March 30, 2021

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

RE: Annual Ambient Air Monitoring Report (IAM-00010348-2020)
Calendar year 2020
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 2020 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 2020 calendar year.

During the 2020 calendar year, the meteorological station (AEP Station ID 00010348-C-1) operated at 99.89 percent annual uptime, which is above the 90 percent uptime threshold required by the Air Monitoring Directive, 2016.

Included in this report are the following:

- Summary of the ambient air monitoring program undertaken at the Facility for 2020
- 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 2020 calendar year

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

Yours truly,

CLEAN HARBORS CANADA INC.

Michael E Parker

Vice President
Canadian Environmental Compliance

Alberta Environment and Parks (AEP) 2020 Annual Ambient Air Monitoring Report (IAM-00010348-2020)

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

Clean Harbors
Environmental Services Inc.

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1. Introduction

1.1 Background

GHD Limited (GHD), on behalf of Clean Harbors Canada (Clean Harbors), is presenting to Alberta Environment and Parks (AEP) the Annual Clean Harbors Ambient Air Monitoring Report for the 2020 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.

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Title:	Plant Manager
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Company:	Clean Harbors
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Name:	Mr. Trevor Lewis
Title:	Air Quality Scientist
Company:	GHD Limited
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1.3 Summary of Electronic Transfer System (ETS) Submittals

The “Alberta Environment and Parks (AEP) 2020 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-00010348-2020.pdf, by March 31, 2021.

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. 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 1.4.

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 1.4.2.

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/m^3) 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.

1.4.1.1 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. PM_{10} 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

1.4.1.2 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
1,3,5-Trimethylbenzene	108-67-8	m, p-Xylene	108-38-3/ 106-42-3
1-Butene/Isobutylene	106-98-9	m-Diethylbenzene	141-93-5
1-Hexene/2-Methyl-1-pentene	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 when the particulate weight is greater than 50 mg. The two air monitoring stations are configured 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 2020. 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 2020, the wind station collected 99.89 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 2020, the predominant wind direction is from the Northwest, which is consistent with historical information and data.

The 2020 annual wind rose and frequency distribution chart is presented in Appendix A.

2.1.1 Meteorological Data Verification, Validation and Uptime

In the 2020 calendar year, the meteorological station had an annual uptime of 99.89 percent, above the 90 percent uptime required. The station maintained an uptime above 90 percent for all of the 12-months in the calendar year.

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

In 2020, 30 samples were collected for PM_{10} analysis at 12-day intervals. No samples were discarded during the year.

The PM_{10} samples in 2020 had a minimum concentration of 0.65 $\mu g/m^3$, a maximum concentration of 66.52 $\mu g/m^3$, and an average concentration of 12.66 $\mu g/m^3$. 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 $\mu g/m^3$. Test 747, that occurred on September 18, 2020, required metals analysis due to a PM_{10} result of 66.52 $\mu g/m^3$. Metal results are discussed in Section 2.3. The 2020 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 2020. The quarterly calibration records are included in Appendix B.

2.3 Metal Concentrations

Twenty-nine of the 30 samples collected in 2020 returned concentrations of PM_{10} were below the 50 $\mu g/m^3$ threshold. Test 747, collected on September 18, 2020, returned a PM_{10} concentration of 66.52 $\mu g/m^3$ and required analysis for metal ions. This sample was sent for additional analysis and the results for this test can be found in Table 3 of this report.

AAAQO are specified for arsenic (0.01 $\mu g/m^3$ annual average and 0.1 $\mu g/m^3$ 1-hour average) and chromium (1.00 $\mu g/m^3$ 1-hour average) but there are currently no AAAQO for either substance for a 24-hour averaging period in Alberta. The lab results for sample 747 were the result of a 24-hour sampling period and therefore could not be directly compared to an AAAQO. However, when comparing the 24-hour results for both arsenic and chromium to the hourly AAAQO, both were still below the thresholds.

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

In 2020, 30 samples were collected for VOC and TNMOC analysis at 12-day intervals. All samples were deemed valid.

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 0.18 ppbv.

The 2020 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 2020, 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 2020 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."

Michael E Parker

Vice President/Report Certifier

Canadian Environmental Compliance

Figure

Image Source: © (2020) Google. Image Aquisition Date: 09/17/2019.

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 27, 2020

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
2020
Calendar Year
PM_{10} Analytical 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**		
20/01/10	**726**	9.47	0.25
20/01/22	**727**	7.01	0.17
20/02/03	**728**	7.69	0.20
20/02/15	**729**	4.78	0.12
20/02/27	**730**	8.24	0.20
20/03/10	**731**	10.62	0.26
20/03/22	**732**	5.21	0.13
20/04/03	**733**	6.77	0.17
20/04/15	**734**	20.98	0.51
20/04/27	**735**	8.53	0.20
20/05/09	**736**	6.15	0.15
20/05/21	**737**	0.65	0.02
20/06/02	**738**	15.64	0.36
20/06/14	**739**	7.20	0.16
20/06/26	**740**	18.63	0.42
20/07/08	**741**	7.85	0.18
20/07/20	**742**	19.56	0.44
20/08/01	**743**	21.55	0.49
20/08/13	**744**	13.95	0.32
20/08/25	**745**	13.20	0.30
20/09/06	**746**	11.20	0.26
20/09/18	**747**	66.52	1.53
20/09/30	**748**	42.68	1.02
20/10/12	**749**	10.64	0.25
20/10/24	**750**	9.29	0.24
20/11/05	**751**	7.08	0.17
20/11/17	**752**	9.31	0.23
20/11/29	**753**	8.51	0.21
20/12/11	**754**	10.28	0.26
20/12/23	**755**	4.76	0.12
	Maximum	**66.52**	**1.53**
	Minimum	**0.65**	**0.02**
	Average	**13.13**	**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
2020 Calendar Year
VOC and TNMOC Analytical Results
AEP Station ID 00010348-I-1
Clean Harbors Canada, Inc.

Parameter	Units	Test ID AAAQO[1][2]	Date 1/10/2020	1/22/2020	2/3/2020	2/15/2020	2/27/2020	3/10/2020	3/22/2020	4/3/2020	4/15/2020	4/27/2020	5/9/2020	5/21/2020	6/2/2020	6/14/2020	6/26/2020	7/8/2020	7/20/2020	8/1/2020	8/13/2020
			Test ID 726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744
1,2,3-Trimethylbenzene	ppbv	-	< 0.07	0.13	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.09	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.09	< 0.08	< 0.14
1,2,4-Trimethylbenzene	ppbv	-	< 0.07	0.19	0.32	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.09	< 0.08	< 0.08	< 0.08	< 0.08	0.20	< 0.08	< 0.09	< 0.08	< 0.14
1,3,5-Trimethylbenzene	ppbv	-	< 0.03	< 0.03	0.17	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.25	< 0.03	< 0.03	< 0.03	< 0.06
1-Butene/Isobutylene	ppbv	-	< 0.03	0.07	0.09	< 0.03	0.04	0.05	0.13	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.06
1-Hexene/2-Methyl-1-pentene	ppbv	-	< 0.03	0.22	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.06
1-Pentene	ppbv	-	< 0.01	0.12	0.10	< 0.02	0.05	0.10	0.10	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.22	< 0.02	< 0.03
2,2,4-Trimethylpentane	ppbv	-	< 0.01	0.29	0.12	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.04	< 0.02	< 0.02	0.40	< 0.03
2,2-Dimethylbutane	ppbv	-	0.04	0.06	0.09	0.02	0.05	0.02	0.09	0.52	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.03
2,3,4-Trimethylpentane	ppbv	-	0.07	0.12	0.09	0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.04	< 0.02	0.10	0.10	< 0.03
2,3-Dimethylbutane	ppbv	-	0.11	0.21	0.18	0.05	0.13	0.17	0.14	0.75	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.12	0.12	0.18	0.15	0.11
2,3-Dimethylpentane	ppbv	-	0.07	0.23	0.09	0.06	< 0.03	0.08	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.07	0.05	< 0.06
2,4-Dimethylpentane	ppbv	-	0.07	0.14	0.09	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.06	< 0.03
2-Methylheptane	ppbv	-	0.04	0.14	0.11	0.05	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.03
2-Methylhexane	ppbv	-	0.1	0.24	0.12	0.09	0.05	0.11	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.07	0.06	< 0.03
2-Methylpentane	ppbv	-	0.24	0.7	0.63	0.23	0.55	0.08	< 0.02	0.75	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.15	< 0.02	0.20	0.31	0.17
3-Methylheptane	ppbv	-	< 0.03	0.07	0.09	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.06	< 0.03	< 0.03	0.08	< 0.06
3-Methylhexane	ppbv	-	0.07	0.23	0.15	0.07	0.06	0.08	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.03	< 0.03	0.08	0.09	< 0.06
3-Methylpentane	ppbv	-	0.16	0.42	0.21	0.15	0.13	0.10	0.12	0.16	0.10	< 0.02	< 0.02	< 0.02	< 0.02	0.18	0.05	0.13	0.15	0.74	0.12
Benzene	ppbv	0.9	0.18	0.59	0.26	0.12	0.25	0.13	0.14	0.16	0.10	< 0.02	< 0.02	0.10	< 0.02	< 0.02	0.08	< 0.02	0.18	0.15	0.13
cis-2-Butene	ppbv	-	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.05	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.06
cis-2-Pentene	ppbv	-	< 0.03	0.12	< 0.03	< 0.03	0.04	0.06	0.09	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.06
Cyclohexane	ppbv	-	0.22	0.43	0.23	0.14	0.13	0.18	0.19	0.40	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.07	< 0.03	0.18	0.21	< 0.06
Cyclopentane	ppbv	-	0.1	0.2	0.21	0.06	0.15	0.12	0.19	0.30	0.12	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.24	< 0.02	0.08	0.21	< 0.03
Ethylbenzene	ppbv	-	< 0.01	0.28	0.29	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.13	< 0.03
Isobutane	ppbv	-	1.36	1.88	2.10	0.76	1.60	1.28	1.49	3.42	1.02	< 0.03	0.06	< 0.03	0.85	0.83	0.65	0.45	0.49	0.90	0.35
Isopentane	ppbv	-	1.19	2.87	2.05	0.64	1.13	1.05	1.11	4.06	0.43	< 0.05	< 0.05	< 0.05	0.34	0.34	0.15	0.16	0.28	0.47	0.11
Isoprene	ppbv	-	< 0.01	0.09	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.21	0.21	0.19	0.59	0.76	0.23
Isopropylbenzene	ppbv	-	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.04	< 0.02	< 0.02	0.05	< 0.03
m,p-Xylene	ppbv	161	< 0.04	0.62	0.71	0.22	< 0.05	0.36	< 0.05	< 0.05	0.46	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.25	< 0.05	< 0.05	0.22	< 0.09
m-Diethylbenzene	ppbv	-	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06	< 0.06	< 0.07	< 0.06	< 0.07	< 0.07	< 0.07	< 0.06	< 0.07	< 0.07	< 0.06	< 0.12
Methylcyclohexane	ppbv	-	< 0.12	< 0.13	0.20	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.14	< 0.13	< 0.14	< 0.13	< 0.14	< 0.13	< 0.13	< 0.14	< 0.13	< 0.23
Methylcyclopentane	ppbv	-	0.15	0.42	0.15	0.13	0.09	< 0.02	< 0.02	0.22	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.06	< 0.02	0.09	0.08	< 0.03
m-Ethyltoluene	ppbv	-	0.1	0.35	0.19	0.17	0.09	0.10	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.04	< 0.03	0.15	0.83	< 0.06
n-Butane	ppbv	-	2.22	4.77	3.60	1.19	3.09	2.11	1.83	1.14	0.80	0.05	0.39	< 0.05	0.80	1.02	0.66	0.57	0.42	1.30	0.49
n-Decane	ppbv	-	< 0.09	0.2	0.19	0.13	< 0.09	< 0.09	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.12	< 0.10	< 0.17
n-Dodecane	ppbv	-	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.7	< 0.6	< 0.6	< 0.7	< 0.6	< 0.7	< 0.7	< 0.7	< 0.6	< 0.7	< 0.7	< 0.6	< 1.2
n-Heptane	ppbv	-	0.23	0.5	0.27	0.06	0.13	0.19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.11	< 0.02	0.19	0.17	< 0.03
n-Hexane	ppbv	1990	0.21	0.73	0.21	0.60	0.08	0.23	0.23	0.15	0.21	< 0.02	0.59	< 0.02	< 0.02	< 0.02	0.09	0.20	0.47	3.89	0.10
n-Nonane	ppbv	-	0.03	0.13	0.15	0.05	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.07	< 0.02	0.10	0.08	< 0.03
n-Octane	ppbv	-	0.08	0.23	0.14	0.06	< 0.03	0.13	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.07	< 0.03	0.11	0.09	< 0.06
n-Pentane	ppbv	-	1.1	2.2	1.60	0.6	1.10	1.00	1.10	0.5	0.4	< 0.2	< 0.2	< 0.2	< 0.2	0.30	< 0.2	< 0.2	0.4	0.40	< 0.3
n-Propylbenzene	ppbv	-	< 0.07	0.14	0.16	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.09	< 0.08	< 0.08	< 0.08	< 0.08	0.09	< 0.08	< 0.09	< 0.08	< 0.14
n-Undecane	ppbv	-	< 0.7	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.9	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.9	< 0.8	< 1.4
o-Ethyltoluene	ppbv	-	< 0.01	0.11	0.13	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.08	< 0.02	< 0.02	< 0.02	< 0.03
o-Xylene	ppbv	161	< 0.01	0.21	0.30	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.13	< 0.02	< 0.02	0.13	< 0.03
p-Ethyltoluene	ppbv	-	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06	< 0.06	< 0.07	< 0.06	< 0.07	< 0.07	< 0.07	< 0.06	< 0.07	< 0.07	< 0.06	< 0.12
Styrene	ppbv	-	< 0.10	< 0.11	0.15	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.12	< 0.11	< 0.12	< 0.12	< 0.12	0.15	< 0.11	< 0.12	< 0.11	< 0.20
Toluene	ppbv	106	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06	< 0.06	< 0.07	< 0.06	< 0.07	< 0.07	< 0.07	< 0.06	< 0.07	< 0.07	0.18	< 0.12
trans-2-Butene	ppbv	-	0.37	1.26	0.61	0.21	0.17	0.19	0.15	< 0.02	0.93	< 0.02	0.67	< 0.02	< 0.02	< 0.02	0.33	0.22	0.22	0.34	0.11
trans-2-Pentene	ppbv	-	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.03
p-Diethylbenzene	ppbv	-	< 0.03	0.16	< 0.03	< 0.03	< 0.03	0.05	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.06
Total Non-Methane Organic Compounds	ppmv	-	< 0.07	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.09	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.09	0.08	< 0.08
Total VOCs	ppbv	-	10.84	23.99	18.39	8.33	11.74	10.50	10.01	15.37	7.46	3.65	3.25	3.50	5.37	6.03	6.92	5.30	7.92	15.01	7.49

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 equal to the lab dection limit, as required by the AMD

Table 2
2020 Calendar Year
VOC and TNMOC Analytical Results
AEP Station ID 00010348-I-1
Clean Harbors Canada, Inc.

Parameter	Units	Date	8/25/2020	9/6/2020	9/18/2020	9/30/2020	10/12/2020	10/24/2020	11/5/2020	11/17/2020	11/29/2020	12/11/2020	12/23/2020	Maximum	Minimum [3]	Average [4]	Mean	% of AAAQO
		Test ID	745	746	747	748	749	750	751	752	753	754	755					
		AAAQO[1][2]																
1,2,3-Trimethylbenzene	ppbv	-	0.15	< 0.08	< 0.08	< 0.08	0.17	0.11	0.14	< 0.08	< 0.08	< 0.08	< 0.06	0.17	0.06	0.09	0.08	
1,2,4-Trimethylbenzene	ppbv	-	0.24	< 0.08	< 0.08	0.31	0.60	0.23	0.31	< 0.08	< 0.08	< 0.08	< 0.06	0.60	0.06	0.14	0.09	
1,3,5-Trimethylbenzene	ppbv	-	0.29	< 0.03	< 0.03	< 0.03	0.37	0.14	0.14	< 0.03	< 0.03	< 0.03	< 0.02	0.37	0.02	0.07	0.03	
1-Butene/Isobutylene	ppbv	-	< 0.04	0.35	0.23	0.13	0.07	0.13	0.39	0.40	0.44	0.74	0.53	0.74	0.03	0.14	0.07	
1-Hexene/2-Methyl-1-pentene	ppbv	-	< 0.04	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.02	0.22	0.02	0.04	0.03	
1-Pentene	ppbv	-	0.10	0.59	0.08	0.18	0.25	0.15	0.28	0.14	< 0.02	0.19	< 0.01	0.59	0.01	0.10	0.10	
2,2,4-Trimethylpentane	ppbv	-	0.10	< 0.02	< 0.02	0.10	0.12	0.11	0.26	< 0.02	0.14	0.15	< 0.01	0.40	0.01	0.07	0.07	
2,2-Dimethylbutane	ppbv	-	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.05	0.11	0.12	< 0.02	0.62	< 0.01	0.62	0.01	0.07	0.03	
2,3,4-Trimethylpentane	ppbv	-	0.10	< 0.02	< 0.02	< 0.02	< 0.02	0.13	0.14	< 0.02	< 0.02	< 0.02	< 0.01	0.14	0.01	0.04	0.02	
2,3-Dimethylbutane	ppbv	-	0.16	< 0.03	0.15	0.21	0.15	0.17	0.21	< 0.03	< 0.03	3.27	< 0.02	3.27	0.02	0.23	0.15	
2,3-Dimethylpentane	ppbv	-	0.11	< 0.03	0.10	0.08	0.07	0.07	0.18	< 0.03	< 0.03	< 0.03	< 0.02	0.23	0.02	0.06	0.07	
2,4-Dimethylpentane	ppbv	-	0.16	0.10	< 0.02	0.08	0.07	0.03	0.08	< 0.02	< 0.02	< 0.02	< 0.01	0.16	0.01	0.04	0.03	
2-Methylheptane	ppbv	-	0.08	< 0.02	< 0.02	< 0.02	0.12	0.17	0.22	< 0.02	< 0.02	< 0.02	< 0.01	0.22	0.01	0.05	0.02	
2-Methylhexane	ppbv	-	0.08	< 0.02	0.10	0.10	0.10	0.14	0.18	< 0.02	< 0.02	< 0.02	< 0.01	0.24	0.01	0.06	0.08	
2-Methylpentane	ppbv	-	0.23	< 0.02	0.16	0.13	0.17	0.31	0.21	0.22	< 0.02	0.52	< 0.01	0.75	0.01	0.21	0.19	
3-Methylheptane	ppbv	-	0.09	0.62	< 0.03	0.10	0.13	0.14	0.14	< 0.03	< 0.03	< 0.03	< 0.02	0.62	0.02	0.07	0.06	
3-Methylhexane	ppbv	-	0.19	0.19	0.12	0.16	0.15	0.19	0.23	< 0.03	0.16	< 0.03	< 0.02	0.23	0.02	0.09	0.09	
3-Methylpentane	ppbv	-	0.20	< 0.02	0.14	0.25	0.17	0.26	0.16	0.15	0.15	0.20	< 0.01	0.74	0.01	0.16	0.15	
Benzene	ppbv	0.9	0.31	< 0.02	0.23	0.10	0.15	0.40	0.45	0.24	0.23	0.46	< 0.01	0.59	0.01	0.18	0.16	19.81%
cis-2-Butene	ppbv	-	< 0.04	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.11	< 0.03	< 0.03	< 0.03	< 0.02	0.11	0.02	0.03	0.03	
cis-2-Pentene	ppbv	-	< 0.04	< 0.03	0.29	< 0.03	< 0.03	< 0.03	0.13	< 0.03	< 0.03	< 0.03	< 0.02	0.29	0.02	0.05	0.03	
Cyclohexane	ppbv	-	0.57	0.73	0.24	0.18	0.18	0.24	0.20	< 0.03	< 0.03	< 0.03	< 0.02	0.73	0.02	0.17	0.18	
Cyclopentane	ppbv	-	0.13	0.37	0.13	0.13	0.07	0.12	0.08	< 0.02	< 0.02	82.70	< 0.01	82.70	0.01	2.86	0.13	
Ethylbenzene	ppbv	-	0.41	0.92	< 0.02	0.27	0.36	0.36	0.48	< 0.02	< 0.02	< 0.02	< 0.01	0.92	0.01	0.13	0.03	
Isobutane	ppbv	-	0.91	1.15	1.67	0.85	0.82	1.05	1.50	1.57	1.46	1.54	2.11	3.42	0.03	1.18	1.15	
Isopentane	ppbv	-	0.89	< 0.05	1.15	0.74	0.67	0.97	1.24	1.31	1.09	11.70	1.22	11.70	0.05	1.25	0.97	
Isoprene	ppbv	-	0.27	< 0.02	0.34	0.16	0.16	< 0.01	0.12	< 0.02	< 0.02	< 0.02	< 0.01	0.76	0.01	0.12	0.12	
Isopropylbenzene	ppbv	-	0.12	< 0.02	< 0.02	< 0.02	0.11	0.05	0.11	< 0.02	< 0.02	< 0.02	< 0.01	0.12	0.01	0.03	0.02	
m,p-Xylene	ppbv	161	0.97	3.32	< 0.05	0.48	0.99	1.30	1.47	< 0.05	< 0.05	0.35	< 0.04	3.32	0.04	0.42	0.35	2.06%
m-Diethylbenzene	ppbv	-	0.15	< 0.06	< 0.07	< 0.07	0.15	0.12	0.17	< 0.07	< 0.06	< 0.06	< 0.05	0.17	0.05	0.08	0.07	
Methylcyclohexane	ppbv	-	0.20	< 0.12	< 0.13	0.15	0.32	0.15	0.22	< 0.13	< 0.13	< 0.12	< 0.10	0.32	0.10	0.15	0.13	
Methylcyclopentane	ppbv	-	0.17	0.44	0.11	0.12	0.09	0.25	0.23	< 0.02	0.16	< 0.02	0.11	0.44	0.02	0.11	0.11	
m-Ethyltoluene	ppbv	-	0.09	0.15	0.13	0.23	0.13	0.19	0.14	0.18	0.16	0.24	< 0.02	0.83	0.02	0.13	0.13	
n-Butane	ppbv	-	1.45	0.50	1.48	0.64	1.13	0.94	1.17	1.88	1.75	2.06	3.07	4.77	0.05	1.45	1.19	
n-Decane	ppbv	-	0.27	< 0.09	0.11	0.13	0.22	0.14	0.32	< 0.10	< 0.09	< 0.09	< 0.07	0.32	0.07	0.13	0.11	
n-Dodecane	ppbv	-	< 0.7	< 0.6	< 0.7	< 0.7	< 0.6	< 0.6	< 0.7	< 0.7	< 0.6	< 0.6	< 0.5	1.20	0.50	0.66	0.60	
n-Heptane	ppbv	-	0.31	0.38	0.19	0.19	0.19	0.31	0.31	< 0.02	0.34	< 0.02	< 0.01	0.50	0.01	0.14	0.19	
n-Hexane	ppbv	1990	0.22	0.30	0.34	0.39	0.45	0.67	0.31	0.36	0.39	0.63	0.31	3.89	0.02	0.41	0.30	0.20%
n-Nonane	ppbv	-	0.13	0.21	< 0.02	0.16	0.21	0.15	0.29	< 0.02	< 0.02	< 0.02	< 0.01	0.29	0.01	0.07	0.07	
n-Octane	ppbv	-	0.16	0.24	0.13	0.12	0.13	0.20	0.24	< 0.03	< 0.03	< 0.03	< 0.02	0.24	0.02	0.09	0.10	
n-Pentane	ppbv	-	0.70	0.50	0.80	0.50	0.60	0.90	0.80	1.2	0.80	5.40	1.10	5.40	0.20	0.85	0.80	
n-Propylbenzene	ppbv	-	0.16	< 0.08	< 0.08	< 0.08	0.18	0.10	0.16	< 0.08	< 0.08	< 0.08	< 0.06	0.18	0.06	0.10	0.08	
n-Undecane	ppbv	-	< 0.9	< 0.8	< 0.8	< 0.8	< 0.8	< 0.7	< 0.8	< 0.8	< 0.8	< 0.8	< 0.6	1.40	0.60	0.82	0.80	
o-Ethyltoluene	ppbv	-	0.17	< 0.02	< 0.02	0.15	0.21	0.10	0.13	< 0.02	< 0.02	< 0.02	< 0.01	0.21	0.01	0.05	0.02	
o-Xylene	ppbv	161	0.45	0.87	< 0.02	0.26	0.44	0.39	0.52	< 0.02	0.26	< 0.02	< 0.01	0.87	0.01	0.14	0.13	0.54%
p-Ethyltoluene	ppbv	-	< 0.07	< 0.06	< 0.07	< 0.07	0.47	< 0.06	0.40	< 0.07	< 0.06	< 0.06	< 0.05	0.47	0.05	0.09	0.07	
Styrene	ppbv	-	0.23	< 0.11	< 0.12	0.21	0.23	< 0.10	< 0.12	< 0.12	< 0.11	< 0.11	< 0.08	0.23	0.08	0.13	0.12	
Toluene	ppbv	106	0.37	0.45	< 0.07	0.34	0.19	0.24	< 0.07	< 0.07	< 0.06	< 0.06	< 0.05	0.45	0.05	0.11	0.07	0.42%
trans-2-Butene	ppbv	-	2.92	6.73	0.33	0.90	0.86	1.38	4.80	0.30	0.27	0.30	0.16	6.73	0.02	0.83	0.33	
trans-2-Pentene	ppbv	-	< 0.02	< 0.02	< 0.02	< 0.02	0.06	< 0.01	0.13	< 0.02	< 0.02	0.06	< 0.01	0.13	0.01	0.03	0.02	
p-Diethylbenzene	ppbv	-	< 0.04	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.02	0.16	0.02	0.04	0.03	
Total Non-Methane Organic Compounds	ppmv	-	< 0.09	< 0.08	< 0.08	< 0.08	< 0.08	< 0.07	< 0.08	< 0.08	< 0.08	< 0.08	< 0.06	0.09	0.06	0.08	0.08	
Total VOCs	ppbv	-	16.92	21.69	11.37	11.28	14.04	14.85	21.36	11.05	10.58	113.81	10.76	113.81	3.25	14.63	10.84	

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 equal to the lab dection limit, as required by the AMD

TABLE 3

Metals Analytical Results
AEP Station ID 00010348-I-1
Clean Harbors Canada, Inc.
Annual Ambient Air Monitoring Report
2020 Metal Analysis Results

Parameter	Date / Sample ID / Lab Results [1]		18-Sep-20 / 747 / (ug/m^3)	AAAQO[2] (ug/m^3)
Antimony	4.60	ng/Filter	2.00E-04	-
Arsenic	13.20	ng/Filter	5.74E-04	0.01 (Annual Average)
Barium	614.00	ng/Filter	2.67E-02	-
Beryllium	1.20	ng/Filter	5.22E-05	-
Boron	152.00	ng/Filter	6.61E-03	-
Cadmium	1.06	ng/Filter	4.61E-05	-
Chromium	44.00	ng/Filter	1.91E-03	1.00 (1-Hour Average)
Cobalt	10.00	ng/Filter	4.35E-04	-
Copper	30.00	ng/Filter	1.30E-03	-
Ammonium	11.20	ug/Filter	4.87E-01	-
Chloride	0.84	ug/Filter	3.67E-02	-
Nitrate	19.20	ug/Filter	8.35E-01	-
Sulfate	29.60	ug/Filter	1.29E+00	-
Iron	43,100.00	ng/Filter	1.87E+00	-
Lead	25.40	ng/Filter	1.10E-03	-
Magnesium	15.20	ug/Filter	6.61E-01	-
Mercury	0.01	ng/Filter	6.09E-07	-
Nickel	25.90	ng/Filter	1.13E-03	-
Selenium	12.00	ng/Filter	5.22E-04	-
Silver	0.40	ng/Filter	1.74E-05	-
Thallium	0.64	ng/Filter	2.78E-05	-
Tin	2.30	ng/Filter	1.00E-04	-
Uranium	2.04	ng/Filter	8.87E-05	-
Vanadium	73.60	ng/Filter	3.20E-03	-
Calcium	63.30	ug/Filter	2.75E+00	-
Magnesium	12.50	ug/Filter	5.43E-01	-
Potassium	6.16	ug/Filter	2.68E-01	-
Sodium	2.25	ug/Filter	9.78E-02	-
Zinc	221.00	ng/Filter	9.61E-03	-
Zirconium	54.30	ng/Filter	2.36E-03	-

Sampling Time (hours)	24
Flow Rate (l/min)	16.7
Volume Sampled (m^3)	23

Notes:
(1) These results are from a 24 hour averaging period that took place on September 18, 2020.
(2) Alberta Ambient Air Quality Objectives

Table 4

2020 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	100.0%
February	696	696	100.0%
March	744	742	99.7%
April	720	720	100.0%
May	744	744	100.0%
June	720	717	99.6%
July	744	741	99.6%
August	744	743	99.9%
September	720	720	100.0%
October	744	744	100.0%
November	720	719	99.9%
December	744	744	100.0%
Total	8784	8774	99.89%

Note:

The meteorlogical station monitors wind speed and direction.

Appendices

Appendix A
Annual Frequency Distribution Chart and Wind Rose

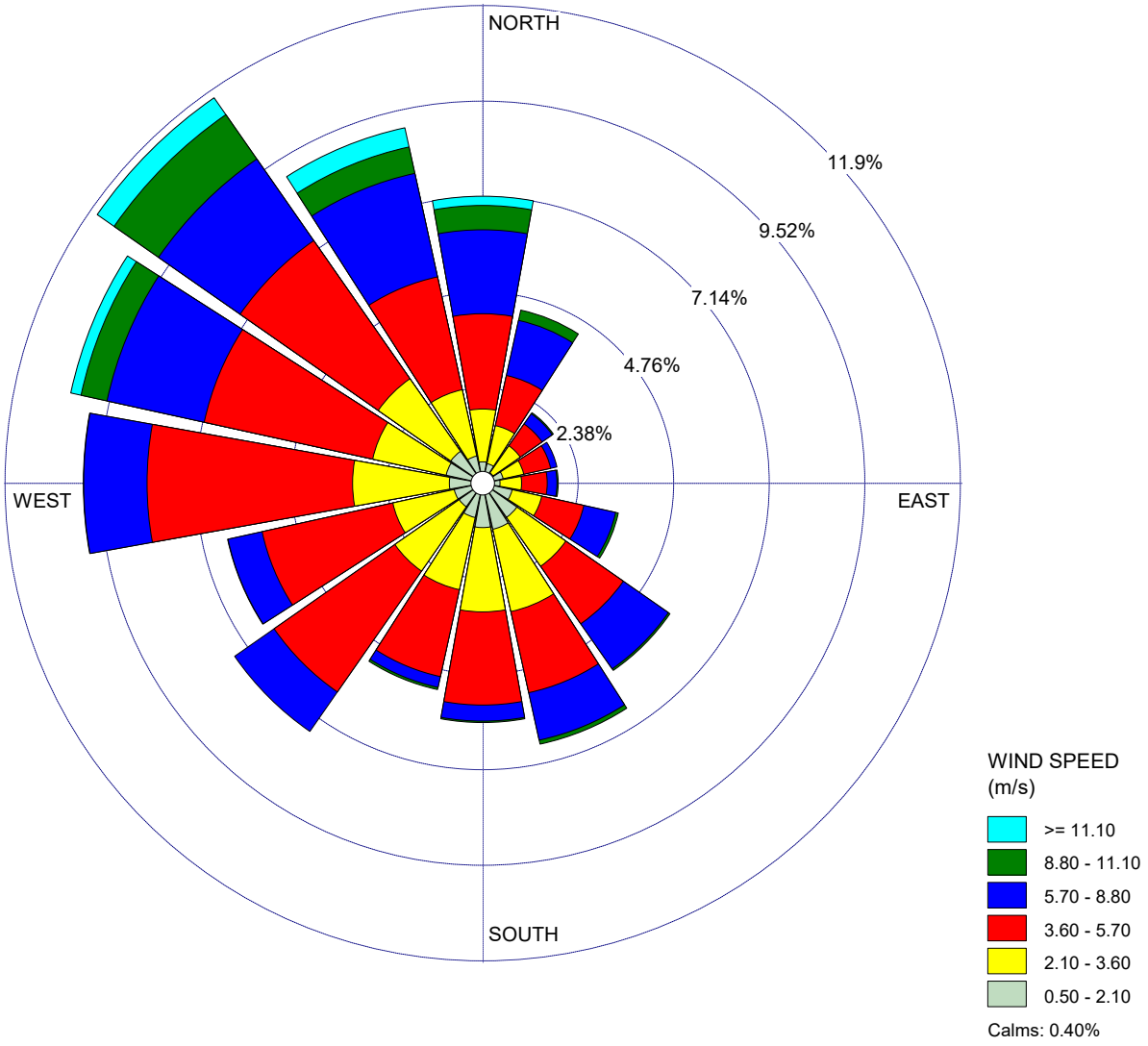
Frequency Distribution Report: Ryley, Alberta - 2020 Summary									
Direction	Angle	Wind Speed (m/s) and Number of Occurences						%	Total Occurrences by Direction
		< 0.5	0.5 to < 1.5	1.5 to < 2.5	2.5 to < 3.5	3.5 to < 4.5	>= 4.5		
North	> 337.5 - 22.5	3	43	104	158	197	757	14.4%	1262
Northeast	> 22.5 - 67.5	4	39	83	87	61	153	4.9%	427
East	> 67.5 - 112.5	2	42	87	57	56	125	4.2%	369
Southeast	> 112.5 - 157.5	7	84	156	178	156	413	11.3%	994
South	> 157.5 - 202.5	8	74	205	249	247	307	12.4%	1090
Southwest	> 202.5 - 247.5	3	54	135	220	290	431	12.9%	1133
West	> 247.5 - 292.5	6	58	164	256	355	745	18.1%	1584
Northwest	> 292.5 - 337.5	2	69	170	246	366	1062	21.8%	1915
Missing/Invalid Hours								0.01%	1
Total Occurences by Speed		35	463	1104	1451	1728	3993		**8775**
Occurences by %		0.4%	5.3%	12.6%	16.5%	19.7%	45.5%	**100.00%**	

WIND ROSE PLOT:

Wind Rose - 2020, Annual
Clean Harbors, Ryley, Alberta

DISPLAY:

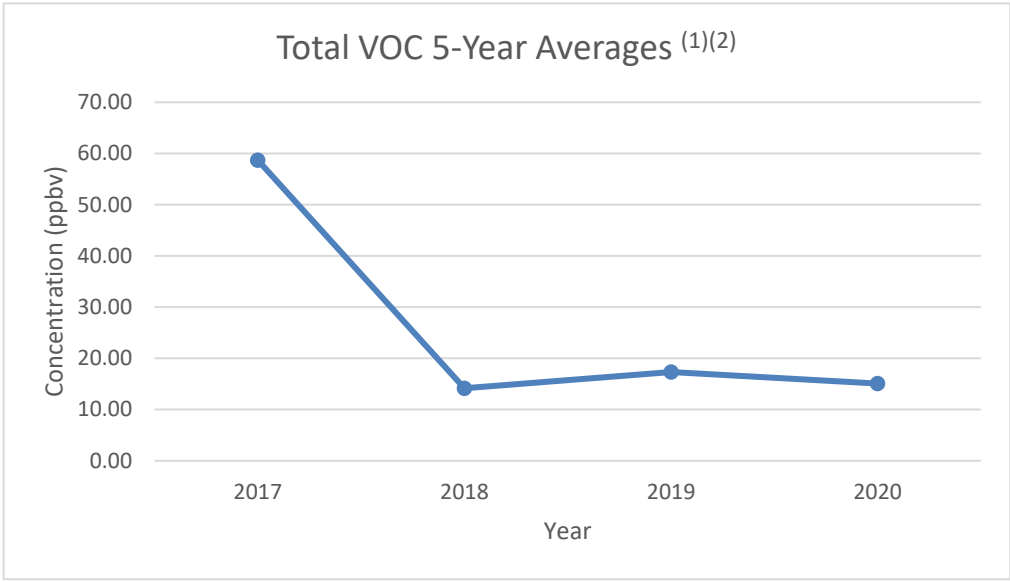
Wind Speed
Direction (blowing from)

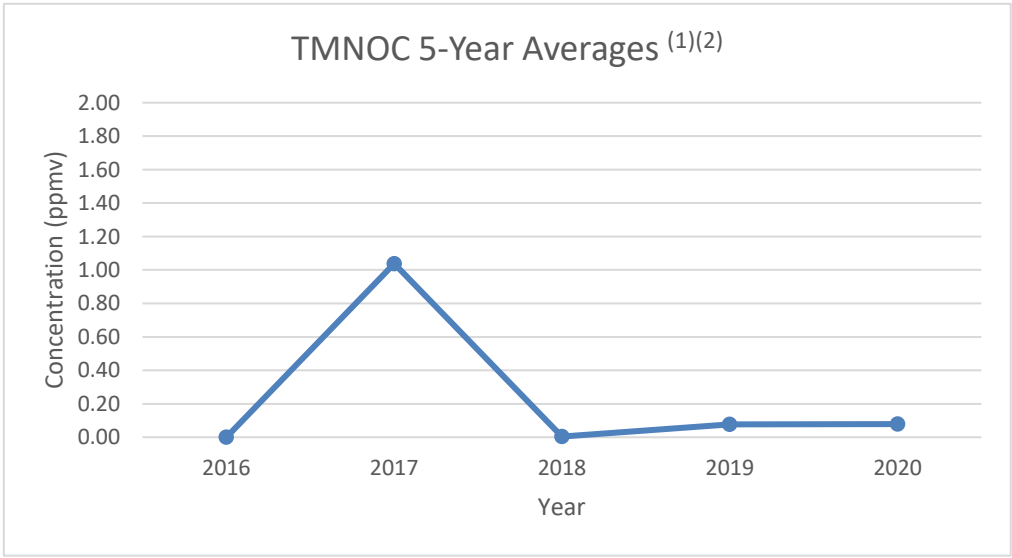


COMMENTS: Source: Clean Harbors (Ryley) on-site meteorological station.	DATA PERIOD: **Start Date: 1/1/2020 - 00:00** **End Date: 12/31/2020 - 23:00**	COMPANY NAME: **Clean Harbors**	
		MODELER: **GHD**	
	CALM WINDS: **0.40%**	TOTAL COUNT: **8774 hrs.**	
	AVG. WIND SPEED: **4.50 m/s**	DATE: **3/3/2021**	PROJECT NO.: **11114644-007-03**

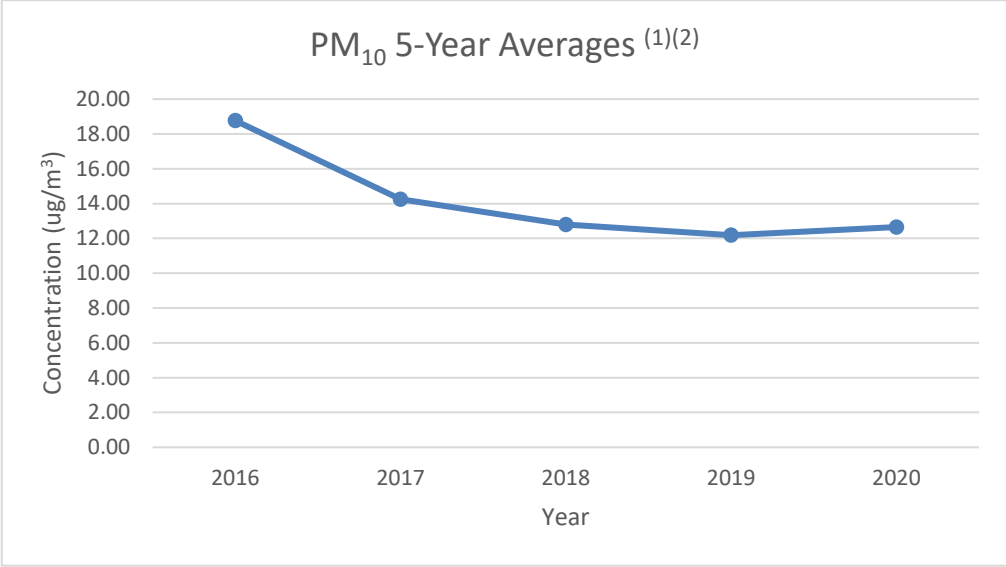
Appendix B
Quarterly Calibration Records for Partisol

Appendix B
5 Year Average Charts



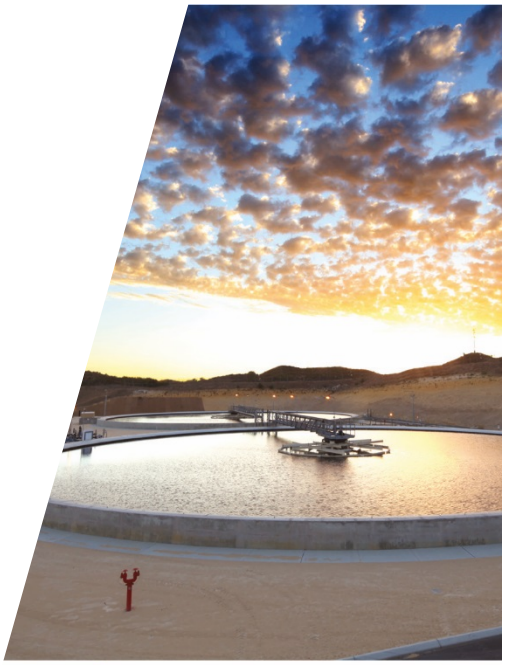


Appendix B
5 Year Average Charts



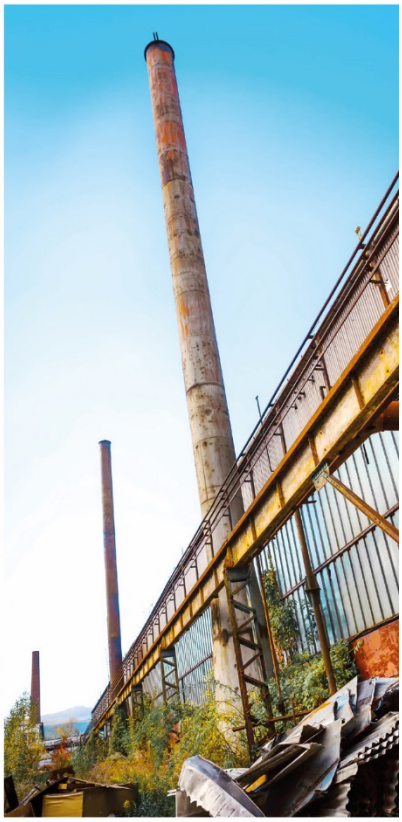
Notes:
(1) All values under the lab method detection limit from 2015-2018 were reported as zero, as per the AMD.
(2) Values under the lab method detection limit from 2019 onward were reported as the lab detection limit, as per updated guidance provided by the AEP.

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



Quarterly Audit Partisol FRM Model 2000

Clean Harbors
50114 Range Rd. 173
Ryley, Alberta T0B 4A0
Quarterly Audit Date: March 24, 2020



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 March 24, 2020. The Quarterly Audit was conducted on the Partisol FRM 2000 Particulate Matter less than 10 microns (PM_{10}) Sampler (Partisol Sampler), located on the roof of the Ryley Lift Station (AEP Station ID 00010348-I-1), which is 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, 2016 (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 (AEP Station ID 00010348-I-1)

The siting location of the Partisol Sampler meets the requirements of Chapter 3, 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 (AEP Station ID 00010348-I-1)

The pressure and temperature audit results of the Partisol Sampler meet the requirements of Chapter 4, 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)	0.8	0.78	0.02	±2°C	Pass
Barometric Pressure (mmHg)	700	701.2	1.2	±10 mmHg	Pass
Filter Temperature (°C)	5.1	5.2	0.1	±2°C	Pass
Flow	16.7 L/min	16.6 L/min	0.1 L/min	±1.0 L/min	Pass

3.3 Leak Check Results (AEP Station ID 00010348-I-1)

3.3.1 Automatic Leak Check

The Partisol firmware performs leak checks in automatic mode and indicates either a "pass" or "fail" based on a pressure drop threshold of 127 mmHg per minute. The Partisol Sampler passed the requirements outlined in the service manual with a pressure drop of 8 mmHg per minute during the audit.

3.3.2 External Manual Leak Check

GHD also performs an external manual leak check on the Partisol Sampler as part of the quarterly audit. The external manual leak check measures the pressure drop on a vacuum gauge located on

the sampler. The pressure drop may not exceed more than 8.5 inHg (216 mmHg) over a 30-second span. The Partisol Sampler passed the requirements of the service manual with a pressure drop of 0.5 inHg in a 30-second span.

3.4 Flow Audit (AEP Station ID 00010348-I-1)

The flow audit results of the Partisol Sampler meet the requirements of Chapter 4 of the AMD, refer to Table 3.2.

3.5 Instrument Condition and Recommendations (AEP Station ID 00010348-I-1)

The Partisol Sampler was visually and functionally inspected on the audit day. Audit recommendations and instrument conditions 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	24/03/2020	Weather Cond.:	Sunny/Calm
Owner	Clean Harbors	Start Time:	12:00
Station Name	Ryley Lift Station	End Time:	12:45
Parameter	PM_{10}	Performed By:	Trevor Lewis

Partisol FRM Model 2000 Identification		**Sampler Data**	
Make/Model:	R & P Partisol FRM 2000	Temperature:	0.8 °C
Unit ID:	Ryley Lift Station	Pressure:	700 mmHg
S/N:	200FB209860905	Flow Set Point:	16.7 L/min

GHD Reference Standards

	Flow	Pressure	Temperature	Manometer
Make:	AirMetrics	TSI	Fluke	Dwyer
Model:	FRM	9565-P	1551A EX	Series 475
Serial Number:	FRM1218	9565P1324039	3520009	MAN-CAL-001
Calibration Date:	5/17/2016	8/13/2019	10/8/2019	10/8/2019

Audit Data

	Sampler Data	Reference Data	Difference	Pass/Fail	Units
Ambient Temperature (+/- 2 °C)	0.8	0.78	0.80	Pass	°C
Barometric Pressure (+/- 10 mmHg)	700	701.2	700.00	Pass	mmHg
Filter Temperature (+/- 2 °C)	5.1	5.2	5.10	Pass	°C
Flow (+/- 1.0 Litres/min)	16.7	16.6	16.70	Pass	Litres/min

Leak Check

Manual Check (-8.5 inHg)

Initial Pressure	Final Pressure	Pressure Drop	Pass/Fail	Units
19.00	18.50	0.50	Pass	inHG

Automatic Check (-127 mmHg)

Leak check was performed in automatic mode, sampler indicated:	8 mmHg/min	Pass	mmHg/min

As Found/As Left	**Yes/No**	**As Found**	**As Left**	**Pass/Fail**
Did the ambient temperature require adjustment?	No	0.8	0.8	Pass
Did the barometric pressure require adjustment?	No	700	700	Pass
Did the filter temperature require adjustment?	No	5.1	5.1	Pass
Did the flow audit require adjustment?	No	16.7	16.7	Pass

Comments

Partisol sampler was moderately dirty, GHD cleaned the components of the sampling inlet, inside the cabinet, all filters and wiped down all seals.

Flow Equation

Set Point (lpm)	Actual Flow *(Qact)* (lpm)	Absolute Difference (lpm)	Pass/Fail (± 1 lpm)
16.7	16.6	0.1	Pass

Manometer *(DH)*	4.51	"H2O	
Actual Temp *(Tact)*	274.15	°K	1.0°C
Actual Pres *(Pact)*	0.935	bar	
Actual Pres *(Pact)*	27.61	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.

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

MONTRÉAL
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: C299060-00-02

Unit Identification

Manufacturer: **Fluke**
Model: **1551A Ex**
Description: **Stik Thermometer**
Serial: **3520009**
Unit ID: **THM-CAL-001**

Calibration Date

Calibration Date: **8-Oct-2019**
Due Date: **8-Oct-2020**

Calibration Conditions

Temperature: **22.1°C**
Humidity: **26 %**
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	4-Jun-2018	4-Jun-2021
CAL0124	Hart Scientific	1502A	11-Apr-2019	11-Apr-2020
CAL0223	Ametek	RTC-158B	2-Apr-2019	2-Oct-2020

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
-0.058 °C		-0.08 °C	-0.11 °C	-0.01 °C	Pass	8.3e-003 °C
25.024 °C		24.98 °C	24.97 °C	25.07 °C	Pass	8.8e-003 °C
100.289 °C		100.26 °C	100.24 °C	100.34 °C	Pass	1.0e-002 °C
150.471 °C		150.45 °C	150.42 °C	150.52 °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

32370

ENVIRONMENT CONDITIONS		
TEMPERATURE	73.3 (22.9)	°F (°C)
RELATIVE HUMIDITY	46	%RH
BAROMETRIC PRESSURE	28.97 (981.0)	inHg (hPa)

MODEL	9565-P
SERIAL NUMBER	9565P1531019

☒ 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	72.2 (22.3)	72.2 (22.3)	70.2~74.2 (21.2~23.4)				

DIFFERENTIAL PRESSURE *Unit: inH_2O (Pa)*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	-4.008 (-998.0)	-4.007 (-997.7)	-4.052~-3.964 (-1008.9~-987.0)	3	8.101 (2017.1)	8.100 (2016.9)	8.016~8.186 (1996.0~2038.3)
2	2.211 (550.5)	2.206 (549.3)	2.185~2.237 (544.1~557.0)	4	14.038 (3495.5)	14.038 (3495.5)	13.894~14.182 (3459.6~3531.3)

BAROMETRIC PRESSURE *Unit: inHg (hPa)*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	19.64 (665.1)	19.65 (665.4)	19.25~20.03 (651.9~678.3)	3	35.56 (1204.2)	35.56 (1204.2)	34.85~36.27 (1180.2~1228.2)
2	28.98 (981.4)	28.98 (981.4)	28.40~29.56 (961.7~1001.0)				

^ 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	Measurement Variable	System ID	Last Cal.	Cal. Due
Temperature	E003170	02-21-19	02-29-20	Pressure	E005254	10-29-18	10-31-19
Pressure	E003982	07-15-19	01-31-20	DC Voltage	E003493	08-23-18	08-31-19

Chimoua Vue
CALIBRATED

August 13, 2019
DATE

Doc. ID: CERT_GEN_WCC_TM

TSI P/N 2300157

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Fax: (403) 248-5194

www.itm.com - information@itm.com

Calibration Certificate

Customer: *GHD Ltd.*

Certificate: C299060-00-01

Unit Identification

Manufacturer: **Dwyer**
Model: **475-0-FM**
Description: **Digital Manometer**
Serial: **N/A**
Unit ID: **MAN-CAL-001**

Calibration Date

Calibration Date: **8-Oct-2019**
Due Date: **8-Oct-2020**

Calibration Conditions

Temperature: **21.5°C**
Humidity: **27 %**
Barometric Pressure: **N/A**

General Information

Remark:**N/A**

Standards Used

Unit ID	Manufacturer	Model	Cal Date	Due Date
CAL0224	Fluke	750P01	5-Jul-2019	5-Jan-2020

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: B. [illegible]

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Test Results
Procedure: **Pressure Gauge 10.00 IN.W.C 0.5% FS /750P01** Rev: **1.1**
Data Type: **As Found** Results: **Fail**

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.						
1.000 inH2O		1.007 inH2O	0.950 inH2O	1.050 inH2O	Pass	1.6e-002 inH2O
2.000 inH2O		2.033 inH2O	1.950 inH2O	2.050 inH2O	Pass	1.6e-002 inH2O
4.000 inH2O		4.032 inH2O	3.950 inH2O	4.050 inH2O	Pass	1.6e-002 inH2O
6.000 inH2O		6.077 inH2O	5.950 inH2O	6.050 inH2O	Fail	1.6e-002 inH2O
8.000 inH2O		8.089 inH2O	7.950 inH2O	8.050 inH2O	Fail	1.6e-002 inH2O
10.000 inH2O		10.113 inH2O	9.950 inH2O	10.050 inH2O	Fail	1.6e-002 inH2O

Test Results
Procedure: **Pressure Gauge 10.00 IN.W.C 0.5% FS /750P01** Rev: **1.1**
Data Type: **As Left** Results: **Pass**

Test Description	True Value	Reading	Lower Limit	Upper Limit	Test Status	Exp Uncert
Results Run: 2.00						
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.						
1.000 inH2O		0.997 inH2O	0.950 inH2O	1.050 inH2O	Pass	1.6e-002 inH2O
2.000 inH2O		2.001 inH2O	1.950 inH2O	2.050 inH2O	Pass	1.6e-002 inH2O
4.000 inH2O		4.005 inH2O	3.950 inH2O	4.050 inH2O	Pass	1.6e-002 inH2O
6.000 inH2O		6.007 inH2O	5.950 inH2O	6.050 inH2O	Pass	1.6e-002 inH2O
8.000 inH2O		7.999 inH2O	7.950 inH2O	8.050 inH2O	Pass	1.6e-002 inH2O
10.000 inH2O		9.996 inH2O	9.950 inH2O	10.050 inH2O	Pass	1.6e-002 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
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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.

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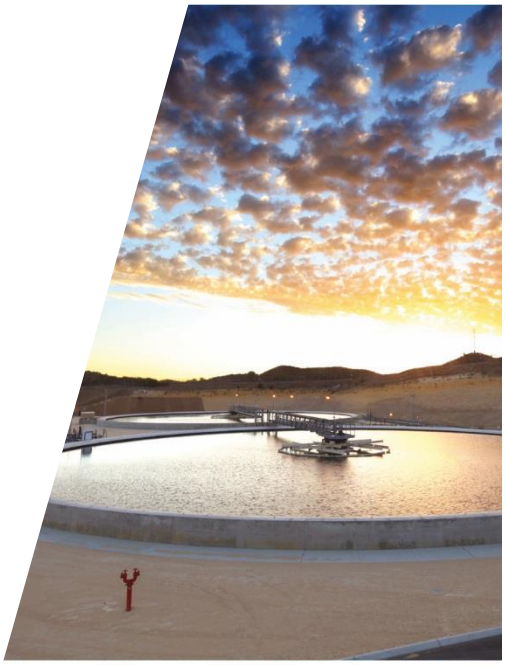

Quarterly Audit Partisol FRM Model 2000

Clean Harbors
50114 Range Rd. 173
Ryley, Alberta T0B 4A0
Quarterly Audit Date: June 29, 2020

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 29, 2020. The Quarterly Audit was conducted on the Partisol FRM 2000 Particulate Matter less than 10 microns (PM_{10}) Sampler (Partisol Sampler), located on the roof of the Ryley Lift Station (AEP Station ID 00010348-I-1), which is 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, 2016 (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 (AEP Station ID 00010348-I-1)

The siting location of the Partisol Sampler meets the requirements of Chapter 3, 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 (AEP Station ID 00010348-I-1)

The pressure and temperature audit results of the Partisol Sampler meet the requirements of Chapter 4, 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)	20.4	21.5	1.1	±2°C	Pass
Barometric Pressure (mmHg)	699.0	701.0	2.0	±10 mmHg	Pass
Filter Temperature (°C)	21.5	22.75	1.25	±2°C	Pass
Flow	16.7 L/min	16.7 L/min	0.0	±1.0 L/min	Pass

3.3 Leak Check Results (AEP Station ID 00010348-I-1)

3.3.1 Automatic Leak Check

The Partisol firmware performs leak checks in automatic mode and indicates either a "pass" or "fail" based on a pressure drop threshold of 127 mmHg per minute. The Partisol Sampler passed the requirements outlined in the service manual with a pressure drop of 11 mmHg per minute during the audit.

3.3.2 External Manual Leak Check

GHD also performs an external manual leak check on the Partisol Sampler as part of the quarterly audit. The external manual leak check measures the pressure drop on a vacuum gauge located on

the sampler. The pressure drop may not exceed more than 8.5 inHg (216 mmHg) over a 30-second span. The Partisol Sampler passed the requirements of the service manual with a pressure drop of 0.0 inHg in a 30-second span.

3.4 Flow Audit (AEP Station ID 00010348-I-1)

The flow audit results of the Partisol Sampler meet the requirements of Chapter 4 of the AMD, refer to Table 3.2.

3.5 Instrument Condition and Recommendations (AEP Station ID 00010348-I-1)

The Partisol Sampler was visually and functionally inspected on the audit day. Audit recommendations and instrument conditions 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	6/29/2020	Weather Cond.:	Overcast/20°C
Owner	Clean Harbors	Start Time:	13:15
Station Name	Ryley Lift Station	End Time:	14:00
Parameter	PM_{10}	Performed By:	Trevor Lewis

Partisol FRM Model 2000 Identification		**Sampler Data**	
Make/Model:	R & P Partisol FRM 2000	Temperature:	20.4°C
Unit ID:	Ryley Lift Station	Pressure:	699 mmHg
S/N:	200FB209860905	Flow Set Point:	16.7 L/min

GHD Reference Standards

	Flow	Pressure	Temperature	Manometer
Make:	AirMetrics	TSI	Fluke	Dwyer
Model:	FRM	9565-P	1551A EX	Series 475
Serial Number:	FRM1218	9565P1324039	3520009	MAN-CAL-001
Calibration Date:	5/17/2016	8/13/2019	10/8/2019	10/8/2019

Audit Data

	Sampler Data	Reference Data	Difference	Pass/Fail	Units
Ambient Temperature (+/- 2 °C)	20.4	21.5	1.10	Pass	°C
Barometric Pressure (+/- 10 mmHg)	699	701	2.00	Pass	mmHg
Filter Temperature (+/- 2 °C)	21.5	22.75	1.25	Pass	°C
Flow (+/- 1.0 Litres/min)	16.7	16.7	0.00	Pass	Litres/min

Leak Check

Manual Check (-8.5 inHg)

Initial Pressure	Final Pressure	Pressure Drop	Pass/Fail	Units
14.00	14.00	0.00	Pass	inHG

Automatic Check (-127 mmHg)

Leak check was performed in automatic mode, sampler indicated:	11 mmHg/min	Pass	mmHg/min

As Found/As Left	**Yes/No**	**As Found**	**As Left**	**Pass/Fail**
Did the ambient temperature require adjustment?	No	20.4	21.5	Pass
Did the barometric pressure require adjustment?	No	699	701	Pass
Did the filter temperature require adjustment?	No	21.5	22.8	Pass
Did the flow audit require adjustment?	No	16.7	16.7	Pass

Comments

Partisol sampler was moderately dirty, GHD cleaned the components of the sampling inlet, inside the cabinet, all filters and wiped down all seals.

Flow Equation

Set Point (lpm)	Actual Flow *(Qact)* (lpm)	Absolute Difference (lpm)	Pass/Fail (± 1 lpm)				
				Manometer *(DH)*	4.21	"H2O	
				Actual Temp *(Tact)*	293.55	°K	20.4°C
				Actual Pres *(Pact)*	0.932	bar	
16.7	16.7	0.0	Pass	Actual Pres *(Pact)*	27.52	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.

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#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: C299060-00-02

Unit Identification

Manufacturer: **Fluke**
Model: **1551A Ex**
Description: **Stik Thermometer**
Serial: **3520009**
Unit ID: **THM-CAL-001**

Calibration Date

Calibration Date: **8-Oct-2019**
Due Date: **8-Oct-2020**

Calibration Conditions

Temperature: **22.1°C**
Humidity: **26 %**
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	4-Jun-2018	4-Jun-2021
CAL0124	Hart Scientific	1502A	11-Apr-2019	11-Apr-2020
CAL0223	Ametek	RTC-158B	2-Apr-2019	2-Oct-2020

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
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Fax: (403) 248-5194

www.itm.com - information@itm.com

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
-0.058 °C		-0.08 °C	-0.11 °C	-0.01 °C	Pass	8.3e-003 °C
25.024 °C		24.98 °C	24.97 °C	25.07 °C	Pass	8.8e-003 °C
100.289 °C		100.26 °C	100.24 °C	100.34 °C	Pass	1.0e-002 °C
150.471 °C		150.45 °C	150.42 °C	150.52 °C	Pass	1.2e-002 °C

ID# 19113

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	73.6 (23.1)	°F (°C)
RELATIVE HUMIDITY	45	%RH
BAROMETRIC PRESSURE	28.66 (970.5)	inHg (hPa)

MODEL	9565-P
SERIAL NUMBER	9565P1139015

☒ AS LEFT ☐ AS FOUND

☒ IN TOLERANCE ☐ OUT OF TOLERANCE

– CALIBRATION VERIFICATION RESULTS –

THERMO COUPLE^ — SYSTEM PRESSURE01-02 — *Unit: °F (°C)*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	71.9 (22.2)	71.9 (22.2)	69.9~73.9 (21.1~23.3)				

DIFFERENTIAL PRESSURE — SYSTEM PRESSURE01-02 — *Unit: inH$_2$O (Pa)*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	-4.010 (-998.5)	-4.011 (-998.7)	-4.054~-3.966 (-1009.4~-987.5)	3	7.890 (1964.6)	7.890 (1964.6)	7.807~7.973 (1943.9~1985.3)
2	2.221 (553.0)	2.217 (552.0)	2.195~2.247 (546.6~559.5)	4	14.101 (3511.1)	14.102 (3511.4)	13.956~14.246 (3475.0~3547.3)

BAROMETRIC PRESSURE — SYSTEM PRESSURE01-02 — *Unit: inHg (hPa)*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	19.91 (674.2)	19.92 (674.6)	19.51~20.31 (660.7~687.8)	3	35.45 (1200.5)	35.44 (1200.1)	34.74~36.16 (1176.4~1224.5)
2	28.67 (970.9)	28.67 (970.9)	28.10~29.24 (951.6~990.2)				

^ *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	Measurement Variable	System ID	Last Cal	Cal. Due
Temperature	E003170	02-21-19	02-29-20	Pressure	E005254	10-29-18	10-31-19
Pressure	E003982	07-15-19	07-31-20	DC Voltage	E003493	08-14-19	08-31-20

Chimoua Vue
CALIBRATED

September 24, 2019
DATE

TSI P/N 2300157

ID# 19113

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	76.2 (24.6)	°F (°C)
RELATIVE HUMIDITY	44	%RH
BAROMETRIC PRESSURE	28.83 (976.3)	inHg (hPa)

MODEL	9565-P
SERIAL NUMBER	9565P1139015

☐ AS LEFT ☒ IN TOLERANCE
☒ AS FOUND ☐ OUT OF TOLERANCE

– CALIBRATION VERIFICATION RESULTS –

THERMO COUPLE^ — SYSTEM PRESSURE01-02 — *Unit: °F (°C)*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	71.5 (21.9)	71.2 (21.8)	69.5~73.5 (20.8~23.1)				

DIFFERENTIAL PRESSURE — SYSTEM PRESSURE01-02 — *Unit: inH_2O (Pa)*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	-4.005 (-997.2)	-3.963 (-986.8)	-4.049~-3.961 (-1008.2~-986.3)	3	8.099 (2016.7)	8.089 (2014.2)	8.014~8.184 (1995.5~2037.8)
2	2.213 (551.0)	2.209 (550.0)	2.187~2.239 (544.6~557.5)	4	13.995 (3484.8)	13.972 (3479.0)	13.851~14.139 (3448.9~3520.6)

BAROMETRIC PRESSURE — SYSTEM PRESSURE01-02 — *Unit: inHg (hPa)*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	20.25 (685.7)	20.14 (682.0)	19.84~20.66 (671.9~699.6)	3	35.59 (1205.2)	35.52 (1202.8)	34.88~36.30 (1181.2~1229.3)
2	28.85 (977.0)	28.77 (974.3)	28.27~29.43 (957.3~996.6)				

^ *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	Measurement Variable	System ID	Last Cal.	Cal. Due
Temperature	E003170	02-21-19	02-29-20	Pressure	E005254	10-29-18	10-31-19
Pressure	E003982	07-15-19	01-31-20	DC Voltage	E003493	08-14-19	08-31-20

ChaoVang
VERIFIED

September 24, 2019
DATE

TSI P/N 2300157

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Fax: (403) 248-5194

www.itm.com - information@itm.com

Calibration Certificate

Customer: *GHD Ltd.*

Certificate: C299060-00-01

Unit Identification

Manufacturer: **Dwyer**
Model: **475-0-FM**
Description: **Digital Manometer**
Serial: **N/A**
Unit ID: **MAN-CAL-001**

Calibration Date

Calibration Date: **8-Oct-2019**
Due Date: **8-Oct-2020**

Calibration Conditions

Temperature: **21.5°C**
Humidity: **27 %**
Barometric Pressure: **N/A**

General Information

Remark:**N/A**

Standards Used

Unit ID	Manufacturer	Model	Cal Date	Due Date
CAL0224	Fluke	750P01	5-Jul-2019	5-Jan-2020

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: B. [illegible]

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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: **1.1**
Data Type: **As Found** Results: **Fail**

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.						
1.000 inH2O		1.007 inH2O	0.950 inH2O	1.050 inH2O	Pass	1.6e-002 inH2O
2.000 inH2O		2.033 inH2O	1.950 inH2O	2.050 inH2O	Pass	1.6e-002 inH2O
4.000 inH2O		4.032 inH2O	3.950 inH2O	4.050 inH2O	Pass	1.6e-002 inH2O
6.000 inH2O		6.077 inH2O	5.950 inH2O	6.050 inH2O	Fail	1.6e-002 inH2O
8.000 inH2O		8.089 inH2O	7.950 inH2O	8.050 inH2O	Fail	1.6e-002 inH2O
10.000 inH2O		10.113 inH2O	9.950 inH2O	10.050 inH2O	Fail	1.6e-002 inH2O

Test Results
Procedure: **Pressure Gauge 10.00 IN.W.C 0.5% FS /750P01** Rev: **1.1**
Data Type: **As Left** Results: **Pass**

Test Description	True Value	Reading	Lower Limit	Upper Limit	Test Status	Exp Uncert
Results Run: 2.00						
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.						
1.000 inH2O		0.997 inH2O	0.950 inH2O	1.050 inH2O	Pass	1.6e-002 inH2O
2.000 inH2O		2.001 inH2O	1.950 inH2O	2.050 inH2O	Pass	1.6e-002 inH2O
4.000 inH2O		4.005 inH2O	3.950 inH2O	4.050 inH2O	Pass	1.6e-002 inH2O
6.000 inH2O		6.007 inH2O	5.950 inH2O	6.050 inH2O	Pass	1.6e-002 inH2O
8.000 inH2O		7.999 inH2O	7.950 inH2O	8.050 inH2O	Pass	1.6e-002 inH2O
10.000 inH2O		9.996 inH2O	9.950 inH2O	10.050 inH2O	Pass	1.6e-002 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

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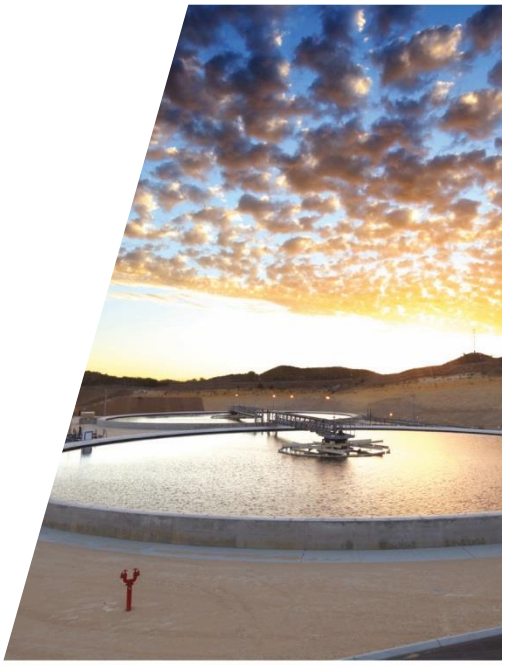

Quarterly Audit Partisol FRM Model 2000

Clean Harbors
50114 Range Rd. 173
Ryley, Alberta T0B 4A0
Quarterly Audit Date: August 28, 2020

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 28, 2020. The Quarterly Audit was conducted on the Partisol FRM 2000 Particulate Matter less than 10 microns (PM_{10}) Sampler (Partisol Sampler), located on the roof of the Ryley Lift Station (AEP Station ID 00010348-I-1), which is 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, 2016 (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 (AEP Station ID 00010348-I-1)

The siting location of the Partisol Sampler meets the requirements of Chapter 3, 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 (AEP Station ID 00010348-I-1)

The pressure and temperature audit results of the Partisol Sampler meet the requirements of Chapter 4, 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)	22.4	22.0	0.4	±2°C	Pass
Barometric Pressure (mmHg)	700	702.0	2.0	±10 mmHg	Pass
Filter Temperature (°C)	21.5	20.8	0.7	±2°C	Pass
Flow	16.7 L/min	16.7 L/min	0.0	±1.0 L/min	Pass

3.3 Leak Check Results (AEP Station ID 00010348-I-1)

3.3.1 Automatic Leak Check

The Partisol firmware performs leak checks in automatic mode and indicates either a "pass" or "fail" based on a pressure drop threshold of 127 mmHg per minute. The Partisol Sampler passed the requirements outlined in the service manual with a pressure drop of 3 mmHg per minute during the audit.

3.3.2 External Manual Leak Check

GHD also performs an external manual leak check on the Partisol Sampler as part of the quarterly audit. The external manual leak check measures the pressure drop on a vacuum gauge located on

the sampler. The pressure drop may not exceed more than 8.5 inHg (216 mmHg) over a 30-second span. The Partisol Sampler passed the requirements of the service manual with a pressure drop of 0.0 inHg in a 30-second span.

3.4 Flow Audit (AEP Station ID 00010348-I-1)

The flow audit results of the Partisol Sampler meet the requirements of Chapter 4 of the AMD, refer to Table 3.2.

3.5 Instrument Condition and Recommendations (AEP Station ID 00010348-I-1)

The Partisol Sampler was visually and functionally inspected on the audit day. Audit recommendations and instrument conditions 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	8/28/2020	Weather Cond.:	Sunny/22°C
Owner	Clean Harbors	Start Time:	12:20
Station Name	Ryley Lift Station	End Time:	13:00
Parameter	PM_{10}	Performed By:	Trevor Lewis

Partisol FRM Model 2000 Identification		**Sampler Data**	
Make/Model:	R & P Partisol FRM 2000	Temperature:	22°C
Unit ID:	Ryley Lift Station	Pressure:	702 mmHg
S/N:	200FB209860905	Flow Set Point:	16.7 L/min

GHD Reference Standards

	Flow	Pressure	Temperature	Manometer
Make:	AirMetrics	TSI	Fluke	Dwyer
Model:	FRM	9565-P	1551A EX	Series 475
Serial Number:	FRM1218	9565P1324039	3520009	MAN-CAL-001
Calibration Date:	5/17/2016	7/1/2020	10/8/2019	10/8/2019

Audit Data

	Sampler Data	Reference Data	Difference	Pass/Fail	Units
Ambient Temperature (+/- 2 °C)	22.40	22.00	0.40	Pass	°C
Barometric Pressure (+/- 10 mmHg)	700.00	702.00	2.00	Pass	mmHg
Filter Temperature (+/- 2 °C)	21.50	20.80	0.70	Pass	°C
Flow (+/- 1.0 Litres/min)	16.70	16.60	0.10	Pass	Litres/min

Leak Check

Manual Check (-8.5 inHg)

Initial Pressure	Final Pressure	Pressure Drop	Pass/Fail	Units
14.00	14.00	0.00	Pass	inHG

Automatic Check (-127 mmHg)

Leak check was performed in automatic mode, sampler indicated:	3 mmHg/min	Pass	mmHg/min

As Found/As Left	**Yes/No**	**As Found**	**As Left**	**Pass/Fail**
Did the ambient temperature require adjustment?	No	22.4	22.4	Pass
Did the barometric pressure require adjustment?	No	700	700	Pass
Did the filter temperature require adjustment?	No	21.5	21.5	Pass
Did the flow audit require adjustment?	No	16.7	16.7	Pass

Comments

Partisol sampler was moderately dirty, GHD cleaned the components of the sampling inlet, inside the cabinet, all filters and wiped down all seals.

Flow Equation

Set Point (lpm)	Actual Flow *(Qact)* (lpm)	Absolute Difference (lpm)	Pass/Fail (± 1 lpm)
16.7	16.4	0.3	Pass

Manometer *(DH)*	4.08	"H2O	
Actual Temp *(Tact)*	295.15	°K	22.0°C
Actual Pres *(Pact)*	0.936	bar	
Actual Pres *(Pact)*	27.64	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
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MONTRÉAL
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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: C299060-00-02

Unit Identification

Manufacturer: **Fluke**
Model: **1551A Ex**
Description: **Stik Thermometer**
Serial: **3520009**
Unit ID: **THM-CAL-001**

Calibration Date

Calibration Date: **8-Oct-2019**
Due Date: **8-Oct-2020**

Calibration Conditions

Temperature: **22.1°C**
Humidity: **26 %**
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	4-Jun-2018	4-Jun-2021
CAL0124	Hart Scientific	1502A	11-Apr-2019	11-Apr-2020
CAL0223	Ametek	RTC-158B	2-Apr-2019	2-Oct-2020

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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16975 Leslie Street
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Fax: (403) 248-5194

www.itm.com - information@itm.com

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
-0.058 °C		-0.08 °C	-0.11 °C	-0.01 °C	Pass	8.3e-003 °C
25.024 °C		24.98 °C	24.97 °C	25.07 °C	Pass	8.8e-003 °C
100.289 °C		100.26 °C	100.24 °C	100.34 °C	Pass	1.0e-002 °C
150.471 °C		150.45 °C	150.42 °C	150.52 °C	Pass	1.2e-002 °C

TSI P/N 2980157

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

25480

ENVIRONMENT CONDITIONS		
TEMPERATURE	72.80 (22.7)	°F (°C)
RELATIVE HUMIDITY	62.9	%RH
BAROMETRIC PRESSURE	29.14 (986.8)	inHg (hPa)

MODEL	964
SERIAL NUMBER	P12120045

☒ AS LEFT ☒ IN TOLERANCE
☐ AS FOUND ☐ OUT OF TOLERANCE

– CALIBRATION VERIFICATION RESULTS –

TEMPERATURE VERIFICATION — SYSTEM T-101 — *Unit: °F (°C)*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	32.1 (0.0)	32.2 (0.1)	31.5~32.6 (-0.3~0.3)	2	140.0 (60.0)	140.2 (60.1)	139.5~140.6 (59.7~60.3)

HUMIDITY VERIFICATION — SYSTEM H-120 — *Unit: %RH*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	10.0	9.4	7.8~12.2	4	70.0	69.5	67.8~72.2
2	30.0	29.2	27.8~32.2	5	90.0	88.7	87.8~92.2
3	50.0	49.5	47.8~52.2				

VELOCITY VERIFICATION — SYSTEM V-107 — *Unit: ft/min (m/s)*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	0 (0.00)	0 (0.00)	-3~3 (-0.02~0.02)	7	647 (3.28)	648 (3.29)	627~666 (3.19~3.38)
2	35 (0.18)	36 (0.18)	32~38 (0.16~0.19)	8	995 (5.05)	995 (5.05)	965~1025 (4.90~5.20)
3	65 (0.33)	64 (0.33)	62~68 (0.31~0.34)	9	1478 (7.51)	1487 (7.55)	1434~1522 (7.28~7.73)
4	100 (0.51)	99 (0.50)	97~102 (0.49~0.52)	10	2486 (12.63)	2506 (12.73)	2412~2561 (12.25~13.01)
5	161 (0.82)	161 (0.82)	156~166 (0.79~0.84)	11	4486 (22.79)	4516 (22.94)	4351~4620 (22.10~23.47)
6	327 (1.66)	327 (1.66)	317~337 (1.61~1.71)	12	8011 (40.70)	8061 (40.95)	7771~8252 (39.48~41.92)

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	E010657	02-14-20	02-28-21
Temperture	E010655	01-21-20	01-31-21
DC Voltage	E001653	08-15-19	02-28-21
Pressure	E001718	01-22-20	07-31-20
Velocity	E010499	8-11-19	8-31-22

Measurement Variable	System ID	Last Cal.	Cal. Due
Temperature	E010658	02-14-20	02-28-21
Humidity	E002008	01-23-20	07-31-20
Temperature	E001643	04-16-20	10-31-20
Pressure	E002389	01-22-20	07-31-20

CALIBRATED

July 2, 2020
DATE

Doc ID CERT CEN V6C

TSI P/N 2300157

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

37661

ENVIRONMENT CONDITIONS		
TEMPERATURE	72.16 (22.3)	°F (°C)
RELATIVE HUMIDITY	61	%RH
BAROMETRIC PRESSURE	29.02 (982.7)	inHg (hPa)

MODEL	9565-P
SERIAL NUMBER	9565P1710002

☒ AS LEFT ☒ IN TOLERANCE
☐ AS FOUND ☐ OUT OF TOLERANCE

– CALIBRATION VERIFICATION RESULTS –

THERMO COUPLE^ — SYSTEM PRESSURE01-02 — *Unit: °F (°C)*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	72.8 (22.7)	72.8 (22.7)	70.8~74.8 (21.6~23.8)				

DIFFERENTIAL PRESSURE — SYSTEM PRESSURE01-02 — *Unit: inH_2O (Pa)*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	-4.008 (-998.0)	-4.008 (-998.0)	-4.052~-3.964 (-1008.9~-987.0)	3	8.124 (2022.9)	8.121 (2022.1)	8.039~8.209 (2001.7~2044.0)
2	2.217 (552.0)	2.215 (551.5)	2.191~2.243 (545.6~558.5)	4	13.885 (3457.4)	13.883 (3456.9)	13.742~14.028 (3421.8~3493.0)

BAROMETRIC PRESSURE — SYSTEM PRESSURE01-02 — *Unit: inHg (hPa)*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	19.81 (670.8)	19.80 (670.5)	19.41~20.21 (657.3~684.4)	3	34.33 (1162.5)	34.34 (1162.9)	33.64~35.02 (1139.2~1185.9)
2	29.03 (983.1)	29.03 (983.1)	28.45~29.61 (963.4~1002.7)				

^ *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	Measurement Variable	System ID	Last Cal.	Cal. Due
Temperature	E004626	02-14-20	02-28-21	Pressure	E005254	10-10-19	10-31-20
Pressure	E003982	01-24-20	07-31-20	DC Voltage	E003493	06-17-20	06-30-21

ChaoVang
CALIBRATED

July 1, 2020
DATE

ITM INSTRUMENTS INC.

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www.itm.com - information@itm.com

Calibration Certificate

Customer: *GHD Ltd.*

Certificate: C299060-00-01

Unit Identification

Manufacturer: **Dwyer**
Model: **475-0-FM**
Description: **Digital Manometer**
Serial: **N/A**
Unit ID: **MAN-CAL-001**

Calibration Date

Calibration Date: **8-Oct-2019**
Due Date: **8-Oct-2020**

Calibration Conditions

Temperature: **21.5°C**
Humidity: **27 %**
Barometric Pressure: **N/A**

General Information

Remark:**N/A**

Standards Used

Unit ID	Manufacturer	Model	Cal Date	Due Date
CAL0224	Fluke	750P01	5-Jul-2019	5-Jan-2020

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: B. [illegible]

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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: **1.1**
Data Type: **As Found** Results: **Fail**

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.						
1.000 inH2O		1.007 inH2O	0.950 inH2O	1.050 inH2O	Pass	1.6e-002 inH2O
2.000 inH2O		2.033 inH2O	1.950 inH2O	2.050 inH2O	Pass	1.6e-002 inH2O
4.000 inH2O		4.032 inH2O	3.950 inH2O	4.050 inH2O	Pass	1.6e-002 inH2O
6.000 inH2O		6.077 inH2O	5.950 inH2O	6.050 inH2O	Fail	1.6e-002 inH2O
8.000 inH2O		8.089 inH2O	7.950 inH2O	8.050 inH2O	Fail	1.6e-002 inH2O
10.000 inH2O		10.113 inH2O	9.950 inH2O	10.050 inH2O	Fail	1.6e-002 inH2O

Test Results
Procedure: **Pressure Gauge 10.00 IN.W.C 0.5% FS /750P01** Rev: **1.1**
Data Type: **As Left** Results: **Pass**

Test Description	True Value	Reading	Lower Limit	Upper Limit	Test Status	Exp Uncert
Results Run: 2.00						
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.						
1.000 inH2O		0.997 inH2O	0.950 inH2O	1.050 inH2O	Pass	1.6e-002 inH2O
2.000 inH2O		2.001 inH2O	1.950 inH2O	2.050 inH2O	Pass	1.6e-002 inH2O
4.000 inH2O		4.005 inH2O	3.950 inH2O	4.050 inH2O	Pass	1.6e-002 inH2O
6.000 inH2O		6.007 inH2O	5.950 inH2O	6.050 inH2O	Pass	1.6e-002 inH2O
8.000 inH2O		7.999 inH2O	7.950 inH2O	8.050 inH2O	Pass	1.6e-002 inH2O
10.000 inH2O		9.996 inH2O	9.950 inH2O	10.050 inH2O	Pass	1.6e-002 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

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about GHD

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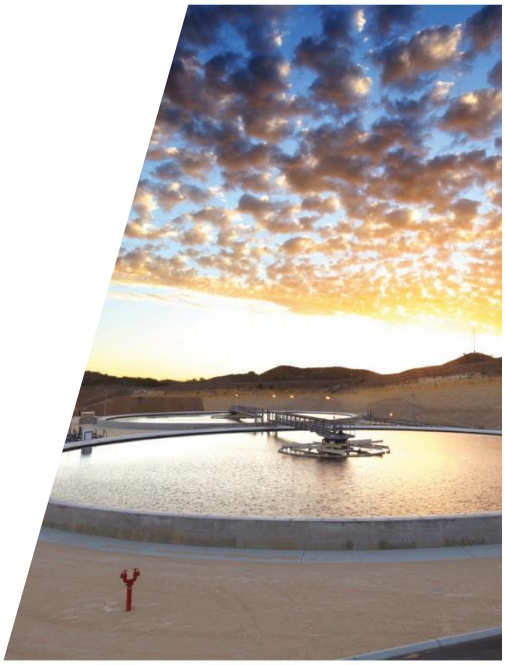
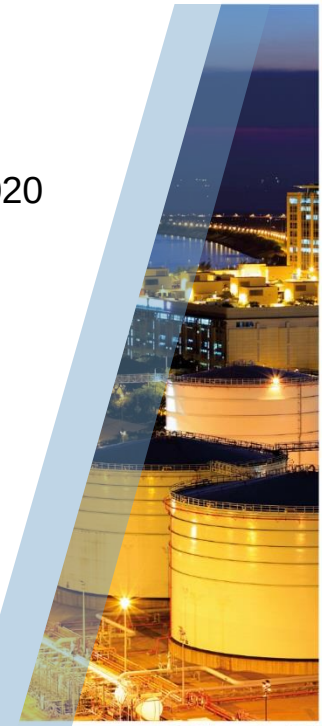


Quarterly Audit Partisol FRM Model 2000

Clean Harbors
50114 Range Rd. 173
Ryley, Alberta T0B 4A0
Quarterly Audit Date: November 6, 2020



Clean Harbors

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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 November 6, 2020. The Quarterly Audit was conducted on the Partisol FRM 2000 Particulate Matter less than 10 microns (PM_{10}) Sampler (Partisol Sampler), located on the roof of the Ryley Lift Station (AEP Station ID 00010348-I-1), which is 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, 2016 (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 (AEP Station ID 00010348-I-1)

The siting location of the Partisol Sampler meets the requirements of Chapter 3, 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 (AEP Station ID 00010348-I-1)

The pressure and temperature audit results of the Partisol Sampler meet the requirements of Chapter 4, 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)	-0.1	0.5	0.6	±2°C	Pass
Barometric Pressure (mmHg)	700	699	1.0	±10 mmHg	Pass
Filter Temperature (°C)	1.0	1.0	0.0	±2°C	Pass
Flow	16.7 L/min	16.6 L/min	0.1	±1.0 L/min	Pass

3.3 Leak Check Results (AEP Station ID 00010348-I-1)

3.3.1 Automatic Leak Check

The Partisol firmware performs leak checks in automatic mode and indicates either a "pass" or "fail" based on a pressure drop threshold of 127 mmHg per minute. The Partisol Sampler passed the requirements outlined in the service manual with a pressure drop of 4 mmHg per minute during the audit.

3.3.2 External Manual Leak Check

GHD also performs an external manual leak check on the Partisol Sampler as part of the quarterly audit. The external manual leak check measures the pressure drop on a vacuum gauge located on

the sampler. The pressure drop may not exceed more than 8.5 inHg (216 mmHg) over a 30-second span. The Partisol Sampler passed the requirements of the service manual with a pressure drop of 0.0 inHg in a 30-second span.

3.4 Flow Audit (AEP Station ID 00010348-I-1)

The flow audit results of the Partisol Sampler meet the requirements of Chapter 4 of the AMD, refer to Table 3.2.

3.5 Instrument Condition and Recommendations (AEP Station ID 00010348-I-1)

The Partisol Sampler was visually and functionally inspected on the audit day. Audit recommendations and instrument conditions 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	11/6/2020	Weather Cond.:	Overcast/0°C
Owner	Clean Harbors	Start Time:	12:30
Station Name	Ryley Lift Station	End Time:	13:00
Parameter	PM_{10}	Performed By:	Trevor Lewis

Partisol FRM Model 2000 Identification		**Sampler Data**	
Make/Model:	R & P Partisol FRM 2000	Temperature:	-0.1
Unit ID:	Ryley Lift Station	Pressure:	700
S/N:	200FB209860905	Flow Set Point:	16.7 L/min

GHD Reference Standards

	Flow	Pressure	Temperature	Manometer
Make:	AirMetrics	TSI	TSI	TSI
Model:	FRM	9565-P	9565-P	9565-P
Serial Number:	FRM1218	9565P1710006	9565P1710006	9565P1710006
Calibration Date:	5/17/2016	6/17/2020	6/17/2020	6/17/2020

Audit Data

	Sampler Data	Reference Data	Difference	Pass/Fail	Units
Ambient Temperature (+/- 2 °C)	-0.1	0.5	0.6	Pass	°C
Barometric Pressure (+/- 10 mmHg)	700	699	1.0	Pass	mmHg
Filter Temperature (+/- 2 °C)	1.0	1.0	0.0	Pass	°C
Flow (+/- 1.0 Litres/min)	16.7	16.6	0.1	Pass	Litres/min

Leak Check

Manual Check (-8.5 inHg)

Initial Pressure	Final Pressure	Pressure Drop	Pass/Fail	Units
14.00	14.00	0.00	Pass	inHG

Automatic Check (-127 mmHg)

Leak check was performed in automatic mode, sampler indicated:	4 mmHg/min	Pass	mmHg/min

As Found/As Left	**Yes/No**	**As Found**	**As Left**	**Pass/Fail**
Did the ambient temperature require adjustment?	No	-0.1	-0.1	Pass
Did the barometric pressure require adjustment?	No	700	700	Pass
Did the filter temperature require adjustment?	No	1.0	1.0	Pass
Did the flow audit require adjustment?	No	16.7	16.7	Pass

Comments

Partisol sampler was moderately dirty, GHD cleaned the components of the sampling inlet, inside the cabinet, all filters and wiped down all seals.

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)*	4.51	"H2O	
Actual Temp *(Tact)*	273.65	°K	0.5°C
Actual Pres *(Pact)*	0.932	bar	
Actual Pres *(Pact)*	27.52	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

INSTRUMENT CALIBRATION REPORT

Advanced Labs, Inc.

Pine Environmental Services, Inc

Instrument ID 28339
Description TSI 9565P VelociCalc
Calibrated 6/17/2020

Manufacturer TSI
Model Number 9565P
Serial Number 9565P1710006
Location New Jersey
Temp 78

Classification
Status pass
Frequency Yearly
Department Lab
Humidity 30

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 / 30.090	inHg	30.090	inHg	30.090	30.090	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 / -4.00	inH2O	-4.00	inH2O	-4.03	-4.03	0.75%	Pass
4.00 / 4.00	inH2O	4.00	inH2O	4.04	4.04	1.00%	Pass
8.00 / 8.00	inH2O	8.00	inH2O	8.06	8.06	0.75%	Pass
12.00 / 12.00	inH2O	12.00	inH2O	12.08	12.08	0.67%	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-1	Dwyer 477AV-1 Digital Manometer	Dwyer	005PM2	10/2/2019	10/2/2020
OMEGA HX93AC/DP25-E	Omega HX93AC/DP25-E	Omega Engineering	1010368 035025 035026	10/11/2018	10/11/2020

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.

INSTRUMENT CALIBRATION REPORT

Advanced Labs, Inc.

Pine Environmental Services, Inc

Instrument ID 25749
Description TSI 964 Probe
Calibrated 6/17/2020

Test Instruments Used During the Calibration

Test Instrument ID	Description	Manufacturer	Serial Number	(As Of Cal Entry Date) Last Cal Date	Next Cal Date
MICHELL DM-509-TX-01	Relative Humidity Meter	Michell	273296	10/2/2019	10/2/2020
OMEGA HX93AC/DP25-E	Omega HX93AC/DP25-E	Omega Engineering	1010368 035025 035026	10/11/2018	10/11/2020
OMEGA PX02K1-16A5T /DP25-E-A	Omega PX02K1-16A5T/DP25-E-A	Omega Engineering	168377/8375030	10/11/2018	10/11/2020
OMEGA WT4401-D	Omega WT4401-D	Omega Engineering	101105	10/11/2018	10/11/2020

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.

INSTRUMENT CALIBRATION REPORT

Advanced Labs, Inc.

Pine Environmental Services, Inc

Instrument ID 25749
Description TSI 964 Probe
Calibrated 6/17/2020

Manufacturer TSI
Model Number 964
Serial Number P09140047
Location New Jersey
Temp 78

Classification
Status pass
Frequency Yearly EOM
Department Lab
Humidity 30

Calibration Specifications

Group # 1
Group Name Relative Humidity
Stated Accy Pct of Reading
Range Acc % 0.0000
Reading Acc % 3.0000
Plus/Minus 0.00

Nom In Val / In Val	In Type	Out Val	Out Type	Fnd As	Lft As	Dev%	Pass/Fail
30.00 / 29.20	%	29.20	%	29.40	29.20	0.00%	Pass

Group # 2
Group Name Temperature
Stated Accy Plus / Minus
Range Acc % 0.0000
Reading Acc % 0.0000
Plus/Minus 1.00

Nom In Val / In Val	In Type	Out Val	Out Type	Fnd As	Lft As	Dev%	Pass/Fail
70.00 / 77.70	°F	77.70	°F	74.70	77.60	-0.13%	Pass

Group # 3
Group Name Velocity
Stated Accy Pct of Reading
Range Acc % 0.0000
Reading Acc % 3.0000
Plus/Minus 0.00

Nom In Val / In Val	In Type	Out Val	Out Type	Fnd As	Lft As	Dev%	Pass/Fail
0.00 / 0.00	ft/min	0.00	ft/min	0.00	0.00	0.00%	Pass
40.00 / 40.00	ft/min	40.00	ft/min	40.00	40.00	0.00%	Pass
70.00 / 70.00	ft/min	70.00	ft/min	71.00	71.00	1.43%	Pass
100.00 / 100.00	ft/min	100.00	ft/min	98.00	98.00	-2.00%	Pass
150.00 / 150.00	ft/min	150.00	ft/min	147.00	147.00	-2.00%	Pass
325.00 / 325.00	ft/min	325.00	ft/min	316.00	316.00	-2.77%	Pass
700.00 / 700.00	ft/min	700.00	ft/min	690.00	690.00	-1.43%	Pass
1000.00 / 1000.00	ft/min	1000.00	ft/min	975.00	975.00	-2.50%	Pass
1500.00 / 1500.00	ft/min	1500.00	ft/min	1,480.00	1,480.00	-1.33%	Pass
2000.00 / 2000.00	ft/min	2000.00	ft/min	1,940.00	1,940.00	-3.00%	Pass
5000.00 / 5000.00	ft/min	5000.00	ft/min	4,850.00	4,850.00	-3.00%	Pass
8000.00 / 8000.00	ft/min	8000.00	ft/min	8,030.00	8,030.00	0.38%	Pass

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

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