



Direct Dial: (804) 550-9222  
bhundley@resourceintl.com  
<http://www.resourceintl.com>

January 10, 2019

P.N. 97007.12

Mr. Dean Starook  
Virginia Department of Environmental Quality  
Piedmont Regional Office  
4949-A Cox Road  
Glen Allen, Virginia 23060

**RE: Goochland County Landfill, Permit No. 179  
Termination of Post Closure Activity Evaluation**

Dear Mr. Starook:

On behalf of Goochland County, Resource International, Ltd. (Resource) is pleased to submit the attached Termination of Post-Closure Activity Evaluation in support of the County's request for the termination of groundwater monitoring at the Permit No. 179 Landfill. Per our discussions, Resource has included an additional Attachment that details the confirmatory groundwater analyses at MW-14 during 2018.

Goochland County will continue to conduct monitoring in accordance with the Post-Closure Care requirements of 9VAC 20-81-170 until such time as partial or total relief from these actions is granted by the Director.

Please contact me if you have questions or comments.

Sincerely,

A handwritten signature in black ink, appearing to read "Robert L. Hundley, Jr.", is written over a light blue horizontal line.

Robert L. Hundley, Jr., P.E.  
Project Manager

/kmp

Attachments

cc: Leigh Dunn, Goochland County  
John Budesky, Goochland County

**P.O. Box 6160 \* 9560 Kings Charter Drive \* Ashland, VA 23005  
(804) 550-9200 \* (804) 550-9259 FAX  
[www.resourceintl.com](http://www.resourceintl.com)**

**TERMINATION OF POST-CLOSURE ACTIVITY EVALUATION  
In Support of Request to Terminate Groundwater Monitoring  
GOOCHLAND COUNTY LANDFILL – PERMIT No. 179  
GOOCHLAND, VIRGINIA 23063  
(VDEQ – Piedmont Regional Office Jurisdiction)**

**Original Date: July 24, 2018  
Revised Date: January 10, 2019**

**PREPARED FOR**

***Goochland County  
1800 Sandy Hook Road, Suite 300  
Goochland, Virginia 23063***

**P.N. 97007.12**



**9 VAC 20-81-170.C.1.a**  
**ENGINEER'S STATEMENT**

I state to the best of my knowledge, information and belief, post-closure care monitoring and maintenance for groundwater has been completed in accordance with Section III (Post Closure Care Activities) of the approved Post Closure Care Plan dated November 2009, for Permit No. 179 issued to Goochland County, with the exception of the deficiencies noted below.

In addition, the facility has been evaluated in terms of its potential for harm to human health and the environment in the event that post-closure care activities are terminated. This statement is based, in part, on my review of the groundwater and landfill gas monitoring, and maintenance/inspection records for this facility. This certification is also based in part on my review of facility site observations conducted on:

October 29, 2007  
May 21, 2008  
May 20, 2009  
August 6, 2010  
July 19, 2011  
July 10, 2012

July 8, 2013  
May 2, 2014  
July 22, 2015  
April 18, 2016  
April 5, 2017

Observations of the facility included examination and review of vegetative cover, final cover, surface water management systems, gas monitoring systems, groundwater monitoring systems, and conditions identified in DEQ annual landfill inspection reports.

Attached to this statement is Resource International, Ltd.'s evaluation and professional opinion of the impact that discontinuing groundwater monitoring at the Goochland County Landfill, operated under Permit No. 179, will have on human health and the environment.

The following deficiencies were noted when reviewing the post-closure care period:

- Groundwater monitoring – no missing sampling event reports; however, DEQ correspondence identified late notification submissions, since corrected.



---

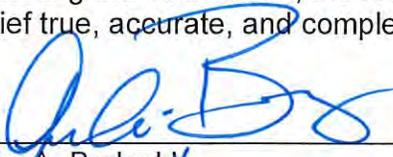
Robert L. Hundley, Jr., P.E.

---

July 24, 2018  
Date

**9 VAC 20-81-170.C.1.a**  
**OWNER REVIEW**

I certify under penalty of law that this document and attachments were prepared under my direction in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief true, accurate, and complete.

  
\_\_\_\_\_  
John A. Budeski  
Goochland County Administrator

7/24/18  
\_\_\_\_\_  
Date

## TABLE OF CONTENTS

SIGNATURE PAGE	
EXECUTIVE SUMMARY .....	1
1.0 INTRODUCTION .....	2
1.1 Purpose.....	2
1.2 Limitations.....	2
1.3 Terminology Used in This Evaluation.....	2
2.0 FACILITY HISTORY AND SITE DESCRIPTION .....	4
2.1 Waste Disposed.....	4
2.2 Dates of Operation .....	4
2.3 Closure Certification.....	4
2.4 Disposal Methods.....	4
2.5 Groundwater or Gas Corrective Action.....	4
2.6 Other Permits .....	5
2.7 Adjacent Land Use Over Time .....	5
3.0 GROUNDWATER EVALUATION .....	6
3.1 Potentiometric Map .....	6
3.2 Aquifer Recognition.....	6
3.3 Groundwater Flow Rate .....	6
3.4 Groundwater Monitoring Well Network.....	7
3.5 Groundwater Monitoring History.....	8
3.6 Groundwater Monitoring Requirements.....	9
3.7 Variances or Other DEQ Approvals.....	9
3.8 Discharges to Surface Water .....	9
3.9 Historical Impacts .....	9
3.10 Corrective Action .....	9
3.11 Groundwater Evaluation.....	10
3.11.1 Statistical Analysis.....	10
4.0 RISK ASSESSMENT .....	13
4.1 Potential Paths of Exposure (Human Receptors).....	13
4.1.1 Ingestion.....	13
4.1.2 Dermal Contact .....	13
4.1.3 Inhalation Contact .....	13
4.2 Potential Paths of Exposure (Environmental Receptors).....	14
4.3 Parent/Daughter Constituent Discussion.....	14
4.3.1 Chlorinated Alkenes .....	14
4.3.2 Chlorinated Benzenes .....	16

4.4	Potential Impact on Human Health and the Environment.....	17
4.5	Adjacent Property Impacts .....	17
5.0	SURFACE WATER EVALUATION .....	18
5.1	Surface Water Site Map .....	18
5.2	Surface Water Identification .....	18
5.3	Surface Water Impacts.....	18
5.4	Surface Water Monitoring Summary .....	18
6.0	GAS MANAGEMENT EVALUATION.....	19
7.0	STORM WATER MANAGEMENT .....	20
8.0	FINAL COVER SYSTEM ACTIVITES.....	21
8.1	FCS Maintenance Requirements .....	21
8.2	Historical FCS Maintenance .....	21
8.3	Impact of Discontinuing FCS Maintenance .....	22
9.0	MAINTENANCE OF MONITORING SYSTEMS & OTHER APPURTENANCES.....	23
10.0	OTHER APPLICABLE INFORMATION .....	24
11.0	FINANCIAL ASSURANCE.....	25

## FIGURES

- FIGURE 1 – SITE LOCATION MAP
- FIGURE 2 – POTENTIOMETRIC MAP
- FIGURE 3 – SURFACE WATER CONDITIONS

## ATTACHMENTS

- ATTACHMENT 1 – GROUNDWATER TREND ANALYSIS
- ATTACHMENT 2 – FINANCIAL ASSURANCE DEMONSTRATION
- ATTACHMENT 3 – 2018 LEAD ANALYSIS FOR MW-14

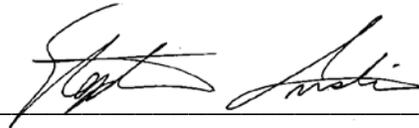
## SIGNATURE PAGE

*Report Prepared by:*

Stephen Anstine  
Senior Hydrogeologist  
Resource International, Ltd.  
P. O. Box 6160  
Ashland, VA 23005-6160  
Phone: 804-550-9221

The information contained in this report is accurate and complete to the best of my knowledge.

Signature: \_\_\_\_\_



## EXECUTIVE SUMMARY

Goochland County maintains a closed sanitary landfill under the Virginia Department of Environmental Quality (DEQ) Permit No. 179. This document has been prepared in support of a request for partial discontinuation of post-closure care. The post-closure care activities for which discontinuation is requested are

- Groundwater Monitoring

Groundwater monitoring activities have occurred in accordance with the facility's October 1994 Closure Plan, the November 2009 Post-Closure Care Plan and the Virginia Solid Waste Management Regulations.

The facility monitors groundwater under an assessment monitoring program and some constituents have been identified in excess of groundwater protection standards (GPS). However, no constituent has been detected in a concentration that exceeded GPS in a compliance well within the past three years. Statistical analysis of groundwater monitoring results detailed within the report reflects steady state or decreasing trends for a majority of detected parameters over time.

The landfill was constructed prior to the requirement for the provision of liners and leachate collection. Leachate generation has not been observed during the post-closure care period.

The facility does not operate under a VPDES permit, SWPPP or other environmental permit or control system.

The property is currently owned by the County and is used frequently as a soccer field or other passive recreational purposes, and this site use will continue.

Based on the evaluation presented herein, discontinuation of groundwater monitoring at the landfill is not anticipated to represent a threat to human health or the environment.

## **1.0 INTRODUCTION**

### **1.1 Purpose**

Goochland County maintains a closed sanitary landfill under the Virginia Department of Environmental Quality (DEQ) Permit No. 179. This document has been prepared in support of a request for partial discontinuation of post-closure care. The post-closure care activities for which discontinuation is requested are as follows:

- Groundwater Monitoring

The Termination of Post-Closure Activity Evaluation (Evaluation) has been formatted as suggested in the DEQ's Solid Waste Permitting Submission Instruction No. 20 (Termination of Post-Closure Activity Evaluation V. 12/2013) released on December 10, 2013. Where applicable, references are given to specific requirements of the Virginia Solid Waste Management Regulations (VSWMR).

### **1.2 Limitations**

The conclusions presented in this Evaluation are based solely on the information included herein. This Evaluation has been prepared in accordance with generally accepted engineering and environmental practices; no other warranty, expressed or implied, is made as to the professional opinions provided under the terms of the agreement and included in this Evaluation. Parties other than Goochland County and the DEQ use this document at their own risk.

### **1.3 Terminology Used in This Evaluation**

ACL: Alternate Concentration Limit

CAP: Corrective Action Plan

DEQ: Virginia Department of Environmental Quality

FCS: Final Cover System

GPS: Groundwater Protection Standard

LEL: Lower Explosive Limit

PCC: Post-Closure Care

PPR: Proposal for Presumptive Remedy

SWPPP: Storm Water Pollution Prevention Plan

TPCA: Termination of Post-Closure Activity

VPDES: Virginia Pollutant Discharge Elimination System

VSWMR: Virginia Solid Waste Management Regulations

## **2.0 FACILITY HISTORY AND SITE DESCRIPTION**

Goochland County maintains a closed sanitary landfill under the Virginia Department of Environmental Quality (DEQ) Permit No. 179. The landfill property is located at Hidden Rock Lane in Goochland County, Virginia (Figure 1). The permitted facility is comprised of two pre-1988 cells which are unlined. The cells have a footprint of approximately 15 acres.

Post-Closure Care requirements at the landfill are outlined in Section III of the Closure Plan (October 1994). As is typical of Post-Closure Care requirement descriptions prepared at that time, this document defaults to the VSWMR requirements for groundwater monitoring requirements.

### **2.1 Waste Disposed**

The facility operated as a sanitary landfill. To the County's knowledge, only household waste and construction/demolition debris were disposed of at the facility.

### **2.2 Dates of Operation**

Waste disposal operations began officially in 1979, but prior waste disposal at the site may have occurred. The last waste was accepted October 6, 1993.

### **2.3 Closure Certification**

The landfill was closed on November 4, 1994. However, the landfill closure plat and deed notation were not filed until 2006. Per a March 14, 2006, Letter of Agreement between the County and the DEQ, the 10-year post-closure care period was to begin on the date these documents were submitted to the DEQ.

### **2.4 Disposal Methods**

Waste disposal occurred initially in unlined trenches prior to the DEQ requirement for liners and leachate collection. In later years, subsequent to the filling of trenches, the area method was used to create the current landfill mound. The base grades of the original trenches were not recorded, and the currently designated waste unit boundary is an approximation.

### **2.5 Groundwater or Gas Corrective Action**

The facility monitors groundwater under an assessment monitoring program. Constituents that have been identified in excess of groundwater protection standards (GPS) are discussed in Section 3.0. The facility is not under corrective action for methane.

## 2.6 Other Permits

The facility does not operate under a VPDES, SWPPP or other environmental permit.

Goochland County operates a solid waste convenience center adjacent to the landfill property, although the convenience center is not subject to DEQ permits.

## 2.7 Adjacent Land Use Over Time

Adjoining land use is primarily residential or undeveloped and forested land. The Goochland County Animal Shelter and Convenience Center border the landfill to the south. Hidden Rock Park is located to the north. Residential/forested parcels are located to the east and west. Private water wells exist on adjoining properties; however, a municipal water supply is located generally along the landfill's eastern boundary and provides water to Hidden Rock Park. No downgradient private drinking water wells are known to be present within 1,000 feet of the waste unit boundary.

### **3.0 GROUNDWATER EVALUATION**

This section presents a discussion of the groundwater monitoring history of the landfill and an evaluation of potential harm to human health or the environment should post-closure groundwater monitoring requirements be terminated.

The PCC Section of the October 1994 Closure Plan indicates that groundwater monitoring is to be conducted per the VSWMR and “the approved groundwater monitoring plan.” It further states that groundwater monitoring data be evaluated in accordance with the VSWMR. The current version of the facility’s Groundwater Monitoring Plan (GMP) is dated October 10, 2014.

#### **3.1 Potentiometric Map**

A potentiometric map indicating the direction and rate of groundwater flow for the facility is included as Figure 2.

#### **3.2 Aquifer Recognition**

The Goochland County Landfill is located in the Piedmont Physiographic Province of Virginia. The facility is underlain by weathered State Farm gneiss, a Proterozoic-aged porphyroblastic garnet-biotite gneiss, locally intruded by pegmatites of light-colored, coarse-grained minerals.

The landfill is located on a broad topographic high within the Courthouse Creek watershed. The landfill is underlain by an unconfined (water table) aquifer in unconsolidated sediments over saprolite. Groundwater flow gently mimics topography throughout the landfill property, although it is possible that anisotropic flow patterns occur within the saprolite. Groundwater flows from the east side of the landfill toward surface water west and north of the landfill. Groundwater likely flows northward into a small perennial stream and pond, and then westward into Courthouse Creek.

#### **3.3 Groundwater Flow Rate**

The groundwater flow rate has been determined semi-annually at the landfill since the time groundwater monitoring was initiated in 1991. The annual groundwater flow has been found to vary between 14 and 26 feet/year. Variations in flow rate appear to be attributable to annual precipitation with higher flow rates potentially following major storm events such as hurricanes and blizzards.

There are no onsite or offsite activities (major grading, cut and fill, pumping, etc.) known which may influence groundwater flow rate or direction.

### 3.4 Groundwater Monitoring Well Network

The monitoring well network utilized in the Permit No. 179 groundwater monitoring program includes:

Well ID	Top of Casing Elevation (ft.)	Depth from TOC (ft.)	Screen Interval from TOC (ft.)
MW-01 (U)	291.72	47.16	37-47
MW-02 (D)*	246.57	11.84	8-13
MW-03R (D)	233.29	13.46	9-14
MW-04 (D)	230.98	17.22	7-17
MW-05 (D)*	241.27	29.11	19-29
MW-06 (U)*	292.85	52.02	43-53
MW-13 (U)*	292.45	94.75	75-95
MW-14 (D)*	223.77	16.98	4-14

Notes: (U) – Upgradient well; (D) – Downgradient well; (TOC) top of casing

\* – Wells identified as compliance well network in 2014 GMP

MW-01, MW-03R and MW-04 were dropped from the program before the 2016 second semiannual event and have been replaced in the program by MW-13 and MW-14 respectively. MW-13 and MW-14 have been designated as Alternate Points of Compliance (APC) based on the DEQ’s June 20, 2014, variance approval. The GMP was updated October 10, 2014, to reflect this modification.

The wells currently included in the Permit No. 179 program are all relatively shallow wells screened in unconsolidated sediment or fragile saprolite to intersect the unconfined water table with the exception of MW-13. MW-13 penetrates the saprolite/competent bedrock zone and was purposely installed at that depth to correspond with the depth of the residential well located east of the landfill.

### 3.5 Groundwater Monitoring History

Groundwater monitoring was initiated at the landfill in 1991. Assessment Monitoring was initiated at the landfill in April 1997. Groundwater Protection Standards (GPS) were established on December 19, 2001. Goochland County utilized the Statewide Variance for GPS on October 1, 2007. Subsequent modifications to GPS were as follows:

- January 27, 2009 (DEQ Alternate Concentration Level [ACL] update)
- January 31, 2011 (DEQ ACL update)
- February 1, 2012 (DEQ ACL update)
- February 3, 2012 (background value for lead)
- July 1, 2013 (DEQ ACL update)
- March 1, 2014 (DEQ ACL update)
- February 15, 2015 (DEQ ACL update)
- February 15, 2016 (DEQ ACL update)

The following table indicates the GPS exceedances associated with the landfill:

Well ID	Constituent	First GPS Exceedance	GPS
MW-01 (Upgradient)	Lead	January 2012	15 µg/L
MW-02 (Downgradient)	Chloroform	July 2009	0.145 µg/L
MW-03R (Downgradient)	Vinyl chloride	July 2007	2 µg/L
	Cobalt	July 2011	77.6 µg/L
	Vanadium	January 2011	109.55 µg/L
	Chromium	January 2012	100 µg/L
	Lead	January 2012	15 µg/L
	Cadmium	January 2016	8 µg/L
MW-04 (Downgradient)	Cadmium	July 2009	5 µg/L
	Thallium	January 2011	2 µg/L
MW-06 (Upgradient)	Cobalt	January 2010	77.6 µg/L
	Cadmium	January 2010	5 µg/L
	Chromium	January 2010	100 µg/L
	Lead	January 2010	15 µg/L
	Vanadium	January 2010	109.55 µg/L
MW-14 (Downgradient)	Lead	February 2015	15 µg/L
	Vanadium	February 2014	86 µg/L

No other constituent being monitoring in groundwater at the landfill has been statistically confirmed above GPS. No exceedances of GPS have been observed in APC well MW-13 since it was installed at the facility in 2013.

### **3.6 Groundwater Monitoring Requirements**

As noted in Section 3.5, the facility's groundwater monitoring requirements have progressed from Phase I (indicator parameter) to assessment monitoring. Transition from one program to another occurred as a result of the identification of a statistically significant increase and/or GPS exceedance in one or more parameters.

The groundwater monitoring requirements applicable to the history of the program are those described in the edition of the VSWMR current at the time of the individual monitoring event. Neither the facility permit nor the Post-Closure Care Plan identify groundwater monitoring requirements differing from or exceeding those listed in the VSWMR.

### **3.7 Variances or Other DEQ Approvals**

The groundwater monitoring program at the landfill operates under an October 1, 2007, variance allowing the use of ACLs for GPS.

In a letter dated July 15, 2011, the DEQ approved the County's request to use site-specific background values for cobalt (77.6 µg/L) and cadmium (8 µg/L) in lieu of the federal maximum contaminant level (MCL), or the DEQ ACL, as GPS for the facility.

In a letter dated June 20, 2014, the DEQ approved the County's variance petition to install Alternate Points of Compliance (APC) MW-13 and MW-14.

### **3.8 Discharges to Surface Water**

Surface water has not been identified to be at risk at the site as a result of Table 3.1 constituents identified in groundwater. An onsite sediment basin is located at the northeast corner of the landfill adjacent to Hidden Rock Park. Adverse impact to the sediment basin has not been identified in connection with the landfill. Discharge to Courthouse Creek, approximately 1,000 feet west of the landfill property, has not been identified.

### **3.9 Historical Impacts**

Impacts to human health or the environment have not been attributed to groundwater contamination in connection with the landfill.

### **3.10 Corrective Action**

The Goochland County Landfill does not operate under a Corrective Action Plan.

### 3.11 Groundwater Evaluation

Groundwater monitoring has been performed at the landfill since 1991. The following discussion addresses potential for harm to human health or the environment if groundwater monitoring is discontinued.

#### 3.11.1 Statistical Analysis

Historically, statistical analysis has been conducted at the landfill for two purposes. During Detection Monitoring, statistical analysis focused on identifying constituents with concentrations that were statistically higher than background. During assessment monitoring, the identification of constituents with concentrations statistically higher than background remains required but does not affect the monitoring program; rather, direct comparison to GPS becomes the critical statistical factor.

With respect to termination of groundwater monitoring, it is critical to evaluate trends in constituent concentrations to determine whether there is statistically demonstrable possibility that contaminant concentration(s) may increase to the point of new GPS exceedance. Accepted methods for statistical evaluation of groundwater quality data at landfills are provided in “Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance” (EPA 530-R-09-007). The Unified Guidance recommends using trend tests to determine whether there is a statistically significant trend over a period of monitoring. The Mann-Kendall test is well suited to data sets of 40 or fewer measurements and has no distributional assumptions (e.g., censored data and irregularly spaced measuring periods are permitted).

Trend analyses were performed on constituents found in quantified concentrations at the landfill during the past five years. The Mann-Kendall analysis was performed using the WQStat Plus<sup>®</sup> Software program (Sanitas Technologies). Copies of the data printouts for the individual tests are included in Attachment 4. For wells MW-02, MW-05, and MW-06, the most recent five years of data were analyzed. For more recently installed wells MW-13 and MW-14, trend analysis was performed on samples collected beginning in February 2013 and October 2013, respectively.

Several organic and inorganic compounds have been detected in quantified concentrations in compliance wells, but no exceedances of GPS have been identified during the most recent three years of sampling events.

Trend analysis of organic and inorganic compounds has not revealed statistically significant increases (SSI) for any compound detected in compliance wells at the facility.

The tables below summarize statistical trends for inorganic and organic compounds detected in confirmed quantified concentrations in compliance monitoring wells at the Goochland County landfill during the past five years.

Inorganic Compounds	Upgradient		Downgradient		
	MW-06	MW-13	MW-02	MW-05	MW-14
Cadmium					X
Chromium	X		X	X	X
Cobalt	X	X	X	X	X
Copper	X		X		X
Lead	X		X		X
Selenium					X
Thallium	X			X	
Vanadium	X		X	X	X
Zinc	X	X	X	X	X

Key: X - Trend is not significant (increasing or decreasing) for historical detections of compound  
 X – Steady-state trend for historical detections of compound  
 X - Significant decreasing trend for historical detections of compound

Organic Compounds	Upgradient		Downgradient		
	MW-06	MW-13	MW-02	MW-05	MW-14
1,4-Dichlorobenzene				X	X
Benzene				X	
Chlorobenzene					X
Chloroform			X		
cis-1,2-Dichloroethylene		X	X	X	X
Dichlorodifluoromethane		X	X		
Tetrachloroethylene		X			
Trichloroethylene		X	X		
Vinyl chloride				X	X
Cyanide	X		X		

Key: X - Trend is not significant (increasing or decreasing) for historical detections of compound  
 X – Steady-state trend for historical detections of compound  
 X - Significant decreasing trend for historical detections of compound

In summary, the majority of constituents detected in compliance wells were found to be in either steady-state or decreasing concentrations over time. With the exception of the constituents detailed below, changes in concentration of detected constituents – either increasing or decreasing – were not found to be statistically significant.

The following constituents were found to be decreasing in concentration over time in a statistically significant trend:

- Copper in MW-06
- zinc in MW-06
- cis-1,2-dichloroethylene in MW-05
- vinyl chloride in MW-05

No constituent was found to be increasing in concentration over time in a statistically significant trend. However, the following organic compounds displayed increasing trends that were not statistically significant:

- 1,4-dichlorobenzene in MW-05 and MW-14
- chlorobenzene in MW-14.

## 4.0 RISK ASSESSMENT

The objective of this risk assessment is to evaluate and define the potential for offsite migration of landfill contaminants detected in groundwater at the Goochland County Landfill. The factors considered in making this assessment are as follows:

- The average groundwater flow rate is approximately 17 feet per year.
- No GPS exceedances have been identified in downgradient wells for the most recent three years.
- Trend analysis did not identify statistically significant increases (SSI) for any detected organic or inorganic compound.

Considering the trend of the overall decrease or steady state in concentration of a majority of constituents at the landfill, it is anticipated that offsite movement of contaminants becomes less probable with the passing of time.

### 4.1 Potential Paths of Exposure (Human Receptors)

The primary exposure pathway of concern for VOCs and anthropogenic metals when they are present in groundwater is migration to groundwater used or potentially used as a drinking water supply. Other pathways of concern include the inhalation and dermal contact. Potential pathways are discussed below.

#### 4.1.1 Ingestion

Exposure by ingestion of VOCs or anthropogenic metals may occur in the event that a contaminant plume migrates to groundwater used or potentially used as a source of drinking water. Groundwater is not currently used as a drinking water source either onsite or downgradient of the landfill.

#### 4.1.2 Dermal Contact

The most prevalent form of dermal contact from contaminants released to groundwater is via water supply (e.g., showering). This exposure route is not considered a factor in this release because there is no onsite use of groundwater.

#### 4.1.3 Inhalation Contact

The most prevalent form of inhalation contact from contaminants released to groundwater is via water supply (e.g., showering). Volatilization of organic compounds measurable in part per billion concentrations is not a factor in outdoor settings; therefore, inhalation contact by landfill workers (e.g., working in or around monitoring wells, etc.) is not anticipated.

## 4.2 Potential Paths of Exposure (Environmental Receptors)

The sole potential environmental receptor identified at the facility is the onsite storm water pond fed by an unnamed tributary to Courthouse Creek. Courthouse Creek lies approximately 1,000 feet west of the landfill and flows in a southeasterly direction into the James River. No known discharges to surface water have been documented at the landfill.

## 4.3 Parent/Daughter Constituent Discussion

Ten organic compounds have been detected at the facility in concentrations exceeding background levels. See table in Section 3.11.1. This section includes a discussion of these constituents and their detected parent and/or daughter products (if applicable).

### 4.3.1 Chlorinated Alkenes

The primary degradation of the most common chlorinated alkenes is microbial reductive dechlorination under anaerobic conditions, although degradation may also occur under aerobic conditions. Degradation of tetrachloroethylene (PCE) yields trichloroethylene (TCE), cis-1,2-dichloroethylene (cDCE), and ultimately, vinyl chloride (VC), which is the main by-product of anaerobic biodegradation of the polychlorinated ethenes.

Chlorinated alkene mother/daughter constituents have been detected in the four current downgradient compliance wells as indicated in the tables below.

Detections for all these constituents display a steady state or decreasing trend in all wells where the compounds have been detected, with the exception of VC in MW-14. Detections of VC display a slight increasing trend in MW-14, although the trend is not statistically significant. Detections of cDCE and VC in MW-05 display a statistically significant decrease. No exceedance of the respective GPS for any of the chlorinated alkenes have occurred in any of the compliance wells at the facility, with the exception of vinyl chloride in MW-05 in August 2003.

#### Tetrachloroethylene

Date	MW-02	MW-13
1/17/2012	<0.2 µg/L	n/a
3/1/2012	n/a	n/a
7/11/2012	<1.0 µg/L	n/a
2/7/2013	<0.2 µg/L	1.5 µg/L
3/5/2013	n/a	n/a
7/25/2013	<0.20 µg/L	2.36 µg/L
8/20/2013	n/a	n/a
10/8/2013	n/a	n/a
2/13/2014	<0.20 µg/L	2.14 µg/L
7/9/2014	<1.00 µg/L	3.11 µg/L

**Tetrachloroethylene**

Date	MW-02	MW-13
2/6/2015	<0.20 µg/L	3.24 µg/L
7/14/2015	<1.00 µg/L	2.60 µg/L
1/20/2016	0.22(j) µg/L	1.73 µg/L
7/13/2016	0.30 J µg/L	1.83 µg/L
1/25/2017	<0.20 µg/L	2.30 µg/L
7/25/2017	1.04 µg/L	1.66 µg/L

**Trichloroethylene**

Date	MW-13
2/7/2013	<1.0 µg/L
3/5/2013	n/a
7/25/2013	<1.00 µg/L
8/20/2013	n/a
10/8/2013	n/a
2/13/2014	<1.00 µg/L
7/9/2014	1.13 µg/L
2/6/2015	1.26 µg/L
7/14/2015	1.05 µg/L
1/20/2016	0.72 µg/L (j)
7/13/2016	0.70 µg/L J
1/25/2017	0.77 µg/L J
7/25/2017	0.60 µg/L J

**cis-1,2-dichloroethylene**

Date	MW-02	MW-05	MW-13	MW-14
1/17/2012	<0.2 µg/L	6.2 µg/L	n/a	n/a
3/1/2012	n/a	n/a	n/a	n/a
7/11/2012	<1.0 µg/L	6.6 µg/L	n/a	n/a
2/7/2013	<0.2 µg/L	5.9 µg/L	5.0	n/a
3/5/2013	n/a	n/a	n/a	n/a
7/25/2013	<1.00 µg/L	5.62 µg/L	7.40 µg/L	n/a
8/20/2013	n/a	n/a	n/a	n/a
10/8/2013	n/a	n/a	n/a	7.93 µg/L
2/13/2014	<1.00 µg/L	5.12 µg/L	7.58 µg/L	5.71 µg/L
7/9/2014	1.06 µg/L	4.60 µg/L	10.1 µg/L	6.11 µg/L
2/6/2015	<1.00 µg/L	5.33 µg/L	11.1 µg/L	6.65 µg/L
7/14/2015	<1.00 µg/L	4.45 µg/L	9.70 µg/L	6.79 µg/L
1/20/2016	0.40 µg/L (j)	3.77 µg/L	6.08 µg/L	5.87 µg/L
7/13/2016	0.80 µg/L J	2.93 µg/L	6.59 µg/L	5.84 µg/L
1/25/2017	0.54 µg/L J	2.94 µg/L	7.04 µg/L	5.05 µg/L
7/25/2017	1.80 µg/L	2.01 µg/L	4.71 µg/L	5.02 µg/L

### Vinyl chloride

Date	MW-05	MW-14
1/17/2012	1.1 µg/L	n/a
3/1/2012	n/a	n/a
7/11/2012	1.0 µg/L	n/a
2/7/2013	0.9 µg/L	n/a
3/5/2013	n/a	n/a
7/25/2013	0.62 µg/L	n/a
8/20/2013	n/a	n/a
10/8/2013	n/a	0.52 µg/L
2/13/2014	0.79 µg/L	0.53 µg/L
7/9/2014	0.69 µg/L	0.62 µg/L
2/6/2015	0.82 µg/L	0.55 µg/L
7/14/2015	0.85 µg/L	0.56 µg/L
1/20/2016	0.72 µg/L	0.53 µg/L
7/13/2016	0.56 µg/L	0.55 µg/L
1/25/2017	0.55 µg/L	<0.20 µg/L
7/25/2017	0.54 µg/L	0.62 µg/L

### 4.3.2 Chlorinated Benzenes

Chlorinated benzene mother/daughter constituents have been detected in two downgradient wells as indicated in the two tables below. 1,4-dichlorobenzene (14-DCB) yields chlorobenzene (CB) via anaerobic biodegradation. Detections of 14-DCB display a slight increasing trend in MW-05 and MW-14, although the trend is not statistically significant. The daughter product, CB, has only been detected in MW-14, and also displays a non-significant increasing trend. It is noted that 14-DCB and CB have each been detected in concentrations more than an order of magnitude below their respective GPS (75 µg/L and 100 µg/L).

#### 1,4-dichlorobenzene

Date	MW-05	MW-14
1/17/2012	1.3 µg/L	n/a
3/1/2012	n/a	n/a
7/11/2012	1.4(b)	n/a
2/7/2013	1.5 µg/L	n/a
3/5/2013	n/a	n/a
7/25/2013	1.23 µg/L	n/a
8/20/2013	n/a	n/a
10/8/2013	n/a	3.19 µg/L
2/13/2014	1.22 µg/L	2.70 µg/L
7/9/2014	1.40 µg/L	3.09 µg/L
2/6/2015	1.48 µg/L	2.72 µg/L

### 1,4-dichlorobenzene

Date	MW-05	MW-14
7/14/2015	1.53 µg/L	3.43 µg/L
1/20/2016	1.51 µg/L	3.12 µg/L
7/13/2016	1.44 µg/L	3.35 µg/L
1/25/2017	1.54 µg/L	3.13 µg/L
7/25/2017	1.24 µg/L	3.33 µg/L

### Chlorobenzene

Date	MW-14
10/8/2013	1.45 µg/L
2/13/2014	1.14 µg/L
7/9/2014	1.68 µg/L
2/6/2015	1.28 µg/L
7/14/2015	1.67 µg/L
1/20/2016	1.40 µg/L
7/13/2016	1.64 µg/L
1/25/2017	1.53 µg/L
7/25/2017	1.89 µg/L

Based on the overall decreasing trends, the relatively low concentrations of the parent/daughter constituents, and the absence of downgradient receptors, adverse effect on human health or the environment is not anticipated as a result of discontinuation of groundwater monitoring.

#### 4.4 Potential Impact on Human Health and the Environment

There are no groundwater users downgradient of the landfill between the landfill and Courthouse Creek (approximate distance of 1000 feet). A public water supply is available to residences located along Route 632. Some private residences located on the north side of Route 632 may rely on private wells for potable or non-potable water supply; however, these are located over 1000 feet from the facility boundary in a cross gradient orientation.

Due to the absence of downgradient receptors, adverse effect on human health or the environment is not anticipated as a result of discontinuation of groundwater monitoring.

#### 4.5 Adjacent Property Impacts

No public or private drinking water wells on adjacent properties are impacted or are in the pathway of a projected contaminant plume.

## **5.0 SURFACE WATER EVALUATION**

### **5.1 Surface Water Site Map**

Figure 3 depicts surface water conditions at the landfill.

### **5.2 Surface Water Identification**

There is an onsite storm water pond fed by an unnamed tributary to Courthouse Creek. Courthouse Creek lies approximately 1,000 feet west of the landfill and flows in a southeasterly direction into the James River.

### **5.3 Surface Water Impacts**

No known discharges to surface water have been documented at the landfill.

### **5.4 Surface Water Monitoring Summary**

Surface water monitoring has not been required under the landfill permit, post-closure care plan, VPDES permit, compliance agreement, or other mechanism.

## 6.0 GAS MANAGEMENT EVALUATION

The facility currently maintains two active extraction blower systems to manage the potential for decomposition landfill gas migration. Once the blower systems are no longer required and turned off, the landfill gas management system will be maintained until monitoring readings for perimeter probes return results below the lower explosive limit for a period of three consecutive years.

A subsequent petition for termination of the landfill gas management system will be submitted upon successful achievement of that milestone.

## 7.0 STORM WATER MANAGEMENT

The facility is not subject to a Storm Water Pollution Prevention Plan (SWPPP). On each landfill cell, storm water runoff from the top of the landfill is either directed to plastic “slope drain” pipes buried within the final cover or flows via sheet flow to the toe of the slope. Where slope drain pipes are used, the drains eventually daylight into the perimeter grass-lined storm water management ditches. Storm water is conveyed from the toe of slopes and from the grass-lined ditches to an intermittent stream north of the disposal cells which eventually flows to a facility sediment basin located along the northwest facility boundary.

Discontinuation of groundwater monitoring at the landfill will not affect current storm water management structures or activities at the site. Therefore, no adverse storm water impacts to human health or the environment are anticipated in connection with release from post-closure groundwater monitoring.

## 8.0 FINAL COVER SYSTEM ACTIVITIES

Discontinuation of the maintenance of the Final Cap System (FCS) is not being proposed.

### 8.1 FCS Maintenance Requirements

FCS maintenance requirements during the post closure care period include regular mowing (typically twice annually), and slope failure and/or erosion damage repair as needed. The slope repairs previously made to the FCS during the post-closure care period have resolved slope stability issues. Based upon inspections of the FCS during quarterly post-closure care inspections, the slope repairs appear to have been successful and limit the potential for significant erosion.

The design of the storm water system incorporated into the landfill cap (see Section 6.0) prevents erosion of the final cover from concentrated storm water runoff flowing down the side slopes of the landfill.

### 8.2 Historical FCS Maintenance

The PCC plan provides limited description of FCS maintenance requirements. However, historical maintenance of the FCS has included:

- bare areas (lack of vegetation) on the cover to be fertilized and re-seeded;
- eroded areas that may compromise the cover system and the closure cap to be filled in, fertilized and re-seeded;
- areas of significant waste and FCS settlement to be backfilled, fertilized and re-seeded provided that the closure cap has not been compromised (where the closure cap has been compromised, the extent of damage must be assessed and the closure cap system in that area replaced);
- animal burrows to be filled in and the animals of concern trapped and removed;
- periodic mowing such that too much vegetation would obscure any closure cap defects that may occur over time; and,
- cutting and removing large shrubs or trees growing on the closure cap (these may have root systems that could compromise the closure cap).

These maintenance items have been monitored via periodic facility inspections to determine if any of the above referenced conditions exist. In addition to the annual VDEQ closed facility compliance inspections, the following routine site inspections are performed:

- Periodic inspections of the closed facility by County staff
- Twice annual (typically) closure cap inspections by the County's engineering consultant

### 8.3 Impact of Discontinuing FCS Maintenance

Since FCS maintenance will not be discontinued, it is not necessary to evaluate the potential impact to human health or the environment in connection with discontinuation.

## **9.0 MAINTENANCE OF MONITORING SYSTEMS & OTHER APPURTENANCES**

The property is currently owned by the County. This ownership provides for ongoing maintenance of facility roads, ditches, fencing, equipment, and gates.

The County proposes to maintain monitoring systems (e.g., landfill gas probes and blower systems, final cover system) until such time as the County ceases to operate on the property.

The landfill gas management system will be maintained by the County as described previously within Section 5.0

## 10.0 OTHER APPLICABLE INFORMATION

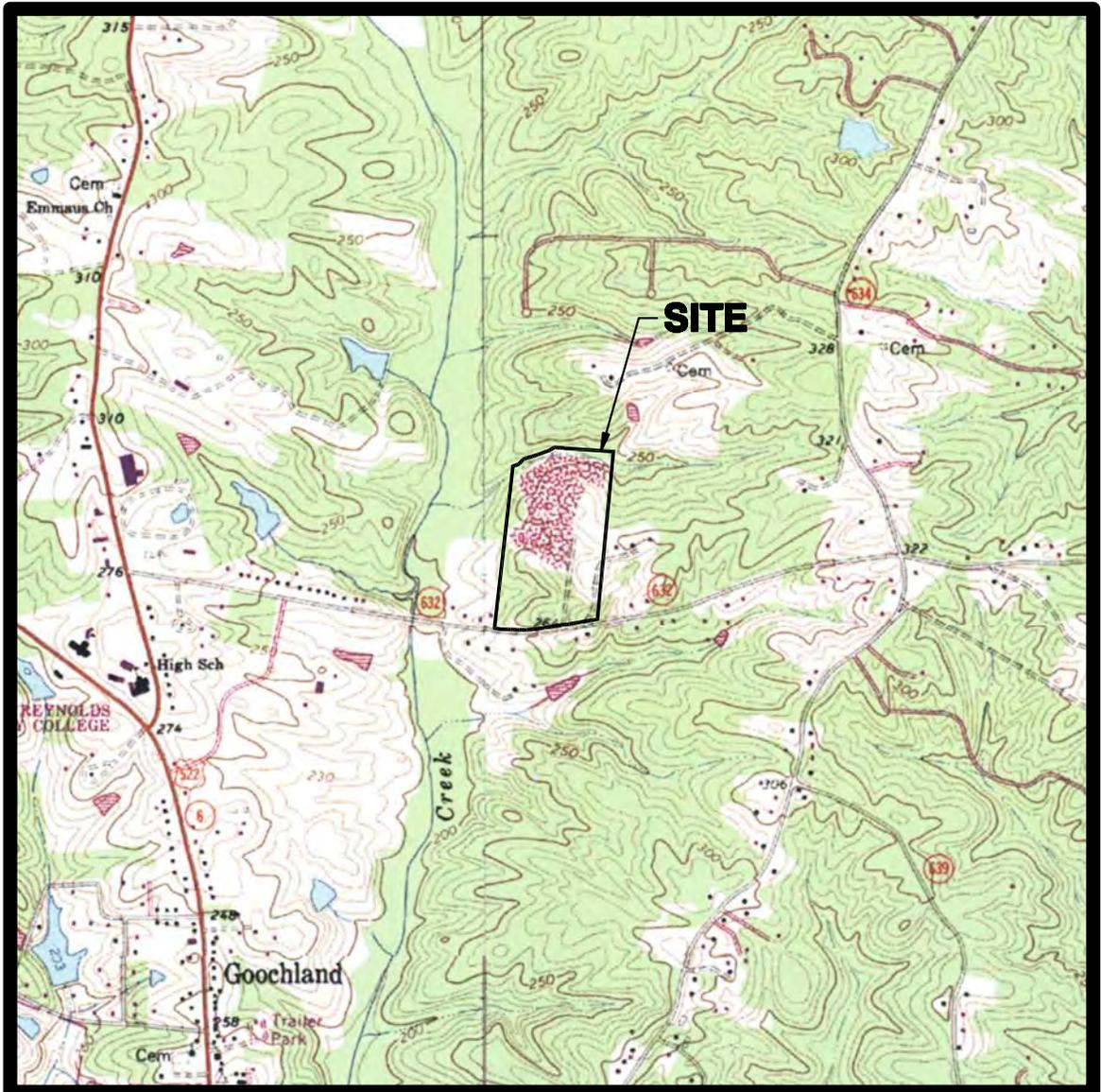
No other actions are envisioned in conjunction with the discontinuation of groundwater monitoring.

## 11.0 FINANCIAL ASSURANCE

While the facility is requesting partial release from post-closure care (i.e., discontinuation of groundwater monitoring), it is noted that the landfill gas management system will continue to operate (see Section 5.0). The PCC section of the November 2009 Post-Closure Care Plan outlines requirements for monitoring of landfill gas and periodic inspection of the landfill gas collection system and operations.

An estimate of the financial assurance requirement for landfill gas management has been determined using the DEQ estimating form, and is included as Attachment 1.

**Figure 1**  
**Site Location Map**



U.S.G.S. 7.5 SERIES QUADRANGLES  
PERKINSVILLE, VIRGINIA (1968 PHOTOREVISED (1987)  
GOOCHLAND, VIRGINIA (1968, PHOTOREVISED 1987)  
SCALE: 1" = 2000'



NOTE: ALL LOCATIONS ARE APPROXIMATE.

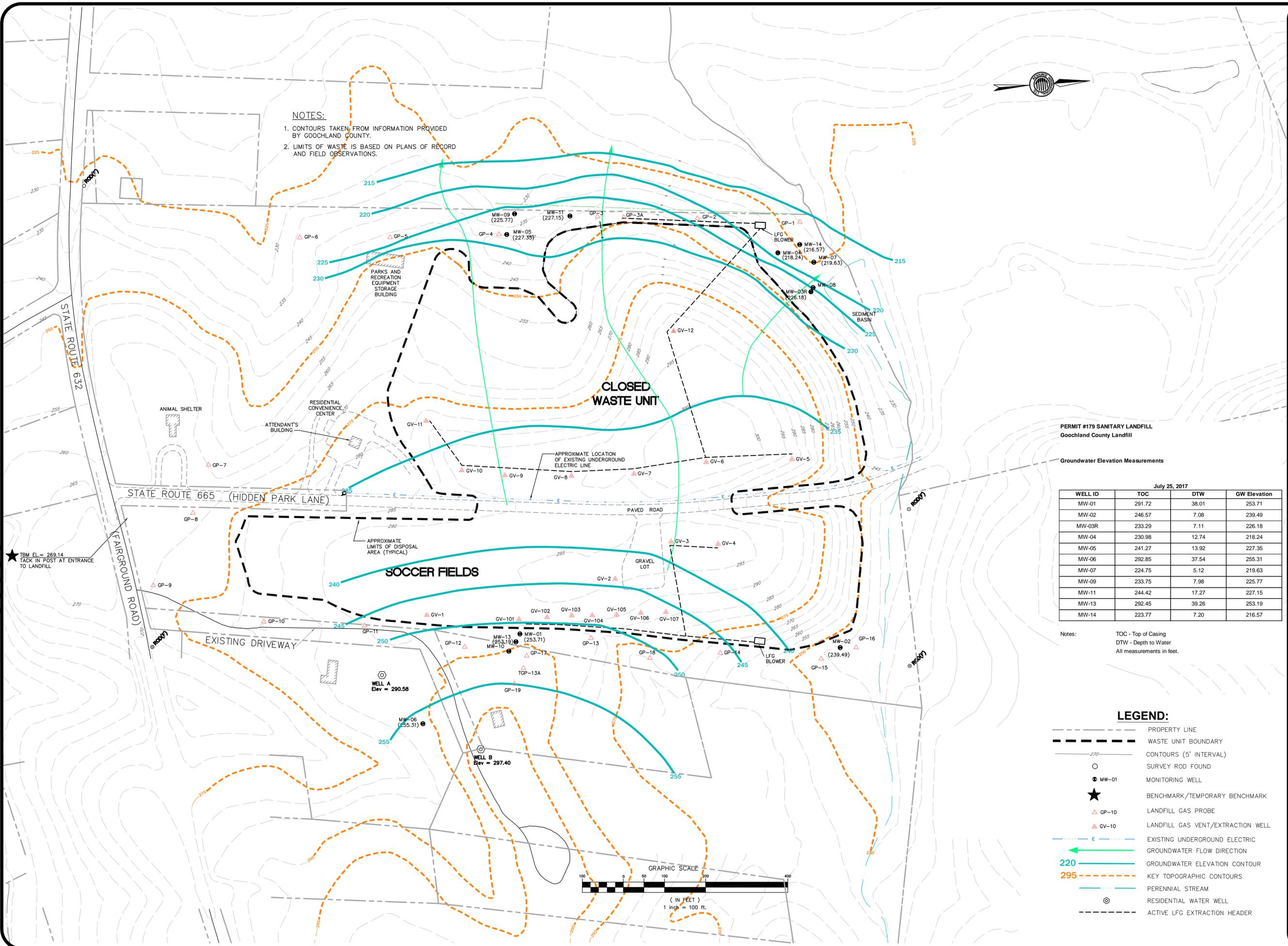
FIGURE 1  
SITE LOCATION MAP  
GOOCHLAND COUNTY SANITARY  
LANDFILL PERMIT NO. 179  
GOOCHLAND, VIRGINIA



**resource**  
INTERNATIONAL  
P.O. Box 6160 • 9560 Kings Charter Drive • Ashland, VA 23005  
(804) 550-9200 • FAX (804) 550-9259

**Figure 2**  
**Potentiometric Map**

H:\97007.12 - Goochland County Sanitary Landfill Drawings\Drawings\Post-Closure\97007.09\_GG\_PC\_FIG\_2.dwg Plotted: Sep 27, 2017 11:15am



**NOTES:**  
 1. CONTOURS TAKEN FROM INFORMATION PROVIDED BY GOOCHLAND COUNTY.  
 2. LIMITS OF WASTE IS BASED ON PLANS OF RECORD AND FIELD OBSERVATIONS.

**PERMIT #179 SANITARY LANDFILL**  
 Goochland County Landfill

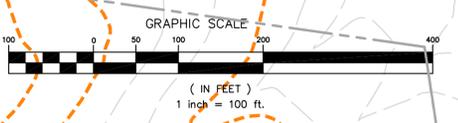
**Groundwater Elevation Measurements**

July 25, 2017			
WELL ID	TOC	DTW	GW Elevation
MW-01	291.72	38.01	253.71
MW-02	246.57	7.08	239.49
MW-03R	233.29	7.11	226.18
MW-04	230.98	12.74	218.24
MW-05	241.27	13.92	227.35
MW-06	292.85	37.54	255.31
MW-07	224.75	5.12	219.63
MW-09	233.75	7.98	225.77
MW-11	244.42	17.27	227.15
MW-13	292.45	39.26	253.19
MW-14	223.77	7.20	216.57

Notes: TOC - Top of Casing  
 DTW - Depth to Water  
 All measurements in feet.

**LEGEND:**

- PROPERTY LINE
- - - WASTE UNIT BOUNDARY
- CONTOURS (5' INTERVAL)
- SURVEY ROD FOUND
- MW-01 MONITORING WELL
- ★ BENCHMARK/TEMPORARY BENCHMARK
- △ GP-10 LANDFILL GAS PROBE
- △ GV-10 LANDFILL GAS VENT/EXTRACTION WELL
- E --- EXISTING UNDERGROUND ELECTRIC
- GROUNDWATER FLOW DIRECTION
- 220 GROUNDWATER ELEVATION CONTOUR
- 295 KEY TOPOGRAPHIC CONTOURS
- PERENNIAL STREAM
- ⊙ RESIDENTIAL WATER WELL
- ACTIVE LFG EXTRACTION HEADER



DESIGNED: V. GILLS  
 DRAWN: B. DAVIS  
 CHECKED: M. WILLINGER  
 DATE: 08/16/2017

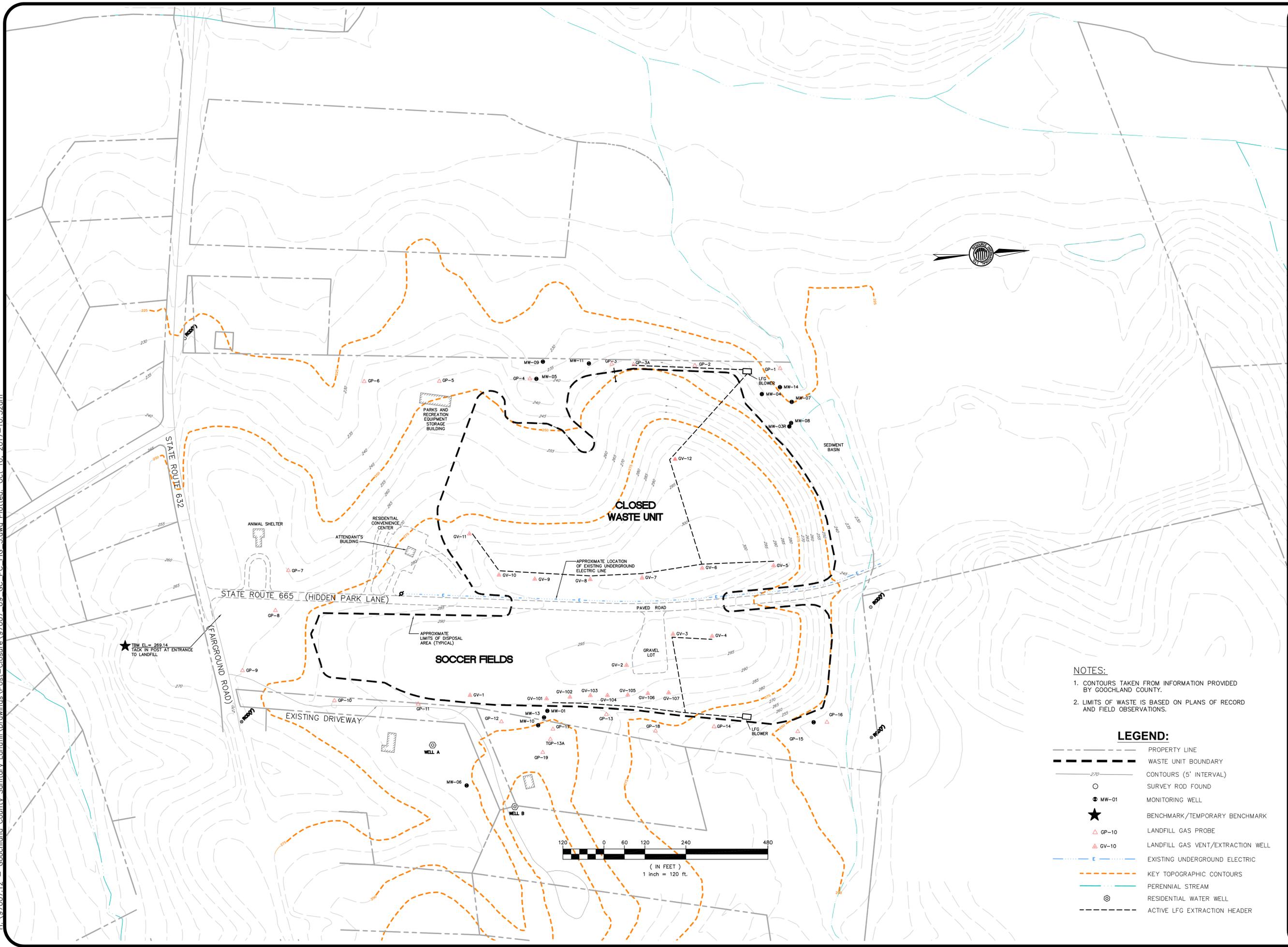
REVISIONS:  
 09-27-17 ADAPTED FOR TERMINATION OF POST-CLOSURE CARE REPORT

**GOOCHLAND COUNTY**  
**SANITARY LANDFILL**  
**PERMIT # 179**  
**GOOCHLAND COUNTY, VIRGINIA**

PROJECT NO.: **97007.12**  
 SHEET: **FIGURE 2**

**Figure 3**  
**Surface Water Conditions**

H:\97007.12 - Goochland County Sanitary Landfill Drawings\Drawings\Post-Closure\97007.09\_GC\_PC\_FIG\_3.dwg Plotted: Oct 16, 2017 10:32am



**NOTES:**  
 1. CONTOURS TAKEN FROM INFORMATION PROVIDED BY GOOCHLAND COUNTY.  
 2. LIMITS OF WASTE IS BASED ON PLANS OF RECORD AND FIELD OBSERVATIONS.

**LEGEND:**

	PROPERTY LINE
	WASTE UNIT BOUNDARY
	CONTOURS (5' INTERVAL)
	SURVEY ROD FOUND
	MONITORING WELL
	BENCHMARK/TEMPORARY BENCHMARK
	GP-10
	GP-10
	EXISTING UNDERGROUND ELECTRIC
	KEY TOPOGRAPHIC CONTOURS
	PERENNIAL STREAM
	RESIDENTIAL WATER WELL
	ACTIVE LFG EXTRACTION HEADER

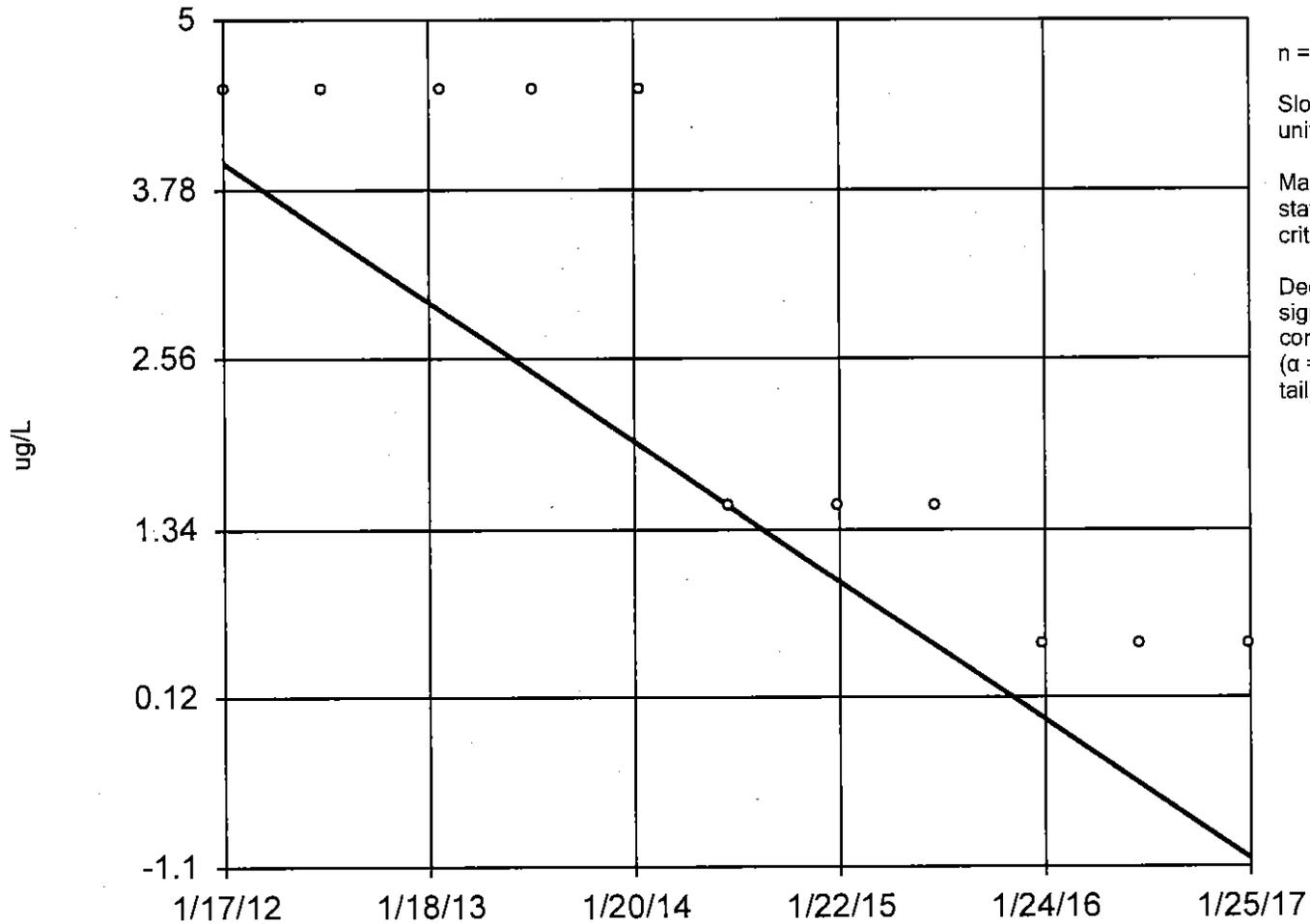
**REVISIONS:**  
 09-27-17 ADAPTED FOR TERMINATION OF POST-CLOSURE CARE REPORT

DESIGNED: V.GILLS  
 DRAWN: B.DAVIS  
 CHECKED: M.WILLINGER  
 DATE: 08/16/2017

**Attachment 1**  
**Groundwater Trend Analysis**

# Sen's Slope Estimator

MW-02



n = 11

Slope = -0.9973  
units per year.

Mann-Kendall  
statistic = -39  
critical = -31

Decreasing trend  
significant at 98%  
confidence level  
( $\alpha = 0.01$  per  
tail).

Constituent: Arsenic Analysis Run 6/30/2017 11:35 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Arsenic (ug/L) Analysis Run 7/2/2017 1:00 PM

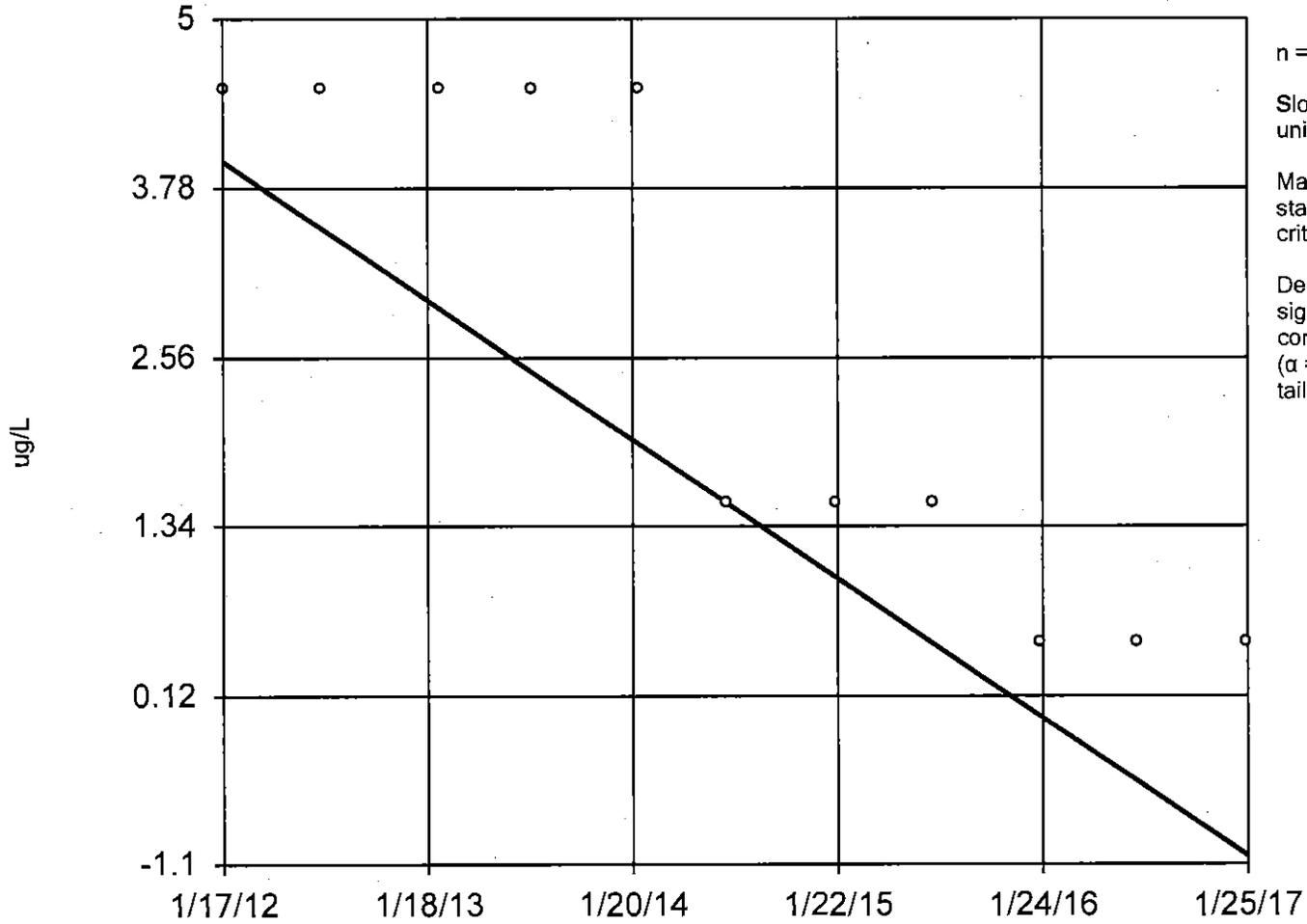
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-02
1/17/2012	<9
7/11/2012	<9
2/7/2013	<9
7/25/2013	<9
1/31/2014	<9
7/9/2014	<3
1/21/2015	<3
7/14/2015	<3
1/20/2016	<1
7/13/2016	<1
1/25/2017	<1

### Sen's Slope Estimator

MW-05



n = 11  
Slope = -0.9973  
units per year.  
Mann-Kendall  
statistic = -39  
critical = -31  
Decreasing trend  
significant at 98%  
confidence level  
( $\alpha = 0.01$  per  
tail).

Constituent: Arsenic Analysis Run 6/30/2017 11:37 AM  
Facility: Gochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Arsenic (ug/L) Analysis Run 7/2/2017 1:00 PM

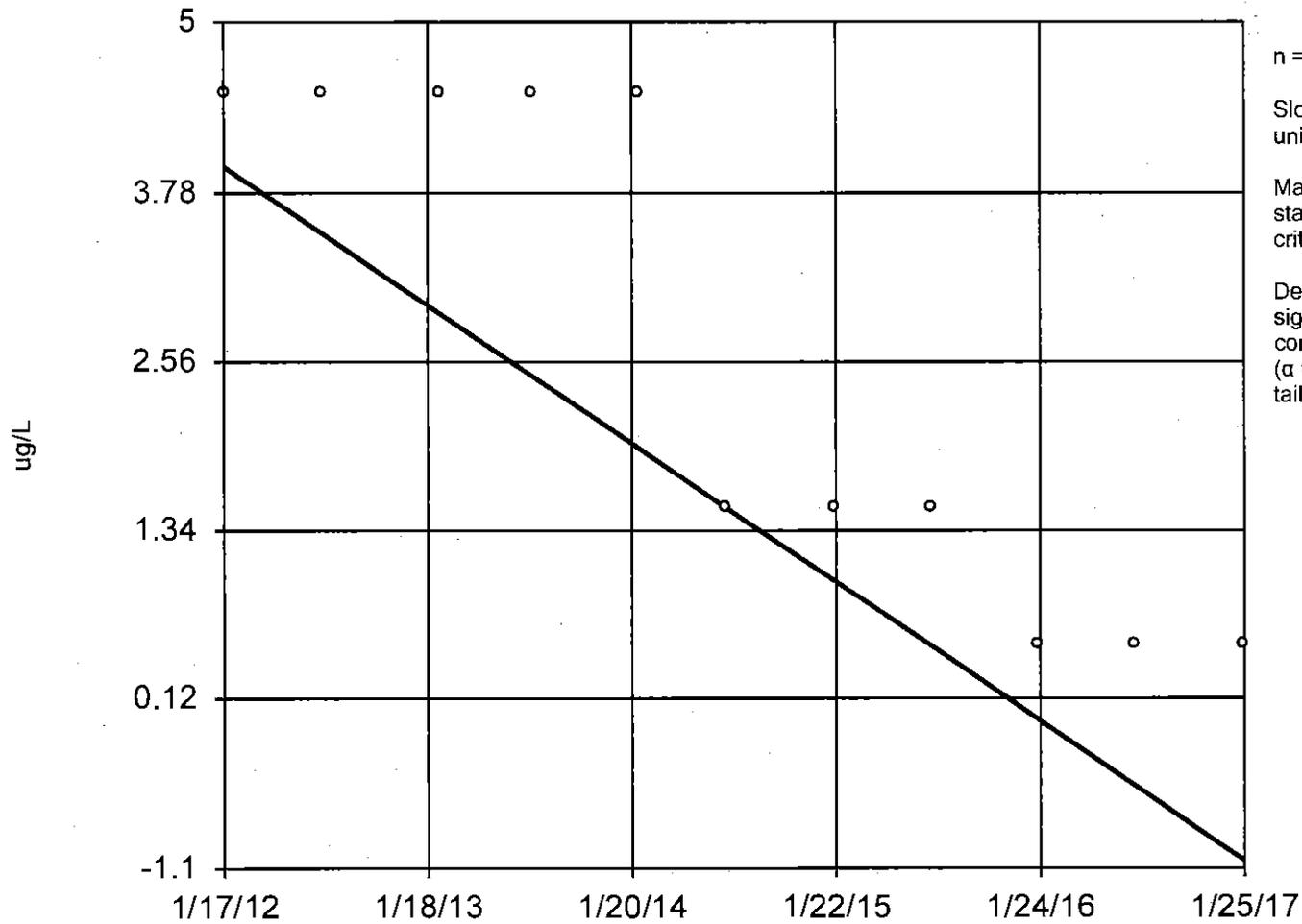
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-05
1/17/2012	<9
7/11/2012	<9
2/7/2013	<9
7/25/2013	<9
1/31/2014	<9
7/9/2014	<3
1/21/2015	<3
7/14/2015	<3
1/20/2016	<1
7/13/2016	<1
1/25/2017	<1

### Sen's Slope Estimator

MW-06 (bg)



n = 11

Slope = -0.9973  
units per year.

Mann-Kendall  
statistic = -39  
critical = -31

Decreasing trend  
significant at 98%  
confidence level  
( $\alpha = 0.01$  per  
tail).

Constituent: Arsenic Analysis Run 6/30/2017 11:37 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Arsenic (ug/L) Analysis Run 6/30/2017 11:37 AM

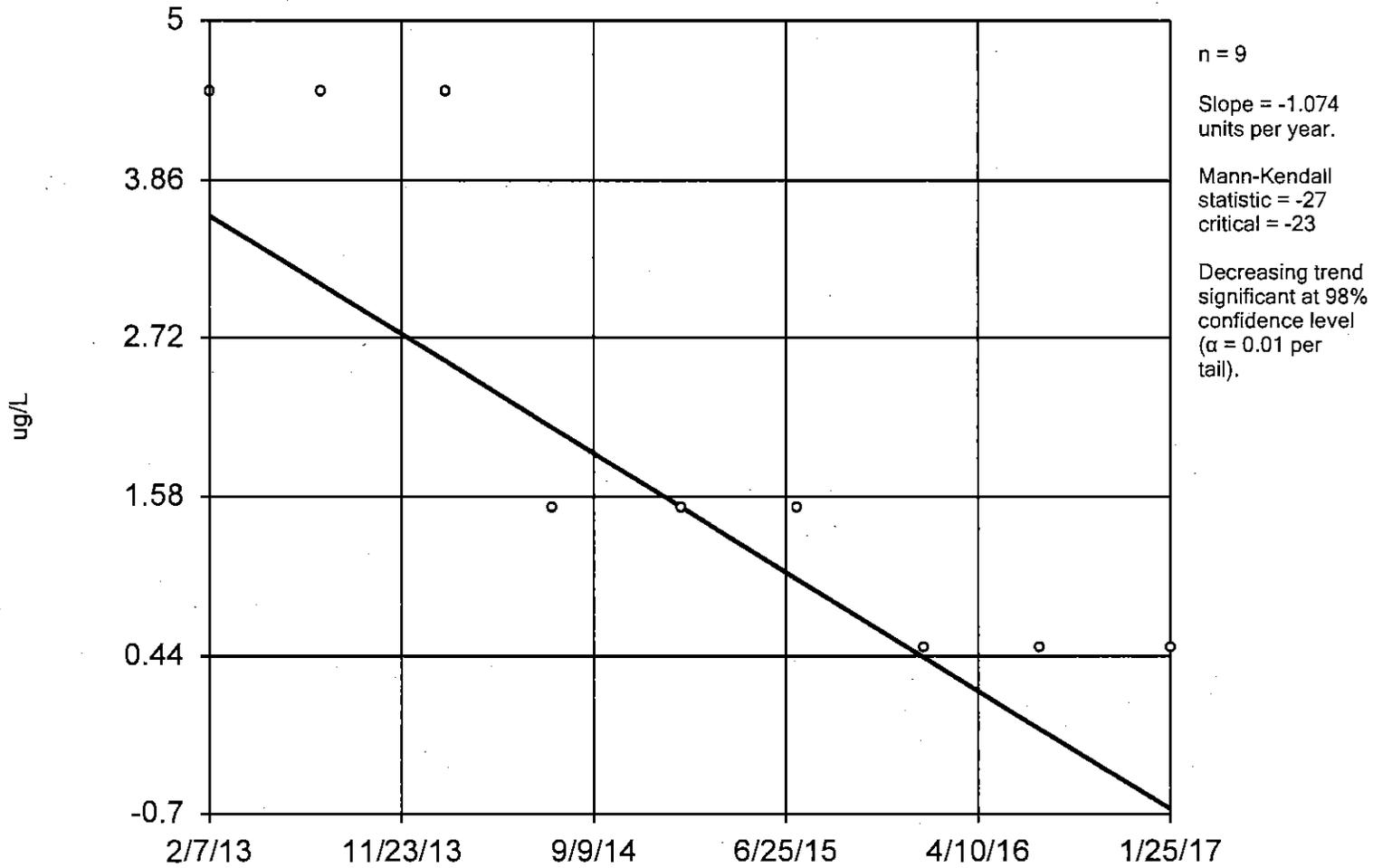
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-06 (bg)
1/17/2012	<9
7/11/2012	<9
2/7/2013	<9
7/25/2013	<9
1/31/2014	<9
7/9/2014	<3
1/21/2015	<3
7/14/2015	<3
1/20/2016	<1
7/13/2016	<1
1/25/2017	<1

### Sen's Slope Estimator

MW-13 (bg)



Constituent: Arsenic Analysis Run 6/30/2017 11:38 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Arsenic (ug/L) Analysis Run 6/30/2017 11:38 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

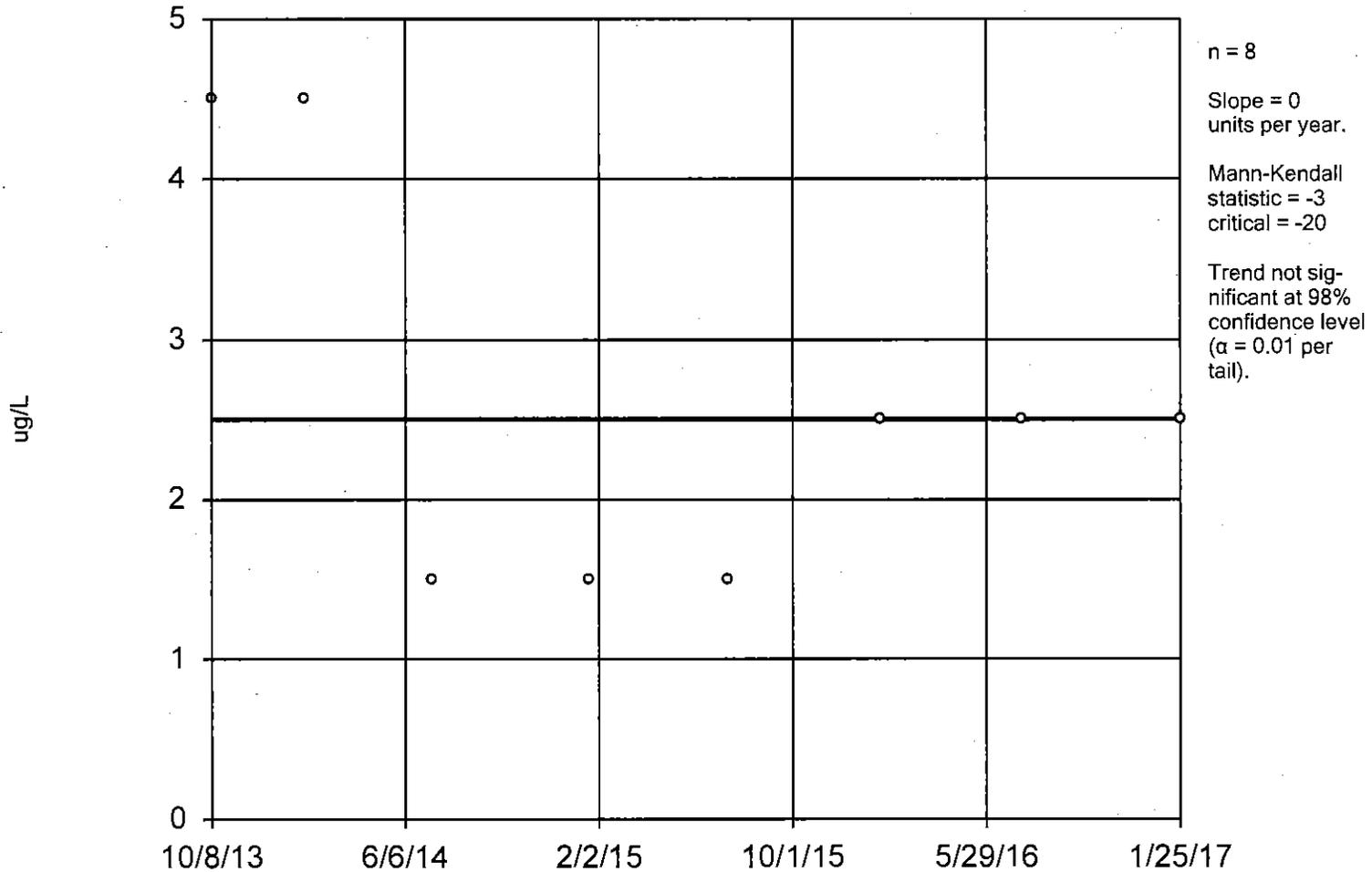
---

	MW-13 (bg)
2/7/2013	<9
7/25/2013	<9
1/31/2014	<9
7/9/2014	<3
1/21/2015	<3
7/14/2015	<3
1/20/2016	<1
7/13/2016	<1
1/25/2017	<1

Hollow symbols indicate censored values.

# Sen's Slope Estimator

MW-14



Constituent: Arsenic Analysis Run 6/30/2017 11:38 AM

Facility: Gochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Arsenic (ug/L) Analysis Run 6/30/2017 11:38 AM

Facility: Goodland Cy Landfill Data File: GCLF 0517

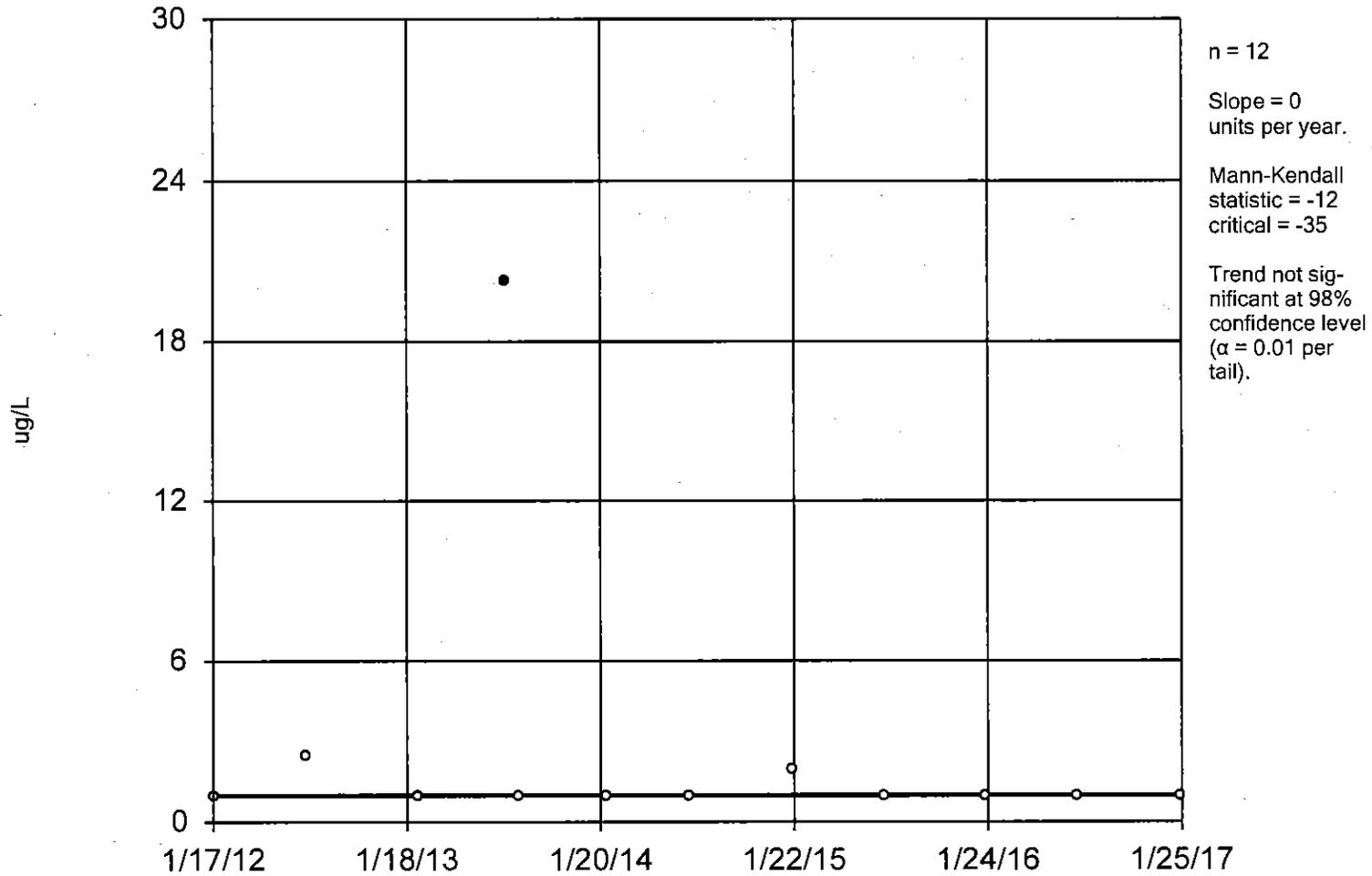
---

	MW-14
10/8/2013	<9
1/31/2014	<9
7/9/2014	<3
1/21/2015	<3
7/14/2015	<3
1/20/2016	<5
7/13/2016	<5
1/25/2017	<5

Hollow symbols indicate censored values.

### Sen's Slope Estimator

MW-02



Constituent: Cadmium Analysis Run 6/30/2017 11:45 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Cadmium (ug/L) Analysis Run 6/30/2017 11:45 AM

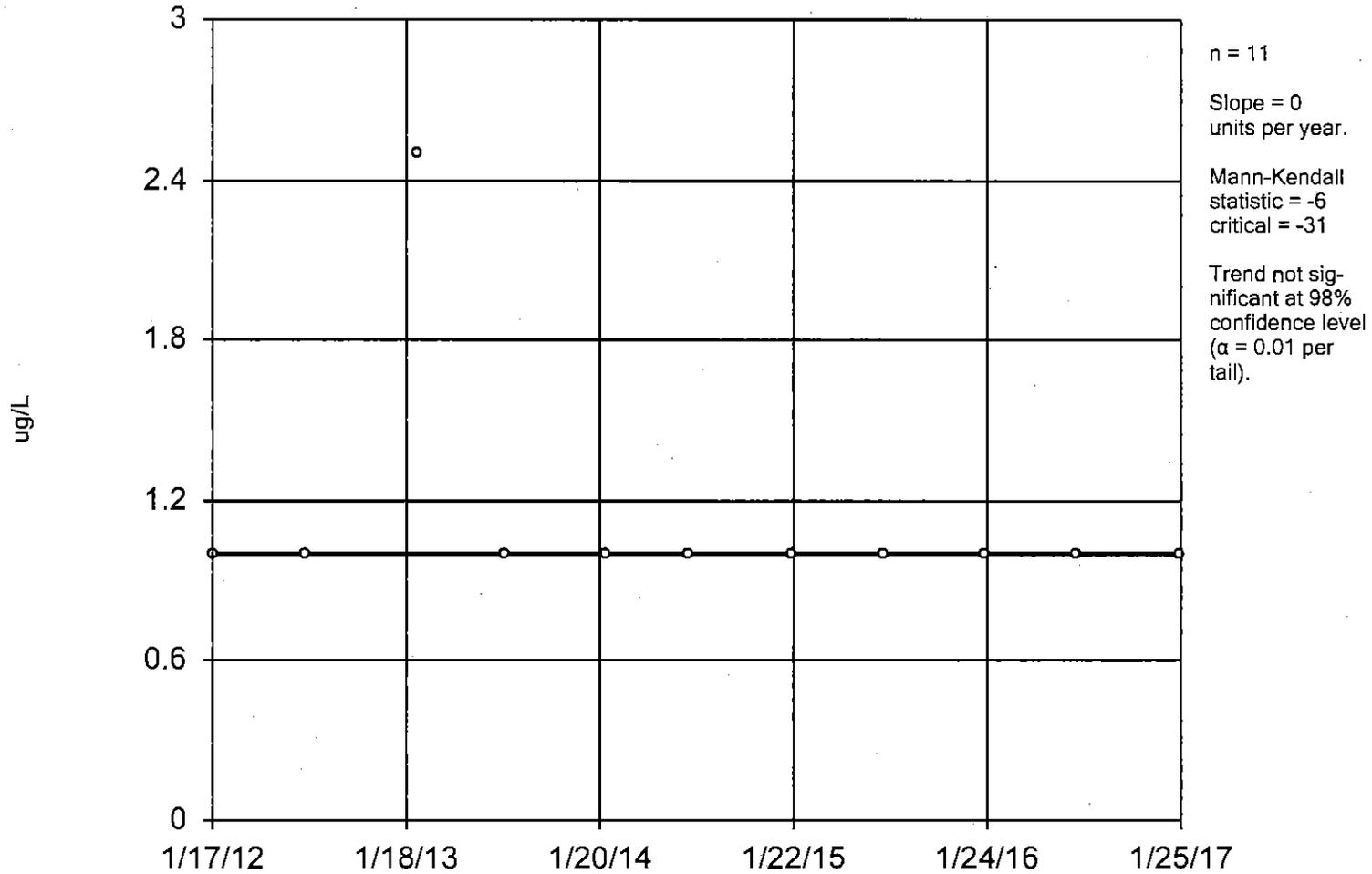
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-02
1/17/2012	<2
7/11/2012	<5
2/7/2013	<2
7/25/2013	20.3
8/20/2013	<2 (V)
1/31/2014	<2
7/9/2014	<2
1/21/2015	<4
7/14/2015	<2
1/20/2016	<2
7/13/2016	<2
1/25/2017	<2

### Sen's Slope Estimator

MW-05



Constituent: Cadmium Analysis Run 6/30/2017 11:46 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Cadmium (ug/L) Analysis Run 6/30/2017 11:46 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

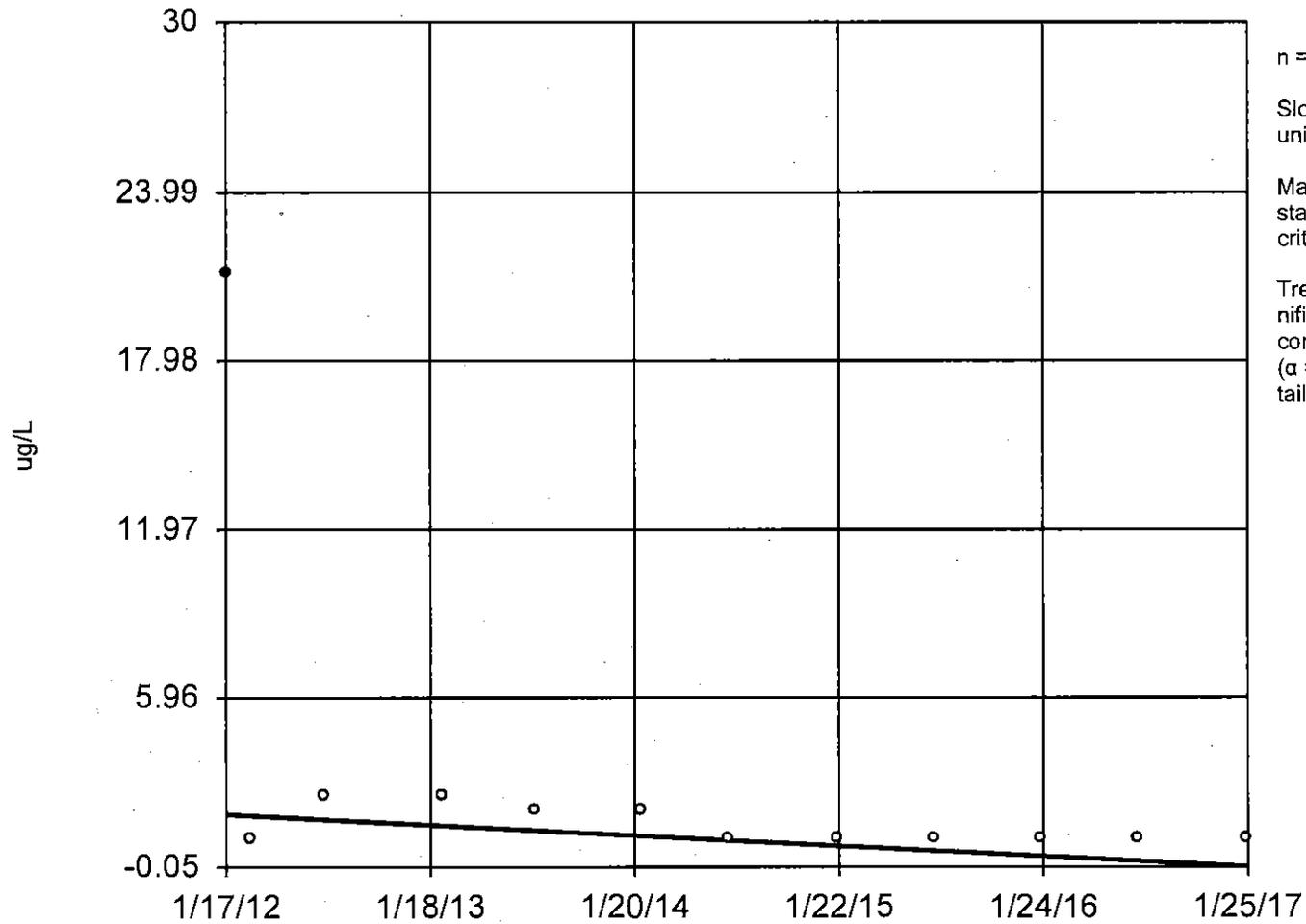
---

MW-05

1/17/2012	<2
7/11/2012	<2
2/7/2013	<5
7/25/2013	<2
1/31/2014	<2
7/9/2014	<2
1/21/2015	<2
7/14/2015	<2
1/20/2016	<2
7/13/2016	<2
1/25/2017	<2

### Sen's Slope Estimator

MW-06 (bg)



n = 12

Slope = -0.3762  
units per year.

Mann-Kendall  
statistic = -35  
critical = -35

Trend not sig-  
nificant at 98%  
confidence level  
( $\alpha = 0.01$  per  
tail).

Constituent: Cadmium Analysis Run 6/30/2017 11:46 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Cadmium (ug/L) Analysis Run 6/30/2017 11:46 AM

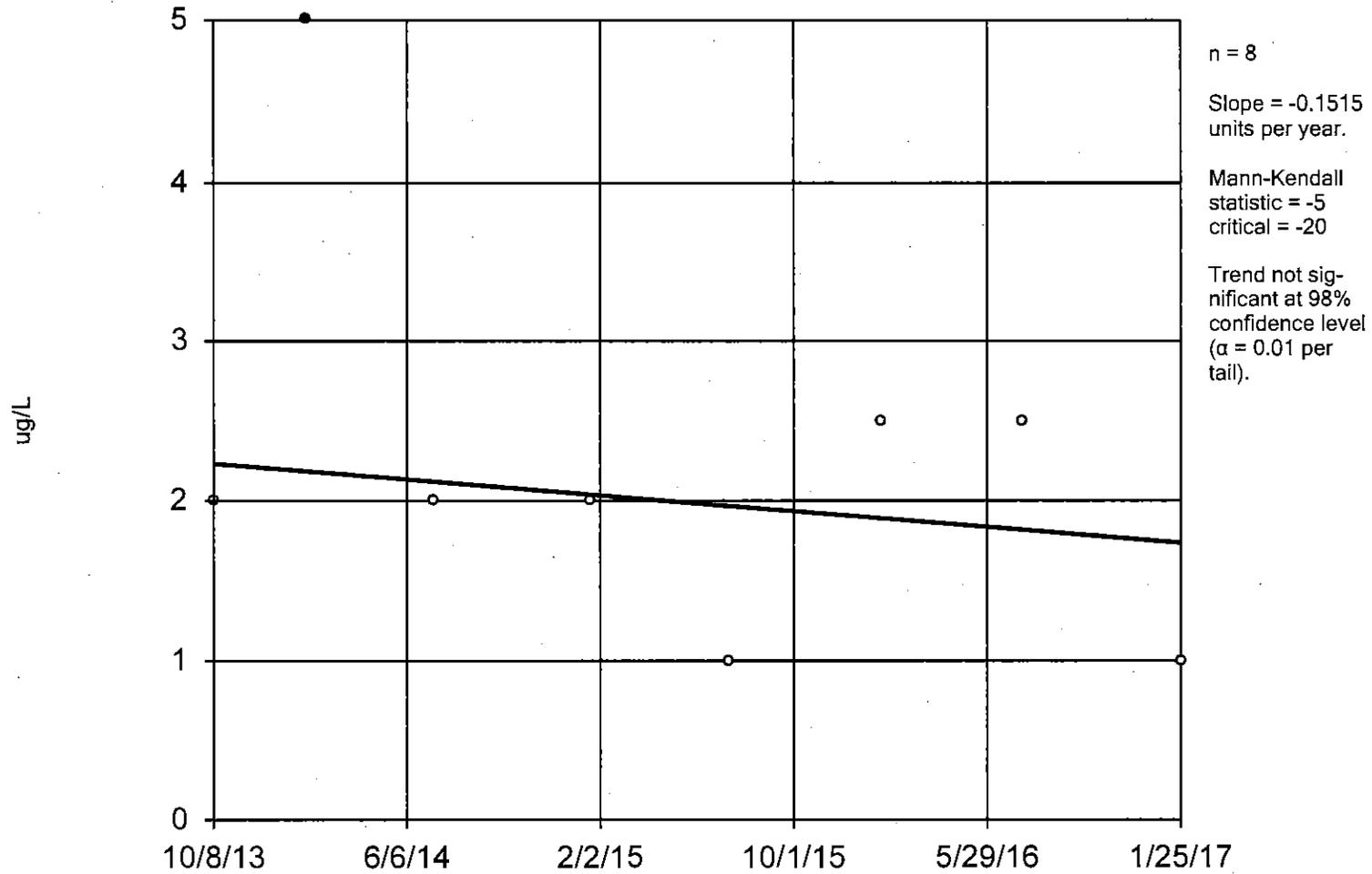
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-06 (bg)
1/17/2012	21.1
3/1/2012	<2 (V)
7/11/2012	<5
2/7/2013	<5
7/25/2013	<4
1/31/2014	<4
7/9/2014	<2
1/21/2015	<2
7/14/2015	<2
1/20/2016	<2
7/13/2016	<2
1/25/2017	<2

### Sen's Slope Estimator

MW-14



Constituent: Cadmium Analysis Run 6/30/2017 11:47 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Cadmium (ug/L) Analysis Run 6/30/2017 11:47 AM

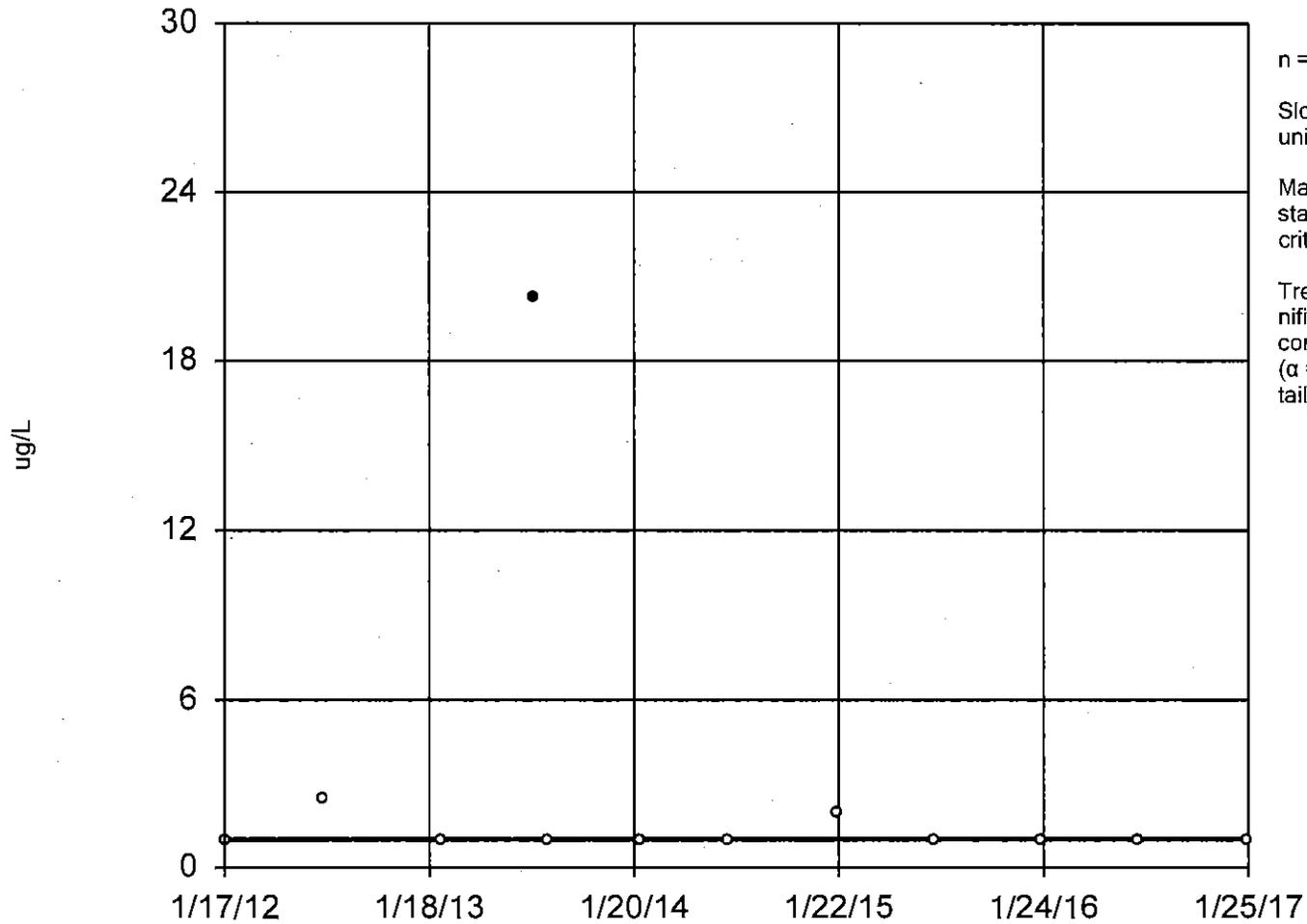
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-14
10/8/2013	<4
1/31/2014	5
7/9/2014	<4
1/21/2015	<4
7/14/2015	<2
1/20/2016	<5
7/13/2016	<5
1/25/2017	<2

# Sen's Slope Estimator

MW-02



n = 12

Slope = 0  
units per year.

Mann-Kendall  
statistic = -12  
critical = -35

Trend not sig-  
nificant at 98%  
confidence level  
( $\alpha = 0.01$  per  
tail).

Constituent: Cadmium Analysis Run 6/30/2017 1:34 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Cadmium (ug/L) Analysis Run 6/30/2017 1:34 PM

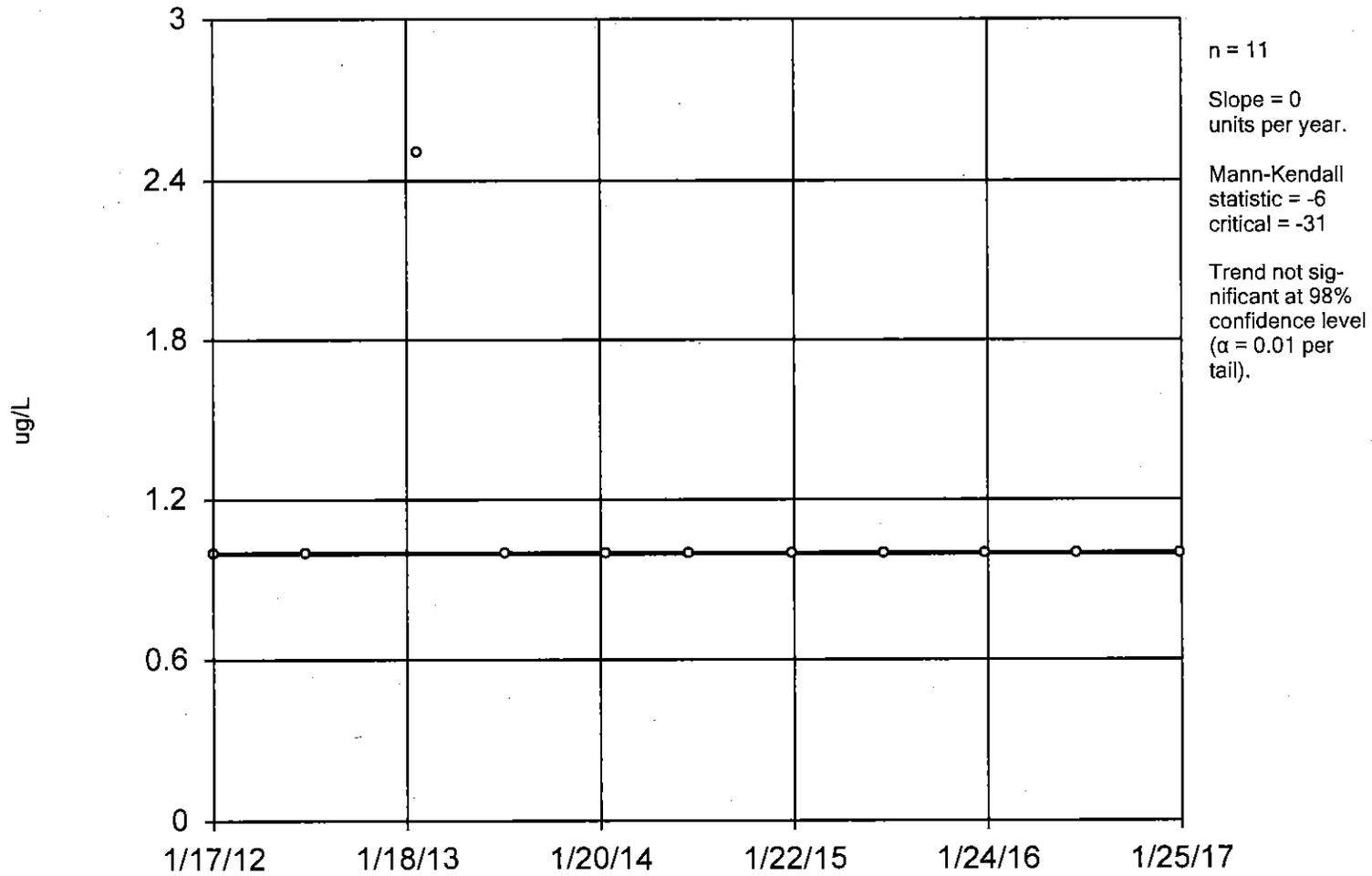
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-02
1/17/2012	<2
7/11/2012	<5
2/7/2013	<2
7/25/2013	20.3
8/20/2013	<2 (V)
1/31/2014	<2
7/9/2014	<2
1/21/2015	<4
7/14/2015	<2
1/20/2016	<2
7/13/2016	<2
1/25/2017	<2

### Sen's Slope Estimator

MW-05



Constituent: Cadmium Analysis Run 6/30/2017 1:35 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Cadmium (ug/L) Analysis Run 6/30/2017 1:35 PM

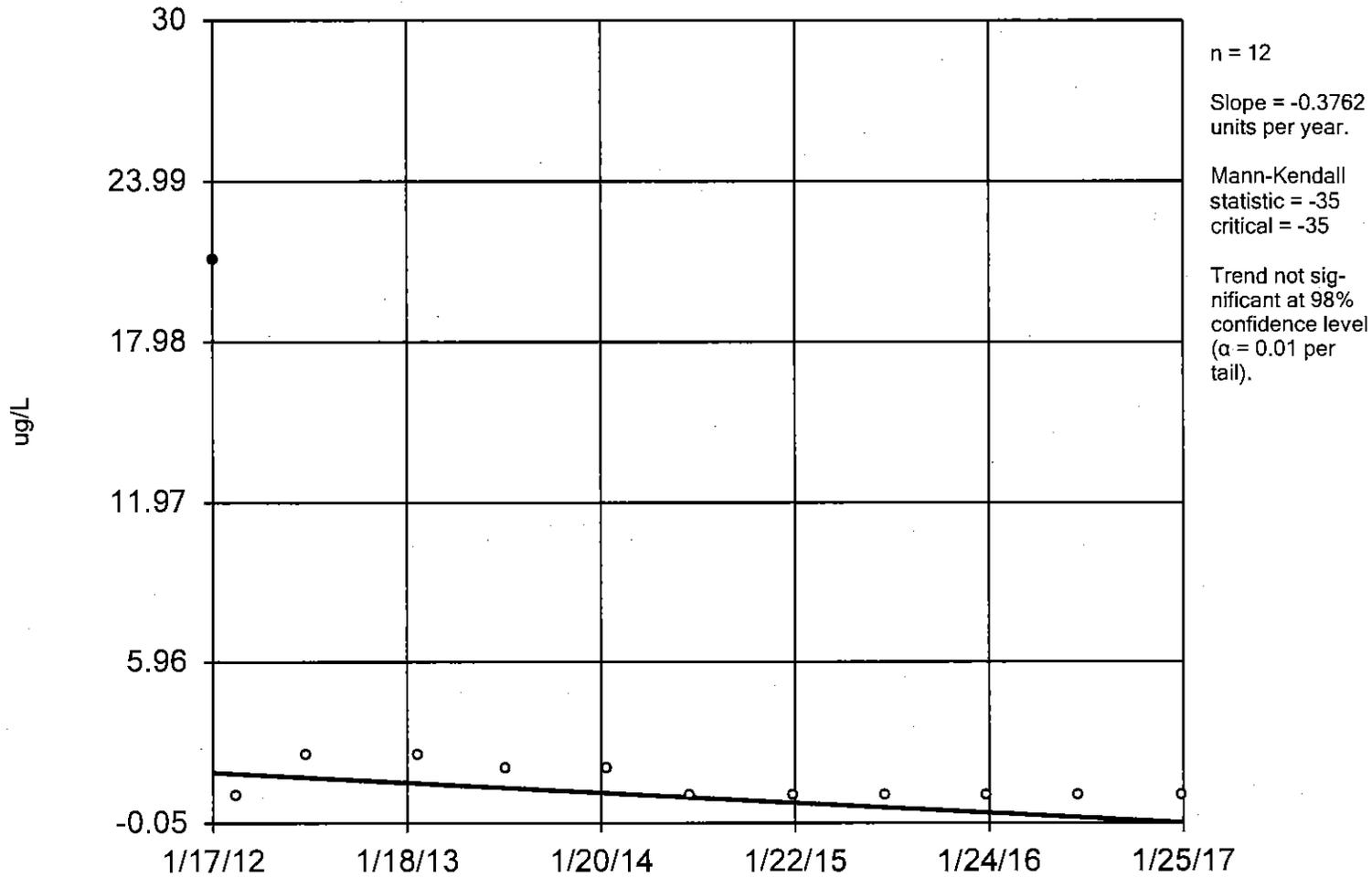
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-05
1/17/2012	<2
7/11/2012	<2
2/7/2013	<5
7/25/2013	<2
1/31/2014	<2
7/9/2014	<2
1/21/2015	<2
7/14/2015	<2
1/20/2016	<2
7/13/2016	<2
1/25/2017	<2

### Sen's Slope Estimator

MW-06 (bg)



Constituent: Cadmium Analysis Run 6/30/2017 1:35 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Cadmium (ug/L) Analysis Run 6/30/2017 1:35 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

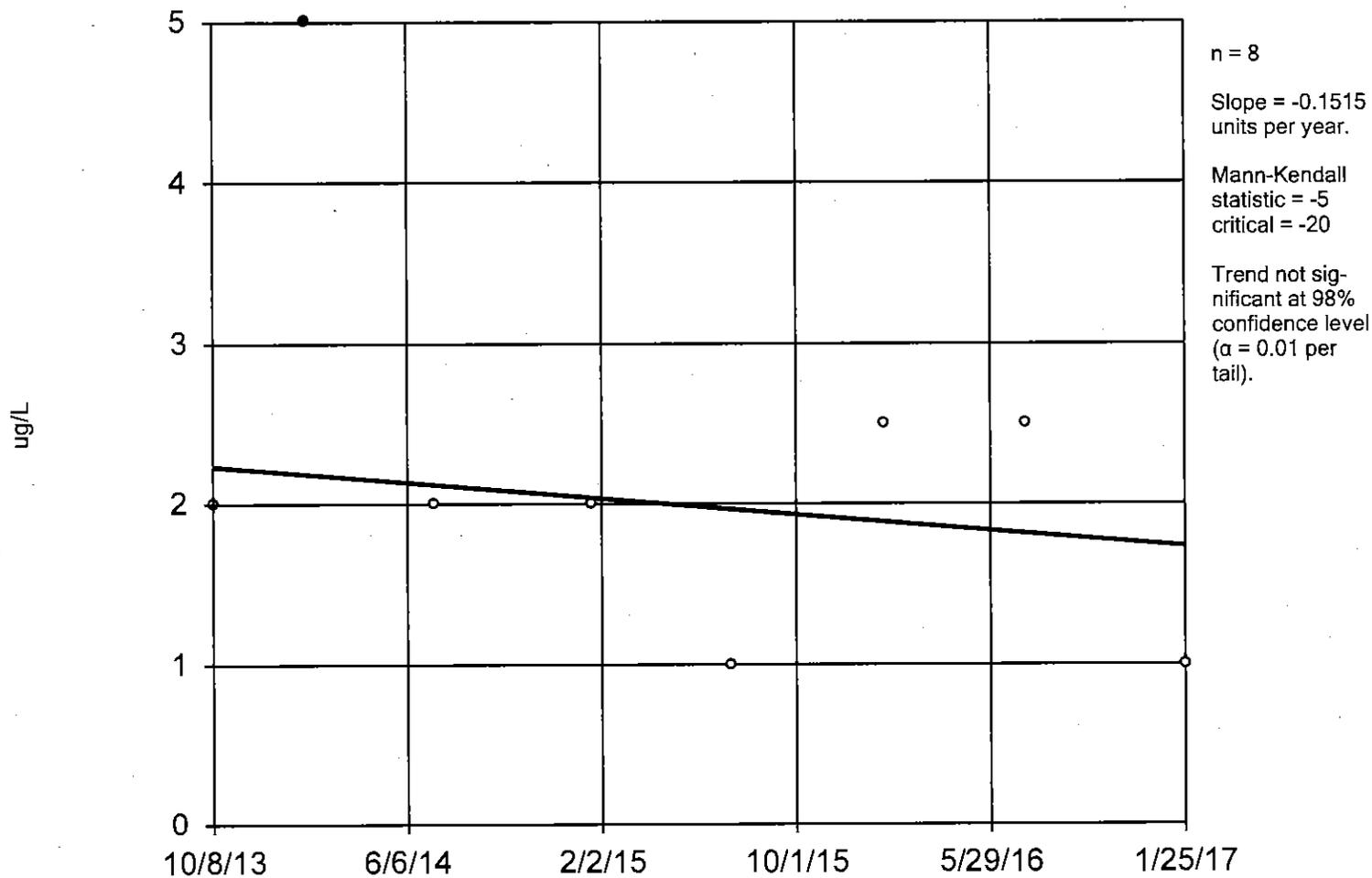
---

	MW-06 (bg)
1/17/2012	21.1
3/1/2012	<2 (V)
7/11/2012	<5
2/7/2013	<5
7/25/2013	<4
1/31/2014	<4
7/9/2014	<2
1/21/2015	<2
7/14/2015	<2
1/20/2016	<2
7/13/2016	<2
1/25/2017	<2

Hollow symbols indicate censored values.

# Sen's Slope Estimator

MW-14



Constituent: Cadmium Analysis Run 6/30/2017 1:36 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Cadmium (ug/L) Analysis Run 6/30/2017 1:36 PM

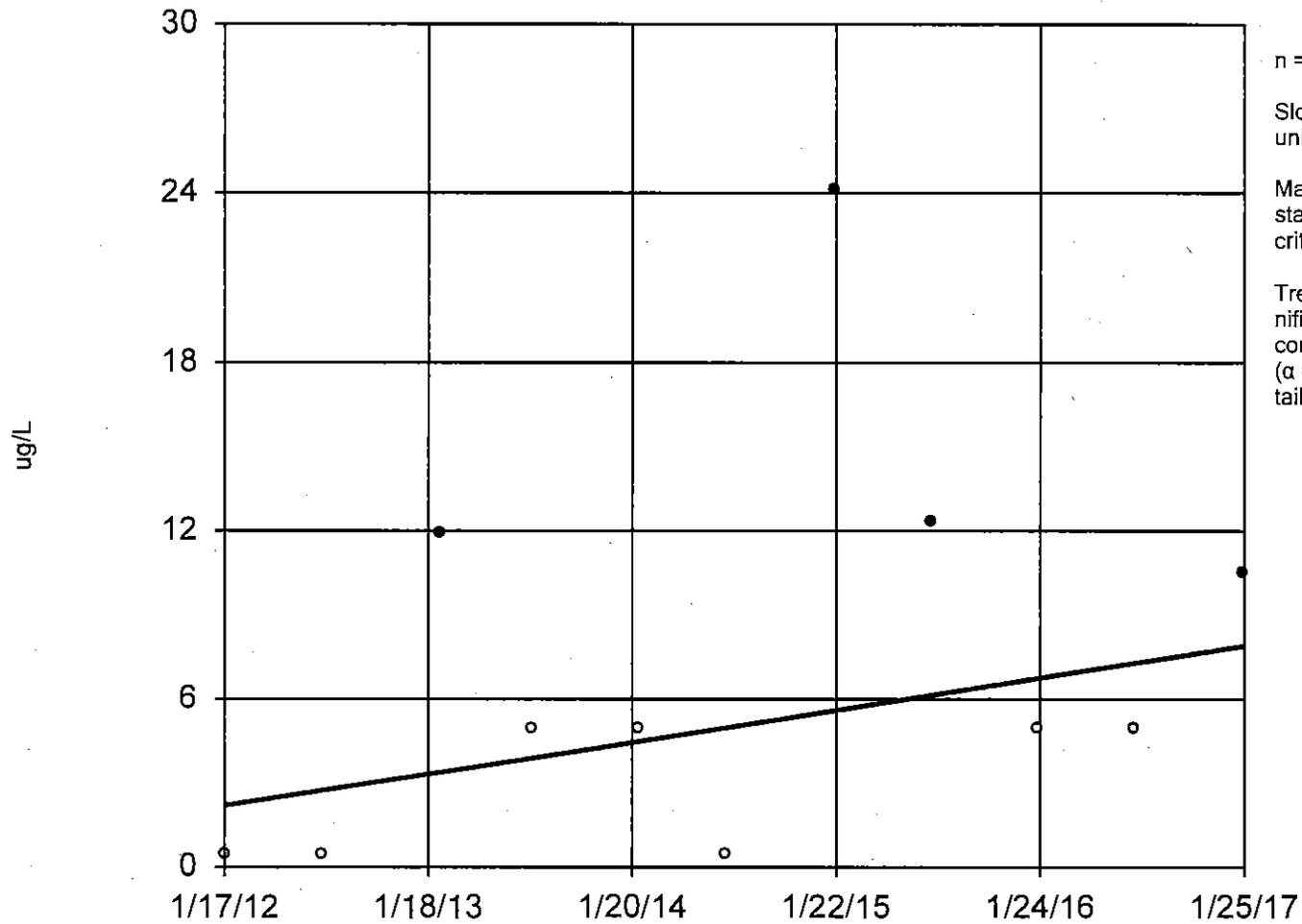
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-14
10/8/2013	<4
1/31/2014	5
7/9/2014	<4
1/21/2015	<4
7/14/2015	<2
1/20/2016	<5
7/13/2016	<5
1/25/2017	<2

### Sen's Slope Estimator

MW-02



n = 11

Slope = 1.123  
units per year.

Mann-Kendall  
statistic = 16  
critical = 31

Trend not sig-  
nificant at 98%  
confidence level  
( $\alpha = 0.01$  per  
tail).

Constituent: Chromium Analysis Run 6/30/2017 1:36 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Chromium (ug/L) Analysis Run 6/30/2017 1:36 PM

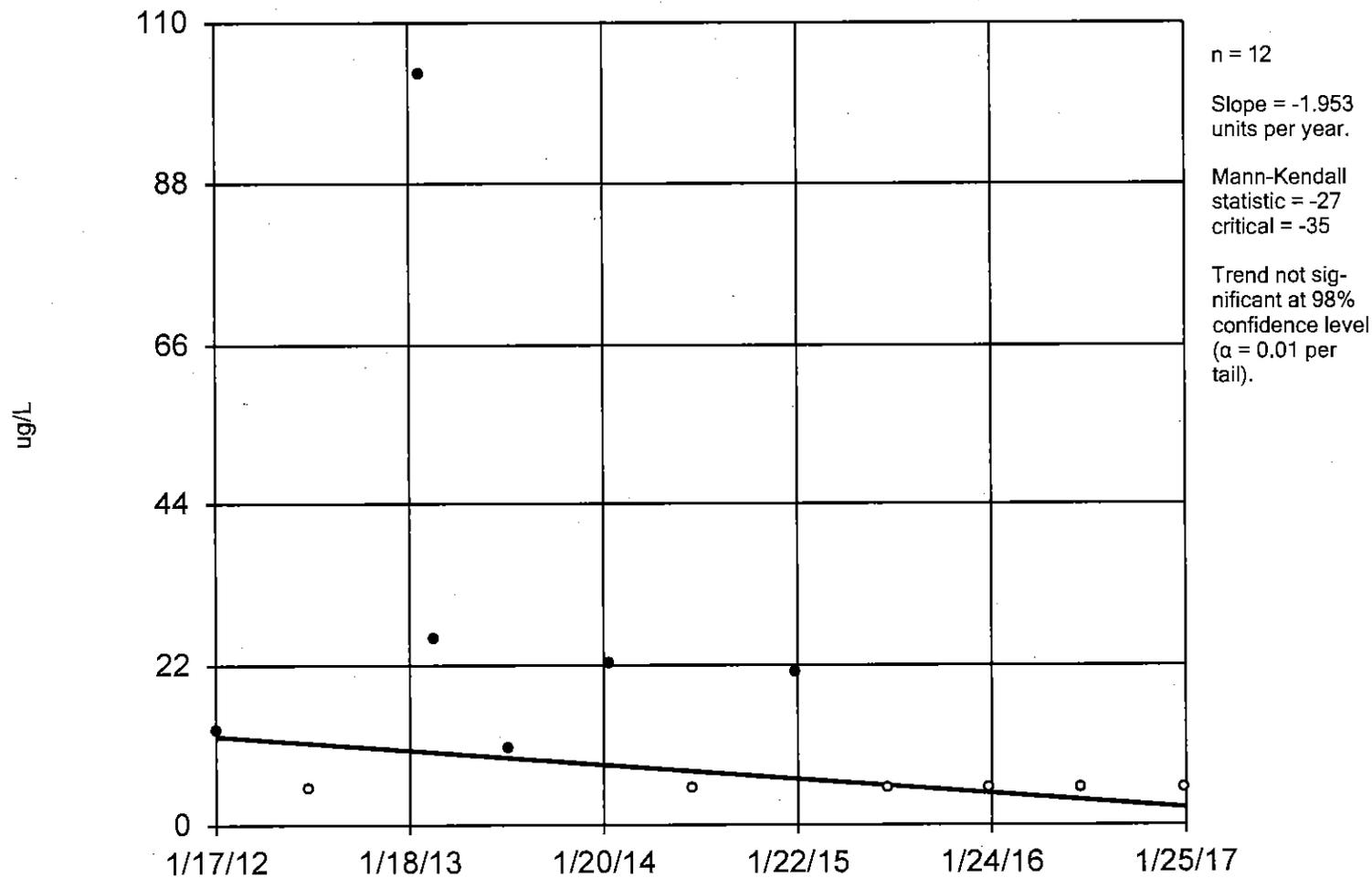
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-02
1/17/2012	<1
7/11/2012	<1
2/7/2013	11.9
7/25/2013	<10
1/31/2014	<10
7/9/2014	<1
1/21/2015	24.1
7/14/2015	12.3
1/20/2016	<10
7/13/2016	<10
1/25/2017	10.5

# Sen's Slope Estimator

MW-05



Constituent: Chromium Analysis Run 6/30/2017 1:37 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Chromium (ug/L) Analysis Run 6/30/2017 1:37 PM

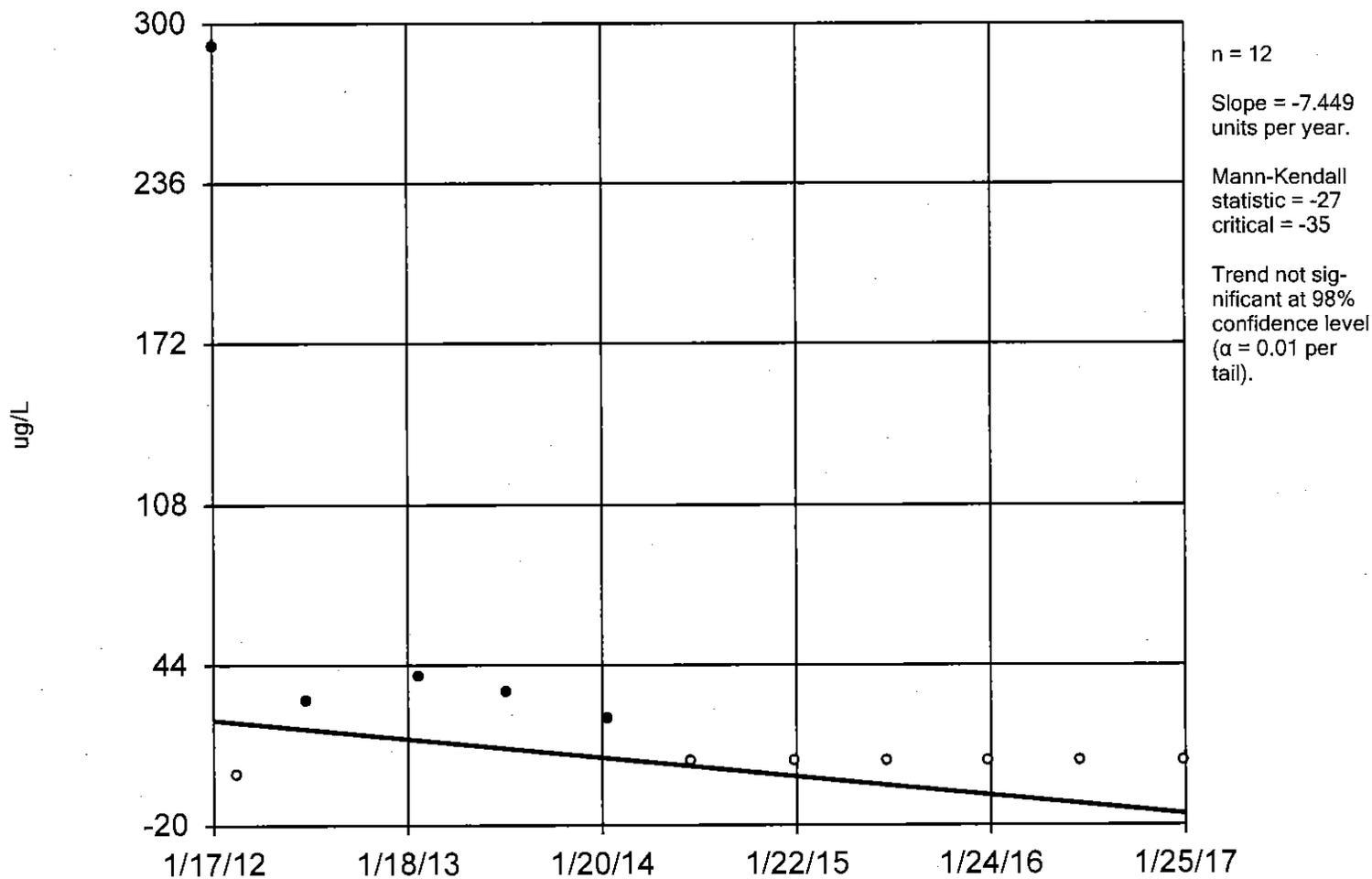
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-05
1/17/2012	13.1
7/11/2012	<10
2/7/2013	103
3/5/2013	25.5 (V)
7/25/2013	10.6
1/31/2014	22.3
7/9/2014	<10
1/21/2015	21
7/14/2015	<10
1/20/2016	<10
7/13/2016	<10
1/25/2017	<10

### Sen's Slope Estimator

MW-06 (bg)



Constituent: Chromium Analysis Run 6/30/2017 1:37 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Chromium (ug/L) Analysis Run 6/30/2017 1:37 PM

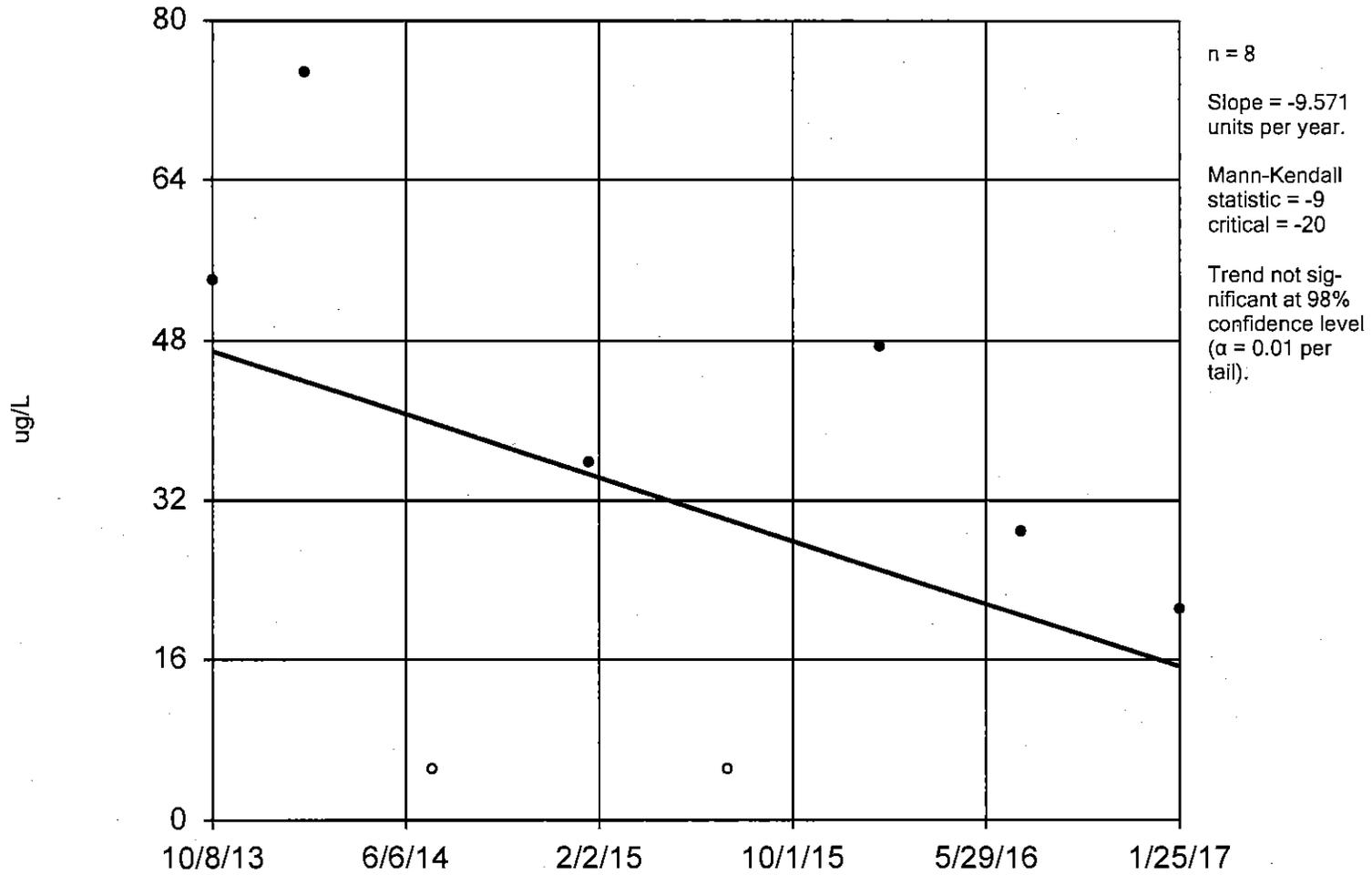
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-06 (bg)
1/17/2012	290.2
3/1/2012	<1 (V)
7/11/2012	29.7
2/7/2013	39.7
7/25/2013	32.7
1/31/2014	22
7/9/2014	<10
1/21/2015	<10
7/14/2015	<10
1/20/2016	<10
7/13/2016	<10
1/25/2017	<10

### Sen's Slope Estimator

MW-14



Constituent: Chromium Analysis Run 6/30/2017 1:38 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Chromium (ug/L) Analysis Run 6/30/2017 1:38 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

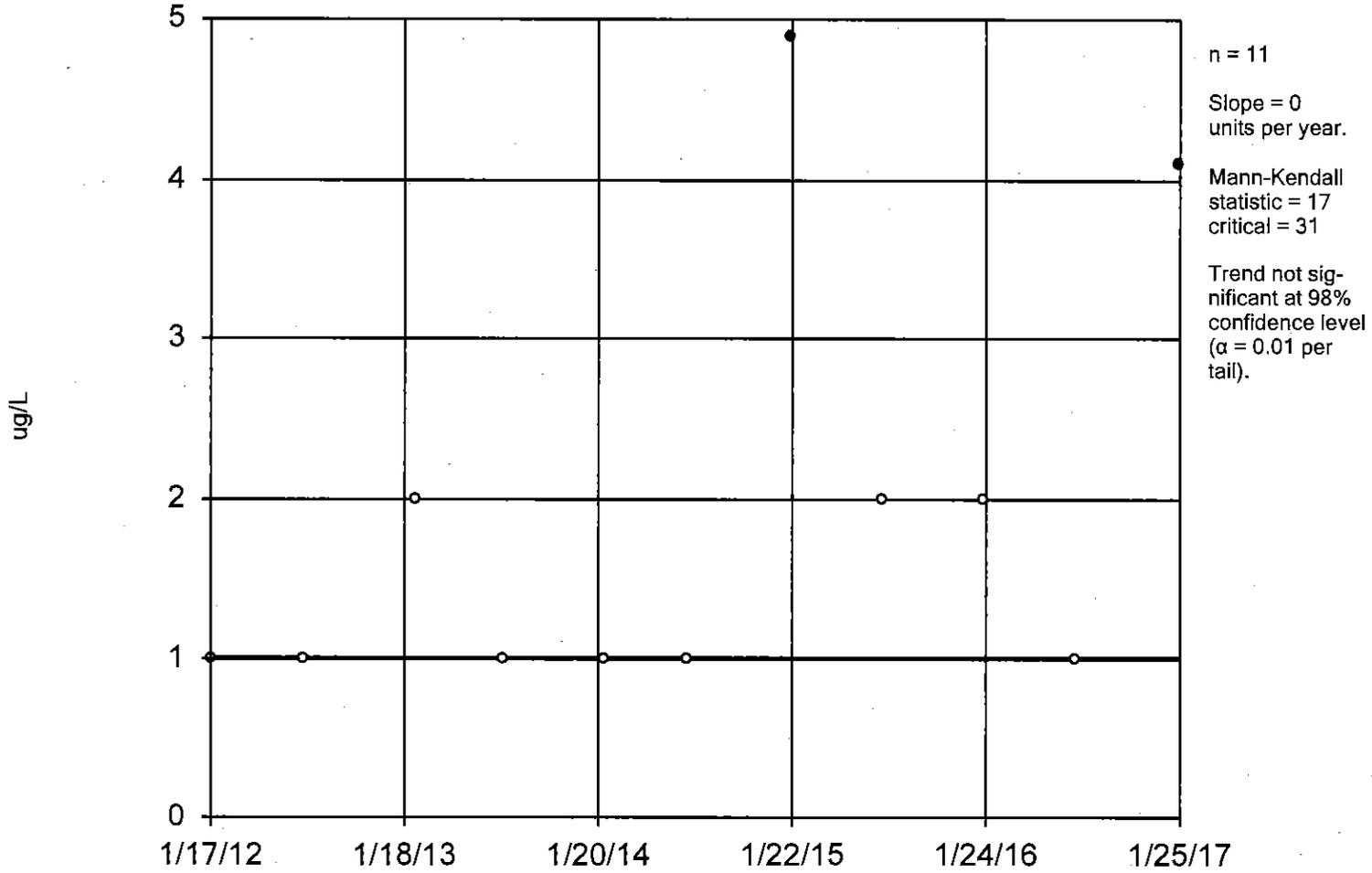
---

	MW-14
10/8/2013	54.1
1/31/2014	74.8
7/9/2014	<10
1/21/2015	35.7
7/14/2015	<10
1/20/2016	47.4
7/13/2016	28.9
1/25/2017	21

Hollow symbols indicate censored values.

### Sen's Slope Estimator

MW-02



Constituent: Cobalt Analysis Run 7/2/2017 2:24 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Cobalt (ug/L) Analysis Run 7/2/2017 2:24 PM

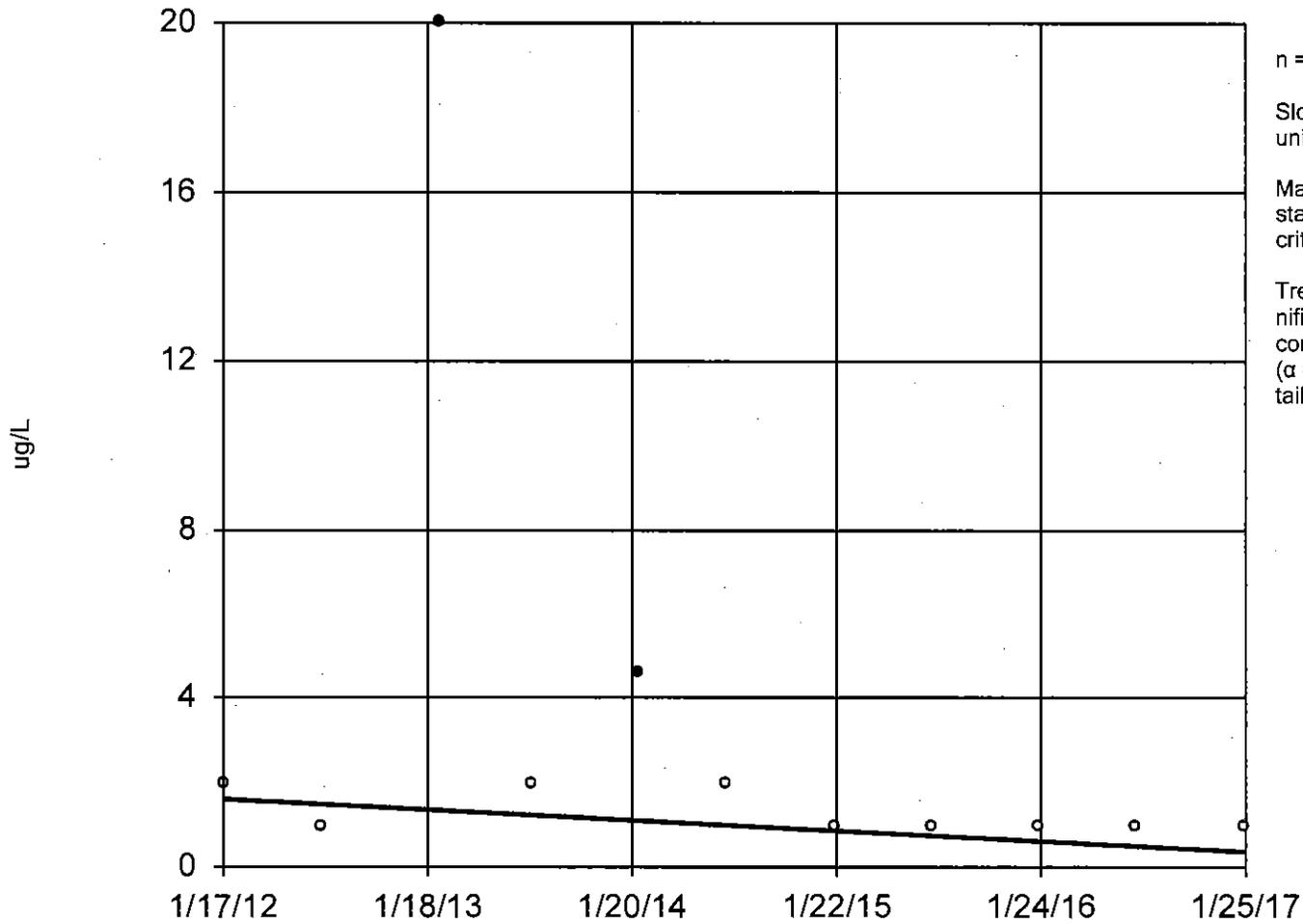
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-02
1/17/2012	<2
7/11/2012	<2
2/7/2013	<4
7/25/2013	<2
1/31/2014	<2
7/9/2014	<2
1/21/2015	4.9
7/14/2015	<4
1/20/2016	<4
7/13/2016	<2
1/25/2017	4.1

### Sen's Slope Estimator

MW-05



n = 11

Slope = -0.2493  
units per year.

Mann-Kendall  
statistic = -23  
critical = -31

Trend not sig-  
nificant at 98%  
confidence level  
( $\alpha = 0.01$  per  
tail).

Constituent: Cobalt Analysis Run 7/2/2017 2:24 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Cobalt (ug/L) Analysis Run 7/2/2017 2:25 PM

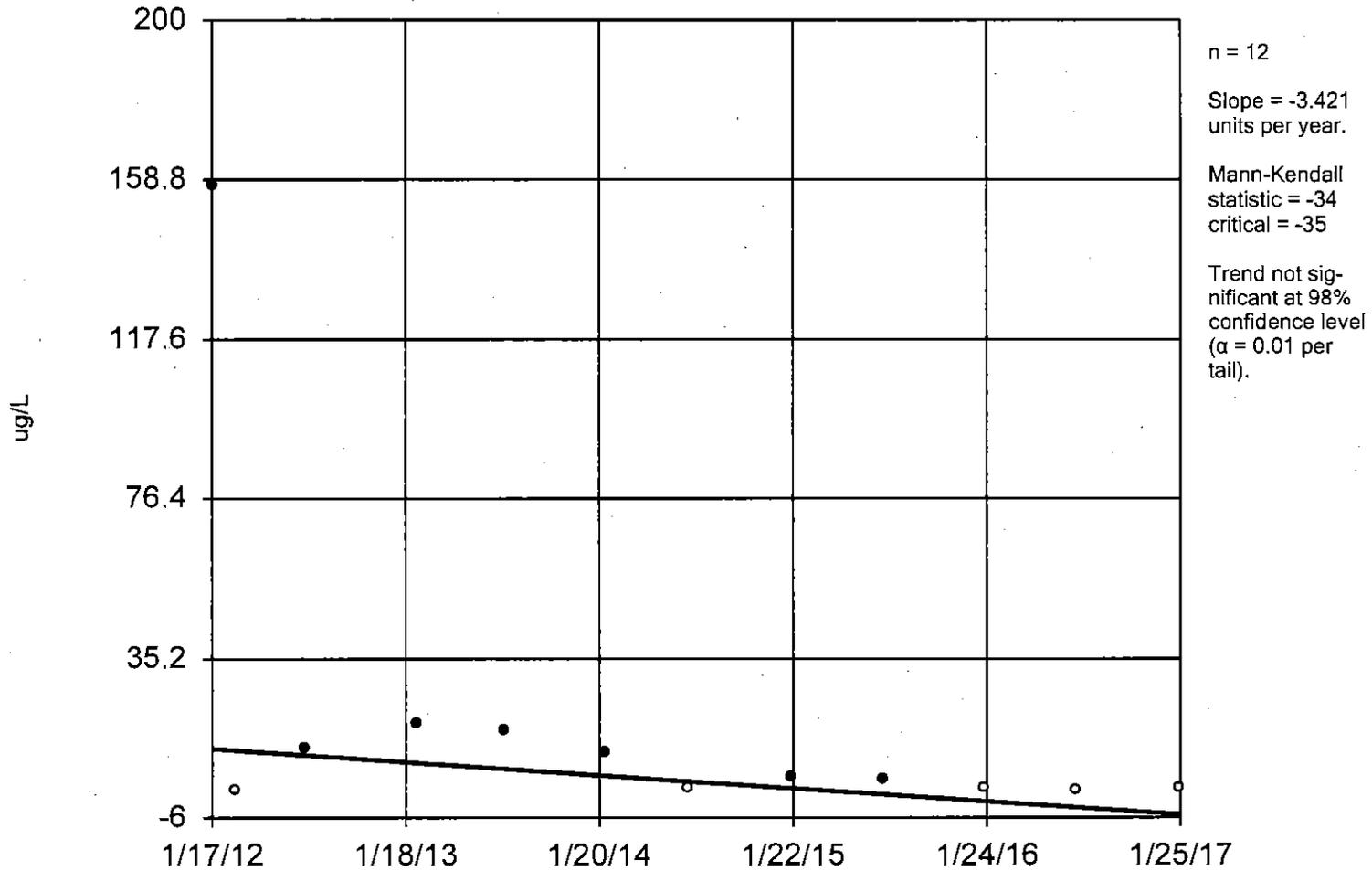
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-05
1/17/2012	<4
7/11/2012	<2
2/7/2013	20
7/25/2013	<4
1/31/2014	4.6
7/9/2014	<4
1/21/2015	<2
7/14/2015	<2
1/20/2016	<2
7/13/2016	<2
1/25/2017	<2

### Sen's Slope Estimator

MW-06 (bg)



Constituent: Cobalt Analysis Run 7/2/2017 2:25 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Cobalt (ug/L) Analysis Run 7/2/2017 2:25 PM

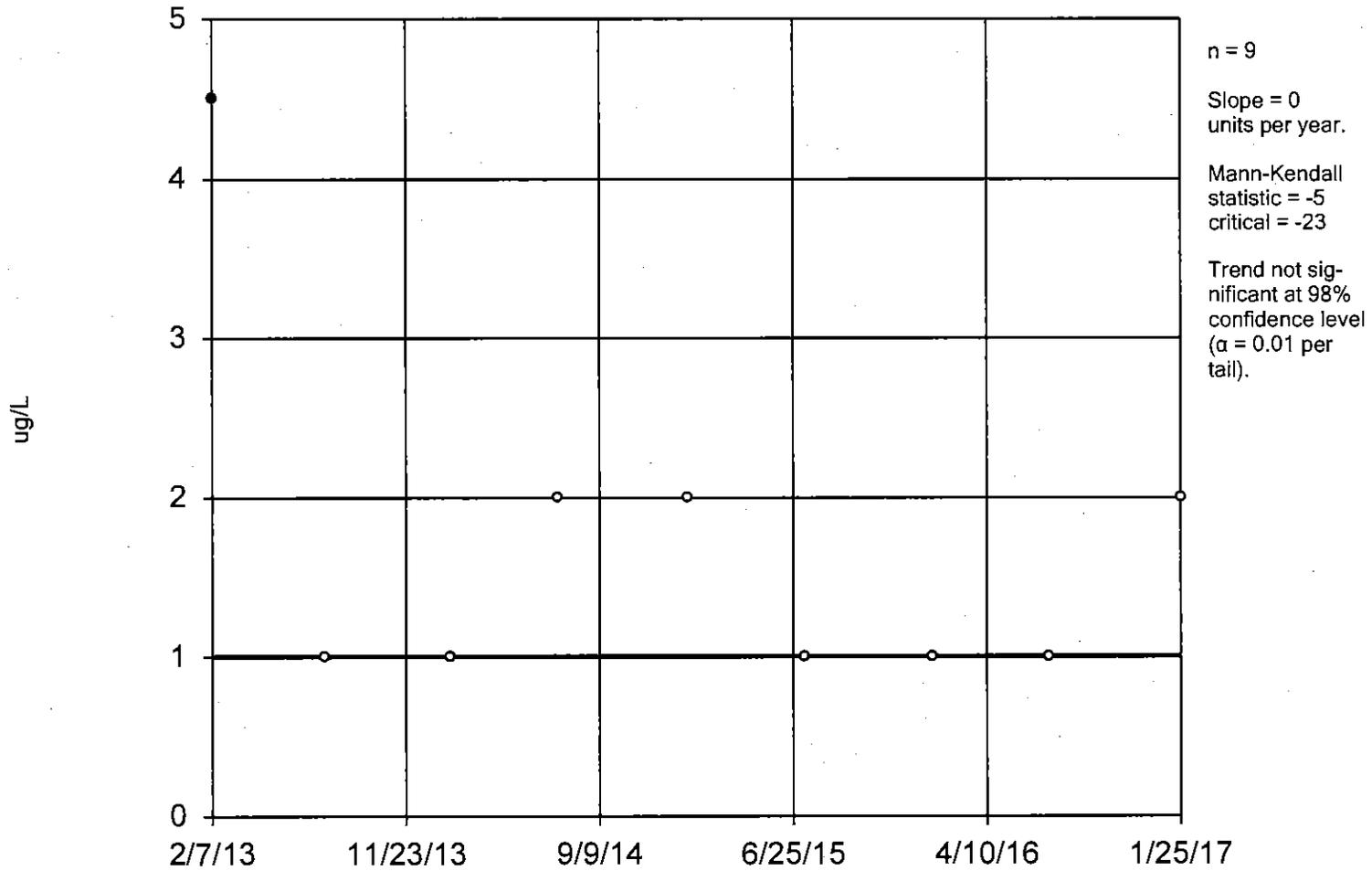
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-06 (bg)
1/17/2012	157.1
3/1/2012	<2 (V)
7/11/2012	11.8
2/7/2013	18.3
7/25/2013	16.5
1/31/2014	10.9
7/9/2014	<4
1/21/2015	4.5
7/14/2015	4
1/20/2016	<4
7/13/2016	<2
1/25/2017	<4

### Sen's Slope Estimator

MW-13 (bg)



Constituent: Cobalt Analysis Run 7/2/2017 2:25 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Cobalt (ug/L) Analysis Run 7/2/2017 2:25 PM

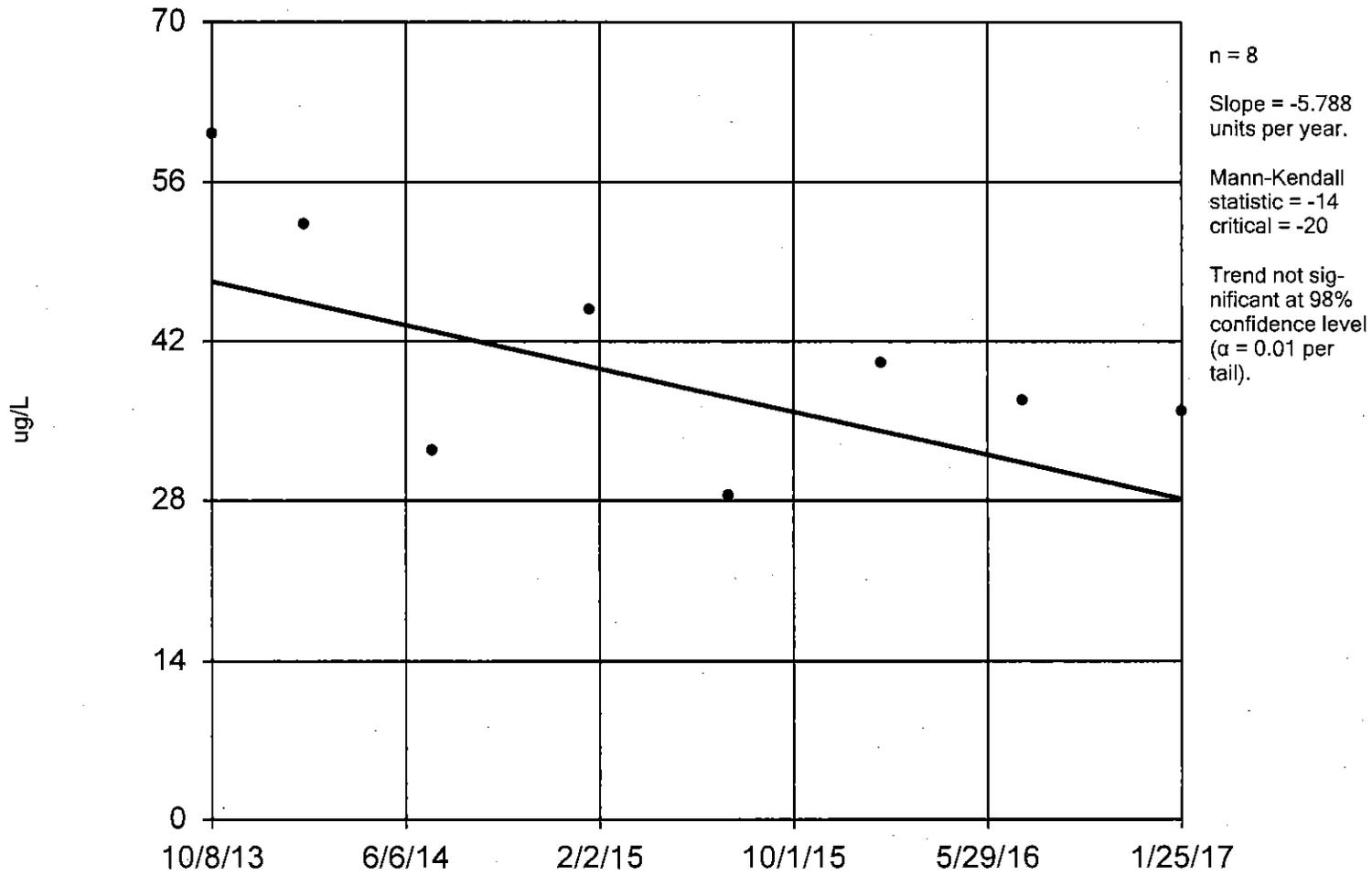
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-13 (bg)
2/7/2013	4.5
7/25/2013	<2
1/31/2014	<2
7/9/2014	<4
1/21/2015	<4
7/14/2015	<2
1/20/2016	<2
7/13/2016	<2
1/25/2017	<4

### Sen's Slope Estimator

MW-14



Constituent: Cobalt Analysis Run 7/2/2017 2:26 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Cobalt (ug/L) Analysis Run 7/2/2017 2:26 PM

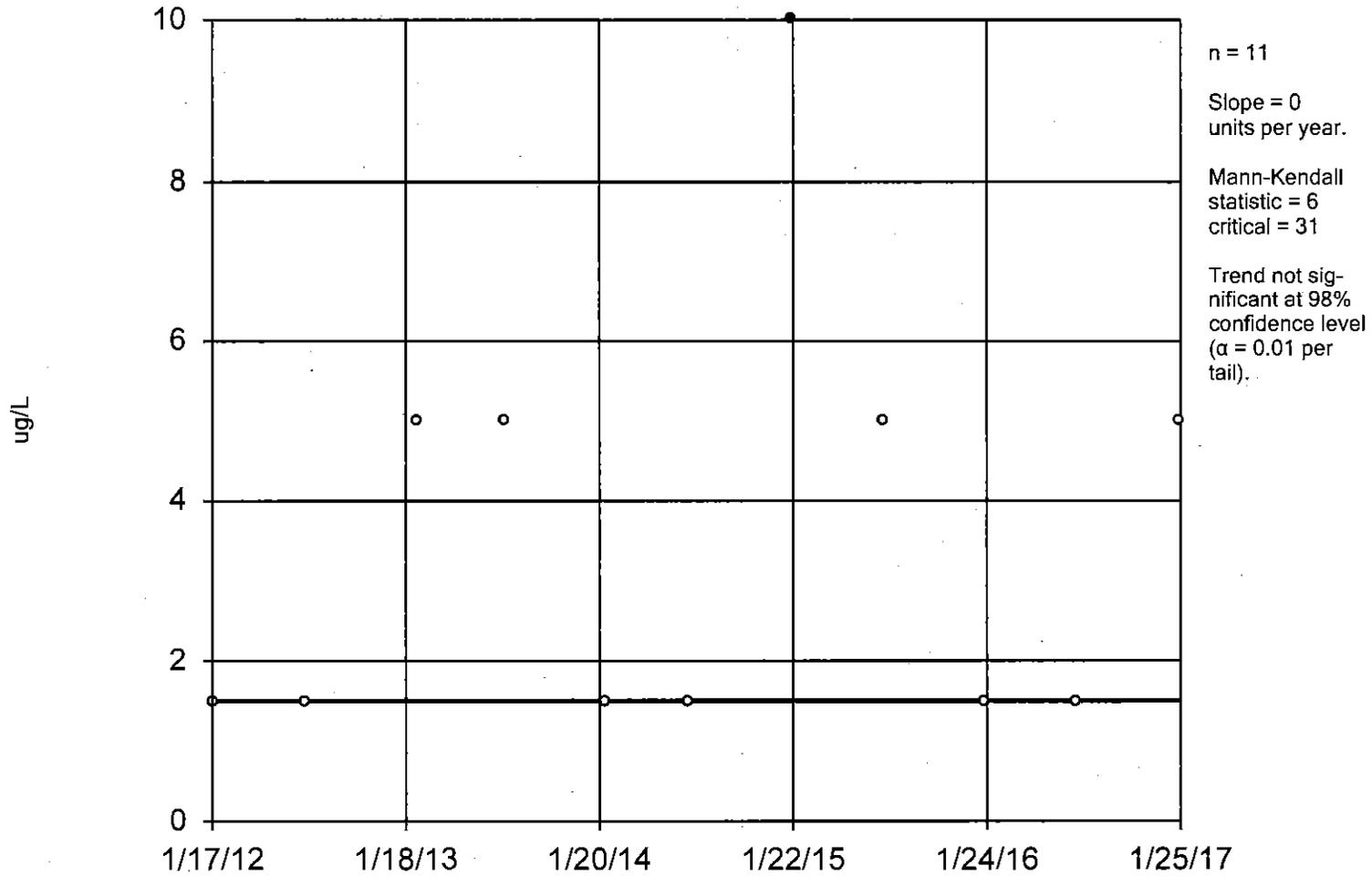
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-14
10/8/2013	60.1
1/31/2014	52.1
7/9/2014	32.3
1/21/2015	44.8
7/14/2015	28.4
1/20/2016	40.1
7/13/2016	36.7
1/25/2017	35.8

### Sen's Slope Estimator

MW-02



Constituent: Copper Analysis Run 6/30/2017 1:38 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Copper (ug/L) Analysis Run 6/30/2017 1:38 PM

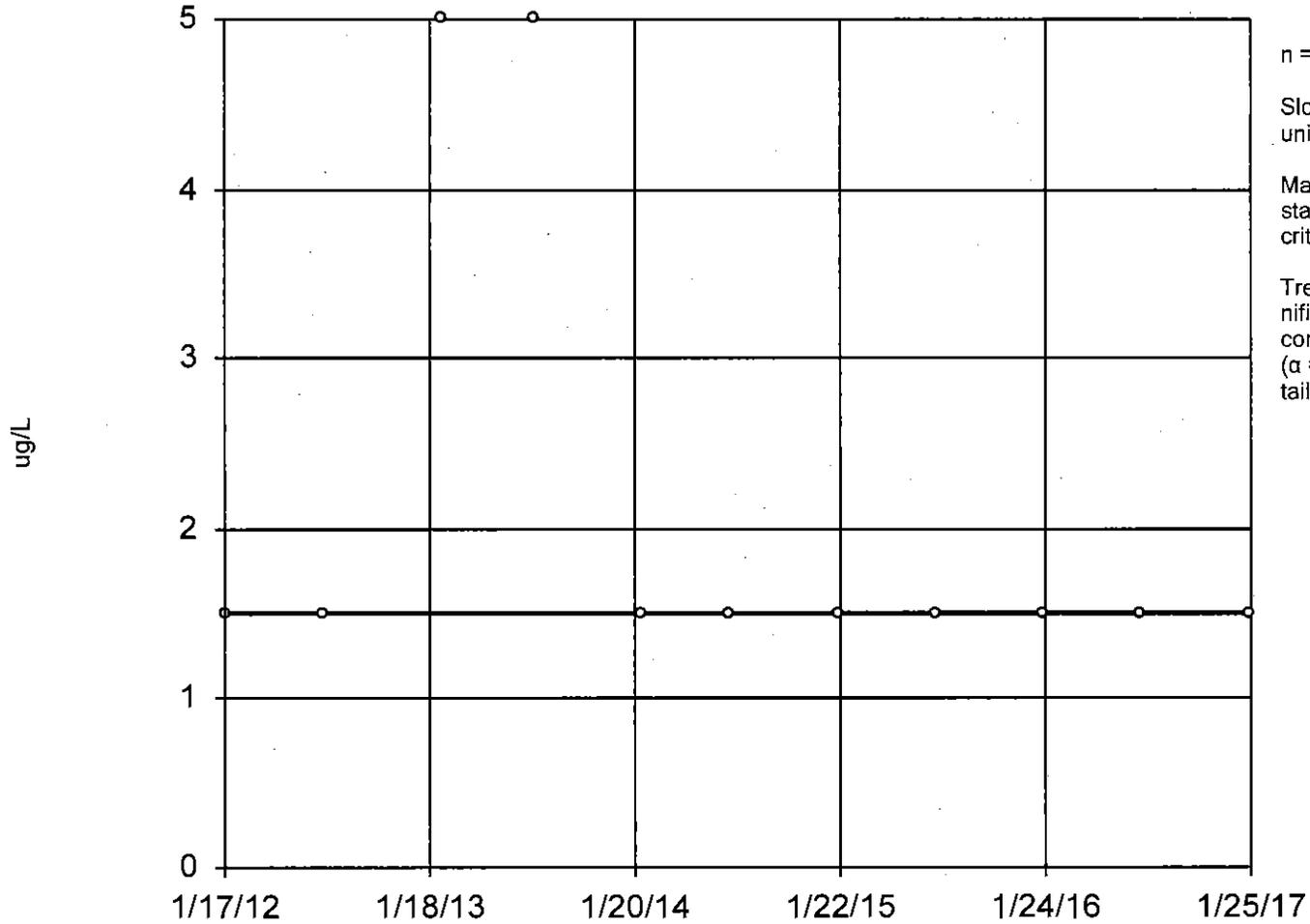
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-02
1/17/2012	<3
7/11/2012	<3
2/7/2013	<10
7/25/2013	<10
1/31/2014	<3
7/9/2014	<3
1/21/2015	10
7/14/2015	<10
1/20/2016	<3
7/13/2016	<3
1/25/2017	<10

### Sen's Slope Estimator

MW-05



n = 11

Slope = 0  
units per year.

Mann-Kendall  
statistic = -10  
critical = -31

Trend not sig-  
nificant at 98%  
confidence level  
( $\alpha = 0.01$  per  
tail).

Constituent: Copper Analysis Run 6/30/2017 1:39 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Copper (ug/L) Analysis Run 6/30/2017 1:39 PM

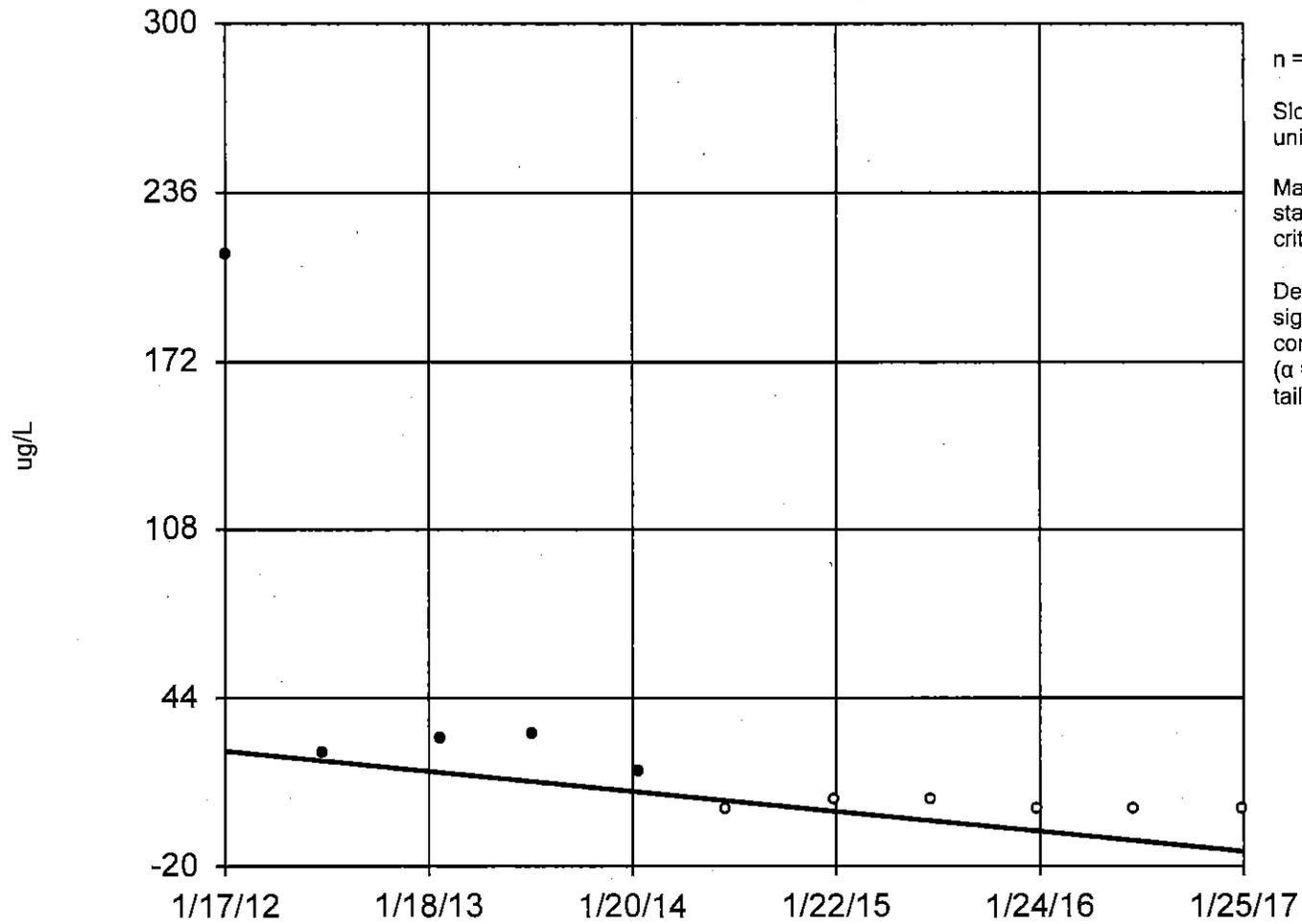
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-05
1/17/2012	<3
7/11/2012	<3
2/7/2013	<10
7/25/2013	<10
1/31/2014	<3
7/9/2014	<3
1/21/2015	<3
7/14/2015	<3
1/20/2016	<3
7/13/2016	<3
1/25/2017	<3

### Sen's Slope Estimator

MW-06 (bg)



n = 11

Slope = -7.615  
units per year.

Mann-Kendall  
statistic = -38  
critical = -31

Decreasing trend  
significant at 98%  
confidence level  
( $\alpha = 0.01$  per  
tail).

Constituent: Copper Analysis Run 6/30/2017 1:39 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Copper (ug/L) Analysis Run 6/30/2017 1:40 PM

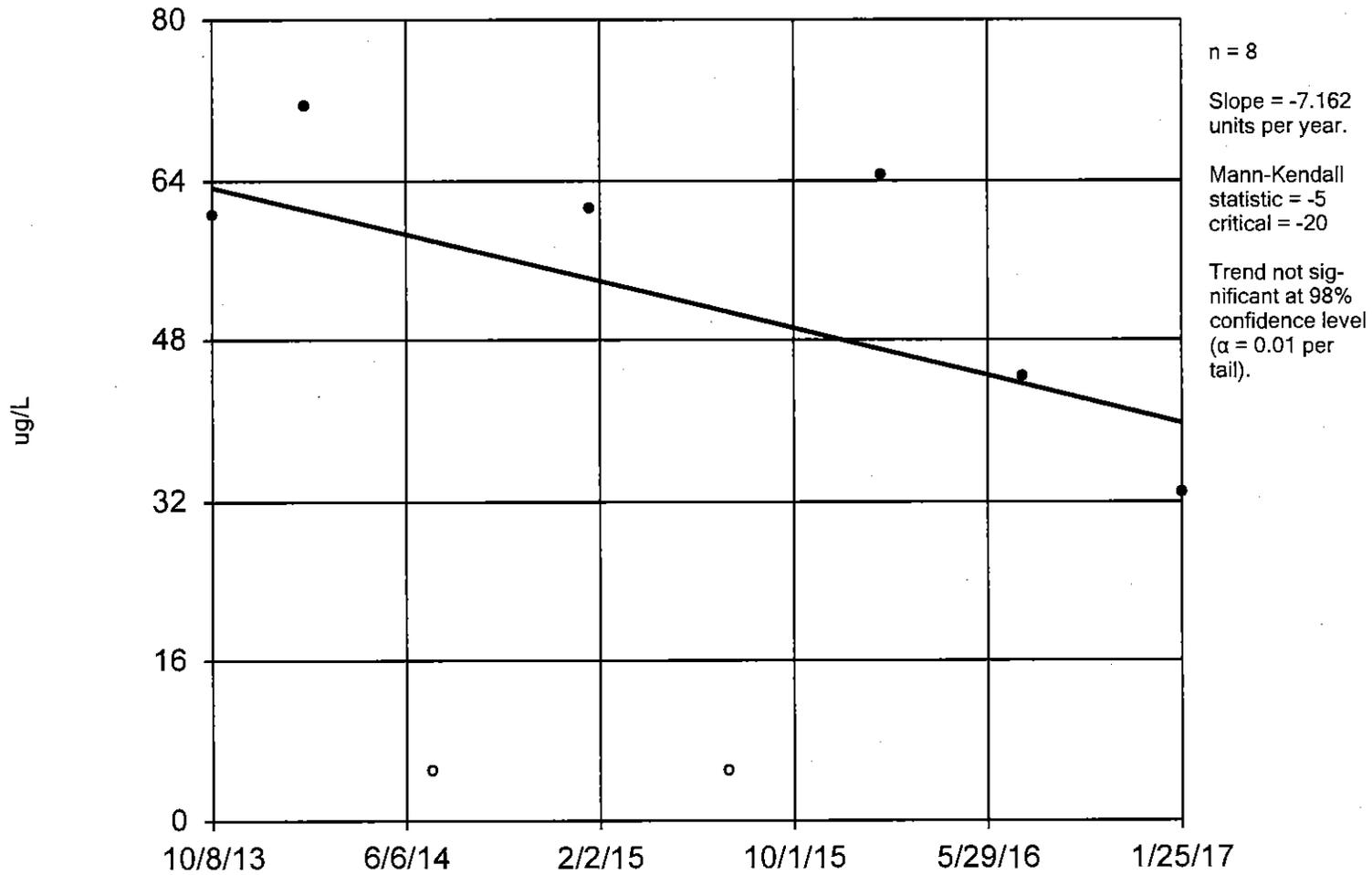
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-06 (bg)
1/17/2012	212
7/11/2012	22.8
2/7/2013	29
7/25/2013	30.1
1/31/2014	16.5
7/9/2014	<3
1/21/2015	<10
7/14/2015	<10
1/20/2016	<3
7/13/2016	<3
1/25/2017	<3

# Sen's Slope Estimator

MW-14



Constituent: Copper Analysis Run 6/30/2017 1:40 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Copper (ug/L) Analysis Run 6/30/2017 1:41 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

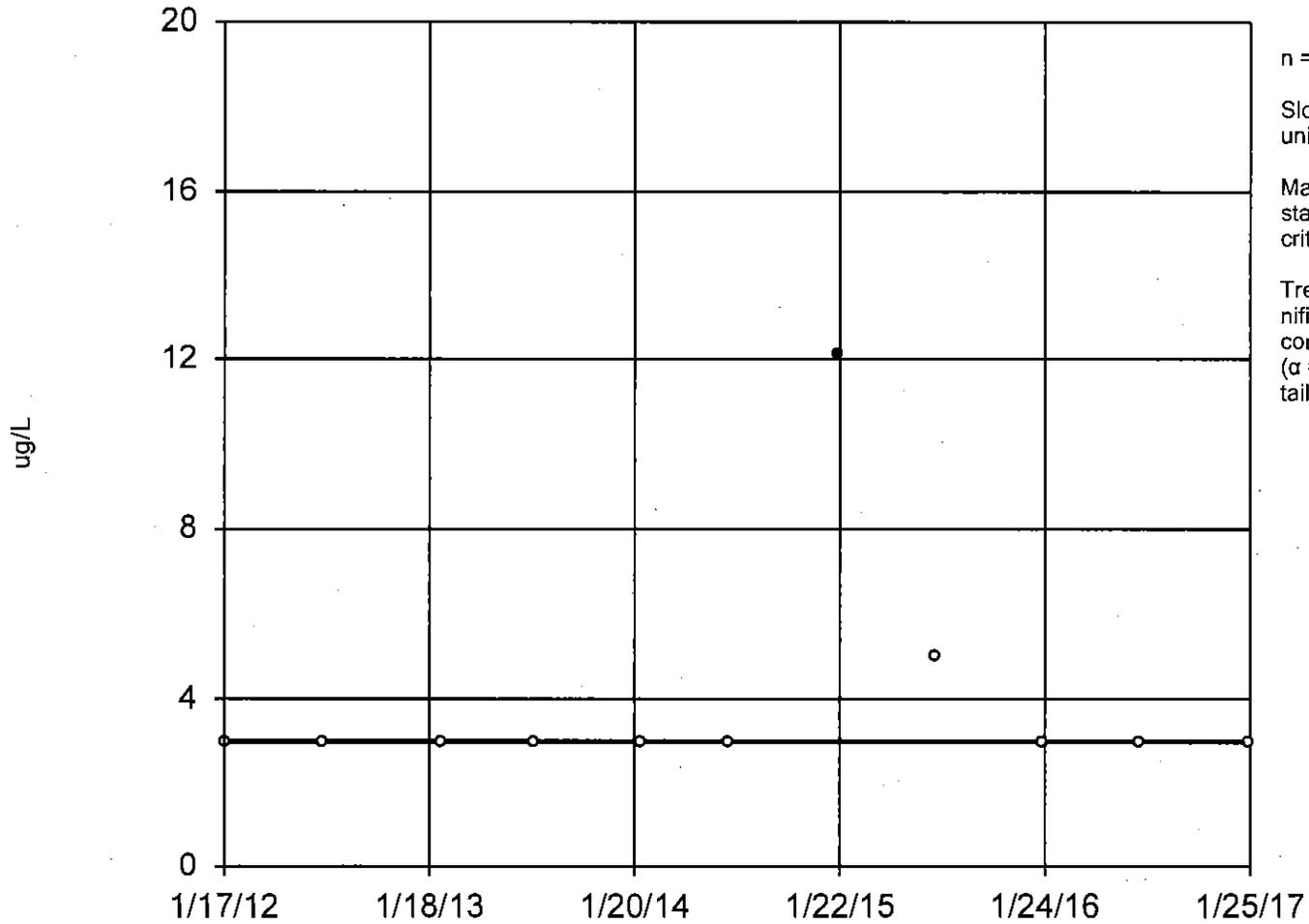
---

	MW-14
10/8/2013	60.6
1/31/2014	71.5
7/9/2014	<10
1/21/2015	61.2
7/14/2015	<10
1/20/2016	64.6
7/13/2016	44.2
1/25/2017	32.9

Hollow symbols indicate censored values.

# Sen's Slope Estimator

MW-02



n = 11

Slope = 0  
units per year.

Mann-Kendall  
statistic = 5  
critical = 31

Trend not sig-  
nificant at 98%  
confidence level  
( $\alpha = 0.01$  per  
tail).

Constituent: Lead Analysis Run 7/2/2017 2:26 PM  
Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Lead (ug/L) Analysis Run 7/2/2017 2:26 PM

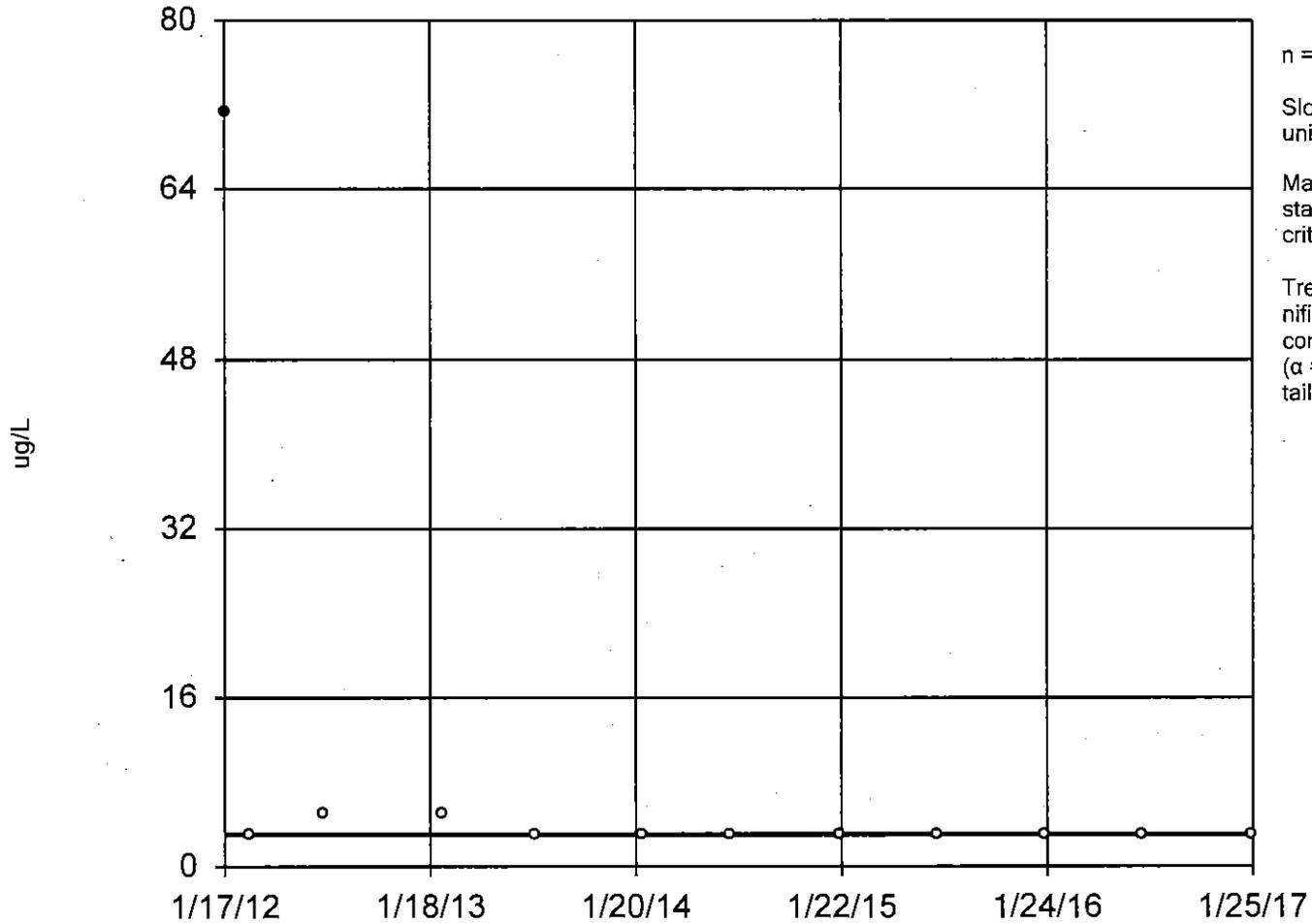
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-02
1/17/2012	<6
7/11/2012	<6
2/7/2013	<6
7/25/2013	<6
1/31/2014	<6
7/9/2014	<6
1/21/2015	12.1
7/14/2015	<10
1/20/2016	<6
7/13/2016	<6
1/25/2017	<6

### Sen's Slope Estimator

MW-06 (bg)



n = 12

Slope = 0  
units per year.

Mann-Kendall  
statistic = -25  
critical = -35

Trend not sig-  
nificant at 98%  
confidence level  
( $\alpha = 0.01$  per  
tail).

Constituent: Lead Analysis Run 7/2/2017 2:27 PM  
Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Lead (ug/L) Analysis Run 7/2/2017 2:27 PM

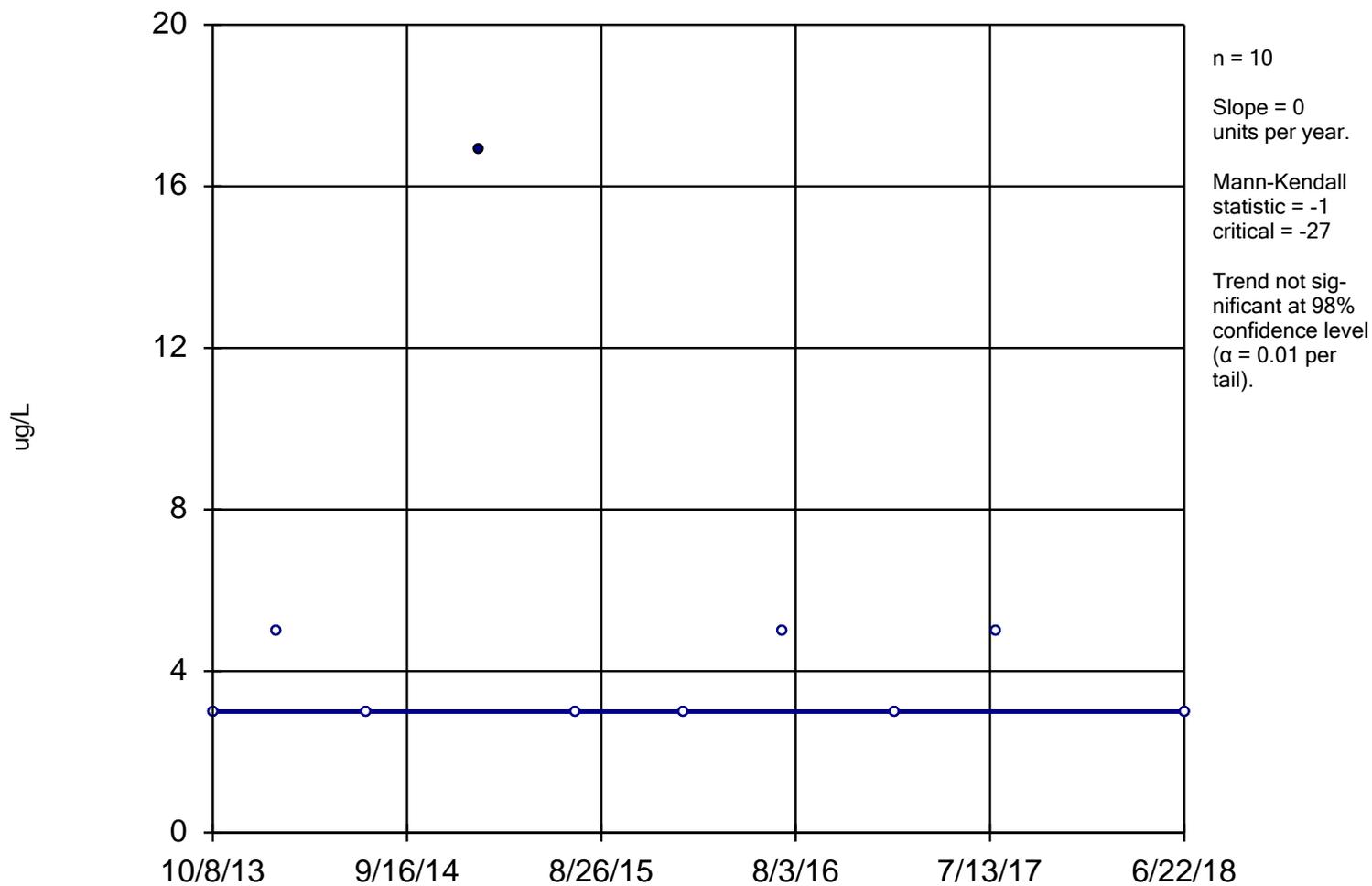
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-06 (bg)
1/17/2012	71.5
3/1/2012	<6 (V)
7/11/2012	<10
2/7/2013	<10
7/25/2013	<6
1/31/2014	<6
7/9/2014	<6
1/21/2015	<6
7/14/2015	<6
1/20/2016	<6
7/13/2016	<6
1/25/2017	<6

# Sen's Slope Estimator

MW-14



Constituent: Lead Analysis Run 7/13/2018 1:42 PM

Facility: Goochland Cy Landfill Data File: WQSTAT for Goochland

# Sen's Slope Estimator

Constituent: Lead (ug/L) Analysis Run 7/13/2018 1:45 PM

Facility: Goochland Cy Landfill Data File: WQSTAT for Goochland

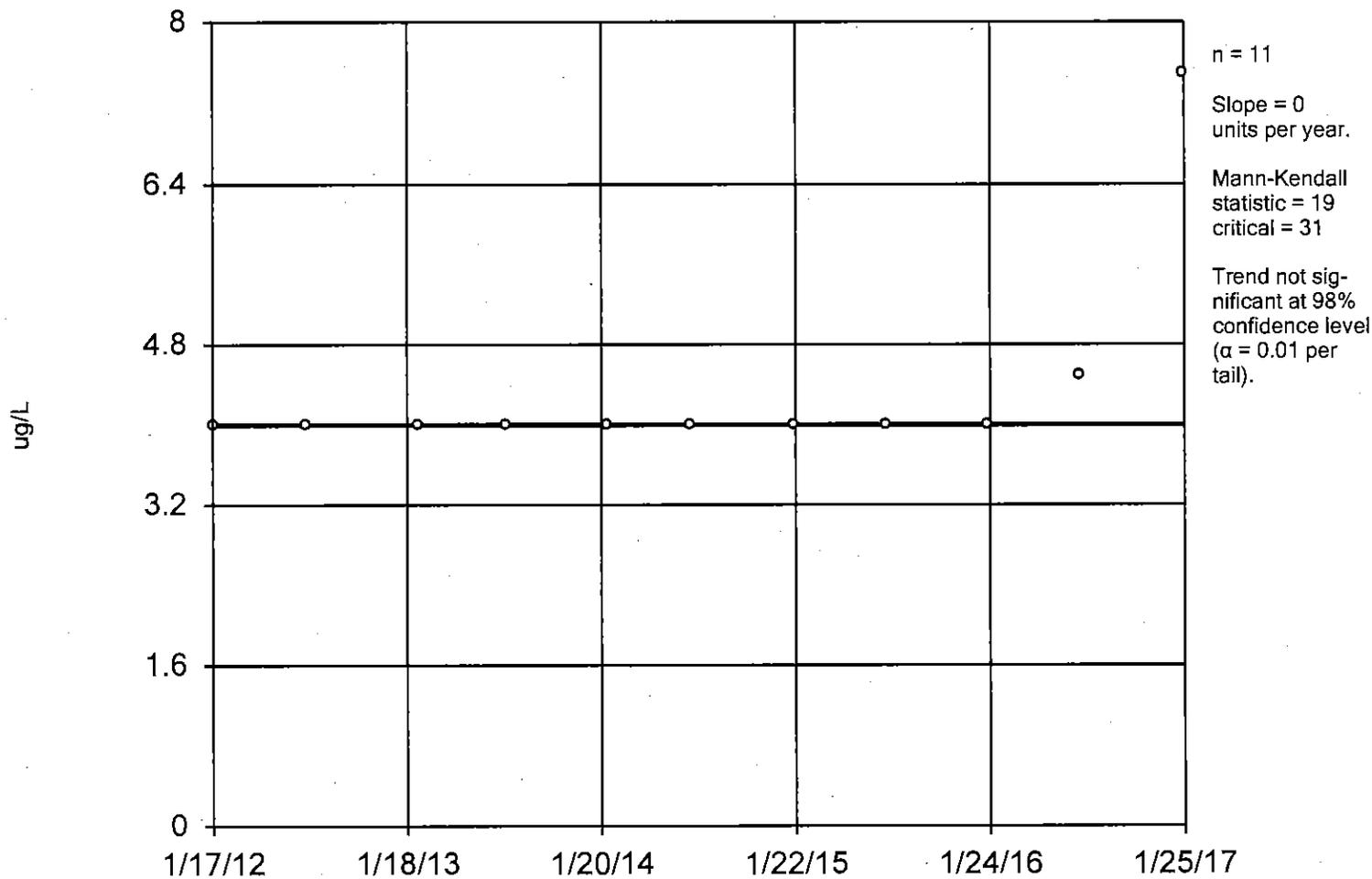
---

	MW-14
10/8/2013	<6
1/31/2014	<10
7/9/2014	<6
1/21/2015	16.9
7/14/2015	<6
1/20/2016	<6
7/13/2016	<10
1/25/2017	<6
7/26/2017	<10
6/22/2018	<6

Hollow symbols indicate censored values.

### Sen's Slope Estimator

MW-02



Constituent: Selenium Analysis Run 6/30/2017 1:48 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Selenium (ug/L) Analysis Run 6/30/2017 1:48 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

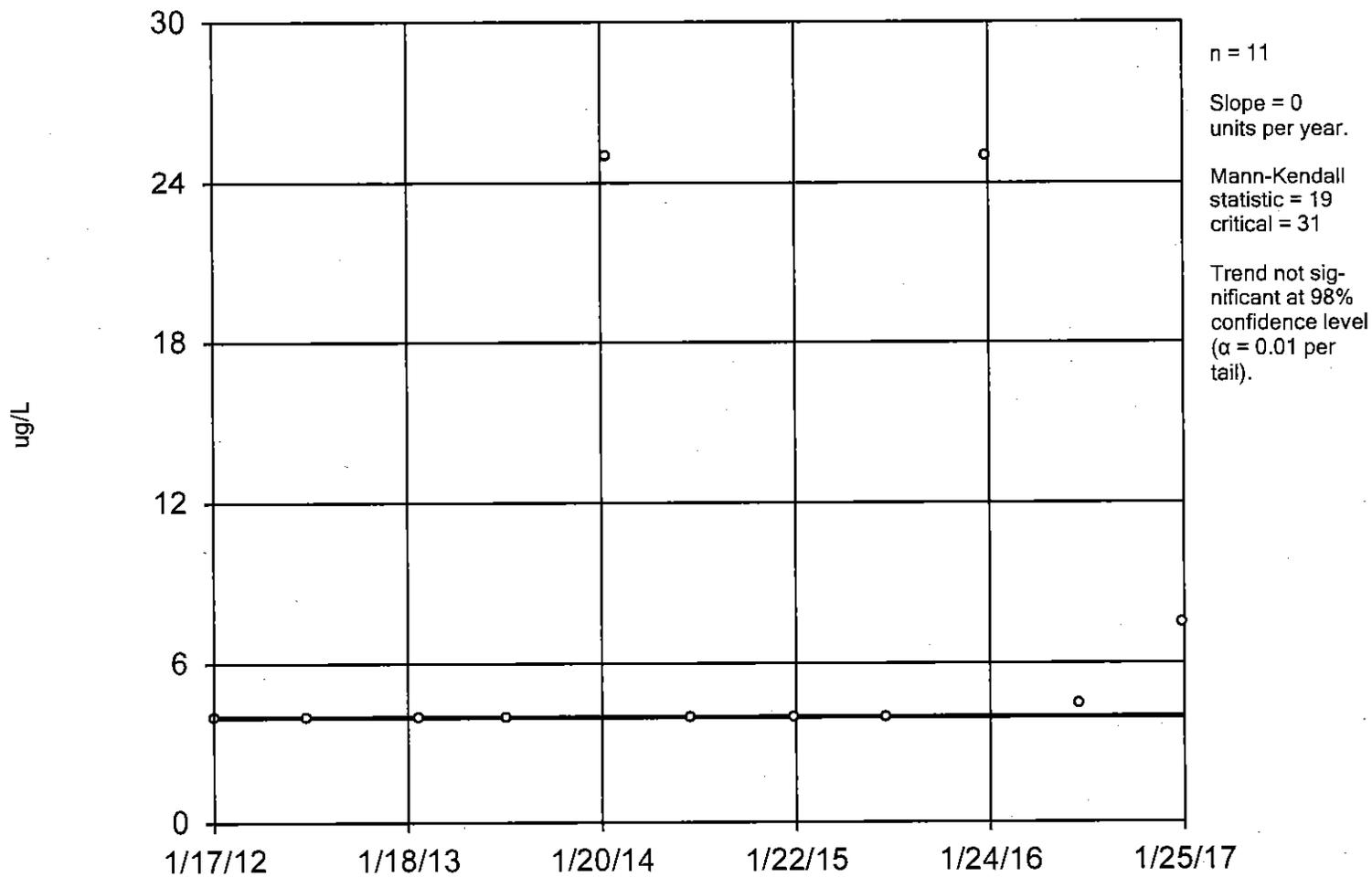
---

	MW-02
1/17/2012	<8
7/11/2012	<8
2/7/2013	<8
7/25/2013	<8
1/31/2014	<8
7/9/2014	<8
1/21/2015	<8
7/14/2015	<8
1/20/2016	<8
7/13/2016	<9
1/25/2017	<15

Hollow symbols indicate censored values.

### Sen's Slope Estimator

MW-05



Constituent: Selenium Analysis Run 6/30/2017 1:49 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Selenium (ug/L) Analysis Run 6/30/2017 1:49 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

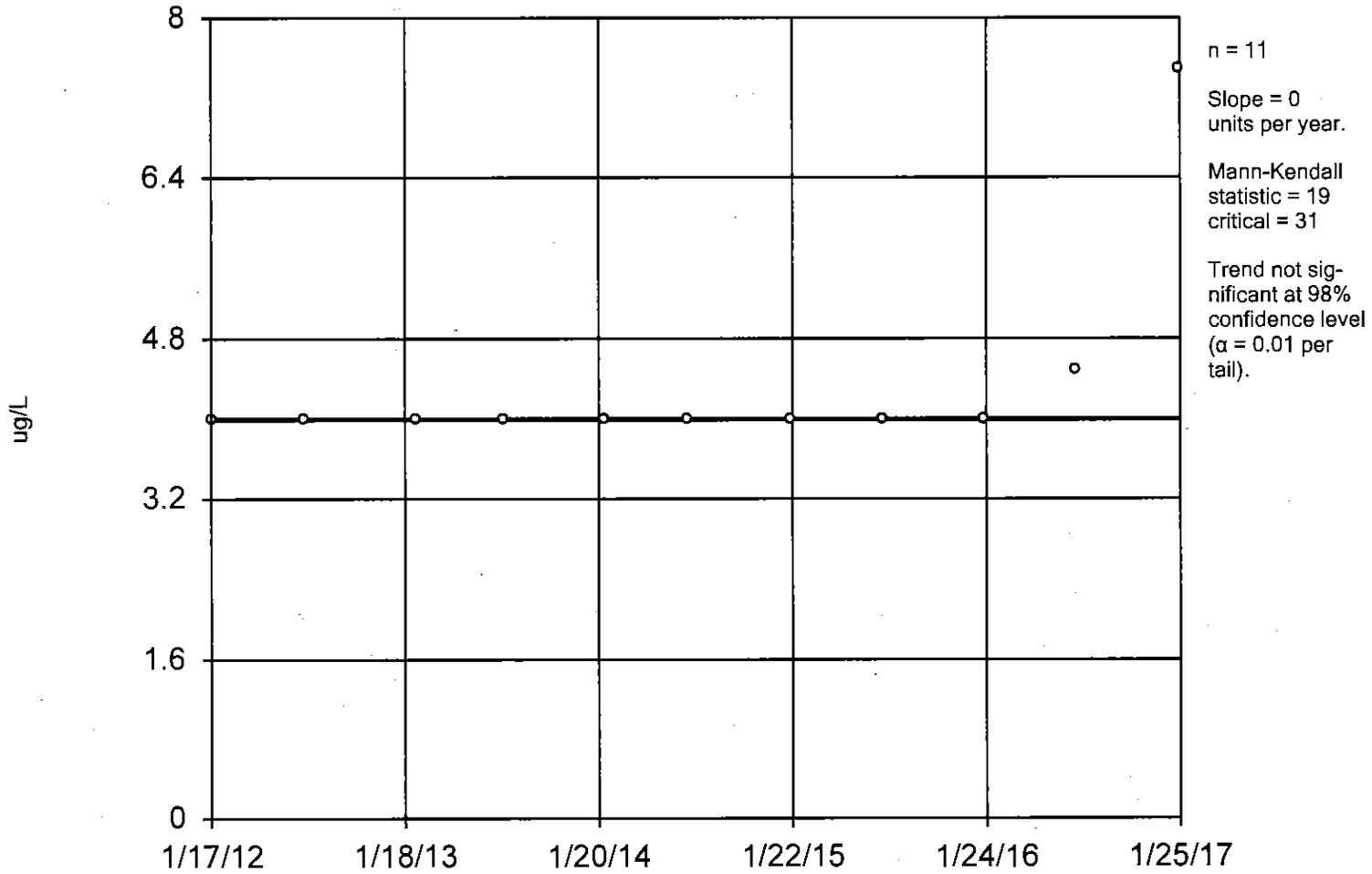
---

	MW-05
1/17/2012	<8
7/11/2012	<8
2/7/2013	<8
7/25/2013	<8
1/31/2014	<50
7/9/2014	<8
1/21/2015	<8
7/14/2015	<8
1/20/2016	<50
7/13/2016	<9
1/25/2017	<15

Hollow symbols indicate censored values.

### Sen's Slope Estimator

MW-06 (bg)



Constituent: Selenium Analysis Run 6/30/2017 1:49 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Selenium (ug/L) Analysis Run 6/30/2017 1:49 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

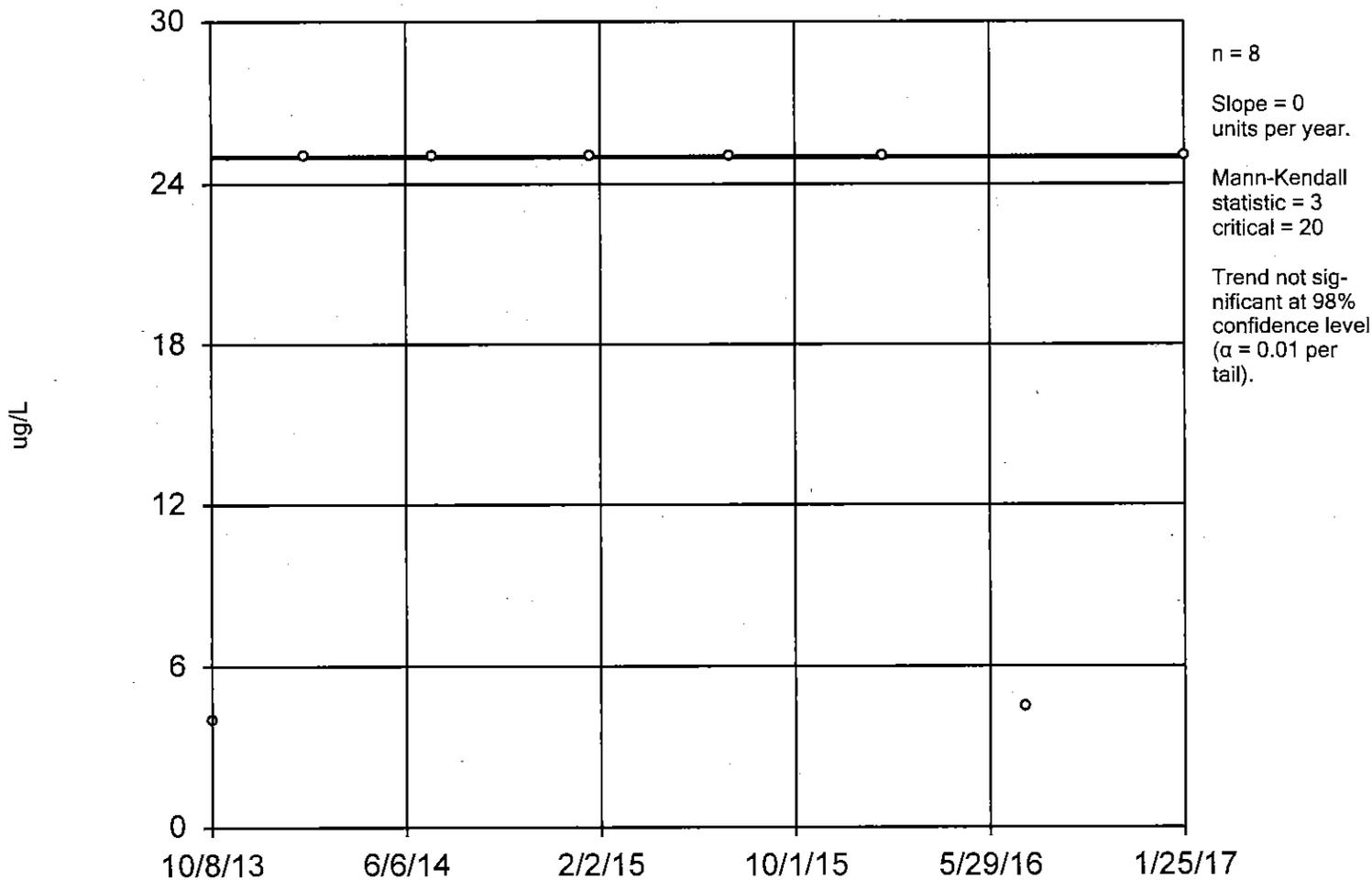
---

	MW-06 (bg)
1/17/2012	<8
7/11/2012	<8
2/7/2013	<8
7/25/2013	<8
1/31/2014	<8
7/9/2014	<8
1/21/2015	<8
7/14/2015	<8
1/20/2016	<8
7/13/2016	<9
1/25/2017	<15

Hollow symbols indicate censored values.

### Sen's Slope Estimator

MW-14



Constituent: Selenium Analysis Run 6/30/2017 1:50 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Selenium (ug/L) Analysis Run 6/30/2017 1:50 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

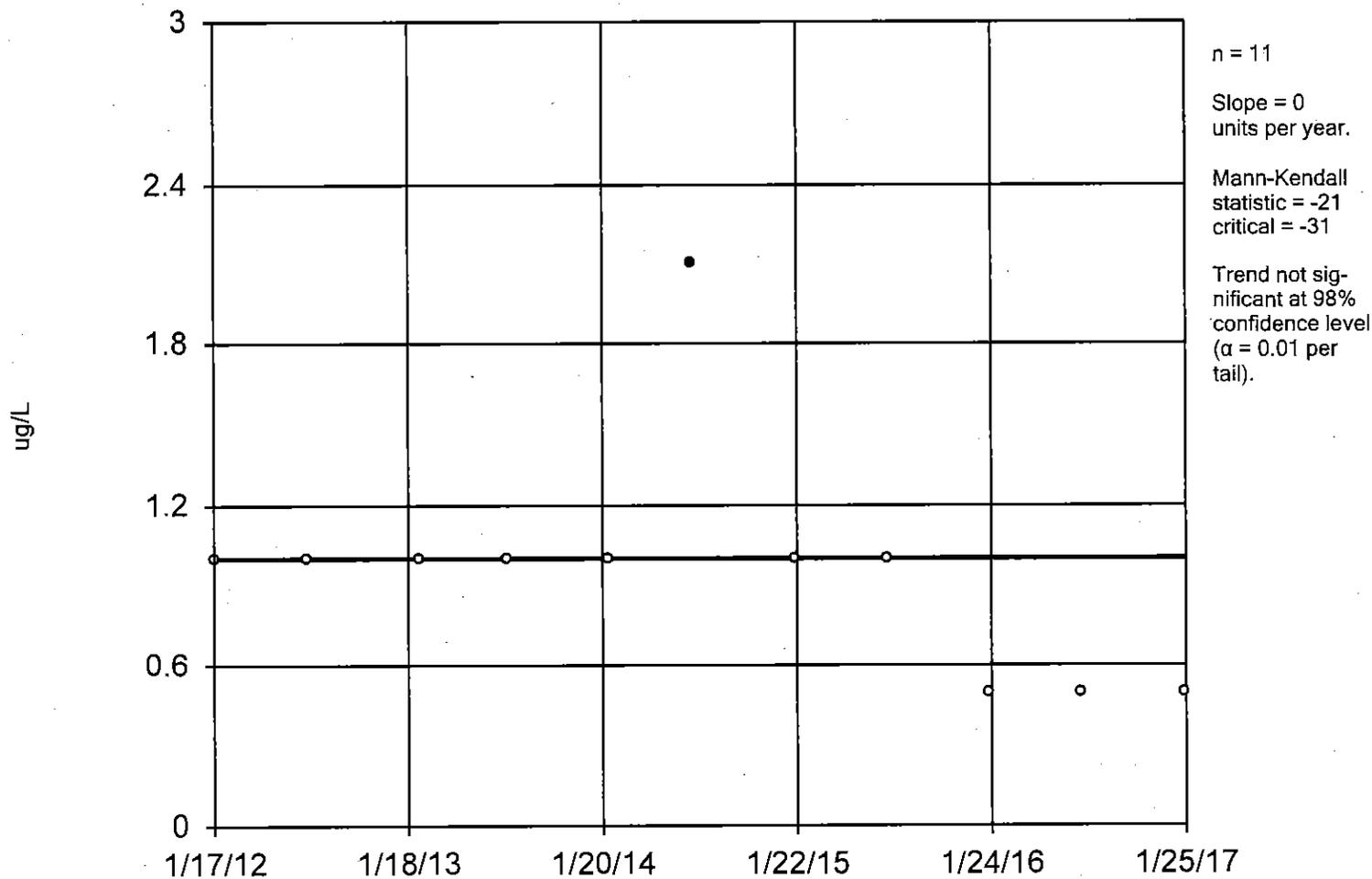
---

	MW-14
10/8/2013	<8
1/31/2014	<50
7/9/2014	<50
1/21/2015	<50
7/14/2015	<50
1/20/2016	<50
7/13/2016	<9
1/25/2017	<50

Hollow symbols indicate censored values.

### Sen's Slope Estimator

MW-05



Constituent: Thallium Analysis Run 6/30/2017 1:45 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Thallium (ug/L) Analysis Run 6/30/2017 1:45 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

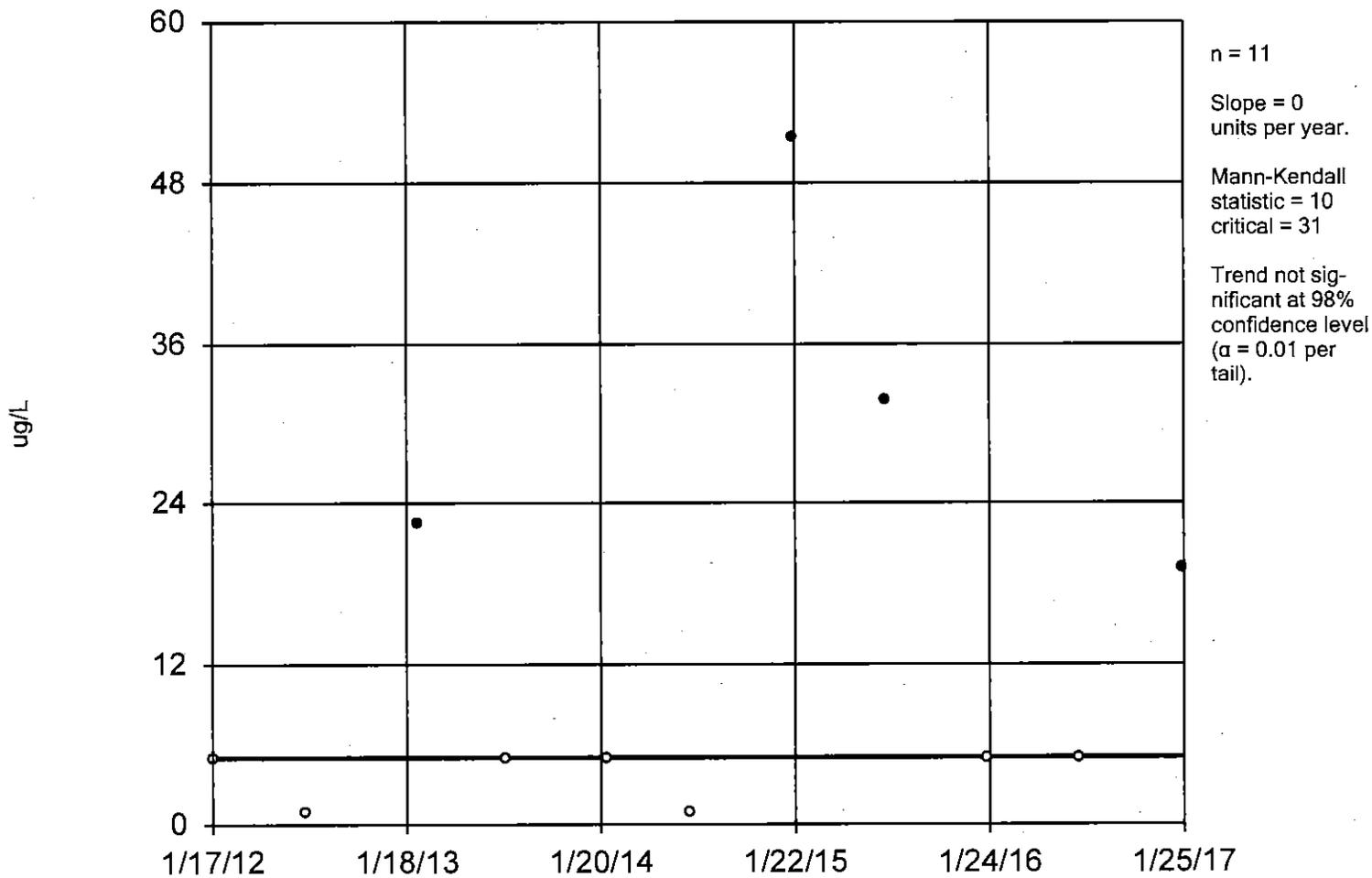
---

	MW-05
1/17/2012	<2
7/11/2012	<2
2/7/2013	<2
7/25/2013	<2
1/31/2014	<2
7/9/2014	2.1
1/21/2015	<2
7/14/2015	<2
1/20/2016	<1
7/13/2016	<1
1/25/2017	<1

Hollow symbols indicate censored values.

### Sen's Slope Estimator

MW-02



Constituent: Vanadium Analysis Run 6/30/2017 2:00 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Vanadium (ug/L) Analysis Run 6/30/2017 2:01 PM

Facility: Goochtand Cy Landfill Data File: GCLF 0517

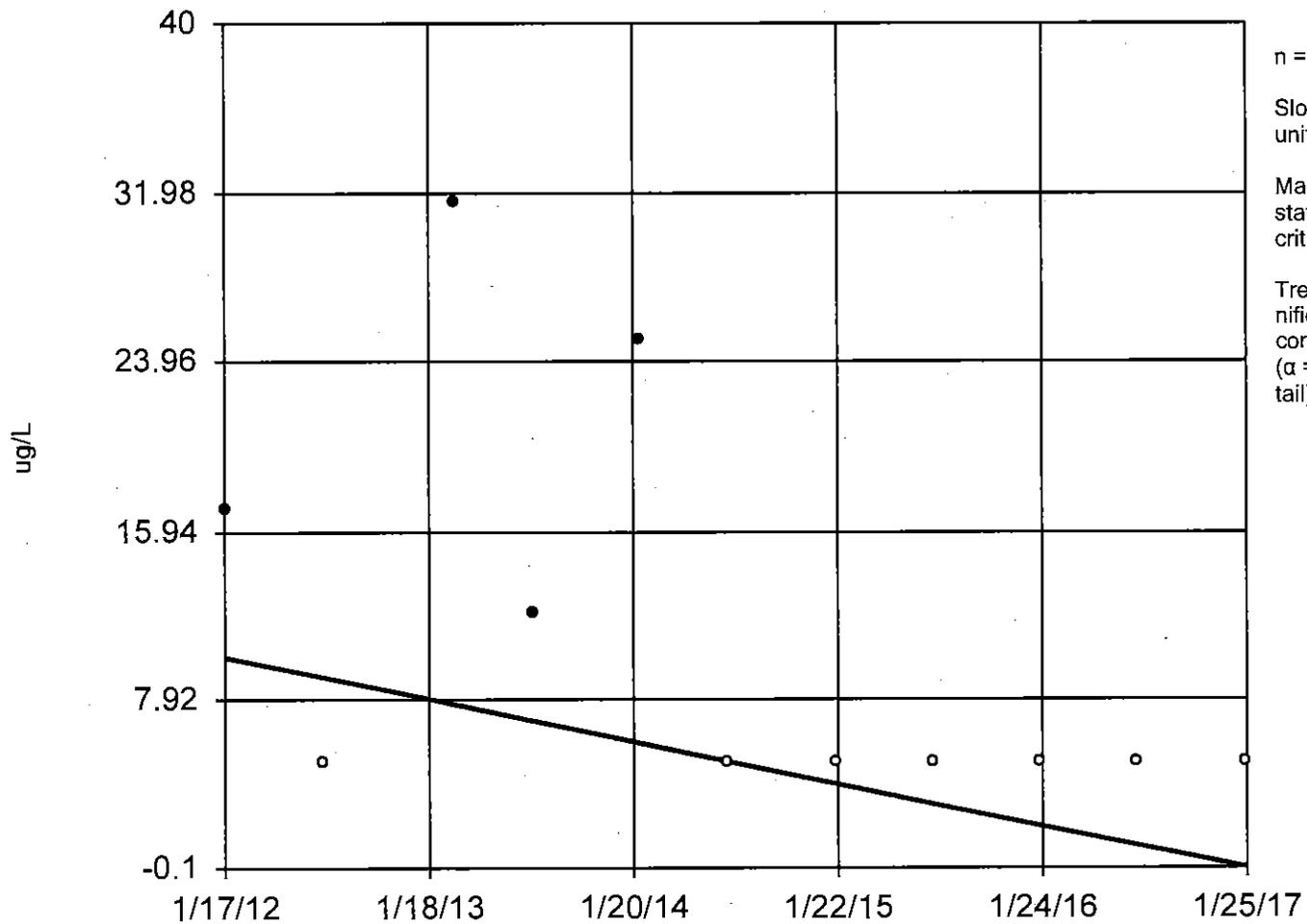
---

	MW-02	
1/17/2012	<10	
7/11/2012	<2	
2/7/2013	22.4	
7/25/2013	<10	
1/31/2014	<10	
7/9/2014	<2	
1/21/2015	51.4	
7/14/2015	31.6	
1/20/2016	<10	
7/13/2016	<10	
1/25/2017	19.2	

Hollow symbols indicate censored values.

# Sen's Slope Estimator

MW-05



n = 11

Slope = -1.996  
units per year.

Mann-Kendall  
statistic = -22  
critical = -31

Trend not sig-  
nificant at 98%  
confidence level  
( $\alpha = 0.01$  per  
tail).

Constituent: Vanadium Analysis Run 6/30/2017 2:01 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Vanadium (ug/L) Analysis Run 6/30/2017 2:01 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

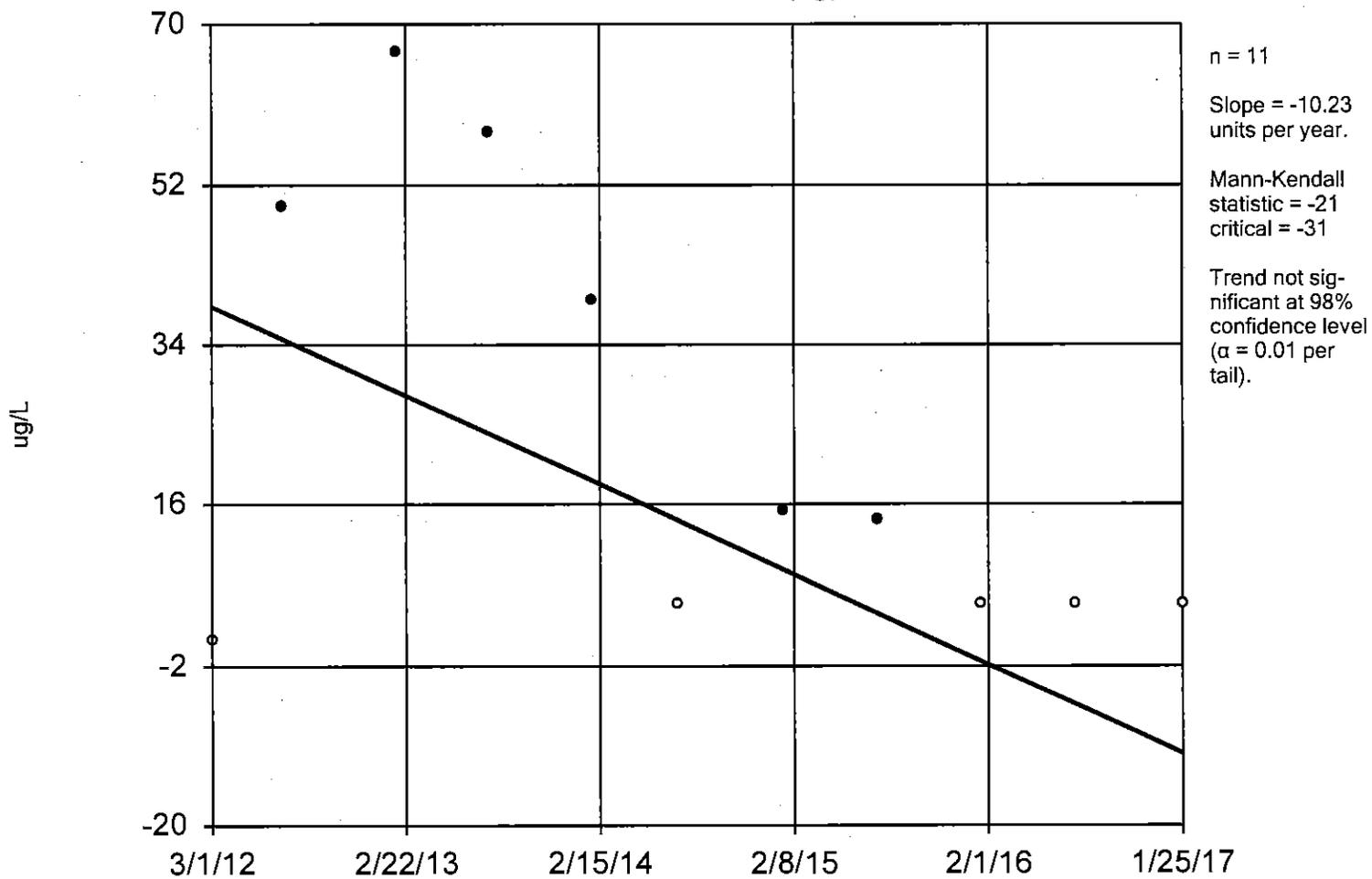
---

	MW-05
1/17/2012	17.1
7/11/2012	<10
3/5/2013	31.6 (V)
7/25/2013	12
1/31/2014	25
7/9/2014	<10
1/21/2015	<10
7/14/2015	<10
1/20/2016	<10
7/13/2016	<10
1/25/2017	<10

Hollow symbols indicate censored values.

### Sen's Slope Estimator

MW-06 (bg)



Constituent: Vanadium Analysis Run 6/30/2017 2:01 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Vanadium (ug/L) Analysis Run 6/30/2017 2:01 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

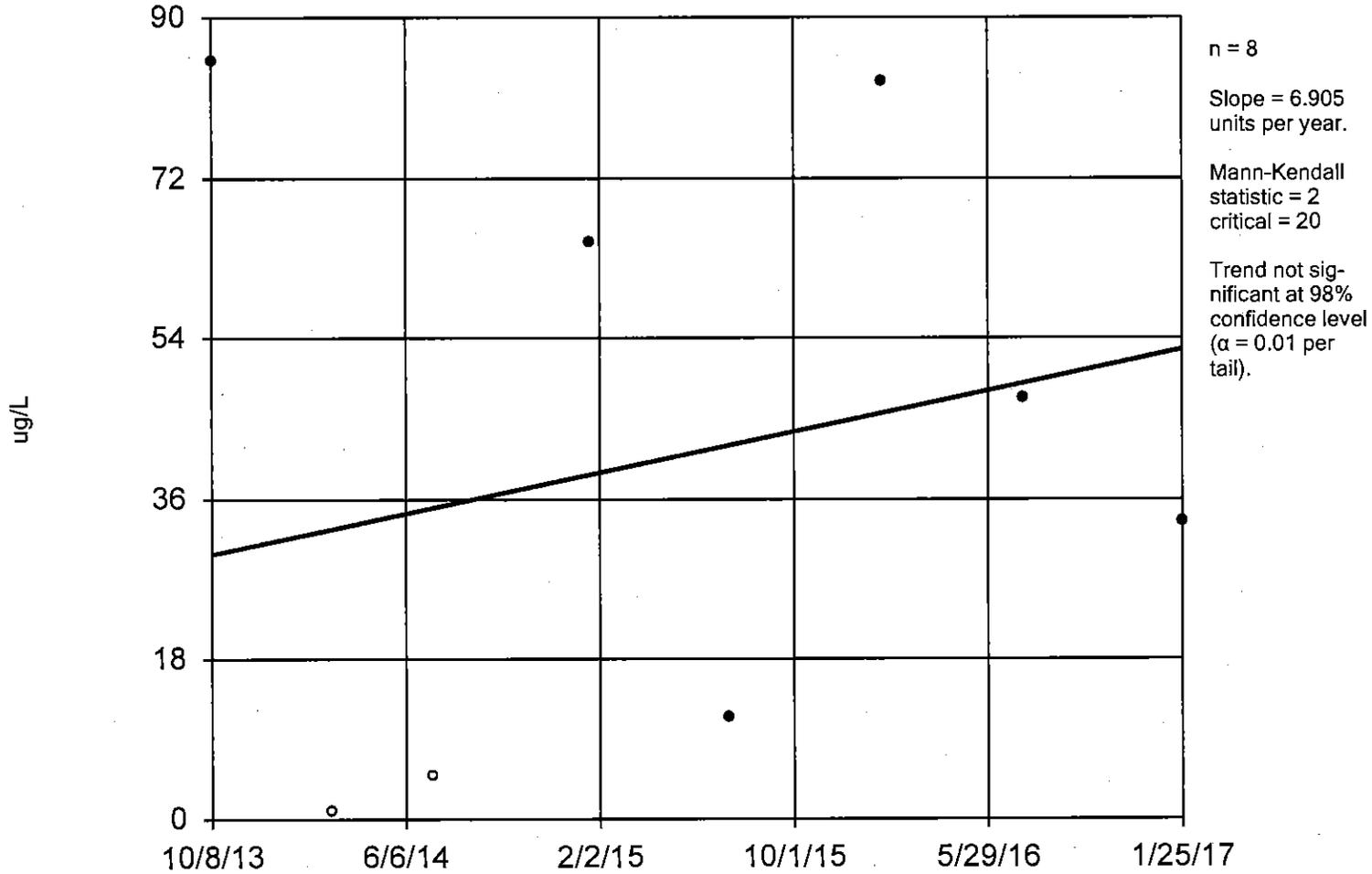
---

	MW-06 (bg)
3/1/2012	<2 (V)
7/11/2012	49.6
2/7/2013	66.8
7/25/2013	57.8
1/31/2014	39.1
7/9/2014	<10
1/21/2015	15.2
7/14/2015	14.2
1/20/2016	<10
7/13/2016	<10
1/25/2017	<10

Hollow symbols indicate censored values.

### Sen's Slope Estimator

MW-14



Constituent: Vanadium Analysis Run 6/30/2017 2:02 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Vanadium (ug/L) Analysis Run 6/30/2017 2:02 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

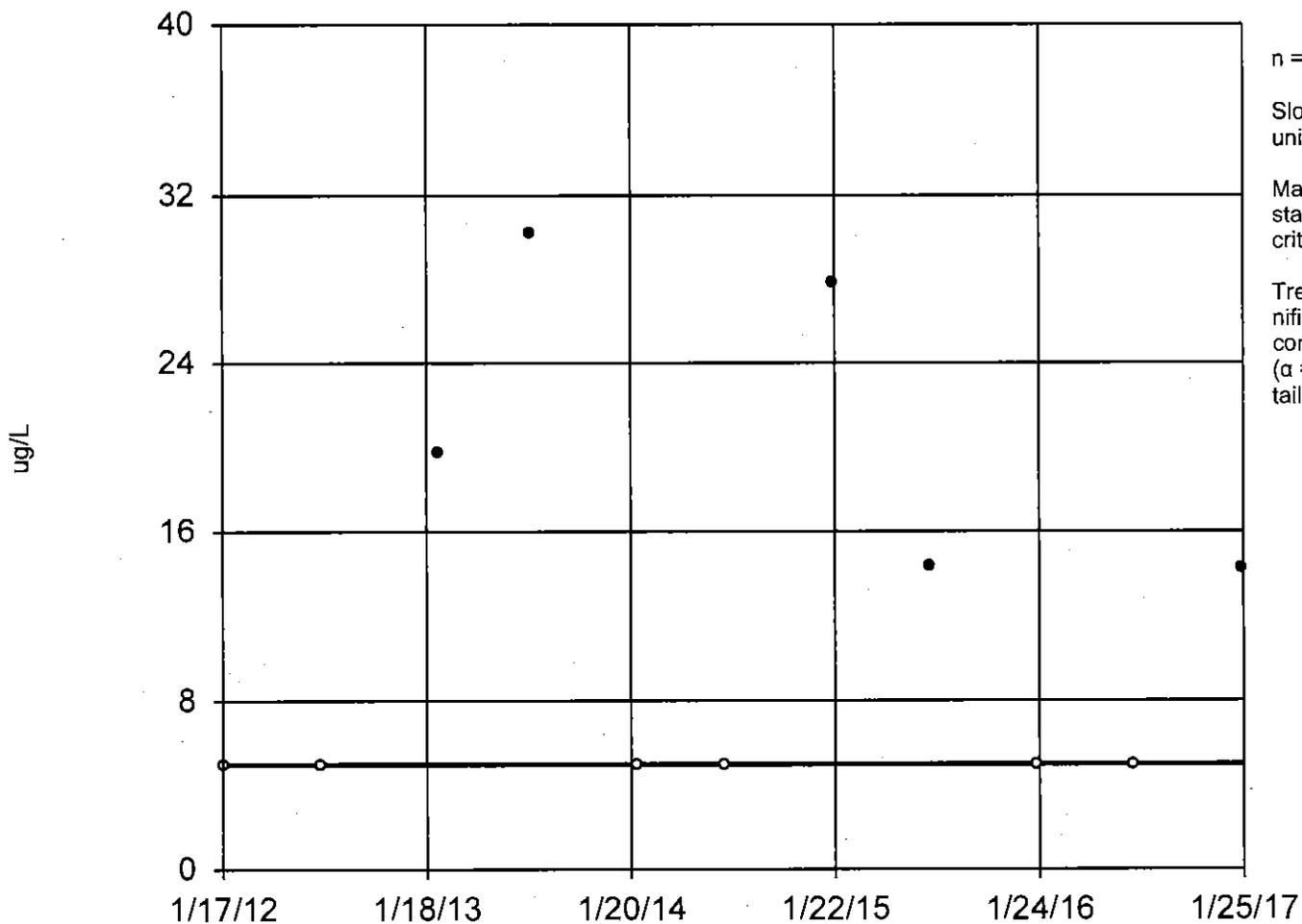
---

	MW-14
10/8/2013	85.1
3/6/2014	<2 (V)
7/9/2014	<10
1/21/2015	64.8
7/14/2015	11.3
1/20/2016	82.9
7/13/2016	47.3
1/25/2017	33.5

Hollow symbols indicate censored values.

### Sen's Slope Estimator

MW-02



n = 11

Slope = 0  
units per year.

Mann-Kendall  
statistic = 0  
critical = 31

Trend not sig-  
nificant at 98%  
confidence level  
( $\alpha = 0.01$  per  
tail).

Constituent: Zinc Analysis Run 6/30/2017 2:03 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Zinc (ug/L) Analysis Run 6/30/2017 2:03 PM

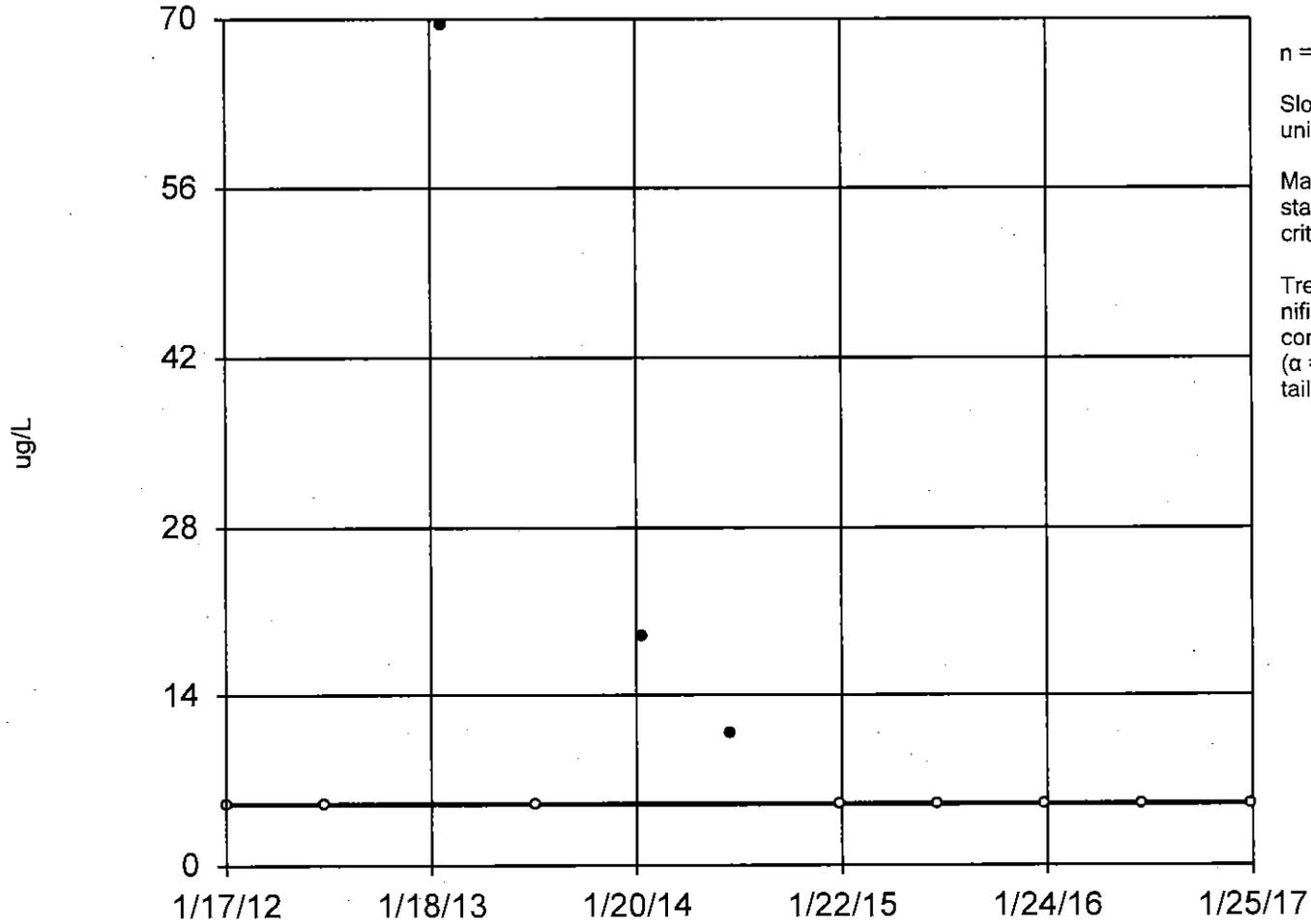
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-02
1/17/2012	<10
7/11/2012	<10
2/7/2013	19.8
7/25/2013	30.1
1/31/2014	<10
7/9/2014	<10
1/21/2015	27.8
7/14/2015	14.3
1/20/2016	<10
7/13/2016	<10
1/25/2017	14.2

# Sen's Slope Estimator

MW-05



n = 11

Slope = 0  
units per year.

Mann-Kendall  
statistic = -11  
critical = -31

Trend not sig-  
nificant at 98%  
confidence level  
( $\alpha = 0.01$  per  
tail).

Constituent: Zinc Analysis Run 6/30/2017 2:03 PM  
Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Zinc (ug/L) Analysis Run 6/30/2017 2:03 PM

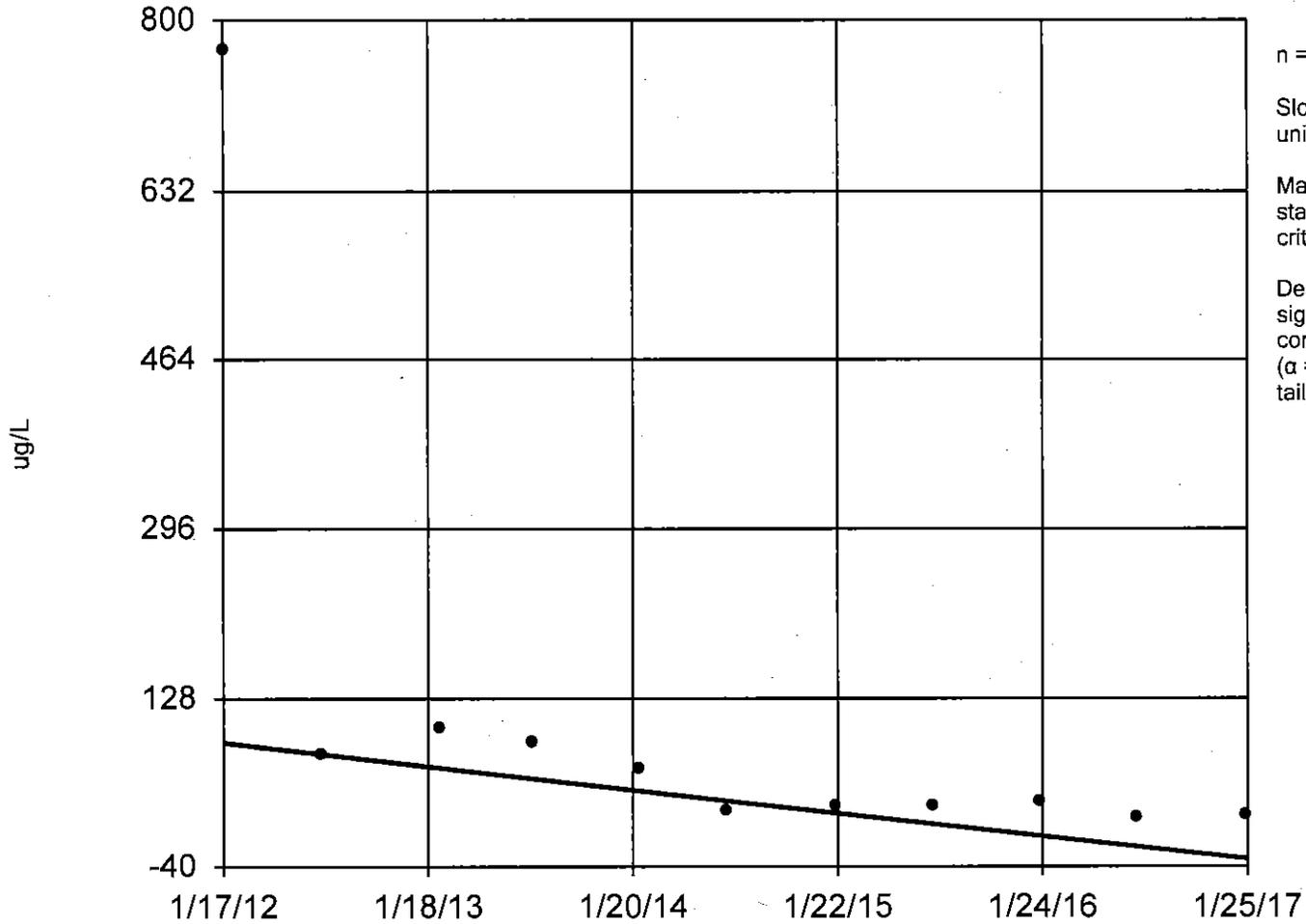
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-05
1/17/2012	<10
7/11/2012	<10
2/7/2013	69.5
7/25/2013	<10
1/31/2014	19
7/9/2014	10.8
1/21/2015	<10
7/14/2015	<10
1/20/2016	<10
7/13/2016	<10
1/25/2017	<10

### Sen's Slope Estimator

MW-06 (bg)



n = 11

Slope = -23.33  
units per year.

Mann-Kendall  
statistic = -39  
critical = -31

Decreasing trend  
significant at 98%  
confidence level  
( $\alpha = 0.01$  per  
tail).

Constituent: Zinc Analysis Run 6/30/2017 2:03 PM  
Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Zinc (ug/L) Analysis Run 6/30/2017 2:04 PM

Facility: Goochland Cy Landfill Data File: GCLF 0517

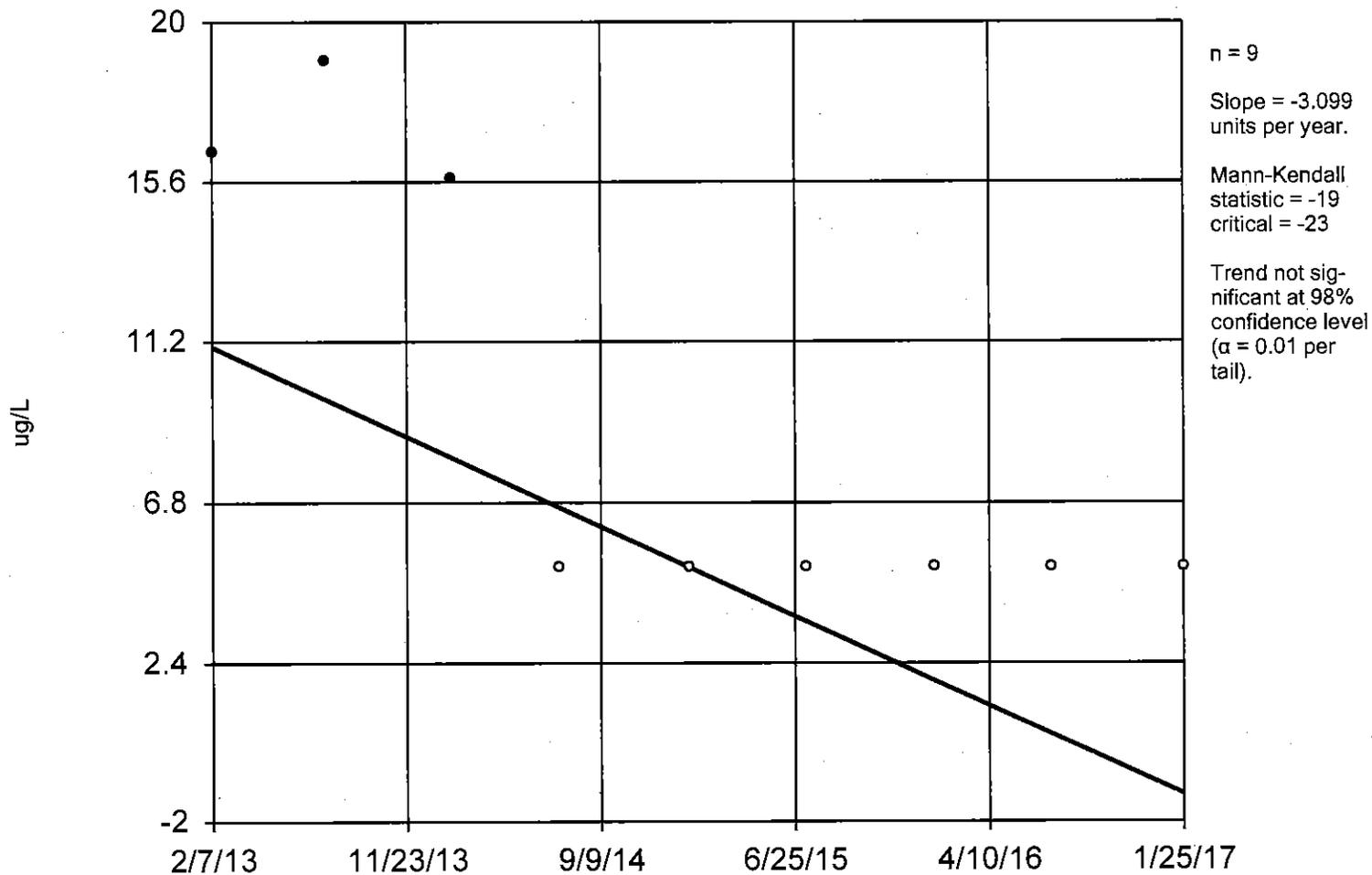
---

	MW-06 (bg)
1/17/2012	770.8
7/11/2012	73.7
2/7/2013	99.5
7/25/2013	85.3
1/31/2014	59.8
7/9/2014	17.5
1/21/2015	22.3
7/14/2015	22
1/20/2016	27.2
7/13/2016	11.2
1/25/2017	13.3

Hollow symbols indicate censored values.

### Sen's Slope Estimator

MW-13 (bg)



Constituent: Zinc Analysis Run 6/30/2017 2:04 PM  
Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Zinc (ug/L) Analysis Run 6/30/2017 2:04 PM

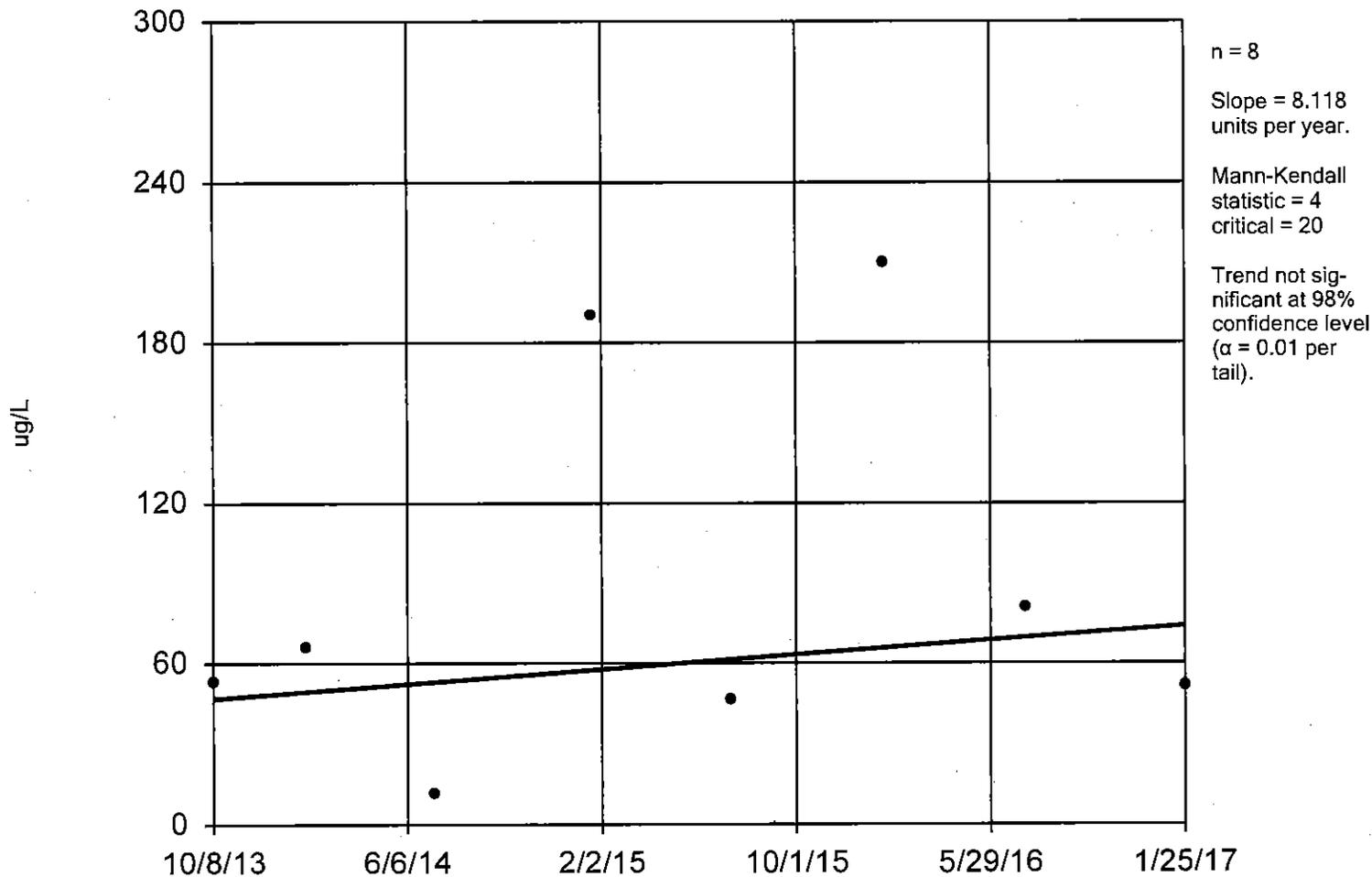
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-13 (bg)
2/7/2013	16.4
7/25/2013	18.9
1/31/2014	15.7
7/9/2014	<10
1/21/2015	<10
7/14/2015	<10
1/20/2016	<10
7/13/2016	<10
1/25/2017	<10

### Sen's Slope Estimator

MW-14



Constituent: Zinc Analysis Run 6/30/2017 2:04 PM  
Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Zinc (ug/L) Analysis Run 6/30/2017 2:05 PM

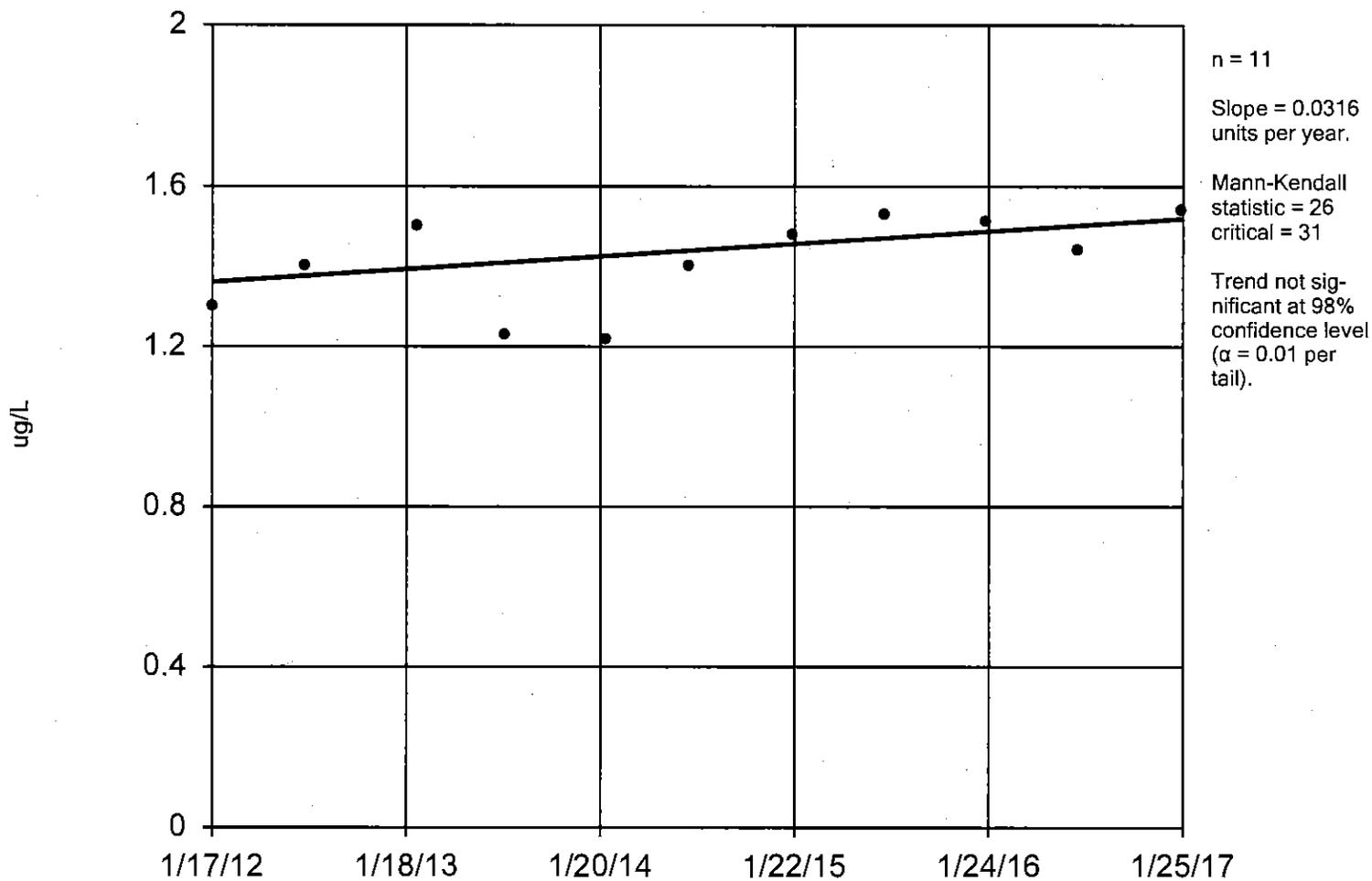
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-14
10/8/2013	53.3
1/31/2014	65.4
7/9/2014	11.6
1/21/2015	190
7/14/2015	46.1
1/20/2016	210
7/13/2016	80.8
1/25/2017	51.7

### Sen's Slope Estimator

MW-05



Constituent: 1,4-Dichlorobenzene Analysis Run 6/30/2017 11:04 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: 1,4-Dichlorobenzene (ug/L) Analysis Run 6/30/2017 11:05 AM

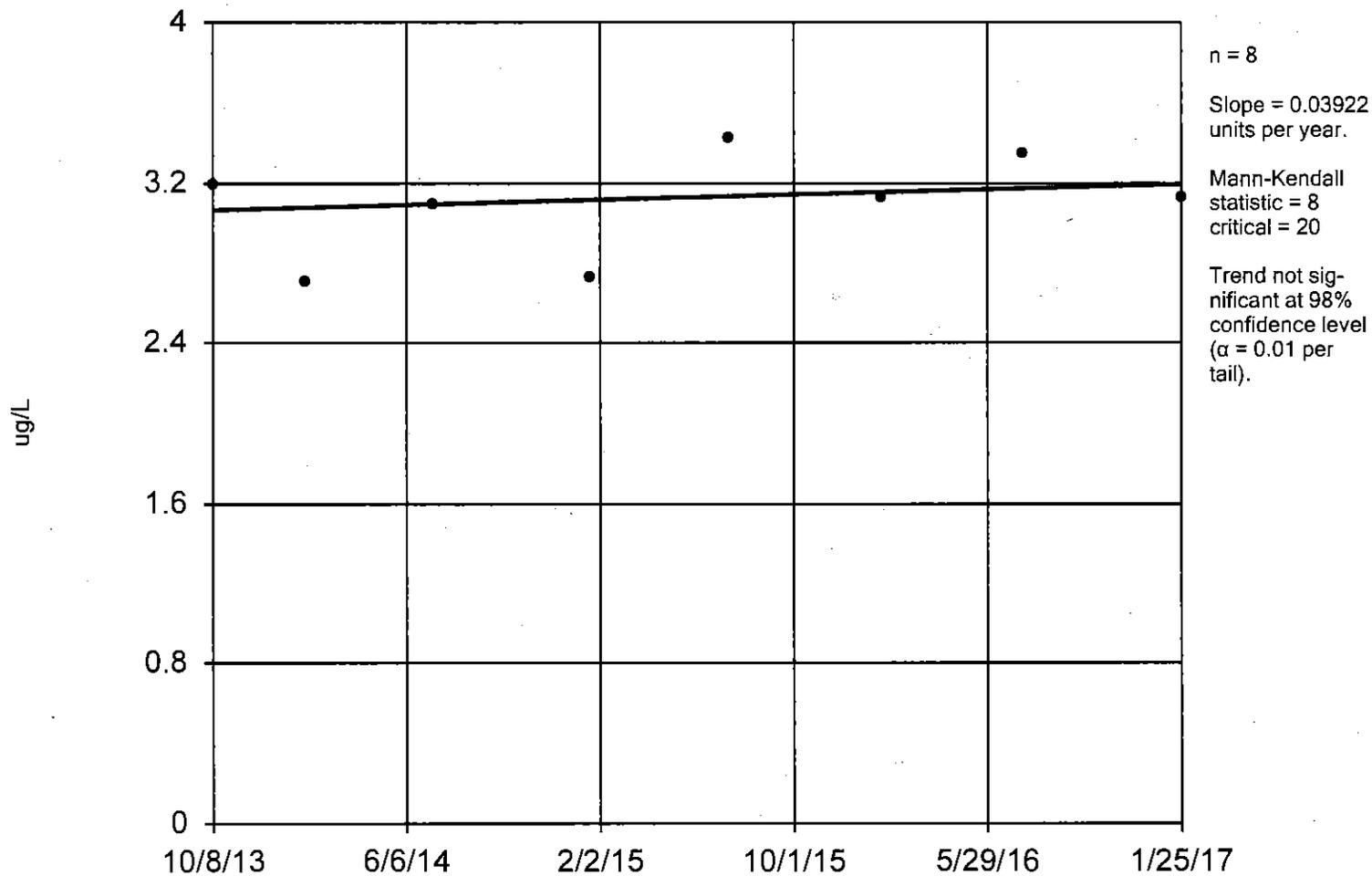
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-05
1/17/2012	1.3
7/11/2012	1.4 (b)
2/7/2013	1.5
7/25/2013	1.23
1/31/2014	1.22
7/9/2014	1.4
1/21/2015	1.48
7/14/2015	1.53
1/20/2016	1.51
7/13/2016	1.44
1/25/2017	1.54

### Sen's Slope Estimator

MW-14



Constituent: 1,4-Dichlorobenzene Analysis Run 6/30/2017 11:06 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: 1,4-Dichlorobenzene (ug/L) Analysis Run 6/30/2017 11:06 AM

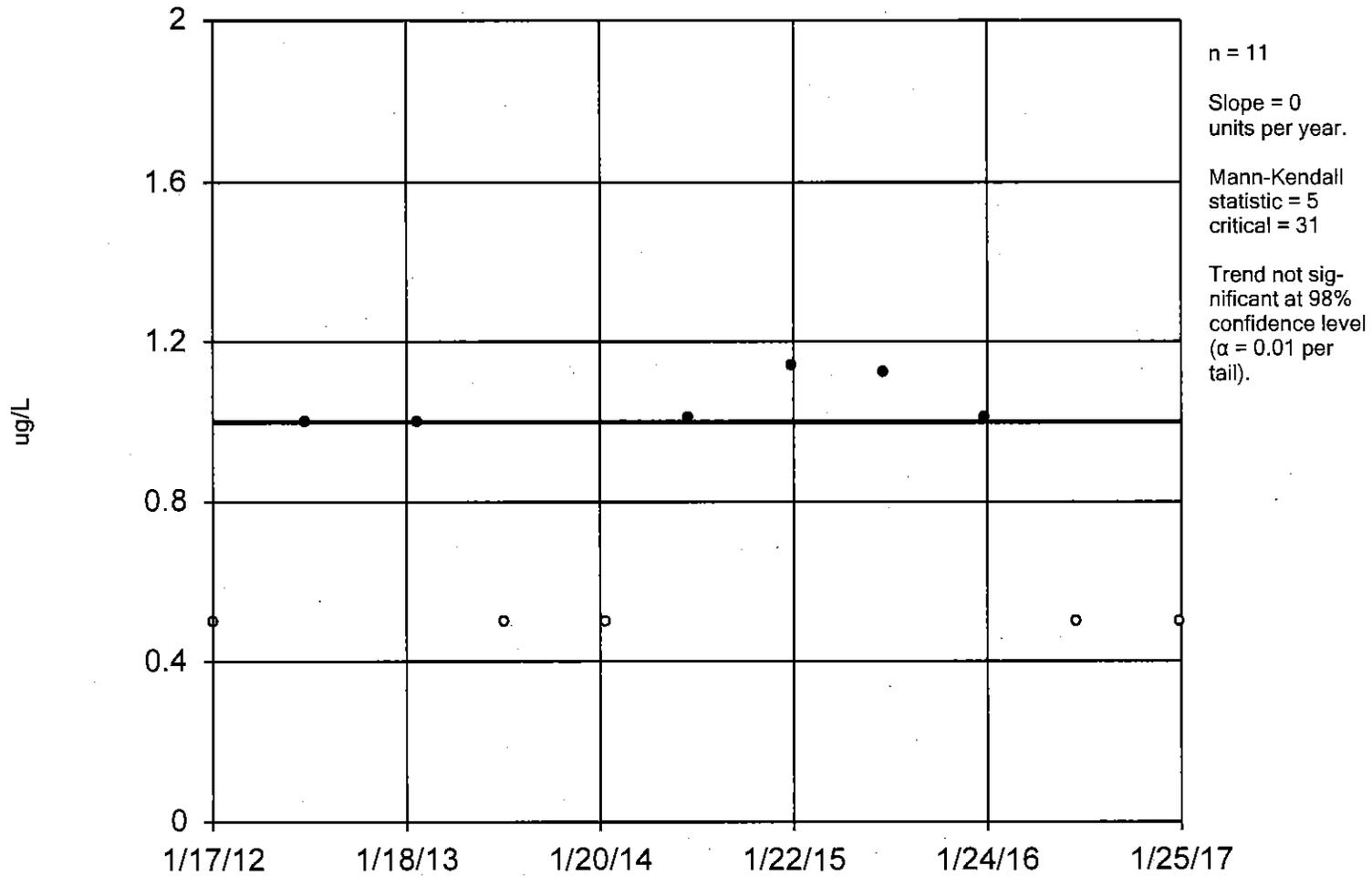
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-14
10/8/2013	3.19
1/31/2014	2.7
7/9/2014	3.09
1/21/2015	2.72
7/14/2015	3.43
1/20/2016	3.12
7/13/2016	3.35
1/25/2017	3.13

### Sen's Slope Estimator

MW-05



Constituent: Benzene Analysis Run 6/30/2017 11:08 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Benzene (ug/L) Analysis Run 6/30/2017 11:08 AM

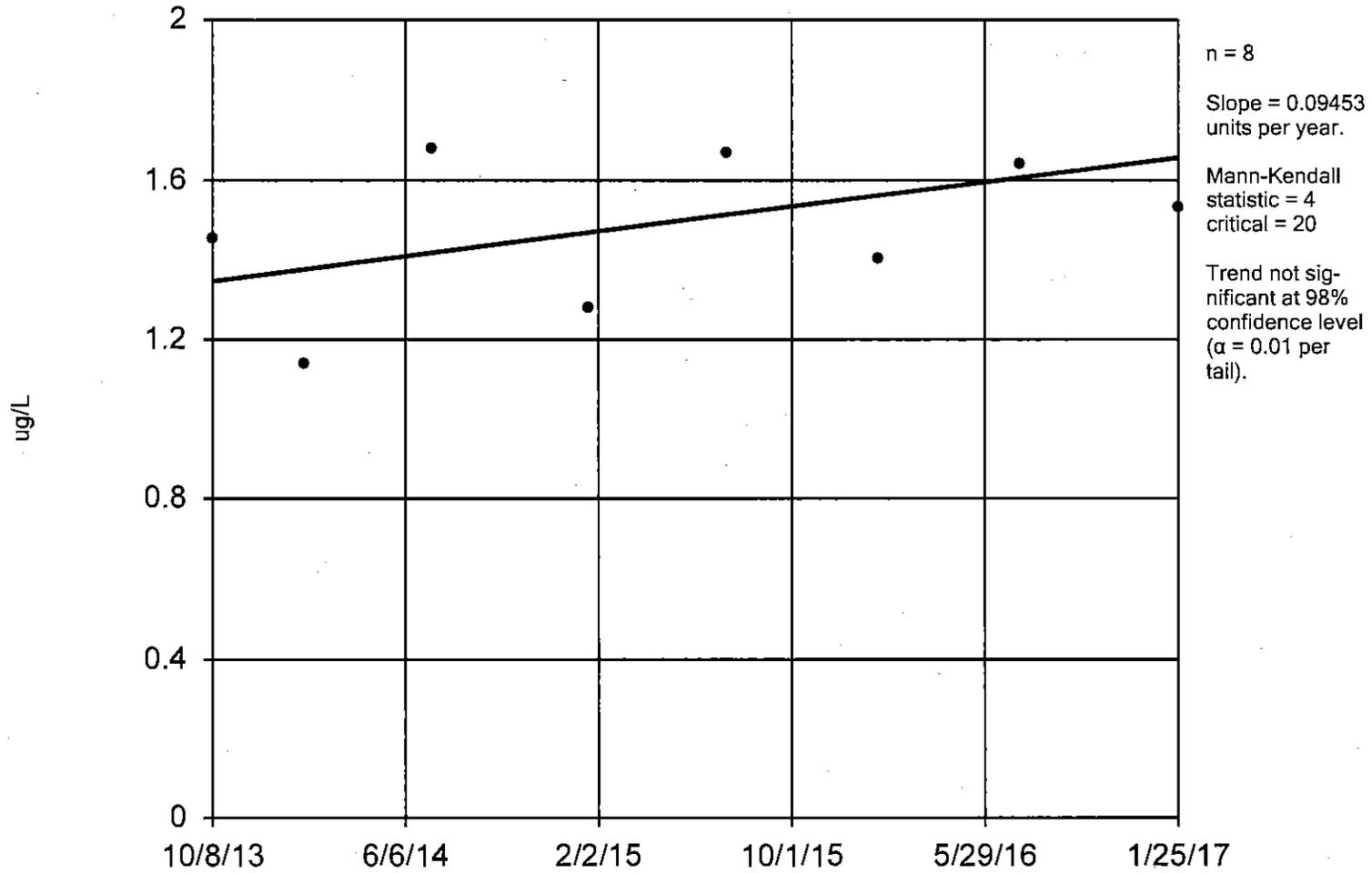
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-05
1/17/2012	<1
7/11/2012	1
2/7/2013	1
7/25/2013	<1
1/31/2014	<1
7/9/2014	1.01
1/21/2015	1.14
7/14/2015	1.12
1/20/2016	1.01
7/13/2016	<1
1/25/2017	<1

### Sen's Slope Estimator

MW-14



Constituent: Chlorobenzene Analysis Run 6/30/2017 11:10 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Chlorobenzene (ug/L) Analysis Run 6/30/2017 11:10 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

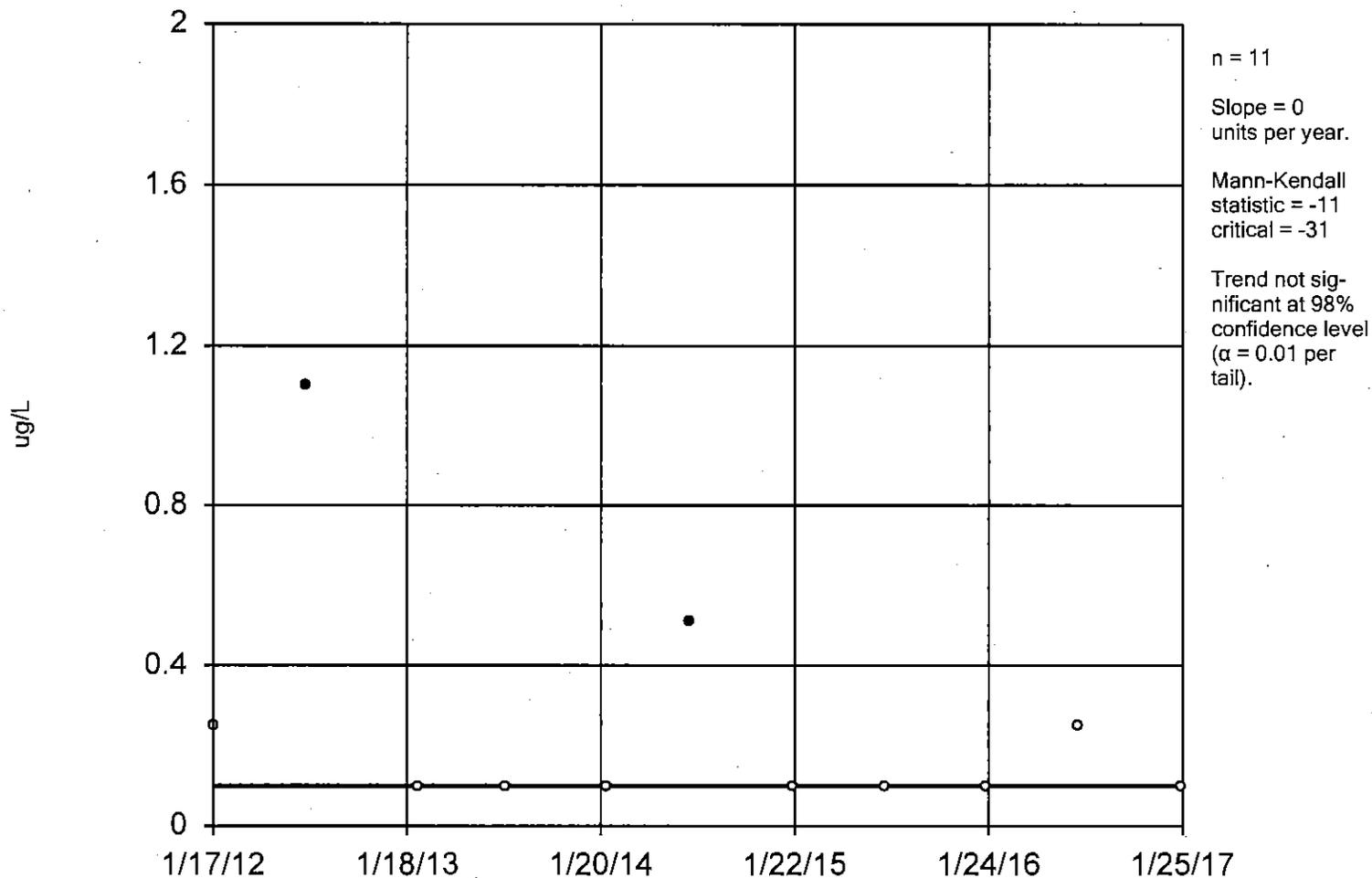
---

	MW-14
10/8/2013	1.45
1/31/2014	1.14
7/9/2014	1.68
1/21/2015	1.28
7/14/2015	1.67
1/20/2016	1.4
7/13/2016	1.64
1/25/2017	1.53

Hollow symbols indicate censored values.

### Sen's Slope Estimator

MW-02



Constituent: Chloroform Analysis Run 6/30/2017 11:12 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Chloroform (ug/L) Analysis Run 6/30/2017 11:12 AM

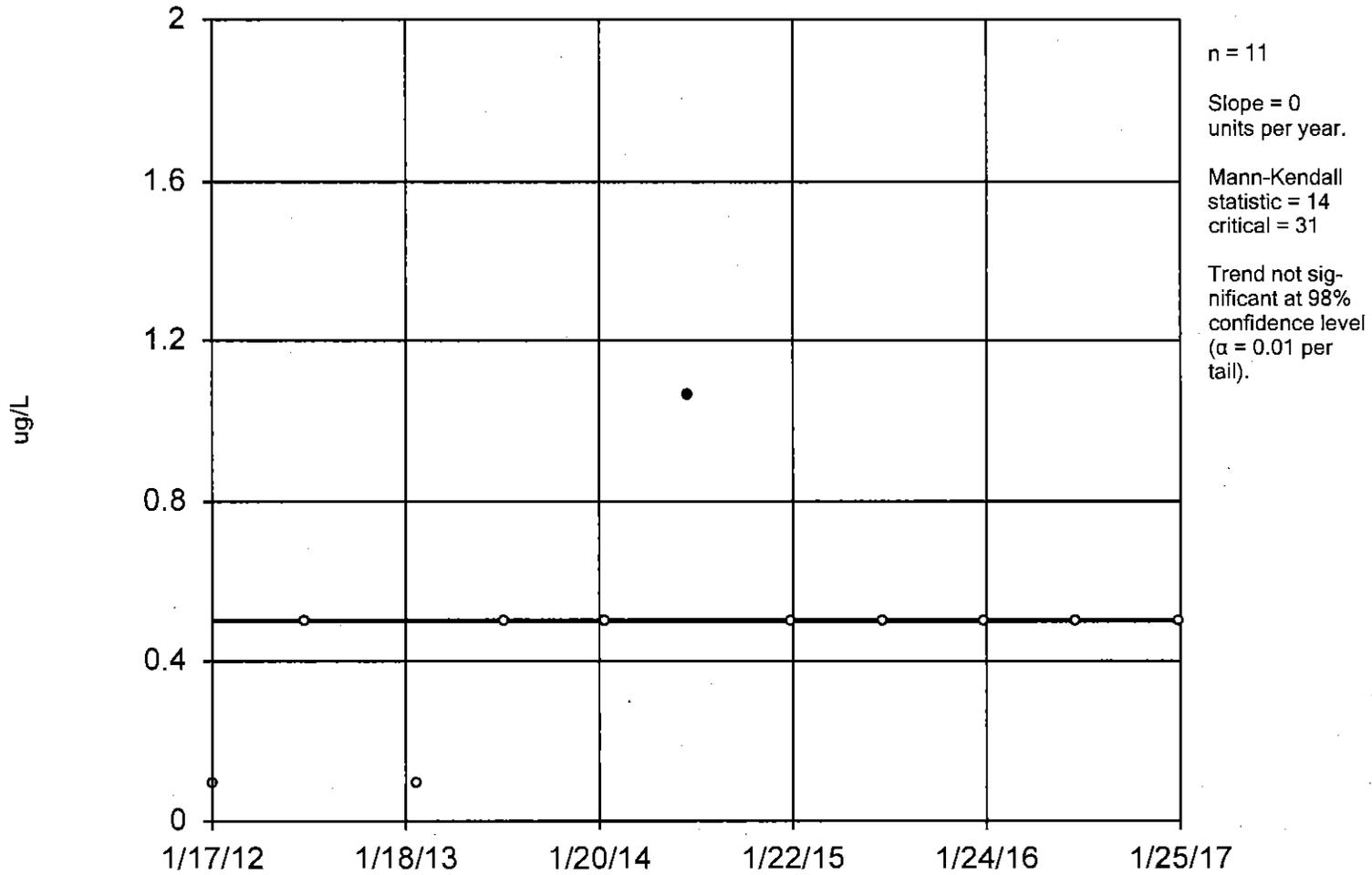
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-02
1/17/2012	<0.5
7/11/2012	1.1
2/7/2013	<0.2
7/25/2013	<0.2
1/31/2014	<0.2
7/9/2014	0.51
1/21/2015	<0.2
7/14/2015	<0.2
1/20/2016	<0.2
7/13/2016	<0.5
1/25/2017	<0.2

### Sen's Slope Estimator

MW-02



Constituent: cis-1,2-Dichloroethylene Analysis Run 6/30/2017 11:21 AM

Facility: Gochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: cis-1,2-Dichloroethylene (ug/L) Analysis Run 6/30/2017 11:21 AM

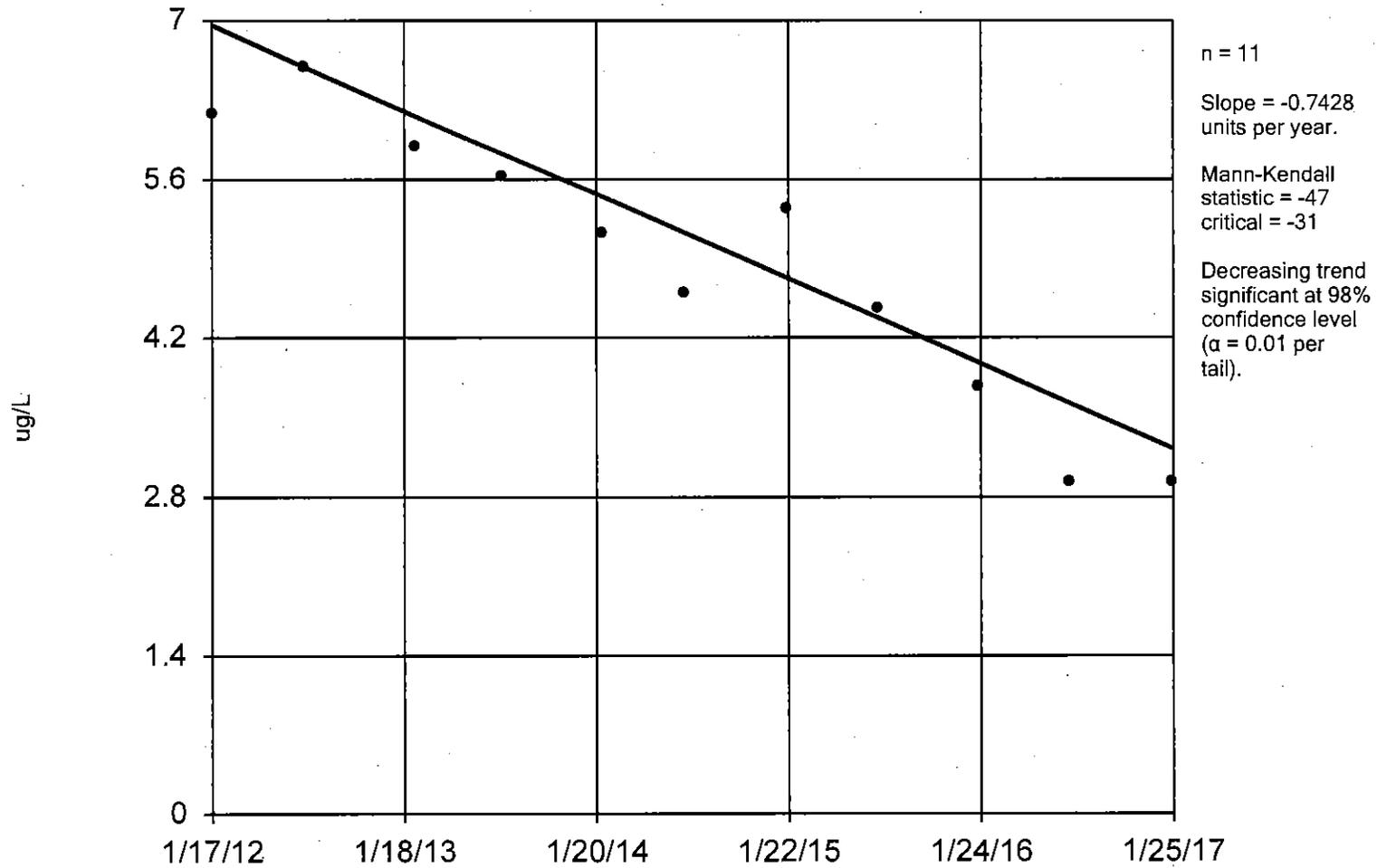
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-02
1/17/2012	<0.2
7/11/2012	<1
2/7/2013	<0.2
7/25/2013	<1
1/31/2014	<1
7/9/2014	1.06
1/21/2015	<1
7/14/2015	<1
1/20/2016	<1
7/13/2016	<1
1/25/2017	<1

### Sen's Slope Estimator

MW-05



Constituent: cis-1,2-Dichloroethylene Analysis Run 6/30/2017 11:22 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: cis-1,2-Dichloroethylene (ug/L) Analysis Run 6/30/2017 11:23 AM

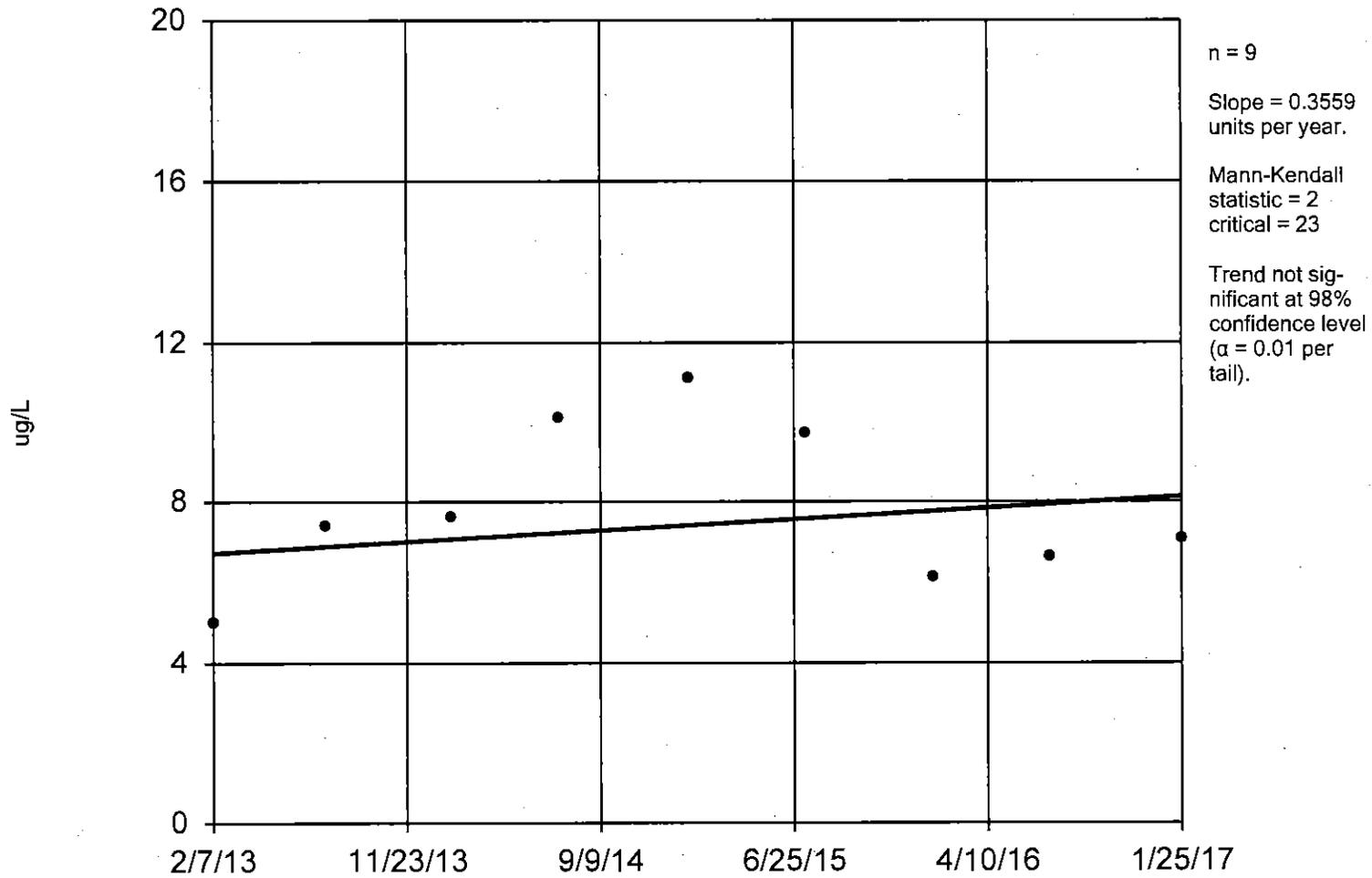
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-05
1/17/2012	6.2
7/11/2012	6.6
2/7/2013	5.9
7/25/2013	5.62
1/31/2014	5.12
7/9/2014	4.6
1/21/2015	5.33
7/14/2015	4.45
1/20/2016	3.77
7/13/2016	2.93
1/25/2017	2.94

### Sen's Slope Estimator

MW-13 (bg)



Constituent: cis-1,2-Dichloroethylene Analysis Run 6/30/2017 11:23 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

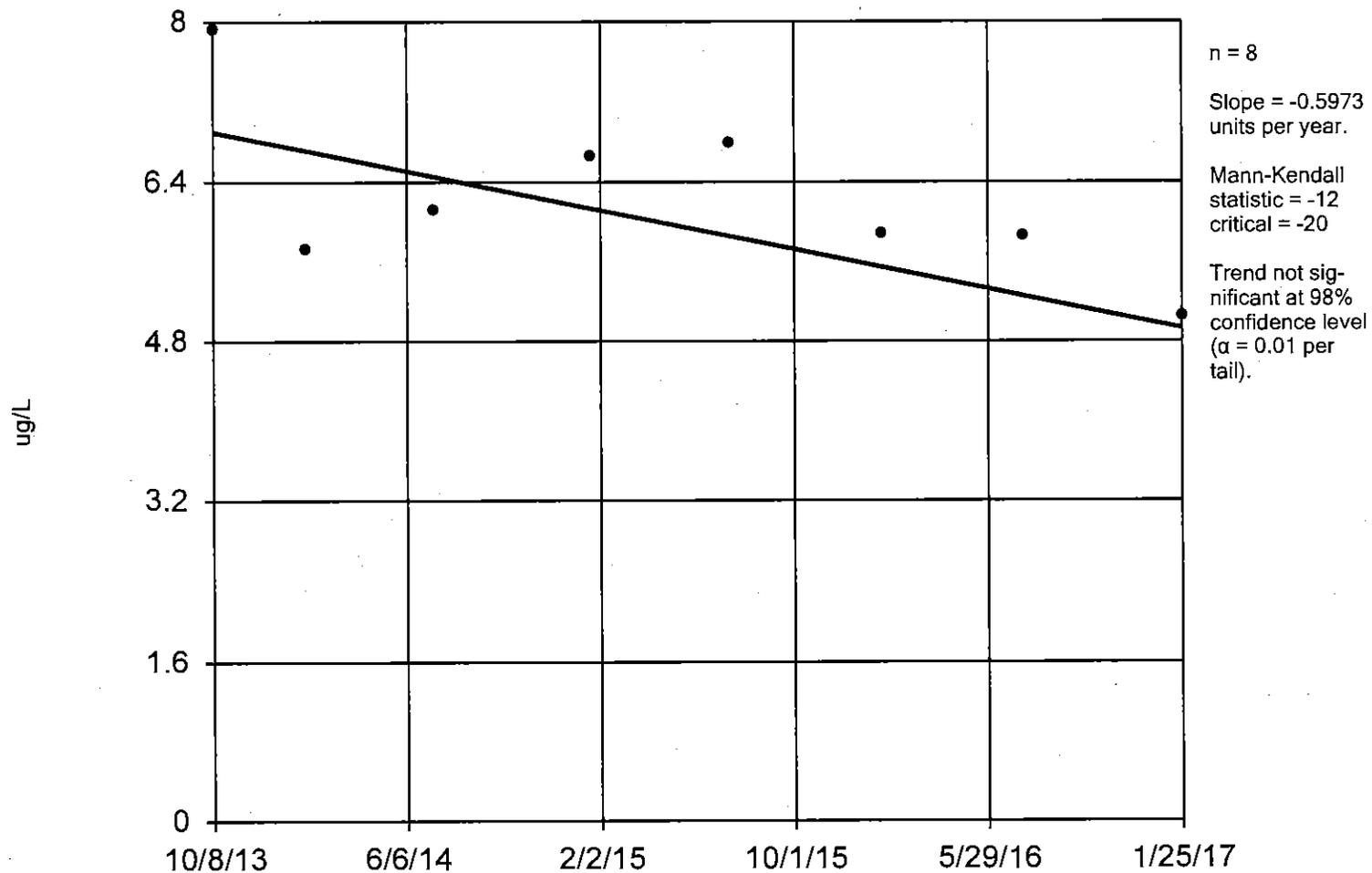
Constituent: cis-1,2-Dichloroethylene (ug/L) Analysis Run 6/30/2017 11:24 AM  
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-13 (bg)
2/7/2013	5
7/25/2013	7.4
1/31/2014	7.58
7/9/2014	10.1
1/21/2015	11.1
7/14/2015	9.7
1/20/2016	6.08
7/13/2016	6.59
1/25/2017	7.04

### Sen's Slope Estimator

MW-14



Constituent: cis-1,2-Dichloroethylene Analysis Run 6/30/2017 11:24 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: cis-1,2-Dichloroethylene (ug/L) Analysis Run 6/30/2017 11:24 AM

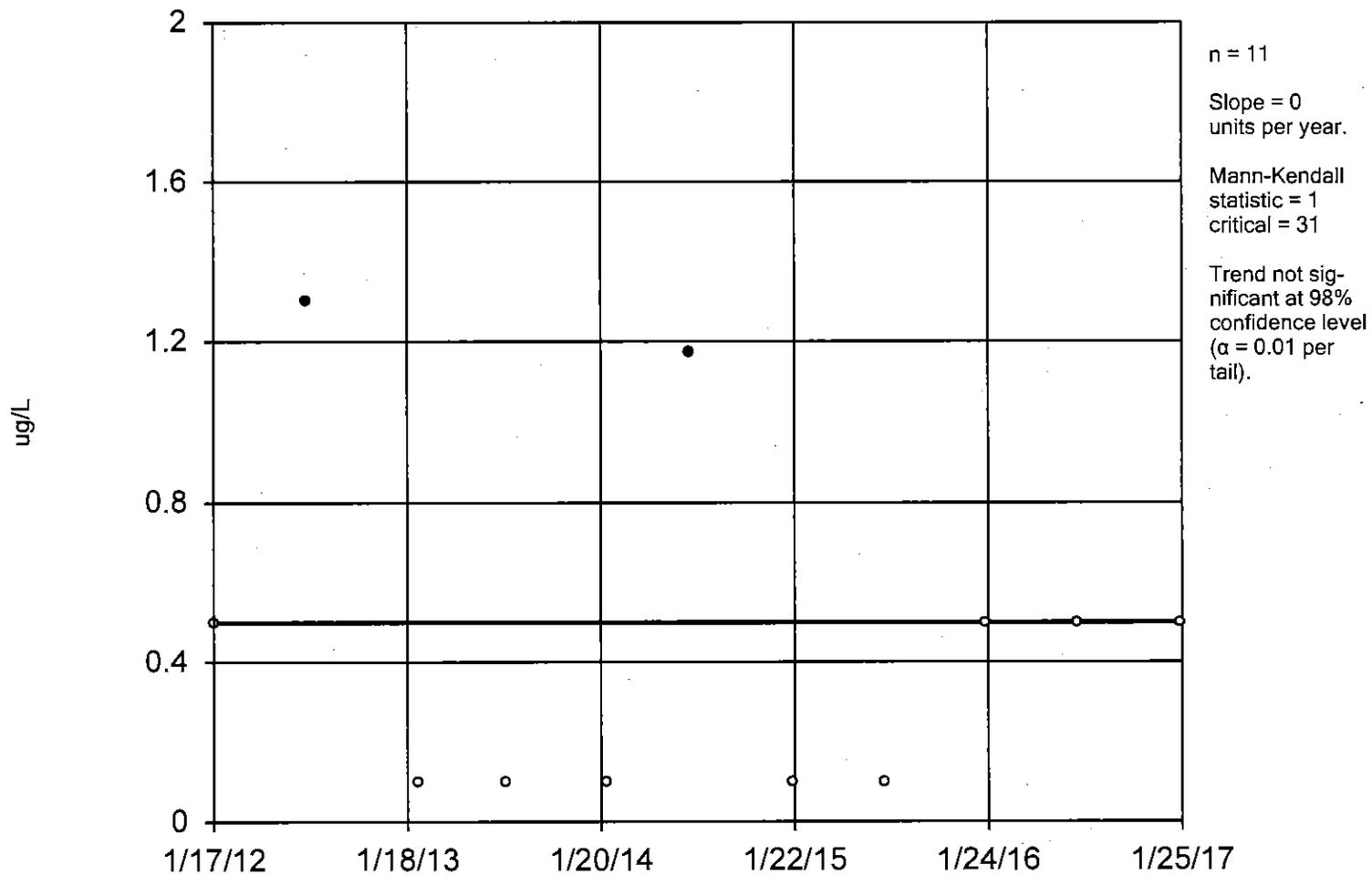
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-14
10/8/2013	7.93
1/31/2014	5.71
7/9/2014	6.11
1/21/2015	6.65
7/14/2015	6.79
1/20/2016	5.87
7/13/2016	5.84
1/25/2017	5.05

### Sen's Slope Estimator

MW-02



Constituent: Dichlorodifluoromethane Analysis Run 6/30/2017 11:25 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Dichlorodifluoromethane (ug/L) Analysis Run 6/30/2017 11:25 AM

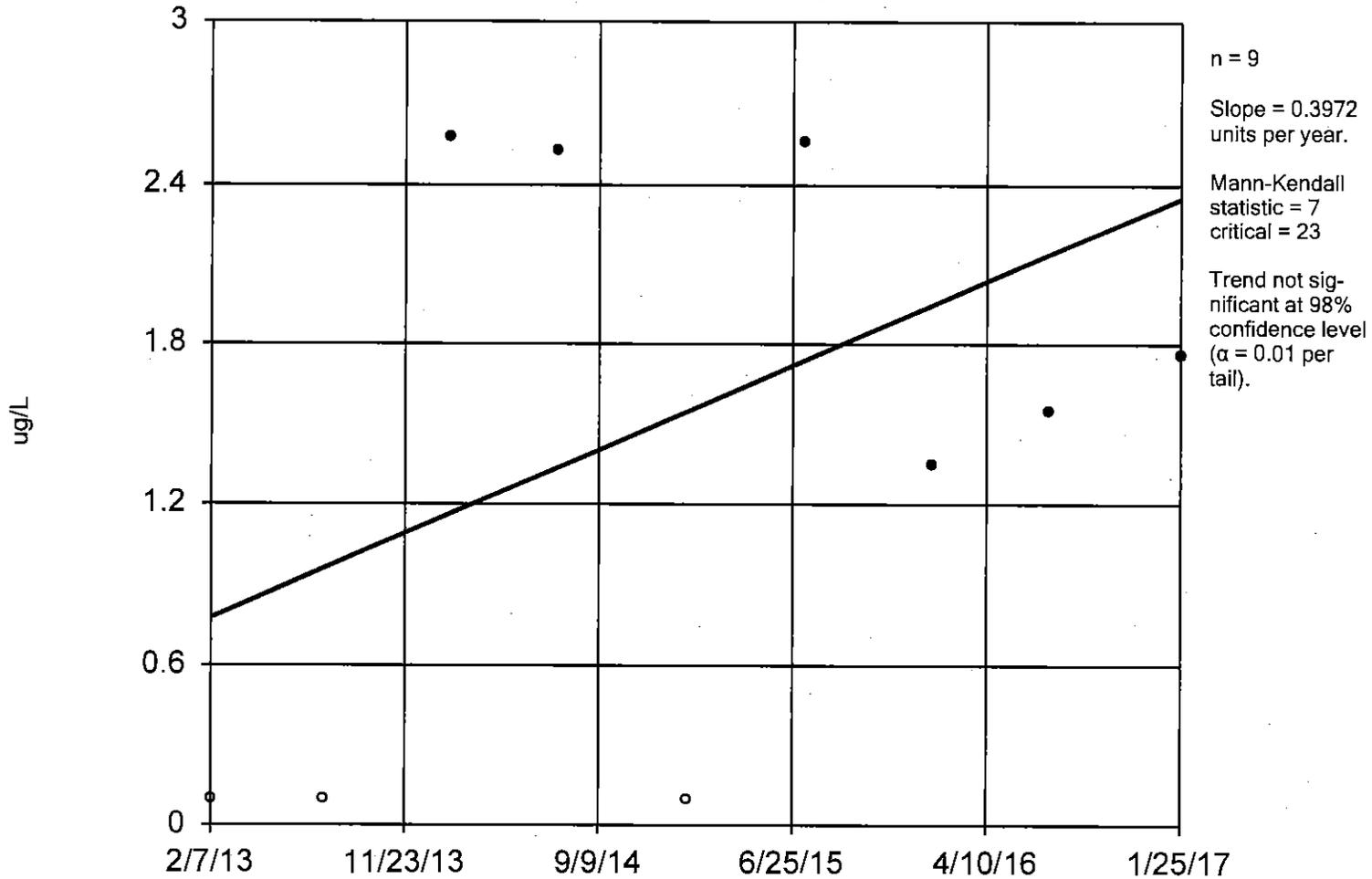
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-02
1/17/2012	<1
7/11/2012	1.3
2/7/2013	<0.2
7/25/2013	<0.2
1/31/2014	<0.2
7/9/2014	1.17
1/21/2015	<0.2
7/14/2015	<0.2
1/20/2016	<1
7/13/2016	<1
1/25/2017	<1

### Sen's Slope Estimator

MW-13 (bg)



Constituent: Dichlorodifluoromethane Analysis Run 6/30/2017 11:25 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Dichlorodifluoromethane (ug/L) Analysis Run 6/30/2017 11:26 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

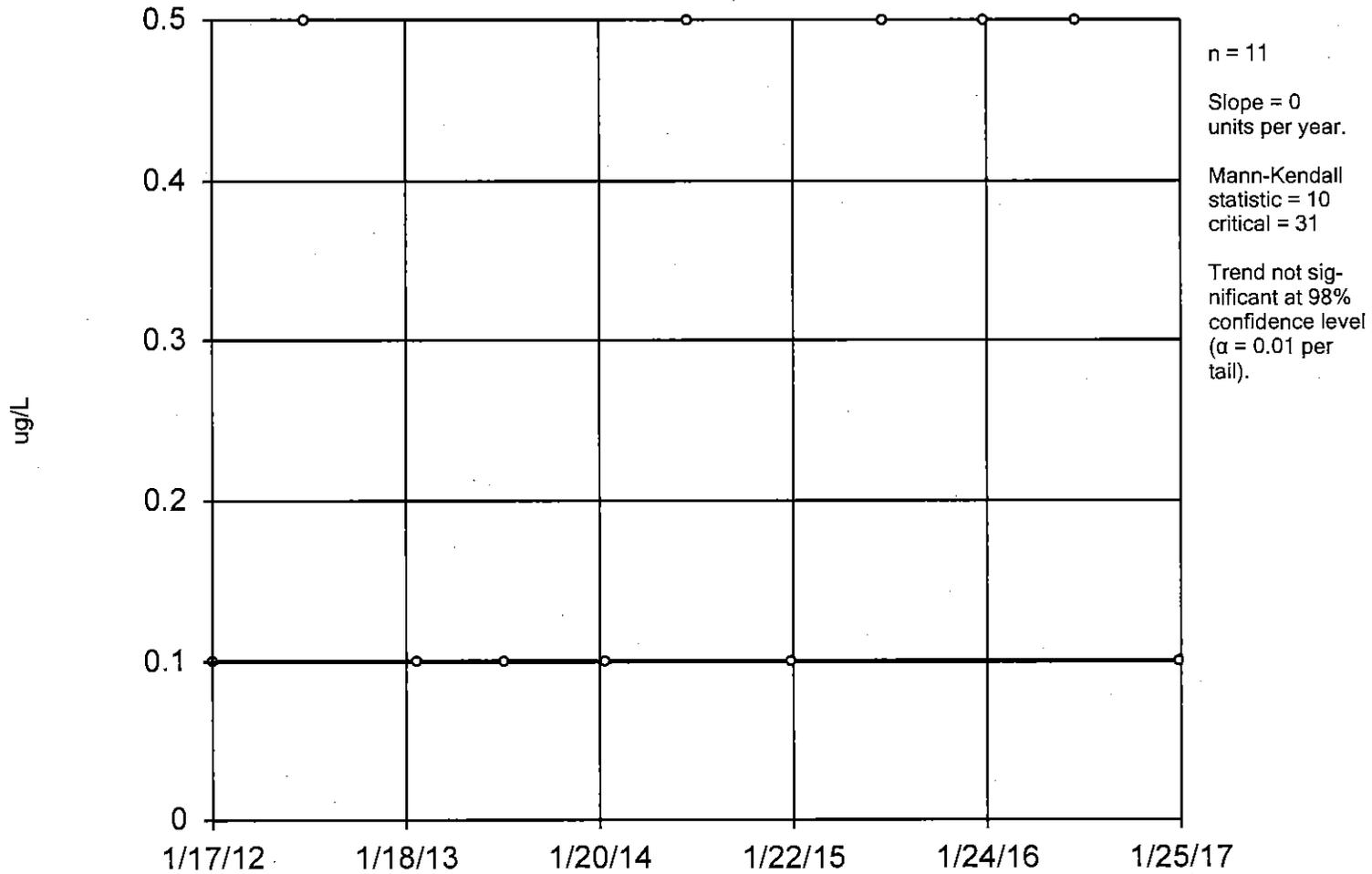
---

	MW-13 (bg)
2/7/2013	<0.2
7/25/2013	<0.2
1/31/2014	2.58
7/9/2014	2.53
1/21/2015	<0.2
7/14/2015	2.56
1/20/2016	1.35
7/13/2016	1.55
1/25/2017	1.76

Hollow symbols indicate censored values.

### Sen's Slope Estimator

MW-02



Constituent: Tetrachloroethylene Analysis Run 6/30/2017 11:28 AM

Facility: Gochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Tetrachloroethylene (ug/L) Analysis Run 6/30/2017 11:28 AM

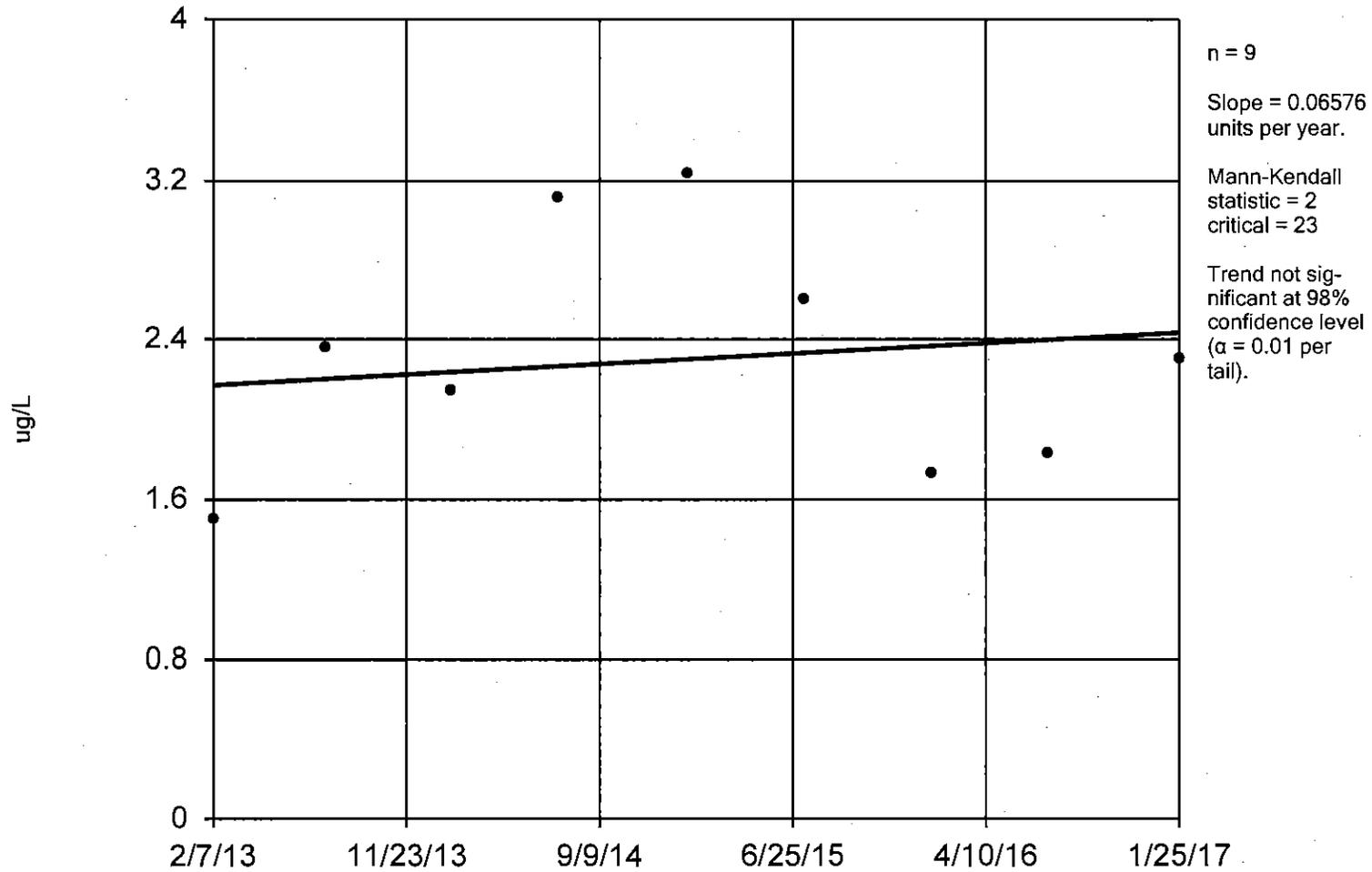
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-02
1/17/2012	<0.2
7/11/2012	<1
2/7/2013	<0.2
7/25/2013	<0.2
1/31/2014	<0.2
7/9/2014	<1
1/21/2015	<0.2
7/14/2015	<1
1/20/2016	<1
7/13/2016	<1
1/25/2017	<0.2

### Sen's Slope Estimator

MW-13 (bg)



Constituent: Tetrachloroethylene Analysis Run 6/30/2017 11:29 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Tetrachloroethylene (ug/L) Analysis Run 6/30/2017 11:29 AM

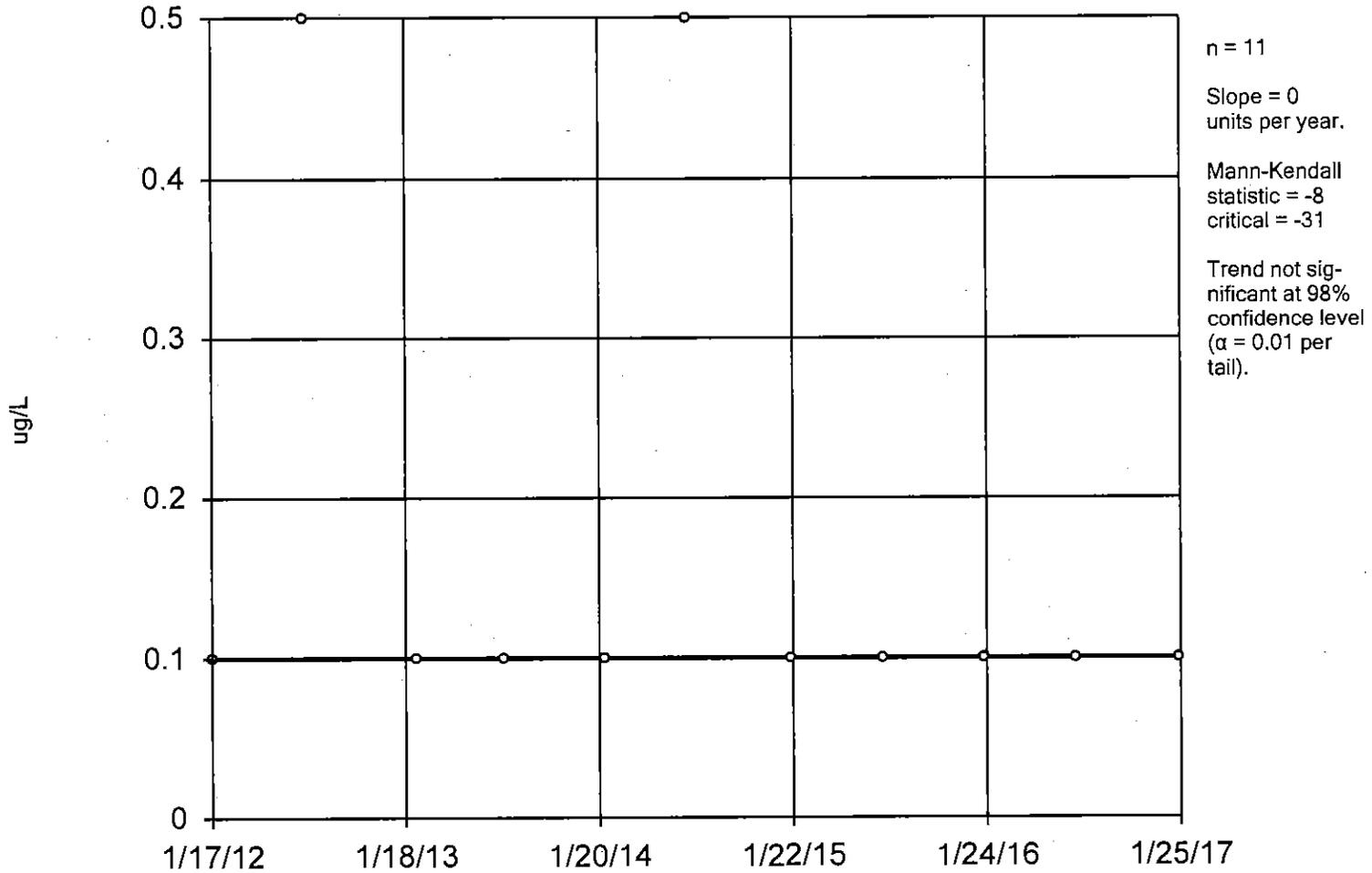
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-13 (bg)
2/7/2013	1.5
7/25/2013	2.36
1/31/2014	2.14
7/9/2014	3.11
1/21/2015	3.24
7/14/2015	2.6
1/20/2016	1.73
7/13/2016	1.83
1/25/2017	2.3

### Sen's Slope Estimator

MW-02



Constituent: Trichloroethylene Analysis Run 6/30/2017 11:30 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Trichloroethylene (ug/L) Analysis Run 6/30/2017 11:31 AM

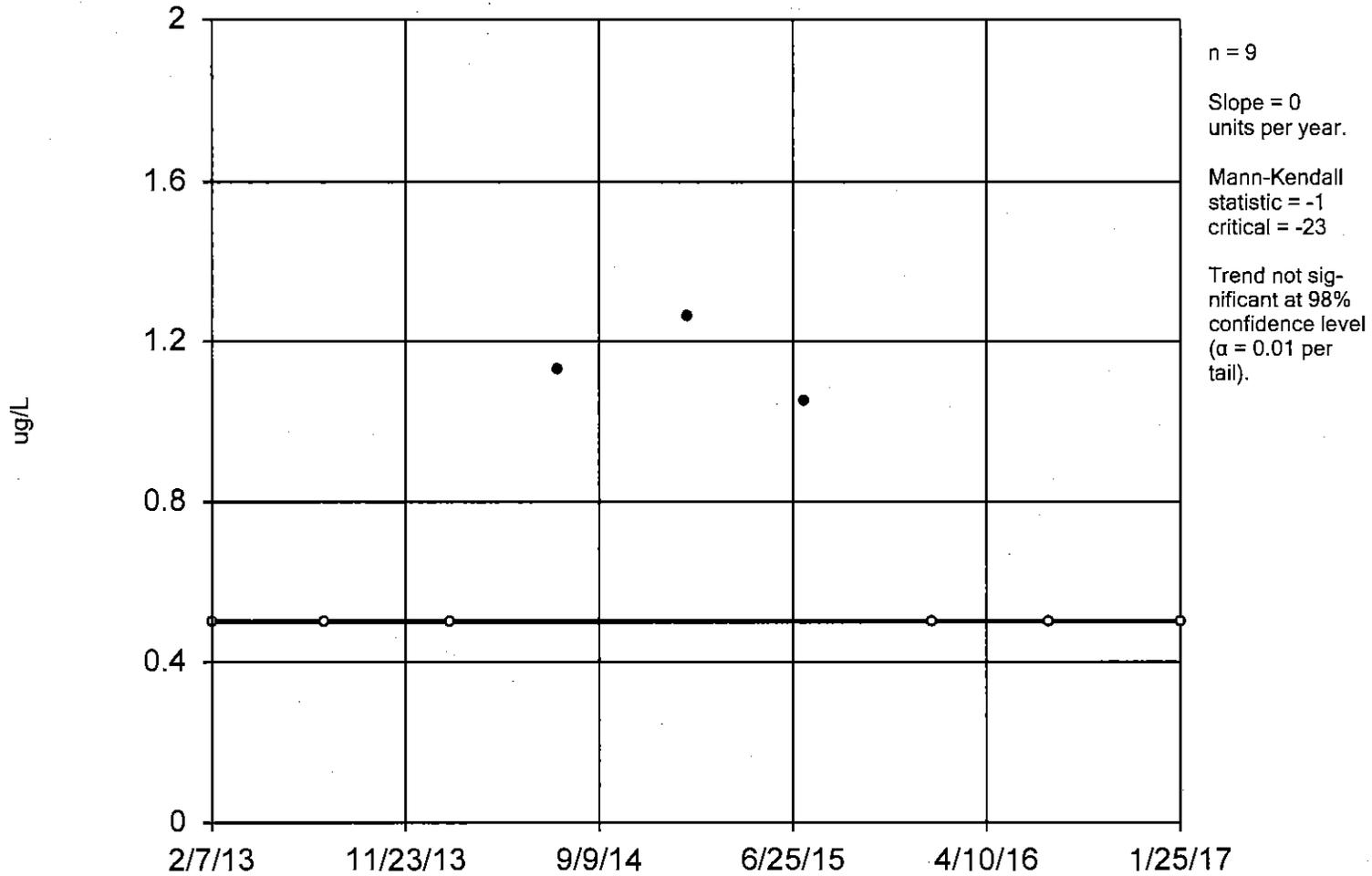
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-02
1/17/2012	<0.2
7/11/2012	<1
2/7/2013	<0.2
7/25/2013	<0.2
1/31/2014	<0.2
7/9/2014	<1
1/21/2015	<0.2
7/14/2015	<0.2
1/20/2016	<0.2
7/13/2016	<0.2
1/25/2017	<0.2

### Sen's Slope Estimator

MW-13 (bg)



Constituent: Trichloroethylene Analysis Run 6/30/2017 11:31 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Trichloroethylene (ug/L) Analysis Run 6/30/2017 11:31 AM

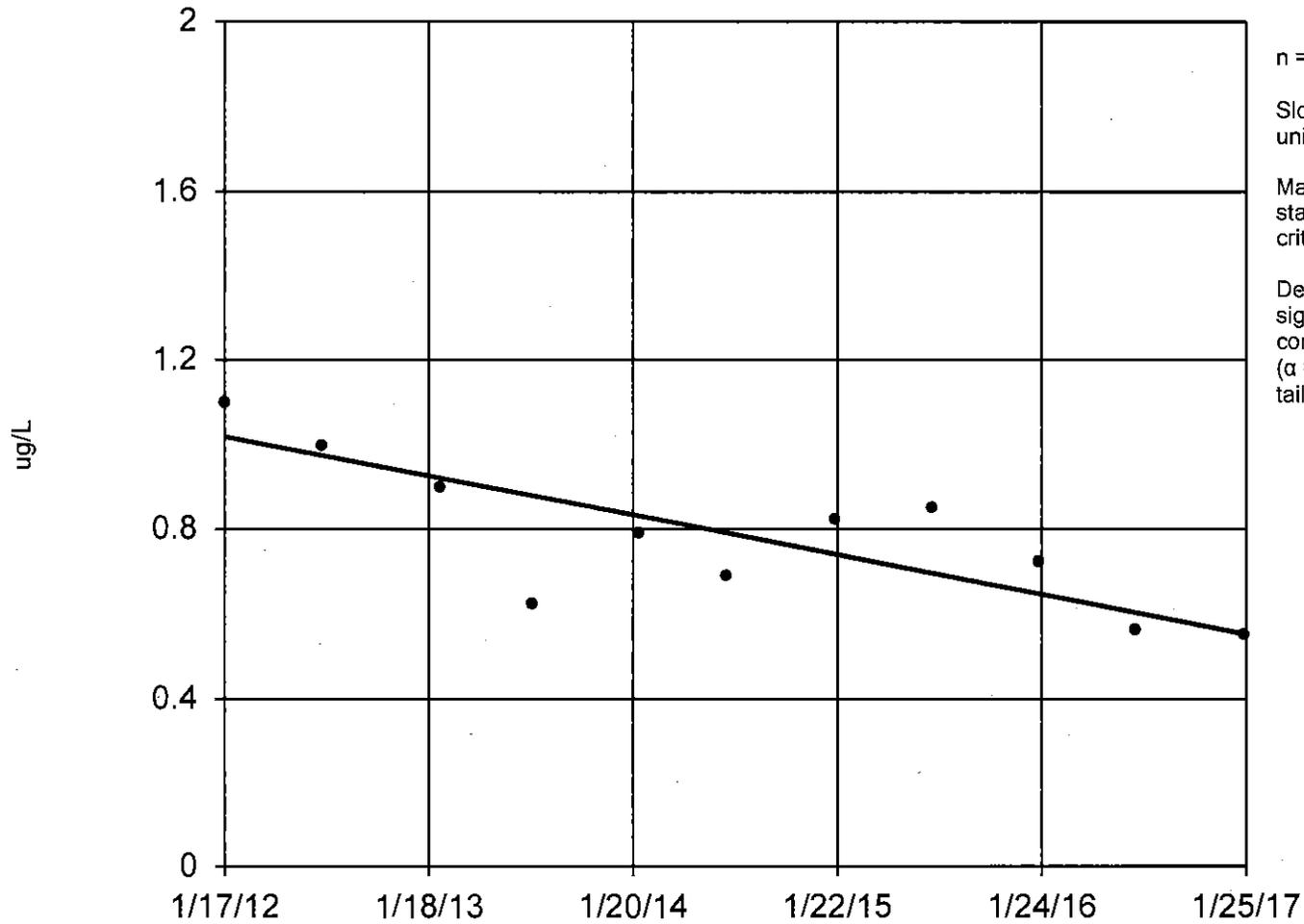
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-13 (bg)
2/7/2013	<1
7/25/2013	<1
1/31/2014	<1
7/9/2014	1.13
1/21/2015	1.26
7/14/2015	1.05
1/20/2016	<1
7/13/2016	<1
1/25/2017	<1

### Sen's Slope Estimator

MW-05



n = 11  
Slope = -0.0939  
units per year.  
Mann-Kendall  
statistic = -33  
critical = -31  
Decreasing trend  
significant at 98%  
confidence level  
( $\alpha = 0.01$  per  
tail).

Constituent: Vinyl Chloride Analysis Run 6/30/2017 11:32 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Vinyl Chloride (ug/L) Analysis Run 6/30/2017 11:32 AM

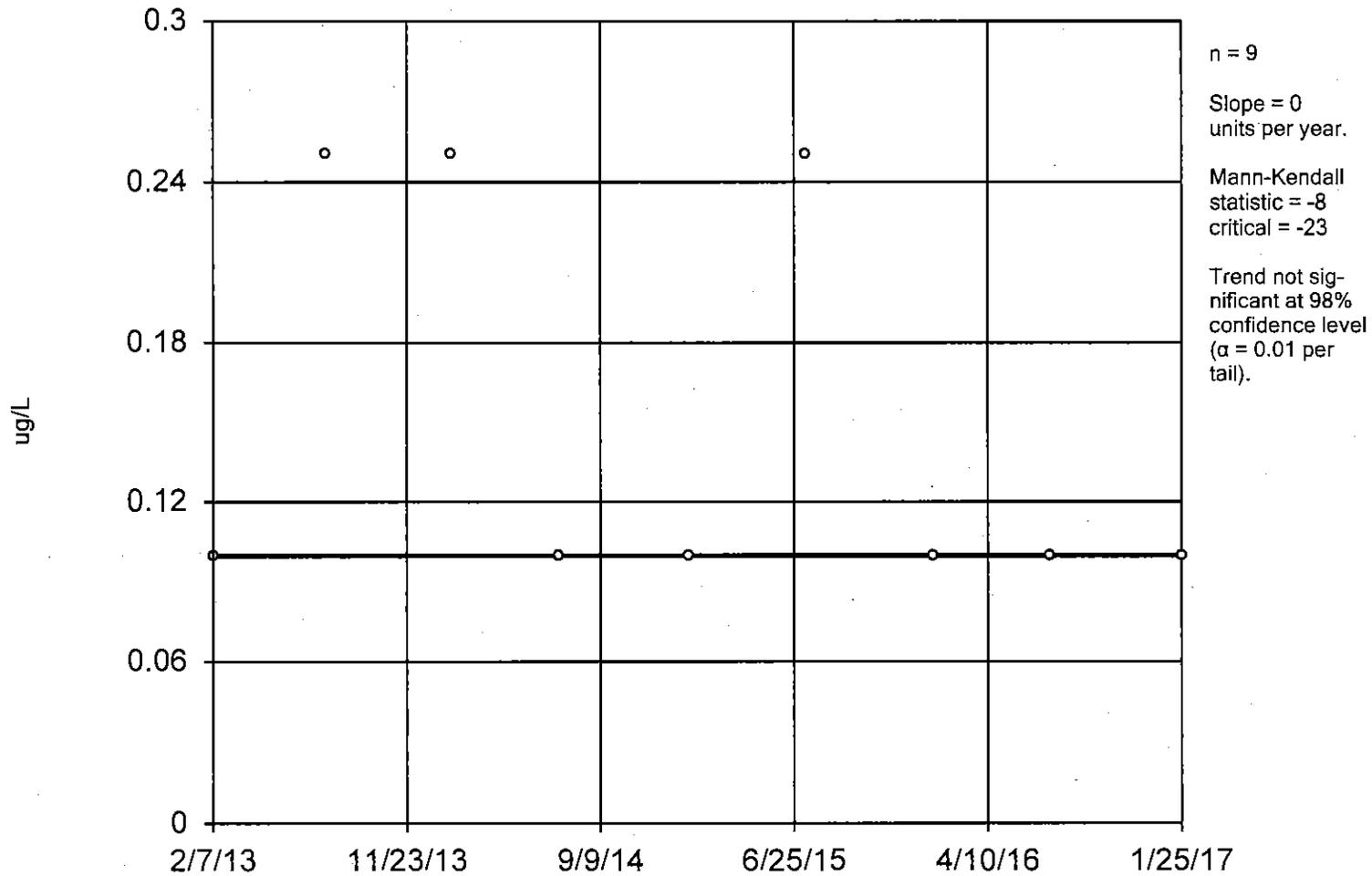
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-05
1/17/2012	1.1
7/11/2012	1
2/7/2013	0.9
7/25/2013	0.62
1/31/2014	0.79
7/9/2014	0.69
1/21/2015	0.82
7/14/2015	0.85
1/20/2016	0.72
7/13/2016	0.56
1/25/2017	0.55

### Sen's Slope Estimator

MW-13 (bg)



Constituent: Vinyl Chloride Analysis Run 6/30/2017 11:33 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Vinyl Chloride (ug/L) Analysis Run 6/30/2017 11:33 AM

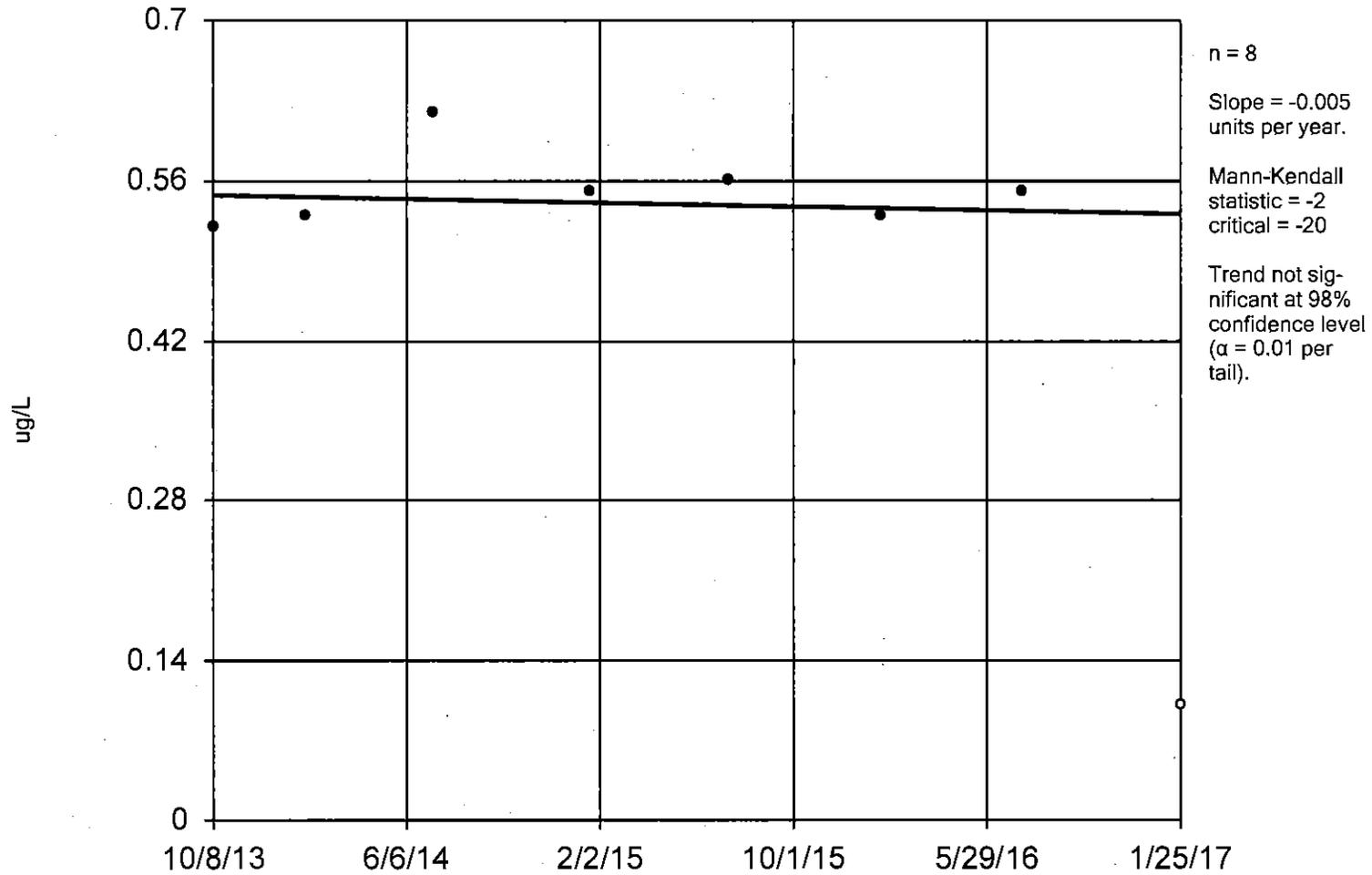
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-13 (bg)
2/7/2013	<0.2
7/25/2013	<0.5
1/31/2014	<0.5
7/9/2014	<0.2
1/21/2015	<0.2
7/14/2015	<0.5
1/20/2016	<0.2
7/13/2016	<0.2
1/25/2017	<0.2

### Sen's Slope Estimator

MW-14



Constituent: Vinyl Chloride Analysis Run 6/30/2017 11:33 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Vinyl Chloride (ug/L) Analysis Run 6/30/2017 11:34 AM

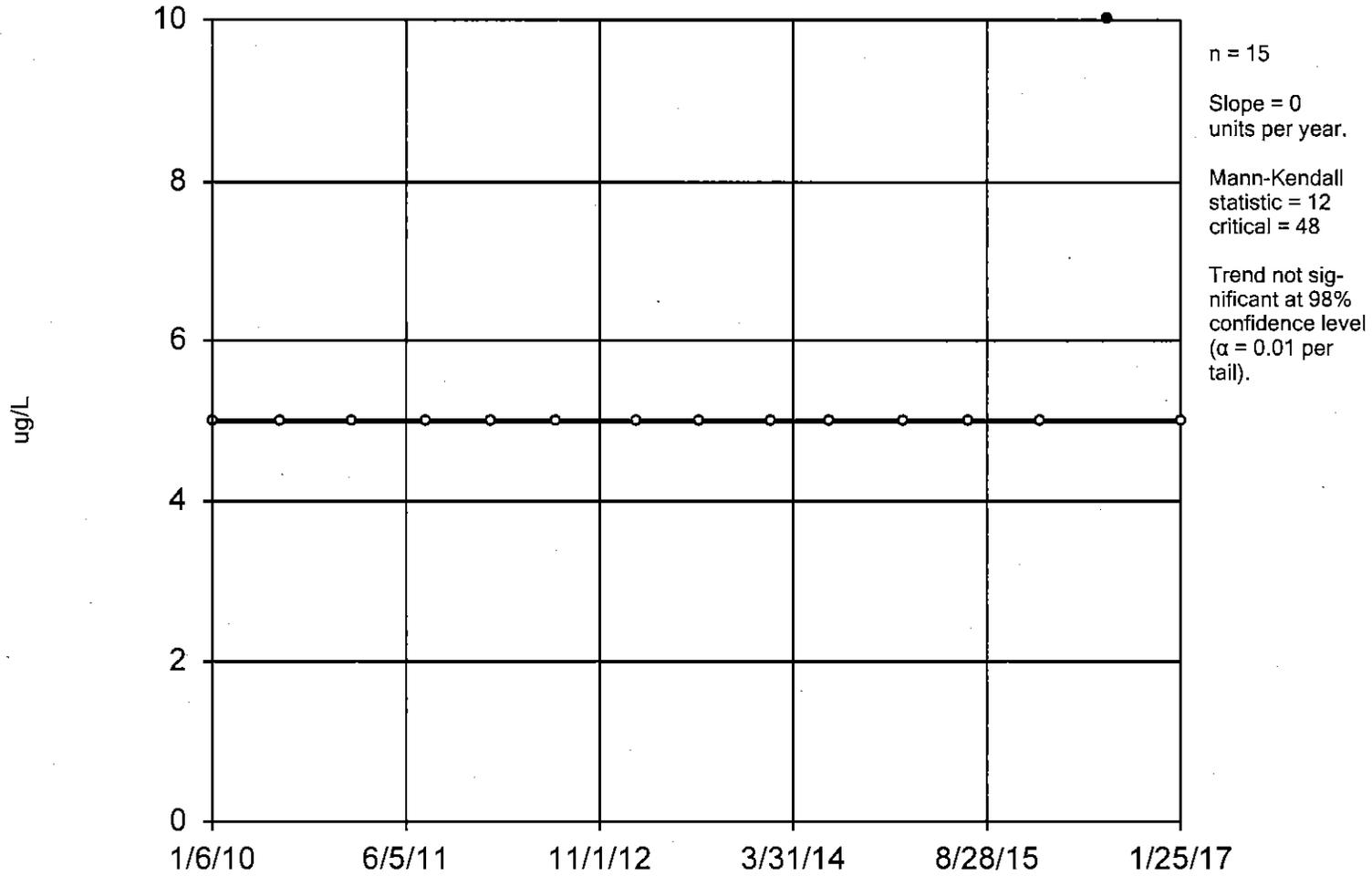
Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-14
10/8/2013	0.52
1/31/2014	0.53
7/9/2014	0.62
1/21/2015	0.55
7/14/2015	0.56
1/20/2016	0.53
7/13/2016	0.55
1/25/2017	<0.2

### Sen's Slope Estimator

MW-06 (bg)



Constituent: Cyanide Analysis Run 6/30/2017 9:42 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

# Sen's Slope Estimator

Constituent: Cyanide (ug/L) Analysis Run 6/30/2017 9:43 AM

Facility: Goochland Cy Landfill Data File: GCLF 0517

---

	MW-06 (bg)
1/6/2010	<10
7/8/2010	<10
1/13/2011	<10
7/28/2011	<10
1/17/2012	<10
7/11/2012	<10
2/7/2013	<10
7/25/2013	<10
1/31/2014	<10
7/9/2014	<10
1/21/2015	<10
7/14/2015	<10
1/20/2016	<10 (CI)
7/13/2016	10
1/25/2017	<10

**Attachment 2**  
**Financial Assurance Demonstration**



## Solid Waste Disposal Facility Cost Estimate Form

Facility Name:		Goochland County Landfill				Permit No. SWP		179	
Address:		1800 Sandy Hook Road, PO Box 103							
City:		Goochland		State:		VA		Zip: 23063	
FA Holder:		Goochland County							
Estimate Prepared By:		Resource International							
Indicate the plan versions for which this cost estimate was prepared, identifying the following information for each plan:									
<b>Closure Plan</b>					<b>Post-Closure Care Plan</b>				
Title:		Final Closure Plan			Title:		Post Closure Care Plan		
Plan Date:		October 1994	Approved:	Nov 1994	Plan Date:		November 2009	Approved:	December 2009
Consultant:		Combine Technologies, Inc.			Consultant:		Resource International, Ltd.		
<b>Corrective Action Plan</b>					<b>Corrective Action Monitoring Plan</b>				
Title:					Title:				
Plan Date:			Approved:		Plan Date:			Approved:	
Consultant:					Consultant:				
<b>Cost Estimate Summary</b>									
Total Closure Cost:		\$							
Total Post-Closure Cost:		\$30,437							
Total Corrective Action Cost:		\$0							
<b>TOTAL:</b>		<b>\$30,437</b>							
<b>References</b>									
Please indicate references used to develop this cost estimate: Goochland County Post Closure Care Plan, 2009; Air Water and Soil Laboratory Analysis Costs; Contractor estimates for sediment basin clean out costs; 2017 estimate revised to reflect petition for Termination of Post-Closure Care for Groundwater Monitoring.									
<b>Certification by Preparer:</b>									
This is to certify that the cost estimates pertaining to the engineering features and monitoring requirements of this solid waste management facility have been prepared by me and are representative of the design specified in the facility's approved Closure, Post-Closure and Corrective Action Plans. The estimate is based on the cost of hiring a third party and does not incorporate any salvage value that may be realized by the sale of wastes, facility structures, or equipment, land or other facility assets at the time of partial or final closure. In my professional judgment, the cost estimates are a true, correct, and complete representation of the financial liabilities for closure, post-closure care, and corrective action of the facility and comply with the requirements of 9 VAC 20-70 and all other DEQ rules and statutes of the Commonwealth of Virginia.									
Name:		Robert L. Hundley, Jr., P.E.			Signature:				
Title:		Project Manager			Date:		7/23/18		
<b>Acknowledgement by Owner/Operator :</b>									
Name:		Barbara Horlacher			Signature:				
Title:		Director of Financial Services			Date:		7/24/18		

## Goochland County Hidden Rock Landfill Post-Closure Care Cost estimate

**\*FILL IN THE BOXES. THE REST WILL BE CALCULATED FOR YOU\***

		<u>Calculation or Conversion</u>	
<b>I. Groundwater Monitoring</b>			
a. Total number of monitoring wells	0	wells	
b. Total number of sampling events/year	0	events/yr	a x b
c. Quantity of additional samples (e.g. QA/QC)	0.3	samples/event	0 samples/yr
d. Total samples per year			a x c
e. Analysis unit cost (Table 3.1 constituents)	\$600.00	/sample	b + c
f. <i>Total Analysis cost</i>			0 samples/yr
g. GW Monitoring unit cost	\$2,400.00	/event	d x e
i. <i>Total sampling cost</i>			\$0.00 /yr
j. Engineering fees & reports	\$0	/yr	f + (g x b)
<b>Yearly Groundwater Monitoring Cost</b>			\$0.00 /yr
			i + j
			<b>\$0 /yr</b>
<b>II. Landfill Gas Monitoring, Maintenance, and Control</b>			
a. Frequency of LFG compliance monitoring	4	events/yr	
b. LFG Monitoring unit cost	\$300.00	/event	
c. <i>Total perimeter LFG monitoring cost</i>			a x b
d. Frequency of surface monitoring (air permit)	0	events/yr	\$1,200 /yr
e. Surface monitoring unit cost	\$0.00	/event	
f. <i>Total surface monitoring cost</i>			d x e
g. Control system operating unit cost	\$4,000	/yr	\$0 /yr
h. Frequency of LFG control system inspections	4	events/yr	
i. Control system inspection cost	\$0.00	/event	
j. <i>Total control system cost</i>			g + (h x i)
<b>Yearly Landfill Gas Monitoring, Maintenance, &amp; Control Cost</b>			\$4,000 /yr
			c + f + j
			<b>\$5,200 /yr</b>
<b>III. Leachate Management</b>			
a. Quantity of leachate generated	-	gal/yr	
<i>On-site Leachate Management or Pre-Treatment</i>			
b. On-site treatment operating unit cost	\$0.00	/gal	
c. <i>Total on-site management cost</i>			a x b
			\$0 /yr
<i>Leachate Disposal</i>			
d. Private disposal unit cost	\$0.00	/gal	
e. POTW disposal unit cost	\$0.00	/gal	
f. Direct discharge to POTW unit cost	\$0.00	/gal	
g. Pump & Haul unit cost	\$0.00	/gal	
h. Subtotal leachate disposal unit cost			d + e + f + g
i. <i>Total leachate disposal cost</i>			\$0.00
j. Leachate sampling & analysis unit cost	\$0.00	/sample	a x h
k. Frequency of leachate sampling & analysis	0	sample/yr	\$0 /yr
l. <i>Total leachate sampling &amp; analysis cost</i>			j x k
			\$0.00 /yr
<b>Yearly Leachate Management Cost</b>			c + i + l
			<b>\$0 /yr</b>
<b>IV. Cap Maintenance &amp; Repair</b>			
a. Closed Landfill Area	24	acres	
<i>Mowing &amp; Fertilization</i>			
b. Mowing frequency	2	visits/yr	
c. Mowing unit cost	\$75.00	/acre/visit	
d. <i>Total mowing cost</i>			a x b x c
e. Fertilizer frequency	1	visits/yr	\$3,600 /yr
f. Fertilizer unit cost	\$200.00	/acre/visit	
g. <i>Total fertilizer cost</i>			a x e x f
			\$4,800 /yr

**Cap Erosion & Repair**

h. Area to reseed/year		33% x a	8.0 acres
i. Reseeding unit cost	<input type="text" value="\$300.00"/>	/acre	
j. Total reseeding cost		h x i	\$2,400.00 /yr
k. Area of cap erosion/year		10% x a	2.4 acres
l. Cap erosion repair unit cost	<input type="text" value="\$100.00"/>	/acre	
m. Mobilization/Demobilization	<input type="text" value="\$150.00"/>	/yr	
n. Total cap erosion repair cost		(k x l) + m	\$390 /yr
<b>Yearly Cap Maintenance &amp; Repair cost</b>		d + g + j + n	<b>\$11,190 /yr</b>

**V. Sediment Basin Maintenance & Repair**

a. Sediment basin cleanout frequency, 1 per	<input type="text" value="3"/>	years	1 / a	0.33 event/yr
b. Sediment basin cleanout unit cost	<input type="text" value="\$7,500"/>	/event		
c. Mobilization/Demobilization	<input type="text" value="\$5,000"/>	/event		
d. Total sediment basin maintenance cost		a x (b + c)		\$4,167 /yr
e. Total number of stormwater sampling locations	<input type="text" value="-"/>	locations		
f. Stormwater sampling frequency	<input type="text" value="-"/>	events/yr		
g. Total number of stormwater samples		e x f		0 samples/yr
h. Analysis unit cost (VPDES permit parameters)	<input type="text" value="\$0"/>	/sample		
i. Total Analysis cost		g x h		\$0 /yr
j. Mobilization unit cost	<input type="text" value="\$300.00"/>	/event		
k. Technician field unit cost	<input type="text" value="\$75.00"/>	/event		
l. Total sampling cost		f x (j + k)		\$0.00 /yr
m. Engineering fees & reports	<input type="text" value="\$0"/>	/yr		
n. Total Stormwater Sampling & Analysis cost		f + i + j		\$0 /yr
<b>Yearly Sediment Basin Maintenance &amp; Repair</b>		d + n		<b>\$4,167 /yr</b>

**VI. Vector & Rodent Control**

a. Vector and rodent control unit cost	<input type="text" value="\$2,000"/>	/yr		
<b>Yearly Vector and Rodent Control Cost</b>		a		<b>\$2,000 /yr</b>

**VII. Post-Closure Care General Inspections**

a. General Inspection unit cost	<input type="text" value="\$380"/>	/inspection		
b. Number of inspections per year	<input type="text" value="1"/>			
<b>Yearly Post-Closure Care General Inspection Cost</b>		a x b		<b>\$380 /yr</b>

**Annual Post-Closure Care Cost (APCC)**

I + ... + VII \$22,937 /yr

**Length of post-closure care (LPCC)** years**Post-Closure Care Cost**

APCC x LPCC \$22,937

**Engineering & Documentation**

Post-Closure Care Evaluation	<input type="text" value="\$6,000"/>
Post-Closure Care Certification	<input type="text" value="\$1,500"/>
Cost for survey and deed notation (if not completed at time of landfill closure)	<input type="text" value="\$0"/>

Engineering Sum \$7,500

**FA Mechanism Maintenance Cost** /yr

FA maintenance x LPCC \$0

**Total Post-Closure Care Cost**Post-Closure Cost + Engineering + FA Maintenance **\$30,437**

**Attachment 3**  
**2018 Lead Analysis for MW-14**



Air Water & Soil Laboratories, Inc.  
1941 Reymet Road  
Richmond, VA 23237  
(804)-358-8295 - Telephone  
(804)-358-8297 - Fax

---

**Analysis Detects Report**

Client Name:  
Client Site ID:  
Submitted To:

Date Issued:

---

**Laboratory Sample ID:**

**Client Sample ID:**

Parameter	Samp ID	Reference Method	Sample Results	Qual	LOD	LOQ	Dil. Factor	Units
-----------	---------	------------------	----------------	------	-----	-----	-------------	-------

There are no reportable results for target analytes in this report.

---

Note that this report is not the "Certificate of Analysis". This report only lists the target analytes that displayed concentrations that exceeded the detection limit specified for that analyte. For a complete listing of all analytes requested and the results of the analysis see the "Certificate of Analysis".



1941 Reymet Road • Richmond, Virginia 23237 • Tel: (804)-358-8295 Fax: (804)-358-8297

### Certificate of Analysis

*Final Report*

Laboratory Order ID 18F0772

Client Name: Resource International, Ltd.  
P.O. Box 6160  
Ashland, VA 23005

Date Received: June 22, 2018 8:45  
Date Issued: June 29, 2018 13:17  
Project Number: 97007.12  
Purchase Order:

Submitted To: Virginia Gills

Client Site I.D.: Goochland Co. LF.

Enclosed are the results of analyses for samples received by the laboratory on 06/22/2018 08:45. If you have any questions concerning this report, please feel free to contact the laboratory.

Sincerely,

Mandy Mishra  
Lab Director/Quality Assurance Manager

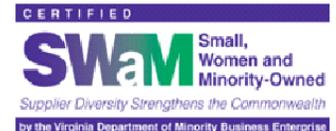
**End Notes:**

The test results listed in this report relate only to the samples submitted to the laboratory and as received by the Laboratory.

Unless otherwise noted, the test results for solid materials are calculated on a wet weight basis. Analyses for pH, dissolved oxygen, temperature, residual chlorine and sulfite that are performed in the laboratory do not meet NELAC requirements due to extremely short holding times. These analyses should be performed in the field. The results of field analyses performed by the Sampler included in the Certificate of Analysis are done so at the client's request and are not included in the laboratory's fields of certification nor have they been audited for adherence to a reference method or procedure.

The signature on the final report certifies that these results conform to all applicable NELAC standards unless otherwise specified. For a complete list of the Laboratory's NELAC certified parameters please contact customer service.

This report shall not be reproduced except in full without the expressed and written approval of an authorized representative of Air Water & Soil Laboratories, Inc.





Air Water & Soil Laboratories, Inc.  
1941 Reymet Road  
Richmond, Virginia 23237  
(804)-358-8295 - Telephone  
(804)-358-8297 - Fax

## Certificate of Analysis

Client Name: Resource International, Ltd.  
Client Site I.D.: Goochland Co. LF.  
Submitted To: Virginia Gills

Date Issued: 6/29/2018 1:17:01PM

### ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
MW-14	18F0772-01	Ground Water	06/21/2018 14:45	06/22/2018 08:45



Air Water & Soil Laboratories, Inc.  
 1941 Reymet Road  
 Richmond, Virginia 23237  
 (804)-358-8295 - Telephone  
 (804)-358-8297 - Fax

**Certificate of Analysis**

Client Name: Resource International, Ltd.  
 Client Site I.D.: Goochland Co. LF.  
 Submitted To: Virginia Gills

Date Issued: 6/29/2018 1:17:01PM

Client Sample ID: MW-14

Laboratory Sample ID: 18F0772-01

Parameter	Samp ID	CAS	Reference Method	Sample Prep Date/Time	Analyzed Date/Time	Sample Results	Qual	LOD	LOQ	DF	Units	Analyst
<b>Metals (Total) by EPA 6000/7000 Series Methods</b>												
Lead	01	7439-92-1	SW6010C	06/26/2018 17:00	06/27/2018 12:28	BLOD		0.0060	0.0100	1	mg/L	BG

## Certificate of Analysis

Client Name: Resource International, Ltd.  
Client Site I.D.: Goochland Co. LF.  
Submitted To: Virginia Gills

Date Issued: 6/29/2018 1:17:01PM

Metals (Total) by EPA 6000/7000 Series Methods - Quality Control

Air Water & Soil Laboratories, Inc.

Analyte	Result	LOQ	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qual
<b>Batch BBF0734 - EPA200.2/R2.8</b>										
<b>Blank (BBF0734-BLK1)</b> Prepared: 06/26/2018 Analyzed: 06/27/2018										
Lead	BLOD	0.0100	mg/L							
<b>LCS (BBF0734-BS1)</b> Prepared: 06/26/2018 Analyzed: 06/27/2018										
Lead	0.477	0.0100	mg/L	0.500		95.5	80-120			
<b>LCS Dup (BBF0734-BSD1)</b> Prepared: 06/26/2018 Analyzed: 06/27/2018										
Lead	0.501	0.0100	mg/L	0.500		100	80-120	4.79	20	
<b>Matrix Spike (BBF0734-MS1)</b> Source: 18F0839-01 Prepared: 06/26/2018 Analyzed: 06/27/2018										
Lead	0.503	0.0100	mg/L	0.500	BLOD	101	75-125			
<b>Matrix Spike (BBF0734-MS2)</b> Source: 18F0839-02 Prepared: 06/26/2018 Analyzed: 06/27/2018										
Lead	0.516	0.0100	mg/L	0.500	BLOD	103	75-125			
<b>Matrix Spike Dup (BBF0734-MSD1)</b> Source: 18F0839-01 Prepared: 06/26/2018 Analyzed: 06/27/2018										
Lead	0.508	0.0100	mg/L	0.500	BLOD	102	75-125	1.02	20	
<b>Matrix Spike Dup (BBF0734-MSD2)</b> Source: 18F0839-02 Prepared: 06/26/2018 Analyzed: 06/27/2018										
Lead	0.503	0.0100	mg/L	0.500	BLOD	101	75-125	2.66	20	

### Analytical Summary

Sample ID	Preparation Factors Initial / Final	Method	Batch ID	Sequence ID	Calibration ID
<b>Metals (Total) by EPA 6000/7000 Series Methods</b>			<b>Preparation Method:</b>	<b>EPA200.2/R2.8</b>	
18F0772-01	50.0 mL / 50.0 mL	SW6010C	BBF0734	SBF0736	AF80134



**Certificate of Analysis**

Client Name: Resource International, Ltd.  
Client Site I.D.: Gochland Co. LF.  
Submitted To: Virginia Gills

Date Issued: 6/29/2018 1:17:01PM

**Certified Analyses included in this Report**

Analyte	Certifications
<i>SW6010C in Non-Potable Water</i>	
Lead	VELAP,WVDEP

Code	Description	Cert Number	Expires
MdDOE	Maryland DE Drinking Water	341	12/31/2018
NC	North Carolina DENR	495	12/31/2018
VELAP Certificate #4337	NELAC-Virginia Certificate #9619	460021	06/14/2019
WVDEP	West Virginia DEP	350	11/30/2018

## Certificate of Analysis

Client Name: Resource International, Ltd.  
Client Site I.D.: Goochland Co. LF.  
Submitted To: Virginia Gills

Date Issued: 6/29/2018 1:17:01PM

### Qualifiers and Definitions

RPD Relative Percent Difference

Qual Qualifiers

-RE Denotes sample was re-analyzed

LOD Limit of Detection

BLOD Below Limit of Detection

LOQ Limit of Quantitation

DF Dilution Factor

TIC Tentatively Identified Compounds are compounds that are identified by comparing the analyte mass spectral pattern with the NIST spectral library. A TIC spectral match is reported when the pattern is at least 75% consistent with the published pattern. Compound concentrations are estimated and are calculated using an internal standard response factor of 1.

PCBs, Total Total PCBs are defined as the sum of detected Aroclors 1016, 1221, 1232, 1248, 1254, 1260, 1262, and 1268.



1941 REYMET ROAD  
 RICHMOND, VIRGINIA 23237  
 (804) 358-8295 PHONE  
 (804)358-8297 FAX

Chain of Custody  
 Form #: F1331  
 Rev. 3.0  
 Effective: Aug 24, 2017

**CHAIN OF CUSTODY**

PAGE 1 OF 1

COMPANY NAME: Resource Int'l. INVOICE TO: Joanna Sylvia PROJECT NAME/Quote #: Goochland Co. LF.  
 CONTACT: Ginny Gills INVOICE CONTACT: SAME SITE NAME:  
 ADDRESS: 1560 Kings Charter Dr. INVOICE ADDRESS: SAME PROJECT NUMBER: 97007.12  
 PHONE #: 804-558-9200 INVOICE PHONE #: EMAIL: vgills@resourceintl.com P.O. #:  
 FAX #:                      Is sample for compliance reporting? (YES) NO (NO) Pretreatment Program: PWS I.D. #:  
 SAMPLER NAME (PRINT): Ginny Gills SAMPLER SIGNATURE: Ginny Gills Turn Around Time: Circle: 10 5 Days or Day(s)

Matrix Codes: WW=Waste Water/Storm Water GW=Ground Water DW=Drinking Water S=Soil/Solids OR=Organic A=Air W=Wipe OT=Other

CLIENT SAMPLE I.D.	Grab	Composite	Field Filtered (Dissolved Metals)	Composite Start Date	Composite Start Time	Grab Date or Composite Stop Date	Grab Time or Composite Stop Time	Time Preserved	Matrix (See Codes)	Number of Containers	ANALYSIS / (PRESERVATIVE)	COMMENTS
1) MW-14	x					6/21/18	1445		GW	1		Preservative Codes: N=Nitric Acid C=Hydrochloric Acid S=Sulfuric Acid H=Sodium Hydroxide A=Ascorbic Acid Z=Zinc Acetate T=Sodium Thiosulfate M=Methanol
2)												PLEASE NOTE PRESERVATIVE(S), INTERFERENCE CHECKS or PUMP RATE (L/min)
3)												
4)												
5)												
6)												
7)												
8)												
9)												

QC Data Package Level III  Level IV

LAB USE ONLY Custody Seals used and intact? (Y/N) (N) COOLER TEMP Received on Ice? (Y/N) 1.3°C

RECEIVED: Ginny Gills 6/21/18 8:45  
 RECEIVED: Joanna Sylvia 6/22/18 9:45  
 RECEIVED:                                          

RIL 18F0772  
 Goochland County Landfill 3.1A +  
 Recd: 06/22/2018 Due: 07/09/2018



## Certificate of Analysis

Client Name: Resource International, Ltd.  
 Client Site I.D.: Goochland Co. LF.  
 Submitted To: Virginia Gills

Date Issued: 6/29/2018 1:17:01PM

## Sample Conditions Checklist

Samples Received at:	1.30°C
How were samples received?	Walk In
Were Custody Seals used? If so, were they received intact?	No
Are the custody papers filled out completely and correctly?	Yes
Do all bottle labels agree with custody papers?	Yes
Is the temperature blank or representative sample within acceptable limits? (above freezing to 6°C) or received on ice and recently taken?	Yes
Are all samples within holding time for requested laboratory tests?	Yes
Is a sufficient amount of sample provided to perform the tests included?	Yes
Are all samples in appropriate containers for the analyses requested?	Yes
Were volatile organic containers received?	No
Are all volatile organic and TOX containers free of headspace?	NA
Is a trip blank provided for each VOC sample set? VOC sample sets include EPA8011, EPA504, EPA8260, EPA624, EPA8015 GRO, EPA8021, EPA524, and RSK-175.	NA
Are all samples received appropriately preserved? Note that metals containers do not require field preservation but lab preservation may delay analysis.	Yes

6/21/18

Goodland Co. LF

9700712

GG

MW-14 sample

onsite: 13:25

offsite: 15:05

weather: cloudy, 70's

Well sampled: MW-14

\*see sample collection log for details.

**E+M**

bailer 2

string 34'

WLF 1

gloves 4

Honpa rental