25	705.12	682.92	22.20
0124	08/18/2020 11:45	705.12	679.36	25.76
0124	11/30/2020 09:35	705.12	680.27	24.85
0126	01/13/2020 00:00	705.54	680.84	24.70
0126	01/27/2020 11:03	705.54	681.99	23.55
0126	02/10/2020 00:00	705.54	681.71	23.83
0126	03/17/2020 00:00	705.54	682.19	23.35
0126	05/21/2020 00:00	705.54	684.82	20.72
0126	06/01/2020 10:36	705.54	682.94	22.60
0126	06/09/2020 00:00	705.54	681.86	23.68
0126	07/15/2020 00:00	705.54	679.44	26.10
0126	08/12/2020 00:00	705.54	679.57	25.97
0126	08/17/2020 12:57	705.54	679.37	26.17
0126	09/16/2020 00:00	705.54	679.19	26.35
0126	10/12/2020 00:00	705.54	678.48	27.06
0126	11/17/2020 00:00	705.54	679.64	25.90
0126	11/30/2020 10:28	705.54	680.28	25.26
0126	12/15/2020 00:00	705.54	680.29	25.25
0138	01/27/2020 09:55	708.04	682.84	25.20
0138	06/01/2020 09:26	708.04	683.33	24.71
0138	08/17/2020 11:47	708.04	680.32	27.72
0138	12/01/2020 09:50	708.04	681.89	26.15
0315	01/28/2020 09:45	723.99	682.07	41.92
0315	06/01/2020 09:12	723.99	682.94	41.05
0315	08/18/2020 08:40	723.99	679.33	44.66
0315	11/30/2020 13:20	723.99	680.45	43.54
0346	01/27/2020 12:29	742.97	727.50	15.47
0346	06/01/2020 10:45	742.97	728.67	14.30
0346	08/18/2020 12:18	742.97	726.32	16.65
0346	11/30/2020 14:38	742.97	725.67	17.30
0347	01/28/2020 10:22	725.20	682.06	43.14
0347	06/01/2020 10:00	725.20	682.93	42.27
0347	08/18/2020 09:23	725.20	679.30	45.90
0347	11/30/2020 01:40	725.20	680.33	44.87

Table C-2. Parcels 6, 7, and 8 Groundwater Elevations (continued)

Well ID	Date/Time	Top of Casing Elevation (ft AMSL)	Groundwater Elevation (ft AMSL)	Depth from Top of Casing (ft)
0379	01/13/2020 00:00	716.11	680.75	35.36
0379	01/27/2020 12:53	716.11	681.98	34.13
0379	02/04/2020 09:47	716.11	681.66	34.45
0379	02/10/2020 00:00	716.11	681.65	34.46
0379	03/17/2020 00:00	716.11	682.19	33.92
0379	05/21/2020 00:00	716.11	684.69	31.42
0379	06/01/2020 13:22	716.11	682.91	33.20
0379	06/04/2020 09:40	716.11	682.60	33.51
0379	06/09/2020 00:00	716.11	681.93	34.18
0379	07/15/2020 00:00	716.11	679.61	36.50
0379	08/12/2020 00:00	716.11	679.55	36.56
0379	08/17/2020 10:28	716.11	679.33	36.78
0379	08/25/2020 09:30	716.11	679.26	36.85
0379	09/16/2020 00:00	716.11	679.16	36.95
0379	10/12/2020 00:00	716.11	678.43	37.68
0379	11/17/2020 00:00	716.11	679.61	36.50
0379	12/01/2020 13:08	716.11	680.40	35.71
0379	12/07/2020 11:20	716.11	680.58	35.53
0379	12/15/2020 00:00	716.11	680.61	35.50
0386	01/28/2020 13:50	724.79	682.06	42.73
0386	06/01/2020 12:45	724.79	682.92	41.87
0386	08/18/2020 10:37	724.79	679.31	45.48
0386	11/30/2020 12:10	724.79	680.21	44.58
0387	01/28/2020 12:53	720.89	682.07	38.82
0387	06/01/2020 12:10	720.89	682.99	37.90
0387	08/17/2020 09:48	720.89	679.32	41.57
0387	11/30/2020 14:00	720.89	680.00	40.89
0389	01/28/2020 13:28	724.65	681.81	42.84
0389	06/01/2020 12:15	724.65	682.90	41.75
0389	08/18/2020 10:15	724.65	679.27	45.38
0389	11/30/2020 12:42	724.65	680.30	44.35
0392	01/28/2020 12:30	720.84	682.18	38.66
0392	06/01/2020 12:50	720.84	683.13	37.71
0392	08/17/2020 09:20	720.84	679.44	41.40
0392	11/30/2020 13:19	720.84	680.34	40.50

Abbreviation:
ft AMSL = feet above mean sea level

Appendix D

2020 Groundwater and Seep Data Tables

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Table D-1. Phase I Groundwater Data

Location	Analyte	Sample Date	Value	Detection Limit	Laboratory Qualifiers	Validation Qualifiers	Units	Sample Type
0353	*cis*-1,2-Dichloroethene	1/29/2020	0.16	0.16	U		µg/L	F
0353	*cis*-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0353	Dissolved Oxygen	1/29/2020	9.2				mg/L	F
0353	Dissolved Oxygen	8/18/2020	2.07				mg/L	F
0353	Oxidation Reduction Potential	1/29/2020	206.2				mV	F
0353	Oxidation Reduction Potential	8/18/2020	-27.4				mV	F
0353	pH	1/29/2020	7.57				s.u.	F
0353	pH	8/18/2020	6.9				s.u.	F
0353	Specific Conductance	1/29/2020	1220				µmhos/cm	F
0353	Specific Conductance	8/18/2020	1300				µmhos/cm	F
0353	Temperature	1/29/2020	9.6				C	F
0353	Temperature	8/18/2020	17.2				C	F
0353	Tetrachloroethene	1/29/2020	0.16	0.16	U		µg/L	F
0353	Tetrachloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0353	*trans*-1,2-Dichloroethene	1/29/2020	0.16	0.16	U		µg/L	F
0353	*trans*-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0353	Trichloroethene	1/29/2020	0.16	0.16	U		µg/L	F
0353	Trichloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0353	Turbidity	1/29/2020	68.6				NTU	F
0353	Turbidity	8/18/2020	94.7				NTU	F
0353	Vinyl chloride	1/29/2020	0.16	0.16	U		µg/L	F
0353	Vinyl chloride	8/18/2020	0.16	0.16	U		µg/L	F
0411	*cis*-1,2-Dichloroethene	1/29/2020	2.54	0.16			µg/L	F
0411	*cis*-1,2-Dichloroethene	8/17/2020	1.82	0.16			µg/L	F
0411	Dissolved Oxygen	1/29/2020	1.55				mg/L	F
0411	Dissolved Oxygen	8/17/2020	4.3				mg/L	F
0411	Oxidation Reduction Potential	1/29/2020	195				mV	F
0411	Oxidation Reduction Potential	8/17/2020	7.8				mV	F
0411	pH	1/29/2020	7.09				s.u.	F
0411	pH	8/17/2020	7.06				s.u.	F
0411	Specific Conductance	1/29/2020	1320				µmhos/cm	F
0411	Specific Conductance	8/17/2020	1300				µmhos/cm	F
0411	Temperature	1/29/2020	11.8				C	F
0411	Temperature	8/17/2020	14.9				C	F

Table D-1. Phase I Groundwater Data (continued)

Location	Analyte	Sample Date	Value	Detection Limit	Laboratory Qualifiers	Validation Qualifiers	Units	Sample Type
0411	Tetrachloroethene	1/29/2020	0.16	0.16	U		µg/L	F
0411	Tetrachloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0411	*trans*-1,2-Dichloroethene	1/29/2020	0.16	0.16	U		µg/L	F
0411	*trans*-1,2-Dichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0411	Trichloroethene	1/29/2020	9.69	0.16			µg/L	F
0411	Trichloroethene	8/17/2020	9.21	0.16			µg/L	F
0411	Turbidity	1/29/2020	6.84				NTU	F
0411	Turbidity	8/17/2020	59.3				NTU	F
0411	Vinyl chloride	1/29/2020	0.16	0.16	U		µg/L	F
0411	Vinyl chloride	8/17/2020	0.16	0.16	U		µg/L	F
0443	*cis*-1,2-Dichloroethene	1/29/2020	0.66	0.16	J		µg/L	F
0443	*cis*-1,2-Dichloroethene	8/17/2020	0.5	0.16	J		µg/L	F
0443	Dissolved Oxygen	1/29/2020	4.61				mg/L	F
0443	Dissolved Oxygen	8/17/2020	5.58				mg/L	F
0443	Oxidation Reduction Potential	1/29/2020	207				mV	F
0443	Oxidation Reduction Potential	8/17/2020	273.1				mV	F
0443	pH	1/29/2020	7.11				s.u.	F
0443	pH	8/17/2020	6.9				s.u.	F
0443	Specific Conductance	1/29/2020	1200				µmhos/cm	F
0443	Specific Conductance	8/17/2020	1270				µmhos/cm	F
0443	Temperature	1/29/2020	10.5				C	F
0443	Temperature	8/17/2020	15				C	F
0443	Tetrachloroethene	1/29/2020	0.16	0.16	U		µg/L	F
0443	Tetrachloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0443	*trans*-1,2-Dichloroethene	1/29/2020	0.16	0.16	U		µg/L	F
0443	*trans*-1,2-Dichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0443	Trichloroethene	1/29/2020	5.85	0.16			µg/L	F
0443	Trichloroethene	8/17/2020	9.27	0.16			µg/L	F
0443	Turbidity	1/29/2020	1.9				NTU	F
0443	Turbidity	8/17/2020	22.9				NTU	F
0443	Vinyl chloride	1/29/2020	0.16	0.16	U		µg/L	F
0443	Vinyl chloride	8/17/2020	0.16	0.16	U		µg/L	F
0444	*cis*-1,2-Dichloroethene	1/29/2020	0.16	0.16	U		µg/L	F
0444	*cis*-1,2-Dichloroethene	8/17/2020	0.16	0.16	U		µg/L	F

Table D-1. Phase I Groundwater Data (continued)

Location	Analyte	Sample Date	Value	Detection Limit	Laboratory Qualifiers	Validation Qualifiers	Units	Sample Type
0444	Dissolved Oxygen	1/29/2020	7.31				mg/L	F
0444	Dissolved Oxygen	8/17/2020	0.73				mg/L	F
0444	Oxidation Reduction Potential	1/29/2020	266.9				mV	F
0444	Oxidation Reduction Potential	8/17/2020	209.1				mV	F
0444	pH	1/29/2020	7.01				s.u.	F
0444	pH	8/17/2020	7.31				s.u.	F
0444	Specific Conductance	1/29/2020	1270				µmhos/cm	F
0444	Specific Conductance	8/17/2020	1190				µmhos/cm	F
0444	Temperature	1/29/2020	11.3				C	F
0444	Temperature	8/17/2020	16.6				C	F
0444	Tetrachloroethene	1/29/2020	0.16	0.16	U		µg/L	F
0444	Tetrachloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0444	*trans*-1,2-Dichloroethene	1/29/2020	0.16	0.16	U		µg/L	F
0444	*trans*-1,2-Dichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0444	Trichloroethene	1/29/2020	0.16	0.16	U		µg/L	F
0444	Trichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0444	Turbidity	1/29/2020	11.2				NTU	F
0444	Turbidity	8/17/2020	4.49				NTU	F
0444	Vinyl chloride	1/29/2020	0.16	0.16	U		µg/L	F
0444	Vinyl chloride	8/17/2020	0.16	0.16	U		µg/L	F
0445	*cis*-1,2-Dichloroethene	1/29/2020	0.16	0.16	U		µg/L	F
0445	*cis*-1,2-Dichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0445	Dissolved Oxygen	1/29/2020	3.28				mg/L	F
0445	Dissolved Oxygen	8/17/2020	0.39				mg/L	F
0445	Oxidation Reduction Potential	1/29/2020	-66.3				mV	F
0445	Oxidation Reduction Potential	8/17/2020	-104				mV	F
0445	pH	1/29/2020	7.06				s.u.	F
0445	pH	8/17/2020	7.1				s.u.	F
0445	Specific Conductance	1/29/2020	20150				µmhos/cm	F
0445	Specific Conductance	8/17/2020	24600				µmhos/cm	F
0445	Temperature	1/29/2020	12.3				C	F
0445	Temperature	8/17/2020	19.5				C	F
0445	Tetrachloroethene	1/29/2020	0.16	0.16	U		µg/L	F
0445	Tetrachloroethene	8/17/2020	0.16	0.16	U		µg/L	F

Table D-1. Phase I Groundwater Data (continued)

Location	Analyte	Sample Date	Value	Detection Limit	Laboratory Qualifiers	Validation Qualifiers	Units	Sample Type
0445	*trans*-1,2-Dichloroethene	1/29/2020	0.16	0.16	U		µg/L	F
0445	*trans*-1,2-Dichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0445	Trichloroethene	1/29/2020	0.16	0.16	U		µg/L	F
0445	Trichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0445	Turbidity	1/29/2020	11.8				NTU	F
0445	Turbidity	8/17/2020	19.3				NTU	F
0445	Vinyl chloride	1/29/2020	0.16	0.16	U		µg/L	F
0445	Vinyl chloride	8/17/2020	0.16	0.16	U		µg/L	F
P064	*cis*-1,2-Dichloroethene	1/29/2020	0.3	0.16	J		µg/L	D
P064	*cis*-1,2-Dichloroethene	1/29/2020	0.29	0.16	J		µg/L	F
P064	*cis*-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	F
P064	*cis*-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	D
P064	Dissolved Oxygen	1/29/2020	4.78				mg/L	F
P064	Dissolved Oxygen	8/18/2020	5.27				mg/L	F
P064	Oxidation Reduction Potential	1/29/2020	139.4				mV	F
P064	Oxidation Reduction Potential	8/18/2020	62				mV	F
P064	pH	1/29/2020	7.03				s.u.	F
P064	pH	8/18/2020	6.68				s.u.	F
P064	Specific Conductance	1/29/2020	1450				µmhos/cm	F
P064	Specific Conductance	8/18/2020	1270				µmhos/cm	F
P064	Temperature	1/29/2020	11.7				C	F
P064	Temperature	8/18/2020	14.2				C	F
P064	Tetrachloroethene	1/29/2020	1.02	0.16			µg/L	D
P064	Tetrachloroethene	1/29/2020	1.05	0.16			µg/L	F
P064	Tetrachloroethene	8/18/2020	1.16	0.16			µg/L	D
P064	Tetrachloroethene	8/18/2020	1.24	0.16			µg/L	F
P064	*trans*-1,2-Dichloroethene	1/29/2020	0.16	0.16	U		µg/L	F
P064	*trans*-1,2-Dichloroethene	1/29/2020	0.16	0.16	U		µg/L	D
P064	*trans*-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	F
P064	*trans*-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	D
P064	Trichloroethene	1/29/2020	0.67	0.16	J		µg/L	F
P064	Trichloroethene	1/29/2020	0.61	0.16	J		µg/L	D
P064	Trichloroethene	8/18/2020	0.57	0.16	J		µg/L	F
P064	Trichloroethene	8/18/2020	0.56	0.16	J		µg/L	D

Table D-1. Phase I Groundwater Data (continued)

Location	Analyte	Sample Date	Value	Detection Limit	Laboratory Qualifiers	Validation Qualifiers	Units	Sample Type
P064	Turbidity	1/29/2020	1.95				NTU	F
P064	Turbidity	8/18/2020	19.4				NTU	F
P064	Vinyl chloride	1/29/2020	0.16	0.16	U		µg/L	F
P064	Vinyl chloride	1/29/2020	0.16	0.16	U		µg/L	D
P064	Vinyl chloride	8/18/2020	0.16	0.16	U		µg/L	F
P064	Vinyl chloride	8/18/2020	0.16	0.16	U		µg/L	D

Abbreviations:
D = analyte determined in diluted sample
F = low flow sampling method used
J = estimated value
µg/L = micrograms per liter
µmhos/cm = micromhos per centimeter
mg/L = milligrams per liter
mV = millivolts
NTU = nephelometric turbidity unit
pCi/L = picocuries per liter
Q = quantitative result due to sampling technique
s.u. = standard unit
U = analytical result below detection limit

Table D-2. Parcels 6, 7, and 8 Groundwater Data

Location	Analyte	Sample Date	Result	Detection Limit	Lab Qualifiers	Validation Qualifiers	Units	Sample Type
0118	cis-1,2-Dichloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0118	cis-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0118	cis-1,2-Dichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0118	cis-1,2-Dichloroethene	12/1/2020	0.16	0.16	U		µg/L	F
0118	Dissolved Oxygen	1/27/2020	8.46				mg/L	F
0118	Dissolved Oxygen	6/1/2020	6.4				mg/L	F
0118	Dissolved Oxygen	8/17/2020	6.12				mg/L	F
0118	Dissolved Oxygen	12/1/2020	6.16				mg/L	F
0118	Oxidation Reduction Potential	1/27/2020	274.4				mV	F
0118	Oxidation Reduction Potential	6/1/2020	162.1				mV	F
0118	Oxidation Reduction Potential	8/17/2020	146.8				mV	F
0118	Oxidation Reduction Potential	12/1/2020	131				mV	F
0118	pH	1/27/2020	7.15				s.u.	F
0118	pH	6/1/2020	7.13				s.u.	F
0118	pH	8/17/2020	7.09				s.u.	F
0118	pH	12/1/2020	7.21				s.u.	F
0118	Specific Conductance	1/27/2020	1060				µmhos/cm	F
0118	Specific Conductance	6/1/2020	1070				µmhos/cm	F
0118	Specific Conductance	8/17/2020	1090				µmhos/cm	F
0118	Specific Conductance	12/1/2020	1090				µmhos/cm	F
0118	Temperature	1/27/2020	13.5				C	F
0118	Temperature	6/1/2020	13.8				C	F
0118	Temperature	8/17/2020	14.8				C	F
0118	Temperature	12/1/2020	13.2				C	F
0118	Tetrachloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0118	Tetrachloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0118	Tetrachloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0118	Tetrachloroethene	12/1/2020	0.16	0.16	U		µg/L	F
0118	trans-1,2-Dichloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0118	trans-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0118	trans-1,2-Dichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0118	trans-1,2-Dichloroethene	12/1/2020	0.16	0.16	U		µg/L	F
0118	Trichloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0118	Trichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0118	Trichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0118	Trichloroethene	12/1/2020	0.16	0.16	U		µg/L	F

Table D-2. Parcels 6, 7, and 8 Groundwater Data (continued)

Location	Analyte	Sample Date	Result	Detection Limit	Lab Qualifiers	Validation Qualifiers	Units	Sample Type
0118	Tritium	1/27/2020	11.5	286	U		pCi/L	F
0118	Tritium	8/17/2020	-33	304	U		pCi/L	F
0118	Turbidity	1/27/2020	34				NTU	F
0118	Turbidity	6/1/2020	13.3				NTU	F
0118	Turbidity	8/17/2020	33.5				NTU	F
0118	Turbidity	12/1/2020	8.4				NTU	F
0118	Vinyl chloride	1/27/2020	0.16	0.16	U		µg/L	F
0118	Vinyl chloride	6/1/2020	0.16	0.16	U		µg/L	F
0118	Vinyl chloride	8/17/2020	0.16	0.16	U		µg/L	F
0118	Vinyl chloride	12/1/2020	0.16	0.16	U		µg/L	F
0124	cis-1,2-Dichloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0124	cis-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0124	cis-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0124	cis-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0124	Dissolved Oxygen	1/27/2020	1.58				mg/L	F
0124	Dissolved Oxygen	6/1/2020	4.14				mg/L	F
0124	Dissolved Oxygen	8/18/2020	3.66				mg/L	F
0124	Dissolved Oxygen	11/30/2020	1.01				mg/L	F
0124	Oxidation Reduction Potential	1/27/2020	286.1				mV	F
0124	Oxidation Reduction Potential	6/1/2020	175.6				mV	F
0124	Oxidation Reduction Potential	8/18/2020	195.5				mV	F
0124	Oxidation Reduction Potential	11/30/2020	230.2				mV	F
0124	pH	1/27/2020	6.86				s.u.	F
0124	pH	6/1/2020	6.77				s.u.	F
0124	pH	8/18/2020	6.85				s.u.	F
0124	pH	11/30/2020	6.53				s.u.	F
0124	Specific Conductance	1/27/2020	1170				µmhos/cm	F
0124	Specific Conductance	6/1/2020	1170				µmhos/cm	F
0124	Specific Conductance	8/18/2020	1180				µmhos/cm	F
0124	Specific Conductance	11/30/2020	1220				µmhos/cm	F
0124	Temperature	1/27/2020	12.9				C	F
0124	Temperature	6/1/2020	14.3				C	F
0124	Temperature	8/18/2020	14				C	F
0124	Temperature	11/30/2020	13				C	F

Table D-2. Parcels 6, 7, and 8 Groundwater Data (continued)

Location	Analyte	Sample Date	Result	Detection Limit	Lab Qualifiers	Validation Qualifiers	Units	Sample Type
0124	Tetrachloroethene	1/27/2020	0.27	0.16	J		µg/L	F
0124	Tetrachloroethene	6/1/2020	0.31	0.16	J		µg/L	F
0124	Tetrachloroethene	8/18/2020	0.38	0.16	J		µg/L	F
0124	Tetrachloroethene	11/30/2020	0.32	0.16	J		µg/L	F
0124	trans-1,2-Dichloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0124	trans-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0124	trans-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0124	trans-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0124	Trichloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0124	Trichloroethene	6/1/2020	0.16	0.16	J		µg/L	F
0124	Trichloroethene	8/18/2020	0.19	0.16	J		µg/L	F
0124	Trichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0124	Turbidity	1/27/2020	1.01				NTU	F
0124	Turbidity	6/1/2020	0.85				NTU	F
0124	Turbidity	8/18/2020	1.18				NTU	F
0124	Turbidity	11/30/2020	8				NTU	F
0124	Vinyl chloride	1/27/2020	0.16	0.16	U		µg/L	F
0124	Vinyl chloride	6/1/2020	0.16	0.16	U		µg/L	F
0124	Vinyl chloride	8/18/2020	0.16	0.16	U		µg/L	F
0124	Vinyl chloride	11/30/2020	0.16	0.16	U		µg/L	F
0126	cis-1,2-Dichloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0126	cis-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0126	cis-1,2-Dichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0126	cis-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0126	Dissolved Oxygen	1/27/2020	5.44				mg/L	F
0126	Dissolved Oxygen	6/1/2020	1.87				mg/L	F
0126	Dissolved Oxygen	8/17/2020	0.87				mg/L	F
0126	Dissolved Oxygen	11/30/2020	1.37				mg/L	F
0126	Oxidation Reduction Potential	1/27/2020	276.3				mV	F
0126	Oxidation Reduction Potential	6/1/2020	146.1				mV	F
0126	Oxidation Reduction Potential	8/17/2020	145.9				mV	F
0126	Oxidation Reduction Potential	11/30/2020	287.4				mV	F
0126	pH	1/27/2020	6.89				s.u.	F
0126	pH	6/1/2020	6.9				s.u.	F
0126	pH	8/17/2020	6.86				s.u.	F
0126	pH	11/30/2020	6.6				s.u.	F

Table D-2. Parcels 6, 7, and 8 Groundwater Data (continued)

Location	Analyte	Sample Date	Result	Detection Limit	Lab Qualifiers	Validation Qualifiers	Units	Sample Type
0126	Specific Conductance	1/27/2020	1270				µmhos/cm	F
0126	Specific Conductance	6/1/2020	1240				µmhos/cm	F
0126	Specific Conductance	8/17/2020	1290				µmhos/cm	F
0126	Specific Conductance	11/30/2020	1320				µmhos/cm	F
0126	Temperature	1/27/2020	12.7				C	F
0126	Temperature	6/1/2020	13.7				C	F
0126	Temperature	8/17/2020	15.1				C	F
0126	Temperature	11/30/2020	12.6				C	F
0126	Tetrachloroethene	1/27/2020	0.83	0.16	J		µg/L	F
0126	Tetrachloroethene	6/1/2020	0.75	0.16	J		µg/L	F
0126	Tetrachloroethene	8/17/2020	0.94	0.16	J		µg/L	F
0126	Tetrachloroethene	11/30/2020	0.95	0.16	J		µg/L	F
0126	trans-1,2-Dichloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0126	trans-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0126	trans-1,2-Dichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0126	trans-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0126	Trichloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0126	Trichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0126	Trichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0126	Trichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0126	Turbidity	1/27/2020	0.52				NTU	F
0126	Turbidity	6/1/2020	2.13				NTU	F
0126	Turbidity	8/17/2020	8.42				NTU	F
0126	Turbidity	11/30/2020	3.56				NTU	F
0126	Vinyl chloride	1/27/2020	0.16	0.16	U		µg/L	F
0126	Vinyl chloride	6/1/2020	0.16	0.16	U		µg/L	F
0126	Vinyl chloride	8/17/2020	0.16	0.16	U		µg/L	F
0126	Vinyl chloride	11/30/2020	0.16	0.16	U		µg/L	F
0138	cis-1,2-Dichloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0138	cis-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0138	cis-1,2-Dichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0138	cis-1,2-Dichloroethene	12/1/2020	0.16	0.16	U		µg/L	F
0138	Dissolved Oxygen	1/27/2020	4.63				mg/L	F
0138	Dissolved Oxygen	6/1/2020	3.81				mg/L	F
0138	Dissolved Oxygen	8/17/2020	6.44				mg/L	F
0138	Dissolved Oxygen	12/1/2020	8.57				mg/L	F

Table D-2. Parcels 6, 7, and 8 Groundwater Data (continued)

Location	Analyte	Sample Date	Result	Detection Limit	Lab Qualifiers	Validation Qualifiers	Units	Sample Type
0138	Oxidation Reduction Potential	1/27/2020	256.6				mV	F
0138	Oxidation Reduction Potential	6/1/2020	133.5				mV	F
0138	Oxidation Reduction Potential	8/17/2020	123.7				mV	F
0138	Oxidation Reduction Potential	12/1/2020	133.5				mV	F
0138	pH	1/27/2020	7.05				s.u.	F
0138	pH	6/1/2020	6.96				s.u.	F
0138	pH	8/17/2020	7.05				s.u.	F
0138	pH	12/1/2020	7.04				s.u.	F
0138	Specific Conductance	1/27/2020	1120				µmhos/cm	F
0138	Specific Conductance	6/1/2020	1120				µmhos/cm	F
0138	Specific Conductance	8/17/2020	1110				µmhos/cm	F
0138	Specific Conductance	12/1/2020	1140				µmhos/cm	F
0138	Temperature	1/27/2020	11.9				C	F
0138	Temperature	6/1/2020	13.3				C	F
0138	Temperature	8/17/2020	15.1				C	F
0138	Temperature	12/1/2020	11.5				C	F
0138	Tetrachloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0138	Tetrachloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0138	Tetrachloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0138	Tetrachloroethene	12/1/2020	0.16	0.16	U		µg/L	F
0138	trans-1,2-Dichloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0138	trans-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0138	trans-1,2-Dichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0138	trans-1,2-Dichloroethene	12/1/2020	0.16	0.16	U		µg/L	F
0138	Trichloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0138	Trichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0138	Trichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0138	Trichloroethene	12/1/2020	0.16	0.16	U		µg/L	F
0138	Tritium	1/27/2020	138	289	U		pCi/L	F
0138	Tritium	8/17/2020	292	295	U		pCi/L	F
0138	Turbidity	1/27/2020	6.13				NTU	F
0138	Turbidity	6/1/2020	11.6				NTU	F
0138	Turbidity	8/17/2020	12.1				NTU	F
0138	Turbidity	12/1/2020	9.8				NTU	F

Table D-2. Parcels 6, 7, and 8 Groundwater Data (continued)

Location	Analyte	Sample Date	Result	Detection Limit	Lab Qualifiers	Validation Qualifiers	Units	Sample Type
0138	Vinyl chloride	1/27/2020	0.16	0.16	U		µg/L	F
0138	Vinyl chloride	6/1/2020	0.16	0.16	U		µg/L	F
0138	Vinyl chloride	8/17/2020	0.16	0.16	U		µg/L	F
0138	Vinyl chloride	12/1/2020	0.16	0.16	U		µg/L	F
0315	cis-1,2-Dichloroethene	1/28/2020	0.16	0.16	U		µg/L	F
0315	cis-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0315	cis-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0315	cis-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	D
0315	cis-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0315	Dissolved Oxygen	1/28/2020	1.43				mg/L	F
0315	Dissolved Oxygen	6/1/2020	0.58				mg/L	F
0315	Dissolved Oxygen	8/18/2020	0.87				mg/L	F
0315	Dissolved Oxygen	11/30/2020	0.6				mg/L	F
0315	Oxidation Reduction Potential	1/28/2020	-3				mV	F
0315	Oxidation Reduction Potential	6/1/2020	-29.7				mV	F
0315	Oxidation Reduction Potential	8/18/2020	-14.5				mV	F
0315	Oxidation Reduction Potential	11/30/2020	0.9				mV	F
0315	pH	1/28/2020	7.06				s.u.	F
0315	pH	6/1/2020	6.98				s.u.	F
0315	pH	8/18/2020	6.98				s.u.	F
0315	pH	11/30/2020	7.16				s.u.	F
0315	Specific Conductance	1/28/2020	1650				µmhos/cm	F
0315	Specific Conductance	6/1/2020	1620				µmhos/cm	F
0315	Specific Conductance	8/18/2020	1660				µmhos/cm	F
0315	Specific Conductance	11/30/2020	1720				µmhos/cm	F
0315	Temperature	1/28/2020	12.7				C	F
0315	Temperature	6/1/2020	14.8				C	F
0315	Temperature	8/18/2020	15.1				C	F
0315	Temperature	11/30/2020	12.3				C	F
0315	Tetrachloroethene	1/28/2020	0.16	0.16	U		µg/L	F
0315	Tetrachloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0315	Tetrachloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0315	Tetrachloroethene	11/30/2020	0.16	0.16	U		µg/L	D
0315	Tetrachloroethene	11/30/2020	0.16	0.16	U		µg/L	F

Table D-2. Parcels 6, 7, and 8 Groundwater Data (continued)

Location	Analyte	Sample Date	Result	Detection Limit	Lab Qualifiers	Validation Qualifiers	Units	Sample Type
0315	trans-1,2-Dichloroethene	1/28/2020	0.16	0.16	U		µg/L	F
0315	trans-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0315	trans-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0315	trans-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0315	trans-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	D
0315	Trichloroethene	1/28/2020	0.61	0.16	J		µg/L	F
0315	Trichloroethene	6/1/2020	0.57	0.16	J		µg/L	F
0315	Trichloroethene	8/18/2020	0.42	0.16	J		µg/L	F
0315	Trichloroethene	11/30/2020	0.64	0.16	J		µg/L	F
0315	Trichloroethene	11/30/2020	0.64	0.16	J		µg/L	D
0315	Turbidity	1/28/2020	78.4				NTU	F
0315	Turbidity	6/1/2020	101				NTU	F
0315	Turbidity	8/18/2020	44.2				NTU	F
0315	Turbidity	11/30/2020	155				NTU	F
0315	Vinyl chloride	1/28/2020	0.16	0.16	U		µg/L	F
0315	Vinyl chloride	6/1/2020	0.16	0.16	U		µg/L	F
0315	Vinyl chloride	8/18/2020	0.16	0.16	U		µg/L	F
0315	Vinyl chloride	11/30/2020	0.16	0.16	U		µg/L	F
0315	Vinyl chloride	11/30/2020	0.16	0.16	U		µg/L	D
0347	cis-1,2-Dichloroethene	1/28/2020	0.16	0.16	U		µg/L	F
0347	cis-1,2-Dichloroethene	1/28/2020	0.16	0.16	U		µg/L	D
0347	cis-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	D
0347	cis-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0347	cis-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	D
0347	cis-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0347	cis-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0347	Dissolved Oxygen	1/28/2020	0.98				mg/L	F
0347	Dissolved Oxygen	6/1/2020	2.82				mg/L	F
0347	Dissolved Oxygen	8/18/2020	2.86				mg/L	F
0347	Dissolved Oxygen	11/30/2020	0.58				mg/L	F
0347	Oxidation Reduction Potential	1/28/2020	31.4				mV	F
0347	Oxidation Reduction Potential	6/1/2020	-45.9				mV	F
0347	Oxidation Reduction Potential	8/18/2020	-38.4				mV	F
0347	Oxidation Reduction Potential	11/30/2020	-32.3				mV	F

Table D-2. Parcels 6, 7, and 8 Groundwater Data (continued)

Location	Analyte	Sample Date	Result	Detection Limit	Lab Qualifiers	Validation Qualifiers	Units	Sample Type
0347	pH	1/28/2020	6.85				s.u.	F
0347	pH	6/1/2020	6.97				s.u.	F
0347	pH	8/18/2020	6.67				s.u.	F
0347	pH	11/30/2020	6.97				s.u.	F
0347	Specific Conductance	1/28/2020	1700				µmhos/cm	F
0347	Specific Conductance	6/1/2020	1680				µmhos/cm	F
0347	Specific Conductance	8/18/2020	1740				µmhos/cm	F
0347	Specific Conductance	11/30/2020	1840				µmhos/cm	F
0347	Temperature	1/28/2020	13.1				C	F
0347	Temperature	6/1/2020	14.3				C	F
0347	Temperature	8/18/2020	14.7				C	F
0347	Temperature	11/30/2020	13.6				C	F
0347	Tetrachloroethene	1/28/2020	0.16	0.16	U		µg/L	F
0347	Tetrachloroethene	1/28/2020	0.16	0.16	U		µg/L	D
0347	Tetrachloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0347	Tetrachloroethene	6/1/2020	0.16	0.16	U		µg/L	D
0347	Tetrachloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0347	Tetrachloroethene	8/18/2020	0.16	0.16	U		µg/L	D
0347	Tetrachloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0347	trans-1,2-Dichloroethene	1/28/2020	0.16	0.16	U		µg/L	F
0347	trans-1,2-Dichloroethene	1/28/2020	0.16	0.16	U		µg/L	D
0347	trans-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	D
0347	trans-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0347	trans-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	D
0347	trans-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0347	trans-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0347	Trichloroethene	1/28/2020	24.1	0.16			µg/L	D
0347	Trichloroethene	1/28/2020	23.8	0.16			µg/L	F
0347	Trichloroethene	6/1/2020	11.2	0.16			µg/L	D
0347	Trichloroethene	6/1/2020	11.1	0.16			µg/L	F
0347	Trichloroethene	8/18/2020	24.7	0.16			µg/L	D
0347	Trichloroethene	8/18/2020	23.6	0.16			µg/L	F
0347	Trichloroethene	11/30/2020	26.2	0.16			µg/L	F

Table D-2. Parcels 6, 7, and 8 Groundwater Data (continued)

Location	Analyte	Sample Date	Result	Detection Limit	Lab Qualifiers	Validation Qualifiers	Units	Sample Type
0347	Tritium	1/28/2020	938	282			pCi/L	D
0347	Tritium	1/28/2020	913	284			pCi/L	F
0347	Tritium	8/18/2020	956	282			pCi/L	D
0347	Tritium	8/18/2020	1070	297			pCi/L	F
0347	Turbidity	1/28/2020	7.71				NTU	F
0347	Turbidity	6/1/2020	12.8				NTU	F
0347	Turbidity	8/18/2020	11.4				NTU	F
0347	Turbidity	11/30/2020	8.86				NTU	F
0347	Vinyl chloride	1/28/2020	0.16	0.16	U		µg/L	D
0347	Vinyl chloride	1/28/2020	0.16	0.16	U		µg/L	F
0347	Vinyl chloride	6/1/2020	0.16	0.16	U		µg/L	D
0347	Vinyl chloride	6/1/2020	0.16	0.16	U		µg/L	F
0347	Vinyl chloride	8/18/2020	0.16	0.16	U		µg/L	F
0347	Vinyl chloride	8/18/2020	0.16	0.16	U		µg/L	D
0347	Vinyl chloride	11/30/2020	0.16	0.16	U		µg/L	F
0379	cis-1,2-Dichloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0379	cis-1,2-Dichloroethene	2/4/2020	0.333	0.333	U		µg/L	F
0379	cis-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0379	cis-1,2-Dichloroethene	6/4/2020	0.333	0.333	U		µg/L	F
0379	cis-1,2-Dichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0379	cis-1,2-Dichloroethene	8/25/2020	0.333	0.333	U		µg/L	F
0379	cis-1,2-Dichloroethene	12/1/2020	0.16	0.16	U		µg/L	F
0379	cis-1,2-Dichloroethene	12/7/2020	0.333	0.333	U		µg/L	F
0379	Dissolved Oxygen	1/27/2020	1.21				mg/L	F
0379	Dissolved Oxygen	2/4/2020	1.31				mg/L	F
0379	Dissolved Oxygen	6/1/2020	2.27				mg/L	F
0379	Dissolved Oxygen	6/4/2020	1.71				mg/L	F
0379	Dissolved Oxygen	8/17/2020	2.03				mg/L	F
0379	Dissolved Oxygen	8/25/2020	2.16				mg/L	F
0379	Dissolved Oxygen	12/1/2020	0.39				mg/L	F
0379	Dissolved Oxygen	12/7/2020	0.64				mg/L	F

Table D-2. Parcels 6, 7, and 8 Groundwater Data (continued)

Location	Analyte	Sample Date	Result	Detection Limit	Lab Qualifiers	Validation Qualifiers	Units	Sample Type
0379	Oxidation Reduction Potential	1/27/2020	12.6				mV	F
0379	Oxidation Reduction Potential	2/4/2020	18.4				mV	F
0379	Oxidation Reduction Potential	6/1/2020	65.1				mV	F
0379	Oxidation Reduction Potential	6/4/2020	38.1				mV	F
0379	Oxidation Reduction Potential	8/17/2020	17.5				mV	F
0379	Oxidation Reduction Potential	8/25/2020	-11.8				mV	F
0379	Oxidation Reduction Potential	12/1/2020	-16.1				mV	F
0379	Oxidation Reduction Potential	12/7/2020	-73.1				mV	F
0379	pH	1/27/2020	7.07				s.u.	F
0379	pH	2/4/2020	7				s.u.	F
0379	pH	6/1/2020	7.16				s.u.	F
0379	pH	6/4/2020	7.1				s.u.	F
0379	pH	8/17/2020	7.06				s.u.	F
0379	pH	8/25/2020	6.93				s.u.	F
0379	pH	12/1/2020	7.11				s.u.	F
0379	pH	12/7/2020	7.11				s.u.	F
0379	Specific Conductance	1/27/2020	1790				µmhos/cm	F
0379	Specific Conductance	2/4/2020	1790				µmhos/cm	F
0379	Specific Conductance	6/1/2020	1490				µmhos/cm	F
0379	Specific Conductance	6/4/2020	1490				µmhos/cm	F
0379	Specific Conductance	8/17/2020	1560				µmhos/cm	F
0379	Specific Conductance	8/25/2020	1580				µmhos/cm	F
0379	Specific Conductance	12/1/2020	1890				µmhos/cm	F
0379	Specific Conductance	12/7/2020	1900				µmhos/cm	F
0379	Temperature	1/27/2020	13.3				C	F
0379	Temperature	2/4/2020	14.1				C	F
0379	Temperature	6/1/2020	15.8				C	F
0379	Temperature	6/4/2020	16.3				C	F
0379	Temperature	8/17/2020	15.8				C	F
0379	Temperature	8/25/2020	16.1				C	F
0379	Temperature	12/1/2020	12.3				C	F
0379	Temperature	12/7/2020	13.3				C	F

Table D-2. Parcels 6, 7, and 8 Groundwater Data (continued)

Location	Analyte	Sample Date	Result	Detection Limit	Lab Qualifiers	Validation Qualifiers	Units	Sample Type
0379	Tetrachloroethene	1/27/2020	0.35	0.16	J		µg/L	F
0379	Tetrachloroethene	2/4/2020	0.47	0.333	J		µg/L	F
0379	Tetrachloroethene	6/1/2020	0.21	0.16	J		µg/L	F
0379	Tetrachloroethene	6/4/2020	0.333	0.333	U		µg/L	F
0379	Tetrachloroethene	8/17/2020	0.45	0.16	J		µg/L	F
0379	Tetrachloroethene	8/25/2020	0.41	0.333	J		µg/L	F
0379	Tetrachloroethene	12/1/2020	0.41	0.16	J		µg/L	F
0379	Tetrachloroethene	12/7/2020	0.4	0.333	J		µg/L	F
0379	trans-1,2-Dichloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0379	trans-1,2-Dichloroethene	2/4/2020	0.333	0.333	U		µg/L	F
0379	trans-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0379	trans-1,2-Dichloroethene	6/4/2020	0.333	0.333	U		µg/L	F
0379	trans-1,2-Dichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0379	trans-1,2-Dichloroethene	8/25/2020	0.333	0.333	U		µg/L	F
0379	trans-1,2-Dichloroethene	12/1/2020	0.16	0.16	U		µg/L	F
0379	trans-1,2-Dichloroethene	12/7/2020	0.333	0.333	U		µg/L	F
0379	Trichloroethene	1/27/2020	0.33	0.16	J		µg/L	F
0379	Trichloroethene	2/4/2020	0.36	0.333	J		µg/L	F
0379	Trichloroethene	6/1/2020	0.27	0.16	J		µg/L	F
0379	Trichloroethene	6/4/2020	0.34	0.333	J		µg/L	F
0379	Trichloroethene	8/17/2020	0.42	0.16	J		µg/L	F
0379	Trichloroethene	8/25/2020	0.42	0.333	J		µg/L	F
0379	Trichloroethene	12/1/2020	0.45	0.16	J		µg/L	F
0379	Trichloroethene	12/7/2020	0.4	0.333	J		µg/L	F
0379	Tritium	1/27/2020	827	287			pCi/L	F
0379	Tritium	8/17/2020	551	297		J	pCi/L	F
0379	Turbidity	1/27/2020	6.7				NTU	F
0379	Turbidity	2/4/2020	2.78				NTU	F
0379	Turbidity	6/1/2020	10.2				NTU	F
0379	Turbidity	6/4/2020	11				NTU	F
0379	Turbidity	8/17/2020	14.8				NTU	F
0379	Turbidity	8/25/2020	25.6				NTU	F
0379	Turbidity	12/1/2020	6				NTU	F
0379	Turbidity	12/7/2020	5.57				NTU	F

Table D-2. Parcels 6, 7, and 8 Groundwater Data (continued)

Location	Analyte	Sample Date	Result	Detection Limit	Lab Qualifiers	Validation Qualifiers	Units	Sample Type
0379	Vinyl chloride	1/27/2020	0.16	0.16	U		µg/L	F
0379	Vinyl chloride	2/4/2020	0.333	0.333	U		µg/L	F
0379	Vinyl chloride	6/1/2020	0.16	0.16	U		µg/L	F
0379	Vinyl chloride	6/4/2020	0.333	0.333	U		µg/L	F
0379	Vinyl chloride	8/17/2020	0.16	0.16	U		µg/L	F
0379	Vinyl chloride	8/25/2020	0.333	0.333	U		µg/L	F
0379	Vinyl chloride	12/1/2020	0.16	0.16	U		µg/L	F
0379	Vinyl chloride	12/7/2020	0.333	0.333	U		µg/L	F
0386	cis-1,2-Dichloroethene	1/28/2020	0.16	0.16	U		µg/L	F
0386	cis-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0386	cis-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0386	cis-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0386	Dissolved Oxygen	1/28/2020	1.62				mg/L	F
0386	Dissolved Oxygen	6/1/2020	1.03				mg/L	F
0386	Dissolved Oxygen	8/18/2020	1.94				mg/L	F
0386	Dissolved Oxygen	11/30/2020	1.49				mg/L	F
0386	Oxidation Reduction Potential	1/28/2020	256.7				mV	F
0386	Oxidation Reduction Potential	6/1/2020	141.5				mV	F
0386	Oxidation Reduction Potential	8/18/2020	152.1				mV	F
0386	Oxidation Reduction Potential	11/30/2020	312.3				mV	F
0386	pH	1/28/2020	6.8				s.u.	F
0386	pH	6/1/2020	6.72				s.u.	F
0386	pH	8/18/2020	6.77				s.u.	F
0386	pH	11/30/2020	6.62				s.u.	F
0386	Specific Conductance	1/28/2020	1310				µmhos/cm	F
0386	Specific Conductance	6/1/2020	1420				µmhos/cm	F
0386	Specific Conductance	8/18/2020	1430				µmhos/cm	F
0386	Specific Conductance	11/30/2020	1390				µmhos/cm	F
0386	Temperature	1/28/2020	12				C	F
0386	Temperature	6/1/2020	14.1				C	F
0386	Temperature	8/18/2020	13.5				C	F
0386	Temperature	11/30/2020	12.2				C	F
0386	Tetrachloroethene	1/28/2020	0.16	0.16	U		µg/L	F
0386	Tetrachloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0386	Tetrachloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0386	Tetrachloroethene	11/30/2020	0.16	0.16	U		µg/L	F

Table D-2. Parcels 6, 7, and 8 Groundwater Data (continued)

Location	Analyte	Sample Date	Result	Detection Limit	Lab Qualifiers	Validation Qualifiers	Units	Sample Type
0386	trans-1,2-Dichloroethene	1/28/2020	0.16	0.16	U		µg/L	F
0386	trans-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0386	trans-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0386	trans-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0386	Trichloroethene	1/28/2020	1.58	0.16			µg/L	F
0386	Trichloroethene	6/1/2020	0.99	0.16	J		µg/L	F
0386	Trichloroethene	8/18/2020	0.79	0.16	J		µg/L	F
0386	Trichloroethene	11/30/2020	0.59	0.16	J		µg/L	F
0386	Turbidity	1/28/2020	2.63				NTU	F
0386	Turbidity	6/1/2020	2.22				NTU	F
0386	Turbidity	8/18/2020	1.21				NTU	F
0386	Turbidity	11/30/2020	1.93				NTU	F
0386	Vinyl chloride	1/28/2020	0.16	0.16	U		µg/L	F
0386	Vinyl chloride	6/1/2020	0.16	0.16	U		µg/L	F
0386	Vinyl chloride	8/18/2020	0.16	0.16	U		µg/L	F
0386	Vinyl chloride	11/30/2020	0.16	0.16	U		µg/L	F
0387	cis-1,2-Dichloroethene	1/28/2020	0.16	0.16	U		µg/L	F
0387	cis-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0387	cis-1,2-Dichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0387	cis-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0387	Dissolved Oxygen	1/28/2020	1.71				mg/L	F
0387	Dissolved Oxygen	6/1/2020	0.9				mg/L	F
0387	Dissolved Oxygen	8/17/2020	0.9				mg/L	F
0387	Dissolved Oxygen	11/30/2020	0.46				mg/L	F
0387	Oxidation Reduction Potential	1/28/2020	229.1				mV	F
0387	Oxidation Reduction Potential	6/1/2020	76.6				mV	F
0387	Oxidation Reduction Potential	8/17/2020	129.5				mV	F
0387	Oxidation Reduction Potential	11/30/2020	353.4				mV	F
0387	pH	1/28/2020	6.89				s.u.	F
0387	pH	6/1/2020	6.88				s.u.	F
0387	pH	8/17/2020	6.82				s.u.	F
0387	pH	11/30/2020	6.6				s.u.	F
0387	Specific Conductance	1/28/2020	1350				µmhos/cm	F
0387	Specific Conductance	6/1/2020	1310				µmhos/cm	F
0387	Specific Conductance	8/17/2020	1350				µmhos/cm	F
0387	Specific Conductance	11/30/2020	1380				µmhos/cm	F

Table D-2. Parcels 6, 7, and 8 Groundwater Data (continued)

Location	Analyte	Sample Date	Result	Detection Limit	Lab Qualifiers	Validation Qualifiers	Units	Sample Type
0387	Temperature	1/28/2020	12.2				C	F
0387	Temperature	6/1/2020	13.5				C	F
0387	Temperature	8/17/2020	14.5				C	F
0387	Temperature	11/30/2020	12.3				C	F
0387	Tetrachloroethene	1/28/2020	0.17	0.16	J		µg/L	F
0387	Tetrachloroethene	6/1/2020	0.27	0.16	J		µg/L	F
0387	Tetrachloroethene	8/17/2020	0.33	0.16	J		µg/L	F
0387	Tetrachloroethene	11/30/2020	0.29	0.16	J		µg/L	F
0387	trans-1,2-Dichloroethene	1/28/2020	0.16	0.16	U		µg/L	F
0387	trans-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0387	trans-1,2-Dichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0387	trans-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0387	Trichloroethene	1/28/2020	0.16	0.16	U		µg/L	F
0387	Trichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0387	Trichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0387	Trichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0387	Turbidity	1/28/2020	4.18				NTU	F
0387	Turbidity	6/1/2020	2.13				NTU	F
0387	Turbidity	8/17/2020	9.11				NTU	F
0387	Turbidity	11/30/2020	1.89				NTU	F
0387	Vinyl chloride	1/28/2020	0.16	0.16	U		µg/L	F
0387	Vinyl chloride	6/1/2020	0.16	0.16	U		µg/L	F
0387	Vinyl chloride	8/17/2020	0.16	0.16	U		µg/L	F
0387	Vinyl chloride	11/30/2020	0.16	0.16	U		µg/L	F
0389	cis-1,2-Dichloroethene	1/28/2020	0.16	0.16	U		µg/L	F
0389	cis-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0389	cis-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0389	cis-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0389	Dissolved Oxygen	1/28/2020	5.28				mg/L	F
0389	Dissolved Oxygen	6/1/2020	2.89				mg/L	F
0389	Dissolved Oxygen	8/18/2020	0.84				mg/L	F
0389	Dissolved Oxygen	11/30/2020	1.6				mg/L	F
0389	Oxidation Reduction Potential	1/28/2020	279.2				mV	F
0389	Oxidation Reduction Potential	6/1/2020	110.4				mV	F
0389	Oxidation Reduction Potential	8/18/2020	116.1				mV	F
0389	Oxidation Reduction Potential	11/30/2020	324.9				mV	F

Table D-2. Parcels 6, 7, and 8 Groundwater Data (continued)

Location	Analyte	Sample Date	Result	Detection Limit	Lab Qualifiers	Validation Qualifiers	Units	Sample Type
0389	pH	1/28/2020	6.77				s.u.	F
0389	pH	6/1/2020	6.73				s.u.	F
0389	pH	8/18/2020	6.83				s.u.	F
0389	pH	11/30/2020	6.6				s.u.	F
0389	Specific Conductance	1/28/2020	1330				µmhos/cm	F
0389	Specific Conductance	6/1/2020	1290				µmhos/cm	F
0389	Specific Conductance	8/18/2020	1400				µmhos/cm	F
0389	Specific Conductance	11/30/2020	1240				µmhos/cm	F
0389	Temperature	1/28/2020	11.7				C	F
0389	Temperature	6/1/2020	14.9				C	F
0389	Temperature	8/18/2020	14.1				C	F
0389	Temperature	11/30/2020	11.6				C	F
0389	Tetrachloroethene	1/28/2020	0.16	0.16	U		µg/L	F
0389	Tetrachloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0389	Tetrachloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0389	Tetrachloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0389	trans-1,2-Dichloroethene	1/28/2020	0.16	0.16	U		µg/L	F
0389	trans-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0389	trans-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0389	trans-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0389	Trichloroethene	1/28/2020	0.16	0.16	U		µg/L	F
0389	Trichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0389	Trichloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0389	Trichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0389	Turbidity	1/28/2020	15.5				NTU	F
0389	Turbidity	6/1/2020	26.4				NTU	F
0389	Turbidity	8/18/2020	11.6				NTU	F
0389	Turbidity	11/30/2020	26.5				NTU	F
0389	Vinyl chloride	1/28/2020	0.16	0.16	U		µg/L	F
0389	Vinyl chloride	6/1/2020	0.16	0.16	U		µg/L	F
0389	Vinyl chloride	8/18/2020	0.16	0.16	U		µg/L	F
0389	Vinyl chloride	11/30/2020	0.16	0.16	U		µg/L	F

Table D-2. Parcels 6, 7, and 8 Groundwater Data (continued)

Location	Analyte	Sample Date	Result	Detection Limit	Lab Qualifiers	Validation Qualifiers	Units	Sample Type
0392	cis-1,2-Dichloroethene	1/28/2020	0.16	0.16	U		µg/L	F
0392	cis-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0392	cis-1,2-Dichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0392	cis-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0392	Dissolved Oxygen	1/28/2020	5.84				mg/L	F
0392	Dissolved Oxygen	6/1/2020	3.99				mg/L	F
0392	Dissolved Oxygen	8/17/2020	2.8				mg/L	F
0392	Dissolved Oxygen	11/30/2020	5.25				mg/L	F
0392	Oxidation Reduction Potential	1/28/2020	256.4				mV	F
0392	Oxidation Reduction Potential	6/1/2020	139.8				mV	F
0392	Oxidation Reduction Potential	8/17/2020	146				mV	F
0392	Oxidation Reduction Potential	11/30/2020	345.2				mV	F
0392	pH	1/28/2020	6.83				s.u.	F
0392	pH	6/1/2020	6.83				s.u.	F
0392	pH	8/17/2020	6.64				s.u.	F
0392	pH	11/30/2020	6.53				s.u.	F
0392	Specific Conductance	1/28/2020	1170				µmhos/cm	F
0392	Specific Conductance	6/1/2020	1270				µmhos/cm	F
0392	Specific Conductance	8/17/2020	1190				µmhos/cm	F
0392	Specific Conductance	11/30/2020	1210				µmhos/cm	F
0392	Temperature	1/28/2020	10.9				C	F
0392	Temperature	6/1/2020	15				C	F
0392	Temperature	8/17/2020	16.1				C	F
0392	Temperature	11/30/2020	11.4				C	F
0392	Tetrachloroethene	1/28/2020	0.16	0.16	U		µg/L	F
0392	Tetrachloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0392	Tetrachloroethene	8/17/2020	0.22	0.16	J		µg/L	F
0392	Tetrachloroethene	11/30/2020	0.22	0.16	J		µg/L	F
0392	trans-1,2-Dichloroethene	1/28/2020	0.16	0.16	U		µg/L	F
0392	trans-1,2-Dichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0392	trans-1,2-Dichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0392	trans-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0392	Trichloroethene	1/28/2020	0.16	0.16	U		µg/L	F
0392	Trichloroethene	6/1/2020	0.16	0.16	U		µg/L	F
0392	Trichloroethene	8/17/2020	0.16	0.16	U		µg/L	F
0392	Trichloroethene	11/30/2020	0.16	0.16	U		µg/L	F

Table D-2. Parcels 6, 7, and 8 Groundwater Data (continued)

Location	Analyte	Sample Date	Result	Detection Limit	Lab Qualifiers	Validation Qualifiers	Units	Sample Type
0392	Turbidity	1/28/2020	2.11				NTU	F
0392	Turbidity	6/1/2020	6.58				NTU	F
0392	Turbidity	8/17/2020	6.85				NTU	F
0392	Turbidity	11/30/2020	3.15				NTU	F
0392	Vinyl chloride	1/28/2020	0.16	0.16	U		µg/L	F
0392	Vinyl chloride	6/1/2020	0.16	0.16	U		µg/L	F
0392	Vinyl chloride	8/17/2020	0.16	0.16	U		µg/L	F
0392	Vinyl chloride	11/30/2020	0.16	0.16	U		µg/L	F

Abbreviations:
D = analyte determined in diluted sample
F = low flow sampling method used
J = estimated value
µg/L = micrograms per liter
µmhos/cm = micromhos per centimeter
mg/L = milligrams per liter
mV = millivolts
NTU = nephelometric turbidity unit
pCi/L = picocuries per liter
Q = quantitative result due to sampling technique
s.u. = standard unit
U = analytical result below detection limit

Table D-3. Seep Data

Location	Analyte	Sample Date	Value	Detection Limit	Laboratory Qualifiers	Validation Qualifiers	Units	Sample Type
0601	cis-1,2-Dichloroethene	1/27/2020	0.64	0.16	J		µg/L	F
0601	cis-1,2-Dichloroethene	6/3/2020	0.57	0.16	J		µg/L	F
0601	cis-1,2-Dichloroethene	8/18/2020	0.39	0.16	J		µg/L	F
0601	cis-1,2-Dichloroethene	11/30/2020	0.62	0.16	J		µg/L	F
0601	Color	1/27/2020	Clear				No Units	F
0601	Color	6/3/2020	Clear				No Units	F
0601	Color	8/18/2020	Clear				No Units	F
0601	Color	11/30/2020	Clear				No Units	F
0601	Dissolved Oxygen	1/27/2020	5.84				mg/L	F
0601	Dissolved Oxygen	6/3/2020	5.09				mg/L	F
0601	Dissolved Oxygen	8/18/2020	6.38				mg/L	F
0601	Dissolved Oxygen	11/30/2020	4.25				mg/L	F
0601	Oxidation Reduction Potential	1/27/2020	134.1				mV	F
0601	Oxidation Reduction Potential	6/3/2020	221				mV	F
0601	Oxidation Reduction Potential	8/18/2020	168.3				mV	F
0601	Oxidation Reduction Potential	11/30/2020	103.4				mV	F
0601	pH	1/27/2020	7.43				s.u.	F
0601	pH	6/3/2020	7.68				s.u.	F
0601	pH	8/18/2020	7.56				s.u.	F
0601	pH	11/30/2020	7.54				s.u.	F
0601	Specific Conductance	1/27/2020	1030				µmhos/cm	F
0601	Specific Conductance	6/3/2020	1050				µmhos/cm	F
0601	Specific Conductance	8/18/2020	1210				µmhos/cm	F
0601	Specific Conductance	11/30/2020	970				µmhos/cm	F
0601	Temperature	1/27/2020	12.9				C	F
0601	Temperature	6/3/2020	13				C	F
0601	Temperature	8/18/2020	13.9				C	F
0601	Temperature	11/30/2020	13.8				C	F
0601	Tetrachloroethene	1/27/2020	9.82	0.16			µg/L	F
0601	Tetrachloroethene	6/3/2020	8.05	0.16			µg/L	F
0601	Tetrachloroethene	8/18/2020	8.8	0.16			µg/L	F
0601	Tetrachloroethene	11/30/2020	10.7	0.16			µg/L	F

Table D-3. Seep Data (continued)

Location	Analyte	Sample Date	Value	Detection Limit	Laboratory Qualifiers	Validation Qualifiers	Units	Sample Type
0601	trans-1,2-Dichloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0601	trans-1,2-Dichloroethene	6/3/2020	0.16	0.16	U		µg/L	F
0601	trans-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0601	trans-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0601	Trichloroethene	1/27/2020	0.83	0.16	J		µg/L	F
0601	Trichloroethene	6/3/2020	0.96	0.16	J		µg/L	F
0601	Trichloroethene	8/18/2020	0.92	0.16	J		µg/L	F
0601	Trichloroethene	11/30/2020	0.83	0.16	J		µg/L	F
0601	Tritium	1/27/2020	6350	290			pCi/L	F
0601	Tritium	8/18/2020	13000	302			pCi/L	F
0601	Turbidity	1/27/2020	180				NTU	F
0601	Turbidity	6/3/2020	22.7				NTU	F
0601	Turbidity	8/18/2020	419				NTU	F
0601	Turbidity	11/30/2020	24.2				NTU	F
0601	Vinyl chloride	1/27/2020	0.16	0.16	U		µg/L	F
0601	Vinyl chloride	6/3/2020	0.16	0.16	U		µg/L	F
0601	Vinyl chloride	8/18/2020	0.16	0.16	U		µg/L	F
0601	Vinyl chloride	11/30/2020	0.16	0.16	U		µg/L	F
0602	cis-1,2-Dichloroethene	1/27/2020	3.43	0.16			µg/L	F
0602	cis-1,2-Dichloroethene	11/30/2020	4.05	0.16			µg/L	F
0602	Color	1/27/2020	Light Brown				No Units	F
0602	Color	11/30/2020	Clear				No Units	F
0602	Dissolved Oxygen	1/27/2020	3.96				mg/L	F
0602	Dissolved Oxygen	11/30/2020	8.98				mg/L	F
0602	Oxidation Reduction Potential	1/27/2020	3.9				mV	F
0602	Oxidation Reduction Potential	11/30/2020	217.1				mV	F
0602	pH	1/27/2020	7.38				s.u.	F
0602	pH	11/30/2020	7.16				s.u.	F
0602	Specific Conductance	1/27/2020	1000				µmhos/cm	F
0602	Specific Conductance	11/30/2020	990				µmhos/cm	F
0602	Temperature	1/27/2020	4.8				C	F
0602	Temperature	11/30/2020	10.8				C	F
0602	Tetrachloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0602	Tetrachloroethene	11/30/2020	0.16	0.16	U		µg/L	F

Table D-3. Seep Data (continued)

Location	Analyte	Sample Date	Value	Detection Limit	Laboratory Qualifiers	Validation Qualifiers	Units	Sample Type
0602	trans-1,2-Dichloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0602	trans-1,2-Dichloroethene	11/30/2020	0.17	0.16	J		µg/L	F
0602	Trichloroethene	1/27/2020	8.25	0.16			µg/L	F
0602	Trichloroethene	11/30/2020	6.81	0.16			µg/L	F
0602	Tritium	1/27/2020	621	283			pCi/L	F
0602	Turbidity	1/27/2020	1000			>	NTU	F
0602	Turbidity	11/30/2020	70.1				NTU	F
0602	Vinyl chloride	1/27/2020	0.16	0.16	U		µg/L	F
0602	Vinyl chloride	11/30/2020	0.16	0.16	U		µg/L	F
0605	cis-1,2-Dichloroethene	1/27/2020	1.3	0.16			µg/L	F
0605	cis-1,2-Dichloroethene	6/3/2020	0.26	0.16	J		µg/L	F
0605	cis-1,2-Dichloroethene	8/18/2020	0.44	0.16	J		µg/L	F
0605	cis-1,2-Dichloroethene	11/30/2020	0.35	0.16	J		µg/L	F
0605	Color	1/27/2020	Light Brown				No Units	F
0605	Color	6/3/2020	Clear				No Units	F
0605	Color	8/18/2020	Clear				No Units	F
0605	Color	11/30/2020	Clear				No Units	F
0605	Dissolved Oxygen	1/27/2020	6.39				mg/L	F
0605	Dissolved Oxygen	6/3/2020	8.75				mg/L	F
0605	Dissolved Oxygen	8/18/2020	9.56				mg/L	F
0605	Dissolved Oxygen	11/30/2020	7.34				mg/L	F
0605	Oxidation Reduction Potential	1/27/2020	73				mV	F
0605	Oxidation Reduction Potential	6/3/2020	276.3				mV	F
0605	Oxidation Reduction Potential	8/18/2020	249.2				mV	F
0605	Oxidation Reduction Potential	11/30/2020	175.3				mV	F
0605	pH	1/27/2020	7.63				s.u.	F
0605	pH	6/3/2020	7.76				s.u.	F
0605	pH	8/18/2020	7.22				s.u.	F
0605	pH	11/30/2020	7.43				s.u.	F
0605	Specific Conductance	1/27/2020	1070				µmhos/cm	F
0605	Specific Conductance	6/3/2020	1080				µmhos/cm	F
0605	Specific Conductance	8/18/2020	1220				µmhos/cm	F
0605	Specific Conductance	11/30/2020	1080				µmhos/cm	F

Table D-3. Seep Data (continued)

Location	Analyte	Sample Date	Value	Detection Limit	Laboratory Qualifiers	Validation Qualifiers	Units	Sample Type
0605	Temperature	1/27/2020	8.9				C	F
0605	Temperature	6/3/2020	12.8				C	F
0605	Temperature	8/18/2020	15.2				C	F
0605	Temperature	11/30/2020	15				C	F
0605	Tetrachloroethene	1/27/2020	0.28	0.16	J		µg/L	F
0605	Tetrachloroethene	6/3/2020	0.16	0.16	U		µg/L	F
0605	Tetrachloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0605	Tetrachloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0605	trans-1,2-Dichloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0605	trans-1,2-Dichloroethene	6/3/2020	0.16	0.16	U		µg/L	F
0605	trans-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0605	trans-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0605	Trichloroethene	1/27/2020	1.67	0.16			µg/L	F
0605	Trichloroethene	6/3/2020	0.66	0.16	J		µg/L	F
0605	Trichloroethene	8/18/2020	0.89	0.16	J		µg/L	F
0605	Trichloroethene	11/30/2020	0.53	0.16	J		µg/L	F
0605	Tritium	1/27/2020	2060	293			pCi/L	F
0605	Tritium	8/18/2020	1830	290			pCi/L	F
0605	Turbidity	1/27/2020	1000			>	NTU	F
0605	Turbidity	6/3/2020	37.5				NTU	F
0605	Turbidity	8/18/2020	310				NTU	F
0605	Turbidity	11/30/2020	138				NTU	F
0605	Vinyl chloride	1/27/2020	0.16	0.16	U		µg/L	F
0605	Vinyl chloride	6/3/2020	0.16	0.16	U		µg/L	F
0605	Vinyl chloride	8/18/2020	0.16	0.16	U		µg/L	F
0605	Vinyl chloride	11/30/2020	0.16	0.16	U		µg/L	F
0606	cis-1,2-Dichloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0606	cis-1,2-Dichloroethene	6/3/2020	0.16	0.16	U		µg/L	F
0606	cis-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0606	cis-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0606	Color	1/27/2020	Light Brown				No Units	F
0606	Color	8/18/2020	Dark Brown				No Units	F
0606	Color	11/30/2020	Light Tan				No Units	F

Table D-3. Seep Data (continued)

Location	Analyte	Sample Date	Value	Detection Limit	Laboratory Qualifiers	Validation Qualifiers	Units	Sample Type
0606	Dissolved Oxygen	1/27/2020	3.42				mg/L	F
0606	Dissolved Oxygen	8/18/2020	8.93				mg/L	F
0606	Dissolved Oxygen	11/30/2020	9.47				mg/L	F
0606	Oxidation Reduction Potential	1/27/2020	12.1				mV	F
0606	Oxidation Reduction Potential	8/18/2020	184.6				mV	F
0606	Oxidation Reduction Potential	11/30/2020	174.6				mV	F
0606	pH	1/27/2020	7.55				s.u.	F
0606	pH	8/18/2020	7.55				s.u.	F
0606	pH	11/30/2020	7.63				s.u.	F
0606	Specific Conductance	1/27/2020	1040				µmhos/cm	F
0606	Specific Conductance	8/18/2020	1490				µmhos/cm	F
0606	Specific Conductance	11/30/2020	1180				µmhos/cm	F
0606	Temperature	1/27/2020	5.4				C	F
0606	Temperature	8/18/2020	19.1				C	F
0606	Temperature	11/30/2020	8.7				C	F
0606	Tetrachloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0606	Tetrachloroethene	6/3/2020	0.16	0.16	U		µg/L	F
0606	Tetrachloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0606	Tetrachloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0606	trans-1,2-Dichloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0606	trans-1,2-Dichloroethene	6/3/2020	0.16	0.16	U		µg/L	F
0606	trans-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0606	trans-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	F
0606	Trichloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0606	Trichloroethene	6/3/2020	0.25	0.16	J		µg/L	F
0606	Trichloroethene	8/18/2020	0.21	0.16	J		µg/L	F
0606	Trichloroethene	11/30/2020	0.17	0.16	J		µg/L	F
0606	Tritium	1/27/2020	1940	287			pCi/L	F
0606	Tritium	8/18/2020	1690	269			pCi/L	F
0606	Turbidity	1/27/2020	1000			>	NTU	F
0606	Turbidity	8/18/2020	999			>	NTU	F
0606	Turbidity	11/30/2020	775				NTU	F

Table D-3. Seep Data (continued)

Location	Analyte	Sample Date	Value	Detection Limit	Laboratory Qualifiers	Validation Qualifiers	Units	Sample Type
0606	Vinyl chloride	1/27/2020	0.16	0.16	U		µg/L	F
0606	Vinyl chloride	6/3/2020	0.16	0.16	U		µg/L	F
0606	Vinyl chloride	8/18/2020	0.16	0.16	U		µg/L	F
0606	Vinyl chloride	11/30/2020	0.16	0.16	U		µg/L	F
0607	cis-1,2-Dichloroethene	1/27/2020	0.24	0.16	J		µg/L	F
0607	cis-1,2-Dichloroethene	6/3/2020	0.56	0.16	J		µg/L	F
0607	cis-1,2-Dichloroethene	8/18/2020	0.78	0.16	J		µg/L	F
0607	cis-1,2-Dichloroethene	11/30/2020	1.42	0.16			µg/L	F
0607	Color	1/27/2020	Clear				No Units	F
0607	Color	8/18/2020	Dark Brown				No Units	F
0607	Color	11/30/2020	Light Grey				No Units	F
0607	Dissolved Oxygen	1/27/2020	7.93				mg/L	F
0607	Dissolved Oxygen	8/18/2020	7.51				mg/L	F
0607	Dissolved Oxygen	11/30/2020	0.19				mg/L	F
0607	Oxidation Reduction Potential	1/27/2020	175				mV	F
0607	Oxidation Reduction Potential	8/18/2020	152.1				mV	F
0607	Oxidation Reduction Potential	11/30/2020	-27.9				mV	F
0607	pH	1/27/2020	7.6				s.u.	F
0607	pH	8/18/2020	7.59				s.u.	F
0607	pH	11/30/2020	7.5				s.u.	F
0607	Specific Conductance	1/27/2020	1160				µmhos/cm	F
0607	Specific Conductance	8/18/2020	1290				µmhos/cm	F
0607	Specific Conductance	11/30/2020	1040				µmhos/cm	F
0607	Temperature	1/27/2020	13.3				C	F
0607	Temperature	8/18/2020	16.2				C	F
0607	Temperature	11/30/2020	11				C	F
0607	Tetrachloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0607	Tetrachloroethene	6/3/2020	0.3	0.16	J		µg/L	F
0607	Tetrachloroethene	8/18/2020	0.2	0.16	J		µg/L	F
0607	Tetrachloroethene	11/30/2020	0.2	0.16	J		µg/L	F
0607	trans-1,2-Dichloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0607	trans-1,2-Dichloroethene	6/3/2020	0.16	0.16	U		µg/L	F
0607	trans-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0607	trans-1,2-Dichloroethene	11/30/2020	0.16	0.16	U		µg/L	F

Table D-3. Seep Data (continued)

Location	Analyte	Sample Date	Value	Detection Limit	Laboratory Qualifiers	Validation Qualifiers	Units	Sample Type
0607	Trichloroethene	1/27/2020	0.48	0.16	J		µg/L	F
0607	Trichloroethene	6/3/2020	1.78	0.16			µg/L	F
0607	Trichloroethene	8/18/2020	1.39	0.16			µg/L	F
0607	Trichloroethene	11/30/2020	1.26	0.16			µg/L	F
0607	Tritium	1/27/2020	1090	287			pCi/L	F
0607	Tritium	8/18/2020	2540	289			pCi/L	F
0607	Turbidity	1/27/2020	150				NTU	F
0607	Turbidity	8/18/2020	999			>	NTU	F
0607	Turbidity	11/30/2020	482				NTU	F
0607	Vinyl chloride	1/27/2020	0.16	0.16	U		µg/L	F
0607	Vinyl chloride	6/3/2020	0.16	0.16	U		µg/L	F
0607	Vinyl chloride	8/18/2020	0.16	0.16	U		µg/L	F
0607	Vinyl chloride	11/30/2020	0.16	0.16	U		µg/L	F
0617	cis-1,2-Dichloroethene	1/27/2020	1.65	0.16			µg/L	F
0617	cis-1,2-Dichloroethene	8/18/2020	1.01	0.16			µg/L	F
0617	Color	1/27/2020	Light Brown				No Units	F
0617	Color	8/18/2020	Dark Brown				No Units	F
0617	Dissolved Oxygen	1/27/2020	1.45				mg/L	F
0617	Dissolved Oxygen	8/18/2020	4.82				mg/L	F
0617	Oxidation Reduction Potential	1/27/2020	-8.3				mV	F
0617	Oxidation Reduction Potential	8/18/2020	-55.1				mV	F
0617	pH	1/27/2020	7.36				s.u.	F
0617	pH	8/18/2020	7.85				s.u.	F
0617	Specific Conductance	1/27/2020	1240				µmhos/cm	F
0617	Specific Conductance	8/18/2020	1500				µmhos/cm	F
0617	Temperature	1/27/2020	9.2				C	F
0617	Temperature	8/18/2020	19.1				C	F
0617	Tetrachloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0617	Tetrachloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0617	trans-1,2-Dichloroethene	1/27/2020	0.16	0.16	U		µg/L	F
0617	trans-1,2-Dichloroethene	8/18/2020	0.16	0.16	U		µg/L	F
0617	Trichloroethene	1/27/2020	5.92	0.16			µg/L	F
0617	Trichloroethene	8/18/2020	4.21	0.16			µg/L	F

Table D-3. Seep Data (continued)

Location	Analyte	Sample Date	Value	Detection Limit	Laboratory Qualifiers	Validation Qualifiers	Units	Sample Type
0617	Turbidity	1/27/2020	1000			>	NTU	F
0617	Turbidity	8/18/2020	999			>	NTU	F
0617	Vinyl chloride	1/27/2020	0.16	0.16	U	J	µg/L	F
0617	Vinyl chloride	8/18/2020	0.16	0.16	U		µg/L	F

Abbreviations:
J = estimated value
µg/L = micrograms per liter
µmhos/cm = micromhos per centimeter
mg/L = milligrams per liter
mV = millivolts
NTU = nephelometric turbidity unit
pCi/L = picocuries per liter
Q = quantitative result due to sampling technique
s.u. = standard unit
U = analytical result below detection limit

Appendix E

Data Assessment Reports

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NAVARRO

Contractor to the U.S. Department of Energy Office of Legacy Management

Data Review and Validation Report

General Information

Task ID:	MND01-01.2001010
Sample Event:	January 27-28, 2020
Site(s):	Mound, Ohio: LTS&M (Parcel 6-7-8)
Laboratory:	GEL Laboratories, Charleston, South Carolina
Work Order No.:	502462
Analysis:	Organics
Validator:	Peter Steves
Review Date:	March 19, 2020

This validation was performed according to *Environmental Data Validation Procedure* (LMS/PRO/S15870), which is available at https://documentmanagement.share.lm.doe.gov/ControlledDocuments/Controlled%20Documents/S15870_Env_DV_Procedure.pdf. The procedure was applied at Level 3, Data Validation.

This validation includes the evaluation of data quality indicators (DQIs) associated with the data. DQIs are the quantitative and qualitative descriptors that are used to interpret the degree of acceptability or utility of data. Indicators of data quality include the analysis of laboratory control samples to assess accuracy; duplicates and replicates to assess precision; and interference check samples to assess bias (see attached Data Validation Worksheets). The comparability, completeness, and sensitivity of the data are also evaluated in the sections to follow.

All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Tritium	LSC-A-001	EPA 906.0 Modified	EPA 906.0 Modified
Volatile Organics, VOA	VOA-A-007	SW-846 5030B	SW-846 8260 LL

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the attached validation worksheets and the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifiers

Sample Number	Location	Analyte	Flag	Reason
MND01-01.2001010-002	124	Acetone	U	Less than 10 times the trip blank
MND01-01.2001010-005	315	Acetone	U	Less than 10 times the trip blank
MND01-01.2001010-006	346	Acetone	U	Less than 10 times the trip blank
MND01-01.2001010-008	379	Acetone	U	Less than 10 times the trip blank
MND01-01.2001010-014	602	Acetone	U	Less than 10 times the trip blank
MND01-01.2001010-015	605	Acetone	U	Less than 10 times the trip blank
MND01-01.2001010-012	392	Acetone	U	Less than 10 times the trip blank
MND01-01.2001010-010	387	Acetone	U	Less than 10 times the trip blank
All **Except** MND01-01.2001010-011 and MND01-01.2001010-018	All **Except** 389 and 347	1,2-Dichloroethane	U	Less than 5 times the method blank

Sample Shipping/Receiving

GEL Laboratories in Charleston, South Carolina, received 20 water samples on January 29, 2020, accompanied by a Chain of Custody (COC) form. The air waybill number was listed on the Sample Receipt and Review Form. The COC form was checked to confirm that all of the samples were listed with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The COC forms were complete with no errors or omissions.

Preservation and Holding Times

The sample shipments were received intact with the temperatures inside the iced coolers between 2 and 3 °C, which complies with requirements. All samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all analytes as required. The MDL, as defined in Title 40 *Code of Federal Regulations* Section 136, is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured and is defined as 5 times the MDL. The reported MDLs for all analytes met the detection limits requirements.

Laboratory Instrument Calibration

Method requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the analytes of interest. Initial calibration verification demonstrates that the instrument is capable of acceptable performance at the beginning of the analytical run. Continuing calibration verification demonstrates that the initial calibration is still valid by checking the performance of the instrument on a continuing basis. Initial and continuing calibration standards must be prepared from independent sources to ensure the validity of the calibration. All laboratory instrument

calibrations and calibration verifications were performed correctly in accordance with the cited methods.

Method SW-846 8260 LL Volatile Organics, VOA
Initial calibrations of instrument VOA2 was performed on January 29-30 and February, 2-3, 2020, using nine calibration standards. Calibration curves are established using linear regression, quadratic regression, or the average response factor approach. Calibrations using average response factors had relative standard deviations of less than 15 percent. Linear or higher order regression calibrations had correlation coefficient values greater than 0.99 and intercepts less than 3 times the MDL. Initial and continuing calibration verification checks were made at the required frequency. Some target compounds had percent drift values greater than 20 percent but were not detected at concentrations greater than the MDL in the associated samples The mass spectrometer calibration and resolution was checked at the beginning of each analytical run in accordance with the procedure.

Method EPA 906.0 Modified Tritium

Liquid scintillation calibrations for instrument LSCGOLD were performed on September 24, 2019. Calibrations resulted in quench curves covering a quench number range of 141 – 324. The sample quench values were all within the calibration range. Daily calibration checks were performed with acceptable results.

Volatiles Internal Standards and Surrogates

The volatile internal standard recoveries and surrogate recoveries were within the acceptance ranges for all samples.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis. All method blank and calibration blank results associated with the samples were below the PQL for all analytes. In cases where the blank concentration exceeds the MDL, associated sample results that are greater than the MDL but less than 5 times the blank concentration are qualified with a U flag as not detected.

Matrix Spike Analysis

Matrix spikes are aliquots of environmental samples to which a known concentration of analyte has been added before analysis. Matrix spike and matrix spike duplicate (MS/MSD) analysis is used to assess the performance of the method by measuring the effects of interferences caused by the sample matrix and reflects the bias of the method for the particular matrix in question. Matrix spike data are not evaluated when the concentration of the unspiked sample is greater than 4 times the spike concentration. The matrix spike recoveries met the acceptance criteria for all analytes evaluated.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for results that are greater than 5 times the PQL should be less

than 20 percent (or less than the laboratory-derived control limits for organics). For results that are less than 5 times the PQL, the range should be no greater than the PQL. The replicate results met these criteria.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. All control sample results were acceptable.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers. The analytical report included the MDL and PQL for all analytes and all required supporting documentation.

Electronic Data Deliverable (EDD) File

The EDD file arrived on February 26, 2020. The EDD was examined to verify that the file was complete and in compliance with requirements. The contents of the file were compared to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Trip Blank

Trip blanks were prepared and analyzed to document contamination attributable to shipping and field handling procedures. This type of blank is useful in documenting contamination of volatile organic samples. Three trip blanks were submitted with these samples. Acetone, 2-butanone, and 1,2-dichloroethane were detected in one or more of the trip blanks. Associated results greater than the MDL and less than 5 times the trip blank concentration (10 times for common laboratory contaminants) were qualified with a U flag as not detected.

Field Duplicate

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates, which measure only laboratory performance. A duplicate sample was collected from location 0347. The relative percent difference for duplicate results that are greater than 5 times the PQL should be less than 20 percent. For results that are less than 5 times the PQL, the range should be no greater than the PQL. The duplicate results met the criteria, demonstrating acceptable overall precision.

Field Measurements

The pre-sampling purge criteria were met for all wells. A turbidity less than 50 NTU could not be achieved at monitoring well 0315.

Outliers Report

Potential outliers are results that lie outside the historical range, possibly due to transcription errors, data calculation errors, or measurement system problems. However, outliers can also represent true values outside the historical range. Potential outliers are identified by generating the Data Validation Outliers Report from data in the environmental database. The new data are compared to historical values and data that fall outside the historical data range are listed on the report along with the historical minimum and maximum values. The potential outliers are further reviewed and may be subject to statistical evaluation using the ProUCL application developed by the EPA (https://www.epa.gov/land-research/proucl-software). The review also includes an evaluation of any notable trends in the data that may indicate the outliers represent true extreme values.

Some laboratory results from this sampling event were identified as potential outliers. The data associated with these results were reviewed in detail with no errors noted. The data for this task are acceptable as qualified.

LESLIE STEVES (Affiliate)
Digitally signed by LESLIE STEVES (Affiliate)
Date: 2020.03.23 16:38:42 -06'00'

Report Prepared By: _____

Peter Steves
Data Validator

Data Validation Outliers Report - No Field Parameters **Report Date: 03/18/2020**

Comparison to Historical Data Since: 1/1/2010 12:00:00 AM Fraction: Any

Task: MND01-01.2001010

Analyte	Location	Analysis Location	Units	Fraction	Result	Lab Qualifier(s)	Type	HistMIN	HistMAX	HistSetSize	Outlier?
Tritium	0138	LB	pCi/L	T	138	U	< HistMIN	250	1770	25	No
Tritium	0346	LB	pCi/L	T	1.52	U	< HistMIN	5.96	1830	25	No
Acetone	0346	LB	ug/L	N	3.13	J	> HistMAX	0.5	2.87	40	Yes
Tritium	0347	LB	pCi/L	T	913		< HistMIN	938	6800	37	No
Tritium	0602	LB	pCi/L	T	621		< HistMIN	850	14700	15	No
Acetone	0602	LB	ug/L	N	8.92		> HistMAX	0.5	7.6	27	Yes
p-Isopropyltoluene	0602	LB	ug/L	N	0.200	J	> HistMAX	0.1	0.16	27	No
Tritium	0605	LB	pCi/L	T	2060		< HistMIN	2550	18500	24	No

FRACTION: D = Dissolved N = NA T = Total

General Data Validation Report

Task Code: MND01-01.2001010 **Lab Code:** GEN **Validator:** Peter Steves **Validation Date:** 03-19-2020

Project: LTS&M (Parcel 6-7-8) **# Samples:** 20

Analysis Type: [ ] General Chemistry [ ] Metals [X] Organics [X] Radiochemistry

Chain of Custody	*Sample*
Present: OK Signed: OK Dated: OK	Integrity: OK Preservation OK Temperature: OK

Check	Summary
Holding Times:	All analyses were completed within the applicable holding times.
Detection Limits:	The reported detection limits are equal to or below the contract required limits.
Field Blanks:	There were 2 field blanks associated with this task.
Field Duplicates:	There was 1 duplicate evaluated.

Validation Report: Field Blanks

19-Mar-2020

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2001010 **Lab Code:** GEN

Blank Type	Sample Code	Location	Method	Analyte	Result	Lab Qualifiers
TB	MND01-01.2001010-019	0999	SW-846 8260	1,2-Dichloroethane	0.200	BJ

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2001010-001	0118	0.200	1	BJ	U
MND01-01.2001010-002	0124	0.210	1	BJ	U
MND01-01.2001010-003	0126	0.180	1	BJ	U
MND01-01.2001010-004	0138	0.190	1	BJ	U
MND01-01.2001010-006	0346	0.170	1	BJ	U
MND01-01.2001010-008	0379	0.190	1	BJ	U
MND01-01.2001010-013	0601	0.200	1	BJ	U
MND01-01.2001010-014	0602	0.180	1	BJ	U
MND01-01.2001010-015	0605	0.190	1	BJ	U
MND01-01.2001010-016	0606	0.190	1	BJ	U
MND01-01.2001010-017	0607	0.190	1	BJ	U

Validation Report: Field Blanks

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2001010 **Lab Code:** GEN

TB	MND01-01.2001010-019	0999	SW-846 8260	2-Butanone	1.19	J

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2001010-001	0118	0.500	1	U	
MND01-01.2001010-002	0124	0.500	1	U	
MND01-01.2001010-003	0126	0.500	1	U	
MND01-01.2001010-004	0138	0.500	1	U	
MND01-01.2001010-006	0346	0.500	1	U	
MND01-01.2001010-008	0379	0.500	1	U	
MND01-01.2001010-013	0601	0.500	1	U	
MND01-01.2001010-014	0602	0.500	1	U	
MND01-01.2001010-015	0605	0.500	1	U	
MND01-01.2001010-016	0606	0.500	1	U	
MND01-01.2001010-017	0607	0.500	1	U	

Validation Report: Field Blanks

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2001010 **Lab Code:** GEN

TB	MND01-01.2001010-019	0999	SW-846 8260	Acetone	11.3	

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2001010-001	0118	0.500	1	U	
MND01-01.2001010-002	0124	2.32	1	J	U
MND01-01.2001010-003	0126	0.500	1	U	
MND01-01.2001010-004	0138	0.500	1	U	
MND01-01.2001010-006	0346	3.13	1	J	U
MND01-01.2001010-008	0379	2.04	1	J	U
MND01-01.2001010-013	0601	0.500	1	U	
MND01-01.2001010-014	0602	8.92	1		U
MND01-01.2001010-015	0605	2.90	1	J	U
MND01-01.2001010-016	0606	0.500	1	U	
MND01-01.2001010-017	0607	0.500	1	U	

Validation Report: Field Blanks

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2001010 **Lab Code:** GEN

TB	MND01-01.2001010-020	0999	SW-846 8260	1,2-Dichloroethane	0.200	BJ

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2001010-005	0315	0.200	1	BJ	U
MND01-01.2001010-007	0347	0.190	1	BJ	U
MND01-01.2001010-009	0386	0.170	1	BJ	U
MND01-01.2001010-010	0387	0.190	1	BJ	U
MND01-01.2001010-011	0389	0.160	1	U	
MND01-01.2001010-012	0392	0.200	1	BJ	U
MND01-01.2001010-018	0347	0.160	1	U	BJ

Validation Report: Field Blanks

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2001010 **Lab Code:** GEN

TB	MND01-01.2001010-020	0999	SW-846 8260	2-Butanone	0.980	J

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2001010-005	0315	0.500	1	U	
MND01-01.2001010-007	0347	0.500	1	U	
MND01-01.2001010-009	0386	0.500	1	U	
MND01-01.2001010-010	0387	0.500	1	U	
MND01-01.2001010-011	0389	0.500	1	U	
MND01-01.2001010-012	0392	0.500	1	U	
MND01-01.2001010-018	0347	0.500	1	U	U

Validation Report: Field Blanks

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2001010 **Lab Code:** GEN

TB	MND01-01.2001010-020	0999	SW-846 8260	Acetone	8.97	

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2001010-005	0315	2.56	1	J	U
MND01-01.2001010-007	0347	0.500	1	U	
MND01-01.2001010-009	0386	0.500	1	U	
MND01-01.2001010-010	0387	2.29	1	J	U
MND01-01.2001010-011	0389	0.500	1	U	
MND01-01.2001010-012	0392	3.10	1	J	U
MND01-01.2001010-018	0347	0.500	1	U	U

Validation Report: Field Duplicates

19-Mar-2020

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2001010 Lab Code: GEN

	Duplicate: MND01-01.2001010-018				Sample: MND01-01.2001010-007 0347						
Analyte	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**RPD**	**RER**	**Units**
1,1,1,2-Tetrachloroethane	0.160	U		1	0.160	U		1			ug/L
1,1,1-Trichloroethane	0.160	U		1	0.160	U		1			ug/L
1,1,2,2-Tetrachloroethane	0.160	U		1	0.160	U		1			ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	1.50	U		1	1.50	U		1			ug/L
1,1,2-Trichloroethane	0.160	U		1	0.160	U		1			ug/L
1,1-Dichloroethane	0.160	U		1	0.160	U		1			ug/L
1,1-Dichloroethene	0.160	U		1	0.160	U		1			ug/L
1,1-Dichloropropene	0.160	U		1	0.160	U		1			ug/L
1,2,3-Trichlorobenzene	0.200	U		1	0.200	U		1			ug/L
1,2,3-Trichloropropane	0.160	U		1	0.160	U		1			ug/L
1,2,4-Trichlorobenzene	0.160	U		1	0.160	U		1			ug/L
1,2,4-Trimethylbenzene	0.160	U		1	0.160	U		1			ug/L
1,2-Dibromo-3-chloropropane	0.160	U		1	0.160	U		1			ug/L
1,2-Dibromoethane	0.160	U		1	0.160	U		1			ug/L
1,2-Dichlorobenzene	0.160	U		1	0.160	U		1			ug/L
1,2-Dichloroethane	0.160	U		1	0.190	BJ		1			ug/L
1,2-Dichloropropane	0.160	U		1	0.160	U		1			ug/L
1,3,5-Trimethylbenzene	0.160	U		1	0.160	U		1			ug/L

QC Checks: RPD: Relative Percent Difference RER: Relative Error Ratio

Validation Report: Field Duplicates

19-Mar-2020

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2001010 Lab Code: GEN

	Duplicate: MND01-01.2001010-018				Sample: MND01-01.2001010-007 0347						
Analyte	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**RPD**	**RER**	**Units**
1,3-Dichlorobenzene	0.160	U		1	0.160	U		1			ug/L
1,3-Dichloropropane	0.160	U		1	0.160	U		1			ug/L
1,4-Dichlorobenzene	0.160	U		1	0.160	U		1			ug/L
2,2-Dichloropropane	0.160	U		1	0.160	U		1			ug/L
2-Butanone	0.500	U		1	0.500	U		1			ug/L
2-Chlorotoluene	0.160	U		1	0.160	U		1			ug/L
2-Hexanone	0.500	U		1	0.500	U		1			ug/L
4-Chlorotoluene	0.160	U		1	0.160	U		1			ug/L
4-Methyl-2-Pentanone	0.500	U		1	0.500	U		1			ug/L
Acetone	0.500	U		1	0.500	U		1			ug/L
Benzene	0.160	U		1	0.160	U		1			ug/L
Bromobenzene	0.160	U		1	0.160	U		1			ug/L
Bromochloromethane	0.160	U		1	0.160	U		1			ug/L
Bromodichloromethane	0.160	U		1	0.160	U		1			ug/L
Bromoform	0.160	U		1	0.160	U		1			ug/L
Bromomethane	0.160	U		1	0.160	U		1			ug/L
Carbon Disulfide	0.500	U		1	0.500	U		1			ug/L
Carbon tetrachloride	1.43			1	1.40			1	2.1		ug/L
Chlorobenzene	0.160	U		1	0.160	U		1			ug/L
Chlorodibromomethane	0.160	U		1	0.160	U		1			ug/L

QC Checks: RPD: Relative Percent Difference RER: Relative Error Ratio

Validation Report: Field Duplicates

19-Mar-2020

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2001010 Lab Code: GEN

	Duplicate: MND01-01.2001010-018				Sample: MND01-01.2001010-007 0347						
Analyte	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**RPD**	**RER**	**Units**
Chloroethane	0.160	U		1	0.160	U		1			ug/L
Chloroform	0.380	J		1	0.360	U		1			ug/L
Chloromethane	0.160	U		1	0.160	U		1			ug/L
cis-1,2-Dichloroethene	0.160	U		1	0.160	U		1			ug/L
cis-1,3-Dichloropropene	0.160	U		1	0.160	U		1			ug/L
Dibromomethane	0.160	U		1	0.160	U		1			ug/L
Dichlorodifluoromethane	0.160	U		1	0.160	U		1			ug/L
Ethylbenzene	0.160	U		1	0.160	U		1			ug/L
Hexachlorobutadiene	0.160	U		1	0.160	U		1			ug/L
Isopropylbenzene	0.160	U		1	0.160	U		1			ug/L
Methylene chloride	0.160	U		1	0.160	U		1			ug/L
n-Butylbenzene	0.160	U		1	0.160	U		1			ug/L
n-Propylbenzene	0.160	U		1	0.160	U		1			ug/L
Naphthalene	0.160	U		1	0.160	U		1			ug/L
p-Isopropyltoluene	0.160	U		1	0.160	U		1			ug/L
sec-Butylbenzene	0.160	U		1	0.160	U		1			ug/L
Styrene	0.160	U		1	0.160	U		1			ug/L
tert-Butylbenzene	0.160	U		1	0.160	U		1			ug/L
Tetrachloroethene	0.160	U		1	0.160	U		1			ug/L
Toluene	0.160	U		1	0.160	U		1			ug/L

QC Checks: RPD: Relative Percent Difference RER: Relative Error Ratio

Validation Report: Field Duplicates

19-Mar-2020

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2001010 Lab Code: GEN

	Duplicate: MND01-01.2001010-018				Sample: MND01-01.2001010-007 0347						
Analyte	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**RPD**	**RER**	**Units**
Total Xylenes	0.160	U		1	0.160	U		1			ug/L
trans-1,2-Dichloroethene	0.160	U		1	0.160	U		1			ug/L
trans-1,3-dichloropropene	0.160	U		1	0.160	U		1			ug/L
Trichloroethene	24.1			1	23.8			1	1.3		ug/L
Trichlorofluoromethane	0.160	U		1	0.160	U		1			ug/L
Tritium	938		269	1	913		266	1		0.1	pCi/L
Vinyl chloride	0.160	U		1	0.160	U		1			ug/L

QC Checks: RPD: Relative Percent Difference RER: Relative Error Ratio

Organics Data Validation Summary

19-Mar-2020

Project: LTS&M (Parcel 6-7-8)

Task Code: MND01-01.2001010

Lab Code: GEN

Surrogate Recovery:	All surrogate recoveries were within the laboratory acceptance limits.
LCS/LCSD Performance:	All LCS/LCSD results were within the laboratory acceptance limits.
MS/MSD Performance:	All MS/MSD results were within the laboratory acceptance limits.
Method Blank Performance:	There was 1 method blank result above the MDL.

Noncompliance Report: Method Blanks

19-Mar-2020

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2001010 **Lab Code:** GEN

Method Blank ID	Date Analyzed	Method	Analyte	Result	Lab Qualifiers	Comment
	02-03-2020	SW-846 8260	1,2-Dichloroethane	0.220	J	

Radiochemistry Data Validation Worksheet

19-Mar-2020

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2001010 **Lab Code:** GEN

Sample ID	Analyte	Analysis Date	QC Type	Result Type	Result	Flag	TPU	Spike Recovery	Spike Dup Recovery	Lower Limit	Upper Limit	RPD	RPD Limit	RER	Comments
	Tritium	02-22-2020	LCS	SC	5370		1210	91.5		75	125				
	Tritium	02-22-2020	MB	TRG	36.9	U	168								
	Tritium	02-22-2020	MS	SC	4890		1120	83.1		75	125				
	Tritium	02-22-2020	R	TRG	-0.703	U	166					0			

QC Types: LCS: Laboratory Control Sample LCSD: Laboratory Control Sample Duplicate MB: Method Blank MS: Matrix Spike MSD: Matrix Spike Duplicate R: Replicate

Result Types: IS: Internal Standard SC: Spike Analyte TRG: Target analyte

QC Checks: RPD: Relative Percent Difference RER: Relative Error Ratio TPU: Total Propagated Uncertainty

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Data Review and Validation Report

General Information

Task Code:	MND01-01.2006012
Sample Event:	June 1 and 3, 2020
Site(s):	Mound, Ohio: LTS&M (Parcel 6-7-8)
Laboratory:	GEL Laboratories, Charleston, South Carolina
Work Order No.:	512536
Analysis:	Organics
Validator:	Samantha Tigar
Review Date:	August 25, 2020

This validation was performed according to *Environmental Data Validation Procedure* (LMS/PRO/S15870), which is available at https://documentmanagement.share.lm.doe.gov/ControlledDocuments/Controlled%20Documents/S15870_Env_DV_Procedure.pdf. The procedure was applied at Level 3, Data Validation.

This validation includes the evaluation of data quality indicators (DQIs) associated with the data. DQIs are the quantitative and qualitative descriptors that are used to interpret the degree of acceptability or utility of data. Indicators of data quality include the analysis of laboratory control samples to assess accuracy; duplicates and replicates to assess precision; and interference check samples to assess bias (see attached Data Validation Worksheets). The comparability, completeness, and sensitivity of the data are also evaluated in the sections to follow.

All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Volatile Organics, VOA	VOA-A-007	SW-846 5030B	SW-846 8260 LL

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the attached validation worksheets and the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifiers

Sample Number	Location	Analyte	Flag	Reason
MND01-01.2006012-016	0606	Acetone	U	Less than 10 times the trip blank

Sample Shipping/Receiving

GEL Laboratories in Charleston, South Carolina, received 10 water samples on June 3 and 4, 2020, accompanied by a Chain of Custody (COC) form. The air waybill numbers were listed on the Sample Receipt and Review Form. The COC forms were checked to confirm that all of the samples were listed with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The COC forms were complete with no errors or omissions.

Preservation and Holding Times

The sample shipments were received intact with the temperatures inside the iced coolers at 5 °C and 6 °C, which complies with requirements. All samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all analytes as required. The MDL, as defined in Title 40 *Code of Federal Regulations* Section 136, is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured and is defined as 5 times the MDL. The reported MDLs for all analytes met the detection limits requirements.

Laboratory Instrument Calibration

Method requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the analytes of interest. Initial calibration verification demonstrates that the instrument is capable of acceptable performance at the beginning of the analytical run. Continuing calibration verification demonstrates that the initial calibration is still valid by checking the performance of the instrument on a continuing basis. Initial and continuing calibration standards must be prepared from independent sources to ensure the validity of the calibration. All laboratory instrument calibrations and calibration verifications were performed correctly in accordance with the cited methods.

Method SW-846 8260 LL Volatile Organics, VOA
Initial calibrations of instrument VOA2 was performed on May 29 and 30, 2020, using nine calibration standards. Calibration curves are established using linear regression, quadratic regression, or the average response factor approach. Calibrations using average response factors had relative standard deviations of less than 15 percent. Linear or higher order regression calibrations had correlation coefficient values greater than 0.99 and intercepts less than 3 times the MDL. Initial and continuing calibration verification checks were made at the required frequency. Some target compounds had percent drift values greater than 20 percent but were not detected at concentrations greater than the MDL in the associated samples. The mass spectrometer calibration and resolution was checked at the beginning of each analytical run in accordance with the procedure.

Volatiles Internal Standards and Surrogates

The volatile internal standard recoveries and surrogate recoveries were within the acceptance ranges for all samples.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis. All method blank and calibration blank results associated with the samples were below the PQL for all analytes. In cases where the blank concentration exceeds the MDL, associated sample results that are greater than the MDL but less than 5 times the blank concentration are qualified with a U flag as not detected.

Matrix Spike Analysis

Matrix spikes are aliquots of environmental samples to which a known concentration of analyte has been added before analysis. Matrix spike and matrix spike duplicate (MS/MSD) analysis is used to assess the performance of the method by measuring the effects of interferences caused by the sample matrix and reflects the bias of the method for the particular matrix in question. Matrix spike data are not evaluated when the concentration of the unspiked sample is greater than 4 times the spike concentration. The matrix spike recoveries met the acceptance criteria for all analytes evaluated.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for results that are greater than 5 times the PQL should be less than 20 percent (or less than the laboratory-derived control limits for organics). For results that are less than 5 times the PQL, the range should be no greater than the PQL. The replicate results met these criteria.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. All control sample results were acceptable.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers. The analytical report included the MDL and PQL for all analytes and all required supporting documentation.

Electronic Data Deliverable (EDD) File

The EDD file arrived on July 3, 2020. The EDD was examined to verify that the file was complete and in compliance with requirements. The contents of the file were compared to the requested analyses to ensure all and only the requested data are delivered. The contents of the

EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Trip Blank

Trip blanks were prepared and analyzed to document contamination attributable to shipping and field handling procedures. This type of blank is useful in documenting contamination of volatile organic samples. The trip blank associated with samples collected June 1, 2020 was submitted under task code MND01-01.2006011. The trip blank associated with samples collected June 3, 2020 was submitted under task code MND01-03.2006020. Acetone, 2-butanone, methylene chloride, and vinyl chloride were detected in the trip blanks. Associated results greater than the MDL and less than 5 times the trip blank concentration (10 times for common laboratory contaminants) were qualified with a U flag as not detected.

Field Measurements

The pre-sampling purge criteria were met for all wells. Field parameters were not recorded in the field EDD for surface water locations 0606 and 0607.

Outliers Report

Potential outliers are results that lie outside the historical range, possibly due to transcription errors, data calculation errors, or measurement system problems. However, outliers can also represent true values outside the historical range. Potential outliers are identified by generating the Data Validation Outliers Report from data in the environmental database. The new data are compared to historical values and data that fall outside the historical data range are listed on the report along with the historical minimum and maximum values. The potential outliers are further reviewed and may be subject to statistical evaluation using the ProUCL application developed by the EPA (https://www.epa.gov/land-research/proucl-software). The review also includes an evaluation of any notable trends in the data that may indicate the outliers represent true extreme values.

One laboratory result from this sampling event was identified as a potential outlier. The laboratory data was reviewed in detail and no errors were identified; the data for this task are acceptable as qualified.

Report Prepared By: Digitally signed by SAMANTHA TIGAR (Affiliate)
Date: 2020.08.25 14:38:16 -06'00'

Samantha Tigar
Data Validator

Data Validation Outliers Report - No Field Parameters **Report Date: 08/13/2020**

Comparison to Historical Data Since: 1/1/2009 12:00:00 AM Fraction: Any

Task: MND01-01.2006012

Analyte	Location	Analysis Location	Units	Fraction	Result	Lab Qualifier(s)	Type	HistMIN	HistMAX	HistSetSize	Outlier?
Chloroform	0607	LB	ug/L	N	0.440	J	> HistMAX	0.1	0.32	48	Yes

FRACTION: D = Dissolved N = NA T = Total

General Data Validation Report

Task Code: MND01-01.2006012 **Lab Code:** GEN **Validator:** Samantha Tigar **Validation Date:** 08-13-2020

Project: LTS&M (Parcel 6-7-8) **# Samples:** 10

Analysis Type: [ ] General Chemistry [ ] Metals [X] Organics [ ] Radiochemistry

Chain of Custody	*Sample*
Present: OK Signed: OK Dated: OK	Integrity: OK Preservation OK Temperature: OK

Check	Summary
Holding Times:	All analyses were completed within the applicable holding times.
Detection Limits:	The reported detection limits are equal to or below the contract required limits.

Validation Report: Field Blanks

25-Aug-2020

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2006011 **Lab Code:** GEN

Blank Type	Sample Code	Location	Method	Analyte	Result	Lab Qualifiers
TB	MND01-01.2006011-021	0999	SW-846 8260	2-Butanone	2.11	J

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2006012-001	0118	0.5	1	U	
MND01-01.2006012-003	0126	0.5	1	U	
MND01-01.2006012-004	0138	0.5	1	U	
MND01-01.2006012-008	0379	0.5	1	U	
MND01-01.2006012-010	0387	0.5	1	U	
MND01-01.2006012-012	0392	0.5	1	U	

Validation Report: Field Blanks

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2006011 **Lab Code:** GEN

TB	MND01-01.2006011-021	0999	SW-846 8260	Acetone	20.4	

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2006012-001	0118	0.5	1	U	
MND01-01.2006012-003	0126	0.5	1	U	
MND01-01.2006012-004	0138	0.5	1	U	
MND01-01.2006012-008	0379	0.5	1	U	
MND01-01.2006012-010	0387	0.5	1	U	
MND01-01.2006012-012	0392	0.5	1	U	

Validation Report: Field Blanks

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2006011 **Lab Code:** GEN

TB	MND01-01.2006011-021	0999	SW-846 8260	Methylene chloride	0.270	J

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2006012-001	0118	0.16	1	U	
MND01-01.2006012-003	0126	0.16	1	U	
MND01-01.2006012-004	0138	0.16	1	U	
MND01-01.2006012-008	0379	0.16	1	U	
MND01-01.2006012-010	0387	0.16	1	U	
MND01-01.2006012-012	0392	0.16	1	U	

Validation Report: Field Blanks

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2006011 **Lab Code:** GEN

TB	MND01-01.2006011-021	0999	SW-846 8260	Vinyl chloride	1.11	

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2006012-001	0118	0.16	1	U	
MND01-01.2006012-003	0126	0.16	1	U	
MND01-01.2006012-004	0138	0.16	1	U	
MND01-01.2006012-008	0379	0.16	1	U	
MND01-01.2006012-010	0387	0.16	1	U	
MND01-01.2006012-012	0392	0.16	1	U	

Validation Report: Field Blanks

25-Aug-2020

Project: OU-1 Field Demonstration **Task Code:** MND01-03.2006020 **Lab Code:** GEN

TB	MND01-03.2006020-030	0999	SW-846 8260B	Acetone	9.90	

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2006012-013	0601	0.5	1	U	
MND01-01.2006012-015	0605	0.5	1	U	
MND01-01.2006012-016	0606	1.45	1	J	U
MND01-01.2006012-017	0607	0.5	1	U	

Validation Report: Field Blanks

Project: OU-1 Field Demonstration **Task Code:** MND01-03.2006020 **Lab Code:** GEN

TB	MND01-03.2006020-030	0999	SW-846 8260B	Vinyl chloride	0.530	J

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2006012-013	0601	0.16	1	U	
MND01-01.2006012-015	0605	0.16	1	U	
MND01-01.2006012-016	0606	0.16	1	U	
MND01-01.2006012-017	0607	0.16	1	U	

Organics Data Validation Summary

13-Aug-2020

Project: LTS&M (Parcel 6-7-8)

Task Code: MND01-01.2006012

Lab Code: GEN

Surrogate Recovery:	All surrogate recoveries were within the laboratory acceptance limits.
LCS/LCSD Performance:	All LCS/LCSD results were within the laboratory acceptance limits.
MS/MSD Performance:	All MS/MSD results were within the laboratory acceptance limits.
Method Blank Performance:	All method blanks were below the MDL.

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Contractor to the U.S. Department of Energy Office of Legacy Management

Data Review and Validation Report

General Information

Task Code:	MND01-01.2008013
Sample Event:	August 17 and 18, 2020
Site(s):	Mound, Ohio: LTS&M (Parcel 6-7-8)
Laboratory:	GEL Laboratories, Charleston, South Carolina
Work Order No.:	519059
Analysis:	Organics and Radiochemistry
Validator:	Samantha Tigar
Review Date:	September 29, 2020

This validation was performed according to *Environmental Data Validation Procedure* (LMS/PRO/S15870), which is available at https://documentmanagement.share.lm.doe.gov/ControlledDocuments/Controlled%20Documents/S15870_Env_DV_Procedure.pdf. The procedure was applied at Level 3, Data Validation.

This validation includes the evaluation of data quality indicators (DQIs) associated with the data. DQIs are the quantitative and qualitative descriptors that are used to interpret the degree of acceptability or utility of data. Indicators of data quality include the analysis of laboratory control samples to assess accuracy; duplicates and replicates to assess precision; and interference check samples to assess bias (see attached Data Validation Worksheets). The comparability, completeness, and sensitivity of the data are also evaluated in the sections to follow.

All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Tritium	LSC-A-001	EPA 906.0 Modified	EPA 906.0 Modified
Volatile Organics, VOA	VOA-A-007	SW-846 5030B	SW-846 8260 LL

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the attached validation worksheets and the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifiers

Sample Number	Location	Analyte	Flag	Reason
MND01-01.2008013-001 to MND01-01.2008013-013	Various	Acetone	U	Less than 10 times the trip blank

Sample Number	Location	Analyte	Flag	Reason
MND01-01.2008013-016 to MND01-01.2008013-018	Various	Acetone	U	Less than 10 times the trip blank
MND01-01.2008013-001 to MND01-01.2008013-012	Various	Methylene chloride	U	Less than 10 times the trip blank
MND01-01.2008013-016 to MND01-01.2008013-018	Various	Methylene chloride	U	Less than 10 times the trip blank
MND01-01.2008013-008	0379	Tritium	J	Less than the determination limit

Sample Shipping/Receiving

GEL Laboratories in Charleston, South Carolina, received 19 water samples on August 19, 2020, accompanied by a Chain of Custody (COC) form. The air waybill numbers were listed on the Sample Receipt and Review Form. The COC forms were checked to confirm that all of the samples were listed with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The COC forms were complete with no errors or omissions.

Preservation and Holding Times

The sample shipments were received intact with the temperatures inside the iced cooler at 2 °C, which complies with requirements. All samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all organics analytes as required. The MDL, as defined in Title 40 *Code of Federal Regulations* Section 136, is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured and is defined as 5 times the MDL.

For radiochemical analytes (those measured by radiometric counting) the MDL and PQL are not applicable, and these results are evaluated using the minimum detectable concentration (MDC), the decision level concentration (DLC), and the determination limit (DL). The DLC is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is estimated as 3 times the 1-sigma total propagated uncertainty. Results that are greater than the MDC but less than the DLC are qualified with a U flag as not detected. The DL for radiochemical results is the lowest concentration that can be reliably measured and is defined as 3 times the MDC. Results that were not previously U qualified and are less than the DL are qualified with a J flag as estimated values.

The reported MDLs for the organics analytes and MDCs for radiochemical analytes met the detection limits requirements.

Laboratory Instrument Calibration

Method requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the analytes of

interest. Initial calibration verification demonstrates that the instrument is capable of acceptable performance at the beginning of the analytical run. Continuing calibration verification demonstrates that the initial calibration is still valid by checking the performance of the instrument on a continuing basis. Initial and continuing calibration standards must be prepared from independent sources to ensure the validity of the calibration. All laboratory instrument calibrations and calibration verifications were performed correctly in accordance with the cited methods.

Method SW-846 8260 LL Volatile Organics, VOA
Initial calibrations of instrument VOA2 was performed on July 22 and 23, 2020, using nine calibration standards. Calibration curves are established using linear regression, quadratic regression, or the average response factor approach. Calibrations using average response factors had relative standard deviations of less than 15 percent. Linear or higher order regression calibrations had correlation coefficient values greater than 0.99 and intercepts less than 3 times the MDL. Initial and continuing calibration verification checks were made at the required frequency. All associated target compound percent drift values were less than 20 percent. The mass spectrometer calibration and resolution was checked at the beginning of each analytical run in accordance with the procedure.

Method EPA 906.0 Modified Tritium

Liquid scintillation calibrations for instrument LSCGOLD were performed on July 1, 2020. Calibrations resulted in quench curves covering a quench number range of 143 – 335. The sample quench values were all within the calibration range. Daily calibration checks were performed with acceptable results.

Volatiles Internal Standards and Surrogates

The volatile internal standard recoveries and surrogate recoveries were within the acceptance ranges for all samples.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis. All method blank and calibration blank results associated with the samples were below the PQL for all analytes. In cases where the blank concentration exceeds the MDL, associated sample results that are greater than the MDL but less than 5 times the blank concentration are qualified with a U flag as not detected. The radiochemistry method blank results were less than the DLC.

Matrix Spike Analysis

Matrix spikes are aliquots of environmental samples to which a known concentration of analyte has been added before analysis. Matrix spike and matrix spike duplicate (MS/MSD) analysis is used to assess the performance of the method by measuring the effects of interferences caused by the sample matrix and reflects the bias of the method for the particular matrix in question. Matrix spike data are not evaluated when the concentration of the unspiked sample is greater than 4 times the spike concentration. The matrix spike recoveries met the acceptance criteria for all analytes evaluated.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for results that are greater than 5 times the PQL should be less than 20 percent (or less than the laboratory-derived control limits for organics). For results that are less than 5 times the PQL, the range should be no greater than the PQL. The relative error ratio for radiochemical replicate results (calculated using the one-sigma total propagated uncertainty) should be less than 3, indicating acceptable precision. The replicate results met these criteria.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. Two control sample results were above the acceptance criteria for volatiles but did not require qualification.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers. The analytical report included the MDL and PQL for all analytes and all required supporting documentation.

Electronic Data Deliverable (EDD) File

The EDD file arrived on September 15, 2020. The EDD was examined to verify that the file was complete and in compliance with requirements. The contents of the file were compared to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Trip Blank

Trip blanks were prepared and analyzed to document contamination attributable to shipping and field handling procedures. This type of blank is useful in documenting contamination of volatile organic samples. Two trip blanks were submitted with these samples. Acetone, 2-butanone, methylene chloride, and vinyl chloride were detected in the trip blanks. Associated results greater than the MDL and less than 5 times the trip blank concentration (10 times for common laboratory contaminants) were qualified with a U flag as not detected.

Field Duplicate

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates, which measure only laboratory performance. Duplicate samples were collected from location 0347. For non-radiochemical measurements, the relative percent difference for duplicate results that are greater than 5 times the PQL should be less than 20 percent. For results less than 5 times the PQL, the range should be no greater than the PQL. For radiochemical measurements, the relative error ratio (the ratio of the absolute

difference between the sample and duplicate results and the sum of the 1-sigma uncertainties) is used to evaluate duplicate results and should be less than 3. All duplicate results met these criteria, demonstrating acceptable precision.

Field Measurements

The pre-sampling purge criteria were met for all wells.

Outliers Report

Potential outliers are results that lie outside the historical range, possibly due to transcription errors, data calculation errors, or measurement system problems. However, outliers can also represent true values outside the historical range. Potential outliers are identified by generating the Data Validation Outliers Report from data in the environmental database. The new data are compared to historical values and data that fall outside the historical data range are listed on the report along with the historical minimum and maximum values. The potential outliers are further reviewed and may be subject to statistical evaluation using the ProUCL application developed by the EPA (https://www.epa.gov/land-research/proucl-software). The review also includes an evaluation of any notable trends in the data that may indicate the outliers represent true extreme values.

Five laboratory results from this sampling event were identified as outliers. The acetone results were qualified as not detected during validation and no further qualification is necessary. The laboratory data was reviewed in detail for the two remaining outliers and no errors were identified; the data for this task are acceptable as qualified.

Digitally signed by SAMANTHA TIGAR (Affiliate)
Date: 2020.09.30 13:01:07 -06'00'

Report Prepared By: _____

Samantha Tigar
Data Validator

Data Validation Outliers Report - No Field Parameters **Report Date: 09/29/2020**

Comparison to Historical Data Since: 1/1/2009 12:00:00 AM Fraction: Any

Task: MND01-01.2008013

Analyte	Location	Analysis Location	Units	Fraction	Result	Lab Qualifier(s)	Type	HistMIN	HistMAX	HistSetSize	Outlier?
Acetone	0124	LB	ug/L	N	5.40		> HistMAX	0.5	2.86	46	Yes
Acetone	0346	LB	ug/L	N	3.94	J	> HistMAX	0.5	3.13	46	Yes
Acetone	0606	LB	ug/L	N	6.65		> HistMAX	0.5	5.42	41	Yes
Carbon tetrachloride	0315	LB	ug/L	N	0.270	J	< HistMIN	0.31	1.63	49	No
Chloroform	0607	LB	ug/L	N	0.770	J	> HistMAX	0.1	0.44	49	Yes
Tetrachloroethene	0124	LB	ug/L	N	0.380	J	> HistMAX	0.16	0.35	46	Yes
Tritium	0605	LB	pCi/L	T	1830		< HistMIN	2060	27100	29	No

FRACTION: D = Dissolved N = NA T = Total

General Data Validation Report

Task Code: MND01-01.2008013 **Lab Code:** GEN **Validator:** Samantha Tigar **Validation Date:** 09-29-2020

Project: LTS&M (Parcel 6-7-8) **# Samples:** 19

Analysis Type: [ ] General Chemistry [ ] Metals [X] Organics [X] Radiochemistry

Chain of Custody	*Sample*
Present: OK Signed: OK Dated: OK	Integrity: OK Preservation OK Temperature: OK

Check	Summary
Holding Times:	All analyses were completed within the applicable holding times.
Detection Limits:	The reported detection limits are equal to or below the contract required limits.
Field Blanks:	There were 2 field blanks associated with this task.
Field Duplicates:	There was 1 duplicate evaluated.

Validation Report: Field Blanks

29-Sep-2020

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2008013 **Lab Code:** GEN

Blank Type	Sample Code	Location	Method	Analyte	Result	Lab Qualifiers
TB	MND01-01.2008013-019	0999	SW-846 8260	2-Butanone	4.25	J

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2008013-001	0118	0.500	1	U	
MND01-01.2008013-003	0126	0.500	1	U	
MND01-01.2008013-004	0138	0.500	1	U	
MND01-01.2008013-008	0379	0.500	1	U	
MND01-01.2008013-010	0387	0.500	1	U	
MND01-01.2008013-012	0392	0.500	1	U	

Validation Report: Field Blanks

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2008013 **Lab Code:** GEN

TB	MND01-01.2008013-019	0999	SW-846 8260	Acetone	48.3	

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2008013-001	0118	1.61	1	J	U
MND01-01.2008013-003	0126	1.61	1	J	U
MND01-01.2008013-004	0138	0.730	1	J	U
MND01-01.2008013-008	0379	2.46	1	J	U
MND01-01.2008013-010	0387	3.25	1	J	U
MND01-01.2008013-012	0392	2.66	1	J	U

Validation Report: Field Blanks

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2008013 **Lab Code:** GEN

TB	MND01-01.2008013-019	0999	SW-846 8260	Methylene chloride	0.530	BJ

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2008013-001	0118	0.370	1	BJ	U
MND01-01.2008013-003	0126	0.350	1	BJ	U
MND01-01.2008013-004	0138	0.360	1	BJ	U
MND01-01.2008013-008	0379	0.340	1	BJ	U
MND01-01.2008013-010	0387	0.370	1	BJ	U
MND01-01.2008013-012	0392	0.320	1	BJ	U

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2008013 **Lab Code:** GEN

TB	MND01-01.2008013-019	0999	SW-846 8260	Vinyl chloride	0.220	J

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2008013-001	0118	0.160	1	U	
MND01-01.2008013-003	0126	0.160	1	U	
MND01-01.2008013-004	0138	0.160	1	U	
MND01-01.2008013-008	0379	0.160	1	U	
MND01-01.2008013-010	0387	0.160	1	U	
MND01-01.2008013-012	0392	0.160	1	U	

Validation Report: Field Blanks

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2008013 **Lab Code:** GEN

TB	MND01-01.2008013-020	0999	SW-846 8260	2-Butanone	2.95	J

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2008013-002	0124	0.500	1	U	
MND01-01.2008013-005	0315	0.500	1	U	
MND01-01.2008013-006	0346	0.500	1	U	
MND01-01.2008013-007	0347	0.500	1	U	
MND01-01.2008013-009	0386	0.500	1	U	
MND01-01.2008013-011	0389	0.500	1	U	
MND01-01.2008013-013	0601	0.500	1	U	
MND01-01.2008013-015	0605	0.500	1	U	
MND01-01.2008013-016	0606	0.500	1	U	
MND01-01.2008013-017	0607	0.500	1	U	
MND01-01.2008013-018	0347	0.500	1	U	U

Validation Report: Field Blanks

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2008013 **Lab Code:** GEN

TB	MND01-01.2008013-020	0999	SW-846 8260	Acetone	27.1	

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2008013-002	0124	5.40	1		U
MND01-01.2008013-005	0315	1.80	1	J	U
MND01-01.2008013-006	0346	3.94	1	J	U
MND01-01.2008013-007	0347	1.29	1	J	U
MND01-01.2008013-009	0386	1.21	1	J	U
MND01-01.2008013-011	0389	4.14	1	J	U
MND01-01.2008013-013	0601	1.70	1	J	U
MND01-01.2008013-015	0605	0.500	1	U	
MND01-01.2008013-016	0606	6.65	1		U
MND01-01.2008013-017	0607	2.43	1	J	U
MND01-01.2008013-018	0347	4.22	1	J	U

Validation Report: Field Blanks

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2008013 **Lab Code:** GEN

TB	MND01-01.2008013-020	0999	SW-846 8260	Methylene chloride	0.380	BJ

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2008013-002	0124	0.350	1	BJ	U
MND01-01.2008013-005	0315	0.310	1	BJ	U
MND01-01.2008013-006	0346	0.330	1	BJ	U
MND01-01.2008013-007	0347	0.340	1	BJ	U
MND01-01.2008013-009	0386	0.350	1	BJ	U
MND01-01.2008013-011	0389	0.350	1	BJ	U
MND01-01.2008013-013	0601	0.160	1	U	
MND01-01.2008013-015	0605	0.160	1	U	
MND01-01.2008013-016	0606	0.350	1	BJ	U
MND01-01.2008013-017	0607	0.360	1	BJ	U
MND01-01.2008013-018	0347	0.180	1	BJ	U

Validation Report: Field Duplicates

29-Sep-2020

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2008013 Lab Code: GEN

	Duplicate: MND01-01.2008013-018				Sample: MND01-01.2008013-007 0347						
Analyte	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**RPD**	**RER**	**Units**
1,1,1,2-Tetrachloroethane	0.160	U		1	0.160	U		1			ug/L
1,1,1-Trichloroethane	0.160	U		1	0.160	U		1			ug/L
1,1,2,2-Tetrachloroethane	0.160	U		1	0.160	U		1			ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	1.50	U		1	1.50	U		1			ug/L
1,1,2-Trichloroethane	0.160	U		1	0.160	U		1			ug/L
1,1-Dichloroethane	0.160	U		1	0.160	U		1			ug/L
1,1-Dichloroethene	0.160	U		1	0.160	U		1			ug/L
1,1-Dichloropropene	0.160	U		1	0.160	U		1			ug/L
1,2,3-Trichlorobenzene	0.200	U		1	0.200	U		1			ug/L
1,2,3-Trichloropropane	0.160	U		1	0.160	U		1			ug/L
1,2,4-Trichlorobenzene	0.160	U		1	0.160	U		1			ug/L
1,2,4-Trimethylbenzene	0.160	U		1	0.160	U		1			ug/L
1,2-Dibromo-3-chloropropane	0.160	U		1	0.160	U		1			ug/L
1,2-Dibromoethane	0.160	U		1	0.160	U		1			ug/L
1,2-Dichlorobenzene	0.160	U		1	0.160	U		1			ug/L
1,2-Dichloroethane	0.160	U		1	0.160	U		1			ug/L
1,2-Dichloropropane	0.160	U		1	0.160	U		1			ug/L
1,3,5-Trimethylbenzene	0.160	U		1	0.160	U		1			ug/L

QC Checks: RPD: Relative Percent Difference RER: Relative Error Ratio

Validation Report: Field Duplicates

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2008013 Lab Code: GEN

	Duplicate: MND01-01.2008013-018				Sample: MND01-01.2008013-007 0347						
Analyte	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**RPD**	**RER**	**Units**
1,3-Dichlorobenzene	0.160	U		1	0.160	U		1			ug/L
1,3-Dichloropropane	0.160	U		1	0.160	U		1			ug/L
1,4-Dichlorobenzene	0.160	U		1	0.160	U		1			ug/L
2,2-Dichloropropane	0.160	U		1	0.160	U		1			ug/L
2-Butanone	0.500	U		1	0.500	U		1			ug/L
2-Chlorotoluene	0.160	U		1	0.160	U		1			ug/L
2-Hexanone	0.500	U		1	0.500	U		1			ug/L
4-Chlorotoluene	0.160	U		1	0.160	U		1			ug/L
4-Methyl-2-Pentanone	0.500	U		1	0.500	U		1			ug/L
Acetone	4.22	J		1	1.29	U		1			ug/L
Benzene	0.160	U		1	0.160	U		1			ug/L
Bromobenzene	0.160	U		1	0.160	U		1			ug/L
Bromochloromethane	0.160	U		1	0.160	U		1			ug/L
Bromodichloromethane	0.160	U		1	0.160	U		1			ug/L
Bromoform	0.160	U		1	0.160	U		1			ug/L
Bromomethane	0.160	U		1	0.160	U		1			ug/L
Carbon Disulfide	0.500	U		1	0.500	U		1			ug/L
Carbon tetrachloride	1.06			1	1.03			1	2.9		ug/L
Chlorobenzene	0.160	U		1	0.160	U		1			ug/L
Chlorodibromomethane	0.160	U		1	0.160	U		1			ug/L

QC Checks: RPD: Relative Percent Difference RER: Relative Error Ratio

Validation Report: Field Duplicates

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2008013 Lab Code: GEN

	Duplicate: MND01-01.2008013-018				Sample: MND01-01.2008013-007 0347						
Analyte	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**RPD**	**RER**	**Units**
Chloroethane	0.160	U		1	0.160	U		1			ug/L
Chloroform	0.450	J		1	0.450	U		1			ug/L
Chloromethane	0.160	U		1	0.160	U		1			ug/L
cis-1,2-Dichloroethene	0.160	U		1	0.160	U		1			ug/L
cis-1,3-Dichloropropene	0.160	U		1	0.160	U		1			ug/L
Dibromomethane	0.160	U		1	0.160	U		1			ug/L
Dichlorodifluoromethane	0.160	U		1	0.160	U		1			ug/L
Ethylbenzene	0.160	U		1	0.160	U		1			ug/L
Hexachlorobutadiene	0.160	U		1	0.160	U		1			ug/L
Isopropylbenzene	0.160	U		1	0.160	U		1			ug/L
Methylene chloride	0.180	BJ		1	0.340	U		1			ug/L
n-Butylbenzene	0.160	U		1	0.160	U		1			ug/L
n-Propylbenzene	0.160	U		1	0.160	U		1			ug/L
Naphthalene	0.160	U		1	0.160	U		1			ug/L
p-Isopropyltoluene	0.160	U		1	0.160	U		1			ug/L
sec-Butylbenzene	0.160	U		1	0.160	U		1			ug/L
Styrene	0.160	U		1	0.160	U		1			ug/L
tert-Butylbenzene	0.160	U		1	0.160	U		1			ug/L
Tetrachloroethene	0.160	U		1	0.160	U		1			ug/L
Toluene	0.160	U		1	0.160	U		1			ug/L

QC Checks: RPD: Relative Percent Difference RER: Relative Error Ratio

Validation Report: Field Duplicates

29-Sep-2020

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2008013 Lab Code: GEN

	Duplicate: MND01-01.2008013-018				Sample: MND01-01.2008013-007 0347						
Analyte	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**RPD**	**RER**	**Units**
Total Xylenes	0.160	U		1	0.160	U		1			ug/L
trans-1,2-Dichloroethene	0.160	U		1	0.160	U		1			ug/L
trans-1,3-dichloropropene	0.160	U		1	0.160	U		1			ug/L
Trichloroethene	24.7			1	23.6			1	4.6		ug/L
Trichlorofluoromethane	0.160	U		1	0.160	U		1			ug/L
Tritium	956		272	1	1070		297	1		0.6	pCi/L
Vinyl chloride	0.160	U		1	0.160	U		1			ug/L

QC Checks: RPD: Relative Percent Difference RER: Relative Error Ratio

Organics Data Validation Summary

29-Sep-2020

Project: LTS&M (Parcel 6-7-8)

Task Code: MND01-01.2008013

Lab Code: GEN

Surrogate Recovery:	All surrogate recoveries were within the laboratory acceptance limits.
LCS/LCSD Performance:	There were 2 LCS/LCSD results outside the laboratory acceptance limits.
MS/MSD Performance:	All MS/MSD results were within the laboratory acceptance limits.
Method Blank Performance:	There were 8 method blank results above the MDL.

Noncompliance Report: LCS/LCSD Performance

29-Sep-2020

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2008013 **Lab Code:** GEN

Sample ID	Date Analyzed	Method	Analyte	LCS Recovery	LCSD recovery	Lower Limit	Upper Limit	RPD	RPD Limit	Comment
	08-21-2020	SW-846 8260	Chlorodibromomethane	127		77	126			
	08-21-2020	SW-846 8260	Tetrachloroethene	122		73	120			

29-Sep-2020

Noncompliance Report: Method Blanks

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2008013 **Lab Code:** GEN

Method Blank ID	Date Analyzed	Method	Analyte	Result	Lab Qualifiers	Comment
	08-21-2020	SW-846 8260	1,2,3-Trichlorobenzene	0.210	J	
	08-21-2020	SW-846 8260	1,2,4-Trichlorobenzene	0.170	J	
	08-21-2020	SW-846 8260	1,2,4-Trichlorobenzene	0.190	J	
	08-21-2020	SW-846 8260	Hexachlorobutadiene	0.180	J	
	08-21-2020	SW-846 8260	Methylene chloride	0.340	J	
	08-21-2020	SW-846 8260	Methylene chloride	0.180	J	
	08-21-2020	SW-846 8260	Naphthalene	0.190	J	
	08-21-2020	SW-846 8260	Naphthalene	0.190	J	

Radiochemistry Data Validation Worksheet

29-Sep-2020

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2008013 **Lab Code:** GEN

Sample ID	Analyte	Analysis Date	QC Type	Result Type	Result	Flag	TPU	Spike Recovery	Spike Dup Recovery	Lower Limit	Upper Limit	RPD	RPD Limit	RER	Comments
	Tritium	09-02-2020	LCS	SC	5140		1120	99.8		75	125				
	Tritium	09-02-2020	MB	TRG	-15.1	U	165								
	Tritium	09-02-2020	MS	SC	5360		1090	83.2		75	125				
	Tritium	09-02-2020	R	TRG	1200		316					11.6	100		RER=0.6

QC Types: LCS: Laboratory Control Sample LCSD: Laboratory Control Sample Duplicate MB: Method Blank MS: Matrix Spike MSD: Matrix Spike Duplicate R: Replicate

Result Types: IS: Internal Standard SC: Spike Analyte TRG: Target analyte

QC Checks: RPD: Relative Percent Difference RER: Relative Error Ratio TPU: Total Propagated Uncertainty

NAVARRO

Contractor to the U.S. Department of Energy Office of Legacy Management

Data Review and Validation Report

General Information

Task Code:	MND01-01.2010014
Sample Event:	November 30 and December 1, 2020
Site(s):	Mound, Ohio: LTS&M (Parcel 6-7-8)
Laboratory:	GEL Laboratories, Charleston, South Carolina
Work Order No.:	528930
Analysis:	Organics
Validator:	Pete Steves
Review Date:	January 11, 2021

This validation was performed according to *Environmental Data Validation Procedure* (LMS/PRO/S15870). The procedure was applied at Level 3, Data Validation.

This validation includes the evaluation of data quality indicators (DQIs) associated with the data. DQIs are the quantitative and qualitative descriptors that are used to interpret the degree of acceptability or utility of data. Indicators of data quality include the analysis of laboratory control samples to assess accuracy; duplicates and replicates to assess precision; and interference check samples to assess bias (see attached Data Validation Worksheets). The comparability, completeness, and sensitivity of the data are also evaluated in the sections to follow.

All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Volatile Organics, VOA	VOA-A-007	SW-846 5030B	SW-846 8260 LL

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the attached validation worksheets and the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifiers

Sample Number	Location	Analyte	Flag	Reason
MND01-01.2010014-002	0124	Acetone	U	Less than 10 times the trip blank
MND01-01.2010014-003	0126	Acetone	U	Less than 10 times the trip blank
MND01-01.2010014-004	0138	Acetone	U	Less than 10 times the trip blank
MND01-01.2010014-005	0315	Acetone	U	Less than 10 times the trip blank
MND01-01.2010014-008	0379	Acetone	U	Less than 10 times the trip blank
MND01-01.2010014-010	0387	Acetone	U	Less than 10 times the trip blank
MND01-01.2010014-014	0602	Acetone	U	Less than 10 times the trip blank
All	All	Methylene chloride	U	Less than 10 times the method blank

Sample Shipping/Receiving

GEL Laboratories in Charleston, South Carolina, received 20 water samples on December 2, 2020, accompanied by a Chain of Custody (COC) form. The air waybill numbers were listed on the Sample Receipt and Review Form. The COC form was checked to confirm that all of the samples were listed with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The COC forms were complete with no errors or omissions.

Preservation and Holding Times

The sample shipments were received intact with the temperatures inside the iced cooler at 1 °C, which complies with requirements. All samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all analytes as required. The MDL, as defined in Title 40 *Code of Federal Regulations* Section 136, is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured and is defined as 5 times the MDL. The reported MDLs for all analytes met the detection limits requirements.

Laboratory Instrument Calibration

Method requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the analytes of interest. Initial calibration verification demonstrates that the instrument is capable of acceptable performance at the beginning of the analytical run. Continuing calibration verification demonstrates that the initial calibration is still valid by checking the performance of the instrument on a continuing basis. Initial and continuing calibration standards must be prepared from independent sources to ensure the validity of the calibration. All laboratory instrument calibrations and calibration verifications were performed correctly in accordance with the cited methods.

Method SW-846 8260 LL Volatile Organics, VOA
Initial calibrations of instrument VOA2 was performed on December 4 and 5, 2020, using nine calibration standards. Calibration curves are established using linear regression, quadratic regression, or the average response factor approach. Calibrations using average response factors had relative standard deviations of less than 15 percent. Linear or higher order regression calibrations had correlation coefficient values greater than 0.99 and intercepts less than 3 times the MDL. Initial and continuing calibration verification checks were made at the required frequency. All target compounds had percent drift values less than 20 percent. The mass spectrometer calibration and resolution was checked at the beginning of each analytical run in accordance with the procedure.

Volatiles Internal Standards and Surrogates

The volatile internal standard recoveries and surrogate recoveries were within the acceptance ranges for all samples.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis. All method blank and calibration blank results associated with the samples were below the PQL for all analytes. In cases where the blank concentration exceeds the MDL, associated sample results that are greater than the MDL but less than 5 times the blank concentration are qualified with a U flag as not detected.

Matrix Spike Analysis

Matrix spikes are aliquots of environmental samples to which a known concentration of analyte has been added before analysis. Matrix spike and matrix spike duplicate (MS/MSD) analysis is used to assess the performance of the method by measuring the effects of interferences caused by the sample matrix and reflects the bias of the method for the particular matrix in question. Matrix spike data are not evaluated when the concentration of the unspiked sample is greater than 4 times the spike concentration. The matrix spike recoveries met the acceptance criteria for all analytes evaluated.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for results that are greater than 5 times the PQL should be less than 20 percent (or less than the laboratory-derived control limits for organics). For results that are less than 5 times the PQL, the range should be no greater than the PQL. The replicate results met these criteria, demonstrating acceptable overall precision.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. All control sample results were acceptable.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers. The analytical report included the MDL and PQL for all analytes and all required supporting documentation.

Chromatography Peak Integration

The integration of analyte peaks was reviewed. All analyte peak integrations were acceptable.

Compound Identification

The mass spectral and retention time data were reviewed for each reported volatile compound to verify that analytes were identified correctly. Compounds that were reported with results above the MDL but that do not meet the mass spectra compound identification criteria are qualified with a U flag as not detected. Compound identification was acceptable for all reported analytes.

Electronic Data Deliverable (EDD) File

The EDD file arrived on December 29, 2020. The EDD was examined to verify that the file was complete and in compliance with requirements. The contents of the file were compared to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Trip Blank

Trip blanks were prepared and analyzed to document contamination attributable to shipping and field handling procedures. This type of blank is useful in documenting contamination of volatile organic samples. Two trip blanks were submitted with these samples. Acetone, 2-butanone, chlorobenzene, and methylene chloride were detected in one or more of the trip blanks. Associated results greater than the MDL and less than 5 times the trip blank concentration (10 times for common laboratory contaminants) were qualified with a U flag as not detected.

Field Duplicate

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates, which measure only laboratory performance. A duplicate sample was collected from location 0315. The relative percent difference for duplicate results that are greater than 5 times the PQL should be less than 20 percent. For results that are less than 5 times the PQL, the range should be no greater than the PQL. The duplicate results met the criteria, demonstrating acceptable overall precision.

Field Measurements

The pre-sampling purge criteria were met for all wells. A turbidity less than 50 NTU was not achieved at monitoring wells 0315, 0605, 0606, and 0607.

Outliers Report

Potential outliers are results that lie outside the historical range, possibly due to transcription errors, data calculation errors, or measurement system problems. However, outliers can also represent true values outside the historical range. Potential outliers are identified by generating the Data Validation Outliers Report from data in the environmental database. The new data are compared to historical values and data that fall outside the historical data range are listed on the report along with the historical minimum and maximum values. The potential outliers are further reviewed and may be subject to statistical evaluation using the ProUCL application developed by the EPA (https://www.epa.gov/land-research/proucl-software). The review also includes an evaluation of any notable trends in the data that may indicate the outliers represent true extreme values.

No laboratory results from this sampling event were identified as potential outliers.

Pete Steves Digitally signed by Pete Steves Date: 2021.01.11 11:10:24 -07'00'

Report Prepared By: _____

Pete Steves
Data Validator

General Data Validation Report

Task Code: MND01-01.2010014 **Lab Code:** GEN **Validator:** Pete Steves **Validation Date:** 01-11-2021

Project: LTS&M (Parcel 6-7-8) **# Samples:** 20

Analysis Type: [ ] General Chemistry [ ] Metals [X] Organics [ ] Radiochemistry

Chain of Custody	*Sample*
Present: OK Signed: OK Dated: OK	Integrity: OK Preservation OK Temperature: OK

Check	Summary
Holding Times:	All analyses were completed within the applicable holding times.
Detection Limits:	The reported detection limits are equal to or below the contract required limits.
Field Blanks:	There were 2 field blanks associated with this task.
Field Duplicates:	There was 1 duplicate evaluated.

11-Jan-2021

Noncompliance Report: Method Blanks

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2010014 **Lab Code:** GEN

Method Blank ID	Date Analyzed	Method	Analyte	Result	Lab Qualifiers	Comment
	12-05-2020	SW-846 8260	Methylene chloride	0.440	J	
	12-05-2020	SW-846 8260	Naphthalene	0.180	J	

Validation Report: Field Blanks

11-Jan-2021

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2010014 **Lab Code:** GEN

Blank Type	Sample Code	Location	Method	Analyte	Result	Lab Qualifiers
TB	MND01-01.2010014-019	0999	SW-846 8260	2-Butanone	1.93	J

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2010014-002	0124	0.500	1	U	
MND01-01.2010014-003	0126	0.500	1	U	
MND01-01.2010014-005	0315	0.500	1	U	
MND01-01.2010014-006	0346	0.500	1	U	
MND01-01.2010014-007	0347	0.500	1	U	
MND01-01.2010014-009	0386	0.500	1	U	
MND01-01.2010014-010	0387	0.500	1	U	
MND01-01.2010014-011	0389	0.500	1	U	
MND01-01.2010014-012	0392	0.500	1	U	
MND01-01.2010014-013	0601	0.500	1	U	
MND01-01.2010014-014	0602	0.500	1	U	
MND01-01.2010014-015	0605	0.500	1	U	
MND01-01.2010014-016	0606	0.500	1	U	
MND01-01.2010014-017	0607	0.500	1	U	
MND01-01.2010014-018	0315	0.500	1	U	U

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2010014 **Lab Code:** GEN

TB	MND01-01.2010014-019	0999	SW-846 8260	Acetone	14.7	

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2010014-002	0124	0.730	1	J	U
MND01-01.2010014-003	0126	0.840	1	J	U
MND01-01.2010014-005	0315	1.36	1	J	U
MND01-01.2010014-006	0346	0.500	1	U	
MND01-01.2010014-007	0347	0.500	1	U	
MND01-01.2010014-009	0386	0.500	1	U	
MND01-01.2010014-010	0387	0.840	1	J	U
MND01-01.2010014-011	0389	0.500	1	U	
MND01-01.2010014-012	0392	0.500	1	U	
MND01-01.2010014-013	0601	0.500	1	U	
MND01-01.2010014-014	0602	0.830	1	J	U
MND01-01.2010014-015	0605	0.500	1	U	
MND01-01.2010014-016	0606	0.500	1	U	
MND01-01.2010014-017	0607	0.500	1	U	
MND01-01.2010014-018	0315	0.500	1	U	J

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2010014 **Lab Code:** GEN

TB	MND01-01.2010014-019	0999	SW-846 8260	Methylene chloride	0.570	BJ

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2010014-002	0124	0.410	1	BJ	U
MND01-01.2010014-003	0126	0.410	1	BJ	U
MND01-01.2010014-005	0315	0.410	1	BJ	U
MND01-01.2010014-006	0346	0.370	1	BJ	U
MND01-01.2010014-007	0347	0.380	1	BJ	U
MND01-01.2010014-009	0386	0.370	1	BJ	U
MND01-01.2010014-010	0387	0.400	1	BJ	U
MND01-01.2010014-011	0389	0.360	1	BJ	U
MND01-01.2010014-012	0392	0.350	1	BJ	U
MND01-01.2010014-013	0601	0.340	1	BJ	U
MND01-01.2010014-014	0602	0.340	1	BJ	U
MND01-01.2010014-015	0605	0.320	1	BJ	U
MND01-01.2010014-016	0606	0.320	1	BJ	U
MND01-01.2010014-017	0607	0.330	1	BJ	U
MND01-01.2010014-018	0315	0.380	1	BJ	U

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2010014 **Lab Code:** GEN

TB	MND01-01.2010014-020	0999	SW-846 8260	2-Butanone	1.44	J

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2010014-001	0118	0.500	1	U	
MND01-01.2010014-004	0138	0.500	1	U	
MND01-01.2010014-008	0379	0.500	1	U	

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2010014 **Lab Code:** GEN

TB	MND01-01.2010014-020	0999	SW-846 8260	Acetone	11.0	

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2010014-001	0118	0.500	1	U	
MND01-01.2010014-004	0138	0.760	1	J	U
MND01-01.2010014-008	0379	0.730	1	J	U

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2010014 **Lab Code:** GEN

TB	MND01-01.2010014-020	0999	SW-846 8260	Chlorobenzene	0.330	J

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2010014-001	0118	0.160	1	U	
MND01-01.2010014-004	0138	0.160	1	U	
MND01-01.2010014-008	0379	0.160	1	U	

Validation Report: Field Blanks

11-Jan-2021

Project: LTS&M (Parcel 6-7-8) **Task Code:** MND01-01.2010014 **Lab Code:** GEN

TB	MND01-01.2010014-020	0999	SW-846 8260	Methylene chloride	0.450	BJ

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-01.2010014-001	0118	0.350	1	BJ	U
MND01-01.2010014-004	0138	0.340	1	BJ	U
MND01-01.2010014-008	0379	0.330	1	BJ	U

Organics Data Validation Summary

11-Jan-2021

Project: LTS&M (Parcel 6-7-8)

Task Code: MND01-01.2010014

Lab Code: GEN

Surrogate Recovery:	All surrogate recoveries were within the laboratory acceptance limits.
LCS/LCSD Performance:	All LCS/LCSD results were within the laboratory acceptance limits.
MS/MSD Performance:	All MS/MSD results were within the laboratory acceptance limits.
Method Blank Performance:	There were 2 method blank results above the MDL.

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Contractor to the U.S. Department of Energy Office of Legacy Management

Data Review and Validation Report

General Information

Task ID:	MND01-02.2001006
Sample Event:	January 27 and 29, 2020
Site(s):	Mound, Ohio: LTS&M (Parcel 6-7-8)
Laboratory:	GEL Laboratories, Charleston, South Carolina
Work Order No.:	502457
Analysis:	Organics
Validator:	Peter Steves
Review Date:	March 25, 2020

This validation was performed according to *Environmental Data Validation Procedure* (LMS/PRO/S15870), which is available at https://documentmanagement.share.lm.doe.gov/ControlledDocuments/Controlled%20Documents/S15870_Env_DV_Procedure.pdf. The procedure was applied at Level 3, Data Validation.

This validation includes the evaluation of data quality indicators (DQIs) associated with the data. DQIs are the quantitative and qualitative descriptors that are used to interpret the degree of acceptability or utility of data. Indicators of data quality include the analysis of laboratory control samples to assess accuracy; duplicates and replicates to assess precision; and interference check samples to assess bias (see attached Data Validation Worksheets). The comparability, completeness, and sensitivity of the data are also evaluated in the sections to follow.

All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Volatile Organics, VOA	VOA-A-007	SW-846 5030B	SW-846 8260 LL

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the attached validation worksheets and the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifiers

Sample Number	Location	Analyte	Flag	Reason
All	All	1,2-Dichloroethane	U	Less than 5 times the method blank
MND01-02.2001006-007	445	Acetone	U	Less than 10 times the trip blank
MND01-02.2001006-008	617	Acetone	U	Less than 10 times the method blank
MND01-02.2001006-008	617	Chloromethane	J	Replicate RPD > acceptance limit
MND01-02.2001006-008	617	Vinyl chloride	J	Replicate RPD > acceptance limit

Sample Shipping/Receiving

GEL Laboratories in Charleston, South Carolina, received nine water samples on January 29 and 30, 2020, accompanied by a Chain of Custody (COC) form. The air waybill numbers were listed on the Sample Receipt and Review Form. The COC form was checked to confirm that all of the samples were listed with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The COC forms were complete with no errors or omissions.

Preservation and Holding Times

The sample shipments were received intact with the temperatures inside the iced coolers between 2 and 4°C, which complies with requirements. All samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all analytes as required. The MDL, as defined in Title 40 *Code of Federal Regulations* Section 136, is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured and is defined as 5 times the MDL. The reported MDLs for all analytes met the detection limits requirements.

Laboratory Instrument Calibration

Method requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the analytes of interest. Initial calibration verification demonstrates that the instrument is capable of acceptable performance at the beginning of the analytical run. Continuing calibration verification demonstrates that the initial calibration is still valid by checking the performance of the instrument on a continuing basis. Initial and continuing calibration standards must be prepared from independent sources to ensure the validity of the calibration. All laboratory instrument calibrations and calibration verifications were performed correctly in accordance with the cited methods.

Method SW-846 8260 LL Volatile Organics, VOA
Initial calibrations of instrument VOA2 was performed on January 29-30 and February, 2-3, 2020, using nine calibration standards. Calibration curves are established using linear regression, quadratic regression, or the average response factor approach. Calibrations using average

response factors had relative standard deviations of less than 15 percent. Linear or higher order regression calibrations had correlation coefficient values greater than 0.99 and intercepts less than 3 times the MDL. Initial and continuing calibration verification checks were made at the required frequency. Some target compounds had percent drift values greater than 20 percent but were not detected at concentrations greater than the MDL in the associated samples The mass spectrometer calibration and resolution was checked at the beginning of each analytical run in accordance with the procedure.

Volatiles Internal Standards and Surrogates

The volatile internal standard recoveries and surrogate recoveries were within the acceptance ranges for all samples.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis. All method blank and calibration blank results associated with the samples were below the PQL for all analytes. In cases where the blank concentration exceeds the MDL, associated sample results that are greater than the MDL but less than 5 times the blank concentration are qualified with a U flag as not detected.

Matrix Spike Analysis

Matrix spikes are aliquots of environmental samples to which a known concentration of analyte has been added before analysis. Matrix spike and matrix spike duplicate (MS/MSD) analysis is used to assess the performance of the method by measuring the effects of interferences caused by the sample matrix and reflects the bias of the method for the particular matrix in question. Matrix spike data are not evaluated when the concentration of the unspiked sample is greater than 4 times the spike concentration. The matrix spike recoveries met the acceptance criteria for all analytes evaluated with the following exception. Several spike recoveries for the sample from location 0617 were above the acceptance range. The associated sample results were nondetects so no qualification was necessary.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for results that are greater than 5 times the PQL should be less than 20 percent (or less than the laboratory-derived control limits for organics). For results that are less than 5 times the PQL, the range should be no greater than the PQL. The replicate results met these criteria The MS/MSD pairs for chloromethane and vinyl chloride were above the RPD criteria at location 0617. The associated sample results were qualified with a J flag as estimated values.
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Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample

preparation. All control sample results were acceptable with the following exception. The recovery for cis-1,3-dichlropropene in one LCS was above the acceptance range. The associated sample results were nondetects so no qualification was necessary.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers. The analytical report included the MDL and PQL for all analytes and all required supporting documentation.

Electronic Data Deliverable (EDD) File

The EDD file arrived on February 26, 2020. The EDD was examined to verify that the file was complete and in compliance with requirements. The contents of the file were compared to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Trip Blank

Trip blanks were prepared and analyzed to document contamination attributable to shipping and field handling procedures. This type of blank is useful in documenting contamination of volatile organic samples. One trip blank was submitted with these samples. Acetone, 2-butanone, chlorobenzene, and 1,2-dichloroethane were detected in one or more of the trip blanks. Associated results greater than the MDL and less than 5 times the trip blank concentration (10 times for common laboratory contaminants) were qualified with a U flag as not detected.

Field Duplicate

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates, which measure only laboratory performance. A duplicate sample was collected from location P064. The relative percent difference for duplicate results that are greater than 5 times the PQL should be less than 20 percent. For results that are less than 5 times the PQL, the range should be no greater than the PQL. The duplicate results met the criteria, demonstrating acceptable overall precision.

Field Measurements

The pre-sampling purge criteria were met for all wells. A turbidity less than 50 NTU could not be achieved at monitoring well 0353.

Outliers Report

Potential outliers are results that lie outside the historical range, possibly due to transcription errors, data calculation errors, or measurement system problems. However, outliers can also represent true values outside the historical range. Potential outliers are identified by generating the Data Validation Outliers Report from data in the environmental database. The new data are compared to historical values and data that fall outside the historical data range are listed on the report along with the historical minimum and maximum values. The potential outliers are further

reviewed and may be subject to statistical evaluation using the ProUCL application developed by the EPA (https://www.epa.gov/land-research/proucl-software). The review also includes an evaluation of any notable trends in the data that may indicate the outliers represent true extreme values.

No laboratory results from this sampling event were identified as potential outliers. The data for this task are acceptable as qualified.

LESLIE STEVES (Affiliate)

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Date: 2020.03.25 10:19:56 -06'00'

Report Prepared By: _____

Peter Steves
Data Validator

Data Validation Outliers Report - No Field Parameters **Report Date: 03/20/2020**

Comparison to Historical Data Since: 1/1/2010 12:00:00 AM Fraction: Any

Task: MND01-02.2001006

Analyte	Location	Analysis Location	Units	Fraction	Result	Lab Qualifier(s)	Type	HistMIN	HistMAX	HistSetSize	Outlier?
Tetrachloroethene	P064	LB	ug/L	N	1.05		> HistMAX	0.67	1.02	10	No

FRACTION: D = Dissolved N = NA T = Total

General Data Validation Report

Task Code: MND01-02.2001006 **Lab Code:** GEN **Validator:** Peter Steves **Validation Date:** 03-20-2020

Project: LTS&M (Phase I) **# Samples:** 9

Analysis Type: [ ] General Chemistry [ ] Metals [X] Organics [ ] Radiochemistry

Chain of Custody	*Sample*
Present: OK Signed: OK Dated: OK	Integrity: OK Preservation OK Temperature: OK

Check	Summary
Holding Times:	All analyses were completed within the applicable holding times.
Detection Limits:	The reported detection limits are equal to or below the contract required limits.
Field Blanks:	There was 1 field blank associated with this task.
Field Duplicates:	There was 1 duplicate evaluated.

Validation Report: Field Blanks

20-Mar-2020

Project: LTS&M (Phase I) **Task Code:** MND01-02.2001006 **Lab Code:** GEN

Blank Type	Sample Code	Location	Method	Analyte	Result	Lab Qualifiers
TB	MND01-02.2001006-010	0999	SW-846 8260	1,2-Dichloroethane	0.170	BJ

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-02.2001006-001	0353	0.190	1	BJ	U
MND01-02.2001006-004	0411	0.180	1	BJ	U
MND01-02.2001006-005	0443	0.180	1	BJ	U
MND01-02.2001006-006	0444	0.180	1	BJ	U
MND01-02.2001006-007	0445	0.190	1	BJ	U
MND01-02.2001006-008	0617	0.200	1	BJ	U
MND01-02.2001006-012	P064	0.190	1	BJ	U
MND01-02.2001006-013	P064	0.190	1	BJ	U

Validation Report: Field Blanks

Project: LTS&M (Phase I) **Task Code:** MND01-02.2001006 **Lab Code:** GEN

TB	MND01-02.2001006-010	0999	SW-846 8260	2-Butanone	0.900	J

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-02.2001006-001	0353	0.500	1	U	
MND01-02.2001006-004	0411	0.500	1	U	
MND01-02.2001006-005	0443	0.500	1	U	
MND01-02.2001006-006	0444	0.500	1	U	
MND01-02.2001006-007	0445	0.500	1	U	
MND01-02.2001006-008	0617	0.500	1	U	
MND01-02.2001006-012	P064	0.500	1	U	
MND01-02.2001006-013	P064	0.500	1	U	U

Validation Report: Field Blanks

Project: LTS&M (Phase I) **Task Code:** MND01-02.2001006 **Lab Code:** GEN

TB	MND01-02.2001006-010	0999	SW-846 8260	Acetone	9.39	

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-02.2001006-001	0353	0.500	1	U	
MND01-02.2001006-004	0411	0.500	1	U	
MND01-02.2001006-005	0443	0.500	1	U	
MND01-02.2001006-006	0444	0.500	1	U	
MND01-02.2001006-007	0445	1.19	1	J	U
MND01-02.2001006-008	0617	2.68	1	BJ	U
MND01-02.2001006-012	P064	0.500	1	U	
MND01-02.2001006-013	P064	0.500	1	U	U

Validation Report: Field Blanks

Project: LTS&M (Phase I) **Task Code:** MND01-02.2001006 **Lab Code:** GEN

TB	MND01-02.2001006-010	0999	SW-846 8260	Chlorobenzene	0.420	J

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-02.2001006-001	0353	0.160	1	U	
MND01-02.2001006-004	0411	0.160	1	U	
MND01-02.2001006-005	0443	0.160	1	U	
MND01-02.2001006-006	0444	0.160	1	U	
MND01-02.2001006-007	0445	0.160	1	U	
MND01-02.2001006-008	0617	0.160	1	U	
MND01-02.2001006-012	P064	0.160	1	U	
MND01-02.2001006-013	P064	0.160	1	U	U

Validation Report: Field Duplicates

20-Mar-2020

Project: LTS&M (Phase I) **Task Code:** MND01-02.2001006 Lab Code: GEN

	Duplicate: MND01-02.2001006-013				Sample: MND01-02.2001006-012 P064						
Analyte	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**RPD**	**RER**	**Units**
1,1,1,2-Tetrachloroethane	0.160	U		1	0.160	U		1			ug/L
1,1,1-Trichloroethane	0.160	U		1	0.160	U		1			ug/L
1,1,2,2-Tetrachloroethane	0.160	U		1	0.160	U		1			ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	1.50	U		1	1.50	U		1			ug/L
1,1,2-Trichloroethane	0.160	U		1	0.160	U		1			ug/L
1,1-Dichloroethane	0.160	U		1	0.160	U		1			ug/L
1,1-Dichloroethene	0.160	U		1	0.160	U		1			ug/L
1,1-Dichloropropene	0.160	U		1	0.160	U		1			ug/L
1,2,3-Trichlorobenzene	0.200	U		1	0.200	U		1			ug/L
1,2,3-Trichloropropane	0.160	U		1	0.160	U		1			ug/L
1,2,4-Trichlorobenzene	0.160	U		1	0.160	U		1			ug/L
1,2,4-Trimethylbenzene	0.160	U		1	0.160	U		1			ug/L
1,2-Dibromo-3-chloropropane	0.160	U		1	0.160	U		1			ug/L
1,2-Dibromoethane	0.160	U		1	0.160	U		1			ug/L
1,2-Dichlorobenzene	0.160	U		1	0.160	U		1			ug/L
1,2-Dichloroethane	0.190	BJ		1	0.190	U		1			ug/L
1,2-Dichloropropane	0.160	U		1	0.160	U		1			ug/L
1,3,5-Trimethylbenzene	0.160	U		1	0.160	U		1			ug/L

QC Checks: RPD: Relative Percent Difference RER: Relative Error Ratio

Validation Report: Field Duplicates

Project: LTS&M (Phase I) **Task Code:** MND01-02.2001006 Lab Code: GEN

	Duplicate: MND01-02.2001006-013				Sample: MND01-02.2001006-012 P064						
Analyte	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**RPD**	**RER**	**Units**
1,3-Dichlorobenzene	0.160	U		1	0.160	U		1			ug/L
1,3-Dichloropropane	0.160	U		1	0.160	U		1			ug/L
1,4-Dichlorobenzene	0.160	U		1	0.160	U		1			ug/L
2,2-Dichloropropane	0.160	U		1	0.160	U		1			ug/L
2-Butanone	0.500	U		1	0.500	U		1			ug/L
2-Chlorotoluene	0.160	U		1	0.160	U		1			ug/L
2-Hexanone	0.500	U		1	0.500	U		1			ug/L
4-Chlorotoluene	0.160	U		1	0.160	U		1			ug/L
4-Methyl-2-Pentanone	0.500	U		1	0.500	U		1			ug/L
Acetone	0.500	U		1	0.500	U		1			ug/L
Benzene	0.160	U		1	0.160	U		1			ug/L
Bromobenzene	0.160	U		1	0.160	U		1			ug/L
Bromochloromethane	0.160	U		1	0.160	U		1			ug/L
Bromodichloromethane	0.160	U		1	0.160	U		1			ug/L
Bromoform	0.160	U		1	0.160	U		1			ug/L
Bromomethane	0.160	U		1	0.160	U		1			ug/L
Carbon Disulfide	0.500	U		1	0.500	U		1			ug/L
Carbon tetrachloride	0.160	U		1	0.160	U		1			ug/L
Chlorobenzene	0.160	U		1	0.160	U		1			ug/L
Chlorodibromomethane	0.160	U		1	0.160	U		1			ug/L

QC Checks: RPD: Relative Percent Difference RER: Relative Error Ratio

Validation Report: Field Duplicates

Project: LTS&M (Phase I) **Task Code:** MND01-02.2001006 Lab Code: GEN

	Duplicate: MND01-02.2001006-013				Sample: MND01-02.2001006-012 P064						
Analyte	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**RPD**	**RER**	**Units**
Chloroethane	0.160	U		1	0.160	U		1			ug/L
Chloroform	0.160	U		1	0.160	U		1			ug/L
Chloromethane	0.160	U		1	0.160	U		1			ug/L
cis-1,2-Dichloroethene	0.300	J		1	0.290	U		1			ug/L
cis-1,3-Dichloropropene	0.160	U		1	0.160	U		1			ug/L
Dibromomethane	0.160	U		1	0.160	U		1			ug/L
Dichlorodifluoromethane	0.160	U		1	0.160	U		1			ug/L
Ethylbenzene	0.160	U		1	0.160	U		1			ug/L
Hexachlorobutadiene	0.160	U		1	0.160	U		1			ug/L
Isopropylbenzene	0.160	U		1	0.160	U		1			ug/L
Methylene chloride	0.160	U		1	0.160	U		1			ug/L
n-Butylbenzene	0.160	U		1	0.160	U		1			ug/L
n-Propylbenzene	0.160	U		1	0.160	U		1			ug/L
Naphthalene	0.160	U		1	0.160	U		1			ug/L
p-Isopropyltoluene	0.160	U		1	0.160	U		1			ug/L
sec-Butylbenzene	0.160	U		1	0.160	U		1			ug/L
Styrene	0.160	U		1	0.160	U		1			ug/L
tert-Butylbenzene	0.160	U		1	0.160	U		1			ug/L
Tetrachloroethene	1.02			1	1.05			1	2.9		ug/L
Toluene	0.160	U		1	0.160	U		1			ug/L

QC Checks: RPD: Relative Percent Difference RER: Relative Error Ratio

Validation Report: Field Duplicates

20-Mar-2020

Project: LTS&M (Phase I) **Task Code:** MND01-02.2001006 Lab Code: GEN

	Duplicate: MND01-02.2001006-013				Sample: MND01-02.2001006-012 P064						
Analyte	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**RPD**	**RER**	**Units**
Total Xylenes	0.160	U		1	0.160	U		1			ug/L
trans-1,2-Dichloroethene	0.160	U		1	0.160	U		1			ug/L
trans-1,3-dichloropropene	0.160	U		1	0.160	U		1			ug/L
Trichloroethene	0.610	J		1	0.670	U		1			ug/L
Trichlorofluoromethane	0.160	U		1	0.160	U		1			ug/L
Vinyl chloride	0.160	U		1	0.160	U		1			ug/L

QC Checks: RPD: Relative Percent Difference RER: Relative Error Ratio

Organics Data Validation Summary

20-Mar-2020

Project: LTS&M (Phase I)

Task Code: MND01-02.2001006

Lab Code: GEN

Surrogate Recovery:	All surrogate recoveries were within the laboratory acceptance limits.
LCS/LCSD Performance:	There was 1 LCS/LCSD result outside the laboratory acceptance limits.
MS/MSD Performance:	There were 9 MS/MSD results outside the laboratory acceptance limits.
Method Blank Performance:	There were 5 method blank results above the MDL.

Noncompliance Report: Method Blanks

20-Mar-2020

Project: LTS&M (Phase I) **Task Code:** MND01-02.2001006 **Lab Code:** GEN

Method Blank ID	Date Analyzed	Method	Analyte	Result	Lab Qualifiers	Comment
	01-30-2020	SW-846 8260	1,2-Dichloroethane	0.220	J	
	01-31-2020	SW-846 8260	1,2-Dichloroethane	0.200	J	
	02-04-2020	SW-846 8260	1,2-Dichloroethane	0.210	J	
	01-30-2020	SW-846 8260	Acetone	0.990	J	
	02-04-2020	SW-846 8260	Methylene chloride	0.200	J	

Noncompliance Report: LCS/LCSD Performance

20-Mar-2020

Project: LTS&M (Phase I) **Task Code:** MND01-02.2001006 **Lab Code:** GEN

Sample ID	Date Analyzed	Method	Analyte	LCS Recovery	LCSD recovery	Lower Limit	Upper Limit	RPD	RPD Limit	Comment
	01-30-2020	SW-846 8260	cis-1,3-Dichloropropene	125		80	124			

Noncompliance Report: MS/MSD Performance

Project: LTS&M (Phase I) **Task Code:** MND01-02.2001006 **Lab Code:** GEN

Sample ID	Date Analyzed	Method	Analyte	MS Recovery	MSD Recovery	Lower Limit	Upper Limit	RPD	RPD Limit	Comment
	01-31-2020	SW-846 8260	1,1,1-Trichloroethane		131	72	128	7	20	
	01-31-2020	SW-846 8260	2,2-Dichloropropane	127		71	125			
	01-31-2020	SW-846 8260	2,2-Dichloropropane		131	71	125	3	20	
	01-31-2020	SW-846 8260	Bromodichloromethane		134	78	125	9	20	
	01-31-2020	SW-846 8260	Carbon tetrachloride		140	75	128	12	20	
	01-31-2020	SW-846 8260	Chloromethane		148	59	147	29	20	
	01-31-2020	SW-846 8260	Dichlorodifluoromethane		154	56	152	9	20	
	01-31-2020	SW-846 8260	Hexachlorobutadiene		131	65	123	9	20	
	01-31-2020	SW-846 8260	Vinyl chloride		149	65	145	29	20	

NAVARRO

Contractor to the U.S. Department of Energy Office of Legacy Management

Data Review and Validation Report

General Information

Task Code:	MND01-02.2008007
Sample Event:	August 17 and 18, 2020
Site(s):	Mound, Ohio: LTS&M (Phase I)
Laboratory:	GEL Laboratories, Charleston, South Carolina
Work Order No.:	519054
Analysis:	Organics
Validator:	Samantha Tigar
Review Date:	September 30, 2020

This validation was performed according to *Environmental Data Validation Procedure* (LMS/PRO/S15870), which is available at https://documentmanagement.share.lm.doe.gov/ControlledDocuments/Controlled%20Documents/S15870_Env_DV_Procedure.pdf. The procedure was applied at Level 3, Data Validation.

This validation includes the evaluation of data quality indicators (DQIs) associated with the data. DQIs are the quantitative and qualitative descriptors that are used to interpret the degree of acceptability or utility of data. Indicators of data quality include the analysis of laboratory control samples to assess accuracy; duplicates and replicates to assess precision; and interference check samples to assess bias (see attached Data Validation Worksheets). The comparability, completeness, and sensitivity of the data are also evaluated in the sections to follow.

All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Volatile Organics, VOA	VOA-A-007	SW-846 5030B	SW-846 8260 LL

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the attached validation worksheets and the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifiers

Sample Number	Location	Analyte	Flag	Reason
MND01-02.2008007-008	0617	2-Butanone	U	Less than 10 times the trip blank
MND01-02.2008007-001 to MND01-02.2008007-008	Various	Acetone	U	Less than 10 times the trip blank
MND01-02.2008007-013	P064	Acetone	U	Less than 10 times the trip blank
MND01-02.2008007-004	0411	Methylene chloride	U	Less than 10 times the trip blank
MND01-02.2008007-005	0443	Methylene chloride	U	Less than 10 times the trip blank
MND01-02.2008007-006	0444	Methylene chloride	U	Less than 10 times the trip blank
MND01-02.2008007-007	0445	Methylene chloride	U	Less than 10 times the trip blank

Sample Shipping/Receiving

GEL Laboratories in Charleston, South Carolina, received 10 water samples on August 19, 2020, accompanied by a Chain of Custody (COC) form. The air waybill numbers were listed on the Sample Receipt and Review Form. The COC form was checked to confirm that all of the samples were listed with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The COC forms were complete with no errors or omissions.

Preservation and Holding Times

The sample shipments were received intact with the temperatures inside the iced cooler at 2 °C, which complies with requirements. All samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all analytes as required. The MDL, as defined in Title 40 *Code of Federal Regulations* Section 136, is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured and is defined as 5 times the MDL. The reported MDLs for all analytes met the detection limits requirements.

Laboratory Instrument Calibration

Method requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the analytes of interest. Initial calibration verification demonstrates that the instrument is capable of acceptable performance at the beginning of the analytical run. Continuing calibration verification demonstrates that the initial calibration is still valid by checking the performance of the instrument on a continuing basis. Initial and continuing calibration standards must be prepared from independent sources to ensure the validity of the calibration. All laboratory instrument calibrations and calibration verifications were performed correctly in accordance with the cited methods.

Method SW-846 8260 LL Volatile Organics, VOA
Initial calibrations of instrument VOA2 was performed on July 22 and 23, 2020, using nine calibration standards. Calibration curves are established using linear regression, quadratic regression, or the average response factor approach. Calibrations using average response factors had relative standard deviations of less than 15 percent. Linear or higher order regression calibrations had correlation coefficient values greater than 0.99 and intercepts less than 3 times the MDL. Initial and continuing calibration verification checks were made at the required frequency. Some target compounds had percent drift values greater than 20 percent but were not detected at concentrations greater than the MDL in the associated samples. The mass spectrometer calibration and resolution was checked at the beginning of each analytical run in accordance with the procedure.

Volatiles Internal Standards and Surrogates

The volatile internal standard recoveries and surrogate recoveries were within the acceptance ranges for all samples.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis. All method blank and calibration blank results associated with the samples were below the PQL for all analytes. In cases where the blank concentration exceeds the MDL, associated sample results that are greater than the MDL but less than 5 times the blank concentration are qualified with a U flag as not detected.

Matrix Spike Analysis

Matrix spikes are aliquots of environmental samples to which a known concentration of analyte has been added before analysis. Matrix spike and matrix spike duplicate (MS/MSD) analysis is used to assess the performance of the method by measuring the effects of interferences caused by the sample matrix and reflects the bias of the method for the particular matrix in question. Matrix spike data are not evaluated when the concentration of the unspiked sample is greater than 4 times the spike concentration. The matrix spike recoveries met the acceptance criteria for all analytes evaluated.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for results that are greater than 5 times the PQL should be less than 20 percent (or less than the laboratory-derived control limits for organics). For results that are less than 5 times the PQL, the range should be no greater than the PQL. The replicate results met these criteria, demonstrating acceptable overall precision.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. All control sample results were acceptable.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers. The analytical report included the MDL and PQL for all analytes and all required supporting documentation.

Electronic Data Deliverable (EDD) File

The EDD file arrived on September 15, 2020. The EDD was examined to verify that the file was complete and in compliance with requirements. The contents of the file were compared to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Trip Blank

Trip blanks were prepared and analyzed to document contamination attributable to shipping and field handling procedures. This type of blank is useful in documenting contamination of volatile organic samples. Two trip blanks were submitted with these samples. Acetone, 2-butanone, chlorobenzene, methylene chloride, and vinyl chloride were detected in one or more of the trip blanks. Associated results greater than the MDL and less than 5 times the trip blank concentration (10 times for common laboratory contaminants) were qualified with a U flag as not detected.

Field Duplicate

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates, which measure only laboratory performance. A duplicate sample was collected from location P064. The relative percent difference for duplicate results that are greater than 5 times the PQL should be less than 20 percent. For results that are less than 5 times the PQL, the range should be no greater than the PQL. The duplicate results met the criteria, demonstrating acceptable overall precision.

Field Measurements

The pre-sampling purge criteria were met for all wells. A turbidity less than 50 NTU was not achieved at monitoring wells 0353 and 0411.

Outliers Report

Potential outliers are results that lie outside the historical range, possibly due to transcription errors, data calculation errors, or measurement system problems. However, outliers can also represent true values outside the historical range. Potential outliers are identified by generating the Data Validation Outliers Report from data in the environmental database. The new data are compared to historical values and data that fall outside the historical data range are listed on the report along with the historical minimum and maximum values. The potential outliers are further reviewed and may be subject to statistical evaluation using the ProUCL application developed by the EPA (https://www.epa.gov/land-research/proucl-software). The review also includes an

evaluation of any notable trends in the data that may indicate the outliers represent true extreme values.

Three laboratory results from this sampling event were identified as potential outliers. These outliers were qualified as not detected during validation and no further qualification was necessary. The data for this task are acceptable as qualified.

Report Prepared By: Digitally signed by SAMANTHA TIGAR (Affiliate)
Date: 2020.09.30 13:10:59 -06'00'

Samantha Tigar
Data Validator

Data Validation Outliers Report - No Field Parameters **Report Date: 09/29/2020**

Comparison to Historical Data Since: 1/1/2009 12:00:00 AM Fraction: Any

Task: MND01-02.2008007

Analyte	Location	Analysis Location	Units	Fraction	Result	Lab Qualifier(s)	Type	HistMIN	HistMAX	HistSetSize	Outlier?
2-Butanone	0617	LB	ug/L	N	2.74	J	> HistMAX	0.5	1.98	24	Yes
Acetone	0444	LB	ug/L	N	3.87	J	> HistMAX	0.5	2.45	23	Yes
Acetone	0445	LB	ug/L	N	3.31	J	> HistMAX	0.5	2.29	23	No
Acetone	P064	LB	ug/L	N	1.84	J	> HistMAX	0.5	0.5	12	Yes
Tetrachloroethene	P064	LB	ug/L	N	1.24		> HistMAX	0.67	1.16	12	No

FRACTION: D = Dissolved N = NA T = Total

General Data Validation Report

Task Code: MND01-02.2008007 **Lab Code:** GEN **Validator:** Samantha Tigar **Validation Date:** 09-29-2020

Project: LTS&M (Phase I) **# Samples:** 10

Analysis Type: [ ] General Chemistry [ ] Metals [X] Organics [ ] Radiochemistry

Chain of Custody	*Sample*
Present: OK Signed: OK Dated: OK	Integrity: OK Preservation OK Temperature: OK

Check	Summary
Holding Times:	All analyses were completed within the applicable holding times.
Detection Limits:	The reported detection limits are equal to or below the contract required limits.
Field Blanks:	There were 2 field blanks associated with this task.
Field Duplicates:	There was 1 duplicate evaluated.

Validation Report: Field Blanks

29-Sep-2020

Project: LTS&M (Phase I) **Task Code:** MND01-02.2008007 **Lab Code:** GEN

Blank Type	Sample Code	Location	Method	Analyte	Result	Lab Qualifiers
TB	MND01-02.2008007-010	0999	SW-846 8260	2-Butanone	1.99	J

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-02.2008007-004	0411	0.500	1	U	
MND01-02.2008007-005	0443	0.500	1	U	
MND01-02.2008007-006	0444	0.500	1	U	
MND01-02.2008007-007	0445	0.500	1	U	

Validation Report: Field Blanks

29-Sep-2020

Project: LTS&M (Phase I) **Task Code:** MND01-02.2008007 **Lab Code:** GEN

TB	MND01-02.2008007-010	0999	SW-846 8260	Acetone	18.5	

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-02.2008007-004	0411	1.05	1	J	U
MND01-02.2008007-005	0443	1.72	1	J	U
MND01-02.2008007-006	0444	3.87	1	J	U
MND01-02.2008007-007	0445	3.31	1	J	U

Project: LTS&M (Phase I) **Task Code:** MND01-02.2008007 **Lab Code:** GEN

TB	MND01-02.2008007-010	0999	SW-846 8260	Chlorobenzene	0.430	J

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-02.2008007-004	0411	0.160	1	U	
MND01-02.2008007-005	0443	0.160	1	U	
MND01-02.2008007-006	0444	0.160	1	U	
MND01-02.2008007-007	0445	0.160	1	U	

Project: LTS&M (Phase I) **Task Code:** MND01-02.2008007 **Lab Code:** GEN

TB	MND01-02.2008007-010	0999	SW-846 8260	Methylene chloride	0.520	BJ

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-02.2008007-004	0411	0.350	1	BJ	U
MND01-02.2008007-005	0443	0.330	1	BJ	U
MND01-02.2008007-006	0444	0.360	1	BJ	U
MND01-02.2008007-007	0445	0.380	1	BJ	U

Validation Report: Field Blanks

Project: LTS&M (Phase I) **Task Code:** MND01-02.2008007 **Lab Code:** GEN

TB	MND01-02.2008007-010	0999	SW-846 8260	Vinyl chloride	0.400	J

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-02.2008007-004	0411	0.160	1	U	
MND01-02.2008007-005	0443	0.160	1	U	
MND01-02.2008007-006	0444	0.160	1	U	
MND01-02.2008007-007	0445	0.160	1	U	

Validation Report: Field Blanks

Project: LTS&M (Phase I) **Task Code:** MND01-02.2008007 **Lab Code:** GEN

TB	MND01-02.2008007-011	0999	SW-846 8260	2-Butanone	1.99	J

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-02.2008007-001	0353	0.500	1	U	
MND01-02.2008007-008	0617	2.74	1	J	U
MND01-02.2008007-012	P064	0.500	1	U	
MND01-02.2008007-013	P064	0.500	1	U	U

Validation Report: Field Blanks

Project: LTS&M (Phase I) **Task Code:** MND01-02.2008007 **Lab Code:** GEN

TB	MND01-02.2008007-011	0999	SW-846 8260	Acetone	20.0	

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-02.2008007-001	0353	0.670	1	J	U
MND01-02.2008007-008	0617	3.33	1	J	U
MND01-02.2008007-012	P064	0.500	1	U	
MND01-02.2008007-013	P064	1.84	1	J	U

Validation Report: Field Blanks

Project: LTS&M (Phase I) **Task Code:** MND01-02.2008007 **Lab Code:** GEN

TB	MND01-02.2008007-011	0999	SW-846 8260	Methylene chloride	0.310	BJ

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-02.2008007-001	0353	0.160	1	U	
MND01-02.2008007-008	0617	0.160	1	U	
MND01-02.2008007-012	P064	0.160	1	U	
MND01-02.2008007-013	P064	0.160	1	U	U

Validation Report: Field Blanks

Project: LTS&M (Phase I) **Task Code:** MND01-02.2008007 **Lab Code:** GEN

TB	MND01-02.2008007-011	0999	SW-846 8260	Vinyl chloride	0.390	J

Associated Samples:

Sample Code	Location	Result	Dilution	Lab Qualifiers	Validation Qualifier
MND01-02.2008007-001	0353	0.160	1	U	
MND01-02.2008007-008	0617	0.160	1	U	
MND01-02.2008007-012	P064	0.160	1	U	
MND01-02.2008007-013	P064	0.160	1	U	U

Validation Report: Field Duplicates

29-Sep-2020

Project: LTS&M (Phase I) **Task Code:** MND01-02.2008007 Lab Code: GEN

	Duplicate: MND01-02.2008007-013				Sample: MND01-02.2008007-012 P064						
Analyte	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**RPD**	**RER**	**Units**
1,1,1,2-Tetrachloroethane	0.160	U		1	0.160	U		1			ug/L
1,1,1-Trichloroethane	0.160	U		1	0.160	U		1			ug/L
1,1,2,2-Tetrachloroethane	0.160	U		1	0.160	U		1			ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	1.50	U		1	1.50	U		1			ug/L
1,1,2-Trichloroethane	0.160	U		1	0.160	U		1			ug/L
1,1-Dichloroethane	0.160	U		1	0.160	U		1			ug/L
1,1-Dichloroethene	0.160	U		1	0.160	U		1			ug/L
1,1-Dichloropropene	0.160	U		1	0.160	U		1			ug/L
1,2,3-Trichlorobenzene	0.200	U		1	0.200	U		1			ug/L
1,2,3-Trichloropropane	0.160	U		1	0.160	U		1			ug/L
1,2,4-Trichlorobenzene	0.160	U		1	0.160	U		1			ug/L
1,2,4-Trimethylbenzene	0.160	U		1	0.160	U		1			ug/L
1,2-Dibromo-3-chloropropane	0.160	U		1	0.160	U		1			ug/L
1,2-Dibromoethane	0.160	U		1	0.160	U		1			ug/L
1,2-Dichlorobenzene	0.160	U		1	0.160	U		1			ug/L
1,2-Dichloroethane	0.160	U		1	0.160	U		1			ug/L
1,2-Dichloropropane	0.160	U		1	0.160	U		1			ug/L
1,3,5-Trimethylbenzene	0.160	U		1	0.160	U		1			ug/L

QC Checks: RPD: Relative Percent Difference RER: Relative Error Ratio

Validation Report: Field Duplicates

Project: LTS&M (Phase I) **Task Code:** MND01-02.2008007 Lab Code: GEN

	Duplicate: MND01-02.2008007-013				Sample: MND01-02.2008007-012 P064						
Analyte	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**RPD**	**RER**	**Units**
1,3-Dichlorobenzene	0.160	U		1	0.160	U		1			ug/L
1,3-Dichloropropane	0.160	U		1	0.160	U		1			ug/L
1,4-Dichlorobenzene	0.160	U		1	0.160	U		1			ug/L
2,2-Dichloropropane	0.160	U		1	0.160	U		1			ug/L
2-Butanone	0.500	U		1	0.500	U		1			ug/L
2-Chlorotoluene	0.160	U		1	0.160	U		1			ug/L
2-Hexanone	0.500	U		1	0.500	U		1			ug/L
4-Chlorotoluene	0.160	U		1	0.160	U		1			ug/L
4-Methyl-2-Pentanone	0.500	U		1	0.500	U		1			ug/L
Acetone	1.84	J		1	0.500	U		1			ug/L
Benzene	0.160	U		1	0.160	U		1			ug/L
Bromobenzene	0.160	U		1	0.160	U		1			ug/L
Bromochloromethane	0.160	U		1	0.160	U		1			ug/L
Bromodichloromethane	0.160	U		1	0.160	U		1			ug/L
Bromoform	0.160	U		1	0.160	U		1			ug/L
Bromomethane	0.160	U		1	0.160	U		1			ug/L
Carbon Disulfide	0.500	U		1	0.500	U		1			ug/L
Carbon tetrachloride	0.160	U		1	0.160	U		1			ug/L
Chlorobenzene	0.160	U		1	0.160	U		1			ug/L
Chlorodibromomethane	0.160	U		1	0.160	U		1			ug/L

QC Checks: RPD: Relative Percent Difference RER: Relative Error Ratio

Validation Report: Field Duplicates

Project: LTS&M (Phase I) **Task Code:** MND01-02.2008007 Lab Code: GEN

	Duplicate: MND01-02.2008007-013				Sample: MND01-02.2008007-012 P064						
Analyte	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**RPD**	**RER**	**Units**
Chloroethane	0.160	U		1	0.160	U		1			ug/L
Chloroform	0.160	U		1	0.160	U		1			ug/L
Chloromethane	0.160	U		1	0.160	U		1			ug/L
cis-1,2-Dichloroethene	0.160	U		1	0.160	U		1			ug/L
cis-1,3-Dichloropropene	0.160	U		1	0.160	U		1			ug/L
Dibromomethane	0.160	U		1	0.160	U		1			ug/L
Dichlorodifluoromethane	0.160	U		1	0.160	U		1			ug/L
Ethylbenzene	0.160	U		1	0.160	U		1			ug/L
Hexachlorobutadiene	0.160	U		1	0.160	U		1			ug/L
Isopropylbenzene	0.160	U		1	0.160	U		1			ug/L
Methylene chloride	0.160	U		1	0.160	U		1			ug/L
n-Butylbenzene	0.160	U		1	0.160	U		1			ug/L
n-Propylbenzene	0.160	U		1	0.160	U		1			ug/L
Naphthalene	0.160	U		1	0.160	U		1			ug/L
p-Isopropyltoluene	0.160	U		1	0.160	U		1			ug/L
sec-Butylbenzene	0.160	U		1	0.160	U		1			ug/L
Styrene	0.160	U		1	0.160	U		1			ug/L
tert-Butylbenzene	0.160	U		1	0.160	U		1			ug/L
Tetrachloroethene	1.16			1	1.24			1	6.7		ug/L
Toluene	0.160	U		1	0.160	U		1			ug/L

QC Checks: RPD: Relative Percent Difference RER: Relative Error Ratio

Validation Report: Field Duplicates

Project: LTS&M (Phase I) **Task Code:** MND01-02.2008007 Lab Code: GEN

	Duplicate: MND01-02.2008007-013				Sample: MND01-02.2008007-012 P064						
Analyte	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**RPD**	**RER**	**Units**
Total Xylenes	0.160	U		1	0.160	U		1			ug/L
trans-1,2-Dichloroethene	0.160	U		1	0.160	U		1			ug/L
trans-1,3-dichloropropene	0.160	U		1	0.160	U		1			ug/L
Trichloroethene	0.560	J		1	0.570	U		1			ug/L
Trichlorofluoromethane	0.160	U		1	0.160	U		1			ug/L
Vinyl chloride	0.160	U		1	0.160	U		1			ug/L

QC Checks: RPD: Relative Percent Difference RER: Relative Error Ratio

Organics Data Validation Summary

29-Sep-2020

Project: LTS&M (Phase I)

Task Code: MND01-02.2008007

Lab Code: GEN

Surrogate Recovery:	All surrogate recoveries were within the laboratory acceptance limits.
LCS/LCSD Performance:	All LCS/LCSD results were within the laboratory acceptance limits.
MS/MSD Performance:	All MS/MSD results were within the laboratory acceptance limits.
Method Blank Performance:	All method blanks were below the MDL.