March 28, 2019

Alberta Environment and Parks (AEP)
Monitoring Branch
11th Floor Oxbridge Place
9820-106 Street
Edmonton, Alberta
T5K 2J6

Re: Annual Ambient Air Monitoring Report
Calendar year 2018
Clean Harbors Canada, Inc. Approval 10348-03-00

To Whom It May Concern:

Clean Harbors Canada, Inc. (Clean Harbors) is presenting this Annual Ambient Air Monitoring Report, which was prepared by GHD Limited (Consultant), for the 2018 calendar year to Alberta Environment and Parks (AEP). The Clean Harbors Ryley Industrial Waste Management Facility (Facility) is located in SE 09-050-17 W4M near Ryley, Alberta.

This ambient air monitoring program at the Facility is conducted in accordance with the requirements outlined in the Facility's Environmental Protection and Enhancement Act (EPEA) Approval, Approval Number: 10348-02-00 (Approval). As part of the Approval requirements, the Facility submitted a Proposal for a new Ambient Air Monitoring Program, which was subsequently approved on June 24, 2009 by the AEP (formally AENV). Operating under the Approval and the approved proposal, Clean Harbors operates two ambient air monitoring stations: AEP Station ID 00010348-I-1 and AEP Station ID 00010348-C-1. There have been no changes to the monitoring locations, monitoring methods or significant changes to monitoring equipment during the 2018 calendar year.

During the 2018 calendar year, the meteorological station (AEP Station ID 00010348-C-1) operated at 98 percent annual uptime, which is above the 90 percent uptime threshold required by the Air Monitoring Directive, 2016. For March 2018 and September 2018, Clean Harbors reported non-compliance events for the wind monitoring station, where the station operated at an uptime of 85 percent and 89 percent respectively. Both of these instances were reported to AEP under Reference No.: 337497 for March 2018 and Reference No.: 345312 for September 2018. Both of these non-compliance events are described in full, in the following report.

During the 2018 calendar year, for the Particulate Matter < 10 microns (PM_{10}) station (AEP Station ID 00010348-I-1), Clean Harbors reported non-compliance events in June 2018 (Reference No.: 340114) and September 2018 (Reference No.: 343639). Both of these events are described in full, in the following report.

There were no non-compliance events for the VOC and TNMOC station (AEP Station ID 00010348-I-1) in 2018.

Included in this report are the following:

- Summary of the ambient air monitoring program undertaken at the Facility for 2018

- Summary of AMD Electronic Transfer System Submittals
- Results for Particulate Matter $\leq$ 10 microns (PM_{10}) reported in ug/m^3
- Results for water-soluble cations; metals or anions if the PM_{10} results were >50 ug/m^3
- Results for Total Non-Methane Organic Compounds (TNMOC) and Volatile Organic Compounds (VOC)
- 5-year average plots for measured compounds outlined in the approval
- Annual wind rose and monthly uptime summary
- Any sampling issues or data issues that occurred during the 2018 calendar year

Should there be any questions and comments regarding this report, please do not hesitate to contact the undersigned.

Type text here

Yours truly,

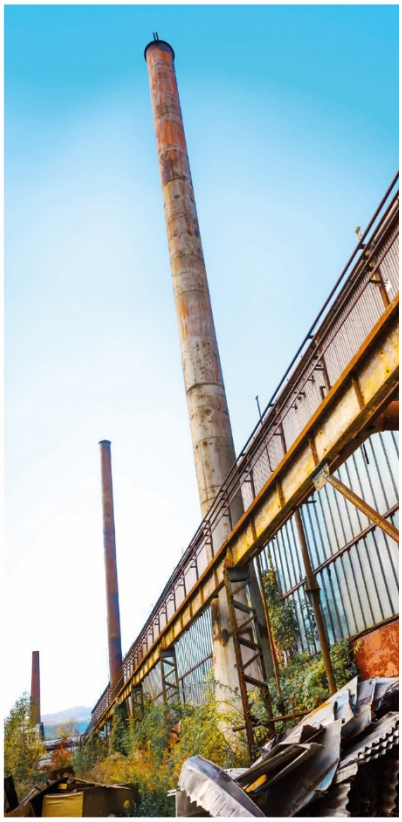
CLEAN HARBORS CANADA INC.

Stan Yuha

Facility Manager
Ryley Facility

Alberta Environment and Parks (AEP) 2018 Annual Ambient Air Monitoring Report

Approval Number: 10348-03-00
Ryley Facility, Alberta



Clean Harbors Canada Inc.

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1. Introduction

1.1 Background

GHD Limited (GHD), on behalf of Clean Harbors Canada, Inc. (Clean Harbors), is presenting to Alberta Environment and Parks (AEP) the Annual Clean Harbors Ambient Air Monitoring Report for the 2018 calendar year. The Clean Harbors Ryley Industrial Waste Management Facility (Facility) is located in SE 09-050-17 W4M near Ryley, Alberta. Figure 1 presents the site location and air monitoring station location map.

The ambient air monitoring program at the Facility is conducted in accordance with the requirements outlined in the Facility's Environmental Protection and Enhancement Act (EPEA) Approval, Approval Number: 10348-03-00 (Approval). As part of the Approval requirements, the Facility submitted a proposal for a new ambient air monitoring program, which was subsequently approved on June 24, 2009 by the AEP (formally AENV).

1.2 Contact Information

As required by AMD Chapter 9, Section 2, contact information is provided for the following Facility personnel and Contractors that assisted with the performance of the Facility's Air Monitoring Program.

Name:	Mr. Stan Yuha
Title:	Plant Manager
Company:	Clean Harbors
Responsibilities:	Report Certifier/ETS Submitter
Address:	PO Box 390, Ryley, AB T0B 4A0
Phone:	780-663-2509
Email:	yuha.stan@cleanharbors.com

Name:	Mr. Jorge Mendoza
Title:	Laboratory Manager
Company:	Clean Harbors
Responsibilities:	Station Field Operator and Field Sampler
Address:	PO Box 390, Ryley, AB T0B 4A0
Phone:	780-663-2513
Email:	mendoza.jorge@cleanharbors.com

Name:	Mr. Brandon Lawrence
Title:	Project Manager
Company:	GHD Limited
Responsibilities:	Consulting/Maintenance/Calibration Services/Report Preparer/ETS Submitter
Address:	3445-114th Ave. SE, Suite 103 Calgary, AB
Phone:	403-271-2000
Email:	brandon.Lawrence@ghd.com

Company:	Innotech
Responsibilities:	Laboratory Analytical Services
Address:	PO Bag 4000, Vegreville, Alberta
Phone:	780-632-8211
Email:	EAS.Results@albertainnovates.ca

1.3 Summary of Electronic Transfer System (ETS) Submittals

The “Alberta Environment and Parks (AEP) 2018 Annual Ambient Air Monitoring Report for Approval Number: 10348-03-00” for the Clean Harbors, Ryley Alberta Facility was submitted to the ETS as IAM-00010348-2018.pdf, by March 31, 2019.

1.4 Monitoring Locations and Methodology

Clean Harbors undertakes ambient air monitoring at three locations to assess ambient air quality at and around the Facility. At these locations include two AEP mandated stations; AEP Station ID 00010348-I-1 and AEP Station ID 00010348-C-1 and one voluntary ambient air monitoring station. The locations of the air monitoring stations are identified on Figure 1.

A full description of the monitoring locations and methodology for the AEP mandated air monitoring program is outlined in Section 1.2.1.

In addition to the two AEP mandated stations, Clean Harbors operates a voluntary air monitoring program for the Village of Ryley. The voluntary air monitoring program utilizes a hi-volume sampler station located at the same location as AEP Station ID 00010348-C-1, and an additional hi-volume sampler/meteorological station that is located at the Ryley School and is described in Section 1.2.2.

1.4.1 Clean Harbors AEP Mandated Air Monitoring Program

The intermittent monitoring station, known as the Ryley Lift Station (AEP Station ID 00010348-I-1), is located on Secondary Road 854, approximately 350 metres southeast of the Facility. At this location, samples are collected and analyzed for the following: particulate matter less than or equal to 10 micrometers (µm) in diameter (PM_{10}), volatile organic compounds (VOCs), and total non-methane organic compounds (TNMOC). Additionally, PM_{10} samples that exceed 50 micrograms per cubic metre (50 µg/m3) are analyzed for a target list of metals, anions, and cations. Sampling is conducted every 12-days as required by the Facility’s Approval.

The second station, located on the roof of the administration building at the Facility (AEP Station ID 00010348-C-1), is a continuous meteorological station that collects wind speed and wind direction data.

PM_{10} Sampling Station (AEP Station ID 00010348-I-1)

PM_{10} is sampled over a 24-hour period at a volumetric flow rate of 16.7 litres per minute. Samples are collected on a Teflon® filter using a federal reference method (FRM) sampler called a Partisol air sampler. Calibration of the Partisol sampler is conducted and documented on a quarterly basis. The filter samples are collected and sent to InnoTech Alberta (Laboratory) under chain of custody procedures. The filters are analyzed gravimetrically utilizing laboratory method AC-029. Should it be determined that the PM_{10} threshold of 50 µg/m^3 is exceeded, the laboratory would proceed with the metal analysis using accepted methodology. The following is a list of the metal parameters that are analyzed when the PM_{10} threshold is exceeded.

Table 1.1 Metal Parameters

Parameter	CAS No.
Particulate Matter (PM_{10})	Not available
Antimony	7440-36-0
Arsenic	7440-38-2
Beryllium	7440-41-4
Cadmium	7440-43-9
Chromium	7440-47-3
Cobalt	7440-48-4
Copper	7440-50-8
Lead	7439-92-1
Manganese	7439-96-5
Mercury	7439-97-6
Nickel	7440-02-0
Silver	7782-49-2
Thallium	7440-28-0
Tin	7440-31-5
Ammonia-N	Not available
Calcium Ion	Not available
Chloride	Not available
Magnesium Ion	Not available
Nitrate	Not available
Potassium Ion	Not available
Sodium Ion	Not available
Sulphate	Not available

Volatile Organic Compound (VOC) and Total Non-Methane Organic Compound (TNMOC) Station (AEP Station ID 00010348-I-1)

For VOC and TNMOC sampling and analysis, 6-litre evacuated SUMMA® canisters are used to collect the sample over a 24-hour period. Flow controllers and pressure gauges supplied by the laboratory are used to maintain a constant sample flowrate over the 24-hour sampling period. The VOC analysis is conducted utilizing laboratory method AC-058 by gas chromatography mass spectrometry. The TNMOC analysis is conducted utilizing laboratory method NA-028 by gas chromatography flame ionization detector. The following is a list of VOCs that are analyzed:

Table 1.2 VOCs

Compound	CAS No.	Compound	CAS No.
1,2,3-Trimethylbenzene	526-73-8	Isoprene	78-79-5
1,2,4-Trimethylbenzene	95-63-6	Isopropylbenzene	98-82-8

Compound	CAS No.	Compound	CAS No.
1,3,5-Trimethylbenzene	108-67-8	m, p-Xylene	108-38-3/ 106-42-3
1-Butene	106-98-9	m-Diethylbenzene	141-93-5
1-Hexene	592-41-6	Methylcyclohexane	108-87-2
1-Pentene	109-67-1	Methylcyclopentane	96-37-7
2,2,4-Trimethylpentane	540-84-1	m-Ethyltoluene	620-14-4
2,2-Dimethylbutane	75-83-2	n-Butane	106-97-8
2,3,4-Trimethylpentane	565-75-3	n-Decane	124-18-5
2,3-Dimethylbutane	79-29-8	n-Dodecane	112-40-3
2,3-Dimethylpentane	565-59-3	n-Heptane	142-82-5
2,4-Dimethylpentane	108-08-7	n-Hexane	110-54-3
2-Methylheptane	592-27-8	n-Nonane	111-84-2
2-Methylhexane	591-76-4	n-Octane	111-65-9
2-Methylpentane	107-83-5	n-Pentane	109-66-0
3-Methylheptane	589-81-1	n-Propylbenzene	103-65-1
3-Methylhexane	589-34-4	n-Undecane	1120-21-4
3-Methylpentane	96-14-0	o-Ethyltoluene	611-14-3
Benzene	71-43-2	o-Xylene	95-47-6
cis-2-Butene	590-18-1	p-Ethyltoluene	622-96-8
cis-2-Pentene	627-20-3	Styrene	100-42-5
Cyclohexane	110-82-7	Toluene	108-88-3
Cyclopentane	287-92-3	trans-2-Butene	624-64-6
Ethylbenzene	100-41-4	trans-2-Pentene	646-04-8
Isobutane	75-28-5	p-Diethylbenzene	105-05-5
Isopentane	78-78-4		

Meteorological Station (AEP Station ID 00010348-C-1)

Clean Harbors operates a RM Young 05305-10A metrological station at the Facility. The meteorological station continuously collects wind speed and wind direction at the site. Reporting for this station is conducted on a monthly and annual basis where 24-hour wind speed and wind direction, wind class frequency distribution and wind roses are presented. As part of the Approval Clean Harbors is also required to ensure that operation of the station is maintained at no less than 90 percent uptime. The uptime data is also presented on a monthly and annual basis.

1.4.2 Clean Harbors Voluntary Air Monitoring Program

Clean Harbors operates two hi-volume sampler stations that collect total particulate matter. One hi-volume sampler station is located on the roof of the administration building at the Facility, near the AEP Station ID 00010348-C-1, and is intended to collect background ambient air data. The second hi-volume sampler station is located at the Ryley School with a meteorological station and is

intended to collect sample data. The samples collected are measured gravimetrically for total particulate and then analyzed for metals by the laboratory. The two air monitoring stations are linked such that the stations only collect air samples when the wind direction is oriented in a north-east to south-west direction and the wind speed is greater than 5 km/hour. The objective of the voluntary program is to determine airborne particulates from landfill operations that could potentially impact the Village of Ryley.

The results of this voluntary air monitoring program are communicated in a letter presented to the Village of Ryley on an annual basis.

2. Results and Discussions

The following section presents the results from the ambient air monitoring program that was conducted by Clean Harbors in 2018. Where applicable, comparisons were made to Alberta Ambient Air Quality Objectives (AAAQO) for parameters that had 24-hour average objectives and annual objectives. These parameters include m,p,o-xylene, hexane, toluene and benzene. For all other parameters, AAAQO have not been established limits or the limits have averaging periods other than 24-hours or annual.

2.1 Meteorological Data for Wind Speed and Direction (AEP Station ID 00010348-C-1) Results and Discussion

In accordance with the Approval, the Facility is required to collect wind data continuously when operations are occurring at the Facility. In 2018, the wind station collected 98 percent of usable data. Appendix A presents the wind data that was collected and also wind rose plots. As illustrated in the wind rose and frequency distribution chart for 2018, the predominant wind direction is from the West, which is consistent with historical information and data.

The 2018 annual wind rose and frequency distribution chart is presented in Appendix A.

2.1.1 Meteorological Data Verification, Validation and Uptime

In the 2018 calendar year, the meteorological station was above 90 percent uptime in 10 of the 12-months. For the months of March and September, the uptime for the station was 85 percent and 89 percent respectively. Annual uptime for the meteorological station for 2018 was 98 percent.

In March of 2018, the meteorological station experienced a power interruption on March 9, causing the station to cease data logging for a period of time. Clean Harbors identified the issue as a faulty power receptacle and subsequently replaced it. This non-compliance event was reported to AEP under Reference No.: 337497.

In September of 2018, the meteorological station experienced a power loss at 2:38 AM on Friday, September 14, 2018, which resulted in a continuous data loss until Monday, September 17, 2018 at 8:30 AM, when power to the meteorological station was reset by Clean Harbors' staff. The power supply circuit for the meteorological station was subsequently inspected by a qualified electrician and reported to be in perfect working order. Clean Harbors continued to monitor the meteorological

station and had no further issues. This non-compliance event was reported to AEP under Reference No.: 345312.

2.2 PM_{10} Monitoring Station (AEP Station ID 00010348-I-1) Results and Discussion

In 2018, 30 samples were collected for PM_{10} analysis at 12-day intervals. Two samples were discarded and are described in Section 2.2.1.

The PM_{10} concentrations in 2018 ranged between 0.456 $\mu g/m^3$ to 25.145 $\mu g/m^3$, with an average concentration of 13.44 $\mu g/m^3$. It is noted that AAAQO are specified for Total Suspended Particulates (TSP) at 100 $\mu g/m^3$ (24-hour averaging period) and $PM_{2.5}$ at 80 $\mu g/m^3$ (1-hour average period). There is currently no AAAQO is specified for PM_{10} over a 24-hour or 1-hour averaging period, however, the Facility is required to analyze for metals should the PM_{10} concentration exceed 50 $\mu g/m^3$. Metals are discussed in Section 2.3. The 2018 test results from the PM_{10} monitoring are presented in Table 1 and include maximum, minimum, and average values for the reporting period. The previous 5-year averages for PM_{10} concentrations can be found in Appendix C.

The Partisol sampling instrument was calibrated on a quarterly basis in 2018. The quarterly calibration records are included in Appendix B.

2.2.1 PM_{10} Sampling Issues

On June 25, 2018 (Test 679) the Partisol air sampler experienced a sample flow issue where the sample flow deviated >10 percent from the flow set point for more than 60-seconds. The flow deviation caused the total sample time to be less than 23-hours. Clean Harbors discarded this test. After Clean Harbors investigated this issue on June 26, 2018, it was suspected that moisture in the sampling system may have caused the flow deviation. The PM_{10} sampler was cleaned, dried and performance was checked during the audit. This non-compliance event was reported to AEP under Reference No.: 340114.

On September 5, 2018 (Test 685) the Partisol air sampler experienced a sample time issue, where the elapsed sample duration was less than 23-hours. The cause of this event was human error when setting up the sampler. This resulted in the total sample time for test 685 to be 16.37-hours, therefore; Clean Harbors discarded the test. This non-compliance event was reported to AEP under Reference No.: 343639.

2.3 Metal Concentrations

As the concentrations of PM_{10} for all samples collected in 2018 were below 50 $\mu g/m^3$, analysis for metal ions was not conducted on any PM_{10} samples during the reporting period.

2.4 VOC and TNMOC Station (AEP Station ID 00010348-I-1) Results and Discussion

In 2018, 30 samples were collected for VOC and TNMOC analysis at 12-day intervals.

There are three VOC parameters that that have corresponding AAAQO with 24-hour averaging periods including o,p,m-xylene, hexane and toluene. There is one VOC parameter (benzene) that has a corresponding annual AAAQO. The annual AAAQO for benzene is 0.9 ppbv. The annual result for benzene samples at the lift station was 0.3 ppbv.

The 2018 sample results from the VOC and TNMOC monitoring are presented in Table 2 and include maximum, minimum, and average values. The previous 5-year averages for VOC and TNMOC parameters can be found in Appendix C.

2.5 Dust Suppression Activities

In 2018, Clean Harbors did not conduct dust suppression activities at the Facility using leachate spread on the surface of the active landfill.

3. Certification

Per the requirements of AMD, Chapter 9, the following certification is provided for the 2018 Annual Ambient Air Monitoring Report.

"I certify that I have reviewed and verified this report and that the information is complete, accurate and representative of the monitoring results, reporting timeframe and the specified analysis, summarization and reporting requirements."

Stan Yuha

Plant Manager/Report Certifier

Figure

Source: ESRI Basemap Imagery, June 2010

0 120 240 360

Meters

Coordinate System:
NAD 1983 UTM Zone 12N

N

GHD

CLEAN HARBORS CANADA, INC.
RANGE ROAD 854, RYLEY, ALBERTA

11114644
Mar 21, 2019

SITE LOCATION AND
AIR MONITORING LOCATION MAP FIGURE 1

GIS File: Q:\GIS\PROJECTS\11114000s\11114644\Layouts\001\11114644-00(001)GIS-OT001.mxd

Tables

Table 1

2018 Calendar Year
Particulate Matter PM_{10} Results
AEP Station ID 00010348-I-1
Clean Harbors Canada, Inc.

	Parameter	PM_{10}	Particulate Weight
	Units	µg/m³ (1)(2)	mg
Date	**Test ID**		
18/01/08	**665**	17.39	0.42
18/01/20	**666**	18.96	0.46
18/02/01	**667**	7.39	0.18
18/02/13	**668**	3.82	0.09
18/02/25	**669**	4.44	0.11
18/03/09	**670**	12.49	0.30
18/03/21	**671**	23.53	0.57
18/04/02	**672**	13.94	0.34
18/04/14	**673**	7.64	0.18
18/04/26	**674**	24.73	0.60
18/05/08	**675**	23.07	0.56
18/05/20	**676**	21.66	0.52
18/06/01	**677**	4.19	0.10
18/06/13	**678**	14.77	0.36
18/06/25	**679**	Sample Discarded	Sample Discarded
18/07/07	**680**	16.52	0.40
18/07/19	**681**	15.64	0.38
18/07/31	**682**	20.75	0.50
18/08/12	**683**	10.42	0.25
18/08/24	**684**	11.87	0.29
18/09/05	**685**	Sample Discarded	Sample Discarded
18/09/17	**686**	4.98	0.18
18/09/29	**687**	8.92	0.22
18/10/11	**688**	11.29	0.27
18/10/23	**689**	25.15	0.61
18/11/04	**690**	6.72	0.16
18/11/16	**691**	0.46	0.01
18/11/28	**692**	12.28	0.30
18/12/10	**693**	10.54	0.25
18/12/22	**694**	5.19	0.13
	Maximum	**25.15**	**0.61**
	Minimum	**0.46**	**0.01**
	Average	**12.81**	**0.31**

Note:

(1) Alberta Ambient Air Quality Objectives do not currently provide an objective fo PM_{10}.

(2) In accordance with the Facility's Approval, PM_{10} samples that exceed 50 µg/m^3 are analyzed for a target list of metals, anions, and cations.

Table 2
2018 Calendar Year
VOC and TNMOC Analytical Results
AEP Station ID 00010348-I-1
Clean Harbors Canada, Inc.

Parameter	Units	AAAQO[1][2]	Date	18/01/08	18/01/20	18/02/01	18/02/13	18/02/25	18/03/09	18/03/21	18/04/02	18/04/14	18/04/26	18/05/08	18/05/20	18/06/01	18/06/13	18/06/25	18/07/07	18/07/19	18/07/31	18/08/12	18/08/24	18/09/05	18/09/17	18/09/29	18/10/11	18/10/23	18/11/04	18/11/16	18/11/28	18/12/10	18/12/22	Maximum	Minimum [3]	Average [4]
			Test ID	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694			
1,2,3-Trimethylbenzene	**ppbv**	-		0.08	< 0.06	< 0.06	< 0.17	< 0.08	< 0.08	< 0.08	< 0.07	< 0.10	< 0.06	< 0.07	< 0.07	< 0.08	< 0.07	< 0.07	0.16	< 0.05	< 0.08	0.54	< 0.05	< 0.07	0.10	< 0.08	< 0.08	< 0.08	< 0.08	< 0.07	0.11	0.58	0.14	0.58	0.08	0.24
1,2,4-Trimethylbenzene	**ppbv**	-		0.08	0.07	< 0.06	0.24	< 0.08	0.17	0.14	< 0.07	< 0.10	0.17	< 0.07	< 0.07	< 0.08	< 0.07	< 0.07	0.25	< 0.05	< 0.08	1.34	< 0.05	< 0.07	0.18	< 0.08	< 0.08	< 0.08	< 0.08	< 0.07	0.28	3.00	0.45	3.00	0.07	0.53
1,3,5-Trimethylbenzene	**ppbv**	-		0.06	0.08	0.04	0.07	< 0.03	0.09	0.08	< 0.03	< 0.04	0.05	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.10	< 0.02	< 0.03	0.66	< 0.02	< 0.03	< 0.03	0.41	< 0.03	< 0.03	< 0.03	< 0.03	0.04	0.97	0.20	0.97	0.04	0.22
1-Butene	**ppbv**	-		0.59	0.59	< 0.02	3.14	1	1.01	0.57	0.07	0.22	0.10	0.16	0.11	0.22	< 0.03	< 0.03	0.08	0.61	0.43	0.90	0.12	0.17	0.21	0.12	< 0.03	0.28	0.29	0.24	0.31	0.48	0.40	3.14	0.07	0.48
1-Hexene	**ppbv**	-		0.06	0.03	< 0.02	< 0.07	< 0.03	< 0.03	< 0.03	< 0.03	0.09	< 0.02	< 0.03	< 0.03	< 0.03	0.23	< 0.03	< 0.03	< 0.02	< 0.03	< 0.03	< 0.02	< 0.03	0.46	0.24	< 0.03	0.13	0.22	< 0.03	0.20	0.21	0.23	0.46	0.03	0.19
1-Pentene	**ppbv**	-		0.09	0.04	< 0.01	0.12	0.02	< 0.02	< 0.02	< 0.01	0.03	0.03	< 0.01	0.07	0.09	0.11	< 0.01	< 0.01	0.17	0.16	0.53	< 0.01	0.03	0.31	0.23	0.05	0.08	0.06	< 0.01	0.24	0.18	0.22	0.53	0.02	0.14
2,2,4-Trimethylpentane	**ppbv**	-		< 0.01	0.07	< 0.01	0.09	< 0.02	< 0.02	< 0.02	< 0.01	0.04	0.03	0.07	< 0.01	0.33	0.31	0.24	< 0.01	0.18	0.24	0.78	0.17	0.11	0.09	0.05	0.17	0.15	0.12	0.16	0.22	0.47	0.19	0.78	0.03	0.19
2,2-Dimethylbutane	**ppbv**	-		0.09	0.04	< 0.01	0.06	< 0.02	< 0.02	< 0.02	< 0.01	0.04	0.02	< 0.01	0.15	< 0.02	0.04	0.22	0.08	0.07	0.04	0.47	< 0.01	< 0.01	0.26	0.13	0.09	0.11	0.12	0.03	0.06	0.24	0.12	0.47	0.02	0.12
2,3,4-Trimethylpentane	**ppbv**	-		0.07	0.02	0.06	0.05	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	0.03	< 0.01	< 0.01	< 0.02	0.06	< 0.01	0.11	0.16	0.11	0.48	0.17	0.03	0.06	0.16	< 0.02	0.12	< 0.02	0.07	0.07	0.10	0.14	0.48	0.02	0.11
2,3-Dimethylbutane	**ppbv**	-		0.09	0.06	< 0.02	< 0.07	< 0.03	< 0.03	< 0.03	< 0.03	< 0.04	< 0.02	< 0.03	0.03	0.06	< 0.03	0.25	< 0.03	< 0.02	0.22	0.45	< 0.02	< 0.03	0.16	0.06	< 0.03	0.11	0.04	0.08	0.10	0.30	0.12	0.45	0.03	0.14
2,3-Dimethylpentane	**ppbv**	-		0.12	0.03	0.1	< 0.07	< 0.03	< 0.03	< 0.03	< 0.03	< 0.04	< 0.02	< 0.03	0.06	0.15	0.15	0.31	0.11	0.06	0.11	0.53	0.14	0.04	0.29	< 0.03	0.09	0.03	0.04	0.08	0.07	0.58	0.12	0.58	0.03	0.15
2,4-Dimethylpentane	**ppbv**	-		0.09	0.03	< 0.01	< 0.03	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.01	< 0.01	< 0.01	0.12	0.08	< 0.01	0.08	< 0.01	< 0.02	0.38	< 0.01	< 0.01	0.16	0.15	0.04	0.04	0.03	0.03	0.02	0.30	0.13	0.38	0.02	0.11
2-Methylheptane	**ppbv**	-		0.08	0.02	0.08	< 0.03	0.02	< 0.02	< 0.02	< 0.01	< 0.02	0.08	0.07	< 0.01	0.13	0.14	0.22	0.35	< 0.01	0.24	0.37	< 0.01	0.07	0.45	0.06	0.16	0.17	0.10	0.13	0.13	1.29	0.24	1.29	0.02	0.21
2-Methylhexane	**ppbv**	-		0.14	0.05	0.14	0.13	< 0.02	0.06	0.04	< 0.01	0.07	0.04	< 0.01	0.08	0.19	0.12	0.11	0.13	0.14	0.14	0.78	< 0.01	0.18	0.68	0.18	0.10	0.08	0.06	0.09	0.13	1.75	0.21	1.75	0.04	0.22
2-Methylpentane	**ppbv**	-		0.32	0.12	< 0.01	0.33	0.18	0.43	< 0.02	0.08	0.27	0.19	< 0.01	0.11	< 0.02	0.19	0.30	< 0.01	0.22	0.13	0.95	0.17	0.08	0.98	0.11	0.15	0.19	0.23	0.07	0.27	3.08	0.30	3.08	0.07	0.38
3-Methylheptane	**ppbv**	-		0.07	0.03	0.06	< 0.07	< 0.03	< 0.03	< 0.03	< 0.03	< 0.04	0.05	< 0.03	< 0.03	< 0.03	0.16	< 0.03	0.22	0.19	0.29	0.53	< 0.02	0.08	0.29	0.28	0.08	0.11	0.08	0.10	0.12	0.70	0.13	0.70	0.03	0.19
3-Methylhexane	**ppbv**	-		0.13	0.04	0.16	0.24	0.05	0.03	< 0.03	< 0.03	0.06	0.07	< 0.03	0.08	0.20	0.14	0.28	0.26	0.23	0.12	< 0.03	< 0.02	0.14	0.63	0.12	< 0.03	0.11	0.11	0.14	0.16	1.63	0.17	1.63	0.03	0.22
3-Methylpentane	**ppbv**	-		0.21	0.1	< 0.01	0.28	0.09	0.21	0.06	0.03	0.21	0.14	0.12	0.12	0.54	0.40	< 0.01	0.26	0.20	0.36	0.86	0.17	0.32	0.73	0.13	0.23	0.17	0.20	0.08	0.22	2.01	0.26	2.01	0.03	0.31
Benzene	**ppbv**	**0.9**		0.32	0.26	0.23	0.32	0.18	0.16	0.11	0.10	0.18	0.15	0.12	0.19	0.46	0.21	0.30	0.08	0.28	0.44	1.04	0.16	0.28	0.51	0.27	0.30	0.32	0.33	0.12	0.27	1.63	0.45	1.63	0.08	0.33
cis-2-Butene	**ppbv**	-		0.13	0.08	< 0.02	0.41	0.07	0.22	< 0.03	< 0.03	< 0.04	< 0.02	0.04	< 0.03	< 0.03	0.04	< 0.03	< 0.03	< 0.02	< 0.03	< 0.03	< 0.02	< 0.03	0.09	0.59	< 0.03	0.12	0.11	0.06	0.09	0.06	0.12	0.59	0.04	0.15
cis-2-Pentene	**ppbv**	-		0.07	< 0.03	< 0.02	< 0.07	< 0.03	< 0.03	< 0.03	< 0.03	< 0.04	< 0.02	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.02	< 0.03	< 0.03	< 0.02	< 0.03	0.30	0.07	< 0.03	< 0.03	0.03	< 0.03	0.28	1.84	0.17	1.84	0.03	0.39
Cyclohexane	**ppbv**	-		0.14	0.08	0.14	0.07	0.16	< 0.03	< 0.03	< 0.03	0.05	0.05	< 0.03	0.11	0.19	0.10	< 0.03	0.21	0.22	0.28	0.75	< 0.02	< 0.03	0.79	< 0.03	< 0.03	0.23	0.19	0.13	0.21	5.76	0.46	5.76	0.05	0.49
Cyclopentane	**ppbv**	-		0.12	0.04	< 0.01	0.04	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	0.02	< 0.01	0.03	0.06	0.09	0.23	0.14	0.10	0.08	0.57	0.15	0.02	0.35	0.27	0.03	0.05	0.08	0.07	0.24	0.45	0.15	0.57	0.02	0.15
Ethylbenzene	**ppbv**	-		0.18	0.1	0.13	< 0.03	0.04	< 0.02	< 0.02	< 0.01	< 0.02	0.15	0.02	0.03	0.12	< 0.01	0.49	0.33	< 0.01	0.34	1.20	< 0.01	0.04	0.82	0.06	0.12	0.23	< 0.02	0.14	0.44	4.32	0.73	4.32	0.02	0.48
Isobutane	**ppbv**	-		2.71	0.8	< 0.02	1.64	1.06	1.36	1.13	0.62	0.69	0.35	0.87	0.39	0.69	0.67	0.50	0.34	1.49	0.62	0.69	0.13	2.53	0.56	0.40	0.46	0.55	0.76	0.51	1.62	2.04	1.09	2.71	0.13	0.94
Isopentane	**ppbv**	-		1.1	0.33	< 0.04	1.33	0.91	1.57	0.8	0.20	0.52	0.29	0.10	0.38	0.51	0.32	0.41	0.47	1.68	0.34	1.22	0.26	0.65	0.91	0.34	0.31	0.42	0.63	0.37	1.37	3.25	0.85	3.25	0.10	0.75
Isoprene	**ppbv**	-		0.16	0.03	< 0.01	< 0.03	0.03	< 0.02	< 0.02	< 0.01	< 0.02	< 0.01	< 0.01	0.06	< 0.02	0.19	0.36	< 0.01	0.43	0.74	0.78	0.28	0.07	0.29	0.37	0.06	0.16	0.16	0.03	0.03	0.14	0.13	0.78	0.03	0.23
Isopropylbenzene	**ppbv**	-		0.09	0.02	0.05	< 0.03	0.03	< 0.02	< 0.02	< 0.01	< 0.02	< 0.01	< 0.01	< 0.01	< 0.02	< 0.01	< 0.01	0.09	< 0.01	< 0.02	< 0.02	< 0.01	0.02	< 0.01	0.40	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	0.32	< 0.01	0.40	0.02	0.13
m,p-Xylene	**ppbv**	**161**		0.48	0.21	0.28	0.63	0.72	0.44	0.41	0.34	0.40	0.67	< 0.04	< 0.04	0.24	0.16	0.27	1.07	0.34	< 0.05	4.14	< 0.03	0.12	3.64	< 0.02	0.09	0.26	< 0.05	0.22	1.40	8.50	2.02	8.50	0.09	1.13
m-Diethylbenzene	**ppbv**	-		< 0.05	< 0.05	< 0.05	< 0.14	< 0.06	0.07	< 0.06	< 0.06	< 0.08	0.18	< 0.06	0.10	< 0.06	< 0.06	< 0.06	0.14	< 0.04	< 0.06	0.59	< 0.04	0.08	< 0.06	1.05	< 0.06	< 0.06	< 0.06	< 0.06	< 0.07	0.31	0.13	1.05	0.07	0.29
Methylcyclohexane	**ppbv**	-		< 0.10	< 0.10	< 0.10	< 0.27	< 0.12	< 0.12	< 0.12	< 0.12	< 0.16	< 0.10	< 0.12	< 0.12	< 0.12	< 0.11	< 0.12	0.15	< 0.08	< 0.13	0.82	< 0.08	< 0.11	0.17	< 0.06	< 0.12	< 0.12	< 0.12	< 0.11	0.25	1.82	0.28	1.82	0.15	0.58
Methylcyclopentane	**ppbv**	-		0.15	0.04	0.15	0.38	0.13	0.19	0.09	0.05	0.18	0.14	< 0.01	0.09	0.19	0.08	0.32	0.46	0.18	0.05	1.34	0.15	0.07	1.46	0.34	0.03	0.03	0.06	0.13	0.15	5.36	0.35	5.36	0.03	0.43
m-Ethyltoluene	**ppbv**	-		0.21	0.1	< 0.02	0.31	0.13	0.18	0.07	0.04	0.17	0.08	0.09	0.07	0.59	0.47	0.31	0.31	0.20	0.50	0.82	0.17	0.32	0.84	0.26	0.25	0.15	0.18	0.08	0.21	2.58	0.28	2.58	0.04	0.34
n-Butane	**ppbv**	-		3.15	1.15	< 0.04	5.7	2.19	2.91	1.92	0.73	1.35	0.75	0.22	0.49	1.04	0.43	0.38	0.58	1.25	0.48	0.70	0.20	2.39	0.96	0.28	1.12	0.86	1.15	0.59	2.85	2.06	1.56	5.70	0.20	1.36
n-Decane	**ppbv**	-		< 0.07	0.18	< 0.07	< 0.20	0.13	< 0.09	< 0.09	< 0.09	< 0.12	0.18	< 0.09	< 0.09	0.37	0.81	0.12	0.30	0.19	< 0.10	0.63	0.12	0.33	0.25	0.47	0.42	< 0.09	< 0.09	< 0.09	0.17	1.03	0.35	1.03	0.12	0.36
n-Dodecane	**ppbv**	-		< 0.5	< 0.5	< 0.5	< 1.4	< 0.6	< 0.6	< 0.6	< 0.6	< 0.8	< 0.5	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.4	< 0.6	0.90	< 0.4	< 0.6	< 0.6	< 0.09	< 0.6	< 0.6	< 0.6	< 0.6	< 0.7	< 0.6	< 0.6	0.90	0.90	0.90
n-Heptane	**ppbv**	-		0.21	0.06	0.2	0.31	0.19	0.28	0.08	0.19	0.19	0.17	< 0.01	0.04	< 0.02	0.10	0.35	0.53	0.12	< 0.02	1.83	< 0.01	0.06	1.64	< 0.6	< 0.02	0.18	0.21	0.19	0.23	4.24	0.39	4.24	0.04	0.50
n-Hexane	**ppbv**	**1990**		0.47	0.37	0.39	0.51	0.32	0.46	0.26	0.14	0.48	0.17	0.27	0.23	2.40	1.14	0.65	0.63	0.71	1.36	1.24	0.20	1.67	2.11	0.26	0.85	0.42	0.39	0.30	0.40	5.63	0.67	5.63	0.14	0.84
n-Nonane	**ppbv**	-		0.09	0.03	0.07	0.17	0.14	< 0.02	< 0.02	< 0.01	< 0.02	< 0.01	< 0.01	< 0.01	< 0.02	0.11	< 0.01	0.42	0.28	0.21	0.78	< 0.01	0.07	0.28	0.55	< 0.02	0.12	0.15	0.14	0.13	0.18	2.07	0.26	2.07	0.04	0.34
n-Octane	**ppbv**	-		0.09	0.14	0.11	0.24	0.17	< 0.03	0.04	< 0.03	< 0.04	0.16	< 0.03	0.14	0.18	0.58	0.39	0.54	0.25	0.31	1.07	0.18	0.38	0.61	0.10	0.12	0.15	0.14	0.13	0.18	2.07	0.26	2.07	0.04	0.34
n-Pentane	**ppbv**	-		0.9	0.2	< 0.1	1.2	0.5	1.4	0.6	0.20	0.40	0.20	< 0.1	0.50	0.30	0.20	0.40	0.50	0.90	0.30	1.40	0.20	0.40	0.90	0.17	0.30	0.40	0.60	0.30	1.10	3.90	0.70	3.90	0.17	0.68
n-Propylbenzene	**ppbv**	-		0.08	< 0.06	< 0.06	< 0.17	< 0.08	< 0.08	< 0.08	< 0.07	< 0.10	< 0.06	< 0.07	< 0.07	< 0.08	< 0.07	0.16	0.13	< 0.05	< 0.08	0.52	< 0.05	< 0.07	< 0.07	0.30	< 0.08	< 0.08	< 0.08	< 0.07	< 0.09	0.84	0.19	0.84	0.08	0.32
n-Undecane	**ppbv**	-		< 0.6	< 0.6	< 0.6	< 1.7	< 0.8	< 0.8	< 0.8	< 0.7	< 1.0	< 0.6	< 0.7	< 0.7	< 0.8	< 0.7	< 0.7	< 0.7	< 0.5	< 0.8	< 0.9	< 0.5	< 0.7	< 0.7	0.12	< 0.8	< 0.8	< 0.8	< 0.7	< 0.9	< 0.7	< 0.7	0.12	0.12	0.12
o-Ethyltoluene	**ppbv**	-		0.06	0.01	0.04	< 0.03	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	0.02	< 0.01	< 0.01	< 0.02	< 0.01	< 0.01	0.17	< 0.01	< 0.02	0.42	< 0.01	0.04	0.07	< 0.8	< 0.02	< 0.02	< 0.02	< 0.01	0.13	0.79	0.17	0.79	0.01	0.17
o-Xylene	**ppbv**	**161**		0.2	0.11	0.14	< 0.03	0.12	< 0.02	< 0.02	< 0.01	0.02	0.12	< 0.01	< 0.01	< 0.02	< 0.01	< 0.01	0.32	0.10	< 0.02	1.59	< 0.01	0.06	0.95	0.09	0.08	0.05	< 0.02	0.02	0.58	2.57	0.71	2.57	0.02	0.44
p-Ethyltoluene	**ppbv**	-		0.07	< 0.05	< 0.05	< 0.14	< 0.06	< 0.06	< 0.06	< 0.06	< 0.08	0.05	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.04	< 0.06	0.89	< 0.04	< 0.06	0.10	0.49	< 0.06	< 0.06	< 0.06	< 0.06	0.18	0.41	0.13	0.89	0.05	0.29
Styrene	**ppbv**	-		< 0.09	< 0.09	< 0.08	< 0.24	< 0.11	< 0.11	< 0.10	< 0.10	< 0.14	< 0.09	< 0.10	< 0.10	< 0.11	< 0.10	< 0.10	< 0.10	< 0.07	< 0.11	< 0.12	< 0.07	< 0.10	< 0.10	< 0.06	< 0.11	< 0.11	< 0.11	< 0.10	0.14	0.53	0.12	0.53	0.12	0.26
Toluene	**ppbv**	**106**		0.34	< 0.05	< 0.05	< 0.14	0.17	< 0.06	< 0.06	< 0.06	< 0.08	< 0.05	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.04	< 0.06	0.87	< 0.04	0.16	< 0.06	< 0.11	< 0.06	< 0.06	< 0.06	< 0.06	< 0.07	1.43	< 0.06	1.43	0.16	0.59
trans-2-Butene	**ppbv**	-		3.33	0.24	0.89	1.23	0.8	0.68	1.04	0.43	0.42	0.81	< 0.01	0.09	0.67	0.36	0.47	0.87	0.50	0.39	7.51	0.14	0.33	6.67	0.33	0.26	0.35	0.24	0.16	3.56	20.50	2.14	20.50	0.09	1.91
trans-2-Pentene	**ppbv**	-		0.15	0.09	< 0.01	0.46	0.09	0.23	< 0.02	< 0.01	< 0.02	< 0.01	0.06	< 0.01	< 0.02	0.12	< 0.01	< 0.01	< 0.01	< 0.02	< 0.02	< 0.01	< 0.01	0.34	1.29	< 0.02	0.05	0.02	0.05	0.07	0.04	0.04	1.29	0.02	0.21
p-Diethylbenzene	**ppbv**	-		0.08	0.03	< 0.02	< 0.07	< 0.03	< 0.03	< 0.03	< 0.03	< 0.04	< 0.02	< 0.03	< 0.03	< 0.03	0.09	< 0.03	< 0.03	0.09	0.05	0.30	0.07	< 0.03	0.20	< 0.02	0.07	0.11	0.12	< 0.03	0.08	0.12	< 0.03	0.30	0.03	0.11
Total Non-Methane Organic Carbon	**ppmv**	-		<0.06	< 0.06	< 0.06	< 0.17	< 0.08	< 0.08	< 0.08	< 0.07	< 0.10	< 0.06	< 0.06	< 0.07	< 0.08	< 0.07	< 0.07	< 0.06	< 0.08	< 0.08	< 0.07	< 0.07	< 0.07	< 0.07	0.13	< 0.08	< 0.08	< 0.08	< 0.07	< 0.09	<0.07	<0.07	0.13	0.13	0.13
Total VOCs	**ppbv**	-		17.37	6.12	3.46	19.70	9.64	12.15	7.44	3.22	6.08	5.86	2.21	3.75	9.85	8.40	8.04	10.97	11.54	9.08	45.16	3.35	11.34	31.85	11.20	6.03	7.35	7.18	5.02	19.23	103.65	18.67	103.65	2.21	14.16

Notes:

(1) Alberta Ambient Air Quality Objectives (Over a 24 hour averaging period for o,m,p-Xylene, n-Hexane, Toluene)
(2) Alberta Ambient Air Quality Objectives (Over an Annual period for Benzene)
(3) Minimum values are the lowest values above the lab detection limit
(4) Averages are taken with the assumption that values under the lab detection limit are zero, as required by the AMD

Table 3

2018 Calendar Year
Meteorlogical Station Uptime Summary
AEP Station ID 00010348-C-1
Clean Harbors Canada, Inc.

Reporting Month	Hours Expected	Hours Reported	% Uptime
January	744	744	100%
February	672	672	100%
March	744	631	85%
April	720	720	100%
May	744	744	100%
June	720	720	100%
July	744	744	100%
August	744	741	100%
September	720	641	89%
October	744	744	100%
November	720	720	100%
December	744	744	100%
Total	8760	8565	98%

Note:

The meteorlogical station monitors wind speed and direction.

Appendices

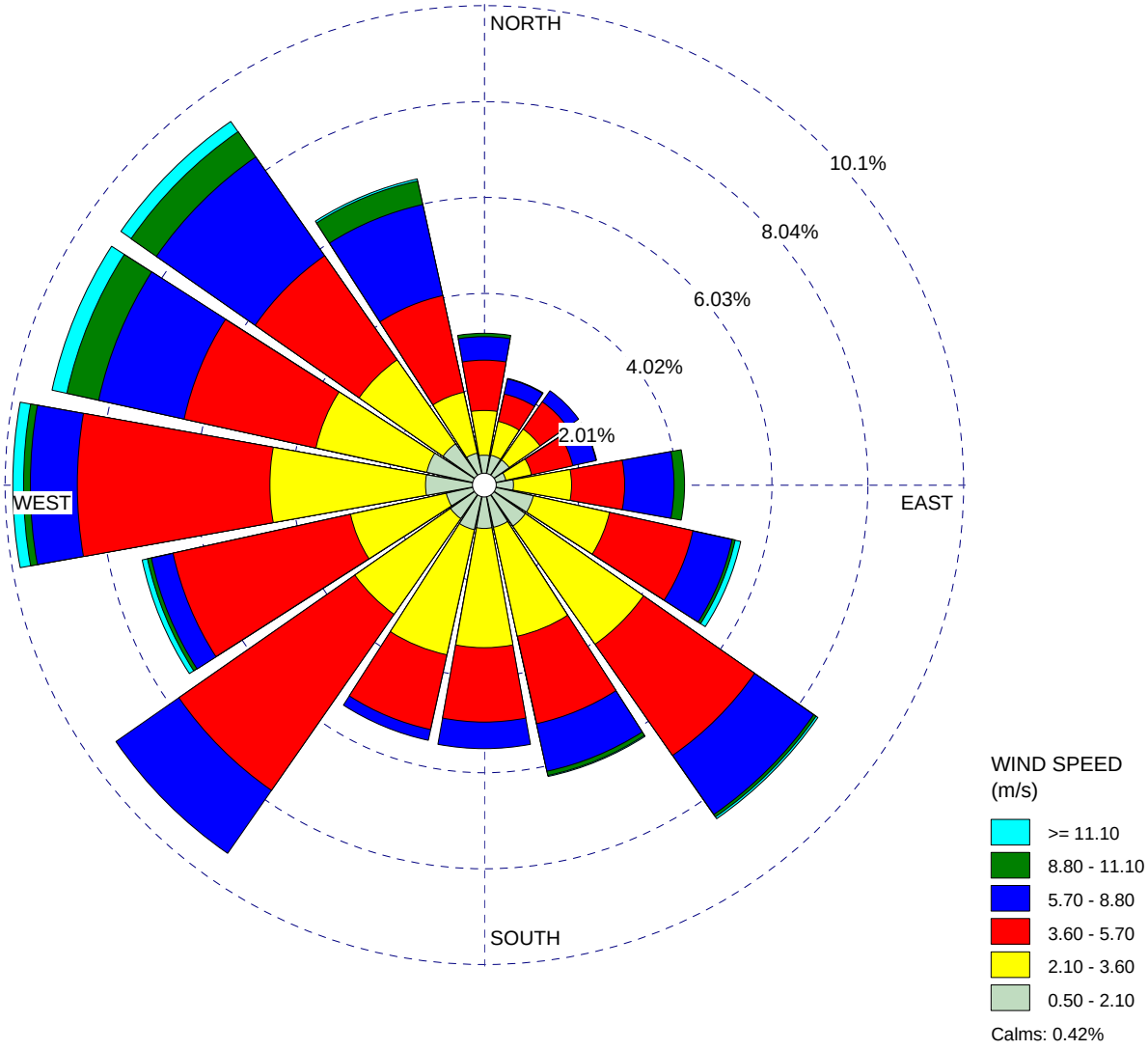
Appendix A
Annual Wind Rose

WIND ROSE PLOT:

Wind Rose - 2018, Annual
Clean Harbors, Ryley, Alberta

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS: Source: Clean Harbors (Ryley) on-site meteorological station.	DATA PERIOD: **Start Date: 1/1/2018 - 00:00** **End Date: 12/31/2018 - 23:00**	COMPANY NAME: **Clean Harbors**	
		MODELER: **GHD**	
	CALM WINDS: **0.42%**	TOTAL COUNT: **8565 hrs.**	
	AVG. WIND SPEED: **4.15 m/s**	DATE: **3/7/2019**	PROJECT NO.: **11114644-007-03**

Frequency Distribution Report: Ryley, Alberta - 2018 Summary									
Direction	Angle	Wind Speed (m/s) and Number of Occurences						%	Total Occurrences by Direction
		0.5 - 2.1	2.1 - 3.6	3.6 - 5.7	5.7 - 8.8	8.8 - 11.1	>= 11.1		
North	> 337.5 - 22.5	110	166	186	106	18	0	6.7%	586
Northeast	> 22.5 - 67.5	110	120	137	55	1	0	4.8%	423
East	> 67.5 - 112.5	117	212	210	156	21	3	8.2%	719
Southeast	> 112.5 - 157.5	176	419	411	217	13	13	14.3%	1249
South	> 157.5 - 202.5	162	460	261	89	4	0	11.1%	976
Southwest	> 202.5 - 247.5	144	389	639	195	1	0	15.6%	1368
West	> 247.5 - 292.5	203	505	665	168	50	46	18.7%	1637
Northwest	> 292.5 - 337.5	182	349	455	429	116	39	17.9%	1570
Calms								0.4%	37
Missing/Invalid Hours								2.2%	195
Total Occurences by Speed		1204	2620	2964	1415	224	101		**8760**
Occurences by %		13.7%	29.9%	33.8%	16.2%	2.6%	1.2%	**100.00%**	

Appendix B
Quarterly Calibration Records for Partisol

Quarterly Audit Partisol FRM Model 2000

Clean Harbors
50114 Range Rd. 173
Ryley, Alberta T0B 4A0

Quarterly Audit Date: March 14, 2018

GHD | 9452 51st Avenue NW Edmonton Alberta T6E 5A6 Canada

11114644 | Report No 17 | April 30, 2018

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Table Index

Appendix Index

1. Introduction

GHD Limited (GHD) was retained by Clean Harbors to conduct a Quarterly Audit at 50114 Range Road 173 Ryley, Alberta (Facility) on March 14, 2018. The Quarterly Audit was conducted on the Partisol FRM 2000 PM_{10} Sampler (Partisol Sampler), located on the roof of the Ryley Lift Station, located southeast of the Facility. The coordinates of the lift station are 53.297961, -112.416076.

2. Audit Procedure

The Partisol Sampler was audited in accordance with the instrument manual and the Alberta Air Monitoring Directive 2015 (AMD). Siting Location, Ambient Pressure, Ambient Temperature, Filter Temperature, Leakage Rate and Flow Rate were audited, as well as overall instrument condition to ensure compliance with the instrument manual and the AMD. Below is a summary of the tasks performed on the Partisol Sampler:

- Siting Location Audit
- Ambient Pressure Audit
- Ambient Temperature Audit
- Filter Temperature Audit
- Leakage Rate Audit
- Flow Rate Audit
- Instrument Condition and Recommendations

GHD verified all of these parameters using calibrated reference instruments. GHD reference instruments either have National Institute of Standards and Technology (NIST) Traceable Certifications, current manufacturer certification, or were verified by a primary standard. The GHD quarterly audit field form can be found in Appendix A. All calibrations and certifications can be found in Appendix B.

3. Audit Results

3.1 Siting Location Audit Results

The siting location of the Partisol Sampler meets the requirements of Chapter 3, Page 8, Table 5 of the AMD. Table 3.1 of this report compares the AMD Siting Requirements for Intermittent Samplers versus the Current Partisol Sampler location.

- The current coordinates of the Partisol Sampler are 53.297961, -112.416076.
- The distance from the nearest roadway is 21 m.

Table 3.1 AMD Requirements vs. Current Partisol Sampler Location

Site Characteristics	AMD Requirements	Current Location	Specification
Sampler Inlet-height above ground (abg)	Minimum 2 m, Maximum 15 m	Meets Requirement	4.63 m abg
Other Requirements	a. Distance from an obstacle greater than 2.5 times the height of the obstacle above the sampler	Meets Requirement	>2.5 times
	b. At least 2 m from any other samplers or inlets with flow rates greater than 200 litres (L) per minute,	Meets Requirement	None
	Or at least 1 m apart from any other samplers or inlets with flow rates less than or equal of 200 L per minute	Meets Requirement	None
	c. Unrestricted air flow in three to four wind quadrants	Meets Requirement	4/4 Unrestricted Quadrants

3.2 Pressure and Temperature Audit Results

The pressure and temperature audit results of the Partisol Sampler meet the requirements of Chapter 4, Page 20, Inset ME 3-33 of the AMD. Table 3.2 of this report compares the Reference results versus the Partisol Sampler readings.

Table 3.2 Reference Results vs. Partisol Sampler Readings

Parameter	Partisol	Reference	Difference	Limit	Pass/Fail
Ambient Temperature (°C)	-10.4	-10.5	0.1	±2%	Pass
Barometric Pressure (mmHg)	697	696	1.0	±10 mmHg	Pass
Filter Temperature (°C)	-6.5	-6.8	0.3	±2%	Pass
Flow	16.7 L/min	16.4 L/min	0.3 L/min	±1 L/min	Pass

3.3 Leak Check Result

The Partisol firmware performs leak checks in automatic mode and indicates either a "pass" or "fail" based on a pressure drop off -4 mmHg per minute. The Partisol Sampler passed the requirements of Chapter 4, Page 20, Inset ME 3-33 of the AMD.

3.4 Flow Audit

The flow audit results of the Partisol Sampler meet the requirements of Chapter 4, Page 20, Inset ME 3-33 of the AMD, refer to Table 3.2.

3.5 Instrument Condition and Recommendations

The Partisol Sampler was visually and functionally inspected on the audit day. Audit recommendations are listed below:

- Liquid crystal display screen is functioning.
- Filter exchange cabinet has been cleaned.
- Ventilation fan filters are clean.
- Filter exchange mechanism is operating normally.
- Filter v-seals are in good condition.
- Ambient temperature and pressure sensor wires in good condition.
- Main power connection wire in good condition.

3.5.1 Recommendations

GHD recommends opening and cleaning PM_{10} sampling inlet prior to next sampling event.

Appendices

Appendix A Quarterly Audit Form

GHD Quarterly Audit Form

Date	3/14/2018	Weather Cond.:	Clear Skies, Sunny
Owner	Clean Harbors	Start Time:	10:15
Station Name	Ryley Lift Station	End Time:	11:04
Parameter	PM 10	Performed By:	Brandon Lawrence

Partisol FRM Model 2000 Identification		**Sampler Data**	
Make/Model:	R & P Partisol FRM 2000	Temperature:	-10.4 Celcius
Unit ID:	Ryley Lift Station	Pressure:	697 mmHg
S/N:	200FB209860905	Flow Set Point:	16.7 lpm

GHD Reference Standards

	Flow	Pressure	Temperature	Manometer
Make:	AirMetrics	TSI	Fluke	Dwyer
Model:	FRM	02-406	1551A EX	Series 475
Serial Number:	FRM1218	160440778	3520009	ITM0003723
Calibration Date:	5/17/2016	11/30/2017	9/14/2017	9/14/2017

Audit Data

	Sampler Data	Reference Data	Difference	Pass/Fail
Ambient Temperature (±2 %)	-10.4	-10.5	0.1	Pass
Barometric Pressure (±10 mmHg)	697	696	1	Pass
Filter Temperature (± 2%)	-6.5	-6.8	0.3	Pass
Flow (±1.0 litres/minute)	16.7	16.4	0.3	Pass

Leak Check

Pressure Drop	Initial Pressure	Final Pressure	Pressure Drop	Pass/Fail	
(-4 mmHg / minute)	-15.50	-12.00	-3.50	Pass	in.HG
Leak check was performed in automatic mode, sampler indicated:				Pass	

As Found/As Left	Yes/No	As Found	As Left	Pass/Fail
Did the ambient temperature require adjustment?	No	-10.4	-10.4	Pass
Did the barometric pressure require adjustment?	No	697	697	Pass
Did the filter temperature require adjustment?	No	-6.7	-6.7	Pass
Did the flow audit require adjustment?	No			Pass

Comments

Cleaned PM10 Inlet to clean. V-Seals Good. Sample Inlet/Tube in good condition w seals greased. All wiring looks in ok condition. Heater working good.

Flow Equation

Set Point (lpm)	Actual Flow *(Qact)* (lpm)	Absolute Difference (lpm)	Pass/Fail (± 1 lpm)			
				Manometer *(DH)*	4.53 "H2O	
				Actual Temp *(Tact)*	262.65 °K	-10.5°C
				Actual Pres *(Pact)*	0.929 bar	
16.7	16.4	0.3	Pass	Actual Pres *(Pact)*	27.44 inHg	

FTS Linear Regression Constants

(mflo) = 0.4452

(bflo) = 0.4430

$$Qact = mflo \times \frac{\sqrt{\Delta H \times Tact}}{Pact} + bflo$$

Appendix B
Calibration Certificates

ITM INSTRUMENTS INC.

TORONTO
16975 Leslie Street
Newmarket, ON L3Y 9A1
Tel: (905) 952-3750
Fax: (905) 952-3751

MONTREAL
20800 Boul. Industriel
Ste-Anne-de-Bellevue, QC H9X 0A1
Tel: (514) 457-7280
Fax: (514) 457-4329

CALGARY
#209, 4615 112 Ave SE
Calgary, AB T2C 5J3
Tel: (403) 272-9332
Fax: (403) 248-5194

www.itm.com - information@itm.com

Calibration Certificate

Customer: *GHD Ltd.*

Certificate: C177098-00-02

Unit Identification

Manufacturer: **Fluke**
Model: **1551A Ex**
Description: **Stik Thermometer**
Serial: **3520009**
Unit ID: **NA**

Calibration Date

Calibration Date: **14-Sep-2017**
Due Date: **14-Sep-2018**

Calibration Conditions

Temperature: **22.2°C**
Humidity: **35 %**
Barometric Pressure: **N/A**

General Information

Remark:**N/A**

Standards Used

Unit ID	Manufacturer	Model	Cal Date	Due Date
CAL0080	Burns Engineering	12001-A-12-6-2-A	1-Apr-2015	1-Apr-2018
CAL0124	Hart Scientific	1502A	5-Apr-2017	5-Apr-2018
CAL0223	Ametek	RTC-158B	15-Feb-2017	15-Feb-2018

The calibration was performed using measurement standards traceable to the National Measurement Institute Standards (NMIS) part of the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to accepted instrinsic standards or measurement, or is derived by ratio type self-calibration techniques. Measurement uncertainties given in this report are based on a coverage factor of k=2 corresponding to a confidence level of approximately 95%.

Calibrated by: *A. Atton*

Approved by:

ITM INSTRUMENTS INC.

TORONTO
16975 Leslie Street
Newmarket, ON L3Y 9A1
Tel: (905) 952-3750
Fax: (905) 952-3751

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Tel: (514) 457-7280
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Test Results

Procedure: **Fluke Stik Thermometer /RTC-158B,1502,PRT** Rev: **1.0**

Data Type: **As Found** Results: **Pass**

Test Description	True Value	Reading	Lower Limit	Upper Limit	Test Status	Exp Uncert
-0.031 °C		-0.01 °C	-0.08 °C	0.02 °C	Pass	8.3e-003 °C
25.004 °C		25.01 °C	24.95 °C	25.05 °C	Pass	8.8e-003 °C
99.953 °C		99.91 °C	99.90 °C	100.00 °C	Pass	1.0e-002 °C
149.879 °C		149.83 °C	149.83 °C	149.93 °C	Pass	1.2e-002 °C

INSTRUMENT CALIBRATION REPORT

Advanced Labs, Inc.

Pine Environmental Services, Inc

Instrument ID 19820
Description TSI 9565P VelociCalc
Calibrated 11/30/2017

Manufacturer TSI
Model Number 9565P
Serial Number 9565P1230033
Location New Jersey
Temp 73

Classification
Status pass
Frequency Yearly EOM
Department Lab
Humidity 25

Calibration Specifications

Group # 1
Group Name Barometric Pressure
Stated Accy Pct of Reading
Range Acc % 0.0000
Reading Acc % 2.0000
Plus/Minus 0.000

Nom In Val / In Val	In Type	Out Val	Out Type	Fnd As	Lft As	Dev%	Pass/Fail
30.000 / 30.070	inHg	30.070	inHg	30.050	30.070	0.00%	Pass

Group # 2
Group Name Differential Pressure
Stated Accy Pct of Reading
Range Acc % 0.0000
Reading Acc % 1.0000
Plus/Minus 0.00

Nom In Val / In Val	In Type	Out Val	Out Type	Fnd As	Lft As	Dev%	Pass/Fail
-4.00 / -3.93	inH2O	-3.93	inH2O	-3.97	-3.97	1.02%	Pass
4.00 / 4.03	inH2O	4.03	inH2O	4.07	4.07	0.99%	Pass
8.00 / 8.03	inH2O	8.03	inH2O	8.07	8.07	0.50%	Pass
12.00 / 12.01	inH2O	12.01	inH2O	12.07	12.07	0.50%	Pass

Test Instruments Used During the Calibration

Test Instrument ID	Description	Manufacturer	Serial Number	(As Of Cal Entry Date) Last Cal Date	Next Cal Date
DWYER 477AV	Dwyer 477AV-000 Digital Manometer	Dwyer	005TRQ	8/30/2017	8/30/2018
DWYER 477AV-1	Dwyer 477AV-1 Digital Manometer	Dwyer	005PM2	8/30/2017	8/30/2018
DWYER 477AV-3	Dwyer 477AV-3 Digital Manometer	Dwyer	005PM1	8/30/2017	8/30/2018
OMEGA HX93AC/DP25-E	Omega HX93AC/DP25-E	Omega Engineering	1010368 035025 035026	9/15/2016	9/15/2018
OMEGA PX02K1-16A5T /DP25-E-A	Omega PX02K1-16A5T/DP25-E-A	Omega Engineering	168377/8375030	9/15/2016	9/15/2018
OMEGA WT4401-D	Omega WT4401-D	Omega Engineering	101105	9/15/2016	9/15/2018

Notes about this calibration

INSTRUMENT CALIBRATION REPORT

Advanced Labs, Inc.

Pine Environmental Services, Inc

Instrument ID 19820
Description TSI 9565P VelociCalc
Calibrated 11/30/2017

Calibration Result Calibration Successful
Who Calibrated Kevin Cole

Advanced Labs, Inc. hereby certifies that this instrument is calibrated and functions to meet the manufacture's specifications using NIST traceable standards, or is derived from accepted values of physical constants.

ITM INSTRUMENTS INC.

TORONTO
16975 Leslie Street
Newmarket, ON L3Y 9A1
Tel: (905) 952-3750
Fax: (905) 952-3751

MONTREAL
20800 Boul. Industriel
Ste-Anne-de-Bellevue, QC H9X 0A1
Tel: (514) 457-7280
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CALGARY
#209, 4615 112 Ave SE
Calgary, AB T2C 5J3
Tel: (403) 272-9332
Fax: (403) 248-5194

www.itm.com - information@itm.com

Calibration Certificate

Customer: *GHD Ltd.*

Certificate: C177098-00-01

Unit Identification

Manufacturer: **Dwyer**
Model: **475-0-FM**
Description: **Digital Manometer**
Serial: **NA**
Unit ID: **ITM0003723**

Calibration Date

Calibration Date: **14-Sep-2017**
Due Date: **14-Sep-2018**

Calibration Conditions

Temperature: **21.9°C**
Humidity: **34 %**
Barometric Pressure: **N/A**

General Information

Remark:**N/A**

Standards Used

Unit ID	Manufacturer	Model	Cal Date	Due Date
CAL0224	Fluke	750P01	14-Sep-2017	14-Mar-2018

The calibration was performed using measurement standards traceable to the National Measurement Institute Standards (NMIS) part of the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to accepted instrinsic standards or measurement, or is derived by ratio type self-calibration techniques. Measurement uncertainties given in this report are based on a coverage factor of k=2 corresponding to a confidence level of approximately 95%.

Calibrated by: *A. Atton*

Approved by:

ITM INSTRUMENTS INC.

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Newmarket, ON L3Y 9A1
Tel: (905) 952-3750
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Calgary, AB T2C 5J3
Tel: (403) 272-9332
Fax: (403) 248-5194

www.itm.com - information@itm.com

Test Results

Procedure: **Pressure Gauge 10.00 IN.W.C 0.5% FS /750P01** Rev: **1.0**

Data Type: **As Found** Results: **Pass**

Test Description	True Value	Reading	Lower Limit	Upper Limit	Test Status	Exp Uncert
Tolerance used (additive if more than one listed): 0.5% of full scale						
UUT is set to the nominal value, Reading is the actual pressure read by the system instrument.						
1 inH2O		1 inH2O	1 inH2O	1 inH2O	Pass	5.8e+000 inH2O
2 inH2O		2 inH2O	2 inH2O	2 inH2O	Pass	5.8e+000 inH2O
4 inH2O		4 inH2O	4 inH2O	4 inH2O	Pass	5.8e+000 inH2O
6 inH2O		6 inH2O	6 inH2O	6 inH2O	Pass	5.8e+000 inH2O
8 inH2O		8 inH2O	8 inH2O	8 inH2O	Pass	5.8e+000 inH2O
10 inH2O		10 inH2O	10 inH2O	10 inH2O	Pass	5.8e+000 inH2O

NIST Traceable Transfer Standard Calibration

Calibration Date:	05/17/2016		Orifice #	FRM1218-	By:
Ambient Temp, °K:	295.5		Pri Std #	LFE774300	
Amb Press, Atm:	1.0000		Manometer #	FRM1218	Chk:

Std ΔH (inH_2O)	Manometer ΔH (inH_2O)	Actual Flow (alpm)	Calc Flow (alpm)	Difference* (%diff)
6.67	6.67	20.179	20.209	-0.15
5.86	5.86	18.988	18.970	0.09
5.10	5.10	17.733	17.727	0.03
4.39	4.39	16.490	16.479	0.07
3.73	3.73	15.233	15.224	0.06
3.12	3.12	13.964	13.962	0.02
2.56	2.56	12.683	12.688	-0.04
2.05	2.05	11.390	11.401	-0.10

Manometer ΔH vs Act Flow
Linear Regression Results:

m_{flo} =	**0.4452**
b_{flo} =	**0.4430**
r^2 =	**1.0000**

* all points must be within ± 2%

The MiniFlo calibration is performed with an NIST-traceable standard. Each unit has a unique pair of calibration constants derived from the calibration which are used to calculate the actual air flow rate at all ambient conditions. The unit's calibration should be recertified annually.

The actual flow rate is a function of the pressure drop across the device, the ambient temperature, and the ambient pressure. The relationship of these variables and the unique calibration constants ("m" and "b") for each device is presented in the following equation (Eq.A):

$$Q_{act} = m_{flo} \times \sqrt{\frac{\Delta H \times T_{act}}{P_{act}}} + b_{flo}$$

Q_{act} = actual flowrate, liters per min
ΔH = manometer reading, inches of water
T_{act} = ambient temperature, °K
P_{act} = ambient pressure, atmospheres

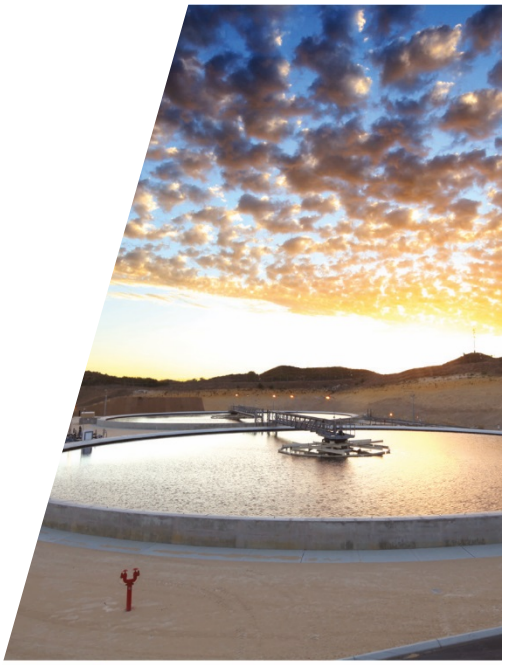
CAUTION: The weather service, most airports, etc, reduce the atmospheric pressure to a common reference (sea level). The equation above requires the atmospheric pressure at the location where the MiniFlo is being used.

The equation below may be used to estimate the ambient atmospheric pressure at any elevation if the sea level pressure is known.

$$P_{act} = P_{sea} \times \left(1 - \frac{E}{145300}\right)^{5.25}$$

P_{act} = Ambient Atmospheric Pressure
P_{sea} = Sea Level Atmospheric Pressure
E = Site elevation, feet

Airmetrics
1940 Don St., Suite 300
Springfield, OR 97477
(541) 683-5420



Quarterly Audit Partisol FRM Model 2000

Clean Harbors
50114 Range Rd. 173
Ryley, Alberta T0B 4A0
Quarterly Audit Date: June 26, 2018

Clean Harbors

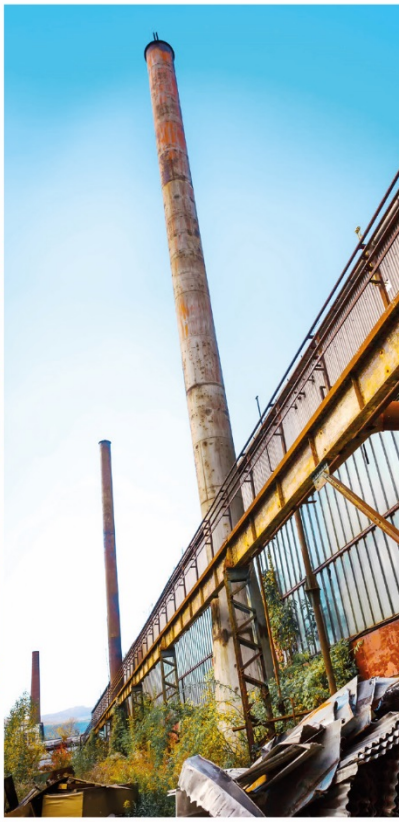


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Table Index

Appendix Index

1. Introduction

GHD Limited (GHD) was retained by Clean Harbors to conduct a Quarterly Audit at 50114 Range Road 173 Ryley, Alberta (Facility) on June 26, 2018. The Quarterly Audit was conducted on the Partisol FRM 2000 PM_{10} Sampler (Partisol Sampler), located on the roof of the Ryley Lift Station, located southeast of the Facility. The coordinates of the lift station are 53.297961, -112.416076.

2. Audit Procedure

The Partisol Sampler was audited in accordance with the instrument manual and the Alberta Air Monitoring Directive 2015 (AMD). Siting Location, Ambient Pressure, Ambient Temperature, Filter Temperature, Leakage Rate and Flow Rate were audited, as well as overall instrument condition to ensure compliance with the instrument manual and the AMD. Below is a summary of the tasks performed on the Partisol Sampler:

- Siting Location Audit
- Ambient Pressure Audit
- Ambient Temperature Audit
- Filter Temperature Audit
- Leakage Rate Audit
- Flow Rate Audit
- Instrument Condition and Recommendations

GHD verified all of these parameters using calibrated reference instruments. GHD reference instruments either have National Institute of Standards and Technology (NIST) Traceable Certifications, current manufacturer certification, or were verified by a primary standard. The GHD quarterly audit field form can be found in Appendix A. All calibrations and certifications can be found in Appendix B.

3. Audit Results

3.1 Siting Location Audit Results

The siting location of the Partisol Sampler meets the requirements of Chapter 3, Page 8, Table 5 of the AMD. Table 3.1 of this report compares the AMD Siting Requirements for Intermittent Samplers versus the Current Partisol Sampler location.

- The current coordinates of the Partisol Sampler are 53.297961 - 112.416076.
- The distance from the nearest roadway is 21 m.

Table 3.1 AMD Requirements vs. Current Partisol Sampler Location

Site Characteristics	AMD Requirements	Current Location	Specification
Sampler Inlet-height above ground (abg)	Minimum 2 m, Maximum 15 m	Meets Requirement	4.63 m abg
Other Requirements	a. Distance from an obstacle greater than 2.5 times the height of the obstacle above the sampler.	Meets Requirement	>2.5 times
	b. At least 2 m from any other samplers or inlets with flow rates greater than 200 litres (L) per minute.	Meets Requirement	None
	Or at least 1 m apart from any other samplers or inlets with flow rates less than or equal of 200 L per minute.	Meets Requirement	None
	c. Unrestricted air flow in three to four wind quadrants.	Meets Requirement	4/4 Unrestricted Quadrants

3.2 Pressure and Temperature Audit Results

The pressure and temperature audit results of the Partisol Sampler meet the requirements of Chapter 4, Page 20, Inset ME 3-33 of the AMD. Table 3.2 of this report compares the Reference results versus the Partisol Sampler readings.

Table 3.2 Reference Results vs. Partisol Sampler Readings

Parameter	Partisol	Reference	Difference	Limit	Pass/Fail
Ambient Temperature (°C)	17.0	16.3	0.7	±2%	Pass
Barometric Pressure (mmHg)	695	694.8	0.2	±10 mmHg	Pass
Filter Temperature (°C)	17.6	18	0.4	±2%	Pass
Flow	16.7 L/min	16.7 L/min	0 L/min	±1 L/min	Pass

3.3 Leak Check Result

The Partisol firmware performs leak checks in automatic mode and indicates either a "pass" or "fail" based on a pressure drop off -4 mmHg per minute. The Partisol Sampler passed the requirements of Chapter 4, Page 20, Inset ME 3-33 of the AMD.

3.4 Flow Audit

The flow audit results of the Partisol Sampler meet the requirements of Chapter 4, Page 20, Inset ME 3-33 of the AMD, refer to Table 3.2.

3.5 Instrument Condition and Recommendations

The Partisol Sampler was visually and functionally inspected on the audit day. Audit recommendations are listed below:

- Liquid crystal display screen is functioning.
- Filter exchange cabinet has been cleaned.
- Ventilation fan filters are clean.
- Filter exchange mechanism is operating normally.
- Filter v-seals are in good condition.
- Ambient temperature and pressure sensor wires in good condition.
- Main power connection wire in good condition.

3.5.1 Recommendations

Clean Harbors indicated that previous sampling event was aborted due to flow error. The instrument was thoroughly inspected and multiple flow and leak checks were performed with no issues found. It is recommended that a filter cabinet cleaning is completed.

Appendices

Appendix A Quarterly Audit Form

GHD Quarterly Audit Form

Date	6/26/2018	Weather Cond.:	Overcast, 24.7°C
Owner	Clean Harbors	Start Time:	13:45
Station Name	Ryley Lift Station	End Time:	14:14
Parameter	PM 10	Performed By:	B. Lawrence

Partisol FRM Model 2000 Identification		**Sampler Data**	
Make/Model:	R & P Partisol FRM 2000	Temperature:	24.7 Celcius
Unit ID:	Ryley Lift Station	Pressure:	695 mmHg
S/N:	200FB209860905	Flow Set Point:	16.7 lpm

GHD Reference Standards

	Flow	Pressure	Temperature	Manometer
Make:	AirMetrics	TSI	Fluke	Dwyer
Model:	FRM	9555-P	1551A EX	Series 475
Serial Number:	FRM1218	9555P0838016	3520009	MAN-CAL-001
Calibration Date:	5/17/2016	7/6/2017	9/14/2017	9/14/2017

Audit Data

	Sampler Data	Reference Data	Difference	Pass/Fail
Ambient Temperature (±2 %)	17.0	16.3	0.7	Pass
Barometric Pressure (±10 mmHg)	695	694.8	0.2	Pass
Filter Temperature (± 2%)	17.6	18	0.4	Pass
Flow (±1.0 litres/minute)	16.7	16.7	0.0	Pass

Leak Check

Pressure Drop	Initial Pressure	Final Pressure	Pressure Drop	Pass/Fail	
(-4 mmHg / minute)	-15.00	-14.00	-1.00	Pass	in.HG
Leak check was performed in automatic mode, sampler indicated:				Pass	

As Found/As Left	Yes/No	As Found	As Left	Pass/Fail
Did the ambient temperature require adjustment?	No	17.0	17.0	Pass
Did the barometric pressure require adjustment?	No	695	695	Pass
Did the filter temperature require adjustment?	No	17.6	17.6	Pass
Did the flow audit require adjustment?	No	16.7	16.7	Pass

Comments

Clean Harbors indicated that previous sampling event was aborted due to flow error. Thoroughly inspected instrument and performed multiple flow checks and leak checks. No issue found. Recommend filter cabinet cleaning.

Flow Equation

Set Point (lpm)	Actual Flow *(Qact)* (lpm)	Absolute Difference (lpm)	Pass/Fail (± 1 lpm)
16.7	16.7	0.0	Pass

Manometer *(DH)*	4.17	"H2O	
Actual Temp *(Tact)*	294.75	°K	21.6°C
Actual Pres *(Pact)*	0.926	bar	
Actual Pres *(Pact)*	27.35	inHg	

FTS Linear Regression Constants

(mflo) = 0.4452

(bflo) = 0.4430

$$Qact = mflo \times \frac{\sqrt{\Delta H \times Tact}}{Pact} + bflo$$

Appendix B
Calibration Certificates

ITM INSTRUMENTS INC.

TORONTO
16975 Leslie Street
Newmarket, ON L3Y 9A1
Tel: (905) 952-3750
Fax: (905) 952-3751

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Ste-Anne-de-Bellevue, QC H9X 0A1
Tel: (514) 457-7280
Fax: (514) 457-4329

CALGARY
#209, 4615 112 Ave SE
Calgary, AB T2C 5J3
Tel: (403) 272-9332
Fax: (403) 248-5194

www.itm.com - information@itm.com

Calibration Certificate

Customer: *GHD Ltd.*

Certificate: C177098-00-02

Unit Identification

Manufacturer: **Fluke**
Model: **1551A Ex**
Description: **Stik Thermometer**
Serial: **3520009**
Unit ID: **NA**

Calibration Date

Calibration Date: **14-Sep-2017**
Due Date: **14-Sep-2018**

Calibration Conditions

Temperature: **22.2°C**
Humidity: **35 %**
Barometric Pressure: **N/A**

General Information

Remark:**N/A**

Standards Used

Unit ID	Manufacturer	Model	Cal Date	Due Date
CAL0080	Burns Engineering	12001-A-12-6-2-A	1-Apr-2015	1-Apr-2018
CAL0124	Hart Scientific	1502A	5-Apr-2017	5-Apr-2018
CAL0223	Ametek	RTC-158B	15-Feb-2017	15-Feb-2018

The calibration was performed using measurement standards traceable to the National Measurement Institute Standards (NMIS) part of the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to accepted instrinsic standards or measurement, or is derived by ratio type self-calibration techniques. Measurement uncertainties given in this report are based on a coverage factor of k=2 corresponding to a confidence level of approximately 95%.

Calibrated by: *A. Atton*

Approved by:

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Test Results

Procedure: **Fluke Stik Thermometer /RTC-158B,1502,PRT** Rev: **1.0**

Data Type: **As Found** Results: **Pass**

Test Description	True Value	Reading	Lower Limit	Upper Limit	Test Status	Exp Uncert
-0.031 °C		-0.01 °C	-0.08 °C	0.02 °C	Pass	8.3e-003 °C
25.004 °C		25.01 °C	24.95 °C	25.05 °C	Pass	8.8e-003 °C
99.953 °C		99.91 °C	99.90 °C	100.00 °C	Pass	1.0e-002 °C
149.879 °C		149.83 °C	149.83 °C	149.93 °C	Pass	1.2e-002 °C

CERTIFICATE OF CALIBRATION AND TESTING

TSI Incorporated, 500 Cardigan Road, Shoreview, MN 55126 USA
Tel: 1-800-874-2811 1-651-490-2811 Fax: 1-651-490-3824 http://www.tsi.com

Environment Conditions		
Temperature	74.7 (23.7)	°F (°C)
Relative Humidity	50	%RH
Barometric Pressure	29.01 (982.4)	inHg (hPa)

Model	9555-P
Serial Number	9555P0838016

☒ As Left ☐ As Found

☒ In Tolerance ☐ Out of Tolerance

– Calibration Verification Results –

Thermo Couple^ *Unit: °F (°C)*

#	Standard	Measured	Allowable Range	#	Standard	Measured	Allowable Range
1	73.2 (22.9)	73.4 (23.0)	71.2~75.2 (21.8~24.0)				

Differential Pressure *Unit: inH$_2$O (Pa)*

#	Standard	Measured	Allowable Range	#	Standard	Measured	Allowable Range
1	-3.742 (-931.8)	-3.759 (-936.0)	-3.783~-3.701 (-942.0~-921.5)	3	8.063 (2007.7)	8.066 (2008.4)	7.978~8.148 (1986.5~2028.9)
2	1.969 (490.3)	1.971 (490.8)	1.945~1.993 (484.3~496.3)	4	14.088 (3507.9)	14.097 (3510.2)	13.943~14.233 (3471.8~3544.0)

Barometric Pressure *Unit: inHg (hPa)*

#	Standard	Measured	Allowable Range	#	Standard	Measured	Allowable Range
1	19.95 (675.6)	19.92 (674.6)	19.55~20.35 (662.0~689.1)	3	35.47 (1201.2)	35.39 (1198.4)	34.76~36.18 (1177.1~1225.2)
2	29.05 (983.7)	29.02 (982.7)	28.47~29.63 (964.1~1003.4)				

^ Circuit portion of temperature measurement only, not including probe.

TSI does hereby certify that the above described instrument conforms to the original manufacturer's specification (not applicable to As Found data) and has been calibrated using standards whose accuracies are traceable to the United States National Institute of Standards and Technology (NIST) or has been verified with respect to instrumentation whose accuracy is traceable to NIST, or is derived from accepted values of physical constants. TSI's calibration system is registered to ISO-9001:2015.

Measurement Variable	System ID	Last Cal.	Cal. Due
Temperature	E003301	04-05-17	04-30-18
Pressure	E003982	02-09-17	08-31-17

Measurement Variable	System ID	Last Cal.	Cal. Due
Pressure	E005254	10-11-16	10-11-17
DC Voltage	E003493	10-21-16	10-31-17

Calibrated

July 6, 2017
Date

TSI P/N 2300157

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www.itm.com - information@itm.com

Calibration Certificate

Customer: *GHD Ltd.*

Certificate: C177098-00-01

Unit Identification

Manufacturer: **Dwyer**
Model: **475-0-FM**
Description: **Digital Manometer**
Serial: **NA**
Unit ID: **ITM0003723**

Calibration Date

Calibration Date: **14-Sep-2017**
Due Date: **14-Sep-2018**

Calibration Conditions

Temperature: **21.9°C**
Humidity: **34 %**
Barometric Pressure: **N/A**

General Information

Remark:**N/A**

Standards Used

Unit ID	Manufacturer	Model	Cal Date	Due Date
CAL0224	Fluke	750P01	14-Sep-2017	14-Mar-2018

The calibration was performed using measurement standards traceable to the National Measurement Institute Standards (NMIS) part of the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to accepted instrinsic standards or measurement, or is derived by ratio type self-calibration techniques. Measurement uncertainties given in this report are based on a coverage factor of k=2 corresponding to a confidence level of approximately 95%.

Calibrated by: *A. Atton*

Approved by:

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Test Results

Procedure: **Pressure Gauge 10.00 IN.W.C 0.5% FS /750P01** Rev: **1.0**

Data Type: **As Found** Results: **Pass**

Test Description	True Value	Reading	Lower Limit	Upper Limit	Test Status	Exp Uncert
Tolerance used (additive if more than one listed): 0.5% of full scale						
UUT is set to the nominal value, Reading is the actual pressure read by the system instrument.						
1 inH2O		1 inH2O	1 inH2O	1 inH2O	Pass	5.8e+000 inH2O
2 inH2O		2 inH2O	2 inH2O	2 inH2O	Pass	5.8e+000 inH2O
4 inH2O		4 inH2O	4 inH2O	4 inH2O	Pass	5.8e+000 inH2O
6 inH2O		6 inH2O	6 inH2O	6 inH2O	Pass	5.8e+000 inH2O
8 inH2O		8 inH2O	8 inH2O	8 inH2O	Pass	5.8e+000 inH2O
10 inH2O		10 inH2O	10 inH2O	10 inH2O	Pass	5.8e+000 inH2O

NIST Traceable Transfer Standard Calibration

Calibration Date:	05/17/2016		Orifice #	FRM1218-	By:
Ambient Temp, °K:	295.5		Pri Std #	LFE774300	
Amb Press, Atm:	1.0000		Manometer #	FRM1218	Chk:

Std ΔH (inH_2O)	Manometer ΔH (inH_2O)	Actual Flow (alpm)	Calc Flow (alpm)	Difference* (%diff)
6.67	6.67	20.179	20.209	-0.15
5.86	5.86	18.988	18.970	0.09
5.10	5.10	17.733	17.727	0.03
4.39	4.39	16.490	16.479	0.07
3.73	3.73	15.233	15.224	0.06
3.12	3.12	13.964	13.962	0.02
2.56	2.56	12.683	12.688	-0.04
2.05	2.05	11.390	11.401	-0.10

Manometer ΔH vs Act Flow
Linear Regression Results:

m_{flo} =	**0.4452**
b_{flo} =	**0.4430**
r^2 =	**1.0000**

* all points must be within ± 2%

The MiniFlo calibration is performed with an NIST-traceable standard. Each unit has a unique pair of calibration constants derived from the calibration which are used to calculate the actual air flow rate at all ambient conditions. The unit's calibration should be recertified annually.

The actual flow rate is a function of the pressure drop across the device, the ambient temperature, and the ambient pressure. The relationship of these variables and the unique calibration constants ("m" and "b") for each device is presented in the following equation (Eq.A):

$$Q_{act} = m_{flo} \times \sqrt{\frac{\Delta H \times T_{act}}{P_{act}}} + b_{flo}$$

Q_{act} = actual flowrate, liters per min
ΔH = manometer reading, inches of water
T_{act} = ambient temperature, °K
P_{act} = ambient pressure, atmospheres

CAUTION: The weather service, most airports, etc, reduce the atmospheric pressure to a common reference (sea level). The equation above requires the atmospheric pressure at the location where the MiniFlo is being used.

The equation below may be used to estimate the ambient atmospheric pressure at any elevation if the sea level pressure is known.

$$P_{act} = P_{sea} \times \left(1 - \frac{E}{145300}\right)^{5.25}$$

P_{act} = Ambient Atmospheric Pressure
P_{sea} = Sea Level Atmospheric Pressure
E = Site elevation, feet

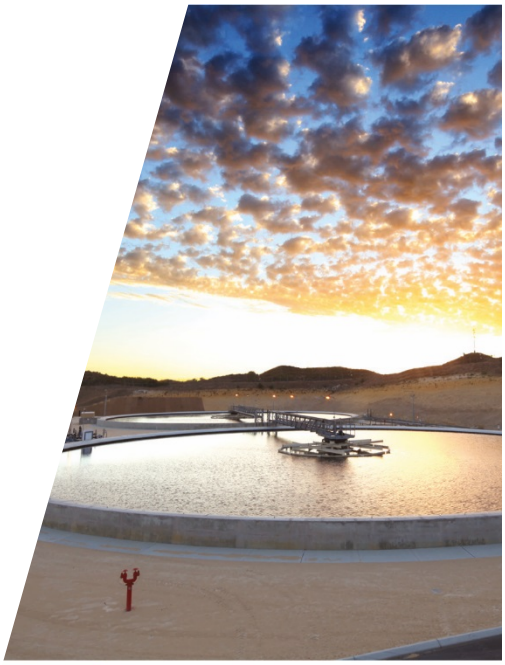
Airmetrics
1940 Don St., Suite 300
Springfield, OR 97477
(541) 683-5420

about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

Brandon Lawrence
brandon.lawrence@ghd.com
403.538.8605

www.ghd.com



Quarterly Audit Partisol FRM Model 2000

Clean Harbors
50114 Range Rd. 173
Ryley, Alberta T0B 4A0
Quarterly Audit Date: August 29, 2018

Clean Harbors

Table of Contents

Table Index

Appendix Index

1. Introduction

GHD Limited (GHD) was retained by Clean Harbors to conduct a Quarterly Audit at 50114 Range Road 173 Ryley, Alberta (Facility) on August 29, 2018. The Quarterly Audit was conducted on the Partisol FRM 2000 PM_{10} Sampler (Partisol Sampler), located on the roof of the Ryley Lift Station, located southeast of the Facility. The coordinates of the lift station are 53.297961, -112.416076.

2. Audit Procedure

The Partisol Sampler was audited in accordance with the instrument manual and the Alberta Air Monitoring Directive 2015 (AMD). Siting Location, Ambient Pressure, Ambient Temperature, Filter Temperature, Leakage Rate and Flow Rate were audited, as well as overall instrument condition to ensure compliance with the instrument manual and the AMD. Below is a summary of the tasks performed on the Partisol Sampler:

- Siting Location Audit
- Ambient Pressure Audit
- Ambient Temperature Audit
- Filter Temperature Audit
- Leakage Rate Audit
- Flow Rate Audit
- Instrument Condition and Recommendations

GHD verified all of these parameters using calibrated reference instruments. GHD reference instruments either have National Institute of Standards and Technology (NIST) Traceable Certifications, current manufacturer certification, or were verified by a primary standard. The GHD quarterly audit field form can be found in Appendix A. All calibrations and certifications can be found in Appendix B.

3. Audit Results

3.1 Siting Location Audit Results

The siting location of the Partisol Sampler meets the requirements of Chapter 3, Page 8, Table 5 of the AMD. Table 3.1 of this report compares the AMD Siting Requirements for Intermittent Samplers versus the Current Partisol Sampler location.

- The current coordinates of the Partisol Sampler are 53.297961, -112.416076.
- The distance from the nearest roadway is 21 m.

Table 3.1 AMD Requirements vs. Current Partisol Sampler Location

Site Characteristics	AMD Requirements	Current Location	Specification
Sampler Inlet-height above ground (abg)	Minimum 2 m, Maximum 15 m	Meets Requirement	4.63 m abg
Other Requirements	a. Distance from an obstacle greater than 2.5 times the height of the obstacle above the sampler	Meets Requirement	>2.5 times
	b. At least 2 m from any other samplers or inlets with flow rates greater than 200 litres (L) per minute,	Meets Requirement	None
	Or at least 1 m apart from any other samplers or inlets with flow rates less than or equal of 200 L per minute	Meets Requirement	None
	c. Unrestricted air flow in three to four wind quadrants	Meets Requirement	4/4 Unrestricted Quadrants

3.2 Pressure and Temperature Audit Results

The pressure and temperature audit results of the Partisol Sampler meet the requirements of Chapter 4, Page 20, Inset ME 3-33 of the AMD. Table 3.2 of this report compares the Reference results versus the Partisol Sampler readings.

Table 3.2 Reference Results vs. Partisol Sampler Readings

Parameter	Partisol	Reference	Difference	Limit	Pass/Fail
Ambient Temperature (°C)	21.4	21.4	0.0	±2%	Pass
Barometric Pressure (mmHg)	694	695.3	1.3	±10 mmHg	Pass
Filter Temperature (°C)	22.0	21.5	0.5	±2%	Pass
Flow	16.7 L/min	16.7 L/min	0 L/min	±1 L/min	Pass

3.3 Leak Check Result

The Partisol firmware performs leak checks in automatic mode and indicates either a "pass" or "fail" based on a pressure drop off -4 mmHg per minute. The Partisol Sampler passed the requirements of Chapter 4, Page 20, Inset ME 3-33 of the AMD.

3.4 Flow Audit

The flow audit results of the Partisol Sampler meet the requirements of Chapter 4, Page 20, Inset ME 3-33 of the AMD, refer to Table 3.2.

3.5 Instrument Condition and Recommendations

The Partisol Sampler was visually and functionally inspected on the audit day. Audit recommendations are listed below:

- Liquid crystal display screen is functioning.
- Filter exchange cabinet has been cleaned.
- Ventilation fan filters are clean.
- Filter exchange mechanism is operating normally.
- Filter v-seals are in good condition.
- Ambient temperature and pressure sensor wires in good condition.
- Main power connection wire in good condition.

3.5.1 Recommendations

During the quarterly audit, it was noted that the roof of the Ryley Lift Station had become cluttered with cobwebs and inhabited by various insects. It is recommended that the area is thoroughly cleaned so that the partisol sampler is easily accessible in the future.

Appendices

Appendix A
Quarterly Audit Forms

GHD Quarterly Audit Form

Date	8/29/2018	Weather Cond.:	Overcast 19°C
Owner	Clean Harbors	Start Time:	13:45
Station Name	Ryley Lift Station	End Time:	14:15
Parameter	PM 10	Performed By:	BL/TL

Partisol FRM Model 2000 Identification		**Sampler Data**	
Make/Model:	R & P Partisol FRM 2000	Temperature:	19°C
Unit ID:	Ryley Lift Station	Pressure:	695.3
S/N:	200FB209860905	Flow Set Point:	16.7 lpm

GHD Reference Standards

	Flow	Pressure	Temperature	Manometer
Make:	AirMetrics	TSI	Fluke	Dwyer
Model:	FRM	9555-P	1551A EX	Series 475
Serial Number:	FRM1218	9555P0838016	3520009	MAN-CAL-001
Calibration Date:	5/17/2016	3/7/2018	9/14/2017	9/14/2017

Audit Data

	Sampler Data	Reference Data	Difference	Pass/Fail
Ambient Temperature (±2 %)	21.4	21.4	0.0	Pass
Barometric Pressure (±10 mmHg)	694	695.3	1.3	Pass
Filter Temperature (± 2%)	22.0	21.5	0.5	Pass
Flow (±1.0 litres/minute)	16.7	16.7	0.0	Pass

Leak Check

Pressure Drop	Initial Pressure	Final Pressure	Pressure Drop	Pass/Fail	
(-4 mmHg / minute)	-14.00	-13.50	-0.50	Pass	in.HG
Leak check was performed in automatic mode, sampler indicated:			Pass @ 16 mmHg/min		

As Found/As Left	**Yes/No**	**As Found**	**As Left**	**Pass/Fail**
Did the ambient temperature require adjustment?	No	21.4	21.4	Pass
Did the barometric pressure require adjustment?	No	694	694	Pass
Did the filter temperature require adjustment?	No	22.0	22.0	Pass
Did the flow audit require adjustment?	No	16.7	16.7	Pass

Comments

Flow Equation

Set Point (lpm)	Actual Flow *(Qact)* (lpm)	Absolute Difference (lpm)	Pass/Fail (± 1 lpm)			
				Manometer *(DH)*	4.03 "H2O	
				Actual Temp *(Tact)*	294.55 °K	21.4°C
				Actual Pres *(Pact)*	0.927 bar	
16.7	16.4	0.3	Pass	Actual Pres *(Pact)*	27.374119 inHg	

FTS Linear Regression Constants

(mflo) = 0.4452

(bflo) = 0.4430

$$Qact = mflo \times \frac{\sqrt{\Delta H \times Tact}}{Pact} + bflo$$

Appendix B
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Calibration Certificate

Customer: *GHD Ltd.*

Certificate: C177098-00-02

Unit Identification

Manufacturer: **Fluke**
Model: **1551A Ex**
Description: **Stik Thermometer**
Serial: **3520009**
Unit ID: **NA**

Calibration Date

Calibration Date: **14-Sep-2017**
Due Date: **14-Sep-2018**

Calibration Conditions

Temperature: **22.2°C**
Humidity: **35 %**
Barometric Pressure: **N/A**

General Information

Remark:**N/A**

Standards Used

Unit ID	Manufacturer	Model	Cal Date	Due Date
CAL0080	Burns Engineering	12001-A-12-6-2-A	1-Apr-2015	1-Apr-2018
CAL0124	Hart Scientific	1502A	5-Apr-2017	5-Apr-2018
CAL0223	Ametek	RTC-158B	15-Feb-2017	15-Feb-2018

The calibration was performed using measurement standards traceable to the National Measurement Institute Standards (NMIS) part of the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to accepted instrinsic standards or measurement, or is derived by ratio type self-calibration techniques. Measurement uncertainties given in this report are based on a coverage factor of k=2 corresponding to a confidence level of approximately 95%.

Calibrated by: *A. Atton*

Approved by:

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Test Results

Procedure: **Fluke Stik Thermometer /RTC-158B,1502,PRT** Rev: **1.0**

Data Type: **As Found** Results: **Pass**

Test Description	True Value	Reading	Lower Limit	Upper Limit	Test Status	Exp Uncert
-0.031 °C		-0.01 °C	-0.08 °C	0.02 °C	Pass	8.3e-003 °C
25.004 °C		25.01 °C	24.95 °C	25.05 °C	Pass	8.8e-003 °C
99.953 °C		99.91 °C	99.90 °C	100.00 °C	Pass	1.0e-002 °C
149.879 °C		149.83 °C	149.83 °C	149.93 °C	Pass	1.2e-002 °C

INSTRUMENT CALIBRATION REPORT

Advanced Labs, Inc.

Pine Environmental Services, Inc

Instrument ID R10536
Description TSI 7565-X Q-Trak
Calibrated 3/7/2018

Manufacturer TSI
Model Number 7565-X
Serial Number 7565X0749020
Location New Jersey
Temp 70

Classification
Status pass
Frequency Yearly EOM
Department Lab
Humidity 23

Calibration Specifications

Group # 1
Group Name Barometric Pressure
Stated Accy Pct of Reading

Range Acc % 0.0000
Reading Acc % 3.0000
Plus/Minus 0.000

Nom In Val / In Val	In Type	Out Val	Out Type	Fnd As	Lft As	Dev%	Pass/Fail
30.000 / 29.620	inHg	29.620	inHg	29.600	29.620	0.00%	Pass

Test Instruments Used During the Calibration

Test Instrument ID	Description	Manufacturer	Serial Number	(As Of Cal Entry Date) Last Cal Date	Next Cal Date
OMEGA HX93AC/DP25-E	Omega HX93AC/DP25-E	Omega Engineering	1010368 035025 035026	9/15/2016	9/15/2018

Notes about this calibration

Calibration Result Calibration Successful
Who Calibrated David Galego

Advanced Labs, Inc. hereby certifies that this instrument is calibrated and functions to meet the manufacture's specifications using NIST traceable standards, or is derived from accepted values of physical constants.

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Calibration Certificate

Customer: *GHD Ltd.*

Certificate: C177098-00-01

Unit Identification

Manufacturer: **Dwyer**
Model: **475-0-FM**
Description: **Digital Manometer**
Serial: **NA**
Unit ID: **ITM0003723**

Calibration Date

Calibration Date: **14-Sep-2017**
Due Date: **14-Sep-2018**

Calibration Conditions

Temperature: **21.9°C**
Humidity: **34 %**
Barometric Pressure: **N/A**

General Information

Remark:**N/A**

Standards Used

Unit ID	Manufacturer	Model	Cal Date	Due Date
CAL0224	Fluke	750P01	14-Sep-2017	14-Mar-2018

The calibration was performed using measurement standards traceable to the National Measurement Institute Standards (NMIS) part of the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to accepted instrinsic standards or measurement, or is derived by ratio type self-calibration techniques. Measurement uncertainties given in this report are based on a coverage factor of k=2 corresponding to a confidence level of approximately 95%.

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Approved by:

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Test Results

Procedure: **Pressure Gauge 10.00 IN.W.C 0.5% FS /750P01** Rev: **1.0**

Data Type: **As Found** Results: **Pass**

Test Description	True Value	Reading	Lower Limit	Upper Limit	Test Status	Exp Uncert
Tolerance used (additive if more than one listed): 0.5% of full scale						
UUT is set to the nominal value, Reading is the actual pressure read by the system instrument.						
1 inH2O		1 inH2O	1 inH2O	1 inH2O	Pass	5.8e+000 inH2O
2 inH2O		2 inH2O	2 inH2O	2 inH2O	Pass	5.8e+000 inH2O
4 inH2O		4 inH2O	4 inH2O	4 inH2O	Pass	5.8e+000 inH2O
6 inH2O		6 inH2O	6 inH2O	6 inH2O	Pass	5.8e+000 inH2O
8 inH2O		8 inH2O	8 inH2O	8 inH2O	Pass	5.8e+000 inH2O
10 inH2O		10 inH2O	10 inH2O	10 inH2O	Pass	5.8e+000 inH2O

NIST Traceable Transfer Standard Calibration

Calibration Date:	05/17/2016		Orifice #	FRM1218-	By:
Ambient Temp, °K:	295.5		Pri Std #	LFE774300	
Amb Press, Atm:	1.0000		Manometer #	FRM1218	Chk:

Std ΔH (inH_2O)	Manometer ΔH (inH_2O)	Actual Flow (alpm)	Calc Flow (alpm)	Difference* (%diff)
6.67	6.67	20.179	20.209	-0.15
5.86	5.86	18.988	18.970	0.09
5.10	5.10	17.733	17.727	0.03
4.39	4.39	16.490	16.479	0.07
3.73	3.73	15.233	15.224	0.06
3.12	3.12	13.964	13.962	0.02
2.56	2.56	12.683	12.688	-0.04
2.05	2.05	11.390	11.401	-0.10

Manometer ΔH vs Act Flow
Linear Regression Results:

m_{flo} =	**0.4452**
b_{flo} =	**0.4430**
r^2 =	**1.0000**

* all points must be within ± 2%

The MiniFlo calibration is performed with an NIST-traceable standard. Each unit has a unique pair of calibration constants derived from the calibration which are used to calculate the actual air flow rate at all ambient conditions. The unit's calibration should be recertified annually.

The actual flow rate is a function of the pressure drop across the device, the ambient temperature, and the ambient pressure. The relationship of these variables and the unique calibration constants ("m" and "b") for each device is presented in the following equation (Eq.A):

$$Q_{act} = m_{flo} \times \sqrt{\frac{\Delta H \times T_{act}}{P_{act}}} + b_{flo}$$

Q_{act} = actual flowrate, liters per min
ΔH = manometer reading, inches of water
T_{act} = ambient temperature, °K
P_{act} = ambient pressure, atmospheres

CAUTION: The weather service, most airports, etc, reduce the atmospheric pressure to a common reference (sea level). The equation above requires the atmospheric pressure at the location where the MiniFlo is being used.

The equation below may be used to estimate the ambient atmospheric pressure at any elevation if the sea level pressure is known.

$$P_{act} = P_{sea} \times \left(1 - \frac{E}{145300}\right)^{5.25}$$

P_{act} = Ambient Atmospheric Pressure
P_{sea} = Sea Level Atmospheric Pressure
E = Site elevation, feet

Airmetrics
1940 Don St., Suite 300
Springfield, OR 97477
(541) 683-5420

about GHD

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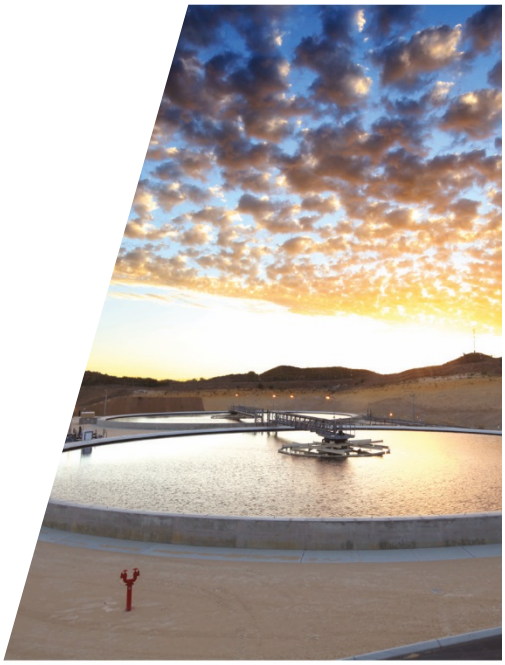
Brandon Lawrence
brandon.lawrence@ghd.com
403.538.8605

www.ghd.com



Quarterly Audit Partisol FRM Model 2000

Clean Harbors
50114 Range Rd. 173
Ryley, Alberta T0B 4A0
Quarterly Audit Date: October 17, 2018

Clean Harbors

Table of Contents

Table Index

Appendix Index

1. Introduction

GHD Limited (GHD) was retained by Clean Harbors to conduct a Quarterly Audit at 50114 Range Road 173 Ryley, Alberta (Facility) on October 17, 2018. The Quarterly Audit was conducted on the Partisol FRM 2000 PM_{10} Sampler (Partisol Sampler), located on the roof of the Ryley Lift Station, located southeast of the Facility. The coordinates of the lift station are 53.297961, -112.416076.

2. Audit Procedure

The Partisol Sampler was audited in accordance with the instrument manual and the Alberta Air Monitoring Directive 2015 (AMD). Siting Location, Ambient Pressure, Ambient Temperature, Filter Temperature, Leakage Rate and Flow Rate were audited, as well as overall instrument condition to ensure compliance with the instrument manual and the AMD. Below is a summary of the tasks performed on the Partisol Sampler:

- Siting Location Audit
- Ambient Pressure Audit
- Ambient Temperature Audit
- Filter Temperature Audit
- Leakage Rate Audit
- Flow Rate Audit
- Instrument Condition and Recommendations

GHD verified all of these parameters using calibrated reference instruments. GHD reference instruments either have National Institute of Standards and Technology (NIST) Traceable Certifications, current manufacturer certification, or were verified by a primary standard. The GHD quarterly audit field form can be found in Appendix A. All calibrations and certifications can be found in Appendix B.

3. Audit Results

3.1 Siting Location Audit Results

The siting location of the Partisol Sampler meets the requirements of Chapter 3, Page 8, and Table 5 of the AMD. Table 3.1 of this report compares the AMD Siting Requirements for Intermittent Samplers versus the Current Partisol Sampler location.

- The current coordinates of the Partisol Sampler are 53.297961, -112.416076.
- The distance from the nearest roadway is 21 m.

Table 3.1 AMD Requirements vs. Current Partisol Sampler Location

Site Characteristics	AMD Requirements	Current Location	Specification
Sampler Inlet-height above ground (abg)	Minimum 2 m, Maximum 15 m	Meets Requirement	4.63 m abg
Other Requirements	a. Distance from an obstacle greater than 2.5 times the height of the obstacle above the sampler	Meets Requirement	>2.5 times
	b. At least 2 m from any other samplers or inlets with flow rates greater than 200 litres (L) per minute,	Meets Requirement	None
	Or at least 1 m apart from any other samplers or inlets with flow rates less than or equal of 200 L per minute	Meets Requirement	None
	c. Unrestricted air flow in three to four wind quadrants	Meets Requirement	4/4 Unrestricted Quadrants

3.2 Pressure and Temperature Audit Results

The pressure and temperature audit results of the Partisol Sampler meet the requirements of Chapter 4, Page 20, Inset ME 3-33 of the AMD. Table 3.2 of this report compares the Reference results versus the Partisol Sampler readings.

Table 3.2 Reference Results vs. Partisol Sampler Readings

Parameter	Partisol	Reference	Difference	Limit	Pass/Fail
Ambient Temperature (°C)	17	17.58	.58	±2%	Pass
Barometric Pressure (mmHg)	696	697.2	1.2	±10 mmHg	Pass
Filter Temperature (°C)	16.1	16.5	0.4	±2%	Pass
Flow	16.7 L/min	16.8 L/min	0.1 L/min	±1 L/min	Pass

3.3 Leak Check Result

The Partisol firmware performs leak checks in automatic mode and indicates either a "pass" or "fail" based on a pressure drop off -4 mmHg per minute. The Partisol Sampler passed the requirements of Chapter 4, Page 20, Inset ME 3-33 of the AMD.

3.4 Flow Audit

The flow audit results of the Partisol Sampler meet the requirements of Chapter 4, Page 20, Inset ME 3-33 of the AMD, refer to Table 3.2.

3.5 Instrument Condition and Recommendations

The Partisol Sampler was visually and functionally inspected on the audit day. Audit recommendations are listed below:

- Liquid crystal display screen is functioning.
- Filter exchange cabinet has been cleaned.
- Ventilation fan filters are clean.
- Filter exchange mechanism is operating normally.
- Filter v-seals are in good condition.
- Ambient temperature and pressure sensor wires in good condition.
- Main power connection wire in good condition.

3.5.1 Recommendations

GHD recommends opening and cleaning PM_{10} sampling inlet prior to next sampling event.

Appendices

Appendix A
Quarterly Audit Form

GHD Quarterly Audit Form

Date	10/17/2018	Weather Cond.:	Windy/18*C
Owner	Clean Harbors	Start Time:	11:15
Station Name	Ryley Lift Station	End Time:	11:50
Parameter	PM 10	Performed By:	Trevor Lewis

Partisol FRM Model 2000 Identification		**Sampler Data**	
Make/Model:	R & P Partisol FRM 2000	Temperature:	18°C
Unit ID:	Ryley Lift Station	Pressure:	703
S/N:	200FB209860905	Flow Set Point:	16.7

GHD Reference Standards

	Flow	Pressure	Temperature	Manometer
Make:	AirMetrics	TSI	Fluke	Dwyer
Model:	FRM	9555-P	1551A EX	Series 475
Serial Number:	FRM1218	9555P0838016	3520009	MAN-CAL-001
Calibration Date:	5/17/2016	3/7/2018	9/14/2017	9/14/2017

Audit Data

	Sampler Data	Reference Data	Difference	Pass/Fail
Ambient Temperature (±2 %)	17.0	17.58	0.6	Pass
Barometric Pressure (±10 mmHg)	703	703	0	Pass
Filter Temperature (± 2%)	16.1	16.5	0.4	Pass
Flow (±1.0 litres/minute)	16.7	16.8	-0.1	Pass

Leak Check

Pressure Drop	Initial Pressure	Final Pressure	Pressure Drop	Pass/Fail	
(-4 mmHg / minute)	-14.00	-12.00	-2.00	Pass	in.HG

Leak check was performed in automatic mode, sampler indicated: Pass @ 59 mmHg/min

As Found/As Left	Yes/No	As Found	As Left	Pass/Fail
Did the ambient temperature require adjustment?	No	17.0	17.0	Pass
Did the barometric pressure require adjustment?	No	703	703	Pass
Did the filter temperature require adjustment?	No	16.1	16.1	Pass
Did the flow audit require adjustment?	No	16.7	16.7	Pass

Comments

Flow Equation

Set Point (lpm)	Actual Flow *(Qact)* (lpm)	Absolute Difference (lpm)	Pass/Fail (± 1 lpm)			
				Manometer *(DH)*	4.03 "H2O	
				Actual Temp *(Tact)*	294.55 °K	21.4°C
				Actual Pres *(Pact)*	0.927 bar	
16.7	16.4	0.3	Pass	Actual Pres *(Pact)*	27.374119 inHg	

FTS Linear Regression Constants

(mflo) = 0.4452

(bflo) = 0.4430

$$Qact = mflo \times \frac{\sqrt{\Delta H \times Tact}}{Pact} + bflo$$

Appendix B
Calibration Certificates

ITM INSTRUMENTS INC.

TORONTO
16975 Leslie Street
Newmarket, ON L3Y 9A1
Tel: (905) 952-3750
Fax: (905) 952-3751

MONTREAL
20800 Boul. Industriel
Ste-Anne-de-Bellevue, QC H9X 0A1
Tel: (514) 457-7280
Fax: (514) 457-4329

CALGARY
#209, 4615 112 Ave SE
Calgary, AB T2C 5J3
Tel: (403) 272-9332
Fax: (403) 248-5194

www.itm.com - information@itm.com

Calibration Certificate

Customer: *GHD Ltd.*

Certificate: C177098-00-02

Unit Identification

Manufacturer: **Fluke**
Model: **1551A Ex**
Description: **Stik Thermometer**
Serial: **3520009**
Unit ID: **NA**

Calibration Date

Calibration Date: **14-Sep-2017**
Due Date: **14-Sep-2018**

Calibration Conditions

Temperature: **22.2°C**
Humidity: **35 %**
Barometric Pressure: **N/A**

General Information

Remark:**N/A**

Standards Used

Unit ID	Manufacturer	Model	Cal Date	Due Date
CAL0080	Burns Engineering	12001-A-12-6-2-A	1-Apr-2015	1-Apr-2018
CAL0124	Hart Scientific	1502A	5-Apr-2017	5-Apr-2018
CAL0223	Ametek	RTC-158B	15-Feb-2017	15-Feb-2018

The calibration was performed using measurement standards traceable to the National Measurement Institute Standards (NMIS) part of the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to accepted instrinsic standards or measurement, or is derived by ratio type self-calibration techniques. Measurement uncertainties given in this report are based on a coverage factor of k=2 corresponding to a confidence level of approximately 95%.

Calibrated by: *A. Atton*

Approved by:

ITM INSTRUMENTS INC.

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Test Results

Procedure: **Fluke Stik Thermometer /RTC-158B,1502,PRT** Rev: **1.0**

Data Type: **As Found** Results: **Pass**

Test Description	True Value	Reading	Lower Limit	Upper Limit	Test Status	Exp Uncert
-0.031 °C		-0.01 °C	-0.08 °C	0.02 °C	Pass	8.3e-003 °C
25.004 °C		25.01 °C	24.95 °C	25.05 °C	Pass	8.8e-003 °C
99.953 °C		99.91 °C	99.90 °C	100.00 °C	Pass	1.0e-002 °C
149.879 °C		149.83 °C	149.83 °C	149.93 °C	Pass	1.2e-002 °C

INSTRUMENT CALIBRATION REPORT

Advanced Labs, Inc.

Pine Environmental Services, Inc

Instrument ID R11391
Description TSI 7565 Q-Trak
Calibrated 5/8/2018

Manufacturer TSI
Model Number 7565-X
Serial Number 7565X0839011
Location New Jersey
Temp 77

Classification
Status pass
Frequency Yearly EOM
Department Lab
Humidity 25

Calibration Specifications

Group # 1
Group Name Barometric Pressure
Stated Accy Pct of Reading

Range Acc % 0.0000
Reading Acc % 3.0000
Plus/Minus 0.000

Nom In Val / In Val	In Type	Out Val	Out Type	Fnd As	Lft As	Dev%	Pass/Fail
30.000 / 30.100	inHg	30.100	inHg	30.070	30.100	0.00%	Pass

Test Instruments Used During the Calibration

Test Instrument ID	Description	Manufacturer	Serial Number	(As Of Cal Entry Date) Last Cal Date	Next Cal Date
OMEGA HX93AC/DP25-E	Omega HX93AC/DP25-E	Omega Engineering	1010368 035025 035026	9/15/2016	9/15/2018
OMEGA PX02K1-16A5T /DP25-E-A	Omega PX02K1-16A5T/DP25-E-A	Omega Engineering	168377/8375030	9/15/2016	9/15/2018
OMEGA WT4401-D	Omega WT4401-D	Omega Engineering	101105	9/15/2016	9/15/2018

Notes about this calibration

Calibration Result Calibration Successful
Who Calibrated Kevin Cole

Advanced Labs, Inc. hereby certifies that this instrument is calibrated and functions to meet the manufacture's specifications using NIST traceable standards, or is derived from accepted values of physical constants.

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Calibration Certificate

Customer: *GHD Ltd.*

Certificate: C177098-00-01

Unit Identification

Manufacturer: **Dwyer**
Model: **475-0-FM**
Description: **Digital Manometer**
Serial: **NA**
Unit ID: **ITM0003723**

Calibration Date

Calibration Date: **14-Sep-2017**
Due Date: **14-Sep-2018**

Calibration Conditions

Temperature: **21.9°C**
Humidity: **34 %**
Barometric Pressure: **N/A**

General Information

Remark:**N/A**

Standards Used

Unit ID	Manufacturer	Model	Cal Date	Due Date
CAL0224	Fluke	750P01	14-Sep-2017	14-Mar-2018

The calibration was performed using measurement standards traceable to the National Measurement Institute Standards (NMIS) part of the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to accepted instrinsic standards or measurement, or is derived by ratio type self-calibration techniques. Measurement uncertainties given in this report are based on a coverage factor of k=2 corresponding to a confidence level of approximately 95%.

Calibrated by: *A. Atton*

Approved by:

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Fax: (403) 248-5194

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Test Results

Procedure: **Pressure Gauge 10.00 IN.W.C 0.5% FS /750P01** Rev: **1.0**

Data Type: **As Found** Results: **Pass**

Test Description	True Value	Reading	Lower Limit	Upper Limit	Test Status	Exp Uncert
Tolerance used (additive if more than one listed): 0.5% of full scale						
UUT is set to the nominal value, Reading is the actual pressure read by the system instrument.						
1 inH2O		1 inH2O	1 inH2O	1 inH2O	Pass	5.8e+000 inH2O
2 inH2O		2 inH2O	2 inH2O	2 inH2O	Pass	5.8e+000 inH2O
4 inH2O		4 inH2O	4 inH2O	4 inH2O	Pass	5.8e+000 inH2O
6 inH2O		6 inH2O	6 inH2O	6 inH2O	Pass	5.8e+000 inH2O
8 inH2O		8 inH2O	8 inH2O	8 inH2O	Pass	5.8e+000 inH2O
10 inH2O		10 inH2O	10 inH2O	10 inH2O	Pass	5.8e+000 inH2O

NIST Traceable Transfer Standard Calibration

Calibration Date:	05/17/2016		Orifice #	FRM1218-	By:
Ambient Temp, °K:	295.5		Pri Std #	LFE774300	
Amb Press, Atm:	1.0000		Manometer #	FRM1218	Chk:

Std ΔH (inH_2O)	Manometer ΔH (inH_2O)	Actual Flow (alpm)	Calc Flow (alpm)	Difference* (%diff)
6.67	6.67	20.179	20.209	-0.15
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5.10	5.10	17.733	17.727	0.03
4.39	4.39	16.490	16.479	0.07
3.73	3.73	15.233	15.224	0.06
3.12	3.12	13.964	13.962	0.02
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Linear Regression Results:

m_{flo} =	**0.4452**
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r^2 =	**1.0000**

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The actual flow rate is a function of the pressure drop across the device, the ambient temperature, and the ambient pressure. The relationship of these variables and the unique calibration constants ("m" and "b") for each device is presented in the following equation (Eq.A):

$$Q_{act} = m_{flo} \times \sqrt{\frac{\Delta H \times T_{act}}{P_{act}}} + b_{flo}$$

Q_{act} = actual flowrate, liters per min
ΔH = manometer reading, inches of water
T_{act} = ambient temperature, °K
P_{act} = ambient pressure, atmospheres

CAUTION: The weather service, most airports, etc, reduce the atmospheric pressure to a common reference (sea level). The equation above requires the atmospheric pressure at the location where the MiniFlo is being used.

The equation below may be used to estimate the ambient atmospheric pressure at any elevation if the sea level pressure is known.

$$P_{act} = P_{sea} \times \left(1 - \frac{E}{145300}\right)^{5.25}$$

P_{act} = Ambient Atmospheric Pressure
P_{sea} = Sea Level Atmospheric Pressure
E = Site elevation, feet

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1940 Don St., Suite 300
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about GHD

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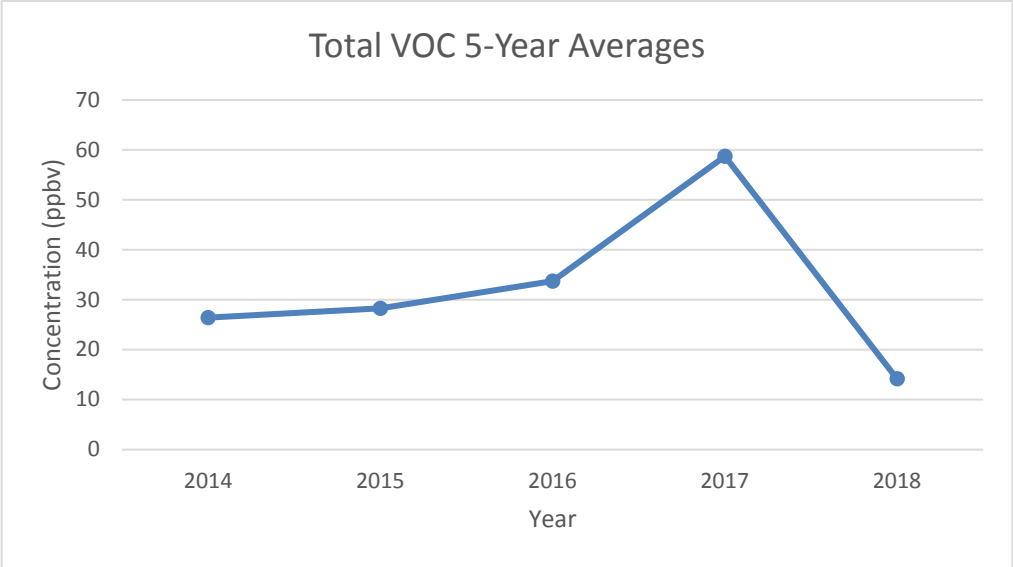
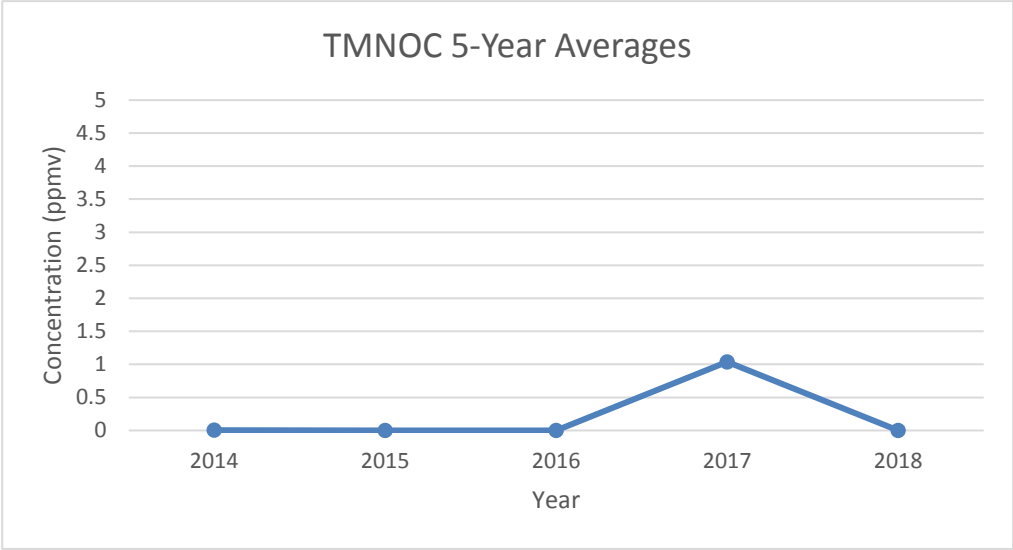
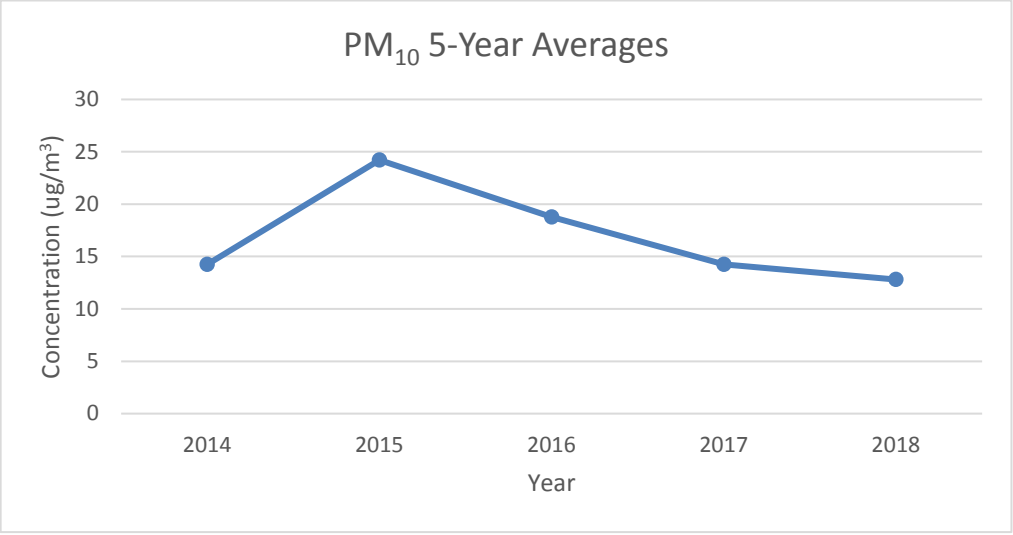
Brandon Lawrence
Brandon.lawrence@ghd.com
403.538.8605

www.ghd.com

Appendix C
5 Year Averages for PM_{10}, VOC and TNMOC Concentrations


Total VOC 5-Year Averages
Concentration (ppbv)
70
60
50
40
30
20
10
0
2014
2015
2016
2017
2018
Year


TMNOC 5-Year Averages
Concentration (ppmv)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
2014
2015
2016
2017
2018
Year


PM10 5-Year Averages
Concentration (ug/m3)
30
25
20
15
10
5
0
2014
2015
2016
2017
2018
Year

about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

Brandon Lawrence
Brandon.lawrence@ghd.com
403.538.8605

www.ghd.com