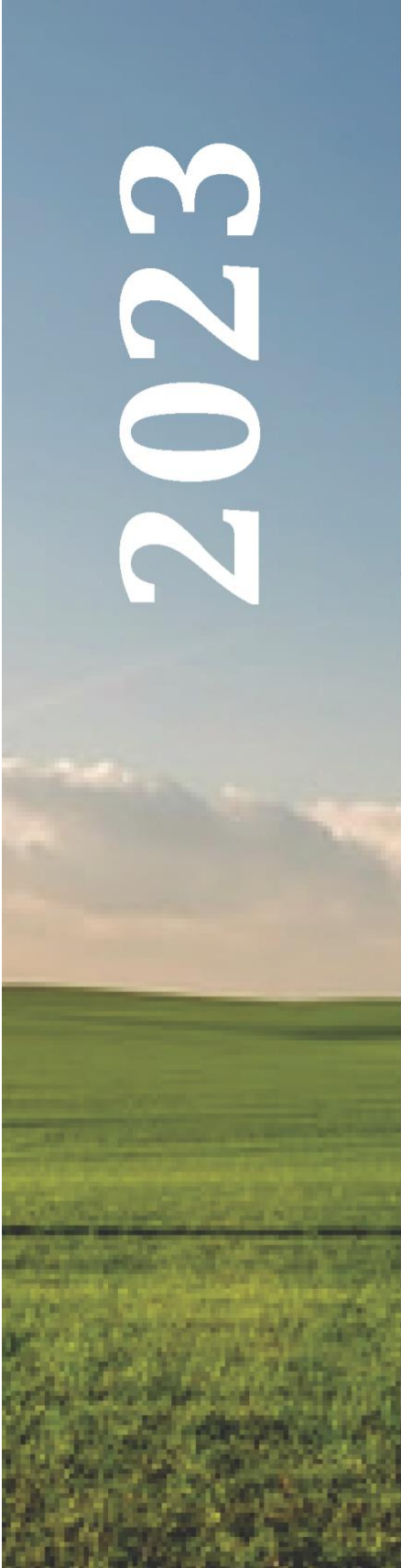


2023

A YEAR IN THE PALLISER AIRSHED





Palliser Airshed Society

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Table of Contents

	Page
TABLE OF CONTENTS	3
INTRODUCTION	4
YEAR IN REVIEW	7
MESSAGE FROM THE CHAIR.....	8
MEMBERSHIP - BOARD OF DIRECTORS.....	9
MEMBERSHIP – FUNDING MEMBERS.....	10
.....	11
HISTORY AND OUTLOOK OF THE PALLISER AIRSHED NETWORK.....	12
CONTINUOUS AIR QUALITY MONITORING PROGRAM.....	15
CONTINUOUS AIR QUALITY MONITORING RESULTS	16
OXIDES OF NITROGEN.....	16
OZONE.....	19
FINE PARTICULATE MATTER	22
TOTAL HYDROCARBONS	27
CARBON MONOXIDE.....	28
AIR QUALITY HEALTH INDEX	29
PASSIVE AIR QUALITY MONITORING RESULTS	32
SULFUR DIOXIDE	33
PAS FINANCIAL STATEMENTS – REVIEWER’S REPORT.....	35
ACKNOWLEDGEMENTS	47

Introduction

The Palliser Airshed Society (PAS) is a multi-stakeholder, not-for-profit organization consisting of industry, local government, environmental organizations, in partnership with Alberta Environment and Protected Areas. PAS was formed in 2003 in response to concerns over air quality in the Medicine Hat region. In 2007, the PAS expanded its borders to the boundaries of the former Palliser Health Region. The airshed zone was expanded again in 2011, when the southwest border was extended to Highway 4 and Highway 36. Our most recent boarder expansion to the North and East and now includes all the MD of Taber, Warner County and Special Areas 1,2,3, and 4. Figure 1 illustrates the boundaries of the area monitored by the Palliser Airshed Society.

The current airshed boundaries encompass an area greater than 58,000 km². Approximately 145,000 people live and work in this area. The major industries include oil and gas processing, power generation, manufacturing, agriculture, ranching and tourism.

The PAS air monitoring network uses a combination of both continuous and passive monitoring technologies. The

network is designed to provide reliable information to a wide range of stakeholders, including those involved in developing strategies to maintain environmental quality through sound management.

In 2023, PAS operated three continuous monitoring stations, and 16 passive sampling sites. The Crescent Heights continuous monitoring station has been in operation since 2003. The airpointer+PM® moved to a new home in Taber and began full operation in June 2021. AEPA has loaned PAS an Airpointer that is located in Brooks at the Medicine Hat College Campus. It began full operation in June 2021.

A new permanent Station for Brooks arrived at the Regional Ball Park in December of 2023. We look forward to it being operational in in Q2 of 2024.

PAS' network now include sensor-based monitoring for PM_{2.5}. Current locations include: Acadia Valley, Bassano, Bow Island, Brooks, Consort, Duchess, Elk Water, Empress, Foremost, Hannah, Irvine, Jenner, Medicine Hat, Milk River, Oyen, Ralston, Raymond, Redcliff, Stirling, Taber, Vauxhall, Warner, and Youngstown.

Vision

Air quality is known and valued to promote a healthy environment.

Mission

Collecting and communicating credible ambient air quality data to develop strategies to manage air quality issues within Palliser Airshed.

Principles

Through the development and achievement of a consensus based, multi-disciplinary stakeholder group, the Palliser Airshed Society (PAS) is committed to:

- ❖ Collecting and communicating credible ambient air quality data.
- ❖ Connecting stakeholders and promoting community involvement.
- ❖ Educating the community, advocating for environmental stewardship
- ❖ Responsibly managing our resources to achieve our vision and mission.
- ❖ Understanding air quality issues prevalent in the airshed and the potential effects to human, animal, and vegetative health.
- ❖ Collaborative actions with Alberta Airsheds Council (AAC) on projects of common interest.

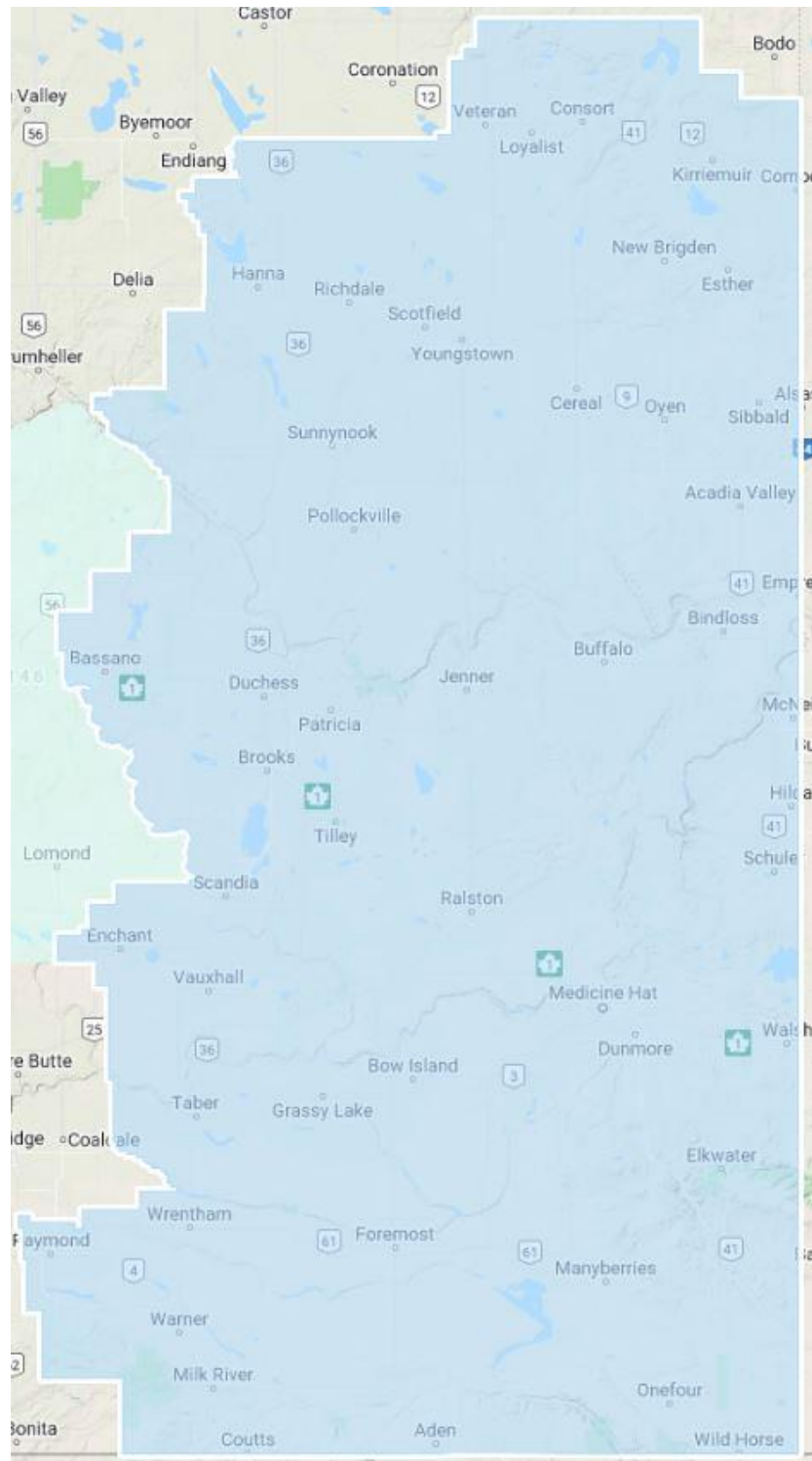


Figure 1. Boundaries of the Palliser Airshed



Year in Review

PAS AIR MONITORING NETWORK

The Crescent Heights air monitoring station and the Taber and Brooks Airpointer® met the operations criteria defined by the Alberta Ambient Air Monitoring Directive (AMD) throughout 2023. The measured air quality was within the Alberta Ambient Air Quality Objectives (AAAQO) for 2023, apart from PM_{2.5} and O₃ exceedance events. In total 44 24-hour and 242 1-hour PM_{2.5} events were recorded between the 3 stations attributed to wildfire smoke and high wind speed events in the region. 3 1-hour O₃ events were recorded at the Crescent Heights station, associated with summertime atmospheric photochemistry.

All passive sampling sites yielded more than 90% valid samples for SO₂, and NO₂.

CONTACT INFORMATION

Please visit the PAS website for additional information: www.palliserairshed.com. If you have any comments or suggestions, please contact Lorna Morishita at (403) 512-0085 or admin@palliserairshed.com.

CONSULTANTS

The PAS Board contracts WSP E&I Canada Limited (formerly Wood) to operate and manage the monitoring equipment as well as reporting of data representative of the airshed. WSP's primary goal is to ensure high quality data is collected while maintaining efficient operations of the monitoring network.

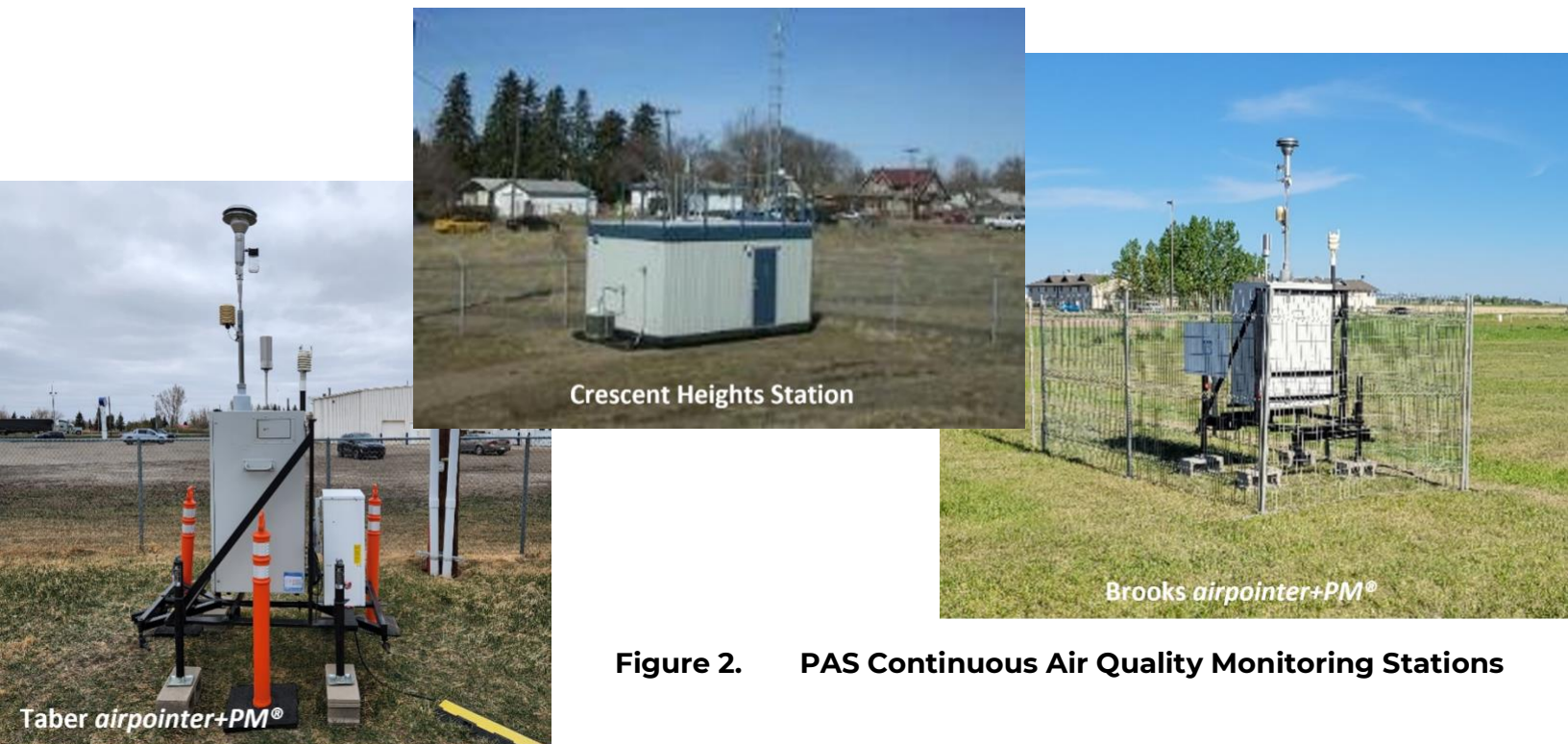


Figure 2. PAS Continuous Air Quality Monitoring Stations

Message from the Chair

On behalf of the Palliser Airshed Society (PAS), it is my pleasure to present the 2023 Annual Report. PAS is a multi-stakeholder, not-for-profit organization consisting of industry, local government, environmental organizations, in partnership with Alberta Environment and Protected Areas. PAS was formed in 2003 in response to concerns over air quality in the Medicine Hat region. In 2007, the PAS expanded its borders to the boundaries of the former Palliser Health Region. The airshed zone was expanded again in 2011, when the southwest border was extended to Highway 4 and Highway 36. Our most recent boarder expansion to the North and East and now includes all the MD of Taber, Warner County and Special Areas 1,2,3, and 4. Figure 1 illustrates the boundaries of the area monitored by the Palliser Airshed Society. The current airshed boundaries encompass an area greater than 58,000 km². Approximately 145,000 people live and work in this area. The major industries include oil and gas processing, power generation, manufacturing, agriculture, ranching and tourism.

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PAS' network now include sensor-based monitoring for PM_{2.5}. Current locations include: Acadia Valley, Bassano, Bow Island, Brooks, Consort, Duchess, Empress, Foremost, Irvine, Jenner, Medicine Hat, Milk River, Oyen, Ralston, Raymond, Redcliff, Stirling, Vauxhall, Warner, and Youngstown.

This extensive network help monitor air quality of the area, including the impacts from the 2023 Wildfire season of British Columbia and Alberta. PM_{2.5} is generally the largest contributor to high AQHI values during wildfire season. When inhaled fine particulate matter inhaled into the lungs, and may cause coughing or may worsen existing heart and lung conditions. Although the 2023 Alberta wildfire season observed less wildfires on average, the amount of hectares of forest burned was over double the previous 5 years combined.

I want to thank AEPA, industry and municipalities for their commitment to airsheds in the province. Without their support our airshed would not be sustainable.

I look forward to an interesting and exciting 2024 and years ahead.

Bill Nalder

Chairman

Membership - Board of Directors

Position	Name	Association
Chair	Bill Nalder	CNRL
Vice-Chair	Ed Rahn	Alberta Energy Regulator
Executive Director	Lorna Morishita	Palliser Airshed Society
Treasurer	Pamela Hodgkinson	Alberta Health Services
Director	Gerry Buck	Lantic Inc.
Director	Frauke Spurrell	Alberta Environment and Protected Areas
Director	Wes Ivy	Cancarb Ltd.
Director	David Gue	Grasslands Naturalists
Director	Adria Coombs	City of Medicine Hat
Director	Boyd Mostoway	City of Medicine Hat Electric Utility
Director	Kim Schacher	International Petroleum Corp.
Director	Crystal Galloway	Methanex

Membership – Funding Members

GOVERNMENT & MUNICIPALITIES

Alberta Environment and Protected Areas, Air and Watershed Stewardship Branch	Alberta Environment and Parks Areas, Intergovernmental Relations & Engagement Branch
City of Medicine Hat	Cypress County
County of Newell	Town of Redcliff

INDUSTRY

Baytex Energy	Journey Energy Inc
Big Marble Farms	Karve Energy
Black Spur Oil Corp	Lamb Weston Canada
Campus Energy	Lantic Inc
CF Industries	Methanex
CanCarb Limited	NAT-1 Ltd Partnership
Canlin Resources	North 40 Resources
Cardinal Energy	Obsidian Energy
CertainTeed Corp	Pembina Pipelines
City of Medicine Hat Electric Utility	Pine Cliff Energy Ltd
City of Medicine Hat Gas Utility	Porocel of Canada Ltd
CNRL	Prairie Gold Produce Ltd
Crescent Point Energy	Prairie Provident Resources
Foothills Pipe Lines	Surge Energy
Gryphon Petroleum Corp	Torxen Energy
Heartland Generation	TC Energy
Hemisphere Energy Corp	West Drum Energy
IPC Canada Ltd	West Lake Energy
JBS Foods Canada	

IN KIND

Alberta Health Services	Alberta Energy Regulator
M.D. of Acadia Valley	Town of Bassano
Town of Bow Island	City of Brooks
Village of Consort	Desert Blume Golf Course
Village of Duchess	Village of Empress
Grasslands Naturalists	Medicine Hat College
Town of Milk River	Special Areas Board
Taber Irrigation District	Town of Vauxhall
Village of Warner	Environment and Climate Change Canada
Town of Hanna	Town of Raymond
Village of Stirling	Prairie Rose School Division
Village of Consort	Village of Youngstown

MEMBER VOLUNTEER HOURS

PAS would like to thank our members who devoted 520 hours in 2023 for Board Meetings, Committee Meetings (Governance and Finance, Communications and Outreach and Technical Advisory).



History and Outlook of the Palliser Airshed Network

The PAS air quality monitoring network design was approved by the Board prior to the fall of 2003. A continuous monitoring station was placed within the Airshed to collect representative, scientifically credible air quality data for the area. In addition, a passive monitoring network of six stations was implemented to augment the data collected at the continuous station.

The continuous monitoring station was established across from the McCoy High School in the Crescent Heights region of Medicine Hat (Figure 3). This station monitors sulfur dioxide (SO₂), nitrogen oxides (NO, NO₂, NO_x), ozone (O₃), total hydrocarbons (THC), carbon monoxide (CO), and fine particulate matter (PM_{2.5}). The station also collects meteorological data, including wind speed, wind direction, ambient temperature, relative humidity, and solar radiation data. Meteorological data is used to assist in interpretation of air quality parameter readings and source investigation.

In 2007, the Palliser Airshed expanded its borders. The airshed was expanded to encompass approximately 40,000 km² and included a population of approximately 100,000 people. The borders were aligned with the boundaries of the former Palliser Health Region. A new monitoring plan was developed based on the expansion. As a result, the network added a portable air monitoring station and fourteen passive sampling stations.

In 2010, the Palliser Airshed Society faced serious financial stress. To resolve the circumstances, the passive sampling program was modified by monitoring ten sites for six months and then switching to the other ten sites for the remainder of the year. The portable monitoring program was downsized to a two-month program at the Jenner Station.

In 2011, the southwest border was extended to the junction of Highway 4 and Highway 36. The portable monitoring station was decommissioned in October following the Hays monitoring program. Two passive sites at Hays were added to the passive network, forming a total of twenty-two passive stations, as shown in Figure 3.

In July 2015, an *airpointer+PM*[®] was commissioned for operation at a location adjacent to the City of Brooks. The *airpointer+PM*[®] is intended for use as a portable monitoring station and was relocated to a site near the Medicine Hat Airport in September 2016, where it operated through to July 2018. The *airpointer+PM*[®] was moved to a site located nearby the Medicine Hat Trap Club in October 2018 and operated through to May 2021. The *airpointer+PM*[®] moved to a new home in Taber and began full operation in June 2021. AEPA has loaned PAS an Airpointer that is located in Brooks at the Medicine Hat College Campus, it began full operation in June 2021.

Due to financial constraints in 2017, PAS completed a rationalization of the passive monitoring network with the technical help of AEPA. As a result of the study, O₃ passive monitoring was discontinued in March 2017. Seven sites were discontinued completely, and SO₂ monitoring was discontinued at an additional seven sites in June 2017. A new NO₂ site was established in December 2017 near Milk River.

In October 2022, the southwest border was extended east to include the MD of Taber, Warner County and Special Areas 2,

3, and 4. The current airshed encompasses an area of greater than 58,000 km², with approximately 145,000 people living and working in this area.

PAS' network now include sensor-based monitoring for PM_{2.5}. Current locations include: Acadia Valley, Bassano, Bow Island, Brooks, Consort, Duchess, Elk Water, Empress, Foremost, Hannah, Irvine, Jenner, Medicine Hat, Milk River, Oyen, Ralston, Raymond, Redcliff, Stirling, Taber, Vauxhall, Warner, and Youngstown.

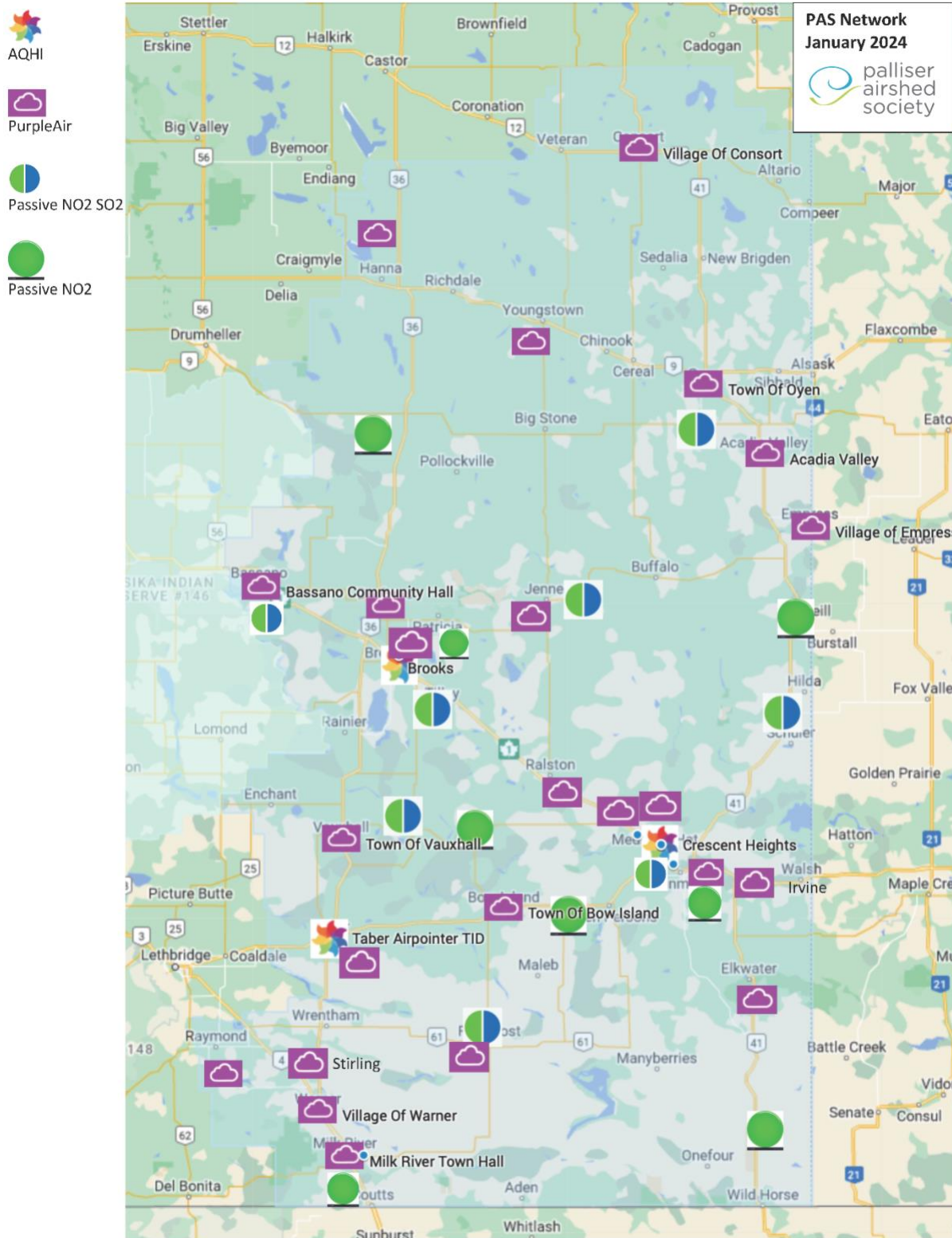


Figure 3. PAS Air Quality Monitoring Network for 2023

Continuous Air Quality Monitoring Program

The Palliser Airshed Society operates three continuous air monitoring stations in the region. The Crescent Heights station is a stationary air monitoring station, which began monitoring operations in December 2003. The *airpointer+PM*® moved to a new home in Taber and began full operation in June 2021. AEPA has loaned PAS an Airpointer that is located in Brooks at the Medicine Hat College Campus, it began full operation in June 2021. The *airpointer*® is a compact monitoring system, and as such, it can be mobilized to address special air monitoring needs within the airshed.

Near real-time data from the continuous air monitoring stations has been available on the PAS website since the spring of 2004, allowing public access to this data and providing an indication of the ambient air quality.

Environment Canada, as a stakeholder, provided a TEOM fine particulate analyzer and a carbon monoxide analyzer for the Crescent Heights station when the PAS airshed began operations. Donation of the equipment was made through a partnership program with Alberta Environment and Protected Areas, and

the National Air Pollution Surveillance program (NAPS) of Environment Canada. In 2013, AEPA provided a SHARP PM_{2.5} monitor to replace the TEOM. This instrument enables the Crescent Heights station to report the Air Quality Health Index (AQHI). The AQHI is a public health tool used to provide advice to the general population and at-risk groups on how to reduce health risk by adjusting daily activities according to the status of air quality. In Alberta, the AQHI is measured and forecast for 31 communities. Near real-time AQHI data is available on the AEPA website:

<https://airquality.alberta.ca/map/>



Continuous Air Quality Monitoring Results

Oxides of Nitrogen

Oxides of nitrogen (NO_x) are present in the air primarily in the form of nitric oxide (NO) and nitrogen dioxide (NO_2). These emissions are produced from the reaction of nitrogen and oxygen gases during combustion, especially at high temperatures. In atmospheric chemistry, oxides of nitrogen refer to the total concentration of nitric oxide and nitrogen dioxide.

Oxides of nitrogen (NO_x) are produced from both natural and anthropogenic sources. Forest fires, lightning, and nitrogen fixation microorganisms are the primary natural contribution sources. Anthropogenic emissions are primarily from fuel combustions, such as transportation sources (automobiles, trucks, and trains), industrial sources (oil and gas industries), power generation plants, and space heating. The largest urban source of oxides of nitrogen is motor vehicles.

Nitrogen dioxide is a major component of photochemical reactions in the atmosphere that leads to smog formation, acid rain, and ground-level ozone formation and scavenging. High concentrations of oxides of nitrogen can damage plants, causing leaf discoloring and impairment of leaf function. Nitrogen dioxide, at higher concentrations, is an irritating gas that can constrict airways of asthmatics and may increase the susceptibility of infection in the general population.

AEPA sets air quality objectives for NO_2 among the nitrogen oxides compounds. The Alberta Ambient Air Quality Objectives for nitrogen dioxide are:

- 1-hour average AAAQO = 159 ppb
- Annual average AAAQO = 24 ppb



The operational uptimes for the Crescent Heights, Taber and Brooks stations were 99.7%, 99.9% and 99.8% respectively. There were no exceedances of the 1-hour and annual AAAQO values. The annual average concentration of NO_2 at the Crescent Heights station was recorded as 6.1 ppb. Averages for Taber and Brooks were 1.2 ppb and 9.6 ppb. The maximum 1-hour average concentration of 41.5 ppb at the Crescent Heights station was detected in January. The maximum 1-hour average concentration of 35.0 ppb at the Taber station in March and 34.3 ppb at Brooks were detected in March.

Figure 4 compares annual average concentrations of NO_2 for the Air Monitoring Stations (AMS) in Alberta. The concentration at Crescent Heights was comparable to other cities of similar size. Higher concentrations of nitrogen dioxide tend to be recorded in large cities, such as Calgary and Edmonton, due to traffic and space heating. A higher concentration of NO_2 is also detected in energy resource operation regions, e.g. Wood Buffalo area.

Parameter	Annual Average Concentration – Nitrogen Oxides (NO/NO ₂ /NO _x , ppb)											
	Crescent Heights						Taber			Brooks		
	2023	2022	2021	2020	2019	2018	2023	2022	2021	2023	2022	2021
NO_x	7.8	7.5	7.2	7.3	8.6	9.6	6.7	5.2	6.7	4.6	5	4.2
NO₂	6.1	5.8	5.6	5.6	6.8	7.2	9.6	3.9	4.4	9.6	4.0	3.3
NO	1.6	0.1	1.6	1.8	1.8	2.3	1.2	1.3	2.4	0.9	1.1	1

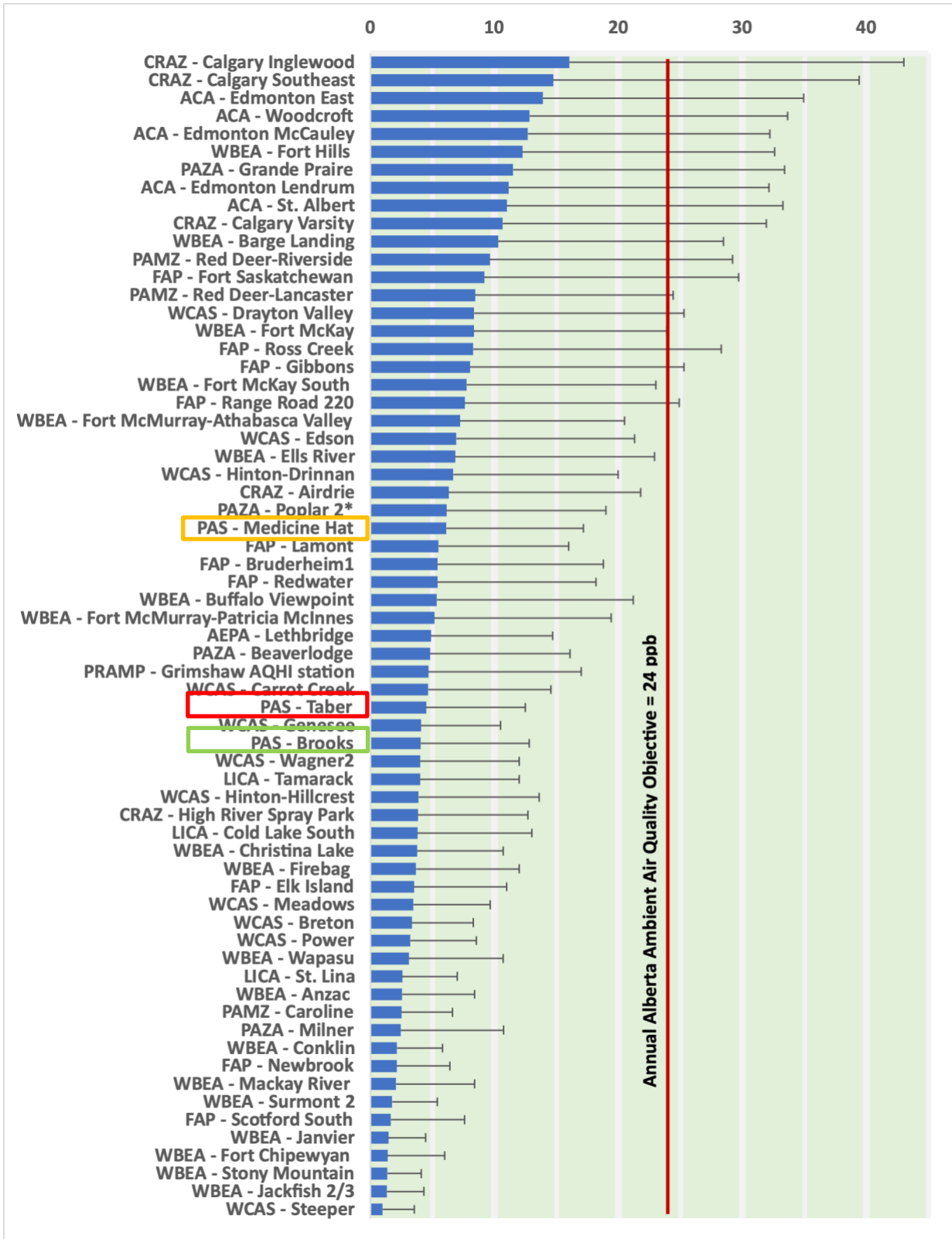


Figure 4. Nitrogen Dioxide (NO₂) – 2023 Annual Average

Ozone

Ozone (O₃) is most commonly known as the “ozone layer” in the upper atmosphere (stratosphere) which shields the Earth against harmful radiation from the sun, particularly ultraviolet B radiation. However, ozone is considered a pollutant at ground level as it is involved with photochemical production of many secondary air pollutants (such as smog). Ozone is described as “Good up high; Bad nearby”.

Ozone is a bluish colored gas that has a distinctive sharp odour at higher concentrations, such as that generated from lightning storms or near photocopiers indoors. At normal outdoor concentrations, ozone tends to be odourless. At higher concentrations, ozone can reduce lung function, aggravate existing respiratory illness, and irritate eyes, nose, and throats.

Ozone is a reactive gas. It tends to react rapidly in the presence of oxides of nitrogen. In Alberta, ozone concentrations are generally lower in urban areas. The trend is due to scavenging of ozone by nitric oxide emitted by traffic emissions and residential/commercial heating. Ozone concentration is typically highest between late spring and summer. Research in the Edmonton Capital Region found that high concentrations of ozone could be associated with contributions from the upper air ozone and photochemical reaction of biogenic emissions. More research is underway to investigate ozone formation mechanisms.

The Alberta Ambient Air Quality Objective for ozone is 76 ppb for the daily maximum concentration averaged over a one-hour period.

All stations were greater than 90% operational for 2023.

There were three recorded exceedances of the 1-hour AAAQO, all occurring at Crescent Heights on June 12. The annual average concentration at the Crescent Heights station was 31 ppb. The maximum 1-hour average concentration of 79 ppb at the Crescent Heights station was detected on June 12. 2023 averages for Taber were 29 ppb and Brooks was 28 ppb. The maximum 1-hour average concentration of 65 ppb at the Taber station in August and 75 ppb at Brooks were detected in July.

The historical annual average concentrations for the past 12 years are summarized in the table below. There is no apparent yearly trend at the Crescent Heights station.

Figure 5 compares 2023 annual average concentrations of O₃ for the AMS located in Alberta. The concentrations at the Crescent Heights station tends to be lower than at rural monitoring stations, and higher than the large cities, such as Edmonton and Calgary. The spatial trend indicates ozone scavenging is an important ozone chemistry mechanism in Alberta.



Monitoring Station	Annual Average Concentration - Ozone (O ₃ ppb)												
	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
Crescent Heights	31	30	31	30	30	30	32	27	27	28	28	29	30
Taber	29	29	29	-	-	-	-	-	-	-	-	-	-
Brooks	28	28	27	-	-	-	-	-	-	-	-	-	-

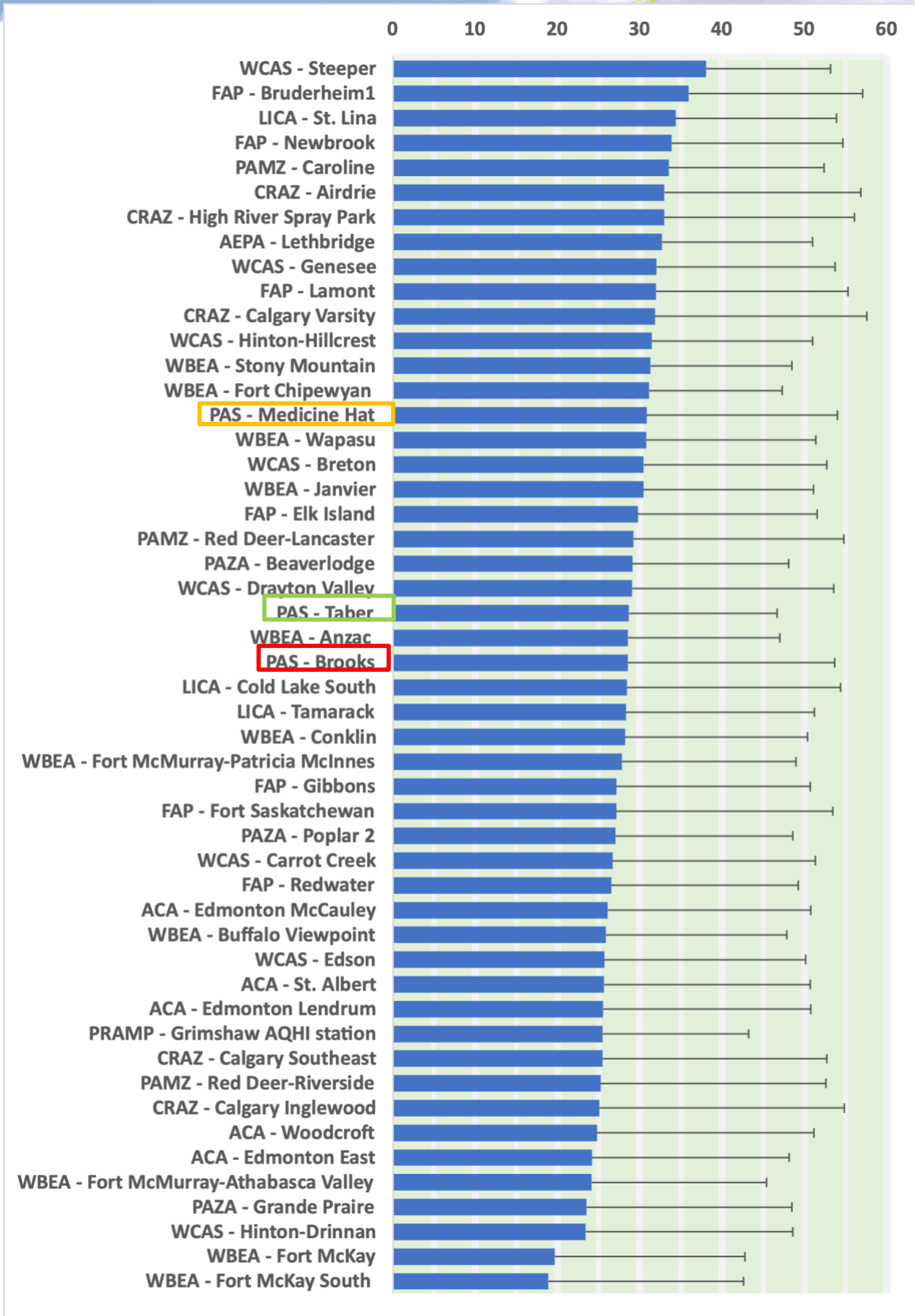


Figure 5. Ozone (O₃) – 2023 Annual Average

Fine Particulate Matter

Particulate matter (PM) is unique among air pollutants for it is identified by its size rather than by its composition. The major health concerns for particulate matter are for small particles, which are referred to as inhalable particulate, or PM₁₀. PM₁₀ is defined for particles which have an aerodynamic diameter less than 10 microns (or 0.01 mm). The small particles can be emitted directly into the air from sources or be generated through physical and chemical reactions in the atmosphere. They can remain airborne for a long period of time and can travel a long distance.

PM₁₀ can be divided into two groups based on particle sizes: fine particles and coarse particles. The fine particles are those particles which have an aerodynamic diameter smaller than 2.5 microns (0.0025 mm) and are identified as PM_{2.5} (respirable particulate matter). In contrast, coarse particles are defined as those that are greater than 2.5 microns and smaller than 10 microns in aerodynamic diameter.

Generally, fine particles pose a greater health risk because these particles can be inhaled deep into the lungs, bringing with them potential chemicals that may be harmful. In the atmosphere, fine particles are the main contributors to reduction of visibility (haze). Exposure to harmful particulate matter can cause eye, nose, and throat irritation. In addition, studies have linked respirable particulate matter to aggravated heart and lung diseases such as asthma, bronchitis, and emphysema.

The Alberta Ambient Air Quality Objectives for PM_{2.5} are:

- 1-hour average AAAQO = 80 µg/m³
- 24-hour average AAAQO = 29 µg/m³

Major particulate emission sources in Alberta include soil erosion, road dust as well as dust resulting from other human activities, smoke from forest fires and from recreational sources, vehicle exhaust emissions, and industrial sources, e.g. power plants, cement manufacturing, mining, and forest products industry.

All stations were greater than 90% operational for 2023. There were 44 exceedances of the 24-hour AAAQO and 242 exceedances of the 1-hour AAAQO, attributed to wildfire smoke. High particulate events were substantially higher in 2023 compared to previous years due to the exceptionally active wildfire season.

The historical annual average concentrations for the past 14 years are summarized in the table below.

Figure 6 compares the annual average concentrations for the Alberta AMS. The concentration at the Crescent Heights, Taber and Brooks stations is at the low end among the reviewed stations. A higher concentration of PM_{2.5} tends to be detected in large cities, energy resource exploration areas, and industrial areas. Wildfire smoke was a significant contributor to PM levels in 2023, impacting more northerly and westerly stations.

Monitoring Station	Annual Arithmetic Average - Fine Particulate Matter (PM _{2.5} , µg/m ³)													
	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010
Crescent Heights	8	5	7	5	5	7	6	4	7	5	8	9	8	8
Taber	10	8	13	-	-	-	-	-	-	-	-	-	-	-
Brooks	9	5	8	-	-	-	-	-	-	-	-	-	-	-

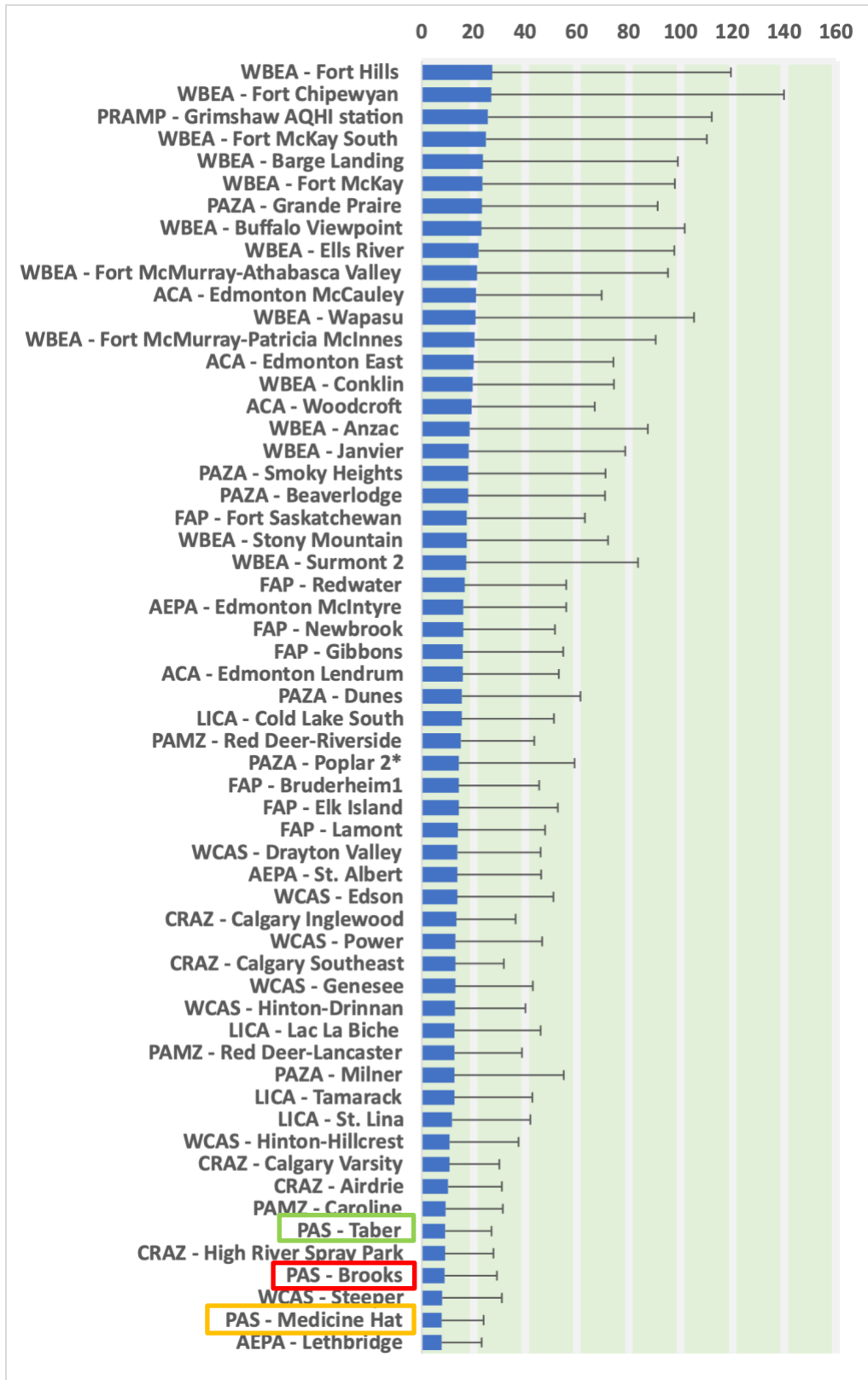


Figure 6. Fine Particulate Matter (PM_{2.5}) – 2023 Annual Arithmetic Average



Sulfur Dioxide

Sulfur dioxide (SO₂) is a colourless gas with a strong, pungent odour. At concentrations as low as 300 ppb, it can be tasted and smelled. Acute exposure to high concentration SO₂ can lead to constricted airways, which can be especially troublesome for people with asthma. Children may experience an increase in respiratory tract infections. Healthy people may experience sore throats, coughing, and breathing difficulties. Chronic exposure to high concentrations of SO₂ has been associated with an increased risk of mortality from respiratory or cardiovascular disease.

Sulfur dioxide is formed during processing and combustion of fossil fuels containing sulfur, such as gasoline, natural gas, oil, coal, and oil sands. On a global basis, volcanic eruptions are the major natural source of sulfur dioxide into the atmosphere.

Sulfur dioxide, once emitted into the atmosphere, can persist for days, allowing for wide spatial distribution of the gas. In the atmosphere, some SO₂ can be oxidized by ozone and hydrogen peroxide to form sulfur trioxide (SO₃). Both SO₂ and SO₃ are soluble in water; hence, if they are present in the atmosphere when condensation occurs, droplets of sulfuric acid (acid rain) are formed.

The Alberta Ambient Air Quality Objectives (AAAQO) for sulfur dioxide:

- 1-hour average AAAQO = 172 ppb
- 24-hour average AAAQO = 48 ppb
- Annual average AAAQO = 8 ppb

The SO₂ analyzer at the Crescent Heights station was 100% operational for 2023. There were no exceedances of the 1-hour, 24-hour, or annual AAAQO values. The measured concentration was typically quite low, with an annual average of 0.1 ppb. The maximum 1-hour average concentration of 3.4 ppb was detected in January.

The historical annual average concentrations for the past 10 years are summarized in the table below. Annual averages tend to be between 0.1 and 0.2 ppb.



Figure 7 compares the annual average concentrations for Alberta AMS. The concentration at the Crescent Heights station is among the lowest in Alberta. A higher concentration of sulfur dioxide tends to be measured in the energy operation regions, e.g. the Wood Buffalo area and Fort Air Partnership area.

Monitoring Station	Annual Average – Sulfur Dioxide (ppb)										
	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013
Crescent Heights	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.2

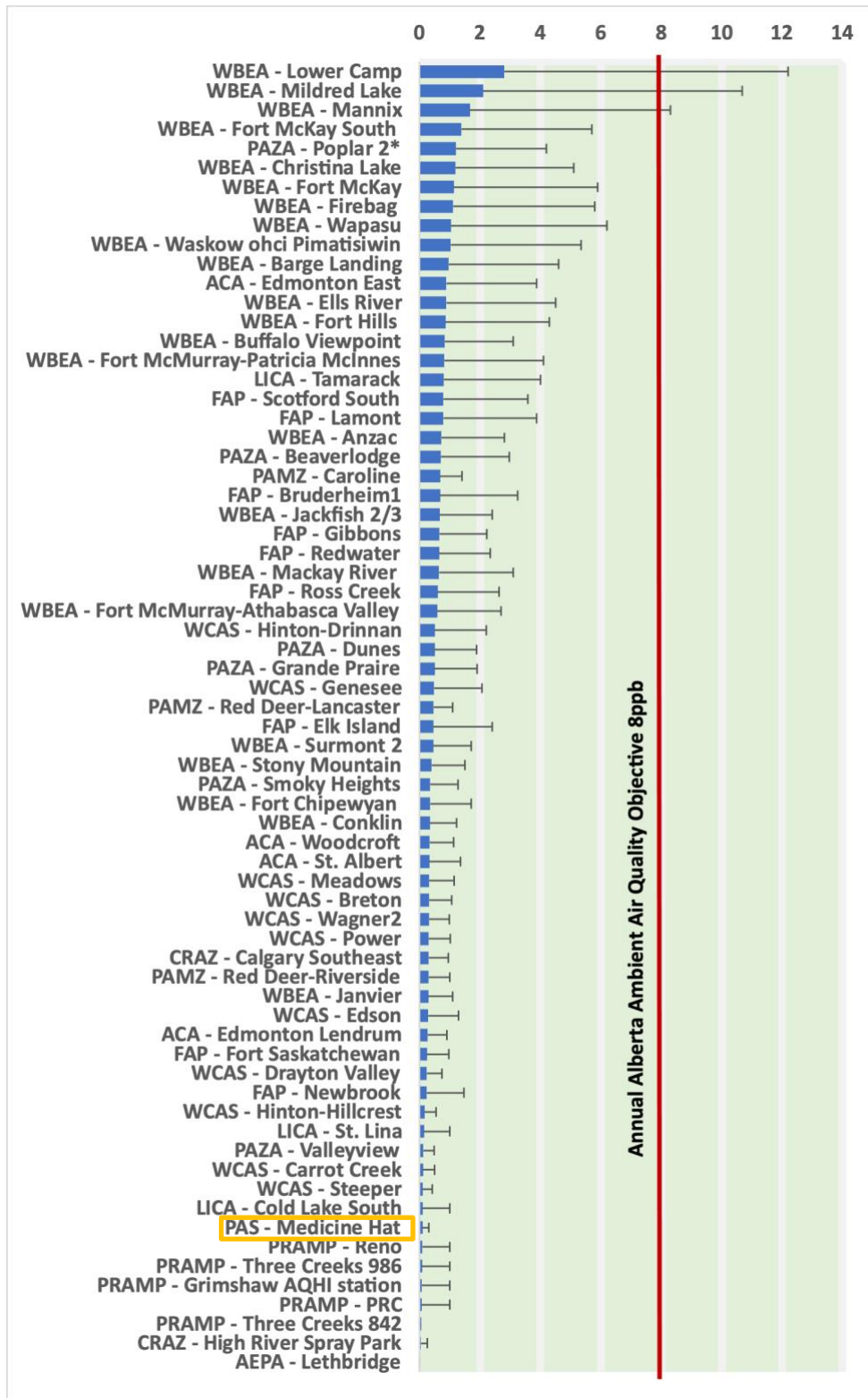


Figure 7. Sulfur Dioxide (SO2) 2023 Annual Average

Total Hydrocarbons

Hydrocarbons are divided into two categories, "reactive" and "non-reactive". The term "total hydrocarbons" (THC) refers to a broad family of chemicals that contain carbon and hydrogen atoms and includes both reactive and non-reactive hydrocarbons. Reactive hydrocarbons include many volatile organic compounds such as alkenes, alkynes, benzene, toluene, ethylbenzenes, xylenes, and other aromatics. Reactive hydrocarbons are important because they can react with oxides of nitrogen in the presence of sunlight to form ozone and may be toxic to humans, animals, or vegetation.

Trees and plants are natural emitters of reactive hydrocarbons. Other significant contribution sources include livestock operations, vehicle emissions, fireplaces, natural gas combustion, and fugitive emissions from fuel storage tanks, petroleum and chemical industries, as well as dry cleaning. Motor vehicles are the primary source of hydrocarbons in urban areas.

The primary non-reactive hydrocarbon in the atmosphere is methane, which is a naturally occurring, colorless, odorless gas. Methane is regarded as a major contributor to the greenhouse effect. Large amounts of methane are produced naturally from bogs, shallow lakes and soils through anaerobic decay of vegetation. The global background

concentration of total hydrocarbons is approximately 1.8 to 2.1 ppm, consisting primarily of methane.



Alberta does not have an ambient air quality objective for total hydrocarbons. Some reactive hydrocarbons such as benzene and styrene are specified in the air quality objectives.

The THC analyzer at the Crescent Heights station has an operational uptime of 99.6% for 2023. The maximum 1-hour average concentration of 4.1 ppm was detected in March, and the annual average concentration was 2.2 ppm. The historical annual average concentrations for the past 12 years are summarized in the table below. There is no apparent yearly trend for total hydrocarbons at the Crescent Heights station.

Monitoring Station	Annual Average Concentration - Total Hydrocarbons (THC, ppm)												
	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
Crescent Heights	2.2	2.2	2.2	2.1	2.1	2.1	2.1	2.1	2.1	2.2	2.2	2.2	2.1

Carbon Monoxide

Carbon Monoxide (CO) is a colourless and odourless gas. It is the most commonly inhaled poisonous substance. CO occurs naturally in the atmosphere, but the major causes of CO poisoning are from vehicles idling in closed ventilated areas, blocked fireplaces, and charcoal grills used in a confined space.

Carbon monoxide is produced from partial oxidation of carbon during fuel combustion. The major anthropogenic emission sources include traffic emissions (automobiles, trucks, and trains), industrial sources (incomplete combustion), space heating, gas stoves, and cigarette smoke. The largest urban source of CO is from motor vehicle emissions. The major natural emission sources include forest fires and volcanic activities.

AEPA sets up air quality objectives based on the protection of human health and life. As CO is inhaled, it combines with the hemoglobin in the red blood cell inhibiting the oxygen carrying capability of the red blood cells. At low concentrations, acute exposure may cause fatigue in healthy people and cause chest pain in people with heart disease.

The Alberta Ambient Air Quality Objectives for carbon monoxide are:

- 1-hour average AAAQO = 13 ppm
- 8-hour average AAAQO = 5 ppm

The CO analyzer was greater than 90% operational for the year 2023. There were no exceedances of the AAAQO values at the Crescent Heights station. The maximum 1-hour average concentration of 1.1 ppm was detected in May.

The historical annual average concentrations for the past 12 years are summarized in the table below. There is no apparent yearly trend at the Crescent Heights station.

Parameter	Annual Average – Crescent Heights Station (ppm)													
	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010
Carbon Monoxide	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.1	0.2	0.2

Air Quality Health Index

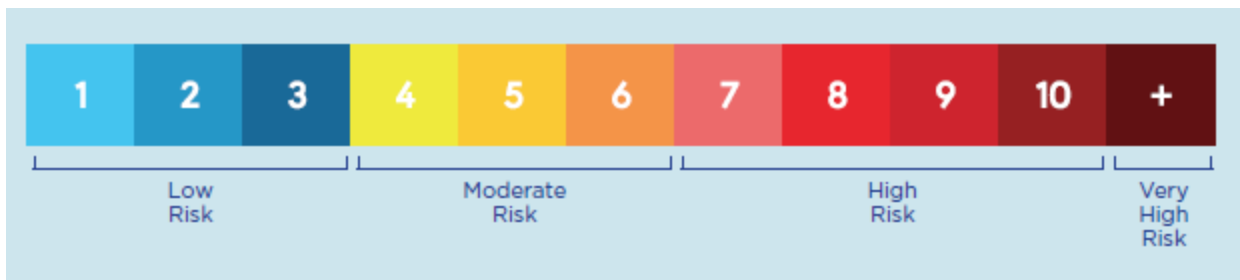
The Air Quality Health Index (AQHI) is a health protection tool that is designed to help the public make decisions to protect their health by limiting short-term exposure to air pollution and adjusting their activity levels during increased levels of air pollution. The AQHI uses concentration data for three air pollutants to calculate a single numerical value to evaluate the health risk associated with air pollution. The three air pollutants are fine particulate matter, nitrogen dioxide, and ozone. All three pollutants are required to calculate the AQHI. If one or more of the pollutants is missing data, the AQHI index cannot be reported.

The following scale illustrates the risk categories and health messages for the

AQHI system (AEPA, 2011). The health risk is classified in four categories: Low (1 to 3), Moderate (4 to 6), High (7 to 10), and Very High (greater than 10).

Figure 8 compares the AQHI ratings for 39 communities in Alberta. For the City of Medicine Hat, air quality was rated Low Risk 90.4% of the time, Moderate Risk 8.4% of the time, High Risk and Very High Risk 11.8% of the time. For the Town of Taber, air quality was rated Low Risk 94.4% of the time, Moderate Risk 4.9% of the time, High Risk 0.7% of the time while the City of Brooks, air quality was rated Low Risk 90.9% of the time, Moderate Risk 8.3% of the time, and High Risk 0.8% of the time.

The Moderate and High-Risk air quality events were primarily attributed to wildfire smoke.



Health Risk	Air Quality Health Index	Health Messages	
		At Risk Population	General Population
Low Risk	1 – 3	Enjoy your usual outdoor activities.	Ideal air quality for outdoor activities.
Moderate Risk	4 – 6	Consider reducing or rescheduling strenuous activities outdoors if you are experiencing symptoms.	No need to modify your usual outdoor activities unless you experience symptoms such as coughing and throat irritation.
High Risk	7 – 10	Reduce or reschedule strenuous activities outdoors. Children and the elderly should also take it easy.	Consider reducing or rescheduling strenuous activities outdoors if you experience symptoms such as coughing and throat irritation.
Very High Risk	10+	Avoid strenuous activities outdoors. Children and the elderly should also avoid outdoor physical exertion.	Reduce or reschedule strenuous activities outdoors, especially if you experience symptoms such as coughing and throat irritation.

Source: <https://www.alberta.ca/about-the-air-quality-health-index.aspx>

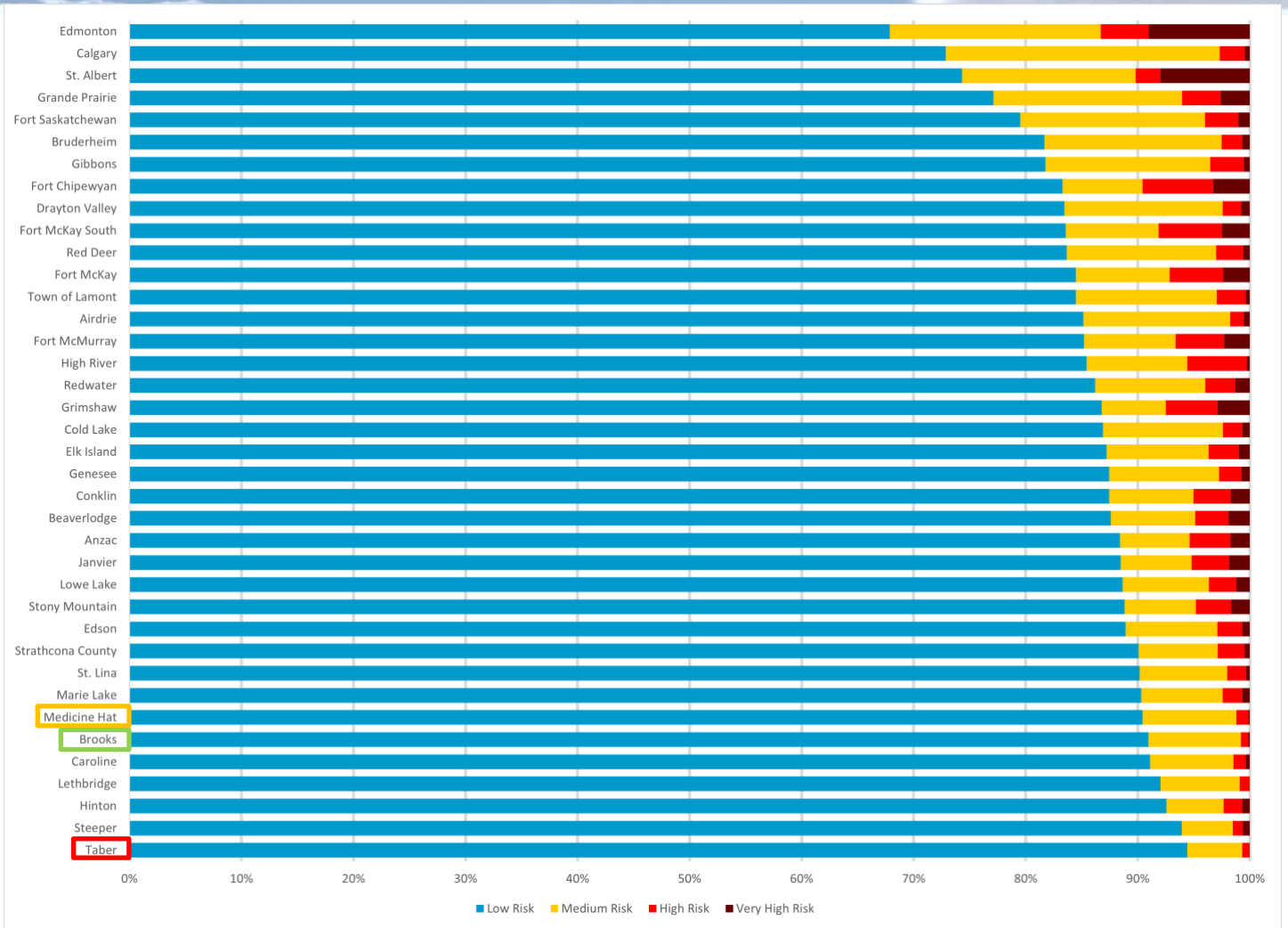


Figure 8. 2023 Air Quality Health Index for Alberta Communities



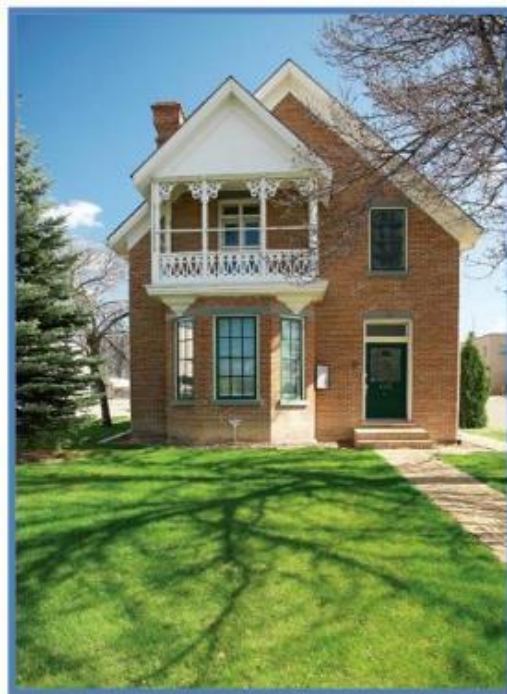
Passive Air Quality Monitoring Results

The PAS Air Quality Monitoring Program uses passive samplers as a cost-effective method to monitor air quality throughout the airshed. The results are used to assess the spatial distribution trend of air pollutants in the region. The monitoring objective is to ensure the air quality is in compliance with Alberta's Ambient Air Quality Objectives (AAAQO), as well as to provide monitoring of long-term trends.

The advantages of passive sampling devices include simple sampler design, low operation costs, and ease of use. Passive samplers require no power, making them suitable for monitoring air quality in remote areas. Passive samplers are designed to monitor long-term average concentrations. The disadvantage of the passive sampling devices is that short-duration events cannot be identified.

Passive sampling devices rely on the principles of permeation and diffusion to uptake the specific compound being sampled. Air pollutants diffuse through a semi-permeable membrane or tube to a sampling medium which has been chemically treated to absorb or react with the target air pollutant. After being exposed in the field for a predetermined period of time, the sampler is analyzed in a certified laboratory. An average concentration is calculated based on the duration of exposure and accounting for the effects of environmental conditions, e.g. temperature, humidity, and wind speed.

Initially, the PAS passive sampling program included 6 passive monitoring



stations that were located based on airshed modeling predictions of high impact areas, and to gather data in sensitive areas within the airshed (e.g. hospitals, schools). Passive Network Rationalization resulted in changes to the passive network in early 2017. The current network is made up of 8 SO₂ sites and 16 NO₂ sites.

The PAS passive network provides 30-day samples to be analyzed for sulfur dioxide (SO₂), nitrogen dioxide (NO₂), and ozone (O₃) (January and February only). These parameters are the priority air quality concerns and remain consistent with those being monitored by other Alberta airsheds. A Multi-Gas Passive Sampler was used for the PAS passive program until May 2014, when it was replaced with the Ogawa Ozone sampler and the Radiello sampler tube for sulfur dioxide and nitrogen dioxide. The samplers were changed again in November 2017, to the Maxxam Passive Air Sampling System (PASS).

Nitrogen Dioxide

The annual average concentration of nitrogen dioxide ranged from 0.3 ppb to 3.0 ppb, which is substantially less than the annual AAAQO of 24 ppb. The maximum 30-day average concentration of 7.7 ppb was detected in December at Site 11 (Brooks), while the lowest 30-day average concentration of <0.1 ppb was detected at multiple sites in February and March.

Figure 11 illustrates the historical data for monthly network average concentrations for passive NO₂. The histogram exhibits a seasonal trend: higher concentrations tend to occur in the winter months. In winter, the Palliser airshed region is characterized by low atmospheric ceilings and thermal inversions such that air pollutants are trapped near the ground level. Emissions from space heating may be another factor contributing to the seasonal trend.

Within the passive network, the maximum annual average concentration of 3.0 ppb was detected at Site 11 (Brooks), while the minimum concentration of 0.3 ppb was detected at Site 17 (Onefour).

Sulfur Dioxide

The concentration of sulfur dioxide generally is quite low in the PAS airshed zone. The annual average concentration of SO₂ ranged from 0.2 to 0.3 ppb, with no exceedances of the annual AAAQO of 8 ppb or of the 30-day AAAQO of 11 ppb.

The annual average concentration in 2023 was 0.2 ppb. The maximum 30-day average concentration of 0.6 ppb was detected in January at Site 3 (Oyen), while the lowest concentration was 0.1 ppb (detected at multiple monitoring sites).



2023 Annual Averages For the Passive Program

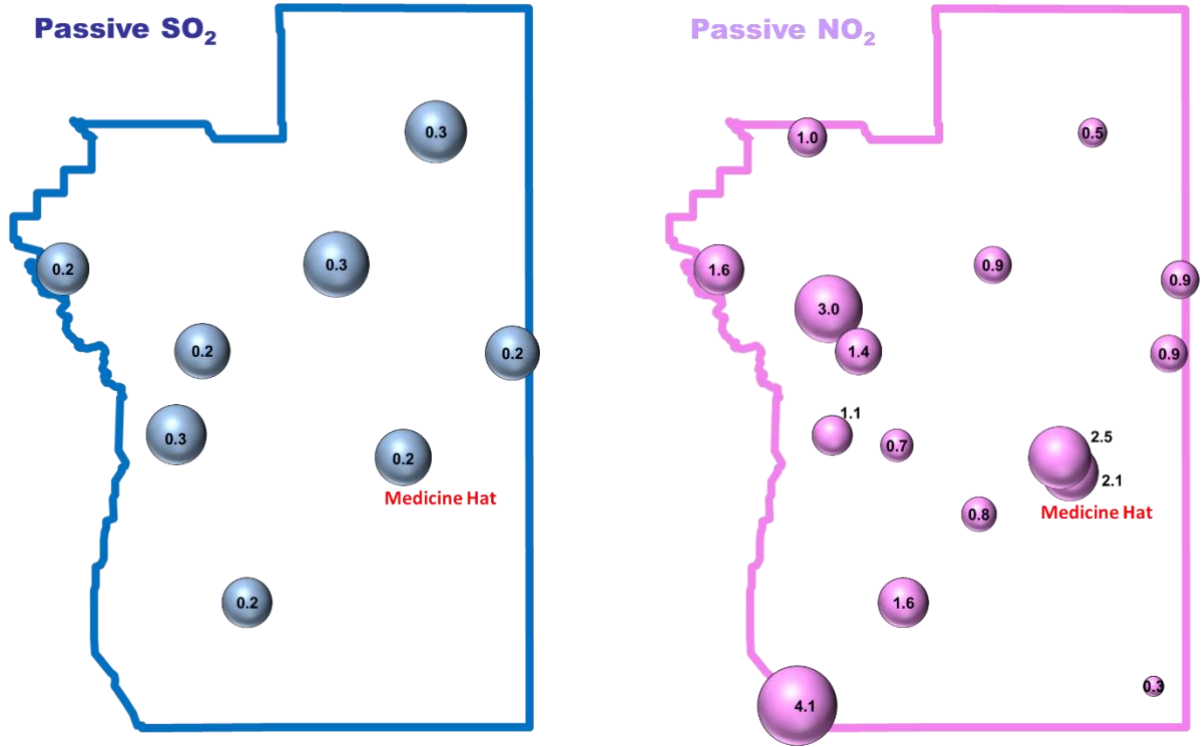


Figure 14. Passive Concentrations in the PAS Airshed – 2023 Annual Averages



PAS Financial Statements – Reviewer’s Report

**Palliser Airshed Society
Index to Financial Statements
For the Year Ended December 31, 2023**

	Page
Independent Practitioner’s Review Engagement Report	1
Financial Statements	
Statement of Financial Position	2
Statement of Operations	3
Statement of Changes in Net Assets	4
Statement of Cash Flows	5
Notes to Financial Statements	6 - 10

**SEAN D. MILLER**

PROFESSIONAL CORPORATION

CHARTERED PROFESSIONAL ACCOUNTANT

Independent Practitioner's Review Engagement Report

To the Members of Palliser Airshed Society

I have reviewed the accompanying financial statements of Palliser Airshed Society (the society) that comprise the statement of financial position as at December 31, 2023, and the statements of operations, changes in net assets and cash flows for the year then ended, and a summary of significant accounting policies and other explanatory information.

Management's Responsibility for the Financial Statements

Management is responsible for the preparation and fair presentation of these financial statements in accordance with Canadian accounting standards for not-for-profit organizations (ASNPO), and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

Practitioner's Responsibility

My responsibility is to express a conclusion on the accompanying financial statements based on my review. I conducted my review in accordance with Canadian generally accepted standards for review engagements, which require me to comply with relevant ethical requirements.

A review of financial statements in accordance with Canadian generally accepted standards for review engagements is a limited assurance engagement. The practitioner performs procedures, primarily consisting of making inquiries of management and others within the entity, as appropriate, and applying analytical procedures, and evaluates the evidence obtained.

The procedures performed in a review are substantially less in extent than, and vary in nature from, those performed in an audit conducted in accordance with Canadian generally accepted auditing standards. Accordingly, I do not express an audit opinion on these financial statements.

Conclusion

Based on my review, nothing has come to my attention that causes me to believe that the financial statements do not present fairly, in all material respects, the financial position of Palliser Airshed Society as at December 31, 2023, and the results of its operations and its cash flows for the year then ended in accordance with ASNPO.



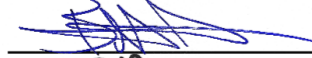
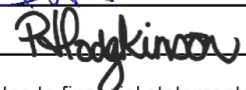
Medicine Hat, Alberta
May 24, 2024

Sean D. Miller Professional Corporation
Chartered Professional Accountant

Palliser Airshed Society
Statement of Financial Position
December 31, 2023

	2023	2022
ASSETS		
CURRENT		
Cash and cash equivalents <i>(Note 4)</i>	\$ 147,203	\$ 229,972
Short term investments <i>(Note 5)</i>	131,306	31,306
Contributions and grants receivable <i>(Note 6)</i>	23,487	29,664
Accrued interest receivable	4,418	270
Goods and services tax recoverable	7,144	6,775
Prepaid expenses	7,536	6,670
	321,094	304,657
CAPITAL ASSETS <i>(Note 7)</i>	27,156	33,945
	\$ 348,250	\$ 338,602
LIABILITIES AND NET ASSETS		
CURRENT		
Accounts payable and accrued liabilities	\$ 21,207	\$ 8,375
NET ASSETS		
Unrestricted net assets	299,887	296,282
Invested in capital assets	27,156	33,945
	327,043	330,227
	\$ 348,250	\$ 338,602

On behalf of the Board


 _____ Chairperson

 _____ Treasurer

See notes to financial statements

Palliser Airshed Society
Statement of Operations
For the Year Ended December 31, 2023

	2023	2022
REVENUE		
Member contributions	\$ 113,382	\$ 125,119
Government contracts - Alberta Environment & Parks	93,950	115,128
Government grants - Alberta Environment & Parks	58,000	31,500
	<u>265,332</u>	<u>271,747</u>
EXPENSES		
Monitoring and program management fees	231,101	229,658
Repairs and maintenance - equipment	11,412	16,365
Insurance	9,403	8,626
Amortization	6,789	8,486
Professional fees	6,300	7,250
Office	2,960	2,619
Memberships and subscriptions	2,475	2,275
Advertising and outreach	1,980	3,343
Meetings and conventions	265	-
Interest and bank charges	143	138
Travel and honorarium	134	75
	<u>272,962</u>	<u>278,835</u>
DEFICIENCY OF REVENUE OVER EXPENSES FROM OPERATIONS	(7,630)	(7,088)
OTHER REVENUE		
Interest	4,446	282
DEFICIENCY OF REVENUE OVER EXPENSES	\$ (3,184)	\$ (6,806)

See notes to financial statements

3

Palliser Airshed Society
Statement of Changes in Net Assets
For the Year Ended December 31, 2023

	Unrestricted Net Assets	Invested in Capital Assets	2023	2022
NET ASSETS - BEGINNING OF YEAR	\$ 296,282	\$ 33,945	\$ 330,227	\$ 337,033
EXCESS (DEFICIENCY) OF REVENUE OVER EXPENSES	3,605	(6,789)	(3,184)	(6,806)
NET ASSETS - END OF YEAR	\$ 299,887	\$ 27,156	\$ 327,043	\$ 330,227

See notes to financial statements

Palliser Airshed Society
Statement of Cash Flows
For the Year Ended December 31, 2023

	2023	2022
OPERATING ACTIVITIES		
Deficiency of revenue over expenses	\$ (3,184)	\$ (6,806)
Item not affecting cash:		
Amortization	6,789	8,486
	<u>3,605</u>	<u>1,680</u>
Changes in non-cash working capital:		
Contributions and grants receivable	6,177	-
Accrued interest receivable	(4,148)	(157)
Goods and services tax recoverable	(369)	(382)
Prepaid expenses	(866)	(668)
Accounts payable and accrued liabilities	12,832	(10,998)
	<u>13,626</u>	<u>(12,205)</u>
Cash flow from (used by) operating activities	<u>17,231</u>	<u>(10,525)</u>
INVESTING ACTIVITIES		
Proceeds from matured guaranteed investment certificate	31,306	31,181
Purchase of guaranteed investment certificate	(131,306)	(31,306)
Cash flow used by investing activities	<u>(100,000)</u>	<u>(125)</u>
DECREASE IN CASH FLOW	(82,769)	(10,650)
Cash and cash equivalents - beginning of year	229,972	240,622
CASH AND CASH EQUIVALENTS - END OF YEAR (Note 4)	\$ 147,203	\$ 229,972

See notes to financial statements

Palliser Airshed Society
Notes to Financial Statements
For the Year Ended December 31, 2023

1. PURPOSE OF THE SOCIETY

Palliser Airshed Society (the "society") is a not-for-profit organization incorporated provincially under the Societies Act of Alberta. The society is exempt from the payment of income tax under Section 149(1) of the Income Tax Act.

The society's principal business activity is to monitor air quality using a combination of both continuous and passive monitoring technologies. The society is committed to collecting and communicating credible ambient air quality data back to all stakeholders.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

Basis of presentation

The financial statements were prepared in accordance with Canadian accounting standards for not-for-profit organizations (ASNPO).

Contributed services

The operations of the society depend on both the contribution of time by volunteers and donated materials from various sources. The fair value of donated materials and services cannot be reasonably determined and are therefore not reflected in these financial statements.

Fund accounting

Palliser Airshed Society follows the deferral method of accounting for contributions.

The Unrestricted Net Assets Fund reports the revenue and expenses related to the day to day monitoring activities and operations.

The Invested in Capital Assets Fund reports the assets, liabilities, revenues, and expenses related to the society's capital assets.

Financial instruments

Financial instruments are recorded at fair value when acquired or issued. In subsequent periods, financial assets with actively traded markets are reported at fair value, with any unrealized gains and losses reported in income. All other financial instruments are reported at amortized cost, and tested for impairment at each reporting date. Transaction costs on the acquisition, sale, or issue of financial instruments are expensed when incurred.

(continues)

Palliser Airshed Society
Notes to Financial Statements
For the Year Ended December 31, 2023

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (*continued*)

Revenue recognition

Palliser Airshed Society follows the deferral method of accounting for contributions.

Restricted contributions are recognized as revenue in the year in which the related expenses are incurred. Unrestricted contributions are recognized as revenue when received or receivable if the amount to be received can be reasonably estimated and collection is reasonably assured.

Restricted contributions consist of grant revenue received from Alberta Environment and Parks and are designated to be spent on executive director fees, office operations, and board expenses. These amounts are included in "Monitoring and program management fees".

Unrestricted contributions consist of member contributions in the year and are not designated for a specific purpose. Membership contributions consist of both mandatory and voluntary memberships.

Mandatory membership fees are received from companies who are regulated and mandated by the jurisdiction to be a local airshed member. These contributions are recognized as revenue at the time of billing.

Voluntary membership fees are received from companies who are regulated but not mandated by the jurisdiction to be a local airshed member. Municipalities also make contributions through voluntary membership. These contributions are recognized as revenue when received instead of at the time of billing due to the fact that these membership fees are voluntary and depend solely on the contributors' decision to renew their annual membership.

Restricted investment income is recognized as revenue in the year in which the related expenses are incurred. Unrestricted investment income is recognized as revenue when earned.

Cash and cash equivalents

Cash and cash equivalents is comprised of cash on hand and bank balances, together with other short-term, highly liquid investments that are readily convertible into known amounts of cash and which are subject to an insignificant risk of changes in value.

Capital assets

Capital assets are stated at cost or deemed cost less accumulated amortization and are amortized over their estimated useful lives at the following rates and methods:

Equipment	20% declining balance method
-----------	------------------------------

The society regularly reviews its capital assets to eliminate obsolete items.

Capital assets acquired during the year but not placed into use before the end of the year are not amortized until they are placed into use.

Measurement uncertainty

The preparation of financial statements in conformity with Canadian accounting standards for not-for-profit organizations requires management to make estimates and assumptions that affect the reported amount of assets and liabilities, disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the period. Items in the financial statements requiring estimates by management include accrued interest receivable, prepaid expenses, the estimated useful life of capital assets and accounts payable and accrued liabilities. Such estimates are periodically reviewed and any adjustments necessary are reported in earnings in the period in which they become known. Actual results could differ from these estimates.

Palliser Airshed Society
Notes to Financial Statements
For the Year Ended December 31, 2023

3. FINANCIAL INSTRUMENTS

The society's carrying value of cash and cash equivalents, short term investments, contributions and grants receivable, accrued interest receivable, goods and services tax recoverable, prepaid expenses and accounts payable and accrued liabilities approximates its fair value due to the immediate or short term maturity of these instruments.

The society is exposed to various risks through its financial instruments and uses risk management to monitor, evaluate and manage these risks. These risks include credit risk, liquidity risk, and interest rate risk. The society does not use any derivative financial instruments to mitigate these risks.

Credit risk

Credit risk arises from the potential that a counter party will fail to perform its obligations. The society is exposed to credit risk from three sources: cash and cash equivalents, short term investments, and contributions and grants receivable. Cash and cash equivalents and short term investments are deposited with reputable, major financial institutions to limit the credit risk exposure. The credit risk from counter parties not paying contributions and grants receivable is not considered to be significant. The society has a significant number of members and contract and grant revenue is provided by the Alberta Government, which minimizes its credit risk.

Liquidity risk

Liquidity risk is the risk that the society will encounter difficulty in meeting obligations associated with its financial liabilities. The society is exposed to this risk mainly in respect of its receipt of funds from its member contributions and government contracts and grants to enable the society to pay its liabilities as they come due.

Interest rate risk

Interest rate risk is the risk that the value of a financial instrument might be adversely affected by a change in the interest rates. The society is exposed to interest rate risk with respect to the following financial instruments: cash and cash equivalents and short term investments. In seeking to minimize the risks from interest rate fluctuations, the society manages exposure through its normal operating and financing activities.

4. CASH AND CASH EQUIVALENTS

	2023	2022
Cash	\$ 147,203	\$ 229,972

5. SHORT TERM INVESTMENTS

	2023	2022
GIC - Royal Bank of Canada (variable interest rate (4.25% at purchase date), matures April 10, 2024)	\$ 100,000	\$ -
GIC - Royal Bank of Canada (interest rate 4.75%, matures February 7, 2024)	31,306	31,306
	\$ 131,306	\$ 31,306

Palliser Airshed Society
Notes to Financial Statements
For the Year Ended December 31, 2023

6. CONTRIBUTIONS AND GRANTS RECEIVABLE

	<u>2023</u>	<u>2022</u>
Alberta Environment & Parks	\$ 21,723	\$ 28,782
Mandatory memberships	1,764	882
	<u>\$ 23,487</u>	<u>\$ 29,664</u>

7. CAPITAL ASSETS

	Cost	Accumulated amortization	2023 Net book value	2022 Net book value
Equipment	\$ 273,077	\$ 245,921	\$ 27,156	\$ 33,945

8. RELATED PARTY TRANSACTIONS

The following is a summary of the society's related party transactions:

	<u>2023</u>	<u>2022</u>
Membership Contributions <i>Contributions received from companies represented on the Board of Directors</i>	\$ 37,197	\$ 39,334
Government Contracts <i>Contributions received from governments represented on the Board of Directors</i>	93,950	115,128
	<u>\$ 131,147</u>	<u>\$ 154,462</u>

Contributions receivable (Note 6) include \$21,723 (2022 - \$28,782) due from members of the society and governments represented on the Board of Directors.

These transactions are in the normal course of operations and are measured at the exchange amount, which is the amount of consideration established and agreed to by the related parties.

Palliser Airshed Society
Notes to Financial Statements
For the Year Ended December 31, 2023

9. CONTRACTUAL OBLIGATIONS

The agreement between the society and Wood Environment & Infrastructure Solutions has been extended for a three-year period of July 1, 2022 - June 30, 2024. The agreement states that Wood Environment & Infrastructure Solutions will provide the following services to the society:

Monitoring Network Operations and Maintenance (July 2022 - June 2024):

\$14,848.92 / month

The society has renewed the contract for Executive Director services for the period January 1, 2022 to December 31, 2024 as follows:

\$ 5,547.50 / month

10. ECONOMIC DEPENDENCE

The society derives substantially all (over 90%) of its revenue from member contributions and Alberta Government contracts and grants. The society's ability to continue viable operations is dependant upon continuing to receive funding from these sources.


Client Number: KC7130

**Resolution of the Shareholders of
Palliser Airshed Society
passed without meeting pursuant to Subsection 156
of the Alberta Societies Act,
to be effective January 1, 2023.**

RESOLVED THAT:


The society waives the statutory requirements for an audit for the year ended December 31, 2023.

"We, the undersigned, on behalf of the Board of Directors of Palliser Airshed Society, a corporation which is not a distributing corporation, do hereby waive all irregularities and informalities in the passing of the foregoing Resolution and have hereunto set our hands in approval thereof."



Mr Bill Nalder, Chairperson

January 1, 2023
Date signed



Ms. Pamela Hodgkinson, Treasurer

January 1, 2023
Date signed



Acknowledgements

The Palliser Airshed Society would like to acknowledge the hard work and contributions of all stakeholders and contractors in partnership with the association. PAS has made significant strides towards achieving the stated goals in 2023. Our member companies and municipalities have continued to provide experience and financial stability to PAS, even in times of less than ideal economic conditions.

Special thanks to Curt Moll for providing photos of the Medicine Hat area.

We are looking forward to a successful 2024





Palliser Airshed Society

PO Box 23121 Medicine Hat Mall

Medicine Hat, AB T1B 4C7

www.palliserairshed.com